I. Application Permit for Scientific Research under the Marine Mammal Protection Act, and Scientific Purposes under the Endangered Species Act

II. Date of Application: 1 August 2005

III. Applicant:

A. Applicant, PI, CIs, Personnel Directly Involved in Taking:

Principal Investigator:

John Calambokidis
Cascadia Research Collective
Waterstreet Bldg.
218½ West Fourth Ave.
Olympia, Washington 89501
Telephone: (360) 943-7325
FAX: (360-943-7026
Email: Calambokidis@CascadiaResearch.org
Web page: www.CascadiaResearch.org

Other Co-Investigators (with Cascadia Research at above address):

Todd Chandler
Robin Baird
Greg Schorr
Erin Falcone
Gretchen Steiger
Annie Douglas

B. Qualifications and Experience:

CVs of the PI and CIs are presented in Appendix 1.
Research outlined in this application includes the continuation of efforts conducted under a number of permits in the past, including those list below in Table 1.

Table 1. Previous permit experience of this PI:

Permit # & Years	**Permitees**	**Description**
540-1502-00 2000-2005	John Calambokidis Cascadia Research	Permit to conduct vessel and aerial surveys and photo-identification studies, collected skin biopsies and tagging of large whales and other species in the eastern North Pacific.
No. 938 1995-99	Moss Landing Marine Labs (PIs John Calambokidis, Jim Harvey, Dan Costa, and Dawn Goley)	Permit to take 25 species of marine mammals by Level B harassment and tagging incidental to a wide variety of research approaches including aerial and vessel surveys, photo-ID, and tag deployment as a part of the Marine Mammal Research Program to study the impacts of the ATOC sound source.
No. 855 1993-98	Cascadia Research	Permit to take blue, humpback, and gray whales by harassment incidental to photographic

		identifications and vessel surveys off California, Oregon, and Washington.
No. 597 1987-92	Cascadia Research	Permit to take Dall's and harbor porpoise and minke, sei, fin, humpback, and blue whales by harassment incidental to aerial and vessel surveys and photo-identification off California, Oregon, and Washington
No. 542 1986-90	Cascadia Research	Permit to take harbor seals, California and northern sea lions, harbor and Dall's porpoise, and gray, minke, and killer whales by harassment incidental to aerial, vessel, and land observations
No.474 1984-85	Cascadia Research	Permit to take harbor seals by harassment incidental to aerial, boat, and land surveys in Washington State.
No. 1437 1998-2003b	Southwest Fisheries Science Center (Mr. Calambokidis has been authorized to approach and biopsy various species by SWFSC)	Permit is for a wide range of research activities by SWFSC. Mr. Calambokidis has been authorized by SWFSC to approach and collect biopsy samples from marine mammals along the U.S. west coast under this permit.
No. 675 1989-94	Dr. C. Scott Baker (Mr. Calambokidis was authorized to approach and biopsy humpback whales under this permit)	Permit is to take humpback whales by harassment incidental to biopsy and photo-identification in U.S. territorial waters. Mr. Calambokidis was authorized to approach and biopsy humpback whales under this permit.
No. 873	Southwest Fisheries Science Center (Mr. Calambokidis was authorized to approach and biopsy various species by SWFSC)	Permit was for a wide range of research activities by SWFSC. Mr. Calambokidis was authorized by SWFSC to approach and collect biopsy samples from marine mammals along the U.S. west coast under this permit.

IV. Description of the Marine Mammals to be Taken and/or Imported and the Proposed Activity

<u>A. Abstract:</u> For the purposes of scientific research, the applicant requests the authority to (1) conduct photographic identification activities to determine the abundance, movements, and population structure of cetaceans in the North Pacific, especially blue, humpback, and gray whales; (2) collect skin biopsies to determine sex, relatedness, and evaluate stock structure of cetaceans, especially blue and humpback whales; and (3) conduct tagging activities to examine the diving behavior, feeding, movements, and vocal behavior of several cetacean species, and (4) conduct aerial, vessel, and shore-based surveys to examine distribution, abundance, habitat, and feeding behavior of marine mammal populations in the eastern North Pacific (including off California, Oregon, Washington and Alaska). These studies will be conducted over a five year period, and are a continuation of the research that applicant has been conducting for many years (large whale studies since 1986). Small numbers of pinnipeds species may be incidentally harassed in association with research activities. Incidental harassment of all species of cetaceans may occur through vessel approach for vessel and aerial surveys for the purpose of locating animals.

B. Summary of Marine Mammals to be Taken, Imported, or Exported:

B1. Species Name(s):

Table 2. List of species to be studied under the proposed permit.

Common Name	**Scientific Name**
Blue whale	*Balaenoptera musculus*
Fin whale	*Balaenoptera physalus*
Sei whale	*Balaenoptera borealis*
Bryde's whale	*Balaenoptera edeni*
Humpback whale	*Megaptera novaeangliae*
Minke whale	*Balaenoptera acutorostrata*
Gray whale	*Eschrichtius robustus*
North Pacific right whale	*Eubalena glacialis*
Sperm whale	*Physeter macrocephalus*
Pygmy sperm whale	*Kogia breviceps*
Dwarf sperm whale	*Kogia simus*
Baird's beaked whale	*Berardius bairdii*
Cuvier's beaked whale	*Ziphius cavirostris*
Mesoplodon beaked whales	*Mesoplodon* spp
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*
Northern right whale dolphin	*Lissodelphis borealis*
Long-beaked common dolphin	*Delphinus capensis*
Short-beaked common dolphin	*Delphinus delphis*
Striped dolphin	*Stenella coeruleoalba*
Bottlenose dolphin	*Tursiops* spp.
Risso's dolphin	*Grampus griseus*
Short-finned pilot whale	*Globicephala macrorhynchus*
False killer whale	*Pseudorca crassidens*
Killer whale	*Orcinus orca*
Dall's porpoise	*Phocoenoides dalli*
Harbor porpoise	*Phocoena phocoena*
Northern fur seal	*Callorhinus ursinus*
Harbor seal	*Phoca vitulina*
Northern elephant seal	*Mirounga angustirostris*
California sea lion	*Zalophus californianus*
Steller sea lion	*Eumetopias jubatus*

B2. Parts or Specimen Samples:

Marine mammal parts to be collected include biopsy samples that small section of skin and blubber, sloughed skin (which comes off on suction-cups used in tagging or collected from behind free-swimming animals) and fecal samples. No marine mammal parts are to be imported or exported.

B3. Status of Affected Stocks:

See Appendix 2.

<u>C. Detailed Description of the Proposed Research Activity (In the Wild or In Captivity):</u>

C1. Duration of the Project and Locations of Taking:

The research described is part of a long-term research program by the applicant (ongoing since 1986) to examine movements, population structure, abundance and trends of cetacean populations in the North Pacific. The research will be carried out over a five-year period in the North Pacific Ocean, with a focus on the waters off California, Oregon and Washington. Field work under this permit would begin ultimately in spring or summer 2006. For photo-identification research, we propose to conduct annual surveys in the North Pacific, with emphasis on launching from ports along the coasts of California, Oregon and Washington. Timing of these surveys would be conducted during periods of highest anticipated whale abundance based on our historical data and sighting reports from the current season (see Table 3). Trips would also be timed to begin during periods of favorable weather to maximize the number of successful survey days on the water.

Table 3. Summary of timing, locations, and number of days of effort engaged in principal research activities proposed.

Activity	**Target species**	**No. days**	**Primary period**	**Regions**
Boat survey, photo-ID & biopsy	Gray whales	20	March-Oct.	Pacific Northwest incl Puget Sound
Boat survey, photo-ID & biopsy	Humpback and blue whales	60	May to October	California, Oregon, & Wash.
Tagging	Humpback, blue, and fin whales	30	June to October	California
Aerial surveys	Harbor porpoise, humpback, and blue whales	20	June to September	California, Oregon, & Wash.
Shore-based effort w/ pinnipeds	Harbor seals	10	May to September	Washington

C2. Types of Taking Involved and Estimate of Number(s) of Animals that May be Taken

We expect only takes by Level B harassment are expected from all methods proposed here: surveys (vessel, land, and aerial), photo-identification, biopsy, and tagging surveys but Level A harassment is possible but unlikely from biopsy and tagging. Takes listed in Table 4 under survey and photo-ID may include all ages and sex classes. We do not propose to biopsy or tag mother or their less than 1-year old accompanied calves A matrix of the maximum number of takes per year by species, location and activity is given below (Table 4). Sample sizes listed reflect a variety of factors, including the likelihood of encountering the species in the study areas in question and research goals. The expected number of takes for all is lower than given, but the buffer allows for unusual conditions. Takes by tagging involve primarily suction-cup attached tags, and are not expected to cause more than Level B harassment. Animals may be taken more than once, and may be taken in more than one manner (*e.g.*, an animal exhibiting Level B harassment from a vessel survey/photo-identification may also exhibit Level B harassment from tagging).

Table 4. Summary of number and types of takes requested annually by species.

		Maximum number of annual takes by disturbance				
Common name	**Species**	**Photo-ID**	**Survey**	**Biopsy**	**Tag**	**Total**
Blue whale	*Balaenoptera musculus*	1,000	1,000	100	50	2,150
Humpback whale	*Megaptera novaeangliae*	2,000	1,000	100	50	3,150
Gray whale	*Escrhictius robustus*	500	1,000	50	30	1,580
Fin whale	*Balaenoptera physalus*	250	1,200	50	20	1,520
Sei whale	*Balaenoptera borealis*	20	50	10		80
Brydes whale	*Balaenoptera edeni*	20	100	10		
Minke whale	*Balaenoptera acutorostrata*	100	100	10		210
Right whale	*Balaena glacialis*	10	10	5		25
Sperm whale	*Physeter macrocephalus*	200	500	100	20	820
Pygmy sperm whale	*Kogia breviceps*		50			50
Dwarf sperm whale	*Kogia sinus*		50			50
Baird's beaked whale	*Berardius bairdii*	20	200	10	5	235
Cuvier's beaked whale	*Ziphius cavirostris*	20	100	10	5	135
Mesoplodon beaked whales	*Mesoplodon sp*	20	100	10	5	135
P white-sided dolphin	*Lagenorhynchus obliquidens*		20,000			20,000
N right whale dolphin	*Lissodelphis borealis*		10,000			10,000
Short-beaked common dolphin	*Delphinus delphis*		10,000			10,000
Long-beaked common dolphin	*Delphinus capensis*		10,000			10,000
Striped dolphin	*Stenella coeruleoalba*		1,000			1,000
Bottlenose dolphin	*Tursiops truncatus*	100	500	50		650
Risso's Dolphin	*Grampus griseus*		1,000	100		1,100
Short-finned pilot whale	*Globicephala macrorhyncus*	50	200			250
False killer whale	*Pseudorca crassidens*	50	200	50		300
Southern Resident Killer whale	*Orcinus orca*	150	150			300
Other (Not SRKW) Killer whale	*Orcinus orca*	350	350	20		720
Harbor porpoise	*Phocoena phocoena*		2,000			2,000
Dall porpoise	*Phocoenoides dalli*		2,000			2,000
California sea lion	*Zalophus californianus*		2,000			2,000
Steller sea lion	*Eumetopias jubatus*		500			500
Northern fur seal	*Callorhinus ursinus*		2,000			2,000
Harbor seal	*Phoca vitulina*		10,000			10,000
Elephant seal	*Mirounga angustirostris*		2,000			2,000

C3. Research Techniques

Photo-identification and vessel surveys: Photo-identification and vessel surveys will be the primary means for determining abundance, distribution, and movements of whales. On-going research conducted by the applicant has provided new information on movements and stock structure of humpback whales (Calambokidis et al. 1990a, 1996, 2000b, 2001b, 2004c, Urbán et al. 2000, Darling et al. 1996, Steiger et al. 1991, Calambokidis and Steiger 1990), blue whales (Calambokidis et al. 1990b, 2004a, Mate et al. 1999, Calambokidis and Barlow 2004, Chandler and Calambokidis 2004) and gray whales (Calambokidis et al. 2002), for example. Estimates of humpback, blue whale and gray whale abundance will be made using capture-recapture methods employed in the past (Calambokidis and Steiger 1995, Calambokidis and Barlow 2004, Calambokidis et al. 1990a, 2002, 2004a, 2004c). These rely primarily on estimates using the two-sample Petersen capture-recapture models. Trends in abundance will be examined several ways. We will test for a significant regression by year using a series of independent two-sample estimates. We will also use several multi-year open population models (such as the Jolly-Seber) to examine rates of natality and mortality for the population. Photo-ID is also being used by the applicant to examine as aspects of reproduction and mortality rates in large cetaceans (Steiger and Calambokidis 2000, 2001, Steiger et al. submitted).

Photo-identification and vessel surveys will usually be conducted from small boats, although some will be undertaken from larger support vessels, particularly for work in offshore waters. The primary vessels we will employ in these dedicated photo-identification surveys will be an 5.3-5.9 m rigid-hulled inflatable boats with outboard engines. Cascadia uses three of these vessels in photo-identification research. All are equipped with back-up engines, multiple VHF radios and GPS (both console and back-up hand-held), depth sounders, emergency locator transmitters (ELTs), survival suits, and other safety equipment. We have routinely used these vessels to cover up to 200 nmi in a day and can operate up to 50 nmi offshore. The boats will be transported from one region to another by trailer so that we can easily respond to changes in whale distribution along the entire US west coast.

Approaches typically will last from a few minutes up to an hour, depending on the sea conditions, time of day, species encountered, behavior, and research goals. The animals will be approached closely enough to optimize photographic quality. Distance for optimal approach varies with the species being photographed. Generally, large whales will be approached within approximately 50 m. Vessel approaches will typically be done slowly and the vessel maneuvered from behind or the side of an animal or group of animals to minimize potential disturbance.
A number of other more opportunistic platforms will be used to obtain additional identification photographs. Although these platforms usually do not provide as large a number of high quality photographs as the dedicated effort, they are extremely valuable in providing samples from time periods and locations that would otherwise not be covered. We will be placing trained photo-identification personnel on several ship cruises conducted by National Marine Sanctuaries, Southwest Fisheries Science Center and Scripps Institute of Oceanography. No photographs will be taken from vessels participating in whale-watching activities under this permit.

Identification photographs will be taken with digital SLR cameras equipped with telephoto lenses (200-400mm). For humpback whales, photographs will be taken of the ventral surface of the flukes.

For blue and gray whales, the right and left sides of the animals' back the vicinity of the dorsal fin or hump will be photographed; flukes will be photographed when possible.

Humpback and blue whale identification photographs obtained will be first internally compared to identify resightings of animals within each year. Comparisons will then be made to Cascadia's historical catalog of all humpback and blue whales identified along the west coast. Individual whales identified each year that do not match past years and which are of suitable quality will be assigned a new unique identification number and added to the catalog.

Sighting, effort, and identification data will be computer coded into standard databases used by Cascadia in past research. These consist of three principal data records: 1) a database containing survey effort (date and times of vessel positions, movements, and sighting conditions) and marine mammal sightings based on the original data recorded in the field and archived by year, 2) an identification database that records all identifications since the inception of our research.

Data analysis will be primarily conducted using custom computer programs. These programs read text files of the databases described above and compile summaries of the number of unique whales seen by region and time period, movements of animals based on resightings of the same individual during a season, interchange rates based on inter-year resightings of animals among regions, and capture-recapture abundance estimates.

Aerial surveys

Aerial surveys will be used to estimate the distribution and abundance of marine mammals in specific regions as well as to assist in locating concentrations of animals for more effective targeting of vessel-based effort and photo-ID. We will also use aerial surveys to assist in locating VHF signals from tagged animals.

Aerial surveys will be conducted in several aircraft types. For prolonged surveys in waters farther from shore such as when conducting line-transect surveys for harbor porpoise or other cetaceans, we will use high-wing twin-engine aircraft like the Partenavia Observer. This aircraft has been extensively used in past surveys conducted by the applicant with the National Marine Mammal Laboratory for harbor porpoise off Oregon, Washington, and Canada (Carretta et al. 2004, Laake et al. 1997, 1998, Calambokidis et al. 1991, 1992, 1993). Scouting surveys for animals will sometimes be conducted from single-engine aircraft if they do not involve extended flights over open water.

Biological data collected during aerial surveys include: species, number, perpendicular distance from the transect line, direction of travel, and general behavior. Date, time, and position (using a GPS system) are recorded each minute. Beaufort sea state, cloud cover, sighting conditions, and glare are noted at the beginning and end of each transect and when significant changes occur. The data will be used to determine the distribution and abundance (and density) of marine animals within the study area.

A wide range of species could be encountered during aerial surveys and be potentially taken. This included not only the cetaceans listed in Table 4 but also pinniped species that could be encountered both while at sea and on their haul-out areas.

Land-based surveys

Land-based surveys will be conducted primarily related to studies of harbor seals and other pinnipeds at haul-out areas in Puget Sound and surrounding areas. These will focus several key objectives:

1. Censuses of harbor seals and other pinnipeds to examine occurrence and abundance primarily in the Puget Sound region. The applicant has conducted land-based censuses of harbor seals and other pinnipeds in Puget Sound going back to the 1970s (Calambokidis et al.1979, 1985, Steiger and Calambokidis 1986, Jeffries et al. 2003). Our primary research interest is in monitoring changes in harbor seal population size at these sites that we have monitored starting in the late 1970s.
2. Determination of mortality and contaminants in harbor seals and other pinnipeds in Washington State. The applicant has conducted studies on mortality rates of pinnipeds in this area and contaminant levels in harbor seals have provided one of longest-term indicators of trends in contaminants in Puget Sound (Calambokidis et al. 1978, 1985, 1991, 2005, Steiger et al. 1989, Hong et al. 1996, Ross et al. 2003). Studies of contaminants and mortality would be conducted as in most of these past studies using examination and samples collected from stranded animals. Mortality studies involve examination of the minimum proportion of pups born at a site that are found dead near the haul out areas and also the causes of death of stranded harbor seals as has been reported by the applicant in past studies (Calambokidis et al 1978, 1985, 1991, Steiger et al. 1989). Contaminant studies have focused on examining trends in contaminants using non-emaciated newborn stranded harbor seals (typically stillborn)
3. Examination of food habits of harbor seals through collection of scat. Applicant has used fecal material to identify prey remains of harbor seals in Washington State (Calambokidis et al. 1978, 1985, 1991). Seal scat will primarily be collected during periods when animals are not present to avoid disturbance. In some cases low numbers of animals may be present and our collections may result in disturbance of animals. As reflected in the small number of takes requested, this will be kept to a minimum.

These land-based surveys may involve disturbance of hauled-out pinnipeds on occasion. This will primarily involve harbor seals but could also occasionally involved California sea lions or in some cases other pinnipeds. The following activities will be involved:

1. Censuses of pinnipeds, primarily harbor seals, on haul-out areas conducted from a land observation site that on rare occasion may result in disturbance. Land counts would be conducted using a spotting scope from distances of 100m or more and generally using methods and observations sites similar to those used in our past research (Calambokidis et al.1979, 1985, Steiger and Calambokidis 1986, Jeffries et al. 2003).
2. Collection of stranded animals (stranding response covered under separate authorization from NMFS Northwest Region as a part of the Northwest Marine Mammal Stranding Network) or fecal material for food habits, which may result in disturbance of pinnipeds on a haul-out area.

These activities would be conducted to best try to avoid disturbing pinnipeds but on occasion disturbance may occur since harbor seals reaction distance to human is often highly variable.

Collection of skin samples from biopsy and water column

Skin samples would be collected to examine genetic relatedness, population structure, and sex of individual whales (see Baker *et al*. 1990, 1991, 1993a, 1993b, 1998 for example of methods). Sampling by the applicant has been extensively used in determination of population structure of humpback and blue whales (Baker et al. 1990, 1991, 1993a, 1993b, 1998, Conway et al. 1995). Biopsy samples are also currently being used as integral part of the SPLASH humpback whale research project. SPLASH is a multi-year international collaborative effort to examine the abundance, trends, population structure, and human impacts of humpback whales in the entire North Pacific. The applicant serves on the Steering Committee of SPLASH, is the coordinator for sampling on the U.S. West Coast and Central America, and is also involved in SPLASH sampling in other regions. Biopsy samples will also be used for determination of pregnancy status based on hormone levels (N. Kellar, SWFSC) as well as other tests including contaminant levels (Krahn et al. 2001).

Samples would be collected both from sloughed skin in the water column and by biopsy sampling. Biopsy samples will be collected from whales using the system developed by Lambertsen (1987). The biopsy system has three integral components: a biopsy dart and punch, a projection unit, and a retrieval system. The biopsy dart consists of a stainless steel shaft or commercially available aluminum crossbow bolt (arrow) and a stainless steel biopsy punch. The biopsy punch is turned out of a solid rod, and has a flange or 'stop' to prevent penetration of the skin. The punch is 7 to 9 mm in diameter and 2 to 5 cm in length and is fitted with two or three internal pins to secure the sample. A hole drilled transversely through the punch and just distal of the flange prevents pressure buildup inside the punch as it penetrates the skin. The projection unit is a commercially available crossbow fitted with a 125 or 150-lb draw fiberglass prod (bow). Two retrieval systems are used. An untethered free-floating bolt similar in principle to that described by Mathews *et al*. (1988) will be used. The free-floating bolt is retrieved by hand from small vessels or with a dip net from larger vessels. This system, in comparison to a line-tether system, eliminates the possibility of entanglement by the whale and gives somewhat greater accuracy of delivery under most conditions. Biopsy punches are sterilized following each attempt, successful or unsuccessful, by immersion in 70% isopropyl alcohol. We will also search the water column in the wake of humpback and blue whales for sloughed skin. This technique has been effective with several species of whales including blue whales off Mexico.

Samples will be frozen as soon as possible after collection. When conducting small boat research, they will be stored on ice then frozen on return to shore. Whenever logistically possible we will have a storage contained of liquid nitrogen to freeze collected samples on return to shore. Samples will generally be shipped to SWFSC for archiving and long-term storage. Samples collected under SPLASH are all being archived and extracted at SWFSC prior to being provided to other collaborating research (CITES transfer is not requested under this permit since this is handled by SWFSC).

Tagging

No animals will be captured or restrained in the tagging process. Tagging will be conducted using a number of different tags (Calambokidis et al. 2003b, 2004b). They will be attached by suction-cup, which has proved effective for short-term deployments on a number of large cetaceans. Because attachment is by suction-cup the tags will not penetrate the skin. Attachment will be achieved by either close approach and attachment using a long pole to make direct contact with the whale or by launching using a crossbow, such as used in the biopsy. In an encounter to place a tag, each individual whale will be approached no more than three times. We will attempt to place the tags on the back of the whale mid-way between the blowhole and the dorsal fin. Instrument packages that we have used successfully previously include the National Geographic “Crittercam” (Marshall 1998), the Bioacoutic Probe (Burgess et al. 2003) and the Woods Hole Oceanographic Institute’s digital tag (Johnson et al. 2003b). All acoustic sampling will be passive (*i.e*., hydrophone recordings).

The instrument packages deployed will contain a combination of the following instruments and devices:

- Hydrophone and recording system for underwater vocalizations
- Pressure sensor to record water depth
- Sensor to monitor and record water temperature
- 3-axis accelerometers to measure pitch and roll of animal
- 3-axis solid state magnetometers to measure heading
- Conductivity switch to control surface and underwater instrument activation
- VHF tag to provide local positioning information
- Satellite tag to record long-range movements
- Underwater video camera to record behavior and prey

The heaviest tag we propose deploying is the Hi-8 version of the Crittercam which weights 2.4 kg. All other systems weigh considerably less than that and an ongoing goal is to continue to shift towards smaller and lighter and systems. Our primary tag, the Burgess bio-acoustic probe weighs under 1 Kg and is currently packaged in resin in a cylindrical form measuring 19.3 cm long and 3.2 cm diameter. Flotation and VHF transmitter roughly double this length. Durations of deployments are expected to be high variable. Some systems like the Crittercam will have release mechanisms since the Hi-8 Crittercam system can only record continuously for 2-4 hours. The Burgess acoustic tag will not have a release because the goal is to deploy the tag for as long as possible and this system can gather and store information (depending on sampling rate) for many days. In practice we have found durations of attachment even without releases to generally be a few hours to a maximum of two days with typical deployment durations of about 4 to 8 hours. Depending on the sampling rate set in advance for the tag (we generaly use sampling rates of 2 to 8 kHz), the current version of the Bio-acoustic probe can gather data for from 1 to 4 days.

When the tag comes off the whale, it floats with the VHF antenna exposed to the air. When a steady VHF signal is received it indicates the tag is off the whale and floating. Directional antennas are then used to get a heading to the floating tag and the recovery boat maneuvers closer until the tag is spotted visually and picked up.

C4. Removing a Marine Mammal from the Wild: N/A

C5. Taking of Marine Mammal Parts or Specimen Samples:

The only marine mammal parts or specimen samples to be collected from the wild are skin/blubber biopsy or fecal samples collected from the water column, or skin samples collected off suction cups involved in tagging. Samples will either be frozen or stored in DMSO/salt solution, and each sample is labeled with a unique catalog number that incorporates information on the date and collector, and information on species and location is noted on the sample container/label. Sub-samples are distributed to an appropriate institution (*e.g*., Southwest Fisheries Science Center) and archived by the applicant.

C6. Import/Export of Marine Mammals/ Marine Mammal Parts: N/A

C7. Research on Captive Animals: N/A

C8. Background and Review of Research:

The permit activities proposed address several important research questions that have been the subject of ongoing research by the applicant. We provide a brief background on each of the key species examined in the research and then address what specific objectives are being addressed and how the permit activities support the research on these topics. Research proposed here focuses on three species, humpback, blue, and gray whales with research also proposed for several other species that would be incidentally encountered and are valuable for comparative purposes or are of secondary focus. General background and status of stocks of all species are covered in Appendix 2 and only the more specific background related to proposed research addressed here.

Humpback whales have been the subject of extensive research by the applicant since 1986 and this research has provided new information on population size, trends, movements and stock structure of this species in the eastern North Pacific that has been summarized in a number of scientific publications, reports, and presentations (Calambokidis et al. 1990a, 1996, 1997, 2000b, 2001b, 2004a, 2004c, Calambokidis and Barlow 2004, Calambokidis and Steiger 1990, Darling et al. 1996, Steiger and Calambokidis 2000, Steiger et al. 1991, Submitted, Urbán et al. 2000). Photographic identification studies of humpback whales have been conducted annually off the U.S. West Coast from 1986 through 2005 and have been the primary means of determining abundance of this distinct feeding aggregation. Starting in 1991, small-boat effort surveyed multiple locations to obtain a broadly representative sample of the entire region and photo-identified 200-400 different individuals each year. Mark-recapture estimates were conducted using annual samples with the closed Petersen estimate or with the open Jolly-Seber model. Abundance estimates prior to 1991 were biased downward by heterogeneity of capture probabilities created by the limited geographic coverage. Abundance estimates since 1991 have ranged from a low of 569 for 1991-92 (CV=0.03) to a high of 1,454 in 2003-04 (CV=0.09). While the overall trend in humpback abundance has been upward, the trend shows three phases, a steady and consistent increase of about 9% per year from 1991 through 1998, a sharp decline immediately after 1998, and then an escalating rate of increase in recent years. The increase through the 1990s was the result of the population recovering from commercial whaling that ended in 1966 in this area. The decline in 1998 coincided with a severe El Nino in that year that resulted in some of the lowest zooplankton abundances that have been observed in this region. The dramatic increases in abundance in recent years have been more puzzling and coincide with an increase in the proportion of whales that have not been seen previously in the region; in 2004 35% of whales identified had not seen previously compared to <10% for 1991-98. One hypothesis is that immigration is occurring from other feeding areas; this would be a departure from previous findings of limited interchange based on genetic and photo-identification data. Despite the increase we document, the population remains below that prior to whaling.

A primary purpose of the work we propose with humpback whales is to continue to document the trends in this recovering population of humpback whales. Both the photo-ID and biopsy samples collected starting in 2004 have also been gathered to contribute to the SPLASH international collaborative research study. As a part of this project identification photographs and samples collected by the applicant will be part of an integrated comparison of humpback whales at all winter breeding and summer feeding areas in the entire North Pacific. Under this program there has been a goal of photo-identifying at least 10% of the population and obtaining samples of 5% of the population each season to obtain an adequate sample size to determine abundance, movements, and population structure. Sample sizes proposed here are in line with these guidelines.

Research on blue whales in the eastern North Pacific has progressed dramatically over the years. On-going research by the applicant has been important in determining both the population size, movements, and structure of this population (Calambokidis et al. 1990b, Calambokidis and Steiger 1997, Mate et al. 1999, Calambokidis et al. 2004a, Calambokidis and Barlow 2004, Chandler et al. 1999, Chandler and Calambokidis 2004). Blue whale populations were severely depleted by commercial whaling and there was fear over the survival of this species. In the 1980s and early 1990s, there was an increase in the occurrence of this species reported in a number of areas including the Gulf of the Farallones, Monterey Bay, and Santa Barbara Channel and increase in sighting rates were noted in SWFSC ship surveys (Barlow 1994). Starting in 1986 the applicant began photo-ID research on blue whales, which have revealed an estimated abundance of about 2,000 blue whales with no apparent signs of increase over the 1990s. Photo-ID comparisons by the applicant have also revealed movements of blue whales from California to as far south as the Costa Rica Dome (off Central America in the ETP) and as far north as the Gulf of Alaska. Genetic studies of blue whales using samples collected by the applicant have been used in examinations of the genetic relatedness of blue whales worldwide (Conway et al. 1995).

