Southern California Range Complex

Environmental Impact Statement/
Overseas Environmental Impact Statement

Volume 2 of 2: Chapters 4-10 and Appendices A-F

Final • December 2008

Commander
United States Navy Pacific Fleet
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Southern California Range Complex

Environmental Impact Statement/ Overseas Environmental Impact Statement (EIS/OEIS)

Volume 2: Chapters 4-10 and Appendices A-F

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Environmental Impact Statement /
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Lead Agency:
Department of the Navy

Action Proponent:
United States Pacific Fleet

Cooperating Agency:
Department of Commerce
National Oceanographic and Atmospheric Administration
National Marine Fisheries Service

Volume 2
Chapters 4-10
Appendices A-F

December 2008

Point of Contact: Mr. Kent Randall
Naval Facilities Engineering Command Southwest
Code: OPME
2730 McKean St. Bldg. 291
San Diego, CA 92136-5198
(619) 556-2168

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4 Cumulative Impacts

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4 CUMULATIVE IMPACTS

4.1 PRINCIPLES OF CUMULATIVE IMPACTS ANALYSIS

The approach taken to analysis of cumulative impacts (or cumulative effects)[1] follows the objectives of the National Environmental Policy Act (NEPA) of 1969, Council on Environmental Quality (CEQ) regulations, and CEQ guidance. CEQ regulations (40 Code of Federal Regulations [C.F.R.] Sections [§§] 1500-1508) provide the implementing procedures for NEPA. The regulations define "cumulative effects" as:

> ". . . the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 C.F.R. 1508.7).

CEQ provides guidance on cumulative impacts analysis in *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997). This guidance further identifies cumulative effects as those environmental effects resulting "from spatial and temporal crowding of environmental perturbations. The effects of human activities will accumulate when a second perturbation occurs at a site before the ecosystem can fully rebound from the effects of the first perturbation." Noting that environmental impacts result from a diversity of sources and processes, this CEQ guidance observes that "no universally accepted framework for cumulative effects analysis exists," while noting that certain general principles have gained acceptance. One such principal provides that "cumulative effects analysis should be conducted within the context of resource, ecosystem, and community thresholds—levels of stress beyond which the desired condition degrades." Thus, "each resource, ecosystem, and human community must be analyzed in terms of its ability to accommodate additional effects, based on its own time and space parameters." Therefore, cumulative effects analysis normally will encompass geographic boundaries beyond the immediate area of the Proposed Action, and a time frame including past actions and foreseeable future actions, in order to capture these additional effects. Bounding the cumulative effects analysis is a complex undertaking, appropriately limited by practical considerations. Thus, CEQ guidelines observe, "[i]t is not practical to analyze cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful."

4.1.1 Identifying Geographical Boundaries for Cumulative Impacts Analysis

Geographic boundaries for analyses of cumulative impacts in this Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) (hereafter referred to as "EIS/OEIS") vary for different resources and environmental media. For air quality, the potentially affected air quality regions are the appropriate boundaries for assessment of cumulative impacts from releases of pollutants into the atmosphere. For wide-ranging or migratory wildlife, specifically marine mammals and sea turtles, any impacts from the Proposed Action or alternatives might combine with impacts from other sources within the range of the population. Therefore, identification of impacts elsewhere in the range of a potentially affected population is appropriate. For terrestrial biological resources, San Clemente Island (SCI) is the appropriate geographical area for assessing cumulative impacts. For all other ocean resources, the ocean ecosystem of the Southern California Bight (SCB) is the appropriate geographic area for analysis

[1] CEQ Regulations provide that the terms "cumulative impacts" and "cumulative effects" are synonymous (40 C.F.R. § 1508.8[b]); the terms are used interchangeably in this document.

of cumulative impacts. The following table identifies the geographic scope of this cumulative impacts analysis, by resource area.

Table 4-1: Geographic Areas for Cumulative Impacts Analysis

Resource	Area for Impacts Analysis
Geology and Soils	SCI
Air Quality	South Coast Air Basin San Diego Air Basin South Central Coast Air Basin
Hazardous Materials and Hazardous Wastes	SCI and SCB
Water Resources	SCI and SCB
Marine Plants and Invertebrates	SCB
Fish	SCB
Sea Turtles	Pacific Range
Marine Mammals	Pacific Range
Seabirds	SCB
Terrestrial Biological Resources	SCI
Cultural Resources	SCI and SCB
Traffic	SCB
Socioeconomics	SCB
Environmental Justice	SCB
Public Safety	SCB

4.1.2 Past, Present, and Reasonably Foreseeable Future Actions

Identifiable present effects of past actions are analyzed, to the extent they may be additive to impacts of the Proposed Action. In general, the Navy need not list or analyze the effects of individual past actions; cumulative impacts analysis appropriately focuses on aggregate effects of past actions. Reasonably foreseeable future actions that may have impacts additive to the effects of the Proposed Action also are to be analyzed.

4.2 ENVIRONMENT POTENTIALLY AFFECTED BY CUMULATIVE IMPACTS

4.2.1 Air Basins

Three air basins, the South Coast Air Basin (SCAB), South Central Coast Air Basin (SCCAB), and San Diego Air Basin (SDAB), are potentially affected by the Proposed Action.

4.2.1.1 South Coast Air Basin

The SCAB comprises Orange County and substantial portions of Los Angeles, Riverside, and San Bernardino Counties, and includes the largest urban area in the western United States. With 15 million inhabitants, the SCAB encompasses 43 percent of California's population, and accounts for 40 percent of all vehicle miles traveled, and one-third of all air pollutants emitted in the state (California Air Resources Board [CARB] 2006). Motor vehicles are the largest category of emission sources of carbon monoxide (CO), nitrogen oxides (NO_x), and reactive organic gases (ROG). A heavy concentration of industrial facilities, several major airports, two major shipping ports, and a dense freeway and surface street network are located in the SCAB.

The SCAB, which includes waters contiguous to SCI, is classified as: a severe nonattainment area for the 8-hour National Ambient Air Quality Standard (NAAQS) for ozone (O_3), a serious nonattainment area for CO, a maintenance area for nitrogen dioxide (NO_2); a serious nonattainment area for particulate matter under 10 microns (PM_{10}), and a nonattainment area for particulate matter under 2.5 microns ($PM_{2.5}$). It should be noted, however, that in its Draft Final 2007 Air Quality Management Plan (AQMP), the South Coast Air Quality Management District (SCAQMD) states it is seeking redesignation as an extreme nonattainment area for the 8-hour NAAQS for O_3 (SCAQMD Air Quality Management District [2007]).

Air quality in surrounding air basins can be affected and even dominated by pollution transported from the SCAB. Offshore winds cause pollution from the SCAB to impact offshore ocean areas, as winds sweep pollutants out over the sea. Further, pollution from the SCAB can impact San Diego when onshore winds blow these pollutants into San Diego. Pollution from the SCAB is also transported over the ocean into Ventura County (i.e., the SCCAB) by wind blowing to the northwest from the SCAB.

4.2.1.2 San Diego Air Basin

The SDAB comprises San Diego County, and encompasses 8 percent of the state's population; with a growth rate of 54 percent since 1981, San Diego is one of the fastest growing areas of the state. SDAB accounts for about 9 percent of vehicle miles driven in California, and includes industrial facilities, an international airport, and a significant seaport. Presently, 7 percent of California's air pollution is generated within the SDAB (CARB 2006).

Air quality in the SDAB is impacted by transport of air pollutants from the SCAB. The quality of the air in SDAB also is impacted by pollution from Tijuana, a city of over 1.2 million inhabitants immediately adjacent to the City of San Diego. For regulatory purposes, the SDAB includes only the County of San Diego, but Tijuana and San Diego in fact lie within the same geographically bounded air basin, and each city's emissions affect both cities.

The SDAB is classified as a basic nonattainment area for the 8-hour ozone NAAQS, and a maintenance area for CO.

4.2.1.3 South Central Coast Air Basin

The SCCAB encompasses Ventura, Santa Barbara, and San Luis Obispo Counties on California's central coast. Four percent of the state's population lives within the SCCAB. Power plants, oil extraction and refining, transportation, and agricultural operations are the major sources of air pollution in the SCCAB. Motor vehicles in the basin account for about 4 percent of vehicle miles driven in California (CARB 2006).

4.2.2 Southern California Bight

The SCB is the ocean area bounded on the north, east, and southeast by a long curve of the California coastline extending from Point Conception in Santa Barbara County, southeast 357 miles (mi.) (578 kilometers [km]) to Cabo Colnett, Baja California, in Mexico. The western border of the SCB is marked by the California Current, which flows southeastward along the coast, continuing the clockwise transport of water in the North Pacific Ocean.

Oceanography

Water current regimes in the SCB are complex and variable on seasonal and longer time scales. In general, because of the eastward indentation of the coast, a surface counterclockwise gyre, the Southern California Eddy, breaks off the California Current and carries water northward through the central SCB (Jones 1971; Hickey 1979). Closer to the shore along the continental shelf, prevailing onshore winds reverse this flow, resulting in a net along-shore surface flow toward the southeast (Lentz and Winant 1979). There is also a very-nearshore circulation pattern caused by surf along the beaches (Jones, 1971). Below about 500 feet (ft), there is a northwestward current flow inshore of the California Current. This water is of equatorial Pacific origin and has higher temperature, salinity, and phosphate concentrations and a lower oxygen concentration than the deep water in the California Current located at the same depth but farther offshore (Jones 1971).

Surface waters in the bight maintain an annual temperature range of 13 degrees Celsius (°C) to 20°C. Temperature drops with increasing water depth to about 4°C in the deeper basins. Dissolved oxygen concentration also tends to decrease with depth.

An important feature throughout the SCB is that deep water is close to shore. The bathymetry underlying the SCB includes an alternating series of 2,000- to 8,000-ft-deep basins and surfacing mountains that form 9 offshore islands or island groups and several large submerged banks and seamounts. Nearshore, 12 large canyons influence movement of sediments and other materials deposited on the bottom. There are also 32 canyons on the continental slope bordering the United States (U.S.) (Emery 1960). Offshore, there are 18 marine basins, 3 of which (Santa Monica, San Pedro, and Santa Barbara) are essentially devoid of oxygen and are virtually devoid of higher life forms. These canyons and deep basins are important sites of accumulation of fine-grained sediments and particulate materials from land runoff, ocean discharges, and ocean dumping.

El Nino

Many environmental changes in the SCB are connected with long-term, low-frequency, inter-annual oceanographic patterns. Displacement of cool surface waters—and their inhabitants—by clear, nutrient-poor warm water is correlated with periodic warm-water events off the coast of Peru and in the tropical Pacific. These are the El Niño events, which occur several times per decade (e.g., 1976, 1979, 1982-84, 1986-87, 1991-92, 1993, 1994, 1997-98, 2002-03, 2006-07 [NOAA 2007]) and are characterized by warm water, a deeper surface-mixed layer, elevated sea levels, increased abundance of southern planktonic and pelagic organisms, alterations of benthic community structure, and degeneration of coastal kelp beds (Jackson, 1986).

Bays and Wetlands

The most important bays in the SCB are Santa Monica Bay, San Pedro Bay, San Diego Bay, and Todos Santos Bay in Baja, California. There are at least 26 wetland systems in coastal lagoons and at the mouths of transient streams and rivers in the U.S. portion of the SCB (Zedler 1982). The total area of these coastal wetlands is only about 129 square miles ($mi.^2$), an estimated 25 percent of the area they encompassed when the first Europeans arrived in Southern California in the late 1500s.

Drainage Basin

The onshore mainland drainage basin of the SCB is bordered on the north by the Santa Monica, San Gabriel, and San Bernardino mountains; and on the east by coastal ranges that continue southward down the length of the Baja Peninsula. Because of the semiarid nature of the drainage basin and the highly seasonal pattern of annual precipitation, most of the rivers draining into the bight are small and are dry for much of the year. From north to south, the major rivers in the drainage basin are the Santa Clara, Los Angeles, San Gabriel, Santa Ana, Santa Margarita, San Luis Rey, San Diego, and Tijuana rivers. Much of the Los Angeles and San Gabriel river beds and other major drainages are lined with concrete.

Fresh water enters the SCB from a variety of sources. Riverine runoff from rain and melting snow is seasonal. Surface and subterranean runoff including storm drain inputs (nonpoint sources), and discharges of wastewater also are transported into the bight. The volumes of water entering the bight from wastewater discharges are comparable to those from riverine and storm drain inputs. Because storm water flow is more variable than wastewater flow, in dry seasons and years wastewater flow far exceeds that of storm water. Wastewater flows are strictly regulated to protect water quality; however, nonpoint source runoff is more difficult to regulate. Such flows may contain chemical contaminants and pathogens.

Habitats and Other Natural Resources

Natural habitats and resources characteristic of the SCB include abundant deep water close to shore, extensive coastal and offshore oil reserves, commercially or recreationally valuable fish and shellfish stocks, wildlife breeding and overwintering areas, kelp beds, beach and water recreation areas, and a temperate climate. These habitats and resources are described in detail in Chapter 3, and are briefly summarized here.

As a result of the local oceanographic regime, particularly the Southern California Eddy, the SCB is an enclave of communities of marine life specific to the area (although diminished during El Niño years). Numerous types of marine mammals are present, including both regional and migratory populations. Four species of sea turtles may be present, at least periodically. Numerous seabirds are present in the bight, and the Channel Islands provide breeding habitat for some species of seabirds. Commercially exploitable stocks of fish spawn and grow primarily in the bight. Deeper waters of the bight host a diversity of mesopelagic fishes that spend parts of their life cycles in surface waters. The benthic fauna of the continental shelf, especially polychaetes and crustaceans, are diverse and constitute an important food source for many fish species. Rocky intertidal and subtidal areas, which cover large areas of the shoreline of the bight, host diverse epifauna (snails, mussels, crabs, etc.) and attached seaweeds.

Beds of the giant kelp *Macrocystis pyrifera*, which attach to the bottom and can grow to over 164 ft in length, extend along the coast of the bight. There are 33 locations in the bight between Point Conception and San Diego where kelp beds are found at least periodically at water depths ranging from 20 to 65 ft. From the 1930s to 1979, individual kelp beds occupied up to 2,720 acres (ac), with the total area occupied by kelp beds in the range of 12,000 to 15,000 ac (Foster and Schiel 1985). The size and distribution of kelp beds varies spatially and temporally in response to changes in natural and anthropogenic conditions. Natural changes in surface water temperature and nutrient concentrations associated with El Niño events, and possibly with longer-term ocean warming trends, have resulted in declining kelp beds in some areas, and winter storms can devastate large kelp beds. These storms probably are the most important factor influencing the condition and extent of kelp beds, but human activities—such as kelp harvests, boat traffic, and possibly wastewater discharges—have also affected local giant kelp beds.

The SCB contains undersea oil deposits. Oil and tar continuously ooze from undersea seeps, periodically creating large marine oil slicks.

Frequent brush fires on land, fed by northeasterly Santa Ana winds, deposit ash and soot onto the sea.

4.2.3 Anthropogenic Activities

4.2.3.1 Fishing

Commercial and recreational fishing constitutes a significant nonmilitary use of the ocean areas of the Southern California (SOCAL) Range Complex. As discussed in Section 3.7, Fish, the California Department of Fish and Game (CDFG) maintains commercial landings statistics for statistical blocks that are 5 degrees latitude by 5 degrees longitude in area (about 81 square nautical miles [nm^2]) for nearshore areas and larger for offshore waters. Commercial landings were obtained for CDFG statistical blocks within the SOCAL Range Complex (Figure 3.7-1). The annual catch of fish and invertebrates in the SOCAL Range Complex from 2002 to 2005 amounted to approximately 64,000 pounds (see Table 3.7-7). In 1993, landings data represented approximately 50 percent of the actual catch, and landings in other years have represented approximately 80 percent or more of the actual catch. Pelagic species account for approximately 97 percent of the average annual catch within the SOCAL Range Complex. Flatfish, demersal fish, and other fish associated with the bottom account for only about 3 percent of the average annual catch of fish. Other commercial fishing targets include crustaceans (lobster and half spot prawns) and squid.

Fishing can adversely affect fish habitat and managed species. Potential impacts of commercial fishing include over-fishing of targeted species and bycatch, both of which negatively affect fish stocks. Mobile fishing gears such as bottom trawls disturb the seafloor and reduce structural complexity. Indirect effects of trawls include increased turbidity, alteration of surface sediment, removal of prey (leading to declines in predator abundance), removal of predators, ghost fishing (i.e., lost fishing gear continuing to ensnare fish and other marine animals), and generation of marine debris. Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats. Recreational fishing also has the potential to affect fish habitats because of the large number of participants and the intense, the concentrated use of specific habitats.

Fishing can have a profound influence on individual populations. In a recent study of retrospective data, Jackson et al. (2001) analyzed paleoecological records of marine sediments from 125,000 years ago to present, archaeological records from 10,000 years before the present, historical documents, and ecological records from scientific literature sources over the past century. Examining this longer term data and information, they concluded that ecological extinction caused by overfishing precedes all other pervasive human disturbance to coastal ecosystems including pollution and anthropogenic climatic change.

Natural stresses include storms and climate-based environmental shifts, such as algal blooms and hypoxia. Disturbance from ship traffic and exposure to biotoxins and anthropogenic contaminants may stress animals, weakening their immune systems, and making them vulnerable to parasites and diseases that would not normally compromise natural activities or be fatal.

4.2.3.2 Commercial and Recreational Marine Traffic

A significant amount of ocean traffic, consisting of both large and small vessels, transits through the SCB. The Port of Los Angeles is the busiest port in the U.S. (by volume of cargo). The Port of Long Beach is the second-busiest U.S. port (Port of Long Beach 2008). Taken together, these two ports (which are contiguous) would constitute the fifth-busiest port in the world. The Port of San Diego also is an important commercial cargo port. Cruise ships make daily use of these port facilities. In 2007, San Diego recorded 235 cruise ship calls while Los Angeles recorded 2,730 (Port of San Diego 2007; Port of Los Angeles 2008). For commercial vessels, the major trans-oceanic routes to the southwest pass north and south of SCI (Figure 3.13-2). The approach and departure routes into San Diego and the ports of Los Angeles-Long Beach pass between SCI and Santa Catalina Island.

Commercial vessels are sources of pollutants introduced into the waters and air basin of the SCB. Additionally, commercial vessels are a source of ship strikes on marine mammals, and are implicated, for example, in the deaths of three blue whales in the Santa Barbara Channel in September 2007 (Chawkins 2007). (Information about ship strikes and other marine mammal stranding events, and about introduction of pollutants into the bight, is provided below).

A very substantial volume of small craft traffic, primarily recreational, occurs throughout Southern California. The region's estimated 40,000 recreational boats are concentrated primarily in marinas on Santa Monica Bay, Alamitos Bay, Long Beach Marina, Huntington Harbor, Balboa-Newport Harbors, San Diego Bay, and Mission Bay; and secondarily in marinas at Oceanside and Dana Point, and in Oxnard, Ventura, and Santa Barbara. Because pleasure boats are sources of fuel leaks and toxins from antifouling paints, they constitute a potential environmental concern that has not been quantified. (Information about pollutants and hazardous wastes introduced into the SCB is provided below).

4.2.3.3 Oil Extraction

Oil extraction has occurred for eight decades offshore of the coast near Goleta, Carpinteria, Ventura, Oxnard, Santa Monica, Redondo Beach, Wilmington, San Pedro, Long Beach, Seal Beach, and Huntington Beach. Offshore oil extraction from shore-based facilities began near the turn of the century along the Santa Barbara Channel and slightly later in southern Los Angeles and Orange counties. Oil production from offshore platforms began 35 years ago on nearby shelves (1 to 3 mi. from shore) and now extends nearly to the shelf break. An extensive shore-based infrastructure exists to support offshore oil production activities, including pipelines, refineries, and oil terminals.

Seventy-nine offshore oil production leases occupying a total of about 400,000 acres are active in the Santa Barbara Channel/Santa Maria Basin area. California has a long-standing moratorium on new oil drilling platforms within the state’s 3-mi. jurisdictional limit. A Federal moratorium on new oil drilling platforms expired on September 30, 2008 to open oil and gas development off all of the nation’s coastlines (Hulse and Pear 2008). Within Federal waters offshore of Southern California lie 36 undeveloped Federal oil leases. Developing these leases could result in several new oil platforms off of the coast. No specific proposals for new oil platforms are now under consideration.

Oil extraction carries risks of accidental oil spills. In 1969, an industrial accident (pressurized “blowout”) on an offshore oil rig caused 3 million gallons of oil to be discharged into the Santa Barbara Channel. Long-term environmental impacts of this event have dissipated.

Natural seeps along the coasts of Santa Barbara, Ventura, Los Angeles, and Orange Counties intermittently or continuously discharge large quantities of oil and tar to nearshore waters of the SCB. Fischer (1978) estimated that as few as 2,000 and as many as 30,000 metric tons (10 million gallons) of oil enter the Santa Barbara Channel each year from natural seeps. (By comparison, the 1989 Exxon Valdez oil spill in Prince William Sound, Alaska, leaked 11 million gallons of oil into marine waters.) The intertidal zone at Goleta is chronically contaminated with oil and tar from this seep. One hundred years ago, the U.S. Fish Commission steamer, *Albatross* dispatched an observer to report on a huge fish kill extending from Santa Barbara to San Diego. He counted thousands of pelagic and demersal fish on the Santa Monica Bay beaches, many of them smelling of petroleum, and suggested that the event was caused by seepage from offshore “oil springs” (Eichbaum et al. 1990).

4.2.3.4 Liquefied Natural Gas Terminals

Liquefied Natural Gas (LNG) facilities have been proposed at several locations on the Pacific coast of North America in recent years in response to the quickly escalating domestic demand for this fuel. Sites under consideration range from British Columbia to Mexico, with at least six locations under consideration within the SCB (see Table 4-2).

Potential environmental impacts include those associated with additional ship traffic generally, and potential releases of LNG. Releases of LNG can result from equipment leaks or spills during operations. Releases can be accidental (e.g., ship collision), or intentional (i.e., from sabotage or terrorist acts). Most accident scenarios are complex or multistage events with cascading impacts: for example, a spill followed by a pool fire, or a leak followed by a vapor cloud ignition. The rate at which the LNG is released, total size of the release, wind speed and direction, and location of the nearest ignition source are all important factors in determining the consequences of the release.

Table 4-2: Liquefied Natural Gas Projects and Proposals

SCB LNG Projects and Proposals[a]	
Proposed LNG Terminals	**Location**
Cabrillo Deepwater Port LNG Facility	Offshore Ventura County
Clearwater Port LNG Project	Offshore Ventura County
Long Beach LNG Facility	Long Beach Harbor
Ocean Way LNG Terminal	Offshore Long Beach
Esperanza Energy LLC	Offshore Long Beach
Terminal GNL Mar Adento de Baja	Offshore Tijuana, Mexico
Moss Maritime LNG	Offshore Rosarito, Mexico

Notes: (a) Excerpted from CA Energy Commission: http://www.energy.ca.gov/lng/projects.html

4.2.3.5 Ocean Pollution

Environmental contaminants in the form of waste materials, sewage, and toxins are present in, and continue to be released into, the oceans off Southern California. Polluted runoff, or nonpoint source pollution, is considered the major cause of impairment of California's ocean waters. Storm water runoff from coastal urban areas and beaches carries waste such as plastics and Styrofoam into coastal waters. Sewer outfalls also are a source of ocean pollution in Southern California. Sewage can be treated to eliminate potentially harmful releases of contaminants; however, releases of untreated sewage occur due to infrastructure malfunctions, resulting in releases of bacteria usually associated with feces, such as *Escerichia coli* and *enterococci*. Bacteria levels are used routinely to determine the quality of water at recreational beaches, and as indicators of the possible presence of other harmful microorganisms.

In the past, toxic chemicals have been released into sewer systems in Southern California. While such dumping has long been forbidden by law, the practice left ocean outflow sites contaminated. In a 1994 report, the U.S. Geological Survey identified elevated levels of dichloro-diphenyl-trichloroethane (DDT) and polychlorinated biphenyls (PCBs), both classified as persistent organic pollutants, in a 17-square-mile area of ocean near Palos Verdes, south of Santa Monica Bay. Sewage treatment facilities generally do not treat or remove persistent organic pollutants. Plastic and Styrofoam waste in the ocean chemically attracts hydrocarbon pollutants such as PCBs and DDT, which accumulate up to 1 million times more in plastic than in ocean water. Fish, other marine animals, and birds consume these wastes containing elevated levels of toxins. DDT mimics estrogen in its effects on some animals, possibly causing the development of female characteristics in male hornyhead turbots and English sole, according to a study by the Southern California Coastal Water Research Project. The California Office of Environmental Health Hazard Assessment currently has consumption warnings for several species including white croaker, corbina, sculpin, rock fish, and kelp bass, primarily due to concerns about DDT and PCBs in the Southern California region.

Regulatory activities have made progress in reducing both nonpoint source pollution such as runoff, and point source pollution such as that which may emanate from sewer outfall sites. In 2000, California received Federal approval of its Coastal Nonpoint Source Pollution Control Program from the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) (the agencies that administer the Clean Water Act [CWA] and Coastal Zone Management Act [CZMA], respectively). The program includes the coordinated participation of the California Coastal Commission (CCC), the State Water Resources Control Board (SWRCB), and the Regional Water Quality Control Boards (RWQCBs). The current plan covers the years 2003 to 2008.

Pollution from vessels is a source of ocean contamination. Sewage, sludge, black water, grey water, bilge water, plastics, and other trash components and waste materials are routinely discharged from vessels into coastal and ocean waters in Southern California. In 2003, the California Legislature passed legislation (Assembly Bills [AB] 121 and 906), which prohibits certain waste discharges from large passenger vessels (cruise ships) into state waters.

4.2.3.6 Coastal Development

Coastal development intensifies use of coastal resources, resulting in potential impacts on water quality, wildlife and fish habitat, air quality, and intensity of land and ocean use. Coastal development is therefore closely regulated in California. (See Section 6.1.1 for a detailed discussion of regulation of activities in the coastal zone.) New development in the coastal zone may require a permit from the California Coastal Commission, or a local government to which permitting authority has been delegated by the Coastal Commission. A Coastal Development Permit is generally required for any project in the coastal zone that includes:

- The placement of any solid material or structure;
- A change in land use density or intensity (including any land division);
- Change in the intensity of water use or access to water; or
- Removal of major vegetation.

Some types of development are exempt from coastal permitting requirements, including in many cases, repairs and improvements to single-family homes, certain "temporary events," and, under specified conditions, replacement of structures destroyed by natural disaster.

Local Coastal Programs (LCPs) identify the locations, types, densities and other ground rules for future development in the coastal-zone portions of the 73 cities and counties along the coast. Each LCP includes a land use plan and its implementing measures (e.g., zoning ordinances). Prepared by local government and approved by the Coastal Commission, these programs govern decisions that affect the conservation and use of coastal resources. While each LCP reflects the unique characteristics of individual local coastal communities, regional and statewide concerns must also be addressed in conformity with the goals and policies of the State Coastal Act.

LCPs are basic planning tools used by local governments to guide development in the coastal zone, in partnership with the Coastal Commission. LCPs contain the ground rules for future development and protection of coastal resources in the 73 coastal cities and counties, including Los Angeles, Orange, and San Diego counties. The LCPs specify appropriate location, type, and scale of new or changed uses of land and water. Each LCP includes a land use plan and measures to implement the plan (such as zoning ordinances). Following adoption by a city council or county board of supervisors, an LCP is submitted to the Coastal Commission for review for consistency with Coastal Act requirements.

Coastal development in Southern California is both intensive and extensive, and the coast adjacent to the SOCAL Range Complex is densely populated. This development has impacted and continues to impact coastal resources in the SOCAL Range Complex EIS Study Area including through point source and nonpoint source pollution; intensive boating and other recreational use; intensive commercial and recreational sport fishing; intensive ship traffic using major port facilities at Los Angeles, Long Beach, and San Diego; and offshore oil and gas facilities (both existing and proposed). Regulation of these activities through the Coastal Development programs discussed above serves primarily to limit new development; however, the coastal zone is already fully developed in many areas, with associated ongoing impacts.

4.2.3.7 Scientific Research

There are currently 30 scientific research permits and General Authorizations for research issued by the National Marine Fisheries Service (NMFS) for cetacean work in the wild in the North Pacific. The most invasive research involves tagging or biopsy while the remainder focuses on vessel and aerial surveys and close approach for photo-identification. Species covered by these permits and authorizations include small odontocetes, sperm whales, and large mysticetes. One permit issued to the Office of Protected Resources of NMFS allows for responses to strandings and entanglements of listed marine mammals. NMFS has also issued General Authorizations for commercial photography of nonlisted marine mammals, provided that the activity does not rise to Level A harassment of the animals. These authorizations are usually issued for no more than 1 or 2 years, depending on the project.

The impacts of this type of research are largely unmeasured. However, given the analysis and scrutiny given to permit applications, it is assumed that any adverse effects are largely transitory (e.g., inadvertent harassment, biopsy effects, etc.). Data to assess population level effects from research are not currently available, and even if data were available it is uncertain that research effects could be separately identified from other adverse effects on cetacean populations in Southern California waters.

4.2.3.8 Commercial and General Aviation

Southern California is served by several large commercial airports. Los Angeles International (LAX), Long Beach International (Long Beach), John Wayne International (Santa Ana), and Lindbergh Field (San Diego) are situated on or near the coastline, while Los Angeles/Ontario International Airport is situated in San Bernardino County, approximately 50 miles west of LAX. The following airport traffic statistics, developed by Airports Council International (ACI 2006), provide data on “total movements” (landing plus takeoff of one aircraft equals a “movement”) at these five airports:

Table 4-3: Landings / Takeoffs (Total Movements) at Five Regional Airports, 2006

Airport	Total Movements (2006)	National Rank	% Increase over 2005
LAX	656,842	4	1%
Long Beach	369,738	24	4.7%
Santa Ana	347,194	27	(0.8%)
San Diego	220,839	52	0.3%
Ontario	136,261	85	4.9%

The City of San Diego operates two general aviation airports: Montgomery Field, located in northeastern San Diego, and Brown Field, located in southern San Diego near the border with Mexico. San Diego County operates eight general aviation airports. Two general aviation airports are located in Orange County. Los Angeles County operates numerous general aviation airports, including the airport at Avalon, Santa Catalina Island. Numerous municipal landing fields are located in the region.

Aircraft operating under visual flight rules (VFR) can fly along the coast between San Diego and Orange County and out to Santa Catalina Island largely unconstrained, except by safety requirements and mandated traffic flow requirements. Aircraft operating under Instrument Flight Rules (IFR) clearances, authorized by the Federal Aviation Administration (FAA), normally fly on the airway route structures. In Southern California these routes include both high- and low-altitude routes between San Diego and Los Angeles and to Santa Catalina Island. There are two

Control Area Extensions (CAE) from Southern California through or nearby Warning Area (W)-291 to facilitate access to the airways to Hawaii and other trans-Pacific locations. CAE 1177 extends from Santa Catalina Island southwest between W-291 and the Pt. Mugu Sea Range. CAE 1156 extends west from San Diego through the northern portion of W-291. When W-291 is active, CAE 1156 is normally closed. CAE 1177, the more important route through the coastal warning areas, is closed only when weapons hazard patterns extend into the area, and this closure is fully coordinated with the FAA. When W-291 is active, aircraft on IFR clearances are precluded from entering W-291 by the FAA. However, since W-291 is located entirely over international waters, nonparticipating aircraft operating under VFR are not prohibited from entering the area. Examples of aircraft flights of this nature include light aircraft, fish spotters, and whale watchers.

4.2.3.9 Air Quality Factors

In their emission inventories by category (CARB 2000) for 2004 and 2020, the SCAB, SDAB, and the SCCAB include emissions from aircraft, ships, and commercial boats. Emission estimates are based on emissions from onshore or nearshore operations (for example, operations within Los Angeles Harbor for ship emissions). These emissions would account for a small percentage of the overall air emissions budgets for each of the air basins. These emissions are generally not included in the State Implementation Plan (SIP) emissions budget and in air quality planning because they are assumed to have a negligible effect on the ambient air quality, and because reductions in emissions from these sources would not generate a great improvement in the ambient air quality.

4.2.4 San Clemente Island

SCI is the southernmost of the eight California Channel Islands. It lies 55 nm south of Long Beach and 68 nm west of San Diego. The island is approximately 21 nautical miles (nm) long and is 4.5 nm across at its widest point. Since 1934, the island has been owned and operated by the U.S. Navy as a training site, by Presidential Executive Order. Presently, and for the foreseeable future, only activities in support of military training are or will be permitted to occur on SCI. Impacts from these activities generally are confined to the island and its immediate nearshore vicinity. Table 4-4 identifies past and present projects undertaken by the Navy at SCI. These activities are addressed, as appropriate in separate environmental analyses, and impacts from these activities generally are temporary and localized.

Table 4-4: Past, Present, and Planned Projects Associated with San Clemente Island

Number	Project Title	Description
1	Southern California Anti-Submarine Warfare Range (SOAR) Cable Refurbishment	Refurbishment of underwater cable arrays and associated range equipment at SOAR involving the installation of hydrophones, array cables, and associated hardware within the existing coverage of the range. The area of SOAR proposed under this activity is located off of West Cove, in the northwestern portion of SCI. The offshore area proposed for range refurbishment extends seaward from West Cove.
2	Wilson Cove Moorings	Installation of 3 Class "E" 50,000 lb moors, and four 9,000 12,000 lb moors, removal of an existing moor at Wilson Cove at SCI, and repair of two existing moors.
3	Commercial Cell Towers Installation	Construction of three cell towers on SCI has been completed.
4	Waste Water Treatment Plant Upgrades	Construction of an effluent outfall extension to an existing Waste Water Treatment Plant and discharge pipe to allow for an increase in capacity and increase in permit requirements.
5	Tomahawk Missile Launch Facility	Construction of an underwater launch facility for the launch of Tomahawk cruise missiles (one per year) on flight tracks over the Point Mugu Sea Range near Naval Ordnance Test Station (NOTS) Pier at SCI. The missiles would be recovered after landing by parachute on San Nicolas Island.
6	P-763 Military Operations on Urban Terrain (MOUT) Facility	Construction of building shells for a variety of building types from residential to business to industrial for urban special operations training at SCI.
7	P-740 Bachelors Quarters	Construction of two 45-unit bachelors quarters buildings (MILCON Projects P740 and P471) and demolition of five bachelor quarters existing buildings (60111, 60116, 60121, 60133, and 60153) at SCI.
8	P- 493 Ridge Road	Road improvements phased over 5 years consisting of resurfacing and widening, construction of an extended Assault Vehicle Maneuver Road, and quarrying and laydown area to provide materials for and facilitate road projects.
9	SCI Runway Upgrades	Repair of runway, taxiway, and parking apron and provision of various lighting and electrical repairs to support safe aircraft operations at the NALF at SCI.
10	Various Maintenance Projects	Maintenance projects such as hangar door replacement, concrete replacement, exterior painting of buildings, and replacement of lighting fixtures.
11	Live-Fire Training Areas and MOUT Facility	Development of three live-fire training areas on SCI and the construction of a MOUT facility. Training activities include direct action, live-fire over-the-beach tactical training, small arms firing, and land demolition.
12	Tomahawk Land Attack Missile Testing in the SCI Missile Impact Range (MIR)	Testing of live and inert warheads at the MIR and the use of an underwater translator launch site for missiles off the eastern side of SCI.
13	Joint Standoff Weapon (JSOW)	Live-fire testing (scheduled from 1996 to 2007) for the JSOW program at the SCI MIR. The JSOW is launched from an aircraft.
14	Land Attack Standard Missile (LASM)	Inert testing of LASM launched from ships positioned 75 nm west of SCI with missile termination at the MIR. Testing involved four non live-fire launches and was completed in 2000.

Table 4-4: Past, Present, and Planned Projects Associated with San Clemente Island (continued)

Number	Project Title	Description
15	Distributed Explosive Technology (DET)	One-time operational test of DET (used to clear bottom-laid and submerged mines) in littoral waters in Horse Beach Cove off of SCI.
16	Surface Ship Radiated Noise Measurement (SSRNM) Array	Installation of hydrophone array with tri-moor configuration 5,000 yards off eastern shore of SCI, for use in measuring sound from transiting ships.
17	Modular Housing	Construction of two single-story modular buildings to be used as temporary military housing.
18	Unmanned Aerial Vehicle (UAV) Infrastructure Construction	Construction of three buildings (60,000 square feet [sf]), water and fuel storage facilities, and road improvements for use as UAV training center.
19	Storage Facility Construction	Construction of storage facility near North Light pier.
20	Antennae Installation	Install antennae and construct associated small shelter near airfield.
21	Building Demolition	Demolish 17 structures at Wilson Cove (site preparation for boat facility construction).
22	Boat Facility Construction	Construct boat maintenance facility and boat storage facility (two structures) at Wilson Cove
23	Missile Launches	Two launches at VC-3, proposed to occur in the July to October 2007 timeframe. The missile booster impact would occur at the MIR. The missile would then fly preplanned waypoints over the island at an altitude of approximately 330 ft (91 meters [m]) above ground level and over the ocean and then return and impact into the MIR. It is estimated that the first and second missile launches would fly over the ocean at a distance of 21 mi. (18 nm) and 31 mi. (27 nm), respectively, from the SCI shoreline.
24	Deployable Surveillance Group Project X (DSG-X)	Environmental Assessment/Finding of No Significant Impact (EA/FONSI) just completed; testing will occur Sep 2008 through May 2009.
25	P-885 Renovate NOTS Pier	Project will repair problem with mooring hardware due to deck height being too high.

4.2.5 Habitats of Migratory Marine Animals

Migratory or wide-ranging marine mammals and sea turtles that may be present in the SOCAL Range Complex may be affected by natural events and anthropogenic activities that occur in areas far removed from Southern California, on breeding grounds, migration routes, wintering areas, or other habitats within a species' range. Events and activities that affect the habitats of these marine species outside the SCB/SOCAL Range Complex include:

- Disease
- Natural toxins
- Weather and climatic influences
- Navigation errors
- Natural predation
- Fishing

- Hunting (including sea turtle egg predation)
- Ocean pollution
- Habitat modification or destruction
- Ship traffic

These stressors on marine habitats and associated effects on sea turtles and marine mammals are discussed in detail in Sections 4.3.8 and 4.3.9, below.

4.2.6 Neighboring Military Ranges

The SOCAL Range Complex is located adjacent to three military test and training areas; the Naval Air Warfare Center Weapons Division (NAWCWPNS) Point Mugu Sea Range, Marine Corps Base (MCB) Camp Pendleton, and Silver Strand Training Complex (SSTC). While these areas are geographically distinct, it is possible for cumulative impacts to occur for some resources due to the mobile nature of certain resources. Resources with the potential for cumulative impacts associated with neighboring ranges include air quality, water quality, fish, sea turtles, marine mammals, and seabirds.

4.2.6.1 Naval Air Warfare Center Weapons Division Point Mugu Sea Range

Activities at the Point Mugu Sea Range primarily focus on tests to evaluate sea, land, and air weapons systems. In addition to these tests, training at the Point Mugu Sea Range is limited to eight training exercises per year: two Fleet exercises, four small scale amphibious warfare exercises, and two special warfare exercises. Although limited, all sonar operations occurring in the Point Mugu Sea Range are evaluated in this EIS/OEIS; therefore, the cumulative effects of sonar operations are also addressed for the Point Mugu Sea Range and the SOCAL Range Complex.

4.2.6.2 Marine Corps Base Camp Pendleton

This EIS/OEIS includes offshore training activities associated with MCB Camp Pendleton in the Camp Pendleton Amphibious Assault Area (CPAAA) and Camp Pendleton Amphibious Vehicle Training Area (CPAVA); therefore, analysis of cumulative impacts associated with Camp Pendleton is not necessary.

4.2.6.3 Silver Strand Training Complex

The Navy conducts training in the SSTC which is adjacent to the SOCAL Range Complex near the cities of Coronado and Imperial Beach. An EIS has been started to assess the impacts of the training at the SSTC; however, analysis is not complete and it has not been released as a draft document. Due to the fact that we are not sure of the impacts of Navy training at SSTC it is difficult to assess the cumulative effects in detail. In general, training at SSTC does not use as much ordnance as training conducted in the SOCAL Range Complex. This is due in part to the fact that the SSTC is in close proximity to urbanized areas. Furthermore, while some species could occur in both the SSTC and the SOCAL Range Complex, many species would not occur in both locations due to the fact that many species do not enter the waters close to shore, primarily due to habitat differences. Some species of fish and small marine mammals, such as dolphins, could occur in both complexes but it is not expected that there will be impacts to these species as analysis of proposed actions in both EISs indicate no significant impact to marine species, and because very little mixing of species or populations from one range complex to another is expected, cumulative impacts would be negligible. For example coastal bottlenose dolphins are a near shore species (only found within 0.5 nm of the Southern California mainland shore) and are unlikely to travel through both the near shore SSTC and offshore SOCAL areas. California sea lions breed and forage around the California offshore islands within the SOCAL Range Complex but only a few individuals would briefly transit through the near shore SSTC area.

4.3 CUMULATIVE IMPACT ANALYSIS

4.3.1 Geology and Soils

Cumulative impacts on terrestrial SCI geology and soils would consist of the effects of the Proposed Action in concert with other Navy actions that disturbed surface soils, such as new construction (see Table 4-4, above). New or expanded training activities that would increase foot traffic could trample and eliminate vegetation and compact surface soils, which in turn could increase surface runoff during rain storms. New construction could remove ground cover, disturb surface soils, alter surface drainage patterns, and, by increasing the ground coverage of impervious surfaces, increase the volume of surface water flows during storms.

While each new activity or construction project on SCI could contribute locally and incrementally to increased runoff and erosion, the cumulative effects would be negligible. Construction projects would include drainage improvements, road improvements, and revegetation of exposed soils, and impacts would predominantly occur in areas of existing development. In addition, Best Management Practices (BMPs) for soil-disturbing activities would be implemented for any construction activity. Foot traffic would be directed to existing roads and trails to the extent practicable.

4.3.2 Air Quality

Activities affecting air quality in the region include, but are not limited to, mobile sources such as automobiles and aircraft, and stationary sources such as power generating stations, manufacturing operations and other industry, and the like. In CARB emission inventories by category (CARB 2000) for 2004 and 2020, the SCAB, SDAB, and SCCAB include emissions from aircraft, ships, and commercial boats. These emissions are included in the mobile source category. Traditionally, the emission estimates are based on emissions from onshore or nearshore operations (e.g., operations within Los Angeles Harbor for ship emissions). Emission estimates for these sources are summarized in Table 4-5.

These emissions would account for a small percentage of the overall air emissions budgets for each of the air basins. They do not include marine vessel emissions for vessels operating outside of U.S. territorial waters. These emissions are generally not included in the SIP emissions budget and in air quality planning because they are assumed to have a negligible effect on the ambient air quality, and because reductions in emissions from these sources would not generate a great improvement in the ambient air quality.

The trends in Southern California in all three of the air basins onshore indicate that air quality is improving. In 2005, the SCAB measured exceedances of the ozone, PM_{10}, and/or $PM_{2.5}$ NAAQS on a total of 89 days at one or more monitoring locations. This compares to 128 days in 2003 and 94 days in 2004. Despite substantial improvement in air quality over the past few decades, some areas in the SCAB still exceed the NAAQS for ozone more frequently than any other area in the United States. In the SDAB there has been a decrease from a high of 88 exceedances of the 1-hour NAAQS for ozone in 1980 to a total of 7 exceedances of the new 8-hour NAAQS for ozone basinwide in 2007. In the SCCAB, only Ventura County is classified as a nonattainment area for the 8-hour NAAQS for ozone, and the number of exceedances in the SCCAB has decreased from 85 in 1981 to 6 in 2007. These trends indicate that progress is being made toward attainment of the NAAQS for ozone without imposing emission limitations on offshore emissions from ships and aircraft. Accordingly, cumulative impacts on air quality would be less than significant.

Table 4-5: Emissions Estimates for Aircraft and Marine Vessels (CARB 2000)

	South Central Coast		South Coast		San Diego	
	2004	2020	2004	2020	2004	2020
Aircraft						
ROG	2	2	8	9	3	3
CO	16	18	56	76	20	21
NOx	1	1	16	28	5	6
PM_{10}	<1	<1	1	1	2	2
Marine Vessels						
ROG	5	2	39	19	10	5
CO	23	19	192	166	72	67
NOx	4	4	57	87	7	7
PM_{10}	1	1	6	9	1	2

Units: Tons per day
Source: California Air Resource Board, Air Emissions Inventories, Emissions by Category, 2004 and 2020. www.arb.ca.gov.

4.3.3 Hazardous Materials and Wastes

The primary impact of cumulative hazardous materials use in the SOCAL Range Complex would be to increase the amounts of hazardous constituents that are released to the environment. Hazardous materials settling out of the water column would contribute to contamination of ocean bottom sediments. Relevant activities would include releases of hazardous constituents from fishing vessels, other ocean vessels, wastewater treatment plant outfalls, and nonpoint source pollution from terrestrial sources. The effects of these activities in the SOCAL Range Complex are known only in a very general sense.

Commercial ocean industries, such as fishing and ocean transport, are dispersed over broad areas of the ocean. Discharges of hazardous constituents from nonpoint source runoff and treatment plant outfalls mostly affect the waters within 3 nm of the coast, whereas most of the Navy activities occur beyond the 12 nm limit of Federal waters. The quantities of contaminants released, however, would be cumulatively insignificant relative to the volume of the water and the area of bottom sediments affected. The use of hazardous materials by the Navy under the Proposed Action, when added to that of other projects, would not significantly impact resources in the SOCAL Range Complex.

The primary impact of hazardous materials on SCI would be to contribute contaminants to surface soils and to surface runoff into the ocean. Construction projects and maintenance activities on SCI beyond those included in the Proposed Action could also contribute minor amounts of hazardous contaminants to surface soils. The contributions of these other projects would be very minor, however, in comparison to the effects of the training and testing activities. Thus, the cumulative impacts would be substantially the same as the impacts described for the Proposed Action.

The primary impact of increased hazardous waste generation resulting from the Proposed Action would be a need for increased hazardous waste storage, transport, and disposal ashore. Other offshore and SCI Navy activities would also contribute to the Navy's overall hazardous waste streams. The Navy's hazardous waste management system and procedures are adequate to accommodate these increases. Other hazardous waste generators in the region, along with the Navy, would require the services of hazardous waste transporters and treatment, storage, and disposal facilities. While the costs for hazardous waste transport, treatment, storage, and disposal could increase substantially in response to increased cumulative demand, the hazardous waste management industry in the region has sufficient physical capacity to respond to this increased demand. Accordingly, cumulative impacts on hazardous waste management would be less than significant.

4.3.4 Water Resources

The Proposed Action would release water pollutants to the marine environment. It also would release chemical contaminants to surface soils; these contaminants could migrate into groundwater aquifers or via surface flows to the marine environment. These effects of the Proposed Action, however, have been determined not to be significant.

The Proposed Action would affect marine geology and sediments in the SOCAL Range Complex chiefly by depositing training debris on bottom sediments and disturbing previously disturbed surface soils in existing training areas on SCI. In Chapter 3, these effects were determined to be less than significant in the context of the existing environment.

Cumulative impacts on marine geology and sediments would consist of the effects of the Proposed Action in concert with other projects, actions, and processes that deposit sediment or debris, or disturb ocean bottom sediments. Relevant effects would include debris contributions from recreational and commercial fishing, offshore oil and gas development, dredging and sand replenishment projects, and other ocean industries. The effects of these activities on the geology and soils within the SOCAL Range Complex are known only in a very general sense.

Commercial ocean industries, such as fishing, are dispersed over broad areas of the ocean, as are the effects of the Proposed Action. Dredging mostly occurs in nearshore areas, whereas most of the Navy training takes place in remote areas of the open ocean. No major offshore oil and gas or LNG facilities are located in the SOCAL Range Complex, and no permit applications for such facilities are under consideration by state or Federal agencies. Cumulative development projects along the Southern California coast would contribute to increased rates of sediment discharge into nearshore waters, but no substantial changes in bottom contours or sediment deposits are expected. In summary, cumulative effects on marine geology and sediments in the open-ocean portions of the SOCAL Range Complex are less than significant.

SCI's nearshore ocean bottom sediments would be disturbed by projects such as the SOAR Cable Refurbishment, Shallow Water Training Range (SWTR) installation, new moorings at Wilson Cove, and an underwater missile launch facility, in addition to the effects of the Proposed Action. These areas would soon be returned to their previous condition by wave action and currents, but the new structures would permanently alter the bottom topography. The new structures would occupy very small portions of the nearshore ocean bottom. The cumulative impact of these projects, in conjunction with the Proposed Action, would be insignificant.

Cumulative impacts on terrestrial SCI water quality would consist of the effects of the Proposed Action in conjunction with other Navy on-island actions that contributed contaminants to surface soils. On-island maintenance activities would involve the use of potential water pollutants, but facilities and procedures in compliance with Federal and state regulations would limit the release of such contaminants to *de minimis* amounts. New construction similarly would require the use and application of potential water pollutants, but construction procedures in compliance with Federal and state regulations would limit any releases of contaminants. A proposed increase in the capacity (and thus discharge volume) of SCI's wastewater treatment plant would require a discharge permit; the permitting process would assure that ocean water quality objectives would continue to be met. Overall, the cumulative effects would be similar to the effects anticipated for the Proposed Action, and would be less than significant.

4.3.5 Acoustic Environment (Airborne)

The Proposed Action activities in the SOCAL Range Complex were deemed to have insignificant effects on the marine (airborne) noise environment, due in large part to the absence of human sensitive receptors on these sea ranges. Commercial ship and aircraft traffic, oil and gas development, and recreational activities all would contribute occasional, short-term noise to small portions of the ocean operating area of the SOCAL Range Complex. The airborne noises they generate would consist chiefly of short-term intrusive noise events in different locations at different times, similar to those of the Proposed Action. Thus, little or no overlap in location or time of discrete noise events would be expected. Peak and average community noise levels would remain largely unchanged. Additionally, human noise receptors would still be absent. Accordingly, cumulative impacts on the marine noise environment would be less than significant.

Cumulative noise sources on SCI would include range operations, training, and maintenance activities not included in the Proposed Action, along with numerous planned construction projects. Noise from these activities generally would consist of short-term, intrusive noise events in different locations. Because these activities would occur relatively near to each other, some potential exists for an additive effect and a modest increase in average hourly noise levels during the day. The only noise-sensitive receptors, however, would be military personnel and their civilian contractors; members of the general public would not be exposed to this cumulative noise environment.

The noise-sensitive receptors most likely to be exposed to cumulative noise from on-island and nearshore Navy activities would be fishermen, fishing and dive charters, and other commercial and recreational vessels in the nearshore waters around SCI. While these individuals could be exposed to high noise levels from naval training activities, especially the use of live ordnance on SCI, they generally would not be exposed to high noise levels from on-island construction projects. Both distance attenuation and topographic shielding generally would substantially reduce the noise level between its source and the closest receptors. Projects such as the SOAR Cable Refurbishment, new moorings at Wilson Cove, and an underwater missile launch facility would generate very little atmospheric noise, and any construction noise would be short in duration. Thus, the cumulative noise environment would be similar to that for the Proposed Action alone, which has been determined to have less than significant impacts.

Proposed upgrades of SCI's NALF would increase total air operations, expanding the +65-decibel noise contour over portions of the ocean. The increase would be modest and the affected area would be small, however, and the exposure of any one vessel to aircraft noise while traversing the area would be short. In addition, little or no overlap between aircraft noise from NALF and noise from noise-intensive training activities such as ordnance delivery would occur, however, because the air field is located on the northern end of SCI and these noise-intensive training activities are concentrated in the Shore Bombardment Area (SHOBA) on the southern end of the island.

In the area of airborne sound, the primary impacts of proposed Navy activities are geographically isolated from population centers and otherwise will not affect natural resources. There would be no significant cumulative impact from these proposed activities.

4.3.6 Marine Plants and Invertebrates

Potential cumulative impacts on marine plants and invertebrates in the SOCAL Range Complex include releases of chemicals into the ocean, introduction of debris into the water column and onto the seafloor, and mortality and injury of marine organisms near the detonation or impact point of ordnance or explosives. The presence of persistent organic compounds such as DDT and PCBs are of particular concern. In light of these concerns, Navy activities would have small or negligible potential impacts. There would be no long-term changes to species abundance or diversity, no loss or degradation of sensitive habitats, and no effects to threatened and endangered species. None of the potential impacts would affect the sustainability of resources, the regional ecosystem, or the human community.

4.3.7 Fish

Potential cumulative impacts of Navy training exercises include release of chemicals into the ocean, introduction of debris into the water column and onto the seafloor, mortality and injury of marine organisms near the detonation or impact point of ordnance or explosives, and, physical and acoustic impacts of vessel activity. The overall effect on fish stocks would be negligible additions to impacts of commercial and recreational fishing in the SOCAL Range Complex.

Due to the wide geographic separation of most of the operations, Navy activities would have small or negligible potential impact, and their potential impacts are not additive or synergistic. Relatively small numbers of fish would be killed by shock waves from mines, inert bombs, and intact missiles and targets hitting the water surface. These and several other types of activities common to many exercises or tests have less-than-significant effects on fish: aircraft, missile, and target overflights; muzzle blast from 5-inch naval guns; releases of munitions constituents; falling debris and small arms rounds; entanglement in military-related debris; and chaff and flares. There would be no long-term changes in species abundance or diversity, no loss or degradation of sensitive habitats, and no effects to threatened and endangered species. None of the potential impacts would affect Essential Fish Habitat (EFH), sustainability of resources, the regional ecosystem, or the human community.

4.3.8 Sea Turtles

Four species of sea turtles—leatherback, loggerhead, olive ridley, and green—occur in the SOCAL Range Complex. Each of these species is globally distributed, and each is listed as threatened or endangered.

4.3.8.1 Distribution and Conservation Status

Olive ridley turtles are globally distributed in the tropical regions of the South Atlantic, Pacific, and Indian oceans. In the South Atlantic Ocean, they are found along the Atlantic coasts of West Africa and South America. In the Eastern Pacific, they occur from Southern California to Northern Chile. Olive ridleys often migrate great distances between feeding and breeding grounds. In two separate satellite telemetry studies, both male and female olive ridleys leaving the breeding and nesting grounds off the Pacific coast of Costa Rica migrated out to the deep waters of the Pacific Ocean. Both sexes migrated to waters deeper than 9,800 ft (3,000 m). The results did not indicate a directed migration to a specific foraging area; instead it appears the olive ridley forages opportunistically in deep ocean waters (Plotkin et al. 1994). Olive ridley populations are listed as endangered or threatened worldwide (NOAA 2007).

The green turtle is globally distributed and generally found in tropical and subtropical waters along continental coasts and islands between 30 degrees north (°N) and 30 degrees south (°S). Nesting occurs in over 80 countries throughout the year (though not throughout the year at each specific location). Green turtles are thought to inhabit coastal areas of more than 140 countries. In the eastern North Pacific, green turtles have been sighted from Baja California to southern Alaska, but most commonly occur from San Diego south. In the central Pacific, green turtles occur around most tropical islands, including the Hawaiian Islands. Green turtle populations are listed as endangered or threatened throughout their range (NOAA 2007).

Leatherback turtles are globally distributed. Leatherback turtle nesting grounds are located around the world, with the largest remaining nesting assemblages found on the coasts of northern South America and western Africa. The U.S. Caribbean, primarily Puerto Rico and the U.S. Virgin Islands, and southeast Florida support minor nesting colonies, but represent the most significant nesting activity within the United States. Adult leatherbacks are capable of tolerating a wide range of water temperatures, and have been sighted along the entire continental coast of the United States as far north as the Gulf of Maine and south to Puerto Rico, the U.S. Virgin Islands, and into the Gulf of Mexico. The Pacific Ocean leatherback population is generally smaller in size than that in the Atlantic Ocean. Leatherback turtles are endangered throughout their range (NOAA 2007).

Loggerheads turtles are circumglobal, occurring throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian oceans. Loggerheads are the most abundant species of sea turtle found in U.S. coastal waters.

In the eastern Pacific, loggerheads have been reported as far north as Alaska, and as far south as Chile. In the United States, occasional sightings are reported from the coasts of Washington and Oregon, but most records are of juveniles off the coast of California. The west coast of Mexico, including the Baja Peninsula, provides critically important developmental habitats for juvenile loggerheads. The only known nesting areas for loggerheads in the North Pacific are found in southern Japan. Loggerhead turtles are threatened throughout their range (NOAA 2007).

4.3.8.2 Impacts on Sea Turtles

Incidental take in fishing operations, or bycatch, is one of the most serious threats to sea turtle populations (NOAA 2008). In the Pacific, NMFS requires measures (e.g., gear modifications, changes to fishing practices, and time/area closures) to reduce sea turtle bycatch in the Hawaii- and California-based pelagic longline fisheries and the California/Oregon drift gillnet fishery.

Marine debris affects marine turtles, which commonly ingest or become entangled in marine debris (e.g., tar balls, plastic bags, plastic pellets, balloons, and ghost fishing gear) as they feed along oceanographic fronts, where debris and their natural food items converge. Marine pollution from coastal runoff, marina and dock construction, dredging, aquaculture, oil and gas exploration and extraction, increased underwater noise, and boat traffic can degrade marine habitats used by marine turtles. Turtles swimming or feeding at or just beneath the surface of the water are vulnerable to boat and vessel strikes, which can result in serious propeller injuries and death. Disease**,** specifically fibropapillomatosis (FP), is a major threat to green turtles in some areas of the world. In addition, scientists have documented FP in populations of loggerhead, olive ridley, and flatback turtles. The effects of FP at the population level are not well understood. How some marine turtle species function within the marine ecosystem is still poorly understood. Global warming could potentially have an extensive impact on all aspects of a turtle's life cycle, as well as impact the abundance and distribution of prey items. Loss or degradation of nesting habitat resulting from erosion control through beach nourishment and armoring, beachfront development, artificial lighting, and nonnative vegetation is a serious threat affecting nesting females and hatchlings (NOAA 2007).

4.3.8.3 Summary

Sea turtles are generally uncommon in the SOCAL Range Complex and do not nest there, but may forage in or transit through the area. Temporary disturbance incidents associated with SOCAL Range Complex activities could result in an incremental contribution to cumulative impacts on sea turtles. The mitigation measures identified in Sections 3.8.1.2 and 3.8.3 would minimize any potential adverse effects on sea turtles. The impacts of the No Action and Proposed Action alternatives are not likely to affect the species' or stock's annual rates of recruitment or survival. Therefore, the incremental impacts of the No Action and Proposed Action alternatives would not present a significant contribution to the effects on sea turtles when added to effects on sea turtles from other past, present, and reasonably foreseeable future actions.

4.3.9 Marine Mammals

Risks to marine mammals emanate primarily from ship strikes, exposure to chemical toxins or biotoxins, exposure to fishing equipment that may result in entanglements, and disruption or depletion of food sources from fishing pressure and other environmental factors. Potential cumulative impacts of Navy activities on marine mammals would result primarily from possible ship strikes and sonar use.

Stressors on marine mammals and marine mammal populations can include both natural and human-influenced causes, as listed below and described in the following sections:

Natural Stressors

- Disease
- Natural toxins
- Weather and climatic influences
- Navigation errors
- Social cohesion

Human-Influenced Stressors

- Ship strikes
- Pollution and ingestion
- Noise

4.3.9.1 Natural Stressors

Significant natural causes of mortality, die-offs, and stranding discussed below include disease and parasitism, marine neurotoxins from algae, navigation errors that lead to inadvertent stranding, and climatic influences that impact the distribution and abundance of potential food resources (i.e., starvation). Stranding is also caused by predation by other species such as sharks (Cockcroft et al. 1989; Heithaus, 2001), killer whales (Constantine et al. 1998; Guinet et al. 2000; Pitman et al. 2001), and some species of pinniped (Hiruki et al., 1999; Robinson et al. 1999).

4.3.9.1.1 Disease

Like other mammals, marine mammals frequently suffer from a variety of diseases of viral, bacterial, and fungal origin (Visser et al., 1991; Dunn et al., 2001; Harwood, 2002). Gulland and Hall (2005, 2007) provide a summary of individual and population effects of marine mammal diseases.

4.3.9.1.2 Marine Neurotoxins

Some single-celled marine algae common in coastal waters, such as dinoflagellates and diatoms, produce toxic compounds that can bioaccumulate in the flesh and organs of fish and invertebrates (Geraci et al., 1999; Harwood, 2002). Marine mammals become exposed to these compounds when they eat prey contaminated by these naturally produced toxins (Van Dolah, 2005).

4.3.9.1.3 Weather Events and Climate Influences

Severe storms, hurricanes, typhoons, and prolonged temperature extremes may lead to local marine mammal strandings (Geraci et al. 1999; Walsh et al. 2001). Storms in 1982 to 1983 along the California coast led to deaths of 2,000 northern elephant seal pups (Le Boeuf and Reiter 1991). Seasonal oceanographic conditions in terms of weather, frontal systems, and local currents may also play a role in stranding (Walker et al. 2005).

The effect of large-scale climatic changes to the world's oceans and how these changes impact marine mammals and influence strandings are difficult to quantify, given the broad spatial and temporal scales involved, and the cryptic movement patterns of marine mammals (Moore 2005; Learmonth et al. 2006). The most immediate, although indirect, effect is decreased prey availability during unusual conditions. This, in turn, results in increased search effort required by marine mammals (Crocker et al. 2006), potential starvation if not successful, and corresponding stranding due directly to starvation or succumbing to disease or predation while in a weakened, stressed state (Selzer and Payne 1988; Geraci et al. 1999; Moore, 2005; Learmonth et al. 2006; Weise et al. 2006).

4.3.9.1.4 Navigational Error

Geomagnetism – Like some land animals and birds, marine mammals may be able to orient to the Earth's magnetic field as a navigational cue, and areas of local magnetic anomalies may influence strandings (Bauer et al., 1985; Klinowska 1985; Kirschvink et al. 1986; Klinowska 1986; Walker et al., 1992; Wartzok and Ketten 1999).

Echolocation Disruption in Shallow Water – Some researchers believe stranding may result from reductions in the effectiveness of echolocation in shallow water, especially in the pelagic species of odontocetes who may be less familiar with coastlines (Dudok van Heel, 1966; Chambers and James, 2005). For an odontocete, echoes from echolocation signals contain important information on the location and identity of underwater objects and the shoreline. The authors postulate that the gradual slope of a beach may present difficulties to the navigational systems of some cetaceans, since live strandings commonly occur along beaches with shallow, sandy gradients (Brabyn and McLean 1992; Mazzuca et al. 1999; Maldini et al. 2005; Walker et al. 2005). A factor contributing to echolocation interference in turbulent, shallow water is the presence of microbubbles from the interaction of wind, breaking waves, and currents. Additionally, ocean water near the shoreline can have an increased turbidity (e.g., floating sand or silt, particulate plant matter) due to the run-off of fresh water into the ocean, either from rainfall or from freshwater outflows (e.g., rivers and creeks). Collectively, these factors can reduce and scatter the sound energy in echolocation signals and reduce the perceptibility of returning echoes of interest.

4.3.9.1.5 Social Cohesion

Many pelagic species such as sperm whales, pilot whales, melon-head whales, and false killer whales, and some dolphins occur in large groups with strong social bonds between individuals. When one or more animals strand due to any number of causative events, then the entire pod may follow suit out of social cohesion (Geraci et al. 1999; Conner 2000; Perrin and Geraci 2002; NMFS, 2007).

Table 4-6: Marine Mammal Unusual Mortality Events in the Pacific Attributed to or Suspected from Natural Causes, 1978-2005

Year	Species and Number	Location	Cause
1978	Hawaiian monk seals (50)	NW Hawaiian Islands	Ciguatoxin and maitotoxin
1983	Multiple pinniped species	West coast of U.S., Galapagos	El Niño
1984	California sea lions (226)	California	Leptospirosis
1987	Sea otters (34)	Alaska	Saxitoxin
1995	California sea lions (222)	California	Leptospirosis
1997-98	California sea lions (100s)	California	El Nino
1998	California sea lions (70)	California	Domoic acid
1998	Hooker's sea lions (60% of pups)	New Zealand	Unknown, bacteria likely
2000	California sea lions (178)	California	Leptospirosis
2000	California sea lions (184)	California	Domoic acid
2000	Harbor seals (26)	California	Unknown; Viral pneumonia suspected
2001-02	Hawaiian monk seals	NW Hawaiian Islands	Ecological factors
2002	Multispecies (common dolphins, California sea lions, sea otters) (approx. 500)	California	Domoic acid
2002	Hooker's sea lions	New Zealand	Pneumonia
2003	Multispecies (common dolphins, California sea lions, sea otters) (approx. 500)	California	Domoic acid
2003	Beluga whales (20)	Alaska	Ecological factors
2003	Sea otters	California	Ecological factors
2004	California sea lions (405)	Canada, U.S. West Coast	Leptospirosis
2005	California sea lions; Northern fur seals	California	Domoic acid

Note: Data from Gulland and Hall (2007); citations for each event contained in Gulland and Hall (2007)

4.3.9.2 Human-Influenced Stressors

During the past few decades there has been an increase in marine mammal mortalities associated with a variety of human activities (Geraci et al. 1999; NMFS, 2007). These activities include fisheries interactions (bycatch and directed catch), pollution (marine debris, toxic compounds), habitat modification (degradation, prey reduction), ship strikes (Laist et al., 2001), and gunshots (see Figure 4-1 for examples of threats).

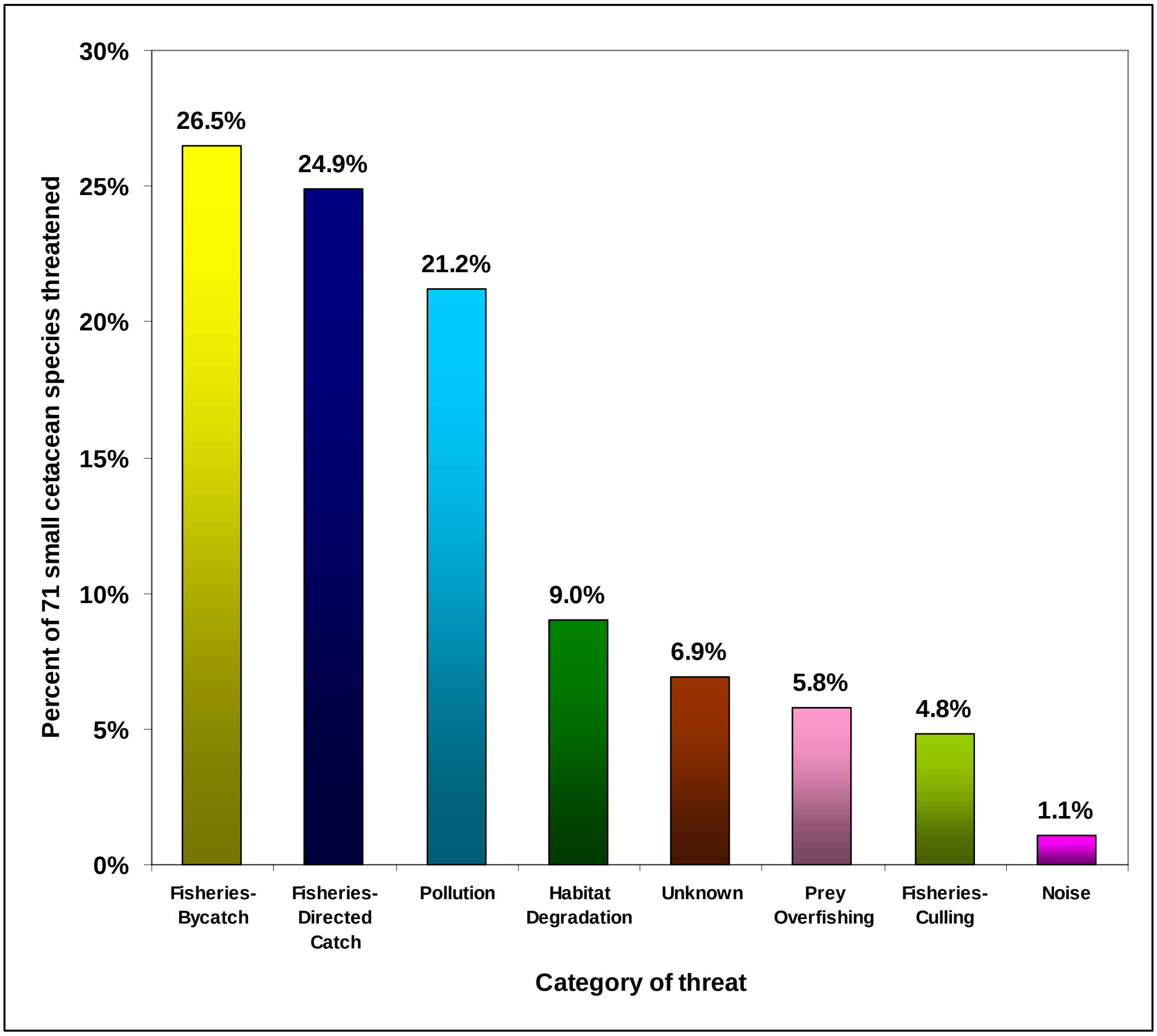

Figure 4-1: Human Threats to Worldwide Small Cetacean Populations

Source: Culik 2002

4.3.9.2.1 Fisheries Interaction: Bycatch, Directed Catch, and Entanglement

The incidental catch of marine mammals in commercial fisheries is a significant threat to the survival and recovery of many populations of marine mammals (Geraci et al. 1999; Baird, 2002; Culik 2002; Carretta et al., 2004; Geraci and Lounsbury 2005; NMFS, 2007). Interactions with fisheries and entanglement in discarded or lost gear continue to be a major factor in marine mammal deaths worldwide (Geraci et al. 1999; Nieri et al., 1999; Geraci and Lounsbury 2005; Read et al., 2006; Zeeberg et al., 2006). For instance, baleen whales and pinnipeds have been found entangled in nets, ropes, monofilament line, and other fishing gear that has been discarded out at sea (Geraci et al., 1999; Campagna et al., 2007).

Bycatch – Bycatch is the catching of nontarget species within a given fishing operation and can include noncommercially used invertebrates, fish, sea turtles, birds, and marine mammals (NRC, 2006). Read et al. (2006) attempted to estimate the magnitude of marine mammal bycatch in U.S. and global fisheries. Within U.S. fisheries, between 1990 and 1999 the mean annual bycatch of marine mammals was 6,215 animals. Eighty-four percent of cetacean bycatch occurred in gill-net fisheries, with dolphins and porpoises constituting most of the cetacean bycatch (Read et al., 2006). Over the decade there was a 40 percent decline in marine mammal bycatch, primarily due to effective conservation measures that were implemented during this time period.

Read et al. (2006) extrapolated data for the same period (1990-1999) and calculated an annual estimate of 653,365 of marine mammals globally, with most of the world's bycatch occurring in gill-net fisheries. With global marine mammal bycatch likely to be in the hundreds of thousands every year, bycatch in fisheries will be the single greatest threat to many marine mammal populations around the world (Read et al. 2006).

Entanglement – Entanglement in active fishing gear is a major cause of death or severe injury among the endangered whales. Entangled marine mammals may die as a result of drowning, escape with pieces of gear still attached to their bodies, or manage to be set free either of their own accord or by fishermen. Many large whales carry off gear after becoming entangled (Read et al. 2006). When a marine mammal swims off with gear attached, the result can be fatal. The gear may become too cumbersome for the animal, or it can be wrapped around a crucial body part and tighten over time. Stranded marine mammals frequently exhibit signs of previous fishery interaction, such as scarring or gear attached to their bodies. For stranded marine mammals, death is often attributed to such interactions (Baird and Gorgone, 2005). Because marine mammals that die due to fisheries interactions may not wash ashore and not all animals that do wash ashore exhibit clear signs of interactions, data probably underestimate fishery-related mortality and serious injury (NMFS, 2005a).

An estimated 78 baleen whales were killed annually in the offshore Southern California/Oregon drift gillnet fishery during the 1980s (Heyning and Lewis 1990). From 1998-2005, based on observer records, 5 fin whales (CA/OR/WA stock), 12 humpback whales (ENP stock), and 6 sperm whales (CA/OR/WA stock) were either seriously injured or killed in fisheries off the west coast of the United States. (California Marine Mammal Stranding Network Database 2006).

4.3.9.2.2 Ship Strike

Ship strikes of marine mammals are another cause of mortality and stranding (Laist et al., 2001; Geraci and Lounsbury, 2005; de Stephanis and Urquiola, 2006). An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or an animal just below the surface could be cut by a vessel's propeller. The severity of injuries typically depends on the size and speed of the vessel and the size of the animal (Knowlton and Kraus, 2001; Laist et al., 2001; Vanderlaan and Taggart, 2007).

The growth in commercial ports and associated commercial vessel traffic is a result of the globalization in trade. The Final Report of the NOAA International Symposium on *Shipping Noise and Marine Mammals: A Forum for Science, Management, and Technology* stated that the worldwide commercial fleet has grown from approximately 30,000 vessels in 1950 to over 85,000 vessels in 1998 (NRC, 2003; Southall, 2005). It is unknown how international shipping volumes and densities will continue to grow. However, current statistics support the prediction that the international shipping fleet will continue to grow at the current rate or at greater rates in the future. Shipping densities in specific areas and trends in routing and vessel design are as, or more, significant than the total number of vessels. Densities along existing coastal routes are expected to increase both domestically and internationally. New routes are also expected to develop as new ports are opened and existing ports are expanded. Vessel propulsion systems are also advancing toward faster ships operating in higher sea states for lower operating costs; and container ships are expected to become larger along certain routes (Southall, 2005).

While there are reports and statistics of whales struck by vessels in U.S. waters, the magnitude of the risks that commercial ship traffic poses to marine mammal populations is difficult to quantify or estimate. In addition, there is limited information on vessel strike interactions between ships and marine mammals outside of U.S. waters (de Stephanis and Urquiola, 2006). Laist et al.

(2001) concluded that ship collisions may have a negligible effect on most marine mammal populations in general, except for regionally-based small populations where the significance of low numbers of collisions would be greater, given smaller populations or populations segments.

U.S. Navy vessel traffic is a small fraction of the overall U.S. commercial and fishing vessel traffic. While U.S. Navy vessel movements may contribute to the ship strike threat, given the lookout and mitigation measures adopted by the U.S. Navy, probability of vessel strikes is greatly reduced. Furthermore, actions to avoid close interaction of U.S. Navy ships and marine mammals and sea turtles, such as maneuvering to keep away from any observed marine mammal and sea turtle are part of existing at-sea protocols and standard operating procedures. Navy ships have dedicated and trained lookouts as well as two to three bridge watchstanders during at-sea movements who would be searching for any whales, sea turtles, or other obstacles on the water surface. Such lookouts are expected to further reduce the chances of a collision.

4.3.9.2.3 Ingestion of Plastic Objects and Other Marine Debris and Toxic Pollution Exposure

For many marine mammals, debris in the marine environment is a great hazard. Not only is debris a hazard because of possible entanglement, animals may mistake plastics and other debris for food (NMFS, 2007). Sperm whales have been known to ingest plastic debris, such as plastic bags (Evans et al. 2003; Whitehead 2003). While this has led to mortality, the scale on which this is affecting sperm whale populations is unknown, but Whitehead (2003) suspects it is not substantial at this time.

High concentrations of potentially toxic substances within marine mammals along with an increase in new diseases have been documented in recent years. Scientists have begun to consider the possibility of a link between pollutants and marine mammal mortality events. NMFS takes part in a marine mammal biomonitoring program not only to help assess the health and contaminant loads of marine mammals, but also to assist in determining anthropogenic impacts on marine mammals, marine food chains, and marine ecosystem health. Using strandings and bycatch animals, the program provides tissue/serum archiving, samples for analyses, disease monitoring and reporting, and additional response during disease investigations (NMFS, 2007).

The impacts of these activities are difficult to measure. However, some researchers have correlated contaminant exposure with possible adverse health effects in marine mammals (Borell 1993; O’Shea and Brownell 1994; O’Hara and Rice 1996; O’Hara et al. 1999).

The manmade chemical PCB (polychlorinated biphenyl), and the pesticide DDT (dichlorodiphyenyltrichloroethane), are both considered persistent organic pollutants that are currently banned in the United States for their harmful effects in wildlife and humans (NMFS, 2007b). Despite having been banned for decades, the levels of these compounds are still high in marine mammal tissue samples taken along U.S. coasts (Hickie et al. 2007; Krahn et al. 2007; NMFS, 2007b). Both compounds are long-lasting, reside in marine mammal fat tissues (especially in the blubber), and can have toxic effects such as reproductive impairment and immunosuppression (NMFS, 2007b).

In addition to direct effects, marine mammals are indirectly affected by habitat contamination that degrades prey species availability, or increases disease susceptibility (Geraci et al., 1999).

U.S. Navy vessel operation between ports and exercise locations has the potential to release small amounts of pollutant discharges into the water column. U.S. Navy vessels are not a typical source, however, of either pathogens or other contaminants with bioaccumulation potential such as pesticides and PCBs. Furthermore, any vessel discharges such as bilgewater and deck runoff associated with the vessels would be in accordance with international and U.S. requirements for eliminating or minimizing discharges of oil, garbage, and other substances, and not likely to contribute significant changes to ocean water quality or to affect marine mammals.

4.3.9.2.4 Anthropogenic Sound

As one of the potential stressors to marine mammal populations, noise and acoustic influences may disrupt marine mammal communication, navigational ability, and social patterns, and may or may not influence stranding. Many marine mammals use sound to communicate, navigate, locate prey, and sense their environment. Both anthropogenic and natural sounds may interfere with these functions, although comprehension of the type and magnitude of any behavioral or physiological responses resulting from man-made sound, and how these responses may contribute to strandings, is rudimentary at best (NMFS, 2007). Marine mammals may respond both behaviorally and physiologically to anthropogenic sound exposure (e.g., Richardson et al., 1995; Finneran et al., 2000; Finneran et al., 2003; Finneran et al., 2005). However, the range and magnitude of the behavioral response of marine mammals to various sound sources is highly variable (Richardson et al., 1995) and appears to depend on the species involved, the experience of the animal with the sound source, the motivation of the animal (e.g., feeding, mating), and the context of the exposure.

Marine mammals are regularly exposed to several sources of natural and anthropogenic sounds. Anthropogenic noise that could affect ambient noise arises from the following general types of activities in and near the sea, any combination of which can contribute to the total noise at any one place and time. These noises include transportation; dredging; construction; oil, gas, and mineral exploration in offshore areas; geophysical (seismic) surveys; sonar; explosions; and ocean research activities (Richardson et al., 1995). Commercial fishing vessels, cruise ships, transport boats, recreational boats, and aircraft all contribute sound into the ocean (NRC, 2003; NRC, 2006). Several investigators have argued that anthropogenic sources of noise have increased ambient noise levels in the ocean over the last 50 years (NRC 1994, 1996, 2000, 2003, 2005; Richardson et al., 1995; Jasny et al., 2005; McDonald et al., 2006). Much of this increase is due to increased shipping due to ships becoming more numerous and of larger tonnage (NRC, 2003; McDonald et al., 2006). Andrew et al. (2002) compared ocean ambient sound from the 1960s with the 1990s for a receiver off the California coast. The data showed an increase in ambient noise of approximately 10 decibels (dB) in the frequency range of 20 to 80 Hertz (Hz) and 200 to 300 Hz, and about 3 dB at 100 Hz over a 33-year period.

Sound emitted from large vessels, particularly in the course of transit, is the principal source of noise in the ocean today, primarily due to the properties of sound emitted by civilian cargo vessels (Richardson et al., 1995; Arveson and Vendittis, 2000). Ship propulsion and electricity generation engines, engine gearing, compressors, bilge and ballast pumps, as well as hydrodynamic flow surrounding a ship’s hull and any hull protrusions, contribute to a large vessels’ noise emissions in the marine environment. Prop-driven vessels also generate noise through cavitation, which accounts for much of the noise emitted by a large vessel depending on its travel speed. Military vessels underway or involved in naval operations or exercises also introduce anthropogenic noise into the marine environment. Noise emitted by large vessels can be characterized as low frequency, continuous, and tonal. The sound pressure levels at the vessel will vary according to speed, burden, capacity, and length (Richardson et al., 1995; Arveson and Vendittis, 2000). Vessels ranging from 135 to 337 m generate peak source sound levels from 169 to 200 dB between 8 Hz and 430 Hz, although Arveson and Vendittis (2000) documented components of higher frequencies (10-30 kHz) as a function of newer merchant ship engines and faster transit speeds. Given the propagation of low-frequency sounds, a large vessel in this sound range can be heard 139 to 463 km away (Ross 1976 in Polefka 2004). U.S. Navy vessels, however, have incorporated significant underwater ship-quieting technology to reduce their acoustic signature (as compared to a similarly sized vessel) and thus reduce their vulnerability to detection by enemy passive acoustics.

Airborne sound from a low-flying helicopter or airplane may be heard by marine mammals and turtles while at the surface or underwater. Due to the transient nature of sounds from aircraft involved in at-sea operations, such sounds would not likely cause physical effects but have the potential to affect behaviors. Responses by mammals and turtles could include hasty dives or turns, or decreased foraging (Soto et al., 2006). Whales may also slap the water with flukes or flippers, and swim away from the aircraft track. Smultea et al. (2008) reported in a population monitoring study of sperm whales that the majority of whales encountered seemed to exhibit no obvious reaction to aircraft overflight of greater than 360 m (1,200 ft) distance. When approached at closer distances a significant subset of groups that were approached did indeed respond with sudden dives as the plane first appeared, and a fourth group took up group formations that the researchers interpreted as agitation, distress, and/or defense. Although they postulated that such disturbance was transient and likely insignificant in terms of population health, the researchers note that “repeated or prolonged exposure to aircraft overflights have the potential to result in significant disturbance of biological functions, especially in important nursery, breeding or feeding areas.” They suggest that such cumulative effects could be possible in areas frequented by military training exercises (Smultea et al., 2008).

Naval sonars are designed for three primary functions: submarine hunting, mine hunting, and shipping surveillance. There are two classes of sonars employed by the U.S. Navy: active sonars and passive sonars. Most active military sonars operate in a limited number of areas, and are most likely not a significant contributor to a comprehensive global ocean noise budget (ICES 2005b).

4.3.9.3 Summary

Both natural and human-induced factors affect the health of marine mammal populations. Temporary disturbance incidents associated with Navy activities on the SOCAL Range Complex could result in an incremental contribution to cumulative impacts on mammals. The mitigation measures identified in Section 3.9.10 would be implemented to minimize any potential adverse effects to marine mammals from Navy activities. Impacts of the alternatives including the Proposed Action are not likely to affect the species through effects on annual rates of recruitment or survival. Therefore, the incremental impacts would not present a significant contribution to the effects on marine mammals when added to effects from other past, present, and reasonably foreseeable future actions.

4.3.10 Seabirds

Seabird populations within the SOCAL Range Complex are affected by direct and indirect perturbations to breeding and foraging locations on the coastal mainland and offshore islands. The single greatest concern is the loss of suitable habitat for nesting and roosting seabirds throughout coastal California due to land development and human encroachment. Historically, seabird populations have sustained numerous impacts from pollution and human activities within the SCB from a variety of sources, including the discharge of hazardous chemicals and sewage. Though the Proposed Action does not directly reduce available seabird habitat within the SOCAL Range Complex, current seabird populations residing within the SOCAL Range Complex become more susceptible to potential impacts due to the concentrated nature of those populations. By default, open space within military installations in coastal locations has become vital to the persistence of seabird breeding and roosting populations.

Land range operations could affect breeding seabirds if the operational footprint encompassed nesting areas during breeding seasons. Current data on breeding seabird populations that overlap with training operations in or near coastal areas, San Clemente Island, or Santa Catalina Island are either unavailable or incomplete, making a comprehensive effects analysis difficult. Though most offshore operations take place in oceanic waters well offshore, are of short duration, and have a small operational footprint, the importance of avoiding sensitive seabird colonies and reducing disturbance should be paramount when accessing new or ongoing training activities.

Training activities concentrated in or near coastal areas or offshore islands, or taking place at regular intervals, would disturb local seabird roosting colonies. The coastal and offshore island areas within the SOCAL Range Complex provide suitable seabird habitat adjacent to training areas, allowing potentially affected seabirds adequate alternative locations to avoid interactions with training operations. Continued expansion of commercial and private aircraft and ocean-going vessels through the SOCAL Range Complex, together with increased SOCAL Range Complex training activities, elevates the potential for direct and indirect impacts on isolated seabird populations. The control of nonnative plants and animals within coastal areas and on islands must continue to be addressed by land owners to ensure further degradation of seabird populations does not occur. Large-scale effects on seabird populations such as global warming, reduced fish populations, and development in other regions or countries are not well defined for individual species but have been attributed to the overall decline of seabirds.

The Proposed Action would not significantly impact any individual seabird population, its overall foraging success, or breeding opportunities within the SOCAL Range Complex.

4.3.11 Terrestrial Biological Resources

The analysis for cumulative impacts to terrestrial biological resources focuses on fire, invasive species, erosion, and habitat degradation.

4.3.11.1 Fire

Numerous activities having the potential to ignite wildfires have been described previously in this EIS/OEIS. These activities have a cumulative contribution to wildfire risk, and various measures identified in this document are intended to address the cumulative impacts of wildfire. The analyses of the individual activities that contribute to wildfire risk concluded that impacts of the individual operations on sensitive species could be mitigated to a less than significant level. This mitigation would be accomplished by implementing the SCI Wildland Fire Management Plan, which builds on recently implemented measures that have been reducing the frequency and size of operations-related fires. After mitigation, there would remain some potential for fire impacts associated with each operation. These remaining potential impacts on sensitive species, including the San Clemente loggerhead shrike, were judged to be less than significant individually. With implementation of the SCI Wildland Fire Management Plan, cumulative impacts of fire would be less than significant.

4.3.11.2 Invasive Species, Erosion, and Habitat Degradation

Several activities contribute cumulatively to habitat degradation, including disturbance to soils and vegetation, spread of invasive nonnative species, erosion and sedimentation, and impacts on native plant species. Although individual impacts may be less than significant, collectively they have the potential to be significant over time and space. Some potential effects of invasive species are difficult to foresee (such as leading to a change in fire frequency or intensity). It is clear, however, that the potential for damage associated with introduction or spread of invasive plant species is high and increases over time with repeated training missions, especially exercises that cover a very large area. This is due to the difficulty in effectively monitoring for invasive establishment and achieving timely control. The Navy is addressing these effects in several important ways including implementation of the SCI Integrated Natural Resources Management Plan (INRMP), the SCI Wildland Fire Management Plan, and continued development and implementation of measures to prevent the establishment of invasive plant species by minimizing the potential for introductions of seed or other plant parts (propagules) of exotic species, and finding and eliminating incipient populations before they are able to spread. Key measures include:

- Minimizing the amount of seed or propagules of nonnative plant species introduced to the island through continued efforts to remove seed and soil from all vehicles, including contractor vehicles, coming to the island by pressure washing on the mainland, and stepped up efforts to ensure that imported construction materials such as sand, gravel, aggregate, or road base material are weed free.
- Regular monitoring and treatment to detect and eliminate exotic species, focusing on areas where equipment and construction materials come ashore (Wilson Cove vicinity, including equipment yards and construction laydown areas, vicinity of beaches where amphibious landings area conducted) and areas within which there is movement of equipment and personnel and soil disturbance which favor the spread and establishment of invasive species (e.g., along roadsides, disturbed areas, including the Assault Maneuver Corridor, and Training Areas and Ranges [TARs]).
- Effective measures to foster the reestablishment of native vegetation in areas where nonnative vegetation is present.
- No living plant material would be brought to the island from the mainland (in order to avoid introduction of inappropriate genetic strains of native plants or exotic species, including weeds, insects, and invertebrates such as snails).
- Continued operation of an on-island nursery to produce all plant material to be used on the island and continued exclusive use of on-island sources of indigenous plants for use in restoration. Because of the site-to-site variability in some of the native species, location-specific sources should be used in propagating many of the native species for use in restoration.
- Measures to correct developing erosion problems, such as correcting drainage from roads and culvert outlets where they contribute to concentration of flow potentially leading to gullying and measures designed to stop the progression of existing gullies associated with developed sites and roads.
- Maintenance of an up-to-date inventory of sensitive plant and wildlife species locations and consulting the inventory in all environmental reviews.

Navy projects at SCI other than the Proposed Action, such as those identified in Table 4-4, also could impact terrestrial biological resources. Any such project at SCI would be required to be in compliance with the established INRMP, SCI Wildland Fire Management Plan, and U.S. Fish and Wildlife Service (USFWS) Biological Opinions (BOs) issued after Endangered Species Act (ESA) Section 7 consultation addressing direct, indirect, and cumulative impacts. As identified in Section 3.11, there are numerous potential impacts of the Proposed Action on terrestrial biology on SCI. These impacts have the potential for significant cumulative impact on such resources. Mitigation measures identified in this EIS/OEIS, considered together with any additional mitigation or conservation measures that might be appropriate after Section 7 consultation, however, will substantially mitigate direct, indirect, and cumulative effects of the Proposed Action.

4.3.12 Cultural Resources

This EIS/OEIS determined that the Proposed Action would have little or no potential to impact underwater cultural resources, primarily because most of the Proposed Action's activities were on or above the surface and cultural resources, if any, are on the ocean bottom. Project activities would not generally disturb areas where cultural resources are known or expected to be present.

For the same reason, most other ongoing and anticipated ocean activities such as commercial ship traffic, fishing, oil and gas development, or scientific research would not substantially affect underwater cultural resources.

This EIS/OEIS also examined the potential for effects on cultural, archaeological, and historic sites on SCI. Due to the large number of known and estimated cultural sites on SCI and the widespread use of the island for training of ground combat forces, Naval Special Warfare, and missile operations, the Proposed Action could increase the potential for adverse effects on cultural resources. Mitigation strategies such as avoidance measures should reduce substantially reduce or eliminate effects on cultural resources that are subject to such measures. To the extent adverse effects to cultural resources are not avoided, any activities with the potential for significant effects will require Section 106 consultation. Adverse-effect determinations resulting from activities identified in the Proposed Action have been or will be resolved in the regulatory Section 106 process.

Other on-island activities (primarily potential construction projects), not addressed in the Proposed Action, have the potential to disturb cultural resources. Such activities would require evaluation of potential effects on a case-by-case basis. To the extent practicable, mitigation measures similar to those described for the Proposed Action would be implemented for such projects. Where the mitigation by avoidance is employed, no cumulative effect would result because no adverse effect on the resource would be likely to occur. Where adverse effects on cultural resources are expected as a result of on-island activities not included in the Proposed Action, such effects would be addressed through the Section 106 consultation process and the resulting resolution of adverse effect (mitigation) practices, usually by data recovery. Adverse effects on cultural resources would result in cumulative impacts, in that, even with mitigation through data recovery, there would be a cumulative loss of the balance of the *in situ* historic properties on SCI.

Cumulative impacts also include those that would result from activities in the SHOBA Impact Areas as these may affect undocumented and unmanageable cultural resources in those areas. The SCI PA provides an alternative approach for addressing CONBC Section 106 compliance responsibilities in the SHOBA Impact Areas; however, even with adverse effects resolved through consultation there will still be cumulative impact.

4.3.13 Traffic (Airspace)

The region that includes the SOCAL Range Complex is one of the busiest areas of the world in terms of air traffic. The Proposed Action does not propose any expansion of military Special Use Airspace (SUA), and would not produce any significant regional cumulative traffic impacts. While hazardous activities in W-291 are in progress, vessel traffic, forewarned through publication of the related Notice to Mariners (NOTMAR), would avoid the affected area. Although the resultant detour might be inconvenient, it would not preclude the affected vessel from arriving at its destination. Similarly for air traffic, when hazardous activities within W-291 close CAE 1156, commercial and general aviation air traffic, operating under IFR enroute to or from San Diego, would be routed to the north to transit CAE 1177. Although this slight detour might be inconvenient, it would not pose an increased safety hazard nor impose an additional burden on the air traffic control system. Coordination with the FAA on all matters affecting airspace would significantly reduce or eliminate the possibility of indirect adverse impacts and associated cumulative impacts on civil aviation and airspace use.

4.3.14 Socioeconomics

Implementation of the Proposed Action would not produce any significant regional employment, income, housing, or infrastructure impacts. Effects on commercial and recreational fishermen, divers, and boaters would be short-term in nature and produce some temporary access limitations. Some offshore operations, especially if coincident with peak fishing locations and periods, could cause temporary displacement and potential economic loss to individual fishermen. However, most offshore operations are of short duration and have a small operational footprint. Effects on fishermen are mitigated by a series of Navy initiatives, including public notification of scheduled activities, near-real time schedule updates, prompt notification of schedule changes, and adjustment of hazardous operations areas. In selected instances where safety requires exclusive use of a specific area, fishermen may be asked to relocate to a safer nearby area for the duration of the exercise. These measures should not significantly impact any individual fisherman, overall commercial revenue, or public recreational opportunities. Therefore, the Proposed Action would not result in significant cumulative socioeconomic impacts.

4.3.15 Environmental Justice and Protection of Children

The Proposed Action would not affect minority or low-income populations, nor would children be exposed to increased noise levels or safety risks.

4.3.16 Public Safety

Environmental pollution (e.g., air pollutants, water pollutants, electromagnetic radiation [EMR]) would have little potential to affect public health because they would be dispersed over large areas of ocean with few human receptors. Project activities (e.g., ship movements, live-firing of weapons) would have little potential to affect public safety because of the general absence of nonparticipating individuals. The same factors—the dispersed nature of the activities and general absence of nonparticipants within the area of effect at the time of the activity—would limit the public health and safety impacts of other ongoing or anticipated activities in the SOCAL Range Complex.

Impacts of the Proposed Action on public health and safety on SCI were determined to be minimal: (a) the public is generally excluded from SCI, and (b) danger zones and exclusion zones have been established in SCI’s nearshore waters to assure that nonparticipants are not exposed to hazardous on-island activities. Other construction, maintenance, and training activities on the island would likewise be isolated from the public. Projects such as the SOAR Cable Refurbishment, SWTR instrumentation, and new moorings at Wilson Cove are not expected to pose any risks to individuals in public use areas around the island. An underwater missile launch facility proposed near NOTS Pier on SCI would be within a restricted zone, and would thus pose no risk to the public.

5 Mitigation Measures

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5 MITIGATION MEASURES

As part of the Navy's commitment to sustainable use of resources and environmental stewardship, the Navy incorporates measures that are protective of the environment into all of its activities. These include employment of best management practice, standard operating procedures (SOPs), adoption of conservation recommendations, and other measures that mitigate the impacts of Navy activities on the environment. Some of these measures are generally applicable and others are designed to apply to certain geographic areas during certain times of year, for specific types of Navy training. Mitigation measures covering habitats and species occurring in the Southern California (SOCAL) Range Complex have been developed through various environmental analyses conducted by the Navy for land and sea ranges and adjacent coastal waters.

The Navy has implemented a variety of marine mammal mitigation measures over the last two decades. This following discussion briefly describes the genesis and status of those mitigation measures.

Since the 1990s, the Navy has developed and implemented mitigation measures either as a result of environmental analysis or in consultation with regulatory agencies for research, development, test and evaluation activities (RDT&E) and training exercises. These measures included visual detection by trained lookouts, power down and shut down procedures, the use of passive sensors to detect marine mammals, and avoidance of marine mammals.

In December 2000, the Navy issued a memorandum entitled "Compliance with Environmental Requirements in the Conduct of Naval Exercises or Training at Sea" (Department of the Navy [DoN] 2000). This memorandum clarified Navy policy for continued compliance with certain environmental requirements including preparation of environmental planning documents, consultations pursuant to the Endangered Species Act (ESA), and applications for "take" authorizations under the Marine Mammal Protection Act (MMPA).

In 2003, the Navy issued the Protective Measures Assessment Protocol (PMAP) that implemented Navy-wide mitigation measures for various types of routine training events. Following the implementation of PMAP, the Navy agreed to additional mitigation measures as part of MMPA authorization and ESA consultation processes for specific training exercises from 2004-2007.

Finally, as authorized by the MMPA, the Secretary of Defense has approved two National Defense Exemptions (NDE) from the requirements of the MMPA for certain military readiness activities that employ mid-frequency active (MFA) sonar. The NDE includes mitigation measures that must be observed for use of MFA sonar during major Navy training exercises and on established Navy ranges and OPAREAs. These measures were designed to strike a reasoned balance between environmental protection, military readiness activities and, ultimately, the Navy's mission of National security. The NDE is in effect through January 2009.

In order to make the findings necessary to issue the MMPA authorization, it may be necessary for the National Marine Fisheries Service (NMFS) to require additional mitigation or monitoring measures beyond those addressed in this Environmental Impact Statement (EIS)/ Overseas Environmental Impact Statement (OEIS) (hereafter referred to as "EIS/OEIS"). These could include measures considered, but eliminated in this EIS/OEIS, or as yet undeveloped measures. In addition to commenting on this EIS/OEIS, the public will have an opportunity to provide information to NMFS through the MMPA process, both during the comment period following NMFS' Notice of Receipt of the application for a Letter of Authorization (LOA), and during the comment period following publication of the proposed rule. NMFS may propose additional mitigation or monitoring measures in the proposed rule. The suite of measures developed to date as a result of those MMPA processes are included and analyzed as part of this section.

Additionally, the Navy is engaging in consultation processes under the ESA with regard to listed species that may be affected by the activities described in this EIS/OEIS. For the purposes of the ESA section 7 consultation, the mitigation measures proposed here may be considered by NMFS as beneficial actions taken by the Federal agency or applicant (50 CFR 402.14[g][8]). If required to satisfy requirements of the Endangered Species Act, NMFS may develop an additional set of measures contained in Reasonable and Prudent Alternatives, Reasonable and Prudent Measures, or Conservation Recommendations in any Biological Opinion issued for this Proposed Action.

The Navy also will consider public comments on proposed mitigation measures described in this EIS/OEIS.

This Section describes mitigation measures applicable to Navy activities in the SOCAL Range Complex.

5.1 GEOLOGY AND SOILS

Existing plans and policies are in place to limit the effects of construction and training on the environment at San Clemente Island (SCI) on an island-wide basis. Specific to earth resources, the Integrated Natural Resources Management Plan (INRMP) identifies erosion as a primary management issue and presents policies to reduce the impacts of erosion on the island. The INRMP notes that "erosion and sedimentation continue, arising from inadequately constructed or maintained roads, or from ongoing damage instigated by past overgrazing by feral goats, exterminated around 1991" (DoN 2002). Policies and SOPs relation to geology and soils include:

- Managing and limiting construction activities, including road construction, through an established site approval process.
- Limiting vehicle travel to existing roads: on SCI, off-road vehicle use is not permitted except in designated off-road areas or on established trails approved by the Navy's regional Natural Resources Office (NRO).
- Prohibiting tracked vehicular maneuvering outside the boundaries of the Armored Vehicle Maneuver Corridor (AVMC). Additionally, tracked vehicle maneuvering and camping are prohibited inside marked environmentally sensitive areas.

Additionally, because SCI is managed as a federal property, island operations comply with the Federal Soil Conservation Act; thus the Navy is required to control and prevent erosion by conducting surveys and implementing conservation measures (Soil Conservation Act, 16 U.S.C. § 5901). In accordance with this mandate, the Navy is studying sedimentation and erosion associated with watersheds on SCI.

Protective measures proposed to minimize erosion effects on terrestrial biological resources are presented in Section 3.11.3. These include development and implementation of a program to monitor for erosion, dust generation, and deposition of dust in adjacent habitats. It is recommended that such a program include monitoring and provide a means for adaptive management of erosion associated with the existing roads and ranges. Specifically, an annual review of the erosion conditions of the Missile Impact Range (MIR), firebreak road, and camera locations would be conducted under coordination with the NRO. Examples of control measures to be considered include placing riprap in problem areas to provide energy dissipation of concentrated runoff from the MIR or the firebreak road or placement of water bars to prevent runoff from concentrating to the point where erosion could occur. A representative from NRO would be consulted to ensure that any proposed erosion control efforts would not adversely affect cultural resources.

5.2 AIR QUALITY

Emissions that may affect air quality are heavily regulated under the Clean Air Act and its implementing regulations, through a comprehensive Federal / State regulatory process (see Section 3.2). Consistent with these regulatory requirements and processes, the Navy has implemented comprehensive air quality management programs to ensure compliance.

5.3 HAZARDOUS MATERIALS AND WASTES

Releases or discharges of hazardous wastes or materials are heavily regulated through a comprehensive Federal / State regulatory process (see Section 3.3.2). Consistent with these regulatory requirements and process, the Navy has implemented comprehensive management programs to ensure compliance.

Shipboard and shore management of hazardous materials and waste is governed by Navy regulations (OPNAVINST 5090.1C). Environmental compliance policies and procedures applicable to operations ashore and afloat are defined in Navy instructions. These instructions reinforce regulatory prohibitions of the Clean Water Act against discharge of harmful quantities of hazardous substances into or upon U.S. waters out to 200 nm (371 km). These instructions include stringent hazardous waste discharge, storage, dumping, and pollution prevention requirements. Navy ships are required to conduct activities at sea in a manner that minimizes or eliminates any adverse impacts on the marine environment from hazardous materials or wastes.

The Navy has an active Pollution Prevention Program that applies to all aspects of its activities. It is Navy policy to conduct its facility management and acquisition programs so as to reduce to the maximum extent possible the quantity of toxic chemicals entering the environment. The Pollution Prevention Program is a comprehensive set of practices that reduce the volumes of wastes to be treated or transferred to the environment. The fundamental tenet of the Navy's Pollution Prevention Program is the reduction of hazardous materials and wastes at their source. This results in less hazardous waste for all waste streams. Pollution prevention practices include:

- Raw material substitution,
- Product reformulation,
- Process redesign or modification,
- Improved operation and maintenance, and
- Aggressive recycling programs.

5.4 WATER RESOURCES

Environmental compliance policies and procedures applicable to operations ashore are identified in Navy instructions that include directives regarding hazardous materials and waste management, pollution prevention, and recycling. Measures about management of hazardous materials and wastes at SCI, as discussed in Section 3.4.3.2.1 *et seq*., provide protections for surface waters and ocean waters. In addition to preventive measures, implementation of the Installation Restoration Program at SCI also provides protection to these water resources from consequences of past practices. With regard to reducing or avoiding water quality degradation from the expenditure of training materials, management practices include activities to remove training debris including unexploded ordnance from land ranges. Certain features of the training materials themselves are designed to reduce pollution, as required by Navy and Department of Defense (DoD) regulations.

5.5 ACOUSTIC ENVIRONMENT (AIRBORNE SOUND)

Military personnel who might be exposed to airborne sound from military activities are required to take precautions, such as the wearing of protective equipment, to reduce or eliminate potential harmful effects of such exposure. With regard to potential exposure of non-military personnel in ocean areas (such as fishermen in the vicinity of SCI) precautions are taken pursuant to SOPs to prevent such exposure. These include advance notice of scheduled operations to the public and the commercial fishing community via the worldwide web, Notices to Mariners (NOTMARs), and Notices to Airmen (NOTAMs). In addition, range safety SOPs ensure that civilians are excluded from, and if necessary removed from areas of military operations, or that military activities do not occur when civilians are present. These procedures have proven effective at minimizing potential military / civilian interactions in the course of active training or other military activities.

The Navy has developed detailed SOPs regarding sound in the ocean environment, particularly with respect to sonar and explosive sources. These measures are discussed in detail below in Section 5.8 with regard to potential effects of sound on marine mammals and sea turtles.

5.6 MARINE PLANTS AND INVERTEBRATES

Marine plants and invertebrates benefit from the following measures in place to protect marine mammals and sea turtles (see Section 5.8). Lookouts are posted to visually survey for floating kelp, plants, or algal mats. In training using explosive ordnance, the intended impact area shall not be within 1000 yards (yd) (585 m) of known or observed kelp beds, floating plants, or algal mats. For training events using non-explosive ordnance, intended impact area shall not be within 200 yds (183 m) of known or observed kelp beds, floating plants, or algal mats. For air-to-surface missile exercises, the buffer zone is extended to 1,800 yds (1,646 m) around kelp forests, floating plants, and algal mats, for both explosive and non-explosive ordnance.

5.7 FISH

Mitigation measures for activities involving underwater detonations, implemented for marine mammals and sea turtles, also offer protections to habitats associated with fish communities. No additional mitigation measures are proposed or warranted because no substantial effects on fish or fish habitat were identified.

5.8 SEA TURTLES AND MARINE MAMMALS

As discussed in Section 3.8 and 3.9, the comprehensive suite of protective measures and SOPs implemented by the Navy to reduce impacts to marine mammals also serves to mitigate potential impacts on sea turtles. In particular, personnel and watchstander training, establishment of turtle-free exclusion zones for underwater detonations of explosives, and pre- and post-exercise surveys, all serve to reduce or eliminate potential impacts of Navy activities on sea turtles that may be present in the vicinity.

Effective training in the SOCAL Range Complex dictates that ship, submarine, and aircraft participants utilize their sensors and exercise weapons to their optimum capabilities as required by the mission. This section is a comprehensive list of mitigation measures that would be utilized for training activities analyzed in the SOCAL EIS/OEIS in order to minimize potential for impacts on marine mammals and sea turtles in the SOCAL Range Complex.

This section includes protective and mitigation measures that are followed for all types of exercises; those that are associated with a particular type of training event; and those that apply to a particular geographic region or season. For major exercises, the applicable mitigation measures are incorporated into a naval message which is disseminated to all of the units participating in the exercise or training event and applicable responsible commands. U.S. participants are required to comply with these measures. Non-U.S. participants involved in events within the territorial seas of the U.S. (12 nm) are requested to comply with these measures to the extent these measures do not conflict with Status Of Forces agreements. Non-U.S. participants involved in events beyond the territorial seas (12 nm) are encouraged to comply with these mitigation measures to the extent the measures do not impair training, operations, or operational capabilities.

5.8.1 General Maritime Measures

5.8.1.1 Personnel Training – Watchstanders and Lookouts

The use of shipboard lookouts is a critical component of all Navy protective measures. Navy shipboard lookouts (also referred to as “watchstanders”) are highly qualified and experienced observers of the marine environment. Their duties require that they report all objects sighted in the water to the officer of the deck (OOD) (e.g., trash, a periscope, marine mammals, sea turtles) and all disturbances (e.g., surface disturbance, discoloration) that may be indicative of a threat to the vessel and its crew. There are personnel serving as lookouts on station at all times (day and night) when a ship or surfaced submarine is moving through the water.

All commanding officers (COs), executive officers (XOs), lookouts, OODs, junior OODs (JOODs), maritime patrol aircraft aircrews, and Anti-submarine Warfare (ASW)/Mine Warfare (MIW) helicopter crews will complete the NMFS-approved Marine Species Awareness Training (MSAT) by viewing the U.S. Navy MSAT digital versatile disk (DVD). MSAT may also be viewed on-line at https://portal.navfac.navy.mil/go/msat. All bridge watchstanders/lookouts will complete both parts one and two of the MSAT; part two is optional for other personnel. Part I of this training addresses the lookout’s role in environmental protection, laws governing the protection of marine species, Navy stewardship commitments and general observation information to aid in avoiding interactions with marine species. Part II focuses on identification of specific species.

- Navy lookouts will undertake extensive training in order to qualify as a watchstander in accordance with the Lookout Training Handbook (Naval Education and Training Command [NAVEDTRA] 12968-D).
- Lookout training will include on-the-job instruction under the supervision of a qualified, experienced watchstander. Following successful completion of this supervised training period, lookouts will complete the Personal Qualification Standard Program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects). Personnel being trained as lookouts can be counted among those listed below as long as supervisors monitor their progress and performance.
- Lookouts will be trained in the most effective means to ensure quick and effective communication within the command structure in order to facilitate implementation of protective measures if marine species are spotted.

5.8.1.2 Operating Procedures & Collision Avoidance

- Prior to major exercises, a Letter of Instruction, Mitigation Measures Message or Environmental Annex to the Operational Order will be issued to further disseminate the personnel training requirement and general marine species protective measures.
- COs will make use of marine species detection cues and information to limit interaction with marine species to the maximum extent possible consistent with safety of the ship.
- While underway, surface vessels will have at least two lookouts with binoculars; surfaced submarines will have at least one lookout with binoculars. Lookouts already posted for safety of navigation and man-overboard precautions may be used to fill this requirement.

As part of their regular duties, lookouts will watch for and report to the OOD the presence of marine mammals and sea turtles.

- On surface vessels equipped with a mid-frequency active sonar, pedestal mounted “Big Eye” (20x10) binoculars will be properly installed and in good working order to assist in the detection of marine mammals and sea turtles in the vicinity of the vessel.
- Personnel on lookout will employ visual search procedures employing a scanning methodology in accordance with the Lookout Training Handbook (NAVEDTRA 12968-D).
- After sunset and prior to sunrise, lookouts will employ Night Lookouts Techniques in accordance with the Lookout Training Handbook. (NAVEDTRA 12968-D)
- While in transit, naval vessels will be alert at all times, use extreme caution, and proceed at a “safe speed” so that the vessel can take proper and effective action to avoid a collision with any marine animal and can be stopped within a distance appropriate to the prevailing circumstances and conditions.
- When marine mammals have been sighted in the area, Navy vessels will increase vigilance and take reasonable and practicable actions to avoid collisions and activities that might result in close interaction of naval assets and marine mammals. Actions may include changing speed and/or direction and are dictated by environmental and other conditions (e.g., safety, weather).
- Naval vessels will maneuver to keep a safe distance from any observed marine mammal and avoid approaching them head-on. This requirement does not apply if a vessel’s safety is threatened, such as when change of course will create an imminent and serious threat to a person, vessel, or aircraft, and to the extent vessels are restricted in their ability to maneuver. Restricted maneuverability includes, but is not limited to, situations when vessels are engaged in dredging, submerged operations, launching and recovering aircraft or landing craft, minesweeping operations, replenishment while underway and towing operations that severely restrict a vessel’s ability to deviate course. Vessels will take reasonable steps to alert other vessels in the vicinity of the whale.
- Floating weeds and kelp, algal mats, clusters of seabirds, and jellyfish are good indicators of sea turtles and marine mammals. Therefore, increased vigilance in watching for sea turtles and marine mammals will be taken where these are present.
- Navy aircraft participating in exercises at sea will conduct and maintain, when operationally feasible and safe, surveillance for marine species of concern as long as it does not violate safety constraints or interfere with the accomplishment of primary operational duties. Marine mammal detections will be immediately reported to assigned Aircraft Control Unit for further dissemination to ships in the vicinity of the marine species as appropriate where it is reasonable to conclude that the course of the ship will likely result in a closing of the distance to the detected marine mammal.
- All vessels will maintain logs and records documenting training operations should they be required for event reconstruction purposes. Logs and records will be kept for a period of 30 days following completion of a major training exercise.

5.8.2 Measures for Specific Training Events

5.8.2.1 Mid-Frequency Active Sonar Operations

5.8.2.1.1 General Maritime Mitigation Measures: Personnel Training

- All lookouts onboard platforms involved in ASW training events will review the NMFS-approved Marine Species Awareness Training material prior to use of mid-frequency active sonar.
- All COs, XOs, and officers standing watch on the bridge will have reviewed the Marine Species Awareness Training material prior to a training event employing the use of mid-frequency active sonar.
- Navy lookouts will undertake extensive training in order to qualify as a watchstander in accordance with the Lookout Training Handbook (Naval Educational Training [NAVEDTRA], 12968-D).
- Lookout training will include on-the-job instruction under the supervision of a qualified, experienced watchstander. Following successful completion of this supervised training period, lookouts will complete the Personal Qualification Standard program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects). This does not forbid personnel being trained as lookouts from being counted as those listed in previous measures so long as supervisors monitor their progress and performance.
- Lookouts will be trained in the most effective means to ensure quick and effective communication within the command structure in order to facilitate implementation of mitigation measures if marine species are spotted.

5.8.2.1.2 General Maritime Mitigation Measures: Lookout and Watchstander Responsibilities

- On the bridge of surface ships, there will always be at least three people on watch whose duties include observing the water surface around the vessel.
- All surface ships participating in ASW training events will, in addition to the three personnel on watch noted previously, have at all times during the exercise at least two additional personnel on watch as lookouts.
- Personnel on lookout and officers on watch on the bridge will have at least one set of binoculars available for each person to aid in the detection of marine mammals.
- On surface vessels equipped with mid-frequency active sonar, pedestal mounted “Big Eye” (20x110) binoculars will be present and in good working order to assist in the detection of marine mammals in the vicinity of the vessel.
- Personnel on lookout will employ visual search procedures employing a scanning methodology in accordance with the Lookout Training Handbook (NAVEDTRA 12968-D).
- After sunset and prior to sunrise, lookouts will employ Night Lookouts Techniques in accordance with the Lookout Training Handbook. Application of these techniques, which include the use of night vision goggles, allow lookouts to effectively monitor a 1,100-yd (1,000-m) safety zone at night.
- Personnel on lookout will be responsible for reporting all objects or anomalies sighted in the water (regardless of the distance from the vessel) to the Officer of the Deck, since any object or disturbance (e.g., trash, periscope, surface disturbance, discoloration) in the water may be indicative of a threat to the vessel and its crew or indicative of a marine species that may need to be avoided as warranted.

5.8.2.1.3 Operating Procedures

- A Letter of Instruction, Mitigation Measures Message, or Environmental Annex to the Operational Order will be issued prior to the exercise to further disseminate the personnel training requirement and general marine mammal mitigation measures.
- COs will make use of marine species detection cues and information to limit interaction with marine species to the maximum extent possible consistent with safety of the ship.
- All personnel engaged in passive acoustic sonar operation (including aircraft, surface ships, or submarines) will monitor for marine mammal vocalizations and report the detection of any marine mammal to the appropriate watch station for dissemination and appropriate action.
- During mid-frequency active sonar operations, personnel will utilize all available sensor and optical systems (such as night vision goggles) to aid in the detection of marine mammals.
- Navy aircraft participating in exercises at sea will conduct and maintain, when operationally feasible and safe, surveillance for marine species of concern as long as it does not violate safety constraints or interfere with the accomplishment of primary operational duties.
- Aircraft with deployed sonobuoys will use only the passive capability of sonobuoys when marine mammals are detected within 200 yds (183 m) of the sonobuoy.
- Marine mammal detections will be immediately reported to assigned Aircraft Control Unit for further dissemination to ships in the vicinity of the marine species as appropriate where it is reasonable to conclude that the course of the ship will likely result in a closing of the distance to the detected marine mammal.
- Safety Zones—When marine mammals are detected by any means (aircraft, shipboard lookout, or acoustically) within 1,000 yds (914 m) of the sonar dome (the bow), the ship or submarine will limit active transmission levels to at least 6 decibels (dB) below normal operating levels. (A 6 dB reduction equates to a 75 percent power reduction. The reason is that decibel levels are on a logarithmic scale, not a linear scale. Thus, a 6 dB reduction results in a power level only 25 percent of the original power.)
    - Ships and submarines will continue to limit maximum transmission levels by this 6-dB factor until the animal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yds (1829 m) beyond the location of the last detection.
    - Should a marine mammal be detected within or closing to inside 500 yds (457 m) of the sonar dome, active sonar transmissions will be limited to at least 10 dB below the equipment's normal operating level. (A 10 dB reduction equates to a 90 percent power reduction from normal operating levels.) Ships and submarines will continue to limit maximum ping levels by this 10-dB factor until the animal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yds (457 m) beyond the location of the last detection.
    - Should the marine mammal be detected within or closing to inside 200 yds (183 m) of the sonar dome, active sonar transmissions will cease. Sonar will not resume until the animal has been seen to leave the area, has not been detected for

30 minutes, or the vessel has transited more than 2,000 yds (457 m) beyond the location of the last detection.

  - Special conditions applicable for dolphins and porpoises only: If, after conducting an initial maneuver to avoid close quarters with dolphins or porpoises, the OOD concludes that dolphins or porpoises are deliberately closing to ride the vessel's bow wave, no further mitigation actions are necessary while the dolphins or porpoises continue to exhibit bow wave riding behavior.
  - If the need for power-down should arise as detailed in “Safety Zones” above, the Navy shall follow the requirements as though they were operating at 235 dB—the normal operating level (i.e., the first power-down will be to 229 dB, regardless of at what level above 235 sonar was being operated).

- Prior to start up or restart of active sonar, operators will check that the Safety Zone radius around the sound source is clear of marine mammals.
- Active sonar levels (generally)—Navy will operate sonar at the lowest practicable level, not to exceed 235 dB, except as required to meet tactical training objectives.
- Helicopters shall observe/survey the vicinity of an ASW training event for 10 minutes before the first deployment of active (dipping) sonar in the water.
- Helicopters shall not dip their sonar within 200 yds (183 m) of a marine mammal and shall cease pinging if a marine mammal closes within 200 yds (183 m) after pinging has begun.
- Submarine sonar operators will review detection indicators of close-aboard marine mammals prior to the commencement of ASW training events involving active mid-frequency sonar.
- Increased vigilance will be practiced during ASW training events with tactical active sonar when critical conditions are present.

  Based on lessons learned from strandings in Bahamas 2000, Madeiras 2000, Canaries 2002 and Spain 2006, beaked whales are of particular concern. The Navy should avoid planning Major ASW Training Exercises with mid-frequency active sonar in areas where they will encounter conditions which, in their aggregate, may contribute to a marine mammal stranding event.

  The conditions to be considered during exercise planning include:

  - Areas of at least 1,000-m depth near a shoreline where there is a rapid change in bathymetry on the order of 1,000-6,000 yds (914-5,486 m) occurring across a relatively short horizontal distance (e.g., 5 nautical miles [nm]).
  - Cases for which multiple ships or submarines (≥ 3) operating mid-frequency active sonar in the same area over extended periods of time (≥ 6 hours) in close proximity (≤ 10 nm apart).
  - An area surrounded by land masses, separated by less than 35 nm and at least 10 nm in length, or an embayment, wherein operations involving multiple ships/subs (≥ 3) employing mid-frequency active sonar near land may produce sound directed toward the channel or embayment that may cut off the lines of egress for marine mammals.

  - Though not as dominant a condition as bathymetric features, the historical presence of a significant surface duct (i.e., a mixed layer of constant water temperature extending from the sea surface to 100 ft or more).

If the Major Range Event is to occur in an area where the above conditions exist in their aggregate, these conditions must be fully analyzed in environmental planning documentation. The Navy will increase vigilance by undertaking the following additional mitigation measure:

- A dedicated aircraft (Navy asset or contracted aircraft) will undertake reconnaissance of the embayment or channel ahead of the exercise participants to detect marine mammals that may be in the area exposed to active sonar. Where practical, advance survey should occur within about 2 hours prior to mid-frequency active sonar use and periodic surveillance should continue for the duration of the exercise. Any unusual conditions (e.g., presence of marine mammals, groups of species milling out of habitat, and any stranded animals) shall be reported to the Office in Tactical Command, who should give consideration to delaying, suspending, or altering the exercise.
- All safety zone power down requirements described above will apply.
- The post-exercise report must include specific reference to any event conducted in areas where the above conditions exist, with exact location and time/duration of the event, and noting results of surveys conducted.

5.8.2.2 Surface-to-Surface Gunnery (up to 5-inch explosive rounds)

- Lookouts will visually survey for floating weeds and kelp, and algal mats which may be inhabited by immature sea turtles in the target area. Intended impact shall not be within 600 yds (585 m) of known or observed floating weeds and kelp, and algal mats.
- A 600 yard radius buffer zone will be established around the intended target.
- From the intended firing position, lookouts will survey the buffer zone for marine mammals and sea turtles prior to commencement and during the exercise as long as practicable. Due to the distance between the firing position and the buffer zone, lookouts are only expected to visually detect breaching whales, whale blows, and large pods of dolphins and porpoises.
- When manned, target towing vessels will maintain a lookout. If a marine mammal or sea turtle is sighted in the vicinity of the exercise, the tow vessel will immediately notify the firing vessel in order to secure gunnery firing until the area is clear.
- The exercise will be conducted only when the buffer zone is visible and marine mammals and sea turtles are not detected within the target area and the buffer zone.

5.8.2.3 Surface-to-Surface Gunnery (non-explosive rounds)

- Lookouts will visually survey for floating weeds and kelp, and algal mats which may be inhabited by immature sea turtles in the target area. Intended impact will not be within 200 yds (183 m) of known or observed floating weeds and kelp, and algal mats.
- A 200-yd (183 m) radius buffer zone will be established around the intended target.
- From the intended firing position, lookouts will survey the buffer zone for marine mammals and sea turtles prior to commencement and during the exercise as long as practicable. Due to the distance between the firing position and the buffer zone, lookouts are only expected to visually detect breaching whales, whale blows, and large pods of dolphins and porpoises.

- When manned, target towing vessels will maintain a lookout. If a marine mammal or sea turtle is sighted in the vicinity of the exercise, the tow vessel will immediately notify the firing vessel in order to secure gunnery firing until the area is clear.
- The exercise will be conducted only when the buffer zone is visible and marine mammals and sea turtles are not detected within the target area and the buffer zone.

5.8.2.4 Surface-to-Air Gunnery (explosive and non-explosive rounds)

- Vessels will orient the geometry of gunnery exercises in order to prevent debris from falling in the area of sighted marine mammals, sea turtles, algal mats, and floating kelp.
- Vessels will expedite the recovery of any parachute deploying aerial targets to reduce the potential for entanglement of marine mammals and sea turtles.
- Target towing aircraft shall maintain a lookout. If a marine mammal or sea turtle is sighted in the vicinity of the exercise, the tow aircraft will immediately notify the firing vessel in order to secure gunnery firing until the area is clear.

5.8.2.5 Air-to-Surface Gunnery (explosive and non-explosive rounds)

- If surface vessels are involved, lookouts will visually survey for floating kelp, which may be inhabited by immature sea turtles, in the target area. Impact should not occur within 200 yds (183 m) of known or observed floating weeds and kelp or algal mats.
- A 200 yd (183 m) radius buffer zone will be established around the intended target.
- If surface vessels are involved, lookout(s) will visually survey the buffer zone for marine mammals and sea turtles prior to and during the exercise.
- Aerial surveillance of the buffer zone for marine mammals and sea turtles will be conducted prior to commencement of the exercise. Aerial surveillance altitude of 500 feet to 1,500 ft (152 - 456 m) is optimum. Aircraft crew/pilot will maintain visual watch during exercises. Release of ordnance through cloud cover is prohibited: aircraft must be able to actually see ordnance impact areas.
- The exercise will be conducted only if marine mammals and sea turtles are not visible within the buffer zone.

5.8.2.6 Small Arms Training - (grenades, explosive and non-explosive rounds)

- Lookouts will visually survey for floating weeds or kelp, algal mats, marine mammals, and sea turtles. Weapons will not be fired in the direction of known or observed floating weeds or kelp, algal mats, marine mammals, sea turtles.

5.8.2.7 Air-to-Surface At-Sea Bombing Exercises (explosive and non-explosive bombs and cluster munitions, rockets)

- If surface vessels are involved, lookouts will survey for floating kelp, which may be inhabited by immature sea turtles. Ordnance shall not be targeted to impact within 1,000 yds (914 m) of known or observed floating kelp, sea turtles, or marine mammals.
- A buffer zone of 1,000 yd (914 m) radius will be established around the intended target.
- Aircraft will visually survey the target and buffer zone for marine mammals and sea turtles prior to and during the exercise. The survey of the impact area will be made by flying at 1,500 feet or lower, if safe to do so, and at the slowest safe speed. Release of ordnance through cloud cover is prohibited: aircraft must be able to actually see

ordnance impact areas. Survey aircraft should employ most effective search tactics and capabilities.

- The exercises will be conducted only if marine mammals and sea turtles are not visible within the buffer zone.

5.8.2.8 Air-to-Surface Missile Exercises (explosive and non-explosive)

- Ordnance shall not be targeted to impact within 1,800 yds (1,646 m) of known or observed floating kelp, which may be inhabited by immature sea turtles.
- Aircraft will visually survey the target area for marine mammals and sea turtles. Visual inspection of the target area will be made by flying at 1,500 (457 m) feet or lower, if safe to do so, and at slowest safe speed. Firing or range clearance aircraft must be able to actually see ordnance impact areas. Explosive ordnance shall not be targeted to impact within 1,800 yds (1646 m) of sighted marine mammals and sea turtles.

5.8.2.9 Mine Countermeasures (Mine Sweeping)

- Establish a 250 yard buffer zone around the vessel and any towed sonar equipment.
- Do not conduct exercise if marine mammals or sea turtles are detected within the buffer zone.
- Use lookouts to survey for kelp beds before and during the exercise.
- Exercise shall not be conducted within 250 yards of known or observed kelp beds.

5.8.2.10 Underwater Detonations (up to 20-lb charges)

To ensure protection of marine mammals and sea turtles during underwater detonation training, the operating area must be determined to be clear of marine mammals and sea turtles prior to detonation. Implementation of the following mitigation measures continue to ensure that marine mammals would not be exposed to temporary threshold shift (TTS), permanent threshold shift (PTS), or injury from physical contact with training mine shapes during Major Exercises.

5.8.2.10.1 Exclusion Zones

All Mine Warfare and Mine Countermeasures Operations involving the use of explosive charges must include exclusion zones for marine mammals and sea turtles to prevent physical and/or acoustic effects to those species. These exclusion zones shall extend in a 700-yard arc radius around the detonation site.

5.8.2.10.2 Pre-Exercise Surveys

For Demolition and Ship Mine Countermeasures Operations, pre-exercise survey shall be conducted within 30 minutes prior to the commencement of the scheduled explosive event. The survey may be conducted from the surface, by divers, and/or from the air, and personnel shall be alert to the presence of any marine mammal or sea turtle. Should such an animal be present within the survey area, the exercise shall be paused until the animal voluntarily leaves the area. The Navy will suspend detonation exercises and ensure the area is clear for a full 30 minutes prior to detonation. Personnel will record any marine mammal and sea turtle observations during the exercise as well as measures taken if species are detected within the exclusion zone.

5.8.2.10.3 Post-Exercise Surveys and Reporting

Surveys within the same radius shall also be conducted within 30 minutes after the completion of the explosive event.

If there is evidence that a marine mammal or sea turtle may have been stranded, injured or killed by the action, Navy training activities will be immediately suspended and the situation immediately reported by the participating unit to the Officer in Charge of the Exercise (OCE), who will follow Navy procedures for reporting the incident to the Commander, Pacific Fleet, Commander, Navy Region Southwest, Environmental Director, and the chain-of-command.

5.8.2.11 Very Shallow Water Underwater Detonations Mitigation Measures

- For each exercise, the safety-boat with an observer is launched 30 or more minutes prior to detonation and moves through the area around the detonation site. The task of the safety observer is to augment a shore observer's visual search of the mitigation zone for marine mammals and turtles. The safety-boat observer is in constant radio communication with the exercise coordinator and shore observer.
- At least 10 minutes prior to the planned initiation of the detonation event-sequence, the shore observer, on an elevated on-shore position, begins a continuous visual search with binoculars of the mitigation zone. At this time, the safety-boat observer informs the shore observer if any marine mammal or turtle has been seen in the zone and, together, both search the surface within and beyond the mitigation zone for marine mammals and turtles.
- The shore observer will indicate that the area is clear of animals after 10 or more minutes of continuous observation with no marine mammals or turtles having been seen in the mitigation zone or moving toward it.
- The observer will indicate that the area is not clear of animals any time a marine mammal or turtle is sited in the mitigation zone or moving toward it and, subsequently, indicate that the area is clear of animals when the animal is out and moving away and no others have been sited.
- Initiation of the detonation sequence will only began on receipt of an indication from the shore observer that the area is clear of animals and will be postponed on receipt of an indication from that observer that the area is not clear of animals.
- Following the detonation, visual monitoring of the mitigation zone continues for 30 minutes for the appearance of any marine mammal or turtle in the zone. Any marine mammal or sea turtle appearing in the area will be observed for signs of possible injury. Possibly injured marine mammals or turtles are reported to the CNRSW Environmental Director and CPF San Diego Detachment office.

5.8.2.12 Mining Operations

Mining Operations involve aerial drops of inert training shapes on target points. Aircrews are scored for their ability to accurately hit the target points. This operation does not involve live ordnance. The probability of a marine species being in the exact spot in the ocean where an inert object is dropped is remote. However, as a conservative measure, initial target points will be briefly surveyed prior to inert ordnance release from an aircraft to ensure the intended drop area is clear of marine mammals and sea turtles.

5.8.2.13 Sinking Exercise

The selection of sites suitable for SINKEX involves a balance of operational suitability, requirements established under the Marine Protection, Research and Sanctuaries Act (MPRSA) permit granted to the Navy (40 Code of Federal Regulations § 229.2), and the identification of areas with a low likelihood of encountering marine mammals and sea turtles. To meet operational suitability criteria, locations must be within a reasonable distance of the target vessels' originating location. The locations should also be close to active military bases to allow participating assets access to shore facilities. For safety purposes, these locations should also be in areas that are not generally used by non-military air or watercraft. The MPRSA permit requires vessels to be sunk in waters which are at least 1,000 fathoms (3,000 yds / 2,742 m)) deep and at least 50 nm from land.

In general, most marine mammals prefer areas with strong bathymetric gradients and oceanographic fronts for significant biological activity such as feeding and reproduction. Typical locations include the continental shelf and shelf-edge.

5.8.2.13.1 Sink Exercise Mitigation Plan

The Navy has developed range clearance procedures to maximize the probability of sighting any ships, marine mammals, or sea turtles in the vicinity of an exercise, which are as follows:

- All weapons firing would be conducted during the period 1 hour after official sunrise to 30 minutes before official sunset.
- Extensive range clearance operations would be conducted in the hours prior to commencement of the exercise, ensuring that no shipping is located within the hazard range of the longest-range weapon being fired for that event.
- An exclusion zone with a radius of 1.0 nm would be established around each target. This exclusion zone is based on calculations using a 990-pound (lb) H6 net explosive weight high explosive source detonated 5 ft below the surface of the water, which yields a distance of 0.85 nm (cold season) and 0.89 nm (warm season) beyond which the received level is below the 182 decibels (dB) re: 1 micropascal squared-seconds (µPa2-s) threshold established for the WINSTON S. CHURCHILL (DDG 81) shock trials (DoN 2001). An additional buffer of 0.5 nm would be added to account for errors, target drift, and animal movements. Additionally, a safety zone, which extends from the exclusion zone at 1.0 nm out an additional 0.5 nm, would be surveyed. Together, the zones extend out 2 nm from the target.
- A series of surveillance over-flights would be conducted within the exclusion and the safety zones, prior to and during the exercise, when feasible. Survey protocol would be as follows:
    - Overflights within the exclusion zone would be conducted in a manner that optimizes the surface area of the water observed. This may be accomplished through the use of the Navy's Search and Rescue Tactical Aid, which provides the best search altitude, ground speed, and track spacing for the discovery of small, possibly dark objects in the water based on the environmental conditions of the day. These environmental conditions include the angle of sun inclination, amount of daylight, cloud cover, visibility, and sea state.
    - All visual surveillance activities would be conducted by Navy personnel trained in visual surveillance. At least one member of the mitigation team would have completed the Navy's marine mammal training program for lookouts.
    - In addition to the overflights, the exclusion zone would be monitored by passive acoustic means, when assets are available. This passive acoustic monitoring would be maintained throughout the exercise. Potential assets include sonobuoys, which can be utilized to detect any vocalizing marine mammals (particularly sperm whales) in the vicinity of the exercise. The sonobuoys would be re-seeded as necessary throughout the exercise. Additionally, passive sonar onboard submarines may be utilized to detect any vocalizing marine mammals in the area. The OCE would be informed of any aural detection of marine mammals and would include this information in the determination of when it is safe to commence the exercise.
    - On each day of the exercise, aerial surveillance of the exclusion and safety zones would commence 2 hours prior to the first firing.

  - The results of all visual, aerial, and acoustic searches would be reported immediately to the OCE. No weapons launches or firing would commence until the OCE declares the safety and exclusion zones free of marine mammals and sea turtles.
  - If a marine mammal or sea turtle is observed within the exclusion zone is diving, firing would be delayed until the animal is re-sighted outside the exclusion zone, or 30 minutes have elapsed. After 30 minutes, if the animal has not been re-sighted it would be assumed to have left the exclusion zone.
  - During breaks in the exercise of 30 minutes or more, the exclusion zone would again be surveyed for any marine mammals or sea turtles. If any marine species are sighted within the exclusion zone, the OCE would be notified, and the procedure described above would be followed.
  - Upon sinking of the vessel, a final surveillance of the exclusion zone would be monitored for 2 hours, or until sunset, to verify that no marine mammals were harmed.
- Aerial surveillance would be conducted using helicopters or other aircraft based on necessity and availability. The Navy has several types of aircraft capable of performing this task; however, not all types are available for every exercise. For each exercise, the available asset best suited for identifying objects on and near the surface of the ocean would be used. These aircraft would be capable of flying at the slow safe speeds necessary to enable viewing of marine vertebrates with unobstructed, or minimally obstructed, downward and outward visibility. The exclusion and safety zone surveys may be cancelled in the event that a mechanical problem, emergency search and rescue, or other similar and unexpected event preempts the use of one of the aircraft onsite for the exercise.
- Every attempt would be made to conduct the exercise in sea states that are ideal for marine mammal sighting, Beaufort Sea State 3 or less. In the event of a 4 or above, survey efforts would be increased within the zones. This would be accomplished through the use of an additional aircraft, if available, and conducting tight search patterns.
- The exercise would not be conducted unless the exclusion zone could be adequately monitored visually.
- In the event that any marine mammals or sea turtles are observed to be harmed in the area, a detailed description, including a description of the state of decomposition, if present, of the animal would be taken, the location noted, and if possible, photos taken. This information would be provided to NOAA Fisheries via the Navy’s regional environmental coordinator for purposes of identification.
- An after action report detailing the exercise’s time line, the time the surveys commenced and terminated, amount, and types of all ordnance expended, and the results of survey efforts for each event would be submitted to NOAA Fisheries.

5.8.2.14 Mitigation Measures Related to Explosive Source Sonobuoys (AN/SSQ-110A)

5.8.2.14.1 AN/SSQ-110A Pattern Deployment

- Crews will conduct visual reconnaissance of the drop area prior to laying their intended sonobuoy pattern. This search should be conducted below 1500 ft at a slow speed when operationally feasible and weather conditions permit. In dual aircraft operations, crews may conduct coordinated area clearances.

- Crews shall conduct a minimum of 30 minutes of visual and aural monitoring of the search area prior to commanding the first post (source/receiver sonobuoy pair) detonation. This 30 minute observation period may include pattern deployment time.
- For any part of the briefed pattern where a post will be deployed within 1000 yds of observed marine mammal activity, crews will deploy the receiver ONLY and monitor while conducting a visual search. When marine mammals are no longer detected within 1000 yds of the intended post position, crews will collocate the AN/SSQ-110A sonobuoy (source) with the receiver.
- When operationally feasible, crews will conduct continuous visual and aural monitoring of marine mammal activity, including monitoring of their aircraft sensors from first sensor placement to checking off-station and out of RF range of the sensors.

5.8.2.14.2 AN/SSQ-110A Pattern Employment

- Aural Detection:
  - Aural detection of marine mammals cues the aircrew to increase the diligence of their visual surveillance.
  - If, following aural detection, no marine mammals are visually detected, then the crew may continue multi-static active search.
- Visual Detection:
  - If marine mammals are visually detected within 1000 yds of the AN/SSQ-110A sonobuoy intended for use, then that payload shall not be detonated. Aircrews may utilize this post once the marine mammals have not been re-sighted for 30 minutes or are observed to have moved outside the 1000 yd safety zone.
  - Aircrews may shift their multi-static active search to another post, where marine mammals are outside the 1000 yd safety zone.

5.8.2.14.3 AN/SSQ-110A Scuttling Sonobuoys

- Aircrews shall make every attempt to manually detonate the unexploded charges at each post in the pattern prior to departing the operations area by using the “Payload 1 Release” command followed by the “Payload 2 Release” command. Aircrews shall refrain from using the “Scuttle” command when two payloads remain at a given post. Aircrews will ensure a 1000 yd safety zone, visually clear of marine mammals, is maintained around each post as is done during active search operations.
- Aircrews shall only leave posts with unexploded charges in the event of a sonobuoy malfunction, an aircraft system malfunction, or when an aircraft must immediately depart the area due to issues such as fuel constraints, inclement weather, and in-flight emergencies. In these cases, the sonobuoy will self-scuttle using the secondary method or tertiary method.
- Aircrews ensure all payloads are accounted for. Sonobuoys that cannot be scuttled shall be reported as unexploded ordnance via voice communications while airborne and, upon landing, via Naval message.
- Mammal monitoring shall continue until out of their aircraft sensor range.

5.8.3 Conservation Measures

5.8.3.1 Proposed Monitoring Plan for the SOCAL Range Complex

The Navy has submitted a draft Monitoring Plan for the SOCAL Range Complex, which may be viewed at NMFS' Web site: *http:// www.nmfs.noaa.gov/pr/permits/incidental.htm*. NMFS and the Navy have worked together on the development of this plan in the months preceding the publication of this Final EIS/OEIS; however, Navy and NMFS are still refining the plan and anticipate that it will contain more details by the time it is finalized in advance of the issuance of the Record of Decision. Additionally, the plan may be modified or supplemented based on comments or new information received from the public. A summary of the primary components of the plan follows.

The draft Monitoring Plan for SOCAL has been designed as a collection of focused ''studies'' (described fully in the SOCAL draft Monitoring Plan) to gather data that will allow the Navy to address the following questions:

- Are marine mammals exposed to MFA sonar, especially at levels associated with adverse effects (i.e., based on NMFS' criteria for behavioral harassment, TTS, or PTS)? If so, at what levels are they exposed?
- If marine mammals are exposed to MFA sonar in the SOCAL Range Complex, do they redistribute geographically as a result of continued exposure? If so, how long does the redistribution last?
- If marine mammals are exposed to MFA sonar, what are their behavioral responses to various levels?
- Is the Navy's suite of mitigation measures for MFA sonar (e.g., measures agreed to by the Navy through permitting) effective at avoiding TTS, injury, and mortality of marine mammals?

Data gathered in these studies will be collected by qualified, professional marine mammal biologists that are experts in their field. They will use a combination of the following methods to collect data:

- Contracted vessel and aerial surveys.
- Passive acoustics.
- Marine mammal observers on Navy ships.

In the five proposed study designs (all of which cover multiple years), the above methods will be used separately or in combination to monitor marine mammals in different combinations before, during, and after training activities utilizing MFA sonar/HFA sonar.

This monitoring plan has been designed to gather data on all species of marine mammals that are observed in SOCAL. The Plan recognizes that deep-diving and cryptic species of marine mammals such as beaked whales have a low probability of detection (Barlow and Gisiner, 2006). Therefore, methods will be utilized to attempt to address this issue (e.g., passive acoustic monitoring).

In addition to the Monitoring Plan for SOCAL, by the end of 2009, the Navy will have completed an Integrated Comprehensive Monitoring Program (ICMP). The ICMP will provide the overarching structure and coordination that will, over time, compile data from both range specific monitoring plans (such as AFAST, the Hawaii Range Complex, and the SOCAL Range Complex) as well as Navy funded research and development (R&D) studies. The primary objectives of the ICMP are to:

- Monitor Navy training events, particularly those involving MFA sonar and underwater detonations, for compliance with the terms and conditions of ESA Section 7 consultations or MMPA authorizations;
- Collect data to support estimating the number of individuals exposed to sound levels above current regulatory thresholds;
- Assess the efficacy of the Navy's current marine species mitigation;
- Add to the knowledge base on potential behavioral and physiological effects to marine species from mid-frequency active sonar and underwater detonations; and,
- Assess the practicality and effectiveness of a number of mitigation tools and techniques (some not yet in use).

More information about the ICMP may be found in the draft Monitoring Plan for SOCAL.

5.8.3.2 Adaptive Management

Adaptive management principles consider appropriate adjustments to mitigation, monitoring, and reporting as the outcomes of the proposed actions and required mitigation are better understood. NMFS includes adaptive management principles in the regulations for the implementation of the proposed action, and any adaptive adjustments of mitigation and monitoring would be led by NMFS via the MMPA process and developed in coordination with the Navy. Continued opportunity for public input would be included via the MMPA process, as appropriate (i.e. via the "Letter of Authorization" process). The intent of adaptive management here is to ensure the continued proper implementation of the required mitigation measures, to conduct appropriate monitoring and evaluation efforts, and to recommend possible adjustments to the mitigation/monitoring/reporting to accomplish the established goals of the mitigation and monitoring which include:

Mitigation

- Avoidance or minimization of injury or death of marine mammals wherever possible (goals b, c, and d may contribute to this goal).
- A reduction in the numbers of marine mammals (total number or number at biologically important time or location) exposed to received levels of sound associated with the proposed active sonar activities,
- A reduction in the number of times (total number or number at biologically important time or location) individuals would be exposed to received levels,
- A reduction in the intensity of exposures (either total number or number at biologically important time or location) to received levels
- A reduction in effects to marine mammal habitat, paying special attention to the food base, activities that block or limit passage to or from biologically important areas, permanent destruction of habitat, or temporary destruction/disturbance of habitat during a biologically important time.
- For monitoring directly related to mitigation - an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation measures (shut-down zone, etc.).

Monitoring

- An increase in the probability of detecting marine mammals, both within the safety zone (thus allowing for more effective implementation of the mitigation) and in general to generate more data to contribute to the effects analyses.
- An increase in our understanding of how many marine mammals are likely to be exposed to levels of MFA sonar/HFA sonar (or explosives or other stimuli) that we associate with specific adverse effects, such as behavioral harassment, TTS, or PTS.
- An increase in our understanding of how marine mammals respond to MFA sonar/HFA sonar (at specific received levels), explosives, or other stimuli expected to result in take and how anticipated adverse effects on individuals (in different ways and to varying degrees) may impact the population, species, or stock (specifically through effects on annual rates of recruitment or survival)
- An increased knowledge of the affected species
- An increase in our understanding of the effectiveness of certain mitigation and monitoring measures

Generally speaking, adaptive management supports the integration of NEPA's principles into the ongoing implementation and management of the Proposed Action, including a process for improving, where needed, the effectiveness of the identified mitigations. Note that any adjustment of mitigation and monitoring would be within the scope of the environmental analyses and considerations presented in this EIS/OEIS.

5.8.3.3 Research

The Navy provides a significant amount of funding and support to marine research. In the past five years the agency funded over $100 million ($26 million in FY08 alone) to universities, research institutions, federal laboratories, private companies, and independent researchers around the world to study marine mammals. The U.S. Navy sponsors seventy percent of all U.S. research concerning the effects of human-generated sound on marine mammals and 50 percent of such research conducted worldwide. Major topics of Navy-supported research include the following:

- Better understanding of marine species distribution and important habitat areas,
- Developing methods to detect and monitor marine species before and during training,
- Understanding the effects of sound on marine mammals, sea turtles, fish, and birds, and
- Developing tools to model and estimate potential effects of sound.

This research is directly applicable to Fleet training activities, particularly with respect to the investigations of the potential effects of underwater noise sources on marine mammals and other protected species. Proposed training activities employ active sonar and underwater explosives, which introduce sound into the marine environment.

The Marine Life Sciences Division of the Office of Naval Research currently coordinates six programs that examine the marine environment and are devoted solely to studying the effects of noise and/or the implementation of technology tools that will assist the Navy in studying and tracking marine mammals. The six programs are as follows:

- Environmental Consequences of Underwater Sound,
- Non-Auditory Biological Effects of Sound on Marine Mammals,
- Effects of Sound on the Marine Environment,

- Sensors and Models for Marine Environmental Monitoring,
- Effects of Sound on Hearing of Marine Animals, and
- Passive Acoustic Detection, Classification, and Tracking of Marine Mammals.

The Navy has also developed the technical reports referenced within this document, including the Marine Resource Assessment. Furthermore, research cruises by the National Marine Fisheries Service (NMFS) and by academic institutions have received funding from the U.S. Navy.

The Navy has sponsored several workshops to evaluate the current state of knowledge and potential for future acoustic monitoring of marine mammals. The workshops brought together acoustic experts and marine biologists from the Navy and other research organizations to present data and information on current acoustic monitoring research efforts and to evaluate the potential for incorporating similar technology and methods on instrumented ranges. However, acoustic detection, identification, localization, and tracking of individual animals still requires a significant amount of research effort to be considered a reliable method for marine mammal monitoring. The Navy supports research efforts on acoustic monitoring and will continue to investigate the feasibility of passive acoustics as a potential mitigation and monitoring tool.

Overall, the Navy will continue to fund ongoing marine mammal research, and is planning to coordinate long term monitoring/studies of marine mammals on various established ranges and operating areas. The Navy will continue to research and contribute to university/ external research to improve the state of the science regarding marine species biology and acoustic effects. These efforts include mitigation and monitoring programs; data sharing with NMFS and via the literature for research and development efforts; and future research as described previously.

5.8.3.4 Stranding Response Plan for Major Navy Training Exercises in the SOCAL Range Complex

NMFS and the Navy have developed a draft Stranding Response Plan for Major Exercises in the SOCAL Range Complex (available at: *http:// www.nmfs.noaa.gov/pr/permits/incidental.htm*). Pursuant to 50 CFR Section 216.105, the plan will be included as part of (attached to) the Navy's MMPA Letter of Authorization (LOA), which contains the conditions under which the Navy is authorized to take marine mammals pursuant to training activities involving MFA sonar/HFA sonar or explosives in the SOCAL Range Complex. The Stranding Response plan is specifically intended to outline the applicable requirements the authorization is conditioned upon in the event that a marine mammal stranding is reported in the SOCAL Range Complex during a major training exercise. As mentioned above, NMFS considers all plausible causes within the course of a stranding investigation and this plan in no way presumes that any strandings that could occur in the SOCAL Range Complex are related to, or caused by, Navy training activities, absent a determination made in a Phase 2 Investigation as outlined in the plan, indicating that MFA sonar or explosive detonation in the SOCAL Range Complex were a cause of the stranding. This plan is designed to address the following three issues:

- Mitigation—When marine mammals are in a situation that can be defined as a stranding, they are experiencing physiological stress. When animals are stranded, and alive, NMFS believes that exposing these compromised animals to additional known stressors would likely exacerbate the animal's distress and could potentially cause its death. Regardless of the factor(s) that may have initially contributed to the stranding, it is NMFS' goal to avoid exposing these animals to further stressors. Therefore, when live stranded cetaceans are in the water and engaged in what is classified as an Uncommon Stranding Event (USE), the shutdown component of this plan is intended to minimize the exposure of those animals to MFA sonar and explosive detonations, regardless of whether or not these activities may have initially played a role in the event.

- Monitoring—This plan will enhance the understanding of how MFA sonar/HFA sonar or underwater detonations (as well as other environmental conditions) may, or may not, be associated with marine mammal injury or strandings. Additionally, information gained from the investigations associated with this plan may be used in the adaptive management of mitigation or monitoring measures in subsequent LOAs, if appropriate.
- Compliance—The information gathered pursuant to this protocol will inform NMFS' decisions regarding compliance with Sections 101(a)(5)(B and C) of the MMPA.

The Stranding Response Plan has several components:

Shutdown Procedures—When an uncommon stranding event occurs during a major exercise in the SOCAL Range Complex, and a live cetacean(s) is in the water exhibiting indicators of distress, NMFS will advise the Navy that they should cease MFA sonar/HFA sonar operation and explosive detonations within 14 nm (26 km) of the live animal involved in the USE (NMFS and Navy will maintain a dialogue, as needed, regarding the identification of the USE and the potential need to implement shutdown procedures). This distance is the approximate distance at which sound from the active sonar sources is anticipated to attenuate to 145 dB (SPL). The risk function predicts that less than 1 percent of the animals exposed to active sonar at this level (mysticete or odontocete) would respond in a manner that NMFS considers Level B Harassment.

Memorandum of Agreement (MOA)—The Navy and NMFS will develop a MOA, or other mechanism consistent with federal fiscal law requirements (and all other applicable laws), that allows the Navy to assist NMFS with the Phase 1 and 2 Investigations of USEs through the provision of in-kind services, such as (but not limited to) the use of plane/boat/truck for transport of stranding responders or animals, use of Navy property for necropsies or burial, or assistance with aerial surveys to discern the extent of a USE. The Navy may assist NMFS with the Investigations by providing one or more of the in-kind services outlined in the MOA, when available and logistically feasible and when the provision does not negatively affect Fleet operational commitments.

Communication Protocol—Effective communication is critical to the successful implementation of this Stranding Response Plan. Very specific protocols for communication, including identification of the Navy personnel authorized to implement a shutdown and the NMFS personnel authorized to advise the Navy of the need to implement shutdown procedures (NMFS Protected Resources HQ—senior administrators) and the associated phone trees, etc. are currently in development and will be refined and finalized for the Stranding Response Plan prior to the issuance of a final rule (and updated yearly).

Stranding Investigation—The Stranding Response Plan also outlines the way that NMFS plans to investigate any strandings (providing staff and resources are available) that occur during major training exercises in the SOCAL Range Complex.

5.8.4 Alternative Mitigation Measures Considered but Eliminated

As described in Chapter 3, Section 3.9, the vast majority of estimated sound exposures of marine mammals during proposed active sonar activities would not cause injury. Potential acoustic effects on marine mammals would be further reduced by the mitigation measures described above. Therefore, the Navy concludes the proposed action and mitigation measures would achieve the least practical adverse impact on species or stocks of marine mammals.

A determination of "least practicable adverse impacts" includes consideration of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity. Therefore, the following additional mitigation measures were analyzed and eliminated from further consideration:

Augmenting Navy lookouts on Navy vessels providing surveillance of ASW or other training events with non-Navy personnel:

Augmenting Navy lookouts on Navy vessels providing surveillance of ASW or other training events with non-Navy personnel: The protection of marine mammals is provided by a lookout sighting the mammal and prompting immediate action. The premise that Navy personnel cannot or will not do this is unsupportable. Navy lookouts are extensively trained in spotting items at or near the water surface and relaying the information to their superiors who initiate action. Navy lookouts utilize their skills more frequently than many third-party trained non-Navy marine mammal observers. Use of Navy lookouts is the most effective means to ensure quick and efficient communication within the command structure, thus ensuring timely implementation of any relevant mitigation measures. A critical skill set of effective Navy training is communication via the chain of command. Navy lookouts are trained to report swiftly and decisively using precise terminology to ensure that critical information is passed to the appropriate supervisory personnel. Furthermore, as analyzed in the Final EIS/OEIS, available berthing space, integration of non-Navy personnel into the command structure, and security issues would present added challenges.

Employing non-Navy observers on non-military aircraft or vessels:

The Final EIS/OEIS concluded that measures in this category do not result in increased protection to marine mammals because the size of the areas, the time it takes to survey, and the movement of marine mammals preclude real-time mitigation. Recognizing that ASW training events could occur throughout the entire SOCAL Range Complex OPAREA (consisting of approximately 113,000 nm^2 [387,500 km^2]), contiguous ASW events may cover many hundreds of square miles in a few hours. Event participants are usually not visible to each other (separated by many tens of miles) and are constantly in motion. The number of civilian ships and/or aircraft required to monitor the area around these events would be considerable. In addition to practical concerns, surveillance of an exercise area during an event raises safety issues. Multiple, land-based, slow civilian aircraft operating in the same airspace as military aircraft will limit both the time available for civilian aircraft to be in the training area and present a concern should such aircraft experience mechanical problems. Scheduling of civilian vessel or aircraft surveillance also presents concerns, as exercise event timetables cannot be precisely fixed but develop freely from the flow of the tactical situation, thus mimicking real combat action. Waiting for civilian aircraft or vessels to complete surveys, refuel, or be on station would interrupt the necessary spontaneity of the exercise and would negatively impact the effectiveness of the military readiness activity. The Navy is committed to maintaining its marine mammal surveillance capability using both Navy surface and, to the extent that aviation assets are participants in the training activity, aerial monitoring.

Avoiding habitats and complex/steep bathymetry, including seamounts, and employing seasonal restrictions:

Seamounts are used by submarines to hide or mask their presence, requiring the need to train in this complex ocean environment. This is precisely the type of area needed by the Navy to train with MFA sonar. Exercise locations are carefully chosen by planners based on training requirements and the ability of ships, aircraft, and submarines to operate safely. However, the full habitat requirements for most marine mammals in the SOCAL Range Complex are unknown. Accordingly, there is insufficient information available regarding possible alternative exercise locations or environmental factors that would be less important to marine mammals in SOCAL. When available, it must be factored with other considerations including safety and access to land ranges and facilities.

Avoidance of the seasonal presence of migrating marine mammals fails to take into account the fact that the Navy's current mitigation measures apply to all detected marine mammals no matter the season. Limiting training activities to fewer than 12 months of the year would not only concentrate all annual training and testing activities into a shorter time period, but would also not meet the readiness requirements of the Navy's mandate to deploy trained forces as might be required by unscheduled real world events.

Avoiding seamounts without exception fails to define scientific parameters for seamounts critical to marine mammals, such as a critical depth from the surface, and it is impossible to establish scientifically what would constitute a buffer that would avoid these areas. In addition, without a scientifically derived definition, there is no means to implement any proposed mitigation measure based on avoidance of seamounts.

Avoidance of steep or complex bathymetry in the SOCAL ignores the fact that there are numerous and a variety of complex bathymetry in the SOCAL. Many of these areas of complex bathymetry and seamounts are in the very locations where Navy trains, and are valuable to Navy training. The purported need for this suggested mitigation measure is based on findings from other areas of the world that do not have direct application to the unique environment present in SOCAL (e.g., the circumstances surrounding the 2000 Bahamas mass-stranding event). Ultimately, the Navy needs to train in representative environments, including near seamounts and in areas of steep or complex bathymetry, as submarines use these environments to avoid detection. Not being allowed to conduct exercises in these areas would have an unacceptable impact on training effectiveness.

Avoiding MFA and HFA sonar use within 12 nm from shore or, in the alternative, 15.5 miles (25 kilometers) from the 200-meter isobath:

During a recent major exercise in Hawaii (RIMPAC 2006), this mitigation measure precluded ASW training in the littoral region, which had a significant impact on realism and training effectiveness. There is no scientific evidence that any set distance from the coast is more protective of marine mammals than any other distance. The Navy has also determined that limiting MFA sonar use to outside 12 nm from the coast prevented crew members from gaining critical experience in training in shallow waters, and training in littoral waters. Sound propagates differently in shallower water. In real world events, it is highly likely crew members would be working in these types of areas, and these are the types of areas where diesel-electric submarines would be operating. Without the critical training near shore that ASW exercises provide, crews will not have the experience needed to successfully operate sonar in these types of waters, impacting vital military readiness.

Using MFA and HFA sonar with output levels as low as possible consistent with mission requirements or using active sonar only when necessary:

Operators of sonar equipment are trained to be aware of the environmental variables affecting sound propagation. In this regard, the sonar equipment power levels are always set consistent with mission requirements. Active sonar is only used when required by the mission since it has the potential to alert opposing forces to the sonar platform's presence. The Navy remains committed to using passive sonar and all other available sensors in concert with active sonar to the maximum extent practicable consistent with mission requirements.

Suspending training at night, periods of low visibility and in high sea-states when marine mammals are not readily visible:

It is imperative that the Navy train to be able to operate at night, in periods of low visibility, and in high sea-states using the full potential of MFA or HFA sonar as a sensor. Anti-submarine warfare requires many hours and days for the situation to develop, to be identified and for the forces to respond. It would be extremely impracticable and unrealistic for the Navy's forces at sea to train only in daylight hours or to wait for weather to clear. Naval forces must train during all conditions to ensure they understand how constantly changing environmental conditions (including changes between day and night) affect sonar's capabilities and their ability to detect and maintain contact with submerged objects. The naval forces must constantly identify those changing conditions and adapt to them.

Maneuvering a vessel at night and during restricted visibility is not a simple activity. Navy vessels use radar and night vision devices to detect any object, whether a marine mammal, a periscope of an adversary submarine, trash, debris, or another surface vessel. Under the International Navigation Rules of the Road, periods of fog, mist, falling snow, heavy rainstorm, sandstorms, or any similar events are referred to as "restricted visibility." In restricted visibility, all mariners, including Navy vessel crews, are required to maintain proper look-out by sight and hearing as well as "by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision." Therefore, Navy vessels are required to use all means available in restricted visibility, including sonar and positioning of additional lookouts for heightened vigilance to avoid collision. Navy vessels use radar and night vision goggles to avoid any object, whether a marine mammal, a periscope of an adversary submarine, trash, debris, or another surface vessel. Prohibiting or limiting vessels from using MFA sonar during periods of restricted visibility therefore violates international navigational rules, increases navigational risk, and jeopardizes the safety of the ship and crew.

Reducing power in significant surface ducting conditions:

Surface ducting occurs when water conditions (e.g., temperature layers, lack of wave action) result in sound energy emitted at or near the surface to be refracted back up to the surface, then reflected from the surface only to be refracted back up to the surface so that relatively little sound energy penetrates to the depths that otherwise would be expected. This increases active detection ranges in a narrow layer near the surface, but decreases active sonar detection below the thermocline, a phenomenon that submarines have long exploited. Significant surface ducts are conditions under which ASW training must occur to ensure Sailors learn to identify these conditions, how they alter the abilities of MFA sonar systems, and how to deal with the resulting effects on MFA sonar capabilities. To be effective, the complexity of ASW requires the most realistic training possible. Reducing power in significant surface ducting conditions undermines training realism because the unit would be operating differently than it would during actual warfare.

Additionally, and significantly, the necessary information regarding water conditions in the exercise areas is not uniform and can change over a period of a few hours as the effects of environmental conditions such as wind, sunlight, cloud cover, and tide changes alter surface duct conditions. Across a typical SOCAL exercise area, the determination of "significant surfacing ducting" is continually changing, and this mitigation measure could not be accurately implemented.

Furthermore, surface ducting alone does not increase the risk of MFA sonar impacts to marine mammals. While surface ducting causes sound to travel farther before losing intensity, simple spherical and cylindrical spreading losses result in a received level of no more than 175 dB at 1,000 meters, even in significant surface ducting conditions. There is no scientific evidence that this mitigation measure is effective or that it provides additional protection for marine mammals beyond that afforded by an appropriate safety zone.

Reduction of MFA sonar power levels by 6 dB to 10 dB results in a 50- to 80-percent reduction of detection of submarines in the area due to a decrease in power of 75 to 90 percent. This means reduction of sonar power levels results in an inability to detect submarines at greater distances which reflect real world situations. As submarines are capable of striking ships at distances greater than a powered-down sonar would be able to detect, effective training is compromised.

The requirement under the current MMPA national defense exemption to consider significant surface ducting as part of an aggregate of conditions in planning major exercises does not apply in the SOCAL Range Complex because those conditions do not exist in the aggregate. Normal safety zone requirements always apply.

Scaling down training to meet core aims:

As with each Navy range complex, the primary mission of the SOCAL Range Complex is to provide a realistic training environment for naval forces to ensure that they have the capabilities and high state of readiness required to accomplish assigned missions. Modern war and security operations are complex. Modern weaponry has brought both unprecedented opportunity and innumerable challenges to the Navy. Smart weapons, used properly, are very accurate and actually allow the military Services to accomplish their missions with greater precision and far less destruction than in past conflicts. But these modern smart weapons are very complex to use. U.S. military personnel must train regularly with them to understand their capabilities, limitations, and operation. Modern military actions require teamwork between hundreds or thousands of people, and their various equipment, vehicles, ships, and aircraft, all working individually and as a coordinated unit to achieve success. These teams must be prepared to conduct activities in multiple warfare areas simultaneously in an integrated and effective manner. Navy training addresses all aspects of the team, from the individual to joint and coalition teamwork. Training events are identified and planned because they are necessary to develop and maintain critical skills and proficiency in many warfare areas. Exercise planners and Commanding Officers are obligated to ensure they maximize the use of time, personnel and equipment during training. The level of training expressed in the proposed action and alternatives is essential to achieving the primary mission of the SOCAL Range Complex.

Limiting the active sonar event locations:

Areas where events are scheduled to occur are carefully chosen to provide for the safety of events and to allow for the realistic development of the training scenario including the ability of the exercise participants to develop, maintain, and demonstrate proficiency in all areas of warfare simultaneously. Limiting the training event to a few areas would have an adverse impact the effectiveness of the training by limiting the ability to conduct other critical warfare areas including, but not limited to, the ability of the Strike Group to defend itself from threats on the surface and in the air while carrying out air strikes and/or amphibious assaults. Limiting the exercise areas would concentrate all active sonar use, resulting in unnecessarily prolonged and intensive sound levels rather than the more transient exposures predicted by the current planning that makes use of multiple exercise areas. Furthermore, major exercises using integrated warfare components require large areas of the littorals and open ocean for realistic and safe training.

Passive acoustic detection and location of marine mammals:

As noted above, the Navy uses its passive detection capabilities to the maximum extent practicable consistent with the mission requirements to alert training participants to the presence of marine mammals in an event location.

Using "ramp-up" of MFA sonar to clear an area prior to the conduct of ASW training events:

Ramp-up procedures involve slowly increasing the sound in the water to levels that would clear an area of marine mammals prior to training at nominal source levels. Ramp-up procedures are not a viable alternative for MFA sonar training events as the ramp-up would alert opponents to the participants' presence, thus undermining training realism and effectiveness of the military readiness activity. When a Strike Group ship turns its sonar on, area submarines are alerted to its presence. A submarine can hear an active sonar transmission farther away than the surface ship can hear the echo of its sonar off the submarine. Ideally, the surface ship will detect the submarine in time to attack the submarine before the submarine can attack one of the ships of the Strike Group. If the MFA sonar ship starts out at a low power and gradually ramps up, it will give time for the submarine to take evasive action, hide, or close in for an attack before the MFA sonar is at a high enough power level to detect the submarine.

Ramp-up procedures purportedly provide marine mammals the opportunity to leave the area. There is no evidence that ramp-up procedures achieve the desired effect of causing the marine mammal to leave the area. Instead, it is well proven that dolphins ride the bow-waves of all vessels, including those employing MFA sonar, which indicates that some species of marine mammals do not flee.

Implementing vessel speed reduction:

Vessels engaged in training use extreme caution and operate at a slow, safe speed consistent with mission and safety. Ships and submarines need to be able to react to changing tactical situations in training as they would in actual combat. Placing arbitrary speed restrictions would not allow them to properly react to these situations. Training differently than that which would be needed in an actual combat scenario would decrease training effectiveness and reduce the crew's abilities.

Using new technology (e.g., unmanned reconnaissance aircraft, underwater gliders, and instrumented ranges) to detect and avoid marine animals:

Although the Navy works with many new technologies, they presently remain unproven and limited in availability. The Navy has been collecting data using the hydrophones at underwater instrumented ranges to collect passive acoustic data on marine mammals. The Navy is working to develop the capability to detect and localize vocalizing marine mammals using these sensors, but based on the current status of acoustic monitoring science, it is not yet possible to use installed systems as mitigation tools. Similarly, research involving a variety of other methodologies (e.g., underwater gliders, radar, and lasers) is not yet developed to the point where they are effective or could be used as an actual mitigation tool.

Using larger shut-down zones:

The current power down and shut down zones are based on scientific investigations specific to MFA sonar for a representative group of marine mammals. They are based on the source level, frequency, and sound propagation characteristics of MFA sonar. The zones are designed to preclude direct physiological effect from exposure to MFA sonar. Specifically, the current power-downs at 500 yards and 1,000 yards, as well as the 200 yard shut-down, were developed to minimize exposing marine mammals to sound levels that could cause TTS and PTS. These safety zone distances were based on experiments involving distances at which the onset of TTS and PTS were identified. They are also supported by the scientific community. The safety zone the Navy has developed is also based on a lookout's ability to realistically maintain situational awareness over a large area of the ocean, including the ability to detect marine mammals at that distance during most conditions at sea. Requirements to implement procedures when marine mammals are present well beyond 1,000 yards dictate that lookouts sight marine mammals at distances that, in reality, are not always practicable. These increased distances also significantly expand the area that must be monitored to implement these procedures. For instance, if a power down zone increases from 1,000 to 4,000 yards, the area that must be monitored increases sixteen-fold. Increases in safety zones are not based in science, do not provide any appreciable benefit to marine mammals and severely impact realistic ASW training. For example, increasing the shutdown zone for example from 200 yards to 2,187 yards contains 121 times the area of the Navy's current 200-yard shutdown zone. This restriction could increase the number of times that a ship would have to shut down active sonar, impacting realistic training and depriving ships of valuable submarine contact time. Commanders responsible for locating, tracking, and attacking a hostile submarine could lose awareness of the tactical situation through the constant stopping and starting of MFA sonar leading to significant exercise event disruption. Increased shutdowns could allow a submarine to take advantage of the lapses of active sonar, and position itself for an attack.

Restricting the use of MFA sonar during ASW training events while conducting transits between islands (i.e., choke-points):

This restriction is not applicable to transit in the SOCAL Range Complex. A chokepoint is a strategic strait or canal. Although there are over 200 major straits around the world, only a handful are considered to be strategic "chokepoints," such as the Strait of Gibraltar, Panama Canal, Strait of Magellan, Strait of Malacca, Bosporus and Dardanelles, Strait of Hormuz, Suez Canal, and Bab el Mandeb. While chokepoints are relatively few in number, significant quantities of international commerce and naval shipping move through these chokepoints, making them strategically important to the United States because a single quiet diesel submarine can position itself in the chokepoint and effectively block access beyond that point. The primary similarity of these chokepoints is lengthy shorelines that restrict maneuverability. The longer and more narrow the passage, the more likely the chokepoint creates an area of restricted egress for marine mammals. The conditions of the channels used in SOCAL differ from other channels around the world, including the Northwest Providence channel in the Bahamas. The Bahamas marine mammal stranding event in 2000 involved a critical confluence of conditions. The Northwest Providence channel is 100 nm long and between 25-30 nm wide. In contrast, the channels between the Channel Islands are formed by adjacent islands rather than long, adjacent land mass boundaries. Therefore, these channels do not constrict movement of marine mammals between two long land masses for many miles, as may have been the case in the Bahamas in 2000. Conducting ASW training events while transiting in the SOCAL Range Complex does not present the same conditions as those that resulted in the Bahamas mass stranding event (see Section 1.1.3.1 of Appendix F). Most importantly, there is no limited egress for marine mammals for events that occur in SOCAL.

Adopting mitigation measures of foreign nation navies:

The Navy typically operates in a Strike Group configuration where the group focuses its efforts on conducting air strikes and/or amphibious operations ashore. This requires that the Navy train to what it calls "integrated warfare" meaning that Strike Groups must conduct many different warfare areas simultaneously. These include the ability to defend itself from attacks from submarines, mines, ships, aircraft and missiles. Other nations do not possess the same integrated warfare capabilities as the United States. As a result, many foreign nations' measures are focused solely on reducing what they perceive to be impacts involving ASW. They are not required to locate training areas and position naval forces for the simultaneous and integrated warfare elements that the Navy conducts. As a result, many nations are willing to move training to areas where they believe marine mammals may not exist and do not train in the same bathymetric and littoral environments as the Navy.

5.9 SEA BIRDS

Avoidance of seabirds and their nesting and roosting habitats provides the greatest degree of protective measure from potential impacts within the SOCAL Range Complex. Currently, the majority of aircraft operations that might affect seabirds are concentrated at the Naval Auxilary Landing Field (NALF) on SCI, and the potential for bird aircraft strikes exists. Pursuant to Navy instruction, measures to evaluate and reduce or eliminate this hazard to aircraft, aircrews, and birds are implemented. Additionally, guidance involving land or water detonations contains instructions to personnel to observe the surrounding area within 600 yds (585 m) for 30 minutes prior to detonation. If birds (or marine mammals or sea turtles) are seen, the operation must be relocated to an unoccupied area or postponed until animals leave the area. Monitoring of seabird populations and colonies by conservation groups and researchers is conducted intermittently within coastal areas and offshore islands with limited support from various military commands.

5.10 TERRESTRIAL BIOLOGICAL RESOURCES

As noted in section 3.11.1.3, the Navy implements measures to avoid, minimize, or compensate for its effects on biological resources including listed species on SCI. Key management and monitoring activities include completion and implementation of the SCI Wildland Fire Management Plan; continued monitoring and management activities for all endangered species but with particular attention to San Clemente loggerhead shrike, San Clemente sage sparrow, island fox, and six federally-listed plant species; invasive species monitoring and control efforts; continued operation of the on-island nursery and restoration efforts being conducted by nursery staff; vegetation condition and trend assessment; and continued implementation of the SCI Integrated Natural Resources Management Plan (INRMP). The Navy proposes to continue these measures. Further, as noted in section 3.11.4, the Navy proposes to implement additional measures to mitigate the environmental effects of its activities. The following is a comprehensive list of current and proposed mitigation measures intended to reduce effects of military activities on biological resources of SCI:

5.10.1 General Measures

- **G-M-1.** Continue to control invasive exotic plant species on an island-wide scale, with an emphasis on the AVMC, the IOA, TARs, and other operations insertion areas such as West Cove, Wilson Cove and the airfield. A pretreatment survey to identify areas needing treatment, one treatment cycle, and a retreatment cycle (when necessary) will be planned each year to minimize the distribution of invasive species. The focus of the invasive exotic plant control program will continue to be the control of highly invasive exotic plants that have the potential to adversely impact habitat for federally listed species in known locations, and the early detection and eradication of new occurrences of such species. Where feasible, include future construction sites in a treatment and retreatment cycle prior to construction.

- **G-M-2.** Continue feral cat and rat control efforts and monitoring level of feral cat and rat population (would benefit all endangered and threatened wildlife on SCI as well as the island fox) as long as they are demonstrated to support listed species recovery and population maintenance. To reduce human-induced increases in the feral cat and rat populations, the Navy will ensure that personnel do not feed cats and that all trash, food waste, and training refuse are disposed of properly in animal proof containers.

- **G-M-3.** Continue implementation of INRMP, with review and revision per Navy directives addressing management of natural resources. Identification of conservation measures that provide additional benefits to the protected resources affected by the proposed action will be given priority consideration for incorporation into the SCI INRMP during reviews, updates and revisions.

- **G-M-4.** Continue to review and coordinate the dissemination of environmental conservation measures to island users. Conservation measures will be distributed to island military and civilian staff in accordance with commander's guidelines, and with Fleet operations.
- **G-M-5.** Conduct any necessary Explosive Ordnance Disposal (EOD) ordnance detonations in or near endangered or threatened species habitat in a manner that minimizes the potential for wildfire without compromising personnel safety.
- **G-M-6.** Coordinate range access to achieve optimal flexibility between training operations and natural resource management activities, according to range use instructions and with priority given to military training.
- **G-M-7.** Locate SHOBA heavy ordnance targets with regard to proximity to sensitive resources, including San Clemente loggerhead shrike, sensitive plants (e.g., away from Horse Beach Canyon), and coastal salt marsh, to the extent feasible while meeting operational needs.
- **G-M-8.** Conduct monitoring and control activities for non-native predators outside the impact area boundaries. Monitoring and control activities would include China Point Road between Impact Areas I and II. Monitoring and control activities may be intensified as needed to prevent elevated predation on listed species outside the Impact Area boundaries attributable to predator populations within the Impact Area boundaries. Access to conduct control efforts would not be limited within SHOBA outside the Impact Area I and II boundaries. (See also related measure **G-M-2)**.
- **G-M-9.** Conduct monitoring and control activities for invasive non-native plant species outside of the impact area boundaries. Monitoring and control activities would include China Point Road and the portion of Horse Beach Canyon Road between Impact Areas I and II. Monitoring and control activities may be intensified as needed to prevent spread of invasive species and effects on listed species outside the Impact Area boundaries attributable to invasive species populations within the Impact Area boundaries. Access to conduct control efforts would not be limited within SHOBA outside the Impact Area I and II boundaries. (See also related measure G-M-1).

5.10.2 Assault Vehicle Maneuver Corridor, Assault Vehicle Maneuver Road, Assault Vehicle Maneuver Area, Artillery Firing Points, Artillery Maneuver Points, Infantry Operations Area, and Amphibious Landing Sites

- **AVMC-M-1.** Survey for Federally listed and sensitive plant species within the AVMC (including AVMAs, AFP-1, AFP-6, AMPs) and IOA.
- **AVMC-M-2.** Conduct periodic monitoring of the AVMC (AVMAs, AMPs, AFPs, AVMR) and IOA as part of vegetation/habitat and sensitive species survey updates for the INRMP.
- **AVMC-M-3.** Develop an erosion control plan and finalize AVMA, AMP, and AFP areas based on field review with soil erosion experts and military personnel, such that operational areas minimize inclusion of steep slopes and drainage heads. Develop, apply and maintain BMPs for erosion/sedimentation where appropriate, and provide

for regular monitoring and control of invasive species. The goals of the plan would be as follows:

- to minimize soil erosion within each of these operational areas and minimize offside impacts;
- to prevent soil erosion from adversely affecting federally listed or proposed species or their habitats;
- to prevent soil erosion from significantly impacting other sensitive resources, including sensitive plant and wildlife species and their habitats, jurisdictional wetlands and non-wetland waters, the area of Special biological Significance (ASBS) surrounding the island, and cultural resources

The plan would lay out the Navy's approach in assessing and reducing soil erosion in the AVMAs, AMPs, AFPs, and the IOAs, as well as routes used to access these areas. The plan would consider the variety of available erosion control measures and determine the most appropriate measure(s) to control erosion in the area. The plan would include an adaptive management approach and contain the following essential elements:

- Site-specific BMPs to minimize soil erosion on site and minimize offsite impacts, which could include:
  - Establishing setbacks or buffers from steep slopes, drainages, and sensitive resources
  - Construction of site specific engineered or bio-engineered structures that would reduce soil erosion and transport of sediment off site
  - Revegetation
  - Maps defining boundaries of operational areas that provide appropriate setbacks
  - A BMP maintenance schedule
- A plan to monitor soil erosion and review the effectiveness of BMPs
- A mechanism for determining and implementing appropriate remedial measures and refining BMPs should the need arise

- **AVMC-M-4.** Military units will be briefed on maneuver area boundaries prior to conducting operations in these areas.
- **AVMC-M-5.** Assault vehicle travel or maneuvering will not be conducted outside the boundaries of the AVMC (including AFPs, AMPs, AVMAs, AVMR).
- **AVMC-M-6.** Develop and implement a project to monitor for erosion, dust generation, and deposition of dust in adjacent habitats.
- **AVMC-M-7.** Prior to coming to SCI, military and non-military personnel will be asked to conduct a brief check for visible plant material, dirt, or mud on equipment and shoes. Any visible plant material, dirt or mud should be removed before leaving for SCI. Tactical ground vehicles will be washed of visible plant material, dirt and mud prior to embarkation for SCI. Additional washing is not required for amphibious vehicles after 15 minutes of self-propelled travel through salt water prior to coming ashore on SCI.

- **AVMC-M-8.** Continue to enforce the existing 35 mph speed limit on Ridge Road for shore all traffic. The Navy will post signs, continue public awareness programs; mow roadside vegetation; and monitor roadways for kills of protected or conservation agreement species including San Clemente loggerhead shrike, San Clemente sage sparrow, and island fox.
- **AVMC-M-9.** Tracked and wheeled vehicles will continue to use the existing route for ingress and egress to/from the beach at West Cove.
- **AVMC-M-10.** For Horse Beach Cove Amphibious Landing and Embarkation Area at TAR 21, vehicles will use an ingress/egress route that avoids impact on wetlands and minimizes impacts on coastal dune scrub. This involves driving amphibious vehicles westward on the unvegetated beach and egressing from beach west of the mouth of Horse Beach Canyon.

5.10.3 Training Areas and Ranges

- **TAR-M-1.** Develop and implement a five-year monitoring plan with annual surveys for Threatened and Endangered plant species when they are known to occur within or adjacent to TARs outside of Impact Areas I and II.

5.10.4 Basic Training Sites (BTSs)

- **BTS-M-1.** Construction of structures will not involve grading and will be conducted outside the sage sparrow breeding season. The footprint of the construction areas will be marked to avoid habitat areas in coordination with the SCI natural resources program. Anti-perch devices will be installed on the structures.

5.10.5 Additional Species-Specific Measures

San Clemente sage sparrow

- **SCSS-M-1.** Continue surveys and population analysis for the San Clemente sage sparrow. Develop additional surveys to assess sage sparrow juvenile survivorship and habitat use. Surveys will be developed and scheduled such that access to training areas are not restricted when training is needed/requested.
- **SCSS-M-2.** Manage the San Clemente sage sparrow population for long-term persistence in accordance with recommendations in the SCSS Management Plan, and in a manner that is compatible with military training requirements. Identification of conservation measures that provide additional benefits to sage sparrows will be given priority consideration for incorporation into the SCI INRMP and the SCSS Management Plan during reviews, updates and revisions. Conservation benefits provided to San Clemente Sage Sparrows will also benefit the Island Night Lizard, as they co-occur in highest densities in the same prime habitat.
- **SCSS-M-3.** Develop and implement a monitoring plan to assess the incidental take of SCSS within and adjacent to TARs 10 and 17. Incorporate findings into recommendations for minimizing or avoiding incidental take, to the extent practicable, into the SCSS Management Plan.

San Clemente Loggerhead Shrike

- **SCLS-M-1.** Continue the currently successful program of habitat restoration, predator management, monitoring, captive breeding, and re-introduction to benefit the San Clemente loggerhead shrike until such time that recovery objectives are identified and achieved.

- **SCLS-M-2.** Evaluate nest success data for SCLS in sites nearest AFP-6, including those in Eagle and Cave Canyons, and compare it to other sites in and out of SHOBA with the objective of determining whether or not success rates are typical for the species**.**
- **SCLS-M-3.** The shrike monitoring team will provide schedulers the location of shrike nests within operational boundaries and prior to the installation of fuel/fire beak lines.
- **SCLS-M-4.** Range schedulers would provide the GPS coordinates of up to four (4) shrike nests at any one time to operators and advise that sensitive resources occur within a 10 m radius of these points. GPS coordinates would only be provided for nests that appear in the IOA in areas wider than 1000 feet, and not in any AVMA, AVMR, AFP, AMP, or TAR.

Island Night Lizard

- **INL-M-1.** Continue population monitoring at 3-year intervals and annual habitat evaluations while the delisting petition is being evaluated by USFWS.

California brown pelican

- **CBP-M-1.** Ensure that California brown pelicans are not in proximity to over-blast pressure prior to underwater demolition activities. Sequential underwater detonations would be conducted either less than 10 seconds apart or greater than 30 minutes apart to avoid impacts to birds attracted by fish kill.

Western Snowy Plover

- **WSP-M-1.** Continue annual breeding and non-breeding season surveys for the western snowy plover at West Cove and Northwest Harbor.

Island Fox

- **IF-M-1.** Continue educational work with on-Island civilian and military personnel to prevent feeding, handling of foxes.
- **IF-M-2.** Continue feral cat control and education and enforcement of prohibitions concerning on-Island civilian and military personnel feeding, keeping, or otherwise encouraging the persistence of cats on SCI.
- **IF-M-3.** Continue posting signs, mowing road verges, and education to help minimize the potential for vehicular collisions with foxes.

Santa Cruz Island Rock-Cress

- **RC-M-1**. Investigate feasibility of establishing additional colonies in suitable habitat farther away from the IOA and AFP--1 using the on-island nursery to propagate from local seed.
- **RC-M-2.** To the extent practicable and as appropriate based on potential impacts, areas surrounding Santa Cruz Island rockcress occurrences will be prioritized as primary targets for weed eradication.

5.11 CULTURAL RESOURCES

Section 3.12.1 details protective measures implemented with regard to cultural resources on SCI. (submerged cultural resources in ocean areas are unaffected by Navy activities.) As noted, the Navy has developed a draft Programmatic Agreement (PA) pursuant to 36 (C.F.R.) § 800.14 (the regulation implementing the National Historic Preservation Act). NHPA Section 106 compliance on SCI will be governed by a PA. The Draft PA stipulates qualifications of personnel, development of an Integrated Cultural Resources Management Plan (ICRMP), determination of an Area of Potential Effects, evaluation of resources to ensure that authorizations for ground-disturbing activities include appropriate measures to protect archaeological resources, emergency procedures, and annual reporting.

The PA identifies Impact Areas I and II in the southern portion of SCI as areas exempt from compliance with Section 106 due to their degree of disturbance and the safety risk to personnel that would be required to survey these areas. The PA defines dispersed pedestrian troop movements as having no potential for affecting cultural resources.

To ensure that cultural resources are managed in a planned and coordinated manner, the Navy is preparing an ICRMP for SCI. There are 18 elements of the ICRMP, as noted in Section 3.12.1.2. Several of these elements already have been addressed in the current Cultural Resources Management Plan for SCI, and some are being addressed in this EIS/ OEIS. All required elements will be addressed in the ICRMP, which will provide for overall management of cultural resources.

Avoidance of adverse effect is the preferred treatment for cultural resources. There are several existing cultural resource measures for site avoidance in place as standard operating procedures at SCI. These measures include:

- All proposed actions except those on existing ranges are reviewed by the NRO for potential effects on cultural resources;
- Ongoing mitigation focuses on treating adverse effects;
- Vehicles are required to stay on established roads or within the AVMC;
- Unauthorized collection of archaeological material is not allowed;
- No digging is permitted;
- Archaeological sites in areas of high use are posted with archaeological site protection signs; and

The Navy uses environmental planning, and project design and redesign to avoid or minimize impacts on resources. When avoidance is not feasible, however, eligible resources must receive appropriate mitigation. For archaeological sites considered important for their potential to provide information, this usually involves data recovery. Mitigating impacts on built resources typically involves Historic American Building Survey/Historic American Engineering Record documentation. The character of treatment is determined through consultation with the California State Historic Preservation Office (SHPO) and Advisory Council on Historic Preservation on adverse effect under 36 C.F.R. § 800.

5.12 TRAFFIC

The Navy strives to ensure that it retains access to ocean training areas and special use airspace (SUA) as necessary to accomplish its mission, while facilitating joint military-civilian use of such areas to the extent practicable and consistent with safety. These goals of military access, joint use, and safety are promoted through various coordination and outreach measures, including:

- Publication of NOTAM advising of the status and nature of activities being conducted in W-291 and other components of SUA in the EIS Study Area.
- Return of SUA to civilian Federal Aviation Administration (FAA) control when not in use for military activities. To accommodate the joint use of SUA, a Letter of Agreement is in place between Los Angeles Air Traffic Control Center (ARTCC) and Fleet Area Control and Surveillance Facility (FACSFAC) San Diego (Navy). The LOA defines the conditions and procedures to ensure safe and efficient joint use of waning areas.
- Publication of NOTMAR and other outreach. The Navy provides information about potentially hazardous activities planned for the SOCAL OPAREA, for publication by the U.S. Coast Guard in NOTMAR. Most such activities occur in the vicinity of SCI. To ensure the broadest dissemination of information about hazards to commercial and recreational vessels, the Navy provides detailed schedules of its activities planned near SCI on a dedicated website.

5.13 SOCIOECONOMICS

Given the nature and location of Navy activities addressed in this EIS/OEIS, mitigation and protective measures are unnecessary with respect to socioeconomic considerations.

5.14 ENVIRONMENTAL JUSTICE AND PROTECTION OF CHILDREN

Given the nature and location of Navy activities addressed in this EIS/OEIS, mitigation and protective measures are unnecessary with respect to socioeconomic considerations.

5.15 PUBLIC SAFETY

Navy activities in the SOCAL Range Complex comply with numerous established safety procedures to ensure the safety of participants and the public. FACSFAC and Navy range managers have published safety procedures for activities on the offshore and nearshore areas. These guidelines are directive for range users. They provide, among other measures, that:

- Commanders are responsible for ensuring that impact areas and targets are clear prior to commencing activities that are hazardous.
- Aircraft or vessels expending ordnance shall not commence firing without permission of the scheduling authority for their specific range area.
- Firing units and targets must remain in their assigned areas, and units must fire in accordance with current safety instructions.
- Except for SCI, ships are authorized to fire their weapons only in offshore areas and at specific distances from land, depending on the caliber and range of the weapons fired. The larger the caliber, the farther offshore that the firing must take place.
- The use of pyrotechnic or illumination devices and marine markers such as smoke or dye markers will be allowed only in the assigned areas, to avoid the launch of Search and Rescue forces when not required. Aircraft carrying ordnance to or from ranges shall avoid populated areas to the maximum extent possible.
- Aircrews operating in W-291 are aware that non-participating aircraft are not precluded from entering the area and may not comply with a NOTAM or radio warning that hazardous activities are scheduled or occurring. Aircrews are required to maintain a continuous lookout for non-participating aircraft while operating under visual flight rules in W-291.

In addition to the FACSFAC and SCORE procedures, the Navy has instituted the following SOPs for use of the SOCAL Range Complex:

5.15.1.1 Aviation Safety

Aircraft in W-291 fly under visual flight rules (VFR) and under visual meteorological conditions. This means that the commanders of military aircraft are responsible for the safe conduct of their flight. Prior to releasing any weapons or ordnance, the impact area must be clear of non-participating vessels, people, or aircraft. The OCE is ultimately responsible for the safe conduct of range training. A qualified Safety Officer is assigned to each training event or exercises and can terminate activities if unsafe conditions exist. Aircraft entering the SCI Air Traffic Area are required to be in radio contact with military air traffic control.

5.15.1.2 Submarine Safety

Vertical separation of at least 100 ft (30.5 m) is required between the top of a submarine's sail and the depth of a surface ship's keel. If a submarine (or submarine simulated target, the MK-30) is at periscope depth, at least a 1,500-yard (yd) (1,372-m) horizontal separation from other vessels must be maintained.

5.15.1.3 Surface Ship Safety

During training events, surface ships maintain radio contact with range control. Prior to launching a weapon, ships are required to obtain a "Green Range," which indicates that all safety criteria have been satisfied, and that the weapons and target recovery conditions and recovery helicopters and boats are ready to be employed.

5.15.1.4 Missile Exercise Safety

Safety is the top priority and paramount concern during missile exercises. These exercises can be surface-to-surface, subsurface-to-surface, surface-to-air, or air-to-air. A Missile Exercise (MISSILEX) Letter of Instruction is prepared prior to any missile firing exercise. This instruction establishes precise ground rules for the safe and successful execution of the exercise. Any MISSILEX participant who observes an unsafe situation can communicate a "Red Range" order over any voice communication systems. Range control is in radio contact with participants at all times during a MISSILEX.

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6 Other Considerations Required by NEPA

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6 OTHER CONSIDERATIONS REQUIRED BY NEPA

6.1 CONSISTENCY WITH OTHER FEDERAL, STATE, AND LOCAL PLANS, POLICIES, AND REGULATIONS

Based on an evaluation with respect to consistency with statutory obligations, the Department of the Navy's (DoN's) alternatives including the Proposed Action for the Southern California (SOCAL) Range Complex Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) (hereafter referred to as "EIS/OEIS") does not conflict with the objectives or requirements of Federal, state, regional, or local plans, policies, or legal requirements. Table 6-1 provides a summary of environmental compliance requirements that may apply.

Table 6-1: Summary of Environmental Compliance for the Proposed Action

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
National Environmental Policy Act (NEPA) of 1969 (42 United States Code [U.S.C.] §§ 4321 *et seq.*) Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [C.F.R.] Sections [§§] 1500-1508) DoN Procedures for Implementing NEPA (32 C.F.R. § 775)	DoN	This EIS has been prepared in accordance with NEPA, CEQ regulations, and Navy NEPA procedures. Public participation and review was conducted in compliance with NEPA.
Executive Order (EO) 12114, 32 C.F.R. 187, Environmental Effects Abroad of Major Federal Actions	DoN	This OEIS has been prepared in accordance with EO 12114, which requires environmental consideration for actions that may result in significant harm to the environment anywhere in the world where NEPA does not apply.
Clean Air Act (CAA) (42 U.S.C. §§ 7401 *et seq.*) CAA General Conformity Rule (40 C.F.R. § 93[B]) State Implementation Plan (SIP)	U.S. Environmental Protection Agency (USEPA) South Coast Air Quality Management District (SCAQMD) San Diego Air Pollution Control District	The Proposed Action would not conflict with attainment and maintenance goals established in SIPs. A CAA conformity determination will not be required because emissions attributable to the alternatives including the Proposed Action would be below *de minimis* thresholds.
Federal Water Pollution Control Act (Clean Water Act [CWA)]) (33 U.S.C. §§ 1344 *et seq.*)	USEPA	No permits are required under the CWA Sections 401, 402, or 404 (b) (1).
Rivers and Harbors Act (33 U.S.C. §§ 401 *et seq.*)	U.S. Army Corps of Engineers	No permit is required under the Rivers and Harbors Act.

Table 6-1: Summary of Environmental Compliance for the Proposed Action (continued)

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
Coastal Zone Management Act (CZMA) (16 C.F.R. §§ 1451 *et seq*.)	California Coastal Commission	See Section 6.1.1, below, for discussion of Navy activities and compliance with the CZMA.
Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801-1802)	National Marine Fisheries Service (NMFS)	The Proposed Action would adversely affect Essential Fish Habitat (EFH) but the effects would be minimal and temporary.
Endangered Species Act (ESA) (16 U.S.C. §§ 1531 et seq.)	DoN U.S. Fish and Wildlife Service (USFWS) NMFS	The EIS/OEIS analyzed potential effects to species listed under the ESA. In accordance with ESA requirements, the Navy completed consultation under Section 7 of the ESA with NMFS and USFWS on the potential that implementation of the Proposed Action may affect listed species. With regard to NMFS jurisdiction, the Navy will adhere to the terms and conditions of the Biological Opinion (BO). In addition, the Navy has applied for a Letter of Authorization (LOA) (see discussion below re: Marine Mammal Protection Act), which imposes terms and conditions that make ESA Section 9 prohibitions inapplicable to covered Navy activities. With regard to USFWS jurisdiction over species present in San Clemente Island (SCI), the Navy has conducted Section 7 consultation and will conduct its activities in accordance with any applicable BOs.
Marine Mammal Protection Act (MMPA) (16 U.S.C. §§ 1431 *et seq*.)	NMFS	The MMPA governs activities with the potential to harm, disturb, or otherwise “harass” marine mammals. As a result of acoustic effects associated with mid-frequency active sonar use and underwater detonations of explosives, implementation of the alternatives including the Proposed Action may result in potential Level A (harm) or Level B (disturbance) harassment to marine mammals. Therefore, the Navy has engaged NMFS in the regulatory process to determine whether incidental “takes” of marine mammals are likely. The Navy will receive an LOA from NMFS to permit takes as appropriate.

Table 6-1: Summary of Environmental Compliance for the Proposed Action (continued)

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
The National Marine Sanctuaries Act (16 U.S.C. §§ 1431 et. seq.)	National Oceanic and Atmospheric Administration (NOAA)	Channel Islands National Marine Sanctuary (CINMS) lies within the study area addressed in this EIS/OEIS. Per CINMS regulations (15 C.F.R. §922.71[a]), national defense activities in existence at the time of designation are not subject to CINMS regulatory prohibitions, provided they are "consistent with the [CINMS] regulations to the maximum extent practicable." CINMS regulations also require that the exemption of additional activities having significant impact shall be determined after consultation with the Director of the National Marine Sanctuary Program (NMSP). The Navy does not propose new activities in the CINMS, or activities that are different from those currently conducted in the CINMS. Therefore, proposed activities are consistent with those activities currently conducted in the CINMS, are consistent with those described in the designation document, and are not being changed or modified in a way that would require consultation. Implementation of the alternatives including the Proposed Action would have no effect on sanctuary resources in the offshore environment of Southern California. Review of agency actions under Section 304 of the National Marine Sanctuaries Act is not required.
The Sikes Act of 1960 (16 U.S.C. §§ 670a-670o, as amended by the Sikes Act Improvement Act of 1997, Pub. L. No. 105-85)	Department of Defense (DoD)	The alternatives including the Proposed Action would be implemented in accordance with the management and conservation criteria developed in the Sikes Act Integrated Natural Resources Management Plans (INRMPs) for SCI.
National Historic Preservation Act (NHPA) (16 U.S.C. §§ 470 *et seq*.)	DoN	The alternatives including the Proposed Action would be implemented in consultation with and under programmatic agreement with the State Historic Preservation Office (SHPO), and pursuant to the criteria developed in the Integrated Cultural Resources Management Plans (ICRMPs) for SCI.
EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	DoN	The Proposed Action would not result in any disproportionately high adverse human health or environmental effects on minority or low-income populations.
EO 13045, Protection of Children from Environmental Health Risks and Safety Risks	DoN	The Proposed Action would not result in environmental health and safety risks to children.

Table 6-1: Summary of Environmental Compliance for the Proposed Action (continued)

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
EO 13112, Invasive Species	DoN	EO 13112 requires agencies to identify actions that may affect the status of invasive species and take measures to avoid introduction and spread of these species. To the extent invasive species management relates to ESA compliance on SCI, the BO ensures compliance with EO 13112. This EIS/OEIS also otherwise satisfies the requirement of EO 13112.
EO 13089, Coral Reef Protection	DoN	EO 13089 preserves and protects the biodiversity, health, heritage, social, and economic value of U.S. coral reef ecosystems and the marine environments. All Navy actions that may affect U.S. coral reef ecosystems shall (a) identify their actions that may affect U.S. coral reef ecosystems; (b) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and (c) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems. Navy Standard Operating Procedures (SOPs) ensure all precautions are made to comply with required statutes. No resources that are governed by this EO exist within the SOCAL Range Complex; therefore, mitigation of effects will not be necessary for the protection of resources under EO 13089.
EO 11990, Protection of Wetlands	DoN	Implementation of the alternatives including the Proposed Action would not have a significant impact on wetlands.
EO 12962, Recreational Fisheries	DoN	EO 12962 requires Federal agencies to fulfill certain duties with regard to promoting the health and access of the public to recreational fishing areas. The alternatives including the Proposed Action comply with EO 12962.
California Coastal National Monument Designation (Presidential Proclamation, January 11, 2000)	Bureau of Land Management (BLM) and California Department of Fish and Game (CDFG)	The proclamation designates all nonmajor U.S.-owned lands (rocks, islands, etc.) along the coast of California from mean high tide out to a distance of 12 nautical miles (nm) (22 kilometers [km]) as national monuments. The SOCAL Range Complex includes resources designated as part of the California Coastal National Monument area. The Navy has agreed with BLM on the terms of a memorandum of understanding (MOU) dated Nov. 5, 2007 regarding Navy activities in the vicinity of monument resources. Implementation of the alternatives including the Proposed Action would be consistent with the MOU and would not affect monument resources.

Table 6-1: Summary of Environmental Compliance for the Proposed Action (continued)

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
California Marine Life Protection Act (MLPA) and Marine Managed Areas Improvement Act (California Fish and Game Code §§ 2850-2863)	CDFG	MLPA requires CDFG to confer with the Navy regarding issues related to Navy activities as such may engage Marine Managed Areas.
Migratory Bird Treaty Act (MBTA) (16 U.S.C. §§ 703-712)	USFWS	The Navy has concluded that implementation of the alternatives including the Proposed Action would cause no significant adverse effects on migratory birds, would comply with the MBTA, and would not require a permit under the MBTA.

6.1.1 Coastal Zone Management Act Compliance

The CZMA of 1972 (16 United States Code [U.S.C.] Section [§] 1451) encourages coastal states to be proactive in managing coastal zone uses and resources. CZMA established a voluntary coastal planning program; participating states submit a Coastal Management Plan (CMP) to the National Oceanographic and Atmospheric Administration (NOAA) for approval. Under CZMA, Federal actions are required to be consistent, to the maximum extent practicable, with the enforceable policies of approved CMPs.

CZMA defines the coastal zone (16 U.S.C. § 1453) as extending, "to the outer limit of State title and ownership under the Submerged Lands Act" (i.e., 3 nautical miles [nm] from the shoreline). The coastal zone extends inland only to the extent necessary to control the shoreline. Excluded from the coastal zone are lands the use of which is by law subject solely to the discretion of, or which is held in trust by, the Federal government (16 U.S.C. § 1453). Accordingly, Federal military lands such as San Clemente Island (SCI) are not within the coastal zone.

The State of California has an approved CMP. The *California Coastal Act* (CCA) of 1976 (California Public Resources Code, Division 20) implements California's CZMA program. The CCA includes policies to protect and expand public access to shorelines, and to protect, enhance, and restore environmentally sensitive habitats, including intertidal and nearshore waters, wetlands, bays and estuaries, riparian habitat, certain woods and grasslands, streams, lakes, and habitat for rare and endangered plants and animals. The California Coastal Commission (CCC) administers the state's CMP.

The CZMA Federal consistency determination process includes a review of the Proposed Action to determine whether it has reasonably foreseeable effects on coastal zone resources or uses, an in-depth examination of any such effects, and a determination on whether those effects are consistent to the maximum extent practicable with the state's enforceable policies. Under the CZMA, the CCC must provide an opportunity for public comment and involvement in the Federal coastal consistency determination process.

In conjunction with the EIS process, the Navy completed a Consistency Determination (CD) under the Federal consistency review process. The CD finds that the Navy is consistent to the maximum extent practicable with the state's enforceable CZMA policies. In particular, the Navy has determined that its Proposed Action is consistent with CCA Article 2 (Public Access), Section 30210 (Access, recreational opportunities, posting); Article 3 (Recreation), Section 30220 (Protection of water-oriented activities); Article 4 (Maritime Environment), Sections 30230 (Marine resources, maintenance), 30231 (Biological productivity, wastewater), and 30234.5

(Fishing; economic, commercial, and recreational importance); and Article 5 (Land Resources), Section 30240 (Environmentally sensitive habitat areas). The Navy has determined that other policies embodied in the articles and sections of the CCA are not applicable to the Proposed Action. On October 15, 2008, the Navy appeared before the California Coastal Commission (CCC) in Ventura, California. The CCC conditionally concurred with the CD. At this point, the Navy and the CCC are continuing the CZMA federal consistency process.

This EIS/OEIS addresses those coastal resources and uses which would be affected by the Proposed Action, although the impact analyses do not specifically distinguish effects within the coastal zone from those effects outside of it. Public access and recreation are discussed in Sections 3.4 (Water Resources) and 3.16 (Public Health and Safety). Marine resources and biological productivity are discussed in Sections 3.6 (Marine Plants and Invertebrates), 3.7 (Fish), 3.8 (Sea Turtles), 3.9 (Marine Mammals), and 3.10 (Sea Birds). Fishing and commercial and recreational economics is discussed in Sections 3.7 (Fish) and 3.14 (Socioeconomics). Cultural resources are discussed in Section 3.12 (Cultural Resources).

6.2 Relationship Between Short-Term Use of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

NEPA requires an analysis of the relationship between a project's short-term impacts on the environment and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This means that choosing one option may reduce future flexibility in pursuing other options, or that committing a resource to a certain use may often eliminate the possibility for other uses of that resource.

The Proposed Action would result in both short- and long-term environmental effects. However, the Proposed Action would not be expected to result in any impacts that would reduce environmental productivity, permanently narrow the range of beneficial uses of the environment, or pose long-term risks to health, safety, or the general welfare of the public. The Navy is committed to sustainable range management, including co-use of the SOCAL Range Complex with the general public and commercial interests to the extent practicable, consistent with accomplishment of the Navy mission and in compliance with applicable law. This commitment to co-use will enhance the long-term productivity of the range areas surrounding SOCAL Range Complex.

6.3 Irreversible or Irretrievable Commitment of Resources

NEPA requires that environmental analysis include identification of "any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented." (NEPA Sec. 102 [2][C][v], 42 U.S.C. § 4332)**.** Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the uses of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy or minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., the disturbance of a cultural site). Construction of the Shallow Water Training Range (SWTR) and the Shallow Water Minefield (SWM) would cause short-term and temporary impacts during construction. Once SWTR is put in place, anchoring points will be carefully chosen by the Navy in order to mitigate any possible effects the laying of SWTR cable might have on marine resources.

For the alternatives including the Proposed Action, most resource commitments are neither irreversible nor irretrievable. Most impacts are short-term and temporary, or, if long lasting, they are negligible. Culturally significant resources known to occur in the area proposed for training activities are carefully managed under a comprehensive cultural resources program which the Navy is currently advancing through a programmatic agreement. This will ensure the future management of these resources. No habitat associated with threatened or endangered species would be lost as a result of implementation of the Proposed Action. Since there would be no building or facility construction, the consumption of materials typically associated with such construction (e.g., concrete, metal, sand, fuel) would not occur. Energy typically associated with construction activities would not be expended and irreversibly lost.

Implementation of the Proposed Action would require fuels used by aircraft, ships, and ground-based vehicles. Since fixed- and rotary-wing flight and ship activities could increase relative to the No Action Alternative, total fuel use would increase. Fuel use by ground-based vehicles involved in training activities would also increase. Therefore, total fuel consumption would increase and this nonrenewable resource would be considered irreversibly lost.

6.4 Energy Requirements and Conservation Potential of Alternatives and Mitigation Measures

Increased training and testing operations on the SOCAL Range Complex would result in an increase in energy demand over the No Action Alternative. This would result in an increase in fossil fuel consumption, mainly from aircraft, vessels, ground equipment, and power supply. Although the required electricity demands of increased intensity of land use would be met by the existing electrical generation infrastructure at the SOCAL Range Complex, the alternatives would result in a net cumulative negative impact on the energy supply.

Energy requirements would be subject to any established energy conservation practices at each facility. No additional power generation capacity other than the potential use of generators would be required for any of the operations. The use of energy sources has been minimized wherever possible without compromising safety, training, or testing operations. No additional conservation measures related to direct energy consumption by the proposed operations are identified.

6.5 Natural or Depletable Resource Requirements and Conservation Potential of Various Alternatives and Mitigation Measures

Resources that will be permanently and continually consumed by project implementation include water, electricity, natural gas, and fossil fuels; however, the amount and rate of consumption of these resources would not result in significant environmental impacts or the unnecessary, inefficient, or wasteful use of resources. Nuclear-powered vessels would be a benefit as their use decreases use of fossil fuels.

In addition, construction activities related to increased training and testing operations on the SOCAL Range Complex would result in the irretrievable commitment of nonrenewable energy resources, primarily in the form of fossil fuels (including fuel oil), natural gas, and gasoline construction equipment. With respect to operational activities, compliance with all applicable building codes, as well as project mitigation measures, would ensure that all natural resources are conserved or recycled to the maximum extent feasible. It is also possible that new technologies or systems will emerge, or will become more cost effective or user-friendly, which will further reduce the site’s reliance upon nonrenewable natural resources; however, even with implementation of conservation measures, consumption of natural resources would generally increase with implementation of the alternatives.

Pollution prevention is an important component of mitigation of the alternatives’ adverse impacts. To the extent practicable, pollution prevention considerations are included.

By virtue of inclusion of proposed increases in SOCAL Range Complex operations in the SIP, the air emissions inventory, and emissions of nitrogen oxides (NO_x) and reactive organic gases

(ROG) associated with the Proposed Action and alternatives are in conformity with the SIP and have demonstrated that they will not cause or contribute to a violation of the ozone standard (SOCAL, 2007 [Section 3.2, Air Quality[). Therefore, because the Proposed Action will not adversely affect the ability of the South Coast Air Basin to attain and maintain the National Ambient Air Quality Standards, the Proposed Action is presumed to conform with the SIP.

Aircraft operations at Naval Auxiliary Landing Field SCI are the single largest airborne noise source. Noise levels in excess of 90 decibal A-weighted can occur at the Basic Underwater Demolition/SEAL (BUD/S) Camp (SOCAL, 2007 [Chapter 3.5, Acoustic Environment]). Mitigation measures (structural attenuation features) are in place.

Sustainable range management practices are in place that protect and conserve natural and cultural resources, and preservation of access to training areas for current and future training requirements, while addressing potential encroachments that threaten to impact range capabilities.

7 List of Preparers

7 LIST OF PREPARERS

GOVERNMENT PREPARERS

Alexander Stone (U.S. Navy Fleet Environmental Division)
EIS Project Manager
B.S. Environmental Studies, George Washington University

Chip Johnson (U.S. Navy Pacific Fleet)
Marine Species Advisor and Staff Marine Biologist
B.S. Biology, University of North Carolina at Wilmington
M.A. Marine Science, Virginia Institute of Marine Science, College of William and Mary

Dean Leach, CDR, JAGC (U.S. Navy Pacific Fleet)
U.S. Navy Judge Advocate, U.S. Pacific Fleet
J.D., 1988
LLM (Environmental), 2001

CONTRACTOR PREPARERS

Matthew Bartlett (Parsons Infrastructure and Technology), Cultural Resources, Public Health/Safety
B.S. Environmental Policy & Planning, Virginia Polytechnic Institute and State University
Years of Experience: 3.5

Blair Brownyard (Man Tech SRS Technologies, Inc.), Environmental Analyst
B.A. History, California State University, San Marcos
J.D. Touro Law Center
Years of Experience: 6

Bruce Campbell (Parsons Infrastructure and Technology), Lead Analyst, Geology/Soils, Noise
B.S. Environmental Biology, University of California, Santa Barbara
M.S. Environmental Management, University of San Francisco
Years of Experience: 26

Brian Fenlon (ManTech SRS Technologies), Military Operations Specialist
B.A. Mathematics, Providence College
Years of experience: 20

Lawrence Honma (Merkel & Associates, Inc.), Marine Biology and Fish
B.S. Wildlife and Fisheries Biology, University of California, Davis M.S. Marine Sciences, Moss Landng Marine Laboratory, California State University, San Francisco
Years of Experience: 18

Krystal Kermott (ManTech SRS), Deputy Project Manager
B.S. Biological Sciences, University of California at Santa Barbara
Years of Experience: 7

Derek Lerma (Tierra Data Inc.), Senior Marine Biologist, USCG 100 Ton Captain, Dive Master
B.S. Biological Oceanography, Humboldt State University
Years of Experience: 20

Thomas W. Mulroy (SAIC), Terrestrial Biological Assessment Leader
Ph.D. Ecology and Evolutionary Biology, University of California at Irvine,
M. A. Biology, University of Arizona; B.A. Zoology, Pomona College.
Years of Experience: 30

Paul Nyenhuis (ManTech SRS), Senior Systems Analyst
B.S. Computer Science, National University
Years of Experience: 17

Karyn Palma (ManTech SRS), Resource Analyst
B.A. Environmental Studies, University of California, Santa Barbara
Years of Experience: 15

Antonio Perez (ManTech SRS), Lead Geospatial Analyst
Geospatial Intelligence Diploma, National Geospatial Intelligence College
Years of Experience: 15

Arthur Popper, PhD
Interim Associate Dean, College of Chemical and Life Sciences, Department of Biology
University of Maryland, College Park, MD

Angela Schnapp (Parsons Infrastructure and Technology), Hazardous Materials / Wastes, Water Quality
B.S., Nuclear Engineering, University of Illinois at Urbana-Champaign, Urbana, Illinois
M.S., Environmental Engineering, University of Illinois at Urbana-Champaign, Urbana, Illinois
Years of Experience: 13

Valorie L. Thompson (Scientific Resources Associated), Air Quality
B.S. Chemistry, Eastern Michigan University
M.S. Chemical Engineering, Purdue University
Ph.D. Chemical Engineering, Purdue University
Years of Experience: 21

Philip Thorson (ManTech SRS), Senior Research Biologist/Marine Mammal Biologist
Ph.D. Biology, University of California at Santa Cruz
Years of Experience: 27

Brian Tucker (ManTech SRS), Project Manager
B.A. University of Notre Dame
J.D. Loyola Law School, Los Angeles
Years of Experience: 21

Karen Waller (ManTech SRS), Vice President/Quality Assurance
B.S. Public and Environmental Affairs, Indiana University
Years of Experience: 20

Brian D. Wauer (ManTech SRS), Project Manager
B.S. 1984, Industrial Management, University of Arkansas
Years of Experience: 22

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CHAPTER 3

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CHAPTER 4

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CHAPTER 5

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CHAPTER 6

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CHAPTER 7

No references in this section

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9 Distribution List

9 DISTRIBUTION LIST

The individuals, agencies, and organizations listed in this Chapter received a compact disk (CD) with a copy of the Southern California Range Complex Environmental Impact Statement / Overseas Environmental Impact Statement.

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NOAA Southwest Fisheries Science Center
William Perrin
La Jolla, CA

NOAA
Office of Protected Resources, National Marine Fisheries Service
Ken Hollingshead
Silver Spring, MD

NOAA
Office of Protected Resources, National Marine Fisheries Service
Jaclyn Daly
Silver Spring, MD

NOAA
Office of Protected Resources, National Marine Fisheries Service
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Sacramento, CA

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Department of Conservation
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Robert Kanter
Long Beach, CA

Port of San Diego
San Diego, CA

Regional Water Quality Control Board
Shirley Virosik
Monterey Park, CA

San Diego Air Pollution Control District
Scott Underhill
San Diego, CA

San Diego Association of Governments
Rob Rundle
San Diego, CA

San Diego Unified Port District
David Merk
San Diego, CA

Elected Officials

U.S. Senate
Hon. Dianne Feinstein
Los Angeles, CA

U.S. Senate
Hon. Barbara Boxer
Los Angeles, CA

U.S. House of Representatives 49th District
Hon. Darrell Issa
Vista, CA

U.S. House of Representatives 50th District
Hon. Bilbray Brian
Solana Beach, CA

U.S. House of Representatives 51st District
Hon. Robert Filner
Chula Vista, CA

U.S. House of Representatives 52nd District
Hon. Duncan Hunter
El Cajon, CA

U.S. House of Representatives, District 44
Hon. Loretta Sanchez
Garden Grove, CA

U.S. House of Representatives, District 46
Hon. Dana Rohrabacher
Huntington Beach, CA

U.S. House of Representatives, District 48
Hon. John Campbell
Newport Beach, CA

U.S. House of Representatives, District 53
Hon. Susan Davis
San Diego, CA

Governor of California
Arnold Schwarzenegger
Sacramento, CA

California State Assembly
Hon. Betty Karnette
Long Beach, CA

California State Assembly
Hon. Lori Saldana
San Diego, CA

California State Assembly
Hon. Shirley Horton
Lemon Grove, CA

California State Senate, District 27
Hon. Alan Lowenthal
Long Beach, CA

California State Senate, District 33
Hon. Dick Ackerman
Tustin, CA

California State Senate, District 35
Hon. Tom Harman
Costa Mesa, CA

California State Senate, District 38
Hon. Mark Wyland
Carlsbad, CA

California State Senate, District 39
Hon. Christine Kehoe
San Diego, CA

San Diego County Board of Supervisors District 1
Hon. Gregory Cox
San Diego, CA

San Diego County Board of Supervisors District 2
Hon. Dianne Jacob
San Diego, CA

San Diego County Board of Supervisors District 3
Hon. Pam Slater
San Diego, CA

San Diego County Board of Supervisors District 4
Hon. Ron Roberts
San Diego, CA

San Diego County Board of Supervisors District 5
Hon. Bill Horn
San Diego, CA

Others

Coast Guard Auxiliary
Coronado Bay Flotilla 16-05
Fred Brown
Coronado, CA

Hubbs-Sea World Research Institute
Ann Bowles / Brent Stewart
San Diego, CA

Maritime Shoshone, Inc.
c/o The Island Gabrieleno Group
Louise Jeffredo-Warden
Moss Beach, CA

San Diego Port Tenants Association
Kristin Tyson
San Diego, CA

Southern California Association of Governments
Maggie Idle
Los Angeles, CA

State Clearinghouse and Other Repositories

California State Clearinghouse
Sacramento, CA

Imperial Beach Branch Library
Jose A. Aponte
Imperial Beach, CA

San Diego Environmental Library
Environmental Services Department
San Diego, CA

Oceanside Public Library
Oceanside, CA

San Clemente Library
San Clemente, CA

San Pedro Regional Branch Library
San Pedro, CA

Individuals

Ahlquist, Dale
Chanhassen, MN

Alarcon, Leonardo
San Ysidro, CA

Allen, Tom
Newport Beach, CA

Alps, Bernado
San Pedro, CA

Alps, Diane
San Pedro, CA

Amoroso, Orlando
San Pedro, CA

Anderson, Jo Ellen
San Diego, CA

Anderson, Scott
San Diego, CA

Anderson, Sean
El Cajon, CA

Anes, Paul
San Diego, CA

Angel, Bradley
San Francisco, CA

Arnold, Jeanne
Los Angeles, CA

Arnold, Jeanne
Los Angeles, California

Arrington, Walt
Orange, CA

Balcomb, Brian
Salinas, CA

Balcomb, Ken
Friday Harbor, WA

Ball, Tom
Santa Barbara, CA

Barnyak, Frank
Studio City, CA

Beck, Joe
Escondido, CA

Beldofe, Herbert
Washington DC

Bertelli, Bob
Sacramento, CA

Bishop, Charles
San Diego, CA

Black, Steve
San Diego, CA

Bohlman, Bob
Washington, DC

Bossier, Bob
San Diego, CA

Bowen, Joanne
Irvine, CA

Brade, Edith
San Dimas, CA

Bradley, Julia
Torrance, CA

Bradstreet, Kailee
San Diego, CA

Bravo, Jose T.
Albuquerque, NM

Brennan, Bat
Santa Ana, CA

Brown, John "Locky"
Ventura, CA

Brown, Liz
Laguna Beach, CA

Byrd, Chris
San Diego, CA

Cadell, George
Portsmouth, VA

Cahil, Jim
Coronado, CA

Carey, Bill
San Diego, CA

Carl, Karyn V.
Harrisburg, PA

Carman, Bret
Avalon, CA

Carpino, Elizabeth
Oakland, CA

Cathcart, Lynn
Newport Beach, CA

Claibourne, Bill
Lafayette, LA

Clark, Cindy
La Jolla, CA

Clark, Steve
Venice, CA

Claycomb, William
Imperial Beach, CA

Colgate, John
Santa Barbara, CA

Conner, Mike
Coronado, CA

Corkill, Roberta
Oceanside, CA

Costa, Anthony E.
Washington, DC

Crivetto, Lou & Sandy
San Diego, CA

Cuevas, Mary
Long Beach, CA

Cummings, Jim
Santa Fe, NM

Curtin, Pete
Chula Vista, CA

Daley, Marsha
Santa Barbara, CA

Daniels, Doug
Avalon, CA

Darlak, Christine
Coronado, CA

Darnell, Ellen
San Diego, CA

de La Rosa, Carlos
Avalon, CA

Deacon, John
Orcutt, CA

DeBeck, Jim
Long Beach, CA

Denny, Sharon
Springfield, CA

Devine, Dennis
Escondido, CA

Deviti, Alfred
Laguna Beach, CA

Dinger, Harlan
La Mesa, CA

Doesburg, Rick
San Clemente, CA

Domlinson, Charlie
Long Beach, CA

Duchene, Lou
San Diego, CA

Duffy, Walter
Arcata, CA

Eberly, Chris
The Plains, VA

Eckenroth, Dean
Coronado, CA

Elliott, Ted
Bakersfield, CA

English, T. Malcolm
PE9 1XQ, U.K.

Evans, Carol
Oceanside, CA

Everett, William
La Jolla, CA

Everitt, Ronald
Angola, IN

Farmer, Dave
Los Angeles, CA

Fisher, George
Laguna Hills, CA

Fisher, Robert
San Diego, CA

Fitzer, Richard,
Long Beach, CA

Fletcher, Bob
San Diego, CA

Ford, Bill
Laguna Beach, CA

Freed, Lynn
Canoga Park, CA

Freireich, Richard
San Diego, CA

Fridell, Lane
Coronado, CA

Fuentes, Gidget
Carlsbad, CA

Fusaro, Craig
Santa Barbara, CA

Gagosian, Bob
Washington, DC

Gaines, Bill
La Jolla, CA

Galway, Megan
Costa Mesa, CA

Gamble, Lynn
San Diego, CA

Gaworecki, Marie
Burbank, CA

Geary, Patty
San Pedro, CA

Glantz, Dale
San Diego, CA

Glassow, Michael
Santa Barbara, CA

Goehring, Vern
Sacramento, CA

Gorss, Marlin
La Jolla, CA

Grader, W.F.
Sausalito, CA

Grader, W.F.
Sausalito, CA

Green, Marsha
Reading, PA

Greenberg, Joel
Los Angeles, CA

Guinther, Eric
Kailua, HI

Gunn, Kara
Oceanside, CA

Guth, John
Vista, CA

Hall, Albert
Irvine, CA

Halmay, Peter
Lakeside, CA

Hansen, Mike
Dana Point, CA

Hanson, Brian
San Pedro, CA

Hark, Bob
Ventura, CA

Harlowe, Anna
Los Angeles, CA

Harper, Rick
Santa Barbara, CA

Harris, Martha
Los Angeles, CA

Hasbrouck, Bruce G.
Tampa, FL

Head, R.G.
Coronado, CA

Heath, Shane
Arcata, CA

Heck, Ronald G
Santa Barbara, CA

Heikkila, Wayne
Redding, CA

Heiser, Dick
Los Angeles, CA

Helgren, Richard
Oceanside, CA

Helling, Harry
Dana Point, CA

Hemphill, Joan
Long Beach, CA

Herold, Laura
Pacifica, CA

Herzik, Terry
Redondo Beach, CA

Hill, Camber
Long Beach, CA

Hine, Gail
Tustin, CA

Hinman, Ken
Leesburg, VA

Hinton, Mel
San Diego, CA

Hisayash, Debbie
Keyport, WA

Hoinkes, Mary Elizabeth
Washington, DC

Holcberg, David
Irvine, CA

Holt, Lynne
Lake Forest, CA

Holtel, M.
Vista, CA

Hoogendam, Heather
Solana Beach, CA

Hoover, Carole
Coronado, CA

Hoskins, Gary
Cypress, CA

Howorth, Peter
Santa Barbara, CA

Hunter, Laura
National City, CA

Huntting-Coronel, Charmaine
Escondido, CA

Ininns, Morgan
Dana Point, CA

Jahnkow, Carol
San Diego, CA

James, Kitty
Irvine, CA

Jasny, Michael
Santa Monica, CA

Jeffredo, John
Fallbrook, CA

Jeffredo-Warden, Louise
Moss Beach, CA

Jeffrey, Walt
Huntington Beach, CA

Jenner, Marcie
Laguna Beach, CA

Jenny, Carol
Gardena, CA

Johnson, Tim
Oceanside, CA

Jones, Marilyn
Sylmar, CA

Jones, Terry
San Luis Obispo, CA

Jurji, Judith
Seattle, WA

Kanig, Ed
San Diego, CA

Kedis, Angelo
Avalon, CA

Kelly, Fred
Imperial Beach, CA

Kelsey, Myrna
Huntington Beach, CA

Kie, John
Fresno, CA

Kingsmill, Jim
San Clemente, CA

Knaster, Alana
Woodland Hills, CA

Knight, Cathy
Santa Monica, CA

Kramer, Rob
Dania Beach, FL

Lang, Valerie
Los Angeles, CA

Lavars, George
Alhambra, CA

Lee, Mike
San Diego, CA

LePore, Paul
Huntington Beach, CA

Lindsey, John
Newport Beach, CA

Lindsey, John
Newport Beach, CA

Lingerfelder, Terry
Solana Beach, CA

Little, Isabelle
Encino, CA

Lowenthal, Alan
Long Beach, CA

Lucasey, Ray
Point Mugu, CA

MacMillan, Adrian
Santa Monica, CA

Mader, Tracey
Petaluma, CA

Marineros, Catalina
Marina Del Rey, CA

Martindell, Chris
San Diego, CA

Martindell, Rich
San Diego, CA

Martus, Carolyn
San Diego, CA

Martz, Patricia
Los Angeles, CA

Mason, Jeff
Santa Barbara, CA

Matson, Lawrence
Cypress, CA

Mautz, William
Hilo, HI

Mazlamian, Bob
Hollywood, CA

McBain, Jim
San Diego, CA

McCall, James L.
Paso Robles, CA

McCorkle, Mike
Summerland, CA

Mcfarland, Chuck
Newport Beach, CA

McGrail, J.
Marina Del Ray, CA

McIntosh, Heather
Patuxent River, MD

McIsaac, Donald O.
Portland, OR

McKeown, John C,
Laguna Beach, CA

McLauren, Jon
San Francisco, CA

Medford, Roberta
Los Angeles, CA

Medina, Nichelle
San Diego, CA

Mehlem, Bill
Studio City, CA

Mello, John
Avalon, CA

Menjivar, Michael
Lake View Terrace, CA

Merriam, Clark
Hampton, VA

Millan, Edward J.
Camarillo, CA

Moor, Sarah
Middletown, RI

Mottola, Mike
Long Beach, CA

Murdick, James
Oceanside, CA

Murphy, Richard
Santa Barbara, CA

Murray, Pat
Houston, TX

Myers, Larry
Sacramento, CA

Navratil, Joe
Coronado, CA

Nowicke, Susan
San Diego CA

Nussman, Mike
Alexandria, VA

Nydegger, David L.
Oceanside, CA

O’Carroll, Susan
Burbank, CA

O'Day, Terry
Santa Monica, CA

Olson, Kevin
Montrose, CA

Opdycke, Jeff
San Diego, CA

Owen, Michael
Manhattan Beach, CA

Parenude, Dave
San Diego, CA

Parr, Michael J.
Washington, DC

Pashley, David
The Plains, VA

Patton, Gary A.
Sacramento, CA

Perez, Edgar
San Gabriel, CA

Perleberg, Brian
Longview, WA

Peters, Dennis
Shalimar, FL

Peterson, Jim
San Pedro, CA

Pitcher, Ben
Long Beach, CA

Pivovaroff, Mary
Irvine, CA

Pleschner-Steele, Diane
Buellton, CA

Potorti, Grace
Reno, NV

Pozniakoff, Robin
Long Beach, CA

Procaccini, Carol
Laguna Beach, CA

Raftican, Tom
Irvine, CA

Rassam, Ghassan
Bethesda, MD

Ratican, Tom
Huntington Beach, CA

Rausa, Rosario
Alexandria, VA

Reamer, Jerry
San Diego, CA

Redfern, Chris
San Diego, CA

Reynolds, Joel
Los Angeles, CA

Reznik, Bruce
San Diego, CA

Richmond, Sue
Long Beach, CA

Risser, Art
San Diego, CA

Rocha, Vera
Baldwin Hills, CA

Rodgers, Terry
San Diego, CA

Rogers, Lou
Point Mugu, CA

Rose, Naomi
Washington, D.C.

Ross, David
Long Beach, CA

Roy, Kristina
Washington, D.C.

Royal, Jim
San Diego, CA

Salamunovich, Peter
Avalon, CA

Sanchez, Gerald
Newbury Park, CA

Sandhu, M.S.
Newport Beach, CA

Schenck, Phil
Westminster, CA

Schillo, Frank
Thousand Oaks, CA

Schriver, Eilien
Van Nuys, CA

Schroeder, James
Seattle, WA

Schuck, Tony
Rio Vista, CA

Schumann, Kai
San Diego, CA

Scoble, John
San Pedro, CA

Scott, Tom
Riverside, CA

Seech, Randal
San Clemente, CA

Serden, Bertram
Beverly Hills, CA

Shaneman, Shabram
Long Beach, CA

Shea, Robert
Campo, CA

Sheavly, Seba
Virginia Beach, VA

Shirey, Jim
Coronado, CA

Simmen, Jeffrey A.
Seattle, WA

Smith, Dennis
San Diego, CA

Smith, Zak
Santa Monica, CA

Smullen, Steve
El Paso, TX

Sobel, Jan
Carlsbad, CA

Sparling, Steven C.
Alexandria, VA

Speelman, Patricia
Long Beach, CA

Squibb, Jim
Oceanside, CA

Storsteen, Erik
Redondo Beach, CA

Sullivan, James J.
La Jolla, CA

Sweeting, Richard
Long Beach, CA

Swisher, Ken
Northridge, CA

Talbert, Joe
Coronado, CA

Terrebone, Pamela
Coronado, CA

Thomas, Scott
Irvine, CA

Thompson, Gary
Lake Elsinore, CA

Thompson, Mark
Imperial Beach, CA

Thompson, Michael R.
San Juan Capistrano, CA

Towler, Blake
Washington, DC

Urone, William V
Laguna Niguel, CA

Valdez, Val
Torrence, CA

Vega, Felix
San Pedro, CA

Vincent, Delores
Orange, CA

Walker, Greg
Coronado, CA

Walker, Cheryl
San Diego, CA

Walsh, Dan
Encinitas, CA

Walter, Debbie
Solana Beach, CA

Ward, Jack
Long Beach, CA

Warnock, Nils
Stinson Beach, CA

Wauben, Scott
Avalon, CA

Wegrzyn, Barry
Van Nuys, CA

Weyrauch, Jenine
Burbank, CA

Wicks, Cara Lou
Oceanside, CA

Wilson, Darrel
Carpenteria, CA

Wilson, Rick
San Diego, CA

Winegrad, Gerald
Washington, DC

Winter, Jay
Los Angelos, CA

Wise, Chuck
San Francisco, CA

Woodard, Bill
Huntington Beach, CA

Woodard, Robert
San Diego, CA

Woodfield, Helen
Oceanside, CA

Woodfield, Jeff
Oceanside, CA

Woodruff, David S.
La Jolla, CA

Wray, Russell
Hancock, ME

Young, Bruce
Coronado, CA

Zechman, Joe
San Diego, CA

Zoggas, Nikos
Escondido, CA

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10 Public Comments

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10 PUBLIC COMMENTS

This chapter presents responses to comments received on the Southern California (SOCAL) Range Complex Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) (April 2008).The comments are from the public comment period for the document, April 4, 2008 through May 19, 2008.

In preparing the SOCAL Range Complex Draft EIS/OEIS each resource section was prepared and reviewed by numerous qualified individuals, each specialists in their respective fields, to ensure that the resources and issues received a rigorous and thorough assessment. The best available scientific data, and the latest peer-reviewed studies were considered.

Due to the controversy surrounding Navy activities and potential effects to the marine environment, the National Marine Fisheries Service (NMFS) was consulted throughout the development of the EIS/OEIS. NMFS is a cooperating agency for the EIS/OEIS and is also the agency with jurisdiction and expertise regarding marine resources, in particular marine mammals. The methodology used for analyzing effects to marine mammals in the EIS/OEIS was provided by NMFS.

In this Final EIS/OEIS, the Navy has made changes to the Draft EIS/OEIS, based on comments received during the public comment period. These changes included factual corrections, additions to existing information, and improvements or modifications to the analyses in the Draft EIS/OEIS. Section 10.2 presents the public comments received and the Navy's responses to these comments. The public should note that these changes are non-substantive and do not result in any significant modifications to the proposed action, the alternatives considered, the affected environment or the environmental effects analyses.

Although all comments have been read and considered, some comments were not specific regarding the analyses or the alternatives in the Draft EIS/OEIS and, therefore, could not be given specific responses. As stated in the Council on Environmental Quality's (CEQ) Regulations for Implementing the National Environmental Policy Act (NEPA), 40 CFR Part 1503.3(a), "Comments on an environmental impact statement or on a proposed action shall be as specific as possible and may address either the adequacy of the statement or the merits of the alternatives discussed or both."

Section 10.1 provides an overview of the Public Involvement Process, and Section 10.2 presents the public comments with Navy responses.

10.1 PUBLIC INVOLVEMENT

The public involvement process began with the issuance of the Notice of Intent to Prepare an Environment Impact Statement in the Federal Register on December 21, 2006. This notice included a project description and scoping meeting dates and locations. Three scoping meetings were held to notify the public of the Navy's proposed project and solicit input regarding the direction of the analysis. Meetings were held in the Cabrillo Marine Aquarium in San Pedro, California on Monday, January 29, 2007; the Civic Center Public Library in Oceanside, California on Tuesday, January 30, 2007; and the Coronado Public Library in Coronado, California on Wednesday, January 31, 2007. All meetings were open from 6 to 8 PM. The scoping meetings were designed so that the public could ask questions of the project team members and collect information, such as fact sheets. In order to publicize the meetings the Navy published 18 advertisements in three newspapers, San Diego Union Tribune, North County Times, and the Daily Breeze (San Pedro), issued a press release, mailed letters to federal, state, and local agencies, and sent postcards to the general public. Comments received from the public during the scoping process are categorized and summarized in Table 10-1.

On April 4, 2008, the Navy published a Notice of Availability of a Draft Environment Impact Statement/Overseas Environment Impact Statement in the Federal Register. Prior to publication of the Notice of Availability, a news release was issued on April 3, 2008 and two media briefings were conducted to inform the public of the impending Notice publication. The Notice of Availability was the start of the public comment period for the Draft EIS/OEIS. The public comment period ended on May 19, 2008. During the public comment period the Navy held public hearings to present information from the EIS/OEIS and solicit public comments. Meetings were held in Oceanside, California on Tuesday, April 29, 2008, Coronado, California on Wednesday, April 30, 2008, and Long Beach, California on Thursday, May 1, 2008. Staffed poster stations with detailed information about the project and the Draft EIS/OEIS results were open for the duration of the meeting and a more formal, structured public hearing began at 7 PM and concluded when all who wished to comment were finished. The public hearing began with a slideshow presentation by the Navy followed by oral public comments. In order to publicize the meetings the Navy published 18 advertisements in three newspapers, San Diego Union Tribune, North County Times, and the Long Beach Press Telegram, mailed letters to federal, state, and local agencies, and sent postcards to the general public.

Table 10-1: Public Scoping Comment Summary

Category	Commentator	Comment Summary
Marine Mammal Focus	California Coastal Commission (CCC) Non-Governmental Organization U.S. EPA Channel Islands National Park Private Citizen	Recommend common, Navy-wide approach to addressing potential impacts of sonar use on marine mammals
Coastal Consistency	CCC	Identified need for consistency review in connection with EIS
Airspace Concerns	FAA California Department of Fish and Game (re: aerial surveys) San Diego County Private citizen	Seeking clarification that the Proposed Action does not contemplate expanding military airspace (Note: The Navy is not proposing expanded airspace.)
Air Quality	U.S. EPA	General comment on regulatory process for air quality matters
Ship traffic	Liquefied Natural Gas (LNG) proponent (commercial entity)	Identifies possibility of conflict between military activities and certain LNG operations in ocean areas
Requests for Information	Los Angeles County Private Citizen	General information requests

A public website was established specifically for this project, www.socalrangecomplexeis.com. This website address was published in the initial Notice of Intent and has subsequently been re-printed in all newspaper advertisements, agency letters, and public postcards for both the Notice of Intent to Prepare an Environment Impact Statement and Notice of Availability of the Draft Environmental Impact Statement. The Draft EIS/OEIS, Scoping Meeting Fact Sheets, and various other materials have been available on the project website throughout the course of the project. This Final EIS/OEIS is available for download on the website as well.

10.2 Public Comments and Navy Responses

Public comments on the Draft EIS/OEIS submitted to the Navy have been reproduced on the following pages. Navy responses are presented after each comment. Because of the length of many comments, each comment has reference numbers to the right, indicating the number of the corresponding response.

10.2.1 Written Public Comments

The comments in this section were received in written form by organizations, agencies, and individuals.

10.2.1.1 California Coastal Commission (CCC)

STATE OF CALIFORNIA – THE RESOURCES AGENCY ARNOLD SCHWARZENEGGER, *GOVERNOR*

CALIFORNIA COASTAL COMMISSION
45 FREMONT STREET, SUITE 2000
SAN FRANCISCO, CA 94105-2219
VOICE AND TDD (415) 904-5200

May 19, 2008

Naval Facilities Engineering Command, Southwest
Attn: SOCAL EIS Project Manager (Code REVCO)
1220 Pacific Highway
Building 127
San Diego, CA 92132-5190

Re: California Coastal Commission (CCC) Comments, U.S. Navy Draft EIS/OEIS for the Southern California Range Complex

Dear Project Manager:

Thank you for the opportunity to comment on this DEIS/OEIS. We appreciate that the DEIS/OEIS acknowledges the need for the Navy to submit a consistency determination for these activities, and we look forward to reviewing it. Most of the comments in this letter are also intended as guidance to the Navy in preparing its consistency determination.

Mitigation Measures. Most fundamentally, we are disappointed that the DEIS/OEIS did not acknowledge or address the concerns raised through the Commission's review of, and conditional concurrence with, Navy consistency determination CD-086-06, primarily with respect to the use of mid-frequency sonar (Navy, U.S. Pacific Fleet's offshore and onshore military training exercises in southern California). We believe the DEIS/OEIS (and subsequent consistency determination) needs to:

(1) expand its alternatives analyses to, at a minimum, review each of the measures the Commission determined were necessary for Coastal Zone Management Act[1] (CZMA) compliance;

(2) determine the degree to which the Navy may already be in compliance with each measure; and

(3) if the Navy believes the measure cannot be feasibly complied with, explain why the Navy believes it cannot be complied with.

[1] 16 U.S.C. Section 1456, with implementing regulations at 15 CFR Part 930.

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This EIS/OEIS is independent of any previous environmental study or Consistency Determination, therefore any measures or compliance issues with previous studies are not relevant. Although we acknowledge earlier efforts and studies, and at times may reference them, this EIS/OEIS is a fresh, rigorous study of environmental effects that takes into consideration new methods of analysis and more recent scientific data.

The Navy has broadly defined its objectives and offers appropriate alternatives to achieve them. To implement its Congressional mandates, the Navy needs to support and to conduct current and emerging training and RDT&E training events in SOCAL and upgrade or modernize range complex capabilities to enhance and sustain Navy training and testing. These objectives are required to provide combat capable forces ready to deploy worldwide in accordance with U.S.C. Title 10, Section 5062. The Assistant Secretary of the Navy (Installations & Environment) determines both the level and mix of training to be conducted and the range capabilities enhancements to be made within SOCAL that best meet the needs of the Navy. The broad objectives set forth in this document are both reasonable and necessary

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This is particularly important given that many of the measures included such language as "to the degree feasible." The Commission's adopted conditions in CD-086-06 are attached (Attachment 1).

We also believe the DEIS/OEIS is remiss in not acknowledging subsequent District Court and Ninth Circuit Court decisions that, in part, stemmed from that review.[2] Given the current status of existing litigation filed against the Navy, we believe it is incumbent on the Navy to provide the same type of analysis requested above for the mitigation measures imposed by the District Court (and, as modified on appeal, by the Ninth Circuit Court), as follows:

District Court Measures:

(1) the Navy shall suspend use of MFA sonar when a marine mammal is detected within 2,200 yards from the sonar source, except where the marine mammal is a dolphin or a porpoise and it appears that the mammal is intentionally following the sonar-emitting naval vessel in order to play in or ride the vessel's bow wave;

(2) the Navy shall reduce the MFA sonar level by 6 dB when significant surface ducting conditions are detected;

(3) the Navy shall not use MFA sonar within 12 nautical miles from the California coastline;

(4) the Navy shall monitor, including by aircraft, for the presence of marine mammals for 60 minutes before employing MFA sonar, shall utilize two dedicated, NOAA- and NMFS-trained lookouts at all times when MFA sonar is being used, shall employ passive acoustic monitoring to supplement visual detection of the presence of marine mammals, and shall use aircraft participating in the training exercises to monitor for marine mammals for the duration of the exercises when MFA sonar is being used;

(5) Navy helicopters shall monitor for marine mammals for 10 minutes before employing active dipping sonar; and

(6) the Navy shall refrain from using MFA sonar in the Catalina Basin between the Santa Catalina and San Clemente Islands because ingress and egress to the basin are restricted and the basin has a high density of marine mammals.

Ninth Circuit Modifications:

(1) The first mitigation measure is modified to require the Navy to suspend its use of MFA sonar if a marine mammal is detected within 2,200 yards of the sonar source, except where a detected marine mammal is a dolphin or a porpoise and it is "bow-riding," and except when MFA sonar is being used at a "critical point in the exercise," in which case the

[2] Natural Resources Defense Council v. Winter, 518 F.3d 658 (9th Cir. 2008).

2 Mitigation measures used in this EIS/OEIS were developed in conjunction with the National Marine Fisheries Service (NMFS), the Federal regulatory authority for actions potentially affecting marine mammals in the SOCAL Range Complex. These measures are identical to those proposed in the Navy's Application for a Letter of Authorization from NMFS pursuant to the Marine Mammal Protection Act, and, to the extent they relate to species listed as threatened or endangered under the ESA, in the Navy's Biological Assessment submitted to NMFS pursuant to Section 7 of the ESA. These measures are based on the best available science, and are appropriate for purposes of this EIS/OEIS.

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Navy shall implement its previously agreed to measures (6 dB reduction at 1,000 meters, 10 dB reduction at 500 meters, and shut down at 200 meters). A "critical point in the exercise" is a point when, in the discretion of the Admiral overseeing the exercise or the commander of the sonar-emitting vessel, continued use of MFA sonar is critical to the certification of a strike group or the effective training of its personnel. For example, the responsible officer, in his discretion, might determine that a shutdown would fundamentally undermine effective training or certification because the particular exercise underway is at a stage that would be seriously compromised by a shutdown.

(2) The second mitigation measure is modified to require the Navy, when significant surface ducting conditions are detected, to reduce the MFA sonar level by 6 decibels where a marine mammal is detected within 2,000 meters of the sonar source, reduce the MFA sonar level by 10 decibels where a marine mammal is detected within 1,000 meters of the sonar source, and suspend its use of MFA sonar where a marine mammal is detected within 500 meters of the sonar source.

Time Period. The DEIS/OEIS does not indicate the time period for which the document is intended to apply to the Navy's activities. We believe any consistency determination submitted to the Commission should be for a limited time period (we note the previous consistency determination was for a two year period), as circumstances and Navy training needs are likely to change over time.

3

The EIS/OEIS is programmatic and designed to cover current and future foreseeable training. The Navy will continue to evaluate its training needs in SOCAL and monitor the status of environmental resources in SOCAL and develop supplemental or additional NEPA documentation as appropriate.

Recent Blue Whale Deaths. We request that the Navy provide information about the three blue whale deaths that occurred in southern California in September 2007. What is the most current information about the cause of these deaths? What is the status of necropsies being performed? To what degree did these deaths occur coincident with Navy training exercises (both temporally and spatially)?

*(Response in reference to paragraph starting: **Recent Blue Whale Deaths**.)* The Navy does not conduct necropsies of marine mammals. The blue whale necropsies were conducted by the Santa Barbara Museum of Natural History. Information on some of the necropsies can be found at a Santa Barbara Museum of Natural History web site: http://www.sbnature2.org/collections/bluewhale/bluewhale07_2.php#3whales

In September 2007, at least three blue whale strandings occurred off the Southern California Coast from Long Beach Harbor to Ventura County. On September 8, 2007 at Long Beach Harbor; September 14, 2007 in Ventura County, Hobson County Beach; and on September 21, 2007 in Ventura County.

It is suspected that the blue whale carcass in Long Beach Harbor was dragged into port on the bow of a commercial ship. While the USS Tarawa Expeditionary Strike Group was undergoing training in waters south of San Clemente Island, the blue whale ship strikes occurred at least 80-120 nm north of any Navy exercises and likely happened in association with the vessel traffic lanes to the north of the northern Channel Islands. Ship strikes to large baleen whales, while unfortunate, are acknowledged by the NMFS as a source of anthropogenic mortality. In recent Biological Opinions for other Navy NEPA documents, the NMFS also acknowledges that blue and fin whales, as very low frequency hearing specialists, are unlikely to either hear or be sensitive to mid-frequency sonars. The Navy does not use low-frequency sonar within SOCAL.

4

SOAR Range Expansion. The Navy is proposing to expand the SOAR range to the east and west of the existing SOAR range, on the west side of San Clemente Island. The westernmost of these two expansion areas contains an area of high biological productivity and seasonal high concentrations of, among other mammals, blue and fin whales (as shown in Appendix F, Figures 2-5 to 2-20). We request that the Navy provide a detailed explanation as to why it needs to expand into this area, an explanation of the biological implications of expanding the SOAR into this area, an explanation of seasonal limitations that will be employed to avoid impacts during the may-October season of high concentrations, and an alternatives analysis of expanding the range into other, less biologically sensitive areas adjacent to the existing SOAR.

West Cove LCAC/Battalion Landings. The Navy plans large battalion amphibious landings (with LCACs) on San Clemente Island, including at West Cove, which has historically been the site of (albeit sporadic) snowy plover nesting, as well as wintering plovers. The Navy's proposed mitigation is to monitor for nesting, and limit use corridors to defined areas to minimize impacts to plovers. We believe this mitigation is inadequate. If plovers are found to be nesting at West Cove, this beach should not be used, as it is clear

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5 As explained in Section 2.5.2.3 of the DEIS, the Navy has developed criteria for siting of a SWTR, and examined alternative siting options in light of those criteria. The Navy has adequately assessed alternatives to the proposed location, in full compliance with applicable law.

6 Each of the beaches on San Clemente Island, including West Cove, are components of a complex network of interdependent training areas. Each beach provides a unique attribute that contributes to Navy and Marine Corps training requirements, allows commanders flexibility to make tactically sound decisions, and promotes realistic training.

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other beaches at San Clemente Island which do not have plover nesting would be available. If the Navy believes it cannot provide comparable training at other beaches, it needs to explain why.

Areas of High Concentrations of Marine Mammals. In its consistency determination, we request that the Navy pay particular attention to the provision of Section 30230 of the Coastal Act which requires that: "Special protection shall be given to areas and species of special biological or economic significance." We note that marine mammal densities and, consequently, predictions of numbers of mammals (and other species) affected, are based on averaging overall marine mammal densities throughout the entire project area. Inherent in this averaging is the understanding that the estimates do not take into consideration specific concentrations of mammals in any particular area and time of year. We further note the comment on page 3.9-62 that the numbers of animals actually detected during 2007 exercises was significantly lower than predicted in the Navy's EA for these exercises (and, as well, that the predictions are made before taking into account Navy-agreed-to mitigation measures). We are also aware that marine mammal protection and Navy training effectiveness are both enhanced when the Navy consciously avoids areas of high marine mammal concentrations.

To date, the Navy has not been willing to agree to avoid areas of high marine mammal concentrations, for a number of reasons, although the Navy has indicated to us that in planning its activities, Navy commanders are provided information that *may be used* to time or locate activities. For the 2007/2008 exercises, we would like to know if any of the planned activities were modified due to known concentrations of marine mammals. We also request that the Navy specifically explain why it cannot successfully conduct its training (using mid-frequency sonar) outside the time period and area from May-October, in and near the Tanner and Cortez Banks, given the high density of marine mammal sightings (particularly blue and fin whales) in this area (as shown in Appendix F, Figures 2-5 to 2-20). We request the same information for the well-established gray whale migration paths and seasons. 7

Finally, since this would appear to be a long-range plan, we would appreciate clarification as to how future improved Navy awareness of locations and timing of areas of high concentrations of marine mammals will be incorporated into subsequent years exercise planning and mitigation/minimization measures. Specifically, we request information on whether and how, if implemented, additional underwater instrument ranges in the Tanner/Cortez banks, as well as on the east side of the SOAR, can be used to provide or enhance passive acoustic monitoring, marine mammal monitoring, and development of additional avoidance, minimization, and/or mitigation measures.

Channel Islands National Marine Sanctuary (CINMS). On Figure 3.9-1, and again, Fig 4-1, p. F-207, Operating Area 1 would appear to include portions of the CINMS (around Santa Barbara Island). Page F-208 states: "the acoustic sonars described in subsection 4.2 are, for the most part, deployed throughout all eight areas." We would like to know what existing activities occur within the sanctuary, what expansion of activities, if any, would occur in the sanctuary, and what the status is of Navy consultation for these with the CINMS.

(In response to paragraph starting: To date, the Navy has not…) Marine mammals are patchily distributed within the ocean, including SOCAL. Variability in animal presence within relatively small ocean sub-areas, such as Tanner or Cortes Banks, is often strongly correlated with daily, weekly, seasonal and even decadal changes in prey availability with prey availability being driven by changes in both local and basin-wide oceanographic conditions. Any specific area of high animal density at a given time may have low animal density the following day, week, or year depending on the biotic and abiotic factors affecting the prey distribution.

Blue whales, for example, "integrate food resources (i.e. search for food) over a large area due to the dietary needs of such a large animal" (D. Crull, UCSC, personal communication 2007). Results for satellite tagging data from blue whales shown on the Tagging of Pacific Predators website (www.topp.org) demonstrate this pronounced variability of distribution while these animals forage within SOCAL on their way to summer feeding grounds in the Pacific Northwest and Gulf of Alaska. Some animals may congregate at local foraging hotspots, but the locations of these hotspots change with time. With satellite tagging, blue whales can be shown to move tens to hundreds of miles over just a few days or weeks.

Operationally, there is some variability in where Navy major exercises may occur within the SOCAL Range Complex. Location is determined by individual strike group needs. Furthermore, since exercises are relatively short in duration (hours to days) and separated in time, no ocean area within SOCAL is subject to continuous sonar use.

Finally, it must be acknowledged that ASW activities have been conducted without incident for decades in SOCAL. In fact, many populations of non-ESA and ESA species alike have been increasing in SOCAL over the last several decades. Given the natural variation of marine mammal location over time within SOCAL, operational variability of Navy ASW operations, and the fact that there is little scientific information demonstrating broad-scale impacts that are either injurious or of significant biological impact to marine mammals, there is little relative risk to marine mammal populations from ASW training exercises.

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(In response to paragraph starting: Finally, since this would appear…) The sample sizes available from systematic survey data are too small to estimate seasonal marine mammal densities for stratified geographic regions such as the Cortes and Tanner Banks; any estimates would have extremely high associated uncertainty. The high number of sightings in these areas is indicative of the greater presence of human activity in these areas, not necessarily of a higher density of marine mammals.

8

Underwater ranges can passively monitor both vessels and marine mammals. Evidence from the Navy instrumented range in Hawaii shows frequent use by cetaceans despite regular use by Navy vessels.

The Navy's mitigation measures are designed to be effective in areas of unknown marine mammal densities.

9 Proposed activities are consistent with those activities currently conducted in the CINMS, are consistent with those described in the designation document, and are not being changed or modified in a way that would require consultation.

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Information Requested in CCC Scoping Letter. The DEIS/OEIS has responded to several information requests contained in our February 1, 2007, scoping letter. However, several of our requests were not responded to (or not fully responded to). We therefore again request:

1. For permanently placed underwater equipment (such as instrument ranges), an analysis of the Navy's long terms plans for removal of the equipment in the event it is no longer needed or functioning;
2. A list of the number of mid-frequency sonars that would exceed a received level, at 1000 yds., of 154 decibels (dB) (re: 1 $\mu Pa^2 \cdot s$), a description of the distance or area that would need to be protected if the Navy were to adopt a 154 decibel safety zone, and a discussion of the feasibility of protecting marine mammals within such a safety zone;
3. Similar information to that requested in the previous item for a safety zone of 173 dB;
4. A discussion of baseline monitoring that will be implemented to determine whether high concentrations of marine mammals are in fact occurring in an area scheduled for an event;
5. A depiction of the maximum noise levels from mid-frequency sonar at 1000 yds., 500 yds., and 200 yds. (the areas cited in the MMPA exemption as warranting possible actions to reduce sound levels if marine mammals are present), including a summary of the modeling programs used to estimate these sound levels, as well as any field verification the Navy has conducted to verify modeled predictions;
6. A discussion of any Navy practices wherein the Navy would relay any distress signals it receives, as well as to cease (or lower) transmissions if it is likely that Navy sonar has caused a situation resulting in a distress signal (or if it is not clear, to cease or lower transmissions until the Navy determines the cause for the distress signal).

Thank you for this opportunity to comment on this important Navy EIS/OEIS. If you have any questions about these information requests, or about preparation of the Navy's upcoming consistency determination, please feel free to contact me at (415) 904-5289.

Sincerely,

Mark Delaplaine

MARK DELAPLAINE
Manager, Energy, Ocean Resources
and Federal Consistency Division

Attachment – CCC conditions, CD-086-06

10 If in the future the Navy no longer has a requirement for or no longer uses underwater equipment for training, then the Navy will comply with applicable federal environmental planning and regulatory requirements pertaining to the disposition of these facilities.

11 The sources are not modeled at energy flux level but as SPL below 195 dB. At 150-160 dB SPL the distance is 6.7 - 19 km (See Table 3.9-4 in the Final EIS/OEIS). As can be seen from Table 3.9-4, a 154 dB safety zone would not be practical as it could extend well beyond the visible horizon. Mitigation measures, such as shutdown or power down zones, have been developed in coordination with NMFS (see Section 3.9.10.2.1 of the Final EIS/OEIS).

12 The Navy, in cooperation with NMFS, is developing a monitoring plan that would investigate the effects on marine mammals from Navy sonar activities. This plan will include pre- and post-exercise monitoring of marine mammal distribution and abundance in the exercise area as well as the effectiveness of Navy mitigation measures. See Section 3.9.10.3.1 of the Final EIS/OEIS.

13 Table 3.9-6 and 3.9-7 in the Final EIS/OEIS provides the MFAS sound level at various distances from the sound source.

14 The Navy, in coordination with NMFS, has developed a Stranding Response Plan for the SOCAL Range Complex. Within this plan, procedures are in place for the Navy to contact NMFS in the event Navy personnel are first to detect a marine mammal stranding or mortality event. Response Plan procedures also provide guidance for sonar shutdown and restart procedures, as well as information collection and investigation.

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cc: San Diego Area Office (Deborah Lee)
CINMS (Sean Hastings)

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Attachment 1
Commission Conditions – CD-086-06

Conditions:

1. Safety Zones. The Navy shall adopt safety zones (i.e., marine mammal preclusion zones) out to the distance at which the sonar has attenuated to 154 dB (received level (RL), expressed in decibels (re 1 μPa^2 · s)). The Navy will monitor the area and lower sonar levels (or delay transmissions until an animal has left the safety zone) such that marine mammals and sea turtles will not be exposed to received levels greater than 154 dB. If the 154 dB level cannot be feasibly achieved, the Navy shall either cease sonar transmissions should a marine mammal be detected within 2 km of the sonar dome, as the Navy has currently agreed to for its SURTASS LFA sonar operations, or the Navy shall provide the Commission with sufficient information about the sonar intensities and attenuation rates, and the maximum capabilities of its monitoring, to enable the Commission to determine that the Navy will protect a safety zone as close as is possible to the 154 dB zone. The Navy shall provide this information to the Commission staff for review and approval by the Executive Director prior to the first exercise involving mid-frequency sonar.

2. Surveillance. Surveillance shall include two dedicated NOAA-trained marine mammal observers at all times during use of mid-frequency sonar.

3. Training. The Navy shall employ the RIMPAC-derived measures, which state:

NMFS-Approved Training
• Navy shipboard lookouts shall be qualified watchstanders who have completed marine species awareness training.
- Navy watchstanders will participate in marine mammal observer training approved by NMFS.

4. Passive Acoustic Monitoring. Passive acoustic monitoring will be used to enforce safety zones. All personnel engaged in passive acoustic sonar operations during an exercise employing mid-frequency sonar shall monitor for marine mammals and report the detection of any marine mammal to the appropriate watch station for dissemination and appropriate action.

5. Aerial Monitoring. The Navy shall ensure that aircraft operating in the Navy's instrumented range off San Clemente will monitor the area for marine mammals during their assigned missions and will monitor the area throughout any mid-frequency sonar exercises on the instrumented range. All other aircraft flying low enough to reasonably spot a marine mammal will watch for marine mammals. The Navy shall require that all aerial sightings of marine mammals be reported to the appropriate watch stations for appropriate action. Appropriate action means taking mitigation measures and disseminating the information to other units and watchstanders for increased situational awareness.

15 *(With regard to Attachment 1):* Please see response to CCC-1.

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6. Gray Whale Migration Season. To the maximum extent feasible, the Navy shall locate and schedule training outside the gray whale migration season, where the sonar is near enough to known or observed gray whale migration paths to expose gray whales to sonar levels above 154 dB. If conducting exercises during the migration season the Navy shall avoid known gray whale migration corridors.

7. Areas of High Marine Mammal Populations. To the maximum extent feasible, the Navy shall avoid training in areas with known high concentrations of marine mammals, including but not limited to:

avoiding active sonar transmissions within the National Marine Sanctuaries off California's coast (e.g., the Channel Islands NMS); and

avoiding seamounts and coastal areas with complex, steep seabed topography, except on the Navy's instrumented range off San Clemente Island.

8. Night and low visibility conditions. The Navy shall employ the RIMPAC-derived measures, which state[3]:

> **Low visibility conditions (i.e., whenever the entire safety zone cannot be effectively monitored due to nighttime, high sea state, fog or other factors) –** The Navy will use additional detection measures, such as infrared (IR) or enhanced passive acoustic detection. Except in extraordinary circumstances, the Navy will power down sonar by 6 dB as if marine mammals were present in the zones it cannot see.

9. Stranding Response and Reporting. The Navy shall employ the RIMPAC-derived measures, which state:

• The Navy will coordinate with the NMFS Stranding Coordinator for any unusual marine mammal behavior, including stranding, beached live or dead cetacean(s), floating marine mammals, or out-of-habitat/milling live cetaceans that may occur at any time during or shortly after major exercises.

• The Navy will provide a report to NMFS after the completion of a major exercise that
includes:

[3] In fact, the U.S. Marine Mammal Commission has specifically recommended that, "given the limitations of night vision devices (based on [NMFS'] assessment in its previous Federal Register notices) and passive acoustic monitoring," the Navy observe a mandatory power-down in low-visibility conditions, assuming it cannot simply avoid them (MMC 2006). (Comments from Tim Ragen, Acting Executive Director, Marine Mammal Commission, to P. Michael Payne, Chief of the Permits Division, NMFS, on the Navy's 2006 Rim of the Pacific (RIMPAC) Exercise.)

15 *(With regard to Attachment 1):* Please see response to CCC-1.

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- An assessment of the effectiveness of these mitigation and monitoring measures with recommendations of how to improve them.

- Results of the marine species monitoring during the major exercise. As much unclassified information as the Navy can provide including, but not limited to, where and when sonar was used (including sources not considered in take estimates, such as submarine and aircraft sonars) in relation to any measured received levels, source levels, numbers of sources, and frequencies, so it can be coordinated with observed cetacean behaviors. If necessary, classified information may be provided to NMFS personnel with an appropriate security clearance and need to know.

10. Surface Ducting Conditions. During significant surface ducting conditions, as defined by NMFS (2006), the Navy shall power down the sonar source by 6 dB. The Navy shall assess whether surface ducting conditions are present at least once hourly during periods as specified by NMFS (and as discussed on page 3 of the NMFS IHA for RIMPAC (Exhibit 13)).

11. Choke-point exercises. - Prior to approving a proposed choke-point exercise, Navy commands shall consult with OPNAV N45.

- The Navy will provide NMFS (Stranding Coordinator and Protected Resources, Headquarters) with information regarding the time and place for the choke-point exercises in advance of any proposed choke-point exercise.

- The Navy and NMFS will mutually agree upon whether non-Navy observers are required.

- The Navy will coordinate a focused monitoring effort around the choke-point exercises, to include pre-exercise monitoring (2 hours), during-exercise monitoring, and post-exercise monitoring (1-2 days). This monitoring effort will include at least one dedicated aircraft or one dedicated vessel for realtime monitoring from the pre- through post-monitoring time period, except at night, with the vessel or airplane maintaining regular communication with a Tactical Officer with the authority to shutdown, power-down, or delay the start-up of sonar operations. These monitors will communicate with the Navy command to ensure the safety zones are clear prior to sonar start-up, to recommend power-down and shut-down during the exercise, and to extensively search for potentially injured or stranding animals in the area and downcurrent of the area post-exercise.

12. Mine Shape Retrieval. To the maximum extent feasible, the Navy shall retrieve inert mine shapes dropped.

13. Monitoring Reports. In addition to the above, as agreed to previously, all monitoring results provided to NMFS (unless classified) shall be submitted to the Commission staff.

15 *(With regard to Attachment 1):* Please see response to CCC-1.

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14. Baseline Monitoring. The Navy shall perform pre-exercise monitoring commencing 30 minutes prior to commencement of mid-frequency sonar use.

15 *(With regard to Attachment 1):* Please see response to CCC-1.

10.2.1.2 Natural Resources Defense Council (NRDC)

NRDC
THE EARTH'S BEST DEFENSE

NATURAL RESOURCES DEFENSE COUNCIL

By Regular Mail

May 14, 2008

Naval Facilities Engineering Command, Southwest
Attention: SOCAL EIS Project Manager (Code REVPO)
1220 Pacific Highway
Building 127
San Diego, CA 92132-5190

Re: Draft Environmental Impact Statement/ Overseas Environmental Impact Statement for the Southern California Range Complex

Dear Sir or Madam:

On behalf of the Natural Resources Defense Council ("NRDC'), The Humane Society of the United States, the International Fund for Animal Welfare, Whale and Dolphin Conservation Society, Cetacean Society International, League for Coastal Protection, the International Ocean Noise Coalition, Ocean Mammal Institute, Seaflow, and Ocean Futures Society and its founder Jean-Michel Cousteau, and on behalf of our millions of members, many thousands of whom reside in California, we are writing to submit comments on the Navy's Draft Environmental Impact Statement/ Overseas Environmental Impact Statement for the Southern California Range Complex ("DEIS"). See 73 Fed. Reg. 18522 (Apr. 4, 2008).[1]

It is important to recognize, at the outset, the context in which this review is being undertaken. The Navy's release of this DEIS comes in the wake of several federal court decisions that have found numerous, critical violations of law in its environmental assessments of active sonar training. See NRDC v. Winter, 527 F.Supp.2d 1216 (C.D. Cal. 2008), aff'd 518 F.3d 658 (9th Cir. 2008); Ocean Mammal Institute v. Gates, __ F.Supp.2d __, 2008 WL 564664 (D. Hawaii 2008). These violations extend well beyond the Navy's illegal adoption of a Finding of No Significant Impact and its failure to prepare an EIS, but implicate its impact assessment, its alternatives analysis, and its

[1] NRDC is aware that comments may be submitted separately by government agencies, individual scientists, environmental organizations, and the public. All of these comments are hereby incorporated by reference, as are public comments submitted on draft NEPA comments for other Navy ranges and operating areas, including the East Coast Undersea Warfare Training Range, the Hawaii Range Complex, and Atlantic Fleet Active Sonar Training activities. The comments that follow do not constitute a waiver of any factual or legal issue raised by any of these organizations or individuals and not specifically discussed herein.

