The study area is located within the Southern California Bight (SCB), an oceanic region bounded landward by the coast and seaward by the continental slope (Patton Escarpment). For the purposes of the Restoration Plan, the SCB is defined as the area between Point Conception (north), Cabo Colonet, located south of Ensenada, Mexico (south), outside of the Cortez and Tanner Banks (west), and coastal watersheds (east). The study area extends from Point Dume to Dana Point along the coast and includes the California Channel Islands and those Baja California Pacific Islands that lie within the SCB. To facilitate National Environmental Policy Act (NEPA) analysis and descriptions, the United States portion of the study area has been divided into three subareas: coastal, the Northern Channel Islands, and the Southern Channel Islands (Figure 3.0-1).

The coastal subarea has been further divided into the following six reaches:

- Coastal Reach 1: Pont Dume to Pacific Palisades
- Coastal Reach 2: Pacific Palisades to Palos Verdes Estates
- Coastal Reach 3: Palos Verdes Estates to Cabrillo Beach
- Coastal Reach 4: Cabrillo Beach to Orange County jurisdictional boundary
- Coastal Reach 5: Orange County jurisdictional boundary to Corona del Mar
- Coastal Reach 6: Corona del Mar to Dana Point

The two subareas of the Channel Islands are separated geographically and geologically, which can also relate to species distribution patterns. The Northern Channel Islands subarea includes four islands: San Miguel, Santa Rosa, Santa Cruz, and Anacapa.

The Southern Channel Islands subarea also includes four islands: Santa Barbara, San Nicolas, Santa Catalina, and San Clemente.

Management and ownership of the Channel Island falls under the jurisdictions of the Channel Islands National Park, the Channel Islands National Marine Sanctuary, the U.S. Navy, the Catalina Island Conservancy, and The Nature Conservancy. Land use, including management, is described in Section 3.5.

The following subsections summarize existing conditions according to major resource categories, including geology and earth resources (Section 3.1), oceanographic and coastal processes (Section 3.2), watershed and coastal water quality (Section 3.3), biological resources (Section 3.4), land use and recreation (Section 3.5), aesthetics and visual resources (Section 3.6), transportation (Section 3.7), air quality (Section 3.8), noise (Section 3.9), cultural resources (Section 3.10), and socioeconomics (Section 3.11).

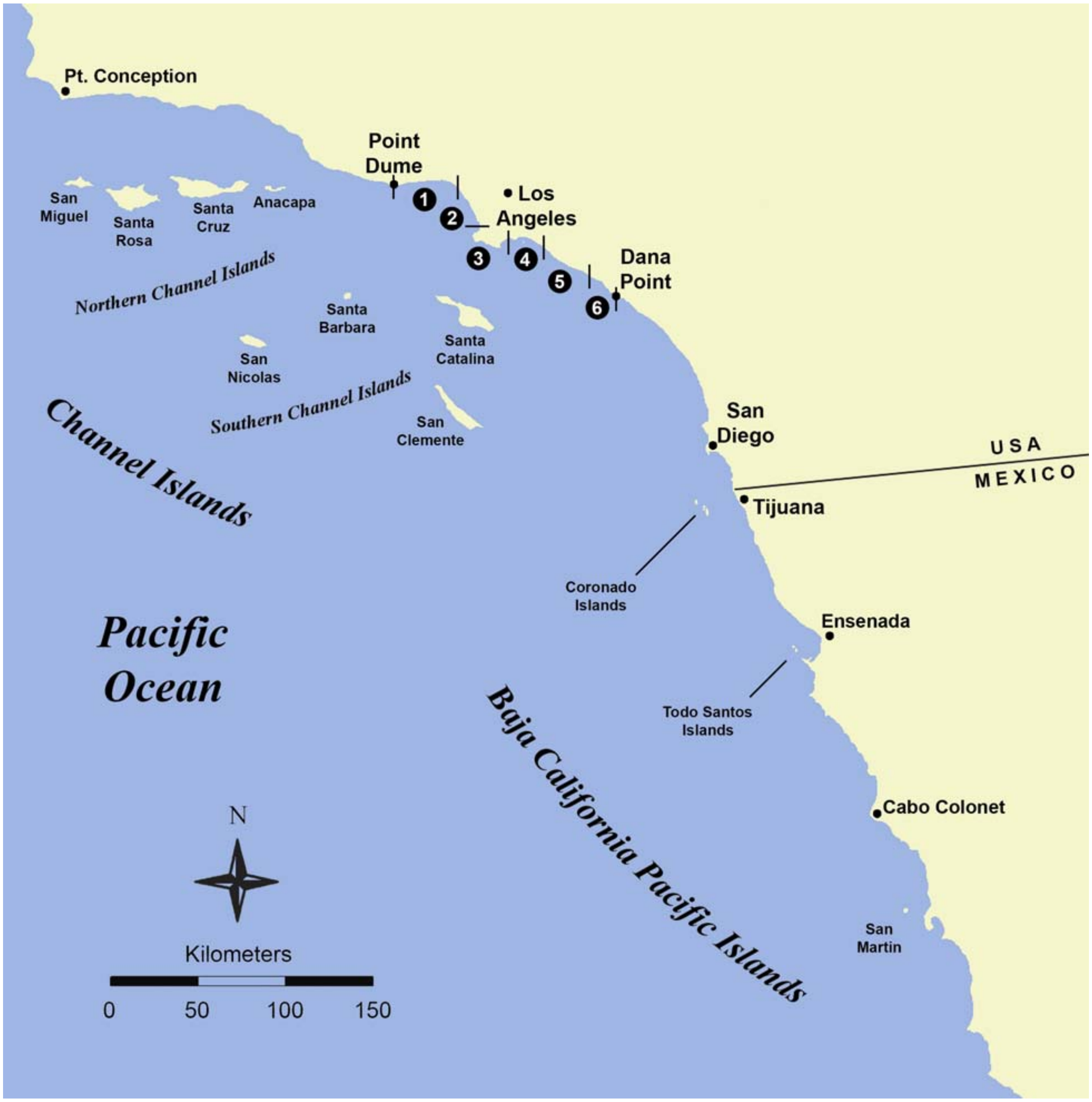


Figure 3.0-1. Study area for the Montrose Settlements Restoration Program with coastal and island subareas.

3.1 GEOLOGY AND EARTH RESOURCES

The study area consists of low lying coastal areas backed by uplifted mountain ranges and uplifted islands offshore (Figure 3.1-1). The shorelines of the coastal mainland are characterized by uplifted marine terraces, coastal bluffs, and “drowned” alluvial plains. The most extensive marine terraces within the study area are exposed along the sides of the Palos Verdes Hills and at Dana Point (California Coastal Commission 1987). The geology of the Channel Islands is predominantly of igneous and sedimentary origin (Thorne 1967, Schaffer 1993), and marine terraces occur along the coasts of these islands.

Three major geomorphic features occur in the marine environment within the Southern California Bight: the Santa Barbara Basin, and the Inner and Outer Borderlands (Dailey et al. 1993). These features include canyons, ridges, and basins defined by unique patterns of seismicity, fault types, sea floor topography, and bottom sediments (Figure 3.1-2). The Santa Barbara Basin is north of the study area. The study area includes the Inner Borderlands and shelf of the Outer Borderlands around the Channel Islands to depths of 200 meters (656 feet) in both areas.

3.1.1 Bathymetry and Topography

The shoreline topography and offshore bathymetry along the coastal reaches of the study area are shown in Figure 3.1-3. Elevations range from sea level along the coast to 451 meters (1,480 feet) in the Palos Verdes Hills. The width of the shelf along the coast varies from 1.9 kilometers (1.2 miles) to 22 kilometers (13.7 miles) and includes several marine canyons that intercept the shelf and slope. The nearshore portion of the study area consists geographically of Santa Monica Bay, Palos Verdes Shelf, San Pedro Bay, and the open coastal waters off Orange County.

Santa Monica Bay is characterized by a gently sloping continental shelf that extends to the shelf break at a water depth of approximately 80 meters (265 feet). At the break, the seafloor becomes steep along the slope but then flattens into the deep Santa Monica Basin in approximately 800 meters (2,630 feet) of water (Terry et al. 1956, SMBRP 1994). The Dume, Santa Monica, and Redondo Canyons bisect Santa Monica Bay.

The Palos Verdes Shelf is narrow and extends offshore to approximately 75 meters (245 feet) of water. The shelf ranges in width from 1.9 to 7.4 kilometers (1.2 to 4.6 miles). Features of the shelf and bathymetry in the vicinity of the Los Angeles County Sanitation Districts’ Joint Water Pollution Control Plant (JWPCP) outfalls offshore of White Point are shown in Figure 3.1-4.

San Pedro Bay consists primarily of the Los Angeles/Long Beach Harbor complex and a relatively flat, wide shelf offshore. The development of the ports has involved a series of dredge-and-fill operations to deepen channels to accommodate deep-draft vessels and to provide fill for additional land areas for terminal development. Typical water depth in the outer harbor is approximately 15 meters (50 feet).

Relatively regular bathymetric features typical of open coasts characterize the coastal region adjacent to Orange County. Newport Canyon bisects the shelf offshore of Newport Bay. The shelf narrows downcoast of the canyon, and the nearshore bathymetry is largely shore-parallel along this reach of the SCB.

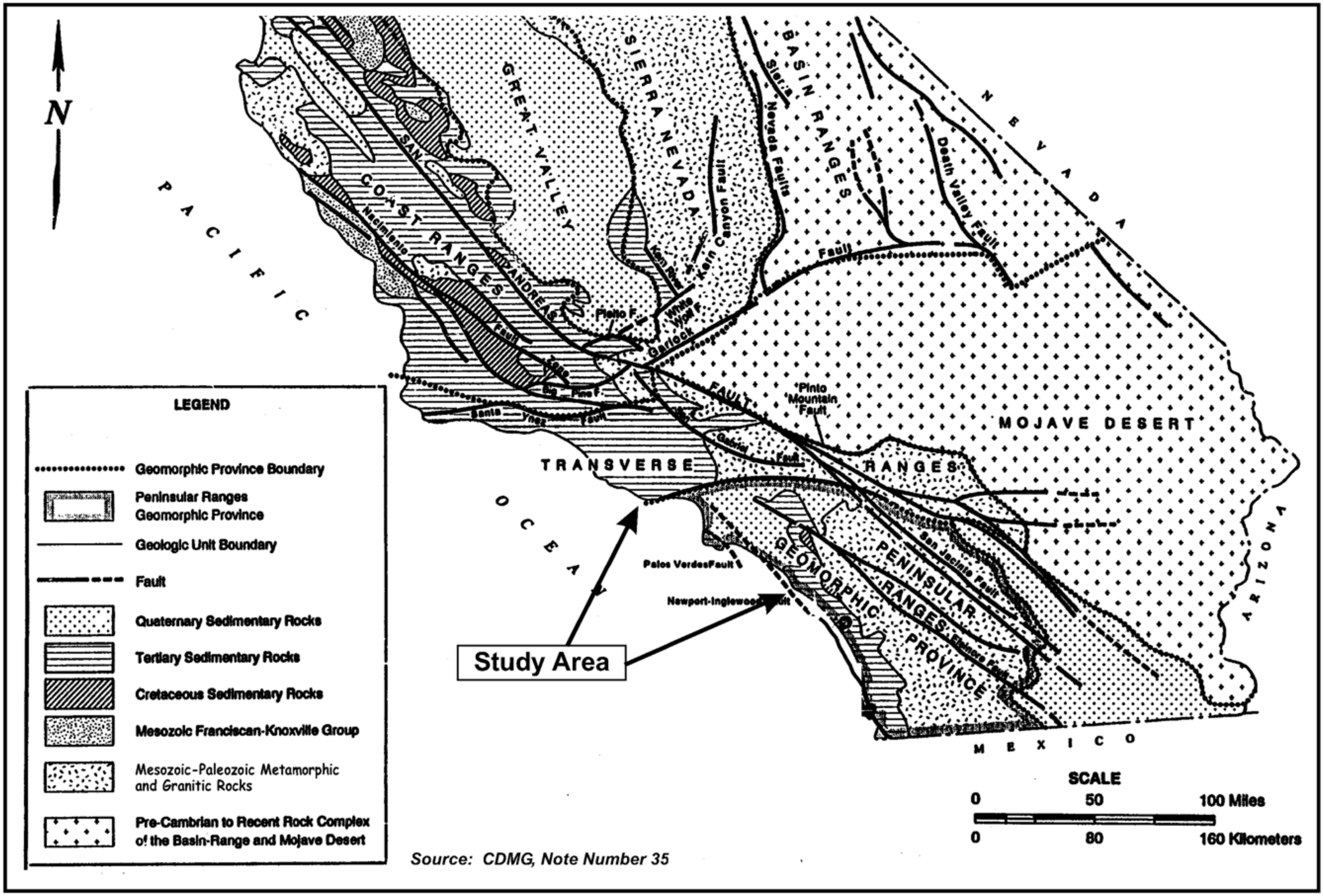


Figure 3.1-1. Geomorphic setting of the region.

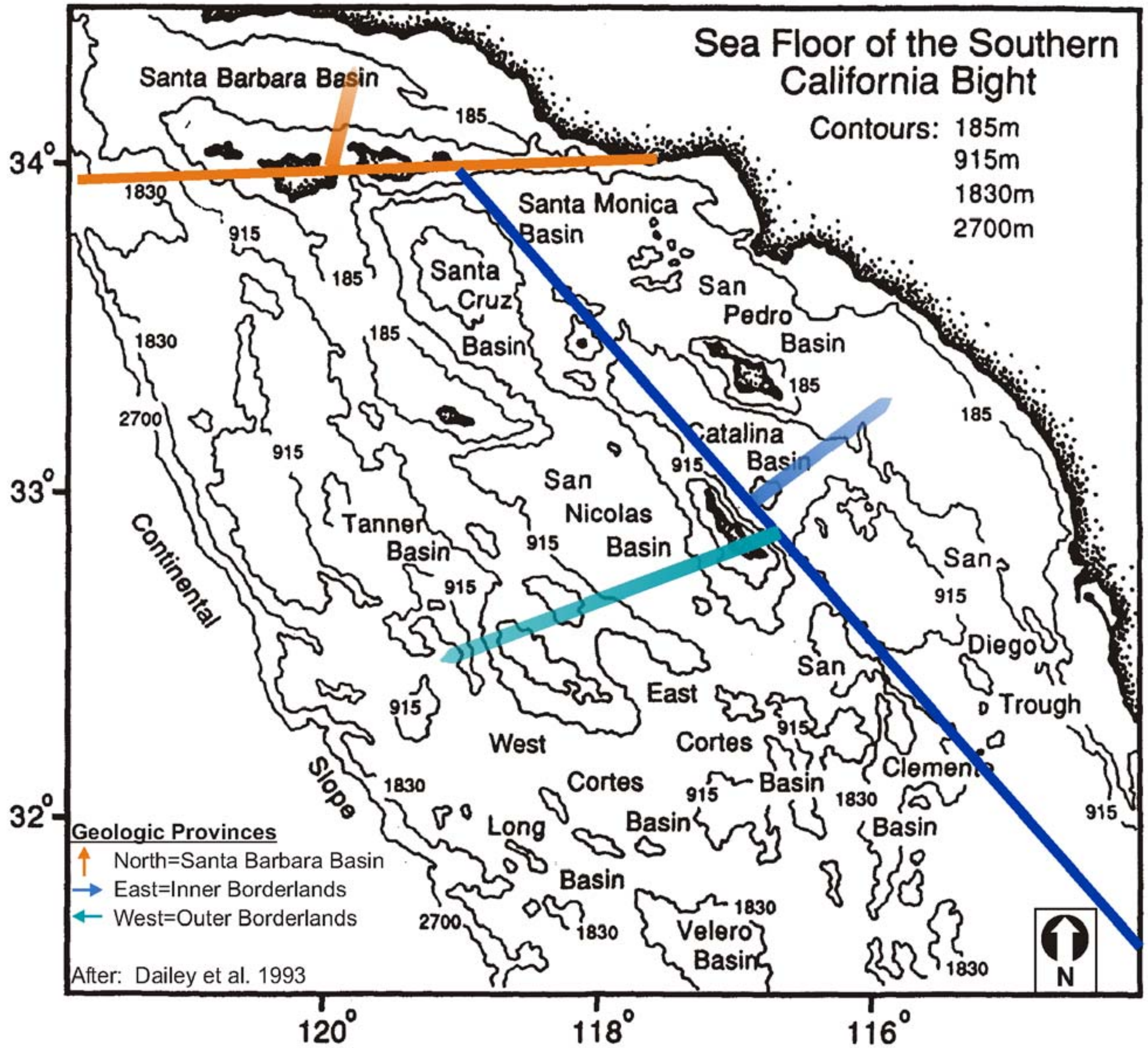


Figure 3.1-2. Major geologic provinces and seafloor characteristics of the Southern California Bight.

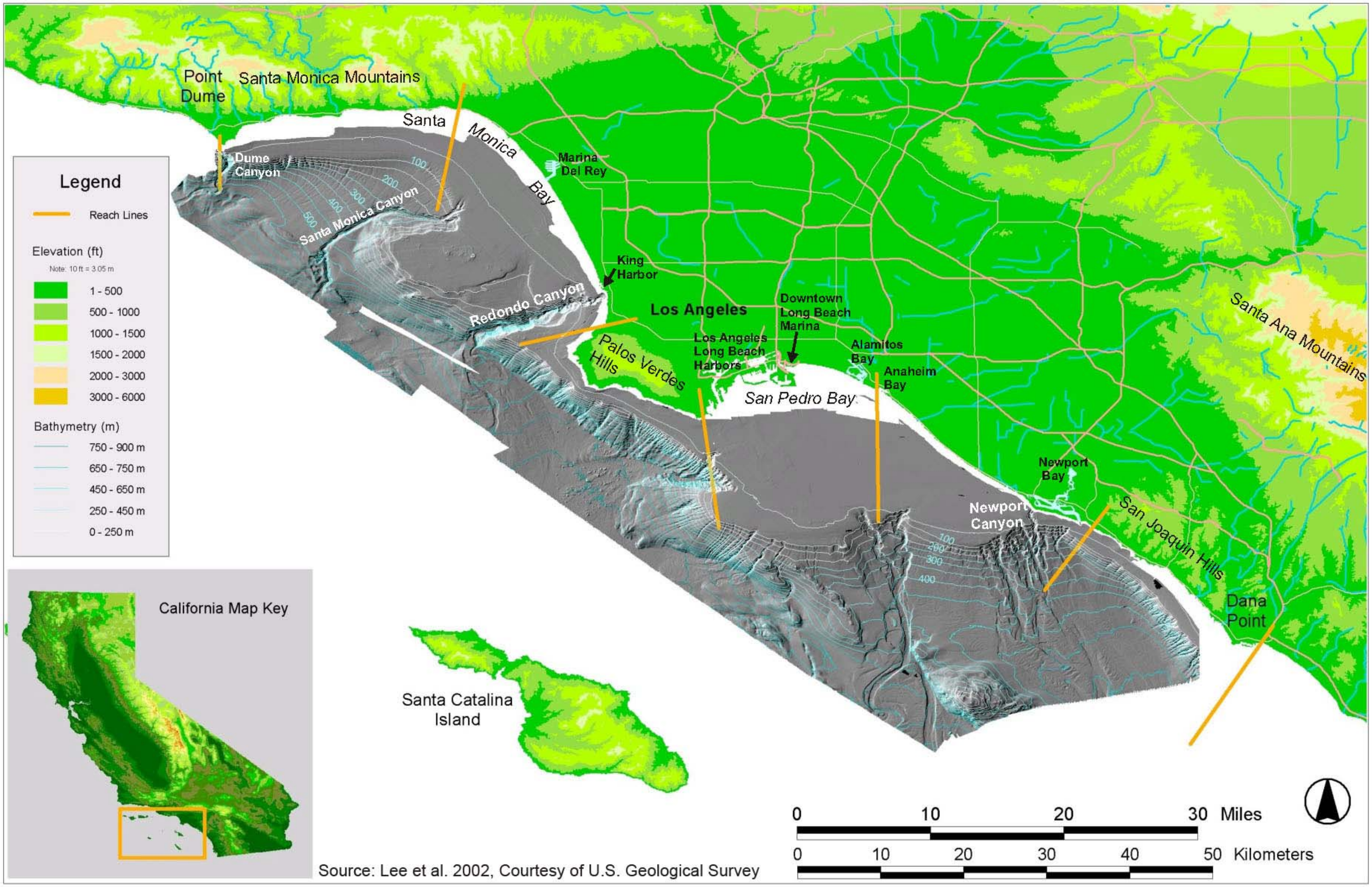


Figure 3.1-3. Elevation and bathymetry along the coastline from Point Dume to Dana Point.

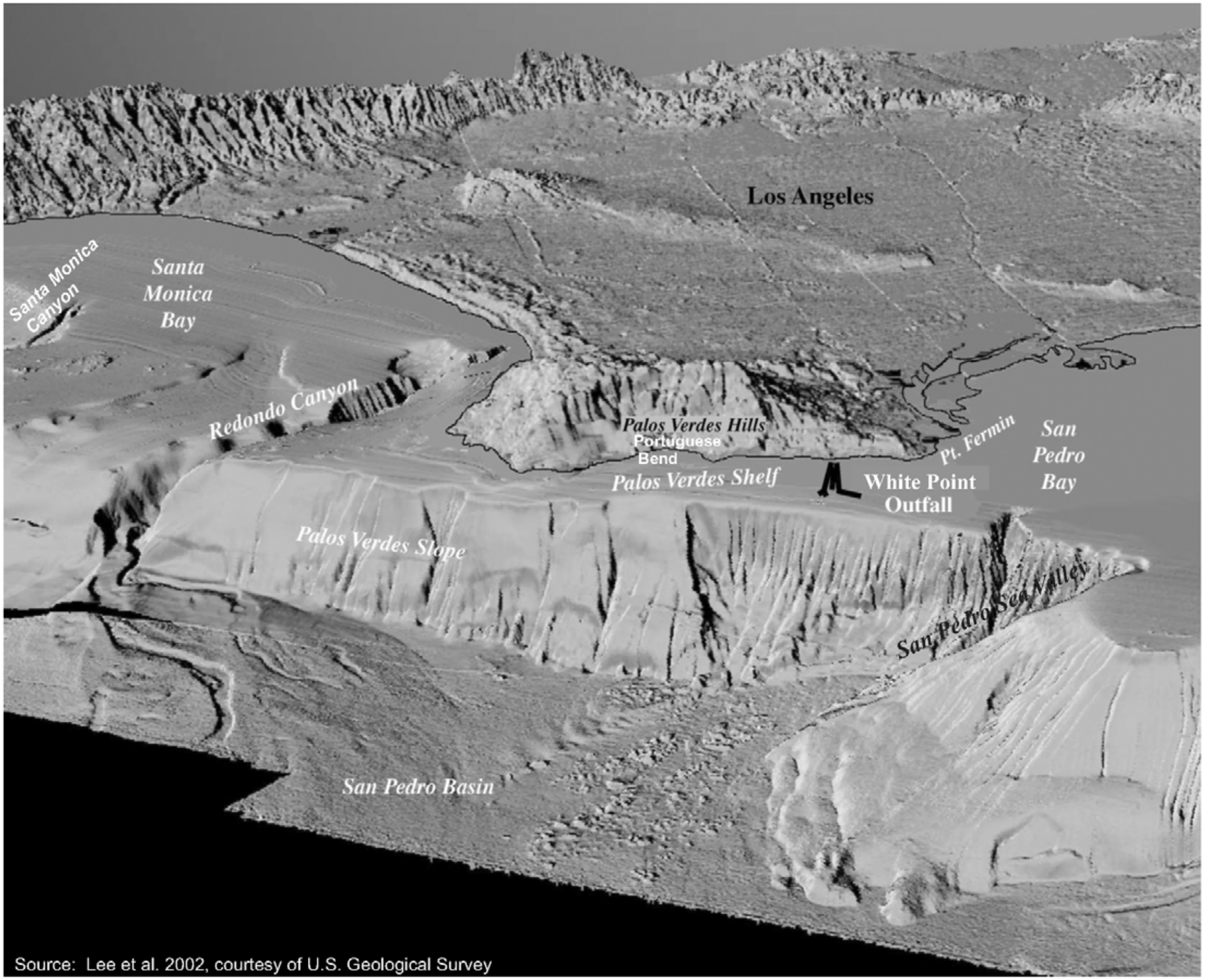


Figure 3.1-4. Oblique view of the Palos Verdes Shelf and slope based on multi-beam bathymetry.

The total land area of the Channel Islands is about 87,102 hectares (215,227 acres), with Santa Cruz being the largest island and Santa Barbara the smallest of the archipelago. Elevations range from sea level to the highest peak at Picacho Diablo on Santa Cruz Island, with an elevation of 747 meters (2,450 feet) (CINMS 2000).

The bathymetry of the Channel Islands forms a relatively wide shelf around San Miguel, San Nicolas, Santa Barbara, and Santa Rosa Islands (Figure 3.1-5). Anacapa and Santa Cruz Islands have a wider shelf on the north than the south sides of the islands. San Clemente and Santa Catalina Islands have relatively narrow shelves. The shelves drop off into basins adjacent to the islands (see Figure 3.1-5).

3.1.2 Shoreline Characteristics and Marine Sediments

Shorelines within the study area were classified into six summary categories: rocky shores, gravel beaches, riprap, sandy beaches, wetlands, and areas with artificial structures (e.g., wharves, piers, or seawalls). These categories, which are based on the California Department of Fish and Game (CDFG) and National Oceanic and Atmospheric Administration (NOAA) Environmental Sensitivity Index Geographical Information System (GIS) database, include shorelines along the seacoast as well as those associated with wetlands, bays, and harbors. Table 3.1-1 summarizes the highest elevation (above mean sea level) and the characteristics of the shorelines within each coastal reach of the study area. In general, shorelines bordered by mountains have rocky shores, shorelines bordered by coastal plains are mostly sandy beaches, and bays and harbors have extensive artificial substrates along their shorelines.

Table 3.1-1
Coastal Shore Elevation and Shoreline Types Within the Coastal Reaches of the Study Area

	COASTAL REACH					
	Reach 1	**Reach 2**	**Reach 3**	**Reach 4**	**Reach 5**	**Reach 6**
Elevation (meters)	427	122	427	61	91	244
Elevation (feet)	1,400	400	1,400	200	300	800
Shoreline Type (%)						
Artificial structure	0	23	0	65	43	10
Gravel beach	0	0	37	0	0	3
Riprap	28	27	1	28	11	22
Rocky shore	20	0	55	0	0	30
Sandy beach	49	46	7	6	15	35
Wetlands	2	4	0	1	30	0

Note: Calculated by MEC Analytical Systems, Inc., for NOAA from Environmental Sensitivity Index GIS data (NOAA and CDFG 2000).

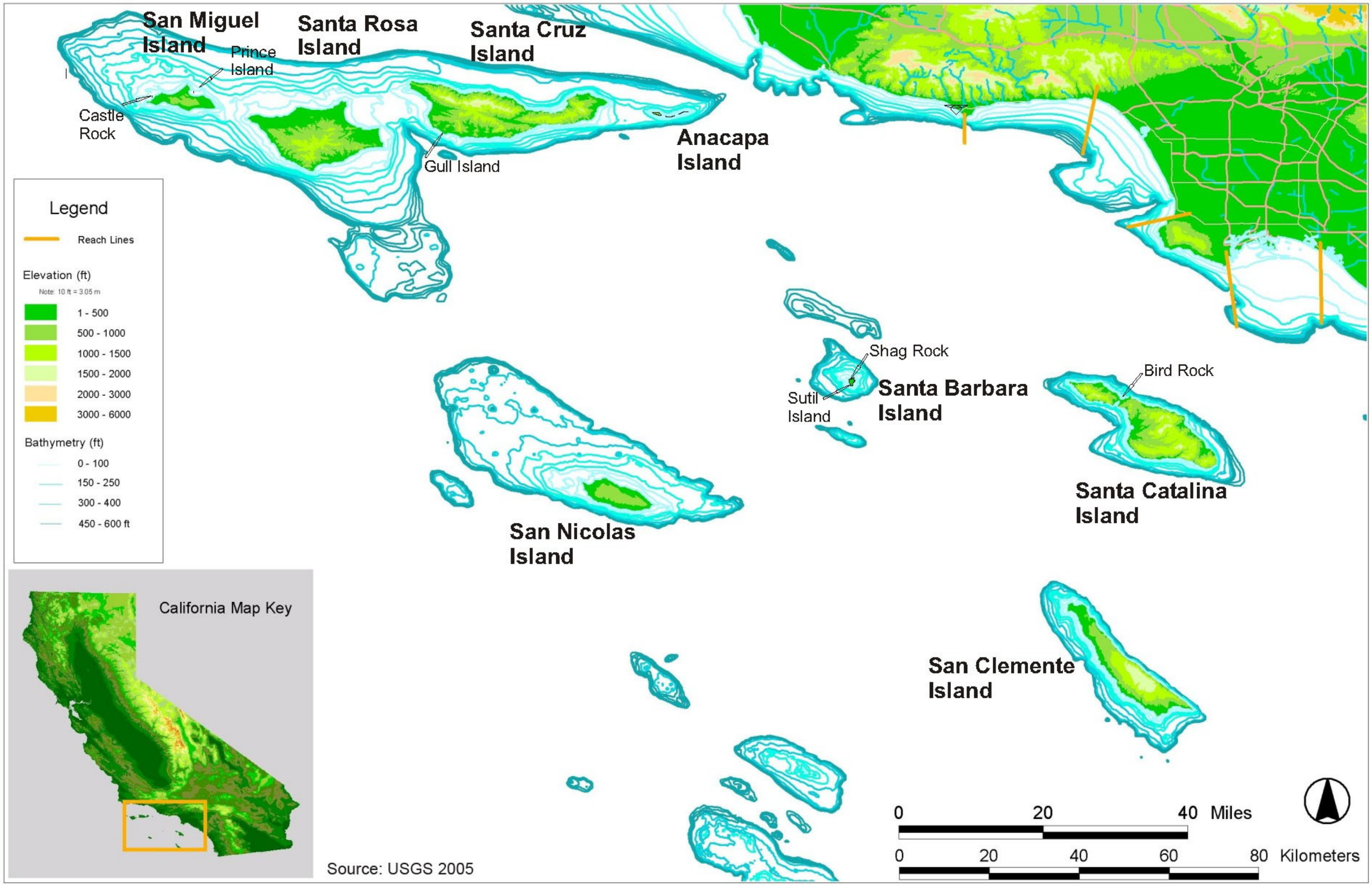


Figure 3.1-5. Elevation and bathymetry for Channel Islands.