Worldwide populations of blue whales remain in trouble, despite the larger numbers than expected in the eastern North Pacific. From a global population of around 300,000, as few as 10,000 or less may exist today even some 40 years after the end of legal commercial whaling for this species (Calambokidis and Steiger 1997, Carretta et al. 2004). The population in the eastern North Pacific that has been the focus of research by the applicant now represents one of the largest populations we know of this species.

Research on gray whales by the applicant has focused on the portion of the population that inhabits waters of the Pacific Northwest as a spring, summer, and fall feeding area (Calambokidis 2005, Calambokidis et al. 1999, 2002, 2003a, Gosho et al. 1999, 2001). Summer feeding aggregations of gray whales have been observed in a number of areas along the coasts of California (Patten and Samaras 1977, Mallonee 1991, Avery and Hawkinson 1992), Oregon (Sumich 1984), Washington (Flaherty 1983, Calambokidis *et al*. 1992, 1994, Wietkamp *et al*.

1992) and British Columbia (Darling 1984, Murison et al. 1984, Plews et al. 1985). Gray whales in these regions feed on a variety of prey including herring eggs/larvae, crab larvae, amphipods, mysids, and ghost shrimp, with locations of feeding often shifting from year and by season in response to shifting prey types and distribution (Darling *et al*. 1998, Nerini 1984).

Starting in 1998, the applicant has helped to coordinate a collaborative effort among a number of groups conducting photographic identification of gray whales in the Pacific Northwest (Calambokidis et al. 2000a, 2002). This collaborative effort has included Cascadia Research, the National Marine Mammal Laboratory, West Coast Whale Research Foundation, University of Victoria, University of British Columbia, Vancouver Aquarium, Department of Fisheries and Oceans, Coastal Ecosystem Research Foundation, and Brian Gisborne of the *Juan de Fuca Express*.

Research by the applicant on gray whales has been funded by the National Marine Mammal Laboratory and others partly because of the need for information on abundance and population structure related to the potential impacts of the resumption in aboriginal whaling by the Makah Tribe in Washington State. While only one whale has been killed in this effort to date and the legality of the hunt challenged in courts, the hunt may resume and continued research on this population is vitally important.

In addition to the targeted work on blue, humpback, and gray whales, the work proposed here also provides important abundance and population structure data on some of the other species listed under this permit. This information is important for evaluating potential impacts of human takes within NOAA's PBR and Stock Assessment determinations. Sightings of all marine mammals will be recorded on all vessel surveys. Photographic identification will also conducted when possible on other species for which this methodology has been shown to be useful. In our past work we have conducted photo-ID for example of fin, minke, sperm, and killer whales (Calambokidis et al. 2004c); these photographed have been used to develop photographic catalogs at Cascadia Research as well as for sharing with other researchers using this technique.

Tagging efforts proposed here also represent a continuation of research that has been conducted by the applicant to address both the underwater feeding behavior of baleen whales and also their vocal behavior (Calambokidis2003, Calambokidis et al. 2001a, 2003b, 2004b, Croll et al. 2001, Oleson et al. 2004, submitted, McDonald et al. 2001, Wiggins et al. 2004, Williams et al. 2000,). Relatively little is known about the underwater behavior of whales and most behavioral research has by necessity focused on their behavior at the surface. Vocal behavior in particular has become of recent interest because: 1) an understanding of call behavior would allow extrapolation of abundances or densities from remote acoustic monitoring data, and 2) assessment of impacts of noise requires an understanding of the role of these vocalizations. Data gathered to date have provided new insights into the frequency and behavioral context of calling, including: 1) only a small proportion of blue whales are actively producing long patterned calls especially when feeding, 2) most if not all whales that produced long calls were males, 3) even though regular callers dominated the acoustic record, irregular callers may be more common, 4) calls are produced at a fairly consistent shallow water depth.

We have been examining the underwater feeding and vocal behavior of primarily blue, fin, and humpback whales through simultaneous visual/acoustic monitoring and deployment of instrument packages providing depth, acoustics, and behavior from video or accelerometers. Insights into feeding behavior obtained so far have included: 1) blue whales conduct multiple upward lunges into prey fields, sometimes inverting, 2) blue whales dive deeper (350 m) than had previously been reported, 3) there are clear regional and diel patterns in diving behavior, 4) blue whale pairs do not appear to be cooperatively feeding, and 5) there are dramatic differences in the feeding behavior between blue, fin, and humpback whales in terns of how they feed underwater.

The proposed research here involving additional deployments of suction-cup tags would be aimed at supplementing the research gathered to date on feeding and vocal behavior in several ways. We would seek to expand our sample size of deployments on calling blue whales. Because only a small proportion of blue whales are calling regularly, the deployments to date have only provided three deployments on blue whales producing the loud A-B call types they are know to generate. We would also focus our additional deployments to understand better the comparative feeding behavior of some of the large baleen whales. Blue, fin, and humpback whales all feed on either exclusively or at least substantially on krill off the US West Coast. These species sometimes overlap in the habitat in which they feed and at other times are separate from each other. Through the tag deployments we hope to better understand the ecological niche each of these species occupies and how they may compete or not compete with each other as their populations recover from whaling.

C9. Lethal Take: N/A

C10. Research on Endangered Species:

The research proposed does involve several species listed as endangered under the ESA, or listed as depleted under the MMPA. Expected research results from work undertaken on these species will fulfill important research needs for these species. A focus of our research efforts are on endangered blue and humpback whales. For both species, the photo-ID work we propose here provides the critical information on population size and trends for these two species in the eastern North Pacific. Biopsy for genetic samples of these species will be used to determine population structure. Our tagging work on vocal behavior of whales is also needed to calibrate estimates of occurrence from remote acoustic monitoring as well as to understand the potential impacts of human-produced sounds on these species.

Other ESA listed species that are opportunistically encountered as part of ongoing research projects. For example, northern right whales will be photo-identified and biopsied if encountered, because such opportunities are rare and it is critical to obtain this information and samples from these chance encounters even if it is not part of our planned research. While such encounters are likely to be extremely rare, including these species in the permit will allow for collection of information that will be of benefit to the overall understanding of these species (giving short-term movement information as well as diving patterns). An incidental scientific benefit to tagging studies on ESA listed species is the collection of small samples of sloughed skin that periodically adhere to the inner surface of the suction cups, which will be contributed to genetic studies being undertaken by other investigators (*e.g.*, SWFSC).

Southern-Resident Killer Whales (SRKW) were listed as endangered during the period this application was submitted and being reviewed. Killer whales are not a focus of our research but it would be important to gather information on this species when they are encountered in our surveys. Killer whales will primarily be approached for photo-ID outside when there identity is uncertain such as outside the primary area used by SRKW. It is possible, however, we would encounter SRKW in outer coast waters or in our other research in areas where SRKW are more common.

D. <u>Describe the Anticipated Effects of the Proposed Activity</u>:

The applicant has undertaken the research described within this application for the last 20 years under NMFS permits 597, 855, 840-1502-00. In these years of research, no significant effects on individual animals or on the stocks being studied were noted as a result of field activities.

D1. Effects on Individual Animals;

Potential effects on individual animals will be short-lived disturbance, from reactions to vessel approach and from suction-cup attachment of tags. Reactions to approach and tagging vary by species and by individual. Some species show little or no reaction to vessel approach, while others appear to actively avoid the research vessel. Suction-cup tags would not be expected to alter the behavior of animals because many whales including blue whales typically have remora sucker fish attached to their bodies. Some of these remora are as large or larger than the tags we deploy.

Photographic-identification is now widely used with many large cetacean species (Hammond 1986) and is generally accepted as having only small impacts. The primary potential impact to whales would be the disruption of feeding and other activities as a result of harassment incidental to the surveys and photographic identification efforts. In our past surveys and photographic identification research with humpback, blue, and gray whales, we have not observed any disruption in the activities of whales from our methods. We do not anticipate any short-term or long-term impacts from our proposed activities. We will still be taking a number of precautions to minimize any effects as described in the following section.

Biopsy sampling has now been utilized by a wide number of studies on many large cetacean species (Baker et al. 1990, 1993, 1994, 1998, Weinrich et al. 1987, 1991, 1992, Clapham and Mattila 1993, Brown et al. 1994, Mathews 1986, Brown et al. 1991, Gauthier and Sears 1999, Whitehead et al. 1990, Barrett-Lennard et al. 1996, Lambertsen et al. 1994) and although no serious impacts have been found a number of these studies have documented behavioral responses. The direct physical impact of the biopsy dart on a fin whale is negligible. The dart penetrates only 2 cm into the whale and removes a tissue sample of less than 1 cc in volume (or 1 gram in weight) from an animal that may exceed 40,000 kilograms in weight. We will make sure darts are cleaned between biopsy contacts to reduce the chance of infection.

A number of studies have examined the reaction of whales to biopsy sampling similar to what we propose. Most of these have been conducted with humpback whales (Weinrich et al. 1987, 1991, 1992, Clapham and Mattila 1993, Brown et al. 1994) as well as with some other species including blue, fin, right, gray, killer, sperm, and minke whales (Mathews 1986, Brown et al. 1991, Gauthier and Sears 1999, Whitehead et al. 1990, Barrett-Lennard et al. 1996, Lambertsen et al. 1994). All of these have shown only moderate response of whales to the biopsy and then a resumption of normal activities.

Weinrich et al. (1987), for example, report on the behavioral response of 71 individual humpback whales to biopsy attempts. They divided immediate behavioral responses into four broad categories: 1) no reaction, the whale continued its pre-biopsy behavior with no detectable change; 2) low level reaction, the animal modified it behavior slightly (e.g. an immediate dive); 3) moderate reaction, the animal modified its behavior in a more forceful manner (e.g. trumpet blows, hard tail flicks) but evidenced no prolonged behavioral disturbance; or 4) strong reaction, the animal modified its behavior to a succession of forceful activities (e.g. rapid travel, tail slashes, numerous trumpet blows). Of the 71 biopsy attempts documented, 5 (7%) involved no reaction, 19 (26.8%) involved low level behavioral reactions, 43 (60.6%) involved moderate reaction, and 4 (5.6%) involved a strong reaction. All of the strong reactions involved temporary entanglement of the whale in the monofilament tether line attached to the biopsy dart.

Weinrich et al. (1987) conclude that the behavioral reactions to biopsy sampling tend to be short-lived and may have limited, if any, biological impact on the individual. They base this conclusion on observations of 22 biopsied individuals during the 30 minutes prior to and the 30 minutes subsequent to the biopsy darting. Despite the immediate response to the biopsy dart, their was little significant difference in the whales overall behavior during the pre- and post-biopsy observation periods.

In general the response of humpback whales, appears to be higher than for some other species. Gauthier and Sears (1999) report that fin and blue whales showed a lower reaction to biopsy than for humpback and minke whales. This is consistent with our own observations form biopsy sampling of a small number of blue whales off California for a number of years. Behavioral response to biopsy was generally much less than with humpback whales with most animals showing no discernable reaction to the biopsy hit. We did observe a tendency for animals to turn away during the approach, which appeared to be a response to a closely approaching vessel.

The tagging we propose here using non-penetrating suction-cup attachment would have many of the same potential impacts of biopsy but without the potential for injury related to penetration of the skin. Tagging of whales has been conducted in the past with a number of large whale species utilizing a wide variety of tag types (for example, Goodyear 1993, Mate and Harvey 1984, Mate et al. 1998, In prep. Watkins 1981, Watkins et al. 1996). Tagging has most of the potential impacts of biopsy sampling, since it also involves close approach and the launching of a projectile that hits the whale. The use of suction-cup attachments avoid the risk of penetration of the skin and blubber of the whale. Potential for injury from tagging has several components: 1) behavioral response from close approach, and 2) behavioral response from attachment, 3) injury from actual attachment.

Tagging, especially with pole deployment generally involves closer approaches than biopsy. Since we generally use a pole of 3-4 m, pole deployment requires approaches to at least this range. This approach is fairly brief and reaction to this appears to be similar to that addressed above for biopsy with no evidence of changes in behavior other than in the few minutes following close approach. Dive data collected to date (Calambokidis 2003, Calambokidis et al. 2001a, 2003b, 2004b, Oleson et al. 2004, submitted, Goldbogen et al. submitted) show an occasional atypical shallow dive of intermediate length immediately after tag deployment followed by a resumption of normal feeding or traveling dives within 5 minutes.

The resumption of typical feeding and traveling behavior after deployment also indicate no adverse response by the whale to the presence of the tag. Many whales and dolphins including blue and humpback whales often live with remora suckerfish attached by suction to their body (Rice and Caldwell 1961, Follett and Dempster 1960, Fertl and Landry 1999). The presence of a small object attached by suction therefore is not something that these animals do not experience normally.

We do not expect any injury to skin of whales from suction-cup attachment other than perhaps the removal of some of the outer layers of skin that are sloughing. Whales slough skin on a regular basis and these pieces of skin can be found in the footprint of whales and have been used by a number of researchers as an alternate means of collecting skin samples. We have recovered skin from the suction cup of tags deployed on whales. We have never seen any injury on whales as a result of deployment of suction cup tags. The primary Burgess tag we will be deploying is pressed on with minimal force.

D2. Effects of Incidental Harassment;

During past research activities, the reaction of cetaceans to incidental harassment through vessel approach has varied from no reaction to swimming away or diving. In aerial surveys, whales sometimes submerge when the plane approached directly overhead, but in general, animals usually show no obvious sings of reaction due to overflights. During small boat operations cetaceans sometimes swim away or dive as they are being approached.

D3. Effects on Stocks;

No long-term adverse effects on the stocks listed in this application are anticipated and no effects on reproductive rates or on continued survival in the wild related to these activities have been identified. Over the period where research has been conducted no significant, persistent response (*i.e*., increased avoidance or evasive behavior) in response to vessels or aircraft by any population of animals under study has been documented.

D4. Stress, Pain, and Suffering:

The proposed research utilizes a technique to obtain continuous information on the sub-surface behavior of cetaceans by applying instruments that are attached with suction-cups. Alternate measures of attaching instruments to cetaceans require penetrating the skin for attachment, and in many cases (with smaller species), capturing animals. Both techniques are more likely to cause stress, pain or suffering than suction-cup tagging. As well, penetrating tags are often not recoverable, thus such studies tend to be more expensive and have small sample sizes (in terms of number of individuals tagged).

Tagging attempts for a particular individual will be discontinued on a particular day if this individual exhibits a strong adverse response to the tagging activity. Regardless, given the distance that animals must be approached for tagging, and the extreme difficulty in approaching animals which are actively avoiding a research vessel, it seems unlikely that an animal seriously disturbed by tagging would be approachable for multiple attempts. Tagging attempts on a particular stock of any species will be discontinued if the majority of tagged animals show strong reactions.

Because the tags attach with a suction-cup, they are not expected to provide substantial drag, even on small cetaceans, since the cups slide off if substantial drag is placed on them. According to an experienced marine mammal veterinarian (L. Cornell, personal communication), the suction-cup attachment should cause no long-term or detrimental damage to tagged animals.

D5. Measures to Minimize Disturbance:

Our research will be conducted to utilize the least invasive technique as required to achieve the research objectives. We will also take a number of steps to keep disturbance at a minimum.

For photo-identification:

- We will keep our photographic approaches to as short as possible by leaving groups after we have obtained suitable identification photographs of the whales in a group.

- We will avoid multiple approaches of the same groups of whales on a given day if we are able to determine that we have already identified that particular group.

- We will suspend photographic identification efforts if our activities are resulting in the disruption of normal whale activities.

- We will avoid traveling in front of or blocking the intended path of groups of whales.

- We will be particularly cautious when approaching cows with calves and will avoid separating or coming between a cow and her calf.

In order to avoid any cumulative impact from our research in combination with the activities of other researchers we will coordinate our activities with other researchers to avoid unnecessary duplication. We maintain excellent working relationships with other researchers in the region most of whom are familiar with our research. There is therefore limited possibility of duplication of research effort or of cumulative impacts. For example:

- Cascadia works closely with Southwest Fisheries Science Center. They have funded much of our work on humpback and blue whales. We have worked on numerous collaborative survey efforts and reports sightings of interest to us. SWFSC has also provided identification photographs to us for use in our research and we have collected biopsy samples for their use and analysis.

- We work closely with the National Marine Mammal Laboratory. They have funded our research on gray whales and harbor porpoise. We collaborate in areas we survey and share information and identification photographs.

- Cascadia works closely with researchers at academic institutions along the west coast including the UC Santa Cruz, Moss Landing Marine Lab, Scripps Institute of Oceanography, and Humboldt State.

- We coordinate with the various national marine sanctuaries along the west coast including the Channel Islands, Monterey Bay, Gulf of the Farallones, Cordell Bank, and Olympic Coast all of whom have also funded portions of our research.

- We work and collaborate with other independent researchers conducting photographic identification of various cetacean species. We assembled a team of most of the active humpback whale researchers in the North Pacific for our collaborative assessment of humpback whale abundance. We share our photographs with others, this includes providing copies of our humpback whale photographs to the National Marine Mammal Laboratory and sending copies of other species such as killer whales to other researchers.

For aerial surveys a number of steps will be taken to minimize the impacts of aerial surveys:

- Aerial surveys will primarily involve strait-line passes along transect line with only limited circling. Our exposure to most marine mammals will therefore be brief and will not involve extensive circling or closer approach.

- Surveys will be conducted primarily with the aircraft at low power setting and using specialized aircraft such as the Partenavia that are relatively quiet.

- Surveys will generally be flown at 600-1,000 feet elevation with lower altitudes only used when absolutely essential (such as for safety reasons during low cloud cover ceilings). In cases where we have to fly lower due to weather constraints we will abandon the survey if forced to fly below 500 feet. Flights over open water will be conducted as described above. Circling over rookeries will generally be conducted at 1,000 feet to reduce chances of disturbance.

For biopsy for collection of skin samples and tagging we will collect skin samples by searching for sloughed skin in areas first whenever possible. If this method is successful in collection of samples, we will minimize our use of biopsy for collection. As described previously we will keep the dart tips clean between biopsy attempts to reduce chances of infection.

Behavioral impacts of tagging and biopsy will be mitigated, when possible, by the following strategies: 1) the use of a free-floating dart for biopsy; 2) the use of small boats and relatively quiet outboard motors; 3) a limit of no more than three close approaches to, and time in pursuit of, an individual or a pod; and 4) the termination of an approach if an animal shows extreme avoidance or surface behaviors indicating extreme behavioral disturbance.

The use of a free-floating dart and small vessels has already been demonstrated to decrease the probability of affecting an extreme response in a biopsied whale. During the summer of 1988, 49 humpback whales were biopsied in the Gulf of Maine using a free-floating dart.

The number of close approaches (less than 25 meters) to a single individual or pod will be limited to no more than three and total time in pursuit will not exceed one hour. Weinrich *et al* (1987) and Mathews (1986) suggest that repeated approaches tend to potentate an individual to disturbance from the vessel itself. This agrees with other observations of baleen whale responses to repeated close approaches by vessels (Baker *et al*. 1982, 1983).

Any given tag or biopsy attempt will be terminated if the pod or individual shows extreme behavioral response to the vessel approach. For this purpose, an extreme behavioral response is defined as avoidance of the vessel by rapid surface swimming (greater than 10 km/hr), displacement from a feeding site, explosive breaching, or evidence of social disruption.

For tagging we will also utilize the least invasive attachment technique suitable for the duration of tag attachment needed. This will include use of suction-cup tags for short-term attachments.

D6. National Environmental Policy Act (NEPA) Considerations:

The following information is provided for consideration under NEPA:

(a) the research involves new, innovative, controversial, or experimental equipment or techniques;
The research activities proposed do not include any new, innovative, controversial or experimental equipment or techniques. All of the activities proposed in this permit application have been conducted for at least 10 years and have become the established methods for collecting cetacean data in the field.

(b) the research techniques are likely to be adopted by other researchers;
The research techniques are already in use by other researchers around the world, including those associated with government research labs, universities, and non-profit groups.

(c) the location in which the research will be conducted is of special importance to other marine mammals;

There are no populations of other marine mammals (species which are not being studied) that could be affected by this research.

(d) the proposed activities involve unique or unknown risks or whether the likely effects are highly uncertain;
Because the proposed activities have been in wide usage for many years and have become standard practices internationally in marine mammal research, the likely effects of the activities are well known and do not involve a high degree of uncertainty.

(e) any aspect of the research possibly affects the public health or safety of humans;
No aspect of the research potentially affects the public health or safety of humans.

(f) the activity may have a significant cumulative effect, considering existing and potential activities;
The level of research activity is not expected to have a significant cumulative effect on any populations.

(g) the activity causes loss or destruction of significant scientific, cultural, or historic resources;
The activity will not cause any loss or destruction of significant scientific, cultural or historic resources.

(h) there will be an adverse effect on endangered or threatened populations or stocks or their habitat;
The activity is not expected to have any adverse effect on any endangered or threatened population or stock or their habitats.

(i) the activity is in violation of a Federal, State, or local law for environmental protection.
The activity is not in violation of any Federal, State, or local law for environmental protection.

E. Publication of Results:

The data collected to achieve the objectives stated here will be compiled, analyzed and written up in contract reports after each field project. Results of the research are regularly presented at scientific conferences (e.g., the Society for Marine Mammalogy Biennial Conferences), and the results are published in peer-reviewed scientific journals (*e.g.*, Marine Mammal Science, Marine Ecology Progress Series, Journal of Cetacean Research and Management, Fisheries Bulletin). All published work conducted under the authority of a NMFS permit will be submitted to the Office of Protected Resources and other associated federal agencies.

F. Proposal and Previous and Other Permits:

F1. Formal Research Proposal: N/A

F2. Sponsors and Cooperating Institutions:

The following key people represent principal sponsors of the research in this application:

Dr. Jay Barlow, Southwest Fisheries Science Center (SWFSC), La Jolla, CA
Dr. Barb Taylor, Genetics lab SWFSC
Dr. Paul Wade, National Marine Mammal Laboratory (NMML), Seattle, WA
Dr. Jeff Laake, NMML
Dr. Phillip Clapham, NMML
Dr. Scott Baker, University of Aukland
David Mattilla, Hawaiian Islands Humpback Whale National Marine Sanctuary, HI
Dr. John Hildebrand, Scripps Institution of Oceanography, La Jolla, CA

F3. Previous Permits: All required reports to date for previous permits have been submitted.

F4. Other Permits: We will obtain permits from the National Marine Sanctuaries for any aerial surveys conducted under 1000 ft.

V. Special Considerations for Applicants Working Abroad
(for Exports of Parts/Samples or Live Animals from the U.S.) N/A

VI. Certification and Signature

I hereby certify that the foregoing information is complete, true, and correct to the best of my knowledge and belief. I understand that this information is submitted for the purpose of obtaining a permit under one or more of the following statutes and the regulations promulgated thereunder, as indicated in Section I. of this application:

The Endangered Species Act of 1973 (16 U.S.C. 1531-1543) and regulations (50 CFR 222.23(b)); and/or

The Marine Mammal Protection Act of 1972 (16 U.S.C. 1361-1407) and regulations (50 CFR Part 216)

I also understand that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or to penalties provided under the Endangered Species Act of 1973, the Marine Mammal Protection Act of 1972, or the Fur Seal Act of 1966, whichever are applicable."

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John Calambokidis, Research Biologist

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APPENDIX 1

Curricula Vitae

John Calambokidis- PI
Todd Chandler – CI
Robin Baird - CI
Gregory Schorr – CI
Erin Falcone – CI
Gretchen Steiger – CI
Anne Douglas - CI

CURRICULUM VITAE

John Calambokidis
April 2005

John Calambokidis, Research Biologist
Cascadia Research Collective
218½ West 4th Avenue
Olympia, WA 98501
Phone: (360)943-7325, FAX: (360)943-7026
email: Calambokidis@CascadiaResearch.org

PROFESSIONAL EXPERIENCE

Research Biologist: Founding member of Cascadia Research (non-profit tax-exempt org.). Served as Principal Investigator of more than 40 research studies on marine mammals, birds, and pollution (see below for examples). Wrote research proposals, conducted field research, analyzed data, and published research results for projects funded by government and private grants and contracts. Supervised staff of up to 20 researchers.
Cascadia Research Collective, September 1979 to present.

Examples of projects directed (see Cascadia Qualifications for more complete list):

- Estimation of the abundance of humpback whales in the entire North Pacific using photographic identification for Southwest Fisheries Science Center.
- Abundance and movements of humpback and blue whales off California using photo-ID for the Gulf of the Farallones, Monterey Bay, and Channel Islands National Marine Sanctuaries.
- Research on the reactions of marine mammals to air guns and mitigation during seismic surveys in Washington and British Columbia under contract to U.S. Geological Survey.
- Study of impact of low-frequency sound from the ATOC sound source on the occurrence, distribution, and behavior of marine mammals under contract to UC, Santa Cruz.
- Impacts of the US Navy LFA sound source on blue and fin whales off S California using aerial surveys and photo-ID for the Office of Naval Research (subcontract from Cornell)
- Population assessment of humpback and blue whales using mark-recapture of identified individuals off California, Oregon, and Washington for Southwest Fisheries Science Center.
- Harbor seal population size, impacts of human disturbance, and habitat requirements at Woodard Bay in Puget Sound, Washington for the Wa. Dept. of Natural Resources.
- Abundance and distribution of marine mammals in the Strait of Juan de Fuca with aerial and vessel surveys and impacts of underwater blasting for the Corps of Engineers.

Adjunct Faculty: Taught graduate level courses on the Biology of Marine Mammals for the Masters of Environmental Studies program at the Evergreen State College.
The Evergreen State College, Olympia, Wa. 98505. May 1989 to present.

Faculty: Developed and led a research and educational program for college students. Conducted research on vessel impact on harbor seals, biology and reproduction of harbor porpoise,

and Canada goose behavior, in Glacier Bay, Alaska. Program is in cooperation with the National Park Service. Published research results in scientific journals.
School for Field Studies, Cambridge, MA 02139. June-August, 1981-83.

Biological Technician: Conducted research on the behavior of northern fur seals on the Pribilof Islands from June to October of two field seasons. Duties included censuses, monitoring behavior, and tagging animals.
National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115. May 1978 to September 1979.

Project Director: Directed Student-Originated Study (SOS) research project funded by National Science Foundation on the biology of harbor seals and the levels and impacts of chlorinated hydrocarbon contaminants. Coordinated the activities of eight student researchers.
National Science Foundation through The Evergreen State College, Olympia, WA 98505. March 1977 to March 1978.

EDUCATION

B.S. 1977 (Biology), The Evergreen State College, Olympia, WA.

PUBLICATIONS (scientific journals and books)

Steiger, G.H., J. Calambokidis, J.M. Straley, Louis M. Herman, Salvatore Cerchio, Dan R. Salden, Jorge Urbán R., Jeff K. Jacobsen, Olga von Ziegesar, Kenneth C. Balcomb, Christine M. Gabriele, Marilyn E. Dahlheim, Senzo Uchida, John K.B. Ford, Paloma Ladrón de Guevara P., Manami Yamaguchi and Jay Barlow. Geographic variation in fluke coloration and rake mark scarring of humpback whales in the North Pacific. Submitted to *Canadian Journal of Zoology*.

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Government reports and publications

Calambokidis, J., T. Chandler, E. Falcone, and A. Douglas. 2004. Research on large whales off California, Oregon, and Washington: Annual report for 2003. Final report to Southwest Fisheries Science Center, La Jolla, CA. Cascadia Research, 218½ W Fourth Ave., Olympia, WA 98501. 48pp

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Rasmussen, K., J. Calambokidis, and G.H. Steiger. 2004. Humpback whales and other marine mammals off Costa Rica and surrounding waters, 1996-2003. Report of the Oceanic Society 2002 field season in cooperation with Elderhostel volunteers. Cascadia Research, 218½ W Fourth Ave., Olympia, WA 98501. 23pp

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Calambokidis, J. 1990. Bacterial contamination of shellfish caused by harbor seals in Puget Sound. Presented to the Wildlife Society Conference, 28 Feb-2 Mar, Rippling River, Oregon.

Calambokidis, J., G.H. Steiger, J.C. Cubbage, K.C. Balcomb, P. Bloedel, and D.W. Bockus. 1989. Abundance and distribution of blue and humpback whales in the Gulf of the Farallones, California. Abstracts of the Eighth Conference on the Biology of Marine Mammals, 7-11 December, Pacific Grove, California.

Calambokidis, J. 1990. Chlorinated hydrocarbons in marine mammals from Puget Sound and the Northeast Pacific. Proceedings of conference on the Bioavailability of Toxic Contaminants in the San Francisco Bay/Delta, the Aquatic Habitat Institute, Richmond, California.

Steiger, G.H., J. Calambokidis, J.C. Cubbage, K.C. Balcomb, and P. Bloedel. 1989. Size and age class of blue and humpback whales in a central California feeding area. Abstracts of the Eighth Conference on the Biology of Marine Mammals, 7-11 December, Pacific Grove, California.

Baker, C.S., S.R. Palumbi, R.H. Lambertson, M.T. Weinrich, J. Calambokidis, and S.J. O'Brien. 1989. Geographic structure of mitochondrial DNA variation in humpback whales. Abstracts of the Eighth Conference on the Biology of Marine Mammals, 7-11 December, Pacific Grove, California.

Calambokidis, J., G.H. Steiger, J.C. Cubbage, K.C. Balcomb, C. Ewald, S. Kruse, and R. Wells. 1988. Population size, movements, and behavior of blue whales, *Balaenoptera musculus*, in central California, as discerned through photo-identification. Symposium on the Use of Non- Lethal Techniques, Especially Photo-Identification Techniques, to Estimate Cetacean Population Parameters, 29 April-1 May, La Jolla, California.