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consideration of ways to mitigate the harmful effects of its exercises. And yet we have not seen any indication, in the Draft EISs already issued for other ranges or in the present document, that the Navy has yet corrected its deeply flawed approach to environmental review. To the contrary, it seems to have fallen back on a hard-line position that is more reflective of certain political dynamics within the Fleets and in Washington than with any operational, legal, or environmental reality.

It is undisputed that sound is a fundamental element of the marine environment. Whales, fish, and other wildlife depend on it for breeding, feeding, navigating, and avoiding predators—in short, for their survival. Many of the exercises proposed for the southern California range would employ the same hull-mounted sonar systems that have been implicated in mass injuries and mortalities of whales around the globe. The same technology is also known to affect marine mammals in countless other ways, such as by inducing panic responses, displacing animals from habitat, and disrupting crucial behavior such as foraging. Impacts on California's coastal environment would be significant. The Navy's "preferred alternative" would more than double the amount of sonar use from surface ships, more than double the number of active sonobuoys deployed on the range, and would increase the use of aerial dipping sonar by a factor of ten over what was annually estimated for SOCAL major exercises in the Navy's prior environmental assessment. That lower level of sonar use has already been determined by a federal court to cause widespread harm and disrupt marine mammals off California at a population level. NRDC v. Winter, 2007 WL 2481037 at *10 (C.D. Cal. 2007), aff'd 518 F.3d 658, 696-97 (9th Cir. 2008).

The vast area encompassed by the SOCAL Range Complex contains some of the richest marine habitat in the world. Under these circumstances, the Navy's exercises must be undertaken with particular care, dictated not by assertions of convenience or of history, but by one fundamental recognition: that protection of the marine environment and safeguarding of our national defense are mutually dependent national interests that can and must be achieved through compliance with our federal environmental laws.

1 To that end, Congress has dictated through NEPA that, in planning exercises, the Navy must employ rigorous standards of environmental review, including a fair and objective description of potential impacts of the range, a comprehensive analysis of all reasonable alternatives, and a thorough delineation of measures to mitigate harm. The DEIS released by the Navy falls far short of these standards. To cite just a few examples:

- The Navy assumes that no marine mammals would be seriously injured or killed at sea, despite a growing, peer-reviewed, scientific record of injuries and mortalities and several court decisions that have rejected the Navy's claims.[2] It takes this position even though the California coast has been identified by experts as one of

[2] See sections II(A)(1)(a) and (A)(2) below.

1 The Draft EIS/OEIS included an analysis of potential impacts of the SOCAL Range Complex (Chapter 3.0) as well as a comprehensive analysis of reasonable alternatives. Chapter 2.0 provided a description of alternatives considered and Chapter 3.0 provided an impact analysis by resource area for each of the alternatives carried forward. Cumulative impacts were addressed in detail in Chapter 4.0 of the Draft EIS/OEIS as well as in the resource sections (Chapter 3) with regard to existing activities and impacts. Also, please see responses to specific comments below.

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the world's "key areas" for beaked whales, a family of species whose dangerous sensitivity to mid-frequency sonar is well known.[3]

- It has manipulated data and thrown out nearly the entire literature on behavioral impacts on marine mammals, in support of an abstract model that contradicts the actual evidence of harm.[4]

- It presumes, entirely without analysis, that all of its impacts are short-term in nature and that none will have cumulative effects, even though the same populations and much of the same habitat would repeatedly be affected, year after year.[5]

- It claims, against generations of field experience, that marine mammals—even cryptic, deep-diving marine mammals like beaked whales—can effectively be spotted from fast-moving ships and avoided.

- It adopts precisely the same mitigation that a federal court has found to be "woefully inadequate and ineffectual" (NRDC v. Winter, 2007 WL 2481037 at *8-9 (C.D. Cal. 2007), aff'd 508 F.3d 885 (9th Cir. 2007)), and fails to prescribe measures that have been used repeatedly by the Navy in the past, used by other navies, or required by the courts.

- It summarily declines to put even a single square mile of habitat within its 120,000 nm^2 range off limits to sonar training and, indeed, has refused even to evaluate possible geographic alternatives. It takes this position in spite of several contrary court decisions, the determinations of the California Coastal Commission, past Navy practice, and agreement within the scientific community that the avoidance of vulnerable habitat represents one of the most effective means of reducing impacts from mid-frequency sonar.

- It commits itself—without any analysis of alternatives—to build an instrumented range on Cortes and Tanner Banks: an extremely productive offshore area that hosts a globally important population of endangered blue whales, has the highest recorded densities of endangered fin whales and other species in the region, and supports some of the highest catch rates of commercial fisheries in southern California.

- It insists that its proposed activities are consistent to the "maximum extent practicable" with the California Coastal Act and coastal zone management plan (DEIS at 6-5)—notwithstanding previous findings to the contrary by the California Coastal Commission and an adverse ruling before a federal court on precisely this

[3] C.D. MacLeod and G. Mitchell, Key Areas for Beaked Whales Worldwide, 7 J. Cetacean Res. Manage. 309-22 (2006).

[4] See section II(A)(3) below.

[5] See section II(D) below.

1 (Refer to response above)

2 *(In response to bullet stating: It claims, against….)* Because continuous visual monitoring by U.S. Navy ships is critical to ship safety and operational effectiveness, training and execution in spotting techniques is, and long has been, integral to ship handling and operation. The Navy is better positioned, trained, and equipped to spot marine mammals and other sea life than most marine vessels. While visual detection of marine mammals is not 100 percent effective, Navy lookouts and bridge personnel (5 in total on surface ships) are highly qualified and experienced marine observers. Compared to commercial vessels, Navy ships' bridges are positioned forward to allow more optimal scanning of the ocean area from the bridge and bow area. Navy lookouts undergo extensive training to include on-the job instruction under supervision of an experienced lookout followed by completion of Personnel Qualification Standard Program. Navy lookouts use both hand held and "Big Eye" (20X110) binoculars. Aerial platforms also undertake visual monitoring prior to commencement of ASW operations. In addition to visual monitoring, passive acoustic systems are used by all platforms to monitor for marine mammal vocalizations, which are then reported to the appropriate watch station for dissemination to observers. Navy ships also monitor their surroundings using all appropriate sensors at night and with night vision goggles as appropriate for activities conducted at night. The Navy believes visual spotting provides effective avoidance of marine mammals, and is effective as mitigation, in conjunction with other proposed mitigation measures.

3 *(In response to bullet stating: It adopts precisely….)* The Navy has consistently adopted mitigation measures that are effective at reducing risk without detrimental effects on training. The Navy has historically declined mitigation measures that are not effective at reducing risk to marine species, yet cause an undue burden on training. Alternative mitigation measures considered but eliminated, and the reasons for their elimination from further consideration was provided in Section 5.8.5 of the Draft EIS/OEIS

4 *(In response to bullet stating: It summarily declines….)* See response to CCC-7.

5 *(In response to bullet stating: It commits itself – without any….)* Please see response to CCC-5.

6 *(In response to bullet stating: It insists that its proposed)* The Navy recently has presented its Federal Consistency Determination to the Coastal Commission, superseding the Consistency Determination at issue in the referenced litigation. The Navy believes, and continues to contend before the Coastal Commission, that its activities as described in the DEIS are consistent to the "maximum extent practicable" with the CZMP.

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issue. NRDC v. Winter, 2007 WL 2481037 at *8-9 (C.D. Cal. 2007), aff'd 508 F.3d 885 (9th Cir. 2007).

All of this clearly suggests the sort of post hoc decision-making that NEPA was intended by Congress to avoid.

In short, the DEIS is fatally flawed by its inconsistency with the weight of scientific evidence and with the standards of environmental review embodied in NEPA. As a matter of science, it lacks objectivity; as a matter of law, it is insupportable, and the hard-line position that it represents has repeatedly been rejected by the courts, state management agencies, and the published science. We urge the Navy to revise its analysis consistent with federal law and to produce a mitigation plan that truly maximizes environmental protection given the Navy's actual operational needs. We also urge the Navy to make available to the public the data and modeling on which its analysis is based, as described below.

I. IMPACTS OF HIGH-INTENSITY SONAR

Scientists agree, and the publicly available scientific literature confirms, that the intense sound generated by military active sonar can induce a range of adverse effects in whales and other species, from significant behavioral changes to stranding and death. By far the most widely-reported and dramatic of these effects are the mass strandings of beaked whales and other marine mammals that have been associated with military sonar use. Associated strandings have occurred in Greece, during the trial of a NATO sonar system; on the islands of Madeira and Porto Santo, during a NATO event involving subs and surface ships; in the U.S. Virgin Islands, during a training exercise for Navy battle groups; in the Bahamas, the Canaries, Hawaii, Spain, Alaska, and other spots around the world.[6] On several occasions, bodies have been recovered in time to give evidence of acoustic trauma. In a 2004 symposium at the International Whaling Commission, more than 100 whale biologists concluded that the association between sonar and beaked whale deaths "is very convincing and appears overwhelming."[7] In the United States, an expert report commissioned by the Navy said much the same thing.[8]

Mass mortalities, though an obvious focus of much reporting and concern, are likely only the tip of the iceberg of sonar's harmful effects. Marine mammals are believed to depend on sound to navigate, find food, locate mates, avoid predators, and communicate with each other. Flooding their habitat with man-made, high-intensity noise interferes with these and other functions. In addition to strandings and non-auditory injuries, the harmful effects of high-intensity sonar include:

[6] A summary of the strandings record appears below at section II(A)(2) ("Strandings and Mortalities Associated with Mid-Frequency Sonar").

[7] International Whaling Commission, 2004 Report of the Scientific Committee, Annex K at § 6.4 (2004).

[8] H. Levine, Active Sonar Waveform 1 (2004) (JASON Group Rep. JSR-03-200) (describing evidence of sonar causation as "completely convincing"). The strandings record is further described infra at section II(A)(2).

7 Please refer to the introductory paragraph of this Public Comments section. Responses to specific comments are provided below.

8 *(In response to sentence starting: We urge the Navy to revise its...)* The SOCAL EIS/OEIS complies with all applicable environmental laws, including NEPA and its requirements.

Please see response to NRDC-3

9 *(In response to sentence starting: We also urge the Navy to make…)* The model has been evolving in response to new data and will be subject to independent peer review for conferences or journal submissions. The EIS/OEIS provides all source levels, frequency ranges, duty cycles, and other technical parameters relevant to determining potential impact on marine life unless this information was classified. Based on the information provided in the EIS/OEIS, others with the required technical expertise can use the existing information to calculate similar results. The CASS/GRAB program is export controlled and not available for public release, however, approximate results can be obtained using other mathematical models commonly available to those with the technical expertise to utilize those tools.

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- temporary or permanent loss of hearing, which impairs an animal's ability to communicate, avoid predators, and detect and capture prey;
- avoidance behavior, which can lead to abandonment of habitat or migratory pathways;
- disruption of biologically important behaviors such as mating, feeding, nursing, or migration, or loss of efficiency in conducting those behaviors;
- aggressive (or agonistic) behavior, which can result in injury;
- masking of biologically meaningful sounds, such as the call of predators or potential mates;
- chronic stress, which can compromise viability, suppress the immune system, and lower the rate of reproduction;
- habituation, causing animals to remain near damaging levels of sound, or sensitization, exacerbating other behavioral effects; and
- declines in the availability and viability of prey species, such as fish and shrimp.

Over the past 20 years, a substantial literature has emerged documenting the range of effects of ocean noise on marine mammals.[9]

Marine mammals are not the only species affected by undersea noise. Impacts on fish are of increasing concern due to several recent studies demonstrating hearing loss and widespread behavioral disruption in commercial species of fish and to reports, both experimental and anecdotal, of catch rates plummeting in the vicinity of noise sources.[10] Sea turtles, most of which are considered threatened or endangered under federal law, have been shown to engage in escape behavior and to experience heightened stress in response to noise. And noise has been shown in several cases to kill, disable, or disrupt the behavior of invertebrates, many of which possess ear-like structures or other sensory mechanisms that could leave them vulnerable. It is clear that intense sources of noise are capable of affecting a wide class of ocean life.

II. THE NAVY'S COMPLIANCE WITH THE NATIONAL ENVIRONMENTAL POLICY ACT

Enacted by Congress in 1969, NEPA establishes a national policy to "encourage productive and enjoyable harmony between man and his environment" and "promote efforts which will prevent or eliminate damage to the environment and biosphere and

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[9] For a review of research on behavioral and auditory impacts of undersea noise, see, e.g., L.S. Weilgart, The Impacts of Anthropogenic Ocean Noise on Cetaceans and Implications for Management, 85 Canadian Journal of Zoology 1091-1116 (2007); W.J. Richardson, C.R. Greene, Jr., C.I. Malme, and D.H. Thomson, Marine Mammals and Noise (1995); National Research Council, Ocean Noise and Marine Mammals (2003); Whale and Dolphin Conservation Society, Oceans of Noise (2004).

[10] See the discussion below, at section II(C) of "Impacts on Fish and Fisheries."

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stimulate the health and welfare of man." 42 U.S.C. § 4321. In order to achieve its broad goals, NEPA mandates that "to the fullest extent possible" the "policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with [NEPA]." 42 U.S.C. § 4332. As the Supreme Court explained,

> NEPA's instruction that all federal agencies comply with the impact statement requirement—and with all the requirements of § 102—"to the fullest extent possible" [cit. omit.] is neither accidental nor hyperbolic. Rather the phrase is a deliberate command that the duty NEPA imposes upon the agencies to consider environmental factors not be shunted aside in the bureaucratic shuffle. Flint Ridge Development Co. v. Scenic Rivers Ass'n, 426 U.S. 776, 787 (1976).

Central to NEPA is its requirement that, before any federal action that "may significantly degrade some human environmental factor" can be undertaken, agencies must prepare an environmental impact statement. Steamboaters v. F.E.R.C., 759 F.2d 1382, 1392 (9th Cir. 1985) (emphasis in original). The fundamental purpose of an EIS is to force the decision-maker to take a "hard look" at a particular action—at the agency's need for it, at the environmental consequences it will have, and at more environmentally benign alternatives that may substitute for it—before the decision to proceed is made. 40 C.F.R. §§ 1500.1(b), 1502.1; Baltimore Gas & Electric v. NRDC, 462 U.S. 87, 97 (1983). The law is clear that the EIS must be a pre-decisional, objective, rigorous, and neutral document, not a work of advocacy to justify an outcome that has been foreordained.

10 In nearly every respect, the Navy's DEIS fails to meet the high standards of rigor and objectivity established under NEPA.

A. Impacts on Marine Mammals

Fundamental to satisfying NEPA's requirement of fair and objective review, agencies must ensure the "professional integrity, including scientific integrity," of the discussions and analyses that appear in environmental impact statements. 40 C.F.R. § 1502.24. To this end, they must make every attempt to obtain and disclose data necessary to their analysis. The simple assertion that "no information exists" will not suffice; unless the costs of obtaining the information are exorbitant, NEPA requires that it be obtained. See 40 C.F.R. § 1502.22(a). Agencies are further required to identify their methodologies, indicate when necessary information is incomplete or unavailable, acknowledge scientific disagreement and data gaps, and evaluate indeterminate adverse impacts based upon approaches or methods "generally accepted in the scientific community." 40 C.F.R. §§ 1502.22(2), (4), 1502.24. Such requirements become acutely important in cases where, as here, so much about a program's impacts depend on newly emerging science.

11 In this case, the Navy's assessment of impacts on marine mammals is consistently undermined by its failure to meet these fundamental responsibilities of scientific integrity, methodology, investigation, and disclosure. As with the Navy's 2007

10 *(In response to sentence starting: In nearly every . . .)* The Navy contends otherwise. The Navy's statement of the purpose and need for the proposed action is detailed and specific, the scope of the proposed action is described in exhaustive detail after careful assessment of training and RDT&E requirements, and the development of alternatives has been conducted according to the highest standards and requirements of NEPA. The EIS/OEIS is the product of extensive analysis applying best available science, including methodologies for analyzing impacts of MFA sonar on marine mammals that were developed in close consultation with NMFS. The Navy has developed, refined, and adopted mitigation measures to address environmental impacts in every affected resource area, and has identified any unavoidable impacts of the proposed action. The Navy has further conducted an appropriate analysis of cumulative effects of its proposed action. The EIS / OEIS inarguably takes a "hard look" at potential environmental consequences of the proposed action and alternatives, and provides sufficient information for careful agency decision-making.

11 The Navy disagrees and notes that, for example, Section 2.4.2 of Appendix F in the Draft EIS/OEIS included relevant information even though it may be seen as being adverse to the Navy's interests. This includes discussions of all strandings alleged to have been associated with the use of sonar

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environmental assessment for major SOCAL exercises, the DEIS excludes a great deal of relevant information adverse to the Navy's interests, uses approaches and methods that would not be acceptable to the scientific community, and ignores whole categories of impacts. In short, it leaves the public with an analysis of environmental harm—behavioral, auditory, and physiological—that is at odds with established scientific authority and practice.

The Navy's assessment is also out of line with its past analysis for major exercises on the SOCAL range. Although the sonar hours from surface ships alone would more than double—increasing by 213%—under the Navy's preferred alternative, and even though the number of sonobuoy deployments would also double and dipping sonar uses increase ten-fold, the total number of takes would increase by only 33% over what was annually estimated for SOCAL major exercises in the Navy's 2007 environmental assessment.[11] At the same time, the Navy concludes that its preferred alternative would result in fewer than 10% of the injuries formerly calculated to occur during its major SOCAL exercises.[12] These downward estimates do not reflect any new discoveries in the science of marine mammals and noise; rather, they are the consequence of new methodologies that are belied by the record.

1. Thresholds of Injury, Hearing Loss, and Significant Behavioral Change

At the core of the Navy's assessment of acoustic impacts on the training range are the thresholds it has established for physical injury, hearing loss, and significant behavioral harassment, the levels above which meaningful effects on marine mammals are found to occur. There are gross problems with the Navy's thresholds here.

a. Injury Threshold

The Navy fixes its highest threshold of 215 dB re 1 $\mu Pa^{2}\bullet s$—which it considers the ground floor for direct physical injury—on the amount of energy necessary to induce permanent hearing loss (or "threshold shift") in marine mammals. DEIS at 3.9-44. Beneath this decision lies an assumption that the tissues of the ear are "the most susceptible to physiological effects of underwater sound" (DEIS at F-158), and, indeed, a few paragraphs are spent in an effort to set aside other types of injury that have been identified or observed. Unfortunately, the Navy's position is inconsistent with the scientific literature, with the legal standard of review, and with recent court decisions. See NRDC v. Winter, 527 F.Supp.2d 1216 (C.D. Cal. 2008), aff'd __ F.3d __, 2008 WL 565680 (9th Cir. 2008); Ocean Mammal Institute v. Gates, 2008 WL 564664 (D. Hawaii 2008).

[11] Compare and DEIS at 3.9-69, 71 and Navy, Joint Task Force Exercises and Composite Training Unit Exercises Environmental Assessment/ Overseas Environmental Assessment 4-78 (2007).

[12] Id.

12

The EIS/OEIS fully and carefully explains that it applies a methodology for assessing impacts of MFA sonar exposure on marine mammals that were recently developed in conjunction with NMFS. This methodology applies the best available scientific information to environmental impacts analysis, consistent with the Navy's commitment as a leader in scientific research and application in the field of marine mammals and underwater acoustics. The methodology in the EIS/OEIS is an improvement over the referenced EA and is based on a revised scientific approach to addressing potential behavioral response (See NRDC response 14 below). Differences in modeling methodology make comparisons between the exposure estimates in the EIS/OEIS and those identified in the EA inappropriate, as explained in the EIS/OEIS.

13

(1) The scientific derivation of TTS and subsequent PTS is explained in Section 3.9.7.3 of the SOCAL Draft EIS/OEIS. Contrary to the statement that the data from TTS studies upon which the PTS is derive, is inapposite, the Navy relies upon these studies because they are the most controlled studies of behavioral reactions to sound exposure available and provide the greatest amount of data. The studies recorded baseline behavior of the test subjects over many sessions so that behavioral alterations could be defined as a deviation from normal behavior. The sound exposure level received by each animal was recorded and quantified. The exposure signals used were close to the frequencies typically employed by MFA sonar. No other study provides the same degree of control or relevance to signal type as the TTS studies from which much of the behavioral response thresholds are derived.

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[12] Id.

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The data from these studies are the "best available" scientific data both with respect to quality and quantity. Data from animals in the wild were utilized when sufficient information on animal behavior (both baseline and reactionary) and sound exposure levels existed. This is unfortunately a sparse amount of data. Utilization of the copious other studies with inadequate control, observational periods, or ability to determine exposure levels of the animals introduces a large amount of guesswork and estimation that weakens any numerical association between behavioral reactions and sound exposure. Furthermore, the deficiencies of the TTS studies referred to in the comment were acknowledged in the original behavioral analysis. Please see "Finneran, J. J., and Schlundt, C. E. (2004). "Effects of intense pure tones on the behavior of trained odontocetes," (SSC San Diego, San Diego, CA)," in particular section 5.1.1 which details the limitations of the data collection and analysis. The NMFS is aware of these deficiencies yet still approves of the usage of the data at this time because of the quality and quantity of the data. As quality data continues to be collected on animals in the wild, the relevance of the behavioral data collected during the TTS studies will decrease and they will eventually be replaced. However, at this time, they provide the best available data for assessing the relationship between behavioral reactions and sound exposure.

(2) The "identified or observed" injuries referred to in the comment have not been directly linked to sound exposure and may result from other processes related to the behavior of the animal. The Navy's position is consistent with the interpretation of the scientific literature and no scientific literature exists that demonstrates a direct mechanism by which injury will occur as a result of sound exposure levels less than those predicted to cause PTS in a marine mammal.

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First, the DEIS disregards data gained from actual whale mortalities. The best available scientific evidence, as reported in the peer-reviewed literature, indicates that sound levels at the most likely locations of beaked whales beached in the Bahamas strandings run far lower than the Navy's threshold for injury here: approximately 150-160 dB re 1 μPa for 50-150 seconds, over the course of the transit.[13] A further modeling effort, undertaken in part by the Office of Naval Research, suggests that the mean exposure level of beaked whales, given their likely distribution in the Bahamas' Providence Channels and averaging results from various assumptions, may have been lower than 140 dB re 1 μPa.[14] (In another context, where it wishes to dismiss evidence of impacts to hearing at lower levels than its standard allows, the Navy refers to the statistical mean as "'the best unbiased estimator.'" DEIS at F-168.) Factoring in duration, then, evidence of actual sonar-related mortalities would compel a maximum energy level ("EL") threshold for serious injury on the order of 182 dB re 1 $\mu Pa^{2}\cdot s$, at least for beaked whales. Indeed, to pay at least some deference to the literature, the Navy—under pressure from NMFS—has previously assumed that non-lethal injury would occur in beaked whales exposed above 173 dB re 1 $\mu Pa^{2}\cdot s$.[15] The Navy's claim that no beaked whales would suffer injury, let alone serious injury or mortality, because none would be exposed to levels above 215 dB re 1 μPa is simply not tenable.

Second, the DEIS fails to take proper account of published research on bubble growth in marine mammals, which separately indicates the potential for injury and death at levels far lower than the Navy proposes. According to the best available scientific evidence, as represented by multiple papers in flagship journals such as *Nature* and *Veterinary Pathology*, gas bubble growth is the causal mechanism most consistent with the observed injuries;[16] in addition, it was singularly and explicitly highlighted as plausible by an expert panel

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[13] J. Hildebrand, "Impacts of Anthropogenic Sound," in T.J. Ragen, J.E. Reynolds III, W.F. Perrin, and R.R. Reeves, Conservation beyond Crisis (2005). See also International Whaling Commission, 2004 Report of the Scientific Committee, Annex K at § 6.3.

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[15] See, e.g., Navy, Joint Task Force Exercises and Composite Training Unit Exercises Final Environmental Assessment/ Overseas Environmental Assessment at 4-44, 4-46 to 4-47 (2007).

[16] See, e.g., A. Fernández, J.F. Edwards, F. Rodríguez, A. Espinosa de los Monteros, P. Herráez, P. Castro, J.R. Jaber, V. Martín, and M. Arbelo, 'Gas and Fat Embolic Syndrome' Involving a Mass Stranding of Beaked Whales (Family Ziphiidae) Exposed to Anthropogenic Sonar Signals, 42 Veterinary Pathology 446 (2005); P.D. Jepson, M. Arbelo, R. Deaville, I.A.P. Patterson, P. Castro, J.R. Baker, E. Degollada, H.M. Ross, P. Herráez, A.M. Pocknell, F. Rodríguez, F.E. Howie, A. Espinosa, R.J. Reid, J.R. Jaber, V. Martín, A.A. Cunningham, and A. Fernández, Gas-Bubble Lesions in Stranded Cetaceans, 425 Nature 575-576 (2003); R.W. Baird, D.L. Webster, D.J. McSweeney, A.D. Ligon, G.S. Schorr, and J. Barlow, Diving Behavior of Cuvier's (Ziphius cavirostris) and Blainville's (Mesoplodon densirostris) Beaked Whales in Hawai'i," 84 Canadian Journal of Zoology 1120-1128 (2006).

14

In response to paragraph starting: First, the DEIS…) Whale mortalities in other locations (such as the Bahamas) far from SOCAL do not relate to the SOCAL context due to differences in oceanographic conditions. The most important factors appear to be the presence of a narrow channel (e.g. Bahamas and Madeira Island, Portugal) that may prevent animals from avoiding sonar exposure and multiple sonar ships within that channel. There are no narrow channels (less than 35 nm wide and 10 nm in length) in the SOCAL Range Complex and the ships would be spread out over a wider area allowing animals to move away from sonar activities if they choose. Please refer to the Draft EIS/OEIS discussion in Section 2.4 of Appendix F on the critical nature of "context" presented in Southall et al. (2007). Since there has never been a stranding or death to any beaked whales associated with decades of sonar use in SOCAL, Navy believes that continued sonar use in SOCAL will not result in any injury to beaked whales.

In spite of this, Navy is not claiming there will be "no injury" and has requested a certain number of mortalities in acknowledgement of the fact that there are possibilities associated with even very unexpected events.

It is true that the criteria previously used in the COMPTUEX/JTFEX EA considered all animals exposed to 173 dB re 1µPa2 s or above as being harassed; however, both the Navy and NMFS agree that the studies of marine mammals in the wild and in experimental settings do not support these assumptions. Different species of marine mammals and different individuals of the same species respond differently to sonar exposure. The Navy and NMFS have developed a new methodology called risk function that takes in to account a variety of behavioral responses of marine mammals exposed to different sound levels down to 120 dB re 1µPa (See Draft EIS/OEIS Section 3.9.7.4). Based on previous studies of Temporary Threshold Shifts in hearing, 195 dB SEL is used for the onset of TTS and 215 dB SEL is used for the onset of PTS for all cetaceans including beaked whales (Section 3.9.7.1.3).

There are significant limitations and challenges to any risk function derived to estimate the probability of marine mammal behavioral responses; these are largely attributable to sparse data. Ultimately there should be multiple functions for different marine mammal taxonomic groups, but the current data are insufficient to support them. The goal is unquestionably that risk functions be based on empirical measurement.

The risk function presented in Draft EIS/OEIS Section 3.16 of Appendix F is based on three data sets that NMFS and Navy have determined are the best available scientific data at this time. Until additional data are available, NMFS and the Navy have determined that these datasets are the most applicable for the direct use in the development of risk function parameters to describe what portion of a population exposed to specific levels of MFA sonar will respond in a manner that NMFS would classify as harassment.

Navy is contributing to an ongoing behavioral response study in the Bahamas that is anticipated to provide some initial information on beaked whales, the species identified as the most sensitive to MFA sonar.

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Second, the DEIS fails to take proper account of published research on bubble growth in marine mammals, which separately indicates the potential for injury and death at levels far lower than the Navy proposes. According to the best available scientific evidence, as represented by multiple papers in flagship journals such as *Nature* and *Veterinary Pathology*, gas bubble growth is the causal mechanism most consistent with the observed injuries;[16] in addition, it was singularly and explicitly highlighted as plausible by an expert panel

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[14] J. Hildebrand, K. Balcomb, and R. Gisiner, Modeling the Bahamas Beaked Whale Stranding of March 2000 (2004) (presentation given at the third plenary meeting of the U.S. Marine Mammal Commission Advisory Committee on Acoustic Impacts on Marine Mammals, 29 July 2004).

[15] See, e.g., Navy, Joint Task Force Exercises and Composite Training Unit Exercises Final Environmental Assessment/ Overseas Environmental Assessment at 4-44, 4-46 to 4-47 (2007).

[16] See, e.g., A. Fernández, J.F. Edwards, F. Rodríguez, A. Espinosa de los Monteros, P. Herráez, P. Castro, J.R. Jaber, V. Martín, and M. Arbelo, 'Gas and Fat Embolic Syndrome' Involving a Mass Stranding of Beaked Whales (Family Ziphiidae) Exposed to Anthropogenic Sonar Signals, 42 Veterinary Pathology 446 (2005); P.D. Jepson, M. Arbelo, R. Deaville, I.A.P. Patterson, P. Castro, J.R. Baker, E. Degollada, H.M. Ross, P. Herráez, A.M. Pocknell, F. Rodríguez, F.E. Howie, A. Espinosa, R.J. Reid, J.R. Jaber, V. Martín, A.A. Cunningham, and A. Fernández, Gas-Bubble Lesions in Stranded Cetaceans, 425 Nature 575-576 (2003); R.W. Baird, D.L. Webster, D.J. McSweeney, A.D. Ligon, G.S. Schorr, and J. Barlow, Diving Behavior of Cuvier's (Ziphius cavirostris) and Blainville's (Mesoplodon densirostris) Beaked Whales in Hawai'i," 84 Canadian Journal of Zoology 1120-1128 (2006).

This page is a duplicate of above.

15 *(In response to paragraph starting: Second, the DEIS…)* The papers cited by NRDC (reference # 16) do not prove that decompression sickness (DCS) occurred in the Bahamas stranding. The papers state that the pathologies reported could be related to DCS but could also be caused by injuries sustained during beaching or the beginnings of decomposition in the warm climate of the Bahamas. Studies by Cox et al. (2006) and Romel et al. (2006) (which include some of the same authors as those cited by NRDC) concluded that the pathologies seen in the stranded animals could have been the result of DCS from sound exposure but that they were not diagnostic of DCS. In addition, for DCS to occur the animal would have to be supersaturated with nitrogen. Current information on the diving behavior of beaked whales make that unlikely (Tyack et al. 2006) and a recent study of diving dolphins did not show an increase in blood nitrogen levels that would lead to bubble formation (Houser 2007).

Sections 3.9.7.3 and 3.9.7.4 of the Draft EIS/OEIS explained the potential effects on marine mammals from Navy mid-frequency active (MFA) sonar in the SOCAL Range Complex. MFA sonar use in SOCAL is not new and has occurred using the same basic sonar equipment and output for decades. Given this history and the scientific evidence, the Navy believes that risk to marine mammals from sonar training is low.
(continued next page…)

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convened by the Marine Mammal Commission, in which the Navy participated.[17] The Navy's argument to the contrary simply misrepresents the available literature. What is more, the default assumption in the DEIS—that whales suffer injury only through the physical act of stranding itself (or through direct tissue injury)—has been soundly rejected in the literature.[18] The Navy's refusal to consider these impacts is insupportable under NEPA. 42 C.F.R. §§ 1502.22, 1502.24.

Third, the numbers do not reflect other non-auditory physiological impacts, as from stress and from chronic exposure during development, which are discussed further among "Other Impacts on Marine Mammals" (below).

Fourth, the Navy's exclusive reliance on energy flux density as its unit of analysis does not take other potentially relevant acoustic characteristics into account. For example, an expert group commissioned by the Office of Naval Research in 2003 to provide recommendations on mitigation suggested that peak power may matter more to beaked whale mortalities than integrated energy.[19] Reflecting this uncertainty, the Navy should establish a dual threshold for marine mammal injury.

Fifth, the Navy's calculation of permanent threshold shift (which it equates to the onset on injury) is based on studies of temporary threshold shift that, as discussed below, have a number of significant limitations.

b. Hearing Loss Threshold

The DEIS sets its threshold for temporary hearing loss, or "threshold shift" ("TTS"), at 195 dB re 1 μPa^{2}•s. DEIS at 3.9-44. It bases this threshold primarily on a synthesis of studies on two species of cetaceans, bottlenose dolphins and beluga whales, conducted by the Navy's SPAWAR laboratory in San Diego and, to a lesser extent, by researchers at the University of Hawaii. DEIS at F-161 to F-162.

First, the Navy's extrapolation of data from bottlenose dolphins and belugas to all cetaceans is not justifiable. Given the close association between acoustic sensitivity and threshold shift, such an approach must presume that belugas and bottlenose dolphins have the best hearing sensitivity in the mid-frequencies of

[17] T.M. Cox, T.J. Ragen, A.J. Read, E. Vos, R.W. Baird, K. Balcomb, J. Barlow, J. Caldwell, T. Cranford, L. Crum, A. D'Amico, G. D'Spain, A. Fernández, J. Finneran, R. Gentry, W. Gerth, F. Gulland, J. Hildebrand, D. Houser, T. Hullar, P.D. Jepson, D. Ketten, C.D. MacLeod, P. Miller, S. Moore, D. Mountain, D. Palka, P. Ponganis, S. Rommel, T. Rowles, B. Taylor, P. Tyack, D. Wartzok, R. Gisiner, J. Mead, and L. Benner, Understanding the Impacts of Anthropogenic Sound on Beaked Whales, 7 Journal of Cetacean Research & Management 177-87 (2006).

[18] Id.

[19] Levine, Active Sonar Waveform at 27.

(Continued from above)

Though the Navy works to minimize impacts on marine mammals to the greatest extent practicable, they are not mandated by any statute to alleviate all risk to marine mammals. Also, it must be acknowledged that ASW activities have been conducted without incident for decades in SOCAL. In fact, many populations of non-ESA and ESA species alike have been increasing in SOCAL over the last several decades. Given the natural variation of marine mammal location over time within SOCAL, operational variability of Navy ASW operations, and the fact that there is little scientific information demonstrating broad-scale impacts that are either injurious or of significant biological impact to marine mammals, there is little relative risk to marine mammal populations from ASW training exercises.

16 The Draft EIS/OEIS provided analysis based upon the best available scientific data on both behavioral and physiological impacts.

17 Regarding a dual threshold, as most recently discussed in Southall et al (2007), the Navy is applying a more conservative approach by using the risk function (SPL) for behavior and energy for PTS /TTS onset given that the 230 dB SPL (peak) metric would not reach beyond the sonar dome containing a 235 dB source. The methodology for assessing potential impacts from sound are discussed in Section 3.9.7 including the use of both an energy (EFD) metric and the sound pressure level (SPL) metric developed in coordination with NMFS.

18 The methodology for assessing potential impacts from sound were discussed in Section 3.9.7 of the Draft EIS/OEIS including a discussion on why TTS reflects the use of best available and applicable science.

19 The explanation for the derivation of the thresholds and the use of the specific data sets was explicit in Section 3.9.7 of the Draft EIS/OEIS. While there are many limitations on these data sets (as detailed), there remain no other more representative or rigorous data from which to derive alternative thresholds. The thresholds and criteria were developed in cooperation with NMFS and as more data becomes available, the methodology and thresholds will be revised as warranted.

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any cetacean. Yet, as noted below at subsection (c) ("Threshold for Significant Behavioral Change"), harbor porpoises and killer whales are more sensitive over part of the mid-frequency range than are the two species in the SPAWAR and Hawaii studies.[20] Furthermore, the animals in the studies may not represent the full range of variation even within their own species, particularly given their age and situation: the SPAWAR animals, for example, have been housed for years in a noisy bay.[21]

Second, the small size of the data set generated by these studies leads the Navy to some arbitrary interpretations. For example, the Navy effectively excludes the results of one study that found threshold shift originating in a bottlenose dolphin at 190 re 1 $\mu Pa^{2\bullet}s$, which is a full 5 dB re 1 $\mu Pa^{2\bullet}s$ below its proposed standard. DEIS at F-162. The basis for this exclusion is the equal energy hypothesis: if you assume that the threshold for hearing loss decreases by a constant amount as the duration of a sound increases, you can fit a straight line connecting the data points that the studies have produced. Yet where the line falls can remain somewhat arbitrary given the small number of points on the chart. In this case, the Navy relied heavily for its line-drawing on a single data point, from a single subject, lying at a distance from the main data cluster (Nachtigall et al. 2003b). Alternatively, it might have dropped the line about 5 dB lower, which would have brought it closer to a third cluster, made of multiple data points from multiple subjects, and conformed more exactly to the point above which TTS was consistently found in the main cluster. See DEIS at F-162. In other words, the Navy's own graphic indicates that a 190 dB re 1 $\mu Pa^{2\bullet}s$ threshold would have fit its data better than the threshold it established and would have had the advantage of being marginally more conservative given the enormous uncertainties—yet there is no justification in the DEIS for the choice it made. The Navy's assumption of a 195 re 1 $\mu Pa^{2\bullet}s$ EL threshold in the present DEIS, as in all documents that depend on the same methodology, is arbitrary and capricious.

c. Threshold for Significant Behavioral Change

The threshold used in the DEIS differs from the one used by the Navy to estimate marine mammal take during RIMPAC 2006 and during subsequent major exercises off California and Hawaii. In short, instead of using an EL standard of 173 dB re 1 $\mu Pa^{2\bullet}s$, which NMFS had insisted the Navy adopt (and which is itself non-conservative), the Navy rather applies a dose-response function that begins at 120 dB re 1 µPa and reaches its mean at 165 dB re 1 µPa.

[20] Richardson et al., Marine Mammals and Noise at 209.

[21] M.L.H. Cook, Behavioral and Auditory Evoked Potential (AEP) Hearing Measurements in Odontocete Cetaceans (2006) (Ph.D. thesis).

19 See response above

20 The EIS/OEIS contains a methodology provided by NMFS for the Navy. Affects of multiple pings are considered under the energy metric (EFD) criteria beginning with TTS, which is the first measurable physiological effect presently known. A new risk function is used in the present analysis has a behavioral response curve with a lower mean (165 dB SPL) than the previously proposed 173 dB SPL.

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In the Hawaii Range Complex, the only region for which comparative data are directly available, the change from the Navy's current standard is significant. Under the current standard, the RIMPAC 2006 event was expected to result in slightly less than 33,000 behavioral takes of marine mammals; under the proposed one, RIMPAC events conducted with the same number of hours of sonar use would supposedly cause fewer than 6,000 takes.[22] Under the current standard, the conduct of 6 USWEX events was predicted to cause over 30,000 behavioral takes of marine mammals; under the proposed one, annual takes would not exceed 20,000.[23]

The SOCAL Range Complex seems to present a very similar picture. The Navy estimates that existing levels of sonar training in SOCAL would result each year in approximately 83,600 behavioral takes of marine mammals; and yet, on applying the current standard in its 2007 environmental assessment, the Navy found that 80,600 behavioral takes would result each year from major exercises alone—exercises that represent roughly half of all mid-frequency sonar use on the range.[24] In other words, the DEIS would have us accept that a doubling in the amount of modeled sonar use would increase takes by only 3-4 percent. All of these data suggest that the Navy's new take estimates—while still large—represent far less than what it would have predicted had it continued to use the previous EL-based standard of 173 re 1 $\mu Pa^2 \cdot s$.

20 See response above

As the Navy should well know, agencies are not entitled to substantial deference under the Administrative Procedure Act when they reverse previously held positions. Among the most significant problems:

First, the Navy again relies on inapposite studies of temporary threshold shift in captive animals for its primary source of data. Marine mammal scientists have long recognized the deficiencies of using captive subjects in behavioral experiments, and to blindly rely on this material, to the exclusion of copious data on animals in the wild, is not supportable by any standard of scientific inquiry. Cf. 42 C.F.R. § 1502.22. The problem is exacerbated further by the fact that the subjects in question, roughly two belugas and five bottlenose dolphins, are highly trained animals that have been working in the Navy's research program in the SPAWAR complex for years.[25] Indeed, the disruptions observed by Navy scientists, which included pronounced, aggressive behavior

[22] Navy, Hawaii Range Complex Draft Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement at 3-24 (2008).

[23] Id. at 3-36.

[24] DEIS at 3.9-69, 3.9-71; Navy, Joint Task Force Exercises and Composite Training Unit Exercises Environmental Assessment/ Overseas Environmental Assessment 4-46 (2007).

[25] See, e.g., S.H. Ridgway, D.A. Carder, R.R. Smith, T. Kamolnick, C.E. Schlundt, and W.R. Elsberry, Behavioral Responses and Temporary Shift in Masked Hearing Threshold of Bottlenose Dolphins, Tursiops truncates, to 1-Second Tones of 141 to 201 dB re 1 μPa (1997) (SPAWAR Tech. Rep. 1751, Rev. 1).

Contrary to the statement that the data from TTS studies is inapposite, the Navy relies upon these studies because they are the most controlled studies of behavioral reactions to sound exposure available and provide the greatest amount of data. The studies recorded baseline behavior of the test subjects over many sessions so that behavioral alterations could be defined as a deviation from normal behavior. The sound exposure level received by each animal was recorded and quantified. The exposure signals used were close to the frequencies typically employed by MFA sonar. No other study provides the same degree of control or relevance to signal type as the TTS studies from which much of the behavioral response thresholds are derived.

21 The data from these studies are the best available scientific data both with respect to quality and quantity. Data from animals in the wild were utilized when sufficient information on animal behavior (both baseline and reactionary) and sound exposure levels existed. This is unfortunately a sparse amount of data. Utilization of the copious other studies with inadequate control, observational periods, or ability to determine exposure levels of the animals introduces a large amount of guesswork and estimation that weakens any numerical association between behavioral reactions and sound exposure. Furthermore, the deficiencies of the TTS studies referred to in the comment were acknowledged in the original behavioral analysis. Please see "Finneran, J. J., and Schlundt, C. E. (2004). "Effects of intense pure tones on the behavior of trained odontocetes," (SSC San Diego, San Diego, CA)," in particular section 5.1.1 which details the limitations of the data

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("attacking" the source) and avoidance of feeding areas associated with the exposure, occurred during a research protocol that the animals had been rigorously trained to complete.[26] The SPAWAR studies have several other major deficiencies that NMFS, among others, has repeatedly pointed out; and in relying so heavily on them, the Navy has once again ignored the comments of numerous marine mammal behaviorists on the Navy's USWTR DEIS, which sharply criticize the Navy for putting any serious stock in them.[27]

21

Second, the Navy appears to have misused data garnered from the Haro Strait incident—one of only three data sets it considers—by including only those levels of sound received by the "J" pod of killer whales when the USS Shoup was at its closest approach (see discussion below at section A.2). DEIS at 3.9-51. These numbers represent the maximum level at which the pod was harassed; in fact, the whales were reported to have broken off their foraging and to have engaged in significant avoidance behavior at far greater distances from the ship, where received levels would have been orders of magnitude lower.[28] Not surprisingly, then, the Navy's results are inconsistent with other studies of the effects of various noise sources, including mid-frequency sonar, on killer whales. We must insist that the Navy provide the public with its propagation analysis for the Haro Strait event, and also describe precisely how this data set, along with results from the SPAWAR and Nowacek et al. studies, were factored into its development of the behavioral risk function.

22

Third, the Navy fails to include data from the July 2004 Hanalei Bay event, in which 150-200 melon-headed whales were embayed for more than 24 hours during the Navy's Rim of the Pacific exercise. According to the Navy's analysis, predicted mean received levels (from mid-frequency sonar) inside and at the mouth of Hanalei Bay ranged from 137.9 dB to 149.2 dB.[29] The Navy has from the beginning denied any connection between its major international exercise and the mass stranding; but the Navy's specious reasoning is at odds

23

[26] C.E. Schlundt, J.J. Finneran, D.A. Carder, and S.H. Ridgway, Temporary Shift in Masked Hearing Thresholds of Bottlenose Dolphins, Tursiops truncates, and White Whales, Delphinapterus leucas, after Exposure to Intense Tones, 107 Journal of the Acoustical Society of America 3496, 3504 (2000).

[27] See comments from M. Johnson, D. Mann, D. Nowacek, N. Soto, P. Tyack, P. Madsen, M. Wahlberg, and B. Møhl, received by the Navy on the Undersea Warfare Training Range DEIS. These comments, and those of the fishermen cited below, are hereby incorporated into this letter. See also Letter from Rodney F. Weiher, NOAA, to Keith Jenkins, Naval Facilities Engineering Command Atlantic (Jan. 30, 2006); Memo, A.R. document 51, NRDC v. Winter, CV 06-4131 FMC (JCx) (undated NOAA memorandum).

[28] See,. e.g., NMFS, Assessment of Acoustic Exposures on Marine Mammals in Conjunction with USS Shoup Active Sonar Transmissions in the Eastern Strait of Juan de Fuca and Haro Strait, Washington—5 May 2003 at 4-6 (2005); Declaration of David E. Bain, NRDC v. Winter, CV 07-0335 FMC (FMOx) (C.D. Cal. 2007).

[29] Navy, 2006 Supplement to the 2002 Rim of the Pacific (RIMPAC) Programmatic Environmental Assessment D-1 to D-2 (May 2006).

(Continued from above)…. collection and analysis. The NMFS is aware of these deficiencies yet still approves of the usage of the data at this time because of the quality and quantity of the data. As quality data continues to be collected on animals in the wild, the relevance of the behavioral data collected during the TTS studies will decrease and they will eventually be replaced.

However, at this time, they provide the best available data for assessing the relationship between behavioral reactions and sound exposure

The Hanalei Bay "stranding" was discussed in the Draft EIS/OEIS, Section 2.4.3.2 of Appendix F. Investigations of Hanalei Bay concluded that it was not known what caused the pod to enter the bay. The report indicated that sonar "may have contributed to a 'confluence of events', including human presence (notably the uncontrolled and random human interactions fragmenting the pods of whales on 3 July) and/or other unknown biological or physical factors.'

Although the NMFS report concludes that MFAS was "… a plausible, if not likely, contributing factor in what may have been a confluence of events" other evidence indicates this was an instance of natural, although uncommon, behavior. Recent information on the Hanalei Bay stranding or "out of habitat event" showed MFAS may not have influenced this event. The lunar phase (near full moon) may have influenced the distribution of prey species of the melon-headed whales (Mobley et al. 2007). A simultaneous event of a mixed group of melon-headed whales and rough toothed dolphins that entered a bay at Rota Island with no associated navy activity (Jefferson et al., 2006), and anecdotal evidence of previous events of dolphins entering bays in Hawaii to feed all occured with no presence of Navy sonar.

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with the stranding behavior observed during the event and with NMFS' report on the matter, which ruled out every other known potential factor and concluded that sonar was the "plausible if not likely" cause.[30] The Navy's failure to incorporate these numbers into its methodology as another data set is not remotely justifiable.

Fourth, the Navy excludes a substantial body of research on wild animals (and some research on other experimental animals as well, within a behavioral experimental protocol). Perhaps most glaringly, while the related DEIS prepared for the Navy's Atlantic Fleet Active Sonar Training activities appears to acknowledge the strong sensitivity of harbor porpoises by setting an absolute take threshold of 120 dB (SPL)—a sensitivity that, as NMFS has noted, is reflected in numerous wild and captive animal studies—it improperly fails to include any of these studies in its data set.[31] The result is clear bias, for even if one assumes (for argument's sake) that the SPAWAR data has value, the Navy has included a relatively insensitive species in setting its general standard for marine mammals while excluding a relatively sensitive one.

By placing great weight on the SPAWAR data, excluding other relevant data, and misusing the Haro Strait data, the Navy has produced a risk function that is belied by the existing record: one that clearly demonstrates high risk of significant behavioral impacts from mid-frequency sources, including mid-frequency sonar, on a diverse range of wild species (e.g., right whales, minke whales, killer whales, harbor porpoises, Dall's porpoises) at levels below the function curve.[32] Given the high sensitivity in the Navy's model, standards that

[30] B.L. Southall, R. Braun, F.M.D. Gulland, A.D. Heard, R.W. Baird, S.M. Wilkin, and T.K. Rowles, Hawaiian Melon-Headed Whale (Peponacephala electra) Mass Stranding Event of July 3-4, 2004 (2006) (NOAA Tech. Memo. NMFS-OPR-31).

[31] Navy, Draft Atlantic Fleet Active Sonar Training Environmental Impact Statement/ Overseas Environmental Impact Statement 4-48, 4-50-51 (2008).

[32] See, e.g., id.; R.A. Kastelein, H.T. Rippe, N. Vaughan, N.M. Schooneman, W.C. Verboom, and D. de Haan, The Effects of Acoustic Alarms on the Behavior of Harbor Porpoises in a Floating Pen, 16 Marine Mammal Science 46 (2000); P.F. Olesiuk, L.M. Nichol, M.J. Sowden, and J.K.B. Ford, Effect of the Sound Generated by an Acoustic Harassment Device on the Relative Abundance of Harbor Porpoises in Retreat Passage, British Columbia, 18 Marine Mammal Science 843 (2002); NMFS, Assessment of Acoustic Exposures on Marine Mammals in Conjunction with USS Shoup Active Sonar Transmissions in the Eastern Strait of Juan de Fuca and Haro Strait, Washington, 5 May 2003 at 10 (2005); D.P. Nowacek, M.P. Johnson, and P.L. Tyack, North Atlantic Right Whales (Eubalaena glacialis) Ignore Ships but Respond to Alerting Stimuli, 271 Proceedings of the Royal Society of London, Part B: Biological Sciences 227 (2004); Statements of D. Bain, K. Balcomb, and R. Osborne (May 28, 2003) (taken by NMFS enforcement on Haro Strait incident); Letter from D. Bain to California Coastal Commission (Jan. 9, 2007); E.C.M. Parsons, I. Birks, P.G.H. Evans, J.C.D. Gordon, J.H. Shrimpton, and S. Pooley, The Possible Impacts of Military Activity on Cetaceans in West Scotland, 14 European Research on Cetaceans 185-190 (2000); P. Kvadsheim, F. Benders, P. Miller, L. Doksaeter, F. Knudsen, P. Tyack, N. Nordlund, F.-P. Lam, F. Samarra, L. Kleivane, and O.R. Godø, Herring (Sild), Killer Whales (Spekkhogger) and Sonar—the 3S-2006 Cruise Report with Preliminary Results (2007).

23 *(See response above)*

24 As explained in the Draft EIS/OEIS Section 3.9.7.4.1, the thresholds established for the risk function did take into account behaviors from wild animals where that data was applicable.

The three data sets used to calculate the mid-point of the risk function were weighted equally. The Haro Strait data were appropriately applied. NMFS and the Navy included the best available and most applicable data in the development of the risk function. While recognizing there is incomplete and unavailable information with regard to behavioral impacts on marine mammals, NMFS and the Navy closely coordinated the development of the risk function to represent the best available science. The cutoff for the risk function curve extends to 120 dB SPL specifically to encompass uncertainty and the potential for behavioral reactions in marine mammal species that may be affected by sounds perceived at levels just above ambient during some parts of the year in SOCAL waters.

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more accurately reflect existing data would produce take numbers far in excess of those calculated here.

Fifth, any risk function must take account of the social ecology of some marine mammal species. For species that travel in tight-knit groups, an effect on certain individuals can adversely influence the behavior of the whole. (Pilot whales, for example, are prone to mass strand for precisely this reason; the plight of the 200 melon-headed whales in Hanalei Bay, and of the "J" pod of killer whales in Haro Strait, as described below, may be pertinent examples.) Should those individuals fall on the more sensitive end of the spectrum, the entire group or pod can suffer significant harm at levels below what the Navy would take as the mean. In developing its "K" parameter, the Navy must take account of such potential indirect effects. 42 C.F.R. § 1502.16(b).

Sixth, the Navy's exclusive reliance on sound pressure levels ("SPLs") in setting a behavioral threshold is misplaced. The discussion in the DEIS speaks repeatedly of uncertainty in defining the risk function and recapitulates, in its summary of the earlier methodology, the benefits implicit in the use of a criterion that takes duration into account. It is therefore appropriate for the Navy to set dual thresholds for behavioral effects, one based on SPLs and one based on energy flux density levels ("ELs").

Seventh, as noted below in the discussion of Cumulative Impacts, the Navy's threshold is applied in such a way as to preclude any assessment of long-term behavioral impacts on marine mammals. It does not account, to any degree, for the problem of repetition: the way that apparently insignificant impacts, such as subtle changes in dive times or vocalization patterns, can become significant if experienced repeatedly or over time.[33]

For all these reasons, the thresholds of injury, hearing loss, and significant behavioral change utilized by the Navy in this DEIS are fundamentally inconsistent with the scientific literature on acoustic impacts, and, indeed, with marine mammal science in general, and, if used to support a Record of Decision, would violate NEPA. Please note that a more technical analysis of the Navy's behavioral risk function methodology will be submitted during the present public comment process by Dr. David Bain, and his comments are hereby incorporated by reference.

2. Strandings and Mortalities Associated with Mid-Frequency Sonar

[33] The importance of this problem for marine mammal conservation is reflected in a recent NRC report, which calls for models that, inter alia, translate such subtle changes into disruptions in key activities like feeding and breeding that are significant for individual animals. National Research Council. Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects 35-68 (2005).

24 *(See response above)*

25 The modeling undertaken does so, as explained in the Draft EIS/OEIS, Appendix F, based on marine mammal densities evenly distributed over the entire area of potential effect. This is conservative since the tendency is to overestimate effects given that marine mammals appearing in pods will be easier to detect and therefore be avoided by use of the Navy's standard operating procedures serving as mitigation measures.

26 In this case, the Navy is using dual thresholds for assessing impacts on marine mammals by use of the sound exposure level (SEL) energy metric and the sound pressure level (SPL) behavioral criteria.

27 Potential indirect effects were discussed in Section 3.9.7.1.1 and Section 3.9.9.2.2 of the Draft EIS/OEIS.

28 The marine mammal acoustical analysis was based on the use of the best available and applicable science (see Section 3.9.7 of the Draft EIS/OEIS) as it applies to mid-frequency and high-frequency sources used during training in SOCAL. The thresholds used in this analysis were developed in cooperation with NMFS, who serves as the regulator for these resources.

29 Response to Dr. Bain's analysis is provided separately.

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Over the last decade, the association between military active sonar and whale mortalities has become a subject of considerable scientific interest and concern. That interest is reflected in the publication of numerous papers in peer-reviewed journals, in reports by inter-governmental bodies such as the IWC's Scientific Committee, and in evidence compiled from a growing number of mortalities associated with sonar.

In March 2000, for example, sixteen whales from at least three species— including two minke whales—stranded over 150 miles of shoreline along the northern channels of the Bahamas. The beachings occurred within 24 hours of Navy ships using mid-frequency sonar (AN/SQS-53C and AN/SQS-56) in those same channels.[34] Post-mortem examinations found, in all whales examined, hemorrhaging in and around the ears and other tissues related to sound conduction or production, such as the larynx and auditory fats, some of which was debilitative and potentially severe.[35] It is now accepted that these mortalities were caused, through an unknown mechanism, by the Navy's use of mid-frequency sonar.

The Bahamas event is one of numerous mortality events coincident with military activities and active sonar that have now been documented:[36]

(1) Canary Islands 1985-1991 – Between 1985 and 1989, at least three separate mass strandings of beaked whales occurred in the Canary Islands, as reported in Nature.[37] Thirteen beaked whales of two species were killed in the February 1985 strandings, six whales of three species stranded in November 1988, and some twenty-four whales of three species stranded in October 1989—all while naval vessels were conducting exercises off shore.[38] An additional stranding of Cuvier's beaked whales, also coinciding with a naval exercise, occurred in 1991.[39] It was reported that mass live strandings occurred each time exercises took place in the area.[40]

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[34] Commerce and Navy, Joint Interim Report at iii, 16.

[35] Id.

[36] The following is not a complete list, as other relevant events have been reported in Bonaire, Japan, Taiwan, and other locations. See, e.g., R.L. Brownell, Jr., T. Yamada, J.G. Mead, and A.L. van Helden, Mass Strandings of Cuvier's Beaked Whales in Japan: U.S. Naval Acoustic Link? (2004) (IWC SC/56E37); J.Y. Wang and S.-C. Yang, Unusual Cetacean Stranding Events of Taiwan in 2004 and 2005, 8 Journal of Cetacean Research and Management 283-292 (2006); P.J.H. van Bree and I. Kristensen, On the Intriguing Stranding of Four Cuvier's Beaked Whales, Ziphius cavirostris, G. Cuvier, 1823, on the Lesser Antillean Island of Bonaire, 44 Bijdragen tot de Dierkunde 235-238 (1974).

[37] M. Simmonds and L.F. Lopez-Jurado, Whales and the Military, 337 Nature 448 (1991).

[38] Id.

[39] V. Martín, A. Servidio, and S. Garcia, Mass Strandings of Beaked Whales in the Canary Islands, in P.G.H. Evans and L.A. Miller, Proceedings of the Workshop on Active Sonar and Cetaceans 33-36 (2004).

[40] Simmonds and Lopez-Jurado, Whales and the Military, 337 Nature at 448.

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(2) Greece 1996, 1997 – In 1996, twelve Cuvier's beaked whales stranded along 35 kilometers on the west coast of Greece. The strandings were correlated, by an analysis published in Nature, with the test of a low- and mid-frequency active sonar system operated by NATO.[41] A subsequent NATO investigation found the strandings to be closely timed with the movements of the sonar vessel, and ruled out all other physical environmental factors as a cause.[42] The following year saw nine additional Cuvier's beaked whales strand off Greece, again coinciding with naval activity.[43]

(3) Virgin Islands 1999 – In October 1999, four beaked whales stranded in the U.S. Virgin Islands as the Navy began an offshore exercise. A wildlife official from the Islands reported the presence of "loud naval sonar."[44] When NMFS asked the Navy for more information about its exercise, the Department's response was to end the consultation that it had begun for the exercise under the Endangered Species Act.[45] In January 1998, according to a NMFS biologist, a beaked whale "stranded suspiciously" at Vieques as naval exercises were set to commence offshore.[46]

(4) Bahamas 2000 – As described above.

(5) Madeira 2000 -- In May 2000, three beaked whales stranded on the beaches of Madeira (and one found floating dead in the water) while several NATO ships were conducting an exercise near shore. Scientists investigating the stranding found that the whales' injuries—including "blood in and around the eyes, kidney lesions, pleural hemorrhage"—and the pattern of their stranding suggest "that a similar pressure event [*i.e.*, similar to that at work in the Bahamas] precipitated or contributed to strandings in both sites."[47]

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[41] A. Frantzis, Does Acoustic Testing Strand Whales? 392 Nature 29 (1998).

[42] See SACLANT Undersea Research Center, Summary Record, La Spezia, Italy, 15-17 June 1998, SACLANTCEN Bioacoustics Panel, SACLANTCEN M-133 (1998).

[43] Id.; A. Frantzis, The First Mass Stranding That Was Associated with the Use of Active Sonar (Kyparissiakos Gulf, Greece, 1996), in P.G.H. Evans and L.A. Miller, Proceedings of the Workshop on Active Sonar and Cetaceans 14-20 (2004).

[44] Personal communication of Dr. David Nellis, U.S. Virgin Island Department of Fish and Game, to Eric Hawk, NMFS (Oct. 1999); personal communication from Ken Hollingshead, NMFS, to John Mayer, Marine Acoustics Inc. (March 19, 2002).

[45] Letter from William T. Hogarth, Regional Administrator, NMFS Southeast Regional Office, to RADM J. Kevin Moran, Navy Region Southeast (undated); personal communication from Ken Hollingshead, NMFS, to John Mayer, Marine Acoustics Inc. (March 19, 2002).

[46] Personal communication from Eric Hawk, NMFS, to Ken Hollingshead, NMFS (Feb. 12, 2002).

[47] D.R. Ketten, Beaked Whale Necropsy Findings 22 (2002) (paper submitted to NMFS); L. Freitas, The Stranding of Three Cuvier's Beaked Whales Ziphius Cavirostris in Madeira Archipelago—May 2000, in P.G.H. Evans and L.A. Miller, Proceedings of the Workshop on Active Sonar and Cetaceans 28-32 (2004).

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(6) Canary Islands 2002 – In September 2002, at least fourteen beaked whales from three different species stranded in the Canary Islands. Four additional beaked whales stranded over the next several days.[48] The strandings occurred while a Spanish-led naval exercise that included U.S. Navy vessels and at least one ship equipped with mid-frequency sonar was conducting anti-submarine warfare exercises in the vicinity.[49] The subsequent investigation, as reported in the journals Nature and Veterinary Pathology, revealed a variety of traumas, including emboli and lesions suggestive of decompression sickness.[50]

(7) Washington 2003 – In May 2003, the U.S. Navy vessel USS Shoup was conducting a mid-frequency sonar exercise while passing through Haro Strait, off the coast of Washington. According to one contemporaneous account, "[d]ozens of porpoises and killer whales seemed to stampede all at once . . . in response to a loud electronic noise echoing through" the Strait.[51] Several field biologists present at the scene reported observing a pod of endangered orcas bunching near shore and engaging in very abnormal behavior consistent with avoidance, a minke whale "porpoising" away from the sonar ship, and harbor porpoises fleeing the vessel in large numbers.[52] Eleven harbor porpoises—an abnormally high number given the average stranding rate of six per year—were found beached in the area of the exercise.[53]

(8) Kauai 2004 – During the Navy's conduct of a major training exercise off Hawaii, called RIMPAC 2004, some 150-200 whales from a species that is rarely seen near shore and had never naturally mass-stranded in Hawaii came into Hanalei Bay, on the island of Kaua'i. The whales crowded into the shallow bay waters and milled there for over 28 hours. Though the whales were ultimately assisted into deeper waters by members of a local stranding network, one whale calf was left behind and found dead the next day. NMFS undertook an investigation of the incident and concluded that the Navy's nearby use of

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[48] Vidal Martin et al., Mass Strandings of Beaked Whales in the Canary Islands, in Proceedings of the Workshop on Active Sonar and Cetaceans 33 (P.G.H. Evans & L.A. Miller eds., 2004); Fernández et al., 'Gas and Fat Embolic Syndrome', 42 Veterinary Pathology at 446-57.

[49] Fernández et al., 'Gas and Fat Embolic Syndrome', 42 Veterinary Pathology at 446; K.R. Weiss, Whale Deaths Linked to Navy Sonar Tests, L.A. Times, Oct. 1, 2002, at A3.

[50] Fernández et al., 'Gas and Fat Embolic Syndrome', 42 Veterinary Pathology at 446-57; Jepson et al., Gas-Bubble Lesions, 425 Nature at 575-76.

[51] Christopher Dunagan, Navy Sonar Incident Alarms Experts, Bremerton Sun, May 8, 2003.

[52] NMFS, Assessment of Acoustic Exposures at 6, 9.

[53] NMFS, Preliminary Report: Multidisciplinary Investigation of Harbor Porpoises (Phocoena phocoena) Stranded in Washington State from 2 May – 2 June 2003 Coinciding with the Mid-Range Sonar Exercises of the USS Shoup 53-55 (2004) (conclusions unchanged in final report). Unfortunately, according to the report, freezer artifacts and other problems incidental to the preservation of tissue samples made the cause of death in most specimens difficult to determine; but the role of acoustic trauma could not be ruled out. Id.

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sonar in RIMPAC 2004 was the "plausible, if not likely" cause of the stranding.[54]

(9) Canary Islands 2004 – In July 2004, four dead beaked whales were found around the coasts of the Canary Islands, within one week of an NATO exercise. The exercise, Majestic Eagle 2004, was conducted approximately 100 kilometers north of the Canaries. Although the three whale bodies that were necropsied were too decomposed to allow detection of gas embolisms (see below), systematic fat embolisms were found in these animals.[55] The probability that the whales died at sea is extremely high.[56]

(10) North Carolina 2005 – During and just after a U.S. training exercise off North Carolina, at least thirty-seven whales of three different species stranded and died along the Outer Banks, including numerous pilot whales (six of which were pregnant), one newborn minke whale, and two dwarf sperm whales. NMFS investigated the incident and found that the event was highly unusual, being the only mass stranding of offshore species ever to have been reported in the region, and that it shared 'a number of features' with other sonar-related mass stranding events (involving offshore species which stranded alive and were atypically distributed along the shore). NMFS concluded that sonar was a possible cause of the strandings and also ruled out the most common other potential causes, including viral, bacterial, and protozoal infection, direct blunt trauma, and fishery interactions.[57]

(11) Spain 2006 – Four Cuvier's beaked whales stranded on the Almerian coast of southern Spain, with the same suite of bends-like pathologies seen in the whales that stranded in the Canary Islands in 2002 and 2004.[58] A NATO response force was performing exercises within 50 miles at the time of the strandings. DEIS at F-136 to F-137.

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[54] B.L. Southall, R. Braun, F.M.D. Gulland, A.D. Heard, R.W. Baird, S.M. Wilkin, and T.K. Rowles, Hawaiian Melon-Headed Whale (Peponacephala electra) Mass Stranding Event of July 3-4, 2004 (2006) (NOAA Tech. Memo. NMFS-OPR-31).

[55] A. Espinosa, M. Arbelo, P. Castro, V. Martin, T. Gallardo, and A. Fernández, New Beaked Whale Mass Stranding in Canary Islands Associated with Naval Military Exercises (Majestic Eagle 2004) (2005) (poster presented at the European Cetacean Society Conference, La Rochelle, France, April 2005); A. Fernández, M. Méndez, E. Sierra, A. Godinho, P. Herráez, A. Espinosa de los Monteros, F. Rodríguez, F., and M. Arbelo, M., New Gas and Fat Embolic Pathology in Beaked Whales Stranded in the Canary Islands (2005) (poster presented at the European Cetaecan Society Conference, La Rochelle, France, April 2005).

[56] Id.

[57] A.A. Hohn, D.S. Rotstein, C.A. Harms, and B.L. Southall, Multispecies Mass Stranding of Pilot Whales (Globicephala macrorhynchus), Minke Whale (Balaenoptera acutorostrata), and Dwarf Sperm Whales (Kogia sima) in North Carolina on 15-16 January 2005 (2006) (NOAA Tech. Memo. NMFS-SEFSC-53).

[58] International Whaling Commission, Report of the Scientific Committee, Annex K at 28 (2006) (IWC/58/Rep1).

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Some preliminary observations can be drawn from these incidents. For example, beaked whales, a group of deep-water species that are seldom seen and may in some cases be extremely rare, seem to be particularly vulnerable to the effects of active sonar. A 2000 review undertaken by the Smithsonian Institution, and reported and expanded by the IWC's Scientific Committee and other bodies, supports this conclusion, finding that every mass stranding on record involving multiple species of beaked whales has occurred with naval activities in the vicinity.[59] Indeed, it is not even certain that some beaked whale species naturally strand in numbers.

But the full magnitude of sonar's effects on these species—or on other marine mammals—is not known. Most of the world lacks networks to identify and investigate stranding events, particularly those that involve individual animals spread out over long stretches of coastline, and therefore the mortalities that have been identified thus far are likely to represent only a subset of a substantially larger problem. For example, most beaked whale casualties (according to NMFS) are bound to go undocumented because of the remote siting of sonar exercises and the small chance that a dead or injured animal would actually strand.[60] It is well understood in terrestrial ecology that dead and dying animals tend to be grossly undercounted given their rapid assimilation into the environment, and one would of course expect profound difficulty where offshore marine species are concerned.[61]

Furthermore, although the physical process linking sonar to strandings is not perfectly understood, the record indicates that debilitating and very possibly lethal injuries are occurring in whales exposed to sonar at sea—only some of which may then strand. As first reported in the journal *Nature*, animals that came ashore during sonar exercises off the Canary Islands, in September 2002, had developed large emboli in their organ tissue and suffered from symptoms resembling those of severe decompression sickness, or "the bends."[62] It has been proposed that the panic led them to surface too rapidly or because it pushed them to dive before they could eliminate the nitrogen accumulated on previous descents, or because the sound itself precipitated the growth of nitrogen bubbles in the blood, which expanded to devastating effect. This finding has since been supported by follow-on papers, by

[59] Marine Mammal Program of the National Museum of Natural History, Historical Mass Mortalities of Ziphiids 2-4 (Apr. 6, 2000); see also 2 J. Cetacean Res. & Mgmt., Supp., Annex J at § 13.8 (2000) (report of the IWC Scientific Committee, Standing Working Group on Environmental Concerns).

[60] J.V. Carretta, K.A. Forney, M.M. Muto, J. Barlow, J. Baker, and M. Lowry, U.S. Pacific Marine Mammal Stock Assessments: 2006 (2007).

[61] See, e.g., G. Wobeser, Investigation and Management of Disease in Wild Animals 13-15 (1994); P.A. Alison, C.R. Smith, H. Kukert, J.W. Deming, B.A. Bennett, Deep-Water Taphonomy of Vertebrate Carcasses: A Whale Skeleton in the Bathyal Santa Catalina Basin, 17 Paleobiology 78-89 (1991).

[62] See P.D. Jepson, M. Arbelo, R. Deaville, I.A.P. Patterson, P. Castro, J.R. Baker, E. Degollada, H.M. Ross, P. Herráez, A.M. Pocknell, F. Rodríguez, F.E. Howie, A. Espinosa, R.J. Reid, J.R. Jaber, V. Martín, A.A. Cunningham, A. Fernández, Gas-Bubble Lesions in Stranded Cetaceans, 425 Nature 575-576 (2003); Fernández et al., 'Gas and Fat Embolic Syndrome', 42 Veterinary Pathology at 415.

30

For the SOCAL context, there are beaked whales with long-term residency in locations where the Navy has been training with sonar for decades. An in-depth discussion of stranding events was presented in the Draft EIS/OEIS in Section 2.4.3.1 of Appendix F. As discussed, not all beaked whale stranding events have been associated with naval activity. In SOCAL, there have been no known beaked whales strandings associated with the use of mid-frequency active sonar. While the absence of evidence does not prove there have been no affects on beaked whales, decades of history with no evidence of any impacts or strandings would seem to indicate that problems encountered in locations far from SOCAL involving beaked whales are location and context specific and do not apply in SOCAL waters.

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published work in other fields, and by expert reviews.[63] In any case, the evidence is considered "compelling" that acoustic trauma, or injuries resulting from behavioral responses, has in some way led to the deaths of many of these animals.[64]

In this light, the Navy's assessment of the risk of marine mammal injury and mortality is astonishingly poor. Despite the presence of several beaked whale species, including Cuvier's beaked whales, within the exercise area, the DEIS assumes away the potential for strandings and injuries of beaked whales.

In its analysis, the Navy capriciously (1) denies the potential for beaked whale mortalities during the myriad training and testing activities proposed for the SOCAL range; (2) dismisses the potential for sonar to injure whales at sea, grossly mischaracterizing the literature; (3) fails to consider the potential for strandings and mortalities in other species of cetaceans; (4) assumes that the Navy's failure to observe mortalities during past sonar training is probative of a lack of mortalities, despite the lack of any remotely adequate monitoring system; and (5) states (without basis) that the "main determinant of causing a stranding appears to be exposure in a narrow channel with no egress" (DEIS at 3.9-63), which the Navy then claims (without basis) could not occur on the SOCAL range. As we have previously noted, NMFS' own analysis is problematic primarily in its conclusions about the injury threshold and in its treatment of the potential for injury at sea (71 Fed. Reg. 20995, 21002), which do not reflect the best available science and violate NEPA. 42 C.F.R. § 1502.22 (requiring agencies to evaluate all "reasonably foreseeable" impacts).

3. Modeling of Acoustic Impacts

The Navy bases its calculation of marine mammal impacts on a series of models that determine received levels of sound within a limited distance of a sonar array and then estimate the number of animals that would therefore suffer injury or disruption. It is difficult to fully gauge the accuracy and rigor of these models with the limited information that the DEIS provides; but even from the description presented here, it is clear that they are deeply flawed. Among the non-conservative assumptions that are implicit in the model:

[63] Cox et al., Understanding the Impacts. For additional papers, see also the studies referenced at section II(A)(1)(a) ("Injury Threshold"). Of course it would be a mistake to assume that an animal must suffer bends-like injury or some other sort of acoustic trauma in order to strand. Some may die simply because the noise disorients them, for instance. See, e.g., NMFS, Assessment of Acoustic Exposures at 9-10.

[64] Cox et al., Understanding the Impacts; see also P.G.H. Evans and L.A. Miller, Concluding Remarks, in Proceedings of the Workshop on Active Sonar and Cetaceans 74 (2004); K.C. Balcomb and D.E. Claridge, A Mass Stranding of Cetaceans Caused by Naval Sonar in the Bahamas, 8(2) Bahamas Journal of Science 1 (2001); D.E. Claridge, Fine-Scale Distribution and Habitat Selection of Beaked Whales (2006) (M.Sc. thesis).

31

The Navy disagrees with each point of this comment. The Draft EIS/OEIS Section 2.4.2 of Appendix F included a thorough and complete assessment of marine mammal injury and mortality in relation to Navy sonar events. In addition, the Draft EIS/OEIS Section 2.4.3.1 of Appendix F provided an analysis of pertinent stranding events.

Nowhere in the analysis does the Navy make any capricious denials of potential for beaked whale mortalities. The Navy's analysis on this point is very thorough. The Navy does not dismiss the potential for sonar to injure whales at sea, but instead applies specific, credible, peer-reviewed studies in its analysis. All species of cetaceans present in SOCAL are considered throughout the analysis. The Navy realizes that the lack of reported mortalities by any of the numerous vessels—recreational, commercial, and military—operating in SOCAL does not by itself prove a lack of mortalities. However, this, when combined with best available scientific studies, and growing populations of many of the species of concern, points to the conclusion reached by the Navy. A review of past stranding events associated with sonar suggest that the potential factors that may contribute to a stranding event are steep bathymetry changes, narrow channels, multiple sonar ships, surface ducting and the presence of beaked whales that may be more susceptible to sonar exposures. As explained in Appendix F of the SOCAL Draft EIS/OEIS (p. 144), the most important factors appear to be the presence of a narrow channel that may prevent animals from avoiding sonar exposure and multiple sonar ships within that channel. There are no narrow channels (less than 35 nm wide and 10 nm in length) in the SOCAL Range Complex and the ships would be spread out over a wider area allowing animals to move away from sonar activities if they choose.

32

(In response to sentence in last paragraph starting with: It is difficult to fully…) The Draft EIS/OEIS sonar acoustic analysis used a risk function methodology provided by NMFS for the Navy. Data from the Haro Strait incident, the only data set available of the behavioral responses of wild, non-captive animal upon exposure to the AN/SQS-53 MFA sonar, were incorporated into this risk function. The Navy has used the best available scientific data in this analysis.

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(1) As discussed above, the thresholds established for injury, hearing loss, and significant behavioral change are inconsistent with the available data and are based, in part, on assumptions not acceptable within the field.

(2) The Navy does not properly account for reasonably foreseeable reverberation effects (as in the Haro Strait incident),[65] giving no indication that its modeling sufficiently represents areas in which the risk of reverberation is greatest;

(3) The model fails to consider the possible synergistic effects of using multiple sources, such as ship-based sonars, in the same exercise, which can significantly alter the sound field, and fails to consider the combined effects of multiple exercises, which, as NMFS indicates, may have played a role in the 2004 Hanalei Bay strandings;[66]

(4) In assuming animals are evenly distributed, the model completely fails to consider the magnifying effects of social structure, whereby impacts on a single animal within a pod, herd, or other unit may affect the entire group; and[67]

(5) The model, in assuming that every whale encountered during subsequent exercises is essentially a new whale, does not address cumulative impacts on the breeding, feeding, and other activities of species and stocks.

In addition, the Navy's analysis of marine mammal distribution, abundance, population structure, and ecology contains false or misleading assumptions that tend both to underestimate cumulative impacts on California species and to impede consideration of reasonable alternatives and mitigation measures. For example:

(1) Abundance modeling in discrete areas: The DEIS does not account for the frequency of sightings of marine mammal species in certain discrete areas, such as Cortes and Tanner Banks. See DEIS at F-90 to F-105. Blue and fin whales, common and Pacific white-sided dolphins, and California sea lions are frequently seen near and around these features, particularly in the warm-water months. While the DEIS notes the limitations of assuming uniform distribution and generally comments on habitat elements that may attract animals (e.g., greater prey abundance, lower predation), it then ignores the clumping that clearly manifests in the Appendix F figures. Given these actual distribution patterns, seasonal avoidance of these areas could reduce acoustic exposures for many species during exercises, but there is no attempt in the DEIS to address this possibility.

[65] NMFS, Assessment of Acoustic Exposures on Marine Mammals in Conjunction with USS Shoup Active Sonar Transmissions in the Eastern Strait of Juan de Fuca and Haro Strait, Washington, 5 May 2003 (2005).

[66] Southall et al., Hawaii Melon-Headed Whale at 31, 45.

[67] The effects of this deficiency are substantially increased by the Navy's use of a risk function, rather than an absolute threshold, to estimate Level B harassment.

(Continued from above)

32 The acoustic modeling does take into effect multiple ships using MFAS (see the Draft EIS/OEIS Section 3.16.7 of Appendix F).

33 The modeling undertaken does so, as explained in the Draft EIS/OEIS, Appendix F, based on marine mammal densities evenly distributed over the entire area of potential effect. This is conservative since the tendency is to overestimate effects given that marine mammals appearing in pods will be easier to detect and therefore be avoided by use of the Navy's standard operating procedures serving as mitigation measures.

34 The sample sizes available from systematic survey data are too small to estimate seasonal marine mammal densities for stratified geographic regions such as the Cortes and Tanner Banks; any estimates would have extremely high associated uncertainty. The acoustic analysis is dependent on quantitative density estimates and therefore must be based on densities estimated for larger geographic areas. Plotted sightings such as those shown in Appendix F don't incorporate survey effort and related sighting probability functions and cannot be used alone as indications of "actual" distribution patterns. The high number of sightings in these areas is indicative of the greater presence of human activity in these areas, not necessarily of a higher density of marine mammals.

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(2) Conflation of marine mammal densities: Although the SOCAL range complex comprises some 120,000 nm^2 of ocean, the Navy presents its density (and take) estimates in a single set of charts that conflate marine mammal abundance (and expected impacts) across a diversity of habitat. These results do not meaningfully reflect the Navy's Marine Resources Assessment for the SOCAL Range Complex (as summarized in the Navy's 2007 environmental assessment for major SOCAL exercises), which found significant differences in marine mammal densities across waters of varying depths and between large blocks studied by NMFS' Southwest Fisheries Science Center.[68] For example, the Navy does not appear even to consider densities south of 30ºN, even though the range extends well south of that line and even though densities there are considerably lower, on average, than those to the north. By conflating these data—and by failing to present other data on the habitat preferences of particular species, also contained in its Marine Resources Assessment and summarized in its 2007 environmental assessment—the Navy has not only precluded its own analysis of geographic alternatives, but has prevented the public from understanding a critical element of its decision-making, contrary to NEPA.

35

The marine mammal densities used in the modeling for the SOCAL Draft EIS/OEIS were prepared by the NMFS – South West Fisheries Science Center. The NMFS biologists have conducted several surveys in the Southern California area and are at the forefront of marine mammal density estimation methodologies.

The sample sizes available from systematic survey data are too small to estimate seasonal marine mammal densities for stratified geographic regions; any estimates would have extremely high associated uncertainty. The acoustic analysis is dependent on quantitative density estimates and therefore must be based on densities estimated for larger geographic areas.

(3) Population estimates: The DEIS uses a mix of sources for its population estimates for marine mammal species, including recent publications from Southwest Fisheries Science Center and entries from the U.S. Pacific Stock Assessment Report available at the time the DEIS was being written. We believe the DEIS should use the most conservative population estimate available from any of its sources (which is usually, but not always, the minimum population estimate provided in NMFS' Stock Assessment Reports); but at the very least it should incorporate information from the 2007 Stock Assessment Report (NOAA-TM-NMFS-SWFSC-414), which contains updates on several species whose assessments had not been revised in years. As noted below, it also indicates abundances for several populations that are significantly smaller—and thus imply smaller levels of potential biological removal—than the DEIS suggests.

36

The final stock assessment report for 2007 was published in April 2008 at the same time as the Draft EIS/OEIS was publicly distributed; therefore, it was too late to incorporate the information. The FEIS/OEIS has been revised to reflect the more recent information.

(4) Blue whales: The DEIS makes several significant errors in its analysis of the blue whale population off southern California—the densest and largest aggregation of endangered blue whales in the world. First, it uses an outdated abundance estimate for the eastern north Pacific population, relying on NMFS' 2006 stock assessments, which assume 550 more animals than are projected by the most recent 2007 stock assessment (1,744 versus 1,186). Second, it assumes that blue whale densities are uniform across the seasons, even though, as it notes elsewhere, the animals are hardly present on the range during the cold-water months. (The error matters, of course, not only for the Navy's estimates of takes, but for its consideration of seasonal mitigation.) Finally, it asserts that eastern north Pacific blue whales have been increasing "during the past two

[68] Navy, Joint Task Force Exercises and Composite Training Unit Exercises Environmental Assessment/ Overseas Environmental Assessment A-13 to A-14 (2007).

37

The final stock assessment report for 2007 was published in April 2008 at the same time as the Draft EIS/OEIS was publicly distributed; therefore, it was too late to incorporate the information. The FEIS/OEIS has been revised to reflect the more recent information. The Draft EIS/OEIS also provides the latest survey results of 842 blue whales in Southern California (Barlow and Forney 2007).

The modeling takes in to account the seasonal migrations of baleen whales and therefore the exposure numbers reflect the presence or absence (reduced number) of those species during the appropriate season.

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decades" while citing only three references, all from the early to mid-1990s; more recent estimates are more equivocal about the abundance trends in this population and, moreover, do not account for recent patterns of mortality and morbidity (as, for example, the pattern of deaths related to vessel collisions off California).

37

(Continued from above) The NMFS 2007 Stock Assessment Report stated that "There is some indication that blue whales increased in abundance in California coastal waters between 1979/80 and 1991 (regression p<0.05, Barlow 1994) and between 1991 and 1996 (not significant, Barlow 1997)." and "Estimates from line transect surveys declined between 1991-2005 (Figure 2), which is probably due to interannual variability in the fraction of the population that utilizes California waters during the summer and autumn."

(5) <u>Sei whales</u>: NMFS' 2007 Stock Assessment Report provides a lower abundance estimate for eastern north Pacific sei whales (43 individuals, with a minimum of 27) than the DEIS assumes (56 individuals). Given this very small number, the latest report allows that fewer than one sei whale can be removed each year without compromising the stock's ability to attain or maintain its optimal sustainable population; indeed, given a 2003 ship-strike, the stock assessment clarifies that anthropogenic take has exceeded the level of potential biological removal for the population. The DEIS' use of minke whale data as a proxy for sei whale distribution is almost certainly ill-advised, given *inter alia* the considerable size difference between the species.

38

The final stock assessment report for 2007 was published in April 2008 at the same time as the Draft EIS/OEIS was publicly distributed; therefore, it was too late to incorporate the information. The FEIS/OEIS has been revised to reflect the more recent information. The Draft EIS/OEIS also provides the latest survey results of 842 blue whales in Southern California (Barlow and Forney 2007).

The SOCAL Draft EIS/OEIS did not use the minke whale or any other species as a proxy for sei whale abundance. The minke whale was considered in approximating dive depths and times for sei and Bryde's whales.

(6) <u>Gray whales</u>: The DEIS inappropriately cites an outdated estimate that significantly undercounts the number of animals remaining in the California gray whale population. The estimate it uses, which it mistakenly credits to NMFS' 2006 Stock Assessment Report for the Alaska region (and which has not been adopted by NMFS since 2002), assumes that the gray whale population is about 50% higher than calculated in the latest Alaska report (or 26,635 versus the report's 18,178 animals). We further note that the DEIS does not discuss other "human impacts" on this species—such as the unusual mortality event that occurred in 1999-2000 or the on-going concern with "skinny" and "stinky" whales, as reported out of the Scientific Committee of the International Whaling Commission and summarized in the 2007 Alaska Stock Assessment Report. In all, there remains significant concern over the status and health of this population, which, according to the best available scientific evidence, is substantially smaller than the Navy suggests.

39

The final stock assessment report for 2007 was published in April 2008 at the same time as the Draft EIS/OEIS was publicly distributed; therefore, it was too late to incorporate the information. The FEIS/OEIS has been revised to reflect the more recent information. The Draft EIS/OEIS also provides the latest survey results of 842 blue whales in Southern California (Barlow and Forney 2007).

The 2007 Alaska stock Assessment Report stated that the "skinny whales" was an acute situation as they were not seen in 2001). There are anecdotal reports that emaciated gray whales are showing up again in the calving lagoons of Mexico. Although some feeding occurs during the migration through SOCAL, most feeding occurs around Alaska, therefore, activities in SOCAL would not impact the foraging abilities of gray whales.

(7) <u>Sperm whales</u>: The DEIS appears to provide no discussion of sperm whales south of 30°N, even though NMFS' recent stock assessments, reflecting work by the Southwest Fisheries Science Center, describe a sperm whale stock off the west coast of Baja California, with a population abundance of 1,640 animals.

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The 30°N line is at the southern end of the SOCAL Range Complex therefore the sperm whale stock is outside of the SOCAL Range Complex. The marine mammal densities used in the modeling were prepared by NMFS-SWFSC.

(8) <u>Baird's beaked whales</u>: The population estimate cited in the DEIS, which—as with certain other species, is mistakenly credited to NMFS' 2006 Stock Assessment Report for the Pacific Region—runs more than three times higher than the latest abundance figures for Baird's beaked whales (1,005 versus 313 animals). Due to the small number of beaked whales in this stock, NMFS believes that only 2 individuals can be lost through anthropogenic take without compromising its optimal sustainable population.

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The population estimate is cited as Barlow and Forney 2007 not the NMFS 2006 Stock Assessment Report. The 1005 is correct for the Barlow and Forney 2007 paper.

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(9) Sea otters: The information provided in the DEIS on the southern sea otter is extremely outdated. The studies it references date, for the most part, from the mid 1990s or earlier, although much has changed in this population in the decade and a half since. For example, the most recent abundance information provided in the DEIS (running up to 1994) suggests the population is increasing; in fact the population appeared to significantly decrease over the following four years.[69]

42

The spring 2007 sea otter count of 3,026 sea otters with a 12.4% increase over 2006 was provided in the Draft EIS/OEIS. http://www.usgs.gov/newsroom/article.asp?ID=1686. Information from 2006 and 2007 was provided on the distribution of sea otters in California.

4. Other Impacts on Marine Mammals

As the Navy's conceptual impact model suggests, the training and testing activities proposed for the SOCAL Range Complex can have impacts that are not limited to the overt physiological and behavioral effects of ocean noise. Unfortunately, the Navy's analysis of most of these other impacts is cursory and inadequate.

(1) The Navy fails to adequately assess the impact of "stress" on marine mammals, a serious problem for animals exposed even to moderate levels of sound for extended periods.[70] As the Navy has previously observed, stress from ocean noise—alone or in combination with other stressors, such as biotoxins—may weaken a cetacean's immune system, making it "more vulnerable to parasites and diseases that normally would not be fatal."[71] And one might add, following studies on terrestrial mammals, that chronic noise can interfere with brain development, increase the risk of myocardial infarctions, depress reproductive rates, cause malformations and other defects in young—all at moderate levels of exposure.[72] Because physiological stress responses are highly conservative across species, it is reasonable to assume that marine mammals would be subject to the same effects, particularly—as appears to be the case here—if they are resident animals exposed repeatedly to a variety of

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There are no data regarding increased stress on marine mammals as a result of sonar. A discussion of potential effects of stress were presented in the Draft EIS/OEIS, Section 3.9.7.1.2 and Section 3.18 in Appendix F. In general, studies on high levels of continuous noise effects on terrestrial species cannot be correlated with marine mammal species in the ocean exposed to intermittent and temporary exposure to relatively low sound pressure levels.

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[69] See U.S. Fish and Wildlife Service, Final Revised Recovery Plan for the Southern Sea Otter (Enhydra lutris nereis) (2003).

[70] See National Research Council, Ocean Noise and Marine Mammals.

[71] Navy, Hawaii Range Complex Draft Environmental Impact Statement/ Overseas Environmental Impact Statement at 5-19 to 5-20 (2007). Additional evidence relevant to the problem of stress in marine mammals is summarized in A.J. Wright, N. Aguilar Soto, A.L. Baldwin, M. Bateson, C.M. Beale, C.Clark, T. Deak, E.F. Edwards, A. Fernández, A. Godinho, L. Hatch, A. Kakuschke, D. Lusseau, D. Martineau, L.M. Romero, L. Weilgart, B. Wintle, G. Notarbartolo di Sciara, and V. Martin, "Do marine mammals experience stress related to anthropogenic noise?" (in press and forthcoming 2008); see also T.A. Romano, M.J. Keogh, C. Kelly, P. Feng, L. Berk, C.E. Schlundt, D.A. Carder, and J.J. Finneran, Anthropogenic Sound and Marine Mammal Health: Measures of the Nervous and Immune Systems Before and After Intense Sound Exposure, 61 Canadian Journal of Fisheries and Aquatic Sciences 1124, 1130-31 (2004).

[72] See, e.g., E.F. Chang and M.M. Merzenich, Environmental Noise Retards Auditory Cortical Development, 300 Science 498 (2003) (rats); S.N. Willich, K. Wegscheider, M. Stallmann, and T. Keil, Noise Burden and the Risk of Myocardial Infarction, European Heart Journal (2005) (Nov. 24, 2005) (humans); F.H. Harrington and A.M. Veitch, Calving Success of Woodland Caribou Exposed to Low-Level Jet Fighter Overflights, 45 Arctic vol. 213 (1992) (caribou).

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stressors in the SOCAL Range Complex. Yet despite the potential for stress in marine mammals and the significant consequences that can flow from it, the Navy assumes that such effects would be minimal. We note that substantial work on noise-related "stress" in marine mammals is shortly to be published, and we strongly encourage the Navy to revise its DEIS accordingly.

(2) The Navy fails to consider the risk of ship collisions with large cetaceans, as exacerbated by the use of active acoustics. As noted below, right whales have been shown to engage in dramatic surfacing behavior, increasing their vulnerability to ship strikes, on exposure to mid-frequency alarms above 133 dB re 1 μPa (SPL)—a level of sound that can occur many tens of miles away from the sonar systems slated for the range.[73] It should be assumed that other large whales (which, as the DEIS repeatedly notes, are already highly susceptible to vessel collisions) are subject to the same hazard.

(3) In the course of its activities, the Navy would release a host of toxic chemicals into the marine environment that could pose a threat to local wildlife over the life of the range. Nonetheless, while there is some brief discussion of potential impacts on human health and safety, the DEIS generally fails to consider the cumulative impacts of these toxins on marine mammals, from past, current, and proposed exercises. Careful study is needed into the way they might disperse and circulate around the islands and how they may affect marine wildlife. The Navy's analysis of hazardous materials is therefore incomplete.

(4) Finally, the Navy's analysis cannot be limited only to direct effects, i.e., effects that occur at the same time and place as the exercises that would be authorized. See id. § 1508.8(a). It must also take into account the activity's indirect effects, which, though reasonably foreseeable (as the DEIS acknowledges), may occur later in time or at a farther remove. See id. § 1508.8(b). This requirement is particularly critical in the present case given the potential of sonar exercises to cause significant long-term impacts not clearly observable in the short or immediate term (a serious problem, as the National Research Council has observed).[74] Thus, for example, the Navy must not only evaluate the potential for mother-calf separation but also the potential for indirect effects—on survivability—that might arise from that transient change. 42 C.F.R. § 1502.16(b).

B. Impacts on Fish and Fisheries

[73] Nowacek et al., North Atlantic Right Whales, 271 Proceedings of the Royal Society of London, Part B: Biological Sciences at 227.

[74] "Even transient behavioral changes have the potential to separate mother-offspring pairs and lead to death of the young, although it has been difficult to confirm the death of the young." National Research Council, Ocean Noise and Marine Mammals at 96.

43 See response above

44 Ship strikes were discussed in the Draft EIS/OEIS, Section 3.9.9.1.1 and Section 2.4.2.2 in Appendix F. Results of the research by Nowacek et al (2004) where right whales reacted to an "alert stimuli", used a sound source that has almost no correlation to MFA sonar. The result of that study were, however, used to develop the risk function from which the quantification of predicted exposures was derived.

45 Past expenditures are part of the baseline environmental conditions described in Chapter 3.0 of the Draft EIS/OEIS. The Draft EIS/OEIS evaluated the proposed future expenditure and environmental fate of a variety of training materials. Both qualitative and quantitative assessments of these expenditures conclude that their effects on water quality and bottom sediments, and on the biota that inhabit these environments, would be negligible. A cumulative impact is the sum of the Proposed Action's effects and the effects of other projects. Thus, while the combined ocean discharges of wastewater treatment plants, urban runoff, marine vessels, and other sources may result in unhealthful concentrations of marine pollutants, the Navy's expended training materials would not contribute to that impact. The EIS/OEIS addresses this issue accordingly.

46 *(In response to 4th paragraph starting: (4) Finally, the Navy's analysis….)* Assessment of indirect effects of the Proposed Action was provided in Chapter 3 of the Draft EIS/OEIS. There are no quantified indirect effects identified. In addition, as described in this analysis, the training activities being analyzed have been occurring in SOCAL waters using the same equipment for many decades. It is not, therefore, reasonably foreseeable that there are significant long-term effects from the continuation of training by the Navy.

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Though the architecture of their ears may differ, fish are equipped, like all vertebrates, with thousands of sensory hair cells that vibrate with sound; and a number of specialized organs like the abdominal sac, called a "swim bladder," that some species possess can boost hearing. Fish use sound in many of the ways that marine mammals do: to communicate, defend territory, avoid predators, and, in some cases, locate prey.[75]

One series of recent studies showed that passing airguns can severely damage the hair cells of fish (the organs at the root of audition) either by literally ripping them from their base in the ear or by causing them to "explode."[76] Fish, unlike mammals, are thought to regenerate hair cells, but the pink snapper in these studies did not appear to recover within approximately two months after exposure, leading researchers to conclude that the damage was permanent.[77] It is not clear which elements of the sound wave contributed to the injury, or whether repetitive exposures at low amplitudes or a few exposures at higher pressures, or both, were responsible.[78] As with marine mammals, sound has also been shown to induce temporary hearing loss in fish. Even at fairly moderate levels, noise from outboard motor engines is capable of temporarily deafening some species of fish, and other sounds have been shown to affect the short-term hearing of a number of other species, including sunfish and tilapia.[79] For any fish that is dependent on sound for predator avoidance and other key functions, even a temporary loss of hearing (let alone the virtually permanent damage seen in snapper) will substantially diminish its chance of survival.[80]

Nor is hearing loss the only effect that ocean noise can have on fish. For years, fisheries in various parts of the world have complained about declines in their catch after intense acoustic activities (including naval exercises) moved into the area, suggesting that noise is seriously altering the behavior of some commercial

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[75] See, e.g., A.N. Popper, Effects of Anthropogenic Sounds on Fishes, 28(10) Fisheries 26-27 (2003); M.C. Hastings & A.N. Popper, Effects of Sound on Fish 19 (2005) (Report to the California Department of Transportation, Contract No. 43A0139), p., 19; D.A. Croll, Marine Vertebrates and Low Frequency Sound—Technical Report for LFA EIS 1-90 (1999).

[76] R. McCauley, J. Fewtrell, and A.N. Popper, High Intensity Anthropogenic Sound Damages Fish Ears, 113 Journal of the Acoustical Society of America 640 (2003).

[77] Id. at 641 (some fish in the experimental group sacrificed and examined 58 days after exposure).

[78] Id.

[79] A.R. Scholik and H.Y. Yan, Effects of Boat Engine Noise on the Auditory Sensitivity of the Fathead Minnow, Pimephales promelas, 63 Environmental Biology of Fishes 203-09 (2002); A.R. Scholik and H.Y. Yan, The Effects of Noise on the Auditory Sensitivity of the Bluegill Sunfish, Lepomis macrochirus, 133 Comparative Biochemisty and Physiology Part A at 43-52 (2002); M.E. Smith, A.S. Kane, & A.N. Popper, Noise-Induced Stress Response and Hearing Loss in Goldfish (Carassius auratus), 207 Journal of Experimental Biology 427-35 (2003); Popper, Effects of Anthropogenic Sounds at 28.

[80] See Popper, Effects of Anthropogenic Sounds at 29; McCauley et al., High Intensity Anthropogenic Sound Damages Fish Ears, at 641.

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species.[81] A group of Norwegian scientists attempted to document these declines in a Barents Sea fishery and found that catch rates of haddock and cod (the latter known for its particular sensitivity to low-frequency sound) plummeted in the vicinity of an airgun survey across a 1600-square-mile area, an area three times the size of the proposed USWTR range and larger than the state of Rhode Island; in another experiment, catch rates of rockfish were similarly shown to decline.[82] Drops in catch rates in these experiments range from 40 to 80 percent.[83] A variety of other species, herring, zebrafish, pink snapper, and juvenile Atlantic salmon, have been observed to react to various noise sources with acute alarm.[84]

In their comments on the Navy's DEIS for the proposed Undersea Warfare Training Range, off North Carolina, several fishermen and groups of fishermen independently reported witnessing sharp declines in catch rates of various species when in the vicinity of Navy exercises.[85] These reports are indicative of behavioral changes, such as a spatial redistribution of fish within the water column, that could affect marine mammal foraging as well as human fisheries. In addition, as NMFS itself has observed, the use of mid-frequency sonar could affect the breeding behavior of certain species, causing them, for example, to cease their spawning choruses, much as certain echolocation signals do.[86] The repetitive use of sonar and other active acoustics could have significant adverse behavioral effects on some species of fish and those who depend on them.

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[81] See "'Noisy' Royal Navy Sonar Blamed for Falling Catches," Western Morning News, Apr. 22, 2002 (sonar off the U.K.); Percy J. Hayne, President of Gulf Nova Scotia Fleet Planning Board, "Coexistence of the Fishery & Petroleum Industries," www.elements.nb.ca/theme/fuels/percy/hayne.htm (accessed May 15, 2005) (airguns off Cape Breton); R.D. McCauley, J. Fewtrell, A.J. Duncan, C. Jenner, M.-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, and K. McCabe, Marine Seismic Surveys: Analysis and Propagation of Air-Gun Signals, and Effects of Air-Gun Exposure on Humpback Whales, Sea Turtles, Fishes, and Squid 185 (2000) (airguns in general).

[82] A. Engås, S. Løkkeborg, E. Ona, and A.V. Soldal, Effects of Seismic Shooting on Local Abundance and Catch Rates of Cod (Gadus morhua) and Haddock (Melanogrammus aeglefinus), 53 Canadian Journal of Fisheries and Aquatic Sciences 2238-49 (1996); J.R. Skalski, W.H. Pearson, and C.I. Malme, Effects of Sound from a Geophysical Survey Device on Catch-Per-Unit-Effort in a Hook-and-Line Fishery for Rockfish (Sebastes spp.), 49 Canadian Journal of Fisheries and Aquatic Sciences 1357-65 (1992). See also S. Løkkeborg and A.V. Soldal, The Influence of Seismic Exploration with Airguns on Cod (Gadus morhua) Behaviour and Catch Rates, 196 ICES Marine Science Symposium 62-67 (1993).

[83] Id.

[84] See J.H.S. Blaxter and R.S. Batty, The Development of Startle Responses in Herring Larvae, 65 Journal of the Marine Biological Association of the U.K. 737-50 (1985); F.R. Knudsen, P.S. Enger, and O. Sand, Awareness Reactions and Avoidance Responses to Sound in Juvenile Atlantic Salmon, Salmo salar L., 40 Journal of Fish Biology 523-34 (1992); McCauley et al., Marine Seismic Surveys at 126-61.

[85] See comments compiled by the Navy and posted on the Undersea Warfare Training Range EIS site, projects.earthtech.com/USWTR (e.g., comments of S. Draughon, S. Fromer, L. and F. Gromadzki, D. Pendergrast, and North Carolina Watermen United).

[86] Letter from Miles M. Croom, NMFS Southeast Regional Office, to Keith Jenkins, Navy (Jan. 31, 2006); see also J.J. Luczkovich, "Potential Impacts of the U.S. Navy's Proposed Undersea Warfare Training Range on Fishes" (2006) (presentation to Navy).

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Finally, high mortalities from noise exposure are seen in developmental stages of fish. A number of studies, including one on non-impulsive noise, show that intense sound can kill eggs, larvae, and fry outright or retard their growth in ways that may hinder their survival later.[87] Significant mortality for fish eggs has been shown to occur at distances of 5 meters from an airgun source; mortality rates approaching 50 percent affected yolksac larvae at distances of 2 to 3 meters.[88] Also, larvae in at least some species are known to use sound in selecting and orienting toward settlement sites.[89] Acoustic disruption at that stage of development could have significant consequences.[90]

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The Navy capriciously dismisses the potential for significant adverse impacts on fish. First, while admitting that mid-frequency sonar can cause significant injury at distances of hundreds of feet, and having noted (with reference to Norwegian studies) that "some sonar levels have been shown to be powerful enough to cause injury to particular size classes of juvenile herring from the water's surface to the seafloor" (DEIS at 3.7-66 to 3.7-67), and even though the Navy will be operating at higher source levels than those used in the Norwegian studies (DEIS at 3.7-66), the Navy claims that SOCAL fish populations would not suffer significant impacts. For this conclusion, it notes only that levels of mortality in Norway were considered small relative to natural daily mortality rates (id.)—a conclusion that fails to take into account the Navy's higher source levels, the specific ecology of California fish populations, the potential for cumulative effects, and the differential impacts that activities in spawning areas may have.

Second, while admitting that mid-frequency noise can alter behavior, the DEIS argues that fish are less responsive to mid-frequency than to low- and high-frequency sounds and therefore would not experience significant behavioral impacts from mid-frequency sonar. DEIS at 3.7-67. The Navy cites no studies for this proposition, though it earlier discusses two studies on mid-frequency acoustic deterrent devices, or "pingers": a technology used in some American fisheries to ward harbor porpoises and certain other marine mammals away from gillnets. DEIS at 3.7-54. Not only do the deterrents featured in the two papers operate at a source

[87] See, e.g., C. Booman, J. Dalen, H. Leivestad, A. Levsen, T. van der Meeren, and K. Toklum, Effecter av luftkanonskyting på egg, larver og yngel (Effects from Airgun Shooting on Eggs, Larvae, and Fry), 3 Fisken og Havet 1-83 (1996) (Norwegian with English summary); J. Dalen and G.M. Knutsen, Scaring Effects on Fish and Harmful Effects on Eggs, Larvae and Fry by Offshore Seismic Explorations, in H.M. Merklinger, Progress in Underwater Acoustics 93-102 (1987); A. Banner and M. Hyatt, Effects of Noise on Eggs and Larvae of Two Estuarine Fishes, 1 Transactions of the American Fisheries Society 134-36 (1973); L.P. Kostyuchenko, Effect of Elastic Waves Generated in Marine Seismic Prospecting on Fish Eggs on the Black Sea, 9 Hydrobiology Journal 45-48 (1973).

[88] Booman et al., Effecter av luftkanonskyting på egg, larver og yngel at 1-83.

[89] S.D. Simpson, M. Meekan, J. Montgomery, R. McCauley, R., and A. Jeffs, Homeward Sound, 308 Science 221 (2005).

[90] Popper, Effects of Anthropogenic Sounds at 27.

The Draft EIS/OEIS included new findings by Popper et al.(2007) who exposed rainbow trout, a fish sensitive to low frequencies, to high-intensity low-frequency sonar (215 dB re 1 µPa2 170-320 Hz) with receive level for two experimental groups estimated at 193 dB for 324 or 648 seconds. Fish exhibited a slight behavioral reaction, and one group exhibited a 20-dB auditory threshold shift at one frequency. No direct mortality, morphological changes, or physical trauma was noted as a result of these exposures. While low-frequency sonar is not included in the Proposed Action, these results of low-frequency sonar effects on low-frequency sensitive rainbow trout are encouraging in that similar results may be found with mid-frequency active sonar use when applied to mid-frequency sensitive fish.

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level literally billions of times less intense (130 dB versus 235 dB re 1 μPa); but, in at least one of the studies, it actually altered the behavior of the fish, drawing them into the gillnet for reasons that are not explored.[91] Further, the Navy dismisses a clearly relevant study of dolphin sounds and their impact on silver perch mating signals—a study that NMFS and state regulators have cited as reason for concern. DEIS at 3.7-55.

The Navy must rigorously analyze the potential for behavioral, auditory, and physiological impacts on fish, including the potential for population-level effects, using models of fish distribution and population structure and conservatively estimating areas of impact from the available literature. 42 C.F.R. § 1502.22. It must also provide appropriate mitigation measures, such as avoidance of spawning grounds and of important habitat for fish species, especially hearing specialists. Notably, as with marine mammals and sea turtles, the Navy does not consider exclusion of important fish habitat on the SOCAL range, even though it passingly identifies a number of areas with high levels of catch—such as the Tanner and Cortes Banks. DEIS at 3.7-15.

Having concluded—without basis—that mid-frequency sonar would have no significant impact on fish and fish habitat, the Navy dismisses the notion that fisheries in the area would suffer economic loss (DEIS at 3.14-1 to 3.14-9), even though (judging by the comments from fishermen on the Navy's USWTR range) its activities appear to have disrupted fishing in the past. But, just as with the North Carolina range, the available evidence underscores the need for a more serious and informed analysis than the DEIS currently provides. The Navy must meaningfully assess the economic consequences of reduced catch rates on commercial and recreational fisheries and on marine mammal foraging in the SOCAL Range Complex.[92]

[91] B.M. Culik, S. Koschinski, N. Tregenza, and G.M. Ellis, Reactions of Harbor Porpoises Phocoena phocoena and Herring Clupea harengus to Acoustic Alarms, 211 Marine Ecology Progress Series 255, 258 (2001).

[92] Sea turtles are also effectively excluded from further analysis of acoustic impacts on the grounds that their best hearing range appears to occur below 1 kHz. DEIS at 3.8-15. But having their best acoustic sensitivity in this range does not mean that sea turtles are oblivious to noise at higher frequencies. Juvenile loggerheads, for example, have their best sensitivity at frequencies all the way up to 1 kHz, suggesting that they continue to detect sounds at higher levels, including potentially the lower end of the intense mid-frequency sources intended for the range. S.M. Bartol, J.A. Musick, and M. Lenhardt, Auditory Evoked Potentials of the Loggerhead Sea Turtle (Caretta caretta), 99 Copeia 836 (1999). Furthermore, they have been shown to engage in startle and escape behavior—behavior that may involve diving and surfacing—and to experience heightened stress in response to vessel noise, which receives no discussion in the DEIS. National Research Council, The Decline of Sea Turtles: Causes and Prevention (1990). Given these findings, and given that all of the sea turtles on the proposed sites belong to endangered or threatened populations, a more rigorous and conservative analysis of potential acoustic impacts is necessary, and areas of particular importance to sea turtles should be taken into consideration in the Navy's alternatives analysis.

47 See response above

48 Reduced catch rates and any associated economic effects are not anticipated. The potential effects on fish from sonar will be negligible as most fish hear below the range of mid-frequency active sonar. Although some fishes may detect sonar, they will likely not respond to it, and it will not affect their hearing. A discussion of sonar and its effects on fishes was provided in the Draft EIS/OEIS, Section 3.7.2.1.1.

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C. Other Impacts on Marine Wildlife

The Navy's current and proposed activities pose risks to marine wildlife beyond ocean noise: injury or death from collisions with ships, bioaccumulation of toxins, and the like. Indeed, many of the same concerns that apply to marine mammals (and are discussed above) apply to fish, sea turtles, and other biota as well. The Navy must adequately evaluate impacts and propose mitigation for each category of harm. 42 C.F.R. §§ 1502.14, 1502.16.

D. Cumulative Impacts

In order to satisfy NEPA, an EIS must include a "full and fair discussion of significant environmental impacts." 40 C.F.R. § 1502.1. It is not enough, for purposes of this discussion, to consider the proposed action in isolation, divorced from other public and private activities that impinge on the same resource; rather, it is incumbent on the Navy to assess cumulative impacts as well, including the "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future significant actions." Id. § 1508.7. Thus, for example, it is necessary to consider the impacts of the proposed exercise alongside those of other activities in the region, including industrial and commercial activities such as fishing, shipping, and coastal development.

As it stands, the Navy says little more than that all of the impacts from its thousands of annual hours of activity would necessarily be "temporary" in nature and therefore would not affect vital rates in individuals or populations. DEIS at 3.9-79, 4-27. The Navy also offers the bromide that mitigation will "minimize" impacts from naval activities and thus, presumably, preclude any significant cumulative effects. DEIS at 4-27. Not only are both statements factually insupportable given the lack of any population analysis or quantitative assessment of long-term effects in the document, the actual results of its mitigation efforts (as captured in its after-action reports for SOCAL major exercises), and the numerous errors in the Navy's thresholds and modeling, discussed above)—but they misapprehend the definition of "cumulative impact," which, according to NEPA's regulations, "can result from individually minor but collectively significant actions taking place over a period of time." 42 C.F.R. § 1508.7.

More particularly, the Navy assumes—capriciously, for the reasons discussed above—that its thousands of hours of sonar activities will not result in the serious injury or death of even a single animal. DEIS at 3.9-74. It simply assumes that all behavioral impacts are short-term in nature and cannot affect individuals or populations through repeated activity—even though the 112,000 annual takes anticipated even under its specious modeling would affect the same California populations (and, indeed, would involve extensive use of many of the same areas, such as the San Clemente Island Range Complex and Tanner and Cortes Banks). And, while it states that behavioral harassment (aside from those caused by masking effects) involves a stress response that may contribute to an animal's allostatic load (DEIS at 3.9-36), it assumes without further analysis that any such impacts would be insignificant. See id.

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Each of these activities was adequately evaluated throughout the Draft EIS/OEIS including the following sections: 3.3.4.1.1, 3.6.2.3.1, 3.8.1.2.2, 3.8.2.2.3, 3.8.2.3.3, 3.8.2.4.3, 3.8.2.4.4, 3.9.9.1.1, 3.9.10.1.2, 3.10.2.2.1, 4.3.9, Appendix E (various), and Appendix F (2.4.2.1, 2.4.2.2).

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(In response to the sentence in the 2nd paragraph stating: Thus, for example, it is …) The Navy does consider its activities alongside those of other activities in the region. As an example, long-range advance notice of scheduled operations times are made available to the public and the commercial fishing community via the internet, and the Navy reports their latest operations schedules to the appropriate agency to make the schedule available to the public through Notice to Airmen (NOTAMs) and Notice to Mariners (NOTMARs) for their area to allow the public to plan accordingly. These actions provide commercial fishermen, recreational boaters and other area users notice that the military will be operating in a specific area and will allow them to plan their own activities accordingly. (discussed in the Draft EIS/OEIS, Section 3.14.1.1.2).

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Navy's current mitigation measures reflect the use of the best available scientific data balanced with the National Marine Fisheries Service (NMFS) approach and the requirements of the Navy to train. There is no suggestion that mitigation measures are 100% effective, but are meant to mitigate impacts while still being able to conduct critical training activities.

The entire Draft EIS/OEIS provides the cumulative impacts analysis, not just Chapter 4. Chapter 3, in particular, provides the past and present impacts and environmental conditions that represent the baseline, and Chapter 3 also discusses the consequences or potential future impacts from Navy activities. Chapter 4, then, discusses the other reasonably foreseeable activities to the extent they are known and the incremental impact of the Navy's proposal when added to past, present, and future impacts.

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Most of the species within the SOCAL Range Complex either migrate seasonally out of the area (e.g., blue, gray and humpback whales), or shift in north/south direction seasonally (e.g., common, Pacific white sided and Risso's dolphins). In addition animals move long distances in search of food. Therefore marine mammals would not be chronically exposed to MFA/HFA sonar.

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Nor does the Navy consider the potential for acute synergistic effects from sonar training. For example, although the DEIS discusses the potential for ship strike in the study area, it does not consider the greater susceptibility to vessel strike of animals that have been temporarily harassed or disoriented by certain SOCAL noise sources. The absence of analysis is particularly glaring in light of the 2004 Nowacek et al. study, which indicates that mid-frequency sources provoke surfacing and other behavior in North Atlantic right whales that increases the risk of vessel strike.[93] Nor does the Navy consider (for example) the synergistic effects of noise with other stressors in producing or magnifying a stress-response.[94] In short, the Navy's conclusion that cumulative and synergistic impacts from SOCAL sonar training are insignificant cannot plausibly be supported.

53 The Navy has not found any information to suggest that animals exposed to MFA/HFA sonar would be more susceptible to vessel collisions. The Nowacek et al., 2004 study was conducted on north Atlantic right whales and North Pacific right whales, which have not been observed in SOCAL for many years. Nowachek et al. 2004 used three types of continuous 2 minute signals for 18 minutes, only one of which was mid frequency type signal. MFAS signal is approximate 1 sec and repeated 2-3 times per minute. Section 3.16.4 in Appendix F of the Draft EIS/OEIS provided a discussion of Nowacek et al., 2004.

All of these failures of analysis are reflected not only in the Navy's unsupported conclusions about the benignity of SOCAL training standing alone, but in its broader conclusions about human activities in California waters. Generally, this chapter makes clear that the range complex is crowded with human activities, many of which introduce noise, chemical pollution, debris, and vessel traffic into the habitat of protected species. The idea that all of these events, when taken as a whole, are having insignificant effects on California populations, and that the Navy's contribution is merely "incremental" (DEIS at 4-27), is, again, unsupported by analysis.

54 The commentor misapprehends the Navy's analysis, in stating that the Navy has concluded that human activities in the region are having insignificant environmental effects. The Navy's analysis indicates that Navy activities, considered in light of ongoing and proposed mitigation measures, are not having significant environmental effects on the resources addressed in the Draft EIS/OEIS, particularly when considered in a cumulative context with all of the non-Navy activities that have potential to adversely affect the environment.

E. Alternatives Analysis

At bottom, an EIS must "inform decision-makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment." 40 C.F.R. § 1502.1. This requirement has been described in regulation as "the heart of the environmental impact statement." Id. § 1502.14. The agency must therefore "[r]igorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated." Id. § 1502.14(a). Consideration of alternatives is required by (and must conform to the independent terms of) both sections 102(2)(C) and 102(2)(E) of NEPA.

First, the Navy declines to consider a reduction in the level of current training in the SOCAL Range Complex. Yet the Navy's assumption that sonar exercises on the range must increase or continue at their current tempo may well be an artifact of the Navy's Tactical Training Theater Assessment and Planning Program (TAP) process, which, in

[93] Nowacek et al., North Atlantic Right Whales, 271 Proceedings of the Royal Society of London, Part B: Biological Sciences at 227-31.

[94] A.J. Wright, N. Aguilar Soto, A.L. Baldwin, M. Bateson, C.M. Beale, C.Clark, T. Deak, E.F. Edwards, A. Fernández, A. Godinho, L. Hatch, A. Kakuschke, D. Lusseau, D. Martineau, L.M. Romero, L. Weilgart, B. Wintle, G. Notarbartolo di Sciara, and V. Martin, "Do marine mammals experience stress related to anthropogenic noise?" (in press and forthcoming 2008); see also other papers published in same volume.

55 This comment betrays a fundamental failure to apprehend both the nature of naval training requirements, which proceed on an continuum that includes, but certainly is not limited to "exercises," and the strategic importance of the SOCAL Range Complex in executing those training requirements. Both concepts are examined in detail in Chapter 1 and Chapter 2 of the Draft EIS/OEIS. For example, as Section 1.2.3 makes plain, the geographic location of the SOCAL Range Complex is strategically significant to the Navy's ability to accomplish its mission. The Navy's range planning efforts do not assume, a priori as the commentator suggests, that its training cannot occur elsewhere. Those planning efforts do assume, contrary to the commentators assumption, that there is a required level of Navy training to be conducted, and that it must occur somewhere. As explained in Section 2.2.2.2 of the Draft EIS/OEIS, an alternative that would decrease military training from current levels would not meet the purpose and need of the Proposed Action

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requiring separate environmental analysis of existing ranges and operating areas, seems to assume a priori that exercises cannot be reapportioned or alternative sites found. Moreover, the DEIS fails to analyze meaningfully whether a different mix of simulators and at-sea exercises would accomplish its aims, reducing the number of sonar use hours. Instead, it rules out the increased use of simulators by stating, in a cursory few sentences, that they do not obviate the need for realistic training. But its summary treatment of this issue does not sufficiently justify the precise number of exercises and use hours that have been proposed. Alternatives that combine greater use of simulators with fewer open-water exercises—or that develop a plan to maximize use of synthetic training—should have been analyzed, not dismissed out of hand.

Second, the Navy summarily dismisses geographic and seasonal exclusions from its alternatives analysis. DEIS at 2-15. It does so even though avoiding concentrations of vulnerable and endangered populations and high abundances of marine life is perhaps the most critical step the Navy can take in reducing impacts, and a "hard look" at geographical alternatives is plainly required by NEPA and other laws.[95] Remarkably, the Pacific Fleet, unlike the Atlantic, has not attempted to develop geographic alternatives for sonar training using survey data and habitat modeling, or even to identify important habitat for vulnerable species and higher density areas. Instead, it speaks in deliberately obtuse and general terms about its needs and declines to reserve any part of a 120,000 nm^2 range from sonar training.

Third, even aside from the omission of reasonable alternative locations, the Navy fails to consider alternatives of any other kind. While the question of proper siting is crucial, it is not the only factor that must be considered in identifying other, less harmful ways to fulfill the Navy's purpose. Indeed, it appears that many reasonable alternatives are missing from the Navy's analysis that might fulfill that purpose while reducing harm to marine life and coastal resources. For example, and as discussed at greater length below, the DEIS fails to include a range of mitigation measures among its alternatives. Many such measures are employed by other countries in their sonar exercises and even by the U.S. Navy in other contexts; and there are many others that should be considered. Such measures are reasonable means of reducing harm to marine life and other resources within the SOCAL Range Complex, and their omission from the alternatives analysis renders that analysis inadequate.

Fourth, the Navy's statement of purpose and need contains no language that would justify the limited set of alternatives that the Navy considers (or the alternative it ultimately prefers). Yet it is a fundamental requirement of NEPA that agencies preparing an EIS specify their project's "purpose and need" in terms that do exclude full consideration of reasonable alternatives. 40 C.F.R. § 1502.13; City of Carmel-by-the-Sea v. United States Dep't of Transp., 123 F.3d 1142, 1155 (9th Cir. 1997) (citing

[95] E.g., NRDC v. Evans, 279 F.Supp.2d at 1664-66; NRDC v. Navy, 857 F.Supp. at 734; T. Agardi, N.A. Soto, A. Cañadas, M. Engel, A. Frantzis, L. Hatch, E. Hoyt, K. Kaschner, E. LaBrecque, V. Martin, G. Notarbartolo di Sciara, G. Pavan, A. Servido, B. Smith, J.Y. Wang, L. Weilgart, B. Wintle, A.J. Wright, A Global Scientific Workshop on Spatio-Temporal Management of Noise 3 (2007).

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(Continued from above) A reduction in levels of training within the SOCAL Range Complex would not support the Navy's ability to meet Federal statutory requirements. In addition, a reduction in training could jeopardize the ability of naval forces using the SOCAL Range Complex for training purposes to be ready and qualified for deployment. Regarding use of simulators, the Draft EIS/OEIS does not say that simulators "do not obviate the need for realistic training. As the Draft EIS/OEIS points out in Section 2.2.2.4 in the course of an extensive discussion of simulation, "current simulation technology does not permit ASW training with the degree of fidelity required to maintain proficiency." The Navy cannot accept substitutes for live training that do not meet the readiness requirements of naval forces.

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The statement of the purpose and need for the agency action appropriately defines the range of alternatives to be addressed in an EIS. In identifying the purpose and need for a major federal action, the agency must consider the goals of Congress, such as those expressed in the agency's statutory authorization to act. With regard to the Southern California (SOCAL) Range Complex, the purpose and need for the agency action is clearly defined in the DEIS. In sum, the purpose and need for Proposed Action is to provide a training environment consisting of ranges, training areas, and range instrumentation with the capacity and capabilities to fully support required training tasks for operational units and military schools. As the DEIS states, the purpose and need furthers the Navy's execution of its statutory roles and responsibilities under Title 10 of the United States Code. The Navy has developed and fully analyzed appropriate alternatives based on this statement of the purpose and need for the Proposed Action. The DEIS does not, as this comment suggests, summarily dismiss geographic and seasonal exclusions from its alternatives analysis. As the DEIS states, and as stated in public articulations of the professional military judgment of senior Navy leaders, alternatives that would impose limitations on training locations within the SOCAL Range Complex, or seasonal constraints on training activities would not support the purpose and need. The analysis mandated by NEPA is not an evaluation of alternative means to accomplish the general goal of an action. Rather, alternatives to be evaluated should be those that reasonably satisfy the specific purpose and need for the agency action. The underlying need is not to generally conduct Navy training in the SOCAL Range Complex. The underlying need is to conduct training of a specific nature, type, and scope that is required to ensure Navy personnel and units are fully trained. The DEIS appropriately limits its analysis to alternatives that meet the Navy's congressionally mandated training mission. Moreover, the Navy has proposed extensive mitigation measures to reduce any potential impacts on marine species and marine resources. Through the NEPA process, a federal agency must certainly take a "hard look" at the potential environmental consequences of the proposed action. The Navy is unaware, however, of authority for the commenter's proposition that NEPA requires the Navy to take a "hard look" at geographical alternatives that, in the considered expertise of the Navy, do not meet the purpose and need of the Proposed Action. With regard to the commentator's view that the "Navy speaks in deliberately obtuse and general terms about its needs," attention is directed to the detailed information contained in the DEIS about the nature and required scope of Navy training events, the nature of the necessary training environment, the strategic importance of the SOCAL Range Complex, and the uniquely important features that enable Navy training in the SOCAL Range Complex, including bathymetric features that are required to conduct necessary sonar training.

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requiring separate environmental analysis of existing ranges and operating areas, seems to assume a priori that exercises cannot be reapportioned or alternative sites found. Moreover, the DEIS fails to analyze meaningfully whether a different mix of simulators and at-sea exercises would accomplish its aims, reducing the number of sonar use hours. Instead, it rules out the increased use of simulators by stating, in a cursory few sentences, that they do not obviate the need for realistic training. But its summary treatment of this issue does not sufficiently justify the precise number of exercises and use hours that have been proposed. Alternatives that combine greater use of simulators with fewer open-water exercises—or that develop a plan to maximize use of synthetic training—should have been analyzed, not dismissed out of hand.

57 Second, the Navy summarily dismisses geographic and seasonal exclusions from its alternatives analysis. DEIS at 2-15. It does so even though avoiding concentrations of vulnerable and endangered populations and high abundances of marine life is perhaps the most critical step the Navy can take in reducing impacts, and a "hard look" at geographical alternatives is plainly required by NEPA and other laws.[95] Remarkably, the Pacific Fleet, unlike the Atlantic, has not attempted to develop geographic alternatives for sonar training using survey data and habitat modeling, or even to identify important habitat for vulnerable species and higher density areas. Instead, it speaks in deliberately obtuse and general terms about its needs and declines to reserve any part of a 120,000 nm^2 range from sonar training.

Third, even aside from the omission of reasonable alternative locations, the Navy fails to consider alternatives of any other kind. While the question of proper siting is crucial, it is not the only factor that must be considered in identifying other, less harmful ways to fulfill the Navy's purpose. Indeed, it appears that many reasonable alternatives are missing from the Navy's analysis that might fulfill that purpose while reducing harm to marine life and coastal resources. For example, and as discussed at greater length below, the DEIS fails to include a range of mitigation measures among its alternatives. Many such measures are employed by other countries in their sonar exercises and even by the U.S. Navy in other contexts; and there are many others that should be considered. Such measures are reasonable means of reducing harm to marine life and other resources within the SOCAL Range Complex, and their omission from the alternatives analysis renders that analysis inadequate.

58 Fourth, the Navy's statement of purpose and need contains no language that would justify the limited set of alternatives that the Navy considers (or the alternative it ultimately prefers). Yet it is a fundamental requirement of NEPA that agencies preparing an EIS specify their project's "purpose and need" in terms that do exclude full consideration of reasonable alternatives. 40 C.F.R. § 1502.13; City of Carmel-by-the-Sea v. United States Dep't of Transp., 123 F.3d 1142, 1155 (9th Cir. 1997) (citing

[95] E.g., NRDC v. Evans, 279 F.Supp.2d at 1664-66; NRDC v. Navy, 857 F.Supp. at 734; T. Agardi, N.A. Soto, A. Cañadas, M. Engel, A. Frantzis, L. Hatch, E. Hoyt, K. Kaschner, E. LaBrecque, V. Martin, G. Notarbartolo di Sciara, G. Pavan, A. Servido, B. Smith, J.Y. Wang, L. Weilgart, B. Wintle, A.J. Wright, A Global Scientific Workshop on Spatio-Temporal Management of Noise 3 (2007).

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(Continued from above) These and other considerations developed in detail in the DEIS appropriately define the purpose and need for the Proposed Action, fully support the delineation of alternatives carried forward for analysis, and justify the elimination of certain alternatives, including geographical and temporal constraints, from further consideration.

(*Response in reference to paragraph starting: Third,*) Please refer to response to comment NRDC-56 above. The Navy assessed the reasonable alternatives that meet the proposed action. Each nation has its own training needs based on that nation's forces, capabilities and missions; therefore, the training needs to different nation's cannot be accurately compared. For the U.S. Navy, the ability to conduct ASW in the shallow water environment is a critical component of national Naval strategy.

Mitigation measures were extensively evaluated and developed in conjunction with the NMFS. Mitigation measures are not required to be part of the alternatives analysis.

(*Response in reference to paragraph starting: Fourth,*) As explained in Section 2.2.2.2 of the Draft EIS/OEIS, an alternative that would decrease military training from current levels would not meet the Purpose and Need of the Proposed Action. "Reasonable alternatives" have been defined as those that reasonably meet the Purpose and Need for the Proposed Action. A reduction in levels of training within SOCAL would not support the Navy's ability to meet United States Code (U.S.C.) Title 10 requirements. In addition, a reduction in training operations could jeopardize the ability of special forces, transient units, and Strike Groups using SOCAL for training purposes to be ready and qualified for deployment.

The Navy has carefully defined its objectives and offers appropriate alternatives to achieve them. To implement its Congressional mandates, the Navy needs to support and to conduct current and emerging training and RDT&E training events in SOCAL and upgrade or modernize range complex capabilities to enhance and sustain Navy training and testing. These objectives are required to provide combat capable forces ready to deploy worldwide in accordance with U.S.C. Title 10, Section 5062. The Assistant Secretary of the Navy (Installations & Environment) determines both the level and mix of training to be conducted and the range capabilities enhancements to be made within SOCAL that best meet the needs of the Navy. The objectives set forth in this document are both reasonable and necessary.

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Citizens Against Burlington, Inc. v. Busey, 938 F.2d 190, 196 (D.C. Cir. 1991)). "The existence of a viable but unexamined alternative renders an environmental impact statement inadequate," Idaho Conservation League v. Mumma, 956 F.2d 1508, 1519 (9th Cir. 1992), and an EIS errs when it accepts "as a given" parameters that it should have studied and weighed. Simmons v. U.S. Army Corps of Eng'rs, 120 F.3d 664, 667 (7th Cir. 1997).

59 In sum, the DEIS omits from its analysis reasonable alternatives—with regard to both the siting of the range and other operational choices—that might achieve the Navy's core aim while minimizing environmental harm. These omissions are all the more unreasonable given the long period during which the Navy has worked on this document and its predecessors. For these reasons, we urge the Navy to issue an EIS that adequately informs the public of all reasonable alternatives that would reduce adverse impacts to whales, fish, sea turtles, and other marine resources. 40 C.F.R. § 1502.1.

Consideration of alternative geographic siting does not support the Navy's purpose and need and is not required within the choice of alternatives. Consideration of alternative locations for training conducted in SOCAL was rejected from further analysis because it does not meet the purpose and need of the Proposed Action. Therefore, this EIS/OEIS meets NEPA requirements in informing the public of all reasonable alternatives.

Further, the analysis in the Draft EIS/OEIS does not support the comment's assumption or contention that the Navy is causing environmental harm.

F. Mitigation Measures

60 To comply with NEPA, an agency must discuss measures designed to mitigate its project's impact on the environment. See 42 C.F.R. § 1502.14(f). There is a large and growing set of options for the mitigation of noise impacts to marine mammals and other marine life, some of which have been imposed by navies—and by the Navy itself, in other contexts—to limit harm from high-intensity sonar exercises. Yet here the Navy does little more than set forth a cribbed set of measures, falling short even of what other navies have implemented for transient exercises and providing no discussion on a variety of other options.

(In response to 3rd paragraph starting with: To comply with NEPA,…) Each nation has its own training needs based on that nation's forces, capabilities and missions. For the U.S. Navy, the ability to conduct ASW in the shallow water environment is critically necessary in order to fight the growing diesel submarine threat.

61 All of the mitigation that the Navy has proposed for acoustic impacts boils down to the following: a very small safety zone around the sonar vessel, maintained primarily with visual monitoring by onboard lookouts, with aid from non-dedicated aircraft (when in the vicinity) and passive monitoring (though the vessel's generic sonar system). Under the proposed scheme, which is virtually identical to that in the Navy's current national defense exemption under the MMPA, operators would power down the system by 6 dB if a marine mammal is detected within 1000 yards, power it down by 10 dB if the protected species is detected within 500 yards, and shut it down if the animal is detected within 200 yards. DEIS at 5-8 to 5-9.

This mitigation scheme disregards the best available science on the significant limits of that technique. Indeed, the species perhaps most vulnerable to sonar-related injuries, beaked whales, are among the most difficult to detect because of their small size and diving behavior. It has been estimated that in anything stronger than a light breeze, only one in fifty beaked whales surfacing in the direct track line of a ship would be sighted; as the distance approaches 1 kilometer, that number drops to zero.[96] The

[96] J. Barlow and R. Gisiner, Mitigating, Monitoring, and Assessing the Effects of Anthropogenic Noise on Beaked Whales, 7 Journal of Cetacean Research and Management 239-249 (2006).

The Navy's mitigation plan is more than just visual monitoring. Aerial monitoring and sonar power-down protocols are used as well. The Draft EIS/OEIS, Section 3.9.10.2.1 and Chapter 5.0, Mitigation Measures, presented the U.S. Navy's protective measures, outlining steps that would be implemented to protect marine mammals and Federally listed species during training events. Navy does not expect that 100% of the animals present in the vicinity of training events will be detected and the acoustic impact modeling quantification is not reduced as a result of mitigation effectiveness. In addition, the probability of trackline detection is for visual observers during a survey. In general, there will be more ships, more observers present on Navy ships, and additional aerial assets all engaged in exercise events having the potential to detect marine mammals, than is present on a single, generally smaller (having a lower height of eye), survey ship from which the 1 in 50 figure is derived.

Further, the analysis in the Draft EIS/OEIS does not support the comment's assumption or contention that the Navy is causing harm to marine mammals.

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Navy's reliance on visual observation as the mainstay of its mitigation plan is therefore profoundly misplaced.

Moreover, the Navy's analysis ignores or improperly discounts an array of options that have been considered and imposed by other active sonar users, including avoidance of coastal waters, high-value habitat, and complex topography; the employment of a safety zone more protective than the 1000-yard power-down and 200-yard shutdown proposed by the Navy; general passive acoustic monitoring for whales; special rules for surfacing ducting and low-visibility conditions; monitoring and shutdown procedures for sea turtles and large schools of fish; and many others.[97] The Navy's conclusions are all the more remarkable given recent court decisions finding that the Navy can and must do more to reduce harm to protected species from sonar training. NRDC v. Winter, 527 F.Supp.2d 1216 (C.D. Cal. 2008), aff'd __ F.3d __, 2008 WL 565680 (9th Cir. 2008); Ocean Mammal Institute v. Gates, 2008 WL 564664 (D. Hawaii 2008).

Measures that the Navy should consider include, inter alia:

(1) Establishment of a coastal exclusion zone for acoustics training and testing, such as one for major exercises that would minimally run at least 25 nautical miles from the coast, or one that would exclude activities shoreward of the 1500 meter isobath;

(2) Seasonal avoidance of habitat important to the California population of blue whales and other listed species, as well as the California gray whale migration;

(3) Avoidance of federal and state marine protected areas, including the Channel Islands National Marine Sanctuary;

(4) Avoidance of bathymetry likely to be associated with high-value habitat for species of particular concern, including submarine canyons and large seamounts, or bathymetry whose use poses higher risk to marine species (such as canyons and inter-island basins);

(5) Avoidance of fronts and other major oceanographic features, such as areas with marked differentials in sea surface temperatures, which have the potential to attract offshore concentrations of animals, including beaked whales (see, e.g., 3.9-95);

(6) Avoidance of areas and seasons with higher modeled takes or with higher densities of particular species, some of which are indicated in the DEIS (see DEIS App. F), the Navy's Marine Resources Assessment for the SOCAL Range Complex,[98] and the Navy's 2007 environmental assessment for major exercises on the range;

[97] See, e.g., Royal Australian Navy, "Maritime Activities Environmental Management Plan," Procedure S-1 and Planning Guide 16 (July 8, 2005); NATO Undersea Research Centre, Human Diver and Marine Mammal Risk Mitigation Rules and Procedures (2006) (NURC-SP-2006-008); ICES, Report of the Ad-hoc Group on the Impacts of Sonar on Cetaceans and Fish 33-36 (2005) (ICES CM 2005/ACE:06). The U.S. Navy has also used additional mitigation measures for various exercises in the past.

[98] Naval Facilities Engineering Command, Pacific, Marine Resources Assessment for the Southern California Operating Area (2005).

61 (See Response above)

62 It is critical that Navy be able to conduct ASW training in a variety of environment and bathymetric conditions, including in the vicinity of seamounts. The seamount allows a submarine to hide in an area that is shadowed by seamount because the active transmission cannot reach the sub via the bottom bounce path. Therefore, it is critical to operate MFA sonar in areas of high bathymetric variability.

Further, the analysis in the Draft EIS/OEIS does not support the comment's assumption or contention that the Navy is causing harm to marine species.

63 The Navy, in conjunction with the NMFS, has considered numerous mitigation measures during the development of this EIS/OEIS (See Section 3.9.10). The mitigation measures adopted were determined to be the most effective and scientifically supported measures.

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(7) Concentration of exercises to the maximum extent practicable in abyssal waters and in surveyed offshore habitat of low value to species;

(8) Use of simulated geography (and other work-arounds) to reduce or eliminate chokepoint exercises in near-coastal environments, particularly within canyons and channels, and use of other important habitat;

(9) Use of sonar and other active acoustic systems at the lowest practicable source level, with clear standards and reporting requirements for different testing and training scenarios;

(10) Expansion of the marine species "safety zone" to a 4 km shutdown, reflecting international best practice, or 2 km, reflecting the standard prescribed by the California Coastal Commission and adopted in NRDC v. Winter, 527 F.Supp.2d 1216 (C.D. Cal. 2008), aff'd __ F.3d __, 2008 WL 565680 (9th Cir. 2008);[99]

(11) Suspension or relocation of exercises when beaked whales or significant aggregations of other species, such as blue whales, are detected by any means within the orbit circle of an aerial monitor or near the vicinity of an exercise;

(12) Avoidance or reduction of training during months with historical significant surface ducting conditions, and use of power-downs during significant surface ducting conditions at other times;

(13) Use of additional power-downs when significant surface ducting conditions coincide with other conditions that elevate risk, such as during exercises involving the use of multiple systems or in beaked whale habitat;

(14) Planning of ship tracks to avoid embayments and provide escape routes for marine animals;

(15) Suspension or postponement of chokepoint exercises during surface ducting conditions and scheduling of such exercises during daylight hours;

(16) Use of dedicated aerial monitors during chokepoint exercises, major exercises, and near-coastal exercises;

(17) Use of dedicated passive acoustic monitoring to detect vocalizing species, through established and portable range instrumentation and the use of hydrophone arrays off instrumented ranges;

(18) Modification of sonobuoys for passive acoustic detection of vocalizing species;

(19) Suspension or reduction of exercises or power-down of sonar outside daylight hours and during periods of low visibility;

(20) Use of aerial surveys and ship-based surveys before, during, and after major exercises;

[99] California Coastal Commission, Adopted Staff Recommendation on Consistency Determination CD-086-06 (2007); Approved Letter from M. Delaplaine, California Coastal Commission, to Rear Adm. Len Hering, Navy (Jan. 11, 2007).

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(21) Use of all available range assets for marine mammal monitoring;

(22) Use of third-party monitors for marine mammal detection;

(23) Establishment of long-term research, to be conducted through the Southwest Fisheries Science Center, or through an independent agent such as the National Fish and Wildlife Foundation, on the distribution, abundance, and population structuring of protected species on the SOCAL range, with the goal of supporting adaptive geographic avoidance of high-value habitat;

(24) Application of mitigation prescribed by the California Coastal Commission and other state regulators, by the courts, by other navies or research centers, or by the U.S. Navy in the past or in other contexts;

(25) Avoidance of fish spawning grounds and of important habitat for fish species potentially vulnerable to significant behavioral change, such as wide-scale displacement within the water column or changes in breeding behavior;

(26) Avoidance of high-value sea turtle habitat, and inclusion of sea turtles in other described mitigation measures, including safety zones, for which floating weeds and kelp and algal mats should be taken as proxies for sea turtle presence;

(27) Evaluating before each major exercise whether reductions in sonar use are possible, given the readiness status of the strike groups involved;

(28) Requiring that other nations abide by U.S. mitigation measures when training on the SOCAL range, except where their own measures are more stringent;

(29) Dedicated research and development of technology to reduce impacts of active acoustic sources on marine mammals;

(30) Establishment of a plan and a timetable for maximizing synthetic training in order to reduce the use of active sonar on the SOCAL range;

(31) Prescription of specific mitigation requirements for individual categories (or sub-categories) of testing and training activities, in order to maximize mitigation given varying sets of operational needs; and

(32) Timely, regular reporting to NOAA, state coastal management authorities, and the public to describe and verify use of mitigation measures during testing and training activities.

Consideration of these measures is minimally necessary to satisfy the requirements of NEPA, and we note that similar or additional measures may be required under the Marine Mammal Protection Act, Endangered Species Act, and other statutes.

G. Project Description and Meaningful Public Disclosure

Disclosure of the specific activities contemplated by the Navy is essential if the NEPA process is to be a meaningful one. See, e.g., LaFlamme v. F.E.R.C., 852 F.2d 389, 398 (9th Cir. 1988) (noting that NEPA's goal is to facilitate "widespread discussion and

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[In reference to # 26] The Navy already has procedures in place that mitigate harm to sea turtles by avoiding sea turtles, and increasing vigilance in looking for sea turtles in the vicinity of floating weeds and kelp, algal mats, clusters of seabirds, and jellyfish. (Draft EIS/OEIS p. 5-6). There is very limited scientific evidence for establishing high-value sea turtle habitats in southern California. Moving exercise events to alternative locations based on limited scientific data to determine when and where specific areas should be avoided will significantly impact the military readiness mission.

Further, the analysis in the Draft EIS/OEIS does not support the comment's assumption or contention that the Navy is causing harm to sea turtles.

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[In reference to # 27] Regarding sonar use during ASW training, the amount of sonar used during a given exercise is not set and depends on the amount necessary to find a submarine. Additional training is not built into the training plan and would not be an efficient use of the resources needed to support the training (e.g. fuel, time). Conversely, reducing ASW training would not allow Sailors to achieve satisfactory levels of readiness needed to accomplish their mission.

Further, the analysis in the Draft EIS/OEIS does not support the comment's assumption or contention that the Navy is causing environmental harm

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[In reference to # 28] When foreign states participate in training that occurs within the U.S. territorial sea, the U.S. Navy requires foreign nations to comply with its mitigation measures. When these operations occur on the SOCAL Range (much of which is outside the territorial sea), the U.S. Navy provides these foreign states with a letter of instruction identifying U.S. mitigation measures and encouraging them to comply with those mitigation measures. The Navy emphasizes, however, that under international law, particularly as reflected in the United Nations Convention on the Law of the Sea, the Navy cannot require foreign nations to abide by U.S. mitigation measures when training on the SOCAL Range beyond the U.S. territorial sea.

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[In reference to # 30] The Draft EIS/OEIS discussed the value and use of synthetic training in Section 1.2.1, and specifically the limits of simulation as it applies to ASW in Section 2.2.2.4.

Further, the analysis in the Draft EIS/OEIS does not support the comment's assumption or contention that the Navy's use of sonar is causing environmental harm.

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consideration of the environmental risks and remedies associated with [a proposed action]").

The Navy—despite repeated requests—has not released or offered to release CASS/GRAB or any of the other modeling systems or functions it used to develop the biological risk function or calculate acoustic harassment and injury. See, e.g., DEIS at 3.9-60. These models must be made available to the public, including the independent scientific community, for public comment to be meaningful under NEPA and the Administrative Procedure Act. 42 C.F.R. §§ 1502.9(a), 1503.1(a) (NEPA); 5 U.S.C. § 706(2)(D) (APA). And guidelines adopted under the Data (or Information) Quality Act also require their disclosure. The Office of Management and Budget's guidelines require agencies to provide a "high degree of transparency" precisely "to facilitate reproducibility of such information by qualified third parties" (67 Fed. Reg. 8452, 8460 (Feb. 22, 2002)); and the Defense Department's own data quality guidelines mandate that "influential" scientific material be made reproducible as well.[100] We encourage the Navy to contact us immediately to discuss how to make this critical information available.

68 Please see response to NRDC-009.

H. Scope of Review

As a threshold issue, we are concerned about the Navy's understanding of its obligations under applicable law. The Navy indicates that its analysis of "extraterritorial" activities, those activities that would take place outside U.S. territorial waters, was prepared under the authority of Executive Order 12114 rather than under NEPA. See DEIS at 1-15. Not only is this position on the scope of review inconsistent with the statute (see, e.g., Environmental Defense Fund v. Massey, 968 F.2d 528 (D.C. Cir. 1994) and NRDC v. Navy, No. CV-01-07781, 2002 WL 32095131 at *9-12 (C.D. Cal. Sept. 19, 2002)), but, insofar as it represents a broader policy, it provides further indication that current operations in the SOCAL Range Complex—beyond the major exercises already found to have violated NEPA—are likewise out of compliance. Most of the area used for sonar training is sited beyond the 12nm territorial boundary, within the U.S. Exclusive Economic Zone. If, as we expect, activities currently taking place there have not received their due analysis in a prior environmental impact statement, then the Navy is operating in ongoing violation of NEPA.

69 The Draft EIS/OEIS has received extensive legal review to ensure that current operations are in compliance all required Federal, state, and local regulations/laws. The current operations are appropriately analyzed under NEPA in this document as the No Action Alternative.

I. Compliance with Other Applicable Laws

[100] Navy, Ensuring the Quality of Information Disseminated to the Public by the Department of Defense: Policy and Procedural Guidance § 3.2.3.1 (Feb. 10, 2003). The Defense Department defines "influential" to mean "that the Component can reasonably determine that dissemination of the information will have or does have clear and substantial impact on important public policies or important private sector decisions"—which is clearly the case here. See Ensuring the Quality of Information Disseminated to the Public by the Department of Defense: Definitions § 3 (Feb. 10, 2003).

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A number of other statutes and conventions are implicated by the proposed activities, considering their marine acoustic impacts alone. Among those that must be disclosed and addressed during the NEPA process are the following:

(1) The Marine Mammal Protection Act ("MMPA"), 16 U.S.C. § 1361 et seq., which requires the Navy to obtain a permit or other authorization from NMFS or the U.S. Fish and Wildlife Service prior to any "take" of marine mammals. The Navy must apply for an incidental take permit under the MMPA, and NRDC will submit comments regarding the Navy's application to NMFS at the appropriate time.

(2) The Endangered Species Act, 16 U.S.C. § 1531 et seq., which requires the Navy to enter into formal consultation with NMFS or the U.S. Fish and Wildlife Service, and receive a legally valid Incidental Take Permit, prior to its "take" of any endangered or threatened marine mammals or other species, including fish, sea turtles, and birds, or its "adverse modification" of critical habitat. See, e.g., 1536(a)(2); Romero-Barcelo v. Brown, 643 F.2d 835 (1st Cir. 1981), rev'd on other grounds, Weinberger v. Romero-Carcelo, 456 U.S. 304, 313 (1982). The Navy must consult with NMFS over blue whales, fin whales, humpback whales, sei whales, sperm whales, Guadalupe fur seals, green sea turtles, leatherback sea turtles, loggerhead sea turtles, Pacific ridley sea turtles, steelhead trout, and brown pelicans, all of which are listed under the Act.

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The Navy has consulted with NMFS and USFWS regarding Endangered Species Act requirements.

(3) The Coastal Zone Management Act, and in particular its federal consistency requirements, 16 U.S.C. § 1456(c)(1)(A), which mandate that activities that affect the natural resources of the coastal zone—whether they are located "within or outside the coastal zone"—be carried out "in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved State management programs." Remarkably, notwithstanding the previous findings of the California Coastal Commission and an adverse ruling before a federal court, NRDC v. Winter, 2007 WL 2481037 at *8-9 (C.D. Cal. 2007), aff'd 508 F.3d 885 (9th Cir. 2007), the Navy has preliminarily determined that the proposed action is consistent to the maximum extent practicable with the California Coastal Act and coastal zone management plan. DEIS at 6-5. Moreover, judging by the description in the DEIS, it remains an open question whether the Navy will include all of its anti-submarine warfare activity in its consistency review, as the law requires. The Navy must fulfill its CZMA commitments.

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This EIS/OEIS is independent of any previous environmental study or Consistency Determination, therefore any measures or compliance issues with previous studies are not relevant. Although we acknowledge earlier efforts and studies, and at times may reference them, this EIS/OEIS is a fresh, rigorous study of environmental effects that takes into consideration new methods of analysis and more recent scientific data.

The Navy has completed a Coastal Consistency Determination and submitted it to the California Coastal Commission in accordance with the CZMA.

(4) The Magnuson-Stevens Fisheries Conservation and Management Act, 16 U.S.C. § 1801 et seq. ("MSA"), which requires federal agencies to "consult with the Secretary [of Commerce] with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken" that "may adversely affect any essential fish habitat" identified under that Act. 16 U.S.C. § 1855 (b)(2). In turn, the MSA defines essential fish habitat as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." 16 U.S.C. § 1802 (10). The SOCAL Range Complex contains such habitat. As

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The Draft EIS/OEIS concluded adverse effects to Essential Fish Habitat in SOCAL waters would be minimal and temporary.

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discussed at length above, anti-submarine warfare exercises alone have the significant potential to adversely affect at least the waters, and possibly the substrate, on which fish in these areas depend. Under the MSA, a thorough consultation is required.

72 See response above

(5) The Marine Protection, Research and Sanctuaries Act, 33 U.S.C. § 1401 et seq., which requires federal agencies to consult with the Secretary of Commerce if their actions are "likely to destroy, cause the loss of, or injure any sanctuary resource." 16 U.S.C. § 1434(d)(1). The Navy indicates that it will not consult with the Channel Islands National Marine Sanctuary, even though the sanctuary falls within the SOCAL study area. DEIS at 6-3. Since the Navy's exercises would cause injury and mortality of species, consultation is clearly required if sonar use takes place either within or in the vicinity of the sanctuary or otherwise affects its resources. The mere claim that Navy activities are "consistent with the [CINMS] regulations to the maximum extent practicable" (see DEIS at 6-3) does not, of course, obviate consultation. Since sonar may impact sanctuary resources even when operated outside its bounds, the Navy should indicate how close it presently operates, or forseeably plans to operate, to the sanctuary.

73 Please see response to comment CCC-9

In addition, the Sanctuaries Act is intended to "prevent or strictly limit the dumping into ocean waters of any material that would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities" (33 U.S.C. § 1401(b)), and prohibits all persons, including Federal agencies, from dumping materials into ocean waters, except as authorized by the Environmental Protection Agency. 33 U.S.C. §§ 1411, 1412(a). The Navy has not indicated its intent to seek a permit under the statute.

74 Please see response to comment CCC-9

(6) The Migratory Bird Treaty Act, 16 U.S.C. § 703 et seq. ("MBTA"), which makes it illegal for any person, including any agency of the Federal government, "by any means or in any manner, to pursue, hunt, take, capture, [or] kill" any migratory birds except as permitted by regulation. 16 U.S.C. § 703. After the District Court for the D.C. Circuit held that naval training exercises that incidentally take migratory birds without a permit violate the MBTA, (see Center for Biological Diversity v. Pirie, 191 F. Supp. 2d 161 (D.D.C. 2002) (later vacated as moot)), Congress exempted some military readiness activities from the MBTA but also placed a duty on the Defense Department to minimize harms to seabirds. Under the new law, the Secretary of Defense, "shall, in consultation with the Secretary of the Interior, identify measures-- (1) to minimize and mitigate, to the extent practicable, any adverse impacts of authorized military readiness activities on affected species of migratory birds; and (2) to monitor the impacts of such military readiness activities on affected species of migratory birds." Pub.L. 107-314, § 315 (Dec. 2, 2002). As the Navy acknowledges, migratory birds occur within the SOCAL Range Complex. The Navy must therefore consult with the Secretary of the Interior regarding measures to minimize and monitor the effects of the proposed range on migratory birds, as required.

75 The military's responsibility with regard to the Migratory Bird Treaty Act was discussed in the Draft EIS/OEIS, Section 3.10.1.1, and impacts on migratory birds were discussed in Section 3.10.2.6. Military readiness activities are exempt from the consultation requirements and take prohibitions of the Migratory Bird Treaty Act, provided they are not likely to result in a significant adverse effect on the population of a migratory bird species. Navy activities in SOCAL are not expected to result in significant adverse effects to populations of bird species, and consultation with the Secretary of the Interior is not required.

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(7) Executive Order 13158, which sets forth protections for marine protected areas ("MPAs") nationwide. The Executive Order defines MPAs broadly to include "any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." E.O. 13158 (May 26, 2000). It then requires that "[e]ach Federal agency whose actions affect the natural or cultural resources that are protected by an MPA shall identify such actions," and that, "[t]o the extent permitted by law and to the maximum extent practicable, each Federal agency, in taking such actions, shall avoid harm to the natural and cultural resources that are protected by an MPA." Id. The Navy must therefore consider and, to the maximum extent practicable, must avoid harm to the resources of all federally- and state-designated marine protected areas, including the Channel Islands National Marine Sanctuary and the other areas potentially affected by activities taking place along the west coast. These include areas implicated by the California Marine Life Protection Act, Cal. Fish & Game C. §§ 2850 et seq., which requires the Navy's conferral with the California Department of Fish & Game.

The proposed activities also implicate the Clean Air Act and Clean Water Act as well as other statutes protecting the public health. The Atlantic Fleet's exercises cannot legally be undertaken absent compliance with these and other laws.

J. Conflicts with Federal, State, and Local Land-Use Planning

NEPA requires agencies to assess possible conflicts that their projects might have with the objectives of federal, regional, state, and local land-use plans, policies, and controls. 40 C.F.R. § 1502.16(c). The Navy's training and testing activities may certainly affect resources in the coastal zone and within other state and local jurisdictions, in conflict with the purpose and intent of those areas. The consistency of Navy operations with these land-use policies must receive more thorough consideration.

K. Alternatives Analysis under Section 102(2)(E) of NEPA

Above and beyond the EIS requirement, NEPA directs agencies to "study, develop, and describe appropriate alternatives" to any project that presents "unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. § 4332(2)(E). Courts have concluded that this duty is "both independent of, and broader than, the EIS requirement." Bob Marshall Alliance v. Hodel, 852 F.2d 1223, 1229 (9th Cir. 1988), cert. denied, 109 S.Ct. 1340 (1989). Because the Navy's proposal presents "unresolved conflicts" about the proper use of "available resources," the Navy must explicitly address its separate and independent obligations under section 4332(2)(E).

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(In response to first paragraph starting: (7) Executive Order…) Areas identified as being within the EO 13158 definition of MPA, and so addressed in the Draft EIS are: the Channel Islands National Marine Sanctuary (CINMS), two national monuments found in the SOCAL Range Complex, namely the Cabrillo National Monument and the California Coastal National Monument; the Channel Islands National Park; the San Diego Wildlife Refuge Complex, a site of the National Estuarine Research Reserve System, namely the Tijuana River National Estuarine Research Reserve; and five California State Ecological Reserves (See Draft EIS/OEIS Sections 3.6.1.1, 3.6.2.3, 3.6.4.2, and 3.6.5.2). The Draft EIS/OEIS further noted that California Marine Life Protection Act (MLPA) proposes a comprehensive plan of "marine life reserves" as essential elements of the MPA system, and that while informational and GIS data has been received for the preliminary 135 MLPA proposed sites, there are currently no new locations proposed for southern California. The Draft EIS/OEIS determined that its activities, considered in light of mitigation measures that are part of the Proposed Action, would not affect MPA resources.

With regard to the CINMS, per CINMS regulations (15 CFR §922.71(a)), national defense activities in existence at the time of designation are not subject to CINMS regulatory prohibitions, provided they meet the terms and conditions of the designation document. Article 5, Section 2 of the designation document requires existing national defense activities "to be consistent with the [CINMS] regulations to the maximum extent practicable."

The Navy has determined that the Alternatives including the Proposed Action do not include new Navy activities in the CINMS, or activities that are different from those currently conducted in the CINMS. Therefore, proposed activities under the No Action Alternative are consistent with those activities currently conducted in the CINMS, are consistent with those described in the designation document, and are not being changed or modified in a way that would require consultation.

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(In response to 3rd paragraph starting: NEPA requires agencies…) The consistency of Navy operations within SOCAL with public land use policies was thoroughly considered in the Coastal Consistency Determination in accordance with the CZMA.

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The EIS/OEIS addresses appropriate alternatives for the Proposed Action. The Proposed Action does not include "uses of available resources."

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III. CONCLUSION

For the reasons set forth above, we urge the Navy to withdraw its DEIS and to revise the document prior to its recirculation for public comment.

Very truly yours,

Michael Jasny
Senior Policy Analyst

10.2.1.3 Citizens Opposing Active Sonar Threats (COAST)

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Citizens Opposing Active Sonar Threats
COAST
536 Point Road
Hancock, Maine 04640
207-422-8273

May 18, 2008

Naval Facilities Engineering Command, Southwest
Attention: SOCAL EIS Project Manager (Code REVPO)
1220 Pacific Highway
Building 127
San Diego, CA 92132-5190

Dear Project Manager;

The following comments are in regard to the Navy's Draft Environmental Impact Statement / Overseas Environmental Impact Statement (DEIS) for its proposed Southern California Range Complex (SOCAL). Please include these comments in the public record.

COAST believes that the Navy's SOCAL DEIS is seriously deficient in several ways. These deficiencies reveal the Navy's apparent lack of interest in scientifically investigating what the true environmental impacts of SOCAL activities may be. One of these deficiencies can be seen in the DEIS failure to adequately address a considerable amount of information relevant to SOCAL. This is often true when that information contradicts or otherwise suggests that the case being made by the DEIS is not accurate. The DEIS also makes a number of assumptions which are flawed, and then uses these assumptions as the foundations upon which many of its conclusions rest. Just as a weak, or crumbling foundation cannot give adequate support to a building, the flawed assumptions used in this DEIS cannot, and do not support its conclusions. Because of this, the overall conclusion made by this DEIS, that SOCAL activities will not significantly impact, or harm the environment, is not accurate, and cannot be supported scientifically.

1 Please refer to Introduction to Chapter 10, page 10-1. Responses to specific comments are provided below.

Purpose and Need

The DEIS seems intent on stressing the threat of hostile submarines that may threaten U.S. national security. However, it appears that the Navy has little recognition, if any, of the fact that the very real environmental problems affecting the world also threaten the national security not only of this nation, but of all nations. Indeed, an unbiased look at conflicts around the world will show that some of these are directly related to dwindling resources such as oil, although, as in the current U.S. war in Iraq, these conflicts are often waged under other pretenses. While the Navy prepared this DEIS because it was required by law to do so, the deficiencies of the DEIS make it

2 The Navy is very concerned about the environment and is a leading sponsor of marine mammal research, spending $26 million in FY08, which includes efforts to understand the relationship between sound and marine mammals. See Section 3.9.10.3 in the Final EIS for more information about the Navy's contribution to conservation and research.

However, it is neither the purpose nor intent of this EIS/OEIS to evaluate the impacts to national security of the state of the environment. The comment regarding adversarial threats to the U.S. is noted but is outside the scope of this EIS/OEIS.

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clear that it does not view the degradation of the environment as a threat to national security. This lack of understanding undermines the security of Americans.

National Environmental Policy Act (NEPA)

Because of the issues raised above, COAST believes that the DEIS was written in an attempt to build the case that the Navy SOCAL activities will have no significant impact upon the environment. In other words, the Navy had already come to its "conclusion", and made its decision, and the DEIS was then written so as to build a case that would support that conclusion and decision. But this is quite the opposite approach of that required by NEPA. Rather than building any pre-decisional case, NEPA mandates that the Navy take a "hard look"at the environmental consequences of its proposed actions, through an unbiased and rigorous investigation. However, this DEIS, like a number of other previous Navy sonar EISs, was written in a manner likely to confuse the reader and mislead them into accepting the Navy conclusion, in much the same way that governments have been known to "fix the intelligence" to achieve a desired policy result. To put it in other words, the DEIS attempts to "pull the wool over our eyes".

COAST also believes that the Navy has failed to meet its legal obligations under NEPA in another important way. One of the core principles of NEPA is that of public participation. This helps promote the fundamental principle of our democracy by allowing citizens a voice in federal agencies's decision making process. This aspect of NEPA reflects the belief that citizens have a right to know, and be heard, when their government proposes actions that will affect them. Scoping meetings, public hearings and comments are the means through which the public participates in the NEPA process. But, if the public's ideas, comments, and concerns fall on deaf ears, if the federal agency will not seriously consider what the public has to offer, then the public's involvement ceases to have any real meaning, and the NEPA process becomes hollow, and is nothing but a sham.

Unfortunately, this has been the case with regards to past Navy sonar EISs, and the Navy clearly has not changed course with regards to this DEIS. In fact, we notice a distinct pattern in which the Navy avoids directly addressing some comments, or dismisses or outright ignores others. This is true not only in regards to COAST's comments, but also for numerous other comments from members of the public, including many very knowledgeable on the issues involved.

Because of these failures in its writing of this DEIS, the Navy has not met its obligations under NEPA.

Coastal Zone Management Act (CZMA)

While the DEIS states that its SOCAL activities are consistent to the maximum extent practicable with the California Coastal Act and its coastal zone management plan, neither the California Coastal Commission nor the federal court (NRDC v.Winter, 2007) share this view. This kind of claim does little to enhance the credibility of this DEIS.

3 The Proposed Action, analysis of resources, and the EIS/OEIS process are complex topics. The Navy has attempted to make the topics as understandable as possible.

The Public was invited to participate in Scoping meetings and to Public Hearings to provide question-and-answer forums, fact sheets, and other information to inform the Public and encourage input.

4 The Navy reviews and considers all comments submitted during the scoping process and the public comment period. Scoping comments are not a part of the EIS/OEIS but are included in the Administrative Record. Chapter 10 includes a copy of comments received on the Draft EIS/OEIS and a response for each comment. Although all comments are reviewed and addressed where appropriate, some comments may be outside the scope of the document.

5 Please see response to CCC-2.

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Environmental Consequences

The marine environment is one that is filled with naturally occurring sound. It is also home to numerous organisms who hear or otherwise sense this sound. Many of these make use of this sound for important functions such as finding food, communication, detecting predators, mating, and other things necessary to their survival. SOCAL activities will result in an increase, sometimes a dramatic increase, of noise levels in the environment. This is due not only to the operation of the aircraft, ships, and submarines involved in the exercises, but also the use of high-intensity mid-frequency active (MFA) sonars. Other SOCAL acoustic sources, including explosive source sonobuoys also produce intense noise. When some or many of these noise sources are operating simultaneously, the result will be a vast increase in noise levels in the air as well as in the marine environment. The Navy may choose to remain in denial about this, but a child understands that in filling ocean areas with SOCAL produced noise, sometimes very intense noise, that we are going to impact the creatures who inhabit or travel through these regions, or depend on others who do. You don't need to be a rocket scientist to understand this. Although this DEIS attempts to minimize the potential impacts to the creatures who inhabit the marine environment, it is obvious that there is a great potential for adverse impacts, including impacts that may push endangered species closer to the brink of extinction.

6 Draft EIS/OEIS Sections 4.3.5 and 4.3.9 discussed anthropogenic sources of ambient airborne and ocean noise that are most likely to have contributed to increases in ambient noise. These include vessel noise from commercial shipping and general vessel traffic, oceanographic research, and naval and other use of sonar.

Expended Materials

The DEIS indicates that SOCAL activities will annually release a large quantity of "expended" materials, including materials that are toxic, into the marine environment, but insists none of these materials will have significant impacts, or cause significant harm to either sediments or water quality. The DEIS attempts to persuade the reader that any impacts will only be negligible because the materials will disperse, and be diluted and diffused. Even should this be true, a claim of no significant impact or harm is not justified, especially when the cumulative effects of these materials are analyzed. The DEIS claim is just as false as would be a similar claim by the operators of the Chernobyl nuclear facility following its disastrous accident. The materials, even if dispersed or diluted, do not just vanish from the face of the planet; they remain in some form somewhere, where they continue to affect life in the environment.

Because these materials will remain in the environment, it is unclear why the DEIS assumes they will not have any impacts upon ocean life. What is very clear is the failure of the DEIS to evaluate in a scientific manner the potential for these materials to have a cumulative adverse impact upon this life.

The SOCAL DEIS reveals little concern on the part of the Navy, but a lot of denial, regarding the impacts of the large quantity of trash, or "expendables" as the DEIS prefers to call it, the Navy will annually dump into the marine environment.

7 The Draft EIS/OEIS evaluated the proposed future expenditure and environmental fate of a variety of training materials. Both qualitative and quantitative assessments of these expenditures concluded that their effects on water quality and bottom sediments, and on the biota that inhabit these environments, would be negligible. The specific support for this assessment was found in section 3.4 of the Draft EIS/OEIS. A cumulative impact is the incremental impact of a proposal's effects when added to the effects of other projects. Thus, while the combined ocean discharges of wastewater treatment plants, urban runoff, marine vessels, and other sources may result in unhealthful concentrations of marine pollutants, the Navy's expended training materials would not measurably contribute to that impact. The EIS/OEIS addresses this issue accordingly.

Stress

While injuries and mortalities caused by SOCAL activities may be more dramatic, it is quite

8 There are limited data regarding increased stress on marine mammals as a result of sonar. A discussion of potential effects of stress was presented in the Draft EIS/OEIS, Section 3.18 of Appendix. (*Continued on next page*)

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possible that the effects of stress brought on by these activities, though harder to observe or measure, are a greater threat to marine animal populations. Stress in animals may lead to serious negative effects. Some of these effects may include a weakening of the immune system, which leaves the animal more vulnerable to parasites and diseases that normally would not be fatal. Stress may also reduce reproduction rates. Chronic stress may cause damage to the heart muscle and vasculature. Due to the intensity of some of the sound sources which will be deployed in SOCAL operations, this noise may impact waters at very considerable distances, particularly if environmental conditions act to create effects such as surface ducting. Large expanses of ocean will be filled with lower levels of sound that will impact the animals in these waters. Stress is one of several adverse effects which may occur in animals exposed to these lower levels of sound. How might increased stress levels affect pregnancy and birth rates? Where in this DEIS is the discussion on the effects of increased noise levels upon a young animal's development? If increased stress leads to increased aggression, what might the impacts of this be? How might increased stress levels resulting from SOCAL activities add to the stress levels marine animals may already be bearing due to other anthropogenic sound sources? As the oceans are oftentimes already filled with sound from these other sources, the addition of even low levels of sound from SOCAL will likely increase stress levels. How might increased stress levels resulting from SOCAL operations add to stress levels caused by threats that are not acoustic in nature? This DEIS has failed to adequately discuss the issue of stress in marine animals resulting from SOCAL activities.

Masking

The DEIS (3.9.9.2.2) states that " If the second sound were artificial, it could be potentially harassing if it disrupted hearing-related behavior such as communications or echolocation." This is true, and it is also true that masking of important sound can lead to animals falling prey to predators, or being struck by vessels, or other injurious results. It can also lead to a reduction in reproductive success. Any of these results could have long-term implications, and in some cases lead to impacts on a population level.

The last paragraph in this section of the DEIS is an obvious attempt to minimize the large potential for important sounds to be masked by SOCAL activities. In stating that the "pulse lengths are short, the duty cycle low, and these hull-mounted mid-frequency active tactical sonars transmit within a narrow band of frequencies (typically less than one-third octave).", the DEIS fails to recognize that reverberation can extend the duration of the noise so that pulse lengths become long; it also attempts to minimize the potential for masking due to the narrow frequency band but avoids the fact that many marine animals use sound in this frequency and will therefore be affected by masking from SOCAL activities. In addition, the DEIS attempts to dismiss adverse impacts that may result from SOCAL noise masking other important sound by emphasizing short pulse lengths and low duty cycles, as if serious negative impacts cannot occur within short periods of time.

The DEIS apparently believes that any masking that is to occur would result only in minimal effects. But if, for example, a sea turtle is struck and injured or killed by a ship because of the

8 (*Continued from previous page*)Sonar activities occur occasionally and are short in duration and do not regularly occur in one area, therefore, chronic exposure to marine mammals is unlikely. Further, a study by the NMFS only found small effects (increases in stress hormones) in dolphins tested in the Eastern Tropical Pacific after being chased for up to 45 minutes and then captured by being encircled in a net (Forney, K.A., D.J. St. Aubin and S.J. Chivers 2002. Chase encirclement stress studies on dolphins involved in Eastern Tropical Pacific ocean purse-seine operations during 2001. Administrative Report LJ-02-32. 27 pp.)

9 The Final EIS/OEIS has been revised to clarify the contribution of sonar to masking:

"Natural and artificial sounds can disrupt behavior by masking, or interfering with an animal's ability to hear other sounds that may be important in navigation, foraging, avoiding predators, or for social behaviors."

However, for the reasons outlined in the Final EIS/OEIS (Section 3.9.9.2.2), the chance of sonar operations causing masking effects is considered negligible.

10 Reverberation was taken into account as described in the explanation of the sonar exposure modeling methodology in Chapter 4 of Appendix F.

11 The potential for masking from MFA sonar activities was analyzed in the Draft EIS/OEIS Section 3.9.9.2.2.

12 The Navy has found no scientific research to suggest that animals exposed to MFA/HFA sonar would be more susceptible to vessel collisions.

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turtle's inability to hear the ship resulting from the masking sound of another ship, or from the use of sonar or other acoustic sources, then that effect could hardly be described as minimal. This is especially true given the threatened and endangered status of sea turtles. Clearly, the masking of important sound can lead directly or indirectly to very serious negative impacts that in turn can lead, in some cases, to population level impacts. Because masking effects may occur at lower received noise levels over large ocean areas containing many marine animals, negative impacts will likely be far greater than the DEIS would lead the reader to believe.

12 (See comment above)

Behavioral Disruption

This DEIS places too much emphasis on the few controlled exposure experiments conducted on a small number of captive animals from only several species held in an unnatural environment, and not enough emphasis on observations of the behavior of marine mammals exposed to sonar in their natural habitat.

In the 2003 Haro Strait event, the behavioral disruptions of Dall's porpoises, at least one minke whale, and the entire J-pod of orcas were observed by recognized marine mammal experts and whale watch operators. Observed behavioral disruptions involved fairly large numbers of wild marine mammals from two different species, and one individual from a third species, in their natural habitat reacting to mid-frequency sonar. Clearly, these observations are far more relevant than the behavioral experiments which were conducted on a small number of animals from only two species held captive in an unnatural environment that were exposed to sounds "similar" to sonar. The DEIS should have placed greater emphasis on the observations made during this incident, but instead attempts to cast doubt on them.

13 The EIS/OEIS sonar acoustic analysis uses a risk function methodology provided by NMFS for the Navy. NMFS is the agency with the expertise and regulatory jurisdiction for marine mammals. Both types of available data, controlled and observed were considered. Data from the Haro Strait incident, the only data set available of the behavioral responses of wild, non-captive animal upon exposure to the AN/SQS-53 MFA sonar, are incorporated into this risk function. The Navy has used the best available scientific data in this analysis.

In 2004, around 200 melon-headed whales, a species normally found only in deeper waters, swam into the shallows of Hanalei Bay during Navy RIMPAC exercises. A calf later washed ashore dead. A marine veterinarian who is a consultant to NMFS, and who observed the behavior of the whales, stated that the pod exhibited signs of being stressed. Again, this incident allowed for observations of behavioral reactions to marine mammals exposed to real sonar in their natural habitat. The Navy should be placing far more weight on the observations made during this, and the Haro Strait incident, as they are both far more relevant to behavioral reactions resulting from SOCAL activities than the trained/captive animal studies are.

14 See response to NRDC-23.

The DEIS (3.16.5.1) states "This 120 dB level is taken as the estimate received level (RL) below which the risk of significant change in a biologically important behavior approaches zero for the MFA sonar risk assessment." How can a basement value for risk of 120 dB be supported, given the body of research on behavioral disruption such as Richardson et al. (1995), which demonstrates behavioral reactions in whales by noise at around that level? In setting the basement value for risk at 120 dB, the Navy continues its attempts to push noise thresholds up higher and higher, regardless of what the thresholds for marine mammals might really be. In other words, the DEIS thresholds have much more to do with political maneuvering then they do with biology.

15 The sources presented in Richardson et al. (1995) that caused a behavioral response below 120 dB were continuous low frequency sounds such as drilling and oil platform machinery. Other sources such as acoustic pingers that emitted a 6-13 kHz pulse every second may have caused sperm whales to cease calling. Those acoustic pingers use a higher frequency and produced a signal with a very high repetition rate (1 per second vs ~2-3 per minute for MFAS). From Richardson et al. (1995; Pg 300)) stated in regards to the effects of seismic survey airguns on baleen whales " They usually continue their normal activities when exposed to pulses with received levels as high as 150 dB re 1 uPa, and sometimes even higher. Such levels are 50+ dB above typical ambient noise levels."

The thresholds for temporary threshold shift (195 dB re 1 uPa-s) and permanent threshold shift (215 re 1 uPa-s) in the hearing of cetaceans are the same thresholds previously used in the RIMPAC EA (2006a), USWEX EA (2006b) and the COMPTUEX/JTFEX EA (2007). As described in section 3.16 of Appendix F of the SOCAL Draft EIS/OEIS, the Risk Function uses a basement value of 120 dB (the B parameter) below which the probability of a behavioral response to MFA/HFA sonar (not continuous, long duration or low frequency sound sources) approaches zero with a mid-point of 165 dB (the K parameter). Previously, the Navy had used a step function with a behavioral response threshold of 173 dB re 1 uPa-s, therefore, the thresholds the Navy uses for behavioral and physiological responses have not increased.

TTS and PTS Noise Thresholds

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One of the key assumptions in this, and other Navy sonar EISs, are the noise thresholds below which the Navy claims certain impacts will not occur. However, the noise thresholds established in this DEIS, as in past Navy sonar EISs, are not scientifically supportable, and are set far too high to ever seriously be considered "conservative", though that claim is made by the DEIS. The noise thresholds do not accurately reflect levels of sound at which marine animals, if exposed to that sound, may be killed, injured, stressed, or behaviorally disrupted. Very clearly, the Navy is attempting to push the thresholds up as high as it feels it can get away with. In so doing, the impacts resulting from SOCAL produced noise will be minimized on paper and perhaps in the public's mind. However, regardless of the numbers appearing on paper, the true impacts in the real world will be far, far greater.

The research cited in the DEIS, upon which thresholds were established for TTS, PTS, and to some degree, behavioral disruption, were based largely upon a very small number of captive individuals from only several species, who have been removed from their natural habitat. The small number of individual animals who were the subjects of these few studies may not accurately reflect even the hearing sensitivity for their own species, let alone all species of marine mammals, as this can vary among individuals within a species. The fact that the thresholds for TTS and PTS were based on studies of animals who may have become habituated to test sound exposure, and to a noisy environment (San Diego Harbor), and may already have suffered some hearing loss further discredits these DEIS thresholds. Although very little is known about the hearing sensitivities of many marine mammal species, the research results from this small number of captive animals from only several species have been extrapolated to apply to all individuals from all species of marine mammals in the wild. This extrapolation is improper, and is not conservative, nor is it justified.

The DEIS claims that the tissues of the ear are the most susceptible to physiological effects of underwater sound. However, the DEIS cannot state, with any certainty, that the tissues of the ear are the most susceptible to physiological effects, as it still is not known if in vivo bubble growth is brought on by sonar sound, or the behavioral reactions of marine mammals to that sound. If bubble growth is brought on by the sound itself, as has been theorized, then that statement is clearly not true, and the threshold for injury is obviously way out of line on that basis alone, as this effect has occurred in marine mammals exposed to received levels of sound much lower than the 215 dB received level EL set by this DEIS as the threshold for injury.

Resonance

The potential of resonance effects leading to injuries in marine mammals exposed to sonar has not been ruled out by the scientific community. If the theory of resonance induced injuries is correct, it is one more reason why the 215 dB threshold for injury is invalid.

Acoustically Mediated Bubble Growth and Decompression Sickness

The DEIS (3.9.9.2.2) "discussion" of acoustically mediated bubble growth and decompression sickness failed to reference some important work that has been done on these subjects.

17 Sections 3.9.7.3 and 3.9.7.4 of the Draft EIS/OEIS explained the potential effects on marine mammals from Navy mid-frequency active (MFA) sonar in the SOCAL Range Complex. MFA sonar use in SOCAL is not new and has occurred using the same basic sonar equipment and output for decades. Given this history and the scientific evidence, the Navy believes that risk to marine mammals from sonar training is low. The Navy works to minimize impacts on marine mammals to the greatest extent practicable.

The thresholds for temporary threshold shift (195 dB re 1 uPa-s) and permanent threshold shift (215 re 1 uPa-s) in the hearing of cetaceans are the same thresholds previously used in the RIMPAC EA (2006a), USWEX EA (2006b) and the COMPTUEX/JTFEX EA (2007). As described in section 3.16 of Appendix F of the SOCAL Draft EIS/OEIS, the Risk Function uses a basement value of 120 dB (the B parameter) below which the probability of a behavioral response to MFA/HFA sonar (not continuous, long duration or low frequency sound sources) approaches zero with a mid-point of 165 dB (the K parameter). Previously, the Navy had used a step function with a behavioral response threshold of 173 dB re 1 uPa-s, therefore, the thresholds the Navy uses for behavioral and physiological responses have not increased.
For reasons discussed throughout the Draft EIS/OEIS, the modeling assumptions and analyses are very conservative, and true impacts will actually be lower.

18 See response to COAST-14 (Referring to 2nd paragraph starting: The research cited in the DEIS,…)

19 See response to NRDC-15.

20 In 2002, NMFS convened a panel of government and private scientists to address the issue of resonance (NOAA 2002). They modeled and evaluated the likelihood that U.S. Navy mid-frequency active sonar caused resonance effects in beaked whales that eventually led to their stranding (Department of Commerce and DON 2001). The conclusion of that group was that resonance in air-filled structures at the frequencies in which resonance was predicted to occur was below the frequencies utilized by the sonar systems employed. Furthermore, air cavity vibrations due to the resonance effect were not considered to be of sufficient amplitude to cause tissue damage. The SOCAL EIS/OEIS assumes that similar phenomenon will not be problematic in other cetacean species.

21 The Houser et al., 2001 paper is cited in the Draft EIS/OEIS section 3.9 page 3.9-77. (Referring to last paragraph starting: The DEIS (3.9.9.2.2) "discussion' of ….)

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Why has the DEIS neglected to mention here a paper by the Navy's own Navy Marine Mammal Program by D.S. Houser, R. Howard, and S. Ridgeway, entitled "Can diving-induced tissue nitrogen supersaturation increase the chance of acoustically driven bubble growth in marine mammals?", published in the Journal of Theoretical Biology in 2001?

Where is the discussion of J.R. Potter's paper entitled "A possible mechanism for acoustic triggering of decompression sickness symptoms in deep-diving marine mammals" presented in Taiwan in April of 2004? Dr. Potter hypothesized that under normal circumstances, air dissolved in the bloodstream of a deep-diving whale flows in and out of the small irregularities in the bloodstream called "nucleation sites"; however, when exposed to an oscillating sound wave such as sonar, more air flows into the nucleation sites than flows out. These nucleation sites then turn into small bubbles, which expand in size as air that is dissolved into the blood diffuses into the small bubbles as the whale ascends. Why did the DEIS neglect to even mention this paper?

Where is the discussion regarding Fernandez et al.,(2005) and Jepson et al., (2005) and the issue of tissue damage resulting from gas and embolic syndrome?

The DEIS states "It is unlikely that the short duration of sonar pings will be long enough to drive bubble growth to any substantial size, if such a phenomenon occurs." What is this DEIS assumption based on? And why has the DEIS neglected to mention here that reverberation effects could extend the duration of the ping?

The DEIS also states "However, an alternative but related hypothesis has also been suggested: stable bubbles could be destabilized by high-level sound exposures such that bubble growth then occurs through static diffusion of gas out of the tissues." What is it that leads the DEIS to assume that high levels of sound would be required to produce this effect? Both the Navy Marine Mammal Program paper mentioned above, and the paper by Dr. Potter suggest that gas bubbles could be activated by brief exposures to sounds of 150 dB (RMS) or lower. If this is true, then the DEIS statement quoted above is misleading.

If stable bubbles can be destabilized by sound exposures of 150 dB (RMS) or lower, leading to injuries and or mortalities in whales and other marine mammals, then clearly, the DEIS sound exposure threshold of 215 dB for physical injury has been set far too high and needs to be adjusted accordingly.

The DEIS has attempted to cast doubt onto the theories that deep-diving whales are falling victim to decompression sickness either as a direct result of sonar sound-induced bubble growth, or, because of their behavioral reactions to that sound. It also has implied that there is less support for these theories within the scientific community than actually exists. But regardless of which theory is correct, or even if both are correct, the end result is the same; injured and/or dead whales. In all likelihood, it doesn't matter much to the whales. However, the DEIS attempt to, for lack of a better term, "weasel its way out of" properly addressing the issue of decompression sickness in marine mammals, be it caused by the sonar sound, or behavioral responses to that sound, indicates once again that the intention of this Navy DEIS was not in investigating what the true

21 *(See response above)*

22 The Potter paper, which was a hypothetical paper delivered at a conference was not cited. That paper presents a hypothetical cause of bubble formation but there are currently no data to support it. The Crum and Mao 1996 and Crum et al 2005 papers were cited. The two Crum papers present laboratory evidence or theoretical calculations of bubble formation. Crum and Mao 1996 concluded that received sound levels of low frequency sound above 210 dB SPL (below 1 kHz) would be needed to cause bubble formation.

23 A detailed discussion of the hypothesis of decompression sickness and damage from bubble formation was provided in the Draft EIS/OEIS Appendix F, section 2.4.3, pages F-135-136, and F-144. Both the Fernandez and Jepson studies were referenced.

24 The statement has been clarified in the Final EIS/OEIS under *Acoustically Mediated Bubble Growth* in Section 3.9.9.2.2.

25 The Crum papers, based on theoretical calculations or experiments on blood and liver samples from bovine species stated that significant bubble growth may occur above 210 dB SPL with low frequency sounds. Terrestrial non-diving species may not be as adapted to a pressure environment as are marine mammals.

The papers suggesting that bubble formation in diving marine mammals with nitrogen gas supersaturation could be caused by ensonification are hypothetical papers with no real life data. Preliminary data from a study of nitrogen saturation in diving marine mammals shows no increase in circulating levels of nitrogen in the blood (Houser, 2007 http://www.onr.navy.mil/sci_tech/32/reports/docs/07/mbfinne2.pdf)

26 The Navy has taken a hard look at scientific studies related to cetacean reaction to sound.
These issues were discussed in the Draft EIS/OEIS on pages 3.9-62 and 3.9-77. Cox et al., 2006 have reviewed the possible mechanisms involved in strandings. Rommel et al., 2007 concluded "It is important to note that no current hypothesis of pathogenic mechanisms resulting in acoustically-related strandings is proven."
Tyack and Zimmer suggested that it is unlikely that a behavioral response to sonar that causes a rapid ascent would cause decompression sickness. Zimmer and Tyack 2007 suggested that shallow repetitive diving may lead to decompression sickness (Draft EIS/OEIS) Page 3.9-77).

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environmental consequences of SOCAL activities may be, but rather in leading the reader to accept their predetermined conclusion that these activities will have no significant impacts on the environment.

Strandings

The DEIS briefly "discussed" some (but by no means all) of the stranding events that have been linked to naval sonar. The failure to even mention a number of other documented mass- stranding events that have coincided with military sonar use or other activities seriously weakens what little credibility this DEIS might have. Of the stranding events the DEIS has mentioned, it has admitted that sonar use may have played a contributing role, along with other factors, in only a few cases, but insists that sonar only played a contributing role, and that without the presence of the other factors, the stranding would not have occurred. However, many sonar-related stranding events have occurred in which other factors mentioned in the DEIS were not present. In all likelihood, the only factors needed to produce a sonar related mass-stranding are the sonar, marine mammals, and a beach upon which the animals can strand.

Regarding the other stranding events mentioned, the DEIS makes strained and unconvincing arguments as to why these incidents were likely caused by factors other than naval sonar.

Mixed-species mass strandings are not common events. They used to be fairly quite rare. Yet a look at the strandings mentioned above shows that a number of these involved more than one species. An analysis by a beaked whale researcher from the Museum of Natural History, Smithsonian Institution, presented at a workshop of the IWC in June of 2000, found that of the seven (as of 2000) historically recorded mixed-species mass strandings involving beaked whales, all seven occurred while naval maneuvers were conducted nearby.

The DEIS discussion on mass strandings would have benefitted had it taken a careful look at the fact that prior to the deployment of high-intensity mid-range sonars in the 1960's, mass strandings of Cuvier's beaked whales were extremely rare events (Friedman 1989). The ever- growing number of these previously rare stranding events should have been included in this discussion. Why has it been neglected?

Another thing to consider regarding the discovery and recording of stranded marine mammals who may have been injured or killed by naval sonars, is that only a portion of those strandings which are discovered are carefully and transparently investigated, especially when they occur on the shores of places where the resources to carry out such investigations are not available. It is conceivable that in some cases, investigations do not take place because political or economic pressure is applied from governments wishing to keep evidence implicating naval sonars in cetacean deaths from being released. It is also possible that, for the same reason, necropsy or stranding reports are written so as to intentionally mislead the reader regarding the cause of stranding and deaths. Because of these possibilities, it is likely that far more strandings are actually caused by naval sonar than have been documented.

26 (Continued from above) Finally, it must be acknowledged that ASW activities have been conducted without incident for decades in SOCAL. In fact, many populations of non-ESA and ESA species alike have been increasing in SOCAL over the last several decades. Given the natural variation of marine mammal location over time within SOCAL, operational variability of Navy ASW operations, and the fact that there is little scientific information demonstrating broad-scale impacts that are either injurious or of significant biological impact to marine mammals, there is little relative risk to marine mammal populations from ASW training exercises.

27 Please see response to NRDC-11.

28 As explained in the Draft EIS/OEIS in Section 2.4.3.3 of Appendix F, there have been no strandings in Southern California associated with Navy sonar. Further investigation of previous strandings that may have been associated with mid-frequency active sonar are not conclusive or were not in fact associated with sonar. The Navy recognizes five strandings associated with mid-frequency active sonar, and the conditions that led to those strandings are not present in the SOCAL Range Complex.

29 The Navy does not conduct necropsies of marine mammals. The NMFS Marine Mammal Stranding Network collects marine mammal carcasses and conducts an investigation in to the cause of a stranding when warranted. However, the fact that no marine mammal death or stranding event in SOCAL has been linked to sonar in the decades of MFA sonar use is strong evidence that strandings are actually not likely to be caused by sonar.

Although the U.S. Navy will fully cooperate with host nations in response to any stranding events in proximity to its vessels, the Navy has no control over the treatment of stranded animals in foreign countries.

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One thing that is missing from this section of the DEIS, and from the DEIS as a whole, is an acknowledgment of the fact that while some whales beach themselves, or are washed ashore dead following exposure to naval sonar, others don't. It is very likely that a great many whales (and other marine mammals) are being injured and killed by naval sonars, but their injuries and deaths are not discovered, and therefore will not be recorded. While some may strand in remote areas, others (perhaps the great majority) go unrecorded due to the simple fact that they do not strand after being injured or killed. It is obvious that a great many naval activities take place far from any shore where injured and dead whales may be beached. Fernandez et al.(2005) show evidence indicating that beaked whales who were exposed to sonar most likely died as a result of decompression sickness. While some of these whales stranded, others were found dead in the water and are believed to have died at sea. As it is likely that many dead whales sink after dying, their deaths go unobserved and unrecorded. Therefore, the true impact of exposure to Navy sonar is likely far greater than is indicated by the injured and dead whales that strand upon the shore following naval sonar exercises. These ones may well be just the tip of the proverbial iceberg.

Mitigation Measures

The DEIS claims that use of its mitigation measures will greatly reduce or eliminate threats to marine mammals and sea turtles posed by SOCAL activities. Much is based upon this DEIS assumption, including its conclusion that only negligible impacts would occur and that these would not affect annual rates of recruitment or survival of affected species. However, this assumption is a terribly flawed assumption. On paper, the proposed mitigation may sound passable, but when one considers applying them in the real world, they can only be seen as thoroughly ineffective. In fact, they have been described as being "woefully inadequate and ineffectual" by a federal judge. Because so many conclusions in the DEIS rest upon the notion that the Navy mitigation measures will actually effectively mitigate harmful effects of SOCAL activities, those conclusions cannot be considered accurate.

The mitigation measures are ineffective for reasons described below, and because of this, they will do little to offer any real degree of protection for marine mammals or sea turtles. Given this, there is no legitimate reason for the DEIS to conclude that SOCAL activities will result in only negligible impacts and that impacts will not affect annual rates of recruitment or the survival of affected species.

The effectiveness of visual detection, either from trained observers aboard ships and surfaced submarines, or from trained observers in aircraft, is extremely limited by a number of factors. It is well known that many marine mammal species can remain submerged below the surface of the water, some for quite extended periods of time. Sperm whales, for example, can remain submerged for well over an hour. Dive times of 87 minutes have been recorded for Cuvier's beaked whales ((Baird et al., 2004; Baird et al., 2005b). When submerged, marine mammals (and sea turtles) can become impossible to visually detect from ships, submarines, and aircraft. While submerged, these animals do not necessarily remain in the same location. Oftentimes individuals or groups of marine mammals swim underwater, thereby changing their location. Even if these animals had been visually detected while at the surface, once submerged, visual detection ceases

30

The Navy has taken a hard look at all possible impacts to marine life from Navy sonar and other training activities.

While it is possible that some animals may sink when dead, decomposition gases would typically cause the carcass to re-float. Due to the large amount of recreational, commercial and military boat and aircraft traffic in Southern California compared to other areas, it is likely that stranded whales would be detected there.

Finally, it must be acknowledged that ASW activities have been conducted without incident for decades in SOCAL. In fact, many populations of non-ESA and ESA species alike have been increasing in SOCAL over the last several decades. Given the natural variation of marine mammal location over time within SOCAL, operational variability of Navy ASW operations, and the fact that there is little scientific information demonstrating broad-scale impacts that are either injurious or of significant biological impact to marine mammals, there is little relative risk to marine mammal populations from ASW training exercises.

31 Please see response to NRDC-3.

32 Please see response to NRDC-61.

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to be effective. Given the duration periods a number of these species can remain submerged, and the distances they can travel while submerged, visual detection is an extremely unreliable method for determining these animals are not in a given area even under the very best of ocean and weather conditions. In choppy or rough seas, it is often extremely difficult to visually detect marine mammals even when they are at the surface. Weather conditions can further contribute to this difficulty. It is estimated for example, that sighting rates for beaked whales are only about two percent (Barlow and Gisiner, 2004). Additionally, the proposed SOCAL activities will be conducted both day and night. During night time, visibility is obviously decreased dramatically, even if Night Lookout Techniques are employed. Because of these factors, visual detection of marine mammals, as well as sea turtles, is extremely unreliable even for highly trained and highly motivated individuals. The DEIS does not address the unreliability of this form of detection. Because the Navy's mitigation measures depend almost entirely on visual detection, these measures are, to a very large degree, unreliable and inadequate.

Passive acoustic detection of marine mammals is also a very unreliable method of detecting marine mammals for the simple reason that in order to detect these animals, they must be making enough sound that is distinguishable from background sounds to be detected and then identified as being sounds produced by marine mammals. Obviously, marine mammals do not always produce these sounds. Nor does it appear that sea turtles produce much sound. This method is extremely unreliable.

For the reasons stated above in these comments, the thresholds for TTS and PTS have been set unjustifiably high, and therefore, the effects of TTS and PTS will be experienced by marine mammals at levels of sound below these thresholds. Furthermore, other forms of physical injuries are very likely to occur at levels well below both of these thresholds due to decompression sickness. Therefore, the impacts upon marine mammals resulting from exposure to sound at these levels will occur over a vastly greater area that any of these "safety zones". Because of this, these zones of "safety" are entirely insufficient, and will offer marine mammals and sea turtles very little real protection, even in cases when these animals are detected.

Had the Navy chosen to avoid certain vulnerable habitat areas, it could have done much to help to mitigate adverse impacts on marine life and the marine environment, yet it has declined to do this despite the fact that it is widely accepted within the scientific community that this avoidance is one of the most effective mitigation measures.

In conclusion, the DEIS proposed mitigation measures are utterly ineffective.

Cumulative Impacts

When addressing the issue of cumulative impacts, this DEIS has, not surprisingly, taken a similar approach to other Navy sonar EISs in the past. The DEIS (4.1) claims that the approach taken follows the objectives of NEPA, and the Council on Environmental Quality (CEQ) regulations and guidance. For the reasons stated below, this claim is inaccurate.

32 See response above

33 Navy's current mitigation measures reflect the use of the best available scientific data balanced with the National Marine Fisheries Service (NMFS) approach and the requirements of the Navy to train. In the RIMPAC 2006 After Action Report, passive detection of a marine mammal led to the implementation of mitigation measures (having a detrimental effect on the training event), so the contention that the Navy's mitigation measure involving passive detection was ineffective is incorrect. There is no suggestion that mitigation measures are 100% effective, but are meant to mitigate impacts while still being able to conduct critical training activities including periods during darkness.

34 See response to COAST-17

35 Please see response to CCC-7.

The DEIS (4.1) states that the regulations define cumulative effects as: "... the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7)."

The DEIS has failed to adequately investigate what the real impacts may be of using multiple noise sources in SOCAL activities, including those with lower source levels. It has failed to discuss how these multiple noise sources may act to confuse and disorient marine mammals (or other marine animals), and how this may lead to more severe effects in greater numbers than the DEIS has estimated. It has also failed to adequately investigate how all these various sources of noise, when combined with other non-SOCAL noise, can further add to the effects mentioned above. Additionally, there is no discussion of how all these acoustic effects may increase the likelihood of impacts that are non-acoustic, such as entanglements and ship strikes. For all these reasons, the DEIS analysis of cumulative impacts is inadequate.

While this DEIS does list a number of other actions, both federal and non-federal that will or already are affecting the environment, it utterly fails to properly assess how the effects of these other actions, when combined with the effects of the proposed action, will impact the environment. Instead, the DEIS often compares the effects of the proposed action to other actions, especially when the other action's impacts are seen to be greater than those predicted for the proposed action. A very clear illustration of this can be seen in the DEIS at Figure 4.1, (Human Threats to World-wide Small Cetacean Populations). However, comparing the effects of actions is not the point of doing an analysis of cumulative effects. The point, (and purpose) in doing such an analysis as stated above, is to assess "the impact on the environment that results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions." And in this regard, the DEIS has utterly failed to meet the requirements set forth by the CEQ and by NEPA.

Alternatives

One of the basic reasons that an agency must undertake an analysis of alternatives when preparing an EIS, is to inform decision-makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts. While this DEIS does present three alternatives, including the No Action Alternative, Alternative 1, and Alternative 2, none of these alternatives actually effectively avoids or minimizes adverse impacts, for all the reasons stated above in these comments.

The Navy decision to build the instrumented range on Cortez and Tanner Banks, productive offshore habitat for endangered blue and fin whales, among others, without analyzing any alternative areas, exemplifies the Navy stance regarding the NEPA requirement to analyze alternatives. It is clear that the only real factors considered in the DEIS "analysis" of alternatives, were the factors of cost and convenience for the Navy. While these factors can legitimately be included in the alternatives analysis, they must be considered with other factors. If an alternative

36 Please see response to NRDC-53.

37 Please see response to NRDC-51.

Figure 4-1, to use the commentators example, succinctly depicts the categories of past, present, and reasonably foreseeable future actions that affect cetacean populations. Identifying such activities, and in fact comparing them for relative impacts is an appropriate approach to cumulative impacts analysis. The Draft EIS/OEIS does more than simply compare activities; it analyzes in detail the effects of Navy actions on specific resources, and places those in the context of other sources of impacts. With regard to marine mammals, the cumulative impacts analysis accurately concludes that Navy activities, while they may affect marine mammal species, will not present significant impact when compared to adverse impacts from other sources.

38 Please see response to CCC-5.

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analysis factors in cost and convenience, but does not give adequate consideration to alternatives that will help to minimize and avoid adverse impacts such as increased protection through more meaningful mitigation measures, more protective noise thresholds, and larger, more realistic safety zones, then it fails to meet the standards set forth under NEPA. That is the case here, in this DEIS. Because of these deficiencies in the analysis of alternatives, this DEIS has failed to meet its obligations under NEPA.

Conclusion

COAST believes that because of the Navy's use of flawed assumptions, a number of conclusions reached in the SOCAL DEIS cannot be scientifically supported and are therefore not valid. The DEIS failure to include information critical to the discussion further damages not only the credibility of this DEIS, but the possibility for any realistic assessment of impacts. When the inadequacy of the proposed mitigation measures is also taken into account, it is clear that SOCAL activities do, in fact, pose a grave threat to marine life and the marine environment. The Navy clearly failed, in writing this DEIS, to engage in a rigorous, and unbiased investigation into the potential environmental consequences that might result from its activities. Because of this, the SOCAL DEIS does not meet the requirements of the detailed environmental analysis required under NEPA.

39 Please refer to Introduction to Chapter 10, page 10-1. Responses to specific comments have been addressed. In addition, the EIS/OEIS provides a rigorous and thorough analysis of potential environmental impacts using best available scientific data, and in cooperation with the NMFS.

COAST strongly urges the Navy to begin to see environmental destruction for what it is; a problem which threatens the security not only of Americans, but of all life on the planet. The Navy would do well to consider a new course involving a new approach; one which recognizes the right of the life within Earth's oceans, not only to existence, but to lives lived in a healthy environment. We appreciate the opportunity to comment on the DEIS, and look forward to having our questions and comments directly responded to.

40 Please refer to Introduction to Chapter 10, page 10-1. Responses to specific comments have been provided.

Sincerely,

Russell Wray

10.2.1.4 Marine Mammal Commission (MMC)

MARINE MAMMAL COMMISSION
4340 EAST-WEST HIGHWAY, ROOM 700
BETHESDA, MD 20814-4447

23 May 2008

Naval Facilities Engineering Command, Southwest
Attention: SOCAL EIS Project Manager (Code REVPO)
1220 Pacific Highway
San Diego CA 92132-5190

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (DEIS) provided by the Department of the Navy to evaluate its Southern California Range Complex (SOCAL) activities (73 FR 18522). The DEIS analyzes the environmental effects of three alternatives (No Action/Continued Action, Alternative 1 Increased Activity, and Alternative 2 Increased Activity [preferred]) for a wide range of antisubmarine warfare, mine warfare, gunnery, bomb and missile exercises, live-fire shore-landing exercises, and more within the more than 120,000 square nautical miles (411,600 km^2) of the SOCAL range complex. The Commission will respond separately to a corresponding application for a Letter of Authorization (LOA) under the Marine Mammal Protection Act (73 FR 20918).

RECOMMENDATIONS

The Marine Mammal Commission recommends that the Navy—

- rename the "No Action" alternative in this DEIS to a term that is reflective of the actual level of activity and associated risks;
- augment its risk analysis in Appendix F to provide all the information needed to evaluate and understand the analyses of those risks, particularly the accumulation of energy from multiple pings and the distribution of that energy across depth bins;
- develop and implement a plan to validate monitoring performance before beginning operations under the approved final EIS and LOA, modify its criteria for resuming full use of operational sonar following a power-down or shutdown because of a marine mammal sighting, and provide follow-up data on the cost-effectiveness of such mitigation efforts;
- remove the mine-countermeasures range on Tanner Bank from the SOCAL DEIS and address it as a separate action when adequate detailed supporting information can be provided; and
- elaborate on the specific details of the Marine Species Monitoring Plan, including when it will be initiated, anticipated levels of effort, external review procedures, reporting milestones with descriptions of anticipated work products, and the manner in which those reports will be used to inform and update risk assessment and mitigation efforts.

1 *(In response to bullet #1 starting: rename the "No Action" alternative…)* The *Forty Most Asked Questions Concerning the Council on Environmental Quality's National Environmental Policy Act Regulations,* Number 3, addresses the question of No-Action alternatives. For EISs that study management levels of Federal assets, the no-action alternative is seen as the current management level of asset usage-in this case, status-quo as the current level of range usage. The no-action alternative can be thought of in terms of continuing with the present course of action until that action is changed. (46 Fed Reg 18026, at 18027).

To consider a no-action alternative that is defined as no range usage is not a correct baseline from which to compare other action alternatives within the EIS; therefore, the no-action alternative under existing Federal authority is current usage of the range asset with no change form current management levels. This presents an accurate baseline of on-going use of the range asset as the no-action alternative, allowing for sharply defined comparative analysis to other alternative levels of range management activity.

2 *(In response to bullet #2 starting: augment its risk analysis in Appendix F …)* The model has been evolving in response to new data and will be subject to independent peer review for conferences or journal submissions. The EIS/OEIS provides all source levels, frequency ranges, duty cycles, and other technical parameters relevant to determining potential impact on marine life unless this information was classified. Based on the information provided in the EIS/OEIS, others with the required technical expertise can use the existing information to calculate similar results. The CASS/GRAB program is export controlled and not available for public release, however, approximate results can be obtained using other mathematical models commonly available to those with the technical expertise to utilize those tools.

3 *(In response to bullet #3 starting: develop and implement a plan to …)* Please see response to CCC-12.

4 *(In response to bullet #4 starting: remove the mine-countermeasures …)* See response #4 below.

5 Please see response to CCC-12.

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RATIONALE

Revisions to the DEIS are recommended in the following areas.

No-Action Alternative: As in previous environmental analyses, the Navy uses the term "No Action" in this DEIS to mean the alternative of continued activity at the current level of effort. The Navy has argued that "No Action" is the appropriate term because "no action" is taken to change the existing level of effort. We remain concerned that this term may be confusing and misleading because No Action typically refers either to the proposed risk-producing actions not being undertaken at all or because the level of action is the same as that under an existing, approved management plan, which is not the case. To simplify an already complex task, the Marine Mammal Commission recommends that the Navy rename the "No Action" alternative in this DEIS to a term that is reflective of the actual level of activity and associated risks.

Generation of Sound Exposure Numbers: The Marine Mammal Commission commends the Navy and the National Marine Fisheries Service for their considerable efforts to develop clear, scientifically based risk criteria despite considerable unknowns. However, the DEIS (Chapter 3 and Appendix F) describes only parts of the modeling/analytical process and required data. As a result, we are not able to follow and verify the calculations of exposure risk and to reconcile input (sound production) and outcomes (exposures). For example, we were not able to understand how multiple pings of sonar were translated into exposure levels for marine mammals that are distributed both geographically and throughout the water column. The exposure function is particularly difficult to understand as it involves a potentially large zone of influence in which sound levels may not be uniformly distributed, horizontally or vertically. The estimation of exposure levels by depth was further confounded because the bins used to characterize sound levels were different than those used to model the depth distribution of marine mammals (which also varied by species). Any computational shortcuts or assumptions used in these analyses of dose levels were not described in the DEIS.

Because the risk assessment provides the primary basis for evaluation of and selection among alternatives, the Marine Mammal Commission recommends that the Navy augment its risk analysis in Appendix F to provide all the information needed to evaluate and understand the analyses of those risks, particularly the accumulation of energy from multiple pings and the distribution of that energy across depth bins. Doing so is necessary to reconcile the estimated number of takes by Level A and Level B harassment based on Navy sound production patterns and patterns of marine mammal distribution and density, both of which are complex in time and space.

Monitoring and Mitigation: The Marine Mammal Commission also commends the Navy's commitment to refining existing monitoring and mitigation capabilities, such as passive acoustic monitoring, and to developing new capabilities for future use. Such investment indicates the Navy's sincere commitment to reducing environmental risk from its activities and represents a substantial contribution to national marine environmental stewardship goals. The Marine Species Monitoring Plan (page 5-16) is an example of such commitment that will generate additional biological data to document long-term trends and inform efforts to plan subsequent exercises.

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With its many capabilities, the Navy is in a position to contribute meaningfully by conducting additional studies to assess the effectiveness of mitigation. Such performance verification procedures are a standard Navy process for many of its tactical and personnel safety systems, are cost-effective, and can be performed in a matter of weeks or months. The Navy's most recent SURTASS LFA EIS included such performance analyses for its monitoring processes. Similar analyses are warranted to evaluate such critical mitigation measures as watchstander training effectiveness and probability of detecting various marine species of concern and the effectiveness of night vision and passive acoustics, as included in the monitoring protocol. Performing such verification and validation tests is essential for determining whether the Navy is, in fact, being realistic in its claims regarding its proposed mitigation efforts.

In previous comments to the Navy, we suggested that the criteria for resuming sonar use or powering up following a shutdown or reduction is not sufficiently precautionary, most especially with respect to the criterion of ship travel. The current criteria for moderating operations are (1) an observed marine mammal is seen leaving the area (which rarely occurs), (2) it is not seen for 30 minutes (which often happens even if it is not a deep diver because successive surfacings are not always seen), or (3) the ship travels 2,000 yards beyond the point at which shutdown or a source level reduction was initially required. We believe this third criterion may allow resumption of sonar too soon after a sighting. A safer course of action might be to adopt a simple rule of 30 minutes for most marine mammals and 60 minutes for deep divers like sperm and beaked whales unless the animal is resighted at a safe range before that time. If the Navy believes that such simple criteria will result in too much lost training time, a six-month or one-year trial could be conducted. The burden imposed by this requirement could then be evaluated after collection of substantive data to determine actual costs and the practicality of this measure.

For these reasons, the Marine Mammal Commission recommends that the Navy develop and implement a plan to validate monitoring performance before beginning operations under the approved final EIS and LOA, modify its criteria for resuming full use of operational sonar following a power-down or shutdown because of a marine mammal sighting, and provide follow-up data on the cost-effectiveness of such mitigation efforts.

Tanner Bank: The DEIS suggests that the Navy may add a mine-countermeasures range within the Tanner Bank area. The biological importance of Tanner Bank is well documented, and any plans to increase naval activity in that area should be carefully weighed against the option of increasing the use of existing countermeasure sites or placing the new site elsewhere where it would have the least possible impact. The SOCAL DEIS provides no coordinates or mapping of the proposed inert mine field within Tanner Bank; nor is there sufficient discussion of the specific likely impact of mine-countermeasures activity. The text refers to Figure 3.4-3, but the banks are not shown on that map, and in a figure that does provide the location of the banks (Figure 1-3), the label for Tanner Bank is misplaced by about 20 nautical miles. The expansion of the SOCAL Offshore Acoustic Range into that area provides an opportunity to better monitor the site at all times, but this aspect of the cost/benefit equation also has not been considered in the DEIS. The prudent and safe course of action is to exclude the proposed Tanner Bank mine-countermeasures exercise range from this DEIS and address it in a separate, independent analysis. For these reasons, the Marine Mammal

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*(In response to comment #4 above and the paragraph below starting: **Tanner Bank**: The DEIS suggest that the Navy….)* Variability in animal presence within relatively small ocean sub-areas, such as Tanner or Cortes Banks, is often strongly correlated with daily, weekly, seasonal and even decadal changes in prey availability with prey availability being driven by changes in both local and basin-wide oceanographic conditions. Any specific area of high animal density at a given time may have low animal density the following day, week, or year depending on the biotic and abiotic factors affecting the prey distribution.

The area depicted around SCI, including Tanner Bank, has been extensively surveyed because of ease of access. Since mid-1990 to 2003, the Navy funded many NMFS surveys (aerial and passive acoustic monitoring) in this region.

Historically, other areas of SOCAL have been under-sampled. These include offshore areas east of San Diego, south of SCI, and from San Diego to and beyond the continental shelf (called the Patton Escarpment). The state of science on small scale animal distribution within SOCAL remains in development and there is much about the seasonality of animal distributions that is unknown.

Figure 1-3 accurately shows the location of Tanner Bank and depicts the general area of the yet-unspecified location of the shallow water minefield.

The shallow water minefield discussion of analysis has been improved in Section 2.5.2.2 of the Final EIS/OEIS. The Navy has concluded that analysis of this range complex enhancement in this EIS/OEIS is sufficient. The Navy has carefully weighed the option of the existing ranges vs the need for new locations and has determined there is a need for the new site based on increased requirements for mine warfare training as described in Section 2.5.2.2.

The Navy, in cooperation with NMFS, is developing a monitoring plan that would investigate the effects on marine mammals from Navy sonar activities. This plan will include pre- and post-exercise monitoring of marine mammal distribution and abundance in the exercise area as well as the effectiveness of Navy mitigation measures. See Section 3.9.10.3.1 of the Final EIS/OEIS.

6

Tanner Bank was confirmed to be properly located, but Cortes Bank was indeed misplaced to the west. This figure has been corrected in this Final EIS/OEIS.

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Commission recommends that the Navy remove the mine-countermeasures range on Tanner Bank from the SOCAL DEIS and address it as a separate action when adequate detailed supporting information can be provided.

DETAILED COMMENTS

The Marine Mammal Commission also offers the following detailed comments and questions to enhance the SOCAL DEIS.

- The label for Tanner Bank is considerably displaced to the west in Figure 1-3, which makes subsequent discussions of important topics, such as the installation of a mine-countermeasures exercise area, difficult to follow.
- The statement on page 2-16 that "the Navy has been operating in the SOCAL Range for over 70 years" is a misleading rationale for justifying the environmental risk from current activities. The types of equipment and the type and tempo of training have changed appreciably over that time. In fact, one could probably document changes within the last five years or less, consistent with changing mission needs and the Navy's strategic approach to addressing those needs.
- Some of the descriptions of baleen whale species, beginning with blue whales on page 3.9-2, state that there is no information on their hearing ability, even though the information provided in Appendix F provides a well-referenced and properly reasoned explanation for why we may reasonably consider them infrasound specialists for the purpose of this risk analysis.
- Chapter 3.9.7 and Chapter 5 are unnecessarily redundant regarding risk thresholds, risk estimation, and mitigation of risk. The DEIS could be shortened considerably without loss of information by eliminating the redundancy.
- The criteria on page 3.9-90 to initiate additional planning and monitoring effort for beaked whales are too speculative and too restrictive to offer the kind of assurance implied. A number of factors have been suggested as possible contributors to the likelihood of stranding, including steeply sloping bathymetry near shore, multiple sonars, a possible strong and deep surface duct, and bottom terrain forming a channel or embayment. However, it is not clear that all these factors are necessary for a stranding to occur. The inclusion of highly speculative and exact numbers for shore steepness, number and duration of multi-ship sonar operations, and dimensions for a "safe" versus "unsafe" bay or channel suggests misleading confidence in our ability to predict and prevent such strandings. The presence of beaked whales is well documented in many parts of the SOCAL range, including areas that do not meet the listed habitat criteria. Typical antisubmarine warfare engagements may involve one or more surface vessels entering a bay or channel or near-shore waters where surface ducts are relatively common. These ducts can strongly affect sonar propagation with important tactical and environmental consequences. All of these factors should be sufficient to invoke additional caution in these exercises. The assumption that one only need be concerned when all of the above conditions are met, which is unlikely in the SOCAL area, is inconsistent with the Navy's own analyses of historical strandings in Appendix F. In those analyses, the Navy

7 The statement is factually accurate, is not intended to be misleading, and is not used to justify environmental risk from current activities. Environmental risk from current (and proposed future) activities is justified in the Draft EIS/OEIS in part by the need to organize, train, and equip the Navy's operating forces to accomplish their national defense missions using the SOCAL Range Complex. The Navy clearly acknowledges that its equipment and tempo of training have increased over time, and in fact the Draft EIS/OEIS documents such changes in some detail in Section 1.2.1 and throughout Chapter 2.

8 The section has been revised in the Final EIS/OEIS to include the references mentioned in the comment.

9 The authors intentionally placed information in more than one section in the Draft EIS/OEIS, with the assumption that some readers will focus on particular sections, and disregard other sections. To keep each discussion complete, this required repeating information.

10 (In regard to last bullet stating: the criteria on page 3.9-90….)

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emphasized that it was impossible to determine the exposure levels during the events because it was not known where the animals were or when and how they reacted in such a way that stranding resulted. In the Bahamas stranding, there were never more than two ships operating sonars at any one time, and the ships did not spend all of the time within 10 miles of each other, and certainly not for six or more hours. In most of the other strandings covered in Appendix F, the exact number of ships, their relative locations, and the number that were actively pinging are not known—or at least have not been publicly reported. This information is enough to preclude any expression of confidence that more than three ships are required to produce the effect, that they must be operating in the area for more than six hours, and that this activity must be in areas of very strictly defined geography for a stranding to occur. Again, under the conditions likely to occur in the SOCAL range, we believe that extra caution is needed in planning and monitoring.

- The use of passive acoustics to detect marine mammals is described in Chapter 5 (page 5-8) and Chapter 3.9.10.1.2 (page 3.9-89). The information does not describe the training and capability of personnel to detect marine mammal sounds and recognize them as such, as is provided from visual watchstander training. The DEIS also does not describe how personnel reconcile competing duties for tactical monitoring or how the passive acoustic information is incorporated into the mitigation decision process. The DEIS also does not provide information on the detection range, localization capability, or frequency bandwidth of the sensors, which is required to evaluate the effectiveness of the passive acoustic sensor. Is it possible, for example, to determine range and bearing to a detected sound or is detection used simply to alert visual watchstanders?
- The Navy's development of a Marine Species Monitoring Program is commendable but should be described in greater detail. Such information will provide a basis for judging the quality and utility of the program in determining the effects of various Navy activities. The idea that the program will only be reviewed by Navy biologists raises concerns regarding accountability and the actual substantive value that might be provided by this effort, should it in fact occur. We strongly encourage the Navy to incorporate a more definite plan into the DEIS and to provide for some form of external expert review and open sharing of data in a timely manner. If the program is implemented, the data will be of great value, not only to verify and improve Navy risk assessment and mitigation but to manage other human activities exerting a cumulative effect on marine species in the region (e.g., the cumulative impacts of urban wastewater discharge, fisheries impacts, shipping and other human activities exerting a cumulative impact on the Southern California Bight). For these reasons, the Marine Mammal Commission recommends that the Navy elaborate on the specific details of the Marine Species Monitoring Plan, including when it will be initiated, anticipated levels of effort, external review procedures, reporting milestones with descriptions of anticipated work products, and the manner in which those reports will be used to inform and update risk assessment and mitigation efforts.
- The Navy has made a significant investment in research on the effects of noise on marine mammals but could do more by sponsoring additional investigations of ongoing and planned research activities and the methods to improve risk assessment or risk reduction. For example, the Effects of Sound on the Marine Environment (ESME) program is intended to

11 Please see response to CCC-12.

12 Please see response to CCC-12.

13 While the Navy is very involved in marine mammal research, the purpose of this EIS is not to evaluate research on marine mammals, but to use the latest information from available research to assess potential impacts to the environment.

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improve modeling of risk, but it is not clear that the Navy plans to evaluate the success of this program or promote its implementation if it is found to be effective.

- The discussion of cumulative effects (Chapter 4) is typical of most National Environmental Policy Act documents. It lists other effects that animals in the region may encounter without offering much depth of analysis as to the cumulative effects of fishery bycatch and naval training, for example. The shortcomings of the cumulative effects analysis are exacerbated by the decision on page 1-14 to not include other Navy activities within or adjacent to the activities and area covered by this DEIS. The Commission believes that some level of discussion about the nearby Point Mugu Sea Range activities and activities associated with San Nicolas Island or Camp Pendleton merit discussion in Chapter 4. Many of the affected animals using the SOCAL range area also are likely to use the area around San Nicolas Island or north of SOCAL in Point Mugu or elsewhere and incur cumulative sonar exposures or cumulative risk from explosives use, vessel traffic, and other naval activities. Although it may not be possible to quantify with confidence activities that have not yet been analyzed to the level apparent in the SOCAL DEIS, the Navy should at least acknowledge the additional risk of exposure from naval activities elsewhere within the migratory range or habitat of marine mammals in this region.
- The subject of post-event reports is unevenly treated. On page 5-10 the specific information to be included in a post-event report to the National Marine Fisheries Service is detailed for one type of activity, but post-event reporting for most, if not all, other activities is either not described or is inadequate. These reports have great potential value to the Navy, regulators, and the interested public. They may elucidate the effectiveness of monitoring, they may document the burden of some mitigation measures now considered "easy" to implement, and they may confirm or suggest areas of improvement for predictive models of animal abundance and risk. Yet the DEIS does not contain a clear requirement for post-event reports, with the possible exception of sighting of dead or stranded animals and the SINKEX report. For an emerging environmental risk like underwater noise, accountability and documentation processes such as post-event reports are critical to resolving the currently divergent opinions about the actual risk of noise, the best way to effectively detect and mitigate acoustic effects, and the actual cost to naval readiness or other sound-producing activities from these newly implemented monitoring and mitigation activities.
- The data on pinniped abundance, pup production and other related data seemed less current than data for most other species. Most pinniped sections in Appendix F reference data from the 1997–1998 El Nino period or surveys dated no later than 2001. If in fact there have been no systematic surveys since 2001, then general population assessments like the NMFS stock assessment reports should perhaps be included in the density estimates. Some species, like elephant seals and California sea lions, have continued to experience a steady and strong rate of population increase since 2001, resulting in considerably higher numbers throughout their range, including the Southern California Bight.
- The use of a single sound velocity profile for the entire SOCAL region (Appendix F-209) does not seem realistic or necessary.

13 *(Refer to response above).*

14 Nearby ranges are included under Cumulative Impacts in the Final EIS/OEIS. Sonar is the only activity conducted on the Point Mugu Sea Range (PMSR) that is not covered in the PMSR EIS. For that reason, sonar, and its potential impacts, are analyzed here in the SOCAL EIS/OEIS. To restate Section 1.3.3 of the SOCAL Draft EIS/OEIS: "ASW training that occurs or would occur as part of the Proposed Action in the southern portion of the Point Mugu Sea Range near the boundary with the SOCAL Range Complex is not addressed in the Point Mugu EIS/OEIS. Such training is therefore addressed in the SOCAL Range Complex EIS/OEIS."

15 Please see response to CCC-12.

16 (In response to 3rd bullet starting: The data…) The best, most applicable, data on pinnipeds was used throughout the development of the Draft EIS/OEIS. Some of the data discussing issues of behavior, physiology, and population status was several years old as noted by the comment. In determining population status information used in the analysis, the authors considered the most recent data available, which included NMFS Stock Assessment Reports for 2006 (Carretta et al. 2007a,) and NMFS Technical Memorandum (e.g. Lowry 2002 for harbor seals; Lowry and Carretta 2003 for northern elephant seals). These reports were cited several times in Appendix F of the Draft EIS/OEIS, including Table 2-1 (footnote p. F-6), population status of Guadalupe fur seals (p. F-26), population status of California sea lions (p. F-57), population status of northern fur seals (p. F-59), and Table 2-3 (Summary of marine mammal densities, p. F-110). Since the publication of the Draft EIS/OEIS, the final 2007 Stock Assessment Report (SAR) for the Pacific became available, and is used in this Final EIS/OEIS. However, only the northern elephant seal and the California sea lion estimated population numbers were updated in the 2007 SAR that was finalized in 2008 (Carretta et al. 2007b) using unpublished data from 2005.

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We have tried to keep our recommendations within the demonstrated capabilities of the Navy. We hope that our comments prove beneficial to the development of the final EIS and request for an LOA under the Marine Mammal Protection Act. Please contact me if you have questions about any of our recommendations or comments.

Sincerely,

Timothy J. Ragen, Ph.D.
Executive Director

Cc: RADM Larry Rice, CNO N45
Hon. Donald Schregardus, DASN E
Craig Johnson, NOAA/NMFS OPR

17 (In regard to last bullet on previous page starting: The use of a single sound…)

10.2.1.5 Environmental Protection Agency (EPA) Region IX

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

June 2, 2008

Ms. Diori Kreske
Naval Facilities Engineering
Command Southwest
2585 Callaghan Highway
San Diego, CA 92136-5198

Subject: EPA comments on the Southern California Range Complex Draft Environmental Impact Statement (DEIS), California (CEQ # 20080119)

Dear Ms. Kreske:

The U.S. Environmental Protection Agency (EPA) has reviewed the above-referenced document pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), and our NEPA review authority under Section 309 of the Clean Air Act. Thank you for agreeing to accept our comments past the comment deadline (phone conversation Diori Kreske and Karen Vitulano, May 14, 2008). Our detailed comments are enclosed.

1 Response to specific comments given below.

The Draft EIS/OEIS (herein DEIS) assesses the impacts of current and increased Navy training, and research and development activities in the Southern California Range Complex (SOCAL Range Complex), which includes over 120,000 square nautical miles (nm^2) off the coast of Southern California including near-shore areas, open ocean, and land on San Clemente Island. The Range Complex includes several biologically rich areas in the Southern California Bight including a portion of the Channel Islands National Marine Sanctuary.

The No-Action Alternative evaluates the current level of Navy training in the Range Complex, including over 39,000 annual operations and up to 14 major range events per year. Alternative 1 evaluates increased scope and intensity of training including over 45,000 annual operations and additional major range events and weapons systems. Alternative 2 evaluates further increased scope and intensity of training including over 50,000 annual operations, establishment of new underwater mine ranges, and the addition of major range events. The Navy's preferred alternative is Alternative 2.

Based on our review, we have rated the DEIS as Environmental Concerns – Insufficient Information (EC-2) (see enclosed "Summary of Rating Definitions"). EPA has concerns regarding impacts to marine resources from the preferred alternative. The preferred alternative proposes substantial increases in training operations, including increases in the use of mid-frequency active (MFA) sonar which has been associated with marine mammal strandings. The preferred alternative will also result in increased hazardous constituent releases to the ocean environment. EPA recommends additional mitigation measures be included in association with

MFA sonar use to represent a more precautionary approach commensurate with the scientific controversy, uncertainty, and unknown risks to seven threatened or endangered marine mammals in the Range Complex. We also request additional information regarding efforts to minimize and reduce the amount of hazardous materials deposited into the ocean from training material expenditures.

We are also concerned with the limited range of alternatives evaluated and suggest that the selection criteria be refined so that additional alternatives can be developed that meet the underlying purpose and need. Lastly, the general conformity analysis is not sufficient to demonstrate conformity with the State Implementation Plan (SIP) and we provide comments for improving this analysis.

EPA appreciates the opportunity to review this DEIS. When the Final EIS is released for public review, please send one copy to the address above (mail code: CED-2). If you have any questions, please contact me at (415) 972-3846 or Karen Vitulano, the lead reviewer for this project, at 415-947-4178 or vitulano.karen@epa.gov.

Sincerely,

for Connell Dunning

Nova Blazej, Manager
Environmental Review Office

Enclosure: Summary of EPA Rating Definitions
EPA's Detailed Comments

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1 *(See response above)*

SUMMARY OF EPA RATING DEFINITIONS

This rating system was developed as a means to summarize EPA's level of concern with a proposed action. The ratings are a combination of alphabetical categories for evaluation of the environmental impacts of the proposal and numerical categories for evaluation of the adequacy of the EIS.

ENVIRONMENTAL IMPACT OF THE ACTION

"LO" (Lack of Objections)

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

"EC" (Environmental Concerns)

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

"EO" (Environmental Objections)

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

"EU" (Environmentally Unsatisfactory)

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potentially unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

ADEQUACY OF THE IMPACT STATEMENT

Category 1" (Adequate)

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

"Category 2" (Insufficient Information)

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analysed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

"Category 3" (Inadequate)

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analysed in the draft EIS, which should be analysed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

EPA DETAILED COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT, SOUTHERN CALIFORNIA RANGE COMPLEX, CALIFORNIA, JUNE 2, 2008

Purpose and Need and Alternatives

Limited Range of Alternatives
EPA is concerned that the DEIS for the Southern California Range Complex does not evaluate a full range of reasonable alternatives that meet the underlying purpose and need for the project. The No-action Alternative represents the existing level of training; Alternative 1 consists of the exercises in the No-action Alternative with the addition of 2 new training exercises and an increased in scope and intensity of training; and Alternative 2 includes the same exercises as Alternative 1 with further increased scope and intensity of training and construction of a shallow water minefield and shallow water training range. The alternatives analysis of this DEIS would be much improved by including alternatives that represented a more diverse level and mix of training instead of formulating alternatives that simply build upon one another. Additionally, the inclusion of an alternative with additional appropriate mitigation (40 CFR 1502.14(f)) would also expand the range of alternatives.

Recommendation: In the Final EIS (FEIS), EPA recommends evaluation of additional alternatives that represent a more diverse level and mix of training and research/ development activities. We suggest an alternative be developed with additional mitigation measures and that an alternative with geographic and/or temporal exclusions be considered (see below).

2 Please see response to NRDC-58.

Alternative with Temporal or Geographic Constraints
EPA is concerned that the DEIS did not fully explore an alternative with temporal or geographic constraints in the alternatives evaluation. The DEIS states that any alternative that would impose limitations on training locations within the SOCAL Range Complex would not be acceptable (p. 2-15). It further states that limitation on access to any component of the Range Complex would threaten the ability of the Navy to integrate its training across all warfare areas and presumably not meet criterion #1 which is to support all requirements of the Fleet Response Training Plan (FRTP).

The use of geographic and/or temporal exclusions can potentially be effective in reducing impacts to marine resources. The DEIS does not clearly demonstrate that developing an alternative with some geographic and/or temporal exclusions would not meet the underlying purpose and need. We note that the Navy includes some geographic limitations in its proposed mitigation measures[1].

Recommendation: EPA recommends the development and evaluation of an alternative(s) with geographic and/or temporal exclusions. We recommend the identification of

3 Please see response to CCC-7.

[1] The operation procedures discussed under mitigation measures state that the Navy should avoid planning major Antisubmarine Warfare (ASW) training exercises with mid-frequency active (MFA) sonar in areas of at least 1,000-meter depth near a shoreline where there is rapid change in bathymetry, areas surrounded by land masses separated by less than 35 nautical miles, or embayments where multiple ships using MFA sonar near land may produce sound directed toward a channel or embayment that may cut off the lines of egress for marine mammals, and areas with historical presence of surface duct (p. 3.9-92, 5-9).

1

geographic areas where resources would benefit from training exclusions and discussion of how inclusion of one or more of these areas would affect training goals and the underlying purpose and need.

Use of Alternative Selection Criteria

EPA is concerned that the criteria developed to eliminate and select the range of alternatives, 1) appears to be so narrowly defined as to restrict the range of alternatives analyzed, 2) does not appear to have been applied consistently, and 3) highlights sustainable range practices that protect and conserve natural and cultural resources, yet does not identify how this was incorporated into alternative selection.

Recommendations: Provide more information regarding the development of criteria used to evaluate alternatives for meeting the purpose and need, and how these criteria were applied to each alternative.

Revise the criteria so that it is not so narrowly defined as to limit the range of alternatives evaluated. For example, criterion #1 states that the alternative should support all requirements of the Fleet Response Training Plan (FRTP). The DEIS does not provide information regarding the FRTP or how an alternative would be deemed supportive of all requirements. It is also unclear why all FRTP requirements must be fulfilled completely by activities in the Southern California Range Complex to meet the underlying purpose and need, or whether other range complexes also operate to fulfill FRTP requirements. The Navy is also substantially increasing or proposing to substantially increase training in the Northwest Range Complex, Hawaii Range Complex, and the Mariana Islands Range Complex. If these other range complexes in the Pacific also are fulfilling FRTP requirements, then the criteria of having the SOCAL Range Complex fulfill all FRTP requirements would be unnecessarily high and limit the range of reasonable alternatives.

Additionally, criterion #11 states that the alternative should support use of the range complex to the "maximum extent possible". This would seem to favor only the preferred alternative, which has the largest increase in scope and intensity of training, and eliminate other alternatives that might meet the underlying purpose and need while avoiding or minimizing adverse effects on the human environment (40 CFR 1500.2 e). The criteria should be revised so that it is not so narrowly defined that it precludes assessing other reasonable alternatives that could avoid or minimize adverse effects upon environmental resources.

Apply criteria consistently across all alternatives. The DEIS states that the No Action Alternative (continued current training levels) generally satisfies Fleet training requirements but does not meet the purpose and need because it does not accommodate surge requirements training (p. 2-17). Alternative 1 is deemed meeting the purpose and need because it partially accommodates these needs even though it does not support criteria #10 for range enhancements (p. 2-32). The application of criteria #10 then does not appear to be applied as the other criteria towards meeting the purpose and need. The criteria should be applied consistently in determining the range of alternatives to be

2

3 *(See response above)*

4 An Agency may identify parameters and criteria related to planning standards and for generating alternatives to which it will devote serious consideration. Without such criteria, an Agency could generate countless alternatives. The analysis presented specifically discusses training criteria which reflect operational readiness objectives. Each criteria is compared to a range of alternatives that examine range usage. This analysis reflects the hard, comparable look at the environmental impacts associated with each reasonable alternative. This comparative analysis results in a thorough discussion of the probable environmental consequences of each alternative.

The criteria used to evaluate alternatives are based upon the Navy's mandate to train naval forces for world-wide deployment while maintaining compliance with applicable laws. Alternatives that do not meet military readiness requirements through the application of defined criteria do not meet the purpose and need of the proposal. Therefore, the application of criteria has assisted the Navy in defining reasonable alternatives suitable for examination in the EIS in light of the objectives of the Federal action.

analyzed in the document and should be refined to assist in eliminating alternatives that would not meet the "underlying purpose and need" (40 CFR 1502.13),

Demonstrate how alternatives meet criterion #12, which states that the alternative should support sustainable range management practices that protect and conserve natural and cultural resources. EPA commends the Navy for including this criterion, however the DEIS does not provide information on how this criterion was considered in evaluating potential alternatives.

Impacts from Mid-Frequency Active (MFA) Sonar

Significance of Impacts
We understand that there is a substantial amount of uncertainty in predicting impacts to marine mammals and resources from MFA sonar. The DEIS describes a complex methodology to attempt to predict the number of harassments and injury that will occur to marine mammals from MFA sonar use. The substantial uncertainty inherent in this evaluation is a cause for concern. The methodology is based on admittedly "sparse data" (p. 3.9-52) (3 data sets), with one of the data sets using acoustic stimuli dissimilar to the Navy's MFA sonar, and another involving inconsistent and anecdotal observations (p. 3.9-53). Additionally, the data represents only four species, and the Navy acknowledges that behavioral responses to sonar can vary significantly by species (p. 3.9-45).

Using this methodology, the DEIS estimates that the preferred alternative 2 will result in 94,370 annual exposures to marine mammals that could alter behavior, 18,838 exposures that will result in temporary hearing loss, and 30 annual exposures that will result in permanent hearing loss, and no mortalities (p. 3.9-83). The basis for concluding that the 30 animals experiencing permanent hearing loss will not be linked to mortalities is not clear considering the important role hearing plays in communication, navigation and foraging (p. 3.9-32).

The DEIS indicates that this represents the best available science, but it also recognizes that there are many unknowns in assessing the effects and significance of marine mammal responses to sound exposures (p. 3.9-31). Applying the criteria for assessing significance under the Council on Environmental Quality (CEQ) Regulations, especially the degree to which the effects on the quality of the human environment are likely to be highly (scientifically) controversial, the degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks, and the degree to which the action may adversely affect endangered or threatened species (40 CFR 1508.27(4),(5) and (9) respectively), EPA maintains that these impacts are potentially significant under NEPA and that robust mitigation measures are needed to reduce environmental impacts.

Recommendation: We recommend the Navy consider the scientific controversy, uncertain/unknown risks, and presence of threatened and endangered species in assessing significance of impacts from MFA sonar on marine resources and the need for mitigation measures. We recommend precaution be maximized regarding the use of MFA sonar. We also recommend the approach used with the Hawaii Range Complex be considered,

3

4 (Refer to response above)

5 As complex as the methodology appears, it remains a simplification of the actual environment. This leads to results that the Navy assess as an overestimation of the overall effects to marine species. For example, the model depicts a uniform distribution of animals when, in fact, they tend to appear in pods, making detection and avoidance more likely.

Also, these acoustic modeling results do not consider any of the Navy's 29 specific mitigation measures, designed to significantly reduce marine mammal exposures.

6 The Draft EIS/OEIS considered and analyzed the best available scientific data and also discussed appropriate mitigation measures.

The level of training activity required to meet training requirements in SOCAL cannot be assumed to be similar to requirements in another range complex. As explained in Section 2.2.2.2, "Any reduction of training would not allow the Navy to achieve satisfactory levels of proficiency and readiness required to accomplish assigned missions." In the case of SOCAL, this applies to MFA sonar training. Reductions in sonar training, whether No Action Alternative levels were distributed across additional exercises or not, would fail to meet the purpose and need of the Proposed Action.

where existing levels of MFA sonar (No Action Alternative) were distributed across additional exercises, and recommend this be discussed in the FEIS.

Mitigation Measures

The DEIS states that the Navy has implemented a comprehensive suite of mitigation measures to reduce impacts to marine mammals (p. 3.9-87). However, the mitigation measures for impacts from MFA sonar in the DEIS do not appear comprehensive and consist only of training and posting lookouts on ships to spot marine mammals, and a safety zone of 1,000 yards within which marine mammal sightings will prompt the ship to limit active sonar transmission by at least 6 decibels (p. 3.9-90). We agree that lookouts are important, but the DEIS acknowledges that cetaceans are difficult to locate visually (3.9-24), and nighttime and inclement weather would reduce visibility making siting even more difficult. The effectiveness of the safety zone depends upon accurate siting. Additionally, it is not clear how the safety zone of 1,000 yards was established.

The DEIS states that any limitations on its activities will threaten military readiness and eliminates mitigation measures on this basis (p. 3.9-101). However, the Navy does adopt some measures that impose significant limitations on training. For example, the DEIS identifies these mitigation measures to reduce impacts from underwater detonations during Major Exercises:

- A pre-exercise survey will take place within 30 minutes of the event and the exercise paused if an animal is present within the survey area until it voluntarily leaves (p. 3.9-95).
- Ordnance cannot be released until the target area is deemed clear (p. 3.8-14) and operations are immediately halted if marine mammals or sea turtles are observed within the target area and delayed until the animal clears the target area (p. 3.8-14).
- Post exercise surveys shall be conducted within 30 minutes after completion of the explosive event (p. 3.9-95).

It is unclear why these mitigation measures do not threaten military readiness while others do. The DEIS should include specific criteria for how and when military readiness is deemed threatened such that mitigation measures to avoid impacts are dismissed.

Because of potentially significant impacts to marine mammals from MFA sonar use (see comment above), we recommend the Navy implement additional mitigation measures to reduce these impacts. We understand that the National Marine Fisheries Service may impose additional mitigation measures for the Letter of Authorization it will issue under the Marine Mammal Protection Act.

Recommendations: EPA recommends the following mitigation measures be considered:

- Utilize a larger safety zone of at least 2,200 yards as recommended by the California Coastal Commission. Other nations are able to train using this safety zone. (North Atlantic Treaty Organization (NATO) applies a 2,000 meter shutdown zone when a marine mammal is detected; Australia applies a 4,000 yard safety zone).
- Avoid areas within the Channel Islands National Marine Sanctuary. The avoidance of this and other biologically rich areas could reduce impacts on marine mammals and other marine resources. The DEIS states that avoiding any area that has the potential for marine mammal populations is impractical (p. 3.9-103), however we are

4

6 (Refer to response above)

Please see response to NRDC-3.

7 While the mitigation measures listed in this comment do have some measured, negative impact on training realism, they are also proven to be effective in mitigating risk to marine species. Please see Section 3.9.10 for an analysis of mitigation measures.

8 Please see response to NRDC-3.

9 Please see response to CCC-7

suggesting avoidance of only areas with the conditions attracting the highest densities of marine mammals.

- During low visibility conditions when siting animals is difficult, avoid exercises in areas of higher habitat value and areas where migrations are occurring.
- Incorporate extra protections for the California Blue whale, especially considering the five blue whale fatalities in the Southern California Bight in the Fall of 2007 which exceeded the Potential Biological Removal[2] of this species of 1.4 whales per year based on their current, endangered population status. While ship strikes are the proximal cause, it remains to be seen if other variables, including mid-frequency acoustic testing, may have been contributing factors[3].
- Map and clarify the mitigation commitment regarding the geographic exclusions identified in the mitigation measure on page 3.9-92 and 5-9. This states that the Navy should avoid exercises in areas of at least 1,000-meter depth near a shoreline where there is rapid change in bathymetry, areas surrounded by land masses separated by less than 35 nautical miles or embayments where multiple ships using MFA sonar near land may produce sound directed toward a channel or embayment that may cut off the lines of egress for marine mammals, and areas with historical presence of surface duct. Ensure these areas are identified and that this mitigation commitment is clear, such as indicating that the Navy "shall" instead of "should" implement this mitigation.

Monitoring and Reporting

The DEIS states that the Navy will coordinate with the NMFS Stranding Coordinator for any unusual marine mammal behavior and any stranding, beached or floating marine mammals that may occur coincident with Navy training (p. 3.9-101). Additionally, the Navy is developing a Marine Species Monitoring Plan (MSMP) which will help determine the effectiveness of the Navy's mitigation measures (p. 3.9-98). More detail is needed regarding these efforts. It is not clear what specific monitoring efforts the Navy will take to look for evidence of marine mammal strandings. The range complex extends south for over 200 miles paralleling the coast of Mexico to just north of Mexico's Guadalupe Island (Figure ES-2). It is not clear if or how monitoring efforts will extend into Mexico.

Recommendation: Provide more details regarding monitoring efforts in the FEIS. Specify how the effectiveness of mitigation measures will be monitored and measured.

Impacts to Water Resources

The DEIS identifies the various hazardous constituents present in the munitions and other training equipment that will be released into the ocean (Section 3.4.3). The preferred alternative will increase the amount of shells, small arms, and bombs from 418 tons per year (tpy) to 571 tpy (Table 3.4-5, 3.4-20), the estimated lead discharged from torpedo ballasts and hoses will increase from 32,200 lbs to 40,300 lbs per year (p. 3.4-57), and the amount of hazardous constituents

[2] The PBR is the maximum number of animals, not including natural mortalities that can be removed from a stock while allowing the stock to reach or maintain its optimum sustainable population.
[3] http://channelislands.noaa.gov/sac/pdf/cpp5-08.pdf

5

9 *(See response above)*

10 Please see response to CCC-7.

(In response to bullet starting with: Incorporate extra protections for the….) The Navy has standard maritime mitigation measures that include lookouts to detect all objects in the water that may be a hazard and also includes detecting marine mammals to avoid a collision. This mitigation measure is more stringent than those used by commercial shipping vessels.

11 Also, it must be acknowledged that ASW activities have been conducted without incident for decades in SOCAL. In fact, many populations of non-ESA and ESA species alike have been increasing in SOCAL over the last several decades. Given the natural variation of marine mammal location over time within SOCAL, operational variability of Navy ASW operations, and the fact that there is little scientific information demonstrating broad-scale impacts that are either injurious or of significant biological impact to marine mammals, there is little relative risk to marine mammal populations from ASW training exercises.

12 *(In response to bullet starting with: Map and clarify the mitigation….)* Appropriate and effective mitigation measures implemented, as well as those determined to be ineffective, impractical, or infeasible were discussed in Appendix F of the Draft EIS/OEIS (p. 322-339).

13 *(In response to 1st paragraph, sentence starting with: It is not clear what specific monitoring….)* Please see response to CCC-12.

from sonobouys released into the ocean would increase from 18,600 lbs to 35,200 lbs per year (p. 3.4-29, 3.4-57).

The DEIS acknowledges that expenditures of ordnance and other training materials can affect ocean water quality (p. 3.4-13). It also states that Navy ships are required to conduct activities at sea in a manner that minimizes or eliminates any adverse impacts on the marine environment (p. 3.4-13). The mitigation measures for water resources (p. 5-3) identify environmental compliance policies and procedures applicable to operations ashore, including reducing or avoiding water quality degradation from the expenditure of training materials from land ranges (p. 5-3). It also states that certain features of the training materials themselves are designed to reduce pollution, and references Section 3.4.3.1.6, however the DEIS does not appear to contain this section number. The DEIS does not identify specific measures it will take to minimize and reduce the amount of hazardous materials deposited into the ocean from training material expenditures.

An addition, the DEIS does not identify the presence of the old chemical munitions dumping area approximately 80 miles south southwest of San Clemente Island or indicate whether underwater detonations will occur in this area.

> *Recommendation:* In the FEIS, identify what practices or procedures will be taken to minimize the release of hazardous materials into the ocean from ordnance and other training materials. Clarify or correct the reference to Section 3.4.3.1.6. Identify the location and potential impacts of training near the old chemical munitions dumping area. EPA recommends against any sediment disturbance in this area.

Hazardous Waste Management

The discussion on the hazardous contamination resulting from the small arms range does not include deposition of chemicals from igniters, such as lead thiocyanate, that build up on soils at the firing line (p. 3.4-37). Additionally, the DEIS states that the amount of small arms ammunition will increase from 2.6 million rounds to 6 million rounds under the preferred alternative, however the amount of solid and liquid detonation products and lead that will be deposited on the range is not predicted to increase (p. 3.3-15 and 3.3-23). This discrepancy should be corrected or clarified.

Also, it is not clear how leftover OTTO fuel will be managed from torpedo use. The OTTO fuel and seawater mixture created during torpedo test firings can be reclaimed, and EPA recommends this practice.

> *Recommendation:* Provide additional information in the FEIS regarding contamination from igniters, including lead thiocyanate, on the small arms range. Correct or clarify the discrepancy regarding the amount of solid and liquid detonation products under the preferred alternative. EPA also recommends Best Management Practices (BMPs) for reducing lead contamination from the small arms firing range. See http://www.epa.gov/region02/waste/leadshot/epa_bmp.pdf.
>
> Identify management practices that will be used for leftover OTTO fuel. EPA recommends OTTO fuel reclamation as a waste minimization measure. See

6

14 The Navy minimizes expenditures of training materials to the extent consistent with good training practices. Because the Navy has adjusted and refined its training practices over the years, reduced its use of hazardous materials, and uses non-explosive training rounds and recoverable targets for many of its training activities, the small amounts of hazardous constituents in expended training materials are released very slowly over time, and no significant impacts are predicted. Thus, additional measures to reduce deposits of these materials are unnecessary. Historical waste disposal is not specifically addressed in the Draft EIS/OEIS because it is not associated with the Proposed Action, and because the potential consequences of such disposal - water pollution - are reflected in the baseline environmental conditions described in the Affected Environment section. No ocean bottom detonations would occur in the deep waters where wastes were dumped. See preceding responses addressing hazardous materials mitigation and historic waste disposal. Removed Chapter 5 reference to 3.4.3.1.6.

15 Assuming that all of the small arms would be typical of 5.56-mm cartridges, the total amount of a common primer such as lead styphnate would be about 22# for 6 million rounds, of which the lead would be about 10#. This compares with an estimated 14 Tons of lead from small arms. There are several small arms ranges, so this small amount per year would be spread over a very large area, such that it would not measurably increase the soil lead concentration.

16 After the practice torpedo is recovered on the range, approximately 4-5 gallons of seawater-OTTO fuel mixture is disposed of as hazardous waste in accordance with applicable procedures. Previous tests have shown that this mixture contains only trace amounts of OTTO fuel. After the torpedo is returned to the intermediate maintenance activity (IMA), the remaining seawater-OTTO fuel mixture is removed and the OTTO fuel is reclaimed.

FEIS has been revised to describe that the unspent OTTO fuel is recovered.

http://www.bmpcoe.org/bestpractices/internal/nuwck/nuwck_22.html for more information.

Air Quality - General Conformity

The DEIS does not sufficiently demonstrate conformity with the State Implementation Plan (SIP). The DEIS states that the emissions associated with the No Action Alternative and Alternative 1 would be less than the de minimis thresholds for all pollutants and therefore does not require a general conformity determination. The DEIS states that should the South Coast Air Basin (SCAB) be redesignated as an extreme non-attainment area for the 8-hour National Ambient Air Quality Standard (NAAQS) for ozone as indicated in the Draft Final 2007 Air Quality Management Plan (AQMP), the de minimis levels for ozone precursors Oxides of Nitrogen (NOx) and reactive organic gases (ROG) would be 10 tons (9,072 kg) per year, and therefore emissions of NOx for Alternative 1 would be above the de minimis threshold (p. 3.2-19).

In its official 8-hour ozone SIP submittal, the California Air Resources Board (CARB) requested that EPA reclassify the SCAB as extreme non-attainment for 8-hour ozone. Since this action could take place prior to the Federal action associated with the DEIS, general conformity for both the 8-hour ozone extreme and severe-17 classifications is appropriate.

The DEIS also states that ground vehicle emissions were included in the overall South Coast Air Quality Management District (SCAQMD) SIP emissions budget for the SCAB for mobile sources, therefore ground vehicles were not included in the total budget for San Clemente Island operations that was submitted to the SCAQMD for inclusion in the update to the AQMP (the DEIS does not include these emissions in Table 3.2-13). General conformity analyses require demonstration that the mobile source emissions associated with the project are specifically identified in the applicable SIP, or that the motor vehicle emissions are included in a conforming transportation plan and transportation improvement program.

Recommendation: The Navy must sufficiently demonstrate compliance with conformity requirements of Section 176(c) of the Clean Air Act for the selected alternative before the federal action commences. In the FEIS, demonstrate that the NOx emissions associated with the project are specifically identified in the applicable 8-hour ozone SIP budget, which in this case is the 1997/1999 1-hour ozone SIP[4]. Provide evidence of general conformity for both the 8-hour ozone extreme and severe-17 classifications of the South Coast Air Basin. State whether the project mobile source emissions are specifically identified in the SIP or in a conforming transportation plan and transportation improvement program.

[4] The 1997/1999 1-hour ozone SIP is the applicable ozone SIP for general conformity purposes for the project. The California Air Resources Board adopted the South Coast air basin 8-hour ozone SIP on September 27, 2007 and transmitted the SIP to EPA on November 28, 2007. EPA has not yet approved the 8-hour ozone SIP.

7

16 See response above

17 The emissions associated with the Proposed Action have been submitted to the SCAQMD for inclusion in their SIP. Letter confirming that the emissions are within the SIP are included in the SOCAL FEIS/OEIS Appendix C.

18 The emissions associated with the Proposed Action have been submitted to the SCAQMD for inclusion in their SIP. Letter confirming that the emissions are within the SIP are included in the SOCAL FEIS/OEIS Appendix C. Thus the Proposed Action will conform with the 8-hour SIP for both extreme and severe-17 classifications because emissions are included in the 8-hour SIP.

19 Ground vehicles account for a small proportion of the emissions on SCI. Ground vehicle emissions at SCI are not specifically accounted for in the RTP as SCI is not part of the regional transportation system. However, given that ground vehicle emission increases would result in 0.01 tons per year of ROG and 0.19 tons per year of NOx under Alternative 1, and 0.02 tons per year of ROG and 0.34 tons per year of NOx, the ground vehicle emissions are accommodated within the SIP budget and would not conflict with the SIP.

20 The emissions associated with the Proposed Action have been submitted to the SCAQMD for inclusion in their SIP. Letter confirming that the emissions are within the SIP are included in the SOCAL FEIS/OEIS Appendix C. Thus the Proposed Action will conform with the 8-hour SIP for both extreme and severe-17 classifications because emissions are included in the 8-hour SIP.

10.2.1.6 U.S. Department of the Interior (DOI)

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Pacific Southwest Region
1111 Jackson Street, Suite 520
Oakland, California 94607

IN REPLY REFER TO:
ER 08/385

Filed Hardcopy

15 May 2008

SOCAL EIS/OEIS Project Manager
Naval Facilities Engineering Command Southwest (Code REVPO)
1220 Pacific Highway, Building 127
San Diego, CA 92132.

Subject: Review of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) for the Southern California Range Complex (Including the San Clemente island Range Complex), San Diego, Orange, and Los Angeles Counties, CA

Dear SOCAL EIS/OEIS Project Manager:

The Department of the Interior has received and reviewed the subject document and has the following comments to offer.

Chapter 8, References, Page 8-12, Kantrud (1991) reference

This reference contains an outdated link and typographical errors; the correct citation and link are:

Kantrud, Harold A. 1991. Wigeongrass (*Ruppia maritima* L.): A literature Review. U.S. Fish and Wildlife Service, Fish and Wildlife Research 10. Jamestown, ND: Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/plants/ruppia/index.htm (Version 16JUL97)

1 Thank you for the information; the Final EIS/OEIS has been revised.

Chapter 8, References, Page 8-16, U. S. Geological Survey (2004) reference

The DEIS indicates that this reference was accessed in June 2004. The page was updated June 14, 2006 and there may be additional information available that could be used in the analyses. The public would benefit for the final EIS to include any new available information that is relevant for the analyses and proposed mitigation actions. In addition, the citation and link contains a typographical error; the correct citation and link are:

2 Thank you for the information; the Final EIS/OEIS has been revised.

http://coastalmap.marine.usgs.gov/regional/contusa/westcoast/socal/cinms/index.html

Chapter 8, References, Page 8-79, Ackerman et al (2004) reference

This citation contains an outdated link and typographical errors. The correct citation and link are:

Ackerman J, Mason J, Takekawa J. 2004. Seabirds off southern California—Surveys reveal patterns in abundance and distribution. USGS Sound Waves Monthly Newsletter, November 2004. Sound Waves, Coastal Science & Research News from Across the USGS. U.S. Geological Survey. Accessed 6 Apr 2007. http://soundwaves.usgs.gov/2004/11/research.html

Thank you for the opportunity to review this project.

Sincerely,

Patricia Sanderson Port
Regional Environmental Officer

cc:
Director, OEPC
USGS, HQ

3 Thank you for the information; the Final EIS/OEIS has been revised.

10.2.1.7 Department of Fish and Game

STATE OF CALIFORNIA – THE RESOURCES AGENCY ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF FISH AND GAME
www.dfg.ca.gov
1416 Ninth Street
Sacramento, CA 95814
(916) 653-7667

July 2, 2008

Alex Stone, Project Manager
Naval Facilities Engineering Command Southwest (Code REVPO)
1220 Pacific Highway, Bldg. 127
San Diego, California 92132-5190

Subject: Southern California Range Complex Draft DEIS/OEIR-SCH#2003082037

Dear Mr. Stone:

The Department of Fish and Game (Department) has reviewed the Draft Environmental Impact Statement (DEIS) for the Department of the Navy (Navy) Southern California (SOCAL) Range Project (Project). The Project proposes to increase training and research, development, test and evaluation (RDT&E) activities of the same types currently conducted. The Navy is also proposing training and RDT&E required by force structure changes associated with introduction of new weapons systems, new classes of ships, and new types of aircraft into the fleet and certain range enhancements would be implemented to include establishment of a shallow water minefield and installation and use of a shallow water training range. Project alternatives 1 and 2 include proposals for approximately 50 percent increases of many of the Navy training operations, which is a significant increase of many operations that include detonations in the water column. Many of these operations would be within State waters around San Clemente Island (SCI).

As trustee for the State's fish and wildlife resources, the Department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species. In this capacity, the Department administers the California Endangered Species Act, the Native Plant Protection Act, and other provisions of the California Fish and Game Code that afford protection to the State's fish and wildlife trust resources. Pursuant to our jurisdiction the Department has the following concerns, comments, and recommendations regarding the project.

MARINE EFFECTS

The DEIS concluded that the Project would have significant adverse impacts to marine resources and habitats and, therefore, mitigation is proposed to reduce impacts to less than significant. Many marine resources have been addressed with mitigation measures that may help. However, additional potential impacts to marine resources should be addressed.

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Specifically, potential adverse impacts to marine resources could occur from the proposed expanded training range and increased operations including the following:

a) Near shore or pelagic fish populations, especially "sensitive" fish species and schooling fish;
b) Kelp forest and seagrasses;
c) White abalone and their habitat and other abalone species; and
d) Populations of rare, threatened or endangered seabird species.

The Department recommends that the Final Environmental Impact Statement (FEIS) include additional discussion and possible mitigation measures for the natural resources as indicated in the items discussed below.

a) Fish Impacts

The Department is concerned that fish species that are "sensitive" (have long lives and low reproductive rates) and are found at SCI, such as the Giant Sea Bass, *Steriolepis gigas*, and many rockfish species (*Sebastes spp.*), could be significantly impacted from increased detonations. Additionally, schooling fish species are important as forage for endangered or threatened seabirds and marine mammals in the area. The Department agrees that the proposed mitigation measures should protect marine mammals and sea turtles from underwater detonations; however, specific measures for fish avoidance should be added to the protocol. Additionally, a fish monitoring study for impacts to fish from Navy activities is recommended since the existing studies mentioned in the DEIS are inconclusive due to few data.

There could be potentially significant direct and indirect impacts to fish populations from water column or surf zone detonations and the Department does not concur with the DEIS conclusion of no significant impacts and no proposed mitigation measures. The DEIS points out on page 60 of section 3.7 that based upon currently available data, it is not possible to conclusively predict fish effects from Navy impulsive activities. The Department recommends fish surveys and impact studies be conducted to conclusively determine significant impacts from Navy activities to "sensitive" fish populations.

The DEIS does not address potential impacts or mitigation measures for California grunion, *Leuresthes tenuis*. Detonations or other activities that generate turbidity in the surf zone at night could have an impact on the spawning behavior. Navy activities that disturb the grunion eggs in the sand will have an adverse impact to grunion eggs. As the DEIS points out, no surveys have been conducted to confirm that they spawn at SCI beaches. Spawning of California grunion has been documented at other Channel Islands, i.e., Santa Catalina Island and Santa Cruz Island (Karen Martin, researcher, personal communication). We recommend that an initial grunion survey, conducted by a researcher with grunion experience, determine whether spawning is occurring on SCI. If California grunion populations are shown to spawn on SCI, impacts and mitigation measures should be discussed in the FEIS.

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(b) Marine Plants and Ecosystem Impacts

The Department agrees with the DEIS that southern California giant kelp, *Macrocystis pyrifera*, an important natural resource, has been significantly declining over the last half-decade, likely due to both natural and human-induced causes. The kelp forest creates an ecosystem that is critical to sustaining fish populations and biodiversity. As the DEIS points out, impacts resulting from the increased operations and the proposed new weaponry are not well understood due to limited studies on few individual species of a kelp ecosystem. We have a very limited understanding of the intricate dynamics of kelp forests including the diverse communities of marine species that shelter, forage and reproduce in this habitat. Additionally, some kelp associated with SCI is subject to both recreational and commercial harvest which is managed by the Department. The Department believes that enhanced mitigation measures for kelp and the associated ecosystem should be identified and included in the FEIS as a safety margin to allow for human errors, hard to estimate cumulative impacts to the kelp, and limited studies to identify the effects of Navy activities on kelp ecosystems. Additionally, ongoing kelp monitoring is recommended to ensure that mitigation measures are adequate to protect the kelp ecosystem.

Surfgrass (*Phyllospadix* sp.) and other seagrasses are not addressed for SCI. Increased detonations and other Navy activities in the surf zone may be detrimental to surfgrass, an important marine plant used for food, spawning, nurseries, and shelter by fish and invertebrates. Potential impacts to near shore seagrasses at SCI cannot be determined from the information provided in the DEIS. A seagrass baseline survey is recommended for the SCI near shore areas in order to determine impacts from Navy activities. If seagrasses are found at SCI, then mitigation and monitoring plans would be appropriate. A discussion addressing these concerns should be included in the FEIS.

(c) Abalone Impacts

The white abalone, *Haliotis sorenseni*, is classified as a federally endangered species. White abalone habitat is usually at depths from 20 to 60 m and is found in open low relief rock or boulder habitat surrounded by sand. Common algae in this habitat include the kelps *Laminaria farlowii* and *Agarum fimbriatum*, and a variety of red algae. Black abalone, *Haliotis cracherodii*, is a federally proposed (endangered) species and is found in intertidal rocky areas. The Department is concerned that the white and black abalone and their habitat could be adversely impacted by detonations along with other abalone species. Abalones are susceptible to adverse impacts that cause them to fall off their substrate, such as if the detonation is close to their habitat. There are no known studies that would support mitigation for this type of potential impact. White, black and all species of abalone should be protected from adverse impacts because of their dwindling numbers in southern California. The Department recommends that post detonation monitoring is appropriate to gain a better understanding of the effects

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of detonations on white, black and all other abalone species. A discussion addressing this concern should be included in the FEIS.

d) Seabirds

Western snowy plover, *Charadrius alexandrinus nivosus*, is a California bird species of special concern and a federally threatened species. Populations of this species have been documented to nest on sandy beach areas of SCI. The Department considers sandy beach habitat as critical to Western snowy plover nesting and survival. There is concern that the remaining habitat will be further constricted as a result of the increase in military exercises. The DEIS references outdated surveys provided for this species. An updated survey for this species should be provided in the FEIS. Mitigation measure WSP-M-1 of the DEIS should be included for all operational areas listed in the DEIS Table D-9. Recent, detailed, and specific information regarding the wintering populations, potential nesting status, and potential impacts to nesting areas should also be included.

Xantus's murrelet, *Synthliboramphus hypoleucus*, is a California threatened species that is known to breed in small numbers at SCI. The last survey for this species on SCI was conducted in 1999. There is no detailed discussion of the current status of this species and no updated survey results to make any determinations on potential impacts to this species. Breeding and nesting behavior may be interrupted by detonation activities or other activities such that an adverse impact may occur. An updated status survey is needed for this species to identify bird populations as well as breeding, nesting and foraging areas. Possible impacts and mitigation and monitoring should be identified and discussed in detail. A discussion addressing these concerns should be included in the FEIS.

Ashy storm petrel, *Oceanodroma homochroa*, is a globally rare bird and is a federally proposed (endangered) species that is known to breed at SCI. The last survey for this species on SCI was conducted in 1999. There is no detailed discussion of the current status of this species and no updated survey results to make any determinations on potential impacts to this species. An updated status survey is needed for this species to identify current bird populations as well as breeding, nesting and foraging areas. Possible impacts as well as mitigation and monitoring should be identified and discussed in the FEIS.

TERRESTRIAL EFFECTS

Impacts to terrestrial habitats and animals cannot be fully determined because not enough detailed or specific information is provided in the DEIS. The Department recommends that the FEIS give additional details concerning the proposed battalion landing exercises. The details associated with these exercises are limited to the spacing between infantry personnel. No additional information has been provided as to the number of personnel and vehicles. Additionally, Naval Special Warfare operations details should be provided on how battalion level forces would potentially

1

(In response to Paragraph starting: Western snowy plover,…) Current (2008) surveys of the suitable western snowy plover habitat on the northern end of SCI (West Cove and Northwest Harbor) indicate no breeding activity. These surveys will be continued as indicated in the Draft EIS/OEIS.

Surveys of the suitable habitat within the southern end of SCI (Pyramid Cove, Horse Beach, and China Cove) remain infeasible due to safety concerns. The suitable southern western snowy plover habitat is not safe for surveying due to the presence of unexploded ordnance; therefore, updated survey results cannot be safely acquired nor can WSP-M-1 of the Draft EIS/OEIS be implemented (currently) for operational areas within Impact Area I and II. However, the Navy is working on the potential for utilization of emerging technologies to identify the potential for surveying for nesting plovers using high resolution aerial photography.

2

(In response to paragraph starting: Xantus's murrelet,…) The California Institute of Environmental Studies successfully completed Xantus's murrelet survey work at San Clemente Island in April 2008. A round-island survey was conducted that revealed small Xantus's murrelet population in the Seal Cove area, (as suspected from earlier vocalization survey work). A total of 12 birds were captured. During the 2008 surveys, shoreline landing survey work occurred on the main island in Seal Cove, on the smaller southern rock in Seal Cove, and further south on the main island but no Xantus's murrelet or ashy storm-petrel nests were found.

The EIS/OEIS does not propose new detonation activities or training areas and ranges within the known habitat (Seal Cove) for this species. The closest TAR is to the north at TAR 17. Between this proposed use and Seal Cove lies a topographic barrier (steep hillside and cliff) which would significantly reduce, if not eliminate, sound and light from TAR 17. Furthermore, direct access to Seal Cove by dirt road or trail has been closed in recent years due to unexploded ordinance (north of Seal Cove). Finally, the steep cliff like topography of Seal Cove does not promote the use of this area for small boat landings and thus impacts are not anticipated from such activities.

