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Draft U.S. Pacific Marine Mammal Stock Assessments: 2009

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NOAA Technical Memorandum NMFS

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U. S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

NOAA Technical Memorandum NMFS
This TM series is used for documentation and timely communication of preliminary results, interim reports, or special purpose information. The TMs have not received complete formal review, editorial control, or detailed editing.

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PREFACE

Under the 1994 amendments to the Marine Mammal Protection Act (MMPA), the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) are required to publish Stock Assessment Reports for all stocks of marine mammals within U.S. waters, to review new information every year for strategic stocks and every three years for non-strategic stocks, and to update the stock assessment reports when significant new information becomes available. This report presents stock assessments for 13 Pacific marine mammal stocks under NMFS jurisdiction, including 8 "strategic" stocks and 5 "non-strategic" stocks (see summary table). A new stock assessment for humpback whales in American Samoa waters is included in the Pacific reports for the first time. New or revised abundance estimates are available for 9 stocks, including Eastern North Pacific blue whales, American Samoa humpback whales, five U.S. west coast harbor porpoise stocks, the Hawaiian monk seal, and southern resident killer whales. A change in the abundance estimate of Eastern North Pacific blue whales reflects a recommendation from the Pacific Scientific Review Group to utilize mark-recapture estimates for this population, which provide a better estimate of total population size than the average of recent line-transect and mark-recapture estimates. The 'Northern Oregon/Washington Coast Stock' harbor porpoise stock assessment includes a name change ('Oregon' is appended to 'Northern Oregon') to reflect recent stock boundary changes. Changes in abundance estimates for the two stocks of harbor porpoise that occur in Oregon waters are the result of these boundary changes, and do not reflect biological changes in the populations. Updated information on the three stocks of false killer whales in Hawaiian waters is also included in these reports. Information on the remaining 50 Pacific region stocks will be reprinted without revision in the final 2009 reports and currently appears in the 2008 reports (Carretta *et al.* 2009). Stock Assessments for Alaskan marine mammals are published by the National Marine Mammal Laboratory (NMML) in a separate report.

Pacific region stock assessments include those studied by the Southwest Fisheries Science Center (SWFSC, La Jolla, California), the Pacific Islands Fisheries Science Center (PIFSC, Honolulu, Hawaii), the National Marine Mammal Laboratory (NMML, Seattle, Washington), and the Northwest Fisheries Science Center (NWFSC, Seattle, WA). Northwest Fisheries Science Center staff prepared the report on the Eastern North Pacific Southern Resident killer whale. National Marine Mammal Laboratory staff prepared the Northern Oregon/Washington coast harbor porpoise stock assessment. Pacific Islands Fisheries Science Center staff prepared the report on the Hawaiian monk seal. Southwest Fisheries Science Center staff prepared stock assessments for 9 stocks. The stock assessment for the American Samoa humpback whale was prepared by staff from the Center for Coastal Studies, Hawaiian Islands Humpback National Marine Sanctuary, the Smithsonian Institution, and the Southwest Fisheries Science Center.

Draft versions of the stock assessment reports were reviewed by the Pacific Scientific Review Group at the November 2008, Maui meeting. The authors also wish to thank those who provided unpublished data, especially Robin Baird and Joseph Mobley, who provided valuable information on Hawaiian cetaceans. Any omissions or errors are the sole responsibility of the authors.

This is a working document and individual stock assessment reports will be updated as new information on marine mammal stocks and fisheries becomes available. Background information and guidelines for preparing stock assessment reports are reviewed in Wade and Angliss (1997). The authors solicit any new information or comments which would improve future stock assessment reports.

These Stock Assessment Reports summarize information from a wide range of sources and an extensive bibliography of all sources is given in each report. We strongly urge users of this document to refer to and cite *original* literature sources rather than citing this report or previous Stock Assessment Reports. If the original sources are not accessible, the citation should follow the format: [Original source], as cited in [this Stock Assessment Report citation].

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HAWAIIAN MONK SEAL (*Monachus schauinslandi*)

STOCK DEFINITION AND GEOGRAPHIC RANGE

Hawaiian monk seals are distributed predominantly in six Northwestern Hawaiian Islands (NWHI) subpopulations at French Frigate Shoals, Laysan and Lisianski Islands, Pearl and Hermes Reef, and Midway and Kure Atoll. Small numbers also occur at Necker, Nihoa, and the main Hawaiian Islands (MHI). Genetic variation among NWHI monk seals is extremely low and may reflect both a long-term history at low population levels and more recent human influences (Kretzmann et al. 1997, 2001, Schultz et al. in press). On average, 10-15% of the seals migrate among the NWHI subpopulations (Johnson and Kridler 1983; Harting 2002). Thus, the NWHI subpopulations are not isolated, though the different island subpopulations have exhibited considerable demographic independence. Observed interchange of individuals among the NWHI and MHI regions is extremely rare, suggesting these may be more appropriately designated as separate stocks. Further evaluation of a separate MHI stock will be pursued following yet preliminary genetic stock structure analysis (Schultz et al. in prep.) suggests and additional studies of MHI monk seals. In the mean time, the species is appropriately managed as a single stock.

POPULATION SIZE

The best estimate of the total population size is 1,1461,208. This estimate is the sum of estimated abundance at the six main Northwest Hawaiian Islands subpopulations, an extrapolation of counts at Necker and Nihoa Islands, and an estimate of minimum abundance in the main Hawaiian Islands. The number of individual seals identified was used as the population estimate at NWHI sites where total enumeration was achieved according to the criteria established by Baker et al. (2006). Where total enumeration was not achieved, capture-recapture estimates from Program CAPTURE were used (Baker 2004; Otis et al. 1978, Rexstad & Burnham 1991, White et al. 1982). When no reliable estimator was obtainable in Program CAPTURE (i.e., the model selection criterion was < 0.75, following Otis et al. 1978), the total number of seals identified was the best available estimate. Finally, sometimes capture-recapture estimates are less than the known minimum abundance (Baker 2004), and in these cases the total number of seals identified was used. In 2006 2007, total enumeration was not definitively achieved at any site, however analysis of discovery curves (Baker et al. 2006) suggested that nearly all seals were identified at Laysan Island, Pearl and Hermes Reef, Midway and Kure Atolls. Capture-recapture analysis either found no suitable estimator was availableor the estimate was lower than known minimum abundance. Thus, abundance at the six main subpopulations was estimated to be 935 (including 151 pups) based upon the total number of seals identified. identification efforts were conducted during two- to six-month studies at all main reproductive sites. Total enumeration was achieved at Lisianski Island, and at Midway Atoll a capture-recapture estimate was lower than the known minimum abundance, so that the latter was considered the best estimate. At the remaining sites, no reliable capture-recapture estimate was obtained, and in these cases minimum abundance was also used. The total abundance estimate at the six main subpopulations in 2006 was 1,016 seals (including 165 pups). Monk seals also occur at Necker and Nihoa Islands, where counts are conducted from zero to a few times in a single year. Abundance is estimated by correcting the mean of all beach counts accrued over the past five years. The mean (±SD) of all counts (excluding pups) conducted between 20032002 and 20072006 was 13.5 (±5.2) 12.3 (±5.5) at Necker Island and 25 (±2.8) 23.0 (±6.6) at Nihoa Island (Johanos and Baker 2004, 2005, 2007, in press, in prep.). The relationship between mean counts and total abundance at the reproductive sites indicates that the total abundance can be estimated by multiplying the mean count by a correction factor of 2.89 (NMFS unpubl. data). Resulting estimates (plus the average number of pups known to have been born during 20032-20076) are 42.0 (±15.0) 37.3 (±15.9) at Necker Island and 78.7 (±8.0) 71.7 (±19.2) at Nihoa Island.

The only complete and systematic surveys for monk seals in the MHI were conducted in 2000 and 2001 (Baker and Johanos 2004). The NMFS collects information on seal sightings reported by a variety of sources. Recently, the number of such reports has increased and related database improvement efforts have been underway. The total number of individually identifiable seals documented in this way in 20072006 was 9083, the current best minimum abundance estimate.

Minimum Population Estimate

The total number of seals 935 (1,016) identified at the six main NWHI reproductive sites is the best estimate of minimum population size at those sites. Minimum population sizes for Necker and Nihoa Islands (based on the formula provided by Wade and Angliss (1997)) are 31 and 72 26 and 57, respectively. The minimum abundance estimate for the main Hawaiian Islands in 20072006 is 9083 seals. The minimum population size for the entire stock (species) is the sum of these estimates, or 1,1291,183 seals.

Current Population Trend

The total of mean non-pup beach counts at the six main reproductive NWHI subpopulations in 2007~~2006~~ is 68%~~66%~~ lower than in 1958. The trend in total abundance at the six main NWHI subpopulations estimated as described above is shown in Figure 1. A log-linear regression of estimated abundance on year from 1998 (the first year for which a reliable total abundance estimate has been obtained) to 2007~~2006~~ estimates that abundance declined -4.1% yr^{-1} ~~-3.9%~~ yr^{-1} (95% CI = -4.9% to -3.3% yr^{-1} ~~-4.8% to -3.0% yr^{-1}~~).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Trends in abundance vary considerably among the six main subpopulations. Mean non-pup beach counts are used as a long-term index of abundance for years when data are insufficient to estimate total abundance as described above). Beach counts at French Frigate Shoals steadily declined 76% ~~74%~~ from 1989-2007~~2006~~. Trends have been more variable among the other sites, but abundance is lower at all subpopulations compared to 2000.

Prior to 1999, beach count increases of up to 7%yr^{-1} were observed at Pearl and Hermes Reef, and this is the highest estimate of the maximum net productivity rate (R_{max}) observed for this species. Since 2000, low juvenile survival, thought to be due largely to food limitation, has been widespread with rare exception in the NWHI, resulting in the population decline (Fig. 1). While the MHI monk seal population may be on the rise (Baker and Johanos 2004), this remains unconfirmed and abundance appears to be too low to strongly influence current total stock trends.

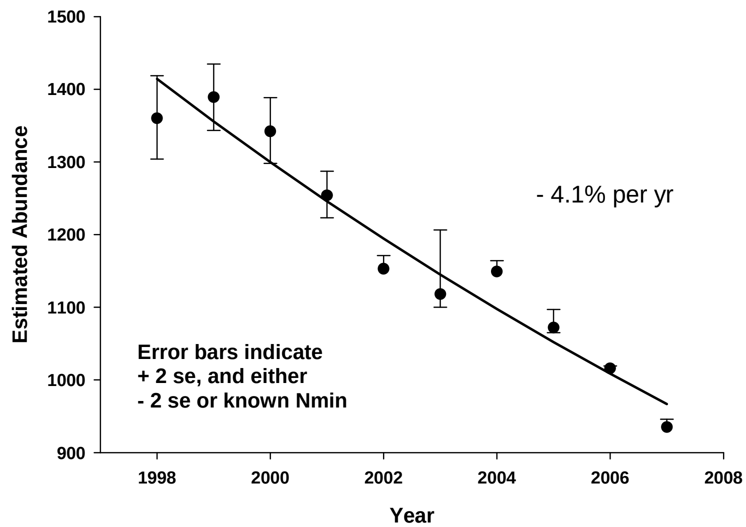

Figure 1. Trend in abundance of monk seals at the six main Northwestern Hawaiian Islands subpopulations, based on a combination of total enumeration and capture–recapture estimates. Error bars indicate ±2 s.e. (from variances of capture-recapture estimates). Fitted log-linear regression line is shown.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal (PBR) is designed to allow stocks to recover to, or remain above, the maximum net productivity level (MNPL) (Wade 1998). An underlying assumption in the application of the PBR equation is that marine mammal stocks exhibit certain dynamics. Specifically, it is assumed that a depleted stock will naturally grow toward OSP (Optimum Sustainable Population), and that some surplus growth could be removed while still allowing recovery. The Hawaiian monk seal population is far below historical levels and has declined ~~3.9%~~ 4.1% yr^{-1} on average since 1998. Thus, the stock's dynamics do not conform to the underlying model for calculating PBR such that PBR for the Hawaiian monk seal is undetermined.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Human-related mortality has caused two major declines of the Hawaiian monk seal (Ragen 1999). In the 1800s, this species was decimated by sealers, crews of wrecked vessels, and guano and feather hunters (Dill and Bryan 1912; Wetmore 1925; Bailey 1952; Clapp and Woodward 1972). Following a period of at least partial recovery in the first half of the 20th century (Rice 1960), most subpopulations again declined. This second decline has not been fully explained, but trends at several sites appear to have been determined by human disturbance from military or U.S. Coast Guard activities (Ragen 1999; Kenyon 1972; Gerrodette and Gilmartin 1990). Currently, human activities in the NWHI are limited and human disturbance is relatively rare, but human-seal interactions have become an important issue in the MHI.

Fishery Information

Fishery interactions with monk seals can include direct interaction with gear (hooking or entanglement), seal consumption of discarded catch, and competition for prey. Entanglement of monk seals in derelict fishing gear, which is believed to originate outside the Hawaiian archipelago, is described in a separate section below.

~~In contrast to the NWHI, f~~Fishery interactions are a serious concern in the MHI, especially involving State of Hawaii managed nearshore fisheries. Three seals have been ~~One seal was~~ found dead in ~~a~~ nearshore (non-recreational) gillnets (in 1994, 2006, and 2007), and a ~~second~~ seal was found dead in 1995 with a hook lodged in its esophagus. A total of 44 ~~37~~ seals have been observed with embedded hooks in the MHI during 1989-2007~~2006~~. Several incidents, including the dead hooked seal mentioned above, involved hooks used to catch ulua (jacks, *Caranx* spp.). Interactions in the MHI appear to be on the rise, as most hookings have occurred since 2000, and five ~~four~~ seals have been observed entangled in nearshore gillnets during 2002-2007~~6since 2002~~ (NMFS unpubl. data). The 2007~~2006~~ nearshore fishery mortality~~serious injury,~~ reported in (Table 1)~~,~~ involved an adult male seal ~~weaned female pup~~ who became entangled and drowned in a gillnet. The MHI bottomfish handline fishery may also interact with monk seals as evidenced by the aforementioned fatty acid research, though no mortality or serious injuries have been attributed to the fishery (Table 1).

In the past, monk seal interactions with fisheries in the NWHI were documented, but direct interactions have since become rare or non-existent, and issues related to competition have also somewhat abated.~~ For example, in 1986 a seal died from entanglement in the bridle rope of lobster trap set in the NWHI lobster fishery.~~ Possible reduction of monk seal prey by the NWHI lobster ~~that~~ fishery (through removal of both target and bycatch species) has also been raised as a concern, though whether the fishery indirectly impacted monk seals remains unresolved. However, the NWHI lobster fishery closed in 2000 and on June 15, 2006, President Bush signed a proclamation that created the Northwestern Hawaiian Islands Marine National Monument. Subsequent regulations prohibit commercial fishing in the Monument except for the bottomfish fishery (and associated pelagic species catch), which may continue until 2011 (U.S. Department of Commerce and Department of the Interior, 2006). In the past, interactions between the Hawaii-based domestic pelagic longline fishery and monk seals were documented (NMFS 2002). This fishery targets swordfish and tunas and does not compete with Hawaiian monk seals for prey. In October 1991, in response to 13 unusual seal wounds thought to have resulted from interactions with this fishery, NMFS established a Protected Species Zone extending 50 nautical miles around the NWHI and the corridors between the islands. Subsequently, no additional monk seal interactions with the longline fishery have been confirmed. Since 1991, there have been no observed or reported interactions of this fishery with monk seals.

The NWHI bottomfish handline fishery has been reported to interact with monk seals. This fishery landed between 95 and 201 metric tons per year from 1989-2007~~2006~~ (Kawamoto 1995; Kawamoto, pers. comm.) and the number of vessels is currently capped at 9 (7 ~~8~~ made NWHI trips in 2007~~2006~~, Kawamoto, pers. comm.). Nitta and Henderson (1993) documented reports of seals taking bottomfish and bait off fishing lines, and reports of seals attracted to discarded bycatch. A Federal observer program of the fishery began in the fourth quarter of 2003 and no monk seal interactions were observed until the program was suspended in 2006. NMFS prepared a Section 7 Biological Opinion on the Fishery Management Plan for the bottomfish fishery, and concluded that the operation of this fishery is not likely to jeopardize the continued existence of the Hawaiian monk seal nor would it likely destroy or adversely modify the monk seal's critical habitat (NMFS 2002). The Biological Opinion has no incidental take statement. An EIS for the bottomfish fishery management plan has also been prepared. Fishermen indicate that they have engaged in mitigating activity over the past several years, e.g., holding discards on-board, etc. (NMFS pers. comm.). The ecological effects of this fishery on monk seals (e.g., competition for prey or alteration of prey assemblages) are unknown. However, published studies on monk seal prey selection based upon scat/spew analysis and seal-mounted video revealed some evidence that monk seals fed on families of bottomfish which contain commercial species (many prey items recovered from scats and spews were identified only to the level of family; Goodman-Lowe 1998, Longenecker et al. 2006, Parrish et al. 2000). Recent quantitative fatty acid signature analysis (QFASA) results support previous studies illustrating that monk seals consume a wide range of species. However, deepwater-slope species, including two commercially targeted bottomfish, were estimated to comprise a large portion of the diet for some individuals. Similar species were estimated to be consumed by seals regardless of location, age or gender but the relative importance of each species varied. Diets differed considerably between individuals. These results highlight the need to better understand potential ecological interactions with the Hawaiian bottomfish fishery.

Table 1. Summary of mortality and serious injury of Hawaiian monk seals due to fisheries and calculation of annual mortality rate. n/a indicates that sufficient data are not available.

Fishery Name	Year	Data Type	% Obs. coverage	Observed/Reported Mortality/Serious Injury	Estimated Mortality/ Serious Injury	Mean Takes (CV)
~~NWHI Lobster~~	~~2000-present~~	~~fishery closed~~				
Pelagic Longline	~~2002~~ 2003 2004 2005 2006 2007	~~observer~~ observer observer observer observer observer	~~24.6%~~ 22.2% 24.6% 26.1% & 100%[1] 22.1% & 100%[1] 20.1% & 100%[1]	~~0~~ 0 0 0 0 0	~~0~~ 0 0 0 0 0	0 (0)
NWHI Bottomfish	~~2002~~ 2003[2] 2004 2005 2006	~~Logbook~~ observer observer observer observer	~~n/a~~ 33% 18.3% 25.0% 3.9%	~~n/a~~ 0 0 0 0	~~n/a~~ 0 0 0 0	0 (0)
MHI Bottomfish[3]	~~2002~~ 2003 2004 2005 2006 2007	n/a	none	~~0~~ 0 0 0 0 0	n/a	n/a
Nearshore[3]	~~2002~~ 2003 2004 2005 2006 2007	n/a	none	~~1~~ 1 2 1 1 1	n/a	n/a

Fishery Mortality Rate

Total fishery mortality and serious injury cannot be considered to be insignificant and approaching a rate of zero. Monk seals are being hooked and entangled in the MHI at a rate which has not been reliably assessed. The information above represents only reported direct interactions and without purpose-designed observation effort the true interaction rate cannot be estimated. Monk seals also die from entanglement in fishing gear and other debris throughout their range (likely originating from various countries), and NMFS along with partner agencies, is pursuing a program to mitigate entanglement (see below). Indirect interactions (i.e., involving competition for prey or consumption of discards) remain the topic of ongoing investigation.

Entanglement in Marine Debris

Hawaiian monk seals become entangled in fishing and other marine debris at rates higher than reported for other pinnipeds (Henderson 2001). A total of 284 ~~268~~ cases of seals entangled in fishing gear or other debris have been observed through 2007~~2006~~ (Henderson 2001; NMFS, unpubl. data), including eight ~~seven~~ documented deaths resulting from entanglement in fisheries debris (Henderson 1990, 2001; NMFS, unpubl. data). The fishing gear fouling the reefs and beaches of the NWHI and entangling monk seals only rarely includes types used in Hawaiian fisheries. For example, trawl net and monofilament gillnet accounted for approximately 35% and 34% of the debris removed from reefs in the NWHI by weight, and trawl net alone accounted for 88% of the debris by frequency (Donohue et al. 2001). Yet there are no commercial trawl fisheries in Hawaii.

The NMFS and partner agencies continue to mitigate impacts of marine debris on monk seals as well as turtles, coral reefs and other wildlife. Marine debris is removed from beaches and entangled seals during annual population assessment activities at the main reproductive sites. Since 1996, annual debris survey and removal efforts in the NWHI coral reef habitat have been ongoing (Donohue et al. 2000, Donohue et al. 2001).

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[1] Observer coverage for deep and shallow-set components of the fishery, respectively

[2] Observer coverage began in fourth quarter of 2003. Data for that quarter provided.

[3] Data for MHI bottomfish and nearshore fisheries are based upon incidental observations (i.e., hooked seals). All hookings not clearly attributable to either fishery with certainty were attributed to the bottomfish fishery, and hookings which resulted in injury of unknown severity were classified as serious.

Other Mortality

Since 1982, 23 seals died during rehabilitation efforts that ceased in 1994. Additionally, two died in captivity, two died when captured for translocation, one was euthanized (an aggressive male known to cause mortality), four died during captive research and fourthree died during field research (Baker and Johanos 2002; NMFS unpubl. data). Included in the foregoing is a sub-adult juvenile female that died during capture for research on Oahu in 2007.

In 1986, a weaned pup died at East Island, French Frigate Shoals, after becoming entangled in wire left when the U.S. Coast Guard abandoned the island three decades earlier. In 1991, a seal died after becoming trapped behind an eroding seawall on Tern Island, French Frigate Shoals. Documented cases of illegal killing of Hawaiian monk seals include a resident of Kauai killing an adult female in 1989 and the 2006 drowning noted above, as the unidentified gillnet fisherman was not compliant with State regulations.

Other sources of mortality that impede recovery include food limitation (see Habitat Issues below), single and multiple-male aggression (mobbing), shark predation, and disease/parasitism. Multiple-male aggression has primarily been identified as a problem at Laysan and Lisianski Islands, though it has also been documented at other subpopulations. In 1994, 22 adult males were removed from Laysan Island, and only nine six seals are thought to have died from multiple-male aggression at this site since their removal (1995-20072006).

Attacks by single adult males have resulted in several monk seal deaths, most notably at French Frigate Shoals in 1997, where at least 8 pups died from this cause. Many more pups were likely killed in the same way but the cause of their deaths could not be confirmed. Two males that killed pups in 1997 were translocated to Johnston Atoll, 870 km to the southwest. Subsequently, mounting injury to pups has decreased.

Shark-related injury and mortality incidents appeared to have increased in the late 1980s and early 1990s at French Frigate Shoals, but such mortality was probably not the primary cause of the decline at this site (Ragen 1993). However, shark predation has accounted for a significant portion of pup mortality in recent years. At French Frigate Shoals in 1999, 17 pups were observed injured by large sharks, and at least 3 were confirmed to have died from shark predation (Johanos and Baker 2001). As many as 22 pups of a total 92 born at French Frigate Shoals in 1999 were likely killed by sharks. After 1999, losses of pups to shark predation have been fewer, but this source of mortality remains a serious concern. Various mitigation efforts have been undertaken by NMFS in cooperation with the U. S. Fish and Wildlife Service (USFWS), which manages French Frigate Shoals as part of the Hawaiian Islands National Wildlife Refuge.

An Unusual Mortality Event (UME) contingency plan has recently been published for the monk seal (Yochem et al. 2004). While disease effects on monk seal demographic trends are uncertain, there is concern that diseases of livestock, feral animals, pets or humans could be transferred to naive monk seals in the main Hawaiian Islands and potentially spread to the core population in the NWHI. Recent diagnoses (R. Braun, pers. comm.) confirm that in 2003 and 2004, two deaths of free-ranging monk seals are attributable to diseases not previously found in the species: leptospirosis and toxoplasmosis. *Leptospira* bacteria are found in many of Hawaii's streams and estuaries and are associated with livestock and rodents. Cats, domestic and feral, are a common source of toxoplasma.

STATUS OF STOCK

In 1976, the Hawaiian monk seal was designated depleted under the Marine Mammal Protection Act of 1972 and as endangered under the Endangered Species Act of 1973. The species is well below its OSP and has not recovered from past declines. Therefore, the Hawaiian monk seal is characterized as a strategic stock.

Habitat Issues

Poor juvenile survival rates and variability in the relationship between weaning size and survival in recent years suggest that prey availability is likelymay be limiting recovery of NWHI monk seals (Baker and Thompson 2007, Baker et al. 2007, Baker 2008). A variety of strategies for improving juvenile survival are being considered and will be developed through an experimental approach in coming years (Baker and Littnan 2008). In Autumn 2006 a test project to provide nutritional support and care to juvenile monk seals was initiated.

Another habitat issue involves loss of terrestrial habitat at French Frigate Shoals, where pupping and resting islets have shrunk or virtually disappeared (Antonelis et al. 2006). Projected increases in global average sea level (Church et al. 2001) may further significantly reduce terrestrial habitat for monk seals in the NWHI (Baker, Littnan and Johnston, 2006).

Goodman-Lowe (1998) provided information on prey selection using hard parts in scats and spewings. Information on at-sea movement and diving is available for seals at all six main subpopulations in the NWHI using satellite telemetry (Stewart et al. 2006). Preliminary studies to describe the foraging habitat of monk seals in the

MHI are reported in Littnan et al. (2006).

Tern Island is the site of a USFWS refuge station, and is one of two sites in the NWHI accessible by aircraft. During World War II, the U.S. Navy enlarged the island to accommodate the runway, and a sheet-pile seawall was constructed to maintain the modified shape of the island. Degradation of the seawall created entrapment hazards for seals and other wildlife. Erosion of the sea wall also raised concerns about the potential release of toxic wastes into the ocean. The USFWS began construction on the Tern Island sea wall in 2004 to reduce entrapment hazards and protect the island shoreline. The USFWS considers this a high priority project to complete, and is pursuing funding to that end. Vessel groundings pose a continuing threat to monk seals and their habitat, through potential physical damage to reefs, oil spills, and release of debris into habitats.

There are indications that monk seal abundance is increasing in the main Hawaiian Islands (Baker and Johanos 2004). Further, the excellent condition of pups weaned on these islands suggests that there may be ample prey resources available. If the monk seal population does expand in the MHI, it may bode well for the species' recovery and long-term persistence. In contrast, there are many challenges that may limit the potential for growth in this region. The human population in the MHI is approximately 1.2 million compared to fewer than 100 in the NWHI, so that the potential impact of disturbance in the MHI is great. As noted above, the hooking of monk seals by fishermen in the MHI is another source of injury and mortality. Finally, vessel traffic in the populated islands carries the potential for collision with seals and impacts from oil spills. Thus, issues surrounding monk seals in the main Hawaiian Islands will likely become an increasing focus for management and recovery of this species.