Cubbage, J.C., J. Calambokidis, G.H. Steiger, K.C. Balcomb, and P. Bloedel. 1988. Photo-identification of humpback whales, *Megaptera novaeangliae*, in the Gulf of the Farallones, California, with an analysis of potential sources of sample bias. Symposium on the Use of Non-Lethal Techniques, Especially Photo-Identification Techniques, to Estimate Cetacean Population Parameters, 29 April-1 May, La Jolla, California.

Sears, R. and J. Calambokidis. Long range movement of blue whales, Balaenoptera musculus, between central California, USA, and the Sea of Cortez, Mexico. Symposium on the Use of Non-Lethal Techniques, Especially Photo-Identification Techniques, to Estimate Cetacean Population Parameters, 29 April-1 May, La Jolla, California.

Calambokidis, J. and B.D. McLaughlin. 1988. Harbor seal populations and their contribution to fecal coliform contamination in Quilcene Bay, Washington. Proceedings of the First Annual Meeting on Puget Sound Research, Vol. 1, pp. 300-306, Puget Sound Water Quality Authority, Seattle.

Calambokidis, J., G.H. Steiger, J.C. Cubbage, S. Kort, S. Belcher, and M. Meehan. 1988. Status of Puget Sound harbor seals: trends in populations size and contaminant concentrations. Proceedings of the First Annual Meeting on Puget Sound Research, Vol. 2, pp. 589-597, Puget Sound Water Quality Authority, Seattle.

Speich, S.M., J. Calambokidis, J. Peard, D.M. Fry, and M. Witter. 1988. Puget Sound Glaucous-winged Gull: biology and contaminants. Proceedings of the First Annual Meeting on Puget Sound Research, Vol. 2, pp. 598-607, Puget Sound Water Quality Authority, Seattle.

Calambokidis, J., and J. Barlow. 1987. Chlorinated hydrocarbon concentrations and their use for describing population discreetness in harbor porpoise from Washington, Oregon, and California. Second Marine Mammal Stranding Workshop, 3-5 December 1987, Miami, Florida, 1991.

Calambokidis, J., S. Kruse, J.C. Cubbage, R. Wells, K.C. Balcomb, C. Ewald, and G.H. Steiger. 1987. Blue whale occurrence and photo-identification along the central California coast. Proceedings (Abstracts) of the Seventh Biennial Conference on the Biology of Marine Mammals. 5-9 December, Miami, Florida.

Cubbage, J.C., J. Calambokidis, K.C. Balcomb, and G.H. Steiger. 1987. Humpback whale (Megaptera novaeangliae) distribution and abundance in the Gulf of Farallones, California. Abstracts of the Seventh Biennial Conference on the Biology of Marine Mammals. 5-9 December, Miami, Florida.

Urban, J., K.C. Balcomb, C. Alvarez, P. Bloedel, J.C. Cubbage, J. Calambokidis, and G.H. Steiger. 1987. Photo-identification matches of humpback whales (*Megaptera novaeangliae*) between Mexico and central California. Abstracts of the Seventh Biennial Conference on the Biology of Marine Mammals. 5-9 December, Miami, Florida.

Calambokidis, J., S.M. Speich, M. Witter, J. Peard, and D.W. Shea. 1987. Eggshell thinning and pathology in Puget Sound Marine Birds and their association with pollutants. Northwest Scientific Association 60th Annual Meeting. Tacoma, Washington.

Calambokidis, J. 1986. Population status, reproduction and mortality of Puget Sound harbor seals. Presentation to the Annual meeting of the Pacific Northwest Bird and Mammal Society, 10 May 1986, Tacoma, Washington.

Calambokidis, J., G.H. Steiger, and J.C. Cubbage. 1985. Biology of Puget Sound marine mammals: Evidence of pollution-related problems. Abstracts of the Sixth Biennial Conference on the Biology of Marine Mammals. 22-26 Nov. 1985, Vancouver, British Columbia.

Cubbage, J.C., J. Calambokidis, and G.H. Steiger. 1985. Photogrammetry techniques applied to marine mammals. Abstracts of the Sixth Biennial Conference on the Biology of Marine Mammals. 22-26 Nov. 1985, Vancouver, British Columbia.

Steiger, G.H., J. Calambokidis, J.C. Cubbage, D.C. Gribble, D.E. Skilling, and A.W. Smith. 1985. Comparative mortality, pathology, and microbiology of harbor seal neonates at different sites in Puget Sound, Washington. Abstracts of the Sixth Biennial Conference on the Biology of Marine Mammals. 22-26 Nov. 1985, Vancouver, British Columbia.

Calambokidis, J. 1985. Status of Puget Sound harbor seals and the evidence for contaminant effects on marine mammals. Presentation to Washington Chapter of the Wildlife Society, 22 June 1985, Seattle, Washington.

Calambokidis, J., G.H. Steiger, and L.E. Healey. 1983. Behavior of harbor seals and their reaction to vessels in Glacier Bay, Alaska. Abstracts of the Fifth Biennial Conference on the Biology of Marine Mammals. 27 Nov-1 Dec. 1983, Boston, Mass.

Calambokidis, J., G.H. Steiger, and L.E. Healey. 1983. Harbor seal (*Phoca vitulina*) population, behavior, and reaction to vessels in Glacier Bay, Alaska. Abstracts of the First Glacier Bay Science Symposium, 23- 26 September 1983. Gustavus, Alaska.

Calambokidis, J., G.H. Steiger, and R.A. Butler. 1983. Biology and behavior of molting Canada geese (*Branta canadensis fulva*) in Glacier Bay, Alaska. Abstracts of the First Glacier Bay Science Symposium, 23- 26 September 1983. Gustavus, Alaska.

Calambokidis, J. and R.L. Gentry. 1981. Growth, behavior, and impact of tagging on newborn northern fur seals, *Callorhinus ursinus*. Abstracts of the Fourth Biennual Conference on the Biology of Marine Mammals. 14-18 Dec. 1981, San Francisco, California.

Cubbage, J., J. Calambokidis, and S. Carter. 1979. Fish otoliths recovered from scat of harbor seals in the inland waters of Washington State. Abstracts of the Third Biennial Conference on the Biology of Marine Mammals, 7-11 October 1979, Seattle, Washington.

Calambokidis, J. S. Carter, and J. Cubbage. 1979. The concentration and dynamics of chlorinated hydrocarbon contaminants in harbor seals and their use in gaining biological information. Abstracts of the Third Biennial Conference on the Biology of Marine Mammals, 7-11 October 1979, Seattle, Washington.

Calambokidis, J., S. Carter, and J. Cubbage. 1979. Variations in the pupping season of harbor seals in Puget Sound and Hood Canal, Washington. Abstracts of the Third Biennial Conference on the Biology of Marine Mammals, 7-11 October 1979, Seattle, Washington.

Calambokidis, J. S. Carter, and J. Cubbage. 1979. Harbor seal haul out habitat and differences in haul out pattern in the inland waters of Washington State. Abstracts of the Third Biennial Conference on the Biology of Marine Mammals, 7-11 October 1979, Seattle, Washington.

Calambokidis, J. 1978. PCB and DDE in harbor seals and fish from Washington State waters. Proceedings of the 33rd Northwest Regional Meeting of the American Chemical Society, 14-16 June 1978, Seattle, Washington.

Calambokidis, J. and L. Kretchmar. 1977. Observations of a suburban population of harbor seals in Eld Inlet, Puget Sound. Annual Meeting of the Pacific Northwest Bird and Mammal Society, 16 April 1977, Olympia, Washington.

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

The Society for Marine Mammalogy
Committee on the Status of Endangered Wildlife in Canada – Marine Mammal Specialist Group
Society for Northwestern Vertebrate Biology
Cascadia Research Collective (Board of Directors)
Washington Chapter - Wildlife Society
NMFS North Pacific Take Reduction Team
North Pacific Right Whale Recovery Team, Canada
Puget Sound Water Quality Authority - Scientific Review Panel 1986-87

Todd Chandler

Cascadia Research Collective
218 ½ West Fourth Ave.
Olympia, WA. 98501
Phone: (360)943 7325, Fax: (360)943 7026
Email: Chandler_Todd@msn.com

EDUCATION

B.S. 1991 (Biology) The Evergreen State College, Olympia, WA.

PROFESSIONAL EXPERIENCE

Marine Mammal Visual Observer

1992, 1993, 2000, 2001 — North Slope Borough
Bowhead Whale Census

- Visual observer for ice-based Bowhead whale census, camp leader 2001.
- Responsible for counting and tracking whales with a theodolite.
- Assist with acoustic effort to count and locate whales acoustically.

1999, 2000, 2001 — Cascadia Research Collective
Blue Whale *Critter Cam* Project

- Joint project with National Geographic Society.
- Assist in locating blue whales for application of Critter cams.
- Track tagged whales visually, acoustically, and with VHF radio tracking equipment.

1998, 2000, 2002 — Cascadia Research Collective
U.S. Geological Survey Seismic Mitigation

- Field Supervisor and visual observer during seismic surveys.
- Responsible for marine mammal observers and coordination with seismic personnel.
- Request seismic gear shut downs when marine mammals are seen within predetermined distances.
- Gather data to determine effects of air gun array on marine mammals.

1995 — Norwegian Government
Norwegian Independent Line Transect Survey (NILS)

- Visual observer for line transect Minke whale survey in Northeast Atlantic.
- Worked with observers from 5 countries including Norwegian scientific whalers.

1992 — National Marine Mammal Laboratory
Kodiak-Aleutian Killer Whale Assessment

- Visual observer on line transect survey of Killer whales.
- Surveyed 5,000 n.m. of Alaskan waters.
- Responsible for driving small boat, photographing individual whales, and recording data.

Aerial Surveys

2002-2003 — Cascadia Research Collective
Harbor Porpoise Aerial Survey

- Field Supervisor during line transect aerial surveys for Harbor Porpoise in Oregon, Washington and British Columbia.

- Responsibilities included scheduling observers and aircraft, making weather and routing decisions, recording data using a computerized data acquisition system and editing data.
- Assisted with preliminary data analysis and generated progress reports.

1995-1998 Cascadia Research Collective
Acoustic Thermometry of Ocean Climate (ATOC)

- Field Supervisor on line transect aerial surveys for Scripps Institute of Oceanography underwater sound project.
- Scheduled observers and aircraft for surveys.
- Recorded data on computerized data acquisition system on over 400 flights.

1997 Cascadia Research Collective
Low Frequency Acoustics (LFA)

- Field supervisor for line transect aerial surveys to assess effects of low frequency sound on baleen whales.
- Conduct inflatable boat surveys for photo-identification of baleen whales to assess long term effects of low frequency sound.
- Assisted in applying time and depth recording tags for UCSC.

Photographic Identification Specialist

2001 Cascadia Research Collective
Oregon, California, and Washington Line Transect Estimates (ORCAWALE)

- Photo-identification specialist for Southwest Fisheries Science Center marine mammal survey.
- Biopsy large whales when biopsy specialist not available and record data.

1991-2003 Cascadia Research Collective
Humpback and Blue Whale Photo Identification

- Photo-Id specialist for Cascadia Research off California, Oregon, and Washington.
- Drive inflatable boat, photograph and biopsy whales, and record data.
- Assist with tag deployments and recovery
- Proficient with radio telemetry tracking and retrieving instrument packages

1995 Cascadia Research Collective
Cetacean and Deep Diving Interval Study (CADDIS)

- Blue whale photo-identification specialist for cruise off outer coast of Baja California, Mexico with Southwest Fisheries Science Center.
- Obtain individual photographs of blue whales from small boat while ship continues surveying for all marine mammals.

1994 Cascadia Research Collective
Population of Delphinus Survey (PODS)

- Humpback and Blue whale photo-identification specialist on Southwest Fisheries Science Center’s Delphinus line transect survey.
- Obtained photographs of whales from inflatable boat while ship continues with primary task of survey.

1991-2003 Cascadia Research Collective
Gray Whale Photo-identification

- Assist Cascadia with collection of photo-identifications of individual gray whales from Puget Sound and outer coasts of Washington, Oregon, and California.

- Drive inflatable boat during surveys, photograph whales and record data.

Boat Driver/Captain

1991-2003 Cascadia Research Collective
Humpback and Blue Whale Inflatable Boat Survey

- Conduct inflatable boat surveys along the California, Oregon, and Washington coasts as part of long term population estimates.
- Responsible for driving boat, navigating, photographing and biopsying whales, recording vocalizations and data.

1998-1999 Cascadia Research Collective
Central America Humpback and Blue Whale Expedition

- Captain of 60’ sailing research vessel *Russamee* on 5 month National Geographic funded humpback and blue whale research expedition.
- Observe for whales, drive inflatable around whales, photograph individuals and record data.
- Listen for whale vocalizations and record to Digital Audio Tape when heard.
- Gather acoustic data with Simrad EY 500 hydroacoustic system.

1997 Cascadia Research Collective
Sperm Whale Cruise

- Inflatable boat driver on Southwest Fisheries Science Center sperm whale cruise.
- Responsible for driving boat for photo-id, tagging, and acoustic personnel.

PUBLICATIONS (scientific journals and books)

Calambokidis, J., J.R. Evenson, T.E. Chandler, and G.H. Steiger. 1992. Individual identification of gray whales in Puget Sound in 1991. Puget Sound Notes 28:1-4

Government reports and publications

Calambokidis, J., T. Chandler and S. Osmek. 1998. Aerial surveys conducted to test the impacts of LFA sound source. Final report for Agreement #33318-5819 to Cornell University as part of LFA Phase I from the Office of Naval Research. 31pp.

Calambokidis, J., K. Rasmussen and T. Chandler. 1998. Photographic identification of blue and fin whales conducted to test the impacts of the LFA sound source. Final report for agreement#33318-5819 to Cornell University as part of LFA phase I from the Office of Naval Research. 31pp.

Calambokidis, J., T. Chandler, K. Rasmussen, G.H. Steiger, and L. Schlender. 1998. Humpback and blue whale photographic identification report on research in 1997. Final Report to Southwest Fisheries Science Center, Olympic Coast National Marine Sanctuaries, University of California at Santa Cruz, and Cornell University. 41pp.

Calambokidis, J., T. Chandler, K. Rasmussen, G.H. Steiger, L. Schlender, D. Ellifrit, and J.L. Quan. 1997. Humpback and blue whale photographic identification: Report of research in 1996. Final report to Monterey Bay, Channel Islands, and Olympic Coast National Marine Sanctuaries, Southwest Fisheries Science Center, and University of California at Santa Cruz. Cascadia Research, 218 ½ West Fourth Ave., Olympia, WA 98501. 40pp.

Presentations to scientific societies and symposia abstracts

Calambokidis, J., Chandler, T.E., Costa, D.P., Clark, C.W., and H. Whitehead. 1998. Effects of ATOC sound source on the distribution of marine mammals observed from aerial surveys off central California. P. 22 *in*: Abstracts of the World Marine Mammal Science Conference, Monaco, 20-24 January 1998. Society for Marine Mammology, Lawrence, KS.

Chandler, T.E., J. Calambokidis, and K. Rasmussen. 1999. Population identity of Blue whales on the Costa Rica Dome. *In:* Abstracts Thirteenth Biennial Conference on the Biology of Marine Mammals, Maui, HI 28 November–3 December 1999. Society for Marine Mammology, Lawrence, KS.

Chandler, T.E., J. Calambokids, R. Sears. 2001. First Report on Sightings of a White Blue Whale. P.41 in Abstracts of 14th Biennial Conference on the Biology of Marine Mammals, Vancouver, B.C. 28 November-3 December, 2001. Society for Marine Mammmology, Lawrence, KS.

Rasmussen, K., J. Calambokidis, G.H. Steiger, and T.E. Chandler. 1999. Central America as a significant wintering ground for North Pacific humpback whales. *in:* Abstracts thirteenth Biennial Conference on the Biology of Marine Mammals, Maui, HI 28 November-3 December 1999. Society for Marine Mammalogy, Lawrence, KS.

Curriculum Vitae

ROBIN W. BAIRD

E-mail: rwbaird@dal.ca or rwbaird@cascadiaresearch.org
http://www.cascadiaresearch.org/robin/robin.htm

EDUCATION

Ph.D., Behavioural Ecology Research Group, Department of Biological Sciences, Simon Fraser University, Burnaby, B.C., 1994. Thesis title: Foraging behaviour and ecology of *transient* killer whales (*Orcinus orca*).
B.Sc., Biology (Co-op), University of Victoria, Victoria, B.C., 1987.

POSITIONS HELD

Member – Marine Mammal Advisory Committee, Western Pacific Fisheries Management Council, 2005.
Affiliate Assistant Professor, University of Washington, Department of Psychology, July 2005-present.
Post-doctoral Fellow - Biology Department, Dalhousie University, Halifax, Nova Scotia, May 1996-2003.
Member - Committee of Scientific Advisors, Society for Marine Mammalogy, 1995-2001.
Invited Expert – Department of Fisheries and Oceans, Quebec, Canada, Scientific Review of St. Lawrence Marine Protected Area, April 2000.
Research Director - Pacific Whale Foundation, Kihei, Hawaii, December 1998-December 1999.
Biologist - Marine Mammal Research Group, Victoria, B.C., 1987-1998.
Member - Cetacean Specialist Group, IUCN Species Survival Commission, 1992-1998.
Adjunct Assistant Professor - University of Victoria, B.C., July 1994-June 1996.
Invited Participant - International Whaling Commission Scientific Committee, Netherlands, 1990 (declined), San Diego, 1989.
Co-founder, Senior Editor - "MARMAM", an electronic mail discussion list focusing on marine mammal research and conservation, 1993-present.
Reviewer (30 journals and several agencies/books) **–** African Journal of Zoology, Animal Behaviour, Antarctic Science, Aquatic Mammals, Behavioral and Brain Sciences, Behavioral Ecology, Behaviour, Biological Reviews, BioScience, Biotropica, Canadian Field-Naturalist, Canadian Journal of Zoology, Conservation Biology, Deep-Sea Research, Ecological Adaptations, Gulf of Mexico Science, Handbook of Marine Mammals, Journal of Cetacean Research and Management, Journal of the Marine Biological Association, Journal of Zoology (London), Latin American Journal of Aquatic Mammals, Marine Ecology Progress Series, Marine Mammal Science, Marine Technology Society Journal, National Science Foundation, Nature, New Zealand Journal of Marine and Freshwater Research, Northeastern Naturalist, Oikos, Pacific Science, Proceedings of the Royal Society of London, Reports of the International Whaling Commission.
Research Associate - The Whale Museum, Friday Harbor, WA, 1987-1991.

RESEARCH EXPERIENCE

Biologist – Cascadia Research Collective, Olympia, WA, September 2003-present. Research on the diving behavior of beaked whales, pilot whales, false killer whales, killer whales; studies on the diet of killer whales; population assessment of Hawaiian odontocetes.

Biologist – National Marine Fisheries Service, Beaufort, NC, April 2001-September 2003. Stock-identification research on bottlenose dolphins along the US mid-Atlantic coast. Organizer and Chief Scientist on multi-vessel bottlenose dolphin biopsy cruises in 2001, 2002, 2003.

Consultant –

National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, CA, November 2000-April 2001, mark-recapture population assessment of bottlenose dolphins in Hawaii. March-May 2002, assessment of inter-island movements of bottlenose dolphins in Hawaii. May-June 2003, assessment of habitat use and inter-island movements of Hawaiian odontocetes, September 2003-February 2004, study of beaked whale diving behavior in Hawaiian waters.

National Marine Mammal Laboratory, Seattle, WA, research on diet of "southern resident" killer whales in Washington state. June, July 2002.

University of Hawaii, Honolulu, HI, research on diving behavior of rough-toothed dolphins, French Polynesia, January and May 2000.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Ottawa, compiling and analyzing sighting, stranding and incidental catch records, and evaluating status of eleven species of cetaceans and two species of pinnipeds in Canada, 1988-2003.

Woods Hole Oceanographic Institution, Woods Hole, MA, research on diving behavior of long-finned pilot whales, Ligurian Sea, July-August 1999.

National Marine Mammal Laboratory, Seattle, WA, research on diving behavior of killer whales in S.E. Alaska, using suction-cup attached TDR/VHF tags. June 1998.

Woods Hole Oceanographic Institution, Woods Hole, MA, research on right whale acoustics using a suction-cup attached acoustic tag. March 1998.

Woods Hole Oceanographic Institution, Woods Hole, MA, using suction-cup attached TDR/VHF tags to examine reactions of gray whales to LFA-sonar. January 1998.

Otsuchi Marine Research Center, Japan, research on diving behavior of short-finned pilot whales off Hokkaido, Japan, using suction-cup attached TDR/VHF tags. September 1997.

National Marine Mammal Laboratory, Seattle, WA, research on diving behavior and movement patterns of Dall's porpoise, involving capture and tagging or remote-deployment of TDR/VHF tags, in Haro Strait. August 1996, May-September 1997, May-June 1998.

Axys Environmental Consulting, Sidney, B.C., assessment and mapping of shellfish aquaculture biophysical capability in Johnstone Strait, July 1995.

Canadian Wildlife Service, Sidney, B.C., undertaking seabird and marine mammals surveys in offshore British Columbia, June 1995.

Triton Environmental Consulting, Richmond, B.C., assessment of marine mammal usage of the Esquimalt Harbour area and potential impacts of development, May 1994.

Department of Fisheries and Oceans, Sidney, B.C., study of the causes of mortality of porpoises around southern Vancouver Island, 1993-1994.

Larkspur Consulting, Victoria, B.C., compiling information on marine, fresh-water and anadromous fish in southwestern B.C. for Ministry of Forests, June 1993, January 1994.

Advisory Committee on Marine Mammals, Department of Fisheries and Oceans, reviewing the live capture of cetaceans in Canada and their maintenance in aquaria, 1992.

LGL Ltd., Sidney, B.C., computerization of marine mammal sighting data base for West Coast Data Compilation and Appraisal Program, DFO, 1992.

LGL Ltd., Sidney, B.C./Provincial Ministry of Environment, compilation and analysis of marine mammal sighting and stranding records around southern Vancouver Island to evaluate seasonal distribution and population status in relation to oil spill vulnerability and clean up measures, 1991.

Department of Fisheries and Oceans, Ottawa, reviewing stranding and incidental catch records and undertaking a questionnaire survey of all commercial fishing license holders in B.C. to evaluate gray whale mortality in fishing gear, 1989-1990.

Coordinator/Co-coordinator - Stranded Whale & Dolphin Program of B.C., 1987-1995. Established and coordinated a monitoring program for marine mammal sightings, strandings and incidental mortality. Undertook necropsies on stranded and incidentally caught animals, coordinated collection and distribution of tissues for external research projects, and curated education and reference collection of marine mammal skeletons.
Field Assistant - Department of Fisheries and Oceans, Bedford, N.S. Assisting with grey seal capture and tagging research on Sable Island, Nova Scotia. December 1996-January 1997.
Research Technician - Department of Fisheries and Oceans, Nanaimo, B.C. Biological sampling and analysis for management of prawn and abalone stocks. September-December 1986.
Research Assistant - University of Victoria. Killer whale management research involving land based tracking, boat based behavioral observations, and questionnaire surveys of whale watchers. May-September 1986.
Assistant Biologist - Pacific Trident Mariculture, Saanich Inlet, B.C. Abalone mariculture. January-April 1985.
Research Technician - Wildlife Branch, Penticton, B.C. Burrowing owl transplant program, involving owl capture, banding, husbandry, monitoring program. Wildlife suitability land assessment. Mountain goat transplant program. May-August 1984.

TEACHING/PUBLIC SPEAKING

Invited Lectures – Western Washington University, 2005; University of Washington, 2004; Duke University Marine Lab, 2001, 2002; British Antarctic Survey, 2000; University of Hawaii, 1999; Museum of Zoology, University of Michigan, 1997; National Marine Mammal Laboratory, Seattle, 1997; University of Washington Friday Harbor Laboratories, 1997; Atlantic Veterinary College, Charlottetown, PEI, 1997; Woods Hole Oceanographic Institution, Woods Hole, MA, 1996; College of the Atlantic, Bar Harbor, ME, 1996; Georgetown University, Washington, DC, 1996; Center for Advanced Study in Behavioral Sciences, Stanford University, CA, 1995.
Lecturer – Lindblad Expeditions, Seattle, USA. Lecturing on marine mammals on trips in Alaska, British Columbia and Washington (May-June 2001, July 2000, August 1995) and Mexico (January 2001, January-February 1996).
Conference/Workshop Talks – European Cetacean Society, 2003, Canary Islands; 10th RT and 4th SOLAMAC Conference, 2002, Chile; Workshop on Whale Watching and Research in the Azores, 2001, Azores; Workshop on the Conservation of Bottlenose Dolphins in the NE Atlantic, 2000, Canary Islands; Society for Marine Mammalogy, 2003 North Carolina, 2001 Vancouver Canada, 1999 Hawaii, 1998 Monaco, 1989 California; International Forum of Dolphin and Whales, 1998, Japan; Reunion Internacional para el Estudio de los Mamiferos

Marinos, 1994, 1995, Mexico; Wildlife Society, 1993, Washington; Pacific Ecology Conference, 1992, Washington.
Course Director/Lecturer – Marine Naturalist Training Course, Pacific Whale Foundation, HI, USA, September – October 1999.
Lecturer - Marine Expeditions, Toronto, Ontario. Lecturing on seabird and marine mammal biology and conservation, accompanying passengers on field landings. Antarctic Peninsula, southern Argentina, November/December 1995 and February/March 1997. South and Central America, March-May 1996.
Professor - Department of Fisheries and Marine Biology, Centro Interdisciplinaro de Ciencias Marinas, Instituto Politechnico National, La Paz, B.C.S., Mexico, co-supervision of three graduate students and research on marine mammals in the Mexican Pacific (including studies of bottlenose and long-beaked common dolphins, short-finned pilot, Brydes, fin, blue and humpback whales), January-April 1995.
Resident Faculty - School for Field Studies, La Paz, B.C.S., Mexico, teaching university undergraduate course on marine mammal biology, supervising three directed research projects on cetaceans, September-December 1994.
Associate Faculty - School for Field Studies, Friday Harbor, Washington, co-teaching university undergraduate course on killer whale ecology/conservation, June-August 1994.
Teacher's Assistant - University of Victoria, February-April 1994. Second year vertebrate zoology.
Teacher's Assistant - Simon Fraser University, January-April 1989. First year biology.
Teacher's Assistant/Laboratory Instructor - Bamfield Marine Station, Bamfield, B.C., June-July 1988. Fourth year level course on biology of marine mammals.

SCHOLARSHIPS/FELLOWSHIPS

Post-doctoral Fellowship, Natural Sciences and Engineering Research Council of Canada, Dalhousie University, 1996-1998.
President's Ph.D. Research Stipend, Simon Fraser University, 1993
Postgraduate Scholarships, Natural Sciences and Engineering Research Council, Simon Fraser University, 1991-1992, 1992-1993
Scholarships, Anne Vallée Ecological Fund, Simon Fraser University, 1990, 1991
Graduate Fellowships, Simon Fraser University, 1989, 1990, 1991, 1993

GRANTS

- Principal Investigator on grant from the Hawaiian Islands Humpback Whale National Marine Sanctuary, “Management implications of humpback whale diving behavior”, 2000.
- Principal Investigator on grant from Ocean Futures Society, “Diving behavior of Icelandic killer whales in relation to post-release monitoring of a captive killer whale”, 1999.
- Principal Investigator on grant from Keiko Foundation, “Ontogeny of diving behavior in killer whales”, 1998.
- Principal Investigator on grant from Woods Hole Oceanographic Institution, “Night-time and sub-surface behavior of killer whales”, 1997.

- Co-principal Investigator on grant from World Wildlife Fund and NSERC, "Harbor porpoise mortality and toxic contaminant levels in B.C. coastal waters: implications for conservation", 1994-1996 (with D.A. Duffus and T.J. Guenther).
- Grant from Whale and Dolphin Conservation Society, "MARMAM" electronic-mail list support, 1996.
- Grants from DFO/NSERC Science Subvention Program, "Behavioral and ecological interactions between harbor seals and killer whales", 1990-1993, (with L.M. Dill, S.F.U.).
- Grants from National Marine Mammal Laboratory, National Marine Fisheries Service, "Collection of tissues from stranded or incidentally killed harbor porpoises in B.C.", 1991, 1992, 1993, 1994, 1994 (with P.J. Stacey and T.J. Guenther, Marine Mammal Research Group).
- Grants from Capital Regional District, "Investigation of causes of mortality of cetaceans around southern Vancouver Island", 1994, 1995 (with T.J. Guenther, Marine Mammal Research Group).
- Grants from Greenpeace International, "Harbor porpoise strandings and incidental mortality in B.C.", 1991 and 1992 (with T.J. Guenther, Marine Mammal Research Group).
- Grant from Cowichan Valley Naturalists, "Cetacean strandings and incidental mortality in B.C.", 1991 (with T.J. Guenther, Marine Mammal Research Group).
- Grants from Friends of Ecological Reserves, "Foraging behavior and habitat use of killer whales", 1990, 1991, 1992, 1994, 1995, 1996 (with P.J. Stacey, Marine Mammal Research Group.
- Grants from The Whale Museum, "Transient killer whale behavior", 1989. "Investigation of causes of cetacean mortality", 1995.
- Grant from Cetacean Society International, Connecticut, "Transient killer whale behavior", 1988 (with P.J. Stacey).

REFEREED PUBLICATIONS (50)

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Baird, R.W. 1995. Should I stay or should I go?: costs and benefits of natal philopatry in two sympatric populations of killer whales. Page 6 in Abstracts of the 11th Biennial Conference on the Biology of Marine Mammals, Orlando, FL. December 14-18, 1995.