3

(In response to paragraph starting: Ashy storm petrel,…) The ashy storm-petrel was specifically addressed by the US Navy in the July 14, 2008 letter to U.S. Fish and Wildlife Service in response to the Notice of 90-day Petition Finding and Initiation of Status Review on the Ashy Storm-Petrel. As referenced above in response to the Xantus's murrelet comment, 2008 seabird surveys did not locate ashy storm-petrel nests on SCI. In addition, the U.S. Geological Survey Report, "At-Sea Distribution of Seabirds and Marine Mammals in the Southern California Bight" does not indicate the presence of any ashy storm-petrels within the vicinity of SCI during the sampling period (May 1999, September 1999, January 2000, and May 2000) (McChesney et al. 2000). Also, as discussed under the previous comment, areas of high suitability for storm-petrels (Seal Cove and the off-shore rocks) are not subject to detonation or other training or range activities under the proposed action that would impact storm-petrels. Lastly, in light of this species proposed listing status, the Navy is in the process of contracting for a species review for SCI which will form the basis for updates to the SCI INRMP.

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of detonations on white, black and all other abalone species. A discussion addressing this concern should be included in the FEIS.

d) Seabirds

Western snowy plover, *Charadrius alexandrinus nivosus*, is a California bird species of special concern and a federally threatened species. Populations of this species have been documented to nest on sandy beach areas of SCI. The Department considers sandy beach habitat as critical to Western snowy plover nesting and survival. There is concern that the remaining habitat will be further constricted as a result of the increase in military exercises. The DEIS references outdated surveys provided for this species. An updated survey for this species should be provided in the FEIS. Mitigation measure WSP-M-1 of the DEIS should be included for all operational areas listed in the DEIS Table D-9. Recent, detailed, and specific information regarding the wintering populations, potential nesting status, and potential impacts to nesting areas should also be included.

Xantus's murrelet, *Synthliboramphus hypoleucus*, is a California threatened species that is known to breed in small numbers at SCI. The last survey for this species on SCI was conducted in 1999. There is no detailed discussion of the current status of this species and no updated survey results to make any determinations on potential impacts to this species. Breeding and nesting behavior may be interrupted by detonation activities or other activities such that an adverse impact may occur. An updated status survey is needed for this species to identify bird populations as well as breeding, nesting and foraging areas. Possible impacts and mitigation and monitoring should be identified and discussed in detail. A discussion addressing these concerns should be included in the FEIS.

Ashy storm petrel, *Oceanodroma homochroa*, is a globally rare bird and is a federally proposed (endangered) species that is known to breed at SCI. The last survey for this species on SCI was conducted in 1999. There is no detailed discussion of the current status of this species and no updated survey results to make any determinations on potential impacts to this species. An updated status survey is needed for this species to identify current bird populations as well as breeding, nesting and foraging areas. Possible impacts as well as mitigation and monitoring should be identified and discussed in the FEIS.

TERRESTRIAL EFFECTS

Impacts to terrestrial habitats and animals cannot be fully determined because not enough detailed or specific information is provided in the DEIS. The Department recommends that the FEIS give additional details concerning the proposed battalion landing exercises. The details associated with these exercises are limited to the spacing between infantry personnel. No additional information has been provided as to the number of personnel and vehicles. Additionally, Naval Special Warfare operations details should be provided on how battalion level forces would potentially

(Duplicated page from above)

Alex Stone
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be deployed during the four day events within the Infantry Operations Areas. The current determination that off-road foot travel would have a minimal effect on species of concern has not been adequately demonstrated. Finally, supplemental details should be provided for the required staging areas for sanitation purposes, supplies, or bivouac needs, e.g., providing map locations of approved routes for ingress and egress that would support these exercises. More specific terrestrial comments are provided below.

a) The DEIS, Section 3.11.7.5, currently states that vegetative coverage of the Infantry Operations Areas consists mostly of non-native grassland. Further discussion should be provided on the extent of sensitive biological resources. The DEIS references are limited to several listed plant species on SCI that would likely be affected. A detailed discussion, including quantitative analysis, should be provided to justify the significance determination that foot traffic and trampling impacts would be less than significant.

b) Off-road foot related impacts associated with the proposed battalion landing exercises cannot be fully determined. Resource surveys should be performed upon the completion of field exercises. This should be incorporated into the existing area-specific mitigation measures that the Navy currently implements in its effort to avoid, minimize, or compensate for effects of activities on biological resources. Subsequently, this would allow confirmation on the extent and intensity of impacts to upland habitat and allow for modification to future activities in order to avoid and minimize resource impacts.

c) The DEIS resource findings should be incorporated into the SCI Integrated Natural Resources Management Plan (INRMP). The DEIS proposed mitigation measures should be incorporated into the Strategies by Management Unit and Implementation sections of the INRMP.

d) Section 5.10.1, General Measures, should be amended to include mitigation options associated with habitat restoration and re-vegetation. This topic is referenced in the wildland fire discussion, section heading 3.11.7.1. However, mitigation options are not discussed as a stand alone mitigation measure outside of its association with the SCI Fire Management Plan. Additional discussion should be provided as to the applicability of the mitigation measure beyond its use in post fire activities. This is an important element for adequately addressing the compensation component associated with the expanded actions of the Southern California Range Complex.

e) The mitigation measures that are identified in the DEIS are unclear as to whether the mitigation measures address or adequately compensate for the direct impact to flora and fauna resources of concern. Currently, the mitigation measures emphasize the control of invasive species, utilization of best management practices for addressing erosion and sediment concerns, and minimization of direct impacts through coordination of events. However, there are statements throughout the DEIS that there is a potential for the increased military exercises to directly impact additional sensitive flora and fauna resources. Discussion

5 *(In response to paragraph starting: a) The DEIS, Section 3.11.7.5,…)* The Infantry Operations Area (IOA) follows the path of the existing main SCI road, Ridge Road, and includes the roadway toward the Impact Areas. These central non-native grassland/roadside areas have lower concentrations of listed species than more pristine native communities on SCI. Because the IOA is dominated by non-native grasslands, it is not known to support the San Clemente sage sparrow (*Amphispiza belli clementeae*) or Island night lizard (*Xantusia riversiana*). Furthermore, San Clemente loggerhead shrike (*Lanius ludovicianus mearnsi*) occupation of non-native grasslands is limited to areas that have experienced higher levels of vegetative recovery and now support nesting and perching substrates; thus, shrikes occur within the IOA only in very low numbers (2 sites in 2008). Foot traffic is not expected to “trample” the shrubs used for nesting and perching by the shrike as the shrubs are obvious (typically hip to shoulder height) and foot traffic is expected to circumvent them.

6 The Navy currently conducts inventorying and/or monitoring of all its federally listed terrestrial resources as well as the San Clemente Island fox (*Urocyon littoralis clementae*). The current programs are anticipated to provide a basis for assessing the progress of each species toward recovery and where necessary are being modified to specifically assess any effects of the proposed action on listed species (see AVMC-M-2 and TAR-M-1).

7 When the SCI INRMP is revised, it will be consistent with the applicable FEIS mitigation measures.

8 Since the Fire Management Plan and Erosion Control Plans (which address habitat restoration) are included as part of the proposed action, habitat restoration or re-vegetation as a stand alone mitigation measure would be potentially redundant. The Fire Management Plan and Erosion Control Plans are anticipated to be the best avenue for identifying areas of high priority for restoration as a result of the proposed action. Outside of the proposed action, the Navy currently funds and supports a botanical restoration program on SCI as well as a long standing, thus-far successful program to recover the San Clemente loggerhead shrike.

9 Application of NEPA policies typically result in greater weight being given to non-compensatory mitigation approaches. However, invasive weed control, as addressed in the EIS/OEIS, is considered “compensatory mitigation” as it is a form of habitat restoration and it is arguably the most appropriate form of restoration for ecosystem-based management of SCI. Currently, the SCI INRMP addresses restoration and invasive species control, and as previously stated, when the SCI INRMP is revised, it will be consistent with the applicable Final EIS/OEIS mitigation measures.

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July 2, 2008

pertaining to the compensation component is limited to minor referrals to habitat restoration without defining the current status of those efforts. Additional discussion should be provided in the FEIS to identify how this issue has been addressed through the application of the INRMP and subsequent strategies to address direct loss of sensitive biological resources.

f) The Department is unclear on the DEIS significance determination that infantry personnel would have a negligible effect on nesting behavior of San Clemente sage sparrow and San Clemente loggerhead shrike. The FEIS should address the specifics as to the duration and number of the troops traversing through potentially occupied habitat. Given the acknowledgement in the document for the lack of avian surveys, the Department does not concur with the current significance determination that is presented in the impact analysis. The Department suggests that surveys of affected areas should be performed prior to commencement of conducting biannual battalion level exercises in order to adequately avoid and minimize impacts to the maximum extent practicable.

The Department reserves the right to modify or change the above determinations based on additional findings or other pertinent information concerning the above mentioned project.

All of the above concerns should be addressed in the FEIS. The Department appreciates the opportunity to review and comment on the DEIS. As always, Department personnel are available to discuss our concerns, comments, and recommendations in greater detail. If you have questions regarding marine issues, please contact Ms. Loni Adams, Environmental Scientist, at (858) 627-3985. For questions regarding terrestrial issues, contact Mr. Paul Schlitt, Environmental Scientist, at (858) 637-5510.

Sincerely,

Marija Vojkovich
Regional Manager
Marine Region

cc: Pages 6 & 7

Ed Pert, Regional Manager R5, San Diego

Sandy Vissman
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
6010 Hidden Valley Road
Carlsbad, CA 92011

9 (See Response above)

10 It is unclear what “acknowledgement in the document for the lack of avian surveys” refers to in this comment. The Navy currently funds and supports surveys and monitoring of the San Clemente sage sparrow throughout the breeding season and year-round surveys and monitoring of the San Clemente loggerhead shrike. Such surveys will continue under the proposed action and can form the basis for any assessment of unanticipated impacts. The results of past surveys were utilized in support of the Draft EIS/OEIS significance determination, which is based on past nesting locations, densities, and types and intensities of proposed uses within occupied habitat.

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Robert Hoffman
Assistant Regional Administrator
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
501 West Ocean Blvd., Suite 4200
Long Beach, CA 90802-4213

Ms. Becky Ota
Department of Fish and Game
Belmont Office

Ms. Loni Adams
Department of Fish and Game
San Diego Office

Mr. Paul Schlitt
Department of Fish and Game
San Diego Office

State Clearinghouse

10.2.1.8 Battocchio

United States Navy

Public Hearing Comment Form

Southern California Range Complex
Environmental Impact Statement /
Overseas Environmental Impact Statement

The U.S. Navy has prepared a Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) for the Southern California (SOCAL) Range Complex. Please record your comments on the Draft EIS/OEIS on this form. You may submit your comments by:

1) Depositing this form at the Public Comment Collection station before you leave tonight
2) Submitting your comments via the project Web site at **www.SOCALRangeComplexEIS.com**
3) Mailing this form to:

SOCAL EIS/OEIS Project Manager
Naval Facilities Engineering Command, Southwest
1220 Pacific Highway (Code REVPO)
San Diego, CA 92132

☐ *Please check the box if you would like to receive a copy of the Final EIS/OEIS. Provide your mailing address below.*

All comments must be received no later than May 19, 2008.

Name: CAROL BATTOCCHIO Date: 5-1-08

Organization/Affiliation: private citizen

Address:*

City, State, Zip Code: LOS ANGELES CA 90046

Comments: The Navy should NOT be using mid-frequency SONAR in EITHER The PACIFIC or The ATLANTIC because it has already been clearly demonstrated that this blast of sound destroys the inner ear qualities of whales, has caused them to bleed internally + beach themselves and ultimately die. It also disrupts the migratory + reproductive patterns. If this must be used it should be used only in areas where it is absolutely confirmed there are no whales or other marine life that can be damaged

Visit **www.SOCALRangeComplexEIS.com** for project information.

*Provide your mailing address to receive future notices about the SOCAL Range Complex EIS/OEIS.

1 The U.S. Navy has conducted mid-frequency active sonar activities without incident for decades in SOCAL. In fact, many populations of non-ESA and ESA species alike have been increasing in SOCAL over the last several decades. Given the natural variation of marine mammal location over time within SOCAL, operational variability of Navy mid-frequency active sonar operations, and the fact that there is little scientific information demonstrating broad-scale impacts that are either injurious or of significant biological impact to marine mammals, there is little relative risk to marine mammal populations from mid-frequency active sonar training exercises.

10.2.1.9 Gaworecki

Marie Gaworecki
18550 Hatteras St. #19
Tarzana, CA 91356

SOCAL EIS/OEIS Project Manager
Naval Facilities Engineering Command Southwest (Code REVPO)
1220 Pacific Highway, Building 127
San Diego, CA 92132

May 2, 2008

I was at lastnight's public hearing in Long Beach where we spoke out against your continued decimation of marine life through your use of high-intensity, mid-frequency sonar in your training exercises. Do you realize that the numbers of people in that room are a drop in the bucket compared to the *millions* who agree with them?

You defend your actions with the argument that you must remain cutting edge, which means you acknowledge our world as ever changing, yes? If that is so, you cannot ignore another colossal change that is reshaping our whole world with each passing day: environmental ethics. Global warming is no longer seen by the masses as a matter of opinion, but as a matter of fact. Tabloids are exploding with indisputable evidence of the tremendous damage we have done in our frantic rush towards mass production. Everyone is finally waking up and realizing that we have to prioritize the maintenance of our planet. Everyone is starting to see that we have no choice, if we intend to survive.

America is already perceived in an extremely negative light by the world for a variety of reasons, one of which is the gigantic negative impact we are having on our planet. What you're doing is adding to this problem! America is being called out by scientists everywhere as one of the biggest contributors to the melting of the polar ice caps, and as one of the most wasteful nations in the world. Meanwhile, our government is *blatantly* breaking laws designed to protect the environment in the pursuit of its own agenda. Through your abominable actions against ocean life, and thus against your own people, you are actually *perpetuating* the world's growing lack of respect for our nation.

Once asleep, we are now wide awake and terrified of what is to become of our planet if we don't immediately do everything in our power to protect it. We are looking at a future where our great-grandchildren will be born into a world where polar bears are extinct, and where blue whales are no more…and why? Because back in the early 2000's, we were too arrogant, impatient and lazy to find a cruelty-free means of completing our national security agendas. All we cared about was getting the results as fast as possible, regardless of the aftermath. That has always been mankind's downfall: to blindly race forward without knowing what consequences we're creating. Why not challenge ourselves to be a more evolved race, by actually *learning* from our past mistakes and not repeating them?

You are not the 70 year-old who started smoking in 1958, because you didn't realize the health repercussions to come of it. You are the 18 year-old who knows full and well *exactly* what you're risking, yet reaches for that cigarette anyway.

These extraordinary animals that you are hurting and killing are the ultimate innocents. You know that what you're doing is wrong. You know that you can find a better way if you decide to. You know that millions of Americans and people all over the world *vehemently* oppose what you're doing.

It's very simple. If you continue these actions, they will help lead to the extinction of important species. The extinction of species will eventually lead to the death of our planet. The death of our planet will lead to the end of the human race as we know it. So if you think big picture and long term, *you are actually contributing to the extinction of your own species.* We are too intelligent a species to hold ourselves to the small-minded standards of yesterday. We must think big picture and long term if we are to survive.

And that's not an opinion. That's a fact.

Sincerely,

Marie Gaworecki

1 Please refer to Introduction to Chapter 10, page 10-1.

10.2.1.10 O'Carroll

Susan J. O'Carroll, Ph.D
1411 West Clark Avenue
Burbank, CA 91506

April 29, 2008

SOCAL EIS/OEIS Project Manager
Naval Facilities Engineering Command Southwest (Code REVPO)
1220 Pacific Highway, Building 127
San Diego, CA 92132.

Subject: Comments on the Draft SOCAL RANGE COMPLEX EIS

Dear EIS Project Manger:

The Draft EIS/OEIS for the SOCAL Range Complex is fatally flawed and must be substantially redone and recirculated for public review and comment.

Fatally Flawed Alternatives Analysis

1 The Draft EIS fails to accomplish one of the most basic purposes of an EIS: to identify and assess the reasonable alternatives to proposed action. Instead the Navy has defined a set of objectives (Draft EIS at p. ES-9 to ES-11) which essentially boil down to being able to do what it is already doing without proper environmental review (Draft EIS at p. ES-6), or more. The Navy then uses the objectives as the basis for ruling the very alternatives that it should be analyzing in the EIS, infeasible. Specifically, the DEIS states:

> Having identified criteria for generating alternatives for consideration in this EIS/OEIS (see Section 2.2.1), the Navy eliminated several alternatives from further consideration after initial review. Specifically, the following potential alternatives (described in Sections 2.2.2.1-2.2.2.4) were not carried forward for analysis:
>
> - Alternative range complex locations;
> - Reduced levels of training;
> - Temporal of geographic constraints on use of the SOCAL Range Complex; and
> - Extensive reliance on simulated training in place of live training.

The Navy disagrees and in fact complies with all applicable environmental laws, including NEPA and its requirements. The Navy has broadly defined its objectives and offers appropriate alternatives to achieve them. To implement its Congressional mandates, the Navy needs to support and conduct current and emerging training and RDT&E activities in the SOCAL Range Complex and upgrade or modernize range complex capabilities to enhance and sustain Navy training and testing. These objectives are required to provide combat capable forces ready to deploy worldwide in accordance with U.S.C. Title 10, Section 5062. The Assistant Secretary of the Navy (Installations & Environment) determines both the level and mix of training to be conducted and the range capabilities enhancements to be made within SOCAL that best meet the needs of the Navy. The broad objectives set forth in this document are both reasonable and necessary. In regard to studied alternatives the Navy is in full compliance with NEPA.

Comment on the SOCAL Range EIS
Page 2

> After careful consideration of each of these potential alternatives in light of the identified criteria, the Navy determined that none of them meets the Navy's purpose and need for the Proposed Action. (Draft EIS at p. ES-11)

This is completely contrary to the requirements of NEPA. The *Memorandum: Forty Most Asked Questions Concerning CEQ's NEPA Regulations (40 Questions)* (46 Fed. Reg. 18026 (March 23, 1981, as amended, 51 Fed Reg. 15618 (April 25, 1986)] clarifies the concept of a reasonable range of alternatives. The Memorandum's response to Question 2 states:

> Section 1502.14 requires the EIS to examine all reasonable alternatives to the proposal. In determining the scope of alternatives to be considered, the emphasis is on what is "reasonable" rather than on whether the proponent or applicant likes or is itself capable of carrying out a particular alternative. Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant.
>
> An alternative that is outside the legal jurisdiction of the lead agency must still be analyzed in the EIS if it is reasonable. A potential conflict with local or federal law does not necessarily render an alternative unreasonable, although such conflicts must be considered. Section 1506.2(d). Alternatives that are outside the scope of what Congress has approved or funded must still be evaluated in the EIS if they are reasonable, because the EIS may serve as the basis for modifying the Congressional approval or funding in light of NEPA's goals and policies. Section 1500.1(a).

2 Please see response to EPA-4.

Clearly the following alternatives are "practical or feasible from the technical and economic standpoint and using common sense." Therefore, EIS must be redone to include analysis of the following alternatives:

- Alternative range complex locations;
- Reduced levels of training;
- Temporal of geographic constraints on use of the SOCAL Range Complex; and
- Extensive reliance on simulated training in place of live training.

3 Each of these suggested alternatives is identified in the Draft EIS/OEIS, but properly not carried forward for analysis for the reasons stated in the Draft EIS/OEIS. For reasons described in Section 2.2.2 of the Draft EIS/OEIS, these alternatives fail to meet critical criteria of the purpose and need of the proposed action.

Furthermore, the Draft EIS is fatally flawed in its definition of a No Action Alternative. The Draft EIS uses as its No Action Alternative, its current level of

4 Please see response to MMC-1.

Comment on the SOCAL Range EIS
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operations, despite the fact that this level of operations has received no prior formal environmental review and there is no ROD authorizing this level of operation and environmental harm. Instead the EIS should include a true No Action alternative involving no use of harmful sonar or explosives during training activities.

4 *(See response above)*

Because the EIS improperly constrains the range of alternatives analyzed, it improperly limits decision makers to choosing between the existing level of operations, with its totally unacceptable level of environmental harm, and even more impacting levels of operations. This is totally unacceptable and contrary to the purpose of NEPA of informing "decisionmakers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment." (40 CFR 1502.1 Purpose).

5 Please see response to EPA-4.

Impacts to Marine Mammals

The EIS identifies the following totally unacceptable annual level of Take of Marine Mammals:

TABLE 1
ANNUAL TAKE
OF MARINE MAMMALS

	"No Action" Alternative	Alternative 1	Alternative 2
Sonar Impacts			
Level B Sonar Exposures	86,686	89,028	94,370
Level B TTS	16,706	17,772	18,838
Level A Sonar Exposures	26	28	30
Underwater Detonation Impacts			
Level B TTS	635	742	817
Level A %50 TM Rupture and Slight Lung Injury	28	29	36
Level A Massive Lung Injury or Death	8	10	12
Total Level B Take	104,027	107,542	114,025
Total Level A Take	62	67	78
TOTAL TAKE	104,089	107,609	114,103

Source: Tables: 3.9-7, 3.9-8, 3.9-10, 3-9-11, 3.9-13 and 3.9-14 of the DEIS
Page 3.9-38 indicates that Level A and B impacts are additive.

6 The existing analysis and tables contained in the EIS are adequate to fully inform the public and decision maker as to the potential impacts of the alternatives.

Comment on the SOCAL Range EIS
Page 4

Table 1 highlights the absurdity of the EIS's "No Action" Alternative and the range of alternatives included in the DEIS.

Furthermore, these impacts need to be clearly identified in a summary table comparing the impacts of the various alternatives, so that the absurdity of the choice offered the DEIS is clear to decision-makers and the public.

Impacts to California Gray Whale are particularly egregious as shown in Table 2:

6 *(Refer to response above)*

TABLE 2
ANNUAL TAKE
TAKE OF CALIFORNIA GRAY WHALES

	"No Action" Alternative	Alternative 1	Alternative 2
Sonar Impacts			
Level B Sonar Exposures	4,797	5,103	5,409
Level B TTS	901	959	1,017
Level A Sonar Exposures	2	2	2
Underwater Detonation Impacts			
Level B TTS	5	6	7
Level A %50 TM Rupture and Slight Lung Injury	0	0	0
Level A Massive Lung Injury or Death	0	0	0
Total Level B Take	5,703	6,068	6,433
Total Level A Take	2	2	2
TOTAL TAKE	5,705	6,070	6,435
Percent of the Gray Whale Population that would experience a Take Annually:	**21%**	**23%**	**24%**

Source: Tables: 3.9-7, 3.9-8, 3.9-10, 3.9-11, 3.9-13 and 3.9-14 of the DEIS
Page 3.9-38 indicates that Level A and B impacts are additive.
Gray Whale population listed as 26,625 in 2002 on page 3.9-8 of the DEIS

It should be noted that the DEIS uses a gray whale population estimate of 26,625, which is the high end of the gray whale population range. According to NOAA-TM-AFSC-161 (2005):

> Systematic counts of gray whales migrating south along the central California coast have been conducted by shore-based observers at Granite Canyon most years since 1967 (Fig. 36). The most recent abundance estimates are based on counts made during the

7 The final stock assessment report for 2007 was published in April 2008 at the same time as the Draft EIS/OEIS was publicly distributed; therefore, it was too late to incorporate the information. The FEIS/OEIS has been revised to reflect the more recent information.

The most recent survey (2002) estimated a population of 18,813 gray whales. The most recent estimates of the eastern north Pacific stock varied between 18,178 and 29,758 (1993 – 2002).

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> 1997/98, 2000/01, and 2001/02 southbound migrations. Analyses of these data resulted in abundance estimates of 29,758 for 1997/98, 19,448 for 2000/01, and 18,178 for 2001/02 (Rugh et al. in press). Recent estimates were: 22,263 (CV = 9.25%) whales in 1995/96, 23,109 (CV = 5.42%) whales in 1993/94 (Laake et al. 1994) and 21,296 (CV = 6.05%) whales in 1987/88 (Buckland et al. 1993). Variations in estimates may be due in part to undocumented sampling variation or to differences in the proportion of the gray whale stock migrating as far as the central California coast each year (Hobbs and Rugh 1999). The decline in the 2000/01 and 2001/02 abundance estimates may be an indication that the abundance was responding to environmental limitations as the population approaches the carrying capacity of its environment. Low encounter rates in 2000/01 and 2001/02 may have been due to an unusually high number of whales that did not migrate as far south as Granite Canyon or the abundance may have actually declined following high mortality rates observed in 1999 and 2000 (Gulland et al. 2005, Fig. 37). Visibly emaciated whales (LeBoeuf et al. 2000; Moore et al. 2001) suggest a decline in food resources, perhaps associated with unusually high sea temperatures in 1997 (Minobe 2002).
>
> Several factors since this mortality event suggest that the high mortality rate was a short-term, acute event and not a chronic situation or trend: 1) counts of stranded dead gray whales dropped to levels below those seen prior to this event, 2) in 2001 living whales no longer appeared to be emaciated, and 3) calf counts in 2001/02, a year after the event ended, were similar to averages for previous years (W. Perryman, NMFSSWFSC, pers. comm.; Rugh et al. in press).

As shown in Table 2, the alternatives analyzed in the Draft EIR would result in either a Level B or Level A Take of between 21%-24% of the Gray Whale population annually. Page 3.9-55 of the DEIS states:

> Level B (behavioral) harassment occurs at the level of the individual(s) and does not assume any resulting population-level consequences, though there are known avenues through which behavioral disturbance of individuals can result in population-level effects.

Given that Gray Whales make one of the longest migrations of any animal, and are largely dependant on fat stores to sustain them during their migration,

8

The exposures modeled as Level B harassment for the SOCAL Range Complex may vary from the animal showing no response to the animal leaving an area. Mitigation measures such as shut down and power down zones would prevent animals from being exposed to sound levels that would elicit the greatest effect. The modeling predicted injury or mortalities without consideration of the mitigation measures that would be in place during underwater detonation activities.

Gray whales only showed a slight effect in migration when exposed to a low frequency continuous sound source Malme et al. 1983. Mid-frequency active sonar is likely above the hearing threshold of gray whales, is intermittent, and is transient. Therefore there should be no impact on the gray whale population. *(Continued below)*

Comment on the SOCAL Range EIS
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disruptions of their normal behaviors as a result of Navy sonar and explosive use have the potential to cause migrating Gray Whales to expend energy they would not ordinarily have to expend during migration, to avoid or flee Navy activity (i.e. as a result of a Level B Take). While this would not result in immediate mortality (i.e. a Level A Take as defined in the EIS), it could easily affect the number of whales and calves that ultimately survive the annual migration. This type of indirect Level A Take has not been adequately assessed in the DEIS. Nor, has the long-term affect of Level B harassment on the population been assessed.

Furthermore, it is difficult to believe that if 21%-24% percent of the Gray Whale population each year experiences Level A or B negative impacts from Navy activity, that migration patterns would not be impacted over time. The DEIS totally fails to analyze the more long-term impacts of the proposed action and fails to include analysis of the likely indirect impacts of the project on marine mammals. Despite the fact that the DEIS identifies substantial annual Level A and B Take of marine mammals, the DEIS fails to analyze the long-term impacts of the project on migration routes, particularly the migration route of California Gray Whales.

8 *(Continued from above)* As explained in the Draft EIS/OEIS, Appendix F, the acoustic modeling results are based on marine mammal densities evenly distributed over the entire area of potential effect. This is conservative since the tendency is to overestimate effects given that marine mammals appearing in pods will be easier to detect and therefore be avoided by use of the Navy's standard operating procedures serving as mitigation measures.

For reasons discussed here and throughout the EIS/OEIS, the modeling assumptions and analyses are very conservative, and true impacts will actually be lower.

Cumulative Impacts

The DEIS is also fatally flawed in its analysis of cumulative impacts, particularly cumulative impacts to marine mammals. The scope of the cumulative analysis is too restricted in scope. Despite the fact that Navy sonar testing and training will also impact marine mammals in the Atlantic, and other parts of the world, the impact analysis only focuses on Pacific Impacts.

9 CEQ Guidelines, as reproduced in the Draft EIS/OEIS, state: "cumulative effects analysis should be conducted in the context of resource, ecosystem, and community thresholds." These guidelines therefore call for the cumulative impacts analysis to identify geographic boundaries for analysis. Table 4-1 of the Draft EIS/OEIS identifies geographic areas for cumulative impacts analysis for each potentially affected resource. It is not necessary or useful for this Draft EIS/OEIS to consider any resource of the Atlantic Ocean in its analysis as that area is well beyond the area of potential impact for the covered activities.

Conclusion

The DEIS must be redone to include a reasonable range of alternatives, including:

- Alternative range complex locations;
- Reduced levels of training;
- Temporal of geographic constraints on use of the SOCAL Range Complex;
- Extensive reliance on simulated training in place of live training; and,
- A true No Action Alternative.

In addition, the DEIS must be redone to address all of the direct and indirect short-term and long-term impacts to marine mammals, including the California Gray Whale.

10 Please see response to O'Carroll 4 and 5.

Comment on the SOCAL Range EIS
Page 7

Most importantly, the level of Take of marine mammals represented by the preferred action and alternatives in the DEIS is totally unacceptable. Decision-makers must be provided with the option of an alternative that eliminates these impacts.

It makes no sense to engage in an action which harms or kills the very animals whose skills you seek to emulate, and who are capable of utilizing sonar without harm to other marine mammals --something that should be the Navy's ultimate aim. Clearly there is much more the Navy can learn from these animals. Their continued existence clearly outweighs the benefits of their destruction.

Thank you for your consideration. Please include me on the mailing list to receive notice regarding this project and provide me with a copy of the response to comments and FEIS.

Sincerely,

Susan O'Carroll

Susan J. O'Carroll, Ph.D.

10 (Continued from above – Please see response to O'Carroll 4 and 5)

10.2.1.11 Thompson

United States Navy

Public Hearing Comment Form

Southern California Range Complex Environmental Impact Statement / Overseas Environmental Impact Statement

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San Diego, CA 92132

☑ *Please check the box if you would like to receive a copy of the Final EIS/OEIS. Provide your mailing address below.*

All comments must be received no later than May 19, 2008.

Name: GARY THOMPSON Date: 5-14-08

Organization/Affiliation: Los Angeles Fathomiers / Sea Urchin Assn. / Sea Cucumber

Address:* 3590 Amberwood Ct., Lake Elsinore, CA 92530

City, State, Zip Code:

Comments: As a member of the sportfishing Club, the LA Fathomiers, we are freedivers and many times per year dive the waters of San Clemente Island.

As a commercial harvester of sea urchins and sea cucumbers I personally spend more than 100 days per year at the island. I do believe the underwater resource is important and sustainable and I work with organizations already in place to that end. I wonder if the estimate of commercial harvesting at San Clemente Island is under reported. We need to work with you to get accurate harvest data.

Please keep in mind, we, the human resource, are also important. We need access as much as possible. We are not a threat. We can be you eyes around the island as to what might be a threat.

1 Please refer to Introduction to Chapter 10, page 10-1.

Visit **www.SOCALRangeComplexEIS.com** for project information.

*Provide your mailing address to receive future notices about the SOCAL Range Complex EIS/OEIS.

10.2.1.12 Richmond

United States Navy

Public Hearing Comment Form

Southern California Range Complex Environmental Impact Statement / Overseas Environmental Impact Statement

The U.S. Navy has prepared a Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) for the Southern California (SOCAL) Range Complex. Please record your comments on the Draft EIS/OEIS on this form. You may submit your comments by:

1) Depositing this form at the Public Comment Collection station before you leave tonight
2) Submitting your comments via the project Web site at **www.SOCALRangeComplexEIS.com**
3) Mailing this form to:

SOCAL EIS/OEIS Project Manager
Naval Facilities Engineering Command, Southwest
1220 Pacific Highway (Code REVPO)
San Diego, CA 92132

☐ *Please check the box if you would like to receive a copy of the Final EIS/OEIS. Provide your mailing address below.*

All comments must be received no later than May 19, 2008.

Name: SUE RICHMOND Date: 5/1/08

Organization/Affiliation: NRDC

Address:* 940 MOLINO AVE

City, State, Zip Code: LB CA 90804

Comments: I WOULD ASK THAT ALL GOVT. AGENTS WHO FAVOR SONAR TO 1) LOCK THEMSELVES IN A CAR FOR A WEEK 2) ACTIVATE THE ALARM EVERY HALF HOUR FOR 24 HRS A DAY FOR THAT WEEK 3) AFTER A WEEK IN THAT CAR, ASK YOURSELF IF YOU COULD DO THAT TO ANOTHER CREATURE

Visit **www.SOCALRangeComplexEIS.com** for project information.

1 Please refer to Introduction to Chapter 10, page 10-1.

10.2.1.13 Procaccini

United States Navy

Public Hearing Comment Form

Southern California Range Complex
Environmental Impact Statement /
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All comments must be received no later than May 19, 2008.

Name: CHERYL PROCACCINI Date: 5/1/08

Organization/Affiliation: LITTLE ONES Music / SURFRIDER'S / GREENPEACE

Address:* 1037 ORO ST.

City, State, Zip Code: LAGUNA BEACH, CA 92651

Comments: I AM A PROFESSIONAL SONGWRITER WHO SPECIALIZES IN WRITING MARINE & OTHER ENVIRONMENTAL EDUCATION SONGS FOR CHILDREN. THE CLASSROOM CHILDREN I SING TO LOVE MARINE MAMMALS. THEY CARE ABOUT THEM IN WAYS THAT ARE SIMILAR TO HOW THEY CARE ABOUT THEIR FRIENDS & FAMILY. WE SPEND ALOT OF TIME DISCUSSING WAYS TO PROTECT THESE ANIMALS & KEEP THE OCEANS CLEAN & SAFE FOR THEIR MARINE FRIENDS.

THESE SAME CHILDREN ALSO LOOK UP TO PEOPLE IN UNIFORMS – The Navy, the Army, Firemen, Policemen. I have no idea how i will explain to them that the Navy is hurting their beloved marine mammal friends with their sonar tests. Please, ~~don't~~ give me a better story to tell them – A story about how the Navy cared so

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1 Please refer to Introduction to Chapter 10, page 10-1.

10.2.1.14 Bain

CRITIQUE OF THE RISK ASSESSMENT MODEL EMPLOYED TO CALCULATE TAKES IN THE HAWAII RANGE COMPLEX SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT

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Abstract

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In reviewing whether the parameters employed were based upon the best available science, the implications in the uncertainty in the values, and biases and limitations in the risk function criteria, The commenter asserted that data were incorrectly interpreted by NMFS when calculating parameter values, resulting in a model that underestimates takes. NMFS, in its regulatory capacity for the MMPA, chose the data sets, interpreted the data, and set parameters for the risk function analysis to quantify exposures to mid-frequency sound sources NMFS may classify as Level B takes for military readiness activities. Of primary importance to The commenter was that the risk function curves specified by NMFS do not account for a wide range of frequencies from a variety of sources (e.g., motor boats, seismic survey activities, "banging on pipes"). In fact, all of The commenter's comments concerning "data sets not considered" by NMFS relate to sound sources that are either higher or lower in frequency than MFA sonar, are contextually different (such those presented in whale watch vessel disturbances or oil industry activities), or are relatively continuous in nature as compared to intermittent sonar pings. These sounds from data sets not considered have no relation to the frequency or duration of a typical Navy MFA sonar as described in the Draft EIS/OEIS.

As discussed above and in the Draft EIS/OEIS, NMFS selected data sets that were relevant to MFA sonar sources and selected parameters accordingly. In order to satisfy The commenter's concern that a risk function must be inherently precautionary, NMFS could have selected data sets and developed parameters derived from a wide variety of sources across the entire spectrum of sound frequencies in addition to or as substitutes for those that best represent the Navy's MFA sonar. The net result, however, would have been a risk function that captures a host of behavioral responses beyond those that are biologically significant as contemplated by the definition of Level B harassment under the MMPA applicable to military readiness activities. The commenter's specific comments and the Navy's responses are provided below.

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2 Given the results of the modeling for SOCAL, having a lower basement value would not result in any significant number of additional takes. This was demonstrated in the Final EIS/OEIS (Table 3-2; page F-186) showing that less than 1% of the predicted number of takes resulted from exposures below 140 dB. The commenter further suggests that the criteria used to establish the risk function parameters should reflect the biological basement where any reaction is detectable. The MMPA was not intended to regulate any and all marine mammal behavioral reactions. Congress amended the MMPA to make clear its intention with the amendment to the MMPA for military readiness activities as enumerated in the following National Defense Authorization Act clarification - (i) any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered. NMFS, in its regulatory capacity for the MMPA, chose the data sets and parameters for use in the risk function analysis to regulate military readiness activities. Congress, by amending the MMPA, specifically is not regulating any and all behavioral reactions.

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3 NMFS, as a cooperating agency and in its role as the MMPA regulator, reviewed all available applicable data and determined that there were specific data from three data sets that should be used to develop the criteria. NMFS then applied the risk function to predict exposures that resulted in exposures that NMFS may classify as harassment. (This is described in the Final EIS/OEIS at Section 3.9.7.5.4). NMFS developed two risk curves based on the Feller adaptive risk function, one for odontocetes and one for mysticetes, with input parameters of B=120 dB, K=45, 99% point = 195 dB, 50% point = 165 dB.

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4 The risk function methodology assumes variations in responses within the species and was chosen specifically to account for uncertainties and the limitations in available data. NMFS considered all available data sets and determined it to be the best data currently available. While the data sets have limitations, they constitute the best available science.

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5 The commenter was concerned that if one animal is "taken" and leaves an area then the whole pod would likely follow. As explained in Appendix F of the Draft EIS/OEIS, the model does not operate on the basis of an individual animal but quantifies exposures NMFS may classify as takes based on the summation of fractional marine mammal densities. Because the model does not consider the many mitigation measures that the Navy utilizes when it is using MFA sonar, to include MFA sonar power down and power off requirements should mammals be spotted within certain distances of the ship, if anything, it over estimates the amount of takes given that large pods of animals should be easier to detect than individual animals.

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Modeling accounts for exposures NMFS may classify as takes at distances up to 140 km as described in the Final EIS/OEIS (Appendix F, Table 3-2). As discussed in Appendix F of both the Final and Draft EIS/OEIS, the SOCAL OPAREA contains a total of 13 distinct environmental provinces with specific sound propagation characteristics. These represent the various combinations of nine bathymetry provinces, one Sound Velocity Profile province, and three high frequency bottom loss classes. Based on these different provinces, the Navy identified eight different representative sonar modeling areas to fully encompass sound attenuation within the SOCAL OPAREA. Within these provinces, sound attenuated down to 140 dB at distances out to about 140 km (Appendix F, Table 3-2). Using these sound propagation characteristics, the risk function modeling for the SOCAL Range Complex resulted in less than 1% of the exposures that NMFS may classify as a take occurring between 120 dB and 140 dB (Appendix F, Figure 3-2). The area encompassed by this sound propagation, as determined by NMFS for exposures that may constitute harassment, avoids a bias towards underestimation because the risk function parameters were designed with this in mind.

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Section 5.8.5 of the Draft EIS/OEIS evaluated alternative and/or additional mitigations, specifically, as it relates to potential mitigation approaches. The examples of the fundamentally different approaches noted in the comment were addressed in this section of the Draft EIS/OEIS. In addition, NMFS has identified general goals of mitigation measures. These goals include avoidance or minimization of injury or death, a reduction in the number of marine mammals exposed to received levels when these are expected to result in takes, a reduction in the number of times marine mammals are exposed when these are expected to result in takes, a reduction in the intensity of exposures that are expected to result in takes, and reduction in adverse effects to marine mammal habitat.

In this regard, NMFS and Navy have identified mitigation measures that are practicable and reasonably effective. For example, the safety zones reduce the likelihood of physiological harm, the number of marine mammals exposed, and the intensity of those exposures.

NMFS and Navy have determined that mitigation measures in conjunction with our understanding of decades of sonar use has resulted in only negligible impacts in the SOCAL Range Complex (Final EIS/OEIS, Section 3.9.9). Mitigation measures that are practicable involve those that reduce direct physiological effects within the TTS and PTS thresholds. The Navy has selected an alternative which maintains a current level of sonar use within SOCAL.

Introduction

The Navy distinguishes two types of takes: Level A, in which there is immediate injury or death; and Level B, in which there is no immediate injury, but cumulative exposure may lead to harm at the population level. However, in certain contexts, Level B harassment may lead to Level A takes through indirect mechanisms.

The population effects of Level A takes on populations are relatively easy to assess, as individuals that are killed are obviously removed from the population, and those that are injured are more likely to die whenever the population is next exposed to stress.

Calculating the population effects of Level B takes is a topic of contemporary research (Trites and Bain 2000). For example, Bain (2002a) explored using energetic consequences of behavior change in conjunction with population dynamics models to estimate population effects of Level B takes. Stress concurrent with Level B harassment would have additional population consequences. Stress may occur in the absence of behavioral change, or the absence of change in significant behavioral patterns such as foraging or nursing, or exclusion from optimal habitat. Lusseau et al. (2006) concluded disturbance caused a decline in and posed a significant threat to the survival of the bottlenose dolphin population in Doubtful Sound, New Zealand. While they noted vessel strikes were occurring (Level A takes), cumulative behavioral effects (Level B takes) were believed to be the primary threat to the population.

Models relating acoustic exposure to takes thus are not sufficient by themselves to interpret the effects of noise on populations. It is likely that different magnitudes of effect, whether physical harm, behavioral change that leads to physical harm, disruption of significant behavioral activities, or behavioral changes that pose negligible risk to populations when they occur only rarely but can become significant when exposure is prolonged or repeated, will have different relationships to noise. The different magnitudes of takes will have different population consequences. Thus it will be challenging to synthesize results of multiple studies, as different measured endpoints may belong on different curves relating them to noise, and different endpoints will have different population consequences. Further, the population consequences can depend on the health of the population (Bain 2002a). All these factors need to be considered when evaluating the environmental consequences of exposing marine mammals to noise.

Unconditional effects

Temporary Threshold Shifts in captive marine mammals are commonly used as an index of physical harm (e.g., Nachtigall et al. 2003, Finneran et al. 2002 and 2005, Kastak et al. 2005). Limiting experimental noise exposure to levels that cause temporary effects alleviates ethical concerns about deliberately causing permanent injury. However, repeated exposure to noise that causes temporary threshold shifts can lead to permanent hearing loss. In fact, chronic exposure to levels of noise too low to cause temporary threshold shifts can cause permanent hearing loss. Animal models (e.g., rats, cats,

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8 Navy agrees with the comment and notes that the recently documented increase in many populations of endangered and non-endangered species in SOCAL, where decades of sonar use, training, and RDT&E have occurred, would suggest that there is an absence of Level A effects from those activities.

9 This issue was recognized and discussed as presented in the Draft EIS/OIES (Section 3.9.7.2, page 3.9-38). Based on prior National Oceanic and Atmospheric Administration rulings, NMFS established that exposures resulting in Level A and B harassment cannot be considered to overlap in an analysis of impacts, otherwise the regulatory distinction between the two criteria would be lost and the take quantification required would be ambiguous. To facilitate the regulatory process, a clear and distinct division between Level A and Level B harassments was maintained as required by NMFS in its role as the regulator and a cooperating agency in the Draft EIS/OEIS.

monkeys, chinchillas) have been used for tests of noise causing permanent physical harm (Henderson et al. 1991, Gao et al. 1992, Blakeslee et al. 1978, Clark 1991). Damage to hearing from noise exposure is an example of unconditional injury from noise. OSHA (2007) requires limiting human exposure to noise at 115 dB above threshold (equivalent to 145 dB re 1 µPa for killer whales, Szymanski et al. 1999) to 15 minutes.

Stress reactions are another available index (e.g., Romano et al. 2004). Ayres (personal communication) found evidence suggesting that whale watching results in increased levels of stress hormones in wild killer whales.

Conditional effects

Changes in behavior resulting from noise exposure could result in indirect injury in the wild. A variety of mechanisms for Level B harassment to potentially lead to Level A takes have been identified.

Gas bubble lesions have been observed in beaked whales (Jepson et al. 2003, Fernandez et al. 2005, Cox et al. 2006). A variety of mechanisms have been proposed for this. While some have proposed these may be due to acoustically mediated bubble growth, and hence are an unconditional consequence of noise exposure (Crum and Mao 1996), it is more likely that these result from decompression sickness. That is, changes in dive behavior may prevent clearance of nitrogen gas from the body, resulting in larger bubbles than would occur in undisturbed dive patterns. One possible change is that beaked whales may remain submerged for an unusually long period of time, and then rapidly ascend. The rapid ascent is a change in behavior that prevents nitrogen from remaining in solution in the blood. Zimmer and Tyack (2007) questioned whether the rapid ascent mechanism would actually result in lesions, and proposed another behavior change that might occur is interruption of deep dives. Deep dives allow the lungs to collapse, preventing nitrogen from reaching the body. Further, a series of rapid breaths at the surface can be used to clear nitrogen absorbed under pressure. Interruption of the normal surface interval can allow nitrogen to build up over time. Changes in depths of dives are of more concern than rapid ascents as this mechanism would be applicable to a wide range of species, while if the rapid ascent mechanism is involved, it would be primarily a concern for deep diving species (Zimmer and Tyack 2007).

While failure to flee may lead to injury in beaked whales, flight may lead to injury in other species. Minke whales have been found stranded after sonar exercises (NOAA and Navy 2001). A minke whale was observed traveling at high speed during exposure to mid-frequency sonar in Haro Strait in 2003. It is easy to see how such behavior would lead to stranding when a beach is located in front of the whale, as minke whales lack echolocation and visibility is limited underwater. Exhaustion from rapid flight leading to heart or other muscle damage (Williams and Thorne 1996) could also account for increased mortality such as was observed in harbor porpoises following sonar exercises in Juan de Fuca and Haro Straits in April and May of 2003. Harbor porpoises, in contrast to

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This issue was recognized and discussed as presented in the Draft EIS/OIES (Section 3.9.7.2, page 3.9-38). Based on prior National Oceanic and Atmospheric Administration rulings, NMFS established that exposures resulting in Level A and B harassment cannot be considered to overlap in an analysis of impacts, otherwise the regulatory distinction between the two criteria would be lost and the take quantification required would be ambiguous. To facilitate the regulatory process, a clear and distinct division between Level A and Level B harassments was maintained as required by NMFS in its role as the regulator and a cooperating agency in the Draft EIS/OEIS.

Dall's porpoises, rarely engage in sustained high energy activities such as rapid swimming or bow riding, and hence are less adapted to long distance flight responses.

Even successful flight may have negative survival consequences. In the absence of disturbance, individuals will tend to occupy optimal habitat. Displacement from optimal habitat will have consequences that will depend on the duration of the displacement, the quality of the alternate habitat, and the condition of the individuals at the time of displacement.

Separation of individuals from social units is another consequence of noise exposure that may lead to mortality. In 2003 in Haro Strait, some killer whales responded to mid-frequency sonar by seeking shelter behind a reef. Others chose to flee, resulting in splitting of a pod that historically spent all of its time together as a single unit. While no deaths resulted from this particular incident, other killer whales have been observed separated from their social units resulting in death prior to reunion or requiring human intervention to restore the individual to its social unit (Schroeder et al. 2007).

Temporary threshold shifts may conditionally lead to harm. Impaired hearing ability increases vulnerability to ship strike. In 2003, blunt force trauma was identified as a cause of death in the investigation of harbor porpoise mortalities following exposure to mid-frequency sonar in Washington State. A minke whale was nearly struck by a research vessel in the area where one had been observed fleeing mid-frequency sonar exposure. These species are familiar with boats in that area, and normally avoid them by a wide margin when they can hear them coming.

Impaired auditory ability may also increase predation risk. For example, Dahlheim and Towell (1994) reported an attack by killer whales on white-sided dolphins. The approach by the whales went undetected due to the noise of the research vessel. Further, impaired hearing may impair foraging ability and communication (Bain and Dahlheim 1994).

The Risk Function Model

The risk function uses three parameters. B is the received level at which the most sensitive individuals start to respond with changes in significant behaviors such as foraging. K is the difference in received level between the level at which half of individuals respond and the level at which the most sensitive individuals respond. That is, B+K is the level at which 50% of individuals respond. A is a shape parameter that attempts to capture the variability in responsiveness of the population. That is, are essentially all the individuals the same and the bulk of them become responsive when the received level is near B+K, in which case a simple threshold model would provide a good approximation, or is there a lot of variation in the population, in which case many individuals become responsive when received levels are near B?

The model is based on the hypothesis that some individuals start to respond at lower levels than others. It anticipates that some individuals will hold out until very high levels before responding. The model includes parameters that allow it to be applied appropriately to species with differing noise tolerance. However, the Navy used one set of parameter values to predict the responses of all species. This paper reviews the accuracy of the choice of parameter values, the implications of using the wrong parameter values, and whether the model makes unbiased predictions when uncertainty in the parameter values exists.

Limitations

Like many models, the risk model has limitations. It fails to take into account social interactions. For example, the model anticipates that individuals may move away from a source at different exposure levels, but fails to recognize that this would result in individuals becoming separated from the group. This is likely to lead to the curve becoming asymmetrical, with the "holdouts" responding to the behavior of their schoolmates rather than the sound. As the area exposed to lower levels of noise is larger than the area exposed to higher levels of noise, this would result in more individuals being affected than the model predicts for social species.

The model does not account for multiple sources. Kruse (1991), Williams and Ashe (2007) and Bain et al. (2006) noted that killer whale responses to vessels varied with the number of vessels present. The magnitude of certain responses increased on the order of 10% per source, although Williams and Ashe (2007) noted that large numbers of sources could result in changes in the opposite direction of small numbers of sources, potentially canceling out the effect. That is, rather than a risk function that simply identifies how likely a response is to occur, one that takes into account the magnitude of the response would be ideal.

Pingers have been used to reduce entanglement in gillnets. Kraus et al. (1997) were able to reduce entanglement of harbor porpoises by 90%. Gearin et al. (1996, 2000) used more pingers, and were able to reduce entanglement by 95%. While this could be accounted for by the fact that more pingers increase the minimum sound level at the net (Bain 2002b), Laake et al. (1997, 1998, 1999) found porpoises typically remained much farther from the net than the spacing between pingers, even after the avoidance response declined due to habituation. Thus, the effect of multiple sources seems larger than the effect of fewer sources. Pingers have also been successful in protecting other species from nets (Barlow and Cameron, 1999; Cameron 1999, Stone et al. 1997).

In addition to quantitative changes in response to multiple sources, there may be a qualitative change in the response. For example, noise is used in drive fisheries of many odontocete species to cause stranding or near strandings. That is, multiple sources were used to displace individuals in a particular direction, and the consequences (stranding) were more serious than displacement from the source alone as would result from exposure to a single source.

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The risk to the population of qualitatively different responses varies not only with the type of response, but the circumstances. If the response is going ashore, fatalities are highly likely to result. If the response is slowly moving away for a short period of time, no fatalities are likely to result. However, if the response is to slowly move away from a prime feeding area for an extended period of time, and the population is food limited, fatalities may result, and the number is likely to be related directly to the duration of exclusion from the feeding area, and only indirectly to the cumulative sound energy received.

Finally, the model assumes that marine mammals behave independently from each other. This is not likely to be the case. Even species that are normally solitary, like harbor seals, have been observed to school in response to high energy noise (personal observation). To remain a member of a group, individuals must remain in geographic proximity to each other. As more sensitive individuals move away, others who are not sufficiently disturbed by the sound itself would need to move as well to remain members of the group. The result is likely to be a step function at moderate exposure levels rather than the gradual increase in risk predicted by the model. The result would be that risk is underestimated. The proportion of individuals necessary to lead all individuals to respond in a similar manner to noise is likely to vary among species, and propensity to mass strand may be a good predictor of the importance of this effect.

Datasets

The Navy chose to rely upon three datasets.

Captive cetaceans

Studies of captive marine mammals provide an excellent setting for identifying direct effects of sound. E.g., one of the datasets employed by the Navy consists of studies relating short-term exposure of bottlenose dolphins and belugas to high levels of noise to Temporary Threshold Shifts. The Navy (Dept. Navy 2008b, p 3-7) noted aggressive behavior toward the test apparatus, suggesting stress was another consequence of the test (see also Romano et al. 2004). Such effects would be unconditional results of noise exposure.

However, extrapolation of the level at which aggression was observed to the level at which behaviorally mediated effects might occur in the wild is problematic, as this depends on how well trained the subjects were. For example, the Navy has been a leader in training dolphins and other marine mammals to cooperate with husbandry procedures. Tasks like taking blood, stomach lavage, endoscopic examination, collection of feces, urine, milk, semen and skin samples, etc. once required removing individuals from the water and using several people to restrain them. With training, painful and uncomfortable procedures can be accomplished without restraint and with a reduction in stress that has significantly extended lifespans of captive marine mammals (Bain1988).

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This was specifically addressed in the Draft EIS/OEIS (Section 3.9.7.4.3) and considered as part of this decision making process. Additional data sets from wild animals were incorporated into development of the risk function parameters specifically to address this concern and these were presented in Section 3.9.7.4.4 of the Draft EIS/OEIS. Additionally, as discussed in Domjan 1998, and as cited in the Draft EIS/OEIS, animals in captivity can be more or less sensitive than those found in the wild. It does not follow, therefore, that the risk function modeling underestimates takes.

That is, the absence of avoidance or aggressive behavior does not imply an absence of physical harm, much less the absence of potential for behavior changes that may lead to indirect harm.

Physical harm may occur in the wild without avoidance responses as well. Yano and Dahlheim (1995) found killer whales continued to predate on longlines despite being physically injured by deterrents such as gunshots. Reeves et al. (1996) reviewed other examples from fishery interactions of injurious approaches to deterrence failing.

If belugas and bottlenose dolphins are like killer whales, and the 50% risk level is about 15 dB below the 50% risk level for behavioral change in trained animals (see below), this would put their value around 170 dB re 1 μPa. Even this is likely to be an overestimate, as boat motors with a source level of 165 dB re 1 μPa can cause behavioral changes in bottlenose dolphins (Nowacek et al. 2001.) This new value, 170 dB re 1 μPa, averaged with the other Navy datasets, would drop the average 50% risk level to 160 dB re 1 μPa.

Killer whales

The second dataset is killer whales exposed to mid-frequency sonar from the USS Shoup in Haro Strait, Washington, in May, 2003. The level quoted in the HRC SDEIS (Dept. Navy 2008b) is an estimate of the received levels experienced when mid-frequency sonar was transmitted from about 3 km away. This level caused major behavioral changes in 100% of exposed whales (Risk=1 for Level B takes of a magnitude that in other contexts or species could lead indirectly to physical harm), but was not to believed to have caused Level A takes (the whales did not strand, and received levels were estimated to be too low to have caused threshold shifts, NMFS OPR 2005) in any individuals (Risk = 0). However, much more data are available from the May, 2003 Shoup incident. Behavioral changes were first observed at 47 km (where the received level was estimated to be 121 dB). The behavioral response was tail slapping by about 25% of the individuals observed, which is consistent with observed responses to vessel noise at a similar level. At a distance greater than 22 km, the direction of travel changed away from a feeding area, and hence foraging behavior was disrupted. At this distance, the received level may have increased to the neighborhood of 135 dB re 1 μPa with about 6 dB of reduced spreading loss and 6 dB reduced absorption. This would be comparable to a vessel traveling at low speed approaching to within 10 m, which is very difficult to accomplish without causing whales to turn away. 100% of killer whales responded by abandoning their feeding ground and moving away from the noise source at this received level. While vessels cause diversion from straight-line paths, they have not been observed to displace killer whales from feeding areas (vessels have been observed to displace killer whales from resting areas, but this is likely mediated by presence rather than noise, as the effect is observed in the presence of silent vessels, Trites et al. 1995). Thus it is not surprising that a qualitatively different behavioral response was exhibited. The peak exposure level was estimated to be 175 dB re 1 μPa (HRC SDEIS, although NMFS noted that estimated levels tended to overestimate measured levels by 1-10 dB [NMFS OPR 2005], so the peak exposure level may have been only 165 dB). In addition to changing

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travel patterns, the pod split, with approximately 50% of the pod continuing to shelter in an acoustic shadow zone, and the other 50% fleeing at high speed. Such behavior has not been observed in the presence of vessels alone. It should be emphasized that 100% of killer whales exhibited a disruption of a significant life process, foraging, at a level that may have been less than 135 dB re 1 μPa, in contrast to the value used in the SDEIS, 169.3 dB re 1 μPa for a 50% response.

Additional datasets are available for killer whale responses to noise. E.g., in Bain and Dahlheim's (1994) study of captive killer whales exposed to band-limited white noise in a band similar to that of mid-frequency sonar at a received level of 135 dB re 1 μPa, abnormal behavior was observed in 50% of the individuals. This is far lower than the level observed in bottlenose dolphins. In addition, Bain (1995) observed that 100% of wild killer whales appeared to avoid noise produced by banging on pipes (fundamental at 300 Hz with higher harmonics) to the 135 dB re 1 μPa contour. This indicates the difference between wild and captive killer whales (non-zero risk in captive marine mammals might correspond to 100% risk in wild individuals of the same species), as well as implying that risk of 100% may occur by 135 dB re 1 μPa for this genus in the wild.

Further, killer whales begin responding to vessel traffic at around 105-110 dB re 1 μPa with minor behavioral changes. By 135 dB re 1 μPa, disruption of foraging may approach 100%. Received level appears to be more important than proximity (Bain 2001). For risk to increase from near 0 at 105 dB re 1 μPa to near 100% by 135 dB re 1 μPa, with A=10, the 50% risk level would need to be about 120 dB re 1 μPa. Substituting 120 for 169 dB re 1 μPa reduces the average level for 50% risk by about 16 dB to 144 dB re 1 μPa. Substituting 135 dB re 1 μPa would reduce the average by 8 dB to 157 dB re 1 μPa.

Finally, the Navy's characterization of the killer whale dataset is incorrect. They indicate the effects observed in the presence of mid-frequency sonar in Haro Strait were confounded by the presence of vessels. However, the effects of vessels on killer whales have been extensively studied (e.g., Kruse 1991, Williams et al. 2002ab, Bain et al. 2006). Behavioral responses attributed to mid-frequency sonar are qualitatively different than those observed to vessels alone. While the observations are anecdotal, they were not inconsistent. The sonar signal was blocked from reaching the whales with full intensity by shallow banks or land masses during three segments of the observation period. The "inconsistencies" can be attributed to differences in behavior depending on whether there was a direct sound path from the Shoup to the whales. It should be noted there was extensive study of this population prior to exposure (see Bigg et al. 1990 and Olesiuk et al. 1990 for a description of typical research protocols), as well as extensive post-exposure monitoring (e.g., Bain et al. 2006).

Right whales

Similarly, the right whale data relied upon are of limited value. While they clearly illustrate that the value at which 50% of animals are influenced is below 135 dB re 1 μPa

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and are therefore helpful in determining the upper limits of the B+K value, they lack sufficient low level exposures needed to fit the low end of the curve. As with killer whales, the Navy misused the data. They averaged values which resulted in 100% response. Thus the average value exceeds the level resulting in a 50% risk.

Right whales exposed to alerting devices consistently responded when received levels were above 135 dB re 1 μPa. Due to the small sample size (six individuals), it is unclear whether this is close to the 50% risk, the 100% risk level, or both. These data do not allow identification of B, as lower exposure levels were not tested. In mysticetes exposed to a variety of sounds associated with the oil industry, typically 50% exhibited responses at 120 dB re 1 μPa. Thus right whales may be similar to killer whales.

The consequences of using incorrect values can be seen by comparing the observed results of the right whale exposures to alert signals (Nowacek et al. 2004) with those predicted by the Navy model. Using the values of B=120, K=45, and A=10 in the HRC SDEIS (Dept. Navy 2008b), the probability of responses for the exposed whales are shown in column two of Table 1. The formula underestimated the number of takes by a factor of over 500. The Navy proposed using A=8 for mysticetes in recognition of this, and the results are shown in column 3. While improved, the model still underestimated takes by a factor of 183. One could try B=105 and K=15. Using A=10 provides a reasonable approximation, overestimating takes by 20% (column 4). A better approximation is provided by A=2, which predicts the number of takes within 2% (column 5). While the probability of all four right whales exposed to the highest alert signals responding is much less than one in a billion based on the Navy model and allows one to unequivocally reject the Navy's choice of parameter values as applying to that species, numerous other combinations of parameter values would fit the data as well as the values shown in the table here. Substituting 120 dB re 1 μPa for 139 dB re 1 μPa results in an average 6 dB lower at 159 dB re 1 μPa.

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11 It is noted that an apparent factual inaccuracy with regard to the only citation provided for the repeated assertion that 50% of marine mammals will react to 120 db re 1uPa. Malme et al., (1983, 1984) indicated that for migrating whales, a 0.5 probability of response occurred at 170 dB.

Table 1. Risk for right whales (model vs. observed)

Received Level (dB re 1 μPa)	RISK B=120,K=45,A=10	RISK B=120,K=45,A=8	RISK B=105,K=15,A=10	RISK B=105,K=15,A=2
Responded				
148	0.008647	0.022021	0.999973	0.891548
143	0.001217	0.004641	0.999908	0.86521
137	5.92E-05	0.000415	0.999488	0.819864
135	1.7E-05	0.000153	0.999026	0.800039
133	4.06E-06	4.86E-05	0.998059	0.777052
No Response				
134	8.52E-06	8.79E-05	0.998633	0.788974
Error Factor	502	183	0.83	1.01

Datasets not considered

The Navy incorrectly concludes that additional datasets are unavailable. In addition to the other killer whale datasets mentioned above, data illustrating the use of acoustic harassment and acoustic deterrent devices on harbor porpoises illustrate exclusion from foraging habitat (Laake et al. 1997, 1998 and 1999, Olesiuk et al. 2002). Data are also available showing exclusion of killer whales from foraging habitat (Morton and Symonds 2002), although additional analysis would be required to assess received levels involved. The devices which excluded both killer whales and harbor porpoises had a source level of 195 dB re 1 μPa, a fundamental frequency of 10 kHz, and were pulsed repeatedly for a period of about 2.5 seconds, followed by a period of silence of similar duration, before being repeated. Devices used only with harbor porpoises had a source level of 120-145 dB re 1 μPa, fundamental frequency of10 kHz, a duration on the order of 300 msec, and were repeated every few seconds. Harbor porpoises, which the Navy treats as having a B+K value of 120 dB re 1 μPa (with A large enough to yield a step function) in the AFAST DEIS (Dept.Navy 2008a), 45 dB lower than the average value used in the HRC SDEIS, may be representative of how the majority of cetacean species, which are shy around vessels and hence poorly known, would respond to mid-frequency sonar. Even if harbor porpoises were given equal weight with the three species used to calculate B+K, including them in the average would put the average value at 154 dB re 1 μPa instead of 165 dB re 1 μPa.

Harbor porpoise responses to various acoustic devices have been documented in captivity and the wild. Pingers with a source level of 130 dB re 1 μPa displace wild harbor porpoises to a distance of at least 100-1000 m, where the received level was likely in the

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The data sources the commenter presents as needing consideration involve contexts that are not applicable to the proposed actions or the sound exposures resulting from those actions. For instance, the commenter's citation to Lusseau et al. (2006) involve disturbance over a three year period to a small pod of dolphins exposed to "8,500 boat tours per year", which is nothing like the type or frequency of action that is proposed by the Navy for SOCAL. In a similar manner, the example from noise used in drive fisheries are not applicable to Navy training. Navy training involving the use of active sonar typically situations ships where the ships are located miles apart, the sound is intermittent, and the training does not involve surrounding the marine mammals at close proximity. Further, suggestions that effects from acoustic harassment devices and acoustic deterrent devices which are relatively continuous sound sources (unlike MFA sonar) and are specifically designed to exclude marine mammals from habitat, are also fundamentally different from the proposed actions and the use of MFA sonar. Finally, reactions to airguns used in seismic research or other activities associated with the oil industry are also not applicable to MFA sonar since the sound/noise sources, their frequency, source levels, and manner of use are fundamentally different.

neighborhood of 80-90 dB re 1 μPa. Studies of harbor porpoises in captivity also found responses to acoustic deterrent devices, but could not be tested at such distances due to limitations in facility size (Kastelein et al. 1997, 2001). This is another example of how studies with captive cetaceans can produce misleading results. Airmar devices with a source level of 195 dB re 1 μPa displaced an estimated 95% of harbor porpoises to a distance of 3 km. While received levels were not measured, they could have been in the neighborhood of 120-130 dB re 1 μPa. These findings are well modeled with a B value of 70 dB re 1 μPa, a K value of 25, and an A value of 4.

Many species are poorly known, due in part to difficulties approaching them from boats and in part because they do not fare well in captivity. Species that may exhibit vulnerability to noise comparable harbor porpoises include many species of Stenella (e.g., striped dolphins), beaked whales, sperm whales (which are best studied from sailboats rather than motorized vessels, and show disruption of foraging at levels below 130 dB re 1 μPa, Jochens et al. 2006), and numerous poorly known species. In contrast, Dall's porpoises are known to bow ride, and appear far less easily disturbed by noise from airguns than harbor porpoises (Calambokidis et al. 1998). They may be an example of a relatively noise tolerant species like the bottlenose dolphins included in the SDEIS.

There are also data that are based on other noise sources. E.g., effects of vessel traffic on whale and dolphin behavior could be interpreted in terms of received levels. While engine noise tends to be continuous rather than intermittent like sonar, in a reverberant environment, mid-frequency sonar may be received as a nearly continuous sound (personal observation).

Likewise, records of marine mammal responses to broadband noise sources like airguns are also likely to be informative. While it may be difficult to extrapolate levels resulting in takes due to potential differences in perception of broadband and narrowband signals, and pulses rather than continuous sounds, they can give an idea of the range of intra-specific and inter-specific variation in B and K values and be applicable to determining the A parameter.

E.g., Calambokidis et al. (1998) found harbor seal responses to airguns typically consisted of visually orienting at received levels from 143 to 158 dB re 1 μPa and moving away at received levels from 158 dB to 185 dB re 1 μPa. However, one harbor seal oriented at 163 dB re 1 μPa rather than moving away. The highest measured received levels for Dall's porpoises were about 170 dB re 1 μPa, but only about 142 dB re 1 μPa for harbor porpoises. Similarly, the highest received levels measured for California sea lions were about 180 dB re 1 μPa, but only about 160 dB re 1 μPa for Steller sea lions. The highest measured received level was also 160 dB re 1 μPa for gray whales. That is, closely related species pairs may differ in their responsiveness to noise by over 20 dB, and taxonomically diverse species pairs may exhibit similar responsiveness.

TTS data similar to those available for cetaceans have been collected from harbor and elephant seals, and California and Steller sea lions (Kastak et al. 1999, 2005). As with cetaceans, field data suggest the Navy parameter values will underestimate takes of some pinniped species, though they may provide a reasonable approximation for harbor seals and California sea lions (e.g., the data described above). Pinniped hearing in species studied to date is less sensitive than in cetaceans (e.g., California sea lions, Schusterman et al. 1972; Steller sea lions, Kastelein et al. 2005; harbor seals, Møhl 1968; northern fur seals, Moore et al. 1987; odontocetes, Au 1993), and it is commonly assumed they are less vulnerable to noise as a result. However, comparisons of Steller sea lions with Dall's porpoises and gray whales exposed to airgun noise indicates this is not always the case. A detailed consideration of pinnipeds is beyond the scope of this paper.

Using the datasets discussed above, 50% risk levels based on trained cetaceans may be 165 dB re 1 μPa, 120 dB re 1 μPa for killer and right whales, and 95 dB re 1 μPa for harbor porpoises. The average of 95, 120, 120 and 165 is 125 dB, 40 dB lower than the 50% risk value of 165 dB used in the Navy model. Even if one uses more stringent criteria for what constitutes takes (120 dB for harbor porpoises, 135 dB for killer and right whales, and 170 dB for bottlenose dolphins), the average would be 140 dB, which is 25 dB lower than the Navy model. Setting B to 100, K to 40, and A to 10 would result in roughly 40 times the number of takes than the model predicts using the Navy's parameter values.

Parameter values

The use of default values for model parameters is problematic. The available data are likely to be biased toward noise tolerant species. That is, species that are intolerant of noise are difficult to approach closely enough to study. They tend to fare poorly in captivity. E.g., spinner dolphins and harbor porpoises showed very poor survivorship in captivity, in contrast to bottlenose dolphins (Bain 1988). Thus averages based on available data are likely to underestimate effects on species for which data are not available.

While the Navy has proposed assuming noise tolerance is predictable along taxonomic lines, which correlate with hearing ability, empirical data do not support this assumption (Bain and Williams 2006). Likewise, there is interspecific variation in noise tolerance in fish (Kastelein 2008).

B Value

The basement value should be set low enough that the risk function predicts takes at the lowest of the level resulting in unconditional injuries, the level at which behaviorally mediated injuries are possible, and the level resulting in minor behavioral changes or stress that can have population level effects with sustained or repeated exposure.

An important property of the model is that the biologically observed basement value is different than the mathematical basement value. The Navy proposes using 120 dB re 1 μPa as the basement value. They indicate the selection of this value is because it was commonly found in noise exposure studies. However, 120 dB re 1 μPa has broadly been

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13 It is noted that an apparent factual inaccuracy with regard to the only citation provided for the repeated assertion that 50% of marine mammals will react to 120 db re 1uPa. Malme et al., (1983, 1984) indicated that for migrating whales, a 0.5 probability of response occurred at 170 dB.

found as the value at which 50% of individuals responded to noise, not a small percentage. Further, a mathematical B of 120 dB corresponds to a risk of less than 2% at 150 dB (with K=45 and A=10), which would be difficult to detect in empirical studies. That is, the studies should be re-evaluated to determine the level at which a small percentage of individuals responded, and then a further correction for the difference between mathematical B and the empirically determined biological B would be needed.

However, further consideration should be given to the nature of the responses used in those studies to determine whether they represent significant behavioral changes or are only likely to have a population scale effect with sustained or repeated exposure.

For example, many looked at changes in migration routes resulting from noise exposure, and found that 50% of migrating whales changed course to remain outside the 120 dB re 1 μPa contour (Malme et al. 1983, 1984). These results might be interpreted in several ways. They could be seen as minor changes in behavior resulting in a slight increase in energy expenditure. Under this interpretation, they would not qualify as changes in a significant behavior, and are irrelevant to setting the basement value. They could be interpreted as interfering with migration, even though the whales did not stop and turn around, and hence 120 dB would make an appropriate B+K value rather than B value. Third, the change in course could have been accompanied by a stress response, in which case the received level at which the course change was initiated rather than the highest level received (120 dB re 1 μPa) could be taken as the biological basement value.

(See response to #13 above)

As discussed above, sensitive species like harbor porpoises may be significantly affected by levels below 100 dB re 1 μPa (Kastelein et al. 1997, 2000, 2001). Foraging behavior of killer whales can be disrupted by levels on the order of 105-110 dB re 1 μPa or less (Williams et al. 2002ab, data in Bain et al. 2006). These are far below the 120 dB re 1 μPa level proposed, and as mentioned above, the mathematical B value needed to predict detectable changes at 110 dB would be far lower than 110 dB. For example, B=80, K=45, and A=10 predicts a risk of less than 2% at 110 dB.

K Value

The K value reflects the difference between the mathematical B value and the level at which 50% of individuals respond. Since determining the B value has problems of its own, this critique will focus on determining the B+K value. The 50% risk level is relatively easy to determine, and has been commonly reported in the literature, as noted in the SDEIS. However, the most common value was 120 dB re 1 μPa, as noted in the SDEIS, yet these studies were not used to calculate B+K. Instead, other datasets were used, and the numbers derived were not the 50% risk levels. As mentioned above, there are problems with extrapolation of responses in trained animals to wild animals, and the right and killer whale values were based on levels that resulted in nearly 100% risk, not 50% risk. (It may not be possible to determine a level at which 50% risk occurred in killer whales, but perhaps collaboration among killer whale researchers, whale watch operators, and the Navy might identify the B+K level for that event).

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The 50% risk level is the median level at which individuals begin to respond, not the mean as calculated in the SDEIS. While there are data suggesting risk of threshold shift is related to duration of exposure, and hence the consequences of exposure to continuous noise sources would be different than exposure to intermittent sources, there are no such data for behaviorally mediated effects. Many species strongly avoid motorized vessels, and hence are more vulnerable to noise than the average of the species considered above. Such species are likely to include those in the sperm and beaked whale families, Pacific right whales, blue whales, melon-headed and pygmy killer whales, right whale dolphins, and Clymene, striped and rough-toothed dolphins. A smaller number of species, like Dall's porpoises, are more tolerant of noise sources than the average of the species considered above. Thus it is unlikely that the average value of B+K across cetacean species would be above 120 dB re 1 μPa, although the value would vary across species.

A value

While the A value is described as relating to the sharpness of the risk function, it also influences the symmetry of the function. As A increases, risk is redistributed from low noise levels to higher noise levels. The relative risk to the population, as opposed to risk to individuals, can be described as the risk to individuals at a given received level times the relative number of individuals receiving that level. As the sound spreads to larger areas, more individuals are exposed to lower levels of noise. The shape of the risk function and the spreading loss model determine the received level that poses the most risk to the population. At high received levels, the risk to the population may be small, because although the risk to individuals is high, the number of individuals likely to be exposed is small. At low levels, the risk to the population may be again small, because although the number of individuals exposed is high, the risk to those individuals is low. At intermediate values, the population experiences the most risk. When A is low, the risk to the population peaks near B, and at high A values, the risk is concentrated near B+K.

The choice of A value appears arbitrary. The Navy indicated they wanted to allow for more response at low levels, and adjusted the A value to accomplish this. However, this would have been better accomplished by lowering the B and B+K values as suggested above.

The significance of an A value underestimating the number of individuals responding to low levels of noise and overestimating the number of individuals responding to high levels of noise is that the area exposed to low levels of noise is larger than the area exposed to high levels of noise, so the calculation would lead to an underestimate of takes.

Calambokidis et al. (1998) employed an appropriate methodology for obtaining data for calculating A values of marine mammals exposed to airguns. They used a small vessel which moved toward and away from the seismic survey vessel, and hence were able to observe behavior and measure received values at distances of over 70 km as well as close

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to the seismic survey vessel. Thus they were able to observe normal behavior in the presence of low levels of noise, as well as identify levels above which 100% of individuals exhibited behavioral change, and note inter-specific variation in response curves.

Interaction of Terms

It appears that B+K is a stronger predictor of the number of takes than either factor separately. As a result, similar risk curves can be generated for many different pairs of B and K as long as the sum is held constant. K and A together determine the range over which risk rises from 5% to 95%. Similarly, pairs of K and A over a range of values can generate similar risk curves.

With B=120, K=45, and A=10, the risk function predicts risk is near zero at received levels near 120, and that over 99.9% of takes will occur above 138 dB re 1 μPa. Even with A = 8, 99.9% of takes occur at levels above 135 dB. With A values this large, B is better described as the level at which the risk function is undefined (it requires dividing by 0) rather than the level at which risk becomes negligible. That is, the mathematical basement value and the biological basement value are different. The level at which data from marine mammals show barely detectable risk will be far above the mathematical basement value when K is 45 and A is 8 or 10. When K or A are small, the mathematical and biological B values become similar.

Another way of looking at the difference between the mathematical and biological basement value is to ask how much risk is detectable. In field studies, it will be difficult to distinguish responses that occur in only 5% of individuals from baseline behavior. Even if a study were sensitive enough to detect this, the received level to cause 5% risk is more than 30 dB above the mathematical B value for B=120, K =45 and A=8 or 10. That is, if risk becomes biologically detectable at 120 dB, the B value used in the equation for risk should be far lower. When the model uses the biological B value as the mathematical B value, it does not accurately predict the observed pattern of takes.

Long range effects

The Navy expressed uncertainty over whether there would be long distance effects, even when sound levels were received that are known to cause effects at close range. While I am not aware of observations at 65 nautical miles, responses at over 20 miles have been observed in killer whales to mid-frequency sonar, as well as at over 15 miles to mid-frequency sonar in Dall's porpoises, and harbor porpoises appeared to respond to airguns at over 40 nm (personal observation). The porpoises were responding at distances greater than they would respond to natural predators (killer whales), which are not believed to be detectable at those ranges.

Further evidence of long range responses to noise can be seen in differences in detection rates of some species using acoustic means and ship-based observations. Such studies indicate that species like Pacific right whales and blue whales avoid motorized vessels at distances which place them over the horizon (Wade et al. 2006, Širović 2006).

Uncertainty and Bias

To assess the effects of uncertainty in the parameter values (B, K, and A) on bias in the estimated number of takes, the following method was used. Two spreading loss models were used. A spherical spreading loss model was used, although this was likely to underestimate received levels, particularly at long distances. The other was spherical spreading at close range followed by a cylindrical spreading loss at longer distances model. An accurate model would depend on actual conditions, which would vary from one sonar exercise to another, both as bottom topography varies from place to place and the structure of the water column varies from time to time. The two models chosen should bracket actual conditions, and will serve for purposes of illustration at this stage. In both models, absorption at 3.5 kHz was used to correct for excess attenuation (Richardson et al. 1995). A source level of 235 dB re 1 μPa was assumed for purposes of illustration.

Individuals were assumed to be distributed uniformly with distance from the source, although in practice, action areas will be large enough that density could reasonably be expected to vary. The action area was divided into concentric rings 10 meters across. As the diameter of the ring increased, the area within the ring increased:

$$A = \pi r_o^2 - \pi r_i^2$$

where r_o is the outer diameter and r_i is the inner diameter of the ring.

The risk was calculated for individuals within the ring using the Navy equation, and the relative number of individuals experiencing that risk level was based on the area of the ring. As in the equation for the individuals, the cumulative impact on the population was normalized to 1 based on the Navy default parameters. The effects of uncertainty were observed by allowing the parameters to vary above and below the default values.

Using this model, the contributions of the innermost rings were small, due to their small area, and the contribution of the outermost rings were small, due to the low risk experienced by individuals in those ring. Figures 1-20 show the shape of the risk function and the relative numbers of takes that would occur as a function of received level for a variety of parameter value combinations.

Selected values of B, K and A were used to calculate relative effects, and the results are shown in Table 2 for a spherical spreading model, and Table 3 for a model that assumes spherical spreading for the first 2 km and then cylindrical spreading after that. The default values are shown in bold. Take numbers are based on Alternative 3 in the Hawaii

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Range Complex SDEIS (Dept. Navy 2008b), which in turn is based on the No Action Alternative, Table 3.3.1-1. Where the number of takes approaches the size of the population, the actual number of takes will be smaller than shown in the table. However, individuals will be taken multiple times and the duration of takes will be longer than if the calculated number of takes were small. Presumably, longer and more frequent takes of individuals will have more impact on the population than takes due to single exposures.

Table 2. Sensitivity Analysis based on a spherical spreading model

B	K	A	Spreading Model	Relative Effect	Humpback takes	Striped Dolphin takes	Basis
80	45	10	Inv. Square	185.29	2,826,414	867,898	Vary B
90	45	10	Inv. square	75.25	1,147,864	352,471	Vary B
100	45	10	Inv. square	23.92	364,876	112,041	Vary B
110	45	10	Inv. square	5.68	86,643	26,605	Vary B
120	**45**	**10**	**Inv. square**	**1.00**	**15,254**	**4,684**	**SDEIS**
130	45	10	Inv. square	0.14	2,136	656	Vary B
140	45	10	Inv. square	0.02	305	94	Vary B
120	5	10	Inv. Square	167.18	2,550,164	783,071	Vary K
120	15	10	Inv. square	62.22	949,104	291,439	Vary K
120	25	10	Inv. square	18.33	279,606	85,858	Vary K
120	35	10	Inv. square	4.47	68,185	20,937	Vary K
120	**45**	**10**	**Inv. square**	**1.00**	**15,254**	**4,684**	**SDEIS**
120	55	10	Inv. square	0.23	3508	1077	Vary K
120	65	10	Inv. square	0.06	915	281	Vary K
120	75	10	Inv. square	0.01	153	47	Vary K
120	45	1	Inv. square	42.40	646,770	198,602	Vary A
120	45	5	Inv. square	3.27	49,881	15,317	Vary A
120	45	8	Inv. square	1.40	21,356	6,558	Vary A
120	**45**	**10**	**Inv. square**	**1.00**	**15,254**	**4,684**	**SDEIS**
120	45	12	Inv. Square	0.80	12,203	3,747	Vary A
120	45	20	Inv. Square	0.52	7,932	2,436	Vary A
120	45	100	Inv. Square	0.39	5,949	1,827	Vary A
120	**45**	**10**	**Inv. square**	**1.00**	**15,254**	**4,684**	**SDEIS**
105	15	10	Inv. square	251.39	3,834,703	1,177,511	*Orcinus*
105	15	8	Inv. square	250.96	3,828,144	1,175,497	
70	25	10	Inv. square	1070.25	16,325,594	5,013,051	*Phocoena*
70	25	8	Inv. square	1067.49	16,283,492	5,000,123	*Phocoena*

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14 The values suggested as parameters, the results of which are presented in the above mentioned tables, are not reasonable given the environmental conditions in SOCAL have ambient noise (naturally occurring background noise) levels at or above those suggested by the commenter as behavioral harassment "B" basement values. The use of these results for examination of potential uncertainty and bias in the risk function as presented in the Draft EIS/OEIS is, therefore, not informative or applicable in SOCAL context.

Table 3. Sensitivity analysis based on a model with spherical spreading for 2 km followed by cylindrical spreading.

B	K	A	Spreading Model	Relative Effect	Humpback takes	Striped Dolphin takes	Basis
80	45	10	Hybrid	132.20	2,016,579	619,225	Vary B
90	45	10	Hybrid	65.31	996,239	305,912	Vary B
100	45	10	Hybrid	25.30	385,926	118,505	Vary B
110	45	10	Hybrid	6.67	101,744	31,242	Vary B
120	**45**	**10**	**Hybrid**	**1.00**	**15,254**	**4,684**	**SDEIS**
130	45	10	Hybrid	0.08	1,220	325	Vary B
140	45	10	Hybrid	.005	76	23	Vary B
120	5	10	Hybrid	127.23	1,940,771	595,947	Vary K
120	15	10	Hybrid	59.67	910,213	279,496	Vary K
120	25	10	Hybrid	21.39	326,238	100,177	Vary K
120	35	10	Hybrid	5.37	81,901	25,149	Vary K
120	**45**	**10**	**Hybrid**	**1.00**	**15,254**	**4,684**	**SDEIS**
120	55	10	Hybrid	0.18	2,724	836	Vary K
120	65	10	Hybrid	0.04	570	175	Vary K
120	75	10	Hybrid	0.01	143	44	Vary K
120	45	1	Hybrid	34.16	521,077	160,005	Vary A
120	45	5	Hybrid	3.65	55,665	17,093	Vary A
120	45	8	Hybrid	1.51	23,016	7,067	Vary A
120	**45**	**10**	**Hybrid**	**1.00**	**15,254**	**4,684**	**SDEIS**
120	45	12	Hybrid	0.73	11,103	3,409	Vary A
120	45	20	Hybrid	0.35	5,353	1,644	Vary A
120	45	100	Hybrid	0.17	2,593	796	Vary A
120	**45**	**10**	**Hybrid**	**1.00**	**15,254**	**4,684**	**SDEIS**
105	15	10	Hybrid	171.9	2,622,166	805,181	*Orcinus*
105	15	8	Hybrid	171.3	2,612,718	802,279	
70	25	10	Hybrid	516.41	7,877,318	2,418,864	*Phocoena*
70	25	8	Hybrid	514.46	7,847,573	2,409,731	*Phocoena*
80	45	10	Hybrid	132.20	2,016,579	619,225	"Average"species
100	40	10	Hybrid	40.88	623,525	191,464	Stringent criteria
120	45	10	Social75	1.004	15,315	4,703	75% step
120	45	10	Social50	1.06	16,169	4,965	50% step
120	45	10	Social25	1.49	22,728	6,979	25% step
120	45	10	Social10	3.02	46,067	14,146	10% step

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An interesting characteristic of the Navy model is that uncertainty causes it to be biased to underestimate risk. The reason for this bias is that the area receiving higher than the level of sound associated with a 50% risk based on default values is smaller than the area receiving lower levels. Thus if a species is 10 dB more sensitive than predicted (the B value), the cumulative risk is underestimated by a factor of 5.68, while if it is overestimated by 10 dB the correction is 0.14. Similarly, if the error is 20 dB, the correction factors are 23.92 and 0.02, respectively. However, the values average to 6.15, not 1 as would be the case if the default values provided an unbiased estimate. Errors in K show a similar pattern.

Likewise, if the default value of A is too low, it makes little difference in the estimated number of takes. However, if the default value of A is higher than the actual value, the effect on the population can be seriously underestimated when default values are used.

It should also be noted that the bias increases with increasing uncertainty.

Another source of uncertainty is propagation. As noted above, there is uncertainty over propagation that depends on the structure of the water column. Expectations can be based on historical measurements, and actual conditions can be measured to allow re-running propagation models with actual conditions. However, when received levels as a function of distance are higher than predicted, the result is asymmetrical relative to an error of the same magnitude in the opposite direction, as is the case for errors in the receiver parameters. E.g., when a sound channel forms, the area receiving enough noise to cause takes will dramatically increase.

Finally, the magnitude of the difference between parameter values based on reanalysis of the datasets used by the Navy (with harbor porpoises added, a species included in the AFAST Draft DEIS, Dept. Navy 2008a), and the Navy analysis should be emphasized. The number of takes predicted for an average species differs by a factor of more than 100. For humpbacks, this suggests individuals would be taken an average of about 250 times. Of course, when refresh times are taken into account, the number of retakes would be below this number, but the duration of takes would go up as a result. The cumulative effect on the population is likely to be far higher with the increased number and duration of takes predicted when more realistic parameters are used than when the Navy parameters are used.

SEL vs. SPL

Studies with captive marine mammals suggest that SEL provides a good predictor of Temporary Threshold Shift. That is, there is a tight relationship among signal strength, duration, and TTS. However, for behaviorally mediated effects, this relationship is likely to be different. SPL is likely to qualitatively determine the response for signals longer than 1 ms in duration. As long as signals are produced sufficiently often, the duration from the first signal to the last is likely to be more important than the SEL. That is, for

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low received levels, one second signals produced every 40 seconds for 120 minutes are likely to have more impact than a continuous signal that lasts 10 minutes, even though the latter contains far more sound energy (600 seconds versus 180 seconds), as a behavioral response will be sustained for hours rather than minutes.

When attempting to predict effects of takes on the population, a take table with multiple columns should be developed. One based on SEL could be used to characterize direct effects such as threshold shifts. The next two should be based on SPL. The first of these should be analyzed to evaluate the total number of individuals that would change their behavior as a result of noise exposure, with particular attention paid to exposure in high risk areas (canyons, near shore, near shipping lanes) for potential indirect injuries. The third analysis would consider duration of exposure (in hours of exercise rather than in the SEL sense) to determine whether factors such as stress, displacement from preferred habitat, changes in foraging success and predation risk, etc., would result in cumulative effects that would alter population growth in a manner equivalent to lethal removals (Bain 2002a).

Summary

In summary, development of a function that recognizes individual variation is a step in the right direction. However, the selected equation is likely to produce underestimates of takes. This is due both to social factors increasing the likelihood of a response at low exposure levels, and asymmetries in the number of individuals affected when parameters are underestimated and overestimated due to uncertainty. Thus it will be important to use the risk function in a precautionary manner.

The sensitivity analysis reveals the importance of using as many datasets as possible. First, for historical reasons, there has been an emphasis on high energy noise sources and the species tolerant enough of noise to be observed near them. Exclusion of the rarer datasets demonstrating responses to low levels of noise biases the average parameter values, and hence underestimates effects on sensitive species. In particular, exclusion of the Navy's own interpretation of harbor porpoise data resulted in an increase of B+K by 11 dB, and a reduction in estimated takes by a factor of about 5. Second, uncertainty is correlated with bias. That is, even if a representative set of noise exposure-response data are used to calculate parameter values, the statistical uncertainty resulting from small samples results in biased parameter estimates that lead to underestimation of effects. Thus when estimating takes, it will be important to correct for bias. When estimating population effects on poorly known species, it will be important to be precautionary.

An important error in the selection of parameter values was in interpretation of existing data. Extrapolating behavioral changes in beluga and killer whales and bottlenose dolphins trained to tolerate physical harm that is in their long-term best interest to the threshold for onset of any physical harm in wild individuals is problematic. A similar mistake was made with the right whale data. The level at which 100% of individuals responded was used as the value at which 50% of individuals responded (B+K).

Likewise, the level at which 100% of killer whales responded to mid-frequency sonar is less than the value derived for B+K in the HRC SDEIS (Dept. Navy 2008b).

The "broad overview" of studies reported responses to received levels of 120 dB re 1 μPa by 50% of individuals. That is, 120 dB re 1 μPa should be taken as a "default" value for B+K, not B. Studies which looked at the level at which statistically significant changes were observed, rather than the level at which 50% of individuals responded found lower levels for B. As a result, B is overestimated, and B+K (the level at which risk is 50%) is as well. The use of data from trained dolphins and white whales biased the average B+K value upward. The exclusion of the effects of AHD's and ADD's on harbor porpoises further biases these values, though the sensitivity analysis suggests that using average values to extrapolate takes is unlikely to be accurate due to the broad range of inter-specific variation.

It is likely that biological B values should be in the range from just detectable above ambient noise to120 dB re 1 μPa. The resulting mathematical B value could be tens of dB lower, not the 120 dB re 1 μPa proposed. For many species, risk may approach 100% in the range from 120-135 dB re 1 μPa, putting K in the 15-45 dB range. A values do not seem well supported by data, and in any case, are likely to be misleading in social species as the risk function is likely to be asymmetrical with a disproportionate number of individuals responding at low noise levels. Re-evaluating the datasets identified by the Navy and including harbor porpoises, an average B+K value of 125 dB was found, and the over-representation of species that fare well in captivity likely biases the average above what it would be for all species. Rather than one equation fitting all species well, parameters are likely to be species typical. As realistic parameter values are lower than those employed in the HRC SDEIS (Dept. Navy 2008b), AFAST DEIS (Dept. Navy 2008a) and related DEIS's, take numbers should be recalculated to reflect the larger numbers of individuals likely to be taken. The difference between the parameter values estimated here and those used in the SDEIS suggests takes were underestimated by two orders of magnitude.

The large number of takes predicted when more sensitive species are used as sources of the parameters indicates that many individuals are likely to be taken many times, and the potential for population scale effects to result from small behavioral changes becomes significant.

Assuming spherical spreading out to 2 km followed by cylindrical spreading, B=120, K=45 and A=10 (the Navy values), most takes occur where the received level is greater than 157 dB re 1 μPa and the distance is less than 13 km. With stringent criteria for what constitutes a take derived in the reanalysis (B=120, K=20, A=10), most takes would occur where the received level is below 145 db re 1 μPa and the distance is over 43 km. With the average values calculated here (B=80, K=45, and assuming A=10), most takes would occur where the received level is below 135 dB re 1 μPa and the distance is over 80 km. These values predict over 100 times more takes as the Navy values, as well as the need for very different approaches to mitigation.

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The Navy recognizes that the occurrence of conditional effects is important to assessing the impact of noise exposure. As such effects are the result of both received levels and environmental conditions, permit conditions will be important in determining these. The potential for conditional harm suggests using mitigation to limit the potential for actual harm. E.g., the risk of causing stranding can be minimized by restricting exercises to areas far from shore. Limiting the duration of exposure can limit the consequences of long-term displacement, risk of injury from prolonged flight, and limit cumulative effects. The risk of causing gas bubble lesions can be minimized by restricting use near canyons, for extended periods of time, and limiting the number of sources. The absolute effects can be minimized by conducting exercises in areas where population density is low, or at times of year when species of concern are absent.

Finally, it will be important to assess the cumulative effects of noise combined with other factors and population status (Wade and Angliss 1997) to assess the likely effects of sonar exercises on marine mammal populations.

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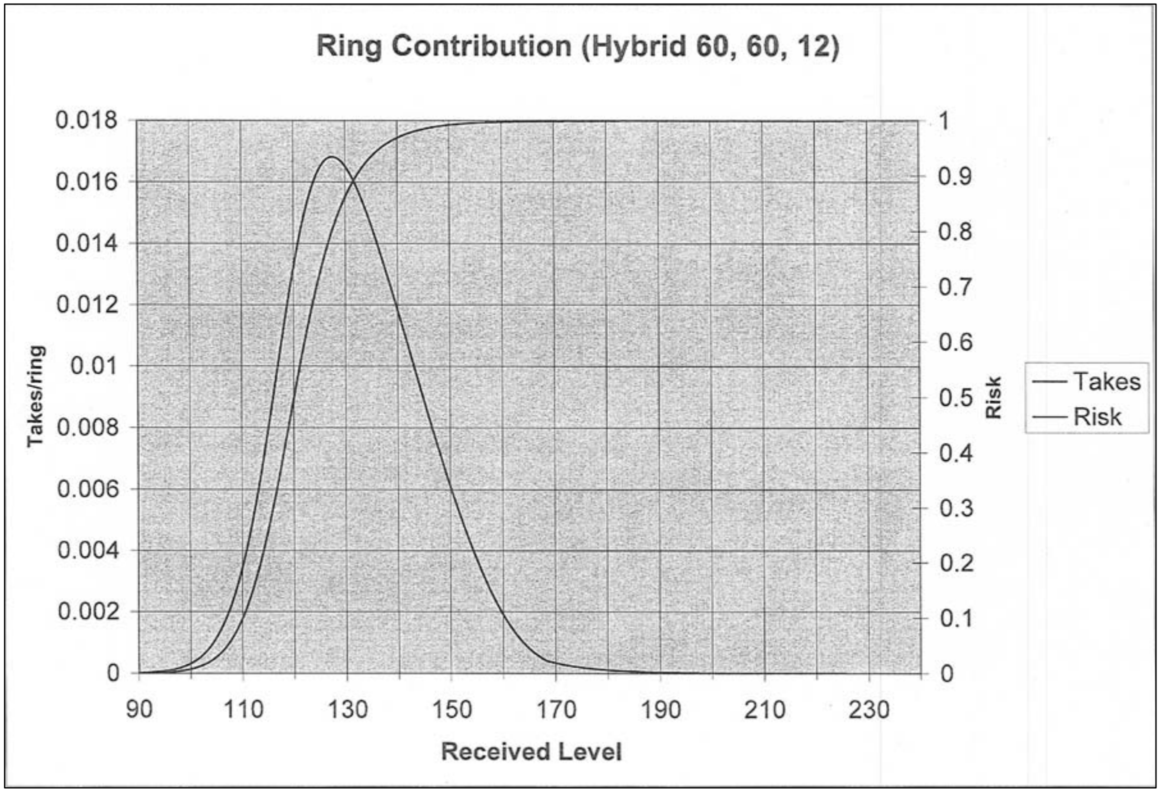
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0.012
0.01
0.008
0.006
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0.002
0
90
110
130
150
170
190
210
230
Received Level
Risk
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0.9
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0.5
0.4
0.3
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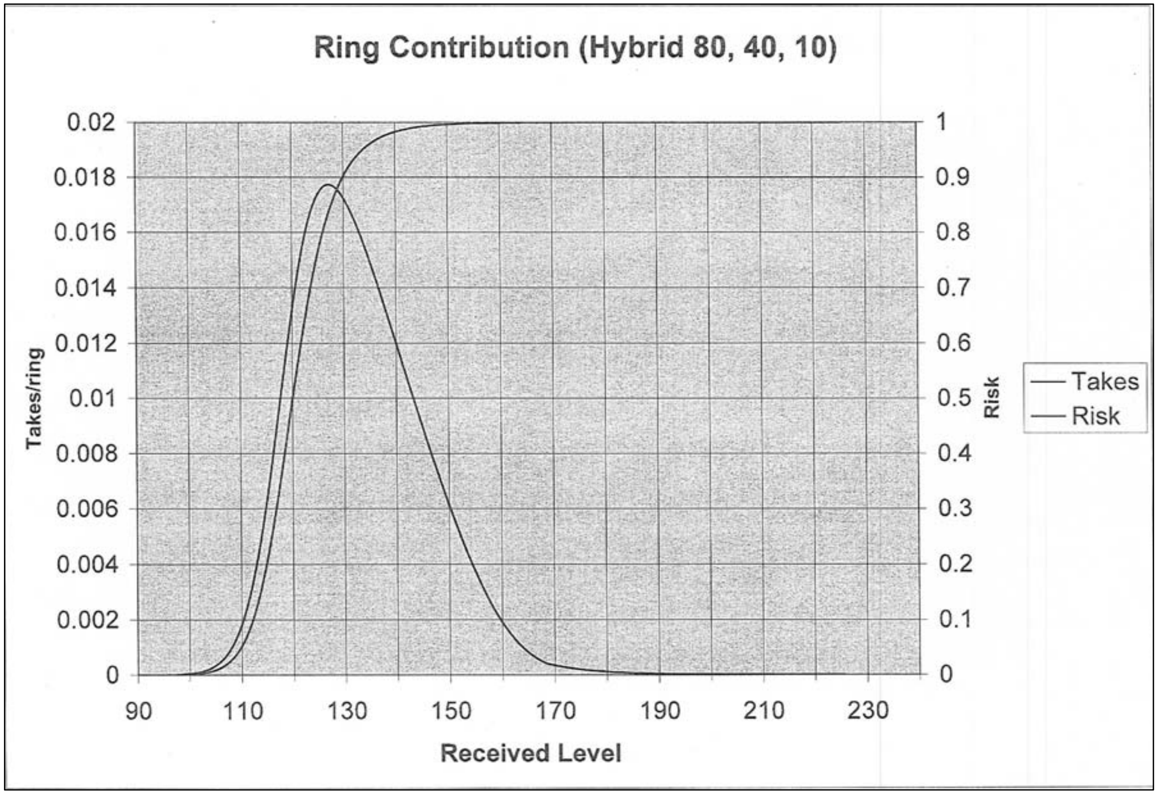
0.1
0
Takes
Risk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0.014
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0.004
0.002
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Risk
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0.9
0.8
0.7
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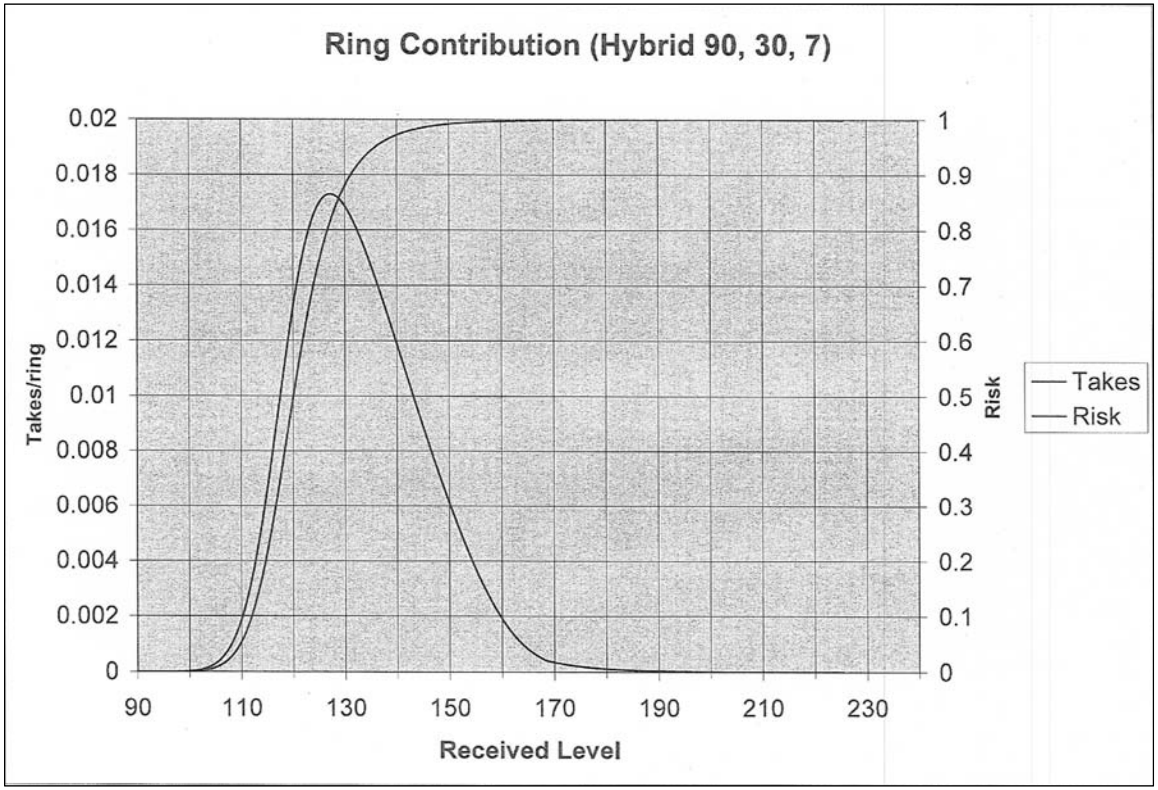
Received Level
Takes
Risk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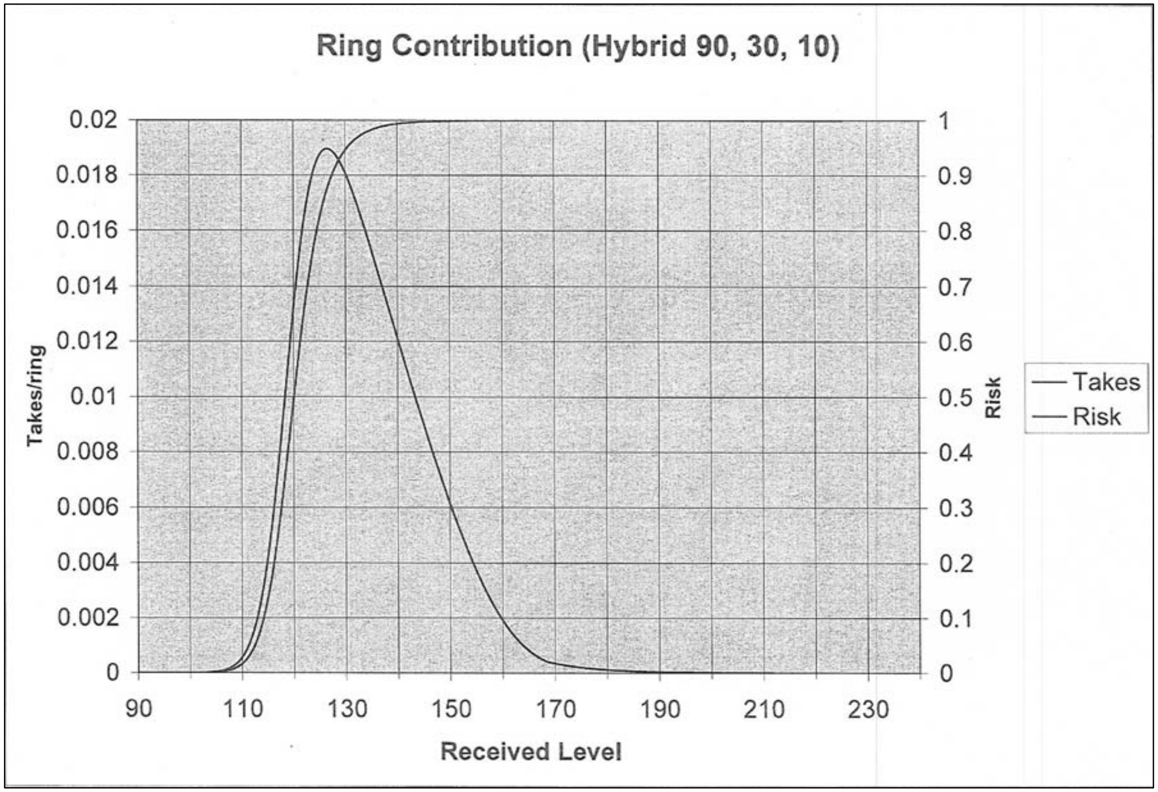
Takes
Risk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Received Level
Risk
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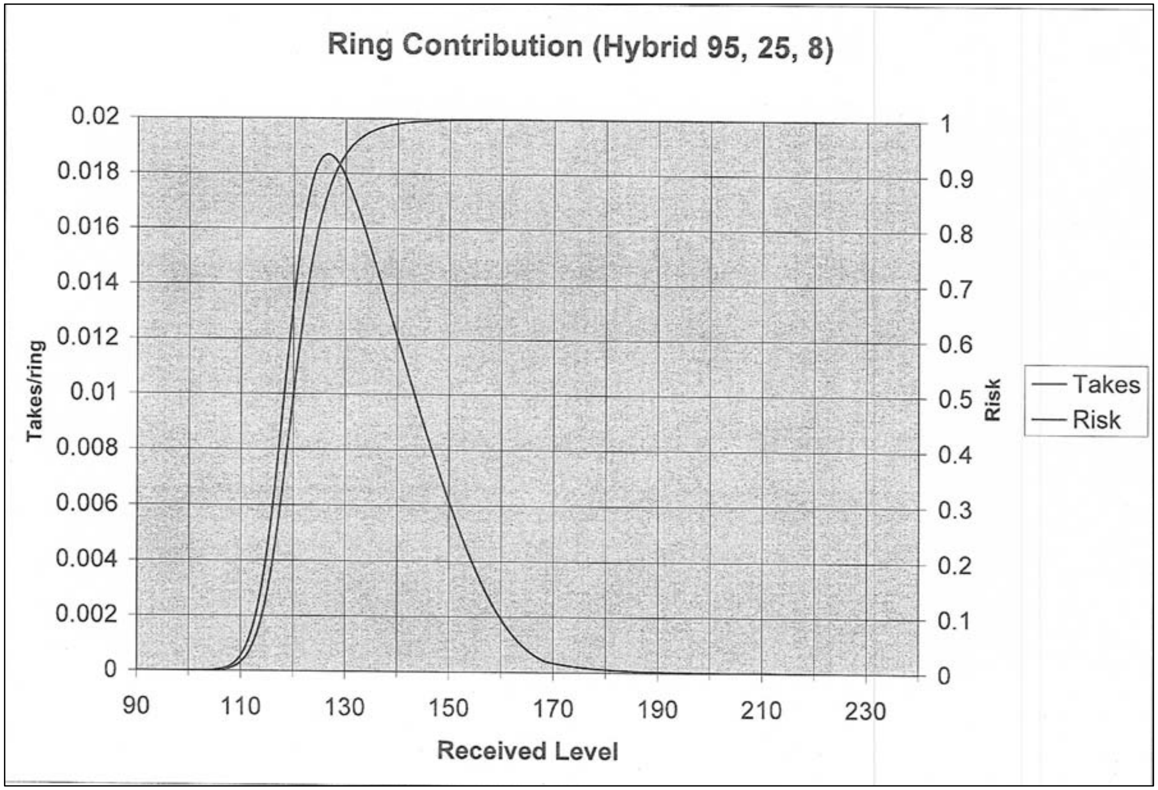
Takes
Risk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Risk
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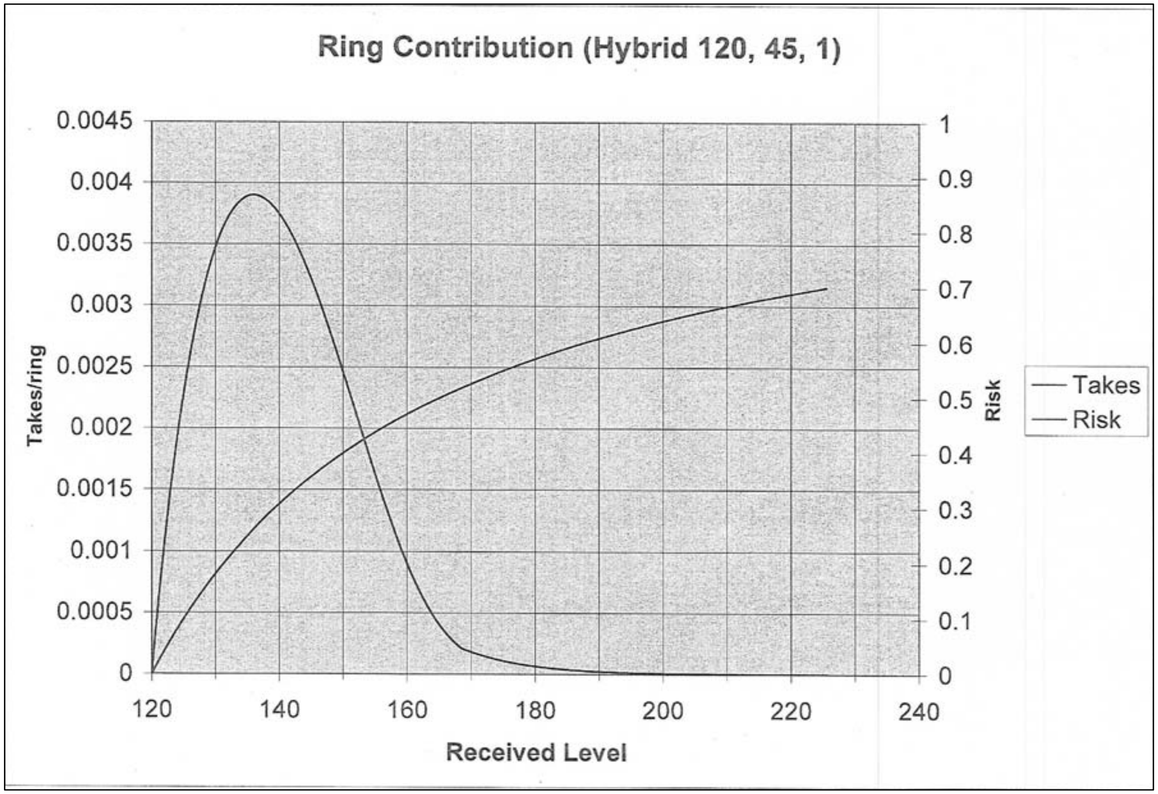
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0.0005
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Received Level
Risk
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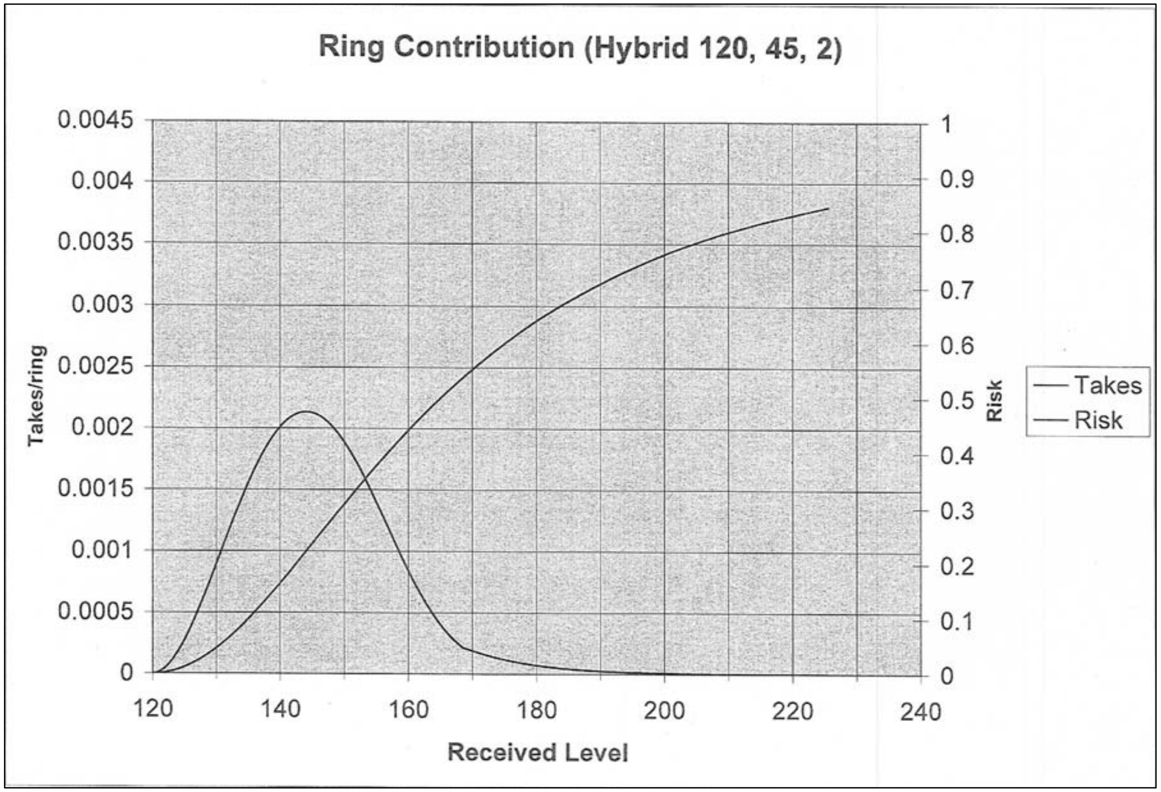
Takes
Risk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0.0005
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Received Level
Risk
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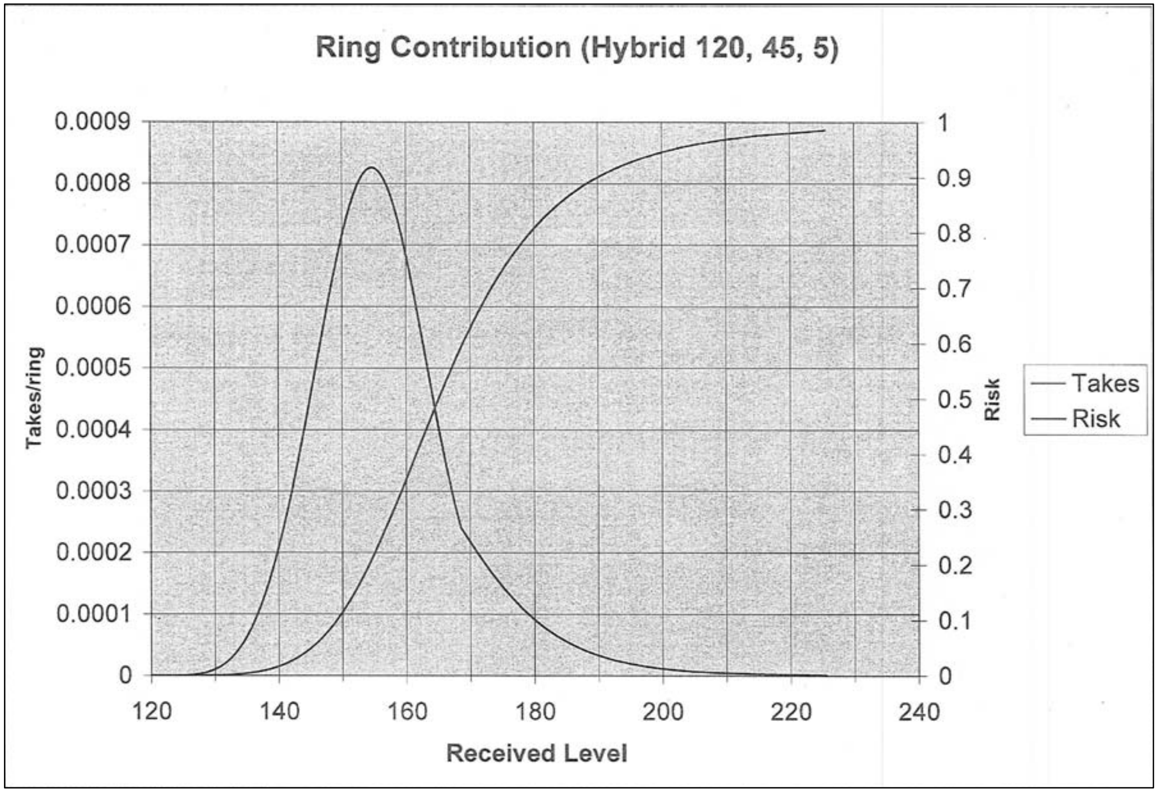
Takes
Risk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0.0001
0
Risk
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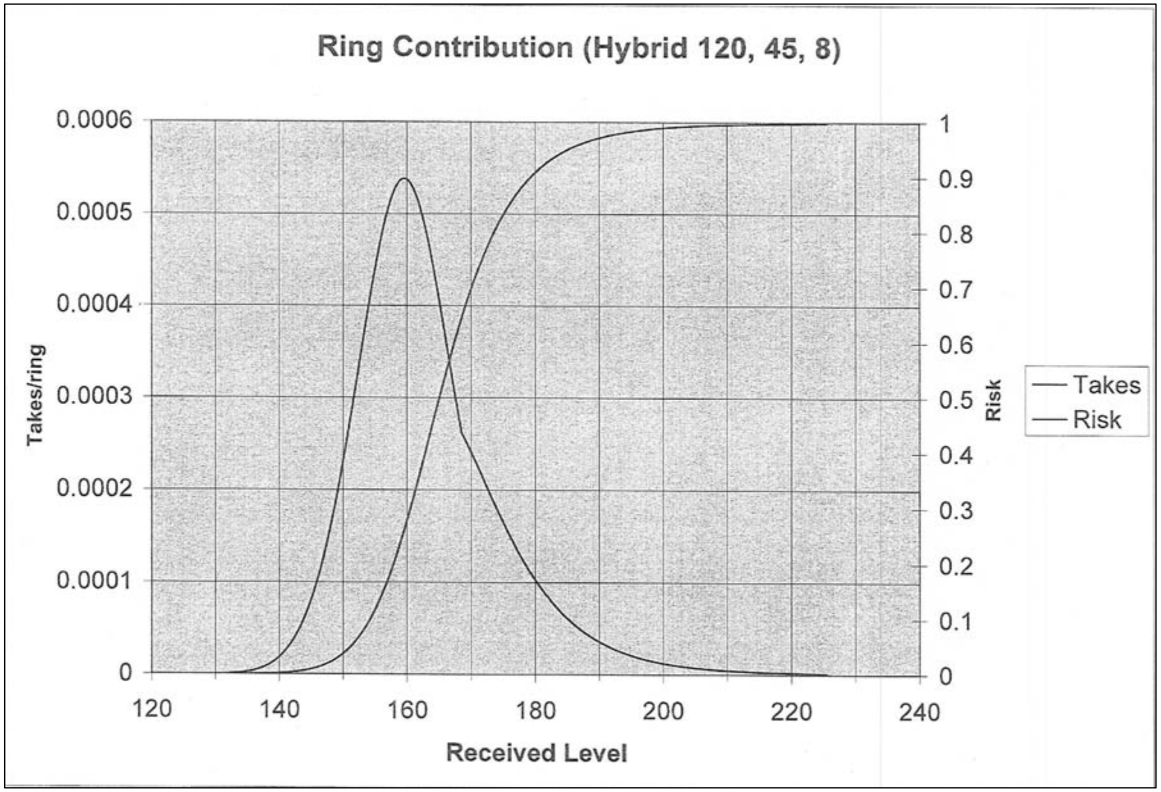
Received Level
Takes
Risk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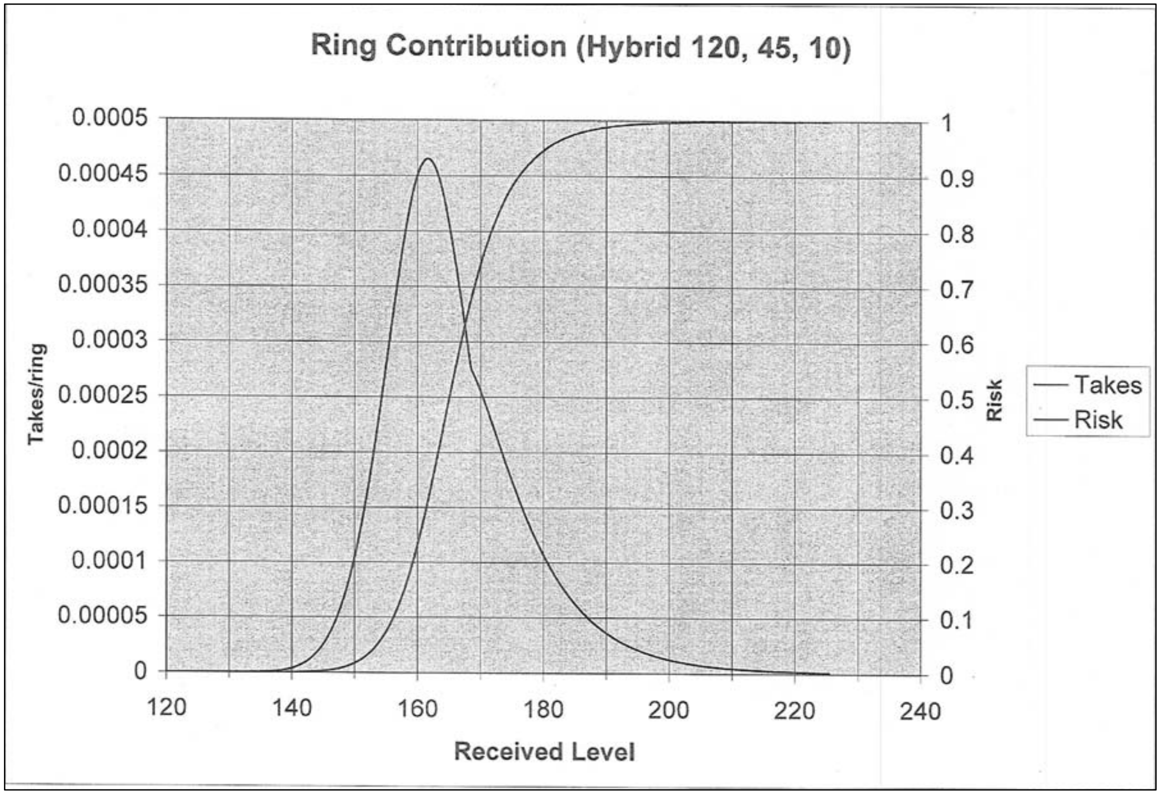
Received Level
Takes
Risk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Received Level
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Takes
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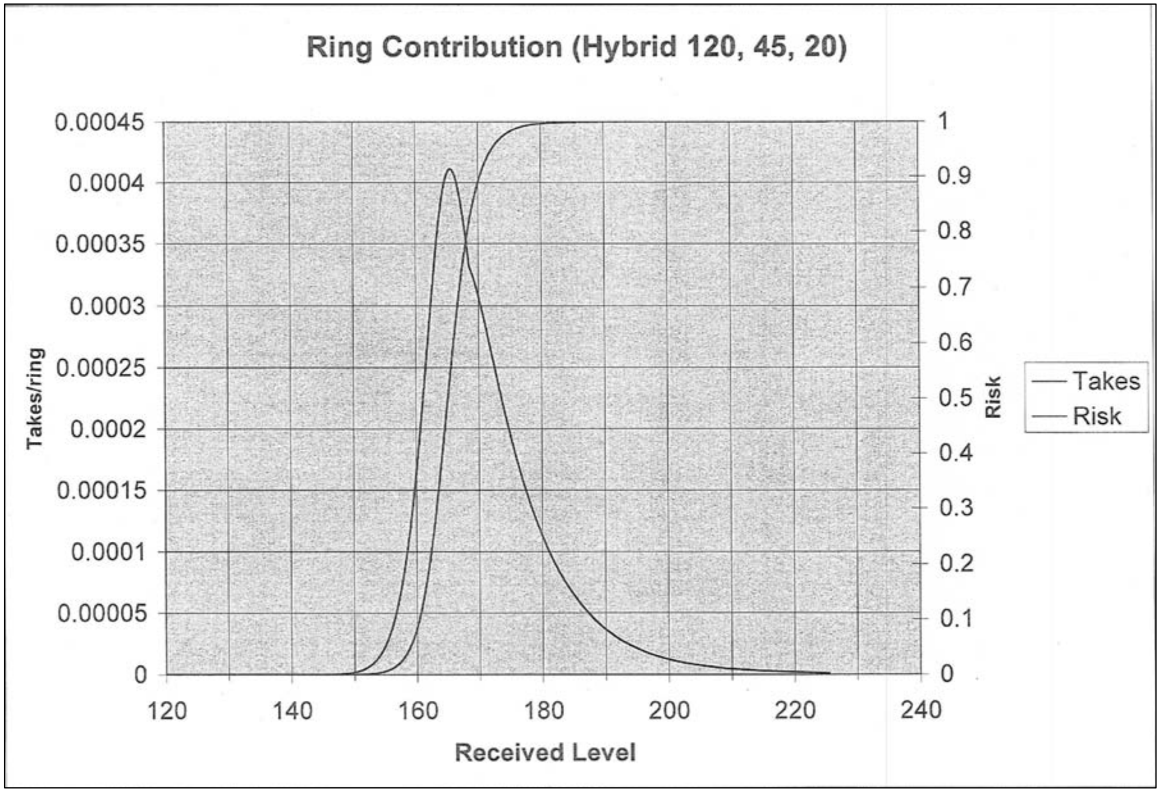
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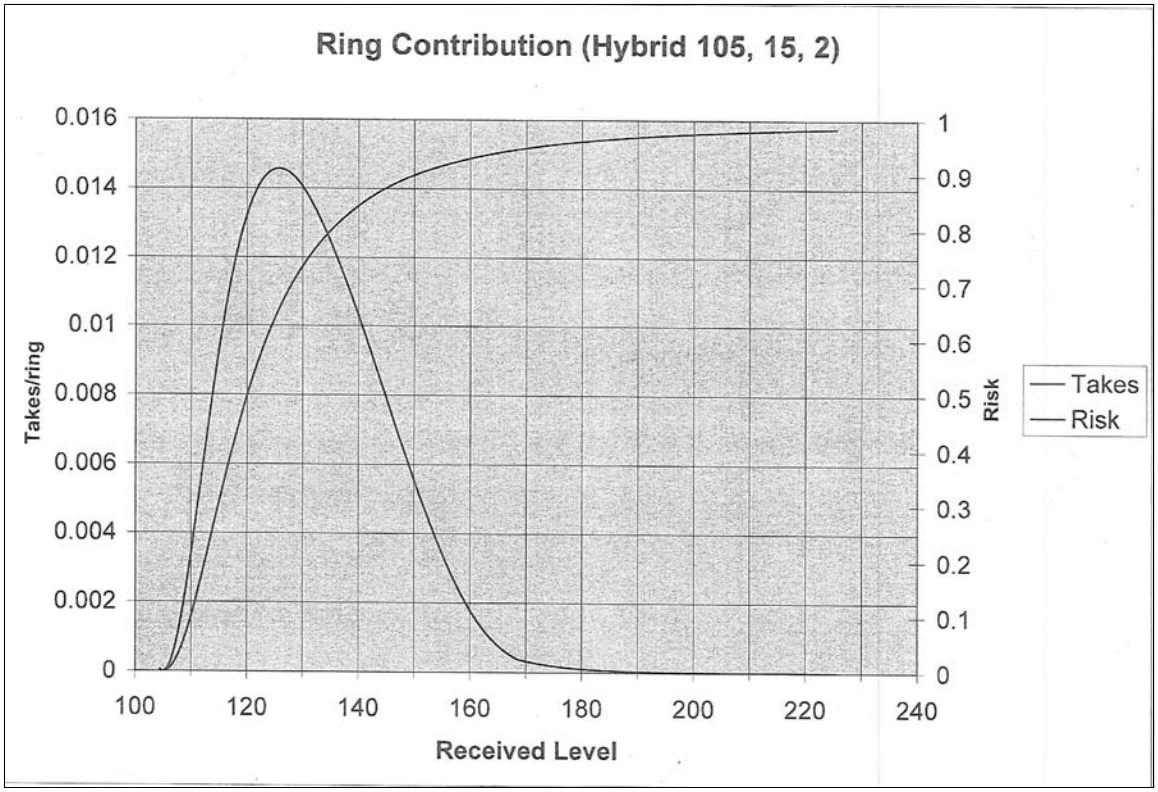
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Received Level
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Takes
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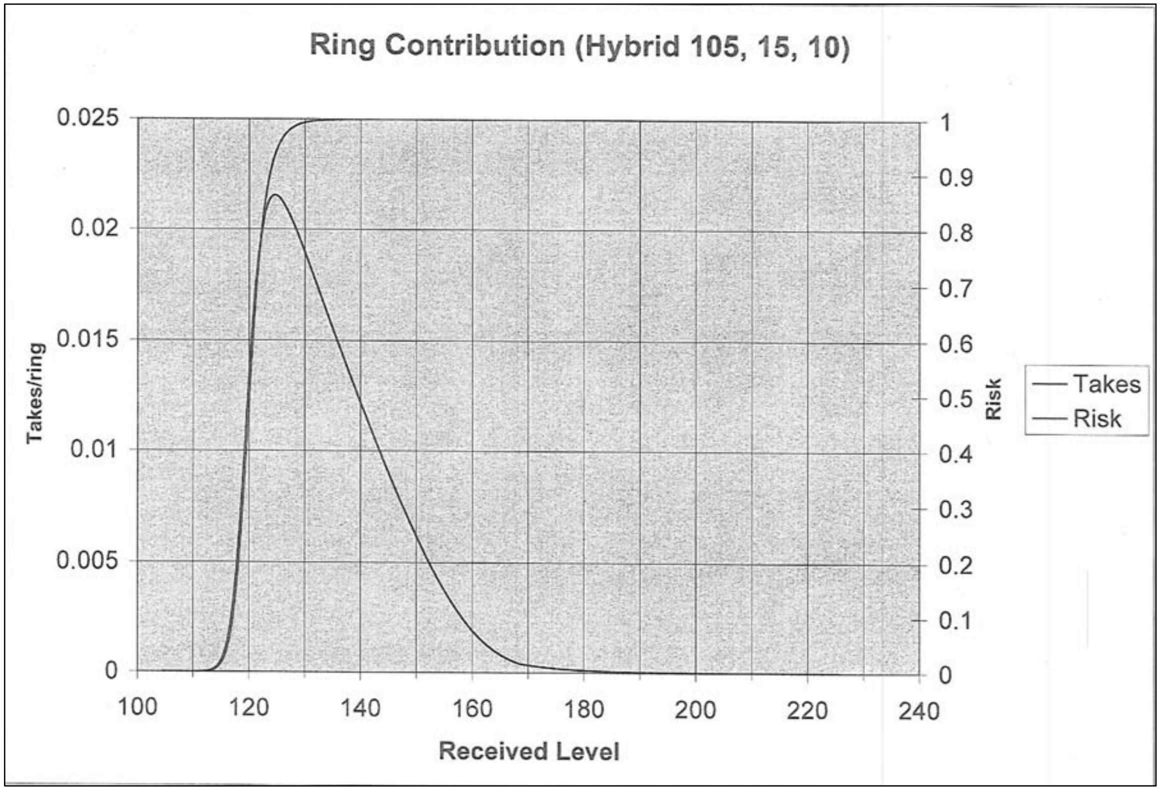
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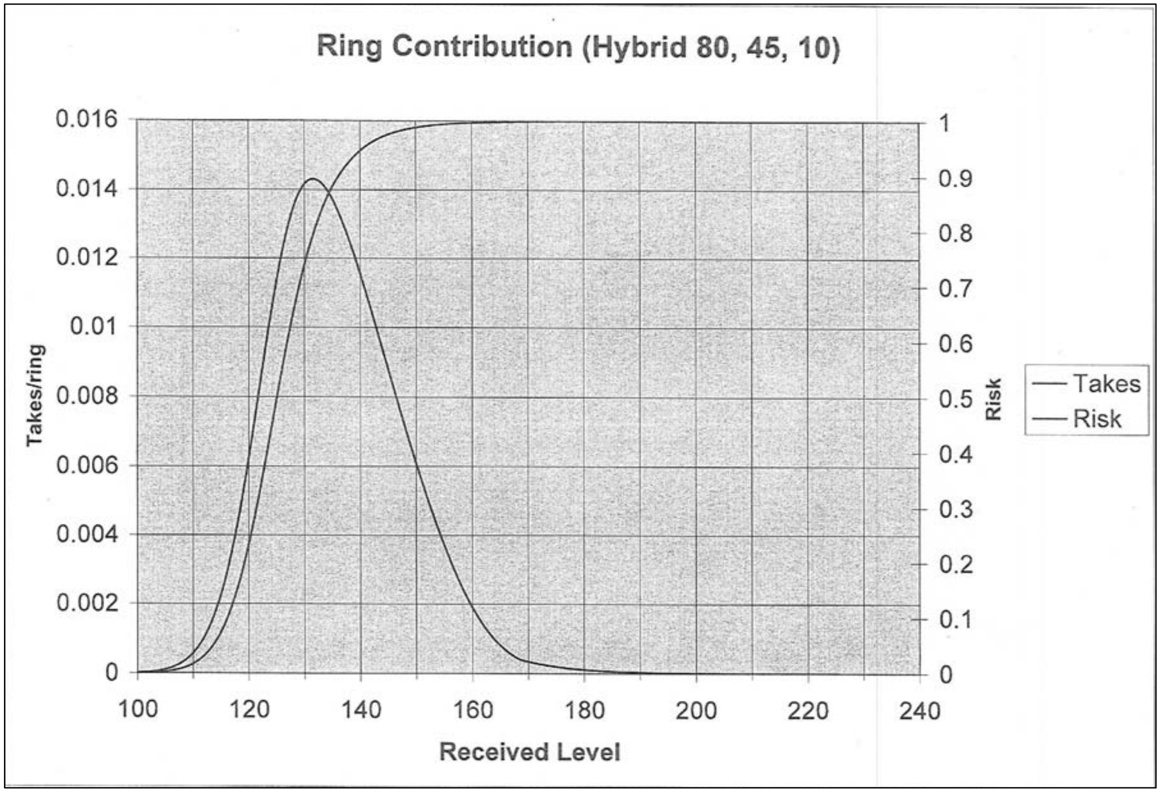
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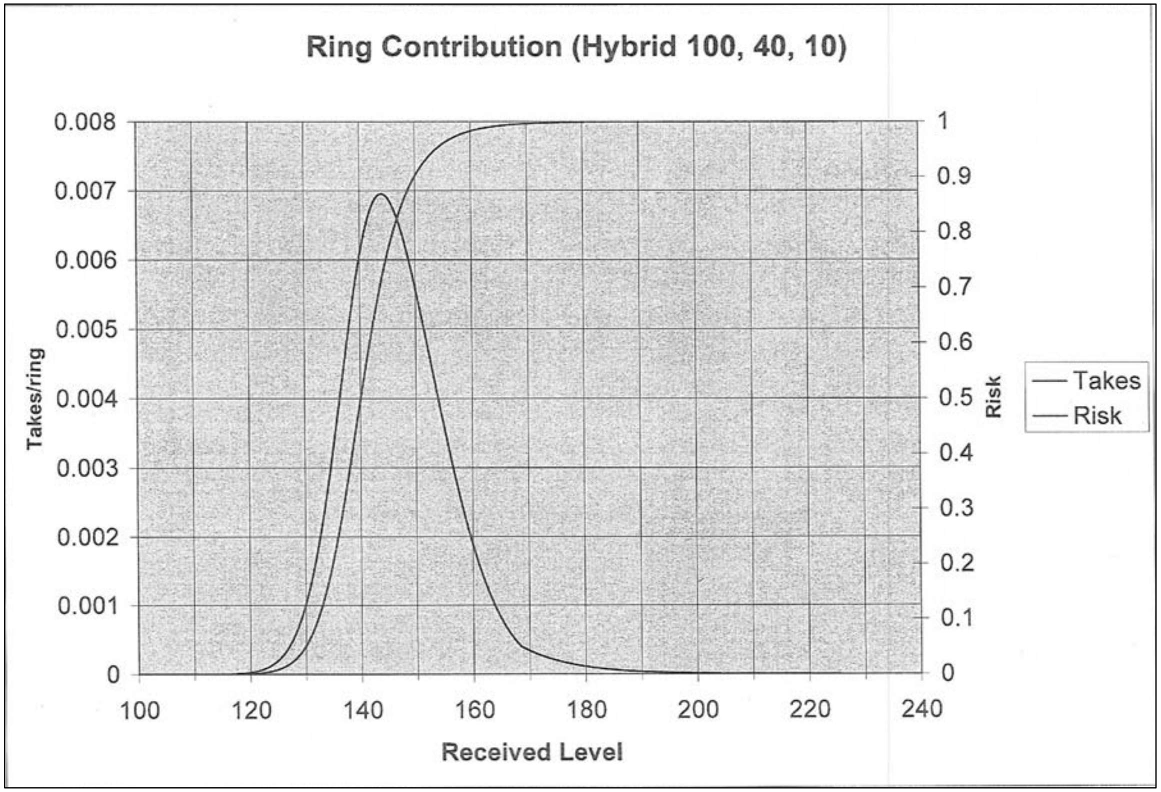
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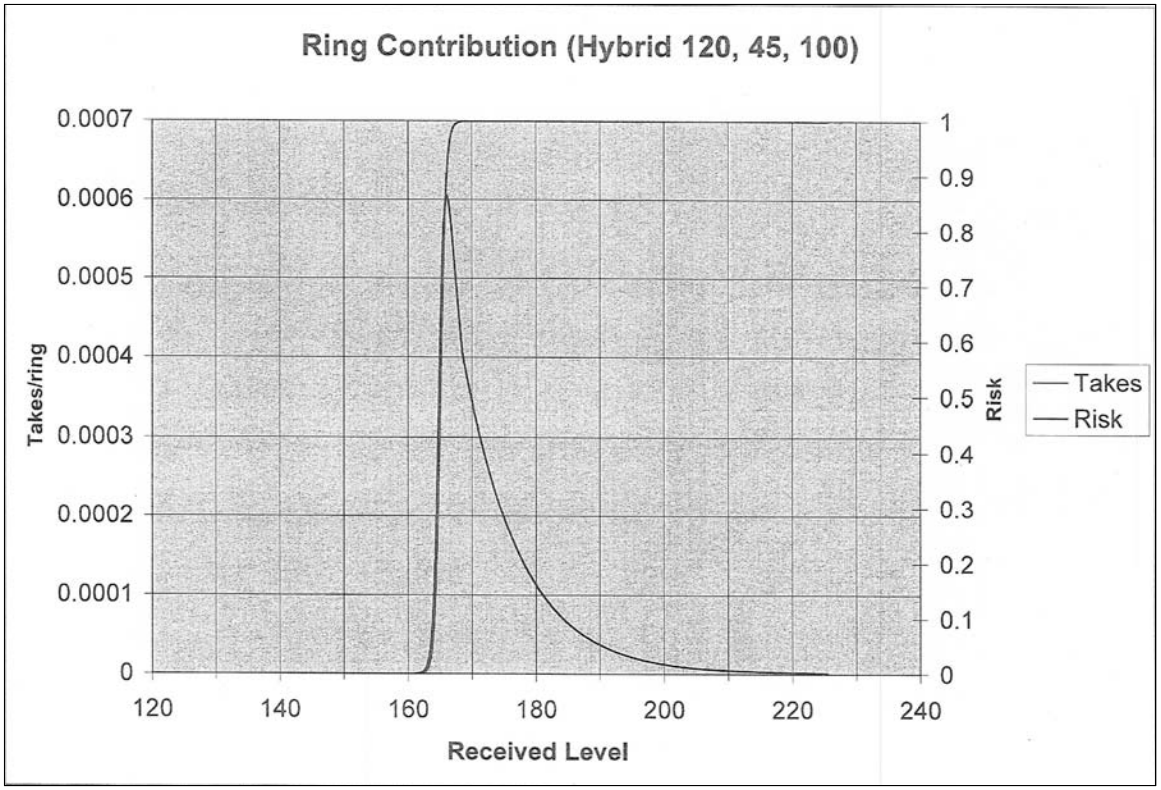
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Received Level
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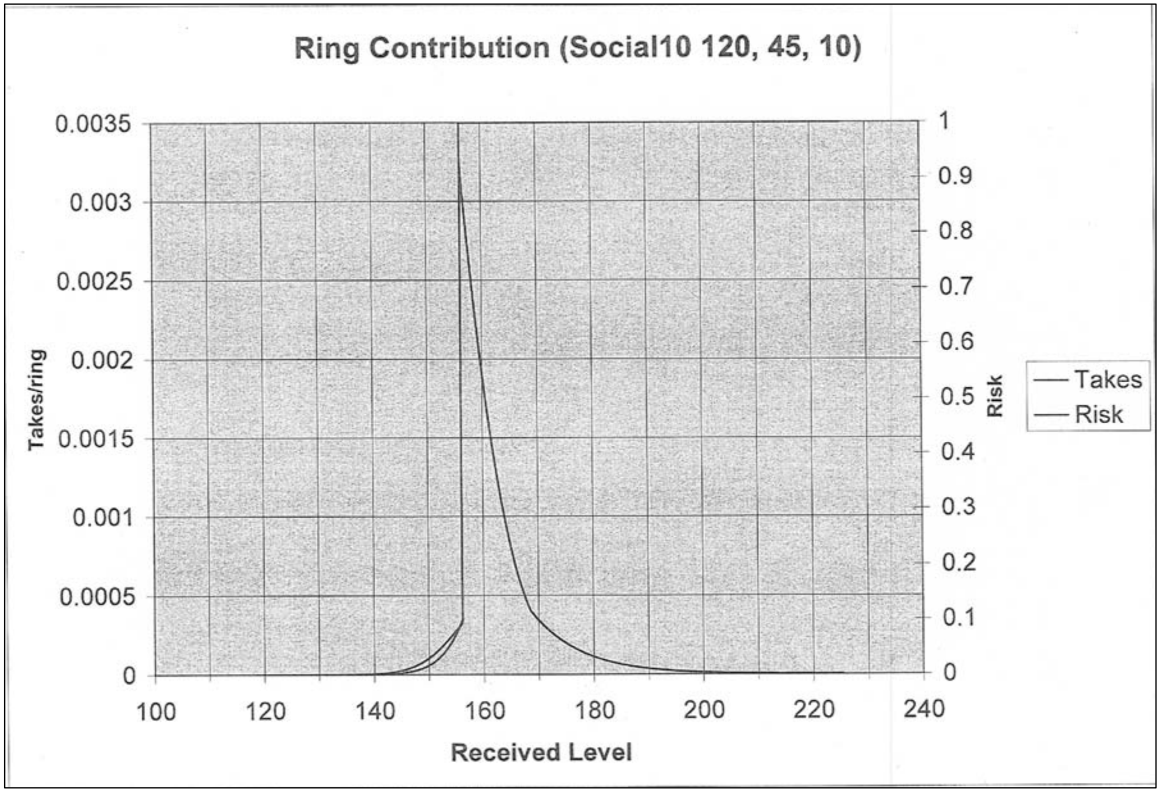
Takes
Risk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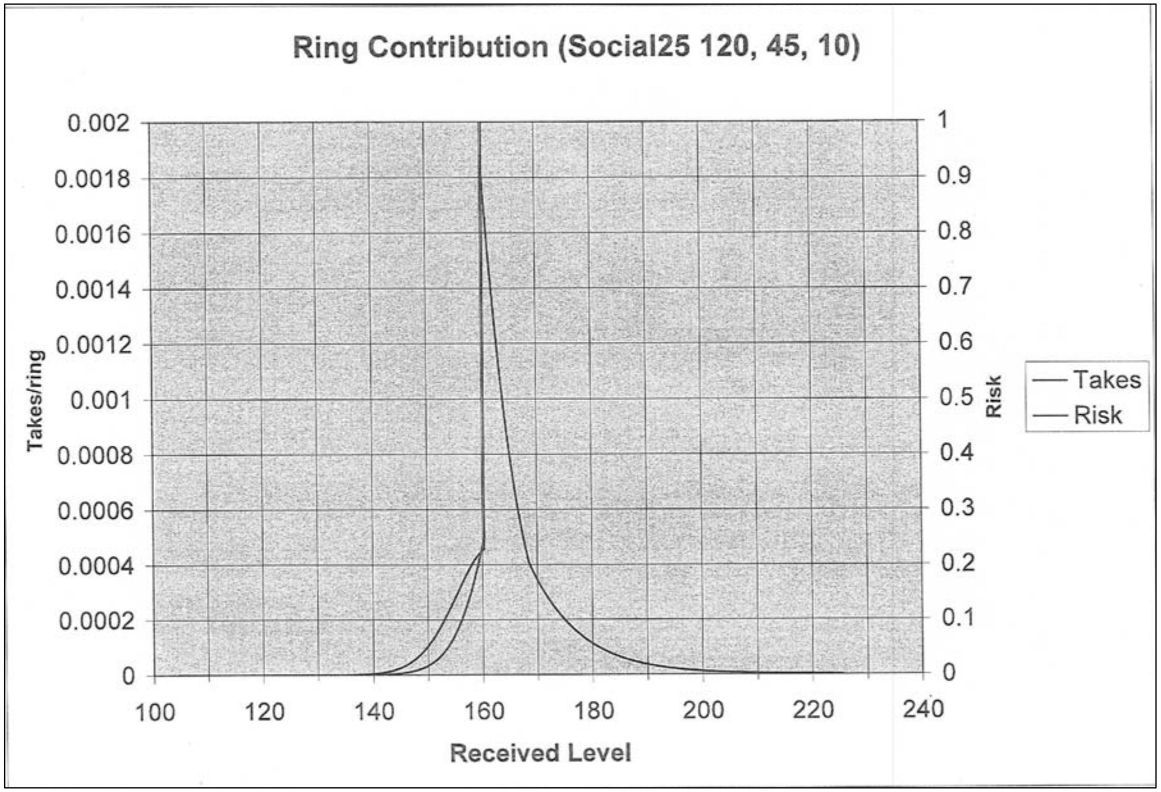
Received Level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Risk
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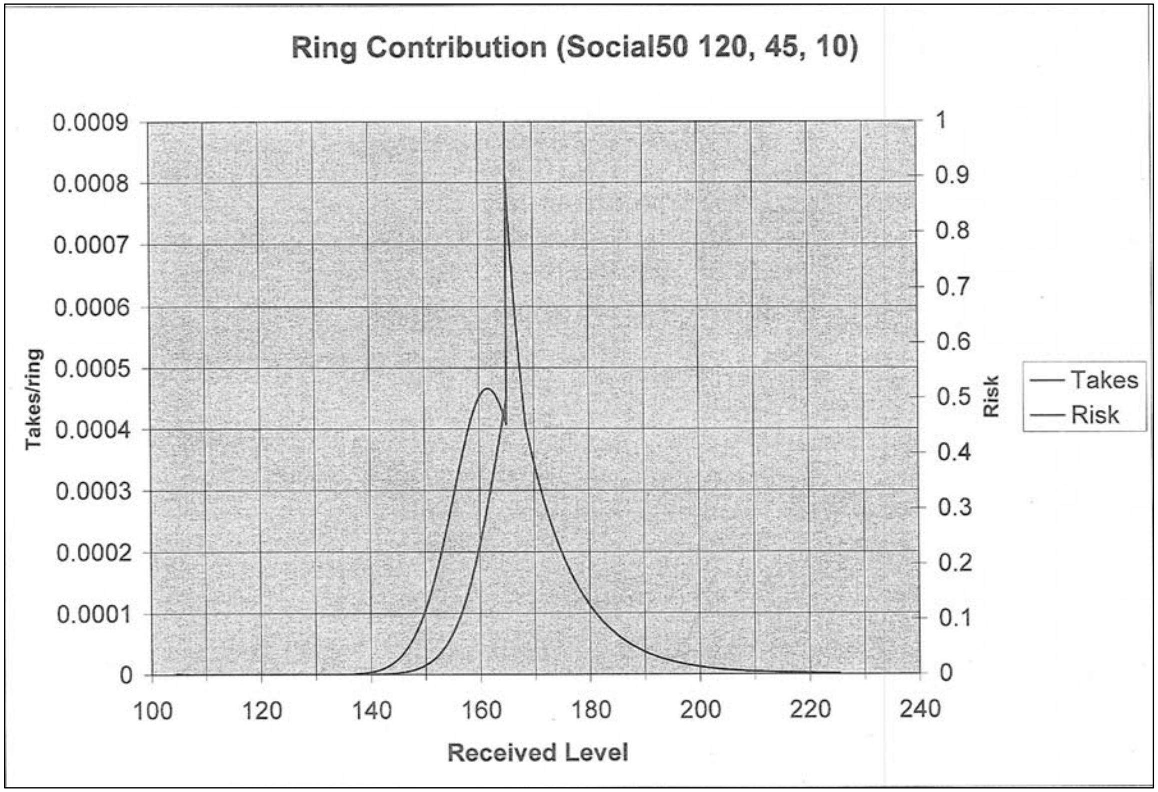
Received Level
Takes
Risk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Risk
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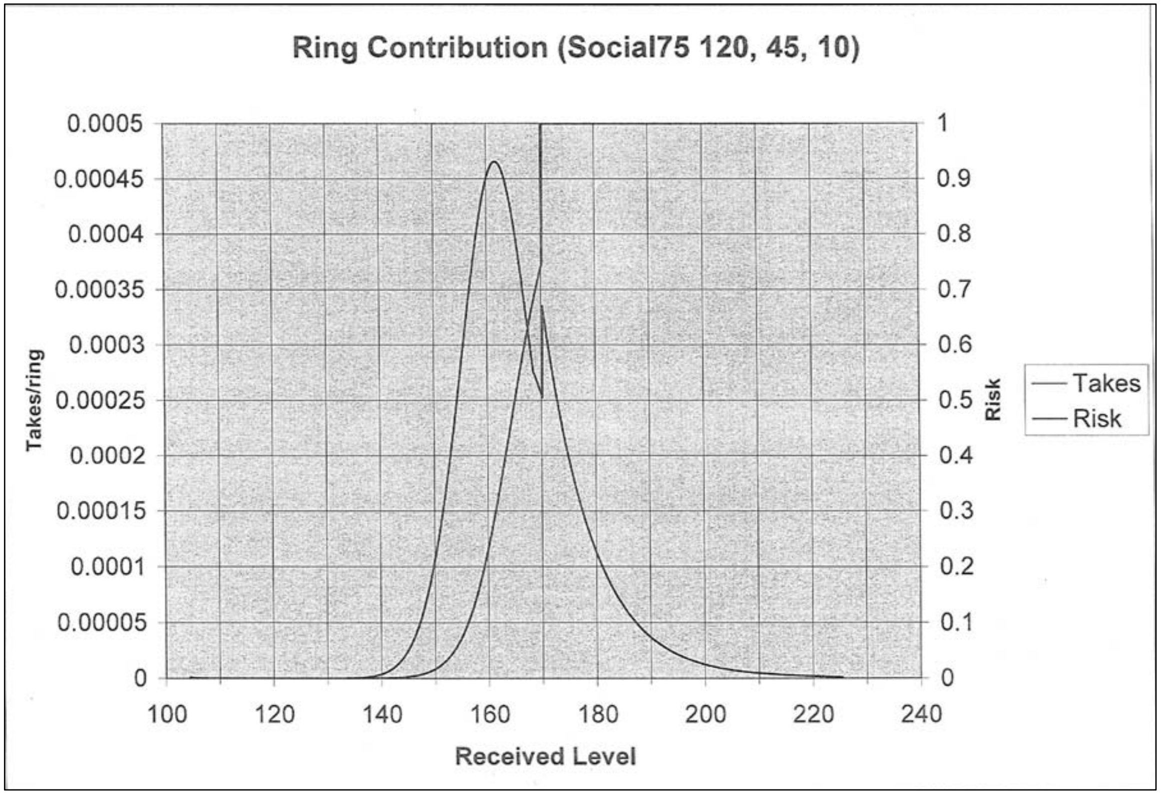
Received Level
Takes
Risk


Ring Contribution (Social75 120, 45, 10)
Takes/ring
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Takes
Risk

10.2.2 Website Comments

The following comments were made via the SOCAL EIS website (http://www.SocalRangeComplexEIS.com) and copied exactly as they were written. Personal information was removed.

10.2.2.1 Wicks

LEAVE THE MARINE MAMMALS ALONE ! The Government and Military have toxified multiply locations on land over many years duration. They can train in other areas rather than where whales breed and migrate. Frankly what 'training' is needed at this time on/in water....have you noted we are at war on a couple of huge hunks of SAND....sonar is not all that valuable as a training tool at this particular moment. Thank you for your attention to marine wildlife, I would sincerely like to have my grandchildren enjoy the few remaining whales we have in the future.
I appreciate your consideration.

1 Please refer to Introduction to Chapter 10, page 10-1.

10.2.2.2 Everitt

This former United States Marine has an personal opinion of anything started by the former U.S. Secretary of Defence should be double-checked for intent but have read enough that possibly ruining the verbal communication of whales as to where their only form of contact/bonding is by keeping an eye on one another should be studied further if not proven allready that mimicing? their form of verbal comunication causes them trouble (as in no doubt it is like the blind leading the blind when they end up beached...).
The personal problem of this former United States Marine with the former U.S. Defence Secretary after having referenced/went on an local fact finding mission was of an communique with his former title on it sent me online (2003/4?) was that it was with decieivng intent for my former USMC mos (3042) be reinstated and return to Washington to work transpirtation problems for an year,this had been contrary to my personally owned business agenda(environmentall affairs)...in this resolve an proposal/gift intended for the USPS was outscourced to an well established over-seas air-support/transit ONLY business only to (pun fun?) in its end result DHL landed on U.S. soil making itself an ground competitor to such delivery services as the USPS itself,Fed Ex and UPS as examples (examples?)

1 Please refer to Introduction to Chapter 10, page 10-1.

10.2.2.3 Moor

In the Table of Contents Page i - 2.3.1 should be shortened so that it is only contained on one line
Table of Contents - Page ii - 2.4 should include leader lines to the page number similar to 2.5
Table of Contents - Page v - 3.11.2.3 - species should be "Species"
Table of Contents - Page vii - 3.11.10.11 spacing is different than lines above and below
Table of Contents - Page x - 5.8.2.2 eliminate the space between "(" and 5-inch
Table of Contents - Page x - 5.8.2.13 eliminate the extra leader line prior to the page number
Table of Contents - Page xi - fix the spacing on 6.1 on the leader line prior the page number
Table of Contents - Page xii - Figure 2-7 there is only one dot for a leader line prior to the page number
Table of Contents - Page xiii - Figure 3.7-12 and Figure 3.9-6 there is an extra space within the leader line
Table of Contents - Check entire table for extra spaces in leader lines prior to page numbers
Table of Contents - Page xiv - Remove underline from Figure 3.14-1
Table of Contents - Page xviii - Table 4-3 there needs to be a space between a comma and 2006
Table of Contents - Acronyms and Abbreviations - It doesn't look centered on the page
Table of Contents - Page iv (Acronyms and Abbreviations) - "This page left intentionally blank"; should be in title case like the rest of the table of contents
Executive Summary - page ES-1 - lines 5 and 6 - "nm2"; the 2 should be superscript
Executive Summary - page ES-2 - line 4 - the end quote should be after the period in the sentence

1 Thank you for your comments. All the corrections have been made.

10.2.2.4 Sanfilippo

Please do not allow the unelected war criminal Bush regime push the tax-stealing, outlaw murderous Blackwater Blackguards into San Diego.

The Navy does NOT need their training, whatever training the Navy needs can be done BY THE NAVY for LESS.

This is actually a cover for a CONCENTRATION CAMP that is going to be built to sweep up any NAFTA refugee slave labor that tries to unionize.

Corporations have been murdering unionists abroad, and now they want to detain, and kill in our own country!

Please, please put Blackwater and all corporate war criminals in JAIL immediately. They have repeatedly broken the law, killed people, declared themselves above the law, etc.

They are a threat to our environment because we believe that they have set the Harris Fire which killed the friend of their only opponent on the Potrero Planning Board. That fire is suspicious, and it has never been investigated. Also, they pushed our Sheriff deputies aside to take over the security for the fire, in which they allowed refugee workers to be burned alive.

1 Please refer to Introduction to Chapter 10, page 10-1.

Please, please, throw these criminals out of our City now, before they start another fire, kill more people, or at the very least, demand 5 times the pay of a democratically-controlled NAVY personnel.

We would not need any special terrorist blowback training if we did not allow the Original Terrorist Perpetrators to go forward with their lying, stealing, cheating, plundering, killing corporate ways.

I don't know what kind of you're pulling on this comment form, but you KNOW I just typed by comments, and you cleared them and did not register them.

I am here to tell you that Blackwater is building a CONCENTRATION CAMP to sweep UNIONISTS in San Diego, and it STARTED THE HARRIS FIRE.

They are STEALING OUR TAXES, MURDERING PEOPLE and are OUTLAWS FOR THE Corporations PLUNDERING WORLD RESOURCES and LABOR. Thank you.

10.2.2.5 Simms

I am concerned that sonar testing by the Navy off the coast of California will result in such a large number of killed, injured, and behaviorally altered marine mammals. The California coast, being a region of cold water upwelling, is one of the most productive marine habitats along the contiguous United States' coastline. It is also home to many endangered organisms, including several marine mammal species. For this reason, it is not an appropriate area in which to conduct these tests.

In addition to the unwarranted ecological damage, loss of marine mammals would negatively impact the tourism industry in California. Many people come to the California coast to observe several species of whales, dolphins, sea otters, seals, sea lions, and elephant seals. They often spend quite a bit of money in their efforts to see these mammals, which contributes to the local economy of coastal communities. Damage to the mammals could reduce their populations and reduce tourism to these areas.

1 As described in the Draft EIS/OEIS, the Navy implements, to the maximum extent possible, protective measures during its training exercises. Furthermore, the Navy is a leader in funding marine mammal research to better understand them and to operate with the least possible impacts.

10.2.2.6 Mehlem

The endangering of marine life through military training needs to stop. I am not an animal activist, I respect the military and its members, and understand the need to train and find new and effective ways of performing duties but not at the cost of endangering animals when I am sure other less threatening methods can be used.

Listen, I don't even like the ocean and I don't care to ever swim with dolphins or go whale watching, but that doesn't mean I feel these animals have any less right to exist than you or I. Please find other means of training without bringing harm to the environment and the animals that inhabit it.

Thank you,

Bill, a guy who doesn't like the ocean.

1 Please see response to Comment # 5 (Simms)

10.2.2.7 Weyrauch

I am appalled to hear that through the U.S. Navy's training they are creating an environment in the marine life off coastal California that is killing and norturing various cetaceans, including whales and dolphins. Worse, the Navy plans to double their training, and therefore, creating more marine deaths and damage. This must be stopped!

1 Please see response to Comment # 5 (Simms)

10.2.2.8 Heiser

The Navy brags that during sonar training, three sailors are stationed as lookouts "24/7". This raises the question: how safe is night sonar training? How are the lookouts able to see the marine mammals at night (marine mammals are not equipped with illumination)? If the lookouts can't see the marine mammals, are the marine mammals being protected?

Night sonar training is not consistent with protecting marine mammals.

1 Visual monitoring is critical for ship safety, irrespective of mitigation. Navy lookouts and bridge personnel (5 in total on surface ships) are highly qualified and experienced marine observers. Compared to commercial vessels, Navy ships' bridges are positioned forward to allow more optimal scanning of the ocean area from the bridge and bow area. Navy lookouts use both hand held and “Big Eye” (20X110) binoculars. Aerial platforms also undertake visual monitoring prior to commencement of ASW operations. Passive acoustic systems are used by all platforms to monitor for marine mammal vocalizations, which are then reported to the appropriate watch station for dissemination. Navy ships also monitor their surroundings using all appropriate sensors at night and with night vision goggles as appropriate for activities conducted at night.

10.2.2.9 Maassen

Strong recovery efforts for the Loggerhead shrike should be maintained and enhanced if possible.

1 The Navy intends to continue its successful recovery and management efforts for the San Clemente loggerhead shrike as described on pages 3.11-31 through 3.11-37 of the Draft EIS/OEIS. The Navy is currently consulting with the U.S. Fish and Wildlife Service pursuant to Section 7 of the Endangered Species Act with regard to the San Clemente loggerhead shrike and other listed species on SCI. The Navy's current and planned future management activities with regard to the shrike are part of the consultation.

10.2.2.10 Cummings

I am writing to submit comments on the Navys Draft Environmental Impact Statement/ Overseas Environmental Impact Statement for the Southern California Range Complex (DEIS), Fed. Reg. 18522 (Apr. 4, 2008). *********

The DEIS you have prepared concerns me on three counts. *********

First and foremost, it appears that due consideration has not been given to assessing alternatives that leave some crucial habitats within the SOCAL range off-limits to sonar training. The failure to assess such alternatives is a major oversight, given the fact that such geographic (and/or temporal) exclusions could provide substantial protection to sensitive species. While the operational desires, or even needs, of the Navy certainly are to be considered, the role of an ENVIRONMENTAL impact statement is to assess the environmental consequences of a variety of alternatives; to preclude such analysis, based on what is or is not operationally "acceptable"; (Executive Summary, 2.2.2.3) is a clear dereliction of the Navy's duty to consider alternatives. *********

1 Please see response to CCC-7.

A closely related shortcoming (in that it undermines the Navy's apparent confidence that it will not cause significant impact on marine species as it operates throughout the range) is the reliance on visual observation from ships and aircraft as a primary mode of assuring that marine mammals are not too close to imminent sonar emissions, especially from dipping sonar, the use of which will be markedly increased. Passive acoustic monitoring does help, but also provides poor qualitative results (as measured by the proportion of animals present that are actually observed). In short, the DEIS does not adequately consider the relative likelihood of successfully observing different species of cetaceans when they are present. Some sort of "detectibility curves" should be utilized, which realistically estimate the likelihood of successfully identifying the presence of each key species, and providing more diligent methods of assuring whether individuals are present prior to sonar activation (these could involve more time spent on either visual or passive monitoring, or use of additional techniques (bottom-mounted or floating/suspended hydrophones, autonomous vehicles or gliders, etc) to provide more reliable acoustic monitoring. *********

The Navy's mitigation plan is more than just visual monitoring. Aerial monitoring and sonar power-down protocols are used as well. The Draft EIS/OEIS, Section 3.9.10.2.1 and Chapter 5.0, Mitigation Measures, presented the U.S. Navy's protective measures, outlining steps that would be implemented to protect marine mammals and Federally listed species during training events. Navy does not expect that 100% of the animals present in the vicinity of training events will be detected and the acoustic impact modeling quantification is not reduced as a result of mitigation effectiveness.

The Navy, in cooperation with NMFS, is developing a monitoring plan that would investigate the effects on marine mammals from Navy sonar activities. This plan will include pre- and post-exercise monitoring of marine mammal
2 distribution and abundance in the exercise area as well as the effectiveness of Navy mitigation measures. See Section 3.9.10.3.1 of the Final EIS/OEIS.

Further, the analysis in the Draft EIS/OEIS does not support the comment's assumption or contention that the Navy is causing harm to marine mammals.

Finally, the cumulative impacts analysis is woefully inadequate. Much of that section (Chapter 4) of the DEIS is taken up with descriptions of OTHER impacts on marine life, which, while useful as context, does not address the subject of THIS document, which is the cumulative impacts of Naval training activities. Even when the chapter turns its attention, briefly, to the impacts of naval operations, it notes that "most active military sonars operate in a limited number of areas, and are most likely not a significant contributor to a comprehensive global ocean noise budget." But the purpose of this document is to address cumulative impacts IN one of those "limited number of areas"! Within this limited area, it is very likely that local populations and individuals will be repeatedly impacted by ongoing naval training activities. The DEIS needs to take an analytical look at the likely scope of repeated exposures, and then, at the cumulative impacts on individuals to such repeated exposures. The global ocean noise budget is irrelevant to this inquiry. While assessment of repeated moderate behavioral disruption is difficult to say the least, some attempt should be made to quantify the cumulative impact of the proposed activity, perhaps following on early efforts by NMFS to assess the biological significance of repeated behavioral disruption. *********

3 The cumulative impacts analysis addresses the environmental impacts that result from the incremental impact of Navy activities when added to the past, present, or reasonably foreseeable future actions that affect the same resources. Figure 4-1 succinctly depicts the categories of past, present, and reasonably foreseeable future actions that affect cetacean populations. Identifying such activities and in fact comparing them for relative impacts is an appropriate approach to cumulative impacts analysis. The Draft EIS/OEIS does more than simply compare activities; it analyzes in detail the effects of Navy actions on specific resources, and places those in the context of other sources of impacts. This cumulative impact analysis occurs throughout the Draft EIS/OEIS, not just within Chapter 4. With regard to marine mammals, the cumulative impacts analysis accurately concludes that Navy activities, while they may affect marine mammal species, will not present significant impact when compared to adverse impacts from other sources.

The entire Draft EIS/OEIS provides the cumulative impacts analysis, not just Chapter 4. Chapter 3, in particular, provides the past and present impacts and environmental conditions that represent the baseline, and Chapter 3 also discusses the consequences or potential future impacts from Navy activities. Chapter 4, then, discusses the other reasonably foreseeable activities to the extent they are known and the incremental impact of the Navy's proposal when added to past, present, and future impacts.

The DEIS as a whole gives the unfortunate impression of having been crafted to provide a retroactive seal of approval to both historical activities, and to a pre-determined "preferred alternative," or to a narrow range of alternatives. While appreciating the challenges imposed by the timeline necessary to produce the document, the limits of current scientific certainty on key issues, and the need to proceed with training activities, the purpose of NEPA and of this document is to take a hard look at the environmental impacts of proposed activities, and to consider a range of alternatives. Failure to do so could fatally undermine the Navy's ability to train effectively by leaving its plans open to long-term legal challenges. *********

4 Please see comment MMC-1.

10.2.2.11 Herold

I am writing to oppose the The US Navy's desired level of sonar and explosives testing off the California Coast. My understanding is the navy estimates that its desired level of sonar use will:

Result in a Level B Take (defined in the EIS as disruption of normal behavior patterns to the point where they are abandoned or significantly altered) of 94,370 marine mammals each year off the California coast.

Significantly affecting the hearing of 18,838 marine mammals on a short-term basis, each year.

And, that sonar testing will maim or kill 30 marine mammals per year.

In addition, the navy estimates that its desired level of explosives testing will:

Result in a Level B Take of 817 marine mammals each year.

50% tympanic membrane rupture or slight lung injury to 36 marine mammals each year.

And, massive lung injury or death to 12 marine mammals each year.

These levels are unacceptable, and impact the California Grey Whale population greatly. They have just begun to recover from being over hunted, and already face enough challenges with lack of food and contaminated water. Please find another way to do your testing, not at the expense of our environment. Thank you.

1

The exposures modeled as Level B harassment for the SOCAL Range Complex may vary from the animal showing no response to the animal leaving an area. Mitigation measures such as shut down and power down zones would prevent animals from being exposed to sound levels that would elicit the greatest effect. The modeling predicted injury or mortalities without consideration of the mitigation measures that would be in place during underwater detonation activities.

Gray whales only showed a slight effect in migration when exposed to a low frequency continuous sound source Malme et al. 1983. Mid-frequency active sonar is likely above the hearing threshold of gray whales, is intermittent, and is transient. Therefore there should be no impact on the gray whale population.

As stated in the NMFS Proposed Rule for the SOCAL Range Complex, NMFS believes that the mitigation measures the Navy has proposed will enable the Navy to avoid injuring any marine mammals and will enable them to minimize the numbers of marine mammals exposed to levels associated with TTS.

10.2.2.12 Schenck

Comment	#	Response
When the Navy acquired use of San Clemente Island, part of the deal was that the fishermen would be guaranteed full access and fishing rights. Now, we the fishermen still require full access and fishing rights which also include anchorage areas. The NTSB and USCG have invested considerable time and resources into the problem of fatique (lack of sleep). A 1996 study has 33% of accidents and 16% of vessel casualties are due to fatique. In 2003 the USCG introduced CEMS where crew can regularly obtains 8 hours uninterrupted sleep. (Flumerrfelt, Leah. Marine Casualties, pg 36. Professional Mariner, Issue #112, April 2008) San Clemente Island has five anchorage areas; Pyramid Cove-a bombing range; Wilson's Cove- no access; Northwest Harbor- open anchorage; West Cove- no access due to misplaced seafloor cables; Seal Cove- too small- accommodates only a couple of boats.	1	Per executive order, signed by Franklin D. Rossevelt on November 7, 1934, the control and jurisdiction of SCI was transferred from the Department of Commerce to the Department of the Navy for "naval purposes". There is no mention of a guarantee of full access and fishing rights in the executive order.
I have fished SCI continuously for thirty-five years and it supplies a significant portion of my family's income. Your EIS does not give plausible lip service to the impacts on the fishing community. You have tried to subvert the EIS/EIR system. You should be ashamed.	2	The Draft EIS/OEIS described potential economic impacts to fishing in Section 3.14.2. In this section, the analysis concluded that impacts would not be significant due to advanced public notification and primarily short-term duration of military activities. No new closure or restricted areas are proposed.
You have made a very unsatisfactory attempt to contact the stakeholders. Your time frame for comments in a farce- 15 DAYS- normal comment periods are usually 30, 60 or 90 days	3	Please refer to Introduction to Chapter 10, page 10-1 and 10-2. The Draft EIS/OEIS was available for a 45-day public review comment period following publication of a Notice of Availability of a Draft EIS/OEIS in the Federal Register on April 4, 2008.
Your attempt to turn Northwest Harbor and Seal Cove into ranges are unacceptable to the fishing community in their present form. In the late 1980s, we fishermen were involved with the Department of the Interior, MMS, and the oil companies. They formatted a "loss of opportunity agreement" which we used. This allowed a win/ win situation. They were able to pursue oil and we were made whole.	4	The Navy has been using Northwest Harbor as range for approximately 30 years. The proposed number of live fire operations in this area is approximately 30 per year, split between day and night. Not all operations will require the evacuation of Seal Cove.

10.2.2.13 Green

The vast area encompassed by the SOCAL Range Complex contains some of the richest marine habitat in the world therefore; the Navys exercises must be undertaken with care. We believe it is possible to protect the marine environment while safeguarding our national defense and that this can be achieved while complying with our federal environmental laws. Congress has dictated through NEPA that, in planning exercises, the Navy must employ rigorous standards of environmental review, including a fair and objective description of potential impacts of the range, a comprehensive analysis of all reasonable alternatives, and a thorough delineation of measures to mitigate harm.

This DEIS, however is fatally flawed by its inconsistency with the weight of scientific evidence and with the standards of environmental review embodied in NEPA. Specific comments are provided below:

Please refer to Introduction to Chapter 10, page 10-1. Responses to specific comments are addressed below.

1. Sound is a fundamental element of the marine environment. Whales, fish, and other wildlife depend on it for breeding, feeding, navigating, and avoiding predators in short, for their survival. Many of the exercises proposed for the southern California range would employ the same hull-mounted sonar systems that have been implicated in mass injuries and mortalities of whales around the globe. The same technology is also known to affect marine mammals in countless other ways, such as by inducing panic responses, displacing animals from habitat, and disrupting crucial behavior such as foraging.

Impacts on California's coastal environment would be significant. The Navy's preferred alternative would more than double the amount of sonar use from surface ships, more than double the number of active sonobuoys deployed on the range, and would increase the use of aerial dipping sonar by a factor of ten over what was annually estimated for SOCAL major exercises in the Navys prior environmental assessment. That lower level of sonar use has already been determined by a federal court to cause widespread harm and disrupt marine mammals off California at a population level. NRDC v. Winter, 2007 WL 2481037 at *10 (C.D. Cal. 2007), affd 518 F.3d 658, 696-97 (9th Cir. 2008).

1

Despite the court's assertion, there is no evidence that mid-frequency active sonar has harmed marine mammals in SOCAL.

The Final EIS/OEIS has been revised to clarify the contribution of sonar to masking: "Natural and artificial sounds can disrupt behavior by masking, or interfering with an animal's ability to hear other sounds that may be important in navigation, foraging, avoiding predators, or for social behaviors."

However, for the reasons outlined in Section 3.9.9.2.2 of the Final EIS/OEIS, the chance of sonar operations causing masking effects is considered negligible.

Other potential behavioral responses described in the comment are addressed in the Draft EIS/OEIS, Section 3.9.9, and in Section 4.6.1 of Appendix F.

2. The Navy assumes that no marine mammals would be seriously injured or killed at sea, despite a growing, peer-reviewed, scientific record of injuries and mortalities and several court decisions that have rejected the Navy's claims. It takes this position even though the California coast has been identified by experts as one of the worlds key areas for beaked whales, a family of species whose dangerous sensitivity to mid-frequency sonar is well known.

2

Despite the court's assertion, there is no evidence that mid-frequency active sonar has harmed marine mammals in SOCAL.

The oceanographic conditions that may have lead to beaked whale strandings during sonar activities in other areas are not present in SOCAL.

Although, as mentioned in the comment, the southern California off-shore area is rich in marine species, it must be acknowledged that mid-frequency active sonar activities have been conducted without incident for decades in SOCAL. In fact, many populations of non-ESA and ESA species alike have been increasing in SOCAL over the last several decades. Given the natural variation of marine mammal location over time within SOCAL, operational variability of Navy ASW operations, and the fact that there is little scientific information demonstrating broad-scale impacts that are either injurious or of significant biological impact to marine mammals, there is little relative risk to marine mammal populations from ASW training exercises.

3. It has manipulated data and thrown out nearly the entire literature on behavioral impacts on marine mammals, in support of an abstract model that contradicts the actual evidence of harm.

3

Most behavioral data on sound effects on the behavior of marine mammals involves either low or high frequency, and continuous sound sources. These are not appropriate to model mid-frequency active sonar effects.

The EIS/OEIS sonar acoustic analysis uses a risk function methodology provided by NMFS for the Navy. NMFS is the agency with the expertise and regulatory jurisdiction for marine mammals. Both types of available data, controlled and observed were considered. Data from the Haro Strait incident, the only data set available of the behavioral responses of wild, non-captive animal upon exposure to the AN/SQS-53 mid-frequency active sonar, are incorporated into this risk function. The Navy has used the best available scientific data in this analysis.

4. It presumes, entirely without analysis, that all of its impacts are short-term in nature and that none will have cumulative effects, even though the same populations and much of the same habitat would repeatedly be affected, year after year.

4

It must be acknowledged that mid-frequency active sonar activities have been conducted without incident for decades in SOCAL. In fact, many populations of non-ESA and ESA species alike have been increasing in SOCAL over the last several decades. Given the natural variation of marine mammal location over time within SOCAL, operational variability of Navy sonar operations, and the fact that there is little scientific information demonstrating broad-scale impacts that are either injurious or of significant biological impact to marine mammals, there is little relative risk to marine mammal populations from ASW training exercises.

5. To think that marine mammals, even cryptic, deep-diving marine mammals like beaked whales can effectively be spotted from fast-moving ships and avoided is not realistic.	5	Visual monitoring is critical for ship safety, irrespective of mitigation. Navy lookouts and bridge personnel (5 in total on surface ships) are highly qualified and experienced marine observers. Compared to commercial vessels, Navy ships' bridges are positioned forward to allow more optimal scanning of the ocean area from the bridge and bow area. Navy lookouts undergo extensive training to include on-the job instruction under supervision of an experienced lookout followed by completion of Personnel Qualification Standard Program. Navy lookouts use both hand held and “Big Eye” (20X110) binoculars. Aerial platforms also undertake visual monitoring prior to commencement of ASW operations. Passive acoustic systems are used by all platforms to monitor for marine mammal vocalizations, which are then reported to the appropriate watch station for dissemination. Navy ships also monitor their surroundings using all appropriate sensors at night and with night vision goggles as appropriate for activities conducted at night.
6. It adopts the same mitigation that a federal court has found to be woefully inadequate and ineffectual (NRDC v. Winter, 2007 WL 2481037 at *8-9 (C.D. Cal. 2007), affd 508 F.3d 885 (9th Cir. 2007)), and fails to prescribe measures that have been used repeatedly by the Navy in the past, used by other navies, or required by the courts.	6	Please see response to NRDC-3.
7. It summarily declines to put even a single square mile of habitat within its 120,000 nm^2 range off limits to sonar training and, indeed, has refused even to evaluate possible geographic alternatives. It takes this position in spite of several contrary court decisions, the determinations of the California Coastal Commission, past Navy practice, and agreement within the scientific community that the avoidance of vulnerable habitat represents one of the most effective means of reducing impacts from mid-frequency sonar.	7	Please see response to CCC-7.

8. It commits itself, without any analysis of alternatives, to build an instrumented range on Cortes and Tanner Banks: an extremely productive offshore area that hosts a globally important population of endangered blue whales, has the highest recorded densities of endangered fin whales and other species in the region, and supports some of the highest catch rates of commercial fisheries in southern California.

8 Please see response to CCC-5

9. It insists that its proposed activities are consistent to the maximum extent practicable with the California Coastal Act and coastal zone management plan (DEIS at 6-5) notwithstanding previous findings to the contrary by the California Coastal Commission and an adverse ruling before a federal court on precisely this issue. NRDC v. Winter, 2007 WL 2481037 at *8-9 (C.D. Cal. 2007), affd 508 F.3d 885 (9th Cir. 2007).

9 Please see response to CCC-2.

The analysis conducted as part of this EIS/OEIS and Federal Consistency process have concluded that the activities are consistent to the "maximum extent practicable" with the CCMP.

10. We urge the Navy to be consistent with federal law and to produce a mitigation plan that truly maximizes environmental protection given the Navy's actual operational needs. We also ask the Navy to make available to the public the data and modeling on which its analysis is based.

10 Please see response to NRDC-3.

10.2.2.14 Moses

Moses (Augustin)
AJ02-WA 1601
Lind Ave. Renton, WA 98057

Comment	#	Response
1. Page 3.4-61 in Vol. 1, Last Para states, Under Alternative 2, about 27,400 air operations would occur compared with about 25,120 under the No Action Alternative, a 9 percent increase. Whereas, in Page 3.13-7, Item 3.13.3.1, Para 2 states, The Proposed Action and alternatives do not include proposed airspace modifications and would not change the existing relationship of the Navy's SUA with federal airways, uncharted visual flight routes, and airport related air traffic operations. Are noise impacts being analyzed for this increased traffic?	1	Noise impacts were addressed in Section 3.5 of the Draft EIS/OEIS is addressed in the FEIS/OEIS.
2. The percent of increase seems to be different in each section. In Section 3.5.2.4 Alternative 2, which states, Due to the logarithmic nature of noise, increases in the number of flight operations at NALF SCI(about 14 percent) would not substantially alter existing noise contours., where as above it states as 9%.	2	As explained in CH 2 Table 2-9, air operations at NALF would increase from about 27,000 to 33,000 annual operations (25% increase). Actual number of airfield operations analyzed in Section 3.4 has been corrected.
3. The percent of increase seems to be different in Section 3.5.2.3, Alternative 1, which states Due to the logarithmic nature of noise, increases in the number of flight operations at NALF SCI (about 6 percent) would not substantially alter existing noise contours.	3	Alt 1 (as described in Table 2-9 and 3.5.2.3) proposes a 6% increase in NALF flight operations, Alt 2 proposes a 25% increase over the No Action Alternative.
4. What is the type of traffic?	4	NALF air operations increases would occur primarily in support of Navy carrier aircraft and USMC training.
5. Do the above statements conform to your statement that no airspace modification are required? Please clarify.	5	Airspace modifications will not be required under the Proposed Action. Air operations conducted in conjunction with naval operations will be conducted in areas consistent with ongoing operations.
6. Will this proposed action affect aircraft flights between the hours of 10:00 p.m and 7: 00 a.m. local time?	6	Yes. However, there are no airspace timing restrictions at NALF, so this is not a change to current airspace scheduling. In addition, many air operations have been moved out to NALF, so as to minimize noise impacts on the public living on the mainland.
7. Is the airport sponsor aware of this project?	7	There is not an "airport sponsor," however military range schedulers are aware of the project.

8. Briefly explain the alternatives to the proposed action.

8 The alternatives are described in Chapter 2 of the Draft EIS/OEIS.

9. In accordance with the current version of FAA Order 1050.1, Policies & Procedures for Considering Environmental Impacts, please address all the impact areas in the EIS that will be subject to the FAA review.

Per FAA Order 1050.1E, 404c The EA/EIS should present detailed analysis, commensurate with the level of impact of the proposed action and alternatives, to determine whether any impacts will be significant. If the proposed action and its alternatives will not cause impacts within specific categories of environmental impacts within specific categories of environmental impacts, a brief statement describing factual basis for the conclusion that the action is not likely to cause environmental impacts within these impact categories is sufficient. If FAA has experience with an environmental management system (EMS) that includes monitoring of the implementation of actions similar to the proposed action & alternatives, the EMS may provide a factual basis for an assessment of the potential environmental impacts. The EA/EIS may also be tiered to cover broad & programmatic actions, such as rulemaking, policy decisions, & regional or national programs.

9 The suggestion provided is appreciated and will be forwarded to the appropriate party. The Navy will coordinate with FAA on any future changes or improvements to the airspace management of offshore military training area ranges, such that any changes would benefit military and civilian users.

10. FAA fully supports the need of the NAVY to accomplish its mission. We also must balance the needs of all of our customers. The Range complexes have historically operated mainly far offshore. In addition the Camp Pendleton Range occupies a limited area & has limited time frames. The study map indicates the possibility of an expansion of the ranges in the areas of SXC - OCN - MZB. We request that the FAA be included early in development of any requests to modify the current ranges. In addition, we request that an expansion of controlled airspace be considered. In particular portions of W-291, W-290, and W-289 need to be made controlled airspace to facilitate hand-offs of commercial air carriers & military aircraft to/from FACSFAC, as well as transitions of the airspace when not in use. Resizing of the ranges should also be considered to improve safety & efficiency in the SOCAL airspace. In particular the W-291 boundary in the vicinity of 33 10 00N/118 00 00W needs to be moved further to the west to improve both the SAN - SXC and SXC - SARGS routes. In short, any changes will have a significant impact on Southern California TRACON &the users of this airspace. We believe that the right changes can result in a benefit for all. We look forward to being involved as these plans progress.

10 As previously noted, the Proposed Action is not depicting a revision to airspace designations. However, these are some very good points concerning airspace over portions of W-291, W-290 and W-289. If future airspace management revisions are considered, the Navy will coordinate closely with the FAA.

10.2.2.15 Bertelli

1. The U.S.Navy is by any historical standard the finest Naval Force the world has ever known. However, when the Navy, or any other military organization uses the same areas as the public, there are bound to be problems. Problems that this E.I.S. does not properly address.

1) The possible 'site' establishing of Marine Protected areas in the waters around San Clemente Island could pose enormous economic impact.

1 The Navy's proposal does not include the establishment of an MPA in the waters around San Clemente Island.

2) Proposed changes in the Code of Federal Regulations, (CFR's) with regard to North West Harbor becoming a restricted access area. This brings up huge marine safety issues, and the potential for significant economic impact. Of the five (5) anchorages at San Clemente Island, only the small and marginal anchorage at Seal Cove would remain open at this time. The San Clemente Island Security often gives false and misleading information to mariners regarding access to North West Harbor and the waters around the Island. Furthermore, written statements such as "The Navy is committed to continued access to the maximum extent possible, to the fishing and recreational ocean areas around the Island" are ambiguous, and therefore subject to the whims of whomever is in charge at any given time or place. Therefore, a written protocol needs to be developed by the Navy, the Coastguard, Interested State agencies and effected recreational and commercial groups. This would be of great help to those in charge of various operations and the User groups in maintaining a continuity over time. This should be part of the final E.I.S./O.E.I.S.

2 The Navy has not submitted a proposal to change the CFR's with regard to Northwest Harbor. This is still in discussion. The Navy did submit a request (which was approved by the Coast Guard) to establish a temporary safety zone (TSZ) in Northwest Harbor on 20 May 2008, from 0545 – 1100. The Navy will be submitting additional requests for TSZ's. The Navy is looking into the establishment of a "range control" for all the ranges on and around SCI. This could provide a means for mariners to contact the Navy real time to facilitate access issues.

3) The E.I.S. briefly mentions the reactivation of a live fire range at Eel Pt. Which begs the question of what effect it might have on the anchorage at Seal Cove? Another Public Safety issue, and more potential for significant economic impact!

3 The proposed number of live fire operations in this area is approximately 30 per year, split between day and night. Not all operations will require the evacuation of Seal Cove.

4) Any increased use and range expansion will have some degree of economic impact on Commercial fishermen. It is incongruous to state little or no economic impact on fisheries.

4 The Draft EIS/OEIS describes potential economic impacts to fishing in Section 3.14.2. In this section, the analysis concludes that impacts would not be significant due to advanced public notification and primarily short-term duration of military activities. No new closure or restricted areas are proposed.

5. The Navy, the Public, other interested Government Agencies and the User Groups would have been better served if the E.I.S.team would have brought us into this process early on via a series of workshops. Instead of three public hearings, spaced very closely together, with an extremely short response window. The period of time from the Navy Open House in Long Beach has been insufficient for adequate review and response. Added to that there were Scoping Sessions that were not adequately published through the Commercial User Groups.

5 The Navy advertised in newspapers and sent notices to members of the public during the Scoping Period and Public Review Period of the Draft EIS/OEIS. Public Scoping was from December 21, 2006 to February 8, 2007 and three Public Scoping Meetings were held. Public Review of the Draft EIS/OEIS was from April 4, 2008 to May 19, 2008, and three Public Hearings were held.

10.2.2.16 Schuster

Los Angeles Center does not have sufficient time to review this document in its entirety. Our primary concern is to maintain access of the airspace to nonparticipating aircraft at or above the current levels. Of particular concern is that an increase in the amount of military aircraft transitioning between land based airports/Special Use Airspace and the SOCAL range complex will result in traffic levels above the National Airspace System's ability to efficiently manage its capacity without having to implement traffic management initiatives. Traffic management initiatives manage system capacity by controlling the number of aircraft for which an individual ATC sector is responsible. Common results of Traffic Management Initiatives are an increase in departure and arrival delays and an increase in flight time and its associated fuel costs.

1 The Navy would not require addition Special Use Airspace and there would be no additional impacts on the use of the National Airspace System as managed by the FAA with implementation of the Proposed Action.

10.2.2.17 Nakagawa

The City of Imperial Beach has no comments at this time other than to ask if any increased training would translate into additional military personnel needing housing in Imperial Beach?

1 The Proposed Action of this Draft EIS/OEIS does not involve increases in personnel stationed at Naval Air Station North Island nor does it include housing at Imperial Beach.

10.2.2.18 Peregrin

1. Thank you for the opportunity to comment on the SOCAL Range Complex Draft EIS/OEIS April 2008.

The preferred alternative would result in actions associated with increased training and range enhancements within the SOCAL Range Complex. These actions include:
- Increase numbers of training operations of the types currently being conducted in the SOCAL Range Complex.
- Expand the size and scope of amphibious landing training exercises in the SOCAL Ocean Operating Areas (OPAREAS) and at San Clemente Island (SCI) to include a battalion sized landing of 1,500+ Marines with weapons and equipment (to be conducted up to two times per year).
- Expand the size and scope of Naval Special Warfare (NSW) training activities in Training Areas and Ranges (TARs), Special Warfare Training Areas (SWATs), and nearshore waters of SCI.
- Install a shallow water training range (SWTR), a proposed extension into shallow water of the existing instrumented deepwater anti-submarine warfare (ASW) range (known as SOAR).
- Conduct operations on the SWTR.
- Increase Commercial Air Services support for Fleet Opposition Forces (OPFOR) and Electronic Warfare (EW) Threat Training.
- Construct a Shallow Water Mine Field (at depths of 40 to 420 feet (ft) (76-128 meters [m])) in offshore and near-shore areas in the vicinity of SCI.
- Conduct operations on the Shallow Water Minefield.
- Conduct Mine Neutralization Exercises.
- Support training for new systems and platforms, specifically, Littoral Combat Ship (LCS), MV-22 Osprey aircraft, the EA-18G Growler aircraft, the SH-60R/S Seahawk Multi-mission Helicopter, the P-8 Poseidon Multi-mission Maritime Aircraft, the Landing Platform-Dock [LPD] 17 amphibious assault ship, the DDG 1000 [Zumwalt Class] destroyer, and an additional aircraft carrier, USS CARL VINSON, proposed for homeporting in San Diego.

The Mission of CA Department of Parks and Recreation is:
- To provide for the health, inspiration and education of the people of California by helping to preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high-quality outdoor recreation.

CA State Parks manages significant stretches of coastal habitat within or adjacent to the SOCAL Range Complex EIS/OEIS Study Area. Many of the natural resources, and visitor experiences, found in the coastal habitats within State Park-managed areas depend heavily upon coastal habitats and resources within and adjacent to State Park boundaries.

2. Some of the activities proposed in the preferred alternative have the potential to disrupt these habitats and negatively affect the states extraordinary natural resources including State and Federally listed Threatened and Endangered species. Some of the activities also have the potential to detract from the recreational value and aesthetic resources of Southern California's coastal State Parks. CA State Parks is concerned with the following potential impacts:

- Disruption of avian nesting habitat from beach landing and training activities, over-flights and other noise disturbances;
- Harm to sensitive marine life, including marine mammals, fish populations and marine invertebrates, due to under-water noise generation, explosive material, and electronic activity;
- Contamination of aquatic and near-shore environment from residue or by-products of explosives testing, accidental release of toxic substances, or other operational activities;
- Loss of historic recreational areas, including surf breaks and scenic beach stretches;
- Noise contamination due to increased over-flights and explosives testing;
- View-shed disruption due to increased over-flights and ocean-surface vessels;
- Decreased access to coastal State Parks throughout and adjacent to the SOCAL Range Complex.

Thank you for the opportunity to comment on this Draft EIS/OEIS. We look forward to working with you on developing appropriate avoidance and mitigation measures for the potential impacts listed above.

1 The effects on birds and avian nesting habitat resulting from noise and disturbance associated with training activities, including foot traffic, vehicle activity, amphibious landings, ordnance use, overflight by helicopters and overflights by fixed wing aircraft are addressed in the Draft EIS/OEIS, Section 3.5, Section 3.11.7.4 and throughout the remainder of the biological analysis.

10.2.3 Oral Comments

The following comments were taken orally during the public hearing held in Long Beach, California. Although the opportunity to provide oral and written comments was made available to the public at each public forum, oral comments were only offered at the Long Beach hearing. The comments were reproduced here directly from the official transcript.

1

10.2.3.1 Pozniakoff

I understand the need to have protection and defenses in place. But we are not at war with a major super power. We're not at war with Russia, China or North Korea or anybody else with a large nuclear sub capability.

We need to control what the Navy does until we understand what the effect on the dolphins and the whales is going to be for their hearing. That's the most sensitive part of their being, is their hearing, their sonar capabilities.

If there's a major breakout of war, hostilities between Russia or North Korea or China, then they can come back and reapply for this testing capability. But until that time is happening – right now, we're in a war on terror, which is low on the radar. It's -- it's anti-IEDs and anti-theologic ideals.

And until we know what the Navy can do with this sonar, then we should not allow the Navy to go ahead with any of this testing anywhere they want to. Let them research what the damage is to dolphins and whales. Let them determine where the places are where the dolphins and the whales do not migrate, where there won't be any damage, and let them do their testing there.

If I was a whale or a dolphin, I would say I'm under attack by not only the Japanese and the Norweigians and the Spaniards, but now also the U.S. Navy, with their high-tech capabilities.

Right now, the Navy has taken an arrogant approach towards the need for high-power sonar to be tested wherever whenever they need or they think they need and without researching the net effect on our heritage, our heritage being whales and dolphins for our children and our children's children.

So my anger against this whole move for the Navy to test high-power sonar is that they are – they are going ahead with a mythological enemy of some sort of the future that doesn't exist today, and we may destroy species of dolphins and whales that our children and our children's children may never see in the future, and I'm against that.

1 The global proliferation of extremely quiet submarines poses a critical threat to the maritime interests of our military alliances and allies. The military use of sonar, and the ability to test and train with it, is critical to U.S. operational readiness and our national defense. Indeed, the national security interests of many nations require that naval forces be able to train with, test, and employ active sonar.

Military training now is critical to ensure preparedness should our forces be called into action. We cannot in good conscience send American men and women into potential trouble spots without adequate training to defend themselves.

10.2.3.2 Heiser

Their [marine mammals] hearing should be valued according to the value of their life, because they rely upon their hearing for 90 percent of their information. So neurological examinations of humans say we're about 90 percent visual in terms of our neuron-anatomy. Whereas dolphins and other marine mammals are about 90 percent auditory.

I was reading in the Environmental Impact Draft Report that we're going -- you're planning to lower the volume to 229 decibels. That sounds thousands of times louder than a jet engine. And so I'm very disturbed to hear a number like that.

The Final EIS/OEIS analyzes potential behavioral impacts described in this comment. For example, “Natural and artificial sounds can disrupt behavior by masking, or interfering with an animal’s ability to hear other sounds that may be important in navigation, foraging, avoiding predators, or for social behaviors.”

However, for the reasons outlined in Section 3.9.9.2.2, the chance of sonar operations causing masking effects is considered negligible.

1 It is inaccurate to compare the noise level of sonar in water to the noise level of jet engines or other loud noises through the air without properly accounting for certain differences, primarily that sound intensity given in dB in water is not directly comparable to sound intensity given in dB in air. To be able to compare relative intensities given in dB to one another, a standard reference intensity or reference pressure must always be used. It is therefore essential that sound levels expressed in decibels include the reference pressure. Scientists have agreed to use 1 microPascal (μPa) as the reference pressure for underwater sound. In air, however, scientists have agreed to use a higher reference pressure of 20 microPascals.

10.2.3.3 Paluska

"Dear Navy, please, please, please, with sugar on top, don't take away any more of our whales. They're trying hard not to go extinct right now."

"That sonar training stuff is killing them, and our Long Beach Aquarium isn't big enough to hold them all and protect them. Besides, whales are supposed to be free in the ocean. What will you give us if you hurt them all to death? We want our children to be able to see whales. We want to see them, too."

"Thank you for stopping that sonar stuff."

Sincerely, Students of Room 31 and 32 at International Elementary School

1 Please refer to Introduction to Chapter 10, page 10-1.

10.2.3.4 Hemphill

1. I believe the argument in the present case should not be whether whales and other marine life are more intrinsically valuable and necessary to us than the ability to wage war on the seas, but whether it is in our self-interest to further degrade an ecosystem vital to our own survival that has already been significantly stressed by the changes brought in the last century and a half of industrialization. Will we allow National Security to trump planetary security?

1 The Navy's proposal does not value National Security over marine life but, rather, attempts to accommodate the necessary training while minimizing impacts to marine life using the best available data, as discussed and analyzed in the Draft EIS/OEIS.

2. Remembering that sound functions in the sea for many marine life forms, not just cetaceans, as a gateway of perception, analogous to the way sight functions on land, and knowing that the sea has become increasingly polluted by noise from many quarters, can we really predict the consequences for us of the screw that will turn from the possible loss of an unknown number of species going through huge and frequent detonations of disorienting sound?

2 The Final EIS/OEIS analyzes potential behavioral impacts described in this comment. For example, "Natural and artificial sounds can disrupt behavior by masking, or interfering with an animal's ability to hear other sounds that may be important in navigation, foraging, avoiding predators, or for social behaviors."

However, for the reasons outlined in Section 3.9.9.2.2, the chance of sonar operations causing masking effects is considered negligible.

Finally, it must be acknowledged that ASW activities have been conducted without incident for decades in SOCAL. In fact, many populations of non-ESA and ESA species alike have been increasing in SOCAL over the last several decades. Given the natural variation of marine mammal location over time within SOCAL, operational variability of Navy ASW operations, and the fact that there is little scientific information demonstrating broad-scale impacts that are either injurious or of significant biological impact to marine mammals, there is little relative risk to marine mammal populations from ASW training exercises.

3. The Marine Mammal Protection Act, which Congress passed in 1972, takes a cautionary approach as regards to sea mammals by requiring that activities with the potential of injuring them or disrupting their behavior be regulated. We can deduce from the beaching of whales, correlated to Navy sonar blasts, that those sonar assaults have already precipitated deadly reactions in these animals, be they physiological or perceptional.

3 Potential impacts of U.S. Navy activities on marine mammals is closely regulated under the Endangered Species Act and marine Mammal Protection Act. The Navy has initiated consultation under the ESA and applied for a Letter of Authorization under the MMPA for such activities.

The U.S. Navy has conducted ASW activities without incident for decades in SOCAL. In fact, many populations of non-ESA and ESA species alike have been increasing in SOCAL over the last several decades. Given the natural variation of marine mammal location over time within SOCAL, operational variability of Navy ASW operations, and the fact that there is little scientific information demonstrating broad-scale impacts that are either injurious or of significant biological impact to marine mammals, there is little relative risk to marine mammal populations from ASW training exercises.

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4. We need to remember that, without the oceans, earth would be just another lifeless planet. The living oceans govern climate, continuously redistributing and recycling water from sea to air to earth and back again. Life began in the oceans, and the oceans still support all life on this planet.

Indeed, they still provide habitats for untold numbers of our planet's life forms, doubtless including many species that achieved evolutionary accommodation with their environment millions of years ago, but remain to be discovered by we humans.

Given the critical importance of the world's oceans and their amazing role in the development and sustenance of all life on the planet, it is curious indeed the extent to which we humans remain ignorant, not only of the full range of life contained within the sea, but also the details of its critically important interrelationship and exchanges with the earth's core, mantel and atmosphere.

4 Please refer to Introduction to Chapter 10, page 10-1.

10.2.3.5 Menjivar

This proposal of sonar testing has not been fully thought out. And if it has, it is carelessly neglecting the repercussions that it will have on aquatic wildlife. To pursue this any further without first addressing the concerns of the public will only bring about opposition and discontent with the Navy.

Your ultimate goal should be to advance; however, it should not be at the expense of such majestic creatures as whales, whose migrations will be affected by this. Until a resolution in which no harm to either our habitat nor ecosystem can be achieved, I urge you to halt these tests.

The Navy has taken a hard look at all possible impacts to marine life from Navy sonar and other training activities.

The Navy has conducted public scoping and public hearings to encourage public participation and input to the Draft EIS/OEIS. All comments were considered in the preparation of the document.

1 The U.S. Navy has conducted ASW activities without incident for decades in SOCAL. In fact, many populations of non-ESA and ESA species alike have been increasing in SOCAL over the last several decades. Given the natural variation of marine mammal location over time within SOCAL, operational variability of Navy ASW operations, and the fact that there is little scientific information demonstrating broad-scale impacts that are either injurious or of significant biological impact to marine mammals, there is little relative risk to marine mammal populations from ASW training exercises.

10.2.3.6 Smith

Comment	No.	Response
1. I regret that the Navy has prepared a deeply flawed Environmental Impact Statement that demonstrates a refusal to comply with the law, a rejection of common sense and abstains from the federal judiciary.	1	Please refer to the introductory paragraph of this Public Comments section.
2. That mid-frequency sonar causes serious injury and death to whales is beyond reasonable scientific dispute. It has been associated with mass strandings in Hawaii, Alaska, the Bahamas, Greece, Japan and numerous other sites. The Navy's own studies conclude that marine mammals are harmed by such sonar.	2	These issues were discussed in the Draft EIS/OEIS on pages 3.9-62 and 3.9-77. Cox et al., 2006 have reviewed the possible mechanisms involved in strandings. Rommel et al., 2007 concluded “It is important to note that no current hypothesis of pathogenic mechanisms resulting in acoustically-related strandings is proven.” Also, it must be acknowledged that ASW activities have been conducted without incident for decades in SOCAL. In fact, many populations of non-ESA and ESA species alike have been increasing in SOCAL over the last several decades. Given the natural variation of marine mammal location over time within SOCAL, operational variability of Navy ASW operations, and the fact that there is little scientific information demonstrating broad-scale impacts that are either injurious or of significant biological impact to marine mammals, there is little relative risk to marine mammal populations from ASW training exercises.
3. In its previous study for SOCAL, it estimated a take of approximately 80,000 marine mammals per year for just half of the exercises contemplated here. Yet we're today discussing a document that turns away from the weight of this scientific evidence, from the standards of environmental review embodied in the National Environmental Policy Act.	3	Reflecting the quickly evolving science in the study of sonar effects on marine mammals, this Draft EIS/OEIS uses a different methodology than was used in previous studies. This methodology, developed jointly by the Navy and the National Marine Fisheries Service, appears to more accurately depict the probability of a response to mid-frequency active sonar. See section 3.9.7.5 for a more complete discussion.
4. The draft EIS covers the Navy's plan to use sonar anywhere in its 120,000-square-mile -- nautical-mile operating area off the coast of Southern California. This is an area roughly the size of New Mexico, the nation's fifth largest state. And the question is: From how much of this area, which is the size of New Mexico, has the Navy excluded the use of sonar to protect marine mammals. The answer, not one square mile. The Navy asserts that it adequately protects marine mammals with its mitigation measures. But federal courts reviewing those same measures have held that the Navy can & must do more to protect whales when it trains off Southern California, &, in one instance, found that these measures are, and I quote, "woefully inadequate & ineffectual."	4	Please see response to CCC-7. Please see response to NRDC-3.

1

5. The draft document is flawed in numerous other ways. For example, it assumes that no marine mammals will be seriously injured or killed despite a growing peer-reviewed scientific record of injuries and mortalities. It presumes entirely without analysis that all of these impacts are short-term in nature and that none will have cumulative effects, even though the same population will be repeatedly affected.

So we urge the Navy to withdraw its DEIS and revise the document. In doing so, we urge the Navy to include a fair and objective description of the Range's potential impact, a comprehensive analysis of all reasonable alternatives and a thorough delineation of measures to mitigate harm.

5 The EIS/OEIS provides a rigorous and thorough analysis of potential impacts using the best available scientific data. Marine mammal impact analysis used the methodology provided by the NMFS, the agency with the expertise and jurisdiction for marine mammals.

10.2.3.7 Seech

When I first heard it, I could not believe what I was hearing, and I'm still hearing the same things, that they're going to go ahead and put in this sonar -- mid-level, mid-frequency sonar technology without even really knowing for sure, by admission of your own biologist outside the door, exactly what the effects will be.

And by what you had just said when I walked in here, I was listening to you say there are species found in no other areas, and yet we're still going to go ahead and do this. It just amazes me. It upsets me that you had just received from the courts --you're -- you're rebuffed on this.

And now we come back on something that even doubles the use, as far as I understand it. I've gotten -- I haven't read your thick book yet, but from what I understand, it will actually increase the amount of testing that goes on, not taking into concern or not adequate concern of the safeguards you were already told to put into place. This kind of goes, like, outside the law, it seems almost to me. Whenever you operate outside of what the courts say, that makes you kind of like an outlaw, you know. And I hate to think of the military that way, but, you know, I'm just kind of -- I'm not sure that that is not the case.

But I really don't think that we are being served well here by this type of process whenever the -- the original -- when the original proposal was turned down by the judiciary and come back with something with even more testing is beyond me.

I mean, looking out over that ocean knowing that those whales are being blasted...too sad.

1 Please refer to Introduction to Chapter 10, page 10-1.

10.2.3.8 Ross

That is, it doesn't seem to me that anything that's said at this podium will influence your positions.

1 Please refer to Introduction to Chapter 10, page 10-1.

10.2.3.9 Speelman

I believe it's a responsibility of the Navy to help protect the oceans in which it trains and operates. It is also a responsibility of the Navy to provide safeguards and protection to whales and other marine life. The Navy has been ordered to do so. However, the Navy, so far, chooses not to comply.
We are not asking the Navy to stop training. We are asking the Navy to accept the court's orders and take necessary precautions to protect our marine mammals. Set limitations. Avoid whale habitats, migration routes and breeding areas.
Accept your responsibility and comply with the court's decisions. Do all that you are capable of doing. We expect nothing less.

1 The Navy takes numerous protective and mitigation measures to protect ocean resources, and will continue to do so, as discussed and analyzed in the EIS/OEIS. Appropriate and effective mitigation measures implemented, as well as those determined to be ineffective, impractical, or infeasible are discussed in Appendix F of the Draft EIS/OEIS (p. 346-349).

The Navy is very concerned about the environment and is a leading sponsor of marine mammal research, spending $26 million in FY08, which includes efforts to understand the relationship between sound and marine mammals.

10.2.3.10 Schenk

...after listening to this, I want to thank you for the job you guys have done and for your mission. And I wish all the luck in continuing on.
My family can sleep safely at night thanks to you. In this ever-changing world where things escalate and happen quickly, you guys have got to be on the cutting edge to protect us. And I want to see you continue on with that mission.
And there's a lot of whales and a lot of porpoises. And I'm sorry, you guys, but I've been a fisherman for 35 years, and there's a lot of, you know -- thank you again for what you've done for us.

1 Thank you for your comment.

10.2.3.11 Kirk

But the science shows that a thousand yards is not enough. And, furthermore, the courts have agreed that the Navy isn't doing enough to safeguard these whales in the -- in these waters as it trains, and the Navy's plan to conduct even more sonar training here without the protections ordered by the courts is unacceptable. Those protections, by the way, include suspension of training during migration and mating times.

1 Acoustic modeling shows that 1,000 yards encompasses the area where nearly 83% of exposures above 160 dB would occur. Animals outside of this 1,000-yard area would avoid potential temporary and permanent threshold shift, and higher levels of behavioral responses.

The Navy takes numerous protective and mitigation measures to protect ocean resources, and will continue to do so, as discussed and analyzed in the EIS/OEIS. Appropriate and effective mitigation measures implemented, as well as those determined to be ineffective, impractical, or infeasible are discussed in Appendix F of the Draft EIS/OEIS (p. 346-349).

10.2.3.12 Clark

1. The first point I would like to make is that not only cetaceans are very sensitive to sound, but even from the tiniest little fish up to the blue whale. If you so much as exhale, they will just run from you. Their hearing is very sensitive.
I think that we have done -- we have a more serious problem in how we've treated the ocean and the state it's in than we do with global warming. And I think even though it's nice out there and everyone sees lots of creatures, it's still severely damaged. And I -- my perspective is we should stop messing with the oceans, because our very lives depend on the ocean.
We don't really understand the navigational and the echo location systems of the pinnipeds and the cetaceans well enough to say unequivocally that this isn't going to do any lasting or major harm

1

The Final EIS/OEIS analyzes potential behavioral impacts described in this comment. For example, "Natural and artificial sounds can disrupt behavior by masking, or interfering with an animal's ability to hear other sounds that may be important in navigation, foraging, avoiding predators, or for social behaviors."

However, for the reasons outlined in Section 3.9.9.2.2, the chance of sonar operations causing masking effects is considered negligible.

Echolocation in toothed whales is well understood (pinnipeds and baleen whales do not echolocate) and most of their echolocation is above the mid-frequency sonar range. In 40 years of mid-frequency active sonar use in SOCAL there is no evidence that MFAS affects migration.

2. I once saw a video shot in the Pacific northwest. There was a Navy ship instituting --turning on their sonar, and an entire pod of orcas leapt out of the water, and they were doing everything they could to keep their ears out of the ocean. And it just looked like they were in such agony. They were right near your ship, so they weren't a thousand yards or whatever your limitation is.

2

The comment appears to refer to the USS SHOUP event on May 5, 2003 in the Haro Strait near Vancouver Island.

Observer opinions regarding orca J-Pod behaviors on 5 May 2003 were inconsistent, ranging from the orca being "at ease with the sound" or "resting" to their being "annoyed." One witness reported observing "low rates of surface active behavior" on behalf of the orca J-Pod, which is in conflict with that of another observer who reported variable surface activity, tail slapping and spyhopping. Witnesses also expressed the opinion that the behaviors displayed by the orca on 5 May 2003 were "extremely unusual," although those same behaviors are observed and reported regularly on the Orca Network Website, are behaviors listed in general references as being part of the normal repertoire of orca behaviors. Given the contradictory nature of the reports on the observed behavior of the J-Pod orca, it is impossible to determine if any unusual behaviors were present. In short, there is no way to assess if any unusual behaviors were present or if present they were in reaction to vessel disturbance from one of many nearby whale watch vessels, use of sonar by USS SHOUP, any other potential causal factor, or a combination of factors.

1

3. Another point, I didn't know about the 229 decibels. When I exhale on my scuba regulator and all the fish dart away, that must be about the same level as human speech in air. And I don't know if everybody knows this, but a decibel, as far as I understand it --one decibel is twice as much sound as two decibels.

So this is an exponential number. It's this huge number that's just -- I can't even imagine what this would sound like. I imagine it would make me go deaf in a second or two. And, remember, water is denser, and sound travels longer. And there are so many creatures in this environment that are impacted by this. And I don't think it's just the whales. I think it's everything.

I have a suggestion. There are many dead zones that we have created in the world that have no marine life in them. And if you're testing sonar, I suspect it's just the water that you need, and I would suggest that the Navy find these dead zones. They're easy to find. They're huge. Hopefully there's one near a naval base where all of this could take place without any ecological damage, whatsoever.

3

It is inaccurate to compare the noise level of sonar in water to the noise level of other loud noises through the air without properly accounting for certain differences, primarily that sound intensity given in dB in water is not directly comparable to sound intensity given in dB in air. To account for these differences, a conversion of approximately 63 dB is generally applied. Using this conversion, a 229 dB sound in the water roughly equates to a 166 dB sound in air.

For a comparison of in-water sound levels; lightning strikes on the ocean surface are approximately 260 dB, seafloor seismic events – 255 dB, Navy sonar – 235 dB, orca echo-location – 200 to 225 dB, and humpback whales – 144 to 190 dB.

The fish are most likely reacting to the sight of the bubbles or to water movement. Most fish and invertebrates only sense low frequency sounds. Through the use of mitigation measures, no marine mammals would be exposed to 229 dB.

Finally, in a report publicized by the United Nations Environment Programme (UNEP), sonar was rated last among current threats to marine mammals.

1

10.2.3.13 Jenny

I think one of the problems we have with our species is we're looking at them as items to be counted, and things, and animals. And the cetaceans, from what I've observed, are far more developed than things to be counted or animals.

I'm looking at them not only from an ecological point of view, because what affects them affects us all, but also from a spiritual point of view. If any of you have ever swam with dolphins and interacted with them, or whales, then you would know what I know, if your mind was open and your heart was open to them. They are much more magnificent than watching them from the coastline.

They're immense beings, not in size only, but in spirit. And the problem isn't with them; the problem is with us. You know, sure, the Navy needs to defend us because, as a species, this is what we do. We fear each other. But the paradigm needs to shift with us, not with them. We are not waging war on them and their environment -- well, yeah, we are. They're not waging war on us. They're not waging war on anybody.

I understand you have a job to do, but if you're given guidelines, you need to follow them. If there's an alternative way of testing, you need to find it. And, you know, they say necessity is the mother of invention. If you can't go about it this way, certainly we're intelligent enough as a species to find another.

1 Please refer to Introduction to Chapter 10, page 10-1.

1

10.2.3.14 Bertelli

I'm here representing the California Sea Urchin Commission, which represents California's sea urchin industry, both processors and divers.

But our main concern, besides -- we're also environmentalists, and we're concerned about the health of the ocean. If the ocean health fails, our fisheries fail, and we're in trouble. But our main concern is access to -- to the fishing grounds and access to save anchorages.

We have had some issues with access in Northwest Harbor in San Clemente Island, and we're fully aware of what goes on at Northwest Harbor, and we know that the people on that island are training for missions that are not Hollywood movies. They're not video games. These people go out in harm's way to defend us, and we're -- you're engaged in serious, serious business.

And we know that sometimes we're going to have to be moved out of the way. But we need you to keep in mind that we do have our -- our ecosystem in the ocean. The way we harvest is based on access to all of our fishing grounds. If we lose any major chunk of our fishing grounds, it's going to defer pressure to new areas. And then we run the risk of overharvesting in a certain area, which we don't want to do.

We've been working for over 30 years to have good sound harvest practices. Most of the environmental community recognizes the sea urchin industry as one of what they call a "clean fishery." We harvest by hand. We only take sea urchins. If we're diving sea cucumbers, we only take sea cucumbers, and we're very, very well managed.

1 The Draft EIS/OEIS described potential economic impacts to fishing in Section 3.14.2. In this section, the analysis concluded that impacts would not be significant due to advanced public notification and primarily short-term duration of military activities. No new closure or restricted areas are proposed.

1

10.2.3.15 Mottola

I have learned also from behavioral experts in my own experience, supervising many employees, that our weaknesses are our strengths taken to extreme. And I believe your plan to conduct sonar training here without the protections that have come from the wisdom of the courts is an example of your strength, your power taken to extreme. I believe it is your weakness, and it is a blind side.

I would ask the Navy to do some core self-reflection. First of all, do you really understand and appreciate the interconnection of all forms of life and that the well being of whales and other marine life is directly related to the well being of those who you are trying to protect? Are you coming from an arrogance that your role to protect our waters from some enemy supersedes all other interest?

1 The Navy is very concerned about the environment and is a leading sponsor of marine mammal research, spending $26 million in FY08, which includes efforts to understand the relationship between sound and marine mammals.

Is there room in your overall mission, your role to take leadership in the protection of all species, especially marine species? You are the Navy -- "marine," get it -- not just American citizens.

Now, I'm a Christian, and I'm committed to the notion of stewardship. If you've heard of that notion before, basically I would suggest that because of the gifts God has given you through our country, that you have a responsibility, a serious responsibility, for the survival of all species.

10.2.3.16 Bradley

I'm the granddaughter of a man who was a member of the Ku Klux Klan, and I think he believed that he was doing, you know, the right thing. He thought that it was for the good of the people.

I look back now, you know, and I think about my great-grandfather, and I realize he was very ignorant. And I'm asking that you think about your grandchildren and great-grandchildren and what they may know, we already know, we know what's going to happen, what you could have done, but chose not to do, and what they're going to think of you when you're dead.

1 Please refer to Introduction to Chapter 10, page 10-1.

Because there were lots of black people, too, weren't there? And, you know, like this gentleman – I wish he wouldn't have left, you know -- but we didn't stop them from beating them, and, you know, that's basically what you're going to do to the marine animals. You're going to beat them up, you know.

So I know my great-grandchildren are going to remember their great-grandmother as someone who tried to make a difference, tried to stop you from what you're about to do.

10.2.3.17 Cuevas

Comment		Response
I just want to reiterate what the gentleman, Michael, said about maybe the Navy searching out the dead zones to do their sonar testing. We spend a lot of money on the military. If we could just spend maybe a little more to find those dead zones that he was talking about, the gentleman who spoke earlier, Michael, that would be the ultimate solution. Otherwise, the 2,000-yard safeguard is what I would like to have the Navy honor & also to respect the migrating & breeding areas of the whales.	1	The distribution and abundance of marine mammals is influenced by a variety of factors, including season, prey distribution, oceanographic conditions and migration or movement patterns. Many of these and other factors are difficult or impossible to predict. What may have been an area of little marine mammal activity one day or one season may be very active another day or another year due to changes in the season or oceanographic conditions.

10.2.3.18 Gaworcki

Comment		Response
I'm a member of NRDC, but I'm an employee at a company that has tens of thousands of other employees who all really prioritize environmentalism. And the COO of our company has put out a company-wide initiative that we all need to be greener and more eco-friendly in our office habits, our home habits. So I know that I speak for many, many, many people when I say that it's really important for the Navy not to go forward with this plan. And if we've learned anything from global warming, it's that we shouldn't pursue something until we're educated on it, & we're not educated on this, & we shouldn't pursue it.	1	Please refer to Introduction to Chapter 10, page 10-1.

10.2.3.19 Shademan

Comment		Response
I'm here to urge the Navy to not push their limits as far as they can push until they get in trouble, because I don't think that's an honorable thing to do. And I tend to think of the Army & the Navy and our military as honorable people, & I think that goes against what I think of them. And in addition to that, I moved here 20 years ago, & I feel very lucky to be here. And I do not want the ocean ruined, & I do want my kids to be able to see it. And I want them to be able to enjoy it & be proud of us for taking the high road & doing the right thing.	1	Please refer to Introduction to Chapter 10, page 10-1.

10.2.3.20 Pozniakoff (2)

Okay. I was born in California. I was born in San Francisco. I learned to swim before I knew how to walk. I've got a photograph of my dad throwing me and my twin brother into the ocean off of North Beach, and I've been on the coast all my life, surfing and diving and ocean-related things, whatever. I have seen the decimation of the species of the pinnipeds, the dolphin, the whales, all the sea life over the years, and nothing is getting better, not through Sierra Club, not through Surfrider Foundation, not through NRDC. Everything is getting worse, and it seems to me that, right now, there's a war on dolphins and whales.

The Japanese just returned from their whale fleet slaughter of whales, and it -- and now the Navy wants to test this high-powered sonar anywhere -- anywhere and everywhere they think that it's necessary.

Now, I'm a retired Department of Defense employee, and I understand the need to have protection and defenses in place. But we are not at war with a major super power. We're not at war with Russia, China or North Korea or anybody else with a large nuclear sub capability.

Why the Navy wants to go ahead and disobey court rulings to do this sonar testing wherever they want to is just ridiculous. It's -- it's an abomination of a civilized society. We need to control what the Navy does until we understand what the – what the effect on the dolphins and the whales is going to be for their hearing. That's the most sensitive part of their being, is their hearing, their sonar capabilities.

And until we know what the Navy can do with this sonar, then we should not allow the Navy to go ahead with any of this testing anywhere they want to. Let them research what the damage is to dolphins and whales. Let them determine where the places are where the dolphins and the whales do not migrate, where there won't be any damage, and let them do their testing there.

If there's a major breakout of war, hostilities between Russia or North Korea or China, then they can come back and reapply for this testing capability. But until that time is happening – right now, we're in a war on terror, which is low on the radar. It's -- it's anti-IEDs and anti-theologic ideals.

We need to save our world, our future for our children and our children's children, and that includes whales and dolphins. If I was a whale or a dolphin, I would say I'm under attack by not only the Japanese and the Norweigians and the Spaniards, but now also the U.S. Navy, with their high-tech capabilities.

That's all I want to say.

1 Please refer to Introduction to Chapter 10, page 10-1.

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Appendix A

Training and Research, Development, Test & Evaluation Descriptions

This Appendix provides detailed information about Training and Research, Development, Test, and Evaluation (RDT&E) activities that are addressed in this Draft Environmental Impact Statement (EIS) / Overseas Environmental Impact Statement (OEIS) (hereafter referred to as "EIS/OEIS").

Organization of this Appendix

The Appendix contains:

- An overview of each of the Navy's Primary Mission Areas (PMARS),
- A Table listing and briefly describing the 53 types of training and RDT&E events analyzed in the EIS/OEIS, categorized by PMAR, and
- A detailed description of each of the 53 types of training and RDT&E events.
- A description of each of the acoustic sources present in SOCAL.

Primary Mission Areas

Anti-Air Warfare Training

Anti-Air Warfare (AAW) is the PMAR that addresses combat operations by air and surface forces against hostile aircraft. Navy ships contain an array of modern anti-aircraft weapon systems, including naval guns linked to radar-directed fire-control systems, surface-to-air missile systems, and radar-controlled cannon for close-in point defense. Strike/fighter aircraft carry anti-aircraft weapons, including air-to-air missiles and aircraft cannon. AAW training encompasses events and exercises to train ship and aircraft crews in employment of these weapons systems against simulated threat aircraft or targets. AAW training includes surface-to-air gunnery surface-to-air and air-to-air missile exercises and aircraft force-on-force combat maneuvers

Anti-Submarine Warfare Training

Anti-Submarine Warfare (ASW) involves helicopter and maritime patrol aircraft, ships, and submarines. These units operate alone or in combination, in operations to locate, track, and neutralize submarines. Controlling the undersea battlespace is a unique naval capability and a vital aspect of sea control. Undersea battlespace dominance requires proficiency in ASW. Every deploying strike group and individual surface combatant must possess this capability.

Various types of active and passive sonars are used by the Navy to determine water depth, locate mines, and identify, track, and target submarines. Passive sonar "listens" for sound waves by using underwater microphones, called hydrophones, which receive, amplify and process underwater sounds. No sound is introduced into the water when using passive sonar. Passive sonar can indicate the presence, character and movement of submarines. However, passive sonar provides only a bearing (direction) to a sound-emitting source; it does not provide an accurate range (distance) to the source. Active sonar is needed to locate objects because active sonar provides both bearing and range to the detected contact (such as an enemy submarine).

Active sonar transmits pulses of sound that travel through the water, reflect off objects and return to a receiver. By knowing the speed of sound in water and the time taken for the sound wave to travel to the object and back, active sonar systems can quickly calculate direction and distance from the sonar platform to the underwater object. There are three types of active sonar.

- High-frequency active sonar, which operates at frequencies greater than 10 kilohertz (kHz). At higher acoustic frequencies, sound rapidly dissipates in the ocean environment, resulting in short detection ranges, typically less than five nm. High-frequency sonar is used primarily for determining water depth, hunting mines and guiding torpedoes.
- Mid-frequency active sonar operates between 1 and 10 kHz, providing an optimal balance of detection range and resolution. Typical mid-frequency sonar detection ranges are up to 10 nautical miles making it the primary tool for conducting anti-submarine warfare.
- Low-frequency sonar operates below 1 kHz and is designed to detect extremely quiet diesel-electric submarines at ranges far beyond the capabilities of mid-frequency active sonars. There are only two ships in use by the U.S. Navy that are equipped with low frequency sonar; both are ocean surveillance vessels operated by Military Sealift Command.

The Navy's ASW training plan, including the use of active sonar in at-sea training scenarios, includes multiple levels of training. Individual-level ASW training addresses basic skills such as detection and classification of contacts, distinguishing discrete acoustic signatures including those of ships, submarines, and marine life, and identifying the characteristics, functions, and effects of controlled jamming and evasion devices.

More advanced, integrated ASW training exercises involving active sonar is conducted in coordinated, at-sea operations during multi-dimensional training events involving submarines, ships, aircraft, and helicopters. This training integrates the full anti-submarine warfare continuum from detecting and tracking a submarine to attacking a target using either exercise torpedoes or simulated weapons. Training events include detection and tracking exercises (TRACKEX) against "enemy" submarine contacts; torpedo employment exercises (TORPEX) against the target; and exercising command and control tasks in a multi-dimensional battlespace.

Anti-Surface Warfare Training

Anti-Surface Warfare (ASUW) is a type of naval warfare in which aircraft, surface ships, and submarines employ weapons, sensors, and operations directed against enemy surface ships or boats. Aircraft-to-surface ASUW is conducted by long-range attacks using air-launched cruise missiles or other precision guided munitions, or using aircraft cannon. ASUW also is conducted by warships employing torpedoes, naval guns, and surface-to-surface missiles. Submarines attack surface ships using torpedoes or submarine-launched, anti-ship cruise missiles. Training in ASUW includes surface-to-surface gunnery and missile exercises, air-to-surface gunnery and missile exercises, and submarine missile or torpedo launch events. Training generally involves expenditure of ordnance against a towed target. A sinking exercise (SINKEX) is a specialized training event that provides an opportunity for ship, submarine, and aircraft crews to use multiple weapons systems to deliver live ordnance on a deactivated vessel, which is deliberately sunk.

ASUW also encompasses maritime interdiction, that is, the interception of a suspect surface ship by a Navy ship for the purpose of boarding-party inspection or the seizure of the suspect ship. Training in these tasks is conducted in Visit, Board, Search and Seizure exercises.

Amphibious Warfare Training

Amphibious Warfare (AMW) is a type of naval warfare involving the utilization of naval firepower and logistics, and Marine Corps landing forces to project military power ashore. AMW encompasses a broad spectrum of operations involving maneuver from the sea to objectives ashore, ranging from reconnaissance or raid missions involving a small unit, to large-scale amphibious operations involving over one thousand Marines and Sailors, and multiple ships and aircraft embarked in a Strike Group.

AMW training includes tasks at increasing levels of complexity, from individual, crew, and small unit events to large task force exercises. Individual and crew training include the operation of amphibious vehicles and naval gunfire support training. Small-unit training operations include events leading to the certification of a Marine Expeditionary Unit (MEU) as "Special Operations Capable" (SOC). Such training includes shore assaults, boat raids, airfield or port seizures, and reconnaissance. Larger-scale amphibious exercises involve ship-to-shore maneuver, shore bombardment and other naval fire support, and air strike and close air support training.

Electronic Combat Training

Electronic Combat (EC) is the mission area of naval warfare that aims to control use of the electromagnetic spectrum and to deny its use by an adversary. Typical EC activities include threat avoidance training, signals analysis for intelligence purposes, and use of airborne and surface electronic jamming devices to defeat tracking systems.

Mine Warfare Training

MIW is the naval warfare area involving the detection, avoidance, and neutralization of mines to protect Navy ships and submarines, and offensive mine laying in naval operations. A naval mine is a self-contained explosive device placed in water to destroy ships or submarines. Naval mines are deposited and left in place until triggered by the approach of or a contact with an enemy ship, or are destroyed or removed. Naval mines can be laid by purpose-built minelayers, other ships, submarines, or airplanes. MIW training includes Mine Countermeasures (MCM) Exercises and Mine Laying Exercises (MINEX).

Naval Special Warfare Training

Naval Special Warfare (NSW) forces (SEALs and Special Boat Units [SBUs]) train to conduct military operations in five Special Operations mission areas: unconventional warfare, direct action, special reconnaissance, foreign internal defense, and counterterrorism. NSW training involves specialized tactics, techniques, and procedures, employed in training events that include: insertion/extraction operations using parachutes rubber boats, or helicopters; boat-to-shore and boat-to-boat gunnery; demolition training on land or underwater; reconnaissance; and small arms training.

Strike Warfare Training

Strike Warfare (STW) operations include training of fixed-wing fighter/attack aircraft in delivery of precision guided munitions, non-guided munitions, rockets, and other ordnance against land targets in all weather and light conditions. Training events typically involve a simulated strike mission with a flight of four or more aircraft. The strike mission may simulate attacks on "deep targets" (i.e., those geographically distant from friendly ground forces), or may simulate close air support of targets within close range of friendly ground forces. Laser designators from aircraft or ground personnel may be employed for delivery of precision guided munitions. Some strike missions involve no-drop events in which prosecution of targets is simulated, but video footage is often obtained by onboard sensors.

Combat Search and Rescue (CSAR) is a strike warfare operation with the purpose of training aircrews to locate, protect, and evacuate downed aviation crew members from hostile territory. The operation can include reconnaissance aircraft to find the downed aircrew, helicopters to conduct the rescue, and fighter aircraft to perform close air support to protect both the downed aircrews and the rescue helicopters.

Explosive Ordnance Disposal Activities

The Explosive Ordnance Disposal (EOD) mission area involves employment of skills, tactics, and equipment designed to safely render unexploded ordnance (UXO). EOD personnel are highly trained and operate in both tactical and administrative capacities. Tactical missions include safe disposal of improvised explosive devices. Administrative missions include range clearance and ordnance safety in support of operational forces.

United States Coast Guard Training

Coast Guard Sector San Diego, a shore command within the Coast Guard 11th District, carries out its mission to serve, protect and defend the American public, maritime infrastructure and the environment. The Sector San Diego Area of Responsibility (AOR) extends southward from the Dana Point harbor to the border with Mexico. Equipment utilized by the Coast Guard includes 25-ft response boats, 41-ft utility boats and 87-ft patrol boats, as well as HH-60 helicopters. Training events include: search and rescue, maritime patrol training, boat handling, and helicopter and surface vessel live-fire training with small arms.

Naval Auxiliary Landing Field San Clemente Island Airfield Activities

Naval Auxilliary Landing Field (NALF) San Clemente Island (SCI) provides opportunities for aviation training and aircraft access to the island. The airfield is restricted to military aircraft and authorized contract flights. There are no permanently assigned aircraft, and aviation support is limited essentially to refueling. NALF SCI has the primary mission of training Naval Air Force Pacific aircrews in Field Carrier Landing Practice (FCLP). FCLP involves landing on a simulated aircraft carrier deck painted on the surface of the runway near its eastern end. Other military activities include visual and instrument approaches and departures, aircraft equipment calibration, survey and photo missions, range support, exercise training, RDT&E test support, medical evacuation, and supply and personnel flights.

Research, Development, Test & Evaluation Events

Space and Naval Warfare Systems Center (SPAWARSYSCEN) conducts RDT&E, engineering, and Fleet support for command, control, and communications systems and ocean surveillance. Space and Naval Warfare System's (SPAWAR's) tests on SCI include a wide variety of ocean engineering, missile firings, torpedo testing, manned and unmanned submersibles, Unmanned aerial vehicles (UAVs), EC, and other Navy weapons systems. Specific events include:

- Ship Tracking and Torpedo Tests;
- Unmanned Underwater Vehicle (UUV) Tests;
- Sonobuoy Quality Assurance (QA)/Quality Control (QC) Tests;
- Ocean Engineering Tests;
- Marine Mammal Mine Shape Location and Research; and
- Missile Flight Tests;

The San Diego Division of the Naval Undersea Warfare Center is a Naval Sea Systems Command (NAVSEA) organization supporting the Pacific Fleet. NUWC operates and maintains the SCI Underwater Range (SCIUR). NUWC conducts tests, analysis, and evaluation of submarine USW exercises and test programs. NUWC also provides engineering and technical support for Undersea Warfare (USW) programs and exercises, design cognizance of underwater weapons acoustic and tracking ranges and associated range equipment, and provides proof testing and evaluation for underwater weapons, weapons systems, and components.

Table A-1: Training and RDT&E Activities on the SOCAL Range Complex

Navy Warfare Area	No.	Operation Type	Summary
Anti-Air Warfare	**1**	Aircraft Combat Maneuvers	Trains fighter crews in basic flight maneuvers and advanced air combat tactics. Participants are from two or four aircraft. No weapons are fired.
	2	Air Defense Exercise	Coordinated operations involving surface ships and aircraft, training in radar detection, and simulated airborne and surface firing. No weapons are fired.
	3	Surface-to-Air Missile Exercise	Live-firing event from a surface ship to an aerial target. Weapons employed are Rolling Airframe Missile (RAM) and STANDARD missile. Aerial targets are drones recovered via parachute and small boat.
	4	Surface-to-Air Gunnery Exercise	Surface-to-air live-fire gunnery at aerial target that simulates a threat aircraft or missile. Weapons include the 5-inch naval gun, 76 mm and 20 mm cannon, and 7.62 machine guns.
	5	Air-to-Air Missile Exercise	Fighter/attack aircraft firing against an aerial target that simulates an enemy aircraft. Missiles include AIM-7 SPARROW, AIM-9 SIDEWINDER, and AIM-120 AMRAAM.
Anti-Submarine Warfare	**6**	Antisubmarine Warfare Tracking Exercise - Helicopter	Trains helicopter crews in anti-submarine search, detection, localization, classification and track. Two primary targets: recoverable MK 30 and expendable MK 39. The target simulates a submarine at varying depths and speeds. MH-60R crews drop sonobuoys to detect and localize the target.
	7	Antisubmarine Warfare Torpedo Exercise - Helicopter	Trains MH-60R crews in employment of air-launched torpedoes. Aircrew drops an inert, running exercise torpedo or a non-running practice torpedo against ASW targets.
	8	Antisubmarine Warfare Tracking Exercise - Maritime Patrol Aircraft	Trains patrol aircraft crews in anti-submarine search, detection, localization, classification and track. Employs multiple sensor systems against a submarine simulating a threat.
	9	Antisubmarine Warfare Torpedo Exercise - Maritime Patrol Aircraft	Trains patrol aircraft crews in employment of air-launched torpedoes. Aircrew drops an inert, running exercise torpedo or a non-running practice torpedo against ASW targets.
	10	Antisubmarine Warfare EER / IEER sonobuoy employment	Trains patrol aircraft crews in deployment and use of Extended Echo Ranging (EER) and Improved EER (IEER) sonobuoy systems.

Table A-1: Training and RDT&E Activities on the SOCAL Range Complex (cont'd)

Navy Warfare Area	No.	Operation Type	Summary
Anti-Submarine Warfare (cont.)	**11**	Antisubmarine Warfare Tracking Exercise - Surface	Trains ship crews in anti-submarine search, detection, localization, classification, track and attack. ASW targets simulate a submarine at varying depths and speeds. Ships crews and MH-60R helicopter crews employ sensors to detect and localize the target.
	12	Antisubmarine Warfare Torpedo Exercise - Surface	Trains ship crews in anti-submarine search, detection, localization, classification, track and attack. One or more torpedoes are dropped/fired in this exercise. Includes Integrated ASW Phase 2 (IAC II).
	13	Antisubmarine Warfare Tracking Exercise - Submarine	Trains submarine crews in ASW using passive sonar (active sonar use is tactically proscribed), No ordnance expended in this exercise.
	14	Antisubmarine Warfare Torpedo Exercise - Submarine	Submarine exercise training Tactical Weapons Proficiency, lasting 1-2 days and multiple firings of exercise torpedoes. Attacking submarines use only passive sonar.
Anti-Surface Warfare	**15**	Visit Board Search and Seizure	Training in interception of a suspect surface craft by a naval ship for the purpose of inspection for illegal activities. Helicopters, surface ships and small boats participate. Small arms may be fired.
	16	Air-Surface Missile Exercise	Ships, helicopters and fighter/attack aircraft expend precision-guided munitions against maneuverable, high-speed, surface targets. The missiles used in this operation are the AGM-114 (Hellfire) and the Harpoon. Small arms are also fired from helicopters.
	17	Air-to-Surface Bombing Exercise	Trains fighter or patrol aircraft crews in delivery of bombs against surface vessels. Involves in-flight arming and releasing of bombs in accordance with appropriate tactics and drop restrictions. These include; Laser-Guided Training Round (LGTR) and Glide Bomb Units (GBUs) 12, 16 and 32i.
	18	Air-to-Surface Gunnery Exercise	Trains helicopter crews in daytime aerial gunnery operations with the GAU-16 (.50 cal) or M-60 (7.62 mm) machine gun.
	19	Surface-to-Surface Gunnery Exercise	Trains surface ship crews in high-speed engagement procedures against mobile seaborne targets, using 5-inch guns, 25 mm cannon, or .50 cal machine guns.

Table A-1: Training and RDT&E Activities on the SOCAL Range Complex (cont'd)

Navy Warfare Area	No.	Operation Type	Summary
Anti-Surface Warfare (cont.)	**20**	Sink Exercise	Trains ship and aircraft crews in delivering live ordnance on aseaborne target, namely a large deactivated vessel, which is deliberately sunk using multiple weapon systems. The ship is cleaned, environmentally remediated and empty. It is towed to sea and set adrift at the exercise location. The precise duration of a SINKEX is variable, ending when the target sinks, whether after the first weapon impacts or and after multiple impacts.
Amphibious Warfare	**21**	Naval Surface Fire Support	Trains ship crews in naval gunnery against shore targets. Training Naval Gunfire Spotters located ashore to direct the fires of naval guns.
	22	Expeditionary Fires Exercise	USMC field training in integration of close air support, naval gunfire, artillery, and mortars.
	23	Expeditionary Assault - Battalion Landing	Proposed training event for a Marine Corps battalion-sized unit (1,500 personnel). This live-fire exercise would last up to 4 days, employ the full combined arms team of a MEU, and occur up to two times per year. The amphibious forces would land by helicopter (primarily CH-46s) and across the beach. Amphibious landings would use rubber boats, and amphibious crafts and vehicles.
	24	Stinger Firing Exercise	Trains Marine Corps personnel in employment of man-portable air defense systems with the Stinger missile. This is a ground-launched missile firing exercise against a small aerial target.
	25	Amphibious Landings and Raids (on SCI)	Trains Marine Corps forces in small unit live-fire and non-live-fire amphibious operations from the sea onto land areas of SCI.
	26	Amphibious Operations - CPAAA	Trains Marine Corps small units including assault amphibian vehicle units and small boat units in amphibious operations.
Electronic Combat	**27**	Electronic Combat Operations	Signal generators on SCI and commercial air services provide air, surface and subsurface units with operating experience in electronic combat, using emitters and electronic and communications jammers to simulate threats.
Mine Warfare	**28**	Mine Countermeasures Exercise	Surface ship uses all organic mine countermeasures, including sonar, to locate and avoid mines. No weapons are fired. Future operations would also use unmanned side-scan sonar systems and be conducted in SWTR Offshore near the Tanner/Cortez Banks.
	29	Mine Neutralization	Training of crews of ships, patrol aircraft, and helicopters crews in mine neutralization
	30	Mine Laying	Training of fighter/attack and patrol aircraft crews in aerial mine laying.

Table A-1: Training and RDT&E Activities on the SOCAL Range Complex (cont'd)

Navy Warfare Area	No.	Operation Type	Summary
Naval Special Warfare	**31**	NSW Land Demolition	Training of NSW personnel in construction, emplacement and safe detonation of explosives for land breaching and demolition of buildings and other facilities.
	32	Underwater Demolition-Single Point Source Charge	Training of NSW personnel to construct, emplace and safety detonate single charge explosives for underwater obstacle clearance.
	33	Underwater Demolition Multiple Charge - Mat Weave and Obstacle Loading	Training of NSW personnel to construct, emplace and safety detonate multiple charges laid in a pattern for underwater obstacle clearance.
	34	Small Arms Training and GUNEX	Training of NSW personnel in employment of small arms up to 7.62 mm.
	35	Land Navigation	Training of NSW personnel in land navigation techniques.
	36	NSW UAV / UAS Operations	Training of NSW personnel in employment of unmanned aerial vehicles.
	37	Insertion/Extraction	Training of NSW personnel in covert insertion and extraction into target areas, using boats, aircraft, and parachutes.
	38	NSW Boat Operations	Training of NSW Special Boat Teams in open-ocean operations, and firing from boats, including into land impact areas of SCI.
	39	SEAL Platoon Operations	SEAL Platoon live-fire training in special operations tactics, techniques and procedures
	40	NSW Direct Action	Training of NSW personnel in live-fire events involving insertion, movement to and actions on the objective, and extraction. May engage close air support and NSFS.
Strike	**41**	Bombing Exercise (Land)	Training of fighter/attack crews in bombing of land targets on SCI, using precision guided munitions and unguided munitions. Typical event involves 2-4 aircraft.
	42	Combat Search & Rescue	Training of aircrews, submarine, an NSW forces in rescue of military personnel in a simulated hostile area.
Explosive Ordnance Disposal	**43**	Explosive Ordnance Disposal SCI	Training of EOD teams to locate and neutralize or destroy unexploded ordnance.
U.S. Coast Guard	**44**	Coast Guard Training	Training in SOCAL OPAREA.
Air Operations-Other	**45**	NALF Airfield Activities	Flight training (e.g., landing and takeoff practice) of aircrews utilizing NALF airfield.

Table A-1: Training and RDT&E Activities on the SOCAL Range Complex (cont'd)

Navy Warfare Area	No.	Operation Type	Summary
RDT&E	46	Ship Torpedo Tests	Test event for reliability, maintainability, and performance of torpedoes used in training (REXTORPS and EXTORPS) and operational torpedoes.
	47	Unmanned Underwater Vehicles	Development and operational testing of UUVs.
	48	Sonobuoy QA/QC Testing	Test event for reliability, maintainability, and performance of lots of sonobuoys.
	49	Ocean Engineering	Test event for reliability, maintainability, and performance of marine designs.
	50	Marine Mammal Mine Shape Location/Research	Events in which marine mammals (primarily porpoises) are trained to locate and mark inert mineshapes.
	51	Missile Flight Tests	Missile testing in which land attack missiles are launched from within SOCAL Range Complex, to impact at SCI or at another range complex outside SOCAL.
	52	NUWC Underwater Acoustics Testing	Test events to evaluate acoustic and non-acoustic ship sensors.
	53	Other Tests	Diverse RDT&E activities.
Major Range Events	NA	Major exercises	Comprised of multiple range events, identified above*

Detailed Operations Descriptions

1. Air Combat Maneuvers

Air Combat Maneuvers (ACM) is the general term used to describe an air-to-air (A-A) event involving two or more strike / fighter aircraft. Aircraft perform intricate flight maneuvers to achieve a gun or missile firing position from which an attack can be made on a threat aircraft with the goal of destroying the adversary aircraft. No ordnance is expended during ACM operations.

ACM training consists of:

- Basic fighter maneuvering, in which two aircraft will engage in offensive and defensive maneuvering practice against each other.
- Intermediate and advanced offensive and defensive counter air training, in which three or more aircraft will engage in offensive and defensive maneuvering. Participating aircraft will be separated at the start by distances up to 50 nm. These exercises which may also occur in the context of major range events, involve high airspeeds (from high subsonic to supersonic) and rapidly changing aircraft altitudes and attitudes.

The preferred ACM training location is on an range located within a Warning Area or Class D Controlled airspace, instrumented with systems having the capability to precisely track and record the location of aircraft conducting maneuvers on the range.

2. Air Defense Exercise

Air Defense Exercises (ADEXs) consist of air-to-air and surface-to-air missile training events. These operations are coordinated between surface ships and aircraft. Tasks include radar detection, positioning, maneuver to a simulated airborne of surface firing position, and recovery of aircraft aboard an aircraft carrier. Air-to-air refueling may be included. These operations vary widely in the numbers of ships and aircraft involved and consist of a full array of tactics and procedures that are practiced between air and surface units for defense of the force. No ordnance is expended during ADEX operations.

3. Surface to Air Missile Exercise

The Surface to Air Missile Exercised (MISSILEX [S-A]) is a basic event to train surface ships' crews to engage threat missiles and aircraft with missiles with the goal of disabling or destroying the threat. The threat is simulated by a target towed behind a commercial air services Lear jet, or by a specialized BQM-74 target (a remote controlled target drone, with a parachute to enable recovery at sea). An exercise typically lasts 2 to 3 hours.

Aircraft carrier crews typically will expend one live or telemetered-inert-missile in the course of the MISSILEX (SA). Other ships and their crews typically will not expend ordnance, but will conduct a "detect to engage exercise," simulating firing of a missile.

4. Surface-to-Air Gunnery Exercise

The Surface-to-Air Gunnery Exercise (GUNEX [S-A]) is a basic event to train surface ships' crews to engage threat missiles and aircraft with gun systems with the goal of disabling or destroying the threat. A target simulating a threat aircraft or missile is deployed on a heading toward the ship. The target tow by a commercial air services Lear jet. Weapons crews practice tracking the target, and also engage the target using main battery guns (5-inch or 76 mm naval guns), or the Close-In Weapon System (CIWS). The exercise lasts about two hours, and typically includes several non-firing tracking runs followed by one or more (up to five) firing runs. The target must maintain an altitude above 500 ft for safety reasons and is not destroyed during the exercise.

Typically six rounds of 5-inch Variable Timed, Non-Fragmentation (VTNF) ammunition and 12 rounds of 76 mm ordnance per gun mount are expended by each main battery gun mount involved in the exercise. CIWS-equipped ships can expend between 900 to 1400 rounds per mount per firing run for each firing run. The CIWS fires a 20 mm inert, projectile made of tungsten. The number of CIWS rounds expended during this exercise varies depending on the ship class, the CIWS model installed, and the available ammunition allowance.

5. Air-to-Air Missile Exercise

The Air-to-Air Missile Exercise (MISSLEX [A-A]) is a basic event to strike fighter aircraft crews to attack a simulated threat target aircraft with air-to-air missiles. The target is an unmanned aerial target drone (BQM-34 or BQM-74) or Tactical Air-Launched Decoy (TALD). BQM targets deploy parachutes, float on the surface of the water, and are recovered by boat. TALDs are expended. The exercise lasts about one hour, is conducted in a Warning Area at sea outside of 12 nm at typical altitudes of 15,000 to 25,000 ft. In the exercise, a flight of two aircraft operating at high speeds approach a target from several miles away and, when within missile range, launch live or inert-telemetry missiles against the target. Missiles fired are not recovered.

6. Antisubmarine Warfare Tracking Exercise–Helicopter

Antisubmarine Warfare Tracking Exercise Helicopter(ASW TRACKEX-Helo) involves helicopters using sonobuoys and dipping sonar to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine.

Sonobuoys are typically employed by a helicopter operating at altitudes below 3,000 ft. Sonobuoys are deployed in specific patterns based on the expected threat submarine and specific water conditions. These patterns will cover many different size areas, depending on these two factors. Both passive and active sonobuoys are employed. For certain sonobuoys, tactical parameters of use may be classified.

The dipping sonar is employed from an altitude of about 50 ft after the search area has been narrowed based on the an sonobuoy search. Both passive and active sonar are employed. As the location of the submarine is further narrowed, a Magnetic Anomaly Device (MAD) is used by the MH-60RB to further confirm and localize the target's location.

The target for this exercise is either an MK-39 Expendable Mobile ASW Training Target (EMATT) or live submarine and may be either non-evading and assigned to a specified track, or fully evasive depending on the state of training of the helicopter. The ASW TRACKEX-Helo usually takes one to two hours. No ordnance is expended. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and/ or ships, including a major range event.

7. Antisubmarine Warfare Torpedo Exercise–Helicopter

The Antisubmarine Warfare Torpedo Exercise (ASW TORPEX-Helo) involves helicopters using sonobuoys and dipping sonar to search for, detect, classify, localize, and track a simulated threat submarine, as in the ASW TRACKEX-Helo. The TORPEX proceeds to the release of an exercise torpedo against the target, which is typically an EMATT or MK-30 target system.

8. Antisubmarine Warfare Tracking Exercise–Maritime Patrol Aircraft

The Antisubmarine Warfare Tracking Exercise-Maritime Patrol Aircraft (ASW TRACKEX-MPA) involves fixed-wing maritime patrol aircraft (MPA) employing sonobuoys to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine.

Sonobuoys are typically employed by an MPA operating at altitudes below 3,000 ft. Sonobuoys are deployed in specific patterns based on the expected threat submarine and specific water conditions. These patterns will cover many different size areas, depending on these two factors. Both passive and active sonobuoys are employed. For certain sonobuoys, tactical parameters of use may be classified. A sonobuoy field pattern delivered by an MPA will typically be much larger than a helicopter pattern, as the MPA can carry and deploy more buoys than a helicopter, and can monitor more buoys at one time. The MPA operates at higher altitudes, allowing monitoring the buoys over a larger search pattern area.

The target for this exercise is either an EMATT or live submarine and may be either non-evading and assigned to a specified track, or fully evasive depending on the state of training of the helicopter. The ASW TRACKEX-MPA usually takes two to four hours. No ordnance is expended. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and/ or ships, including a major range event.

9. Antisubmarine Warfare Torpedo Exercise–Maritime Patrol Aircraft (ASW TORPEX-MPA)

The Antisubmarine Warfare Torpedo Exercise Maritime Patrol Aircraft (ASW TORPEX-MPA) involves patrol aircraft using sonobuoys to search for, detect, classify, localize, and track a simulated threat submarine, as in the ASW TRACKEX-Helo. Additionally, the TORPEX proceeds to the release of an exercise torpedo against the target, which is typically an EMATT or MK-30 target system.

10. Antisubmarine Warfare-Extended Echo Ranging / Improved EER Training

This training event is an at-sea flying exercise designed to train MPA crews in the deployment and use of the Extended Echo Ranging (EER) and Improved EER (IEER) sonobuoy systems. These systems both use the SSQ-110 source. An EER event and an IEER event differ in the number and type of sonobuoys used. The EER event uses the SSQ-77 as the receiver buoy, while the SSQ-101 is the receiver buoy during IEER events. Both use the SSQ-110A sonobuoy as the signal source.

11. Antisubmarine Warfare Tracking Exercise–Surface

The Antisubmarine Warfare Tracking Exercise (ASW TRACKEX-Surface) involves a surface ship employing hull mounted and/or towed array sonar against a target which may be an EMATT or live submarine. The target may be either non-evading and assigned to a specified track or fully evasive depending on the state of training of the ship and crew. Passive and active sonar may be employed depending on the type of threat submarine, the tactical situation, and water conditions that may affect sonar effectiveness. Active sonar transmits at varying power levels, pulse types, and intervals, while passive sonar listens for noise emitted by the threat submarine. Passive sonar is typically employed first for tactical reasons, followed by active sonar to determine an exact target location; however, active sonar may be employed during the initial search phase against an extremely quiet submarine or in situations where the water conditions do not support acceptable passive reception. There is no ordnance expended in this exercise. An ASW TRACKEX-Surface usually lasts two to four hours. This exercise may involve a single ship, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and/ or ships, including a major range event.

12. Antisubmarine Warfare Torpedo Exercise–Surface

The Antisubmarine Warfare Torpedo Exercise-Surface (ASW TORPEX-Surface) involves a surface ship using hull-mounted and towed sonar arrays to search for, detect, classify, localize, and track a simulated threat submarine, as in the ASW TRACKEX-Surface. Additionally, the TORPEX proceeds to the release of an exercise torpedo against the target, which is typically an EMATT or MK-30 target system.

13. Antisubmarine Warfare Tracking Exercise–Submarine

The Antisubmarine Warfare Tracking Exercise-Submarine (ASW TRACKEX-Sub) involves a submarine employing hull mounted and/or towed array sonar against a target which may be an EMATT or live submarine. During this event, passive sonar is used almost exclusively; active sonar use is tactically proscribed because it would reveal the tracking submarine's presence to the target submarine. The preferred range for this exercise is an instrumented underwater training range with the capability to track the locations of submarines and targets, to enhance the after-action learning component of the training. There is no ordnance expended in this exercise. An ASW TRACKEX-Surface usually lasts two to four hours. This exercise may involve a single submarine, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event.

14. Antisubmarine Warfare Torpedo Exercise–Submarine

The Antisubmarine Warfare Torpedo Exercise-Submarine (ASW TORPEX-Sub) involves a submarine employing hull mounted and/or towed array sonar against a target which may be an EMATT or MK-30 Mobile ASW Target, followed by launch of a MK-48 exercise torpedo. The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other operating areas depending on training requirements and available assets.

15. Visit, Board, Search, and Seizure

The Visit, Board, Search and Seizure (VBSS) involves training of boarding parties delivered by helicopters and surface ships to surface vessels for the purpose of simulating vessel search and seizure operations. Various training scenarios are employed. Small arms with inert blanks may be used. The entire exercise may last two to three hours.

16. Missile Exercise: Air-to-Surface

The MISSILEX (A-S) trains fixed winged aircraft and helicopter crews to launch missiles at surface maritime targets, day and night, with the goal of destroying or disabling enemy ships or boats.

In the typical helicopter event, one or two helicopters approach and acquire an at-sea surface target, which is then designated with a laser to guide the missile to the target. Specially prepared targets with an expendable target area on a stationary floating or remote controlled platform are employed. The missile passes through the expendable target without damaging the platform and explodes near the surface of the water. Live Hellfire missiles are expended.

In the typical fixed-wing event, a flight of two aircraft approach an at-sea surface target from an altitude dictated by the missile parameters. The majority of fixed-wing exercises involve the use of captive carry (inert, no release) training missiles; the aircraft perform all detection, tracking, and targeting requirements without actually releasing a missile. A MISSLEX (A-S) not involving live ordnance may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, including a major range event. Live ordnance, if employed by a strike fighter aircraft would be either a SLAM-ER or Maverick missile. A patrol aircraft may launch SLAM-ER, Maverick, or Harpoon missiles. A MISSLEX (A-S) involving fixed-wing delivery of live ordnance typically will be carried out in conjunction with a SINKEX (see Event No. 20).

17. Bombing Exercise: Air-to-Surface

BOMBEX (A-S) involve training of strike fighter and MPA in delivery of bombs against surface maritime targets in day or night conditions.

Exercises for strike fighters typically involve a flight of two aircraft delivering unguided or guided munitions that may be either live or inert. Exercises at night will normally be done with captive carry (no drop) simulated guided weapons because of safety considerations. The very large safety footprints of precision guided munitions limit their employment to events at-sea, typically in conjunction with a SINKEX. The following munitions may be employed by strike fighter in the course of the BOMBEX: Unguided munitions: MK-76 and BDU-45 (inert training bombs); MK-80 series (inert or live); MK-20 Cluster Bomb (inert or live). Precision-guided munitions: Laser-guided bombs (LGB) (inert or live); Laser-guided Training Rounds (LGTR) (inert); Joint Direct Attack Munition (JDAM) (inert or live).

MPA use bombs to attack surfaced submarines and surface craft that would not present a major threat to the MPA itself. The MPA is larger and slower than an F/A-18, so its bombing tactics differ markedly. A single MPA approaches the target at a low altitude. MPA have the capability to deliver the following unguided munitions, which may be used in the BOMBEX: BDU-45 inert bomb; MK-82 (500 Lb bomb) (inert or live); MK-20 (Rockeye cluster bomb) (inert or live); CBU-99 (cluster bomb) (inert or live). In most training exercises, it drops inert training munitions, such as the BDU-45 on a MK-58 smoke float used as the target. This exercise may involve a single aircraft (MPA), a flight of two strike fighters, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and/ or ships, including a major range event or SINKEX.

18. Gunnery Exercise: Air-to-Surface

GUNEX (A-S) involves training strike fighter aircraft or helicopters to employ guns to attack surface maritime targets in day or night. Sea targets simulate enemy ships, boats, or floating or near-surface mines. Land targets simulate enemy formations, vehicles or facilities. Exercises involving strike fighter aircraft typically involve a flight of two aircraft firing approximately 250 rounds of inert ammunition against either land (most often) or water targets. Helicopter exercises typically involve a single helicopter flying at an altitude between 50 ft to 100 ft in a racetrack pattern around an at-sea target. Several gunners will each expend about 200 rounds of .50 cal and 800 rounds of 7.62 mm ordnance in each exercise. 40mm grenades fired from hand-held weapons also may be expended. The target is normally a non-instrumented floating object such as an expendable smoke float, steel drum, or cardboard box, but may be a remote controlled speed boat or jet ski type target. Gunners will shoot special target areas or at towed targets when using a remote controlled target to avoid damaging them. The exercise lasts about 1 hour.

19. Gunnery Exercise: Surface-to-Surface, Boat

This exercises involves training of crews manning small boats to use a machine guns to attack and disable or destroy a surface target that simulates another ship, boat, floating mine or near shore land targets. A number of different types of boats are used depending on the unit using the boat and their mission. Boats are most used by Naval Special Warfare (NSW) teams and Navy Expeditionary Combat Command (NECC) units with a mission to protect ships in harbors and high value units, such as: aircraft carriers, nuclear submarines, liquid natural gas tankers, etc., while entering and leaving ports, as well as to conduct riverine operations, insertion and extractions, and various naval special warfare operations. The boats used by these units include: Small Unit River Craft (SURC), Combat Rubber Raiding Craft (CRRC), Rigid Hull Inflatable Boats (RHIB), Patrol Craft, and many other versions of these types of boats. These boats use inboard or outboard, diesel or gasoline engines with either propeller or water jet propulsion.

This exercise is usually a live fire exercise, but at times blanks may be used so that the boat crews can practice their ship handling skills for the employment of the weapons without being concerned with the safety requirements involved with live weapons. Boat crews may use high or low speeds to approach and engage targets simulating other boats, swimmers, floating mines, or near shore land targets with .50 cal, 7.62 mm, or 40 mm machine guns (about 200, 800, and 10 rounds respectively). The most common exercise target is a 50 gallon steel drum that is expended during the exercise and not recovered.

20. Gunnery Exercise: Surface-to-Surface, Ship

This exercise involves ships' gun crews engaging surface targets at sea with their main battery 5-inch and 76 mm naval guns as well as small arms (25 mm, .50 cal, or 7.62 mm machine guns). There are three types of main battery shipboard guns currently in use: 5-inch/54, 5-inch/62, and 76 mm. Both 5-inch guns use the same types of 5-inch projectiles for training exercises. The difference between the 5-inch guns is the longer range of the 5-inch/62 because of the larger powder propulsion charge. Targets employed include the QST-35 Seaborne Powered Target

(SEPTAR), High Speed Maneuverable Surface Target (HSMST), or a specially configured remote controlled water craft.

The exercise proceeds with the target boat approaching from about 10 nm distance. The target is tracked by radar, and when it is within five to nine nm, it is engaged by approximately 60 rounds of 5-inch or 76 mm, (fired with an offset so as not to actually hit the targets) over a period of about 3 hours. After impacting the water, the live rounds are expected to detonate within 3 ft of the surface. Inert rounds and fragments from the live rounds will sink to the bottom of the ocean.

This exercise may involve a single firing ship, or be undertaken in the context of a coordinated larger exercise involving multiple ships, including a major range event.

Ships use machine guns to practice defensive marksmanship, typically against stationary floating targets. The target is typically a 10-foot diameter red balloon tethered by a sea anchor, or a 50 gallon steel drum, or other available target, such as a cardboard box. Targets are expended during the exercise and are not recovered.

21. Sinking Exercise

A SINKEX is typically conducted by aircraft, surface ships, and submarines in order to take advantage of a full size ship target and an opportunity to fire live weapons.

The target is typically a decommissioned combatant or merchant ship that has been made environmentally safe for sinking. It is placed in a specific location so that when it sinks it will serve another purpose, such as a reef, or be in deep water where it will not be a navigation hazard to other shipping.

Ship, aircraft, and submarine crews typically are scheduled to attack the target with coordinated tactics and deliver live ordnance to sink the target. Inert ordnance is often used during the first stages of the event so that the target may be available for a longer time. The duration of a SINKEX is unpredictable because it ends when the target sinks, but the goal is to give all forces involved in the exercise an opportunity to deliver their live ordnance. Sometimes the target will begin to sink immediately after the first weapon impact and sometimes only after multiple impacts by a variety of weapons. Typically, the exercise lasts for 4 to 8 hours and possibly over 1 to 2 days, especially if inert ordnance, such as 5-inch gun projectiles or MK-76 dummy bombs, is used during the first hours.

A SINKEX occurs only occasionally, maybe once a year per coast, probably during a JTFEX, and is conducted under the auspices of a permit from the U.S. Environmental Protection Agency (EPA).

The participants and assets could include:

- One full-size target ship hulk
- One to five CG, DDG, or FFG firing ships
- One to 10 F/A-18, or MPA firing aircraft
- One or two HH-60H, MH-60R/S, or SH-60B Helicopters
- One E-2 aircraft for Command and Control
- One firing submarine
- One to three range clearance aircraft.
- Some or all of the following weapons could be employed:
- Two to four Harpoon surface-to-surface or air-to-surface missiles

- Two to eight air-to-surface Maverick missiles
- Two to 16 MK-82 General Purpose Bombs
- Two to four Hellfire air-to-surface missiles
- One or two SLAM-ER air-to-surface missiles
- Fifty to 500 rounds 5-inch and 76 mm gun
- One MK-48 heavyweight submarine-launched torpedo
- Two to Ten Thousand rounds .50 cal and 7.62 mm.