Two primary types of sedimentary environments occur within the study area: soft-bottom and hard substrate. Soft-bottom areas range from sands to muds. Hard substrate includes gravel, cobbles, boulders, and exposed bedrock. Figure 3.1-6 illustrates seafloor characteristics based on backscatter soundings measured by the U.S. Geological Survey (Edwards et al. 2003). Human-made hard-bottom areas (e.g., the Hyperion and County Sanitation Districts of Orange County wastewater outfall pipelines and their associated rock ballast) are included in the figure.

Sediments of the inner shelf are usually coarse and fine sands, whereas those of the outer shelf tend to be silts and clays with localized intrusions of differing sediments (Thompson et al. 1993). Sources of sediment include coast bluff erosion, runoff from rivers and creeks, runoff through storm drains, and suspended solids discharged from wastewater treatment outfalls. The discharge of solids has decreased dramatically over the past 18 years with improvements to wastewater treatment (SCCWRP 1993).

Anthropogenic sources of sediment have included pollutants from wastewater outfalls and non-point source runoff from storm drains and rivers. Recent sediments include clay mineral and sand particles that are mixed with organic, chemical, and metal pollutants (Connolly and Glasser 2002). Sediments containing pollutants occur in Coastal Reaches 2 and 3:

- Coastal Reach 2: Anthropogenic sediments occur on the shelf in Santa Monica Bay; these sediments have been estimated to range in thickness from a few centimeters to 60 centimeters (24 inches) (Edwards et al. 2003).
- Coastal Reach 3: Effluent-affected sediments occur on the Palos Verdes Shelf northwest and offshore of the JWPCP outfall off of White Point (LACSD 2002). The size of the deposit is estimated to be more than 40 square kilometers (15 square miles). Within this deposit, concentrations of p,p’-DDE range up to several hundred parts per million (ppm), and concentrations of PCBs are as high as 15 ppm (LACSD 2002, Lee et al. 2002).

Many of the shores of the Channel Islands are characterized by rugged sea cliffs, waterfalls, stream canyons, and sea caves (NPS and Channel Islands National Park 2002). Shoreline platforms of wave-cut terraces with rocky or gravel beaches predominate; however, a few sandy beaches occur on most of the islands (Table 3.1-2). Rocky reefs extend offshore of much of the shorelines of the islands.

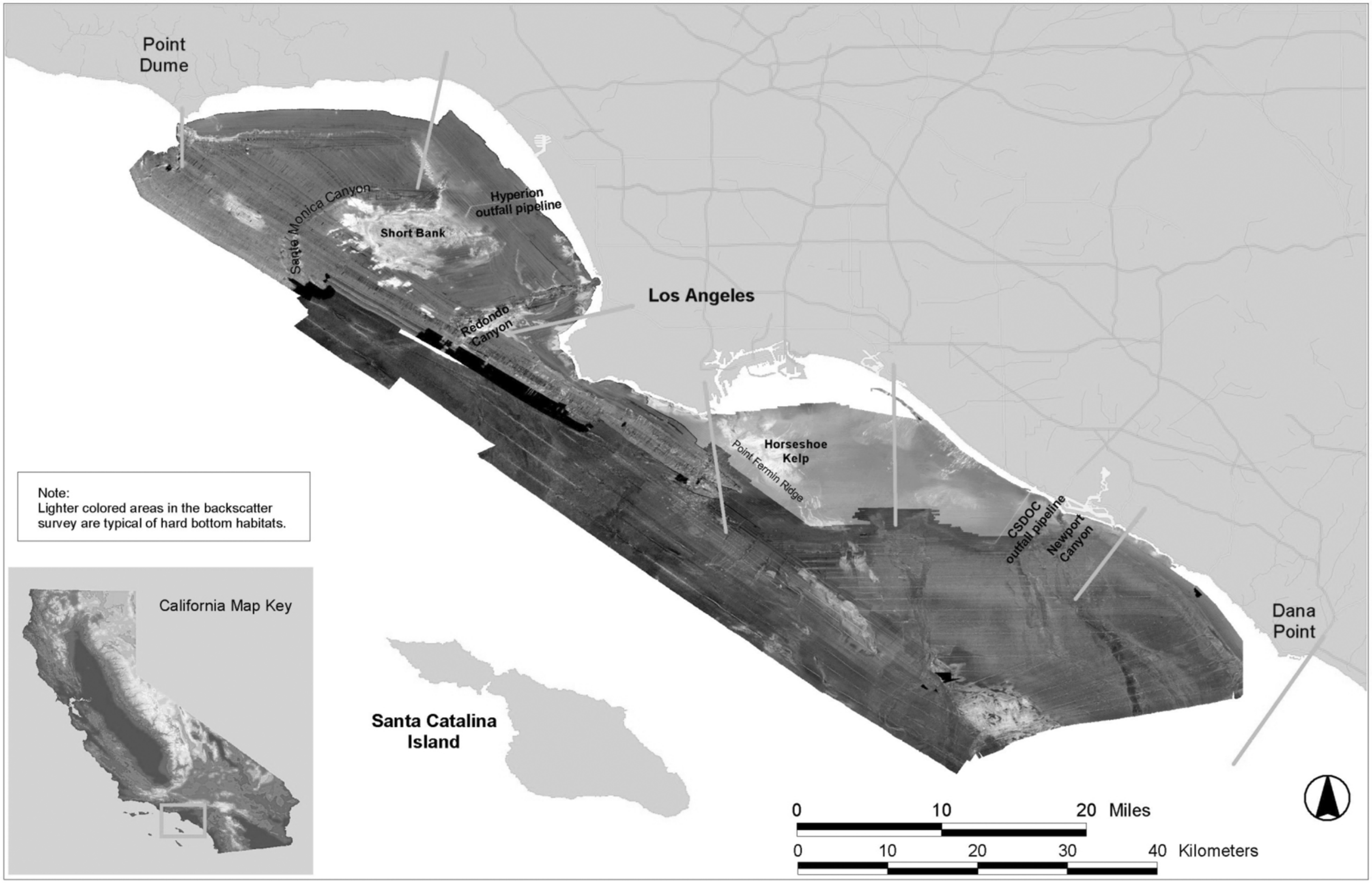


Figure 3.1-6. Multibeam backscatter image of seafloor characteristics along the coastline from Point Dume to Dana Point.

(Modified from Edwards et al. 2003.)

Table 3.1-2
Elevation, Size, and Shoreline Types for Channel Islands

	Island							
	San Miguel	**Santa Rosa**	**Santa Cruz**	**Anacapa**	**Santa Barbara**	**San Nicolas**	**Santa Catalina**	**San Clemente**
Elevation (meters)	252	483	742	283	194	277	648	599
Elevation (feet)	831	1584	2434	930	635	910	2125	1965
Area (hectares)	3,841	21,470	25,080	298	261	644	19,400	14,500
Area (acres)	9,491	53,051	61,972	737	644	1,591	47,937	35,830
Shoreline Type (%)								
Artificial structures	0	0	0	0	0	0	1	0
Gravel beach	0	1	9	13	10	6	45	35
Riprap	0	0	0	0	0	1	2	0
Rocky shore	69	63	71	86	88	59	41	58
Sand beach	31	35	20	1	2	34	10	6
Wetlands	0	1	0	0	0	0	0	0

Sources: NPS 1999, Power 1980.

3.1.3 Seismology

Several major faults occur within the study area (Figure 3.1-7), including well-known faults such as the San Andreas, Elsinore, and Whittier. However, less-known faults off the coast and along the shoreline are more likely to affect the SCB than well-known faults. Unmapped blind-thrust faults also represent an undefined potential hazard to the SCB (Simila 1993). Within the SCB, the Santa Barbara Channel Region, with its associated coast and islands, has been the most seismically active area off the shore of Southern California in the past 100 years. The San Pedro Basin, east of Catalina Island, has a moderate level of seismicity. The San Nicolas Basin has a low level of seismicity (Simila 1993).

The highest seismic gravity ratings occur along the Northern Channel Islands and along Coastal Reach 1. This hazard rating indicates that these areas are likely to experience earthquakes of significant magnitude between five and six times per century. Coastal Reaches 2 through 5 have moderate seismic gravity ratings with significant earthquakes predicted once per century. Coastal Reach 6 and Santa Catalina Island are predicted to have significant earthquakes on the order of once every 200 years. The seismic hazard rating is once per 300 years for the other Southern Channel Islands. However, the San Clemente fault zone is considered to be active and potentially hazardous (Reynolds 2003).

3.1.4 Liquefaction

Soil type is an important factor in determining earthquake hazard. Unconsolidated sediments, such as those that lie on the shelf regions of the Santa Monica and San Pedro Bays, may experience liquefaction (SCEC 1996). These marine soils are already saturated and when exposed to strong shaking may flow along a gradient (Kramer 1996). Seismic hazard zones associated with liquefaction also occur in areas of unconsolidated sediment along the shoreline, drainages, creeks, coastal lagoons, and embayments. Areas of greatest hazard include Malibu Lagoon, Marina Del Rey, and King Harbor within Coastal Reaches 1 and 2, Los Angeles/Long Beach Harbor and Alamitos Bay in Coastal Reach 4, Anaheim Bay, Huntington Harbor, Bolsa Chica wetlands, and Newport Bay in Coastal Reach 5, and creek drainages and Dana Point Harbor in Coastal Reach 6 (SCEC 1996).

3.1.5 Landslides

Pacific Palisades in Coastal Reach 2 is a well-known landslide area. Similarly, Portuguese Bend and Royal Palms on the Palos Verdes Peninsula are known landslide locations. Landslide materials represent a major source of sediments to the shelf. It has been estimated that landslide-derived sediments on the Palos Verdes Shelf range from 5.7 and 9.4 million metric tons (6.3 to 10.4 million U.S. tons) (Kayen et al. 2002). Mineralogical data indicate that at least 2.7 million metric tons (3 million U.S. tons) of landslide-derived sediment has mixed with the mid- and outer-shelf effluent-affected sediment layer off the Palos Verdes Peninsula (Kayen et al. 2002).

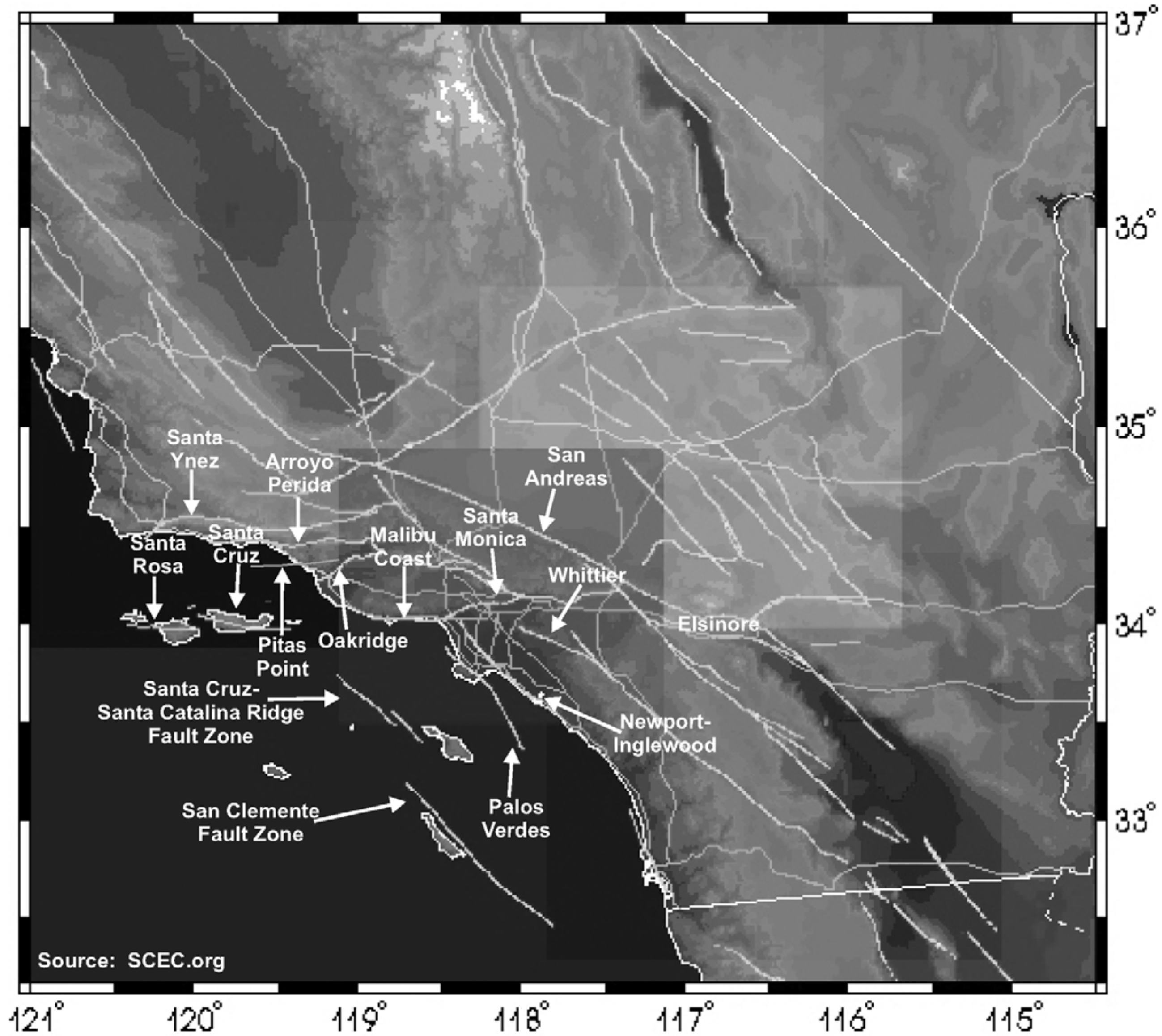


Figure 3.1-7. Major faults within the study area.

3.2 OCEANOGRAPHIC AND COASTAL PROCESSES

3.2.1 Currents and Tides

The California Current is a broad, equator-ward flow that brings cold water from the Gulf of Alaska down the coast along the seaward boundary of the SCB and turns shoreward near the U.S.-Mexico border (Hickey 1993). A branch of the California Current turns pole-ward into the SCB, where it is known as the Southern California Countercurrent. This countercurrent moves warm water from Southern California northwestward up the coast. This countercurrent is strongest in summer and fall when it can be eddy-like (Southern California Eddy) and rejoin the California Current, and in winter when pole-ward flow north can be continuous; during the spring this countercurrent appears to be absent.

The California Undercurrent, which flows approximately 240 to 270 meters (800 to 900 feet) below water surface with relatively high temperature and salinity, moves pole-ward over the continental slope; this undercurrent is the strongest during the summer. The undercurrent surfaces north of Point Conception during the fall and winter and is known then as the Davidson Current.

The California Current moves closer to shore during spring and away from shore during summer, which results in a predominantly equator-ward flow during summer and pole-ward flow during winter within the SCB (DiGiacomo and Holt 2003, Jackson 1986). No obvious seasonal structure has been observed in the flow (Noble et al. 2002).

Tides within the SCB are of a mixed, semidiurnal type consisting of two unequal high tides and two unequal low tides within a tidal period of 24 hours and 50 minutes. Table 3.2-1 shows the tide datums relative to mean lower low water (MLLW) based on data recorded at the NOAA tide station in Los Angeles Outer Harbor. These data show that the tides in San Pedro Bay have a tidal range of approximately 1.7 meters (5.5 feet) and a mean tidal level of approximately 0.9 meter (2.9 feet) MLLW. The tidal range and datums within the SCB vary slightly from those recorded in San Pedro Bay as a result of interactions with landforms.

Table 3.2-1
Tide Datums

Tide	Elevation (meters, MLLW)
Highest observed water level	2.43
Mean higher high water	1.68
Mean high water	1.45
Mean tide level	0.87
Mean low water	0.29
Mean lower low water	0.00
Lowest observed water level	-0.79

3.2.2 Wave Characteristics

The wave climate within the SCB is affected by the presence of numerous offshore islands, shallow banks, and coastal submarine canyons that partially shelter the coastline from deep ocean surface waves. The wave pattern within the SCB is thus spatially complex due to the reflection, refraction, diffraction, and dissipation of the incident deep ocean waves.

Wave climate within the SCB is composed of waves generated by extratropical storms, tropical storms, and southern hemisphere extratropical storms. Prefrontal winds and local winds also generate waves of shorter periods within the region.

Extratropical storm waves approach the SCB primarily from the general west during northern hemisphere winters. Generated by North Pacific low-pressure systems developed along the polar front, the extratropical storm waves are the predominant wave component affecting the SCB during winters.

Tropical storm waves generated by tropical cyclones approach the SCB from the southeast off the Mexican coast during northern hemisphere summers. These storms occur approximately 15 to 20 times a year and affect the SCB when taking a southeasterly track. Sheltering afforded by offshore islands, such as San Clemente Island, tends to reduce the wave energy for portions of the nearshore SCB.

Southern hemisphere swell generated by large South Pacific storm systems during southern hemisphere winters approaches the SCB from a south-southwest window. However, the long travel distances of these waves result in the characteristically narrow frequency bands, which enhance the capacity of the waves to amplify nearshore.

Prefrontal seas generated by strong winds prior to frontal passages approach the coasts in the SCB from the southeast. Wave data indicate that wave conditions over the SCB are produced primarily by deepwater waves approaching the SCB (CDIP 2003). These data demonstrate the dissipation of wave energy by island and headland shadowing, diffraction, refraction, and dissipation. Although swell from the south is present, its energy is negligible compared with that from the northwest and therefore does not appear in the directional wave spectrum.

3.2.3 Sediment Transport

Sediment transport within the SCB consists of littoral drift in the nearshore and sedimentation on and near the shelves. Littoral drift is composed of sediment transport in and near the surf zone in longshore and cross-shore directions driven primarily by wave-induced currents. Sedimentation on the continental shelves is driven by a combination of surface gravity waves, internal waves, and subtidal currents.

Sediment transport in the nearshore is normally evaluated as a component in the sediment budget within a littoral cell. Sediment transport in the Santa Barbara littoral cell is driven by the predominantly westerly waves. The southerly waves are to a large extent sheltered by the Channel Islands. The longshore transport rate along the Santa Barbara littoral cell was estimated to be approximately 214,100 cubic meters/year (280,000 cubic yards/year) in an eastward direction (SWQCB 1965).

Longshore sediment transport in the Santa Monica littoral cell is marked by predominantly downcoast drift with occasional upcoast reversals as a result of seasonal variations in wave approach direction. The net longshore drift is downcoast (southward) at a rate of approximately 146,000 to 191,000 cubic meters/year (191,000 to 250,000 cubic yards/year) off Santa Monica Beach (DMJM 1984, Ingle 1966), 151,000 cubic meters/year (198,000 cubic yards/year) off Dockweiler Beach, and 167,000 cubic meters/year (219,000 cubic yards/year) off Manhattan

Beach and Hermosa Beach (Landrum-Brown 1996). Approximately 153,000 to 306,000 cubic meters/year (200,000 to 400,000 cubic yards/year) were estimated to be lost to Redondo Canyon from both up- and downcoast beaches (Gorsline 1958).

Sediment transport on the Palos Verdes Shelf is characterized by predominant northwestward fluxes along the shelf, with occasional southeastward reversals. Shelf sediment is typically resuspended by gravity waves from the seabed and transported by prevailing currents at the time of resuspension. The currents that carry the suspended sediment are generally independent of wave conditions (Wiberg et al. 2002) and can include the currents produced by internal waves and tidal processes (Jones et al. 2002). It was estimated that the frequency of significant resuspension and transport is approximately 10 events per year in 60 meters (200 feet) of water on the shelf and 3 events per year in 90 meters (300 feet) of water beyond the shelf break

Sediment movement in the San Pedro littoral cell is obstructed by the presence of the Los Angeles/Long Beach Harbor complex, which alters the wave conditions near the beaches. The longshore transport rate along Peninsula Beach was estimated at approximately 41,000 cubic meters/year (54,000 cubic yards/year) in an upcoast (toward northwest) direction (Morris 1998). Farther downcoast off of Seal Beach and the beaches of Orange County, longshore sediment transport occurs in both directions with net drift directed to the downcoast (southeast) direction. The longshore transport rate has been estimated to be approximately 211,000 cubic meters/year (276,000 cubic yards/year) off of Surfside-Sunset Beach, 86,000 cubic meters/year (112,000 cubic yards/year) at the Santa Ana River mouth, and 97,000 cubic meters/year (127,000 cubic yards/year) off Newport Beach (Hales 1980).

Sedimentation on the continental shelves within the SCB is characterized by resuspension of sediment by wave action and transport by subtidal currents. Transport of the resuspended sediment in the nearshore portions of the shelves mostly follows the subtidal currents, which are largely directed parallel to the isobaths. In the deeper portions of the shelves where internal waves occur (e.g., near the shelf break off Santa Monica Bay), sediment has been observed to transport offshore across the shelf breaks and deposit on the continental slopes (Lee et al. 2002).

3.2.4 ENSO Events

El Niño Southern Oscillation (ENSO) events are climatic phenomena characterized by decreases in atmospheric pressure in the eastern tropical Pacific Ocean and easterly trade winds, and an increase in sea level on the west coast of North and South America (Chelton and Davis 1982). During an ENSO event, the equator-ward California Current is weakened, and the warmer, low-salinity Equatorial Countercurrent moves pole-ward into the North Pacific Ocean. Within the SCB, the ENSO condition causes increases in seawater temperature by several degrees Celsius above normal (Dailey et al. 1993), increases in sea levels (Chelton and Davis 1982, Flick and Badan-Dangon 1989), and more vigorous winter storms with pole-ward coastal winds (Hickey 1993).

3.2.5 Upwelling

Upwelling is an oceanographic process in which offshore winds move the surface water away from shore and the deep, anaerobic, and nutrient-rich water rises to replace the displaced surface water. Strong wind-driven upwelling occurs in the SCB in winter and early spring, which causes modifications to water properties such as salinity and temperature distributions in the water column within the SCB. One of the most significant upwelling events occurs off Point Conception, where strong wind-driven upwelling sends upwelled water into the Santa Barbara Channel and basins south of the Channel Islands, resulting in significant modification of water properties in the upper water columns in these regions (Hickey 1993, Atkinson et al. 1986).

3.3 WATERSHED AND COASTAL WATER QUALITY

The six coastal reaches within the study area of this project represent a large portion of the SCB. Watersheds in this area are diverse, ranging from large river systems, such as the Los Angeles and San Gabriel Rivers, to small, coastal streams. Most of the rivers and streams in these watersheds drain urbanized areas as they approach the coast, which impacts water quality along the coast. However, a few systems support diverse aquatic habitats and wildlife. Coastal features within the study area include bays, harbors, estuaries, wetlands, beaches, and open ocean. Several coastal wetlands are also found in the study area, including large wetlands such as Anaheim Bay, Upper Newport Bay, and the Bolsa Chica wetlands, the moderate-sized Ballona wetlands and Los Cerritos wetlands, and several smaller wetlands. In addition, recreational beaches can be found throughout the study area, occurring along lengthy stretches of coastal waters.

3.3.1 Watershed Descriptions

Regulatory Background

Within Coastal Reaches 1 through 6 (Figure 3.3-1), four Regional Boards have the responsibility for setting and enforcing water quality standards:

- The Central Coast Region (Region 3): The Central Coast Region is responsible for setting water quality standards in the study area on the Northern Channel Islands of San Miguel, Santa Rosa, and Santa Cruz.
- The Los Angeles Region (Region 4): The Los Angeles Regional Board covers Coastal Reaches 1 through 4, the Southern Channel Islands, and Anacapa Island.
- The Santa Ana Region (Region 8): The Santa Ana Region is responsible for all of Coastal Reach 5 and the northern third of Coastal Reach 6.
- The San Diego Region (Region 9): The San Diego Region is responsible for water quality standards within the southern two-thirds of Coastal Reach 6.

Under federal terminology, water quality standards must contain two components: (1) beneficial uses and (2) water quality objectives. Both of these must satisfy all of the applicable requirements of the California Water Code, Division 7 (Porter-Cologne Act) and the Clean Water Act (CRWQCB 1995a). These standards are regulated by the Regional Water Quality Control Boards.

A water body has beneficial use if it can be used for the benefit of people and/or wildlife (CRWQCB 1995b). Examples include drinking, swimming, industrial and agricultural water supply, and the support of freshwater and saltwater aquatic habitats. Definitions of the various beneficial uses listed in the basin plans are presented in Table 3.3-1. Table 3.3-2 summarizes beneficial uses by Coastal Reach for surface water bodies within the study area.

Land use source: NOAA 2000; 303(d) source: FWRCB 2005

Figure 3.3-1. Watersheds and impaired water bodies within the study area.

(Back of Figure 3.3-1)

Table 3.3-1
Beneficial Use Definitions for Water Bodies in the Study Area

Acronym	Use	Definition
MUN	Municipal and domestic water supply	Uses of water for community, military, or individual water supply systems, including but not limited to drinking water supply.
AGR	Agricultural supply	Uses of water for farming, horticulture, or ranching, including but not limited to irrigation, stock watering, or support of vegetation for range grazing.
PROC	Industrial process supply	Uses of water for industrial activities that depend primarily on water quality.
IND	Industrial service supply	Uses of water for industrial activities that do not depend primarily on water quality, including but not limited to mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.
GWR	Ground water recharge	Uses of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.
NAV	Navigation	Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.
POW	Hydropower generation	Uses of water for hydropower generation.
REC-1	Water contact recreation	Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include but are not limited to swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.
REC-2	Non-contact water recreation	Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include but are not limited to picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
COMM	Commercial and sport fishing	Uses of water for commercial or recreational collection of fish, shellfish, or other organisms, including but not limited to uses involving organisms intended for human consumption or bait purposes.
WARM	Warm freshwater habitat	Uses of water that support warm water ecosystems, including but not limited to preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
COLD	Cold freshwater habitat	Uses of water that support cold water ecosystems, including but not limited to preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
EST	Estuarine habitat	Uses of water that support estuarine ecosystems, including but not limited to preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, or shorebirds).
MAR	Marine habitat	Uses of water that support marine ecosystems, including but not limited to preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals or shorebirds).
WILD	Wildlife habitat	Uses of water that supports terrestrial ecosystems, including but not limited to preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, or invertebrates), or wildlife water and food sources.
BIOL	Preservation of biological habitats	Uses of water that support designated areas or habitats, such as areas of special biological significance, established refuges, parks, sanctuaries, ecological reserves, or other areas where the preservation or enhancement of natural resources requires special protection.

Table 3.3-2
Summary of Beneficial Uses and Impairments Within Coastal Reaches and Channel Island Subareas of the Study Area

	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Offshore Channel Islands	Nearshore Channel Islands
Beneficial uses								
MUN	X	X	X	X	X		X	X
IND		X		X	X	X		
PROC				X				
NAV	X	X	X	X	X	X		X
GWR			I	X	I			X
AGR						X		X
REC 1	X, I	X, I	X, I	X	X, I	X	X	X
REC 2	X, I	X, I	X, I	X	X, I	X	X	X
COMM	X	X, I	X	X	X	X	X	X
WARM	X, I	X, I	X, I	X, I	X, I	X	X	
COLD	X			I				
EST	X	X		X	X		X	
MAR	X	X	X	X	X	X		X
WILD	X	X	X	X	X, I	X	X	X
BIOL	X	X		X	X		X	X
RARE	X	X	X	X	X	X	X	X
MIGR	X	X		X		X		
SPWN	X, I	X	X	X	X	X		X
SHELL	X	X	X	X	X	X		X
WET	X	X	X	X				
Impairments								
Abnormal fish histology				P				
Ammonia		P		P				
Beach closures	P	P	P	P				
Benthic community effects	P			P				
Coliform bacteria	P	P	P	P	P	P		
Debris		P						
DDT/PCB fish consumption advisory	P	P	P	P				
Enteric viruses	P	P						
Eutropic	P			P				
Exotic vegetation		P						
Fish barriers	P							
Habitat alterations		P						
Hydromodification		P						
Metals	P	P		P	P	P		
Nutrients (algae)	P			P				
Odors				P				
Polynuclear aromatic hydrocarbons (PAHs)		P		P				
Pathogens		P	P		P			
Pesticides		P	P		P			
Reduced tidal flushing		P						
Scum/foam	P			P				
Sedimentation	P							
Sediment toxicity		P		P				
Trash	P	P		P				

X = Present or potential beneficial use
P = Present
I = Intermittent beneficial use

The water quality objectives for surface waters in Coastal Reaches 1 through 6 are established by the Water Quality Control Plans for Regions 3 (Central Coast), 4 (Los Angeles), 8 (Santa Ana), and 9 (San Diego) (CRWQCB 1995a, 1995b, 1995c, and 1995d, respectively). The standards represent maximum levels that allow beneficial uses of the water basin to continue unimpaired.

Assembly Bill 411 includes new standards for concentrations of bacterial indicators that are used for beach postings and closures. The standards, known as the AB411 criteria, are applied in Southern California from April 1 through October 31, which represents the maximum public use period for Southern California beaches. The minimum protective bacterial concentrations are established by the AB411 criteria for waters adjacent to public beaches and public water-contact sports areas.