Guenther, T.J., R.W. Baird, P. Wilson, B. White and P.M. Willis. 1995. An inter-generic hybrid in the Family Phocoenidae. Page 48 in Abstracts of the 11th Biennial Conference on the Biology of Marine Mammals, Orlando, FL. December 14-18, 1995.

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Willis, P.M., R.W. Baird and T.J. Guenther. 1995. A review of strandings and sightings of beaked whales (Family Ziphiidae) in British Columbia, Canada. Page 123 in Abstracts of the 11th Biennial Conference on the Biology of Marine Mammals, Orlando, FL. December 14-18, 1995.

Baird, R.W. 1995. Seasonal and pod-specific variability in occurrence and behaviour of *transient* killer whales around southern Vancouver Island: implications for studies of this species elsewhere. Page 4 in Abstracts of the 20th Reunion Internacional para el Estudio de los Mamiferos Marinos, April 1995, La Paz, Baja California Sur.

Fertl, D., A. Acevedo, B. Wursig, R.W. Baird and T. Kieckhefer. 1995. Cooperative feeding in delphinids: possible costs, benefits, and causes. Page 1 in Abstracts of the 20th Reunion Internacional para el Estudio de los Mamiferos Marinos, April 1995, La Paz, Baja California Sur.

Baird, R.W. 1994. Diving behaviour of killer whales. Page 51 in Abstracts of the 19th Reunion Internacional para el Estudio de los Mamiferos Marinos, May 1994, La Paz, Baja California Sur.

Baird, R.W., and J.D. Goodyear. 1993. An examination of killer whale diving behaviour using a recoverable, suction-cup attached TDR/VHF tag. Page 25 in Abstracts of the 10th Biennial Conference on the Biology of Marine Mammals, November 1993, Galveston, TX.

Guenther, T.J., R.W. Baird, R.J. Lewis, M.L. McAdie, and T.E. Cornish. 1993. An unusual porpoise (*Phocoena phocoena* and *Phocoenoides dalli*) mortality event in southern British Columbia. Page 56 in Abstracts of the 10th Biennial Conference on the Biology of Marine Mammals, November 1993, Galveston, TX.

Baird, R.W., and L.M. Dill. 1992. Group foraging in transient-type killer whales (*Orcinus orca*). In Abstracts of the Fourth International Behavioral Ecology Congress, Princeton, NJ, 17-22 August 1992.

Baird, R.W., L.M. Dill, P.J. Stacey and T.J. Guenther. 1991. Are there adaptive differences in the "blows" of transient and resident killer whales (*Orcinus orca*)? Pg. 4 in Abstracts of the Ninth Biennial Conference on the Biology of Marine Mammals, December 1991, Chicago, IL.

Baird, R.W., P.A. Abrams and L.M. Dill. 1990. Possible indirect interactions between transient and resident killer whales (*Orcinus orca*). Pg. 2-3 in Abstracts of the Third International Orca Symposium, March 1990. Victoria, B.C.

Baird, R.W., L.M. Dill and P.J. Stacey. 1990. Group size-specific foraging efficiency in transient killer whales (*Orcinus orca*) around southern Vancouver Island. Pg. 3 in Abstracts of the Third International Orca Symposium, March 1990. Victoria, B.C.

Calambokidis, J., K.M. Langelier, P.J. Stacey and R.W. Baird. 1990. Environmental contaminants in killer whales from Washington, British Columbia, and Alaska. Pg. 4 in Abstracts of the Third International Orca Symposium, March 1990. Victoria, B.C.

Jefferson, T.A., P.J. Stacey and R.W. Baird. 1990. A review of killer whale interactions with other marine mammals: predation to co-existence. Pg. 10 in Abstracts of the Third International Orca Symposium, March 1990. Victoria, B.C.

Stacey, P.J., R.W. Baird and A.B. Hubbard-Morton. 1990. Transient killer whale (*Orcinus orca*) harrasment, predation, and "surplus killing" of marine birds in British Columbia. Pg. 12 in Abstracts of the Pacific Seabird Group Annual Meeting, February 1990. Victoria, B.C.

Baird, R.W., P. Watts and P.J. Stacey. 1989. Factors affecting foraging efficiency of transient killer whales (*Orcinus orca*) around southern Vancouver Island. Pg. 4 in Abstracts of the Eighth Biennial Conference on the Biology of Marine Mammals. December 7-11, 1989. Pacific Grove, CA.

Barry, L.M., R.W. Baird, J. Hall, R. Gonzales and P.J. Stacey. 1989. Observations on the behavior of a lone false killer whale (*Pseudorca crassidens*) in British Columbia. Pg. 5 in Abstract of the Eighth Biennial Conference on the Biology of Marine Mammals, December 7-11, 1989. Pacific Grove, CA.

UNPUBLISHED CONFERENCE PRESENTATIONS (10)

Baird, R.W. 1998. Using remotely-deployed suction-cup attached tags to study sub-surface behaviour of odontocetes. Presentation at the Workshop on Methods for Assessing Behavioral Impacts on Marine Mammals from Human Activities, Monaco, January 1998

Baird, R.W., R. Otis and R.W. Osborne. 1998. Killer whales and boats in the Haro Strait area: biology, politics, esthetics and human attitudes. Presenation at the Workshop on Whale Watching Research, Monaco, January 1998.

Baird, R.W., and L.M. Dill. 1993. An optimal foraging group size in transient killer whales (*Orcinus orca*). Presentation to the 1993 Annual Meeting of the Wildlife Society, Blaine, WA. March 1993.

Baird, R.W., and L.M. Dill. 1993. Ecological and social determinants of group size in transient killer whales. Presentation to the 14th Annual Pacific Ecology Conference, Bamfield, B.C., March 5-7, 1993.

Guenther, T.J., R.W. Baird and A.V. Murray. 1993. A baseline investigation of the status of the harbour porpoise (*Phocoena phocoena*) in British Columbia. Presentation to the 1993 Annual Meeting of the Wildlife Society, Blaine, WA. March 1993.

Guenther, T.J., R.W. Baird and P.M. Willis. 1993. The investigation of cetacean strandings as a research and management tool in British Columbia, 1987-1992. Presentation to the 1993 Annual Meeting of the Wildlife Society, Blaine, WA. March 1993.

Baird, R.W., and L.M. Dill. 1992. Group foraging in transient-type killer whales (*Orcinus orca*). Presentation to the 13th Annual Pacific Ecology Conference, Friday Harbor, WA, March 6-8, 1992.

Stacey, P.J., K.M. Langelier and R.W. Baird. 1991. Strandings and incidental mortality of cetaceans on the B.C. coast. Presentation to the Western Canada Wildlife Health Workshop, Victoria, B.C., February 15-16, 1991.

Langelier, K.M., R.W. Baird, P.J. Stacey and R.J. Lewis. 1990. An investigation into the diseases and environmental contaminants of marine mammals of British Columbia. Presentation to the Canadian Veterinary Students Association Conference, Saskatoon, January, 1990.

Stacey, P.J., and R.W. Baird. 1989. Harbour seal (*Phoca vitulina*) predation by killer whales (*Orcinus orca*). Presentation to the Society for Northwestern Vertebrate Biology, January 14, 1989, Victoria, B.C.

GREGORY S. SCHORR

2420 Neillita Rd NW (206) 931-4638
Seabeck, WA 98380 gschorr@earthlink.net

EXPERIENCE

RESEARCH BIOLOGIST *March 2005 -Present*
Cascadia Research Collective **Olympia, WA**

- Conduct field research projects on a variety of species. Data collection includes behavioral observations, photo ID, biopsy darting, and time-depth recorder tagging.

OPERATIONS MANAGER / PRINCIPAL *March 1998 –Present*
Marine Research Consultants, LLC **Seattle, WA**

- Co-founded and operate a marine research consulting company.
- Projects include:
  - Contracted to the NOAA Beaufort Lab for a two week Tursiops biopsy project,
  - Contracted with the University of Alaska, Fairbanks to train researchers on suction cup deployed Time Depth Recorder tagging of humpback and fin whales;
  - Contracted with Cascadia Research Collective to conduct coastal surveys, including collecting data for the SPLASH humpback project, and for a southern resident killer whale foraging study
  - Contracted with NOAA Fisheries for successful capture, rehab, release, and post-release tracking of a free-ranging killer whale (A73);
  - Contracted with NOAA Fisheries for the transport, release and post-release tracking of 5 pilot whales in the Florida Keys;
  - Assisted Dalhousie University and the Wild Whale Research Foundation with a time depth recorder tagging, biopsy, photo id, and critter cam project in Hawaii on a variety of species of cetaceans.
  - Assisted NMFS with the capture and restraint of Dall's porpoise and harbor porpoise, the placement of satellite and VHF transmitter tags, and post-release tracking.

FISHERIES BIOLOGIST II *July-August 2004*
Johnson Controls, Inc. **Pascagoula, MS**

- Assisted with two legs of the 2004 pilot whale/pelagic marine mammal stock assessment and biopsy cruise. Coxswain of the 7 meter RHIB for biopsy and photo ID small boat work.

OPERATIONS MANAGER *February 2002-March 2004*
NOAA Fisheries / JIMAR (2003-2004) and Aquatic Farms (2002) **Honolulu, HI**

- Responsible for the daily operations of the Coral Reef Ecosystem Division marine debris project, including the supervision of 21 personnel.
- Duties include overseeing scientific data collection, small boat and diving operations, permit applications, and coordination of a multi-agency effort.
- Responsible for managing and allocating a 3 million dollar annual budget for the marine debris project.

SENIOR MARINE FIELD TECHNICIAN / ANIMAL CARE SPECIALIST *June 1998- September 2001*
Ocean Futures Society/ Free Willy Keiko Foundation **Vestmannaeyjar, Iceland**

- Responsible for the daily boat and diving operations of the Keiko project. Duties included boat handling and diving in remote and extreme adverse conditions.
- Assisted with three field seasons of data collection related to free-ranging killer whales including photo identification studies, behavioral observations, acoustical data collection, time-depth recorder tagging, genetic sampling, and aerial surveys.
- Experience with satellite, VHF and time-depth recorder tagging on captive and free-ranging killer whales including extensive VHF tracking via vessel and aircraft.
- Experience building VHF and Satellite tags, and satellite and time-depth recorder tag programming.
- Supervised staff of three Marine Field Technicians in daily boat and diving operations.
- Over 350 working dives logged. Dive experience included baypen and barrier net installation, drilling, rock bolting, and extensive work with air bags. Worked alongside commercial divers on all major projects.

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GEOLOGIST August *1997- January 1998*

Shannon & Wilson, Inc. **Seattle, WA**

- Responsible for site investigations of landslides, river washouts, and areas of high erosion along a section of the Union Pacific Railroad.
- Duties included monitoring and inspecting the repair work performed at these sites in order to assure the work conformed to the design specifications required by Shannon & Wilson.

FIELD MANAGER *July 1996-August 1997*

Concentrating Systems of America **Colorado Springs, CO**

- Responsible for managing the field operations of a mineral exploration project involving the development of a vermiculite mine.
- Duties included supervising employees and surveying process, field mapping and interpretations, procuring permits with appropriate government agencies, managing drilling program, implementing and managing reclamation measures, and reporting status of activities to investors. Assisted in the assaying and analysis of samples collected during drilling.

EDUCATION

THE COLORADO COLLEGE May 1996

Bachelor of Arts: Geology Colorado Springs, CO

- Honors: Deans List; Distinction in Geology
- Degree emphasized field and lab work

SKILLS

- US Coast Guard 50-ton master, near coastal captain’s license
- Certified NOAA small boat instructor
- Extensive photography skills including the servicing and use of underwater camera and video housings
- 6 years of job-related boat operation, maintenance, and repair skills. Over 20 years of boating experience
- Certified SCUBA diver for 14 years, including NOAA working diver, advanced PADI certifications, mixed gas and re-breather diving certifications from Technical Diving International.
- Emergency Medical Technician training (practicing for 5 months), current Advanced Wilderness First Aid
- Computer literacy: proficient in the use of Word, Excel, ArcView GIS, navigational software, PowerPoint
- Excellent written and verbal communication skills

PUBLICATIONS

Noah, M.D., Schorr, G.S., and Stephenson, J.R., 2004. Benthic Habitat Impacts Caused by Derelict Fishing Gear, Pearl and Hermes Atoll. Pacific Congress Symposium, Abstracts with Programs, in print.

Stephenson, J.R., and Schorr, G.S., 2004. Derelict Fishing Gear in the Coral Reef Ecosystem of the Northwestern Hawaiian Islands. Second National Conference on Coastal and Estuarine Habitat Restoration, Abstracts with Programs, in print.

Schorr, G. S., 1996. Interpretation of structural geometries of the King Peak Subterrane from Telegraph Creek to Miller Flat, Northern California: The Ninth Keck Research Symposium in Geology, p. 162-165.

Schorr, G.S., and Smith, C.H., 1995. Migmatites of the Alexandra Mountains, West Antarctica: Evidence against correlation with the Fosdick Complex of Marie Byrd Land: Geologic Society of America, Abstracts with Programs, v. 27, n. 4, p. 54.

AWARDS

- William A. Fischer Special Recognition Award in Geology
- The Colorado College Venture Grant Recipient
- Brian J. Hannigan Scholarship for Fieldwork in Geology
- Keck Geology Consortium Grant for field work

REFERENCES

Available Upon Request

ERIN ANDREA FALCONE
P.O. Box 6331 Olympia, WA
(360) 943-7325 office, (360) 789-6474 cellular
efalcone@cascadiaresearch.org

Education:

Humboldt State University, Arcata, California. Bachelor of Science in Zoology, December 1999. Senior thesis entitled "Associations among Individuals in a Breeding Population of Humpback Whales (*Megaptera novaeangliae*)".

Palomar College, San Marcos, California. Spring 1994-Spring 1995. Undergraduate general education.

Professional Experience:

Research Assistant. July 2003- present. Cascadia Research Collective, Olympia, WA. Humpback whale photo-ID specialist. Office duties include photo management, matching, database design and maintenance (Microsoft Access and Excel), data analysis, and presentation and manuscript preparation. Field duties include small boat handling and maintenance, photo-identification, crossbow biopsy sampling, large vessel observation, and marine mammal stranding response.

Field Research Assistant. March 2003. Tursiops Biopsy Project, N.O.A.A. Lab, Beaufort, North Carolina. Small boat operations, photo-identification, dolphin observations and data recording, radio telemetry. Robin Baird, project leader.

Research Biologist, Humpback Whales. July 1995-June 2003. Study of the behavioral biology and population dynamics of humpback whales in the Revillagigedo Islands, Mexico and in northern California. Field experience included small boat handling, navigation, and maintenance, photographic identification of individual whales, film processing, digital image processing, underwater song recording, crossbow biopsy sampling, and behavioral observation. Other experience included database management (MS-DOS programming, Visual dBase, Microsoft Excel), statistical analysis (NCSS), grant writing, and the production of technical reports (Microsoft Word).

Floor Supervisor. December 2000-present. Abruzzi Catering, Arcata, California. Elizabeth Adams, Catering Director.

Horse Trainer/Riding Instructor. January 1995-present. Self-employed. Riding emphasis on fundamental balanced riding skills, bareback equitation, and improved horse-rider communication. Training focuses on mature horses with behavioral difficulties.

Student Assistant. California Department of Transportation, District 1 Traffic Safety Division. May-August 1999. Data entry and database management (Excel), office organization, field reviews.

Field Biologist, Marine Bird Surveys. June-August 1996, August 1997, July 1999, September 2001. At-sea surveys for marbled murrelets and other sea birds off the coast of Oregon and northern California for Crescent Coastal Research (Crescent City, California), Mad River Biologists (McKinleyville, California), and the U.S. Forest Service, Redwood Sciences Laboratory, (Arcata, California). Experience included visual identification of birds by species and age class, near shore navigation, and taking/transcription of vocal field notes.

Grader. August-December 1998. Grading homework assignments and entering scores for Math 115 and Statistics 108, Humboldt State University Math Department.

Foreign Language: Fluent in Spanish**.**

Scientific Publications and Presentations:

Falcone, E. A., J. K. Jacobsen. 2000. The Humpback Whales (*Megaptera novaeangliae*) of the Archipiélago Revillagigedo 1996-2000: Differences among the Sexes and Evidence for Male-Male Coalitions. Abstract, XXV Reunión Internacional Para el Estudio de los Mamíferos Marinos, May 7-11, 2000, La Paz, B.C.S., Mexico.

Jacobsen, J. K., E. Andrea Falcone, R. Gomez, S. Cerchio. 2000. The Humpback Whales (*Megaptera novaeangliae*) of the Archipiélago Revillagigedo 1996-2000: General Population Characteristics. Abstract, XXV Reunión Internacional Para el Estudio de los Mamíferos Marinos, May 7-11, 2000, La Paz, B.C.S., Mexico.

Falcone, E. A., J. K. Jacobsen, S. Cerchio, R. Gomez, and D. Cholewiak. 2000. Associations Among Humpback Whales at the Archipiélago Revillagigedo, Pacifico Mexicano, 1996-2000. Abstract, Humpback Whale Conference 2000, August 29-September 1 2000, Queensland Museum, Brisbane, Australia.

J. K. Jacobsen, E. A. Falcone, S. Cerchio, R. Gomez, and D. Cholewiak, 2000. Humpback whales of the Archipiélago Revillagigedo, Pacifico Mexicano, 1996-2000: General Population Characteristics. Abstract, Humpback Whale Conference 2000, August 29-September 1 2000, Queensland Museum, Brisbane, Australia.

J. K. Jacobsen, E. A. Falcone, S. Cerchio, and D. Cholewiak. 2001. Humpback Whale Research at Isla Socorro, Archipiélago Revillagigedo Biosphere Reserve, Mexico, February – April 2001. NMML technical report, contract reference #40ABNF101034.

Cerchio, S., Jacobsen, J., Cholewiak, D., Falcone, E. and Merriwether, D.A. 2005. Paternity in humpback whales, Megaptera novaeangliae: assessing polygyny and skew in male reproductive success. Animal Behavior. 70(2): 267-277

References

Jeff Jacobsen, Biologist. PO Box 4492, Arcata, CA 95518. (707) 822-0182

Salvatore Cerchio, Biologist. Wildlife Conservation Society, c/o AMNH , Central Park West at 79th Street. New York, NY 10024 USA

Robin Baird, Cetacean Research Biologist. Cascadia Research Collective, 218 ½ W. Fourth Ave., Olympia, Wa. (360) 943-7325.

CURRICULUM VITA

Gretchen H. Steiger
June 2005

Gretchen Steiger, Research Biologist
Cascadia Research Collective
218½ West 4th Avenue
Olympia, Washington 98501

PROFESSIONAL EXPERIENCE

Research biologist: Conducted research for a non-profit, independent research organization. I have written and edited research proposals, developed study methodology, conducted field research, managed data, and participated in data analysis and report and manuscript preparation. Projects have included:

-Managed data to make a population estimate the humpback whales in the North Pacific Ocean using capture-recapture statistics. Organized identification photographs from researchers from all regions of the North Pacific. Supervised data processing and comparison of over 4,000 photographs (1995-1997).

-Estimated abundance of humpback and blue whales along the California coast using photo-identification techniques. Conducted vessel surveys, photographed and matched whales, managed data, developed catalogs, and estimated abundance using mark-recapture statistics (1991-1996).

-Examined reproductive rates of humpback whales off California using photo-identification. Tracked reproductive histories of females, examined crude birth rates and calving intervals (1986-1996).

-Studied gray whale occurrence in Washington state inland waters. Determined movements and residency patterns through photo-identification. Participated in the necropsy, sampling, and photo-identification of dead gray whales (1985-1992).

-Examined the distribution and abundance of humpback and blue whales off central California. Conducted boat and aerial surveys, photographed whales for identification of individuals with 35mm cameras, managed data, developed catalogs, measured whale lengths using aerial photogrammetry techniques, compared population estimates using both mark-recapture statistics and line-transect methods (1986-1990).

-Examined trends in chemical contaminant levels in harbor seals in Puget Sound and adjacent waters. Searched for and conducted detailed necropsies on harbor seal pups.

-Evaluated the contribution of harbor seals to fecal coliform pollution in Puget Sound, Washington. Examined fecal coliform levels in water, shellfish, and seal scat at haul-out areas, examined seal prey items, compiled information on pathogens to evaluate the potential human-health risks from disease transmission.

-Studied the distribution and photographic identification of blue whales off Baja California. Led research cruise from La Paz to San Diego in cooperation with Mexican researchers.
-Studied human-caused harbor seal disturbance at Henderson Inlet, Puget Sound. Determined disturbance rates, causes, and distances using a theodolite.

-Developed a protocol for sampling marine mammals for contaminant studies in Washington state.

-Examined biological disorders in marine mammals in relation to chemical contaminants in Puget Sound, Washington. Examined harbor seal population dynamics, reproductive rates, mortality, and behavior at ten sites within Puget Sound and the Strait of Juan de Fuca.

-Studied marine mammal occurrence in the in the Strait of Juan de Fuca, Washington, by conducting aerial, vessel and land- based surveys. Study included monitoring the spring gray whale migration past Cape Flattery.

-Monitored increased numbers and feeding habits of California and northern sea lions in southern Puget Sound. Censuses conducted using aerial and boat surveys.

-Assisted in determining contaminant levels in harbor porpoise using gas chromatography.

-Summarized background information on fur seal biology for the development of a model assessing the effect of an oil spill on the Bering Sea northern fur seal population.

-Reviewed levels of chemical contaminants reported in marine mammal tissues throughout the world.

Nov 1982-present. Cascadia Research Collective, Waterstreet Building, 218½ West Fourth Street, Olympia, Washington 98501

Research Associate: Participated in a study of the movements and behavior of ringed seals out of Resolute, Northwest Territories. Assisted in: the location of breathing holes and lairs using trained dogs, ringed seal live-capture, instrumenting seals with radio transmitters, establishing hydrophone arrays, monitoring radio-telemetry receivers and locating seals hauled in lairs, monitoring under-ice movements with a computer tracking program, and recorded and summarized data.
April-May 1991. University of Alaska, Fairbanks. Principal Investigators:Brendan P. Kelly, Univ. of Alaska and Douglas Wartzok, Univ. of Missouri-St. Louis.

Whale Census Technician: Examined, using acoustic techniques, the bowhead whale migration past Point Barrow, Alaska. Deployed and maintained a passive hydrophone array and monitored and recorded bowhead whale calls under isolated polar conditions. April-June 1988. North Slope Borough, Barrow, Alaska. Principal Investigator: Christopher Clark, Cornell University, Ithaca, NY.

EDUCATION

B.S. Zoology 1982, University of North Carolina, Chapel Hill, N.C.
Kent School, Kent, Connecticut

PUBLICATIONS

Calambokidis, J., G.H. Steiger, D.K. Ellifrit, B.L. Troutman and C.E. Bowlby. 2004. Distribution and abundance of humpback whales and other marine mammals off the northern Washington coast. *Fisheries Bulletin* 102:563-580.

Calambokidis, J., G.H Steiger, J.M Straley, L.M. Herman, S. Cerchio, D.R. Salden, J. Urbán R., J.K. Jacobsen, O. von Ziegesar, K.C. Balcomb, C.M. Gabriele, M.E. Dahlheim, S. Uchida, G. Ellis, Y. Miyamura, P. Ladrón de Guevara P., M. Yamaguchi, F. Sato, S.A. Mizroch, L. Schlender, K. Rasmussen, J. Barlow and T.J. Quinn II. 2001. Movements and population structure of humpback whales in the North Pacific. *Marine Mammal Science* 17:769-794.

Steiger, G.H. and J. Calambokidis. 2000. Reproductive rates of humpback whales off California. *Marine Mammal Science* 16:220-239 .

Calambokidis, J., G.H. Steiger, K. Rasmussen, J. Urbán R., K.C. Balcomb, P. Ladrón de Guevara P., M. Salinas Z., J.K. Jacobsen, C.S. Baker, L.M. Herman, S. Cerchio and J.D. Darling. 2000. Migratory destinations of humpback whales that feed off California, Oregon and Washington. *Marine Ecology Progress Series* 192:295-304.

Urbán R., J., A. Jaramillo L., A Aguayo L., P. Ladrón de Guevara P., M. Salinas Z., C. Alvarez F., L. Medrano G., J.K. Jacobsen, K.C. Balcomb, D.E. Claridge, J. Calambokidis, G.H. Steiger, J.M. Straley, O. von Ziegesar, J.M. Waite, S. Mizroch, M.E. Dahlheim, J.D. Darling and C.S. Baker. 2000. Migratory destinations of humpback whales wintering in the Mexican Pacific. *Journal of Cetacean Research and Management* 2:101-110.

Calambokidis, J. and G.H. Steiger. 1997. Blue Whales. Worldlife Series Library. Voyager Press, Stillwater, MN.

Calambokidis, J., G.H. Steiger, J.R. Evenson, K.R. Flynn, K.C. Balcomb, D.E. Claridge, P. Bloedel, J.M. Straley, C.S. Baker, O. von Ziegesar, M.E. Dahlheim, J.M. Waite, J.D. Darling, G. Ellis, and G.A. Green. 1996. Interchange and isolation of humpback whales off California and other North Pacific feeding grounds. *Marine Mammal Science* 12:215-226.

Hong, C-S., J. Calambokidis, B. Bush, G.H. Steiger, and S. Shaw. 1996. Polychlorinated biphenyls and organochlorine pesticides in harbor seal pups from the inland waters of Washington state. *Environmental Science and Technology* 30:837-844.

Calambokidis, J., J.R. Evenson, T.E. Chandler, and G.H. Steiger. 1992. Individual identification of gray whales in Puget Sound in 1991. *Puget Sound Notes* 28:1-4

Steiger, G.H., J. Calambokidis, R. Sears, K.C. Balcomb, and J.C. Cubbage. 1991. Movement of humpback whales between California and Costa Rica. *Marine Mammal Science* 7:306-310.

Calambokidis, J., J.C. Cubbage, G.H. Steiger, K.C. Balcomb, and P. Bloedel. 1990. Population estimates of humpback whales in the Gulf of the Farallones, California. *Report of the International Whaling Commission* (Special Issue 12):325-333.

Calambokidis, J., G.H. Steiger, J.C. Cubbage, K.C. Balcomb, C. Ewald, S. Kruse, R. Wells, and R. Sears. 1990. Sightings and movements of blue whales off central California 1986-88 from photo-identification of individuals. *Report of the International Whaling Commission* (Special Issue 12):343-348.

Calambokidis, J. and G.H. Steiger. 1990. Sightings and movements of humpback whales in Puget Sound, Washington. *Northwestern Naturalist* 71:45-49.

Steiger, G.H., J. Calambokidis, J.C. Cubbage, D.E. Skilling, A.W. Smith, and D.H. Gribble. 1989. Mortality of harbor seal pups at different sites in the inland waters of Washington. *Journal of Wildlife Diseases* 25:319-328.

Calambokidis, J., B.L. Taylor, S.D. Carter, G.H. Steiger, P.K. Dawson, and L.D. Antrim. 1987. Distribution and haul-out behavior of harbor seals in Glacier Bay, Alaska. *Canadian Journal of Zoology* 65:1391-1396.

Steiger, G.H. and J. Calambokidis. 1986. California and northern sea lions in southern Puget Sound, Washington. *Murrelet* 67:93-96.

Calambokidis, J. and G. H. Steiger. 1985. Bald eagles feeding on harbor seal placenta in Glacier Bay, Alaska. *Journal of Raptor Research* 19:145.

Manuscirpts submitted for publication

Steiger, G.H., J. Calambokidis, J.M. Straley, Louis M. Herman, Salvatore Cerchio, Dan R. Salden, Jorge Urbán R., Jeff K. Jacobsen, Olga von Ziegesar, Kenneth C. Balcomb, Christine M. Gabriele, Marilyn E. Dahlheim, Senzo Uchida, John K.B. Ford, Paloma Ladrón de Guevara P., Manami Yamaguchi and Jay Barlow. Geographic variation in killer whale rake-mark scarring of humpback whales in the North Pacific. Submitted to *Canadian Journal of Zoology*, June 2005.

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MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

The Society for Marine Mammalogy (Charter Member)
Society for Northwestern Vertebrate Biology
Cascadia Research Collective (Board of Directors)

Anne Bolling Douglas
2841 18th Ave. NE
Olympia, WA 98506
(360)754-3542
Email: douglasannie76@hotmail.com

WORK EXPERIENCE:

Cascadia Research Collective
John Calambokidis
218 ½ W. 4th Ave.
Olympia, WA 98501
Dates Employed: 09/1997-present

Research Assistant
As a research assistant of Cascadia Research, I have helped gather and process data for numerous contracts and projects for a variety of agencies. Primary duties include: daily comparison of new whale identification photographs to existing catalogs; conducting seasonal photographic identification of blue, humpback, and gray whales from various platforms; conducting vessel, aerial and land-based surveys for various marine mammal species; occasional printing of photographs for mark-recapture projects; occasional necropsy and disposal of stranded whales; compiling, organizing and entering data; Marine mammal conference poster presentation of CRC data; seasonal education and training of interns in data processing, data collection in the field, and marine mammal mitigation for USGS seismic surveys.
Supervisor's Name: John Calambokidis.
Phone: (360) 943-7325
e-mail: calambokidis@cascadiaresearch.org

SWFSC
South West Fisheries Science Center
8604 La Jolla Shores Drive
La Jolla, CA 92037

General biologist on the SWFSC STAR 2003 ETP Cruise
Land based spring gray whale census, Piedras Blancas CA, 2002
Photo-id specialist on the SWFSC ORCAWALE 2001 Cruise
General biologist on the SWFSC STAR 2000 ETP Cruise

Georgia DNR
One Conservation Way
Brunswick, Georgia 31520-8687
Dates Employed: 01/01/01-03/15/01

Aerial Observer of right whales off of Georgia and Florida
Observation of right whales from a twin prop skymaster. I participated in all steps of initial data collection for this project which included photo-id, use of clinometers, hand held binoculars, data recording and data entry.
(Supervisor's Name: Barb Zoodsma, Sr. Wildlife Biologist
Telephone: 912/264-7218 FAX: 912/262-3143)

EDUCATION:

The Evergreen State College
Olympia, WA 98505
USA
B.S., 1999
180 Quarter Hours

Berkshire School
Sheffield, MA 98505
USA
High School, 1999
GPA: 3.2 out of 4.