21. Naval Surface Fire Support

The Naval Surface Fire Support (NSFS) trains surface ships' crews to employ main battery guns in support of amphibious operations and operations by forces ashore. NSFS normally consists of the bombardment of a target within an impact area on SCI's Shore Bombardment Area (SHOBA), by one or more ships. The ship is often supported by Navy or Marine spotters ashore, or by spotters embarked in fixed-wing aircraft or helicopters in the air, to call for the fire support from the ship, and to adjust the fall of shot onto the target. Target shapes simulate vehicles, aircraft or personnel on the ground.

The ship positions itself in the NSFS area offshore of SCI about four to six nm from the target area to receive information concerning the target and the type and exact location of the target from the assigned spotter. One or more rounds are fired at the target. The fall of the round is observed by the spotter, who then tells the ship if the target was hit or if the ship needs to adjust where the next round should fall. More shots are fired, and once the rounds are falling on the target, then the spotter will request a larger number of rounds to be fired to effectively destroy the target. Typically five rounds are fired in rapid succession (about one round every five to seven seconds). Ten or more minutes will pass, and then similar missions will be conducted until the allocated number of rounds for the exercise has been expended.

About 70 rounds of 5-inch inert or high explosive ordnance (typically 53% live and 47% inert), in addition to about 5 rounds of illumination are expended during a NSFS FIREX. Portions of the exercise are conducted during both the day and the night to achieve full qualification. A ship will normally conduct three FIREXs at different levels of complexity over several months to become fully qualified.

A Shore Fire Control Party (SFCP) may consist of about 10 personnel who supply target information to the ship. From positions on the ground, the Navy, Marine, or NSW personnel who make up the SFCP provide the target coordinates at which the ship's crew directs its fire. As the rounds fall, the SFCP records where the rounds falls and provide adjustments to the fall of shot, as necessary, to ensure the target is "destroyed."

This exercise may involve a single ship, or be undertaken in the context of a coordinated larger exercise involving multiple ships, aircraft conducting BOMBEX or CAS missions in support of troops on the ground, and / or artillery located ashore on SCI including a major range event.

The locations and opportunities for live-fire from a ship at sea to targets ashore are very limited, and often the training range area is not adequate to establish and maintain surface fire support proficiency. A technology solution has been developed to precisely determine the impact of rounds fired at a simulated or virtual land area containing virtual targets located in the ocean, which enables ships to complete NSFS training in the absence of a land target or impact area. The current training system is called the VAST, which is supported by the Integrated Maritime Portable Acoustic Scoring and Simulation System (IMPASS). VAST is an onboard computer system that provides a realistic presentation, such as a land mass with topography, to the ship's systems. The scoring system is deployed by the firing ship and consists of five sonobuoys set in a pentagon-shaped arrangement at 1.3 km intervals. Within the ship’s combat system, VAST creates a virtual land mass that overlays the array and simulates land targets. The ship fires its ordnance into this target area; the sonobuoys detect the bearing to the acoustic noise resulting from the impact of a high explosive or inert round landing in the water then transmit their GPS position and their bearing information to the ship. From the impact location data collected, the VAST computer triangulates the exact point of impact of the round, and, from that data, the exercise may be conducted as if the ship were firing at an actual land target. When the training is complete, the IMPASS buoy system is recovered by the ship.

The FIREX (VAST) exercise is conducted very similarity to the FIREX (Land) exercise from the ship perspective, even though the exercise is conducted completely at sea. Approximately 5 to 70 rounds of 5-inch inert or high explosive ordnance and five rounds of illumination are expended per exercise over several hours. All exercises are conducted in daylight and outside of 12 nm from land in order to have sufficient sea space to maneuver the ship and lay out the IMPASS sonobuoy pattern.

22. Expeditionary Fires Exercise /Supporting Arms Coordination Exercise

The Expeditionary Fires Exercise (EFEX)/Supporting Arms Coordination Exercises (SACEX) is a major training exercise oriented around NSFS and Marine artillery fires in support of ground amphibious operations. The mission of the exercises is to achieve effective integration of Naval gunfire, close air support, and artillery fire support. EFEX/SACEX is typically eight days long, during which the ESG commander runs a schedule-of-operations driven exercise. NSFS ships must have completed NSFS certification (see NSFS FIREX [#21] above) prior to commencement of the exercise.

An EFEX/SACEX is the final evaluation of amphibious warfare, conventional warfare, and special operations capability and serves as the formal pre-deployment coordination exercise of the supporting arms capabilities of Expeditionary Strike Group (ESG). This exercise involves employment of live ordnance by an artillery battery (six howitzers), 81 mm mortars (eight mortars), four AH-1Ws attack helicopters, six fixed wing strike fighter or attack aircraft, two NSFS ships, and associated spotting teams, controllers, and liaison personnel. Additional support elements can include an additional artillery battery for simulated naval gunfire and additional aircraft from a carrier air wing.

23. Infantry Battalion-Sized Amphibious Landing

Battalion landing operations are proposed for SCI because the island’s challenging terrain, high plateaus, and shallow beaches provide the a superior littoral training environment, and the only range area in the U.S. inventory at which live NSFS may be coordinated with amphibious landing operations. Proposed operations would employ a Marine Air Ground Task Force of approximately 1,500 personnel including infantry, armored vehicle, logistics, command and control, and aviation personnel and their aircraft, vehicles, and other weapons systems. This exercise would last up to 4 days and occur up to two times per year. The amphibious forces would land by helicopter and across the beach by amphibious landing craft and amphibious vehicles This exercise may involve a single ship, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and/ or ships, including a major range event.

The concept of operations around which the Battalion Landing is being analyzed includes the following:

Day 1. An opposition force of one infantry company would land by helicopter at VC-3 and take up positions to defend the airfield. The company of about 140 would bivouac in the field, remaining within the Infantry Operations Area. A small reconnaissance unit (12 Marines) would land by rubber boat at Eel Cove and proceed on foot in tactical formation, across open country, not using established roadways.

Day 2. Multiple company-sized units embarked in boats, landing craft, or vehicles would land at Northwest Harbor, West Cove, Wilson Cove, and Horse Beach. These units would execute a coordinated attack on a designated objective such as VC-3, using the Infantry Operations Area as the boundary of their operation. Tanks, EFVs and other amphibious assault vehicles would remain in the AVMC. The size (width) of the AVMC is a critical factor in providing a realistic training venue for armored vehicles.

Day 3. Operations would continue across SCI in accordance with exercise objectives.

Day 4. Forces would redeploy off the island.

Aircraft would support all phases of the operation. Live-fire training operations would take place in day and night. Specific components of the amphibious landing are described below:

23A. Reconnaissance

Reconnaissance mission activities would involve about a dozen Marines inserted by helicopter on the broad uplands on SCI. Their main mission would be patrolling and reporting, and there would be no live ordnance. The mission would take about 48 hours, and virtually all activity, including insertion and extraction, would occur at nighttime.

23B. Helicopter Assault

This operation consists of the airlift of approximately 150 Marines and four Fast Attack Vehicles from amphibious ships offshore into a landing zone near the Old Airfield, VC-3. Insertion and extraction would be by helicopter with support from AH-1 attack helicopters and AV-8B Harrier jets. The operation would take about 8 hours and involve daytime or nighttime movement from VC-3 to NALF along the AVMR and practice of airfield seizure techniques. No ordnance would be used.

23C. Armored Operations

In these events, four M1 tanks (for purposes of environmental impacts, M1 category of tanks includes M1A1 tanks and other tracked vehicles), four HMMWVs, and 25 Marines would land at West Cove, offloading from two LCUs and two LCACs. The tanks would proceed to SHOBA via the AVMC, and the HMMWVs via Ridge Road. The force could be escorted by attack helicopters and fighter / attack aircraft. In SHOBA, they would conduct live-fire operations with the tanks; the impact discussion within SHOBA is detailed in the EFEX discussion. The exercise would last for 2 days and operations would occur mostly during the daytime. Under Alternative 1, such armor operations would occur three times per year.

23D. Amphibious Assault Operations

Each Amphibious Assault Operation is a Company-size event taking place on SCI, involving an Amphibious Assault Vehicles (AAV) platoon (10 to 14 AAVs) and up to 240 personnel. The AAV and associated personnel are transported to SCI by Navy amphibious shipping and come ashore at West Cove. HMMWVs and Light Armored Vehicles (LAVs) would offload from LCACs and LCUs landing at Wilson Cove. Movement of personnel and vehicles from the landing sites would occur within the AVMC and Ridge Road south to SHOBA where live firing exercises would take place. The movement of Marine force could be accompanied by four to five helicopters, AH-1s, and an UH-1. In SHOBA, AV-8Bs may provide CAS during the exercise. These operations usually take 1-2 days to complete. The groups leave the island by moving north along the AVMC and then into West Cove and Wilson Cove for reboarding onto Navy amphibious ships. Most amphibious landings would occur in daylight conditions and would be 2 days in duration.

23E. Combat Engineer Operations

Combat Engineering Operations involve demolition training with live ordnance at the Northwest Harbor demolition training area. The operation requires approximately 30 Marines to come ashore from an LCU along with three HMMWVs and one 5-ton truck. Each operation lasts 1 day.

23F. Advanced Amphibious Assault Vehicle/Expeditionary Fighting Vehicle Assault

Each AAAV/EFV Assault exercise would take approximately 3 days and would take place during both daytime and nighttime hours. Twelve AAVs (and increasingly after 2007, new EFVs) with 100 Marines would land at West Cove or Horse Beach Cove from amphibious Navy ships offshore. The EFV, when employed, would practice live firing exercises onshore and in nearshore waters off SHOBA. AAV/EFVs would move inland along the AVMR to the VC-3 where an assault would be conducted on an objective. Offshore access to SHOBA would be provided at Horse Beach Cove. EFV vehicles would traverse SHOBA via transit routes to be established on a portion of the AVMC to be developed along previously used tank trail parallel to the Ridge Road and a route to Horse Beach Cove that would run parallel to and in places be co-located with the China Point Road, ultimately diverging eastward from the China Point Road down an existing unpaved road to Horse Beach Cove. Development of these routes would be addressed under a separate environmental review.

23G. Expeditionary Fighting Vehicle Company Assault

This exercise would involve landing a company of 46 EFVs with 225-300 Marines at West Cove or Horse Beach Cove, practicing land maneuvers through the AVMC to the vicinity of VC-3, where Marines would dismount and targets would be assaulted using blanks and smoke charges. The operation would involve live-fire on land within SHOBA including the EFV’s 30 mm gun, 7.62 mm machine gun and small arms and would involve land-based live-fire and sea to land firing from the nearshore waters into SHOBA Impact Areas I and II. This assault would take place twice a year and would be a 1-day operation; activities would take place almost exclusively during the daytime.

23H. Assault Amphibian School

This operation would take place when the EFV becomes available (about 2009). Each operation would involve 5-6 EFVs and 50 USMC students plus instructors. The EFVs would be dropped off by LCACs about 2 nm (4 km) from shore near West Cove or Horse Beach Cove. The operation involves maneuvering and practice firing of the turret mounted machine gun and cannon on land in SHOBA and into SHOBA from the nearshore waters. There would be 3-5 days of live-fire and firing could take place during day or night. There would be travel and maneuvering via the AVMC, including AVMAs and AMP D to VC-3 for parking or bivouac. Because this is not a tactical operation, the vehicles could be parked in an administrative manner with instructor supervision.

24. Stinger Missile Firing

The Stinger missile is a portable, shoulder fired weapon that also may be mounted on and fired from a vehicle. Stinger firing has occurred in the past; however not for several years. Proposed stinger training would be conducted from positions on-shore in SHOBA, toward the ocean, not over land, at target drones, either Ballistic Aerial Targets (BATs) or Remotely Piloted Vehicles (RPVs). The BAT is a solid-rocket, ground-launched glider target that is destroyed upon impact with the water and is not recovered. The RPV is a small, gasoline-powered aircraft and is remote controlled. The RPV can be used repeatedly, if not damaged by the missile. RPVs would land in SHOBA after the firing exercise. Training would occur predominantly in the daytime.

25. Amphibious Landings and Raids by Small Units

SCI supports training of small units of Marines or NSW personnel in the conduct of amphibious operations using small boats, amphibious craft or assault amphibian vehicles. Training includes both live-fire and non-live-fire events, including reconnaissance missions, raids, tactical recovery of aircraft and personnel (TRAP) exercises, assault amphibian vehicle landing events. These events typically involve units of from 12 to 40 personnel, and may be conducted across beaches at Wilson Cove, Horse Beach Cove, Northwest Harbor, and Eel Point, and in any of various training areas designated on SCI.

Amphibious Operations-Camp Pendleton Amphibious Assault Area

The ocean area adjacent to Camp Pendleton is designated as the CPAAA. This area is utilized extensively for amphibious training by units of the 1st Marine Expeditionary Force, 1st Marine Division, and 1st Marine Logistics Group. Training events conducted by these operating forces in this area include: reconnaissance unit training, small boat unit training, assault amphibian vehicle crew and unit training, and Marine Expeditionary Unit (Special Operations Capable) events, and ESG training. Initial training to qualify marines to operate amphibian vehicles is conducted by the Assault Amphibian School Battalion in the CPAAA. Naval Beach Groups, which operate Landing Craft, Air Cushioned (LCAC) vehicles utilize the CPAAA for training. The Amphibian Vehicle Test Branch conducts RDT&E of vehicles including EFVs in the CPAAA. Events conducted in the CPAAA include:

- amphibious demonstrations
- amphibious raids
- amphibious assaults
- amphibious withdrawals
- basic amphibious training
- amphibious support training
- parachute operations
- submarine operations (wet deck/dry deck)
- diving operations
- scout swimmer training
- Tactical Recovery of Aircraft and Personnel (TRAP)

27. Electronic Combat Operations

These events train aircraft, surface ship, and submarine crews to control critical portions of the electromagnetic spectrum used by threat radars, communications equipment, and electronic detection equipment. EC operations can be active or passive, offensive or defensive.

Active EC uses radio frequency (RF) transmissions in the 2-12 gigahertz frequency spectrum to conduct jamming of threat equipment and deception through generation of false targets.

Passive EC uses the enemy’s electromagnetic transmissions to obtain intelligence about their operations and to recognize and categorize enemy threats.

Offensive EC uses active or passive installed EC systems against enemy search, EC, and weapons systems.

Defensive EC uses active or passive installed EC systems in reaction to enemy threat systems. Missile, gun or search radar signals are common threat signals that can initiate an automatic response, including dispersion of chaff (very thin metal strips) and flares as decoys.

Navy units can conduct EC training in stand-alone events, involving few aircraft, or single ships or submarines, however EC operations typically are conducted in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event.

28 / 29. Mine Countermeasures Training

Mine Countermeasures (MCM) consists of mine avoidance training (#28) and mine neutralization training (#29). These events trains surface ships and aircraft to detect and either avoid or neutralize mines. Training utilizes simulated minefields constructed of moored or bottom mines, or instrumented mines that can record effectiveness of mine detection efforts. Mine or small object avoidance training for surface ships involves use of mid-frequency active sonar systems to detect mines. Submarines also have the capability to detect mines utilizing organic sonar; however, use of active sonar is tactically proscribed for submarines as it allows detection. Therefore, MCM training is primarily conducted by surface ships. Ship or submarine-mounted MFAS systems employed are:

- AN/SQS-53
- AN/SQS-56
- AN/SQQ-32
- AN/BQQ-5 or 10

Helicopters engage in airborne MCM training, utilizing specialized equipment including:

- AN/AQS-20 Mine Hunting System (employing side-looking sonar)
- AN/AES-1 Airborne Laser Mine Detection System
- AN/ALQ-220 Organic Airborne Surface Influence Sweep

MCM exercises typically last one or two hours for surface ships and helicopters, and may last up to 15 hours for specially configured MCM ships. Navy units typically conduct MCM training in stand-alone events, involving few aircraft, or single ships or submarines, however MCM training may occur in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event.

30. Mine Laying

Fixed-winged aircraft and submarines lay offensive or defensive mines to create a tactical advantage for friendly forces. Offensive mines prevent enemy shipping from leaving an enemy port or area, or supplies from entering an enemy port or area. Defensive mines protect friendly forces and facilities by preventing enemy forces from entering the friendly port or area.

At the basic level of training, fixed winged aircraft use precise navigation to lay a minefield pattern for a specific tactical situation. A flight of two strike fighter aircraft or a single MPA attempt to fly undetected to the area where the mines will be laid and use either a low or high altitude tactic to lay the mines. The aircrew typically drops a series of four inert training shapes (MK-76, BDU-45, or BDU-48), making multiple passes in the same flight pattern, and dropping one or more shapes each time. The shapes are scored for accuracy as they enter the water, and the aircrew is later debriefed on their performance. Advanced training scenarios involve multiple aircraft to evaluate the ability of an entire squadron to plan, load, and execute a mine-laying mission. The aircraft drop their shapes in a pre-determined pattern and return to the carrier or base. Since the final location of each mine shape is of tactical importance, the drops are scored and the shapes are recovered.

Submarine mine laying operations are typically "virtual" with no expenditure of any mine shape or any range requirements.

31. Land Demolitions

NSW or EOD personnel train in use of explosive charges to destroy land mines, explosives such as improvised explosive devices, unexploded ordnance, structures, or other items as required. The size of an explosive charge is defined in terms of net explosive weight (NEW). Charge sizes typically employed range from 1 to 20 pounds NEW.

32 / 33. Underwater Demolitions

NSW or EOD personnel use small explosive charges to destroy obstacles or other structures in an underwater area that could cause interference with friendly or neutral forces and planned operations. Underwater demolitions training involves either a single charge (#32) or multiple charges laid in a pattern. In atypical training scenario, NSW or EOD personnel locate barriers or obstacles designed to block amphibious vehicle access to beach areas, then use small explosive charges to destroy them. These training events typically use less than five pounds NEW of explosives which are detonated near the shoreline in water less than 21 ft deep.

34. Small Arms Training

Navy personnel training in the use small arms and small unit tactics to defend unit positions or attack simulated enemy positions. Small arms training exercises may include use of 9 mm pistols, 12-gauge shotguns, 5.56 mm automatic rifles, .50 caliber, 7.62 mm, 5.56 mm machine guns, and 40 mm grenades. Training involving live-fire of small arms may be conducted on marksmanship training ranges with fixed firing points and fixed targets, or may occur in free-play training events with firing positions dictated by the training scenario and use of mobile or pop-up targets. While small arms training events typically occur on designated ranges ashore on SCI, training of personnel also is conducted aboard surface ships at sea firing into the sea.

35. Land Navigation

Training in land navigation is conducted on SCI by individuals and small units on foot utilizing maps, compasses, and other navigation aids on established courses.

36. Unmanned Aerial Vehicle Operations

Unmanned Aerial Vehicles (UAV) obtain information about the activities of an enemy or potential enemy or tactical area of operations by use of various onboard surveillance systems including: visual, aural, electronic, photographic, or other means. There are currently numerous types of UAVs employed to obtain intelligence data on threats. UAVs are typically flown at altitudes well above 3,000 ft in patterns to best collect the required data, yet remain beyond the reach threat weapon systems. The UAVs may be controlled by a pilot at a remote location, just as if the pilot were onboard, or may fly a preplanned, preprogrammed route from start to finish. Missions will typically last four to six hours, but will vary depending on the scheduled mission training. Training occurs in restricted airspace on and above SCI.

37. Naval Special Warfare Insertion / Extraction

NSW and other personnel train to approach or depart an objective area using various transportation methods and tactics. These operations train forces to insert and extract personnel and equipment day or night. Tactics and techniques employed include insertion from aircraft by parachute, by rope, or from low, slow-flying helicopters from which personnel jump into the water. Parachute training is required to be conducted on surveyed drop zones to enhance safety. Insertion and extraction methods also employ submarine deliver of personnel into the water, and small inflatable boats.

Insertion and extraction training typically is conducted in the context of additional related exercises, and such as direct action training of NSW personnel, live-fire small arms training, and NSFS spotter training.

38. Naval Special Warfare Boat Operations

NSW personnel assigned to Special Boat Units conduct training in open ocean and littoral operations, including in the vicinity of SCI. Training events include firing of crew-served machine guns and hand held weapons into land impact areas of SHOBA.

39. Naval Special Warfare Sea, Air, Land Platoon Operations

NSW SEAL platoons perform special operations using tactics that are applicable to the specific tactical situations where the NSW personnel are employed. They are specially trained, equipped, and organized to conduct special operations in maritime, littoral, and riverine environments. SCI is a principal training venue for SEAL platoons and other NSW personnel. NSW training is continually evolving to meet the tactical requirements and special weapons required to complete the mission assigned. NSW personnel train to move covertly or overtly, by sea, air, or land, to an area of operation as the tactical situation demands and perform those tasks required to capture a site, destroy a target, rescue personnel, or perform a multitude of operations against hostile forces, using weapons required by the tactical situation. Opposing forces and targets within training range areas are utilized for realism. Typically, NSW personnel employ a variety of live fire or blank small arms and explosive ordnance in the course of training. SEAL platoon training may be conducted in isolation, or may occur in the context of larger-scale events and exercises, including major range events.

40. Direct Action

Direct action training is a specialized NSW event involving a squad or platoon size force of personnel inserted into and later extracted from a hostile area by helicopter, small boat or other means to conduct live-fire offensive actions against simulated hostile forces or targets. These offensive actions can include: raids, ambushes, standoff attacks, designating or illuminating targets for precision-guided munitions, providing support for cover and deception operations, and sabotage. Small arms such as 7.62 mm, 5.56 mm, 9 mm, 12-gauge, 40 mm grenades, laser illuminators, and other squad or platoon weapons are typically employed.

41. Bombing Exercise (Air-to-Ground)

Bombing Exercise Air-to-Ground (BOMBEX [A-G]) involves training of strike fighter aircraft or helicopter delivery of ordnance against land targets in day or night conditions. The BOMBEX may involve Close Air Support (CAS) training in direct support of and in close proximity to forces on the ground, such as NSW or marine forces engaged in training exercises on SCI.

For strike fighter aircraft, in a typical exercise at the basic level, a flight of two aircraft will approach the target from an altitude of between 15,000 ft to less than 3,000 ft and, when on an established range, will usually establish a racetrack pattern around the target. The pattern is established in a predetermined horizontal and vertical position relative to the target to ensure that all participating aircraft follow the same flight path during their target ingress, ordnance delivery, target egress, and “downwind” profiles. This type of pattern is designed to ensure that only one aircraft will be releasing ordnance at any given time. The typical bomb release altitude is below 3,000 ft and within a range of 1,000 yards for unguided munitions; above 15,000 ft and may be in excess of 10 nm for precision-guided munitions. Exercises at night will normally be done with captive carry (no drop) weapons because of safety considerations. Laser designators from the aircraft dropping the bomb, a support aircraft, or ground support personnel are used to illuminate certified targets for use with lasers when using laser guided weapons.

Advanced-level training events for strike fighters typically involve a flight of four or more aircraft, with or without a designated opposition force. Participating aircraft attack the target using tactics which may require that several aircraft approach the target and deliver their ordnance simultaneously from different altitudes and/or directions. An E-2 aircraft is typically involved in this exercise from a command and control perspective, and an EA-18G aircraft may provide electronic combat support in major range events.

The following munitions may be employed by strike fighters in the course of the BOMBEX: Unguided munitions: MK-76 and BDU-45 (inert training bombs); MK-80 series (inert or live); MK-20 Cluster Bomb (inert or live). Precision-guided munitions: Laser-guided bombs (LGB) (inert or live); Laser-guided Training Rounds (LGTR) (inert); Joint Direct Attack Munition (JDAM) (inert or live). Rockets: 5-inch Zuni rockets.

Helicopter training involves one or two helicopters approaching an assigned target. The target is attacked with guns, Zuni rockets, or a Hellfire missile. A laser is used to guide a Hellfire missile to the target. The laser designator is either the one of the attacking aircraft or a designator team (typically NSW or Marine forces) on the ground. The helicopter launches one live missile per exercise from an altitude of about 300 ft while in forward flight or in a hover, against a specially prepared target. The target can be a stationary target or a remote controlled vehicle whose infrared signature has been augmented with a heat source to better represent a typical threat vehicle.

42. Combat Search and Rescue

CSAR training involves fixed-winged aircraft, helicopters and / or submarines using tactical procedures to rescue military personnel within a hostile area of operation. In a helicopter training scenario, helicopters fly below 3,000 ft the target area. Machine guns (7.62 mm or 5.56 mm) are mounted in the side door, and blank ammunition is normally used in this exercise. Chaff and flares may be expended if a surface-to-air or air-to-air threat or opposing force is employed to provide additional complexity. NSW personnel may be embarked during this exercise to act as the rescue party. This NSW squad would debark from the helicopter, "rescue" the personnel to be recovered, and return to the helicopter to be removed from the area. This basic exercise would last about one and a half hours. More advanced training would involve command and control aircraft and strike fighter aircraft in a role as a combat air patrol. In a submarine training scenario, the submarine proceeds to a specified location near land, locates the persons to be rescued, and surfaces to embark them. This exercise may involve a single helicopter or submarine, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and/ or ships, including a major range event.

43. Explosive Ordnance Disposal

Explosive Ordnance Disposal (EOD) personnel train to gain and maintain qualification and proficiency in locating, neutralizing or destroying unexploded ordnance (UXO) and conducting other hazardous range clearance activities. Removal of UXO is important for personnel safety and environmental sustainability of ranges. Operations are conducted in impact areas on SCI. These EOD activities are similar in nature to the activities described under the heading Land Demolition (# 31), the difference being that EOD range clearance actions are not undertaken in a tactical training environment, but are administrative in nature.

44. Coast Guard Training

Coast Guard Sector San Diego is a command within the Coast Guard 11th District. The Sector San Diego Area Of Responsibility (AOR) extends from the border with Mexico north to Dana Point. Coast Guard personnel regularly train in maritime rescue and patrol activities in the SOCAL Range Complex, using a variety of boats, small ships, and helicopters.

45. Naval Auxiliary Landing Field

The NALF on SCI supports aviation events, including training and logistics activities. The primary training activity conducted at the NALF is Field Carrier Landing Practice (FCLP), which are characterized by touch-and-go practice in day and night conditions on a simulated aircraft carrier outline marked on the landing field. NALF also supports regular resupply and personnel transport aircraft runs between SCI and mainland bases.

46. Ship Torpedo Tests

This is a test event for reliability, maintainability, and performance of EXTORPS and REXTORPS. Events include torpedo firing.

47. Unmanned Underwater Vehicle Tests

These are in-water events for the development and operational testing of advanced designs of underwater vehicles, conducted in the vicinity of NOTS Pier.

48. Sonobuoy Quality Assurance and Quality Control Tests

This testing event evaluates random lots of sonobuoys and determine the quality of the set. The sonobuoys are dropped from an aircraft into the SCIUR area east of SCI. Defective buoys are recovered. All non-defective buoys are scuttled.

49. Ocean Engineering

Ocean engineering tests determine the characteristics, reliability, maintainability and endurance of various pieces of marine design. The items to be tested are left in the water off NOTS Pier for an extended period, and are monitored by Navy personnel.

50. Marine Mammal Mine Shape Location / Research

In this series of events, trained marine mammals are taught to locate and mark inert mine shapes. The marine mammals, most of which are porpoises, are penned and cared for at Naval Base Point Loma, and transported to SCI for mine location and applied research.

51. Missile Flight Tests

Missile flight test events confirm performance, reliability, maintainability and suitability for operational use of various missiles in the Navy inventory. Tests involve launches from operational ships and aircraft from within either the Point Mugu Sea Range or the SOCAL Range Complex against airborne targets in W-291, or land targets in the Missile Impact Range on SCI

52. Underwater Acoustic Sensor Tests

These tests are conducted to evaluate the accuracy of several acoustic and nonacoustic ship sensors. Tests occur at SCIUR.

53. Other Tests

The SOCAL Range Complex supports diverse tests including surface warfare tests against fast-moving, small boats, mine countermeasures, naval gunfire, electronic combat and combat systems verification. Testing is conducted primarily in the waters west of SCI.

1-42. Integrated Training and Major Range Events

A major range event is comprised of several "unit level" range operations conducted by several units operating together while commanded and controlled by a single commander. These exercises typically employ an exercise scenario developed to train and evaluate the Strike Group / Force in required naval tactical tasks. In a major range event, most of the operations and activities being directed and coordinated by the Strike Group commander are identical in nature to the operations conducted in the course in individual, crew, and smaller-unit training events. In a major range event, however, these disparate training tasks are conducted in concert, rather than in isolation.

Major range events include:

- Composite Training Unit Exercise (COMPTUEX). The COMPTUEX is an Integration Phase, at-sea, major range event. For the CSG, this exercise integrates the aircraft carrier and carrier air wing with surface and submarine units in a challenging operational environment. For the ESG, this exercise integrates amphibious ships with their associated air wing, surface ships, submarines, and MEU. Live-fire operations that may take place during COMPTUEX include long-range air strikes, Naval Surface Fire Support (NSFS), and surface-to-air, surface-to-surface, and air-to-surface missile exercises. The MEU also conducts realistic training based on anticipated operational requirements and to further develop the required coordination between Navy and Marine Corps forces. Special Operations training may also be integrated with the exercise scenario. The COMPTUEX is typically 21 days in length. The exercise is conducted in accordance with a schedule of events, which may include two 1-day, scenario-driven, “mini” battle problems, culminating with a scenario-driven 3-day Final Battle Problem. COMPTUEX occurs three to four times per year.

- JTFEX. The JTFEX is a dynamic and complex major range event that is the culminating exercise in the Sustainment Phase training for the CSGs and ESGs. For an ESG, the exercise incorporates an Amphibious Ready Group (ARG) Certification Exercise (ARG CERT) for the amphibious ships and a Special Operations Capable Certification (SOCCERT) for the MEU. When schedules align, the JTFEX may be conducted concurrently for an ESG and CSG. JTFEX emphasizes mission planning and effective execution by all primary and support warfare commanders, including command and control, surveillance, intelligence, logistics support, and the integration of tactical fires. JTFEXs are complex scenario-driven exercises that evaluate a strike group in all warfare areas. JTFEX is normally 10 days long, not including a 3-day in-port Force Protection Exercise, and is the final at-sea exercise for the CSG or ESG prior to deployment. JTFEX occurs three to four times per year.

Integrated unit-level training events, which pursue tailored training objectives for components of a Strike Group, are complex exercises of lesser scope than Major Range Events. This type of training includes:

- Ship ASW Readiness and Evaluation Measuring (SHAREM). SHAREM is a Chief of Naval Operations (CNO) chartered program with the overall objective to collect and analyze high-quality data to quantitatively "assess" surface ship ASW readiness and effectiveness. The SHAREM will typically involve multiple ships, submarines, and aircraft in several coordinated events over a period of a week or less. A SHAREM may take place once per year in SOCAL.
- Sustainment Exercise. Included in the FRTP is a requirement to conduct post-deployment training, and maintenance. This ensures that the components of a Strike Group maintain an acceptable level of readiness after returning from deployment. A sustainment exercise is an exercise designed to challenge the strike group in all warfare areas. This exercise is similar to a COMPTUEX but of shorter duration. One to two sustainment exercises may occur each year in SOCAL.
- Integrated ASW Course (IAC) Phase II. IAC exercises are combined aircraft and surface ship events. The IAC Phase II consists of two 12-hour events conducted primarily on SOAR over a 2-day period. The typical participants include four helicopters, two P-3 aircraft, two adversary submarines, and two Mk 30 or Mk 39 targets. Frequently, IACs include the introduction of an off-range Mk 30 target. Four IAC Phase II exercises may occur per year.

Acoustic Sources

Various active acoustic sources that may or may not affect the local marine mammal population are deployed by platforms during various training exercises, maintenance events, and RDT&E activities. The following sections discuss the acoustic sources that would be present during such training exercises, maintenance events, and RDT&E activities.

Surface Ship Sonars

- AN/SQS-53 – a computer-controlled, hull-mounted surface-ship sonar that has both active and passive operating capabilities, providing precise information for anti-submarine warfare (ASW) weapons control and guidance. The system is designed to perform direct-path ASW search, detection, localization, and tracking from a hull-mounted transducer array. The AN/SQS-53 (Figure C-1) is characterized as a mid-frequency active (MFA) sonar, operating from 1 to 10 kilohertz (kHz); however, the exact frequency is classified. The AN/SQS-53 sonar is the major component to the AN/SQQ-89 sonar suite, and it is installed on Arleigh Burke Class guided missile destroyers (DDGs), and Ticonderoga Class guided missile cruisers (CGs).

Figure C-1. Arleigh Burke Class DDG equipped with AN/SQS-53 (L); Ticonderoga Class CG showing AN/SQS-53 (R)

- AN/SQS-53 Kingfisher – a modification to the AN/SQS-53 sonar system that provides the surface ship with an object detection capability. The system uses MFA sonar, although the exact frequency range is classified. This sonar system is installed on Arleigh Burke Class DDGs, and Ticonderoga Class CGs.

- AN/SQS-56 – a hull-mounted sonar that features digital implementation, system control by a built-in mini computer, and an advanced display system. The sonar is an active/passive, preformed beam, digital sonar providing panoramic active echo ranging and passive digital multibeam steering (DIMUS) surveillance. The sonar system is characterized as MFA sonar, although the exact frequency range is classified. The AN/SQS-56 (Figure C-2) is the major component of the AN/SQQ-89 sonar suite and is installed on Oliver Hazard Perry Class frigates (FFGs).

Figure C-2. Oliver Hazard Perry Class FFG equipped with AN/SQS-56

- AN/SQR-19 – a tactical towed array sonar (TACTAS) that is able to passively detect adversary submarines at a very long range. The AN/SQR-19, which is a component of the AN/SQQ-89 sonar suite, is a series of passive hydrophones towed from a cable several thousand feet behind the ship. This sonar system is a passive sensing device; therefore, it is not analyzed in this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS). The AN/SQR-19 (Figure C-3) can be deployed by Arleigh Burke Class DDGs, Ticonderoga Class CGs, and Oliver Hazard Perry Class FFGs.

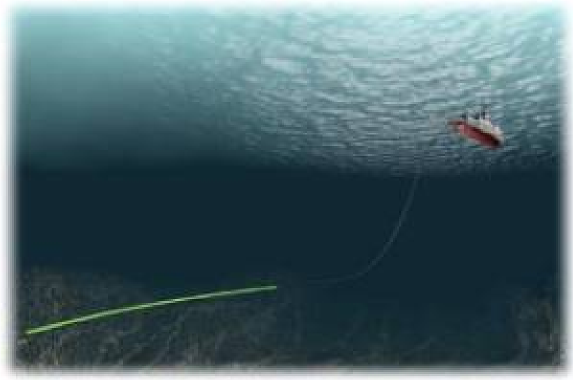

Figure C-3. AN/SQR-19

Surface Ship Fathometer

The surface ship fathometer (AN/UQN-4) is used to measure the depth of water from the ship's keel to the ocean floor for safe operational navigation. Fathometers are operated from all classes of United States (U.S.) Navy surface ships and are considered MFA sonar, although the exact frequency range is classified.

Submarine Sonars

- AN/BQQ-5 **–** a bow- and hull-mounted passive and active search and attack sonar system. The system includes the TB-16 and TB-23 or TB-29 towed arrays and Combat Control System (CCS) MK 2. This sonar system is characterized as MFA, although the exact frequency range is classified. The AN/BQQ-5 (Figure C-4) sonar system is installed on Los Angeles Class nuclear attack submarines (SSNs) and Ohio Class ballistic missile nuclear submarines (SSBNs), although the AN/BQQ-5 systems installed on Ohio Class SSBNs do not have an active sonar capability. The AN/BQQ-5 system is being phased out on all submarines in favor of the AN/BQQ-10 sonar. The operating parameters of both systems with regard to sound output in the ocean are almost identical. For these reasons, these systems will be referred to as AN/BQQ-10 in this EIS.

Figure C-4. AN/BQQ-5

- AN/BQQ-10 (also known as Advanced Rapid Commercial-Off-the-Shelf Insertion [ARCI]) – a four-phase program for transforming existing submarine sonar systems (i.e., AN/BQQ-5) from legacy systems to more capable and flexible active and passive systems with enhanced processing using commercial-off-the-shelf (COTS) components. The system is characterized as MFA, although the exact frequency range is classified. The AN/BQQ-10 (Figure C-5) is installed on Seawolf Class SSNs, Virginia Class SSNs, Los Angeles Class SSNs, and Ohio

Class SSBN/nuclear guided missile submarines (SSGNs). The BQQ-10 systems installed on Ohio Class SSBNs do not have an active sonar capability.

Figure C-5. Sailors operating AN/BQQ-10

Submarine Fathometer

A submarine fathometer (AN/BQN-17, AN/UQN-4) is used to measure the depth of water from the submarine's keel to the ocean floor for safe operational navigation. All U.S. Navy submarines operate fathometers, which operate at MFA, although the exact frequency range is classified.

Submarine Auxiliary Sonar Systems

- TB-16, TB-23, TB-29, and TB-33 – passive acoustic sensor arrays, which are towed behind a submarine on a cable 732 meters (m) (2,400 feet [ft]) long, 0.94 centimeters (cm) (0.37 inches [in]) in diameter, weighing 204 kilograms (kg) (450 pounds [lbs]) (Figure C-6). The actual arrays vary in length from several hundred to several thousand feet long, depending on the type. These arrays are not analyzed in the EIS/OEIS because they are not active sensing devices. All submarines can deploy two towed arrays, the TB-16 and either the TB-23, TB-29, or the new TB-33. While submerged, a submarine usually has the TB-16 towed array deployed.

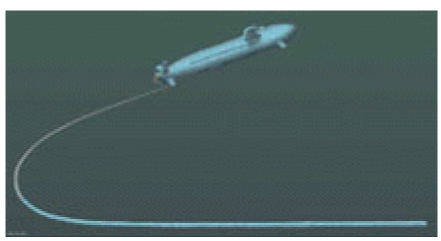

Figure C-6. Submarine Towed Array

- AN/BQS-15 – an under-ice navigation and mine-hunting sonar (Figure C-7) that uses both mid- and high-frequency (i.e., greater than 10 kHz) active sonar, although the exact frequencies are classified. Later versions of the AN/BQS-15 are also referred to as Submarine Active Detection Sonar (SADS). The Advanced Mine Detection System (AMDS) is being phased in on all ships and will eventually replace the AN/BQS-15 and SADS. These systems are installed on Seawolf Class SSNs, Virginia Class SSNs, Los Angeles Class SSNs, and Ohio Class SSGNs.

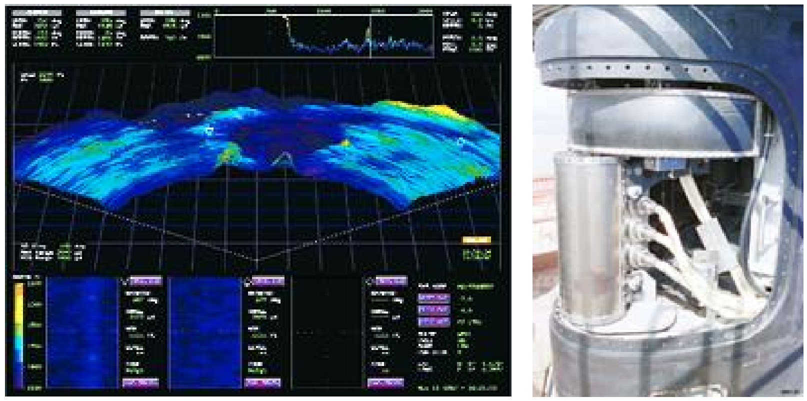

Figure C-7. AN/BQS-15 display (L), and sensor components (R)

- AN/WQC-2 – an MFA sonar underwater communications system that can transmit either voice or signal data in two bands, 1.5 to 3.1 kHz or 8.3 to 11.1 kHz. The AN/WQC-2 (Figure C-8), also referred to as the “underwater telephone” (UWT), is on all submarines and most surface ships, and allows voice and tonal communications between ships and submarines.

Figure C-8. AN/WQC-2 transducer (L), and control unit (R)

Aircraft Sonar Systems

Aircraft sonar systems that could be deployed during active sonar events include sonobuoys (tonal [active], listening [passive], and extended echo ranging [EER] or improved extended echo ranging [IEER]) and dipping sonar (AN/AQS-13/22 or AN/AOS-22). Sonobuoys may be deployed by Marine Patrol Aircraft (MPA) or MH-60R helicopters. A sonobuoy is an expendable device used by aircraft for the detection of underwater acoustic energy and for conducting vertical water column temperature measurements. Most sonobuoys are passive, but some can generate active acoustic signals as well as listen passively. Dipping sonars are used by MH-60R helicopters. Dipping sonar is an active or passive sonar device lowered on cable by helicopters to detect or maintain contact with underwater targets. A description of various types of sonobuoys and dipping sonar is provided below.

- AN/AQS-13 Helicopter Dipping Sonar – an active scanning sonar that detects and maintains contact with underwater targets through a transducer lowered into the water from a hovering helicopter. It operates at mid-frequency, although the exact frequency is classified. The AN/AQS-13 (Figure C-9) is operated by MH-60R helicopters.

Figure C-9. AN/AQS-13 being deployed by SH-60 helicopter

- AN/AQS-22 Airborne Low-Frequency Sonar (ALFS) – the U.S. Navy's dipping sonar system for the MH-60R helicopter Light Airborne Multi-Purpose System III (LAMPS III), which is deployed from aircraft carriers, cruisers, destroyers, and frigates. It operates at mid-frequency, although the exact frequency is classified. The AN/AQS-22 (Figure C-10) employs both deep- and shallow-water capabilities.

Figure C-10. AN/AQS-22 being deployed by SH-60 helicopter

- AN/SSQ-62C Directional Command Activated Sonobuoy System (DICASS) – sonobuoy that operates under direct command from ASW fixed-wing aircraft or MH-60R helicopters (Figure C-11). The system can determine the range and bearing of the target relative to the sonobuoys position and can deploy to various depths within the water column. The active sonar operates at mid-frequency, although the exact frequency range is classified. After water entry, the sonobuoy transmits sonar pulses (continuous waveform [CW] or linear frequency modulation [LFM]) upon command from the aircraft. The echoes from the active sonar signal are processed in the buoy and transmitted to the receiving station onboard the launching aircraft.

Figure C-11. AN/SQS-62 (L); MPA equipped with AN/SQS-62 sonobuoys (R)

- AN/SSQ-110A Explosive Source Sonobuoy – a commandable, air-dropped, high source level explosive sonobuoy. The AN/SSQ-110A explosive source sonobuoy (Figure C-12) is composed of two sections, an active (explosive) section and a passive section. The upper section is called the "control buoy" and is similar to the upper electronics package of the AN/SSQ-62 DICASS sonobuoy. The lower section consists of two signal underwater sound (SUS) explosive payloads of Class A explosive weighing 1.9 kg (4.2 lbs) each. The arming and firing mechanism is hydrostatically armed and detonated. Once in the water, the SUS charges explode, creating a loud acoustic signal. The echoes from the explosive charge are then analyzed on the aircraft to determine a submarine's position. The AN/SSQ-110A explosive source sonobuoy is deployed by MPA.

Figure C-12. MPA deploying AN/SSQ-110A

- AN/SSQ-53D/E Directional Frequency Analysis and Recording (DIFAR) – a passive sonobuoy deployed by MPA aircraft and MH-60R helicopters. The DIFAR sonobuoy (Figure C-13) provides acoustic signature data and bearing of the target of interest to the monitoring unit(s) and can be used for search, detection, and classification. The buoy uses a hydrophone with directional detection capabilities in the very low frequency, low frequency, and mid-frequency ranges, as well as an omnidirectional hydrophone for general listening purposes.

Figure C-13. AN/SSQ-53 (L); AN/SSQ-53 being loaded onto MPA (R)

Mine-Hunting Sonar Systems

Mine-hunting sonars are used to detect, locate, and characterize mine-like objects under various environmental conditions, including those suspended in the water (i.e., moored mines), mines on the ocean floor (i.e., proud mines), and mines buried under the ocean floor. In addition, the majority of the sonar sensors used can be deployed by more then one platform (i.e., towed body from a helicopter, unmanned underwater vehicles [UUVs], surf zone crawler, or surface ship) and may be interchangeable within the sensor package. Types of mine-hunting sonar systems are described below.

- AN/AQS-14 – an active-controlled, helicopter-towed mine-hunting active sonar (Figure C-14). It is a multibeam, side-looking sonar with electronic beam forming, all-range focusing, and an adaptive processor. The high frequency (HF) sonar system's exact frequency is classified. The system consists of three parts: a stabilized underwater vehicle, electromechanical tow cable, and airborne electronic console. The underwater vehicle is 3.3 m (10.7 ft) long and can be maintained at a fixed depth above the sea floor. It is towed by MH-60 helicopters. This system was not analyzed in this document, due to the fact that it operates above 200 kHz.

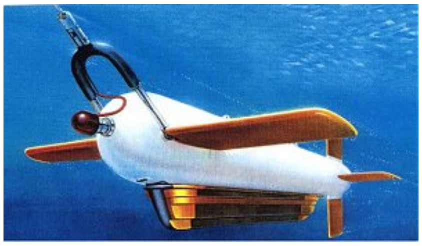

Figure C-14. AN/AQS-14

- AN/AQS-24 – the upgraded version of AN/AQS-14, including digital electronics, smaller avionics, higher resolution (image clarity), and the optional addition of a laser line scanner for target identification. The HF side-looking sonar is towed by MH-53 helicopters (Figure C-15), but the exact frequency range is classified. This system was not analyzed in this document, due to the fact that it operates above 200 kHz.

Figure C-15. AN/AQS-24

- AN/BLQ-11 Long Term Mine Reconnaissance System (LMRS) – a UUV (Figure C-16) that, when in operation, can be launched and recovered through the torpedo tubes by all classes of submarines. It can be equipped with MFA sonar for mine detection and is intended to extend the submarine's reach for mine reconnaissance missions, although the exact frequency is classified.

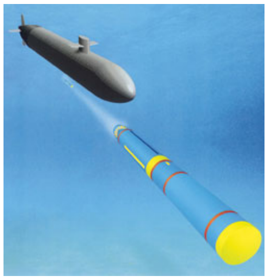

Figure C-16. AN/BLQ-11

- AN/SQQ-32 – a variable-depth mine detection and classification HF active sonar (Figure C-17), although the system's exact frequency range is classified. The AN/SQQ-32 became the standard sonar for the Avenger Class mine countermeasures (MCM), replacing the AN/SQQ-30. The AN/SQQ-32 displays search and classification information simultaneously and independently, using separate search and classification transducers in a stable, variable-depth body. The AN/SQQ-32 can also be used from the vessel's hull in shallow water.

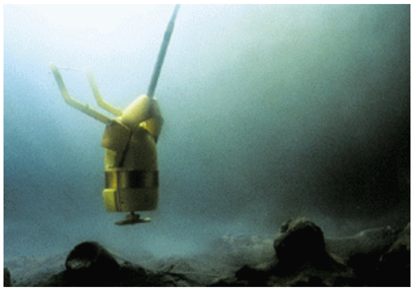

Figure C-17. AN/SQQ-32

- AN/AQS-20A-FLS/VSS/SLS/GFS – a high-frequency active towed sonar system composed of five independent sonar sensors intended to detect and identify deeper moored mines and visible bottom mines (Figure C-18). The exact frequency range of this system is classified. It consists of a state-of-the-art, side-looking, multibeam active sonar system that delivers real-time high-resolution imagery of the ocean bottom. The AN/AQS-20 is towed by MH-53, H-60 helicopters and RMS. This system was not analyzed in this document, due to the fact that it operates above 200 kHz.

Figure C-18. AN/AQS-20

- AN/SLQ-48 – a system (Figure C-19) that uses a remote-controlled submersible vehicle to identify underwater objects and, if they are mines, render them safe. The operating frequency of the AN/SLQ-48 is classified. The prime feature is the 1,225-kg (2,700-lb), tethered, video and sonar-equipped mine neutralization vehicle (MNV), which places an explosive destructive charge on bottom mines and cuts the cables of moored mines. The AN/SLQ-48 is best suited to deep water and is deployed by Avenger Class MCMs. This system was not analyzed in this document, due to the fact that it operates above 200 kHz.

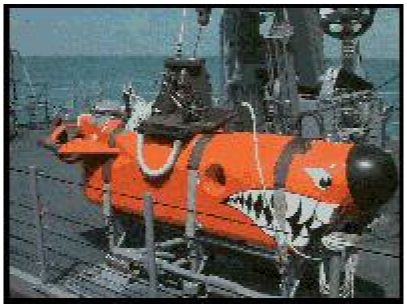

Figure C-19. AN/SLQ-48

- AN/SLQ-37 – installed on Avenger Class MCMs and consists of a straight tail magnetic sweep (M MK 5A) combined with the A MK 4(v) and/or A MK 6(b) active acoustic sweep sonar. The operating frequency of the AN/SLQ-37 (Figure C-20) is classified. Earlier versions of these components were used by Navy World War II sweepers. The system can be configured several ways, including diverting the magnetic cable and/or the acoustic devices by using components of the AN/SLQ-38 mechanical sweep gear. This system was not analyzed in this document, due to the fact that it operates above 200 kHz.

Figure C-20. Avenger Class MCM equipped with AN/SLQ-37

- SEABAT – a forward-looking active sonar that provides high-resolution sonar imaging of the water column or ocean floor for mine and object detection. The SEABAT (Figure C-21) can be carried by (Remotely Operated Vehicles/Unmanned Undersea Vehicles [ROVs/UUVs]) and operates at high frequency and low power , ranging from 100 to 455 kHz . Although the low spectrum of this system is below 200 kHz, it was not analyzed due to its low power and its infrequent operation.

Figure C-21. SEABAT

- Dual Frequency Acoustic Lens System (DFALS) – an active sonar intended to detect buried or proud objects and mines. The active frequencies are unavailable. The DFALSs have low source levels, and are installed on ROVs and UUVs.

Torpedoes

Torpedoes are the primary ASW weapon used by surface ships, aircraft, and submarines. When torpedoes operate actively, they transmit an active acoustic signal to ensonify the target and use the received echoes for guidance.

- MK 48 and MK 48 Advanced Capability (ADCAP) (Figure C-22) are heavyweight torpedoes deployed on all classes of Navy submarines. MK 48 and MK 48 ADCAP torpedoes are inert and considered HF sonar, but the frequency ranges are classified. Due to the fact that both torpedoes are essentially identical in terms of environmental interaction, they will be referred to collectively as the MK48 in this EIS.

Figure C-22. MK 48/MK 48 ADCAP (L); Seawolf Class SSN launching MK-48/MK-48 ADCAP (R)

- MK 46 Lightweight Torpedo (Figure C-23) are ASW torpedoes. They are less than half the size of the MK 48 and can be launched from surface ships, helicopters, and fixed wing aircraft. When used in training, the MK 46 is inert and considered HF sonar, but the exact frequency range is classified. When dropped from an aircraft, the MK 46 may have a parachute, which is jettisoned when it enters the water. The MK 46 torpedo also carries a small sea dye marker (Fluorescein) that is marks the torpedo's position on the surface to facilitate recovery. The MK 46 is planned to remain in service until 2015.

Figure C-23. MK 46 Torpedo at launch (L), and recovery (R)

- MK 54 Lightweight Hybrid Torpedo (LHT) (Figure C-24) can be launched from surface ships, fixed wing aircraft, and helicopters. The MK-54 is half the size of a MK 48. The training torpedoes are inert and may carry a parachute, which is jettisoned as it enters the water. The MK 54 torpedo also carries a small sea dye marker (Fluorescein) that is marks the torpedo's position on the surface to facilitate recovery.

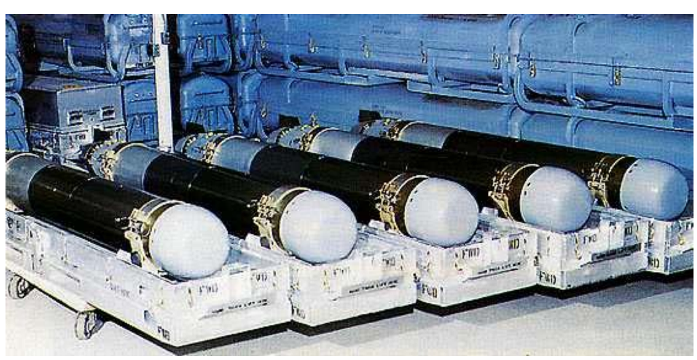

Figure C-24. MK 54 Torpedoes

Countermeasures

Several types of countermeasure (CM) devices (Figure C-25) could be deployed during active sonar events, including the Noise Acoustic Emitter (NAE), Acoustic Device Countermeasure (ADC) MK 1, MK 2, MK 3, MK 4 and the AN/SLQ-25A (NIXIE). CM devices are submarine simulators and act as decoys to avert localization and torpedo attacks. Countermeasures produce low- and mid-frequency sound. The NAE and ADC are deployed from submarines and are free floating, while the AN/SLQ-25 (NIXIE) is towed from surface ships.

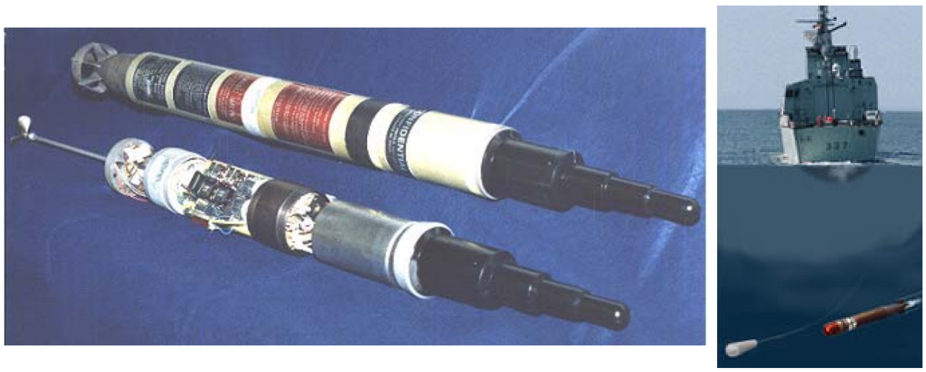

Figure C-25. ADC CM (L), and AN/SLQ-25 (NIXIE) CM (R)

Exercise Training Targets

There are two types of training targets, the MK 30 Acoustic Target and the MK 39 Expendable Mobile ASW Training Target (EMATT) (Figure C-26). ASW training targets simulate submarines as an ASW target in the absence of participation by a submarine in an exercise. They are equipped with acoustic projectors emanating sounds to simulate submarine acoustic signatures, and echo repeaters to simulate the characteristics of the reflection of a sonar signal from a submarine.

Figure C-26. MK 39 EMATT (L) and MK 30 (R)

In addition, surface targets such as “sleds” (aluminum catamarans), seaborne powered targets (radio-controlled high-speed boats), and target drone units (TDUs) could also be deployed during training exercises.

Tracking Pingers, Transponders, and Acoustical Communications (ACOMs)

Tracking pingers are installed on training platforms to track the position of underwater vehicles. The pingers generate a precise, preset, acoustic signal for each target to be tracked. ACOMs and transponders provide the communication link between sensor packages and base platform allowing information to be exchanged.

MK 84 Pinger Signal, Underwater Sound (SUS) – an air or surface dropped noisemaking device (Figure C-27) that emits one of five mid-frequency tonal patterns using two MFA sonars with frequencies at 3.1 and 3.5 kHz; it is used to provide prearranged signal communications to submerged submarines.

Figure C-27. MK 84

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Appendix B

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[I.D. 121506A]

Endangered and Threatened Species; Initiation of a Status Review under the Endangered Species Act for the Atlantic White Marlin

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice of initiation of a status review under the Endangered Species Act (ESA); request for information.

SUMMARY: We, NMFS, announce the initiation of a status review for the Atlantic white marlin (*Tetrapturus albidus*), and we solicit information on the status of and threats to the species.

DATES: Information regarding the status of and threats to the Atlantic white marlin must be received by February 20, 2007.

ADDRESSES: You may submit information on the Atlantic white marlin by any one of the following methods:

- Fax: 727–824–5309, Attention: Dr. Stephania Bolden
- Mail: Information on paper, disk or CD-ROM should be addressed to the Assistant Regional Administrator for Protected Resources, NMFS Southeast Regional Office, 263 13th Avenue South, St. Petersburg, FL 33701
- E-mail: *whitemarlin.info@noaa.gov*. Include in the subject line the following identifier: white marlin review

FOR FURTHER INFORMATION CONTACT: Dr. Stephania Bolden, NMFS, Southeast Regional Office (727) 824–5312, or Ms. Marta Nammack, NMFS, Office of Protected Resources (301) 713–1401.

SUPPLEMENTARY INFORMATION:

Background

We conducted a status review of the Atlantic white marlin under the ESA and published a 12-month determination that listing was not warranted (67 FR 57204; September 9, 2002). As a result of subsequent litigation and a settlement agreement with the Center for Biological Diversity, we agreed to initiate a status review following the 2006 stock assessment by the International Commission for the Conservation of Atlantic Tunas (ICCAT); the 2006 ICCAT white marlin stock assessment can be found at *www.iccat.int*. Atlantic white marlin are billfish (Family: Istiophoridae) found throughout tropical and temperate waters of the Atlantic Ocean and adjacent seas. White marlin, along with other billfish and tunas, are managed internationally by the member nations of the ICCAT. At this time we announce commencement of a new status review for the Atlantic white marlin, and request information regarding the status of and threats to the species, pursuant to the terms of the aforementioned settlement agreement.

Request for Information

To support this status review, we are soliciting information relevant to the status of and threats to the species, including, but not limited to, information on the following topics: (1) historical and current abundance and distribution of the species and congeners throughout the species range; (2) potential factors for the species' decline throughout the species range; (3) rates of capture and release of the species from both recreational and commercial fisheries; (4) post-release mortality; (5) life history information (size/age at maturity, growth rates, fecundity, reproductive rate/success, etc.); (6) morphological and molecular information to assist in determining taxonomy of this species and congeners; (7) threats to the species, particularly: (a) present or threatened destruction, modification, or curtailment of habitat or range; (b) over-utilization for commercial, recreational, scientific, or educational purposes; (c) disease or predation, (d) inadequacy of existing regulatory mechanisms, or (e) other natural or manmade factors affecting its continued existence; and (8) any ongoing conservation efforts for the species. See **DATES** and **ADDRESSES** for guidance on and deadlines for submitting information.

Authority: 16 U.S.C. 1531 *et seq.*

Dated: December 18, 2006.

Donna Wieting,

Deputy Director, Office of Protected Resources, National Marine Fisheries Service.

[FR Doc. 06–9812 Filed 12–18–06; 2:45 pm]

BILLING CODE 3510–22–S

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Intent To Prepare an Environmental Impact Statement/ Overseas Environmental Impact Statement for the Southern California Range Complex (including the San Clemente Island Range Complex) and To Announce Public Scoping Meetings

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council on Environmental Quality regulations (40 CFR parts 1500–1508), and Presidential Executive Order 12114 (Environmental Effects Abroad of Major Federal Actions), the Department of the Navy (DON) announces its intent to prepare an Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to evaluate the potential environmental effects associated with conducting naval readiness activities in the Southern California (SOCAL) Range Complex (to include the San Clemente Island (SCI) Range Complex). DON proposes to support current, emerging, and future military activities in the SOCAL and SCI Range Complexes as necessary to achieve and sustain Fleet readiness, including military training; research, development, testing, and evaluation (RDT&E) of systems, weapons, and platforms; and investment in range resources and range infrastructure, all in furtherance of our statutory obligations under Title 10 of the United States Code governing the roles and responsibilities of the DON.

On August 17, 1999, DON initiated the NEPA process for an EIS/OEIS evaluating the impacts of DON activities at the SCI Range Complex by publishing a Notice of Intent in the **Federal Register** (64 FR 44716–44717). DON has determined that it is appropriate to include within the scope of the SOCAL Range Complex EIS/OEIS the previously announced environmental analysis of military activities on the SCI Range. Therefore, this Notice of Intent supersedes and withdraws the August 17, 1999, notice of the DON's intent to prepare an EIS/OEIS for the SCI Range Complex.

Dates and Addresses: Three public scoping meetings will be held to receive oral and written comments on environmental concerns that should be addressed in the EIS/OEIS. Public scoping meetings will be held on the following dates, at the times and locations specified:

1. Wednesday, January 29, 2007, 6 p.m.–8 p.m., Cabrillo Marine Aquarium Library, 3720 Stephen M. White Drive, San Pedro, CA.
2. Tuesday, January 30, 2007, 6 p.m.–8 p.m., Oceanside Civic Center Library, 330 North Coast Highway, Oceanside, CA.
3. Wednesday, January 31, 2007, 6 p.m.–8 p.m., Coronado Public Library, 640 Orange Avenue, Coronado, CA.

Each meeting will consist of an information session staffed by DON representatives, to be followed by a presentation describing the proposed action and alternatives. Written comments from interested parties are encouraged to ensure that the full range of relevant issues is identified. Members of the public can contribute oral or written comments at the scoping meetings, or written comments by mail or fax, subsequent to the meetings. Additional information concerning the scoping meetings is available at: *http://www.SocalRangeComplexEIS.com.*

FOR FURTHER INFORMATION CONTACT: Ms. Diori Kreske, Naval Facilities Engineering Command Southwest, 2585 Callaghan Hwy., San Diego, CA 92136–5198; telephone 619–556–8706.

SUPPLEMENTARY INFORMATION: The SOCAL Range Complex is a suite of land ranges and training areas, surface and subsurface ocean ranges and operating areas, and military airspace that is centrally managed and controlled by DON agencies. The complex geographically encompasses near-shore and offshore surface ocean operating areas and extensive military Special Use Airspace generally located between Marine Corp Base Camp Pendleton to the north and San Diego to the south. It extends more than 600 miles to the southwest in the Pacific Ocean covering approximately 120,000 square nautical miles of ocean area. The SCI Range Complex is geographically encompassed by the SOCAL Range Complex. The SCI Range Complex consists of land ranges and training areas on San Clemente Island and certain near-island ocean operating areas and ranges.

Collectively, the components of the SOCAL Range Complex provide the space and resources needed to execute training events across the training continuum, from individual skills training to complex joint exercises. The mission of the SOCAL Range Complex is to support DON, Marine Corps, and joint (multi-service) training by maintaining and operating range facilities and by providing range services and support to the Pacific Fleet, U.S. Marine Corps Forces Pacific, and other forces and military activities. The Commander, Fleet Forces Command and Commander, U.S. Pacific Fleet are responsible for operations, maintenance, training, and support of this national training asset.

Naval transformation initiatives determine current, emerging, and future requirements for training access to the SOCAL Range Complex. Moreover, recent world events have placed the U.S. military on heightened alert in the defense of the U.S., and in defense of allied nations. At this time, the U.S. military, and specifically the U.S. Navy, is actively engaged in anti-terrorism efforts around the globe. Title 10 U.S. Code Section 5062 directs the Chief of Naval Operations to maintain, train, and equip all naval forces for combat so that they are capable of winning wars, deterring aggression, and maintaining freedom of the seas. To achieve this level of readiness, naval forces must have access to ranges, operating areas (OPAREAs), and airspace where they can develop and maintain skills for wartime missions and conduct RDT&E of naval weapons systems. As such, DON ranges, OPAREAs, and airspace must be maintained and/or enhanced to accommodate necessary training and testing activities in support of national security objectives.

The proposed action, therefore, responds to DON's need to: (1) Maintain baseline operations at current levels; (2) accommodate future increases in operational training tempo in the SOCAL and SCI Range Complexes as necessary to support the deployment of naval forces; (3) achieve and sustain readiness in ships and squadrons so that the DON can quickly surge significant combat power in the event of a national crisis or contingency operation and consistent with Fleet Readiness Training Plan; (4) support the acquisition, testing, training, and introduction into the Fleet of advanced platforms and weapons systems; and, (5) implement investments to optimize range capabilities required to adequately support required training. DON will meet these needs and maintain the long-term viability of the SOCAL Range Complex, while protecting human health and the environment.

Three alternatives will be evaluated in the EIS/OEIS, including: (1) The No Action Alternative, comprised of baseline operations and support of existing range capabilities; (2) Alternative 1 comprised of the No Action Alternative plus additional operations on upgraded/-modernized existing ranges; and (3) Alternative 1 plus new ranges, new dedicated capabilities, additional increased tempo (beyond Alternative 1) to optimize training in support of future contingencies. The analysis will address potentially significant direct, indirect, and cumulative impacts on biological resources, land use, air quality, water quality, water resources, and socioeconomics, as well as other environmental issues that could occur with the implementation of the DON's proposed actions and alternatives.

The DON is initiating the scoping process to identify community concerns and local issues to be addressed in the EIS/OEIS. Federal, State, and local agencies, and interested parties are encouraged to provide oral and/or written comments to the DON that identify specific issues or topics of environmental concern that should be addressed in the EIS/OEIS. Written comments must be postmarked by February 8, 2007, and should be mailed to: Naval Facilities Engineering Command Southwest, 2585 Callaghan Hwy., San Diego, CA 92136–5198; Attention: Ms. Diori Kreske, telephone 619–556–8706.

Dated: December 13, 2006.

M.A. Harvison,

Lieutenant Commander, Judge Advocate General's Corps, Federal Legislative Liaison Officer.

[FR Doc. E6–21802 Filed 12–20–06; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF EDUCATION

Notice of Proposed Information Collection Requests

AGENCY: Department of Education.

ACTION: Notice of proposed information collection requests.

SUMMARY: The IC Clearance Official, Regulatory Information Management Services, Office of Management, invites comments on the proposed information collection requests as required by the Paperwork Reduction Act of 1995.

DATES: An emergency review has been requested in accordance with the Act (44 U.S.C. Chapter 3507 (j)), since public harm is reasonably likely to result if normal clearance procedures are followed. Approval by the Office of Management and Budget (OMB) has been requested by January 22, 2007. A regular clearance process is also beginning. Interested persons are invited to submit comments on or before February 20, 2007.

ADDRESSES: Written comments regarding the emergency review should be addressed to the Office of Information and Regulatory Affairs, Attention: Rachael Potter, Desk Officer, Department of Education, Office of Management and Budget; 725 17th Street, NW., Room 10222, New Executive Office Building, Washington, DC 20503 or faxed to (202) 395–6974.

SUPPLEMENTARY INFORMATION: Section 3506 of the Paperwork Reduction Act of 1995 (44 U.S.C. Chapter 35) requires that the Director of OMB provide interested Federal agencies and the

Dated: March 31, 2008.

Al Matera,

Director, Office of Acquisition Policy.

[FR Doc. E8–7051 Filed 4–3–08; 8:45 am]

BILLING CODE 6820–EP–S

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Public Hearings for the Draft Environmental Impact Statement/Overseas Environmental Impact Statement for the Southern California Range Complex (Including the San Clemente Island Range Complex)

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969 and the regulations implemented by the Council on Environmental Quality (40 CFR Parts 1500–1508), and Presidential Executive Order 12114, the Department of the Navy (Navy) prepared and filed with the U.S. Environmental Protection Agency on March 28, 2008, a Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) for the Southern California Range Complex (including the San Clemente Island Range Complex). This Draft EIS/OEIS evaluates the potential environmental effects of current and emerging training and research, development, test, and evaluation (RDT&E) activities in the Southern California (SOCAL) Range Complex, and proposed upgrades and modernization of range complex capabilities for Navy training and testing. A Notice of Intent for this Draft EIS/OEIS was published in the **Federal Register** on December 21, 2006 (71 FR 76639).

The Navy will conduct three public hearings to receive oral and written comments on the Draft EIS/OEIS. Federal, State, and local agencies and interested individuals are invited to be present or represented at the public hearings. This notice announces the dates and locations for the public hearings for the Draft EIS/OEIS.

DATES AND ADDRESSES: An open house session will precede the public hearing at each of the locations listed below. Individuals will be allowed to review the information presented in the Draft EIS/OEIS and Navy representatives will be available during the open house sessions to clarify information related to the Draft EIS/OEIS. For all meetings, the open house will be held from 5 p.m. to 9:30 p.m., and the public hearing will be held from 7 p.m. to 9:30 p.m.

Public hearings will be held on the following dates and at the following locations in California:

1. April 29, 2008 at the Oceanside Civic Center Public Library, 330 North Coast Highway, Oceanside, California;

2. April 30, 2008 at the Coronado Community Center, 1845 Strand Way, Coronado, California;

3. May 1, 2008 at the Long Beach Public Library, 101 Pacific Avenue, Long Beach, California.

FOR FURTHER INFORMATION CONTACT: Naval Facilities Engineering Command Southwest, Attention: SOCAL EIS Project Manager (Code REVPO), 1220 Pacific Highway, Building 127, San Diego, California 92132–5190; phone 619–532–2803; or *http://www.socalrangecomplexeis.com.*

SUPPLEMENTARY INFORMATION: The mission of the SOCAL Range Complex is to serve as the principal U.S. Navy training venue in the eastern Pacific with the unique capability and capacity to support required current, emerging, and future training. As a result, the Navy proposes to implement actions within the SOCAL Range Complex to: increase training and research, development, test, and evaluation (RDT&E) operations from current levels as necessary to support the Fleet Readiness Training Plan (FRTP); accommodate mission requirements associated with force structure changes and introduction of new weapons and systems to the Fleet; and implement enhanced range complex capabilities.

The purpose of the Proposed Action is to achieve and maintain fleet readiness using the SOCAL Range Complex, while enhancing training resources through investment on the ranges. The need for the Proposed Action is to enable the Navy to meet its statutory responsibility (found in Title 10 of the United States Code, section 5062) to organize, train, equip, and maintain combat-ready naval forces and to successfully fulfill its current and future global mission of winning wars, deterring aggression, and maintaining freedom of the seas. The existing SOCAL Range Complex plays a vital part in the execution of this naval readiness mandate and has done so successfully for the last 70 years. The San Diego, California, region is home to the largest concentration of U.S. naval forces in the world, and the SOCAL Range Complex is the most capable and heavily used Navy range complex in the eastern Pacific region. The Navy's Proposed Action is a step toward ensuring the continued vitality of this essential naval training resource.

The SOCAL Range Complex consists of three primary components: ocean operating areas, military special use airspace, and San Clemente Island (SCI). The range complex is situated between Dana Point and San Diego along the California coast, and extends more than 600 nautical miles (nm) southwest into the Pacific Ocean. The SOCAL Range Complex encompasses 120,000 square nm of sea space, 113,000 square nm of designated airspace, and over 42 square nm of land area (SCI). The Navy proposes to maintain the existing established boundaries of the range complex's ocean areas and designated airspace.

Three alternatives are evaluated in this Draft EIS/OEIS, including two action alternatives (Alternatives 1 and 2) and the No-action Alternative. The No-action Alternative stands as no change from current levels of training and RDT&E usage. Alternatives 1 and 2 analyze increased tempo and frequency of training in the SOCAL Range Complex.

Alternative 1 and Alternative 2 also address proposed new types of training, as well as training associated with new types of ships, weapons, and systems that are being introduced into the Navy's fleet (e.g., The Littoral Combat Ship). Force structure changes associated with new weapons systems would include new mine countermeasures systems and also would include training and operations associated with the proposed homeporting of the aircraft carrier USS CARL VINSON at Naval Base Coronado. In addition, Alternative 2 addresses the proposed construction and use of a shallow water training range (SWTR) and shallow water minefield, as well as an increase in use of commercial air services to support training events. Alternative 2 is the Navy's preferred alternative.

The Draft EIS/OEIS has been distributed to various Federal, State, and local agencies, as well as other interested individuals and organizations. In addition, copies of the Draft EIS/OEIS are available for public review at the following libraries: San Diego Central Library, 820 ''E'' Street, San Diego, California; Oceanside Civic Center Public Library, 330 North Coast Highway, Oceanside, California; San Clemente Public Library, 242 Avenida Del Mar, San Clemente, California; San Pedro Regional Library, 931 South Gaffey Street, San Pedro, California; and Long Beach Public Library, 101 Pacific Avenue, Long Beach, California. Single copies of the Draft EIS/OEIS are available upon written request to: SOCAL EIS, SOCAL EIS Project Manager (Code REVPO), 1220 Pacific Highway, Building 127, San Diego, California 92132–5190. In addition, an electronic copy of the Draft EIS/OEIS is also available for public viewing or download at *http://www.socalrangecomplexeis.com.* The Web site also contains information about the SOCAL Range Complex and a form for submission of electronic comments.

Federal, State, and local agencies and interested parties are invited to be present or represented at the public hearings. Written comments can be submitted during the public hearings. Oral statements will be heard and transcribed by a stenographer; however, to ensure the accuracy of the record, all oral statements should be submitted in writing. All statements, both oral and written, will become part of the public record on the Draft EIS/OEIS and will be addressed in the Final EIS/OEIS. Equal weight will be given to both oral and written statements.

In the interest of available time, and to ensure that all who wish to give an oral statement have the opportunity to do so, each speaker's comments will be limited to three (3) minutes. If a long statement is to be presented, it should be summarized at the public hearing and the full text submitted in writing either at the hearing, via the project Web site, or mailed to Naval Facilities Engineering Command Southwest, Attention SOCAL EIS Project Manager (Code REVPO), 1220 Pacific Highway, Building 127, San Diego, California, 92132–5190.

All written comments must be postmarked or received by May 19, 2008, to ensure they become part of the official record. The project Web site, *http://www.socalrangecomplexeis.com,* provides a form for submission of electronic comments. All timely comments will be addressed in the Final EIS/OEIS.

Dated: March 27, 2008.

T.M. Cruz,

Lieutenant, Judge Advocate General's Corps, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. E8–7085 Filed 4–3–08; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Closed Meeting of the Secretary of the Navy Advisory Panel

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: The Secretary of the Navy Advisory Panel will report on the findings and recommendations for Department of the Navy intelligence and information related strategies, activities, processes, organization, and governance.

DATES: The meeting will be held on April 24th and April 25th 2008 from 8 a.m. to 5 p.m.

ADDRESSES: The meeting will be held in the Secretary of the Navy's Conference Room in the Pentagon and the Pentagon Joint Staff Conference Center.

FOR FURTHER INFORMATION CONTACT: Colonel Caroline Simkins-Mullins, SECNAV Advisory Panel, Office of Program and Process Assessment 1000 Navy Pentagon, Washington, DC 20350, telephone: 703–697–9154.

SUPPLEMENTARY INFORMATION: Pursuant to the provisions of the Federal Advisory Committee Act (5 U.S.C. App. 2), these matters constitute classified information that is specifically authorized by Executive Order to be kept secret in the interest of national defense and are, in fact, properly classified pursuant to such Executive Order. Accordingly, the Secretary of the Navy has determined in writing that the public interest requires that all sessions of this meeting be closed to the public because they will be concerned with matters listed in section 552b(c)(1) of title 5, United States Code.

Individuals or interested groups may submit written statements for consideration by the Secretary of the Navy Advisory Panel at any time or in response to the agenda of a scheduled meeting. All requests must be submitted to the Designated Federal Officer at the address detailed below.

If the written statement is in response to the agenda mentioned in this meeting notice then the statement, if it is to be considered by the Panel for this meeting, must be received at least five days prior to the meeting in question.

The Designated Federal Officer will review all timely submissions with the Secretary of the Navy Advisory Panel Chairperson, and ensure they are provided to members of the Secretary of the Navy Advisory Panel before the meeting that is the subject of this notice.

To contact the Designated Federal Officer, write to: Designated Federal Officer, SECNAV Advisory Panel, Office of Program and Process Assessment 1000 Navy Pentagon, Washington, DC 20350; telephone: 703–697–9154.

Dated: March 31, 2008.

T.M. Cruz,

Lieutenant, Judge Advocate General's Corps, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. E8–6967 Filed 4–3–08; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

Combined Notice of Filings #1

March 28, 2008.

Take notice that the Commission received the following electric rate filings:

Docket Numbers: ER05–18–004; ER05–309–004.
Applicants: New Dominion Energy Cooperative; Old Dominion Electric Cooperative, Inc.
Description: New Dominion Energy Cooperative *et al.* submits the appended attachments to serve as the Compliance Filing required by the Order.
Filed Date: 03/26/2008.
Accession Number: 20080327–0129.
Comment Date: 5 p.m. Eastern Time on Wednesday, April 16, 2008.

Docket Numbers: ER07–1372–004.
Applicants: Midwest Independent Transmission System Operator, Inc.
Description: Midwest Independent Transmission System Operator Inc submits clarifications and revisions to the Open Access Transmission, Energy and Operating Reserve Markets Tariff.
Filed Date: 03/26/2008.
Accession Number: 20080327–0153.
Comment Date: 5 p.m. Eastern Time on Wednesday, April 16, 2008.

Docket Numbers: ER08–415–001.
Applicants: Potomac Electric Power Company.
Description: Potomac Electric Power Company submits their compliance filing with the required modifications to the Construction Agreement with Mirant Mid-Atlantic LLC.
Filed Date: 03/25/2008.
Accession Number: 20080327–0050.
Comment Date: 5 p.m. Eastern Time on Tuesday, April 15, 2008.

Docket Numbers: ER08–416–001.
Applicants: Midwest Independent Transmission System Operator, Inc.
Description: Midwest Independent Transmission System Operator Inc submits proposed revisions to both its current Open Access Transmission and Energy Markets Tariff and its Open Access Transmission Energy and Operating Reserve Markets Tariff.
Filed Date: 03/25/2008.
Accession Number: 20080327–0040.

Summary: EPA expressed environmental concerns about air quality impacts. EPA requested an analysis of air emissions from current and proposed recreational uses, and to demonstrate general conformity.

Rating EC2.

EIS No. 20080049, ERP No. D–FRC–G03037–00, Midcontinent Express Pipeline Project, (Docket Nos. CP08–6–000), Construction and Operation to Facilitate the Transport of 1,500, 000 dekatherms per day of Natural Gas from Production Fields in eastern TX, OK, and AR to Market Hub, Located in various counties and parishes in OK, TX, LA, MS and AL.

Summary: EPA expressed environmental concerns about air quality impacts, wetland impacts, environmental justice issues, and requested information and mitigation to address these concerns.

Rating EC2.

EIS No. 20070021, ERP No. DS–BLM–J02039–MT, Montana Statewide Oil and Gas, Development Alternative for Coal Bed Natural Gas Production and Amendment of the Powder River and Billings Resource Management Plans, Additional Information Three New Alternatives, Implementation, U.S. Army COE section 404 Permit, NPDES Permit,Several Cos, MT.

Summary: EPA expressed environmental concerns about potential impacts to air quality and water quality. EPA recommended establishment of an air quality stakeholder group; additional near-field air quality modeling; and additional water and air quality monitoring.

Rating EC2.

FINAL EISs

EIS No. 20080061, ERP No. F–AFS–L65538–OR, Thorn Fire Salvage Recovery Project, Salvaging Dead and Dying Timber, Shake Table Fire Complex, Malheur National Forest, Grant County, OR.

Summary: EPA's previous concerns have been resolved; therefore, EPA has no objections to the proposed action.

EIS No. 20080064, ERP No. F–BIA–C60006–NY, Oneida Nation of New York Conveyance of Lands into Trust, Proposes to Transfer 17,370 Acre of Fee Land into Federal Trust Status, Oneida, Madison and New York Counties, NY.

Summary: EPA does not object to the proposed action.

EIS No. 20080075, ERP No. F–AFS–F65067–WI, Fishel Vegetation and Transportation Management Project, To Implement Land Management Activities, Eagle River-Florence Ranger District, Chequamegor-Nicolet National Forest, Forest and Vilas Counties, WI.

Summary: EPA's previous issues have been resolved; therefore, EPA does not object to the proposed action.

EIS No. 20070486, ERP No. FS–COE–E36074–00, Yazoo Basin Reformulation Study, Supplement No. 1 to the 1982 Yazoo Area Pump Project, Flood Control, Mississippi River and Tributaries, Yazoo Basin, MS and LA.

Summary: EPA continues to have environmental concerns about significant degradation of extremely valuable wetlands resources that have been, and continue to be, vulnerable to conversion and loss throughout the Mississippi Delta. Uncertainties regarding the efficacy of the compensatory mitigation plan and the potential availability of practicable, less environmentally damaging alternatives to provide needed flood protection improvements, magnify EPA's concerns regarding the nature and extent of the wetlands impacts. EPA considers the proposal a candidate for referral to CEQ. EPA is also considering whether to proceed with an additional review of the project pursuant to our authorities under the CWA.

EIS No. 20080046, ERP No. FS–WAP–K08024–CA, Sacramento Area Voltage Support Project, Selected Preferred Alternative B, Proposal to Build a Double-Circuit 230–kV Transmission Line, Placer, Sacramento and Sutter Counties, CA.

Summary: EPA does not object to the proposed project.

Dated: April 1, 2008.

Ken Mittelholtz,

Environmental Protection Specialist, Office of Federal Activities.

[FR Doc. E8–7055 Filed 4–3–08; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[ER–FRL–6697–5]

Environmental Impacts Statements; Notice of Availability

Responsible Agency: Office of Federal Activities, General Information (202) 564–7167 or *http://www.epa.gov/compliance/nepa/.*

Weekly Receipt of Environmental Impact Statements

Filed 03/24/2008 Through 03/28/2008

Pursuant to 40 CFR 1506.9.

EIS No. 20080117, Draft EIS, AFS, 00, Selway-Bitterroot Wilderness Plants Management Project, To Prevent the Establishment of New Invaders and Reduce the Impacts of Established Invasive Plants on Native Plant Community Stability, Sustainability and Diversity, Nez Perce, Clearwater, Lolo, and Bitterroot National Forests, ID and MT, *Comment Period Ends:* 05/19/2008, *Contact:* Chad Benson 208–942–3113.

EIS No. 20080118, Final EIS, FAA, CA, Horizon Air Service to Mammoth Yosemite Airport Project, Proposed Operations Specifications Amendment To Provide Scheduled Air Service, Town of Mammoth Lakes, Mono County, CA, *Wait Period Ends:* 05/05/2008, *Contact:* Chuck Cox 425–227–2243.

EIS No. 20080119, Draft EIS, USN, CA, Southern California Range Complex, To Organize, Train, Equip, and Maintain Combat-Ready Naval Forces, San Diego, Orange and Los Angeles Counties, CA, *Comment Period Ends:* 05/19/2008, *Contact:* Alexander Stone 619–545–8128.

EIS No. 20080120, Draft EIS, USN, FL, Naval Surface Warfare Center Panama City Division (NSWC PCD), Capabilities To Conduct New and Increased Mission Operations for the Department of Navy (DON) and Customers within the three Military Operating Area and St. Andrew Bay (SAT), Gulf of Mexico, FL, *Comment Period Ends:* 05/19/2008, *Contact:* Carmen Ferrer 850–234–4146.

EIS No. 20080121, Final EIS, FHW, 00, Interstate I–94, I–43, I–894, and WI–119 (Airport Spur) I–94/USH 41 Interchange to Howard Avenue, To Address Freeway System's Deteriorated Conditions, Funding and U.S. Army COE Section 404 Permit, Kenosha, Racine and Milwaukee Counties, WI and Lake County, IL, *Wait Period Ends:* 05/05/2008, *Contact:* David Scott 608–829–7522 .

EIS No. 20080122, Draft EIS, UAF, NV, Nellie Air Force Base (AFB), Proposes to Base 36 F–35 Fighter Aircraft, Assigned to the Force Development Evaluation (FDE) Program and Weapons School (WS) Beddown, Clark County, NV, *Comment Period Ends:* 05/19/2008, *Contact:* Sheryl Parker 703–604–5264.

EIS No. 20080123, Final EIS, NPS, MN, Pipestone National Monument General Management Plan, Implementation, Pipestone County, MN, *Wait Period Ends:* 05/05/2008, *Contact:* Nick Chevance 507–825–5464.

EIS No. 20080124, Final EIS, USN, MD, National Naval Medical Center, Activities To Implement 2005 Base Realignment and Closure Actions, Construction and Operation of New Facilities for Walter Reed National

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Appendix C

AIR QUALITY ANALYSIS
SUPPORTING DATA

This Appendix provides supporting data for the analysis contained in Section 3.2 (Air Quality).

Pages C-3 and C-4 are included to demonstrate confirmation that the SOCAL emissions are within the State Implementation Plan.

Table C-1 Surface Ship Air Emissions – No Action Alternative
Table C-2 Surface Ship Air Emissions – Alternative 1
Table C-3 Surface Ship Air Emissions – Alternative 2

Tables provide estimates of emissions from combustion of fuel by marine vessels during SOCAL Range operations. Each table includes a listing of individual training operations from the SOCAL Operations Data Book, number of each type of marine vessel participating in the operations for the No Action Alternative and Alternatives 1 and 2, and hours on range for each training operation. Percentage of time within 0 to 3 nm of shore, 3 to 12 nm from shore, and > 12 nm from shore for both SCI and the SDAB are based on the SOCAL Operations Data Book. Emission factors are provided by JJMA in terms of lbs/hour. Emissions are then calculated for each area as follows:

Lbs/year per operation = No. of marine vessels in each category x hours per operation x percentage of time at the specified distance from shore x emission factor (lbs/hour).

Table C-4 Aircraft Air Emissions – No Action Alternative
Table C-5 Aircraft Air Emissions – Alternative 1
Table C-6 Aircraft Air Emissions – Alternative 2

Tables provide estimates of emissions from combustion of fuel by aircraft during SOCAL Range operations. Each table includes a listing of individual training operations from the SOCAL Operations Data Book, number of each type of aircraft participating in the operations for each alternative, and hours on range for each operation. Emissions below 3,000 ft above ground level are not counted in the emission calculations as they are not assumed to affect ambient air quality. Percentage of time below 3,000 feet, and within 0 to 3 nm of shore, 3 to 12 nm from shore, and > 12 nm from shore for both SCI and the SDAB are based on the SOCAL Operations Data Book. Fuel flow in lbs/hour and emission factors in terms of lbs/1000 lbs/ fuel are provided by AESO for each type of aircraft and each type of operation. Aircraft is generally assumed to operate in cruise mode unless otherwise specified. Emissions are then calculated for each area as follows:

Lbs/year per operation = No. of aircraft in each category x hours per operation x percentage of time below 3,000 feet AGL x percentage of time at the specified distance from shore x fuel flow (lbs/hour) emission factor (lbs/1,000 lbs fuel).

Table C-7 Takeoffs/Landings from NALF – No Action Alternative
Table C-8 Takeoffs/Landings from NALF – Alternative 1
Table C-9 Takeoffs/Landings from NALF – Alternative 2

Tables provide estimates of emissions from combustion of fuel during takeoffs/landings at the NALF. Numbers of takeoffs/landings per aircraft type were provided by the Navy. Different types of operations (i.e., takeoff, arrival, touch and go, etc.) were identified for each aircraft type. Emissions were estimated based on data from AESO for each operation. AESO provided emission factors in lbs/operation. Emissions are then calculated for each area as follows:

Lbs/year per operation = No. of aircraft in each category x number of operations x lbs/operation.

Table C-10 SOCAL Ordnance Expenditures – No Action Alternative
Table C-11 SOCAL Ordnance Expenditures – Alternative 1
Table C-12 SOCAL Ordnance Expenditures – Alternative 2

Tables provide estimates of emissions from ordnance used in SOCAL Range operations. Estimates of total ordnance use by category were obtained from the SOCAL Operations Data Book. Total ordnance use for each alternative was summed by ordnance type. Emissions by ordnance type were estimated based on emission factors from the EPA's AP-42 document. Emissions were calculated as follows:

Lbs/year per ordnance type = Amount of ordnance by type x emission factor (lbs/ordnance used or weight of explosives).

Table C-13 Ground Vehicle Operations – No Action Alternative
Table C-14 Ground Vehicles Operations – Alternative 1
Table C-15 Ground Vehicles Operations – Alternative 2

Tables provide estimates of emissions from ground vehicles used in SOCAL Range operations. Each table includes a listing of individual training operations from the SOCAL Operations Data Book, number of each type of ground vehicle participating in the operations for each alternative, and hours on range for each operation. Emission factors were obtained either from the Navy or from the ARB's EMFAC2007 model, which provides emission estimates in grams/VMT; vehicle speeds were estimated to be 5 mph during training exercises to estimate emissions in lbs/hour. Emissions are then calculated for each area as follows:

Lbs/year per operation = No. of ground vehicles in each category x hours per operation x emission factor (lbs/hour).

Table C-16 Total Emissions with 3 nm – SOCAL Conformity

Table presents a summary of emissions within 3 nm of shore and onshore for the purpose of demonstrating conformity with the San Diego Air Pollution Control District.

Record of Non-Applicability (RONA) for Clean Air Act Conformity

Following the emissions tables is the RONA in which the Navy evaluated the emissions produced as a result of the Proposed Action. The Navy has concluded that *de minimis* thresholds for applicable criteria pollutants would not be exceeded nor would the projected emissions be regionally significant. Therefore, the Department of the Navy concludes that further formal Conformity Determination procedures are not required, resulting in this Record of Non-Applicability.

South Coast
Air Quality Management District
21865 E. Copley Drive, Diamond Bar, CA 91765-4182
(909) 396-2000 · http://www.aqmd.gov

March 13, 2002

Martha Gandy
Environmental Program Manager
Department of the Navy
937 N. Harbor Dr.
San Diego, CA 92132

Dear Ms. Gandy:

This letter is in response to your letter dated February 19, 2002, in which you inquired as to the inclusion of the emissions for the San Clemente Island Range in the upcoming 2002 AQMP inventory.

Based on the information provided by Department of the Navy on March 28, 2001 (and additional back up documentation on April 19, 2001), we have incorporated both aircraft and marine vessels emissions associated with the San Clemente Island Range in the 2002 AQMP inventory. The Navy provided the 1997 and 2006 emissions data (attached table) and requested to consider a 1% increase in emissions from 2006 to 2020 which are now included in our inventory.

If you require additional details, please contact me at (909) 396-3186 or Zorik Pirveysian at (909) 396-3133.

Sincerely,

Elaine Chang, DrPH
Deputy Executive Officer
Planning, Rule Development, and Area Sources

cc: Barry R. Wallerstein

EC:MAN:ZP

Summary of Annual Emissions
San Clemente Island Range Complex
(Tons/Year)

1997 Baseline	CO	NOx	HC	SOx	PM10
Aircraft - Range Operations	3.31	2.53	0.32	0.16	1.77
Surface Ships	16.21	26.83	17.76	4.90	1.00
Ordnance (Aircraft)	18.00	0.06	0.01	0.00	0.26
NALF Aircraft	267.81	43.74	94.51	3.23	55.03
Total	305.33	73.16	112.60	8.29	58.06
2006 Forecast					
Aircraft - Range Operations	4.57	5.66	0.48	0.31	3.39
Surface Ships	17.94	29.05	10.66	6.13	1.16
Ordnance (Aircraft)	21.20	0.07	0.01	0.00	0.26
NALF Aircraft	333.15	55.71	106.43	3.66	61.35
Total	376.86	90.49	117.58	10.10	66.16

Table C-1. Surface Ship Air Emissions—No Action Alternative

Scenario	Type Training	Number of Ships	Program Totals	Nomenclature	Ship/Boat Type	Vessel Mode	Ship Time on Range (hrs) (Hours)	Percent at Each Power Level (%)	Total Time on Range (hrs) (Hours)	Percentage 0-3 nm from shore (Percent)	Percentage 3-12 nm from Shore (Percent)	Percentage >12 nm from Shore (Percent)	Total Time 0-3 nm from shore (Hours)	Total Time 3-12 nm from shore (Hours)	Total Time >12 nm from shore (Hours)	Emissions Factors (lb/hr) CO	Emissions Factors NOx	Emissions Factors HC	Emissions Factors SOx	Emissions Factors PM10	Emissions 0-3 nm Offshore (lbs) CO	Emissions 0-3 nm Nox	Emissions 0-3 nm HC	Emissions 0-3 nm Sox	Emissions 0-3 nm PM	Emissions 3-12 nm Offshore - US Territory (lbs) CO	Emissions 3-12 nm Nox	Emissions 3-12 nm HC	Emissions 3-12 nm Sox	Emissions 3-12 nm PM	Emissions >12 nm Offshore - Outside US Territory: Offshore San Diego CO	Offshore San Diego NOx	Offshore San Diego HC	Offshore San Diego SOx	Offshore San Diego PM	Offshore Mexico CO	Offshore Mexico NOx	Offshore Mexico HC	Offshore Mexico SOx	Offshore Mexico PM
Training Exercises																																								
1	Air Combat Maneuvers	0																																						
2	Air Defense Exercise	107		CG	Cruiser	CG-2	1.0	100%	107.0	0%	0%	100%	0.0	0.0	107.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11532.5	5041.8	943.7	2249.1	281.4					
		214		DDG	Guided Missile Destroyer	DDG-2	1.0	100%	214.0	0%	0%	100%	0.0	0.0	214.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22253.9	10464.6	1718.4	3839.2	526.4					
		22		CVN	Nuclear Carrier (No emissions)					0%	0%	100%																												
		4		FFG	Guided Missile Frigate	FFG-2	3.7	100%	14.8	0%	0%	100%	0.0	0.0	14.8	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	988.9	1002.3	115.6	171.2	48.1					
3	S-A Missiles	1		CVN	Nuclear Carrier (No emissions)					0%	0%	100%																												
		1		TRB	Torpedo Retrieval Boats	TRB-3	4.0	100%	4.0	1%	2%	97%	0.0	0.1	3.9	6.47	56.2	1.6	7.4	1.2	0.3	2.2	0.1	0.3	0.0	0.5	4.5	0.1	0.6	0.1	25.1	218.1	6.0	28.7	4.6					
4	S-A Gunnery Exercise	17		CVN						0%	0%	100%																												
		33		CG	Cruiser	CG-2	1.5	100%	49.5	0%	0%	100%	0.0	0.0	49.5	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						5335.1	2332.4	436.6	1040.5	130.2
		68		DDG	Guided Missile Destroyer	DDG-2	1.5	100%	102.0	0%	0%	100%	0.0	0.0	102.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						10607.0	4987.8	819.1	1829.9	250.9
		41		FFG	Guided Missile Frigate	FFG-2	1.5	100%	61.5	0%	0%	100%	0.0	0.0	61.5	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						4109.4	4164.8	480.3	711.6	199.9
		10		LHA	Amphib. Assault Ship - Tarawa	LHA-1	1.5	100%	15.0	0%	0%	100%	0.0	0.0	15.0	7.38	43.5	5.5	131.0	26.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						110.7	653.0	83.0	1964.6	394.4
		11		LDH	Large Helicopter-dock Ships	LHD-1	1.5	100%	16.5	0%	0%	100%	0.0	0.0	16.5	5.89	34.8	4.4	104.6	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						97.2	573.7	72.9	1725.9	346.3
		16		LPD	Amphibious Transport Dock - Wasp	LPD-1	1.5	100%	24.0	0%	0%	100%	0.0	0.0	24.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						44.3	261.3	33.2	786.1	157.8
		18		LSD	Landing Ship Dock	LPD-1	1.5	100%	27.0	0%	0%	100%	0.0	0.0	27.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						49.8	294.0	37.4	884.4	177.5
		28		USCGS	US Coast Guard	USCG	1.5	100%	42.0	0%	0%	100%	0.0	0.0	42.0	5.74	57.9	0.9	11.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						241.1	2432.2	37.0	485.1	8.8
		20		Other Ship	Coastal Patrol-Independent Low Speed (	PC-1	1.5	100%	30.0	0%	0%	100%	0.0	0.0	30.0	6.5	12.5	1.1	2.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						195.0	373.8	31.5	75.3	10.5
5	A-A Missiles	1		TRB	Torpedo Retrieval Boats	TRB-3	4.0	100%	4.0	1%	2%	97%	0.0	0.1	3.9	6.47	56.2	1.6	7.4	1.2	0.3	2.2	0.1	0.3	0.0	0.5	4.5	0.1	0.6	0.1						25.1	218.1	6.0	28.7	4.6
6	Helicopter ASW TRACKEX	9		CG	Cruiser	CG-3	3.6	100%	32.4	1%	10%	89%	0.3	3.2	28.8	114.75	65.2	7.7	33.6	3.4	37.2	21.1	2.5	10.9	1.1	371.8	211.3	24.9	108.7	11.1	3308.9	1880.7	221.2	967.4	99.2					
		23		DDG	Guided Missile Destroyer	DDG-3	3.6	100%	82.8	1%	10%	89%	0.8	8.3	73.7	106.67	53.8	7.8	21.2	2.8	88.3	44.6	6.5	17.6	2.3	883.2	445.8	64.9	175.7	23.2	7860.7	3967.6	577.7	1563.7	206.3					
		14		TRB	Torpedo Retrieval Boats	TRB-3	3.6	100%	50.4	1%	10%	89%	0.5	5.0	44.9	6.47	56.2	1.6	7.4	1.2	3.3	28.3	0.8	3.7	0.6	32.6	283.3	7.8	37.3	5.9	290.2	2521.8	69.5	331.9	52.9					
7	Helicopter ASW TORPEX	21		CG	Cruiser	CG-3	3.6	100%	75.6	1%	10%	89%	0.8	7.6	67.3	114.75	65.2	7.7	33.6	3.4	86.8	49.3	5.8	25.4	2.6	867.5	493.1	58.0	253.6	26.0	7720.8	4388.3	516.1	2257.4	231.5					
		57		DDG	Guided Missile Destroyer	DDG-3	3.6	100%	205.2	1%	10%	89%	2.1	20.5	182.6	106.67	53.8	7.8	21.2	2.8	218.9	110.5	16.1	43.5	5.7	2188.9	1104.8	160.9	435.4	57.5	19480.9	9832.7	1431.8	3875.4	511.4					
		55		TRB	Torpedo Retrieval Boats	TRB-3	3.6	100%	198.0	1%	10%	89%	2.0	19.8	176.2	6.47	56.2	1.6	7.4	1.2	12.8	111.3	3.1	14.7	2.3	128.1	1113.2	30.7	146.5	23.4	1140.1	9907.1	273.1	1304.0	207.9					
8	MPA ASW TRACKEX																																							
9	MPA ASW TORPEX	2		CG	Cruiser	CG-3	2.0	100%	4.0	5%	10%	85%	0.2	0.4	3.4	114.75	65.2	7.7	33.6	3.4	23.0	13.0	1.5	6.7	0.7	45.9	26.1	3.1	13.4	1.4	390.2	221.7	26.1	114.1	11.7					
		4		DDG	Guided Missile Destroyer	DDG-3	2.0	100%	8.0	5%	10%	85%	0.4	0.8	6.8	106.67	53.8	7.8	21.2	2.8	42.7	21.5	3.1	8.5	1.1	85.3	43.1	6.3	17.0	2.2	725.4	366.1	53.3	144.3	19.0					
		3		FFG	Guided Missile Frigate	FFG-3	2.0	100%	6.0	5%	10%	85%	0.3	0.6	5.1	120.04	78.1	11.6	16.1	4.3	36.0	23.4	3.5	4.8	1.3	72.0	46.9	7.0	9.6	2.6	612.2	398.4	59.4	82.0	21.9					
		13		TRB	Torpedo Retrieval Boats	TRB-3	2.0	100%	26.0	5%	10%	85%	1.3	2.6	22.1	6.47	56.2	1.6	7.4	1.2	8.4	73.1	2.0	9.6	1.5	16.8	146.2	4.0	19.2	3.1	143.0	1242.5	34.3	163.5	26.1					
10	EER/IEER ASW																																							
11	Surface Ship ASW TRACKEX	228		CG	Cruiser	CG-3	2.0	100%	456.0	1%	10%	89%	4.6	45.6	405.8	114.75	65.2	7.7	33.6	3.4	523.3	297.4	35.0	153.0	15.7	5232.6	2974.0	349.8	1529.9	156.9	46570.1	26468.9	3112.8	13615.9	1396.1					
		450		DDG	Guided Missile Destroyer	DDG-3	2.0	100%	900.0	1%	10%	89%	9.0	90.0	801.0	106.67	53.8	7.8	21.2	2.8	960.0	484.6	70.6	191.0	25.2	9600.3	4845.6	705.6	1909.8	252.0	85442.7	43125.8	6279.8	16997.2	2242.8					
		169		FFG	Guided Missile Frigate	FFG-3	2.0	100%	338.0	1%	10%	89%	3.4	33.8	300.8	120.04	78.1	11.6	16.1	4.3	405.7	264.0	39.3	54.4	14.5	4057.4	2640.1	393.4	543.5	145.3	36110.4	23497.1	3501.5	4837.2	1293.5					
		0		Support	Torpedo Retrieval Boats	TRB-3	2.0	100%	0.0	1%	10%	89%	0.0	0.0	0.0	6.47	56.2	1.6	7.4	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
12	Surface Ship ASW TORPEX	6		CG	Cruiser	CG-3	3.7	100%	22.2	1%	10%	89%	0.2	2.2	19.8	114.75	65.2	7.7	33.6	3.4	25.5	14.5	1.7	7.4	0.8	254.7	144.8	17.0	74.5	7.6	2267.2	1288.6	151.5	662.9	68.0					
		10		DDG	Guided Missile Destroyer	DDG-3	3.7	100%	37.0	1%	10%	89%	0.4	3.7	32.9	106.67	53.8	7.8	21.2	2.8	39.5	19.9	2.9	7.9	1.0	394.7	199.2	29.0	78.5	10.4	3512.6	1773.0	258.2	698.8	92.2					
		5		FFG	Guided Missile Frigate	FFG-3	3.7	100%	18.5	1%	10%	89%	0.2	1.9	16.5	120.04	78.1	11.6	16.1	4.3	22.2	14.5	2.2	3.0	0.8	222.1	144.5	21.5	29.7	8.0	1976.5	1286.1	191.7	264.8	70.8					
		10		TRB	Torpedo Retrieval Boats	TRB-3	3.7	100%	37.0	1%	10%	89%	0.4	3.7	32.9	6.47	56.2	1.6	7.4	1.2	2.4	20.8	0.6	2.7	0.4	23.9	208.0	5.7	27.4	4.4	213.1	1851.3	51.0	243.7	38.9					
13	Sub ASW Trackex	45		SSN	Submarines (No emissions)																																			
		14		TRB	Torpedo Retrieval Boats	TRB-3	12.8	100%	179.2	1%	2%	97%	1.8	3.6	173.8	6.47	56.2	1.6	7.4	1.2	11.6	100.7	2.8	13.3	2.1	23.2	201.5	5.6	26.5	4.2	1124.6	9772.4	269.4	1286.3	205.1					
14	Sub ASW TORPEX	18		SSN	Submarines (No emissions)																																			
		18		TRB	Torpedo Retrieval Boats	TRB-3	11.7	100%	210.6	1%	2%	97%	2.1	4.2	204.3	6.47	56.2	1.6	7.4	1.2	13.6	118.4	3.3	15.6	2.5	27.3	236.8	6.5	31.2	5.0	1321.7	11484.7	316.6	1511.7	241.1					
15	VBSS	13		CG	Cruiser	CG-2	4.0	100%	52.0	0%	0%	100%	0.0	0.0	52.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5604.6	2450.2	458.6	1093.0	136.8					
		26		DDG	Guided Missile Destroyer	DDG-2	4.0	100%	104.0	0%	0%	100%	0.0	0.0	104.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10815.0	5085.6	835.1	1865.8	255.8					
		5		FFG	Guided Missile Frigate	FFG-2	4.0	100%	20.0	0%	0%	100%	0.0	0.0	20.0	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1336.4	1354.4	156.2	231.4	65.0					
		2		LPD	Amphibious Transport Dock - Wasp	LPD-1	4.0	100%	8.0	0%	0%	100%	0.0	0.0	8.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.8	87.1	11.1	262.0	52.6					
		5		LSD		LPD-1	4.0	100%	20.0	0%	0%	100%	0.0	0.0	20.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.9	217.8	27.7	655.1	131.5					
16	ASUW MISSILEX	30		TRB	Torpedo Retrieval Boats	TRB-2	7.0	100%	210.0	5%	28%	67%	10.5	58.8	140.7	7.64	33.1	0.6	3.4	1.2	80.2	347.4	6.2	35.6	12.2	449.2	1945.7	34.7	199.3	68.2	1074.9	4655.8	83.0	477.0	163.2					
		2		CG	Cruiser	CG-2	4.0	100%	8.0	0%	0%	100%	0.0	0.0	8.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	862.2	377.0	70.6	168.2	21.0					
		2		DDG	Guided Missile Destroyer	DDG-2	4.0	100%	8.0	0%	0%	100%	0.0	0.0	8.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	831.9	391.2	64.2	143.5	19.7					
17	A-S BOMBEX	0																																						
18	A-S GUNEX	0																																						
19	S-S GUNEX	1		CVN	Nuclear Carrier (No emissions)																																			
		64		CG	Cruiser	CG-1	2.5	100%	160.0	0%	28%	72%	0.0	44.8	115.2	102.58	40.6	9.2	17.7	2.1	0.0	0.0	0.0	0.0	0.0	4595.6	1819.3	413.1	793.4	95.0						11817.2	4678.3	1062.1	2040.2	244.2
		132		DDG	Guided Missile Destroyer	DDG-1	2.5	100%	330.0	0%	28%	72%	0.0	92.4	237.6	102.98	47.3	8.1	17.0	2.4	0.0	0.0	0.0	0.0	0.0	9515.4	4374.2	748.4	1574.5	217.1						24468.0	11248.0	1924.6	4048.7	558.4
		44		FFG	Guided Missile Frigate	FFG-1	2.5	100%	110.0	0%	28%	72%	0.0	30.8	79.2	65.75	66.4	7.9	10.9	3.1	0.0	0.0	0.0	0.0	0.0	2025.1	2043.6	243.0	335.4	96.7						5207.4	5254.9	624.9	862.5	248.7
		2		LPD	Amphibious Transport Dock - Wasp	LPD-1	2.5	100%	5.0	0%	28%	72%	0.0	1.4	3.6	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	2.6	15.2	1.9	45.9	9.2						6.6	39.2	5.0	117.9	23.7
		1		LSD	Landing Ship Dock	LPD-1	2.5	100%	2.5	0%	28%	72%	0.0	0.7	1.8	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	1.3	7.6	1.0	22.9	4.6						3.3	19.6	2.5	59.0	11.8
		1		LHD	Large Helicopter-dock Ships	LHD-2	2.5	100%	2.5	0%	28%	72%	0.0	0.7	1.8	6.8	40.1	5.1	120.7	24.2	0.0	0.0	0.0	0.0	0.0	4.8	28.1	3.6	84.5	17.0						12.2	72.2	9.2	217.3	43.6
		16		Unknown	Other	PC-2	2.5	100%	40.0	0%	28%	72%	0.0	11.2	28.8	17.21	38.1	2.9	8.2	0.9	0.0	0.0	0.0	0.0	0.0	192.8	427.2	32.9	92.2	10.3						495.6	1098.4	84.7	237.0	26.5
		36		USCG	US Coast Guard	USCG	2.5	100%	90.0	0%	28%	72%	0.0	25.2	64.8	5.74	57.9	0.9	11.6	0.2	0.0	0.0	0.0	0.0	0.0	144.6	1459.3	22.2	291.1	5.3						372.0	3752.6	57.0	748.4	13.6
20	SINKEX	4		CG	Cruiser	CG-2	16.0	100%	64.0	0%	0%	100%	0.0	0.0	64.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						6897.9	3015.7	564.5	1345.3	168.3
		4		DDG	Guided Missile Destroyer	DDG-2	16.0	100%	64.0	0%	0%	100%	0.0	0.0	64.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						6655.4	3129.6	513.9	1148.2	157.4
		4		DD	Destroyer	DDG-2	16.0	100%	64.0	0%	0%	100%	0.0	0.0	64.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						6655.4	3129.6	513.9	1148.2	157.4
		4		FFG	Guided Missile Frigate	FFG-2	16.0	100%	64.0	0%	0%	100%	0.0	0.0	64.0	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						4276.5	4334.1	499.8	740.5	208.0
		2		SSN	Submarines (No emissions)																																			
21	NSFS	15		CG	Cruiser	CG-2	9.0	100%	135.0	0%	30%	70%	0.0	40.5	94.5	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	4365.1	1908.4	357.2	851.3	106.5	10185.2	4452.8	833.5	1986.4	248.5					
		32		DDG	Guided Missile Destroyer	DDG-2	9.0	100%	288.0	0%	30%	70%	0.0	86.4	201.6	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	8984.7	4225.0	693.8	1550.0	212.5	20964.4	9858.2	1618.8	3616.7	495.9					
		4		FFG	Guided Missile Frigate	FFG-2	9.0	100%	36.0	0%	30%	70%	0.0	10.8	25.2	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	721.7	731.4	84.3	125.0	35.1	1683.9	1706.5	196.8	291.6	81.9					
22	EFEX	2		CG	Cruiser	CG-2	72.0	100%	144.0	0%	100%	0%	0.0	144.0	0.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	15520.3	6785.3	1270.1	3026.9	378.7	0.0	0.0	0.0	0.0	0.0					
		2		DDG	Guided Missile Destroyer	DDG-2	72.0	100%	144.0	0%	100%	0%	0.0	144.0	0.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	14974.6	7041.6	1156.3	2583.4	354.2	0.0	0.0	0.0	0.0	0.0					
23	Battalion Landing	0		LHA	Amphib. Assault Ship - Tarawa	LHA-1	6.0	100%	0.0	10%	30%	60%	0.0	0.0	0.0	7.38	131.0	26.3	7.4	43.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		LCU	Landing Craft Utility	LCU	3.0	100%	0.0	10%	30%	60%	0.0	0.0	0.0	36.21	3.1	1.6	36.2	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		AAV/EFV	Amphibious Assault Vehicle	AAV-2	6.0	100%	0.0	10%	30%	60%	0.0	0.0	0.0	0.633674	3.8	0.2	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		LCAC	Landing Craft Air Cushioned	LCAC	3.0	100%	0.0	10%	30%	60%	0.0	0.0	0.0	25.41	43.3	3.9	25.4	55.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		CRRC	Combat Raiding Rubber Craft	CRRC-4	6.0	100%	0.0	10%	30%	60%	0.0	0.0	0.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
24	USMC Stinger	0																																						
25	Amphibious Landings & Raids																																							
25A	Recon Mission	0																																						
25B	Helicopter Assault	0		LHD	Large Helicopter-dock Ships	LHD-2	6.0	100%	0.0	0%	0%	100%	0.0	0.0	0.0	6.8	40.1	5.1	120.7	24.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		LHA	Amphib. Assault Ship - Tarawa	LHA-1	6.0	100%	0.0	0%	0%	100%	0.0	0.0	0.0	7.38	131.0	26.3	7.4	43.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
25C	Armored Operations	0		LHD	Large Helicopter-dock Ships	LHD-2	12.0	100%	0.0	33%	33%	33%	0.0	0.0	0.0	6.8	40.1	5.1	120.7	24.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		LHA	Amphib. Assault Ship - Tarawa	LHA-1	12.0	100%	0.0	33%	33%	33%	0.0	0.0	0.0	7.38	131.0	26.3	7.4	43.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		LCAC	Landing Craft Air Cushioned	LCAC	12.0	100%	0.0	33%	33%	33%	0.0	0.0	0.0	25.41	43.3	3.9	25.4	55.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		LCU	Landing Craft Utility	LCU	12.0	100%	0.0	33%	33%	33%	0.0	0.0	0.0	36.21	3.1	1.6	36.2	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
25D	Artillery Operations	2		LHD	Large Helicopter-dock Ships	LHD-2	24.0	100%	48.0	100%	0%	0%	48.0	0.0	0.0	6.8	40.1	5.1	120.7	24.2	326.4	1925.8	244.8	5793.6	1163.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		1		LHA	Amphib. Assault Ship - Tarawa	LHA-1	24.0	100%	24.0	20%	40%	40%	4.8	9.6	9.6	7.38	43.5	5.5	131.0	26.3	35.4	208.9	26.5	628.7	126.2	70.8	417.9	53.1	1257.3	252.4	70.8	417.9	53.1	1257.3	252.4					
		4		LCAC	Landing Craft Air Cushion	LCAC	24.0	100%	96.0	100%	0%	0%	96.0	0.0	0.0	25.41	55.3	0.7	43.3	3.9	2439.4	5310.7	69.1	4156.8	373.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		4		LCU	Landing Craft Utility	LCU	24.0	100%	96.0	100%	0%	0%	96.0	0.0	0.0	36.21	45.0	0.5	3.1	1.6	3476.2	4315.2	49.9	298.6	150.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
25E	Amphibious Assault	0		LHD	Large Helicopter-dock Ships	LHD-2	8.0	100%	0.0	38%	38%	25%	0.0	0.0	0.0	6.8	40.1	5.1	120.7	24.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					

Table C-1. Surface Ship Air Emissions—No Action Alternative

Scenario	Type Training	Number of Ships	Program Totals	Nomenclature	Ship/Boat Type	Vessel Mode	Ship Time on Range (hrs) (Hours)	Percent at Each Power Level (%)	Total Time on Range (hrs) (Hours)	Percentage 0-3 nm from shore (Percent)	Percentage 3-12 nm from Shore (Percent)	Percentage >12 nm from Shore (Percent)	Total Time 0-3 nm from shore (Hours)	Total Time 3-12 nm from shore (Hours)	Total Time >12 nm from shore (Hours)	Emissions Factors (lb/hr) CO	Emissions Factors (lb/hr) NOx	Emissions Factors (lb/hr) HC	Emissions Factors (lb/hr) SOx	Emissions Factors (lb/hr) PM10	Emissions: Emissions 0-3 nm Offshore (lbs) CO	Nox	HC	Sox	PM	Emissions 3-12 nm Offshore - US Territory (lbs) CO	Nox	HC	Sox	PM	Emissions >12 nm Offshore - Outside US Territory CO	Nox	HC	Sox	PM	CO	Nox	HC	Sox	PM
		0		LHA	Amphib. Assault Ship - Tarawa	LHA-1	8.0	100%	0.0	38%	38%	25%	0.0	0.0	0.0	7.38	43.5	5.5	131.0	26.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		LPD	Amphibious Transport Dock - Wasp	LPD-1	8.0	100%	0.0	38%	38%	25%	0.0	0.0	0.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		LCAC	Landing Craft Air Cushioned	LCAC	8.0	100%	0.0	38%	38%	25%	0.0	0.0	0.0	25.41	43.3	3.9	25.4	55.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		LCU	Landing Craft Utility	LCU	8.0	100%	0.0	38%	38%	25%	0.0	0.0	0.0	36.21	3.1	1.6	36.2	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
25F	Combat Engineer Ops	0		LHA	Amphib. Assault Ship - Tarawa	LHA-1	6.0	100%	0.0	33%	33%	33%	0.0	0.0	0.0	7.38	131.0	26.3	7.4	43.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		LCU	Landing Craft Utility	LCU	6.0	100%	0.0	33%	33%	33%	0.0	0.0	0.0	36.21	3.1	1.6	36.2	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
25G	Amphibious Assault Vehicle Ops	0		LHA	Amphib. Assault Ship - Tarawa	LHA-1	8.0	100%	0.0	25%	25%	50%	0.0	0.0	0.0	7.38	131.0	26.3	7.4	43.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		EFV	Expeditionary Fighting Vessel	EFV-1	8.0	100%	0.0	25%	25%	50%	0.0	0.0	0.0	2.0611	4.17	0.72	0.06	0.3211	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
25H	EFV	0		LPD	Amphibious Transport Dock - Wasp	LPD-1	8.0	100%	0.0	25%	25%	50%	0.0	0.0	0.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		LCAC	Landing Craft Air Cushioned	LCAC	8.0	100%	0.0	25%	25%	50%	0.0	0.0	0.0	25.41	43.3	3.9	25.4	55.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		EFV	Expeditionary Fighting Vessel	EFV-1	8.0	100%	0.0	25%	25%	50%	0.0	0.0	0.0	2.0611	4.17	0.72	0.06	0.3211	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
25I	Assault Amphibian School	0		LCAC	Landing Craft Air Cushioned	LCAC	8.0	100%	0.0	0%	0%	100%	0.0	0.0	0.0	25.41	43.3	3.9	25.4	55.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		LCU	Landing Craft Utility	LCU	8.0	100%	0.0	0%	0%	100%	0.0	0.0	0.0	36.21	3.1	1.6	36.2	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		0		EFV	Amphibious Assault Vehicle	EFV-1	8.0	100%	0.0	0%	0%	100%	0.0	0.0	0.0	2.0611	4.17	0.72	0.06	0.3211	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
26	Ambphibious Operations CPAAA																																							
26A	Amphibious Operations	1530		AAV/EFV	Amphibious Assault Vehicle	AAV-1	16.8	20%	25704.0	100%	0%	0%	25704.0	0.0	0.0	0.444918	1.0	0.2	0.1	0.2	11436.2	26631.2	4474.8	1323.2	4604.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
				AAV/EFV	Amphibious Assault Vehicle	AAV-2	16.8	80%	0.0	100%	0%	0%	0.0	0.0	0.0	0.633674	3.8	0.2	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		6		LCAC	Landing Craft Air Cushion	LCAC	16.8	100%	100.8	100%	0%	0%	100.8	0.0	0.0	25.41	55.3	0.7	43.3	3.9	2561.3	5576.3	72.6	4364.6	392.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
26B	Amphibious Ops	4		LHD	Large Helicopter-dock Ships	LHD-1	4.2	90%	15.2	0%	0%	100%	0.0	0.0	15.2	5.89	34.8	4.4	104.6	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89.3	527.0	67.0	1585.3	318.1					
				LHD	Large Helicopter-dock Ships	LHD-2	4.2	10%	1.7	0%	0%	100%	0.0	0.0	1.7	6.8	40.1	5.1	120.7	24.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.5	67.6	8.6	203.3	40.8					
		4		LCAC	Landing Craft Air Cushion	LCAC	4.2	100%	16.8	0%	0%	100%	0.0	0.0	16.8	25.41	55.3	0.7	43.3	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	427.9	931.6	12.1	729.2	65.5					
		60		CRRC	Combat Raiding Rubber Craft	CRRC-1	4.2	22%	55.6	28%	36%	36%	15.6	20.0	20.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.4					
				CRRC	Combat Raiding Rubber Craft	CRRC-4	4.2	27%	55.6	28%	36%	36%	15.6	20.0	20.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	2.6					
				CRRC	Combat Raiding Rubber Craft	CRRC-5	4.2	51%	128.8	28%	36%	36%	36.1	46.4	46.4	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	5.4	0.0	0.0	0.0	0.0	6.9	0.0	0.0	0.0	0.0	6.9					
		4		LCU	Landing Craft Utility	LCU	4.2	100%	16.8	32%	0%	68%	5.4	0.0	11.5	36.21	45.0	0.5	3.1	1.6	195.1	242.2	2.8	16.8	8.5	0.0	0.0	0.0	0.0	0.0	414.6	514.7	6.0	35.6	18.0					
26C	Amphibious Ops	130		AAV/EFV	Amphibious Assault Vehicle	AAV-1	15.0	10%	195.0	100%	0%	0%	195.0	0.0	0.0	0.444918	1.0	0.2	0.1	0.2	86.8	202.0	33.9	10.0	34.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						AAV-2	15.0	90%	1755.0	100%	0%	0%	1755.0	0.0	0.0	0.633674	3.8	0.2	0.1	0.3	1112.1	6596.0	300.9	184.8	516.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
26D	Amphibious Ops	5		AAV	Amphibious Assault Vehicle	AAV-1	2.4	20%	2.4	100%	0%	0%	2.4	0.0	0.0	0.444918	1.0	0.2	0.1	0.2	1.0	2.4	0.4	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						AAV-2	2.4	80%	9.4	100%	0%	0%	9.4	0.0	0.0	0.633674	3.8	0.2	0.1	0.3	6.0	35.3	1.6	1.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		1502		EFV	Amphibious Assault Vehicle	EFV-1	2.4	33%	1176.4	28%	70%	2%	329.4	823.5	23.5	2.0611	4.17	0.72	0.06	0.3211	678.9	1372.6	237.5	20.8	105.8	1697.3	3431.6	593.8	52.0	264.4	48.5	98.0	17.0	1.5	7.6					
						EFV-2	2.4	67%	2353.3	28%	70%	2%	658.9	1647.3	47.1	2.0611	4.17	0.72	0.06	0.3211	1358.1	2745.7	475.1	41.6	211.6	3395.2	6864.2	1187.9	104.1	528.9	97.0	196.1	33.9	3.0	15.1					
		2268		RIB	Rigid Inflatable	RIB-1	2.4	7%	355.5	28%	70%	2%	99.5	248.8	7.1	0.04	1.6	0.0	0.2	0.0	4.0	158.3	1.0	16.9	2.0	10.0	395.7	2.5	42.3	5.0	0.3	11.3	0.1	1.2	0.1					
						RIB-3		13%	708.9	28%	70%	2%	198.5	496.2	14.2	0.08	3.0	0.0	0.4	0.0	15.9	595.4	2.0	71.5	7.9	39.7	1488.6	5.0	178.6	19.8	1.1	42.5	0.1	5.1	0.6					
						RIB-4		80%	4263.8	28%	70%	2%	1193.9	2984.7	85.3	0.34	9.1	0.1	1.4	0.2	405.9	10912.0	71.6	1719.2	179.1	1014.8	27280.0	179.1	4298.0	447.7	29.0	779.4	5.1	122.8	12.8					
		756		Support	Coastal Patrol-Independent Low Speed (	PC-1	2.4	20%	355.3	28%	70%	2%	99.5	248.7	7.1	6.5	12.5	1.1	2.5	0.4	646.7	1239.6	104.5	249.7	34.8	1616.7	3099.1	261.2	624.3	87.1	46.2	88.5	7.5	17.8	2.5					
					Dynamic Maneuvering	PC-3		80%	1421.3	28%	70%	2%	398.0	994.9	28.4	59.93	187.6	9.3	47.1	4.8	23849.6	74661.0	3709.0	18751.8	1898.3	59624.1	186652.4	9272.4	46879.5	4745.7	1703.5	5332.9	264.9	1339.4	135.6					
26E	Amphibious Ops	348		AAV	Amphibious Assault Vehicle	AAV-1	13.2	20%	918.7	100%	0%	0%	918.7	0.0	0.0	0.444918	1.0	0.2	0.1	0.2	408.8	951.9	159.9	47.3	164.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						AAV-2	13.2	80%	3674.9	100%	0%	0%	3674.9	0.0	0.0	0.633674	3.8	0.2	0.1	0.3	2328.7	13811.7	630.1	387.0	1081.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		156		CRRC	Combat Raiding Rubber Craft	CRRC-1	13.2	28%	566.3	70%	30%	0%	396.4	169.9	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9	0.0	0.0	0.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0					
				CRRC	Combat Raiding Rubber Craft	CRRC-4	13.2	18%	360.4	70%	30%	0%	252.3	108.1	0.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	33.3	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0					
				CRRC	Combat Raiding Rubber Craft	CRRC-5	13.2	55%	1132.6	70%	30%	0%	792.8	339.9	0.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	117.8	0.0	0.0	0.0	0.0	50.5	0.0	0.0	0.0	0.0	0.0					
26F	Amphibious Warfare	964		LCAC	Landing Craft Air Cushion	LCAC	8.5	100%	8194.0	16%	55%	29%	1311.0	4506.7	2376.3	25.41	55.3	0.7	43.3	3.9	33313.5	72526.7	943.9	56768.0	5099.9	114515.2	249310.6	3244.8	195140.1	17531.1	60380.8	131454.7	1710.9	102892.1	9243.7					
		221		LCU	Landing Craft Utility	LCU	8.5	100%	1878.5	75%	5%	20%	1408.9	93.9	375.7	36.21	45.0	0.5	3.1	1.6	51015.4	63328.9	732.6	4381.6	2211.9	3401.0	4221.9	48.8	292.1	147.5	13604.1	16887.7	195.4	1168.4	589.8					
		72		Support	Coastal Patrol-Independent Low Speed (	PC-2	8.5	100%	612.0	100%	0%	0%	612.0	0.0	0.0	17.21	38.1	2.9	8.2	0.9	10532.5	23341.7	1799.3	5036.8	563.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		72		LCM-8		LCU	8.5	100%	612.0	100%	0%	0%	612.0	0.0	0.0	36.21	45.0	0.5	3.1	1.6	22160.5	27509.4	318.2	1903.3	960.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		30		LARC		LCU	8.5	100%	255.0	100%	0%	0%	255.0	0.0	0.0	36.21	45.0	0.5	3.1	1.6	9233.6	11462.3	132.6	793.1	400.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		36		SLWT	SLWT (assume LPD)	LPD-2	8.5	20%	61.2	95%	5%	0%	58.1	3.1	0.0	2.935967	17.3	2.2	52.1	10.5	170.7	1007.1	128.0	3029.9	608.1	9.0	53.0	6.7	159.5	32.0	0.0	0.0	0.0	0.0	0.0					
						LPD-3	8.5	80%	244.8	95%	5%	0%	232.6	12.2	0.0	6.549492	38.6	4.9	116.3	23.3	1523.1	8986.6	1142.4	27035.9	5426.2	80.2	473.0	60.1	1422.9	285.6	0.0	0.0	0.0	0.0	0.0					
		36		SLWT	SLWT (assume LPD)	LPD-2	8.5	20%	61.2	95%	5%	0%	58.1	3.1	0.0	2.935967	17.3	2.2	52.1	10.5	170.7	1007.1	128.0	3029.9	608.1	9.0	53.0	6.7	159.5	32.0	0.0	0.0	0.0	0.0	0.0					
						LPD-3	8.5	80%	244.8	95%	5%	0%	232.6	12.2	0.0	6.549492	38.6	4.9	116.3	23.3	1523.1	8986.6	1142.4	27035.9	5426.2	80.2	473.0	60.1	1422.9	285.6	0.0	0.0	0.0	0.0	0.0					
		18		BW	Boston Whaler	BW-2	8.5	20%	30.6	95%	5%	0%	29.1	1.5	0.0	0	0.1	9.0	0.0	0.0	0.0	2.6	262.1	0.0	0.0	0.0	0.1	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						BW-3	8.5	80%	122.4	95%	5%	0%	116.3	6.1	0.0	0	0.3	26.3	0.0	0.0	0.0	30.7	3058.2	0.0	0.0	0.0	1.6	161.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
26G	Amphibious Ops	614		CRRC	Combat Raiding Rubber Craft	CRRC-1	6.2	28%	1038.4	80%	20%	0%	830.7	207.7	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.5	0.0	0.0	0.0	0.0	4.1	0.0	0.0	0.0	0.0	0.0					
				CRRC	Combat Raiding Rubber Craft	CRRC-4	6.2	18%	660.8	80%	20%	0%	528.7	132.2	0.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	69.8	0.0	0.0	0.0	0.0	17.5	0.0	0.0	0.0	0.0	0.0					
				CRRC	Combat Raiding Rubber Craft	CRRC-5	6.2	55%	2076.9	80%	20%	0%	1661.5	415.4	0.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	246.8	0.0	0.0	0.0	0.0	61.7	0.0	0.0	0.0	0.0	0.0					
27	Elec Combat	314		CVN	Nuclear Carrier (No emissions)																																			
		741		CG	Cruiser	CG-2	4.9	100%	3630.9	0%	3%	97%	0.0	108.9	3522.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	11740.2	5132.6	960.7	2289.6	286.5	379598.2	165955.4	31063.8	74031.9	9262.8					
		635		DDG	Guided Missile Destroyer	DDG-2	4.9	100%	3111.5	0%	3%	97%	0.0	93.3	3018.2	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	9706.9	4564.6	749.6	1674.6	229.6	313857.9	147587.8	24235.8	54145.7	7424.7					
		23		DD	Destroyer	DDG-2	4.9	100%	112.7	0%	3%	97%	0.0	3.4	109.3	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	351.6	165.3	27.1	60.7	8.3	11368.1	5345.7	877.8	1961.2	268.9					
		18		FFG	Guided Missile Frigate	FFG-2	4.9	100%	88.2	0%	3%	97%	0.0	2.6	85.6	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	176.8	179.2	20.7	30.6	8.6	5716.7	5793.7	668.2	989.9	278.1					
		5		FFH	Canadian Frigate	FFG-2	4.9	100%	24.5	0%	3%	97%	0.0	0.7	23.8	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	49.1	49.8	5.7	8.5	2.4	1588.0	1609.4	185.6	275.0	77.2					
		5		AOE	Logistics/Support	AOE-1	4.9	100%	24.5	0%	3%	97%	0.0	0.7	23.8	3.73	22.0	2.8	66.1	13.3	0.0	0.0	0.0	0.0	0.0	2.7	16.2	2.1	48.6	9.8	88.6	522.6	66.3	1571.8	315.6					
		2		MHC		PC-1	4.9	100%	9.8	0%	3%	97%	0.0	0.3	9.5	6.5	12.5	1.1	2.5	0.4	0.0	0.0	0.0	0.0	0.0	1.9	3.7	0.3	0.7	0.1	61.8	118.4	10.0	23.9	3.3					
		16		LPD	Amphibious Transport Dock - Wasp	LPD-1	4.9	100%	78.4	0%	3%	97%	0.0	2.4	76.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	4.3	25.6	3.3	77.0	15.5	140.3	828.0	105.3	2491.0	500.0					
		230		LHD	Large Helicopter-dock Ships	LHD-1	4.9	100%	1127.0	0%	3%	97%	0.0	33.8	1093.2	5.89	34.8	4.4	104.6	21.0	0.0	0.0	0.0	0.0	0.0	199.1	1175.6	149.4	3536.5	709.7	6438.9	38010.2	4831.9	114347.7	22946.1					
		15		LSD	Landing Ship Dock	LPD-1	4.9	100%	73.5	0%	3%	97%	0.0	2.2	71.3	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	4.1	24.0	3.1	72.2	14.5	131.6	776.2	98.7	2335.3	468.7					
		175		LHA	Amphib. Assault Ship - Tarawa	LHA-1	4.9	100%	857.5	0%	3%	97%	0.0	25.7	831.8	7.38	43.5	5.5	131.0	26.3	0.0	0.0	0.0	0.0	0.0	189.9	1119.8	142.3	3369.2	676.3	6138.5	36207.2	4599.7	108937.6	21867.4					
		1		AGF		LPD-1	4.9	100%	4.9	0%	3%	97%	0.0	0.1	4.8	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.3	1.6	0.2	4.8	1.0	8.8	51.7	6.6	155.7	31.2					
		4		WHEC	US Coast Guard	USCG	4.9	100%	19.6	0%	3%	97%	0.0	0.6	19.0	5.74	57.9	0.9	11.6	0.2	0.0	0.0	0.0	0.0	0.0	3.4	34.1	0.5	6.8	0.1	109.1	1101.0	16.7	219.6	4.0					
		144		Unknown		PC-1	4.9	100%	705.6	0%	3%	97%	0.0	21.2	684.4	6.5	12.5	1.1	2.5	0.4	0.0	0.0	0.0	0.0	0.0	137.6	263.8	22.2	53.1	7.4	4448.8	8528.0	718.7	1717.9	239.6					
		10		SSN	Submarines (No emissions)																																			
		2		SSBN	Submarines (No emissions)																																			
28A	Sm Obj Avoidance	8		CG	Cruiser	CG-2	1.8	100%	14.0	100%	0%	0%	14.0	0.0	0.0	107.78	47.1	8.8	21.0	2.6	1508.9	659.7	123.5	294.3	36.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		13		DDG	Guided Missile Destroyer	DDG-2	1.8	100%	22.8	100%	0%	0%	22.8	0.0	0.0	103.99	48.9	8.0	17.9	2.5	2365.8	1112.5	182.7	408.1	56.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		10		FFG	Guided Missile Frigate	FFG-2	1.8	100%	17.5	100%	0%	0%	17.5	0.0	0.0	66.82	67.7	7.8	11.6	3.3	1169.4	1185.1	136.7	202.5	56.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		15		MCM		USCG	1.8	100%	26.3	100%	0%	0%	26.3	0.0	0.0	5.74	57.9	0.9	11.6	0.2	150.7	1520.1	23.1	303.2	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		21		MHC		USCG	1.8	100%	36.8	100%	0%	0%	36.8	0.0	0.0	5.74	57.9	0.9	11.6	0.2	210.9	2128.2	32.3	424.5	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
29	Mine Neutralization	0																																						
30	Mining Exercise	2		MHC		USCG	0.5	100%	1.0	50%	40%	10%	0.5	0.4	0.1	5.74	57.9	0.9	11.6	0.2	2.9	29.0	0.4	5.8	0.1	2.3	23.2	0.4	4.6	0.1	0.6	5.8	0.1	1.2	0.0					
31	NSWC Land Demolition	3		CRRC		CRRC-2	4.0	90%	10.8	100%	0%	0%	10.8	0.0	0.0	0	0.0	2.3	0.0	0.0	0.0	0.3	24.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						CRRC-3		10%	1.2	100%	0%	0%	1.2	0.0	0.0	0	0.1	6.3	0.0	0.0	0.0	0.1	7.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
32	NSWC UW Demo	72		CRRC		CRRC-2	6.0	90%	388.8	100%	0%	0%	388.8	0.0	0.0	0	0.0	2.3	0.0	0.0	0.0	10.3	891.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						CRRC-3		10%	43.2	100%	0%	0%	43.2	0.0	0.0	0	0.1	6.3	0.0	0.0	0.0	3.1	272.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
33	Mat Weave	28		CRRC		CRRC-2	4.0	90%	100.8	100%	0%	0%	100.8	0.0	0.0	0	0.0	2.3	0.0	0.0	0.0	2.7	231.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						CRRC-3		10%	11.2	100%	0%	0%	11.2	0.0	0.0	0	0.1	6.3	0.0	0.0	0.0	0.8	70.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
34	NSWC Small Arms	20		CRRC		CRRC-2	6.0	90%	108.0	100%	0%	0%	108.0	0.0	0.0	0	0.0	2.3	0.0	0.0	0.0	2.9	247.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						CRRC-3		10%	12.0	100%	0%	0%	12.0	0.0	0.0	0	0.1	6.3	0.0	0.0	0.0	0.9	75.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
35	NSWC Land Nav	0																																						
36	NSW UAV Operationa	0																																						
37	Insertion/Extraction	0																																						
38	NSW Boat Operations	220		MK V	MK V	MK-1	10.0	50%	1100.0	5%	42%	53%	55.0	462.0	583.0	1.94	14.8	0.5	2.4	0.2	106.7	815.7	27.5	131.5	11.0	896.3	6851.5	231.0	1104.2	92.4	1131.0	8645.9	291.5	1393.4	116.6					
						MK-3		50%	1100.0	5%	42%	53%	55.0	462.0	583.0	13.22	71.5	1.1	15.7	1.2	727.1	3931.4	57.8	860.8	63.3	6107.6	33023.8	485.1	7230.3	531.3	7707.3	41672.8	612.2	9124.0	670.5					
		67		RIB	Rigid Inflatable	RIB-3	10.0	50%	335.0	5%	42%	53%	16.8	140.7	177.6	0.08	3.0	0.0	0.4	0.0	1.3	50.3	0.2	6.0	0.7	11.3	422.1	1.4	50.7	5.6	14.2	532.7	1.8	63.9	7.1					
						RIB-4		50%	335.0	5%	42%	53%	16.8	140.7	177.6	0.34	9.1	0.1	1.4	0.2	5.7	153.1	1.0	24.1	2.5	47.8	1286.0	8.4	202.6	21.1	60.4	1622.8	10.7	255.7	26.6					

Table C-1. Surface Ship Air Emissions—No Action Alternative

Scenario	Type Training	Number of Ships	Program Totals	Nomenclature	Ship/Boat Type	Vessel Mode	Ship Time on Range (hrs)	Percent at Each Power Level	Total Time on Range (hrs)	Percentage 0-3 nm from shore	Percentage 3-12 nm from Shore	Percentage >12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Emissions Factors (lb/hr) CO	NOx	HC	SOx	PM10
							Hours	%	Hours	Percent			Hours			CO	NOx	HC	SOx	PM10
39	NSWG-1 Platoon Ops	2		PC	Coastal Patrol-Independent Low Speed (	PC-3	4.0	100%	8.0	20%	30%	50%	1.6	2.4	4.0	59.93	187.6	9.3	47.1	4.8
		25		CRRC		CRRC-5	0.5	100%	12.5	100%	0%	0%	12.5	0.0	0.0	0	0.1	12.9	0.0	0.0
		42		SOW	MK V	MK-3	0.5	100%	21.0	100%	0%	0%	21.0	0.0	0.0	13.22	71.5	1.1	15.7	1.2
40	Direct Action	2		PC	Coastal Patrol-Independent Low Speed (	PC-2	8.0	80%	12.8	30%	20%	50%	3.8	2.6	6.4	17.21	38.1	2.9	8.2	0.9
					Dynamic Maneuvering	PC-3		20%	3.2	30%	20%	50%	1.0	0.6	1.6	59.93	187.6	9.3	47.1	4.8
		3		SOW	MK V	MK-1	4.0	80%	9.6	30%	25%	45%	2.9	2.4	4.3	1.94	14.8	0.5	2.4	0.2
						MK-3		20%	2.4	30%	25%	45%	0.7	0.6	1.1	13.22	71.5	1.1	15.7	1.2
		1		LCAC	Landing Craft Air Cushion	LCAC	1.0	100%	1.0	100%	0%	0%	1.0	0.0	0.0	25.41	55.3	0.7	43.3	3.9
		10		CRRC	Combat Rubber Raiding Craft	CRRC-3	1.0	100%	10.0	100%	0%	0%	10.0	0.0	0.0	0	0.1	6.3	0.0	0.0
		10		SDV	Combat Rubber Raiding Craft	CRRC-3	1.0	100%	10.0	100%	0%	0%	10.0	0.0	0.0	0	0.1	6.3	0.0	0.0
41	Bombing Exercise - Land	0																		
42	CSAR	0																		
43	EOD Outside SHOBA	0																		
44	USCG Ops	149		Response	Coastal Patrol-Independent Low Speed (	PC-1	3.2	2%	9.5	80%	20%	0%	7.6	1.9	0.0	6.5	12.5	1.1	2.5	0.4
						PC-2		2%	9.5	80%	20%	0%	7.6	1.9	0.0	17.21	38.1	2.9	8.2	0.9
				Utility	Dynamic Maneuvering	PC-3		96%	457.7	80%	20%	0%	366.2	91.5	0.0	59.93	187.6	9.3	47.1	4.8
		149		Utility	Coastal Patrol-Independent Low Speed (	PC-1	3.2	15%	71.5	80%	20%	0%	57.2	14.3	0.0	6.5	12.5	1.1	2.5	0.4
						PC-2		60%	286.1	80%	20%	0%	228.9	57.2	0.0	17.21	38.1	2.9	8.2	0.9
					Dynamic Maneuvering	PC-3		25%	119.2	80%	20%	0%	95.4	23.8	0.0	59.93	187.6	9.3	47.1	4.8
		100		Cutter	US Coast Guard	USCG	3.2	100%	320.0	20%	20%	60%	64.0	64.0	192.0	5.74	57.9	0.9	11.6	0.2
		49		Cutter	US Coast Guard	USCG	3.2	100%	156.8	5%	5%	90%	7.8	7.8	141.1	5.74	57.9	0.9	11.6	0.2
45	NALF Airfield	0																		
46	Ship Torpedo Test	2		DDG	Guided Missile Destroyer	DDG-3	6.5	100%	13.0	0%	23%	77%	0.0	3.0	10.0	106.67	53.8	7.8	21.2	2.8
		2		DDH	Japanese Destroye Helo Deck (FMS)	CG-3	6.5	100%	13.0	0%	23%	77%	0.0	3.0	10.0	114.75	65.2	7.7	33.6	3.4
		2		DD	Japanese Destroyer (FMS)	CG-3	6.5	100%	13.0	0%	23%	77%	0.0	3.0	10.0	114.75	65.2	7.7	33.6	3.4
		7		FFH	Helicopter Frigate (Canadian)	FFG-3	6.5	100%	45.5	0%	23%	77%	0.0	10.6	34.9	120.04	78.1	11.6	16.1	4.3
47	UUV	10		BW	Boston Whalers	BW-1	10.0	100%	100.0	100%	0%	0%	100.0	0.0	0.0	0	0.1	7.5	0.0	0.0
		10		HS	Harbor Security	RIB-2	10.0	100%	100.0	100%	0%	0%	100.0	0.0	0.0	0.04	1.6	0.0	0.2	0.0
		20			Phanton DS4 (no emissions)					100%	0%	0%								
48	Sonobuoy QA/QC	60		AE	Acoustic Explorer	AE-2	4.0	100%	240.0	50%	30%	20%	120.0	72.0	48.0	20.17	20.9	1.0	6.0	1.6
49	Ocean Engineering	65		BW	Boston Whaler	BW-2	3.0	100%	195.0	100%	0%	0%	195.0	0.0	0.0	0	0.1	9.0	0.0	0.0
50	MM Mine Location	1		AE	Acoustic Explorer	AE-1	12.0	100%	12.0	100%	0%	0%	12.0	0.0	0.0	7.31	8.5	0.4	2.1	0.6
		5		BW	Boston Whaler	BW-2	12.0	100%	60.0	100%	0%	0%	60.0	0.0	0.0	0	0.1	9.0	0.0	0.0
51	Missile Flight Test	3		CG		CG-2	4.0	100%	12.0	0%	0%	100%	0.0	0.0	12.0	107.78	47.1	8.8	21.0	2.6
		6		DDG	Guided Missile Destroyer	DDG-2	4.0	100%	24.0	0%	0%	100%	0.0	0.0	24.0	103.99	48.9	8.0	17.9	2.5
52	NUWC UW Acoustic	44		FFG	Guided Missile Frigate	FFG-2	4.0	100%	176.0	0%	0%	100%	0.0	0.0	176.0	66.82	67.7	7.8	11.6	3.3
		12		AE	Acoustic Explorer	AE-1	4.0	100%	48.0	0%	0%	100%	0.0	0.0	48.0	7.31	8.5	0.4	2.1	0.6
		44		BW	Boston Whaler	BW-2	4.0	100%	176.0	0%	0%	100%	0.0	0.0	176.0	0	0.1	9.0	0.0	0.0
53	Other Tests (MCM, ASUW, FIREX)	6		CG	Cruiser	CG-2	4.0	100%	24.0	0%	0%	100%	0.0	0.0	24.0	107.78	47.1	8.8	21.0	2.6
		18		DDG	Guided Missile Destroyer	DDG-2	4.0	100%	72.0	0%	0%	100%	0.0	0.0	72.0	103.99	48.9	8.0	17.9	2.5
		19		FFH	Helicopter Frigate (Canadian)	FFG-2	4.0	100%	76.0	0%	0%	100%	0.0	0.0	76.0	66.82	67.7	7.8	11.6	3.3
		1		DD	Japanese Destroyer (FMS)	CG-2	4.0	100%	4.0	0%	0%	100%	0.0	0.0	4.0	107.78	47.1	8.8	21.02	2.6
		4		AOR	Canadian	AOE-1	4.0	100%	16.0	0%	0%	100%	0.0	0.0	16.0	3.73	22.0	2.8	66.1	13.3
	Total	####																		

Emissions

Scenario	Vessel Mode	Emissions 0-3 nm Offshore (lbs) CO	Nox	HC	Sox	PM	Emissions 3-12 nm Offshore - US Territory (lbs) CO	Nox	HC	Sox	PM	Emissions >12 nm Offshore - Outside US Territory CO	Nox	HC	Sox	PM	CO	Nox	HC	Sox	PM
39	PC-3	95.9	300.2	14.9	75.4	7.6	143.8	450.3	22.4	113.1	11.4	239.7	750.4	37.3	188.5	19.1					
	CRRC-5	0.0	1.9	161.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
	MK-3	277.6	1501.1	22.1	328.7	24.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
40	PC-2	66.1	146.5	11.3	31.6	3.5	44.1	97.6	7.5	21.1	2.4	110.1	244.1	18.8	52.7	5.9					
	PC-3	57.5	180.1	8.9	45.2	4.6	38.4	120.1	6.0	30.2	3.1	95.9	300.2	14.9	75.4	7.6					
	MK-1	5.6	42.7	1.4	6.9	0.6	4.7	35.6	1.2	5.7	0.5	8.4	64.1	2.2	10.3	0.9					
	MK-3	9.5	51.5	0.8	11.3	0.8	7.9	42.9	0.6	9.4	0.7	14.3	77.2	1.1	16.9	1.2					
	LCAC	25.4	55.3	0.7	43.3	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
	CRRC-3	0.0	0.7	63.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
	CRRC-3	0.0	0.7	63.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
44	PC-1	49.6	95.1	8.0	19.1	2.7	12.4	23.8	2.0	4.8	0.7	0.0	0.0	0.0	0.0	0.0					
	PC-2	131.3	291.0	22.4	62.8	7.0	32.8	72.7	5.6	15.7	1.8	0.0	0.0	0.0	0.0	0.0					
	PC-3	21945.3	68699.5	3412.8	17254.5	1746.7	5486.3	17174.9	853.2	4313.6	436.7	0.0	0.0	0.0	0.0	0.0					
	PC-1	371.9	712.9	60.1	143.6	20.0	93.0	178.2	15.0	35.9	5.0	0.0	0.0	0.0	0.0	0.0					
	PC-2	3938.7	8728.9	672.9	1883.6	210.6	984.7	2182.2	168.2	470.9	52.6	0.0	0.0	0.0	0.0	0.0					
	PC-3	5714.9	17890.5	888.8	4493.4	454.9	1428.7	4472.6	222.2	1123.3	113.7	0.0	0.0	0.0	0.0	0.0					
	USCG	367.4	3706.2	56.3	739.2	13.4	367.4	3706.2	56.3	739.2	13.4	1102.1	11118.7	169.0	2217.6	40.3					
	USCG	45.0	454.0	6.9	90.6	1.6	45.0	454.0	6.9	90.6	1.6	810.0	8172.3	124.2	1629.9	29.6					
46	DDG-3	0.0	0.0	0.0	0.0	0.0	321.7	162.4	23.6	64.0	8.4	1065.0	537.5	78.3	211.9	28.0					
	CG-3	0.0	0.0	0.0	0.0	0.0	346.1	196.7	23.1	101.2	10.4	1145.7	651.2	76.6	335.0	34.3					
	CG-3	0.0	0.0	0.0	0.0	0.0	346.1	196.7	23.1	101.2	10.4	1145.7	651.2	76.6	335.0	34.3					
	FFG-3	0.0	0.0	0.0	0.0	0.0	1267.1	824.5	122.9	169.7	45.4	4194.7	2729.5	406.7	561.9	150.3					
47	BW-1	0.0	7.6	751.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
	RIB-2	4.0	159.0	1.0	17.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
48	AE-2	2420.4	2511.6	118.8	716.4	188.4	1452.2	1507.0	71.3	429.8	113.0	968.2	1004.6	47.5	286.6	75.4					
49	BW-2	0.0	17.7	1758.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
50	AE-1	87.7	101.5	4.6	25.4	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
	BW-2	0.0	5.4	541.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
51	CG-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1293.4	565.4	105.8	252.2	31.6					
	DDG-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2495.8	1173.6	192.7	430.6	59.0					
52	FFG-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11760.3	11918.7	1374.6	2036.3	572.0					
	AE-1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	350.9	406.1	18.2	101.8	26.4					
	BW-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	1587.1	0.0	0.0					
53	CG-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2586.7	1130.9	211.7	504.5	63.1					
	DDG-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7487.3	3520.8	578.2	1291.7	177.1					
	FFG-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5078.3	5146.7	593.6	879.3	247.0					
	CG-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	431.1	188.5	35.3	84.1	10.5					
	AOE-1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59.7	351.8	44.6	1058.2	212.5					
Total Emissions (SCI) tons		**8.69**	**12.84**	**3.22**	**7.22**	**1.16**	**56.32**	**32.58**	**4.70**	**15.29**	**2.39**	**583.20**	**437.81**	**50.56**	**281.98**	**43.31**	**43.84**	**28.03**	**3.95**	**11.12**	**1.77**
Total Emissions (SD) tons		**104.07**	**234.73**	**12.64**	**90.96**	**16.79**	**100.50**	**276.82**	**8.58**	**133.08**	**12.92**										
Total Emissions within US Territory (SCI)		**65.01**	**45.42**	**7.92**	**22.52**	**3.55**															
Total Emissions within US Territory (SD)		**204.57**	**511.55**	**21.22**	**224.04**	**29.72**															
					56768.0																

Date: 13-May-2007

Notes: 1 - Ship nomenclature highlighted in yellow signifies no specific AQ Emissions data for that vessel.
For vessels without AQ emissions data, the following data was used:

Support (for USW)	TRB	AGF	LPD
Support (for Surf Firing)	PC	WHEC	USCG
MCM	USCG	Unknown (for Elec Combat)	PC
MHC	USCG	SOW	MKV
LSD	LPD	EFV	AAV
Unknown (for VBSS)	PC	DDH	CG
DD	CG	HS	RIB
FFH	FFG	AOR	AOE

Table C-2. Surface Ship Air Emissions—Alternative 1

Scenario	Type Training	Number of Ships	Program Totals	Nomenclature	Ship/Boat Type	Vessel Mode	Ship Time on Range (hrs)	Percent at Each Power Level	Total Time on Range (hrs)	Percentage 0-3 nm from shore	Percentage 3-12 nm from Shore	Percentage >12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Emissions Factors (lb/hr) CO	NOx	HC	SOx	PM10	Emissions 0-3 nm Offshore (lbs) CO	Nox	HC	Sox	PM	Emissions 3-12 nm Offshore - US Territory (lbs) CO	Nox	HC	Sox	PM	Emissions >12 nm Offshore - Outside US Territory: Offshore San Diego CO	Nox	HC	Sox	PM	Offshore Mexico CO	Nox	HC	Sox	PM
							Hours	%	Hours	Percent			Hours			CO	NOx	HC	SOx	PM10	CO	Nox	HC	Sox	PM	CO	Nox	HC	Sox	PM	CO	Nox	HC	Sox	PM	CO	Nox	HC	Sox	PM
Training Exercises																																								
1	Air Combat Maneuvers	0																																						
2	Air Defense Exercise	111		CG	Cruiser	CG-2	1.0	100%	111.0	0%	0%	100%	0.0	0.0	111.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11963.6	5230.3	979.0	2333.2	291.9					
		221		DDG	Guided Missile Destroyer	DDG-2	1.0	100%	221.0	0%	0%	100%	0.0	0.0	221.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22981.8	10806.9	1774.6	3964.7	543.7					
		23		CVN	Nuclear Carrier (No emissions)					0%	0%	100%																												
		4		FFG	Guided Missile Frigate	FFG-2	3.7	100%	14.8	0%	0%	100%	0.0	0.0	14.8	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	988.9	1002.3	115.6	171.2	48.1					
3	S-A Missiles	4		CVN	Nuclear Carrier (No emissions)					0%	0%	100%																												
		4		TRB	Torpedo Retrieval Boats	TRB-3	4.0	100%	16.0	1%	2%	97%	0.2	0.3	15.5	6.47	56.2	1.6	7.4	1.2	1.0	9.0	0.2	1.2	0.2	2.1	18.0	0.5	2.4	0.4	100.4	872.5	24.1	114.8	18.3					
4	S-A Gunnery Exercise	23		CVN						0%	0%	100%																												
		44		CG	Cruiser	CG-2	1.5	100%	66.0	0%	0%	100%	0.0	0.0	66.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						7113.5	3109.9	582.1	1387.3	173.6
		91		DDG	Guided Missile Destroyer	DDG-2	1.5	100%	136.5	0%	0%	100%	0.0	0.0	136.5	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						14194.6	6674.9	1096.1	2448.8	335.8
		55		FFG	Guided Missile Frigate	FFG-2	1.5	100%	82.5	0%	0%	100%	0.0	0.0	82.5	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						5512.7	5586.9	644.3	954.5	268.1
		13		LHA	Amphib. Assault Ship - Tarawa	LHA-1	1.5	100%	19.5	0%	0%	100%	0.0	0.0	19.5	7.38	43.5	5.5	131.0	26.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						143.9	848.8	107.8	2553.9	512.7
		15		LDH	Large Helicopter-dock Ships	LHD-1	1.5	100%	22.5	0%	0%	100%	0.0	0.0	22.5	5.89	34.8	4.4	104.6	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						132.5	782.3	99.5	2353.5	472.3
		21		LPD	Amphibious Transport Dock - Wasp	LPD-1	1.5	100%	31.5	0%	0%	100%	0.0	0.0	31.5	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						58.1	343.0	43.6	1031.8	207.1
		24		LSD	Landing Ship Dock	LPD-1	1.5	100%	36.0	0%	0%	100%	0.0	0.0	36.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						66.4	392.0	49.8	1179.2	236.7
		37		USCGS	US Coast Guard	USCG	1.5	100%	55.5	0%	0%	100%	0.0	0.0	55.5	5.74	57.9	0.9	11.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						318.6	3214.0	48.8	641.0	11.7
		27		Other Ship	Coastal Patrol-Independent Low Speed (	PC-1	1.5	100%	40.5	0%	0%	100%	0.0	0.0	40.5	6.5	12.5	1.1	2.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						263.3	504.6	42.5	101.7	14.2
5	A-A Missiles	1		TRB	Torpedo Retrieval Boats	TRB-3	4.0	100%	4.0	1%	2%	97%	0.0	0.1	3.9	6.47	56.2	1.6	7.4	1.2	0.3	2.2	0.1	0.3	0.0	0.5	4.5	0.1	0.6	0.1						25.1	218.1	6.0	28.7	4.6
6	Helicopter ASW TRACKEX	28		CG	Cruiser	CG-3	3.6	100%	100.8	1%	10%	89%	1.0	10.1	89.7	114.75	65.2	7.7	33.6	3.4	115.7	65.7	7.7	33.8	3.5	1156.7	657.4	77.3	338.2	34.7	10294.5	5851.0	688.1	3009.8	308.6					
		71		DDG	Guided Missile Destroyer	DDG-3	3.6	100%	255.6	1%	10%	89%	2.6	25.6	227.5	106.67	53.8	7.8	21.2	2.8	272.6	137.6	20.0	54.2	7.2	2726.5	1376.2	200.4	542.4	71.6	24265.7	12247.7	1783.5	4827.2	637.0					
		43		TRB	Torpedo Retrieval Boats	TRB-3	3.6	100%	154.8	1%	10%	89%	1.5	15.5	137.8	6.47	56.2	1.6	7.4	1.2	10.0	87.0	2.4	11.5	1.8	100.2	870.3	24.0	114.6	18.3	891.4	7745.5	213.5	1019.5	162.6					
7	Helicopter ASW TORPEX	28		CG	Cruiser	CG-3	3.6	100%	100.8	1%	10%	89%	1.0	10.1	89.7	114.75	65.2	7.7	33.6	3.4	115.7	65.7	7.7	33.8	3.5	1156.7	657.4	77.3	338.2	34.7	10294.5	5851.0	688.1	3009.8	308.6					
		75		DDG	Guided Missile Destroyer	DDG-3	3.6	100%	270.0	1%	10%	89%	2.7	27.0	240.3	106.67	53.8	7.8	21.2	2.8	288.0	145.4	21.2	57.3	7.6	2880.1	1453.7	211.7	572.9	75.6	25632.8	12937.8	1884.0	5099.2	672.8					
		72		TRB	Torpedo Retrieval Boats	TRB-3	3.6	100%	259.2	1%	10%	89%	2.6	25.9	230.7	6.47	56.2	1.6	7.4	1.2	16.8	145.7	4.0	19.2	3.1	167.7	1457.2	40.2	191.8	30.6	1492.6	12969.3	357.6	1707.1	272.2					
8	MPA ASW TRACKEX																																							
9	MPA ASW TORPEX	2		CG	Cruiser	CG-3	2.0	100%	4.0	5%	10%	85%	0.2	0.4	3.4	114.75	65.2	7.7	33.6	3.4	23.0	13.0	1.5	6.7	0.7	45.9	26.1	3.1	13.4	1.4	390.2	221.7	26.1	114.1	11.7					
		4		DDG	Guided Missile Destroyer	DDG-3	2.0	100%	8.0	5%	10%	85%	0.4	0.8	6.8	106.67	53.8	7.8	21.2	2.8	42.7	21.5	3.1	8.5	1.1	85.3	43.1	6.3	17.0	2.2	725.4	366.1	53.3	144.3	19.0					
		3		FFG	Guided Missile Frigate	FFG-3	2.0	100%	6.0	5%	10%	85%	0.3	0.6	5.1	120.04	78.1	11.6	16.1	4.3	36.0	23.4	3.5	4.8	1.3	72.0	46.9	7.0	9.6	2.6	612.2	398.4	59.4	82.0	21.9					
		14		TRB	Torpedo Retrieval Boats	TRB-3	2.0	100%	28.0	5%	10%	85%	1.4	2.8	23.8	6.47	56.2	1.6	7.4	1.2	9.1	78.7	2.2	10.4	1.7	18.1	157.4	4.3	20.7	3.3	154.0	1338.0	36.9	176.1	28.1					
																																			0.0					
10	EER/IEER ASW																																							
11	Surface Ship ASW TRACKEX	225		CG	Cruiser	CG-3	2.0	100%	450.0	1%	10%	89%	4.5	45.0	400.5	114.75	65.2	7.7	33.6	3.4	516.4	293.5	34.5	151.0	15.5	5163.8	2934.9	345.2	1509.8	154.8	45957.4	26120.6	3071.8	13436.8	1377.7					
		450		DDG	Guided Missile Destroyer	DDG-3	2.0	100%	900.0	1%	10%	89%	9.0	90.0	801.0	106.67	53.8	7.8	21.2	2.8	960.0	484.6	70.6	191.0	25.2	9600.3	4845.6	705.6	1909.8	252.0	85442.7	43125.8	6279.8	16997.2	2242.8					
		225		FFG	Guided Missile Frigate	FFG-3	2.0	100%	450.0	1%	10%	89%	4.5	45.0	400.5	120.04	78.1	11.6	16.1	4.3	540.2	351.5	52.4	72.4	19.4	5401.8	3515.0	523.8	723.6	193.5	48076.0	31283.1	4661.8	6440.0	1722.2					
		0		Support	Torpedo Retrieval Boats	TRB-3	2.0	100%	0.0	1%	10%	89%	0.0	0.0	0.0	6.47	56.2	1.6	7.4	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
12	Surface Ship ASW TORPEX	8		CG	Cruiser	CG-3	3.7	100%	29.6	1%	10%	89%	0.3	3.0	26.3	114.75	65.2	7.7	33.6	3.4	34.0	19.3	2.3	9.9	1.0	339.7	193.1	22.7	99.3	10.2	3023.0	1718.2	202.1	883.8	90.6					
		12		DDG	Guided Missile Destroyer	DDG-3	3.7	100%	44.4	1%	10%	89%	0.4	4.4	39.5	106.67	53.8	7.8	21.2	2.8	47.4	23.9	3.5	9.4	1.2	473.6	239.0	34.8	94.2	12.4	4215.2	2127.5	309.8	838.5	110.6					
		6		FFG	Guided Missile Frigate	FFG-3	3.7	100%	22.2	1%	10%	89%	0.2	2.2	19.8	120.04	78.1	11.6	16.1	4.3	26.6	17.3	2.6	3.6	1.0	266.5	173.4	25.8	35.7	9.5	2371.8	1543.3	230.0	317.7	85.0					
		12		TRB	Torpedo Retrieval Boats	TRB-3	3.7	100%	44.4	1%	10%	89%	0.4	4.4	39.5	6.47	56.2	1.6	7.4	1.2	2.9	25.0	0.7	3.3	0.5	28.7	249.6	6.9	32.9	5.2	255.7	2221.6	61.2	292.4	46.6					
13	Sub ASW Trackex	53		SSN	Submarines (No emissions)																																			
		16		TRB	Torpedo Retrieval Boats	TRB-3	12.8	100%	204.8	1%	2%	97%	2.0	4.1	198.7	6.47	56.2	1.6	7.4	1.2	13.3	115.1	3.2	15.2	2.4	26.5	230.3	6.3	30.3	4.8	1285.3	11168.4	307.9	1470.1	234.4					
14	Sub ASW TORPEX	22		SSN	Submarines (No emissions)																																			
		22		TRB	Torpedo Retrieval Boats	TRB-3	11.7	100%	257.4	1%	2%	97%	2.6	5.1	249.7	6.47	56.2	1.6	7.4	1.2	16.7	144.7	4.0	19.0	3.0	33.3	289.4	8.0	38.1	6.1	1615.4	14036.9	387.0	1847.6	294.6					
15	VBSS	18		CG	Cruiser	CG-2	4.0	100%	72.0	0%	0%	100%	0.0	0.0	72.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7760.2	3392.6	635.0	1513.4	189.4					
		36		DDG	Guided Missile Destroyer	DDG-2	4.0	100%	144.0	0%	0%	100%	0.0	0.0	144.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14974.6	7041.6	1156.3	2583.4	354.2					
		7		FFG	Guided Missile Frigate	FFG-2	4.0	100%	28.0	0%	0%	100%	0.0	0.0	28.0	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1871.0	1896.2	218.7	324.0	91.0					
		3		LPD	Amphibious Transport Dock - Wasp	LPD-1	4.0	100%	12.0	0%	0%	100%	0.0	0.0	12.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.1	130.7	16.6	393.1	78.9					
		7		LSD		LPD-1	4.0	100%	28.0	0%	0%	100%	0.0	0.0	28.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.7	304.9	38.8	917.2	184.1					
																																			0.0					
16	ASUW MISSILEX	32		TRB	Torpedo Retrieval Boats	TRB-2	7.0	100%	224.0	5%	28%	67%	11.2	62.7	150.1	7.64	33.1	0.6	3.4	1.2	85.6	370.6	6.6	38.0	13.0	479.2	2075.4	37.0	212.6	72.8	1146.6	4966.1	88.5	508.8	174.1					
		2		CG	Cruiser	CG-2	4.0	100%	8.0	0%	0%	100%	0.0	0.0	8.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	862.2	377.0	70.6	168.2	21.0					
		2		DDG	Guided Missile Destroyer	DDG-2	4.0	100%	8.0	0%	0%	100%	0.0	0.0	8.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	831.9	391.2	64.2	143.5	19.7					
17	A-S BOMBEX	0																																						
18	A-S GUNEX	0																																						
19	S-S GUNEX	1		CVN	Nuclear Carrier (No emissions)																																			
		71		CG	Cruiser	CG-1	2.5	100%	177.5	0%	28%	72%	0.0	49.7	127.8	102.58	40.6	9.2	17.7	2.1	0.0	0.0	0.0	0.0	0.0	5098.2	2018.3	458.2	880.2	105.4						13109.7	5190.0	1178.3	2263.3	270.9
		147		DDG	Guided Missile Destroyer	DDG-1	2.5	100%	367.5	0%	28%	72%	0.0	102.9	264.6	102.98	47.3	8.1	17.0	2.4	0.0	0.0	0.0	0.0	0.0	10596.6	4871.3	833.5	1753.4	241.8						27248.5	12526.2	2143.3	4508.8	621.8
		49		FFG	Guided Missile Frigate	FFG-1	2.5	100%	122.5	0%	28%	72%	0.0	34.3	88.2	65.75	66.4	7.9	10.9	3.1	0.0	0.0	0.0	0.0	0.0	2255.2	2275.8	270.6	373.5	107.7						5799.2	5852.1	695.9	960.5	276.9
		2		LPD	Amphibious Transport Dock - Wasp	LPD-1	2.5	100%	5.0	0%	28%	72%	0.0	1.4	3.6	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	2.6	15.2	1.9	45.9	9.2						6.6	39.2	5.0	117.9	23.7
		1		LSD	Landing Ship Dock	LPD-1	2.5	100%	2.5	0%	28%	72%	0.0	0.7	1.8	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	1.3	7.6	1.0	22.9	4.6						3.3	19.6	2.5	59.0	11.8
		1		LHD	Large Helicopter-dock Ships	LHD-2	2.5	100%	2.5	0%	28%	72%	0.0	0.7	1.8	6.8	40.1	5.1	120.7	24.2	0.0	0.0	0.0	0.0	0.0	4.8	28.1	3.6	84.5	17.0						12.2	72.2	9.2	217.3	43.6
		18		Unknown	Other	PC-2	2.5	100%	45.0	0%	28%	72%	0.0	12.6	32.4	17.21	38.1	2.9	8.2	0.9	0.0	0.0	0.0	0.0	0.0	216.8	480.6	37.0	103.7	11.6						557.6	1235.7	95.3	266.7	29.8
		40		USCG	US Coast Guard	USCG	2.5	100%	100.0	0%	28%	72%	0.0	28.0	72.0	5.74	57.9	0.9	11.6	0.2	0.0	0.0	0.0	0.0	0.0	160.7	1621.5	24.6	323.4	5.9						413.3	4169.5	63.4	831.6	15.1
20	SINKEX	4		CG	Cruiser	CG-2	16.0	100%	64.0	0%	0%	100%	0.0	0.0	64.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						6897.9	3015.7	564.5	1345.3	168.3
		8		DDG	Guided Missile Destroyer	DDG-2	16.0	100%	128.0	0%	0%	100%	0.0	0.0	128.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						13310.7	6259.2	1027.8	2296.3	314.9
		0		DD	Destroyer	DDG-2	16.0	100%	0.0	0%	0%	100%	0.0	0.0	0.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						0.0	0.0	0.0	0.0	0.0
		4		FFG	Guided Missile Frigate	FFG-2	16.0	100%	64.0	0%	0%	100%	0.0	0.0	64.0	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						4276.5	4334.1	499.8	740.5	208.0
		2		SSN	Submarines (No emissions)																																			
21	NSFS	16		CG	Cruiser	CG-2	9.0	100%	144.0	0%	30%	70%	0.0	43.2	100.8	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	4656.1	2035.6	381.0	908.1	113.6	10864.2	4749.7	889.1	2118.8	265.1					
		34		DDG	Guided Missile Destroyer	DDG-2	9.0	100%	306.0	0%	30%	70%	0.0	91.8	214.2	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	9546.3	4489.0	737.2	1646.9	225.8	22274.7	10474.4	1720.0	3842.7	526.9					
		4		FFG	Guided Missile Frigate	FFG-2	9.0	100%	36.0	0%	30%	70%	0.0	10.8	25.2	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	721.7	731.4	84.3	125.0	35.1	1683.9	1706.5	196.8	291.6	81.9					
22	EFEX	2		CG	Cruiser	CG-2	72.0	100%	144.0	0%	100%	0%	0.0	144.0	0.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	15520.3	6785.3	1270.1	3026.9	378.7	0.0	0.0	0.0	0.0	0.0					
		2		DDG	Guided Missile Destroyer	DDG-2	72.0	100%	144.0	0%	100%	0%	0.0	144.0	0.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	14974.6	7041.6	1156.3	2583.4	354.2	0.0	0.0	0.0	0.0	0.0					
23	Battalion Landing	1		LHA	Amphib. Assault Ship - Tarawa	LHA-1	6.0	100%	6.0	10%	30%	60%	0.6	1.8	3.6	7.38	131.0	26.3	7.4	43.5	4.4	78.6	15.8	4.4	26.1	13.3	235.7	47.3	13.3	78.4	26.6	471.5	94.6	26.6	156.7					
		1		LHD	Large Helicopter-dock Ships	LHD-2	2.5	100%	2.5	10%	30%	60%	0.3	0.8	1.5	6.8	40.1	5.1	120.7	24.2	1.7	10.0	1.3	30.2	6.1	5.1	30.1	3.8	90.5	18.2	10.2	60.2	7.7	181.1	36.3					
		1		LPD	Amphibious Transport Dock - Wasp	LPD-1	2.5	100%	2.5	10%	30%	60%	0.3	0.8	1.5	1.845393	10.9	1.4	32.8	6.6	0.5	2.7	0.3	8.2	1.6	1.4	8.2	1.0	24.6	4.9	2.8	16.3	2.1	49.1	9.9					
		6		LCU	Landing Craft Utility	LCU	3.0	100%	18.0	10%	30%	60%	1.8	5.4	10.8	36.21	3.1	1.6	36.2	45.0	65.2	5.6	2.8	65.2	80.9	195.5	16.8	8.5	195.5	242.7	391.1	33.6	17.0	391.1	485.5					
		14		AAV/EFV	Amphibious Assault Vehicle	EFV-2	6.0	100%	84.0	10%	30%	60%	8.4	25.2	50.4	2.0611	4.17	0.72	0.06	0.3211	17.3	35.0	6.1	0.5	2.7	51.9	105.0	18.2	1.6	8.1	103.9	210.0	36.3	3.2	16.2					
		5		LCAC	Landing Craft Air Cushioned	LCAC	3.0	100%	15.0	10%	30%	60%	1.5	4.5	9.0	25.41	43.3	3.9	25.4	55.3	38.1	65.0	5.8	38.1	83.0	114.3	194.9	17.5	114.3	248.9	228.7	389.7	35.0	228.7	497.9					
		0		CRRC	Combat Raiding Rubber Craft	CRRC-4	6.0	100%	0.0	10%	30%	60%	0.0	0.0	0.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
24	USMC Stinger	0																																						
25	Amphibious Landings & Raids																																							
25A	Recon Mission	8		LPD	Amphibious Transport Dock - Wasp	LPD-1	4.0	100%	32.0	0%	0%	100%	0.0	0.0	32.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59.1	348.4	44.3	1048.2	210.4					
25B	Helicopter Assault	4		LHD	Large Helicopter-dock Ships	LHD-2	6.0	100%	24.0	0%	0%	100%	0.0	0.0	24.0	6.8	40.1	5.1	120.7	24.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	163.2	962.9	122.4	2896.8	581.5					
		4		LHA	Amphib. Assault Ship - Tarawa	LHA-1	6.0	100%	24.0	0%	0%	100%	0.0	0.0	24.0	7.38	131.0	26.3	7.4	43.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	177.1	3143.3	631.0	177.1	1044.7					
25C	Armored Operations	3		LHD	Large Helicopter-dock Ships	LHD-2	12.0	100%	36.0	33%	33%	33%	12.0	12.0	12.0	6.8	40.1	5.1	120.7	24.2	81.5	481.0	61.1	1447.0	290.5	81.5	481.0	61.1	1447.0	290.5	81.5	481.0	61.1	1447.0	290.5					
		3		LHA	Amphib. Assault Ship - Tarawa	LHA-1	12.0	100%	36.0	33%	33%	33%	12.0	12.0	12.0	7.38	131.0	26.3	7.4	43.5	88.5	1570.1	315.2	88.5	521.8	88.5	1570.1	315.2	88.5	521.8	88.5	1570.1	315.2	88.5	521.8					
		6		LCAC	Landing Craft Air Cushioned	LCAC	12.0	100%	72.0	33%	33%	33%	24.0	24.0	24.0	25.41	43.3	3.9	25.4	55.3	609.2	1038.2	93.3	609.2	1326.4	609.2	1038.2	93.3	609.2	1326.4	609.2	1038.2	93.3	609.2	1326.4					
		6		LCU	Landing Craft Utility	LCU	12.0	100%	72.0	33%	33%	33%	24.0	24.0	24.0	36.21	3.1	1.6	36.2	45.0	868.2	74.6	37.6	868.2	1077.7	868.2	74.6	37.6	868.2	1077.7	868.2	74.6	37.6	868.2	1077.7					
25D	Artillery Operations	2		LHD	Large Helicopter-dock Ships	LHD-2	24.0	100%	48.0	100%	0%	0%	48.0	0.0	0.0	6.8	40.1	5.1	120.7	24.2	326.4	1925.8	244.8	5793.6	1163.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		1		LHA	Amphib. Assault Ship - Tarawa	LHA-1	24.0	100%	24.0	20%	40%	40%	4.8	9.6	9.6	7.38	43.5	5.5	131.0	26.3	35.4	208.9	26.5	628.7	126.2	70.8	417.9	53.1	1257.3	252.4	70.8	417.9	53.1	1257.3	252.4					
		4		LCAC	Landing Craft Air Cushion	LCAC	24.0	100%	96.0	100%	0%	0%	96.0	0.0	0.0	25.41	55.3	0.7	43.3	3.9	2439.4	5310.7	69.1	4156.8	373.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		4		LCU	Landing Craft Utility	LCU	24.0	100%	96.0	100%	0%	0%	96.0	0.0	0.0	36.21	45.0	0.5	3.1	1.6	3476.2	4315.2	49.9	298.6	150.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					

Table C-2. Surface Ship Air Emissions—Alternative 1

Emissions

Scenario	Type Training	Number of Ships	Program Totals	Nomenclature	Ship/Boat Type	Vessel Mode	Ship Time on Range (hrs)	Percent at Each Power Level	Total Time on Range (hrs)	Percentage 0-3 nm from shore	Percentage 3-12 nm from Shore	Percentage >12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Emissions Factors (lb/hr)					Emissions 0-3 nm Offshore (lbs)					Emissions 3-12 nm Offshore - US Territory (lbs)					Emissions >12 nm Offshore - Outside US Territory									
							Hours	%	Hours	Percent			Hours			CO	NOx	HC	SOx	PM10	CO	Nox	HC	Sox	PM	CO	Nox	HC	Sox	PM	CO	Nox	HC	Sox	PM	CO	Nox	HC	Sox	PM
25E	Amphibious Assault	2		LHD	Large Helicopter-dock Ships	LHD-2	8.0	100%	16.0	38%	38%	25%	6.0	6.0	4.0	6.8	40.1	5.1	120.7	24.2	40.8	240.7	30.6	724.2	145.4	40.8	240.7	30.6	724.2	145.4	27.2	160.5	20.4	482.8	96.9					
		1		LHA	Amphib. Assault Ship - Tarawa	LHA-1	8.0	100%	8.0	38%	38%	25%	3.0	3.0	2.0	7.38	43.5	5.5	131.0	26.3	22.1	130.6	16.6	392.9	78.9	22.1	130.6	16.6	392.9	78.9	14.8	87.1	11.1	261.9	52.6					
		3		LPD	Amphibious Transport Dock - Wasp	LPD-1	8.0	100%	24.0	38%	38%	25%	9.0	9.0	6.0	1.845393	10.9	1.4	32.8	6.6	16.6	98.0	12.5	294.8	59.2	16.6	98.0	12.5	294.8	59.2	11.1	65.3	8.3	196.5	39.4					
		4		LCAC	Landing Craft Air Cushioned	LCAC	8.0	100%	32.0	38%	38%	25%	12.0	12.0	8.0	25.41	43.3	3.9	25.4	55.3	304.9	519.6	46.7	304.9	663.8	304.9	519.6	46.7	304.9	663.8	203.3	346.4	31.1	203.3	442.6					
		4		LCU	Landing Craft Utility	LCU	8.0	100%	32.0	38%	38%	25%	12.0	12.0	8.0	36.21	3.1	1.6	36.2	45.0	434.5	37.3	18.8	434.5	539.4	434.5	37.3	18.8	434.5	539.4	289.7	24.9	12.6	289.7	359.6					
25F	Combat Engineer Ops	1		LHA	Amphib. Assault Ship - Tarawa	LHA-1	6.0	100%	6.0	33%	33%	33%	2.0	2.0	2.0	7.38	131.0	26.3	7.4	43.5	14.7	261.7	52.5	14.7	87.0	14.7	261.7	52.5	14.7	87.0	14.7	261.7	52.5	14.7	87.0					
		2		LCU	Landing Craft Utility	LCU	6.0	100%	12.0	33%	33%	33%	4.0	4.0	4.0	36.21	3.1	1.6	36.2	45.0	144.7	12.4	6.3	144.7	179.6	144.7	12.4	6.3	144.7	179.6	144.7	12.4	6.3	144.7	179.6					
25G	Amphibious Assault Vehicle Ops	6		LHA	Amphib. Assault Ship - Tarawa	LHA-1	8.0	100%	48.0	25%	25%	50%	12.0	12.0	24.0	7.38	131.0	26.3	7.4	43.5	88.6	1571.6	315.5	88.6	522.4	88.6	1571.6	315.5	88.6	522.4	177.1	3143.3	631.0	177.1	1044.7					
		36		EFV	Expeditionary Fighting Vessel	EFV-1	8.0	100%	288.0	25%	25%	50%	72.0	72.0	144.0	2.0611	4.17	0.72	0.06	0.3211	148.4	300.0	51.9	4.6	23.1	148.4	300.0	51.9	4.6	23.1	296.8	600.0	103.8	9.1	46.2					
25H	EFV	2		LPD	Amphibious Transport Dock - Wasp	LPD-1	8.0	100%	16.0	25%	25%	50%	4.0	4.0	8.0	1.845393	10.9	1.4	32.8	6.6	7.4	43.6	5.5	131.0	26.3	7.4	43.6	5.5	131.0	26.3	14.8	87.1	11.1	262.0	52.6					
		1		LCAC	Landing Craft Air Cushioned	LCAC	8.0	100%	8.0	25%	25%	50%	2.0	2.0	4.0	25.41	43.3	3.9	25.4	55.3	50.8	86.6	7.8	50.8	110.6	50.8	86.6	7.8	50.8	110.6	101.6	173.2	15.6	101.6	221.3					
		46		EFV	Expeditionary Fighting Vessel	EFV-1	8.0	100%	368.0	25%	25%	50%	92.0	92.0	184.0	2.0611	4.17	0.72	0.06	0.3211	189.6	383.4	66.3	5.8	29.5	189.6	383.4	66.3	5.8	29.5	379.2	766.7	132.7	11.6	59.1					
25I	Assault Amphibian School	80		LCAC	Landing Craft Air Cushioned	LCAC	8.0	100%	640.0	0%	0%	100%	0.0	0.0	640.0	25.41	43.3	3.9	25.4	55.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16262.4	27712.0	2489.6	16262.4	35404.8					
		40		LCU	Landing Craft Utility	LCU	8.0	100%	320.0	0%	0%	100%	0.0	0.0	320.0	36.21	3.1	1.6	36.2	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11587.2	995.2	502.4	11587.2	14384.0					
		60		EFV	Amphibious Assault Vehicle	EFV-1	8.0	100%	480.0	0%	0%	100%	0.0	0.0	480.0	2.0611	4.17	0.72	0.06	0.3211	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	989.3	2000.2	346.1	30.3	154.1					
26	Ambphibious Operations CPAAA																																							
26A	Amphibious Operations	1688		AAV/EFV	Amphibious Assault Vehicle	EFV-1	16.8	20%	5671.7	28%	70%	2%	1588.1	3970.2	113.4	2.0611	4.17	0.72	0.06	0.3211	3273.2	6617.5	1145.2	100.4	509.9	8182.9	16543.7	2862.9	250.9	1274.8	233.8	472.7	81.8	7.2	36.4					
				AAV/EFV	Amphibious Assault Vehicle	EFV-2	16.8	80%	22686.7	28%	70%	2%	6352.3	15880.7	453.7	2.0611	4.17	0.72	0.06	0.3211	13092.7	26470.0	4580.6	401.5	2039.7	32731.7	66174.9	11451.6	1003.7	5099.3	935.2	1890.7	327.2	28.7	145.7					
		6		LCAC	Landing Craft Air Cushion	LCAC	16.8	100%	100.8	100%	0%	0%	100.8	0.0	0.0	25.41	55.3	0.7	43.3	3.9	2561.3	5576.3	72.6	4364.6	392.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
26B	Amphibious Ops	5		LHD	Large Helicopter-dock Ships	LHD-1	4.2	90%	18.9	0%	0%	100%	0.0	0.0	18.9	5.89	34.8	4.4	104.6	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	111.6	658.7	83.7	1981.6	397.7					
				LHD	Large Helicopter-dock Ships	LHD-2	4.2	10%	2.1	0%	0%	100%	0.0	0.0	2.1	6.8	40.1	5.1	120.7	24.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	84.5	10.7	254.1	51.0					
		5		LCAC	Landing Craft Air Cushion	LCAC	4.2	100%	21.1	0%	0%	100%	0.0	0.0	21.1	25.41	55.3	0.7	43.3	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	534.9	1164.5	15.2	911.5	81.9					
		69		CRRC	Combat Raiding Rubber Craft	CRRC-1	4.2	22%	63.9	28%	36%	36%	17.9	23.0	23.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5					
				CRRC	Combat Raiding Rubber Craft	CRRC-4	4.2	27%	78.4	28%	36%	36%	22.0	28.2	28.2	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0	0.0	3.7					
				CRRC	Combat Raiding Rubber Craft	CRRC-5	4.2	51%	148.1	28%	36%	36%	41.5	53.3	53.3	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	6.2	0.0	0.0	0.0	0.0	7.9	0.0	0.0	0.0	0.0	7.9					
		5		LCU	Landing Craft Utility	LCU	4.2	100%	21.1	32%	0%	68%	6.7	0.0	14.3	36.21	45.0	0.5	3.1	1.6	243.9	302.8	3.5	20.9	10.6	0.0	0.0	0.0	0.0	0.0	518.3	643.4	7.4	44.5	22.5					
26C	Amphibious Ops	143		AAV/EFV	Amphibious Assault Vehicle	EFV-1	2.4	33%	112.0	28%	70%	2%	31.4	78.4	2.2	2.0611	4.17	0.72	0.06	0.3211	64.6	130.7	22.6	2.0	10.1	161.6	326.7	56.5	5.0	25.2	4.6	9.3	1.6	0.1	0.7					
						EFV-2	2.4	67%	224.0	28%	70%	2%	62.7	156.8	4.5	2.0611	4.17	0.72	0.06	0.3211	129.3	261.4	45.2	4.0	20.1	323.2	653.5	113.1	9.9	50.4	9.2	18.7	3.2	0.3	1.4					
26D	Amphibious Ops	5		AAV	Amphibious Assault Vehicle	AAV-1	2.4	20%	2.4	100%	0%	0%	2.4	0.0	0.0	0.444918	1.0	0.2	0.1	0.2	1.0	2.4	0.4	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						AAV-2	2.4	80%	9.4	100%	0%	0%	9.4	0.0	0.0	0.633674	3.8	0.2	0.1	0.3	6.0	35.3	1.6	1.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		2258		EFV	Amphibious Assault Vehicle	EFV-1	2.4	33%	1768.6	28%	70%	2%	495.2	1238.0	35.4	2.0611	4.17	0.72	0.06	0.3211	1020.7	2063.5	357.1	31.3	159.0	2551.7	5158.8	892.7	78.2	397.5	72.9	147.4	25.5	2.2	11.4					
						EFV-2	2.4	67%	3537.7	28%	70%	2%	990.6	2476.4	70.8	2.0611	4.17	0.72	0.06	0.3211	2041.6	4127.7	714.3	62.6	318.1	5104.1	10319.1	1785.7	156.5	795.2	145.8	294.8	51.0	4.5	22.7					
		2268		RIB	Rigid Inflatable	RIB-1	2.4	7%	355.5	28%	70%	2%	99.5	248.8	7.1	0.04	1.6	0.0	0.2	0.0	4.0	158.3	1.0	16.9	2.0	10.0	395.7	2.5	42.3	5.0	0.3	11.3	0.1	1.2	0.1					
						RIB-3		13%	708.9	28%	70%	2%	198.5	496.2	14.2	0.08	3.0	0.0	0.4	0.0	15.9	595.4	2.0	71.5	7.9	39.7	1488.6	5.0	178.6	19.8	1.1	42.5	0.1	5.1	0.6					
						RIB-4		80%	4263.8	28%	70%	2%	1193.9	2984.7	85.3	0.34	9.1	0.1	1.4	0.2	405.9	10912.0	71.6	1719.2	179.1	1014.8	27280.0	179.1	4298.0	447.7	29.0	779.4	5.1	122.8	12.8					
		756		Support	Coastal Patrol-Independent Low Speed (	PC-1	2.4	20%	355.3	28%	70%	2%	99.5	248.7	7.1	6.5	12.5	1.1	2.5	0.4	646.7	1239.6	104.5	249.7	34.8	1616.7	3099.1	261.2	624.3	87.1	46.2	88.5	7.5	17.8	2.5					
					Dynamic Maneuvering	PC-3		80%	1421.3	28%	70%	2%	398.0	994.9	28.4	59.93	187.6	9.3	47.1	4.8	23849.6	74661.0	3709.0	18751.8	1898.3	59624.1	186652.4	9272.4	46879.5	4745.7	1703.5	5332.9	264.9	1339.4	135.6					
26E	Amphibious Ops	386		AAV	Amphibious Assault Vehicle	AAV-1	13.2	20%	1019.0	100%	0%	0%	1019.0	0.0	0.0	0.444918	1.0	0.2	0.1	0.2	453.4	1055.8	177.4	52.5	182.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						AAV-2	13.2	80%	4076.2	100%	0%	0%	4076.2	0.0	0.0	0.633674	3.8	0.2	0.1	0.3	2583.0	15319.8	698.9	429.2	1199.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		173		CRRC	Combat Raiding Rubber Craft	CRRC-1	13.2	28%	628.0	70%	30%	0%	439.6	188.4	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0	0.0	0.0					
				CRRC	Combat Raiding Rubber Craft	CRRC-4	13.2	18%	399.6	70%	30%	0%	279.7	119.9	0.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	36.9	0.0	0.0	0.0	0.0	15.8	0.0	0.0	0.0	0.0	0.0					
				CRRC	Combat Raiding Rubber Craft	CRRC-5	13.2	55%	1256.0	70%	30%	0%	879.2	376.8	0.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	130.6	0.0	0.0	0.0	0.0	56.0	0.0	0.0	0.0	0.0	0.0					
26F	Amphibious Warfare	964		LCAC	Landing Craft Air Cushion	LCAC	8.5	100%	8194.0	16%	55%	29%	1311.0	4506.7	2376.3	25.41	55.3	0.7	43.3	3.9	33313.5	72526.7	943.9	56768.0	5099.9	114515.2	249310.6	3244.8	195140.1	17531.1	60380.8	131454.7	1710.9	102892.1	9243.7					
		221		LCU	Landing Craft Utility	LCU	8.5	100%	1878.5	75%	5%	20%	1408.9	93.9	375.7	36.21	45.0	0.5	3.1	1.6	51015.4	63328.9	732.6	4381.6	2211.9	3401.0	4221.9	48.8	292.1	147.5	13604.1	16887.7	195.4	1168.4	589.8					
		72		Support	Coastal Patrol-Independent Low Speed (	PC-2	8.5	100%	612.0	100%	0%	0%	612.0	0.0	0.0	17.21	38.1	2.9	8.2	0.9	10532.5	23341.7	1799.3	5036.8	563.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		72		LCM-8		LCU	8.5	100%	612.0	100%	0%	0%	612.0	0.0	0.0	36.21	45.0	0.5	3.1	1.6	22160.5	27509.4	318.2	1903.3	960.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		30		LARC		LCU	8.5	100%	255.0	100%	0%	0%	255.0	0.0	0.0	36.21	45.0	0.5	3.1	1.6	9233.6	11462.3	132.6	793.1	400.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		36		SLWT	SLWT (assume LPD)	LPD-2	8.5	20%	61.2	95%	5%	0%	58.1	3.1	0.0	2.935967	17.3	2.2	52.1	10.5	170.7	1007.1	128.0	3029.9	608.1	9.0	53.0	6.7	159.5	32.0	0.0	0.0	0.0	0.0	0.0					
						LPD-3	8.5	80%	244.8	95%	5%	0%	232.6	12.2	0.0	6.549492	38.6	4.9	116.3	23.3	1523.1	8986.6	1142.4	27035.9	5426.2	80.2	473.0	60.1	1422.9	285.6	0.0	0.0	0.0	0.0	0.0					
		36		SLWT	SLWT (assume LPD)	LPD-2	8.5	20%	61.2	95%	5%	0%	58.1	3.1	0.0	2.935967	17.3	2.2	52.1	10.5	170.7	1007.1	128.0	3029.9	608.1	9.0	53.0	6.7	159.5	32.0	0.0	0.0	0.0	0.0	0.0					
						LPD-3	8.5	80%	244.8	95%	5%	0%	232.6	12.2	0.0	6.549492	38.6	4.9	116.3	23.3	1523.1	8986.6	1142.4	27035.9	5426.2	80.2	473.0	60.1	1422.9	285.6	0.0	0.0	0.0	0.0	0.0					
		18		BW	Boston Whaler	BW-2	8.5	20%	30.6	95%	5%	0%	29.1	1.5	0.0	0	0.1	9.0	0.0	0.0	0.0	2.6	262.1	0.0	0.0	0.0	0.1	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						BW-3	8.5	80%	122.4	95%	5%	0%	116.3	6.1	0.0	0	0.3	26.3	0.0	0.0	0.0	30.7	3058.2	0.0	0.0	0.0	1.6	161.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
26G	Amphibious Ops	675		CRRC	Combat Raiding Rubber Craft	CRRC-1	6.2	28%	1141.6	80%	20%	0%	913.3	228.3	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.1	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0					
				CRRC	Combat Raiding Rubber Craft	CRRC-4	6.2	18%	726.5	80%	20%	0%	581.2	145.3	0.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	76.7	0.0	0.0	0.0	0.0	19.2	0.0	0.0	0.0	0.0	0.0					
				CRRC	Combat Raiding Rubber Craft	CRRC-5	6.2	55%	2283.2	80%	20%	0%	1826.6	456.6	0.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	271.3	0.0	0.0	0.0	0.0	67.8	0.0	0.0	0.0	0.0	0.0					
27	Elec Combat	317		CVN	Nuclear Carrier (No emissions)																																			
		748		CG	Cruiser	CG-2	4.9	100%	3665.2	0%	3%	97%	0.0	110.0	3555.2	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	11851.1	5181.1	969.8	2311.3	289.2	383184.2	167523.1	31357.3	74731.2	9350.3					
		641		DDG	Guided Missile Destroyer	DDG-2	4.9	100%	3140.9	0%	3%	97%	0.0	94.2	3046.7	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	9798.7	4607.7	756.6	1690.4	231.8	316823.5	148982.3	24464.8	54657.3	7494.8					
		23		DD	Destroyer	DDG-2	4.9	100%	112.7	0%	3%	97%	0.0	3.4	109.3	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	351.6	165.3	27.1	60.7	8.3	11368.1	5345.7	877.8	1961.2	268.9					
		18		FFG	Guided Missile Frigate	FFG-2	4.9	100%	88.2	0%	3%	97%	0.0	2.6	85.6	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	176.8	179.2	20.7	30.6	8.6	5716.7	5793.7	668.2	989.9	278.1					
		5		FFH	Canadian Frigate	FFG-2	4.9	100%	24.5	0%	3%	97%	0.0	0.7	23.8	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	49.1	49.8	5.7	8.5	2.4	1588.0	1609.4	185.6	275.0	77.2					
		5		AOE	Logistics/Support	AOE-1	4.9	100%	24.5	0%	3%	97%	0.0	0.7	23.8	3.73	22.0	2.8	66.1	13.3	0.0	0.0	0.0	0.0	0.0	2.7	16.2	2.1	48.6	9.8	88.6	522.6	66.3	1571.8	315.6					
		2		MHC		PC-1	4.9	100%	9.8	0%	3%	97%	0.0	0.3	9.5	6.5	12.5	1.1	2.5	0.4	0.0	0.0	0.0	0.0	0.0	1.9	3.7	0.3	0.7	0.1	61.8	118.4	10.0	23.9	3.3					
		16		LPD	Amphibious Transport Dock - Wasp	LPD-1	4.9	100%	78.4	0%	3%	97%	0.0	2.4	76.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	4.3	25.6	3.3	77.0	15.5	140.3	828.0	105.3	2491.0	500.0					
		232		LHD	Large Helicopter-dock Ships	LHD-1	4.9	100%	1136.8	0%	3%	97%	0.0	34.1	1102.7	5.89	34.8	4.4	104.6	21.0	0.0	0.0	0.0	0.0	0.0	200.9	1185.8	150.7	3567.3	715.8	6494.9	38340.7	4873.9	115342.0	23145.6					
		15		LSD	Landing Ship Dock	LPD-1	4.9	100%	73.5	0%	3%	97%	0.0	2.2	71.3	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	4.1	24.0	3.1	72.2	14.5	131.6	776.2	98.7	2335.3	468.7					
		177		LHA	Amphib. Assault Ship - Tarawa	LHA-1	4.9	100%	867.3	0%	3%	97%	0.0	26.0	841.3	7.38	43.5	5.5	131.0	26.3	0.0	0.0	0.0	0.0	0.0	192.0	1132.6	143.9	3407.7	684.0	6208.7	36621.0	4652.3	110182.6	22117.3					
		1		AGF		LPD-1	4.9	100%	4.9	0%	3%	97%	0.0	0.1	4.8	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.3	1.6	0.2	4.8	1.0	8.8	51.7	6.6	155.7	31.2					
		4		WHEC	US Coast Guard	USCG	4.9	100%	19.6	0%	3%	97%	0.0	0.6	19.0	5.74	57.9	0.9	11.6	0.2	0.0	0.0	0.0	0.0	0.0	3.4	34.1	0.5	6.8	0.1	109.1	1101.0	16.7	219.6	4.0					
		145		Unknown		PC-1	4.9	100%	710.5	0%	3%	97%	0.0	21.3	689.2	6.5	12.5	1.1	2.5	0.4	0.0	0.0	0.0	0.0	0.0	138.5	265.6	22.4	53.5	7.5	4479.7	8587.2	723.6	1729.9	241.2					
		204		SSN	Submarines (No emissions)																																			
		41		SSBN	Submarines (No emissions)																																			
28A	Sm Obj Avoidance	8		CG	Cruiser	CG-2	1.8	100%	14.0	100%	0%	0%	14.0	0.0	0.0	107.78	47.1	8.8	21.0	2.6	1508.9	659.7	123.5	294.3	36.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		14		DDG	Guided Missile Destroyer	DDG-2	1.8	100%	24.5	100%	0%	0%	24.5	0.0	0.0	103.99	48.9	8.0	17.9	2.5	2547.8	1198.1	196.7	439.5	60.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		10		FFG	Guided Missile Frigate	FFG-2	1.8	100%	17.5	100%	0%	0%	17.5	0.0	0.0	66.82	67.7	7.8	11.6	3.3	1169.4	1185.1	136.7	202.5	56.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		16		MCM		USCG	1.8	100%	28.0	100%	0%	0%	28.0	0.0	0.0	5.74	57.9	0.9	11.6	0.2	160.7	1621.5	24.6	323.4	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		22		MHC		USCG	1.8	100%	38.5	100%	0%	0%	38.5	0.0	0.0	5.74	57.9	0.9	11.6	0.2	221.0	2229.5	33.9	444.7	8.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
29	Mine Neutralization	0																																						
30	Mining Exercise	2		MHC		USCG	0.5	100%	1.0	50%	40%	10%	0.5	0.4	0.1	5.74	57.9	0.9	11.6	0.2	2.9	29.0	0.4	5.8	0.1	2.3	23.2	0.4	4.6	0.1	0.6	5.8	0.1	1.2	0.0					
31	NSWC Land Demolition	6		CRRC		CRRC-2	4.0	90%	21.6	100%	0%	0%	21.6	0.0	0.0	0	0.0	2.3	0.0	0.0	0.0	0.6	49.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						CRRC-3		10%	2.4	100%	0%	0%	2.4	0.0	0.0	0	0.1	6.3	0.0	0.0	0.0	0.2	15.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
32	NSWC UW Demo	85		CRRC		CRRC-2	6.0	90%	459.0	100%	0%	0%	459.0	0.0	0.0	0	0.0	2.3	0.0	0.0	0.0	12.1	1052.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						CRRC-3		10%	51.0	100%	0%	0%	51.0	0.0	0.0	0	0.1	6.3	0.0	0.0	0.0	3.7	321.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
33	Mat Weave	32		CRRC		CRRC-2	4.0	90%	115.2	100%	0%	0%	115.2	0.0	0.0	0	0.0	2.3	0.0	0.0	0.0	3.0	264.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						CRRC-3		10%	12.8	100%	0%	0%	12.8	0.0	0.0	0	0.1	6.3	0.0	0.0	0.0	0.9	80.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
34	NSWC Small Arms	24		CRRC		CRRC-2	6.0	90%	129.6	100%	0%	0%	129.6	0.0	0.0	0	0.0	2.3	0.0	0.0	0.0	3.4	297.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						CRRC-3		10%	14.4	100%	0%	0%	14.4	0.0	0.0	0	0.1	6.3	0.0	0.0	0.0	1.0	90.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
35	NSWC Land Nav	0																																						
36	NSW UAV Operationa	0																																						
37	Insertion/Extraction	0																																						
38	NSW Boat Operations	245		MK V	MK V	MK-1	10.0	50%	1225.0	5%	42%	53%	61.3	514.5	649.3	1.94	14.8	0.5	2.4	0.2	118.8	908.3	30.6	146.4	12.3	998.1	7630.0	257.3	1229.7	102.9	1259.5	9628.4	324.6	1551.7	129.9					
						MK-3		50%	1225.0	5%	42%	53%	61.3	514.5	649.3	13.22	71.5	1.1	15.7	1.2	809.7	4378.2	64.3	958.6	70.4	6801.7	36776.5	540.2	8051.9	591.7	8583.1	46408.4	681.7	10160.8	746.6					

Table C-2. Surface Ship Air Emissions—Alternative 1

Scenario	Type Training	Number of Ships	Program Totals	Nomenclature	Ship/Boat Type	Vessel Mode	Ship Time on Range (hrs)	Percent at Each Power Level	Total Time on Range (hrs)	Percentage 0-3 nm from shore	Percentage 3-12 nm from Shore	Percentage >12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Emissions Factors (lb/hr) CO	NOx	HC	SOx	PM10	Emissions: Emissions 0-3 nm Offshore (lbs) CO	Nox	HC	Sox	PM	Emissions 3-12 nm Offshore - US Territory (lbs) CO	Nox	HC	Sox	PM	Emissions >12 nm Offshore - Outside US Territory CO	Nox	HC	Sox	PM	CO	Nox	HC	Sox	PM
							Hours	%	Hours	Percent			Hours			CO	NOx	HC	SOx	PM10	CO	Nox	HC	Sox	PM	CO	Nox	HC	Sox	PM	CO	Nox	HC	Sox	PM	CO	Nox	HC	Sox	PM
		75		RIB	Rigid Inflatable	RIB-3	10.0	50%	375.0	5%	42%	53%	18.8	157.5	198.8	0.08	3.0	0.0	0.4	0.0	1.5	56.3	0.2	6.8	0.8	12.6	472.5	1.6	56.7	6.3	15.9	596.3	2.0	71.6	8.0					
						RIB-4		50%	375.0	5%	42%	53%	18.8	157.5	198.8	0.34	9.1	0.1	1.4	0.2	6.4	171.4	1.1	27.0	2.8	53.6	1439.6	9.5	226.8	23.6	67.6	1816.6	11.9	286.2	29.8					
39	NSWG-1 Platoon Ops	3		PC	Coastal Patrol-Independent Low Speed (	PC-3	4.0	100%	12.0	20%	30%	50%	2.4	3.6	6.0	59.93	187.6	9.3	47.1	4.8	143.8	450.3	22.4	113.1	11.4	215.7	675.4	33.6	169.6	17.2	359.6	1125.7	55.9	282.7	28.6					
		38		CRRC		CRRC-5	0.5	100%	19.0	100%	0%	0%	19.0	0.0	0.0	0	0.1	12.9	0.0	0.0	0.0	2.8	245.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		63		SOW	MK V	MK-3	0.5	100%	31.5	100%	0%	0%	31.5	0.0	0.0	13.22	71.5	1.1	15.7	1.2	416.4	2251.6	33.1	493.0	36.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
40	Direct Action	2		PC	Coastal Patrol-Independent Low Speed (	PC-2	8.0	80%	12.8	30%	20%	50%	3.8	2.6	6.4	17.21	38.1	2.9	8.2	0.9	66.1	146.5	11.3	31.6	3.5	44.1	97.6	7.5	21.1	2.4	110.1	244.1	18.8	52.7	5.9					
					Dynamic Maneuvering	PC-3		20%	3.2	30%	20%	50%	1.0	0.6	1.6	59.93	187.6	9.3	47.1	4.8	57.5	180.1	8.9	45.2	4.6	38.4	120.1	6.0	30.2	3.1	95.9	300.2	14.9	75.4	7.6					
		3		SOW	MK V	MK-1	4.0	80%	9.6	30%	25%	45%	2.9	2.4	4.3	1.94	14.8	0.5	2.4	0.2	5.6	42.7	1.4	6.9	0.6	4.7	35.6	1.2	5.7	0.5	8.4	64.1	2.2	10.3	0.9					
						MK-3		20%	2.4	30%	25%	45%	0.7	0.6	1.1	13.22	71.5	1.1	15.7	1.2	9.5	51.5	0.8	11.3	0.8	7.9	42.9	0.6	9.4	0.7	14.3	77.2	1.1	16.9	1.2					
		1		LCAC	Landing Craft Air Cushion	LCAC	1.0	100%	1.0	100%	0%	0%	1.0	0.0	0.0	25.41	55.3	0.7	43.3	3.9	25.4	55.3	0.7	43.3	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		10		CRRC	Combat Rubber Raiding Craft	CRRC-3	1.0	100%	10.0	100%	0%	0%	10.0	0.0	0.0	0	0.1	6.3	0.0	0.0	0.0	0.7	63.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		10		SDV	Combat Rubber Raiding Craft	CRRC-3	1.0	100%	10.0	100%	0%	0%	10.0	0.0	0.0	0	0.1	6.3	0.0	0.0	0.0	0.7	63.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
41	Bombing Exercise - Land	0																																						
42	CSAR	0																																						
43	EOD Outside SHOBA	0																																						
44	USCG Ops	149		Response	Coastal Patrol-Independent Low Speed (	PC-1	3.2	2%	9.5	80%	20%	0%	7.6	1.9	0.0	6.5	12.5	1.1	2.5	0.4	49.6	95.1	8.0	19.1	2.7	12.4	23.8	2.0	4.8	0.7	0.0	0.0	0.0	0.0	0.0					
						PC-2		2%	9.5	80%	20%	0%	7.6	1.9	0.0	17.21	38.1	2.9	8.2	0.9	131.3	291.0	22.4	62.8	7.0	32.8	72.7	5.6	15.7	1.8	0.0	0.0	0.0	0.0	0.0					
				Utility	Dynamic Maneuvering	PC-3		96%	457.7	80%	20%	0%	366.2	91.5	0.0	59.93	187.6	9.3	47.1	4.8	21945.3	68699.5	3412.8	17254.5	1746.7	5486.3	17174.9	853.2	4313.6	436.7	0.0	0.0	0.0	0.0	0.0					
		149		Utility	Coastal Patrol-Independent Low Speed (	PC-1	3.2	15%	71.5	80%	20%	0%	57.2	14.3	0.0	6.5	12.5	1.1	2.5	0.4	371.9	712.9	60.1	143.6	20.0	93.0	178.2	15.0	35.9	5.0	0.0	0.0	0.0	0.0	0.0					
						PC-2		60%	286.1	80%	20%	0%	228.9	57.2	0.0	17.21	38.1	2.9	8.2	0.9	3938.7	8728.9	672.9	1883.6	210.6	984.7	2182.2	168.2	470.9	52.6	0.0	0.0	0.0	0.0	0.0					
					Dynamic Maneuvering	PC-3		25%	119.2	80%	20%	0%	95.4	23.8	0.0	59.93	187.6	9.3	47.1	4.8	5714.9	17890.5	888.8	4493.4	454.9	1428.7	4472.6	222.2	1123.3	113.7	0.0	0.0	0.0	0.0	0.0					
		100		Cutter	US Coast Guard	USCG	3.2	100%	320.0	20%	20%	60%	64.0	64.0	192.0	5.74	57.9	0.9	11.6	0.2	367.4	3706.2	56.3	739.2	13.4	367.4	3706.2	56.3	739.2	13.4	1102.1	11118.7	169.0	2217.6	40.3					
		49		Cutter	US Coast Guard	USCG	3.2	100%	156.8	5%	5%	90%	7.8	7.8	141.1	5.74	57.9	0.9	11.6	0.2	45.0	454.0	6.9	90.6	1.6	45.0	454.0	6.9	90.6	1.6	810.0	8172.3	124.2	1629.9	29.6					
45	NALF Airfield	0																																						
46	Ship Torpedo Test	1		DDG	Guided Missile Destroyer	DDG-3	6.5	100%	6.5	0%	23%	77%	0.0	1.5	5.0	106.67	53.8	7.8	21.2	2.8	0.0	0.0	0.0	0.0	0.0	160.9	81.2	11.8	32.0	4.2	532.5	268.8	39.1	105.9	14.0					
		1		DDH	Japanese Destroye Helo Deck (FMS)	CG-3	6.5	100%	6.5	0%	23%	77%	0.0	1.5	5.0	114.75	65.2	7.7	33.6	3.4	0.0	0.0	0.0	0.0	0.0	173.0	98.4	11.6	50.6	5.2	572.8	325.6	38.3	167.5	17.2					
		1		DD	Japanese Destroyer (FMS)	CG-3	6.5	100%	6.5	0%	23%	77%	0.0	1.5	5.0	114.75	65.2	7.7	33.6	3.4	0.0	0.0	0.0	0.0	0.0	173.0	98.4	11.6	50.6	5.2	572.8	325.6	38.3	167.5	17.2					
		5		FFH	Helicopter Frigate (Canadian)	FFG-3	6.5	100%	32.5	0%	23%	77%	0.0	7.5	25.0	120.04	78.1	11.6	16.1	4.3	0.0	0.0	0.0	0.0	0.0	905.1	588.9	87.8	121.2	32.4	2996.2	1949.6	290.5	401.4	107.3					
47	UUV	10		BW	Boston Whalers	BW-1	10.0	100%	100.0	100%	0%	0%	100.0	0.0	0.0	0	0.1	7.5	0.0	0.0	0.0	7.6	751.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		10		HS	Harbor Security	RIB-2	10.0	100%	100.0	100%	0%	0%	100.0	0.0	0.0	0.04	1.6	0.0	0.2	0.0	4.0	159.0	1.0	17.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		20			Phanton DS4 (no emissions)					100%	0%	0%																												
48	Sonobuoy QA/QC	60		AE	Acoustic Explorer	AE-2	4.0	100%	240.0	50%	30%	20%	120.0	72.0	48.0	20.17	20.9	1.0	6.0	1.6	2420.4	2511.6	118.8	716.4	188.4	1452.2	1507.0	71.3	429.8	113.0	968.2	1004.6	47.5	286.6	75.4					
49	Ocean Engineering	65		BW	Boston Whaler	BW-2	3.0	100%	195.0	100%	0%	0%	195.0	0.0	0.0	0	0.1	9.0	0.0	0.0	0.0	17.7	1758.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
50	MM Mine Location	4		AE	Acoustic Explorer	AE-1	12.0	100%	48.0	100%	0%	0%	48.0	0.0	0.0	7.31	8.5	0.4	2.1	0.6	350.9	406.1	18.2	101.8	26.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		20		BW	Boston Whaler	BW-2	12.0	100%	240.0	100%	0%	0%	240.0	0.0	0.0	0	0.1	9.0	0.0	0.0	0.0	21.8	2164.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
51	Missile Flight Test	9		CG		CG-2	4.0	100%	36.0	0%	0%	100%	0.0	0.0	36.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3880.1	1696.3	317.5	756.7	94.7					
		18		DDG	Guided Missile Destroyer	DDG-2	4.0	100%	72.0	0%	0%	100%	0.0	0.0	72.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7487.3	3520.8	578.2	1291.7	177.1					
52	NUWC UW Acoustic	83		FFG	Guided Missile Frigate	FFG-2	4.0	100%	332.0	0%	0%	100%	0.0	0.0	332.0	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22184.2	22483.0	2592.9	3841.2	1079.0					
		23		AE	Acoustic Explorer	AE-1	4.0	100%	92.0	0%	0%	100%	0.0	0.0	92.0	7.31	8.5	0.4	2.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	672.5	778.3	35.0	195.0	50.6					
		83		BW	Boston Whaler	BW-2	4.0	100%	332.0	0%	0%	100%	0.0	0.0	332.0	0	0.1	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.1	2993.8	0.0	0.0					
53	Other Tests	3		CG	Cruiser	CG-2	4.0	100%	12.0	0%	0%	100%	0.0	0.0	12.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1293.4	565.4	105.8	252.2	31.6					
	(MCM, ASUW, FIREX)	8		DDG	Guided Missile Destroyer	DDG-2	4.0	100%	32.0	0%	0%	100%	0.0	0.0	32.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3327.7	1564.8	257.0	574.1	78.7					
		0		FFH	Helicopter Frigate (Canadian)	FFG-2	4.0	100%	0.0	0%	0%	100%	0.0	0.0	0.0	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		8		DD	Japanese Destroyer (FMS)	CG-2	4.0	100%	32.0	0%	0%	100%	0.0	0.0	32.0	107.78	47.1	8.8	21.02	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3449.0	1507.8	282.2	672.6	84.2					
		2		AOR	Canadian	AOE-1	4.0	100%	8.0	0%	0%	100%	0.0	0.0	8.0	3.73	22.0	2.8	66.1	13.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.8	175.9	22.3	529.1	106.2					
	Total	####														**Total Emissions (SCI) tons**					**10.90**	**17.35**	**4.88**	**10.34**	**4.13**	**61.75**	**39.01**	**5.63**	**19.15**	**5.66**	**636.96**	**492.10**	**57.58**	**310.73**	**74.35**	**49.73**	**32.19**	**4.50**	**13.14**	**2.11**
																Total Emissions (SD) tons					**106.77**	**236.91**	**13.36**	**90.56**	**15.68**	**122.89**	**323.63**	**16.31**	**134.24**	**16.40**										
																Total Emissions within US Territory (SCI)					**72.65**	**56.36**	**10.51**	**29.48**	**9.78**															
																Total Emissions within US Territory (SD)					**229.65**	**560.54**	**29.67**	**224.80**	**32.08**															

Date: 13-May-2007

Notes: 1 - Ship nomenclature highlighted in yellow signifies no specific AQ Emissions data for that vessel.
For vessels without AQ emissions data, the following data was used:

56768.0

Support (for USW)	TRB	AGF	LPD
Support (for Surf Firing)	PC	WHEC	USCG
MCM	USCG	Unknown (for Elec Combat)	PC
MHC	USCG	SOW	MKV
LSD	LPD	EFV	AAV
Unknown (for VBSS)	PC	DDH	CG
DD	CG	HS	RIB
FFH	FFG	AOR	AOE

Table C-3. Surface Ship Air Emissions—Alternative 2

Scenario	Type Training	Number of Ships	Program Totals	Nomenclature	Ship/Boat Type	Vessel Mode	Ship Time on Range (hrs) Hours	Percent at Each Power Level %	Total Time on Range (hrs) Hours	Percentage 0-3 nm from shore	Percentage 3-12 nm from Shore	Percentage >12 nm from Shore	Total Time 0-3 nm from shore (Hours)	Total Time 3-12 nm from shore (Hours)	Total Time >12 nm from shore (Hours)	Emissions Factors (lb/hr) CO	NOx	HC	SOx	PM10	Emissions 0-3 nm Offshore (lbs) CO	Nox	HC	Sox	PM	Emissions 3-12 nm Offshore - US Territory (lbs) CO	Nox	HC	Sox	PM	Emissions >12 nm Offshore - Outside US Territory: Offshore San Diego CO	Nox	HC	Sox	PM	Offshore Mexico CO	Nox	HC	Sox	PM
Training Exercises																																								
1	Air Combat Maneuvers	0																																						
2	Air Defense Exercise	117		CG	Cruiser	CG-2	1.0	100%	117.0	0%	0%	100%	0.0	0.0	117.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12610.3	5513.0	1031.9	2459.3	307.7					
		234		DDG	Guided Missile Destroyer	DDG-2	1.0	100%	234.0	0%	0%	100%	0.0	0.0	234.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24333.7	11442.6	1879.0	4198.0	575.6					
		24		CVN	Nuclear Carrier (No emissions)					0%	0%	100%																												
		4		FFG	Guided Missile Frigate	FFG-2	3.7	100%	14.8	0%	0%	100%	0.0	0.0	14.8	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	988.9	1002.3	115.6	171.2	48.1					
3	S-A Missiles	6		CVN	Nuclear Carrier (No emissions)					0%	0%	100%																												
		6		TRB	Torpedo Retrieval Boats	TRB-3	4.0	100%	24.0	1%	2%	97%	0.2	0.5	23.3	6.47	56.2	1.6	7.4	1.2	1.6	13.5	0.4	1.8	0.3	3.1	27.0	0.7	3.6	0.6	150.6	1308.8	36.1	172.3	27.5					
4	S-A Gunnery Exercise	23		CVN						0%	0%	100%																												
		44		CG	Cruiser	CG-2	1.5	100%	66.0	0%	0%	100%	0.0	0.0	66.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						7113.5	3109.9	582.1	1387.3	173.6
		91		DDG	Guided Missile Destroyer	DDG-2	1.5	100%	136.5	0%	0%	100%	0.0	0.0	136.5	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						14194.6	6674.9	1096.1	2448.8	335.8
		55		FFG	Guided Missile Frigate	FFG-2	1.5	100%	82.5	0%	0%	100%	0.0	0.0	82.5	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						5512.7	5586.9	644.3	954.5	268.1
		13		LHA	Amphib. Assault Ship - Tarawa	LHA-1	1.5	100%	19.5	0%	0%	100%	0.0	0.0	19.5	7.38	43.5	5.5	131.0	26.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						143.9	848.8	107.8	2553.9	512.7
		15		LDH	Large Helicopter-dock Ships	LHD-1	1.5	100%	22.5	0%	0%	100%	0.0	0.0	22.5	5.89	34.8	4.4	104.6	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						132.5	782.3	99.5	2353.5	472.3
		21		LPD	Amphibious Transport Dock - Wasp	LPD-1	1.5	100%	31.5	0%	0%	100%	0.0	0.0	31.5	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						58.1	343.0	43.6	1031.8	207.1
		24		LSD	Landing Ship Dock	LPD-1	1.5	100%	36.0	0%	0%	100%	0.0	0.0	36.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						66.4	392.0	49.8	1179.2	236.7
		37		USCGS	US Coast Guard	USCG	1.5	100%	55.5	0%	0%	100%	0.0	0.0	55.5	5.74	57.9	0.9	11.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						318.6	3214.0	48.8	641.0	11.7
		27		Other Ship	Coastal Patrol-Independent Low Speed (	PC-1	1.5	100%	40.5	0%	0%	100%	0.0	0.0	40.5	6.5	12.5	1.1	2.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						263.3	504.6	42.5	101.7	14.2
5	A-A Missiles	1		TRB	Torpedo Retrieval Boats	TRB-3	4.0	100%	4.0	1%	2%	97%	0.0	0.1	3.9	6.47	56.2	1.6	7.4	1.2	0.3	2.2	0.1	0.3	0.0	0.5	4.5	0.1	0.6	0.1						25.1	218.1	6.0	28.7	4.6
6	Helicopter ASW TRACKEX	28		CG	Cruiser	CG-3	3.6	100%	100.8	1%	10%	89%	1.0	10.1	89.7	114.75	65.2	7.7	33.6	3.4	115.7	65.7	7.7	33.8	3.5	1156.7	657.4	77.3	338.2	34.7	10294.5	5851.0	688.1	3009.8	308.6					
		71		DDG	Guided Missile Destroyer	DDG-3	3.6	100%	255.6	1%	10%	89%	2.6	25.6	227.5	106.67	53.8	7.8	21.2	2.8	272.6	137.6	20.0	54.2	7.2	2726.5	1376.2	200.4	542.4	71.6	24265.7	12247.7	1783.5	4827.2	637.0					
		43		TRB	Torpedo Retrieval Boats	TRB-3	3.6	100%	154.8	1%	10%	89%	1.5	15.5	137.8	6.47	56.2	1.6	7.4	1.2	10.0	87.0	2.4	11.5	1.8	100.2	870.3	24.0	114.6	18.3	891.4	7745.5	213.5	1019.5	162.6					
7	Helicopter ASW TORPEX	28		CG	Cruiser	CG-3	3.6	100%	100.8	1%	10%	89%	1.0	10.1	89.7	114.75	65.2	7.7	33.6	3.4	115.7	65.7	7.7	33.8	3.5	1156.7	657.4	77.3	338.2	34.7	10294.5	5851.0	688.1	3009.8	308.6					
		75		DDG	Guided Missile Destroyer	DDG-3	3.6	100%	270.0	1%	10%	89%	2.7	27.0	240.3	106.67	53.8	7.8	21.2	2.8	288.0	145.4	21.2	57.3	7.6	2880.1	1453.7	211.7	572.9	75.6	25632.8	12937.8	1884.0	5099.2	672.8					
		72		TRB	Torpedo Retrieval Boats	TRB-3	3.6	100%	259.2	1%	10%	89%	2.6	25.9	230.7	6.47	56.2	1.6	7.4	1.2	16.8	145.7	4.0	19.2	3.1	167.7	1457.2	40.2	191.8	30.6	1492.6	12969.3	357.6	1707.1	272.2					
8	MPA ASW TRACKEX																																							
9	MPA ASW TORPEX	2		CG	Cruiser	CG-3	2.0	100%	4.0	5%	10%	85%	0.2	0.4	3.4	114.75	65.2	7.7	33.6	3.4	23.0	13.0	1.5	6.7	0.7	45.9	26.1	3.1	13.4	1.4	390.2	221.7	26.1	114.1	11.7					
		5		DDG	Guided Missile Destroyer	DDG-3	2.0	100%	10.0	5%	10%	85%	0.5	1.0	8.5	106.67	53.8	7.8	21.2	2.8	53.3	26.9	3.9	10.6	1.4	106.7	53.8	7.8	21.2	2.8	906.7	457.6	66.6	180.4	23.8					
		3		FFG	Guided Missile Frigate	FFG-3	2.0	100%	6.0	5%	10%	85%	0.3	0.6	5.1	120.04	78.1	11.6	16.1	4.3	36.0	23.4	3.5	4.8	1.3	72.0	46.9	7.0	9.6	2.6	612.2	398.4	59.4	82.0	21.9					
		10		TRB	Torpedo Retrieval Boats	TRB-3	2.0	100%	20.0	5%	10%	85%	1.0	2.0	17.0	6.47	56.2	1.6	7.4	1.2	6.5	56.2	1.6	7.4	1.2	12.9	112.4	3.1	14.8	2.4	110.0	955.7	26.4	125.8	20.1					
10	EER/IEER ASW																																							
11	Surface Ship ASW TRACKEX	225		CG	Cruiser	CG-3	2.0	100%	450.0	1%	10%	89%	4.5	45.0	400.5	114.75	65.2	7.7	33.6	3.4	516.4	293.5	34.5	151.0	15.5	5163.8	2934.9	345.2	1509.8	154.8	45957.4	26120.6	3071.8	13436.8	1377.7					
		450		DDG	Guided Missile Destroyer	DDG-3	2.0	100%	900.0	1%	10%	89%	9.0	90.0	801.0	106.67	53.8	7.8	21.2	2.8	960.0	484.6	70.6	191.0	25.2	9600.3	4845.6	705.6	1909.8	252.0	85442.7	43125.8	6279.8	16997.2	2242.8					
		225		FFG	Guided Missile Frigate	FFG-3	2.0	100%	450.0	1%	10%	89%	4.5	45.0	400.5	120.04	78.1	11.6	16.1	4.3	540.2	351.5	52.4	72.4	19.4	5401.8	3515.0	523.8	723.6	193.5	48076.0	31283.1	4661.8	6440.0	1722.2					
		0		Support	Torpedo Retrieval Boats	TRB-3	2.0	100%	0.0	1%	10%	89%	0.0	0.0	0.0	6.47	56.2	1.6	7.4	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
12	Surface Ship ASW TORPEX	8		CG	Cruiser	CG-3	3.7	100%	29.6	1%	10%	89%	0.3	3.0	26.3	114.75	65.2	7.7	33.6	3.4	34.0	19.3	2.3	9.9	1.0	339.7	193.1	22.7	99.3	10.2	3023.0	1718.2	202.1	883.8	90.6					
		12		DDG	Guided Missile Destroyer	DDG-3	3.7	100%	44.4	1%	10%	89%	0.4	4.4	39.5	106.67	53.8	7.8	21.2	2.8	47.4	23.9	3.5	9.4	1.2	473.6	239.0	34.8	94.2	12.4	4215.2	2127.5	309.8	838.5	110.6					
		6		FFG	Guided Missile Frigate	FFG-3	3.7	100%	22.2	1%	10%	89%	0.2	2.2	19.8	120.04	78.1	11.6	16.1	4.3	26.6	17.3	2.6	3.6	1.0	266.5	173.4	25.8	35.7	9.5	2371.8	1543.3	230.0	317.7	85.0					
		12		TRB	Torpedo Retrieval Boats	TRB-3	3.7	100%	44.4	1%	10%	89%	0.4	4.4	39.5	6.47	56.2	1.6	7.4	1.2	2.9	25.0	0.7	3.3	0.5	28.7	249.6	6.9	32.9	5.2	255.7	2221.6	61.2	292.4	46.6					
13	Sub ASW Trackex	53		SSN	Submarines (No emissions)																																			
		16		TRB	Torpedo Retrieval Boats	TRB-3	12.8	100%	204.8	1%	2%	97%	2.0	4.1	198.7	6.47	56.2	1.6	7.4	1.2	13.3	115.1	3.2	15.2	2.4	26.5	230.3	6.3	30.3	4.8	1285.3	11168.4	307.9	1470.1	234.4					
14	Sub ASW TORPEX	22		SSN	Submarines (No emissions)																																			
		22		TRB	Torpedo Retrieval Boats	TRB-3	11.7	100%	257.4	1%	2%	97%	2.6	5.1	249.7	6.47	56.2	1.6	7.4	1.2	16.7	144.7	4.0	19.0	3.0	33.3	289.4	8.0	38.1	6.1	1615.4	14036.9	387.0	1847.6	294.6					
15	VBSS	21		CG	Cruiser	CG-2	4.0	100%	84.0	0%	0%	100%	0.0	0.0	84.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9053.5	3958.1	740.9	1765.7	220.9					
		42		DDG	Guided Missile Destroyer	DDG-2	4.0	100%	168.0	0%	0%	100%	0.0	0.0	168.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17470.3	8215.2	1349.0	3013.9	413.3					
		8		FFG	Guided Missile Frigate	FFG-2	4.0	100%	32.0	0%	0%	100%	0.0	0.0	32.0	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2138.2	2167.0	249.9	370.2	104.0					
		3		LPD	Amphibious Transport Dock - Wasp	LPD-1	4.0	100%	12.0	0%	0%	100%	0.0	0.0	12.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.1	130.7	16.6	393.1	78.9					
		8		LSD		LPD-1	4.0	100%	32.0	0%	0%	100%	0.0	0.0	32.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59.1	348.4	44.3	1048.2	210.4					
16	ASUW MISSILEX	32		TRB	Torpedo Retrieval Boats	TRB-2	7.0	100%	224.0	5%	28%	67%	11.2	62.7	150.1	7.64	33.1	0.6	3.4	1.2	85.6	370.6	6.6	38.0	13.0	479.2	2075.4	37.0	212.6	72.8	1146.6	4966.1	88.5	508.8	174.1					
17	A-S BOMBEX	0																																						
18	A-S GUNEX	0																																						
19	S-S GUNEX	1		CVN	Nuclear Carrier (No emissions)																																			
		71		CG	Cruiser	CG-1	2.5	100%	177.5	0%	28%	72%	0.0	49.7	127.8	102.58	40.6	9.2	17.7	2.1	0.0	0.0	0.0	0.0	0.0	5098.2	2018.3	458.2	880.2	105.4						13109.7	5190.0	1178.3	2263.3	270.9
		147		DDG	Guided Missile Destroyer	DDG-1	2.5	100%	367.5	0%	28%	72%	0.0	102.9	264.6	102.98	47.3	8.1	17.0	2.4	0.0	0.0	0.0	0.0	0.0	10596.6	4871.3	833.5	1753.4	241.8						27248.5	12526.2	2143.3	4508.8	621.8
		49		FFG	Guided Missile Frigate	FFG-1	2.5	100%	122.5	0%	28%	72%	0.0	34.3	88.2	65.75	66.4	7.9	10.9	3.1	0.0	0.0	0.0	0.0	0.0	2255.2	2275.8	270.6	373.5	107.7						5799.2	5852.1	695.9	960.5	276.9
		2		LPD	Amphibious Transport Dock - Wasp	LPD-1	2.5	100%	5.0	0%	28%	72%	0.0	1.4	3.6	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	2.6	15.2	1.9	45.9	9.2						6.6	39.2	5.0	117.9	23.7
		1		LSD	Landing Ship Dock	LPD-1	2.5	100%	2.5	0%	28%	72%	0.0	0.7	1.8	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	1.3	7.6	1.0	22.9	4.6						3.3	19.6	2.5	59.0	11.8
		1		LHD	Large Helicopter-dock Ships	LHD-2	2.5	100%	2.5	0%	28%	72%	0.0	0.7	1.8	6.8	40.1	5.1	120.7	24.2	0.0	0.0	0.0	0.0	0.0	4.8	28.1	3.6	84.5	17.0						12.2	72.2	9.2	217.3	43.6
		18		Unknown	Other	PC-2	2.5	100%	45.0	0%	28%	72%	0.0	12.6	32.4	17.21	38.1	2.9	8.2	0.9	0.0	0.0	0.0	0.0	0.0	216.8	480.6	37.0	103.7	11.6						557.6	1235.7	95.3	266.7	29.8
		40		USCG	US Coast Guard	USCG	2.5	100%	100.0	0%	28%	72%	0.0	28.0	72.0	5.74	57.9	0.9	11.6	0.2	0.0	0.0	0.0	0.0	0.0	160.7	1621.5	24.6	323.4	5.9						413.3	4169.5	63.4	831.6	15.1
20	SINKEX	6		CG	Cruiser	CG-2	16.0	100%	96.0	0%	0%	100%	0.0	0.0	96.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						10346.9	4523.5	846.7	2017.9	252.5
		12		DDG	Guided Missile Destroyer	DDG-2	16.0	100%	192.0	0%	0%	100%	0.0	0.0	192.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						19966.1	9388.8	1541.8	3444.5	472.3
		0		DD	Destroyer	DDG-2	16.0	100%	0.0	0%	0%	100%	0.0	0.0	0.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						0.0	0.0	0.0	0.0	0.0
		6		FFG	Guided Missile Frigate	FFG-2	16.0	100%	96.0	0%	0%	100%	0.0	0.0	96.0	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						6414.7	6501.1	749.8	1110.7	312.0
		3		SSN	Submarines (No emissions)																																			
21	NSFS	17		CG	Cruiser	CG-2	9.0	100%	153.0	0%	30%	70%	0.0	45.9	107.1	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	4947.1	2162.8	404.8	964.8	120.7	11543.2	5046.6	944.6	2251.2	281.7					
		35		DDG	Guided Missile Destroyer	DDG-2	9.0	100%	315.0	0%	30%	70%	0.0	94.5	220.5	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	9827.1	4621.1	758.8	1695.3	232.5	22929.8	10782.5	1770.6	3955.8	542.4					
		4		FFG	Guided Missile Frigate	FFG-2	9.0	100%	36.0	0%	30%	70%	0.0	10.8	25.2	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	721.7	731.4	84.3	125.0	35.1	1683.9	1706.5	196.8	291.6	81.9					
22	EFEX	3		CG	Cruiser	CG-2	72.0	100%	216.0	0%	100%	0%	0.0	216.0	0.0	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	23280.5	10177.9	1905.1	4540.3	568.1	0.0	0.0	0.0	0.0	0.0					
		3		DDG	Guided Missile Destroyer	DDG-2	72.0	100%	216.0	0%	100%	0%	0.0	216.0	0.0	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	22461.8	10562.4	1734.5	3875.0	531.4	0.0	0.0	0.0	0.0	0.0					
23	Battalion Landing	2		LHA	Amphib. Assault Ship - Tarawa	LHA-1	6.0	100%	12.0	10%	30%	60%	1.2	3.6	7.2	7.38	131.0	26.3	7.4	43.5	8.9	157.2	31.5	8.9	52.2	26.6	471.5	94.6	26.6	156.7	53.1	943.0	189.3	53.1	313.4					
		2		LHD	Large Helicopter-dock Ships	LHD-2	2.5	100%	5.0	10%	30%	60%	0.5	1.5	3.0	6.8	40.1	5.1	120.7	24.2	3.4	20.1	2.6	60.4	12.1	10.2	60.2	7.7	181.1	36.3	20.4	120.4	15.3	362.1	72.7					
		2		LPD	Amphibious Transport Dock - Wasp	LPD-1	2.5	100%	5.0	10%	30%	60%	0.5	1.5	3.0	1.845393	10.9	1.4	32.8	6.6	0.9	5.4	0.7	16.4	3.3	2.8	16.3	2.1	49.1	9.9	5.5	32.7	4.2	98.3	19.7					
		12		LCU	Landing Craft Utility	LCU	3.0	100%	36.0	10%	30%	60%	3.6	10.8	21.6	36.21	3.1	1.6	36.2	45.0	130.4	11.2	5.7	130.4	161.8	391.1	33.6	17.0	391.1	485.5	782.1	67.2	33.9	782.1	970.9					
		48		AAV/EFV	Amphibious Assault Vehicle	EFV-2	6.0	100%	288.0	10%	30%	60%	28.8	86.4	172.8	2.0611	4.17	0.72	0.06	0.3211	59.4	120.0	20.8	1.8	9.2	178.1	360.0	62.3	5.5	27.7	356.2	720.1	124.6	10.9	55.5					
		10		LCAC	Landing Craft Air Cushioned	LCAC	3.0	100%	30.0	10%	30%	60%	3.0	9.0	18.0	25.41	43.3	3.9	25.4	55.3	76.2	129.9	11.7	76.2	166.0	228.7	389.7	35.0	228.7	497.9	457.4	779.4	70.0	457.4	995.8					
		0		CRRC	Combat Raiding Rubber Craft	CRRC-4	6.0	100%	0.0	10%	30%	60%	0.0	0.0	0.0	0	0.0	0.0	0.06	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
24	USMC Stinger	0																																						
25	Amphibious Landings & Raids																																							
25A	Recon Mission	12		LPD	Amphibious Transport Dock - Wasp	LPD-1	4.0	100%	48.0	0%	0%	100%	0.0	0.0	48.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.6	522.6	66.4	1572.3	315.6					
25B	Helicopter Assault	6		LHD	Large Helicopter-dock Ships	LHD-2	6.0	100%	36.0	0%	0%	100%	0.0	0.0	36.0	6.8	40.1	5.1	120.7	24.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	244.8	1444.3	183.6	4345.2	872.3					
		6		LHA	Amphib. Assault Ship - Tarawa	LHA-1	6.0	100%	36.0	0%	0%	100%	0.0	0.0	36.0	7.38	131.0	26.3	7.4	43.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	265.7	4714.9	946.4	265.7	1567.1					
25C	Armored Operations	4		LHD	Large Helicopter-dock Ships	LHD-2	12.0	100%	48.0	33%	33%	33%	16.0	16.0	16.0	6.8	40.1	5.1	120.7	24.2	108.7	641.3	81.5	1929.3	387.3	108.7	641.3	81.5	1929.3	387.3	108.7	641.3	81.5	1929.3	387.3					
		4		LHA	Amphib. Assault Ship - Tarawa	LHA-1	12.0	100%	48.0	33%	33%	33%	16.0	16.0	16.0	7.38	131.0	26.3	7.4	43.5	118.0	2093.4	420.2	118.0	695.8	118.0	2093.4	420.2	118.0	695.8	118.0	2093.4	420.2	118.0	695.8					
		8		LCAC	Landing Craft Air Cushioned	LCAC	12.0	100%	96.0	33%	33%	33%	32.0	32.0	32.0	25.41	43.3	3.9	25.4	55.3	812.3	1384.2	124.4	812.3	1768.5	812.3	1384.2	124.4	812.3	1768.5	812.3	1384.2	124.4	812.3	1768.5					
		8		LCU	Landing Craft Utility	LCU	12.0	100%	96.0	33%	33%	33%	32.0	32.0	32.0	36.21	3.1	1.6	36.2	45.0	1157.6	99.4	50.2	1157.6	1437.0	1157.6	99.4	50.2	1157.6	1437.0	1157.6	99.4	50.2	1157.6	1437.0					
25D	Artillery Operations	2		LHD	Large Helicopter-dock Ships	LHD-2	24.0	100%	48.0	100%	0%	0%	48.0	0.0	0.0	6.8	40.1	5.1	120.7	24.2	326.4	1925.8	244.8	5793.6	1163.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		2		LHA	Amphib. Assault Ship - Tarawa	LHA-1	24.0	100%	48.0	20%	40%	40%	9.6	19.2	19.2	7.38	43.5	5.5	131.0	26.3	70.8	417.9	53.1	1257.3	252.4	141.7	835.8	106.2	2514.6	504.8	141.7	835.8	106.2	2514.6	504.8					

Table C-3. Surface Ship Air Emissions—Alternative 2

Scenario	Type Training	Number of Ships	Program Totals	Nomenclature	Ship/Boat Type	Vessel Mode	Ship Time on Range (hrs) Hours	Percent at Each Power Level %	Total Time on Range (hrs) Hours	Percentage 0-3 nm from shore	Percentage 3-12 nm from Shore	Percentage >12 nm from Shore	Total Time 0-3 nm from shore (Hours)	Total Time 3-12 nm from shore (Hours)	Total Time >12 nm from shore (Hours)	Emissions Factors (lb/hr) CO	NOx	HC	SOx	PM10	Emissions 0-3 nm Offshore (lbs) CO	Nox	HC	Sox	PM	Emissions 3-12 nm Offshore - US Territory (lbs) CO	Nox	HC	Sox	PM	Emissions >12 nm Offshore - Outside US Territory CO	Nox	HC	Sox	PM	CO	Nox	HC	Sox	PM
		4		LCAC	Landing Craft Air Cushion	LCAC	24.0	100%	96.0	100%	0%	0%	96.0	0.0	0.0	25.41	55.3	0.7	43.3	3.9	2439.4	5310.7	69.1	4156.8	373.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		4		LCU	Landing Craft Utility	LCU	24.0	100%	96.0	100%	0%	0%	96.0	0.0	0.0	36.21	45.0	0.5	3.1	1.6	3476.2	4315.2	49.9	298.6	150.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
25E	Amphibious Assault	2		LHD	Large Helicopter-dock Ships	LHD-2	8.0	100%	16.0	38%	38%	25%	6.0	6.0	4.0	6.8	40.1	5.1	120.7	24.2	40.8	240.7	30.6	724.2	145.4	40.8	240.7	30.6	724.2	145.4	27.2	160.5	20.4	482.8	96.9					
		2		LHA	Amphib. Assault Ship - Tarawa	LHA-1	8.0	100%	16.0	38%	38%	25%	6.0	6.0	4.0	7.38	43.5	5.5	131.0	26.3	44.3	261.2	33.2	785.8	157.7	44.3	261.2	33.2	785.8	157.7	29.5	174.1	22.1	523.9	105.2					
		4		LPD	Amphibious Transport Dock - Wasp	LPD-1	8.0	100%	32.0	38%	38%	25%	12.0	12.0	8.0	1.845393	10.9	1.4	32.8	6.6	22.1	130.7	16.6	393.1	78.9	22.1	130.7	16.6	393.1	78.9	14.8	87.1	11.1	262.0	52.6					
		6		LCAC	Landing Craft Air Cushioned	LCAC	8.0	100%	48.0	38%	38%	25%	18.0	18.0	12.0	25.41	43.3	3.9	25.4	55.3	457.4	779.4	70.0	457.4	995.8	457.4	779.4	70.0	457.4	995.8	304.9	519.6	46.7	304.9	663.8					
		6		LCU	Landing Craft Utility	LCU	8.0	100%	48.0	38%	38%	25%	18.0	18.0	12.0	36.21	3.1	1.6	36.2	45.0	651.8	56.0	28.3	651.8	809.1	651.8	56.0	28.3	651.8	809.1	434.5	37.3	18.8	434.5	539.4					
25F	Combat Engineer Ops	2		LHA	Amphib. Assault Ship - Tarawa	LHA-1	6.0	100%	12.0	33%	33%	33%	4.0	4.0	4.0	7.38	131.0	26.3	7.4	43.5	29.5	523.4	105.1	29.5	173.9	29.5	523.4	105.1	29.5	173.9	29.5	523.4	105.1	29.5	173.9					
		4		LCU	Landing Craft Utility	LCU	6.0	100%	24.0	33%	33%	33%	8.0	8.0	8.0	36.21	3.1	1.6	36.2	45.0	289.4	24.9	12.5	289.4	359.2	289.4	24.9	12.5	289.4	359.2	289.4	24.9	12.5	289.4	359.2					
25G	Amphibious Assault Vehicle Ops	8		LHA	Amphib. Assault Ship - Tarawa	LHA-1	8.0	100%	64.0	25%	25%	50%	16.0	16.0	32.0	7.38	131.0	26.3	7.4	43.5	118.1	2095.5	420.6	118.1	696.5	118.1	2095.5	420.6	118.1	696.5	236.2	4191.0	841.3	236.2	1393.0					
		48		EFV	Expeditionary Fighting Vessel	EFV-1	8.0	100%	384.0	25%	25%	50%	96.0	96.0	192.0	2.0611	4.17	0.72	0.06	0.3211	197.9	400.0	69.2	6.1	30.8	197.9	400.0	69.2	6.1	30.8	395.7	800.1	138.5	12.1	61.7					
25H	EFV	4		LPD	Amphibious Transport Dock - Wasp	LPD-1	8.0	100%	32.0	25%	25%	50%	8.0	8.0	16.0	1.845393	10.9	1.4	32.8	6.6	14.8	87.1	11.1	262.0	52.6	14.8	87.1	11.1	262.0	52.6	29.5	174.2	22.1	524.1	105.2					
		2		LCAC	Landing Craft Air Cushioned	LCAC	8.0	100%	16.0	25%	25%	50%	4.0	4.0	8.0	25.41	43.3	3.9	25.4	55.3	101.6	173.2	15.6	101.6	221.3	101.6	173.2	15.6	101.6	221.3	203.3	346.4	31.1	203.3	442.6					
		92		EFV	Expeditionary Fighting Vessel	EFV-1	8.0	100%	736.0	25%	25%	50%	184.0	184.0	368.0	2.0611	4.17	0.72	0.06	0.3211	379.2	766.7	132.7	11.6	59.1	379.2	766.7	132.7	11.6	59.1	758.5	1533.5	265.4	23.3	118.2					
25I	Assault Amphibian School	120		LCAC	Landing Craft Air Cushioned	LCAC	8.0	100%	960.0	0%	0%	100%	0.0	0.0	960.0	25.41	43.3	3.9	25.4	55.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24393.6	41568.0	3734.4	24393.6	53107.2					
		60		LCU	Landing Craft Utility	LCU	8.0	100%	480.0	0%	0%	100%	0.0	0.0	480.0	36.21	3.1	1.6	36.2	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17380.8	1492.8	753.6	17380.8	21576.0					
		90		EFV	Amphibious Assault Vehicle	EFV-1	8.0	100%	720.0	0%	0%	100%	0.0	0.0	720.0	2.0611	4.17	0.72	0.06	0.3211	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1484.0	3000.2	519.2	45.5	231.2					
26	Ambphibious Operations CPAAA																																							
26A	Amphibious Operations	1688		AAV/EFV	Amphibious Assault Vehicle	EFV-1	16.8	20%	5671.7	28%	70%	2%	1588.1	3970.2	113.4	2.0611	4.17	0.72	0.06	0.3211	3273.2	6617.5	1145.2	100.4	509.9	8182.9	16543.7	2862.9	250.9	1274.8	233.8	472.7	81.8	7.2	36.4					
				AAV/EFV	Amphibious Assault Vehicle	EFV-2	16.8	80%	22686.7	28%	70%	2%	6352.3	15880.7	453.7	2.0611	4.17	0.72	0.06	0.3211	13092.7	26470.0	4580.6	401.5	2039.7	32731.7	66174.9	11451.6	1003.7	5099.3	935.2	1890.7	327.2	28.7	145.7					
		6		LCAC	Landing Craft Air Cushion	LCAC	16.8	100%	100.8	100%	0%	0%	100.8	0.0	0.0	25.41	55.3	0.7	43.3	3.9	2561.3	5576.3	72.6	4364.6	392.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
26B	Amphibious Ops	5		LHD	Large Helicopter-dock Ships	LHD-1	4.2	90%	18.9	0%	0%	100%	0.0	0.0	18.9	5.89	34.8	4.4	104.6	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	111.6	658.7	83.7	1981.6	397.7					
				LHD	Large Helicopter-dock Ships	LHD-2	4.2	10%	2.1	0%	0%	100%	0.0	0.0	2.1	6.8	40.1	5.1	120.7	24.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	84.5	10.7	254.1	51.0					
		5		LCAC	Landing Craft Air Cushion	LCAC	4.2	100%	21.1	0%	0%	100%	0.0	0.0	21.1	25.41	55.3	0.7	43.3	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	534.9	1164.5	15.2	911.5	81.9					
		74		CRRC	Combat Raiding Rubber Craft	CRRC-1	4.2	22%	68.5	28%	36%	36%	19.2	24.7	24.7	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.5					
				CRRC	Combat Raiding Rubber Craft	CRRC-4	4.2	27%	84.1	28%	36%	36%	23.6	30.3	30.3	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	3.1	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	4.0					
				CRRC	Combat Raiding Rubber Craft	CRRC-5	4.2	51%	158.9	28%	36%	36%	44.5	57.2	57.2	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0	8.5	0.0	0.0	0.0	0.0	8.5					
		5		LCU	Landing Craft Utility	LCU	4.2	100%	21.1	32%	0%	68%	6.7	0.0	14.3	36.21	45.0	0.5	3.1	1.6	243.9	302.8	3.5	20.9	10.6	0.0	0.0	0.0	0.0	0.0	518.3	643.4	7.4	44.5	22.5					
26C	Amphibious Ops	143		AAV/EFV	Amphibious Assault Vehicle	EFV-1	2.4	33%	112.0	28%	70%	2%	31.4	78.4	2.2	2.0611	4.17	0.72	0.06	0.3211	64.6	130.7	22.6	2.0	10.1	161.6	326.7	56.5	5.0	25.2	4.6	9.3	1.6	0.1	0.7					
						EFV-2	2.4	67%	224.0	28%	70%	2%	62.7	156.8	4.5	2.0611	4.17	0.72	0.06	0.3211	129.3	261.4	45.2	4.0	20.1	323.2	653.5	113.1	9.9	50.4	9.2	18.7	3.2	0.3	1.4					
26D	Amphibious Ops	5		AAV	Amphibious Assault Vehicle	AAV-1	2.4	20%	2.4	100%	0%	0%	2.4	0.0	0.0	0.444918	1.0	0.2	0.1	0.2	1.0	2.4	0.4	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						AAV-2	2.4	80%	9.4	100%	0%	0%	9.4	0.0	0.0	0.633674	3.8	0.2	0.1	0.3	6.0	35.3	1.6	1.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		3004		EFV	Amphibious Assault Vehicle	EFV-1	2.4	33%	2352.9	28%	70%	2%	658.8	1647.0	47.1	2.0611	4.17	0.72	0.06	0.3211	1357.9	2745.3	475.1	41.6	211.5	3394.7	6863.2	1187.7	104.1	528.9	97.0	196.1	33.9	3.0	15.1					
						EFV-2	2.4	67%	4706.5	28%	70%	2%	1317.8	3294.6	94.1	2.0611	4.17	0.72	0.06	0.3211	2716.2	5491.4	950.3	83.3	423.2	6790.4	13728.4	2375.7	208.2	1057.9	194.0	392.2	67.9	5.9	30.2					
		2268		RIB	Rigid Inflatable	RIB-1	2.4	7%	355.5	28%	70%	2%	99.5	248.8	7.1	0.04	1.6	0.0	0.2	0.0	4.0	158.3	1.0	16.9	2.0	10.0	395.7	2.5	42.3	5.0	0.3	11.3	0.1	1.2	0.1					
						RIB-3		13%	708.9	28%	70%	2%	198.5	496.2	14.2	0.08	3.0	0.0	0.4	0.0	15.9	595.4	2.0	71.5	7.9	39.7	1488.6	5.0	178.6	19.8	1.1	42.5	0.1	5.1	0.6					
						RIB-4		80%	4263.8	28%	70%	2%	1193.9	2984.7	85.3	0.34	9.1	0.1	1.4	0.2	405.9	10912.0	71.6	1719.2	179.1	1014.8	27280.0	179.1	4298.0	447.7	29.0	779.4	5.1	122.8	12.8					
		756		Support	Coastal Patrol-Independent Low Speed (	PC-1	2.4	20%	355.3	28%	70%	2%	99.5	248.7	7.1	6.5	12.5	1.1	2.5	0.4	646.7	1239.6	104.5	249.7	34.8	1616.7	3099.1	261.2	624.3	87.1	46.2	88.5	7.5	17.8	2.5					
					Dynamic Maneuvering	PC-3		80%	1421.3	28%	70%	2%	398.0	994.9	28.4	59.93	187.6	9.3	47.1	4.8	23849.6	74661.0	3709.0	18751.8	1898.3	59624.1	186652.4	9272.4	46879.5	4745.7	1703.5	5332.9	264.9	1339.4	135.6					
26E	Amphibious Ops	386		AAV	Amphibious Assault Vehicle	AAV-1	13.2	20%	1019.0	100%	0%	0%	1019.0	0.0	0.0	0.444918	1.0	0.2	0.1	0.2	453.4	1055.8	177.4	52.5	182.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						AAV-2	13.2	80%	4076.2	100%	0%	0%	4076.2	0.0	0.0	0.633674	3.8	0.2	0.1	0.3	2583.0	15319.8	698.9	429.2	1199.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		173		CRRC	Combat Raiding Rubber Craft	CRRC-1	13.2	28%	628.0	70%	30%	0%	439.6	188.4	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0	0.0	0.0					
				CRRC	Combat Raiding Rubber Craft	CRRC-4	13.2	18%	399.6	70%	30%	0%	279.7	119.9	0.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	36.9	0.0	0.0	0.0	0.0	15.8	0.0	0.0	0.0	0.0	0.0					
				CRRC	Combat Raiding Rubber Craft	CRRC-5	13.2	55%	1256.0	70%	30%	0%	879.2	376.8	0.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	130.6	0.0	0.0	0.0	0.0	56.0	0.0	0.0	0.0	0.0	0.0					
26F	Amphibious Warfare	964		LCAC	Landing Craft Air Cushion	LCAC	8.5	100%	8194.0	16%	55%	29%	1311.0	4506.7	2376.3	25.41	55.3	0.7	43.3	3.9	33313.5	72526.7	943.9	56768.0	5099.9	114515.2	249310.6	3244.8	195140.1	17531.1	60380.8	131454.7	1710.9	102892.1	9243.7					
		221		LCU	Landing Craft Utility	LCU	8.5	100%	1878.5	75%	5%	20%	1408.9	93.9	375.7	36.21	45.0	0.5	3.1	1.6	51015.4	63328.9	732.6	4381.6	2211.9	3401.0	4221.9	48.8	292.1	147.5	13604.1	16887.7	195.4	1168.4	589.8					
		72		Support	Coastal Patrol-Independent Low Speed (	PC-2	8.5	100%	612.0	100%	0%	0%	612.0	0.0	0.0	17.21	38.1	2.9	8.2	0.9	10532.5	23341.7	1799.3	5036.8	563.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		72		LCM-8		LCU	8.5	100%	612.0	100%	0%	0%	612.0	0.0	0.0	36.21	45.0	0.5	3.1	1.6	22160.5	27509.4	318.2	1903.3	960.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		30		LARC		LCU	8.5	100%	255.0	100%	0%	0%	255.0	0.0	0.0	36.21	45.0	0.5	3.1	1.6	9233.6	11462.3	132.6	793.1	400.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		36		SLWT	SLWT (assume LPD)	LPD-2	8.5	20%	61.2	95%	5%	0%	58.1	3.1	0.0	2.935967	17.3	2.2	52.1	10.5	170.7	1007.1	128.0	3029.9	608.1	9.0	53.0	6.7	159.5	32.0	0.0	0.0	0.0	0.0	0.0					
						LPD-3	8.5	80%	244.8	95%	5%	0%	232.6	12.2	0.0	6.549492	38.6	4.9	116.3	23.3	1523.1	8986.6	1142.4	27035.9	5426.2	80.2	473.0	60.1	1422.9	285.6	0.0	0.0	0.0	0.0	0.0					
		36		SLWT	SLWT (assume LPD)	LPD-2	8.5	20%	61.2	95%	5%	0%	58.1	3.1	0.0	2.935967	17.3	2.2	52.1	10.5	170.7	1007.1	128.0	3029.9	608.1	9.0	53.0	6.7	159.5	32.0	0.0	0.0	0.0	0.0	0.0					
						LPD-3	8.5	80%	244.8	95%	5%	0%	232.6	12.2	0.0	6.549492	38.6	4.9	116.3	23.3	1523.1	8986.6	1142.4	27035.9	5426.2	80.2	473.0	60.1	1422.9	285.6	0.0	0.0	0.0	0.0	0.0					
		18		BW	Boston Whaler	BW-2	8.5	20%	30.6	95%	5%	0%	29.1	1.5	0.0	0	0.1	9.0	0.0	0.0	0.0	2.6	262.1	0.0	0.0	0.0	0.1	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						BW-3	8.5	80%	122.4	95%	5%	0%	116.3	6.1	0.0	0	0.3	26.3	0.0	0.0	0.0	30.7	3058.2	0.0	0.0	0.0	1.6	161.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
26G	Amphibious Ops	675		CRRC	Combat Raiding Rubber Craft	CRRC-1	6.2	28%	1141.6	80%	20%	0%	913.3	228.3	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.1	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0					
				CRRC	Combat Raiding Rubber Craft	CRRC-4	6.2	18%	726.5	80%	20%	0%	581.2	145.3	0.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	76.7	0.0	0.0	0.0	0.0	19.2	0.0	0.0	0.0	0.0	0.0					
				CRRC	Combat Raiding Rubber Craft	CRRC-5	6.2	55%	2283.2	80%	20%	0%	1826.6	456.6	0.0	0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	271.3	0.0	0.0	0.0	0.0	67.8	0.0	0.0	0.0	0.0	0.0					
27	Elec Combat	325		CVN	Nuclear Carrier (No emissions)																																			
		768		CG	Cruiser	CG-2	4.9	100%	3763.2	0%	3%	97%	0.0	112.9	3650.3	107.78	47.1	8.8	21.0	2.6	0.0	0.0	0.0	0.0	0.0	12167.9	5319.7	995.7	2373.1	296.9	393429.8	172002.3	32195.7	76729.4	9600.3					
		658		DDG	Guided Missile Destroyer	DDG-2	4.9	100%	3224.2	0%	3%	97%	0.0	96.7	3127.5	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	10058.5	4729.9	776.7	1735.3	237.9	325226.0	152933.5	25113.6	56106.9	7693.6					
		24		DD	Destroyer	DDG-2	4.9	100%	117.6	0%	3%	97%	0.0	3.5	114.1	103.99	48.9	8.0	17.9	2.5	0.0	0.0	0.0	0.0	0.0	366.9	172.5	28.3	63.3	8.7	11862.3	5578.1	916.0	2046.5	280.6					
		19		FFG	Guided Missile Frigate	FFG-2	4.9	100%	93.1	0%	3%	97%	0.0	2.8	90.3	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	186.6	189.1	21.8	32.3	9.1	6034.3	6115.6	705.3	1044.9	293.5					
		5		FFH	Canadian Frigate	FFG-2	4.9	100%	24.5	0%	3%	97%	0.0	0.7	23.8	66.82	67.7	7.8	11.6	3.3	0.0	0.0	0.0	0.0	0.0	49.1	49.8	5.7	8.5	2.4	1588.0	1609.4	185.6	275.0	77.2					
		5		AOE	Logistics/Support	AOE-1	4.9	100%	24.5	0%	3%	97%	0.0	0.7	23.8	3.73	22.0	2.8	66.1	13.3	0.0	0.0	0.0	0.0	0.0	2.7	16.2	2.1	48.6	9.8	88.6	522.6	66.3	1571.8	315.6					
		2		MHC		PC-1	4.9	100%	9.8	0%	3%	97%	0.0	0.3	9.5	6.5	12.5	1.1	2.5	0.4	0.0	0.0	0.0	0.0	0.0	1.9	3.7	0.3	0.7	0.1	61.8	118.4	10.0	23.9	3.3					
		17		LPD	Amphibious Transport Dock - Wasp	LPD-1	4.9	100%	83.3	0%	3%	97%	0.0	2.5	80.8	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	4.6	27.2	3.5	81.9	16.4	149.1	879.7	111.8	2646.7	531.2					
		238		LHD	Large Helicopter-dock Ships	LHD-1	4.9	100%	1166.2	0%	3%	97%	0.0	35.0	1131.2	5.89	34.8	4.4	104.6	21.0	0.0	0.0	0.0	0.0	0.0	206.1	1216.5	154.6	3659.5	734.4	6662.9	39332.3	5000.0	118325.0	23744.2					
		16		LSD	Landing Ship Dock	LPD-1	4.9	100%	78.4	0%	3%	97%	0.0	2.4	76.0	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	4.3	25.6	3.3	77.0	15.5	140.3	828.0	105.3	2491.0	500.0					
		181		LHA	Amphib. Assault Ship - Tarawa	LHA-1	4.9	100%	886.9	0%	3%	97%	0.0	26.6	860.3	7.38	43.5	5.5	131.0	26.3	0.0	0.0	0.0	0.0	0.0	196.4	1158.2	147.1	3484.7	699.5	6349.0	37448.6	4757.4	112672.6	22617.1					
		1		AGF		LPD-1	4.9	100%	4.9	0%	3%	97%	0.0	0.1	4.8	1.845393	10.9	1.4	32.8	6.6	0.0	0.0	0.0	0.0	0.0	0.3	1.6	0.2	4.8	1.0	8.8	51.7	6.6	155.7	31.2					
		4		WHEC	US Coast Guard	USCG	4.9	100%	19.6	0%	3%	97%	0.0	0.6	19.0	5.74	57.9	0.9	11.6	0.2	0.0	0.0	0.0	0.0	0.0	3.4	34.1	0.5	6.8	0.1	109.1	1101.0	16.7	219.6	4.0					
		149		Unknown		PC-1	4.9	100%	730.1	0%	3%	97%	0.0	21.9	708.2	6.5	12.5	1.1	2.5	0.4	0.0	0.0	0.0	0.0	0.0	142.4	272.9	23.0	55.0	7.7	4603.3	8824.1	743.6	1777.6	247.9					
		209		SSN	Submarines (No emissions)																																			
		42		SSBN	Submarines (No emissions)																																			
28A	Sm Obj Avoidance	9		CG	Cruiser	CG-2	1.8	100%	15.8	100%	0%	0%	15.8	0.0	0.0	107.78	47.1	8.8	21.0	2.6	1697.5	742.1	138.9	331.1	41.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		14		DDG	Guided Missile Destroyer	DDG-2	1.8	100%	24.5	100%	0%	0%	24.5	0.0	0.0	103.99	48.9	8.0	17.9	2.5	2547.8	1198.1	196.7	439.5	60.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		11		FFG	Guided Missile Frigate	FFG-2	1.8	100%	19.3	100%	0%	0%	19.3	0.0	0.0	66.82	67.7	7.8	11.6	3.3	1286.3	1303.6	150.3	222.7	62.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		16		MCM		USCG	1.8	100%	28.0	100%	0%	0%	28.0	0.0	0.0	5.74	57.9	0.9	11.6	0.2	160.7	1621.5	24.6	323.4	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		23		MHC		USCG	1.8	100%	40.3	100%	0%	0%	40.3	0.0	0.0	5.74	57.9	0.9	11.6	0.2	231.0	2330.9	35.4	464.9	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
29	Mine Neutralization	0																																						
30	Mining Exercise	2		MHC		USCG	0.5	100%	1.0	50%	40%	10%	0.5	0.4	0.1	5.74	57.9	0.9	11.6	0.2	2.9	29.0	0.4	5.8	0.1	2.3	23.2	0.4	4.6	0.1	0.6	5.8	0.1	1.2	0.0					
31	NSWC Land Demolition	6		CRRC		CRRC-2	4.0	90%	21.6	100%	0%	0%	21.6	0.0	0.0	0	0.0	2.3	0.0	0.0	0.0	0.6	49.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						CRRC-3		10%	2.4	100%	0%	0%	2.4	0.0	0.0	0	0.1	6.3	0.0	0.0	0.0	0.2	15.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
32	NSWC UW Demo	85		CRRC		CRRC-2	6.0	90%	459.0	100%	0%	0%	459.0	0.0	0.0	0	0.0	2.3	0.0	0.0	0.0	12.1	1052.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						CRRC-3		10%	51.0	100%	0%	0%	51.0	0.0	0.0	0	0.1	6.3	0.0	0.0	0.0	3.7	321.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
33	Mat Weave	36		CRRC		CRRC-2	4.0	90%	129.6	100%	0%	0%	129.6	0.0	0.0	0	0.0	2.3	0.0	0.0	0.0	3.4	297.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						CRRC-3		10%	14.4	100%	0%	0%	14.4	0.0	0.0	0	0.1	6.3	0.0	0.0	0.0	1.0	90.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
34	NSWC Small Arms	24		CRRC		CRRC-2	6.0	90%	129.6	100%	0%	0%	129.6	0.0	0.0	0	0.0	2.3	0.0	0.0	0.0	3.4	297.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
						CRRC-3		10%	14.4	100%	0%	0%	14.4	0.0	0.0	0	0.1	6.3	0.0	0.0	0.0	1.0	90.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
35	NSWC Land Nav	0																																						
36	NSW UAV Operationa	0																																						