Watershed Descriptions

Watershed descriptions come from the Southern California Watershed Inventory (SCWI), which is part of the California Coastal Conservancy's Southern California Wetlands Recovery Project. SCWI has identified six major hydrologic units that discharge to the SCB within the six coastal regions defined in this project. The major hydrologic units are shown in Figure 3.3-1. The characteristics of the hydrologic units and the major watersheds and wetlands within them are presented in Table 3.3-3. The six major hydrologic units are:

- **Santa Monica Bay.** The Santa Monica Bay hydrologic unit covers an area of approximately 103,637 hectares (256,000 acres). The hydrologic unit is subdivided into 28 separate drainages that discharge to Coastal Reaches 1, 2, and 3.
- **Dominguez Channel.** The Dominguez Channel hydrologic unit covers an area of 4,102 hectares (10,131 acres). The Los Angeles Harbor is located within Coastal Reach 4.
- **Los Angeles River.** The Los Angeles River is a large hydrologic unit that encompasses 216,351 hectares (534,420 acres). The watershed drains into San Pedro Bay and is located within Coastal Reach 4.
- **San Gabriel River.** The San Gabriel River hydrologic unit covers an area of 183,778 hectares (453,960 acres). The main stem of the San Gabriel River discharges near the Los Angeles/Orange County Line. The mouth is located at the southern end of Coastal Reach 4.
- **Lower Santa Ana River.** The Lower Santa Ana River hydrologic unit covers an area of approximately 725,460 hectares (1,792,000 acres) and can be divided into two major watersheds. The Santa Ana River watershed of approximately 438,248 hectares (1,082,540 acres) and the San Diego Creek Watershed of approximately 39,900 hectares (98,560 acres). Both watersheds lie within Coastal Reach 5.
- **San Juan.** The San Juan hydrological unit covers an area of approximately 129,546 hectares (320,000 acres). The majority of the San Juan Hydrologic Unit lies within Coastal Reach 6. The two largest watersheds within this hydrologic unit are the Aliso Creek Watershed (7,876 hectares [19,456 acres]) and the San Juan Creek Watershed (34,693 hectares [85,696 acres]).

Table 3.3-3
Characterization of Watersheds and Coastal Features Within the Study Area

Hydrologic Unit	Watershed	Wetland	Approx. Size hectares (acres)	Harbor / Marina	Major Tributaries
			COASTAL REACH 1		
Santa Monica Bay	Santa Monica Bay		147,583 (364,554)		
	Ramirez Canyon		1,215 (~3,000)		None
	Solstice Creek		1,150 (2,842)		None
	Malibu Creek		28,241 (69,760)		Cold Creek, Las Virgenes Creek, Medea Creek
		Malibu Lagoon			Malibu Creek
	Las Flores Canyon		1,174 (2,899)		Little Canyon
	Tuna Canyon Creek		411 (1,016)		None
	Topanga Creek		5,091 (12,575)		Garapito Creek, Santa Maria Creek, Suttphur Creek
		Topanga Lagoon			Topanga Creek
			COASTAL REACH 2		
Santa Monica Bay	Santa Monica Bay		147,583 (364,554)		
	Santa Monica Canyon		11,127 (27,485)		Rustic Canyon
	Ballona Creek		23,059 (56,960)		Centinela Creek, Sepulveda Channel
		Ballona Lagoon			None
		Ballona Wetlands			Ballona Creek
				Marina Del Rey	None
				King Harbor	None
				Redondo Beach Marina	None
			COASTAL REACH 3		
Santa Monica Bay	Santa Monica Bay		147,583 (364,554)		
			COASTAL REACH 4		
Dominguez Channel	Dominguez Channel		4,102 (10,131)		Cerritos Channel
				Los Angeles Harbor complex	Dominguez Channel
Los Angeles River	Los Angeles River		216,351 (534,420)		Compton Creek, Rio Hondo
		Los Angeles River mouth			Los Angeles River
				Long Beach Harbor complex	Los Angeles River, Dominguez Channel
				Downtown Long Beach Marina	None
San Gabriel River			183,778 (453,960)		
	San Gabriel River	Hellman Ranch			San Gabriel River, Los Cerritos Channel
		Los Cerritos Wetlands			Los Cerritos Channel
				Alamitos Bay, Long Beach Marina	Los Cerritos Channel

Table 3.3-3
Characterization of Watersheds and Coastal Features Within the Study Area

Hydrologic Unit	Watershed	Wetland	Approx. Size hectares (acres)	Harbor / Marina	Major Tributaries
			COASTAL REACH 5		
Santa Ana River			725,460 (1,792,000)		
	Anaheim Bay	Anaheim Bay			Bolsa Chica Channel, East Garden Grove-Wintersburg Channel
		Bolsa Chica Wetlands			Bolsa Chica Channel, East Garden Grove-Wintersburg Channel
	Talbert/Huntington Beach flood control channels	Huntington Beach Wetlands			Huntington Beach Channel, Talbert Channel
				Huntington Harbor	Huntington Beach Channel, Talbert Channel
	Santa Ana River		438,250 (1,082,500)		
		Santa Ana River Mouth Estuary	438,248 (1,082,540)		Santa Ana River
	San Diego Creek		39,900 (98,560)		San Joaquin Channel, Peters Canyon Wash, El Madera Irvine Channel
		Upper Newport Bay			Bonita Creek, San Diego Creek, Santa Ana-Delhi Channel, Big Canyon Wash
		San Joaquin Marsh			San Diego Creek
				Newport Harbor	Bonita Creek, San Diego Creek, Santa Ana-Delhi Channel, Big Canyon Wash
			COASTAL REACH 6		
Santa Ana River			725,460 (1,792,000)		
San Juan			129,546 (320,000)		San Juan Creek, Arroyo Trabuco, Oso Creek
	Los Trancos / Muddy Creek		2,902 (7,168)		Los Tancos Creek and Muddy Creek
	Laguna Canyon		2,720 (6,720)		None
	Aliso Creek		7,876 (19,456)		Aliso Creek, Wood Canyon, Sulphur Creek, Aliso Hills Channel, & English Channel
	Salt Creek		1,580 (3,904)		Arroyo Salado
	San Juan Creek		34,693 (85,696)		San Juan Creek, Arroyo Trabuco, & Oso Creek
		San Juan Creek			San Juan Creek
				Dana Point Harbor	None

Source: Southern California Wetlands Recovery Project at http://eureka.regis.berkeley.edu/coast/dbs/profile and http://www.ocwatersheds.com/watersheds/introduction.asp accessed on 1/31/2003.

3.3.2 Coastal Reaches

The major watersheds and coastal features within each of the major hydrological units are characterized below by coastal reach. Under Section 303(d) of the 1972 Clean Water Act, states, territories, and authorized tribes are required to develop a list of water quality limited segments. These segments do not meet water quality standards, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for water on the lists and develop Total Maximum Daily Loads to improve water quality. The Section 303(d)-listed water bodies are shown in Figure 3.3-1.

Coastal Reach 1

Several watersheds discharge along Coastal Reach 1, from Point Dume to Pacific Palisades (Figure 3.3-1). The majority are small watersheds that drain the deep and narrow canyons of the Santa Monica Mountains. The largest watersheds in this area are Malibu Creek and Topanga Creek. No harbors or marinas are located within Coastal Reach 1.

Malibu Creek is the largest watershed within Coastal Reach 1 (Figure 3.3-1). It drains an area of approximately 28,241 hectares (69,760 acres) (Table 3.3-3). Urban land use dominates the watershed, particularly in the upper segments. However, a large portion of the watershed is protected within Malibu Creek State Park. Outflow from the drainage empties into Santa Monica Bay through Malibu Lagoon. The streambed of Malibu Creek has not been channelized.

Many of the pollutants of concern in the Malibu Creek watershed are from non-point sources. They include excess nutrients, sediment, and bacteria. Malibu Creek is on the 303(d) list for fish barriers, high coliform count, nutrients, scum/foam-unnatural conditions, benthic community effects, enteric viruses, and eutrophic conditions.

The Topanga Creek watershed lies to the east of Malibu Canyon at the eastern end of Coastal Reach 1. It encompasses an area of approximately 5,091 hectares (12,575 acres) (Table 3.3-3). Topanga Creek is the sole tributary to the Topanga Lagoon, which is located at the mouth of the Creek. Topanga Creek is on the state's 303(d) list for excessive levels of lead.

Within Coastal Reach 1, 17 water bodies are on the state's 2002 303(d) list. Two of these (Malibu Creek and Topanga Canyon Creek) are in watersheds that drain to the study area. The rest are coastal water features that include numerous beaches and one lagoon (Malibu Lagoon). Most of the beach sites are listed for exceedances of standards related to concentrations of DDTs and PCBs in fish tissue and subsequent fish consumption advisories. In addition, Dan Blocker Memorial Beach was listed due to exceedances of coliform bacterial levels.

Coastal Reach 2

Ballona Creek is the largest drainage within Coastal Reach 2 (Figure 3.3-1). The watershed encompasses an area of approximately 23,059 hectares (56,960 acres) (Table 3.3-3). A large majority of Ballona Creek is channelized and paved, and the creek contains little in-stream or riparian habitat. The creek discharges to the Ballona wetlands by four concrete culverts.

Santa Monica Canyon is located on the northeast border of Santa Monica Bay (Figure 3.3-1). This watershed encompasses an area of approximately 11,127 hectares (27,485 acres)

(Table 3.3-3). Two major drainages occur in the watershed: Santa Monica Canyon Creek and Rustic Canyon Creek.

Coastal Reach 2 contains 17 water bodies on the state's 2002 303(d) list. Four of these are classified as rivers: Santa Monica Canyon (listed for high coliform count and lead), the Pico Kenter storm drain (listed for ammonia, copper, enteric viruses, and high coliform counts), Ballona Creek (listed for cadmium in the sediment), and Ballona Creek estuary (listed for chlordane in fish tissue and sediment). One tidal wetland (Ballona Creek wetlands) and one beach site (Manhattan Beach) occur. The remainder of the water bodies on the 303(d) list within Coastal Reach 2 are classified as a bay or a harbor. Most of these are listed for high coliform counts. However, Marina Del Rey is listed for a variety of contaminants, including organochlorine pesticides (including DDTs), PCBs, metals, and sediment toxicity. In addition, the offshore and nearshore areas of all of Santa Monica Bay are included on the 303(d) list in Coastal Reach 2. The list for Santa Monica Bay includes DDTs and PCBs (in sediment and fish), chlordane, polynuclear aromatic hydrocarbons (PAHs), and sediment toxicity.

Coastal Reach 3

Coastal Reach 3 encompasses the seaward portion of the Palos Verdes Peninsula (Figure 3.3-1). The entire reach lies within the Santa Monica Bay hydrologic unit. However, no sub-watersheds discharge directly to the coast within Coastal Reach 3. Also, no marinas or harbors are located within the reach.

Coastal Reach 3 contains 12 water bodies on Palos Verdes Peninsula, all of which are classified as a coastal shoreline or beach. Nearly the entire beach area on the Palos Verdes Peninsula is listed on the 303(d) list (Figure 3.3-1). All of the water bodies listed except Lunada Beach, Palos Verdes Shoreline Park Beach, and Point Vicente Beach are in exceedance of standards for DDTs and PCBs. In addition, the entire Palos Verdes area is covered by a fish consumption advisory.

Coastal Reach 4

Three major hydrologic units discharge to the coast within Coastal Reach 4: the Dominguez Channel, the Los Angeles River, and the San Gabriel River (Figure 3.3-1).

The Dominguez Channel hydrologic unit covers an area of 4,102 hectares (10,131 acres) (Table 3.3-3). The main drainage in the basin is the Dominguez Channel, which flows south and empties into the Consolidated Slip area of Los Angles Harbor in San Pedro Bay. The Dominguez Channel is on the state's 303(d) list for ammonia, pesticides (including DDTs in fish tissue and sediment), chromium, ChemA contaminants, and benthic community effects. The Consolidated Slip is one of the most polluted areas of Los Angeles Harbor. It is listed for DDTs and PCBs (in fish tissue and sediment) several metals, chlordane, dieldrin, toxaphene, and sediment toxicity.

The Los Angeles River hydrologic unit drains an area of approximately 216,351 hectares (534,420 acres) (Table 3.3-3). Two main tributaries discharge to the lower sections of the Los Angeles River: Compton Creek, which drains an area northwest of the Los Angeles River main stem, and Rio Hondo, which drains an area to the northeast. The Los Angeles River is completely channelized except for one small reach in the middle portion of the river called the narrows. Both the Los Angeles River and Queensway Bay, where the river discharges, are listed for several contaminants.

The Los Angeles and Long Beach Harbors are located in San Pedro Bay at the mouths of the Dominguez Channel and the Los Angeles River (Figure 3.3-1). Extensive modification of the area has taken place since the late 1800s, and the Los Angeles/Long Beach Harbor complex is now one of the largest ports in the country. Influences on water quality in the area include two generating stations in the inner harbor areas, numerous non-process waste dischargers, secondary treated effluent from a public-owned treatment works, and runoff from the Los Angles River and the Dominguez Channel, which drains a highly industrialized area.

Due to inputs of contaminants from the above sources, combined with poor tidal flushing in some areas of the Los Angeles/Long Beach complex, contaminant levels have repeatedly exceeded the standards for the area. Both nearshore and offshore zones of all of San Pedro Bay are on the state's 303(d) list for sediment toxicity and the following contaminants that have been found in the bay's sediment: chromium, copper, DDTs, PCBs, PAHs, and zinc. San Pedro Bay is also on the 303(d) list for fish consumption advisories for excessive levels of DDTs and PCBs that have been found in fish tissue. The Los Angeles Harbor Consolidated Slip (which receives runoff from Dominguez Channel), the Main Channel, Fish Harbor, the Southwest Slip, the Inner Breakwater, and Cabrillo Beach are all on the 303(d) list for a variety of contaminants, including DDTs and other pesticides, PCBs, PAHs, metals, sediment toxicity, and benthic community effects. A similar list of contaminants is found on the 303(d) list for several areas in Long Beach Harbor, including the Main Channel, the Southeast Basin, the West Basin, Pier J, and the Breakwater.

The San Gabriel River watershed encompasses an area of approximately 183,778 hectares (453,960 acres) (Table 3.3-3). Flow is dominated by effluent from several municipal wastewater treatment facilities and urban runoff. However, the San Gabriel River estuary and the lower portions of the river are on the 303(d) list only for abnormal fish histology.

One lake is on the 303(d) list within Coastal Reach 4: Machado Lake, which is located in Harbor Regional Park. Machado Lake has been impacted by industrial waste products in the past and is on the 303(d) list for a variety of constituents, including organochlorine pesticides (including DDTs), PCBs, ammonia, eutrophic conditions, and trash. Also, two beaches within Coastal Reach 4 are on the 303(d) list: Inner and Outer Cabrillo Beaches. Both beaches are listed for the presence of fish consumption advisories due to excessive levels of DDTs and PCBs.

Coastal Reach 5

Coastal Reach 5 extends from the Orange County jurisdictional boundary just south of the San Gabriel River to Corona Del Mar. All of this area lies within the Santa Ana River hydrologic unit (Figure 3.3-1). Three major watersheds terminate along the coast within Coastal Reach 5: the Anaheim Bay/Bolsa Chica wetlands, the Santa Ana River (including the Talbert/Huntington Beach wetlands), and the San Diego Creek/Newport Bay system (Table 3.3-3). Also, several coastal wetlands occur within Reach 5, including Anaheim Bay, Huntington Harbor, the Bolsa Chica and Santa Ana River/Huntington Beach wetlands, and Newport Bay.

Of the watersheds that terminate in Coastal Reach 5, the Santa Ana River watershed is the largest. It drains an area of approximately 438,250 hectares (1,082,500 acres) (Table 3.3-3). Surface diversions and groundwater pumping have eliminated most of the dry weather surface flows and most of the Santa Ana River is effluent dominated (CRWQCB 1995c). The Orange County Water District diverts and recharges nearly all the dry weather flows in the Santa Ana

River at the groundwater recharge areas near Anaheim. Downstream of this area, the Santa Ana River is normally dry.

The San Diego Creek watershed encompasses approximately 39,900 hectares (98,560 acres) (Table 3.3-3). Other drainages to Newport Bay include the Santa Ana-Delhi Channel, which discharges at the north end of the bay.

Seven water bodies within Coastal Reach 5 are on the 303(d) list. Only one, San Diego Creek (Reach 2), is classified as a stream or river. San Diego Creek is on the 303(d) list for metals and toxicity from unknown point sources. This creek is the main tributary to Upper Newport Bay. The water quality issues in Newport Bay are primarily non-point in nature. They are discussed under wetlands in Section 3.4.

The remainder of the water bodies on the 303(d) list in Coastal Reach 5 are Seal Beach, Huntington Beach Harbor, and Huntington Beach State Park. All three are listed for excessive levels of bacterial indicators.

Coastal Reach 6

Coastal Reach 6 extends from Corona Del Mar to Dana Point. Two major hydrologic units occur within Coastal Reach 6: the Santa Ana River and San Juan Creek (Figure 3.3-1).

The Los Trancos/Muddy Creek watershed lies within the Santa Ana River hydrologic unit. The watershed covers an area of approximately 2,902 hectares (7,168 acres) and consists of two drainages: Los Trancos Creek and Muddy Creek (Table 3.3-3). The creeks drain the San Joaquin Hills and discharge to the beach at Crystal Cove State Park. Los Trancos Creek is on the state’s 303(d) list for excessive levels of fecal coliform bacteria. Beaches near the Los Trancos/Muddy Creek watersheds are on the state’s 303(d) list for elevated levels of bacterial indicators.

The remainder of the watersheds that discharge within Coastal Reach 6 lie within the San Juan hydrologic unit (Figure 3.3-1). The Laguna Canyon Watershed covers an area of 2,720 hectares (6,720 acres) (Table 3.3-3) and discharges at Laguna Beach. The main drainage in the watershed is the Laguna Canyon Channel. The coastline at Laguna Beach is on the 303(d) list for elevated levels of bacterial indicators.

Aliso Creek is the second largest watershed within the San Juan hydrologic unit (Figure 3.3-1). It covers an area of 7,876 hectares (19,456 acres) (Table 3.3-3). Aliso Creek, which discharges at Aliso Beach, is the main drainage in the watershed. Aliso Canyon Wash is on the 303(d) list. Also, Aliso Creek, its mouth, and the shoreline at Aliso Beach are listed.

The Salt Creek Watershed is the smallest within Coastal Reach 6 (1,580 hectares [3,904 acres]) (Table 3.3-3) and the smallest in Orange County (OCWCRD 2003). Arroyo Salado is the major drainage in the watershed. It discharges at Salt Creek Beach Park, just north of Dana Point (Figure 3.3-1). Land use in the watershed is primarily urban. Salt Creek is on the state’s 303(d) list for elevated bacterial indicators.

The San Juan Creek Watershed encompasses an area of 34,693 hectares (85,696 acres) (Table 3.3-3) and is the largest watershed within Coastal Reach 6 (Figure 3.3-1). San Juan Creek forms the main drainage in the watershed. Arroyo Trabuco and Oso Creek are major tributaries. At the mouth of San Juan Creek is the San Juan Creek wetland, which is discussed under wetlands in Section 3.4. San Juan Creek, its mouth, and the adjacent shoreline are on the state’s 303(d) list for elevated levels of bacterial indicators.

Dana Point Harbor, located in the City of Dana Point, is the only harbor within Coastal Reach 6. The Harbor's Baby Beach is on the state's 303(d) list for elevated levels of bacterial indicators.

Northern and Southern Channel Islands

The Northern and Southern Channel Islands have minimal water quality problems. Except for limited development within Avalon on Santa Catalina Island, land use on the islands is predominantly open space. Surface runoff on the islands drains to the coast from intermittently flowing creeks in small valleys and canyons or through sheet flow over the ground surface (CRWQCB 1995b). The only water feature on any of the islands that is on the 303(d) list is Avalon Beach on Santa Catalina Island, which is listed for bacterial indicators.

3.3.3 Coastal Water Characteristics

The surface temperatures of the coastal waters within Coastal Reaches 1 through 6 range from about 11^{o} to 23^{o} Centigrade (C) (52^{o} to 73^{o} Fahrenheit [F]) (CLADPW 1982). Surface temperatures are affected most by variations in the California Current and the Southern California Countercurrent. At a depth of approximately 60 meters (200 feet), water temperatures in the area range from 10^{o} to 15^{o} C (50 to 59^{o} F).

Historical levels of salinity have been fairly uniform in the surface waters of the SCB. Salinity ranges from 33.5 to 34.1 parts per thousand (ppt) in the California Current and from 33.4 to 34.6 ppt in the California Undercurrent (CLADPW and USEPA 1977). Within the study area, the salinity values of surface waters typically range from 32 to 34 ppt and tend to be fairly homogenous with depth, with differences of less than 1 ppt from surface to bottom waters.

Dissolved oxygen (DO) levels within the study area are usually highest in surface waters due to photosynthetic activity and contact with the atmosphere. At the surface, DO levels are generally near saturation, which varies with temperature and salinity. Historical DO values of surface water in the study area range from 5.0 to 11.6 milligrams per liter (mg/L). The pH of water along the Southern California coast generally has limited variability due to the high buffering capacity of seawater. Surface water pH values in the study area typically range from 7.5 to 8.6. As depth increases, pH levels decrease. A greater range of pH values is often observed in coastal embayments and estuaries due in part due to elevated levels of photosynthesis and respiration.

Turbidity is a result of particles suspended in the water column. In coastal areas and embayments, elevated turbidity levels can result from natural causes (e.g., plankton blooms, wave action, and watershed runoff) and from anthropogenic sources (e.g., urban runoff, wastewater discharge, and dredging disposal). Concentrations of contaminants are often higher in turbid waters due to adhesion to sediment particles. Turbidity levels generally are elevated in coastal embayments and lagoons due to shallow depths (mixing of bottom sediments), river discharges, storm water runoff, and algal blooms.

The density of seawater is a function of its temperature and salinity. Layers of distinctly different water densities (a pycnocline) can result from changes in temperature (a thermocline), salinity (a halocline) or a combination of the two. Pycnoclines form natural barriers to exchange of water between the two layers. Within the study area, a thermocline often develops in the spring as surface temperatures increase. When the surface temperature drops in the fall, the thermocline breaks down. Regional stratification may also occur (primarily in the spring) when storm water runoff produces a freshwater lens on the sea surface. Stratification is usually less distinct in shallow coastal embayments.

3.4 BIOLOGICAL RESOURCES

The distribution of marine habitats and species within the SCB is related to the complex hydrography and geology of the region. The mainland consists of rocky shores, sandy beaches, wetlands, and embayments of various types. Distributed between the mainland and the Channel Islands is a complex mosaic of submarine canyons, ridges, basins, and seamounts. This habitat complexity has contributed to abundant and diverse marine biota. More than 5,000 species of benthic invertebrates, 481 species of fish, and 496 species of algae and seagrasses occur within the SCB (Dailey et al. 1993). The SCB is also the seasonal residence of more than 200 species of coastal and offshore birds and 39 species of marine mammals.

Several sources of information were used to describe existing biological conditions within the study area. The primary sources of information were two regional surveys conducted in 1994 and 1998 (SCCWRP 2004); the data from the vicinity of the Palos Verdes Shelf were augmented by data from the Los Angeles County monitoring program for the wastewater outfall at Palos Verdes (LACSD 2002). Other important sources of information include the comprehensive volume *The Ecology of the Southern California Bight* (Dailey et al. 1993), monitoring programs conducted at the Channel Islands, information from the Southern California Wetlands Recovery Project (2004), environmental sensitivity index maps prepared by the CDFG, and several published and unpublished reports.

The discussion of biological resources is organized into three main subsections. Section 3.4.1 describes the marine and coastal habitats (pelagic, subtidal benthic, intertidal benthic, coastal wetlands, and the Channel Islands) that occur in the study area. Sections 3.4.2 through 3.4.5 discuss the animals of special relevance to the project (namely, fish, birds, marine mammals, and terrestrial mammals). Section 3.4.6 lists the threatened and endangered species in the study area. Because the injuries of the Montrose case focused on marine-associated species, terrestrial resources are not the primary focus of this discussion of biological resources. However, limited discussion of terrestrial resources is presented for the Channel Islands, as they represent breeding habitats for bald eagles, peregrine falcons, and a number of species of seabirds. Sensitive terrestrial species also are addressed, as appropriate, in the threatened and endangered species subsection.

3.4.1 Marine and Coastal Habitats of the Study Area

The marine environment is complex and three-dimensional; it supports a broad diversity of plants and animals. The Southern California marine environment includes 481 species of fish, over 5,000 species of invertebrates, over 400 species of marine macrophytes (plants and algae), 34 species of marine mammals, and 195 species of birds (Dailey et al. 1993). In this document, marine habitats are divided into pelagic, subtidal benthic (soft-bottom and hard-bottom), and intertidal benthic. This section also discusses coastal wetlands (sandy beach and rocky shoreline) and habitats on the Channel Islands (terrestrial, shoreline, and nearshore). The following sections provide brief descriptions of these habitats, discuss the fish and macrophytes associated with them, and outline how each habitat relates to the injuries of the Montrose case.

Pelagic Habitats

Pelagic habitats occur in open water and support free-swimming organisms. The pelagic zone provides important habitat for plankton, though plankton are not exclusive to pelagic habitats.

Plankton is a generic term that includes a broad and diverse group of plants and animals that are found everywhere in aquatic environments. Typically, the smallest plankton are microscopic plant organisms called phytoplankton. The most abundant and important components of phytoplankton are generally the diatoms and dinoflagellates, which range in size from a few micrometers to a few hundred micrometers. Larger planktonic animals include zooplankton, larvae of benthic invertebrates, and ichthyoplankton (larval fish and eggs). Bacteria, which play a critical role in the degradation of particulate organic matter, are also plankton.

Currents, water column stratification, and winds all can affect the movement and distribution of planktonic organisms. Plankton are generally short-lived organisms, or organisms that reside in the water column a short time (ranging from days to months). Thus, species composition and abundance patterns vary greatly on a seasonal and inter-annual basis in response to the fluxes of nutrients, trace elements, and other conditions that affect phytoplankton production.

The vast majority of life in the sea is dependent on the production of organic matter (photosynthesis) in the lighted surface layers (the euphotic zone). Ocean life is largely dependent either directly or indirectly on phytoplankton, tiny unicellular or colonial algae, and macrophytes (larger algae and plants). Phytoplankton provides over 90 percent of the basic organic material that supports marine food webs. Phytoplankton are grazed on by herbivorous zooplankton and small fishes such as anchovies, which in turn are fed upon by larger carnivorous creatures. Fish and seabirds also utilize pelagic habitats.

The role of plankton as a basis for pelagic food webs is critical in several of the restoration options considered in this Restoration Plan. Plankton communities appear to have much lower levels of DDT and PCB contamination than do benthic communities, which also act as the basis of some marine food webs. Fish species that primarily derive their food from plankton-based food webs tend to be lower in contamination than those that derive most of their food from benthic-based food webs. Thus, fish consumption advisories for pelagic fish species tend to occur in few areas and be less limiting than those applied to soft-bottom species (Table 3.4-1). This basic concept will be an important building block for restoring injuries to fish and fishing.

Table 3.4-1
Summary of Recreational Landings (Released Fish Excluded) and Fish Consumption Advisories for Species Targeted by Anglers in Southern California, 1999–2003

Species	Recreational landings (kg)			Consumption advisories
	Shore	Boat	Total	Most limiting (Number of Locations)[4]
Hard-Bottom Species				
Opaleye	47,783	72,317	120,100	
Sargo	9,606	14,752	24,358	
Kelp Bass	1,640	1,338,274	1,339,914	1 meal every 2 weeks (1)
Surfperches- BF[1]	152,770	29,441	182,211	1 meal a month (3)*
Surfperches – WCF[2]	21,886	712	22,599	1 meal a month (3)*
Rockfishes[3]	12,058	834,092	846,150	1 meal every 2 weeks (1)
California Sheephead	1,617	308,496	310,112	
Hard/Soft-Bottom Species				
Topsmelt	8,778	328	9,106	
Barred Sandbass	5,312	1,739,120	1,744,432	
Halfmoon	2,710	124,680	127,389	
California Scorpionfish	1,394	324,167	325,560	1 meal a month (2)
White Seabass	5,399	962,327	967,726	
Black Croaker	1,104	1,007	2,111	1 meal a month (2)
Pelagic Species				
Chub Mackerel	429,185	453,568	882,753	
Pacific Sardine	89,101	791	89,892	
Pacific Bonito	3,002	116,163	119,166	
Pacific Barracuda	1,031	1,632,729	1,633,761	
Yellowtail	91	1,544,432	1,544,523	
Soft-Bottom Species				
White Croaker	19,113	65,138	84,251	Do not consume (7)
Jacksmelt	41,690	25,170	66,860	
Yellowfin Croaker	58,574	8,779	67,353	
California Corbina	20,464	672	21,136	1 meal every 2 weeks (2)
California Halibut	27,285	1,478,456	1,505,741	
Shovelnose Guitarfish	45,502	23,189	68,691	
Queenfish	58,364	2,014	60,379	1 meal a month (3)

Note: Landings are divided into boat and shore modes, and fish species are organized into the habitats with which they are most frequently associated. Biomass estimates are developed from the Pacific Recreational Fisheries Information Network (RecFIN) data. Fishing advisories are as reported by California EPA's Office of Environmental Health Hazard and Assessment (OEHHA). "Shore" refers to all fishing from shore-based modes (beach/bank/pier), and "Boat" refers to boat-based modes 0 to 3 miles from shore. Species are grouped according to their habitats (based on the information presented in Allen 1999).

[1] The "Surfperches - BF" complex includes the following benthic feeding species of surfperch: white seaperch, barred surfperch, calico surfperch, pile perch, black perch, rainbow seaperch, dwarf perch, striped seaperch, and rubberlip seaperch.

[2] The "Surfperches - WCF" complex includes the following water column feeding species of surfperch: walleye surfperch, silver surfperch, spotfin surfperch, shiner perch, and kelp perch.

[3] The "Rockfishes" complex includes the entire *Sebastes* genus blue rockfish.

[4] Numbers indicate the number of locations (out of 11 possible locations) where fish consumption advisories are currently in place in the Southern California Bight. "Most limiting" refers to the advisory where the fewest meals per month are recommended for the species. Absence of a fish consumption advisory for a species may be due either to a lack of data or data indicating low concentrations of contaminants.

*Fish consumption advisories are given for surfperches as a group and are not broken into "BF" and "WCF" sub-categories.

Subtidal Benthic Habitats

Benthic habitats include the substrata and the boundary of the water column that is physically influenced by the substrata. Benthic habitats are typically characterized by water depth and substrate type. Within the SCB, both soft-bottom (i.e., sand and mud) and hard-bottom habitats (i.e., rock and sandstone reefs) are common and each type supports a unique biota. Organisms that live in the sediments are referred to as infauna, those that live on the surface are generally referred to as epifauna or epibenthic, and those that live near the bottom are generally called demersal.