Knowledge, Skill and Ability

As an employee for Cascadia Research Collective since 1997 and a participant of 2000 STAR, 2001 ORCAWALE, 2003 STAR cruises and Right Whale surveys off Georgia with DNR I have participated in several projects that have given me experience working from various platforms and with a wide range of research equipment.

Humpback and blue whale population studies

- Identify and photograph humpback whales and blue whales from various platforms.
- Assist in printing negatives, processing data, and comparison of photographs to Cascadia's existing catalogs.

Photo-identification specialist

- Photo-identification of various species of whales and dolphins on NOAA ship *McArthurII* and *David Starr Jordan* for the STAR 2003 project in the ETP. July 2003-December 2003
- Photo-id specialist and marine mammal observer on NOAA ships *McArthur* and *David Starr Jordan* SWFSC ORCAWALE cruise 2001, July -December 2001
- Photo-identification of various species of whales and dolphins on NOAA ship *McArthur* and *David Starr Jordan* for the STAR 2000 project in the ETP. July 2000-December 2000
- Photo-identification of blue whales on Costa Rica Dome; photo-identification of humpbacks and blue whales off Central America and Mexico. Platform of work was either the auxiliary staysail schooner, *Russamee* or a 14-foot ridged hulled inflatable, November 1998-April 1999
- Photo-identification of blue whales while conducting line-transect surveys aboard NOAA ship *McArthur*, September-October.1997
- Conducted photo-identification of blue whales, humpback whales, gray whales, sperm whales, and killer whales for various projects in the eastern Pacific Ocean, November 1997-present

Humpback whale and blue whale matching specialist

- Supervise and assist the comparison of 250 Sea of Cortez blue whales to Cascadia's blue whale catalog, April 2000
- Compare all 1999 field season blue whale photographs to Cascadia's catalog, 1999-2000
- Participate in analyzing humpback whale photos from California and Costa Rica 1997 and 1999.
- Participate in 1997 blue whale comparison of photographs to Cascadia's catalog, 1997- 1998

Shipboard and small boat experience:

- Marine mammal observer on SCRIPPS vessel FLIP off of San Clemente Island, September 2004
- Marine mammal observer on NOAA ship David Starr Jordan for CalCOFI cruise, July 2004
- Marine mammal observer on NOAA ship *Mcarthur II* in the Olympic National Marine Sanctuary, May 2004
- Completed the Power Squadron boater safety class, Spring 2004
- Marine mammal observer and photo-identification specialist on NOAA ships *McArthurII* and *David Starr Jordan*, July-December 2003

- Photo-id specialist and marine mammal observer on NOAA ships *McArthur* and *David Starr Jordan* SWFSC ORCAWALE cruise 2001, July -December 2001
- Marine mammal mitigation and lead observer for USGS seismic survey around Oahu and Molokai on the charter vessel *Wiloa*, September 2001
- Marine mammal observer and photo-identification specialist on NOAA ships *McArthur* and *David Starr Jordan*, July-December 2000
- Marine mammal mitigation and observer for USGS seismic survey off Southern California. Four week survey on the *Auriga*, June 2000
- Marine mammal mitigation and observer for USGS seismic survey off Southern California. Two week survey on the *Ocean Olympic*, June 1999
- Marine mammal observer, research assistant and crew aboard the 60-foot auxiliary staysail schooner *Russamee*. Blue whale and humpback whale survey from San Francisco, California to Costa Rica Dome, November 1998-April 1999
- Marine mammal observer and photo-identification specialist. Blue whale and humpback whale survey off California coast aboard schooner *Russamee*, September 1998
- Marine mammal mitigation and observer for USGS seismic survey aboard the University of Washington research vessel, *Thomas G. Thompson*, March 1998
- Marine mammal observer and research assistant while conducting line-transect surveys aboard NOAA ship *McArthur* off California, September-October 1997

Acoustics and biology experience:
- Biopsy of dolphins in the Eastern Tropical Pacific, 2000
- Representing Cascadia Research and the NW stranding response team I have lead or assisted at numerous necropsies in Washington State. Species include gray whale, humpback whale, sperm whale, fin whale, and Cuvier's beaked whale, 1997-present. Performed partial or complete necropsies on harbor seal pups for an on going study of contaminant levels in harbor seals in the Puget Sound, WA, spring 2004
- Research assistant for collection of blue whale sloughed skin in ETP, 1999
- Research assistant while recording humpback song with hydrophone and DAT off Costa Rica and Central America, 1999
- Research assistant while recording blue whale song with navy sona buoys from NOAA vessel *McArthur*, 1997
- Oceanography research assistant from *McArthur*, and *McArthurII*, 2001 and 2004

Aerial Survey experience:
- Arial observer for harbor porpoise population estimates in Washington, USA and southern Vancouver Island, BC coastal waters with Cascadia Research, Jun-Aug, 2002
- Aerial observer and photographer for right whale cow/calves off Georgia with Department of Natural Resources, Jan. -March, 2001
- Gray whale survey in Puget Sound, WA. In accordance with the Washington State Fish and Wildlife shellfish harvest census. June 2000

Marine mammal species seen in field
- Observed species list:

Blue whale
Humpback whale
Fin whale
Minke whale
Bryde's whale
Gray whale
Sperm whale
Right whale (Atlantic)
Killer whale
Cuvier's beaked whale
Baird's beaked whale
Pygmy beaked whale
Melon headed whale
Tropical bottlenose whale
Blainville's beaked whale
Dwarf sperm whale
Common dolphin
Pacific white-sided dolphin
Risso's dolphin
Northern right whale dolphin
Bottlenose dolphin (Pacific-Atlantic)
Long-snouted spinner dolphin
Pantropical spotted dolphin
Rough toothed dolphin

Striped dolphin	Northern fur seal
Harbor porpoise	Harbor seal
Dall’s porpoise	California sea lion
Dusky dolphin	Steller sea lion
Fraser’s dolphin	Elephant seal

APPENDIX 2
STATUS OF AFFECTED SPECIES

Appendix 2. Status of Affected Species

The applicant requests the authority to take marine mammals during research activities described in the application. Below is a status summary of each species for which takes are being requested.

CETACEANS:

Harbor Porpoise (*Phocoena phocoena*): Harbor porpoises are widely distributed in cold-temperate waters of the Northern Hemisphere. In the Pacific Ocean, harbor porpoise are found in coastal and inland waters from Point Conception, California to Alaska and across to Kamchatka and Japan (Gaskin 1984). Harbor porpoise appear to have more restricted movements along the western coast of the continental U.S. than along the eastern coast. Regional differences in pollutant residues in harbor porpoise indicate they do not mix freely between California, Oregon, and Washington (Calambokidis and Barlow 1991). This pattern is in sharp contrast to the eastern coast of the U.S. and Canada where harbor porpoise are believed to migrate seasonally from as far south as the Carolinas to the Gulf of Maine and the Bay of Fundy (Polacheck *et al.* 1990). Genetic studies indicate that harbor porpoise along the west coast of North America are not pan-mictic or migratory, and movement is sufficiently restricted that genetic differences have evolved (Rosel 1992; Rosel *et al.* 1995; Barlow *et al.* 1995). In the eastern North Pacific, the following five stocks of harbor porpoise are currently recognized for management purposes under the MMPA: Central California, Northern California, Oregon/Washington coastal, Washington inland-waters, and Alaska. Furthermore, three stocks have been proposed and recommended by the Alaska SRG: the southeast Alaska stock, the Gulf of Alaska stock, and the Bering Sea stock (Angliss *et al.* 2001). However, this additional stock division has not yet been recognized for management purposes.

The central California stock is estimated to be 7,579 animals (CV = 0.38) based on pooled aerial surveys conducted between 1995 and 1999 (NMFS, K. Forney, unpubl. based on methods from Forney 1999a). Incidental mortality of harbor porpoise in fishing gear is largely limited to halibut set gillnet fisheries in central California. The average minimum gillnet mortality from 1995-99 was 80 animals is greater than the calculated PBR (56). Therefore, the population is considered strategic under the MMPA (Caretta *et al.* 2001).

The northern California stock was also estimated based on pooled aerial surveys conducted between 1995 and 1999, resulting in 15,198 harbor porpoise (CV = 0.39) (NMFS, K. Forney, unpubl. based on methods in Forney 1999a). No significant trends in relative abundance were evident (Forney 1999b). The incidental capture of harbor porpoise in California is largely limited to set gillnet fisheries in central California. Coastal setnets are not allowed in northern California, however, there was one reported mortality in the CA Klamath River tribal salmon gillnet fishery. This resulted in a minimum total annual take of 0.2 from 1995-99. Since this is below 10% of PBR (22), the fishery-caused mortality is considered insignificant. Additionally, this stock is not considered strategic under the MMPA since human-caused mortalities are below PBR (221). Harbor porpoise in northern California are considered to be within their OSP level (Caretta *et al.* 2001).

For harbor porpoise in coastal Oregon and Washington waters the best corrected estimate of abundance is 44,644 animals (CV = 0.38) based on an aerial survey in the early 1997 (Laake *et al.* 1998). This estimate is significantly higher than a 1991 estimate (26,175) due to a larger sampling area and different estimate of g(0) (Laake *et al.* 1998). In the U.S. EEZ of Oregon and

Washington, fishery mortalities from set gillnets are presently known only to occur in northern Washington (Forney *et al.* 2000). The total fishery mortality is estimated to be 12.4 animals per year based on 1993-98 data and is considered insignificant (Forney *et al.* 2000). The Oregon/Washington coastal stock of harbor porpoise is not considered strategic under the MMPA because estimated human caused mortalities (12) do not exceed PBR (328). Its status relative to OSP and its population trends are unknown (Forney *et al.* 2000).

The Washington inland-waters stock of harbor porpoise is estimated to be animals 3,509 (CV = 0.396) based on aerial surveys during the early 1996 (Calambokidis *et al.* 1997, Laake *et al.* 1997a, 1997b). Northern Washington set gillnet fisheries were monitored by NMFS observers from 1993-98 and the only fishery for which mortalities were observed was the Puget Sound treaty and non-treaty sockeye salmon gillnet (areas 7 and 7A) (Forney *et al.* 2000). An incidental take estimate of 15 animals was calculated for this fishery and cannot be considered insignificant because it exceeds 10% of PBR (2.0) (Forney *et al.* 2000). Because the estimated human-caused mortality does not exceed the calculated PBR(20) for this stock, it is not considered strategic under the MMPA. Data are insufficient to determine its status relative to OSP (Forney *et al.* 2000).

Until further genetic analyses are conducted, only one stock of harbor porpoise is recognized in Alaskan waters. A corrected abundance estimate from aerial surveys of 27,714 (CV = 0.215) plus a corrected abundance estimate from vessel surveys of 2,030 (CV = 0.404) give a total corrected abundance estimate of 29,744 animals for this stock (Small and DeMaster 1995). However, this should be considered a minimum abundance estimate because survey effort did not include the Aleutian Islands or the Bering Sea. No reliable abundance estimates for British Columbia are available. There is currently no reliable information on trends in abundance for this stock. NMFS observers monitored incidental take in the following six fisheries within the range of the Alaska stock of harbor porpoise during 1990-1993: Bering Sea (and Aleutian Islands) groundfish trawl, longline and pot fisheries, and Gulf of Alaska groundfish, trawl, and pot fisheries. No mortalities were observed in these fisheries by the observer program, however, one harbor porpoise mortality and one injury were recorded in boat operators' log books in 1990 (Small and DeMaster 1995). NMFS fishery observers in Prince William Sound observed one incidental take in 1990 and three incidental takes in 1991 in the salmon drift gillnet fishery (Small and DeMaster 1995). The estimated average annual mortality rate incidental to commercial fisheries is 33 animals. Based on available information, the estimated level of human-caused mortality does not exceed the calculated PBR for this stock, thus the Alaska stock of harbor porpoise is not considered strategic under the MMPA.

The southeast Alaska stock's uncorrected abundance of harbor porpoise was estimated as 3,550 whales based on an aerial survey flown in 1997. A corrected abundance estimate for this stock is 10,508 (CV 0.274) whales, based on a correction factor of 2.96 (Laake *et al.* 1997b). Mortalities from fishery data were estimated to be 3 animals per year when averaged from 1990-1998, based on logbook records (Angliss *et al.* 2001). Based on the best scientific information available, human caused mortalities (3) are not known to exceed PBR (83) and therefore this stock of harbor porpoise are not considered strategic under the MMPA (Angliss *et al.* 2001).

The Gulf of Alaska stock of harbor porpoise stock was estimated based on a 1998 aerial survey and resulted in an abundance estimate of 21,451 (CV = 0.309) (Angliss *et al.* 2001). The mean annual mortality from commercial fisheries affecting this stock is a minimum of 25 animals, based on observer data. It is suspected that mortalities are underestimated due to under-reporting, however, based on the best available scientific information, human caused mortalities do not exceed PBR (166) for this stock (Angliss *et al.* 2001). Therefore, this is not a strategic stock under the MMPA.

The Bering Sea stock of harbor porpoise were evaluated based on a 1991 aerial survey and the abundance was estimated to be 10,946 (CV = 0.300) animals (Angliss *et al.* 2001). The estimated minimum annual mortality rate from commercial fisheries based on 1990-1998 data was 2 animals (Angliss *et al.* 2001). Again, it is expected that there is under-reporting; however, based on the best scientific information, human caused mortality does no exceed PBR (86) for this stock (Angliss *et al.* 2001). Therefore, this in not considered a strategic stock under the MMPA.

Dall's Porpoise (*Phocoenoides dalli*): Dall's porpoise are endemic to the temperate waters of the North Pacific Ocean and adjacent seas where it occurs from central Baja California, Mexico in the east, northern Japan in the west, and the southern Bering Sea in the north (Jefferson 1988). They have been sighted as far north as 65°N (Buckland *et al.* 1993a) and as far south as 28°N (Leatherwood and Fielding 1974). Throughout its entire range, as many as eight stocks have been proposed, but in many areas questions regarding stock structure have yet to be resolved (IWC 1991b, 1992a).

The stock structure of this species in the eastern North Pacific is not known, but based on patterns of stock differentiation in the western North Pacific, where they have been more intensely studied, it is expected that separate stocks will emerge when data become available (Perrin and Brownell 1994). The following stocks are currently recognized for management purposes in U.S. waters: the California/Oregon/Washington stock and the Alaska stock.

The best overall abundance estimate for the California/Oregon/Washington stock is 117,545 Dall's porpoise (CV = 0.45; Forney *et al.* 2000), from combining average estimates for inland Washington waters and an outer coast estimate from 1991-96 (Barlow 1997). No information regarding trends in abundance is available for this stock. Dall's porpoise are incidentally killed in drift gillnets used to catch swordfish, thresher shark and mako shark in offshore California, Oregon and Washington waters (Hanan *et al.* 1993). The average estimated annual mortality for Dall's porpoise in this fishery during five years of monitoring (1994-98) is 12 animals. This figure is less than 10% of the PBR for this stock; therefore, total fishery mortality for the California/Oregon/Washington stock of Dall's porpoise is considered insignificant. Similar drift gillnet fisheries occur along the entire Pacific coast of Baja California, Mexico and may take some Dall's porpoise from the same population during cold-water periods (Barlow *et al.* 1995). Additional mortality is also known to occur in the California/Oregon/Washington groundfish trawl fisheries, the California salmon troll fishery and the Washington Puget Sound salmon set and drift gillnet fishery. However, no overall estimate of mortality can be made for these three fisheries because of uncertainties in the data (Barlow *et al.* 1995). The average annual estimated human-caused mortality for this stock (12) is less than the PBR (737); thus, this stock is not considered strategic under the MMPA.

For the Alaska stock of Dall's porpoise, the best available abundance estimate is 83,400 based on abundance estimates from vessel surveys, which were corrected for vessel attraction behavior (Small and DeMaster 1995). At present, there is no reliable information on trends in abundance for this stock. The following six commercial fisheries operate within the range of the Alaska stock of Dall's porpoise: Bering Sea (and Aleutian Islands) groundfish trawl, longline and pot fisheries, and the Gulf of Alaska groundfish trawl, longline and pot fisheries. The minimum total estimated annual mortality rate incidental to commercial fisheries based on data from 1990-1998 is 42 animals and is considered insignificant relative to this stock's PBR (154). This stock is not considered strategic under the MMPA (Anglis *et al.* 2001).

Dall's porpoise have been taken in large numbers in salmon and squid driftnet fisheries based out of Japan, Taiwan, and Korea (IWC 1992a). An estimated 3,839 animals were incidentally take in the high-seas driftnet fishing operations during 1990 (Hobbs and Jones 1993), however, these fisheries were to have ceased operations in the North Pacific by the end of 1992. Dall's porpoise are also taken directly by hand harpoon off northern Japan (Reeves and Leatherwood 1994). Catch levels in this directed fishery have decreased from approximately 40,000 in 1988 to 11,403 in 1992 (IWC 1994).

Pacific White-sided Dolphin (*Lagenorhynchus obliquidens*): In U.S. waters, the following two stocks of Pacific white-sided dolphins are recognized for management purposes under the MMPA: California/Oregon/Washington stock and the Alaska stock. Along the U.S. West Coast, two forms of white-sided dolphins are known to occur (Walker *et al.* 1986; Chivers *et al.* 1993). However, there are no known differences in color pattern between these two forms, and it is not currently possible to distinguish animals without genetic or morphometric analysis (Carretta *et al.* 2001). Until means of differentiating the two forms for abundance and mortality estimation are developed, these two stocks must be managed as a single unit, namely the California/Oregon/Washington stock (Carretta *et al.* 2001). The best available abundance estimate for Pacific white-sided dolphins in U.S. West Coast waters for both the northern and southern forms is 25,825 animals (CV = 0.49), from a 1991-96 weighted average abundance estimates fro California, Oregon and Washington based on three ship surveys (Barlow 1997).

In U.S. waters, Pacific white-sided dolphins are incidentally caught in California/Oregon thresher shark/swordfish drift gillnet fishery and in the California/Oregon/Washington domestic groundfish trawl fisheries (Carretta *et al.* 2001). The average estimated annual mortality for Pacific white-sided dolphins in this fishery for 1994-1998 is 6.8 animals (Carretta *et al.* 2001). Similar driftnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and probably take the southern form of this species. The overall marine mammal mortality rate in this fishery is similar to the California driftnet fisheries during 1990-1993 (0.15 marine mammals per set), but species-specific information is not available for the Mexican fishery. Average annual human-caused mortality for this stock during 1994-98 (6.8) is considerably less than the calculated PBR (157) and therefore is not considered a strategic stock under the MMPA. The status of Pacific white-sided dolphins in California, Oregon and Washington relative to OSP is not known and there is no indication of a trend in abundance for this stock (Carretta *et al.* 2001). The total fishery mortality is less than 10% of PBR and can therefore be considered insignificant.

The North Pacific stock of Pacific white-sided dolphins can be calculated from surveys conducted between 1987 and 1990 over the central North Pacific. Results from that survey (abundance estimate of 931,000 animals, Buckland *et al.* 1993) were applied to the area North of 45°N to estimate the number of dolphins in the Gulf of Alaska. This resulted in an abundance estimate of 26,880 which is considered N_{min} for this stock. Between 1978 and 1991, thousands of Pacific white-sided dolphins were killed annually incidental to high seas fisheries; however, these fisheries have not operated in the central North Pacific since 1991. The current estimated annual mortality rate incidental to commercial fisheries for this stock is 3.05 animals which is well below PBR (269). Therefore, this stock is not considered strategic under the MMPA.

Moderate numbers of Pacific white-sided dolphins are sometimes killed in harpoon and drive fisheries in Japan (Miyazaki 1983; Kishiro and Kasuya 1993) as well as in gillnets throughout the species' range (Miyazaki 1983; Perkins *et al.* 1992).

Risso's Dolphin (*Grampus griseus*): Risso's dolphins are distributed world-wide in temperate and tropical waters (Carretta *et al.* 2001). In the eastern North Pacific, Risso's dolphins are commonly seen on the shelf in the Southern California Bight and in slope and offshore waters of California, Oregon, and Washington. The southern end of this population's range in the eastern North Pacific is not well-documented, but Risso's dolphins have been sighted off northern Baja California, Mexico but a conspicuous 500 nmi gap was present between these animals and Risso's dolphins sighted south of Baja California and in the Gulf of California (Mangels and Gerrodette 1994). Thus, the Risso's dolphins off the U.S. west coast appear to be separate from those found in the ETP and the Gulf of California. Risso's dolphins are divided into two discrete areas for MMPA stock assessment reports: 1) waters off California, Oregon and Washington, and 2) Hawaiian waters.

An abundance estimate of 16,483 Risso's dolphins (CV = 0.28) was produced for waters of California, Oregon and Washington waters, from a weighted 1991-96 average based on three ship surveys (Barlow 1997). No definitive statement on population trends or productivity rates are available for this stock (Carretta *et al.* 2001).

Risso's dolphins are incidentally killed in thresher shark/swordfish drift gillnets of California and Oregon, with an average estimated annual fishery-related mortality of 5.5 animals from 1994-98 (Carretta *et al.* 2001). Similar drift gillnet fisheries exist along the entire Pacific coast of Baja California, Mexico and may take animals from the same population (Carretta *et al.* 2001). The overall mortality rate for this fishery is similar to that observed in the California driftnet fishery, but species-specific information is not available for the Mexican fishery (Julian and Beeson 1998). Risso's dolphin mortality of an unknown extent has also been documented in the squid purse seine fishery off Southern California (Heyning *et al.* 1994). This mortality probably represents animals killed intentionally to protect catch or gear, rather than incidental mortality, and such intentional takes are now illegal under the 1994 amendments to the MMPA. The status of Risso's dolphins off the U.S. west coast relative to OSP is not known, and there are insufficient data to evaluate potential trends in abundance. The average annual human-cause mortality for this stock (5.5) is estimated to be less than the PBR (105), so it is not classified as strategic under the MMPA.

Wade and Gerrodette (1993) made an abundance estimate of 175,800 Risso's dolphins (CV = 0.381) in the ETP based on five ship surveys conducted each year between 1986 and 1990. During these surveys, Risso's dolphins were seen most frequently in the shelf waters off Mexico and Guatemala, and in the Gulf of Panama and in the Peru current (Wade and Gerrodette 1993).

In Hawaiian waters, Risso's dolphins appear to be rare. Only one sighting was made during aerial surveys in 1993, 1995 and 1998 and therefore no meaningful abundance estimate could be made from this (Mobley *et al.* 2000). No estimate of annual human-caused mortality exits because there are no reports of direct or incidental takes of this species in Hawaiian waters. In Hawaiian waters, the overall status of this species is unknown, as is its status relative to OSP. Although information on this species in Hawaiian waters is limited, this stock would be considered non-strategic under the MMPA given the absence of fishery-related mortality (Carretta *et al.* 2001). They are not listed as depleted under the MMPA.

In the western North Pacific, Risso's dolphins inhabit the waters off the pacific coast of Japan (Miyashita 1993) and the East China Sea and the Sea of Japan (Kirishima 1986). Stock structure in the region is uncertain, and Miyashita (1993) considered the density gap between 145° E and 148° E could represent a boundary between offshore and coastal stocks. From 34 line-transect cruises between 1983 and 1991 in the western North Pacific, an abundance estimate of 83,289 Risso's dolphins (CV = 0.179) was produced (Miyashita 1993). Risso's dolphins are taken in Japanese drive fisheries (Kishiro and Kasuya 1993). Risso's dolphins are also taken in small-type whaling operations and in the hand-harpoon fishery (Kishiro and Kasuya 1993). Since 1992, only 30 animals are allowed to be taken per year in the small-type whaling operations (Kishiro and Kasuya 1993).

In southeast Asia, there is no information on the population status or structure. Risso's dolphins are known to be taken as bait for nautilus fisheries in the western Philippines, but the take appears to be small and decreasing (Perrin *et al.* 1996). They are also taken in an Indonesian harpoon fishery. They may be taken in gillnet and driftnet fisheries in Southeast Asia (Perrin *et al.* 1996), and they are known to be taken in driftnets set for tuna and billfish in the Philippines (Dolar *et al.* 1994), but no estimates of bycatch levels for these fisheries are available.

In the western North Atlantic, Risso's dolphins are found from Florida to eastern Newfoundland (Leatherwood *et al.* 1976; Baird and Stacey 1990). There is no information on stock structure for this species in the western North Atlantic. Two stocks of Risso's dolphins are recognized in the U.S. waters of the Atlantic for management purposes under the MMPA, the western North Atlantic stock and the northern Gulf of Mexico stock. The total number of Risso's dolphins off the eastern U.S. and Canadian Atlantic coasts is unknown. The best abundance estimate for the western North Atlantic stock two combined estimates from 1998 is 29,110 (CV = 0.29) animals (Waring *et al.* 2001). There are insufficient data to evaluate population trends or productivity rates for this stock (Waring *et al.* 2001). Total average annual fishery-related mortality for this population is 56 animals (CV = 0.89). The status of Risso's dolphins relative to OSP in U.S. Atlantic EEZ waters is unknown. Average annual fishery-related mortality exceeds 10% of PBR (18.3); thus, this cannot be considered insignificant. However, the annual human-caused mortality does not exceed PBR, therefore, the stock is not considered strategic.

The size of the northern Gulf of Mexico stock is estimated to be 2,749 Risso's dolphins (CV = 0.27) based on vessel surveys in the early 1990s (Hansen *et al.* 1995). This species has been incidentally taken in the U.S. longline swordfish/tuna fishery in the northern Gulf of Mexico and in the U.S. Atlantic. Estimated average annual fishery-related mortality attributable to this fishery in the Gulf of Mexico in 1992-1993 was 19 Risso's dolphins (CV = 0.20) (Blaylock *et al.* 1995). The status of this stock relative to OSP is unknown. The northern Gulf of Mexico stock of Risso's dolphins is not considered strategic under the MMPA because the estimated level of fishery-related mortality does not exceed the calculated PBR.

In the eastern Atlantic, Risso's dolphins probably occur along the entire west coast of Africa, but little is known about the abundance, stock structure or fishery-related mortality of this species in eastern Atlantic waters.

Records of Risso's dolphins from the Indian Ocean indicate that this species is distributed throughout much of the area, particularly in deeper coastal waters seaward of the continental shelf (Kruse *et al.* 1991). Although sightings of Risso's dolphins have been clustered in the northern and western regions of the Indian Ocean, it is thought that they have a cosmopolitan distribution in the Indian Ocean and a lack of sightings in the central and eastern Indian Ocean is likely an artifact of coverage rather than an actual hiatus in this species' distribution (Leatherwood and Reeves 1989; Kruse *et al.* 1991). However, data are currently insufficient to accurately characterize this species' distribution and abundance in the Indian Ocean (Kruse *et al.* 1991). Risso's dolphins are reportedly taken in harpoon and drift gillnet fisheries in several areas of the Indian Ocean. No status determinations for this species have been made for this region given the lack of information.

Bottlenose Dolphin (*Turisiops truncatus*): Bottlenose dolphins are distributed world-wide in tropical and warm-temperate waters. In many regions, separate coastal and offshore populations are known (Walker 1981; Ross and Cockcroft 1990; Van Waerebeek *et al.* 1990).

In U.S. Pacific waters of the Pacific Ocean, the following three stocks are recognized for management purposes under the MMPA: the California coastal stock, the California/Oregon/Washington offshore stock and the Hawaii stock. California coastal bottlenose dolphins are found within about one kilometer of shore (Hansen 1990; Carretta *et al.* 1998) primarily from Point Conception south into Mexican waters, at least as far as Ensenada.

The best available abundance estimate for the California coastal stock is 206 bottlenose dolphins (CV=0.12), the weighted average of 1999-2000 aerial surveys (Carretta *et al.* 2001). Because this stock has a strictly coastal habitat, it is susceptible to fishery-related mortality in coastal set net fisheries. However, as of 1994 California coastal set gillnet fisheries are no longer expected to overlap with the range of coastal bottlenose dolphins because they have been banned from nearshore areas. Nevertheless, coastal gillnet fisheries exist in Mexico and probably take animals from this stock, but no significant information is available for these fisheries. The total fishery mortality for the California coastal bottlenose stock is currently considered insignificant. The status of this stock relative to OSP is unknown, and there is no evidence of a trend in abundance. Because no recent fishery takes have been documented, this stock is not considered strategic under the MMPA.