Table C-3. Surface Ship Air Emissions—Alternative 2

Scenario	Type Training	Number of Ships	Program Totals	Nomenclature	Ship/Boat Type	Vessel Mode	Ship Time on Range (hrs)	Percent at Each Power Level	Total Time on Range (hrs)	Percentage 0-3 nm from shore	Percentage 3-12 nm from Shore	Percentage >12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Emissions Factors (lb/hr) CO	NOx	HC	SOx	PM10
							Hours	%	Hours	Percent			Hours			CO	NOx	HC	SOx	PM10
37	Insertion/Extraction	0																		
38	NSW Boat Operations	245		MK V	MK V	MK-1	10.0	50%	1225.0	5%	42%	53%	61.3	514.5	649.3	1.94	14.8	0.5	2.4	0.2
						MK-3		50%	1225.0	5%	42%	53%	61.3	514.5	649.3	13.22	71.5	1.1	15.7	1.2
		75		RIB	Rigid Inflatable	RIB-3	10.0	50%	375.0	5%	42%	53%	18.8	157.5	198.8	0.08	3.0	0.0	0.4	0.0
						RIB-4		50%	375.0	5%	42%	53%	18.8	157.5	198.8	0.34	9.1	0.1	1.4	0.2
39	NSWG-1 Platoon Ops	4		PC	Coastal Patrol-Independent Low Speed (	PC-3	4.0	100%	16.0	20%	30%	50%	3.2	4.8	8.0	59.93	187.6	9.3	47.1	4.8
		49		CRRC		CRRC-5	0.5	100%	24.5	100%	0%	0%	24.5	0.0	0.0	0	0.1	12.9	0.0	0.0
		83		SOW	MK V	MK-3	0.5	100%	41.5	100%	0%	0%	41.5	0.0	0.0	13.22	71.5	1.1	15.7	1.2
40	Direct Action	2		PC	Coastal Patrol-Independent Low Speed (	PC-2	8.0	80%	12.8	30%	20%	50%	3.8	2.6	6.4	17.21	38.1	2.9	8.2	0.9
					Dynamic Maneuvering	PC-3		20%	3.2	30%	20%	50%	1.0	0.6	1.6	59.93	187.6	9.3	47.1	4.8
		4		SOW	MK V	MK-1	4.0	80%	12.8	30%	25%	45%	3.8	3.2	5.8	1.94	14.8	0.5	2.4	0.2
						MK-3		20%	3.2	30%	25%	45%	1.0	0.8	1.4	13.22	71.5	1.1	15.7	1.2
		1		LCAC	Landing Craft Air Cushion	LCAC	1.0	100%	1.0	100%	0%	0%	1.0	0.0	0.0	25.41	55.3	0.7	43.3	3.9
		12		CRRC	Combat Rubber Raiding Craft	CRRC-3	1.0	100%	12.0	100%	0%	0%	12.0	0.0	0.0	0	0.1	6.3	0.0	0.0
		12		SDV	Combat Rubber Raiding Craft	CRRC-3	1.0	100%	12.0	100%	0%	0%	12.0	0.0	0.0	0	0.1	6.3	0.0	0.0
41	Bombing Exercise - Land	0																		
42	CSAR	0																		
43	EOD Outside SHOBA	0																		
44	USCG Ops	149		Response	Coastal Patrol-Independent Low Speed (	PC-1	3.2	2%	9.5	80%	20%	0%	7.6	1.9	0.0	6.5	12.5	1.1	2.5	0.4
						PC-2		2%	9.5	80%	20%	0%	7.6	1.9	0.0	17.21	38.1	2.9	8.2	0.9
				Utility	Dynamic Maneuvering	PC-3		96%	457.7	80%	20%	0%	366.2	91.5	0.0	59.93	187.6	9.3	47.1	4.8
		149		Utility	Coastal Patrol-Independent Low Speed (	PC-1	3.2	15%	71.5	80%	20%	0%	57.2	14.3	0.0	6.5	12.5	1.1	2.5	0.4
						PC-2		60%	286.1	80%	20%	0%	228.9	57.2	0.0	17.21	38.1	2.9	8.2	0.9
					Dynamic Maneuvering	PC-3		25%	119.2	80%	20%	0%	95.4	23.8	0.0	59.93	187.6	9.3	47.1	4.8
		100		Cutter	US Coast Guard	USCG	3.2	100%	320.0	20%	20%	60%	64.0	64.0	192.0	5.74	57.9	0.9	11.6	0.2
		49		Cutter	US Coast Guard	USCG	3.2	100%	156.8	5%	5%	90%	7.8	7.8	141.1	5.74	57.9	0.9	11.6	0.2
45	NALF Airfield	0																		
46	Ship Torpedo Test	2		DDG	Guided Missile Destroyer	DDG-3	6.5	100%	13.0	0%	23%	77%	0.0	3.0	10.0	106.67	53.8	7.8	21.2	2.8
		2		DDH	Japanese Destroye Helo Deck (FMS)	CG-3	6.5	100%	13.0	0%	23%	77%	0.0	3.0	10.0	114.75	65.2	7.7	33.6	3.4
		2		DD	Japanese Destroyer (FMS)	CG-3	6.5	100%	13.0	0%	23%	77%	0.0	3.0	10.0	114.75	65.2	7.7	33.6	3.4
		6		FFH	Helicopter Frigate (Canadian)	FFG-3	6.5	100%	39.0	0%	23%	77%	0.0	9.0	30.0	120.04	78.1	11.6	16.1	4.3
47	UUV	15		BW	Boston Whalers	BW-1	10.0	100%	150.0	100%	0%	0%	150.0	0.0	0.0	0	0.1	7.5	0.0	0.0
		15		HS	Harbor Security	RIB-2	10.0	100%	150.0	100%	0%	0%	150.0	0.0	0.0	0.04	1.6	0.0	0.2	0.0
		30			Phanton DS4 (no emissions)					100%	0%	0%								
48	Sonobuoy QA/QC	62		AE	Acoustic Explorer	AE-2	4.0	100%	248.0	50%	30%	20%	124.0	74.4	49.6	20.17	20.9	1.0	6.0	1.6
49	Ocean Engineering	65		BW	Boston Whaler	BW-2	3.0	100%	195.0	100%	0%	0%	195.0	0.0	0.0	0	0.1	9.0	0.0	0.0
50	MM Mine Location	6		AE	Acoustic Explorer	AE-1	12.0	100%	72.0	100%	0%	0%	72.0	0.0	0.0	7.31	8.5	0.4	2.1	0.6
		30		BW	Boston Whaler	BW-2	12.0	100%	360.0	100%	0%	0%	360.0	0.0	0.0	0	0.1	9.0	0.0	0.0
51	Missile Flight Test	12		CG		CG-2	4.0	100%	48.0	0%	0%	100%	0.0	0.0	48.0	107.78	47.1	8.8	21.0	2.6
		24		DDG	Guided Missile Destroyer	DDG-2	4.0	100%	96.0	0%	0%	100%	0.0	0.0	96.0	103.99	48.9	8.0	17.9	2.5
52	NUWC UW Acoustic	139		FFG	Guided Missile Frigate	FFG-2	4.0	100%	556.0	0%	0%	100%	0.0	0.0	556.0	66.82	67.7	7.8	11.6	3.3
		38		AE	Acoustic Explorer	AE-1	4.0	100%	152.0	0%	0%	100%	0.0	0.0	152.0	7.31	8.5	0.4	2.1	0.6
		139		BW	Boston Whaler	BW-2	4.0	100%	556.0	0%	0%	100%	0.0	0.0	556.0	0	0.1	9.0	0.0	0.0
53	Other Tests	3		CG	Cruiser	CG-2	4.0	100%	12.0	0%	0%	100%	0.0	0.0	12.0	107.78	47.1	8.8	21.0	2.6
	(MCM, ASUW, FIREX)	10		DDG	Guided Missile Destroyer	DDG-2	4.0	100%	40.0	0%	0%	100%	0.0	0.0	40.0	103.99	48.9	8.0	17.9	2.5
		1		FFH	Helicopter Frigate (Canadian)	FFG-2	4.0	100%	4.0	0%	0%	100%	0.0	0.0	4.0	66.82	67.7	7.8	11.6	3.3
		11		DD	Japanese Destroyer (FMS)	CG-2	4.0	100%	44.0	0%	0%	100%	0.0	0.0	44.0	107.78	47.1	8.8	21.02	2.6
		2		AOR	Canadian	AOE-1	4.0	100%	8.0	0%	0%	100%	0.0	0.0	8.0	3.73	22.0	2.8	66.1	13.3
	Total	####																		

Emissions

Scenario	Vessel Mode	Emissions 0-3 nm Offshore (lbs) CO	Nox	HC	Sox	PM	Emissions 3-12 nm Offshore - US Territory (lbs) CO	Nox	HC	Sox	PM	Emissions >12 nm Offshore - Outside US Territory CO	Nox	HC	Sox	PM	CO	Nox	HC	Sox	PM
38	MK-1	118.8	908.3	30.6	146.4	12.3	998.1	7630.0	257.3	1229.7	102.9	1259.5	9628.4	324.6	1551.7	129.9					
	MK-3	809.7	4378.2	64.3	958.6	70.4	6801.7	36776.5	540.2	8051.9	591.7	8583.1	46408.4	681.7	10160.8	746.6					
	RIB-3	1.5	56.3	0.2	6.8	0.8	12.6	472.5	1.6	56.7	6.3	15.9	596.3	2.0	71.6	8.0					
	RIB-4	6.4	171.4	1.1	27.0	2.8	53.6	1439.6	9.5	226.8	23.6	67.6	1816.6	11.9	286.2	29.8					
39	PC-3	191.8	600.4	29.8	150.8	15.3	287.7	900.5	44.7	226.2	22.9	479.4	1500.9	74.6	377.0	38.2					
	CRRC-5	0.0	3.6	316.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
	MK-3	548.6	2966.4	43.6	649.5	47.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
40	PC-2	66.1	146.5	11.3	31.6	3.5	44.1	97.6	7.5	21.1	2.4	110.1	244.1	18.8	52.7	5.9					
	PC-3	57.5	180.1	8.9	45.2	4.6	38.4	120.1	6.0	30.2	3.1	95.9	300.2	14.9	75.4	7.6					
	MK-1	7.4	56.9	1.9	9.2	0.8	6.2	47.5	1.6	7.6	0.6	11.2	85.4	2.9	13.8	1.2					
	MK-3	12.7	68.6	1.0	15.0	1.1	10.6	57.2	0.8	12.5	0.9	19.0	102.9	1.5	22.5	1.7					
	LCAC	25.4	55.3	0.7	43.3	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
	CRRC-3	0.0	0.9	75.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
	CRRC-3	0.0	0.9	75.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
44	PC-1	49.6	95.1	8.0	19.1	2.7	12.4	23.8	2.0	4.8	0.7	0.0	0.0	0.0	0.0	0.0					
	PC-2	131.3	291.0	22.4	62.8	7.0	32.8	72.7	5.6	15.7	1.8	0.0	0.0	0.0	0.0	0.0					
	PC-3	21945.3	68699.5	3412.8	17254.5	1746.7	5486.3	17174.9	853.2	4313.6	436.7	0.0	0.0	0.0	0.0	0.0					
	PC-1	371.9	712.9	60.1	143.6	20.0	93.0	178.2	15.0	35.9	5.0	0.0	0.0	0.0	0.0	0.0					
	PC-2	3938.7	8728.9	672.9	1883.6	210.6	984.7	2182.2	168.2	470.9	52.6	0.0	0.0	0.0	0.0	0.0					
	PC-3	5714.9	17890.5	888.8	4493.4	454.9	1428.7	4472.6	222.2	1123.3	113.7	0.0	0.0	0.0	0.0	0.0					
	USCG	367.4	3706.2	56.3	739.2	13.4	367.4	3706.2	56.3	739.2	13.4	1102.1	11118.7	169.0	2217.6	40.3					
	USCG	45.0	454.0	6.9	90.6	1.6	45.0	454.0	6.9	90.6	1.6	810.0	8172.3	124.2	1629.9	29.6					
46	DDG-3	0.0	0.0	0.0	0.0	0.0	321.7	162.4	23.6	64.0	8.4	1065.0	537.5	78.3	211.9	28.0					
	CG-3	0.0	0.0	0.0	0.0	0.0	346.1	196.7	23.1	101.2	10.4	1145.7	651.2	76.6	335.0	34.3					
	CG-3	0.0	0.0	0.0	0.0	0.0	346.1	196.7	23.1	101.2	10.4	1145.7	651.2	76.6	335.0	34.3					
	FFG-3	0.0	0.0	0.0	0.0	0.0	1086.1	706.7	105.3	145.5	38.9	3595.4	2339.6	348.6	481.6	128.8					
47	BW-1	0.0	11.3	1127.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
	RIB-2	6.0	238.5	1.5	25.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
48	AE-2	2501.1	2595.3	122.8	740.3	194.7	1500.6	1557.2	73.7	444.2	116.8	1000.4	1038.1	49.1	296.1	77.9					
49	BW-2	0.0	17.7	1758.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
50	AE-1	526.3	609.1	27.4	152.6	39.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
	BW-2	0.0	32.6	3246.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
51	CG-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5173.4	2261.8	423.4	1009.0	126.2					
	DDG-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9983.0	4694.4	770.9	1722.2	236.2					
52	FFG-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37151.9	37652.3	4342.4	6432.9	1807.0					
	AE-1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1111.1	1285.9	57.8	322.2	83.6					
	BW-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.4	5013.7	0.0	0.0					
53	CG-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1293.4	565.4	105.8	252.2	31.6					
	DDG-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4159.6	1956.0	321.2	717.6	98.4					
	FFG-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	267.3	270.9	31.2	46.3	13.0					
	CG-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4742.3	2073.3	388.1	924.9	115.7					
	AOE-1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.8	175.9	22.3	529.1	106.2					
Total Emissions (SCI) tons		**12.09**	**19.82**	**5.99**	**12.03**	**5.51**	**71.36**	**45.13**	**6.65**	**22.83**	**7.51**	**670.52**	**521.13**	**62.50**	**328.43**	**90.70**	**55.85**	**35.60**	**5.03**	**14.24**	**2.28**
Total Emissions (SD) tons		**107.27**	**237.93**	**13.54**	**90.57**	**15.76**	**124.15**	**326.19**	**16.75**	**134.28**	**16.59**										
Total Emissions within US Territory (SCI)		**83.45**	**64.95**	**12.64**	**34.86**	**13.02**															
Total Emissions within US Territory (SD)		**231.42**	**564.12**	**30.29**	**224.86**	**32.36**															

Date: 13-May-2007

Notes: 1 - Ship nomenclature highlighted in yellow signifies no specific AQ Emissions data for that vessel.
For vessels without AQ emissions data, the following data was used:

Support (for USW)	TRB	AGF	LPD
Support (for Surf Firing)	PC	WHEC	USCG
MCM	USCG	Unknown (for Elec Combat)	PC
MHC	USCG	SOW	MKV
LSD	LPD	EFV	AAV
Unknown (for VBSS)	PC	DDH	CG
DD	CG	HS	RIB
FFH	FFG	AOR	AOE

Table C-4. Aircraft Air Emissions—No Action Alternative

Scenario	Type Training	A/C Sorties (No.)	Nomenclature	Ave. A/C Time on Range (hrs) (Hours)	Total Time on Range (hrs) (Hours)	% Below 3,000 ft (%)	Time Below 3,000 ft (Hours)	Percentage 0-3 nm from shore (Percent)	Percentage 3-12 nm from Shore (Percent)	Percentage >12 nm from Shore (Percent)	Total Time 0-3 nm from shore (Hours)	Total Time 3-12 nm from shore (Hours)	Total Time >12 nm from shore (Hours)
Training Operations													
1	Air Combat Maneuvers	10200	FA-18E/F	1.1	1123.1			1%	2%	97%			
		624	AV-8B	1.2	748.8			1%	2%	97%			
2	Air Defense Exercise	107	E-2	1.0	107.0	50%	53.5	1%	2%	97%	0.54	1.07	51.90
		642	FA-18E/F	1.0	642.0	50%	321.0	1%	2%	97%	3.21	6.42	311.37
		107	S-3B	1.0	107.0	50%	53.5	1%	2%	97%	0.54	1.07	51.90
		321	FA-18E/F	1.0	321.0	50%	160.5	1%	2%	97%	1.61	3.21	155.69
		107	Learjet	1.0	107.0	50%	53.5	1%	2%	97%	0.54	1.07	51.90
3	S-A MISSILEX	1	SH-60B	1.0	1.0	100%	1.0	1%	2%	97%	0.01	0.02	0.97
		1	P-3	3.0	3.0	67%	2.0	1%	2%	97%	0.02	0.04	1.94
		1	Learjet	1.5	1.5	67%	1.0	1%	2%	97%	0.01	0.02	0.97
		1	C-130	1.5	1.5	67%	1.0	1%	2%	97%	0.01	0.02	0.97
4	S-A GUNEX	262	Learjet	1.5	393.0	50%	196.5	1%	2%	97%	1.97	3.93	190.61
5	A-A MISSILEX	52	FA-18A/C	2.0	104.0					100%			
		78	FA-18E/F	2.0	156.0					100%			
		13	E-2C	4.0	52.0					100%			
		13	DC-130	4.0	52.0			1%	2%	97%			
6	Helicopter ASW TRACKEX	95	SH-60B	3.6	342.0	100%	342.0		24%	76%		80.71	261.29
		449	SH-60F	3.6	1616.4	100%	1616.4		24%	76%		381.47	#####
7	Helicopter ASW TORPEX	65	SH-60B	3.6	234.0	100%	234.0		24%	76%		55.22	178.78
		122	SH-60F	3.6	439.2	100%	439.2		24%	76%		103.65	335.55
		16	Other Helo (SH-3)	3.6	57.6	100%	57.6		24%	76%		13.59	44.01
8	MPA ASW TRACKEX	25	P-3	6.0	150.0	75%	112.5	5%	10%	85%	5.63	11.25	95.63
9	MPA ASW TORPEX	35	P-3	2.0	70.0	100%	70.0	1%	2%	97%	0.70	1.40	67.90
		9	SH-60B	2.0	18.0	100%	18.0	1%	2%	97%	0.18	0.36	17.46
10	EER/IEER ASW	2	P-3	6.0	12.0	75%	9.0			100%			9.00
11	Surface Ship ASW TRACKEX												
12	Surface Ship ASW TORPEX	7	Other Helo (SH-3)	3.7	25.9	100%	25.9	1%	2%	97%	0.26	0.52	25.12
13	Submarine ASW TORPEX												
14	Submarine ASW TORPEX												
15	VBSS	12	SH-60B	4.0	48.0	100%	48.0			100%			48.00
		1	SH-60F	4.0	4.0	100%	4.0			100%			4.00
16	A-S MISSILEX	26	SH-60B	3.0	78.0	100%	78.0	1%	2%	97%	0.78	1.56	75.66
		13	SH-60F	3.0	39.0	100%	39.0	1%	2%	97%	0.39	0.78	37.83
		14	FA-18A/C	2.0	28.0			1%	2%	97%			
		14	FA-18E/F	2.0	28.0			1%	2%	97%			
		11	S-3B	3.0	33.0	100%	33.0	1%	2%	97%	0.33	0.66	32.01
17	A-S BOMBEX	17	FA-18A/C	1.0	17.0	10%	1.7		50%	50%		0.85	0.85
		17	FA-18E/F	1.0	17.0	10%	1.7		50%	50%		0.85	0.85
		9	P-3	1.0	9.0	10%	0.9		50%	50%		0.45	0.45
		15	S-3B	1.0	15.0	10%	1.5		50%	50%		0.75	0.75
18	A-S GUNEX	76	SH-60B	1.0	76.0	100%	76.0		50%	50%		38.00	38.00
		26	SH-60F	1.0	26.0	100%	26.0		50%	50%		13.00	13.00
		1	HH-60	1.0	1.0	100%	1.0		50%	50%		0.50	0.50
19	S-S GUNEX												
20	SINKEX	4	E-2	16.0	64.0	10%	6.4			100%			6.40
		16	FA-18E/F	16.0	256.0	10%	25.6			100%			25.60
		2	P-3	16.0	32.0	10%	3.2			100%			3.20
		4	SH-60B	16.0	64.0	10%	6.4			100%			6.40
21	Naval Surface Fire Support Exercise												
22	Expeditionary Fires Exercise	1	FA-18E/F	3.0	3.0	100%	3.0		100%			3.00	
		1	AH-1	3.0	3.0	100%	3.0		100%			3.00	
		1	AV-8B	3.0	3.0	100%	3.0		100%			3.00	
23	USMC Battalion Landing		FA-18A/C	0.5		15%		20%	50%	30%			
			FA-18E/F	0.5		15%		20%	50%	30%			
			AV-8B	0.5		25%		90%	5%	5%			
			AH-1	1.0		100%		90%	5%	5%			
			C-130	1.4				20%	50%	30%			
			H-53	1.5		100%		90%	5%	5%			
			H-46	1.5		100%		90%	5%	5%			
			UH-1	1.0		100%		90%	5%	5%			
24	USMC Stinger Firings												
25	Amphibious Landings and Raids												
25A	Amphibious Ops		AH-1	4.0		100%		100%					
			CH-46	4.0		100%		100%					
			CH-53	4.0		100%		100%					
			UH-1	4.0		100%		100%					
25B	Helicopter Assault		AH-1	2.0		60%		100%					
			CH-46	2.0		60%		100%					
			CH-53	2.0		60%		100%					
			AV-8B	2.0		60%		100%					
			UH-1	2.0		60%		100%					
25C	Armored Ops		AH-1	8.0		50%		100%					
			AV-8B	8.0		50%		100%					
25D	Artillery Ops		AH-1	3.0		100%		100%					
			CH-46	3.0		100%		100%					
			CH-53	3.0		100%		100%					
25E	Amphibious Assault		AH-1	3.0		100%		100%					
			CH-46	3.0		100%		100%					
			CH-53	3.0		100%		100%					
			UH-1	3.0		100%		100%					
25F	Combat Engineer		None										
25G	AAV Ops		AH-1	4.0		100%		100%					
25H	EFV Ops		AH-1	4.0		100%		100%					
25I	Assault Amphibian School		None										
26	Amphibious Operations - CPAAA												
26A	Amphibious Operations		None										
26B	Amphibious Operations	24	CH-46	4.2	101.0	100%	101.0	79%	21%		79.42	21.52	
		24	CH-53	4.2	101.0	100%	101.0	79%	21%		79.42	21.52	
26C	Amphibious Operations		None										
26D	Amphibious Operations		None										
26E	Amphibious Operations	68	AV-8B	0.5	34.0	97%	33.0	50%	30%	20%	16.49	9.89	6.60
		80	AH-1	0.5	40.0	97%	38.8	50%	30%	20%	19.40	11.64	7.76
		59	UH-1	0.5	29.5	97%	28.6	50%	30%	20%	14.31	8.58	5.72

Scenario	Scenario No.	Aircraft Type	Engines: Engine Model	Engines: No.	Fuel Flow lbs/hr	Emission Indices, lbs/1,000 lbs fuel: CO	NOx	HC	SOx	PM10	Emissions Factors (lb/hr): CO	NOx	HC	SOx	PM10
1		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
2		E-2	T56-A-425 (assume 30%	2	1100	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		S-3B	TF34-GE-400 (assume t	2	1145	14.10	4.07	1.86	0.40	3.62	32.29	9.32	4.26	0.92	8.29
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		Learjet	TFE 731-2-2B	2	531.76	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
3		SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
		P-3	T56-A-14 (assume ASUV	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
		Learjet	TFE 731-2-2B	2	531.76	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
		C-130	T56-A-425 (assume appr	4	850	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50
4		Learjet	TFE 731-2-2B	2	531.76	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
5		FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		E-2C	T56-A-425 (assume 40%	2	1100	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73
		DC-130	T56-A-425 (assume appr	4	850	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50
6	6	SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
		SH-60F	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
7	7	SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
		SH-60F	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
		Other Helo (SH	T58-GE-402 (assume 49	2	529	21.28	3.88	2.20	0.40	4.00	22.51	4.11	2.33	0.42	4.23
8		P-3	T56-A-14 (assume ASUV	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
9		P-3	T56-A-14 (assume ASUV	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
		SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
10		P-3	T56-A-14 (assume ASUV	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
12		Other Helo (SH	T58-GE-402 (assume 49	2	529	21.28	3.88	2.20	0.40	4.00	22.51	4.11	2.33	0.42	4.23
15		SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
16		SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
		SH-60F	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
		FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		S-3B	TF34-GE-400 (assume t	2	1145	14.10	4.07	1.86	0.40	3.62	32.29	9.32	4.26	0.92	8.29
17		FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		P-3	T56-A-14 (assume ASUV	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
		S-3B	TF34-GE-400 (assume t	2	1145	14.10	4.07	1.86	0.40	3.62	32.29	9.32	4.26	0.92	8.29
18		SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
		SH-60F	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
		HH-60	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
20		E-2	T56-A-425 (assume 30%	2	1100	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		P-3	T56-A-14 (assume ASUV	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
		SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
22		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
23		FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		C-130	T56-A-425 (assume appr	4	850	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50
		H-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
		H-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91
25A		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91
25B		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91
25C		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
25D		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
25E		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91
25G		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
25H		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
26B		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
26E		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91

Emissions

Scenario	Aircraft	Emissions 0-3 nm Offshore (lbs): CO	NOx	HC	SOx	PM	Emissions 3-12 nm Offshore—US Territory (lbs): CO	NOx	HC	SOx	PM	Emissions >12 nm Offshore—Outside US Territory, Offshore San Diego: CO	NOx	HC	SOx	PM	Offshore Mexico			SOx	PM
2	E-2	2.54	9.49	0.58	0.47	4.67	5.08	18.97	1.15	0.94	9.35	246.61	920.20	55.94	45.67	453.25					
	FA-18E/F	23.14	301.02	3.12	10.40	164.03	46.27	602.03	6.24	20.80	328.05	2244.11	29198.67	302.58	1008.59	15910.50					
	S-3B	17.27	4.99	2.28	0.49	4.44	34.55	9.97	4.56	0.98	8.87	1675.64	483.68	221.04	47.54	430.20					
	FA-18E/F	11.57	150.51	1.56	5.20	82.01	23.14	301.02	3.12	10.40	164.03	1122.06	14599.34	151.29	504.29	7955.25					
	Learjet	12.73	3.36	2.44	0.31	2.39	25.47	6.71	4.87	0.61	4.78	1235.18	325.63	236.22	29.80	231.80					
3	SH-60B	0.08	0.08	0.01	0.00	0.05	0.15	0.15	0.01	0.01	0.10	7.28	7.45	0.64	0.47	4.89					
	P-3	0.17	0.81	0.04	0.04	0.38	0.35	1.62	0.08	0.08	0.76	16.96	78.54	3.82	3.73	36.99					
	Learjet	0.24	0.06	0.05	0.01	0.04	0.48	0.13	0.09	0.01	0.09	23.10	6.09	4.42	0.56	4.33					
	C-130	0.14	0.23	0.03	0.01	0.14	0.27	0.46	0.07	0.03	0.27	13.30	22.14	3.20	1.32	13.10					
4	Learjet	46.77	12.33	8.94	1.13	8.78	93.54	24.66	17.89	2.26	17.55						4536.70	1196.00	867.61	109.46	851.39
6	SH-60B						605.34	619.87	53.27	38.74	406.79	1959.66	2006.69	172.45	125.42	1316.89					
	SH-60F						2861.03	2929.69	251.77	183.11	1922.61	9261.97	9484.26	815.05	592.77	6224.05					
7	SH-60B						414.18	424.12	36.45	26.51	278.33	1340.82	1373.00	117.99	85.81	901.03					
	SH-60F						777.38	796.04	68.41	49.75	522.40	2516.62	2577.01	221.46	161.06	1691.17					
	Other Helo (SH-3)						306.05	55.80	31.64	5.75	57.53	990.77	180.65	102.43	18.62	186.24					
8	P-3	49.14	227.61	11.07	10.80	107.19	98.28	455.22	22.14	21.60	214.38	835.38	3869.37	188.19	183.60	1822.23					
9	P-3	6.12	28.32	1.38	1.34	13.34	12.23	56.65	2.76	2.69	26.68	593.17	2747.51	133.63	130.37	1293.90					
	SH-60B	1.35	1.38	0.12	0.09	0.91	2.70	2.76	0.24	0.17	1.81	130.95	134.09	11.52	8.38	88.00					
10	P-3											78.62	364.18	17.71	17.28	171.50					
12	Other Helo (SH-3)	5.83	1.06	0.60	0.11	1.10	11.66	2.13	1.21	0.22	2.19	565.63	103.13	58.48	10.63	106.32					
15	SH-60B											360.00	368.64	31.68	23.04	241.92					
16	SH-60B	5.85	5.99	0.51	0.37	3.93	11.70	11.98	1.03	0.75	7.86	567.45	581.07	49.94	36.32	381.33					
	SH-60F	2.93	3.00	0.26	0.19	1.97	5.85	5.99	0.51	0.37	3.93	283.73	290.53	24.97	18.16	190.66					
	S-3B	10.66	3.08	1.41	0.30	2.74	21.31	6.15	2.81	0.60	5.47	1033.57	298.34	136.34	29.32	265.36					
17	FA-18A/C						13.76	38.02	2.48	2.26	35.87	13.76	38.02	2.48	2.26	35.87					
	FA-18E/F						6.13	79.71	0.83	2.75	43.43	6.13	79.71	0.83	2.75	43.43					
	P-3						3.93	18.21	0.89	0.86	8.58	3.93	18.21	0.89	0.86	8.58					
	S-3B						24.22	6.99	3.19	0.69	6.22	24.22	6.99	3.19	0.69	6.22					
18	SH-60B						285.00	291.84	25.08	18.24	191.52	285.00	291.84	25.08	18.24	191.52					
	SH-60F						97.50	99.84	8.58	6.24	65.52	97.50	99.84	8.58	6.24	65.52					
	HH-60						3.75	3.84	0.33	0.24	2.52	3.75	3.84	0.33	0.24	2.52					
20	E-2																30.41	113.48	6.90	5.63	55.90
	FA-18E/F																184.50	2400.64	24.88	82.92	1308.12
	P-3																27.96	129.48	6.30	6.14	60.98
	SH-60B																48.00	49.15	4.22	3.07	32.26
22	FA-18E/F						21.62	281.32	2.92	9.72	153.30										
	AH-1						26.88	14.16	1.43	1.02	10.71										
	AV-8B						147.40	164.63	10.34	7.66	72.74										
26B	CH-46	1755.82	350.45	305.09	35.58	158.33	475.81	94.97	82.68	9.64	42.91										
	CH-53	755.13	2864.52	53.18	141.81	783.49	204.63	776.26	14.41	38.43	212.32										
26E	AV-8B	810.21	904.92	56.82	42.09	399.85	486.13	542.95	34.09	25.25	239.91	324.09	361.97	22.73	16.84	159.94					
	AH-1	173.85	91.54	9.24	6.60	69.27	104.31	54.92	5.54	3.96	41.56	69.54	36.62	3.69	2.64	27.71					
	UH-1	10.01	57.36	1.29	3.96	41.61	6.00	34.42	0.77	2.38	24.96	4.00	22.94	0.52	1.59	16.64					

Scenario	Type Training	A/C Sorties	Nomenclature	Ave. A/C Time on Range (hrs)	Total Time on Range (hrs)	% Below 3,000 ft	Time Below 3,000 ft	Percentage 0-3 nm from shore	Percentage 3-12 nm from Shore	Percentage >12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Scenario	Aircraft Type	Engines Engine Model	No.	Fuel Flow lbs/hr
No.				Hours	Hours	%	Hours	Percent			Hours			No.				
		62	CH-46	0.5	31.0	97%	30.1	50%	30%	20%	15.04	9.02	6.01		CH-46	T58-GE-16	2	560
		228	CH-53	0.5	114.0	97%	110.6	50%	30%	20%	55.29	33.17	22.12		CH-53	T64-GE-415 (assume cn	3	1488
26F	Amphibious Operations		None															
26G	Amphibious Operations		None															
27	Electronic Combat Exercise	60	SH-60B	2.1	126.0	100%	126.0		3%	97%		3.78	122.22		SH-60B	T700-GE-401C	2	600
		37	SH-60F	2.1	77.7	100%	77.7		3%	97%		2.33	75.37		SH-60F	T700-GE-401C	2	600
		3	HH-60	2.1	6.3	100%	6.3		3%	97%		0.19	6.11		HH-60	T700-GE-401C	2	600
		31	P-3	2.0	62.0				3%	97%					P-3	T56-A-14 (assume ASU\	4	1200
		202	FA-18A/C	2.0	404.0				3%	97%					FA-18A/C	F404-GE-400 (assume a	2	3318
		203	FA-18E/F	2.0	406.0				3%	97%					FA-18E/F	F414-GE-400 (assume a	2	4049
		15	E-2C	2.0	30.0				3%	97%					E-2C	T56-A-425 (assume 40%	2	1100
		17	EA-6B	2.0	34.0				3%	97%					EA-6B	J52-P-408A (assume ap	2	4227
		144	Learjet	2.0	288.0				3%	97%					Learjet	TFE 731-2-2B	2	531.76
		8	Unknown	2.0	16.0				3%	97%					Unknown	TFE 731-2-2B	2	531.76
28A	Small Object Avoidance	15	MH-60R	1.8	26.3	100%	26.3	100%			26.25				MH-60R	T700-GE-401C	2	600
29	Mine Neutralization																	
30	Mine Laying	5	P-3	0.9	4.5	67%	3.0	50%	40%	10%	1.50	1.20	0.30		P-3	T56-A-14 (assume ASU\	4	1200
		11	FA-18A/C	0.5	5.5	7%	0.4	50%	40%	10%	0.18	0.15	0.04		FA-18A/C	F404-GE-400 (assume a	2	3318
		10	FA-18E/F	0.5	5.0	7%	0.3	50%	40%	10%	0.17	0.13	0.03		FA-18E/F	F414-GE-400 (assume a	2	4049
31	NSW Center Land Demolitions																	
32	NSWC Underwater Demolitions		NONE															
33	NSWC Underwater Mat Weave		NONE															
34	NSWC BUD/S Small Arms Training	10	SH-60F	6.0	60.0	100%	60.0	100%			60.00				SH-60F	T700-GE-401C	2	600
35	NSWC BUD/S Land Navigation		NONE															
36	NSW UAV Operations	16	Neptune/Scan	1.0	16.0	100%	16.0	100%			16.00							
37	Insertion/Extraction	5	C-130	2.0	10.0	50%	5.0		5%	95%		0.25	4.75		C-130	T56-A-425 (assume appı	4	850
38	NSW Boat Operations																	
39	NSW GRU ONE SEAL Platoon Ops	3	SH-60B	8.0	24.0	100%	24.0	20%	30%	50%	4.80	7.20	12.00		SH-60B	T700-GE-401C	2	600
		1	SH-60F	8.0	8.0	100%	8.0	20%	30%	50%	1.60	2.40	4.00		SH-60F	T700-GE-401C	2	600
		6	CH-46	8.0	48.0	100%	48.0	20%	30%	50%	9.60	14.40	24.00		CH-46	T58-GE-16	2	560
40	Direct Action																	
41	Bombing Exercise - Land	2	SH-60F	2.5	5.0	100%	5.0	40%	40%	20%	2.00	2.00	1.00		SH-60F	T700-GE-401C	2	600
		389	FA-18A/C	1.0	389.0	10%	38.9	10%	30%	60%	3.89	11.67	23.34		FA-18A/C	F404-GE-400 (assume a	2	3318
		388	FA-19E/F	1.0	388.0	10%	38.8	10%	30%	60%	3.88	11.64	23.28		FA-19E/F	F414-GE-400 (assume a	2	4049
		12	E-2	2.5	30.0					100%					E-2	T56-A-425 (assume 40%	2	1100
		7	EA-6B	2.5	17.5					100%					EA-6B	J52-P-408A (assume ap	2	4227
		6	AH-1	2.5	15.0	100%	15.0	40%	40%	20%	6.00	6.00	3.00		AH-1	T700-GE-401 (assume c	2	425.1
		1	AV-8B	1.0	1.0	20%	0.2	30%	50%	20%	0.06	0.10	0.04		AV-8B	F402-RR-406A (assume	1	6381
		3	KC-130	1.0	3.0			10%	30%	60%					KC-130	T56-A-425 (assume appı	4	850
			H-53	2.5		100%		40%	40%	20%					H-53	T64-GE-415 (assume cn	3	1488
			H-46	2.5		100%		40%	40%	20%					H-46	T58-GE-16	2	560
42	Combat Search and Rescue	49	MH-60S	3.0	147.0	100%	147.0	40%	40%	20%	58.80	58.80	29.40		MH-60S	T700-GE-401C	2	600
		133	FA-18A/C	1.5	199.5	10%	20.0	10%	30%	60%	2.00	5.99	11.97		FA-18A/C	F404-GE-400 (assume a	2	3318
		133	FA-18E/F	1.5	199.5	10%	20.0	10%	30%	60%	2.00	5.99	11.97		FA-18E/F	F414-GE-400 (assume a	2	4049
		14	E-2	3.0	42.0					100%					E-2	T56-A-425 (assume 40%	2	1100
43	EOD Outside SHOBA																	
44	USCG Ops	70	HH-60	3.2	224.0	100%	224.0	50%	30%	20%	112.00	67.20	44.80		HH-60	T700-GE-401C	2	600
45	NALF Airfield		See NALF Ops															
46	Ship Torpedo Tests	3	SH-60B	3.0	9.0	100%	9.0		23%	77%		2.09	6.91		SH-60B	T700-GE-401C	2	600
		15	MH-60R	3.0	45.0	100%	45.0		23%	77%		10.44	34.56		MH-60R	T700-GE-401C	2	600
		2	SH-3	3.0	6.0	100%	6.0		23%	77%		1.39	4.61		SH-3	T58-GE-402 (assume 49	2	529
47	Unmanned Underwater Vehicle Test		NONE															
48	Sonobuoy QA/QC Test	2	P-3	5.0	10.0	100%	10.0	50%	30%	20%	5.00	3.00	2.00		P-3	T56-A-14 (assume ASU\	4	1200
		115	NC-12B Kingair	3.0	345.0	100%	345.0	50%	30%	20%	172.50	103.50	69.00		NC-12B Kinga	PT6A-42 (assume appro	2	249
49	Ocean Engineering		NONE	NONE														
50	Marine Mammal Mine Shape Location		NONE	NONE														
51	Missile Flight Test	1	SH-60B	4.0	4.0	100%	4.0	5%	10%	85%	0.20	0.40	3.40		SH-60B	T700-GE-401C	2	600
		4	P-3	4.0	16.0	50%	8.0	5%	10%	85%	0.40	0.80	6.80		P-3	T56-A-14 (assume ASU\	4	1200
		6	FA-18A/C	4.0	24.0				5%	95%					FA-18A/C	F404-GE-400 (assume a	2	3318
		3	FA-18E/F	4.0	12.0				5%	95%					FA-18E/F	F414-GE-400 (assume a	2	4049
		2	Learjet	4.0	8.0				5%	95%					Learjet	TFE 731-2-2B	2	531.76
		1	Gulfstream	4.0	4.0				5%	95%					Gulfstream	BR700-710A1-10	2	1698
		1	Other Helo	4.0	4.0	100%	4.0	5%	10%	85%	0.20	0.40	3.40		Other Helo (S-	T58-GE-402 (assume 49	2	529
52	NUWC Underwater Acoustics Testing		NONE															
53	Other Tests	4	SH-60F	4.0	16.0	100%	16.0	5%	8%	77%	0.80	1.28	12.32		SH-60F	T700-GE-401C	2	600
		2	P-3	4.0	8.0	50%	4.0	5%	8%	77%	0.20	0.32	3.08		P-3	T56-A-14 (assume ASU\	4	1200
		2	Learjet	4.0	8.0			1%	2%	97%					Learjet	TFE 731-2-2B	2	531.76
		1	Other Helo	4.0	4.0	100%	4.0	5%	8%	77%	0.20	0.32	3.08		Other Helo (S-	T58-GE-402 (assume 49	2	529
	Totals	16354																

Source: SCORE FY2004 Participants Conversion.xls

Scenario	Aircraft Type	Emission Indices, lbs/1,000 lbs fuel CO	NOx	HC	SOx	PM10	Emission Factors (lb/hr) CO	NOx	HC	SOx	PM10	Emissions 0-3 nm Offshore (lbs) CO	NOx	HC	SOx	PM	Emissions 3-12 nm Offshore—US Territory (lbs) CO	NOx	HC	SOx	PM	Emissions >12 nm Offshore—Outside US Territory CO	NOx	HC	SOx	PM				SOx	PM
	CH-46	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99	332.41	66.35	57.76	6.74	29.97	199.44	39.81	34.66	4.04	17.98	132.96	26.54	23.10	2.69	11.99					
	CH-53	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87	525.72	1994.26	37.02	98.73	545.46	315.43	1196.56	22.21	59.24	327.28	210.29	797.70	14.81	39.49	218.18					
27	SH-60B	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04						28.35	29.03	2.49	1.81	19.05	916.65	938.65	80.67	58.67	615.99					
	SH-60F	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04						17.48	17.90	1.54	1.12	11.75	565.27	578.83	49.74	36.18	379.86					
	HH-60	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04						1.42	1.45	0.12	0.09	0.95	45.83	46.93	4.03	2.93	30.80					
	P-3	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06																				
	FA-18A/C	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20																				
	FA-18E/F	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10																				
	E-2C	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73																				
	EA-6B	5.19	6.77	0.84	0.40	10.48	43.88	57.23	7.10	3.38	88.60																				
	Learjet	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47																				
	Unknown	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47																				
28A	MH-60R	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	196.88	201.60	17.33	12.60	132.30															
30	P-3	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06	13.10	60.70	2.95	2.88	28.59	10.48	48.56	2.36	2.30	22.87	2.62	12.14	0.59	0.58	5.72					
	FA-18A/C	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20	2.97	8.20	0.54	0.49	7.74	2.38	6.56	0.43	0.39	6.19	0.59	1.64	0.11	0.10	1.55					
	FA-18E/F	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10	1.20	15.64	0.16	0.54	8.52	0.96	12.51	0.13	0.43	6.82	0.24	3.13	0.03	0.11	1.70					
34	SH-60F	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	450.00	460.80	39.60	28.80	302.40															
37	C-130	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50						3.43	5.70	0.82	0.34	3.37	65.08	108.37	15.67	6.46	64.12					
39	SH-60B	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	36.00	36.86	3.17	2.30	24.19	54.00	55.30	4.75	3.46	36.29	90.00	92.16	7.92	5.76	60.48					
	SH-60F	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	12.00	12.29	1.06	0.77	8.06	18.00	18.43	1.58	1.15	12.10	30.00	30.72	2.64	1.92	20.16					
	CH-46	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99	212.24	42.36	36.88	4.30	19.14	318.37	63.54	55.32	6.45	28.71	530.61	105.91	92.20	10.75	47.85					
41	SH-60F	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	15.00	15.36	1.32	0.96	10.08	15.00	15.36	1.32	0.96	10.08	7.50	7.68	0.66	0.48	5.04					
	FA-18A/C	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20	62.99	173.99	11.36	10.33	164.18	188.96	521.96	34.07	30.98	492.53	377.92	1043.92	68.15	61.95	985.06					
	FA-19E/F	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10	27.96	363.85	3.77	12.57	198.26	83.89	1091.54	11.31	37.70	594.79	167.78	2183.08	22.62	75.41	1189.57					
	E-2	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73																				
	EA-6B	5.19	6.77	0.84	0.40	10.48	43.88	57.23	7.10	3.38	88.60																				
	AH-1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57	53.77	28.31	2.86	2.04	21.43	53.77	28.31	2.86	2.04	21.43	26.88	14.16	1.43	1.02	10.71					
	AV-8B	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25	2.95	3.29	0.21	0.15	1.45	4.91	5.49	0.34	0.26	2.42	1.97	2.20	0.14	0.10	0.97					
	KC-130	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50																				
	H-53	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87																				
	H-46	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99																				
42	MH-60S	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	441.00	451.58	38.81	28.22	296.35	441.00	451.58	38.81	28.22	296.35	220.50	225.79	19.40	14.11	148.18					
	FA-18A/C	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20	32.30	89.23	5.83	5.30	84.20	96.91	267.69	17.48	15.89	252.60	193.82	535.38	34.95	31.77	505.19					
	FA-18E/F	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10	14.38	187.08	1.94	6.46	101.94	43.14	561.24	5.82	19.39	305.82	86.27	1122.48	11.63	38.77	611.65					
	E-2	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73																				
44	HH-60	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	840.00	860.16	73.92	53.76	564.48	504.00	516.10	44.35	32.26	338.69	336.00	344.06	29.57	21.50	225.79					
46	SH-60B	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04						15.66	16.04	1.38	1.00	10.52	51.84	53.08	4.56	3.32	34.84					
	MH-60R	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04						78.30	80.18	6.89	5.01	52.62	259.20	265.42	22.81	16.59	174.18					
	SH-3	21.28	3.88	2.20	0.40	4.00	22.51	4.11	2.33	0.42	4.23						31.34	5.71	3.24	0.59	5.89	103.75	18.92	10.73	1.95	19.50					
48	P-3	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06	43.68	202.32	9.84	9.60	95.28	26.21	121.39	5.90	5.76	57.17	17.47	80.93	3.94	3.84	38.11					
	NC-12B Kinga	4.93	4.42	0.23	0.40	4.20	2.46	2.20	0.11	0.20	2.09	423.51	379.70	19.76	34.36	360.80	254.11	227.82	11.85	20.62	216.48	169.40	151.88	7.90	13.74	144.32					
51	SH-60B	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	1.50	1.54	0.13	0.10	1.01	3.00	3.07	0.26	0.19	2.02	25.50	26.11	2.24	1.63	17.14					
	P-3	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06	3.49	16.19	0.79	0.77	7.62	6.99	32.37	1.57	1.54	15.24	59.40	275.16	13.38	13.06	129.58					
	FA-18A/C	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20																				
	FA-18E/F	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10																				
	Learjet	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47																				
	Gulfstream	4.78	7.68	0.05	1.00	0.00	16.23	26.08	0.17	3.40	0.00																				
	Other Helo (S-	21.28	3.88	2.20	0.40	4.00	22.51	4.11	2.33	0.42	4.23	4.50	0.82	0.47	0.08	0.85	9.01	1.64	0.93	0.17	1.69	76.55	13.96	7.91	1.44	14.39					
53	SH-60F	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	6.00	6.14	0.53	0.38	4.03	9.60	9.83	0.84	0.61	6.45	92.40	94.62	8.13	5.91	62.09					
	P-3	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06	1.75	8.09	0.39	0.38	3.81	2.80	12.95	0.63	0.61	6.10	26.91	124.63	6.06	5.91	58.69					
	Learjet	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47																				
	Other Helo (S-	21.28	3.88	2.20	0.40	4.00	22.51	4.11	2.33	0.42	4.23	4.50	0.82	0.47	0.08	0.85	7.20	1.31	0.74	0.14	1.35	69.34	12.64	7.17	1.30	13.03					
							Total Emissions (SCI) tons					**1.13**	**1.76**	**0.12**	**0.10**	**1.14**	**3.91**	**5.52**	**0.39**	**0.30**	**3.54**	**16.45**	**40.16**	**1.85**	**1.81**	**23.16**	**2.41**	**1.94**	**0.45**	**0.10**	**1.15**
							Total Emissions (SD) tons					**2.60**	**3.59**	**0.30**	**0.19**	**1.30**	**1.15**	**1.63**	**0.12**	**0.09**	**0.62**										

Table C-5. Aircraft Air Emissions—Alternative 1

Scenario	Type Training	A/C Sorties (No.)	Nomenclature	Ave. A/C Time on Range (hrs) (Hours)	Total Time on Range (hrs) (Hours)	% Below 3,000 ft (%)	Time Below 3,000 ft (Hours)	Percentage 0-3 nm from shore	Percentage 3-12 nm from Shore	Percentage >12 nm from Shore	Total Time 0-3 nm from shore (Hours)	Total Time 3-12 nm from shore (Hours)	Total Time >12 nm from shore (Hours)
Training Operations													
1	Air Combat Maneuvers	11223	FA-18E/F	1.1	1123.1			1%	2%	97%			
		687	AV-8B	1.2	824.4			1%	2%	97%			
2	Air Defense Exercise	111	E-2	1.0	111.0	50%	55.5	1%	2%	97%	0.56	1.11	53.84
		665	FA-18E/F	1.0	665.0	50%	332.5	1%	2%	97%	3.33	6.65	322.53
			S-3B	1.0		50%		1%	2%	97%			
		333	FA-18E/F	1.0	333.0	50%	166.5	1%	2%	97%	1.67	3.33	161.51
		111	Learjet	1.0	111.0	50%	55.5	1%	2%	97%	0.56	1.11	53.84
3	S-A MISSILEX	4	SH-60B	1.0	4.0	100%	4.0	1%	2%	97%	0.04	0.08	3.88
		4	P-3	3.0	12.0	67%	8.0	1%	2%	97%	0.08	0.16	7.76
		4	Learjet	1.5	6.0	67%	4.0	1%	2%	97%	0.04	0.08	3.88
		4	C-130	1.5	6.0	67%	4.0	1%	2%	97%	0.04	0.08	3.88
4	S-A GUNEX	350	Learjet	1.5	525.0	50%	262.5	1%	2%	97%	2.63	5.25	254.63
5	A-A MISSILEX	52	FA-18A/C	2.0	104.0					100%			
		78	FA-18E/F	2.0	156.0					100%			
		13	E-2C	4.0	52.0					100%			
		13	DC-130	4.0	52.0			1%	2%	97%			
6	Helicopter ASW TRACKEX	1690	MH-60R	3.6	6084.0	100%	6084.0		24%	76%		#####	#####
7	Helicopter ASW TORPEX	245	MH-60R	3.6	882.0	100%	882.0		24%	76%		208.15	673.85
		21	Other Helo (SH-3)	3.6	75.6	100%	75.6		24%	76%		17.84	57.76
8	MPA ASW TRACKEX	28	P-3	6.0	168.0	75%	126.0	5%	10%	85%	6.30	12.60	107.10
9	MPA ASW TORPEX	37	P-3	2.0	74.0	100%	74.0	1%	2%	97%	0.74	1.48	71.78
		10	SH-60B	2.0	20.0	100%	20.0	1%	2%	97%	0.20	0.40	19.40
10	EER/IEER ASW	3	P-3	6.0	18.0	75%	13.5			100%			13.50
11	Surface Ship ASW TRACKEX												
12	Surface Ship ASW TORPEX	8	Other Helo (SH-3)	3.7	29.6	100%	29.6	1%	2%	97%	0.30	0.59	28.71
13	Submarine ASW TORPEX												
14	Submarine ASW TORPEX												
15	VBSS	18	MH-60R	4.0	72.0	100%	72.0			100%			72.00
16	A-S MISSILEX	41	MH-60R	3.0	123.0	100%	123.0	1%	2%	97%	1.23	2.46	119.31
		15	FA-18A/C	2.0	30.0			1%	2%	97%			
		15	FA-18E/F	2.0	30.0			1%	2%	97%			
			S-3B	3.0		100%		1%	2%	97%			
17	A-S BOMBEX	19	FA-18A/C	1.0	19.0	10%	1.9		50%	50%		0.95	0.95
		19	FA-18E/F	1.0	19.0	10%	1.9		50%	50%		0.95	0.95
		10	P-3	1.0	10.0	10%	1.0		50%	50%		0.50	0.50
			S-3B	1.0		10%			50%	50%			
18	A-S GUNEX	110	MH-60R	1.0	110.0	100%	110.0		50%	50%		55.00	55.00
19	S-S GUNEX												
20	SINKEX	4	E-2	16.0	64.0	10%	6.4			100%			6.40
		16	FA-18E/F	16.0	256.0	10%	25.6			100%			25.60
		2	P-3	16.0	32.0	10%	3.2			100%			3.20
		4	SH-60B	16.0	64.0	10%	6.4			100%			6.40
21	Naval Surface Fire Support Exercise												
22	Expeditionary Fires Exercise	1	FA-18E/F	3.0	3.0	100%	3.0		100%			3.00	
		1	AH-1	3.0	3.0	100%	3.0		100%			3.00	
		1	AV-8B	3.0	3.0	100%	3.0		100%			3.00	
23	USMC Battalion Landing	16	FA-18A/C	0.5	8.0	15%	1.2	20%	50%	30%	0.24	0.60	0.36
			FA-18E/F	0.5		15%		20%	50%	30%			
		6	AV-8B	0.5	3.0	25%	0.8	90%	5%	5%	0.68	0.04	0.04
		4	AH-1	1.0	4.0	100%	4.0	90%	5%	5%	3.60	0.20	0.20
		2	C-130	1.4	2.8			20%	50%	30%			
		4	H-53	1.5	6.0	100%	6.0	90%	5%	5%	5.40	0.30	0.30
		12	H-46	1.5	18.0	100%	18.0	90%	5%	5%	16.20	0.90	0.90
		3	UH-1	1.0	3.0	100%	3.0	90%	5%	5%	2.70	0.15	0.15
24	USMC Stinger Firings												
25	Amphibious Landings and Raids												
25A	Amphibious Ops		AH-1	4.0		100%		100%					
			CH-46	4.0		100%		100%					
			CH-53	4.0		100%		100%					
		32	UH-1	4.0	128.0	100%	128.0	100%			128.00		
25B	Helicopter Assault	32	AH-1	2.0	64.0	60%	38.4	100%			38.40		
		48	CH-46	2.0	96.0	60%	57.6	100%			57.60		
		24	CH-53	2.0	48.0	60%	28.8	100%			28.80		
		32	AV-8B	2.0	64.0	60%	38.4	100%			38.40		
		8	UH-1	2.0	16.0	60%	9.6	100%			9.60		
25C	Armored Ops	6	AH-1	8.0	48.0	50%	24.0	100%			24.00		
		6	AV-8B	8.0	48.0	50%	24.0	100%			24.00		
25D	Artillery Ops	24	AH-1	3.0	72.0	100%	72.0	100%			72.00		
		9	CH-46	3.0	27.0	100%	27.0	100%			27.00		
		9	CH-53	3.0	27.0	100%	27.0	100%			27.00		
25E	Amphibious Assault	16	AH-1	3.0	48.0	100%	48.0	100%			48.00		
			CH-46	3.0		100%		100%					
			CH-53	3.0		100%		100%					
		8	UH-1	3.0	24.0	100%	24.0	100%			24.00		
25F	Combat Engineer		None										
25G	AAV Ops	12	AH-1	4.0	48.0	100%	48.0	100%			48.00		
25H	EFV Ops	2	AH-1	4.0	8.0	100%	8.0	100%			8.00		
25I	Assault Amphibian School		None										
26	Amphibious Operations - CPAAA												
26A	Amphibious Operations		None										
26B	Amphibious Operations	28	CH-46	4.2	117.9	100%	117.9	79%	21%		92.65	25.11	
		28	CH-53	4.2	117.9	100%	117.9	79%	21%		92.65	25.11	
26C	Amphibious Operations		None										
26D	Amphibious Operations		None										
26E	Amphibious Operations	75	AV-8B	0.5	37.5	97%	36.4	50%	30%	20%	18.19	10.91	7.28
		89	AH-1	0.5	44.5	97%	43.2	50%	30%	20%	21.58	12.95	8.63
		65	UH-1	0.5	32.5	97%	31.5	50%	30%	20%	15.76	9.46	6.31

Training scenario	Scenario	Aircraft Type	Engines Engine Model	No.	Fuel Flow lbs/hr	Emission Indices, lbs/1,000 lbs fuel CO	NOx	HC	SOx	PM10	Emissions Factors (lb/hr) CO	NOx	HC	SOx	PM10
1		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
2		E-2	T56-A-425 (assume 30%	2	1100	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		S-3B	TF34-GE-400 (assume t	2	1145	14.10	4.07	1.86	0.40	3.62	32.29	9.32	4.26	0.92	8.29
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		Learjet	TFE 731-2-2B	2	531.76	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
3		SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
		P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
		Learjet	TFE 731-2B	2	531.76	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
		C-130	T56-A-425 (assume app	4	850	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50
4		Learjet	TFE 731-2B	2	531.76	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
5		FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		E-2C	T56-A-425 (assume 40%	2	1100	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73
		DC-130	T56-A-425 (assume app	4	850	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50
6		MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
7	7	MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
		Other Helo (SH	T58-GE-402 (assume 4	2	529	21.28	3.88	2.20	0.40	4.00	22.51	4.11	2.33	0.42	4.23
8		P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
9		P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
		SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
10		P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
12		Other Helo (SH	T58-GE-402 (assume 4	2	529	21.28	3.88	2.20	0.40	4.00	22.51	4.11	2.33	0.42	4.23
15		MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
16		MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
		FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		S-3B	TF34-GE-400 (assume t	2	1145	14.10	4.07	1.86	0.40	3.62	32.29	9.32	4.26	0.92	8.29
17		FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
		S-3B	TF34-GE-400 (assume t	2	1145	14.10	4.07	1.86	0.40	3.62	32.29	9.32	4.26	0.92	8.29
18		MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
20		E-2	T56-A-425 (assume 30%	2	1100	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
		SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
22		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
23		FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		C-130	T56-A-425 (assume app	4	850	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50
		H-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
		H-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91
25A		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91
25B		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91
25C		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
25D		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
25E		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91
25G		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
25H		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
26B		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
26E		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91

Emissions

Training scenario	Aircraft	Emissions 0-3 nm Offshore (lbs) CO	NOx	HC	SOx	PM	Emissions 3-12 nm Offshore—US Territory (lbs) CO	NOx	HC	SOx	PM	Emissions >12 nm Offshore—Outside US Territory: Offshore San Diego CO	NOx	HC	SOx	PM	Offshore Mexico CO	NOx	HC	SOx	PM
2	E-2	2.64	9.84	0.60	0.49	4.85	5.27	19.68	1.20	0.98	9.69	255.82	954.60	58.03	47.37	470.19					
	FA-18E/F	23.96	311.80	3.23	10.77	169.90	47.93	623.60	6.46	21.54	339.80	2324.51	30244.73	313.42	1044.72	16480.51					
	FA-18E/F	12.00	156.14	1.62	5.39	85.08	24.00	312.27	3.24	10.79	170.16	1164.00	15145.11	156.94	523.15	8252.64					
	Learjet	13.21	3.48	2.53	0.32	2.48	26.42	6.96	5.05	0.64	4.96	1281.36	337.80	245.05	30.92	240.47					
3	SH-60B	0.30	0.31	0.03	0.02	0.20	0.60	0.61	0.05	0.04	0.40	29.10	29.80	2.56	1.86	19.56					
	P-3	0.70	3.24	0.16	0.15	1.53	1.40	6.48	0.32	0.31	3.05	67.83	314.16	15.28	14.91	147.95					
	Learjet	0.95	0.25	0.18	0.02	0.18	1.91	0.50	0.36	0.05	0.36	92.40	24.36	17.67	2.23	17.34					
	C-130	0.55	0.91	0.13	0.05	0.54	1.10	1.83	0.26	0.11	1.08	53.19	88.56	12.80	5.28	52.40					
4	Learjet	62.48	16.47	11.95	1.51	11.73	124.96	32.94	23.90	3.02	23.45						6060.48	1597.71	1159.02	146.23	1137.35
6	MH-60R						10768.68	11027.13	947.64	689.20	7236.55	34861.32	35697.99	3067.80	2231.12	23426.81					
7	MH-60R						1561.14	1598.61	137.38	99.91	1049.09	5053.86	5175.15	444.74	323.45	3396.19					
	Other Helo (SH-3)						401.69	73.24	41.53	7.55	75.51	1300.39	237.10	134.44	24.44	244.43					
8	P-3	55.04	254.92	12.40	12.10	120.05	110.07	509.85	24.80	24.19	240.11	935.63	4333.69	210.77	205.63	2040.90					
9	P-3	6.46	29.94	1.46	1.42	14.10	12.93	59.89	2.91	2.84	28.20	627.07	2904.51	141.26	137.82	1367.84					
	SH-60B	1.50	1.54	0.13	0.10	1.01	3.00	3.07	0.26	0.19	2.02	145.50	148.99	12.80	9.31	97.78					
10	P-3											117.94	546.26	26.57	25.92	257.26					
12	Other Helo (SH-3)	6.66	1.22	0.69	0.13	1.25	13.33	2.43	1.38	0.25	2.51	646.43	117.86	66.83	12.15	121.51					
15	MH-60R											540.00	552.96	47.52	34.56	362.88					
16	MH-60R	9.23	9.45	0.81	0.59	6.20	18.45	18.89	1.62	1.18	12.40	894.83	916.30	78.74	57.27	601.32					
17	FA-18A/C						15.38	42.49	2.77	2.52	40.09	15.38	42.49	2.77	2.52	40.09					
	FA-18E/F						6.85	89.09	0.92	3.08	48.54	6.85	89.09	0.92	3.08	48.54					
	P-3						4.37	20.23	0.98	0.96	9.53	4.37	20.23	0.98	0.96	9.53					
18	MH-60R						412.50	422.40	36.30	26.40	277.20	412.50	422.40	36.30	26.40	277.20					
20	E-2																30.41	113.48	6.90	5.63	55.90
	FA-18E/F																184.50	2400.64	24.88	82.92	1308.12
	P-3																27.96	129.48	6.30	6.14	60.98
	SH-60B																48.00	49.15	4.22	3.07	32.26
22	FA-18E/F						21.62	281.32	2.92	9.72	153.30										
	AH-1						26.88	14.16	1.43	1.02	10.71										
	AV-8B						147.40	164.63	10.34	7.66	72.74										
23	FA-18A/C	3.89	10.73	0.70	0.64	10.13	9.72	26.84	1.75	1.59	25.32	5.83	16.10	1.05	0.96	15.19					
	AV-8B	33.17	37.04	2.33	1.72	16.37	1.84	2.06	0.13	0.10	0.91	1.84	2.06	0.13	0.10	0.91					
	AH-1	32.26	16.99	1.71	1.22	12.86	1.79	0.94	0.10	0.07	0.71	1.79	0.94	0.10	0.07	0.71					
	H-53	51.34	194.77	3.62	9.64	53.27	2.85	10.82	0.20	0.54	2.96	2.85	10.82	0.20	0.54	2.96					
	H-46	358.16	71.49	62.23	7.26	32.30	19.90	3.97	3.46	0.40	1.79	19.90	3.97	3.46	0.40	1.79					
	UH-1	1.89	10.82	0.24	0.75	7.85	0.10	0.60	0.01	0.04	0.44	0.10	0.60	0.01	0.04	0.44					
25A	UH-1	89.51	513.15	11.52	35.45	372.23															
25B	AH-1	344.11	181.19	18.28	13.06	137.12															
	CH-46	1273.47	254.18	221.28	25.80	114.83															
	CH-53	273.84	1038.79	19.28	51.43	284.12															
	AV-8B	1886.73	2107.26	132.32	98.01	931.12															
	UH-1	6.71	38.49	0.86	2.66	27.92															
25C	AH-1	215.07	113.25	11.43	8.16	85.70															
	AV-8B	1179.21	1317.04	82.70	61.26	581.95															
25D	AH-1	645.20	339.74	34.28	24.49	257.10															
	CH-46	596.94	119.15	103.72	12.10	53.83															
	CH-53	256.72	973.87	18.08	48.21	266.37															
25E	AH-1	430.13	226.49	22.85	16.32	171.40															
	UH-1	16.78	96.22	2.16	6.65	69.79															
25G	AH-1	430.13	226.49	22.85	16.32	171.40															
25H	AH-1	71.69	37.75	3.81	2.72	28.57															
26B	CH-46	2048.46	408.86	355.94	41.51	184.71	555.12	110.80	96.46	11.25	50.06										
	CH-53	880.98	3341.94	62.04	165.44	914.07	238.74	905.64	16.81	44.83	247.71										
26E	AV-8B	893.62	998.07	62.67	46.42	441.01	536.17	598.84	37.60	27.85	264.60	357.45	399.23	25.07	18.57	176.40					
	AH-1	193.40	101.84	10.28	7.34	77.07	116.04	61.10	6.17	4.40	46.24	77.36	40.74	4.11	2.94	30.83					
	UH-1	11.02	63.19	1.42	4.37	45.84	6.61	37.92	0.85	2.62	27.50	4.41	25.28	0.57	1.75	18.34					

Scenario	Type Training	A/C Sorties No.	Nomenclature	Ave. A/C Time on Range (hrs) Hours	Total Time on Range (hrs) Hours	% Below 3,000 ft %	Time Below 3,000 ft Hours	Percentage 0-3 nm from shore	Percentage 3-12 nm from Shore	Percentage >12 nm from Shore	Total Time 0-3 nm from shore (Hours)	Total Time 3-12 nm from shore (Hours)	Total Time >12 nm from shore (Hours)
		69	CH-46	0.5	34.5	97%	33.5	50%	30%	20%	16.73	10.04	6.69
		253	CH-53	0.5	126.5	97%	122.7	50%	30%	20%	61.35	36.81	24.54
26F	Amphibious Operations		None										
26G	Amphibious Operations		None										
27	Electronic Combat Exercise	98	MH-60R	2.1	205.8	100%	205.8		3%	97%		6.17	199.63
		3	HH-60	2.1	6.3	100%	6.3		3%	97%		0.19	6.11
		31	P-3	2.0	62.0				3%	97%			
		204	FA-18A/C	2.0	408.0				3%	97%			
		205	FA-18E/F	2.0	410.0				3%	97%			
		15	E-2C	2.0	30.0				3%	97%			
		17	EA-6B	2.0	34.0				3%	97%			
		145	Learjet	2.0	290.0				3%	97%			
		8	Unknown	2.0	16.0				3%	97%			
28A	Small Object Avoidance	16	MH-60R	1.8	28.0	100%	28.0	100%			28.00		
29	Mine Neutralization	720	MH-60R	2.5	1800.0	100%	1800.0	55%	40%	5%	990.00	720.00	90.00
30	Mine Laying	5	P-3	0.9	4.5	67%	3.0	50%	40%	10%	1.50	1.20	0.30
		11	FA-18A/C	0.5	5.5	7%	0.4	50%	40%	10%	0.18	0.15	0.04
		10	FA-18E/F	0.5	5.0	7%	0.3	50%	40%	10%	0.17	0.13	0.03
31	NSW Center Land Demolitions												
32	NSWC Underwater Demolitions		NONE										
33	NSWC Underwater Mat Weave		NONE										
34	NSWC BUD/S Small Arms Training	12	SH-60F	6.0	72.0	100%	72.0	100%			72.00		
35	NSWC BUD/S Land Navigation		NONE										
36	NSW UAV Operations	3	Neptune/Scan	1.0	3.0	100%	3.0	100%			3.00		
37	Insertion/Extraction	10	C-130	2.0	20.0	50%	10.0		5%	95%		0.50	9.50
38	NSW Boat Operations												
39	NSW GRU ONE SEAL Platoon Ops	5	SH-60B	8.0	40.0	100%	40.0	20%	30%	50%	8.00	12.00	20.00
		2	SH-60F	8.0	16.0	100%	16.0	20%	30%	50%	3.20	4.80	8.00
		9	CH-46	8.0	72.0	100%	72.0	20%	30%	50%	14.40	21.60	36.00
40	Direct Action												
41	Bombing Exercise - Land	2	SH-60F	2.5	5.0	100%	5.0	40%	40%	20%	2.00	2.00	1.00
		435	FA-18A/C	1.0	435.0	10%	43.5	10%	30%	60%	4.35	13.05	26.10
		434	FA-19E/F	1.0	434.0	10%	43.4	10%	30%	60%	4.34	13.02	26.04
		13	E-2	2.5	32.5					100%			
		8	EA-6B	2.5	20.0					100%			
		7	AH-1	2.5	17.5	100%	17.5	40%	40%	20%	7.00	7.00	3.50
		1	AV-8B	1.0	1.0	20%	0.2	30%	50%	20%	0.06	0.10	0.04
		3	KC-130	1.0	3.0			10%	30%	60%			
			H-53	2.5		100%		40%	40%	20%			
			H-46	2.5		100%		40%	40%	20%			
42	Combat Search and Rescue	56	MH-60S	3.0	168.0	100%	168.0	40%	40%	20%	67.20	67.20	33.60
		152	FA-18A/C	1.5	228.0	10%	22.8	10%	30%	60%	2.28	6.84	13.68
		152	FA-18E/F	1.5	228.0	10%	22.8	10%	30%	60%	2.28	6.84	13.68
		16	E-2	3.0	48.0					100%			
43	EOD Outside SHOBA												
44	USCG Ops	70	HH-60	3.2	224.0	100%	224.0	50%	30%	20%	112.00	67.20	44.80
45	NALF Airfield		See NALF Ops										
46	Ship Torpedo Tests	12	MH-60R	3.0	36.0	100%	36.0		23%	77%		8.35	27.65
47	Unmanned Underwater Vehicle Test		NONE										
48	Sonobuoy QA/QC Test	2	P-3	5.0	10.0	100%	10.0	50%	30%	20%	5.00	3.00	2.00
		115	NC-12B Kingair	3.0	345.0	100%	345.0	50%	30%	20%	172.50	103.50	69.00
49	Ocean Engineering		NONE	NONE									
50	Marine Mammal Mine Shape Location		NONE	NONE									
51	Missile Flight Test	3	MH-60R	4.0	12.0	100%	12.0	5%	10%	85%	0.60	1.20	10.20
		12	P-3	4.0	48.0	50%	24.0	5%	10%	85%	1.20	2.40	20.40
		18	FA-18A/C	4.0	72.0				5%	95%			
		9	FA-18E/F	4.0	36.0				5%	95%			
		6	Learjet	4.0	24.0				5%	95%			
		3	Gulfstream	4.0	12.0				5%	95%			
		3	MH-60R	4.0	12.0	100%	12.0	5%	10%	85%	0.60	1.20	10.20
52	NUWC Underwater Acoustics Testing		NONE										
53	Other Tests	2	SH-60F	4.0	8.0	100%	8.0	5%	8%	77%	0.40	0.64	6.16
		1	P-3	4.0	4.0	50%	2.0	5%	8%	77%	0.10	0.16	1.54
		1	Learjet	4.0	4.0			1%	2%	97%			
			Other Helo	4.0		100%		5%	8%	77%			
	Totals	19957											

Scenario No.	Aircraft Type	Engines: Engine Model	No.	Fuel Flow lbs/hr	Emission Indices, lbs/1,000 lbs fuel: CO	NOx	HC	SOx	PM10	Emissions Factors (lb/hr): CO	NOx	HC	SOx	PM10
	CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
	CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
	MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	HH-60	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
	FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
	FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
	E-2C	T56-A-425 (assume 40%	2	1100	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73
	EA-6B	J52-P-408A (assume ap	2	4227	5.19	6.77	0.84	0.40	10.48	43.88	57.23	7.10	3.38	88.60
	Learjet	TFE 731-2-2B	2	531.76	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
	Unknown	TFE 731-2-2B	2	531.76	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
	MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
	FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
	FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
	SH-60F	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	C-130	T56-A-425 (assume app	4	850	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50
	SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	SH-60F	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
	SH-60F	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
	FA-19E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
	E-2	T56-A-425 (assume 40%	2	1100	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73
	EA-6B	J52-P-408A (assume ap	2	4227	5.19	6.77	0.84	0.40	10.48	43.88	57.23	7.10	3.38	88.60
	AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
	AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
	KC-130	T56-A-425 (assume app	4	850	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50
	H-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
	H-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
	MH-60S	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
	FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
	E-2	T56-A-425 (assume 40%	2	1100	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73
	HH-60	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
	NC-12B Kinga	PT6A-42 (assume appro	2	249	4.93	4.42	0.23	0.40	4.20	2.46	2.20	0.11	0.20	2.09
	MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
	FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
	FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
	Learjet	TFE 731-2-2B	2	531.76	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
	Gulfstream	BR700-710A1-10	2	1698	4.78	7.68	0.05	1.00	0.00	16.23	26.08	0.17	3.40	0.00
	MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	SH-60F	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
	Learjet	TFE 731-2-2B	2	531.76	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
	Other Helo (S-	T58-GE-402 (assume 49	2	529	21.28	3.88	2.20	0.40	4.00	22.51	4.11	2.33	0.42	4.23

Emissions

Aircraft Type	Emissions 0-3 nm Offshore (lbs): CO	NOx	HC	SOx	PM	Emissions 3-12 nm Offshore—US Territory (lbs): CO	NOx	HC	SOx	PM	Emissions >12 nm Offshore—Outside US Territory: CO	NOx	HC	SOx	PM	CO	NOx	HC	SOx	PM
CH-46	369.94	73.84	64.28	7.50	33.36	221.96	44.30	38.57	4.50	20.01	147.97	29.53	25.71	3.00	13.34					
CH-53	583.36	2212.93	41.08	109.55	605.27	350.02	1327.76	24.65	65.73	363.16	233.34	885.17	16.43	43.82	242.11					
MH-60R						46.31	47.42	4.07	2.96	31.12	1497.20	1533.13	131.75	95.82	1006.12					
HH-60						1.42	1.45	0.12	0.09	0.95	45.83	46.93	4.03	2.93	30.80					
MH-60R	210.00	215.04	18.48	13.44	141.12															
MH-60R	7425.00	7603.20	653.40	475.20	4989.60	5400.00	5529.60	475.20	345.60	3628.80	675.00	691.20	59.40	43.20	453.60					
P-3	13.10	60.70	2.95	2.88	28.59	10.48	48.56	2.36	2.30	22.87	2.62	12.14	0.59	0.58	5.72					
FA-18A/C	2.97	8.20	0.54	0.49	7.74	2.38	6.56	0.43	0.39	6.19	0.59	1.64	0.11	0.10	1.55					
FA-18E/F	1.20	15.64	0.16	0.54	8.52	0.96	12.51	0.13	0.43	6.82	0.24	3.13	0.03	0.11	1.70					
SH-60F	540.00	552.96	47.52	34.56	362.88															
C-130						6.85	11.41	1.65	0.68	6.75	130.17	216.73	31.33	12.92	128.23					
SH-60B	60.00	61.44	5.28	3.84	40.32	90.00	92.16	7.92	5.76	60.48	150.00	153.60	13.20	9.60	100.80					
SH-60F	24.00	24.58	2.11	1.54	16.13	36.00	36.86	3.17	2.30	24.19	60.00	61.44	5.28	3.84	40.32					
CH-46	318.37	63.54	55.32	6.45	28.71	477.55	95.32	82.98	9.68	43.06	795.92	158.86	138.30	16.13	71.77					
SH-60F	15.00	15.36	1.32	0.96	10.08	15.00	15.36	1.32	0.96	10.08	7.50	7.68	0.66	0.48	5.04					
FA-18A/C	70.43	194.56	12.70	11.55	183.59	211.30	583.68	38.10	34.64	550.77	422.61	1167.37	76.21	69.28	1101.55					
FA-19E/F	31.28	406.98	4.22	14.06	221.77	93.84	1220.95	12.65	42.17	665.30	187.68	2441.90	25.30	84.35	1330.60					
AH-1	62.73	33.03	3.33	2.38	25.00	62.73	33.03	3.33	2.38	25.00	31.36	16.52	1.67	1.19	12.50					
AV-8B	2.95	3.29	0.21	0.15	1.45	4.91	5.49	0.34	0.26	2.42	1.97	2.20	0.14	0.10	0.97					
MH-60S	504.00	516.10	44.35	32.26	338.69	504.00	516.10	44.35	32.26	338.69	252.00	258.05	22.18	16.13	169.34					
FA-18A/C	36.92	101.98	6.66	6.05	96.23	110.75	305.93	19.97	18.16	288.68	221.50	611.86	39.94	36.31	577.36					
FA-18E/F	16.43	213.81	2.22	7.39	116.50	49.30	641.42	6.65	22.16	349.51	98.59	1282.84	13.29	44.31	699.03					
HH-60	840.00	860.16	73.92	53.76	564.48	504.00	516.10	44.35	32.26	338.69	336.00	344.06	29.57	21.50	225.79					
MH-60R						62.64	64.14	5.51	4.01	42.09	207.36	212.34	18.25	13.27	139.35					
P-3	43.68	202.32	9.84	9.60	95.28	26.21	121.39	5.90	5.76	57.17	17.47	80.93	3.94	3.84	38.11					
NC-12B Kinga	423.51	379.70	19.76	34.36	360.80	254.11	227.82	11.85	20.62	216.48	169.40	151.88	7.90	13.74	144.32					
MH-60R	4.50	4.61	0.40	0.29	3.02	9.00	9.22	0.79	0.58	6.05	76.50	78.34	6.73	4.90	51.41					
P-3	10.48	48.56	2.36	2.30	22.87	20.97	97.11	4.72	4.61	45.73	178.21	825.47	40.15	39.17	388.74					
MH-60R	4.50	4.61	0.40	0.29	3.02	9.00	9.22	0.79	0.58	6.05	76.50	78.34	6.73	4.90	51.41					
SH-60F	3.00	3.07	0.26	0.19	2.02	4.80	4.92	0.42	0.31	3.23	46.20	47.31	4.07	2.96	31.05					
P-3	0.87	4.05	0.20	0.19	1.91	1.40	6.47	0.31	0.31	3.05	13.45	62.31	3.03	2.96	29.35					
Total Emissions (SCI) tons	9.11	9.73	0.85	0.57	5.61	10.65	12.56	1.00	0.74	8.14	28.69	55.15	2.93	2.69	32.66	3.18	2.15	0.60	0.12	1.30
Total Emissions (SD) tons	2.91	4.03	0.34	0.22	1.43	1.26	1.80	0.13	0.10	0.68										

Source: SCORE FY2004 Participants Conversion.xls

Table C-6. Aircraft Air Emissions—Alternative 2

Scenario	Type Training	A/C Sorties	Nomenclature	Ave. A/C Time on Range (hrs)	Total Time on Range (hrs)	% Below 3,000 ft	Time Below 3,000 ft	Percentage 0-3 nm from shore	Percentage 3-12 nm from Shore	Percentage >12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore
No.				Hours	Hours	%	Hours	Percent			Hours		
Training Operations													
1	Air Combat Maneuvers	11223	FA-18E/F	1.1	1123.1			1%	2%	97%			
		687	AV-8B	1.2	824.4			1%	2%	97%			
2	Air Defense Exercise	117	E-2	1.0	117.0	50%	58.5	1%	2%	97%	0.59	1.17	56.75
		703	FA-18E/F	1.0	703.0	50%	351.5	1%	2%	97%	3.52	7.03	340.96
			S-3B	1.0		50%		1%	2%	97%			
		352	FA-18E/F	1.0	352.0	50%	176.0	1%	2%	97%	1.76	3.52	170.72
		117	Learjet	1.0	117.0	50%	58.5	1%	2%	97%	0.59	1.17	56.75
3	S-A MISSILEX	6	SH-60B	1.0	6.0	100%	6.0	1%	2%	97%	0.06	0.12	5.82
		6	P-3	3.0	18.0	67%	12.0	1%	2%	97%	0.12	0.24	11.65
		6	Learjet	1.5	9.0	67%	6.0	1%	2%	97%	0.06	0.12	5.82
		6	C-130	1.5	9.0	67%	6.0	1%	2%	97%	0.06	0.12	5.82
4	S-A GUNEX	350	Learjet	1.5	525.0	50%	262.5	1%	2%	97%	2.63	5.25	254.63
5	A-A MISSILEX	52	FA-18A/C	2.0	104.0					100%			
		78	FA-18E/F	2.0	156.0					100%			
		13	E-2C	4.0	52.0					100%			
		13	DC-130	4.0	52.0			1%	2%	97%			
6	Helicopter ASW TRACKEX	1690	MH-60R	3.6	6084.0	100%	6084.0		24%	76%		#####	#####
7	Helicopter ASW TORPEX	245	MH-60R	3.6	882.0	100%	882.0		24%	76%		208.15	673.85
		21	Other Helo (SH-3)	3.6	75.6	100%	75.6		24%	76%		17.84	57.76
8	MPA ASW TRACKEX	29	P-3	6.0	174.0	75%	130.5	5%	10%	85%	6.53	13.05	110.93
9	MPA ASW TORPEX	40	P-3	2.0	80.0	100%	80.0	1%	2%	97%	0.80	1.60	77.60
		10	SH-60B	2.0	20.0	100%	20.0	1%	2%	97%	0.20	0.40	19.40
10	EER/IEER ASW	3	P-3	6.0	18.0	75%	13.5			100%			13.50
11	Surface Ship ASW TRACKEX												
12	Surface Ship ASW TORPEX	8	Other Helo (SH-3)	3.7	29.6	100%	29.6	1%	2%	97%	0.30	0.59	28.71
13	Submarine ASW TORPEX												
14	Submarine ASW TORPEX												
15	VBSS	21	MH-60R	4.0	84.0	100%	84.0			100%			84.00
16	A-S MISSILEX	41	MH-60R	3.0	123.0	100%	123.0	1%	2%	97%	1.23	2.46	119.31
		15	FA-18A/C	2.0	30.0			1%	2%	97%			
		15	FA-18E/F	2.0	30.0			1%	2%	97%			
			S-3B	3.0		100%		1%	2%	97%			
17	A-S BOMBEX	21	FA-18A/C	1.0	21.0	10%	2.1		50%	50%		1.05	1.05
		21	FA-18E/F	1.0	21.0	10%	2.1		50%	50%		1.05	1.05
		11	P-3	1.0	11.0	10%	1.1		50%	50%		0.55	0.55
			S-3B	1.0		10%			50%	50%			
18	A-S GUNEX	131	MH-60R	1.0	131.0	100%	131.0		50%	50%		65.50	65.50
19	S-S GUNEX												
20	SINKEX	6	E-2	16.0	96.0	10%	9.6			100%			9.60
		24	FA-18E/F	16.0	384.0	10%	38.4			100%			38.40
		3	P-3	16.0	48.0	10%	4.8			100%			4.80
		6	SH-60B	16.0	96.0	10%	9.6			100%			9.60
21	Naval Surface Fire Support Exercise												
22	Expeditionary Fires Exercise	1	FA-18E/F	3.0	3.0	100%	3.0		100%			3.00	
		1	AH-1	3.0	3.0	100%	3.0		100%			3.00	
		1	AV-8B	3.0	3.0	100%	3.0		100%			3.00	
23	USMC Battalion Landing	32	FA-18A/C	0.5	16.0	15%	2.4	20%	50%	30%	0.48	1.20	0.72
			FA-18E/F	0.5		15%		20%	50%	30%			
		12	AV-8B	0.5	6.0	25%	1.5	90%	5%	5%	1.35	0.08	0.08
		8	AH-1	1.0	8.0	100%	8.0	90%	5%	5%	7.20	0.40	0.40
		4	C-130	1.4	5.6			20%	50%	30%			
		8	H-53	1.5	12.0	100%	12.0	90%	5%	5%	10.80	0.60	0.60
		24	H-46	1.5	36.0	100%	36.0	90%	5%	5%	32.40	1.80	1.80
		6	UH-1	1.0	6.0	100%	6.0	90%	5%	5%	5.40	0.30	0.30
24	USMC Stinger Firings												
25	Amphibious Landings and Raids												
25A	Amphibious Ops		AH-1	4.0		100%		100%					
			CH-46	4.0		100%		100%					
			CH-53	4.0		100%		100%					
		48	UH-1	4.0	192.0	100%	192.0	100%			192.00		
25B	Helicopter Assault	48	AH-1	2.0	96.0	60%	57.6	100%			57.60		
		72	CH-46	2.0	144.0	60%	86.4	100%			86.40		
		36	CH-53	2.0	72.0	60%	43.2	100%			43.20		
		48	AV-8B	2.0	96.0	60%	57.6	100%			57.60		
		12	UH-1	2.0	24.0	60%	14.4	100%			14.40		
25C	Armored Ops	8	AH-1	8.0	64.0	50%	32.0	100%			32.00		
		8	AV-8B	8.0	64.0	50%	32.0	100%			32.00		
25D	Artillery Ops	32	AH-1	3.0	96.0	100%	96.0	100%			96.00		
		12	CH-46	3.0	36.0	100%	36.0	100%			36.00		
		12	CH-53	3.0	36.0	100%	36.0	100%			36.00		
25E	Amphibious Assault	24	AH-1	3.0	72.0	100%	72.0	100%			72.00		
			CH-46	3.0		100%		100%					
			CH-53	3.0		100%		100%					
		12	UH-1	3.0	36.0	100%	36.0	100%			36.00		
25F	Combat Engineer		None										
25G	AAV Ops	16	AH-1	4.0	64.0	100%	64.0	100%			64.00		
25H	EFV Ops	4	AH-1	4.0	16.0	100%	16.0	100%			16.00		
25I	Assault Amphibian School		None										
26	Amphibious Operations - CPAAA												
26A	Amphibious Operations		None										
26B	Amphibious Operations	30	CH-46	4.2	126.3	100%	126.3	79%	21%		99.27	26.90	
		30	CH-53	4.2	126.3	100%	126.3	79%	21%		99.27	26.90	
26C	Amphibious Operations		None										
26D	Amphibious Operations		None										
26E	Amphibious Operations	75	AV-8B	0.5	37.5	97%	36.4	50%	30%	20%	18.19	10.91	7.28
		89	AH-1	0.5	44.5	97%	43.2	50%	30%	20%	21.58	12.95	8.63
		65	UH-1	0.5	32.5	97%	31.5	50%	30%	20%	15.76	9.46	6.31

Scenario	Scenario No.	Aircraft Type	Engines Engine Model	No.	Fuel Flow lbs/hr	Emission Indices, lbs/1,000 lbs fuel CO	NOx	HC	SOx	PM10	Emissions Factors (lb/hr) CO	NOx	HC	SOx	PM10
1		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
2		E-2	T56-A-425 (assume 30%	2	1100	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		S-3B	TF34-GE-400 (assume t	2	1145	14.10	4.07	1.86	0.40	3.62	32.29	9.32	4.26	0.92	8.29
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		Learjet	TFE 731-2-2B	2	531.76	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
3		SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
		P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
		Learjet	TFE 731-2B	2	531.76	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
		C-130	T56-A-425 (assume app	4	850	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50
4		Learjet	TFE 731-2-2B	2	531.76	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
5		FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		E-2C	T56-A-425 (assume 40%	2	1100	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73
		DC-130	T56-A-425 (assume app	4	850	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50
6		MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
7	7	MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
		Other Helo (SH	T58-GE-402 (assume 4§	2	529	21.28	3.88	2.20	0.40	4.00	22.51	4.11	2.33	0.42	4.23
8		P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
9		P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
		SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
10		P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
12		Other Helo (SH	T58-GE-402 (assume 4§	2	529	21.28	3.88	2.20	0.40	4.00	22.51	4.11	2.33	0.42	4.23
15		MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
16		MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
		FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		S-3B	TF34-GE-400 (assume t	2	1145	14.10	4.07	1.86	0.40	3.62	32.29	9.32	4.26	0.92	8.29
17		FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
		S-3B	TF34-GE-400 (assume t	2	1145	14.10	4.07	1.86	0.40	3.62	32.29	9.32	4.26	0.92	8.29
18		MH-60R	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
20		E-2	T56-A-425 (assume 30%	2	1100	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		P-3	T56-A-14 (assume ASU\	4	1200	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06
		SH-60B	T700-GE-401C	2	600	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
22		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
23		FA-18A/C	F404-GE-400 (assume a	2	3318	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
		FA-18E/F	F414-GE-400 (assume a	2	4049	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		C-130	T56-A-425 (assume app	4	850	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50
		H-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
		H-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91
25A		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91
25B		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91
25C		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
25D		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
25E		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91
25G		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
25H		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
26B		CH-46	T58-GE-16	2	560	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99
		CH-53	T64-GE-415 (assume cr	3	1488	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87
26E		AV-8B	F402-RR-406A (assume	1	6381	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25
		AH-1	T700-GE-401 (assume c	2	425.1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57
		UH-1	T400-CP-400	2	346.2	1.01	5.79	0.13	0.40	4.20	0.70	4.01	0.09	0.28	2.91

Emissions

Scenario	Aircraft	Emissions 0-3 nm Offshore (lbs) CO	NOx	HC	SOx	PM	Emissions 3-12 nm Offshore—US Territory (lbs) CO	NOx	HC	SOx	PM	Emissions >12 nm Offshore—Outside US Territory: Offshore San Diego CO	NOx	HC	SOx	PM	Offshore Mexico CO	NOx	HC	SOx	PM
2	E-2	2.78	10.37	0.63	0.51	5.11	5.56	20.75	1.26	1.03	10.22	269.65	1006.20	61.17	49.94	495.61					
	FA-18E/F	25.33	329.62	3.42	11.39	179.61	50.67	659.24	6.83	22.77	359.22	2457.34	31973.00	331.33	1104.42	17422.25					
	FA-18E/F	12.68	165.04	1.71	5.70	89.93	25.37	330.09	3.42	11.40	179.87	1230.42	16009.24	165.90	553.00	8723.52					
	Learjet	13.92	3.67	2.66	0.34	2.61	27.85	7.34	5.33	0.67	5.23	1350.62	356.06	258.30	32.59	253.47					
3	SH-60B	0.45	0.46	0.04	0.03	0.30	0.90	0.92	0.08	0.06	0.60	43.65	44.70	3.84	2.79	29.33					
	P-3	1.05	4.86	0.24	0.23	2.29	2.10	9.72	0.47	0.46	4.58	101.74	471.24	22.92	22.36	221.92					
	Learjet	1.43	0.38	0.27	0.03	0.27	2.86	0.75	0.55	0.07	0.54	138.59	36.54	26.51	3.34	26.01					
	C-130	0.82	1.37	0.20	0.08	0.81	1.65	2.74	0.40	0.16	1.62	79.79	132.84	19.20	7.92	78.60					
4	Learjet	62.48	16.47	11.95	1.51	11.73	124.96	32.94	23.90	3.02	23.45						6060.48	1597.71	1159.02	146.23	1137.35
6	MH-60R						10768.68	11027.13	947.64	689.20	7236.55	34861.32	35697.99	3067.80	2231.12	23426.81					
7	MH-60R						1561.14	1598.61	137.38	99.91	1049.09	5053.86	5175.15	444.74	323.45	3396.19					
	Other Helo (SH-3)						401.69	73.24	41.53	7.55	75.51	1300.39	237.10	134.44	24.44	244.43					
8	P-3	57.00	264.03	12.84	12.53	124.34	114.00	528.06	25.68	25.06	248.68	969.04	4488.47	218.30	212.98	2113.79					
9	P-3	6.99	32.37	1.57	1.54	15.24	13.98	64.74	3.15	3.07	30.49	677.91	3140.01	152.72	148.99	1478.75					
	SH-60B	1.50	1.54	0.13	0.10	1.01	3.00	3.07	0.26	0.19	2.02	145.50	148.99	12.80	9.31	97.78					
10	P-3											117.94	546.26	26.57	25.92	257.26					
12	Other Helo (SH-3)	6.66	1.22	0.69	0.13	1.25	13.33	2.43	1.38	0.25	2.51	646.43	117.86	66.83	12.15	121.51					
15	MH-60R											630.00	645.12	55.44	40.32	423.36					
16	MH-60R	9.23	9.45	0.81	0.59	6.20	18.45	18.89	1.62	1.18	12.40	894.83	916.30	78.74	57.27	601.32					
17	FA-18A/C						17.00	46.96	3.07	2.79	44.32	17.00	46.96	3.07	2.79	44.32					
	FA-18E/F						7.57	98.46	1.02	3.40	53.65	7.57	98.46	1.02	3.40	53.65					
	P-3						4.80	22.26	1.08	1.06	10.48	4.80	22.26	1.08	1.06	10.48					
18	MH-60R						491.25	503.04	43.23	31.44	330.12	491.25	503.04	43.23	31.44	330.12					
20	E-2																45.62	170.23	10.35	8.45	83.85
	FA-18E/F																276.76	3600.95	37.32	124.39	1962.18
	P-3																41.93	194.23	9.45	9.22	91.47
	SH-60B																72.00	73.73	6.34	4.61	48.38
22	FA-18E/F						21.62	281.32	2.92	9.72	153.30										
	AH-1						26.88	14.16	1.43	1.02	10.71										
	AV-8B						147.40	164.63	10.34	7.66	72.74										
23	FA-18A/C	7.77	21.47	1.40	1.27	20.26	19.43	53.67	3.50	3.19	50.65	11.66	32.20	2.10	1.91	30.39					
	AV-8B	66.33	74.08	4.65	3.45	32.73	3.69	4.12	0.26	0.19	1.82	3.69	4.12	0.26	0.19	1.82					
	AH-1	64.52	33.97	3.43	2.45	25.71	3.58	1.89	0.19	0.14	1.43	3.58	1.89	0.19	0.14	1.43					
	H-53	102.69	389.55	7.23	19.28	106.55	5.70	21.64	0.40	1.07	5.92	5.70	21.64	0.40	1.07	5.92					
	H-46	716.33	142.97	124.47	14.52	64.59	39.80	7.94	6.91	0.81	3.59	39.80	7.94	6.91	0.81	3.59					
	UH-1	3.78	21.65	0.49	1.50	15.70	0.21	1.20	0.03	0.08	0.87	0.21	1.20	0.03	0.08	0.87					
25A	UH-1	134.27	769.73	17.28	53.18	558.35															
25B	AH-1	516.16	271.79	27.42	19.59	205.68															
	CH-46	1910.20	381.27	331.91	38.71	172.25															
	CH-53	410.76	1558.19	28.93	77.14	426.19															
	AV-8B	2830.10	3160.89	198.47	147.02	1396.67															
	UH-1	10.07	57.73	1.30	3.99	41.88															
25C	AH-1	286.76	151.00	15.24	10.88	114.27															
	AV-8B	1572.28	1756.05	110.26	81.68	775.93															
25D	AH-1	860.27	452.99	45.71	32.65	342.80															
	CH-46	795.92	158.86	138.30	16.13	71.77															
	CH-53	342.30	1298.49	24.11	64.28	355.16															
25E	AH-1	645.20	339.74	34.28	24.49	257.10															
	UH-1	25.18	144.32	3.24	9.97	104.69															
25G	AH-1	573.51	301.99	30.47	21.77	228.53															
25H	AH-1	143.38	75.50	7.62	5.44	57.13															
26B	CH-46	2194.78	438.07	381.36	44.47	197.91	594.77	118.71	103.35	12.05	53.63										
	CH-53	943.91	3580.65	66.47	177.26	979.36	255.79	970.33	18.01	48.04	265.40										
26E	AV-8B	893.62	998.07	62.67	46.42	441.01	536.17	598.84	37.60	27.85	264.60	357.45	399.23	25.07	18.57	176.40					
	AH-1	193.40	101.84	10.28	7.34	77.07	116.04	61.10	6.17	4.40	46.24	77.36	40.74	4.11	2.94	30.83					
	UH-1	11.02	63.19	1.42	4.37	45.84	6.61	37.92	0.85	2.62	27.50	4.41	25.28	0.57	1.75	18.34					

Scenario	Type Training	A/C Sorties	Nomenclature	Ave. A/C Time on Range (hrs)	Total Time on Range (hrs)	% Below 3,000 ft	Time Below 3,000 ft	Percentage 0-3 nm from shore	Percentage 3-12 nm from Shore	Percentage >12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Scenario	Aircraft	Engines		Fuel Flow
		No.		Hours	Hours	%	Hours	Percent			Hours			No.	Type	Engine Model	No.	lbs/hr
		69	CH-46	0.5	34.5	97%	33.5	50%	30%	20%	16.73	10.04	6.69		CH-46	T58-GE-16	2	560
		253	CH-53	0.5	126.5	97%	122.7	50%	30%	20%	61.35	36.81	24.54		CH-53	T64-GE-415 (assume cr	3	1488
26F	Amphibious Operations		None															
26G	Amphibious Operations		None															
27	Electronic Combat Exercise	101	MH-60R	2.1	212.1	100%	212.1		3%	97%		6.36	205.74		MH-60R	T700-GE-401C	2	600
		3	HH-60	2.1	6.3	100%	6.3		3%	97%		0.19	6.11		HH-60	T700-GE-401C	2	600
		32	P-3	2.0	64.0				3%	97%					P-3	T56-A-14 (assume ASU\	4	1200
		209	FA-18A/C	2.0	418.0				3%	97%					FA-18A/C	F404-GE-400 (assume a	2	3318
		210	FA-18E/F	2.0	420.0				3%	97%					FA-18E/F	F414-GE-400 (assume a	2	4049
		16	E-2C	2.0	32.0				3%	97%					E-2C	T56-A-425 (assume 40%	2	1100
		18	EA-6B	2.0	36.0				3%	97%					EA-6B	J52-P-408A (assume ap	2	4227
		149	Learjet	2.0	298.0				3%	97%					Learjet	TFE 731-2-2B	2	531.76
		8	Unknown	2.0	16.0				3%	97%					Unknown	TFE 731-2-2B	2	531.76
28A	Small Object Avoidance	16	MH-60R	1.8	28.0	100%	28.0	100%			28.00				MH-60R	T700-GE-401C	2	600
29	Mine Neutralization	720	MH-60R	2.5	1800.0	100%	1800.0	55%	40%	5%	990.00	720.00	90.00		MH-60R	T700-GE-401C	2	600
30	Mine Laying	5	P-3	0.9	4.5	67%	3.0	50%	40%	10%	1.50	1.20	0.30		P-3	T56-A-14 (assume ASU\	4	1200
		12	FA-18A/C	0.5	6.0	7%	0.4	50%	40%	10%	0.20	0.16	0.04		FA-18A/C	F404-GE-400 (assume a	2	3318
		11	FA-18E/F	0.5	5.5	7%	0.4	50%	40%	10%	0.18	0.15	0.04		FA-18E/F	F414-GE-400 (assume a	2	4049
31	NSW Center Land Demolitions																	
32	NSWC Underwater Demolitions		NONE															
33	NSWC Underwater Mat Weave		NONE															
34	NSWC BUD/S Small Arms Training	12	SH-60F	6.0	72.0	100%	72.0	100%			72.00				SH-60F	T700-GE-401C	2	600
35	NSWC BUD/S Land Navigation		NONE															
36	NSW UAV Operations	5	Neptune/Scan	1.0	5.0	100%	5.0	100%			5.00							
37	Insertion/Extraction	15	C-130	2.0	30.0	50%	15.0		5%	95%		0.75	14.25		C-130	T56-A-425 (assume app	4	850
38	NSW Boat Operations																	
39	NSW GRU ONE SEAL Platoon Ops	6	SH-60B	8.0	48.0	100%	48.0	20%	30%	50%	9.60	14.40	24.00		SH-60B	T700-GE-401C	2	600
		2	SH-60F	8.0	16.0	100%	16.0	20%	30%	50%	3.20	4.80	8.00		SH-60F	T700-GE-401C	2	600
		12	CH-46	8.0	96.0	100%	96.0	20%	30%	50%	19.20	28.80	48.00		CH-46	T58-GE-16	2	560
40	Direct Action																	
41	Bombing Exercise - Land	2	SH-60F	2.5	5.0	100%	5.0	40%	40%	20%	2.00	2.00	1.00		SH-60F	T700-GE-401C	2	600
		477	FA-18A/C	1.0	477.0	10%	47.7	10%	30%	60%	4.77	14.31	28.62		FA-18A/C	F404-GE-400 (assume a	2	3318
		476	FA-19E/F	1.0	476.0	10%	47.6	10%	30%	60%	4.76	14.28	28.56		FA-19E/F	F414-GE-400 (assume a	2	4049
		15	E-2	2.5	37.5					100%					E-2	T56-A-425 (assume 40%	2	1100
		9	EA-6B	2.5	22.5					100%					EA-6B	J52-P-408A (assume ap	2	4227
		7	AH-1	2.5	17.5	100%	17.5	40%	40%	20%	7.00	7.00	3.50		AH-1	T700-GE-401 (assume c	2	425.1
		1	AV-8B	1.0	1.0	20%	0.2	30%	50%	20%	0.06	0.10	0.04		AV-8B	F402-RR-406A (assume	1	6381
		4	KC-130	1.0	4.0			10%	30%	60%					KC-130	T56-A-425 (assume app	4	850
			H-53	2.5		100%		40%	40%	20%					H-53	T64-GE-415 (assume cr	3	1488
			H-46	2.5		100%		40%	40%	20%					H-46	T58-GE-16	2	560
42	Combat Search and Rescue	56	MH-60S	3.0	168.0	100%	168.0	40%	40%	20%	67.20	67.20	33.60		MH-60S	T700-GE-401C	2	600
		152	FA-18A/C	1.5	228.0	10%	22.8	10%	30%	60%	2.28	6.84	13.68		FA-18A/C	F404-GE-400 (assume a	2	3318
		152	FA-18E/F	1.5	228.0	10%	22.8	10%	30%	60%	2.28	6.84	13.68		FA-18E/F	F414-GE-400 (assume a	2	4049
		16	E-2	3.0	48.0					100%					E-2	T56-A-425 (assume 40%	2	1100
43	EOD Outside SHOBA																	
44	USCG Ops	70	HH-60	3.2	224.0	100%	224.0	50%	30%	20%	112.00	67.20	44.80		HH-60	T700-GE-401C	2	600
54	NALF Airfield		See NALF Ops															
46	Ship Torpedo Tests	16	MH-60R	3.0	48.0	100%	48.0		23%	77%		11.14	36.86		MH-60R	T700-GE-401C	2	600
47	Unmanned Underwater Vehicle Test		NONE															
48	Sonobuoy QA/QC Test	2	P-3	5.0	10.0	100%	10.0	50%	30%	20%	5.00	3.00	2.00		P-3	T56-A-14 (assume ASU\	4	1200
		118	NC-12B Kingair	3.0	354.0	100%	354.0	50%	30%	20%	177.00	106.20	70.80		NC-12B Kinga	PT6A-42 (assume appro	2	249
49	Ocean Engineering		NONE	NONE														
50	Marine Mammal Mine Shape Location		NONE	NONE														
51	Missile Flight Test	4	MH-60R	4.0	16.0	100%	16.0	5%	10%	85%	0.80	1.60	13.60		MH-60R	T700-GE-401C	2	600
		16	P-3	4.0	64.0	50%	32.0	5%	10%	85%	1.60	3.20	27.20		P-3	T56-A-14 (assume ASU\	4	1200
		24	FA-18A/C	4.0	96.0				5%	95%					FA-18A/C	F404-GE-400 (assume a	2	3318
		12	FA-18E/F	4.0	48.0				5%	95%					FA-18E/F	F414-GE-400 (assume a	2	4049
		8	Learjet	4.0	32.0				5%	95%					Learjet	TFE 731-2-2B	2	531.76
		4	Gulfstream	4.0	16.0				5%	95%					Gulfstream	BR700-710A1-10	2	1698
		4	MH-60R	4.0	16.0	100%	16.0	5%	10%	85%	0.80	1.60	13.60		MH-60R	T700-GE-401C	2	600
52	NUWC Underwater Acoustics Testing		NONE															
53	Other Tests	2	MH-60R	4.0	8.0	100%	8.0	5%	8%	77%	0.40	0.64	6.16		MH-60R	T700-GE-401C	2	600
		1	P-3	4.0	4.0	50%	2.0	5%	8%	77%	0.10	0.16	1.54		P-3	T56-A-14 (assume ASU\	4	1200
		1	Learjet	4.0	4.0			1%	2%	97%					Learjet	TFE 731-2-2B	2	531.76
		1	Other Helo	4.0	4.0	100%	4.0	5%	8%	77%	0.20	0.32	3.08		Other Helo (S-	T58-GE-402 (assume 49	2	529
	Totals	20402																

Scenario	Aircraft Type	Emission Indices, lbs/1,000 lbs fuel					Emissions Factors (lb/hr)					Emissions: Emissions 0-3 nm Offshore (lbs)					Emissions: Emissions 3-12 nm Offshore—US Territory (lbs)					Emissions: Emissions >12 nm Offshore—Outside US Territory									
		CO	NOx	HC	SOx	PM10	CO	NOx	HC	SOx	PM10	CO	NOx	HC	SOx	PM	CO	NOx	HC	SOx	PM	CO	NOx	HC	SOx	PM	CO	NOx	HC	SOx	PM
	CH-46	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99	369.94	73.84	64.28	7.50	33.36	221.96	44.30	38.57	4.50	20.01	147.97	29.53	25.71	3.00	13.34					
	CH-53	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87	583.36	2212.93	41.08	109.55	605.27	350.02	1327.76	24.65	65.73	363.16	233.34	885.17	16.43	43.82	242.11					
27	MH-60R	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04						47.72	48.87	4.20	3.05	32.07	1543.03	1580.06	135.79	98.75	1036.91					
	HH-60	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04						1.42	1.45	0.12	0.09	0.95	45.83	46.93	4.03	2.93	30.80					
	P-3	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06																				
	FA-18A/C	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20																				
	FA-18E/F	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10																				
	E-2C	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73																				
	EA-6B	5.19	6.77	0.84	0.40	10.48	43.88	57.23	7.10	3.38	88.60																				
	Learjet	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47																				
	Unknown	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47																				
28A	MH-60R	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	210.00	215.04	18.48	13.44	141.12															
29	MH-60R	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	7425.00	7603.20	653.40	475.20	4989.60	5400.00	5529.60	475.20	345.60	3628.80	675.00	691.20	59.40	43.20	453.60					
30	P-3	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06	13.10	60.70	2.95	2.88	28.59	10.48	48.56	2.36	2.30	22.87	2.62	12.14	0.59	0.58	5.72					
	FA-18A/C	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20	3.24	8.95	0.58	0.53	8.45	2.59	7.16	0.47	0.42	6.76	0.65	1.79	0.12	0.11	1.69					
	FA-18E/F	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10	1.32	17.20	0.18	0.59	9.37	1.06	13.76	0.14	0.48	7.50	0.26	3.44	0.04	0.12	1.87					
34	SH-60F	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	540.00	552.96	47.52	34.56	362.88															
37	C-130	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50						10.28	17.11	2.47	1.02	10.12	195.25	325.10	47.00	19.38	192.35					
39	SH-60B	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	72.00	73.73	6.34	4.61	48.38	108.00	110.59	9.50	6.91	72.58	180.00	184.32	15.84	11.52	120.96					
	SH-60F	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	24.00	24.58	2.11	1.54	16.13	36.00	36.86	3.17	2.30	24.19	60.00	61.44	5.28	3.84	40.32					
	CH-46	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99	424.49	84.73	73.76	8.60	38.28	636.73	127.09	110.64	12.90	57.42	1061.22	211.81	184.40	21.50	95.69					
41	SH-60F	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	15.00	15.36	1.32	0.96	10.08	15.00	15.36	1.32	0.96	10.08	7.50	7.68	0.66	0.48	5.04					
	FA-18A/C	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20	77.24	213.35	13.93	12.66	201.32	231.71	640.04	41.78	37.98	603.95	463.41	1280.08	83.57	75.97	1207.91					
	FA-19E/F	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10	34.31	446.37	4.63	15.42	243.23	102.92	1339.10	13.88	46.26	729.68	205.84	2678.21	27.75	92.51	1459.37					
	E-2	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73																				
	EA-6B	5.19	6.77	0.84	0.40	10.48	43.88	57.23	7.10	3.38	88.60																				
	AH-1	10.54	5.55	0.56	0.40	4.20	8.96	4.72	0.48	0.34	3.57	62.73	33.03	3.33	2.38	25.00	62.73	33.03	3.33	2.38	25.00	31.36	16.52	1.67	1.19	12.50					
	AV-8B	7.70	8.60	0.54	0.40	3.80	49.13	54.88	3.45	2.55	24.25	2.95	3.29	0.21	0.15	1.45	4.91	5.49	0.34	0.26	2.42	1.97	2.20	0.14	0.10	0.97					
	KC-130	4.03	6.71	0.97	0.40	3.97	13.70	22.81	3.30	1.36	13.50																				
	H-53	2.13	8.08	0.15	0.40	2.21	9.51	36.07	0.67	1.79	9.87																				
	H-46	19.74	3.94	3.43	0.40	1.78	22.11	4.41	3.84	0.45	1.99																				
42	MH-60S	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	504.00	516.10	44.35	32.26	338.69	504.00	516.10	44.35	32.26	338.69	252.00	258.05	22.18	16.13	169.34					
	FA-18A/C	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20	36.92	101.98	6.66	6.05	96.23	110.75	305.93	19.97	18.16	288.68	221.50	611.86	39.94	36.31	577.36					
	FA-18E/F	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10	16.43	213.81	2.22	7.39	116.50	49.30	641.42	6.65	22.16	349.51	98.59	1282.84	13.29	44.31	699.03					
	E-2	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73																				
44	HH-60	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	840.00	860.16	73.92	53.76	564.48	504.00	516.10	44.35	32.26	338.69	336.00	344.06	29.57	21.50	225.79					
46	MH-60R	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04						83.52	85.52	7.35	5.35	56.13	276.48	283.12	24.33	17.69	185.79					
48	P-3	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06	43.68	202.32	9.84	9.60	95.28	26.21	121.39	5.90	5.76	57.17	17.47	80.93	3.94	3.84	38.11					
	NC-12B Kinga	4.93	4.42	0.23	0.40	4.20	2.46	2.20	0.11	0.20	2.09	434.56	389.61	20.27	35.26	370.21	260.74	233.76	12.16	21.16	222.13	173.82	155.84	8.11	14.10	148.09					
51	MH-60R	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	6.00	6.14	0.53	0.38	4.03	12.00	12.29	1.06	0.77	8.06	102.00	104.45	8.98	6.53	68.54					
	P-3	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06	13.98	64.74	3.15	3.07	30.49	27.96	129.48	6.30	6.14	60.98	237.62	1100.62	53.53	52.22	518.32					
	FA-18A/C	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20																				
	FA-18E/F	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10																				
	Learjet	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47																				
	Gulfstream	4.78	7.68	0.05	1.00	0.00	16.23	26.08	0.17	3.40	0.00																				
	MH-60R	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	6.00	6.14	0.53	0.38	4.03	12.00	12.29	1.06	0.77	8.06	102.00	104.45	8.98	6.53	68.54					
53	MH-60R	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04	3.00	3.07	0.26	0.19	2.02	4.80	4.92	0.42	0.31	3.23	46.20	47.31	4.07	2.96	31.05					
	P-3	1.82	8.43	0.41	0.40	3.97	8.74	40.46	1.97	1.92	19.06	0.87	4.05	0.20	0.19	1.91	1.40	6.47	0.31	0.31	3.05	13.45	62.31	3.03	2.96	29.35					
	Learjet	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47																				
	Other Helo (S-	21.28	3.88	2.20	0.40	4.00	22.51	4.11	2.33	0.42	4.23	4.50	0.82	0.47	0.08	0.85	7.20	1.31	0.74	0.14	1.35	69.34	12.64	7.17	1.30	13.03					
	Total Emissions (SCI) tons											11.10	11.63	1.06	0.68	6.50	10.85	12.82	1.03	0.75	8.31	29.40	57.41	3.04	2.79	33.91	3.25	2.82	0.61	0.15	1.66
	Total Emissions (SD) tons											3.02	4.16	0.35	0.23	1.47	1.29	1.84	0.14	0.10	0.69										

Source: SCORE FY2004 Participants Conversion.xls

Table C-7. Takeoffs/Landings from NALF SCI—No Action Alternative

Aircraft Type	Engine Model	Type of Operation	Baseline Total Number of "Operations"	Emissions per Operation, lbs/operation CO	NOx	HC	SO2	PM10	Total Emissions, tons/year CO	NOx	HC	SO2	PM10
Navy/Marines													
F/A-18C/D[1]	F404-GE-400		**9,617**										
		Start/Taxi/TO	**961**	69.38	10.23	24.47	0.49	7.04	33.34	4.92	11.76	0.24	3.38
		Touch and Go	**3,845**	0.95	4.77	0.19	0.18	2.55	1.83	9.17	0.37	0.35	4.90
		Arrival with Break	**192**	29.09	2.898	11.728	0.205	4.638	2.79	0.28	1.13	0.02	0.45
		Straight In Arrival	**769**	27.17	2.498	11.118	0.215	4.828	10.45	0.96	4.27	0.08	1.86
		Transit	**4**										
		Total FA-18A/C	**9,617**						**48.41**	**15.33**	**17.53**	**0.68**	**10.59**
F/A-18E/F[1]	F414-GE-400		**3,147**										
		Start/Taxi/TO	**315**	209.67	16.41	31.66	0.58	7.9	32.97	2.58	4.98	0.09	1.24
		Touch and Go	**1,258**	0.47	9.01	0.07	0.22	3.04	0.30	5.67	0.04	0.14	1.91
		Arrival with Break	**63**	22.397	5.732	13.531	0.235	5.2	0.70	0.18	0.43	0.01	0.16
		Straight In Arrival	**252**	20.957	5.462	13.011	0.255	5.61	2.64	0.69	1.64	0.03	0.71
		Transit	**1**										
		Total FA-18E/F	**3,147**						**36.61**	**9.12**	**7.09**	**0.27**	**4.02**
F-14[2]	F110-GE-400		**582**										
		Start/Taxi/TO (assum	**58**	21.41	13.63	4.82	0.71	15.25	0.62	0.40	0.14	0.02	0.44
		Touch and Go	**233**	1.21	4.47	0.5	0.17	2.62	0.14	0.52	0.06	0.02	0.30
		Arrival with Break	**12**	8.87	3.03	2.10	0.29	7.10	0.05	0.02	0.01	0.00	0.04
		Straight In Arrival	**47**	8.05	4.53	1.95	0.34	7.28	0.19	0.11	0.05	0.01	0.17
		Transit	**0**										
		Total F-14	**582**						**1.00**	**1.04**	**0.26**	**0.05**	**0.96**
EA-6B[3]	J52-P-408A		**1,198**										
		Start/Taxi/TO	**120**	30.53	5.51	15.04	0.39	14.03	1.83	0.33	0.90	0.02	0.84
		Touch and Go	**479**	2.95	4.65	0.5	0.24	5.83	0.71	1.11	0.12	0.06	1.40
		Arrival with Break	**0**	19.812	5.426	8.793	0.372	12.367	0.00	0.00	0.00	0.00	0.00
		Straight In Arrival	**120**	19.972	5.526	8.723	0.402	13.357	1.20	0.33	0.52	0.02	0.80
		Total EA-6B	**1,198**						**3.73**	**1.77**	**1.54**	**0.10**	**3.04**
E-2[4]	T56-A-425/427		**603**										
		Start/Taxi/TO	**30**	8.08	3.83	5.56	0.23	2.29	0.12	0.06	0.08	0.00	0.03
		Touch and Go	**263**	0.5	2.85	0.11	0.13	1.26	0.07	0.37	0.01	0.02	0.17
		Arrival with Break	**0**	1.371	3.561	0.478	0.215	6.199	0.00	0.00	0.00	0.00	0.00
		Straight In Arrival	**30**	1.321	2.251	0.468	0.12	4.759	0.02	0.03	0.01	0.00	0.07
		Transit	**17**										
		Total E-2	**603**						**0.21**	**0.47**	**0.11**	**0.02**	**0.27**
C-2[5]	T56-A-425		**402**										
		Start/Taxi/TO	**8**	8.11	3.93	5.57	0.24	2.3	0.03	0.02	0.02	0.00	0.01
		Touch and Go	**0**	0.5	2.85	0.11	0.13	1.26	0.00	0.00	0.00	0.00	0.00
		GCA Box	**386**	0.8	4.2	0.18	0.19	1.9	0.15	0.81	0.03	0.04	0.37
		Straight In Arrival	**8**	1.321	2.251	0.468	0.12	1.225	0.01	0.01	0.00	0.00	0.00
		Total C2	402						**0.19**	**0.84**	**0.06**	**0.04**	**0.38**
P-3[6]	T56-A-16		**201**										
		Start/Taxi/TO	**2**	21.1	12.04	13.46	0.77	5.49	0.02	0.01	0.02	0.00	0.01
		Touch and Go	**0**	0.77	5.67	0.17	0.24	2.42	0.00	0.00	0.00	0.00	0.00
		GCA Box	**197**	1.13	8.7	0.26	0.37	3.69	0.11	0.85	0.03	0.04	0.36
		Straight In Arrival	**2**	16.4	9.17	11.13	0.56	5.29	0.02	0.01	0.01	0.00	0.01
		Total P3	201						**0.15**	**0.88**	**0.05**	**0.04**	**0.37**
C-9[7]	JT8D-9		**789**										
		Start/Taxi/TO	**355**	17.13	11.91	4.68	0.56	16.01	3.04	2.11	0.83	0.10	2.84
		Touch and Go	**0**	3.18	4.83	0.55	0.22	8.1	0.00	0.00	0.00	0.00	0.00
		Straight In Arrival	**355**	16.19	6.71	4.1	0.45	17.1	2.87	1.19	0.73	0.08	3.04
		GCA Box	**79**	5.77	7.2	1.09	0.35	12.87	0.23	0.28	0.04	0.01	0.51

Aircraft Type	Engine Model	Type of Operation	Baseline Total Number of "Operations"	CO	NOx	HC	SO2	PM10	CO	NOx	HC	SO2	PM10
		Total C-9	789						**6.14**	**3.59**	**1.60**	**0.19**	**6.39**
H-3[8]	T58-GE-402		**603**										
		Start/Taxi/TO	**268**	15.63	0.79	5.13	0.1	0.85	2.10	0.11	0.69	0.01	0.11
		Touch and Go	**30**	2.14	0.5	0.36	0.05	0.24	0.03	0.01	0.01	0.00	0.00
		Arrival	**268**	12.491	0.786	3.483	0.097	0.807	1.67	0.11	0.47	0.01	0.11
		Transits	**7**										
		Total H-3	603						**3.80**	**0.22**	**1.16**	**0.03**	**0.23**
H-60[9]	T700-GE-401C		**402**										
		Start/Taxi/TO	**184**	5.16	1.59	0.62	0.12	1.04	0.47	0.15	0.06	0.01	0.10
		Touch and Go	**4**	0.94	1.14	0.09	0.07	0.72	0.00	0.00	0.00	0.00	0.00
		Arrival	**184**	4.595	1.14	0.635	0.095	0.725	0.42	0.10	0.06	0.01	0.07
		Transits	**27**										
		Total H-60	402						**0.90**	**0.25**	**0.12**	**0.02**	**0.16**
AV-8B[10]	F402-RR-408		**201**										
		Start/Taxi/TO	**52**	14.652	2.044	0.916	0.206	5.574	0.38	0.05	0.02	0.01	0.15
		Touch and Go	**48**	4.39	7.33	0.18	0.35	5.08	0.11	0.18	0.00	0.01	0.12
		Arrival	**52**	21.92	3.35	1.33	0.33	8.76	0.57	0.09	0.03	0.01	0.23
		Arrival with Break	**0**	21.57	2.53	1.33	0.28	8.16	0.00	0.00	0.00	0.00	0.00
		Total AV-8B	201						**1.06**	**0.32**	**0.06**	**0.02**	**0.50**
S-3[11]	TF34-GE-400		**2,360**										
		Start/Taxi/TO	**236**	29.92	2.47	5.53	0.25	1.61	3.52	0.29	0.65	0.03	0.19
		Touch and Go	**943**	2.17	0.95	0.26	0.08	0.61	1.02	0.45	0.12	0.04	0.29
		Arrival with Break	**47**	12.905	2.081	2.172	0.199	1.511	0.30	0.05	0.05	0.00	0.04
		Straight In Arrival	**189**	12.325	1.561	2.122	0.169	1.291	1.16	0.15	0.20	0.02	0.12
		Transits	**3**										
		Total S-3	2,360						**6.01**	**0.93**	**1.03**	**0.09**	**0.63**
		TOTAL NAVY/MARINES	**20,105**										
Other Military													
B-1			**298**										
		Departure from Low Approach	**134**	0.708	13.5	0.032	0.787	0.781	0.05	0.91	0.00	0.05	0.05
		GCA Box	**134**	0.373	8.73	0.0168	0.415	0.342	0.03	0.59	0.00	0.03	0.02
		Transit	**30**										
		Total B-1	**298**						**0.07**	**1.49**	**0.00**	**0.08**	**0.08**
F-16			**298**										
		Touch and Go	**119**	1.25	9.06	0.096	0.964	1.25	0.07	0.54	0.01	0.06	0.07
		Arrival with Break	**24**	24.97	3.32	15.97	0.26	5.48	0.30	0.04	0.19	0.00	0.07
		Straight In Arrival	**6**	25.00	3.75	15.99	0.27	5.54	0.07	0.01	0.05	0.00	0.02
		Transit	**30**										
		Total F-16	**298**						**0.45**	**0.59**	**0.24**	**0.06**	**0.16**
T-38			**149**										
		Touch and Go	**60**	1.10	1.87	0.08	0.06	0.52	0.03	0.06	0.00	0.00	0.02
		Arrival with Break	**12**	9.05	2.19	5.43	0.14	2.49	0.05	0.01	0.03	0.00	0.01
		Straight In Arrival	**3**	8.69	2.05	5.28	0.12	2.17	0.01	0.00	0.01	0.00	0.00
		Transit	**15**										
		Total T-38	**149**						**0.10**	**0.07**	**0.04**	**0.00**	**0.03**
		TOTAL OTHER MILITARY	**745**										
Air Carrier													
SW-4[18]	PT6A-45		**3,263**										
		Start/Taxi/TO	**1,632**	0.75	0.49	0.12	0.07	0.08	0.61	0.40	0.10	0.06	0.06
		Straight In Arrival	**1,632**	1.14	0.67	0.12	0.12	0.15	0.93	0.54	0.10	0.10	0.12
		Total SW-4	**3,263**						**1.54**	**0.94**	**0.19**	**0.16**	**0.18**
		TOTAL AIR CARRIER	**3,263**										
Gen. Aviation													
Cessna 421[14]	TSIO-360C		**996**										

Aircraft Type	Engine Model	Type of Operation	Baseline Total Number of "Operations"	CO	NOx	HC	SO2	PM10	CO	NOx	HC	SO2	PM10
		Start/Taxi/TO	**486**	21.39	0.09	1.19	0.01	0.20	5.20	0.02	0.29	0.00	0.05
		Straight In Arrival	**486**	3.99	0.01	0.39	0.00	0.03	0.97	0.00	0.10	0.00	0.01
		Transits	**23**										
		Total Cessna 421	**996**						**6.17**	**0.02**	**0.39**	**0.00**	**0.05**
Piper Navajo[15]	TI0-540		**747**										
		Start/Taxi/TO	**362**	64.41	0.03	1.56	0.01	0.20	11.66	0.01	0.28	0.00	0.04
		Straight In Arrival	**362**	13.83	0.00	0.45	0.00	0.03	2.50	0.00	0.08	0.00	0.00
		Transits	**23**										
		Total Piper Navajo	**747**						**14.16**	**0.01**	**0.36**	**0.00**	**0.04**
Beech King[16]	PT6A-34B		**521**										
		Start/Taxi/TO	**261**	12.42	0.58	10.40	0.17	0.20	1.62	0.08	1.35	0.02	0.03
		Straight In Arrival	**261**	4.01	0.14	3.50	0.04	0.03	0.52	0.02	0.46	0.01	0.00
		Total Beech King	**521**						**2.14**	**0.09**	**1.81**	**0.03**	**0.03**
TOTAL GENERAL AVIATION			**2,264**										
		GRAND TOTAL	**26,377**	**Total NALF Emissions, tons per year, NAA**					**132.86**	**37.97**	**33.63**	**1.89**	**28.11**

Date: 13-May-2007

NOTES:

1 Start/Taxi/TO: Departure, AESO 9815 Rev E; Touch and Go: Touch and Go, AESO 9933B; Arrival with Break: Arrival with Break, AESO 9815 Rev E; Straight-In Arrival: Arrival, AESO 9815 Rev E

2 Start/Taxi/TO: Departure, AESO 9813 Rev G; Touch and Go: Touch and Go, AESO 9945 Rev B; Arrival with Break: Arrival with Break, AESO 9813 Rev G; Straight-In Arrival: Arrival, AESO 9813 Rev G

3 Start/Taxi/TO: Departure, AESO 9917 Rev B; Touch and Go: Touch and Go, AESO 9941 Rev A; Arrival with Break: Arrival with Break, AESO 9917 Rev B; Straight-In Arrival: Arrival, AESO 9917 Rev B

4 Start/Taxi/TO: Departure, AESO 9920 Rev B; Touch and Go: Touch and Go, AESO 9943 Rev B; Arrival with Break: Arrival with Break, AESO 9920 Rev B; Straight-In Arrival: Arrival, AESO 9920 Rev B

5 Start/Taxi/TO: Departure, AESO 9919 Rev B; Touch and Go: Touch and Go, AESO 9936 Rev B; GCA Box: GCA Box, AESO 9936 Rev B; Straight-In Arrival: Straight Arrival, AESO 9919 Rev B

6 Start/Taxi/TO: Departure, AESO 9911 Rev B; Touch and Go: Touch and Go, AESO 9948 Rev B; Straight-In Arrival: Straight Arrival, AESO 9911 Rev B; GCA Box: GCA Box, AESO 9948 Rev B

7 Start/Taxi/TO: Departure, AESO 9926; Straight-In Arrival: Arrival, AESO 9926; GCA Box: GCA Box, AESO 9942 Rev A, Touch and Go: Touch and Go, AESO 9942 Rev A

8 Start/Taxi/TO: Departure, AESO 9927 Rev A; Touch and Go: Touch and Go, AESO 9934 Rev B; Straight-In Arrival: Straight Arrival, AESO 9927 Rev A

9 Start/Taxi/TO: Departure, AESO 9929; Touch and Go: Touch and Go, AESO 9953; Straight-In Arrival: Straight Arrival, AESO 9929

10 Start/Taxi/TO: Conventional Takeoff, AESO 9913 Rev C; Arrival: Slow Landing without Break, AESO 9913 Rev C; Arrival with Break: Slow Landing with Break, AESO 9913 Rev C, Touch and Go: Touch and Go, AESO 9963 Rev A

11 Start/Taxi/TO: Departure, AESO 9915 Rev A; Touch and Go: Touch and Go, AESO 9954; Arrival with Break: Arrival with Break, AESO 9915 Rev A; Straight-In Arrival: Arrival, AESO 9915 Rev A

14 Straight In Arrival: Assumed 27% of time-in-mode for taxi operations is associated with arrival. Emission factors from AP-42, Volume IV, Table II-1-7, 501D22A, emissions for Idle X 27%, Approach.

Start/Taxi/TO: Assumed 73% of time-in-mode for taxi operations is associated with start/taxi/to. Emission factors from AP-42, Volume IV, Table II-1-7, TSIO-360C, emissions for Idle X 73%, takeoff, and climbout.

15 Straight In Arrival: Assumed 27% of time-in-mode for taxi operations is associated with arrival. Emission factors from AP-42, Volume IV, Table II-1-7, TSIO-360C, emissions for Idle X 27%, Approach.

Start/Taxi/TO: Assumed 73% of time-in-mode for taxi operations is associated with start/taxi/to. Emission factors from AP-42, Volume IV, Table II-1-7, TIO-540, emissions for Idle X 73%, takeoff, and climbout.

16 Straight In Arrival: Assumed 27% of time-in-mode for taxi operations is associated with arrival. Emission factors from AP-42, Volume IV, Table II-1-7, TIO-540, emissions for Idle X 27%, Approach.

17 Start/Taxi/TO: Assumed 73% of time-in-mode for taxi operations is associated with start/taxi/to. Emission factors from AP-42, Volume IV, Table II-1-7, PT6A-41, emissions for Idle X 73%, takeoff, and climbout.

Straight In Arrival: Assumed 27% of time-in-mode for taxi operations is associated with arrival. Emission factors from AP-42, Volume IV, Table II-1-7, PT6A-41, emissions for Idle X 27%, Approach.

Table C-8. Takeoffs/Landings from NALF San Clemente Island—Alternative 1

Aircraft Type	Engine Model	Type of Operation	Total Number of Operations	Emissions per Operation, lbs/operation CO	NOx	HC	SO2	PM10	Total Emissions, tons/year CO	NOx	HC	SO2	PM10
Navy/Marines													
F/A-18C/D[1]	F404-GE-400		9,617										
		Start/Taxi/TO	961	69.38	10.23	24.47	0.49	7.04	33.34	4.92	11.76	0.24	3.38
		Touch and Go	3,845	0.95	4.77	0.19	0.18	2.55	1.83	9.17	0.37	0.35	4.90
		Arrival with Break	192	29.09	2.898	11.728	0.205	4.638	2.79	0.28	1.13	0.02	0.45
		Straight In Arrival	769	27.17	2.498	11.118	0.215	4.828	10.45	0.96	4.27	0.08	1.86
		Transit	4										
		Total FA-18A/C	9,617						**48.41**	**15.33**	**17.53**	**0.68**	**10.59**
F/A-18E/F[1]	F414-GE-400		4,196										
		Start/Taxi/TO	419	209.67	16.41	31.66	0.58	7.9	43.96	3.44	6.64	0.12	1.66
		Touch and Go	1,678	0.47	9.01	0.07	0.22	3.04	0.39	7.56	0.06	0.18	2.55
		Arrival with Break	84	22.397	5.732	13.531	0.235	5.2	0.94	0.24	0.57	0.01	0.22
		Straight In Arrival	336	20.957	5.462	13.011	0.255	5.61	3.52	0.92	2.18	0.04	0.94
		Transit	2										
		Total FA-18	4,196						**48.81**	**12.16**	**9.45**	**0.36**	**5.37**
EA-6B[3]	J52-P-408A		1,141										
		Start/Taxi/TO	114	30.53	5.51	15.04	0.39	14.03	1.74	0.31	0.86	0.02	0.80
		Touch and Go	456	2.95	4.65	0.5	0.24	5.83	0.67	1.06	0.11	0.05	1.33
		Arrival with Break	0	19.812	5.426	8.793	0.372	12.367	0.00	0.00	0.00	0.00	0.00
		Straight In Arrival	114	19.972	5.526	8.723	0.402	13.357	1.14	0.31	0.50	0.02	0.76
		Total EA-6B	1,141						**3.55**	**1.69**	**1.47**	**0.10**	**2.89**
E-2[4]	T56-A-425/427		603										
		Start/Taxi/TO	30	8.08	3.83	5.56	0.23	2.29	0.12	0.06	0.08	0.00	0.03
		Touch and Go	263	0.5	2.85	0.11	0.13	1.26	0.07	0.37	0.01	0.02	0.17
		Arrival with Break	0	1.371	3.561	0.478	0.215	6.199	0.00	0.00	0.00	0.00	0.00
		Straight In Arrival	30	1.321	2.251	0.468	0.12	4.759	0.02	0.03	0.01	0.00	0.07
		Transit	17										
		Total E-2	603						**0.21**	**0.47**	**0.11**	**0.02**	**0.27**
C-2[5]	T56-A-425		421										
		Start/Taxi/TO	8	8.11	3.93	5.57	0.24	2.3	0.03	0.02	0.02	0.00	0.01
		Touch and Go	0	0.5	2.85	0.11	0.13	1.26	0.00	0.00	0.00	0.00	0.00
		GCA Box	404	0.8	4.2	0.18	0.19	1.9	0.16	0.85	0.04	0.04	0.38
		Straight In Arrival	8	1.321	2.251	0.468	0.12	1.225	0.01	0.01	0.00	0.00	0.01
		Total C2	421						**0.20**	**0.87**	**0.06**	**0.04**	**0.40**
P-3[5]	T56-A-16		210										
		Start/Taxi/TO	2	21.1	12.04	13.46	0.77	5.49	0.02	0.01	0.02	0.00	0.01
		Touch and Go	0	0.77	5.67	0.17	0.24	2.42	0.00	0.00	0.00	0.00	0.00
		Straight In Arrival	205	1.13	8.7	0.26	0.37	3.69	0.12	0.89	0.03	0.04	0.38
		GCA Box	2	16.4	9.17	11.13	0.56	5.29	0.02	0.01	0.01	0.00	0.01
		Total P3	210						**0.16**	**0.92**	**0.06**	**0.04**	**0.39**
C-9[6]	JT8D-9	338	751										
		Start/Taxi/TO	338	17.13	11.91	4.68	0.56	16.01	2.89	2.01	0.79	0.09	2.71
		Touch and Go	0	3.18	4.83	0.55	0.22	8.1	0.00	0.00	0.00	0.00	0.00
		Straight In Arrival	338	16.19	6.71	4.1	0.45	17.1	2.74	1.13	0.69	0.08	2.89
		GCA Box	75	5.77	7.2	1.09	0.35	12.87	0.22	0.27	0.04	0.01	0.48
		Total C-9	751						**5.85**	**3.42**	**1.52**	**0.18**	**6.08**
H-3[8]	T58-GE-402		402										
		Start/Taxi/TO	179	15.63	0.79	5.13	0.1	0.85	1.40	0.07	0.46	0.01	0.08
		Touch and Go	20	2.14	0.5	0.36	0.05	0.24	0.02	0.00	0.00	0.00	0.00
		Arrival	179	12.491	0.786	3.483	0.097	0.807	1.12	0.07	0.31	0.01	0.07
		Transits	5										
		Total C2	402						**2.53**	**0.15**	**0.77**	**0.02**	**0.15**
H-60[9]	T700-GE-401C		517										
		Start/Taxi/TO	236	5.16	1.59	0.62	0.12	1.04	0.61	0.19	0.07	0.01	0.12
		Touch and Go	5	0.94	1.14	0.09	0.07	0.72	0.00	0.00	0.00	0.00	0.00
		Arrival	236	4.595	1.14	0.635	0.095	0.725	0.54	0.13	0.08	0.01	0.09

Aircraft Type	Engine Model	Type of Operation	Total Number of Operations	Emissions per Operation, lbs/operation CO	NOx	HC	SO2	PM10	Total Emissions, tons/year CO	NOx	HC	SO2	PM10
		Transits	34										
		Total H-60	517						**1.15**	**0.33**	**0.15**	**0.03**	**0.21**
AV-8B[10]	F402-RR-408		764										
		Start/Taxi/TO	199	14.652	2.044	0.916	0.206	5.574	1.46	0.20	0.09	0.02	0.55
		Touch and Go	183	4.39	7.33	0.18	0.35	5.08	0.40	0.67	0.02	0.03	0.47
		Arrival	199	21.92	3.35	1.33	0.33	8.76	2.18	0.33	0.13	0.03	0.87
		Arrival with Break	0	21.57	2.53	1.33	0.28	8.16	0.00	0.00	0.00	0.00	0.00
		Total AV-8B	764						**4.03**	**1.21**	**0.24**	**0.09**	**1.89**
F-35	F135-PW-100		100										
		Start/Taxi/TO	0						0.00	0.00	0.00	0.00	0.00
		Touch and Go	50	0.94	22.88	0.19	0.91	4.33	0.02	0.57	0.00	0.02	0.11
		Arrival	0						0.00	0.00	0.00	0.00	0.00
		Transits	0										
		Total H-60	100						**0.02**	**0.57**	**0.00**	**0.02**	**0.11**
S-3[11]	TF34-GE-400		0										
		Start/Taxi/TO	0	29.92	2.47	5.53	0.25	1.61	0.00	0.00	0.00	0.00	0.00
		Touch and Go	0	2.17	0.95	0.26	0.08	0.61	0.00	0.00	0.00	0.00	0.00
		Arrival with Break	0	12.905	2.081	2.172	0.199	1.511	0.00	0.00	0.00	0.00	0.00
		Straight In Arrival	0	12.325	1.561	2.122	0.169	1.291	0.00	0.00	0.00	0.00	0.00
		Transits	0										
		Total S-3	0						**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Other Military													
KC-135[11]	F108-100		48										
		Departure from L	22	0.708	13.5	0.032	0.787	0.781	0.01	0.15	0.00	0.01	0.01
		GCA Box	22	0.373	8.73	0.0168	0.415	0.342	0.00	0.09	0.00	0.00	0.00
		Transit	5										
		Total KC-135	48						**0.01**	**0.24**	**0.00**	**0.01**	**0.01**
KC-10	CF6-50C2		100										
		Departure from L	45	20.98	49.41	2.53	2.54	0.33	0.47	1.11	0.06	0.06	0.01
		GCA Box	45	24.03	11.49	2.60	1.71	0.01	0.54	0.26	0.06	0.04	0.00
		Transit	10										
		Total KC-10	100						**1.01**	**1.37**	**0.12**	**0.10**	**0.01**
C-17	F117-PW-100		200										
		Start/Taxi/TO	100	23.54	64.03	2.24	1.52	0.02	1.18	3.20	0.11	0.08	0.00
		Straight In Arrival	100	25.09	17.40	2.44	1.10	0.01	1.25	0.87	0.12	0.05	0.00
		Total C-17	200						**2.43**	**4.07**	**0.23**	**0.13**	**0.00**
B-1	F108-100		398										
		Departure from Low Approach	179	0.708	13.5	0.032	0.787	0.781	0.06	1.21	0.00	0.07	0.07
		GCA Box	179	0.373	8.73	0.0168	0.415	0.342	0.03	0.78	0.00	0.04	0.03
		Transit	40										
		Total KC-135	398						**0.10**	**1.99**	**0.00**	**0.11**	**0.10**
E-3[12] **or F-16**	TF33-100A		315										
		Touch and Go	126	1.25	9.06	0.096	0.964	1.25	0.08	0.57	0.01	0.06	0.08
		Arrival with Break	25	24.97	3.32	15.97	0.26	5.48	0.31	0.04	0.20	0.00	0.07
		Straight In Arrival	6	25.00	3.75	15.99	0.27	5.54	0.08	0.01	0.05	0.00	0.02
		Transit	32										
		Total F-16	315						**0.47**	**0.62**	**0.26**	**0.06**	**0.17**
T-38			158										
		Touch and Go	63	1.10	1.87	0.08	0.06	0.52	0.03	0.06	0.00	0.00	0.02
		Arrival with Break	13	9.05	2.19	5.43	0.14	2.49	0.06	0.01	0.03	0.00	0.02
		Straight In Arrival	3	8.69	2.05	5.28	0.12	2.17	0.01	0.00	0.01	0.00	0.00
		Transit	16										
		Total T-38	158						**0.11**	**0.08**	**0.05**	**0.00**	**0.04**
Air Carrier													
SW-4[17]	PT6A-45		5,284										
		Start/Taxi/TO	2,642	0.75	0.49	0.12	0.07	0.08	1.00	0.65	0.15	0.10	0.10
		Straight In Arrival	2,642	1.14	0.67	0.12	0.12	0.15	1.50	0.88	0.16	0.16	0.20
		Total SW-4	5,284						**2.50**	**1.53**	**0.31**	**0.25**	**0.30**
Gen. Aviation													

Aircraft Type	Engine Model	Type of Operation	Total Number of Operations	Emissions per Operation, lbs/operation CO	NOx	HC	SO2	PM10	Total Emissions, tons/year CO	NOx	HC	SO2	PM10
Cessna 421[14]	TSIO-360C		1,424										
		Start/Taxi/TO	695	21.387	0.086943	1.1906	0.006083	0.196921	7.43	0.03	0.41	0.00	0.07
		Straight In Arrival	695	3.993	0.011157	0.3929	0.001577	0.026279	1.39	0.00	0.14	0.00	0.01
		Transits	34										
		Total Cessna 421	1,424						**8.82**	**0.03**	**0.55**	**0.00**	**0.08**
Piper Navajo[15]	TI0-540		1,067										
		Start/Taxi/TO	517	64.413	0.030849	1.5634	0.012659	0.196921	16.65	0.01	0.40	0.00	0.05
		Straight In Arrival	517	13.827	0.003841	0.4531	0.003174	0.026279	3.57	0.00	0.12	0.00	0.01
		Transits	33										
		Total Piper Navajo	1,067						**20.23**	**0.01**	**0.52**	**0.00**	**0.06**
Beech King[16]	PT6A-34B		744										
		Start/Taxi/TO	372	12.416	0.58223	10.397	0.1746	0.196921	2.31	0.11	1.93	0.03	0.04
		Straight In Arrival	372	4.0123	0.13557	3.4978	0.0436	0.026279	0.75	0.03	0.65	0.01	0.00
		Total Beech King	744						**3.06**	**0.13**	**2.58**	**0.04**	**0.04**
		Total Operation	**28460**	**Total NALF Emissions, tons per year, Alt 1**					**153.67**	**47.18**	**35.98**	**2.30**	**29.14**

Date: 13-May-2007

NOTES:

1 Start/Taxi/TO: Departure, AESO 9815 Rev E; Touch and Go: Touch and Go, AESO 9933B; Arrival with Break: Arrival with Break, AESO 9815 Rev E; Straight-In Arrival: Arrival, AESO 9815 Rev E

2 Start/Taxi/TO: Departure, AESO 9917 Rev B; Touch and Go: Touch and Go, AESO 9941 Rev A; Arrival with Break: Arrival with Break, AESO 9917 Rev B; Straight-In Arrival: Arrival, AESO 9917 Rev B

3 Start/Taxi/TO: Departure, AESO 9920 Rev B; Touch and Go: Touch and Go, AESO 9943 Rev B; Arrival with Break: Arrival with Break, AESO 9920 Rev B; Straight-In Arrival: Arrival, AESO 9920 Rev B

4 Start/Taxi/TO: Departure, AESO 9919 Rev B; Touch and Go: Touch and Go, AESO 9936 Rev B; GCA Box: GCA Box, AESO 9936 Rev B; Straight-In Arrival: Straight Arrival, AESO 9919 Rev B

5 Start/Taxi/TO: Departure, AESO 9911 Rev B; Touch and Go: Touch and Go, AESO 9948 Rev B; Straight-In Arrival: Straight Arrival, AESO 9911 Rev B; GCA Box: GCA Box, AESO 9948 Rev B

6 Start/Taxi/TO: Departure, AESO 9926; Straight-In Arrival: Arrival, AESO 9926; GCA Box: GCA Box, AESO 9942 Rev A, Touch and Go: Touch and Go, AESO 9942 Rev A

7 Start/Taxi/TO: Departure, AESO 9927 Rev A; Touch and Go: Touch and Go, AESO 9934 Rev B; Straight-In Arrival: Straight Arrival, AESO 9927 Rev A

8 Start/Taxi/TO: Departure, AESO 9929; Touch and Go: Touch and Go, AESO 9953; Straight-In Arrival: Straight Arrival, AESO 9929

9 Start/Taxi/TO: Conventional Takeoff, AESO 9913 Rev C; Arrival: Slow Landing without Break, AESO 9913 Rev C; Arrival with Break: Slow Landing with Break, AESO 9913 Rev C, Touch and Go: Touch and Go, AESO 9963 Rev A

10 Start/Taxi/TO: Departure, AESO 9915 Rev A; Touch and Go: Touch and Go, AESO 9954; Arrival with Break: Arrival with Break, AESO 9915 Rev A; Straight-In Arrival: Arrival, AESO 9915 Rev A

11 Departure from Low Approach: Departure, AESO Memorandum 2000-09 Rev B; GCA Box: GCA Box, AESO Memorandum 2000-10, Rev B.

12 To be Provided

13 Start/Taxi/TO: Assumed 73% of time-in-mode for taxi operations is associated with start/taxi/to. Emission factors from AP-42, Volume IV, Table II-1-7, 501D22A, emissions for Idle X 73%, takeoff, and climbout.
Straight In Arrival: Assumed 27% of time-in-mode for taxi operations is associated with arrival. Emission factors from AP-42, Volume IV, Table II-1-7, 501D22A, emissions for Idle X 27%, Approach.

14 Start/Taxi/TO: Assumed 73% of time-in-mode for taxi operations is associated with start/taxi/to. Emission factors from AP-42, Volume IV, Table II-1-7, TSIO-360C, emissions for Idle X 73%, takeoff, and climbout.
Straight In Arrival: Assumed 27% of time-in-mode for taxi operations is associated with arrival. Emission factors from AP-42, Volume IV, Table II-1-7, TSIO-360C, emissions for Idle X 27%, Approach.

15 Start/Taxi/TO: Assumed 73% of time-in-mode for taxi operations is associated with start/taxi/to. Emission factors from AP-42, Volume IV, Table II-1-7, TIO-540, emissions for Idle X 73%, takeoff, and climbout.
Straight In Arrival: Assumed 27% of time-in-mode for taxi operations is associated with arrival. Emission factors from AP-42, Volume IV, Table II-1-7, TIO-540, emissions for Idle X 27%, Approach.

16 Start/Taxi/TO: Assumed 73% of time-in-mode for taxi operations is associated with start/taxi/to. Emission factors from AP-42, Volume IV, Table II-1-7, PT6A-41, emissions for Idle X 73%, takeoff, and climbout.
Straight In Arrival: Assumed 27% of time-in-mode for taxi operations is associated with arrival. Emission factors from AP-42, Volume IV, Table II-1-7, PT6A-41, emissions for Idle X 27%, Approach.

17 Start/Taxi/TO: Assumed SW4 is represented by Fairchild SA-227 Metroliner, emissions from EDMS.

Table C-9. Takeoffs/Landings from NALF San Clemente Island—Alternative 2

Aircraft Type	Engine Model	Type of Operation	Total Number of Operations	Emissions per Operation, lbs/operation CO	NOx	HC	SO2	PM10	Total Emissions, tons/year CO	NOx	HC	SO2	PM10
		GRAND TOTAL	**25,120**										
Navy/Marines													
F/A-18C/D[1]	F404-GE-400		9,617										
		Start/Taxi/TO	961	69.38	10.23	24.47	0.49	7.04	33.34	4.92	11.76	0.24	3.38
		Touch and Go	3,845	0.95	4.77	0.19	0.18	2.55	1.83	9.17	0.37	0.35	4.90
		Arrival with Break	192	29.09	2.898	11.728	0.205	4.638	2.79	0.28	1.13	0.02	0.45
		Straight In Arrival	769	27.17	2.498	11.118	0.215	4.828	10.45	0.96	4.27	0.08	1.86
		Transit	4										
		Total FA-18	9,617						**48.41**	**15.33**	**17.53**	**0.68**	**10.59**
F/A-18E/F[1]	F414-GE-400		4,496										
		Start/Taxi/TO	449	209.67	16.41	31.66	0.58	7.9	47.11	3.69	7.11	0.13	1.77
		Touch and Go	1,798	0.47	9.01	0.07	0.22	3.04	0.42	8.10	0.06	0.20	2.73
		Arrival with Break	90	22.397	5.732	13.531	0.235	5.2	1.01	0.26	0.61	0.01	0.23
		Straight In Arrival	360	20.957	5.462	13.011	0.255	5.61	3.77	0.98	2.34	0.05	1.01
		Transit	2										
		Total FA-18	4,496						**52.30**	**13.03**	**10.12**	**0.38**	**5.75**
EA-6B[3]	J52-P-408A		1,255										
		Start/Taxi/TO	125	30.53	5.51	15.04	0.39	14.03	1.91	0.35	0.94	0.02	0.88
		Touch and Go	502	2.95	4.65	0.5	0.24	5.83	0.74	1.17	0.13	0.06	1.46
		Arrival with Break	0	19.812	5.426	8.793	0.372	12.367	0.00	0.00	0.00	0.00	0.00
		Straight In Arrival	125	19.972	5.526	8.723	0.402	13.357	1.25	0.35	0.55	0.03	0.84
		Total EA-6B	1,255						**3.91**	**1.86**	**1.62**	**0.11**	**3.18**
E-2[4]	T56-A-425/427		660										
		Start/Taxi/TO	33	8.08	3.83	5.56	0.23	2.29	0.13	0.06	0.09	0.00	0.04
		Touch and Go	288	0.5	2.85	0.11	0.13	1.26	0.07	0.41	0.02	0.02	0.18
		Arrival with Break	0	1.371	3.561	0.478	0.215	6.199	0.00	0.00	0.00	0.00	0.00
		Straight In Arrival	33	1.321	2.251	0.468	0.12	4.759	0.02	0.04	0.01	0.00	0.08
		Transit	18										
		Total E-2	660						**0.23**	**0.51**	**0.12**	**0.02**	**0.30**
C-2[5]	T56-A-425		460										
		Start/Taxi/TO	9	8.11	3.93	5.57	0.24	2.3	0.04	0.02	0.03	0.00	0.01
		Touch and Go	0	0.5	2.85	0.11	0.13	1.26	0.00	0.00	0.00	0.00	0.00
		GCA Box	442	0.8	4.2	0.18	0.19	1.9	0.18	0.93	0.04	0.04	0.42
		Straight In Arrival	9	1.321	2.251	0.468	0.12	1.225	0.01	0.01	0.00	0.00	0.01
		Total C2	460						**0.22**	**0.96**	**0.07**	**0.04**	**0.44**
P-3[5]	T56-A-16		229										
		Start/Taxi/TO	3	21.1	12.04	13.46	0.77	5.49	0.03	0.02	0.02	0.00	0.01
		Touch and Go	0	0.77	5.67	0.17	0.24	2.42	0.00	0.00	0.00	0.00	0.00
		Straight In Arrival	224	1.13	8.7	0.26	0.37	3.69	0.13	0.97	0.03	0.04	0.41
		GCA Box	3	16.4	9.17	11.13	0.56	5.29	0.02	0.01	0.01	0.00	0.01
		Total P3	229						**0.17**	**1.00**	**0.06**	**0.04**	**0.43**
C-9[6]	JT8D-9		826										
		Start/Taxi/TO	372	17.13	11.91	4.68	0.56	16.01	3.18	2.21	0.87	0.10	2.98
		Touch and Go	0	3.18	4.83	0.55	0.22	8.1	0.00	0.00	0.00	0.00	0.00
		Straight In Arrival	372	16.19	6.71	4.1	0.45	17.1	3.01	1.25	0.76	0.08	3.18
		GCA Box	83	5.77	7.2	1.09	0.35	12.87	0.24	0.30	0.05	0.01	0.53
		Total C-9	826						**6.43**	**3.76**	**1.68**	**0.20**	**6.69**
H-3[8]	T58-GE-402		431										
		Start/Taxi/TO	192	15.63	0.79	5.13	0.1	0.85	1.50	0.08	0.49	0.01	0.08
		Touch and Go	21	2.14	0.5	0.36	0.05	0.24	0.02	0.01	0.00	0.00	0.00
		Arrival	192	12.491	0.786	3.483	0.097	0.807	1.20	0.08	0.33	0.01	0.08
		Transits	5										
		Total C2	431						**2.72**	**0.16**	**0.83**	**0.02**	**0.16**
H-60[9]	T700-GE-401C		536										
		Start/Taxi/TO	245	5.16	1.59	0.62	0.12	1.04	0.63	0.19	0.08	0.01	0.13
		Touch and Go	5	0.94	1.14	0.09	0.07	0.72	0.00	0.00	0.00	0.00	0.00

Aircraft Type	Engine Model	Type of Operation	Total Number of Operations	Emissions per Operation, lbs/operation CO	NOx	HC	SO2	PM10	Total Emissions, tons/year CO	NOx	HC	SO2	PM10
		Arrival	245	4.595	1.14	0.635	0.095	0.725	0.56	0.14	0.08	0.01	0.09
		Transits	35										
		Total H-60	536						**1.20**	**0.34**	**0.15**	**0.03**	**0.22**
AV-8B[10]	F402-RR-408		1,146										
		Start/Taxi/TO	298	14.652	2.044	0.916	0.206	5.574	2.18	0.30	0.14	0.03	0.83
		Touch and Go	275	4.39	7.33	0.18	0.35	5.08	0.60	1.01	0.02	0.05	0.70
		Arrival	298	21.92	3.35	1.33	0.33	8.76	3.27	0.50	0.20	0.05	1.31
		Arrival with Break	0	21.57	2.53	1.33	0.28	8.16	0.00	0.00	0.00	0.00	0.00
		Total AV-8B	1,146						**6.05**	**1.81**	**0.36**	**0.13**	**2.83**
F-35	F135-PW-100		200										
		Start/Taxi/TO	0						0.00	0.00	0.00	0.00	0.00
		Touch and Go	100	0.94	22.88	0.19	0.91	4.33	0.05	1.14	0.01	0.05	0.22
		Arrival	0						0.00	0.00	0.00	0.00	0.00
		Transits	0										
		Total H-60	200						**0.05**	**1.14**	**0.01**	**0.05**	**0.22**
S-3[10]	TF34-GE-400		0										
		Start/Taxi/TO	0	29.92	2.47	5.53	0.25	1.61	0.00	0.00	0.00	0.00	0.00
		Touch and Go	0	2.17	0.95	0.26	0.08	0.61	0.00	0.00	0.00	0.00	0.00
		Arrival with Break	0	12.905	2.081	2.172	0.199	1.511	0.00	0.00	0.00	0.00	0.00
		Straight In Arrival	0	12.325	1.561	2.122	0.169	1.291	0.00	0.00	0.00	0.00	0.00
		Transits	0										
		Total S-3	0						**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Other Military													
KC-135[11]	F108-100		30										
		Departure from Lo	14	0.708	13.5	0.032	0.787	0.781	0.00	0.09	0.00	0.01	0.01
		GCA Box	14	0.373	8.73	0.0168	0.415	0.342	0.00	0.06	0.00	0.00	0.00
		Transit	3										
		Total KC-135	30						**0.01**	**0.15**	**0.00**	**0.01**	**0.01**
KC-10	CF6-50C2		100										
		Departure from Lo	45	20.98	49.41	2.53	2.54	0.33	0.47	1.11	0.06	0.06	0.01
		GCA Box	45	24.03	11.49	2.60	1.71	0.01	0.54	0.26	0.06	0.04	0.00
		Transit	10										
		Total KC-10	100						**1.01**	**1.37**	**0.12**	**0.10**	**0.01**
C-17	F117-PW-100		400										
		Start/Taxi/TO	200	23.54	64.03	2.24	1.52	0.02	2.35	6.40	0.22	0.15	0.00
		Straight In Arrival	200	25.09	17.40	2.44	1.10	0.01	2.51	1.74	0.24	0.11	0.00
		Total C-17	400						**4.86**	**8.14**	**0.47**	**0.26**	**0.00**
B-1	F108-100		426										
		Departure from Low Approach	192	0.708	13.5	0.032	0.787	0.781	0.07	1.29	0.00	0.08	0.07
		GCA Box	192	0.373	8.73	0.0168	0.415	0.342	0.04	0.84	0.00	0.04	0.03
		Transit	43						**0.10**	**2.13**	**0.00**	**0.12**	**0.11**
		Total B-1	426										
E-3[12] or F-16	TF33-100A		355										
		Touch and Go	142	1.25	9.06	0.096	0.964	1.25	0.09	0.64	0.01	0.07	0.09
		Arrival with Break	28	24.97	3.32	15.97	0.26	5.48	0.35	0.05	0.23	0.00	0.08
		Straight In Arrival	7	25.00	3.75	15.99	0.27	5.54	0.09	0.01	0.06	0.00	0.02
		Transit	36										
		Total F-16	355						**0.53**	**0.70**	**0.29**	**0.07**	**0.19**
T-38			178										
		Touch and Go	71	1.10	1.87	0.08	0.06	0.52	0.04	0.07	0.00	0.00	0.02
		Arrival with Break	14	9.05	2.19	5.43	0.14	2.49	0.06	0.02	0.04	0.00	0.02
		Straight In Arrival	4	8.69	2.05	5.28	0.12	2.17	0.02	0.00	0.01	0.00	0.00
		Transit	18										
		Total T-38	178						**0.12**	**0.09**	**0.05**	**0.00**	**0.04**
Air Carrier													
SW-4[17]	PT6A-45		6,838										
		Start/Taxi/TO	3,419	0.75	0.49	0.12	0.07	0.08	1.29	0.84	0.20	0.12	0.13
		Straight In Arrival	3,419	1.14	0.67	0.12	0.12	0.15	1.94	1.14	0.20	0.20	0.25
		Total SW-4	6,838						**3.23**	**1.98**	**0.40**	**0.33**	**0.39**

Aircraft Type	Engine Model	Type of Operation	Total Number of Operations	Emissions per Operation, lbs/operation CO	NOx	HC	SO2	PM10	Total Emissions, tons/year CO	NOx	HC	SO2	PM10
Gen. Aviation													
Cessna 421[14]	TSIO-360C		1,518										
		Start/Taxi/TO	741	21.387	0.086943	1.1906	0.006083	0.196921	7.93	0.03	0.44	0.00	0.07
		Straight In Arrival	741	3.993	0.011157	0.3929	0.001577	0.026279	1.48	0.00	0.15	0.00	0.01
		Transits	36										
		Total Cessna 421	1,518						**9.41**	**0.04**	**0.59**	**0.00**	**0.08**
Piper Navajo[15]	TI0-540		1,138										
		Start/Taxi/TO	551	64.413	0.030849	1.5634	0.012659	0.196921	17.76	0.01	0.43	0.00	0.05
		Straight In Arrival	551	13.827	0.003841	0.4531	0.003174	0.026279	3.81	0.00	0.12	0.00	0.01
		Transits	35										
		Total Piper Navajo	1,138						**21.57**	**0.01**	**0.56**	**0.00**	**0.06**
Beech King[16]	PT6A-34B		789										
		Start/Taxi/TO	395	12.416	0.58223	10.397	0.1746	0.196921	2.45	0.11	2.05	0.03	0.04
		Straight In Arrival	395	4.0123	0.13557	3.4978	0.0436	0.026279	0.79	0.03	0.69	0.01	0.01
		Total Beech King	789						**3.24**	**0.14**	**2.74**	**0.04**	**0.04**
			31628	**Total NALF Emissions, tons per year, Alt 2**					**165.78**	**54.63**	**37.75**	**2.65**	**31.72**

Date: 13-May-2007

NOTES:

1 Start/Taxi/TO: Departure, AESO 9815 Rev E; Touch and Go: Touch and Go, AESO 9933B; Arrival with Break: Arrival with Break, AESO 9815 Rev E; Straight-In Arrival: Arrival, AESO 9815 Rev E

2 Start/Taxi/TO: Departure, AESO 9917 Rev B; Touch and Go: Touch and Go, AESO 9941 Rev A; Arrival with Break: Arrival with Break, AESO 9917 Rev B; Straight-In Arrival: Arrival, AESO 9917 Rev B

3 Start/Taxi/TO: Departure, AESO 9920 Rev B; Touch and Go: Touch and Go, AESO 9943 Rev B; Arrival with Break: Arrival with Break, AESO 9920 Rev B; Straight-In Arrival: Arrival, AESO 9920 Rev B

4 Start/Taxi/TO: Departure, AESO 9919 Rev B; Touch and Go: Touch and Go, AESO 9936 Rev B; GCA Box: GCA Box, AESO 9936 Rev B; Straight-In Arrival: Straight Arrival, AESO 9919 Rev B

5 Start/Taxi/TO: Departure, AESO 9911 Rev B; Touch and Go: Touch and Go, AESO 9948 Rev B; Straight-In Arrival: Straight Arrival, AESO 9911 Rev B; GCA Box: GCA Box, AESO 9948 Rev B

6 Start/Taxi/TO: Departure, AESO 9926; Straight-In Arrival: Arrival, AESO 9926; GCA Box: GCA Box, AESO 9942 Rev A, Touch and Go: Touch and Go, AESO 9942 Rev A

7 Start/Taxi/TO: Departure, AESO 9927 Rev A; Touch and Go: Touch and Go, AESO 9934 Rev B; Straight-In Arrival: Straight Arrival, AESO 9927 Rev A

8 Start/Taxi/TO: Departure, AESO 9929; Touch and Go: Touch and Go, AESO 9953; Straight-In Arrival: Straight Arrival, AESO 9929

9 Start/Taxi/TO: Conventional Takeoff, AESO 9913 Rev C; Arrival: Slow Landing without Break, AESO 9913 Rev C; Arrival with Break: Slow Landing with Break, AESO 9913 Rev C, Touch and Go: Touch and Go, AESO 9963 Rev A

10 Start/Taxi/TO: Departure, AESO 9915 Rev A; Touch and Go: Touch and Go, AESO 9954; Arrival with Break: Arrival with Break, AESO 9915 Rev A; Straight-In Arrival: Arrival, AESO 9915 Rev A

11 Departure from Low Approach: Departure, AESO Memorandum 2000-09 Rev B; GCA Box: GCA Box, AESO Memorandum 2000-10, Rev B.

12 To be Provided

13 Start/Taxi/TO: Assumed 73% of time-in-mode for taxi operations is associated with start/taxi/to. Emission factors from AP-42, Volume IV, Table II-1-7, 501D22A, emissions for Idle X 73%, takeoff, and climbout.
Straight In Arrival: Assumed 27% of time-in-mode for taxi operations is associated with arrival. Emission factors from AP-42, Volume IV, Table II-1-7, 501D22A, emissions for Idle X 27%, Approach.

14 Start/Taxi/TO: Assumed 73% of time-in-mode for taxi operations is associated with start/taxi/to. Emission factors from AP-42, Volume IV, Table II-1-7, TSIO-360C, emissions for Idle X 73%, takeoff, and climbout.
Straight In Arrival: Assumed 27% of time-in-mode for taxi operations is associated with arrival. Emission factors from AP-42, Volume IV, Table II-1-7, TSIO-360C, emissions for Idle X 27%, Approach.

15 Start/Taxi/TO: Assumed 73% of time-in-mode for taxi operations is associated with start/taxi/to. Emission factors from AP-42, Volume IV, Table II-1-7, TIO-540, emissions for Idle X 73%, takeoff, and climbout.
Straight In Arrival: Assumed 27% of time-in-mode for taxi operations is associated with arrival. Emission factors from AP-42, Volume IV, Table II-1-7, TIO-540, emissions for Idle X 27%, Approach.

16 Start/Taxi/TO: Assumed 73% of time-in-mode for taxi operations is associated with start/taxi/to. Emission factors from AP-42, Volume IV, Table II-1-7, PT6A-41, emissions for Idle X 73%, takeoff, and climbout.
Straight In Arrival: Assumed 27% of time-in-mode for taxi operations is associated with arrival. Emission factors from AP-42, Volume IV, Table II-1-7, PT6A-41, emissions for Idle X 27%, Approach.

17 Start/Taxi/TO: Assumed SW4 is represented by Fairchild SA-227 Metroliner, emissions from EDMS.

Table C-10. SOCAL Ordnance Expenditures—No Action Alternative

NOTE: Units of Measure (UOM) for ordnance rounds are 1 each (ea.) and for Demolitions and Other Ordnance are in pounds Net Explosive Weight (NEW).								Emission Factor (lb per lb or lb per item)							Emissions, tons/year						
Ordnance Group	**AQ Data**	**Ordnance Type**	**Fate**	**Quantity Fired**	**Consolidated Nos.**	**NEW ea.**	**UOM/ Cum NEW**	**CO2**	**CO**	**Nox**	**PM10**	**PM2.5**	**SO2**	**Lead**	**CO2**	**CO**	**Nox**	**PM10**	**PM2.5**	**SO2**	**Lead**
BOMB		CBU MK20 ROCKEYE	Clusters Explode Underwater	13		99	ea.														
	No Data	GBU32I JDAM	Clusters Explode Underwater	9		385	ea.														
	No Data	LGTR	Rocket fires Inert warhead	103		0	ea.														
		MK76	Only small spotting charge	1,496		Neg.	ea.														
	No Data	BDU 48	Only small spotting charge	93		Neg.	ea.														
		MK82 HE		418		192	ea.		0.3184						0	12.77676	0	0	0	0	0
	No Data	GBU12 500 lb		12		192	ea.														
	NA	MK82 INERT	No emissions	18		0	ea.														
	No Data	BDU 45		162		0	ea.														
		MK83 HE		116		445	ea.		0.1482						0	3.825042	0	0	0	0	0
	No Data	GBU 16		28		445	ea.														
	NA	MK83 INERT		93		0	ea.														
		Total:		**2,561**	**0**																
OTHER ORD	**No AQ data**	**Type**		**No.**		**NEW**															
	CNAP & SPAWAR	EER/IEER AN/SQQ-110	Explode deep in water			4.2	0	1.2	0.0044	0.011				0.00004	0	0	0	0	0	0	0
	No Data	BLASTING CAP MK11	On Land only	1,113		Neg.	0														
		Detonator		120																	
	No Data	FIRING DEVICE		54		Neg.	0														
	No Data	FUSE		1,080		Neg.	0														
		GRENADE SIMULATOR	Land	290		0.0813	23.6	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0.007427	0.000248	7.42676E-05	0.000248	0.000177	1.41462E-06	1.65E-06
		Grenades	Land	896		0.0813	72.8	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0.022946	0.000765	0.000229461	0.000765	0.000546	4.37069E-06	5.1E-06
		Haversacks		75		20.0000	1500.0	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04							
		K143 Antipersonnel Mine		124																	
	No Data	M1A2 BANGALORE TORP	Land	109		10.00	1090								0	0	0	0	0	0	0
		M7 BANDOLEER MK57 (Claymore mine)	Land	40		8.16	326.4		0.15108						0	0.024656	0	0	0	0	0
	AP-42	M112 DEMO CHARGE	Land	105		1.20	126	7.90E-01	2.60E-02	7.90E-03	2.60E-02	1.90E-02		1.70E-04	0.04977	0.001638	0.0004977	0.001638	0.001197	0	1.07E-05
	No Data	M700 BLASTING FUSE	Land	1,000		0.001	1														
	No Data	MK20 Cable Cutter	Land	69		0.0028	0.2														
	No Data	MK22 Projectile Unit	Land	105		Neg.	Neg.														
	No Data	MK36 M0 DEMO CHARGE	Land	30		4.10	123								0	0	0	0	0	0	0
	No Data	MK75 CHARGE	In Shallow water	105		50.00	5,250								0	0	0	0	0	0	0
	No Data	MK84 [86] EOD Shaped Charge	On Land only	109		0.08	8.72								0	0	0	0	0	0	0
	No Data	MK120 NONELEC DET (ft)	On Land only	512		0.00001	0.0073														
	No Data	MK123 NONELEC DET (ft)	On Land only	2,120		0.00001	0.0303														
	No Data	MK138 DEMO CHG ASSEMBLY	In water			20.00	0	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0	0	0	0	0	0	0
	No Data	MK140 FLEXIBLE CHARGE	On Land only	150		0.04	6.6														
	No Data	PBXN-109 TEST Det Cord	On Land only	16		0.0060	0.096														
	No Data	SIGNAL MK 18(G950) SMOKE	On Land only	355		0.23	82.786														
	No Data	C4 1.25 LB		19,260		1.25	24075	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	7.58E+00	0.252788	0.07583625	0.252788	0.180563	0.0014445	0.001685
	No Data	C4 5 LB	On Land only			5.00	0	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0	0	0	0	0	0	0

Ordnance Group	AQ Data	Ordnance Type	Fate	Quantity Fired	Consolidated Nos.	NEW ea.	UOM/ Cum NEW	CO2	CO	Nox	PM10	PM2.5	SO2	Lead	CO2	CO	Nox	PM10	PM2.5	SO2	Lead
	No Data	C4 15 LB	On Land only	20		15.00	300	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	9.45E-02	0.00315	0.000945	0.00315	0.00225	0.000018	0.000021
	No Data	C4 40 LB	On Land only	3,600		40.00	144000	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	4.54E+01	1.512	0.4536	1.512	1.08	0.00864	0.01008
	No Data	C4 100 LB	On Land only	400		100.00	40000	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	12.6	0.42	0.126	0.42	0.3	0.0024	0.0028
	No Data	C4 300 LB	On Land only	12,260		1.00	12260	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	3.8619	0.12873	0.038619	0.12873	0.09195	0.0007356	0.000858
	No Data	C4 500 LB	On Land only	15,100		1.00	15100	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	4.7565	0.15855	0.047565	0.15855	0.11325	0.000906	0.001057
	No Data	TNT Blocks 0.5 lbd	On Land only	885		1.00	885		0.398							0.176115					
	No Data	DEMO SHEET	On Land only	263		6.00	1578														
	No Data	DETONATING CORD		34,000		0.006	204														
	No Data	DEMO CHARGE	Land	30		5.00	150														
	AP-42	SIMULATED ARTILLERY	M110 Land	210		0.1375	28.875	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0.009096	0.000303	9.09563E-05	0.000303	0.000217	1.7325E-06	2.02E-06
		Totals		**94,605**			**247,192**														
GUNFIRE (Large)	AP-42	155MM HE		238			ea.	6.51	2.35E+01	1.43E+00	0.496	0.2418		2.26E-03	0.77469	2.794215	0.169694	0.059024	0.028774	0	0.000269
	AP-42	155MM ILL		8			ea.	1.8	2.62E-02	9.40E-02	3	3		5.80E-05	0.0072	0.000105	0.000376	0.012	0.012	0	2.32E-07
		122 MM		40																	
5"/54		5"/54 BLP	BLP is INERT	5,178			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.041424	0.05178	0	0.003107	0.002408	0	1.55E-05
		5"/54 HCVT+32 (EOD)		195			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.00156	0.00195	0	0.000117	9.07E-05	0	5.85E-07
		5"/54 HECVT		2,442			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.019536	0.02442	0	0.001465	0.001136	0	7.33E-06
		5"/54 HEPD		85			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.00068	0.00085	0	0.000051	3.95E-05	0	2.55E-07
		5"/54 HEVT		183			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.001464	0.00183	0	0.00011	8.51E-05	0	5.49E-07
		5"/54 ILL		110			ea.	1.50E-02	1.40E-02	3.60E-04	9.20E-04	7.60E-04		1.30E-06	0.000825	0.00077	0.0000198	5.06E-05	4.18E-05	0	7.15E-08
		5"54/54 VTNF		50			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.0004	0.0005	0	0.00003	2.33E-05	0	1.5E-07
5"/62		5"/62		631			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.005048	0.00631	0	0.000379	0.000293	0	1.89E-06
		5"/62 HE-MFF		84			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.000672	0.00084	0	5.04E-05	3.91E-05	0	2.52E-07
		5"/62 HECVT		831			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.006648	0.00831	0	0.000499	0.000386	0	2.49E-06
		5"/62 HEET		8			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.000064	0.00008	0	4.8E-06	3.72E-06	0	2.4E-08
		5"/62 KEET		37			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.000296	0.00037	0	2.22E-05	1.72E-05	0	1.11E-07
60mm	AP-42	60MM		234			ea.	2.90E-01	3.00E-02	4.20E-03	3.20E-02	1.70E-02		2.30E-04	0.03393	0.00351	0.0004914	0.003744	0.001989	0	2.69E-05
		60MM WP					ea.	2.90E-01	3.00E-02	4.20E-03	3.20E-02	1.70E-02		2.30E-04	0	0	0	0	0	0	0
76mm		76MM BLP	INERT	1,534			ea.	1.44E-02	1.80E-02		1.08E-03	8.37E-04		5.40E-06	0.011045	0.013806	0	0.000828	0.000642	0	4.14E-06
	AP-42	81MM HE		303			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.002424	0.00303	0	0.000182	0.000141	0	9.09E-07
	AP-42	81MM ILL		18			ea.	1.50E-02	1.40E-02	3.60E-04	9.20E-04	7.60E-04		1.30E-06	0.000135	0.000126	0.00000324	8.28E-06	6.84E-06	0	1.17E-08
CAS	No data	GAU-17 30mm					ea.														
		Total:		**12,209**																	
GUNFIRE (small)	AMW 114,1125	20MM	Fired by aircraft at low alt.	1,429,225			ea.														
		25MM	Fired by ship	55,309			ea.														
	No Data	30MM EFV Main Gun	Fired on land or sea	1,425			ea.														
	AP-42	40MM	NSW on land	4,260			ea.	2.60E-04	3.50E-04	3.60E-05	2.60E-05	2.30E-05		6.70E-04	0.000554	0.000746	0.00007668	5.54E-05	4.9E-05	0	0.001427
	AP-42	40MM HE	NSW on land	745			ea.	6.60E-02	7.00E-03	1.60E-03	1.30E-02	6.60E-03		7.30E-05	0.024585	0.002608	0.000596	0.004843	0.002459	0	2.72E-05
	No Data	40MM ILL	NSW on land	352			ea.	2.60E-04	3.50E-04	3.60E-05	2.60E-05	2.30E-05		6.70E-04	4.58E-05	6.16E-05	0.000006336	4.58E-06	4.05E-06	0	0.000118
	AP-42	40MM PRACTICE	NSW on land	2,548			ea.	2.60E-04	3.50E-04	3.60E-05	2.60E-05	2.30E-05		6.70E-04	0.000331	0.000446	0.000045864	3.31E-05	2.93E-05	0	0.000854
	AP-42	.45 CAL	NSW and USMC	5,730			ea.	2.20E-04	2.60E-04	8.10E-06	3.70E-05	3.10E-05		1.20E-05	0.00063	0.000745	2.32065E-05	0.000106	8.88E-05	0	3.44E-05
	AP-42	5.56	NSW and USMC	1,457,152			ea.	8.70E-04	1.60E-03	8.50E-05	3.90E-05	2.80E-05		5.10E-06	0.633861	1.165722	0.06192896	0.028414	0.0204	0	0.003716
	AP-42	5.56 BLANK	NSW and USMC	2,450			ea.	2.30E-04	2.80E-04	2.00E-05	6.90E-06	2.00E-06		9.70E-07	0.000282	0.000343	0.0000245	8.45E-06	2.45E-06	0	1.19E-06
	AP-42	.50CAL	NSW and USMC	262,957			ea.	5.10E-03	1.10E-02	1.20E-03	3.10E-04	1.90E-04		1.30E-05	0.67054	1.446264	0.1577742	0.040758	0.024981	0	0.001709
		.50CAL	USCG	12,000			ea.	5.10E-03	1.10E-02	1.20E-03	3.10E-04	1.90E-04		1.30E-05	0.0306	0.066	0.0072	0.00186	0.00114	0	0.000078
	AP-42	.50CAL BLANK	NSW and USMC	10,000			ea.	2.10E-03	1.80E-03	2.80E-05	9.80E-05	8.80E-05		1.20E-05	0.0105	0.009	0.00014	0.00049	0.00044	0	0.00006
	AP-42	7.62	NSW and USMC	110,440			ea.	1.20E-03	2.30E-03	9.70E-05	5.10E-05	3.80E-05		4.90E-06	0.066264	0.127006	0.00535634	0.002816	0.002098	0	0.000271
		7.62	USCG	21,000			ea.	1.20E-03	2.30E-03	9.70E-05	5.10E-05	3.80E-05		4.90E-06	0.0126	0.02415	0.0010185	0.000536	0.000399	0	5.15E-05
	AP-42	9MM	NSW and USMC	1,060,000			ea.	2.00E-04	3.10E-04	1.50E-05	2.40E-05	2.00E-05		6.80E-06	0.106	0.1643	0.00795	0.01272	0.0106	0	0.003604
	No Data	.300 WIN MAG	Environmental Contractors				ea.	2.00E-04	3.10E-04	1.50E-05	2.40E-05	2.00E-05		6.80E-06	0	0	0	0	0	0	0
	No Data	.223 Rifle Rounds	Environmental Contractors				ea.	6.80E-05	7.20E-05	3.10E-06	2.60E-06	1.90E-06		1.80E-06	0	0	0	0	0	0	0
	No Data	.22 Magnum	Environmental Contractors				ea.	7.50E-05	8.00E-05	5.00E-06	3.40E-06	2.60E-06		1.90E-06	0	0	0	0	0	0	0
	AP-42	.22 Long Rifle	Environmental Contractors				ea.	6.80E-05	7.20E-05	3.10E-06	2.60E-06	1.90E-06		1.80E-06	0	0	0	0	0	0	0
		12 Guage Shotgun	Environmental Contractors				ea.	5.10E-03	1.10E-02	1.20E-03	3.10E-04	1.90E-04		1.30E-05	0	0	0	0	0	0	0
		Total:		**4,435,593**																	
MINE SHAPE	AP-42	M18A1		105			ea.	1.6	2.00E-02	1.80E-02	4.90E-02	2.60E-02		5.70E-05	0.084	0.00105	0.000945	0.002573	0.001365	0	2.99E-06
		MK76		64			ea.														
		MK62		12			ea.	No emissions													
		Total:		**181**																	
MISSILE		AGM-114B	Fired at low altitude	14			ea.														
		AGM-65 Maverick		3																	
		AGM-84		7																	
		AIM-120	Fired well above 3,000 ft	4			ea.														
		AIM-7	Fired well above 3,000 ft	7			ea.														
		AIM-9	Fired well above 3,000 ft	5			ea.														
		BGM-71E TOW-A	Fired at ground level	1			ea.														
		GBU-9		9																	
		HARM		2																	
AW 25		NSM	Fired at ocean surface				ea.														
		JSOW	No emissions	3			ea.														
		Japanese Missile Tests					ea.														
		Tactical Tomahawk					ea.														
		Seasparrow Missile		2																	
		SLAM ER		1																	
		SM2 or equivalent	Fired from ship-to-air	5			ea.														
		Total:		**63**																	
ROCKET		2.75" RKT		353			ea.	4.50E-01	5.60E-02	7.10E-03	6.10E-02	3.80E-02		1.20E-03	0.079425	0.009884	0.00125315	0.010767	0.006707	0	0.000212
		2.75" RKT HE					ea.	4.50E-01	5.60E-02	7.10E-03	6.10E-02	3.80E-02		1.20E-03	0	0	0	0	0	0	0
		2.75" RKT I	INERT Warhead				ea.	4.50E-01	5.60E-02	7.10E-03	6.10E-02	3.80E-02		1.20E-03	0	0	0	0	0	0	0
		Total:		**353**																	

Ordnance Group	AQ Data	Ordnance Type	Fate	Quantity Fired	Consolidated Nos.	NEW ea.	UOM/ Cum NEW	CO2	CO	Nox	PM10	PM2.5	SO2	Lead	CO2	CO	Nox	PM10	PM2.5	SO2	Lead
FLARES		**FLARES****		**647**			**ea.**														
SMOKE		MK58 Marine Location Marker		8			ea.	1	1.30E-02	1.20E-02	3.20E-02	1.70E-02	6.10E-05	3.80E-05	0.004	0.000052	0.000048	0.000128	0.000068	0.000000244	1.52E-07
		SMOKE GRENADE		76			ea.	1	1.30E-02	1.20E-02	3.20E-02	1.70E-02	6.10E-05	3.80E-05	0.038	0.000494	0.000456	0.001216	0.000646	0.000002318	1.44E-06
		Total:		**84**																	
TORPEDO	NA	MK30	No emissions	235			ea.														
	NA	MK39	No emissions	992			ea.														
	NA	MK46	No emissions	8			ea.														
	NA	MK46-HOVER	No emissions				ea.														
	NA	MK46-LAMPS	No emissions				ea.														
	NA	MK-46-REX-FLYIN	No emissions				ea.														
	NA	MK46-REX-HOVER	No emissions				ea.														
	NA	MK46-REX-LAMPS	No emissions				ea.														
	NA	MK46-EXTORP	No emissions	66			ea.														
	NA	MK50-REX-FLYIN	No emissions	12			ea.														
	NA	MK50-REX-LAMPS	No emissions				ea.														
	NA	REXTORP-46	No emissions	98			ea.														
	NA	REXTORP-50	No emissions	16			ea.														
	NA	MK46-REX-SVTT	No emissions	12			ea.														
	NA	MK46-SVTT	No emissions				ea.														
	NA	MK46-VLA	No emissions				ea.														
	NA	REXTORP	No emissions				ea.														
	NA	MK48-ADCAP	No emissions	69			ea.														
	NA	MK48-ER	No emissions				ea.														
	NA	MK48-STD	No emissions				ea.														
	NA	MK54	No emissions	2			ea.														
		SSN	No emissions	58			ea.														
		Total:		**1,568**																	
		GRAND TOTAL ROUNDS		**4,547,864**																	
		GRAND TOTAL POUNDS NEW					**247,192**														
													SOCAL/SCI		76.97	25.12	1.15	2.66	1.89	0.01	0.03
													SOCAL/SD		0.04	0.09	0.01	0.00	0.00	0.00	0.00

Date: 13-May-2007

Table C-11. SOCAL Ordnance Expenditures—Alternative 1

NOTE: Units of Measure (UOM) for ordnance rounds are 1 each (ea.) and for Demolitions and Other Ordnance are in pounds Net Explosive Weight (NEW).								Emission Factor (lb per lb or lb per item)							Emissions, tons/year						
Ordnance Group	AQ Data	Ordnance Type	Fate	Quantity Fired	Consolidated Nos.	NEW ea.	UOM/ Cum NEW	CO2	CO	Nox	PM10	PM2.5	SO2	Lead	CO2	CO	Nox	PM10	PM2.5	SO2	Lead
BOMB		CBU MK20 ROCKEYE	Clusters Explode Underwater	14		99	ea.														
	No Data	GBU32I JDAM	Clusters Explode Underwater	10		385	ea.														
	No Data	LGTR	Rocket fires Inert warhead	226		0	ea.														
		MK76	Only small spotting charge	1,675		Neg.	ea.														
	No Data	BDU 48	Only small spotting charge	105		Neg.	ea.														
		MK82 HE		478		192	ea.		0.3184						0	14.61074	0	0	0	0	0
	No Data	GBU12 500 lb		13		192	ea.														
	NA	MK82 INERT	No emissions	20		0	ea.														
	No Data	BDU 45		181		0	ea.														
		MK83 HE		134		445	ea.		0.1482						0	4.418583	0	0	0	0	0
	No Data	GBU 16		31		445	ea.														
	NA	MK83 INERT		105		0	ea.														
		Total:		2,992	0																
OTHER ORD	No AQ data	Type		No.		NEW															
	CNAP & SPAWAR	EER/IEER AN/SQQ-110	Explode deep in water			4.2	0	1.2	0.0044	0.011				0.00004	0	0	0	0	0	0	0
	No Data	BLASTING CAP MK11	On Land only	2,156		Neg.	0														
		Detonator		240																	
	No Data	FIRING DEVICE		91		Neg.	0														
	No Data	FUSE		1,728		Neg.	0														
		GRENADE SIMULATOR	Land	460		0.0813	37.4	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0.01178	0.000393	0.000117804	0.000393	0.00028	2.24388E-06	2.62E-06
		Grenades	Land	1,787		0.0813	145.3	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0.045764	0.001525	0.000457642	0.001525	0.00109	8.71699E-06	1.02E-05
		Haversacks		88		20.0000	1760.0	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04							
		K143 Antipersonnel Mine		240																	
	No Data	M1A2 BANGALORE TORP	Land	248		10.00	2480								0	0	0	0	0	0	0
		M7 BANDOLEER MK57 (Claymore mine)	Land	68		8.16	554.88		0.15108						0	0.041916	0	0	0	0	0
	AP-42	M112 DEMO CHARGE	Land	158		1.20	189.6	7.90E-01	2.60E-02	7.90E-03	2.60E-02	1.90E-02		1.70E-04	0.074892	0.002465	0.00074892	0.002465	0.001801	0	1.61E-05
	No Data	M700 BLASTING FUSE	Land	1,506		0.001	1.506														
	No Data	MK20 Cable Cutter	Land	163		0.0028	0.5														
	No Data	MK22 Projectile Unit	Land	158		Neg.	Neg.														
	No Data	MK36 M0 DEMO CHARGE	Land	45		4.10	184.5								0	0	0	0	0	0	0
	No Data	MK75 CHARGE	In Shallow water	217		50.00	10,850								0	0	0	0	0	0	0
	No Data	MK84 [86] EOD Shaped Charge	On Land only	166		0.08	13.28								0	0	0	0	0	0	0
	No Data	MK120 NONELEC DET (ft)	On Land only	771		0.00001	0.0110														
	No Data	MK123 NONELEC DET (ft)	On Land only	3,192		0.00001	0.0456														
	No Data	MK138 DEMO CHG ASSEMBLY	In water			20.00	0	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0	0	0	0	0	0	0
	No Data	MK140 FLEXIBLE CHARGE	On Land only	226		0.04	9.944														
		MK258		360																	
	No Data	PBXN-109 TEST Det Cord	On Land only	30		0.0060	0.18														
	No Data	SIGNAL MK 18(G950) SMOKE	On Land only	530		0.23	123.596														
	No Data	C4 1 LB		415		1.00	415	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	1.31E-01	0.004358	0.00130725	0.004358	0.003113	0.0000249	2.91E-05

Ordnance Group	AQ Data	Ordnance Type	Fate	Quantity Fired	Consolidated Nos.	NEW ea.	UOM/ Cum NEW	CO2	CO	Nox	PM10	PM2.5	SO2	Lead	CO2	CO	Nox	PM10	PM2.5	SO2	Lead
	No Data	C4 1.25 LB		31,872		1.25	39840	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	1.25E+01	0.41832	0.125496	0.41832	0.2988	0.0023904	0.002789
	No Data	C4 5 LB	On Land only			5.00	0	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0	0	0	0	0	0	0
	No Data	C4 15 LB	On Land only	40		15.00	600	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	1.89E-01	0.0063	0.00189	0.0063	0.0045	0.000036	0.000042
	No Data	C4 40 LB	On Land only	3,762		40.00	150480	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	4.74E+01	1.58004	0.474012	1.58004	1.1286	0.0090288	0.010534
	No Data	C4 100 LB	On Land only	500		100.00	50000	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	15.75	0.525	0.1575	0.525	0.375	0.003	0.0035
	No Data	C4 300 LB	On Land only	12,896		1.00	12896	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	4.06224	0.135408	0.0406224	0.135408	0.09672	0.00077376	0.000903
	No Data	C4 500 LB	On Land only	15,863		1.00	15863	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	4.996845	0.166562	0.04996845	0.166562	0.118973	0.00095178	0.00111
	No Data	TNT Blocks 0.5 lbd	On Land only	925		1.00	925		0.398							0.184075					
	No Data	DEMO SHEET	On Land only	462		6.00	2772														
	No Data	DETONATING CORD		74,500		0.006	447														
	No Data	DEMO CHARGE	Land	57		5.00	285														
	AP-42	SIMULATED ARTILLERY	M110 Land	316		0.1375	43.45	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0.013687	0.000456	0.000136868	0.000456	0.000326	0.000002607	3.04E-06
		Totals		**156,236**			**290,917**														
GUNFIRE (Large)	AP-42	155MM HE		1,101			ea.	6.51	2.35E+01	1.43E+00	0.496	0.2418		2.26E-03	3.583755	12.92618	0.785013	0.273048	0.133111	0	0.001246
	AP-42	155MM ILL		57			ea.	1.8	2.62E-02	9.40E-02	3	3		5.80E-05	0.0513	0.000747	0.002679	0.0855	0.0855	0	1.65E-06
		122 MM		40																	
5"/54		5"/54 BLP	BLP is INERT	5,822			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.046576	0.05822	0	0.003493	0.002707	0	1.75E-05
		5"/54 HCVT+32 (EOD)		207			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.001656	0.00207	0	0.000124	9.63E-05	0	6.21E-07
		5"/54 HECVT		2,585			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.02068	0.02585	0	0.001551	0.001202	0	7.76E-06
		5"/54 HEPD		90			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.00072	0.0009	0	0.000054	4.19E-05	0	2.7E-07
		5"/54 HEVT		195			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.00156	0.00195	0	0.000117	9.07E-05	0	5.85E-07
		5"/54 ILL		117			ea.	1.50E-02	1.40E-02	3.60E-04	9.20E-04	7.60E-04		1.30E-06	0.000878	0.000819	0.00002106	5.38E-05	4.45E-05	0	7.61E-08
		5"54/54 VTNF		53			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.000424	0.00053	0	3.18E-05	2.46E-05	0	1.59E-07
5"/62		5"/62		1,136			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.009088	0.01136	0	0.000682	0.000528	0	3.41E-06
		5"/62 HE-MFF		70			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.00056	0.0007	0	0.000042	3.26E-05	0	2.1E-07
		5"/62 HECVT		814			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.006512	0.00814	0	0.000488	0.000379	0	2.44E-06
		5"/62 HEET		3			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.000024	0.00003	0	1.8E-06	1.4E-06	0	9E-09
		5"/62 KEET		15			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.00012	0.00015	0	0.000009	6.98E-06	0	4.5E-08
60mm	AP-42	60MM		245			ea.	2.90E-01	3.00E-02	4.20E-03	3.20E-02	1.70E-02		2.30E-04	0.035525	0.003675	0.0005145	0.00392	0.002083	0	2.82E-05
		60MM WP					ea.	2.90E-01	3.00E-02	4.20E-03	3.20E-02	1.70E-02		2.30E-04	0	0	0	0	0	0	0
76mm		76MM BLP	INERT	1,872			ea.	1.44E-02	1.80E-02		1.08E-03	8.37E-04		5.40E-06	0.013478	0.016848	0	0.001011	0.000783	0	5.05E-06
	AP-42	81MM HE		324			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.002592	0.00324	0	0.000194	0.000151	0	9.72E-07
	AP-42	81MM ILL		21			ea.	1.50E-02	1.40E-02	3.60E-04	9.20E-04	7.60E-04		1.30E-06	0.000158	0.000147	0.00000378	9.66E-06	7.98E-06	0	1.37E-08
		122MM Main Tank Gun		120																	
CAS	No data	GAU-17 30mm					ea.														
		Total:		**14,887**																	
GUNFIRE (small)	AMW 114,1125	20MM	Fired by aircraft at low alt.	1,906,588			ea.														
		25MM	Fired by ship	61,479			ea.														
	No Data	30MM EFV Main Gun	Fired on land or sea	2,759			ea.														
	AP-42	40MM	NSW on land	5,880			ea.	2.60E-04	3.50E-04	3.60E-05	2.60E-05	2.30E-05		6.70E-04	0.000764	0.001029	0.00010584	7.64E-05	6.76E-05	0	0.00197
	AP-42	40MM HE	NSW on land	833			ea.	6.60E-02	7.00E-03	1.60E-03	1.30E-02	6.60E-03		7.30E-05	0.027489	0.002916	0.0006664	0.005415	0.002749	0	3.04E-05
	No Data	40MM ILL	NSW on land	422			ea.	2.60E-04	3.50E-04	3.60E-05	2.60E-05	2.30E-05		6.70E-04	5.49E-05	7.39E-05	0.000007596	5.49E-06	4.85E-06	0	0.000141
	AP-42	40MM PRACTICE	NSW on land	2,771			ea.	2.60E-04	3.50E-04	3.60E-05	2.60E-05	2.30E-05		6.70E-04	0.00036	0.000485	0.000049878	3.6E-05	3.19E-05	0	0.000928
	AP-42	.45 CAL	NSW and USMC	6,869			ea.	2.20E-04	2.60E-04	8.10E-06	3.70E-05	3.10E-05		1.20E-05	0.000756	0.000893	2.78195E-05	0.000127	0.000106	0	4.12E-05
	AP-42	5.56	NSW and USMC	2,800,472			ea.	8.70E-04	1.60E-03	8.50E-05	3.90E-05	2.80E-05		5.10E-06	1.218205	2.240378	0.11902006	0.054609	0.039207	0	0.007141
	AP-42	5.56 BLANK	NSW and USMC	3,689			ea.	2.30E-04	2.80E-04	2.00E-05	6.90E-06	2.00E-06		9.70E-07	0.000424	0.000516	0.00003689	1.27E-05	3.69E-06	0	1.79E-06
	AP-42	.50CAL	NSW and USMC	305,988			ea.	5.10E-03	1.10E-02	1.20E-03	3.10E-04	1.90E-04		1.30E-05	0.780269	1.682934	0.1835928	0.047428	0.029069	0	0.001989
		.50CAL	USCG	15,059			ea.	5.10E-03	1.10E-02	1.20E-03	3.10E-04	1.90E-04		1.30E-05	0.0384	0.082825	0.0090354	0.002334	0.001431	0	9.79E-05
	AP-42	.50CAL BLANK	NSW and USMC	10,000			ea.	2.10E-03	1.80E-03	2.80E-05	9.80E-05	8.80E-05		1.20E-05	0.0105	0.009	0.00014	0.00049	0.00044	0	0.00006
	AP-42	7.62	NSW and USMC	190,240			ea.	1.20E-03	2.30E-03	9.70E-05	5.10E-05	3.80E-05		4.90E-06	0.114144	0.218776	0.00922664	0.004851	0.003615	0	0.000466
		7.62	USCG	21,000			ea.	1.20E-03	2.30E-03	9.70E-05	5.10E-05	3.80E-05		4.90E-06	0.0126	0.02415	0.0010185	0.000536	0.000399	0	5.15E-05
	AP-42	9MM	NSW and USMC	2,118,024			ea.	2.00E-04	3.10E-04	1.50E-05	2.40E-05	2.00E-05		6.80E-06	0.211802	0.328294	0.01588518	0.025416	0.02118	0	0.007201
	No Data	.300 WIN MAG	Environmental Contractors				ea.	2.00E-04	3.10E-04	1.50E-05	2.40E-05	2.00E-05		6.80E-06	0	0	0	0	0	0	0
	No Data	.223 Rifle Rounds	Environmental Contractors				ea.	6.80E-05	7.20E-05	3.10E-06	2.60E-06	1.90E-06		1.80E-06	0	0	0	0	0	0	0
	No Data	.22 Magnum	Environmental Contractors				ea.	7.50E-05	8.00E-05	5.00E-06	3.40E-06	2.60E-06		1.90E-06	0	0	0	0	0	0	0
	AP-42	.22 Long Rifle	Environmental Contractors				ea.	6.80E-05	7.20E-05	3.10E-06	2.60E-06	1.90E-06		1.80E-06	0	0	0	0	0	0	0
		12 Guage Shotgun	Environmental Contractors				ea.	5.10E-03	1.10E-02	1.20E-03	3.10E-04	1.90E-04		1.30E-05	0	0	0	0	0	0	0
		Total:		**7,452,073**																	
MINE SHAPE	AP-42	M18A1		132			ea.	1.6	2.00E-02	1.80E-02	4.90E-02	2.60E-02		5.70E-05	0.1056	0.00132	0.001188	0.003234	0.001716	0	3.76E-06
		MK76		64			ea.														
		MK62		12			ea.	No emissions													
		Total:		**208**																	
MISSILE		AGM-114B	Fired at low altitude	16			ea.														
		AGM-65 Maverick		6																	
		AGM-84		10																	
		AIM-120	Fired well above 3,000 ft	4			ea.														
		AIM-7	Fired well above 3,000 ft	7			ea.														
		AIM-9	Fired well above 3,000 ft	5			ea.														
		BGM-71E TOW-A	Fired at ground level	1			ea.														
		GBU-9		9																	
		HARM		4																	
		NSM	Fired at ocean surface	1			ea.														
AW 25		JSOW	No emissions	5			ea.														
		Japanese Missile Tests		5			ea.														
		Tactical Tomahawk		2			ea.														
		Seasparrow Missile		8																	
		SLAM ER		2																	
		Stinger		51																	
		SM2 or equivalent	Fired from ship-to-air	7			ea.														
		Total:		**143**																	

Ordnance Group	AQ Data	Ordnance Type	Fate	Quantity Fired	Consolidated Nos.	NEW ea.	UOM/ Cum NEW	CO2	CO	Nox	PM10	PM2.5	SO2	Lead	CO2	CO	Nox	PM10	PM2.5	SO2	Lead
ROCKET		2.75" RKT		396			ea.	4.50E-01	5.60E-02	7.10E-03	6.10E-02	3.80E-02		1.20E-03	0.0891	0.011088	0.0014058	0.012078	0.007524	0	0.000238
		2.75" RKT HE					ea.	4.50E-01	5.60E-02	7.10E-03	6.10E-02	3.80E-02		1.20E-03	0	0	0	0	0	0	0
		2.75" RKT I	INERT Warhead				ea.	4.50E-01	5.60E-02	7.10E-03	6.10E-02	3.80E-02		1.20E-03	0	0	0	0	0	0	0
		Total:		**396**																	
FLARES		**FLARES****		**962**			**ea.**														
SMOKE		MK58 Marine Location Marker		8			ea.	1	1.30E-02	1.20E-02	3.20E-02	1.70E-02	6.10E-05	3.80E-05	0.004	0.000052	0.000048	0.000128	0.000068	0.000000244	1.52E-07
		SMOKE GRENADE		120			ea.	1	1.30E-02	1.20E-02	3.20E-02	1.70E-02	6.10E-05	3.80E-05	0.06	0.00078	0.00072	0.00192	0.00102	0.00000366	2.28E-06
		Total:		**128**																	
TORPEDO	NA	MK30	No emissions	601			ea.														
	NA	MK39	No emissions	1,406			ea.														
	NA	MK46	No emissions	8			ea.														
	NA	MK46-HOVER	No emissions				ea.														
	NA	MK46-LAMPS	No emissions				ea.														
	NA	MK-46-REX-FLYIN	No emissions				ea.														
	NA	MK46-REX-HOVER	No emissions				ea.														
	NA	MK46-REX-LAMPS	No emissions				ea.														
	NA	MK46-EXTORP	No emissions	85			ea.														
	NA	MK50-REX-FLYIN	No emissions	12			ea.														
	NA	MK50-REX-LAMPS	No emissions				ea.														
	NA	REXTORP-46	No emissions	124			ea.														
	NA	REXTORP-50	No emissions	20			ea.														
	NA	MK46-REX-SVTT	No emissions	14			ea.														
	NA	MK46-SVTT	No emissions				ea.														
	NA	MK46-VLA	No emissions				ea.														
	NA	REXTORP	No emissions				ea.														
	NA	MK48-ADCAP	No emissions	84			ea.														
	NA	MK48-ER	No emissions				ea.														
	NA	MK48-STD	No emissions				ea.														
	NA	MK54	No emissions	1			ea.														
		SSN	No emissions	89			ea.														
		Total:		**2,444**																	
		GRAND TOTAL ROUNDS		**7,630,469**																	
		GRAND TOTAL POUNDS NEW					**290,917**														
													SOCAL/SCI		91.62481	39.65623	1.972609576	3.366984	2.362794	0.016223112	0.040467
													SOCAL/SD		0.051	0.106975	0.0100539	0.00287	0.00183	0	0.000149

Date: 13-May-2007

Table C-12. SOCAL Ordnance Expenditures—Alternative 2

		NOTE: Units of Measure (UOM) for ordnance rounds are 1 each (ea.) and for Demolitions and Other Ordnance are in pounds Net Explosive Weight (NEW).						Emission Factor (lb per lb or lb per item)							Emissions, tons/year						
Ordnance Group	AQ Data	Ordnance Type	Fate	Quantity Fired	Consolidated Nos.	NEW ea.	UOM/ Cum NEW	CO2	CO	Nox	PM10	PM2.5	SO2	Lead	CO2	CO	Nox	PM10	PM2.5	SO2	Lead
BOMB		CBU MK20 ROCKEYE	Clusters Explode Underwater	16		99	ea.														
	No Data	GBU32I JDAM	Clusters Explode Underwater	10		385	ea.														
	No Data	LGTR	Rocket fires Inert warhead	238		0	ea.														
		MK76	Only small spotting charge	1,854		Neg.	ea.														
	No Data	BDU 48	Only small spotting charge	117		Neg.	ea.														
		MK82 HE		534		192	ea.		0.3184						0	16.32246	0	0	0	0	0
	No Data	GBU12 500 lb		13		192	ea.														
	NA	MK82 INERT	No emissions	22		0	ea.														
	No Data	BDU 45		199		0	ea.														
		MK83 HE		147		445	ea.		0.1482						0	4.847252	0	0	0	0	0
	No Data	GBU 16		32		445	ea.														
	NA	MK83 INERT		116		0	ea.														
		Total:		3,298	0																
OTHER ORD	No AQ data	Type		No.		NEW															
	CNAP & SPAWAR	EER/IEER AN/SQQ-110	Explode deep in water			4.2	0	1.2	0.0044	0.011				0.00004	0	0	0	0	0	0	0
	No Data	BLASTING CAP MK11	On Land only	2,565		Neg.	0														
		Detonator		288																	
	No Data	FIRING DEVICE		105		Neg.	0														
	No Data	FUSE		2,076		Neg.	0														
		GRENADE SIMULATOR	Land	561		0.0813	45.6	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0.014367	0.000479	0.000143669	0.000479	0.000342	2.73656E-06	3.19E-06
		Grenades	Land	2,143		0.0813	174.2	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0.054881	0.001829	0.000548812	0.001829	0.001307	1.04536E-05	1.22E-05
		Haversacks		105		20.0000	2100.0	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04							
		K143 Antipersonnel Mine		288																	
	No Data	M1A2 BANGALORE TORP	Land	277		10.00	2770								0	0	0	0	0	0	0
		M7 BANDOLEER MK57 (Claymore mine)	Land	77		8.16	628.32		0.15108						0	0.047463	0	0	0	0	0
	AP-42	M112 DEMO CHARGE	Land	206		1.20	247.2	7.90E-01	2.60E-02	7.90E-03	2.60E-02	1.90E-02		1.70E-04	0.097644	0.003214	0.00097644	0.003214	0.002348	0	2.1E-05
	No Data	M700 BLASTING FUSE	Land	1,965		0.001	1.965														
	No Data	MK20 Cable Cutter	Land	181		0.0028	0.5														
	No Data	MK22 Projectile Unit	Land	206		Neg.	Neg.														
	No Data	MK36 M0 DEMO CHARGE	Land	59		4.10	241.9								0	0	0	0	0	0	0
	No Data	MK75 CHARGE	In Shallow water	244		50.00	12,200								0	0	0	0	0	0	0
	No Data	MK84 [86] EOD Shaped Charge	On Land only	214		0.08	17.12								0	0	0	0	0	0	0
	No Data	MK120 NONELEC DET (ft)	On Land only	1,006		0.00001	0.0144														
	No Data	MK123 NONELEC DET (ft)	On Land only	4,165		0.00001	0.0595														
	No Data	MK138 DEMO CHG ASSEMBLY	In water			20.00	0	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0	0	0	0	0	0	0
	No Data	MK140 FLEXIBLE CHARGE	On Land only	295		0.04	12.98														
		MK258		360																	
	No Data	PBXN-109 TEST Det Cord	On Land only	30		0.0060	0.18														
	No Data	SIGNAL MK 18(G950) SMOKE	On Land only	686		0.23	159.9752														
	No Data	C4 1 LB		830		1.00	830	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	2.61E-01	0.008715	0.0026145	0.008715	0.006225	0.0000498	5.81E-05

Ordnance Group	AQ Data	Ordnance Type	Fate	Quantity Fired	Consolidated Nos.	NEW ea.	UOM/ Cum NEW	CO2	CO	Nox	PM10	PM2.5	SO2	Lead	CO2	CO	Nox	PM10	PM2.5	SO2	Lead
	No Data	C4 1.25 LB		37,403		1.25	46753.75	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	1.47E+01	0.490914	0.147274313	0.490914	0.350653	0.002805225	0.003273
	No Data	C4 5 LB	On Land only			5.00	0	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0	0	0	0	0	0	0
	No Data	C4 15 LB	On Land only	48		15.00	720	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	2.27E-01	0.00756	0.002268	0.00756	0.0054	0.0000432	5.04E-05
	No Data	C4 40 LB	On Land only	4,385		40.00	175400	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	5.53E+01	1.8417	0.55251	1.8417	1.3155	0.010524	0.012278
	No Data	C4 100 LB	On Land only	1,000		100.00	100000	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	31.5	1.05	0.315	1.05	0.75	0.006	0.007
	No Data	C4 300 LB	On Land only	15,000		1.00	15000	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	4.725	0.1575	0.04725	0.1575	0.1125	0.0009	0.00105
	No Data	C4 500 LB	On Land only	18,459		1.00	18459	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	5.814585	0.19382	0.05814585	0.19382	0.138443	0.00110754	0.001292
	No Data	TNT Blocks 0.5 lbd	On Land only	1,078		1.00	1078		0.398							0.214522					
	No Data	DEMO SHEET	On Land only	546		6.00	3276														
	No Data	DETONATING CORD		85,000		0.006	510														
	No Data	DEMO CHARGE	Land	57		5.00	285														
	AP-42	SIMULATED ARTILLERY	M110 Land	413		0.1375	56.7875	6.30E-01	0.021	6.30E-03	2.10E-02	1.50E-02	1.20E-04	1.40E-04	0.017888	0.000596	0.000178881	0.000596	0.000426	3.40725E-06	3.98E-06
			Totals	**182,321**			**380,969**														
GUNFIRE (Large)	AP-42	155MM HE		1,504			ea.	6.51	2.35E+01	1.43E+00	0.496	0.2418		2.26E-03	4.89552	17.65756	1.072352	0.372992	0.181834	0	0.001702
	AP-42	155MM ILL		75			ea.	1.8	2.62E-02	9.40E-02	3	3		5.80E-05	0.0675	0.000983	0.003525	0.1125	0.1125	0	2.18E-06
		122 MM		80																	
5"/54		5"/54 BLP	BLP is INERT	5,901			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.047208	0.05901	0	0.003541	0.002744	0	1.77E-05
		5"/54 HCVT+32 (EOD)		216			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.001728	0.00216	0	0.00013	0.0001	0	6.48E-07
		5"/54 HECVT		2,881			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.023048	0.02881	0	0.001729	0.00134	0	8.64E-06
		5"/54 HEPD		94			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.000752	0.00094	0	5.64E-05	4.37E-05	0	2.82E-07
		5"/54 HEVT		202			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.001616	0.00202	0	0.000121	9.39E-05	0	6.06E-07
		5"/54 ILL		122			ea.	1.50E-02	1.40E-02	3.60E-04	9.20E-04	7.60E-04		1.30E-06	0.000915	0.000854	0.00002196	5.61E-05	4.64E-05	0	7.93E-08
		5"54/54 VTNF		55			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.00044	0.00055	0	0.000033	2.56E-05	0	1.65E-07
5"/62		5"/62		1,139			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.009112	0.01139	0	0.000683	0.00053	0	3.42E-06
		5"/62 HE-MFF		77			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.000616	0.00077	0	4.62E-05	3.58E-05	0	2.31E-07
		5"/62 HECVT		860			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.00688	0.0086	0	0.000516	0.0004	0	2.58E-06
		5"/62 HEET		4			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.000032	0.00004	0	2.4E-06	1.86E-06	0	1.2E-08
		5"/62 KEET		21			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.000168	0.00021	0	1.26E-05	9.77E-06	0	6.3E-08
60mm	AP-42	60MM		285			ea.	2.90E-01	3.00E-02	4.20E-03	3.20E-02	1.70E-02		2.30E-04	0.041325	0.004275	0.0005985	0.00456	0.002423	0	3.28E-05
		60MM WP					ea.	2.90E-01	3.00E-02	4.20E-03	3.20E-02	1.70E-02		2.30E-04	0	0	0	0	0	0	0
76mm		76MM BLP	INERT	1,881			ea.	1.44E-02	1.80E-02		1.08E-03	8.37E-04		5.40E-06	0.013543	0.016929	0	0.001016	0.000787	0	5.08E-06
	AP-42	81MM HE		489			ea.	1.60E-02	2.00E-02		1.20E-03	9.30E-04		6.00E-06	0.003912	0.00489	0	0.000293	0.000227	0	1.47E-06
	AP-42	81MM ILL		22			ea.	1.50E-02	1.40E-02	3.60E-04	9.20E-04	7.60E-04		1.30E-06	0.000165	0.000154	0.00000396	1.01E-05	8.36E-06	0	1.43E-08
		122MM Main Tank Gun		160																	
CAS	No data	GAU-17 30mm					ea.														
		Total:		**16,068**																	
GUNFIRE (small)	AMW 114,1125	20MM	Fired by aircraft at low alt.	1,909,274			ea.														
		25MM	Fired by ship	61,553			ea.														
	No Data	30MM EFV Main Gun	Fired on land or sea	3,681			ea.														
	AP-42	40MM	NSW on land	7,380			ea.	2.60E-04	3.50E-04	3.60E-05	2.60E-05	2.30E-05		6.70E-04	0.000959	0.001292	0.00013284	9.59E-05	8.49E-05	0	0.002472
	AP-42	40MM HE	NSW on land	901			ea.	6.60E-02	7.00E-03	1.60E-03	1.30E-02	6.60E-03		7.30E-05	0.029733	0.003154	0.0007208	0.005857	0.002973	0	3.29E-05
	No Data	40MM ILL	NSW on land	422			ea.	2.60E-04	3.50E-04	3.60E-05	2.60E-05	2.30E-05		6.70E-04	5.49E-05	7.39E-05	0.000007596	5.49E-06	4.85E-06	0	0.000141
	AP-42	40MM PRACTICE	NSW on land	3,090			ea.	2.60E-04	3.50E-04	3.60E-05	2.60E-05	2.30E-05		6.70E-04	0.000402	0.000541	0.00005562	4.02E-05	3.55E-05	0	0.001035
	AP-42	.45 CAL	NSW and USMC	6,869			ea.	2.20E-04	2.60E-04	8.10E-06	3.70E-05	3.10E-05		1.20E-05	0.000756	0.000893	2.78195E-05	0.000127	0.000106	0	4.12E-05
	AP-42	5.56	NSW and USMC	3,391,607			ea.	8.70E-04	1.60E-03	8.50E-05	3.90E-05	2.80E-05		5.10E-06	1.475349	2.713286	0.144143298	0.066136	0.047482	0	0.008649
	AP-42	5.56 BLANK	NSW and USMC	4,814			ea.	2.30E-04	2.80E-04	2.00E-05	6.90E-06	2.00E-06		9.70E-07	0.000554	0.000674	0.00004814	1.66E-05	4.81E-06	0	2.33E-06
	AP-42	.50CAL	NSW and USMC	334,687			ea.	5.10E-03	1.10E-02	1.20E-03	3.10E-04	1.90E-04		1.30E-05	0.853452	1.840779	0.2008122	0.051876	0.031795	0	0.002175
		.50CAL	USCG	19,647			ea.	5.10E-03	1.10E-02	1.20E-03	3.10E-04	1.90E-04		1.30E-05	0.0501	0.108059	0.0117882	0.003045	0.001866	0	0.000128
	AP-42	.50CAL BLANK	NSW and USMC	10,000			ea.	2.10E-03	1.80E-03	2.80E-05	9.80E-05	8.80E-05		1.20E-05	0.0105	0.009	0.00014	0.00049	0.00044	0	0.00006
	AP-42	7.62	NSW and USMC	261,202			ea.	1.20E-03	2.30E-03	9.70E-05	5.10E-05	3.80E-05		4.90E-06	0.156721	0.300382	0.012668297	0.006661	0.004963	0	0.00064
		7.62	USCG	21,000			ea.	1.20E-03	2.30E-03	9.70E-05	5.10E-05	3.80E-05		4.90E-06	0.0126	0.02415	0.0010185	0.000536	0.000399	0	5.15E-05
	AP-42	9MM	NSW and USMC	2,515,859			ea.	2.00E-04	3.10E-04	1.50E-05	2.40E-05	2.00E-05		6.80E-06	0.251586	0.389958	0.018868943	0.03019	0.025159	0	0.008554
	No Data	.300 WIN MAG	Environmental Contractors				ea.	2.00E-04	3.10E-04	1.50E-05	2.40E-05	2.00E-05		6.80E-06	0	0	0	0	0	0	0
	No Data	.223 Rifle Rounds	Environmental Contractors				ea.	6.80E-05	7.20E-05	3.10E-06	2.60E-06	1.90E-06		1.80E-06	0	0	0	0	0	0	0
	No Data	.22 Magnum	Environmental Contractors				ea.	7.50E-05	8.00E-05	5.00E-06	3.40E-06	2.60E-06		1.90E-06	0	0	0	0	0	0	0
	AP-42	.22 Long Rifle	Environmental Contractors				ea.	6.80E-05	7.20E-05	3.10E-06	2.60E-06	1.90E-06		1.80E-06	0	0	0	0	0	0	0
		12 Guage Shotgun	Environmental Contractors				ea.	5.10E-03	1.10E-02	1.20E-03	3.10E-04	1.90E-04		1.30E-05	0	0	0	0	0	0	0
		Total:		**8,551,986**																	
MINE SHAPE	AP-42	M18A1		164			ea.	1.6	2.00E-02	1.80E-02	4.90E-02	2.60E-02		5.70E-05	0.1312	0.00164	0.001476	0.004018	0.002132	0	4.67E-06
		MK76		68			ea.														
		MK62		13			ea.	No emissions													
		Total:		**245**																	
MISSILE		AGM-114B	Fired at low altitude	16			ea.														
		AGM-65 Maverick		6																	
		AGM-84		10																	
		AIM-120	Fired well above 3,000 ft	4			ea.														
		AIM-7	Fired well above 3,000 ft	7			ea.														
		AIM-9	Fired well above 3,000 ft	5			ea.														
		BGM-71E TOW-A	Fired at ground level	1			ea.														
		GBU-9		9																	
		HARM		4																	
		NSM	Fired at ocean surface	1			ea.														
AW 25		JSOW	No emissions	10			ea.														
		Japanese Missile Tests		10			ea.														
		Tactical Tomahawk		2			ea.														
		Seasparrow Missile		12																	
		SLAM ER		2																	
		Stinger		68																	
		SM2 or equivalent	Fired from ship-to-air	7			ea.														
		Total:		**174**																	

Ordnance Group	AQ Data	Ordnance Type	Fate	Quantity Fired	Consolidated Nos.	NEW ea.	UOM/ Cum NEW	CO2	CO	Nox	PM10	PM2.5	SO2	Lead	CO2	CO	Nox	PM10	PM2.5	SO2	Lead
ROCKET		2.75" RKT		488			ea.	4.50E-01	5.60E-02	7.10E-03	6.10E-02	3.80E-02		1.20E-03	0.1098	0.013664	0.0017324	0.014884	0.009272	0	0.000293
		2.75" RKT HE					ea.	4.50E-01	5.60E-02	7.10E-03	6.10E-02	3.80E-02		1.20E-03	0	0	0	0	0	0	0
		2.75" RKT I	INERT Warhead				ea.	4.50E-01	5.60E-02	7.10E-03	6.10E-02	3.80E-02		1.20E-03	0	0	0	0	0	0	0
		Total:		**488**																	
FLARES		**FLARES****		**1,135**			**ea.**														
SMOKE		MK58 Marine Location Marker		10			ea.	1	1.30E-02	1.20E-02	3.20E-02	1.70E-02	6.10E-05	3.80E-05	0.005	0.000065	0.00006	0.00016	0.000085	0.000000305	1.9E-07
		SMOKE GRENADE		120			ea.	1	1.30E-02	1.20E-02	3.20E-02	1.70E-02	6.10E-05	3.80E-05	0.06	0.00078	0.00072	0.00192	0.00102	0.00000366	2.28E-06
		Total:		**130**																	
TORPEDO	NA	MK30	No emissions	602			ea.														
	NA	MK39	No emissions	1,409			ea.														
	NA	MK46	No emissions	8			ea.														
	NA	MK46-HOVER	No emissions				ea.														
	NA	MK46-LAMPS	No emissions				ea.														
	NA	MK-46-REX-FLYIN	No emissions				ea.														
	NA	MK46-REX-HOVER	No emissions				ea.														
	NA	MK46-REX-LAMPS	No emissions				ea.														
	NA	MK46-EXTORP	No emissions	85			ea.														
	NA	MK50-REX-FLYIN	No emissions	12			ea.														
	NA	MK50-REX-LAMPS	No emissions				ea.														
	NA	REXTORP-46	No emissions	126			ea.														
	NA	REXTORP-50	No emissions	20			ea.														
	NA	MK46-REX-SVTT	No emissions	14			ea.														
	NA	MK46-SVTT	No emissions				ea.														
	NA	MK46-VLA	No emissions				ea.														
	NA	REXTORP	No emissions				ea.														
	NA	MK48-ADCAP	No emissions	84			ea.														
	NA	MK48-ER	No emissions				ea.														
	NA	MK48-STD	No emissions				ea.														
	NA	MK54	No emissions	2			ea.														
		SSN	No emissions	89			ea.														
		Total:		**2,451**																	
		GRAND TOTAL ROUNDS		**8,758,296**																	
		GRAND TOTAL POUNDS NEW					**380,969**														
													SOCAL/SCI		120.8916	48.26435	2.585025836	4.437102	3.111851	0.021450327	0.050923
													SOCAL/SD		0.0627	0.132209	0.0128067	0.003581	0.002265	0	0.000179

Date: 13-May-2007

Table C-13. Ground Vehicle Operations - No Action Alternative

Scenario	Type Training	Days	Ground Vehicles	Number	Engine Load	Hours per day	Emissions Factors (lb/hr)					Emissions (lbs)				
Training Exercises							**CO**	**NOx**	**HC**	**SOx**	**PM10**	**CO**	**Nox**	**HC**	**Sox**	**PM**
1	Air Combat Maneuvers		None													
2	Air Defense Exercise		None													
3	S-A Missiles		None													
4	S-A Gunnery Exercise		None													
5	A-A Missiles		None													
6	Helicopter ASW TRACKEX		None													
7	MPA ASW TRACKEX		None													
8	Helicopter ASW TORPEX		None													
9	MPA ASW TORPEX		None													
10	Surface Ship ASW TRACKEX		None													
11	Surface Ship ASW TORPEX		None													
12	Surface Ship Integrated ASW		None													
13	Sub ASW Trackex		None													
14	Sub ASW TORPEX		None													
15	VBSS		None													
16	A-S MISSILEX		None													
17	A-S BOMBEX		None													
18	A-S GUNEX		None													
19	S-S GUNEX		None													
20	SINKEX		None													
21	NSFS		None													
22	EFEX	3	5-ton Truck	12	80%	8	0.04	0.06	0.01	0.00	0.01	12.71	18.65	2.46	0.05	1.75
		3	HMMWV	2	65%	8	0.04	0.06	0.01	0.00	0.01	2.12	3.11	0.41	0.01	0.29
23	Battalion Landing	0	LAV	20		8	0.04	0.06	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
		0	FAV	12		8	0.04	0.06	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
		0	HMMWV	2		8	0.04	0.06	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
		0	7-ton Truck	8		8	0.12	0.44	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00
		0	M-1 Tank	4		8	0.12	0.44	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00
24	USMC Stinger	0	LAV	0		5	0.04	0.06	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
25	Amphibious Landings & Raids															
25A	Recon Mission		None													

Scenario	Type Training	Days	Ground Vehicles	Number	Engine Load	Hours per day	Emissions Factors (lb/hr)					Emissions (lbs)				
Training Exercises							**CO**	**NOx**	**HC**	**SOx**	**PM10**	**CO**	**Nox**	**HC**	**Sox**	**PM**
25B	Helicopter Assault	0	FAV	0	Idle	1										
					65%	4	0.04	0.06	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
25C	Armored Operations	0	HMMWV	0	Idle	2	0.06	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
					65%	3	0.04	0.06	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
			M1	0	Idle	1	0.06	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
					60%	2	0.12	0.44	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00
25D	Amphibious Landings & Raids	1	HMMWV	2	Idle	2	0.06	0.17	0.01	0.00	0.00	0.23	0.66	0.03	0.00	0.01
					65%	3	0.04	0.06	0.01	0.00	0.01	0.26	0.39	0.05	0.00	0.04
			5-ton Trucks		Idle	1	0.06	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
					80%	1	0.04	0.06	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
25E	Amphibious Assault		None													
25F	Combat Engineer Ops	1	HMMWV	0	Idle	2	0.06	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
					65%	3	0.04	0.06	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
			5-ton Trucks	2	Idle	1	0.06	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
					80%	1	0.04	0.06	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
25G	Amphibious Assault Vehicle Ops															
25H	EFV	1	HMMWV	0	Idle	2	0.06	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
					65%	3	0.04	0.06	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
			5-ton Trucks	0	Idle	1	0.06	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
					80%	1	0.04	0.06	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
			Refueler			1	0.12	0.44	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00
25I	Assault Amphibian School	5	7-ton Truck	0	Idle	1	0.06	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
					80%	1	0.12	0.44	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00
			HMMWV	0	Idle	2	0.06	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
					65%	3	0.04	0.06	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
26	Ambphibious Operations CPAAA															
26A	Amphibious Operations		None													
26B	Amphibious Ops		None													
26C	Amphibious Ops		None													
26D	Amphibious Ops		None													
26E	Amphibious Ops		None													
26F	Amphibious Warfare		None													
26G	Amphibious Ops		None													
27	Elec Combat		None													
28A	Sm Obj Avoidance		None													
29	Mine Neutralization		None													
30	Mining Exercise		None													
31	NSWC Land Demolition		None													

Scenario	Type Training	Days	Ground Vehicles	Number	Engine Load	Hours per day	Emissions Factors (lb/hr)					Emissions (lbs)				
Training Exercises							CO	NOx	HC	SOx	PM10	CO	Nox	HC	Sox	PM
32	NSWC UW Demo		None													
33	Mat Weave		None													
34	NSWC Small Arms		None													
35	NSWC Land Nav	1	Pickup Truck	99		6	0.30	0.03	0.02	0.00	0.00	180.82	15.14	9.47	0.17	0.54
36	NSW UAV Operationa		None													
37	Insertion/Extraction		None													
38	NSW Boat Operations		None													
39	NSWG-1 Platoon Ops		None													
40	Direct Action		None													
41	Bombing Exercise - Land		None													
42	CSAR		None													
43	EOD Outside SHOBA		None													
44	USCG Ops		None													
45	NALF Airfield		None													
46	Ship Torpedo Test		None													
47	UUV		None													
48	Sonobuoy QA/QC		None													
49	Ocean Engineering		None													
50	MM Mine Location		None													
51	Missile Flight Test		None													
52	NUWC UW Acoustic		None													
53	Other Tests		None													
	Total						**Total Ground Vehicle Emissions, tons**					0.09807741	0.0189756	0.006208	0.000112	0.001312

Table C-14. Ground Vehicle Operations - Alternative 1

Scenario	Type Training	Days	Ground Vehicles	Number	Engine Load	Hours per day	Emissions Factors (lb/hr)					Emissions (lbs)				
Training Exercises							CO	NOx	HC	SOx	PM10	CO	Nox	HC	Sox	PM
1	Air Combat Maneuvers		None													
2	Air Defense Exercise		None													
3	S-A Missiles		None													
4	S-A Gunnery Exercise		None													
5	A-A Missiles		None													
6	Helicopter ASW TRACKEX		None													
7	MPA ASW TRACKEX		None													
8	Helicopter ASW TORPEX		None													
9	MPA ASW TORPEX		None													
10	Surface Ship ASW TRACKEX		None													
11	Surface Ship ASW TORPEX		None													
12	Surface Ship Integrated ASW		None													
13	Sub ASW Trackex		None													
14	Sub ASW TORPEX		None													
15	VBSS		None													
16	A-S MISSILEX		None													
17	A-S BOMBEX		None													
18	A-S GUNEX		None													
19	S-S GUNEX		None													
20	SINKEX		None													
21	NSFS		None													
22	EFEX	3	5-ton Truck	14	80%	8	0.04	0.06	0.01	0.00	0.01	14.83	21.76	2.87	0.06	2.04
		3	HMMWV	2	65%	8	0.04	0.06	0.01	0.00	0.01	2.12	3.11	0.41	0.01	0.29
23	Battalion Landing	4	LAV	20		8	0.04	0.06	0.01	0.00	0.01	28.25	41.45	5.47	0.11	3.88
		4	FAV	12		8	0.04	0.06	0.01	0.00	0.01	16.95	24.87	3.28	0.06	2.33
		4	HMMWV	2		8	0.04	0.06	0.01	0.00	0.01	2.83	4.14	0.55	0.01	0.39
		4	7-ton Truck	8		8	0.12	0.44	0.01	0.00	0.02	31.46	111.78	3.72	0.20	4.61
		4	M-1 Tank	4		8	0.12	0.44	0.01	0.00	0.02	15.73	55.89	1.86	0.10	2.31
24	USMC Stinger	1	LAV	3		5	0.04	0.06	0.01	0.00	0.01	0.66	0.97	0.13	0.00	0.09
25	Amphibious Landings & Raids															
25A	Recon Mission		None													

Scenario	Type Training	Days	Ground Vehicles	Number	Engine Load	Hours per day	Emissions Factors (lb/hr)					Emissions (lbs)				
Training Exercises							CO	NOx	HC	SOx	PM10	CO	Nox	HC	Sox	PM
25B	Helicopter Assault	1	FAV	32	Idle	1	0.06	0.17	0.01	0.00	0.00	1.86	5.29	0.22	0.00	0.07
					65%	4	0.04	0.06	0.01	0.00	0.01	5.65	8.29	1.09	0.02	0.78
25C	Armored Operations	1	HMMWV	12	Idle	2	0.06	0.17	0.01	0.00	0.00	1.39	3.97	0.17	0.00	0.05
					65%	3	0.04	0.06	0.01	0.00	0.01	1.59	2.33	0.31	0.01	0.22
			M1	12	Idle	1	0.06	0.17	0.01	0.00	0.00	0.70	1.99	0.08	0.00	0.03
					60%	2	0.12	0.44	0.01	0.00	0.02	2.95	10.48	0.35	0.02	0.43
25D	Amphibious Landings & Raids	1	HMMWV	18	Idle	2	0.06	0.17	0.01	0.00	0.00	2.09	5.96	0.25	0.00	0.08
					65%	3	0.04	0.06	0.01	0.00	0.01	2.38	3.50	0.46	0.01	0.33
			5-ton Trucks	36	Idle	1	0.06	0.17	0.01	0.00	0.00	2.09	5.96	0.25	0.00	0.08
					80%	1	0.04	0.06	0.01	0.00	0.01	1.59	2.33	0.31	0.01	0.22
25E	Amphibious Assault		None													
25F	Combat Engineer Ops	1	HMMWV	3	Idle	2	0.06	0.17	0.01	0.00	0.00	0.35	0.99	0.04	0.00	0.01
					65%	3	0.04	0.06	0.01	0.00	0.01	0.40	0.58	0.08	0.00	0.05
			5-ton Trucks	1	Idle	1	0.06	0.17	0.01	0.00	0.00	0.06	0.17	0.01	0.00	0.00
					80%	1	0.04	0.06	0.01	0.00	0.01	0.04	0.06	0.01	0.00	0.01
25G	Amphibious Assault Vehicle Ops															
25H	EFV	1	HMMWV	4	Idle	2	0.06	0.17	0.01	0.00	0.00	0.46	1.32	0.06	0.00	0.02
					65%	3	0.04	0.06	0.01	0.00	0.01	0.53	0.78	0.10	0.00	0.07
			5-ton Trucks	2	Idle	1	0.06	0.17	0.01	0.00	0.00	0.12	0.33	0.01	0.00	0.00
					80%	1	0.04	0.06	0.01	0.00	0.01	0.09	0.13	0.02	0.00	0.01
			Refueler	1		1	0.12	0.44	0.01	0.00	0.02	0.12	0.44	0.01	0.00	0.02
25I	Assault Amphibian School	5	7-ton Truck	10	Idle	1	0.06	0.17	0.01	0.00	0.00	2.90	8.27	0.35	0.00	0.11
					80%	1	0.12	0.44	0.01	0.00	0.02	6.15	21.83	0.73	0.04	0.90
			HMMWV	10	Idle	2	0.06	0.17	0.01	0.00	0.00	5.80	16.55	0.70	0.01	0.22
					65%	3	0.04	0.06	0.01	0.00	0.01	6.62	9.71	1.28	0.02	0.91
			Refueler	10		1	0.12	0.44	0.01	0.00	0.02	6.15	21.83	0.73	0.04	0.90
26	Ambphibious Operations CPAAA															
26A	Amphibious Operations		None													
26B	Amphibious Ops		None													
26C	Amphibious Ops		None													
26D	Amphibious Ops		None													
26E	Amphibious Ops		None													
26F	Amphibious Warfare		None													
26G	Amphibious Ops		None													
27	Elec Combat		None													
28A	Sm Obj Avoidance		None													
29	Mine Neutralization		None													
30	Mining Exercise		None													

Scenario	Type Training	Days	Ground Vehicles	Number	Engine Load	Hours per day	Emissions Factors (lb/hr) CO	NOx	HC	SOx	PM10	Emissions (lbs) CO	Nox	HC	Sox	PM
Training Exercises																
31	NSWC Land Demolition		None													
32	NSWC UW Demo		None													
33	Mat Weave		None													
34	NSWC Small Arms		None													
35	NSWC Land Nav	1	Pickup Truck	118		6	0.30	0.03	0.02	0.00	0.00	215.53	18.05	11.28	0.20	0.64
36	NSW UAV Operationa		None													
37	Insertion/Extraction		None													
38	NSW Boat Operations		None													
39	NSWG-1 Platoon Ops		None													
40	Direct Action		None													
41	Bombing Exercise - Land		None													
42	CSAR		None													
43	EOD Outside SHOBA		None													
44	USCG Ops		None													
45	NALF Airfield		None													
46	Ship Torpedo Test		None													
47	UUV		None													
48	Sonobuoy QA/QC		None													
49	Ocean Engineering		None													
50	MM Mine Location		None													
51	Missile Flight Test		None													
52	NUWC UW Acoustic		None													
53	Other Tests		None													
	Total						**Total Ground Vehicle Emissions, tons**					0.19021591	0.2075521	0.018598	0.000467	0.01105

Table C-15. Ground Vehicle Operations - Alternative 2

Scenario	Type Training	Days	Ground Vehicles	Number	Engine Load	Hours per day	Emissions Factors (lb/hr)					Emissions (lbs)				
Training Exercises							CO	NOx	HC	SOx	PM10	CO	Nox	HC	Sox	PM
1	Air Combat Maneuvers		None													
2	Air Defense Exercise		None													
3	S-A Missiles		None													
4	S-A Gunnery Exercise		None													
5	A-A Missiles		None													
6	Helicopter ASW TRACKEX		None													
7	MPA ASW TRACKEX		None													
8	Helicopter ASW TORPEX		None													
9	MPA ASW TORPEX		None													
10	Surface Ship ASW TRACKEX		None													
11	Surface Ship ASW TORPEX		None													
12	Surface Ship Integrated ASW		None													
13	Sub ASW Trackex		None													
14	Sub ASW TORPEX		None													
15	VBSS		None													
16	A-S MISSILEX		None													
17	A-S BOMBEX		None													
18	A-S GUNEX		None													
19	S-S GUNEX		None													
20	SINKEX		None													
21	NSFS		None													
22	EFEX	3	5-ton Truck	16	80%	8	0.04	0.06	0.01	0.00	0.01	16.95	24.87	3.28	0.06	2.33
		3	HMMWV	3	65%	8	0.04	0.06	0.01	0.00	0.01	3.18	4.66	0.62	0.01	0.44
23	Battalion Landing	4	LAV	40		8	0.04	0.06	0.01	0.00	0.01	56.51	82.89	10.93	0.21	7.76
		4	FAV	24		8	0.04	0.06	0.01	0.00	0.01	33.91	49.74	6.56	0.13	4.66
		4	HMMWV	4		8	0.04	0.06	0.01	0.00	0.01	5.65	8.29	1.09	0.02	0.78
		4	7-ton Truck	16		8	0.12	0.44	0.01	0.00	0.02	62.93	223.55	7.45	0.40	9.23
		4	M-1 Tank	8		8	0.12	0.44	0.01	0.00	0.02	31.46	111.78	3.72	0.20	4.61
24	USMC Stinger	1	LAV	4		5	0.04	0.06	0.01	0.00	0.01	0.88	1.30	0.17	0.00	0.12
25	Amphibious Landings & Raids															
25A	Recon Mission		None													

Scenario	Type Training	Days	Ground Vehicles	Number	Engine Load	Hours per day	Emissions Factors (lb/hr)					Emissions (lbs)				
Training Exercises							CO	NOx	HC	SOx	PM10	CO	Nox	HC	Sox	PM
25B	Helicopter Assault	1	FAV	48	Idle	1	0.06	0.17	0.01	0.00	0.00	2.78	7.94	0.34	0.00	0.10
					65%	4	0.04	0.06	0.01	0.00	0.01	8.48	12.43	1.64	0.03	1.16
25C	Armored Operations	1	HMMWV	16	Idle	2	0.06	0.17	0.01	0.00	0.00	1.86	5.29	0.22	0.00	0.07
					65%	3	0.04	0.06	0.01	0.00	0.01	2.12	3.11	0.41	0.01	0.29
			M1	16	Idle	1	0.06	0.17	0.01	0.00	0.00	0.93	2.65	0.11	0.00	0.03
					60%	2	0.12	0.44	0.01	0.00	0.02	3.93	13.97	0.47	0.02	0.58
25D	Amphibious Landings & Raids	1	HMMWV	24	Idle	2	0.06	0.17	0.01	0.00	0.00	2.78	7.94	0.34	0.00	0.10
					65%	3	0.04	0.06	0.01	0.00	0.01	3.18	4.66	0.62	0.01	0.44
			5-ton Trucks	48	Idle	1	0.06	0.17	0.01	0.00	0.00	2.78	7.94	0.34	0.00	0.10
					80%	1	0.04	0.06	0.01	0.00	0.01	2.12	3.11	0.41	0.01	0.29
25E	Amphibious Assault		None													
25F	Combat Engineer Ops	1	HMMWV	6	Idle	2	0.06	0.17	0.01	0.00	0.00	0.70	1.99	0.08	0.00	0.03
					65%	3	0.04	0.06	0.01	0.00	0.01	0.79	1.17	0.15	0.00	0.11
			5-ton Trucks	2	Idle	1	0.06	0.17	0.01	0.00	0.00	0.12	0.33	0.01	0.00	0.00
					80%	1	0.04	0.06	0.01	0.00	0.01	0.09	0.13	0.02	0.00	0.01
25G	Amphibious Assault Vehicle Ops															
25H	EFV	1	HMMWV	8	Idle	2	0.06	0.17	0.01	0.00	0.00	0.93	2.65	0.11	0.00	0.03
					65%	3	0.04	0.06	0.01	0.00	0.01	1.06	1.55	0.21	0.00	0.15
			5-ton Trucks	4	Idle	1	0.06	0.17	0.01	0.00	0.00	0.23	0.66	0.03	0.00	0.01
					80%	1	0.04	0.06	0.01	0.00	0.01	0.18	0.26	0.03	0.00	0.02
			Refueler	2		1	0.12	0.44	0.01	0.00	0.02	0.25	0.87	0.03	0.00	0.04
25I	Assault Amphibian School	5	7-ton Truck	15	Idle	1	0.06	0.17	0.01	0.00	0.00	4.35	12.41	0.52	0.01	0.16
					80%	1	0.12	0.44	0.01	0.00	0.02	9.22	32.75	1.09	0.06	1.35
			HMMWV	15	Idle	2	0.06	0.17	0.01	0.00	0.00	8.70	24.82	1.05	0.01	0.33
					65%	3	0.04	0.06	0.01	0.00	0.01	9.93	14.57	1.92	0.04	1.36
			Refueler	15		1	0.12	0.44	0.01	0.00	0.02	9.22	32.75	1.09	0.06	1.35
26	Ambphibious Operations CPAAA															
26A	Amphibious Operations		None													
26B	Amphibious Ops		None													
26C	Amphibious Ops		None													
26D	Amphibious Ops		None													
26E	Amphibious Ops		None													
26F	Amphibious Warfare		None													
26G	Amphibious Ops		None													
27	Elec Combat		None													
28A	Sm Obj Avoidance		None													
29	Mine Neutralization		None													
30	Mining Exercise		None													

Scenario	Type Training	Days	Ground Vehicles	Number	Engine Load	Hours per day	Emissions Factors (lb/hr)					Emissions (lbs)				
Training Exercises							**CO**	**NOx**	**HC**	**SOx**	**PM10**	**CO**	**Nox**	**HC**	**Sox**	**PM**
31	NSWC Land Demolition		None													
32	NSWC UW Demo		None													
33	Mat Weave		None													
34	NSWC Small Arms		None													
35	NSWC Land Nav	1	Pickup Truck	118		6	0.30	0.03	0.02	0.00	0.00	215.53	18.05	11.28	0.20	0.64
36	NSW UAV Operationa		None													
37	Insertion/Extraction		None													
38	NSW Boat Operations		None													
39	NSWG-1 Platoon Ops		None													
40	Direct Action		None													
41	Bombing Exercise - Land		None													
42	CSAR		None													
43	EOD Outside SHOBA		None													
44	USCG Ops		None													
45	NALF Airfield		None													
46	Ship Torpedo Test		None													
47	UUV		None													
48	Sonobuoy QA/QC		None													
49	Ocean Engineering		None													
50	MM Mine Location		None													
51	Missile Flight Test		None													
52	NUWC UW Acoustic		None													
53	Other Tests		None													
	Total						**Total Ground Vehicle Emissions, tons**					0.25185605	0.3605397	0.028176	0.000757	0.019352

Table C-16. Total Emissions within 3 nm - SOCAL OPAREA (conformity)

No Action Alternative	CO	NOx	HC	SOx	PM10	PM2.5
Aircraft–Operations	1.13	1.76	0.12	0.10	1.14	1.13
Surface Ships	8.69	12.84	3.22	7.22	1.16	3.61
NALF	132.86	37.97	33.63	1.89	28.11	27.83
Ordnance	25.12	1.15	0.00	0.01	2.66	1.89
Total	**167.80**	**53.72**	**36.97**	**9.23**	**33.08**	**34.46**
Alternative 1						
Aircraft–Operations	9.11	9.73	0.85	0.57	5.61	5.55
Surface Ships	10.90	17.35	4.88	10.34	4.13	4.09
NALF	153.67	47.18	35.98	2.30	29.14	28.85
Ordnance	39.66	1.97	0.00	0.02	3.37	2.36
Total	**213.34**	**76.23**	**41.72**	**13.22**	**42.24**	**40.85**
Alternative 2						
Aircraft–Operations	11.10	11.63	1.06	0.68	6.50	6.43
Surface Ships	12.09	19.82	5.99	12.03	5.51	7.34
NALF	165.78	54.63	37.75	2.65	31.72	31.40
Ordnance	48.26	2.59	0.00	0.02	4.44	3.11
Total	**237.23**	**88.67**	**44.80**	**15.37**	**48.17**	**48.29**
Increases over Baseline						
Alternative 1	45.54	22.51	4.74	3.99	9.17	6.39
Alternative 2	69.43	34.94	7.82	6.14	15.09	13.83
De Minimus Limits	**100.00**	**10.00**	**10.00**	**100.00**	**70.00**	**100.00**
Alternative 1 Above De Minimis?	NO	YES	NO	NO	NO	NO
Alternative 2 Above De Minimis?	NO	YES	NO	NO	NO	NO

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Aircraft - Operations	4.57	5.66	0.48	0.31	3.39
Surface Ships	17.94	29.05	10.66	6.13	1.16
Ordnance	21.2	0.07	0.01	0	0.26
NALF Aircraft	333.15	55.71	106.43	3.66	61.35
Total	**376.66**	**90.49**	**117.58**	**10.10**	**66.16**
Alt 1 Above 2006 Emissions Budget?	NO	NO	NO	YES	NO
Alt 2 Above 2006 Emissions Budget?	NO	NO	NO	YES	NO

RECORD OF NON-APPLICABILITY (RONA)
FOR CLEAN AIR ACT CONFORMITY
Southern California Range Complex Environmental Impact Statement

INTRODUCTION

The United States Environmental Protection Agency (USEPA) published *Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule*, in the 30 November 1993, Federal Register (40 Code of Federal Regulations (CFR) Parts 6, 51, and 93). The U.S. Navy published *Interim Guidance on Compliance with the Clean Air Act General Conformity Rule* in Appendix F, Office of Chief of Naval Operations Instruction (OPNAVINST) 5090.1C, dated 30 October 2007. These publications provide implementing guidance to document Clean Air Act Conformity Determination requirements.

Federal regulations state that no department, agency, or instrumentality of the federal government shall engage in, support in any way or provide financial assistance for, license to permit, or approve any activity that does not conform to an applicable implementation plan. It is the responsibility of the federal agency to determine whether a federal action conforms to the applicable implementation plan, before the action is taken (40 CFR Part 1 51.850[a]).

Federal actions may be exempt from conformity determinations if they do not exceed designated *de minimis* levels for criteria pollutants (40 CFR Part 51.853[b]). The Proposed Action includes activities in the South Coast Air Basin (SCAB), which is classified as a severe non-attainment area for the federal 8-hour ozone (O_3) standard, a maintenance area for nitrogen dioxide (NO_2), and a non-attainment area for carbon monoxide (CO) and particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}); and the San Diego Air Basin (SDAB), which is classified as a basic non-attainment area for the federal 8-hour O_3 standard, and a maintenance area for CO. *De minimis* levels (in tons/year) for the air basins potentially affected by the Proposed Action are listed in Tables 1 and 2.

Table 1: *De minimis* Levels for Criteria Pollutants in the South Coast Air Basin

Criteria Pollutant	*De minimis* Level (tons/year)
Carbon Monoxide (CO)	100
Volatile Organic Compounds (VOC)	25
Oxides of Nitrogen (NO_x)	25
Particulate Matter (PM_{10})	70
Fine Particulate Matter ($PM_{2.5}$)	100

Source: 40 CFR 93.153

Table 2: *De minimis* Levels for Criteria Pollutants in the San Diego Air Basin

Criteria Pollutant	De minimis Level (tons/year)
Carbon Monoxide (CO)	100
Volatile Organic Compounds (VOC)	100
Oxides of Nitrogen (NOx)	100

Source: 40 CFR 93.153

It should be noted that should the SCAB be redesignated as an extreme non-attainment area for the 8-hour National Ambient Air Quality Standard (NAAQS) for O_3 as indicated in the Draft Final 2007 Air Quality Management Plan (AQMP), the *de minimis* levels for O_3 precursor oxides of nitrogen NO_x and VOC would be 10 tons (9,072 kilograms [kg]) per year.

Federal actions that are exempt from conformity determinations must also demonstrate that the action's emissions would not be regionally significant. Regionally significant emissions are defined as 10 percent or more of the projected regional emissions in the air basin in which the Proposed Action occurs. Should emissions be regionally significant, a Conformity Determination would be required.

PROPOSED ACTION

Action Proponent: The U. S. Department of the Navy.

Location: Southern California (SOCAL) Range Complex, California.

Proposed Action Name**:** Southern California Range Complex Environmental Impact Statement (EIS)

Proposed Action Summary:
The Navy proposes to implement actions within the SOCAL Range Complex to:

- Increase training and Research, Development, Test, and Evaluation (RDT&E) operations from current levels as necessary to support the Navy's Fleet Response Training Plan (FRTP);
- Accommodate mission requirements associated with force structure changes and introduction of new weapons and systems to the Fleet; and
- Implement enhanced range complex capabilities.

Three alternatives are under consideration: the No Action Alternative and Alternatives 1 and 2.

The No Action Alternative is required by regulations of the Council on Environmental Quality (CEQ) as a baseline against which the impacts of the Proposed Action are compared. For the purposes of this EIS, the No Action Alternative serves as the baseline level of operations on the SOCAL Range Complex, representing the regular and historical level of training and testing activity necessary to maintain Navy readiness. Consequently, the No Action Alternative stands as no change from current levels of training and testing usage. This interpretation of the No Action Alternative is consistent with guidance provided by CEQ (40 Questions #3), which indicates that where ongoing programs continue, even as new plans are developed, "no action" is "no change" from current management direction or level of management intensity.

Training activities in the SOCAL Range Complex vary from basic individual or unit level events of relatively short duration involving few participants to coordinated major range training events, such as a Joint Task Force Exercise (JTFEX), which may involve thousands of participants over several weeks. Over the years, the tempo and types of training and RDT&E activities have fluctuated within the SOCAL Range Complex due to changing requirements, the introduction of new technologies, the dynamic nature of international events, advances in warfighting doctrine and procedures, and force structure changes. Such developments have influenced the frequency, duration, intensity, and location of required training. The factors influencing tempo and types of operations are fluid in nature, and will continue to cause fluctuations in training activities within the SOCAL Range Complex. Accordingly, operational data used throughout this EIS/OEIS are a representative baseline for evaluating impacts that may result from the proposed training operations under the No Action Alternative.

A detailed description of all training operations associated with the No Action Alternative are provided in Section 2.3 of the EIS/Overseas EIS (OEIS).

Alternative 1 is a proposal designed to meet Navy and Department of Defense (DoD) current and near-term operational training requirements. If Alternative 1 were to be selected, in addition to accommodating training operations currently conducted, the SOCAL Range Complex would support an increase in training operations including major range events and force structure changes associated with introduction of new weapons systems, vessels, and aircraft into the Fleet. Under Alternative 1, baseline-training operations would be increased. Two new types of training events would be conducted, namely, a battalion-sized amphibious landing and additional amphibious training events at San Clemente Island (SCI), and mine neutralization exercises in the SOCAL OPAREAs. In addition, training and operations associated with force structure changes would be implemented for the LCS, MV-22 Osprey, EA-18G Growler, MH-60R/S Seahawk Multimission Helicopter, P-8 Poseidon Maritime Multimission Aircraft, Landing Platform-Dock [LPD] 17 amphibious assault ship, and DDG 1000 [Zumwalt Class] destroyer. Force structure changes associated with new weapons systems would include MCM systems. Force structure changes also would include training and operations associated with the proposed homeporting of the aircraft carrier USS CARL VINSON at Naval Base (NB) Coronado.

While Alternative 1 would partially meet the Navy's purpose and need, it does not enhance the training capabilities of the Range Complex. A detailed description of all training operations associated with the No Action Alternative is provided in Section 2.4 of the EIS/OEIS.

Implementation of Alternative 2 would include all elements of Alternative 1 (accommodating training operations currently conducted, increasing training operations [including major range events], and accommodating force structure changes). In addition, under Alternative 2:

- In order to optimize training throughput and meet the FRTP, many training operations of the types currently conducted would be increased over levels identified in Alternative 1;

- Range enhancements would be implemented, to include an increase in Commercial Air Services, establishment of a shallow water minefield; and establishment of the shallow water training range (SWTR) in the Southern California Anti-Submarine Warfare Range (SOAR) extensions.

Alternative 2 is the preferred alternative, because it would optimize the training capability of the SOCAL Range Complex. A detailed description of all training operations associated with the No Action Alternative is provided in Section 2.5 of the EIS/OEIS.

The Proposed Action would result in selectively focused but critical increases in training, and range enhancements to address test and training resource shortfalls as necessary to ensure the SOCAL Range Complex supports Navy and Marine Corps training and readiness objectives.

Actions to support current, emerging, and future training and RDT&E in the SOCAL Range Complex, including implementation of range enhancements, were evaluated in this analysis. These actions include:

- Increasing numbers of training operations of the types currently being conducted in the SOCAL Range Complex.
- Expanding the size and scope of amphibious landing training exercises in the SOCAL Ocean Operating Areas (OPAREAs) and at SCI to include a battalion-sized landing of 1,500+ Marines with weapons and equipment (to be conducted up to two times per year).
- Expanding the size and scope of Naval Special Warfare (NSW) training activities in Training Areas and Ranges (TARs), Special Warfare Training Areas (SWATs), and nearshore waters of SCI.
- Installing a SWTR, a proposed extension into shallow water of the existing instrumented deepwater anti-submarine warfare (ASW) range (known as "SOAR").
- Conducting operations on the SWTR.
- Increasing Commercial Air Services support for Fleet Opposition Force (OPFOR) and Electronic Warfare (EW) Threat Training.
- Constructing a Shallow Water Minefield, at depths of 250 to 420 feet (ft) (76 to 128 meters [m]) in offshore and nearshore areas in the vicinity of SCI.
- Conducting training on the Shallow Water Minefield.
- Conducting Mine Neutralization Exercises.
- Supporting training for new systems and platforms, specifically, the Littoral Combat Ship (LCS), MV-22 Osprey aircraft, EA-18G Growler aircraft, MH-60R/S Seahawk Multi-mission Helicopter, P-8 Poseidon Multi-mission Maritime Aircraft, Landing Platform-Dock (LPD) 17 amphibious assault ship, DDG 1000 (Zumwalt Class) destroyer, and an additional Pacific Fleet aircraft carrier, USS CARL VINSON, proposed for homeporting in San Diego.

Description of the SOCAL Range Complex

Military activities in SOCAL Range Complex occur (1) on the ocean surface, (2) under the ocean surface, (3) in the air, and (4) on land at SCI. For purposes of scheduling and managing these activities and the ranges, the Range Complex is divided into multiple components. Descriptions of the ranges and location maps are presented below.

W-291 and Associated Ocean OPAREAS and Ranges

W-291 is the Federal Aviation Administration (FAA) designation of the Special Use Airspace (SUA) of the SOCAL Range Complex. This SUA extends from the ocean surface to 80,000 ft (24,384 m) above mean sea level (MSL) and encompasses 113,000 square nautical miles (nm^2) (387,500 square kilometers [km^2]) of airspace. The ocean area underlying the W-291 forms the majority of the ocean OPAREAs of the SOCAL Range Complex. This OPAREA extends to the seafloor.

Within the area defined by the lateral bounds of W-291, the Range Complex encompasses specialized range or training areas in the air, on the surface, or undersea. Depending on the intended use, these specialized range areas may encompass only airspace or may extend from the seafloor to 80,000 ft MSL. A designated air-to-air combat maneuver area is an example of specialized airspace-only range area. Range areas designated for helicopter training in ASW or submarine missile launches, for example, extend from the ocean floor to 80,000 ft (24,384 m) MSL. The W-291 airspace and associated OPAREAs, including specialized range areas, are described in Table 3 and depicted in Figure 1.

Ocean OPAREAs and Ranges not Located within the Bounds of W-291

There are several OPAREAs in the SOCAL Range Complex that do not underlie W-291. These OPAREAs are used for ocean surface and subsurface training. Military aviation activities may be conducted in airspace that is not designated as military SUA. Military aviation activities therefore occur in the SOCAL Range Complex outside of W-291. These aviation activities do not include use of live or non-explosive ordnance. For example, amphibious operations involving helicopters and carrier flight operations occur in the Range Complex outside of W-291. Ocean OPAREAS and ranges that are not within W-291 are described in Table 4 and depicted in Figure 2.

San Clemente Island

A component part of the SOCAL Range Complex, SCI is composed of existing land ranges and training areas that are integral to training of Pacific Fleet air, surface, and subsurface units; 1st Marine Expeditionary Force (I MEF) units; NSW units; and selected formal schools. SCI provides instrumented ranges, operating areas, and associated facilities to conduct and evaluate a wide range of exercises within the scope of naval warfare. SCI also provides range areas and services to RDT&E activities. Over 20 Navy and Marine Corps commands conduct training and testing activities in the SCI. Due to its unique capabilities, SCI supports multiple training activities from every Navy Primary Mission Area (PMAR), and provides critical training resources for Expeditionary Strike Group (ESG), Carrier Strike Group (CSG), and Marine Expeditionary Unit (MEU) certification exercises. SCI land ranges are described in Table 5 and depicted in Figures 3 and 4.

ASW Activities Extending into Point Mugu Sea Range

In the course of major range events, certain ASW training occurs across the boundaries of the SOCAL Range Complex into the Point Mugu Sea Range. This ASW extension occurs in surface and subsurface ocean areas.

Table 3: W-291 and Associated OPAREAs

Area Designation	Description
Warning Area (W-291)	W-291 encompasses 113,000 nm^2 (209,276 km^2) located off of the southern California coastline (Figure 2-1), extending from the ocean surface to 80,000 ft above MSL. W-291 supports aviation training and RDT&E conducted by all aircraft in the Navy and Marine Corps inventories. Ordnance use is permitted.
Tactical Maneuvering Areas (TMA) (Papa 1-8)	W-291 airspace includes eight TMAs (designated Papa 1-8) extending from 5,000 to 40,000 ft (1,524 to 12,192 m) MSL. Exercises conducted include Air Combat Maneuvering (ACM), air intercept control aerobatics, and AA gunnery. Ordnance use is permitted.
Air Refueling Areas	W-291 airspace includes three areas that are designated for aerial refueling.
Class “E” airspace (Area Foxtrot)	W-291 airspace includes Class "E" airspace designated as Area Foxtrot, which is activated by the FAA for commercial aviation use as needed (such as during periods of inclement weather or when Lindbergh Field International Airport is utilizing Runway 09).
Fleet Training Area Hot (FLETA HOT)	FLETA HOT is an open ocean area that extends from the ocean bottom to 80,000 ft (24,384 m). The area is used for hazardous operations, primarily surface-to-surface, surface-to-air and air-to-air ordnance. Types of exercises conducted include AAW, ASW, NSW, underway training, and Independent Steaming Exercises (ISE). Ordnance use is permitted.
Over-water parachute drop zones	Three parachute drop zones used by Navy and Marine Corps units are designated within the SOCAL Range Complex. Two of these (Neptune and Saint) lie within the bounds of W-291. One (Leon) lies between W-291 and Naval Amphibious Base (NAB).
Missile Range 1 and 2 (MISR-1/MISR-2)	MISR-1 and MISR-2 are located about 60 nm (111 km) south and southwest of NBC, and extend from the ocean bottom up to 80,000 ft MSL. Exercises conducted include rocket and missile firing, ASW, carrier and submarine operations, fleet training, ISE, and surface and air gunnery. Ordnance use is permitted.
Northern Air Operating Area (NAOPA)	The NAOPA is located east of SCI and approximately 90 nm (167 km) west of NBC. It extends from the ocean bottom to 80,000 ft (24,384 m). Exercises in NAOPA include fleet training, multi-unit exercises, and individual unit training. Ordnance use is permitted.
Kingfisher Training Range (KTR)	KTR is a 1-by-2 nm (1.85 x 3.7 km) area in the waters approximately 1 nm (1.85 km) offshore of SCI. The range provides training to surface warfare units in mine detection and avoidance. The range consists of mine-like shapes moored to the ocean bottom by cables.

Table 3: W-291 and Associated OPAREAs (continued)

Area Designation	Description
Electronic Warfare (EW) Range	The EW Range utilizes advanced technology to simulate electronic attacks on naval systems from sites on SCI. The range is not defined as a designated location. Rather it is defined by the electronic nature and extent of the training support it provides. The EW Range supports 50 types of electronic warfare training events for ships and aircraft operating in W-291 airspace and throughout the OPAREAS.
Laser Training Range (LTR)	LTRs 1 and 2 are offshore water ranges northwest and southwest of SCI, established to conduct over-the-water laser training and testing of the laser-guided Hellfire missile.
Mine Training Range (MTR)	Two MTRs and two mine laying areas are established in the nearshore areas of SCI. MTR-1 is the Castle Rock Mining Range off the northwestern coast of the island. MTR-2 is the Eel Point Mining Range off the midpoint of the southwestern side. In addition, mining training takes place in the China Point area, off the southwestern point of the island, and in the Pyramid Head area, off the island's southeastern tip. These ranges are used for training of aircrews in offensive mine laying by delivery of inert mine shapes (no explosives) from aircraft.
OPAREA 3803	OPAREA 3803 is an area adjacent to SCI extending from the seafloor to 80,000 ft. Operations in OPAREA 3803 include aviation training and submarine training events during JTFEX and COMPTUEX. The SCI Underwater Range lies within OPAREA 3803.
San Clemente Island Underwater Range (SCIUR)	SCIUR is a 5-nm2 (9.3-km2) area northeast of SCI. The range is used for ASW training and RDT&E of undersea systems. The range contains six passive hydrophone arrays mounted on the seafloor.
Southern California ASW Range (SOAR)	SOAR is located offshore to the west of SCI. The underwater tracking range covers over 670 nm2 (1,241 km2), and consists of seven subareas. The range has the capability of providing three-dimensional underwater tracking of submarines, practice weapons, and targets with a set of 84 acoustic sensors (hydrophones) located on the seafloor. Communication with submarines is possible through use of an underwater telephone capability. SOAR supports various ASW training scenarios that involve air, surface, and subsurface units.
SOAR Variable Depth Sonar (VDS) No-Notice Area	The VDS area is used as an unscheduled and no-notice area for training with surface ships' sonar devices. The vertical dimensions are from the surface to a maximum depth of 400 ft (122 m). The VDS overlaps portions of the SOAR and the MINEX training range.
SOCAL Missile Range	SOCAL Missile Range is not a permanently designated area, but is invoked by the designation of portions of the ocean OPAREAS and W-291 airspace, as necessary, to support Fleet live-fire training missile exercises. The areas invoked vary, depending on the nature of the exercise, but generally are extensive areas over water south/southwest of SCI.
Fire Support Areas (FSAs) I and II.	FSAs are designated locations offshore of SCI for the maneuvering of naval surface ships firing guns into impact areas located on SCI. The offshore FSAs and the region of the onshore impact areas together are designated as the Shore Bombardment Area (SHOBA).