Soft-bottom Habitats

Soft-bottom benthic communities show seasonal variability, with diversity and abundance typically highest in spring and summer and lowest in winter. Benthic communities can also be affected by winter storms (waves and rain) that can physically disrupt bottom communities and/or subsequent runoff that can transport sediment, debris, and nutrients to benthic habitats.

Soft-bottom communities show characteristic zonation related to water depth and (in the nearshore) wave energy and wave surge. Thus, regional surveys and monitoring studies have found distinct benthic communities organized along depth gradients (Jones 1969, Fauchald and Jones 1983, Thompson et al. 1987, Thompson et al. 1993, Diener et al. 1995, Bergen et al. 1999). Soft-bottom subtidal habitats in the SCB support several thousand benthic invertebrate species, which in turn are preyed upon by a variety of demersal fish species.

The types of benthic invertebrates living on and within sediment also vary according to sediment type, depth, and environmental stress. The Inner Shelf has fewer invertebrate species and smaller populations than the Middle and Outer Shelf assemblages. Polychaete worms and small, mobile crustaceans dominate the Inner to Middle Shelf infaunal communities. The infauna of the Outer Shelf include annelid polychaetes, echinoderms, bivalve mollusks, and crustacean ostracods. Epibenthic invertebrates of the Inner Shelf and Middle Shelf include echinoderms (e.g., sand stars and sea stars), crustaceans (e.g., rock crabs and hermit crabs), and mollusks (e.g., sea slugs and sea pens). The Outer Shelf epibenthic invertebrates include sea urchins, brittlestars, and rock shrimp.

Nearshore soft-bottom areas of the SCB support a high abundance of species such as flatfish, surfperch, and croakers. Middle and Outer Shelf species include numerous kinds of flatfish, sulpin, combfish, midshipman, and rockfish. The number of fish species caught, abundance, and biomass increase with water depth out to the Outer Shelf. In many cases, soft-bottom species derive much of there food from benthic infauna and are therefore more highly contaminated with DDTs and PCBs in areas where sediment contamination levels are high. For example, white croaker, which is typically found in soft-bottom areas and feeds primarily on benthic infauna has some of the highest levels of DDT and PCB contamination among the fishes commonly caught in the SCB. Thus, fish consumption advisories are more widespread and more limiting (i.e., "do not consume" in some areas) for this species than for other species (Table 3.4-1).

Eelgrass (*Zostera* spp.) is the primary plant species found in soft-bottom habitat; this species generally grows in beds on mud or sand in protected habitats such as bays, coastal lagoons, and estuaries. It is found from 0 to 6 meters (20 feet), but occurrences at depths shallower than 3 meters (10 feet) are rare, as turbidity from resuspension of fine sediments is a chronic problem. Eelgrass distribution is controlled by depth, substrate stability, and light (Backman and Barilotti

1976). Two species have been reported within the study area. *Z. marina* is the species most commonly reported within the SCB. *Z. asiatica* recently was reported in a few locations south of Point Conception; however, it generally ranges northward to Tomales Bay (Phillips and Echeverria 1990). The characteristics of these species intergrade, and it is not clear what species occur in the Channel Islands (CINMS 2000).

Eelgrass habitat is known to be ecologically important habitat for a variety of invertebrates and fish. Nearly twice as many invertebrates and fish have been reported to occur within eelgrass beds than on surrounding sand habitats (CINMS 2000). Eelgrass provides nursery habitat for a variety of recreationally and commercially important fish and shellfish. Baitfish, such as anchovies and other small fish (e.g., topsmelt), spend an extensive portion of their early life in eelgrass beds. Seabirds such as California brown pelicans and terns prefer baitfish and often forage on the invertebrates and fish associated with eelgrass beds. Waterfowl such as the black brant feed nearly exclusively on the plants. In addition to these apparent biological values, eelgrass plays an important role in stabilizing sediments, recycling nutrients, generating oxygen, and trapping suspended particulates.

Eelgrass beds are found along the coast of Southern California, including shallow water habitats in Los Angeles Harbor, Alamitos Bay, Anaheim Bay, Huntington Harbor, Newport Harbor, and Dana Point (MEC Analytical Systems 1997, MEC Analytical Systems 2000). Eelgrass also occurs in sheltered coves on Anacapa, Santa Cruz, and Santa Rosa Islands. It is not known at this time whether eelgrass occurs on the other Channel Islands.

Hard-bottom Habitats

Hard-bottom and rocky reef habitats are considered to be very productive ecosystems that support a variety of plants and animals. Natural hard-bottom habitats are common in the subtidal areas of the narrow mainland shelf, and they become more abundant as one proceeds from the southeast to the northwest along the coast. Hard-bottom habitats are especially characteristic around the Channel Islands (Thompson et al. 1993). The types of hard-bottom habitats include submerged rock and sand/mud platforms, deformed sedimentary substrate, and boulder and cobble fields. Rocky shores constitute about 20 percent of the SCB (Bakus 1989), but beyond the depth of 30 meters (98 feet) only about 3 percent of the sea floor is hard substrate (Thompson et al. 1993). The distribution of subtidal hard-bottom habitats is less well known than the distribution of intertidal hard-bottom habitats due to a lack of large-scale mapping studies. Often nearshore reefs are found where rocky intertidal habitat occurs; kelp beds are generally good indicators of subtidal reefs (Ambrose et al. 1989).

Many hard-bottom fish species derive their food via pelagic or kelp-based food webs (Cross and Allen 1993) and therefore are typically lower in DDT and PCB contamination than species associated with and feeding from soft-bottom habitats (LACSD 2002). Thus, fish consumption advisories for the hard-bottom species commonly targeted by Southern California anglers tend to be less broadly distributed (i.e., occurring in fewer locations) and less limiting than those applied to soft-bottom species (Table 3.4-1).

Artificial hard-bottom habitats have become common in the SCB either incidentally from development of coastal resources (e.g., construction of piers and wharves, offshore platforms and pipelines, and ocean outfalls) or by design to enhance fisheries, environmental mitigation, and/or recreational uses (e.g., artificial fishing reefs or sunken ships for scuba diving). Lewis and

McKee (1989) provides a list of the artificial reefs that the California Department of Fish and Game has built in the SCB. Many of the wastewater ocean outfalls provide large hard-bottom habitats that function as reefs. An ongoing scientific debate exists about whether artificial hard-bottom habitats contribute to greater productivity and biomass (e.g., Cross and Allen 1993). Some studies report comparable or greater fish density and biomass on artificial reefs than on natural reefs (e.g., Turner et al. 1969, Stephens et al. 1984, Jessee et al. 1985, Ambrose and Swarbrick 1989, Thompson et al. 1993). Other studies have found lower biomass on artificial reefs, which may be related to different reef sizes and complexity (Ambrose and Swarbrick 1989, DeMartini et al. 1989). Nonetheless, artificial reefs do alter the benthic community by providing habitat that displaces soft-bottom species and by recruiting reef-dwelling species. These effects of artificial reefs on local community structure, coupled with the fact that many reef-dwelling species derive there food from sources other than soft-bottom infauna (i.e., pelagic or hard-bottom macrophyte-based food webs) are important aspects of the options considered in this Restoration Plan.

In the SCB, the dominant macrophitic communities associated with hard-bottom habitats are kelp forests. These forests are typically dominated by the giant kelp (*Macrocystis pyrifera*) but include several hundred other species of marine algae. Giant kelp grows well in wave-exposed areas of nutrient-rich, cool water at depths of 6 to 36 meters (20 to 120 feet) (Leet et al. 1992). Kelp attaches to hard substrate by means of a holdfast. Kelp fronds originate from the holdfast and grow to the water surface. Each frond has several leaf-like blades with bladders that buoy the fronds in the water column. The density and abundance of the kelp canopy vary by location, season, and year. Kelp beds in Southern California commonly deteriorate to some degree during summer and fall when temperatures are higher and nutrient concentrations are lower (Foster and Schiel 1985, Tegner and Dayton 1987). Yearly variations in the spatial extent of kelp beds are common.

Although the spatial extent of kelp beds varies seasonally, persistence of kelp within a bed is related to hard substrate size and relief. Point Loma and La Jolla kelp beds in San Diego are typified by large, complex, and high rocky relief and almost always sustain kelp (persistence over large areas for longer than 10 years). Factors that affect kelp persistence include turbidity and/or sedimentation. Kelp are adversely affected by burial, scour, or reduced ambient light levels (Devinny and Volse 1978, Foster and Schiel 1985). Temperature and nutrient concentrations also contribute to yearly differences. El Niño conditions, which result in higher than average temperatures and low nutrient concentrations, have been linked to periodic widespread reductions in kelp canopy (Tegner and Dayton 1987, Dean and Jacobsen 1986).

The presence of kelp on a rocky habitat greatly enhances the community by providing food, shelter, substrate, and nursery areas for many species of fish and invertebrates. Invertebrates found in kelp beds are similar to those found in other hard-bottom habitats. They include lobster, sea stars, sea urchins, and mollusks. Brown, green, and red (fleshy and coralline) algae occur in kelp beds. Surfperch and rockfish (*Sebastes* spp.) usually dominate the fish assemblages (Ebeling et al. 1980, Foster and Schiel 1985, Bodkin 1986). Species generally associated with the kelp canopy include mysids, fouling organisms (e.g., bryozoans), gastropods and crustaceans living on and within the fronds, transient fish (e.g., mackerel [*Scombridae*], Pacific barracuda [*Sphyraena argentea*], Pacific bonito [*Sarda chiliensis*], silversides [*Atherinidae*]), and canopy-associated fish (e.g., kelp perch [*Brachyistius frenatus*], señorita [*Oxyjulis californica*], halfmoon [*Medialuna californiensis*], blacksmith (*Chromis punctipinnis*), rockfish, kelp bass [*Paralabrax* *clathratus*], and kelp fish [*Clinidae* spp.]) (Feder et al. 1974). California sheephead (*Semicossyphus pulcher*), garibaldi (*Hypsypops rubicunda*), and opaleye (*Girella nigricans*) are common in Southern California kelp beds (U.S. Navy 1997a, 1997b). Many kelp-bed fish species are also found in areas of shallower vegetated and unvegetated rocky reefs (Figure 3.4-1). However, the abundance of fish is greater on reefs with high densities of kelp compared to those with low kelp densities (Larson and DeMartini 1984, Cross and Allen 1993). Kelp beds also provide a large food supply for marine birds and mammals (Foster and Schiel 1985). Cormorants are the birds most closely associated with California kelp beds; however, gulls commonly scavenge on the surface canopy, and California brown pelicans and terns exploit schooling fish along the canopy’s edge (Foster and Schiel 1985). Mammals such as sea lions, seals, and whales use kelp beds as transitory foraging areas (Foster and Schiel 1985). Kelp (genus *Macrocystis)* is commercially harvested for use in a variety of food products, pharmaceuticals, adhesives, paper products, paints and finishes, rubbers, and textiles (Bakus 1989).

Surfgrass (*Phyllospadix* sp.) generally forms beds on hard-bottom substrate in the lower intertidal and shallow subtidal zones, an area characterized by high turbidity and sedimentation. Surfgrass may form conspicuous beds in the low intertidal to shallow subtidal zones of rocky beaches and generally is found from about 0 to 6 meters (0 to 20 feet). Both the vegetative shoot density and the number of flowering shoots of surfgrass decrease with increasing depth, indicating that light is a limiting resource for both growth and reproduction (Williams 1995). Photoperiod and temperature are major environmental factors controlling reproduction in surfgrass. In Southern California, plants flower all year long, though most reproduction takes place between May and August, especially during June and July. Predators on surfgrass include grazers such as fish, particularly opaleye, and crabs (Williams 1995).

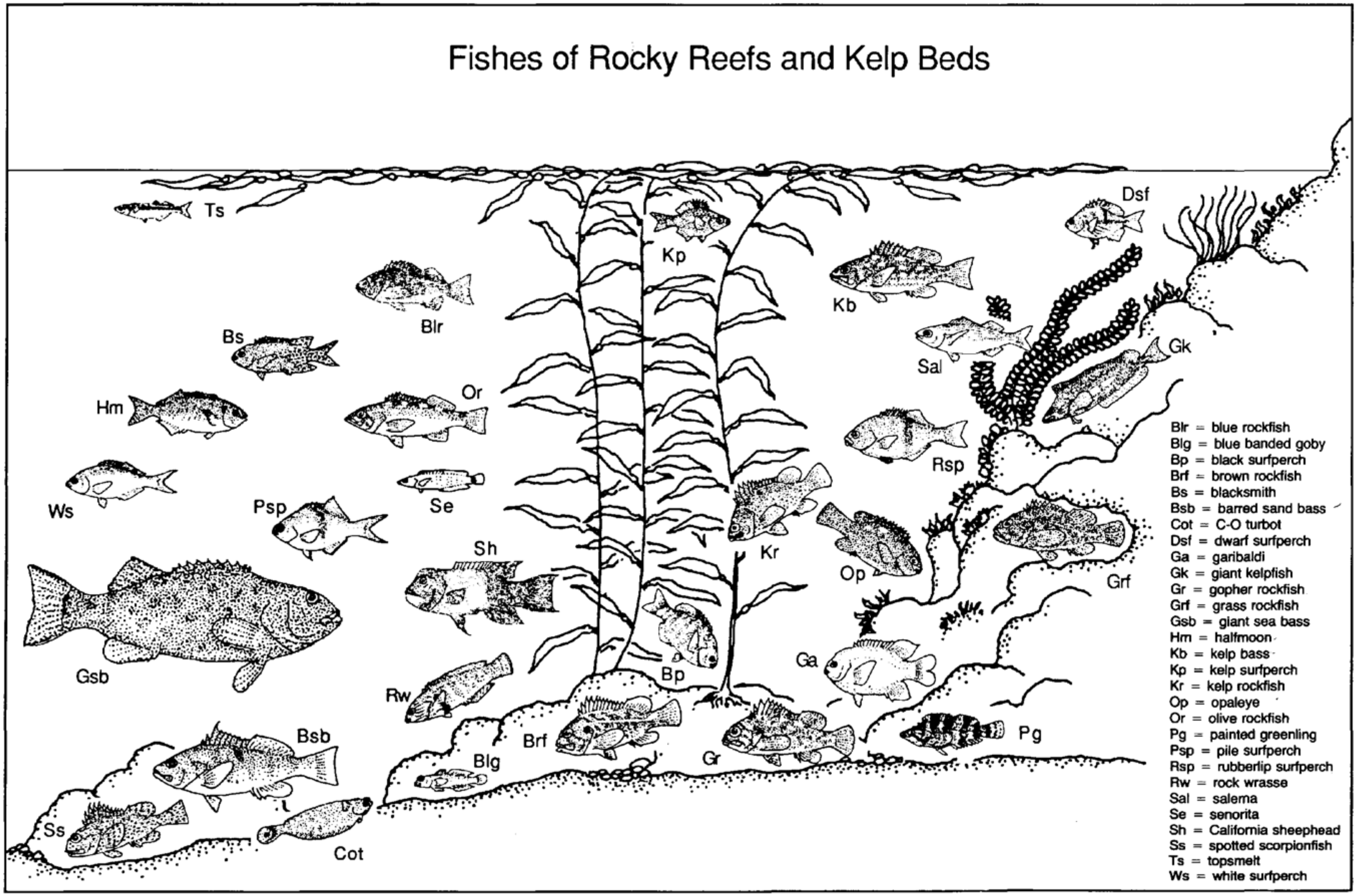
Surfgrass beds provide an important habitat for a diverse assemblage of algae, invertebrates, and fish (Stewart and Myers 1980). In the SCB, surfgrass serves as a nursery for the California spiny lobster (*Panulirus interruptus*) (Williams 1995, Engle 1979). Abundant species of fish found in surfgrass habitats on low-relief, sandstone rock include topsmelt (*Atherinops affinis*), blacksmith, walleye surfperch (*Hyperprosopon argenteum*), señorita, opaleye, and black perch (*Embiotoca jacksoni*) (DeMartini 1981). Garibaldi, surfperch, barred sand bass (*Paralabrax nebulifer*), the gorgonian (*Muricea californica*), California spiny lobster, brown algae (*Egregia menziesii* and *Eisenia arborea*), coralline algae, and a red alga (*Erythroglossum californicum*) are common to abundant in areas where reef and surfgrass are more developed.

Intertidal Benthic Habitats

Intertidal benthic habitats are those ocean bottom environments that exist between mean high tide and mean low tide (sometimes also called the littoral zone). Generally, about 70 percent of the mainland shoreline is sandy shores, and about 70 percent of all rocky shores in the SCB are found on the Channel Islands. Generalized summaries of the sandy beach and rocky intertidal habitats within the SCB are presented below.

Sandy Beach Habitat

Open coast sandy beaches are dynamic environments that undergo sand accretion in summer due to reduced wave energy and erosion in winter as a result of larger, higher-energy waves. This seasonal change in the amount of sand on the beach results in a greater variety and abundance of



Source: Thompson et al. 1993

Figure 3.4-1. Schematic diagram of fishes within rocky reef and kelp bed habitats.

invertebrates inhabiting the intertidal portion of the beach during late spring through summer. The benthic invertebrates in turn provide prey for a variety of shorebirds, including migratory species whose abundance increases in the SCB from summer through fall.

The dynamic nature of sandy beach habitats results in relatively low organic content in the sediments relative to subtidal soft-bottom areas. An inshore-offshore gradient occurs in the levels of DDT and PCB contamination in sediment because DDTs and PCBs adhere more readily to organic sediments and because the primary source of these contaminants (i.e., the White Point wastewater outfall) is in deep, offshore water (LACSD 2002). Thus, the lowest sediment contamination levels are in the intertidal areas, and the soft-bottom species that forage in these areas (e.g., California corbina) have lower contamination levels and consequently less pervasive and restrictive fish consumption advisories (Table 3.4-1).

Although more than 200 species of invertebrates have been reported from surveys of beaches within the SCB, most of these species have been washed ashore or dislodged from adjacent rocky habitats. It is probable that only about 20 species regularly occur on sandy beaches (Straughan 1982, Parr et al. 1978).

Common species of the upper intertidal habitat include insects such as beach hoppers (*Orchestoidea*) and worms such as the bloodworm (*Euzonus mucronata*), which can burrow deeply and is patchily distributed (Parr et al. 1978, Straughan 1982, Thompson et al. 1993). The middle to low intertidal is often dominated by the common sand crab (*Emerita analoga*).

Three species of fish are associated with sandy beach habitat. The best known is the California grunion (*Leuresthes tenuis*), which is managed as a game species by the CDFG. Grunion travel from their habitat in nearshore waters to spawn at night on sandy beaches on the first few nights following each new and full moon between March and August. Spawning occurs 1 to 3 hours after high tide with the eggs being deposited deep into the sand. The eggs are exposed on subsequent high tides, about 10 days later and as they are washed out of the sand they hatch. Grunion are most often found on long and gently sloping beaches with moderately fine grain size. The other two fish species associated with sandy beach habitat include the California corbina (*Menticirrhus undulatus*) and the barred surfperch (*Amphistichus argenteus*), which can often be found foraging for sand crabs in the shallow subtidal habitat of the lower beach (Cross and Allen 1993).

<u>Rocky Shoreline Habitat</u>

Rocky intertidal habitats are varied; they include submerged rock platforms, deformed sedimentary rock, and boulder cobble fields. The organisms of rocky intertidal communities show vertical zonation in response to the extremes of the physical environment (e.g., temperature, tidal exposure, surf exposure, availability, and type of substrate) and biological interactions (e.g., food availability, predation, and population density). The variability among these vertical strata results in different species compositions among rocky habitats: of the 315 species of macroinvertebrates found at 22 sites throughout the SCB, only 14 species were common to all sites (Littler 1979).

The upper intertidal is characterized by acorn barnacles (*Chthamalus*), periwinkles (*Littorina planaxis*), and the western sea roach (*Liga occidentalis*), which is a nearly terrestrial isopod. The middle intertidal zone is often referred to as the mussel zone, with its mussels (e.g., *Mytilus californiensis* and *M. galloprovincialis*) and barnacles (e.g., *Pollicipes polymerus)*. Several of the mid-intertidal species extend into the lower intertidal, and other species such as sea urchins (*Strongylocentrotus purpuratus*), ochre sea star (*Pisaster ochraceum*), bat star (*Asterina miniata*), sea hares (*Aplysia californica*), sand tube worm (*Phragmatopoma californica*), and algae are more abundant in the lower intertidal.

Only six species of fish are resident in the rocky intertidal zones of the SCB (Cross and Allen 1993). Wooly sculpin (*Clinocottus analis*), reef finspot (*Paraclinus nigripinnis*), rockpool blenny (*Hypsoblennis gilberi*) spotted kelpfish (*Gibbonsi elegans*), and California clingfish (*Gobiesox rhessodon*) spend all but their larval life in the intertidal, and the dwarf surfperch (*Micrometrus aurora*) often releases its young into tide pools. Most of these residents feed on small crustaceans and worms, and the opaleye is mostly herbivorous. Most of these fish are small and difficult to see, as they spend much of their time hiding in holes, crevices, or beneath algae.

Coastal Wetlands

Wetlands, which are areas of soft and marshy land, occur where aquatic habitats meet terrestrial habitats. The wetlands in the study area include mudflats, salt panne, saltwater marshes, and freshwater marshes. Wetlands provide many ecological benefits, such as improving water quality, reducing erosion and flooding, and providing habitat for wildlife. Coastal wetland habitats have declined over the past decades due to human population growth and development. However, the loss of wetland habitat and an increased appreciation of wetland benefits have resulted in increased efforts to restore coastal wetlands. Although the extent of wetlands in the SCB has been drastically reduced from historical levels, several coastal wetlands within the study area still support diverse plant and animal communities. Unfortunately, many of these wetlands suffer from restricted flows, habitat degradation, and polluted urban runoff.

Wetlands represent important habitats for over 200 species of resident and migratory birds as well as for a variety of other wildlife. The Southern California coastal wetlands provide important habitat for various bird species, including shorebirds, marsh birds, water birds, and terrestrial birds. Both year-round residents and migratory species use these habitats to breed and forage. Large numbers of migratory birds (including sandpipers, plovers, and many species of ducks) migrate to and from Southern California during the fall and spring months. Some of the bird species that migrate to Southern California wetlands in the summer include terns, avocets, stilts, and skimmers. A small suite of bird species, including great blue herons, mallards, and killdeer, are considered year-round residents of the Southern California coastal wetlands. Table 3.4-2 provides basic information on the size and habitat characteristics of wetlands in the study area.

Table 3.4-2
Summary of Wetland Size and Habitat Types in the Study Area

Wetland	Approximate Wetland Size (hectares/acres)	Open Water	Tidal Flats (non-vegetated)	Tidal Flats (vegetated)	Salt Marsh	Brackish/ Freshwater Marsh	Riparian	Seasonal Wetlands
Malibu Lagoon	37(92)	12 (28)			7 (18)		19 (46)	
Topanga Lagoon	0.85 (2)						0.85 (2)	
Ballona Lagoon	7 (16)	6 (15)	0.6 (1.5)[1]					
Ballona Wetlands	78 (192)		10 (24)	19 (48)	43 (105)		6 (15)	
Los Angeles River	95 (234)[2]					Present*		
Los Cerritos Wetlands	> 57 (140)	39 (95)	3 (8)[3]		8 (19)[4]	7 (18)		
Hellman Ranch	11 (27)		4 (10)[5]		6 (15)			0.8 (2)
Anaheim Bay	387 (956)	89 (220)	61 (151)		229 (566)	0.81 (2)	7 (17)	
Bolsa Chica Wetlands	365 (900)	69 (171)	144 (355)		149 (368)	2 (6)[6]		
Huntington Beach Wetlands	Total acreage data not available	5 (13)	2 (4)		51 (125)	Present*		
Santa Ana River Mouth Estuary	Total acreage data not available		9 (21)		60 (147)	Present*	Present*	
Upper Newport Bay	550 (1357)	366 (904)	27 (67)		155 (382)	2 (4)	0.8 (2)	
San Joaquin Marsh	153 (378)					59 (145)	30 (73)	65 (160)
San Juan Creek mouth	1 (3)						1 (3)	
Buena Vista Lagoon	90 (223)	51 (127)				15 (36)	Present*	6 (14)
Batiquitos Lagoon	212 (524)	141 (348)		34 (85)	40 (100)	3 (7)		

Notes:

Information provided in format of hectares (acres).

*Habitat present, but acreage data not available.

[1]Intertidal; numerous non-native species occupy the higher elevations.

[2]Brackish/freshwater and riverine habitats are present, but acreage data not available.

[3]Intertidal mud flats.

[4]Salt marsh (7.7 acres [19 acres]); salt pan: salt flats are present; acreage data not available.

[5]Tidal channel (1.2 hectares [3 acres]); salt panne: alkaline flats (2.8 hectares [7 acres]).

[6]Freshwater pond (0.4 hectares [1 acre]); freshwater marsh (2.0 hectares [5 acres]).

Source: Southern California Wetlands Recovery Project 2004.

Channel Islands

Terrestrial Habitats

The climate of the Channel Islands is cool and wet in the winter and hot and dry in the summer, though the extremes of temperature are moderated by the maritime influence of the ocean currents, which produce frequent fog. This mild maritime climate has allowed a number of species to persist on the islands even though their mainland counterparts are found near or to the north of San Francisco Bay, or have been completely extirpated on the mainland due to climatic and other factors (Raven 1967). Documentation of the original range and distribution of island endemics is complicated by the current domination of non-native plants that have “only become naturalized on the islands since their introduction by Euro-Americans during the last 200 years” (USFWS 1995b). The spread of non-native and invasive plants on the Channel Islands has been facilitated by overgrazing and trampling of native vegetation by domestic animals (Raven 1967, Thorne 1967, Philbrick 1980).

The general terrestrial native habitats of the Channel Islands are maritime scrub, island chaparral, grasslands, coastal dunes, riparian scrub, riparian woodlands, wetlands, and coastal bluffs. Several treatments of plant communities exist in the literature. Junak et al. (1995), as cited in NPS (1999), developed the detailed list of communities for the Northern Channel Islands based on these treatments. Scrub and non-native grassland communities dominate the landscapes of the Channel Islands. Woodlands are sparse on the islands, though they may have been more extensive before the island habitats were denuded by introduced grazers.

San Miguel Island was dominated by blowing dunes that buried fertile grazing lands through the late 1800s and early part of this century. However, evidence of a scrubland environment on the coast of San Miguel Island exists in the form of trunks that were carbonized in pre-historic fires and the evidence of forests represented by the fossilized “caliche forest” (Johnson 1980, NPS 1999). San Nicolas Island has a history of drought, vegetation stripping by herbivores, and dune formation that mirrors that of San Miguel’s. After vegetation stripping, blowing sands turned rocky coastal shores to sandy beaches and wiped out kelp forests that surrounded the islands. Today the islands have mostly recovered their rocky shores and kelp.

Only Santa Rosa, Santa Cruz, and Santa Catalina Islands have significant arborescent woodlands. Santa Rosa Island has been affected by dune formation after vegetation denudation, but one woodland exists on the north-central part of the island. A variety of oak species occur in woodlands on Santa Rosa, Santa Cruz, and Santa Catalina Islands along with endemic ironwood. A small woodland of the federally endangered Catalina Island mountain mahogany (*Cercocarpus traskiae*) grows on Santa Catalina Island in Wild Boar Canyon. Significant Bishop pine woodlands are found on three mostly north-facing slopes on Santa Cruz Island (Hobbs 1980). Riparian woodlands are uncommon in spite of the many suitable canyon streams because they have been impacted by erosion and vegetation denudation, though a few woody riparian species can be found on most islands (Minnich 1980).

Shoreline and Nearshore Habitats

The Northern Channel Islands experience strong northerly winds that produce active dunes on the windward side of the islands and a zone of strong onshore flow that leaves beaches rocky or gravelly (NPS 1999, Dailey et al. 1993). Sandy beaches account for 20 to 35 percent of the shoreline on San Miguel, Santa Rosa, and Santa Cruz Islands, and are more common on the lee side of the islands or in protected coves (Table 3.1-2).

The Southern Channel Islands have a combination of hard substrate, and sand and gravel beaches (Table 3.1-2). Rocky shores are a predominant habitat, and gravel and/or sandy beaches account for most of the remaining shoreline.

Ocean upwelling from deep basins on the south sides of the Northern Channel Islands provides a rich source of nutrients for plankton and the food chain that supports the island species. Kelp beds favor the northwest and south shores of these islands providing additional habitat and cover to support abundant marine and bird life.

3.4.2 Fish

Fish are an important resource relevant to the Montrose Settlements Restoration Program (MSRP). Although no direct impacts from DDTs and PCBs were demonstrated to have occurred on fish in the Montrose case, fish habitat was demonstrated to have been impacted by these chemicals in a way that compromised the services rendered by fish (Dixon and Schroeter 1998). The Southern California fish fauna comprises over 129 families with over 450 species (Cross and Allen 1993). This diverse assemblage of fish makes use of all habitats, from shallow wetlands and intertidal areas to open pelagic and deepwater benthic habitats (see Section 3.4.1 for more details). The fish assemblage also has a broad size range and a wide range of life-spans. For example, the blue-banded goby (*Lythrypnus dalli*) rarely exceeds 1 inch and typically lives no more than a year, whereas the giant (black) sea bass (*Stereolepis gigas*) may exceed 7 feet, reach a weight of 500 pounds, and live as long as 75 years (Love 1996). This diversity of fish in the SCB results in the broad ecological, recreational, and commercial value of this resource. Fish are important predators of all sizes of prey and are therefore an important structuring force in marine communities. Fish are a major prey item for birds, marine mammals, other larger fishes, and humans, and are therefore a principal transfer pathway of DDTs and PCBs through the food web to species in which the effects of the contaminants of the case were demonstrated (Figure 3.4-2). As a result, fish contamination advisories have been released for several of the fish species that anglers commonly target in the SCB (Table 3.4-1). The fish of the SCB also support important commercial and recreational fisheries and attract thousands of scuba and free divers to the inshore and offshore waters of the SCB every year for sightseeing, fish-counting, hunting, and underwater photography.