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HARBOR PORPOISE (*Phocoena phocoena*): Morro Bay Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the Pacific, 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 that they do not move extensively between California, Oregon, and Washington (Calambokidis and Barlow 1991). That study also showed some regional differences within California (although the sample size was small). This pattern stands as a 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 Bay of Fundy (Polacheck et al. 1995). A phylogeographic analysis of genetic data from northeast Pacific harbor porpoise did not show complete concordance between DNA sequence types and geographic location (Rosel 1992). However, an analysis of molecular variance (AMOVA) of the same data with additional samples found significant genetic differences for four of the six pair-wise comparisons between the four areas investigated: California, Washington, British Columbia, and Alaska (Rosel et al. 1995). These results demonstrate that harbor porpoise along the west coast of North America are not panmictic or migratory, and movement is sufficiently restricted that genetic differences have evolved. Recent preliminary genetic analyses of samples ranging from Monterey Bay, California to Vancouver Island, British Columbia indicate that there is small-scale subdivision within the U.S. portion of this range (Chivers *et al.*, 2002, 2007).

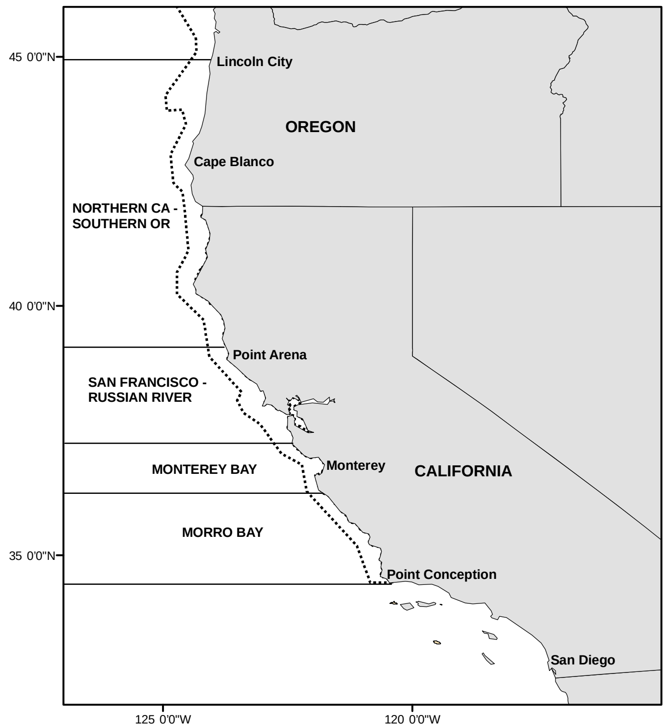

Figure 1. Stock boundaries and distributional range of harbor porpoise along the California and southern Oregon coasts. Dashed line represents harbor porpoise habitat (0-200 m) in this region.

In their assessment of harbor porpoise, Barlow and Hanan (1995) recommended that the animals inhabiting central California (defined to be from Point Conception to the Russian River) be treated as a separate stock. Their justifications for this were: 1) fishery mortality of harbor porpoise is limited to central California, 2) movement of individual animals appears to be restricted within California, and consequently 3) fishery mortality could cause the local depletion of harbor porpoise if central California is not managed separately. Although geographic structure exists along an almost continuous distribution of harbor porpoise from California to Alaska, stock boundaries are difficult to draw because any rigid line is (to a greater or lesser extent) arbitrary from a biological perspective. Nonetheless, failure to recognize geographic structure by defining management stocks can lead to depletion of local populations. Based on recent genetic findings (Chivers *et al.*, 2002, 2007), California coast stocks were re-evaluated, and significant genetic differences were found among 4 identified sampling sites. Revised stock boundaries are presented here based on these genetic data and density discontinuities identified from aerial surveys, resulting in six California/Oregon/Washington stocks where previously there had been four (Carretta *et al.* 2001a). The stock boundaries for animals that occur in California/southern Oregon waters are shown in

Figure 1. For the ~~2004~~ 2009 Marine Mammal Protection Act (MMPA) Stock Assessment Reports, other Pacific coast harbor porpoise stocks include: 1) a Monterey Bay stock, 2) a San Francisco-Russian River stock, 3) a northern California/southern Oregon stock, 4) an Oregon/Washington coast stock, 5) an Inland Washington stock, 6) a Southeast Alaska stock, 7) a Gulf of Alaska stock, and 8) a Bering Sea stock. Stock assessment reports for Monterey Bay, San Francisco-Russian River, northern California/southern Oregon, Northern Oregon/Washington coast, and Inland Washington waters harbor porpoise appear in this volume. The three Alaska harbor porpoise stocks are reported separately in the Stock Assessment Reports for the Alaska Region.

POPULATION SIZE

Previous estimates of abundance for California harbor porpoise were based on aerial surveys conducted between the coast and the 50-fm isobath during 1988-95 (Barlow and Forney 1994, Forney 1999a). These estimates did not include an unknown number of animals found in deeper waters. Barlow (1988) found that the vast majority of harbor porpoise in California were within the 0-50-fm depth range; however, Green et al. (1992) found that 24% of harbor porpoise seen during aerial surveys of Oregon and Washington were between the 100m and 200m isobaths (55 to 109 fathoms). A systematic ship survey of depth strata out to 90 m in northern California showed that porpoise abundance declined significantly in waters deeper than 60 m (Carretta *et al.* 2001b). A recent analysis of harbor porpoise trends including oceanographic data suggests that the proportion of California harbor porpoise in deeper waters may vary between years (Forney 1999b). ~~In~~ Since 1999 ~~and 2002,~~ aerial surveys have extended farther offshore (to the 200m depth contour or a minimum of 10 nmi from shore in the region of the Morro Bay stock) to provide a more complete abundance estimate. Based on ~~1999 and~~ 2002-2007 aerial surveys conducted under good survey conditions (Beaufort ≤2, cloud cover ≤25%) the estimate of abundance for this stock is ~~1,656~~ 2,044 animals (CV = ~~0.39~~ 0.40) (Carretta ~~and Forney 2004~~ et al., in prep.).

Minimum Population Estimate

The minimum population estimate for the Morro Bay harbor porpoise stock is taken as the lower 20th percentile of the log-normal distribution of the abundance estimated from the ~~1999~~ 2002-2007 aerial surveys, or ~~1,206~~ 1,478 animals.

Current Population Trend

~~Analyses of a 1986-95 time series of aerial surveys have been conducted to examine trends in harbor porpoise abundance in central California (Forney, 1995; 1999b). After controlling for the effects of sea state, cloud cover, and area on sighting rates, Forney (1995) found a negative trend in population size; however, that trend was no longer significant when sea surface temperature (a proxy measure of oceanographic conditions) was included in an updated non-linear trend analysis (Forney 1999b). The negative correlation between harbor porpoise sighting rates and sea surface temperatures indicates that apparent trends could be caused by changing oceanographic conditions and movement of animals into and out of the study area. Encounter rates for the 1997 survey, however, were very high (Forney 1999a) despite the warmer sea surface temperatures caused by strong El Niño conditions. These observations suggest that patterns of harbor porpoise movement are not directly related to sea surface temperature, but rather to the more complex distribution of potential prey species in this area.~~ There has been an increasing trend in porpoise abundance in the Morro Bay stock since 1988, which is statistically significant (p < ~~=~~0.002), Figure 2. The observed increase in abundance estimates for this stock since 1988 implies an annual population growth rate of approximately 13%, which is consistent with the median growth rate of 10% reported by Caswell et al. (1998) for Atlantic harbor porpoise and high reproductive rates reported for this species by Read and Hohn (1995). It is possible that some of the observed growth of the Morro Bay stock is partly due to emigration of animals from the Monterey Bay stock. ~~More detailed studies of encounter rate patterns in relation to satellite-derived sea surface temperature are planned to shed light on potential oceanography-related movement patterns of harbor porpoise in this region.~~

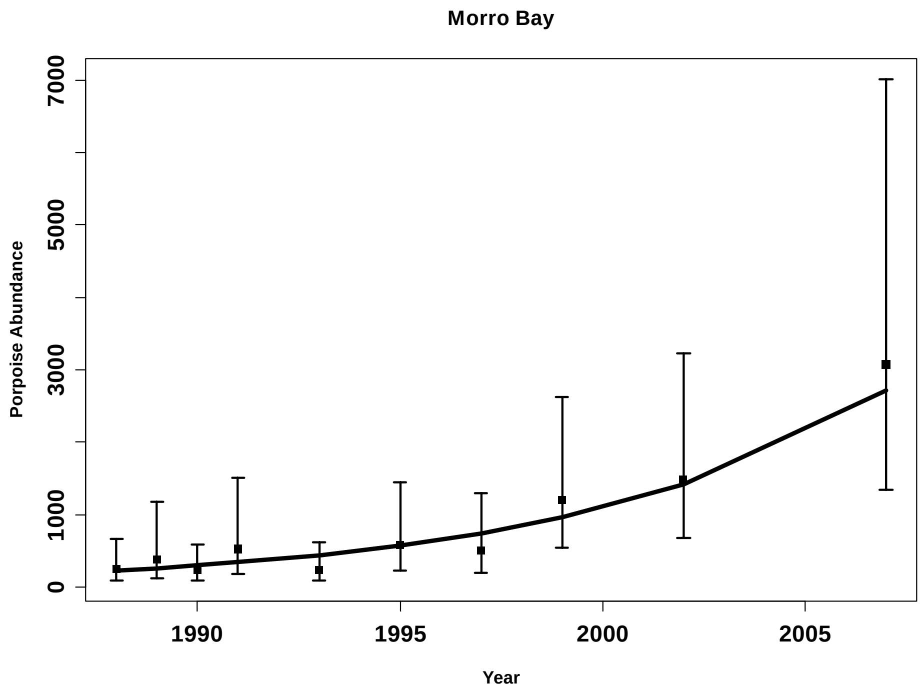

Figure 2. Aerial survey annual estimates of abundance for the Morro Bay stock of harbor porpoise (inshore stratum only), 1988-~~2002~~ 2007. Error bars represent lower and upper 95% confidence intervals. Solid line represents a linear regression on the natural logarithm of abundance over time. The slope of this regression is statistically significant ($p < 0.002$, $r^2 = 0.83$).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Based on what are argued to be biological limits of the species (i.e. females give birth first at age 4 and produce one calf per year until death), the theoretical, maximum-conceivable growth rate of a closed harbor porpoise population was estimated as 9.4% per year (Barlow and Boveng 1991). This maximum theoretical rate may not be achievable for any real population. [Woodley and Read (1991) calculate a maximum growth rate of approximately 5% per year, but their argument for this being a maximum (i.e. that porpoise survival rates cannot exceed those of Himalayan thar) is not well justified.] Population growth rates have not actually been measured for any harbor porpoise population. Because a reliable estimate of the maximum net productivity rate is not available for Morro Bay harbor porpoise, we use the default maximum net productivity rate (R_{MAX}) of 4% for cetaceans (Wade and Angliss 1997) be employed.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (~~1,206~~ 1,478) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of ~~0.4~~ 0.5 (for a stock of unknown status ~~with a mortality rate CV ≥ 0.80~~; Wade and Angliss 1997), resulting in a PBR of ~~10~~ 15.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

~~The set gillnet fishery for halibut and angel shark has operated in the vicinity of Morro Bay, and fishing effort there peaked in 2001. A ban on set gillnets inshore of 60 fathoms from Point Arguello to Point Reyes, California, has been in place since September 2002. California Department of Fish and Game (CDFG) estimated fishing effort for 1998-2002 in this fishery is 139, 121, 284, 391, and 21 days respectively. Mortality rates of harbor porpoise in the set gillnet fishery in this region are available only from 43 trips observed between 1990-94 (Julian and Beeson 1998), in which one harbor porpoise was~~

killed. This represents a kill rate of 0.023 porpoise/day fished (bootstrap CV = 0.97). Projected mortality levels based on this kill rate and effort levels for 1998-2002 are summarized in Table 1. It should be noted that this kill rate includes sets made in less than 30 fathoms of water, where the potential to entangle porpoise is higher. The white seabass set gillnet fishery also has operated in the vicinity of Morro Bay, and this fishery has been documented to take harbor porpoise in the past (Norris and Prescott 1961). Effort in the white seabass fishery in the vicinity of Morro Bay for the last five years (1998-2002) has been 26, 7, 61, 132, and 32 fishing days respectively. Because of the aforementioned depth restrictions for gillnets in this region, it is expected that harbor porpoise interactions with the white seabass set gillnet fishery would be near zero. Gillnet fisheries for halibut and white seabass that historically operated in the vicinity of Morro Bay were eliminated in this stock's range in 2002 by a ban on gillnets inshore of 60 fathoms (~110 m) from Point Arguello to Point Reyes, California. The large-mesh drift gillnet fishery for swordfish and thresher shark operates too far offshore to interact with harbor porpoise in this region. Since 2002, fishery-related strandings of harbor porpoise have been recorded north of this stock's range. The responsible fisheries have not been identified and the locations of the strandings indicate that the animals are from stocks to the north (see Monterey Bay, San Francisco – Russian River, and Northern California/Southern Oregon stock assessments).

Table 1. Summary of available information on incidental mortality and injury of harbor porpoise (Morro Bay stock) in commercial fisheries that might take this species (Cameron and Forney 2000, Carretta 2001, Forney et al., 2001; Carretta 2002, Carretta and Chivers 2003). Mean annual takes are based on 1998-2002 data unless noted otherwise.

Fishery Name	Year(s)	Data Type	Percent Observer Coverage	Observed Mortality	Kill/Day	Estimated Mortality (CV in parentheses)	Mean Annual Takes (CV in parentheses)
CA angel shark / halibut and other species large mesh (>3.5") set gillnet fishery	1998 1999 2000 2001 2002	1990-94 observer data Fishery closed permanently in waters < 60 fathoms	0% 0% 0% 0%	- - - - -	0.023[1]	3 (0.97) 3 (0.97) 7 (0.97) 9 (0.97) 0.5 (n/a)	4.5 (0.97)[2]
Minimum total annual takes							4.5 (0.97)[2]

[1]Mortality rate is based on 1 observed mortality from 43 observed trips in this region between 1990-94.
[2]Mean annual takes are based on 1998-2002 effort data and 1990-94 kill rates.

Both of the above central California gillnet fisheries were restricted by a series of emergency closures beginning in September 2000, because of concern over mortality of Common Murres and a decline in the southern sea otter population. During the emergency closure, fishing was allowed in waters deeper than 30 fathoms between Yankee Point (Monterey County) and Pt. Sal (Santa Barbara County) until April 2002, and fishing effort initially increased within the range of the Morro Bay harbor porpoise stock. A ban on the use of gill and trammel nets in all ocean waters 60 fathoms or less between Point Reyes (Marin County) and Point Arguello (Santa Barbara County) became effective on September 4, 2002. The ban is expected to virtually eliminate bycatch of Morro Bay harbor porpoise in these two gillnet fisheries, because this species is primarily found in waters shallower than 60 fathoms.

STATUS OF STOCK

Harbor porpoise in California are not listed as threatened or endangered under the Endangered Species Act nor as depleted under the Marine Mammal Protection Act. Barlow and Hanan (1995) calculate the status of harbor porpoise relative to historic carrying capacity (K) using a technique called back-projection. They calculate that the central California population (including Morro Bay, Monterey Bay, and San Francisco-Russian River stocks) could have been reduced to between 30% and 97% of K by incidental fishing mortality, depending on the choice of input parameters. They conclude that there is no practical way to reduce the range of this estimate. New information does not change this conclusion, and the status of central California harbor porpoise populations relative to their Optimum Sustainable Population (OSP) levels must be treated as unknown.

Based on the last 5 years of fishing effort (1998-2002), mean annual takes are 4.5 porpoise per year, which is less than the PBR of 10 animals, resulting in a "non-strategic" classification. A set gillnet closure inside of 60 fathoms was finalized in September 2002, effectively eliminating set gillnets from most harbor porpoise habitat in the region of this stock. This is expected to reduce fishery mortality of Morro Bay harbor porpoise to near zero. Although in recent years the average fishery mortality exceeded 10% of the PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and injury rate, it is likely that this goal will be met following the 2002 gillnet closure. Research activities will continue to monitor the population size and to investigate population trends. No fishery-related mortality of harbor porpoise has been documented within this stock's range between 2003 and 2007. Current fishery mortality is zero and can be considered insignificant and approaching zero mortality rate. The stock is considered non-strategic and the population appears to have grown at approximately 11% annually since surveys began in the late 1980s. There are no known habitat issues that are of particular concern for this stock.

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HARBOR PORPOISE (*Phocoena phocoena*): Monterey Bay Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the Pacific, 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 that they do not move extensively between California, Oregon, and Washington (Calambokidis and Barlow 1991). That study also showed some regional differences within California (although the sample size was small). This pattern stands as a 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 Bay of Fundy (Polacheck et al. 1995). A phylogeographic analysis of genetic data from northeast Pacific harbor porpoise did not show complete concordance between DNA sequence types and geographic location (Rosel 1992). However, an analysis of molecular variance (AMOVA) of the same data with additional samples found significant genetic differences for four of the six pair-wise comparisons between the four areas investigated: California, Washington, British Columbia, and Alaska (Rosel et al. 1995). These results demonstrate that harbor porpoise along the west coast of North America are not panmictic or migratory, and movement is sufficiently restricted that genetic differences have evolved. Recent preliminary genetic analyses of samples ranging from Monterey Bay, California to Vancouver Island, British Columbia indicate that there is small-scale subdivision within the U.S. portion of this range (Chivers *et al*., 2002, 2007).

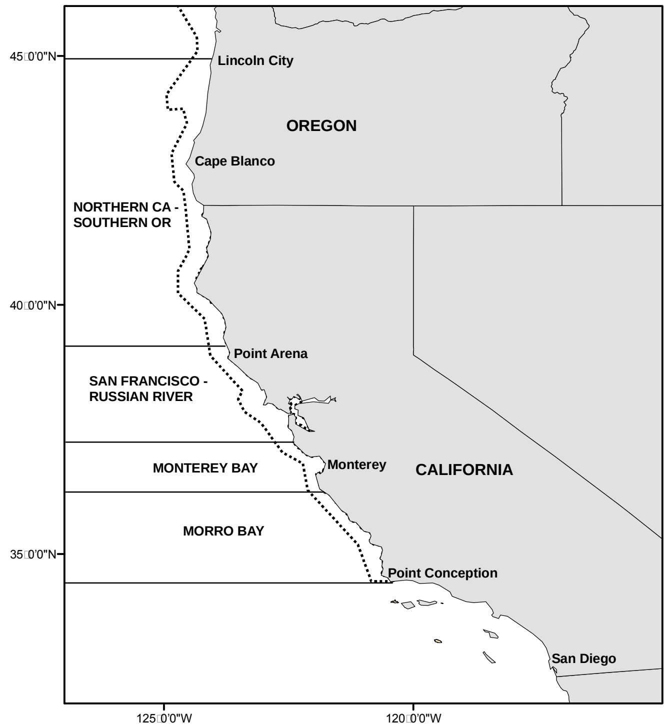

Figure 1. Stock boundaries and distributional range of harbor porpoise along the California/southern Oregon coast. Dashed line represents harbor porpoise habitat (0-200 m) along the U.S. west coast.

In their assessment of harbor porpoise, Barlow and Hanan (1995) recommended that the animals inhabiting central California (defined to be from Point Conception to the Russian River) be treated as a separate stock. Their justifications for this were: 1) fishery mortality of harbor porpoise is limited to central California, 2) movement of individual animals appears to be restricted within California, and consequently 3) fishery mortality could cause the local depletion of harbor porpoise if central California is not managed separately. Although geographic structure exists along an almost continuous distribution of harbor porpoise from California to Alaska, stock boundaries are difficult to draw because any rigid line is (to a greater or lesser extent) arbitrary from a biological perspective. Nonetheless, failure to recognize geographic structure by defining management stocks can lead to depletion of local populations. Based on recent genetic findings (Chivers *et al*., 2002, 2007), California coast stocks were re-evaluated, and significant genetic differences were found among 4 identified sampling sites. Revised stock boundaries are presented here based on these genetic data and density discontinuities identified from aerial surveys, resulting in six California/Oregon/Washington stocks where previously there had been four (Carretta *et al.*

2001a). The stock boundaries for animals that occur in California/southern Oregon waters are shown in Figure 1. For the 2004 2009 Marine Mammal Protection Act (MMPA) Stock Assessment Reports, other Pacific coast harbor porpoise stocks include: 1) a Monterey Bay stock, 2) a San Francisco-Russian River stock, 3) a northern California/southern Oregon stock, 4) an Oregon/Washington coast stock, 5) an Inland Washington stock, 6) a Southeast Alaska stock, 7) a Gulf of Alaska stock, and 8) a Bering Sea stock. Stock assessment reports for Morro Bay, San Francisco-Russian River, northern California/southern Oregon, Oregon/Washington coast, and Inland Washington waters harbor porpoise appear in this volume. The three Alaska harbor porpoise stocks are reported separately in the Stock Assessment Reports for the Alaska Region.

POPULATION SIZE

Previous estimates of abundance for California harbor porpoise were based on aerial surveys conducted between the coast and the 50-fm isobath during 1988-95 (Barlow and Forney 1994, Forney 1999a). These estimates did not include an unknown number of animals found in deeper waters. Barlow (1988) found that the vast majority of harbor porpoise in California were within the 0-50-fm depth range; however, Green et al. (1992) found that 24% of harbor porpoise seen during aerial surveys of Oregon and Washington were between the 100m and 200m isobaths (55 to 109 fathoms). A systematic ship survey of depth strata out to 90 m in northern California showed that porpoise abundance declined significantly in waters deeper than 60 m (Carretta et al. 2001b). A recent analysis of harbor porpoise trends including oceanographic data suggests that the proportion of California harbor porpoise in deeper waters may vary between years (Forney 1999b). Starting in In 1999, and 2002, aerial surveys extended farther offshore (to the 200m depth contour or a minimum of 15 nmi from shore in the region of the Monterey Bay stock) to provide a more complete abundance estimate. Based on 1999 and 2002-2007 aerial surveys under good survey conditions (Beaufort ≤2, cloud cover ≤25%) the estimate of abundance for this stock is 1,613 1,492 animals (CV = 0.42 0.40) (Carretta et al., in prep. and Forney 2004).

Minimum Population Estimate

The minimum population estimate for the Monterey Bay harbor porpoise stock is taken as the lower 20th percentile of the log-normal distribution of the abundance estimated from the 1999-2002-2007 aerial surveys, or 1,149 1,079 animals.

Current Population Trend

Analyses of a 1986-95 time series of aerial surveys have been conducted to examine trends in harbor porpoise abundance in central California (Forney, 1995; 1999b). After controlling for the effects of sea state, cloud cover, and area on sighting rates, Forney (1995) found a negative trend in population size; however, that trend was no longer significant when sea surface temperature (a proxy measure of oceanographic conditions) was included in an updated non-linear trend analysis (Forney 1999b). The negative correlation between harbor porpoise sighting rates and sea surface temperatures indicates that apparent trends could be caused by changing oceanographic conditions and movement of animals into and out of the study area. Encounter rates for the 1997 survey, however, were very high (Forney 1999a) despite the warmer sea surface temperatures caused by strong El Niño conditions. These observations suggest that patterns of harbor porpoise movement are not directly related to sea surface temperature, but rather to the more complex distribution of potential prey species in this area. A linear regression of of the natural logarithm of abundance over time for the Monterey Bay stock is not statistically significant (p=0.64, Figure 2). More detailed studies of encounter rate patterns in relation to satellite-derived sea surface temperature during 1993-99 are planned to shed light on potential oceanography-related movement patterns of harbor porpoise in this region. Abundance estimates from aerial surveys conducted between 1988 and 2007 show evidence of a declining trend, though this decline is not statistically significant and it should be noted that survey effort in 2007 was sparse compared to previous years (Figure 2).

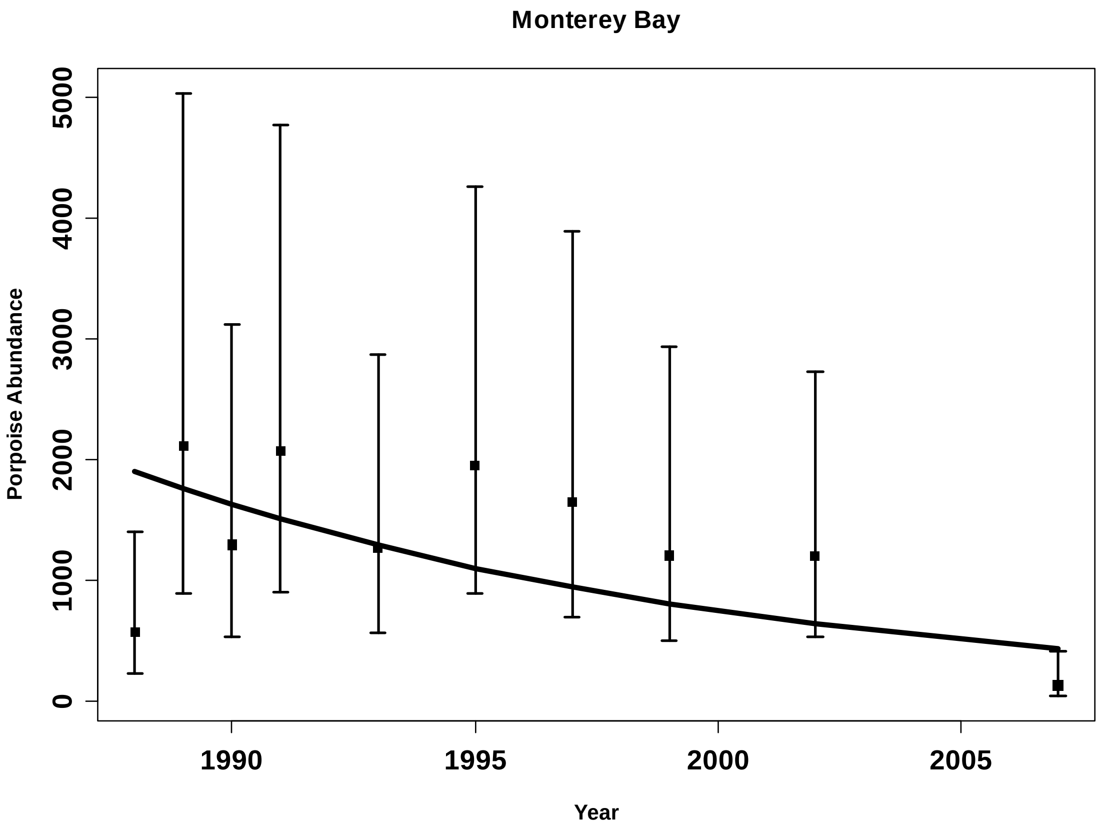

Figure 2. Aerial survey annual estimates of abundance for the Monterey Bay stock of harbor porpoise, 1988-~~2002~~ 2007 (inshore stratum only). Error bars represent lower and upper 95% confidence intervals. Solid line represents a linear regression of the natural logarithm of abundance over time. The slope of this regression is not statistically significant (p = ~~0.64~~ 0.08, $r^2 = 0.24$).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Based on what are argued to be biological limits of the species (i.e. females give birth first at age 4 and produce one calf per year until death), the theoretical, maximum-conceivable growth rate of a closed harbor porpoise population was estimated as 9.4% per year (Barlow and Boveng 1991). This maximum theoretical rate may not be achievable for any real population. [Woodley and Read (1991) calculate a maximum growth rate of approximately 5% per year, but their argument for this being a maximum (i.e. that porpoise survival rates cannot exceed those of Himalayan thar) is not well justified.] Population growth rates have not actually been measured for any harbor porpoise population. Because a reliable estimate of the maximum net productivity rate is not available for Monterey Bay harbor porpoise, we use the default maximum net productivity rate (R_{MAX}) of 4% for cetaceans (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (~~1,149~~ 1,079) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of ~~0.45~~ 0.5 (for a stock of unknown status ~~with a mortality rate CV ≥0.60 and ≤0.80~~; Wade and Angliss 1997), resulting in a PBR of ~~10~~ 11.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

~~The incidental capture of Monterey Bay harbor porpoise is largely limited to the halibut angel shark set gillnet fishery. Detailed information on this fishery is provided in Appendix 1. A summary of estimated fishery mortality and injury for this stock of harbor porpoise for 1998-2002 is given in Table 1. Mortality estimates for 1998 are based on total estimated fishing effort and prior year entanglement rate data (Julian and Beeson 1998), because no observer program was in place that year. Mortality estimates for 1999-2001 are based on a National Marine Fisheries Service monitoring program in Monterey Bay (Cameron and Forney 2000, Carretta 2001; Carretta 2002, Carretta and Chivers 2003).~~ A 2002 ban on gillnets inshore of the 60 fathom (110 m) isobath was thought to eliminate the potential for harbor porpoise mortality to near zero in this stock's range. However, there have been five observed harbor porpoise strandings in this stock's range between 2003 and 2007 (three in 2004 and two in 2005) that showed evidence of fishery interactions, such as gillnet-like markings on the carcass or fishing line and hooks wrapped around the body. The responsible fisheries are unknown.