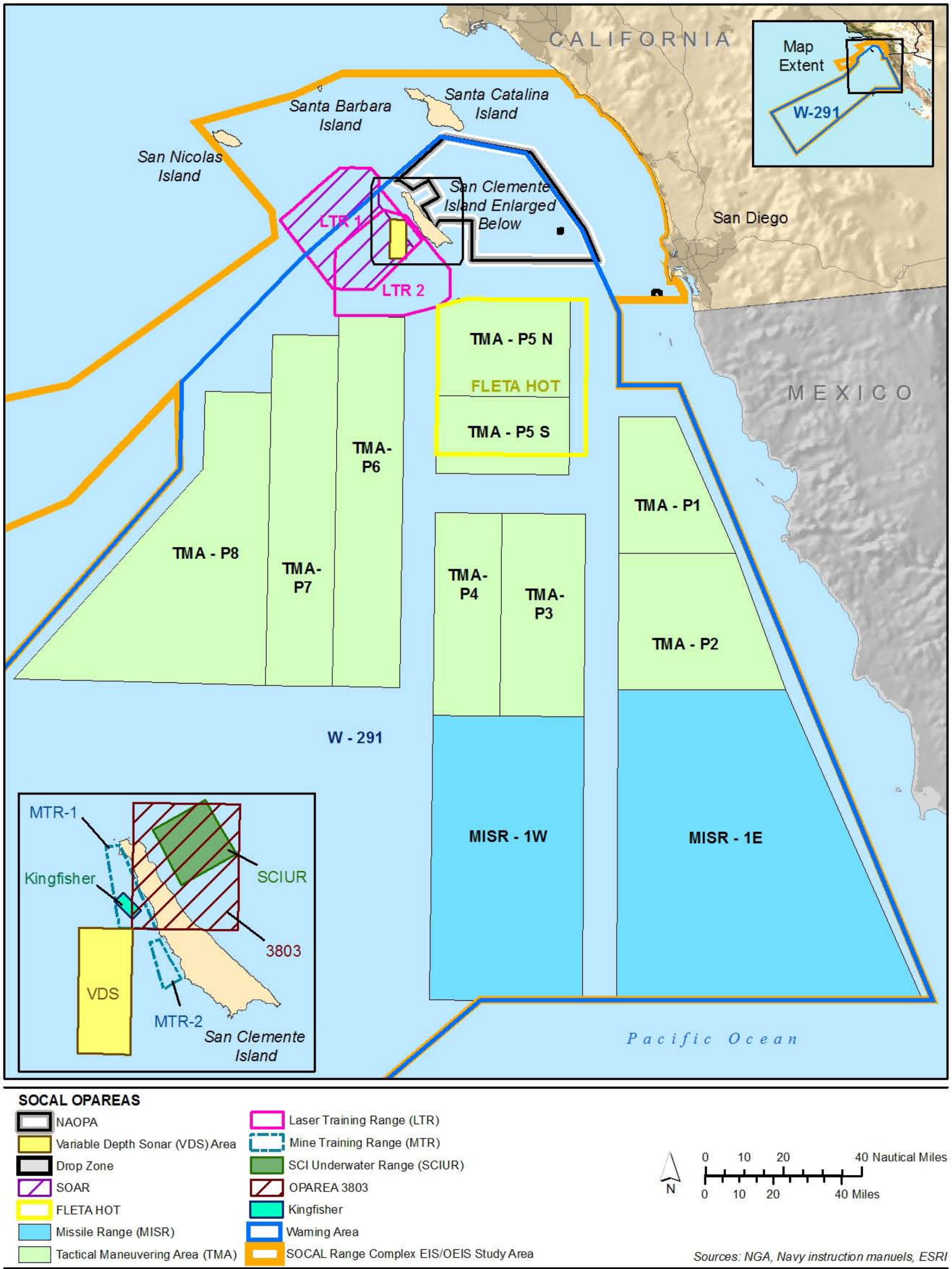

Figure 1. SOCAL Range Complex W-291 (portion) and Ocean OPAREAs

Table 4: Ocean OPAREAs Outside W-291

Ocean Area	Description
Advance Research Projects Agency (ARPA) Training Minefield	The ARPA Training Minefield lies within the Encinitas Naval Electronic Test Area (ENETA), and extends to a depth of 400 ft. Exercises conducted are mine detection and avoidance. Ordnance use is not permitted.
Encinitas Naval Electronic Test Area (ENETA)	The ENETA is located about 20 nm (37 km) northwest of NBC. The area extends from the ocean bottom up to 700 ft (213 m) MSL. Exercises conducted include fleet training and ISE. Ordnance use is not permitted.
Helicopter Offshore Training Area (HCOTA)	Located in the ocean area off NBC, the HCOTA is divided into five "dipping areas" (designated A/B/C/D/E), and extends from the ocean bottom to 1,000 ft (305 m) MSL. This area is designed for ASW training for helicopters with dipping sonar. Ordnance use is not permitted.
San Pedro Channel Operating Area (SPCOA)	The SPCOA is an open ocean area about 60 nm (111 km) northwest of the NBC, extending to the vicinity of Santa Catalina Island, from the ocean floor to 1,000 ft (305 m) MSL. Exercises conducted here include fleet training, mining, mine countermeasures, and ISE. Ordnance use is not permitted.
Western San Clemente Operating Area (WSCOA)	The WSCOA is located about 180 nm (333 km) west of NBC. It extends from the ocean floor to 5,000 ft (1,524 m) MSL. Exercises conducted include ISE and various fleet training events. Ordnance use is not permitted.
Camp Pendleton Amphibious Assault Area (CPAAA) and Amphibious Vehicle Training Area (CPAVA)	CPAAA is an open ocean area located approximately 40 nm (74 km) northwest of NBC, used for amphibious operations. Ordnance use is not permitted. CPAVA is an ocean area adjacent to the shoreline of Camp Pendleton used for near-shore amphibious vehicle and landing craft training. Ordnance use is not permitted.
Extension Area into Point Mugu Sea Range.	The extension area consists of ____ nm2 of surface and subsurface sea space. While this area encompasses two Channel Islands (Santa Barbara and San Nicolas), training events addressed in this EIS / OEIS occur only at sea. Live ordnance use is not permitted.

Table 5: SCI Range Areas

SCI Ranges	Description
SHOBA Impact Areas	SHOBA is the only range in the United States that supports naval surface fire support training using on-the-ground spotters and surveyed targets. The southern one-third of SCI contains Impact Areas I and II, which comprise the onshore portion of SHOBA. (The offshore component provides designated locations [FSAs] for firing ships to maneuver.). The main training activities that occur in SHOBA are naval gun firing, artillery, and air-to-ground bombing. A variety of munitions, both live and inert, are expended in SHOBA. NSW operations also occur in this area.
Naval Special Warfare Training Areas (SWATs)	SCI contains six SWATs. Each includes contiguous land and water areas. The land areas range in size from 100 to 4,400 acres [ac] (.4 to 18 km2) and are used as ingress and egress to specific Training Areas and Ranges (TARs). Basic and advanced special operations training is conducted within these areas by Navy and Marine Corps units.
NSW Training Areas and Ranges (TARs)	TARs are littoral operating areas that support demolition, over-the-beach, and tactical ingress and egress training for NSW personnel. There are 22 TARs on SCI designated as TAR 1 through 22. TARs 2 and 3 occur in the water only. TARs 1, 6, 9, 11 – 16, 18 and 19 occur on land only, while TARs 4, 5, 10, 17, 20 – 22 are littoral (both land water components). TARs 7 and 8 are offshore drop zones.

Table 5: SCI Range Areas (continued)

SCI Ranges	Description
Assault Vehicle Maneuver Corridor (AVMC)	The AVMC encompasses linked areas on SCI: Assault Vehicle Maneuver Areas (AVMAs), and Assault Vehicle Maneuver Road (AVMR) The AVMA accounts for four existing or planned areas for authorized off-road vehicle use. The AVMR is a dirt track that runs the length of the island to allow transit by tactical vehicles through areas that are restricted from off-road use by vehicles.
Artillery Firing Points (AFP) and Artillery Maneuver Points (AMP)	An AFP is a location from which artillery weapons such as the 155mm howitzer are positioned and used in live-fire employment of munitions. Guns are towed by trucks along primary roads, often in convoy with munitions trucks and HMMWVs. Two AFPs are identified on SCI, both in SHOBA. AFP 1 and AFP 6 are currently in use. An AMP is used for non-live-fire training in emplacement and displacement of artillery weapons.
Infantry Operations Area (IOA)	The IOA, generally located on either side of the AVMC, is on the upland plateau, which is designated for foot traffic by military units. No vehicles are authorized in the off-road areas. Specifically, this area is intended for use by Marine Corps forces during amphibious training events.
Old Airfield (VC-3)	The Old Airfield, called VC-3, located within TAR 15, is approximately 6 nm (11 km) from the northern end of the island. The presence of a number of buildings allows for training of forces in a semi-urban environment. It is suitable for small unit training by NSW and Marine Corps forces.
Missile Impact Range (MIR)	The MIR, located within TAR 16, is in the north-central portion of the island, just south of VC-3. It is situated at the ridge crest of the island's central plateau. The MIR is 3,200 by 1,000 ft (305 by 975 m) at an elevation of 1,000 ft (305 m) MSL. The MIR contains fixed targets, and is equipped with sophisticated instruments for recording the flight, impacts, and detonations of weapons. Weapons expended on the MIR include the Joint Standoff Weapon (JSOW) and the Tomahawk Land Attack Missile (TLAM).
Naval Auxiliary Landing Field (NALF)	The NALF, located at the northern end of the island, has a single runway of 9,300 ft (2,835 m) equipped with aircraft arresting gear.

Figure 2. Ocean OPAREAs Outside W-291

Figure 3. SCI Ranges: SWATs, TARs, and SHOBA Impact Areas

Figure 4. San Clemente Island: Roads, Artillery Firing Points, Infrastructure

Figure 5 presents a map showing the air basin boundaries. SCI is within the SCAB.

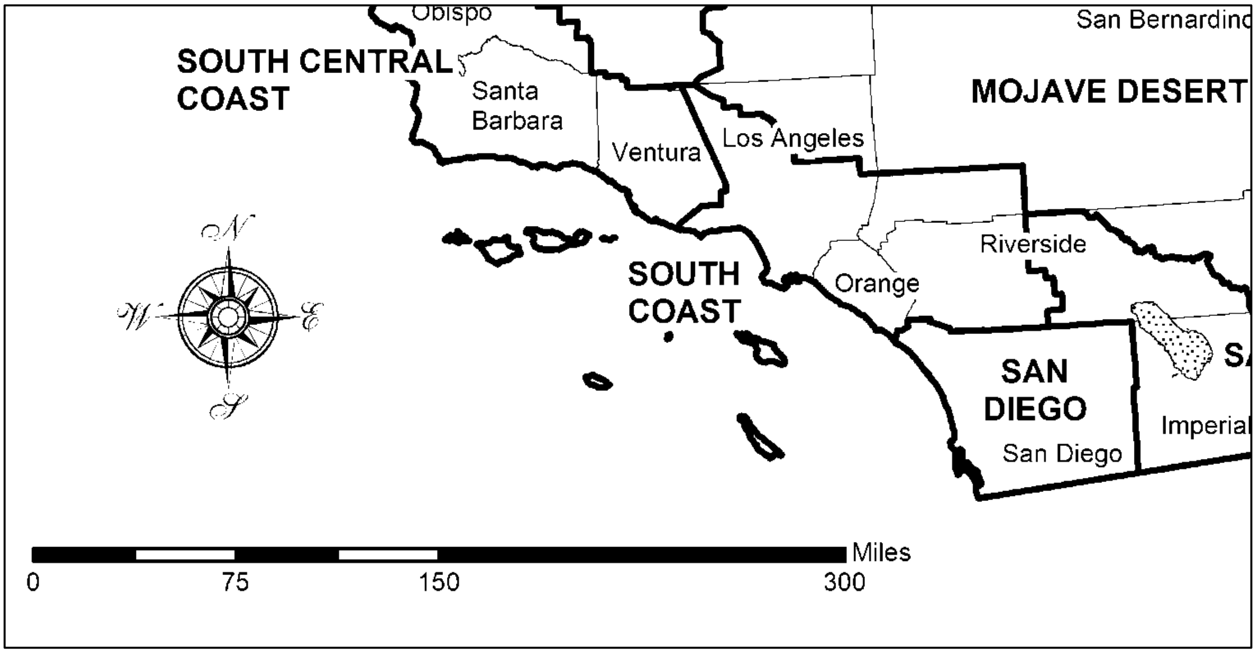

Figure 5. Air Basin Boundaries

The United States military is maintained to ensure the freedom and safety of all Americans both at home and abroad. The Navy's mission, derived from Title 10 of the United States Code, requires the Navy to "maintain, train and equip combat-ready naval forces capable of winning wars, deterring aggression and maintaining freedom of the seas." The Proposed Action is needed to ensure that the SOCAL Range Complex provides range facilities for and fully supports the training and equipping of combat capable naval forces ready to deploy worldwide. In this regard, the SOCAL Range Complex furthers the Navy's execution of its roles and responsibilities under Title 10.

To comply with its Title 10 mandate, the Navy needs to:

- Maintain current levels of military readiness by training in the SOCAL Range Complex;
- Accommodate future increases in operational training tempo in the SOCAL Range Complex and support the rapid deployment of naval units or strike groups;
- Achieve and sustain readiness of ships and squadrons using the SOCAL Range Complex so that the Navy can quickly surge significant combat power in the event of a national crisis or contingency operation;
- Support the acquisition and implementation into the Fleet of advanced military technology using the SOCAL Range Complex to conduct RDT&E and implementation of training events for new platforms and associated weapons systems such as the Littoral Combat Ship (LCS), MV-22 Osprey aircraft, EA-18G Growler aircraft, P-8 Poseidon aircraft, MH-60R/S Seahawk helicopter, Landing Platform-Dock (LPD) 17 amphibious assault ship, and the DDG 1000 (Zumwalt Class) destroyer;

- Identify shortfalls in range capabilities, particularly training infrastructure and instrumentation, and address through range investments and enhancements; and
- Maintain the long-term viability of the SOCAL Range Complex as a premiere Navy training and testing area protecting human health and the environment, and enhancing the communication capability and safety of the range complex.

Emissions associated with the Proposed Action are attributable to increases in training operations and tempo above baseline levels, as discussed in the description of the No Action Alternative and Alternatives 1 and 2 above.

Air Emissions Summary: As described above, the Proposed Action includes increases in training tempo and new training activities on the SOCAL Range Complex. Participants in training activities include aircraft, marine vessels, and ground vehicles. Ordnance use is also proposed for training activities. Factors needed to derive operational source emission rates were obtained from *Compilation of Air Pollutant Emission Factors, AP-42, Volume I* (USEPA 2007), the EMFAC 2007 model (for ground vehicles), the Navy Aircraft Environmental Support Office (for aircraft), and the database developed for Naval Sea Systems Command (NAVSEA) by JJMA Consultants (JJMA 2001) (for marine vessels).

Table 6 provides a summary of annual air emissions within 3 nm (5.6 km) of SCI. The estimated emissions for operations on SCI and within 3 nm (6 km) of SCI were estimated for the No Action Alternative, Alternative 1, and Alternative 2. Because ground vehicle emissions were included in the overall South Coast Air Quality Management District (SCAQMD) State Implementation Plan (SIP) emissions budget for the SCAB for mobile sources, ground vehicles were not included in the total budget for SCI operations that was submitted to the SCAQMD for inclusion in the update to the AQMP. Ground vehicle emissions are therefore not included in Table 6, because they are not subject to a specific requirement to demonstrate that they are included in the SIP since all ground vehicle emissions in the SCAB are part of the SIP emissions budget. The net emissions increase over the baseline case was then calculated. The results are shown in Table 6. As shown in the table, the net emissions increases for CO, NOx (as NO_2 precursor), VOC, PM_{10}, fine particulate matter ($PM_{2.5}$), and $PM_{2.5}$ precursors are below the *de minimis* thresholds for requiring a full conformity determination, and are therefore exempt from further analysis.

The SCAQMD has included SCI emissions in its most recent update to the ozone SIP emissions inventory, including a 1 percent growth factor to accommodated estimated increases in operational tempo at SCI and in contiguous waters within 3 nm (5.6 km).

Emissions associated with the No Action Alternative and Alternative 1 would be less than the *de minimis* thresholds for all pollutants, and would therefore not require a Conformity Determination. Should the SCAB be redesignated as an extreme non-attainment area for the 8-hour NAAQS for O_3, emissions of VOC would still be below the *de minimis* threshold of 10 tons per year. Emissions of NO_x would, however, be above the *de minimis* threshold of 10 tons per year for Alternative 1.

As shown in Table 6, NO_x emissions increases associated with Alternative 2 would likely be greater than the *de minimis* emission levels set by regulations, regardless of the designation of the SCAB as a "severe" or "extreme" non-attainment area for O_3. The total NO_x emissions for the SCI activities contained in the SIP emissions budget, including emissions from the Expeditionary Fighting Vehicles (EFVs), are 100.11 tons (90,818 kg) per year for 2006, with a 1 percent increase in each subsequent year. For conservative purposes, emissions have been compared with the 2006 emissions budget. Under Alternative 2, while NO_x emissions would be above the *de minimis* thresholds, they would be within the SIP emissions budget. Also, should the SCAB be redesignated as an extreme non-attainment area for the 8-hour NAAQS for O_3, emissions under Alternative 1 would also be within the SIP emissions budget. The Proposed Action under either Alternative 1 or 2 would therefore conform with the SIP.

Table 6: Annual Air Emissions within 3 nm of South Coast Air Basin

Emission Source	Emissions, tons/year					
	CO	NOx	VOC	SOx	PM_{10}	$PM_{2.5}$
No Action Alternative						
Aircraft Operations	1.1	1.8	0.1	0.1	1.1	1.1
Marine Vessels	8.7	12.8	3.2	7.2	1.2	1.2
Ordnance	25.1	1.2	0.0	0.0	2.7	1.9
Naval Auxiliary Landing Field (NALF) Operations	132.9	38.0	33.6	1.9	28.1	27.8
Total	**167.8**	**53.7**	**37.0**	**9.2**	**33.1**	**32.0**
Alternative 1						
Aircraft Operations	9.1	9.7	0.9	0.6	5.6	5.6
Marine Vessels	10.9	17.4	4.9	10.3	4.1	4.1
Ordnance	39.7	2.0	0.0	0.0	3.4	2.4
NALF Operations	153.7	47.2	36.0	2.3	29.1	28.9
Total	**213.3**	**76.2**	**41.7**	**13.2**	**42.3**	**40.9**
Alternative 2						
Aircraft Operations	11.1	11.6	1.1	0.7	6.5	6.4
Marine Vessels	12.1	19.8	6.0	12.0	5.5	5.5
Ordnance	48.3	2.6	0.0	0.0	4.4	3.1
NALF Operations	165.8	54.6	37.8	2.7	31.7	31.4
Total	**237.2**	**88.7**	**44.8**	**15.4**	**48.2**	**46.4**
Increase over Baseline (No Action Alternative)						
Alternative 1	**45.5**	**22.5**	**4.7**	**4.0**	**9.2**	**8.9**
Alternative 2	**69.4**	**35.0**	**7.8**	**6.2**	**15.1**	**14.4**
***De minimis* limits**	**100**	**25[a]/100[b]**	**25[a]/100[b]**	**100[b]**	**70**	**100**
SCAQMD SIP Budget	**381.4**	**100.1**	**119.0**	**10.3**	**102.4**	**101.3[c]**

[a]*De minimis* threshold for NO_x and VOC would be 10 tons per year should the SCAB be redesignated to an extreme non-attainment are for the 8-hour NAAQS for O_3.

[b]As NO_2 (for NO_x) and $PM_{2.5}$ precursor.

[c]Assuming PM_{10} is comprised of 99% $PM_{2.5}$.

The estimated emissions for operations within 3 nm (5.6 km) of the San Diego mainland coast were estimated for the No Action Alternative, Alternative 1, and Alternative 2. The net emissions increase over the baseline case was then calculated. The results are shown in Table 7. As shown in the table, the net emissions for CO, NOx, and VOC are below the *de minimis* thresholds for requiring a full conformity determination, and are therefore exempt from further analysis.

Table 7: Annual Air Emissions within 3 nm of San Diego Air Basin

Emission Source	Emissions, tons/year		
	CO	NOx	VOC
No Action Alternative			
Aircraft Operations	2.6	3.6	0.3
Marine Vessels	104.1	234.7	12.6
Ordnance	0.1	0.0	0.0
Total	**106.8**	**238.3**	**12.9**
Alternative 1			
Aircraft Operations	2.9	4.0	0.3
Marine Vessels	106.8	236.9	13.4
Ordnance	0.1	0.0	0.0
Total	**109.8**	**241.0**	**13.7**
Alternative 2			
Aircraft Operations	3.0	4.2	0.4
Marine Vessels	107.3	237.9	13.5
Ordnance	0.1	0.0	0.00
Total	**110.4**	**242.1**	**13.9**
Increase over Baseline (No Action Alternative)			
Alternative 1	**3.0**	**2.62**	**0.8**
Alternative 2	**3.6**	**3.77**	**1.0**
De minimis limits	**100**	**100**	**100**
San Diego Air Basin forecast emissions for 2010(1)	270,793	57,451	63,035

(1) Emissions for year 2010 are from California Air Resources Board emissions inventory website, http://www.arb.ca.gov/app/emsinv/emseic1_query.php

The emissions estimates supporting that conclusion are shown in Tables 6 and 7, which provide a summary of the calculations, methodology, data, and references included in Appendix A of the EIS for the Proposed Action. All emission calculations are provided in Appendix A to this RONA.

Date RONA prepared: November 20, 2008

EMISSIONS EVALUATION AND CONCLUSION

Emissions associated with operations for the Proposed Action were calculated based on standardized methodologies. Emissions were then compared with *de minimis* thresholds for the air basins in which they would occur.

The Department of the Navy concludes that *de minimis* thresholds for applicable criteria pollutants would not be exceeded nor would the projected emissions be regionally significant (i.e., greater than 10 percent of the air basin's emission budgets) as a result of implementation of the Proposed Action. Therefore, the Department of the Navy concludes that further formal Conformity Determination procedures are not required, resulting in this Record of Non-Applicability.

RONA APPROVAL

To the best of my knowledge, the information presented in this Record of Non-Applicability is correct and accurate and I concur in the finding that the Proposed Action is not subject to the General Conformity Rule.

Signature: ____________________ **Date:** 24 NOV 2008

Name/Rank: YF-03

Position: Fleet Environmental Officer (N01CE1)

Activity: Commander, U.S. Pacific Fleet

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Appendix D

LIST OF TABLES

LIST OF FIGURES

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Table D-1. Amount of Vegetation and Wildlife Habitat within Individual Operations Areas on SCI, Description of Potential Impacts of Existing and Proposed Operations, Applicable Mitigation Measures, and Impact Significance. Evaluation of Impact Significance for the No Action Alternative is Based on Comparison with the Baseline.

<table>
<tr><th>Operations Area[1]</th><th>Amount of Resource[1]</th><th>Description of Impacts</th><th>Applicable Mitigation Measures and Impact Significance[2,3]</th></tr>
<tr>
<td>IMPACT AREA I
2,346.4 ac</td>
<td>Vegetation Types (acreage)
Coastal Strand: None
Coastal Salt Marsh: 19.3 ac
Delineated wetland 0.5 ac
Island Woodland: 43.5 ac
Disturbed: 440.5 ac
Grassland: 1.0 ac
MDS Cholla Phase: 932.3 ac
MDS Lycium Phase: 511.6 ac
MDS Prickly Pear-Cholla Phase: 397.7 ac</td>
<td>Existing patterns of disturbance from ordnance impacts and fire would be expected to continue under the no-action alternative, given the long history of similar use as a range for incoming heavy ordnance including naval bombardment, aerial bombardment, conventional artillery and mortars, and live-fire involving small arms. Under no action, Impact Area I receives about 6% of the large caliber ordnance used in SHOBA including about 199 bombs (mostly inert practice bombs), 244 large caliber artillery rounds and 138 2.75-inch rockets fired from helicopters at low altitude. Currently portions of the Impact Area where targets have most frequently been placed are highly disturbed by ordnance and frequent fires. The disturbance level decreases with distance from the target areas as exposure to incoming ordnance and fires decreases. This applies to all the habitats listed at left. Island Woodland, a sensitive community, is additionally protected from frequent fire or ordnance impact by distance from targets and topography. Targets are not placed in the area mapped as Coastal Salt Marsh, including the delineated wetland.

Continued use as an impact area would not be expected to substantially change the condition of vegetation and wildlife habitat given the existing condition and long history of disturbance.

The increases in ordnance associated with Alternatives 1 and 2 (11% and 21% increase in bombs, 31% and 47% increase in large caliber artillery rounds, and 28% and 57% increase in rockets, respectively) would not be expected to substantially change the existing intensity and patterns of disturbance within Impact Area I because the majority of this ordnance would fall into areas already highly disturbed by incoming ordnance. Moreover, improvements in weapons systems would be expected to lead to a higher percentage of ordnance hitting the intended target and fewer stray rounds.

<table>
<tr><th></th><th>Impact Area I
Baseline</th><th>Alt 1</th><th>Alt 2</th></tr>
<tr><td>Bombs</td><td>199</td><td>221</td><td>241</td></tr>
<tr><td>Artillery</td><td>244</td><td>319</td><td>359</td></tr>
<tr><td>Rockets</td><td>138</td><td>176</td><td>217</td></tr>
<tr><td>Total</td><td>581</td><td>716</td><td>817</td></tr>
</table>
</td>
<td>Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2.
G-M-1*
G-M-3*
G-M-4
G-M-5
G-M-6*
G-M-7
G-M-9
*CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them.

No Action: Impacts are less than significant.
Alternative 1: Impacts would be less than significant with mitigation.
Alternative 2: Impacts would be less than significant with mitigation</td>
</tr>
</table>

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
IMPACT AREA II 1,112.9 ac	Vegetation Types (acreage) Coastal Strand: 7.1 ac Island Woodland: 10.1 ac MDS Cholla Phase: 448.5 ac MDS Lycium Phase: 572.2 ac MDS Prickly Pear Phase: 28.0 ac Stabilized sand Dunes: 46.9 ac	Existing patterns of disturbance from ordnance impacts and fire would be expected to continue, given the long history of similar use as a range for incoming heavy ordnance including naval bombardment, aerial bombardment, conventional artillery and mortars, and live-fire involving small arms. Impact Area II includes Impact Area IIA, the "bomb box", where the use of large live bombs (500-2,000 lb) is permitted. Under No Action, Impact Area II (including IIA) receives ~94% of the large caliber ordnance used in SHOBA, including 2,453 bombs, 7,572 artillery rounds, 168 rockets, and 174 mortar rounds. Most of the bombs and nearly all of the rockets go into Impact Area IIA, which is very highly disturbed by ordnance impacts and frequent fires as are adjacent portions of Impact Area II where targets have most frequently been placed. The disturbance level decreases with increasing distance from the target areas as exposure to incoming ordnance and fires decreases. This applies to all the habitats listed at left. Island Woodland, a sensitive community, is additionally protected from frequent fire or ordnance impact by distance from targets and topography. Continued use as an impact area would not be expected to substantially change the condition of vegetation and wildlife habitat given the existing condition of the site and long history of disturbance. The increases in ordnance associated with Alternatives 1 and 2 (11% and 21% increase in bombs, 31% and 47% increase in large caliber artillery rounds, and 28% and 57% increase in rockets, respectively) would not be expected to substantially change the existing intensity and patterns of disturbance within Impact Area II because the majority of this ordnance would fall into areas already highly disturbed by incoming ordnance. Moreover, improvements in weapons systems would be expected to lead to a higher percentage of ordnance hitting the intended target and fewer stray rounds. Impact Area II (incl IIA) Baseline / Alt 1 / Alt 2 Bombs: 2,453 / 2,715 / 2,968 Artillery: 7,572 / 9,926 / 11,141 Rockets: 168 / 215 / 264 Totals: 10,193 / 12,856 / 14,373	Applicable mitigation measures and Impact significance are as described for Impact Area I above.
NALF AVMA 264.8ac	Vegetation Types (acreage) Coastal Strand: 5.1 ac Disturbed: 240.1 ac MDS Lycium Phase: 26.1 ac	Surface disturbance of the AVMA by tracked vehicles in Alternatives 1 and 2 would lead to reduction of vegetation in general; replacement of native shrubs such as boxthorn (*Lycium californicum)* by non-native annual grasses and weeds; and disturbance of soils, leading to an increase in wind and water erosion and opportunities for establishment of invasive species. Native vegetation includes MDS Lycium (along the southern boundary) and Coastal strand (at the egress from West Cove) vegetation types. Some further degradation of existing coastal strand and disturbed habitat is likely to result from USMC amphibious landings involving LCACs (if they run	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
		up into existing vegetation) and heavy tracked and wheeled vehicles including AAVs, EFVs, tanks and wheeled vehicles (if they run over vegetated areas while egressing from the beach).The majority of the AVMA has been disturbed by past grading and these portions would be less substantially affected by tracked vehicle use, except that the movements of tracked vehicles in this AVMA are likely to spread an infestation of veldt grass (*Ehrharta calycina*) that has been noted in this area southward on the Island if the current aggressive treatment of veldt grass is not effective. Designation of this AVMA is part of Alternatives 1 and 2. Alternative 1. The AVMA could be used by tracked vehicles during approximately 43 (42 USMC Amphibious plus 1 USMC Battalion Landing) operations per year. Alternative 2. The AVMA could be used by tracked vehicles during approximately 63 (61 USMC Amphibious plus 2 USMC Battalion Landing) operations per year. Greater impacts than for Alternative 1 due to the 47% increase in operations using the AVMA, compared to Alternative 1.	G-M-4 AVMC-M-1 AVMC-M-2 AVMC-M-3 AVMC-M-4 AVMC-M-5 AVMC-M-6 AVMC-M-7 AVMC-M-9 No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
Old Rifle Range AVMA 200.3 ac	Vegetation Types (acreage) Disturbed: 62.6 ac Grassland: 0.5 ac MDS Lycium Phase: 137.2 ac	Surface disturbance of the AVMA by tracked vehicles in Alternatives 1 and 2 would inhibit ecosystem recovery and lead to reduction of vegetation in general; replacement of native shrubs such as boxthorn (*Lycium californicum)* by non-native annual grasses and weeds; and disturbance of soils, leading to an increase in wind and water erosion. The western boundary of the AVMA contains steep slopes prone to erosion. Drainages previously determined to be under Corps of Engineers jurisdiction cross the AVMA and would be affected by vehicular activity and may require grading to enable vehicular passage. Native vegetation is MDS Lycium (along the southern boundary). Portions of the AVMA have been disturbed by past grading and other activities (development and use as a firing range) and these portions would be less substantially affected by tracked vehicle use. Designation of this AVMA is part of Alternatives 1 and 2. Alternatives 1 and 2: Operations would be as described above for NALF AVMA.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 AVMC-M-1 AVMC-M-2 AVMC-M-3 AVMC-M-4 AVMC-M-5 AVMC-M-6 AVMC-M-7 No Action: No Impact Alternatives 1 and 2: As described above for NALF AVMA, impacts would be less than significant with mitigation.

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
VC-3 AVMA 587.8 ac	Vegetation Types (acreage) Disturbed: 309.8 ac Grassland: 275.5 ac MDS Prickly Pear-Cholla Phase: 2.5 ac Vernal pool wetland: 0.3 ac	Surface disturbance of the AVMA by tracked vehicles in Alternatives 1 and 2 would inhibit ecosystem recovery and lead to reduction of vegetation in general and disturbance of soils, leading to an increase in wind and water erosion and susceptibility to invasive species. Over half of the AVMA has been disturbed by past grading and other uses, including aerial bombardment in the 1930s or 1940s, and would be less substantially affected by tracked vehicle use. The tiny vernal pool wetlands in the southern portion of the AVMA are probably artifacts of the former use of the area for bombing; tracked vehicle activity could adversely affect these pools by crushing or uprooting plants and increasing turbidity. Under some conditions, tracked vechicles may expand the pools by compacting soils and creating new ruts. The movements of tracked vehicles after departing from this AVMA are likely to spread localized infestations of invasive species including salsify (*Tragopogon porrifolius*) and smilo grass (*Piptatherum miliaceum*) to other parts of the island . Designation of this AVMA is part of Alternatives 1 and 2. Alternatives 1 and 2: Operations would be as described above for NALF AVMA	Applicable Mitigation Measures as listed for Old Rifle Range AVMA (above) No Action: No Impact Alternatives 1 and 2: Impacts would be less than significant with mitigation.
AVMC in SHOBA 72.2 ac	Vegetation Types (acreage) Disturbed: 0.9 ac Grassland: 9.1 ac MDS Cholla Phase: 6.7 ac MDS Prickly Pear-Cholla Phase: 9.6 ac	Operation of the AVMC in SHOBA in Alternatives 1 and 2 would have localized impacts on roadside vegetation and habitat including erosion, deposition of dust on vegetation, and spread of invasive plant species. The impacts would be localized along the sides of the AVMC, where invasive species would be detectable and treatable. Frequency of use would be up to approximately 43 times per year in Alternative 1 and up to 63 times per year in Alternative 2. (Construction of the route would be addressed in a separate environmental document and permitted separately).	Applicable Mitigation Measures as listed for Old Rifle Range AVMA (above) No Action: No Impact Alternative 1: Impacts from use of the route during operations would be less than significant with mitigation. Alternative 2: Impacts from use of the route during operations would be less than significant with mitigation.
Island Airfield AMP (AMP-A) 20.2 ac	Vegetation Types (acreage) Disturbed: 20.2 ac	Maneuvering of tracked and wheeled vehicles and howitzers for simulated attacks would inhibit ecosystem recovery, maintain soil and vegetation in disturbed condition, maintain conditions favorable to establishment or spread of invasive plant species, including veldt grass. Existing condition of site is disturbed. Designation of the AMP is part of Alternatives 1 and 2. Alternative 1: Artillery maneuvering during 3-day exercises up to 6 times per year plus 1 USMC Battalion Landing. Alternative 2. Artillery maneuvering during 3-day exercises up to 8 times per year plus 2 USMC Battalion Landings.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 AVMC-M-1 AVMC-M-2 AVMC-M-3 AVMC-M-4 AVMC-M-5

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
			AVMC-M-6 AVMC-M-7 AVMC-M-8 No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
Old Rifle Range (ORR) AMP (AMP-B) 25.4 ac	Vegetation Types (acreage) Disturbed: 20.6 ac MDS Lycium Phase: 4.7 ac	Maneuvering of wheeled and tracked vehicles and placement of howitzers for simulated attack coupled with use of the overlapping AVMA in Alternatives 1 and 2 is expected to inhibit ecosystem recovery and cause reduction of vegetation in general; replacement of native shrubs such as boxthorn (*Lycium californicum*) by non-native annual grasses and weeds; and disturbance of soils, leading to an increase in wind and water erosion. Designation of the AMP is part of Alternatives 1 and 2. Frequency of use is as described for Island Airfield AMP (AMP A) above.	Applicable conservation measures and Impact significance are as described for Island Airfield AMP (AMP A) above.
Self Help AMP (AMP-C) 5.5 ac	Vegetation Types (acreage) Disturbed: 2.1 ac Grassland: 3.4 ac	Maneuvering of wheeled and tracked vehicles and placement of howitzers for simulated attack in Alternatives 1 and 2 is expected to cause reduction of vegetative cover in general and disturbance of soils, leading to an increase in wind and water erosion especially near an existing drainage head on the east side of the AMP. This small site is previously disturbed and lacks perennial vegetation. Periodic use of the AMP by vehicles would inhibit ecosystem recovery by causing soil and vegetation to remain in disturbed condition and maintaining conditions favorable to establishment or spread of invasive plant species. Designation of the AMP is part of Alternatives 1 and 2. Frequency of use is as described for Island Airfield AMP (AMP A) above.	Applicable conservation measures and Impact significance are as described for Island Airfield AMP (AMP A) above.
Old Airfield AMP (AMP-D) 6.2 ac	Vegetation Types (acreage) Disturbed: 3.9 ac Grassland: 2.3 ac	Maneuvering of wheeled and tracked vehicles and placement of howitzers for simulated attack in Alternatives 1 and 2 is expected to cause reduction of vegetative cover in general and disturbance of soils, leading to an increase in wind and water erosion. This small site is previously disturbed owing to its location on one arm of the historic VC-3 runway and lacks native perennial vegetation. Periodic use of the AMP by vehicles would cause soil and vegetation to remain in disturbed condition and maintain conditions favorable to establishment or spread invasive plant species including salsify (*Tragopogon porrifolius*) and smilo grass (*Piptatherum miliaceum*), which are established onsite and have the potential to be carried to other parts of the island through vehicle and foot traffic. Designation of the AMP is part of Alternatives 1 and 2. Frequency of use is as described for Island Airfield AMP (AMP A) above.	Applicable conservation measures and Impact significance are as described for Island Airfield AMP (AMP A) above.
AFP-1 SHOBA 34.1 ac	Vegetation Types (acreage) AFP-1: MDS -Cholla Phase: 34.1 ac	Maneuvering of heavy wheeled and tracked vehicles, including tanks, and digging in of recoil spades on howitzers is expected to cause a reduction in vegetation cover in general, a reduction	Implementation of the SCI Wildland Fire Management Plan is

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
		in native shrub cover and biomass, replacement of native shrubs with non-native grasses and weeds, and to maintain the vegetation and soils on site in disturbed condition, subject to wind and water erosion, and establishment of invasive plant species. Portions of the 34-acre site have been previously affected by vehicles and equipment. Less than significant impacts for No Action due to small size and existing condition of site. No Action: 5 operations per year from this general area. Designation of this AFP is included in Alternatives 1 and 2. Alternative 1. Artillery maneuvering during 3-day USMC artillery exercises up to 6 times per year plus 1 USMC Battalion Landing. Alternative 2. Artillery maneuvering during 3-day USMC artillery exercises up to 8 times per year plus 2 USMC Battalion Landings.	part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 G-M-9 AVMC-M-1 AVMC-M-2 AVMC-M-3 AVMC-M-4 AVMC-M-5 AVMC-M-6 AVMC-M-7 AVMC-M-8 No Action: Impacts are less than significant. Alternative 1. Impacts would be less than significant with mitigation. Alternative 2. Impacts would be less than significant with mitigation.
AFP-6 SHOBA 124.2 ac	Vegetation Types (acreage) Grassland 123.3 ac; MDS -Cholla Phase: 1 ac Vernal pool wetland: 0.4 ac	Maneuvering of heavy wheeled and tracked vehicles, including tanks, and maneuvering and digging in of recoil spades on howitzers in Alternatives 1 and 2 is expected to cause a reduction in vegetation cover in general, a reduction in grass cover and biomass, and to maintain the vegetation and soils on site in disturbed condition, subject to wind and water erosion and establishment of invasive plant species. Vehicle activity in the AFP could adversely affect the small vernal pools by crushing or uprooting plants and increasing turbidity. Under some conditions, tracked or wheeled vehicle use may expand the pools somewhat by compacting soils and creating new ruts that could retain water. Impacts would be less than significant with mitigation. No action: Designation of this AFP is included in Alternatives 1 and 2. Alternative 1. Artillery maneuvering during 3-day USMC artillery exercises up to 6 times per year plus 1 USMC Battalion Landing. Alternative 2. Artillery maneuvering during 3-day USMC artillery exercises up to 8 times per year plus 2 USMC Battalion Landings.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4, G-M-9 AVMC-M-1 AVMC-M-2 AVMC-M-3 AVMC-M-4 AVMC-M-5 AVMC-M-6

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
			AVMC-M-7 AVMC-M-8 No Action: No impact. This site was not included in the No Action Alternative. Alternative 1. Impacts would be less than significant with mitigation. Alternative 2. Impacts would be less than significant with mitigation.
TAR 1—Demolition Range Northeast Point 1.8 ac	Vegetation Types (acreage) Disturbed: 1.4 ac Stabilized sand dunes: 0.4 ac	Light disturbance of vegetation and soils by small groups on foot except for a small area (<0.25 ac) used for demolitions and safety bunker. Sandy soils, gently sloping terrain, and small disturbance area have low potential for erosion. Invasive species may establish around the margins of the disturbed are where they would be localized, detectable, and treatable. Less than significant impacts given light disturbance outside demolitions area, small size and existing condition of the site for No Action. No Action: 23 ops/yr. This TAR has been previously established. Alternative 1: 28 ops/yr. Alternative 2: 30 ops/yr. For Alternatives 1 and 2, with application of mitigation measures, the potential for disturbance of vegetation and soils but impacts would remain low for the reasons stated above despite the increased tempo of operations.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: 23 operations/yr. Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 2—Graduation Beach Underwater Demolition Range 13.8 ac	Vegetation Types (acreage) Disturbed: 13.2 ac	Disturbance of onshore vegetation and soils would be from small groups on foot similar to historical use. Most of the activity at this TAR would occur on the beach and in the water. Impacts of No Action are less than significant. Baseline use = 5 ops/yr. Designation of this TAR is part of Alternatives 1 and 2. Alternative 1: 24 ops/yr. Alternative 2: 30 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 3—BUD/S Beach Underwater Demolition Range 4.1 ac	Vegetation Types (acreage) Disturbed with coastal strand and possibly some coastal dune. Quantitative data not available for this site.	This site has a long history of frequent high level NSW training activity and is adjacent to two permanent manned NSW facilities that use it for training. Native vegetation is somewhat disturbed. There would be additional disturbance by small groups on foot plus site improvements in Alternatives 1 and 2, which include erosion control on the access road and the demolition area, communication line telephone, maintenance of a demolition preparation area, and a demolition staging area. Some potential for establishment of invasive species but should be readily detectable and treatable given small size, accessibility, and frequent use of site. Most of the activity at this TAR would occur on the beach and in the water. Baseline use = 82 ops/yr. Designation of this TAR is part of Alternatives 1 and 2. Alternative 1: 82 ops/yr. Alternative 2: 95 NSW and 4 USMC Amphibious ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 4—Whale Point/Castle Rock 27.1 ac	Vegetation Types (acreage) Disturbed: 15.4 ac MDS Lycium Phase: 11.7 ac	Ongoing and proposed operations would be expected to gradually degrade the MDS Lycium Phase habitat due to direct impacts resulting from frequent use by small groups on foot coupled with use of demolitions, flares, pyrotechnics, and small arms (including tracers). Indirect impacts associated with spread of invasive species that increase in response to disturbance of vegetation and soils and frequent small fires would also expected to adversely affect the MDS Lycium Phase habitat, because the dominant species regenerates slowly after fire or other disturbance and short fire return intervals are likely to cause long-term loss (DoN 2005, Draft FMP BA). Implementation of the SCI Wildland Fire Management Plan as described herein would be expected to reduce impacts of future operations under Alternatives 1 and 2. No Action: Baseline use = 222 ops/yr. This TAR has been previously established. Alternative 1: 240 ops/yr. Alternative 2: 300 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts on vegetation are significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 5— West Cove Amphibious Assault Training Area 2.1 ac	Vegetation Types (acreage) Coastal strand: 2.1 ac[1]	NSW activities would have minimal impact due to their infrequent occurrence and low intensity nature. Some further degradation of existing coastal strand and disturbed habitat is likely to result from USMC amphibious landings involving LCACs (if they run up into existing vegetation) and heavy tracked and wheeled vehicles including AAVs, EFVs, tanks and wheeled vehicles (if they run over vegetated areas while egressing from the beach). Existing use is for amphibious landings and extractions and access to NALF AVMA, which overlaps West Cove. Movements of vehicles and personnel from this TAR to other parts of the Island are likely to spread an infestation of veldt grass (*Ehrharta calycina*) that has been noted in this area and has been the target of weed treatments for several years. Baseline use = 10 ops/yr incl. 10 USMC Amphibious. Designation of this TAR is part of Alternatives 1 and 2. Alternative 1: 25ops/yr (incl. 17 USMC Amphibious). Alternative 2: 55 ops/yr (incl. 44 USMC Amphibious).	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 AVMC-M-9 For amphibious landings measures listed above for NALF AVMA are also applicable. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 6—White House Training Area 3.3 ac	Vegetation Types (acreage) MDS *Lycium* Phase: 3.3 ac	Minimal disturbance to native vegetation and soils is anticipated in Alternatives 1 and 2. Site has existing developed features and access road. Some amount of disturbed vegetation is present and not reflected in the vegetation types data. Baseline use = 0 ops/yr. Designation of this TAR is part of Alternatives 1 and 2. Alternative 1: 8 ops/yr. Alternative 2: 10 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 9—Photo Lab Training Area 26.3 ac	Vegetation Types (acreage) Disturbed: 23.5 ac Grassland: 2.8 ac	Physical disturbance to vegetation and habitat from continuing operations in the No-Action Alternative would be minimal (small groups on foot). Constructed roads and paths already exist between buildings. Use of breaching charges would be confined to designated currently disturbed areas. Baseline use = 23 ops/yr. Designation of this TAR is part of Alternatives 1 and 2. Alternative 1: 32 ops/yr. Alternative 2: 44 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 10—Demolition Range West 54.9 ac	Vegetation Types (acreage) Disturbed 29.6 ac MDS Lycium Phase: 25.3 ac Stabilized sand dune: 0.1 ac Salt marsh wetland: 0.14 ac	Development and use of the TAR would be concentrated in previously disturbed parts of the site, some of which have partially revegetated with native species. The proposed facility at this TAR would include a 200 ft^2 (19 m^2) personnel safety bunker and a 1,000 ft^2 (93 m^2) range building. The area of disturbance including demolitions area would be limited to a 10,000 ft^2 (930 m^2) area. Outside of the demolition areas operations would be by small groups on foot. Some potential for invasive species to establish on the site and along the access road and to spread into undisturbed MDS-Lycium and stabilized dune vegetation. Potential for wildland fires originating onsite, spreading into contiguous MDS-Lycium habitat to the north and south of TAR 10 has been addressed in the SCI Wildland Fire Management Plan and BA, with effective measures designed to minimize spread of fire beyond the TAR and avoid type conversion of habitat (see above). Assuming implementation of the Wildland Fire Management Plan as described herein and confining construction and concentrated human activities to existing disturbed areas, impacts on vegetation would be less than significant in Alternatives 1 and 2. Baseline use = 3 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 20 ops/yr. Alternative 2: 20 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 11—Surveillance Training Area 8.8 ac	Vegetation Types (acreage) Maritime sage scrub: 8.8 ac	Low disturbance of vegetation based on infrequent use by small groups on foot only, with helicopter insertion. Moderate potential for wildland fire ignition associated with use of flares and ordnance. Low potential for introduction and spread of invasive species due to small groups and relatively infrequent use, however sensitive plant communities and T/E plant populations are present on site and in surrounding area and could be adversely affected by an introduction of invasive species. Less than significant impacts for Alternatives 1 and 2 assuming implementation of the Wildland Fire Management Plan as described herein. Baseline use = 4 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 17 ops/yr. Alternative 2: 22 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 12—Radar Site Training Area 5.1 ac	Vegetation Types (acreage) Grassland: 4.9 ac Maritime sage scrub: 0.2 ac	Low impacts on vegetation and soils caused by infrequent foot traffic by small groups in Alternatives 1 and 2. Low to moderate potential for introduction and spread of invasive species. Low risk of wildland fire ignition. Baseline use = 11 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 12 ops/yr. Alternative 2: 17 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 13—Randall Radar Site Training Area 17.1 ac	Vegetation Types (acreage) Disturbed: 6.4 ac Grassland: 7.4 ac MDS Prickly Pear: 0.1 ac Maritime sage scrub: 3.6 ac	Low impacts on vegetation and soils caused by infrequent foot traffic by small groups. Use of flares, illumination rounds, and pyrotechnics creates a moderate risk of igniting a wildland fire. Live-fire would be indoors only. Less than significant impacts for Alternatives 1 and 2 assuming implementation of the Wildland Fire Management Plan as described herein. Baseline use = 29 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 31 ops/yr. Alternative 2: 52 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 14— VC-3 Onshore Parachute Drop Zone "Twinky" 338.7 ac	Vegetation Types (acreage) Disturbed: 5.2 ac Grassland: 324.9 ac MDS Prickly Pear: 8.6 ac	Low disturbance of vegetation caused by NSW activities based on use by small groups on foot only, some with helicopter insertion. Existing vegetation reflects substantial disturbance from past activities. Moderate potential for wildland fire ignition associated with use of flares and ordnance. Low potential for introduction and spread of invasive species due to small groups and relatively infrequent use. No sensitive species or vegetation types known from the site. Less than significant impacts for Alternatives 1 and 2 assuming implementation of the Fire Plan. Baseline use = 20 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 30 ops/yr. Alternative 2: 68 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 15— VC-3 Airfield Training Area 770.8 ac	Vegetation Types (acreage) Disturbed: 368.7 ac Grassland: 397.1 ac MDS Prickly Pear: 5.1 ac Vernal pool wetland: 0.3 ac	Low disturbance of vegetation caused by NSW activities based on use by small groups on foot only, with helicopter or land insertion. Existing vegetation reflects substantial disturbance from past activities. Moderate potential for wildland fire ignition associated with use of flares and ordnance high potential for spread under high and extreme FDRS. Low potential for introduction and spread of invasive species due to small groups and relatively infrequent use. Except for a small area of vernal pool wetlands in the southern tip of the TAR and overlying VC-3 AVMA (see above), no sensitive species or sensitive vegetation types are known from the site. The vernal pools would not be adversely affected (see text). Less than significant impacts for Alternatives 1 and 2 assuming implementation of the Wildland Fire Management Plan as described herein. Baseline use = 20 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 25 ops/yr. Alternative 2: 94 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 16—South VC-3 (Missile Impact Range) 134.7 ac	Vegetation Types (acreage) Grassland: 129.8 ac Disturbed: 3.8 ac MDS-Prickly Pear Phase: 1.1 ac	Proposed activities, including vehicle traffic, use as a missile target, land demolition, direct action, parachute drops, UAV training, convoy/mounted operations, and use during Battalion Landings would be expected to have some additional impact on the habitat at this site. Existing condition of grassland habitat of the Missile Impact Range (MIR) is disturbed as a result of use as a missile target area, including grading and the construction and rearrangement of very large scale targets. Additional acreage outside the MIR is primarily grassland with some disturbance by roads and other past activities. Training activities in this expanded area would be the same as those listed above, except for the following activities, which will not occur in the expanded area south of the existing MIR: parachute landings zones; convoy operations; land demolition; and target placement. There is a moderate potential for wildland fire ignition associated with use of flares, pyrotechnics, and tracers. Low potential for introduction and spread of invasive species due to small groups and relatively infrequent use of the TAR. Due to the resilience of the grassland habitat and the low impact of activities that would take place outside of the disturbed MIR, less than significant impacts for Alternatives 1 and 2 are anticipated assuming implementation of the Wildland Fire Management Plan as described herein. Baseline use = 25 ops/yr. This TAR has been previously established. Alternative 1: 41 ops/yr. Alternative 2: 52 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 17— Eel Point Tactical Training Range 11.9 ac	Vegetation Types (acreage) Disturbed: 4.7 ac MDS Lycium Phase: 7.2 ac	Outside of existing disturbed areas where demolitions would occur, disturbance of vegetation and soils would be limited to small groups on foot using tactical environmental movement. Low disturbance of vegetation, soils, and crusts would result from the foot traffic. There is a moderate potential for invasive species to spread following the foot traffic and into the surrounding undisturbed MDS Lycium vegetation. Potential for wildland fires originating onsite to spread into contiguous MDS-Lycium habitat to the north or to the south of TAR 17 has been addressed in the SCI Fire Management Plan and BA, with effective measures designed to minimize spread of fire beyond the TAR and avoid type conversion of habitat. Assuming implementation of the Wildland Fire Management Plan as described herein and confining most activities including demolitions and flare use to existing disturbed areas, impacts on vegetation would be less than significant in Alternatives 1 and 2. Baseline use = 15 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 31 ops/yr. Alternative 2: 40 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 18—Close Quarter Battle Training Complex 0.64 ac	Vegetation Types (acreage) Disturbed: 0.6 ac	Development and use of site in Alternatives 1 and 2 would impact disturbed vegetation and habitat only. Baseline use = 0 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 25 ops/yr. Alternative 2: 30 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 19—Simulated POW Camp and SAM Site 2.4 ac	Vegetation Types (acreage) Disturbed: 2.4 ac	Development and use of site in Alternatives 1 and 2 would impact disturbed vegetation and habitat only. Baseline use = 0 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 10 ops/yr. Alternative 2: 10 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 20—Pyramid Cove Training Area 167.2 ac	Vegetation Types (acreage) Coastal salt marsh: 11.6 ac Disturbed: 155.6 ac The coastal marsh is evidently mapped on the basis of vegetation and appears to be very infrequently flooded and lacking surface water. It is dominated by native salt marsh plant species due to the presence of saturated saline soils.	Impacts would be less than significant for No Action given the levels of existing disturbance in Impact Area I, including the portion designated as TAR 20. Ship to shore live-fire from small boats and other live-fire from people on foot would be expected to increase and vegetation and habitat would be expected to remain in similar condition or experience an incremental increase in disturbance as a result of ordnance use, fire, and foot traffic in Alternatives 1 and 2. Minimal impacts on the salt marsh habitat, which is low-lying and set back from the beach, would be expected from ordnance and fire. Vehicle traffic, including mounted patrol operations, would be confined to existing roads. Baseline use = 44 ops/yr. (This TAR is located in SHOBA Impact Area I where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 50 ops/yr. Alternative 2: 60 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-3* G-M-4, G-M-9 TAR-M-1* *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 21—Horse Beach Cove Training Area and Horse Beach Cove Amphibious Landing and Embarkation Area. 88.1 ac	Vegetation Types (acreage) Coastal salt marsh: 7.6 ac Island Woodland: 0.2 ac MDS Lycium Phase: 80.3 ac The coastal salt marsh in TAR 21 is the second largest mapped on SCI	TAR 21. Frequent use by small groups on foot with live firing has caused localized disturbance to vegetation in frequently used areas and routes. There is a moderate potential to introduce and spread invasive species related to the types and frequency of operations conducted in and proposed for TAR 21. Increased fire frequency resulting from the intensification of uses may lead to changes in vegetation (possibly leading to type conversion) under No Action and in Alternatives 1 and 2. The Wildland Fire Management Plan does not provide for ground based fire suppression within SHOBA. Amphibious Landing and Embarkation: Direct impacts of vehicular traffic on vegetation would be localized between the beach and the egress road, but vehicle traffic could significantly affect coastal salt marsh and coastal strand/foredune vegetation while maneuvering between beach and egress road in Alternatives 1 and 2. No amphibious landings are conducted under No Action. Baseline use = 79 ops/yr. (This TAR is located in SHOBA Impact Area I where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.) Alternative 1: 91 ops/yr. including 81 NSW, 10 USMC Amphibious and 1 USMC Battalion Landing.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-3* G-M-4, G-M-7, G-M-9 TAR-M-1* AVMC-M-3 AVMC-M-4 AVMC-M-5 AVMC-M-7 AVMC-M-10 *CRNSW policy prohibiting access for natural resource surveys or

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
		Alternative 2: 102 ops/yr. including 90 NSW, 10 USMC Amphibious and 2 USMC Battalion Landing.	management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts on vegetation are significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: 102 ops/yr. including 90 NSW, 10 USMC Amphibious and 2 USMC Battalion Landing. Impacts would be less than significant with mitigation.
TAR 22—China Cove Training Area 289 ac	Vegetation Types (acreage) Island Woodland: 0.1 ac MDS Cholla Phase: 22.3 ac MDS Lycium Phase: 229.6 ac Stabilized sand dunes: 37.0 ac	Most of the land area of TAR 22 is disturbed, a result of a long history of Naval artillery and aerial bombardment and other live-fire training. Proposed uses in Alternatives 1 and 2 would incrementally add to the existing disturbance, primarily as a result of ordnance use, demolition activities, fire, and foot traffic by platoon-sized groups (12-15). Entry to the site by swimming for many of the operations minimizes the potential for introducing or spreading invasive species. Stabilized sand dunes above beach are in relatively good condition despite evidence of ordnance and training impacts. Baseline use = 96 ops/yr including 33 NSW ops/yr. and 63 Non-NSW Naval ops/yr. (This TAR is located in SHOBA Impact Area II and contains Impact Area IIA, where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.) Alternative 1: 200 ops/yr. including 33 NSW, 6 USMC Amphibious, 1 USMC Battalion Landing and 160 other naval operations. Alternative 2: 220 ops/yr. including 40 NSW, 16 USMC Amphibious, 2 USMC Battalion Landing and 162 other naval operations. (Other naval operations include naval artillery and air-to-ground ordnance delivery into overlapping Impact Area II and IIA (which are included above under Impact Area II).	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1*, G-M-3* G-M-4, G-M-7, G-M-9 TAR-M-1* *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts on vegetation are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
Infantry	Vegetation Types (acreage)	Foot traffic has a moderate potential for localized physical disturbance of the vegetation and soils over an	Implementation of the SCI

Table D-1 (continued). Amount of Vegetation and Wildlife Habitat Within Individual Operations Areas on SCI

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
Operations Area 8,815.3 ac	Coastal strand: 4.5 ac Coastal salt marsh: 4.0 ac Island woodland: 3.2 ac Disturbed: 974.5 ac Grassland: 6351.4 ac MDS-Cholla Phase: 550.6 ac MDS Lycium Phase: 311.1 ac MDS Prickly Pear/Cholla phase: 435.6 ac MDS Prickly Pear Phase: 179.6 ac Vernal pool wetland 2.1 ac	extensive area, especially on sloping surfaces and when soils are wet. Grassland habitat, which constitutes the majority (~72%) of the Infantry Operations Area, has comparatively low botanical sensitivity. Habitat classified as disturbed constitutes another 11% of the Infantry Operations Area, however much of this disturbed habitat is incorporated into overlapping operations areas such as TARs and AVMAs addressed above. Because of the infrequency and dispersed nature of the foot traffic, direct impacts on vegetation and soils are expected to be temporary and less than significant. Island woodland, coastal strand and coastal salt marsh communities have high botanical sensitivity. The coastal strand and coastal salt marsh communities are in overlapping portions of Impact Area I and TAR 21. The Island woodland occurs in canyons mostly around the periphery of the IOA particularly on the edge of the eastern escarpment where the community is unlikely to be affected by foot traffic because of the terrain. Foot traffic spread over a large area has the potential to introduce or spread invasive plant species, an indirect impact. The large size and remoteness of parts of the Infantry Operations Area will make beginning infestations of invasive species difficult to detect when they are localized and most treatable. The large number of personnel and equipment involved in the Battalion Landing Operations and their dispersal over the island make introductions and spreading of invasive species almost unavoidable. The consequences of a particular introduction are not entirely predictable, however there are many documented cases of landscape transformations with serious ecological impacts resulting from introductions, most notably on islands. Baseline use = 0 ops/yr, Battalion-sized landings have occurred on SCI in the past, but not during the baseline year. Foot traffic by individuals and groups is permitted within the IOA and elsewhere on the Island under the No Action Alternative. Alternative 1: 1 USMC Battalion-sized landing per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road. 2 USMC Battalion-sized landings per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road. Alternative 2: 2 USMC Battalion-sized landings per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road.:	Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 G-M-9 AVMC-M-1 AVMC-M-2 AVMC-M-4 AVMC-M-7 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Note:
1. Vegetation acreage based on the classification and mapping by Sward and Cohen (1980). Resource acreage totals are approximate and may not agree with operations area total due to rounding and other factors associated with the GIS data layers.
2. Impact significance conclusion is based on discussion in "Description of Impacts" column and is assessed assuming application of mitigation measures identified in this document. Impact significance of No Action is based on condition of the resource existing in 2004 and continuance of operations at baseline levels.
3. Impact significance assessment assumes mitigation for Alternatives 1 and 2.

Table D-2. Occurrence of San Clemente Island Indian Paintbrush Within Individual Operations Areas on SCI, Description of Potential Impacts of Existing and Proposed Operations, and Impact Significance. Evaluation of Impact Significance for the No Action Alternative is Based on Comparison with the Baseline

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
IMPACT AREA I	SCI Indian paintbrush: 52 of 335 occurrences on SCI (15.5% of SCI total occurrences), 2034 of 14,064 individuals on SCI (14.5% of SCI total individuals). Nearly all of Impact Area I occurrences are in Horse Beach Canyon	Impact Area I contains about 15% of the known SCI Indian paintbrush on SCI. The occurrences of these plants are mainly in Horse Beach Canyon and are generally away from target locations and somewhat shielded by topography, minimizing potential for ordnance hits. Since removal of non-native herbivores from the Island, SCI Indian paintbrush has been increasing in abundance in this area despite ongoing use of live ordnance. Effect of fire on SCI Indian paintbrush is unknown but indications are that it might benefit from occasional fire. Under No Action, Impact Area I receives about 6% of the large caliber ordnance used in SHOBA, and the increases with Alternatives 1 and 2 are as described in Table D-1. Increased use of large ordnance in Alternatives 1 and 2 would have minimal effects on this species based on the increase of the plants during ongoing operations, adaptation to fire, distance from frequently used targets and topographic shielding. Implementation of the Navy Access Policy applying to Impact Areas I and II and TARS 20, 21, and 22 will preclude future direct monitoring of this endangered plant species and its habitat in these locations.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-3* G-M-4 G-M-5 G-M-6* G-M-7 G-M-9 *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant. Alternative 2: Impacts would be less than significant.
IMPACT AREA II	SCI Indian paintbrush: 3 of 335 SCI occurrences (0.9% of SCI total occurrences) with 43 individuals (0.3% of 14,064 SCI total individuals). These are located in China Canyon.	Existing patterns of disturbance from ordnance impacts and fire would be expected to continue, given the long history of similar use. This species is located in China Canyon where there is some topographic shielding, and it is not near targets, reducing the likelihood of a direct hit or near miss by ordnance. This species is increasing in abundance in SHOBA. As described in Table D-1, Impact Area II (including IIA) would receive about 94 % of the incoming large caliber ordnance in SHOBA and the increases with Alternatives 1 and 2 are as described in Table D-1. Heavy use of Impact Area II would have no adverse effects on this species based on the likelihood that the existing occurrences would persist or expand.	Applicable conservation measures and Impact significance are as described for Impact Area I above.

Table D-2 (continued). Occurrence of San Clemente Island Indian Paintbrush Within Individual Operations Areas on SCI

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
NALF AVMA	SCI Indian paintbrush: 6 of 335 SCI occurrences (1.8% of SCI total occurrences) with a total of 6 individuals (0.04% of 14,064 SCI total individuals) are clustered a short distance inland of the TAR 5 boundary. The location of each individual was recorded as a separate occurrence in this survey rather than as a single location with six individuals at one location as has been the more common practice.	The six Indian paintbrush plants in this AVMA are newly discovered and are located in a cluster with 3 other sensitive species (discussed in Table D-10) a short distance inland of the egress from TAR 5. At this location, surface disturbance of the AVMA by tracked vehicles in Alternatives 1 and 2 could lead to damage to or elimination of these plants from this area. Protection of the localized area containing the paintbrush can be addressed through development of the erosion control plan (AVMC-M-3), briefing of maneuver area boundaries prior to conducting operations in these areas (AVMC-M-4), and continuing to use the existing route for ingress and egress from the beach at West Cove (AVMC-M-9), as appropriate. Tracked vehicle use in this AVMA is likely to spread an infestation of veldt grass (*Ehrharta calycina*) within the AVMA and southward on the Island if the current aggressive treatment of veldt grass is not effective. Designation of this AVMA is part of Alternatives 1 and 2. Alternative 1. The AVMA could be used by tracked vehicles during approximately 43 (42 USMC Amphibious plus 1 USMC Battalion Landing) operations per year. Alternative 2. The AVMA could be used by tracked vehicles during approximately 63 (61 USMC Amphibious plus 2 USMC Battalion Landing) operations per year.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 AVMC-M-1 AVMC-M-2 AVMC-M-3 AVMC-M-4 AVMC-M-5 AVMC-M-6 AVMC-M-7 AVMC-M-9 No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
AFP-1 SHOBA	SCI Indian paintbrush: 1 of 335 SCI occurrences (0.3% of SCI total occurrences) with 28 individuals (0.2% of 14,064 SCI total individuals). These are located in the central portion of the AFP near the Ridge road.	Maneuvering of heavy wheeled and tracked vehicles, including tanks, and digging in of recoil spades on howitzers are likely to adversely affect individuals in this population through the physical effects of vehicle activity and possibly by spread of invasive species facilitated by the activity. Portions of this 34-acre site had been disturbed previously by grading and off-road tracked vehicle and artillery activity. The paintbrush occurrences appear to be in operationally accessible portions of the site but outside of the previously used portions of the site. Depending on the specifics of the site, protection of the localized area containing the paintbrush could potentially be addressed as part of development of the erosion control plan (AVMC-M-3) and/or briefing of maneuver area boundaries prior to conducting operations in these areas (AVMC-M-4). Less than significant impacts for No Action due to small size and previous disturbance of site and the small proportion of the SCI Indian Paintbrush population represented on site (<<1 percent). No Action: 5 operations per year from this general area. Designation of this AFP is included in Alternatives 1 and 2. Alternative 1. Artillery maneuvering during 3-day USMC artillery exercises up to 6 times per	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 G-M-9 AVMC-M-1 AVMC-M-2 AVMC-M-3 AVMC-M-4 AVMC-M-5

Table D-2 (continued). Occurrence of San Clemente Island Indian Paintbrush Within Individual Operations Areas on SCI

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
		year plus 1 USMC Battalion Landing. Alternative 2. Artillery maneuvering during 3-day USMC artillery exercises up to 8 times per year plus 2 USMC Battalion Landings.	AVMC-M-6 AVMC-M-7 AVMC-M-8 No Action: Impacts are less than significant. Alternative 1. Impacts would be less than significant with mitigation. Alternative 2. Impacts would be less than significant with mitigation.
TAR 21—Horse Beach Cove Training Area and Horse Beach Cove Amphibious Landing and Embarkation Area.	SCI Indian paintbrush: 1 of 335 occurrences on SCI (0.3% of SCI total occurrences), 3 of 14,064 individuals on SCI (0.02% of SCI total individuals). About 15% of SCI total individuals/occurrences of SCI Indian paintbrush are located in Horse Beach Canyon, in Impact Area I upstream from this TAR.	TAR 21. Occurrences of this species are primarily inland of the TAR boundary and are associated with the floodplain, hill slopes, or canyon walls of Horse Beach Canyon. Frequent foot traffic by small groups, ordnance use, and demolitions could directly affect this species. These effects would be localized to the specific activity areas. There is a moderate potential to introduce and spread invasive species related to the frequency of operations in TAR 21. Ship to shore live firing, tracers, use of flares and other devices have the potential to ignite fires that could spread north of the TAR boundary into areas occupied by this species, which appears able to survive periodic fire by reproduction from seed. Repeated fires at a short interval could adversely affect this species by killing plants before its seed bank has been replenished. Horse Beach Canyon upstream from the TAR 21 boundary supports about 15% of the SCI total occurrences of the SCI Indian paintbrush. The Wildland Fire Management Plan does not provide for ground-based fire suppression within SHOBA. Fires would be unlikely to spread far beyond the TAR boundary in an up-canyon direction due to the gentle elevational gradient of the lower canyon coupled with the direction of prevailing NW or NE winds under high and very high FDRS (DoN 2006), which would be opposed to spreading of fire in an up-canyon direction. Increased use in Alternatives 1 and 2 would increase the potential for adverse effects on this species. Amphibious Landing and Embarkation: Direct impacts of vehicular traffic on vegetation would be localized between the beach and the egress road where the SCI Indian paintbrush is not known to occur, so vehicular traffic associated with amphibious exercises would have less than significant impact on the species. Associated activity is as described above for TAR 21. Baseline use = 79 ops/yr. This TAR is located in SHOBA where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2. Alternative 1: 91 ops/yr. including 81 NSW, 10 USMC Amphibious and 1 USMC Battalion Landing. Alternative 2: 102 ops/yr. including 90 NSW, 10 USMC Amphibious and 2 USMC Battalion Landing.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-3* G-M-4 G-M-5 G-M-6* G-M-7 G-M-9 AVMC-M-1 AVMC-M-2* AVMC-M-3* AVMC-M-4 AVMC-M-5 AVMC-M-7 AVMC-M-10 TAR-M-1* *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them.

Table D-2 (continued). Occurrence of San Clemente Island Indian Paintbrush Within Individual Operations Areas on SCI

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
			No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-2 (continued). Occurrence of San Clemente Island Indian Paintbrush Within Individual Operations Areas on SCI

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 22—China Cove Training Area	SCI Indian paintbrush: 1 of 335 occurrences on SCI (0.3% of SCI total occurrences), 23 of 14,064 individuals on SCI (0.16% of SCI total individuals).	The single location within TAR 22 is within Impact Area II at the eastern boundary of the TAR, where it is unlikely to be affected by activities. The plants are located in China Canyon near the TAR boundary where they are afforded some topographic shielding and are not in proximity with target areas, reducing the likelihood of a direct hit or near miss by ordnance. This species is increasing in abundance in SHOBA despite historic and ongoing bombardment, ordnance use and wildland fire. Effect of fire on SCI Indian paintbrush would be as described above. Activities within the TAR under No Action apparently have not adversely affected this species due to the distance of the plants from the TAR and topographic shielding that makes direct ordnance impacts unlikely, even after the long exposure of these populations to similar activities. Increased use of the TAR 22 in Alternatives 1 and 2 would increase the potential for effects on this species. Baseline use = 96 ops/yr including 33 NSW ops/yr. and 63 Non-NSW Naval ops/yr. (This TAR is located in SHOBA where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.) Alternative 1: 200 ops/yr. including 33 NSW, 6 USMC Amphibious, 1 USMC Battalion Landing and 160 other naval operations. Alternative 2: 220 ops/yr. including 40 NSW, 16 USMC Amphibious, 2 USMC Battalion Landing and 162 other naval operations (naval artillery and air-to-ground ordnance into overlapping Impact Area II and IIA (covered under Impact Area II).	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-3* G-M-4 G-M-5 G-M-6* G-M-7 G-M-9 TAR-M-1* *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
Infantry Operations Area	SCI Indian paintbrush: 53 of 335 SCI 1998-2007 occurrences identified (15.8% of SCI total occurrences), 808 of 14,064 individuals on SCI (5.75% of SCI total individuals).	About 16% of the known occurrences of SCI Indian paintbrush on SCI are located in the Infantry Operations Area, where there would be an increase in dispersed foot traffic associated with Battalion Landings under Alternatives 1 and 2. Surveys of the 8,815-ac area have been recently completed with over 50 additional populations of this species located within the boundaries of the IOA. SCI Indian paintbrush is a small shrub and is unlikely to be adversely affected by occasional foot traffic. Any effects of foot traffic on a local occurrence of this species would be dispersed (because the Marines would be spread out), minor (trampled leaves or broken branches), infrequent (up to twice per year, generally less) and temporary. Because of the dispersion of the Marines and the small effect that the foot travel would have on plants, it is not expected that the direct effects of foot travel on this species would be substantial or significant.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 G-M-9 AVMC-M-1

Table D-2 (continued). Occurrence of San Clemente Island Indian Paintbrush Within Individual Operations Areas on SCI

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
		However, the potential for introduction or spread of invasive species as a result of dispersed battalion landing foot traffic is not discountable and adverse consequences from such an event on endangered plant species are reasonably foreseeable. Baseline use: Battalion-sized landings have occurred on SCI in the past, but not during the baseline year. Foot traffic by individuals and groups is permitted within the IOA and elsewhere on the Island under the No Action Alternative. Alternative 1: 1 USMC Battalion landing per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road. Alternative 2: 2 USMC Battalion-sized landings per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road.	AVMC-M-2 AVMC-M-4 AVMC-M-7 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Note:
1. See text for an explanation of the 1998-2007 rare plant data. Under “amount of resource” resources (e.g., occurrences and numbers of individuals) occurring in overlapping operations areas are reported for each of the overlapping areas, enabling the effects of the differing operations in the overlapping areas to be assessed.
2. Impact significance conclusion is based on discussion in “Description of Impacts” column and is assessed assuming application of mitigation measures identified in this document.
3. Impact significance assessment assumes mitigation for Alternatives 1 and 2.

Table D-3. Occurrence of San Clemente Island larkspur within or near individual operations areas on SCI, description of potential impacts of existing and proposed operations, and impact significance. Evaluation of impact significance for the no action alternative is based on comparison with the baseline.

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TARs 14 & 15	No populations documented in these TARs but substantial populations are located on the eastern side and downslope from TARs 14 and 15.	No direct effect. Modeled fires under moderate Fire Danger Rating System conditions with southwest winds 5 mph (without implementing Wildland Fire Management Plan (DoN 2005) precautions and countermeasures referenced in Section 2-x and summarized below) spread into SCI larkspur habitat during nighttime hours, affecting up to 24 occurrences and 5,000 individuals 12 hours after ignition. This would be unlikely given implementation of the measures specified in the plan, because the fire would originate and burn initially in grassland habitat in moderate, accessible terrain in which fire suppression is most feasible. During the conditions when fire would be most likely, the SCI larkspur exists as dormant underground storage roots that resprout the following rainy season. This species, which is most prevalent in grassland habitats, may benefit from the removal of competing vegetation and thatch caused by periodic fire. The grassland habitat of the larkspur also recovers rapidly after fire. These model results do not take into account precautions and countermeasures specified in the SCI Wildland Fire Management Plan, which incorporates a series of increasing precautions and fire suppression measures related to increasing FDRS ratings, including having a fully equipped and staffed fire truck positioned within line of sight of the TAR and action area and having the ability to be on scene and pumping water within 10 minutes of an ignition report, whenever any type of incendiary ordnance is used and at higher danger ratings imposing restrictions on the use of demolitions or other flame or heat producing ordnance, including flares, tracers, and pyrotechnics, during daytime hours except under specific conditions. Increased operations in TARs 14 and 15 under Alternatives 1 and 2 would increase the potential for fires that could adversely affect the species. Even with the resiliency of the plants and their habitat with regard to fire, implementation of the SCI Fire Management Plan would be necessary to reduce those effects. Designation of TARs 14 and 15 is part of Alternatives 1 and 2 TAR 14: Baseline use = 20 ops/yr. Alternative 1: 30 ops/yr. Alternative 2: 68 ops/yr. TAR 15: Baseline use = 20 ops/yr. Alternative 1: 25 ops/yr. Alternative 2: 94 ops/yr.	Fire Management Plan Implementation G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1. Impacts would be less than significant with mitigation. Alternative 2. Impacts would be less than significant with mitigation.

Table D-3 (continued). Occurrence of San Clemente Island larkspur within or near individual operations areas on SCI.

Operations Area[1]	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
Infantry Operations Area	SCI larkspur: 7 of 38 1998-2007 occurrences on SCI (18.4% of SCI total 1998-2006 occurrences), 284 of 7,389 individuals on SCI (3.8% of SCI total individuals); 12 of 46 pre-1998 historic SCI occurrences (26.1% SCI total historic occurrences) totaling 13.3 of 87 pre-1998 SCI acres (15.3%).	Less than 20% of known occurrences of this endangered plant species on SCI are within the Infantry Operations Area, where they would be exposed to dispersed foot traffic associated with Battalion Landings up to 2 times per year under Alternatives 1 and 2. Surveys of the 8,815-ac area were recently completed and 5 new occurrences totaling 59 individuals were located within the IOA. Any effects of foot traffic on a local population of this plant species would be dispersed (because the Marines would be spread out), minor (damaged leaves or flower stems), infrequent (up to twice per year, generally less) and temporary. SCI larkspur would be affected only during its winter-spring season of growth when foliage is above ground. The rest of the year they exist as dormant storage roots and dormant seed. Because of the dispersion of the Marines and the small effect that the foot travel would have on individual plants, it is not expected that the direct effects of foot travel on this species would be substantial. However, the potential for introduction or spread of invasive species as a result of dispersed battalion landing foot traffic is not discountable, and adverse consequences from such an event on this species in the Infantry Operations Area are reasonably foreseeable. Baseline use: none. Battalion-sized landings have occurred on SCI in the past, but are not considered part of the baseline. Foot traffic by individuals and groups is permitted within the IOA and elsewhere on the Island under the No Action Alternative. Alternative 1: 1 USMC Battalion-sized landing per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road. Alternative 2: 2 USMC Battalion-sized landings per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 AVMC-M-1 AVMC-M-2 AVMC-M-4 AVMC-M-7 No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Notes:
1. See text for an explanation of the 1998-2007 rare plant data and pre-1998 "historical" data used in the analysis.
2. Impact significance conclusion is based on discussion in "Description of Impacts" column and is assessed assuming application of mitigation measures identified in this document.
3. Impact significance assessment assumes mitigation for Alternatives 1 and 2.

Table D-4. Occurrence of San Clemente Island broom within or near individual operations areas on SCI, description of potential impacts of existing and proposed operations, and impact significance. Evaluation of impact significance for the no action alternative is based on comparison with the baseline.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 11: Surveillance Training Area	SCI broom: 1 of 147 occurrences on SCI (0.7% of SCI total occurrences); 14 of 9674 individuals on SCI (0.1% of SCI total individuals) About 20 additional occurrences are in the general vicinity of the TAR.	Operations in No Action likely result in temporary damage to some individuals as a result of trampling and use of flares and pyrotechnics. Some potential exists for spreading of invasive species into habitat associated with the foot traffic. Fire originating as a result of operations could affect 10% or more of the Island population. Seedling establishment of this short-lived subshrub is fire-stimulated and the species also establishes from seed after minor disturbances. Burned plants are generally killed outright by fire. Increasing the number of operations in Alternatives 1 and 2 would increase the potential for effects on this species. Baseline use = 4 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 17 ops/yr. Alternative 2: 22 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3. G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
Infantry Operations Area	SCI broom: 14 of 147 1998-2007 occurrences on SCI (9.5% of SCI total 1998-2007 occurrences), 241 of 9674 individuals on SCI (2.5% of SCI total individuals).	Less than 10% of known occurrences and 2.5 % of known individuals of SCI broom on SCI are located in the Infantry Operations Area, where they would be exposed to dispersed foot traffic associated with Battalion Landings up to 2 times per year. SCI broom is a small shrub and is unlikely to be affected by occasional foot traffic. Any effects of foot traffic on a local population of this species would be dispersed (because the Marines would be spread out), minor (damaged leaves or broken branches), infrequent (up to twice per year, generally less) and temporary. Because of the dispersion of the Marines and the small effect that the foot travel would have on plants, it is expected that the direct effects of occasional foot travel on this species would be minor. However, as described above, the potential for introduction or spread of invasive species as a result of dispersed battalion landing foot traffic is not discountable and adverse consequences from such an event on this plant species are reasonably foreseeable.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 AVMC-M-1 AVMC-M-2 AVMC-M-4 AVMC-M-7 No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-4 (continued). Occurrence of San Clemente Island broom within or near individual operations areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
		Baseline Use: none. Battalion-sized landings have occurred on SCI in the past, but are not considered part of the baseline. Foot traffic by individuals and groups is permitted within the IOA and elsewhere on the Island under the No Action Alternative. Alternative 1: 1 USMC Battalion-sized landing per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road. Alternative 2: 2 USMC Battalion-sized landings per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road.	

Note:
1. See text for an explanation of the 1998-2007 rare plant data and pre-1998 “historical” data used in the analysis.
2. Impact significance conclusion is based on discussion in “Description of Impacts” column and is assessed assuming application of mitigation measures identified in this document.
3. Impact significance assessment assumes mitigation for Alternatives 1 and 2.

Table D-5. Occurrence of San Clemente Island Bush Mallow Within or Near Individual Operations Areas on SCI, Description of Potential Impacts of Existing and Proposed Operations, and Impact Significance. Evaluation of Impact Significance for the No Action Alternative is Based on Comparison with the Baseline.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
IMPACT AREA I	SCI bush mallow: 54 of 80 occurrences on SCI (67.5% of SCI total occurrences), 864 of 1591individuals on SCI (54.3% of SCI total individuals) Nearly all of the Impact Area I occurrences are in Horse Beach Canyon	The occurrences of these plants are mainly in Horse Beach Canyon and are generally away from targets for naval artillery and air-ground ordnance and somewhat shielded by topography, minimizing potential for ordnance hits. SCI bush mallow is increasing in abundance in this area despite ongoing use of live ordnance. Evidence is that occasional fire is beneficial to bush mallow. Under baseline conditions, Impact Area I receives about 6% of the large caliber ordnance used in SHOBA and the increases with Alternatives 1 and 2 are as described in Table D-1. Increased use of large ordnance in Alternatives 1 and 2 would have minimal effects on this species based on the increase of the plants during ongoing operations, adaptation to fire, distance from heavy ordnance targets currently in use, and topographic shielding. Implementation of the Navy Access Policy applying to Impact Areas I and II and TARS 20, 21, and 22 will preclude future direct monitoring of this endangered plant species and its habitat in these locations.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-3* G-M-4 G-M-5 G-M-6* G-M-7 G-M-9 *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-5 (continued). Occurrence of San Clemente Island Bush Mallow Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
IMPACT AREA II	SCI bush mallow: 2 of 80 SCI occurrences (2.5% of SCI total occurrences) with 78 of 1591 individuals (4.9% of SCI total individuals). These plants are located in China Canyon.	Existing patterns of disturbance from ordnance impacts and fire would be expected to continue, given the long history of similar use. The known occurrences for this species in Impact Area II are in China Canyon where the plants are afforded some topographic shielding and are not in proximity with target areas, reducing the likelihood of a direct hit or near miss by ordnance. This species is increasing in abundance in SHOBA. Impact Area II receives about 94% of the large caliber ordnance used in SHOBA under baseline conditions and the increases with Alternatives 1 and 2 are as described in Table D-1. Increased use of Impact Area II would not be expected to have substantial adverse effects on this species based on the likelihood that the existing occurrences would persist or expand as the area continues to recover from the effects of feral goats. Implementation of the Navy Access Policy applying to Impact Areas I and II and TARS 20, 21, and 22 will preclude future direct monitoring of this endangered plant species and its habitat in these locations.	Applicable conservation measures and Impact significance are as described for Impact Area I above.
TAR 21— Horse Beach Cove Training Area and Horse Beach Cove Amphibious Landing and Embarkation Area	SCI bush mallow: 17 of 80 occurrences on SCI (21.2% of SCI total occurrences), 223 of 1591 individuals on SCI (14.0 % of SCI total individuals). All of these occurrences are also within Impact Area I, which overlaps TAR 21.	TAR 21: Occurrences of SCI bush mallow are inland of the coastal road that parallels the beach and are associated with the floodplain or canyon sides of Horse Beach Canyon. Frequent foot traffic by small groups, ordnance use, and demolitions could directly affect this species where activity is most frequent. These effects would be localized to the specific activity areas. There is a moderate potential to introduce and spread invasive species related to the frequency of operations and disturbances proposed for TAR 21. Ship to shore live firing, tracers, use of flares, etc. have the potential to ignite fires that could spread into areas occupied by this species, which survives periodic fire by resprouting. It has not been observed to reproduce from seed on SCI (WFMP DoN 2005). Repeated fires at a very short return interval could adversely affect SCI bush mallow by killing plants before underground reserves have been replenished. Horse Beach Canyon in Impact Area I (including the overlapping portion of TAR 21) has a substantial proportion (67.5%) of the total documented occurrences of the SCI bush-mallow. Increased fire frequency resulting from the intensification of uses may lead to localized changes in vegetation (type conversion). The Wildland Fire Management Plan does not provide for ground-based fire suppression within SHOBA. However, fires are unlikely to spread far beyond the TAR boundary in an up-canyon direction because of the low elevational gradient of the lower canyon coupled with the direction of prevailing NW or NE winds under high and very high FDRS (DoN 2006) which would be opposed to spreading of fire in an up-canyon direction. Increased use in Alternatives 1 and 2 would increase the potential for adverse effects on this species. Amphibious Landing and Embarkation: Assuming no maneuvering or parking of vehicles inland of the egress road, direct impacts of vehicular traffic on vegetation would be localized between the beach and the egress road where the SCI bush	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-3* G-M-4 G-M-5 G-M-6* G-M-7 G-M-9 AVMC-M-1 AVMC-M-2* AVMC-M-3* AVMC-M-4 AVMC-M-5 AVMC-M-7 AVMC-M-10 TAR-M-1* *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant.

Table D-5 (continued). Occurrence of San Clemente Island Bush Mallow Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
		mallow is not known to occur, so vehicular traffic associated with amphibious exercises would have less than significant impact on the species. Associated activity is accounted for above. Implementation of the Navy Access Policy applying to Impact Areas I and II and TARS 20, 21, and 22 will preclude future direct monitoring of this endangered plant species and its habitat in these locations. Baseline use = 79 ops/yr. ((This TAR is located in SHOBA where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.) Alternative 1: 91 ops/yr. including 81 NSW, 10 USMC Amphibious and 1 USMC Battalion Landing. Alternative 2: 102 ops/yr. including 90 NSW, 10 USMC Amphibious and 2 USMC Battalion Landing.	Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 22—China Cove Training Area	A pre-1998 historic occurrence of SCI bush mallow was not observed during 2005 surveys of this TAR.	Proposed activities at TAR 22 are unlikely to affect the previously documented occurrence of SCI bush mallow, which may no longer exist, given that it was not relocated during 2005 surveys of the TAR. This species is increasing in abundance in SHOBA despite historic and ongoing bombardment, ordnance use, and wildland fire. Evidence is that occasional fire is beneficial to bush mallow and impacts of No Action are less than significant. Increasing the number of operations in Alternatives 1 and 2 would increase the potential for effects on this species. Implementation of the Navy Access Policy applying to Impact Areas I and II and TARS 20, 21, and 22 will preclude future direct monitoring of this endangered plant species and its habitat in these locations. Baseline use = 96 ops/yr including 33 NSW ops/yr. and 63 Non-NSW Naval ops/yr. (This TAR is located in SHOBA where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.) Alternative 1: 200 ops/yr. including 33 NSW, 6 USMC Amphibious, 1 USMC Battalion Landing and 160 other naval operations. Alternative 2: 220 ops/yr. including 40 NSW, 16 USMC Amphibious, 2 USMC Battalion Landing and 162 other naval operations. (Other naval operations include naval artillery and delivery of air-to-ground ordnance into overlapping Impact Area II and IIA , which are overed under Impact Area II).	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-3* G-M-4 G-M-5 G-M-6* G-M-7 G-M-9 TAR-M-1* *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
Infantry Operations Area	SCI bush mallow: 0 of 80 SCI 1998-2005 occurrences identified (0.0%); 1 of 28 pre-1998 historic SCI occurrences (3.6% SCI total occurrences) totaling 0.4 of 15.6 pre-1998	Less than 5% of known historic occurrences and individuals of SCI bush mallow are located in the Infantry Operations Area, where they would be exposed to dispersed foot traffic associated with Battalion Landings up to 2 times per year. Surveys of the 8,815-ac area have been recently completed and no additional occurrences of SCI bush mallow were located within the boundaries of the IOA. SCI bush mallow is a small to medium sized shrub and is unlikely to be affected by occasional foot traffic.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3

Table D-5 (continued). Occurrence of San Clemente Island Bush Mallow Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
	SCI acres (2.6%).	Any effects of foot traffic on a local occurrence of this species would be dispersed (because the Marines would be spread out), minor (damage to leaves or possible broken branches), infrequent (up to twice per year, generally less) and temporary. Because of the dispersion of the Marines and the small effect that the foot travel would have on plants, it is not expected that the direct effects of occasional foot travel on this species would be substantial. However, the potential for introduction or spread of invasive species as a result of dispersed battalion landing foot traffic is not discountable and adverse consequences from such an event on endangered plant species are reasonably foreseeable. Baseline use: Battalion-sized landings have occurred on SCI in the past, but are not considered part of the baseline. Foot traffic by individuals and groups is permitted within the IOA and elsewhere on the island. Proposed Action: Two USMC Battalion-sized landings per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road.	G-M-4 AVMC-M-1 AVMC-M-2 AVMC-M-4 AVMC-M-7 No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Note:

1. See text for an explanation of the 1998-2007 rare plant data and pre-1998 "historical" data used in the analysis. Under "amount of resource", resources (e.g., occurrences and numbers of individuals) occurring in overlapping operations areas are reported for each of the overlapping areas (e.g., Impact Area I and TAR 21), enabling the effects of the differing operations in the overlapping areas to be assessed.
2. Impact significance conclusion is based on discussion in "Description of Impacts" column and is assessed assuming application of mitigation measures identified in this document.
3. Impact significance assessment assumes mitigation for Alternatives 1 and 2.

Table D-6. Occurrence of Island Night Lizard (INL) Within or Near Individual Operations Areas on SCI, Description of Potential Impacts of Existing and Proposed Operations, and Impact Significance. Evaluation of Impact Significance for the No Action Alternative is Based on Comparison with the Baseline.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
IMPACT AREA I	INL Medium density habitat: 511.6 (8.7% of SCI total) Low density habitat: 397.8 (26% of SCI total) Lowest density habitat: 1.0 (<1% of SCI total) Estimated population in 511.6 ac of MDS Lycium is 400,583 individuals, based on average density of 783 individuals/acre for MDS Lycium habitat (DoN 2005, based on data from Mautz 2000). 397.9 ac of low density habitat would be expected to support about 229,190 individuals; 1.0 ac of lowest density would support 462 individuals.	Exposure to direct ordnance impacts, noise, and habitat degradation. Existing patterns of habitat disturbance from ordnance impacts and fire would be expected to continue, given the long history of similar use. Many individuals survive and populations are observed to persist in areas exposed to repeated fires and artillery bombardment, probably because of the high proportion of time spent by INL under cover (e.g., in rock crevices). Some take may occur from direct hits but would not be measurable at the population level. Table D-1 provides a summary of ordnance use for No Action, Alternative 1 and Alternative 2. Implementation of the Navy Access Policy applying to Impact Areas I and II and TARS 20, 21, and 22 will preclude future direct monitoring of this species and its habitat in these locations.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-2* G-M-3* G-M-4 G-M-5 G-M-6* G-M-7 G-M-8 G-M-9 INL-M-1* *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-2, G-M-3, G-M-6, INL-M-1) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-6 (continued). Occurrence of Island Night Lizard (INL) Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
IMPACT AREA II	INL High density habitat: 28.0 ac (0.4% of SCI total) Medium density habitat: 572.0 ac (9.8% of SCI total) Low density habitat: 0.0 ac Lowest density habitat: 0.0 ac Estimated population in 28.0 ac of high density habitat is 29,008 individuals, based on average density of 1,036 individuals/ac for MDS Prickly Pear habitat (DoN 2005, based on data from Mautz 2000). 572.0 ac of medium density habitat would be expected to support about 447,876 individuals	Existing patterns of habitat disturbance from ordnance impacts and fire would be expected to continue, given the long history of similar use. No observable effect on the population would be expected. Impacts on the species are less than significant, given the demonstrated continuance of the population despite historic and ongoing use and the low proportion of the SCI total habitat exposed in Impact Area II. Table D-1 provides a summary of ordnance use for No Action, Alternative 1 and Alternative 2. Implementation of the Navy Access Policy applying to Impact Areas I and II and TARS 20, 21, and 22 will preclude future direct monitoring of this species and its habitat in these locations.	Applicable conservation measures and Impact significance are as described for Impact Area I above.
NALF AVMA	INL Medium density habitat: 26.1 ac (4% of SCI total) Estimated population in 26.1 ac of MDS Lycium is 20,436 individuals, based on average density of 783 individuals/acre (DoN 2005, based on data from Mautz 2000).	Tracked vehicles, including M-1 tanks, AAVs, and EFVs would degrade coastal strand and MDS Lycium habitat by causing a reduction in shrub (especially boxthorn) cover with a concomitant reduction of thermal cover and suitability for INL. Some mortality of individuals is likely but probably would not be observable. Degradation of 26.1 ac of habitat would lead to reduced reproduction of breeding adults and reduced survivorship of non-breeding individuals in that habitat. This would be a long term effect but less than significant because of the small effect on the overall population (< 0.5% of the medium density habitat on SCI). Designation of the AVMA is part of Alternatives 1 and 2. Alternative 1. The AVMA could be used by tracked vehicles during approximately 43 (42 USMC Amphibious plus 1 USMC Battalion Landing) operations per year. Alternative 2. The AVMA could be used by tracked vehicles during approximately 63 (61 USMC Amphibious plus 2 USMC Battalion Landing) operations per year.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-2 G-M-3 G-M-4 AVMC-M-2 AVMC-M-3 AVMC-M-5 AVMC-M-6 AVMC-M-7 AVMC-M-8 INL-M-1 No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-6 (continued). Occurrence of Island Night Lizard (INL) Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
Old Rifle Range AVMA	INL Medium density habitat: 137.2 ac (2.3% of SCI total) Lowest density habitat: 0.5 ac (<1% of SCI total) Estimated population in 137.2 ac of MDS Lycium is 107,428 individuals, based on average density of 783 individuals/acre (DoN 2005, based on data from Mautz 2000). 0.5 ac of lowest density habitat would be expected to support about 231 additional individuals.	Tracked vehicles would degrade MDS Lycium habitat and grassland by causing a reduction in shrub (boxthorn) cover with a concomitant reduction of thermal cover and suitability for INL. Some mortality of individuals is likely but probably not observable. Take would include degradation of 143 ac of habitat expected to lead to reduced reproduction of breeding adults and reduced survivorship of non-breeding individuals in that habitat. This would be a long term effect but less than significant impact because of the small effect on the overall population (< 2.5% of the medium density and lowest density habitat on SCI). Designation of the AVMA is part of Alternatives 1 and 2. Alternative 1. The AVMA could be used by tracked vehicles during approximately 43 (42 USMC Amphibious plus 1 USMC Battalion Landing) operations per year. Alternative 2. The AVMA could be used by tracked vehicles during approximately 63 (61 USMC Amphibious plus 2 USMC Battalion Landing) operations per year.	Applicable Mitigation Measures as listed for NALF AVMA (above). No Action: No Impact Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
VC-3 AVMA	INL Low density habitat: 2.6 ac (0.2% of SCI total) Lowest density habitat: 275.5 ac (2.3% of SCI total) Estimated population in 275.5 ac of grassland habitat is 127,281 individuals, based on average density of 462 individuals/acre; 2.6 ac of MDS Cholla-Prickly Pear habitat would be expected to support about 1,498 additional individuals based on an average estimated density of 576 individuals/acre (DoN 2005, based on data from Mautz 2000).	Tracked vehicles would degrade MDS Cholla-Prickly Pear and grassland habitat by causing a reduction in vegetation cover with a concomitant reduction of thermal cover and suitability for INL. Some mortality of individuals is likely but probably not observable. Take would include degradation of 278 ac of habitat leading to reduced reproduction of breeding adults and reduced survivorship of non-breeding individuals in that habitat. This would be a long term effect but less than significant impact because of the small effect on the overall population (< 2.5% of the medium and lowest density habitat on SCI). Designation of the AVMA is part of Alternatives 1 and 2. Alternative 1. The AVMA could be used by tracked vehicles during approximately 43 (42 USMC Amphibious plus 1 USMC Battalion Landing) operations per year. Alternative 2. The AVMA could be used by tracked vehicles during approximately 63 (61 USMC Amphibious plus 2 USMC Battalion Landing) operations per year.	Applicable Mitigation Measures as listed for NALF AVMA (above). No Action: No Impact Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
Old Rifle Range (ORR) AMP	INL Medium density habitat: 4.7 ac (<0.08% of SCI total). Estimated population in 4.7 ac of MDS Lycium is 3,680 individuals, based on average density of 783 individuals/acre (DoN 2005, based on data from Mautz 2000).	Vehicular activity would probably result in degradation of habitat, including reduction of thermal cover, possibly leading to a measurable reduction in population size in the affected area due to habitat degradation. Mortality of individual INLs may also result from vehicular activity. Take would include degradation of 4.7 ac of medium density INL habitat and reduction of carrying capacity for INL. Designation of the AMP is part of Alternatives 1 and 2. Alternative 1: Artillery maneuvering during 3-day exercises up to 6 times per year plus 1 USMC Battalion Landing. Alternative 2. Artillery maneuvering during 3-day exercises up to 8 times per year plus 2 USMC Battalion Landings.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-2 G-M-3 G-M-4 AVMC-M-2 AVMC-M-3

Table D-6 (continued). Occurrence of Island Night Lizard (INL) Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
			AVMC-M-5 AVMC-M-6 AVMC-M-7 AVMC-M-8 INL-M-1 No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
Self Help AMP	INL Lowest density habitat: 3.4 ac (<0.01% of Island total). Estimated population in 3.4 ac of grassland is 1,571 individuals, based on average density of 462 individuals/acre for grassland habitat (DoN 2005, based on data from Mautz 2000).	Vehicular activity would probably result in degradation of habitat, including reduction of thermal cover, possibly leading to a measurable reduction in population size in the affected area due to habitat degradation. Mortality of individual INLs may also result from vehicular activity. Take includes degradation of 3.4 ac of lowest density INL habitat and reduction of carrying capacity for INL. Grassland, because it is dominated by weedy annual species, would be expected to recover rapidly after cessation of disturbance, compared to habitats dominated by native shrubs such as boxthorn. Designation of the AMP is part of Alternatives 1 and 2. Alternative 1: Artillery maneuvering during 3-day exercises up to 6 times per year plus 1 USMC Battalion Landing. Alternative 2. Artillery maneuvering during 3-day exercises up to 8 times per year plus 2 USMC Battalion Landings.	Applicable Mitigation Measures as listed for Old Rifle Range (ORR) AMP (above). No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
Old Airfield AMP	INL Lowest density habitat: 2.3 ac (<0.02% of SCI total). Estimated population in 2.3 ac of grassland habitat is 1,063 individuals, based on average density of 462 individuals/acre (DoN 2005, based on data from Mautz 2000).	Vehicular activity would probably result in degradation of habitat, including reduction of thermal cover, possibly leading to a measurable reduction in population size in the affected area due to habitat degradation. Mortality of individual INLs may also result from vehicular activity. Take includes degradation of 2.3 ac of lowest density INL habitat and reduction of carrying capacity for INL. Grassland, because it is dominated by weedy annual species, would be expected to recover rapidly after cessation of disturbance, compared to habitats dominated by native shrubs such as boxthorn. Designation of the AMP is part of Alternatives 1 and 2. Alternative 1: Artillery maneuvering during 3-day exercises up to 6 times per year plus 1 USMC Battalion Landing. Alternative 2. Artillery maneuvering during 3-day exercises up to 8 times per year plus 2 USMC Battalion Landings.	Applicable Mitigation Measures as listed for Old Rifle Range (ORR) AMP (above). No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-6 (continued). Occurrence of Island Night Lizard (INL) Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
AFP-1	INL Low density habitat: 34.1 ac (2.2% of Island total). Estimated population in 34.1 ac of MDS Prickly Pear-Cholla is 19,642 individuals, based on an average density of 576 individuals/acre for MDS Prickly Pear-Cholla habitat (DoN 2005, based on data from Mautz 2000).	Vehicular activity would result in degradation of habitat, including reduction of thermal cover, possibly leading to a measurable reduction in population size in the affected area due to habitat degradation. Mortality of individual INLs may also result from vehicular activity. Take would include degradation of about 34 ac of low density INL habitat leading to reduced reproduction of breeding adults and reduced survivorship of non-breeding individuals in that habitat and a probable reduction in carrying capacity of the habitat. This is a long term effect but less than significant impact because of the small effect on the overall population (~2.2% of the low density habitat on SCI). INL would be expected to survive on the site but at lower population level. 5 operations per year from this general area. .Designation of this AFP is included in Alternatives 1 and 2. Alternative 1. Artillery maneuvering during 3-day USMC artillery exercises up to 6 times per year plus 1 USMC Battalion Landing. Alternative 2. Artillery maneuvering during 3-day USMC artillery exercises up to 8 times per year plus 2 USMC Battalion Landings.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-2 G-M-3, G-M-4 G-M-8, G-M-9 AVMC-M-2 AVMC-M-3 AVMC-M-5 AVMC-M-7 AVMC-M-8 INL-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2. Impacts would be less than significant with mitigation.
AFP-6	INL Lowest density habitat: 123.3 ac (1.0% of Island total) Estimated population in 3.6 ac of MDS Prickly Pear-Cholla is 56,978 individuals, based on average density of 462 individuals/acre for grassland habitat (DoN 2005, based on data from Mautz 2000).	Vehicular activity would probably result in degradation of the grassland habitat, including reduction of thermal cover, possibly leading to a measurable reduction in population size in the affected area due to habitat degradation. Mortality of individual INLs may also result from vehicular activity. Take would include degradation of 123.3 ac of lowest density INL habitat leading to reduced reproduction of breeding adults and reduced survivorship of non-breeding individuals in that habitat and a probable reduction in carrying capacity of the habitat. This would be a long term effect but less than significant impact because of the small effect on the overall population (~1% of the lowest density habitat on SCI). INL would be expected to survive on the site but at lower population level. This site was not included in the No Action Alternative. Designation of this AFP is included in Alternatives 1 and 2. Alternative 1. Artillery maneuvering during 3-day USMC artillery exercises up to 6 times per year plus 1 USMC Battalion Landing. Alternative 2. Artillery maneuvering during 3-day USMC artillery exercises up to 8 times per year plus 2 USMC Battalion Landings.	Applicable Mitigation Measures as listed for AFP-1 (above). No Action: No impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 4—Whale	INL	Continued operations, including ordnance use, fire, and foot traffic, outside of developed	Implementation of the SCI Wildland Fire

Table D-6 (continued). Occurrence of Island Night Lizard (INL) Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
Point/Castle Rock	Medium density habitat: 11.7 ac (0.20% of SCI total). An additional 119.1 acres of medium density habitat are in the action area. Estimated population in 11.7 ac of MDS Lycium is 9,161 individuals, based on average density of 783 individuals/acre for MDS Lycium habitat (DoN 2005, based on data from Mautz 2000), with an additional 93,255 individuals in the action area.	facilities in this established TAR would be expected to lead to some reduced reproduction of breeding adults and reduced survivorship of non-breeding individuals as well as some direct mortality in heavily used portions of the habitat. Effect on population levels may not be detectable. The anticipated effects of operations on INL at this TAR would be long-term but less than significant because of the small effect on the overall population (~0.1% of the medium density INL habitat on SCI). This TAR was previously established. Baseline use = 222 ops/yr. Alternative 1: 240 ops/yr. Alternative 2: 300 ops/yr.	Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-2 G-M-3 G-M-4 INL-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 10—Demolition Range West	INL Medium density habitat: 25.3 ac (0.43% of SCI total) An additional 9.0, 156.2 and 7.2 ac of lowest, medium, and high density habitat, respectively, are within the action area. Estimated population in 25.3 ac of MDS Lycium is 19,810 individuals, based on average density of 783 individuals/acre for MDS Lycium habitat (DoN 2005, based on data from Mautz 2000). 9.0, 156.2 and 7.2 ac of lowest, medium, and high density habitat would respectively be expected to support 4,158; 122,305; and 7,459 individuals.	Approximately 0.25 acres of habitat would be affected by construction, demolitions, or concentrated foot traffic. Take would include loss or degradation of 1.5 acres of habitat affected by construction, demolitions, or concentrated foot traffic, which would be expected to lead to reduced reproduction of breeding adults and reduced survivorship of non-breeding individuals in that habitat. Effect on population levels may not be detectable. The loss or degradation of habitat at this TAR would be a long term effect but less than significant (NEPA) because of the small effect on the overall population (< 0.5% of the medium density INL habitat on SCI). Baseline use = 3 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 20ops/yr. Alternative 2: 20 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-2 G-M-3 G-M-4 INL-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-6 (continued). Occurrence of Island Night Lizard (INL) Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 17— Eel Point Tactical Training Range	INL Medium density habitat 7.2 ac (0.1% of SCI total); action area contains an additional 53.6 ac of medium density habitat and 35.8 ac of high density habitat. Estimated population in 7.2 ac of MDS Lycium is 5638 individuals, based on average density of 783 individuals/acre for MDS Lycium habitat (DoN 2005, based on data from Mautz 2000). Additional 53.6 ac of medium density habitat and 35.8 ac of high density habitat would respectively be expected to support 41,969 and 37,088 individuals.	Assuming that approximately 0.5 ac of habitat outside of existing disturbed areas would be affected by training operations, especially concentrated foot traffic, take would include loss or degradation of 0.5 ac of habitat expected to lead to reduced reproduction of breeding adults and reduced survivorship of non-breeding individuals in that habitat. Effect on population levels may not be detectable. The loss or degradation of habitat at this TAR would be a long term effect but less than significant (NEPA) because of the small effect on the overall population (~ 0.1% of the medium density INL habitat on SCI). Baseline use = 15 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 31 ops/yr. Alternative 2: 40 ops/yr.	Applicable Mitigation Measures as listed for TAR--10 (above). No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-6 (continued). Occurrence of Island Night Lizard (INL) Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 21—Horse Beach Cove Training Area	INL Medium density habitat: 80.3 ac (1.4% of SCI total medium density habitat). Action area contains an additional 172.6 ac (~3% of SCI total). Estimated population in 80.3 ac of MDS Lycium is 62,875 individuals, based on average density of 783 individuals/acre for MDS Lycium habitat (DoN 2005, based on data from Mautz 2000). Additional 172.6 ac of medium density habitat in action area would be expected to support 135,146 individuals.	Assuming that approximately 1 ac of habitat outside of existing disturbed areas would be directly affected by training operations, especially concentrated foot traffic, take would include loss or degradation of 1 ac of habitat expected to lead to reduced reproduction of breeding adults and reduced survivorship of non-breeding individuals in that habitat. Additionally fire would be expected to affect habitat and thermal cover. INL have been demonstrated to survive fire, even repeated fires. Effect on population levels may not be detectable unless sampling effort is intensive. The loss or degradation of habitat at this TAR would be a long term effect but less than significant (NEPA) because of the small effect on the overall population (~ 1.4% of the medium density INL habitat on SCI). Baseline use = 79 ops/yr. ((This TAR is located in SHOBA where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.). Alternative 1: 91 ops/yr. including 81 NSW, 10 USMC Amphibious and 1 USMC Battalion Landing. Alternative 2: 102 ops/yr. including 90 NSW, 10 USMC Amphibious and 2 USMC Battalion Landing.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-2* G-M-3* G-M-4 G-M-6* G-M-7 G-M-8 G-M-9 AVMC-M-2* AVMC-M-3* AVMC-M-4 AVMC-M-5 AVMC-M-6* AVMC-M-7 AVMC-M-10 INL-M-1* *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-6 (continued). Occurrence of Island Night Lizard (INL) Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 22—China Cove Training Area	INL Medium density habitat: 229.6 ac (3.9% of SCI total medium density habitat). Action area contains an additional 218 ac (3.7% of SCI total). Estimated population in 229.6 ac of MDS Lycium is 179,777 individuals, based on average density of 783 individuals/acre for MDS Lycium habitat (DoN 2005, based on data from Mautz 2000). Additional 218 ac of medium density habitat in action area would be expected to support an additional 170,694 individuals.	Existing patterns of habitat disturbance from activities of small groups on foot, demolitions, small arms use, and fire would be expected to continue, given the long history of similar use and impact of heavy ordnance in overlapping Impact Area II. No observable effect on the population would be expected from continued uses and impacts on the species are less than significant, given the demonstrated continuance of the population despite historic and ongoing use and the low proportion of the SCI total habitat exposed in TAR 22. Baseline use = 96 ops/yr including 33 NSW ops/yr. and 63 Non-NSW Naval ops/yr. (This TAR is located in SHOBA where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.) Alternative 1: 200 ops/yr. including 33 NSW, 6 USMC Amphibious, 1 USMC Battalion Landing and 160 other naval operations. Alternative 2: 220 ops/yr. including 40 NSW, 16 USMC Amphibious, 2 USMC Battalion Landing and 162 other naval operations. (Other naval operations include naval artillery and delivery of air-to-ground ordnance into overlapping Impact Area II and IIA , which are covered under Impact Area II).	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-2 G-M-3* G-M-4, G-M-7, G-M-8, G-M-9 INL-M-1* *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
Infantry Operations Area	INL High density habitat: 179.6 ac (2.4% of SCI total high density habitat) Medium density habitat: 311.1 ac (5.4% of SCI total medium density habitat) Low density habitat: 435.6 ac (29.6% of SCI total low density habitat) Lowest density habitat: 6,351.6 ac (53.7% of SCI total lowest density habitat) Estimated population in 179.6 ac of MDS prickly pear is 186,066 individuals, based on average density of 1036 individuals/acre for MDS prickly pear habitat (DoN 2005, based on data from	Although it is possible that individual lizards under cover could be injured by foot traffic this would be an infrequent event and there would be no observable effect on the population. Establishment and spread of invasive species in the IOA from foot traffic may occur but effects on INL would depend on the characteristics of the species that establish, their growth habitats and growth forms, and their effect on the habitat including other plant species. No Action: Battalion-sized landings have occurred on SCI in the past, but are not considered part of the baseline. Foot traffic by individuals and groups is permitted within the IOA and elsewhere on the Island under the No Action Alternative. Alternative 1: 1 USMC Battalion-sized landing per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road. Alternative 2: 2 USMC Battalion-sized landings per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-2 G-M-3 G-M-4 G-M-8 G-M-9 INL-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less

Table D-6 (continued). Occurrence of Island Night Lizard (INL) Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
	Mautz 2000). Estimated populations for 314.5 areas of medium density, 447.8 areas of low density, and 6,351.6 areas of lowest density would, respectively, be expected to support 246,254; 257,933; and 2,934,439 individuals.		than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Notes:

1. Population density categorizations (high density, medium density, low density, and lowest density) are based on population density figures in DoN (2005) based on data of Mautz (2000) and relate to vegetation classification and mapping by Sward and Cohen (1980). Under "amount of resource", resources (e.g., acres of habitat) occurring in overlapping operations areas are reported for each of the overlapping areas (e.g., Impact Area I and TAR 21), enabling the effects of the differing operations in the overlapping areas to be assessed.
2. Impact significance conclusion is based on discussion in "Description of Impacts" column and is assessed assuming application of mitigation measures identified in this document.
3. Impact significance assessment assumes mitigation for Alternatives 1 and 2.

Table D-7. Occurrence of San Clemente Loggerhead Shrike Within or Near Individual Operations Areas on SCI, Description of Potential Impacts of Existing and Proposed Operations, and Impact Significance. Evaluation of Impact Significance for the No Action Alternative is Based on Comparison with the Baseline.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
IMPACT AREA I	2007: Two of 66 nest sites on SCI (3.0% of SCI total) 2001-2007: Nine of 375 nesting records on SCI (2.4% of SCI total) Five additional nest sites used between 2001 and 2007 are located outside but within 500 ft of the Impact Area I boundary (on the western boundary). Wintering birds also present. Nest locations used during 2001-2007 are present in upper and lower Horse Beach Canyon. The three nest sites used between 2001 to 2005 within Impact Area I represent <5% of Island total during same period and have typical records of reproductive success for shrikes on SCI. Nest site HB2 (used in 2005) successfully fledged young. HB4 (used in 2003) was unsuccessful. HB1, near the northwestern corner of Impact Area I successfully fledged young in 3 of 4 seasons between 2001 and 2005.	Nest sites used since 2000 are located in Horse Beach Canyon along the western boundary of Impact Area I, away from targets and 1 km or more up canyon from the beach. The next sites used during 2007 are in upper Horse Beach Canyon at the northern boundary of Impact Area I. Potential for direct hits by ordnance is very low due to distance from targets and topographic shielding. Impact Area I receives about 6 % of the large ordnance incoming to SHOBA (the remainder goes to Impact Area II including Impact Area IIA). Existing large ordnance use and increases associated with Alternatives 1 and 2 are summarized under Vegetation in Table D-1. There is some exposure to impact noise, flares, and potential fires. Potential for injury or death resulting from direct hit or near miss is so unlikely as to be discountable. There is some potential for take of individuals or damage to essential habitat elements due to possible adverse effects from fire on nest trees or possible adverse response by individual shrikes to visual and noise effects associated with NSFS and CAS in the vicinity. Any reasonably foreseeable take under No Action and both alternatives would affect <<5% of the population, would average less than one individual per year, and would not likely be measurable. Implementation of the Navy Access Policy applying to Impact Areas I and II and TARS 20, 21, and 22 will preclude future direct monitoring of this endangered plant species and its habitat in these locations. Effects of existing and proposed operations are less than significant due to the unlikelihood of direct hit or near miss, infrequency of direct effect on habitat or individuals (e.g., by fire), the reproductive success of nearby pairs exposed to existing uses of the Impact Area, and the very small proportion of the population in proximity to the Impact Area.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-2* G-M-3* G-M-4 G-M-5 G-M-6* G-M-7 G-M-8 G-M-9 SCLS-M-1* *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-7 (continued). Occurrence of San Clemente Loggerhead Shrike Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
IMPACT AREA II	2007: One of 66 nest sites (1.5% of SCI total) 2001-2007: Ten of 375 nest sites (2.7% of SCI total) Two additional nest sites used between 2001 and 2007 are located outside but within 500 ft of the Impact Area II boundary. Wintering birds also present including males that remain around their breeding territories. Nest sites used during 2001-2007 are located in China Canyon, with one site used in 2005 at the NW edge of TAR 22 in Red Canyon. The Red Canyon site was not monitored because of its location adjacent to a target in the middle of the Impact Area (and < 200 m from the NW corner of Impact Area IIA). Other nesting territories in Impact Area II used in one or more years between 2001 and 2005 have had success in years when nesting occurred. These are China 11 (2/2), China 8 (3/3), China 3 (2/2). Nests at China 8 in 1999 and at China 3 in 1997 and 1998 were unsuccessful. Years 1997 and 1998 had generally poor nesting success throughout the San Clemente loggerhead strike population.	Nest sites used since 2001 in Impact Area II are located in Red Canyon, near the center of Impact Area II, and in China Canyon along the eastern boundary of Impact Area II. The nest site in Red Canyon was discovered in 2005 and is in very close proximity to two targets (approximately 175 m from the location of the nearer of the two targets). The nearest target to a China Canyon nest site is about 750 m to the southwest. Potential for direct hits or near misses by ordnance at the Red Canyon site is relatively high due to the proximity of targets but is low at the China Canyon sites due to distance from targets and a certain amount of topographic shielding. There would be some exposure to impact noise, flares, and potential fires. Potential for injury or death resulting from direct hit or near miss is discountable except at Red Canyon, given proximity of that site to targets. At Red Canyon, should that nest site be reoccupied in the future, the potential for take is higher, ranging from behavioral response leading to harm, to injury or death of an individual or loss of a clutch or nestlings. Existing large ordnance use and increases associated with Alternatives 1 and 2 are summarized under Vegetation in Table D-1. There is some additional potential for take of individuals or damage to essential habitat elements due to possible adverse effects from fire on nest trees or adverse response to visual and noise effects associated with NSFS and air-to-ground bombardment in the vicinity. Any reasonably foreseeable take under No Action and both alternatives would affect <<5% of the population, would probably average less than one individual per year, and would not likely be measurable in most years. Implementation of the Navy Access Policy applying to Impact Areas I and II and TARS 20, 21, and 22 will preclude future direct monitoring of this endangered plant species and its habitat in these locations. Effects of existing and proposed operations are less than significant due to the unlikelihood of direct hit or near miss, infrequency of direct effect on habitat or individuals (e.g., by fire), the reproductive success of nearby pairs, and the very small proportion of the population in proximity to the Impact Area.	Applicable conservation measures and Impact significance are as described for Impact Area I above.
VC-3 AVMA	2007: No nesting documented. 2001-2007: One of 375 nests documented during the period (0.3% of the SCI total). The one documented nest in this area was constructed in a building at VC-3 near Ridge Road at the southern edge of the AVMA during 2006. The first nesting attempt was depredated by a raven and the second is also believed to have been depredated.	Tracked vehicles would degrade habitat in the AVMA by causing a reduction in vegetation cover. Some of this habitat may be used by foraging shrikes from this one-time nest location. The likelihood of shrikes nesting here in the future is not known. The nest location at the edge of the AVMA would provide access to habitat outside the AVMA as well as within it. A nest at this location would be exposed to noise and activity of vehicles and personnel on Ridge Road and the AVMR. These disturbances would continue to affect this site in the future, which has also been used by wintering shrikes. Whatever the future use, this site represents a small fraction of the sites that have been used by shrikes for nesting in recent years. Designation of the AVMA is part of Alternatives 1 and 2. Alternative 1. The AVMA could be used by tracked vehicles during approximately 43 (42	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-2 G-M-3 G-M-4 AVMC-M-2 AVMC-M-3

Table D-7 (continued). Occurrence of San Clemente Loggerhead Shrike Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
		USMC Amphibious plus 1 USMC Battalion Landing) operations per year. Alternative 2. The AVMA could be used by tracked vehicles during approximately 63 (61 USMC Amphibious plus 2 USMC Battalion Landing) operations per year.	AVMC-M-5 AVMC-M-6 AVMC-M-7 AVMC-M-8 SCLS-M-1 No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
AFP-1	Wintering only, nearest San Clemente loggerhead strike nest sites are about 4,000 m to the west in Horse Beach Canyon.	In the unlikely event that a shrike would be at the AFP during an operation in Alternative 1 or 2, it would be expected to be unaffected or to avoid the activity (Insignificant effect not reaching the level of "take"). There is a very low potential that artillery fired from this location could land in Horse Beach Canyon or China Canyon and directly affect San Clemente loggerhead strike or other listed species (potential so low as to be discountable). Nesting shrikes in Horse Beach and China Canyon are unlikely to be adversely affected by noise caused by live artillery and other weapons firing from this position and would be out of the line of sight of this AFP and impact areas due to their typical location in canyon bottoms (insignificant effect not reaching the level of take). Designation of this AFP is included in Alternatives 1 and 2. Artillery has been historically fired from this general area into SHOBA. Alternative 1. Artillery maneuvering during 3-day USMC artillery exercises up to 6 times per year plus 1 USMC Battalion Landing. Alternative 2. Artillery maneuvering during 3-day USMC artillery exercises up to 8 times per year plus 2 USMC Battalion Landings.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-2 G-M-3 G-M-4 G-M-5 G-M-6, G-M-8, G-M-9 AVMC-M-2 AVMC-M-3 AVMC-M-4 AVMC-M-5 AVMC-M-9 SCLS-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
AFP-6	Wintering only, nearest San Clemente loggerhead strike nest sites are approximately 400 m to the north in Eagle	In the unlikely event that a shrike would be at the AFP during an operation in Alternative 1 or 2, it would be expected to be unaffected or to avoid the activity (Insignificant effect not reaching the level of "take"). There is a very low potential that artillery fired from this location	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1

Table D-7 (continued). Occurrence of San Clemente Loggerhead Shrike Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
	Canyon and 700 m to the west in Cave Canyon. Firing would be toward Impact Area II (south-southeast of the AFP).	toward Impact Area IIA could directly affect San Clemente loggerhead strike or other listed species (potential so low as to be discountable). Nesting shrikes in Cave and Eagle Canyons are within 400 to 800 m of the AFP, but are at lower elevation and topographically shielded from the AFP site. They would be exposed to noise from the artillery firing but would be out of the line of sight from the AFP and out of the line of fire, as well. The noise levels at these sites would be difficult to predict, given the topographic factors, but there would be no visual or other accompaniments to the firing and some habituation to artillery noise would be expected as a result of regular exposure to more distant naval artillery without any accompanying threat. Exposure to the artillery noise would happen up to 7 to 10 times per year, with Alternatives 1 and 2, respectively. Baseline use: Designation of this AFP is included in Alternatives 1 and 2. Alternative 1. Artillery maneuvering and firing during 3-day USMC artillery exercises up to 6 times per year plus 1 USMC Battalion Landing. Alternative 2. Artillery maneuvering and firing during 3-day USMC artillery exercises up to 8 times per year plus 2 USMC Battalion Landings.	and Alternative 2. G-M-1 G-M-2 G-M-3 G-M-4 G-M-5 G-M-6, G-M-8, G-M-9 AVMC-M-2 AVMC-M-3 AVMC-M-4 AVMC-M-5 AVMC-M-9 SCLS-M-1 SCLS-M-2 No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 15	2007: No nesting documented. 2001-2007: One of 375 nests documented during the period (0.3% of the SCI total). The one documented nest in this area was constructed in a building at VC-3 near Ridge Road at the southern edge of the AVMA during 2006. The first nesting attempt was depredated by a raven and the second is also believed to have been depredated. This is the same nest discussed above under the VC-3 AVMA, which overlaps TAR -15 at this location.	Low effects on habitat associated with infrequent foot traffic by small groups near this one-time nesting location. There is some likelihood of disturbance of nesting shrikes at this location by noise of simulated weapons and human activity if a nearby location is chosen as an objective for NSW training. The likelihood of future nesting at this location is unknown. Likelihood of direct effects on a bird or nest is so low as to be discountable given the fact that all live fire on TAR 15 would be directed toward the east (away from the buildings on site and away from the SCLS nest site. Fire effects would be less than significant in the annual grassland foraging habitat. The increase in operations with Alternatives 1 and 2 would incrementally increase the potential for fire or disturbance around a nest but impacts would be less than significant with mitigation. Baseline use = 20 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 25 ops/yr. Alternative 2: 94 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-2 G-M-3 G-M-4 G-M-5 G-M-6 TAR-M-1 SCLS-M-1 No Action: Impacts are less than significant.

Table D-7 (continued). Occurrence of San Clemente Loggerhead Shrike Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
			Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 21—Horse Beach Cove Training Area and Horse Beach Cove Amphibious Landing and Embarkation Area	Wintering only (documented); a breeding site used unsuccessfully in 2003 (HB4) is located about 500 m up the canyon from the TAR boundary; a breeding site used successfully in 2005 (HB2) is located over 800 m from the TAR boundary. These two nest sites represent < 1% of the nest sites used by San Clemente loggerhead strike on SCI between 2001 and 2005.	TAR 21-In the event that a wintering or foraging shrike would be at TAR 21 during an operation, it would be expected to be unaffected or to avoid the activity (Insignificant effect not reaching the level of "take"). Nesting locations used in 2003 and 2005 would be visually and topographically screened from TAR 21, minimizing disturbance of San Clemente loggerhead strike from activities within the TAR. A fire originating from activities within the TAR, including ship to shore weapons fire, could burn up canyon affecting shrike breeding habitat and, depending on the timing, could affect breeding shrikes. The general areas up canyon from TAR 21 have burned 1-3 times between 1979 and about 2000 (SCI INRMP, DoN 2002). Fires would be unlikely to spread far beyond the TAR boundary in an up-canyon direction because of the low elevational gradient of the lower canyon coupled with the direction of prevailing NW or NE winds under high and very high FDRS (DoN 2006), which would be opposed to spreading of fire in an up-canyon direction. The two San Clemente loggerhead strike territories in lower Horse Beach Canyon that have been occupied between 2001 and 2005 (HB2 and HB4-see additional information in column to left) represent <1% of the nesting sites occupied by San Clemente loggerhead strike during that period. Horse Beach Cove Amphibious Landing and Embarkation Area- A wintering or foraging shrike present at Horse Beach Cove during an amphibious landing or embarkation would be expected to be unaffected or to avoid the activity (Insignificant effect not reaching the level of "take"). Nesting locations used in 2003 and 2005 would be visually and topographically screened from the landing/embarkation site, minimizing disturbance of San Clemente loggerhead strike from activities at the landing site (Insignificant effect not reaching the level of "take"). The potential for fire to burn upcanyon from the landing site to areas where shrikes have nested in the past 5 years is very low as discussed above under TAR 21 and supported by analysis in the FMP BA (DoN 2006). Baseline use = 79 ops/yr. ((This TAR is located in SHOBA where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.) Alternative 1: 91 ops/yr. including 81 NSW, 10 USMC Amphibious and 1 USMC Battalion Landing. Alternative 2: 102 ops/yr. including 90 NSW, 10 USMC Amphibious and 2 USMC Battalion Landing.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-2* G-M-3* G-M-4 G-M-5 G-M-6*, G-M-7, G-M-8, G-M--9 SCLS-M-1* Horse Beach Cove Amphibious Landing and Embarkation Area Same as TAR 21 plus AVMC-M-2* AVMC-M-3* AVMC-M-4 AVMC-M-5 AVMC-M-6* AVMC-M-7 AVMC-M-10 *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less

Table D-7 (continued). Occurrence of San Clemente Loggerhead Shrike Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
			than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 22—China Cove Training Area	One nest on NW boundary of the TAR in Red Canyon was active in 2005 but success not known. TAR 22 and vicinity is a documented wintering location. The next nearest nest site (CH 11) is located in China Canyon about 500 m north of the TAR 22 boundary. It was used twice since 2001 and was successful in both years (2004 and 2005) The next nearest nest site (CH 8) was successful in 3 of 4 years with nesting attempts since 2001.	See Discussion above under Impact Area II which overlaps TAR 22. NSW activities in TAR 22 are not expected to be concentrated near the nest site in Red Canyon that was active in 2005 but not known to be active during 2006. This is the only nesting documented within or near TAR 22 in recent years (see discussion above under Impact Area II). In the event that a wintering shrike would be at TAR 22 during an operation, it would be expected to be unaffected or to avoid the activity (Insignificant effect not reaching the level of "take"). Effects of existing operations are less than significant due to the unlikelihood of direct hit or near miss, infrequency of direct effect on habitat or individuals (e.g., by fire), the reproductive success of nearby pairs, and the very small proportion of the population in proximity to the TAR. The near doubling of activity in the TAR associated with Alternatives 1 and 2 including increases in heavy ordnance use in overlapping Impact Areas II and IIA would make some level of take increasingly likely compared to under the No Action Alternative, but impacts would be less than significant because of the low percentage of the shrike population exposed to operations in this area. Baseline use = 96 ops/yr including 33 NSW ops/yr. and 63 Non-NSW Naval ops/yr. (This TAR is located in SHOBA where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.) Alternative 1: 200 ops/yr. including 33 NSW, 6 USMC Amphibious, 1 USMC Battalion Landing and 160 other naval operations. Alternative 2: 220 ops/yr. including 40 NSW, 16 USMC Amphibious, 2 USMC Battalion Landing and 162 other naval operations. (Other naval operations include naval artillery and delivery of air-to-ground ordnance into overlapping Impact Area II and IIA, which are covered under Impact Area II).	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-2* G-M-3* G-M-4 G-M-5 G-M-6*, G-M-7, G-M-8, G-M-9 SCLS-M-1* *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
Infantry Operations Area	Nesting and wintering. 2007: 0 of 66 documented nest locations on SCI (0% of SCI total locations) were in the Infantry Operations Area. Between 2001 and 2007: 16 of 375 documented nest site locations were within the Infantry Operations Area (4.3% SCI total locations).	In the event that a wintering shrike would be in the vicinity of advancing Marines in the IOA during an operation, it would be expected to be unaffected or to avoid the activity (Insignificant effect not reaching the level of "take"). During the breeding season, approaching Marines could cause nesting adults to temporarily fly away from the nest, returning momentarily after the personnel have passed. This would be a brief exposure because the Marines would normally be spaced apart in formation perpendicular to the direction of travel. Many variables come into play in determining whether this would represent an adverse effect. Direct injury or harassment of adults is so unlikely as to be discountable. Some potential for injury or mortality to nestlings is possible, but unlikely given the brief duration of the proximity to the nest of a human walking by and the low likelihood of	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-2 G-M-3 G-M-4

Table D-7 (continued). Occurrence of San Clemente Loggerhead Shrike Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
		a very close approach of a human to a nest. Under current levels of shrike nesting activity, about one nest (about 1.5% of the nesting population) per breeding season could be exposed to close approaching foot traffic within the Infantry Operations Area. Assuming that a reaction reaching the level of take happened in about 1 of 5 encounters, then take would represent 1 nesting attempt affected every 5 years or so. This would be a short-term effect on less than 5% of the breeding pairs and would not be expected to affect renesting of the pair. Impacts would be less than significant due to infrequency of the effect, small portion of the population affected, and temporary nature of the effect. Baseline use: Battalion-sized landings have occurred on SCI in the past, but are not considered part of the baseline. Foot traffic by individuals and groups is permitted within the IOA and elsewhere on the Island under the No Action Alternative. Alternative 1: 1 USMC Battalion-sized landing per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road. Alternative 2: 2 USMC Battalion-sized landings per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road.	G-M-5 G-M-6 G-M-8 G-M-9 AVMC-M-1 AVMC-M-2 AVMC-M-4 AVMC-M-6 AVMC-M-7 SCLS-M-1 No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Note:

1. Documented nest locations and totals 2001-2005 from the SCI GIS, based on annual monitoring studies. Under "amount of resource", resources (e.g., nest sites used during different years) occurring in overlapping operations areas are reported for each of the overlapping areas (e.g., Impact Area I and TAR 21), enabling the effects of the differing operations in the overlapping areas to be assessed.
2. Impact significance conclusion is based on discussion in "Description of Impacts" column and is assessed assuming application of mitigation measures identified in this document.
3. Impact significance assessment assumes mitigation for Alternatives 1 and 2.

Table D-8. Impacts on San Clemente Sage Sparrow Within Individual Operations Areas on SCI, Description of Potential Impacts of Existing and Proposed Operations, and Impact Significance. Evaluation of Impact Significance for the No Action Alternative is Based on Comparison with the Baseline.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
IMPACT AREA II	Low density habitat: 176.9 ac along lower terraces in the western part of the Impact Area. This is about 6.8% of the low density habitat mapped on SCI. Based on 1999-2007 average SCSS density for low density habitat (0.11 adults/ac), 177 ac would be expected to support about 19 adults (roughly 2% of the population); however, according to Turner et al. (2006), sightings have been very infrequent in this area, which is near the southern limit of the species range on SCI, and so the population is probably lower.	Any disturbance from ordnance impacts would be expected to continue as a result of continuing Naval Surface Fire Support, air strikes and close air support. This includes exposure to impact noise, flares, and potential fires. There is some potential for take of individuals or damage to essential habitat elements due to possible adverse effects from fire on MDS-Lycium habitat, which does not recover rapidly after fire, or from adverse behavioral response by individuals to visual and noise effects associated with NSFS and CAS in the vicinity. Some habituation to these exposures would be expected, reducing the chance of adverse behavioral response. Any reasonably foreseeable take under No Action, Alternative 1, or Alternative 2 would affect <<5% of the SCSS population and would probably average less than one individual per year. Impacts are expected to be less than significant (NEPA) because of the extended history of use of this site as an impact area for live ordnance, the small proportion of individuals and habitat potentially exposed to the effects. Existing levels of large ordnance associated with No Action, and projected increases associated in Alternatives 1 and 2 are presented in Table D-1.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-2* G-M-3* G-M-4 G-M-5 G-M-6*, G-M-8, G-M-9 SCSS-M-1* SCSS-M-2* *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-8 (continued). Impacts on San Clemente Sage Sparrow Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
Old Rifle Range AVMA	Low density habitat: 142.5 ac (5% of SCI total low density habitat) contiguous with low and medium density habitat along the western and northern edges of the AVMA. The ORR AVMA is contiguous with large blocks of low and medium density habitat along its western boundary. Based on 1999-2007 average for low density habitat (0.11 adults/acre), about 16 adults would be expected in the 142 ac of low density habitat on the ORR AVMA.	Tracked vehicle activity associated with Alternatives 1 and 2 is expected result in take through a reduction in shrub cover and other long-term changes in the habitat reducing or eliminating its suitability to SCSS. In addition to gradual loss of habitat value, low levels of additional take (up to 2 individuals or nests per year) in the form of possible loss of eggs or nestlings, nest failure, unintentional harassment, injury, or death of adults are anticipated from the activities of tracked vehicles in this area. Because of sloping terrain on the western side of the AVMA associated with drainage heads and between-terrace slopes there is the potential for off site effects on SCSS habitat caused by increased runoff from the AVMA. Designation of the AVMA is part of Alternatives 1 and 2. Alternative 1. The AVMA could be used by tracked vehicles during approximately 43 (42 USMC Amphibious plus 1 USMC Battalion Landing) operations per year.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-2 G-M-3, G-M-4 G-M-5, G-M-6 AVMC-M-2 AVMC-M-3 AVMC-M-4; AVMC-M-5
		Alternative 2. The AVMA could be used by tracked vehicles during approximately 63 (61 USMC Amphibious plus 2 USMC Battalion Landing) operations per year.	AVMC-M-7 AVMC-M-7 AVMC-M-9 AVMC-M-10 SCSS-M-1 SCSS-M-2 No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
Old Rifle Range (ORR) AMP	Low density habitat: 15.05 ac (<0.6% of SCI total low density habitat). Contiguous with low density habitat in adjacent portions of the overlapping AVMA and along the western edge of the AMP.	Degradation of vegetation and soils from vehicular activity associated with Alternatives 1 and 2 leading to loss of shrub cover, especially boxthorn, expected to make the habitat on the site unsuitable for this species. Habitat on site is estimated to be capable of supporting about 1-2 adults. Take would include degradation of 15.05 ac of SCSS habitat and reduction in carrying capacity for SCSS. Designation of the AMP is part of Alternatives 1 and 2. Alternative 1. Artillery maneuvering during 3-day exercises up to 6 times per year plus 1 USMC Battalion Landing. Alternative 2. Artillery maneuvering during 3-day exercises up to 8 times per year plus 2 USMC Battalion Landings.	Applicable mitigation measures as identified above under Old Rifle Range AVMA. No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-8 (continued). Impacts on San Clemente Sage Sparrow Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 4--Whale Point/Castle Rock	Medium density habitat: 27.1 ac (1.6% of SCI total medium density habitat). TAR 4 is surrounded by medium density habitat with 110 additional acres of medium density habitat and 29.9 ac of low density habitat within 1,000 feet of the TAR. Based on 1999-2007 average for medium density habitat (0.21 adults/ac), about 6 adults would be expected in the 27.1 ac medium density habitat and about 26 additional adults expected in the medium and low density habitat within 1,000 feet of the TAR. The mean SCSS population size on the Island is 808 adults (1999-2007). TAR 4 plus the area within 1,000 feet includes 8.3% of the medium density habitat and 1.1% of the low density habitat on the island.	In the TAR 4 area, most of the area occupied by sage sparrows (>75%) is infrequently used for military training (Turner et al. 2005, page 50). Construction activities, accidental fires, demolitions, and other disturbances have been documented during 2003 and 2004, which have affected sage sparrow habitat and which, based on timing and location, may have a causal association with the disappearance of a marked adult and a nest failure (Turner et al. 2005). However, a comparison of population dynamics from a study plot at TAR 4 with other plots established on the island conducted by Beaudry et al. (2004) indicated that the study plot encompassing TAR 4 generally fell within the range of other plots with regard to most parameters measured, including percent of nest success (high), number of fledglings per nest (high), and percent of birds resighted on plot from 2002 (high) despite ongoing construction and military use since its establishment. Based on continued reproductive success of the sage sparrow population at TAR 4, impacts of baseline use at TAR 4 are less than significant under No Action. Impacts associated with Alternative 1 would be less than significant with mitigation, including implementation of the Wildland Fire Management Plan. Alternative 2 would have a substantial increase in operations at TAR 4 compared to No Action and Alternative 1; however, a large proportion of these operations would be at developed facilities in the TAR (e.g., the MOUT, the village site, and the rifle ranges) and would involve minimal exposure of sage sparrows or sage sparrow habitat to the activities. Baseline use = 212 ops/yr. This TAR has been previously established. Alternative 1: 230 ops/yr. Alternative 2: 300 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-2 G-M-3 G-M-4 G-M-5 G-M-6 TAR-M-1 SCSS-M-1 SCSS-M-2 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 10—Demolition Range West	High density habitat 43.6 ac (4.7% of SCI total). Medium density habitat: 11.3 ac (0.7% of SCI total). TAR 10 is surrounded by medium and high density SCSS habitat with 101.3, 119.3, and 25.0 additional acres of high, medium and low density habitat, respectively, within 1,000 feet of the TAR. TAR 10 plus the area within 1,000 feet of the TAR contain 15.7%, 7.9% and <1% of SCI totals of high density, medium density, and low density habitat, respectively.	Noise from weapons and demolition, human activity, and helicopters could disturb SCSS especially when bonding and establishing nests (late January through March), early in the breeding season. Fire and invasive species spread could affect habitat. Development of two small range buildings on this site would occupy about 0.25 ac, assumed to be in previously disturbed habitat. The potential for fire carrying from this TAR into adjacent contiguous areas of high and medium density SCSS habitat has been identified as a key issue. The SCI Draft Wildland Fire Management Plan (DoN 2006) has a series of increasing precautions and fire suppression measures related to increasing fire danger ratings, including a fully equipped and staffed fire truck in the vicinity of the TAR within line of sight visibility of the TAR and action area and ability to be on scene and pumping water within 10 minutes of an ignition report whenever any type of incendiary ordnance is used (See Section 2.X). The Fire Plan notes the slow growth and recovery of boxthorn and places a priority on preventing short-interval recurrences of fire that might result in replacement of shrub-dominated native vegetation by grasses or weeds (type conversion). Impacts on habitat are less than significant as described in Table D-1. Monitoring of SCSS in the vicinity of TAR 4 during a period of training operations coupled with construction of the MOUT and related facilities has shown that the SCSS population there is healthy and comparable to other SCSS populations on the Island (as described above under TAR 4). Most of the	Applicable mitigation measures are as identified for TAR 4. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-8 (continued). Impacts on San Clemente Sage Sparrow Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
		training activity and all of the demolition within TAR 10 would be in previously disturbed areas, so that effects on habitat would be less than significant. Based on the results of monitoring sage sparrow response to NSW training at TAR 4, it is assumed that low levels of take (up to 2 individuals per year) in the form of unintentional harassment of birds nesting in the area would occur but this would not likely be measurable because it is expected that population levels and reproductive parameters would remain with the range of other sage sparrows on SCI. Baseline use = 3 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 25 ops/yr. Alternative 2: 40 ops/yr.	
TAR 14—VC-3 Onshore Parachute Drop Zone "Twinky"	No SCSS habitat mapped within the TAR. TAR 14 lies approximately 1,500 feet or more to the east of SCSS low density habitat.	The nearest SCSS habitat lies about 1,500 feet from the western boundary of TAR 14 and effects on the SCSS population or habitat from activities in TAR 14 would be insignificant (effects on habitat) or so unlikely as to be discountable (injury, death, or harassment of an SCSS). All live-fire on TAR 14 is directed toward the east (away from the SCSS habitat). Modeling in the Fire Plan BA shows considerable spread of fire into SCSS habitat off site during NE winds and very high to extreme FDRS (Fire Danger Rating System) conditions (DoN 2006). A variety of precautions have been defined to be in effect under these conditions, including a standby fully-equipped wildland fire truck staffed with 3 wildland fire certified personnel whenever incendiary ordnance (e.g., flares) is to be used (SCI Wildland Fire Management Plan DoN 2005). Modeling in the Fire Management Plan BA indicates take of SCSS ranging from <1 to 4 individuals under different fire scenarios associated with fire originating on TAR 14. Impacts are less than significant because of the distance from the site to the habitat, the small fraction of the population and habitat that would be affected, the ability of the population to recover rapidly, and the likelihood that with implementation of the Fire Management Plan (FMP), fires would become smaller in extent, less frequent, and less likely to result in habitat type conversion. The increase in operations with Alternatives 1 and 2 would incrementally increase the potential for fire but impacts would be less than significant with mitigation. Baseline use = 20 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 30 ops/yr. Alternative 2: 68 ops/yr.	Applicable mitigation measures are as identified for TAR 4. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-8 (continued). Impacts on San Clemente Sage Sparrow Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 15—VC-3 Airfield Training Area	Low density habitat: 5.0 ac in the SW corner of the TAR (<0.2% of SCI total low density habitat). An additional 92.3 ac of low density habitat (3.5% of SCI total) extends from the SW corner of the TAR within 1,000 feet of the TAR.	Low effects on habitat by infrequent foot traffic by small groups. Likelihood of direct effects on a bird or nest is so low as to be discountable given the fact that all live-fire on TAR 15 is directed toward the east (away from the SCSS habitat); the out of the way location of the SCSS habitat in the extreme southwestern corner of the TAR; and the very small area of the habitat. Fire effects are possible under very high and extreme FDRS and NE winds only. Take in the event of a fire would be generally as described under TAR 14 and impacts would be less than significant as described under TAR 14. The increase in operations with Alternatives 1 and 2 would incrementally increase the potential for fire but impacts would be less than significant with mitigation. Baseline use = 20 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 25 ops/yr. Alternative 2: 94 ops/yr.	Applicable mitigation measures are as identified for TAR 4. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-8 (continued). Impacts on San Clemente Sage Sparrow Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 17— Eel Point Tactical Training Range	High density habitat: 11.9 ac within TAR 17 (1.3% of SCI total high density habitat). TAR 17 is surrounded by high and medium density SCSS habitat with 43.6 and 40.3 additional acres of high and medium density habitat, respectively, within 1,000 feet of the TAR. TAR 17 plus the area within 1,000 feet of the TAR contain 6.0% and 2.4% of SCI totals of high density and medium density habitat, respectively.	Noise from weapons and demolition, human activity, and helicopters could disturb SCSS especially when bonding and establishing nests (late January through March), early in the breeding season. Fire and invasive species spread could affect habitat. Small groups on foot traveling across country between TAR 17 and another location (e.g., TAR 14) have the potential to damage low boxthorn shrubs in areas of dense shrubs, vines, and cactus, despite stealthy foot travel using Tactical Environmental Movement. Contact or very close approach to a nest shrub could cause abandonment, although this would be statistically unlikely given the small number of people in an operation (12-15), use of Tactical Environmental Movement, the low density and dispersion of nests (ranging from 1 nest per 8, 14, or 27 ac, in high, medium, and low density habitat, respectively, based on densities of males between 1999-2005 and assuming 1 nest per male), and small number of operations conducted annually during the nesting season (< 5 expected mid-March through June for No Action, ~ 10 for Alternative 1, ~12 for Alternative 2). Proposed measures in the SCI Fire Plan to reduce frequency and extent of wildland fire discussed under TAR 10 would apply to TAR 17, reducing the chance of repeated fires that could lead to habitat type conversion. Monitoring of SCSS in the vicinity of TAR 4 during a period of training operations coupled with construction of the MOUT and related facilities has shown that the SCSS population there is healthy and comparable to other SCSS populations on the Island (as described above under TAR 4). Although much of the training activity and all of the demolition within TAR 17 would be in previously disturbed areas, it is assumed that take in the form of 0.5 ac of habitat loss or degradation is likely and a low level of additional take (up to 2 individuals per year) in the form of possible loss of eggs or nestlings, nest failure, unintentional harassment, injury, or death of adult individuals is anticipated. Baseline use = 15 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 31 ops/yr. Alternative 2: 40 ops/yr.	Applicable mitigation measures are as identified for TAR 4. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 22—China Cove Training Area	Low density habitat: 18.2 ac (~0.7% of SCI total), all of which is accounted for in Impact Area II. The area within 1,000 feet of the TAR contains 28.9 additional acres of low density habitat (1.1% of SCI total). Based on average densities for low density habitat between 1999 and 2006, 18.2 ac would be expected to support two adult SCSS and the area within 1,000 feet of	Based on the amount of habitat present, the exposed population of SCSS would be very low in TAR 22 (~ 2 individuals or less) with 3 individuals or less in nearby habitat. Noise from weapons and demolition, human activity, and overflight by helicopters, fixed wing attack aircraft, and small UAVs could disturb SCSS especially when bonding and establishing nests (from late January through March), early in the breeding season. The sparseness of the vegetation in TAR 22 minimizes the potential for damage to low boxthorn shrubs from platoon-sized movements on foot through SCSS habitat in TAR 22. Contact or very close approach to a nest shrub would be very unlikely given the improbability of there being a nest in the TAR, the small number of people in an operation (12-15), sparseness of the MDS-Lycium at this locality, and use of stealthy Tactical Environmental Movement. Fire and	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-2* G-M-3* G-M-4 G-M-5

Table D-8 (continued). Impacts on San Clemente Sage Sparrow Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
	the TAR would be expected to support about 3 adults. However, actual densities at this location near the southern limit of the species on SCI are probably lower. According to Turner et al. (2006), SCSS are sighted infrequently in the area south of Kinkipar Canyon (near the western boundary of Impact Area II) including Impact Area II and TAR 22.	invasive species spread could affect habitat. However, spread of wildland fire through the MDS-Lycium habitat in the TAR and adjacent impact area would be expected to occur slowly because of the sparseness of the vegetation and infrequency of conditions that would cause fire to spread up the coast in the direction of additional habitat. Insertion of SEALS would be primarily by boat or by swimming (vs. overland) minimizing the potential for introduction/spread of invasive species. Monitoring of SCSS in the vicinity of TAR 4 during a period of training operations coupled with construction of the MOUT and related facilities has shown that the SCSS population there is healthy and comparable to other SCSS populations on the Island (as described above under TAR 4). Because the training activity, including demolition within TAR 22, would be in previously disturbed areas, take of SCSS in the form of habitat loss or degradation is not anticipated with No Action, Alternative 1, or Alternative 2. Given the low size of the exposed population (~ 2 individuals or less in the TAR with an additional 3 individuals or less within1,000 feet of the TAR), additional take in the form of possible loss of eggs or nestlings, nest failure, unintentional harassment, injury, or death of adult individuals is expected to be very low (<1/year) and probably not observable for No Action and also for Alternative 1 and Alternative 2 due to the very low probability of impact. Impacts are less than significant. Baseline use = 96 ops/yr including 33 NSW ops/yr. and 63 Non-NSW Naval ops/yr. (This TAR is located in SHOBA where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.) Alternative 1: 200 ops/yr. including 33 NSW, 6 USMC Amphibious, 1 USMC Battalion Landing and 160 other naval operations. Alternative 2: 220 ops/yr. including 40 NSW, 16 USMC Amphibious, 2 USMC Battalion Landing and 162 other naval operations. (Other naval operations include naval artillery and delivery of air-to-ground ordnance into overlapping Impact Area II and IIA, which are covered under Impact Area II).	G-M-6* G-M-8 G-M-9 TAR-M-1* SCSS-M-1* SCSS-M-2 *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-8 (continued). Impacts on San Clemente Sage Sparrow Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
Infantry Operations Area	Low density habitat: 153.5 ac, about 6% of the SCI total low density habitat. Most (130.4 ac) of the SCSS habitat within the IOA is addressed above under the overlapping NALF AVMA, Old Rifle Range AVMA, the associated AMPs, and TAR 15.	Foot traffic in the IOA would occur during the USMC Battalion Landings which could occur once to twice per year in Alternatives 1 and 2, respectively. Marines walking through the area would normally be spread out more or less perpendicular to the direction of travel with about 5-m spacing between individuals. Where not overlapped by an AVMA or AMP, direct impacts on the shrub-dominated habitat in the IOA would be short term and minor given the infrequency of the operation. The peripheral location of the SCSS habitat to the IOA would probably reduce the chances that it would be walked through in any given operation. Individual SCSS, if present in the vicinity of advancing personnel during the operation, would be expected to be unaffected or to avoid the activity (insignificant effect not reaching the level of "take"). During the breeding season, approaching Marines could cause nesting adults to temporarily fly away from the nest, returning momentarily after the line of personnel has passed. Direct injury or harassment of adults is so unlikely as to be discountable. Some potential for injury or mortality to nestlings is possible, but unlikely given the brief duration that a human walking by would be in proximity of the nest and the low likelihood of a very close approach of a human to a nest. Under current levels of sage sparrow nesting activity, about one nest (less than 0.1% of the nesting population) per breeding season could be exposed to close approaching foot traffic within the Infantry Operations Area. [This is based on the low density and dispersion of nests (ranging from 1 nest per 8, 14, or 27 ac, in high, medium, and low density habitat, respectively, assuming observed densities of males between 1999-2005 and assuming 1 nest per male)]. Impact on SCSS from use of the IOA under Alternatives 1 and 2 would be less than significant because of the minimal nature of the potential exposure to foot traffic, the temporary and likely insignificant nature of any response, and the small portion of the population and habitat exposed. Baseline use: Battalion-sized landings have occurred on SCI in the past, but are not considered part of the baseline . Foot traffic by individuals and groups is permitted within the IOA and elsewhere on the Island under the No Action Alternative. Alternative 1: 1 USMC Battalion-sized landing per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road. Alternative 2: 2 USMC Battalion-sized landings per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-2 G-M-3 G-M-4 G-M-8 G-M-9 AVMC-M-2 AVMC-M-5 AVMC-M-7 SCSS-M-1 SCSS-M-2 No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Note:

1. Population density figures by habitat density category are averages of density estimates in annual reports for 1999 through 2007. Under “amount of resource”, resources (e.g., acres of medium density habitat) occurring in overlapping operations areas are reported for each of the overlapping areas (e.g., Old Rifle Range AVMA, AMP B, Infantry Operations Area), enabling the effects of the differing operations in the overlapping areas to be assessed.
2. Impact significance conclusion is based on discussion in “Description of Impacts” column and is assessed assuming application of mitigation measures identified in this document.
3. Impact significance assessment assumes mitigation for Alternatives 1 and 2.

Table D-9. Occurrence of Western Snowy Plover Within or Near Individual Operations Areas on SCI, Description of Potential Impacts of Existing and Proposed Operations, and Impact Significance. Evaluation of Impact Significance for the No Action Alternative is Based on Comparison with the Baseline.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
IMPACT AREA I	21.1 ac (mostly where it overlaps TARs 20 and 21). SCI INRMP (DoN 2002) reported breeding attempts at Horse Beach Cove in 1997 (nest depredated) and 1998 ("probably hatched"). These are the most recent breeding attempts reported on SCI. Compared to elsewhere on SCI, Pyramid Cove consistently has had the highest numbers of wintering birds (15-25 individuals) on SCI while being used for NSFS, CAS and other training activities that are part of the baseline.	The beaches within Impact Area I are used by the western snowy plover primarily for winter foraging and roosting; plovers are generally absent during the breeding season months. Plovers may temporarily leave the affected area in response to noise or visual effects from ordnance use including flares during exercises such as FIREX or EFEX. See Table D-1 for a breakdown of heavy ordnance associated with No Action, Alternative 1 and Alternative 2. Likelihood of injury or mortality from ordnance hit in plover habitat is discountable. Effects of amphibious landings are addressed under Horse Beach Cove Amphibious Landing and Embarkation Area. Impact Area I receives < 6% of incoming large-caliber ordnance. Implementation of the Navy Access Policy applying to Impact Areas I and II and TARS 20, 21, and 22 will preclude future direct monitoring of this endangered plant species and its habitat in these locations.	G-M-1* G-M-2* G-M-3* G-M-4 G-M-5 G-M-7 G-M-8 *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant.
IMPACT AREA II	9.1 ac (mostly where it overlaps TAR 22). Used by wintering birds only.	The beaches within Impact Area II are used by the western snowy plover primarily for winter foraging and roosting; plovers are generally absent during the breeding season months. Bombardment is generally inland from the beach. Plovers may temporarily leave the affected area during NSFS exercises in response to noise or visual effects of ordnance use, including flares. The proposed increases in heavy ordnance associated with Alternatives I and 2 (see Table D-1) would not increase the likelihood of injury or mortality from an ordnance hit in plover habitat to a level above discountable or result in adverse behavioral response above that for ongoing activities. Implementation of the Navy Access Policy applying to Impact Areas I and II and TARS 20, 21, and 22 will preclude future direct monitoring of this endangered plant species and its habitat in these locations.	Applicable conservation measures and Impact significance are as described for Impact Area I above.

Table D-9 (continued). Occurrence of Western Snowy Plover Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
NALF AVMA	See TAR 5 below.	See discussion of amphibious landings and embarkation under TAR 5 which is overlapped by the NALF AVMA.	See TAR 5 and West Cove Landing and Embarkation Area (below).
TAR 3--BUD/S Beach Underwater Demolition Range	4.8 ac mapped within the TAR with an additional 7.9 ac within action area. Beach is used by small numbers of wintering plovers. No breeding has been documented at this site.	Plovers would be expected to be unaffected by the NSW activity or, if approached closely by a boat or personnel coming ashore, would be expected to move to another part of the beach and continue their activities (insignificant effect not reaching the level of "take"). Impacts are less than significant in No Action. Alternatives 1 and 2 would increase the number of operations and, therefore, the potential for impacts to plovers. Baseline use = 82 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2) Alternative 1: 82 ops/yr. Alternative 2: 95 NSW and 4 USMC Amphibious ops/yr.	G-M-1 G-M-2 G-M-3 G-M-4 G-M-5 G-M-6 WSP-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 5--West Cove Amphibious Assault Training Area and West Cove Landing and Embarkation area for NALF AVMA	0.8 ac mapped plus 3.4 ac where TAR 5 is overlapped by NALF AVMA. One nesting attempt with 1 chick documented in 1989, it is not known whether it fledged (SCI INRMP, DoN 2002). No other nesting attempts documented despite periodic monitoring in subsequent years. Used by small numbers (typically 5-10) of plovers during winter.	TAR 5. Most potential snowy plover nesting habitat at this site is subject to periodic inundation during high tides and frequented by predators such as domestic cat, island fox, and ravens making it largely unsuitable for nesting. Plovers would be expected to be unaffected by the increased NSW activity in Alternatives 1 and 2, or, if approached closely by a boat or personnel coming ashore, would be expected to move to another part of the beach and continue their activities (insignificant effect not reaching the level of "take"). West Cove Landing and Embarkation Area. Wintering snowy plovers would be expected to move to other parts of the beach or to another site during frequent landings and unloadings of LCACs and LCUs on the beach, as well as landings and transit of AAVs (and ultimately EFVs) across the beach. This is considered an insignificant effect and is not expected to reach the level of take. Baseline use = 10 ops/yr incl. 10 USMC Amphibious. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 25 ops/yr (incl. 17 USMC Amphibious). Alternative 2: 55 ops/yr (incl. 44 USMC Amphibious).	G-M-1 G-M-2 G-M-3 G-M-4 G-M-5 G-M-6 AVMC-M-9 WSP-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-9 (continued). Occurrence of Western Snowy Plover Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 20—Pyramid Cove Training Area	9.1 ac, all of which are accounted for under Impact Area I. Pyramid Cove Beach has generally had the largest number of wintering plovers on SCI (ranging from 10 to 20 during peak months) but was not monitored in 2004 or subsequently because of safety concerns related to unexploded ordnance (Lynn et al. 2005).	The beach at Pyramid Cove within and adjacent to Impact Area I is used by WSP primarily for winter foraging and roosting; plovers are generally absent during the breeding season months. Plovers may temporarily move from the affected area in response to noise or visual effects from daytime or nighttime operations during NSW exercises such as GUNEX or EFEX, in which landings by CRRC and ship to shore firing are involved. Impacts would be less than significant; likelihood of injury or mortality from ship to shore weapons fire in plover habitat is low, but possible, if it is not preceded by some type of stimulus to cause them to move from the area. Baseline use = 44 ops/yr. (This TAR is located in SHOBA where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.). Alternative 1: 50 ops/yr. Alternative 2: 60 ops/yr.	G-M-1* G-M-2* G-M-3* G-M-4 G-M-5 G-M-7 G-M-8 *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 21—Horse Beach Cove Training Area and Horse Beach Cove Amphibious Landing and Embarkation Area	12.0 ac, all of which are previously accounted for under Impact Area I. The beach at Horse Beach Cove is used by small numbers of WSP (typically 0-5) primarily for winter foraging and roosting; plovers are generally absent during the breeding season months. However, SCI INRMP (DoN 2002) reported breeding attempts at Horse Beach Cove in 1997 (nest depredated) and 1998 ("probably hatched"). These are the most recent breeding attempts reported on SCI.	TAR 21: Roosting or foraging plovers may temporarily move away from the human activity, noise or visual effects of daytime or nighttime operations during live-fire exercises such as GUNEX or EFEX, which may include landings by CRRC, weapons firing from support craft to shore, demolitions, and overflights by helicopters, fixed-wing attack aircraft, and small UAVs. Observations suggest that the plovers would rapidly resume normal behavior after moving away from the activity. The scope of some of the operations and multiple sources of disturbance may result in take in the form of unintentional harassment of a small number of birds. Likelihood of injury or mortality to an individual plover from ship to shore weapons fire or other project-related activity in plover habitat is very low, but possible. Impacts (NEPA) for No Action, Alternative 1, and Alternative 2 would be less than significant due to the low likelihood of harm to individuals and the small number of individuals potentially exposed to the activity. Horse Beach Cove Amphibious Landing and Embarkation Area. Roosting or foraging plovers may temporarily move away from the human and vehicular activity, noise or visual effects of daytime or nighttime amphibious landings. Observations suggest that the plovers would rapidly resume normal behavior after moving away from the activity. The scope of some of the operations and multiple sources of disturbance may result in take in the form of unintentional harassment of a small number of birds. Likelihood of injury or mortality to an individual plover from project-related activity in plover habitat is very low, but possible. It is estimated that take in the form of	G-M-1* G-M-2* G-M-3* G-M-4 G-M-5 G-M-7 G-M-8 *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than

Table D-9 (continued). Occurrence of Western Snowy Plover Within or Near Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
		unintentional harassment would not exceed 4 individuals per year. Take in the form of injury or mortality to individuals is so improbable as to be discountable. Impacts (NEPA) for No Action, Alternative 1, and Alternative 2 would be less than significant because of the low likelihood of harm to individuals and the small number of individuals potentially exposed to the activity. Baseline use = 79 ops/yr. ((This TAR is located in SHOBA where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.). Alternative 1: 91 ops/yr. including 81 NSW, 10 USMC Amphibious and 1 USMC Battalion Landing. Alternative 2: 102 ops/yr. including 90 NSW, 10 USMC Amphibious and 2 USMC Battalion Landing.	significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 22—China Cove Training Area	9.2 ac, all of which is accounted for under Impact Area II. This is the narrowest and most exposed of the SHOBA beaches. There have been no records of plovers breeding or attempting to breed on this beach. The beach at China Cove within Impact Area II is used by small numbers of WSP primarily for winter foraging and roosting; plovers are generally absent during the breeding season months. During 2004, a median number of 8 birds was observed at this location when birds were present (range 1-19).	Roosting or foraging plovers may temporarily move away from the human activity, noise or visual effects of daytime or nighttime operations during live-fire exercises such as GUNEX or EFEX, which may include landings by CRRC, weapons firing from support craft to shore, demolitions, and overflights by helicopters, fixed-wing attack aircraft, and small UAVs. Observations suggest that the plovers would rapidly resume normal behavior after moving away from the activity. The scope of some of the operations and multiple sources of disturbance may result in take in the form of unintentional harassment of a small number of birds. There would be no effects on breeding WSP. Likelihood of injury or mortality to an individual plover from ship to shore weapons fire or other project-related activity in plover habitat is very low, but possible. Impacts (NEPA) would be less than significant because of the low likelihood of harm to individuals and the small number of individuals potentially exposed to the activity. Baseline use = 96 ops/yr including 33 NSW ops/yr. and 63 Non-NSW Naval ops/yr. (This TAR is located in SHOBA where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.) Alternative 1: 200 ops/yr. including 33 NSW, 6 USMC Amphibious, 1 USMC Battalion Landing and 160 other naval operations. Alternative 2: 220 ops/yr. including 40 NSW, 16 USMC Amphibious, 2 USMC Battalion Landing and 162 other naval operations. (Other naval operations include naval artillery and delivery of air-to-ground ordnance into overlapping Impact Area II and IIA, which are covered under Impact Area II).	G-M-1* G-M-2* G-M-3* G-M-4 G-M-5 G-M-7 G-M-8 *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Note:

1. Habitat acreage calculated from the SCI GIS. Acreages are approximate and should be used only for comparative purposes for several reasons including seasonal and year to year changes in the narrow strips of beach habitat.
2. Impact significance conclusion is based on discussion in “Description of Impacts” column and is assessed assuming application of mitigation measures identified in this document.
3. Impact significance assessment assumes mitigation for Alternatives I and 2.

Table D-10. State-listed and California Native Plant Society (CNPS)-List 1B Plant Species (Rare and Endangered in California and Elsewhere) Within Individual Operations Areas on SCI, Description Of Potential Impacts Of Existing and Proposed Operations, and Impact Significance. Evaluation of Impact Significance for the No Action Alternative is Based on Comparison With the Baseline.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
IMPACT AREA I	State Listed and Sensitive Plant Species SCI bedstraw (*Galium catalinense* ssp. *acrispum*): 2 of 224 (0.9% of SCI total occurrences) with 48 individuals (1.8% of 2,647 SCI total individuals). SCI silvery hosackia (*Lotus argophyllus* subsp. *adsurgens*): 25 of 207 occurrences on SCI (12.1% of SCI total occurrences); 330 of 5,505 individuals on SCI (6% of total SCI individuals). Aphanisma *(Aphanisma blitoides)* : 46 of 175 occurrences on SCI (26.3% of SCI total occurrences). SCI milkvetch (*Astragalus nevinii*) : 21 of 205 occurrences on SCI (10.2% of SCI total occurrences). South Coast saltscale (*Atriplex pacifica*): 9 of 67 occurrences on SCI (13.4% of SCI total occurrences). SCI evening primrose (suncup) (*Camissonia guadalupensis clementina*): 6 of 89 occurrences on SCI (6.7% of SCI total occurrences). Island apple-blossom *(Crossosoma californicum)*: 4 of 60 occurrences on SCI (6.7% of SCI total occurrences). Island green dudleya (*Dudleya virens* ssp. *virens*) : 7 of 324 occurrences on SCI (2.2% of SCI total occurrences). SCI buckwheat (*Eriogonum giganteum var. formosum*): 1 of 270 occurrences on SCI (0.4% of SCI total occurrences). SCI hazardia (*Hazardia cana*): 2 of 153 occurrences on SCI (1.3% of SCI total occurrences).	Existing patterns of disturbance from ordnance impacts and fire would be expected to continue, given the long history of similar use. Much of the distribution of SCI silvery hosackia (*Lotus argophyllus adsurgens*) is within SHOBA, and 12% of the populations documented since 1998 are within Impact Area I, where this state-listed endangered species is relatively abundant on south facing slopes and ridgetops. These habitats are largely away from target areas and many of the occurrences are very sparsely vegetated and unlikely to carry fire. This species regenerates from seed after fire. Under no action, Impact Area I receives about 6 % of the large caliber ordnance used in SHOBA. Because of its distribution is in up-canyon locations away from target areas, and the long history of ordnance use in Impact Area I, continued use of Impact Area I would have less than significant impacts on this species. Other sensitive species in Impact Area I have smaller proportions of their Island distribution in Impact Area I and would also be expected to experience less than significant impacts from continued use of the Impact Area. Increases in ordnance use associated with Alternatives 1 and 2 are as described in Table D-1. The patterns of disturbance from the increased use associated with these alternatives would be expected to be similar to existing patterns. Compared to baseline conditions, substantial changes in distribution and abundance of state-listed and sensitive plant species, including the SCI silvery hosackia, would not be expected. Implementation of the Navy Access Policy applying to Impact Areas I and II will preclude future monitoring of these state-listed and sensitive plants species and their habitat.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-3* G-M-4 G-M-5 G-M-6* G-M-7 G-M-9 *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

	Guadalupe Island lupine (*Lupinus guadalupensis*): 5 of 356 occurrences on SCI (1.4% of SCI total occurrences). SCI phacelia (*Phacelia floribunda*): 3 of 52 occurrences on SCI (5.8% of SCI total occurrences).			

Table D-10 (continued). State-Listed and CNPS-Listed Sensitive Plant Species Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
IMPACT AREA II	State Listed and Sensitive Plant Species SCI bedstraw (*Galium catalinense* ssp. *acrispum*): 2 of 224 (0.9% of SCI total occurrences) with 3 individuals (0.1% of 2,647 SCI total individuals). SCI silvery hosackia (*Lotus argophyllus* subsp. *adsurgens*): 2 of 207 occurrences on SCI (1.0% of SCI total occurrences) with 70 individuals (1.3% of 5,505 SCI total individuals). Aphanisma *(Aphanisma blitoides)* : 1 of 175 occurrences on SCI (0.6% of SCI total occurrences). SCI evening primrose (suncup) (*Camissonia guadalupensis clementina*): 6 of 89 occurrences on SCI (6.7% of SCI total occurrences). Trask's cryptantha (Cryptantha traskiae): 1 of 25 occurrences on SCI (4.0% of SCI total occurrences). Island green dudleya (*Dudleya virens* ssp. *virens*): 5 of 324 occurrences on SCI (1.5% of SCI total occurrences). SCI buckwheat (*Eriogonum giganteum var. formosum*): 5 of 270 occurrences on SCI (1.85% of SCI total occurrences). SCI hazardia (*Hazardia cana*): 1 of 153 occurrences on SCI (0.6% of SCI total occurrences). Guadalupe Island lupine (*Lupinus guadalupensis*): 7 of 356 occurrences on SCI (2.0% of SCI total occurrences). SCI tritelia: 1 of 88 occurrences on SCI (1.1% of SCI total occurrences).	Existing patterns of disturbance from ordnance impacts and fire would be expected to continue, given the long history of similar use. Continued use of Impact area II would have less than significant impacts on these species based on the historic and ongoing pattern of the disturbance, the ability of these species to survive or escape (through habitat association) fire or other disturbance, and the low proportions of their Island occurrences in Impact Area II. Increases in ordnance use associated with Alternatives 1 and 2 are as described in Table D-1. Impacts of the alternatives on these species would be less than significant despite the increased ordnance use because the patterns of disturbance are expected to be similar to existing and historic patterns. Implementation of the Navy Access Policy applying to Impact Areas I and II will preclude future monitoring of these state-listed and sensitive plants species and their habitat.	Applicable conservation measures and Impact significance are as described for Impact Area I above.
NALF AVMA	State Listed and Sensitive Plant Species SCI silvery hosackia *Lotus argophyllus* subsp. *adsurgens*): 2 of 207 occurrences on SCI (1.0% of SCI total occurrences) with 2 individuals (0.04% of 5,505 SCI total	Physical disturbance to vegetation and soils caused by tracked vehicle activity coupled with indirect impacts associated with introduction or spread of invasive species may lead to a reduction in these local populations of sensitive species. Newly discovered occurrences of southern Island tree mallow, SCI silvery hosackia (state-listed as endangered, SCI Indian paintbrush (federally listed as endangered Table D-2), and SCI milkvetch are clustered near	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2.

Table D-10 (continued). State-Listed and CNPS-Listed Sensitive Plant Species Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
	individuals). SCI milkvetch (*Astragalus nevinii*) : 5 of 205 occurrences on SCI (2.4% of SCI total occurrences). SCI evening primrose (suncup) *(Camissonia guadalupensis clementina*): 4 of 89 occurrences on SCI (4.5% of SCI total occurrences). Southern Island Tree Mallow (*Lavatera assurgentifolia* subsp. *glabra*): 5 of 32 occurrences on SCI (15.6% of the total SCI occurrences) with 5 individuals (1.8% of 276 SCI total individuals). The southern island tree mallow has also been noted in the SCI INRMP (DoN 2002) to occur on sandy soils south of the airfield immediately adjacent to the AVMA and AMP. This plant, which is CNPS 1B status, is noted in the INRMP (page D-17) as being in danger of extirpation on SCI because it is known from only 32 occurrences comprising less than 300 individuals total.	the egress from TAR 5, where their localized habitat may be susceptible to impacts from vehicle traffic. Protection of this localized area can be addressed through development of the erosion control plan (AVMC-M-3), briefing of maneuver area boundaries prior to conducting operations in these areas (AVMC-M-4), and continuing to use the existing route for ingress and egress from the beach at West Cove (AVMC-M-9), as appropriate. The occurrences of SCI evening primrose and SCI milkvetch at the northwestern and northeastern boundaries of the overlapping TAR 5 and along the southern boundary of the AVMA would probably not be affected during most operations because their peripheral locations would not receive frequent tracked vehicle activity. There would not be a substantial impact given the existing level of disturbance, the infrequency of activity at the sites, and the low proportion of the occurrences on SCI represented on this site. The southern island tree mallow population is inside the boundary of this AVMA and upwind from most of the activity and is therefore unlikely to be directly or indirectly affected by tracked vehicle activity within the AVMA. Designation of this AVMA is part of Alternatives 1 and 2. Alternative 1. The AVMA could be used by tracked vehicles during approximately 43 (42 USMC Amphibious plus 1 USMC Battalion Landing) operations per year. Alternative 2. The AVMA could be used by tracked vehicles during approximately 63 (61 USMC Amphibious plus 2 USMC Battalion Landing) operations per year.	G-M-1, G-M-3, G-M-4 AVMC-M-1 AVMC-M-2 AVMC-M-3 AVMC-M-4 AVMC-M-5 AVMC-M-6 AVMC-M-7, AVMC-M-9 No Action: No Impact. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
Old Rifle Range AVMA	State Listed and Sensitive Plant Species Aphanisma *(Aphanisma blitoides)*: 1 of 175 occurrences on SCI (0.6% of SCI total occurrences). SCI milkvetch (*Astragalus nevinii*) : 5 of 205 occurrences on SCI (2.4% of SCI total occurrences). Island appleblossom (*Crossosoma californicum*): 1 of 60 occurrences on SCI (1.7% of total SCI occurrences).	Physical disturbance to vegetation and soils caused by tracked vehicle activity coupled with indirect impacts associated with introduction or spread of invasive species may lead to a reduction in this local population. It might be able to persist on site given its annual habitat and association with sparsely vegetated habitats. Low proportions of the occurrences of aphanisma, SCI milkvetch, and island appleblossom on SCI are represented on this site (0.6%, 2.4%, and 1.7 %, respectively). Designation of this AVMA is part of Alternatives 1 and 2. Alternative 1. The AVMA could be used by tracked vehicles during approximately 43 (42 USMC Amphibious plus 1 USMC Battalion Landing) operations per year. Alternative 2. The AVMA could be used by tracked vehicles during approximately 63 (61 USMC Amphibious plus 2 USMC Battalion Landing) operations per year.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 AVMC-M-1 AVMC-M-2 AVMC-M-3 AVMC-M-4 AVMC-M-5 AVMC-M-6 AVMC-M-7 No Action: No Impact

Table D-10 (continued). State-Listed and CNPS-Listed Sensitive Plant Species Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
			Alternatives 1 and 2: As described above for NALF AVMA, impacts would be less than significant with mitigation.
VC-3 AVMA	State Listed and Sensitive Plant Species Guadalupe Island lupine (*Lupinus guadalupensis*): 5 of 356 occurrences on SCI (1.4% of SCI total occurrences).	Physical disturbance to vegetation and soils caused by tracked vehicle activity coupled with indirect impacts associated with introduction or spread of invasive species may lead to a reduction in the local population of this species. A low proportion (< 3%) of the occurrences on SCI represented on this site. It might be able to persist on site given its annual habitat and association with sparsely vegetated habitats. Designation of this AVMA is part of Alternatives 1 and 2. Alternative 1. The AVMA could be used by tracked vehicles during approximately 43 (42 USMC Amphibious plus 1 USMC Battalion Landing) operations per year. Alternative 2. The AVMA could be used by tracked vehicles during approximately 63 (61 USMC Amphibious plus 2 USMC Battalion Landing) operations per year.	Applicable mitigation measures as identified above for Old Rifle Range AVMA. No Action: No Impact No Action: No Impact Alternatives 1 and 2: As described above for NALF AVMA, impacts would be less than significant with mitigation.
AVMC in SHOBA	Thorne's royal larkspur (*Delphinium variegatum* subsp. *Thornei*): 3 of 78 SCI occurrences (3.8 percent of SCI total occurrences) with 51 of 10,026 individuals (0.5% of SCI total individuals). Guadalupe Island lupine (*Lupinus guadalupensis*): 1 of 356 occurrences on SCI (0.3% of SCI total occurrences).	Construction of the AVMC in SHOBA would require engineering and would be addressed in a separate environmental document and permitted separately. The occurrences of Thorne's royal larkspur and Guadalupe Island lupine in the 26.3-acre conceptual alignment represent a low proportion of the SCI totals for these plants. Operation of the AVMC in SHOBA in Alternatives 1 and 2 would have localized impacts including erosion, deposition of dust on vegetation, and spread of invasive plant species. The impacts would be localized along the sides of the AVMC, where beginning populations of invasive species would be detectable and treatable. Frequency of use would be up to approximately 43 times per year in Alternative 1 and up to 63 times per year in Alternative 2. (Construction of the route would be addressed in a separate environmental document and permitted separately).	Applicable Mitigation Measures as listed for Old Rifle Range AVMA (above) No Action: No Impact Alternative 1: Impacts from use of the route during operations would be less than significant with mitigation. Alternative 2: Impacts from use of the route during operations would be less than significant with mitigation.
AFP-1 SHOBA	SCI silvery hosackia (*Lotus argophyllus* subsp *adsurgens*): 4 of 207 SCI occurrences (1.9% of SCI total occurrences) with 289 individuals (5.2% of 5,505 SCI total individuals).	Maneuvering of heavy wheeled and tracked vehicles, including tanks, and digging in of recoil spades on howitzers may adversely affect individuals in this population through the physical effects of vehicle activity and possibly by spread of invasive species facilitated by the activity. Portions of this 34-acre site had been disturbed previously by grading and off-road tracked vehicle and artillery activity. The newly discovered silvery hosackia occurrences appear to be outside of the previously disturbed portions of the site and at least some appear to be in operationally inaccessible portions of the site due to topographic constraints. Depending on the specifics of the site, protection of some or all of the silvery hosackia occurrences could potentially be addressed through development of the erosion control plan (AVMC-M-3) and/or briefing of maneuver area boundaries prior to conducting operations in these areas (AVMC-M-4).Less than significant impacts for No Action due to small size and previous disturbance of site, the likely inaccessibility of some or all of the occurrences, and the small	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 G-M-9 AVMC-M-1 AVMC-M-2

Table D-10 (continued). State-Listed and CNPS-Listed Sensitive Plant Species Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
		proportion of the SCI silvery hosackia population represented on site (5.2 percent). No Action: 5 operations per year from this general area, which had been disturbed by past activities. Future disturbance under no action would be confined to the previously used portions of AFP-1. Designation of this AFP is included in Alternatives 1 and 2. Alternative 1. Artillery maneuvering during 3-day USMC artillery exercises up to 6 times per year plus 1 USMC Battalion Landing. Alternative 2. Artillery maneuvering during 3-day USMC artillery exercises up to 8 times per year plus 2 USMC Battalion Landings.	AVMC-M-3 AVMC-M-4 AVMC-M-5 AVMC-M-6 AVMC-M-7 AVMC-M-8 No Action: Impacts are less than significant. Alternative 1. Impacts would be less than significant with mitigation. Alternative 2. Impacts would be less than significant with mitigation.
TAR 1-Demolition Range Northeast Point	State Listed and Sensitive Plant Species Trask's cryptantha: 1 of 10 occurrences reported by Junak and Wilken (1998) is located outside this TAR and was estimated to contain 10,000 individuals of this annual plant species, comprising 50% of the individuals located by Junak and Wilken (1998).	This population was considered in the EA authorizing development and use of this TAR, which was originally proposed to be about 65 ac, much larger than its current 1.8 ac extent. The plants reported in 1998 and addressed in the EA are outside the boundary of this TAR. This species, an annual plant that exists as dormant seed during conditions unfavorable for growth, was not found during 2005 surveys of the TAR. No Action: 23 ops/yr. This TAR has been previously established. Alternative 1: 28 ops/yr. Alternative 2: 30 ops/yr.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 4--Whale Point/Castle Rock	State Listed and Sensitive Plant Species Guadalupe Island lupine (*Lupinus guadalupensis*): 1 of 356 occurrences on SCI (0.3% of SCI total occurrences).	A single occurrences of this annual species is documented on this site. The seedbank of this species would be expected to survive fire and the species has been observed to reappear abundantly after fire where a seedbank is present. This species would probably tolerate disturbance from foot traffic and germinate and establish in areas where there has been light disturbance to perennial shrub cover and would be expected to persist on site. Impacts are less than significant given the expected persistence of the species on site and the small	Applicable mitigation measures as identified above for TAR 1. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with

Table D-10 (continued). State-Listed and CNPS-Listed Sensitive Plant Species Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
		portions of their SCI populations represented on site. Baseline use = 212 ops/yr. This TAR has been previously established. Alternative 1: 230 ops/yr. Alternative 2: 300 ops/yr.	mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 5--West Cove Amphibious Assault Training Area	State Listed and Sensitive Plant Species SCI milkvetch (*Astragalus nevinii*): 1 of 205 occurrences on SCI (0.5% of SCI total occurrences). SCI evening primrose (suncup) (*Camissonia guadalupensis clementina*): 1 of 89 occurrences on SCI (1.1% of SCI total occurrences).	NSW activities are unlikely to affect these species due to their infrequent, low intensity nature. Species are located at the northwestern and northeastern boundaries of the TAR where frequent activity of NSW forces or amphibious vehicles are not expected. See also discussion above under NALF AVMA, which overlaps this site. Existing use is for amphibious landings and extractions and access to NALF AVMA, which overlaps West Cove. Impacts are less than significant due to out of the way location of the sensitive species and the small proportion of the SCI population represented on site. Baseline use = 10 ops/yr incl. 10 USMC Amphibious. Designation of this TAR is part of Alternatives 1 and 2. Alternative 1: 22 ops/yr (incl. 17 USMC Amphibious). Alternative 2: 52 ops/yr (incl. 44 USMC Amphibious).	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 TAR-M-1 AVMC-M-9 For amphibious landings measures listed above for NALF AVMA are also applicable. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 10—Demolition Range West	State Listed and Sensitive Plant Species Aphanisma (*Aphanisma blitoides*): 2 of 175 occurrences on SCI (1.1% of SCI total occurrences). SCI milkvetch (*Astragalus nevinii*): 15 of 205 occurrences on SCI (7.3% of SCI total occurrences). SCI evening primrose (suncup) *Camissonia guadalupensis clementina*: 1 of 89 occurrences on SCI (1.1% of SCI total occurrences). Southern island tree mallow (*Lavatera assurgentifolia* ssp. *glabra*): 1 of 32	Sensitive species occurrences are concentrated in a sandy area along the northeastern part of the access road and in relatively undisturbed habitat east and south of the previously disturbed demolitions area. At these locations, direct impacts would be primarily from foot traffic by small groups and are expected to be less than significant. Development of range facilities associated with Alternatives 1 and 2 is assumed to be in existing disturbed habitat lacking these species. Implementation of the Wildland Fire Management Plan is assumed to contain fires and prevent spread of fires at short intervals and possible type conversion of habitat. Establishment and spread of invasive species as a result of training operations could adversely affect these sensitive species within the TAR and in adjacent undisturbed habitat. These species regenerate from fire by seed and possibly by resprouting. Implementation of the Wildland Fire Management Plan is assumed to contain fires and prevent spread of fires at short intervals and possible type conversion of habitat. Impacts are less than significant due to infrequency of operations and small number of individuals involved coupled with	Applicable mitigation measures as identified above for TAR 1. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-10 (continued). State-Listed and CNPS-Listed Sensitive Plant Species Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
	occurrences on SCI (3.1% of SCI total occurrences). Guadalupe Island lupine (*Lupinus guadalupensis*): 13 of 356 occurrences on SCI (3.6% of SCI total occurrences).	demolitions in existing disturbed area. Baseline use = 3 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 25 ops/yr. Alternative 2: 40 ops/yr.	
TAR 13—Randall Radar Site Training Area	State Listed and Sensitive Plant Species SCI bedstraw (*Galium catalinense* ssp. *acrispum*): 1 of 224 occurrences on SCI (0.4% of SCI total occurrences) with 1 individual (0.04% of 2,647 total SCI individuals).	Low effects on these species would be caused by infrequent foot traffic by small groups. Some potential for spreading of invasive species into habitat associated with the foot traffic. This species is able to regenerate following fire. Baseline use = 10 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 16 ops/yr. Alternative 2: 22 ops/yr.	Applicable mitigation measures as identified above for TAR 1. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 14—VC-3 Onshore Parachute Drop Zone "Twinky"	State Listed and Sensitive Plant Species Guadalupe Island lupine *Lupinus guadalupensis*): 1 of 356 occurrences on SCI (0.3% of SCI total occurrences).	Infrequent use by small groups on foot are unlikely to adversely affect this annual species, which is also unlikely to be adversely affected by fire because fire would generally not be expected to burn through its grassland habitat until after the plant has produced its seed. Some potential for spreading of invasive species into habitat associated with the foot traffic. Baseline use = 20 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 30 ops/yr. Alternative 2: 68 ops/yr.	Applicable mitigation measures as identified above for TAR 1. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-10 (continued). State-Listed and CNPS-Listed Sensitive Plant Species Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 15—VC-3 Airfield Training Area	State Listed and Sensitive Plant Species Guadalupe Island lupine *Lupinus guadalupensis*): 8 of 356 occurrences on SCI (2.2% of SCI total occurrences).	Infrequent use by small groups on foot are unlikely to adversely affect this annual species, which is also unlikely to be adversely affected by fire because fire would generally not be expected to burn through its grassland habitat until after the plant has produced its seed. Some potential for spreading of invasive species into habitat associated with the foot traffic. Baseline use = 43 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 80 ops/yr. Alternative 2: 94 ops/yr.	Applicable mitigation measures as identified above for TAR 1. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 16—South VC-3 (Missile Impact Range)	State Listed and Sensitive Plant Species SCI brodiaea: 20 of 142 occurrences on SCI (14.1% of SCI total occurrences). About one third (21,305) of the total number of plants of this species on SCI (64,015) occur in the southern and western portions of this TAR. Guadalupe Island lupine: 3 of 356 occurrences (0.8% of SCI total occurrences).	The largest number of these plants and concentration of SCI brodiaea occurrences lie to the south of the southern boundary of the Missile Impact Range in the area proposed for expansion of the TAR. Of the SCI brodiaea plants in the TAR, approximately 19,955 plants (~31 percent of the SCI total) in 14 occurrences are located within the expanded TAR boundary on its southeastern end. The remaining occurrences are near the southern boundary of the MIR and just west of the southern portion of the MIR. Direct effects on the plants or the soils from trampling are possible during the growing season. The lupines are annuals and grow only during the late winter and spring, existing as dormant seeds the rest of the year. The brodiaea exist as dormant underground corms (bulbs) during most of the summer and fall after they set seed and do not sprout leaves until after seasonal rains start. Because of the dormancy, both species are resistant to impact much of the year. Both species are unlikely to be adversely affected by fire for the same reason. Many related species increase after fire from dormant underground corms or seed. There is some potential for spreading of invasive species into habitat associated with actions at the TAR, however this is expected to be low due to the limited number of personnel and operations involved. Although a substantial portion of the total SCI population of the brodiaea occurs within this TAR, because of the resilience of the species and its habitat, and the low impact of activities that would take place in the portion of the TAR where they are most concentrated, impacts on this species and the Guadalupe Island lupine are expected to be less than significant. Baseline use = 25 ops/yr. This TAR has been previously established but is proposed for expansion in Alternatives 1 and 2. Alternative 1: 41 ops/yr. Alternative 2: 52 ops/yr.	Applicable mitigation measures as identified above for TAR 1. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
TAR 17— Eel Point Tactical Training Range	State Listed and Sensitive Plant Species Aphanisma (*Aphanisma blitoides*): 1 of 175 occurrences on SCI (0.6% of SCI total occurrences). SCI milkvetch: 1 of 205 occurrences on SCI	Less than significant impacts expected due to the low physical disturbance outside the demolition areas and the small proportion of SCI's populations present at TAR 17. Spread of invasive species could adversely affect these occurrences. Fire is unlikely to adversely affect these annual or short-lived perennial species.	Applicable mitigation measures as identified above for TAR 1. No Action: Impacts are less than significant.

Table D-10 (continued). State-Listed and CNPS-Listed Sensitive Plant Species Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
	(0.5% of SCI total occurrences). South coast allscale (*Atriplex pacifica*): 3 of 67 SCI occurrences (4.5% of SCI total occurrences). Guadalupe Island lupine (*Lupinus guadalupensis*): 5 of 356 occurrences on SCI (1.4% of SCI total occurrences).	Baseline use = 15 ops/yr. (Designation of this TAR is part of Alternatives 1 and 2). Alternative 1: 31 ops/yr. Alternative 2: 40 ops/yr.	Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-10 (continued). State-Listed and CNPS-Listed Sensitive Plant Species Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 21—Horse Beach Cove Training Area and Horse Beach Cove Amphibious Landing and Embarkation Area	State Listed and Sensitive Plant Species Aphanisma (*Aphanisma blitoides*): 9 of 175 occurrences on SCI (5.1% of SCI total occurrences). SCI milkvetch (*Astragalus nevinii*): 8 of 205 occurrences on SCI (3.9% of SCI total occurrences). SCI evening primrose (suncup) (*Camissonia guadalupensis clementina*): 6 of 89 occurrences on SCI (6.7% of SCI total occurrences) Island green dudleya (*Dudleya virens virens*): 2 of 280 occurrences on SCI (0.71% of SCI total occurrences). Guadalupe Island lupine (*Lupinus guadalupensis*): 2 of 356 occurrences on SCI (0.6% of SCI total occurrences). Most of these occurrences are located in Horse Beach Canyon, including the associated hillslopes and canyon walls. Additional occurrences are located upstream of the TAR 21 boundary.	TAR 21: Frequent use by small groups on foot with live firing is likely to cause localized disturbance to individual plants when they are located in or near frequently used areas and routes. There is a moderate potential to introduce and spread invasive species related to the frequency of operations proposed for TAR 21. Increased fire frequency resulting from the intensification of uses is likely to lead to localized changes in vegetation in the most frequently used areas, possibly affecting sensitive species. The Wildland Fire Management Plan does not provide for ground based fire suppression within SHOBA. All of these species are able to survive or regenerate after fire. Most of the sensitive species occurrences in the TAR are located east of the landing beach or north of it where they would be exposed to effects from individuals on foot and live-fire but not vehicular traffic. With the exception of Island green dudleya (a succulent perennial) these species are annual or perennial herbs and would be sensitive to foot traffic only when actively growing, existing during the dry months as seed or as seed and dormant stems or roots. Impacts are less than significant because most if not all of the occurrences on the TAR would be expected to persist given the nature of the training activities and the resilience of the plants and because of the relatively small proportion of their numbers located within the TAR. Horse Beach Cove Amphibious Landing and Embarkation Area: None of the sensitive species is known from the area between the beach and the coast road that would be used during amphibious landings and embarkations, therefore none of these species is expected to be directly affected by amphibious operations. Impacts are less than significant. Baseline use = 79 ops/yr. (This TAR is located in SHOBA where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.) Alternative 1: 91 ops/yr. including 81 NSW, 10 USMC Amphibious and 1 USMC Battalion Landing. Alternative 2: 102 ops/yr. including 90 NSW, 10 USMC Amphibious and 2 USMC Battalion Landing.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-3* G-M-4 G-M-5 G-M-6* G-M-7 G-M-9 AVMC-M-1 AVMC-M-2* AVMC-M-3* AVMC-M-4 AVMC-M-5 AVMC-M-7 AVMC-M-10 *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-10 (continued). State-Listed and CNPS-Listed Sensitive Plant Species Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
TAR 22—China Cove Training Area	State Listed and Sensitive Plant Species SCI bedstraw (*Galium catalinense* ssp. *acrispum*): 1 of 224 occurrences on SCI (0.4% of SCI total occurrences) with 2 individuals (0.08% of 2,647 SCI total individuals). SCI evening primrose (suncup) (*Camissonia guadalupensis clementina*): 5 of 89 occurrences on SCI (5.6% of SCI total occurrences). Island green dudleya (*Dudleya virens* ssp. *virens*):: 1 of 324 occurrences on SCI (0.3% of SCI total occurrences). SCI buckwheat (*Eriogonum giganteum var. formosum*): 3 of 270 occurrences on SCI (1.1% of SCI total occurrences). SCI hazardia (*Hazardia cana*): 1 of 153 occurrences on SCI (0.6% of SCI total occurrences). Guadalupe Island lupine (*Lupinus guadalupensis*): 7 of 356 occurrences on SCI (2.0% of SCI total occurrences). SCI tritelia: 1 of 88 occurrences on SCI (1.1% of SCI total occurrences).	Existing patterns of disturbance from ordnance impacts and fire would be expected to continue and the sensitive plant populations would be expected to persist, given their presence despite a long history of similar use. Use of TAR 22 by NSW as proposed would have less than significant impacts on these species based on the historic and ongoing pattern of disturbance in this area and the low proportions of their Island occurrences in TAR 22. Baseline use = 96 ops/yr including 33 NSW ops/yr. and 63 Non-NSW Naval ops/yr. (This TAR is located in SHOBA where ongoing live-fire and bombardment are included in the No Action Alternative. Designation of this TAR is part of Alternatives 1 and 2.) Alternative 1: 200 ops/yr. including 33 NSW, 6 USMC Amphibious, 1 USMC Battalion Landing and 160 other naval operations. Alternative 2: 220 ops/yr. including 40 NSW, 16 USMC Amphibious, 2 USMC Battalion Landing and 162 other naval operations.	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1* G-M-3* G-M-4 G-M-5 G-M-6* G-M-7 G-M-9 *CRNSW policy prohibiting access for natural resource surveys or management means that some applicable mitigation measures (e.g., G-M-1, G-M-3, G-M-6) would be conducted around the periphery of impact areas but not within them. No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.
Infantry Operations Area	State Listed and Sensitive Plant Species SCI bedstraw (*Galium catalinense* ssp. *acrispum*): 3 of 224 occurrences on SCI (1.3% of SCI total occurrences) with 5 individuals (0.2% of 2,647 SCI total individuals). SCI silvery hosackia (*Lotus argophyllus* subsp. *adsurgens*): 92 of 207 occurrences on SCI (44% of SCI total occurrences) with 1,662 individuals (30.2% of 5,505 SCI total	During the dry season on SCI when many of the sensitive species are dormant, direct effects of foot travel would be minimal and dispersed. Direct effects of trampling are possible, especially when soils are wet and seasonal plants such as geophytes and annuals are actively growing. Geophytes, such as Thorne's royal larkspur, SCI brodiaea, and SCI tritelia, go dormant after producing seed and survive unfavorable periods as underground bulbs, corms, rhizomes, or similar underground structures. Annuals, such as Guadalupe Island lupine, complete their life cycles from seed to seed within a few months and exist as seed during the dry season. Generally, the majority of the affected plants would be expected to survive the foot traffic even during the growing season and would complete their life cycle. During the dry months there would be little effect of foot traffic on seasonal species. Because	Implementation of the SCI Wildland Fire Management Plan is part of the No Action Alternative, Alternative 1 and Alternative 2. G-M-1 G-M-3 G-M-4 G-M-8 AVMC-M-1 AVMC-M-2

Table D-10 (continued). State-Listed and CNPS-Listed Sensitive Plant Species Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
	individuals). Aphanisma (*Aphanisma blitoides*): 2 of 175 occurrences on SCI (1.1% of SCI total occurrences). SCI milkvetch (*Astragalus nevinii*): 98 of 205 occurrences on SCI (47.8% of SCI total occurrences). South coast allscale (Atriplex pacifica): 2 of 67 SCI occurrences (3.0 % of SCI total occurrences). SCI brodiaea: 59 of 142 occurrences on SCI (41.6% of SCI total occurrences). San Clemente SCI evening primrose (suncup) (*Camissonia guadalupensis clementina*): 3 of 89 occurrences on SCI (3.4% of SCI total occurrences). Island apple-blossom (*Crossosoma californicum*): 6 of 60 occurrences on SCI (10.0% of SCI total occurrences). Thorne's royal larkspur (*Delphinium variegatum subsp. thornei*): 40 of 78 occurrences on SCI (51.3% of SCI total occurrences). Island green dudleya (*Dudleya virens* ssp. *virens*): 27 of 324 occurrences on SCI (8.3% of SCI total occurrences). SCI buckwheat (*Eriogonum giganteum var. formosum*): 75 of 270 occurrences on SCI (27.8% of SCI total occurrences). SCI hazardia (*Hazardia cana*): 28 of 153 occurrences on SCI (18.3% of SCI total occurrences). Southern island tree mallow (*Lavatera assurgentifolia* ssp. *glabra*): 19 of 32 occurrences on SCI (59.4% of SCI total occurrences). Guadalupe Island lupine Guadalupe Island lupine (*Lupinus guadalupensis*): 197 of 356 occurrences on SCI (55.3% of SCI total occurrences).	infantry would be spread across the landscape with approximately 5 m spacing between individual Marines, impacts on any individual population would be very dispersed. Shrubs and trees would be minimally affected by foot traffic. There is a potential for foot traffic to introduce or spread invasive plant species. Because the Marines would be spread over a large area when advancing, the large size and remoteness of parts of the Infantry Operations Area will make beginning infestations of invasive species difficult to detect when they are localized and most treatable. The outcome of an invasive plant species introduction is not always predictable, however it is very well documented, especially on islands, that plant invasions can result in dramatic ecological changes affecting the survival of plant and wildlife species. As described above, introduction or spread of invasive plant species as a result of use of the IOA by large numbers of personnel associated with the Battalion Landing is a reasonably foreseeable indirect impact with the potential for serious adverse consequences on sensitive plant species. Baseline use = 0 ops/yr, Battalion-sized landings have occurred on SCI in the past, but not during the baseline year. Foot traffic by individuals and groups is permitted within the IOA and elsewhere on the Island under the No Action Alternative. Alternative 1: 1 USMC Battalion-sized landing per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road. Alternative 2: 2 USMC Battalion-sized landings per year with troops on foot using the IOA and mechanized vehicles using the AVMC or Ridge Road.:	AVMC-M-4 AVMC-M-7 No Action: Impacts are less than significant. Alternative 1: Impacts would be less than significant with mitigation. Alternative 2: Impacts would be less than significant with mitigation.

Table D-10 (continued). State-Listed and CNPS-Listed Sensitive Plant Species Within Individual Operations Areas on SCI.

Operations Area	Amount of Resource[1]	Description of Impacts	Applicable Mitigation Measures and Impact Significance[2,3]
	Santa Cruz ironwood: 4 of 153 occurrences on SCI (2.6% of SCI total occurrences). Blair's stephanomeria: 20 of 296 occurrences on SCI (6.8% of SCI total occurrences).		

Note:

1. Sensitive plant occurrence and abundance is based on information in the SCI GIS developed from information in Junak and Wilken (1998), the SCI INRMP (DoN 2002), Junak (2006), and Tierra Data, Inc (2007). The data reported by Junak also includes occurrences documented by the Soil Ecology and Restoration Group (SERG), who operate the on-island nursery and conduct restoration projects on behalf of the Navy. The surveys by Junak and Wilken (1998), Junak (2006) were botanically driven and not focused on operations areas and covered large portions of the Island including TARs. The Tierra Data Inc surveys were conducted in 2005-2007 and were focused on operations areas including the AVMAs, AMPs, AFPs, and IOA. Three CNPS List 1B species [*Eriophyllum* (=*Constancea*) *nevinii*, *Galvezia speciosa*, and *Linanthus* (=*Leptosiphon*) *pygmaeus* ssp. *pygmaeus)*] were found to be so widespread and abundant that they were not included in the island-wide datasets of Junak and Wilken (1998) and Junak (2006) . Table 3.11-8 provides additional information about distribution, status, and population size as well as scientific and common names for these species. These species are listed alphabetically by genus, starting with the two state-listed endangered species *Galium* and *Lotus*. Under "amount of resource" resources (e.g., occurrences) occurring in overlapping operations areas are reported for each of the overlapping areas, enabling the effects of the differing operations in the overlapping areas to be assessed.
2. Impact significance conclusion is based on discussion in "Description of Impacts" column and is assessed assuming application of mitigation measures identified in this document.
3. Impact significance assessment assumes mitigation for Alternatives I and 2.

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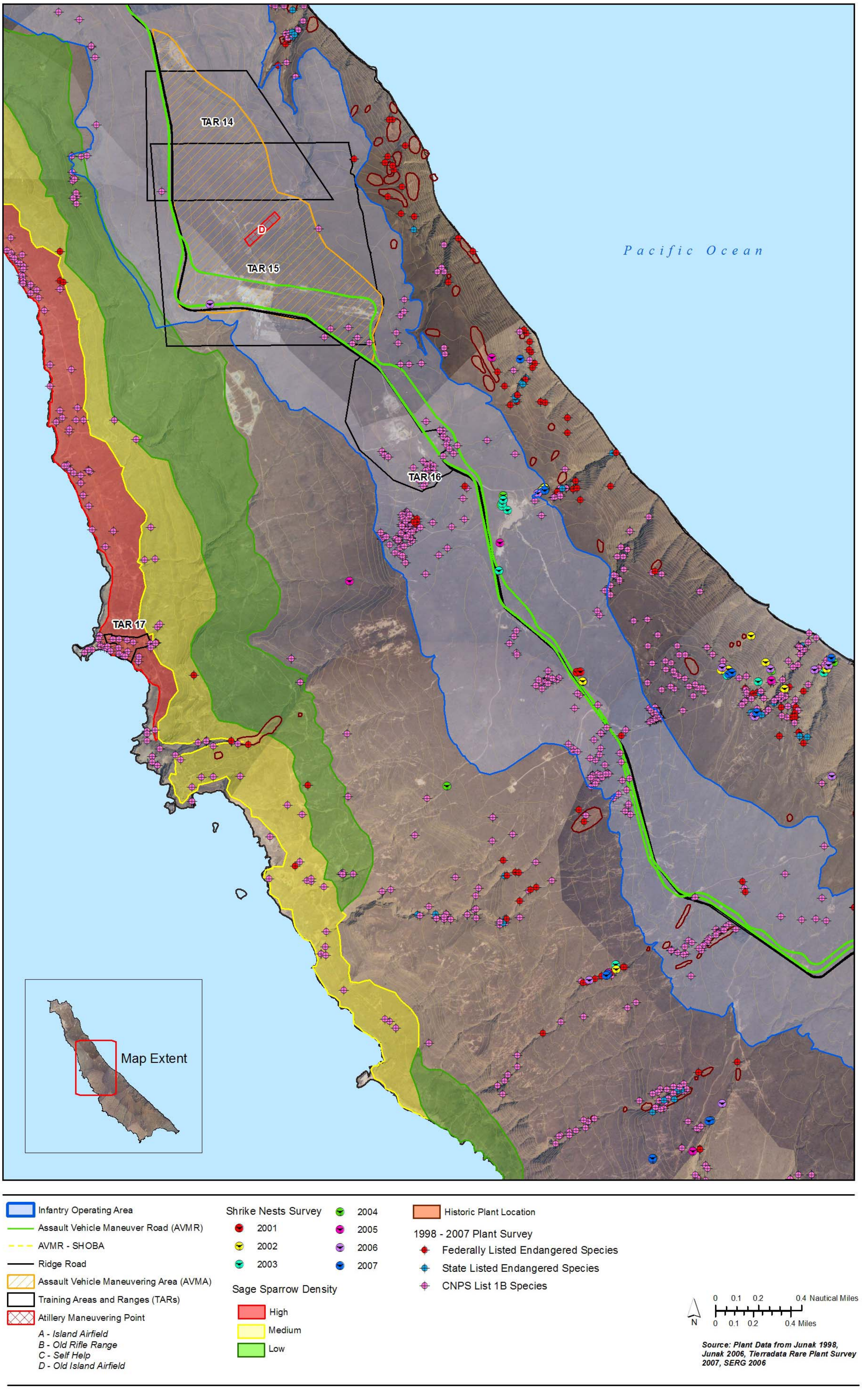

Figure D-1. Listed and California Native Plant Society Species Located in Middle San Clemente Island

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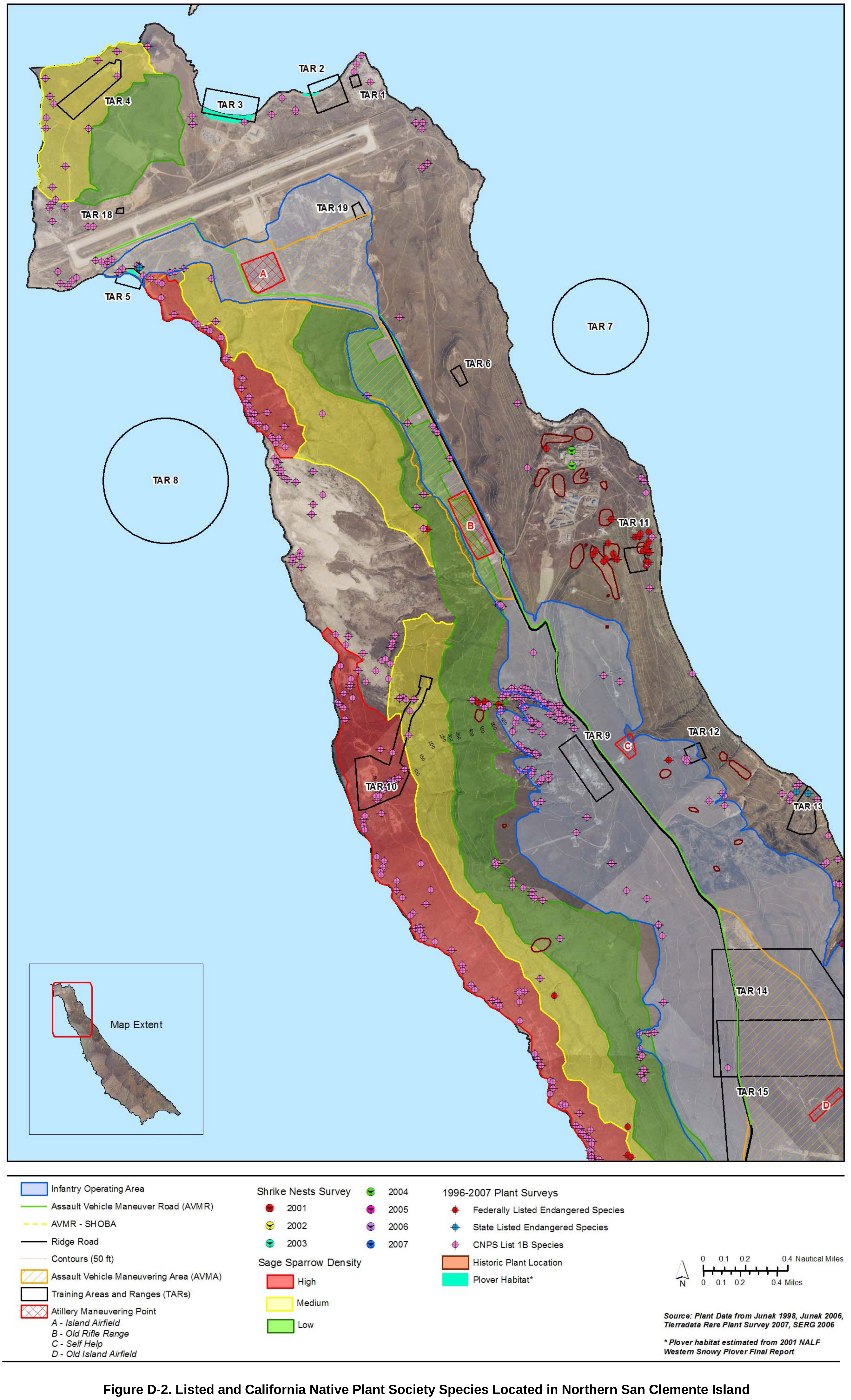

Figure D-2. Listed and California Native Plant Society Species Located in Northern San Clemente Island

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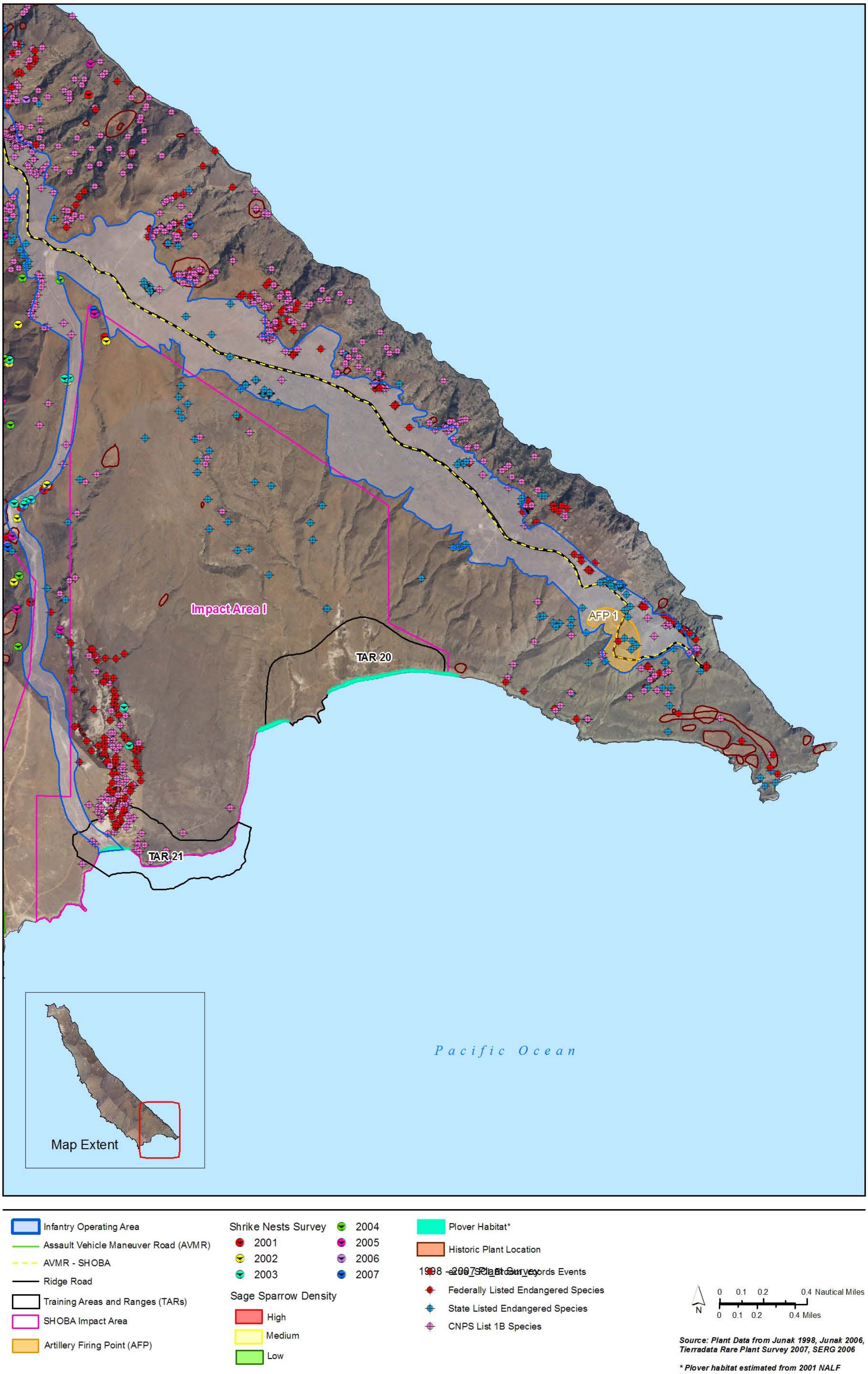

Figure D-3. Listed and California Native Plant Society Species Located in Southeastern San Clemente Island

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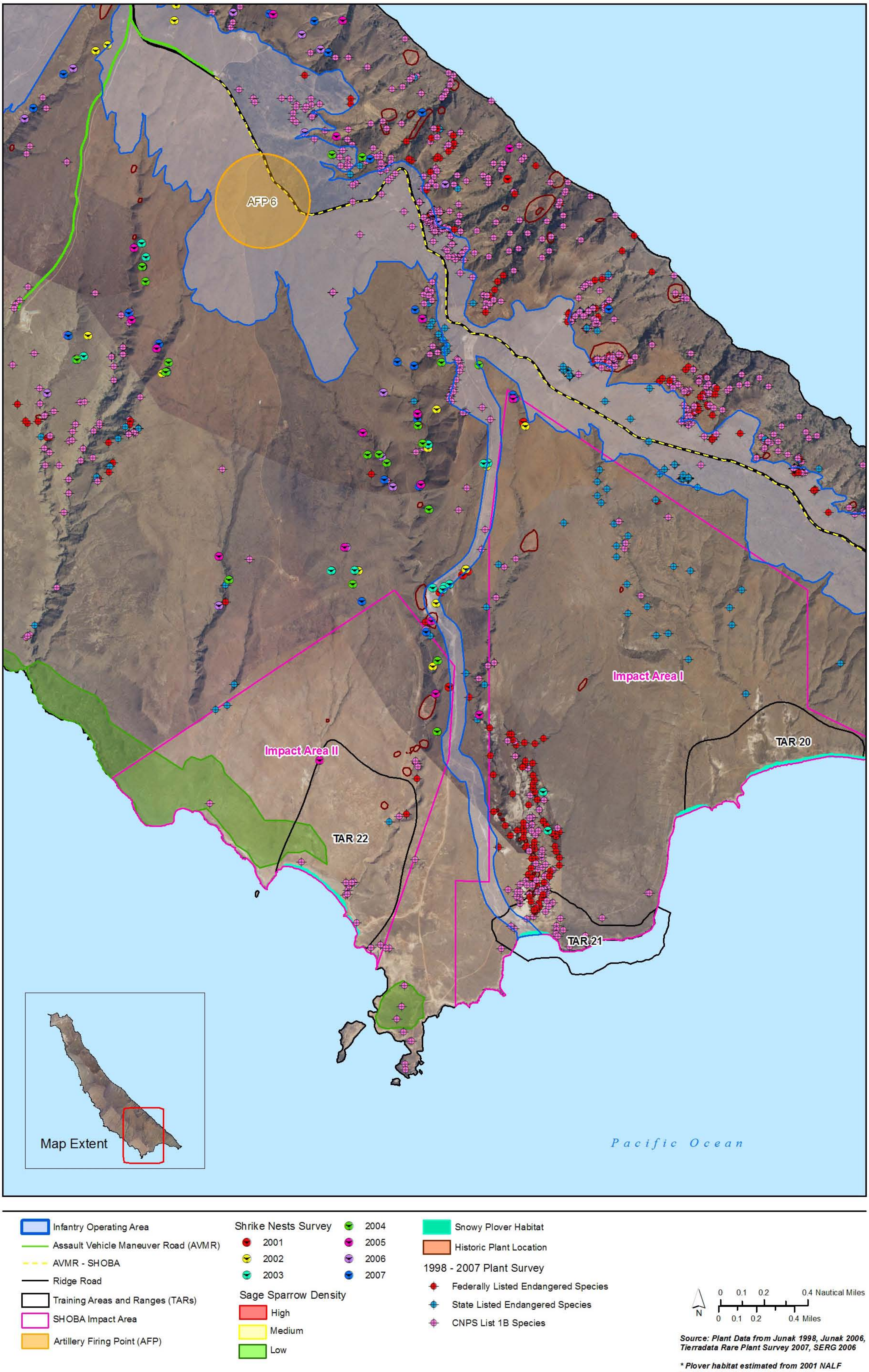

Figure D-4. Listed and California Native Plant Society Species Located in Southern San Clemente Island

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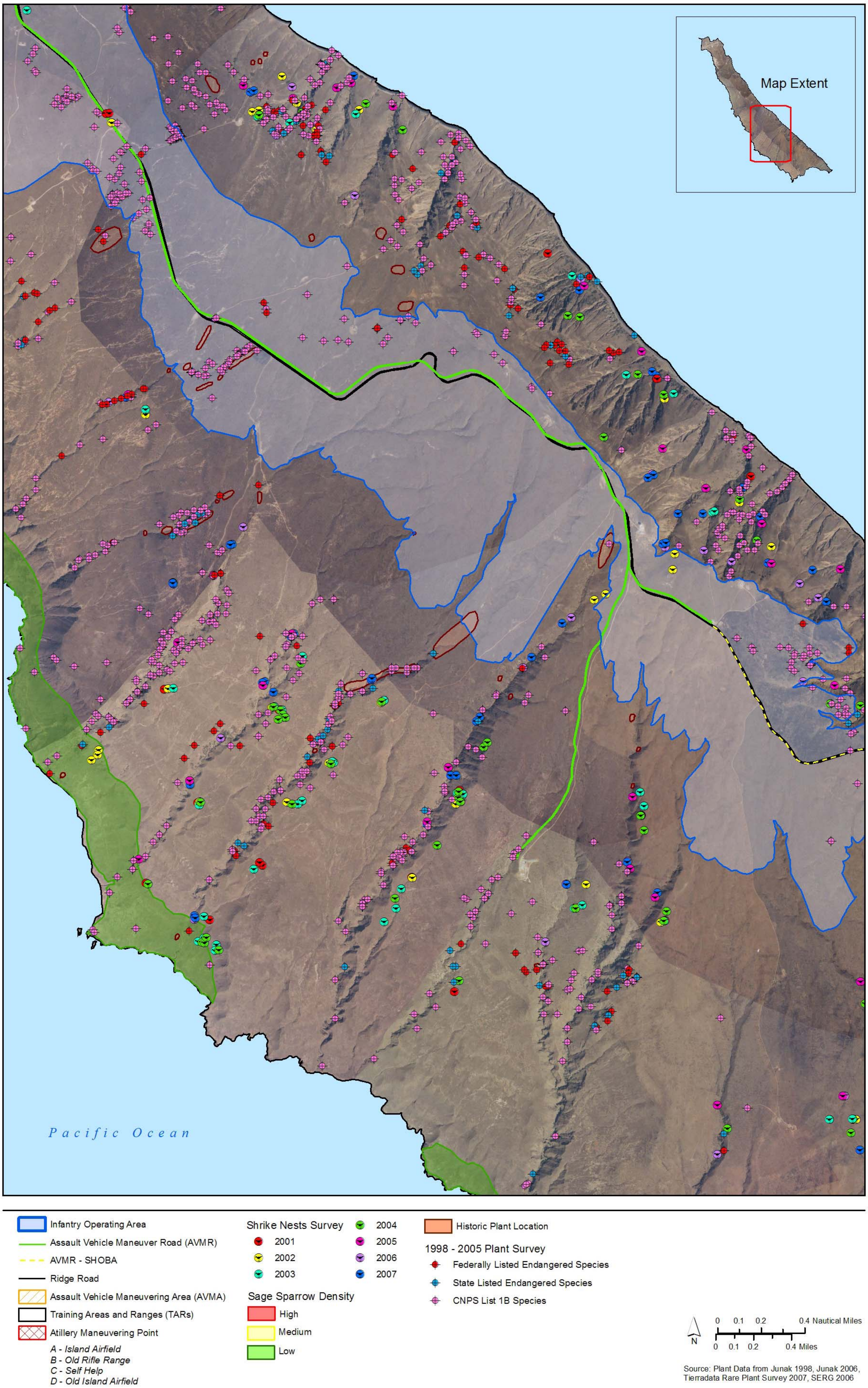

Figure D-5. Listed and California Native Plant Society Species Located in Southwestern San Clemente Island

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Appendix E

FINAL

ESSENTIAL FISH HABITAT ASSESSMENT

Prepared for:
Department of the Navy
Commander, U.S. Pacific Fleet

DECEMBER 2008

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EXECUTIVE SUMMARY

This assessment of the impact of United States Navy training in the Southern California (SOCAL) Range Complex on Essential Fish Habitat (EFH) covers regulatory issues, Fishery Management Plans and Managed Species, the project area, proposed actions, impacts, and mitigation measures. The SOCAL Range Complex encompasses 120,000 square nautical miles (nm^2) of ocean between Dana Point and San Diego, California, and extends more than 600 miles (mi) southwest into the Pacific Ocean. It includes land areas, water areas, and airspace used to conduct operations, training, research, development, testing, and evaluation of military hardware, personnel, tactics, munitions, explosives, and electronic combat systems.

The Magnuson-Stevens Fisheries Conservation and Management Act (16 United States Code [U.S.C.] § 1801 *et seq.*), mandates identification and protection of EFH. A second habitat type is also protected: Habitat Areas of Particular Concern (HAPC). These subsets of EFH are rare, sensitive, ecologically important, or located in an area that is already stressed. Federal agencies are required to consult with the NOAA Fisheries Service and to prepare an EFH Assessment describing potential adverse affects of their activities on EFH.

The SOCAL Range Complex contains EFH for 109 species covered under Fishery Management Plans. These 109 Managed Species include 83 species of groundfish that live on or near the bottom (e.g., rockfish and flatfish), six pelagic species that live in the water column (e.g., anchovies, mackerel, and squid), and 13 highly migratory species including tuna, billfish, and sharks. Three federal Fisheries Management Plans, for Groundfish, Coastal Pelagic Species, and Highly Migratory Species, include areas within the SOCAL Range Complex.

All marine waters in the SOCAL Range Complex offshore to depths of 3,500 meters (m) (1,914 fathoms (fm)) are designated as EFH for Groundfish Managed Species (seamounts out to 200 nautical miles (nm) offshore are also included). EFH for Coastal Pelagic Species includes all marine and estuarine waters above the thermocline from the shoreline to 200 nm offshore. Highly Migratory Species EFH includes all marine waters from the shoreline to 200 nm offshore. Estuaries, sea grass beds, canopy kelp, rocky reefs, and other "areas of interest" (e.g., seamounts, offshore banks, canyons) are designated Groundfish HAPCs. No HAPCs have been adopted for Coastal Pelagic or Highly Migratory Species in the SOCAL Range Complex.

Navy operations in the SOCAL Range Complex involve a wide variety of activities including: tactical reconnaissance and surveillance; attacking surface and subsurface targets; intercepting and engaging aircraft and missiles; suppressing air defenses; conducting electronic attack; interdicting enemy forces and targets; conducting fire support; mine and mine countermeasures exercises; performing search and rescue; and, research, development, testing and evaluation. These exercises utilize fixed-winged aircraft, helicopters, unmanned aerial vehicles, boats and ships, submarines, unmanned surface and underwater vehicles, divers, and amphibious vehicles. Radar, sonar, and lasers are used in the course of these training activities.

The following factors were considered in the analysis of potential impacts: the duration, frequency, intensity, and spatial extent of the impact; the sensitivity/vulnerability of the habitat; habitat functions that might be altered by the impact; and the timing of the impact relative to when Managed Species may use or need the habitat. Adverse effects are considered to be more than minimal, not temporary, causing significant change in ecological function, and not allowing the environment to recover without measurable impact.

Impacts to EFH and Managed Species could be associated with vessel movement, aircraft over-flight, expended materials, hazardous chemicals, detonation of explosive ordnance, weapons training, sensor testing, and sonar use. Navy operations could have direct and indirect impacts on individual species, modify their habitat, or alter water quality. The EFH assessment focuses on activities and impacts common to most offshore operations, but also discusses specific types of operations such as Expeditionary Assault, TORPEX, and SINKEX that may have the unique aspects relevant to the EFH Assessment.

Vessel movement and aircraft over-flights would cause brief, reversible disruptions in fish distribution. Fuel spills are unlikely, with any occurrence mitigated through standard spill control responses and wildlife rescue procedures. Discharge from ships would comply with international conventions and have minimal impact.

Potential impacts from expended material (e.g., flares, chaff, dye, torpedo accessories, sunken targets and vessels) could result from exposure to toxic chemicals, through contact with or ingestion of debris, and from entanglement. The small quantity of material expended, the rapid dilution of dissolved constituents, the relatively non-toxic nature of the debris, and its eventual encrustation and incorporation into the sediments would minimize adverse affects on resident marine communities. Bioaccumulation of toxic metals and organic compounds to higher-order food chain species is not expected. Expended material would not significantly disturb the sea floor or compromise habitat components that support feeding, resting, sheltering, reproduction, or migration of Managed Species.

Underwater detonations and weapons training could disrupt habitats, release hazardous chemical by-products, kill or injure marine life, affect hearing organs, modify behavior, mask biologically-relevant sounds, induce stress, and have indirect effects on prey species and other components of the food web. Underwater detonation will not take place within 1,000 m (3,281 ft) of live, hard-bottom habitats, artificial reefs, or shipwrecks. Initial concentrations of explosion by-products are not hazardous to marine life and would not accumulate because training exercises are widely dispersed over time and space. A small number of fish would be killed by shockwaves from explosions or would be injured and could subsequently die or suffer greater rates of predation. Beyond the range of direct, lethal or sub-lethal impacts to fish, minor, short-term behavioral reactions would not be ecologically significant or substantially impact their ability to survive, grow, and reproduce. No lasting adverse effect of underwater detonations or weapons training on prey availability or on the food web is expected.

Most bombs and missiles used in SOCAL Range Complex exercises would not have explosive warheads. The shock force from dummy bombs and missiles hitting the sea surface could result in a limited number of fish kills or injuries, and minor acoustic displacement, but would not substantially affect local species or habitats. Although few fish would be directly struck by naval gun fire, explosive 5-inch gunnery rounds could kill or injure a small proportion of the nearby assemblage. Behavioral reactions of fish would extend over a larger area. However, adverse regional consequences are not anticipated.

Training torpedoes used in the SOCAL EIS/OEIS Range Complex would not have exploding warheads. The physical force marine organisms would be exposed to would be limited to torpedo launch and movement. Due to the small size of torpedo transit areas, the probability of fish strikes would be low. Similar, minimal effects would be expected from training exercises employing Expendable Mobile Acoustic Torpedo Targets and Acoustic Device Countermeasures.

Some fish species may be able to detect mid-frequency sonar at the lower end of its range. Short-term behavioral responses such as startle and avoidance may occur, but are not likely to adversely affect indigenous fish communities. Auditory damage from sonar signals is not expected and there is no indication that non-impulsive acoustic sources result in significant fish mortality at the population level.

This assessment concludes that adverse effects on EFH and Managed Species could result from the activities associated with the Proposed Action. Based on the limited extent, duration, and magnitude of potential impacts from SOCAL Range Complex training and testing, the adverse effects would be minimal and temporary. Further, mitigation measures for the action would adequately avoid, minimize, mitigate, or otherwise offset the adverse impacts to EFH and Managed Species. Range operations would not significantly contribute to cumulative impacts on present or future uses of the area.

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Acronyms and Abbreviations

A-A	Air-to-Air
AAMEX	Air-to-Air Missile Exercise
AASBn	Assault Amphibian School Battalion
AAV	Amphibious Assault Vehicle
AAW	Anti-Air Warfare
ACM	Air Combat Maneuvering
ADC	Acoustic Device Countermeasures
ADEX	Air Defense Exercise
ALMDS	Airborne Laser Mine Detection System
AMCM	Airborne Mine Countermeasures
AMNS	Airborne Mine Neutralization System
AMW	Amphibious Warfare
AS	At-Sea
ASROC	Rocket-Assisted Anti-Submarine Torpedo
ASUW	Anti-Surface Warfare
ASW	Anti-Submarine Warfare
ATC	Air Traffic Control
BA	Biological Assessment
BFM	Basic Fighter Maneuvers
BO	Biological Opinion
°C	Degrees Celsius
C3F	Commander, Third Fleet
CAS	Commercial Air Services
CCC	Command Control and Communications
CEQ	Council on Environmental Quality
CFFC	Commander, United States Navy Fleet
CFR	Code of Federal Regulations
CIWS	Close-In Weapon System
CJTFEX	Combined Joint Task Force Exercise
cm	Centimeter
CMLMA	California Marine Life Management Act
CNO	Chief of Naval Operations
COMPACFLT	Commander, Pacific Fleet
COMPTUEX	Composite Training Unit Exercise
CPAAA	Camp Pendleton Amphibious Assault Area
CPAVA	Camp Pendleton Amphibious Vehicle
CPF	Commander, Pacific Fleet
CPS	Coastal Pelagic Species
CRRC	Combat Rubber Raiding Craft
CSAR	Combat Search and Rescue
CSG	Carrier Strike Group
DoD	Department of Defense
DON	Department of the Navy
DoN	Department of the Navy
e.g.	For Example
EA	Environmental Assessment
EC	Electronic Combat
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EHF	Extremely High-frequency
EIS	Environmental Impact Statement
EMW	Expeditionary Maneuver Warfare
ENETA	Encinitas Naval Electronic Test Area
EO	Executive Order
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESG	Expeditionary Strike Group
ESGEX	Expeditionary Strike Group Exercise
EW	Electronic Warfare
EX	Exercise
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
FL	Flight Level
FLEETEX	Fleet Exercise
FLETA	Fleet Training Area
fm	Fathom
FMC	Fisheries Management Council
FMP	Fishery Management Plan
FPT	Fleet Project Team
FRP	Fleet Response Plan
FRTP	Fleet Response Training Plan
ft	Foot/Feet
FTS	Fleet Training Strategy
GHz	Gigahertz
GPS	Global Positioning System
GUNEX	Gun Exercise
HAPC	Habitat Areas of Particular Concern
HCOTA	Helicopter Offshore Training Area
HF	High-frequency
HMS	Highly Migratory Species
Hz	Hertz
IEER	Improved Extended Echo Ranging
Sonobuoy	
I MEF	First Marine Expeditionary Force
i.e.	That Is
IPHC	International Pacific Halibut Commission
IOC	Initial Operational Capability
IR	Infra Red
ISE	Independent Steaming Exercise
ISR	Intelligence, Surveillance and Reconnaissance
JFCOM	Joint Forces Command
JNTC	Joint National Training Capability
JSF	Joint Strike Fighter
JTFEX	Joint Task Force Exercise
KB(X)	Kernel Blitz Experimental
kg	Kilogram
KHz	Kilohertz
km	Kilometer
km^2	Square Kilometers
kt	Knot
lb	Pound
LCAC	Landing Craft Air Cushion
LCS	Littoral Combat Ship
LMRS	Long-Term Mine Reconnaissance System
m	Meter
m^2	Square Meter
MARFORPAC	Marine Forces Pacific
MCM	Mine Countermeasures
MCT	Marine Corps Training
MCTL	Marine Corps Task List
MEU	Marine Expeditionary Unit
mi	Mile
min	Minute
MINEX	Mine Warfare Exercise
MISR	Missile Range
MISSILEX	Missile Exercise
MIW	Mine Warfare

mm	Millimeter
MMPA	Marine Mammal Protection Act
MOA	Military Operating Area
Mph	Mile Per Hour
MPRSA	Marine Protection Research & Sanctuaries Act
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
msl	Mean Sea Level
N	North
N.E.W.	Net Explosive Weight
NAOPA	Northern Air Operating Area
NAS	Naval Air Station
NBC	Naval Base Coronado
NEPA	National Environmental Policy Act
nm	Nautical Mile
nm	Nautical Miles
nm^2	Square Nautical Miles
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic & Atmospheric Administration
NSFS	Naval Surface Fire Support
NSW	Naval Special Warfare
NTTL	Navy Tactical Task List
OAMCM	Organic Airborne Mine Countermeasures
OCS	Outer Continental Shelf
OEA	Overseas Environmental Assessment
OEIS	Overseas Environmental Impact Statement
^{o}F	Degrees Fahrenheit
OMCM	Organic Mine Countermeasures
OPAREA	Operating Area
OPFOR	Opposition Force
Ops	Operations
PFMC	Pacific Fisheries Management Council
PACFIRE	Pre-Action Calibration Firing Planning
PTS	Permanent Threshold Shift
R&D	Research and Development
RAMICS	Rapid Airborne Mine Clearance System
RCMP	Range Complex Management Plan
RDT&E	Research, Development, Test and Evaluation
RF	Radio Frequency
RHIB	Rigid Hull Inflatable Boat
RTE	Routine Training Exercise
RTS	Remote Training Site
S-A	Surface-to-Air
SBTA	San Diego Bay Training Area
SCB	Southern California Bight
SCI	San Clemente Island
SFA	Sustainable Fisheries Act
SHOBA	Shore Bombardment Area
SINKEX	Sinking Exercise
SMCM	Surface Mine Countermeasures
SMZ	Special Management Zone
SOA	Sustained Operations Ashore
SOCAL	Southern California
SPCOA	San Pedro Channel Operating Area
S-S	Surface-to-Surface
STW	Strike Warfare
SUA	Special Use Airspace
SUW	Surface Warfare
T&E	Testing & Evaluation
TAP	Tactical Training Theater Assessment and Planning
TLAM	Tomahawk Land Attack Missile
TNT	Trinitrotoluene
TORPEX	Torpedo Exercise
TRACKEX	Tracking Exercise
TTS	Temporary Threshold Shift
UNDET	Underwater Detonation
U.S.	United States of America
U.S.C.	U.S. Code
UHF	Ultra High-frequency
UNDET	Underwater Detonation
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USS	United States Ship
USW	Undersea Warfare
UUV	Unmanned undersea vehicle
VAST/IMPASS	Virtual At-Sea Training/Integrated
VHF	Very High-frequency
W	West
WSCOA	Western San Clemente Island

1 INTRODUCTION

This assessment of the impact of United States (U.S.) Navy activities in the Southern California (SOCAL) Range Complex on "Essential Fish Habitat" (EFH) covers the regulatory background, project area, environmental setting, Fishery Management Plans and Managed Species, designated EFH in the SOCAL Range Complex, proposed actions, project impacts, mitigation measures, and cumulative impacts. The Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) to which this EFH Assessment is appended details Navy operations in the SOCAL Range Complex, describes the existing environment for marine biology and fish, and discusses potential environmental effects associated with ongoing and proposed naval activities. The Marine Resources Assessment prepared for the Southern California Operating Area (DON 2005a) also contains comprehensive descriptions of the ocean environment including: climate; marine geology; physical, chemical, and biological oceanography; marine biology; marine habitats; and protected species in the project area.

This assessment uses the term "fish" to include both cartilaginous species - sharks, skates, and rays - and bony species. Cartilaginous fish, as the name implies, have a skeleton of cartilage, which is partially calcified, but is not true bone. Bony fish also have cartilage, but their skeletons consist of calcified bone.

1.1 REGULATORY SETTING

1.1.1 The Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) of 1976 (16 United States Code [U.S.C.] § 1801 *et seq.*) established jurisdiction over marine fishery resources in the 200-nautical mile (nm) (370-kilometer (km)) U.S. Exclusive Economic Zone (EEZ). The MSFCMA was reauthorized and amended by the Sustainable Fisheries Act (SFA) of 1996 (Public Law 104-297) which provided a new habitat conservation tool: the Essential Fish Habitat mandate. The SFA requires that regional Fishery Management Councils (FMCs) prepare Fishery Management Plans (FMPs) identifying EFH for federally "Managed Species". Managed Species are species covered under FMPs.

Congress defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. § 1802(10)). The term "fish" is defined in the SFA as "finfish, mollusks, crustaceans, and all other forms of marine animals and plant life other than marine mammals and birds". The National Marine Fisheries Service (NMFS) in 2002 further clarified EFH with the following definitions (50 Code of Federal Regulations [C.F.R.] §§ 600.05–600.930):

- "Waters" include all aquatic areas and their associated biological, chemical, and physical properties that are used by fish and may include aquatic areas historically used by fish where appropriate.
- "Substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities.
- "Necessary" means the habitat required to support a sustainable fishery and the Managed Species' contribution to a healthy ecosystem; and "Spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle" (NMFS 2002a).

The SFA requires that EFH be identified and mapped for each federally Managed Species (NMFS 2007a). The NMFS and regional FMCs determine the species distributions by life stage and characterize associated habitats, including Habitat Areas of Particular Concern (HAPC). HAPCs are discrete areas within EFH that either play especially important ecological roles in the life cycles of Managed Species or are especially vulnerable to degradation from human-induced activities (50 CFR 600.815[a][8]). The SFA requires federal agencies to consult with the NMFS on activities that may adversely affect EFH. For actions that affect a threatened or endangered species, or its critical habitat, and its EFH, federal agencies must integrate Endangered Species Act (ESA) and EFH consultations.

An Essential Fish Habitat Assessment is a critical review of the proposed project and its potential impacts to EFH (NMFS 2004a,b). As set forth in the rules (50 C.F.R. § 600.920(e)(3)), EFH Assessments must include: (1) a description of the proposed action; (2) an analysis of the effects, including cumulative effects, of the action on EFH, and Managed Species; (3) the federal agency's views regarding the effects of the action on EFH; and (4) proposed mitigation, if applicable. Once the NMFS learns of a federal or state activity that may have adverse effects on designated EFH, the NMFS is required to develop EFH consultation recommendations for the activity. These recommendations may include measures to avoid, minimize, mitigate, or otherwise offset adverse effects on EFH (NMFS 2002a).

1.2 PROJECT AREA

1.2.1 SOCAL Range Complex

The SOCAL Range Complex consists of three primary components: ocean operating areas, special use airspace, and San Clemente Island. The SOCAL Range Complex is geographically situated between Dana Point and San Diego, and extends more than 600 nm southwest into the Pacific Ocean (Figures 1-1 and 1-2). The SOCAL Range Complex encompass 120,000 nm^2 of sea space, 113,000 nm^2 of special use airspace (SUA), and over 42 nm^2 of land area (San Clemente Island). The ocean areas of the SOCAL Range Complex include surface and subsurface operating areas extending generally southwest from the coastline of southern California between Dana Point and San Diego for a distance of approximately 600 nm into international waters west of the coast of Baja California, Mexico. The SOCAL Range Complex includes military airspace designated as Warning Area 291, or W-291. W-291 comprises 113,057 nm^2 of SUA that generally overlays the SOCAL ocean operating areas (OPAREAS) and San Clemente Island, extending seaward to the southwest beginning approximately 12 nm off the coast for a distance of approximately 600 nm. W-291 is the largest component of SUA in the Navy range inventory. San Clemente Island includes a Shore Bombardment Area (SHOBA), landing beaches, several live-fire areas and ranges for small arms, maneuvers, and other types of training.

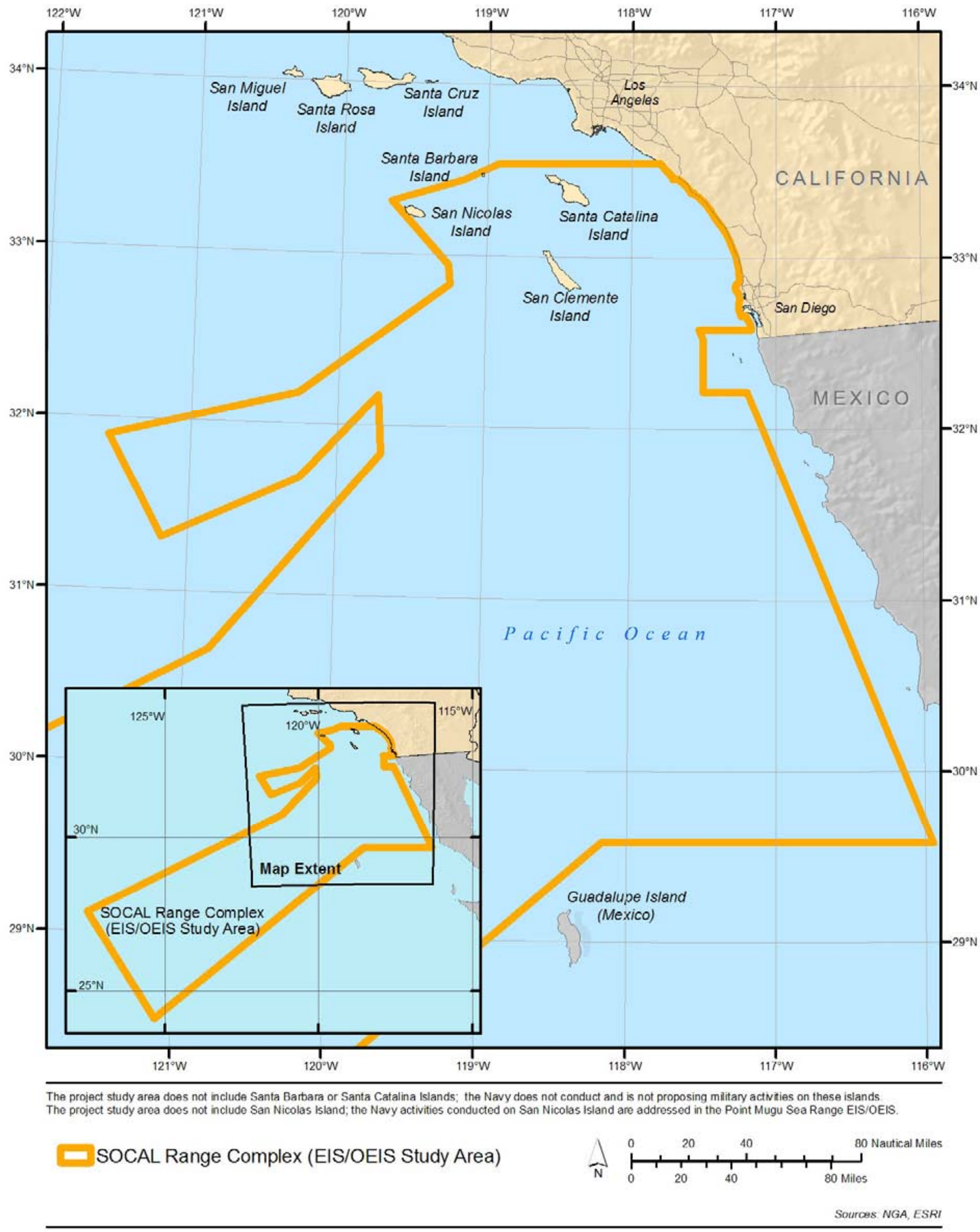

Figure 1-1: SOCAL Range Complex

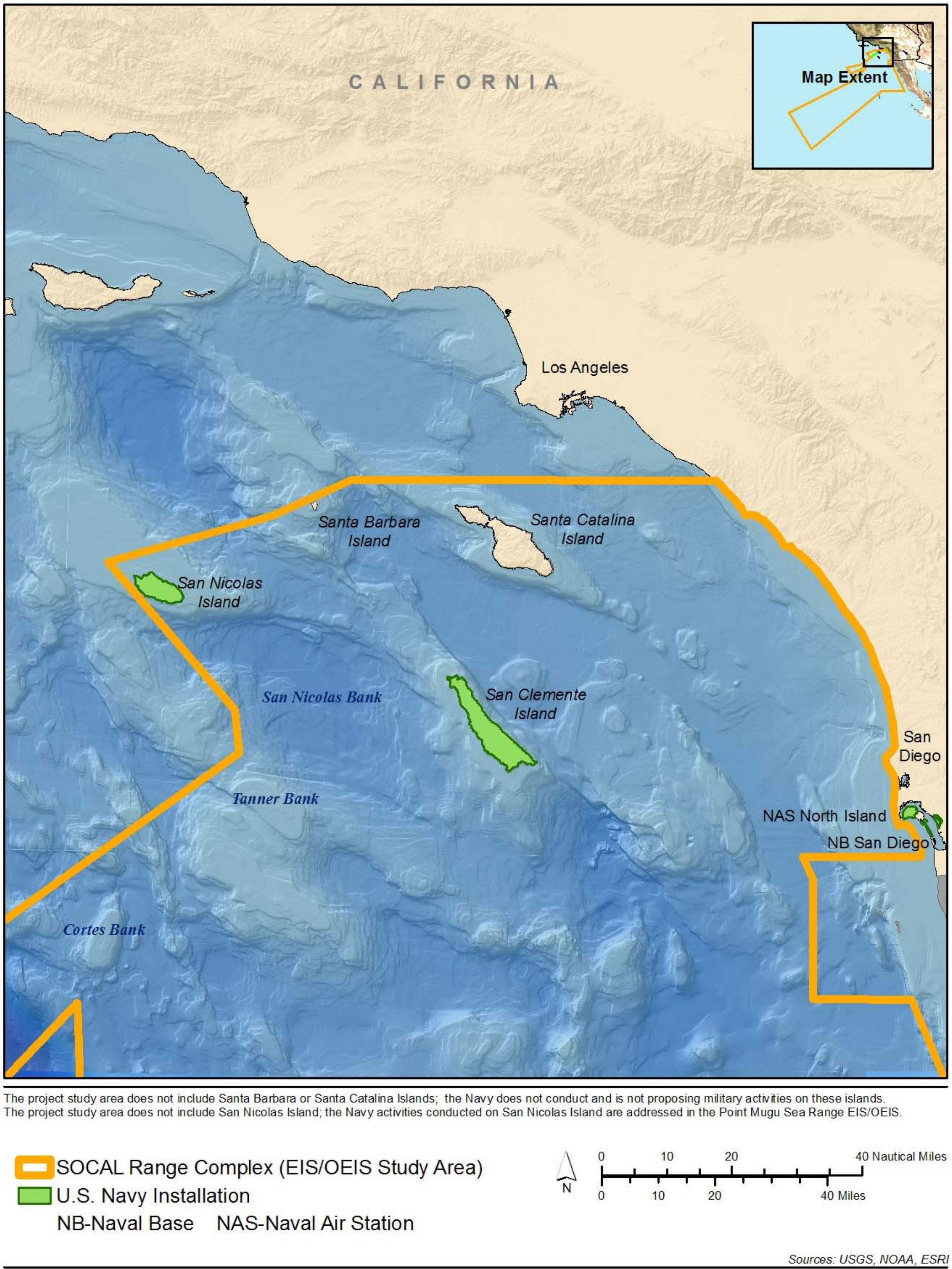

Figure 1-2. Northern Portion of the SOCAL Range Complex Bathymetry and Topography

1.3 ENVIRONMENTAL SETTING

An indentation of California's coastline south of Point Conception creates a broad ocean embayment known as the Southern California Bight (SCB). The SCB encompasses the area from Point Conception south to Mexico, including the offshore Channel Islands, and is influenced by two major oceanic currents: the southward-flowing, cold-water California Current and the northward-flowing, warm-water California Countercurrent (DON 2005a, Perry 2007). These currents mix in the SCB and strongly influence patterns of ocean water circulation, sea temperatures, and distributional trends of marine flora and fauna assemblages along the southern California coast and Channel Islands (Folley *et al.* 1993).

The SOCAL Range Complex is situated in a region of diverse ichthyofauna. High species richness is a product of the region's complex oceanographic topography and the convergence of multiple, influential water masses (Cross and Allen 1993, DON 2005a). The SCB is home to over 480 species of marine fish and more than 5,000 species of marine invertebrates (Cross and Allen 1993, Schiff *et al.* 2000, Allen *et al.* 2006). The diversity of species, fish and invertebrates, is greatest in southern California and declines as one moves north through the region (Horn and Allen 1978, Horn et al. 2006). The study area is located within a transitional zone between subarctic and subtropical water masses. Specifically, Point Conception, California (34.5ºN) is the distinguished ichthyofaunal boundary between subtropical species (i.e., species with preferences of temperatures above 10º to 20ºC) of the San Diego Province and temperate fish species (*i.e.*, species with temperature preferences below 15ºC) of the Oregon Province (Horn and Allen 1978, Froese and Pauly 2004, Horn *et al.* 2006).

The California Current system is rich in microscopic organisms (i.e., diatoms, tintinnids, and dinoflagellates) which form the base of the food chain in the area (DON 2005a). Small coastal pelagic fish and squid depend on this planktonic food supply and in turn are fed upon by larger species. Groundfish (e.g., flatfish, roundfish, skates/sharks/chimeras, rockfish, etc.) are important recreational and commercial species (Love 2006). The shelf and slope demersal rockfish are the most specious genus of fish off the western coast of North America (Love *et al.* 2000). These fish are typically the dominant species documented in many ichthyological surveys, in terms of abundance and diversity, especially between the 20 to 200 m isobaths (Mearns *et al.* 1980). Highly Migratory Species (HMS) (*e.g.*, tuna, billfish, sharks, dolphinfish, and swordfish) and Coastal Pelagic Species (CPS) (e.g., anchovies, mackerels, sardines, and squids) support extensive fisheries in the area (Allen and Cross 2006).

The diverse habitats of the SCB greatly influence the distribution of fish and invertebrates in the area (Horn *et al.* 2006). Cross and Allen (1993) defined these habitats in three broad categories: the pelagic zone, soft substrate habitats (i.e., bays, estuaries, open coast), and hard substrate and kelp bed habitats (*i.e.*, rocky habitats, reefs). The pelagic zone, relating to open water, is the largest habitat in the area with 40% of the fish species inhabiting this area. This zone is subdivided into three distinct regions: epipelagic (up to 50 m deep), mesopelagic (50 to 500 m deep), and bathypelagic regions (greater than 500 m deep) (Cross and Allen 1993). The epipelagic region is inhabited by small, planktivorous schooling fish (*e.g.*, northern anchovy), predatory schooling fish (*e.g.*, Pacific mackerel), and large solitary predators (*e.g.*, blue shark). Abundance of all epipelagic species changes seasonally with fish moving offshore to spawn. The northern anchovy is the most abundant epipelagic species in the study area. The mesopelagic region is characterized by steep environmental gradients and fish that are small, slow growing, long-lived, and reproduce early and repeatedly (*e.g.*, bigeye lightfish). The bathypelagic zone is a rather uniform system containing large, sluggish, fast growing, short-lived fish, that reproduce late and typically only once (*e.g.*, bigscale and hatchetfish) (Cross and Allen 1993).

Typical fish utilizing soft substrates (sand, silt, and mud) include sharks, skates, rays, smelts, flatfish (flounders), gobies and northern anchovies (Pondella and Allen 2000). Regions with hard substrates and kelp beds (*Macrocystis*) are not as abundant as other benthic habitats in the SCB, but they nevertheless provide important habitats for many species. Shallow reefs (*i.e.*, <30 m depth) are the most common type of hard substrate (*i.e.*, coarse sand, calcareous organic debris, rocks) found in the study area (Cross and

Allen 1993, DON 2005a). These reefs also support kelp beds, which provide nursery areas for various fish species. Rocky intertidal regions are often turbulent, dynamic environments, where organisms must cope with stresses associated with tides (*e.g.*, changes in temperature, salinity, oxygen, and pH). Deep reef fish, found along deep banks and seamounts, are typically large, mobile species (*e.g*., rockfish and spiny dogfish). Kelp beds are regions with a high diversity of fish species. Smaller fish feed on high plankton densities in the area, while larger fish are attracted to these habitats to feed on smaller species. They are especially important habitats for young-of-the-year rockfish species, such as the kelp rockfish, whose densities correlate to the size of the kelp bed (McCain 2003).

Inshore areas (bays and estuaries) provide important nursery habitats and feeding grounds to a variety of species, some of commercial importance (e.g., California halibut) (Allen et al. 2002). San Diego Bay's seagrass beds are used by schooling species, such as anchovies and topsmelt (Cross and Allen 1993) with the highest abundance and biomass of fish occurring in the spring (i.e., April) and summer (i.e., July) (Allen et al. 2002). Juvenile northern anchovy, topsmelt, and slough anchovy comprise up to 79% of the fish in the Bay (Allen et al. 2002).

The influence of the California Current on the physical and biological environment of the SCB undergoes significant year-to-year fluctuations (Horn and Stephens 2006). Its impact is also affected by larger-scale climate variations, such as El Niño-La Niña and the Pacific Decadal Oscillation (PDO) (Hickey 1993). El Niño-La Niña (also called the El Niño Southern Oscillation (ENSO)) is the result of interannual changes in sea level pressures between the eastern and western hemispheres of the tropical Pacific; these events can initiate large shifts in the global climate, atmospheric circulation, and oceanographic processes (NOAA 2007a). ENSO conditions typically last 6 to 18 months although they can persist for longer periods of time. They are the main signs of global change over time scales of months to years (Benjamin and Carlton 1999, Schwing et al. 2002). Under normal conditions, rainfall is low in the eastern Pacific and is high over the warm waters of the western Pacific. El Niño conditions occur when unusually high atmospheric pressure develops over the western tropical Pacific and Indian Oceans and low sea level pressure develop in the southeastern Pacific. During El Niño conditions, the trade winds weaken in the central and west Pacific; thus, the normal east to west surface water transport and upwelling along South America decreases. This results in increased (sometimes extreme) rainfall across the southern U.S. and Peru and drought conditions in the western Pacific (NOAA 2007a). La Niña is the opposite phase of El Niño in the Southern Oscillation cycle. La Niña is characterized by strong trade winds that push the warm surface waters back across to the western Pacific increasing upwelling along the eastern Pacific coastline, causing unusually cold sea surface temperatures. The PDO is a longer-term climatic pattern than ENSO with similar warm and cool phases that may persist for 20 to 30 years (Miller 1996, Benjamin and Carton 1999).

During years experiencing an El Niño event, tropical species (i.e., species with temperature preferences above 20ºC) begin to migrate into the study area, while temperate species, which normally inhabit the area, move north and out of the region (Froese and Pauly 2004). For example, two tropical species, the Mexican barracuda and scalloped hammerhead shark, were recorded off southern California for the first time during the 1997/1998 El Niño event (Moser et al. 2000). Rockfish are particularly sensitive to El Niño, with these events resulting in recruitment failure and adults demonstrating reduced growth, ultimately a decline in biomass is exhibited and poor overall condition in the region becomes evident. Landings of market squid were dramatically decreased during the 1997/1998 El Niño event (Hayward 2000).

Past La Niña events have not had such a dramatic impact on ichthyofauna and marine invertebrate populations as El Niño events. Nevertheless, La Niña years can result in below normal recruitment for many invertebrate species (e.g., rock crabs), and larval rockfish abundance has been reportedly low during years experiencing La Niña events (Lundquist et al. 2000). Cooling trend years (i.e., 1999 La Niña event) can result in increased abundance and commercial landing of herring, anchovies, and squid populations (Hayward 2000; Lluch-Belda et al. 2003).

1.4 FISHERIES MANAGEMENT PLANS

Under the MSFCMA, the federal government has jurisdiction to manage fisheries in the U. S. EEZ which extends from the outer boundary of state waters (3 nm (5.6 km) from shore) to a distance of 200 nm (370 km) from shore. Offshore fisheries in the SOCAL Range Complex are managed by NMFS with assistance from the Pacific Fisheries Management Council (PFMC) (PFMC 2007a), and the Southwest Fisheries Science Center (National Oceanic and Fisheries Administration (NOAA)) (NOAA 2007b,c). Inshore fisheries (less than 3 nm (5.6 km) from shore) are managed by the California Department of Fish and Game (CDFG) (CDFG 2007a). However, in practice, state and federal fisheries agencies manage fisheries cooperatively and FMPs generally cover the area from coastal estuaries out to 200 nm (370 km) offshore.

Fishery Management Plans are extensive documents that are constantly revised and updated. The Pacific Coast Groundfish Fishery Management Plan, for example, originally produced in 1977, has been amended 19 times (PFMC 2006a). FMPs describe the nature, status, and history of the fishery, and, specify management recommendations, yields, quotas, regulations, and harvest guidelines. Associated Environmental Impact Statements (EISs) addresses the biological and socioeconomic consequences of management policies. Fishery Management Councils have web sites that present the various elements of their FMPs, current standards and regulations, committee hearings and decisions, research reports, source documents, and links to related sites (see, for example, PFMC 2007a). Recent coverage of the ecology of marine fish, fisheries and marine environmental issues in California is presented in reviews by Allen 2006, Allen, Pondella and Horn 2006, Allen and Cross 2006, Horn and Stephens 2006, Horn et al. 2006, and Love 2006.

Fishery Management Plans covering the SOCAL Range Complex include; Coastal Pelagic Species (CPS) complex (6 species), Pacific Groundfish (GF) (83 species), and Highly Migratory Species (HMS) (13 species) (Tables 1-1, 1-2, and 1-3). The Pacific halibut (*Hippoglossus stenolepis*), a flat groundfish, is regulated by the United States and Canada through a bilateral commission, the International Pacific Halibut Commission (IPHC) (IPHC 2007) and is therefore not in a federal FMP. The usual range of Pacific halibut is from Santa Barbara, CA to Nome, Alaska and it would not usually be found in the study area.

Table 1-1: Coastal Pelagic Management Plan Species

Coastal Pelagic Management Plan Species **http://www.pcouncil.org/cps/cpsfmp.html**
Jack mackerel (*Traxchurus symmetricus*)
Krill (euphausiids)
Pacific mackerel (*Scomber japonicus*)
Pacific sardine(*Sardinops sagax*)
Market squid (*Loligo opalescens*)
Northern anchovy (*Engraulis mordax*)
Source: PFMC 2003, 2005.

Table 1-2. Groundfish Management Plan Species

Groundfish Management Plan Species http://www.pcouncil.org/groundfish/gffmp.html
Flatfish
Arrowtooth flounder *(Atheresthes stomias)*
Butter sole *(Isopsetta isolepis)*
Curlfin sole (*Pleuronichthys decurrens*)
Dover sole (*Microstomus pacificus*)
English sole (*Parophrys vetulus*)
Flathead sole *(Hippoglossoides elassodon)*
Pacific sanddab (*Citharichthys sordidus*)
Petrale sole (*Eopsetta jordani*)
Rex sole (*Glyptocephalus zachirus*)
Rock sole (*Lepidopsetta bilineata*)
Sand sole (*Psettichthys melanostictus*)
Starry flounder (*Platichthys stellatus*)
Rockfish
Aurora rockfish (*Sebastes aurora*)
Bank rockfish (*Sebastes rufus*)
Black rockfish (*Sebastes melanops*)
Black-and-yellow rockfish (*S. chrysomelas*)
Blackgill rockfish (*Sebastes melanostomus*)
Blue rockfish (*Sebastes mystinus*)
Bocaccio (*Sebastes paucispinis*)
Bronzespotted rockfish (*Sebastes gilli*)
Brown rockfish (*Sebastes auriculatus*)
Calico rockfish (*Sebastes dallii*)
Canary rockfish (*Sebastes pinniger*)
Chameleon rockfish (*Sebastes phillipei*)
Chilipepper (*Sebastes goodei*)
China rockfish (*Sebastes nebulosus)*
Copper rockfish (*Sebastes caurinus*)
Cowcod (*Sebastes levis*)
Darkblotched rockfish (*Sebastes crameri*)
Dusky rockfish (*Sebastes ciliatus*)
Dwarf-red rockfish (*Sebastes rufinanus*)
Flag rockfish (*Sebastes rubrivinctus*)
Freckled rockfish (*Sebastes lentiginosus*)
Gopher rockfish (*Sebastes carnatus*)
Grass rockfish (*Sebastes rastrelliger*)
Greenblotched rockfish (*Sebastes rosenblatti*)
Greenspotted rockfish (*Sebastes chlorostictus*)
Squarespot rockfish (*Sebastes hopkinsi*)
Starry rockfish (*Sebastes constellatus*)
Stripetail rockfish (*Sebastes saxicola*)
Swordspine rockfish (*Sebastes ensifer*)
Source: NMFS 2005a, PFMC 2006a.

Table 1-2. Groundfish Management Plan Species (continued)

Groundfish Management Plan Species http://www.pcouncil.org/groundfish/gffmp.html
Rockfish (continued)
Tiger rockfish (*Sebastes nigrocinctus*)
Treefish (*Sebastes serriceps*)
Vermillion rockfish (*Sebastes miniatus*)
Widow rockfish (*Sebastes entomelas*)
Yelloweye rockfish (*Sebastes ruberrimus*)
Yellowmouth rockfish (*Sebastes reedi*)
Yellowtail rockfish (*Sebastes flavidus*)
Scorpionfish
Ca. scorpionfish (*Scorpaena guttatta*)
Thorneyheads
Longspine thornyhead (*Sebastolobus altivelis*)
Shortspine thornyhead (*S. alascanus*)
Roundfish
Cabezon (*Scorpaenichthvs marmoratus*)
Kelp greenling (*Hexagrammos decagrammus*)
Lingcod (*Opiodon elongatus*)
Pacific cod (*Gadus macrocephalus*)
Pacific hake (*Merluccius productus*)
Sablefish (*Anoplopoma fimbria*)
Skates, Sharks and Chimeras
Big skate (*Raja binoculata*)
California skate (*Raja inornata*)
Finescale codling (*Antimora microlepis)*
Leopard shark (*Triakis semifasciata*)
Longnose skate (*Raja rhina*)
Pacific rattail (*Coryphaenoides acrolepis)*
Soupfin shark (*Galeorhinus zyopterus*)
Spiny dogfish (*Squalus acanthias*)
Spotted ratfish (*Hydrolagus colliei*)
Source: NMFS 2005a, PFMC 2006a.

Table 1-1: Highly Migratory Management Plan Species

Highly Migratory Management Plan Species http://www.pcouncil.org/hms/hmsfmp.html
Sharks
Bigeye thresher shark (*Alopias superciliosus*)
Blue shark (*Prionace glauca*)
Common thresher shark (*Alopias vulpinus*)
Pelagic thresher shark (*Alopias pelagicus*)
Shortfin mako shark (*Isurus oxyrinchus*)
Tunas
Albacore tuna (*Thunnus alalunga*)
Bigeye tuna (*Thunnus obesus*)
Northern bluefin tuna (*Thunnus orientalis*)
Skipjack tuna (*Katsuwonus pelamis*)
Yellowfin tuna (*Thunnus albacares*)
Billfish
Striped marlin (*Tetrapturus audax*)
Swordfish
Broadbill swordfish (*Xiphias gladius*)
Dolphin-fish
Dorado (mahi mahi) (*Coryphaena hippurus*)
Source: PFMC 2006b

1.5 ESSENTIAL FISH HABITAT DESCRIPTIONS AND IDENTIFICATIONS

The NMFS and the PFMC designate Essential Fish Habitat and develop Fishery Management Plans for all fisheries occurring within the boundary of the EEZ in the SCB from Point Conception to the U.S./Mexico border. The MSFCMA, as amended by the SFA, contains provisions for the identifying and protecting habitat essential to federally Managed Species. The FMPs identify EFH, describe EFH impacts (fishing and non-fishing), and suggest measures to conserve and enhance EFH. The FMPs also designate HAPCs where one or more of the following criteria are demonstrated: (a) important ecological function; (b) sensitivity to human-induced environmental degradation; (c) development activities stressing the habitat type; or (d) rarity of habitat.

With respect to EFH, nearshore areas are considered to be shallower than 120 ft (36 m) with offshore areas beyond that depth. The continental shelf is considered to begin at the 656 ft (200 m) contour (Figure 1-3). EFH/HAPC designations and detailed life histories, habitat preferences, and distribution maps for each Managed Species are included in the Marine Resources Assessment for the Southern California Operating Area (DON 2005a).

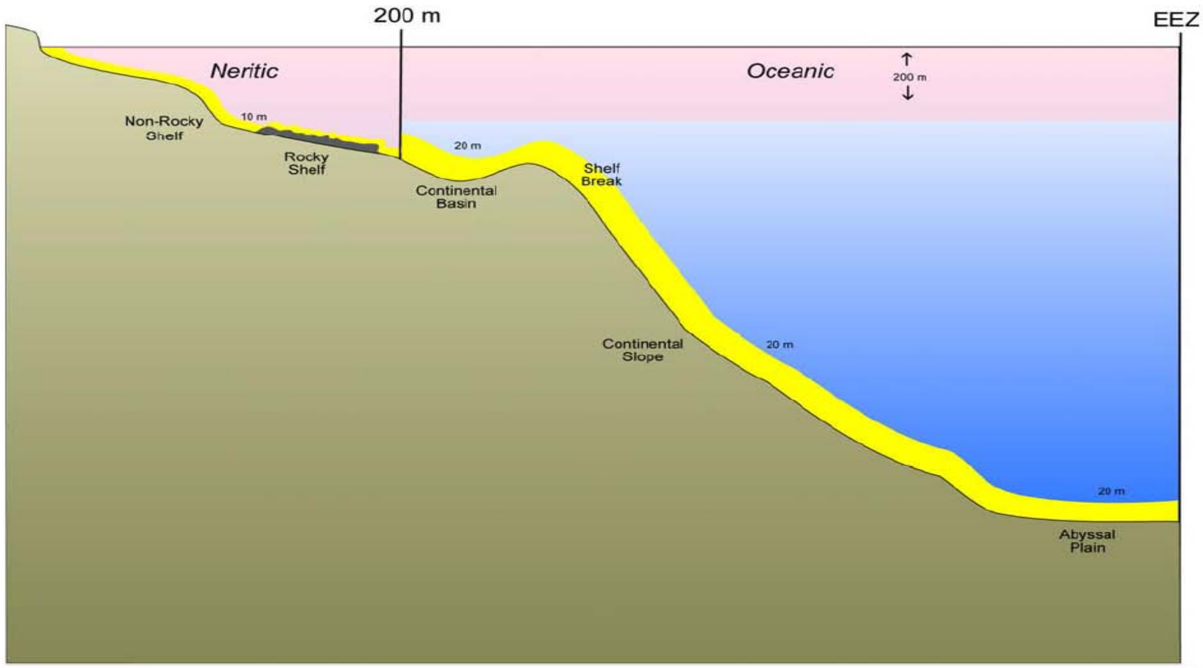

Figure 1-3. Continental Shelf Biological Zones (from SOCAL MRA)

Groundfish species are bottom dwelling finfish. More than 80 species of marine fish are included under the Pacific Coast Groundfish FMP that was adopted by the PFMC in 1982 (PFMC, 2006a). In general, the FMP provides for management of bottom dwelling finfish species (including all rockfish and whiting) that are found in U.S. waters off Washington, Oregon, and California. Of these, fewer than 20 of the commercially and recreationally most important have ever been comprehensively assessed. Groundfish management is complicated and demanding because fisheries for many of the species are interrelated, but the various stocks have responded differently to fishing pressure. For example, flat fish populations such as Dover, Petrale, and English soles have been subjected to significant commercial fisheries for decades yet have not shown the magnitude of declines that have occurred in other rockfish populations. The current status of many rockfish and lingcod off the West Coast is poor, and significant changes in the groundfish fishery have been necessary to address this situation. In response to the sharp decline in groundfish landings and the generally poor condition of West Coast groundfish stocks, the Secretary of Commerce formally announced a disaster determination for the fishery in January 2000 (NOAA 2000).