For the California/Oregon/Washington offshore stock, the best available abundance estimate is 956 animals (CV = 0.14), based on ship surveys conducted in 1991-1996 (Barlow 1997). After implementation of pingers and net-extenders on California and Oregon drift gillnets in 1997, there were no observed offshore bottlenose dolphin mortalities in 1997-1998. Therefore, the average estimated annual mortality for offshore bottlenose dolphins in this fishery averaged over 1994-1998 is zero animals (Carretta *et al.* 2001). Driftnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and probably take the southern form of this species. The overall marine mammal mortality rate in this fishery is similar to the California driftnet fisheries during 1990-1993 (0.14 marine mammals per set; Julian and Beeson 1998), but species-specific information is not available for the Mexican fishery. The total annual fishery mortality for this stock between 1994 and 1998 (zero animals per year) is less than 10 % of PBR (0.85) and can therefore be considered insignificant. The status of this stock relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance. Because the average annual human-caused mortality (zero) is estimated to be less than the PBR (8.5), this stock is not considered strategic under the MMPA.

In Hawaiian waters, onshore-offshore forms of bottlenose dolphins similar to those off the U.S. West Coast may exist, but currently only one stock is recognized in this area.

Bottlenose dolphins are relatively common throughout the Hawaiian Islands, from the island of Hawaii to the Kure Atoll (Shallenberger 1981). In the Northwestern Hawaiian Islands, they are found primarily in relatively shallow inshore waters (Rice 1960). In the main Hawaiian Islands, they are found in both shallow inshore waters and deep channels between islands. Population estimates have been made in Japanese waters (Miyashita 1993) and the eastern tropical Pacific (Wade and Gerrodette 1993), but it is not known whether these animals are part of Hawaiian stock. The Hawaiian stock was estimated at 743 bottlenose dolphins (CV=0.56) based on aerial surveys conducted in 1993, 1995 and 1998 (Mobley *et al.* 2000). Although some mortality of bottlenose dolphins has been observed in inshore gillnets, no estimate of annual human-caused mortality is available for this stock. The overall status of bottlenose dolphins in Hawaiian waters is unknown, but given the insignificance of reported fishery-related mortality, this stock is not considered strategic under the MMPA. Additionally, the stock is not considered depleted under the MMPA.

Based on shipboard surveys in the ETP, Wade and Gerrodette (1993) produced an abundance estimate of 243,500 bottlenose dolphins (CV = 0.286). Bottlenose dolphins are not targeted by the tuna purse seine fishery in this area, and there is no reason to believe that the ETP population is below its carrying capacity. Gerrodette and Palacios (1996) estimated the abundance of bottlenose dolphins in the EEZ waters of the ETP to be approximately 145,200 animals. The effect of coastal gillnet fisheries in national waters of the ETP is unknown.

An estimate abundance for bottlenose dolphins in Japanese coastal waters of the Pacific (north of 30°N and west of 145°E) is approximately 37,000 animals (Miyashita 1993). In these waters, bottlenose dolphins have been directly taken in some years in the harpoon and drive fisheries there (Miyazaki 1983). In Southeast Asian waters, the overall status of bottlenose dolphins is unknown (Perrin *et al.* 1996). Incidental takes of bottlenose dolphins in various fisheries have been reported from China (Chen *et al.* 1995), Thailand, and the Philippines (Dolar *et al.* 1994).

In U.S. waters of the western North Atlantic, the following eight stocks of bottlenose dolphins are recognized for management purposes under the MMPA: the Gulf of Mexico outer continental shelf stock; the Gulf of Mexico continental shelf edge and continental slope stock; the western Gulf of Mexico coastal stock; the northern Gulf of Mexico coastal stock; the eastern Gulf of Mexico coastal stock; the Gulf of Mexico bay, sound and estuarine; the western North Atlantic offshore stock; and the western North Atlantic coastal stock.

The Gulf of Mexico outer continental shelf stock is estimated at 50,247 bottlenose dolphins (CV = 0.18) based aerial surveys between 1992 and 1994 (Blaylock *et al.* 1995). No fishery-related mortality has been documented for this stock. The status of this stock relative to OSP is unknown and insufficient data preclude determining population trends. Because fishery-related mortality does not exceed the calculated PBR, this stock is not considered strategic under the MMPA.

The Gulf of Mexico continental shelf edge and continental slope stock has been estimated at 5,618 animals (CV = 0.26) based on shipboard surveys during 1992-1994 (Blaylock *et al.* 1995). No fishery-related mortality has been documented for this stock. The status of this stock relative to OSP is unknown and insufficient data preclude determining population trends. Because fishery-related mortality does not exceed the calculated PBR, this stock is not considered strategic under the MMPA.

The western Gulf of Mexico coastal stock is estimated at 3,499 bottlenose dolphins (CV = 0.21) based on aerial surveys during 1992 (Blaylock and Hoggard 1994). The known level of fishery-related mortality for this stock does not exceed the PBR; thus, this stock is not considered strategic under the MMPA. The status of this stock relative to OSP is unknown and insufficient data preclude determining population trends.

The northern Gulf of Mexico coastal stock is estimated at 4,191 animals (CV = 0.21) based on aerial surveys during 1993 (Blaylock and Hoggard 1994). The level of direct human-caused mortality is unknown. The status of this stock relative to OSP is unknown and insufficient data preclude determining population trends. Because known fishery-related mortality does not exceed the calculated PBR, this stock is not considered strategic under the MMPA.

The eastern Gulf of Mexico coastal stock of bottlenose dolphins is estimated at 9,912 animals (CV = 0.12) based on aerial surveys during 1994 (Blaylock *et al.* 1995). The level of direct human-caused mortality is unknown. The status of this stock relative to OSP is unknown and insufficient data preclude determining population trends. Because fishery-related mortality does not exceed the calculated PBR, this stock is not considered strategic under the MMPA.

Bottlenose dolphins are distributed throughout the bays, sounds, and estuaries of the Gulf of Mexico (Mullin 1988) and genetic data support the concept that they are discrete stocks (Waring *et al.* 2001). The minimum estimate for these stocks of bottlenose dolphins is 3,933 (Waring *et al.* 2001). Total fishery mortalities are known to be high and that they would exceed PBR for most of the bay, sound and estuary stocks; therefore, each of these stocks is considered strategic under the MMPA (Waring *et al.* 2001).

The total number of bottlenose dolphins off the U.S. Atlantic coast is not known, but a minimum population estimate for the western North Atlantic offshore stock is 24,897 animals (Waring *et al.* 2001). Estimated average annual fishery-related mortality for this stock is 5 animals (CV = 0.03). The status of this stock relative to OSP is unknown, but the stock is not considered strategic under the MMPA because estimated annual average fishery-related mortality does not exceed the PBR (249 dolphins).

A minimum population estimate of 2,482 bottlenose dolphins for the western North Atlantic coastal stock of bottlenose dolphins has been suggested (Blaylock *et al.* 1995). Dolphins from this stock have been taken incidentally in the menhaden purse seine fishery, coastal gillnet fisheries, and in the shrimp trawl fishery (Blaylock *et al.* 1995). The total fishery-related annual mortality (46 dolphins) is not less than 10% of the calculated PBR (2.5 dolphins) and is not considered insignificant (Waring *et al.* 2001). This stock is considered to be depleted relative to OSP and is listed as depleted under the MMPA; consequently, it also is considered a strategic stock under the MMPA.

The bottlenose dolphin is common in the Indian Ocean (Leatherwood and Reeves 1989). A few animals have been reportedly taken in gillnet fisheries there, and there is some concern that the coastal populations along the coasts of Africa and Australia may be adversely affected by the anti-shark nets. There is insufficient information regarding the Indian Ocean population of bottlenose dolphins to obtain abundance estimates or to determine its overall status in those waters (Klinowska and Cooke 1991).

Striped Dolphin (*Stenella coeruleoalba*): Striped dolphins are found in tropical and warm-temperate pelagic waters worldwide (Carretta *et al.* 2001). In U.S. waters, the following th stocks of striped dolphins are recognized for management purposes under the MMPA: the California/Oregon/Washington stock, the Hawaii stock, and the western North Atlantic stock.

For the California/Oregon/Washington stock, Barlow (1997) estimates a population size of 20,235 animals (CV = 0.14), from a 1991-96 weighted average based on three ship surveys. A Take Reduction Plan was implemented in 1997, which led to a decline in overall cetacean entanglements in drift gillnet fisheries. The average minimum estimated annual mortality from 1994-1998 was therefore zero. Similar driftnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and probably take the southern form of this species. The overall marine mammal mortality rate in this fishery is similar to the California driftnet fisheries during 1990-1995 (0.14 marine mammals per set; Julian and Beeson 1998), but species-specific information is not available for the Mexican fishery. Total fishery mortality for this stock is considered insignificant. The status of this stock relative to OSP is unknown. Because of the low levels of human-caused mortality, striped dolphins in the U.S. waters of the west coast are not considered a strategic stock under the MMPA.

Population estimates are available for striped dolphins in Japanese waters (Miyashita 1993) and the ETP (Wade and Gerrodette 1993), but it is not known if any of these are part of the Hawaii stock. Aerial surveys of the main Hawaiian Islands was conducted in 1993, 1995 and 1998 and resulted in an abundance estimate of 114 (CV=1.19) spinner dolphins (Mobley *et al.* 2000). This is an underestimate of spinner dolphins in the Hawaiian EEZ because the survey did not encompass their range (Carretta *et al.* 2001). There are no reports of direct or incidental takes of striped dolphins in Hawaiian waters (Nitta and Henderson 1993). The overall status of striped dolphins in Hawaiian waters is unknown and this stock's status relative to OSP is also unknown. Although information on striped dolphins in Hawaiian waters is limited, this stock is not considered strategic nor depleted under the MMPA.

In the western North Atlantic this species is found from Nova Scotia south to at least Jamaica and in the Gulf of Mexico (Blaylock *et al.* 1995). There is no information concerning stock structure for this species in this region, and for management purposes under the MMPA, two stocks are recognized in U.S. Atlantic waters, the western North Atlantic stock and the northern Gulf of Mexico stock. A minimum population estimate of 44,500 animals (CV = 0.40) has been suggested for the western North Atlantic stock of striped dolphins (Waring *et al.* 2001). Total annual estimated fishery-related mortality for this stock during 1994-1998 was 7.3 striped dolphins (CV = 0.08) (Waring *et al.* 2001). Because average annual fishery-related mortality does not exceed the calculated PBR, this stock is not considered strategic under the MMPA. The status of striped dolphins in the western North Atlantic relative to OSP is not known (Waring *et al.* 2001).

The northern Gulf of Mexico stock is estimated to be 4,858 striped dolphins (CV = 0.44) based on vessel surveys during the early 1990s (Hansen *et al.* 1995). Available information on fishery-related mortality for this stock indicates there is little, if any, fisheries interactions with striped dolphins in the northern Gulf of Mexico (Blaylock *et al.* 1995). The total known fishery-related mortality for this stock is believed to be insignificant relative to the calculated PBR; thus, this stock is not considered strategic under the MMPA. This stock's status relative to OSP is unknown and there are insufficient data to determine population trends.

In the western North Pacific, three migratory stocks have been provisionally recognized (Kishiro and Kasuya 1993). The population of striped dolphins in the western North Pacific is estimated to be 570,038 animals (CV = 0.186). Striped dolphins in this area are taken directly in the Japanese drive fishery. Catches in this fishery have declined dramatically since the 1950s. The annual catch off the Pacific coast of Japan at Taiji has declined to approximately 1,000 dolphins in recent years (Kishiro and Kasuya 1993).

Striped dolphins in the ETP are currently considered to form a single stock. Wade and Gerrodette (1993) estimated this stock to be 1,918,000 animals (CV = 0.112). This stock has been impacted, but not significantly depleted, by the tuna purse seine fishery in the ETP. In the EEZ waters of the ETP an estimate of approximately 324,100 striped dolphins has been proposed (Gerrodette and Palacios 1996).

In the Mediterranean striped dolphins are impacted by pollution and incidental capture in purse seines and pelagic drift gillnets (IWC 1992a). Striped dolphins are also taken directly and incidentally in other parts of their range, but there is no evidence of major stock declines outside the western North Pacific and the Mediterranean (Reeves and Leatherwood 1994).

Leatherwood and Reeves (1989) suggested striped dolphins are abundant in the Indian Ocean, but population estimates for this area are not available.

Common Dolphin (*Delphinus spp.*): Common dolphins are widely, although not continuously, distributed in temperate, tropical and subtropical waters of the Pacific, Atlantic and Indian Oceans. Recently, two species of common dolphin have been recognized in the Pacific Ocean, the short-beaked common dolphin (*Delphinus delphis*) and the long-beaked common dolphin (*Delphinus capensis*) (Heyning and Perrin 1994; Rosel *et al.* 1994). In the eastern Pacific the distributions of the two species overlap, and most of the available information on abundance, distribution, and incidental mortality has not been distinguished between the two species.

Short-beaked Common Dolphin (*Delphinus delphis*): In the eastern Pacific, the short-beaked common dolphin (*Delphinus delphis*) is widely distributed from southern California to central Chile, and west to about 135°W. For management purposes under the MMPA, three stocks of common dolphins are currently recognized in the eastern tropical Pacific (ETP): northern common, central common and southern common (Perrin *et al.* 1985; Dizon *et al.* 1992a). Wade and Gerrodette (1993) produced abundance estimates for these stocks from data collected during annual large-scale surveys between 1986 and 1990. The estimates (with coefficients of variation in parentheses) are as follows: northern, 476,300 (0.367); central, 406,100 (0.383); and southern 2,210,900 (0.217). Observers rarely distinguished between the short-beaked and long-beaked species during these surveys, so the estimate for the northern stock likely includes long-beaked common dolphins as well (Wade and Gerrodette 1993).

For management purposes under the MMPA, a single Pacific stock of short-beaked common dolphins is recognized and includes only animals found in the U.S. EEZ of California, Oregon, and Washington. Along California this species is the most common cetacean and occurs between the coast and at least 300 nmi offshore (Carretta *et al.* 2001). They have been sighted as far north as 42°N, but are primarily seen south of Point Conception, California (Barlow *et al.* 1995). Their southward distribution into Mexican waters is continuous to approximately 13°N (Perrin *et al.* 1985; Wade and Gerrodette 1993; Mangels and Gerrodette 1994) and may be an extension of the northern common dolphin stock recognized in the ETP (Perrin *et al.* 1985). However, preliminary data on variation in dorsal fin color pattern suggests that there may be multiple stocks in California (Farley 1995). The best available abundance estimate for this stock is 373,573 animals (CV = 0.19) from a 1991-96 weighted average based on three ship surveys (Barlow 1997).

Gerrodette and Palacios (1996) estimated abundance of common dolphins in the Pacific EEZ waters of Mexico, "Central America" (Guatemala, El Salvador, Honduras, Nicaragua), Costa Rica, Panama, Columbia and Ecuador from line-transect ship surveys which occurred between 1986 and 1993. Gerrodette and Palacios (1996) provide a single estimate of abundance per species per country; thus, the sightings were not stratified by stock, although more than one recognized stock or subspecies of common dolphins may occur in a given country. Estimates for short-beaked common dolphins in these waters were: Mexico, 272,000; “Central America,” 65,500; Costa Rica, 52,300; Panama, 24,800; and Columbia, 12,500; and Ecuador, 96,400.

In the ETP, common dolphins have been targeted by the purse seine fishery for yellowfin tuna since the late 1950's, but overall dolphin mortality in this fishery has been dramatically reduced in the last decade (Joseph 1994). The fishery that has the greatest impact on the California/Oregon/Washington stock of short-beaked common dolphins is the CA/OR thresher shark/swordfish drift gillnet fishery. Common dolphin mortality is also observed in set gillnet fisheries in California coastal waters. The estimated minimum total annual take from 1994-98 is 79 animals (Carretta *et al.* 2001). Similar drift and gillnet fisheries exist along the entire Pacific coast of Baja California, Mexico, which probably take short-beaked common dolphins from the same population (Carretta *et al.* 2001). Interactions between common dolphins the coastal gillnets in Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Columbia and Ecuador are likely, but little quantitative information on mortality is available (Gerrodette and Palacios 1996).

The status of the population relative to OSP is currently unknown. The total fishery mortality (79) is less than 10% of PBR (319) and can be considered insignificant (Carretta *et al.* 2001). Additionally, the total human-caused mortality (79) is less than PBR (3,188); therefore, short-beaked common dolphins are not considered a strategic stock under the MMPA (Carretta *et al.* 2001).

Long-beaked common dolphin (*Delphinus capensis*): Like the short-beaked common dolphin, only a single Pacific management stock exists under the MMPA and includes only animals from the U.S. EEZ of California. The best available population estimate for this stock is 32,239 (C.V. = 0.18), a 1991-96 weighted average based on three ship surveys (Barlow 1997). This species is taken incidentally in the same fisheries as the short-beaked common dolphin, with an estimated minimum total annual take of 14 dolphins from 1994-98 (Carretta *et al.* 2001). The status of long-beaked common dolphins relative to OSP is unknown, and there are insufficient data to evaluate potential trends in abundance for this species. The average total estimated human-caused mortality (14) for this species is lower than the PBR (250), so it is not considered a strategic stock under the MMPA.

During the majority of vessel surveys in the ETP, sufficient criteria to distinguish the long-beaked form from the short-beaked form of common dolphin did not exist. Since insufficient information existed to distinguish sightings of the two forms, Wade and Gerrodette (1993) did not make separate abundance estimates for long-beaked common dolphins in the ETP.

Gerrodette and Palacios (1996) estimated the abundance of long-beaked common dolphins in the Pacific EEZ waters of Mexico from line-transect ship surveys which occurred between 1986 and 1993 to be approximately 211, 000 animals.

In the Atlantic Ocean, common dolphins appear to be widely distributed along most coasts over both the eastern and western continental shelves primarily along the 200-300 m isobaths, or over prominent underwater topography such as the mid-Atlantic ridge and sea mounts, from 40°N latitude to 40° S latitude (Evans 1994). Currently, the is no substantive information on stock structure for this species in the North Atlantic, but the existence of more than one stock is likely.

For the purposes of management under the MMPA, one stock of common dolphins, the western North Atlantic stock, is recognized in the U.S. EEZ of the Atlantic Ocean. In the western North Atlantic, common dolphins (*Delphinus delphis*) are distributed along the continental slope (100 to 2,000 m). In the western North Atlantic, this species is less common south of Cape Hatteras, although some sightings have occurred as far south as Florida (Gaskin 1992c). The total number of common dolphins off the eastern coasts of the U.S. and Canada is not known, but the best estimate for common dolphins is 30,768 (CV=0.32), based on a 1998 aerial survey. Common dolphins in the western Atlantic Ocean are incidentally taken in foreign *Loglio* squid fishing operations (Waring *et al.* 1990), foreign mackerel-fishing operations (Waring *et al.* 1990), pelagic driftnet and pair trawl fisheries (Blaylock *et al.* 1995). Its status relative to OSP is unknown. Because average annual fishery-related mortality (406 animals, CV = 0.45) exceeds the PBR (227 animals), this stock is classified as strategic under the MMPA.

In the temperate waters of the eastern North Atlantic, this is one of the most common species of cetacean in both offshore and inshore waters (Forcada *et al.* 1990). However, more detailed information on abundance is not available. In the eastern Atlantic, common dolphins may be taken incidentally in pelagic and coastal fisheries, but present information is insufficient to assess the effects of such activities on the population.

The paucity of information on the population of common dolphins in the Indian Ocean precludes any estimation of abundance or fishery-related mortality and any evaluation of its status. Some animals are taken incidentally in gillnet fisheries in Sri Lanka (Leatherwood and Reeves 1989).

Northern Right Whale Dolphin (*Lissodelphis borealis*): The northern right whale dolphin is widely distributed in the cold-temperate North Pacific (Carretta *et al.* 2001). Little information is available on the stock structure or population size of this species. In U.S. EEZ, there is only a California/Oregon/Washington stock recognized for management purposes under the MMPA. The best estimated abundance for this stock is 13,705 animals (CV = 0.38), from a 1991-96 weighted average from three ship surveys in California, Oregon and Washington waters (Barlow 1997). In U.S. waters, northern right whale dolphins are taken incidentally in the California/Oregon thresher shark/swordfish drift gillnet fishery, with a estimated minimum total annual take of 15 animals from 1994-98 (Carretta *et al.* 2001). Only 1997-98 mortality estimates are included in the average because takes dropped significantly after the 1997 Take Reduction Plan was implemented. Drift gillnets exist along the entire Pacific coast of Baja California, Mexico and may take additional animals from this population, likely at a similar rate to those taken in the California fishery (an estimated 0.14 animals per set; Julian and Beeson, 1998).

The average annual human-caused mortality (15) is estimated to be less than the calculated PBR (97); thus, this stock is not considered strategic under the MMPA (Carretta *et al.* 2001). The total fishery mortality is greater than 10% of PBR and cannot be considered insignificant. They are not listed as threatened or endangered under the ESA or depleted under the MMPA. This stock's status relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance.

False Killer Whale (*Pseudorca crassidens*): The false killer whale is distributed in tropical and warm-temperate waters worldwide (Stacey *et al.* 1994). In the North Pacific this species is well known from Japan, Hawaii and the ETP. In U.S. Pacific waters, one stock of false killer whales, the Hawaiian stock, is recognized for management purposes under the MMPA. False killer whales occur around all the main Hawaiian Islands, but its presence round the Northwestern Hawaiian Islands has not yet been established (Nitta and Henderson 1993). Population estimates for this species have been made for Japanese waters (16,600 animals, Miyashita 1993) and the ETP (39,800 animals, CV = 0.636, Wade and Gerrodette 1993). Aerial surveys were flown within 25nim of the main Hawaiian Islands in 1993, 1995 and 1998 and resulted in an abundance estimate of 121 (CV=0.47) false killer whales for this stock (Mobley *et al.* 2000). This is an underestimate of abundance because the survey did not encompass their entire range in Hawaiian waters (Carretta *et al.* 2001). An estimated 9 animals per year are seriously injured or killed by the Hawaiian longline fishery within the U.S. EEZ. This number exceeds PBR (0.8) and therefore this stock is considered strategic under the MMPA. The status of this species in Hawaiian waters relative to OSP is unknown, however, the species is not listed as depleted under the MMPA (Carretta *et al.* 2001).

In U.S. Atlantic waters, one stock of false killer whales in the northern Gulf of Mexico is recognized for management purposes under the MMPA. An estimate of 381 whales (CV = 0.62) has been suggested for this stock (Hansen *et al.* 1995). The level of direct human-caused mortality is unknown, but available information indicates there is little, if any, fisheries interactions with false killer whales in the northern Gulf of Mexico (Blaylock *et al.* 1995). The status of this stock relative to OSP is unknown and insufficient data preclude determining population trends. Because fishery-related mortality does not exceed the calculated PBR, this stock is not considered strategic under the MMPA.

Some unknown number of false killer whales are known to be taken incidentally in fishing gear and opportunistically in directed fisheries for small cetaceans in various parts of their range (Leatherwood *et al.* 1991; Anonymous 1992).

Killer Whale (*Orcinus orca*): Killer whales have been observed in all oceans and seas throughout the world (Leatherwood and Dahlheim 1978). In U.S. waters, the following six stocks of killer whales are recognized for management purposes under the MMPA: the eastern North Pacific northern resident Stock, the eastern North Pacific southern resident stock, the eastern North Pacific transient stock, the eastern North Pacific offshore stock, the Hawaiian stock, and the western North Atlantic (Carretta *et al.* 2001).

The eastern North Pacific northern resident stock of killer whales occur from British Columbia through Alaska (Carretta *et al.* 2001). Killer whales along British Columbia and Washington State have been labeled as resident, transient and offshore (Bigg *et al.* 1990, Ford *et al.* 1994). Although less is known about killer whales in Alaska, it appears that all three types exist in these waters (Dalheim *et al.* 1997). The minimum estimate given for the eastern North Pacific resident stock is 723 killer whales, when combining the counts of known resident whales (Angliss *et al.* 2001). Killer whale mortalities incidental to commercial fisheries in these waters have not been identified as either resident or transient. Six fisheries that potentially interact with killer whales were monitored between 1990 and 1999 and the only fisheries for which incidental kill was observed was the Bering Sea groundfish trawl and longline fishery. An estimated 1.4 mortalities occurred per year (when averaged from 1990 to 1999) for both the resident and transient stocks. This number cannot be considered insignificant because it is greater than 10% of PBR (0.72); however, since human related mortalities were below PBR (7.2) this stock is not considered strategic under the MMPA (Angliss *et al.* 2001).

The eastern North Pacific southern resident stock of killer whales occurs from mainly within the inland waters of Washington state and southern British Columbia, but also in coastal waters from British Columbia through California (Carretta *et al.* 2001). The population estimate for this stock was 82 whales in 2000, which declined from a 1995 estimate of 99 whales (Ford *et al.* 2000). The total fishery mortality and serious injury for this stock is zero and can therefore be considered insignificant. The stock is not classified as strategic under the MMPA since total human-caused mortality (zero) does not exceed PBR (0.8; Carretta *et al.* 2001). They are not listed as endangered or threatened under the ESA nor as depleted under the MMPA.

The eastern North Pacific transient stock of killer whales occurs from Alaska through California (Carretta *et al.* 2001). An estimated minimum population estimate for this stock is 346 killer whales, based on combining counts of cataloged 'transient' whales (Ford and Ellis 1999, Matkin *et al.* 1999, Black *et al.* 1997). There are six different commercial fisheries that could interact with killer whales and the two in which incidental takes are documented is the Bering Sea/Aleutian Is. groundfish trawl and longline fisheries. The estimated total annual takes for these fisheries from 1994-98 is 0.6 whales (Carretta *et al.* 2001). This number exceeds 10% of PBR and cannot be considered insignificant. The estimated annual human-caused mortality (0.8) is not known to exceed PBR (2.8); therefore the stock is not considered strategic under the MMPA (Carretta *et al.* 2001).

Occurring from Southeast Alaska through California is the eastern North Pacific offshore stock of killer whales (Carretta *et al.* 2001). A conservative estimate for this stock is 285 animals (Black *et al.* 1997). The CA/OR thresher shark/swordfish fishery was observed from 1994-98 and resulted in an estimated mortality of zero killer whales. Set and drift gillnet fisheries exist along the entire Pacific coast of Baja California, Mexico and may take animals from the same population (Carretta *et al.* 2001). Since reported fishery mortalities are known to be zero, it is considered insignificant. The status of killer whales in California relative to OSP is unknown. There are no known human-caused mortalities, therefore, they are not classified as strategic under the MMPA. Additionally, they are not listed as threatened or endangered under the ESA nor as depleted under the MMPA.

Killer whales are rare in Hawaiian waters, and no data are available to estimate abundance for this species in the central Pacific. Aerial surveys were flown within 25 nmi of the main Hawaiian Islands in 1993, 1995 and 1998, however there were no killer whale sightings (Mobley *et al.* 2000). Therefore, there is no abundance estimate for this stock (Carretta *et al.* 2001). Likewise, no estimate of human-caused mortality is available (Nitta and Henderson 1993). The overall status of killer whales in Hawaiian waters is unknown, as is their status relative to OSP. Although information on killer whales in Hawaiian waters is limited, this stock is not considered strategic under the MMPA given the insignificance of reported fishery-related mortality.

Killer whales are considered uncommon or rare in U.S. Atlantic waters (Katona *et al.* 1988). The total number of killer whales off the eastern U.S. coast is unknown and present data are insufficient to calculate an abundance estimate for the western North Atlantic stock. The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. Because there is no evidence of human-caused mortality, this stock is not considered strategic under the MMPA even though a PBR cannot be calculated because data were lacking.

For the ETP, Wade and Gerrodette (1993) estimated the killer whale population to be 8,500 animals (CV = 0.368). The Indian Ocean population of killer whales has been estimated to consist of a few thousand animals (Nishiwaki 1977, 1983; Leatherwood *et al.* 1991), but more rigorous abundance estimate for this population are not available.

Killer whales are taken directly in Greenland (Heide-Jorgensen 1988), Indonesia (Barnes 1991), Japan (Miyazaki 1983), and in the Lesser Antilles (Price 1985). Killer whales are also occasionally taken incidentally in gillnets in the Indian Ocean (Leatherwood *et al.* 1991) and possibly elsewhere.

Short-finned Pilot Whale (*Globicephala macrorhynchus*): The short-finned pilot whale occurs in tropical and warm temperate waters worldwide. In the North Pacific Ocean its distribution extends into cool temperate waters. In general, stocks for this species are not well defined, except off Japan where two morphologically distinct allopatric stocks occur (Kasuya *et al.* 1988). The species overall abundance is undoubtedly high but some populations are depleted (IWC 1987).

In U.S. waters the following four stocks of short-finned pilot whales are recognized for management purposes under in the MMPA: the California/Oregon/Washington stock, the Hawaii stock, the western North Atlantic stock, and the northern Gulf of Mexico stock.

Although the full geographic range of the California/Oregon/Washington stock is not known, it may be continuous with animals found off Baja California, and is morphologically distinct from short-finned pilot whales found further south in the ETP (Polisini 1981). The 1991-96 weighted average abundance estimate for the stock based on three ship surveys is 970 animals (CV= 0.37; Barlow 1997). Short-finned pilot whales are taken incidentally in CA/OR thresher shark/swordfish drift gillnet fishery. The average estimated annual mortality for short-finned pilot whales in this fishery for the five complete years of monitoring (1994-1998) is 3 animals. Similar drift gillnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and may take animals from the same population. The overall mortality rate in this fishery is similar to that observed in California driftnet fisheries in 1990-1995 (0.14 marine mammals per set; Julian and Beeson 1998), but species specific information is not available for the Mexican fisheries. The status of short-finned pilot whales off California, Oregon, and Washington relative to OSP is unknown. The estimated human-caused mortality (3) is less than PBR (5.7), therefore, the stock is not considered strategic. However, fishery mortalities (3) exceed 10% of PBR, and therefore cannot be considered insignificant (Carretta *et al.* 2001). This stock is not listed as threatened or endangered under the ESA nor as depleted under the MMPA .