Table 1. Summary of available on incidental mortality and injury of harbor porpoise ~~(central CA stock 1997-98; Monterey Bay stock 1999-2002)~~ in commercial fisheries that might take this species ~~(Cameron and Forney 2000, Carretta 2001, Carretta 2002, Forney et al., 2001)~~. Mean annual takes are based on ~~2001-2002~~ 2003-2007 data ~~because of fishery restrictions implemented in late 2000~~. n/a indicates that data are not available.

Fishery Name	Year(s)	Data Type	Percent Observer Coverage	Observed Mortality	Kill/Day	Estimated Mortality (CV in parentheses)	Mean Annual Takes (CV in parentheses)
~~CA angel shark / halibut and other species large mesh (>3.5") set gillnet fishery~~				-	-		~~9.5 (0.66)[1]~~
	~~1998~~	~~1990-94 observer data~~	~~0%~~	-	-	~~57 (0.19)~~	
	~~1999~~	~~observer data~~	~~23.0%~~	~~28[2]~~	~~0.17~~	~~133 (0.23)[2]~~	
	~~2000~~		~~27.0%~~	~~7~~	~~0.10~~	~~26 (0.50)~~	
	~~2001~~	~~2000 observer data~~	~~0%~~	-	~~0.10~~	~~3 (0.77)~~	
	~~2002~~	~~Fishery closed permanently~~	~~0%~~	-	~~0.10~~	~~16 (0.77)~~	
Unidentified fisheries	2003-2007	Stranding	n/a	5	n/a	≥5	≥ 1.0 (n/a)
Minimum total annual takes							~~9.5 (0.66)[1]~~ ≥ 1.0 (n/a)

~~[1]Only 2001-2002 mortality estimates are included in the average because the fishery was largely closed under emergency regulations in September 2000. The closure was made permanent in September 2002.~~
~~[2] This includes one unidentified cetacean that was almost certainly a harbor porpoise; without this animal the mortality estimate would be 128 (CV=0.23).~~

~~All central California nearshore gill and trammel net fisheries were restricted by a series of emergency closures beginning in September 2000, because of concern over mortality of Common Murres and a decline in the southern sea otter population. During the emergency closures, fishing was prohibited in waters less than 60 fathoms in the region of the Monterey Bay harbor porpoise stock. There were an estimated 156 days of set gillnet fishing effort in Monterey Bay in 2002 following a brief lapse in the closure prior to a ban on set gillnets in this region on September 4, 2002. The ban is expected to virtually eliminate bycatch of Monterey Bay harbor porpoise in these gillnet fisheries, because this species is primarily found in waters shallower than 60 fathoms. Although mortality estimates for the most recent five years (1998-2002) are presented in Table 1, average annual takes in the setnet fishery are estimated using 2001-2002 data, because the fishery was largely closed under emergency regulations after September 2000. The closure was made permanent in September 2002. An annual average of 9.5 harbor porpoise (CV= 0.66) were killed in this fishery in Monterey Bay from 2001-2002.~~

~~Twelve fishery-related stranding mortalities of harbor porpoise were documented within the range of the Monterey Bay harbor porpoise stock between 1998 and 2002: 1998(1); 1999(2); 2000 (2); 2001 (2) and 2002 (5). The five strandings in 2002 occurred during March and April, prior to a September ban on~~

gillnets inshore of 60 fathoms in this region. These mortalities probably originated from the halibut set gillnet fishery in Monterey Bay, and are thus accounted for in the mortality estimates for this fishery.

STATUS OF STOCK

Harbor porpoise in California are not listed as threatened or endangered under the Endangered Species Act nor as depleted under the Marine Mammal Protection Act. Barlow and Hanan (1995) calculate the status of harbor porpoise relative to historic carrying capacity (K) using a technique called back-projection. They calculate that the central California population could have been reduced to between 30% and 97% of K by incidental fishing mortality, depending on the choice of input parameters. They conclude that there is no practical way to reduce the range of this estimate. New information does not change this conclusion, and the status of harbor porpoise relative to their Optimum Sustainable Population (OSP) levels in central California must be treated as unknown.

The annual mortality for 2001, after implementation of the emergency closure for central California gillnet fisheries, was 9.5 harbor porpoise, which is less than the calculated PBR (10) for Monterey Bay harbor porpoise; therefore, the Monterey Bay harbor porpoise population is not considered "strategic" under the MMPA. A permanent set gillnet closure inside of 60 fathoms was implemented in September 2002, effectively eliminating set gillnets from most harbor porpoise habitat in the region of this stock. This is expected to virtually eliminate gillnet mortality of Monterey Bay harbor porpoise. Although in recent years the average fishery mortality exceeded Fishery-related mortality of harbor porpoise still occurs in this stock's range, though the bycatch levels and responsible fisheries are unknown. Because the overall level of fishery mortality is unknown relative to the PBR and, therefore, it cannot be considered to be insignificant and approaching zero mortality and injury rate, it is likely that this goal will be met following the 2002 permanent gillnet closure. Although there is uncertainty regarding the observed levels of fishery-related mortality for this stock, mortality is less than the PBR, thus this stock is not considered "strategic" under the MMPA. Research activities will continue to monitor the population size and to investigate population trends. There are no known habitat issues that are of particular concern for this stock.

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HARBOR PORPOISE (*Phocoena phocoena*): San Francisco-Russian River Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

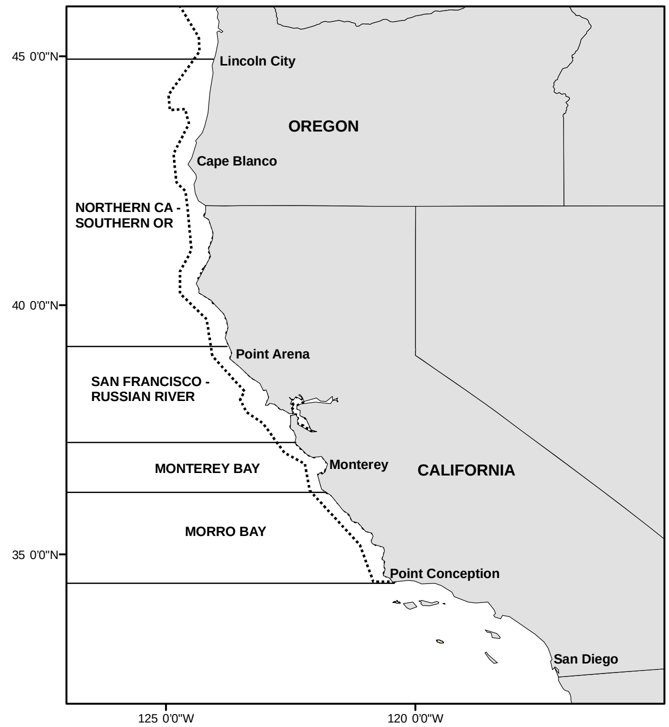

Figure 1. Stock boundaries and distributional range of harbor porpoise along the California and southern Oregon coasts. Dashed line represents harbor porpoise habitat (0-200 m) along the U.S. west coast.

In the Pacific, 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 that they do not move extensively between California, Oregon, and Washington (Calambokidis and Barlow 1991). That study also showed some regional differences within California (although the sample size was small). This pattern stands as a 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 Bay of Fundy (Polacheck et al. 1995). A phylogeographic analysis of genetic data from northeast Pacific harbor porpoise did not show complete concordance between DNA sequence types and geographic location (Rosel 1992). However, an analysis of molecular variance (AMOVA) of the same data with additional samples found significant genetic differences for four of the six pair-wise comparisons between the four areas investigated: California, Washington, British Columbia, and Alaska (Rosel et al. 1995). These results demonstrate that harbor porpoise along the west coast of North America are not panmictic or migratory, and movement is sufficiently restricted that genetic differences have evolved. Recent preliminary genetic analyses of samples ranging from Monterey Bay, California to Vancouver Island, British Columbia indicate that there is small-scale subdivision within the U.S. portion of this range (Chivers *et al.*, 2002, 2007).

In their assessment of harbor porpoise, Barlow and Hanan (1995) recommended that the animals inhabiting central California (defined to be from Point Conception to the Russian River) be treated as a separate stock. Their justifications for this were: 1) fishery mortality of harbor porpoise is limited to central California, 2) movement of individual animals appears to be restricted within California, and consequently 3) fishery mortality could cause the local depletion of harbor porpoise if central California is not managed separately. Although geographic structure exists along an almost continuous distribution of harbor porpoise from California to Alaska, stock boundaries are difficult to draw because any rigid line is (to a greater or lesser extent) arbitrary from a biological perspective. Nonetheless, failure to recognize geographic structure by defining management stocks can lead to depletion of local populations. Based on recent genetic findings (Chivers *et al.*, 2002, 2007), California coast stocks were re-evaluated, and significant genetic differences were found among 4 identified sampling sites. Revised stock boundaries are presented here based on these genetic data and density discontinuities identified from aerial surveys, resulting in six California/Oregon/Washington stocks where previously there had been four (Carretta *et al*. 2001a). The stock boundaries for animals that occur in California/southern Oregon waters are shown in Figure 1. For the 2002 Marine Mammal Protection Act (MMPA) Stock Assessment Reports, other Pacific coast harbor porpoise stocks include: 1) a Morro Bay stock, 2) a Monterey Bay stock, 3) a northern California/southern Oregon stock, 4) an Oregon/Washington coast stock, 5) an Inland Washington stock, 6) a Southeast Alaska stock, 7) a Gulf of Alaska stock, and 8) a Bering Sea stock. Stock assessment reports for Morro Bay, Monterey Bay, northern California/southern Oregon, Oregon/Washington coast, and Inland Washington waters harbor porpoise appear in this volume. The three Alaska harbor porpoise stocks are reported separately in the Stock Assessment Reports for the Alaska Region.

POPULATION SIZE

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Minimum Population Estimate

The minimum population estimate for the San Francisco-Russian River harbor porpoise stock is taken as the lower 20th percentile of the log-normal distribution of the abundance estimated from ~~1999-~~2002-2007 aerial surveys, or ~~6,254~~ 6,745 animals.

Current Population Trend

~~Analyses of a 1986-95 time series of aerial surveys have been conducted to examine trends in harbor porpoise abundance in central California (Forney, 1995; 1999b). After controlling for the effects of sea state, cloud cover, and area on sighting rates, Forney (1995) found a negative trend in population size; however, that trend was no longer significant when sea surface temperature (a proxy measure of oceanographic conditions) was included in an updated non-linear trend analysis (Forney 1999b). The negative correlation between harbor porpoise sighting rates and sea surface temperatures indicates that apparent trends could be caused by changing oceanographic conditions and movement of animals into and out of the study area. Encounter rates for the 1997 survey, however, were very high (Forney 1999a) despite the warmer sea surface temperatures caused by strong El Niño conditions. These observations suggest that patterns of harbor porpoise movement are not directly related to sea surface temperature, but rather to the more complex distribution of potential prey species in this area.~~ Abundance of the San Francisco - Russian River harbor porpoise stock appeared to be stable or declining between 1988-1991 and has steadily increased since 1993. The slope of the linear regression on the natural logarithm of abundance over time is not statistically significant (p = ~~0.24~~ 0.14, Figure 2). ~~More detailed studies of encounter rate patterns in relation to satellite-derived sea surface temperature are planned to shed light on potential oceanography-related movement patterns of harbor porpoise in this region.~~

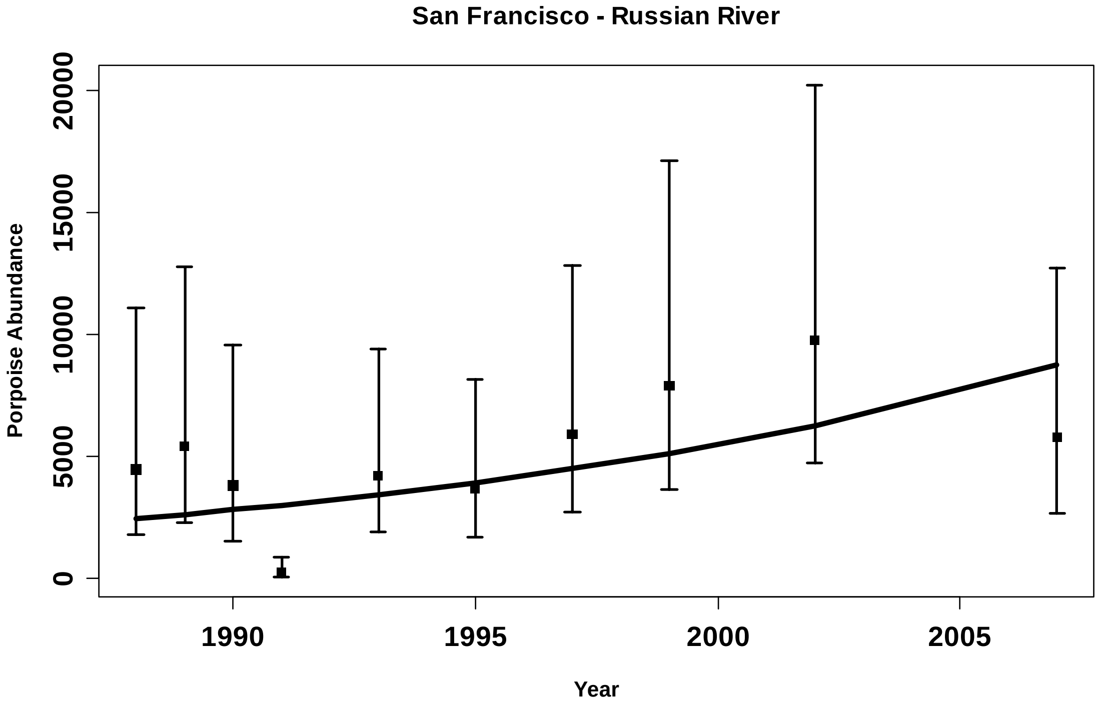

Figure 2. Aerial survey annual estimates of abundance for the San Francisco – Russian River stock of harbor porpoise (inshore stratum only), 1988~~-2002~~ 2007. Error bars represent lower and upper 95% confidence intervals. Solid line represents a linear regression of the natural logarithim of abundance over time. The slope of this regression line is not statistically significant (p = ~~0.24~~ 0.24, r^2=0.17)

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Based on what are argued to be biological limits of the species (i.e. females give birth first at age 4 and produce one calf per year until death), the theoretical, maximum-conceivable growth rate of a closed harbor porpoise population was estimated as 9.4% per year (Barlow and Boveng 1991). This maximum theoretical rate may not be achievable for any real population. [Woodley and Read (1991) calculate a maximum growth rate of approximately 5% per year, but their argument for this being a maximum (i.e. that porpoise survival rates cannot exceed those of Himalayan thar) is not well justified.] Population growth rates have not actually been measured for any harbor porpoise population. Because a reliable estimate of the maximum net productivity rate is not available for northern California harbor porpoise, we use the default maximum net productivity rate (R_{MAX}) of 4% for cetaceans (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (~~6,254~~ 6,745) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.5 (for a species of unknown status; Wade and Angliss 1997), resulting in a PBR of ~~63~~ 67.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

~~The incidental capture of harbor porpoise in California has largely been limited to set gillnet fisheries in Monterey Bay and to a lesser extent, Morro Bay. Coastal setnets are not allowed north of Bodega Head (to protect salmon resources there). However, two harbor porpoise strandings near Bodega Head in 1998, one inside San Francisco Bay in 1998, and one near Montara, San Mateo County in 2001 were attributed to fishery-related mortality, but the responsible fishery is unknown. Although the stranding locations fall within the range of the San Francisco-Russian River harbor porpoise stock and this is~~

probably the source stock for the mortalities, it is possible that some of these animals were taken from the northern California/southern Oregon stock and subsequently drifted southward to the stranding location. A ban on set gillnets inshore of 60 fathoms from Point Reyes south to Point Arguello, California has been in place since September 2002. Although coastal gillnets are prohibited throughout this stock's range, there have been fishery-related strandings in past years. No fishery-related strandings occurred during the most recent five-year period (2003-2007), but did occur to the north and south of this stock's range. It is possible that some of the fishery-related strandings recorded in the Monterey Bay area during the most recent five-year period were killed in the San Francisco – Russian River stratum and drifted south to their observed stranding locations.

Table 1. Summary of available information on incidental mortality and injury of harbor porpoise (San Francisco-Russian River stock) in commercial fisheries that might take this species. Mean annual takes are based on 1998-2002 data unless noted otherwise. n/a indicates that data are not available. No fishery takes or fishery-related strandings were reported in this region between 2003 and 2007. n/a indicates that data are not available.

Fishery Name	Year(s)	Data Type	Percent Observer Coverage	Observed Mortality	Kill/Day	Estimated Mortality (CV in parentheses)	Mean Annual Takes (CV in parentheses)
Unknown fishery	1998-2002 2003-2007	stranding	n/a	3 (in 1998) 1 in 2001 none	n/a	n/a	≥0.8 (n/a) 0 (n/a)
Minimum total annual takes							≥0.8 (n/a) 0 (n/a)

STATUS OF STOCK

Harbor porpoise in California are not listed as threatened or endangered under the Endangered Species Act nor as depleted under the Marine Mammal Protection Act. Barlow and Hanan (1995) calculate the status of harbor porpoise relative to historic carrying capacity (K) using a technique called back-projection. They calculate that the central California population (including Morro Bay, Monterey Bay, and San Francisco-Russian River stocks) could have been reduced to between 30% and 97% of K by incidental fishing mortality, depending on the choice of input parameters. They conclude that there is no practical way to reduce the range of this estimate. New information does not change this conclusion, and the status of central California harbor porpoise populations relative to their Optimum Sustainable Population (OSP) levels must be treated as unknown. There are no known habitat issues that are of particular concern for this stock. Because the known human-caused mortality or serious injury (0.8 zero harbor porpoise per year) is less than the PBR (63 67), this stock is not considered a "strategic" stock under the MMPA. Because average annual fishery mortality is less than 10% of the PBR, the fishery mortality can be considered insignificant and approaching zero mortality and serious injury rate.

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Revised ~~10/31/2002~~ 11/05/2008

HARBOR PORPOISE (*Phocoena phocoena*): Northern California/Southern Oregon Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the Pacific, 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 that they do not move extensively between California, Oregon, and Washington (Calambokidis and Barlow 1991). That study also showed some regional differences within California (although the sample size was small). This pattern stands as a 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 Bay of Fundy (Polacheck et al. 1995). A phylogeographic analysis of genetic data from northeast Pacific harbor porpoise did not show complete concordance between DNA sequence types and geographic location (Rosel 1992). However, an analysis of molecular variance (AMOVA) of the same data with additional samples found significant genetic differences for four of the six pair-wise comparisons between the four areas investigated: California, Washington, British Columbia, and Alaska (Rosel et al. 1995). These results demonstrate that harbor porpoise along the west coast of North America are not panmictic or migratory, and movement is sufficiently restricted that genetic differences have evolved. Recent preliminary genetic analyses of samples ranging from Monterey Bay, California to Vancouver Island, British Columbia indicate that there is small-scale subdivision within the U.S. portion of this range Chivers *et al.*, ~~in press~~ 2002, 2007).

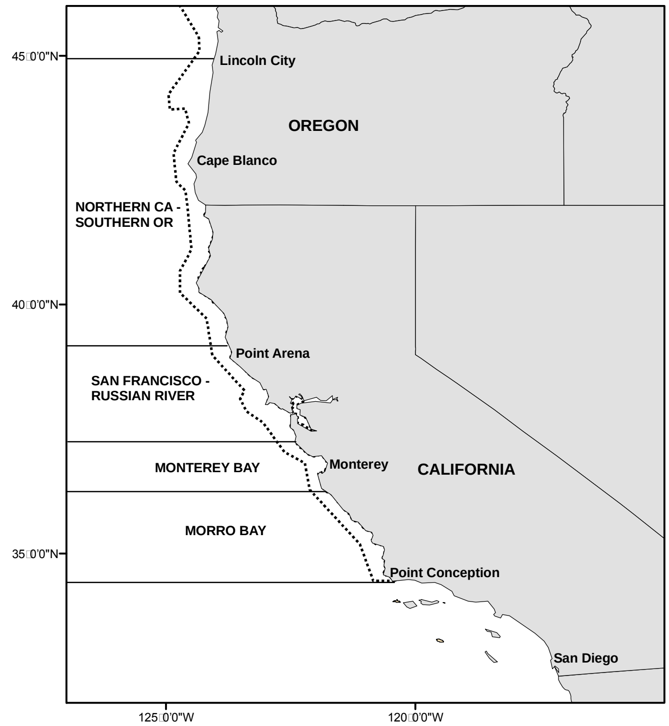

Figure 1. Stock boundaries and distributional range of harbor porpoise along the California/southern Oregon coasts. Dashed line represents harbor porpoise habitat (0-200 m) along the U.S. west coast.

In their assessment of harbor porpoise, Barlow and Hanan (1995) recommended that the animals inhabiting central California (defined to be from Point Conception to the Russian River) be treated as a separate stock. Their justifications for this were: 1) fishery mortality of harbor porpoise is limited to central California, 2) movement of individual animals appears to be restricted within California, and consequently 3) fishery mortality could cause the local depletion of harbor porpoise if central California is not managed separately. Although geographic structure exists along an almost continuous distribution of harbor porpoise from California to Alaska, stock boundaries are difficult to draw because any rigid line is (to a greater or lesser extent) arbitrary from a biological perspective. Nonetheless, failure to recognize geographic structure by defining management stocks can lead to depletion of local populations. Based on recent genetic findings (Chivers *et al.*, ~~in press~~ 2002, 2007), California coast stocks were re-evaluated and significant genetic differences were found among four identified sampling sites. Revised stock boundaries are presented here based on these genetic data and density discontinuities identified from aerial surveys, resulting in six west coast stocks where previously there had been four (Carretta *et al.* 2001a). These new stock boundaries are shown in Figure 1. The northern boundary of the Northern California/Southern Oregon stock of harbor porpoise has been moved north to approximately the latitude of Lincoln City, Oregon, based on additional genetic analyses and a recommendation from the Pacific Regional Scientific Review Group to revise the boundary. For the 2002 Marine Mammal Protection Act (MMPA) Stock Assessment Reports, other Pacific coast harbor porpoise stocks include: 1) a Morro Bay stock, 2) a Monterey Bay stock, 3) a San Francisco-Russian River stock, 4) an Oregon/Washington coast stock, 5) an Inland Washington stock, 6) a Southeast Alaska stock, 7) a Gulf of Alaska stock, and 8) a Bering Sea stock. The stock assessment reports for Morro Bay, Monterey Bay, and San Francisco-Russian River, harbor porpoise appear in this volume. The three Alaska harbor porpoise stocks are reported separately in the Stock Assessment Reports for the Alaska Region.

POPULATION SIZE

Previous estimates of abundance for California harbor porpoise were based on aerial surveys conducted between the coast and the 50-fm isobath during 1988-95 (Barlow and Forney 1994, Forney 1999a). These estimates did not include an unknown number of animals found in deeper waters. Barlow (1988) found that the vast majority of harbor porpoise in California were within the 0-50-fm depth range; however, Green et al. (1992) found that 24% of harbor porpoise seen during aerial surveys of Oregon and Washington were between the 100m and 200m isobaths (55 to 109 fathoms). A systematic ship survey of depth strata out to 90 m in northern California showed that porpoise abundance declined significantly in waters deeper than 60 m (Carretta et al. 2001b). A recent analysis of harbor porpoise trends including oceanographic data suggests that the proportion of California harbor porpoise in deeper waters may vary between years (Forney 1999b; see Current Population Trend below). ~~In~~ Since 1999, aerial surveys extended farther offshore (to the 200m depth contour or 15 nmi distance, whichever is farther) to provide a more complete abundance estimate. Based on pooled ~~1997-99~~ 2002-2007 aerial survey data including data from both inshore and offshore areas, an updated estimate of abundance for the northern California/southern Oregon harbor porpoise stock is ~~17,763~~ 39,581 harbor porpoise (CV=0.39). This estimate represents a combined estimate of aerial surveys completed between 2002-2007 by SWFSC (Carretta et al., in prep.) and unpublished data from the National Marine Mammal Laboratory. ~~Approximately 1,572 (CV=0.86) porpoise were estimated in the northern California offshore stratum (SWFSC, unpublished data); 11,135 (CV= 0.38) in the northern California inshore stratum (SWFSC, unpublished data); 4,808 (CV = 0.49) from southern Oregon Area VI (Laake et al. 1998), and 250 (CV = 1.09) animals from southern Oregon Area VIF (Laake et al. 1998).~~

Minimum Population Estimate

The minimum population estimate for harbor porpoise in northern California/southern Oregon is taken as the lower 20th percentile of the log-normal distribution of the abundance estimate obtained from 2002-2007 aerial surveys, or 28,833 animals. ~~d from 1997-99 aerial surveys in northern California and 1997 aerial surveys in southern Oregon, or 12,940 animals~~. This estimate includes harbor porpoise within an area extending to the 200m isobath or 15 nmi, whichever is farther from shore.