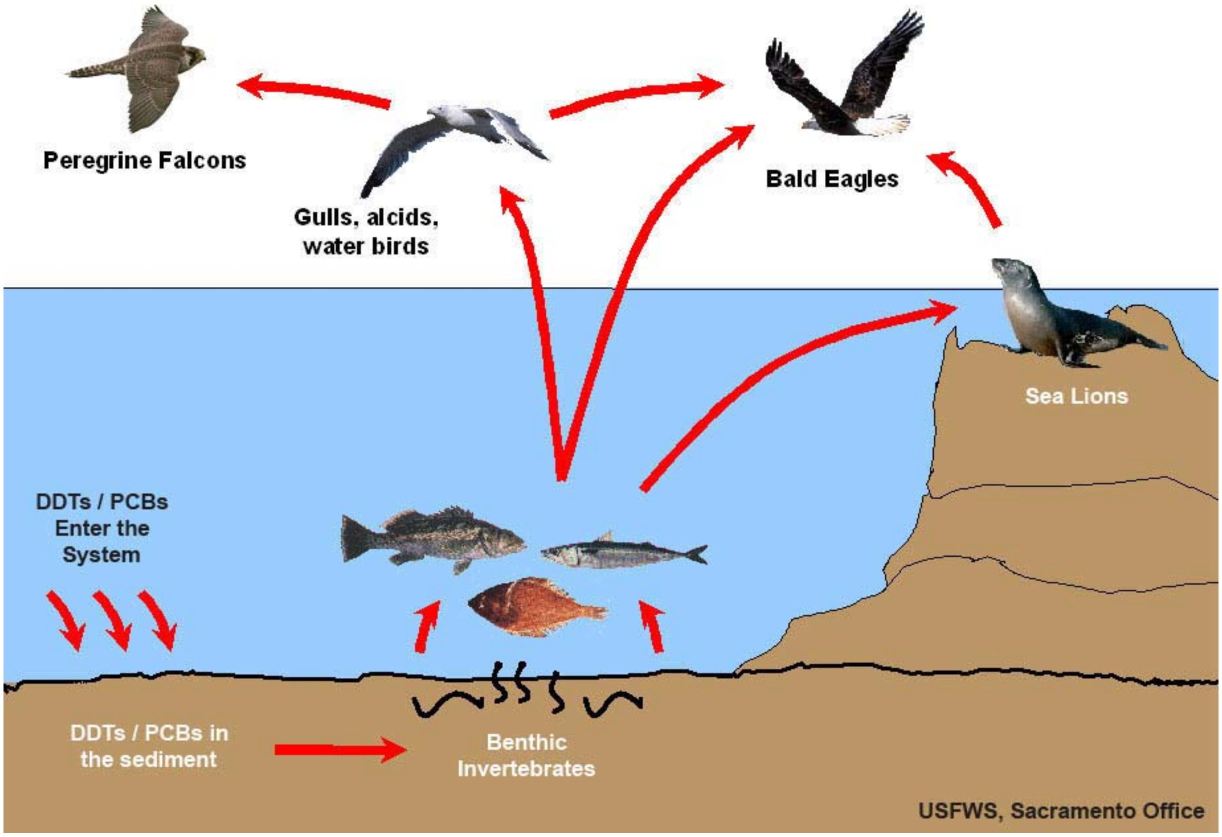


Figure 3.4-2. Major DDT/PCB pathways and the role of fish in the transfer of DDTs and PCBs to upper trophic levels.

The recreational fisheries of the SCB are of particular importance in the Montrose case because the court accepted the lost use of fish resources due to DDT- and PCB-related consumption advisories as an injury in the case. Recreational fishing occurs along the entire Southern California coast, from near Point Conception to the U.S.-Mexico border. The Marine Recreation Fisheries Statistics Survey from 1980 to the present (RecFin 2004) provides a basis for assessing where and how recreational fish species are caught and how the catch has changed over time.

Studies of seafood consumption by recreational anglers indicate that the fish consumption rate in Southern California exceeds the national average (Puffer et al. 1982). A study conducted in the early 1990s found that chub mackerel (*Scomber japonicus*) is the most frequently caught species, but the most frequently consumed species are kelp bass, barred sand bass, rockfishes, Pacific barracuda, and California halibut (*Paralichthys californicus*) (Allen et al. 1996). A more recent review of the fishes retained by anglers in the SCB based on data from the Pacific Recreational Fisheries Information Network (RecFIN 2004) found that the most commonly consumed fish were barred sand bass, Pacific barracuda, yellowtail (*Seriola lalandi*), California halibut, and kelp bass, and that chub mackerel were not the most commonly captured species (Table 3.4-1). Angler consumption rates of potentially contaminated species (e.g., white croaker) varied by ethnic group, indicating that health risk advisories should target the languages and habits of high-risk anglers.

3.4.3 Birds

Birds are another important resource relevant to the MSRP. Top predators such as the bald eagle (*Haliaeetus leucocephalus)* continue to be injured by the DDTs and PCBs that are the subject of the case. Also, seabirds were dramatically impacted by the past discharges of these contaminants and are in various states of recovery since the discharges were stopped. Bald eagles and peregrine falcons consume certain seabird species; thus, the impact of contamination on seabirds is important to understand not only for the potential for adverse impacts on their populations but also as a causative factor in the injury of top predators. DDT and PCB contamination in bald eagles, peregrine falcons, and seabirds, as considered in the case history, is addressed in Section 2.

Over 200 species of birds use coastal and/or offshore habitats within the SCB (Baird 1993). The number of birds fluctuates seasonally with migratory patterns. Seabirds (e.g., auklets, cormorants, gulls, pelicans, phalaropes, shearwaters, storm-petrels, skimmers, and terns) and grebes, loons, and sea ducks account for the greatest biomass of birds within the SCB. The distribution and relative abundance of selected species and groups of birds are described in the following subsections.

Bald Eagles

The bald eagle is currently federally listed as a threatened species. However, the U.S. Fish and Wildlife Service (USFWS) has proposed to de-list the bald eagle, as the birds have made a substantial recovery within their range, particularly on the mainland of the United States. The Pacific Bald Eagle Recovery Plan indicates that the most suitable habitat for recovery in Southern California is on the Channel Islands, particularly Santa Catalina and Santa Cruz Islands (USFWS 1986, Jurek 2000).

Historically, bald eagles occupied all of the Channel Islands in the SCB. From the 1800s to 1950, bald eagle nesting areas were reported from a minimum of 35 different locations on the islands, making the Channel Islands a stronghold for this species in Southern California (Kiff 2000). However, by the early 1960s, bald eagles had disappeared from the Channel Islands. The extirpation is believed to have resulted from a combination of factors, including egg collecting, hunting, urbanization, and DDE contamination (see Section 2.1).

Bald eagles reside along seacoasts, lakeshores, and major rivers. They are large birds, weighing between 10 and 14 pounds, with females typically weighing more than males. Bald eagles that breed in the southern United States are smaller in size than those that reside in the northern United States and Canada. They are a monogamous species, mating for life; however, if one partner dies, the other will select a new mate. The breeding season generally occurs between January and August. Bald eagles do not always breed every year. Nests are built in large trees and are often re-used year after year. Bald eagles lay from one to three eggs, which are incubated for 35 days. The length of time from when the eggs are laid to when all chicks are fledged (first flight) is 16 to 18 weeks. Hatched eagle chicks have a 50 percent survival rate during their first year. Bald eagles reach sexual maturity between the ages of 4 and 5 years, at which time they develop their distinctive white feathers on the head and tail. In the wild, the lifespan of a bald eagle is approximately 30 years.

Bald eagles are only partially migratory. In the winter, migration from their breeding grounds to nearby coastal areas only occurs if their fishing areas freeze over. They have also been known to migrate during the winter from northern breeding grounds to warmer southern regions. The bald eagle is a scavenger and predator of a variety of species. The diet of eagles on Santa Catalina Island consists mainly of pelagic fish snatched from the ocean surface; however, bald eagles also eat birds, mammals (mainly carcasses of sea lions and seals), and invertebrates as well (Garcelon 1994b). Diet is probably similar among individuals on all the Channel Islands (Sharpe and Garcelon 1999a, Valoppi et al. 2000). Adult bald eagles spend more time hunting and killing prey, whereas juveniles are more likely to scavenge and steal food due to their undeveloped hunting skills.

In 1980, the Institute of Wildlife Studies, the USFWS, and the CDFG initiated a program to reintroduce bald eagles to Santa Catalina Island (Figure 3.4-3). The MSRP Trustee Council has funded recent years of this program. Between 1980 and 1986, 33 chicks from wild nests were brought to the island, reared on artificial nest platforms, and released (Sharpe 2003). Several of these eagles have survived and formed nesting pairs. However, none of their eggs have been hatched normally to date, as the eggshells have been too thin for normal incubation, and would have broken under the weight of the adults. Also, the embryos have suffered water loss through the thin eggshells. From1989 to 2005, the population was maintained by collecting the eggs, transporting them to the San Francisco Zoo for artificial incubation, and re-introducing the chicks back to the nests. In 2005, an incubation facility was built on the island, and the eggs were hatched on-site.

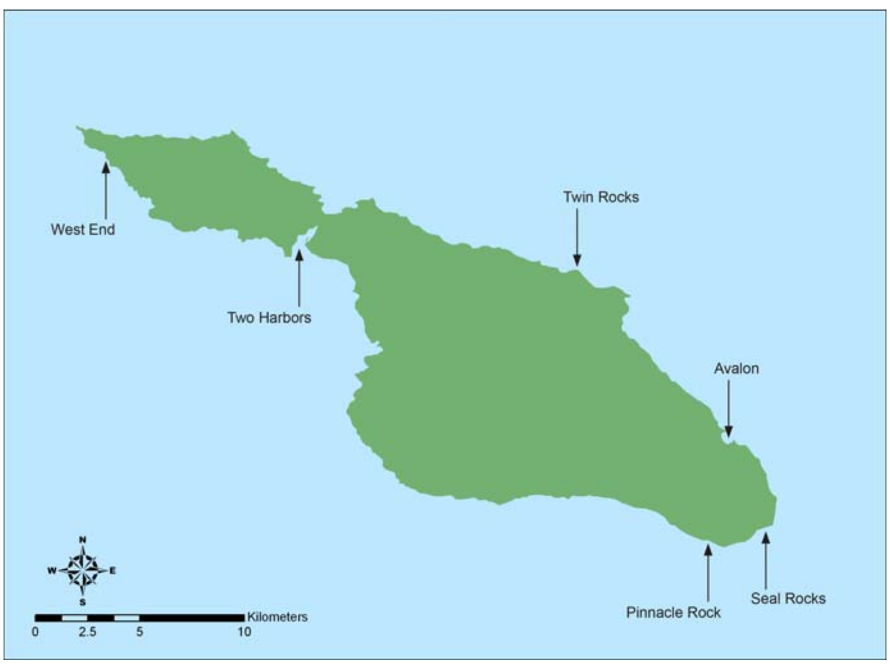


Figure 3.4-3. Active bald eagle territories and points of reference on Santa Catalina Island, California.

Golden Eagles

Prior to the 1990s, golden eagles (*Aquila chrysaetos*) were never known to be year-round residents of the Channel Islands. The species increased in abundance on the Northern Channel Islands because feral pigs provided an abundant food source. With little competition from bald eagles, golden eagles took up residence on several of the Northern Channel Islands. Feral pigs have since been eradicated from Santa Rosa Island, and the eradication of pigs from Santa Cruz Island began in 2005.

Golden eagles became a specific issue of concern on the Northern Channel Islands beginning in the 1990s, when they began preying on the endangered Santa Cruz island fox. In 1999 a program was initiated to capture golden eagles on Santa Cruz and Santa Rosa Islands and relocate them to the mainland in cooperation with the National Park Service and other agencies. From 1999 through September 2005, 19 males, 9 females, and 7 nestlings were removed from Santa Cruz Island and relocated, and 2 males, 1 female, and 3 nestlings were removed from Santa Rosa Island and relocated. As of September 2005, the best estimates are that 1 to 2 adult females, 1 adult male, and 2 to 3 sub-adults remain on Santa Cruz Island and only 1 adult female remains on Santa Rosa Island (Sharpe, pers. comm., 2005).

Peregrine Falcons

Peregrine falcons once numbered in the hundreds in Southern California, and between 20 and 30 pairs nested on the Channel Islands prior to 1945 (Kiff 1980, Hunt 1994). However, peregrine falcons had disappeared from the Channel Islands by 1955, and only two pairs were located in California in 1970 (see Section 2). The peregrine falcon has made a dramatic recovery since 1975, in large part due to an active release program conducted by the Santa Cruz Predatory Bird Research Group. Incubation of thin-shelled eggs removed from wild nests and a captive breeding program provided source birds for the release program. At least 719 peregrine falcons were released in California between 1978 and 1993 (Hunt 1994). Between 1985 and 1993, six peregrine falcon hatchlings were released at sites on San Miguel Island, and 17 hatchlings were released on Santa Catalina Island.

The minimum breeding age for peregrine falcons is 2 years. In 1987, the first reestablished peregrine falcon pair was recorded on San Miguel Island. In 1989, active nests were recorded on Anacapa and Santa Cruz Islands (Hunt 1994). Between 8 and 10 pairs were noted on the Northern Channel Islands between 1992 and 1994 (Hunt 1994). In 2004, approximately 21 peregrine falcon pairs were occupying breeding territories on six of the eight Channel Islands (PBRG 2004). The majority of the pairs (18 of 21) occur on the Northern Channel Islands (San Miguel, Santa Rosa, Santa Cruz, and Anacapa Islands), and 3 pairs occur on the Southern Channel Islands (2 pairs were recently confirmed on Santa Catalina Island and 1 on Santa Barbara Island). Peregrine falcons nest almost exclusively on cliff ledges that are associated with suitable foraging areas; they also have been observed nesting on man-made structures in urbanized areas (CINMS 2000).

The release program has had substantial success in increasing the population of peregrine falcons in California and the rest of the United States. The number of peregrine falcons in California increased from an estimated low of 5 to 10 breeding pairs in the early 1970s to a minimum of 167 occupied sites in 1998 (Herman et al. 1970, USFWS 1999). The Pacific Coast Recovery Plan for the peregrine falcon outlined a recovery goal of 120 pairs in California, including 5 pairs for the Channel Islands (USFWS 1982).

The peregrine falcon was de-listed from the List of Threatened and Endangered Species on August 25, 1999 (USFWS 1999). At the time of de-listing, the recovery goals had been met in California, though full recovery in some areas of California was impeded by ongoing elevated levels of DDTs (Jarman 1994, Walton 1997). Eggshells measured in 1992–1993 averaged 19 percent thinner than eggshells measured before 1947 and had elevated concentrations of DDE (Hunt 1994, Kiff 1994). Productivity rates are substantially lower when eggshells range between 17 and 20 percent thinner than normal (Peakall and Kiff 1988). It has been estimated that 1 ppm of DDE in the diet of peregrine falcons is sufficient to cause the eggshells to be 16 percent thinner, and 3 ppm of DDE results in eggshells that are 10 to 28 percent thinner (Enderson et al. 1982, Deweese et al. 1986, Hunt 1994). Peregrine falcons prey almost exclusively on other birds. Data collected in 1992 indicated that contamination in the food web was still at sufficient levels to result in substantial eggshell thinning on the Channel Islands.

As mentioned above, the peregrine falcon is a highly specialized feeder, concentrating almost entirely on other birds. Kiff (1980) reports that peregrine falcons prey on at least 22 species of birds on the Channel Islands and Coronado Islands. Dietary studies of peregrine falcons in 1992 and 1993 showed that gulls, alcids, and land birds constituted between 73 and 82 percent of their diet, depending on season (Hunt 1994). Grebes, shorebirds, and phalaropes constituted a smaller but still substantial part of their diet. Within these groups of birds, the species that accounted for 5 percent or more of the prey biomass included the California gull (*Larus californicus*), western gull (*Larus occidentalis*), Cassin's auklet (*Ptychoramphus aleuticus*), Xantus's murrelet (*Synthliboramphus hypoleucus*), unidentified grebes, red phalarope (*Phalaropus fulicaria*), rock dove (*Columba livia*), mourning dove (*Zenaida macroura*), and European starling (*Sturnus vulgaris*).

In 1998, eggs from eight peregrine falcon territories on the Northern Channel Islands were sampled to determine eggshell thinning. The average eggshell thinning for all territories on the Channel Islands was slightly below 17 percent. In most coastal Channel Island territories, eggshell thinning exceeded the 17 percent level, whereas the results in most inland Channel Island territories were less than this level (Walton 1999). These differences are likely a reflection of the higher levels of DDE in marine-oriented prey (i.e., seabirds) than terrestrial prey (i.e., land birds) (Walton 1999).

Seabirds

A total of 43 species of seabirds have been reported in the SCB (Baird 1993). These include albatrosses, alcids, cormorants, gulls, jaegers, pelicans, phalaropes, shearwaters, storm-petrels, skimmers, and terns. A total of 14 species of seabirds breed on the Channel Islands (Table 3.4-3). The following sections provide brief profiles of the different types of seabirds within the SCB. Foraging areas for selected seabirds are shown in Figure 3.4-4.

Alcids

This group of seabirds includes the common murre (*Uria aalge*), Xantus's murrelet, Cassin's auklet, Rhinoceros auklet (*Cerorhinca monocerata*), pigeon guillemot (*Cepphus columba*), and the tufted puffin (*Fratercula cirrhata*).

Common murres spend most of their time on the open ocean; they nest on sea cliffs and protected seacoasts (Baird 1993). They build no nests and lay their eggs on narrow rock ledges. They dive to depths of up to 100 meters (328 feet) and feed primarily on fish, shrimp, and squid. They have been extirpated from the Channel Islands, but were observed in 2004 in breeding plumage on Prince Island (Whitworth, pers. comm., 2004). Common murres may also be observed in the SCB in offshore areas. They are particularly vulnerable to entanglement in gill nets due to their underwater foraging behavior, oil spills because they spend long periods sitting on the water, and El Niño events that affect their food supply.

Table 3.4-3
List of Seabirds with Breeding Colonies on the Channel Islands

Common Name	Scientific Name	Status	Channel Islands							
			San Miguel	Santa Rosa	Santa Cruz	Anacapa	Santa Barbara	San Nicolas	Santa Catalina	San Clemente
Ashy storm-petrel	*Oceanodroma homochroa*	SSC	X		X	S	X		S	X
Black storm-petrel	*Oceanodroma melania*	SSC	S			S	X			S
Leach's storm-petrel	*Oceanodroma leucorhoa beali*		X				X			
California brown pelican	*Pelecanus occidentalis*	FE, SE	E		E	X	X			
Brandt's cormorant	*Phalacrocorax penicillatus*		X	X	X	X	X	X		X
Double-crested cormorant	*Phalacrocorax auritus*	SSC	X		E	X	X		E	
Pelagic cormorant	*Phalacrocorax pelagicus*		X	X	X	X	X			
Western gull	*Larus occidentalis*		X	X	X	X	X	X	X	X
Common murre	*Uria aalge*		E							
Pigeon guillemot	*Cepphus columba*		X	X	X	X	X			
Cassin's auklet	*Ptychoramphus aleuticus aleuticus*		X		X	X	E		X	
Rhinoceros auklet	*Cerrorhinca moncerata*	SSC	X							
Tufted puffin	*Fratercula cirrhata*	SSC	S		E	E	E			
Xantus's murrelet	*Synthiboramphus hypoleucus scrippsi*	SSC, ST	X		X	X	X		S	X

FE = Federal endangered
SE = State endangered, ST= State threatened
SSC = Species of Special Concern
Notes: X- Breeder; S- Suspected Breeder; E = Extirpated
Sources: Carter et al. 1992, Wolf 2002, Carter, pers. comm., 2003.

Xantus's murrelets are small, burrow-nesting seabirds (Unitt 1984) that establish colonies on crevices, ledges, and sometimes under dense vegetation. They are particularly vulnerable to nest predation by deer mice and introduced rats on some of the Channel Islands. This species is nocturnal and feeds mostly on fish such as anchovies, the larvae of other fish, and aquatic invertebrates (CINMS 2000). The worldwide breeding range of Xantus's murrelet is restricted to the Channel Islands and the west coast of Baja California, Mexico. Currently, this range consists of only 12 nesting islands scattered along 500 miles of coastline (Burkett et al. 2003). Historical accounts and literature from the 1940s indicate that Xantus's murrelet numbers have declined substantially. At present, the murrelet is considered an uncommon species, with approximately

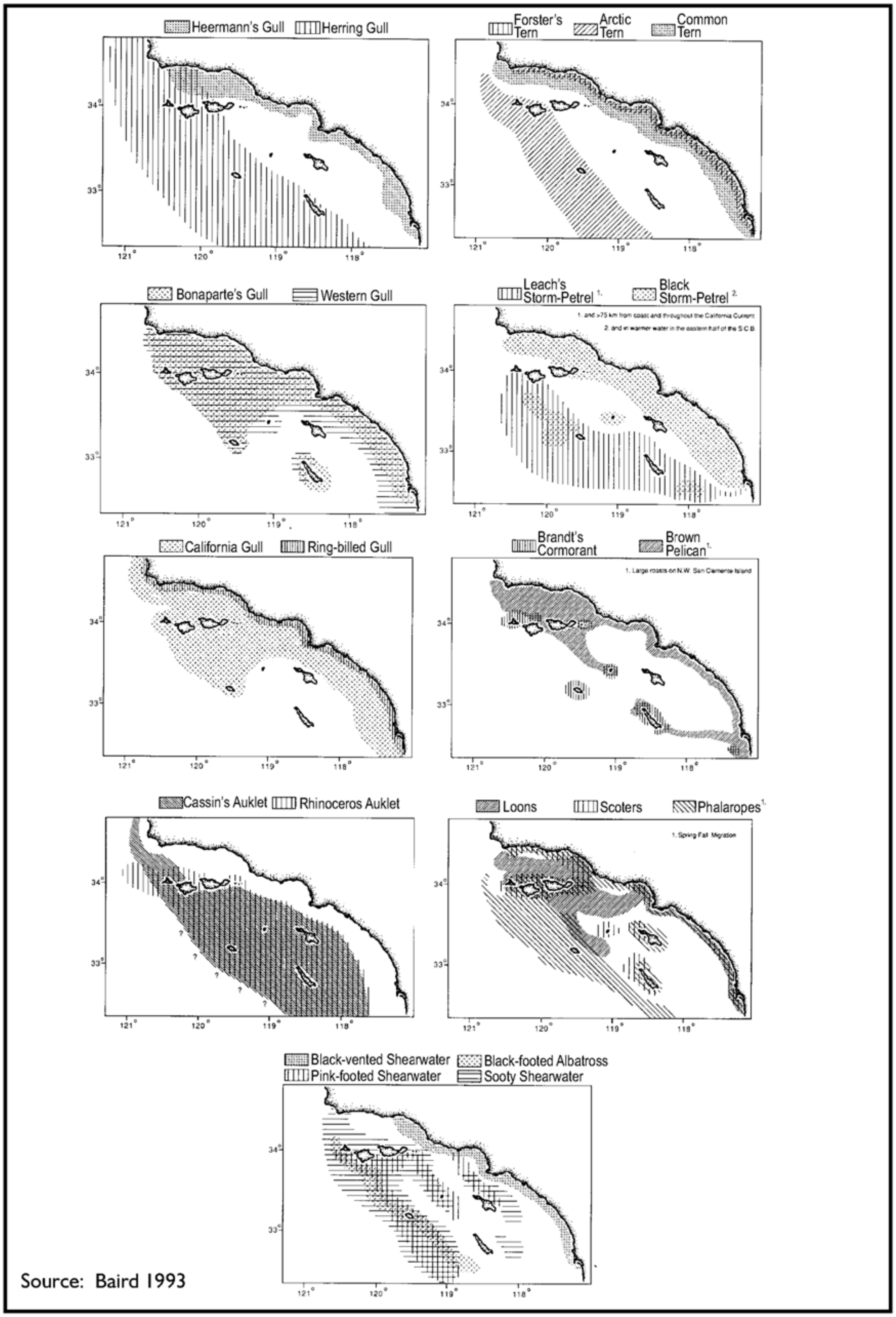


Figure 3.4-4. Most heavily used foraging areas for selected seabirds in the SCB.

3,000 breeding birds in California and less than 10,000 birds worldwide (Burkett et al. 2003). The California Fish and Game Commission made a finding in February 2004 to list the Xantus's murrelet as a threatened species under the California Endangered Species Act. This listing was finalized in June 2004 (CDFG 2004a).

In May 2004, the Xantus's murrelet was also listed as a candidate species for listing as a federally threatened species.

Cassin's auklets breed primarily on Prince Island (near San Miguel Island) and have been observed and may be breeding on other Channel Islands (Carter et al. 1992, Wolf 2002). During the breeding season, Cassin's auklets are dispersed from the midshelf seaward to 150 kilometers (93 miles) offshore. From August through October, following the nesting season, they are observed throughout the SCB (Briggs et al. 1987, Baird 1993). Cassin's auklets are small, burrow-nesting seabirds that are nocturnal and feed diurnally (mainly on copepods and euphasids) at sea, mainly offshore around the Channel Islands. The species is listed as a second priority Species of Special Concern (PRBO 2005).

Rhinoceros auklets are abundant during the winter months on offshore waters along the California coastline concentrating seaward of the shelf break, where they spend their time resting and foraging (Briggs et al 1987, Baird 1993). No historical data exist on breeding populations prior to 1991; however, in 1994, this species was recorded breeding on San Miguel Island (Carter, pers. comm., 2003). The species breeds colonially in burrows in maritime and inland grassy slopes, occasionally on flat ground on forest floors (CINMS 2000). It feeds mainly on small fish, and sometimes squid. Auklets are particularly vulnerable to oil spills because they spend a considerable amount of time sitting on the water (Briggs et al. 1987, Baird 1993).

The pigeon guillemot is more abundant north of Point Conception, but breeding colonies are located on San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara Islands, which form the southern limit of their breeding range (Baird 1993). This species can breed either in colonies or solitarily on cliffs and slopes, occasionally excavating a burrow; eggs are laid in natural crevices or holes (CINMS 2000). It feeds on small demersal fish (blennies and sculpins) and nearshore schooling fish.

Tufted puffins bred on the Channel Islands (Anacapa, Santa Barbara, and San Miguel Islands), the southernmost part of their breeding range, until they were extirpated in the mid-1900s. Recently, this species has been observed in small numbers on Prince Island near San Miguel Island (McChesney et al. 1995, Wolf 2002). The tufted puffin is listed as a first priority Species of Special Concern (PRBO 2005). It builds its nests in holes or crevices; it feeds by diving on fish, squid, and crustaceans and catching them while underwater (CINMS 2000).

Cormorants

This group of seabirds include the Brandt's cormorant (*Phalacrocorax penicillatus*), the double-crested cormorant (*Phalacrocorax auritus*), and the pelagic cormorant (*Phalacrocorax pelagicus*). These species spend most of their time on land roosting and typically forage within 1 kilometer (0.6 miles) of the shore (McChesney et al. 2000).

Brandt's cormorant is considered to be one of the most abundant seabirds in the SCB (Baird 1993). It breeds on all of the Channel Islands with the exception of Santa Catalina Island. This cormorant species is typically found within 10 kilometers (6.2 miles) of the shore and no further than 25 kilometers (15.5 miles) from the mainland or island roosts and colonies. It breeds on islands and gently sloping hillsides (CINMS 2000). The most heavily used foraging areas are around the Channel Islands (Briggs et al. 1987, Baird 1993). It feeds by diving and capturing fish. Although not listed, the Brandt's cormorant has been affected by human disturbance, habitat destruction, and DDE in their eggshells, which causes nesting failure (Gress et al. 1973, Hunt et al. 1980, Baird 1993).

Double-crested cormorants breed on San Miguel, Anacapa, and Santa Barbara Islands; they have been extirpated on Santa Cruz and Santa Catalina Islands (Carter et al. 1992, Wolf 2002). These cormorants were once abundant in the SCB; however, habitat destruction, the presence of DDE in their eggshells, and human disturbance have led to nesting failure and have contributed to population declines (Remsen 1978, Gress et al. 1973, Hunt et al. 1980, Baird 1993). Populations have increased since the 1980s; and breeding populations on the Channel Islands have numbered approximately 2,500 birds in the 1990s (Carter et al. 1992, Gress 1994, McChesney et al. 2000). Double-crested cormorants also have been observed roosting and foraging in the winter in the open water habitats of Bolsa Chica wetlands (Chambers Group 2000). It feeds on schooling fish, aquatic invertebrates, and (rarely) small invertebrates. It builds a nesting platform of sticks, seaweed, and other material and nests along the coast, around marshes or lakes, or on coastal cliffs (CINMS 2000).

Pelagic cormorants are found year-round in the SCB. They breed in small colonies primarily on the Northern Channel Islands and Santa Barbara Island. They are found along the north coast of the SCB, near Point Conception. Peak numbers occur in mid-winter (McChesney et al. 2000).

Gulls

This group of seabirds includes Bonaparte's gull (*Larus philadelphia*), Heermann's gull (*Larus heermanni*), the ring-billed gull (*Larus delawarensis*), the California gull, the herring gull (*Larus argentatus*), the western gull, and the black-legged kittiwake (*Rissa tridactyla*).

Bonaparte's gulls overwinter in the SCB from December through March, congregating along the coastal shores (Briggs et al. 1987, Baird 1993). These gulls forage along the mainland coast and around the Channel Islands.

Heermann's gulls are found in large numbers in San Diego County and along the beaches in the Santa Barbara Channel (Briggs et al. 1987, Baird 1993). Only small numbers of these gulls can be found over open water or near the Channel Islands; most forage within a few kilometers of the mainland shore.

Ring-billed gulls congregate in sheltered bays and estuaries along the mainland coast of the SCB. In winter, they rarely venture further than 1 kilometer (0.6 miles) offshore, and during late spring they migrate to the Rocky Mountain states to begin breeding (Baird 1976).

California gulls are abundant in the SCB along the shallow waters of the coast during the fall and winter months (Briggs et al. 1987, Baird 1993). They typically forage along the mainland coast and around the Northern Channel Islands. Peak numbers occur in the SCB from January through March. During the spring the birds migrate inland to begin breeding.

Herring gulls are found throughout the SCB on island and mainland beaches. During the winter, smaller populations are found on the beaches of San Diego and the eastern portion of the Santa Barbara Channel, and larger populations are found foraging west of the Santa Rosa–Cortes Ridge. Peak numbers occur from January through March (Briggs et al. 1987, Baird 1993).