The groundfish species managed by the Pacific Groundfish FMP range throughout the EEZ and occupy diverse habitats at all stages in their life histories (Table 1-4). Some species are broadly dispersed during specific life stages, especially those with pelagic eggs and larvae. The distribution of other species and/or life stages may be relatively limited, as with adults of many nearshore rockfish which show strong affinities to a particular location or substrate type.

Table 1-2: Groundfish Species Essential Fish Habitat

Pacific Groundfish Species EFH and Life Stages Associated With the Seven EFH Designations.							
Group/Species	Estuarine	Rocky Shelf	Non-Rocky Shelf	Neritic	Canyon	Continent Slope/ Basin	Ocean
Flatfish							
Curlfin Sole			A, SA	E		A, SA	E
Dover Sole			A, SA, J	L, E		A, SA, J	L, E
English Sole	A*, SA, J*, L*, E	A*, SA, J*	A*,SA, J*	L*, E		A*	
Petrale Sole			A, J	L, E		A, SA	L, E
Rex Sole	A		A, SA	E		A, SA	L, E
Rock Sole		A*, SA*, J*, E*	A*, SA*, J*, E*	L		A*, SA*, J*, E*	
Sand Sole			A, SA, J	L, E			
Pacific Sanddab	J, L, E		A*, SA, J	L, E			L, E
Rockfish							
Aurora Rockfish			A, MA, LJ			A, MA, LJ	L
Bank Rockfish		A, J	A, J		A, J	A, J	
Black Rockfish	A*, SJ*	LJ*	LJ*	A*, SJ*			A*
Black-and-yellow Rockfish		A*, MA, LJ*, SJ*, P		L*			
Blackgill Rockfish		LJ		SJ, L		A, LJ	S, LJ
Blue Rockfish		A*, MA, LJ*	LJ*	SJ*,L			
Bocaccio	SJ*, L	A*, LJ*	A*, LJ*	SJ*, L	LJ*	A*, LJ*	
Bronzespotted Rockfish						A	
Brown Rockfish	A*, MA, J*, P	A*, MA, J*, P					
Calico Rockfish	A, J	A, J	A, J				
Canary Rockfish		A, P		SJ*, L		A, P	SJ*, L
Chilipepper		A, LJ, P	A, LJ, P	SJ*, L		A, LJ, P	
China Rockfish		A, J, P		L			
Copper Rockfish	A*, LJ*, SJ*, P	A*, LJ*		SJ*, P			
Cowcod		A, J	J	L			
Darkblotched Rockfish		A, MA, LJ, P	A, MA, LJ, P			A, MA, P	SJ, L

Table 1-3: Groundfish Species Essential Fish Habitat (cont'd)

Pacific Groundfish Species EFH and Life Stages Associated With the Seven EFH Designations.							
Flag Rockfish		A, P					
Gopher Rockfish		A*, MA, J*, P	A*, A, J*, P				
Grass Rockfish		A*, J*, P					
Greenblotched Rockfish		A, J, P	A, J, P		A, J, P	A, P	
Greenspotted Rockfish		A, J, P	A, J, P				
Greenstriped Rockfish		A, P	A, P				
Honeycomb Rockfish		A, J, P			J		
Kelp Rockfish	SJ*	A*, LJ*,P		SJ*			
Mexican Rockfish		A	A	L			L
Olive Rockfish		A*, J*, P			A*, P		
Pacific Ocean Perch		A, LJ	A, LJ	SJ	A	A, P	SJ, L
Pink Rockfish		A	A			A	
Redbanded Rockfish			A			A	
Redstripe Rockfish		A, P				A, P	
Rosethorn Rockfish		A, P	A, P			A, P	
Rosy Rockfish		A, J, P					
Rougheye Rockfish		A	A			A	
Sharpchin Rockfish		A, P	A, P			A, P	L
Shortbelly Rockfish		A*, P	A*, P		A*, P	A*, P	
Silverygray Rockfish		A*	A*			A*	
Speckled Rockfish		A, J, P			A, P	A, P	
Splitnose Rockfish			A,J*, P			A, P	
Squarespot Rockfish		A, P			A, P		
Starry Rockfish		A, P				A, P	
Stripetail Rockfish			A, P			A, P	
Tiger Rockfish		A				A	
Treefish		A					
Vermilion Rockfish		A, J*	J*		A	A	
Widow Rockfish		A, MA, LJ,P	A, MA, LJ, P	SJ*, L	A, MA, LJ, P	A, MA, P	SJ*, L
Yelloweye Rockfish		A, P				A, P	
Yellowtail Rockfish		A, MA, LJ, P	A, MA, LJ, P	SJ*		A, MA, P	SJ*
Scorpionfish							
California Scorpionfish	E	A, SA, J	A, SA, J	E			
Thornyheads							
Longspine Thornyhead						A, SA, J	L, E
Shortspine Thornyhead			A			A, SA	L, E

Table 1-4: Groundfish Species Essential Fish Habitat (cont'd)

Pacific Groundfish Species EFH and Life Stages Associated With the Seven EFH Designations.							
Roundfish							
Cabezon	A, SA, LJ, SJ*, L, E	A, SA, LJ, E		SJ*, L			SJ*, L
Kelp Greenling	A*, SA, LJ*, SJ*, L, E	A*, SA, LJ*, E		SJ*, L			SJ*, L
Lingcod	A*, SA, LJ*, SJ*, L, E	A*, SA, LJ*, E	A*, LJ*	SJ*, L		A*	
Pacific Cod	A, SA, J, L, E		A, SA, J, E	A, SA, J, L		A, SA, E	A, SA, J, L
Pacific Hake (Whiting)	A, SA, J, L, E			A, SA, J, L, E			A, SA, L, E
Pacific Flatnose					A	A	
Pacific Grenadier			A, SA, J			A, SA, J	L
Sablefish	SJ	A	A, LJ	SJ, L	A, LJ	A, SA	SJ, L, E
Skates/Sharks/Chimeras							
Big Skate			A, MA, J, E			A, MA	
California Skate	A, MA, J, E		A, MA, J, E			A, MA, J, E	
Longnose Skate			A, MA, J, E			A, MA, J, E	
Leopard Shark	A, MA, J, P	A, MA, J, P	A, MA, J, P	A, MA, J, P			
Soupfin Shark	A, MA, J, P	A, MA, J	A, MA, J, P	A, MA, J, P	A, MA, J		A, MA, J
Spiny Dogfish	A, LJ, SJ, P	A, MA, LJ	A, LJ, P	A, LJ, SJ	A	A, MA	A
Spotted Ratfish	A, MA, J	A, MA, J, E	A, MA, J, E			A, MA, J, E	

A = Adults, SA = Spawning Adults, MA = Mating Adults, LJ = Large Juveniles, SJ = Small Juveniles, J = Juveniles, L = Larvae, E = Eggs, P = Parturition (PFMC 2006a). * =Associated with macrophytes, algae, or seagrass. (from DON 2005a).

The Groundfish Management Plan designates EFH for Managed Species (i.e., those covered under FMPS) as: all waters and substrate within the following areas; 1) depths less than or equal to 3,500 m (1,914 fm) to mean higher high water level or the upriver extent of saltwater intrusion, 2) seamounts in depths greater than 3,500 m, and 3) areas designated as HAPCs not already identified by the above criteria (Figure 1-4).

The Pacific Fisheries Management Council has identified six HAPC types. One of these types, certain oil rigs in Southern California waters, was disapproved by NMFS. The current HAPC types are: estuaries, canopy kelp, seagrass, rocky reefs, and "areas of interest" (e.g., submarine features, such as banks, seamounts, and canyons) (Table 1-5, Figure 1-5).

Coastal pelagic species (CPS) include six pelagic species. While "pelagic" designates organisms that live in the water column as opposed to living near the sea floor, some species can be distributed anywhere from the surface to 1,000 m (3,280 ft) depending on species-specific preference. Most pelagic species are typically within 200 m of the surface (PMFC 2003, 2005, Allen and Cross 2006).

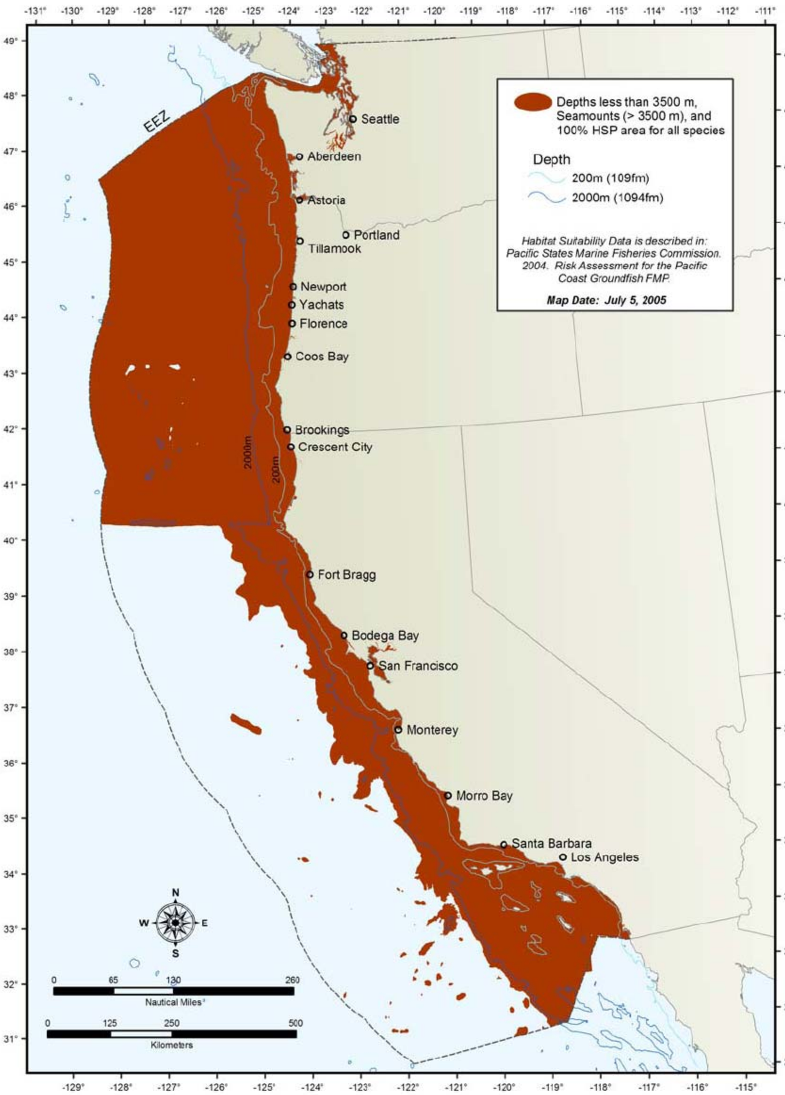

Figure 1-4: Groundfish EFH (from PFMC 2006a)

EFH identified for CPS Managed Species is wide-ranging. It includes the geographical range where they are currently found, have been found in the past, and may be found in the future (PFMC 2005). In the SOCAL Range Complex, the CPS EFH includes all marine waters above the thermocline from the shoreline offshore to the limits of the EEZ with no HAPCs designated (PFMC 2005). The thermocline is an area in the water column where water temperature changes rapidly, usually from colder at the bottom to warmer on top. The CPS live near the surface primarily above the thermocline, and within a few hundred miles of the coast, so their designated EFH is less complex than for groundfish Managed Species (Table 1-6).

Table 1-5: EFH and HAPCs in the SOCAL Range Complex

Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPCs) for the SOCAL Range Complex.		
	EFH	HAPCs
Pacific Groundfish	Marine and esturarine waters less than or equal to 3,500 m (1,914 fm) to mean higher high water level or the upwater extent of seawater intrusion, seamounts in depths greater than 3,500 m, and areas designated as HAPCs not identified by the above criteria.	Estuaries, canopy kelp, sea grass, rocky reefs, and other areas of interest.
Coastal Pelagic Species	All marine and estuarine waters above the thermocline from the shoreline offshore to 200 nm offshore.	No HAPCs designated.
Highly Migratory Species	All marine waters from the shoreline offshore to 200 nm offshore.	No HAPCs designated.
Pacific Coast Salmon	North of project area.	North of project area.
Source: NMFS 2005a, PFMC 2005, 2006a,b		

Only market squid are significantly associated with benthic environments; the females lay their eggs in sheaths on sandy bottom in 33-165 ft (10-50 m) depths (PFMC 2005). The CPS are found in shallow waters and within bays and even brackish waters, but are not considered dependent upon these habitats. They prefer temperatures in the 10-28 °C range with successful spawning and reproduction occurring from 14 to 16 °C. Larger, older individuals are generally found farther offshore and farther north than younger, smaller individuals. Northern areas tend to be utilized most often when temperatures and abundance is high. All life stages of all CPS species are found in the SOCAL Range Complex.

The term “Highly Migratory Species” (HMS) derives from Article 64 of the United Nations Convention on the Law of the Sea (United Nations 1982). Although the Convention does not provide an operational definition of the term, an annex to it lists species considered highly migratory by parties to the Convention. In general, these species have a wide geographic distribution, both inside and outside countries’ 200-mile zones, and undertake migrations of significant but variable distances across oceans for feeding or reproduction. They are pelagic species, which means they do not live near the sea floor, and mostly live in the open ocean, although they may spend part of their life cycle in near shore waters (DON 2005a, Allen and Cross 2006).

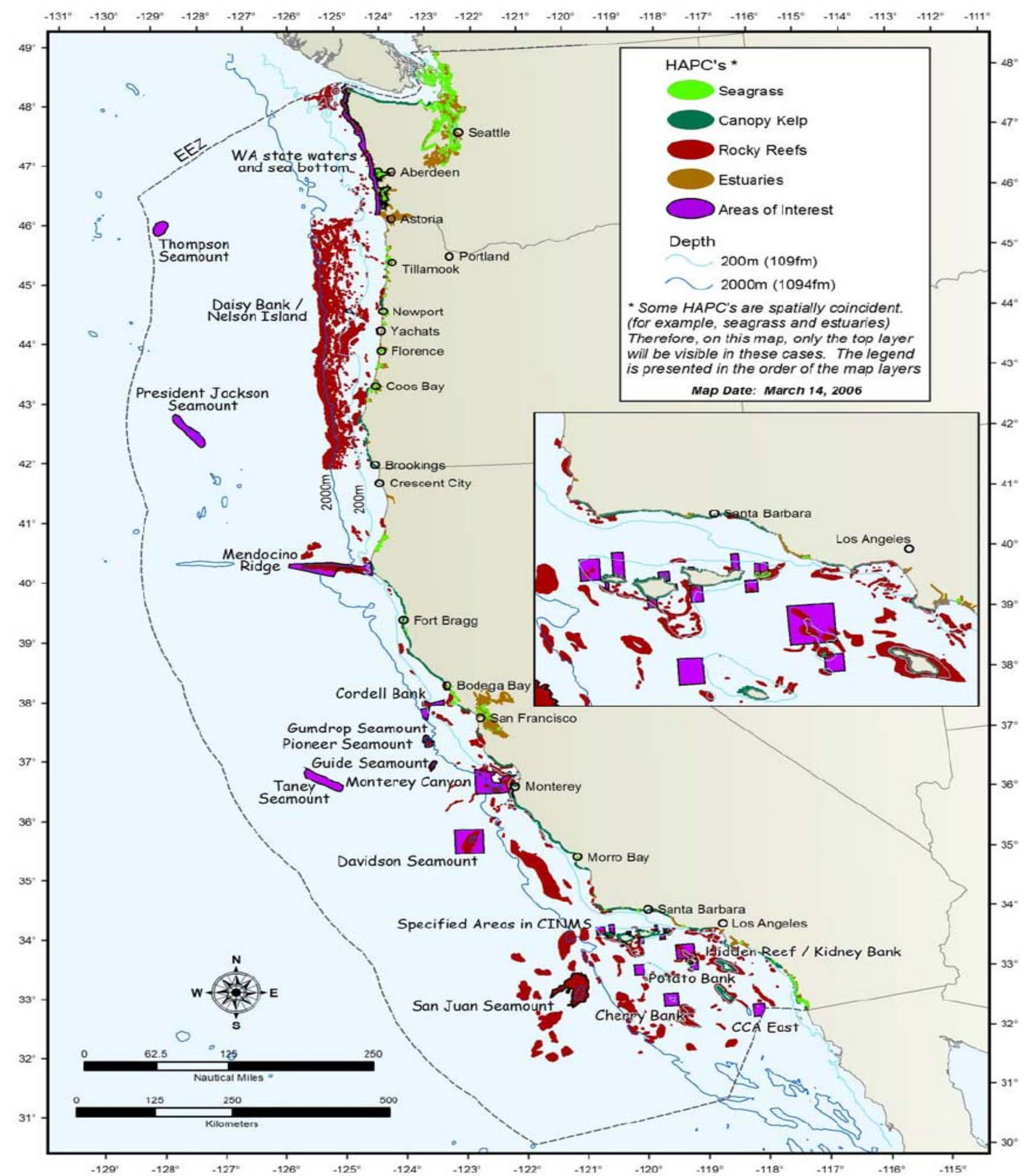

Figure 1-5: Pacific Groundfish HAPCs (from PFMC 2006a)

Table 1-6: Coastal Pelagic Species Essential Fish Habitat

Coastal Pelagic Species and Lifestages Associated with EFH designations.			
Group/Species	Coastal epipelagic	Coastal mesopelagic	Coastal benthic
Krill	E, L, J, A		
Northern anchovy	E, L, J, A		
Mackerels	E, L, J, A		
Sardine	E, L, J, A		
Market Squid	L, J, A		E
A = Adults, J = Juveniles, L = Larvae, E = Eggs. (PFMC 2005).			

HMS species are highly migratory across broad ocean scales, with occurrence in the SCB subject to extreme variability in horizontal and vertical distribution (DON 2005a). Of these pelagic and HMS species, the largest commercial fisheries in Southern California (Los Angeles and San Diego), are for swordfish, albacore tuna, yellowfin tuna, and pacific mackerel based on poundage landed and value reported for the Los Angeles and San Diego areas (see EIS/OEIS Section 3.14, Socioeconomics).

Highly Migratory Species EFH designation for species likely within the Range Complex includes the common thresher shark (all life stages), pelagic thresher shark (late juveniles/sub-adults, adult life stages), bigeye thresher shark (late juveniles/sub-adults, adult life stages), shortfin mako shark (all life stages), blue shark (all life stages), albacore tuna (juvenile and adult life stages), bigeye tuna (juvenile and adult life stages), northern bluefin tuna (juvenile and adult life stages), skipjack tuna (adult life stages), yellowfin tuna (juvenile and adult life stages), striped marlin (adult life stages), broadbill swordfish (juvenile and adult life stages), and dorado (mahi mahi) (juvenile and adult life stages) (DON 2005a).

EFH for Highly Migratory Species such as tuna, sharks, and billfish is even more extensive than for CPS (Table 1-7) (PFMC 2006b, 2007b). HMS travel widely in the ocean, both in terms of area and depth. They are usually not associated with the features typically considered fish habitat (like estuaries, seagrass beds, or rocky bottoms). Their habitat selection appears to be less related to physical features and more to temperature ranges, salinity levels, oxygen levels, and currents. For the U.S. West Coast Fisheries for Highly Migratory Species, EFH occurs throughout the SOCAL Range Complex (PFMC 2006b, 2007b). The PFMC has currently identified no HMS HAPCs . Further, EFH in the Pacific Coast Salmon Plan (PFMC 2003) extends northward from Point Conception and is, thus, out of the Range Complex.

Table 1-7: Highly Migratory Species Essential Fish Habitat

Highly Migratory Species and Lifestages Associated with EFH Designations.				
Group/Species	**Coastal epi-pelagic**	**Coastal meso-pelagic**	**Oceanic epi-pelagic**	**Oceanic meso-pelagic**
Sharks				
Blue Shark			N, EJ, LJ, SA, A	
Shortfin Mako			N, EJ, LJ, SJ, A	
Thresher Sharks	LJ, SA, A	LJ, SA, A	LJ, SA, A	LJ, SA, A
Tunas				
Albacore			J, A	
Bigeye Tuna			J, A	J, A
Northern Bluefin			J	
Skipjack			A	
Yellowfin			J	
Billfish				
Striped Marlin			A	
Swordfish				
Broadbill Swordfish			J, A	J, A
Dolphinfish				
Dorado			J, SA, A	
A = Adults, SA = Sub-Adults, LJ = Late Juveniles, N= Neonate, EJ = Early Juveniles, J = Juveniles, L = Larvae, E = Eggs. (PFMC 2006b, 2007b**).**				

1.6 MANAGED SPECIES

Groundfish Managed Species are found throughout the SOCAL Range Complex. As indicated above, EFH for groundfish includes all waters from the high tide line to 3,500 m (1,914 fathoms (fm)) in depth (PFMC 2006a).

The Pacific coast groundfish fishery is the largest, most important fishery managed by the Pacific Fishery Management Council in terms of landings and value (PFMC 2006a). The 83 species managed under the Pacific Groundfish Management Plan are usually found on or near the bottom; rockfish - 63 species including widow, yellowtail, canary, shortbelly, and vermilion rockfish; bocaccio, chilipepper, cowcod, yelloweye, thornyheads, and Pacific Ocean perch; roundfish - six species: lingcod, cabezon, kelp greenling, Pacific cod, Pacific whiting (hake), and sablefish; flatfish - 12 species including various soles, starry flounder, and sanddab; sharks and skates - six species: leopard shark, soupfin shark, spiny dogfish, big skate, California skate, and longnose skate; and three other species: ratfish, finescale codling, and Pacific rattail grenadier (Table 1-1) (PFMC 2006a).

Rockfish can be found from the intertidal zone out to deepest waters of the EEZ (Love 1998, Love et al. 2002, Leet et al. 2001, CDFG 2000). For management purposes, these species are often placed in three groups defined by depth range and distance offshore; nearshore rockfish, shelf rockfish, and slope rockfish (Table 1-8).

Table 1-8: Rockfish Distribution in the SOCAL Range Complex

Shallow Nearshore Rockfish	
black-and-yellow (S. chrysomelas)	grass (S. rastrelliger)
China (S. nebulosus)	kelp (S. atrovirens)
gopher (S. carnatus)	
Deeper Nearshore Rockfish	
black (Sebastes melanops)	copper (S. caurinus)
blue (S. mystinus)	olive (S. serranoides)
brown (S. auriculatus)	quillback (S. maliger)
calico (S. dalli)	treefish (S. serriceps)
Shelf Rockfish	
bocaccio (Sebastes paucispinis)	pinkrose (S. simulator)
bronzespotted (S. gilli)	pygmy (S. wilsoni)
canary (S. pinniger)	redstriped (S. proriger)
chameleon (*S. phillipsi*)	rosethorn (*S. helvomaculatus*)
chilipepper (*S. goodei*)	rosy (*S. rosaceus*)
cowcod (*S. levis*)	silvergrey (*S. brevispinis*)
dwarf-red (*S. rufinanus*)	speckled (*S. ovalis*)
flag (*S. rubrivinctus*)	squarespot (*S. hopkinsi*)
freckled (*S. lentiginosus*)	starry (*S. constellatus*)
greenblotched (*S. rosenblatti*)	stripetail (*S. saxicola*)
greenspotted (*S. chlorostictus*)	swordspine (*S. ensifer*)
greenstriped (*S. elongatus*)	tiger (*S. nigrocinctus*)
halfbanded (*S. semicinctus*)	vermilion (*S. miniatus*)
honeycomb (*S. umbrosus*)	yelloweye (*S. ruberrimus*)
Mexican (*S. macdonaldi*)	yellowtail (*S. flavidus*)
pink (*S. eos*)	
Slope Rockfish	
aurora (*S. aurora*)	rougheye (*S. aleutianus*)
bank (*S. rufus*)	sharpchin (*S. zacentrus*)
blackgill (*S. melanostomus*)	shortraker (*S. borealis*)
darkblotched (*S. crameri*)	splitnose (*S. diploproa*)
Pacific ocean perch (*S. alutus*)	yellowmouth (*S. reedi*)
redbanded (*S. babcocki*)	
Source: CDFG 2007b	

The nearshore rockfish spend most of their lives in relatively shallow water. This group is often subdivided into a shallow component and a deeper component. Shelf rockfish are found along the continental shelf (Figure 1-3). Slope rockfish occur in the deeper waters of the shelf and down the continental slope. The roundfish, flatfish, sharks, and skates covered under the Groundfish FMP are generally concentrated in shallow water while the ratfish, finescale codling, and Pacific rattail are deepsea fish (Eschmeyer et al. 1985, CDFG 2000, Leet et. al. 2001).

A variety of different fishing gear is used to target groundfish including troll, longline, hook and line, pots, gillnets, and other types of gear (Table 1-9 (from NMFS 2005b)). The West Coast groundfish fishery has four components: limited entry - which limits the number of vessels allowed to participate; open access - which allocates a portion of the harvest to fishers without limited entry permits; recreational; and tribal - fishers who have a federally recognized treaty rights (PFMC 2006a).

Table 1-9: Gear Types Used in the West Coast Groundfish Fishery

Fishery	Trawl and Other Net	Longline, Pot, Hook & Line	Other
Limited Entry Fishery (commercial)	Mid-water Trawl, Whiting trawl, Scottish Seine	Pot, Longline	
Open Access Fishery Directed Fishery (commercial)	Set Gillnet Sculpin Trawl	Pot, Longline, Vertical hook/line, Rod/Reel, Troll/dinglebar, Jig, Drifted (fly gear), Stick	
Open Access Fishery Incidental Fishery (commercial)	Exempted Trawl (pink shrimp, spot and ridgeback prawn, CA halibut, sea cucumber), Setnet, Driftnet, Purse Seine (Round Haul Net)	Pot (Dungeness crab, CA sheephead, spot prawn) Longline, Rod/reel Troll	Dive (spear) Dive (with hook and line) Poke Pole
Recreational	Dip Net, Throw Net (within 3 miles)	Hook and Line methods Pots (within 3 miles) from shore, private boat, commercial passenger vessel	Dive (spear)

The Coastal Pelagics FMP includes four finfish (northern anchovy, Pacific sardine, Pacific (chub) mackerel, jack mackerel), and two invertebrates, market squid and krill (Table 1-2). The CPS inhabit the pelagic realm, i.e., live in the water column, not near the sea floor. They are usually found from the surface to 1,000 m (3,281 ft) deep (PFMC 2005).

Northern anchovy (*Engraulis mordax*) are small, short-lived fish that typically school near the surface. They occur from British Columbia to Baja California. Northern anchovies are divided into northern, central, and southern sub-populations. The central sub-population used to be the focus of large commercial fisheries in the U.S. and Mexico. Most of this sub-population is located in the SCB between Point Conception, California and Point Descanso, Mexico. Northern anchovy are an important part of the food chain for other species, including other fish, birds, and marine mammals.

Pacific sardine (*Sardinops sagax*), also small schooling fish, have been the most abundant fish species managed under the Pacific Groundfish FMP. They range from the tip of Baja California to southeastern Alaska and throughout the Gulf of Mexico. Sardines live up to 13 years, but are usually captured in the fishery at less than 5 years old.

Pacific (chub) mackerel (*Scomber japonicus*) are found from Mexico to southeastern Alaska, but are most abundant south of Point Conception, California within 20 miles (mi) (32 km) from shore. The "northeastern Pacific" stock of Pacific mackerel is harvested by fishers in the U.S. and Mexico. Like sardines and anchovies, mackerel are schooling fish, often co-occurring with other pelagic species like jack mackerel and sardines. As with other CPS, they are preyed upon by a variety of fish, mammals, and sea birds.

Jack mackerel (*Trachurus symmetricus*) grow to about 60 centimeters (cm) (2 ft) and can live up to 35 years. They are found throughout the northeastern Pacific, often well outside the EEZ. Small jack mackerel are most abundant in the SCB, near the mainland coast, around islands, and over shallow rocky banks. Older, larger fish range from Cabo San Lucas, Baja California, to the Gulf of Alaska, offshore into deep water and along the coast to the north of Point Conception. Jack mackerel in southern California usually school over rocky banks, artificial reefs, and shallow rocky reefs (PFMC 2005).

Market squid (*Loligo opalescens)* range from the southern tip of Baja California to southeastern Alaska. They are most abundant between Punta Eugenio, Baja California, and Monterey Bay, California. Usually found near the surface, market squid can occur to depths of 800 m (2,625 ft) or more. Squid live less than a year and prefer full-salinity ocean waters. They are important forage foods for fish, birds and marine mammals (PFMC 2005).

In 2006, the PFMC adopted a complete ban on commercial fishing for all species of krill in West Coast federal waters (PFMC 2006c). Krill (euphausiids) are small shrimp-like crustaceans that are an important basis of the marine food chain. They are eaten by many Managed Species, as well as by whales and seabirds. The PFMC is presently considering identifying EFH and possibly HAPCs for two individual krill species, *Euphausia pacifica* and *Thysanoessa spinifera*, and for other species of krill as a separate category.

Coastal pelagic species are harvested directly and incidentally (as bycatch) in other fisheries. Usually targeted with "round-haul" gear including purse seines, drum seines, lampara nets, and dip nets, they are also taken as bycatch in midwater trawls, pelagic trawls, gillnets, trammel nets, trolls, pots, hook-and-line, and jigs. Market squid are fished nocturnally using bright lights to attract the squid to the surface. They are pumped directly from the sea into the hold of the boat, or taken with an encircling net (PFMC 2005).

Most of the CPS commercial fleet is located in California, mainly in Los Angeles, Santa Barbara-Ventura, and, Monterey. About 75 percent of the market squid and Pacific sardine catch are exported, mainly to China, Australia (where they are used to feed farmed tuna), and Japan (where they are used as bait for longline fisheries).

The U.S. West Coast Fisheries for HMS covers 13 free-ranging species; 5 tuna - Pacific albacore, yellowfin, bigeye, skipjack, and northern bluefin; 5 sharks - common thresher, pelagic thresher, bigeye thresher, shortfin mako, and blue shark; 2 billfish - striped marlin and Pacific swordfish; and dorado (also known as dolphinfish and mahi-mahi) (Table 1-3) (PFMC 2006b). HMS have a wide geographic distribution, both inside and outside the EEZ. They are open-ocean, pelagic species, that may spend part of their life cycle in nearshore waters. HMS are harvested by U.S. commercial and recreational fishers and by foreign fishing fleets, with only a fraction of the total harvest taken within U.S. waters (PFMC 2006b). HMS are also an important component of the recreational sport fishery, especially in southern California.

The PFMC has developed stock rebuilding plans for seven overfished, depleted species; Bocaccio, Canary Rockfish, Cowcod, Darkblotched Rockfish, Pacific Ocean Perch, Widow Rockfish, and Yelloweye Rockfish (PFMC 2006d). Conservation Areas, closed to fishing, have also been established to protect sensitive Pacific Coast Groundfish habitat (Figure 1-6, from PMFC 2006a). Though not much bottom trawling is done south of Pt. Conception, bottom trawling and other bottom fishing activities are prohibited in Cowcod Conservation Areas (Figure 1-7, PMFC 2006a).

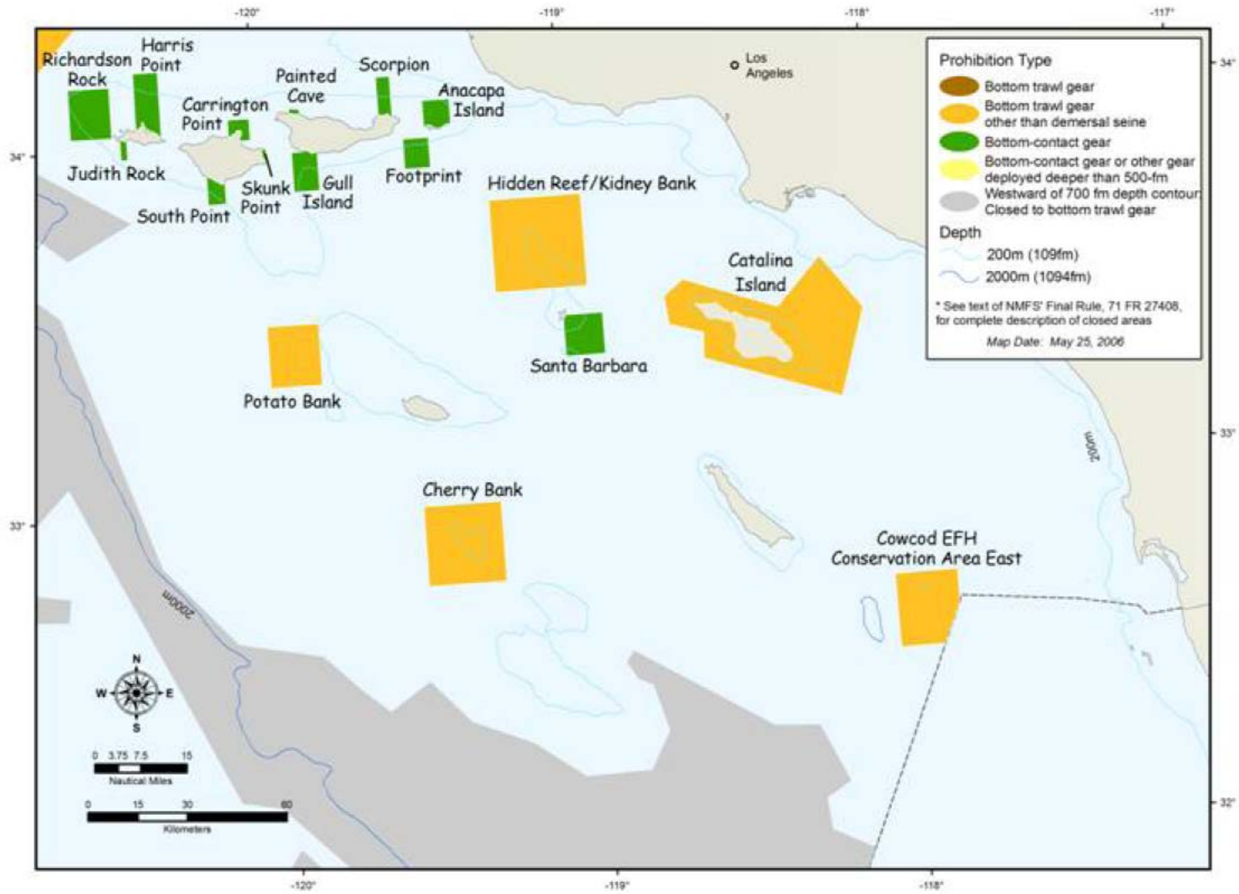

Figure 1-6: Essential Fish Habitat Conservation Areas

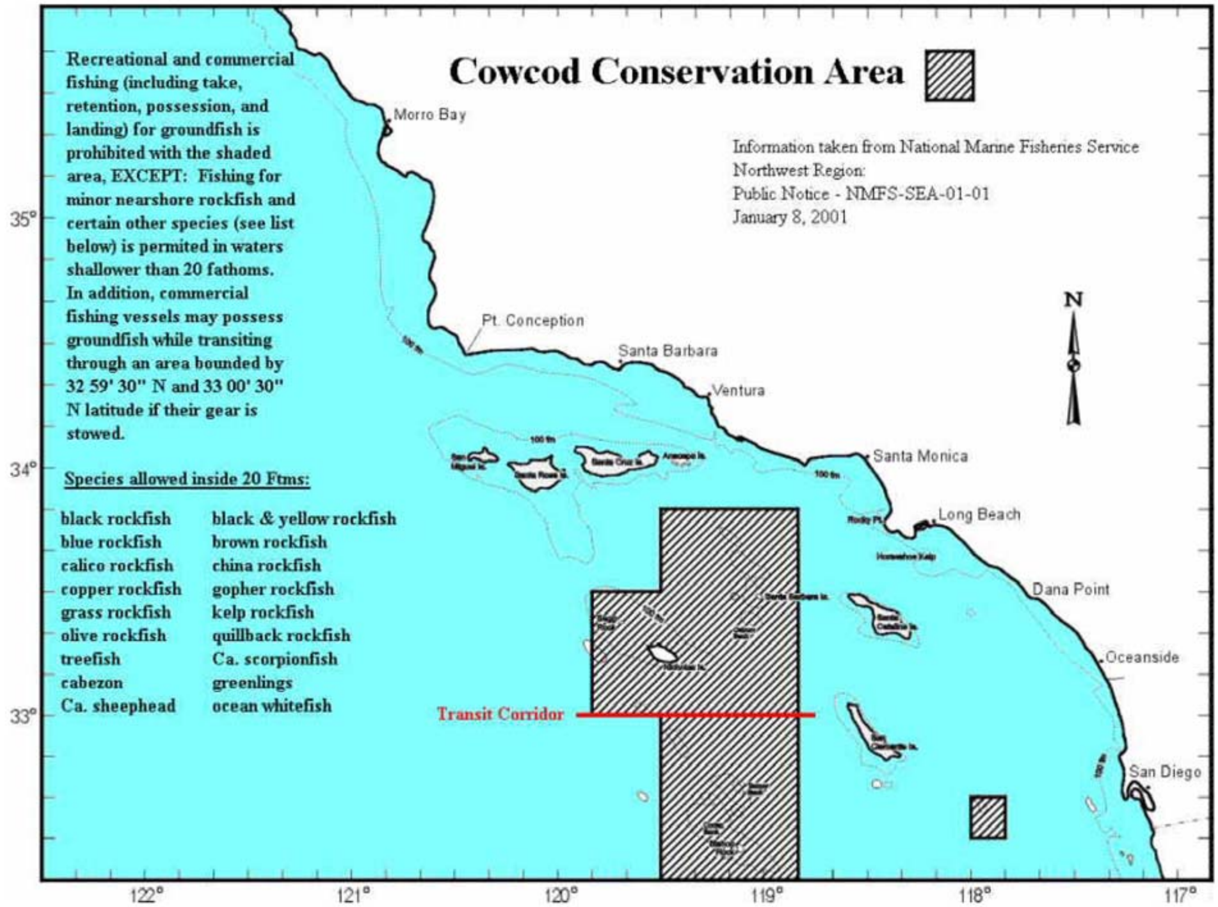

Figure 1-7: Cowcod Conservation Areas

Under the HMS FMP, the PFMC monitors other species for informational purposes. In addition, some species-including great white sharks, megamouth sharks, basking sharks, Pacific halibut, and Pacific salmon - are designated as prohibited catch. If fishers targeting highly migratory species catch these species, they are required to immediately release them (PFMC 2006b). The HMS fishery, with the exception of the swordfish drift gillnet fishery off California, is one of the only remaining open access fishery on the West Coast. However, the PFMC is currently considering a limited entry program to control excess capacity (PFMC 2006b).

Many different gear types are used to catch HMS in California (PFMC 2006b). These include; 1) <u>trolling lines</u> - fishing lines with jigs or live bait deployed from a moving boat, 2) <u>drift gillnets</u> - panels of netting weighted along the bottom and suspended vertically in the water by floats that are anchored to a vessel drifting along with the current, 3) <u>harpoon</u> - a small and diminishing fishery mainly targeting swordfish, 4) <u>pelagic longlines</u> - baited hooks on short lines attached to a horizontal line (the HMS FMP now prohibits West Coast longliners from fishing in the EEZ due to concerns about the take of endangered sea turtles), 5) <u>coastal purse seines</u> - encircling nets closed by synching line threaded through rings on the bottom of the net (usually targeting sardines, anchovies, and, mackerel but also target tuna where available), 6) <u>large purse seines</u> - used in major fisheries in the eastern tropical Pacific and the central and western Pacific (this fishery is monitored by the Inter-American Tropical Tuna Commission, and, in the EEZ by NMFS); and, 7) <u>recreational fisheries</u> - HMS recreational fishers in California include private vessels and charter vessels using hook-and-line to target tunas, sharks, billfish, and dorado (NMFS2006b).

Pacific halibut (*Hippoglossus stenolepis*) is managed by the International Pacific Halibut Commission (IPHC 2007). This large species of halibut is mainly encountered well north of the project area, and, its harvest is prohibited in the SOCAL Range Complex. A smaller relative, the California halibut (*Paralichthys californicus*), is found along the coast of southern California, but is not included in a FMP.

Although EFH mandates are stipulated in federal legislation, EFH habitat defined in FMPs includes state waters. These areas in California (i.e., inshore of 3 nm) are managed under the California Marine Life Management Act (CMLMA) (CDFG 2007c). Four California FMPs have been produced covering market squid, white seabass, nearshore finfish, and abalone (CDFG 2007d,e,f,g).

Market squid (*Loligo opalescens*), discussed previously under the Coastal Pelagics FMP, is the state's largest fishery by tonnage and economic value (CDFG 2007d). Market squid are also important to the recreational fishery as bait and as forage for fish, marine mammals, birds, and other marine life. Squid belong to the class Cephalopoda of the phylum Mollusca. They have large eyes and strong parrot-like beaks. Using their fins for swimming and jets of water from their funnel they are capable of rapid propulsion forward or backward. The squid's capacity for sustained swimming allows it to migrate long distances (CDFG 2007d).

White seabass (*Atractoscion nobilis*), large members of the croaker family, occur in ocean waters off the west coasts of California and Mexico. This highly-prized species is recovering from reduced population levels in late 1900s. The current, California management strategy provides for moderate harvests while protecting young white seabass and spawning adults through seasonal closures, gear provisions, and size and bag limits (CDFG 2007e).

The California Nearshore Fishery Management Plan (CDFG 2007f) covers 28 species that frequent kelp beds and reefs less than 120 ft (36 m) deep off the coast of California and near offshore islands (Table 1-10, from CDFG 2007f).

Table 1-10: Species Managed Under the California Nearshore Fisheries Management Plan

Kelp greenling - *Hexagrammos decagrammus*	Lingcod - *Ophiodon elongatus*
Pacific cod - *Gadus macrocephalus*	Pacific whiting - *Merluccius productus*
Sablefish - *Anoplopoma fimbria*	Black rockfish - *Sebastes melanops*
Black-and-yellow rockfish - *Sebastes chrysomelas*	Blue rockfish - *Sebastes mystinus*
Brown rockfish - *Sebastes auriculatus*	Cabezon - *Scorpaenichthys marmoratus*
Calico rockfish - *Sebastes dallii*	California rockfish - *Scorpena guttatta*
California sheephead – *Semicossyphus pulcher*	China rockfish - *Sebastes nebulosus*
Copper rockfish - *Sebastes caurinus*	Gopher rockfish - *Sebastes carnatus*
Kelp greenling – *Hexagrammos decagrammus*	Kelp rockfish - *Sebastes atrovirens*
Monkeyface prickleback – *Cebidichthys violaceus*	Olive rockfish - *Sebastes serranoides*
Quillback rockfish - *Sebastes maliger*	Rock greenling - *Hexagrammos lagocephalus*
Treefish - *Sebastes serriceps*	Vermilion rockfish - *Sebastes miniatus*
Widow rockfish - *Sebastes entomelas*	Yelloweye rockfish - *Sebastes ruberrimus*
Yellowmouth rockfish - *Sebastes reedi*	Yellowtail rockfish - *Sebastes flavidus*

Thirteen of these species are rockfish - all of which are included in the Pacific Groundfish FMP. Three of the remaining six species are also covered under the Pacific Groundfish FMP. The three species not covered by the Pacific Groundfish FMP are the California sheephead (*Semicossyphus pulcher*), the rock greenling (*Hexagrammos lagocephalus*), and the monkeyface prickleback (*Cebidichthys violaceus*) (CDFG 2007f).

The California sheephead is a large, colorful member of the wrasse family (Love 1996). Male sheephead reach a length of 3 ft (90 cm), a weight of 36 pounds (lb), and have a white chin, black head, and, a pink to red body. Females are smaller, with a brown-colored body (Eschmeyer, Herald, and Hammann 1985). Sheephead populations off southern California have declined because of fishing pressure. Large males are now rare because they are sought by recreational spear fishermen. Sheephead are taken commercially by traps and kept alive for display in restaurant aquaria where patrons select a specific fish for preparation (Leet et al. 2001). The rock greenling is a smaller member of the lingcod family. The monkeyface prickleback, also called the monkeyface eel, is more closely related to rockfish than eels. Its elongate shape is an adaptation to living in cracks, crevices, and under boulders (Love 1996).

The Abalone Recovery and Management Plan (CDFG 2007g) provides a cohesive framework for the recovery of depleted abalone populations in southern California. All of California's abalone species are included in the plan: red abalone, *Haliotis rufescens*; green abalone, *H. fulgens*; pink abalone, *H. corrugata*; white abalone, *H. sorenseni*; pinto abalone, *H. kamtschatkana* (including *H.k. assimilis*); black abalone, *H. cracherodii*; and flat abalone, *H. walallensis*. A recovery and management plan for these species is needed to manage abalone fisheries and prevent further population declines throughout California, and to ensure that current and future populations will be sustainable.

The decline of abalone is due to a variety of factors, primarily commercial and recreational fishing, disease, and natural predation. The recovery of a near-extinct abalone predator, the sea otter, has further eliminated the possibility for an abalone fishery in most of central California. Withering syndrome, a lethal bacterial infection, has caused widespread decline among black abalone in the Channel Islands and along the central California coast. As nearshore abalone populations became depleted, fishermen traveled to more distant locations, until stocks in most areas had collapsed. Advances in diving technology also played a part in stock depletion. The advent of self-contained underwater breathing apparatus (SCUBA) in the mid-1900s gave birth to the recreational fishery in southern California, which placed even more pressure on a limited number of fishing areas.

Following stock collapse, the California Fish and Game Commission closed the southern California pink, green, and white abalone fisheries in 1996, and all abalone fishing south of San Francisco in early 1997. The southern abalone fishery was closed indefinitely with the passage of the Thompson bill (AB 663) in 1997. This bill created a moratorium on taking, possessing, or landing abalone for commercial or recreational purposes in ocean waters south of San Francisco, including all offshore islands.

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2 PROPOSED ACTION

2.1 SOCAL RANGE COMPLEX OPERATIONS

The Navy proposes to implement actions within the SOCAL Range Complex to: maintain baseline training and research, development, testing, and evaluation (RDT&E) operations at current levels; increase training and RDT&E operations from current levels as necessary to support Fleet readiness; accommodate mission requirements associated with force structure changes and introduction of new weapons and systems to the Fleet; and, implement enhanced range complex capabilities.

These actions potentially include: increased numbers of training operations of the types currently being conducted in the SOCAL Range Complex; expansion of the size and scope of amphibious landing training exercises in the SOCAL Ocean OPAREAS and at San Clemente Island (offshore and on land); conduct of operations on the planned extension of the Shallow Water Training Range (SWTR) in the offshore area of the SCI; development of additional Training Areas and Ranges (TARs) for Naval Special Warfare (NSW) training on the land areas of SCI; increase in Commercial Air Services support for Fleet Opposition Forces (OPFOR) and Electronic Combat (EC) Threat Training; construction and operation of a Shallow Water Mine Field in the offshore and near-shore areas of SCI; and, support of training for Littoral Combat Ship (LCS) warfare missions (including MIW, ASW, and SUW), MH-60R/S helicopter warfare mission areas (including MIW, ASW, SUW, and Combat Search and Rescue (CSAR)), and EA-18G Growler EC aircraft missions throughout the SOCAL Range Complex.

Military activities in SOCAL Range Complex occur (1) on the ocean surface, (2) under the ocean surface, (3) in the air, and (4) on land at SCI. For purposes of scheduling and managing these activities and the ranges, the Range Complex is divided into multiple components.

“W-291” is the Federal Aviation Administration (FAA) designation of the extensive Special Use Airspace (SUA) of the SOCAL Range Complex. This SUA extends from the ocean surface to 80,000 ft. mean sea level (MSL) and encompasses 113,000 nm^3 of airspace. The ocean area underlying the W-291 (i.e., 113,000 nm^3 of sea space) forms the majority of the ocean OPAREA of the SOCAL Range Complex. This OPAREA extends to the sea floor.

Within the area defined by the lateral bounds of W-291, the SOCAL Range Complex encompasses specialize range or training areas in the air, on the surface, or undersea. Depending on the intended use, these specialized range areas may encompass only airspace or may extend from the sea floor to 80,000 ft MSL. A designated air-to-air combat maneuver area is an example of specialized airspace-only range area. Range areas designated for helicopter training in ASW or submarine missile launches, for example, extend from the ocean floor to 80,000 ft. MSL.

The W-291 airspace and associated OPAREAs, including specialized range areas, are described in Table 2-1 and depicted in Figure 2-1. There are several OPAREAS in the SOCAL Range Complex that do not underlay W-291 (Table 2-2). These OPAREAS are used for ocean surface and subsurface training. Military aviation activities also occur in the SOCAL Range Complex outside of W-291. These aviation activities do not include use of live or non-explosive ordnance. For example, amphibious operations involving helicopters and carrier flight operations occur in the SOCAL Range Complex outside W-291.

Table 2-1: W-291 and Associated OPAREAs

Area Designation	Description
Warning Area (W-291)	W-291 is the largest component of SUA in the Navy inventory. It encompasses 113,000 nm^2 (387,500 km^2) located off of the southern California coastline (Figure 2-1), extending from the ocean surface to 80,000 ft above MSL. W-291 supports aviation training and RDT&E conducted by all aircraft in the Navy and Marine Corps inventories. Conventional ordnance use is permitted.
Tactical Maneuvering Areas (TMA) (Papa 1-8)	W-291 airspace includes eight TMAs (designated Papa 1-8) extending from 5,000 to 40,000 ft (1,524 to 12,192 m) MSL. Exercises conducted include Air Combat Maneuvering (ACM), air intercept control aerobatics, and AA gunnery. Conventional ordnance use is permitted.
Air Refueling Areas	W-291 airspace includes three areas which are designated for aerial refueling.
Class “E” airspace (Area Foxtrot)	W-291 airspace includes Class "E" airspace designated as Area Foxtrot, which is activated by the FAA for commercial aviation use as needed (such as during periods of inclement weather or when Lindbergh Field International Airport is utilizing Runway 09).
Fleet Training Area Hot (FLETA HOT)	FLETA HOT is an open ocean area that extends from the ocean bottom to 80,000 ft (24,384 m). The area is used for hazardous operations, primarily surface-to-air and air-to-air ordnance. Types of exercises conducted include AAW, ASW, underway training, and Independent Steaming Exercises (ISE). Conventional ordnance use is permitted.
Over-water parachute drop zones	Three parachute drop zones used by Navy and Marine Corps units are designated within the SOCAL Range Complex. Two of these (Neptune and Saint) lie within the bounds of W-291. One (Leon) lies between W-291 and Naval Base Coronado (NBC).
Missile Range 1 and 2 (MISR-1/MISR-2)	MISR-1 and MISR-2 are located about 60 nm (111 km) south and southwest of NBC, and extend from the ocean bottom up to 80,000 ft MSL. Exercises conducted include rocket and missile firing, ASW, carrier and submarine operations, Fleet training, ISE, and surface and air gunnery. Conventional ordnance use is permitted.
Northern Air Operating Area (NAOPA)	The NAOPA is located east of SCI and approximately 90 nm (167 km) west of NBC. It extends from the ocean bottom to 80,000 ft (24,384 m). Exercises in NAOPA include Fleet training, multi-unit exercises, and individual unit training. Conventional ordnance is use is permitted.
Electronic Warfare (EW) Range	The EW Range utilizes advanced technology to simulate electronic attacks on naval systems from sites on SCI. The range not is defined as a designated location. Rather it is defined by the electronic nature and extent of the training support it provides. The EW Range supports 50 types of electronic warfare training events for ships and aircraft operating in W-291 airspace and throughout the OPAREAS.
Kingfisher Training Range (KTR)	KTR is a 1-by-2 nm (1.85 x 3.7 km) area in the waters approximately 1 nm (1.85 km) offshore of SCI. The range provides training to surface warfare units in mine detection and avoidance. The range consists of mine-like shapes moored to the ocean bottom by cables.

Table 2-2: W-291 and Associated OPAREAs (cont'd)

Area Designation	Description
Laser Training Range (LTR)	LTRs 1 and 2 are offshore water ranges northwest and southwest of SCI, established to conduct over-the-water laser training and testing of the laser-guided Hellfire missile.
Mine Training Range (MTR)	Two MTRs and two mine laying areas are established in the nearshore areas of SCI. MTR-1 is the Castle Rock Mining Range off the northwestern coast of the island. MTR-2 is the Eel Point Mining Range off the midpoint of the southwestern side. In addition, mining training takes place in the China Point area, off the southwestern point of the island, and in the Pyramid Head area, off the island's southeastern tip. These ranges are used for training of aircrews in offensive mine laying by delivery of non-explosive mine shapes (no explosives) from aircraft.
OPAREA 3803	OPAREA 3803 is an area adjacent to SCI extending from the sea floor to 80,000 ft. Operations in OPAREA 3803 include aviation training and submarine training events during JTFEX and COMPTUEX. The SCI Underwater Range lies within OPAREA 3803.
San Clemente Island Underwater Range (SCIUR)	SCIUR is a 5-nm^2 (9.3-km^2) area northeast of SCI. The range is used for ASW training and RDT&E of undersea systems. The range contains six hydrophone arrays mounted on the sea floor that produce acoustic target signals.
Southern California ASW Range (SOAR)	SOAR is located offshore to the west of SCI. The underwater tracking range covers over 670 nm^2 (1,241 km^2), and consists of seven subareas. The range has the capability of providing three-dimensional underwater tracking of submarines, practice weapons, and targets with a set of 84 acoustic sensors (hydrophones) located on the sea floor. Communication with submarines is possible through use of an underwater telephone capability. SOAR supports various ASW training scenarios that involve air, surface, and subsurface units.
SOAR Variable Depth Sonar (VDS) No-Notice Area	The VDS area is used as an unscheduled and no-notice area for training with surface ships' sonar devices. The vertical dimensions are from the surface to a maximum depth of 400 ft (122 m). The VDS overlaps portions of the SOAR and the MINEX training range.
SOCAL Missile Range	SOCAL Missile Range is not a permanently designated area, but is invoked by the designation of portions of the ocean OPAREAS and W-291 airspace, as necessary, to support Fleet live-fire training missile exercises. The areas invoked vary, depending on the nature of the exercise, but generally are extensive areas over water south/southwest of SCI.
Fire Support Areas (FSAs) I and II.	FSAs are designated locations offshore of SCI for the maneuvering of naval surface ships firing guns into impact areas located on SCI. The offshore FSAs and onshore impact areas together are designated as the Shore Bombardment Area (SHOBA).

Table 2-3: Ocean OPAREAs Outside W-291

Ocean Area	Description
Advance Research Projects Agency (ARPA) Training Minefield	The ARPA Training Minefield lies within the Encinitas Naval Electronic Test Area (ENETA), and extends from the ocean bottom to the surface. Exercises conducted are mine detection and avoidance. Ordnance use is not permitted.
Encinitas Naval Electronic Test Area (ENETA)	The ENETA is located about 20 nm (37 km) northwest of NBC. The area extends from the ocean bottom up to 700 ft (213 m) MSL. Exercises conducted include Fleet training and ISE. Ordnance use is not permitted.
Helicopter Offshore Training Area (HCOTA)	Located in the ocean area off NBC, the HCOTA is divided into five “dipping areas” (designated A/B/C/D/E), and extends from the ocean bottom to 1,000 ft (305 m) MSL. This area is designed for ASW training for helicopters with dipping sonar. Ordnance use is not permitted.
San Pedro Channel Operating Area (SPCOA)	The SPCOA is an open ocean area about 60 nm (111 km) northwest of the NBC, extending to the vicinity of Santa Catalina Island, from the ocean floor to 1,000 ft (305 m) MSL. Exercises conducted here include Fleet training, mining, mine countermeasures, and ISE. Ordnance use is not permitted.
Western San Clemente Operating Area (WSCOA)	The WSCOA is located about 180 nm (333 km) west of NBC. It extends from the ocean floor to 5,000 ft (1,524 m) MSL. Exercises conducted include ISE and various Fleet training events. Ordnance use is not permitted.
Camp Pendleton Amphibious Assault Area (CPAAA) and Amphibious Vehicle Training Area (CPAVA)	CPAAA is an open ocean area located approximately 40 nm (74 km) northwest of NBC, used for amphibious operations. No live or non-explosive ordnance is authorized. CPAVA is an ocean area adjacent to the shoreline of Camp Pendleton used for near-shore amphibious vehicle and landing craft training. Ordnance use is not permitted.

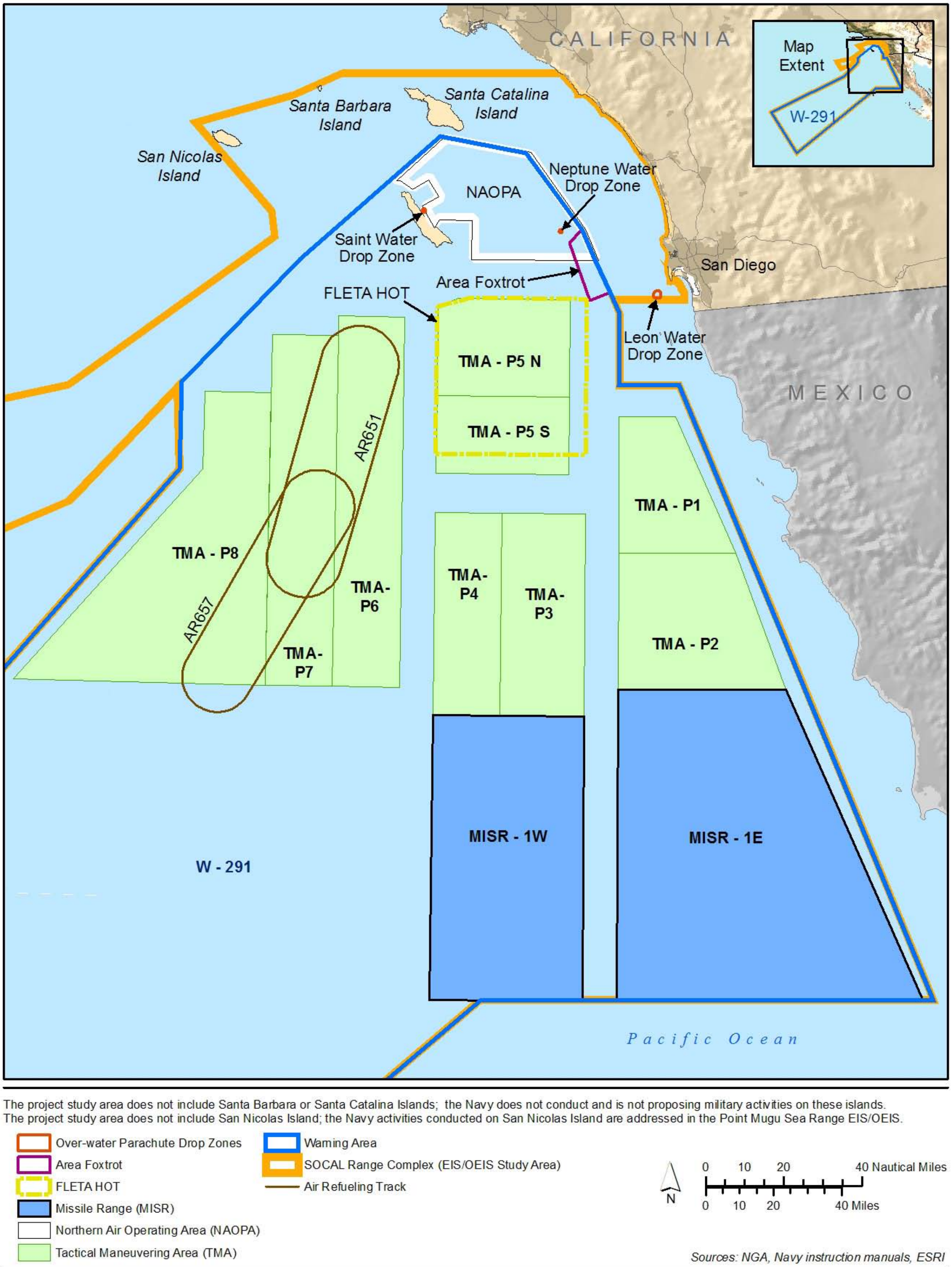

Figure 2-1: SOCAL Range Complex W-291 and Ocean OPAREAs

Table 2-4: San Clemente Island Areas

SCI Ranges	Description
SHOBA Impact Areas	SHOBA is the only range on the western coast of the United States that supports naval surface fire support training using on-the-ground spotters and surveyed targets. The southern one-third of SCI contains Impact Areas I and II, which comprise the onshore portion of SHOBA. (The offshore component provides designated locations [FSAs] for firing ships to maneuver.). The main training activities that occur in SHOBA are naval gun firing, artillery, and air-to-ground bombing. A variety of munitions, both live and non-explosive, are expended in SHOBA. NSW operations also occur in this area.
Naval Special Warfare Training Areas (SWATs)	SCI contains six SWATs. Each includes contiguous land and water areas. The land areas range in size from 100 to 4,400 acres [ac] (.4 to 18 km^2) and are used as ingress and egress to specific Training Areas and Ranges (TARs). Basic and advanced special operations training is conducted within these areas by Navy and Marine Corps units.
NSW Training Areas and Ranges (TARs)	A TAR is an area used for planning and scheduling purposes for specific types of training operations and range activities in the SCI. There are currently 22 TARs, designated as TARS 1-22. All the TARs contain land area, with the exception of two (TAR 7 and 8) which are water drop zones. Three TARs (2, 3, and 5) include beach and nearshore waters, while the rest cover land only. With the exception of the water drop zones, the TARs do not include airspace. TARs are generally small (1-800 ac) and are designed to support NSW training for "actions at the objective."
Assault Vehicle Maneuver Corridor (AVMC)	The AVMC encompasses three linked areas on SCI: • Assault Vehicle Maneuver Areas (AVMAs), and • Assault Vehicle Maneuver Road (AVMR) plus an AVMR Extension The AVMA accounts for four existing or planned areas for authorized off-road vehicle use. The AVMR is a dirt track that runs the length of the island to allow transit by tactical vehicles through areas that are restricted from off-road use by vehicles.
Artillery Firing Points (AFP) and Artillery Maneuver Points (AMP)	An AFP is a location from which artillery weapons such as the 155mm howitzer are positioned and used in live-fire employment of munitions. Guns are towed by trucks along primary roads, often in convoy with munitions trucks and HMMWVs. Two AFPs are being used at the current time: AFP 1 and AFP 6, both in SHOBA. An AMP is used for non-live fire training in emplacement and displacement of artillery weapons. SCI has four AMPs.
Infantry Operations Area	The Infantry Operations Area, generally located on either side of the AVMC, is on the upland plateau, which is designated for foot traffic by military units. No vehicles are authorized in the off-road areas. Specifically, this area is intended for use by Marine Corps small units during amphibious training events.
Old Airfield (VC-3)	The Old Airfield, called VC-3, located within TAR 15, is approximately 6 nm (11 km) from the northern end of the island. The presence of a number of buildings allows for training of forces in a semi-urban environment. It is suitable for small unit training by NSW and Marine Corps forces.
Missile Impact Range (MIR)	The MIR, located within TAR 16, is in the north-central portion of the island, just south of VC-3. It is situated at the ridge crest of the island's central plateau. The MIR is 3,200 by 1,000 ft (305 by 975 m) at an elevation of 1,000 ft (305 m) MSL. The MIR contains fixed targets, and is equipped with sophisticated instruments for recording the flight, impacts, and detonations of weapons. Weapons expended on the MIR include the Joint Standoff Weapon (JSOW) and the Tomahawk Land Attack Missile (TLAM).
Naval Auxiliary Landing Field (NALF)	The NALF, located at the northern end of the island, has a single runway of 9,300 ft (2,835 m) equipped with aircraft arresting gear.

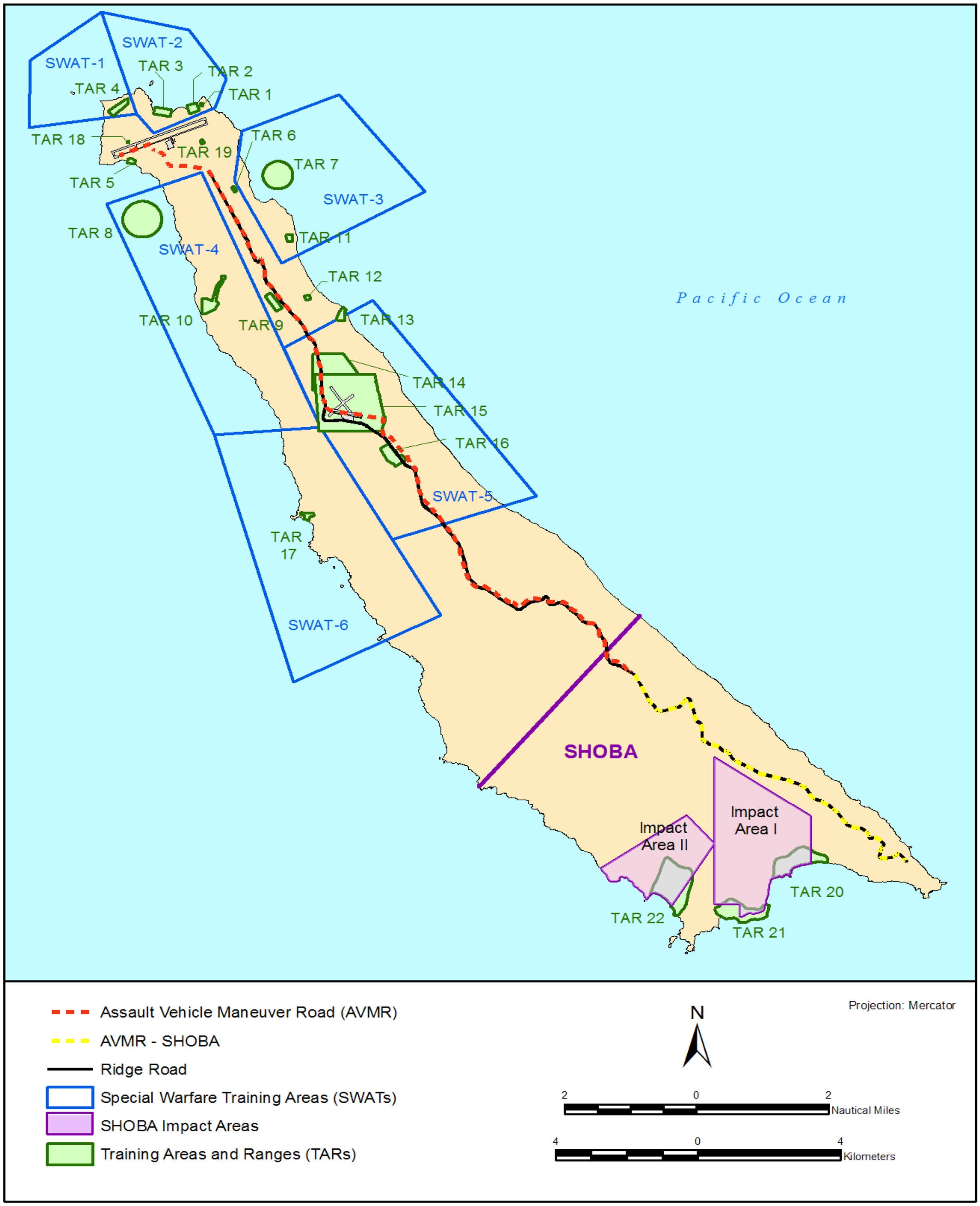

Figure 2-2: SCI Ranges: SWATs, TARs and SHOBA Impact Areas

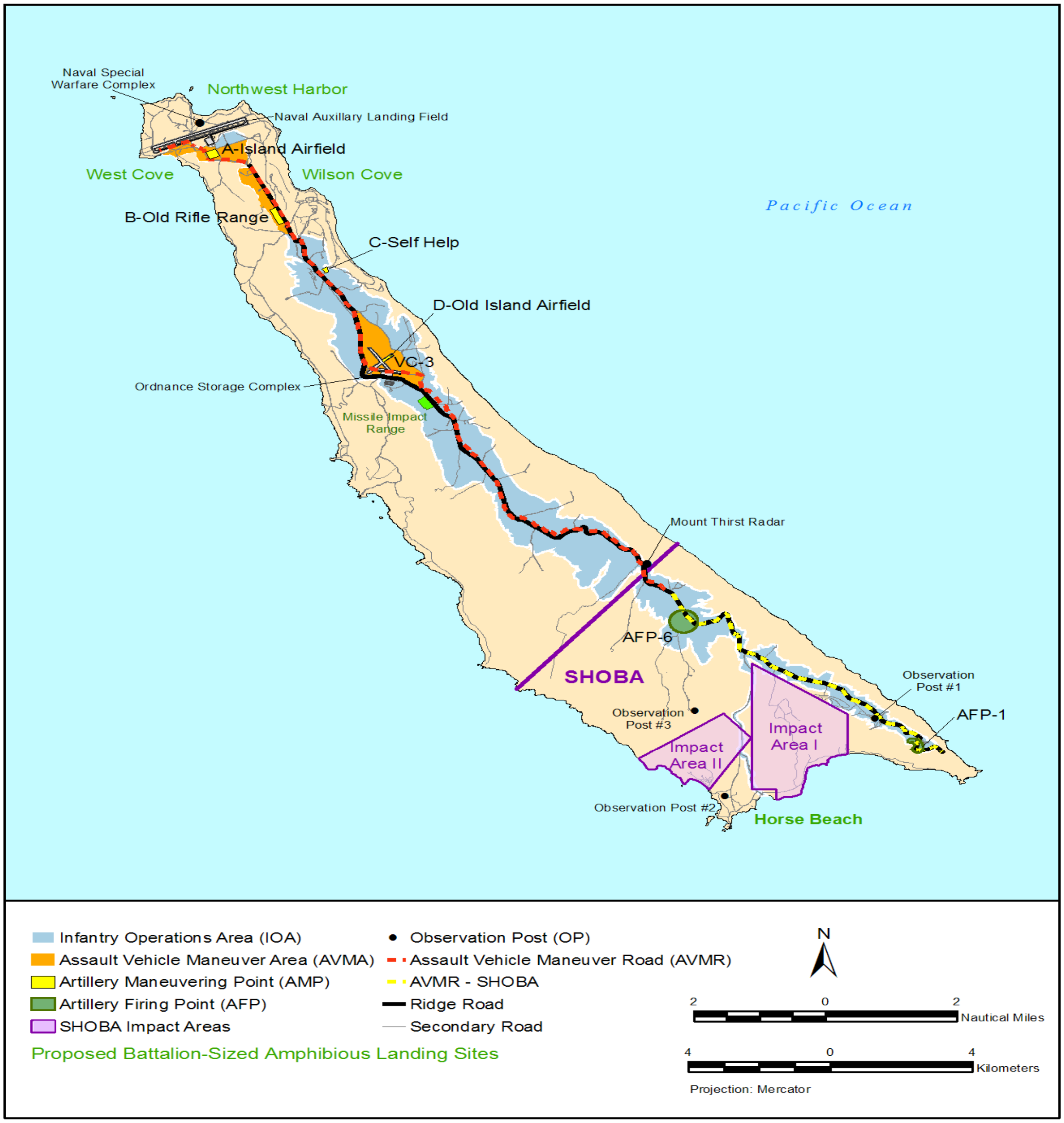

Figure 2-3: San Clemente Island Infantry, Artillery, and Vehicle Range Areas

All of San Clemente Island is dedicated to training and RDT&E activities, utilizing the several distinct ranges at SCI. These land ranges are described above in Table 2-3 and shown in Figures 2-2 and 2-3.

A component part of the SOCAL Range Complex, SCI provides a suite of land ranges and training areas that are integral to training of Pacific Fleet air, surface, and subsurface units; I MEF units; NSW units; and selected formal schools. SCI provides instrumented ranges, operating areas and associated facilities to conduct and evaluate a wide range of exercises within the scope of naval warfare. SCI also provides range areas and services to RDT&E activities. Over 20 Navy and Marine Corps commands conduct training and testing activities at SCI.

2.2 ALTERNATIVES

Three alternatives are analyzed in the SOCAL Range Complex EIS/OEIS: 1) The No Action Alternative – Current Operations; 2) Alternative 1 - Increase Operational Training and Accommodate Force Structure Changes, and 3) Alternative 2 – Increase Operational Training, Accommodate Force Structure Changes, and Implement Range Enhancements.

2.2.1 No-Action Alternative

The Navy has been operating in the SOCAL Range Complex for over 70 years. Under the No Action Alternative, training operations and major range events would continue at current levels. The SOCAL Range Complex would not accommodate an increase in training operations due to the requirements of the FRTP or proposed force structure changes, and it would not implement additional investments associated with the other alternatives. Evaluation of the No-Action Alternative provides a credible baseline for assessing environmental impacts of Alternative 1 and Alternative 2 (Preferred Alternative), as described below.

Operations currently conducted on the SOCAL Range Complex are described below by warfare mission area. Training activities in the SOCAL Range Complex vary from basic individual or unit level events of relatively short duration involving few participants to integrated major range training events such as JTFEX which may involve thousands of participants over several weeks.

Over the years, the tempo and types of operations have fluctuated within the SOCAL Range Complex, due to changing requirements, the dynamic nature of international events, the introduction of advances in warfighting doctrine and procedures, and force structure changes. The factors influencing tempo and types of operations are fluid in nature and will continue to cause fluctuations in training activities within the SOCAL Range Complex.

2.2.1.1 Description of Current Training Operations within the SOCAL Range Complex

2.2.1.1.1 Anti-Submarine Warfare Training

ASW training engages helicopter and sea control aircraft, ships, and submarines operating alone or in combination in training to detect, localize, and attack submarines. ASW training involves sophisticated training and simulation devices including underwater targets and sonobuoys which emit sound through the water. When the object of the exercise is to track the target but not attack it, the exercise is called a Tracking Exercise (TRACKEX). A Torpedo Exercise (TORPEX) takes the operation one step further, culminating in the release of an actual torpedo, which can be either running (EXTORP) or non-running (REXTORP). All torpedoes used in training are have non-explosive warheads. ASW training occurs in W-291 and all ocean operating areas of the SOCAL Range Complex. SOAR is designed specifically for ASW training, with underwater acoustic sensors and communications to allow for the monitoring of training activities and post-mission debriefing feedback to the participants.

2.2.1.1.2 Mine Warfare Training

MIW training includes Mine Countermeasures (MCM) Exercises and Mine Laying Exercises (MINEX). MCM training is currently conducted on the Kingfisher Range and offshore areas in the Tanner and Cortez Banks. MCM training engages ships' crews in the use of sonar for mine detection and avoidance, and minefield navigation and reporting. The proposed extension of the SOAR is intended for use in such training. MINEX events involve aircraft dropping non-explosive training shapes, and less frequently submarine mine laying. MINEX events are conducted on the MINEX Training Ranges in the Castle Rock, Eel Point, China Point, and Pyramid Head areas offshore of SCI.

2.2.1.1.3 Anti-Air Warfare Training

Surface-to-Air Gunnery Exercise (GUNEX S-A): GUNEX S-A exercises require air services to simulate a threat aircraft or missile towing a target to be fired upon by ship crews utilizing shipboard gun systems.

Air Defense Exercise (ADEX): ADEX is an exercise to train surface and air assets in coordination and tactics for defense of the strike group or other Naval Force from airborne threats.

Simulated Surface-to-Air Missile Exercise (MISSILEX-S): The MISSILEX-S is a non-firing event meeting training requirements for missile engagement of air threats up to the point of actual launch of a missile.

Simulated Air-to-Air Missile Exercise (AAMEX): AAMEXs are non-firing exercises, but may include activities such as air intercept control, where the final objective is to intercept and attack another aircraft.

Air Combat Maneuvers (ACM): ACM includes Basic Fighter Maneuvers (BFM) where aircraft engage in offensive and defensive maneuvering against each other. No ordnance is released during this exercise.

Missile Firing Exercises (MISSILEX): A MISSILEX is an operation in which missiles are fired from either aircraft or ships against aerial targets. Air-to-Air exercises involve a fighter or fighter/attack aircraft firing a missile at an aerial target. Aerial targets are typically launched, controlled, and recovered from SCI while firing operations usually take place in W-291. The preferred launch location for aerial-launched targets is south of SCI, with the hazard pattern extending over portions of the SOAR range.

2.2.1.1.4 Anti-Surface Warfare Training

Sinking Exercise (SINKEX): A SINKEX provides an opportunity for ship, submarine, and aircraft crews to deliver live ordnance on a deactivated vessel, which is deliberately sunk using multiple weapons systems. The duration of a SINKEX is unpredictable since it ends when the target sinks, sometimes immediately after the first weapon impact and sometimes only after multiple impacts by a variety of weapons. A SINKEX is conducted only occasionally, typically during a Joint Task Force Exercise (JTFEX), and is conducted under a permit from the U.S. Environmental Protection Agency (EPA).

Surface-to-Surface Gunnery Exercise (GUNEX): A GUNEX takes place in the open ocean to provide gunnery practice for ship crews utilizing shipboard gun systems. Exercises involve a variety of surface targets, both stationary and maneuverable.

Visit Board Search and Seizure (VBSS): These exercises involve the interception of a suspect surface ship by a Navy ship for the purpose of boarding-party inspection or the seizure of suspect ship.

Aircraft Laser Weapons Exercise—Sea: In these training events, helicopters or fighter/attack aircraft expend precision-guided munitions against maneuverable, high-speed, surface targets. Primary operations areas are Laser Training Ranges (LTRs) 1 and 2.

Airborne Surface Attack Exercises: This event involves conducting attacks on surface vessels from naval aircraft. It involves pairs of FA-18, MH-60, or P-3 aircraft delivering ordnance against towed targets.

Surface Firing Exercise: These operations train surface ship crews in high-speed surface engagement procedures against mobile (towed or self-propelled) seaborne targets. Both live and non-explosive training rounds are used against the targets.

2.2.1.1.5 Electronic Combat Training

Electronic combat operations are conducted in offshore areas and on the Electronic Warfare (EW) Range at the SCIR. Offshore events generally consist of electronic threat simulation and jamming services that are provided to surface ships. Appropriately configured aircraft fly threat profiles against the ships so that crews are trained to detect electronic signatures of various threat aircraft counter jamming of their own electronic equipment by the simulated threat. The EW Range provides air, surface, and subsurface units with operating experience in a dense electronic threat environment similar to what they would face in an actual combat theater. Electronic signals emanate primarily from the Range Electronic Warfare Simulator (REWS), in the north part of SHOBA. Typical EW activities include threat avoidance training, signals analysis, use of airborne and surface electronic jamming devices to defeat tracking radar systems, and the firing of very small simulated surface-to-air missiles (called Smokey SAMs).

2.2.1.1.6 Naval Special Warfare Training

NSW forces (SEALs and Special Boat Units [SBUs]) train to conduct military operations in five Special Operations mission areas: unconventional warfare, direct action, special reconnaissance, foreign internal defense, and counterterrorism. Specific training events include:

Insertion/Extraction: NSW personnel conduct insertion/extraction operations including parachute training of personnel, rubber boats, and equipment, within the Leon Water Drop Zone and in transit to San Clemente Island.

Gunnery Exercises (GUNEX): GUNEX is primarily a ground operation involving an amphibious landing, ground maneuver, live-fire and demolition training by a Marine Corps special operations or NSW units. This category also includes boat-to-shore and boat-to-boat gunnery. Demolition training can be either on land or underwater. A typical GUNEX is a NSW mission conducted against an objective in SHOBA, usually at night, using small arms live-fire and demolitions charges

Basic Training—BUD/S: BUD/S individual training is conducted by the NSW Center. A portion of this training occurs on SCI, including land and underwater demolition, small arms training.

UAV Training: NSW forces train on SCI with UAVs, which provide remotely-piloted aerial reconnaissance.

Other NSW Training Events: NSW training, primarily conducted on SCI, includes: the SEAL Weapons Systems (SWS) course, which provides training in a wide range of underwater and land demolitions; the Special Warfare Combatant Crew (SWCC) course, Seal Qualification Training; and a variety of operational training events for SEAL units and SBUs.

2.2.1.1.7 Amphibious Warfare Training

Amphibious Warfare training includes individual and crew, small unit, large unit, and MAGTF-level events. Individual and crew training includes operation of amphibious vehicles and naval gunfire support training. Small unit training operations include events leading to the certification of a MEU as “Special Operations Capable” (SOC). Such training includes shore assaults, boat raids, airfield or port seizures, and reconnaissance. Larger-scale amphibious exercises are carried out principally by MAGTFs or elements of MAGTFs embarked with ESGs; these include:

Naval Surface Fire Support (FIREX) and Expeditionary Firing Exercise (EFEX): These exercises are required pre-deployment training events, conducted in SHOBA. EFEX is conducted by Marine forces in conjunction with a Fire Support Coordination Center Exercise (FSCEX). The EFEX involves coordination of naval gunfire from surface ships with land-based artillery and CAS. The naval gunfire component trains surface ships in land bombardment, and is known as a FIREX. Amphibious landings operations may be associated with these events. A typical operation involves landing an artillery battery (truck-towed 155mm howitzers) on SCI for live-fire training.

Air Strikes and Close Air Support (CAS): Air strikes are aircraft or missile attacks of ground targets that are located in SHOBA’s Impact Areas I and II. The operations can originate from an aircraft carrier or land bases. CAS operations are air strikes that are integrated with the fire and maneuver of ground forces.

Aircraft Laser Weapons Exercise—Land: These operations train aircrews in the delivery of laser-guided weapons against targets in SHOBA.

Stinger Air-Defense Missile Firing: The Stinger is a small shoulder-fired or vehicle mounted anti-aircraft missile utilized by Marine and NSW forces. Training is conducted from positions on-shore in SHOBA, or by NSW units firing the missiles from boats in the near-shore area.

2.2.1.1.8 Explosive Ordnance Disposal Activities

EOD operations are conducted on SCI, primarily in SHOBA and the Missile Impact Range. These operations consist of specially trained personnel conducting sweeps, inspections, and cleanup of Unexploded Ordnance (UXO).

2.2.1.1.9 Combat Search and Rescue

The CSAR operation is usually in conjunction with a larger COMPTUEX or other Fleet exercise. The purpose of the operation is to locate, protect, and evacuate downed aviation crew members from hostile territory. The operation can include reconnaissance aircraft to find the downed aircrew, helicopters to conduct the rescue, and fighter aircraft to perform CAS to protect both the downed aircrews and the rescue helicopters.

2.2.1.1.10 Research, Development, Testing & Evaluation

SPAWARSYSCEN (SSC Pacific) conducts RDT&E, engineering, and Fleet support for command, control, and communications systems and ocean surveillance. SSC Pacific's tests on SCIR include a wide variety of ocean engineering, missile firings, torpedo testing, manned and unmanned submersibles, UAVs, EC, and other Navy weapons systems. Specific events include:

Ship Tracking and Torpedo Tests

Unmanned Underwater Vehicle (UUV) Tests

Sonobuoy Quality Assurance (QA)/Quality Control (QC) Tests

Ocean Engineering Tests

Marine Mammal Mine Shape Location and Research

Radio Frequency (RF) Tests

Unmanned Aerial Vehicles (UAV) Tests

Missile Flight Tests

2.2.1.1.11 Naval Undersea Warfare Center Acoustics Tests

The San Diego Division of Naval Undersea Warfare Center (NUWC) is a Naval Sea Systems Command (NAVSEA) organization supporting the Pacific Fleet. NUWC operates and maintains the SCI Underwater Range (SCIUR). NUWC conducts tests, analysis, and evaluation of submarine USW exercises and test programs. It also provides engineering and technical support for Undersea Warfare (USW) programs and exercises design cognizance of underwater weapons acoustic and tracking ranges and associated range equipment. It also provides proof testing and evaluation for underwater weapons, weapons systems, and components.

2.2.1.1.12 Naval Auxiliary Landing Field SCI Airfield Activities

Naval Auxiliary Landing Field (NALF) San Clemente Island (SCI) provides opportunities for aviation training and aircraft access to the island. The airfield is restricted to military aircraft and authorized contract flights. There are no permanently assigned aircraft, and aviation support is limited essentially to refueling. NALF SCI has the primary mission of training Naval Air Force Pacific aircrews in Field Carrier Landing Practice (FCLP). FCLP involves landing on a simulated aircraft carrier deck painted on the surface of the runway near its east end. Other military activities include visual and instrument approaches and departures, aircraft equipment calibration, survey and photo missions, range support, exercise training, RDT&E test support, medical evacuation, and supply and personnel flights.

2.2.1.1.13 Major Range Events

The SOCAL Range Complex hosts "major ranges events." These generally are "capstone" exercises, conducted as required milestones in the pre-deployment certification of naval strike groups, such as an ESG or CSG. Major range events bring together the elements of a naval strike group (e.g., surface combatant ships, support ships, submarines, fixed-wing and helicopter aviation squadrons, and Marine Corps forces) to training in complex command and control functions, and in coordination of the operations and activities of these component parts of the task force.

Major range exercises must be understood as part of a training continuum that includes individual and crew training, training of smaller formations, and complex, strike group training. In a major range event, most of the operations and activities being directed and coordinated by the strike group commander are identical in nature to the operations conducted in the course of individual, crew, and smaller-unit training events. In a major range event, however, these disparate training tasks are conducted in concert, rather than in isolation. Aspects of training that are unique to major range events involve the exercise of complex command, control, and logistics functions.

Major range events involve a large number of personnel, air, surface, subsurface, and ground assets in a multi-dimensional exercise. These exercises typically employ an exercise scenario developed to test and train the strike group in required naval tactical tasks. While exercise scenarios for different major range events will be similar, they will not be identical. Exercise scenarios would differ based on the strike group's mission and the operating environment it expects to encounter. Thus, a pre-deployment exercise for a CSG or ESG deploying to the western Pacific Ocean may differ from an exercise conducted by a similar strike group deploying to the Indian Ocean or the Arabian Sea.

Examples of major range events include the Composite Training Unit Exercise (COMPTUEX) and Joint Task Force Exercise (JTFEX). The COMPTUEX is an Integration Phase, at-sea, major range event. For the CSG, this exercise integrates the aircraft carrier and carrier air wing with surface and submarine units in a challenging operational environment. For the ESG, this exercise integrates amphibious ships with their associated air wing, surface ships, submarines, and Marine Expeditionary Unit (MEU). Live fire operations that may take place during COMPTUEX include long-range air strikes, Naval Surface Fire Support (NSFS), and surface-to-air, surface-to-surface, and air-to-surface missile exercises. The MEU also conducts realistic training based on anticipated operational requirements and to further develop the required coordination between Navy and Marine Corps forces. Special Operations training may also be integrated with the exercise scenario. The COMPTUEX is typically 21 days in length. The exercise is conducted in accordance with a schedule of events, which may include two 1-day, scenario-driven, "mini" battle problems, culminating with a scenario-driven 3-day Final Battle Problem.

The JTFEX is a dynamic and complex major range event that is the culminating exercise in the Sustainment Phase training for the CSGs and ESGs. For an ESG, the exercise incorporates an Amphibious Ready Group (ARG) Certification Exercise (ARG CERT) for the amphibious ships and a Special Operations Capable Certification (SOCCERT) for the MEU. When schedules align, the JTFEX may be conducted concurrently for an ESG and CSG. JTFEX emphasizes mission planning and effective execution by all primary and support warfare commanders, including command and control, surveillance, intelligence, logistics support, and the integration of tactical fires. JTFEXs are complex scenario-driven exercises that evaluate a strike group in all warfare areas. JTFEX is normally 10 days long, not including a 3-day in-port Force Protection Exercise, and is the final at-sea exercise for the CSG or ESG prior to deployment.

Table 2-4 identifies typical training operations conducted in the SOCAL Range Complex. This table also groups operations according to the location within the Complex where the operation is generally conducted.

Table 2-5: SOCAL Range Complex: Current Operations by Warfare Area and Location

Navy Warfare Area	No.	Operation Type	Short title	Areas
Anti-Air Warfare	**1**	Aircraft Combat Maneuvers	ACM	W-291 PAPA Areas
	2	Air Defense Exercise	ADEX	W-291
	3	Surface-to-Air Missile Exercise	A-A MISSILEX	W-291
	4	Surface-to-Air Gunnery Exercise	S-A MISSILEX	W-291
	5	Air-to-Air Missile Exercise	S-A GUNEX	FLETA HOT
Anti-Submarine Warfare	**6**	Antisubmarine Warfare Tracking Exercise - Helicopter	ASW TRACKEX - Helicopter	W-291/SOAR/USWTRs*
	7	Antisubmarine Warfare Tracking Exercise - Maritime Patrol Aircraft	ASW TRACKEX - MPA	W-291/SOAR/USWTRs*
	8	Antisubmarine Warfare Torpedo Exercise - Helicopter	ASW TORPEX - Helicopter	SOAR/USWTRs*
	9	Antisubmarine Warfare Torpedo Exercise - Maritime Patrol Aircraft	ASW TORPEX - MPA	SOAR/USWTRs*
	10	Antisubmarine Warfare Tracking Exercise - Surface	ASW TRACKEX - Surface	W-291/SOAR/USWTRs*
	11	Antisubmarine Warfare Torpedo Exercise - Surface	ASW TORPEX - Surface	SOAR/USWTRs*
	12	Surface Ship Integrated ASW (IAC II)	IAC II	SOAR/USWTRs
	13	Antisubmarine Warfare Torpedo Exercise - Submarine	ASW TORPEX - Sub	SOAR/USWTRs
Anti-Surface Warfare	**14**	Visit Board Search and Seizure	VBSS	W-291/3803, SOAR
	15	Air-to-Surface Missile Exercise	MISSILEX (A-S)	SOAR
	16	Air-to-Surface Bombing Exercise	BOMBEX (Sea)	SOAR
	17	Air-to-Surface Gunnery Exercise	GUNEX (A-S)	SOAR
	18	Surface-to-Surface Gunnery Exercise	GUNEX (S-S)	FLETA HOT/SOAR
	19	Sink Exercise	SINKEX	W-291
Amphibious Warfare	**20**	Naval Surface Fire Support	NSFS	SHOBA/SWTR Nearshore
	21	Expeditionary Fires Exercise	EFEX	SHOBA/SWTR Nearshore

Table 2-6: SOCAL Range Complex: Current Operations by Warfare Area and Location (cont'd)

Navy Warfare Area	No.	Operation Type	Short title	Areas
	22	Expeditionary Assault - Battalion Landing	BN Landing	SHOBA/SWTR Nearshore
	23	USMC Stinger Firing Exercise	Stinger	SHOBA
	24	Amphibious Landings and Raids (on SCI)	AMW Landings	West Cove, NW Harbor
	25	Amphibious Operations - CPAAA	AMW Operations	CPAAA
Electronic Warfare	**26**	Electronic Combat Operations	EC OPS	EW Range
Mine Warfare	**27a**	Small Object Avoidance	SOA	Kingfisher
	27b	Small Object Avoidance - USWTR	SOA/USWTR	SWTR OS
	28	Mine Neutralization	Mine Neutralization	
	29	Mine Laying	Mine Laying	MTRs/SWTRs
Naval Special Warfare	**30**	NSW Land Demolition	Land Demo	Demolition Range
	31	Underwater Demolition	Water Demo-sm	NW Harbor
	32	Underwater Mat Weave	Water Demo-lg	NW Harbor
	33	Small Arms Training	Small Arms	Small Arms Range
	34	Land Navigation	LANDNAV	Northern Half of SCI
	35	NSW UAV Operations	UAV	North of SHOBA
	36	Insertion/Extraction	Insert	Leon DZ
	37	NSW Boat Operations	NSW Boat Ops	All north of SHOBA
	38	NSW GRU ONE SEAL Platoon Operations	NSW Platoon Ops	All north of SHOBA
	39	NSW GUNEX Full Mission Profile	GUNEX (S-S)	SHOBA/SWTR Nearshore
Strike	**40**	Bombing Exercise (Land)	BOMBEX (Land)	SHOBA
	41	Combat Search & Rescue	CSAR	All SCI
Non-Combatant Operations	**42**	Explosive Ordnance Disposal SCI	EOD	SHOBA/MIR
SSC Pacific	**43**	Ship Torpedo Tests	Torp Tests	SOAR
	44	Unmanned Underwater Vehicles	UUV	NOTS Pier Area

Table 2-7: SOCAL Range Complex: Current Operations by Warfare Area and Location (cont'd)

Navy Warfare Area	No.	Operation Type	Short title	Areas
	45	Sonobuoy QA/QC Testing	Sonobuoy	SCIUR
	46	Ocean Engineering	Ocean Engineering	NOTS Pier Area
	47	Marine Mammal Mine Shape Location/Research	Mine Location	Mine Training Ranges/NOTS Pier
	48	RF Emissions	RF	Northern Plateau
	49	UAV Tests	UAV	Cancelled 7/20/05
	50	Missile Flight Tests	Missile Flight Tests	Entire Island
	51	Other Tests	Other	SOAR/SHOBA/Kingfisher
NUWC	**52**	NUWC Underwater Acoustics Testing	NUWC	SCIUR
Air Operations	**53**	NALF Airfield Activities	NALF	NALF San Clemente
Major Range Events	**NA**	Major Range Events (by reference)		
* There are two USWTR areas: Offshore (OS) and Nearshore (NS)				

2.2.2 Alternative 1

Alternative 1 is a proposal designed to meet Navy and DOD current and near-term operational training requirements. If Alternative 1 were to be selected, in addition to accommodating training operations currently conducted, the SOCAL Range Complex would support an increase in training operations including Major Range Events and force structure changes associated with introduction of new weapons systems, vessels, and aircraft into the Fleet. Under Alternative 1, baseline-training operations would be increased. In addition, training and operations associated with force structure changes would be implemented for new platforms and vehicles. Force structure changes associated with new weapons systems would include Offensive Mine Counter Measure (OMCM) systems.

2.2.2.1 Additional Operations

Table 2-5 identifies the baseline and proposed increases in operations in the SOCAL Range Complex if Alternative 1 is implemented.

2.2.2.2 Force Structure Changes

The SOCAL Range Complex is required to accommodate and support training with new ships, aircraft, and vehicles as they become operational in the Fleet. In addition, the SOCAL Range Complex is required to support training with new weapons/sensor systems. Several future platforms and weapons/sensor systems that are in development will likely be incorporated into the Navy and Marine Corps training requirement within the 10-year planning horizon. Several of these new technologies are in early stages of development, and thus specific concepts of operations, operating parameters, or training requirements are not available.

2.2.2.3 New Platforms/Vehicles

New platform/vehicles would include the Littoral Combat Ship (LCS), the MV-22 Osprey, the EA-18G Growler, the MH-60R Seahawk Multi-Mission Helicopter, the Aircraft Carrier USS CARL VINSON, the

P-8 Poseidon Multimission Maritime Aircraft, the LPD 17 San Antonio Class Amphibious Assault Ship, and the DDG 1000 Zumwalt Class Destroyer (see Chapter 2 of the EIS/OEIS for specific details).

2.2.2.4 New Weapons Systems

Under the proposed action, the only weapons system being introduced at this time that warrants evaluation in this EIS/OEIS are the Organic Mine Countermeasures Systems (OMCMs). Five OMCM airborne systems will be deployed by the MH-60R/S which include: AN/AQS-20 Sonar, mine detecting set; AN/AES-1 Airborne Laser Mine Detection System (ALMDS); Airborne Mine Neutralization System (AMNS); AN/ALQ-220 Organic Airborne and Surface Influence Sweep (OASIS); and AN/AWS-2 Rapid Airborne Mine Clearance System (RAMCIS). One OMCM System, the Remote Minehunting System (RMS), will be deployed from a surface ship. Another OMCM system, the Long-term Mine Reconnaissance System (LMRS), will be deployed from submarine.

2.2.3 Alternative 2

Alternative 2, if selected would implement all elements of Alternative 1 (accommodating training operations currently conducted; increase in training operations [including Major Range Events], and force structure changes). In addition, under Alternative 2: training operations of the types currently conducted would be increased over the levels identified in Alternative 1 (see Table 2-6) and, range enhancements would be implemented, to include an increase in Commercial Air Services, establishment of a shallow water minefield; and establishment of the shallow water training range in the SOAR extensions, as described below.

Alternative 2 is the preferred alternative.

2.2.3.1 SOCAL Range Complex Enhancements

Several specific investments and recommendations are required to optimize range capabilities to adequately support training for all missions and roles assigned to the SOCAL Range Complex. Investment recommendations are based on capability shortfalls (or gaps) and were assessed using the Navy and Marine Corps range required capabilities. Proposed enhancements that pertain to the SOCAL Range Complex are analyzed in the associated EIS/OEIS.

2.2.3.1.1 Commercial Air Services Increase

Under the proposed action, an increase in Commercial Air Services would be implemented. This is a Priority 1 investment because Fleet aircraft are no longer being funded to provide opposition forces (OPFOR) for the CSG and ESG exercises including major range events. In order to provide the required training for CSGs and ESGs, a corresponding increase in Commercial Air Services acting as OPFOR will be required. This would provide for an increase in the number of supersonic and subsonic aircraft within the SOCAL Range Complex. Implementation of the increase is necessary to mitigate for the loss of Fleet aircraft funding and to meet Navy RCD OPFOR requirements.

2.2.3.1.2 Shallow Water Minefield

The Navy plans to construct a shallow water minefield in the SOCAL Range Complex. Multiple site options off Tanner Bank, Cortes Bank, La Jolla and Point Loma have been identified with consideration being given to bathymetry and required capabilities. Of the five areas identified, an area known as Advanced Research Project Agency Training Minefield (ARPA) off La Jolla and historically used for shallow water submarine MCM training is the desired location for expanding MCM training.

Shallow water minefield support of submarine MCM training requires a depth of 250-420 feet, and a sandy bottom and flat contour in an area relatively free from high swells and waves. The size of the area should be a minimum of 2x2-nm and optimally 3x3-nm. Mine shapes would be approximately 500-700 yards apart and 30-35 inches in size, and would consist of a mix of recoverable/replaceable bottom shapes (~10 cylinders weighed down with cement) and moored shapes (~15 shapes, no bottom drilling required for mooring). Shapes would typically need maintenance or cleaning every two years. The MH-60S has similar requirements for shallow water minefield mine training shapes. A fixed shallow water minefield site is not a requirement for Organic Airborne Mine Counter Measures (OAMCM) training however a fixed site would see usage for non-explosive training.

Use of the shallow water minefield would include submarines, surface vessels, and helicopters utilizing a mix of mid to high-frequency navigation/mine detecting sonar systems that are either platform based or remotely operated. Airborne laser mine detection systems may also be used to locate surface, moored, and bottom mines. Once located, mine neutralization of permanent shapes by explosive shaped-charge, ordnance, or removal would be by simulation only.

2.2.3.1.3 Shallow Water Training Range Extension

This component of the Proposed Action is to instrument and use two extensions of the current SOAR, one 250-nm^2 area to the west in the area of the Tanner/Cortes Banks, and one 250-nm^2 between SOAR and the southern section of SCI. The instrumentation would be in the form of undersea cables and sensor nodes, which would constitute a SWTR portion of SOAR. The cables and sensors are similar to those that instrument the current deep-water range (SOAR). The combination of deep-water and shallow-water instrumentation provides range uninterrupted coverage of air, surface, and subsurface operations. The instrumented area would be connected to the shore via a single trunk cable.

Phased construction of the SWTR instrumentation array is planned. Construction is scheduled to take place in three increments that would occur over a projected 9-year period (i.e., each phase would take 3 years), beginning with an initial increment of 200 nm2 (370 km2), followed by another 200-nm2 (370-km2) increment, and a final increment of 100 nm2 (185 km2). Because of the size and operational requirements, this section of the range would only be used in a limited manner initially (for the first 3 to 6 years). The analysis conducted in this document addresses full usage of the range once construction has been completed. Before all three phases are complete, range use would be more limited than that described in this document; therefore, effects would be less than those predicted in this analysis.

3 RESOURCE ANALYSIS

Potential effects on EFH and Managed Species from SOCAL operations are described in the following section. The evaluation reflects determinations made in sections of the EIS/OEIS where impacts on the marine environment are quantified, specifically Sections: 3.1 Geology and Soils, 3.3 Hazardous Materials and Wastes, 3.4 Water Quality, 3.5 Acoustic Environment, 3.6 Marine Environment, 3.7 Fish, and 3.14 Socioeconomics (commercial and recreational fishing).

Effects on EFH and Managed Species could be associated with vessel movement, aircraft over-flight, expended materials, hazardous chemicals, detonation of explosive ordnance, weapons training, sensor testing, and sonar use. Navy operations could have direct and indirect effects on individual species, modify their habitats, or alter water quality. The EFH assessment focuses on activities and effects common to offshore operations, but also discusses individual exercises such as Expeditionary Assault, TORPEX, and SINKEX with unique aspects. Mitigation measures and cumulative impacts are described in the final two sections.

3.1 IMPACT DEFINITION

EFH regulations require analysis of potential impacts that could have an adverse effect on EFH and Managed Species (NMFS 2007a). Adverse effect is defined as any impact which reduces the quality and/or quantity of essential fish habitat (NMFS 2004a, b). Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (NMFS 2004a,b).

3.2 VESSEL MOVEMENT

Vessels performing training exercises in the SOCAL Range Complex are primarily large ocean going ships and submarines operating in waters greater than 328 ft (100 m) and small fast moving vessels. Large ocean going vessels (greater than 100 ft (30.4 m) in length) include a host of tactical military ships performing live firing, electronic monitoring, and avoidance maneuvering. Considering the complexity of the training operations and the required logistical mobilization and demobilization requirements, the majority of all ocean operations involve passive transit of vessels within the SOCAL Range Complex. Of the 4,102 ocean operations currently performed within the SOCAL Range Complex 3,000 are amphibious ocean operations. Other than amphibious operations the primary ocean operation components are surface to surface gunnery exercises (315 exercises), and surface to air gunnery exercises (262 exercises). Large ships operating in offshore waters move at approximately 20 knots at full speed but more often operate at significantly slower speeds while engaged in training activities.

Collisions with commercial and navy ships can injure or kill slow-moving marine animals. Most vulnerable are marine mammals and sea turtles that spend extended periods of time at the surface restoring oxygen levels after deep dives (e.g. Right Whale) (NMFS 2005c). Accordingly, the Navy has adopted protective measures to reduce the potential for collisions with surfaced marine animals. These include the use of lookouts trained to detect all objects on the surface of the water, and, reasonable and prudent actions to avoid the close interaction of Navy assets with marine mammals and sea turtles (DON 2007a,b,c,d). Marine fish are highly mobile and would likely sense approaching vessels and be able to avoid being struck (Chapman and Hawkins 1973, Acoustic Ecology 2007).

The noise from Navy vessels could affect fish behavior. However, Navy vessels are quiet compared to commercial vessels of comparable size. Bubble screens are commonly used to reduce propeller noise and other sound reduction mechanisms may be employed (Richardson et al. 1998).

Studies documenting behavioral responses of fish to vessels show that fish may exhibit avoidance responses to engine noise, sonar, depth finders, and fish finders (Jorgensen et al. 2004, Acoustic Ecology

2007). Avoidance reactions are quite variable depending on the type of fish, its life history stage, behavior, time of day, and the sound propagation characteristics of the water (Schwartz 1985). Misund (1997) found that fish ahead of a ship, that showed avoidance reactions, did so at ranges of 160 to 490 ft (50 to 350 m). When the vessel passed over them, some species of fish responded with sudden escape responses that included lateral avoidance and/or downward compression of the school.

The low-frequency sounds of large vessels or accelerating small vessels caused avoidance responses among herring (Chapman and Hawkins 1973). Avoidance ended within 10 seconds after the vessel departed. Twenty five percent of the fish groups habituated to the sound of the large vessel and 75 percent of the responsive fish groups habituated to the sound small boats.

Fish are capable of active avoidance so ship strikes would be a rare event. Behavioral impacts would be transient with return to normal behavior after a ship passes. SOCAL Range Complex vessel movement would not have an adverse effect on fish populations.

3.3 AIRCRAFT OVER-FLIGHT

Aircraft flyovers will be a routine event during training exercises. Most high-performance would fly at altitudes over 5,000 ft (1,524 m). However, aviation exercises can involve aircraft operating at low altitude (less than 1,500 ft (457 m)), at high speeds, for a brief periods, over relatively small areas in vicinity of practice targets. Otherwise, low-level flights are usually restricted to take-offs and landings, and flights by helicopters and observation aircraft.

Airborne sound from a low-flying airplanes or helicopters may be heard by marine animals at the surface or underwater but the acoustic intensity would not be likely to cause physical damage since sound does not transmit well from air to water (USAF 2002, DON 2007a,d).

The sounds from aircraft flying over the ocean could trigger startle responses and swimming away from the aircraft track in some sensitive species of fish in the upper portion of the water column. The primary factor causing abrupt movements of animals is engine noise, specifically changes in engine noise (Richardson et al.1995, Hain et al. 1999). Responses to aircraft noise would be within the range of normal behavior and highly transitory. Therefore, no significant effects on fish are expected.

Aircraft flown in warfare training areas may fly at supersonic speeds (i.e., speeds greater than the speed of sound). At supersonic speeds, air pressure waves combine and produce shock waves known as sonic booms. The penetration of sound pressure waves including sonic booms through an air/water interface is relatively inefficient (Yagla and Stiegler 2003, DON 2007b). Sonic booms would be infrequent and are not expected to have significant effects on marine life.

3.4 FUEL SPILLS

Fish could be harmed by petroleum hydrocarbons spilled as a result of ship or aircraft accidents and weapons and target use (DON 2007a,b,c,d). Oil and diesel fuel pose less risk than jet fuel which is particularly toxic. However, jet fuel floats on sea water and vaporizes quickly so it would not be likely to contact many fish. Assuming that an aerial target disintegrates on contact with the water, toxic components of the fuel would evaporate within several hours to days and/or be degraded by biogenic organisms (e.g., bacteria, phytoplankton, zooplankton) (NRC 1985). Small petro-chemical releases from weapons and targets would be spatially separated and occur at different times, even in areas of highest use (e.g., FLETA HOT and around San Clemente Island).

If a fuel spill occurs, the effects would be mitigated through compliance with standard spill-control responses and wildlife rescue procedures. Fuel dumping by aircraft rarely occurs. Department of the Navy (DON) aircrews are prohibited from dumping fuel below 6,000 ft (1,829 m), except in an emergency situation. Above 6,000 ft (1,829 m), the fuel has enough time to completely vaporize and dissipate and would therefore have a no effect on the sea below. Fuel spills should not be a significant hazard to EFH and Managed Species.

3.5 DISCHARGES FROM SHIPS

The International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) prohibits certain discharges of oil, garbage, and other substances from vessels. The MARPOL Convention and its Annexes are implemented by national legislation, including the Act to Prevent Pollution from Ships (APPS) (33 USC 1901 to 1915) and the Federal Water Pollution Control Act (FWPCA) (33 USC 1321 to 1322). These statutes are further implemented and amplified by DON and the Office of the Chief of Naval Operations Environmental and Natural Resources Program Manual (OPNAVINST 5090.1 series), which establishes US Navy policy, guidance, and requirements for the operation of US Navy vessels. The vessels operating on the SOCAL Range Complex would comply with the discharge requirements established in OPNAVINST 5090.1 (series), minimizing or eliminating potential impacts from the discharges of ships.

3.6 EXPENDED MATERIAL

Most weapons and devices used during training exercises would be removed at the conclusion of the exercises. However, some weapons and devices are unrecoverable. This equipment includes: lightsticks, flares, chaff, dye, markers, sensing devices such as sonobuoys and expendable bathythermographs, torpedo accessories, targets, and sunken vessels.

3.6.1 Lightsticks

Lightsticks are small, plastic chemiluminescent devices used as portable light sources during training and rescue operations after dark (United States Air Force (USAF) 1997, 2002). Lightsticks are also used by divers and commercial fishers to mark their fishing gear. Lightsticks contain two solutions which, when mixed together by breaking two small glass ampoules within the plastic casing, produce a light with little or no heat. Their chemical contents are not classified as hazardous waste, although hydrogen peroxide, one of the constituents, is an irritant to mammalian skin and mucous membranes at high concentrations. They do, however, contribute to the overall plastics load and could end up on beaches or in kelp beds.

The release of lightstick chemicals into the marine environment is unlikely since the housing is a tough, pliable plastic. If the lightstick casing were broken, either through degradation over time or by physical destruction, the enclosed small quantity of chemicals would disperse and be rapidly neutralized by sea water. There could be some risk of injury to marine animals if a lightstick, or sharp plastic or glass shards from a broken lightstick were ingested, although this would be a rare event given the relatively small number of lightsticks deployed and the low probability of breakage. Therefore, lightstick use would not result in significant adverse effects.

3.6.2 Flares

Flares are chemical candles that burn at high temperatures creating bright light (USAF 1997, 2002). The typical white light is produced by burning magnesium in an aluminum canister. Other colors of light may also be created by including other metals. Flares cast light at ranges of up to 3,000 ft (914 m) with burn times lasting from three to seven minutes. At the brightest point, the flare light is 0.46 foot-candles. For comparison, the sun at mid-day in summer registers 10,000 to 12,000 foot-candles.

A second type of flare provides infrared (IR) illumination. Unlike the magnesium burning flares which produce light in the visible spectrum, these IR lights have very long wavelengths and are used mainly to enhance night vision capabilities. Because the sun shines infrared light onto the Earth as well as visible light and ultraviolet light; infrared illumination would result in an insignificant adverse effect.

Flares are designed to burn completely (including the aluminum casing), thus reducing the amount of waste material that falls into the ocean. Toxicity of flare debris is not a significant concern because the primary material in flares, magnesium, is not highly toxic (Naval Research Laboratory (NRL) 1999). There have been no documented reports of wildlife consuming flare materials (USAF 2002). The probability of injury from falling dud flares and debris would be extremely remote. Only a small area would be affected by the occasional flare that is not extinguished before hitting the sea surface. The primary constituent of flares and illumination rounds is magnesium, which is nontoxic and occurs naturally in soils. Although impulse cartridges and squibs used in some flares contain chromium and lead, a screening health risk assessment concluded that they do not present a significant health risk in the environment in the quantities proposed to be used (NRL 1999).

Contact with marine flare debris would not cause injury to skin or eyes because exposure would be brief and the materials contained in spent flares are biologically non-explosive. Flares at night would be much brighter than natural moonlight but altered behavior of fish in areas illuminated by flares would be unlikely to have significant consequences, considering the limited duration (3-5 minutes) and extent of flare usage (3,000 ft). Thus, the use of flares would have negligible effect on fish populations and their habitat.

3.6.3 Chaff

Chaff is deployed to confuse radar tracking devices (USAF 2002). Chaff canisters burst in the air releasing millions of aluminum coated glass or silicon fibers. Chaff particles are very light and designed to remain airborne as long as possible. Depending on wind speed and direction, chaff particles may be distributed over a wide area. When finally reaching the water, they may remain suspended on the surface for a while before sinking (NRL 1997, DON 2007b).

A fish surfacing in an area where chaff has fallen on the ocean surface could have its skin covered with the particles (NRL 1999). However, it is unlikely that the concentration of chaff particles would be great enough to restrict mobility. As the animal submerges, the particles would either disperse into the water, or remain temporarily attached. Fish are unlikely to suffer physical effects from chaff lodging in their gills or ingesting toxic quantities of chaff (USAF 1997).

Eventually, chaff particles would sink or be carried away by currents. Ocean floor sediments are largely composed of silicates (crystalline solids such as quartz and feldspar make up a large percentage of the earth's crust). The ocean water is constantly exposed to these silicates. Likewise, aluminum is a natural component of the ocean environment, entering the water from sediments and through hydrothermal vents. So, the addition of small amounts of these chemicals from chaff would be unlikely to have an effect on water or sediment composition (NRL 1999). Effects of chaff on resident populations of fish are likely to be short-term and would not be expected to adversely affect EFH or Managed Species.

3.6.4 Dyes

During search and rescue training operations brightly-colored fluorescein dye may be deployed to provide visual reference (USAF 2002). The dye, contained in a small plastic bag, may be discharged from aircraft and surface vessels, or by divers. It may also be released at the end of a torpedo run to mark its location (DON 2005b). The dye rapidly disperses on contact with the water and is visible at very low concentrations. At dilute concentrations the dye is relatively non-explosive (USAF 2002). The associated plastic bags may remain on the surface of the water or sink to the bottom, causing a potential ingestion hazard. However, sea dye bags would be a small fraction of the total man-made plastic debris to which local fish are exposed (Kullenberg 1994, Ocean Conservancy 2007). Adverse effects on EFH and fish would not result from the deployment of tactical dyes because of the small amount of dye released, its rapid dissolution in water, and infrequent use.

3.6.5 Marine Markers

Marine markers that produce chemical flames and smoke are used in training exercises to mark a surface position on the ocean. The flame of a marine marker burns like a flare but also produces smoke. The light generated from the marker is bright enough to be seen up to three miles away in ideal conditions, but as with flares is much less intense than the sun. Smoke from marine markers would be rapidly diffused by air movement. The marker itself is not designed to be recovered and would eventually sink to the bottom with similar, minimal effects of flares.

3.6.6 Sonobuoys

Sonobuoys are expendable acoustic devices used to detect subsurface objects and targets. They are powered by seawater-activated batteries containing lead, copper, silver, magnesium, and/or lithium (DON 2005b, 2007b). Seawater enters the battery to activate it, and the battery then powers the deployment of the sonobuoy's flotation unit. Sonobuoys are deployed at the surface and in the water column.

All sonobuoys use a small, lithium-containing calculator-type battery to power the upper electronics unit. If the upper portion of the sonobuoy is lost to the seabed, these small lithium batteries are also lost. Active sonobuoys contain a larger battery pack in the lower electronics unit which also contains lithium – if the lower portion of the sonobuoy is lost to the seabed; these larger lithium battery packs become seabed debris.

If a sonobuoy were damaged, small concentrations of chemical components from the battery would enter the water but would be quickly diffused by the surrounding ocean water (DON 2005b). Modeling of the amount of lead, silver, and copper that could be released from damaged sonobuoys and batteries indicates compliance with EPA Ocean Water Quality Limits (see Water Quality Analysis, Section 3.4.4 of the EIS/OEIS).

Lead, copper, and silver are heavy, naturally-occurring metals, widely distributed in the marine environment. They have relatively low solubility in seawater and slow corrosion rates (D'Itri 1990). The slow rate at which metal components are corroded by seawater translates into slow release rates into the marine environment. Once the metal surfaces corrode, the rate of metal released would decline. Releases of chemical constituents from all metal and non-metal sonobuoy components would be further minimized as a result of natural encrustation of exposed surfaces. Therefore, corrosive components of the sonobuoy would not result in substantial degradation of marine water quality.

The majority of objects that fall to the sea floor become buried in the sediment. Metals like lead, copper, and silver will oxidize in the upper part of the sediment where bioturbation creates oxygen-rich conditions. Below this level, oxidation is less likely, and when leaching does occur, the metals tend to adsorb onto the particulate organic carbon in the sediments (Ankley 1996). Acid volatile sulphide is formed in anoxic zones and complexes with the metal ions in the porewater, rendering the metal relatively nontoxic and less subject to bioaccumulation. Metals can also form complexes with soluble ligands (both organic and inorganic) in pore water (Ankley 1996). Many of the heavier expendable objects are made of metal and tend to sink deeply into the anoxic layer of the sediments.

Magnesium naturally balances ocean pH and assists in normal biological functions of ocean organisms. Many species are equipped with the physiological capability to filter excess magnesium from their system. Lithium chloride can inhibit cell growth if an animal is exposed to high concentrations. However, relatively small amounts of battery chemicals would be released and they would be rapidly diluted by the surrounding sea water. The likelihood of a marine animal being exposed to concentrations great enough to cause damage is small, and little or no impact to marine life is expected.

Under the No Action Alternative, approximately 5,960 sonobuoys per year are planned to be used for training and Quality Assurance/Quality Control (QA/QC) testing (Section 3.3.3.2.1 of the EIS/OEIS). Approximately 3,180 sonobuoys would be used for QA/QC testing east of SCI in the San Clemente Island Underwater Range. Of the 3,180 sonobuoys, approximately 440 would be retrieved from the water to provide additional information about sonobuoy performance across a variety of conditions and sea states. The remainder of the sonobuoys would be used throughout the SOCAL RANGE COMPLEXs during training exercises. Using representative amounts of constituents found in sonobuoys, the total constituents deposited in the water were calculated. For the approximately 5,520 sonobuoys left in the SCIC, approximately 16,200 lb (7,360 kg) of materials would be released into the water.

Based on the known amounts of battery constituents, known battery life (eight hours), and known solubilities, maximum concentrations in seawater were estimated for lead and copper. The amount of lead released is based on a maximum amount of lead in the seawater cell of 0.9 lb (0.4 kg). Metallic lead is converted to lead ion in water. A concentration of 11 micrograms per liter (µg/L) (parts per billion [ppb]) was calculated for lead. The maximum concentration of copper in seawater from a cuprous thiocyanate seawater battery was estimated at 0.015 µg/L (DON 1993).

Lithium batteries, used only in active sonobuoys, consist of an exterior nickel-plated steel jacket containing sulfur dioxide (SO_2), lithium metal, carbon, acetonitrile, and lithium bromide. During battery operation, the lithium reacts with the SO_2 and forms lithium dioxide. The reaction proceeds nearly to completion once the cell is activated, so only a limited amount of reactants are present when the battery life terminates.

Based on estimates for the three types of batteries, marine water quality would not be substantially degraded by the release of metals from batteries (DON 1993). Other components that could affect marine water quality include the metal housing (nickel-plated steel coated with polyvinyl chloride plastic to reduce corrosion), lithium batteries, and internal wiring that, over time, could release chemical constituents into the water. Solid metal components of the sonobuoy are corroded by seawater at slow rates, which translates into slow release rates. Once the metal surfaces corrode, the rate of metal released into the environment would decrease.

About 0.7 ounces (20 grams) of lead solder are used in the internal wiring of each sonobuoy, and 15 ounces (425 grams) of lead are used for the transducer node and lead shot ballast. These lead sources are in the non-ionized metallic form of lead that is insoluble in water, so the lead shot and solder would not be released into the seawater. Various lead salts, such as $PbCl_2$, $PbCO_3$, and PbO H_2, would probably form eventually on the exposed metal surfaces, but these metal salts have very low solubilities: 9.9 grams/liter (g/L), 0.001 g/L, and 0.14 g/L, respectively (DON 1993).

All of the expendable materials would eventually sink to the bottom, but are unlikely to result in any physical impacts to the sea floor because they would sink into a soft bottom and eventually be covered by shifting sediments. Soft-bottom habitats are considered less sensitive than hard bottom habitats, and in such areas, the effects of debris would be minimal because the density of organisms and debris are low. Debris may also serve as a potential habitat or refuge for invertebrates and fish.

In summary, operations involving sonobuoys would result in the accumulation of scuttled sonobuoys on the ocean floor. However, because of the large area over which these sensors are deployed, the density would be quite low. Leaching of metals and chemicals from sonobuoys would have little potential for negative biological effects because of dilution by prevailing currents and low solubility/toxicity in the sediments. Expended sonobuoys eventually become encrusted and/or incorporated into the sediments by natural processes.

3.6.7 Expendable Bathythermographs

Operation of Naval vessels requires the routine determination of water temperature. This is done with an expendable bathythermograph (XBT) - a probe that measures temperature as it falls through the water. Data is relayed to the ship through a thin wire that unreels from the probe as it descends. The wire eventually breaks and the probe is lost (DON 2007a). XBTs do not use batteries and do not contain potentially hazardous materials.

With the exception of a chance encounter by a large marine animal as an XBT descends, it is unlikely that any sea life would ingest an XBT, due to its size and rapid decent. It is also unlikely that an XBT would collide with macroscopic sea life on arrival at the sea floor. The unreeled wire is too fragile to pose a threat of entanglement. Due to the benign nature of their operation and composition, XBTs are not expected to significantly affect marine fish or habitats.

3.6.8 Torpedo Accessories

Torpedo accessories include a control wires, flex hoses, ballast, and, protective nose covers, suspension bands, air stabilizers, and propeller baffles used with air-launched torpedoes. A single-strand control wire pays out from a torpedo as it moves through the water. At the end of a torpedo run, which can be several miles-long, the control wire is released from both the firing vessel and the torpedo to enable recovery of the torpedo. The long, thin-gauge copper wire sinks rapidly and settles on the ocean floor. Torpedoes use a flex hose to protect the control wire. It is also expended after completion of the torpedo run and sinks to the bottom. Practice torpedoes may have lead ballast, steel-jacketed lead ballast, or steel plates that are released to allow them to rise to the surface for retrieval. Air launched torpedoes have a variety of accessories that are expended, including protective nose covers, suspension bands, air stabilizers, and propeller baffles.

The copper wires, plastic flex hoses, ballast, and air-launch accessories left on the ocean bottom after torpedo exercises would not present a significant toxic hazard to marine life (DON 2005b). Encrustation by oxidation or by the growth of colonies of marine life (corals, barnacles, anemones, etc.) slows the rate of chemical diffusion into surrounding water. Over a period of years, torpedo accessories would degrade, corrode, become encrusted and/or be incorporated into the sediments.

Upon completion of a torpedo run, two lead ballast weights would be released. Because each ballast weighs 37 lb (16.8 kg), it would sink rapidly to the bottom and, in areas of soft bottoms, be buried in the sediments. Of the 228 torpedoes estimated for the No Action Alternative (Section 3.4.4.2.1 of the EIS/OEIS), about 150 would be non-running recoverable exercise torpedoes that do not drop ballast weights. The remaining 78 torpedoes would jettison their ballast weights. Therefore, 156 ballasts would be expended annually for ASW.

Lead (Pb) and lead compounds are designated as priority toxic pollutants pursuant to Section 304(a) of the CWA of 1977. The USEPA saltwater quality standard for lead is 8.1 µg/L, continuous, and 210 µg/L maximum concentration (65 Federal Register 31682). Lead is a minor constituent of seawater, with a background concentration of 0.02 to 0.4 µg/L (Section 3.4.4.2.1 of the EIS/OEIS).

The probability that the metallic lead of the ballast weights would mobilize into the sediment or water as lead ions is very low. First, the lead would be jacketed with steel, so the surface of the lead would not be exposed directly to the actions of seawater. Second, even if the lead were exposed, the general bottom conditions of slightly high pH and low oxygen content (i.e., a reducing environment) would prohibit the lead from ionizing. Finally, in areas of soft bottoms, the lead weight would be buried due to the velocity of its impact with the bottom. As a result, releases of soluble lead to bottom waters are expected to be negligible.

Lead has the potential to accumulate in bottom sediments, but the potential concentrations would be well below sediment quality criteria based on thresholds for negative biological effects (see Section 3.4 of the EIS/OEIS). By far the greatest amount of material is likely to be deposited in relatively non-explosive form, as the lead ballast weights that become encrusted with lead oxide and other salts and would be covered by the bottom sediments.

Analysis of possible adverse impact from expended torpedo accessories indicates minimal potential for effects to nearby organisms and no significant bioaccumulation in marine food webs (DON 2005b). Therefore, no adverse effect on the EFH or Managed Species is anticipated.

3.6.9 Targets

At sea targets are usually remotely operated airborne, surface or subsurface traveling units, most of which are designed to be recovered for reuse. A typical aerial target drone is powered by a jet fuel engine, generates radio frequency (RF) signals for tracking purposes, and is equipped with a parachute to allow recovery. There are also recoverable, remotely controlled target boats and underwater targets designed to simulate submarines. If severely damaged or displaced, targets may sink before they can be retrieved.

Targets could accidentally strike marine animals on the sea surface. However, given the large exercise area, few fish would suffer direct contact with targets.

Small concentrations of fuel from targets could enter the water and contaminate limited areas. This would occur in the open ocean away from sensitive EFH such as HAPCs. Target debris on the seafloor would gradually degrade, be overgrown by marine life, and/or be incorporated into the sediments.

Floating debris, such as Styrofoam, may be lost from target boats, but is non-explosive and either degrades over time, or washes ashore as flotsam. A few fish could die from contact or ingestion, but no adverse effect at the population level is anticipated.

3.6.10 Expendable Mobile Acoustic Torpedo Targets

Unlike torpedo targets that simulate submarines (that are recovered at the end of each run) expendable mobile acoustic torpedo targets (EMATTs) scuttle themselves and sink to the sea floor to be left in place. The EMATTs are unlikely to result in any physical impacts to the sea floor. They would sink into a soft bottom or would lie on a hard bottom, where they may provide a substrate for benthic colonization or eventually be covered by shifting sediments. Solid metal components are corroded by seawater at slow rates. Natural encrustation of exposed surfaces would eventually occur as invertebrates grow on the surfaces of the sunken objects. As the exterior becomes progressively more encrusted, the rates at which the metals will dissolve into the surrounding water will also decrease. Rates of deterioration would vary, depending on material and conditions in the immediate marine and benthic environment. Factors such as oxygen content, salinity, temperature and pH all contribute to the manner and speed at which metals will dissolve. Over a period of years, the EMATTs would degrade, corrode, and become encrusted or incorporated into the sediments, thus precluding adverse effects on EFH and Managed Species.

3.6.11 Acoustic Device Countermeasures

Submarines launch acoustic device countermeasures (ADCs) to foil opponents' sensors and weapons. ADCs are the size of small torpedoes and emit acoustic and electro-magnetic signals, which could be detected by elasmobranches (sharks, skates and rays) which can sense the electromagnetic potential from the muscle movements of prey. ADCs are expendable and not normally retrieved. Impacts of their operation and the consequences of their ocean disposal are similar to other expended material. Thus, resulting in no significant impact to EFH or managed species.

3.6.12 Sunken Vessels

During sinking exercises (SINKEXs), ordnance is fired at vessels that subsequently sink. The targets are primarily decommissioned naval vessels, such as former amphibious assault ships, destroyers, and frigates. They are empty, cleaned, and, environmentally remediated to U.S. EPA specifications (DON 2006a).

Materials expended during a SINKEX would be primarily metal from the target vessel and shell fragments that quickly settle to the bottom. Sinking debris would not include lines, rope, plastic, or other material with potential to ensnare or entangle marine animals (see Section 3.6.13). Because SINKEXs would not take place in the same location, expended material would be spread over a wide ocean area.

The vessels themselves would settle to the bottom eliminating the marine habitat directly underneath and altering the nature of the environment in the immediate vicinity. However, they would add vertical relief and protected niches especially on sedimentary bottoms and thus act as an artificial reef, enhancing habitat quality.

Only minimal concentrations of hazardous chemicals have been detected in water and sediments around Navy ships that were sunk to create artificial reefs (SPAWAR 2006). Chemical contaminants in fish and invertebrate tissues around sunken Navy vessels have also been analyzed. Johnston et al. (2005) reviewed data and studies on natural reefs, Navy vessel reefs, and other artificial reefs off of the South Carolina coast. Tissues samples in reef fish and invertebrates in proximity to Navy vessel reefs showed chemical concentrations below known effects levels and a risk assessment concluded that there was minimal threat of bioaccumulation by higher food chain predators (dolphins, fish eating birds, diving birds) feeding in the area.

The limited number of SINKEXs would not be expected to have adverse effects on EFH and Managed Species.

3.6.13 Entanglement

Entanglement in man-made debris is an increasing source of injury and mortality to marine animals throughout the world (Kullenberg 1999). Although most incidents are related to commercial fishing operations (Ocean Conservancy 2007), fish in the SOCAL Range Complex may be exposed to Navy expended material that poses a risk of entanglement. Flare and sonobuoy parachutes, aerial target parachutes, and torpedo control wires and flex hoses are the primary sources of potential entanglement in related to training in the SOCAL Range Complex. Entanglement could cause tissue damage, strangulation, or drowning.

Aerial target parachutes are large and usually recovered during normal operations. The small, expendable parachutes that may be used with flares and sonobuoys are made of non-toxic material, but pose a risk of entanglement as they float on the ocean surface, sink through the water column, or lie on the sea floor. The limited number of parachutes expended during SOCAL Range Complex training operations would be scattered across a large area and should not have a substantial effect on critical habitats or fish assemblages.

Discarded torpedo control wires could snare marine life as they sink or rest on the bottom. The wire has a low breaking strength (40 lb (18 kg) (DON 2004a), but still could pose a potential threat if the wire loops or tangles. However, the wire is more rigid than materials like rope or fishing line which tend to loop and coil in the water. Instead, as the torpedo moves through the water, it leaves the copper wire in a relatively straight line, and the wire continues to fall in this form. The real danger comes from an animal becoming wrapped in the wire and the wire tightening, but because the fall to the ocean floor is essentially a straight line, the threat for looping and tangling is small. Thus, control wires are unlikely to pose significant threat to fish. Discarded flex hose could also present a threat. But, like control wire, it would be unlikely to loop and tangle. So, the discarded torpedo control wires and flex hoses are not likely to pose a significant risk of entanglement to marine life.

3.6.14 Hazardous Chemicals

Expended material would introduce small amounts of potentially hazardous chemicals into the marine environment. The water quality analysis of current and proposed operations indicates that concentrations of constituents of concern associated with material expended in the SOCAL Range Complex are well below water quality criteria established to protect aquatic life (see EIS/OEIS Section 3.4, Water Quality). This should adequately protect for EFH and Managed Species and avoid adverse effects.

3.6.15 Summary

Based on the analysis presented in Section 3.3.3.3.1 of the EIS/OEIS, approximately 50,000 pounds (23,000 kg) per year, or more, of hazardous constituents would be deposited in SOCAL RANGE COMPLEXs as a result of Navy training activities. In the aggregate, these materials would have adverse effects on EFH and Managed Species. However, these adverse effects would be minimal and temporary. Distributed over the approximately 120,000 nm^2 of this area, the density of discarded hazardous materials would be less than a pound per year per nm^2.

A total of about 1.7 million training items would be expended under the No-Action Alternative (see Table 3.2-1, EIS/OEIS). These expended training items would have an adverse effect on EFH and Managed Species. However, these effects would be minimal and temporary. For an ocean floor area of 120,000 nm^2 (222,000 km^2), this would be 14 items per nm^2 (8 items per km^2). Over the entire period of military training, assuming the same amounts of training materials would be used annually for 20 years, the aggregate density of debris on the ocean floor would be 280 items per nm^2 (20 items per km^2). This would be about one item per 3 acres (1.2 hectares) of bottom habitat. At this density, training debris should have no discernable effect on EFH and Managed Species.

3.7 RADIO FREQUENCY EMISSIONS

Aircraft, surface ships, and land-based centers use radio frequency (RF) emissions to transmit data, track targets, and communicate with other personnel. Biological effects of high intensity, long-duration exposure to RF emissions include deep tissue heating, degradation of eye faculties, damage to reproductive organs, and, changes in behavior (DON 2007a, b). Unlike sonar which has the potential to affect marine animals because it propagates well in sea water, RF wavelengths are shorter and quickly attenuate. There would be no or minimal impact on fish since exposure to high intensity RF emissions for a sustained period of time would not occur.

3.8 SOUND GENERATING DEVICES

Aviation exercises include the use of Long Range Acoustic Devices (LRADs). These devices emit a sound within the hearing threshold of humans loud enough to cause hearing loss. The 33-inch wide beam of sound is used for only a few seconds to drive enemy personnel out from ships. This short duration results in annoyance, with no permanent hearing damage to personnel (DON 2007a). Impacts on fish in the vicinity of LRAD transmissions are unlikely because the sound is not sustained and is inefficiently transmitted through the air/water interface.

3.9 LASERS

Lasers are used to guide missiles and other munitions to their targets. Lasers are not pointed toward aircraft, ships, personnel, or at the water. Thus, marine life in the water would not be illuminated by laser beams and there should be no impact on EFH or Managed Species.

3.10 UNDERWATER DETONATIONS

Underwater detonations (UNDETs) during SOCAL Range Complex operations would be associated with Naval Special Warfare (NSW) training and with testing and use of the Improved Extended Echo Ranging (IEER) Sonobuoy. Navy SEAL Basic Underwater Demolitions courses and SEAL platoon training exercises involve a variety of single and multiple charge detonations. The IEER sonobuoy uses a ribbon charge that detonates in the water column. Navy SEAL underwater detonations take place in shallow water. IEER sonobuoy testing and use is conducted in deeper water.

Potential effects of explosive charge detonations on fish and EFH include: 1) disruption of habitat, 2) exposure to chemical by-products, 3) disturbance, injury, or death from the shock (pressure) wave, 4) acoustic impacts, and 5) indirect effects including those on prey species and other components of the food web.

3.10.1 Habitat Disruption

The underwater detonation of explosives may result in physical alteration of fish habitats (Wright and Hopky 1998). Live hard-bottom, artificial reefs, seagrass beds, and kelp beds harbor a wide variety of marine organisms (Cahoon et al. 1990). These habitats support productive biological assemblages and dense aggregations of fish (Thompson et al. 1999). The Navy selects UNDET areas to avoid these key habitats (DON 2005b). SOCAL Range Complex underwater detonations would only take place in waters overlying unconsolidated sediment. Thus, the cratering of soft-bottom seafloor is the only habitat disruption that would result.

Naval Special Warfare (NSW) forces (SEALs) conduct nearshore underwater demolition training at San Clemente Island in depths of 6 to 20 ft (2 to 6 m) at the Northwest Harbor area and at Horse Beach Cove. Detonations would include 5-lb (2.3-kg) C-4 blocks, 20-lb (9-kg) C-4 blocks, haversacks containing 20 lb (9 kg) of C-4, 4.6-lb (2-kg) limpet charges, a Mat Weave made from 10 MK-75 50-lb (23-kg) tubular charges, and an Obstacle Loading charge consisting of 16 haversacks each containing 20 lb (9 kg) of C-4.

Underwater detonations at San Clemente Island take place in areas of sandy bottom, which is not a sensitive habitat, nor are sensitive species present (see EIS/OEIS Sections 3.6 and 3.7). The explosions would disturb surface sediments and displace organisms living on and in the substrate, and in the overlying water column. Mobile species are expected to rapidly move back into the area following detonations, whereas sedentary species may or may not recover to previous abundances depending on the spatial overlap and time interval between detonations. The Marine Environment and Fish evaluations in the EIS/OEIS (Sections 3.6 and 3.7) conclude that impacts of UNDET would be less than significant. Turbidity increases following explosions would be brief, i.e., lasting a few minutes to a few hours, and not expected to extend a substantial distance away. The local sediments are coarse and would rapidly fall out of suspension or be dispersed by waves and currents. Effects on sediment-dwelling organisms, which are regularly exposed to high turbidity as a result of waves and currents, would be insignificant. Increased turbidity could temporarily decrease the foraging efficiency of fish, however, given the dynamic nature of the habitat and the grain size of the material, turbidity is expected to be minimal and localized. Detonation by-products are non-hazardous and would not degrade water quality (see following section, 3.10.2, Chemical By-products). Therefore, habitat disruption from NSW underwater demolition training would occur, but would be less than significant due to the minimized impact and the short duration of the effects.

3.10.2 Chemical By-products

Combustion products from the detonation of high explosives - CO, CO^2, H^2, H^2O, N^2, and NH^3 - are commonly found in sea water. The primary constituents that would be released from explosives training are nitroaromatic compounds such as trinitrotoluene (TNT), cyclonite (Royal Demolition Explosive or RDX), and octogen (High Melting Explosive or HMX) (URS et al. 2000). Initial concentrations of explosion by-products are not expected to be hazardous to marine life (DON 2001a) and would not accumulate in the training area because exercises are spread out over time and the chemicals will rapidly disperse in the ocean. Therefore, no adverse effects to EFH from chemical by-products of detonation would be expected.

3.10.3 Pressure Effects

An underwater explosion generates a shock wave that produces a sudden, intense change in local pressure as it passes through the water (DON 1998, DON 2001a). Pressure waves extend to a greater distance than other forms of energy produced by the explosion (i.e., heat and light) and are therefore the most likely source of negative impacts on marine life (Craig 2001, SIO 2005, DON 2006a).

The shock wave from an underwater explosion is lethal to fish at close range, causing massive organ and tissue damage and internal bleeding (Keevin and Hempen 1997). At greater distance from the detonation point, the extent of mortality or injury depends on a number of factors including fish size, body shape, orientation, and species (Wright 1982, Keevin and Hempen 1997). At the same distance from the source, larger fish are generally less susceptible to death or injury, elongated forms that are round in cross-section are less at risk than deep-bodied forms, and fish oriented sideways to the blast suffer the greatest impact (Yelverton et al. 1975, Wiley et al. 1981, O'Keefe and Young 1984a,b, Edds-Walton and Finneran 2006). Species with gas-filled organs have higher mortality than those without them (Goertner et al. 1994, CSA 2004).

Two aspects of the shock wave appear most responsible for injury and death to fish: the received peak pressure and the time required for the pressure to rise and decay (Dzwilewski and Fenton 2003). Higher peak pressure and abrupt rise and decay times are more likely to cause acute pathological effects (Wright and Hopky 1998). Rapidly oscillating pressure waves may rupture the kidney, liver, spleen, and sinus and cause venous hemorrhaging (Keevin and Hempen 1997). They can also generate bubbles in blood and other tissues, possibly causing embolism damage (Ketten 1998). Oscillating pressure waves may also burst gas-containing organs. The swim bladder, the gas-filled organ used by many pelagic fish to control buoyancy, is the primary site of damage from explosives (Yelverton et al. 1975, Wright 1982). Gas-filled fish swim bladders resonate at different frequencies than surrounding tissue and can be torn by rapid oscillation between high- and low-pressure waves. Swim bladders are a characteristic of bony fish and are not present in sharks and rays. However, hemorrhaging of the liver in sharks exposed to the shock waves from explosives could have deleterious effects on the buoyancy function provided by the livers of these species (Edds-Walton and Finneran 2006). Delayed lethality could result from the accumulation of sub-lethal injuries (DON 200a).

Studies that have documented fish killed during planned underwater explosions indicate that most fish that die do so within one to four hours, and almost all die within a day (Hubbs and Rechnizer 1952, Yelverton et al. 1975). Fitch and Young (1948) found that the type of fish killed changed when blasting was repeated at the same marine location within 24 hours of previous blasting. They observed that most fish killed on the second day were scavengers, presumably attracted by the victims of the previous day's blasts. However, fish collected during these types of studies have mostly been recovered floating on the waters surface. Gitschlag et al. (2000) collected both floating fish and those that were sinking or lying on the bottom after explosive removal of nine oil platforms in the northern Gulf of Mexico. They found that as few as 3% of the specimens killed during a blast may float to the surface. Other impediments to accurately characterizing the magnitude of fish kills included currents and winds that transported floating fish out of the sampling area and predation by seabirds or other fish.

There have been few studies of the impact of underwater explosions on early life stages of fish (eggs, larvae, juveniles). Fitch and Young (1948) reported the demise of larval anchovies exposed to underwater blasts off California, and Nix and Chapman (1985) found that anchovy and smelt larvae died following the detonation of buried charges. Similar to adult fish, the presence of a swim bladder contributes to shock wave-induced internal damage in larval and juvenile fish (Settle et al. 2002). Shock wave trauma to internal organs of larval Pinfish and Spot from shock waves was documented by Govoni et al. (2003). These were laboratory studies, however, and have not been verified in the field.

Data on the effects of underwater explosions on aquatic plants are extremely limited. The potential for injury and mortality to aquatic invertebrates from underwater blasts is a little better known (Keevin and Hempen 1997). These studies indicate that invertebrates are relatively insensitive to pressure-related damage from underwater explosions, perhaps because they lack gas-containing organs which have been implicated in internal damage and mortality in vertebrates.

The variety of environmental parameters and biological features that can modify the impact of underwater explosions complicates the effort to predict lethal effect ranges in the field (Wright 1982, Keevin and Hempen 1997). Predictive models have, however, been developed over the past three decades (Wiley et al. 1981, Goertner 1982, Young 1991). These are based on measurements of the pressure produced by underwater explosions at increasing distance from the detonation point (O'Keefe and Young 1984, Wright and Hopky 1998, Dzwilewski and Fenton 2003). Different types of explosive materials are normalized in effect range models by establishing an equivalent weight of TNT known as the "Net Explosive Weight" or "n.e.w.".

Young (1991) provides equations that allow estimation of the potential effect on swim bladder fish using a damage prediction method developed by Goertner (1982). Young's parameters include the size of the fish and its location relative to the explosive source, but are independent of environmental conditions (e.g., depth of fish and explosive shot frequency). An example of such model predictions is shown in Table 3-1 which lists estimated fish-effects ranges using Young's (1991) method for swim bladder fish exposed to a 60-lb explosion at depth of 10 ft (3.3 m). The 10% mortality range is the distance beyond which 90% of the fish present would be expected to survive. It is difficult to predict the range of more subtle effects causing injury but not mortality (CSA 2004).

Table 3-1: Estimated Fish-Effects Ranges for 60-lb NEW Underwater Explosion

Weight of Fish	10% Mortality Range	
	ft	m
1 oz	712	217
1 lb	496	151
30 lbs	319	97

Young's model for 90 percent fish survivability applies to simple explosives. However, several of the explosives used in the San Clemente Island NSW training have complicated configurations and blast parameters. Thus, impulse and effects were computed separately for the fish effects analysis in the EIS/OEIS (Section 3.7). In addition, Young's model was based on open, deep-water conditions, where blast effects are predicted more easily. Explosives used in the SOCAL Range Complex NSW training at SCI are detonated in shallow water, just off the shoreline. This restricts the effected area to a small nearshore wedge, rather than a large circular area. Given the difficulty determining the areas of influence in these shallow-water conditions and the lack of definitive estimates of the size of fish populations in such small, nearshore areas, modeling of fish mortality was not done for Northwest Harbor and Horse Beach Cove. However, field studies indicate that previous demolition operations have not diminished or altered the composition of the fish populations (Kushner and Rich 2004). Fish injured or killed at Northwest Harbor and Horse Beach Cove appear to be rapidly replaced because fish were abundant at kelp monitoring sites in 2003 and 2004, and diversity was comparable to other Channel Islands within similar oceanographic regimes such as Catalina and Santa Barbara Islands. Additional consideration of explosive effects on fish is contained in Section 3.7 of the EIS/OEIS.

Improved Extended Echo Ranging (IEER) sonobuoys would not be used in the No Action Alternative but would be used in Alternative 1. The IEER sonobuoy uses a ribbon charge that is detonated in the water column. Fish populations in the offshore, deep-water environment where IEER sonobuoys are tested are widely dispersed. Given the limited number of IEER tests spread over a large ocean area, only a very small fraction of fish stocks would be influenced. Thus, adverse effects of IEER sonobuoy detonations on fish would be minimal and short-term.

To summarize, a limited number of fish would be killed in the immediate proximity of explosive charges detonated during NSW training and IEER sonobuoy testing. Additional fish would be injured and could subsequently die or suffer greater rates of predation. Beyond the range of direct physical impacts, there would be short-term, reversible behavioral responses. However, given the relatively small area that would be affected, and the abundance and distribution of the species concerned, no significant effects would be expected. When exercises are completed, the fish stock should repopulate the affected areas. The regional abundance and diversity of fish are unlikely to measurably decrease. While this conclusion is primarily based on qualitative judgments, it is supported by the best scientific information currently available. Reliable, quantitative predictions of population level effects are simply beyond the capacity of contemporary ocean science.

3.10.4 Acoustic Impacts

Sound is the only form of energy that propagates well underwater and is used by many aquatic animals for imaging, navigation, and communication. Light, so commonly employed in sensory perception by terrestrial animals, does not penetrate far in seawater, especially in turbid coastal environments. The following paragraphs present a brief introduction to the acoustic capabilities of fish and the potential for impact from anthropogenic (man-made) sounds. Comprehensive technical reviews are available elsewhere (e.g., Popper 2003, Popper et al. 2004, Hastings and Popper 2005, NRC 2003, 2005, ICES 2005, DON 2005b, Edds-Walton and Finneran 2006, NOAA 2007c,d,e).

Sound is a wave of energy from an impulse or vibration that alternately compresses and decompresses a medium like air or water. A sound wave moves through the medium causing two types of actions; an oscillation of the pressure of the medium and an oscillating movement of particles in the medium.

A sound wave has three basic attributes; frequency, wavelength, and amplitude. Frequency is the number of cycles of compression and decompression per second – expressed in units called Hertz (Hz) equal to one cycle per second. The human voice can generate frequencies between 100 and 10,000 Hz and the human ear can detect frequencies of 20 to 20,000 Hz. Some animals like dogs and bats can hear sounds at much higher frequencies - up to 160,000 Hz. At the other end of the spectrum, whales and elephants can produce and detect sounds at frequencies in the range of 15 to 35 Hz.

Wavelength is the distance between two successive compressions or the distance the wave travels in one cycle of vibration. The amplitude of a sound wave is the distance a vibrating particle is displaced. Small variations in amplitude produce weak or quiet sounds, while large variations produce strong or loud sounds. The amplitude of a sound is directly related to the amount of energy transmitted.

A number of factors determine the energy level of a sound received at a distance from the source. As sound travels through the ocean, the intensity associated with the wavefront diminishes, or attenuates. This decrease in intensity, called propagation or transmission loss, results from absorption, spreading, and scattering. The distance waves travel before losing so much energy that they cannot cause the medium to oscillate depends on their frequency. High frequencies are more readily absorbed and thus travel shorter distances than low frequencies. The spreading of a wavefront causes the total power associated with the wavefront to be distributed over an increasingly large area with a concomitant decease in intensity. Sound waves can also be diminished by striking boundaries, such as the sea surface, thermocline, seafloor, or biota in the water column.

Ambient noise in the ocean is persistent, world-wide, and comes from all directions (NRDC 1999, NRC 2003, NOAA 2007c,d,e). Background environmental noise has been measured over frequency ranges from below 1 Hz to over 100,000 Hz (100 kHz) (Cato and McCauley 2001, Andrew et al. 2002).

The levels and frequencies of ambient noise in coastal waters are subject to wide variations depending on time and location. Anthropogenic noise is produced by watercraft (from jet skis to supertankers), offshore oil/gas exploration and production, sonar, underwater telemetry and communication, construction projects, and ocean research (Richardson et al. 1995, NRDC 1999). Naturally occurring environmental noises include the sound of wind and waves, tides and currents, rain, thunder and lightning, tectonic and volcanic activity, as well as sounds produced by marine animals. At any given time and place, the ambient noise level is a mixture of these noise types with higher sound levels over consolidated substrate than sand or mud.

Surface shipping is the most widespread source of anthropogenic, low-frequency (0 to 1,000 Hz) noise in the oceans (NOAA 2007e). The radiated noise spectrum of merchant ships ranges from 20 to 500 Hz with higher frequencies produced by sonar operations (Richardson et al. 1995). Most ocean going vessels have sonar systems for navigating, depth sounding, and sometimes "fish finding". Depth sounding sonars usually operate in the 15 kHz to 200 kHz frequency range, while locating, positioning, and navigational sonars use the mid-frequency band of 1 kHz to 20 kHz. Long-range sonars generally operate in the 100 Hz to 3 kHz range. Commercial fishing boats may also use pingers to prevent seals, dolphins, and turtles from being caught in nets (Gearin et al. 2000). There are two basic types of pinger devices, harassment devices and deterrent devices. "Acoustic Harassment Devices" are pingers specifically used to deter pinnipeds from preying on captured fish. These devices use high intensity signals in the middle to high frequencies (5-30 kHz; Reeves et al. 2001). “Acoustic Deterrent Device” pingers use low intensity sound signals in the middle to high frequencies (2.5 – 10 kHz) with higher harmonic frequencies (up to 160-180 kHz). They are designed to prevent bycatch of small cetaceans (Reeves et al. 1996, 2001).

Of the estimated 27,000 fish species only a small percentage have been studied in terms of auditory capability or sound production. Of those studied, many fishes produce vocalizations in the low-frequency band (50-3000 Hz). Hearing or sound production is documented in 247 species, while actual hearing capabilities data exist for only 100 of the 27,000 fish species (Hastings and Popper, 2005).

Fish have evolved two main sensory organs for detecting sound in the aquatic environment: the inner ear, located in the skull, and the lateral line system along the flanks and on the head (Ladich and Popper 2004). Fish have two inner ears, but no middle or external ear like terrestrial vertebrates. Sound passes directly through the body to the inner ear. The structure of the fish inner ear and the mechanism for converting acoustic energy to electrical signals received by the brain is similar to that found in all other vertebrates. Sensory hair cells translate vibrations into electrical signals conveyed by the nervous system to the brain (Popper et al. 2003). Fish have three fluid-filled otolith organs each containing a dense calcified otolith overlying tissue containing sensory hair cells. The otoliths sense the position of the head in the vertical plane and in other directions relative to the acceleration of the body (Popper and Lu 2000). The otoliths are denser than the surrounding tissues and the water so their sound-induced vibrations are at a different phase and amplitude which creates a shearing movement of the hair cells (Popper and Fay 1999).

The same sensory hair cells as in the ear are found in the lateral line system (Hastings and Popper 1996). They detect particle motion from sound waves over a distance of one to two body lengths, and at low frequencies (lower than 200 Hz). This acoustic input is used for coordinating group movements and maintaining coherent schools (Popper and Fay 1999).

The perception of sound pressure is restricted to fish species with gas-filled swim bladders. Due to the higher compressibility of gas than water, the swim bladder responds effectively to sound pressure fluctuations. In some species of fish, a series of modified vertebra connect the inner ear to the swim bladder acting as a transducer that converts sound pressure waves into particle motion which stimulates the otoliths. Species with no swim bladder (for example, mackerel, tuna, sharks) or a much-reduced one (many benthic species, including flatfish) tend to have relatively low auditory sensitivity.

With regard to auditory capabilities, fish have traditionally been divided into two groups – hearing generalists and hearing specialists. Most fish species do not have known hearing specializations and appear to only detect sounds from about 100 to 1,000 Hz (Hastings and Popper 2005). The best hearing sensitivity of many hearing generalists is at or around 300 Hz (Popper 2003). Hearing specialists perceive acoustic signals over a broader range of frequencies and at lower amplitudes than generalists. They have unique adaptations that facilitate their auditory sensitivity, such the previously mentioned acoustic coupling between the swim bladder and the ear. The auditory capability of most hearing specialists ranges to over 3,000 Hz, with best hearing from about 300 to 1000 Hz (Popper et al. 2003, Ladich and Popper 2004, Ramcharitar and Popper 2004). Specialists detect both the particle motion and pressure components of sound whereas generalists are limited to detection of the particle motion component of low-frequency sounds at relatively high sound intensities (Amoser and Ladich 2005). Examples of specialists include goldfish, catfish, squirrelfish, and herrings. Hearing specializations are most often found in freshwater species, while in marine species, specializations are quite rare (Amoser and Ladich 2005). The evolution of hearing specializations appears to have been facilitated by low ambient noise levels found in lakes, slowly flowing waters, and the deep sea (Ladich and Bass 2003, Amoser and Ladich 2005). This evolution most likely came about due to the essential need to detect abiotic noise, avoid approaching predators and detect prey, and to a much lesser degree, communicate acoustically (Amoser and Ladich 2005). Some species like cod and salmon have hearing capabilities in the infrasonic range (< 20 Hz) (Knudsen et al. 1997, Sand et al. 2000, Sonny et al. 2006), while members of the shad family can detect sounds in the ultrasonic range, i.e., over 20 kHz. (Mann 2001, Gregory and Clabburn 2003, Popper et al. 2004, Higgs et al. 2004, Higgs 2005). However, other Clupeids, including species of sardines and anchovies, do not detect ultrasound; with peak hearing sensitivity generally ranging from 200 to 800 Hz.

Studies on the hearing ability of marine fish have mostly shown poor hearing sensitivity. Sharks and rays (Myrberg 2001, Casper et al. 2003, Casper and Mann 2006), scorpionfish, searobins, and sculpins (Lovell et al. 2005), scombrids (i.e. albacores, bonitos, mackerels, tunas) (Iversen 1967, 1969, Song et al. 2006), Atlantic salmon (*Salmo salar*) (Hawkins and Johnstone 1978), and Gulf toadfish (*Opsanus beta*) (Remage-Healey et al. 2006) are all believed to be hearing generalists. While the hearing of relatively few marine species has been investigated, and in a number of fish groups both generalists and specialists exist, it is reasonable to suggest that unless most species are very close (within a few meters) to very high intensity sounds (e.g. seismic air guns or sonar) from which they cannot swim away, short- and long-term effects may be minimal or non-existent (Song et al. 2006).

Experiments on elasmobranch fish have demonstrated poor hearing abilities and frequency sensitivity from 20 to 1,000 Hz with best sensitivity at lower ranges (Myrberg 2001, Casper et al. 2003; Casper and Mann 2006). While only five elasmobranch species have been tested for hearing thresholds it is believed that all elasmobranchs will only detect low-frequency sounds because of their lack of a swim bladder. Without an air-filled cavity fish, theoretically, are limited to detecting particle motion and not pressure (Casper and Mann 2006).

The lateral line system of a fish also allows for sensitivity to sound (Hastings and Popper 2005). This system is a series of receptors along the body of the fish that detects water motion relative to the fish that arise from sources within a few body lengths of the animal. The sensitivity of the lateral line system is generally below a few hundred Hz (Hastings and Popper 2005). The only study on the effect of exposure to sound on the lateral line system suggests no effect on these sensory cells (Hastings et al. 1996). While studies on the effect of sound on the lateral line are limited, Hasting et al.'s (1996) work suggests sensitivity of a fish's lateral line system is limited to within a few body lengths and to sounds below a few hundred Hz.

Fish are able to distinguish sounds of different magnitudes and frequencies, detect a sound in the presence of other signals, and determine the direction of a sound source. Beyond the basic ability to detect sound, these higher level capabilities allow fish to discriminate between sounds of predator versus those of prey, sense the direction of a sound emitted by potential predators or prey, and establish the nature of one sound source in the presence of others including anthropogenic masking sounds.

In addition to their ability to hear sounds, fish are known to produce sound (vocalize), generally in the range of about 50 to 8,000 Hz. (URI 2007). The sound is generated by a variety of means to alert competitors, deceive prey, attract mates, and coordinate breeding and spawning (USF 2007). Grunts, croaks, clicks and snaps are produced by rubbing skeletal parts together (e.g., teeth, fins) and by resonating the swim bladder.

Most assessments of the potential impact of noise in the ocean have concerned marine mammals (Bowles et al. 1994, NRC 2003, 2005), but, there is growing interest in acoustic effects on fish (Popper 2003, Popper et al. 2004, Popper and Hastings 2005, Popper et al. 2005, Edds-Walton and Finneran 2006). In addition to the peer-reviewed scientific literature, information on fish hearing and anthropogenic effects is available in technical reviews (e.g., ICES 2005), on government and university web sites (e.g., NMFS 2007b, NOAA 2007b, ONR 2007, URI 2007, UM 2007, USF 2007), and from environmental impact/analysis documents (e.g., DON 2005, 2006, 2007, SIO 2005).

The potential acoustic impacts may be considered in four categorizes: masking - interference with the ability to hear biologically important sounds; stress - physiological responses including elevated heart rate and release of hormones; behavior - disruption of natural activities like swimming, schooling, feeding, breeding, and migration; and, hearing - permanent hearing loss from high intensity/long duration sounds or temporary hearing loss from less intense sounds.

3.10.4.1 Masking

Marine animals rely on sound for numerous life activities (e.g., to alert competitors, locate prey, escape predators, for schooling, and for mating) (Hastings and Popper 2005). A decrease in the ability of fish to detect biologically-relevant sounds because of interference by anthropogenic noise could have significant consequences (Richardson et al. 1995, McCauley et al 2003, NRC 2003, 2005). Laboratory studies have indicated the potential for auditory masking by anthropogenic sounds (DON 2005b).

Navigation by larval fish may be particularly vulnerable to masking. There is indication that larvae of some species navigate to juvenile and adult habitat by listening for sounds indicative of a particular habitat (Higgs 2005). In a study of an Australian reef system it was determined the sound signature emitted from fish choruses were between 800 Hz and 1,600 Hz (Cato 1978) and could be detected 5 to 8 km from the reef (McCauley and Cato 2000). This bandwidth is well within the detectable bandwidth of adults and larvae of many species of reef fish (Kenyon 1996).

Detecting effects of masking under field conditions is complicated. Hearing thresholds represent the lowest levels of sound animals can detect in a quiet environment. But the sea is usually noisy, even in the absence of man-made sounds. Potential consequences of masking, such as altered feeding success, predation rate, and reproductive success are difficult to distinguish from other possible causes including those related to natural cycles and human-related impacts. Consequently, the ecological effect of auditory masking in the ocean is virtually unknown.

The zone of masking is the region within which a noise is strong enough to interfere with detection of biologically-relevant sounds. In general, distant man-made noise is unlikely to mask short-distance acoustic communication. Given that the energy distribution of an explosion covers a broad frequency spectrum, sound from underwater explosions might overlap with some environmental cues significant to marine animals. However, the time scale of individual explosions is very limited, and training exercises involving explosions are dispersed in space and time. Thus, the likelihood of underwater detonations resulting in significant masking is considered low.

Studies have indicated that acoustic communication and orientation of fish may be restricted by noise regimes in their environment (Wysocki and Ladich 2005). Although some species may be able to produce sound at higher frequencies (> 1 kHz), vocal marine fish largely communicate below the range of mid-frequency levels used by most sonar employed in the proposed action. Further, most marine fish species are not expected to able to detect sounds in the mid-frequency range of the operational sonars. The few fish species that have been shown to be able to detect mid-frequencies do not have their best sensitivities in the range of the operational sonars. Thus, these fish can only hear mid-frequency sounds when they are very loud (i.e. when sonars are operating at their highest energy levels and fish are within a few meters). Considering the low-frequency detection of most marine species and the limited time of exposure due to the moving sound sources, the most sonar sound sources used in the SOCAL Range Complex would not have the potential to significantly mask key environmental sounds.

3.10.4.2 Stress

Although an increase in background noise is known to cause stress in humans, there have been few studies on fish (Popper 2003, ICES 2005). There is some indication of physiological effects on fish such as a change in hormones levels and altered behavior (Pickering 1981, Smith et al. 2004a,b, Remage-Healey et al. 2006). Only a limited number of studies have measured biochemical responses by fish to acoustic stress. McCauley et al. (2000, 2002) investigated physiological effects of exposure to loud sounds on various fish species, squid, and cuttlefish. No significant increases in physiological stress were detected. Sverdrup et al. (1994) found that Atlantic salmon subjected to acoustic stress released primary stress hormones, adrenaline and cortisol, as a biochemical response. All experimental subjects returned to their normal physiological levels within 72 hours of exposure. Wysocki et al. 2006 report elevated cortisol levels in freshwater fish under laboratory conditions exposed to recorded ship noise versus broad-spectrum (control) noise.

Since stress affects human health, it seems reasonable that stress from loud sound may impact fish health, but available information is too limited to adequately address the issue. However, due to the punctuated nature of EOD exercises, the resulting stress on fish is not likely to jeopardize the health of widespread resident populations.

3.10.4.3 Behavior

Many factors affect how fish react when exposed to noise. The presence of predators or prey, seasonal and daily variations in physiology, spawning or migratory activities, and other factors may make them more or less sensitive to unfamiliar sounds (Popper et al. 2004).

Fish have been observed to change their behavior in response to sound by moving away from a sound source or up and down in the water column (Popper 2003). Studies of caged fish have identified three basic behavioral reactions to sound: startle, alarm, and avoidance (Pearson et al. 1992, McCauley et al. 2000, SIO 2005). The startle response in characterized by fish flexing their bodies powerfully and swimming away at high speed without changing direction. At lower levels of noise, alarm may occur in the absence of a startle response. For schooling fish, alarm involves a general increase in activity and tighter packing with abrupt changes in direction. During avoidance behavior, fish slowly move away from the sound source. The time of year, whether or not the fish have eaten, and the nature of the sound signal may all influence fish response. Changes in sound intensity may be more important to a fish's behavior than the maximum sound level. Sounds that reach their peak intensity rapidly tend to elicit stronger responses from fish than sounds with longer rise times, but equal peak intensities (Schwarz 1985).

Recent studies on the behavioral response of caged fish to low-frequency sonar pulses (Popper et al. 2005a, 2007) documented an immediate "startle response" and displacement in the water column for some species. Rainbow trout exhibited only a small initial response and quickly returned to pre-stimulus behavior. Behavioral sensitivity is lowest in flatfish that have no swim bladder and also in salmonids in which the swim bladder is present but somewhat remote from the inner ear (Hastings and Popper 2005). Gadoid fish (cod, whiting) in which the swim bladder is closely associated with the inner ear display a relatively high sensitivity to sound pressure (Turnpenny et al. 1994).

Most studies have been conducted in the laboratory where fish can be readily observed under controlled conditions, but some field studies have been performed. A number of these have investigated the effect of sub-bottom profiling in seismic explorations. These explorations use airguns that release blasts of compressed air producing sounds loud enough to penetrate the ocean floor.

Pearson et al. (1992) used a floating enclosure off the California coast to observe individual responses of rockfish to intense low-frequency seismic survey noise. They observed startle and alarm responses to airgun blasts for two sensitive rockfish species, but not for two other species, as well as subtle changes in the behavior in other species of rockfish. The rockfish returned to their normal behavior within minutes of cessation of the seismic noise stimulus, however, their field data indicated that continuous air-gun noise could reduce catchability of free-ranging rockfish, which moved out of the range of the hooks-and-lines used by fishers (Skalski et al., 1992). Experiments conducted by Skalski et al. (1992), Dalen and Raknes (1985), and, Dalen and Knutsen (1986) demonstrated that some fish were forced to the bottom and others driven from the area in response to low-frequency airgun noise. Other studies have shown no impact of airguns on fish behavior. Wardle et al. 2001 used video cameras to document reef fish behavior after exposure to airgun emissions. The observations showed no apparent damage to fish and no dislocation from the reef during the course of the study.

An investigation by Engås et al. (1996) revealed persistent changes in the horizontal distribution of two important food fish following 5 days of continuous seismic shooting during surveys. The study indicated that fish populations had moved to sites over 18 nm from the shooting area. There was no evidence of fish mortality as a result of the seismic shooting. The decline in fish density in the shooting area persisted for at least 5 days, at which point the study was ended. Slotte et al. (2004) report both horizontal and vertical displacement of pelagic fish during seimic shooting.

Edds-Walton and Finneran (2006) point out that a shift in fish density of even a few days could have significant economic consequences given the restricted time limits placed on fishing for some commercially-important species. And, fish are found in particular locations for ecological or physiological reasons - forcing a departure from those areas can reduce the overall fitness of a population. In their review of the behavior of fish in response to human-generated noise sources, these authors also indicate that avoidance behavior appears to be less likely in territorial fish (like those on coral reefs or defending nest sites) for whom departure from an area would carry a heavy biological price. Fish that are actively feeding on patchy prey or that are part of a spawning aggregation are also less likely to abandon their location in the presence of noise levels that would cause avoidance under other circumstances. Diminished auditory capabilities are more likely to occur in species that do not avoid intense noise sources, although population-level consequences would be directly related to the role that sound plays in the normal behavior of the species involved.

Habituation and sensitization are results of repeated presentations of the same stimuli (NRC 2003). Habituation to repeated presentations of a signal that does not cause physical discomfort or immediate stress is a common adaptive response to almost every sort of stimuli, including noise (NRC 2005). It is not known if marine species habituate to the sound of distant explosions. The natural motility of fish decreases the probability that any particular animal would be exposed to multiple exercises. Therefore, habituation is possible but unlikely due to the brevity, frequency, and variable locations of the exercises. Sensitization is a conditioned response in conjunction with a particular stimulus (including noise) as a result of a previous negative experience for the animal (NRC 2003). Subsequent exposures produce responses that are more marked. Like habituation, the potential for an animal to become sensitized to the noise of underwater explosions exists, particularly if the exposure causes discomfort. However, sensitization becomes less likely because of the brevity, frequency, and variable location of the exercises.

Long-term behavioral impacts can include habitat abandonment. For example, long-term habitat abandonment, observed at a baleen whale calving area (Bryant et al. 1984) and at a killer whale feeding area (Morton and Symonds 2002), resulted from chronic exposures to specific types of anthropogenic sound (dredging operations and seal acoustic harassment devices) over long periods of time. Similar situations have not been established for fish. Repeated disturbance leading to habitat abandonment is not expected due to the infrequent nature and variability of locations of underwater detonations associated with proposed SOCAL Range Complex exercises.

Low-frequency pulses of sound have been shown to attract sharks in both coastal and pelagic habitats (Nelson and Johnson 1972, Myrberg 2001). The pulsed sounds are most attractive when pulse presentation is intermittent and not continuous. These low-frequency pulses (25-200 Hz) are similar to the sounds produced by struggling prey or actively feeding fish. Nelson and Johnson (1972) found that some sharks exhibited a startle response if they were within a meter of the speaker when pulsing began, but those sharks did not exhibit avoidance behavior after the initial startle reaction. Since low-frequency sound travels far in sea water, sharks could be attracted from hundreds of meters away. The resulting concentration of sharks could alter normal behavioral patterns and induce aggressive interactions between sharks that normally would not interact. Myrberg et al. (1972) also suggested that the rotors of low-flying/hovering helicopters could produce pulsed sounds below the water surface at levels sufficient to attract epipelagic sharks.

In summary, sounds that disrupt natural patterns like sheltering, schooling, feeding, breeding, and migration can have significant consequences if basic life functions are appreciably altered. Effects on individuals can have population-level consequences, affecting the viability of fish stocks and the species.

However, the difficulty tracking changes in the behavior of free-ranging fish and establishing the subsequent ecological impact limits our ability to establish the long-term ecological consequences of changes in fish behavior in response to anthropogenic noise.

Although some fish in the vicinity of the training exercises may react negatively to the noise of underwater detonations, the noises are relatively short-term and localized. Behavioral changes are not expected to have lasting impacts on the survival, growth, or reproduction of fish populations. As exercises commence, the natural reaction of fish in the vicinity would be to leave the area. When exercises are completed, the fish stock would be expected to repopulate the area. The abundance and diversity of fish is unlikely to decrease measurably as a result of SOCAL Range Complex underwater detonations.

3.10.4.4 Hearing

Studies of acoustic capabilities of fish have been aimed at establishing the range of frequencies (or bandwidth) that a fish can hear, and the "threshold" (lowest level) of the sound detected at each frequency (Hastings and Popper 2005). If, following exposure to intense acoustic input, a higher level of sound is required to detect that frequency, a threshold shift has occurred. For humans, temporary threshold shifts may occur after loud concerts or following exposure to industrial noise. There are two kinds of threshold shifts: temporary threshold shift (TTS) or permanent threshold shift (PTS). A TTS may continue for minutes, hours or days, but the auditory deficit is eventually reversed. With PTS, however, hearing is permanently compromised and never recovers.

Permanent threshold shifts in vertebrates may result from both chronic exposures to high noise levels and from a single, highly traumatic event. People who experience high noise levels on a daily basis and do not wear hearing protection devices can suffer PTS. Very loud sounds (e.g., an explosion) can also cause a PTS or even deafness. In mammals, permanent threshold shifts involve damage to the hair cells of the inner ear, and other auditory structures (Bohne and Harding 2000). In mammals, dead hair cells are not replaced by production of new hair cells, resulting in permanent loss of auditory receptors in the damaged area.

The impact of anthropogenic noise has been studied in a number of fish species. Some investigations have shown damage to fish hearing from loud sounds generated by air-guns used in seismic surveys. For example, McCauley et al. (2002) investigated the effects of exposure to blasts from a seismic air-gun on the pink snapper *Pagrus auratus*. Fish were placed in a large cage in a bay and exposed to air guns over several hours. The fish were allowed to survive for different intervals after exposure, and the ears were then examined for any damage resulting from exposure to the sound. There was extensive damage to the sensory cells of the ear and the level of damage increased the longer the fish were allowed to survive post-exposure. However, Popper et al. (2005b) examined three species, including a salmonid (broad whitefish *Coregonus nasus*), after stimulation with five or twenty blasts of a seismic air gun. The broad whitefish showed no loss of hearing after exposure to the sounds, whereas northern pike *Esox lucius* and lake chub *Couesius plumbeus* showed 10-15 dB of hearing loss, but with complete recovery within 24 hours after exposure. No animals died as a result of exposure.

Other studies also indicate that loud sound may damage the neuromasts of the fish's lateral line and hair cells in the ears (Popper 2003, McCauley et al. 2003, Hastings and Popper 2005) with the probability of harm increasing with the time of exposure (Hastings et al. 1996, Popper et al. 2005). Damage to the sensory cells may not be visible until several days after exposure to the intense sound. There is some evidence that fish subjected to ear and lateral line injury may eventually replace some of the damaged sensory hair cells (Hastings et al. 1996, Lombarte et al., 1993). No information is available on the incidence of permanent threshold shift in fish due to environmental noise. Temporary threshold shifts, however, have been documented in laboratory investigations. Edds-Walton and Finneran (2006) provide an extensive critique of these studies. As they suggest, even a temporary impairment in hearing could have negative results, such as, failure to find food, failed communication with other members of their population, or failure to detect the approach of a predator.

The hearing of fish beyond the lethal range of underwater detonations could be adversely affected. Temporary threshold shifts would be likely and permanent hearing loss could result if sensory cells in the ear and on the lateral line are damaged and do not recover or regenerate. However, blast noises would be highly constrained in time and space, affecting the hearing of only a small percentage of the indigenous fish. Lasting impact on the survival, growth, or reproduction of fish populations would not be expected.

3.10.5 Invertebrate Hearing and Sound Production

Because invertebrates do not have air-filled cavities or sensory cells like those in the ears of fish, they do not have the capacity to detect changes in pressure that accompany sound waves (URI 2007). However, invertebrates are sensitive to particle displacement (Popper et al. 2001). When exposed to sound during experiments, some marine invertebrates show definite responses. Vibrations associated with sound are detected by special water motion receptors known as chordotonal organs. These organs facilitate the detection of potential predators and prey and provide environmental information such as the movement of tides and currents. The fiddler crab and spiny lobster have both been shown to use chordotonal organs to respond to nearby predators and prey. There is very limited data on invertebrate hearing, with only cephalopods (octopus and squid) and decapods (lobster, shrimp, and crab) thought to sense low-frequency sound (Offutt, 1970, Budelmann and Williamson 1994, Lovell et al. 2005). Packard et al. (1990) reported sensitivity to sound vibrations between 1-100 Hz for three species of cephalopods. Wilson et al. 2007 documents a lack of physical or behavioral response for squid exposed to experiments using high intensity sounds designed to mimic killer whale echolocation signals.

Like fish, invertebrates produce sound for the purpose of communication. Sound is used in territorial behavior, to deter predators, to find a mate, and to pursue courtship (Zelick et al. 1999, Popper et al. 2001). Most marine invertebrates known to produce sounds do so by rubbing parts of their body together. Spiny lobsters, for example, make a rasping sound with their antennae that can startle predators. Snapping shrimp produce loud enough sounds to stun prey by closing a large, specialized claw at a very high speed. This causes the water to form a bubble of vapor that collapses energetically. Light, also produced when the bubble collapses, has been referred to as 'shrimpoluminescence' by researchers (URI 2007).

3.10.6 Indirect Impacts

In addition to directly affecting fish, underwater detonations could affect other species in the food web including prey species. For example, sharks may consume sea turtles and small marine mammals and could be indirectly affected by explosive impacts to those prey items.

The effects of underwater explosions would differ depending upon the type of prey species in the area of the blast. As previously indicated, fish with swim bladders are more susceptible to blast injuries than fish without swim bladders. Invertebrate species, however, like squid, do not possess air-filled cavities, and therefore are less prone to near-field blast effects (Voss 1965), although impulsive noise has been implicated in mortality of deep water species (Guerra et al. 2004).

In addition to physical effects of an underwater blast, prey may have behavioral reactions to underwater sound. For instance, squid may exhibit a strong startle reaction to detonations that may include swimming to the surface, jetting away from the source, and releasing ink (McCauley et al. 2000). This startle and flight response is the most common secondary defense among animals (Hanlon and Messenger 1996). The noise from underwater explosions may induce startle reactions and temporary dispersal of schooling fish and squid if they are within close proximity. The abundances of fish and invertebrate prey species near the detonation point could be diminished for a few hours before being repopulated by animals from adjacent waters. No lasting effect on prey availability or the pelagic food web is expected.

3.11 WEAPONS TRAINING

EFH and Managed Species could be affected from shock waves and noise associated with weapons use, from sound generated as the projectile travels to the target, and from shock waves, sound, and debris created by impact and/or explosion of the weapon.

3.11.1 Bombing

Typically, bombing exercises (BOMBEX) at sea involve one or more aircraft bombing a target simulating a hostile surface vessel (DON 2005c). Most of the bombs used in SOCAL Range Complex exercises will be practice bombs without explosive warheads (DON 2007b). Weapons with non-explosive warheads would generate physical shock entering the water but would not explode. The shock from practice bombs hitting the sea surface would cause a small number of fish kills or injuries and minor acoustic displacement but would not jeopardize fish populations. Based on the density of fish in the area (from average landings data), the annual mortality associated with non-explosive missiles, targets, and mines hitting the water during training exercises is estimated in Section 3.7.2.2.1 of the EIS/OEIS to be <3 lb (1.35 kg) of the commercial fish catch in the SOCAL Range Complex.

Practice bombs entering the water would be devoid of combustion chemicals found in the warheads of explosive bombs. After sinking to the bottom, the physical structure of bombs would be incorporated into the marine environment by natural encrustation and/or sedimentation.

Aircraft need to qualify with both explosive and non-explosive ordnance. Air-to-ground bombing using explosive ordnance is mostly conducted at land ranges. However, some live bombs are dropped at sea. Exploding bombs are also used in other exercises such as SINKEX.

As with underwater detonations, the range within which fish may sustain injury or death from an exploding bomb would depend on environmental parameters, the size, location, and species of the fish, and its internal anatomy (e.g., whether it has a swim bladder) (DON 2005c). Fish without swim bladders are far more resistant to explosions than those with swim bladders (Keevin and Hempen 1997).

Propelled fragments are produced by an exploding bomb. In close proximity to the explosion, fish could be killed outright or sustain injury from propelled fragments (Stuhmiller et al. 1990). However, studies of underwater bomb blasts have shown that fragments are larger than those produced during air blasts and decelerate much more rapidly (O'Keeffe and Young 1984, Swisdak Jr. and Montaro 1992), reducing the risk to marine life.

Explosive bombs will be fused to detonate on contact with the water and it is estimated that 99 percent of them will explode within 5 ft (1.5 m) of the ocean surface (DON 2005c). Table 3-2, based on Young's (1991) model, displays 10-percent mortality (90-percent survival) ranges for the largest explosive bombs that may be deployed during at-sea exercises.

Table 3-2: Estimated Fish-Effects Ranges for Explosive Bombs

Warhead Weight NEW (lb-TNT)	10 % Mortality Range by Weight of Fish		
	1 ounce	1 pound	30 pounds
500-lb	1,289 ft (393 m)	899 ft (274 m)	578 ft (176 m)
1,000-lb	1,343 ft (409 m)	937 ft (286 m)	602 ft (184 m)
2,000-lb	1,900 ft (579 m)	1,325 ft (404 m)	852 ft (260 m)

Table 3-2, as expected, reflects the fact that smaller fish are more subject to mortal effects from underwater explosions than larger fish. It also shows the non-linear relationship of the model equations relating explosive weight to range of effect. A four-fold increase in NEW increases the 10% mortality range by one and one-half times (doubling the area of effect).

Unlike the nearshore, shallow-water San Clemente Island NSW underwater explosive training areas, live bombing exercises would take place in deep water, so fish-effects range models would be appropriate for estimating the impact on fish populations. Computations reported in the Fish Section (3.7.2.2.1) of the EIS/OEIS indicate for the No Action Alternative an estimated 763 lb (329 kg) of fish would be killed annually in training with explosive-warhead bombs. This represents 0.061 percent the commercial fish catch in the SOCAL Range Complex.

Fish would be killed or injured from detonation of explosive bombs in relatively small areas compared to the vast expanse of the SOCAL Range Complex. Beyond the range of physical effects, the natural reaction of most fish would be to leave the area. When the exercise concludes, the area would be repopulated and the fish stock would rebound. The overall impact to water column habitat would be localized and transient. The abundance and diversity of fish within SOCAL Range Complex is unlikely to measurably decrease as a result of bombing exercises.

Acoustic impacts on fish during live bomb exercises would be similar to those discussed earlier for underwater detonations associated with underwater detonations. Although some fish in the vicinity of the exercises might react negatively to the noise of bomb explosions, the limited number of these events and the relatively small areas affected should minimize the effect on local fish populations. Chemical by-products of bomb detonations would not pose a hazard to marine animals since the chemicals will be diluted prevailing currents and the exercises will be dispersed in time and space.

Noise produced during weapons use may disrupt the behaviors of marine species in the immediate area. Because of the localized nature and short duration of the exercise, there would be no lasting impact on prey availability, as only small portions of the prey population would be affected and populations would rapidly replenish. Due to the shallow detonation depth (<5 ft (1.5 m) below the surface, bombs dropped in waters deeper than 100 m (328 ft) would have negligible effects on the seafloor and on the animals that dwell there. The detonation of large bombs in shallow water is very unlikely.

Fragments from detonated bombs would settle to the sea floor where solid metal components would be corroded by seawater at slow rates. Over time, natural encrustation of exposed surfaces would occur, reducing the rate at which subsequent corrosion occurs. Rates of deterioration would vary, depending on the type of material and on environmental conditions. Due to the large area of the SOCAL Range Complex, expended ordnance would be widely scattered on the ocean floor and would have a minimal impact on the benthic environment.

The proposed bombing exercises could adversely affect the quality and quantity of EFH within SOCAL Range Complex. The disruption to habitat components that support feeding, resting, sheltering, reproduction, or migration of fish would be minimal and temporary.

3.11.2 Naval Gun Fire

Potential effects from the use of Naval gun systems have been analyzed in a variety of environmental documents (DON 2000, 2001a, 2002a, 2004a,b, 2007a). The 5-inch gun has the largest warhead fired during routine gunnery exercises. Most training uses non-explosive 5-inch rounds. The surface area of the ocean impacted by a non-explosive 5-in round has been estimated to be 129 cm^2 (20 in^2) (DON 2007a). So the approximately 6,000 non-explosive 5-in rounds fired annually in the SOCAL Range Complex would create a cumulative impact area of 77 m^2 (833 ft^2). Considering the vast expanse of the SOCAL Range Complex, few fish would be directly struck by a shell from a 5-inch gun.

Explosive rounds would have the greatest potential for impacts to fish in surface waters. As previously indicated, biological effects of an underwater explosion depend on many factors, including the size, type, and depth of both the animal and the explosive, the depth of the water column, the standoff distance from the charge to the animal, and the sound-propagation properties of the environment. Potential impacts can range from brief acoustic effects, tactile perception, and physical discomfort, to slight injury to internal organs and the auditory system, to death of the animal (Keevin and Hempen 1997).

Table 3-3 provides an estimation of the potential range of lethal effects on swim bladder fish based on Young's (1991) model for five-inch explosive projectiles. These rounds have a NEW of TNT of approximately 8 lbs (3.6 kg) and are assumed to detonate at a depth of 5 ft (1.3 m). Behavioral reactions of fish would extend over a substantially larger area. The overall impacts to water-column habitat would, however, be minor as fish would return following the exercise. The abundance and diversity of fish and the quality and quantity of fish habitat within the range is unlikely to decrease as a result of gun fire training.

Table 3-3: Estimated Fish-Effects Ranges for 5-in Naval Gunfire Rounds

Weight of Fish	10% Mortality Range	
	ft	m
1 oz	405	123
1 lb	282	86
30 lbs	181	55

Accurate measurements of the size of the debris field from the underwater explosion of 5-inch shells are not available. However, the shells are typically fused to explode at the sea surface. This, combined with the high downward velocity of the shell at impact, suggests that the debris field from the exploding shell would be restricted in size. As with exploding bombs, the shell fragments rapidly decelerate through contact with the surrounding water. The possibility that the exploding shell fragments and debris would significantly affect EFH and fish populations is considered negligible.

Contaminants released from the detonation of exploding shells would be similar to those discussed previously for bombs. Thus, it is unlikely that the explosive compounds or their combustion products would pose a threat to fish or EFH.

Unexploded five-inch shells and non-explosive ordnance practice shells would not be recovered and would sink to the bottom. The rapid-detonating explosive (RDX) material of unexploded ordnance would not be exposed to the marine environment, as it is encased in a non-buoyant cylindrical package. Should the RDX be exposed on the ocean floor, it would break down within a few hours (DON 2001a). It does not bioaccumulate in fish or in humans. Over time, the RDX residue would be covered by ocean sediments or diluted by ocean water.

Solid-metal components of unexploded ordnance and non-explosive ordnance would be corroded by seawater at slow rates, which comparable slow release rates. Exposure of fish to chemical constituents from all metallic and non-metallic ordnance components would be further reduced as a result of natural encrustation of external surfaces. Consequently, the release of contaminants from unexploded ordnance and non-explosive ordnance would not result in substantial degradation of marine water quality.

3.11.2.1 Acoustic Impacts of Naval Gunfire

Naval gunfire could have acoustic effects from: 1) noise generated by firing the gun (muzzle blast), 2) vibration from the blast propagating through the ship's hull, 3) sonic-booms generated by the shell flying through the air, and 4) noise from the impact and explosion of the shell.

Firing a deck gun produces a shock wave in air that propagates away from the muzzle in all directions, including toward the air/water surface. Direct measurements of shock wave pressures transferred through the air/water interface from the muzzle blast of a 5-inch gun are well below levels known to be harmful at shallow depths (DON 2000, Yagla and Stiegler 2003). Navy watch standers would observe waters surrounding the ship to ensure significant biological aggregations are not in proximity to the ship during firing exercises. Noise produced during gunfire may disturb fish in the vicinity of the ship. Because the noise is brief, no extended disruption of fish behavior is expected.

Gun fire sends energy through the ship structure, into the water, and away from the ship. This effect was also investigated in conjunction with the measurement of 5-inch caliber gun blasts described above (DON 2000, Yagla and Stiegler 2003). The energy transmitted through the ship to the water for a typical round was found to be about 6% of that from the air blast impinging on the water. Therefore, noise transmitted from the gun, through the hull into the water should have negligible impact on marine life.

The sound generated by a shell in its flight at supersonic speeds above the water is transmitted into the water in much the same way as a muzzle blast (Pater 1981). The region of underwater noise influence from a single traveling shell is relatively small, diminishes quickly as the shell gains altitude, and is of short duration. The penetration of sound through the air\water interface is relatively limited (Miller 1991, Yagla and Stiegler 2003). Studies reviewed in DON 2007a indicate only a small number of submerged species would be exposed to the pressure waves from sonic booms from 5-inch shells fired during routine training exercises.

The potential exists for energy from multiple sonic booms to accumulate over time from multiple, possibly rapid firings of a gun. However, because the area directly below the shells' path, where the conditions are correct for energy to enter the ocean is small, it is highly unlikely that the energy from more than two or three shells would be additive.

Behavioral effects from the noise of naval gunnery shells exploding would be similar to that already described for other types of underwater explosions. Although fish in the vicinity of the explosion may exhibit avoidance reactions, the noises generated are relatively short-term and localized, and behavioral disruptions would not be expected to have lasting impacts on the survival, growth, or reproduction of fish populations.

3.11.3 Small Arms Fire

Small arms rounds and Close-In Weapons System (CIWS) rounds fired directly into the water decelerate to non-lethal velocity within 56 cm (22 in) of the water's surface after impact (DON 2007a, DON 2007b). The Point Mugu Sea Range EIS/OEIS (DON 2002a) analyzed the impacts associated with CIWS operations. The maximum area of water surface that might be struck by the 20 mm CIWS rounds was estimated by taking the cross-sectional surface area of a 20 mm round multiplied by the total number of rounds fired during a typical year. Local marine mammal densities were then multiplied by the maximum area of water surface that might be hit by a round. The analyses determined that the probability of a marine mammal being hit or injured by a CIWS operation would be very low; so low that it could take hundreds of thousands of years before a marine mammal would be hit. Similarly, given the large area of the SOCAL Range Complex, limited fish mortality and injury would be expected from CIWS and other small arms fire.

Few fish would be directly hit by bullets striking the water during small arms exercises. Bullets rapidly decelerate on contact with water, presenting minimal threat to fish swimming below the surface. The shock waves generated by bullets hitting the water is not expected to be great enough to cause harm to marine animals (DON 2007a,b). Fish in the area would be startled by the sound, but should return to normal behavior shortly after the exercise.

Fish feeding in the vicinity of the small arms fire exercises could potentially ingest expended shells, shell fragments, or shell casings. The shiny metallic surface of a newly discharged shell casing and its movement through the water may trigger a feeding response. If ingested, the casing could lodge in the digestive system and interfere with food consumption and digestion. However, the probability of such events is low and significant consequences at the level of fish populations would not be likely. Spent shell casings deposited on the sea floor could also be mistaken for food, although, discharged casings will remain shiny for only a short period, reducing the potential for ingestion by fish.

Expended bullets may release small amounts of iron, aluminum, and copper into the sediments and the overlying water column as bullets corrode. Although, elevated levels of these elements can cause toxic reactions in exposed animals, high concentrations in sediments would be restricted to a small zone around the bullet, and releases to the overlying water column would be quickly diluted. The projectiles for 5.56-mm and 7.62-mm gun ammunition have lead cores; however, no significant releases of lead into the water through dissolution are expected because of the neutral pH of ocean waters and sediments (DON 2005d). Based on the low probability of ingestion and/or absorption of lead from bullet cores, slight to non-existent effects on fisheries are expected.

3.11.4 Torpedo Exercises

Torpedo exercises (TORPEXs) entail aircraft, surface ship, or submarine crews attacking targets with torpedoes (DON 2004c, 2005b). Submarines practice launching non-explosive training torpedoes against surface ship targets. When a torpedo “hits” its target, or runs out of fuel if it misses its intended target, it drops ballast weights (see previous expended material section) or inflates a gas chamber and floats to the surface to be recovered by a ship. Torpedoes used in aviation exercises typically employ recoverable exercise torpedoes which do not have fuel or propulsion. Attempts are made to recover all torpedoes.

No ordnance would be detonated during a TORPEX, so the physical force that marine organisms are exposed to would be limited to that produced by torpedo launching and movement. Due to the small area of torpedo traverse, the number of fish strikes by torpedoes would be low.

The primary potential impact to the marine environment would be the release of combustion products into the ocean from torpedo fuel. Torpedo exhaust products, nitrogen oxides, carbon monoxide, carbon dioxide, hydrogen, nitrogen, methane, ammonia, and hydrogen cyanide, would be rapidly dissolved, disassociated, or dispersed in the water column (DON 2004c). Carbon dioxide, nitrogen, methane and ammonia are naturally-occurring in seawater. Carbon monoxide and hydrogen have low solubility in seawater and would bubble to the surface dissipating into the air. Trace amounts of nitrogen oxides may be present, but are usually below detectable limits.

Hydrogen cyanide (HCN) does not normally occur in seawater, and if present in high-enough concentration, could pose a potential risk to marine biota. The US Environmental Protection Agency national water-quality criterion for HCN in marine waters is 1 part per billion for both acute and chronic effects. In order for the HCN concentration to be below this threshold and be considered non-toxic, marine life would need to be outside an estimated 6.3 m (21 ft) zone of influence around the torpedo’s path until such time that the HCN is diffused into the water (DON 2004c). Because HCN has extremely high solubility in seawater, the HCN will rapidly diffuse to levels below one ppb and thus would pose no significant threat to marine organisms. For a substantial quantity of torpedo fuel to be released into the ocean, the torpedo would have to be subjected to stresses beyond its structural design limits and catastrophically fail. Such stress is very unlikely to occur.

The Mk 50 torpedo uses lithium metal fuel. Its operation does not result in a routine discharge. A breach of the lithium-fueled boiler systems is extremely rare, but might occur at an estimated rate of once per year worldwide. Based on an analysis of worst-case scenarios, the Navy concluded that a breach of the lithium boiler system at any point in the torpedo run would not have a significant impact on the marine environment (DON 2004c).

3.11.5 Acoustic Device Countermeasures and Expendable Mobile Anti-Submarine Warfare Training Target Exercises

Lithium sulfur dioxide (LiSO2) battery cells power both ADCs and EMATTs. Since they are expended, battery chemical could eventually be released into the marine environment (DON 2005b). Lithium is the 17th most abundant element in seawater. In addition to it being found naturally in seawater, currents would rapidly diffuse its concentration around ADCs or EMATTs, thus minimizing the potential impact. The lithium metal contained in the ADC or EMATT is extremely reactive with water. When the lithium reacts with water it causes an exothermic (heat liberating) reaction that generates soluble hydrogen gas and lithium hydroxide. The hydrogen gas eventually enters the atmosphere and the lithium hydroxide dissociates, forming lithium ions and hydroxide ions. The hydroxide is neutralized by the hydrolysis of the acidic sulfur dioxide, ultimately forming water. Sulfur dioxide, a gas that is highly soluble in water, is the major reactive component in the battery. The sulfur dioxide ionizes in the water, forming bisulfite (HSO3) that is easily oxidized to sulfate in the slightly alkaline environment of the ocean. Sulfur is present as sulfate in large quantities in the ocean. Chemical reactions of the lithium sulfur dioxide batteries would be highly localized and short-lived. Ocean currents would greatly diffuse concentrations of the chemicals leached by the ADC or EMATT batteries. For these reasons the lithium sulfur dioxide batteries would not significantly affect water quality, marine fish, or EFH.

3.11.6 Missile Exercises

In these exercises, missiles are fired by aircraft, ships, and Naval Special Warfare (NSW) operatives at a variety of airborne and surface targets. Missiles used in most aviation exercises are non-explosive versions and do not explode upon contact with the target or sea surface. Practice missiles do not use rocket motors or their potentially hazardous rocket fuel. The main environmental impact would be the physical structure of the missile itself entering the water.

Intact missiles and aerial targets falling from the sky would impact the ocean surface with great force, producing shock waves that could kill and injure fish. In Section 3.2.2.y of the EIS/OEIS, the pressure levels known to cause injury and mortality were used to estimate effects of shock pulses created by falling missiles and targets. Calculations were also made for sea surface impact effects from non-explosive bombs and practice mines dropped from aircraft. For all of the exercises of these types in the SOCAL Range Complex, an amount of fish equivalent to <1 lb (0.45 kg) of commercial fish catch would be killed annually.

Exploding warheads may be used in air-to-air missile exercises, but to avoid damaging the aerial target, the missile explodes in the air, disintegrates, then, falls into the ocean. Regions of missile target practice are monitored by Navy personnel to identify marine animals and avoid areas of significant concentration.

The quantity of fish killed or injured by practice missiles or their debris striking the water would be a very small fraction of the indigenous fish community.

3.11.7 Expeditionary Assault

Expeditionary Assault involves a seaborne force assaulting across a beach in a combination of helicopters, vertical takeoff and landing (VTOL) aircraft, landing craft air cushion (LCAC), amphibious assault vehicles (AAVs), expeditionary fighting vehicle (EFV) and landing craft. More robust expeditionary assault operations include support by Naval surface fire support (NSFS), close air support (CAS), and Marine artillery.

The large vehicles and landing craft crossing shallow water and the beach in an amphibious assault could damage EFH. Before each major amphibious landing exercise is conducted, a hydrographic survey is performed to map out the precise transit routes through sandy bottom areas. During the landing, the crews follow established procedures, such as having a designated lookout watching for other vessels, obstructions to navigation, and significant concentrations of marine animals. Sensitive habitats such as rocky reefs, seagrass beds, and kelp beds would be avoided.

Although amphibious landings are restricted to specific areas of designated beaches, amphibious landings in nearshore sandy subtidal habitat could lead to a temporary adverse impact on Managed Species due to death or injury, loss of benthic epifauna and infauna that may serve as prey, and increased turbidity. Increases in turbidity could temporarily decrease the foraging efficiency of fish, however, given the dynamic nature of the habitat and the grain size of the material, turbidity is expected to be minimal and localized. Artillery rounds that fall short of land would destroy patches of sandy bottom habitat kill or injure nearby marine life. However, the overall impacts on marine biological resources would be limited because sandy beach habitats support relatively few organisms and are adapted to recover quickly from disturbance.

3.11.8 Shallow Water Minefield

Multiple possible sites off Tanner Bank, Cortes Bank, La Jolla, and Point Loma have been considered for a shallow water minefield. Of these, an area known as Advanced Research Project Agency Training Minefield (ARPA) off La Jolla (and historically used for shallow water submarine MCM training) is the desired location for expanding MCM training.

Shallow water minefield support of submarine MCM training requires a depth of 250-420 feet, and a sandy bottom and flat contour in an area relatively free from high swells and waves. The size of the area would be a minimum of 2x2 nm and optimally 3x3 nm. Mine shapes would be approximately 500-700 yards apart and 30-35 inches in size, and would consist of a mix of recoverable/replaceable bottom shapes (~10 cylinders weighed down with cement) and moored shapes (~15 shapes, no bottom drilling required for mooring). Localized, temporary impacts on water quality and sessile benthic fauna would occur during installation of the mine shapes; therefore, adverse impacts on Managed Species or EFH would be expected.

3.11.9 Shallow Water Training Range Extension

This component of the Proposed Action is to instrument and use two extensions of the current SOAR, one 250-nm^2 (463-km^2) area to the west in the area of the Tanner/Cortez Banks, and one 250-nm^2 (463-km^2) area between SOAR and the southern section of SCI. The instrumentation would be in the form of undersea cables and sensor nodes, which would constitute a SWTR portion of SOAR. The cables and sensors are similar to those that instrument the current deep-water range (SOAR). The combination of deep-water and shallow-water instrumentation provides range uninterrupted coverage of air, surface, and subsurface operations. The instrumented area would be connected to the shore via a single trunk cable. Installation of additional acoustic sensors in the nearshore and offshore shallow water extensions has the potential to have localized impacts on fish. These impacts would generally consist of fish fleeing the construction area, and would not have adverse effects at the population level.

3.11.10 Sinking Exercises

During a SINKEX, Navy crews fire live and non-explosive ordnance at a target vessel that has been towed to a location in the SOCAL Range Complex. Target vessels are empty, cleaned, and, environmentally remediated to U.S. EPA specifications. A wide variety of assets may be involved, including aircraft, helicopters, surface ships, and submarines (DON 2006a).

The numbers and types of weapons used in a SINKEX depend on training requirements and the size of the target vessel, but could include air-to-surface missiles and bombs, surface-to-surface missiles, torpedoes, and naval gun fire. The total net explosive weight (NEW) expended would not exceed 20,000 lb (9,072 kg) per target during the exercise. The NEW of any individual weapon would not exceed 1000 lb (454 kg) (DON 2006a).

Prior to conducting an exercise, a Notice to Mariners and a Notice to Airmen delineating the exercise area and time would be published. Extensive range clearance operations would be conducted prior to the exercise, ensuring that no shipping is within the range of weapons being fired. In addition, for 90 minutes prior to the commencement of the exercise and between certain series of weapon firings, a 2.5 nm exclusion zone would be surveyed by visual and acoustic means to detect the presence of protected marine mammals and sea turtles. A safety zone would also be established which extends from the exclusion zone at 2.5 nm out another 2 nm. Together, the exclusion and safety zones extend out 4.5 nm from the target.

In the rare event that the deployed ordnance does not sink the target, EOD personnel would scuttle the ship, typically the following day, using charges placed in locations that would breech the hull to sink the unstable ship. Whether guided or unguided, the majority of ordnance would hit the target. Of all the weapons used, only the torpedo is designed to explode in the water column.

The transfer of pressure waves and acoustic energy from detonation of ordnance within the target should have minimal impact on adjacent marine life (DON 2006a). Effects from gun fire shells, bombs, and missiles that fall short of the target and torpedoes striking the vessel, as discussed previously, could cause mortality or injure pelagic marine life, but should not have significant, long-term, biological consequences. Although SINKEX can have an adverse effects on Managed Species, all vessel sinkings are conducted in water at least 1,000 fathoms (6,000 feet) deep and at least 50 nautical miles from land to avoid impacts to sensitive EFH,. Thus, SINKEX operations would not destroy or adversely effect sensitive benthic habitats, but may alter soft bottom habitats and may provide a beneficial use by providing consolidated habitat in the deep water environment.

3.12 SONAR USE

Antisubmarine warfare (ASW) and mine warfare (MIW) exercises include training sonar operators to detect, classify, and track underwater objects and targets. There are two basic types of sonar: passive and active. Passive sonars only listen to incoming sounds and, since they do not emit sound energy in the water, lack the potential to acoustically affect the environment. Active sonars emit acoustic energy to obtain information about a distant object from the reflected sound energy. Active sonars are the most effective detection systems against modern, ultra-quiet submarines and sea mines in shallow water.

Modern sonar technology has developed a multitude of sonar sensor and processing systems. In concept, the simplest active sonars emit acoustic pulses (“pings”) and time the arrival of the reflected echoes from the target object to determine range. More sophisticated active sonars emit a ping and then scan the received beam to provide directional as well as range information. Only about half of the U.S. Navy's ships are equipped with active sonar and their use is generally limited to training and maintenance activities - 90% of sonar activity by the Navy is passive (DON 2007e).

Active sonars operate at different frequencies, depending on their purpose. High-frequency sonar (>10 kHz) is mainly used for establishing water depth, detecting mines, and guiding torpedoes. At higher frequencies, sound energy is greatly attenuated by scattering and absorption as it travels through the water. This results in shorter ranges, typically less than five nautical miles. Mid-frequency sonar is the primary tool for identifying and tracking submarines. Mid-frequency sonar (1 kHz - 10 kHz) suffers moderate attenuation and has typical ranges of 1-10 nautical miles. Low-frequency sonar (<1 kHz) has the least attenuation, achieving ranges over 100 nautical miles. Low-frequency sonars are primarily used for long-range search and surveillance of submarines. Surveillance Towed Array Sensor System Low-frequency Active (SURTASS LFA) is the U.S. Navy's low-frequency sonar system (DON 2001b, 2005surtass). It employs a vertical array of 18 projectors using the 100-500 Hz frequency range.

Sonars used in ASW are predominantly in the mid-frequency range (DON 2007e). ASW sonar systems may be deployed from surface ships, submarines, and rotary and fixed wing aircraft. The surface ships are typically equipped with hull mounted sonar but may tow sonar arrays as well. Helicopters are equipped with dipping sonar (lowered into the water). Helicopters and fixed wing aircraft and may also deploy both active and passive sonobuoys and towed sonar arrays to search for and track submarines.

Submarines also use sonars to detect and locate other subs and surface ships. A submarine’s mission revolves around stealth, and therefore submarines use their active sonar very infrequently since the pinging of active sonar gives away their location. Submarines are also equipped with several types of auxiliary sonar systems for mine avoidance, for top and bottom soundings to determine the submarine’s position in the water column, and for acoustic communications. ASW training targets simulating submarines may also emit sonic signals through acoustic projectors.

Sonars employed in MIW training are typically high-frequency (greater than 10 kHz). They are used to detect, locate, and characterize mines that are moored, laid on the bottom, or buried (DON 2002c, 2005b, c,d). MIW sonars can be deployed from multiple platforms including towed systems, unmanned underwater vehicles (UUVs), surf zone crawlers, or surface ships.

Torpedoes use high-frequency, low-power, active sonar. Their guidance systems can be autonomous or electronically controlled from the launching platform through an attached wire. The autonomous guidance systems are acoustically based. They operate either passively, exploiting the emitted sound energy by the target, or actively, ensonifying the target and using the received echoes for tracking and targeting.

Military sonars for establishing depth and most commercial depth sounders and fish finders operate at high frequencies, typically between 24 and 200 kHz.

3.12.1 Low-frequency Sonar

Low-frequency sound travels efficiently in the deep ocean and is used by whales for long-distance communication (Richardson et al. 1995, NRC 2003, 2005). Concern about the potential for low-frequency sonar (<1 kHz) to interfere with cetacean behavior and communication has prompted extensive debate and research (DON 2001b, 2005b, 2007e, NRC 2000, 2003).

Some studies have shown that low-frequency noise will alter the behavior of fish. For example, research on low-frequency devices used to deter fish away from turbine inlets of hydroelectric power plants showed stronger avoidance responses from sounds in the infrasound range (5-10 Hz) than from 50 and 150 Hz sounds (Knudsen et al. 1992, 1994). In test pools, wild salmon exhibit an apparent avoidance response by swimming to a deeper section of the pool when exposed to low-frequency sound (Knudsen et al. 1997).

Turnpenny et al. (1994) reviewed the risks to marine life, including fish, of high intensity, low-frequency sonar. Their review focused on the effects of pure tones (sine waves) at frequencies between 50-1000 Hz. Johnson (2001) evaluated the potential for environmental impacts of employing the SURTASS LFA sonar system. While concentrating on the potential effects on whales, the analysis did consider the potential effects on fish, including bony fish and sharks. It appears that the swimbladders of most fish are too small to resonate at low frequencies and that only large pelagic species such as tunas have swimbladders big enough to resonate in the low-frequency range. However, investigations by Sand and Hawkins (1973), and Sand and Karlsen (1986) revealed resonance frequencies of cod swim bladders from 2 kHz down to 100 Hz.

Hastings et al. (1996) studied the effects of low-frequency underwater sound on fish hearing. More recently, Popper et al. (2005a, 2007) investigated the impact of U. S. Navy SURTASS LFA sonar on hearing and on non-auditory tissues of several fish species. In this study, three species of fish in Plexiglas cages suspended in a freshwater lake were exposed to high intensity LFA sonar pulses for periods of time considerably longer than likely LFA exposure. Results showed no mortality and no damage to body tissues either at the gross or histological level. Some individuals exhibited temporary hearing loss but recovered within several days of exposure. The study suggests that SURTASS LFA sonar does not kill or damage fish even in a worst case scenario.

Low-frequency sonar use in SOCAL is not expected, so there would be no adverse affects to EFH or Managed Species from low-frequency sonar.

3.12.2 Mid-frequency Sonar

ASW training operations would use mid-frequency (1-10 kHz) sound sources. Most fish only detect sound below this range (Popper, 2003; Hastings and Popper, 2005). Thus, it is expected that few fish species would be able to detect the ASW mid-frequency sonar.

Some investigations have been conducted on the effect on fish of acoustic devices designed to deter marine mammals from gillnets (Gearin et al. 2000, Culik et al. 2001). These devices generally have a mid-frequency range, similar to the sonar devices that would be used in ASW exercises. Adult sockeye salmon exhibited an initial startle response to the placement of inactive acoustic alarms designed to deter harbor porpoise. The fish resumed their normal swimming pattern within 10 to 15 seconds. After 30 seconds, the fish approached the inactive alarm to within 30 cm (1 ft). The same experiment was conducted with the alarm active. The fish exhibited the same initial startle response from the insertion of the alarm into the tank; however, within 30 seconds, the fish were swimming within 30 cm (1 ft) of the active alarm. After five minutes of observation, the fish did not show any reaction or behavior change except for the initial startle response. This demonstrated that the alarms were either inaudible to the fish, or the fish were not disturbed by the mid-frequency sound.

Jørgensen et al. (2005) carried out experiments examining the effects of mid-frequency (1 to 6.5 kHz) sound on survival, development, and behavior of fish larvae and juveniles. Experiments were conducted on the larvae and juveniles of Atlantic herring, Atlantic cod, saithe *Pollachius virens*, and spotted wolffish *Anarhichas minor*. Swimbladder resonance experiments were attempted on juvenile Atlantic herring, saithe, and Atlantic cod. Sound exposure simulated Naval sonar signals. These experiments did not cause any significant direct mortality among the exposed fish larvae or juveniles, except in two (of a total of 42) experiments on juvenile herring where significant mortality (20-30%) was observed. Among fish kept in tanks one to four weeks after sound exposure, no significant differences in mortality or growth related parameters (length, weight and condition) between exposed groups and control groups were observed. Some incidents of behavioral reactions were observed during or after the sound exposure - ‘panic’ swimming or confused and irregular swimming behavior. Histological studies of organs, tissues, or neuromasts from selected Atlantic herring experiments did not reveal obvious differences between control and exposed groups.

The work of Jørgensen et al. (2005) was used in a study by Kvadsheim and Sevaldsen (2005) to examine the possible ‘worse case’ scenario of sonar use over a spawning ground. They conjectured that normal sonar operations would affect less than 0.06% of the total stock of a juvenile fish of a species, which would constitute less than 1% of natural daily mortality. However, these authors did find that the use of continuous-wave transmissions within the frequency band corresponding to swim bladder resonance will escalate this impact by an order of magnitude. The authors therefore suggested that modest restrictions on the use of continuous-wave transmissions at specific frequencies in areas and at time periods when there are high densities of Atlantic herring present would be appropriate.

Studies have indicated that acoustic communication and orientation of fish may be restricted by noise regimes in their environment (Wysocki and Ladich 2005). Although some species may be able to produce sound at higher frequencies (> 1 kHz), vocal marine fish largely communicate below the range of mid-frequency levels used in the proposed action. Further, most marine fish species are not expected to able to detect sounds in the mid-frequency range of the operational sonars used in the proposed action. The few fish species that have been shown to be able to detect mid-frequencies do not have their best sensitivities in the range of the operational sonars. Thus, these fish can only hear mid-frequency sounds when they are very loud (i.e. when sonars are operating at their highest energy levels and fish are within a few meters). Considering the low-frequency detection of most marine species and the limited time of exposure due to the moving sound sources, the mid-frequency sound sources used in the proposed action do not have the potential to significantly mask key environmental sounds.

Experiments on fish classified as hearing specialists (but not those classified as hearing generalists) have shown that exposure to loud sound can result in temporary hearing loss, but it is not evident that this may lead to long-term behavioral disruptions in fish that are biologically significant (Amoser and Ladich 2003, Smith et al. 2004 a,b). There is no information available that suggests that exposure to non-impulsive acoustic sources results in significant fish mortality at the population level.

In summary, while some marine fish may be able to detect mid-frequency sounds, most marine fish are hearing generalists and have their best hearing sensitivity below mid-frequency sonar. If they occur, behavioral responses would be brief, reversible, and not biologically significant. Sustained auditory damage is not expected. Sensitive life stages (juvenile fish, larvae and eggs) very close to the sonar source may experience injury or mortality, but area-wide effects would likely be minor. The use of Navy mid-frequency sonar would not compromise the productivity of fish or adversely affect their habitat.

3.12.3 High-frequency Sonar

Although most fish cannot hear sound frequencies over 10 kHz, some shad and herring species can detect sounds in the ultrasonic range, i.e., over 20 kHz. (Mann et al., 2001; Higgs et al., 2004). Ross et al., (1995, 1996) reviewed the use of high-frequency sound to deter alewives from entering power station inlets. The alewife, a member of the shad family (Alosinae) which can hear sounds at ultrasonic frequencies (Mann et al., 2001), uses high-frequency hearing to detect and avoid predation by cetaceans. Studies conducted on the following species showed avoidance to sound at frequencies over 100 kHz: alewife (*Alosa pseudoharengus*) (Dunning et al., 1992; Ross et al., 1996), blueback herring (*A. aestivalis*) (Nestler et al., 2002), Gulf menhaden (*Brevoortia patronus*) (Mann et al., 2001) and American shad (*A. sapidissima*) (Popper and Carlson, 1998). The highest frequency to solicit a response in any marine fish was 180 kHz for the American shad (Gregory and Clabburn, 2003; Higgs et al., 2004).

Since high-frequency sound attenuates quickly in water, high levels of sound from mine hunting sonars would be restricted to within a few meters of the source. Even for fish able to hear sound at high frequencies, only short-term exposure would occur, thus high-frequency military sonars are not expected to have significant effects on resident fish populations.

Because a torpedo emits sonar pulses intermittently and is traveling through the water at a high speed, individual fish would be exposed to sonar from a torpedo for a brief period. At most, an individual animal would hear one or two pings from a torpedo and would be unlikely to hear pings from multiple torpedoes over an exercise period. Most fish hear best in the low- to mid-frequency range and therefore are unlikely to be disturbed by torpedo pings.

The effects of high-frequency sonar, on fish behavior, for species that can hear high-frequency sonar, would be transitory and of little biological consequence. Most species would probably not hear these sounds and would therefore experience no disturbance.

3.12.4 Conclusion

While the impact of anthropogenic noise on marine mammals has been studied, the effects of noise on fish are largely unknown (Popper 2003, Hastings and Popper 2005). There is a dearth of empirical information on the effects of exposure to sound, let alone sonar, for the vast majority of fish. The few studies on sonar effects have focused on behavior of individuals of a few species and it is unlikely their responses are representative of the wide diversity of other marine fish species (ICES 2005, Jorgensen et al. 2005). The literature on vulnerability to injury from exposure to loud sounds is similarly limited, relevant to particular species, and, because of the great diversity of fish, not easily extrapolated. More well-controlled studies are needed on the hearing thresholds for fish species and on temporary and permanent hearing loss associated with exposure to sounds. The effects of sound may not only be species specific, but also depend on the mass of the fish (especially where any injuries are being considered) and life history phase (eggs and larvae may be more or less vulnerable to exposure than adult fish). The use of sounds during spawning by some fish, and their potential vulnerability to masking by anthropogenic sound sources, also requires further investigation. No studies have established effects of cumulative exposure of fish to any type of sound or have determined whether subtle and long-term effects on behavior or physiology could have an impact upon survival of fish populations. The use of sounds during spawning by some fish and their potential vulnerability to masking by anthropogenic sound sources requires closer investigation.

With these caveats and qualifications in mind, the limited information currently available suggests that populations of fish are unlikely to be affected by the projected rates and areas of use of military sonar. Thus, significant harm to fish is not anticipated from Navy sonar used in SOCAL Range Complex training.

3.13 RESEARCH, DEVELOPMENT, TESTING, AND EVALUATION

SOCAL Range Complex operations include a wide variety of Research, Development, Testing, and Evaluation (RDT&E) of underwater weapons, weapons systems, and components. Specific events include: Ship Tracking and Torpedo Tests; Unmanned Underwater Vehicle (UUV) Tests; Sonobuoy Quality Assurance (QA)/Quality Control (QC) Tests; Ocean Engineering Tests; Marine Mammal Mine Shape Location and Research; Radio Frequency (RF) Tests; Unmanned Aerial Vehicles (UAV) Tests Missile Flight Tests; and, Naval Undersea Warfare Center (NUWC) Acoustics Tests. With the exception of Marine Mammal Mine Shape Location and Research, the potential impact of various elements of RDT&E activities are considered in sections dealing with common components of offshore operations (e.g., weapons and sonar use).

Marine Mammal Mine Shape Location and Research involves the deployment of trained bottlenose dolphins and California sea lions to locate and retrieve non-explosive mine shapes. No ordnance is involved. The recoverable mine shapes emit pings for retrieval purposes. The only aspect of the training that has potential effects on fish is the use of the high-frequency (28–45 kHz) pingers that are attached to non-explosive mines to allow recovery. High-frequency sounds attenuate rapidly in seawater, and would be inaudible or only faintly audible to most fish (see Section 3.8 (Fish) of the EIS/OEIS). Any disturbance effects would be localized, short-term, and insignificant in an ecological context.

The Marine Communities and Fish evaluations in the EIS/OEIS (Sections 3.5 and 3.8) conclude that the only RDT&E activity that has the potential for adverse effects on marine animals is Underwater Acoustics Testing involving mid-frequency sonar. Effects of mid-frequency sonar on fish would be less than significant.

3.14 IMPACT SUMMARY

The SOCAL Range Complex covers a vast area from coastal beaches to 600 nautical miles (1,111 km) offshore encompassing approximately 120,000 nm^2 (411,588 km^2). The wide dispersion in time and space of Navy training operations superimposed on the variable temporal and seasonal distributions of the fish species present minimizes the potential for interaction with local populations. Although adverse effects on EFH and Managed Species are expected, given the limited extent, duration, and magnitude of potential impacts, these effects would be minimal (Table 3-4).

Table 3-4: Impact Summary

Action or Activity	Impact Assessment
Vessel Movement	Ship strikes on fish would be rare. Behavioral alterations would occur only close to a ship and involve short-term redistributions with little potential for adverse effect on fish populations.
Aircraft Over-Flight	Response of fish to aircraft over-flight would be within the range of normal behavior. Sonic booms would be sporadic and are not expected to have significant effects on underwater life.
Fuel Spills	Infrequent fuel spills, mitigated through standard spill control responses and wildlife rescue procedures, should not jeopardize EFH or Managed Species.
Discharges from Ships	Navy vessels would comply with National and International conventions, minimizing or eliminating potential impacts from discharges.
<u>Expended Material</u>	Expended material poses a risk from direct contact, ingestion, entanglement, and exposure to hazardous chemicals.
Lightsticks	Deploying a limited number of lightsticks over the large SOCAL Range Complex would have an insignificant biological effect.
Flares	Light from flares would not be bright enough or sustained enough to interfere with ecological processes. Flare debris is unlikely to injure fish, modify water quality, or degrade benthic sediments.
Chaff	Fish would not suffer lasting physical effects from chaff particles coating the skin, passing through the gills or from ingestion.
Dye	Dye would be rapidly dispersed and is non-toxic. The plastic bags containing the dye would pose a small ingestion hazard compared to the total load of man-made plastic to which local fish are exposed.
Markers	Light generated from marine markers is intense but brief, and associated smoke would be rapidly diffused by air movement. Marker debris would sink to the bottom and be encrusted and/or incorporated into the sediments.
Sonobuoys	The relatively small amounts of battery chemicals released if a sonobuoy were damaged would be quickly diluted to non-toxic concentrations. The physical components of expended sonobuoys would not pose a threat to marine life.
XBTs	It is possible, but unlikely, that fish would ingest an Expendable Bathythermograph, due to its size and rapid decent. XBTs would slowly degrade, corrode, and/or be buried by sediments on the seafloor.
Torpedo Accessories	Control wires, flex hoses, ballast weights, and other torpedo accessories left on the ocean bottom after torpedo exercises would not be a toxic hazard.
Targets	Airborne, surface or subsurface targets are designed to be recovered. If severely damaged, however, they may sink before retrieval is possible - but would not harm Managed Species or EFH.
EMATTs	Expendable Mobile Acoustic Torpedo Targets sink to the bottom after use, eventually settling into sediments or becoming encrusted on hard-bottom substrates with minimal impact.
ADCs	Acoustic Device Countermeasures are expendable and not normally retrieved. The consequences of their residence on the sea floor would be similar to other expended material.
Sunken Vessels	Clean, empty target vessels would settle to the bottom eliminating marine habitat directly underneath. They would subsequently function as artificial reefs possibly enhancing habitat quality.
Entanglement	Torpedo control wires and flex hoses resist looping and are unlikely to snare marine life. Small, expendable parachutes used with flares and sonobuoys pose a risk of entanglement, but the limited number deployed should not have adverse effects on fish populations or their habitats.
Hazardous Chemicals	The small amounts of potentially hazardous chemicals introduced into the ocean from expended material would have adverse effects, but would be minimal and temporary.

Table 3-5: Impact Summary (cont'd)

Action or Activity	Impact Assessment
Radio Frequency Emissions	Fish would not be exposed to high intensity RF emissions for a sustained period of time.
Sound Generating Devices	Effects on fish from Long Range Acoustic Devices are unlikely since sound is not effectively transmitted through the air/water interface.
Lasers	Marine life in the water would not be illuminated by laser beams.
Underwater Detonation	Underwater detonation will only take place in waters overlying soft sediments. Displacement of bottom sediments and increased turbidity will be temporary and localized. Disturbed area recovery would be relatively rapid. Explosion by-products would not pose a risk to marine life and would not bioaccumulate. A limited number of fish would be killed by the shockwave or debris from explosive detonations. Some fish would be injured and could subsequently die or suffer greater rates of predation. However, the overall impact would be local and transient. When exercises are completed, the fish stock would repopulate the area. Fish abundance and diversity are unlikely to measurably decrease. Given the limited time scale of individual explosions and their broad distribution in time and space, masking of acoustic environmental cues and physiological stress should not be significant. Behavioral responses including alarm, avoidance, and interruption of communication would not substantially effect the ability of fish or their prey to survive, grow, or reproduce. The potential for permanent hearing loss is unknown, but temporary auditory deficits may occur, with normal hearing returning over a period of minutes to days.
Bombing	Most bombs used in training exercises will be practice bombs without explosive warheads. The shock from practice bombs hitting the sea surface could result in a small number of fish kills or injuries and minor acoustic displacement, but would not substantially affect fish populations. Practice bombs would not introduce combustion chemicals into the ocean. After sinking to the bottom, the physical structure of bombs would be incorporated into the marine environment by natural encrustation and/or sedimentation. Some fish would be killed or injured from the pressure wave created by the exploding bomb and by propelled fragments. Beyond the area of physical effects, the natural reaction of fish would be to leave, but the fish stock would be repopulated when the exercise concludes. The overall impact to water column habitat would be brief and would be restricted to a small area. The abundance and diversity of fish within SOCAL Range Complex are unlikely to measurably decrease as a result of bombing exercises.
Naval Gun Fire	Gun fire shells rapidly decelerate on contact with water. Few fish would be directly struck, but the shock wave from exploding rounds would cause death, injury, and behavioral disruptions. The overall impacts would be minor with fish returning after the exercise. Debris sinking to the bottom would have negligible influence on the benthic environment.
Torpedo Exercises	Ordnance would not be detonated during torpedo exercises. Due to the small size of the transit area of torpedoes, the probability of fish strikes would be low. Concentrations of combustion products from torpedo fuel would be below levels hazardous to marine life. Release of fuel from catastrophic torpedo failure is highly unlikely.
EMATT and ADC Exercises	Chemicals from lithium sulfur dioxide batteries used to power EMATTs and ADCs could be released into the marine environment. Chemical reactions would be localized and short-lived with insignificant impact on water quality.
Missile exercises	Missiles used in most training exercises are non-explosive. The main environmental impact would be the physical structure of the missile itself entering the water. Practice missiles do not use rocket motors or their potentially hazardous rocket fuel. The number of fish adversely affected by missile exercises would be a small fraction of the indigenous community.

Table 3-6: Impact Summary (cont'd)

Action or Activity	Impact Assessment
Shallow Water Minefield	Localized, temporary impacts on water quality and sessile benthic fauna would occur during installation of mine shapes, but no adverse effect on Managed Species or EFH would be expected.
Shallow Water Training Range Extension	Installation of additional acoustic sensors would cause fish to leave the area, but would not have adverse effects at the level of fish populations.
Expeditionary Assault	Landing craft crossing shallow water and artillery shells that fall short could damage EFH. However, the biological impact would be limited because sandy beach habitats support relatively few organisms and those present are adapted to recover quickly from disturbance.
Sinking Exercises	Pressure waves from detonation of ordnance within target vessels should be relatively contained. Gun fire, bombs, and missiles that fall short of the target, and torpedoes striking the vessel, would affect nearby marine life, but would not have significant, long-term biological consequences.
SONAR Exercises	U.S. Navy low-frequency sonar does not appear to have the potential to kill or injure marine fish. Temporary hearing loss and behavioral modifications have been demonstrated in laboratory studies, but field populations should not be compromised given the limited use of low-frequency sonar. Most fish species would be not able to detect mid-frequency sonar at the lower end of its range. For those who can, short-term behavioral responses such as startle and avoidance are possible which could adversely affect sensitive species during critical times such as breeding and spawning. The resulting ecological consequences are unknown, but major effects at the population level would not be anticipated. Most fish would not be able to detect high-frequency sonar sounds. High frequencies quickly attenuate in water, restricting potential adverse effects to within a few meters of the source. Area-wide impacts are unlikely.
Research, Development, Testing, and Evaluation	The only RDT&E test with the potential to impact fish is Underwater Acoustics Testing, which involves mid-frequency sonar use. Effects would be less than significant (see following SONAR summary).

3.15 ALTERNATIVES COMPARISON

Three alternatives are analyzed in the SOCAL Range Complex EIS/OEIS: 1) The No Action Alternative – Current Operations; 2) Alternative 1 - Increase Operational Training and Accommodate Force Structure Changes, and 3) Alternative 2 – Increase Operational Training, Accommodate Force Structure Changes, and Implement Range Enhancements. As described in the Impact Definition section (3.1), for Essential Fish Habitat and Managed Species an adverse effect is considered to be: 1) more than minimal, 2) not temporary, 3) causes significant changes in ecological function, and, 4) does not allow the environment to recover without measurable impact.

On the basis of impact determinations in the EIS/OEIS (Sections: 3.1-3.14) and this EFH assessment, none of the three alternatives would be expected to have adverse effects on EFH and Managed Species (Table 3-5).

Table 3-7: Alternatives Comparison – Effects on EFH and Managed Species

Alternative	Impact Assessment
No Action Alternative - Current Operations	Adverse Effects would be minimal and temporary. • Vessel movement, aircraft over-flight, fuel spills, discharges from ships, expended materials, radio frequency emissions, sound generating devices, and lasers would have less than significant effects on Managed Species and EFH. • Munitions constituents and other materials from training devices and training and testing exercises would have result in short-term, localized impacts. • Small numbers of fish would be killed by shock waves from practice mines, non-explosive bombs, non-exploding gunfire rounds, and intact missiles and targets hitting the water surface. Minor, acoustic displacement would also occur, but would not substantially affect local fish populations. • Underwater detonation would only take place in waters overlying soft sediments. Disturbance of bottom sediments and increased turbidity would be temporary and localized with minimal and temporary impacts on EFH and Managed Species. • Relatively small numbers of fish would be killed by bombs exploding near the surface, but effects on EFH would be minimal and temporary since live bombing exercises are conducted away from sensitive habitats or HAPCs. • Landing craft crossing shallow water would have short-term impacts on small areas of sandy bottom. The biological effect would be limited because this type of habitat is naturally resilient and recovers quickly from disturbance. • Only a few species of fish would detect the relatively high frequencies generated by tactical sonar - effects of sonar use on EFH and Managed Species would be less than significant. • No long-term changes in diversity or abundance of Managed Species. • No loss or degradation of Essential Fish Habitat or HAPCs.
Alternative 1 - Increased Operational Training and Force Structure Changes	Adverse Effects would be minimal and temporary. Impacts as described in the No Action Alternative plus the following: • Effects of sonar used in the Surface Ship ASW Integrated Anti-submarine Warfare exercises on Managed Species would be less than significant. • Relatively small numbers of fish would be killed by Improved Extended Echo Ranging (IEER) sonobuoy detonation in ASW exercises, but effects on fish populations would be insignificant. • Battalion-sized amphibious landings and USMC Amphibious Warfare exercises added in Alternative 1 involve types of activities common to many exercises discussed above, and would have minimal and temporary adverse effects on EFH. • Small increases in the number of Offshore Operations, Underwater Demolitions exercises, and RDT&E tests would have insignificant changes to No Action impacts on Managed Species and EFH.
Alternative 2 (Preferred Alternative) - Increased Operational Training, Force Structure Changes, and Range Enhancements	Adverse Effects would be minimal and temporary. Impacts same as described for No Action Alternative plus Alternative 1. • Small increases in the number of Offshore Operations, Underwater Demolitions exercises, and RDT&E tests would result in less than significant changes to impacts on EFH and Managed Species. • Increased Commercial Air Services, use of the Shallow Water Mine Minefield, extension of the Shallow Water Training Range would have similar, minimal and temporary adverse effects on Managed Species and EFH.

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4 MITIGATION MEASURES

The Navy has established standard protective measures to minimize potential environmental impacts from training exercises. Some of these mitigation measures are generally applicable and others are designed to apply to certain geographic areas during certain times of year, for specific types of Navy training. Mitigation measures covering habitats and species occurring in the SOCAL Range Complex have been developed through various environmental analyses conducted by the Navy for land and sea ranges and adjacent coastal waters (see DON BAs, EAs, OEAs, EISs, and OEISs in the Reference Section). Consultations with the NMFS on previous training events that included the SOCAL Range Complex have produced mitigation measures specifically designed to protect local threatened and endangered species (e.g., NMFS 2002c). In addition, the Navy also has a Protective Measures Assessment Protocol (PMAP) initiative in place which is intended to ensure the latest protected species/habitats mitigation data and guidance are available to the operators conducting training exercises (DON 2004a, 2006f). These mitigation measures are typically promulgated through the use of Navy messages issued to all units and commands participating in an exercise as well as to non-Navy participants (other DOD services and NATO allies) to encourage their overall use.

Each element of the EIS/OEIS includes mitigation measures specific to that resource area (e.g., Water Resources Section 3.1.2.4). General mitigation measures that help minimize impacts on Managed Species and EFH include: using non-explosive versions of ordnance and passive acoustical and tracking tools, avoiding protected and/or sensitive habitats, including HAPCs, conducting most exercises during daylight hours in calm seas, and visual monitoring to assure an area is clear of significant concentrations of sea life including fish before ordnance or explosives are used. In addition, zones of influence (or buffer zones) have been designated for various types of training operations. For example, underwater detonations may not be conducted if marine mammals or sea turtles are detected within 1,000 yards (914 m) of a 60-lb mine neutralization charge site (DON 2005d). Furthermore, no detonations may take place: within 1,000 m (1,094 yd) of any artificial reef, shipwreck, or live hard-bottom community; within 3,000 m (1.6 nm) of shoreline; or, within 6,000 m (3.2 nm) of an estuarine inlet (DON 2005d). General and specific mitigation measures are also presented in Navy environmental documents covering specific types of training exercises, individual Range exercises, and joint exercises covering multiple ranges (see DON references in the Reference Section).

With the inclusion of the above mitigation measures, the Navy believes any adverse impacts to EFH that may occur will be adequately addressed.

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5 CUMULATIVE IMPACTS

Federal and Department of the Navy regulations implementing NEPA (42 USC § 4321 *et seq*. and 32 C.F.R. § 775 respectively) require that the cumulative impacts of a proposed action be assessed. CEQ Regulations implementing the procedural provisions of NEPA define cumulative impact as: the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future action regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR § 1508.7).

In general, a particular action or group of actions must meet all of the following criteria to be considered a cumulative impact: effects of several actions occur in a common locale or region; effects on a particular resource are similar in nature, such that the same specific element of a resource is affected in the same specific way; and, effects are long-term as short-term impacts dissipate over time and cease to contribute to cumulative impacts.

Human uses of the SOCAL Range Complex include prior, current, and future Navy activities, navigation, transportation, coastal development, oil/gas exploration and development, sand and mineral mining, dredge and fill operations, beach nourishment, cooling water intake and discharge, wastewater discharge, mariculture, recreational and commercial fishing, and whale-watching. Potential threats to EFH and Managed Species include degradation of water quality, habitat modification, pollution (chemicals, marine debris, etc.), introduction of exotic species, disease, natural events, and global climate change (Field et al. 2003, Jackson et al. 2001, IEF (In Ex Fishing) 2006).

Fishing and non-fishing activities, individually or in combination, can adversely affect EFH and Managed Species (NOAA 1998, Dayton et al. 2003, Morgan and Chuenpagdee 2003, Levin et al. 2006). Potential impacts of commercial fishing include over-fishing of targeted species and bycatch, both of which negatively affect fish stocks (Barnette 2001, NRC 2002, Dieter et al. 2003). Mobile fishing gears such as bottom trawls disturb the seafloor and reduce structural complexity (Auster and Langton 1998, Johnson 2002). Indirect effects of trawls include increased turbidity; alteration of surface sediment, removal of prey (leading to declines in predator abundance), removal of predators, ghost fishing, and generation of marine debris (Hamilton 2000). Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats. Recreational fishing also poses a threat because of the large number of participants and the intense, concentrated use of specific habitats (Coleman et al. 2004).

Removal of fish by fishing can have a profound influence on individual populations, their survival, and shifts in community composition. In a recent study of retrospective data, Jackson et al. (2001) analyzed paleoecological records from marine sediments from 125,000 years ago to present, archaeological records from 10,000 years before present, historical documents, and ecological records from scientific literature sources over the past century. Examining this longer term data and information, they concluded that ecological extinction caused by overfishing preceeds all other pervasive human disturbance to coastal ecosystems including pollution, degradation of water quality, and anthropogenic climatic change.

Natural stresses include storms and climate-based environmental shifts, such as harmful algal blooms and hypoxia (DON 2005a). Disturbance from ship traffic and exposure to biotoxins and anthropogenic contaminants may stress animals, weaken their immune systems, and make them vulnerable to parasites and diseases that would not normally compromise natural activities or be fatal (Pew Oceans Commissions 2003).

Potential cumulative impacts of Navy training exercises include release of chemicals into the ocean, introduction of debris into the water column and onto the seafloor, mortality and injury of marine organisms near the detonation or impact point of ordnance or explosives, and, physical and acoustic impacts of vessel activity. The incremental contribution by the proposed action or alternatives to impacts on the marine environment is expected to be insignificant. The overall effect on fish stocks would be negligible compared to the impact of commercial and recreational fishing in the SOCAL Range Complex.

After completion of an exercise, repopulation of an area by fish should take place within a matter of hours. Implementation of mitigation measures designed to avoid significant or long-term impacts would further protect marine life and the environment.

Because of the transient nature of the training exercises and the minor, localized potential effects, there would not be incremental or synergistic impacts on present or reasonably foreseeable future uses of the SOCAL Range Complex. The proposed action and alternatives would not make a significant contribution to the regional cumulative impacts on EFH or Managed Species.

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Appendix F

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1 MARINE MAMMAL STRANDINGS

1.1 CETACEAN STRANDINGS AND THREATS

Strandings can be a single animal or several to hundreds. An event where animals are found out of their habitat may be considered a stranding even though animals do not necessarily end up beaching if the animals are deemed to be unable to return to their natural habitat without human intervention such as herding or capture and relocation (such as the July 2004 Hanalei Mass Stranding Event; Southall et al. 2006). Several hypotheses have been given for the mass strandings which include the impact of shallow beach slopes on odontocete sonar, disease or parasites, geomagnetic anomalies that affect navigation, following a food source in close to shore, avoiding predators, social interactions that cause other cetaceans to come to the aid of stranded animals, and human actions. Generally, inshore species do not strand in large numbers but generally just as a single animal. This may be due to their familiarity with the coastal area whereas pelagic species that are unfamiliar with obstructions or sea bottom tend to strand more often in larger numbers (Woodings 1995). The Navy has studied several stranding events in detail that may have occurred in association with Navy sonar activities. To better understand the causal factors in stranding events that may be associated with Navy sonar activities, the main factors, including bathymetry (i.e. steep drop offs), narrow channels (less than 35 nm), environmental conditions (e.g. surface ducting), and multiple sonar ships (see Section on Stranding Events Associated with Navy Sonar) were compared between the different stranding events.

1.1.1 What is a Stranded Marine Mammal?

When a live or dead marine mammal swims or floats onto shore and becomes “beached” or incapable of returning to sea, the event is termed a “stranding” (Geraci et al. 1999; Perrin and Geraci 2002; Geraci and Lounsbury 2005; NMFS 2007). The legal definition for a stranding within the U.S. is that “a marine mammal is dead and is (i) on a beach or shore of the United States; or (ii) in waters under the jurisdiction of the United States (including any navigable waters); or (B) a marine mammal is alive and is (i) on a beach or shore of the United States and is unable to return to the water; (ii) on a beach or shore of the United States and, although able to return to the water, is in need of apparent medical attention; or (iii) in the waters under the jurisdiction of the United States (including any navigable waters), but is unable to return to its natural habitat under its own power or without assistance.” (16 United States Code [U.S.C.] 1421h).

The majority of animals that strand are dead or moribund (NMFS, 2007). For animals that strand alive, human intervention through medical aid and/or guidance seaward may be required for the animal to return to the sea. If unable to return to sea, rehabilitation at an appropriate facility may be determined as the best opportunity for animal survival. An event where animals are found out of their normal habitat is may be considered a stranding depending on circumstances even though animals do not necessarily end up beaching (Southhall 2006).

Three general categories can be used to describe strandings: single, mass, and unusual mortality events. The most frequent type of stranding is a single stranding, which involves only one animal (or a mother/calf pair) (NMFS 2007).

Mass stranding involves two or more marine mammals of the same species other than a mother/calf pair (Wilkinson 1991), and may span one or more days and range over several miles (Simmonds and Lopez-Jurado 1991; Frantzis 1998; Walsh et al. 2001; Freitas 2004). In North America, only a few species typically strand in large groups of 15 or more and include sperm whales, pilot whales, false killer whales, Atlantic white-sided dolphins, white-beaked dolphins, and rough-toothed dolphins (Odell 1987, Walsh et al. 2001). Some species, such as pilot whales, false-killer whales, and melon-headed whales occasionally strand in groups of 50 to 150 or more

(Geraci et al. 1999). All of these normally pelagic off-shore species are highly sociable and usually infrequently encountered in coastal waters. Species that commonly strand in smaller numbers include pygmy killer whales, common dolphins, bottlenose dolphins, Pacific white-sided dolphins, Frasier’s dolphins, gray whale and humpback whales (West Coast only), harbor porpoise, Cuvier’s beaked whales, California sea lions, and harbor seals (Mazzuca et al. 1999, Norman et al. 2004, Geraci and Lounsbury 2005).

Unusual mortality events (UMEs) can be a series of single strandings or mass strandings, or unexpected mortalities (i.e., die-offs) that occur under unusual circumstances (Dierauf and Gulland 2001; Harwood 2002; Gulland, 2006; NMFS 2007). These events may be interrelated: for instance, at-sea die-offs lead to increased stranding frequency over a short period of time, generally within one to two months. As published by the NMFS, revised criteria for defining a UME include include (71 FR 75234, 2006):

(1) A marked increase in the magnitude or a marked change in the nature of morbidity, mortality, or strandings when compared with prior records.

(2) A temporal change in morbidity, mortality, or strandings is occurring.

(3) A spatial change in morbidity, mortality, or strandings is occurring.

(4) The species, age, or sex composition of the affected animals is different than that of animals that are normally affected.

(5) Affected animals exhibit similar or unusual pathologic findings, behavior patterns, clinical signs, or general physical condition (e.g., blubber thickness).

(6) Potentially significant morbidity, mortality, or stranding is observed in species, stocks or populations that are particularly vulnerable (e.g., listed as depleted, threatened or endangered or declining). For example, stranding of three or four right whales may be cause for great concern whereas stranding of a similar number of fin whales may not.

(7) Morbidity is observed concurrent with or as part of an unexplained continual decline of a marine mammal population, stock, or species.

UMEs are usually unexpected, infrequent, and may involve a significant number of marine mammal mortalities. As discussed below, unusual environmental conditions are probably responsible for most UMEs and marine mammal die-offs (Vidal and Gallo-Reynoso 1996; Geraci et al. 1999; Walsh et al. 2001; Gulland and Hall 2005).

United States Stranding Response Organization

Stranding events provide scientists and resource managers information not available from limited at-sea surveys, and may be the only way to learn key biological information about certain species such as distribution, seasonal occurrence, and health (Rankin 1953; Moore et al. 2004; Geraci and Lounsbury 2005). Necropsies are useful in attempting to determine a reason for the stranding, and are performed on stranded animals when the situation and resources allow.

In 1992, Congress amended the MMPA to establish the Marine Mammal Health and Stranding Response Program (MMHSRP) under authority of the NMFS. The MMHSRP was created out of concern started in the 1980s for marine mammal mortalities, to formalize the response process, and to focus efforts being initiated by numerous local stranding organizations and as a result of public concern.

Major elements of the MMHSRP include (NMFS 2007):

• National Marine Mammal Stranding Network

• Marine Mammal UME Program

• National Marine Mammal Tissue Bank (NMMTB) and Quality Assurance Program

• Marine Mammal Health Biomonitoring, Research, and Development

• Marine Mammal Disentanglement Network

• John H. Prescott Marine Mammal Rescue Assistance Grant Program (a.k.a. the Prescott Grant Program)

• Information Management and Dissemination.

The United States has a well-organized network in coastal states to respond to marine mammal strandings. Overseen by the NMFS, the National Marine Mammal Stranding Network is comprised of smaller organizations manned by professionals and volunteers from nonprofit organizations, aquaria, universities, and state and local governments trained in stranding response animal health, and disease investigation. Currently, 141 organizations are authorized by NMFS to respond to marine mammal strandings (NMFS 2007o). Through a National Coordinator and six regional coordinators, NMFS authorizes and oversees stranding response activities and provides specialized training for the network.

NMFS Regions and Associated States and Territories

NMFS Northeast Region- ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, VA

NMFS Southeast Region- NC, SC, GA, FL, AL, MS, LA, TX, PR, VI

NMFS Southwest Region- CA

NMFS Northwest Region- OR, WA

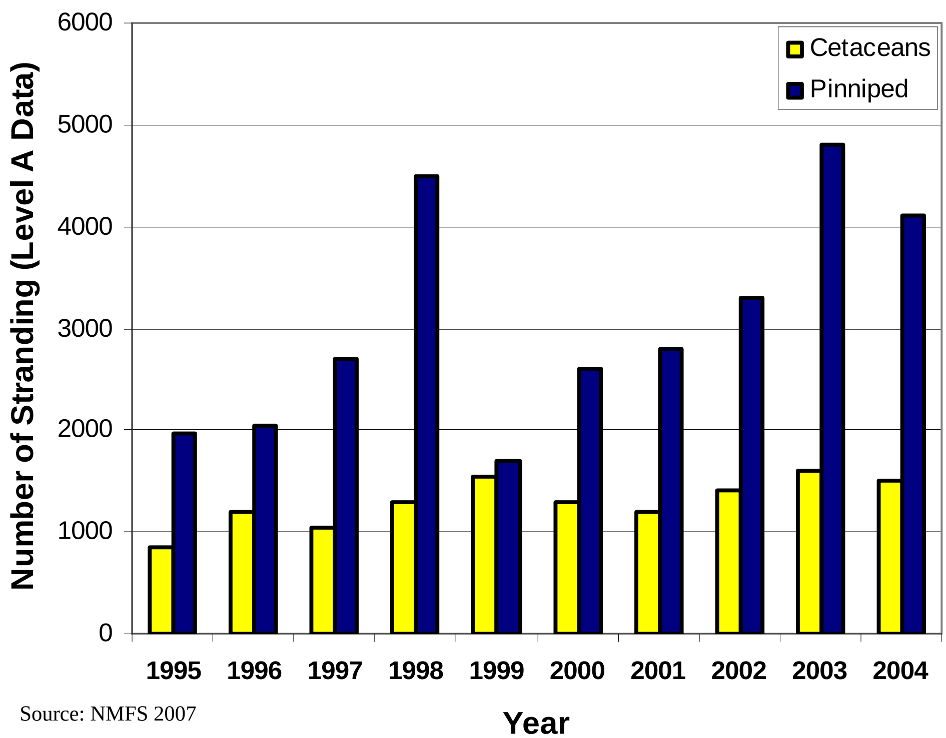
NMFS Alaska Region- AK

NMFS Pacific Islands Region- HI, Guam, American Samoa, Commonwealth of the Northern Mariana Islands (CNMI)

Stranding reporting and response efforts over time have been inconsistent, although effort and data quality within the U.S. have been improving within the last 20 years (NMFS 2007). Given the historical inconsistency in response and reporting, however, interpretation of long-term trends in marine mammal stranding is difficult (NMFS 2007). During the past decade (1995 – 2004), approximately 40,000 stranded marine mammals (about 12,400 are cetaceans) have been reported by the regional stranding networks, averaging 3,600 strandings reported per year (NMFS 2007). The highest number of strandings were reported between the years 1998 and 2003 (NMFS 2007). Detailed regional stranding information including most commonly stranded species can be found in Zimmerman (1991), Geraci and Lounsbury (2005), and NMFS (2007). United States stranding data from 1995 through 2004 is shown in Table 1-1 and Figure 1-1 depict annual strandings by region.

Table 1-1. Cetacean And Pinniped Stranding Count By NMFS Region 2001-2004.

NMFS Region	# of Cetaceans	# of Pinnipeds
Northeast	1,620	4,050
Southeast	2,830	45
Southwest	676	9,945
Northwest	188	1,430
Alaska	269	348
Pacific Islands	59	10
Four Year Total	17,866	5,928



Source: NMFS 2007

Figure 1-1. United States Annual Cetacean And Pinniped Stranding From 1995-2004.

1.1.1.1 Unusual Mortality Events (UMEs)

Table 1-2 contains a list of documented UMEs within the U.S.

Table 1-2. Documented UMEs within the United States

Year	Composition	Determination
1991	Harbor seals in New York	Infectious Disease
1991	California sea lions in California	Infectious Disease
1991	Bottlenose dolphins in Florida (Sarasota)	Undetermined
1992	Phocids in New England	Infectious Disease
1992	Bottlenose Dolphins in Texas	Undetermined
1992-1993	Pinnipeds in California	Ecological Factors
1993	Harbor seals, Steller sea lions, and California sea lions on the central Washington coast	Human Interaction
1994	Bottlenose dolphins in the Gulf of Mexico	Infectious Disease Morbillivirus
1994	Common dolphins in California	Cause not determined
1996	Right whales off Florida/Georgia coast	Evidence of human interactions
1996	Manatees on the west coast of Florida	Brevetoxin
1996	Bottlenose dolphins in Mississippi	Cause not determined
1997	Harbor seals in California	Unknown infectious respiratory disease
1998	California sea lions in central California	Harmful algal bloom; Domoic acid

Table 1-3. Documented UMEs within the United States (Continued)

Year	Composition	Determination
1999	Harbor porpoises on the East Coast	Determined not to meet criteria for UME because of multiplicity of causes
1999/2000	Bottlenose dolphins in the Panhandle of Florida	Harmful algal bloom is suspected; still under investigation
1999/2000	Gray whales from Alaska to Mexico	Still under investigation
2000	California Sea Lions in California	Biotoxin
2000	Harbor Seals in California	Infectious disease
2001	Bottlenose Dolphins in Florida (Indian River)	Undetermined
2001-2002	Hawaiian Monk Seals in the Northwest Hawaiian Islands	Ecological factors
2002	Common Dolphins, California Sea Lions, and Sea Otters in California	Biotoxin
2002	Manatees in Florida (West Coast)	Biotoxin
2003	Sea Otters in California	Ecological factors
2003	Large whales (mostly Humpbacks) in Gulf of Maine	Undetermined
2003	Manatees in Florida (West Coast)	Biotoxin
2003	Harbor Seals and Minke Whales in Maine	Undetermined
2004	Small Cetaceans in Virginia	Undetermined
2004	Small cetaceans in North Carolina	Undetermined
2004	Bottlenose dolphins along the Florida Panhandle	Uncertain, red tide is suspected
2005	Bottlenose dolphins, manatees, sea turtles, and seabirds in west central Florida	Unknown
2005	Harbor Porpoises in North Carolina	Undetermined
2005	Large Whales in the North Atlantic	Undetermined
2005-2006	Multi-Species (Manatees And Bottlenose Dolphins) In Florida (West Coast)	Biotoxin
2005-2006	Bottlenose Dolphins in Florida (Panhandle)	Biotoxin
2006	Sea Otters in Alaska	Undetermined
2006	Humpback whales in the North Atlantic	Undetermined
2006	Pinnipeds in the North Atlantic	Undetermined
2006	Harbor Porpoises in the Pacific Northwest	Undetermined
2006	Manatees in Florida (Everglades)	Biotoxin
2007	Bottlenose Dolphins in Texas and Louisiana	Undetermined
2007	Cetaceans in California	Undetermined
2007	Manatees in Southwest Florida	Biotoxin
2007	Large whales in California	Human interaction
2007	Guadalupe fur seals in the Northwest	Undetermined
2008	Bottlenose dolphins in Texas	Undetermined
2008	Common and Atlantic white-sided dolphins in North Carolina and New Jersey	Undetermined
2008	Bottlenose dolphins in Florida (Indian River)	Undetermined
Source: NMFS 2007c		

1.1.2 Threats to Marine Mammals and Potential Causes for Stranding

Reports of marine mammal strandings can be traced back to ancient Greece (Walsh et al. 2001). Like any wildlife population, there are normal background mortality rates that influence marine mammal population dynamics, including starvation, predation, aging, reproductive success, and disease (Geraci et al. 1999; Carretta et al. 2007). Strandings in and of themselves may be reflective of this natural cycle or, more recently, may be the result of anthropogenic sources (i.e., human impacts). Current science suggests that multiple factors, both natural and man-made, may be acting alone or in combination to cause a marine mammal to strand (Geraci et al. 1999; Culik

2002; Perrin and Geraci 2002; Hoelzel 2003; Geraci and Lounsbury 2005; NRC 2006). While post-stranding data collection and necropsies of dead animals are attempted in an effort to find a possible cause for the stranding, it is often difficult to pinpoint exactly one factor that can be blamed for any given stranding. An animal suffering from one ailment becomes susceptible to various other influences because of its weakened condition, making it difficult to determine a primary cause. In many stranding cases, scientists never learn the exact reason for the stranding.

Specific potential stranding causes can include both natural and human influenced (anthropogenic) causes listed below and described in the following sections:

Natural Stranding Causes

- Disease
- Natural toxins
- Weather and climatic influences
- Navigation errors
- Social cohesion
- Predation

Human Influenced (Anthropogenic) Stranding Causes

- Fisheries interaction
- Vessel strike
- Pollution and ingestion
- Noise

1.1.2.1 Natural Stranding Causes

Significant natural causes of mortality, die-offs, and stranding discussed below include disease and parasitism; marine neurotoxins from algae; navigation errors that lead to inadvertent stranding; and climatic influences that impact the distribution and abundance of potential food resources (i.e., starvation). Other natural mortality not discussed in detail includes predation by other species such as sharks (Cockcroft et al. 1989; Heithaus 2001), killer whales (Constantine et al. 1998; Guinet et al. 2000; Pitman et al. 2001), and some species of pinniped (Hiruki et al. 1999; Robinson et al. 1999).

Disease

Like other mammals, marine mammals frequently suffer from a variety of diseases of viral, bacterial, parasitic, and fungal origin (Visser et al. 1991; Dunn et al. 2001; Harwood 2002). Gulland and Hall (2005) provide a more detailed summary of individual and population effects of marine mammal diseases.

Microparasites such as bacteria, viruses, and other microorganisms are commonly found in marine mammal habitats and usually pose little threat to a healthy animal (Geraci et al. 1999). For example, long-finned pilot whales that inhabit the waters off of the northeastern coast of the U.S. are carriers of the morbillivirus, yet have grown resistant to its usually lethal effects (Geraci et al. 1999). Since the 1980s, however, virus infections have been strongly associated with marine mammal die-offs (Domingo et al. 1992; Geraci and Lounsbury, 2005). Morbillivirus is the most significant marine mammal virus and suppresses a host’s immune system, increasing risk of secondary infection (Harwood 2002). Die-offs ranged from northwestern Florida to Texas, with an increased number of deaths as it spread (NMFS 2007c). A 2004 UME in Florida was also associated with dolphin morbillivirus (NMFS 2004). Influenza A was responsible for the first reported mass mortality in the U.S., occurring along the coast of New England in 1979-1980 (Geraci et al. 1999; Harwood 2002). Canine distemper virus (a type of morbillivirus) has been responsible for large scale pinniped mortalities and die-offs (Grachev et al. 1989; Kennedy et al., 2000; Gulland and Hall, 2005), while a bacteria, *Leptospira pomona*, is responsible for periodic die-offs in California sea lions about every four years (Gulland et al. 1996; Gulland and Hall 2005). It is difficult to determine whether microparasites commonly act as a primary pathogen, or whether they show up as a secondary infection in an already weakened animal (Geraci et al. 1999). Most marine mammal die-offs from infectious disease in the last 25 years, however, have had viruses associated with them (Simmonds and Mayer 1997; Geraci et al. 1999; Harwood 2002).

Macroparasites are usually large parasitic organisms and include lungworms, trematodes (parasitic flatworms), and protozoans (Geraci and St.Aubin 1987; Geraci et al. 1999). Marine mammals can carry many different types, and have shown a robust tolerance for sizeable infestation unless compromised by illness, injury, or starvation (Morimitsu et al. 1987; Dailey et al. 1991; Geraci et al., 1999). Nasitrema, a usually benign trematode found in the head sinuses of cetaceans (Geraci et al. 1999), can cause brain damage if it migrates (Ridgway and Dailey 1972). As a result, this worm is one of the few directly linked to stranding in the cetaceans (Dailey and Walker 1978; Geraci et al. 1999).

Non-infectious disease, such as congenital bone pathology of the vertebral column (osteomyelitis, spondylosis deformans, and ankylosing spondylitis [AS]), has been described in several species of cetacean (Paterson 1984; Alexander et al. 1989; Kompanje 1995; Sweeny et al. 2005). In humans, bone pathology such as AS, can impair mobility and increase vulnerability to further spinal trauma (Resnick and Niwayama 2002). Bone pathology has been found in cases of single strandings (Paterson 1984; Kompanje 1995), and also in cetaceans prone to mass stranding (Sweeny et al. 2005), possibly acting as a contributing or causal influence in both types of events.

Naturally Occurring Marine Neurotoxins

Some single cell marine algae common in coastal waters, such as dinoflagellates and diatoms, produce toxic compounds that can accumulate (termed bioaccumulation) in the flesh and organs of fish and invertebrates (Geraci et al. 1999; Harwood 2002). Marine mammals become exposed to these compounds when they eat prey contaminated by these naturally produced toxins although exposure can also occur through inhalation and skin contact (Van Dolah 2005). Figure 1-2 shows U.S. animal mortalities from 1997-2006 resulting from toxins produced during harmful algal blooms.

Source: Woods Hole Oceanographic Institute (WHO) http://www.whoi.edu/redtide/HABdistribution/HABmap.html

Figure 1-2. Animal Mortalities From Harmful Algal Blooms Within The U.S. From 1997-2006.

In the Gulf of Mexico and mid- to southern Atlantic states, "red tides," a form of harmful algal bloom, are created by a dinoflagellate (*Karenia brevis*). *K. brevis* is found throughout the Gulf of Mexico and sometimes along the Atlantic coast (Van Dolah 2005; NMFS 2007). It produces a neurotoxin known as brevetoxin. Brevetoxin has been associated with several marine mammal UMEs within this area (Geraci 1989; Van Dolah et al. 2003; NMFS 2004; Flewelling et al. 2005; Van Dolah 2005; NMFS 2007). On the U.S. west coast and in the northeast Atlantic, several species of diatoms produce a toxin called demoic acid which has also been linked to marine mammal strandings (Geraci et al. 1999; Van Dolah et al. 2003; Greig et al. 2005; Van Dolah 2005; Brodie et al. 2006; NMFS 2007; Bargu et al. 2008; Goldstein et al. 2008). Other algal toxins associated with marine mammal strandings include saxitoxins and ciguatoxins and are summarized by Van Dolah (2005).

Weather events and climate influences

Severe storms, hurricanes, typhoons, and prolonged temperature extremes may lead to localized marine mammal strandings (Geraci et al. 1999; Walsh et al. 2001). Hurricanes may have been responsible for mass strandings of pygmy killer whales in the British Virgin Islands and Gervais' beaked whales in North Carolina (Mignucci-Giannoni et al. 2000; Norman and Mead 2001). Storms in 1982-1983 along the California coast led to deaths of 2,000 northern elephant seal pups (Le Boeuf and Reiter 1991). Ice movement along southern Newfoundland has forced groups of blue whales and white-beaked dolphins ashore (Sergeant 1982). Seasonal oceanographic conditions in terms of weather, frontal systems, and local currents may also play a role in stranding (Walker et al. 2005).

The effect of large scale climatic changes to the world's oceans and how these changes impact marine mammals and influence strandings is difficult to quantify given the broad spatial and temporal scales involved, and the cryptic movement patterns of marine mammals (Moore 2005;

Learmonth et al. 2006). The most immediate, although indirect, effect is decreased prey availability during unusual conditions. This, in turn, results in increased search effort required by marine mammals (Crocker et al. 2006), potential starvation if not successful, and corresponding stranding due directly to starvation or succumbing to disease or predation while in a more weakened, stressed state (Selzer and Payne 1988; Geraci et al. 1999; Moore 2005; Learmonth et al. 2006; Weise et al. 2006).

Two recent papers examined potential influences of climate fluctuation on stranding events in southern Australia, including Tasmania, an area with a history of more than 20 mass stranding since the 1920s (Evans et al. 2005; Bradshaw et al. 2006). These authors note that patterns in animal migration, survival, fecundity, population size, and strandings will revolve around the availability and distribution of food resources. In southern Australia, movement of nutrient-rich waters pushed closer to shore by periodic meridinal winds (occurring about every 12 – 14 years) may be responsible for bringing marine mammals closer to land, thus increasing the probability of stranding (Bradshaw et al. 2006). The papers conclude, however, that while an overarching model can be helpful for providing insight into the prediction of strandings, the particular reasons for each one are likely to be quite varied.

Navigation Error

Geomagnetism- It has been hypothesized that, like some land animals, marine mammals may be able to orient to the Earth’s magnetic field as a navigational cue, and that areas of local magnetic anomalies may influence strandings (Bauer et al. 1985; Klinowska 1985; Kirschvink et al. 1986; Klinowska, 1986; Walker et al. 1992; Wartzok and Ketten 1999). In a plot of live stranding positions in Great Britain with magnetic field maps, Klinowska (1985; 1986) observed an association between live stranding positions and magnetic field levels. In all cases, live strandings occurred at locations where magnetic minima, or lows in the magnetic fields, intersect the coastline. Kirschvink et al. (1986) plotted stranding locations on a map of magnetic data for the east coast of the U.S., and were able to develop associations between stranding sites and locations where magnetic minima intersected the coast. The authors concluded that there were highly significant tendencies for cetaceans to beach themselves near these magnetic minima and coastal intersections. The results supported the hypothesis that cetaceans may have a magnetic sensory system similar to other migratory animals, and that marine magnetic topography and patterns may influence long-distance movements (Kirschvink et al. 1986). Walker et al. (1992) examined fin whale swim patterns off the northeastern U.S. continental shelf, and reported that migrating animals aligned with lows in the geometric gradient or intensity. While a similar pattern between magnetic features and marine mammal strandings at New Zealand stranding sites was not seen (Brabyn and Frew 1994), mass strandings in Hawaii typically were found to occur within a narrow range of magnetic anomalies (Mazzuca et al. 1999).

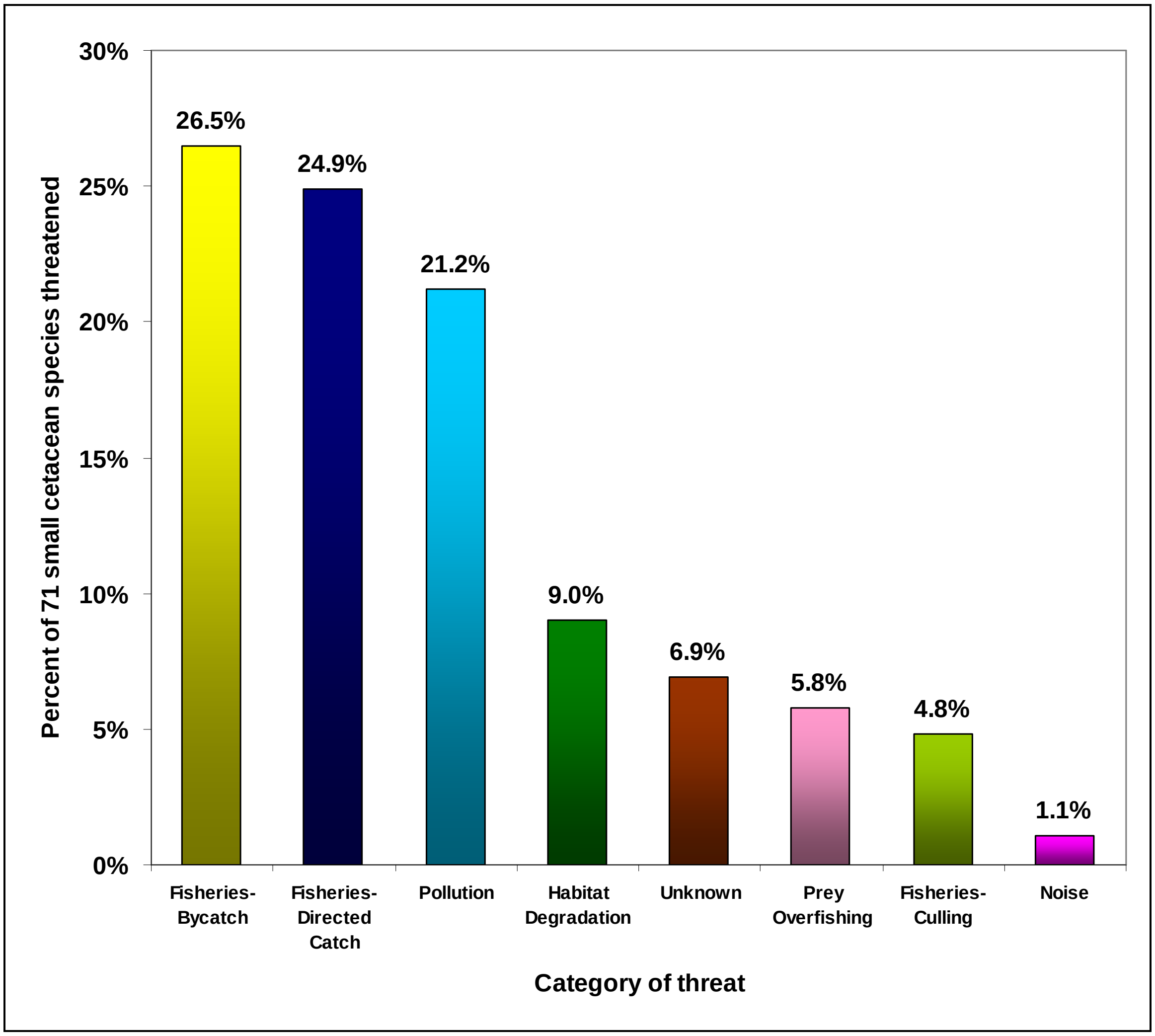
Echolocation Disruption in Shallow Water- Some researchers believe stranding may result from reductions in the effectiveness of echolocation within shallow water, especially with the pelagic species of odontocetes who may be less familiar with coastline (Dudok van Heel 1966; Chambers and James 2005). For an odontocete, echoes from echolocation signals contain important information on the location and identity of underwater objects and the shoreline. The authors postulate that the gradual slope of a beach may present difficulties to the navigational systems of some cetaceans, since it is common for live strandings to occur along beaches with shallow, sandy gradients (Brabyn and McLean 1992; Mazzuca et al. 1999; Maldini et al. 2005; Walker et al. 2005). A contributing factor to echolocation interference in turbulent, shallow water is the presence of microbubbles from the interaction of wind, breaking waves, and currents. Additionally, ocean water near the shoreline can have an increased turbidity (e.g., floating sand or silt, particulate plant matter, etc.) due to the run-off of fresh water into the ocean, either from rainfall or from freshwater outflows (e.g., rivers and creeks). Collectively, these factors can reduce and scatter the sound energy within echolocation signals and reduce the perceptibility of returning echoes of interest.