Current Population Trend

~~Forney (1999b) examines trends in relative harbor porpoise abundance in central and northern California based on aerial surveys from 1989-95. No significant trends were evident over this time period for the Northern California Stock. The 1997-99 survey results continue to show no trend in relative abundance~~ Because the northern boundary of this stock has changed two times in recent years, trends in abundance have been examined only for the northern California portion of this stock. A possible increasing trend in abundance is apparent from surveys conducted between 1989 and 2007, but the trend is not statistically significant (Figure 2).

Northern California

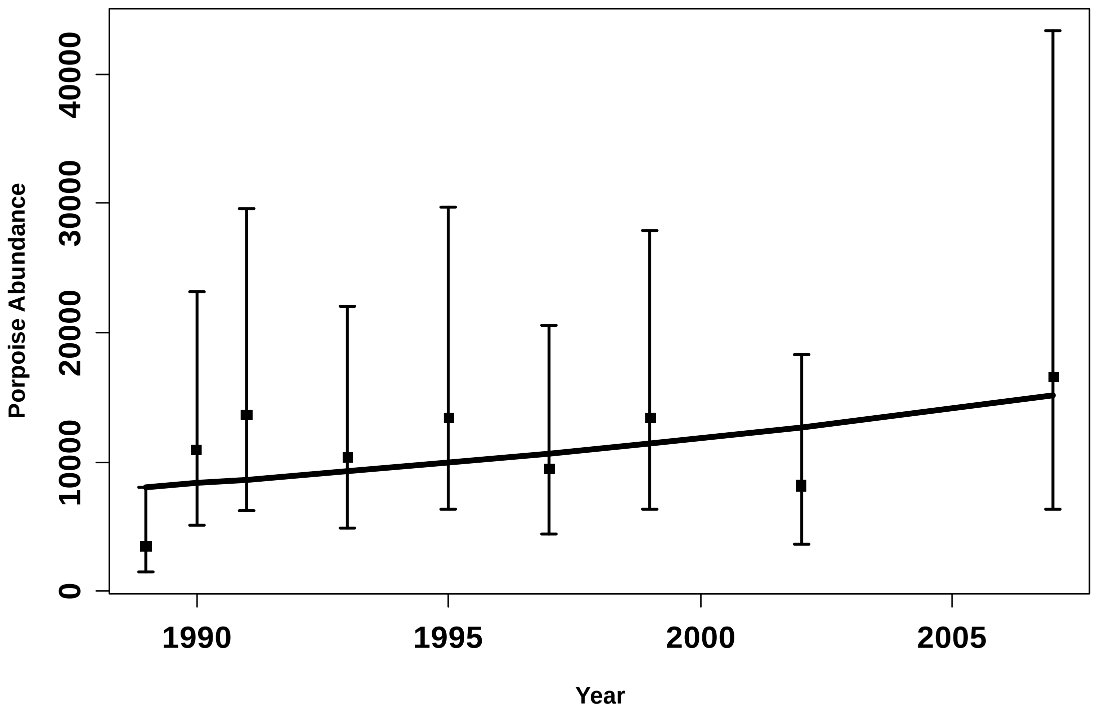

Figure 2. Aerial survey annual estimates of harbor porpoise abundance for the northern California inshore stratum, 1989-2007. Solid line represents a linear regression on the natural logarithim of abundance over time. The slope of this regression is not statistically significant ($p = 0.21$, $r^2=0.22$).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Based on what are argued to be biological limits of the species (i.e. females give birth first at age 4 and produce one calf per year until death), the theoretical, maximum-conceivable growth rate of a closed harbor porpoise population was estimated as 9.4% per year (Barlow and Boveng 1991). This maximum theoretical rate may not be achievable for any real population. [Woodley and Read (1991) calculate a maximum growth rate of approximately 5% per year, but their argument for this being a maximum (i.e. that porpoise survival rates cannot exceed those of Himalayan thar) is not well justified.] Population growth rates have not actually been measured for any harbor porpoise population. Because a reliable estimate of the maximum net productivity rate is not available for northern California harbor porpoise, we use the default maximum net productivity rate (R_{MAX}) of 4% for cetaceans (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (~~12,940~~ 28,833) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 1.0 (for a species within its Optimal Sustainable Population; Wade and Angliss 1997), resulting in a PBR of 577 ~~259~~.

HUMAN-CAUSED MORTALITY

Fishery Information

~~The incidental capture of harbor porpoise in California is largely limited to set gillnet fisheries in central California. Coastal set gillnets are not allowed in northern California (to protect salmon resources there). However, one harbor porpoise mortality was documented for the Klamath River tribal salmon gillnet fishery in 1995 (NMFS, Southwest Region, unpublished data). There have been no observed harbor~~

~~porpoise mortalities or fishery-related strandings in the Klamath River tribal salmon gillnet fishery for the most recent five-year period (1996-2000) (pers. comm., Kathleen Williamson, Yurok tribe biologist).~~

There were 4 harbor porpoise strandings in this stock's range that showed evidence of interactions with entangling net fisheries between 2003 and 2007. At least two of these were reported to be entangled in river salmon gillnet gear. There has been documented harbor porpoise mortality in the Klamath River tribal salmon gillnet fisheries as recently as 1995. It is possible that recent gillnet-related strandings in this area are attributable to that fishery.

Table 1. Summary of available information on incidental mortality and injury of harbor porpoise (northern CA stock) in fisheries that might take this species. n/a indicates that data are not available.

Fishery Name	Year(s)	Data Type	Percent Observer Coverage	Observed Mortality	Estimated Mortality (CV in parentheses)	Mean Annual Takes (CV in parentheses)
~~**CA Klamath River tribal salmon gillnet fishery**~~	~~1996-2000~~	~~Observation~~	~~n/a~~	~~0~~	~~0~~	~~0~~
Unknown fishery	2003-2007	Stranding	n/a	4	n/a	≥4 (n/a)
Minimum total annual takes						~~0~~ ≥4 (n/a)

STATUS OF STOCK

Harbor porpoise in northern California/southern Oregon are not listed as threatened or endangered under the Endangered Species Act nor as depleted under the Marine Mammal Protection Act. There are no known habitat issues that are of particular concern for this stock. Because of the lack of recent or historical sources of human-caused mortality, the harbor porpoise stock in northern California has been concluded to be within their Optimum Sustainable Population (OSP) level (Barlow and Forney 1994). Because the known human-caused mortality or serious injury (~~0~~ ≥4 harbor porpoise per year) is less than the PBR (~~259~~ 577), this stock is not considered a "strategic" stock under the MMPA. Because average annual fishery mortality is less than 10% of the PBR, the fishery mortality can be considered insignificant and approaching zero mortality and serious injury rate.

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HARBOR PORPOISE (*Phocoena phocoena*): Northern Oregon/Washington Coast Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the eastern North Pacific Ocean, harbor porpoise are found in coastal and inland waters from Point Barrow, along the Alaskan coast, and down the west coast of North America to Point Conception, California (Gaskin 1984). Harbor porpoise are known to occur year-round in the inland trans-boundary waters of Washington and British Columbia, Canada (Osborne et al. 1988), and along the Oregon/Washington coast (Barlow 1988, Barlow et al. 1988, Green et al. 1992). Aerial survey data from coastal Oregon and Washington, collected during all seasons, suggest that harbor porpoise distribution varies by depth (Green et al. 1992). Although distinct seasonal changes in abundance along the west coast have been noted, and attributed to possible shifts in distribution to deeper offshore waters during late winter (Dohl et al. 1983, Barlow 1988), seasonal movement patterns are not fully understood.

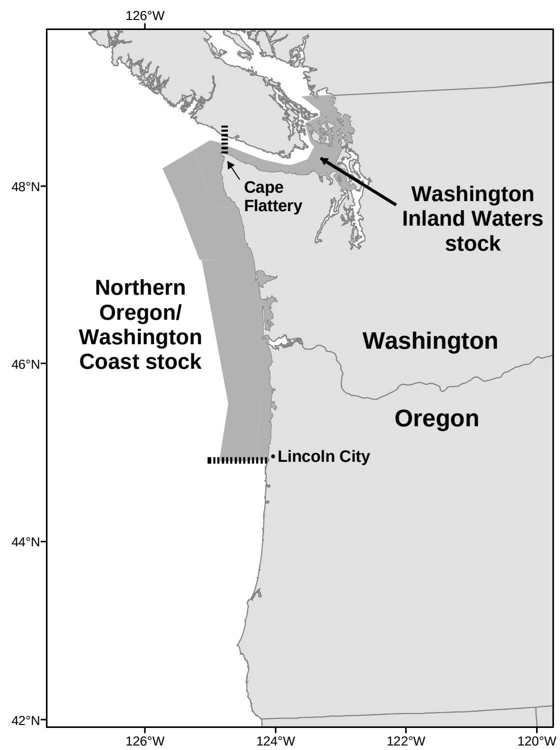

Figure 1. Stock boundaries (dashed lines) and approximate distribution (shaded areas) of harbor porpoise along the coasts of Washington and northern Oregon.

Investigation of pollutant loads in harbor porpoise ranging from California to the Canadian border suggests restricted harbor porpoise movements (Calambokidis and Barlow 1991). Stock discreteness in the eastern North Pacific was analyzed using mitochondrial DNA from samples collected along the west coast (Rosel 1992) and is summarized in Osmek et al. (1994). Two distinct mtDNA groupings or clades exist. One clade is present in California, Washington, British Columbia, and Alaska (no samples were available from Oregon), while the other is found only in California and Washington. Although these two clades are not geographically distinct by latitude, the results may indicate a low mixing rate for harbor porpoise along the west coast of North America. Further genetic testing of the same data, along with additional samples, found significant genetic differences for four of the six pair-wise comparisons between the four areas investigated: California, Washington, British Columbia, and Alaska (Rosel et al. 1995). These results demonstrate that harbor porpoise along the west coast of North America are not panmictic or migratory and that movement is sufficiently restricted that genetic differences have evolved. Recent preliminary genetic analyses of samples ranging from Monterey Bay, California, to Vancouver Island, British Columbia, indicate that there is small-scale subdivision within the U.S. portion of this range (Chivers et al. 2002, 2007). This is consistent with low movement suggested by genetic analysis of harbor porpoise specimens from the North Atlantic, where numerous stocks have been delineated with clinal differences over areas as small as the waters surrounding the British Isles.

Using the 1990-1991 aerial survey data of Calambokidis et al. (1993) for water depths <50 fathoms, Osmek et al. (1996) found significant differences in harbor porpoise mean densities (Z=~~5~~6.9, P<0.001) between the waters of coastal Oregon/Washington and inland Washington/southern British Columbia, Canada (i.e., Strait of Juan de Fuca/San Juan Islands). ~~Although differences in density exist between coastal Oregon/Washington and inland Washington waters, a specific stock boundary line cannot be identified based upon biological or genetic differences. However, harbor porpoise movements and rates of intermixing within the eastern North Pacific are restricted, and there has been a significant decline in harbor porpoise sightings within southern Puget Sound since the 1940s; therefore, f~~Following a risk averse management strategy, two stocks were ~~are~~ recognized in the waters of Oregon and Washington, with a boundary at Cape Flattery, Washington~~: the Oregon/Washington Coast stock (between~~

~~Cape Blanco, OR, and Cape Flattery, WA) and the Washington Inland Waters stock (in waters east of Cape Flattery) (see Fig. 1)~~. Based on r~~R~~ecent genetic evidence, which suggests that the population of eastern North Pacific harbor porpoise is more finely structured ~~than is currently recognized~~ (Chivers et al. 2002, 2007), stock boundaries on the Oregon/Washington coast have been revised, resulting in three stocks in Oregon/Washington waters: a Northern California/Southern Oregon stock (Point Arena, CA, to Lincoln City, OR), a Northern Oregon/Washington Coast stock (Lincoln City, OR, to Cape Flattery, WA), and the Washington Inland Waters stock (in waters east of Cape Flattery). ~~All relevant data (e.g., genetic samples, contaminant studies, and satellite tagging) will be reviewed~~ Additional analyses are needed to determine whether to adjust the stock boundaries for harbor porpoise in ~~Oregon and~~ Washington inland waters (Chivers et al. 2007).

In their assessment of California harbor porpoise, Barlow and Hanan (1995) recommended two stocks be recognized in California, with the stock boundary at the Russian River. Based on recent genetic findings (Chivers et al. 2002, 2007), California coast stocks were re-evaluated and significant genetic differences were found among four identified sampling sites. Revised stock boundaries, based on these genetic data and density discontinuities identified from aerial surveys, resulted in six California/Oregon/Washington stocks where previously there had been four (e.g., Carretta et al. 2001): 1) the Washington Inland Waters stock, 2) the Northern Oregon/Washington Coast stock, 3) the Northern California/Southern Oregon stock, 4) the San Francisco-Russian River stock, 5) the Monterey Bay stock, and 6) the Morro Bay stock. The stock boundaries for animals that occur in northern Oregon/Washington~~/northern Oregon~~ waters are shown in Figure 1. This report considers only the Northern Oregon/Washington Coast stock. Stock assessment reports for Washington Inland Waters, Northern California/Southern Oregon, San Francisco-Russian River, Monterey Bay, and Morro Bay harbor porpoise also appear in this volume. Stock assessment reports for the three harbor porpoise stocks in the inland and coastal waters of Alaska, including 1) the Southeast Alaska stock, 2) the Gulf of Alaska stock, and 3) the Bering Sea stock, are reported separately in the Stock Assessment Reports for the Alaska Region. The harbor porpoise occurring in British Columbia have not been included in any of the U.S. stock assessment reports.

POPULATION SIZE

In August and September 2002, an aerial survey of Oregon, Washington, and southern British Columbia coastal waters, from shore to 200 m depth, resulted in an uncorrected abundance estimate of ~~11,036~~ 4,583 (CV=~~0.11~~ 0.145) harbor porpoise in U.S. waters ~~north of Cape Blanco~~ between Lincoln City, ~~OR~~ Oregon, and Cape Flattery, Washington (J. Laake, unpublished data). Using a correction factor of 3.42 (1/g(0); g(0)=0.292, CV=0.366) (Laake et al. 1997a), to adjust for groups missed by aerial observers, the corrected estimate of abundance for harbor porpoise in the coastal waters of northern Oregon (north of ~~Cape Blanco~~Lincoln City) and Washington ~~waters~~ is ~~37,745~~ 15,674 (CV=~~0.38~~ 0.394).

Minimum Population Estimate

The minimum population estimate for this stock is calculated as the lower 20th percentile of the log-normal distribution (Wade and Angliss 1997) of the 2002 population estimate of ~~37,745~~ 15,674, which is ~~27,705~~ 11,383 harbor porpoise.

Current Population Trend

There are no reliable data on population trends of harbor porpoise for coastal Oregon, Washington, or British Columbia waters; however, the uncorrected estimates of abundance for the Northern Oregon/Washington Coast stock in 1997 (~~11,599~~ 6,406; SE=826.5) and 2002 (~~11,036~~ 4,583) were not significantly different (Z=~~-.31~~ -1.73, P=~~0.76~~ 0.08), although the survey area in 1997 (Regions I-S through III) was slightly larger than in 2002 (Strata D-G) (Laake et al. 1998a; J. Laake, unpublished data).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently not available for harbor porpoise. Therefore, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% (Wade and Angliss 1997) be employed for the Northern Oregon/Washington Coast harbor porpoise stock.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (~~27,705~~ 11,383) <u>times</u> one-half the default maximum net growth rate for cetaceans (½ of 4%) <u>times</u> a recovery factor of 0.5 (for a stock of unknown status, Wade and Angliss 1997), resulting in a PBR of ~~277~~ 114 harbor porpoise per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Within the EEZ boundaries of the coastal waters of northern Oregon and Washington,~~ human-caused (fishery) mortalities of~~ harbor porpoise mortalities are ~~presently~~ known to occur ~~only~~ in the northern Washington marine set (tribal) gillnet fishery. ~~During 1992-1993, the Washington/Oregon Lower Columbia River, Washington Grays Harbor, and Washington Willapa Bay drift gillnet fisheries were monitored at observer coverages of approximately 4% and 2%, respectively. There were no observed harbor porpoise mortalities in these fisheries.~~ Total f~~F~~ishing effort in ~~the northern Washington marine set gillnet~~ this fishery (areas 4, 4A, 4B, and 5) is conducted within the range of both harbor porpoise stocks (Northern Oregon/Washington Coast and Washington Inland Waters) occurring in Washington State waters (Gearin et al 1994). Some movement of harbor porpoise between Washington's coastal and inland waters is likely, but it is currently not possible to quantify the extent of such movements. For the purposes of this stock assessment report, the animals taken in waters south and west of Cape Flattery, W~~A~~ashington (areas 4 and 4A), are assumed to have belonged to the Northern Oregon/Washington Coast stock, and Table 1 includes data only from that portion of the fishery. ~~NMFS observers monitored 100% of the 50 net days (1 net day equals a 100-fathom length net set for 24 hours) of fishing effort in coastal waters in 2000 and observed three harbor porpoise takes; n~~ There has been a reduction in fishing effort in the coastal portion of this fishery due to reduced numbers of chinook salmon (a target species) in coastal waters. No fishing effort occurred in the coastal portion of the fishery in ~~1999 or~~ 2001-2003 or 2005. Complete records of observer coverage and fishing effort in 2004 are not available; however, one vessel fished at least 60 net days (1 net day equals a 100-fathom-length net set for 24 hours) in areas 4 and 4A and the vessel operator reported two harbor porpoise mortalities (~~Gearin, et al. 1994, 2000;~~ P. Gearin, unpublished data; N. Pamplin, unpublished data).~~ There has been a reduction in fishing effort in the coastal portion of this fishery due to reduced numbers of chinook salmon (a target species) in coastal waters.~~ The mean estimated mortality for this fishery in ~~1999-2003~~ 2001-2005 is ~~0.6~~ 0 (CV=0) harbor porpoise per year from ~~this stock~~ observer data plus 0.4 porpoise per year from fisher self-reports.

Table 1. Summary of incidental mortality and serious injury of harbor porpoise (Northern Oregon/Washington Coast stock) in commercial and tribal fisheries and calculation of the mean annual mortality rate; n/a indicates that data are not available. Mean annual takes are based on ~~2000-2004~~2003-2007 data unless noted otherwise.

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean annual takes (CV in parentheses)
Northern WA marine set gillnet (tribal fishery in coastal waters: areas 4 and 4A)	~~1999~~	observer data	~~no fishery~~	~~0~~	~~0~~	~~0.6 (0)~~[1]
	~~2000~~		~~100%~~	~~3~~	~~3~~	
	2001		no fishery	0	0 (0)	0 (0)[1]
	2002		no fishery	0	0 (0)	
	2003		no fishery	0	0 (0)	
	2004		unknown[2]	n/a	n/a	
	2005		no fishery	0	0 (0)	
	2004	fisher self-reports		2		≥0.4 (n/a)
Unknown West Coast fisheries	2007	stranding data		2		≥0.4 (n/a)
~~Estimated~~ Minimum total annual takes						~~0.6 (0)~~ ≥0.8 (0)

[1]The ~~1999~~2001-2003 and 2005 mortality estimates are included in the average.
[2]Complete records of observer coverage in 2004 are not available.

In 1995-1997, data were collected for the coastal portions (areas 4 and 4A) of the northern Washington marine set gillnet fishery as part of an experiment, conducted in cooperation with the Makah Tribe, designed to explore the merits of using acoustic alarms to reduce bycatch of harbor porpoise in salmon gillnets. Results in 1995-1996 indicated that the nets equipped with acoustic alarms had significantly lower entanglement rates, as only 2 of the 49 mortalities occurred in alarmed nets (Gearin et al. 1996, 2000; Laake et al. 1997b). In 1997, 96% of the sets were equipped with acoustic alarms and 13 mortalities were observed (Gearin et al. 2000; P. Gearin, unpublished data). Harbor porpoise were displaced by an acoustic buffer around the alarmed nets, but it is unclear whether the porpoise or their prey were repelled by the alarms (Kraus et al. 1997, Laake et al. 1998b). However, the acoustic alarms did not appear to affect the target catch (chinook salmon and sturgeon) in the fishery (Gearin et al. 2000). In 2000, 84% of the sets (42 of 50 net days) in coastal waters were equipped with acoustic alarms and all three of the observed mortalities occurred in nets without alarms. For the past decade, Makah tribal regulations have required nets set in coastal waters (areas 4 and 4A) to be equipped with acoustic alarms.

A harbor porpoise mortality was also reported in a tribal steelhead gillnet fishery in the Chehalis River in 2007 (NMFS, Northwest Region, unpublished data), resulting in an average annual mortality of 0.2 for this fishery.

The Marine Mammal Authorization Program (MMAP) fisher self-reports, required of commercial vessel operators by the MMPA, are an additional source of information on the number of harbor porpoise killed or seriously injured incidental to commercial fishery operations. Current MMAP data are not available; however, Between 2000 and 2004, there were no fisher self-reports of harbor porpoise mortalities from any MMAP-listed fishery operating within the range of the Northern Oregon/Washington Coast stock between 2001 and October 2005. Although these reports are considered incomplete (see details in Appendix 1), they represent a minimum mortality.

According to Northwest Marine Mammal Stranding Network records, maintained by the NMFS Northwest Region (NMFS, Northwest Region, unpublished data), there have been no were two fishery-related strandings of harbor porpoise from this stock reported on the northern Oregon/southern Washington coast in 2007, resulting in an average annual mortality of 0.4 harbor porpoise in 2003-2007 dating back to at least 1990. Evidence of fishery interactions included net marks, rope marks, and knife cuts. Since these mortalities could not be attributed to a particular fishery, and they were the only documented fishery-related mortalities in this area in 2007, they are listed in Table 1 as occurring in unknown West Coast fisheries. Nine additional strandings reported in 2003-2007 (5 in 2004, 1 in 2006, and 3 in 2007) were considered possible fishery-related strandings but were not included in the estimate of average annual mortality. This estimate is considered a minimum because not all stranded animals are found, reported, or examined for cause of death (via necropsy by trained personnel).

Other Mortality

According to the Marine Mammal Stranding Network records, maintained by the NMFS Northwest Region, no human-caused harbor porpoise mortalities or serious injuries were reported from non-fisheries sources in 2000-2004. This estimate is considered a minimum because not all stranded animals are found, reported, or examined for cause of death (via necropsy by trained personnel).

A significant increase in the number of harbor porpoise strandings reported throughout Oregon and Washington in 2006 prompted the Working Group on Marine Mammal Unusual Mortality Events to declare an Unusual Mortality Event (UME) on 3 November 2006 (Huggins 2008). A total of 114 harbor porpoise strandings were reported and confirmed throughout Oregon and Washington in 2006 and 2007 (Huggins 2008). The cause of the UME has not been determined and several factors, including contaminants, genetics, and environmental conditions, are still being investigated. Cause of death, determined for 48 of 81 porpoise that were examined in detail, was attributed mainly to trauma and infectious disease. Suspected or confirmed fishery interactions were the primary cause of adult/subadult traumatic injuries, while birth-related trauma was responsible for the neonate deaths.

STATUS OF STOCK

Harbor porpoise are not listed as “depleted” under the MMPA or listed as “threatened” or “endangered” under the Endangered Species Act. Based on the currently available data, the level of human-caused mortality and serious injury (0.6 1.0) does not exceed the PBR (277 114). Therefore, the Northern Oregon/Washington Coast stock of harbor porpoise is not classified as “strategic.” The total fishery mortality and serious injury for this stock (0.6 1.0: based on observer data self-reported fisheries information (0.6) and stranding data (0.4) where observer data were not available or failed to detect harbor porpoise mortalities) is not known to exceed 10% of the calculated PBR (27.7 11.4) and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. The status of this stock relative to its Optimum Sustainable Population (OSP) level and population trends is unknown.

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Revised ~~05/01/2008~~ 11/05/2008

KILLER WHALE (*Orcinus orca*): Eastern North Pacific Southern Resident Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Killer whales have been observed in all oceans and seas of the world (Leatherwood and Dahlheim 1978). Although reported from tropical and offshore waters, killer whales prefer the colder waters of both hemispheres, with greatest abundances found within 800 km of major continents (Mitchell 1975). Along the west coast of North America, killer whales occur along the entire Alaskan coast (Braham and Dahlheim 1982), in British Columbia and Washington inland waterways (Bigg et al. 1990), and along the outer coasts of Washington, Oregon, and California (Green et al. 1992; Barlow 1995, 1997; Forney et al. 1995). Seasonal and year-round occurrence has been noted for killer whales throughout Alaska (Braham and Dahlheim 1982) and in the intracoastal waterways of British Columbia and Washington State, where pods have been labeled as 'resident,' 'transient,' and 'offshore' (Bigg et al. 1990, Ford et al. 1994) based on aspects of morphology, ecology, genetics, and behavior (Ford and Fisher 1982, Baird and Stacey 1988, Baird et al. 1992, Hoelzel et al. 1998). Through examination of photographs of recognizable individuals and pods, movements of whales between geographical areas have been documented. For example, whales identified in Prince William Sound have been observed near Kodiak Island (Matkin et al. 1999) and whales identified in Southeast Alaska have been observed in Prince William Sound, British Columbia, and Puget Sound (Leatherwood et al. 1990, Dahlheim et al. 1997).

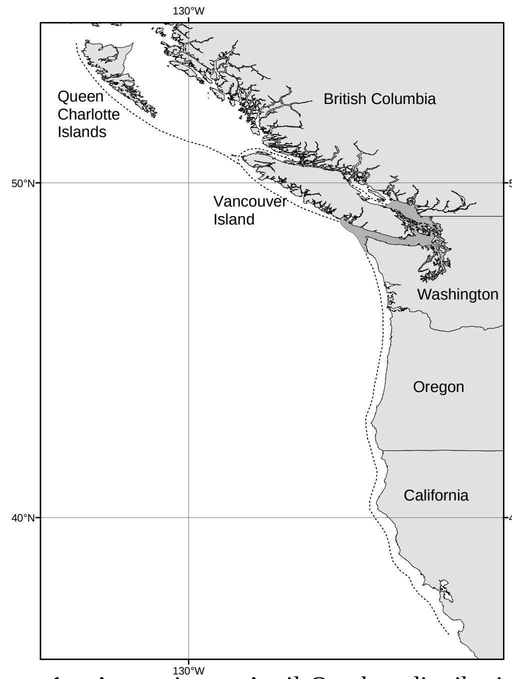

Figure 1. Approximate April-October distribution of the Eastern North Pacific Southern Resident killer whale stock (shaded area) and range of sightings (dotted line).