Short-finned pilot whales are commonly observed around the main Hawaiian Islands and are probably also present around the Northwestern Hawaiian Islands (Shallenberger 1981). Estimates of short-finned pilot whale populations have been made off Japan (Miyashita 1993) and in the ETP (Wade and Gerrodette 1993), but it is not known if these animals are part of the Hawaiian stock. Aerial surveys were flown within 25 nmi of the main Hawaiian Islands in 1993, 1995 and 1998 and resulted in an abundance estimate of 1,708 (CV=0.32) short-finned pilot whales (Mobley *et al.* 2001). This is an underestimate of the stock in the Hawaiian EEZ because the survey did not encompass their range (Carretta *et al.* 2001). No estimates of annual human-caused mortality is available because there are no reports of direct or incidental takes of this species in Hawaiian waters. However, there is potential for mortalities in international waters from the Hawaiian longline fishery. The overall status of short-finned pilot whales in Hawaiian waters is unknown as is their status relative to OSP. Although information on this species in Hawaiian waters is limited, this stock would not be considered strategic under the MMPA given the absence of fishery-related mortality. There is insufficient information to determine if fishery mortalities are insignificant and approaching zero (Carretta *et al.* 2001).

The estimated abundance of short-finned pilot whales in the western North Atlantic is 14,524 (CV = 0.30) based on combined estimates from two 1998 U.S. Atlantic surveys (Waring *et al.* 2001). The two surveys included: the northern Atlantic which was estimated at 9,800 whales from ship and aerial surveys and the southern Atlantic which was estimated at 4,724 whales from shipboard surveys (Mullin in review). The level of human caused mortality in the U.S. Atlantic EEZ is unknown. The short-finned pilot whale has been taken in the U.S. longline swordfish/tuna fishery in Atlantic waters off the southeastern U.S. (SEFSC unpublished data). Total estimated annual fishery-related mortality of pilot whales from pelagic longline, drift gillnet, and groundfish trawl fisheries is 245 animals (CV =0.44); however, this estimate does not distinguish between *G. macrorhynchus* and *G. melas*. The status of short-finned pilot whales relative to OSP in U.S. Atlantic coast waters is unknown and there are insufficient data to determine population trends for this stock. This stock is considered strategic under the MMPA because the 1995-99 estimated average annual fishery-related mortality for pilot whales (*Globicephala* spp.) exceeds PBR for this stock (Waring *et al.* 2001).

The estimated abundance of short-finned pilot whales in the northern Gulf of Mexico is 350 animals (CV = 0.89) based on vessel surveys in the early 1990s (Hansen *et al.* 1995). The level of human-caused mortality of short-finned pilot whales in the northern Gulf of Mexico is unknown. This species has been taken in the U.S. longline swordfish/tuna fishery in U.S. Atlantic waters. Total known fishery-related mortality is estimated to be 0.3 whales per year (Blaylock *et al.* 1995). Status of the stock relative to OSP is unknown and there are insufficient data to determine population trends. The total level of estimated annual fishery-related mortality is unknown, but because a fishery-related mortality has been recorded and because of the extremely low estimated stock size, the short-finned pilot whale is considered a strategic stock under the MMPA.

In the ETP, the population of *Globicephala* spp. has been estimated at 160,200 animals (CV = 0.138) based on vessels surveys between 1986 and 1990 (Wade and Gerrodette 1993). In the EEZ waters of the ETP, an estimated 39,690 *G. macrorhynchus* occur (Gerrodette and Palacios 1996). In the western North Pacific, two forms of short-finned pilot whales, the northern form and the southern form, are found (Kasuya *et al.* 1988). The southern form, which is harvested by the Japanese drive fisheries has an estimated population size of 53,680 animals (CV = 0.224) (Miyashita 1993). In the Indian Ocean, the two species of pilot whales may overlap in their distribution as they do in the western North Atlantic (Leatherwood *et al.* 1991). There is no information on the abundance of short-finned pilot whales in the Indian Ocean, and their current overall status there is unknown. They are taken in unknown numbers intentionally and incidentally in the Indian Ocean (Leatherwood *et al.* 1991).

Baird's Beaked Whale (*Berardius bairdii*): The Baird's beaked whale is found in deep waters and along the continental slopes of the North Pacific Ocean, mainly north of 34°N in the west and 28°N in the east (Balcomb 1989). It also inhabits the seas adjacent to the North Pacific, namely the Bering Sea, the Okhotsk Sea, Sea of Japan, and the southern Gulf of California, Mexico (Balcomb 1989). They have been harvested and studied in Japan, but little is known about this species elsewhere (Balcomb 1989). In the U.S. waters of the eastern North Pacific, the following two stocks of Baird's beaked whales are recognized for management purposes under the MMPA: the California/Oregon/Washington stock and the Alaska stock.

Although this species has been sighted along the west coast on several aerial and shipboard line-transect surveys, sightings have generally been too rare to produce reliable population estimates for the California/Oregon/Washington stock. The best population estimate currently available for this stock is 379 animals (CV = 0.23), from a 1991-96 weighted average based on three ship surveys (Barlow 1997). This stock of Baird's beaked whales is susceptible to mortality in drift gillnets, which are used to catch swordfish, thresher shark, and mako shark in California offshore waters. Mean annual takes from this fishery for 1994-98 was zero. The estimate was based only on 1997-98 data because the Take Reduction Plan, implemented in 1997, significantly reduced mortality. Similar driftnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and probably take this species. The overall marine mammal mortality rate in this fishery is similar to the California driftnet fisheries during 1990-1993 (0.14 marine mammals per set; Julian and Beeson 1998), but species-specific information is not available for the Mexican fishery. The status of Baird's beaked whales in California, Oregon, and Washington waters relative to OSP in unknown, and there are insufficient to determine population trends. They are not classified as strategic since the known human-caused mortality is zero. They are not listed as endangered or threatened under the ESA nor as depleted under the MMPA.

Reliable abundance estimates for the Alaska stock of Baird's beaked whales are currently unavailable. There have been no observed reports of incidental mortality related to commercial fishery operations in Alaskan waters in the last five years (Angliss *et al.* 2001). The Japanese fishery has reported taking 54 Baird's beaked whales annually between 1992 and 1997; however, it is not known if there are from the Alaskan stock (Angliss *et al.* 2001). This stock's status relative to OSP is unknown, and there are insufficient data to determine population trends. The Alaska stock of Baird's beaked whales is not considered strategic under the MMPA.

In the western North Pacific there are three putative stock of Baird's beaked whales, the western Pacific, the Okhotsk Sea, and the Sea of Japan stocks (Kasuya and Miyashita 1989). Surveys have indicated a total population in the western North Pacific and adjacent seas of approximately 6,000 whales. The removal rate of this species in the Japanese traditional hunt has been around 1% of the population in recent years (Reeves and Leatherwood 1994).

***Mesoplodon* spp.:** There is relatively little information for any of the species within the *Mesoplodon* genus. Within U.S. Pacific waters, mesoplodont beaked whales are distributed throughout deep waters and along the continental slopes of the North Pacific Ocean (Carretta *et al.* 2001). Although mesoplodont beaked whales have been sighted along the U.S. west coast on several aerial and shipboard line-transect surveys, sighting have generally been too rare to produce reliable abundance estimates, and species identification has been problematic. For the MMPA stock assessment reports, four *Mesoplodon* stocks are defined: all *Mesoplodon* species off California, Oregon and Washington waters, M. *densirostris* in Hawaiian waters, *M. stejnegeri* in Alaskan waters, and a western north Atlantic stock.

At least five species in this genus have been recorded off the U.S. west coast, but owing to the rarity of records and the difficulty in identifying these animals in the field, virtually no species-specific information is available (Mead 1989b). The five species known to occur in this range are: Blainville's beaked whale (*M. densirostris*), Hector's beaked whale (*M. hectori*), Stejneger's beaked whale (*M. stejnegeri*), Ginko-toothed beaked whale (*M. ginkodens*), and Hubb's beaked whale (*M. carlhubbsi*). The best possible abundance estimate for the California/Oregon/Washington stock of mesoplodont beaked whales is 3,738 animals (CV =

0.50) plus 360 (CV = 2.0) Blainville's beaked whales, from a 1991-96 weighted average based on three ship surveys (Barlow 1997). Mesoplodont beaked whales are susceptible to mortality in drift gillnets, which are used to catch swordfish, thresher shark, and mako shark in California offshore waters. The average annual estimated mortality for in this fishery of whales identified to the genus *Mesoplodon* for five years of monitoring, 1994-98, is zero animals (Carretta *et al.* 2001). Similar driftnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and may take animals from the same populations. The overall marine mammal mortality rate in this fishery is similar to the California driftnet fisheries during 1994-98 (0.14 marine mammals per set; Julian and Beeson 1998), but species-specific information is not available for the Mexican fishery. The status of mesoplodont beaked whales in California, Oregon, and Washington waters relative to OSP in unknown, and there are insufficient to determine population trends (Carretta *et al.* 2001). The estimated annual average human-caused mortality does not exceeds the PBR; thus, this group of species is not considered strategic under the MMPA. None of the five species are listed as endangered or threatened under the ESA nor as depleted under the MMPA.

Aerial surveys were flown within 25 nmi of the main Hawaiian Islands in 1993, 1995 and 1998 and resulted in an abundance estimate of 68 Blainville's beaked whales for the Hawaiian stock (Mobley *et al.* 2000). This is an underestimate of the stocks abundance because their entire range was not encompassed in the aerial surveys (Carretta *et al.* 2001). There is no estimate available on human-caused mortalities for this stock because there are no reports of takes of Blainville's beaked whales in Hawaiian waters (Nitta and Henderson 1993). There is no information on this stock relative to OSP and there is insufficient information to determine if fishery mortalities are insignificant and approaching zero (Carretta *et al.* 2001). The increasing levels of anthropogenic noise are potential concern for beaked whales.

In Alaskan waters, a single stock of Stejneger's beaked whales (*M. stejnegeri*) is recognized for management purposes under the MMPA (Angliss *et al.* 2001). However, no abundance estimates are available for this stock. There have been no observed reports of incidental mortality related to commercial fisheries operations for this species in the last five years (Angliss *et al.* 2001). This stock of beaked whales is not considered strategic under the MMPA given the lack of significant fishery-related mortality.

Within the genus *Mesoplodon*, there are four species of beaked whales that occur in the northwest Atlantic. These include Gervais's beaked whale (*M. europaeus*), True's beaked whale (*M. mirus*), Blainville's beaked whale (*M. densirostris*), and Sowerby's beaked whale (*M. bidens*). Because these species are difficult to identify to the species level at sea, much of the information for these animals in the northwest Atlantic is to genus level only. Present data are insufficient to calculate a minimum population estimate for these species (Blaylock *et al.* 1995). The total average annual estimated fishery-related mortality for these species combined from 1989-1993 is 34 animals (CV = 0.69) (Blaylock *et al.* 1995). The status of the mesoplodonts in U.S. Atlantic waters relative to OSP is unknown, and there are insufficient data to determine population trends. This group of species is considered a strategic stock under the MMPA because of the uncertainty regarding stock size and the evidence of fishery-related mortality.

Cuvier's Beaked Whale (*Ziphius cavirostris*): Cuvier's beaked whale are more commonly encountered than most other beaked whales. Three stocks of Cuvier's beaked whales have been defined based on (1) large distances between areas in which they are found, (2) different oceanographic habitats found in those areas, and (3) the different fisheries that operate within those three areas. The three stocks are: California/Oregon/Washington, Hawaii, and Alaska.

The 1991-96 weighted average abundance estimate for California, Oregon and Washington waters is 5,870 (CV = 0.38) Cuvier's beaked whales (Barlow 1997). The population to which the animals in California belongs, may be affected by high-seas driftnets and coastal driftnets and therefore, the status of these animals should be considered uncertain (Forney 1994). From the observed CA/OR thresher shark/swordfish drift gillnet fishery, the minimum total annual take from 1994-98 is estimated to be zero (Carretta *et al.* 2001). The status of this stock relative to OSP is unknown. They are not listed as endangered or threatened under the ESA nor as depleted under the MMPA. Additionally, the stock is not considered strategic since there are no known human-caused mortalities.

In Hawaiian waters, nothing is known about the stock structure of this species. Wade and Gerrodette (1993) made an abundance estimate of Cuvier's beaked whales in the ETP of 20,000 (CV = 0.265), but it is not known if these are part of the Hawaiian stock. Aerial surveys were flown within 25 nmi of the main Hawaiian Islands in 1993, 1995 and 1998 and resulted in an estimated abundance of 43 (CV=0.51) Cuvier's beaked whales for this stock (Mobley *et al.* 2000). This is an underestimate of this stocks abundance because the aerial survey did not encompass their entire range (Carretta *et al.* 2001). There is no estimate of annual human-caused mortality due to no reports of takes in Hawaiian waters (Nitta and Henderson 1993). The stock is therefore not considered strategic under the MMPA since there is no known human-caused mortality.

For the Alaska stock, nothing is know about the abundance or stock structure (Angliss *et al.* 2001). This stock is not listed as threatened, endangered or strategic under the ESA or MMPA.

In the Atlantic there are two stocks of Cuvier's beaked whales: the western North Atlantic stock and the northern Gulf of Mexico stock. The abundance for the western North Atlantic stock is unknown (Waring *et al.* 2001). Total human-caused mortality for this stock was zero. The most recent minimum abundance estimate for the northern Gulf of Mexico stock is 20 whales (Waring *et al.* 2001), but a stock assessment report hasn't been revised since 1995. Fishery mortality is unknown for this stock and therefore, there is no calculated annual human-caused mortality. The stock is not listed as strategic under the MMPA.

Sperm Whale (*Physeter macrocephalus*): The sperm whale has an extensive distribution that ranges throughout all deep oceans of the world from the equator to the edges of the polar pack ice (Rice 1989). There is much uncertainty surrounding the identity and status of sperm whale populations.

In the U.S. waters of the North Pacific, the following three discrete, non-contiguous areas are recognized for management purposes under the MMPA: the California/Oregon/Washington stock, the Hawaii stock, and the Alaska stock. The most precise abundance estimate for sperm whales of the California/Oregon/Washington stock is 1,407 animals (CV = 0.39), based on 1993 and 1996 ship line transect surveys in California, Oregon and Washington coastal waters (Barlow and Taylor 2001). Sperm whales are likely to be caught only in offshore drift gillnets, which are used to catch swordfish, thresher shark, and mako shark in California offshore waters (Hanan *et al.* 1993). Over the last three years , the average annual rate of mortality in fisheries has been 1.7 sperm whales per year (Carretta *et al.* 2001). Similar driftnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and probably take the southern form of this species. The overall marine mammal mortality rate in this fishery is similar to the California driftnet fisheries during 1990-1995 (0.14 marine mammals per set; Julian and Beeson 1998), but species-specific information is not available for the Mexican fishery. Sperm whales are classified as endangered under the ESA; consequently, the California to Washington stock is automatically considered depleted and strategic under the MMPA.

In Hawaiian waters, sperm whales have occur throughout the main islands and have also been sighted around several of the Northwestern Hawaiian Islands (Rice 1989). Aerial surveys were flown within 25 nmi of the main Hawaiian Islands in 1993, 1995 and 1998 and resulted in an average abundance estimate of 66 (CV=0.56) sperm whales (Mobley *et al.* 2000). This is an underestimate of abundance within the Hawaiian EEZ because the survey did not encompass the stock's entire range (Carretta *et al.* 2001). No estimate of annual human-caused mortality is available because there re no reports of recent direct or indirect takes of sperm whales in Hawaiian waters (Nitta and Henderson 1993). The overall status of sperm whales in Hawaiian waters is unknown, as is their status relative to OSP. This species is classified as endangered under the ESA; thus, the Hawaiian stock is considered depleted and strategic under the MMPA.

There is no reliable estimate of abundance for the Alaskan stock of sperm whales. There are no observed reports of incidental mortality related to commercial fishery operations for the last five years (Angliss *et al.* 2001). Like the other two stock in U.S. North Pacific waters, the Alaska stock is listed as endangered under the ESA, and depleted and strategic under the MMPA.

Surveys in the ETP (Wade and Gerrodette 1993) show that although sperm whales are widely distributed in the tropics, their relative abundance tapers off markedly westward toward the middle of the tropical Pacific and tapers off northward towards the tip of Baja California, Mexico. The structure of sperm whale populations in the ETP is not known, but the only matches of know individuals from this area have been between the Galapagos Islands and the coastal waters of South America (Dufault and Whitehead 1995), suggesting that the eastern tropical animals constitute a distinct stock. The population of sperm whales in the ETP is estimated at 22,700 (95% CI = 14,800 - 34,600) based on shipboard line-transect surveys between 1986 and 1990 (Wade and Gerrodette 1993). Additionally, a recent survey was conducted in the eastern temperate North Pacific in 1997, combining visual and acoustic effort. The survey resulted in an estimated abundance of 24,000 (CV=0.46) sperm whales based on the visual sightings and 39,200 (CV=0.60) sperm whales based on acoustic detections (Barlow and Taylor 1998).

Sperm whales that occur in the U.S. EEZ waters of the North Atlantic likely represent only a fraction of the total population in the western North Atlantic, but for management purposes there are two stocks of sperm whales in the U.S. EEZ waters of this region is recognized under the MMPA: the North Atlantic stock and the northern Gulf of Mexico stock (Blaylock *et al.* 1995).

The best estimate abundance estimate for the western North Atlantic stock of sperm whales is 4,702 (CV=0.36) (Wade and Angliss 1997). Total estimated humam-caused mortality is zero for this stock of sperm whales (Waring *et al.* 2001). The status of this stock relative to OSP is unknown, but the species is listed as endangered under the ESA.

For the northern Gulf of Mexico stock, an abundance estimate, based on surveys with the most complete coverage of the continental shelf edge and continental slope waters of the western North Atlantic of 337 sperm whales (CV = 0.50) has been proposed (Blaylock *et al.* 1995). Total annual estimated average mortality for this stock between 1989 and 1993 was 1.6 sperm whales (CV = 2.72) (Blaylock *et al.* 1995). The status of this stock relative to OSP is unknown, and insufficient data are available to determine population trends. Like those stocks in U.S. waters of the Pacific, the western North Atlantic stock of sperm whales is considered depleted and strategic under the MMPA because this species is listed as endangered under the ESA.

Pygmy Sperm Whale (*Kogia breviceps*): The pygmy sperm whale, like the dwarf sperm whale, is widely distributed throughout the world's oceans, but they are not known to occur in polar and subpolar latitudes (Caldwell and Caldwell 1989). They are difficult to see and identify in the wild, and there are no reliable population estimates for this species. Owing to the difficulty in distinguishing between the pygmy and dwarf sperm whale in the field and the rarity of encounters, additional study is required before each of the two species can be evaluated comprehensively.

In U.S. Pacific waters, available data are insufficient to identify any seasonality in the distribution of pygmy sperm whales, or to delineate possible stock boundaries. For management purposes under the MMPA, two stocks of pygmy sperm whales are recognized in U.S. waters of the Pacific Ocean, the California/Oregon/Washington stock and the Hawaii stock. Sightings of pygmy sperm whales along the U.S. west coast have been generally too rare to produce reliable population estimates (Barlow *et al.* 1995).

Recent analyses by Barlow and Gerrodette (1996) and Barlow and Sexton (1996) have resulted in improved abundance estimates for the California/Oregon/Washington stock by 1) combining data from three surveys conducted between 1991-96, and 2) estimating a correction factor for dive intervals. The 1991-96 weighted average is 2,933 pygmy sperm whales (CV=0.54), plus an estimated 1,813 (CV=1.53) pygmy or dwarf sperm whales (only identified to *Kogia*; Barlow 1997). Since there have been no reported dwarf sperm whales along the U.S. West coast since the 1970's, it is highly likely that the estimated 1,813 *Kogia* were pygmy sperm whales. Therefore, the total estimated abundance for pygmy sperm whales is potentially closer to 4,746 (CV=0.67; Carretta *et al.* 2001). Pygmy sperm whales have potential to interact with the CA/OR thresher shark/swordfish drift gillnet fishery. The average annual estimated mortality of pygmy sperm whales for this fishery for five years of monitoring (1994-98) is zero animals per year. Similar driftnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and may take animals from the same population. The overall marine mammal mortality rate in this fishery is similar to the California driftnet fisheries during 1990-1995 (0.14 marine mammals per set; Julian and Beeson 1998), but species-specific information is not available for the Mexican fishery. The status of pygmy sperm whale in California, Oregon and Washington waters relative to OSP is unknown. Estimated human-caused mortality of these animals in California, Oregon and Washington waters (zero) is not known to exceed the calculated PBR (28); therefore, this stock of pygmy sperm whales is not considered strategic under the MMPA (Carretta *et al.* 2001).

Aerial surveys were flown within 25 nmi of the main Hawaiian Islands during 1993, 1995 and 1998 and resulted in two sightings of five pygmy or dwarf sperm whales (Mobley *et al.* 2000). These sightings were excluded because they were made during poor sighting condition, therefore, there is no abundance estimate for pygmy sperm whales of the Hawaiian stock (Carretta *et al.* 2001). No estimate of human-caused mortality is available because there are no reports of direct or incidental takes of pygmy sperm whales in Hawaiian waters (Nitta and Henderson 1993). The overall status of this species in Hawaiian waters is unknown, as is their status relative to OSP. Although information on pygmy sperm whales in Hawaiian waters is limited, this stock is not considered strategic under the MMPA give the absence of reported fishery-related mortality.

Along the U.S. Atlantic coast, two stocks of pygmy sperm whales are recognized for management purposes under the MMPA, the western North Atlantic stock and the northern Gulf of Mexico stock. However, there is no information on stock differentiation for the Atlantic population. In the western North Atlantic, only an abundance estimate for the dwarf sperm whale and the pygmy sperm whale combined is available (Waring *et al.* 2000). The best available abundance estimate for *Kogia sp.* is combined estimated from two 1998 survey, resulting in 536 (CV=0.45) whales. Available information indicates there is little, if any, fisheries interactions with pygmy sperm whales in the U.S. waters of the Atlantic Ocean (Waring *et al.* 2000). The status of the western North Atlantic stock of pygmy sperm whales relative to OSP is unknown. This is a strategic stock because the species is listed as endangered under the ESA.

In the northern Gulf of Mexico, only an abundance estimate for the dwarf sperm whale and the pygmy sperm whale combined is available. Hansen *et al.* (1995) estimated 547 animals of the genus *Kogia* (CV = 0.28) for this region based on vessel surveys in the early 1990s. Available information indicates there is little, if any, fisheries interactions with pygmy sperm whales in the U.S. waters of the Atlantic Ocean (Blaylock *et al.* 1995). The status of the northern Gulf of Mexico stock of pygmy sperm whales relative to OSP is unknown. Upon the advice of the Atlantic Scientific Review Group this stock has been designated strategic under the MMPA because PBR cannot be determined and there is an unknown level of possible human-caused mortality from the ingestion of marine debris such as plastic bags.

In the Indian Ocean, there is limited information on this species. Available information, most of which is based on strandings and incidental catches, was reviewed by Chantrapornsyl *et al.* (1991), but no conclusions about the relative abundance and status of this species can be made. A few animals have recently been taken incidentally in Sri Lanka's gillnet fishery.

Dwarf Sperm Whale (*Kogia sima*): The dwarf sperm whale, like the pygmy sperm whale is found in tropical to warm-temperate waters worldwide (Nagorsen 1985). This species was only recognized as being distinct from the pygmy sperm whale in 1966 (Handley 1966), and early records of the two species are confounded. They are difficult to see and identify in the wild, and there are no reliable population estimates except for the ETP, where a conservative estimate of approximately 11,200 dwarf sperm whales was made (Wade and Gerrodette 1993). Owing to the difficulty in distinguishing between the pygmy and dwarf sperm whale in the field and the rarity of encounters, additional study is required before each of the two species can be evaluated comprehensively.

For management purposes under the MMPA, one stock of dwarf sperm whales are recognized in U.S. Pacific waters including only animals found within the Hawaiian EEZ. Aerial surveys were flown within 25 nmi of the main Hawaiian Islands during 1993, 1995 and 1998 and resulted in two sightings of five pygmy or dwarf sperm whales (Mobley *et al.* 2000). These sightings were excluded because they were made during poor sighting condition, therefore, there is no abundance estimate for dwarf sperm whales of the Hawaiian stock (Carretta *et al.* 2001). No estimate of annual human-caused mortality is available for the Hawaiian stock because no reports of direct or incidental takes have been reported in Hawaiian waters (Nitta and Henderson 1993). The status of this stock relative to OSP is unknown. Although information on dwarf sperm whales in Hawaiian waters is limited, the stock is not considered strategic under the MMPA.

Along the U.S. Atlantic coast, two stocks of dwarf sperm whales are recognized for management purposes under the MMPA, the western North Atlantic stock and the northern Gulf of Mexico stock. However, there is no information on stock differentiation for the Atlantic population (Waring *et al.* 2001). In the western North Atlantic, only an abundance estimate for the dwarf sperm whale and the pygmy sperm whale combined is available. This resulted in an estimated abundance of 536 animals of the genus *Kogia* (CV = 0.45) based on combining two 1998 surveys. Available information indicates there is little, if any, fisheries interactions with dwarf sperm whales in the U.S. waters of the Atlantic Ocean (Waring *et al.* 2001). The status of the western North Atlantic stock of dwarf sperm whales relative to OSP is unknown. Total fishery-related mortality is less than 10% of PBR and can therefore be considered insignificant.

In the northern Gulf of Mexico, only an abundance estimate for the dwarf sperm whale and the pygmy sperm whale combined is available. Hansen *et al.* (1995) estimated 547 animals of the genus *Kogia* (CV = 0.28) for this region based on vessel surveys in the early 1990s. Available information indicates there is little, if any, fisheries interactions with dwarf sperm whales in the U.S. waters of the Atlantic Ocean (Blaylock *et al.* 1995). The status of the northern Gulf of Mexico stock of dwarf sperm whales relative to OSP is unknown. Upon the advice of the Atlantic Scientific Review Group this stock has been designated strategic under the MMPA because PBR cannot be determined and there is an unknown level of possible human-caused mortality from the ingestion of marine debris such as plastic bags.

In the Indian Ocean, there is limited information on this species. Available information, most of which is based on strandings and incidental catches, was reviewed by Chantrapornsyl *et al.* (1991), but no conclusions about the relative abundance and status of this species can be made. A few animals have recently been taken incidentally in Sri Lanka's gillnet fishery.

Northern Right Whale (*Eubalaena japonica*): In U.S. waters, two populations of right whales are currently recognized for management purposes under the MMPA, the North Pacific population and the North Atlantic population (*Eubalaena glacialis*). Whaling records indicate that right whales in the North Pacific range across the entire ocean north of 35°N and occasionally occur as far south as 20°N. Migration patterns of the North Pacific population are unknown. A reliable abundance estimate for the North Pacific stock is not available (Carretta *et al.* 2001). In June 1983, a right whale was apparently killed in a gillnet in Russian waters (NMFS 1991), but no other observed takes have occurred in the North Pacific. The North Pacific stock of right whales is classified as endangered under the ESA; thus, it is considered a strategic stock under the MMPA.

Gray Whale *(Eschrichtius robustus*): The only extant stocks of gray whales occur in the Pacific Ocean. The western Pacific stock, which is found off the east coast of Asia, is estimated at approximately 250 animals (Vladirmirov 1994), but no quantitative data are available to assess this estimate (Berzin *et al.* 1995). The western North Pacific stock feeds in the northern Okhotsk Sea and winters off southern Korea and Japan (Wolman 1985).

The eastern Pacific stock spends the summer feeding in the northern Bering, Chukchi and Beaufort Seas (Rice and Wolman 1971). The whales in this stock migrate near shore along the coast of North America from Alaska to the Central California coast (Rugh *et al.* 1993) starting in October and November. From Point Conception south to Baja California most of the whales take a more direct offshore route across the southern California Bight to northern Baja California (Rice *et al.* 1984). The eastern North Pacific Stock winters mainly along the west coast of Baja California, where females give birth to their calves in certain bays and lagoons there from early January to mid-February (Rice *et al.* 1981). The northern migration generally begins in mid-February and continues through May (Rice *et al.* 1981). There are at least a few hundred gray whales, called "seasonal residents" that feed in summer months from northern California to southeastern Alaska (Calambokidis et al. 2002). The most recent reliable estimate for the eastern North Pacific stock is 26,635 animals (CV = 0.1006) based on shore counts from a 1997/1998 survey (Hobbs and Rugh 1999). This estimate is not significantly larger than estimates from the 1995/96 survey or the 1993/94 (22,263 and 23,109, respectively), but it is significantly higher than the 1992/93 survey (17,674).

No mortalities were reported for any of the six Alaska fisheries from 1990-98. There was a minimum estimated annual mortality of 5.9 resulting from commercial fisheries (Angliss *et al.* 2001). That estimate was based on reports from NMFS observers and self reports in 1990-98 for the following fisheries: the northern Washington set gillnet fishery (0.2), the CA/OR thresher shark/ swordfish drift gillnet fishery (1.0), the Bristol Bay salmon set and drift gillnet fishery (0.5), and from unknown West coast fisheries (4.2) (Angliss *et al.* 2001). This stock of gray whales is subjected to direct takes from subsistence hunters. In 1997, the IWC approved a 5-year quota (1998-2002) of 620 gray whales for Russian and U.S. aboriginals, to average 124/ year and not to exceed 140 whales. In 1998, 122 whales were harvested. Another source of human-caused mortalities for gray whales is ship-strikes, averaging a minimum of 1 whale per year from 1990-98 (Angliss *et al.* 2001).