Social cohesion

Many pelagic species such as sperm whale, pilot whales, melon-head whales, and false killer whales, and some dolphins occur in large groups with strong social bonds between individuals. When one or more animals strand due to any number of causative events, then the entire pod may follow suit out of social cohesion (Geraci et al. 1999; Conner 2000; Perrin and Geraci 2002; NMFS 2007).

1.1.2.2 Anthropogenic Threats to Marine Mammals

With the exception of historic whaling in the 19th and early part of the 20th century, over the past few decades there has been an increase in marine mammal mortalities associated with a variety of human activities (Geraci et al. 1999; NMFS 2007). These include fisheries interactions (bycatch and directed catch), pollution (marine debris, toxic compounds), habitat modification (degradation, prey reduction), direct trauma (vessel strikes, gunshots), and noise. Figure 1-3 shows potential worldwide risk to small toothed cetaceans by source.



(Source: Culik 2002)

Figure 1-3. Human Threats to World Wide Small Cetacean Populations

Fisheries Interaction: By-Catch, Directed Catch, and Entanglement

The incidental catch of marine mammals in commercial fisheries is a significant threat to the survival and recovery of many populations of marine mammals (Geraci et al.,1999; Baird 2002; Culik 2002; Carretta et al. 2004; Geraci and Lounsbury 2005; NMFS 2007). Interactions with fisheries and entanglement in discarded or lost gear continue to be a major factor in marine mammal deaths worldwide (Geraci et al. 1999; Nieri et al. 1999; Geraci and Lounsbury 2005; Read et al. 2006; Zeeber et al. 2006). For instance, baleen whales and pinnipeds have been found entangled in nets, ropes, monofilament line, and other fishing gear that has been discarded out at sea (Geraci et al. 1999; Campagna et al. 2007).

Bycatch- Bycatch is the catching of non-target species within a given fishing operation and can include non-commercially used invertebrates, fish, sea turtles, birds, and marine mammals (NRC 2006). Read et al. (2006) attempted to estimate the magnitude of marine mammal bycatch in U.S. and global fisheries. Data on marine mammal bycatch within the United States was obtained from fisheries observer programs, reports of entangled stranded animals, and fishery logbooks, and was then extrapolated to estimate global bycatch by using the ratio of U.S. fishing vessels to the total number of vessels within the world's fleet (Read et al. 2006). Within U.S. fisheries, between 1990 and 1999 the mean annual bycatch of marine mammals was 6,215 animals, with a standard error of +/- 448 (Read et al. 2006). Eight-four percent of cetacean bycatch occurred in gill-net fisheries, with dolphins and porpoises constituting most of the cetacean bycatch (Read et al. 2006). Over the decade there was a 40 percent decline in marine mammal bycatch, which was significantly lower from 1995-1999 than it was from 1990-1994 (Read et al. 2006). Read et al. (2006) suggests that this is primarily due to effective conservation measures that were implemented during this time period.

Read et al. (2006) then extrapolated this data for the same time period and calculated an annual estimate of 653,365 of marine mammals globally, with most of the world's bycatch occurring in gill-net fisheries. With global marine mammal bycatch likely to be in the hundreds of thousands every year, bycatch in fisheries will be the single greatest threat to many marine mammal populations around the world (Read et al. 2006).

Entanglement- Entanglement in active fishing gear is a major cause of death or severe injury among the endangered whales in the action area. Entangled marine mammals may die as a result of drowning, escape with pieces of gear still attached to their bodies, or manage to be set free either of their own accord or by fishermen. Many large whales carry off gear after becoming entangled (Read et al. 2006). Many times when a marine mammal swims off with gear attached, the end result can be fatal. The gear may be become too cumbersome for the animal, or it can be wrapped around a crucial body part and tighten over time. Stranded marine mammals frequently exhibit signs of previous fishery interaction, such as scarring or gear attached to their bodies, and the cause of death for many stranded marine mammals is often attributed to such interactions (Baird and Gorgone 2005). Because marine mammals that die or are injured in fisheries may not wash ashore and not all animals that do wash ashore exhibit clear signs of interactions, stranding data probably underestimate fishery-related mortality and serious injury (NMFS 2005a)

From 1993 through 2003, 1,105 harbor porpoises were reported stranded from Maine to North Carolina, many of which had cuts and body damage suggestive of net entanglement (NMFS 2005e). In 1999 it was possible to determine that the cause of death for 38 of the stranded porpoises was from fishery interactions, with one additional animal having been mutilated (right flipper and fluke cut off) (NMFS 2005e). In 2000, one stranded porpoise was found with monofilament line wrapped around its body (NMFS 2005e). In 2003, nine stranded harbor porpoises were attributed to fishery interactions, with an additional three mutilated animals (NMFS 2005e). An estimated 78 baleen whales were killed annually in the offshore southern

California/Oregon drift gillnet fishery during the 1980s (Heyning and Lewis 1990). From 1998-2005, based on observer records, five fin whales (CA/OR/WA stock), 12 humpback whales (ENP stock), and six sperm whales (CA/OR/WA stock) were either seriously injured or killed in fisheries off the mainland west coast of the U.S. (California Marine Mammal Stranding Network Database 2006).

Ship Strike

Vessel strikes to marine mammals are another cause of mortality and stranding (Laist et al. 2001; Geraci and Lounsbury 2005; de Stephanis and Urquiola 2006). An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or an animal just below the surface could be cut by a vessel's propeller. The severity of injuries typically depends on the size and speed of the vessel (Knowlton and Kraus 2001; Laist et al. 2001; Vanderlaan and Taggart 2007).

An examination of all known ship strikes from all shipping sources (civilian and military) indicates vessel speed is a principal factor in whether a vessel strike results in death (Knowlton and Kraus 2001; Laist et al. 2001, Jensen and Silber 2003; Vanderlaan and Taggart 2007). In assessing records in which vessel speed was known, Laist et al. (2001) found a direct relationship between the occurrence of a whale strike and the speed of the vessel involved in the collision. The authors concluded that most deaths occurred when a vessel was traveling in excess of 13 knots although most vessels do travel greater than 15 kts. Jensen and Silber (2003) detailed 292 records of known or probable ship strikes of all large whale species from 1975 to 2002. Of these, vessel speed at the time of collision was reported for 58 cases. Of these cases, 39 (or 67%) resulted in serious injury or death (19 or 33% resulted in serious injury as determined by blood in the water, propeller gashes or severed tailstock, and fractured skull, jaw, vertebrae, hemorrhaging, massive bruising or other injuries noted during necropsy and 20 or 35% resulted in death). Operating speeds of vessels that struck various species of large whales ranged from 2 to 51 knots. The majority (79%) of these strikes occurred at speeds of 13 knots or greater. The average speed that resulted in serious injury or death was 18.6 knots. Pace and Silber (2005) found that the probability of death or serious injury increased rapidly with increasing vessel speed. Specifically, the predicted probability of serious injury or death increased from 45 percent to 75 % as vessel speed increased from 10 to 14 knots, and exceeded 90% at 17 knots. Higher speeds during collisions result in greater force of impact, but higher speeds also appear to increase the chance of severe injuries or death by pulling whales toward the vessel. Computer simulation modeling showed that hydrodynamic forces pulling whales toward the vessel hull increase with increasing speed (Clyne 1999, Knowlton et al. 1995).

The growth in civilian commercial ports and associated commercial vessel traffic is a result in the globalization of trade. The Final Report of the NOAA International Symposium on "Shipping Noise and Marine Mammals: A Forum for Science, Management, and Technology" stated that the worldwide commercial fleet has grown from approximately 30,000 vessels in 1950 to over 85,000 vessels in 1998 (NRC 2003; Southall 2005). Between 1950 and 1998, the U.S. flagged fleet declined from approximately 25,000 to less than 15,000 and currently represents only a small portion of the world fleet. From 1985 to 1999, world seaborne trade doubled to 5 billion tons and currently includes 90 percent of the total world trade, with container shipping movements representing the largest volume of seaborne trade. It is unknown how international shipping volumes and densities will continue to grow. However, current statistics support the prediction that the international shipping fleet will continue to grow at the current rate or at greater rates in the future. Shipping densities in specific areas and trends in routing and vessel design are as, or more, significant than the total number of vessels. Densities along existing coastal routes are expected to increase both domestically and internationally. New routes are also expected to develop as new ports are opened and existing ports are expanded. Vessel propulsion systems are also advancing toward faster ships operating in higher sea states for lower operating costs; and container ships are expected to become larger along certain routes (Southall 2005).

While there are reports and statistics of whales struck by vessels in U.S. waters, the magnitude of the risks of commercial ship traffic poses to marine mammal populations is difficult to quantify or estimate. In addition, there is limited information on vessel strike interactions between ships and marine mammals outside of U.S. waters (de Stephanis and Urquiola 2006). Laist et al. (2001) concluded that ship collisions may have a negligible effect on most marine mammal populations in general, except for regional based small populations where the significance of low numbers of collisions would be greater given smaller populations or populations segments.

U.S. Navy vessel traffic is a small fraction of the overall U.S. commercial and fishing vessel traffic. While U.S. Navy vessel movements may contribute to the ship strike threat, given the lookout and mitigation measures adopted by the U.S. Navy, probability of vessel strikes is greatly reduced. Furthermore, actions to avoid close interaction of U.S. Navy ships and marine mammals and sea turtles, such as maneuvering to keep away from any observed marine mammal and sea turtle are part of existing at-sea protocols and standard operating procedures. Navy ships have up to three or more dedicated and trained lookouts as well as two to three bridge watchstanders during at-sea movements who would be searching for any whales, sea turtles, or other obstacles on the water surface. Such lookouts are expected to further reduce the chances of a collision.

Commercial and Private Marine Mammal Viewing

Specific prohibitions regarding wildlife viewing activities with regards to humpback whales in Hawaii and Alaska, right whales, and western Steller sea lions. These prohibitions would not apply to the Southern California range area. In addition, NMFS launched an education and outreach campaign to provide commercial operators and the general public with responsible marine mammal viewing guidelines. In January 2002, NMFS also published an official policy on human interactions with wild marine mammals which states that: "NOAA Fisheries cannot support, condone, approve or authorize activities that involve closely approaching, interacting or attempting to interact with whales, dolphins, porpoises, seals, or sea lions in the wild. This includes attempting to swim, pet, touch or elicit a reaction from the animals."

Although considered by many to be a non-consumptive use of marine mammals with economic, recreational, educational, and scientific benefits, marine mammal watching is not without potential negative impacts. One concern is that animals become more vulnerable to vessel strikes once they habituate to vessel traffic (Swingle et al. 1993; Wiley et al. 1995). Another concern is that preferred habitats may become abandoned if disturbance levels are too high. A whale's behavioral response to whale watching vessels depends on the distance of the vessel from the whale, vessel speed, vessel direction, vessel noise, and the number of vessels (Amaral and Carlson 2005; Au and Green 2000; Cockeron 1995; Erbe 2002; Felix 2001; Magalhaes et al. 2002; Richter et al. 2003; Schedat et al. 2004; Simmonds 2005; Watkins 1986; Williams et al. 2002). The whale's responses changed with these different variables and, in some circumstances, the whales did not respond to the vessels, but in other circumstances, whales changed their vocalizations surface time, swimming speed, swimming angle or direction, respiration rates, dive times, feeding behavior, and social interactions. In addition to the information on whale watching, there is also direct evidence of pinniped haul out site (Pacific harbor seals) abandonment because of human disturbance at Strawberry Spit in San Francisco Bay (Allen 1991).

Ingestion of Plastic Objects and Other Marine Debris And Toxic Pollution Exposure

For many marine mammals, debris in the marine environment is a great hazard and can be harmful to wildlife. Not only is debris a hazard because of possible entanglement, animals may mistake plastics and other debris for food (NMFS 2007g). There are certain species of cetaceans, along with Florida manatees, that are more likely to eat trash, especially plastics, which is usually fatal for the animal (Geraci et al. 1999).

Between 1990 through October 1998, 215 pygmy sperm whales stranded along the U.S. Atlantic coast from New York through the Florida Keys (NMFS 2005a). Remains of plastic bags and other debris were found in the stomachs of 13 of these animals (NMFS 2005a). During the same time period, 46 dwarf sperm whale strandings occurred along the U.S. Atlantic coastline between Massachusetts and the Florida Keys (NMFS 2005d). In 1987 a pair of latex examination gloves was retrieved from the stomach of a stranded dwarf sperm whale (NMFS 2005d). 125 pygmy sperm whales were reported stranded from 1999 – 2003 between Maine and Puerto Rico; in one pygmy sperm whale found stranded in 2002, red plastic debris was found in the stomach along with squid beaks (NMFS 2005a).

Sperm whales have been known to ingest plastic debris, such as plastic bags (Evans et al. 2003; Whitehead 2003). While this has led to mortality, the scale to which this is affecting sperm whale populations is unknown, but Whitehead (2003) suspects it is not substantial at this time.

High concentrations of potentially toxic substances within marine mammals along with an increase in new diseases have been documented in recent years. Scientists have begun to consider the possibility of a link between pollutants and marine mammal mortality events. NMFS takes part in a marine mammal bio-monitoring program not only to help assess the health and contaminant loads of marine mammals, but also to assist in determining anthropogenic impacts on marine mammals, marine food chains and marine ecosystem health. Using strandings and bycatch animals, the program provides tissue/serum archiving, samples for analyses, disease monitoring and reporting, and additional response during disease investigations (NMFS 2007).

The impacts of these activities are difficult to measure. However, some researchers have correlated contaminant exposure to possible adverse health effects in marine mammals. Contaminants such as organochlorines do not tend to accumulate in significant amounts in invertebrates, but do accumulate in fish and fish-eating animals. Thus, contaminant levels in planktivorous mysticetes have been reported to be one to two orders of magnitude lower compared to piscivorous odontocetes (Borell 1993; O'Shea and Brownell 1994; O'Hara and Rice 1996; O'Hara et al. 1999).

The manmade chemical PCB (polychlorinated biphenyl), and the pesticide DDT (dichlorodiphyenyltrichloroethane), are both considered persistent organic pollutants that are currently banned in the United States for their harmful effects in wildlife and humans (NMFS 2007c). Despite having been banned for decades, the levels of these compounds are still high in marine mammal tissue samples taken along U.S. coasts (NMFS 2007c). Both compounds are long-lasting, reside in marine mammal fat tissues (especially in the blubber), and can be toxic causing effects such as reproductive impairment and immunosuppression (NMFS 2007c).

Both long-finned and short-finned pilot whales have a tendency to mass strand throughout their range. Short-finned pilot whales have been reported as stranded as far north as Rhode Island, and long-finned pilot whales as far south as South Carolina (NMFS 2005b). For U.S. east coast stranding records, both species are lumped together and there is rarely a distinction between the two because of uncertainty in species identification (NMFS 2005b). Since 1980 within the Northeast region alone, between 2 and 120 pilot whales have stranded annually either individually or in groups (NMFS 2005b). Between 1999 and 2003 from Maine to Florida, 126 pilot whales were reported to be stranded, including a mass stranding of 11 animals in 2000 and another mass stranding of 57 animals in 2002, both along the Massachusetts coast (NMFS 2005b).

It is unclear how much of a role human activities play in these pilot whale strandings, and toxic poisoning may be a potential human-caused source of mortality for pilot whales (NMFS 2005b). Moderate levels of PCBs and chlorinated pesticides (such as DDT, DDE, and dieldrin) have been found in pilot whale blubber (NMFS 2005b). Bioaccumulation levels have been found to be more similar in whales from the same stranding event than from animals of the same age or sex (NMFS 2005b). Numerous studies have measured high levels of toxic metals (mercury, lead, and cadmium), selenium, and PCBs in pilot whales in the Faroe Islands (NMFS 2005b). Population effects resulting from such high contamination levels are currently unknown (NMFS 2005b).

Habitat contamination and degradation may also play a role in marine mammal mortality and strandings. Some events caused by man have direct and obvious effects on marine mammals, such as oil spills (Geraci et al. 1999). But in most cases, effects of contamination will more than likely be indirect in nature, such as effects on prey species availability, or by increasing disease susceptibility (Geraci et al. 1999).

U.S. Navy vessel operation between ports and exercise locations has the potential for release of small amounts of pollutant discharges into the water column. U.S. Navy vessels are not a typical source, however, of either pathogens or other contaminants with bioaccumulation potential such as pesticides and PCBs. Furthermore, any vessel discharges such as bilgewater and deck runoff associated with the vessels would be in accordance with international and U.S. requirements for eliminating or minimizing discharges of oil, garbage, and other substances, and not likely to contribute significant changes to ocean water quality.

Deep Water Ambient Noise

Urick (1983) provided a discussion of the ambient noise spectrum expected in the deep ocean. Shipping, seismic activity, and weather, are the primary causes of deep-water ambient noise. The ambient noise frequency spectrum can be predicted fairly accurately for most deep-water areas based primarily on known shipping traffic density and wind state (wind speed, Beaufort wind force, or sea state) (Urick 1983). For example, for frequencies between 100 and 500 Hz, Urick (1983) estimated the average deep water ambient noise spectra to be 73 to 80 dB for areas of heavy shipping traffic and high sea states, and 46 to 58 dB for light shipping and calm seas. D'Spain and Batchelor (2006) reported the source spectral density in waters deeper than 246 ft. within the Southern California Bight is 105 to 120 dB re 1 uPa2 /Hz@1 m. (centered around 1.5 kHz and between 4 and 5 kHz).

Shallow Water Ambient Noise

In contrast to deep water, ambient noise levels in shallow waters (i.e., coastal areas, bays, harbors, etc.) are subject to wide variations in level and frequency depending on time and location. The primary sources of noise include distant shipping and industrial activities, wind and waves, marine animals (Urick 1983). At any give time and place, the ambient noise is a mixture of all of these noise variables. In addition, sound propagation is also affected by the variable shallow water conditions, including the depth, bottom slope, and type of bottom. Where the bottom is reflective, the sounds levels tend to be higher, then when the bottom is absorptive.

Noise from Aircraft and Vessel Movement

Surface shipping is the most widespread source of anthropogenic, low frequency (0 to 1,000 Hz) noise in the oceans and may contribute to over 75% of all human sound in the sea (Simmonds and Hutchinson 1996, ICES 2005b). Ross (1976) has estimated that between 1950 and 1975, shipping had caused a rise in ambient noise levels of 10 dB. He predicted that this would increase by another 5 dB by the beginning of the 21st century. The National Resource Council (1997) estimated that the background ocean noise level at 100 Hz has been increasing by about 1.5 dB per decade since the advent of propeller-driven ships. Michel et al. (2001) suggested an association between long-term exposure to low frequency sounds from shipping and an increased incidence of marine mammal mortalities caused by collisions with ships.

Airborne sound from a low-flying helicopter or airplane may be heard by marine mammals and turtles at or just below the surface. Due to the transient nature of sounds from aircraft involved in at-sea operations, such sounds would not likely cause physical effects but have the potential to affect behaviors. Responses by mammals and turtles could include hasty dives or turns, or decreased foraging (Soto et al., 2006). Whales may also slap the water with flukes or flippers, or swim away from the aircraft track.

Sound emitted from large vessels, particularly in the course of transit, is the principal source of noise in the ocean today, primarily due to the properties of sound emitted by civilian cargo vessels (Richardson et al. 1995; Arveson and Vendittis 2000). Ship propulsion and electricity generation engines, engine gearing, compressors, bilge and ballast pumps, as well as hydrodynamic flow surrounding a ship's hull and any hull protrusions contribute to a large vessels' noise emission into the marine environment. Prop-driven vessels also generate noise through cavitation, which accounts for much of the noise emitted by a large vessel depending on its travel speed. Military vessels underway or involved in naval operations or exercises, also introduce anthropogenic noise into the marine environment. Noise emitted by large vessels can be characterized as low-frequency, continuous, and tonal. The sound pressure levels at the vessel will vary according to speed, burden, capacity and length (Richardson et al. 1995; Arveson and Vendittis 2000). Vessels ranging from 135 to 337 meters generate peak source sound levels from 169- 200 dB between 8 Hz and 430 Hz, although Arveson and Vendittis (2000) documented components of higher frequencies (10-30 kHz) as a function of newer merchant ship engines and faster transit speeds.

Whales have variable responses to vessel presence or approaches, ranging from apparent tolerance to diving away from a vessel. Unfortunately, it is not always possible to determine whether the whales are responding to the vessel itself or the noise generated by the engine and cavitation around the propeller. Apart from some disruption of behavior, an animal may be unable to hear other sounds in the environment due to masking by the noise from the vessel. Any masking of environmental sounds or conspecific sounds is expected to be temporary, as noise dissipates with a vessel transit through an area. Vessel noise primarily raises concerns for masking of environmental and conspecific cues. However, exposure to vessel noise of sufficient intensity and/or duration can also result in temporary or permanent loss of sensitivity at a given frequency range, referred to as temporary or permanent threshold shifts (TTS or PTS). Threshold shifts are assumed to be possible in marine mammal species as a result of prolonged exposure to large vessel traffic noise due to its intensity, broad geographic range of effectiveness, and constancy.

Collectively, significant cumulative exposure to individuals, groups, or populations can occur if they exhibit site fidelity to a particular area; for example, whales that seasonally travel to a regular area to forage or breed may be more vulnerable to noise from large vessels compared to transiting whales. Any permanent threshold shift in a marine animal's hearing capability, especially at particular frequencies for which it can normally hear best, can impair its ability to perceive threats, including ships. Most observations of behavioral responses of marine mammals to human generated sounds have been limited to short-term behavioral responses, which included the cessation of feeding, resting, or social interactions. Nowacek et al. (2007) provide a detailed summary of cetacean response to underwater noise.

Given the sound propagation of low frequency sounds, a large vessel in this sound range can be heard 139-463 kilometers away (Ross 1976 in Polefka 2004). U.S. Navy vessels, however, have incorporated significant underwater ship quieting technology to reduce their acoustic signature (as compared to a similarly-sized vessel) in order to reduce their vulnerability to detection by enemy passive acoustics (Southall 2005). Therefore, the potential for TTS or PTS from U.S. Navy vessel and aircraft movement is extremely low given that the exercises and training events are transitory in time, with vessels moving over large area of the ocean. A marine mammal or sea turtle is unlikely to be exposed long enough at high levels for TTS or PTS to occur. Any masking of environmental sounds or conspecific sounds is expected to be temporary, as noise dissipates with a U.S. Navy vessel transiting through an area. If behavioral disruptions result from the presence of aircraft or vessels, it is expected to be temporary. Animals are expected to resume their migration, feeding, or other behaviors without any threat to their survival or reproduction. However, if an animal is aware of a vessel and dives or swims away, it may successfully avoid being struck.

Stranding Events Associated with Navy Sonar

There are two classes of sonars employed by the U.S. Navy: active sonars and passive sonars. Most active military sonars operate in a limited number of areas, and are most likely not a significant contributor to a comprehensive global ocean noise budget (ICES 2005b).

The effects of mid-frequency active naval sonar on marine wildlife have not been studied as extensively as the effects of air-guns used in seismic surveys (Madsen et al. 2006; Stone and Tasker 2006; Wilson et al. 2006; Palka and Johnson 2007; Parente et al. 2007). Maybaum (1989, 1993) observed changes in behavior of humpbacks during playback tapes of the M-1002 system (using 203 dB re 1 µPa-m for study); specifically, a decrease in respiration, submergence, and aerial behavior rates; and an increase in speed of travel and track linearity. Direct comparison of Maybaum's results, however, with U.S Navy mid-frequency active sonar are difficult to make. Maybaum's signal source, the commercial M-1002, is not similar to how naval mid-frequency sonar operates. In addition, behavioral responses were observed during playbacks of a control tape, (i.e. a tape with no sound signal) so interpretation of Maybaum's results are inconclusive.

Research by Nowacek, et al. (2004) on North Atlantic right whales using a whale alerting signal designed to alert whales to human presence suggests that received sound levels of only 133 to 148 pressure level (decibel [dB] re 1 microPascals [µPa]) for the duration of the sound exposure may disrupt feeding behavior. The authors did note, however, that within minutes of cessation of the source, a return to normal behavior would be expected. Direct comparison of the Nowacek et al. (2004) sound source to MFA sonar, however, is not possible given the radically different nature of the two sources. Nowacek et al.'s source was a series of non-sonar like sounds designed to purposely alert the whale, lasting several minutes, and covering a broad frequency band. Direct differences between Nowacek et al. (2004) and MFA sonar is summarized below from Nowacek et al. (2004) and Nowacek et al. (2007):

(1) Signal duration: Time difference between the two signals is significant, 18-minute signal used by Nowacek et al. verses < 1-sec for MFA sonar.

(2) Frequency modulation: Nowacek et al. contained three distinct signals containing frequency modulated sounds:

1st - alternating 1-sec pure tone at 500 and 850 Hz

2nd - 2-sec logarithmic down-sweep from 4500 to 500 Hz

3rd - pair of low-high (1500 and 2000 Hz) sine wave tones amplitude modulated at 120 Hz

(3) Signal to noise ratio: Nowacek et al.'s signal maximized signal to noise ratio so that it would be distinct from ambient noise and resist masking.

(4) Signal acoustic characteristics: Nowacek et al.'s signal comprised of disharmonic signals spanning northern right whales' estimated hearing range.

Given these differences, therefore, the exact cause of apparent right whale behavior noted by the authors can not be attributed to any one component since the source was such a mix of signal types.

The effects of naval sonars on marine wildlife have not been studied as extensively as have the effects of airguns used in seismic surveys (Nowacek et al. 2007). In the Caribbean, sperm whales were observed to interrupt their activities by stopping echolocation and leaving the area in the presence of underwater sounds surmised to have originated from submarine sonar signals (Watkins and Schevill 1975; Watkins et al. 1985). The authors did not report receive levels from these exposures, and also got a similar reaction from artificial noise they generated by banging on their boat hull. It was unclear if the sperm whales were reacting to the sonar signal itself or to a potentially new unknown sound in general. Madsen et al. (2006) tagged and monitored eight sperm whales in the Gulf of Mexico exposed to seismic airgun surveys. Sound sources were from approximately 2 to 7 nm (4 to 13 km) away from the whales and based on multipath propagation RLs were as high as 162 dB re 1 uPa with energy content greatest between 0.3 to 3.0 kHz. Sperm whales engaged in foraging dives continued the foraging dives throughout exposures to these seismic pulses. In the Caribbean Sea, sperm whales avoided exposure to mid-frequency submarine sonar pulses, in the range 1000 Hz to 10,000 Hz (IWC 2005). Sperm whales have also moved out of areas after the start of air gun seismic testing (Davis et al. 1995). In contrast, during playback experiments off the Canary Islands, André et al. (1997) reported that foraging sperm whales exposed to a 10 kHz pulsed signal did not exhibit any general avoidance reactions.

The Navy sponsored tests of the effects of low-frequency active (LFA) sonar source, between 100 Hz and 1000 Hz, on blue, fin, and humpback whales. The tests demonstrated that whales exposed to sound levels up to 155 dB did not exhibit significant disturbance reactions, though there was evidence that humpback whales altered their vocalization patterns in reaction to the noise. Given that the source level of the Navy's LFA is reported to be in excess of 215 dB, the possibility exists that animals in the wild may be exposed to sound levels much higher than 155 dB.

Acoustic exposures have been demonstrated to kill marine mammals, result in physical trauma, and injury (Ketten 2005). Animals in or near an intense noise source can die from profound injuries related to shock wave or blast effects. Acoustic exposures can also result in noise induced hearing loss that is a function of the interactions of three factors: sensitivity, intensity, and frequency. Loss of sensitivity is referred to as a threshold shift; the extent and duration of a threshold shift depends on a combination of several acoustic features and is specific to particular species (TTS or PTS, depending on how the frequency, intensity and duration of the exposure combine to produce damage). In addition to direct physiological effects, noise exposures can impair an animal's sensory abilities (masking) or result in behavioral responses such as aversion or attraction.

Acoustic exposures can also result in the death of an animal by impairing its foraging, ability to detect predators or communicate, or by increasing stress, and disrupting important physiological events. Whales have moved away from their feeding and mating grounds (Bryant et al. 1984; Morton and Symnods 2002; Weller et al. 2002), moved away from their migration route (Richardson et al. 1995), and have changed their calls due to noise (Miller et al. 2000). Acoustic exposures such as MFA sonar tend to be infrequent and short in duration, and therefore effects are likely indirect and to be short lived. In situations such as the alteration of gray whale migration routes in response to shipping and whale watching boats, those acoustic exposures were chronic over several years (Moore and Clarke 2002). This was also true of the effect of seismic survey airguns (daily for 39 days) on the use of feeding areas by gray whales in the western North

Pacific although whales began returning to the feeding area within one day of the end of the exposure (Weller et al. 2002).

Below are evaluations of the general information available on the variety of ways in which cetaceans and pinnipeds have been reported to respond to sound, generally, and mid-frequency sonar, in particular.

Strandings can be a single animal or several to hundreds. An event where animals are found out of their normal habitat is considered a stranding even though animals do not necessarily end up beaching (such as the July 2004 Hanalei Mass Stranding Event; Southall et al. 2006). Several hypotheses have been given for the mass strandings which include the impact of shallow beach slopes on odontocete sonar, disease or parasites, geomagnetic anomalies that affect navigation, following a food source in close to shore, avoiding predators, social interactions that cause other cetaceans to come to the aid of stranded animals, and human actions.

When a marine mammal swims or floats onto shore and becomes "beached" or stuck in shallow water, it is considered a "stranding" (MMPA section 410 (16 USC section 1421g; NMFS 2007a). NMFS explains that "a cetacean is considered stranded when it is on the beach, dead or alive, or in need of medical attention while free-swimming in U.S. waters. A pinniped is considered to be stranded either when dead or when in distress on the beach and not displaying normal haul-out behavior" (NMFS 2007b).

Over the past three decades, several "mass stranding" events [strandings involving two or more individuals of the same species (excluding a single cow-calf pair) and at times, individuals from different species] that have occurred over the past two decades have been associated with naval operations, seismic surveys, and other anthropogenic activities that introduce sound into the marine environment (Canary Islands, Greece, Vieques, U.S. Virgin Islands, Madeira Islands, Haro Strait, Washington State, Alaska, Hawaii, North Carolina).

Information was collected on mass stranding events (events in which two or more cetaceans stranded) that have occurred and for which reports are available, from the past 40 years. Any causal agents that have been associated with those stranding events were also identified. Major range events undergo name changes over the years, however, the equivalent of COMPTUEX and JTFEX have been conducted in southern California since 1934. Training involving sonar has been conducted since World War II and sonar systems described in the SOCAL EIS/OEIS since the 1970's (Jane's 2005).

1.1.3 Stranding Analysis

Over the past two decades, several mass stranding events involving beaked whales have been documented. While beaked whale strandings have been reported since the 1800s (Geraci and Lounsbury 1993; Cox et al. 2006; Podesta et al. 2006), several mass strandings since have been associated with naval operations that may have included mid-frequency sonar (Simmonds and Lopez-Jurado 1991; Frantzis 1998; Jepson et al. 2003; Cox et al. 2006). As Cox et al. (2006) concludes, the state of science can not yet determine if a sound source such as mid-frequency sonar alone causes beaked whale strandings, or if other factors (acoustic, biological, or environmental) must co-occur in conjunction with a sound source.

A review of historical data (mostly anecdotal) maintained by the Marine Mammal Program in the National Museum of Natural History, Smithsonian Institution reports 49 beaked whale mass stranding events between 1838 and 1999. The largest beaked whale mass stranding occurred in the 1870s in New Zealand when 28 Gray's beaked whales (*Mesoplodon grayi*) stranded. Blainsville's beaked whale (*Mesoplodon densirostris*) strandings are rare, and records show that they were involved in one mass stranding in 1989 in the Canary Islands. Cuvier's beaked whales

(*Ziphius cavirostris*) are the most frequently reported beaked whale to strand, with at least 19 stranding events from 1804 through 2000 (DoC and DoN 2001; Smithsonian Institution 2000).

The discussion below centers on those worldwide stranding events that may have some association with naval operations, and global strandings that the Navy feels are either inconclusive or can not be associated with naval operations.

1.1.3.1 Naval Association

In the following sections, specific stranding events that have been putatively linked to potential sonar operations are discussed. Of note, these events represent a small overall number of animals over an 11 year period (40 animals) and not all worldwide beaked whale strandings can be linked to naval activity (ICES 2005a; 2005b; Podesta et al. 2006). Four of the five events occurred during NATO exercises or events where U.S. Navy presence was limited (Greece, Portugal, Spain). One of the five events involved only U.S. Navy ships (Bahamas).

Beaked whale stranding events associated with potential naval operations.

1996 May	Greece (NATO)
2000 March	Bahamas (US)
2000 May	Portugal, Madeira Islands (NATO/US)
2002 September	Spain, Canary Islands (NATO/US)
2006 January	Spain, Mediterranean Sea coast (NATO/US)

Case Studies of Stranding Events (coincidental with or implicated with naval sonar)

1996 Greece Beaked Whale Mass Stranding (May 12 – 13, 1996)

<u>Description</u>: Twelve Cuvier's beaked whales (*Ziphius cavirostris*) stranded along a 38.2-kilometer strand of the coast of the Kyparissiakos Gulf on May 12 and 13, 1996 (Frantzis, 1998). From May 11 through May 15, the NATO research vessel Alliance was conducting sonar tests with signals of 600 Hz and 3 kHz and root-mean-squared (rms) sound pressure levels (SPL) of 228 and 226 dB re: 1μPa, respectively (D'Amico and Verboom 1998; D'Spain et al. 2006). The timing and the location of the testing encompassed the time and location of the whale strandings (Frantzis 1998).

<u>Findings</u>: Partial necropsies of eight of the animals were performed, including external assessments and the sampling of stomach contents. No abnormalities attributable to acoustic exposure were observed, but the stomach contents indicated that the whales were feeding on cephalods soon before the stranding event. No unusual environmental events before or during the stranding event could be identified (Frantzis 1998).

<u>Conclusions</u>: The timing and spatial characteristics of this stranding event were atypical of stranding in Cuvier's beaked whale, particularly in this region of the world. No natural phenomenon that might contribute to the stranding event coincided in time with the mass stranding. Because of the rarity of mass strandings in the Greek Ionian Sea, the probability that the sonar tests and stranding coincided in time and location, while being independent of each other, was estimated as being extremely low (Frantzis 1998). However, because information for the necropsies was incomplete and inconclusive, the cause of the stranding cannot be precisely determined.

2000 Bahamas Marine Mammal Mass Stranding (March 15-16, 2000)

<u>Description</u>: Seventeen marine mammals comprised of Cuvier's beaked whales, Blainville's beaked whales (*Mesoplodon densirostris*), minke whale (*Balaenoptera acutorostrata*), and one

spotted dolphin (*Stenella frontalis*), stranded along the Northeast and Northwest Providence Channels of the Bahamas Islands on March 15-16, 2000 (Evans and England 2001). The strandings occurred over a 36-hour period and coincided with U.S. Navy use of mid-frequency active sonar within the channel. Navy ships were involved in tactical sonar exercises for approximately 16 hours on March 15. The ships, which operated the AN/SQS-53C and AN/SQS-56, moved through the channel while emitting sonar pings approximately every 24 seconds. The timing of pings was staggered between ships and average source levels of pings varied from a nominal 235 dB SPL (AN/SQS-53C) to 223 dB SPL (AN/SQS-56). The center frequency of pings was 3.3 kHz and 6.8 to 8.2 kHz, respectively.

Seven of the animals that stranded died, while ten animals were returned to the water alive. The animals known to have died included five Cuvier’s beaked whales, one Blainville’s beaked whale, and the single spotted dolphin. Six necropsies were performed and three of the six necropsied whales (one Cuvier’s beaked whale, one Blainville’s beaked whale, and the spotted dolphin) were fresh enough to permit identification of pathologies by computerized tomography (CT). Tissues from the remaining three animals were in a state of advanced decomposition at the time of inspection.

Findings: The spotted dolphin demonstrated poor body condition and evidence of a systemic debilitating disease. In addition, since the dolphin stranding site was isolated from the acoustic activities of Navy ships, it was determined that the dolphin stranding was unrelated to the presence of Navy active sonar.

All five necropsied beaked whales were in good body condition and did not show any signs of external trauma or disease. In the two best preserved whale specimens, hemorrhage was associated with the brain and hearing structures. Specifically, subarachnoid hemorrhage within the temporal region of the brain and intracochlear hemorrhages were noted. Similar findings of bloody effusions around the ears of two other moderately decomposed whales were consistent with the same observations in the freshest animals. In addition, three of the whales had small hemorrhages in their acoustic fats, which are fat bodies used in sound production and reception (i.e., fats of the lower jaw and the melon). The best-preserved whale demonstrated acute hemorrhage within the kidney, inflammation of the lung and lymph nodes, and congestion and mild hemorrhage in multiple other organs. Other findings were consistent with stresses and injuries associated with the stranding process. These consisted of external scrapes, pulmonary edema and congestion.

Conclusions: The post-mortem analyses of stranded beaked whales lead to the conclusion that the immediate cause of death resulted from overheating, cardiovascular collapse and stresses associated with being stranded on land. However, the presence of subarachnoid and intracochlear hemorrhages were believed to have occurred prior to stranding and were hypothesized as being related to an acoustic event. Passive acoustic monitoring records demonstrated that no large scale acoustic activity besides the Navy sonar exercise occurred in the times surrounding the stranding event. The mechanism by which sonar could have caused the observed traumas or caused the animals to strand was undetermined. The spotted dolphin was in overall poor condition for examination, but showed indications of long-term disease. No analysis of baleen whales (minke whale) was conducted. Baleen whale stranding events have not been associated with either low-frequency or mid-frequency sonar use (ICES 2005a, 2005b).

2000 Madeira Island, Portugal Beaked Whale Strandings (May 10 – 14, 2000)

Description: Three Cuvier’s beaked whales stranded on two islands in the Madeira Archipelago, Portugal, from May 10 – 14, 2000 (Cox et al. 2006). A joint NATO amphibious training exercise, named “Linked Seas 2000,” which involved participants from 17 countries, took place in Portugal during May 2 – 15, 2000. The timing and location of the exercises overlapped with that of the stranding incident.

Findings: Two of the three whales were necropsied. Two heads were taken to be examined. One head was intact and examined grossly and by CT; the other was only grossly examined because it was partially flensed and had been seared from an attempt to dispose of the whale by fire (Ketten 2005).

No blunt trauma was observed in any of the whales. Consistent with prior CT scans of beaked whales stranded in the Bahamas 2000 incident, one whale demonstrated subarachnoid and peribullar hemorrhage and blood within one of the brain ventricles. Post-cranially, the freshest whale demonstrated renal congestion and hemorrhage, which was also consistent with findings in the freshest specimens in the Bahamas incident.

Conclusions: The pattern of injury to the brain and auditory system were similar to those observed in the Bahamas strandings, as were the kidney lesions and hemorrhage and congestion in the lungs (Ketten 2005). The similarities in pathology and stranding patterns between these two events suggested a similar causative mechanism. Although the details about whether or how sonar was used during "Linked Seas 2000" is unknown, the presence of naval activity within the region at the time of the strandings suggested a possible relationship to Navy activity.

2002 Canary Islands Beaked Whale Mass Stranding (24 September 2002)

Description: On September 24, 2002, 14 beaked whales stranded on Fuerteventura and Lanzaote Islands in the Canary Islands (Jepson et al. 2003). Seven of the 14 whales died on the beach and the 7 were returned to the ocean. Four beaked whales were found stranded dead over the next three days either on the coast or floating offshore (Fernández et al. 2005). At the time of the strandings, an international naval exercise (Neo-Tapon 2002) that involved numerous surface warships and several submarines was being conducted off the coast of the Canary Islands. Tactical mid-frequency active sonar was utilized during the exercises, and strandings began within hours of the onset of the use of mid-frequency sonar (Fernández et al. 2005).

Findings: Eight Cuvier's beaked whales, one Blainville's beaked whale, and one Gervais' beaked whale were necropsied; six of them within 12 hours of stranding (Fernández et al. 2005). The stomachs of the whales contained fresh and undigested prey contents. No pathogenic bacteria were isolated from the whales, although parasites were found in the kidneys of all of the animals. The head and neck lymph nodes were congested and hemorrhages were noted in multiple tissues and organs, including the kidney, brain, ears, and jaws. Widespread fat emboli were found throughout the carcasses, but no evidence of blunt trauma was observed in the whales. In addition, the parenchyma of several organs contained macroscopic intravascular bubbles and lesions, putatively associated with nitrogen off-gassing.

Conclusions: The association of NATO mid-frequency sonar use close in space and time to the beaked whale strandings, and the similarity between this stranding event and previous beaked whale mass strandings coincident with sonar use, suggests that a similar scenario and causative mechanism of stranding may be shared between the events. Beaked whales stranded in this event demonstrated brain and auditory system injuries, hemorrhages, and congestion in multiple organs, similar to the pathological findings of the Bahamas and Madeira stranding events. In addition, the necropsy results of Canary Islands stranding event lead to the hypothesis that the presence of disseminated and widespread gas bubbles and fat emboli were indicative of nitrogen bubble formation, similar to what might be expected in decompression sickness (Jepson et al. 2003; Fernández et al. 2005). Whereas gas emboli would develop from the nitrogen gas, fat emboli would enter the blood stream from ruptured fat cells (presumably where nitrogen bubble formation occurs) or through the coalescence of lipid bodies within the blood stream.

The possibility that the gas and fat emboli found by Fernández et al. (2005) was due to nitrogen bubble formation has been hypothesized to be related to either direct activation of the bubble by sonar signals or to a behavioral response in which the beaked whales flee to the surface following sonar exposure. The first hypothesis is related to rectified diffusion (Crum and Mao 1996), the process of increasing the size of a bubble by exposing it to a sound field. This process is facilitated if the environment in which the ensonified bubbles exist is supersaturated with gas. Repetitive diving by marine mammals can cause the blood and some tissues to accumulate gas to a greater degree than is supported by the surrounding environmental pressure (Ridgway and Howard 1979). Deeper and longer dives of some marine mammals, such as those conducted by beaked whales, are theoretically predicted to induce greater levels of supersaturation (Houser et al. 2001). If rectified diffusion were possible in marine mammals exposed to high-level sound, conditions of tissue supersaturation could theoretically speed the rate and increase the size of bubble growth. Subsequent effects due to tissue trauma and emboli would presumably mirror those observed in humans suffering from decompression sickness. It is unlikely that the short duration of sonar pings would be long enough to drive bubble growth to any substantial size, if such a phenomenon occurs. However, an alternative but related hypothesis has also been suggested: stable bubbles could be destabilized by high-level sound exposures such that bubble growth then occurs through static diffusion of gas out of the tissues. In such a scenario the marine mammal would need to be in a gas-supersaturated state for a long enough period of time for bubbles to become of a problematic size. The second hypothesis speculates that rapid ascent to the surface following exposure to a startling sound might produce tissue gas saturation sufficient for the evolution of nitrogen bubbles (Jepson et al. 2003; Fernández et al. 2005). In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation. Tyack et al. (2006) showed that beaked whales often make rapid ascents from deep dives suggesting that it is unlikely that beaked whales would suffer from decompression sickness. Zimmer and Tyack (2007) speculated that if repetitive shallow dives that are used by beaked whales to avoid a predator or a sound source, they could accumulate high levels of nitrogen because they would be above the depth of lung collapse (above about 210 ft) and could lead to decompression sickness. There is no evidence that beaked whales dive in this manner in response to predators or sound sources and other marine mammals such as Antarctic and Galapagos fur seals, and pantropical spotted dolphins make repetitive shallow dives with no apparent decompression sickness (Kooyman and Trillmich 1984; Kooyman et al. 1984; Baird et al. 2001).

Although theoretical predictions suggest the possibility for acoustically mediated bubble growth, there is considerable disagreement among scientists as to its likelihood (Piantadosi and Thalmann 2004). Sound exposure levels predicted to cause in vivo bubble formation within diving cetaceans have not been evaluated and are suspected as needing to be very high (Evans 2002; Crum et al. 2005). Moore and Early (2004) reported that in analysis of sperm whale bones spanning 111 years, gas embolism symptoms were observed indicating that sperm whales may be susceptible to decompression sickness due to natural diving behavior. Further, although it has been argued that traumas from recent beaked whale strandings are consistent with gas emboli and bubble-induced tissue separations (Jepson et al. 2003), there is no conclusive evidence supporting this hypothesis and there is concern that at least some of the pathological findings (e.g., bubble emboli) are artifacts of the necropsy. Currently, stranding networks in the United States have agreed to adopt a set of necropsy guidelines to determine, in part, the possibility and frequency with which bubble emboli can be introduced into marine mammals during necropsy procedures (Arruda et al. 2007).

2006 Spain, Gulf of Vera Beaked Whale Mass Stranding (26-27 January 2006)

Description: The Spanish Cetacean Society reported an atypical mass stranding of four beaked whales that occurred January 26 to 28, 2006, on the southeast coast of Spain near Mojacar (Gulf of Vera) in the Western Mediterranean Sea. According to the report, two of the whales were discovered the evening of January 26 and were found to be still alive. Two other whales were discovered during the day on January 27, but had already died. A following report stated that the first three animals were located near the town of Mojacar and were examined by a team from the University of Las Palmas de Gran Canarias, with the help of the stranding network of Ecologistas en Acción Almería-PROMAR and others from the Spanish Cetacean Society. The fourth animal was found dead on the afternoon of May 27, a few kilometers north of the first three animals.

From January 25-26, 2006, a NATO surface ship group (seven ships including one U.S. ship under NATO operational command) conducted active sonar training against a Spanish submarine within 50 nm of the stranding site.

Findings: Veterinary pathologists necropsied the two male and two female beaked whales (*Z. cavirostris*).

Conclusions: According to the pathologists, a likely cause of this type of beaked whale mass stranding event may have been anthropogenic acoustic activities. However, no detailed pathological results confirming this supposition have been published to date, and no positive acoustic link was established as a direct cause of the stranding.

Even though no causal link can be made between the stranding event and naval exercises, certain conditions may have existed in the exercise area that, in their aggregate, may have contributed to the marine mammal strandings (Freitas 2004):

- Operations were conducted in areas of at least 1000 meters in depth near a shoreline where there is a rapid change in bathymetry on the order of 1000 – 6000 meters occurring a cross a relatively short horizontal distance (Freitas 2004).

- Multiple ships, in this instance, five MFA sonar equipped vessels, were operating in the same area over extended periods of time (20 hours) in close proximity.

- Exercises took place in an area surrounded by landmasses, or in an embayment. Operations involving multiple ships employing mid-frequency active sonar near land may produce sound directed towards a channel or embayment that may cut off the lines of egress for marine mammals (Freitas 2004)

1.1.3.2 Other Global Stranding Discussions

In the following sections, stranding events that have been linked to U.S. Navy activity in popular press are presented. As detailed in the individual case study conclusions, the U.S. Navy believes there is enough evidence available to refute allegations of impacts from mid-frequency sonar, or at least indicate that a substantial degree of uncertainty in time and space that preclude a meaningful scientific conclusion.

Case Studies of Stranding Events

2003 Washington State Harbor Porpoise Strandings (May 2 – June 2 2003)

Description: At 10:40 a.m. on May 5, 2003, the USS SHOUP began the use of mid-frequency tactical active sonar as part of a naval exercise. At 12:20 p.m., the USS SHOUP entered the Haro Strait and terminated active sonar use at 1438, thus limiting active sonar use within the strait to less than 20 minutes. Between May 2 and June 2, 2003, approximately 16 strandings involving 15 harbor porpoises (*Phocoena phocoena*) and one Dall's porpoise (*Phocoenoides dalli*) were reported to the Northwest Marine Mammal Stranding Network. A comprehensive review of all strandings and the events involving USS SHOUP on 5 May 2003 were presented in U.S. Department of Navy (2004). Given that the USS SHOUP was known to have operated sonar in the strait on May 5, and that supposed behavioral reactions of killer whales (*Orcinus orca*) had been putatively linked to these sonar operations (NMFS Office of Protected Resources, 2005), the NMFS undertook an analysis of whether sonar caused the strandings of the harbor porpoises.

Whole carcasses of ten of harbor porpoises and the head of an additional porpoise were collected for analysis. Necropsies were performed on ten of the harbor porpoises and six whole carcasses and two heads were selected for CT imaging. Gross examination, histopathology, age determination, blubber analysis, and various other analyses were conducted on each of the carcasses (Norman et al. 2004).

Findings: Post-mortem findings and analysis details are found in Norman et al. (2004). All of the carcasses suffered from some degree of freeze-thaw artifact that hampered gross and histological evaluations. At the time of necropsy, three of the porpoises were moderately fresh, whereas the remainder of the carcasses was considered to have moderate to advanced decomposition. None of the 11 harbor porpoises demonstrated signs of acoustic trauma. In contrast, a putative cause of death was determined for 5 of the porpoises; 2 animals had blunt trauma injuries and 3 animals had indication of disease processes (fibrous peritonitis, salmonellosis, and necrotizing pneumonia). A cause of death could not be determined in the remaining animals, which is consistent with expected percentage of marine mammal necropsies conducted within the northwest region. It is important to note, however, that these determinations were based only on the evidence from the necropsy so as not to be biased with regard to determinations of the potential presence or absence of acoustic trauma. The result was that other potential causal factors, such as one animal (Specimen 33NWR05005) found tangled in a fishing net, was unknown to the investigators in their determination regarding the likely cause of death.

Conclusions: The NMFS concluded from a retrospective analysis of stranding events that the number of harbor porpoise stranding events in the approximate month surrounding the USS SHOUP use of sonar was higher than expected based on annual strandings of harbor porpoises (Norman et al. 2004). In this regard, it is important to note that the number of strandings in the May-June timeframe in 2003 was also higher for the outer coast indicating a much wider phenomenon than use of sonar by USS SHOUP in Puget Sound for one day in May. The conclusion by NMFS that the number of strandings in 2003 was higher is also different from that of The Whale Museum, which has documented and responded to harbor porpoise strandings since 1980 (Osborne 2003). According to The Whale Museum, the number of strandings as of May 15, 2003, was consistent with what was expected based on historical stranding records and was less than that occurring in certain years. For example, since 1992 the San Juan Stranding Network has documented an average of 5.8 porpoise strandings per year. In 1997 there were 12 strandings in the San Juan Islands with more than 30 strandings throughout the general Puget Sound area. Disregarding the discrepancy in the historical rate of porpoise strandings and its relation to the USS SHOUP, NMFS acknowledged that the intense level of media attention focused on the strandings likely resulted in an increased reporting effort by the public over that which is normally observed (Norman et al. 2004). NMFS also noted in its report that the “sample size is too small and biased to infer a specific relationship with respect to sonar usage and subsequent strandings.”

Seven of the porpoises collected and analyzed died prior to SHOUP departing to sea on May 5, 2003. Of these seven, one, discovered on May 5, 2003, was in a state of moderate decomposition, indicating it died before May 5; the cause of death was determined to be due, most likely, to salmonella septicemia. Another porpoise, discovered at Port Angeles on May 6, 2003, was in a state of moderate decomposition, indicating that this porpoise also died prior to May 5. One stranded harbor porpoise discovered fresh on May 6 is the only animal that could potentially be linked in time to the USS SHOUP’s May 5 active sonar use. Necropsy results for this porpoise found no evidence of acoustic trauma. The remaining eight strandings were discovered one to three weeks after the USS SHOUP’s May 5 transit of the Haro Strait, making it difficult to causally link the sonar activities of the USS SHOUP to the timing of the strandings. Two of the eight porpoises died from blunt trauma injury and a third suffered from parasitic infestation, which possibly contributed to its death (Norman et al. 2004). For the remaining five porpoises, NMFS was unable to identify the causes of death.

The speculative association of the harbor porpoise strandings to the use of sonar by the USS SHOUP is inconsistent with prior stranding events linked to the use of mid-frequency sonar. Specifically, in prior events, the stranding of whales occurred over a short period of time (less than 36 hours), stranded individuals were spatially co-located, traumas in stranded animals were consistent between events, and active sonar was known or suspected to be in use. Although mid-frequency active sonar was used by the USS SHOUP, the distribution of harbor porpoise strandings by location and with respect to time surrounding the event do not support the suggestion that mid-frequency active sonar was a cause of harbor porpoise strandings. Rather, a complete lack of evidence of any acoustic trauma within the harbor porpoises, and the identification of probable causes of stranding or death in several animals, further supports the conclusion that harbor porpoise strandings were unrelated to the sonar activities of the USS SHOUP.

Additional allegations regarding USS SHOUP use of sonar having caused behavioral effects to Dall’s porpoise, orca, and a minke whale also arose in association with this event (DoN 2004 for a complete discussion).

Dall’s porpoise: Information regarding the observation of Dall’s porpoise on 5 May 2003 came from the operator of a whale watch boat at an unspecified location. This operator reported the Dall’s porpoise were seen “going north” when the SHOUP was estimated by him to be 10 miles away. Potential reasons for the Dall’s movement include the pursuit of prey, the presence of harassing resident orca or predatory transient orca, vessel disturbance from one of many whale watch vessels, or multiple other unknowable reasons including the use of sonar by USS SHOUP. In short, there was nothing unusual in the observed behavior of the Dall’s porpoise on 5 May 2003 and no way to assess if the otherwise normal behavior was in reaction to the use of sonar by USS SHOUP, any other potential causal factor, or a combination of factors.

Orca: Observer opinions regarding orca J-Pod behaviors on 5 May 2003 were inconsistent, ranging from the orca being “at ease with the sound” or “resting” to their being “annoyed.” One witness reported observing “low rates of surface active behavior” on behalf of the orca J-Pod, which is in conflict with that of another observer who reported variable surface activity, tail slapping and spyhopping. Witnesses also expressed the opinion that the behaviors displayed by the orca on 5 May 2003 were “extremely unusual,” although those same behaviors are observed and reported regularly on the Orca Network Website, are behaviors listed in general references as being part of the normal repertoire of orca behaviors. Given the contradictory nature of the reports on the observed behavior of the J-Pod orca, it is impossible to determine if any unusual behaviors were present. In short, there is no way to assess if any unusual behaviors were present or if present they were in reaction to vessel disturbance from one of many nearby whale watch vessels, use of sonar by USS SHOUP, any other potential causal factor, or a combination of factors.

Minke whale: A minke whale was reported porpoising in Haro Strait on 5 May 2003, which is a rarely observed behavior. The cause of this behavior is indeterminate given multiple potential causal factors including but not limited to the presence of predatory Transient orca, possible interaction with whale watch boats, other vessels, or SHOUP’s use of sonar. The behavior of the minke whale was the only unusual behavior clearly present on 5 May 2003, however, no way to given the existing information if the unusual behavior observed was in reaction to the use of sonar by USS SHOUP, any other potential causal factor, or a combination of factors.

2004 Hawai'i Melon-Headed Whale Mass Stranding (July 3-4 2004)

Description: The majority of the following information is taken from the NMFS report on the stranding event (Southall et al. 2006) but is inclusive of additional and new information not presented in the NMFS report. On the morning of July 3, 2004, between 150-200 melon-headed whales (*Peponocephala electra*) entered Hanalei Bay, Kauai. Individuals attending a canoe blessing ceremony observed the animals entering the bay at approximately 7:00 a.m. The whales were reported entering the bay in a "wave as if they were chasing fish" (Braun 2006). At 6:45 a.m. on July 3, 2004, approximately 25 nm north of Hanalei Bay, active sonar was tested briefly prior to the start of an anti-submarine warfare exercise.

The whales stopped in the southwest portion of the bay, grouping tightly, and displayed spy-hopping and tail-slapping behavior. As people went into the water among the whales, the pod separated into as many as four groups, with individual animals moving among the clusters. This continued through most of the day, with the animals slowly moving south and then southeast within the bay. By about 3 p.m., police arrived and kept people from interacting with the animals. The Navy believes that the abnormal behavior by the whales during this time is likely the result of people and boats in the water with the whales rather than the result of sonar activities taking place 25 or more miles off the coast. At 4:45 p.m. on July 3, 2004, the RIMPAC Battle Watch Captain received a call from a National Marine Fisheries representative in Honolulu, Hawaii, reporting the sighting of as many as 200 melon-headed whales in Hanalei Bay. At 4:47 p.m. the Battle Watch Captain directed all ships in the area to cease active sonar transmissions.

At 7:20 p.m. on July 3, 2004, the whales were observed in a tight single pod 75 yards from the southeast side of the bay. The pod was circling in a group and displayed frequent tail slapping and whistle vocalizations and some spy hopping. No predators were observed in the bay and no animals were reported as having fresh injuries. The pod stayed in the bay through the night of July 3, 2004. On the morning of July 4, 2004, the whales were observed to still be in the bay and collected in a tight group. A decision was made at that time to attempt to herd the animals out of the bay. A 700-to-800-foot rope was constructed by weaving together beach morning glory vines. This vine rope was tied between two canoes and with the assistance of 30 to 40 kayaks, was used to herd the animals out of the bay. By approximately 11:30 a.m. on July 4, 2004, the pod was coaxed out of the bay.

A single neonate melon-headed whale was observed in the bay on the afternoon of July 4, after the whale pod had left the bay. The following morning on July 5, 2004, the neonate was found stranded on Lumahai Beach. It was pushed back into the water but was found stranded dead between 9 and 10 a.m. near the Hanalei pier. NMFS collected the carcass and had it shipped to California for necropsy, tissue collection, and diagnostic imaging.

Following the stranding event, NMFS undertook an investigation of possible causative factors of the stranding. This analysis included available information on environmental factors, biological factors, and an analysis of the potential for sonar involvement. The latter analysis included vessels that utilized mid-frequency active sonar on the afternoon and evening of July 2. These vessels were to the southeast of Kauai, on the opposite side of the island from Hanalei Bay.

Findings: NMFS concluded from the acoustic analysis that the melon-headed whales would have had to have been on the southeast side of Kauai on July 2 to have been exposed to sonar from naval vessels on that day (Southall et al. 2006). There was no indication whether the animals were in that region or whether they were elsewhere on July 2. NMFS concluded that the animals would have had to swim from 1.4-4.0 m/s for 6.5 to 17.5 hours after sonar transmissions ceased to reach Hanalei Bay by 7:00 a.m. on July 3. Sound transmissions by ships to the north of Hanalei Bay on July 3 were produced as part of exercises between 6:45 a.m. and 4:47 p.m. Propagation analysis conducted by the 3rd Fleet estimated that the level of sound from these transmissions at the mouth of Hanalei Bay could have ranged from 138-149 dB re: 1 μPa.

NMFS was unable to determine any environmental factors (e.g., harmful algal blooms, weather conditions) that may have contributed to the stranding. However, additional analysis by Navy investigators found that a full moon occurred the evening before the stranding and was coupled with a squid run (Mobley et al. 2007). One of the first observations of the whales entering the bay reported the pod came into the bay in a line "as if chasing fish" (Braun 2005). In addition, a group of 500-700 melon-headed whales were observed to come close to shore and interact with humans in Sasanhaya Bay, Rota, on the same morning as the whales entered Hanalei Bay (Jefferson et al. 2006). Previous records further indicated that, though the entrance of melon-headed whales into the shallows is rare, it is not unprecedented. A pod of melon-headed whales entered Hilo Bay in the 1870s in a manner similar to that which occurred at Hanalei Bay in 2004.

The necropsy of the melon-headed whale calf suggested that the animal died from a lack of nutrition, possibly following separation from its mother. The calf was estimated to be approximately one week old. Although the calf appeared not to have eaten for some time, it was not possible to determine whether the calf had ever nursed after it was born. The calf showed no signs of blunt trauma or viral disease and had no indications of acoustic injury.

Conclusions: Although it is not impossible, it is unlikely that the sound level from the sonar caused the melon-headed whales to enter Hanalei Bay. This conclusion is based on a number of factors:

1. The speculation that the whales may have been exposed to sonar the day before and then fled to the Hanalei Bay is not supported by reasonable expectation of animal behavior and swim speeds. The flight response of the animals would have had to persist for many hours following the cessation of sonar transmissions. Such responses have not been observed in marine mammals and no documentation of such persistent flight response after the cessation of a frightening stimulus has been observed in other mammals. The swim speeds, though feasible for the species, are highly unlikely to be maintained for the durations proposed, particularly since the pod was a mixed group containing both adults and neonates. Whereas adults may maintain a swim speed of 4.0 m/s for some time, it is improbable that a neonate could achieve the same for a period of many hours.

2. The area between the islands of Oahu and Kauai and the PMRF training range have been used in RIMPAC exercises for more than 20 years, and are used year-round for ASW training using mid frequency active sonar. Melon-headed whales inhabiting the waters around Kauai are likely not naive to the sound of sonar and there has never been another stranding event associated in time with ASW training at Kauai or in the Hawaiian Islands. Similarly, the waters surrounding Hawaii contain an abundance of marine mammals, many of which would have been exposed to the same sonar operations that were speculated to have affected the melon-headed whales. No other strandings were reported coincident with the RIMPAC exercises. This leaves it uncertain as to why melon-headed whales, and no other species of marine mammal, would respond to the sonar exposure by stranding.

3. At the nominal swim speed for melon-headed whales, the whales had to be within 1.5 to 2 nm of Hanalei Bay before sonar was activated on July 3. The whales were not in their open ocean habitat but had to be close to shore at 6:45 a.m. when the sonar was activated to have been observed inside Hanalei Bay from the beach by 7:00 a.m (Hanalei Bay is very large area). This observation suggests that other potential factors could be causative of the stranding event (see below).

4. The simultaneous movement of 500-700 melon-headed whales and Risso's dolphins into Sasanhaya Bay, Rota, in the Northern Marianas Islands on the same morning as the 2004 Hanalei stranding (Jefferson et al. 2006) suggests that there may be a common factor which prompted the melon-headed whales to approach the shoreline. A full moon occurred the evening before the stranding and a run of squid was reported concomitant with the lunar activity (Mobley et al. 2007). Thus, it is possible that the melon-headed whales were capitalizing on a lunar event that provided an opportunity for relatively easy prey capture (Mobley et al. 2007). A report of a pod entering Hilo Bay in the 1870s indicates that on at least one other occasion, melon-headed whales entered a bay in a manner similar to the occurrence at Hanalei Bay in July 2004. Thus, although melon-headed whales entering shallow embayments may be an infrequent event, and every such event might be considered anomalous, there is precedent for the occurrence.

5. The received noise sound levels at the bay were estimated to range from roughly 95 – 149 dB re: 1 μPa. Received levels as a function of time of day have not been reported, so it is not possible to determine when the presumed highest levels would have occurred and for how long. However, received levels in the upper range would have been audible by human participants in the bay. The statement by one interviewee that he heard "pings" that lasted an hour and that they were loud enough to hurt his ears is unreliable. Received levels necessary to cause pain over the duration stated would have been observed by most individuals in the water with the animals. No other such reports were obtained from people interacting with the animals in the water.

Although NMFS concluded that sonar use was a "plausible, if not likely, contributing factor in what may have been a confluence of events (Southall et al. 2006)," this conclusion was based primarily on the basis that there was an absence of any other compelling explanation. The authors of the NMFS report on the incident were unaware, at the time of publication, of the simultaneous event in Rota. In light of the simultaneous Rota event, the Hanalei stranding does not appear as anomalous as initially presented and the speculation that sonar was a causative factor is weakened. The Hanalei Bay incident does not share the characteristics observed with other mass strandings of whales coincident with sonar activity (e.g., specific traumas, species composition, etc.). In addition, the inability to conclusively link or exclude the impact of other environmental factors makes a causal link between sonar and the melon-headed whale strandings highly speculative at best.

1980- 2004 Beaked Whale Strandings in Japan (Brownell et al. 2004)

Description: Brownell et al. (2004) compare the historical occurrence of beaked whale strandings in Japan (where there are U.S. Naval bases), with strandings in New Zealand (which lacks a U.S. Naval base) and concluded the higher number of strandings in Japan may be related to the presence of the US. Navy vessels using mid-frequency sonar. While the dates for the strandings were well documented, the authors of the study did not attempt to correlate the dates of any navy activities or exercises with the dates of the strandings.

To fully investigate the allegation made by Brownell et al. (2004), the Center for Naval Analysis (CNA) in an internal Navy report, looked at the past U.S. Naval exercise schedules from 1980 to 2004 for the water around Japan in comparison to the dates for the strandings provided by Brownell et al. (2004). None of the strandings occurred during or soon (within weeks) after any U.S. Navy exercises. While the CNA analysis began by investigating the probabilistic nature of any co-occurrences, the strandings and sonar use were not correlated by time. Given there was no instance of co-occurrence in over 20 years of stranding data, it can be reasonably postulated that sonar use in Japan waters by U.S. Navy vessels did not lead to any of the strandings documented by Brownell et al. (2004).

2004 Alaska Beaked Whale Strandings (7-16 June 2004)

Description: In the timeframe between 17 June and 19 July 2004, five beaked whales were discovered at various locations along 1,600 miles of the Alaskan coastline and one was found floating (dead) at sea. Because the Navy exercise Alaska Shield/Northern Edge 2004 occurred within the approximate timeframe of these strandings, it has been alleged that sonar may have been the probable cause of these strandings.

The Alaska Shield/Northern Edge 2004 exercise consisted of a vessel tracking event followed by a vessel boarding search and seizure event. There was no ASW component to the exercise, no use of mid-frequency sonar, and no use of explosives in the water. There were no events in the Alaska Shield/Northern Edge exercise that could have caused in any of the strandings over this 33 day period covering 1,600 miles of coastline.

2005 North Carolina Marine Mammal Mass Stranding Event (January 15-16, 2005)

Description: On January 15 and 16, 2005, 36 marine mammals consisting of 33 short-finned pilot whales, 1 minke whale, and 2 dwarf sperm whales stranded alive on the beaches of North Carolina (Hohn et al. 2006a). The animals were scattered across a 111-km area from Cape Hatteras northward. Because of the live stranding of multiple species, the event was classified as a UME. It is the only stranding on record for the region in which multiple offshore species were observed to strand within a two- to three-day period

The U.S. Navy indicated that from January 12-14 some unit level training with mid-frequency active sonar was conducted by vessels that were 93 to 185 km from Oregon Inlet. An expeditionary strike group was also conducting exercises to the southeast, but the closest point of active sonar transmission to the inlet was 650 km away. The unit level operations were not unusual for the area or time of year and the vessels were not involved in antisubmarine warfare exercises. Marine mammal observers on board the vessels did not detect any marine mammals during the period of unit level training. No sonar transmissions were made on January 15-16.

The National Weather Service reported that a severe weather event moved through North Carolina on January 13 and 14. The event was caused by an intense cold front that moved into an unusually warm and moist air mass that had been persisting across the eastern United States for about a week. The weather caused flooding in the western part of the state, considerable wind damage in central regions of the state, and at least three tornadoes that were reported in the north central part of the state. Severe, sustained (one to four days) winter storms are common for this region.

Over a two-day period (January 16-17), two dwarf sperm whales, 27 pilot whales, and the minke whale were necropsied and tissue samples collected. Twenty-five of the stranded cetacean heads were examined; two pilot whale heads and the heads of the dwarf sperm whales were analyzed by CT.

Findings: The pilot whales and dwarf sperm whale were not emaciated, but the minke whale, which was believed to be a dependent calf, was emaciated. Many of the animals were on the beach for an extended period of time (up to 48 hours) prior to necropsy and sampling, and many of the biochemical abnormalities (related to dehydration, electrolyte imbalances, and muscle and organ degeneration) noted in the animals were suspected of being related to the stranding and prolonged time on land. Lesions were observed in all of the organs, but there was no consistency across species. Musculoskeletal disease was observed in two pilot whales and cardiovascular disease was observed in one dwarf sperm whale and one pilot whale. Parasites were a common finding in the pilot whales and dwarf sperm whales but were considered consistent with the expected parasite load for wild odontocetes. None of the animals exhibited traumas similar to those observed in prior stranding events associated with mid-frequency sonar activity.

Specifically, there was an absence of auditory system trauma and no evidence of distributed and widespread bubble lesions or fat emboli, as was previously observed (Fernández et al. 2005).

Sonar transmissions prior to the strandings were limited in nature and did not share the concentration identified in previous events associated with mid-frequency active sonar use (Evans and England 2001). The operational/environmental conditions were also dissimilar (e.g., no constrictive channel and a limited number of ships and sonar transmissions). NMFS noted that environmental conditions were favorable for a shift from up-welling to down-welling conditions, which could have contributed to the event. However, other severe storm conditions existed in the days surrounding the strandings and the impact of these weather conditions on at-sea conditions is unknown. No harmful algal blooms were noted along the coastline.

Conclusions: All of the species involved in this stranding event are known to occasionally strand in this region. Although the cause of the stranding could not be determined, several whales had preexisting conditions that could have contributed to the stranding. Cause of death for many of the whales was likely due to the physiological stresses associated with being stranded. A consistent suite of injuries across species, which was consistent with prior strandings where sonar exposure is expected to be a causative mechanism, was not observed.

NMFS was unable to determine any causative role that sonar may have played in the stranding event. The acoustic modeling performed, as in the Hanalei Bay incident, was hampered by uncertainty regarding the location of the animals at the time of sonar transmissions. However, as in the Hanalei Bay incident, the response of the animals following the cessation of transmissions would imply a flight response that persisted for many hours after the sound source was no longer operational. In contrast, the presence of a severe weather event passing through North Carolina during January 13 and 14 is a possible, if not likely, contributing factor to the North Carolina UME of January 15. Hurricanes may have been responsible for mass strandings of pygmy killer whales in the British Virgin Islands and Gervais' beaked whales in North Carolina (Mignucci-Giannoni et al. 2000; Norman and Mead 2001).

1.1.3.3 Causal Associations for Stranding Events

Several stranding events have been associated with Navy sonar activities but relatively few of the total stranding events that have been recorded occurred spatially or temporally with Navy sonar activities. While sonar may be a contributing factor under certain rare conditions, the presence of sonar it is not a necessary condition for stranding events to occur.

A review of past stranding events associated with sonar suggest that the potential factors that may contribute to a stranding event are steep bathymetry changes, narrow channels, multiple sonar ships, surface ducting and the presence of beaked whales that may be more susceptible to sonar exposures. The most important factors appear to be the presence of a narrow channel (e.g. Bahamas and Madeira Island, Portugal) that may prevent animals from avoiding sonar exposure and multiple sonar ships within that channel. There are no narrow channels (less than 35 nm wide and 10 nm in length) in the SOCAL Range Complex and the ships would be spread out over a wider area allowing animals to move away from sonar activities if they choose. In addition, beaked whales may not be more susceptible to sonar but may favor habitats that are more conducive to sonar effects.

There have been no mass strandings in Southern California waters are attributed to Navy sonar. Given the large military presence and private and commercial vessel traffic in the Southern California waters, it is likely that a mass stranding event would be detected. Therefore, it is unlikely that the conditions that may have contributed to past stranding events involving Navy sonar would be present in the SOCAL Range Complex.

1.1.3.4 California Stranding Patterns

While major range events undergo name changes over the years, the equivalent of COMPTUEX and JTFEX have been conducted in Southern California, specifically SCIRC, since 1934. Sonar training activities have been conducted since World War II, and sonar systems assessed in the COMPTUEX/JTFEX EA/OEA (DoN 2006a) have been used since the 1970's (J. Marshall U.S. Navy, pers. comm.). Between 1982-2005, eight blue whales, 14 fin whales, seven humpback whales, two sperm whales, zero sei whales, and 12 Guadalupe fur seals (California Marine Mammal Stranding Network Database 2006), were reported as stranded in California. Known strandings also occurred in all months with no significant temporal trend (California Marine Mammal Stranding Network Database 2006). Beaked whales have also stranded in Southern California, however they were not considered mass stranding events nor were they correlated with sonar. Eleven beaked whales stranded between 1982-2005 from San Diego to Santa Barbara County [specifically, Blainville's, Hubb's (*M. carhubbsi*), Cuvier's, and Stejneger's (*M. stejnegeri*)] (California Marine Mammal Stranding Network Database 2006).

1.1.4 Stranding Section Conclusions

Marine mammal strandings have been a historic and ongoing occurrence attributed to a variety of causes. Over the last fifty years, increased awareness and reporting has lead to more information about species effected and raised concerns about anthropogenic sources of stranding. While there has been some marine mammal mortalities potentially associated with mid-frequency sonar effects to a small number of species (primarily limited numbers of certain species of beaked whales), the significance and actual causative reason for any impacts is still subject to continued investigation.

By comparison and as described previously, potential impacts to all species of cetaceans worldwide from fishery related mortality can be orders of magnitude more significant (100,000s of animals vice 10s of animals) (Culik 2002; ICES 2005b; Read et al. 2006). This does not negate the influence of any mortality or additional stressor to small, regionalized sub-populations which may be at greater risk from human related mortalities (fishing, vessel strike, sound) than populations with larger oceanic level distribution or migrations. ICES (2005a) noted, however, that taken in context of marine mammal populations in general, sonar is not major threat, or significant portion of the overall ocean noise budget.

In conclusion, a constructive framework and continued research based on sound scientific principles is needed in order to avoid speculation as to stranding causes, and to further our understanding of potential effects or lack of effects from military mid-frequency sonar (Bradshaw et al. 2005; ICES 2005b; Barlow and Gisiner 2006; Cox et al. 2006).

2 MODELING ACOUSTIC AND EXPLOSIVE EFFECTS

The methodology for analyzing potential impacts from sonar and explosives is presented in this section, which defines the model process in detail, describes how the impact threshold derived from Navy-NMFS consultations are derived, and discusses relative potential impact based on species biology.

The Navy acoustic exposure model process uses a number of inter-related software tools to assess potential exposure of marine mammals to Navy generated underwater sound including sonar and explosions. For sonar, these tools estimate potential impact volumes and areas over a range of thresholds for sonar specific operating modes. Results are based upon extensive pre-computations over the range of acoustic environments that might be encountered in the operating area.

The process includes four steps used to calculate potential exposures:

- Identify unique acoustic environments that encompass the operating area. Parameters include depth and seafloor geography, bottom characteristics and sediment type, wind and surface roughness, sound velocity profile, surface duct, sound channel, and convergence zones.

- Compute transmission loss (TL) data appropriate for each sensor type in each of these acoustic environments. Propagation can be complex depending on a number of environmental parameters listed in step one, as well as sonar operating parameters such as directivity, source level, ping rate, and ping length, and for explosives the amount of explosive material detonated. The Navy standard CASS-GRAB acoustic propagation model is used to resolve these complexities for underwater propagation prediction.

- Use that TL to estimate the total sound energy received at each point in the acoustic environment.

- Apply this energy to predicted animal density for that area to estimate potential acoustic exposure, with animals distributed in 3-D based on best available science on animal dive profiles.

Modeling of the effects of mid-frequency sonar and underwater detonations was conducted using methods described in the following sections.

The primary potential impact to marine mammals from underwater acoustics is Level B harassment from noise. For explosions, in the absence of any mitigation or monitoring measures, there is a very small chance that a marine mammal could be injured or killed when exposed to the energy generated from an explosive force on the sea floor. Analysis of noise impacts to cetaceans is based on criteria and thresholds initially presented in U.S. Navy Environmental Impact Statements for ship shock trials of the Seawolf submarine and the Winston Churchill (DDG 81), and subsequently adopted by NMFS.

Non-lethal injurious impacts (Level A Harassment) are defined in those documents as tympanic membrane (TM) rupture and the onset of slight lung injury. The threshold for Level A Harassment corresponds to a 50-percent rate of TM rupture, which can be stated in terms of an energy flux density (EFD) value of 205 dB re 1 μPa^2-s. TM rupture is well-correlated with permanent hearing impairment. Ketten (1998) indicates a 30-percent incidence of permanent threshold shift (PTS) at the same threshold.

The criteria for onset of slight lung injury were established using partial impulse because the impulse of an underwater blast wave was the parameter that governed damage during a study using mammals, not peak pressure or energy (Yelverton 1981). Goertner (1982) determined a way to calculate impulse values for injury at greater depths, known as the Goertner "modified" impulse pressure. Those values are valid only near the surface because as hydrostatic pressure increases with depth, organs like the lung, filled with air, compress. Therefore the "modified" impulse pressure thresholds vary from the shallow depth starting point as a function of depth.

The shallow depth starting points for calculation of the "modified" impulse pressures are mass-dependent values derived from empirical data for underwater blast injury (Yelverton 1981). During the calculations, the lowest impulse and body mass for which slight, and then extensive, lung injury found during a previous study (Yelverton et al 1973) were used to determine the positive impulse that may cause lung injury. The Goertner model is sensitive to mammal weight; such that smaller masses have lower thresholds for positive impulse so injury and harassment will be predicted at greater distances from the source for them. Impulse thresholds of 13.0 and 31.0 psi-msec, found to cause slight and extensive injury in a dolphin calf, were used as thresholds in the analysis contained in this document.

Level B (non-injurious) Harassment includes temporary (auditory) threshold shift (TTS), a slight, recoverable loss of hearing sensitivity. One criterion used for TTS is 182 dB re 1 μPa^2-s maximum EFD level in any 1/3-octave band above 100 Hz for toothed whales (e.g., dolphins). A second criterion, 23 psi, has recently been established by NMFS to provide a more conservative range for TTS when the explosive or animal approaches the sea surface, in which case explosive energy is reduced, but the peak pressure is 1 μPa^2-s is not. NMFS applies the more conservative of these two. Table 2-1 lists the thresholds for explosives.

Table 2-1. Explosive Source Thresholds

Threshold Type (Explosives)	Threshold Level
Level A – 50% Eardrum rupture (peak)	205 dB
Temporary Threshold Shift (TTS) (peak one-third octave energy)	182 dB
Temporary Threshold Shift (TTS) (peak pressure)	23 psi
Level A – Slight lung injury (positive impulse)	13 psi-ms
Fatality – 1% Mortal lung injury (positive impulse)	31 psi-ms

For non-explosive sound sources, Level B Harassment includes behavioral modifications resulting from repeated noise exposures (below TTS) to the same animals over a relatively short period of time. Cetaceans exposed to ELs of 195 dB re 1 μPa^2-s up to 215 dB re 1 μPa^2-s are assumed to experience TTS. At 215 dB re 1 μPa^2-s, cetaceans are assumed to experience PTS. Unlike cetaceans, the TTS and PTS thresholds used for exposure modeling for pinnipeds vary with species. Otariids have thresholds of 206 dB re 1 μPa^2-s for TTS and 226 dB re 1 μPa^2-s for PTS. Northern elephant seals are similar to otariids (TTS = 204 dB re 1 μPa^2-s, PTS = 224 dB re 1 μPa^2-s) but are lower for harbor seals (TTS = 183 dB re 1 μPa^2-s, PTS = 203 dB re 1 μPa^2-s).

A certain proportion of marine mammals are expected to experience behavioral disturbance at different received sound pressure levels and are counted as Level B harassment exposures. The details of the behavioral disturbance calculation are described in the Risk Response section. Table 2-2 lists the thresholds for sonar.

Table 2-2. Sonar Source Thresholds For Cetaceans and Pinnipeds

Physiological Effects			
Animal	**Criteria**	**Threshold (re 1μPa²-s)**	**MMPA Effect**
Cetacean	TTS	195	Level B Harassment
	PTS	215	Level A Harassment
Pinnipeds			
Northern Elephant Seal	TTS	204	Level B Harassment
	PTS	224	Level A Harassment
Pacific Harbor Seal	TTS	183	Level B Harassment
	PTS	203	Level A Harassment
California Sea Lion	TTS	206	Level B Harassment
	PTS	226	Level A Harassment
Guadalupe Fur Seal	TTS	206	Level B Harassment
	PTS	226	Level A Harassment
Northern Fur Seal	TTS	206	Level B Harassment
	PTS	226	Level A Harassment

The sound sources will be located in an area that is inhabited by species listed as threatened or endangered under the Endangered Species Act (ESA, 16 USC §§ 1531-1543). Operation of the sound sources, that is, transmission of acoustic signals in the water column, could potentially cause harm or harassment to listed species.

"Harm" defined under ESA regulations is "an act which actually kills or injures" (50 CFR 222.102) listed species. "Harassment" is an "intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (50 CFR 17.3).

Level A harassment criteria and thresholds under MMPA are appropriate to apply as "harm" criteria and thresholds under ESA. Analysis that predicts Level A harassment under MMPA will occur as a result of the proposed action would correspond to harm to listed species under ESA. Level B harassment criteria and thresholds under MMPA are appropriate to apply as harassment criteria and thresholds under ESA.

If a federal agency determines that its proposed action "may affect" a listed species, it is required to consult, either formally or informally, with the appropriate regulator. There is no permit issuance under ESA, rather consultation among the cognizant federal agencies under § 7 of the ESA. Such consultations would likely be concluded favorably, subject to requirements that the activity will not appreciably reduce the likelihood of the species' survival and recovery and impacts are minimized and mitigated. The Navy will initiate formal interagency consultation by submitting a Biological Assessment to NMFS, detailing the proposed action's potential effects on listed species and their designated critical habitats. Consultation would conclude with NMFS' issuance of a Biological Opinion that addresses the issues of whether the project can be expected to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

2.1 ACOUSTIC SOURCES

The Southern California (SOCAL) acoustic sources are categorized as either broadband (producing sound over a wide frequency band) or narrowband (producing sound over a frequency band that that is small in comparison to the center frequency). In general, the narrowband sources in this exercise are ASW sonars and the broadband sources are explosives. This delineation of source types has a couple of implications. First, the transmission loss used to determine the impact ranges of narrowband ASW sonars can be adequately characterized by model estimates at a single frequency. Broadband explosives, on the other hand, produce significant acoustic energy across several frequency decades of bandwidth. Propagation loss is sufficiently sensitive to frequency as to require model estimates at several frequencies over such a wide band.

Second, the types of sources have different sets of harassment metrics and thresholds. Energy metrics are defined for both types. However, explosives are impulsive sources that produce a shock wave that dictates additional pressure-related metrics (peak pressure and positive impulse). Detailed descriptions of both types of sources are provided in the following subsections.

2.1.1 Sonars

To estimate impacts from mid- and high-frequency sonar, five types of narrowband sonars representative of those used in operations in the SOCAL Range Complex were modeled. Exposure estimates are calculated for each sonar according to the manner in which it operates. For example, the SQS-53C is a hull-mounted, surface ship sonar that operates for many hours at a time, so it is most useful to calculate and report SQS-53C exposures per hour of operation. The SQS-56C is a hull-mounted, surface ship sonar (not as power full as the SQS-53C) that operates for many hours at a time, so it is most useful to calculate and report SQS-56C exposures per hour of operation. The AQS-22 is a helicopter-deployed sonar, which is lowered into the water, pings a number of times, and then moves to a new location. For the AQS-22, it is most helpful to calculate and report exposures per dip. Table 2-3 presents the deploying platform, frequency class, and the reporting metric for each sonar.

Table 2-3. Active Sonars Employed in SOCAL Range and Modeled

Sonar	Description	Frequency Class	Exposures Reported
MK-48	Torpedo sonar	High frequency	Per torpedo
AN/SQS-53C	Surface ship sonar	Mid-frequency	Per hour
AN/SQS-56C	Surface ship sonar	Mid-frequency	Per hour
BQQ-10	Submarine sonar	Mid-Frequency	Per hour
AN/SSQ-62	Sonobuoy sonar	Mid-frequency	Per sonobuoy
AN/AQS-22	Helicopter-dipping sonar	Mid-frequency	Per dip
MK-46[1]	Torpedo sonar	High Frequency	Per torpedo
SLQ-25-NIXIE[2]	Acoustic Device Countermeasure	Mid-Frequency	Not sonobuoy

[1] All MK-46 and 48 exposures were modeled as the more powerful MK-48 source
[2] the SLQ-NIXIE was not modeled because of its low sound level
Note that MK-48 source described here is the active pinger on the torpedo; the explosive source of the detonating torpedo is described in the next subsection.

The acoustic modeling that is necessary to support the exposure estimates for each of these sonars relies upon a generalized description of the manner of the sonar's operating modes. This description includes the following:

- "Effective" energy source level – The total energy across the band of the source, scaled by the pulse length (10 $\log_{10}$ [pulse length]), and corrected for source beam width so that it reflects the energy in the direction of the main lobe. The beam pattern correction consists of two terms:
  - Horizontal directivity correction: 10 $\log_{10}$ (360 / horizontal beam width)
  - Vertical directivity correction: 10 $\log_{10}$ (2 / [$\sin(\theta_1) - \sin(\theta_2)$]), where θ_1 and θ_2 are the 3-dB down points on the main lobe.
- Source depth – Depth of the source in meters.
- Nominal frequency – Typically the center band of the source emission. These are frequencies that have been reported in open literature and are used to avoid classification issues. Differences between these nominal values and actual source frequencies are small enough to be of little consequence to the output impact volumes.
- Source directivity – The source beam is modeled as the product of a horizontal beam pattern and a vertical beam pattern. Two parameters define the horizontal beam pattern:
  - Horizontal beam width – Width of the source beam (degrees) in the horizontal plane (assumed constant for all horizontal steer directions).
  - Horizontal steer direction – Direction in the horizontal in which the beam is steered relative to the direction in which the platform is heading

  The horizontal beam is rectangular with constant response across the width of the beam and with flat, 20-dB down sidelobes. (Note that steer directions ϕ, $-\phi$, $180^o - \phi$, and $180^o + \phi$ all produce equal impact volumes.)

  Similarly, two parameters define the vertical beam pattern:
  - Vertical beam width – Width of the source beam (degrees) in the vertical plane measured at the 3-dB down point. (The width is that of the beam steered towards broadside and not the width of the beam at the specified vertical steer direction.)
  - Vertical steer direction – Direction in the vertical plane that the beam is steered relative to the horizontal (upward looking angles are positive).

  To avoid sharp transitions that a rectangular beam might introduce, the power response at vertical angle θ is

  $$\max \{ \sin^2 [n(\theta_s - \theta)] / [n \sin (\theta_s - \theta)]^2, 0.01 \}$$

  where $n = 180^o / \theta_w$ is the number of half-wavelength-spaced elements in a line array that produces a main lobe with a beam width of θ_w. θ_s is the vertical beam steer direction.
- Ping spacing – Distance between pings. For most sources this is generally just the product of the speed of advance of the platform and the repetition rate of the sonar. Animal motion is generally of no consequence as long as the source motion is greater than the speed of the animal (nominally, three knots). For stationary (or nearly stationary) sources, the "average" speed of the animal is used in place of the platform speed. The attendant assumption is that the animals are all moving in the same constant direction.

These parameters are defined for each of the active sonars (including two operating modes for the 53C) in Table 2-4.

Table 2-4. Source Description of SOCAL Mid- and High-Frequency Active Sonars

Sonar	Source Depth	Center Freq	Source Level	Emission Spacing	Vertical Directivity	Horizontal Directivity
AN/SQS-53C Search Mode	7 m	3.5 kHz	235 dB	154 m	Omni	240^{o} Forward-looking
AN/SQS-53C Kingfisher Mode	7 m	3.5 kHz	236 dB	4.6 m	20^{o} Width 42^{o} D/E	120^{o} Forward-looking
SQS-56C	27 m	6.8 to 8.2 kHz	225 dB	128.6 m	13^{o}	30^{o}
BQQ-10	7 m	Classified	Classified	n/a	Omni	Omni
MK-48	27 m	Classified	Classified	144 m	Omni	Omni
AN/SSQ-62	27 m	8 kHz	201 dB	450 m	Omni	Omni
AN/SSQ-125	Varies	Classified	Classified	450 m	Omni	Omni
AN/AQS-22	27 m	4.1 kHz	217 dB	15 m	Omni	Omni
SLQ-25 NIXIE	Varies	Classified	Classified	n/a	n/a	n/a

2.1.2 Explosives

Explosives detonated underwater introduce loud, impulsive, broadband sounds into the marine environment. Three source parameters influence the effect of an explosive: the weight of the explosive warhead, the type of explosive material, and the detonation depth. The net explosive weight (or NEW) accounts for the first two parameters. The NEW of an explosive is the weight of only the explosive material in a given round, referenced to the explosive power of TNT.

The detonation depth of an explosive is particularly important due to a propagation effect known as surface-image interference increasingly. For sources located near the sea surface, a distinct interference pattern arises from the coherent sum of the two paths that differ only by a single reflection from the pressure-release surface. As the source depth and/or the source frequency decreases, these two paths increasingly, destructively interfere with each other, reaching total cancellation at the surface (barring surface-reflection scattering loss). For the SOCAL Range there are two types of explosive sources: demolition charges and munitions (Mk-48 torpedo, Maverick and Harpoon missiles, Mk-82 and Mk-83 bombs, 5” rounds and 76 mm rounds). Demolition charges are typically modeled as detonating near the middle of the water column. The Mk-48 detonates immediately below the hull of its target (nominally 50 feet). A source depth of two meters is used for bombs and missiles that do not strike their target. For the gunnery rounds, a source depth of one foot is used. The NEW for these sources are as follows:

- Demolition charge – 20 pounds,
- Mk-48 – 851 pounds,
- Maverick – 78.5 pounds,
- Harpoon – 448 pounds,
- Mk-82 – 238 pounds,
- Mk-83 – 574 pounds,
- 5” rounds – 9.54 pounds, and
- 76 mm rounds – 1.6 pounds
- IEER – 4.1 pounds

The exposures expected to result from these sources are computed on a per in-water explosive basis. The cumulative effect of a series of explosives can often be derived by simple addition if the detonations are spaced widely in time or space, allowing for sufficient animal movements as to ensure a different population of animals is considered for each detonation.

The cases in which simple addition of the exposures estimates may not be appropriate are addressed by the modeling of a "representative" sinking exercise (SINKEX). In a SINKEX, a decommissioned surface ship is towed to a specified deep-water location and there used as a target for a variety of weapons. Although no two SINKEXs are ever the same, a representative case derived from past exercises is described in the *Programmatic SINKEX Overseas Environmental Assessment (March 2006)* for the Western North Atlantic.

In a SINKEX, weapons are typically fired in order of decreasing range from the source with weapons fired until the target is sunk. A torpedo is used after all munitions have been expended if the target is still afloat. Since the target may sink at any time during the exercise, the actual number of weapons used can vary widely. In the representative case, however, all of the ordnances are assumed expended; this represents the worst case of maximum exposure.

The sequence of weapons firing for the representative SINKEX is described in Table 2-5. Guided weapons are nearly 100% accurate and are modeled as hitting the target (that is, no underwater acoustic effect) in all but two cases: (1) the Maverick is modeled as a miss to represent the occasional miss, and (2) the MK-48 torpedo intentionally detonates in the water column immediately below the hull of the target. Unguided weapons are more frequently off-target and are modeled according to the statistical hit/miss ratios. Note that these hit/miss ratios are artificially low in order to demonstrate a worst-case scenario; they should not be taken as indicative of weapon or platform reliability.

Table 2-5. Representative SINKEX Weapons Firing Sequence

Time (Local)	Event Description
0900	Range Control Officer receives reports that the exercise area is clear of non-participant ship traffic, marine mammals, and sea turtles.
0909	Hellfire missile fired, hits target.
0915	2 HARM missiles fired, both hit target (5 minutes apart).
0930	1 Penguin missile fired, hits target.
0940	3 Maverick missiles fired, 2 hit target, 1 misses (5 minutes apart).
1145	1 SM-1 fired, hits target.
1147	1 SM-2 fired, hits target.
1205	5 Harpoon missiles fired, all hit target (1 minute apart).
1300-1335	7 live and 3 inert MK 82 bombs dropped – 7 hit target, 2 live and 1 inert miss target (4 minutes apart).
1355-1410	4 MK 83 bombs dropped – 3 hit target, 1 misses target (5 minutes apart).
1500	Surface gunfire commences – 400 5-inch rounds fired (one every 6 seconds), 280 hit target, 120 miss target.
1700	MK 48 Torpedo fired, hits, and sinks target.

2.2 ENVIRONMENTAL PROVINCES

Propagation loss ultimately determines the extent of the Zone of Influence (ZOI) for a particular source activity. In turn, propagation loss as a function of range responds to a number of environmental parameters:

- water depth
- sound speed variability throughout the water column
- bottom geo-acoustic properties, and
- wind speed

Due to the importance that propagation loss plays in Anti-Submarine Warfare (ASW), the Navy has over the last four to five decades invested heavily in measuring and modeling these environmental parameters. The result of this effort is the following collection of global databases of these environmental parameters, most of which are accepted as standards for all Navy modeling efforts.

- Water depth – Digital Bathymetry Data Base Variable Resolution (DBDBV)
- Sound speed – Generalized Digital Environmental Model (GDEM)
- Bottom loss – Low-Frequency Bottom Loss (LFBL), Sediment Thickness Database, and High-Frequency Bottom Loss (HFBL), and
- Wind speed – U.S. Navy Marine Climatic Atlas of the World

This section provides a discussion of the relative impact of these various environmental parameters. These examples then are used as guidance for determining environmental provinces (that is, regions in which the environmental parameters are relatively homogenous and can be represented by a single set of environmental parameters) within the SOCAL Range.

2.2.1 Impact of Environmental Parameters

Within a typical operating area, the environmental parameter that tends to vary the most is bathymetry. It is not unusual for water depths to vary by an order of magnitude or more, resulting in significant impacts upon the Zone of Influence (ZOI) calculations. Bottom loss can also vary considerably over typical operating areas but its impact upon ZOI calculations tends to be limited to waters on the continental shelf and the upper portion of the slope. Generally, the primary propagation paths in deep water, from the source to most of the ZOI volume, do not involve any interaction with bottom. In shallow water, particularly if the sound velocity profile directs all propagation paths to interact with the bottom, bottom loss variability can play a larger role.

The spatial variability of the sound speed field is generally small over operating areas of typical size. The presence of a strong oceanographic front is a noteworthy exception to this rule. To a lesser extent, variability in the depth and strength of a surface duct can be of some importance. In the mid-latitudes, seasonal variation often provides the most significant variation in the sound speed field. For this reason, both summer and winter profiles are modeled for each selected environment.

2.2.2 Environmental Provincing Methodology

The underwater acoustic environment can be quite variable over ranges in excess of ten kilometers. For ASW applications, ranges of interest are often sufficiently large as to warrant the modeling of the spatial variability of the environment. In the propagation loss calculations, each of the environmental parameters is allowed to vary (either continuously or discretely) along the path from acoustic source to receiver. In such applications, each propagation loss calculation is conditioned upon the particular locations of the source and receiver.

On the other hand, the range of interest for marine animal harassment by most Naval activities is more limited. This reduces the importance of the exact location of source and marine animal and makes the modeling required more manageable in scope.

In lieu of trying to model every environmental profile that can be encountered in an operating area, this effort utilizes a limited set of representative environments. Each environment is characterized by a fixed water depth, sound velocity profile, and bottom loss type. The operating area is then partitioned into homogeneous regions (or provinces) and the most appropriately representative environment is assigned to each. This process is aided by some initial provincing of the individual environmental parameters. The Navy-standard high-frequency bottom loss database in its native form is globally partitioned into nine classes. Low-frequency bottom loss is likewise provinced in its native form, although it is not considered in the process of selecting environmental provinces. Only the broadband sources produce acoustic energy at the frequencies of interest for low-frequency bottom loss (typically less than 1 kHz); even for those sources the low-frequency acoustic energy is secondary to the energy above 1 kHz. The Navy-standard sound velocity profiles database is also available as a provinced subset. Only the Navy-standard bathymetry database varies continuously over the world's oceans. However, even this environmental parameter is easily provinced by selecting a finite set of water depth intervals. For this analysis "octave-spaced" intervals (10, 20, 50, 100, 200, 500, 1000, 2000, and 5000 m) provide an adequate sampling of water depth dependence.

Zone of influence volumes are then computed using propagation loss estimates derived for the representative environments. Finally, a weighted average of the ZOI volumes is taken over all representative environments; the weighting factor is proportional to the geographic area spanned by the environmental province.

The selection of representative environments is subjective. However, the uncertainty introduced by this subjectivity can be mitigated by selecting more environments and by selecting the environments that occur most frequently over the operating area of interest.

As discussed in the previous subsection, ZOI estimates are most sensitive to water depth. Unless otherwise warranted, at least one representative environment is selected in each bathymetry province. Within a bathymetry province, additional representative environments are selected as needed to meet the following requirements.

- In shallow water (less than 1,000 meters), bottom interactions occur at shorter ranges and more frequently; thus significant variations in bottom loss need to be represented.
- Surface ducts provide an efficient propagation channel that can greatly influence ZOI estimates. Variations in the mixed layer depth need to be accounted for if the water is deep enough to support the full extent of the surface duct.

Depending upon the size and complexity of the operating area, the number of environmental problems tends to range for 5 - 20.

2.2.3 Description of Environmental Provinces

The SOCAL Range is located in an area south of 34^{o} N, off the west coast of the US and Mexico. The range encompasses most of Warning Area W-291 and additional near-coastal areas to the north. For this analysis, eight areas within this range have been identified as representative. Seven of these areas are quasi-rectangular regions as described below and depicted in Figure 2-1.

- Area 1: Immediately east of San Nicolas Island; boundary vertices are
  119° 6’ W 33° 40’ N
  118° 51’ W 33° 29’ N
  119° 10’ W 33° 3’ N
  119° 25’ W 33° 14’ N
- Area 2: Between San Clemente and Santa Catalina Islands; boundary vertices are:
  118° 40’ W 33° 29’ N
  118° 4’ W 32° 2’ N
  118° 15’ W 32° 48’ N
  118° 51’ W 33° 15’ N
- Area 3: Off-shore area immediately west of MCB Camp Pendleton; boundary vertices are:
  117° 44’ W 33° 29’ N
  117° 19’ W 33° 4’ N
  117° 31’ W 32° 52’ N
  117° 56’ W 33° 17’ N

  Area 4: Area immediately south and west of San Clemente Island; boundary vertices are:
  118° 44’ W 33° 6’ N
  118° 26’ W 32° 44’ N
  119° W 32° 18’ N
  119° 17’ W 32° 40’ N
- Area 5: Area 25 nm. south and east of San Clemente Island; boundary vertices are:
  118° 25’ W 32° 19’ N
  117° 44’ W 32° 19’ N
  117° 44’ W 31° 27’ N
  118° 25’ W 31° 27’ N
- Area 6: Off-shore area immediately west of NB Coronado; boundary vertices are:
  117° 35’ W 32° 35’ N
  117° 9’ W 32° 35’ N
  117° 9’ W 32° 18’ N
  117° 35’ W 32° 18’ N
- Area 7: Deep-water area near the middle of W-291; boundary vertices are:
  119° 16’ W 30° 53’ N
  118° 41’ W 30° 19’ N
  119° 25’ W 29° 34’ N
  120° W 30° 8’ N

The final region, Area 8, includes all areas outside the previous seven areas that are within the quasi-rectangular region bounded in latitude by 29° N and 34° N, and in longitude by 120° 30’ W and 116° 30’ W.

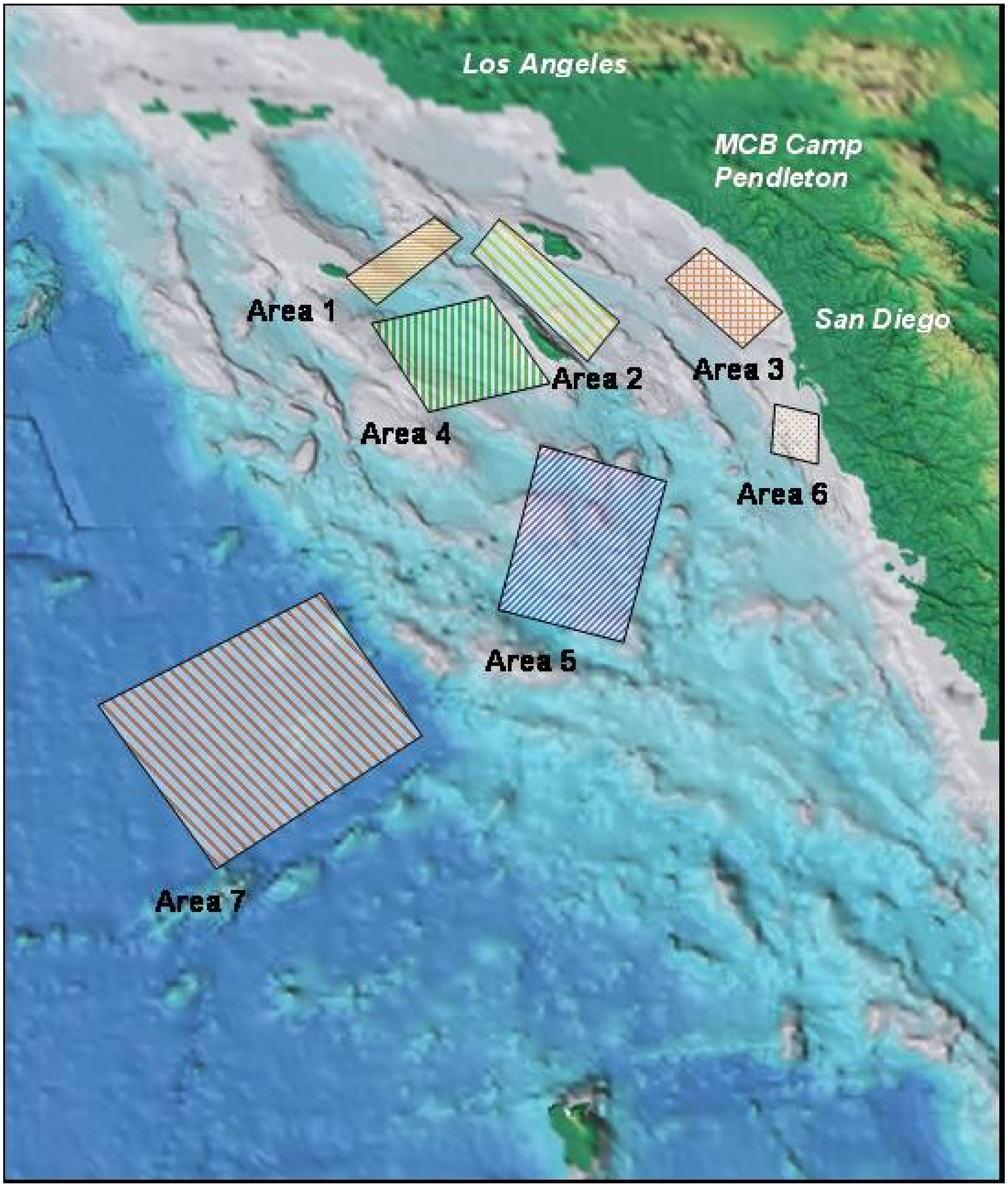


Figure 2-1. Representative Sonar Modeling Areas Within the SOCAL Range Complex

The acoustic sonars described in subsection 2.2 are, for the most part, deployed throughout all eight areas. The lone exception is Area 6 which is restricted to only the helicopter dipping sonar The explosive sources, other than demolition charges, are primarily limited by the SINKEX restrictions (at least 50 nm. from land in water depths greater than 6000 ft.) to the southern portion of Area 5, all of Area 7, and parts of Area 8. The use of demolition charges is limited to the north shore of SCI (Northwest Harbor).

This subsection describes the representative environmental provinces selected for the SOCAL Range. For all of these provinces, the average wind speed, winter and summer, is 11 knots.

The SOCAL Range contains a total of 13 distinct environmental provinces. These represent various combinations of nine bathymetry provinces, one Sound Velocity Profile (SVP) province, and three High-Frequency Bottom Loss (HFBL) classes.

The bathymetry provinces represent depths ranging from 33 ft. to typical deep-water depths (slightly more than 16,000 ft.). Nearly half of the range is characterized as deep-water (depths of 6562 ft. or more). The second most prevalent water depth regime, covering more than 40% of the range, is representative of waters along the continental slope. The remaining water depths (656 ft. and less) provide only small contributions (less than 10%) to the analysis. The distribution of the bathymetry provinces over the SOCAL Range Complex is provided in Table 2-6.

Table 2-6. Distribution of Bathymetry Provinces in SOCAL Range

Province Depth (m)	Frequency of Occurrence
10	Demolition Charges Only
20	0.33 %
50	1.17 %
100	1.74 %
200	3.28 %
500	9.92 %
1000	33.66 %
2000	17.03 %
5000	32.54 %

A single SVP province (45) describes the entire SOCAL Range Complex. The seasonal variation is likewise of limited dynamic range, as might be expected given that the range is located in temperate waters. The surface sound speed of the winter profile is about ten m/s slower than the summer profile as depicted in Figure 2-2. Both seasons exhibit a shallow and relatively weak surface duct.

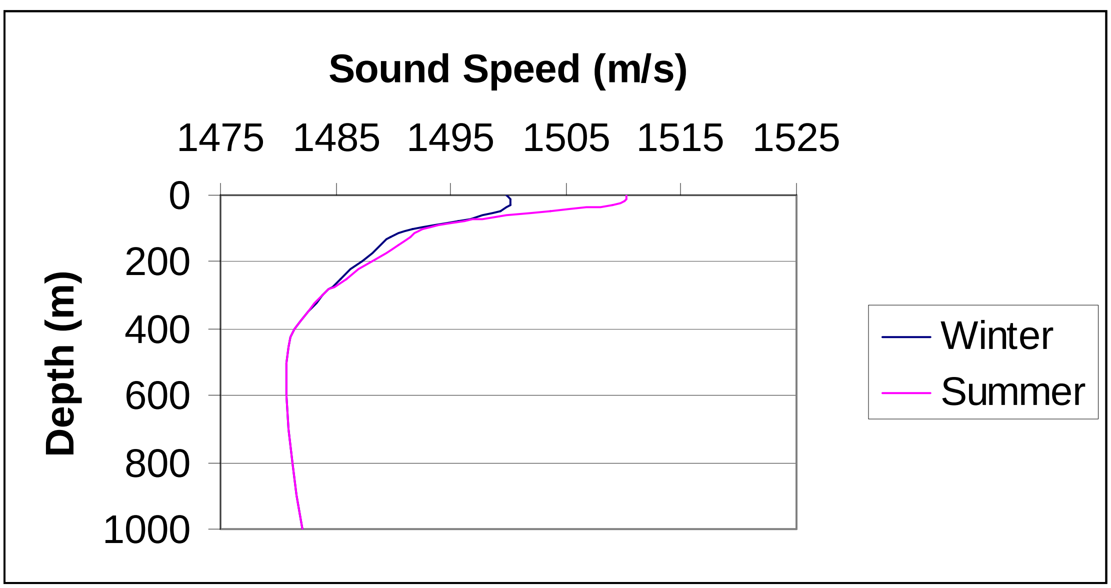


Figure 2-2. Winter and Summer SVPs in SOCAL Range

The three HFBL classes represented in the SOCAL Range are either low-loss bottoms (class 2, typically in shallow water) or high-loss bottoms (classes 7 or 8, predominately in intermediate to deep water). This partitioning by water depth leads to a distribution that is more than 90 % high-loss bottoms as indicated in Table 2-7.

Table 2-7. Distribution of High-Frequency Bottom Loss Classes in SOCAL Range

HFBL Class	Frequency of Occurrence
2	6.22 %
7	16.65 %
8	77.13 %

The logic for consolidating the environmental provinces focuses upon water depth, using the sound speed profile (in deep water) and the HFBL class (in shallow water) as secondary differentiating factors. The first consideration was to ensure that all six bathymetry provinces are represented. Then within each bathymetry province further partitioning of provinces proceeded as follows:

- The three shallowest bathymetry provinces are each represented by one environmental province. In each case, the bathymetry province is dominated (in some cases almost exclusively) by a single HFBL class, so that the secondary differentiating environmental parameter is of no consequence.
- The 100-, 200-, and 500-meter bathymetry provinces each have two environmental provinces, differing in HFBL class only (one has a low-loss bottom, the other a high-loss bottom). Since the frequency of occurrence of the secondary province is not overwhelmed by the dominant province, both are included in the analysis to ensure thoroughness.
- The 1000- and 2000-meter bathymetry provinces each contain two environmental provinces that feature different HFBL classes. However, in both cases the dominant province in the pair occurs more than a hundred times more frequently rendering the secondary province of no consequence in this analysis.
- The 5000-meter bathymetry province consists of three environmental provinces that differ only in HFBL class. One of the three provinces occurs so infrequently in comparison to the other two that it is excluded from this analysis.

The resulting thirteen environmental provinces used in the SOCAL Range acoustic modeling are described in Table 2-8.

Table 2-8. Distribution of Environmental Provinces in SOCAL Range

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
1	20 m	45	2	0	0.2 secs	0.44 %
2	50 m	45	2	0	0.2 secs	1.05 %
3	100 m	45	2	0	0.2 secs	1.13 %
4	200 m	45	2	0	0.2 secs	0.90 %
5	200 m	45	8	– 49*	0.2 secs	0.66 %
6	500 m	45	2	0	0.2 secs	1.02 %
7	500 m	45	8	– 49*	0.2 secs	6.06 %
8	1000 m	45	8	– 49*	0.2 secs	22.34 %
9	2000 m	45	8	13	0.18 secs	27.58 %
10	5000 m	45	7	13	0.11 secs	24.40 %
11	5000 m	45	8	13	0.11 secs	13.66 %
12	100 m	45	8	– 49*	0.2 secs	0.36 %
13	10 m	45	2	0	0.2 secs	Demolition Charges Only

* Negative province numbers indicate shallow water provinces

The percentages given in the preceding table indicate the frequency of occurrence of each environmental province across all eight areas in the SOCAL Range as described in Figure 2-1. The distribution of the environments within each of the eight individual areas in provided in Table 2-9.

Table 2-9. Distribution of Environmental Provinces within SOCAL Areas

Environmental Province	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8
1	1.33%	1.00%	0.00%	0.09%	0.00%	7.44%	0.00%	0.45%
2	3.55%	2.19%	0.84%	1.54%	0.00%	7.89%	0.00%	1.05%
3	0.00%	0.66%	2.95%	1.30%	0.00%	4.57%	0.00%	1.13%
4	0.00%	0.80%	4.70%	5.37%	0.00%	4.49%	0.00%	0.90%
5	14.58%	2.73%	1.15%	4.71%	0.18%	1.07%	0.00%	0.66%
6	0.00%	2.69%	10.06%	5.10%	0.00%	2.27%	0.00%	1.02%
7	31.20%	10.87%	43.13%	13.20%	3.53%	15.44%	0.00%	6.06%
8	37.23%	54.90%	36.69%	51.81%	43.57%	48.97%	0.00%	22.34%
9	6.45%	21.64%	0.00%	12.62%	52.72%	7.86%	6.82%	27.58%
10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	47.68%	24.40%
11	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	45.50%	13.66%
12	5.66%	2.52%	0.48%	4.26%	0.00%	0.00%	0.00%	0.36%
13	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.39%

Finally, the SINKEX areas are limited to regions that are more than 50 nm. from land and deeper than 1000 fathoms. This includes part of Area 5, all of Area 7 and part of Area 8. The distribution of environmental provinces in these three areas is provided in Table 2-10.

Table 2-10. Distribution of Environmental Provinces within SINKEX Areas

Environmental Province	Area 5	Area 7	Area 8	All Areas
9	100.00 %	6.82 %	29.74 %	26.53 %
10	0.00 %	47.68 %	42.17 %	43.10 %
11	0.00 %	45.50 %	28.09 %	30.37 %

2.3 IMPACT VOLUMES AND IMPACT RANGES

Many naval actions include the potential to injure or harass marine animals in the neighboring waters through noise emissions. The number of animals exposed to potential harassment in any such action is dictated by the propagation field and the characteristics of the noise source.

The impact volume associated with a particular activity is defined as the volume of water in which some acoustic metric exceeds a specified threshold. The product of this impact volume with a volumetric animal density yields the expected value of the number of animals exposed to that acoustic metric at a level that exceeds the threshold. The acoustic metric can either be an energy term (energy flux density, either in a limited frequency band or across the full band) or a pressure term (such as peak pressure or positive impulse). The thresholds associated with each of these metrics define the levels at which half of the animals exposed will experience some degree of harassment (ranging from behavioral change to mortality).

Impact volume is particularly relevant when trying to estimate the effect of repeated source emissions separated in either time or space. Impact range, which is defined as the maximum range at which a particular threshold is exceeded for a single source emission, defines the range to which marine mammal activity is monitored in order to meet mitigation requirements.

With the exception of explosive sources, the sole relevant measure of potential harm to the marine wildlife due to sonar operations is the accumulated (summed over all source emissions) energy flux density received by the animal over the duration of the activity. Harassment measures for explosive sources include energy flux density and pressure-related metrics (peak pressure and positive impulse).

Regardless of the type of source, estimating the number of animals that may be injured or otherwise harassed in a particular environment entails the following steps.

- Each source emission is modeled according to the particular operating mode of the sonar. The “effective” energy source level is computed by integrating over the bandwidth of the source, scaling by the pulse length, and adjusting for gains due to source directivity. The location of the source at the time of each emission must also be specified.
- For the relevant environmental acoustic parameters, transmission loss (TL) estimates are computed, sampling the water column over the appropriate depth and range intervals. TL data are sampled at the typical depth(s) of the source and at the nominal center frequency of the source. If the source is relatively broadband, an average over several frequency samples is required.
- The accumulated energy within the waters that the source is “operating” is sampled over a volumetric grid. At each grid point, the received energy from each source emission is modeled as the effective energy source level reduced by the appropriate propagation loss from the location of the source at the time of the emission to that grid point and summed. For the peak pressure or positive impulse, the appropriate metric is similarly modeled for each emission. The maximum value of that metric, over all emissions, is stored at each grid point.

- The impact volume for a given threshold is estimated by summing the incremental volumes represented by each grid point for which the appropriate metric exceeds that threshold.
- Finally, the number of exposures is estimated as the "product" (scalar or vector, depending upon whether an animal density depth profile is available) of the impact volume and the animal densities.

This section describes in detail the process of computing impact volumes (that is, the first four steps described above). This discussion is presented in two parts: active sonars and explosive sources. The relevant assumptions associated with this approach and the limitations that are implied are also presented. The final step, computing the number of exposures is discussed in subsection 2.5.

2.3.1 Computing Impact Volumes for Active Sonars

This section provides a detailed description of the approach taken to compute impact volumes for active sonars. Included in this discussion are:

- Identification of the underwater propagation model used to compute transmission loss data, a listing of the source-related inputs to that model, and a description of the output parameters that are passed to the energy accumulation algorithm.
- Definitions of the parameters describing each sonar type.
- Description of the algorithms and sampling rates associated with the energy accumulation algorithm.

Transmission Loss Calculations

Transmission loss (TL) data are pre-computed for each of two seasons in each of the environmental provinces described in the previous subsection using the GRAB propagation loss model (Keenan, 2000). The TL output consists of a parametric description of each significant eigenray (or propagation path) from source to animal. The description of each eigenray includes the departure angle from the source (used to model the source vertical directivity later in this process), the propagation time from the source to the animal (used to make corrections to absorption loss for minor differences in frequency and to incorporate a surface-image interference correction at low frequencies), and the transmission loss suffered along the eigenray path.

The frequency and source depth TL inputs are specified in Table 2-11.

Table 2-11. TL Frequency and Source Depth by Sonar Type

SONAR	FREQUENCY	SOURCE DEPTH
MK-48	> 10 kHz	27 m
AN/SQS-53C	3.5 kHz	7 m
AN/SQS-56C	6.8 to 8.2 kHz	7 m
AN/AQS-22	4.1 kHz	27 m
AN/ASQ-62	8 kHz	27 m
BQQ-10	1-10 kHz	20 m

The eigenray data for a single GRAB model run are sampled at uniform increments in range out to a maximum range for a specific "animal" (or "target" in GRAB terminology) depth. Multiple GRAB runs are made to sample the animal depth dependence. The depth and range sampling parameters are summarized in Table 2-12. Note that some of the low-power sources do not require TL data to large maximum ranges.

Table 2-12. TL Depth and Range Sampling Parameters by Sonar Type

SONAR	RANGE STEP	MAXIMUM RANGE	ANIMAL DEPTH
MK-48	10 m	10 km	0 – 1 km in 5 m steps 1 km – Bottom in 10 m steps
AN/SQS-53C	10 m	200 km	0 – 1 km in 5 m steps 1 km – Bottom in 10 m steps
AN/AQS-22	10 m	10 km	0 – 1 km in 5 m steps 1 km – Bottom in 10 m steps
AN/ASQ-62	5 m	5 km	0 – 1 km in 5 m steps 1 km – Bottom in 10 m steps
BQQ-10	20 m	150 km	0 – 1 km in 5 m steps 1 km – Bottom in 10 m steps

In a few cases, most notably the AN/SQS-53C for thresholds below approximately 180 dB, TL data may be required by the energy summation algorithm at ranges greater than covered by the pre-computed GRAB data. In these cases, TL is extrapolated to the required range using a simple cylindrical spreading loss law in addition to the appropriate absorption loss. This extrapolation leads to a conservative (or under) estimate of transmission loss at the greater ranges.

Although GRAB provides the option of including the effect of source directivity in its eigenray output, this capability is not exercised. By preserving data at the eigenray level, this allows source directivity to be applied later in the process and results in fewer TL calculations.

The other important feature that storing eigenray data supports is the ability to model the effects of surface-image interference that persist over range. However, this is primarily important at frequencies lower than those associated with the sonars considered in this subsection. A detailed description of the modeling of surface-image interference is presented in the subsection on explosive sources.

Energy Summation

The summation of energy flux density over multiple pings in a range-independent environment is a trivial exercise for the most part. A volumetric grid that covers the waters in and around the area of sonar operation is initialized. The source then begins its set of pings. For the first ping, the TL from the source to each grid point is determined (summing the appropriate eigenrays after they have been modified by the vertical beam pattern), the "effective" energy source level is reduced by that TL, and the result is added to the accumulated energy flux density at that grid point. After each grid point has been updated, the accumulated energy at grid points in each depth layer is compared to the specified threshold. If the accumulated energy exceeds that threshold, then the incremental volume represented by that grid point is added to the impact volume for that depth layer. Once all grid points have been processed, the resulting sum of the incremental volumes represents the impact volume for one ping.

The source is then moved along one of the axes in the horizontal plane by the specified ping separation range and the second ping is processed in a similar fashion. Again, once all grid points have been processed, the resulting sum of the incremental volumes represents the impact volume for two pings. This procedure continues until the maximum number of pings specified has been reached.

Defining the volumetric grid over which energy is accumulated is the trickiest aspect of this procedure. The volume must be large enough to contain all volumetric cells for which the accumulated energy is likely to exceed the threshold but not so large as to make the energy accumulation computationally unmanageable.

Determining the size of the volumetric grid begins with an iterative process to determine the lateral extent to be considered. Unless otherwise noted, throughout this process the source is treated as omni directional and the only animal depth that is considered is the TL target depth that is closest to the source depth (placing source and receiver at the same depth is generally an optimal TL geometry).

The first step is to determine the impact range (R_{MAX}) for a single ping. The impact range in this case is the maximum range at which the effective energy source level reduced by the transmission loss is greater than the threshold. Next, the source is moved along a straight-line track and energy flux density is accumulated at a point that has a CPA range of R_{MAX} at the mid-point of the source track. That total energy flux density summed over all pings is then compared to the prescribed threshold. If it is greater than the threshold (which, for the first R_{MAX}, it must be) then R_{MAX} is increased by ten percent, the accumulation process is repeated, and the total energy is again compared to the threshold. This continues until R_{MAX} grows large enough to ensure that the accumulated energy flux density at that lateral range is less than the threshold. The lateral range dimension of the volumetric grid is then set at twice R_{MAX}, with the grid centered along the source track. In the direction of advance for the source, the volumetric grid extends of the interval from [–R_{MAX}, 3 R_{MAX}] with the first source position located at zero in this dimension. Note that the source motion in this direction is limited to the interval [0, 2 R_{MAX}]. Once the source reaches 2 R_{MAX} in this direction, the incremental volume contributions have approximately reached their asymptotic limit and further pings add essentially the same amount. This geometry is demonstrated in Figure 2-3.

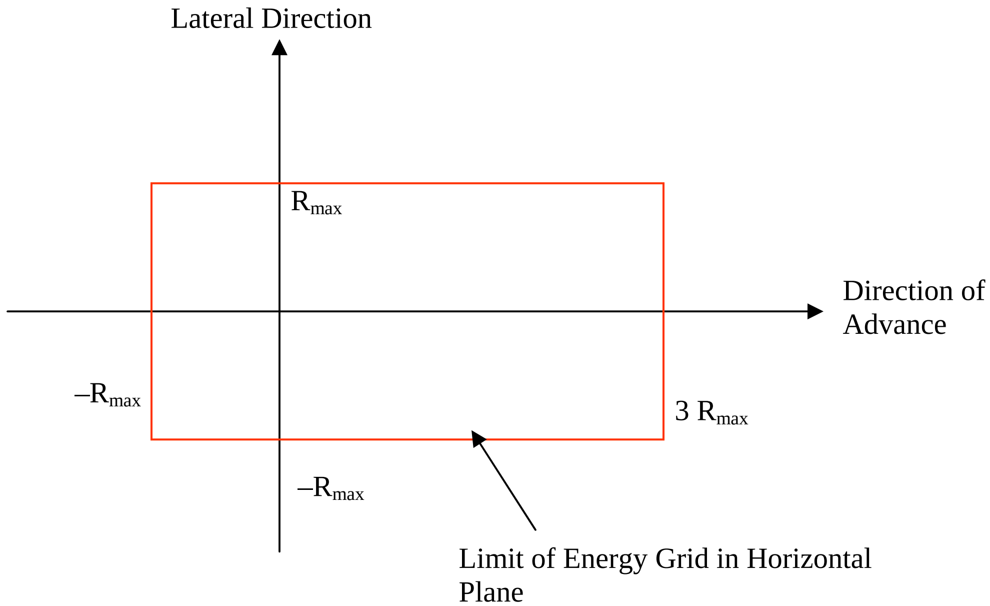


Figure 2-3. Horizontal Plane of Volumetric Grid for Omni Directional Source

If the source is directive in the horizontal plane, then the lateral dimension of the grid may be reduced and the position of the source track adjusted accordingly. For example, if the main lobe of the horizontal source beam is limited to the starboard side of the source platform, then the port side of the track is reduced substantially as demonstrated in Figure 2-4.

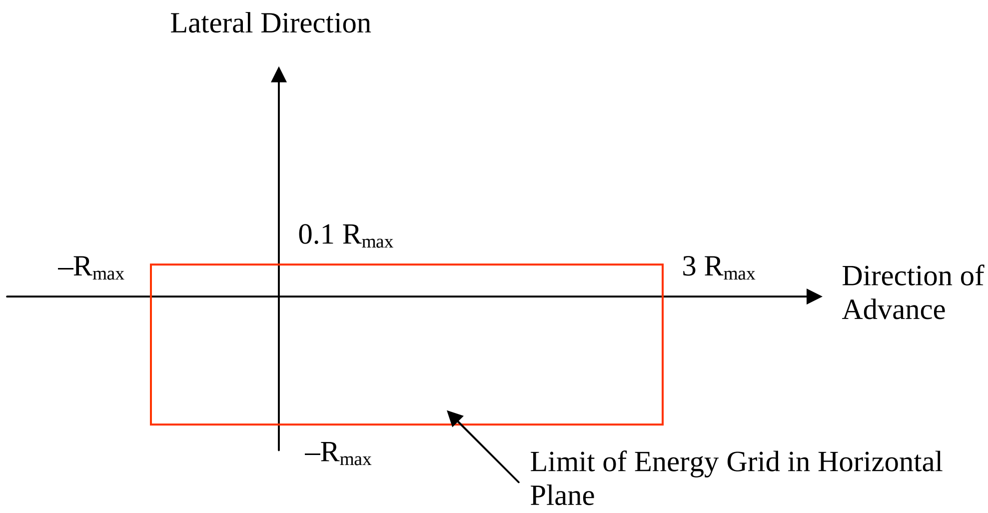


Figure 2-4. Horizontal Plane of Volumetric Grid for Starboard Beam Source

Once the extent of the grid is established, the grid sampling can be defined. In both dimensions of the horizontal plane the sampling rate is approximately $R_{MAX}/100$. The round-off error associated with this sampling rate is roughly equivalent to the error in a numerical integration to determine the area of a circle with a radius of R_{MAX} with a partitioning rate of $R_{MAX}/100$ (approximately one percent). The depth-sampling rate of the grid is comparable to the sampling rates in the horizontal plane but discretized to match an actual TL sampling depth. The depth-sampling rate is also limited to no more than ten meters to ensure that significant TL variability over depth is captured.

Impact Volume per Hour of Sonar Operation

The impact volume for a sonar moving relative to the animal population increases with each additional ping. The rate at which the impact volume increases varies with a number of parameters but eventually approaches some asymptotic limit. Beyond that point the increase in impact volume becomes essentially linear as depicted in Figure 2-5.

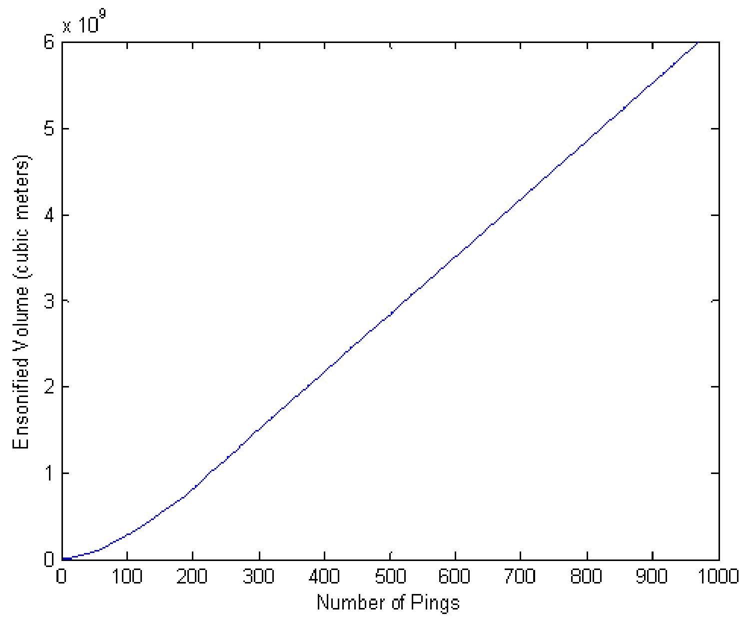


Figure 2-5. 53C Impact Volume by Ping

The slope of the asymptotic limit of the impact volume a given depth is the impact volume added per ping. This number multiplied by the number of pings in an hour gives the hourly impact volume for the given depth increment. Completing this calculation for all depths in a province, for a given source, gives the hourly impact volume vector, v_n, which contains the hourly impact volumes by depth for province n. Figure 2-6 provides an example of an hourly impact volume vector for a particular environment.

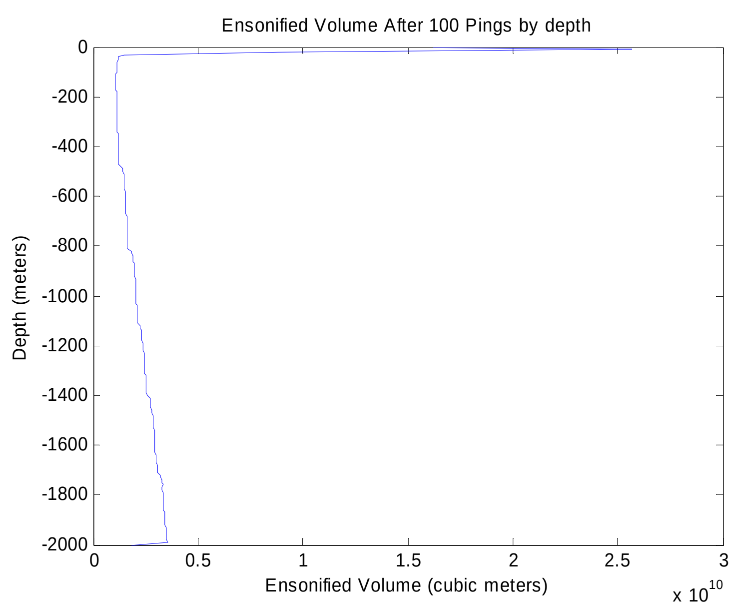


Figure 2-6. Example of an Impact Volume Vector

2.3.2 Computing Impact Volumes for Explosive Sources

This section provides the details of the modeling of the explosive sources. This energy summation algorithm is similar to that used for sonars, only differing in details such as the sampling rates and source parameters. These differences are summarized in the following subsections. A more significant difference is that the explosive sources require the modeling of additional pressure metrics: (1) peak pressure, and (2) "modified" positive impulse. The modeling of each of these metrics is described in detail in the subsections of 2.3.2.3.

2.3.2.1 Transmission Loss Calculations

Modeling impact volumes for explosive sources span requires the type of same TL data as needed for active sonars. However unlike active sonars, explosive ordnances and the EER source are very broadband, contributing significant energy from tens of Hertz to tens of kilohertz. To accommodate the broadband nature of these sources, TL data are sampled at seven frequencies from 10 Hz to 40 kHz, spaced every two octaves.

An important propagation consideration at low frequencies is the effect of surface-image interference. As either source or target approach the surface, pairs of paths that differ in history by a single surface reflection set up an interference pattern that ultimately causes the two paths to perfectly cancel each other when the source or target is at the surface. A fully coherent summation of the eigenrays produces such a result but also introduces extreme fluctuations that would have to be highly sampled in range and depth, and then smoothed to give meaningful results. An alternative approach is to implement what is sometimes called a semi-coherent summation. A semi-coherent sum attempts to capture significant effects of surface-image interference (namely the reduction of the field as the source or target approach the surface) without having to deal with the more rapid fluctuations associated with a fully coherent sum. The semi-coherent sum is formed by a random phase addition of paths that have already been multiplied by the expression:

$$\sin^2 [\, 4\pi\, f\, z_s\, z_a \,/\, (c^2\, t) \,]$$

where f is the frequency, z_s is the source depth, z_a is the animal depth, c is the sound speed and t is the travel time from source to animal along the propagation path. For small arguments of the sine function this expression varies directly as the frequency and the two depths. It is this relationship that causes the propagation field to go to zero as the depths approach the surface or the frequency approaches zero

A final important consideration is the broadband nature of explosive sources. This is handled by sampling the TL field at a limited number of frequencies. However, the image-interference correction given above varies substantially over that frequency spacing. To avoid possible under sampling, the image-interference correction is averaged over each frequency interval.

2.3.2.2 Source Parameters

Unlike active sonars, explosive sources are defined by only two parameters: (1) net explosive weight, and (2) source detonation depth. Values for these source parameters are defined earlier in subsection 4.1.2.

The effective energy source level, which is treated as a de facto input for the other sonars, is instead modeled directly for EER and munitions. For both, the energy source level is comparable to the model used for other explosives (Arons (1954), Weston (1960), McGrath (1971), Urick (1983), Christian and Gaspin (1974). The energy source level over a one-third octave band with a center frequency of f for a source with a net explosive weight of w pounds is given by

$$\mathbf{10\ log_{10}\ (0.26\ f) + 10\ log_{10}\ (\ 2\ p_{max}^{\ 2}\ /\ [1/\theta^2 + 4\ \pi\ f^2]\ ) + 197\ dB}$$

where the peak pressure for the shock wave at one meter is defined as

$$\mathbf{p_{max} = 21600\ (w^{1/3}\ /\ 3.28\ )^{1.13}\ psi} \qquad \textbf{(4-1)}$$

and the time constant is defined as:

$$\mathbf{\theta = [(0.058)\ (w^{1/3})\ (3.28\ /\ w^{1/3})^{\ 0.22}\ ]\ /\ 1000\ msec} \qquad \textbf{(4-2)}$$

In contrast to munitions that are modeled as omnidirectional sources, the EER source is a continuous line array that produces a directed source. The EER array consists of two explosive strips that are fired simultaneously from the center of the array. Each strip generates a beam pattern with the steer direction of the main lobe determined by the burn rate. The resulting response of the entire array is a bifurcated beam for frequencies above 200 Hz, while at lower frequencies the two beams tend to merge into one.

Since very short ranges are under consideration, the loss of directivity of the array needs to be accounted for in the near field of the array. This is accomplished by modeling the sound pressure level across the field as the coherent sum of contributions of infinitesimal sources along the array that are delayed according to the burn rate. For example, for frequency f the complex pressure contribution at a depth z and horizontal range x from an infinitesimal source located at a distance z' above the center of the array is

$$e^{\ i}$$

where

$$\phi = kr' + \alpha z'$$

$$\alpha = 2\pi f / c_b$$

with k the acoustic wave number, c_b the burn rate of the explosive ribbon, and r' the slant range from the infinitesimal source to the field point (x,z)

Beam patterns as function of vertical angle are then sampled at various ranges out to a maximum range that is approximately L^2 / λ, where L is the array length and λ is the wavelength. This maximum range is a rule-of-thumb estimate for the end of the near field (Bartberger, 1965). Finally, commensurate with the resolution of the TL samples, these beam patterns are averaged over octave bands.

A couple of sample beam patterns are provided in Figure 2-7 and Figure 2-8. In both cases, the beam response is sampled at various ranges from the source array to demonstrate the variability across the near field. The 80-Hz family of beam patterns presented in Figure 2-7 shows the rise of a single main lobe as range increases.

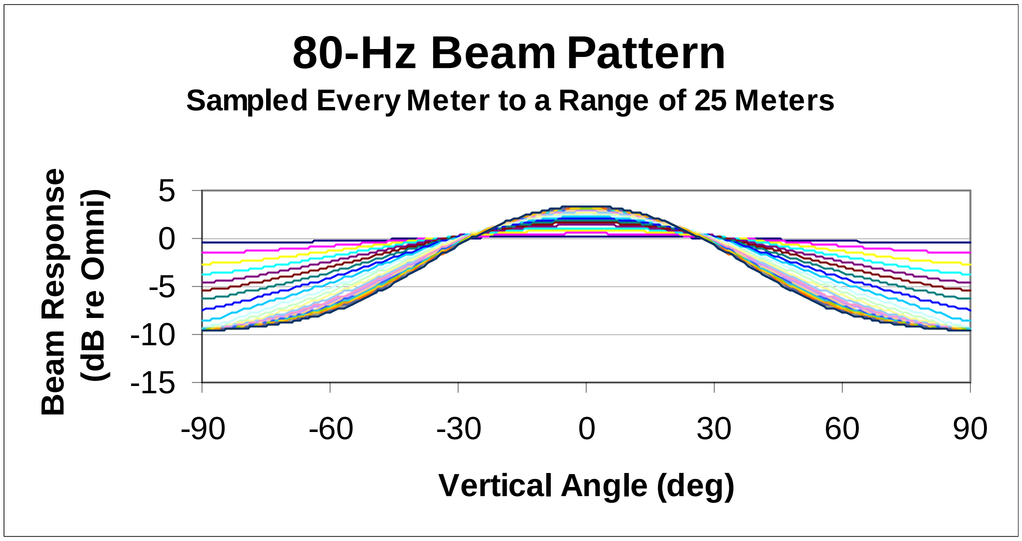


Figure 2-7. 80-Hz Beam Patterns across Near Field of EER Source

On the other hand, the 1250-Hz family of beam patterns depicted in Figure 2-8 demonstrates the typical high-frequency bifurcated beam.

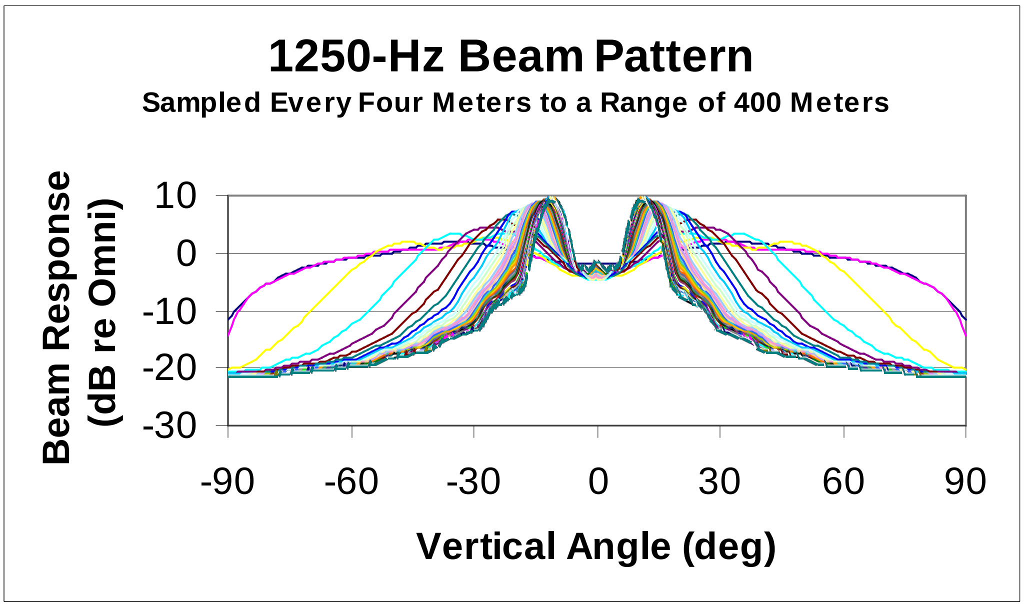


Figure 2-8. 1250-Hz Beam Patterns Across Near Field of EER Source

2.3.2.3 Impact Volumes for Various Metrics

The impact of explosive sources on marine wildlife is measured by three different metrics, each with its own thresholds. The energy metric, peak one-third octave, is treated in similar fashion as the energy metric used for the active sonars, including the summation of energy if there are multiple source emissions. The other two, peak pressure and positive impulse, are not accumulated but rather the maximum levels are taken.

2.3.2.4 Peak One-Third Octave Energy Metric

The computation of impact volumes for the energy metric follows closely the approach taken to model the energy metric for the active sonars. The only significant difference is that energy flux density is sampled at several frequencies in one-third-octave bands and only the peak one-third-octave level is accumulated.

2.3.2.5 Peak Pressure Metric

The peak pressure metric is a simple, straightforward calculation at each range/animal depth combination. First, the transmission ratio, modified by the source level in a one-octave band and the vertical beam pattern, is averaged across frequency on an eigenray-by-eigenray basis. This averaged transmission ratio (normalized by the total broadband source level) is then compared across all eigenrays with the maximum designated as the peak arrival. Peak pressure at that range/animal depth combination is then simply the product of:

- the square root of the averaged transmission ratio of the peak arrival,
- the peak pressure at a range of one meter (given by equation 4-1), and
- the similitude correction (given by $r^{-0.13}$, where r is the slant range along the eigenray estimated as tc with t the travel time along the dominant eigenray and c the nominal speed of sound).

If the peak pressure for a given grid point is greater than the specified threshold, then the incremental volume for the grid point is added to the impact volume for that depth layer.

2.3.2.6 "Modified" Positive Impulse Metric

The modeling of positive impulse follows the work of Goertner (Goertner, 1982). The Goertner model defines a "partial" impulse as

$$\int_0^{T_{min}} p(t)\, dt$$

where p(t) is the pressure wave from the explosive as a function of time t, defined so that p(t) = 0 for t < 0. This pressure wave is modeled as

$$p(t) = p_{max}\, e^{-t/\theta}$$

where p_{max} is the peak pressure at one meter (see, equation B-1), and θ is the time constant defined as

$$\theta = 0.058\, w^{1/3} (r/w^{1/3})^{0.22} \text{ seconds}$$

with w the net explosive weight (pounds), and r the slant range between source and animal.

The upper limit of the "partial" impulse integral is

$$T_{min} = \min \{T_{cut}, T_{osc}\}$$

where T_{cut} is the time to cutoff and T_{osc} is a function of the animal lung oscillation period. When the upper limit is T_{cut}, the integral is the definition of positive impulse. When the upper limit is defined by T_{osc}, the integral is smaller than the positive impulse and thus is just a "partial" impulse. Switching the integral limit from T_{cut} to T_{osc} accounts for the diminished impact of the positive impulse upon the animals lungs that compress with increasing depth and leads to what is sometimes call a "modified" positive impulse metric.

The time to cutoff is modeled as the difference in travel time between the direct path and the surface-reflected path in an isospeed environment. At a range of r, the time to cutoff for a source depth z_s and an animal depth z_a is

$$T_{cut} = 1/c \, \{ \, [r^2 + (z_a + z_s)^2]^{1/2} - [r^2 + (z_a - z_s)^2]^{1/2} \, \}$$

where c is the speed of sound.

The animal lung oscillation period is a function of animal mass M and depth z_a and is modeled as

$$T_{osc} = 1.17 \, M^{1/3} \, (1 + z_a/33)^{-5/6}$$

where M is the animal mass (in kg) and z_a is the animal depth (in feet).

The modified positive impulse threshold is unique among the various injury and harassment metrics in that it is a function of depth and the animal weight. So instead of the user specifying the threshold, it is computed as $K \, (M/42)^{1/3} \, (1 + z_a / 33)^{1/2}$. The coefficient K depends upon the level of exposure. For the onset of slight lung injury, K is 19.7; for the onset of extensive lung hemorrhaging (1% mortality), K is 47.

Although the thresholds are a function of depth and animal weight, sometimes they are summarized as their value at the sea surface for a typical dolphin calf (with an average mass of 12.2 kg). For the onset of slight lung injury, the threshold at the surface is approximately 13 psi-msec; for the onset of extensive lung hemorrhaging (1% mortality), the threshold at the surface is approximately 31 psi-msec.

As with peak pressure, the "modified" positive impulse at each grid point is compared to the derived threshold. If the impulse is greater than that threshold, then the incremental volume for the grid point is added to the impact volume for that depth layer.

2.3.2.7 Impact Volume per Explosive Detonation

The detonations of explosive sources are generally widely spaced in time and/or space. This implies that the impact volume for multiple firings can be easily derived by scaling the impact volume for a single detonation. Thus the typical impact volume vector for an explosive source is presented on a per-detonation basis.

2.3.3 Impact Volume by Region

The SOCAL Range is described by eleven environmental provinces. The hourly impact volume vector for operations involving any particular source is a linear combination of the eleven impact volume vectors with the weighting determined by the distribution of those thirteen environmental provinces within the range. Unique hourly impact volume vectors for winter and summer are calculated for each type of source and each metric/threshold combination.

2.4 RISK RESPONSE: THEORETICAL AND PRACTICAL IMPLEMENTATION

This section discusses the recent addition of a risk function "threshold" to acoustic effects analysis procedure. This approach includes two parts, a new metric, and a function to map exposure level under the new metric to probability of harassment. What these two parts mean, how they affect exposure calculations, and how they are implemented are the objects of discussion.

Thresholds and Metrics

The term "thresholds" is broadly used to refer to both thresholds and metrics. The difference, and the distinct roles of each in effects analyses, will be the foundation for understanding the dose-response approach, putting it in perspective, and showing that, conceptually, it is similar to past approaches.

Sound is a pressure wave, so at a certain point in space, sound is simply rapidly changing pressure. Pressure at a point is a function of time. Define p(t) as pressure (in micropascals) at a given point at time t (in seconds); this function is called a "time series." Figure 2-9 gives the time series of the first "hallelujah" in Handel's Hallelujah Chorus.

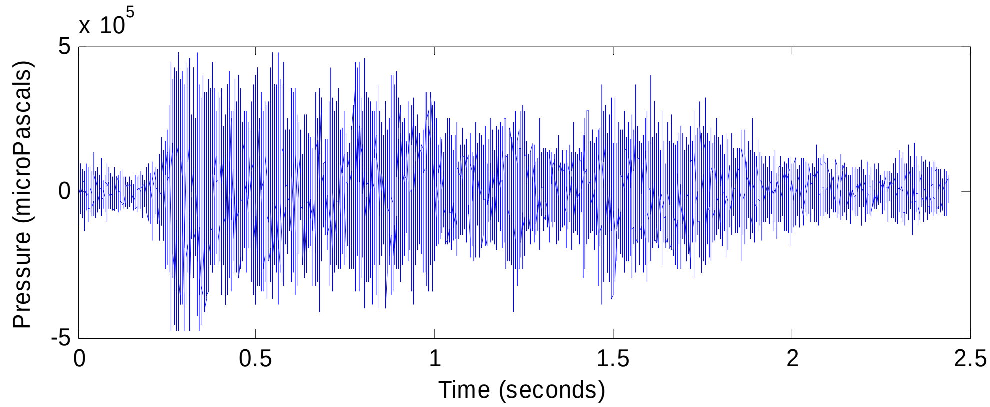


Figure 2-9. Time Series

The time-series of a source can be different at different places. Therefore, sound, or pressure, is not only a function of time, but also of location. Let the function p(t), then be expanded to p(t;x,y,z) and denote the time series at point (x,y,z) in space. Thus, the series in Figure 2-9 p(t) is for a given point (x,y,z). At a different point in space, it would be different.

Assume that the location of the source is (0,0,0) and this series is recorded at (0,10,-4). The time series above would be p(t;0,10,-4) for 0<t<2.5.

As in Figure 2-9, pressure can be positive or negative, but usually the function is squared so it is always positive, this makes integration meaningful. Figure 2-10 is $p^2(t;0,10,-4)$.

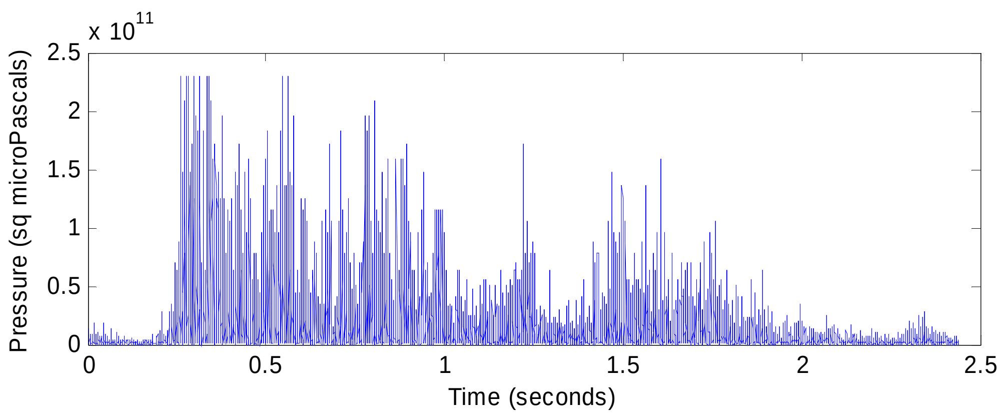


Figure 2-10. Time Series Squared

The metric chosen to evaluate the sound field at the end of this first "hallelujah" determines how the time series is summarized from thousands of points, as in Figure 2-9, to a single value for each point (x,y,z) in the space. The metric essentially "boils down" the four dimensional p(t,x,y,z) into a three dimensional function m(x,y,z) by dealing with time. There is more than one way to summarize the time component, so there is more than one metric.

Max SPL

One way to summarize $p^2(t;x,y,z)$ to one number over the 2.5 seconds is to only report the maximum value of the function over time or,

$$SPL_{\max} = \max\left\{p^2(t,x,y,z)\right\} \text{ for } 0<t<2.5$$

The $SPL_{\max}$ for this snippet of the Hallelujah Chorus is $2.3\times10^{11}\ \mu Pa^2$ and occurs at 0.2825 seconds, as shown in Figure 2-11.

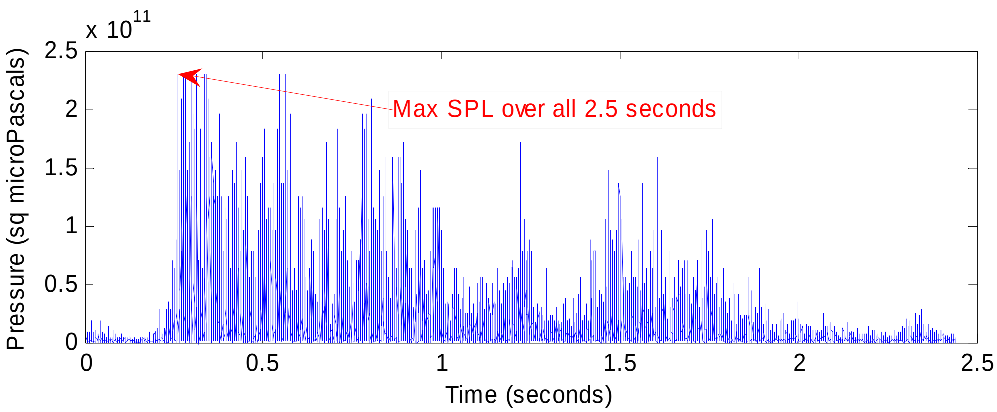


Figure 2-11. Max SPL of Time Series Squared Integration

$SPL_{\max}$ is not necessarily influenced by the duration of the sound (2.5 seconds in this case). Integrating the function over time does take this duration into account. A simple integration of $p^2(t;x,y,z)$ over t is common and usually called "energy."

$$Energy = \int_0^T p^2(t,x,y,z)dt \text{ where T is the maximum time of interest, in this case 2.5}$$

The energy for this snippet of the Hallelujah Chorus is $1.24\times10^{11}\ \mu Pa\cdot s$.

Energy is sometimes called "equal energy" because if p(t) is a constant function and the duration is doubled, the effect is the same as doubling the signal amplitude (y value). Thus, the duration and the signal have an "equal" influence on the energy metric.

Mathematically,

$$\int_0^{2T} p(t)^2\,dt = 2\int_0^T p(t)^2\,dt = \int_0^T 2\,p(t)^2\,dt$$

or a doubling in duration equals a doubling in energy equals a doubling in signal.

Sometimes, the integration metrics are referred to as having a "3 dB exchange rate" because if the duration is doubled, this integral increases by a factor of two, or 10log10(2)=3.01 dB. Thus, equal energy has "a 3 dB exchange rate."

After p(t) is determined (i.e., when the stimulus is over), propagation models can be used to determine p(t;x,y,z) for every point in the vicinity and for a given metric. Define

$m_a(x, y, z, T) =$ value of metric "a" at point (x,y,z) after time T

So,

$$m_{energy}(x, y, z; T) = \int_0^T p(t)^2 \, dt$$

$$m_{\max SPL}(x, y, z; T) = \max(p(t)) \; over \; [0, T]$$

Since modeling is concerned with the effects of an entire event, T is usually implicitly defined: a number that captures the duration of the event. This means that $m_a(x, y, z)$ is assumed to be measured over the duration of the received signal.

Three Dimensions vs Two Dimensions

To further reduce the calculation burden, it is possible to reduce the domain of $m_a(x, y, z)$ to two dimensions by defining $m_a(x, y) = \max\{m_a(x, y, z)\}$ over all z.

This reduction is not used for this analysis, which is exclusively three-dimensional.

Threshold

For a given metric, a threshold is a function that gives the probability of exposure at every value of m_a. This threshold function will be defined as

$$D(m_a(x, y, z)) = \Pr(effect \; at \; m_a(x, y, z))$$

The domain of D is the range of $m_a(x, y, z)$, and its range is the number of thresholds.

An example of threshold functions is the Heavyside (or unit step) function, currently used to determine permanent and temporary threshold shift (PTS and TTS) in cetaceans. For PTS, the metric is $m_{energy}(x, y, z)$, defined above, and the threshold function is a Heavyside function with a discontinuity at 215 dB, shown in Figure 2-12.

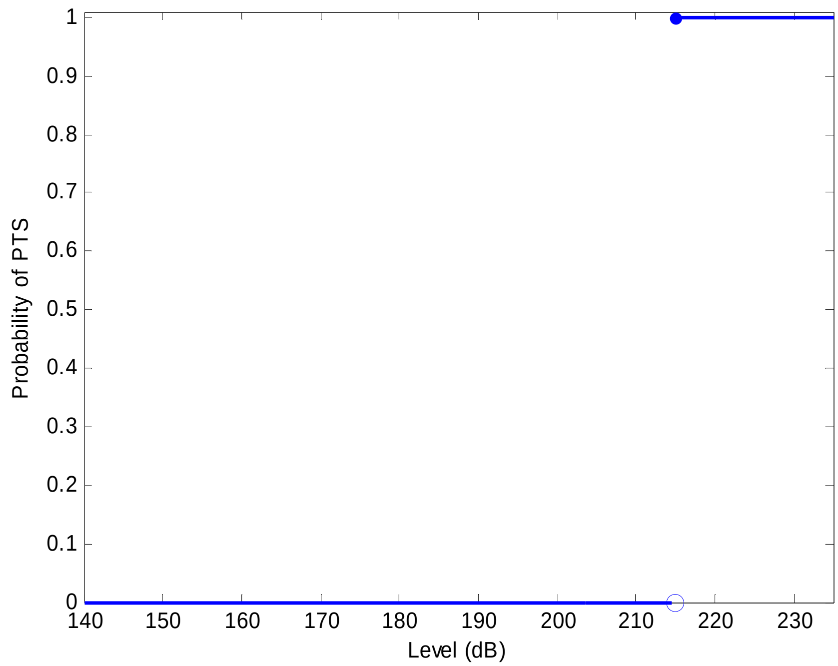


Figure 2-12. PTS Heavyside Threshold Function

Mathematically, this D is defined as:

$$D(m_{energy}) = \begin{cases} 0 \ \ for \ m_{energy} < 215 \\ 1 \ \ for \ m_{energy} \geq 215 \end{cases}$$

Any function can be used for D, as long as its range is in [0,1]. The dose-response functions use normal cumulative distribution functions (ncdfs) instead of heavyside functions, and use the max SPL metric instead of the energy metric. While a Heavyside function is specified by a single parameter, the discontinuity, a normal cumulative distribution function requires two parameters: the mean and the standard deviation. This particular approach defines a third parameter, "cutoff," to limit the support (domain of definition) of D. Mathematically, these "dose" functions are defined as

$$D(m_{\max SPL}) = \begin{cases} ncdf(\mu, \sigma, m_{\max SPL}) \ for \ m_a \geq a \\ 0 \ \ for \ m_{\max SPL} < a \end{cases}$$

where a=cutoff, μ=mean, and σ=standard deviation.

Multiple Metrics and Thresholds

It is possible to have more than one metric, and more than one threshold in a given metric. For example, in this document, humpback whales have two metrics (energy and max SPL), and three thresholds (two for energy, one for max SPL). The energy thresholds are heavyside functions, as described above, with discontinuities at 215 and 195 EL for PTS and TTS respectively.

Calculation of Expected Exposures

Determining the number of expected exposures for disturbance is the object of this analysis.

Expected exposures in volume V= $\int_V \rho(V) D(m_a(V)) dV$

For this analysis, $m_a = m_{\max SPL}$, so

$$\int_V \rho(V) D(m_a(V)) dV = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} \rho(x,y,z) D(m_{\max SPL}(x,y,z)) dxdydz$$

In this analysis, the densities are constant over the x/y plane, and the z dimension is always negative, so this reduces to

$$\int_{-\infty}^{0} \rho(z) \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z)) dxdydz$$

Numeric Implementation

Numeric integration of $\int_{-\infty}^{\infty} \rho(z) \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z)) dxdydz$ can be involved because, although the bounds are infinite, D is non-negative out to 141 dB, which, depending on the environmental specifics, can drive propagation loss calculations and their numerical integration out to more than 100 km.

The first step in the solution is to separate out the x/y-plane portion of the integral:

Define f(z)= $\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z)) dxdy$.

Calculation of this integral is the most involved and time consuming part of the calculation. Once it is complete,

$$\int_{-\infty}^{0} \rho(z) \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z)) dxdydz = \int_{-\infty}^{0} \rho(z) f(z) dz,$$

which, when numerically integrated, is a simple dot product of two vectors.

Thus, the calculation of f(z) requires the majority of the computation resources for the numerical integration. The rest of this section presents a brief outline of the steps to calculate f(z) and preserve the results efficiently.

The concept of numerical integration is, instead of integrating over continuous functions, to sample the functions at small intervals and sum the samples to approximate the integral. The smaller the size of the intervals, the closer the approximation, but the longer the calculation, so a balance between accuracy and time is determined in the decision of step size. For this analysis, z is sampled in 5 meter steps to 1000 meters in depth and 10 meter steps to 2000 meters, which is the limit of animal depth in this analysis. The step size for x is 5 meters, and y is sampled with an interval that increases as the distance from the source increases. Mathematically,

$z \in Z = \{0,5,...1000,1010,...,2000\}$
$x \in X = \{0,\pm 5,...,\pm 5k\}$
$y \in Y = \{0,\pm 5(1.005)^0, 5 \pm (1.005)^1, \pm 5(1.005)^2,...,5(1.005)^j\}$

for integers k,j, which depend on the propagation distance for the source. For this analysis, k=20,000 and j=600

With these steps, $f(z_0) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z_0))dxdy$ is approximated as

$$\sum_{z \in Y}\sum_{x \in X} D(m_{\max SPL}(x,y,z_0))\Delta x \Delta y$$

where X,Y are defined as above.

This calculation must be repeated for each $z_0 \in Z$, to build the discrete function f(z).

With the calculation of f(z) complete, the integral of its product with $\rho(z)$ must be calculated to complete evaluation of

$$\int_{-\infty}^{\infty}\rho(z)\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z))dxdydz = \int_{-\infty}^{0}\rho(z)f(z)dz$$

Since f(z) is discrete, and $\rho(z)$ can be readily made discrete,

$\int_{-\infty}^{0}\rho(z)f(z)dz$ is approximated numerically as $\sum_{z \in Z}\rho(z)f(z)$, a dot product.

Preserving Calculations for Future Use

Calculating f(z) is the most time-consuming part of the numerical integration, but the most time-consuming portion of the entire process is calculating $m_{\max SPL}(x,y,z)$ over the area range required for the minimum cutoff value (120 dB). The calculations usually require propagation estimates out to over 100 km, and those estimates, with the beam pattern, are used to construct a sound field that extends 200 km x 200 km--40,000 sq km, with a calculation at the steps for every value of X and Y, defined above. This is repeated for each depth, to a maximum of 2000 meters.

Saving the entire $m_{\max SPL}$ for each z is unrealistic, requiring great amounts of time and disk space. Instead, the different levels in the range of $m_{\max SPL}$ are sorted into 0.5 dB wide bins; the volume of water at each bin level is taken from $m_{\max SPL}$, and associated with its bin. Saving this, the amount of water ensonified at each level, at 0.5 dB resolution, preserves the ensonification information without using the space and time required to save $m_{\max SPL}$ itself. Practically, this is a histogram of occurrence of level at each depth, with 0.5 dB bins. Mathematically, this is simply defining the discrete functions $V_z(L)$, where $L = \{.5a\}$ for every positive integer a, for all $z \in Z$. These functions, or histograms, are saved for future work. The information lost by saving only the histograms is *where* in space the different levels occur, although *how often* they occur is saved. But the thresholds (dose response curves) are purely a function of level, not location, so this information is sufficient to calculate f(z).

Applying the dose function to the histograms is a dot

product: $\sum_{\ell \in L_1} D(\ell) V_{z_0}(\ell) \approx \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z_0))dxdy$

So, once the histograms are saved, neither $m_{\max SPL}(x,y,z)$ nor f(z) must be recalculated to

generate $\int_{-\infty}^{0} \rho(z) \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z))dxdydz$ for a new threshold function.

For the interested reader, the following section includes an in-depth discussion of the method, software, and other details of the f(z) calculation.

Software Detail

The risk function metric uses the cumulative normal probability distribution to determine the probability that an animal is affected by a given sound pressure level. The probability distribution is defined by a mean, standard deviation, and low level cutoff, below which it is assumed that animals are not affected. The acoustic quantity of interest is the maximum sound pressure level experienced over multiple pings in a range-independent environment. The procedure for calculating the impact volume at a given depth is relatively simple. In brief, given the sound pressure level of the source and the transmission loss (TL) curve, the sound pressure level is calculated on a volumetric grid. For a given depth, volume associated with a sound pressure level interval is calculated. Then, this volume is multiplied by the probability that an animal will be affected by that sound pressure level. This gives the impact volume for that depth, that can be multiplied by the animal densities at that depth, to obtain the number of animals affected at that depth. The process repeats for each depth to construct the impact volume as a function of depth.

The case of a single emission of sonar energy, one ping, illustrates the computational process in more detail. First, the sound pressure levels are segregated into a sequence of bins that cover the range encountered in the area. The sound pressure levels are used to define a volumetric grid of the local sound field. The impact volume for each depth is calculated as follows: for each depth in the volumetric grid, the sound pressure level at each x/y plane grid point is calculated using the sound pressure level of the source, the TL curve, the horizontal beam pattern of the source, and the vertical beam patterns of the source. The sound pressure levels in this grid become the bins in the volume histogram. Figure 2-13 shows a volume histogram for a low power sonar. Level bins are 0.5 dB in width and the depth is 50 meters in an environment with water depth of 100 meters. The oscillatory structure at very low levels is due the flattening of the TL curve at long distances from the source, which magnifies the fluctuations of the TL as a function of range. The "expected" impact volume for a given level at a given depth is calculated by multiplying the volume in each level bin by the dose response probability function at that level. Total expected impact volume for a given depth is the sum of these "expected" volumes. Figure 2-14 is an example of the impact volume as a function of depth at a water depth of 100 meters.

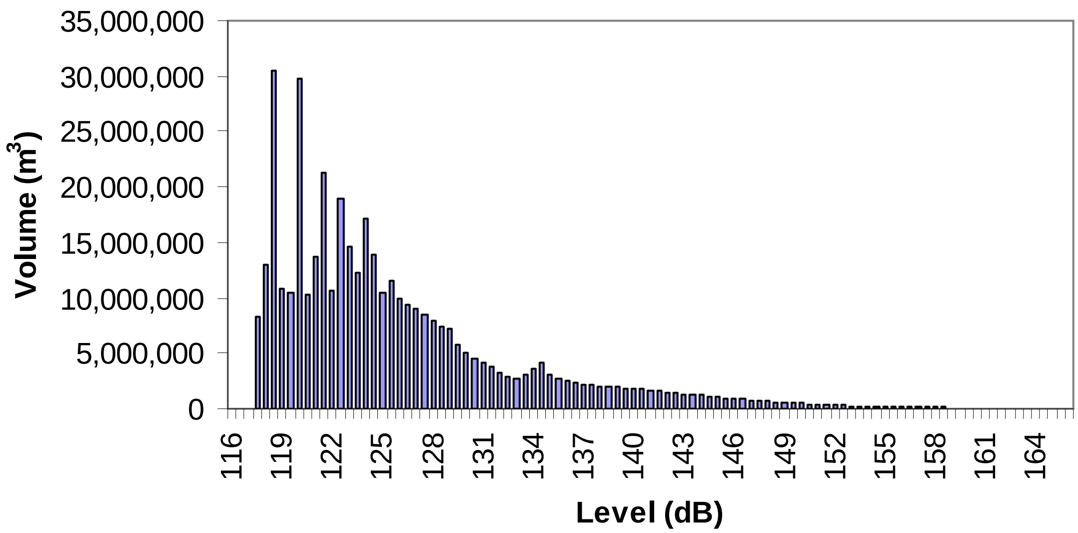


Figure 2-13. Example of a Volume Histogram

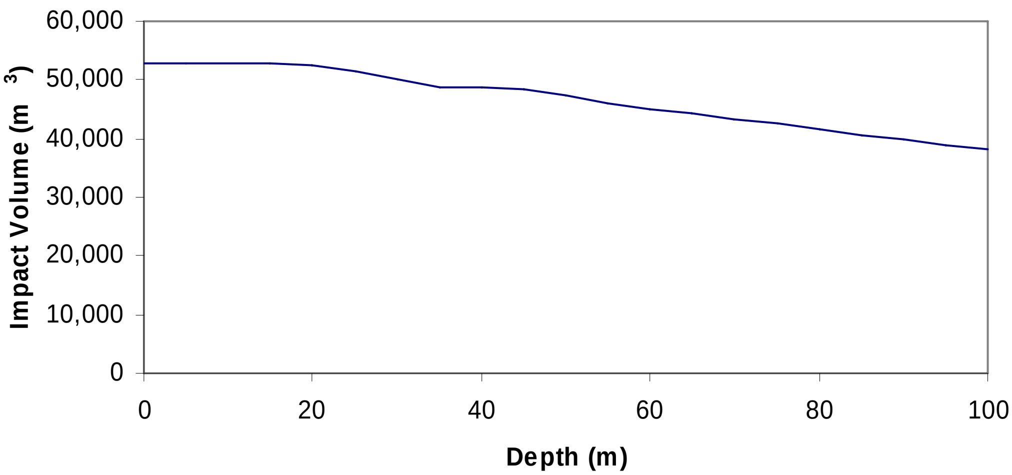


Figure 2-14. Example of the Dependence of Impact Volume on Depth

The volumetric grid covers the waters in and around the area of sonar operation. The grid for this analysis has a uniform spacing of 5 meters in the x-coordinate and a slowly expanding spacing in the y-coordinate that starts with 5 meters spacing at the origin. The growth of the grid size along the y-axis is a geometric series. Each successive grid size is obtained from the previous by multiplying it by 1+Ry, where Ry is the y-axis growth factor. This forms a geometric series. The n^{th} grid size is related to the first grid size by multiplying by $(1+Ry)^{(n-1)}$. For an initial grid size of 5 meters and a growth factor of 0.005, the 100^{th} grid increment is 8.19 meters. The constant spacing in the x-coordinate allows greater accuracy as the source moves along the x-axis. The slowly increasing spacing in y reduces computation time, while maintaining accuracy, by taking advantage of the fact that TL changes more slowly at longer distances from the source. The x-and y-coordinates extend from –Rmax to +Rmax, where Rmax is the maximum range used in the TL calculations. The z direction uses a uniform spacing of 5 meters down to 1000 meters and 10 meters from 1000 to 2000 meters. This is the same depth mesh used for the effective energy metric as described above. The depth mesh does not extend below 2000 meters, on the assumption that animals of interest are not found below this depth.

The next three figures indicate how the accuracy of the calculation of impact volume depends on the parameters used to generate the mesh in the horizontal plane. Figure 2-15 shows the relative change of impact volume for one ping as a function of the grid size used for the x-axis. The y-axis grid size is fixed at 5m and the y-axis growth factor is 0, i.e., uniform spacing. The impact volume for a 5 meters grid size is the reference. For grid sizes between 2.5 and 7.5 meters, the change is less than 0.1%. A grid size of 5 meters for the x-axis is used in the calculations. Figure 2-16 shows the relative change of impact volume for one ping as a function of the grid size used for the y-axis. The x-axis grid size is fixed at 5 meters and the y-axis growth factor is 0. The impact volume for a 5 meters grid size is the reference. This figure is very similar to that for the x-axis grid size. For grid sizes between 2.5 and 7.5 meters, the change is less than 0.1%. A grid size of 5 meters is used for the y-axis in our calculations. Figure 2-17 shows the relative change of impact volume for one ping as a function of the y-axis growth factor. The x-axis grid size is fixed at 5 meters and the initial y-axis grid size is 5 meters. The impact volume for a growth factor of 0 is the reference. For growth factors from 0 to 0.01, the change is less than 0.1%. A growth factor of 0.005 is used in the calculations.

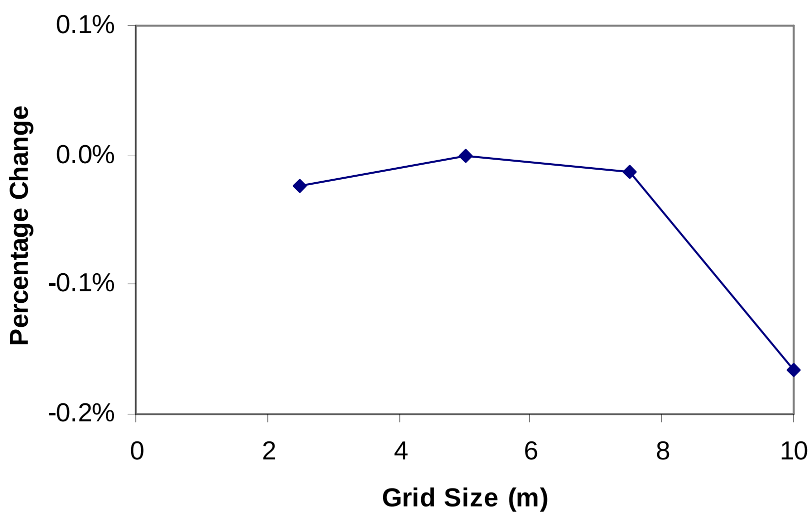


Figure 2-15. Change of Impact Volume as a Function of X-Axis Grid Size

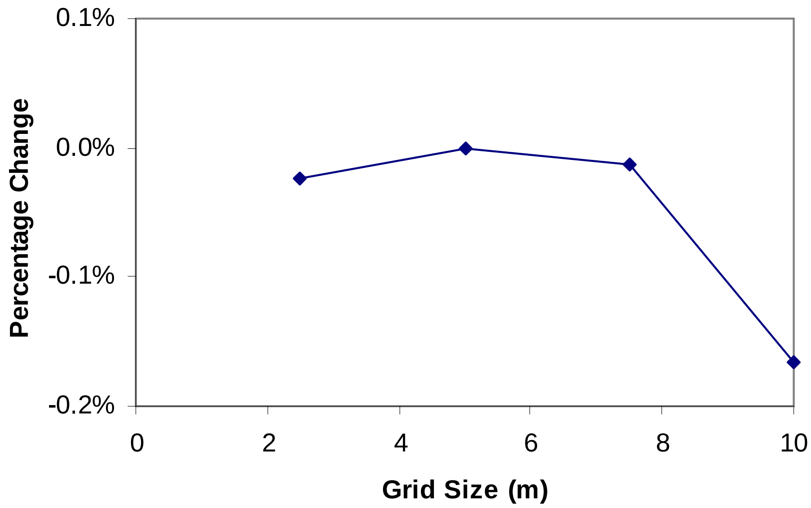


Figure 2-16. Change of Impact Volume as a Function of Y-Axis Grid Size

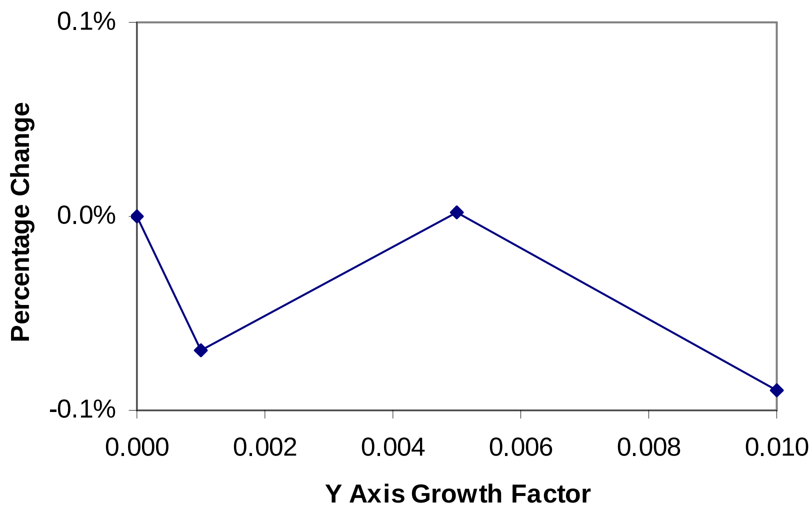


Figure 2-17. Change of Impact Volume as a Function of Y-Axis Growth Factor

Another factor influencing the accuracy of the calculation of impact volumes is the size of the bins used for sound pressure level. The sound pressure level bins extend from 100 dB (far lower than required) up to 300 dB (much higher than that expected for any sonar system). Figure 2-18 shows the relative change of impact volume for one ping as a function of the bin width. The x-axis grid size is fixed at 5 meters the initial y-axis grid size is 5 meters, and the y-axis growth factor is 0.005. The impact volume for a bin size of 0.5 dB is the reference. For bin widths from 0.25 dB to 1.00 dB, the change is about 0.1%. A bin width of 0.5 is used in our calculations.

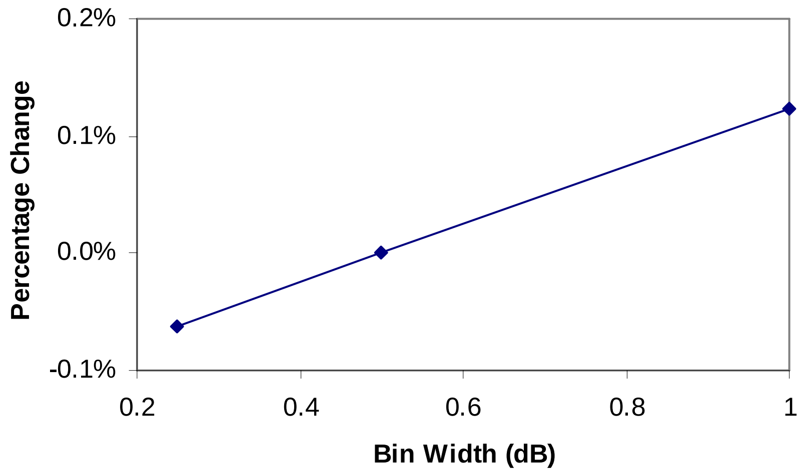


Figure 2-18. Change of Impact Volume as a Function of Bin Width

Two other issues for discussion are the maximum range (Rmax) and the spacing in range and depth used for calculating TL. The TL generated for the energy accumulation metric is used for dose-response analysis. The same sampling in range and depth is adequate for this metric because it requires a less demanding computation (i.e., maximum value instead of accumulated energy).

The process of obtaining the maximum sound pressure level at each grid point in the volumetric grid is straightforward. The active sonar starts at the origin and moves at constant speed along the positive x-axis emitting a burst of energy, a ping, at regularly spaced intervals. For each ping, the distance and horizontal angle connecting the sonar to each grid point is computed. Calculating the TL from the source to a grid point has several steps. The TL is made up of the sum of many eigenrays connecting the source to the grid point. The beam pattern of the source is applied to the eigenrays based on the angle at which they leave the source. After summing the vertically beamformed eigenrays on the range mesh used for the TL calculation, the vertically beamformed TL for the distance from the sonar to the grid point is derived by interpolation. Next, the horizontal beam pattern of the source is applied using the horizontal angle connecting the sonar to the grid point. To avoid problems in extrapolating TL, only use grid points with distances less than R_{max} are used. To obtain the sound pressure level at a grid point, the sound pressure level of the source is reduced by that TL. For the first ping, the volumetric grid is populated by the calculated sound pressure level at each grid point. For the second ping and subsequent pings, the source location increments along the x-axis by the spacing between pings and the sound pressure level for each grid point is again calculated for the new source location. Since the dose-response metric uses the maximum of the sound pressure levels at each grid point, the newly calculated sound pressure level at each grid point is compared to the sound pressure level stored in the grid. If the new level is larger than the stored level, the value at that grid point is replaced by the new sound pressure level.

For each bin, a volume is determined by summing the ensonified volumes with a maximum SPL in the bin's interval. This forms the volume histogram shown in Figure 2-13. Multiplying by the dose-response probability function for the level at the center of a bin gives the impact volume for that bin. The result can be seen in Figure 2-14, which is an example of the impact volume as a function of depth.

The impact volume for a sonar moving relative to the animal population increases with each additional ping. The rate at which the impact volume increases for the dose response metric is essentially linear with the number of pings. Figure 2-19 shows the dependence of impact volume on the number of pings. The function is linear; the slope of the line at a given depth is the impact volume added per ping. This number multiplied by the number of pings in an hour gives the hourly impact volume for the given depth increment. Completing this calculation for all depths in a province, for a given source, gives the hourly impact volume vector which contains the hourly impact volumes by depth for a province. Figure 2-20 provides an example of an hourly impact volume vector for a particular environment. Given the speed of the sonar, the hourly impact volume vector could be displayed as the impact volume vector per kilometer of track.

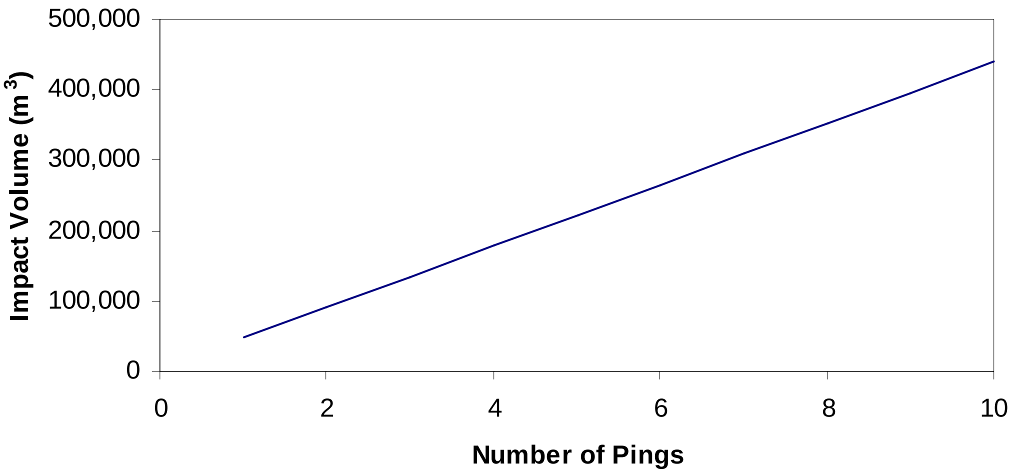


Figure 2-19. Dependence of Impact volume On the Number of Pings

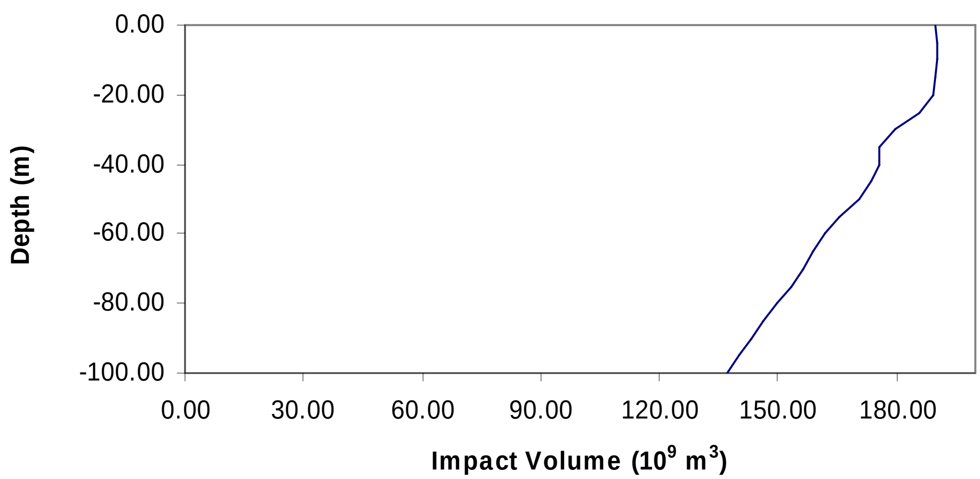


Figure 2-20. Example of an Hourly Impact Volume Vector

2.5 EXPOSURES

This section defines the animal densities and their depth distributions for the SOCAL Range. This is followed by a series of tables providing exposure estimates per unit of operation for each source type (active sonars and explosives).

2.5.1 Animal densities

Densities are usually reported by marine biologists as animals per square kilometer, which is an area metric (presented for each species in Section 2.1). This gives an estimate of the number of animals below the surface in a certain area, but does not provide any information about their distribution in depth. The impact volume vector (see subsection 2.4.3) specifies the volume of water ensonified above the specified threshold in each depth interval. A corresponding animal density for each of those depth intervals is required to compute the expected value of the number of exposures. The two-dimensional area densities do not contain this information, so three-dimensional densities must be constructed by using animal depth distributions to extrapolate the density at each depth. The density estimates used fro the acoustic modeling assumes a uniform density through the modeling area. Exposure Estimates

The following sperm whale example demonstrates the methodology used to create a three-dimensional density by merging the area densities with the depth distributions. The sperm whale surface density is 0.0028 whales per square kilometer. From the depth distribution report, "depth distribution for sperm whales based on information in the Amano paper is: 19% in 0-2 m, 10% in 2-200 m, 11% in 201-400 m, 11% in 401-600 m, 11% in 601-800 m and 38% in >800 m." So the sperm whale density at 0-2 m is 0.0028*0.19/0.002 = 0.266 per cubic km, at 2-200 m is 0.0028*0.10/0.198 = 0.001414 per cubic km, and so forth.

In general, the impact volume vector samples depth in finer detail than given by the depth distribution data. When this is the case, the densities are apportioned uniformly over the appropriate intervals. For example, suppose the impact volume vector provides volumes for the intervals 0-2 meters, 2-10 meters, and 10-50 meters. Then for the depth-distributed densities discussed in the preceding paragraph,

- 0.266 whales per cubic km is used for 0-2 meters,
- 0.001414 whales per cubic km is used for the 2-10 meters, and
- 0.001414 whales per square km is used for the 10-50 meters.

Once depth-varying, three-dimensional densities are specified for each species type, with the same depth intervals and the ensonified volume vector, the density calculations are finished. The expected number of ensonified animals within each depth interval is the ensonified volume at that interval multiplied by the volume density at that interval and this can be obtained as the dot product of the ensonified volume and animal density vectors.

Since the ensonified volume vector is the ensonified volume per unit operation (i.e. per hour, per sonobuoy, etc), the final exposure count for each animal is the unit operation exposure count multiplied by the number of units (hours, sonobuoys, etc). For sonar sources, exposures are reported at 195 dB, and 215 dB EL. For explosive sources, exposures are reported by level A (corresponding to 182 dB one-third-octave energy) and level B (corresponding to 205 dB one-third-octave energy and 13 psi-ms). These thresholds are explained in section 2.1.

2.5.2 Exposure Estimates Example

The following sperm whale example demonstrates the methodology used to create a three-dimensional density by merging the area densities with the depth distributions. The sperm whale surface density is 0.0028 whales per square kilometer. From the depth distribution report, "depth distribution for sperm whales based on information in the Amano paper is: 19% in 0-2 m, 10% in 2-200 m, 11% in 201-400 m, 11% in 401-600 m, 11% in 601-800 m and 38% in >800 m." So the sperm whale density at 0 to 2 m is (0.0028*0.19/0.002 =) 0.266 per cubic km, at 2-200 m is (0.0028*0.10/0.198 =) 0.001414 per cubic km, and so forth.

In general, the impact volume vector samples depth in finer detail than given by the depth distribution data. When this is the case, the densities are apportioned uniformly over the appropriate intervals. For example, suppose the impact volume vector provides volumes for the intervals 0 to 2 m, 2 to 10 m, and 10 to 50 m. Then for the depth-distributed densities discussed in the preceding paragraph,

- 0.266 whales per cubic km is used for 0 to 2 m,
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Once depth-varying, three-dimensional densities are specified for each species type, with the same depth intervals and the ensonified volume vector, the density calculations are finished. The expected number of ensonified animals within each depth interval is the ensonified volume at that interval multiplied by the volume density at that interval and this can be obtained as the dot product of the ensonified volume and animal density vectors.

Since the ensonified volume vector is the ensonified volume per unit operation (i.e., per hour, per sonobuoy, etc), the final exposure count for each animal is the unit operation exposure count multiplied by the number of units (hours, sonobuoys, etc). The tables below are organized by Alternative and threshold level; each table represents the total yearly exposures modeled at different threshold levels for each alternative. For sonar sources, exposures are reported at the appropriate risk function level, 195 dB, and 215 dB SEL.

2.6 SUMMARY OF MARINE MAMMAL RESPONSE TO ACOUSTIC AND EXPLOSIVE EXPOSURES

The best scientific information on the status, abundance and distribution, behavior and ecology, diving behavior and acoustic abilities are provided for each species expected to be found within the SOCAL EIS Study Area. Information was reviewed on the response of marine mammals to other sound sources such as seismic air guns or ships but these sources tend to be longer in the period of exposure or continuous in nature. The response of marine mammals to those sounds, and mid-frequency active sonar, are variable with some animals showing no response or moving toward the sound source while others may move away (Review by Richardson et al. 1995; Andre et al. 1997; Nowacek et al. 2004). The analytical framework shows the range of physiological and behavioral responses that can occur when an animal is exposed to an acoustic source. Physiological effects include auditory trauma (TTS, PTS, and tympanic membrane rupture), stress or changes in health and bubble formation or decompression sickness. Behavioral responses may occur due to stress in response to the sound exposure. Behavioral responses may include flight response, changes in diving, foraging or reproductive behavior, changes in vocalizations (may cease or increase intensity), changes in migration or movement patterns or the use of certain habitats. Whether an animal responds, the types of behavioral changes, and the magnitude of those changes may depend on the intensity level of the exposure and the individual animal's prior status or behavior. Little information is available to determine the response of animals to mid-frequency active sonar and its effects on ultimate and proximate life functions or at the population or species level.

Acoustic exposures are evaluated based on their potential direct effects on marine mammals, and these effects are then assessed in the context of the species biology and ecology to determine if there is a mode of action that may result in the acoustic exposure warranting consideration as a harassment level effect. A large body of research on terrestrial animal and human response to airborne sound exists, but results from those studies are not readily extendible to the development of effect criteria and thresholds for marine mammals. For example, "annoyance" is one of several criteria used to define impact to humans from exposure to industrial sound sources. Comparable criteria cannot be developed for marine mammals because there is no acceptable method for determining whether a non-verbal animal is annoyed. Further, differences in hearing thresholds, dynamic range of the ear, and the typical exposure patterns of interest (e.g., human data tend to focus on 8-hour-long exposures) make extrapolation of human sound exposure standards inappropriate. Behavioral observations of marine mammals exposed to anthropogenic sound sources exist, however, there are few observations and no controlled measurements of behavioral disruption of cetaceans caused by sound sources with frequencies, waveforms, durations, and repetition rates comparable to those employed by the tactical sonars to be used in the SOCAL Range Complex. At the present time there is no consensus on how to account for behavioral effects on marine mammals exposed to continuous-type sounds (NRC 2003).

This analysis uses behavioral observations of trained cetaceans exposed to intense underwater sound under controlled circumstances to develop a criterion and threshold for behavioral effects of sound. These data are described in detail in Schlundt et al. (2000) and Finneran and Schlundt (2004). These data, because they are based on controlled, tonal sound exposures within the tactical sonar frequency range, are the most applicable.

When analyzing the results of the acoustic effect modeling to provide an estimate of harassment, it is important to understand that there are limitations to the ecological data used in the model, and to interpret the model results within the context of a given species' ecology.

Limitations in the model include:

- Density estimates assume uniformity of distribution (May be limited in duration and time of year and are modeled to derive density estimates).
- When reviewing the acoustic effect modeling results, it is also important to understand that the estimates of marine mammal sound exposures are presented without consideration of mitigation which may reduce the potential for estimated sound exposures to occur.
- Overlap of TTS and risk function.

2.6.1 Acoustic Impact Model Process Applicable to All Alternative Discussions

The methodology for analyzing potential impacts from sonar and explosives is presented in Section 2.2, which explains the model process in detail, describes how the impact threshold derived from Navy-NMFS consultations are derived, and discusses relative potential impact based on species biology.

The Navy acoustic exposure model process uses a number of inter-related software tools to assess potential exposure of marine mammals to Navy generated underwater sound including sonar and explosions. For sonar, these tools estimate potential impact volumes and areas over a range of thresholds for sonar specific operating modes. Results are based upon extensive pre-computations over the range of acoustic environments that might be encountered in the operating area (Section 4).

The acoustic model includes four steps used to calculate potential exposures:

1. Identify unique acoustic environments that encompass the operating area. Parameters include depth and seafloor geography, bottom characteristics and sediment type, wind and surface roughness, sound velocity profile, surface duct, sound channel, and convergence zones.

2. Compute transmission loss (TL) data appropriate for each sensor type in each of these acoustic environments. Propagation can be complex depending on a number of environmental parameters listed in step one, as well as sonar operating parameters such as directivity, source level, ping rate, and ping length, and for explosives the amount of explosive material detonated. The standard Navy CASS-GRAB acoustic propagation model is used to resolve complexities for underwater propagation prediction.

3. Use that TL to estimate the total sound energy received at each point in the acoustic environment.

4. Apply this energy to predicted animal density for that area to estimate potential acoustic exposure, with animals distributed in 3-D based on best available science on animal dive profiles.

3 NAVY POST MODELING ANALYSIS

When modeling the effect of sound projectors in the water, the ideal task presents modelers with complete a priori knowledge of the location of the source(s) and transmission patterns during the times of interest. In these cases, calculation inputs include the details of ship path, proximity of shoreline, high-resolution density estimates, and other details of the scenario. However, in the SOCAL Range Complex, there are sound-producing events for which the source locations, number of projectors, and transmission patterns are unknown, but still require analysis to predict effects. For these cases, a more general modeling approach is required: "We will be operating somewhere in this large area for X hours. What are the potential effects on average?"

Modeling these general scenarios requires a statistical approach to incorporate the scenario nuances into harassment calculations. For example, one may ask: "If an animal receives 130 dB SPL when the ship passes at closest point of approach (CPA) on Tuesday morning, how do we know it doesn't receive a higher level on Tuesday evening?" This question cannot be answered without knowing the path of the ship (and several other facts). Because the path of the ship is unknown, the number of an individual's re-exposures cannot be calculated directly. But it can, on average, be accounted for by making appropriate assumptions.

Table 3-1 lists unknowns created by uncertainty about the specifics of a future proposed action, the portion of the calculation to which they are relevant, and the assumption that allows the effect to be computed without the detailed information:

Table 3-1. Unknowns and Assumptions For Post Modeling Analysis

Unknowns	Relevance	Assumption
Path of ship (esp. with respect to animals)	Ambiguity of multiple exposures, Local population: upper bound of harassments	Most conservative case: ships are everywhere within Area
Ship(s) locations	Ambiguity of multiple exposures, land shadow	Equal distribution of action in each modeling area
Direction of sonar transmission	Land shadow	Equal probability of pointing any direction
Number of ships	Effect of multiple ships	Average number of ships per exercise
Distance between ships	Effect of multiple ships	Average distance between ships

The following sections discuss three topics that require action details, and describes how the modeling calculations used the general knowledge and assumptions to overcome the future-action uncertainty consider re-exposure of animals, land shadow, and the effect of multiple-ship exercises.

1) Multiple Exposures in General Modeling Scenario

Consider the following hypothetical scenario. A box is painted on the surface of a well-studied ocean environment with well-known propagation. A sonar-equipped ship and 44,000 whales are inserted into that box and a curtain is drawn. What will happen? This is the general scenario. The details of what will happen behind the curtain are unknown, but the existing knowledge, and general assumptions, can allow for a general calculation of average affects.

For the first period of time, the ship is traveling in a straight line and pinging at a given rate. In this time, it is known how many animals, on average, receive their max SPLs from each ping. As long as the ship travels in a straight line, this calculation is valid. However, after an undetermined amount of time, the ship will change course to a new and unknown heading.

If the ship changes direction 180 degrees and travels back through the same swath of ocean, all the animals the ship passes at closest point of approach (CPA) before the next course change have already been exposed to what will be their maximum SPL, so the population is not "fresh." If the direction does not change, only new animals will receive what will be their maximum SPL from that ship (though most have received sound from it), so the population is completely "fresh." Most ship headings lead to a population of a mixed "freshness," varying by course direction. Since the route and position of the ship over time are unknown, the freshness of the population at CPA with the ship is unknown. This ambiguity continues through the remainder of the exercise.

What is known? The source and, in general, the animals remain in the sonar operating area (SOA). Thus, if the farthest range to a possible effect from the ship is X km, no animals farther than X km outside of the SOA can be harassed. The intersection of this area with a given animal's habitat multiplied by the density of that animal in its habitat represents the maximum number of animals that can be harassed by activity in that SOA, which shall be defined as "the local population." Two details: first, this maximum should be adjusted down if a risk-response function is being used, because not 100% of animals within X km of the SOA border will be harassed. Second, it should be adjusted up to account for animal motion in and out of the area.

The ambiguity of population freshness throughout the exercise means that multiple exposures cannot be calculated for any individual animal. It must be dealt with generally at the population level.

Solution to the Ambiguity of Multiple Exposures in the General Modeling Scenario

At any given time, each member of the population has received a maximum SPL (possibly zero) that indicates the probability of harassment in the exercise. This probability indicates the contribution of that individual to the expected value of the number of harassments. For example, if an animal receives a level that indicates 50% probability of harassment, it contributes 0.5 to the sum of the expected number of harassments. If it is passed later with a higher level that indicates a 70% chance of harassment, its contribution increases to 0.7. If two animals receive a level that indicates 50% probability of harassment, they together contribute 1 to the sum of the expected number of harassments. That is, we statistically expect exactly one of them to be harassed. Let the expected value of harassments at a given time be defined as "the harassed population" and the difference between the local population (as defined above) and the harassed population be defined as "the unharassed population." As the exercise progresses, the harassed population will never decrease and the unharassed population will never increase.

The unharassed population represents the number of animals statistically "available" for harassment. Since we do not know where the ship is, or where these animals are, we assume an average (uniform) distribution of the unharassed population over the area of interest. The densities of unharassed animals are lower than the total population density because some animals in the local population are in the harassed population.

Density relates linearly to expected harassments. If action A in an area with a density of 2 animals per square kilometer produces 100 expected harassments, then action A in an area with 1 animal per square kilometer produces 50 expected harassments. The modeling produces the number of expected harassments per ping starting with 100% of the population unharassed. The next ping will produce slightly fewer harassments because the pool of unharassed animals is slightly less.

For example, consider the case where 1 animal is harassed per ping when the local population is 100, 100% of which are initially unharassed. After the first ping, 99 animals are unharassed, so the number of animals harassed during the second ping are

$$10\left(\frac{99}{100}\right) = 1(.99) = 0.99 \text{ animals}$$

and so on for the subsequent pings.

Mathematics

A closed form function for this process can be derived as follows.

Define $P_n =$ unharassed population after ping n

Define $H =$ number of animals harassed in a ping with 100% unharassed population

$P_0 =$ local population

$$P_1 = P_0 - H$$

$$P_2 = P_1 - H\left(\frac{P_1}{P_0}\right)$$

...

$$P_n = P_{n-1} - H\left(\frac{P_{n-1}}{P_0}\right)$$

Therefore,

$$P_n = P_{n-1}\left(1 - \left(\frac{H}{P_0}\right)\right) = P_{n-2}\left(1 - \left(\frac{H}{P_0}\right)\right)^2 = \ldots = P_0\left(1 - \left(\frac{H}{P_0}\right)\right)^n$$

Thus, the total number of harassments depends on the per-ping harassment rate in an unharassed population, the local population size, and the number of operation hours.

Local Population: Upper Bound on Harassments

As discussed above, Navy planners have confined period of sonar use to operation areas. The size of the harassed population of animals for an action depends on animal re-exposure, so uncertainty about the precise ship path creates variability in the "harassable" population. Confinement of sonar use to a sonar operating area allows modelers to compute an upper bound, or worst case, for the number of harassments with respect to location uncertainty. This is done by assuming that there is a sonar transmitting from each point in the confined area throughout the action length.

NMFS has defined a twenty-four hour "refresh rate," or amount of time in which an individual can be harassed no more than once. Navy has determined that, in a twenty-four hour period, all sonar operations in the SOCAL Range Complex transmit for a subset of that time. Table 3-2 provides those times for each type of major exercise.

Table 3-2. Duration of Sonar Use During 24-hour Period

Action	Duration of Sonar Use in 24 hour Period
IAC	16 hours
Major Exercise	12 hours
Sustainment Exercise	12 hours
ULT	4 hours

Creating the most conservative ship position by assuming that a sonar transmits from each point in the SOA simultaneously can produce an upper bound on harassments for a single ping, but animal motion over the period in the above table can bring animals into range that otherwise would be out of the harassable population.

Animal Motion Expansion

Though animals often change course to swim in different directions, straight-line animal motion would bring the more animals into the harassment area than a "random walk" motion model. Since precise and accurate animal motion models exist more as speculation than documented fact and because the modeling requires an undisputable upper bound, calculation of the upper bound for SOCAL modeling areas uses a straight-line animal motion assumption. This is a conservative assumption.

For a circular area, the straight-line motion with initial random direction assumption produces an identical result to the initial fixed direction. Since the SOCAL Sonar Operating Areas (SOAs) are non-circular polygons, choosing the initial fixed direction as perpendicular to the longest diagonal produces greater results than the initial random direction. Thus, the product of the longest diagonal and the distance the animals move in the period of interest gives an overestimate of the expansion in SOCAL modeling areas due to animal motion. The SOCAL expansions use this overestimate for the animal-motion expansion.

Figure 3-1 is an example that illustrates the overestimation, which occurs during the second arrow:

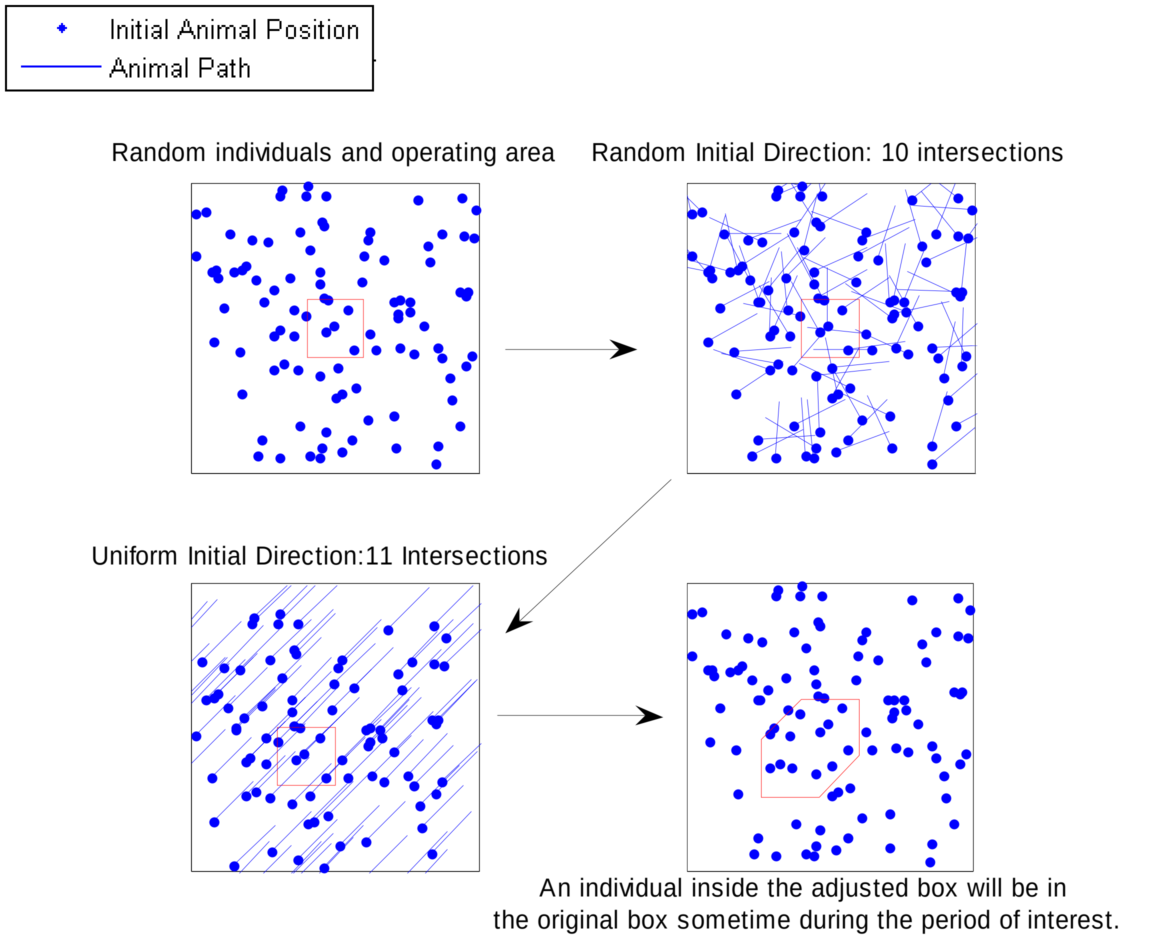


Figure 3-1. Process of Overestimating Individuals Present in Area at Any Time.

Risk Response Expansion

The expanded area contains the number of animals that will enter the SOA over the period of interest. However, an upper bound on harassments must also include animals outside the area that would be affected by a ship transmitting from the area's edge. A gross overestimation could simply include all area with levels greater than the risk response cutoff. In the case of SOCAL, this would include all area within approximately 120 km from the edge of the adjusted box. This basic method would give a crude and inaccurately high upper bound, since only a fraction of the population is affected in much of that area. A more refined upper bound on harassments can be found by maintaining the assumption that a sonar is transmitting from each point in the adjusted box and calculating the expected ensonified area.

The expected lateral range from the edge of a polygon to the cutoff range can be expressed as,

$$\int_{0}^{L^{-1}(120\,dB)} D(L(r))dr$$

where D is the dose response function with domain in level and range in probability, L is the SPL function with domain in range and range in level, and r is the range from the sonar operating area.

At the corners of the polygon, additional area can be expressed as

$$\frac{[\pi-\theta]\int_0^{L^{-1}(120dB)} D(L(r))rdr}{2\pi}$$

with D, L, and r as above, and θ the inner angle of the polygon corner, in radians.

For the risk response function and transmission loss of SOCAL, this method adds an area equivalent to expanding the boundaries of the adjusted box by four kilometers. The resulting shape, the adjusted box with a boundary expansion of 4 km, does not possess special meaning for the problem. But the number of individuals contained by that shape, as demonstrated above, is an overestimate of the number of harassments that would occur if sonars transmitted continuously from each point in the SOA over the exercise length, an upper bound on harassments for that operation.

Figure 3-2 illustrates the growth of area for the sample case above. The shapes of the boxes are unimportant. The area after the final expansion, though, gives an upper bound on the "harassable," or unharassed population.

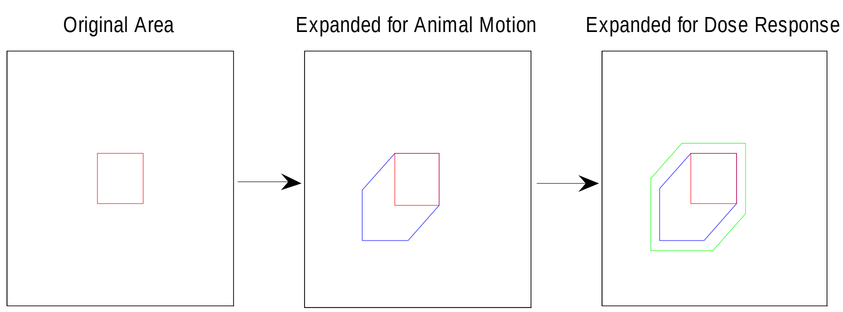


Figure 3-2. Process of Expanding Area to Create Upper Bound of Harassments

Example Case

Consider a sample case from the SOCAL Range Complex: the rate of exposure for short-beaked common dolphins in Area 2 during the summer, in a IAC exercise with three active SQS-53C sonars is 0.0703 harassments per ping. The exercise will transmit sonar pings for 16 hours in a 24 hour period, as given in the action table above, with 120 pings per hour, a total of 16*120=1920 pings in a 24 hour period.

Area 2 has an area of approximately 2,302 square kilometers and a diagonal of 85.1 km. Adjusting this with straight-line (upper bound) animal motion of 5.5 kilometers per hour for 16 hours, animal motion adds 85.1*5.5*16= 7,489 square kilometers to the area. Using risk response to calculate the expected range outside the SOA adds another 848 square kilometers, bringing the total affected area to 10,639 square km.

For this analysis, short-beaked common dolphins have a density of 0.83 animals per square kilometer in the SOCAL area, so the upper bound number of bottlenose dolphins that can be affected by sonar activity in Area 2 during a 16 hour period is 10,639 *0.83 = 530 dolphins.

In the first ping, 0.0703 bottlenose dolphins will be harassed. With the second ping, bottlenose $0.0703\left(\frac{530-0.0703}{530}\right)=0.07029$ dolphins will be harassed. Using the formula derived above, after 16 hours of continuous operation, the remaining unharassed population is:

$$P_{1920}=P_0\left(1-\left(\frac{h}{P_0}\right)\right)^{1920}=530\left(1-\left(\frac{0.0703}{530}\right)\right)^{1920}\approx 410$$

So the harassed population will be 120 animals.

Contrast this with linear accumulation of harassments without consideration of the local population and the dilution of the unharassed population:

Harassments = 0.0703 *1920= 135

Figure 3-3 illustrates the difference between the two approaches

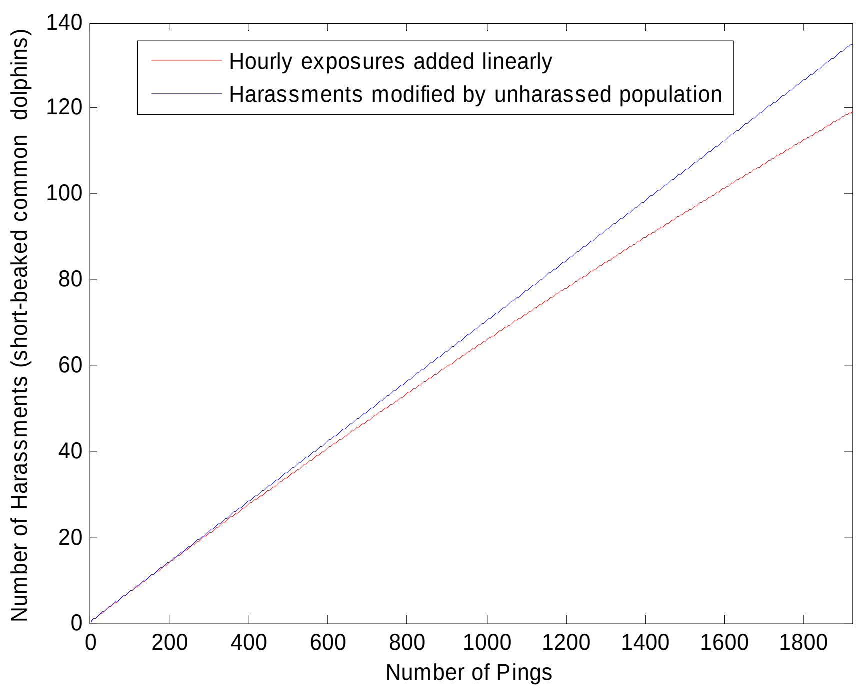


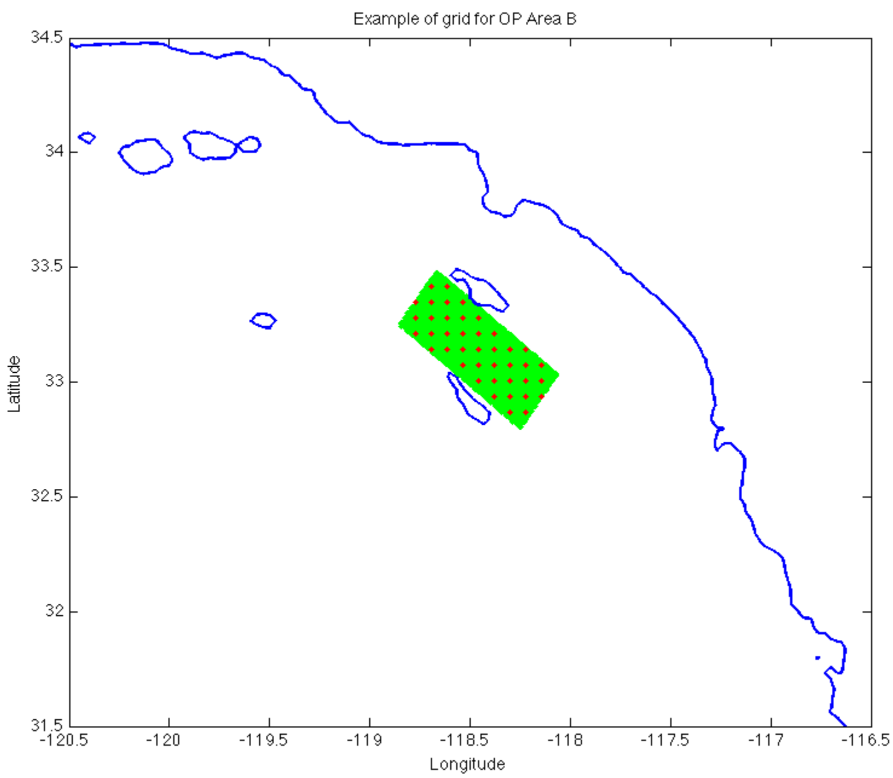
Figure 3-3. Comparison of Harassments from Unlimited and Limited Populations

2) Land Shadow

The risk response function considers harassment possible if an animal receives 120 dB sound pressure level, or above. In the SOCAL, this occurs as far away as 160 km, in the surface duct during the cold season, and in the surface duct in the warm season, this can happen at 60 km. On average, across season, sound drops below 120 dB at about 110 to 120 kilometers away from an SQS-53C-transmitting ship so over a large "effect" area, sonar sound could, but does not necessarily, harass an animal. The harassment calculations for a general modeling case must assume that this effect area covers only water fully populated with animals, but in some portions of the SOCAL Sonar Operating Areas, land partially encroaches on the area, obstructing sound propagation.

As discussed in the introduction of "Additional Modeling Considerations..." Navy planners do not know the exact location and transmission direction of the sonars at any time. These factors however, completely determine the interference of the land with the sound, or "land shadow," so a general modeling approach does not have enough information to compute the land shadow effects directly. However, modelers can predict the reduction in harassments at any point due to land shadow for different pointing directions and use expected probability distribution of activity to calculate the average land shadow for operations in each SOA.

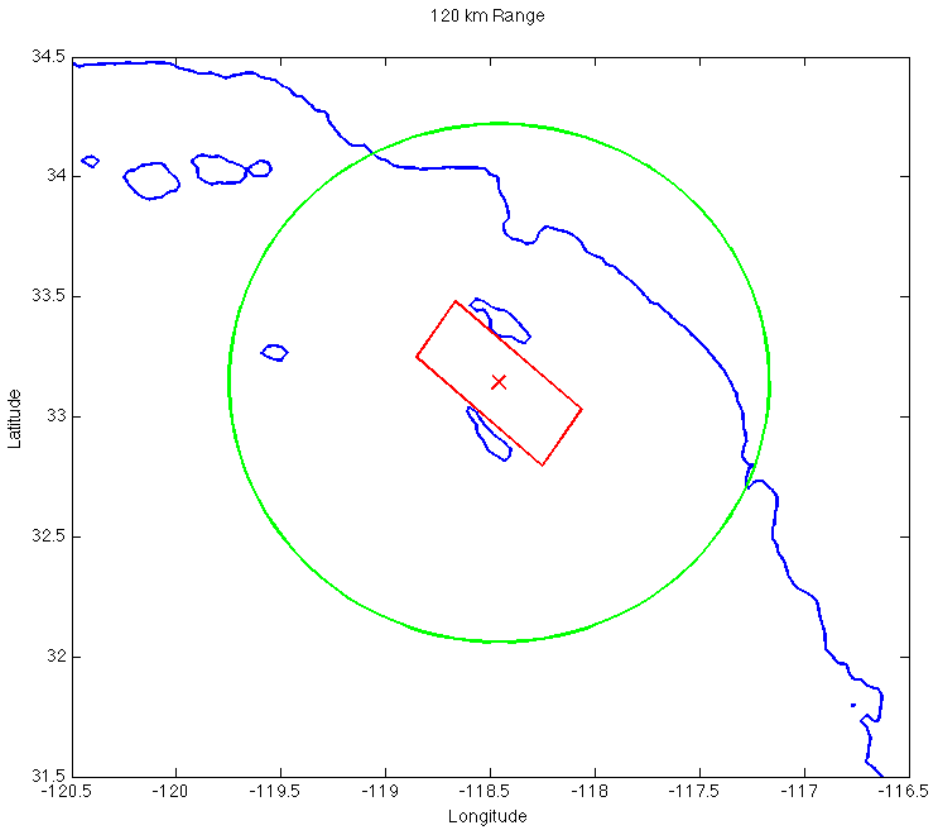
For SOCAL, the land shadow is computed over a dense grid in each operations area. An example of the grid, for Area 2, is shown in Figure 3-4.



Note: The dense grid is shown by the near continuous gree dots. For illustrative purposes, every 25th point is shown as a red dot.

Figure 3-4. Land Shadow Grid Example, Area 2

For each grid point, the land shadow is computed by combining the distance to land and the azimuth coverage. The process finds all of the points within 120 km of the gridpoint, as shown in Figure 3-5.

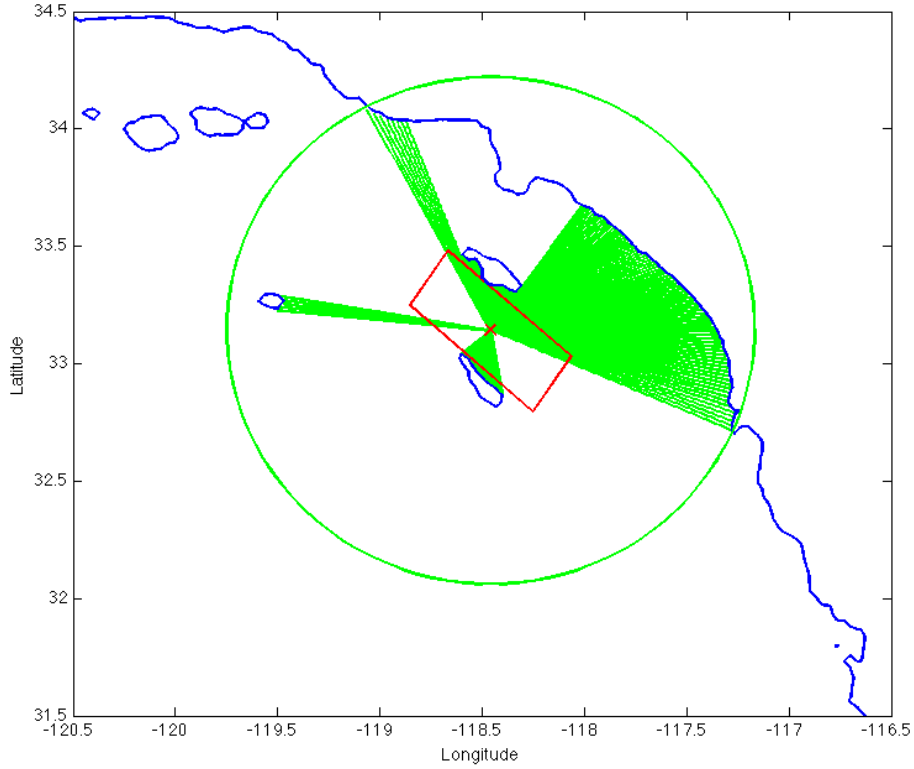


Note: The red box is the operations area. The red X is one grid point, with the green circle corresponding to a radius of 120 km from the grid point.

Figure 3-5. Land Shadow Grid – Second Example

For each of the coastal points that are within 120 km of the grid, the azimuth and distance is computed. In the computation, only the minimum range at each azimuth is computed. The minimum range compared with azimuth for the sample point is shown in Figure 3-6.

Now, the average of the distances to shore, along with the angular profile of land is computed (by summing the unique azimuths that intersect the coast) for each grid point. The values are then used to compute the land shadow for the grid points. The land shadow effect at the example point is 0.9997, or there is a 0.03% reduction in effect due to land shadow.



Note: The nearest point at each azimuth (with 1° spacing) to a sample grid point (red X) is shown by the green lines.

Figure 3-6. Land Shadow Example – Minimum Range and Azimuth

Computing the Land Shadow Effect at Each Grid Point

The effect of land shadow is computed by determining the levels, and thus the distances from the sources, at which the harassments occur. Sound propagation in SOCAL greatly varies between the cold and warm seasons. Tables 3-3 and 3-4 and Figures 3-7 and 3-8 depict the distances at which various received levels extend in SOCAL in the cold and warm season. The land shadow was calculated using the average propagation in the surface duct in those seasons. For the interested reader, however, mathematically extrapolated details of ensonification are given below. Note the difference in ensonification between the cold and warm seasons in Figure 3-9. The SOCAL area develops a strong surface duct in the winter, which allows sound to propagate unusually well in the top 50 meters of water. But the warm season has a downward-refracting sound speed profile, which forces sound down towards the high-loss bottom.

Table 3-3. Harassments at each Received Level Band--cold season

Received Level (dB SPL)	Distance at which Levels Occur in SOCAL	Percent of Harassments Occurring at Given Levels
Below 140	44 km - 140 km	< 1 %
140>Level>150	19 km - 44 km	2 %
150>Level>160	6.7 km - 19 km	19 %
160>Level>170	2.2 km - 6.7 km	41 %
170>Level>180	0.68 km - 2.2 km	25 %
180>Level>190	210 m – 0.68 km	9 %
190>Level>200	60 m - 210 m	3 %
200>Level>210	20 m - 60 m	1%
Above 210	0 m - 20 m	< 1%

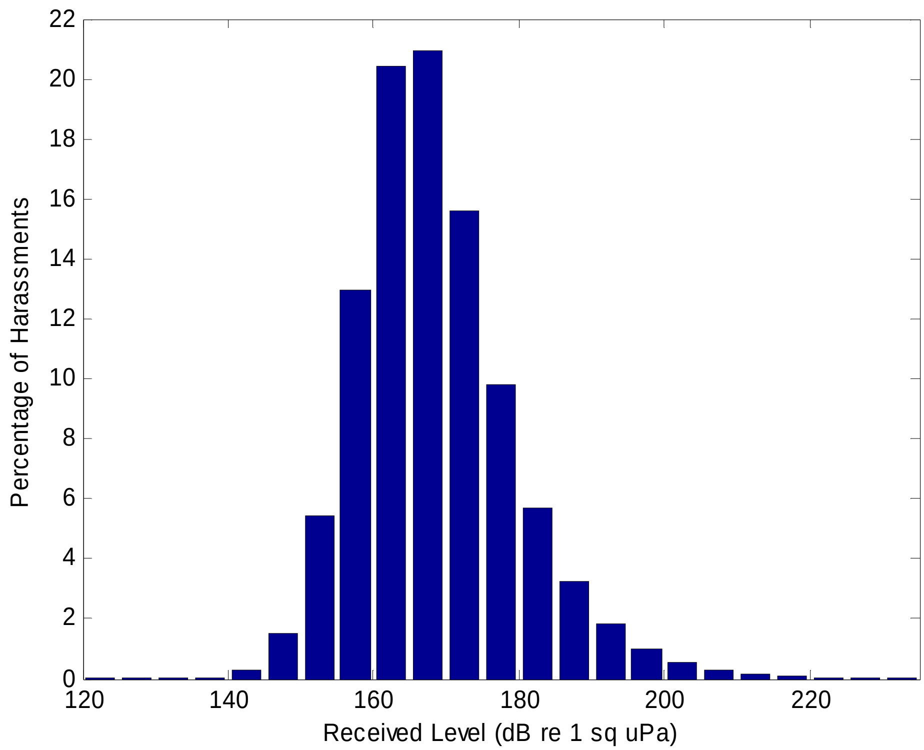


Figure 3-7. The Percentage Of Behavioral Harassments For Every 5 Degree Band Of Received Level In The Cold Season

Table 3-4. Harassments At Each Received Level Band--Warm Season

Received Level (dB SPL)	Distance at which Levels Occur in SOCAL	Percent of Harassments Occurring at Given Levels
Below 140	8.3 km - 40 km	< 1 %
140>Level>150	3.4 km - 8.3 km	2 %
150>Level>160	1.3 km - 3.4 km	16 %
160>Level>170	0.5 km - 1.3 km	36 %
170>Level>180	200 m - 500 m	27 %
180>Level>190	100 m - 200 meters	12 %
190>Level>200	50-100 meters	4%
Above 200	0-50 meters	<3%

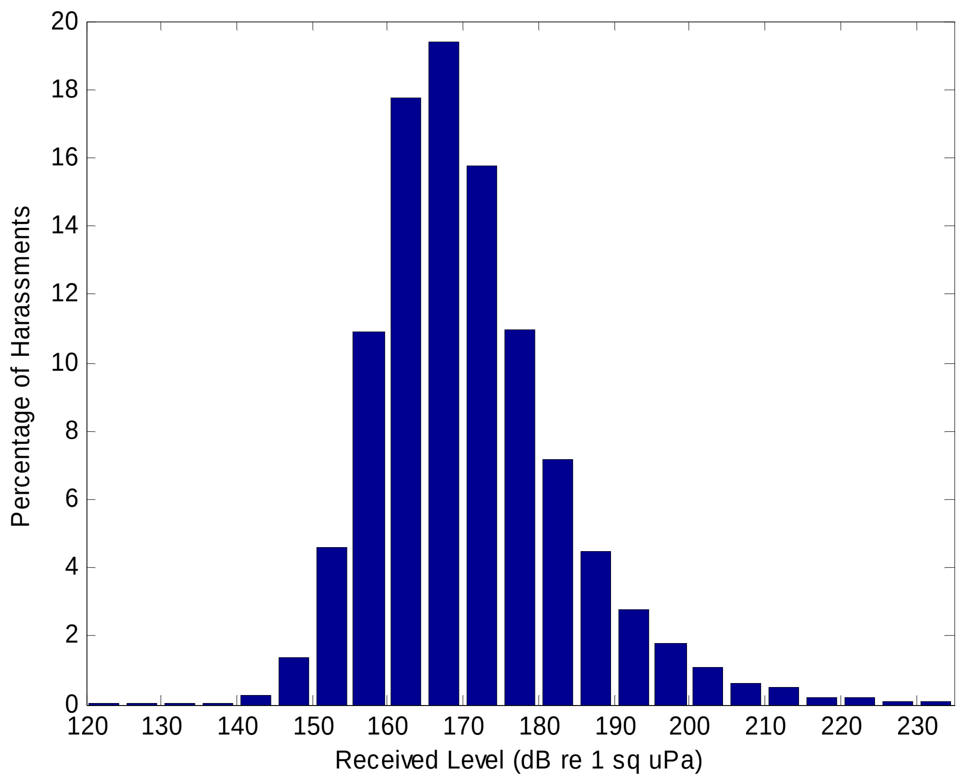


Figure 3-8. The Percentage Of Behavioral Harassments Occurring In Every 5 Degree Band Of Received Level In The Warm Season

For comparison, the following figure plots the data in Figures 3-7 and 3-8 together, so show the difference in ensonification between winter and summer.

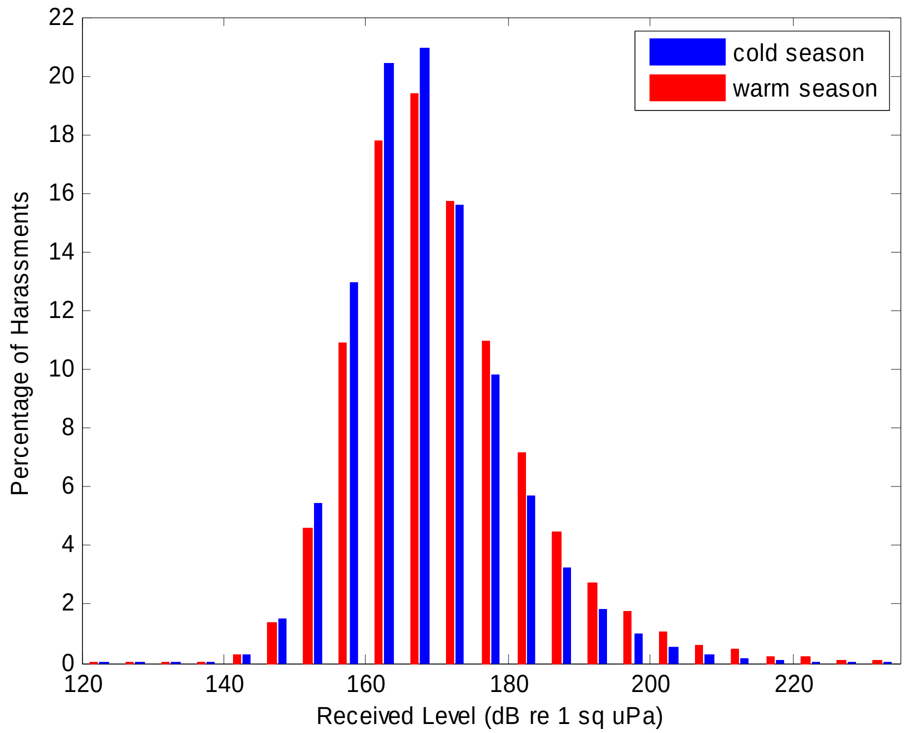


Figure 3-9. The Percentage Of Behavioral Harassments Occurring In Every 5 Degree Band Of Received Level In Both Seasons

The information about the levels at which harassments occur allows for an estimation of the correction required if land obstructs the path of sound before it reaches 120 dB.

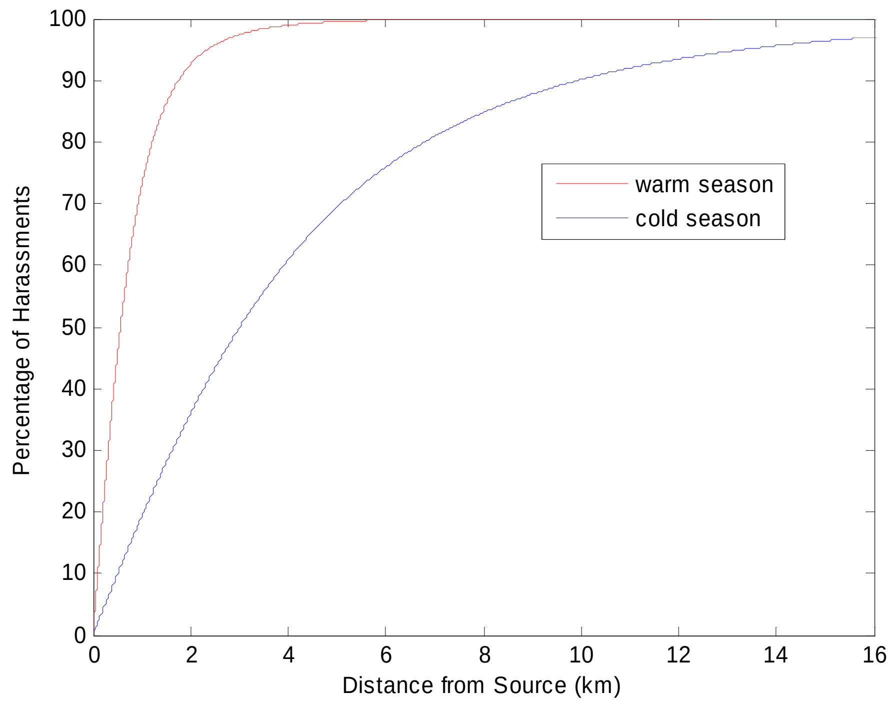


Figure 3-10. Percentage of Harassments Occurring Within a Given Distance Per Season

With the data used to produce the last two figures, the average effect reduction across season for a sound path blocked by land can be calculated. For example, since approximately 100% of harassments occur within 10 kilometers of the source during the warm season, and approximately 90% of harassments occur within 10 km during the cold season, a sound path blocked by land at 10 kilometers will, on average cause approximately 95% the effect of an unblocked path.

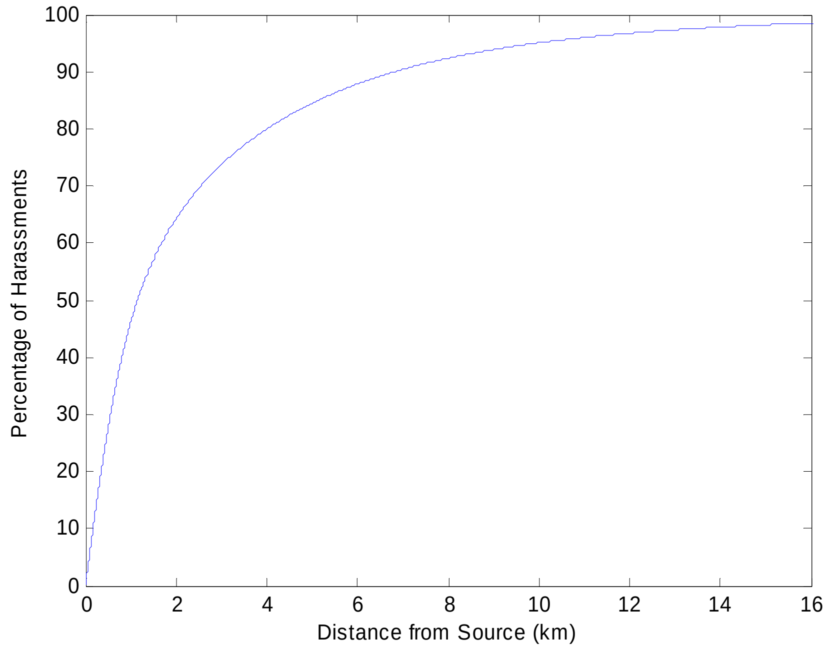


Figure 3-11. Average Percentage of Harassments Occurring Within a Given Distance

As described above, the mapping process determines the angular profile of and distance to the coastline(s) from each grid point. The distance, then, determines the reduction due to land shadow when the sonar is pointed in that direction. The angular profile, then, determines the probability that the sonar is pointed at the coast.

Define θn = angular profile of coastline at point n in radians

Define rn = mean distance to shoreline

Define A(r) = average effect adjustment factor for sound blocked at distance r

The land shadow at point n can be approximated by A(rn)θn/(2π). Figures 3-12 through 3-18 give the land shadow reduction factor at each point in each SOA. The white portions of the plot indicate the areas more than 120 km from land. The land shadow effects for most points are white (not within 120 km), or burgundy (within 120 km, but negligible effect).

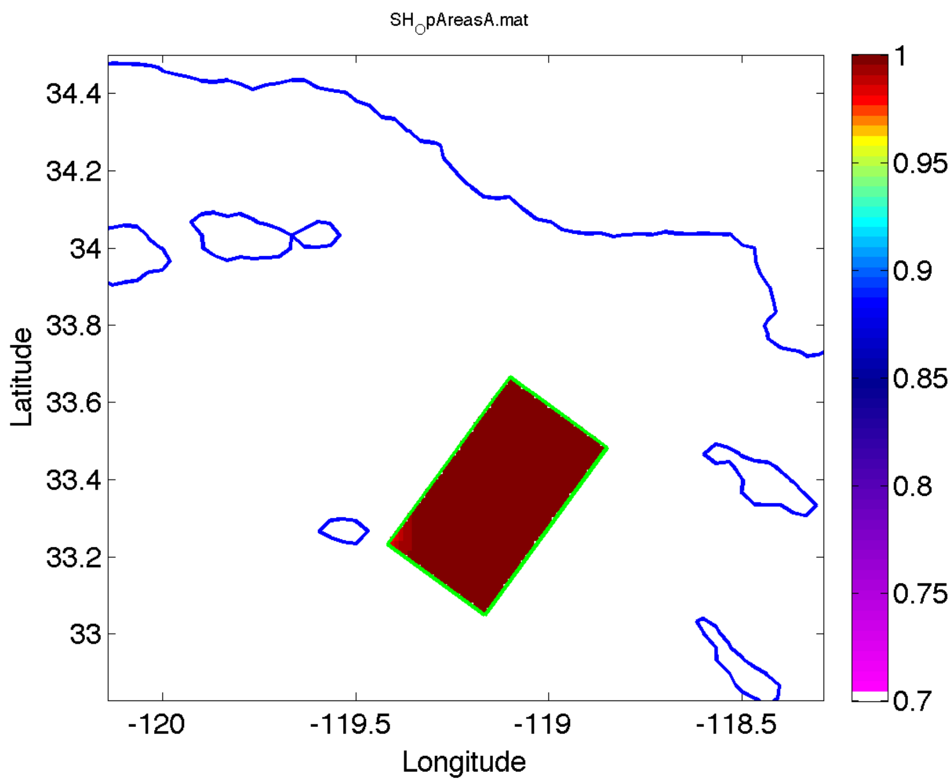


Figure 3-12. Land Shadow Factor for Area 1

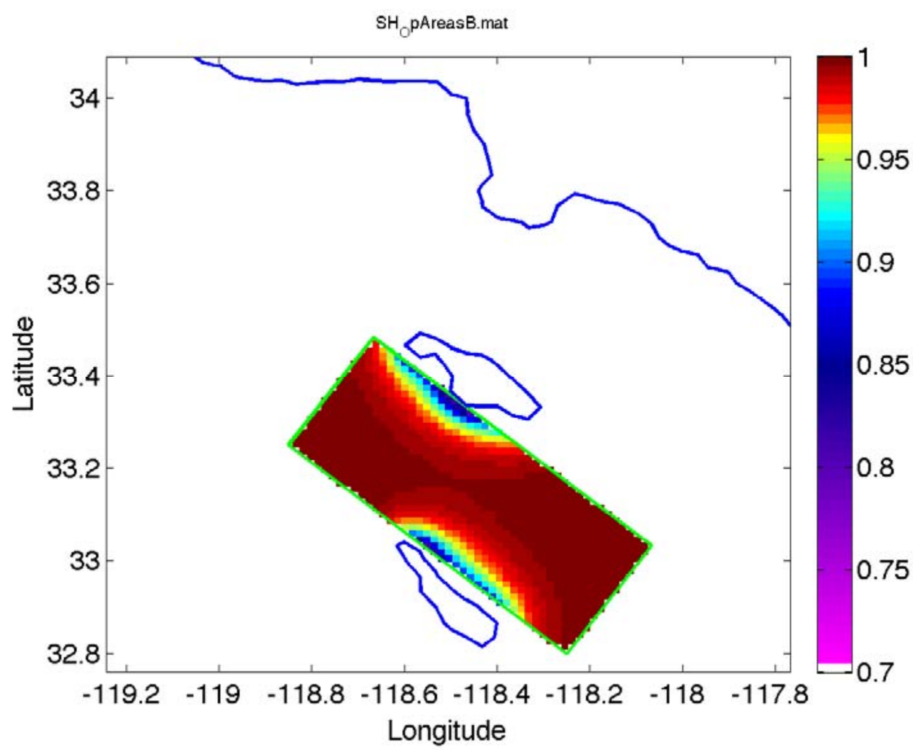


Figure 3-13. Land Shadow Factor for Area 2

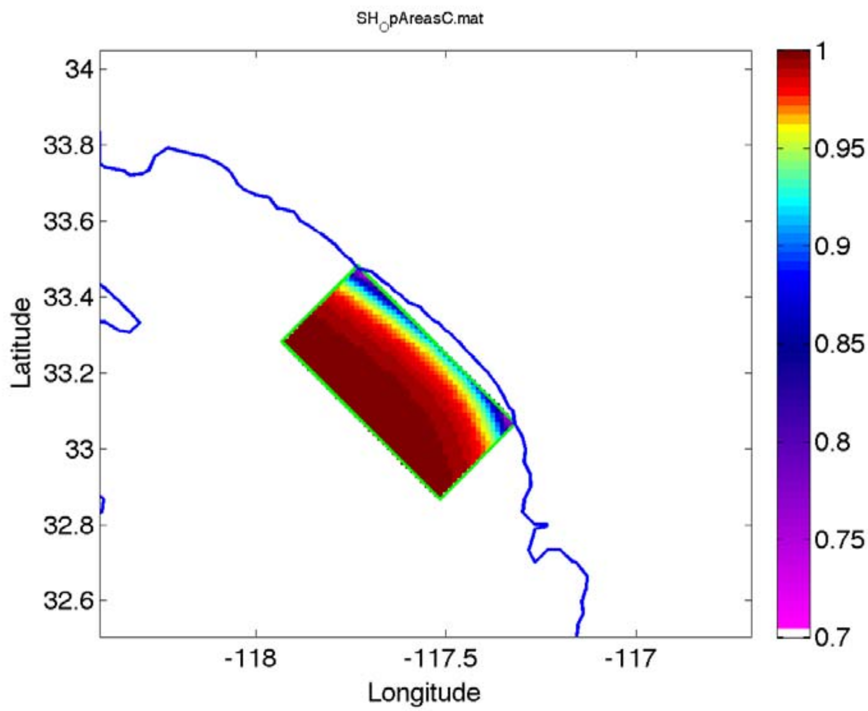


Figure 3-14. Land shadow Factor for Area 3

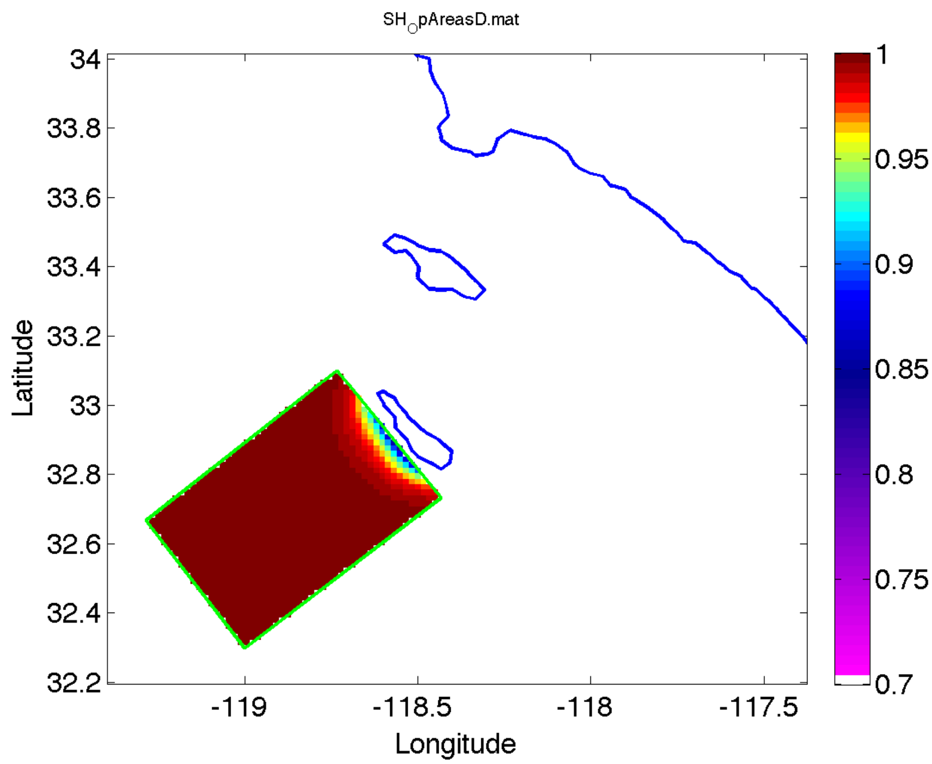


Figure 3-15. Land Shadow Factor for Area 4

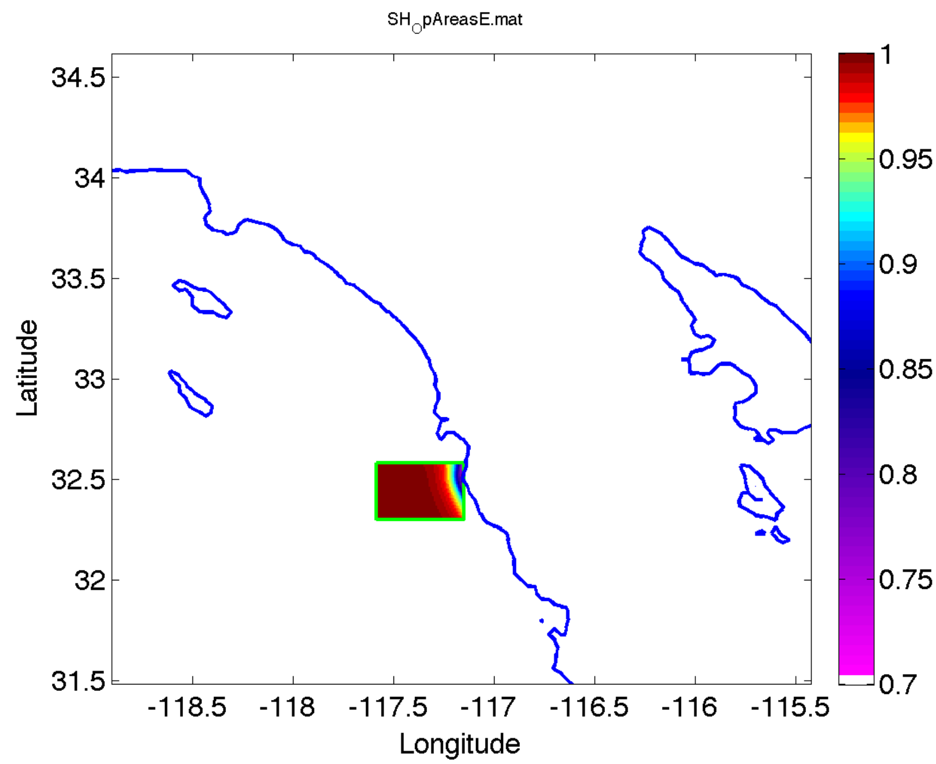


Figure 3-16. Land Shadow Factor for Area 5

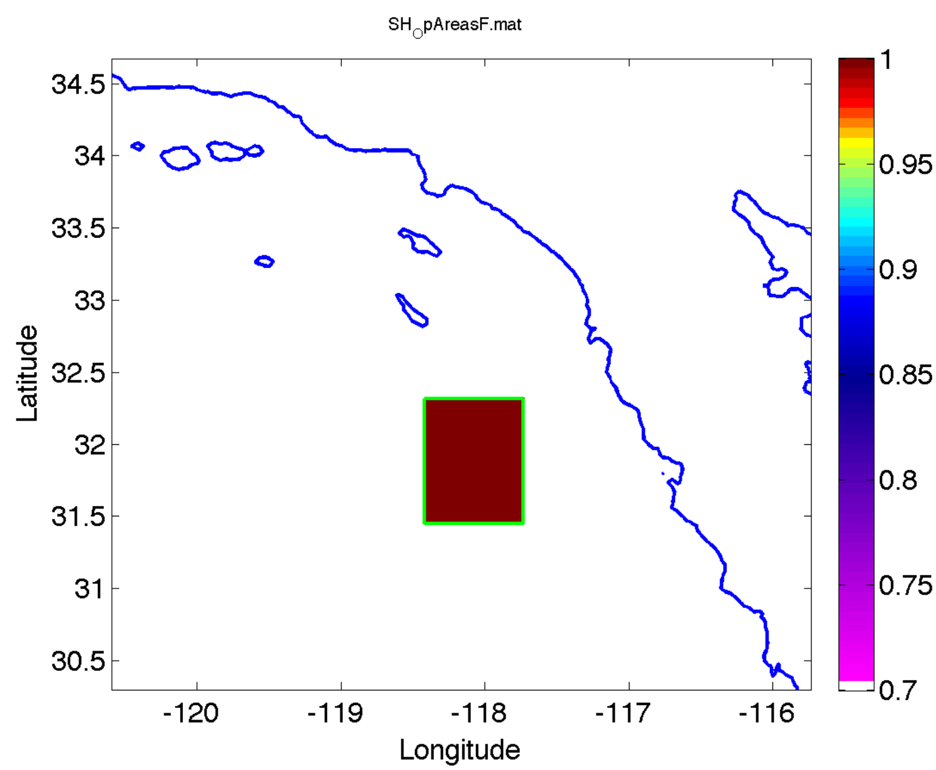


Figure 3-17. Land Shadow Factor for Area 6

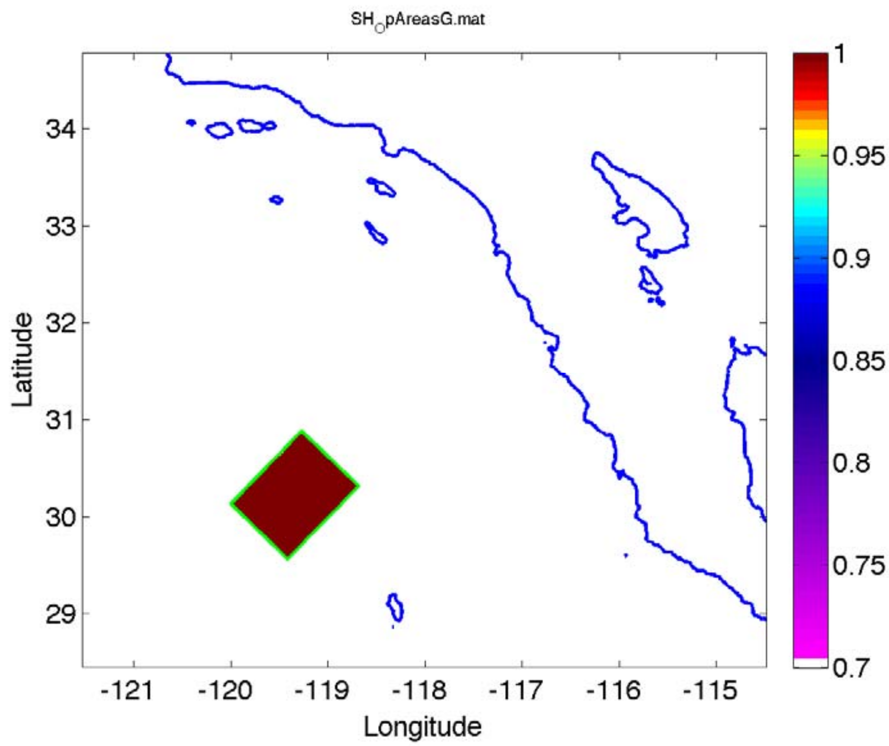


Figure 3-18. Land Shadow Factor for Area 7

Land shadow reduces the effect of the sonar differently in each area, as given in Table 3-5 below.

Table 3-5. Average Reduction Due to Land Shadow in Each SOCAL Area

Location	Reduction due to land shadow
Area 1	0.05%
Area 2	1.6%
Area 3	2.4%
Area 4	0.45%
Area 5	1.9%
Area 6	0%
Area 7	0%

3) The Effect of Multiple Ships

Behavioral harassment, under risk function response, uses maximum sound pressure level over a 24 hour period as the metric for determining the probability of harassment. An animal that receives sound from two sonars, operating simultaneously, receives its maximum sound pressure level from one of the ships. Thus, the effects of the louder, or closer, sonar determine the probability of harassment, and the more distant sonar does not. If the distant sonar operated by itself, it would create a lesser effect on the animal, but in the presence of a more dominating sound, its effects are cancelled. When two sources are sufficiently close together, their sound fields within the cutoff range will partially overlap and the larger of the two sound fields at each point in that overlap cancel the weaker. If the distance between sources is twice as large as the range to cutoff, there will be no overlap.

Computation of the overlap between sound fields requires the precise locations and number of the source ships. The general modeling scenarios of the SOCAL Range Complex do not have these parameters, so the effect was modeled using an average ship distance, 20 km, and an average number of ships per exercise. The number of ships per exercise varied based on the type of exercise, as given in Table 3-6 below.

Table 3-6. Average Number of 53C-Transmitting Ships in the SOCAL Exercise Types

Action	Average number of SQS-53C-transmitting ships
IAC	3
Major Exercise	2
Sustainment Exercise	2
ULT	1.5

The formation of ships in any of the above exercised has been determined by Navy planners. The ships are located in a straight line, perpendicular to the direction has traveled. Figures 3-19 and 3-20 below show examples with four ships, and their ship tracks.

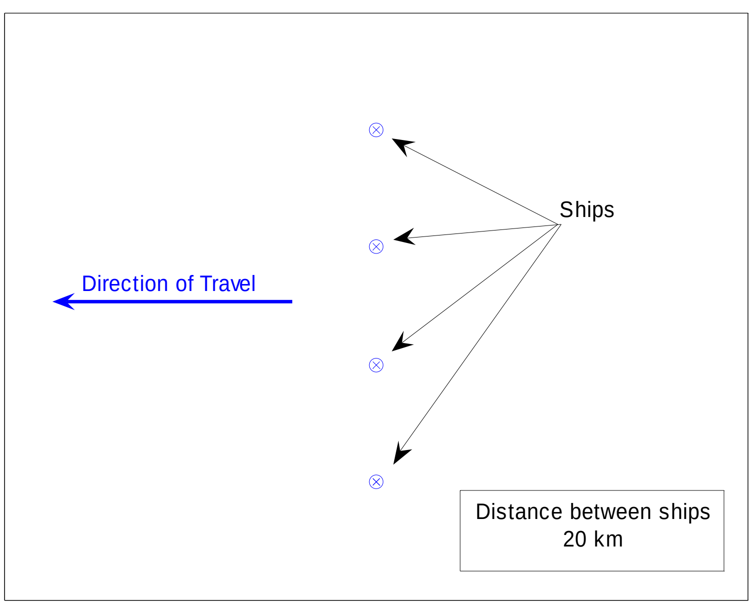


Figure 3-19. Formation and Bearing of Ships in 4-Ship Example

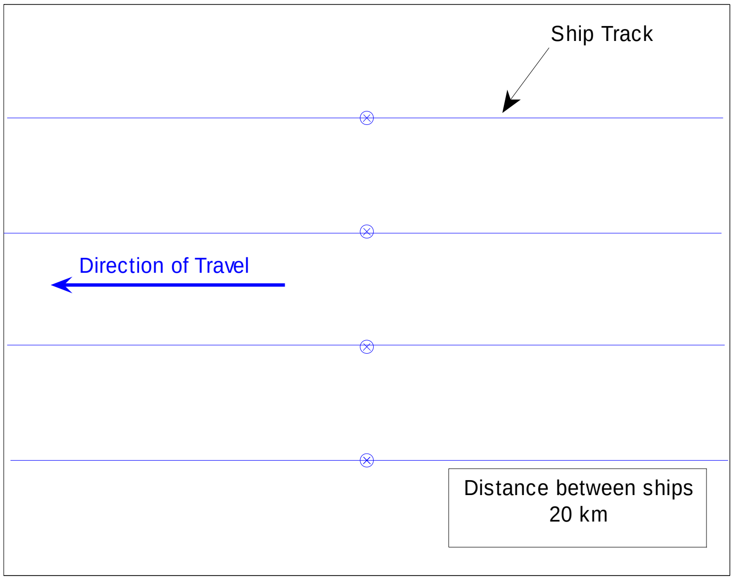


Figure 3-20. Ship Tracks of Ships in 4-Ship Example

The sound field created by these ships, which transmit sonar continually as they travel will be uniform in the direction of travel (or the "x" direction), and vary by distance from the ship track in the direction perpendicular to the direction of travel (or the "y" direction) (see Figure 3-21).

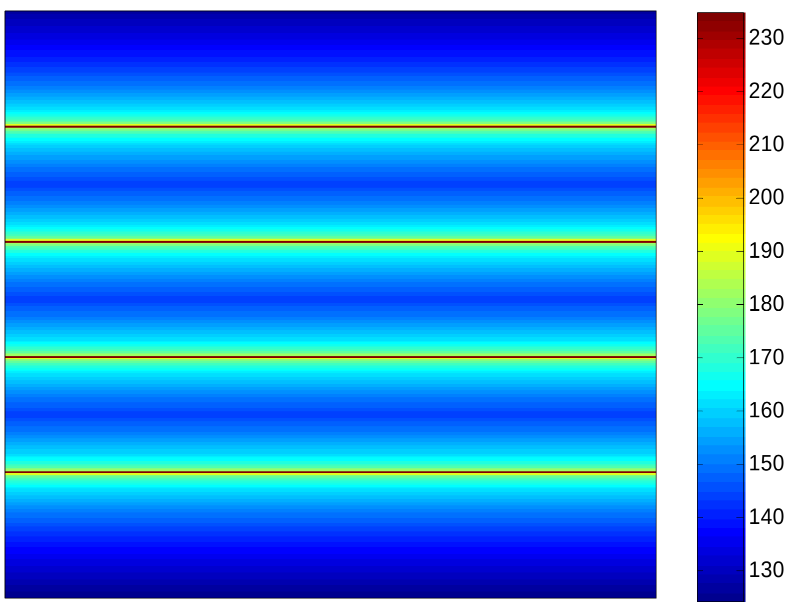


Figure 3-21. Sound Field Produced by Multiple Ships

This sound field of the four ships operating together ensonifies less area than four ships operating individually. However, because at the time of modeling, even the average number of ships and mean distances between them were unknown, a post-calculation correction should be applied.

Referring to the above picture of the sound field around the ship tracks, the portion above the upper-most ship track, and the portion below the lower-most ship track sum to produce exactly the sound field as an individual ship (see Figure 3-22).

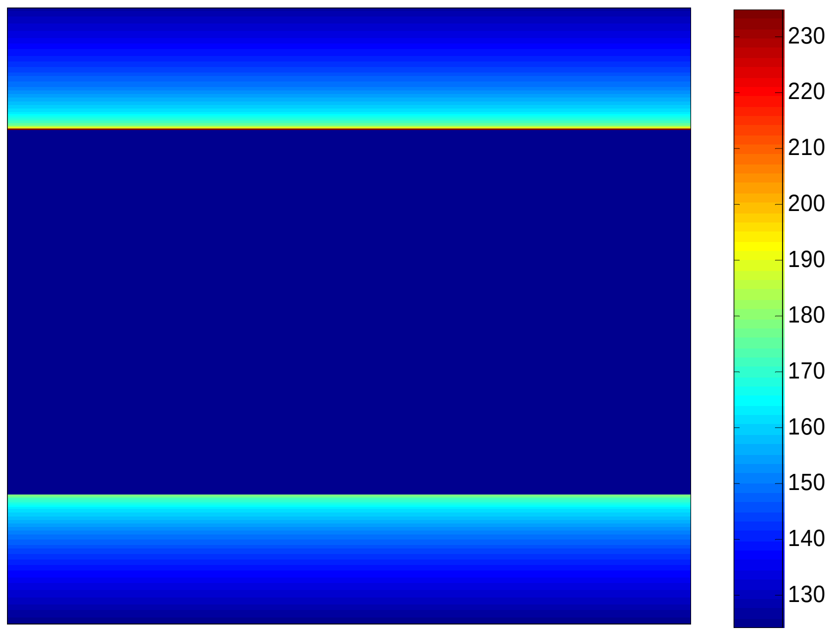


Figure 3-22. Upper and Lower Portion of Sound Field

Therefore, the remaining portion of the sound field, between the uppermost ship track and the lowermost ship track, is the contribution of the three additional ships (see Figure 3-23).

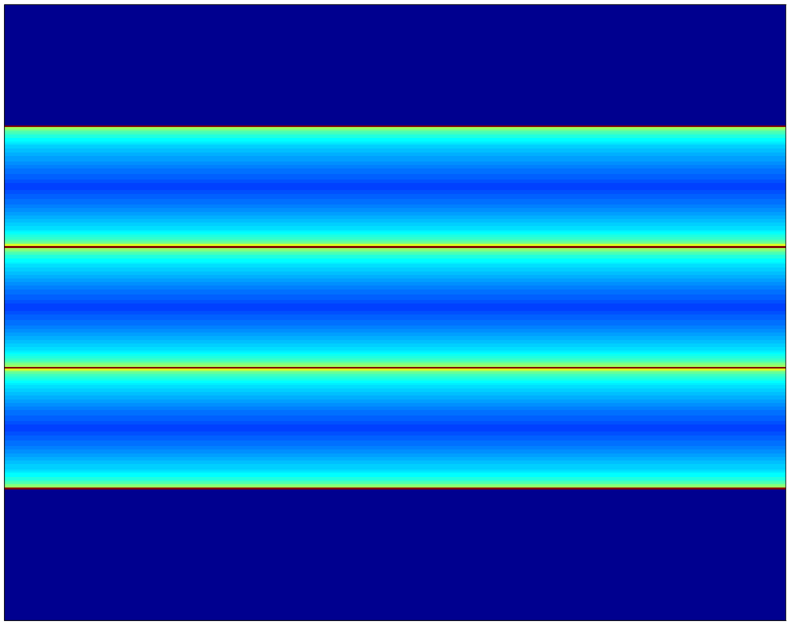


Figure 3-23. Central Portion of Sound Field

This remaining sound field is made up of three bands. Each of the three additional ships contributes one band to the sound field. Each band is somewhat less than the contribution of the individual ship because its sound is overcome by the nearer source at the center of the band. Since each ship maintains 20 kilometer distance between it and the next, the height of these bands is 20 km, and the sound from each side projects 10 kilometers before it is overcome by the source on the other side of the band. Thus, the contribution to a sound field for an additional ship is identical to that produced by an individual ship whose sound path is obstructed at 10 kilometers. The work in the previous discussion on land shadow provides a calculation of effect reduction for obstructed sound at each range. An AQS-53C-transmitting ship with obstructed signal at 10 kilometers causes 95% of the number of harassments as a ship with an unobstructed signal. Therefore, each additional ship causes 0.91 times the harassments of the individual ship. Applying this factor to the four exercise types from the above table, an adjustment from the results for a single ship can be applied to predict the effects of multiple ships as presented in Table 3-7.

Table 3-7. Adjustment Factors for Multiple Ships in SOCAL Exercise Types

Action	Average number of SQS-53C-transmitting ships	Adjustment factor from individual ship for formation and distance
IAC	3	2.9
Major Exercise	2	1.95
Sustainment Exercise	2	1.95
ULT	1.5	1.47

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