Studies on mtDNA restriction patterns provide evidence that the 'resident' and 'transient' types are genetically distinct (Stevens et al. 1989, Hoelzel 1991, Hoelzel and Dover 1991, Hoelzel et al. 1998). Analysis of 73 samples collected from eastern North Pacific killer whales from California to Alaska has demonstrated significant genetic differences among 'transient' whales from California through Alaska, 'resident' whales from the inland waters of Washington, and 'resident' whales ranging from British Columbia to the Aleutian Islands and Bering Sea (Hoelzel et al. 1998). However, low genetic diversity throughout this species world-wide distribution has hampered efforts to clarify its taxonomy. At an international symposium in cetacean systematics in May 2004, a workshop was held to review the taxonomy of killer whales. A majority of invited experts felt that the Resident- and Transient-type whales in the eastern North Pacific probably merited species or subspecies status (Reeves et al. 2004).

Most sightings of the Eastern North Pacific Southern Resident stock of killer whales have occurred in the summer in inland waters of Washington and southern British Columbia. However, pods belonging to this stock have also been sighted in coastal waters off southern Vancouver Island and Washington (Bigg et al. 1990, Ford et al. 2000, NWFSC unpubl. data). The complete winter range of this stock is uncertain. Of the three pods comprising this stock, one (J1) is commonly sighted in inshore waters in winter, while the other two (K1 and L1) apparently spend more time offshore (Ford et al. 2000). These latter two pods have been sighted as far south as Monterey Bay and central California in recent years (N. Black, pers. comm., K. Balcomb, pers. comm.) They sometimes have also been seen entering the inland waters of Vancouver Island from the north–through Johnstone Strait–in the spring (Ford et al. 2000), suggesting that they may spend time along the entire outer coast of Vancouver Island during the winter. In May 2003, these pods were sighted off the northern end of the Queen Charlotte Islands, the furthest north they had ever previously been documented (J. Ford, pers. comm.).

Based on data regarding association patterns, acoustics, movements, genetic differences and potential fishery interactions, five killer whale stocks are recognized within the Pacific U.S. EEZ: 1) the Eastern North Pacific Northern Resident stock - occurring from British Columbia through Alaska, 2) the Eastern North Pacific Southern

Resident stock - occurring mainly within the inland waters of Washington State and southern British Columbia (see Fig. 1), 3) the Eastern North Pacific Transient stock - occurring from Alaska through California, 4) the Eastern North Pacific Offshore stock - occurring from Southeast Alaska through California, and 5) the Hawaiian stock. The Stock Assessment Reports for the Alaska Region contain information concerning the Eastern North Pacific Northern Resident and Eastern North Pacific Transient stocks.

POPULATION SIZE

The Eastern North Pacific Southern Resident stock is a trans-boundary stock including killer whales in inland Washington and southern British Columbia waters. Photo-identification of individual whales through the years has resulted in a substantial understanding of this stock's structure, behaviors, and movements. In 1993, the three pods comprising this stock totaled 96 killer whales (Ford et al. 1994). The population increased to 99 whales in 1995, then declined to 79 whales in 2001, and most recently numbered ~~86~~ 85 whales in ~~2007~~ 2008. (Fig. 2; Ford et al. 2000; Center for Whale Research, unpubl. data). The 2001-2005 counts included a whale born in 1999 (L-98) that was listed as missing during the annual census in May and June 2001 but was subsequently discovered alone in an inlet off the west coast of Vancouver Island (J. Ford, pers. comm.). L-98 remained separate from L pod until 10 March 2006 when he died due to injuries associated with a vessel interaction in Nootka Sound. L-98 has been subtracted from the official 2006 and subsequent population censuses. The most recent census includes two new calves and the mortality of two post reproductive adult females and a subadult male since 1 July 2007. It does not include a calf born last fall that did not survive to 1 July 2008. This estimate also does not include a stillborn neonate from this past summer, or the mortality of two reproductive age females, or a calf that was born and died during the late summer (Center for Whale Research, unpubl. data). ~~In addition, two calves that have been observed during the fall 2007 surveys will not be confirmed as members of the population until the official census is completed in May/June 2008 (Center for Whale Research, unpubl. data).~~

Minimum Population Estimate

The abundance estimate for this stock of killer whales is a direct count of individually identifiable animals. It is thought that the entire population is censused every year. This estimate therefore serves as both a best estimate of abundance and a minimum estimate of abundance. Thus, the minimum population estimate (N_{MIN}) for the Eastern North Pacific Southern Resident stock of killer whales is ~~86~~ 85 animals.

Current Population Trend

During the live-capture fishery that existed from 1967 to 1973, it is estimated that 47 killer whales, mostly immature, were taken out of this stock (Ford et al. 1994). The first complete census of this stock occurred in 1974. Between 1974 and 1993 the Southern Resident stock increased approximately 35%, from 71 to 96 individuals (Ford et al. 1994). This represents a net annual growth rate of 1.8% during those years. Since 1995, the population declined to 79 whales before increasing from 2002-2005 to a total of 91 whales. The population has declined for the past ~~two~~ three years to ~~86~~ 85 whales (Ford et al. 2000; Center for Whale Research, unpubl. data).

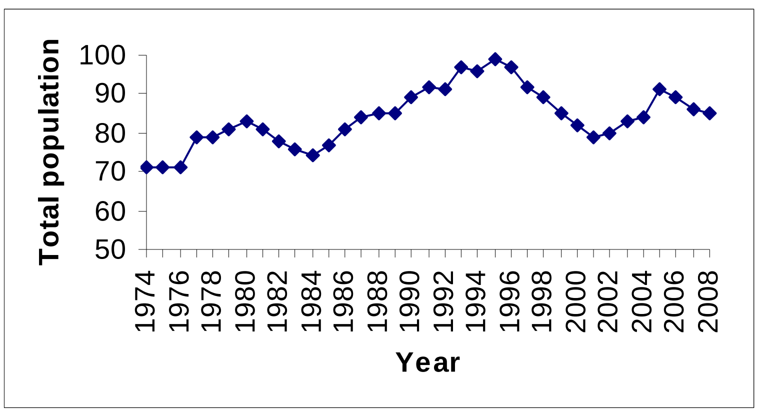

Figure 2. Population of Eastern North Pacific Southern Resident stock of killer whales, 1974-~~2007~~ 2008. Each year's count includes animals first seen and first missed; a whale is considered first missed the year after it was last seen alive (Ford et al. 2000; Center for Whale Research, unpubl. data).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for this stock of killer whales. Studies of 'resident' killer whale pods in British Columbia and Washington waters resulted in estimated population growth rates of 2.92% and 2.54% over the period from 1973 to 1987 (Olesiuk et al. 1990, Brault and Caswell 1993). For southern resident killer whales, estimates of the population growth rate have been made during the three periods when the population has been documented increasing since monitoring began in 1974. From 1974 to 1980 the population increased at a rate of 2.6%/year, 2.3%/year from 1985 to 1996, and 3.6%/year from 2002 to

2005 (Center for Whale Research, unpubl. data). However, a population increases at the maximum growth rate (R_{MAX}) only when the population is at extremely low levels; thus, any of these estimates may be an underestimate of R_{MAX}. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (~~86~~ 85) times one-half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.1 (for an endangered stock, Wade and Angliss 1997), resulting in a PBR of 0.17 whales per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

NMFS observers have monitored the northern Washington marine set gillnet fishery since 1988 (Gearin et al. 1994, 2000; P. Gearin, unpubl. data). Observer coverage ranged from approximately 40 to 83% in the entire fishery (coastal + inland waters) between 1998 and 2002. There was no observer coverage in this fishery from 1999-2003. However, the total fishing effort was 4, 46, 4.5 and 7 net days (respectively) in those years, it occurred only in inland waters, and no killer whale takes were reported. No killer whale mortality has been recorded in this fishery since the inception of the observer program.

In 1993, as a pilot for future observer programs, NMFS in conjunction with the Washington Department of Fish and Wildlife (WDFW) monitored all non-treaty components of the Washington Puget Sound Region salmon gillnet fishery (Pierce et al. 1994). Observer coverage was 1.3% overall, ranging from 0.9% to 7.3% for the various components of the fishery. Encounters (whales within 10 m of a net) with killer whales were reported, but not quantified, though no entanglements occurred.

In 1994, NMFS and WDFW conducted an observer program during the Puget Sound non-treaty chum salmon gillnet fishery (areas 10/11 and 12/12B). A total of 230 sets were observed during 54 boat trips, representing approximately 11% observer coverage of the 500 fishing boat trips comprising the total effort in this fishery, as estimated from fish ticket landings (Erstad et al. 1996). No interactions with killer whales were observed during this fishery. The Puget Sound treaty chum salmon gillnet fishery in Hood Canal (areas 12, 12B, and 12C) and the Puget Sound treaty sockeye/chum gillnet fishery in the Strait of Juan de Fuca (areas 4B, 5, and 6C) were also monitored in 1994 at 2.2% (based on % of total catch observed) and approximately 7.5% (based on % of observed trips to total landings) observer coverage, respectively (NWIFC 1995). No interactions resulting in killer whale mortality was reported in either treaty salmon gillnet fishery.

Also in 1994, NMFS, WDFW, and the Tribes conducted an observer program to examine seabird and marine mammal interactions with the Puget Sound treaty and non-treaty sockeye salmon gillnet fishery (areas 7 and 7A). During this fishery, observers monitored 2,205 sets, representing approximately 7% of the estimated number of sets in the fishery (Pierce et al. 1996). Killer whales were observed within 10 m of the gear during 10 observed sets (32 animals in all), though none were observed to have been entangled.

Killer whale takes in the Washington Puget Sound Region salmon drift gillnet fishery are unlikely to have increased since the fishery was last observed in 1994, due to reductions in the number of participating vessels and available fishing time (see details in Appendix 1). Fishing effort and catch have declined throughout all salmon fisheries in the region due to management efforts to recover ESA-listed salmonids.

An additional source of information on the number of killer whales killed or injured incidental to commercial fishery operations is the self-reported fisheries information required of vessel operators by the MMPA. During the period between 1994 and 2004, there were no fisher self-reports of killer whale mortality from any fisheries operating within the range of this stock. However, because logbook records (fisher self-reports required during 1990-94) are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. Logbook data are available for part of 1989-1994, after which incidental mortality reporting requirements were modified. Under the new system, logbooks are no longer required; instead, fishers provide self-reports. Data for the 1994-1995 phase-in period is fragmentary. After 1995, the level of reporting dropped dramatically, such that the records are considered incomplete and estimates of mortality based on them represent minimums (see Appendix 7 in Angliss and Lodge 2002 for details).

Due to a lack of observer programs, there are few data concerning the mortality of marine mammals incidental to Canadian commercial fisheries. Since 1990, there have been no reported fishery-related strandings of killer whales in Canadian waters. However, in 1994 one killer whale was reported to have contacted a salmon gillnet but did not entangle (Guenther et al. 1995). Data regarding the level of killer whale mortality related to commercial fisheries in Canadian waters are not available, though the mortality level is thought to be minimal.

During this decade there have been no reported takes from this stock incidental to commercial fishing operations (D. Ellifrit, pers. comm.), no reports of interactions between killer whales and longline operations (as occurs in Alaskan waters; see Yano and Dahlheim 1995), no reports of stranded animals with net marks, and no photographs of individual whales carrying fishing gear. The total fishery mortality and serious injury for this stock is zero.

Other Mortality

According to Northwest Marine Mammal Stranding Network records, maintained by the NMFS Northwest Region, no human-caused killer whale mortality or serious injuries were reported from non-fisheries sources in 1998-2004. There was documentation of a whale-boat collision in Haro Strait in 2005 which resulted in a minor injury to a whale. In 2006, whale L98 was killed during a vessel interaction. It is important to note that L98 had become habituated to regularly interacting with vessels during its isolation in Nootka Sound. The annual level of human-caused mortality for this stock over the past five years is 0.2 animals per year (reflecting the vessel strike mortality of animal L98 in 2006).

STATUS OF STOCK

On November 15, 2005 NMFS listed Southern Resident killer whales as endangered under the ESA. Total annual fishery mortality and serious injury for this stock (0) is not known to exceed 10% of the calculated PBR (0.17) and, therefore, appears to be insignificant and approaching zero mortality and serious injury rate. The estimated annual level of human-caused mortality and serious injury of 0.2 animals per year exceeds the PBR (0.17). Southern Resident killer whales are formally listed as “endangered” under the ESA and consequently the stock is automatically considered as a “depleted” and “strategic” stock under the MMPA.

Habitat Issues

Several of the potential risk factors identified for this population have habitat implications. The summer range of this population, the inland waters of Washington and British Columbia, is the home to a large commercial whale watch industry as well as high levels of recreational boating and commercial shipping. There continues to be concern about potential for masking effects by noise generated from these activities on the whales’ communication and foraging. This population appears to be Chinook salmon specialists (Ford and Ellis 2006, NWFSC unpubl.data), and there is some evidence that changes in coast–wide Chinook abundance has affected this population (Ford et al. 2005). In addition, the high trophic level and longevity of the animals has predisposed them to accumulate levels of contaminants that are high enough to cause potential health impacts. In particular, there is recent evidence of extremely high levels of flame retardants in young animals (Krahn et. al 2007).

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Revised ~~05/01/2008~~ 11/01/2008

HUMPBACK WHALE (*Megaptera novaeangliae*): California/Oregon/Washington Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Although the International Whaling Commission (IWC) only considered one stock (Donovan 1991), there is now good evidence for multiple populations of humpback whales in the North Pacific (Johnson and Wolman 1984; Baker et al. 1990). Humpback whales in the North Pacific feed in coastal waters from California to Russia and in the Bering Sea. They migrate south to wintering destinations off Mexico, Central America, Hawaii, southern Japan, and the Philippines. Mitochondrial and nuclear genetic markers show that considerable structure exists in humpback whale populations in the North Pacific (Baker et al. 1998). Significant levels of mitochondrial and nuclear genetic differences were found between central California and Southeast Alaska feeding areas (Baker et al. 1998). Mitochondrial genetic differences are also found between feeding area in the Atlantic (Palsboll et al. 1995). The genetic exchange rate between California and Alaska is estimated to be less than 1 female per generation (Baker 1992). Two breeding areas (Hawaii and coastal Mexico) showed fewer genetic differences than did the two feeding areas (Baker 1992). Individually identified whales have been found to move between winter breeding areas in Hawaii and Mexico (Baker et al. 1990). There have been no individual matches between 597 humpbacks photographed in California and 617 humpbacks photographed in Alaska (Calambokidis et al. 1996). Only two of the 81 whales photographed in British Columbia have matched with a California catalog (Calambokidis et al. 1996), indicating that the U.S./Canada border is an approximate geographic boundary between feeding populations. Waters off northern Washington may be an area of mixing between the California/Oregon/Washington stock and a southern British Columbia stock. For humpback whales, maternally directed fidelity to specific feeding areas within an ocean basin appears to be so strong that genetic differences have evolved in both the Atlantic, where there is a single breeding area, and in the Pacific, where there are multiple breeding areas. Because fidelity appears to be greater in feeding areas than in breeding areas, the stock structure of humpback whales is defined based on feeding areas.

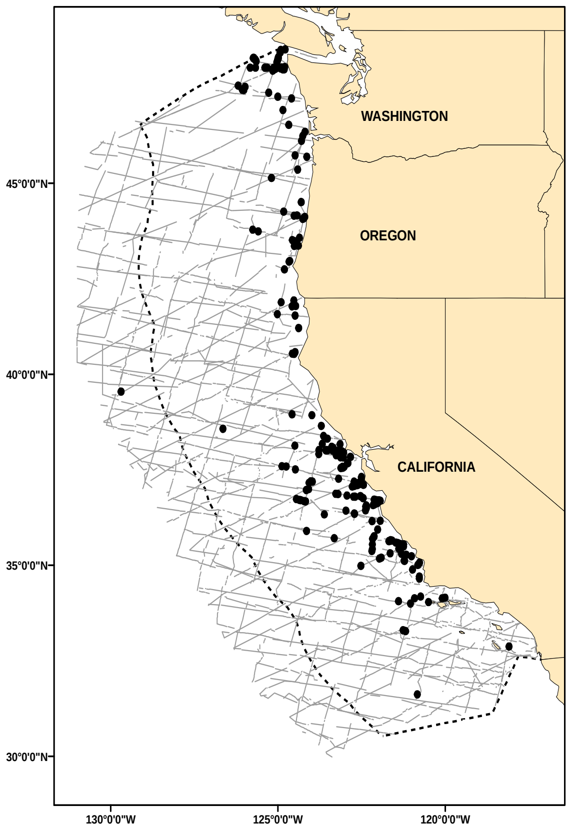

Figure 1. Humpback whale sightings based on shipboard surveys off California, Oregon, and Washington, 1991-2005. Dashed line represents the U.S. EEZ, thin lines indicate completed transect effort of all surveys combined. See Appendix 2 for data sources and information on timing and location of survey effort.

For the Marine Mammal Protection Act (MMPA) stock assessment reports, the California/Oregon/Washington Stock is defined to include humpback whales that feed off the west coast of the United States. The winter migratory destination of this stock is primarily in coastal waters of Mexico and Central America. Two other stocks are recognized in the U.S. MMPA stock assessment reports: the Central North Pacific Stock (with feeding areas from Southeast Alaska to the Alaska Peninsula) and the Western North Pacific Stock (with feeding areas from the Aleutian Islands, the Bering Sea, and Russia).

POPULATION SIZE

Based on whaling statistics, the pre-1905 population of humpback whales in the North Pacific was estimated to be 15,000 (Rice 1978), but this population was reduced by whaling to approximately 1,200 by 1966 (Johnson and Wolman 1984). A photo-identification study in 2004-2006 estimated the abundance of humpback whales in the entire Pacific Basin to be approximately 18,000-20,000 (Calambokidis et al. 2008). Estimates of regional abundance in the California/Oregon stratum from that study (1,702) are less precise than estimates from dedicated west-coast studies. Barlow and Forney (2007) estimated 1,096 (CV= 0.22) humpbacks in California, Oregon, and Washington waters based on summer/fall ship line-transect surveys in 2001. Forney (2007) estimated 1,769 (CV=0.16) humpbacks in the same region based on a 2005 summer/fall ship line-transect survey, which included additional fine-scale coastal strata not included in the 2001 survey. The combined 2001 and 2005 line-transect estimate of abundance is the geometric mean of the two annual estimates, or 1,392 (CV=0.13). Calambokidis et al. (2004) estimated humpback whale abundance in these feeding areas from 1991 to 2003 using Petersen mark-recapture estimates based on photo-identification collections in adjacent pairs of years (Figure 2). These data show a general upward trend in abundance followed by a large (but not statistically significant) drop in the 1999/2000 and 2000/2001 estimates. The 2002/2003 mark-recapture population estimate (1,391, CV=0.22) is higher than any previous mark-recapture estimates and may indicate that the apparent decline in the previous two estimates exaggerates any real decline that might have occurred (Calambokidis et al. 2003) or that a real decline was followed by an influx of new whales from another area (Calambokidis et al. 2004). This latter view is substantiated by the greater fraction of new whales seen for the first time in 2003 (Calambokidis et al. 2004). In general, mark-recapture estimates are negatively biased due to heterogeneity in sighting probabilities (Hammond 1986); however, this bias is likely to be minimal because the above mark-recapture estimate is based on data from nearly half of the entire population (the 2002/2003 data contained 542 known individuals). The best estimate of abundance is the unweighted geometric mean of 2002/2003 mark-recapture and 2001-2005 line transect estimates, or 1,391 (CV=0.13) whales.

Minimum Population Estimate

The minimum population estimate for humpback whales in the California/Mexico stock is taken as the lower 20th percentile of the log-normal distribution of the unweighted mean estimate or approximately 1,250.

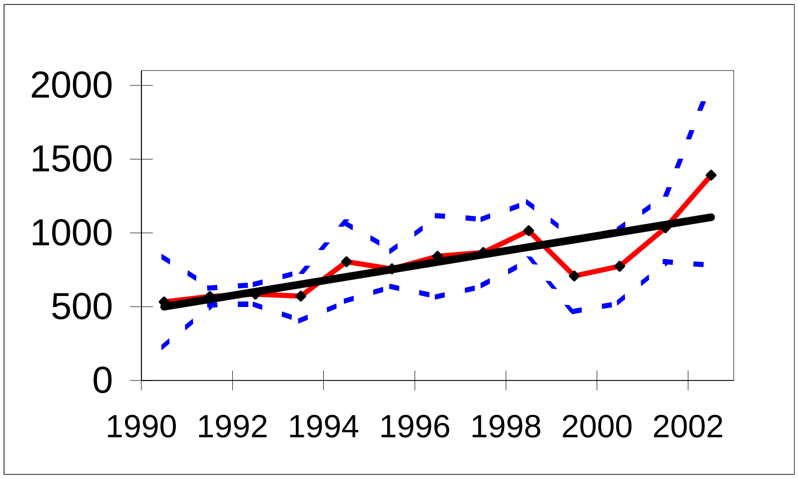

Figure 2. Mark-recapture estimates of the abundance of humpback whales feeding off California, Oregon, and Washington, based on photo-identification studies (Calambokidis et al. 2004). Dotted lines indicate +/- 2 standard errors for each estimate. Straight, bold line indicates linear regression.

Current Population Trend

Ship surveys provide some indication that humpback whales increased in abundance in California coastal waters between 1979/80 and 1991 (Barlow 1994) and between 1991 and 2005 (Barlow and Forney 2007; Forney 2007), but this increase was not steady, and estimates showed a slight dip in 2001. Mark-recapture population estimates increased steadily from 1988/90 to 1997-98 at about 8% per year (Calambokidis et al. 1999), showed a decrease around 1999-2001, and then increased again in 2002-2003 (Figure 2, Calambokidis et al. 2004). The observed decrease in abundance between 1999-2001 may have been related to prevailing oceanographic conditions off the U.S. west coast. The apparent dip in the 1999/2000 and 2000/2001 estimates may indicate that population growth is slowing, but the subsequent increases in 2001/2002 and 2002/2003 casts some doubt on this explanation. Population estimates for the entire North Pacific have also increased substantially from 1,200 in 1966 to 6,000-8,000 circa 1992. Although these estimates are based on different methods and the earlier estimate is extremely uncertain, the growth rate implied by these estimates (6-7%) is consistent with the recently observed growth rate of the California/Oregon/Washington stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

The proportion of calves in the California/Oregon/Washington stock from 1986 to 1994 appeared much lower than previously measured for humpback whales in other areas (Calambokidis and Steiger 1994), but in 1995-97 a greater proportion of calves were identified, and the 1997 reproductive rates for this population are closer to those reported for humpback whale populations in other regions (Calambokidis et al. 1998). Despite the apparently low proportion of calves, two independent lines of evidence indicate that this stock was growing in the 1980s and early 1990s (Barlow 1994; Calambokidis et al. 2003) with a best estimate of 8% growth per year (Calambokidis et al. 1999). The current net productivity rate is unknown.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (1,250) times one half the estimated population growth rate for this stock of humpback whales (½ of 8%) times a recovery factor of 0.1 (for an endangered species with N_{min} < 1,500), resulting in a PBR of 5. Because this stock spends approximately half its time outside the U.S. EEZ, the PBR allocation for U.S. waters is 2.5 whales per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Information on historic whaling has been moved to the Status of Stock section.

Fishery Information

A summary of known fishery mortality and injury for this stock of humpback whales for ~~2002-2006~~ 2003-2007 is given in Table 1. A total of ~~14~~ 19 humpback whales were observed entangled in fishing gear ~~from 2002-2006~~ during 2003-2007 in California and Oregon (Table 1). No entanglements were reported from the observer program that monitors the large-mesh swordfish and thresher shark drift gillnet fishery (Carretta and Chivers 2004, Carretta et al. 2005a, 2005b, Carretta and Enriquez 2006, 2007); however, a free-swimming humpback was observed entangled in gillnet gear of unknown origin in 2006 (NMFS, Southwest Regional Stranding Program, unpublished data). ~~Ten~~ Of the 19 humpbacks entangled in fishing gear, 13 ~~humpbacks~~ were reported entangled at sea in trap/pot fishery gear off California and Oregon ~~during 2002-2006~~, including one animal that was later found dead in Oregon (Northwest Regional Stranding Program, unpublished data). Six humpbacks were reported entangled in unknown gillnet or other gear, including lines and buoys of unknown origin. Two of the 13 pot/trap gear entanglements could be attributed to specific fisheries: One whale was entangled in sablefish trap gear and another in spot prawn trap gear (NMFS, Southwest Regional Stranding Program, unpublished data). The whale entangled in sablefish trap gear was successfully disentangled by divers who removed all the gear, and the animal swam away immediately following disentanglement. ~~The remaining seven entanglements were attributed to unknown trap/pot gear or crab pot line.~~ Two of the sightings involving crab pot gear were cow/calf pairs where the cow was entangled. ~~Three additional whales were observed entangled in net/rope or other gear of unknown origin during this same period. Other unobserved fisheries may also result in injuries or deaths of humpback whales. Other than the humpback that died off Oregon in 2006 and the whale disentangled from the sablefish trap gear, the final status of the 12 remaining entangled whales is unknown.~~ Due to the trailing gear, ~~they~~ 17 of the humpbacks are considered as serious injuries in Table 1 (the released animal is not considered seriously injured). Including the ~~12~~ 17 serious injuries and ~~1~~ one mortality, total mean annual serious injury and mortality for the commercial fisheries listed in Table 1 is ~~2.6~~ 3.6 per year for the period ~~2002-2006~~ 2003-2007. In addition to the humpback entanglements, there were five unidentified whales observed entangled in pot or trap gear and two unidentified whales entangled in unknown gillnet gear during 2003-2007. It is likely that some of these whales were humpbacks.

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. Quantitative data are available only for the Mexican swordfish drift gillnet fishery, which uses vessels, gear, and operational procedures similar to those in the U.S. drift gillnet fishery, although nets may be up to 4.5 km long (Holts and Sosa-Nishizaki 1998). The fleet increased from two vessels in 1986 to 31 vessels in 1993 (Holts and Sosa-Nishizaki 1998). The total number of sets in this fishery in 1992 can be estimated from data provided by these authors to be approximately 2700, with an observed rate of marine mammal bycatch of 0.13 animals per set (10 marine mammals in 77 observed sets; Sosa-Nishizaki et al. 1993). This overall mortality rate is similar to that observed in California driftnet fisheries during 1990-95 (0.14 marine mammals per set; Julian and Beeson, 1998), but species-specific information is not available for the Mexican fisheries. Previous efforts to convert the Mexican swordfish driftnet fishery to a longline fishery have resulted in a mixed-fishery, with 20 vessels alternately using longlines or driftnets, 23 using driftnets only, 22 using longlines only, and seven with unknown gear type (Berdegué 2002).

Table 1. Summary of available information on the incidental mortality and injury of humpback whales (eastern North Pacific stock) for commercial fisheries that might take this species (Carretta and Chivers 2004, Carretta et al. 2005a, 2005b). Injury includes any entanglement that does not result in immediate death and may include serious injury resulting in death. n/a indicates that data are not available. Mean annual takes are based on ~~2002-2006~~ 2003-2007 data unless noted otherwise.