The total human-caused mortalities was estimated to be 83, therefore, the eastern North Pacific stock is not classified as strategic under the MMPA because it does not exceed PBR (575) (Angliss *et al.* 2001). In 1999, NMFS convened a meeting at NMML on the status of gray whales since their de-listing from the ESA in 1994. It was decided at the meeting the this stock of gray whales have continued to increase and are in no threat of becoming extinct (Angliss *et al.* 2001). Therefore, their status remains unlisted. The western North Pacific stock is still considered endangered under the ESA.

Minke Whale (*Balaenoptera acutorostrata*): The minke whale has a cosmopolitan distribution in polar, temperate and tropical waters worldwide. Several stocks are recognized around the world. The IWC recognizes three stocks of minke whales in the North Pacific: one in the Sea of Japan/East China Sea, one in the rest of the western Pacific west of 180°N, and one in the remainder of the Pacific (Donovan 1991). Although reliable abundance estimates do not exist for several of the stocks, the worldwide population size of minke whales is likely in the hundreds of thousands.

In U.S. waters of the North Pacific, two stocks of minke whales, the California/Oregon/Washington stock and the Alaska stock, are recognized for management purposes under the MMPA. No estimates have been made for the number of minke whales in the entire North Pacific. The best estimate for the California/Oregon/Washington stock is 631 minke whales (CV = 0.45) based on ship survey off California, Oregon and Washington between 1991 and 1996 (Barlow 1997). Minke whales from this stock may occasionally be incidentally taken in both coastal set gillnets and offshore drift gillnets. Coastal set gillnets are used to catch halibut, flounder, angel, shark, yellowtail, white seabass, and white croaker in California coastal waters. Drift gillnets are used to catch swordfish, thresher shark, and mako shark in California offshore waters (Hanan *et al.* 1993). Mean annual fishery takes were zero, based on 1994-98 data; however, only 1997-98 mortality estimates were included due to the 1997 Take Reduction Plan reducing takes significantly (Carretta *et al.* 2001). The overall marine mammal mortality rate in this fishery is similar to the California driftnet fisheries during 1990-1995 (0.14 marine mammals per set; Julian and Beeson 1998), but species-specific information is not available for the Mexican fishery. The status of this stock is unknown and there is no information on trends in the abundance. The annual human-caused mortality appears to be less than the calculated PBR for this stock (4.4), so they are not considered a strategic stock under the MMPA. Additionally, they are not listed as depleted under the MMPA.

There are no abundance estimates for the Alaska stock of minke whales. Like animals in the California/Oregon/ Washington stock, minke whales of the Alaska stock are reportedly taken incidentally in coastal set gillnets and drift gillnets. However, there have been no reported mortalities since 1995, which is possibly a sign of under-reporting. Nonetheless, this leads to a mortality estimate of zero from the fishery. The status of this stock is unknown, which is mainly a result of the uncertainty pertaining to the stock structure of this species in the eastern North Pacific. Minke whales are considered common in the waters off Alaska and are not considered endangered under the ESA or strategic stock under the MMPA because human-related removals currently are thought to be near-zero (Angliss *et al.* 2001).

In the North Atlantic, the following four stocks are recognized: Canadian east coast, west Greenland, central North Atlantic, and northeastern North Atlantic (Donovan 1991). Minke whales in the waters off the U.S. east coast are considered to be part of the Canadian east coast population, which inhabits the area from the eastern half of Davis Strait out to 45°W and south to the Gulf of Mexico. The total number of minke whales in the Canadian east coast stock is unknown. The best abundance estimate for this stock in U.S. waters is 4,018 (CV=0.16), the sum of a 1999 survey from George's Bank to the Gulf of St. Lawrence (2,998) and a 1995 Gulf of St. Lawrence survey (1,020) (Waring *et al.* 2001). The total annual estimated fishery-related mortality in Atlantic fisheries was 2.2 minke whales per year and the total estimated human-caused mortality was 2.4 minke whales per year. However, accurate estimates of human-caused mortality are not available because it is likely that many entanglements, injuries, and mortalities go unobserved or unrecorded. The status of this stock relative to OSP is unknown. Estimated fishery-related mortality does not exceed PBR (35) for this stock; thus, it is not considered strategic under the MMPA.

Whaling for minke whales occurs in the Antarctic where the Japanese take approximately 300 animals per year under a scientific permit issued by the IWC and in the North Atlantic where the Norwegian commercial take has numbered about 200-300 animals each year since 1993.

Sei Whale (*Balaenoptera borealis*): The Sei whale is widely distributed in all oceans, although it is not found as far into polar waters as the other rorquals (Gambell 1985). Several stocks of sei whales have been devised by Updated estimates of the number of sei whales worldwide are not available, but the Southern Hemisphere stocks are thought to number 37,000 and the North Pacific stock about 14,000. The general lack of information regarding sei whales in the Atlantic has precluded the stocks there from being adequately assessed, but only a few thousand sei whales are thought to occur in the North Atlantic (Allen 1980). In the North Pacific, the IWC recognizes only one stock of sei whales (Donovan 1991), but some evidence exists for multiple populations (Masaki 1977; Mizroch *et al.* 1984; Horwood 1987). Lacking additional information on sei whale population structure, sei whales in the eastern North Pacific (east of longitude 180°) are considered a separate stock for management purposes under the MMPA. Only one confirmed sighting of a sei whale and 5 possible sightings (identified as sei or Bryde's whales) were made in California waters during extensive ship and aerial surveys in 1991, 1992 and 1993 (Hill and Barlow 1992; Carretta and Forney 1993; Mangels and Gerrodette 1994). Green *et al.* (1992) did not report any sightings of sei whales in aerial surveys of Oregon and Washington. There are no abundance estimates for sei whales along the west coast of the U.S. or in the eastern North Pacific.

To date, no sei whales mortality has been associated with any eastern North Pacific fisheries, but the true mortality rate must be considered unknown because of unobserved mortality. Previously, sei whales were estimated to have been reduced to 20% (8,600 out of 42,000) of their pre-whaling abundance in the North Pacific (Tillman 1977). The initial abundance has never been reported separately for the eastern North Pacific stock, but this stock was also probably depleted by whaling. Under the MMPA, this stock is considered depleted and strategic because the sei whales is listed as endangered under the ESA. A possible habitat concern for sei whales is the increasing levels of anthropogenic noise that may affect their communication (Carretta *et al.* 2001).

In the North Atlantic, the IWC adopted general boundaries for two stocks of sei whales, the Nova Scotia stock and the Labrador Sea stock; however, the IWC also noted that the stock identity of sei whales was a major research problem. For management purposes under the MMPA, the proposed IWC stock definition is provisionally adopted; thus, the Nova Scotia stock, also called the western North Atlantic stock, of sei whales is the only stock recognized in U.S. Atlantic waters. There are no current estimates of abundance for this stock (Waring *et al.* 2001). There are no reports of mortality, entanglement or injury of sei whales in these waters, although the total level of fishery-related mortality is unknown, it is believed to be insignificant (Waring *et al.* 2001). The status of this stock relative to OSP is unknown. This stock is considered depleted and strategic under the MMPA because the sei whale is listed as endangered under the ESA. A recovery plan for sei whales has been written and is waiting for legal clearance (Waring *et al.* 2001).

Bryde's Whale (*Balaenoptera edeni*): The Bryde's whale has a pantropical distribution and several stocks are recognized throughout the world's oceans. It is one of the least known of the large whales and its population size is virtually unknown (Cummings 1985). Confusion of this species with sei whales has been widespread, leading to uncertainties about the exact distribution of both species in the areas of overlap (Klinowska and Cooke 1991).

The IWC recognizes three stocks of Bryde's whale in the North Pacific Ocean (eastern, western, and east China Sea), three stocks in the South Pacific Ocean (eastern, western, and Solomon Islands), and one cross-equatorial stock (Peruvian) (Donovan 1991). This species is widely distributed across the tropical and warm-temperate waters of the Pacific (Leatherwood *et al.* 1982), and there is no real justification for splitting stocks between the northern and southern hemispheres (Donovan 1991). Recent surveys (Wade and Gerrodette 1993; Lee 1993) have shown them to be common and distributed throughout the ETP with a concentration around the equator east of 110°W (corresponding approximately to the IWC's "Peruvian" stock) and a reduction west of 140°W. They are also the most common baleen whale in the central Gulf of California (Tershy *et al.* 1990). Only one Bryde's whale was positively identified in surveys of California coastal waters (Barlow 1995). Bryde's whales in these waters are likely to belong to a larger population inhabiting at least the eastern part of the tropical Pacific Ocean. For management purposes under the MMPA, two stocks of Bryde's whales are recognized in the U.S. waters of the eastern Pacific, the ETP stock (east of 150°W and including the Gulf of California and waters off California) and the Hawaii stock.

Bryde's whale abundance has never been estimated for the entire eastern Pacific Ocean; however, a portion of that stock in the ETP was estimated recently at 13,000 (CV = 0.20) (Wade and Gerrodette 1993), an estimate of 12 animals in California, Oregon and Washington (Barlow 1997), and the minimum number in the Gulf of California is 160 based on individually-identified whales (Tershy *et al.* 1990). The only fishery that Bryde's whales potentially interact with is the offshore drift gillnet fishery, but there were no observed mortalities from 1994-98 (Carretta *et al.* 2001). Similar driftnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and may take animals from the same population. The overall marine mammal mortality rate in this fishery is similar to the California driftnet fisheries during 1990-1995 (0.14 marine mammals per set; Julian and Beeson 1998), but species-specific information is not available for the Mexican fishery. The ETP stock of Bryde's whales is not considered strategic under the MMPA.

Twelve aerial surveys were flown within 25 nmi of the main Hawaiian Islands between 1993-1998 and resulted in no sightings of Bryde's whales. Therefore there is no estimate of abundance for this stock. Wade and Gerrodette (1993) estimated the abundance of Bryde's whales in the ETP to be 13,000 (CV=0.202); however, it is not known if any of these animals are part of the Hawaiian stock. No estimate of annual human-caused mortality is available for the Hawaiian stock because there are no reports of recent direct or incidental takes of Bryde's whales in Hawaiian waters (Carretta *et al.* 2001). The overall status of the Bryde's whale in Hawaiian waters is unknown. Although information on Bryde's whales in Hawaiian waters is limited, this stock is not considered strategic under the MMPA given the absence of reported fishery-related mortality.

In the Atlantic Ocean, Bryde's whales are seen from Virginia, the Gulf of Mexico, and the Caribbean southward to Brazil, and from Morocco southward to the Cape of Good Hope (Cummings 1985). In the eastern Atlantic, it is postulated that the Bryde's whales found in the Gulf of Mexico may represent a resident stock (Schmidly 1981; Leatherwood and Reeves 1983), but there is no information on stock differentiation. For management purposes under the MMPA, a single stock of Bryde's whales is recognized in the U.S. waters of the eastern North Atlantic and is called the Northern Gulf of Mexico stock. The estimate average abundance for this stock is 35 animals (CV = 1.10) based on vessel surveys in the early 1990's (Hansen *et al.* 1995). The level of human-caused mortality of Bryde's whales in the northern Gulf of Mexico is unknown, but available information indicates there is little, if any, fisheries interactions with this species (Blaylock *et al.* 1995). The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. Because the total level of human-caused mortality is thought to be insignificant, this stock is not considered strategic under the MMPA.

The species' range within the Indian Ocean spans from the Cape of Good Hope north to the Persian Gulf, east to Burma and south to Shark Bay, Western Australia. Bryde's whales are also found in the central Indian Ocean (Best 1977; Cummings 1985; Leatherwood and Reeves 1989; Robineau 1991; Kasuya and Wada 1991). Information from Japanese whaling and research vessels indicate there are at least four Bryde's whale stocks in the Indian Ocean (Kasuya and Wada 1991). Although the current status of Bryde's whales in these waters is unknown, it is probably better off than most of the other large baleen whales, mainly because it inhabits tropical and low-latitude waters, most of which have been closed to pelagic whaling since the 1930s by measures originally intended to protect the breeding grounds of other baleen whale species. In addition, Bryde's whales were not of major interest to commercial pelagic whaling fleets.

Blue Whale (*Balaenoptera musculus*): Blue whales are found in tropical to polar waters worldwide. The IWC formally recognizes several management stocks, but stock differentiation for blue whales throughout the world still remains equivocal.

In the North Pacific, the IWC only recognizes one stock (Donovan 1991); however, strong evidence exists for a separate population that spends winter/spring in Mexican coastal waters and summer/autumn in California waters (Calambokidis et al. 1990; Barlow *et al.* 1995). For management purposes under the MMPA, two stocks are considered to occur in U.S. waters of the North Pacific, the eastern North Pacific stock (California/Oregon/Washington) and the Hawaii stock. The best abundance estimate for this stock is 1,940 blue whales (CV=0.15), resulting from averaging line transect (Barlow 1997) and a mark-recapture (Calambokidis and Steiger 1994) results, weighted by their variances (Calambokidis and Barlow 2004). The population trend has some indication of an increase since 1979/80 (Barlow 1994), but this is not conclusive when compared to other studies.

Blue whales from this stock potentially interact with the offshore gillnet fishery, but no mortalities or serious injury were observed from 1994 to 1998 (Carretta *et al.* 2001). Similar driftnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and may take animals from the same population. The overall marine mammal mortality rate in this fishery is similar to the California driftnet fisheries during 1990-1995 (0.14 marine mammals per set; Julian and Beeson 1998), but species-specific information is not available for the Mexican fishery. Previously, blue whales in the entire North Pacific were estimated to be at 33% (1,600 out of 4,900) of historic carrying capacity (Mizroch *et al.* 1984). The initial abundance has never been estimated separately for the "California" stock, but it was almost certainly depleted by commercial whaling. Because blue whales are formally classified as endangered under the ESA, the California/Oregon/Washington stock is considered strategic under the MMPA.

Blue whales are extremely rare in Hawaii and there is no data available to estimate population size for the Hawaiian stock (Carretta *et al.* 2001). Twelve aerial surveys were flown from 1993-1998 within 25 nmi of the main Hawaiian Islands and resulted in no sightings of blue whales. Wade and Gerrodette (1993) estimated there are 1,400 blue whales in the ETP. No estimate of human-caused mortality of the Hawaiian stock is available because there are no reports of recent direct or incidental takes of blue whales in Hawaiian waters. The status of the Hawaiian stock is unknown, but the Hawaiian stock is automatically considered strategic and depleted under the MMPA because blue whales are classified as endangered under the ESA.

In U.S. waters of the western North Atlantic, a single stock of blue whales is recognized for management purposes under the MMPA, but little is known of these animals except in the Gulf of St. Lawrence area. Sears *et al.* (1987) catalogued 308 animals and this is considered N_{min} for this stock of blue whales (Waring *et al.* 2001). There are no records of fishery-related mortality of blue whales in U.S. Atlantic waters. This stock's status relative to OSP is unknown and there are insufficient data to determine trends in abundance. The total level of human-caused mortality is unknown, but is believed to be insignificant; however, because this stock of blue whales is classified as endangered under the ESA it is considered a strategic under the MMPA.

In the eastern North Atlantic, the blue whale population near Iceland is estimated to be increasing by about 5% per year since 1969 (Sigurjonsson and Gunnlagusson 1990). In the Southern Hemisphere, however, recent estimates suggest that only a few thousand blue whales survive (Yochem and Leatherwood 1985; Butterworth and De Decker 1990; Borchers *et al.* 1991).

The Antarctic blue whale (*Balaenoptera musculus intermedia*) ranges from Australia and New Zealand to Madagascar, South Africa, Namibia, Angola, Gabon, Argentina, Brazil, Chile and Peru (Boyd 2002). Their abundance is estimated in the range of 400 to 500 whales (Boyd 2002). The small population size due to past hunting is a potential threat to this group of whales (Boyd 2002).

Fin Whale (*Balaenoptera physalus*): The fin whale occurs in all major oceans worldwide and seasonally migrates between temperate and polar waters (Gambell 1985). Several stocks have been suggested for both the Southern and Northern Hemisphere. However, whether the current stock boundaries define biologically isolated units is uncertain and confirmation or revision of such boundaries awaits further study. Available abundance estimates for fin whale stocks worldwide vary in their reliability, depending on the data available and the analytical techniques used. Fin whales in the Southern Hemisphere number approximately 103,000 (Gambell 1985) .

In the North Pacific, the IWC recognizes two stocks of fin whales, the east China Sea stock and the rest of the North Pacific (Donovan 1991). For management purposes under the MMPA, four stocks of fin whales are recognized in the U.S. waters: the California/Oregon/Washington stock, the Alaska stock (Northeast Pacific), the Hawaii stock, and the western North Atlantic stock.

Recently, 1,851 fin whales (CV=0.19) were estimated for California, Oregon and Washington waters based on ship surveys in summer/autumn of 1993 and 1996 (Barlow and Taylor 2001). There is some indication that fin whales have increased in abundance in California coastal waters between 1979/80 and 1991 (Barlow 1991) and between 1991 and 1996 (Barlow 1997), but these trends are not significant. The only fishery that potentially interacts with fin whales is the offshore drift gillnet fishery. One fin whale death was observed in 1999 and this resulted in an estimated average annual take from 1995-99 of 1.5 whales. Fin whales in the entire North Pacific were estimated to be less than 38% (16,625 out of 43,500) of historic carrying capacity (Mizroch *et al.* 1984). Because fin whales are listed as an endangered species under the ESA, this stock is automatically considered strategic under the MMPA. The observed fishery mortality (1.5) is greater than 10% of PBR (0.32) and therefore cannot be considered insignificant and approaching zero.

There are no abundance estimates for the Alaska or Hawaii stocks. There was 1 fishery-related mortality observed for the Alaska stock, averaging a minimum estimated annual mortality of 0.6 for 1995-99 (Angliss *et al.* 2001). This cannot be considered insignificant since the status of the stock is unknown. The status of the Alaska and Hawaii stocks relative to OSP is unknown and both stocks are considered strategic under the MMPA because the fin whale is listed as endangered under the ESA.

Although it is generally agreed that fin whale stocks in the North Atlantic have all been reduced to some extent, their degree of depletion has been disputed (Reeves and Leatherwood 1994). The total current population in the North Atlantic may be somewhat more than 46,000 (IWC 1992b; Buckland *et al.* 1992). Fin whales off the eastern U.S. coast, north to Nova Scotia to the southeast coast of New Foundland are believed to constitute a single stock by the IWC

(Donovan 1991). For management purposes under the MMPA, this group of fin whales is considered a single stock and is called the western North Atlantic stock. A minimum population estimate of 2,362 fin whales has been suggested for this stock (Waring *et al.* 2001). NMFS anecdotal records from 1995-99 resulted in an estimated annual fishery take of 0.6 and yielded an average 1.8 human caused mortalities per year; however, these data only encompass a portion of this stocks range (Waring *et al.* 2001). The fishery mortalities cannot be considered insignificant because it exceeds 10% of PBR. The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This stock is considered strategic under the MMPA because the fin whale is listed as endangered under the ESA.

In the Indian Ocean there have been very few fin whale sightings recorded (Leatherwood and Reeves 1989), except for those recorded on the Japanese whaling and research vessels (Ohsumi and Yamamura 1982; Kasuya and Wada 1991).

Humpback Whale (*Megaptera novaeangliae*): The humpback whale has a cosmopolitan distribution and several stocks are recognized throughout the world. This species occurs in all ocean basins, though it is less common in Arctic waters. Katona and Beard (1990) estimated that approximately 8,000 individual humpback whales had been photo-identified throughout the world as of 1990, and this number has increased substantially since then. The world population of humpbacks is probably still in the low tens of thousands. At present there is little direct killing of humpback whales, and incidental mortality is apparently not a major problem in most areas.

Although the IWC only recognizes a single stock in the North Pacific (Donovan 1991), there is now good evidence for multiple populations of humpback whales here (Johnson and Wolman 1984; Baker *et al.* 1990; Calambokidis et al. 2001). Four relatively separate migratory populations have been identified in the North Pacific (Barlow 1995; Calambokidis et al. 2001) based on sightings of distinctively-marked individuals: the eastern North Pacific stock (coastal California/Oregon/Washington - Mexico stock)(Calambokidis et al. 1997, 2001, 2004; Urbán et al. 2000), the Mexico offshore island stock (feeding destination unknown), the central North Pacific stock (Hawaii/Alaska), and the western North pacific stock (Japan/feeding destination probably the Aleutian Islands). All but the Mexico offshore island stock are formally recognized for management purposes under the MMPA.

The eastern north Pacific stock (California/Oregon/Washington - Mexico) is estimated at 1,024 humpback whales (CV = 0.10) (Calambokidis *et al.* 2000). Mark-recapture population estimates provide some indication that humpback whales of this stock are increasing, although estimates from 1999 to 2001 represented the first substantial decline in number in this trend (Calambokidis and Barlow 2004; Calambokidis et al. 2003). Humpback whales from this stock are likely to be taken only in offshore drift gillnets, which are used to catch swordfish, thresher shark, and mako shark. The deaths of two humpback whales in southern California have been attributed to entanglement in fishing gear (Heyning and Lewis 1990). Also, two unidentified whales, possibly humpbacks, were taken in the approximately 1% of drift gillnets observed in 1980-1985 (Hanan 1986; Heyning and Lewis 1990). Total annual fishery takes, averaged from 1995-99 was 0.2 (Carretta *et al.* 2001). Similar driftnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and may take animals from the same population. The overall marine mammal mortality rate in this fishery is similar to the California driftnet fisheries during 1990-1995 (0.14 marine mammals per set; Julian and Beeson 1998), but species-specific information is not available for the Mexican fishery. Humpback whales are classified as endangered under the ESA; thus, California/Oregon/Washington - Mexico stock is automatically considered depleted and strategic under the MMPA.

The central North Pacific stock of humpback whales winters in Hawaiian waters and migrates in the spring to northern British Columbia/Southeast Alaska and Prince William Sound west to Kodia (Calambokidis *et al.* 1997). The most recent abundance estimate for the central North Pacific stock of humpback whales is 4,005 (CV=0.095) whales, based on averaging estimates of abundance in their wintering areas from 1991-1993 (Calambokidis *et al.* 1997). The estimated minimum mortality rate incidental to commercial fisheries is 3.5 humpback whales per year (determined from 1990-99 data), based on observer data (0.4), and self-reported fisheries information (0.4) , stranding records traceable to a specific fishery (0.2) and other stranding records indicating mortality or serious injury (2.5). Additionally, mortalities due to ship strikes averaged 0.8 from 1995-99. Fishery caused mortalities (3.5) exceeds 10% of PBR (0.7) and therefore cannot be considered insignificant. Since the estimated total human caused mortality (4.3) is a minimum estimate, it is unclear if this exceeds PBR (7.4). The humpback whale is listed as endangered under the ESA and therefore is also listed as depleted and strategic under the MMPA.

The western North Pacific stock spends winter/spring off Japan and probably migrates to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian Islands)in the summer/fall (Berzin and Rovnin 1966; Nishiwaki 1966; Darling 1991). The most recent abundance estimate for the central North Pacific stock of humpback whales is 394 (CV=0.084) whales, based on averaging estimates of abundance in their wintering areas from 1991-1993 (Calambokidis *et al.* 1997). NMFS observers reported 1 mortality of humpback whales incidental to commercial fisheries in Alaska in 1999 and 1 humpback whale stranded in 1997 due to an unknown fishery. These give an minimum estimated annual mortality of 0.6 from 1990-99 (Angliss *et al.* 2001). This number (0.6) exceeds 10% of PBR (0.07) and therefor cannot be considered insignificant. Since the estimated human-caused mortality (0.6) is a minimum, it is unclear if this exceeds the PBR (0.7) (Angliss *et al.* 2001). This stock is considered strategic under the MMPA because humpback whales are listed as endangered under the ESA. Trend data and the status of this stock relative to OSP are currently unknown.

For management purposes under the MMPA, a single stock of humpback whales is recognized in the U.S. waters of the North Atlantic, and that is the Gulf of Maine stock. The best abundance estimate for this stock is 816 (CV=0.45) whales (Palka 2000). The best estimate for the entire North Atlantic (including the Gulf of Maine) is 10,600 (CV=0.067) humpback whales, based on photographic mark-recapture analyses (Smith *et al.* 1999). The total level of human-caused mortality is unknown, but current data indicate that it is significant (Waring *et al.* 2001). Because humpback whales are classified as endangered under the ESA, the western North Atlantic stock is considered depleted and strategic under the MMPA.

Reeves *et al.* (1991) reviewed the records of humpback whales in the northern Indian Ocean to determine whether this population is separate form the Antarctic population. From available data, they concluded that some humpbacks are resident in the northern Indian Ocean, which is in agreement with studies done by Payne and Katona (1986). There are roughly 500+ humpback whales in the northern Indian Ocean (Winn and Reichley 1985) and approximately 12,000 animals in the Southern Hemisphere (Borchers *et al.* 1991).

PINNIPEDS:

California Sea Lion (*Zalophus californianus*): California sea lions breed on San Miguel, San Nicolas, Santa Barbara, and San Clemente islands in southern California. The minimum population size of the U.S. stock is 109,854 (NMFS unpubl. data). It includes all California sea lions counted during the July 1999 census at the four rookeries in southern California and at the haulout sites located between Point Conception and the Oregon/California border. The minimum population size was determined from counts of all age and sex classes that were ashore at all the major rookeries and haulout sites during the 1999 breeding season. Between 1980 and 1999 the net productivity rate averaged 16.1%. California sea lions are killed incidentally in set and drift gillnet fisheries They are not listed as "endangered" or "threatened" under the Endangered Species Act or as "depleted" under the MMPA.

Harbor Seal (*Phoca vitulina*): Harbor seals are widely distributed in the North Atlantic and North Pacific. Two subspecies exist in the Pacific: *P. v. stejnegeri* in the western North Pacific, near Japan, and *P. v. richardsi* in the eastern North Pacific. The latter subspecies inhabits near-shore coastal and estuarine areas from Baja California, Mexico, to the Pribilof Islands in Alaska. The minimum size of the California harbor seal population is 27,962 (2001 SAR). Harbor seal counts have continued to increase except during El Niño events (eg. 1992-93). The net production appears, however, to be slowing in California (Fig. 3) and in Oregon and Washington. The minimum population estimate for the stock along the Oregon/Washington coast is 24,70 5 harbor seals.
Historical levels of harbor seal abundance in Oregon and Washington are unknown.
Between 1983 and 1996, the annual rate of increase for this stock was 4%. Harbor seals are not considered to be “depleted” under the MMPA or listed as “threatened “ or “endangered” under the Endangered Species Act.

Northern Elephant Seal (*Mirounga angustirostris*): Northern elephant seals are distributed in the northeast Pacific Ocean. The minimum population size for northern elephant seals can be estimated very conservatively as 51,625. Based on trends in pup counts, northern elephant seal colonies were continuing to grow in California through 1994 but app ear to be stable o r slowly decreasing in Mexico. Northern elephant seals are incidentally caught in drift gillnet and set gillnet fisheries, however, the population is continuing to grow and fishery mortality is relatively constant. They are not listed as "endangered" or "threatened" under the Endangered Species Act nor as "depleted" under the MMPA.

Steller Sea Lion (*Eumetopias jubatus*): Steller sea lion are distributed across the North Pacific Ocean rim from northern Hokkaido, Japan, through the Kuril Islands, Okhotsk Sea, and Commander Islands in Russia, the Aleutian Islands, central Bering Sea, and southern coast of Alaska, and south to the Channel Islands off California. The minimum population estimate is 34,600 for the western U. S. stock of Steller sea lion. The number of Steller sea lions in the western stock has shown a continuous decline since the 1970s. Steller sea lions are taken incidentally in several commercial fisheries operating within the stock’s range. The western U. S. stock of Steller sea lion is currently listed as “endangered” under the ESA, and therefore designated as “depleted” under the MMPA. The stock is classified as a strategic stock. The eastern stock of Steller Sea lions includes animals east of Cape Suckling, Alaska and is distributed down the West Coasts of Canada and the United States. The minimum population estimate for the eastern stock is 31,082 (2002 SAR). The eastern U. S. stock of Steller sea lion is currently listed as “threatened” under the ESA, and therefore designated as “depleted” under the MMPA. As a result, this stock is classified as a strategic stock.

Northern Fur Seal (*Callorhinus ursinus*): Northern fur seals occur from southern California north to the Bering Sea and west to the Okhotsk Sea and Honshu Isalnd, Japan (Angliss and Lodge 2003). During the breeding season, about three-quarters of the worldwide population is found on the Pribilof Islands in the southern Bering Sea; others are found in the southern Bering Sea and San Miguel Island off southern California (NMFS 1993). The animals that we will encounter will be animals from either the Eastern Pacific of San Miguel Island stock, found offshore at sea during the non-breeding season, when both males and females leave the breeding areas and migrate south to spend 7-8 months at sea (Roppel 1984 in Angliss and Lodge 2003). Adults females and pups from the Pribilof Islands migrate into the North Pacific Ocean, ofter to the Oregon and California offshore waters. Many pups may remain at sea for 22 months before returning to their rookery of birth. Adult males migrate south in the Gulf of Alaska (Kajimura 1984 in Angliss and Lodge 2003). The most recent abundance estimate for the Eastern Pacific stock is 888,120 animals (Angliss and Lodge 2003). Numbers have declined since the mid-1970s, recent pup counts were lower than previous years; estimated pup production is now below levels found in the early 1900s (Angliss and Lodge 2003). The Alaska population of northern fur seals was designated as “depleted” under the MMPA in 1988 (NMFS 1993). The San Miguel population is not considered to be “depleted” under the MMPA or listed as “threatened” or “endangered” under the ESA.

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