Western gulls are found extensively throughout the SCB. They are one of the most abundant breeding seabirds in the SCB (McChesney et al. 2000). These birds breed during the months of April through August on all of the Channel Islands. Anacapa Island currently hosts approximately 5,000 breeding pairs (Martin, pers. comm., 2005), and from 1994–1996 western gull populations on Santa Barbara Island ranged from 2,500 to 4,100 breeding pairs. Western gulls also occasionally breed in small numbers along the Southern California mainland at North San Diego Bay, the La Jolla cliffs in San Diego County, Lower Newport Bay in Orange County, and Vandenberg Air Force Base in Santa Barbara County. Western gulls breed colonially, and nests are located on rocky cliffs or headlands on the ground. Western gulls are also found foraging year-round along the shallow waters of the SCB, such as in Anaheim Bay and Upper Newport Bay (MEC Analytical Systems 1995, MEC Analytical Systems 1997). They seldom venture further than 25 kilometers (15.5 miles) offshore of the shelf break. Periods of storms and ocean warming have contributed to population declines (Briggs et al. 1987, Baird 1993).

Black-legged kittiwakes are a Northern California resident species that occasionally migrates to the SCB during the winter. During this time large numbers of kittiwakes can be found on the open ocean, inshore waters, and along beaches and estuaries. A few individuals can be seen in the SCB throughout the year (Briggs et al. 1987, Baird 1993).

California Brown Pelicans

The California brown pelican (*Pelecanus occidentalis*) largely breeds on Anacapa Island in the Channel Islands. A smaller colony also exists on Santa Barbara Island. In 2002, the number of nests and fledglings produced by the Southern California nesting population was estimated at 6,440 and 3,220 individuals, respectively, though the number of nest attempts and fledglings produced is variable by year (the range is 628 to 6,440 and 372 to 6,390, respectively, during the past twenty years [1983–2002]) (Gress et al. 2003).

The Channel Islands also provide important nocturnal and diurnal roosting sites for this ground-nesting bird. High numbers of pelicans (up to 6,000) roost on Santa Barbara Island compared to other areas in the SCB (Baird 1993). Pelicans also roost on a variety of shoreline structures (such as offshore rocks and islands) where human disturbance and predation from mammals is limited. Along the coast of the SCB, pelicans primarily use artificial structures such as breakwaters or jetties. Some important mainland roosting sites are the breakwaters of Long Beach Harbor and Marina del Rey due to the length of the structures, which provide unlimited capacity and protection from winter surf (Strong and Jaques 2003). Higher numbers of pelicans roost on the mainland coast during the months of June through October, as the pelicans move away from their nesting sites. Abundances at roosting sites are affected not only by the time of the year but also by pulses of migration, large storm events (such as El Niño), or high localized abundances of prey. Non-existing or limited roosting habitat occurs from Point Dume to the Santa Monica breakwater (Strong and Jaques 2003). Figure 3.4-5 shows California brown pelican roosting sites along the Southern California coast.

California brown pelicans primarily forage in shallow waters residing within 20 kilometers (12.4 miles) of the mainland coast (Briggs et al. 1987, Baird 1993). These birds have a preference for warmer waters and have been known to concentrate at sea during the months of August through October, when surface temperatures are higher. The California brown pelican is listed as state and federally endangered and is further discussed in Section 3.4.6 of this report.

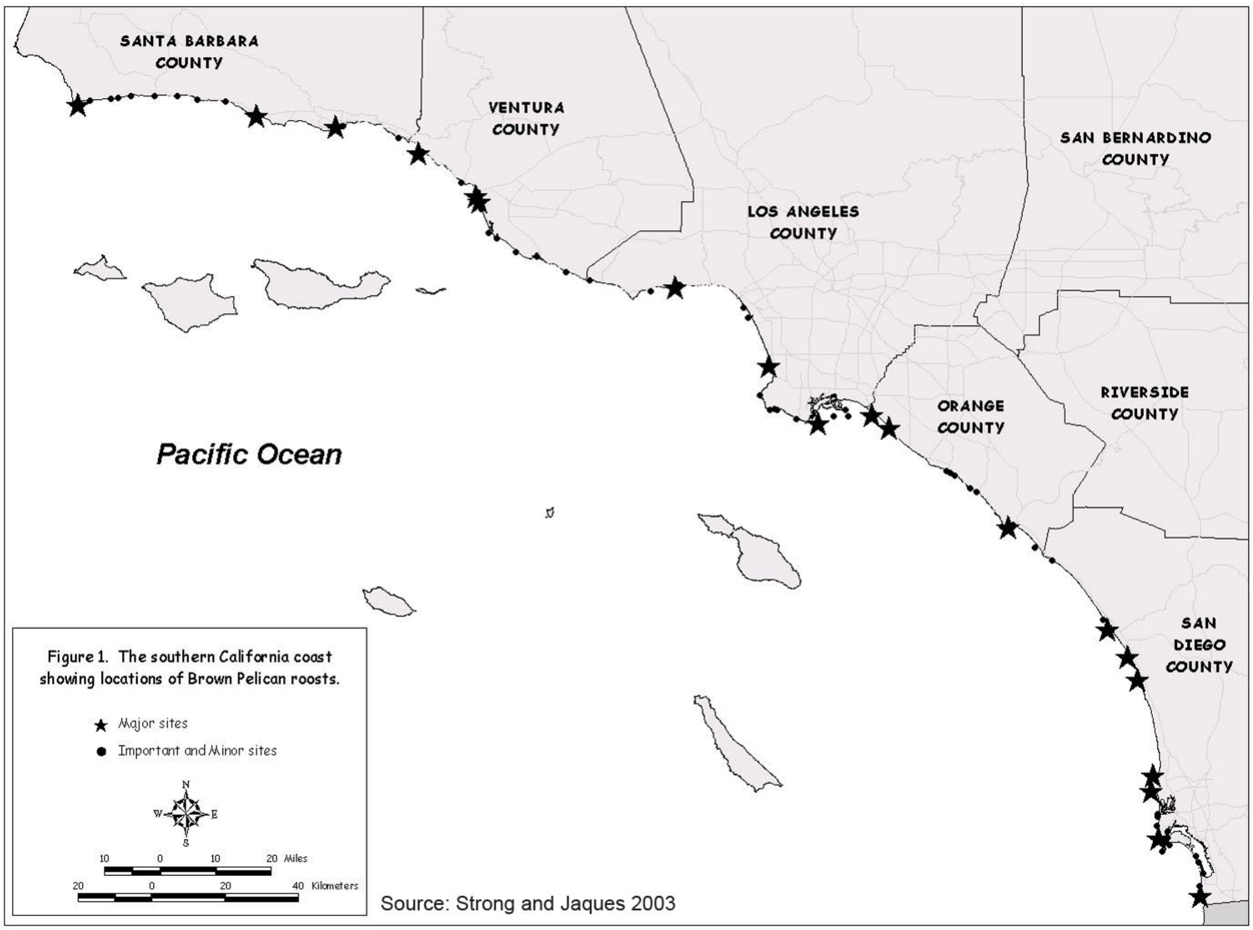


Figure 3.4-5. California brown pelican roosting sites along the Southern California coast.

Storm-petrels

This group of seabirds includes Leach's storm-petrel (*Oceanodroma leucorhoa*), the black storm-petrel (*Oceanodroma melania*), the ashy storm-petrel (*Oceanodroma homochroa*), and the least storm-petrel (*Oceanodroma microsoma*).

Leach's storm-petrels can be found nesting in small numbers on Prince Island (near San Miguel Island) and Santa Barbara Island in the SCB (Figure 3.1-5). A highly pelagic species, this storm-petrel is most numerous offshore of the central continental slope, where they spend most of their time foraging for food. Non-breeding Leach's storm-petrels are found more than 75 kilometers (46.5 miles) offshore during their mid-summer migration (Briggs et al. 1987, Baird 1993). Although the majority continue to migrate northwest, a few can be found during the winter months 100 kilometers (62 miles) offshore of Point Conception (Crossin 1974).

Black storm-petrels are found year-round in the SCB, preferring to forage in waters with warm surface temperatures. Small numbers of this species nest on Santa Barbara Island and Sutil Island; these constitute the entire breeding population of California (Pitman and Speich 1976, Baird 1993) (Figure 3.1-5). Peak numbers occur during the late summer months through the fall. The black storm-petrel is listed as a third priority Species of Special Concern (PRBO 2005).

The ashy storm-petrel is a sparrow-sized seabird endemic to California islands and a few adjacent mainland sites (Ainley 1995). Ashy storm-petrels are restricted to the northeast Pacific Ocean, breeding on islands from central to Southern California (with a few small colonies in Baja California and Northern California). Unlike most other storm-petrels, ashy storm-petrels are non-migratory, residing within the California Current system year-round. Approximately half of the world's population of ashy storm-petrels, which is estimated at less than 10,000 individuals, nest at the Farallon Islands, and half at the Channel Islands, primarily at San Miguel, Santa Barbara, and Santa Cruz Islands (Carter et al. 1992). During the past 20 years, this species has undergone a dramatic decline in abundance at its largest colony on the Farallon Islands (Sydeman et al. 1998). In the Channel Islands, ashy storm-petrels nest at scattered locations among talus, within rocky crevices in sea caves, and on steep, inaccessible cliffs (Hunt et al. 1979, Carter et al. 1992). The ashy storm-petrel is a globally rare seabird species. Currently, it has the following listings: "near threatened" by the World Conservation Union (Bird Life International 2000), Category 2 Candidate Species under the Endangered Species Act (USFWS 1994), and a Species of Management Concern by USFWS and CDFG.

Least storm-petrels are found in the SCB during the fall months. In the late 1980s, approximately 200,000 birds could be found during this time of year, usually in the warmer waters of the SCB (Briggs et al. 1987).

Skimmers and Terns

Skimmers and terns are seabirds that breed in coastal areas of the SCB. This group of seabirds includes the royal tern (*Sterna maxima*), elegant tern (*Sterna elegans*), common tern (*Sterna hirundo*), arctic tern (*Sterna paradisaea*), Forster's tern (*Sterna forsteri*), Caspian tern (*Sterna caspia*), black skimmer (*Rynchops niger*), and the California least tern (*Sterna antillarum browni*). Tern populations have been greatly reduced since the early part of the twentieth century due to human disturbance and destruction of their habitat. Human population growth has infringed on their nesting sites, which mainly occur on mainland beaches, estuaries, and lagoons

(Baird 1993). The California least tern has been listed as a federally Endangered Species and is discussed under threatened and endangered species (Section 3.4.6).

Royal terns nest in San Diego Bay and in Bolsa Chica Lagoon (Baird 1993). They are found in small numbers (a few hundred) along the shores of San Miguel, Santa Rosa, and San Clemente Islands during their non-breeding season. They are rarely found greater than 1 kilometer (0.6 miles) offshore preferring areas of warmer waters. Peak abundance is during the month of September. Royal terns are listed as a third priority Species of Special Concern (PRBO 2005).

Elegant terns have been observed nesting in San Diego Bay, Bolsa Chica Lagoon, and along the western riprap of Pier 400 in the Port of Los Angeles (Baird 1993, Chambers Group 2000). They have also been sighted courting along the Santa Margarita River estuary at Camp Pendleton. Non-breeding elegant terns are found on mainland beaches throughout Southern California, and are rarely sighted more than 4 kilometers (2.5 miles) offshore of the mainland, preferring areas of warmer waters. Numbers range in the several thousands and are on the increase. Northward migration to Northern California occurs during the late summer and fall (Baird 1993). The elegant tern is listed as a Species of Special Concern (PRBO 2005).

Common terns and arctic terns are migratory species and do not breed in the SCB. They are typically found west of the Santa Barbara channel to the Cortes Bank during their fall migration to South America, where they spend the winter. Common terns in the SCB usually occur within 25 kilometers (15.5 miles) of the mainland on coastal beaches and estuaries and forage close to shore. Arctic terns are more numerous than common terns over 25 kilometers (15.5 miles) offshore. Peak abundance for both species in the SCB occurs during their spring migration (April to May). Approximately 30,000 to 50,000 common and arctic terns were reported in the early 1990s (Briggs et al. 1987, Baird 1993) and these species today remain common visitors to the SCB.

Forster's terns are typically found throughout the SCB foraging along mainland beaches, coastal bays, and estuaries during the late spring and summer (Baird 1993). They have been observed nesting in Upper Newport Bay and Bolsa Chica (MEC Analytical Systems 1997, Chambers Group 2000). This species can also be found up to 15 kilometers (9.3 miles) from the mainland shore. Approximately 500 Forster's terns were found along the beaches and 80 at Bolsa Chica Lagoon during the early 1990s (Baird 1993).

Caspian terns are observed year-round in the SCB. They typically nest along the coast and in marshes, rivers, and inland lakes (NGS 1987). Nesting sites have been recorded at San Diego Bay (less than a thousand breeding pairs) and Bolsa Chica Lagoon (around two hundred breeding pairs) (CDFG 1980, Baird 1993, Chambers Group 2000). They also have been observed nesting in the Port of Los Angeles along Pier 400 (over 300 nests) (Port of LA 2005).

Black skimmer nesting sites are located at Bolsa Chica Lagoon (more than 300), Anaheim Bay, and San Diego Bay (Baird 1993, Chambers Group 2000). They are relatively common in the Bolsa Chica lowlands during migration and winter periods and have been observed nesting in the Port of Los Angeles along Pier 400 (183 birds) (Chambers Group 2000). The black skimmer is listed as a Species of Special Concern (PRBO 2005).

Other Seabirds

Other seabird species that are occasionally found in the SCB include the black-footed albatross (*Phoebastria nigripes*), Laysan's albatross (*P. immutabilis*), and the short-tailed albatross (*P. albatrus*); the northern fulmar (*Fulmarus glacialis*); the pomarine jaeger (*Stercorarius pomarinus*) and the parasitic jaeger (*S. parasiticus*); the red phalarope (*Phalaropus fulicaria*) and the red-necked phalarope (*P. lobatus*); and the pink-footed shearwater (*Puffinus creatopus*), sooty shearwater (*P. griseus*), Buller's shearwater (*P. bulleri*), black-vented shearwater (*P. opisthomelas*), and the short-tailed shearwater (*P. tenuirostris*). Water birds found in the SCB include the western grebe (*Aechmophorus occidentalis*) and Clark's grebe (*A. clarkii*); the Pacific loon (*Gavia pacifica*), common loon (*G. immer*) and the red-throated loon (*G. stellata*); and the surf scoter (sea duck) (*Melanitta perspicillata*) and the white-winged scoter (sea duck) (*M. fusca*).

3.4.4 Marine Mammals

The waters off the coast of California support numerous species of marine mammals, including sea lions and seals (pinnipeds), dolphins, whales, porpoises (cetaceans), and sea otters. Thirty-four species have been recorded in the SCB. Many of these species are common to the area, having established breeding populations or foraging grounds. Other species migrate through the SCB at certain times of the year, and many species are infrequent or rare (Bonnell and Dailey 1993). These marine mammals have varied diets, including pelagic and demersal fish, cephalopods, and crustaceans.

The following subsections summarize the more common marine mammals that occur in the SCB. This discussion covers species distribution, breeding populations (if they exist in the SCB), migratory patterns, and relevant dietary information. The last subsection reviews marine mammal strandings in Los Angeles County and Orange County based on the most recent data available.

Sea Lions and Seals

Six pinniped species are known to inhabit the SCB: the California sea lion (*Zalophus californianus californianus*), Pacific harbor seal (*Phoca vitulina richardsi*), northern elephant seal (*Mirounga angustirostris*), northern fur seal (*Callorhinus ursinus*), northern or Stellar sea lion (*Eumetopias jubatus*), and the Guadalupe fur seal (*Arctocephalus townsendi*). Of these, the California sea lion, Pacific harbor seal, northern elephant seal, and the northern fur seal have breeding populations within the SCB. Pacific harbor seals and northern elephant seals breed throughout the Channel Islands (Stewart et al. 1994, Bonnell and Dailey 1993). The breeding range of the California sea lion extends from the Channel Islands south to the Gulf of California in Mexico (Bonnell and Dailey 1993). Northern fur seals breed on San Miguel Island (USDI et al. 2002 [2003]). Although northern sea lions and Guadalupe fur seals once ranged extensively along California, they are rarely seen today in the SCB (Bonnell and Dailey 1993) and are not discussed further in this report.

Sea Otters

The normal range of the sea otter (*Enhydra lutris*) in California extends from the Santa Maria River north to Point Año Nuevo. In 1987, 69 sea otters were translocated to San Nicolas Island, within the SCB, in an attempt to rebuild the California population, which had greatly declined due to commercial hunting into the early 1900s. In recent years, it has been estimated that approximately 20 sea otters remain around the island. Quite a few of the sea otters died or were unaccounted for after a winter storm. Others migrated to the mainland and subsequently were returned to their range in central California (Bonnell and Dailey 1993).

It is estimated that sea otters in California can live up to 12–16 years (Pietz et al. 1988). Females usually have one pup every one or two years and give birth in the water. They care for their young for about six months. The pups reach sexual maturity in about 3 to 4 years. Dietary preferences are primarily macroinvertebrates, including mussels, crabs, clams, tunicates, abalone, and sea stars. Sea otters also prey on octopus (Estes et al. 1981, Ralls et al. 1988). They live in kelp beds and seldom forage more than 1 to 1.5 miles from shore.

Whales, Dolphins, and Porpoises

Several species of baleen and toothed whales may be seen offshore of Southern California. The whale species commonly seen in the SCB include grey (*Eschrichtius robustus*), blue (*Balaenoptera musculus*), fin (*Balaenoptera physalus*), minke, and humpback (*Megaptera novaeangliae*) whales. Uncommon whale species include beaked whale species, sperm (*Physeter macrocephalus*), killer (*Orcinus orca*), false killer (*Pseudorca crassidens*), pygmy sperm (*Kogia* breviceps), dwarf sperm (*Kogia simius*), northern right (*Balaena glacialis*), sei (*Balaenoptera borealis*) and Bryde's whales (*Balaenoptera edeni*).

Dolphins and porpoises belong to the same order as toothed whales (*Odontocetes*). Common species within the SCB include common (*Delphinus delphis*), bottlenose (*Tursiops truncates*), northern right-whale (*Lissodelphis borealis*) and Risso's (*Grampus griseus*) dolphins as well as Dall's porpoise (*Phocoenoides dalli*). Two species, the harbor porpoise (*Phocoena phocoena*) and the striped dolphin (*Stemella coeruleoalba*, a tropical delphinid), mainly occur offshore on the outer continental shelf and are infrequent or rare visitors to the SCB.

3.4.5 Terrestrial Mammals

Three native terrestrial mammal species are found on the Channel Islands: the island fox (*Urocyon littoralus)*, which is federally endangered, the deer mouse (*Peromyscus maniculatus*), and the island spotted skunk (*Spilogale gracilis*).

The island fox, a diminutive relative of the mainland gray fox is distributed as six subspecies, one on each of the six largest California Channel Islands. Three of the subspecies occur on the Northern Channel Islands, within the boundaries of Channel Islands National Park: the San Miguel island fox, Santa Rosa Island fox, and the Santa Cruz Island fox. The latter occurs on both National Park Service (NPS) lands and lands owned by The Nature Conservancy on Santa Cruz Island. On the Southern Channel Islands, the San Nicolas Island fox and San Clemente Island fox occur on lands managed by the U. S. Navy, and the Santa Catalina Island fox occurs on lands managed by the Catalina Island Conservancy.

Island foxes have undergone a catastrophic decline on San Miguel, Santa Rosa, and Santa Cruz Islands (Coonan et al. 1998, Roemer 1999), as well as an unrelated catastrophic decline on Santa Catalina Island. The decline in populations on the Northern Channel Islands was caused by the recent appearance of golden eagles as a resident species on the island. Golden eagles are aggressive predators of terrestrial mammals and were never known to be year-round residents on the islands prior to the 1990s. A captive breeding program, designed to protect the subspecies from elimination by enhancing breeding, was initiated on all the Northern Channel Islands where fox populations declined. Efforts are currently under way to remove golden eagles on the Northern Channel Islands by live trapping and translocating the birds.

The fox decline on Santa Catalina Island was due to the introduction of distemper to the island, probably by a domestic dog. The Santa Catalina Island fox population has largely recovered, and the Catalina Island Conservancy is working to educate the public about the threat that domestic dog diseases pose to island foxes.

All of the Channel Islands (including Prince Island and Sutil Rocks) have native deer mice. Separate subspecies have been identified on each of the major islands, but the mice on Prince Island and Sutil Rocks are not known to be separate subspecies from the mice on San Miguel Island or Santa Barbara Island, respectively.

Island spotted skunks occur only on Santa Cruz and Santa Rosa Islands, having been extirpated from San Miguel Island. Little is known about the ecology of the Channel Islands spotted skunk. Skunk populations on Santa Cruz and Santa Rosa Islands appear to have increased substantially in conjunction with the decline of fox populations.

3.4.6 Threatened and Endangered Species

Several threatened and endangered species occur within the study area. Several of these species are associated with habitats that have become limited within the ranges of these species (e.g., coastal wetlands, riparian forests, or dune habitats). Other species are endemic to the Channel Islands and have been impacted by feral and/or exotic animals and human disturbance. In a few cases, the species were put into jeopardy by DDT contamination, human disturbance, and/or overexploitation.

Table 3.4-4 lists the threatened and endangered (federally and state-listed) plants of the Channel Islands. Table 3.4-5 presents the threatened and endangered (federally and state-listed) animals of the study area and the parts of the study area where they occur.

Table 3.4-4
Threatened and Endangered Plants of the Channel Islands

Common Name	Scientific Name	Status	San Miguel Island	Santa Rosa Island	Santa Cruz Island	Anacapa Island	Santa Barbara Island	San Nicolas Island	Santa Catalina Island	San Clemente Island
Hoffmann’s rock cress	*Arabis hoffmannii*	FE		X	X	X				
Santa Rosa Island manzanita	*Arctostaphylos confertiflora*	FE		X						
Island barberry	*Berberis pinnata* ssp. *Insularis*	FE		X	X	X?				
San Clemente Island	*Castilleja grisea*	SE/FE								X

Table 3.4-4
Threatened and Endangered Plants of the Channel Islands

Common Name	Scientific Name	Status	San Miguel Island	Santa Rosa Island	Santa Cruz Island	Anacapa Island	Santa Barbara Island	San Nicolas Island	Santa Catalina Island	San Clemente Island
Indian paintbrush										
Soft-leaved Indian paintbrush	*Castilleja mollis*	FE	X	X						
Catalina Island mountain-mahogany	*Cercocarpus traskiae*	SE/FE							X	
San Clemente Island larkspur	*Delphinium variegatum* ssp. *Kinkiense*	SE/FE								X
Beach spectaclepod	*Dithyrea maritima*	ST	X					X		
Santa Cruz Island dudleya	*Dudleya nesiotica*	FT			X					
Santa Barbara Island dudleya	*Dudleya traskiae*	SE/FE					X			
San Nicolas Island buckwheat	*Eriogonum grande* var. *timorum*	SE						X		
Box bedstraw	*Galium buxifolium*	FE								X
San Miguel Island bedstraw	*Galium californicum* ssp. *Miguelense*	FE	X		X					
San Clemente Island bedstraw	*Galium catalinense* ssp. *Acrispum*	SE								X
Hoffmann's slender-flowered gilia	*Gilia tenuiflora* ssp. *Hoffmannii*	FE		X						
Island rush-rose	*Helianthemum greenei*	FE	X?	X	X				X	
Santa Cruz Island woodland star	*Lithophragma maximum*	SE/FE			E					X
San Clemente Island bird's-foot trefoil	*Lotus argophyllus* var. *adsurgens*	SE								X
Santa Cruz Island bird's-foot trefoil	*Lotus argophyllus* var. *niveus*	SE			X					
San Clemente Island lotus	*Lotus dendroideus* var. *traskiae*	SE/FE								X
San Clemente Island bush mallow	*Malacothamnus clementinus*	SE/FE								X
Santa Cruz Island bush mallow	*Malacothamnus fasciculatus* var. *nesioticus*	SE/FE			X					
Santa Cruz Island malacothrix	*Malacothrix indecora*	FE		X	X					
Island malacothrix	*Malacothrix squalida*	FE	X	X	X	X				

Table 3.4-4
Threatened and Endangered Plants of the Channel Islands

Common Name	Scientific Name	Status	San Miguel Island	Santa Rosa Island	Santa Cruz Island	Anacapa Island	Santa Barbara Island	San Nicolas Island	Santa Catalina Island	San Clemente Island
Lyon's pentachaeta	*Pentachaeta lyonii*	SE/FE							X	
Northern Channel Islands phacelia	*Phacelia insularis* var. *insularis*	FE	X	X						
Santa Cruz Island rock cress	*Sibara filifolia*	FE			E				E	X
Santa Cruz Island fringepod	*Thysanocarpus conchuliferus*	FE			X					

Notes:

E=Extirpated in these localities as reported by Philbrick 1980.

FE=Federally endangered

FT=Federally Threatened

SE=State Endangered

ST=State Threatened

X= extant

X?=location uncertain

Table 3.4-5
Threatened and Endangered Wildlife within the Study Area

Common Name	Scientific Name	Status	San Miguel Island	Santa Rosa Island	Santa Cruz Island	Anacapa Island	Santa Barbara Island	San Nicolas Island	Santa Catalina Island	San Clemente Island	Coastal Mainland
Invertebrates											
El Segundo blue butterfly	*Euphilotes battoidea allyni*	FE									X
Palos Verdes blue butterfly	*Glaucopsyche lygdamus palosverdesensis*	FE									X
White abalone	*Haliotis sorenseni*	FE	E	E	E	E	E	E	E	X	E
Fish											
Southern steelhead trout	*Oncorhynchus mykiss*	FE									X
Tidewater goby	*Eucyclogobius newberryi*	FE									X
Reptiles											
Island night lizard	*Xantusia riversiana*	FT					X	X		X	
Green sea turtle	*Chelonia mydas*	FT									M
Leatherback sea turtle	*Dermochelys coriacea*	FE	M	M	M	M	M	M	M	M	M
Loggerhead sea turtle	*Caretta caretta*	FT	M	M	M	M	M	M	M	M	M
Olive ridley sea turtle	*Lepidochelys olivacea*	FT									M
Birds											
Bald eagle	*Haliaeetus leucocephalus*	SE,FT	X	X	X	X	E	E	X	E	X
Belding's savannah sparrow	*Passerculus sandwichensis beldingi*	SE									X
California black rail	*Laterallus jamaicensis coterniculis*	ST									E
California brown pelican	*Pelicanus occidentalis californicus*	SE,FE	X	X	X	X	X	X	X	X	X
Coastal California gnatcatcher	*Polioptila californica californica*	FT									X
California least tern	*Sterna antillarum browni*	SE,FE									X
Least Bell's vireo	*Vireo bellii pusillus*	SE,FE									X
Light-footed clapper rail	*Rallus longirostris levipes*	SE,FE									X
Marbled murrelet*	*Brachyramphus marmoratus*	SE,FT									
Peregrine falcon	*Falco peregrinus anatum*	SE	X	X	X	X	X	X	X	X	X

Table 3.4-5
Threatened and Endangered Wildlife within the Study Area

Common Name	Scientific Name	Status	San Miguel Island	Santa Rosa Island	Santa Cruz Island	Anacapa Island	Santa Barbara Island	San Nicolas Island	Santa Catalina Island	San Clemente Island	Coastal Mainland
San Clemente loggerhead shrike	*Lanius ludovicianus mearnsi*	FE								X	
San Clemente sage sparrow	*Amphispiza belli clementeae*	FT								X	
Southwestern willow flycatcher	*Empidonax traillii extimus*	SE,FE									X
Western snowy plover	*Charadrius alexandrinus nivosus*	FT	X	X	X			X		X	X
Xantus's murrelet	*Synthliboramphus hypoleucus*	ST	X	X	X	X	X	X	X	X	
Mammals											
Pacific pocket mouse	*Perognathus longimembris pacificus*	FE									X
Island fox	*Urocyon littoralus*	ST,FE	X	X	X			X	X		
Southern sea otter	*Enhydra lutris nereis*	FT	E	E	E	E	E	X			
Guadalupe fur seal*	*Arctocephalus townsendi*	ST,FT									
Stellar sea lion*	*Eumetopias jubatus*	FT									
Sei whale	*Balaenoptera borealis*	FE	M	M	M	M	M	M	M	M	M
Blue whale	*Balaenoptera musculus*	FE	M	M	M	M	M	M	M	M	M
Fin whale	*Balaenoptera physalus*	FE	M	M	M	M	M	M	M	M	M
Humpback whale	*Megaptera novaeangliae*	FE	M	M	M	M	M	M	M	M	M
Right whale	*Balaena glacialis*	FE	M	M	M	M	M	M	M	M	M

Notes:
*Rarely seen throughout study area.
E=Extirpated in these localities
FE=Federally endangered
FT=Federally Threatened
M=Migratory
SE=State Endangered
ST=State Threatened
X=Extant
X?=location uncertain

3.5 LAND USE AND RECREATION

3.5.1 Coastal Land Use and Recreation

The coastal study area encompasses sixteen cities and a number of unincorporated communities in Los Angeles and Orange Counties (Figures 3.5-1 and 3.5-2). The cities are as follows (generally from north to south):

- City of Malibu
- City of Santa Monica
- City of Los Angeles
- City of El Segundo
- City of Manhattan Beach
- City of Hermosa Beach
- City of Redondo Beach
- City of Torrance
- City of Palos Verdes Estates
- City of Rancho Palos Verdes
- City of Long Beach
- City of Seal Beach
- City of Huntington Beach
- City of Newport Beach
- City of Laguna Beach
- City of Dana Point

Generally, the land uses along the coastline include public beaches, marinas, and/or harbors. Inland from the immediate coastline, the land use pattern is typically mixed, with residential and supporting commercial uses. Two key industrial ports (Port of Los Angeles and Port of Long Beach) are situated in Coastal Reach 4, and several parks are located in various reaches. The state, county, and local beaches that are within each of the six coastal reaches are identified in Figures 3.5-3 and 3.5-4. The beaches are often operated by a jurisdiction different from the adjacent city or community. Restoration projects on the immediate coastline require consultation with and approval by both jurisdictions, if applicable.