Fishery Name	Year(s)	Data Type	Percent Observer Coverage	Observed Mortality (and injury)	Estimated mortality	Mean Annual Takes
CA/OR thresher shark/swordfish drift gillnet fishery	~~2002~~ 2003 2004 2005 2006 2007	Observer	~~22.1%~~ 20.2% 20.6% 20.9% 18.5% 16.4%	~~0~~ 0 0 0 0 0	~~0~~ 0 0 0 0 0	0 (n/a)
CA ~~angel shark/~~halibut and white seabass and other species large mesh (>3.5") set gillnet fishery	~~1990-94~~ ~~2002~~ 2003 2004 2005 2006 2007	~~No fishery-wide observer program since 1994~~ Observer	~~10-15%~~ ~~0%~~ 0% 0% 0% 0% 17.8%	~~0,0,0,0,0~~ ~~n/a~~ n/a n/a n/a n/a 0 (0)	~~0,0,0,0,0~~ n/a	~~n/a~~ 0 (n/a)
Pot or trap fisheries	~~2002-2006~~ 2003 2004 2005 2006 2007	Strandings & sightings	n/a	~~1~~ ~~(9)~~ 0 (5) 0 (0) 0 (3) 1 (1) 0 (2)	n/a	≥~~2.0~~ 2.4
unidentified fisheries	~~2002-2006~~ 2003 2004 2005 2006 2007	Strandings& sightings	~~n/a~~	~~0~~ ~~(3)~~ 0 (0) 0 (1) 0 (0) 0 (2) 0 (3)	n/a	≥~~0.6~~ 1.2
Total Annual Takes						≥~~2.6~~ 3.6

Ship Strikes

~~Ship strikes were implicated in the deaths of at least two humpback whales in 1993, one in 1995, and one in 2000 (NMFS, Southwest Regional Office, unpubl. data).~~ One humpback was reported injured as the result of a ship strike in 2005, and another in 2007, but the fate of ~~that~~ both animals is unknown and details are lacking to determine if ~~it was a~~ these were serious ~~injury~~ injuries. During ~~2002-2006~~ 2003-2007, there were an additional ~~seven~~ six injuries ~~and one mortality~~ of unidentified large whales attributed to ship strikes. Additional mortality from ship strikes probably goes unreported because the whales do not strand or, if they do, they do not have obvious signs of trauma. Several humpback whales have been photographed in California with large gashes in their dorsal surface that appear to be from ship strikes (J. Calambokidis, pers. comm.). The average number of documented humpback whale deaths by ship strikes for ~~2002-2006~~ 2003-2007 is zero per year, but it is apparent that animals struck by ships are unlikely to be reported.

Other human-caused mortality

There was no humpback whale mortality reported from non-commercial fishery sources for the period ~~2002-2006~~ 2003-2007. The average number of humpback deaths from unknown anthropogenic sources is zero per year from ~~2002-2006~~ 2003-2007.

STATUS OF STOCK

Approximately 15,000 humpback whales were taken from the North Pacific from 1919 to 1987 (Tonnessen and Johnsen 1982; C. Allison, IWC unpubl. Data), and, of these, approximately 8,000 were taken from the west coast of Baja California, California, Oregon and Washington (Rice 1978), presumably from this stock. Shore-based whaling apparently depleted the humpback whale stock off California twice: once prior to 1925 (Clapham et al. 1997) and again between 1956 and 1965 (Rice 1974). There has been a prohibition on taking humpback whales since 1966. As a result of commercial whaling, humpback whales were ~~formally~~ listed as "endangered" under the Endangered Species Conservation Act of 1969. This protection was transferred to the Endangered Species Act (ESA) in 1973. The species is still listed as "endangered", and consequently the California/Mexico stock is automatically considered as a "depleted" and "strategic" stock under the MMPA. The estimated annual mortality and serious injury due to entanglement (~~2.6/yr~~ 3.6/yr), other anthropogenic sources (zero), plus ship strikes (zero) in California exceeds the PBR allocation of 2.5 for U.S. waters. ~~The 12 humpbacks that were entangled at sea and whose final status are unknown were either trailing pot or trap gear, buoys, or had netting wrapped around one or more body parts, and are considered seriously injured.~~ Based on strandings and at sea observations, annual humpback whale mortality and serious injury in commercial fisheries is greater than 10% of the PBR; therefore, total fishery mortality and serious injury is not approaching zero mortality and serious injury rate. The eastern North Pacific stock appears to be increasing in abundance.

Habitat Concerns

Increasing levels of anthropogenic sound in the world's oceans (Andrew et al. 2002), such as those produced by shipping traffic, ATOC (Acoustic Thermometry of Ocean Climate) or LFA (Low Frequency Active) sonar, have been suggested to be a habitat concern for whales, particularly for baleen whales that may communicate using low-frequency sound. Based on vocalizations (Richardson et al. 1995; Au et al. 2006), reactions to sound sources (Lien et al. 1990, 1992; Maybaum 1993), and anatomical studies (Hauser et al. 2001), humpback whales also appear to be sensitive to mid-frequency sounds, including those used in active sonar military exercises (Navy 2007).

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Revised ~~12/15/2008~~ 05/29/2009

BLUE WHALE (*Balaenoptera musculus*): Eastern North Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The International Whaling Commission (IWC) has formally considered only one management stock for blue whales in the North Pacific (Donovan 1991), but this ocean is thought to include more than one population (Ohsumi and Wada 1972; Braham 1991), possibly as many as five (Reeves et al. 1998). Blue whales in the North Pacific produce two distinct, stereotypic calls that have been termed the northwestern and northeastern call types, and it has been proposed that these represent two distinct populations with some degree of geographic overlap (Stafford et al. 2001). The northeastern call predominates in the Gulf of Alaska, the U.S. West Coast, and the eastern tropical Pacific, and the northwestern call predominates from south of the Aleutian Islands to the Kamchatka Peninsula in Russia (Stafford et al. 2001). Both call types are represented in lower latitudes in the central North Pacific but differ in their seasonal patterns (Stafford et al. 2001). Gilpatrick and Perryman (submitted) showed that blue whales from California to Central America are on average about two meters shorter than blue whales from the central and western north Pacific regions. Mate et al. (1999) used satellite tags to show that the eastern tropical Pacific is a migratory destination for blue whales that were tagged off southern California, and photographs of blue whales on the Costa Rica Dome in the eastern tropical Pacific have matched individuals that had been previously photographed off California (Calambokidis, pers. comm.). Photographs of blue whales in California have also been matched to individuals photographed off the Queen Charlotte Islands in northern British Columbia ~~(Calambokidis, pers. comm.)~~ and to one individual photographed in the northern Gulf of Alaska ~~(Calambokidis and Barlow, pers. comm.).~~ (Calambokidis et al. 2009).

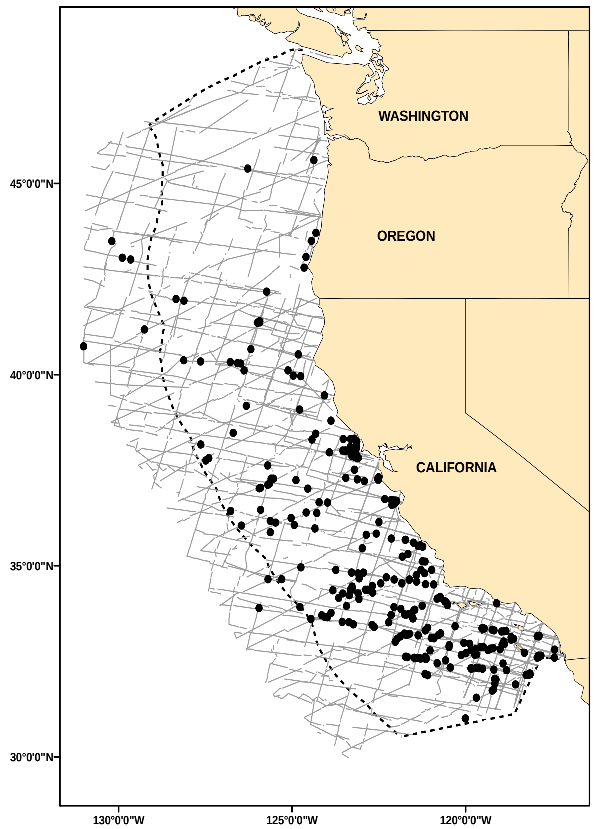

Figure 1. Blue whale sighting locations based on aerial and summer/autumn shipboard surveys off California, Oregon, and Washington, 1991-2005 (see Appendix 2 for data sources and information on timing and location of surveys). Dashed line represents the U.S. EEZ; thin lines represent completed transect effort for all surveys combined.

For the Marine Mammal Protection Act (MMPA) stock assessment reports, the Eastern North Pacific Stock of blue whales includes animals found in the eastern North Pacific from the northern Gulf of Alaska to the eastern tropical Pacific. This definition is consistent with both the distribution of the northeastern call type and with the known range of photographically identified individuals. Based on locations where the northeastern call type has been recorded, some individuals in this stock may range as far west as Wake Island and as far south as the Equator (Stafford et al. 1999, 2001). The U.S. West Coast is certainly one of the most important feeding areas in summer and fall (Figure 1), but, increasingly, blue whales from this stock have been found feeding to the north and south of this area during summer and fall. Most of this stock is believed to migrate south to spend the winter and spring in high productivity areas off Baja California, in the Gulf of California, and on the Costa Rica Dome. Given that these migratory destinations are areas of high productivity and given the observations of feeding in these areas, blue whales can be assumed to feed year round. Some individuals from this stock may be present year-round on the Costa Rica Dome (Reilly and Thayer 1990). However, it is also possible that some Southern Hemisphere blue whales might occur north of the equator during the austral winter. One other stock of North Pacific blue whales (in Hawaiian waters) is recognized in the Marine Mammal Protection Act (MMPA) Stock Assessment Reports.

POPULATION SIZE

The size of the feeding stock of blue whales off the U.S. West Coast was estimated recently by both line-transect and mark-recapture methods. Barlow and Forney (2007) estimated 603 (CV=0.29) blue whales off California, Oregon, and Washington based on ship line-transect surveys in 2001 and Forney (2007), estimated 721 (CV=0.27) from a 2005 line-transect survey of the same area. The unweighted geometric mean of the 2001 and 2005 line transect estimates is 659 (CV=0.20) whales. Calambokidis et al. (2007) used photographic mark-recapture and estimated population sizes of 2,117 0.34) based on 2004-2006 photographs of left sides and 3,568 0.42) based on right sides. The average of the mark-recapture estimates is 2,842 (CV=0.41) whales. Mark-recapture estimates are often negatively biased by individual heterogeneity in sighting probabilities (Hammond 1986); however, Calambokidis et al. (2007) minimize such effects by selecting one sample that was taken randomly with respect to distance from the coast. Similarly, the line-transect estimates may also be negatively biased because some blue whales in this stock are outside of the study area at the time of survey (Calambokidis and Barlow 2004). Because some fraction of the population is always outside the survey area, the line-transect and mark recapture estimation methods provide different measures of abundance for this stock. Line transect estimates reflect the average density and abundance of blue whales in the study area during summer and autumn surveys, while mark recapture estimates provide an estimate of total population size. Therefore, ~~The~~ the best estimate of blue whale abundance is the ~~unweighted geometric mean of the line-transect and~~ average of mark-recapture estimates, or ~~1,368~~ 2,842 (CV= ~~0.22~~ 0.41).

Minimum Population Estimate

The minimum population estimate for blue whales is taken as the lower 20th percentile of the log-normal distribution of abundance estimated from the combined mark-recapture and line-transect estimates, or approximately ~~1,136~~ 2,039.

Current Population Trend

There is some indication that blue whales increased in abundance in California coastal waters between 1979/80 and 1991 (regression $p<0.05$, Barlow 1994) and between 1991 and 1996 (not significant, Barlow 1997). Although this may be due to an increase in the stock as a whole, it could also be the result of an increased use of California as a feeding area. The size of the apparent increase in abundance seen by Barlow (1994) is too large to be accounted for by population growth alone. Also, Larkman and Veit (1998) did not detect any increase along consistently surveyed tracklines in the Southern California Bight from 1987 to 1995. Although the population in the North Pacific is expected to have grown since being given IWC protected status in 1966, there is no evidence showing that the eastern North Pacific stock is currently growing. Estimates from line transect surveys declined between 1991-2005 (Figure 2), which is probably due to interannual variability in the fraction of the population that utilizes California waters during the summer and autumn.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

No information exists on the rate of growth of blue whale populations in the Pacific (Best 1993).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (~~1,136~~ 2,039) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.1 (for an endangered species which has a minimum abundance less than 1,500), resulting in a PBR of ~~2.0~~. 4.0 Because this stock spends approximately half its time outside the U.S. EEZ, the PBR allocation for U.S. waters is half this total, or ~~1.0~~ 2.0 whales per year.

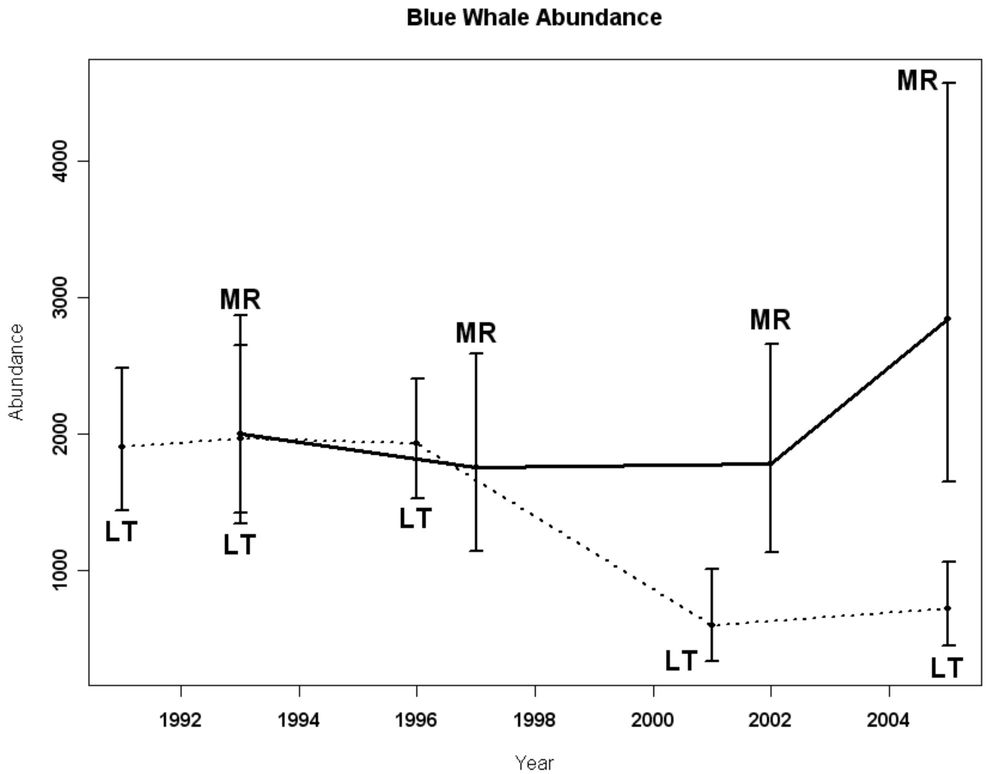

Figure 2. Estimates of abundance from vessel-based line transect (LT) and mark-recapture (MR) surveys conducted in California waters, 1991-2005 (Barlow and Forney 2007; Calambokidis et al. 2003; Calambokidis and Barlow 2004; Forney 2007; Calambokidis et al. 2007). The four line transect estimates are based on annual surveys conducted in 1991, 1993, 1996, 2001, and 2005, respectively. The three mark-recapture estimates are based on 1991-1993, 1995-1997, 2000-2002, and 2004-2006 pooled estimates, respectively.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

The offshore drift gillnet fishery is the only fishery that is likely to take blue whales from this stock, but no fishery mortality or serious injuries have been observed (Table 1). Detailed information on this fishery is provided in Appendix 1. After the 1997 implementation of a Take Reduction Plan, which included skipper education workshops and required the use of pingers and minimum 6-fathom extenders, overall cetacean entanglement rates in the drift gillnet fishery dropped considerably (Barlow and Cameron 1999). Mean annual takes for this fishery (Table 1) are based only on ~~2002-2006~~ 2003-2007 data (Carretta and Chivers 2004, Carretta et al. 2005a, 2005b, Carretta and Enriquez 2006, 2007, Carretta and Enriquez, in prep.). This results in an average estimate of zero blue whales taken annually. Some gillnet mortality of large whales may go unobserved because whales swim away with a portion of the net; however, fishermen report that large rorquals (blue and fin whales) usually swim through nets without entangling and with very little damage to the nets.

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. Quantitative data are available only for the Mexican swordfish drift gillnet fishery, which uses vessels, gear, and operational procedures similar to those in the U.S. drift gillnet fishery, although nets may be up to 4.5 km long (Holts and Sosa-Nishizaki 1998). The fleet increased from two vessels in 1986 to 31 vessels in 1993 (Holts and Sosa-Nishizaki 1998). The total number of sets in this fishery in 1992 can be estimated from data provided by these authors to be approximately 2700, with an observed rate of marine mammal bycatch of 0.13 animals per set (10 marine mammals in 77 observed sets; Sosa-Nishizaki et al. 1993). This overall mortality rate is similar to that observed in California driftnet fisheries during 1990-95 (0.14 marine mammals per set; Julian and Beeson, 1998), but species-specific information is not available for the Mexican fisheries. Previous efforts to convert the Mexican swordfish driftnet fishery to a longline fishery have resulted in a mixed-fishery, with 20 vessels alternately using longlines or driftnets, 23 using driftnets only, 22 using longlines only, and seven with unknown gear type (Berdegué 2002).

Table 1. Summary of available information on the incidental mortality and injury of blue whales (Eastern North Pacific stock) for commercial fisheries that might take this species (Carretta and Chivers 2004, Carretta et al. 2005a, 2005b, Carretta and Enriquez 2006, 2007). Mean annual takes are based on ~~2002-2006~~ 2003-2007 data unless noted otherwise.

Fishery Name	Year(s)	Data Type	Percent Observer Coverage	Observed Mortality (and injury)	Estimated mortality (CV in parentheses)	Mean Annual Takes (CV in parentheses)
CA/OR thresher shark/swordfish drift gillnet fishery	~~2002~~ 2003 2004 2005 2006 2007	observer	~~22.1%~~ 20.2% 20.6% 20.9% 18.5% 16.4%	~~0~~ 0 0 0 0 0	~~0~~ 0 0 0 0 0	0 (n/a)
Total Annual Takes						0 (n/a)

Ship Strikes

Ship strikes were implicated in the deaths of five blue whales ~~in 1980, 1986, 1987, 1993, 2002 and 2004~~, from 2003-2007 (~~J. Cordaro, Southwest Region, NMFS and J. Heyning, pers. comm.~~ NMFS SWR Stranding Database). Four of these deaths were attributed to ship strikes in 2007, the highest number recorded for any year. In addition, there was one blue whale injured as the result of a ship strike in 2003 (blood observed in the water). During ~~2002-2006~~ 2003-2007, there were an additional ~~twelve~~ six injuries ~~and one mortality~~ of unidentified large whales attributed to ship strikes. Additional mortality from ship strikes probably goes unreported because the whales do not strand or, if they do, they do not always have obvious signs of trauma. Several blue whales have been photographed in California with large gashes in their dorsal surface that appear to be from ship strikes (J. Calambokidis, pers. comm.). Including the serious injury in 2003 and the 5 deaths between 2003-2007, ~~B~~blue whale mortality and injuries attributed to ship strikes in California waters averaged ~~0.6~~ 1.2 per year for ~~2002-2006~~ 2003-2007. The high number of ship strikes observed in 2007 resulted in NOAA implementing a plan to reduce these deaths. The plan involved NOAA weather radio and U.S. Coast Guard advisory broadcasts to mariners entering the Santa Barbara Channel to be observant for whales and recommended that they transit the channel at 10 knots or less. The Channel Islands National Marine Sanctuary also developed a blue whale/ship strike response plan, which involved weekly overflights to record whale locations. Additional plan information can be found at http://channelislands.noaa.gov/focus/alert.html.

STATUS OF STOCK

The reported take of North Pacific blue whales by commercial whalers totaled 9,500 between 1910 and 1965 (Ohsumi and Wada 1972). Approximately 3,000 of these were taken from the west coast of North America from Baja California, Mexico to British Columbia, Canada (Tonnessen and Johnsen 1982; Rice 1992; Clapham et al. 1997; Rice 1974). Blue whales in the North Pacific were given protected status by the IWC in 1966, but Doroshenko (2000) reported that a small number of blue whales were taken illegally by Soviet whalers after that date. As a result of commercial whaling, blue whales were ~~formally~~ listed as "endangered" under the Endangered Species Conservation Act of 1969. This protection was transferred to the Endangered Species Act (ESA) in 1973. They are still listed as "endangered", and consequently the Eastern North Pacific stock is automatically considered as a "depleted" and "strategic" stock under the MMPA. The annual incidental mortality and injury rate (~~0.6~~ 1.2/year) from ship strikes is less than the calculated PBR (~~1.0~~ 2.0) for this stock, but this rate does not include unidentified large whales struck by vessels, some of which may have been blue whales. To date, no blue whale mortality has been associated with California gillnet fisheries; therefore, total fishery mortality is approaching zero mortality and serious injury rate.

Habitat Concerns

Increasing levels of anthropogenic sound in the world's oceans (Andrew et al. 2002) have been suggested to be a habitat concern for blue whales (Reeves et al. 1998).

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FALSE KILLER WHALE (*Pseudorca crassidens*): Pacific Islands Region Stock Complex - Hawaii Insular, Hawaii Pelagic, and Palmyra Atoll Stocks

STOCK DEFINITIONS AND GEOGRAPHIC RANGES

False killer whales are found worldwide mainly in tropical and warm-temperate waters (Stacey et al. 1994). In the North Pacific, this species is well known from southern Japan, Hawaii, and the eastern tropical Pacific. There are six stranding records from Hawaiian waters (Nitta 1991; Maldini 2005). One on-effort sighting of false killer whales was made during a 2002 shipboard survey of waters within the U.S. Exclusive Economic Zone (EEZ) of the Hawaiian Islands (Figure 1; Barlow 2006). Smaller-scale surveys conducted around the main Hawaiian Islands (Figure 2) show that false killer whales are also commonly encountered in nearshore waters (Baird et al. 2005, Mobley et al. 2000, Mobley 2001, 2002, 2003, 2004). This species also occurs in U.S. EEZ waters around Palmyra Atoll (Figure 1) and sightings of false killer whales have been recently confirmed within the Johnston Atoll EEZ (NMFS/PIR/PSD unpublished data) and the U.S. EEZ waters of American Samoa (Johnston et al., In Press).

Genetic analyses of tissue samples collected within the Eastern North Pacific (ENP) indicate restricted gene flow between false killer whales sampled near the main Hawaiian Islands and false killer whales sampled in all other regions of the ENP (Chivers et al. 2007). Since 2003, observers of the Hawaii-based longline fishery have also been collecting tissue samples of caught cetaceans for genetic analysis whenever possible. Four false killer whale samples, two collected outside the Hawaiian EEZ and two collected more than 100 nautical miles from the main Hawaiian Islands (See Figure 3) were determined to have ENP-like haplotypes. This indicates The latter two samples indicate that false killer whales within the Hawaiian EEZ belong to two different genetic populations, with a boundary somewhere within the Hawaiian EEZ. Based on sighting locations and genetic analyses of tissue samples, Chivers et al. (2008) suggested a stock boundary at about 75 nmi distance from the main Hawaiian Islands. This corresponds roughly to the February-September longline exclusion area (Figure 1), which is provisionally applied as a stock boundary in this report, to recognize insular and pelagic false killer whales as separate stocks for management (NMFS 2005). (Chivers et al. 2008), this stock assessment report applies a stock boundary corresponding to the 25-75 nmi longline

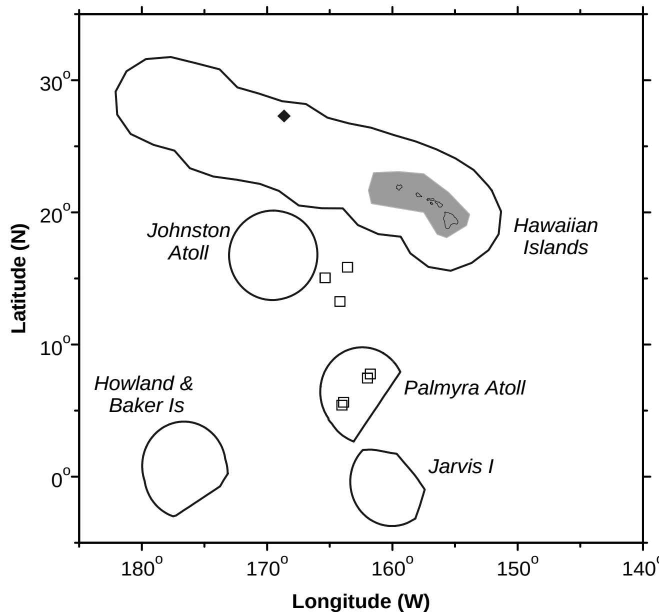

Figure 1. False killer whale sighting locations during standardized shipboard surveys of the Hawaiian U.S. EEZ (2002, black diamond, Barlow 2006), the Palmyra U.S. EEZ and pelagic waters of the central Pacific south of the Hawaiian Islands (2005, open squares, Barlow and Rankin 2007). Outer lines represent approximate boundary of U.S. EEZs; shaded gray area is the 25-75nmi February - September longline exclusion zone around the main Hawaiian Islands, proposed as a false killer whale stock boundary.

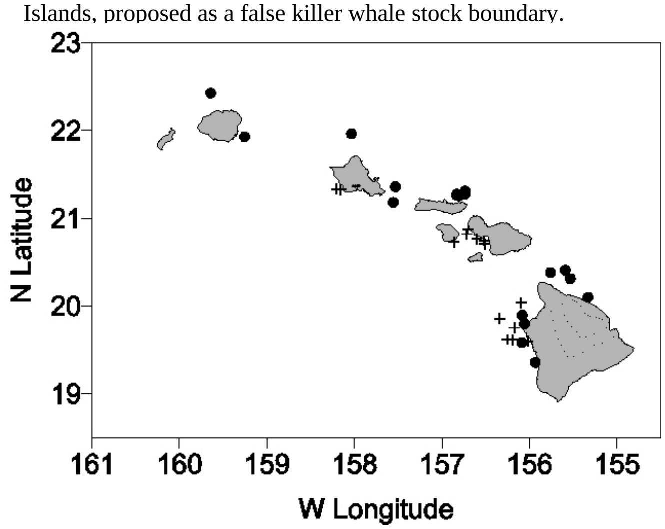

Figure 2. False killer whale sighting locations during 2000-2004 boat-based surveys (+) (Baird et al. 2005) and 1993-2003 aerial surveys (•) (Mobley et al. 2000, Mobley 2001, 2002, 2003, 2004) around the main Hawaiian Islands. See Appendix 2 for details on timing and location of survey effort.

exclusion zone around the main Hawaiian Islands, to recognize the insular false killer whale population as a separate stock for management. This boundary may be revised in the future as additional information becomes available. For example, recent satellite telemetry studies, boat-based surveys, and photo-identification analyses of false killer whales around the island of Hawaii (Baird et al. 2008a,b) yielded a maximum offshore extent of about 96km (52 nmi) for insular false killer whales. Animals belonging to the pelagic stock of false killer whales have been documented 42-70km (23-38 nmi) offshore (Baird et al. 2008b,c). These studies provide the first movement data for animals from both stocks, but sample sizes are small and the results are not yet sufficient for revising stock boundaries. NMFS will continue to evaluate new information on stock ranges as it becomes available.

Comparisons amongst false killer whales sampled at Palmyra Atoll and those sampled in the waters of the pelagic ENP, Panama and Mexico also reveal some level of restricted gene flow, although the sample size remains low for robust comparisons (Chivers et al. 2007). Efforts are currently underway to obtain and analyze additional tissue samples of false killer whales for further studies of population structure in the North Pacific Ocean.

For the Marine Mammal Protection Act (MMPA) stock assessment reports, there are currently three Pacific Islands Region management stocks (Chivers et al. 2008): 1) the Hawaii Insular Stock, which includes animals inhabiting waters within the 25-75 nmi February-September longline exclusion zone around the main Hawaiian Islands, and 2) the Hawaii Pelagic Stock, which includes false killer whales inhabiting the waters of the U.S. EEZ of Hawaii outside of the 25-75 nmi February-September longline exclusion zone around the main Hawaiian Islands, and 3) the Palmyra Stock, which includes false killer whales found within the U.S. EEZ of Palmyra Atoll. Estimates of abundance, potential biological removal, and status determinations for these three stocks are presented separately below.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Interactions with cetaceans have been reported for Hawaiian pelagic fisheries, and false killer whales have been identified in fishermen's logs and NMFS observer records as taking catches from pelagic longlines (Nitta and Henderson 1993, NMFS/PIR unpublished data). They have also been observed feeding on mahi mahi, *Coryphaena hippurus*, and yellowfin tuna, *Thunnus albacares*, and they have been reported to take large fish (up to 70 pounds) from the trolling lines of both commercial and recreational fishermen (Shallenberger 1981).

There are two distinct longline fisheries based in Hawaii: a deep-set longline (DSLL) fishery that targets primarily tunas, and a shallow-set longline fishery (SSLL) that targets swordfish. Following implementation of regulations to protect sea turtles and seabirds in the SSLL fishery in 2004, no false killer whales have been observed hooked or entangled through the end of 2007, with 100% observer coverage (Forney and Kobayashi, 2007, Forney and McCracken 2008, McCracken and Forney 2008). Between 1994 and 2007, 24 false killer whales and fifteen unidentified cetaceans that may have been false killer whales (based on the observer's descriptions), have been documented hooked or entangled in the DSLL fishery. In the most recent five years (2003-2007), with 20-28% observer coverage in the DSLL fishery, 14 false killer whale mortalities and serious injuries were documented in 18,848 observed sets (a rate of 0.74 per 1000 sets). Estimates of overall mortality and serious injury for false killer whales, by EEZ, are shown in Table 1.

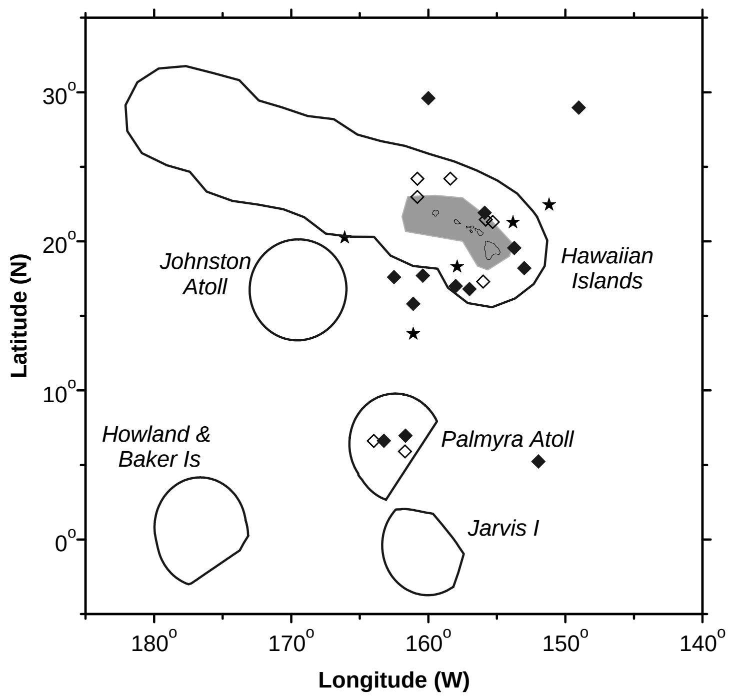

Figure 3. Locations of observed false killer whale takes (filled symbols) and possible takes of this species (open symbols) in the Hawaii-based longline fishery, 2002-2006. Stars are locations of genetic samples from fishery-caught false killer whales. Solid lines represent the U.S. EEZ; shaded gray area is the 75nmi February-September longline exclusion boundary around the main Hawaiian Islands. Set locations in this fishery are summarized in Appendix 1.

All observed false killer whale interactions with longline fisheries within the Hawaiian EEZ occurred more than 75nmi from the Hawaiian Islands, and the two genetic samples obtained from animals hooked or entangled in the longline fishery within the Hawaiian Islands EEZ were determined to be from the Pelagic Stock (S. Chivers, NMFS unpublished data). Therefore, the estimated takes of false killer whales are provisionally considered to have come from the Hawaii Pelagic Stock. However, from October to January, a small subset of longline fishing effort takes place within the current stock range of the Hawaiian Insular Stock, and Baird and Gorgone (2005) documented a high rate of dorsal fin disfigurements, which were consistent with injuries from unidentified fishing line. At the present time, it is unknown whether these injuries might have been caused by longline gear or other hook-and-line gear used around the main Hawaiian Islands. Additional research is needed to evaluate potential overlap between the insular false killer whale stock and line fisheries and to determine whether any of the estimated false killer whale takes in the longline fishery might have involved the Hawaiian Insular Stock.

~~Between 1994 and 2006, 24 false killer whales were observed hooked or entangled in the Hawaii-based longline fisheries, with approximately 4-34% of all effort observed (Forney and Kobayashi 2007, Forney and McCracken 2008). Fifteen additional unidentified cetaceans, which may have been false killer whales based on the observer's descriptions, were also taken (hooked or entangled) in this fishery, but were not included in this analysis (Figure 3; Forney and Kobayashi 2007, Forney and McCracken 2008). During 28,542 observed sets, the average interaction rate of false killer whales was 0.83 false killer whales per 1,000 sets. Two of the false killer whales were killed, two were considered not seriously injured, and all others caught were considered seriously injured, based on an evaluation of the observer's description of the interaction (Forney and Kobayashi, 2007, Forney and McCracken 2008) and following established guidelines for assessing serious injury in marine mammals (Angliss and DeMaster 1998). Average 5-yr estimates of annual mortality and serious injury for 2002-2006 are 7.6 (CV = 0.43) false killer whales outside of U.S. EEZs, 5.7 (CV = 0.64) within the Hawaiian Islands EEZ, and 1.2 (CV = 0.67) within the EEZ of Palmyra Atoll (Table 1). Total estimated annual mortality and serious injury for all U.S. EEZs combined averaged 7.0 (CV = 0.54) between 2002 and 2006. Since 2001, the Hawaii-based longline fishery has undergone a series of regulatory changes, primarily to protect sea turtles (NMFS 2001). Potential impacts of these regulatory changes on the rate of false killer whale interactions are unknown.~~

Table 1. Summary of available information on incidental mortality and serious injury of false killer whales (Pacific Islands Stock Complex) in commercial fisheries, within and outside of selected U.S. EEZs (Forney and McCracken 2008, McCracken and Forney 2008). Mean annual takes are based on ~~2002-2006~~ 2003-2007 data unless otherwise indicated.

Fishery Name	Year	Data Type	Percent Observer Coverage	Observed and estimated mortality and serious injury of false killer whales, by EEZ region								
				Outside of U.S. EEZs			Hawaiian Islands EEZ [1]			Palmyra Atoll EEZ		
				Obs.	Estimated (CV)	Mean Annual Takes (CV)	Obs.	Estimated (CV)	Mean Annual Takes (CV)	Obs.	Estimated (CV)	Mean Annual Takes (CV)
Hawaii-based deep-set longline fishery	2003 2004 2005 2006 2007	observer data	21.9% 25.4% 34.2% 25.5% 20.0%	0 3 1 1 0	0 (-) 14 (0.43) 3 (2.76) 7 (1.42) 3 (6.50)	5.4 (0.45)	2 3 1 1 1	7 (0.83) 12 (0.46) 3 (3.16) 7 (1.84) 8 (1.98)	7.4 (0.19)	0 0 0 0 1	0 0 0 0 2 (5.50)	0.3 (1.01)
Hawaii-based shallow-set longline fishery	2003 2004 2005 2006 2007	observer data	no fishing 100% 100% 100% 100%	0 0 0 0 0	0	0	0	0	0	0	0	0
~~**Hawaii-based longline fisheries[2]**~~	~~2002 2003 2004 2005 2006~~	~~observer data~~	~~24.8% 21.9% 25.4% 34.2% 25.5%~~	~~3 0 3 1 1~~	~~14 (0.40) 0 (-) 14 (0.43) 3 (2.76) 7 (1.42)~~	~~7.6 (0.43)~~	~~0 2 3 1 1~~	~~0 (-) 7 (0.83) 12 (0.46) 3 (3.16) 7 (1.84)~~	~~5.7 (0.64)~~	~~2 0 0 0 0~~	~~6 (0.43) 0 (-) 0 (-) 0 (-) 0 (-)~~	~~1.2 (0.67)~~
Minimum total annual takes within U.S. EEZ waters							**~~7.0 (0.54)~~ 7.7 (0.19)**					

[1]All false killer whales taken by the Hawaii longline fisheries within the Hawaiian EEZ were ~~obtained~~ >75 nmi from the main Hawaiian Islands, within the stock range of the Hawaii Pelagic Stock., and genetic analyses for the two available samples indicated these animals were part of the Hawaii Pelagic Stock. ~~Furthermore the longline fishery is, for the most part, prohibited from operating within about 75 nmi of the Main Hawaiian Islands. Therefore, all~~ All Hawaiian Islands EEZ takes of false killer whales are, therefore, provisionally considered to be from the Hawaii Pelagic Stock; however, there is potential for overlap between insular false killer whales and the longline fishery and further study is needed (see text above).

~~[2] The Hawaii-based longline fisheries include a shallow-set fishery (with 100% observer coverage since 2004) and a deep-set fishery (with about 20% observer coverage). No false killer whales were observed killed or injured in the shallow-set fishery during 2002-2006.~~

HAWAII INSULAR STOCK

POPULATION SIZE

A recent mark-recapture study of photo-identification data obtained during 2000-2004 around the main Hawaiian Islands produced an estimate of 123 (CV=0.72) false killer whales (Baird et al. 2005). This updates an estimate of 121 (CV=0.47) made by Mobley et al. (2000) based on 1994-1998 aerial surveys. Both estimates apply only to Hawaii Insular Stock because surveys were conducted within 75 nmi of the main Hawaiian Islands.

Minimum Population Estimate

The minimum population estimate for the Hawaii Insular stock false killer whales is the number of distinct individuals identified in this population during the 2002-2004 photo-identification studies, 76 individuals (Baird et al. 2005). This is similar to the log-normal 20th percentile of the mark-recapture abundance estimate, 71 false killer whales.

Current Population Trend

No data are available on current population trend. A recent study (Reeves et al. 2009) summarized information on false killer whale sightings near Hawaii between 1989 and 2007, based on various survey methods, and suggested that the insular stock of false killer whales may have declined during the last two decades. However, because of differences in survey methods, no quantitative analysis of the sightings data and population trend has been made.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

No data are available on current or maximum net productivity rate for this species in Hawaiian waters.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for the insular Hawaii false killer whale stock is calculated as the minimum population size (76) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.50 (for a stock of unknown status with no documented human-caused mortality and serious injury; see Wade and Angliss 1997), resulting in a PBR of 0.8 false killer whales per year.

STATUS OF STOCK

The status of false killer whales in insular Hawaiian waters (within 75 nmi) relative to OSP is unknown. , and A recent study (Reeves et al. 2009) suggested that this population may have declined since the late 1980s; however, there are insufficient data to evaluate trends in abundance quantitatively. No habitat issues are known to be of concern for this species, but a recent study (Ylitalo et al. 2008) documented elevated levels of polychlorinated biphenyls (PCBs) in three of nine insular false killer whales sampled, and biomass of some false killer whale prey species has declined around the main Hawaiian Islands (Reeves et al. 2009). although a high incidence of fin disfigurements in this stock (Baird and Gorgone 2005) indicate that interactions with fisheries may be of concern. They False killer whales are not listed as "threatened" or "endangered" under the Endangered Species Act (1973), nor as "depleted" under the MMPA. This stock is not considered "strategic" under the 1994 amendments to the MMPA because there has been no documented human-caused mortality or serious injury of false killer whales belonging to the Hawaii Insular Stock. However, a high incidence of fin disfigurements in this stock (Baird and Gorgone 2005) indicates that interactions with unidentified line fisheries may be of concern, and the stock range includes an area where some longline fishing operations take place seasonally.

HAWAII PELAGIC STOCK

POPULATION SIZE

Analyses of a 2002 shipboard line-transect survey of the Hawaiian Islands EEZ (HICEAS survey) resulted in an abundance estimate of 236 (CV=1.13) false killer whales (Barlow 2006) outside of 75 nm of the main Hawaiian Islands. A recent re-analysis of the HICEAS data using improved methods and incorporating additional sighting information obtained on line-transect surveys south of the Hawaiian EEZ during 2005, resulted in a revised estimate of 484 (CV = 0.93) false killer whales within the Hawaiian Islands EEZ outside of 75 nmi of the main Hawaiian Islands (Barlow & Rankin 2007). This is the best available abundance estimate for the Hawaii Pelagic Stock of false killer whales.

Minimum Population Estimate

The log-normal 20th percentile of the 2002 abundance estimate for the Hawaiian Islands EEZ outside of 75 nmi from the main Hawaiian Islands (Barlow & Rankin 2007) is 249 false killer whales.

Current Population Trend

No data are available on current population trend.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

No data are available on current or maximum net productivity rate for this species in Hawaiian waters.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for the Hawaii Pelagic Stock of false killer whale is calculated as the minimum population size (249) <u>times</u> one half the default maximum net growth rate for cetaceans (½ of 4%) <u>times</u> a recovery factor of ~~0.45~~ 0.50 (for a stock of unknown status with a Hawaiian Islands EEZ mortality and serious injury rate CV ~~>0.60~~ <0.30; Wade and Angliss 1997), resulting in a PBR of ~~2.2~~ 2.5 false killer whales per year.

STATUS OF STOCK

The status of the Hawaii Pelagic Stock of false killer whale relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance. No habitat issues are known to be of concern for this ~~species~~ stock. They are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor as “depleted” under the MMPA. Because the rate of mortality and serious injury to false killer whales within the Hawaiian Islands EEZ and outside of 75 nmi in the Hawaii-based longline fishery (~~5.7~~ 7.4 animals per year) exceeds the PBR (~~2.2~~ 2.5), this stock is considered a “strategic stock” under the 1994 amendments to the MMPA. The total fishery mortality and serious injury for Hawaiian false killer whales cannot be considered to be insignificant and approaching zero, because it exceeds the PBR. Furthermore, additional injury and mortality of false killer whales is known to occur in U.S and international longline fishing operations in international waters, and the potential effect on the Hawaii Pelagic Stock is unknown.

<u>PALMYRA STOCK</u>

POPULATION SIZE

Recent line transect surveys in the U.S. EEZ waters of Palmyra Atoll produced an estimate of 1,329 (CV = 0.65) false killer whales (Barlow & Rankin 2007). This is the best available abundance estimate for false killer whales within the Palmyra Atoll EEZ.

Minimum Population Estimate

The log-normal 20th percentile of the 2002 abundance estimate for the Palmyra Atoll EEZ (Barlow & Rankin 2007) is 806 false killer whales.

Current Population Trend

No data are available on current population trend.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

No data are available on current or maximum net productivity rate for this species in Palmyra Atoll waters.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for the Palmyra Atoll false killer whale stock is calculated as the minimum population size (806) <u>times</u> one half the default maximum net growth rate for cetaceans (½ of 4%) <u>times</u> a recovery factor of ~~0.45~~ 0.40 (for a stock of unknown status with a mortality and serious injury rate CV >~~0.60~~ 0.80; Wade and Angliss 1997), resulting in a PBR of ~~7.2~~ 6.4 false killer whales per year.

STATUS OF STOCK

The status of false killer whales in Palmyra Atoll EEZ waters relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance. No habitat issues are known to be of concern for this ~~species~~ stock. They are not listed as “threatened” or “endangered” under the Endangered Species Act (1973), nor as “depleted” under the MMPA. The rate of mortality and serious injury to false killer whales within the Palmyra Atoll EEZ in the Hawaii-based longline fishery (~~1.2~~ 0.3 animals per year) does not exceed the PBR (~~7.2~~ 6.4) for this stock and thus, this stock is not considered “strategic” under the 1994 amendments to the MMPA. The total fishery mortality and serious injury for Palmyra Atoll false killer whales is ~~greater~~ less than 10% of the PBR and, therefore, can~~not~~ be considered to be insignificant and approaching zero. Additional injury and mortality of false killer whales is known to occur in U.S and international longline fishing operations in international waters, and the potential effect on the Palmyra stock is unknown.

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HUMPBACK WHALE (*Megaptera novaeangliae*)
IUCN Oceania subpopulation – American Samoa Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The humpback whale has a global distribution. Humpback whales migrate long distances between their feeding grounds at mid- to high latitudes and their calving and mating grounds in tropical waters. The Oceania subpopulation (as defined by the IUCN Red List process, see Childerhouse *et al*. 2008) ranges throughout the South Pacific, except the west coast of South America, and from the equator to the edges of the Antarctic ice. Humpback whales have been recorded across most of the lower latitudes of the South Pacific from approximately 30°S northwards to the equator during the austral autumn and winter. Although there have been no comprehensive surveys of this huge area, humpback whale densities are known to vary extensively from high densities in East Australia to low densities at many island groups. Many regional research projects have documented the presence of these whales around various island groups but they are also found in open water away from islands (SPWRC 2008). Movements of individual whales between the tropical wintering grounds and the Antarctic summer feeding grounds have been documented by a variety of methods including Discovery tagging, photo-identification, matching genotypes from biopsies or carcasses, and satellite telemetry (Mackintosh 1942; Chittleborough 1965; Dawbin 1966; Mikhalev 2000; Rock *et al*. 2006, Franklin *et al*. 2007, Robbins *et al*. 2008). However, migratory routes and specific destinations remain poorly known. Unlike the other humpback stocks found in U. S. waters, the IUCN Oceania subpopulation is defined by structure on its calving grounds (Garrigue *et al*. 2006b, Olavarria *et al*. 2006, 2007) rather than on its feeding grounds. The Oceania subpopulation consists of breeding stocks E (including E1, E2 and E3) and F recognized by the International Whaling Commission (IWC). It is found in the area defined by the following approximate boundaries: 145°E (eastern Australia) in the west, 120°W (between French Polynesia and South America) in the east, the equator in the north, and 30°S in the south (Childerhouse *et al.* 2008).

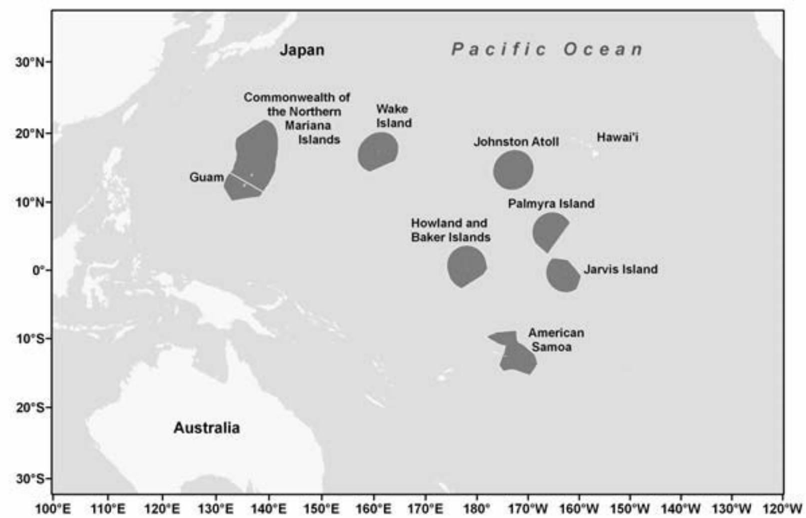

Figure 1. Western Pacific Exclusive Economic Zones for selected U.S. territories, including American Samoa. Information on the American Samoa stock of humpback whales in this report is derived from survey work conducted within the American Samoa EEZ, although animals range well outside this area (see text).

For the Marine Mammal Protection Act (MMPA) stock assessment reports, there is need for only one South Pacific Island region management stock of humpback whales, the American Samoa stock. American Samoa lies at the boundary of breeding stocks E3 and F. Surveys have been undertaken annually at the primary island of Tutuila since 2003. A total of 150 unique individuals were identified by fluke photographs during 58 days at sea, 2003-2008 (D. Mattila and J. Robbins, unpublished data). Individuals have been resighted on multiple days in a single breeding season, but only three inter-annual re-sightings have been made to date (two based on dorsal fin photographs) (D. Mattila and J. Robbins, unpublished data). Breeding behavior and the presence of very young calves has been documented in American Samoa waters. One whale that was sighted initially without a calf was re-sighted later in the season with a calf. Individual exchange has been documented with Western Samoa (SPWRC 2008), as well as Tonga, French Polynesia and the Cook Islands (Garrigue *et al*. 2007). Although the feeding range of American Samoan whales has not yet been defined, there has been one photo-ID match to the Antarctic Peninsula (IWC Antarctic Area I, Robbins *et al*. 2008). Whales at Tonga have exhibited exchange with both Antarctic Area V (Dawbin 1959) and Area I (Brown 1957, Dawbin 1956) and so whales from American Samoa may have a similarly wide feeding range.

On-going photographic studies indicate a higher frequency of certain types of skin lesions on humpback whales at American Samoa as compared to humpback whale populations at Hawaii or the Gulf of Maine (Mattila and Robbins, 2008). However, the cause and implications have yet to be determined. Some similar skin lesions on blue whales in Chilean waters have been observed (Brownell *et al*. 2008).

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Historic whaling

Southern Hemisphere humpback whales were hunted extensively during the last two centuries and it is thought that populations have been reduced to a small percentage of their former levels (Chapman 1974). After correcting catch records for illegal Soviet whaling, (Clapham & Baker 2002) estimated that over 200,000 Southern Hemisphere humpback whales were killed from 1904 to 1980. Humpback whales were protected from commercial whaling in 1966 by the IWC but they continued to be killed illegally by the Soviet Union until 1972. Illegal Soviet catches of 25,000 humpback whales in two seasons (1959/60 and 1960/61) precipitated a population crash and the closure of land stations in Australia and New Zealand, including Norfolk Island (Mikhalev 2000; Clapham *et al*. 2005).

POPULATION SIZE

There is currently no estimate of abundance for humpback whales in American Samoan waters. The South Pacific Whale Research Consortium produced a number of preliminary mark recapture estimates of abundance for Oceania and its subregions (SPWRC, 2006). A closed population estimate of 3,827 (CV 0.15) was calculated for eastern Oceania (breeding stocks E3 and F) for 1999-2004 and this may be the most relevant of those currently available, given observed exchange between American Samoa, Tonga, the Cook Islands, and French Polynesia (Garrigue *et al.* 2006a). However, the extent and biological significance of the documented interchange is still poorly understood.

Minimum Population Estimate

The minimum population estimate for this stock is 150 whales, which is the number of individual humpbacks identified in the waters around American Samoa between 2003-2008 by fluke photo identification (J. Robbins, personal communication). This is clearly an underestimation of the true minimum population size as photo ID studies have been conducted over a few weeks per year and there is also evidence of exchange with other areas in Oceania. There are also insufficient data to estimate the proportion of time Oceania humpback whales spend in waters of American Samoa.

Current Population Trend

No data are available on current population trend.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

No estimates of current or maximum net productivity rates are available for this species in Samoan waters. However, the maximum plausible growth rate for Southern Hemisphere humpback whale populations is estimated as 10.6% (Clapham *et al*. 2006).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) for this stock is calculated as the minimum population size (150) times one half the estimated maximum growth rate for humpback whales in the Southern Hemisphere (1/2 of 10.6%) times a recovery factor of 0.1 (for an endangered species with a total population size of less than 1,500), resulting in a PBR of 0.8. This stock of humpback whales is migratory and thus, it is reasonable to expect that animals spend at least half the year outside of the relatively small American Samoa EEZ. Therefore, the PBR allocation for U.S. waters is half of 0.8, or 0.4 whales.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

No human-related mortalities of humpback whales have been recorded in American Samoan waters. Human-related mortality of humpback whales due to entanglements in fishing gear and collisions with ship have been reported elsewhere in the Southern Hemisphere. Entanglement of humpback whales in pot lines has been reported in both New Zealand and Australia but there are no estimated rates available. There is little information from the rest of the South Pacific but a humpback mother (with calf) was reported entangled in a longline in 2007 in the Cook Islands (N. Hauser, reported in SPWRC 2008).

A photographic-based scar study of the humpback whales of American Samoa has been initiated and there is some indication of healed entanglement and ship strike wounds, although perhaps not at the levels found in some Northern Hemisphere populations (D. Mattila and J. Robbins, unpublished data). However, the sample size to date is insufficient for robust comparison and the study is ongoing.

STATUS OF STOCK

The status of humpback whales in American Samoan EEZ waters relative to OSP is unknown and there are insufficient data to estimate trends in abundance. However, humpback whale populations throughout the South Pacific were drastically reduced by historical whaling and IUCN classifies the Oceania subpopulation as "endangered" (Childerhouse *et al.* 2008). Worldwide humpback whales are listed as "endangered" under the Endangered Species Act (1973) so the Samoan stock is automatically considered a "depleted" and "strategic" stock under the MMPA. There are no habitat concerns for the stock.

Japan has proposed killing 50 humpback whales as part of its program of scientific research under special permit (scientific whaling) called JARPA II in the IWC management areas IV and V in the Antarctic (Gales *et al.* 2005). Areas IV and V have demonstrated links with breeding stock E. Japan postponed their proposed catch in the 2007/08 and 2008/09 seasons, but have not removed them from their future whaling program. The JARPA II program has the potential to negatively impact the recovery of humpbacks in Oceania.