The Los Angeles, and Orange County coastlines have abundant recreational facilities. Much of the shorelines have been preserved as open space and/or for recreational uses. Favored recreational resources include state and county parks and beaches. Other recreational facilities include piers, golf courses, and small neighborhood parks.

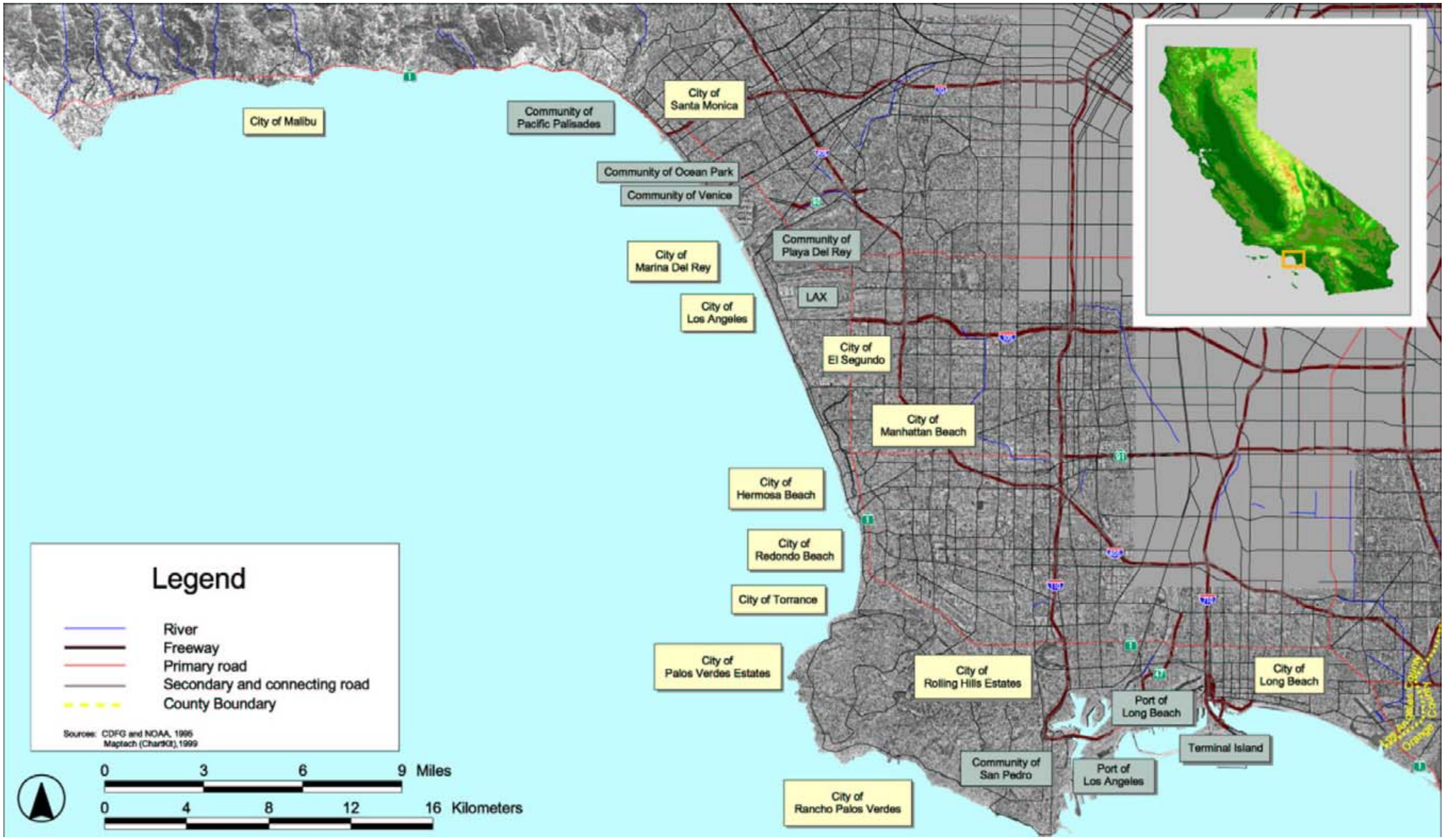


Figure 3.5-1. Coastal cities and communities, Los Angeles County.

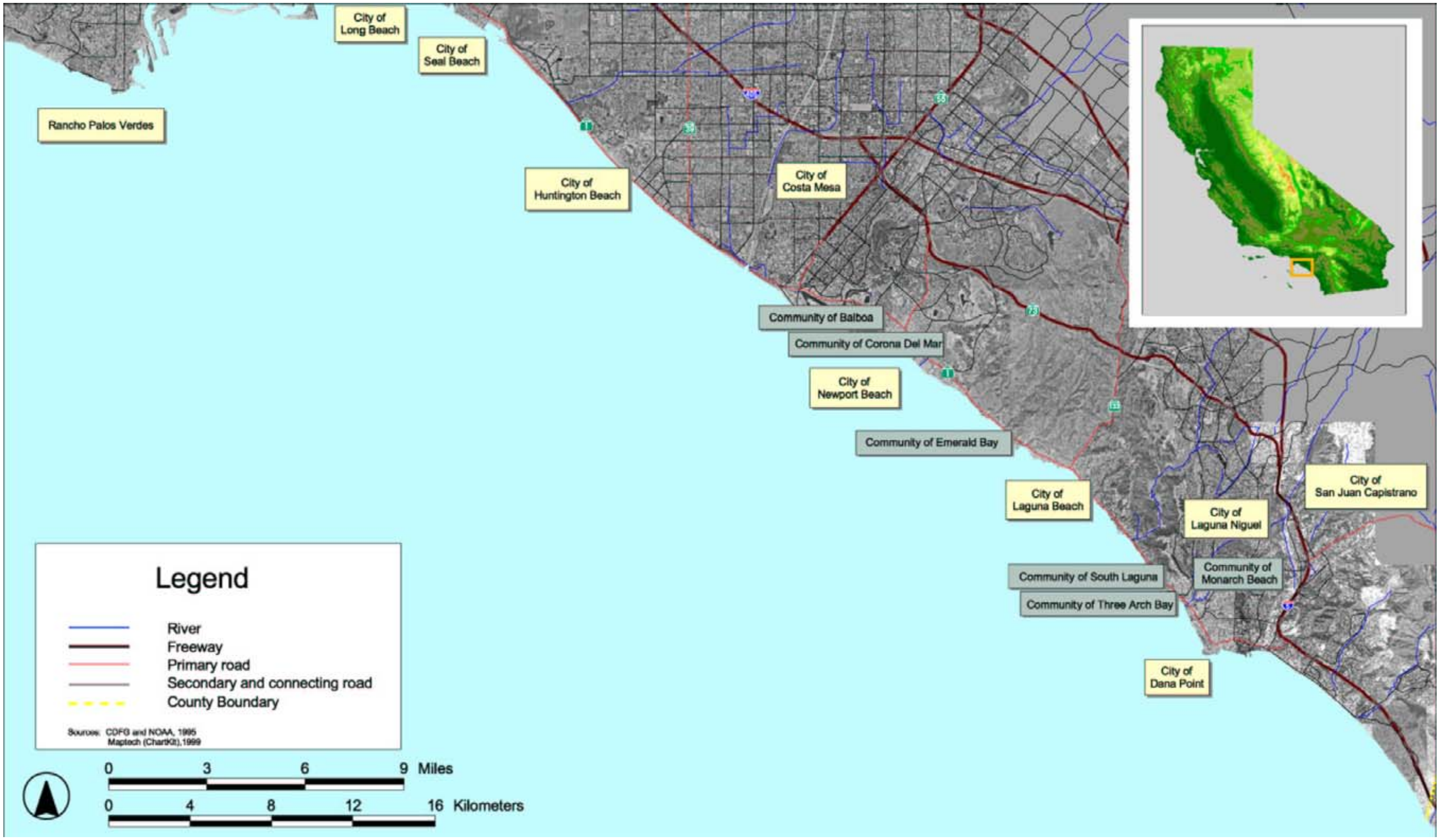


Figure 3.5-2. Coastal cities and communities, Orange County.

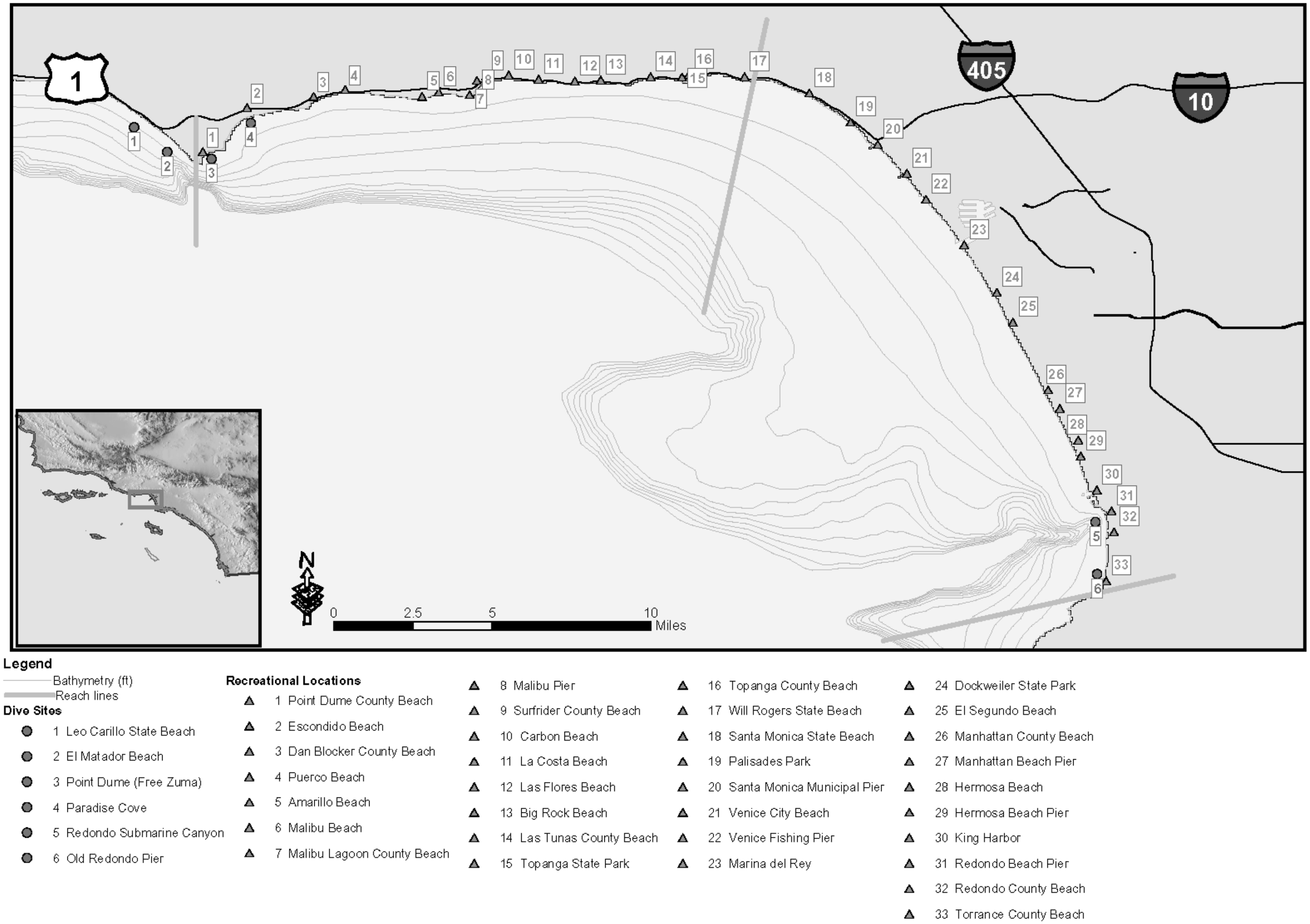
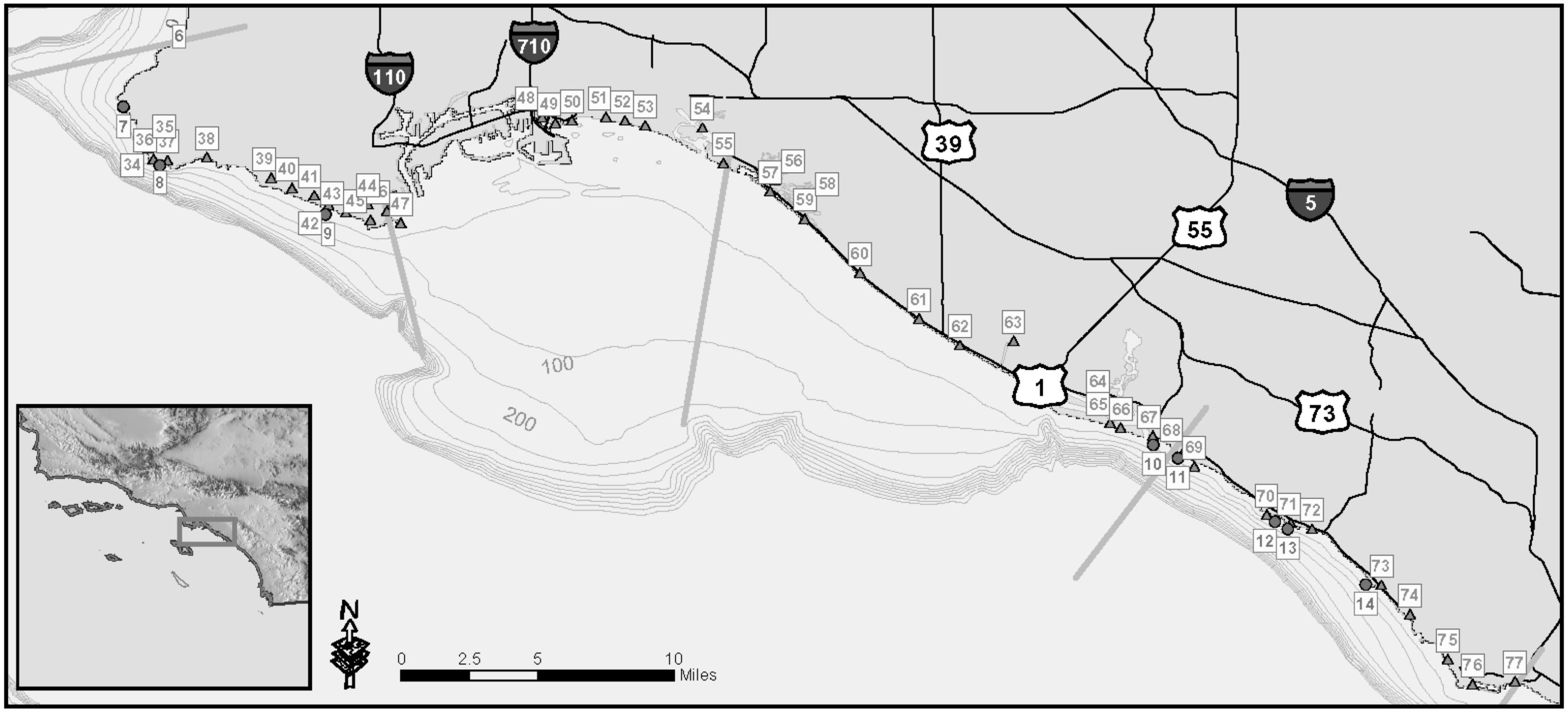


Figure 3.5-3. Generalized locations of recreational resources, Coastal Reaches 1 and 2.



Legend

Bathymetry (ft)
Reach lines

Dive Sites

- 7 Christmas Tree Cove
- 8 Point Vicente Fishing Access
- 9 White Point
- 10 Little Corona
- 11 Scotchman's Cove
- 12 Shaw's Cove
- 13 Rocky beach
- 14 Moss Street

Recreational Locations

- 34 Point Vicente Interpretive Center
- 35 Point Vicente Park
- 36 Point Vicente Lighthouse
- 37 Point Vicente Fishing Access
- 38 Abalone Cover Shoreline Park
- 39 Ocean Trails Golf Course
- 40 Palos Verdes Shoreline Park
- 41 Royal Palms County Beach
- 42 White Point County Beach
- 43 Point Fermin Park
- 44 Angels Gate Park
- 45 Point Fermin Historic Lighthouse
- 46 Cabrillo Beach
- 47 Cabrillo Beach Fishing Pier
- 48 Golden Shore Wildlife Preserve
- 49 Shoreline Park
- 50 Marina Green Park
- 51 Bixby Park
- 52 Bluff Park
- 53 Belmont Pier
- 54 Marine Stadium Park
- 55 Municipal Pier
- 56 Sunset Aquatic Park
- 57 Sunset County Beach
- 58 Huntington Harbor
- 59 Bolsa Chica State Park
- 60 Huntington City Beach
- 61 Huntington Beach Pier
- 62 Huntington State Beach
- 63 Talbert Regional Park
- 64 Newport Bay
- 65 Balboa Pier
- 66 Penninsula Park
- 67 Corona del Mar State Beach
- 68 Crystal Cove State Park
- 69 State Undersea Park
- 70 Cameo Cove State Undersea Park
- 71 Crescent Bay Point Park
- 72 Heisler Park
- 73 Aliso Beach
- 74 1000 Steps County Beach
- 75 Salt Creek Beach Park
- 76 Dana Cove Park
- 77 Doheny State Beach

Figure 3.5-4. Generalized locations of recreational resources, Coastal Reaches 3, 4, 5, and 6.

3.5.2 Land Use and Recreation on the Channel Islands

Northern Channel Islands

The Northern Channel Islands—San Miguel, Santa Rosa, Santa Cruz, and Anacapa—include four of the five islands in the Channel Islands National Park, which is operated by the NPS. The Nature Conservancy owns 76 percent of Santa Cruz Island, the largest of the Channel Islands; however, this island is under the jurisdiction of the NPS. The fifth island in the Channel Islands National Park, Santa Barbara, is located further south and is grouped with the Southern Channel Islands in this document. The Channel Islands National Park is the only national park in the study area. It includes the five islands and 1 nautical mile of marine waters surrounding the islands. In 1980, the U.S. Congress designated the islands and 50,000 hectares (125,000 acres) of the surrounding waters as a national park because of their unique natural and cultural resources. For this reason, the NPS has jurisdiction over the islands and surrounding waters. The parkland holds an Open Space land use designation as well as a National Marine Sanctuaries jurisdictional designation. The Channel Islands National Marine Sanctuary extends for 6 nautical miles surrounding these same islands.

For each of the Northern Channel Islands, the following discussion lists the island's relevant management agency, size, and available recreational opportunities. Opportunities for kayaking, ranger-led hikes, and educational programs are available on the park's islands. Some restrictions and closures are in force to protect sensitive species. Two popular dive sites—Wilson Rock and Richardson Rock—are located in the vicinity of the Northern Channel Islands but are not connected to one island. Figure 3.5-5 shows the dive sites and recreational sites on the Northern Channel Islands.

- Anacapa Island (NPS)
  - 283 hectares (699 acres)
  - Hiking trails, visitor center, lighthouse exhibits, primitive campground, and picnic areas
  - Opportunities for scuba diving, snorkeling, bird-watching, fishing, and observing marine mammals
  - Recreational areas: Frenchy's Cove, Winifield Scott Wreck, and East Fish Camp.
- San Miguel Island (NPS)
  - 3,774 hectares (9,325 acres)
  - Primitive campground, miles of hiking, and beaches
  - Ranger-led hikes, marine-mammal observation, beach exploration, and bird-watching
  - Recreational areas: Crook Point, Tyler Bight, Judith Rock, Adams Cove, Point Bennett, Harris Point, Cuyler Harbor, and Nifty Rock
- Santa Rosa Island (NPS)
  - 21,118 hectares (52,794 acres)
  - Hiking trails and primitive campground

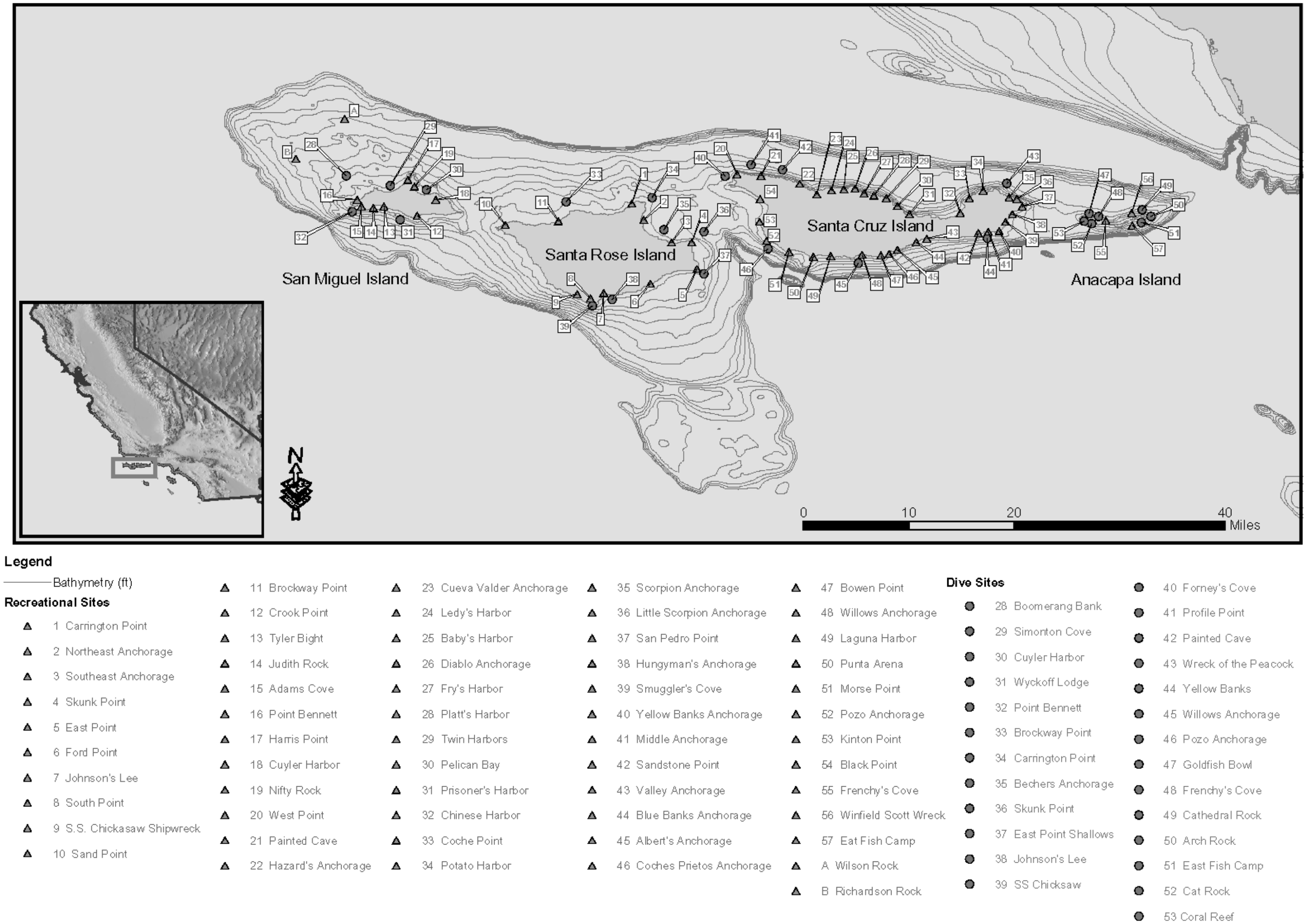


Figure 3.5-5. Dive sites and recreational sites, Northern Channel Islands.

  - Beach exploration, wildlife observation, ranger-led hikes, vehicle tours, and kayak beach-camping
  - Recreational areas: Carrington Point, Northeast Anchorage, Southeast Anchorage, Skunk Point, East Point, Ford Point, Johnson's Lee, South Point, S.S. Chickasaw shipwreck, Sand Point, and Brockway Point

- Santa Cruz Island (The Nature Conservancy: 76% ownership/NPS: 24% ownership)
  - 24,258 hectares (60,645 acres)
  - NPS land: observe wildlife, hike, camp
  - Marine resources: 125,000 acres for sailing, power boating, fishing, SCUBA diving, snorkeling, surfing, wildlife observation and bird watching
  - Recreational areas: West Point, Painted Cave, Hazard's Anchorage, Cueva Anchorage, Ledy's Harbor, Baby's Harbor, Diablo Anchorage, Fry's Harbor, Platt's Harbor, Twin Harbors, Pelican Bay, Prisoners' Harbor, Chinese Harbor, Coche Point, Potato Harbor, Scorpion Anchorage, Little Scorpion Anchorage, San Pedro Point, Hungryman's Anchorage, Smugglers' Cove, Yellow Banks Anchorage, Middle Anchorage, Sandstone Point, Valley Anchorage, Blue Banks Anchorage, Albert's Anchorage, Coches Prietos Anchorage, Bowen Point, Willows Anchorage, Laguna Harbor, Punta Arena, Morse Point, Pozo Anchorage, Kinton Point, and Black Point

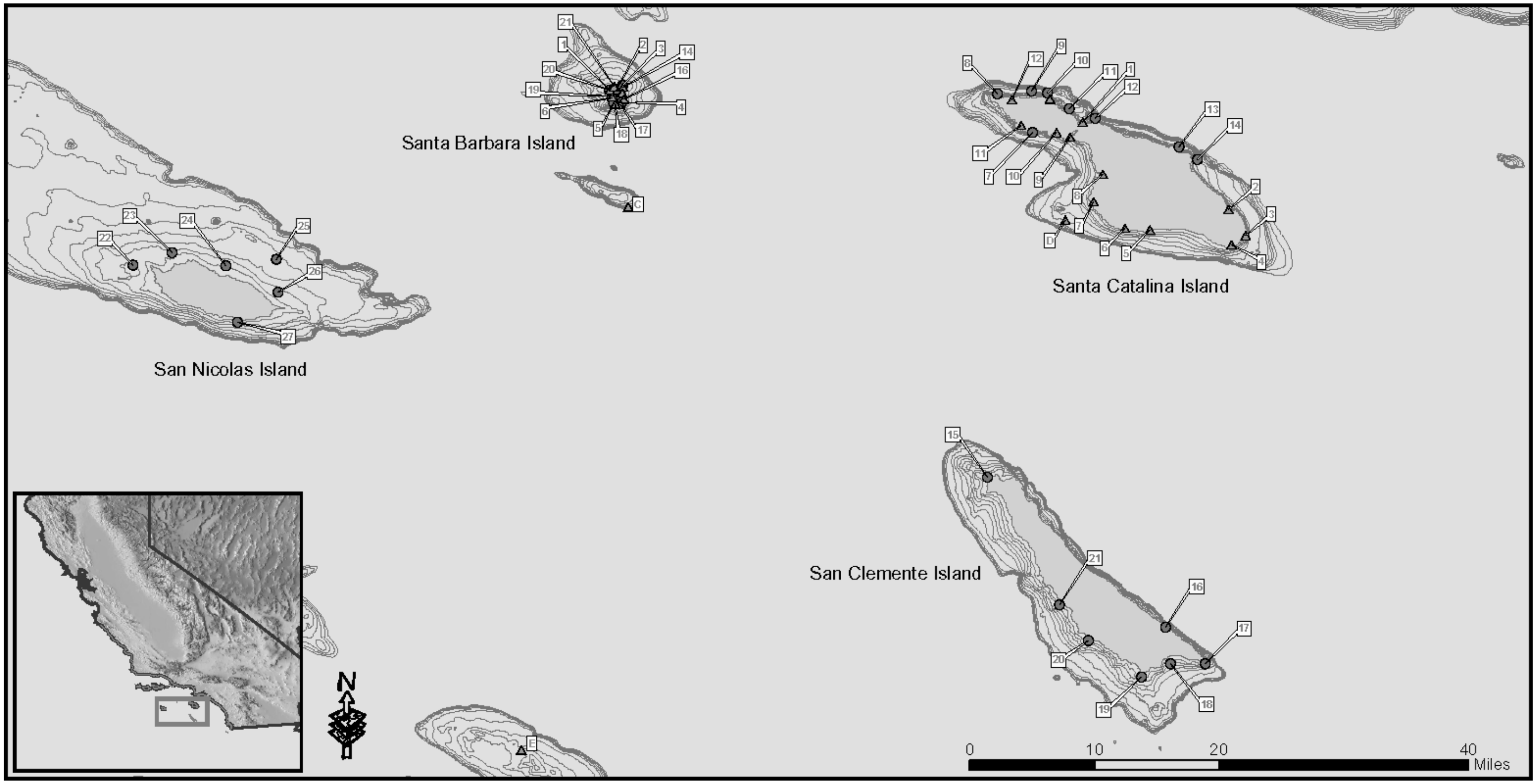
Southern Channel Islands

The Southern Channel Islands—Santa Barbara, Santa Catalina, San Nicolas, and San Clemente—all have separate jurisdictions. Santa Barbara Island is the southernmost island in the Channel Islands National Park, and the island and its surrounding waters are under the jurisdiction of the NPS. Santa Catalina Island is owned by the Catalina Island Conservancy, with a small portion still belonging to the previous owner: the Santa Catalina Island Company. The island is also a part of the Los Angeles Park System. Santa Catalina Island is approximately 197 square kilometers (76 square miles). The island is the highest-visited island in California, with visitors coming for both the terrestrial and the marine environments. Both the island and the surrounding waters are under the jurisdiction of the Catalina Island Conservancy and Los Angeles County. Santa Catalina Island includes the City of Avalon, the only city on the Channel Islands. Avalon is the only place in the Channel Islands with permanent residents, excluding the U.S. Navy owned islands of San Nicolas and San Clemente. The land use designation in Avalon is Open Space, Residential, and Commercial. Areas of Special Biological Significance are designated at the east and west ends of the islands.

San Nicolas Island and San Clemente Island are owned and operated by the U.S. Navy. These islands are not open for public visitation; however, the surrounding waters are periodically open for diving expeditions. San Clemente Island has terrestrial amenities for S.E.A.L. operations and Underwater Demolition Team facilities. Other parts of the island are used for artillery storage and other naval activities. The island is included in the County of Los Angeles Land Use Policy and is designated as Open Space. Restoration projects on these islands would require coordination with the U.S. Navy and Los Angeles County.

For each of the Southern Channel Islands, the following discussion lists the agency with jurisdiction over the island, the size of the island, and the recreational opportunities available on the island. Three major dive sites—Osbourne Bank, Farnsworth Bank, and Tanner Bank—are located in the vicinity of the Southern Channel Islands but are not connected to one island. Figure 3.5-6 shows the dive sites and other recreational sites on the Southern Channel Islands:

- Santa Barbara Island (NPS)
  - 256 hectares (639 acres)
  - Hiking trails, visitor center, primitive campground, and picnic areas
  - Opportunities for scuba diving, snorkeling, bird-watching, fishing, and observing marine mammals
  - Recreational areas: Arch Point, Landing Cove, Canyon View Nature Trail, Sea Lion Rookery, Webster Point, Elephant Seal Cove, and the Santa Barbara Island Light.
- Santa Catalina (Los Angeles County, Catalina Island Conservancy)
  - 19,472 hectares (48,680 acres)
  - Sport fishing, yachting, snorkeling, scuba diving
  - Camping, hiking, biking
  - Recreational areas: Two Harbors, Avalon, Seal Rocks, Church Rock, Salta Verde Point, China Point, Ben Weston Beach, Little Harbor, Catalina Harbor, Lobster Bay, Iron Bound Bay, Starlight Beach, and Parsons Landing
- San Nicolas (U.S. Navy)
  - 5,632 hectares (14,080 acres)
  - Part of Pacific Missile Range
  - Access by special arrangement only
  - Diving areas surround the island, but use is restricted
- San Clemente (U.S. Navy)
  - 14,336 hectares (35,840 acres)
  - Access by special arrangement only
  - Diving areas surround the island, but use is restricted



Legend

Bathymetry (ft)

Recreational Sites

- 1 Two Harbors
- 10 Lobster Bay
- 11 Iron Bound Bay
- 12 Starlight Beach
- 13 Parsons Landing
- 14 Arch Point
- 15 Landing Cove
- 16 Canyon View Nature Trail
- 17 Sea Lion Rookery
- 18 Cat Canyon
- 19 Webster Point
- 2 Avalon
- 20 Elephant Seal Cove
- 21 Santa Barbara Island Light
- 3 Seal Rocks
- 4 Church Rock
- 5 Salta Verde Point
- 6 China Point
- 7 Ben Weston Beach
- 8 Little Harbor
- 9 Catalina Harbor
- C Osborne Bank
- D Farnsworth Bank
- E Tanner Bank

Dive Sites

- 1 Shag Rock
- 10 Bird Rock
- 11 Ship Rock
- 12 Yellowtail Point
- 13 Avalon's Casino Point
- 14 Little Farmsworth
- 15 The Towers
- 16 Windowpane
- 17 The Boilers
- 18 Pyramid Cove
- 19 China Point
- 2 AB City
- 20 Mail Point
- 21 The Caverns
- 22 The Boilers
- 23 "Alpha" Breakers
- 24 "Alpha" Foul Area
- 25 Three Mile Reef
- 26 "Charlie" Area Sandpit
- 27 Dutch Harbor
- 3 The Rockery
- 4 Southeast Reef
- 5 Rubschlager Reef
- 6 Webster Point
- 7 Cat Head
- 8 Johnson's Rocks
- 9 Lion Head

Figure 3.5-6. Dive sites and recreational sites, Southern Channel Islands.

3.6 AESTHETICS AND VISUAL RESOURCES

3.6.1 Coastal Aesthetics and Visual Resources

The coastline from the Ventura County line to the San Diego County line is a scenic stretch of Southern California; the terrain ranges from rocky cliffs to sandy beaches. Picturesque views from the coast include the Pacific Ocean and, in clear weather, many of the Channel Islands. The islands are known for their gorgeous land views and diversity as well as their striking underwater variety and abundance of life.

California state scenic routes are designated and managed by the California Department of Transportation Office of State Landscape Architecture. A scenic highway includes the road and the right-of way as well as a scenic corridor. The scenic corridor is the area visible from the road and generally adjacent to the right-of-way with scenic, historical, or aesthetic characteristics. The California Scenic Highway Program designates highways using the following nine categories:

- Officially Designated State Scenic Highway
- Officially Designated County Scenic Highway
- Officially Designated State Scenic Highway and National Scenic Byway
- Officially Designated State Scenic Highway and All American Road
- Eligible State Scenic Highway—Not Officially Designated
- Unconstructed State Highway Eligible for Scenic Designation
- Historic Parkway
- Connecting Federal Highway
- Connecting Federal Highway and National Scenic Byway

State goals for scenic highways include preserving the visual, biological, and ecological resources; preventing conditions that compromise aesthetic resources; encouraging development that contributes to aesthetic qualities; encouraging historical preservation; and encouraging community civic groups to create programs that increase local interest in the visual resources.

This section describes the varying coastline visual characteristics from Point Dume to Dana Point. Figure 3.6-1 shows representative photographs of the various types of scenic views in the study area, including undeveloped coastline, sandy beach, pier and boardwalk, mixed-use residential/commercial, rugged cliffs, marina, and port/harbor.

3.6.2 Channel Islands Aesthetics and Visual Resources

Figure 3.6-2 shows representative photographs of the Channel Islands.

Northern Channel Islands

The coastlines of the Northern Channel Islands include sandy and rocky beaches, cliffs, tide pools, and sandy and rocky sea caves. Inland, the islands are home to rugged mountains, scenic fields, deep canyons, and year-round streams. The land and underwater diversity of these islands

Undeveloped Coastline/Sandy Beach
Photo taken in Malibu Beach. Source: City of Malibu

Pier/Boardwalk
Photo of Santa Monica Pier. Source:
http://www.schonlau.net/images/smshore.jpg

Mixed Use Residential/Commercial
Photo of Malibu Pier. Source: City of Malibu

Rocky Cliffs
Photo taken in Rancho Palos Verdes. Photo taken by: Mary Donovan

Marina
Photo taken at Marina del Rey marina. Photo taken by Nitsa.

Port/Harbor
Photo of Port of Long Beach. Source: Port of Long Beach

Figure 3.6-1. Representative photographs of the Los Angeles and Orange County coastline environment.

Figure 3.6-1 BACK

Figure 3.6-2. Representative photographs of the Channel Islands.

Figure 3.6-2 BACK

creates an aesthetically stimulating experience that is vastly different than the nearby California coast. The pristine natural beauty of the Channel Islands is visually pleasing to visitors.

No Eligible State Scenic Highways or Officially Designated State Scenic Highways are located on the Northern Channel Islands.

Southern Channel Islands

The Southern Channel Islands also provide diverse and beautiful underwater scenery. The land forms and diversity of Santa Catalina Island are similar to those of the Northern Channel Islands. The land forms of San Clemente and San Nicolas Islands are relatively flat, and do not exhibit the rugged hills and cliffs of the other islands. The land forms of Santa Barbara Island include both flat areas and rugged cliffs.

No Eligible State Scenic Highways or Officially Designated State Highways are located on the Southern Channel Islands.

3.7 TRANSPORTATION

3.7.1 Coastal Transportation

Coastal access is readily available along most of the coastline of Los Angeles and Orange Counties. The beach can be accessed via a variety of major highways, roads, paths, and sandy trails. Much of the coastline is lined with roadways, boardwalks, and trails. Several ports offer transportation to the Channel Islands. Once on the islands, developed roadways allow car traffic around many of the islands, and dirt trails allow hiking and biking.

The counties or cities with jurisdiction along the coastline areas each have general plans that include a circulation element. This element identifies the roads and highways within the jurisdictional boundaries as well as the programs and policies in place to provide an effective transportation network. Any restoration project that would affect transportation or involve roadways would need to consider the land use and circulation elements of the applicable general plans.

3.7.2 Channel Islands Transportation

The Channel Islands do not have extensive roadway networks.

Santa Catalina Island has the most developed roadway system of all of the Channel Islands. The island has primary and secondary roadways that traverse the length of the island and several maintenance roads/trails that increase the accessible areas of the island.

Santa Rosa, Anacapa, San Miguel, Santa Barbara, and Santa Cruz Islands do not have primary or secondary roadways but have dirt roads and/or trails. These islands are owned by the NPS and are accessible to the public for recreational purposes.

The remaining two Channel Islands, San Nicolas and San Clemente, are owned and operated by the U.S. Navy. These islands have roadways that are maintained by the Navy, but the roadways are not open to the public.

Access to the Channel Islands is available through various transport companies leaving from the California coast. Air travel to Santa Rosa and Santa Catalina Islands is also available.

3.8 AIR QUALITY

"Air pollution" is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. Individual air pollutants may adversely affect human or animal health, reduce visibility, damage property, or reduce the productivity or vigor of crops and natural vegetation.

The U.S. Environmental Protection Agency (EPA) has identified seven air pollutants of nationwide concern: carbon monoxide (CO); ozone (O_3); nitrogen dioxide (NO_2); particulate matter equal to or less than 10 microns in size (PM_{10}), which is also called respirable particulate and suspended particulate; fine particulate matter equal to or less than 2.5 microns in size ($PM_{2.5}$); sulfur dioxide (SO_2); and lead (Pb). These pollutants are collectively referred to as criteria pollutants.

The federal Clean Air Act (Title 42 United States Code Sections 7401–7671q) requires the adoption of national ambient air quality standards (NAAQS) to protect the public health and welfare from the effects of air pollution. The NAAQS have been updated as needed. Current standards are set for CO, NO_2, SO_2, O_3, PM_{10}, $PM_{2.5}$, and Pb. Areas are classified under the federal Clean Air Act as either "attainment" or "nonattainment" areas for each criteria pollutant based on whether or not the NAAQS have been achieved. In 2004, the Santa Barbara County remained unclassified for all criteria pollutants. Ventura County was classified as a nonattainment area for O_3, unclassified for PM_{10}, CO, and NO_2, and as an attainment area for SO_2. Los Angeles and Orange Counties were classified as nonattainment areas for O_3, PM_{10}, and CO, unclassified for NO_2, and as attainment areas for SO_2. San Diego County was classified as a nonattainment area for O_3, unclassified for PM_{10}, CO and NO_2, and as an attainment area for SO_2 (CARB 2005).

The State of California Air Resources Board (CARB) has established additional standards, which are generally more stringent than the NAAQS; CARB has also set standards for sulfates, hydrogen sulfide, and "visibility-reducing particles." In 2004, the areas from Santa Barbara to San Diego remained unclassified for CO, NO_2, SO_2, sulfates, Pb, hydrogen sulfide, and visibility-reducing particles. These areas were classified as nonattainment areas for 0_3, PM_{10}, and $PM_{2.5}$, except for Santa Barbara County, which was unclassified for $PM_{2.5}$ (CARB 2005).

3.9 NOISE

3.9.1 Overview and Noise Standards

Noise is defined as unwanted or objectionable sound. The effects of noise on people can include general annoyance, interference with speech communication, sleep disturbance, and, in the extreme, hearing impairment. The A-weighted noise scale, which measures noise levels in decibels (dBA), weighs the frequencies to which humans are sensitive. Because decibels are measured on a logarithmic scale, a doubling of the energy of a noise source equates to a 3 dBA increase in noise level.

People tend to compare an intruding noise with the existing background noise. If the new noise is readily identifiable or considerably louder than the background or ambient noise levels, it usually becomes objectionable. An aircraft flying over a residential area is an example. In the presence of normal environmental background noise, an average healthy ear can readily detect a 5 dBA change in noise level. A 10 dBA change is usually perceived as a doubling, or halving, of the noise level.

3.9.2 Coastal Noise Generators and Sensitive Receptors

The existing noise environment and additional noise sources associated with the six coastal reaches are summarized in Table 3.9-1 (MSRP 2003).

Table 3.9-1
Baseline Noise Environment, Noise Generators, and Sensitive Noise Receptors in the Study Area

Coastal Reach	Baseline Noise Environment	Noise Generators	Sensitive Receptors
1	Surf, Residential, Commercial	No major noise generators	Malibu Pier and beaches Surfrider beach Coastline recreation
2	Residential, Commercial	Santa Monica Municipal Airport Los Angeles International Airport Traffic and roadways	Recreational beaches Boardwalks and piers
3	Residential, Commercial	No major noise generators	Residential development Point Fermin Park Abalone Cove Beach Park Portuguese Bend Co-op Preschool Long Point Resort Hotel
4	Commercial	Port of Los Angeles Port of Long Beach	Residential development Long Beach Pier
5	Surf, Residential, Commercial	Naval Weapons Stations Huntington Harbor Traffic and roadways	Seal Beach NWR Bolsa Chica Ecological Reserve
6	Residential, Commercial	Harbor at Dana Point Amtrak trains	Crystal Cove State Park Laguna Coast Wilderness Park

NWR = National Wildlife Refuge

3.9.3 Noise Generators and Sensitive Receptors on the Channel Islands

Six of the eight Channel Islands are protected ecologically sensitive areas: Santa Catalina, San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara Islands. These islands preserve a diverse range of plant and animal species that are noise sensitive. Each of these six islands is available at some level for recreational use to the public, which has expectations of a natural, low-noise environment. The plant and wildlife species on these islands are all sensitive receptors.

The remaining two Channel Islands, San Nicolas and San Clemente, are owned and operated by the U.S. Navy and are used for training. Naval operations such as bombing and target practice can generate high noise levels. The underwater areas surrounding the islands are periodically used for recreational purposes, including whale watching and diving, and host many species that are noise sensitive.

3.10 CULTURAL RESOURCES

This section presents an overview of the historical and cultural resources that are likely to be found in the coastal areas of Los Angeles and Orange Counties. Future restoration projects must be aware of potentially significant cultural resources that may be located within these coastal and offshore areas. These resources include archaeological sites and historic sites listed on the National Register of Historic Places that are near the coast.

3.10.1 Prehistoric Overview

The initial occupation of the Southern California coast appears to have occurred as early as 10,000 years ago (Jones 1992).

Southern California coastal archaeological sites increase dramatically in number after about 8,000 years ago, a period when sites associated with the Milling Stone Horizon appear (Wallace 1955). Research in Southern California demonstrates that this period was marked by regional differentiation, adaptation to local conditions, and more permanent habitation.

The Late Prehistoric period, spanning from approximately 1,500 years ago to the mission era, is the period associated with contemporary Native American groups known as the Chumash and the Gabrieliño (Wallace 1955). Juan Rodriguez Cabrillo was the first documented European to make contact with these groups in 1542.

3.10.2 Historic Overview

The Chumash and Gabrieliño were virtually ignored between Cabrillo's visit and the Spanish Period, which began in 1769. Missions were established at San Gabriel in 1771, San Juan Capistrano in 1776, and San Fernando in 1797. By the 1800s, the majority of the Chumash and Gabrieliño mainland population had entered the Spanish mission system (Jackson 1999), with the island populations entering somewhat later.

The pueblo Nuestra Señora la Reina de los Angeles de Prociuncula (Los Angeles) was founded in 1781, and grew slowly based primarily on cattle ranching. The first civilian land grants in the Los Angeles area were awarded in 1784 to Manuel Nieto (Rancho Los Alamitos) and Jose Maria Verdugo (Rancho San Rafael). By the mid-1800s, hunters, settlers, and ranchers, made their way to the area, and ranching became an economic mainstay.

In 1821, colonial New Spain became the independent Republic of Mexico. Economic competition and political tension between the new Mexican republic and the Catholic Church became intense, and the missions were secularized beginning in 1831 (Rolle 1998). In 1845, Governor Pio Pico moved the capital of California to Los Angeles, and in 1850 California gained statehood.

Attracting settlers during the late nineteenth and early twentieth centuries, the beautiful California coastline became accessible by rail and quickly became a mecca for industrial, commercial, residential, and recreational uses. The coastline continues to serve these uses into the twenty-first century.

3.10.3 Archaeological Resources

Onshore Sites

Archaeological surveys and excavations over the past century have revealed a diverse and extensive cultural landscape. Hundreds of archaeological sites have been identified along the Southern California coast; the major concentrations are in the vicinity of bays, estuaries, lakes, streams, marshes, and at the mouths of canyons (Altschul and Grenda 2002). Four key locations in Los Angeles and Orange Counties have been identified: (1) from the vicinity of Malibu Lagoon, south to Malibu Point, and north to the Ventura County line; (2) Santa Monica Bay, in the vicinity of Marina del Rey and the Ballona Lagoon; (3) the southern portion of San Pedro Bay, in and around Seal Beach, Long Beach, and Huntington Beach and the Bolsa Chica Lagoon; and (4) the vicinity of Newport Bay (Jones 1992).

Thousands of archaeological sites have been identified on the Channel Islands. Due to the lack of abundant terrestrial resources, island sites tend to concentrate along the island fringes, particularly on the shores of the islands' small, protected inlets (Jones 1992).

Offshore Sites

Over 100 prehistoric underwater archaeological sites have been identified off the coast of Southern California (Masters and Schneider 2000). Although the majority of underwater sites identified are located offshore of San Diego County, underwater sites are also likely to occur in the waters offshore of Los Angeles and Orange Counties.

Shipwrecks

As of June 2001, the California State Lands Commission listed 156 shipwrecks off the Los Angeles County coast (ships built between 1853 and 1945) and 37 shipwrecks off the Orange County coast (ships built between 1837 and 1944). Shipwrecks tend to cluster in Santa Monica Bay, San Pedro Bay, and Newport Bay; the shipwrecks involve schooners, oil screws, steamboats, barges, masted ships, ferries, military craft, tankers, submarines, and sailboats. The general locations of these shipwrecks can be seen on Figure 3.10-1.

3.10.4 Historic Resources

The area encompassing the Los Angeles and Orange County coastlines and the Channel Islands contains a variety of historic resources, including an assortment of structures, features, and cultural landscapes, most associated with late-nineteenth- and early-twentieth-century shipping and rail industry, early-twentieth-century residential and commercial development, and coastal tourism and recreation. Many of these resources are likely to have historic significance, but have yet to be evaluated.

3.11 SOCIOECONOMICS

The section provides a summary of the socioeconomic state of the coastal cities within the study area. This information is largely presented in tables, which present the demographic and economic data from the 2000 Census (http://factfinder.census.gov) that pertain to the 19 coastal cities within Los Angeles and Orange Counties. The study area includes cities along the coast of both counties and extends inland for approximately 3.2 kilometers (2 miles). Communities such

Source: California State Lands Commission 2005.

Figure 3.10-1. Generalized locations of known shipwrecks.

as Venice and Playa del Rey are within 3.2 kilometers (2 miles) of the coastline yet are part of the larger City of Los Angeles. Accordingly, the tables in this section include the City of Los Angeles as a line item. This jurisdiction encompasses a substantially larger area and population than any of the other 80+ cities in Los Angeles County and dwarfs the areas and populations of the other coastal cities.

Avalon City, on the island of Santa Catalina, is also included under Los Angeles County data. It is the only portion of the Channel Islands for which demographic data are available; the remaining islands have small populations because they are parklands or are limited to military personnel.

3.11.1 Population and Age

Table 3.11-1 shows the total population and median age of the cities within the study area. Most of the cities within the study area have relatively small populations, with many having significantly less than 20,000 residents. The obvious exception is Los Angeles, which extends many kilometers (miles) inland from the coast. The smallest city, Rolling Hills, with 1,871 residents, accounts for only 0.02 percent of the total population of Los Angeles County. Only a few cities show larger populations. Long Beach, the largest city within the study area, forms 4.85 percent of the population of Los Angeles County and significantly exceeds the population of Huntington Beach, the second largest city, which forms 1.99 percent of the total population of Orange County.

The median ages within the study area are substantially higher than the respective county averages. In Los Angeles County, the median age is 32 years. In comparison, the median age in the Cities of Palos Verdes Estates (46.7 years), Rancho Palos Verdes (44.7 years), and Rolling Hills (47.7 years) is significantly higher. In Orange County, with an average median age of 33.3 years, the tendency of median ages to be higher in the study area is most pronounced in the Cities of Laguna Beach (43.4 years) and Seal Beach (54.1years).

Table 3.11-1
Los Angeles and Orange Counties: Population and Age (2000)

Jurisdiction	Total Population	% Total County Population	Median Age
Los Angeles County	9,519,338	100%	32
Avalon *	3,127	0.03%	33.7
El Segundo	16,033	0.17%	36.4
Hermosa Beach	18,566	0.20%	34.2
Long Beach	461,522	4.85%	30.8
Los Angeles	3,694,820	38.81%	31.6
Malibu	12,575	0.13%	42.9
Manhattan Beach	33,852	0.36%	37.7
Palos Verde Estates	13,340	0.14%	46.7
Rancho Palos Verdes	41,145	0.43%	44.7
Redondo Beach	63,261	0.66%	36.7
Rolling Hills	1,871	0.02%	47.7
Santa Monica	84,084	0.88%	39.3
Signal Hill	9,333	0.10%	33.4
Torrance	137,946	1.45%	38.7
Orange County	2,846,289	100%	33.3
Costa Mesa	108,724	1.14%	32.0
Dana Point	35,110	0.37%	39.8
Huntington Beach	189,594	1.99%	36.0
Laguna Beach	23,727	0.25%	43.4
Newport Beach	70,032	0.74%	41.6
San Clemente	49,936	0.52%	38.0
Seal Beach	24,157	0.25%	54.1

*Located on Santa Catalina Island in the Channel Islands. The remaining islands in the Channel Islands group are either Naval Stations or National Parks.

Source: U.S. Census Bureau Census 2000 information accessed at http://factfinder.census.gov

3.11.2 Race and Ethnicity

Table 3.11-2 shows the racial and ethnic characteristics of the study area. The majority of the population within the coastal cities is white, with much smaller proportions of other racial or ethnic minorities. Apart from the Cities of Long Beach, Signal Hill, and Avalon, all of the cities within the study area showed white populations much greater than that of the respective county averages, ranging from 59.2 percent (Torrance) to as high as 92.2 percent (Newport Beach).

It should be noted that “Hispanic” refers to ethnicity and is not a racial category. Thus, persons can be considered Hispanic regardless of race. Due to this overlap, racial and ethnic categories total in excess of 100 percent. With regard to Hispanic populations, apart from the Cities of Los Angeles, Avalon, Long Beach, Signal Hill and Costa Mesa, all of the cities within the study area showed much lower levels than that of the respective county averages, ranging from 15.9 percent (San Clemente) to as low as 4.5 percent (Rolling Hills).

3.11.3 Income, Household Size, and Poverty Status

Table 3.11-3 shows the income, household size, and poverty status within the coastal study area. The majority of cities in the study area show median household income levels that are significantly above their respective county averages, with some cities such as Rolling Hills, Palos Verdes Estates, and Malibu showing extremely high income levels. Within the study area, only Avalon City, Los Angeles, Long Beach, and Seal Beach show median household income levels that are below their respective county averages. Although the average household sizes of all of the cities within the study area were below their respective county average household sizes, within the Cities of Hermosa Beach (1.95 persons), Santa Monica (1.83 persons), and Seal Beach (1.83 persons) the average household sizes were substantially below the respective county averages.

The majority of the cities in the study area show poverty levels that are substantially below their respective county averages, dramatically lower in the case of Rolling Hills (0.0 percent) Palos Verdes Estates (1.1 percent), and Rancho Palos Verdes (2.0 percent). The Cities of Long Beach, Los Angeles, and Costa Mesa, at 19.3 percent, 18.3 percent, and 8.2 percent, respectively, are the only cities within the study area that showed poverty levels that were above their respective county averages. The City of Signal Hill, at 13.6 percent, is only marginally below its county average.

Table 3.11-2
Los Angeles and Orange Counties: Race and Ethnicity (2000)

Jurisdiction	Total Population	White	Black /Af. American	Am. Indian Alaskan Nat.	Asian	Nat. Hawaii /Pacific Is	Some Other Race	Hispanic or Latino (Of any Race)
Los Angeles County	9,519,338	48.7% 4,637,062	9.8% 930,957	0.8% 76,988	11.9% 1,137,500	0.3% 27,053	23.5% 2,239,997	44.6% 4,242,213
Avalon *	3,127	71.6% 2,240	0.7% 23	1.0% 32	0.6% 19	0.2% 7	20.4% 637	46% 1,437
El Segundo	16,033	83.6% 13,405	1.2% 187	0.5% 75	6.4% 1,028	0.3% 47	3.5% 562	11.0% 1765
Hermosa Beach	18,566	89.6% 16,632	.8% 150	.4% 74	4.4% 817	0.2% 41	1.7% 312	6.7% 1253
Los Angeles	3,694,820	46.9% 1,734,036	11.2% 415,195	0.8% 29,412	10.0% 369,254	0.2% 5,915	25.7% 949,720	46.5% 1,719.073
Long Beach	461,522	45.2% 208,410	14.9% 68,618	.5% 3,881	12.0% 55,591	1.2% 5,605	2.06% 95,107	35.8% 165,092
Malibu	12,575	91.9% 11,558	0.9% 113	0.2% 27	2.5% 313	0.1% 12	1.7% 210	5.5% 689
Manhattan Beach	33,852	89.0% 30,124	.6% 208	.2% 70	6.0% 2,043	0.1% 41	1.2% 415	5.2% 1756
Palos Verde Estates	13,340	78.3% 10,488	1.0% 132	0.1% 18	17.1% 2,286	0.1% 16	0.6% 80	2.8% 378
Rancho Palos Verdes	41,145	67.2% 27,660	2.0% 815	0.2% 62	25.9% 10,676	0.1% 41	1.2% 497	5.7% 2339
Redondo Beach	63,261	78.6% 49,735	2.5% 1,592	0.5% 295	9.1% 5,756	0.4% 224	4.4% 2,762	13.5% 8524
Rolling Hills	1,871	79.8% 1,493	2.0% 38	0% 0	14% 262	0.5% 9	1.2% 22	4.5% 85
Santa Monica	84,084	78.3% 65,832	3.8% 3,176	1.5% 396	7.3% 6,100	0.1% 86	6.0% 5,019	13.4% 11,304
Signal Hill	9,333	45.5% 4,245	13.0% 1,212	0.6% 55	16.5% 1,539	2.1% 194	16.2% 1,510	29.0% 2707
Torrance	137,946	59.2% 81,605	2.2% 3,022	0.4% 560	28.6% 39,462	0.3% 481	4.6% 6,307	12.8% 17,637

Source: U.S. Census Bureau Census 2000 information accessed at http://factfinder.census.gov

Table 3.11-2
Los Angeles and Orange Counties: Race and Ethnicity (2000)

Jurisdiction	Total Population	White	Black /Af. American	Am. Indian Alaskan Nat.	Asian	Nat. Hawaii /Pacific Is	Some Other Race	Hispanic or Latino (Of any Race)
Orange County	2,846,289	64.8% 1,844,652	1.7% 47,649	0.7% 19,906	13.6% 386,785	0.3% 8,938	14.8% 421,208	30.8% 875,579
Costa Mesa	108,724	69.5% 75,542	1.4% 1,520	0.8% 845	6.9% 7,501	0.6% 656	16.6% 18,018	31.8% 34,523
Dana Point	35,110	87.2% 30,633	0.8% 288	0.6% 201	2.5% 884	0.1% 36	5.9% 2,080	15.5% 5440
Huntington Beach	189,594	79.2% 150,194	0.8% 1,527	0.6% 1,224	9.3% 17,707	0.2% 456	5.8% 11,019	14.7% 27,798
Laguna Beach	23,727	92.0% 21,826	0.8% 190	0.4% 86	2.1% 494	0.1% 20	2.2% 524	6.6% 1570
Newport Beach	70,032	92.2% 64,583	0.5% 371	0.3% 179	4.0% 2,804	0.1% 83	1.1% 792	4.7% 3,301
San Clemente	49,936	87.9% 43,905	0.8% 385	0.6% 307	2.6% 1,317	0.1% 69	5.1% 2,552	15.9% 7,933
Seal Beach	24,157	88.9% 21,477	1.4% 347	0.3% 73	5.7% 1,386	0.2% 43	1.3% 309	6.4% 1,554

*Located on Santa Catalina Island in the Channel Islands. The remaining islands in the Channel Islands group function as Naval Stations or National Parks.

Source: U.S. Census Bureau Census 2000 information accessed at http://factfinder.census.gov

Table 3.11-3
Los Angeles and Orange Counties: Income, Household Size and Poverty Level (2000)

Jurisdiction	Total Population	Median Household Income ($)	% Above/Below County Average	Average H'hold Size	Number of Families Below Poverty Level in 1999	% Of Families Below Poverty Level in 1999
Los Angeles County	9,519,338	42,189	0.0	2.98	311,226	14.4
Avalon *	3,127	33,327	-21.0	2.65	66	9.2
El Segundo	16,033	61,341	45.4	2.27	122	3.1
Hermosa Beach	18,566	81,153	92.4	1.95	61	1.7
Los Angeles	3,694,820	36,687	-13.0	2.83	147,516	18.3
Long Beach	461,522	37,270	-11.7	2.77	19,512	19.3
Malibu	12,575	102,031	141.8	2.39	103	3.2
Manhattan Beach	33,852	100,750	138.8	2.34	173	2.0
Palos Verde Estates	13,340	123,534	192.8	2.67	44	1.1
Rancho Palos Verdes	41,145	95,503	126.4	2.66	248	2.0
Redondo Beach	63,261	69,173	64.0	2.21	616	4.0
Rolling Hills	1,871	**200,000	374.1	2.90	0	0.0
Santa Monica	84,084	50,714	20.2	1.83	911	5.4
Signal Hill	9,333	48,938	16.0	2.56	289	13.6
Torrance	137,946	56,489	33.9	2.51	1,642	4.5
Orange County	2,846,289	58,820	39.4	3.00	46,894	7.0
Costa Mesa	108,724	50,732	20.2	2.69	1,892	8.2
Dana Point	35,110	63,043	49.4	2.41	320	3.4
Huntington Beach	189,594	64,824	53.7	2.56	2,081	4.3
Laguna Beach	23,727	75,808	79.7	2.05	164	2.8
Newport Beach	70,032	83,455	97.8	2.09	356	2.1
San Clemente	49,936	63,507	50.5	2.56	604	4.6
Seal Beach	24,157	42,079	0.3	1.83	194	3.2

*Located on Santa Catalina Island in the Channel Islands. The remaining islands in the Channel Islands group function as Naval Stations or National Parks.
** Median Household Income for Rolling Hills city is at least $200,000 and up.

Source: U.S. Census Bureau Census 2000 information accessed at http://factfinder.census.gov