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The Marine Mammal Protection Act (MMPA) requires NMFS to publish a list of commercial fisheries (List Of Fisheries or "LOF") and classify each fishery based on whether incidental mortality and serious injury of marine mammals is frequent (Category I), occasional (Category II), or unlikely or unknown (Category III). The LOF is published annually in the Federal Register. The most recent list of commercial fisheries is the List of Fisheries for 2009; Final Rule, published December 1, 2008 in the Federal Register (73 FR 73032). The categorization of a fishery in the LOF determines whether participants in that fishery are subject to certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. The categorization criteria as they appear in the LOF is reprinted below:

The fishery classification criteria consist of a two-tiered, stock-specific approach that first addresses the total impact of all fisheries on each marine mammal stock, and then addresses the impact of individual fisheries on each stock. This approach is based on consideration of the rate, in numbers of animals per year, of incidental mortality and serious injury of marine mammals due to commercial fishing operations relative to the Potential Biological Removal (PBR) level for each marine mammal stock. The MMPA (16 U.S.C. 1362 (20)) defines the PBR level as the maximum number of animals, not including natural mortality, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. This definition can also be found in the implementing regulations for section 118 at 50 CFR 229.2.

Tier 1: If the total annual mortality and serious injury across all fisheries that interact with a stock is less than or equal to 10 percent of the PBR level of the stock, all fisheries interacting with the stock would be placed in Category III. Otherwise, these fisheries are subject to the next tier (Tier 2) of analysis to determine their classification.

Tier 2, Category I: Annual mortality and serious injury of a stock in a given fishery is greater than or equal to 50 percent of the PBR level.

Tier 2, Category II: Annual mortality and serious injury of a stock in a given fishery is greater than 1 percent and less than 50 percent of the PBR level.

Tier 2, Category III: Annual mortality and serious injury of a stock in a given fishery is less than or equal to 1 percent of the PBR level.

While Tier 1 considers the cumulative fishery mortality and serious injury for a particular stock, Tier 2 considers fishery-specific mortality and serious injury for a particular stock. Additional details regarding how the categories were determined are provided in the preamble to the final rule implementing section 118 of the MMPA (60 FR 45086, August 30, 1995). Since fisheries are categorized on a per-stock basis, a fishery may qualify as one Category for one marine mammal stock and another Category for a different marine mammal stock. A fishery is typically categorized on the LOF at its highest level of classification (e.g., a fishery that qualifies for Category III for one marine mammal stock and for Category II for another marine mammal stock will be listed under Category II).

Other Criteria That May Be Considered

In the absence of reliable information indicating the frequency of incidental mortality and serious injury of marine mammals by a commercial fishery, NMFS will determine whether the incidental serious injury or mortality qualifies for Category II by evaluating other factors such as fishing techniques, gear used, methods used to deter marine mammals, target species, seasons and areas fished, qualitative data from logbooks or fisher reports, stranding data, and the species and distribution of marine mammals in the area, or at the discretion of the Assistant Administrator for Fisheries (50 CFR 229.2).

This appendix describes commercial fisheries that occur in California, Oregon, Washington, and Hawaiian waters and that interact or may interact with marine mammals. The first three sections describe sources of marine mammal mortality data for these fisheries. The fourth section describes the commercial fisheries for these states. A list of all known fisheries for these states was published as a proposed rule in the Federal Register, 71 FR 20941, 24 April 2006.

1. Sources of Mortality/Injury Data

There are three major sources of marine mammal mortality/injury data for the active commercial fisheries in California, Oregon, and Washington. These sources are the NMFS Observer Programs, the Marine Mammal Authorization Program (MMAP) data, and the NMFS Marine Mammal Stranding Network (MMSN) data. Each of these data sources has a unique objective. Data on mammal mortality and injury are reported to the MMAP by fishers in any commercial fisheries. Marine mammal mortality and injury is also monitored by the NMFS Marine Mammal Stranding Network (MMSN). Data provided by the MMSN is not duplicated by either the NMFS Observer Program or MMAP reporting. Human-related data from the MMSN include occurrences of mortality due to entrainment in power station intakes, ship strikes, shooting, evidence of net fishery entanglement (net remaining on animal, net marks, severed flukes), and ingestion of hooks.

2. Marine Mammal Reporting from Fisheries

In 1994, the MMPA was amended to implement a long-term regime for managing mammal interactions with commercial fisheries (the Marine Mammal Authorization Program, or MMAP). Logbooks are no longer required - instead vessel owners/operators in any commercial fishery (Category I, II, or III) are required to submit one-page pre-printed reports for <u>all interactions</u> (including those that occur while an observer is onboard) resulting in an injury or mortality to a marine mammal. The report must include owner/operator's name and address, vessel name and ID, where and when the interaction occurred, the fishery, species involved, and type of injury (if the animal was released alive). These postage-paid report forms are mailed to all Category I and II fishery participants that have registered with NMFS, and must be completed and returned to NMFS within 48 hours of returning to port for trips in which a marine mammal injury or mortality occurred. The number of self-reported marine mammal interactions is considerably lower than the number reported by fishery observers, even though observer reports are typically based on 20% observer effort. For example, from ~~2000-2004~~, 2005 to 2008, there were ~~112~~ 33 fisher self-reports of marine mammal interactions in the California swordfish/thresher shark drift gillnet fishery. This compares with ~~141~~ 59 observed interactions over the same period, based on only 15% to 20% observer coverage. This suggests that fisher self-reports are grossly underreported. ~~A summary comparing fisher self-reports and observer reports of marine mammal interactions for the swordfish drift gillnet fishery is given in Table 1 of this Appendix.~~

3. NMFS Marine Mammal Stranding Network data

~~From 2000-2004, there were 1,022 cetacean and 13,215 pinniped strandings recorded in California, Oregon, and Washington states.~~ Historically, ~~A~~ approximately 10% of all cetacean and 6% of all pinniped strandings in California have exhibited ~~showed~~ evidence of human-caused mortality ~~during this period~~. Human-related causes of mortality include: entrainment in power station intakes, shooting, net fishery entanglement, ~~and~~ hook/line, set-net and trap fishery interactions, and ship strikes. A species summary of all cetacean and pinniped strandings for ~~the period 2000-2004~~ 2006 and 2007 is given in Table ~~2~~ 1 of this Appendix.

4. Fishery Descriptions

Category I, CA/OR thresher shark/swordfish drift gillnet fishery (≥14 inch mesh)

<u>Number of permit holders:</u> The number of eligible permit holders in California for ~~2002-2006~~ 2003-2007 ~~are~~ were ~~106,~~ 100, 96, 90, ~~and~~ 88, and 86, respectively (data source: California Deparment of Fish and Game website: www.dfg.ca.gov/licensing). Permits are non-transferable and are linked to individual fishermen, not vessels.

<u>Number of active permit holders:</u> The number of vessels active in this fishery from 2002-2006 were 50, 43, 43, 40, and 43 respectively. Information on the number of permit holders is obtained from the <u>Status of the U.S. west coast fisheries for Highly Migratory Species through 2004; Stock Assessment and Fishery Evaluation</u> report available from the Pacific Fishery Management Council website (www.pcouncil.org) and the California Department of Fish and Game.

<u>Total effort:</u> ~~Both estimated and observed effort for the drift-net fishery during the calendar years 1990 through 2006 are shown in Figure 2.~~ Fishing effort averaged approximately 1,260 sets for the years 2003 to 2007 (Fig. 2).

<u>Geographic range:</u> ~~Effort in this fishery ranges from the U.S./Mexico border north to waters off the state of Oregon. For this fishery there are area-season closures (see below). Figures 1-5 show locations of observed sets and Figure 6 shows approximate locations of observed marine mammal entanglements for the period 1998-2002.~~ Most fishing effort occurs

south of Point Conception, California between August and January (Fig. 1). A small percentage of sets are fished in the leatherback turtle closure area after November 15^{th} of each year.

Seasons: This fishery is subject to season-area restrictions. From February 1 to May 15 effort must be further than 200 nautical miles (nmi) from shore; from May 16 to August 14, effort must be further than 75 nmi from shore, and from August 15 to January 31 there is only the 3 nmi off-shore restriction for all gillnets in southern California (see halibut and white seabass fishery below). The majority of the effort occurs from October through December. A season-area closure to protect leatherback sea turtles was implemented in this fishery in August 2001. The closure area prohibits drift gillnet fishing from August 15 through November 15, in the area bounded by straight lines from Point Sur, California (N36^o 17') to N 34^o 27' W 123^o 35', west to W129^o, north to N 45^o, then east to the Oregon coast. ~~In March 2006, the Pacific Fishery Management Council approved a recommendation to NMFS to reopen the current closure area under an exempted fishing permit (EFP). The EFP requires 100% observer coverage and limits the number of sets fished to 300. Additionally, fishing in the area would cease prior to the 300 set limit if 2 leatherback turtles are entangled. In addition, fishing would cease if one mortality or serious injury is documented for any of the following species: gray whale, short-finned pilot whale, sperm whale, fin whale, humpback whale, and minke whale. NMFS may modify this recommendation and will make a final decision on the EFP in 2006.~~ An additional season-area closure south of Point Conception and east of W120 degrees longitude is effective during the months of June, July, and August during El Niño years to protect loggerhead turtles (Federal Register, 68 FR 69962, 16 December 2003).

Gear type and fishing method: Typical gear used for this fishery is a 1000 fathom gillnet with a stretched mesh size typically ranging from 18-22 inches (14 inch minimum). The net is set at dusk and allowed to drift during the night after which, it is retrieved. The fishing vessel is typically attached to one end of the net. Soak duration is typically 12-14 hours depending on the length of the night. Net extender lengths of a minimum 36 ft. became mandatory for the 1997-1998 fishing season. The use of acoustic warning devices (pingers) became mandatory 28 October 1997.

Regulations: The fishery is managed under a Fishery Management Plan (FMP) developed by the Pacific Fishery Management Council and NMFS.

Management type: The drift-net fishery is a limited entry fishery with seasonal closures and gear restrictions (see above). The state of Oregon restricts landing to swordfish only.

Comments: This fishery has had a NMFS observer program in place since July 1990. Due to bycatch of strategic stocks including short-finned pilot whale, beaked whales, sperm whale and humpback whale, a Take Reduction Team was formed in 1996. Since then, the implementation of increased extender lengths and the deployment of pingers have substantially decreased cetacean entanglement. The fraction of active vessels in this fishery that are not observed owing to a lack of berthing space for observers has been increasing as larger vessels drop out of this fishery.

Category ~~I~~[1] II, CA halibut/white seabass and other species set gillnet fishery (>3.5 inch mesh).

~~Note: This fishery has not targeted angel shark since 1994, when regulatory changes resulted in nets being fished >3 nmi from shore in southern California. Thus, there is a proposed name change to this fishery to reflect current fishing practices.~~ Halibut are typically targeted using 8.5 inch mesh while the remainder of the fishery targets white seabass and yellowtail using 6.5 inch mesh. In recent years, there has been an increasing number of 6.0-6.5 inch mesh sets fished using drifting methods; this component is now identified as a separate fishery (see "**CA yellowtail, barracuda, white seabass, and tuna drift gillnet fishery (>3.5 and <14 in mesh)**" fishery described below). This fishery was recategorized as a Category II fishery in the 2009 List of Fisheries (73 FR 73052, December 1, 2008).

Number of permit holders: There is no specific permit category for this fishery. Overall, the current number of legal permit holders for gill and trammel nets, excluding swordfish drift gillnets and herring gillnets for ~~2002-2006~~ 2003-2007 were ~~are 209,~~ 193, 187, 172, ~~and~~ 166, and 160, respectively. Information on permit numbers is available from the California Department of Fish and Game website (http://www.dfg.ca.gov/licensing).

~~[1] Due to the closure of the fishery in central California, which has reduced the threat to stocks of harbor porpoise in this region, the draft 2009 NMFS MMPA List of Fisheries proposes to recategorize this fishery to 'Category II'.~~

Number of active permit holders: ~~Based on logbook data, there were at least 62 active permit holders during the period 2002-2006. Annual participation in the fishery appears to have declined, as the number of active permit holders by individual year (43, 42, 41, 31, 28) has declined.~~ The number of active permit holders ranged between 30 and 41 during the period 2003 to 2007.

Total effort: Fishing effort in the halibut fishery has declined from over ~~3,200~~ 2,700 sets in ~~2002~~ 2003 to approximately 1,400 sets in ~~2006~~ 2007. A summary of estimated fishing effort and observer coverage for the years 1990-~~2003~~ 2007 is shown in Figure 8. Effort in the white seabass and yellowtail portion of this fishery ~~has ranged between 456 and 948~~ averaged 680 days annually for the period ~~2002-2006~~ 2003-2007. A portion of the effort in the white seabass and yellowtail fishery utilizes drifting nets (see "CA yellowtail, barracuda, white seabass, and tuna drift gillnet fishery (>3.5 and <14 in mesh)" fishery description in the Category II fishery section below).

Geographic range: Effort in this fishery previously ranged from the U.S./Mexico border north to Monterey Bay and was localized in more productive areas: San Ysidro, San Diego, Oceanside, Newport, San Pedro, Ventura, Santa Barbara, Morro Bay, and Monterey Bay. Fishery effort is now predominantly in the Ventura Flats area off of Ventura, the San Pedro area between Pt. Vicente and Santa Catalina Island and in the Monterey Bay area. The central California portion of the fishery from Point Arguello to Point Reyes has been closed since September 2002 when a ban on gillnets inshore of 60 fathoms took effect.

Seasons: This fishery operates year round. Effort generally increases during the summer months and declines during the last three months of a year.

Gear type and fishing method: Typical gear used for this fishery is a 200 fathom gillnet with a stretched mesh size of 8.5 inches. The component of this fishery that targets white seabass and yellowtail utilizes 6.5 inch mesh. The net is generally set during the day and allowed to soak for up to 2 days. Soak duration is typically 8-10, 19-24, or 44-49 hours. The depth of water ranges from 15-50 fathoms with most sets in water depths of 15-35 fathoms.

Regulations: This fishery is managed by the California Dept. of Fish and Game in accordance with state and federal laws.

Management type: The halibut and white seabass set-net fishery is a limited entry fishery with gear restrictions and area closures.

Comments: An observer program for the halibut and white seabass portion of this fishery operated from 1990-94 and was discontinued after area closures were implemented in 1994, which prohibited gillnets within 3 nmi of the mainland and within 1 nmi of the Channel Islands in southern California. NMFS re-established an observer program for this fishery in Monterey Bay in 1999-2000 due to a suspected increase in harbor porpoise mortality in Monterey Bay. In 1999 and 2000, fishery mortality exceeded PBR for the Monterey Bay harbor porpoise stock, which at that time, was designated as strategic [the stock is currently non-strategic]. In the autumn of 2000, the California Department of Fish and Game implemented the first in a series of emergency area closures to set gillnets within 60 fathoms along the central California coast in response to concerns over mortality of common murres and threats to sea otters. This effectively reduced fishing effort to negligible levels in 2001 and 2002 in Monterey Bay. A ban on gill and trammel nets inside of 60 fathoms from Point Reyes to Point Arguello became effective in September 2002. Mortality of marine mammals continues in the southern California portion of this fishery, as evidenced by fisher self-reports under the Marine Mammal Authorization Program (MMAP) from 2000-2005. During this time, fishermen reported mortality of 60 California sea lions, 20 harbor seals, one northern elephant seal and one unidentified common dolphin. NMFS renewed observer coverage in halibut/white seabass set gillnet fishery in 2006 and through 2007, observers recorded bycatch data from 260 sets. No cetaceans were observed entangled during this period, but there were 34 California sea lions, two harbor seals, and one unidentified pinniped observed killed.

~~Category I, Hawaii swordfish, tuna, billfish, mahi mahi, wahoo, and oceanic shark longline/set line fishery.~~[2]

[2] ~~This fishery description was provided in part by Chris Yates (NMFS) and from published fishery regulations in the Federal Register; 69 FR 48407, published 10 August 2004.~~

Note: The classification of this fishery was elevated to Category I in 2004 based on revised PBR levels of false killer whales and observed false killer whale mortality in this fishery (Federal Register 69 FR 48407 1, 10 August 2004).

Category I, Hawaii deep-set longline fishery.

Note: This fishery is the result of the Hawaii longline fishery being split into two separate fisheries. The two fisheries are the "Category I Hawaii deep-set (tuna target) longline/set line fishery" and the "Category II Hawaii shallow set (swordfish target) longline/set line fishery" (Federal Register 73, December 1, 2008, p. 73037).

Number of permit holders: The number of Hawaii longline limited access permit holders is 164. Not all such permits are renewed and used every year (approximately 126 127 were renewed in 2003 2008). Most holders of Hawaii longline limited access permits are based in, or operate out of, Hawaii. Longline general permits are not limited by number. Approximately 67 longline general permits were issued in 2003, about 48 of which were active. In 2003 all but two holders of longline general permits were based in, or operated out of, American Samoa. The remaining two, neither of which was active in 2003, were based in the Mariana Islands (Federal Register 69 FR 17329, 2 April 2004).

Number of active permit holders: From 1998-2002 there were 115, 122, 125, 101, and 102 vessels actively fishing, respectively. There were 126 permits renewed in 2003 (Federal Register 69 FR 17329, 2 April 2004). In 2004, there were 125 Hawaii longline limited access permits renewed, with 119 active. In 2004, there were 40 active permits in American Samoa. There were 127 vessels active in 2008. Some vessels participate in both the shallow and deep set fisheries.

Total effort: For the years 1998-2002, there were 1,181, 1,165, 1,135, 1,075, and 1,193 trips made respectively. The number of hooks set has steadily increased since 1997 (15.5 million) and peaked in 2002 with 27 million hooks set. In 2002, most effort occurred within the U.S. EEZ (approximately 15 million hooks set), while 12 million hooks were set outside the U.S. EEZ. At Kingman Reef and Palmyra Atoll there were 2.1 million hooks set in 2002. In 2003, there were 1,214 trips recorded (with tuna as the target species). There were a total of 29.8 million hooks set in 2003, of these, 15 million occurred outside the U.S. EEZ, 11 million within the Main Hawaiian Islands EEZ, 2.7 million within the Northwest Hawaiian Islands EEZ, and the remaining 0.9 million within other U.S. possession EEZs. The preliminary estimate of hooks fished in 2004 is 32 million hooks. 2003 logbook data for American Samoa consisted of 932 trips by 51 vessels, which made 6,220 sets, with 14.2 million hooks fished. Preliminary logbook data from 2004 in American Samoa consists of 623 trips by 40 vessels, which made 4,804 sets, with 11.6 million hooks fished. Observed effort in this fishery in 2008 included 288 fishing trips, 3,915 sets, and 8.7 million hooks fished. This represents approximately 22% of the total fishing effort conducted. Logbook data for this fishery in the first half of 2008 indicates there were 756 fishing trips, 8,682 sets, and 19 million hooks fished (http://www.pifsc.noaa.gov/fmsd/reports.php).

Geographic range: This fishery encompasses a huge geographic range extending North-South from 40° N to the equator and East-West from Kure Atoll to as far as 135° W. Fishing for swordfish generally occurs north of Hawaii, (as much as 2,000 miles from Honolulu), whereas fishing for tunas occurs around the Main Hawaiian Islands (MHI) and south of the Hawaiian Islands. New regulations published in 2004 lift previous area closures north of the equator.

Seasons: This fishery operates year-round. Effort is generally lower in the third quarter of the year.

Gear type: The basic unit of gear is the main line which is made of monofilament and stored on a large hydraulic reel. Eight hundred to 1000 hooks are attached to 30 to 40 miles of main line on a typical fishing day. Shallow sets for swordfish and deep sets for tuna are fished with a requirement that the fishermen must declare prior to departure which set type will be employed. (There was no Hawaii-based shallow set swordfish fishery from 2001-2003). All shallow swordfish sets are required to utilize size 18/0 circle hooks with a 10 degree offset and mackerel bait (the use of squid bait is prohibited). Deployment and retrieval of gear must occur at night. For deep sets, all float lines must be at least 20 meters in length; with a minimum of 15 branch lines between any two floats (except basket-style longline gear which may have as few as 10 branch lines between any two floats); without the use of light sticks; and resulting in the possession or landing of no more than 10 swordfish (Xiphias gladius) at any time during a given trip. As used in this definition "float line" means a line used to suspend the main longline beneath a float and ``light stick" means any type of light emitting device, including any fluorescent "glow bead", chemical, or electrically powered light that is affixed underwater to the longline gear . There are currently no Hawaii longline vessels deploying basket gear.

While similar, swordfish and tuna gear differ in the depth at which it is deployed, the number of hooks deployed, and the time of day at which it is set. Both styles use a monofilament mainline that is generally 3.2- 4.0 mm in diameter that is stored, deployed, and retrieved using a large hydraulic reel (some vessels may have two). In general, swordfish gear is deployed at an average depth (deepest) of 70m, with 600-1000 hooks deployed per day (3-6 hooks between floats), and the line is set at night and hauled during daylight hours. Additionally, float lines are usually less than the required twenty meters (~10m) for tuna fishing. Because some swordfish vessels carry two reels of mainline, it is not uncommon for swordfish vessels to set as much as 60 miles of line in a day. In contrast, tuna gear is set much deeper (~200m), with 1500-2200 hooks deployed per day (20-35 hooks between floats), the line is set in the morning and hauled in the evening. In addition, tuna mainline is deployed using a hydraulic line shooter. Regulations permit a minimum of 15 hooks between floats. There is no minimum for trips targeting swordfish. The line shooter sends the line off the vessel faster than the vessel is moving creating deep arcing caternaries in the line. This allows them to target deep dwelling tunas. Swordfish mainline is set at the same speed as the vessel to keep the line in shallower depths. Finally, lightsticks are prohibited during tuna (deep set) fishing operations. These are allowed in the swordfish fishery.

The leaders attached to the mainline also differ between the two fisheries. A tuna leader is usually comprised of a hook immediately followed by a length of wire (1-2 mm thick) which is attached to a weighted swivel. The rest of the tuna leader in comprised of ~2mm thick monofilament and a snap for attachment to the mainline. The swordfish gear is comprised of a 18/0 or larger circle hook attached to a ~ 10m length of ~2mm monofilament line to a weighted swivel followed by another ~10m length of ~2mm monofilament. All attachments are made using loops secured by crimps.

Vessel operators are required to call NMFS for possible observer placement 72 hours prior to departure. At that time they must declare if they intend to go on a shallow-set or deep-set fishing trip. Regulations prohibiting the presence of lightsticks and float lines shorter than 20m aboard vessels on declared deep-set trips preclude fishermen from fishing trip types while at sea - additionally a vessel returning from a deep-set trip cannot land more than 10 swordfish (50 CFR 660.22).

Additional requirements for seabirds went into effect 18 January 2006 for vessels fishing above 23 degrees north latitude (Federal Register 70 FR 75075, 19 December 2005). Fishermen will be given a choice between side setting and employing a suite of seabird mitigation measures. Currently, regulations require deep-setting vessels to dye their bait blue, thoroughly thaw the bait, and throw all offal on the opposite side of the vessel from which fishing operations are taking place. (There have been no observations of marine mammals feeding on offal discarded from Hawaii-based longline vessels.) Additionally, these vessels are required to use a line shooter – which they would have anyway – and at least forty-five gram weights on the line.

<u>Regulations:</u> Effort is required to be outside of 50 nautical miles from the entire Northwestern Hawaiian islands (NWHI) because of possible protected species (monk seal) interactions. Several 25-75 mile closed areas also exist around the MHI to prevent gear conflicts with smaller fishing vessels. Current regulations require 100% observer coverage for shallow swordfish sets and 20% observer coverage for deep tuna sets. There are fleet-wide annual limits on the number of allowable sea turtle interactions in this fishery (16 leatherbacks or 17 loggerheads). The shallow set component of the fishery is closed if either threshold is reached, or is expected to be reached Federal Register 69 FR 17329, April 2, 2004. There is an annual limit of 2,120 shallow sets north of the equator. Vessel operators must obtain single shallow set certificates from NMFS, which are transferable, and valid for one calendar year. Hawaii-based longline vessels are prohibited from making more shallow-sets north of the equator during a trip than the number of valid shallow-set certificates on board the vessel. Within 72 hours of landing a pelagic management unit species, vessel operators are required to submit one valid shallow-set certificate to the Regional Adminstrator for every shallow set fished north of the equator during a fishing trip. On 14 March 2006, the Western Pacific Regional Fishery Management Council voted to initiate an emergency closure of the Hawaii longline swordfish fishery because the fishery had already reached allowable interaction levels with loggerhead turtles in 2006. The shallow set component of the fishery north of the equator was closed on 20 March 2006 (Federal Register 71 FR 14824, 24 March 2006).

<u>Management type:</u> Federal limited access program. This fishery is managed under a Fishery Management Plan (FMP), developed by the Western Pacific Fishery Management Council and NMFS.

<u>Comments</u>: This Hawaii longline fishery is active year-round and targets swordfish and tuna, other species are caught incidentally. Interactions with bottlenose dolphins, false killer whales, humpback whales, short-finned pilot whales,

spinner dolphins, short-beaked common dolphins, pantropical spotted dolphins, Blainville's beaked whale, sperm whales, and Risso's dolphins have been documented[3]. Longline hooks have also been recovered from Hawaiian monk seals, but these were not observed during longline fishing operations. Due to interactions with protected species, especially turtles, this fishery has been observed since February 24, 1994. Initially, observer coverage was less than 5%, increased to 10% in 2000, and has exceeded 20% in 2001 and 2002. In 2003, observer coverage was 22.2% (based on vessel departures), with 6.4 million hooks observed from 3,204 sets. Observed injuries of marine mammals in this fishery in 2003 included 2 false killer whales, 1 unidentified cetacean and 1 unidentified whale. Additionally, there was one observed mortality of a bottlenose dolphin (Pacific Islands Regional Office preliminary report dated 9 February 2004). In 2004, observer coverage was 24.6% (based on vessel departures), with 7.9 million hooks observed from 3,958 sets. Observed injuries of marine mammals in this fishery in 2004 included 5 false killer whales, 1 humpback whale and 1 short-finned pilot whale. Additionally, there was one observed mortality of a false killer whale. In the shallow set component of this fishery, observer coverage in 2004 was 100% (88 sets and 76,750 hooks observed). No marine mammal interactions were observed in the shallow set component of the fishery (Pacific Islands Regional Office preliminary report dated 25 January 2005).

Category II Hawaii shallow set longline/set line fishery

Number of permit holders: See permit holder section for Hawaii deep-set fishery above.

Number of active permit holders: There were 127 vessels active in 2008. Some vessels participate in both the shallow and deep set fisheries.

Total effort: Observed effort in this fishery in the 4th quarter of 2007 and all of 2008 included 95 fishing trips, 1,487 sets, and 1.35 million hooks fished, representing 100% observer coverage in the fishery.

Geographic range: See geographic range description for the deep set Hawaii longline fishery above.

Seasons: This fishery operates year-round. Effort is generally lower in the third quarter of the year.

Gear type: See gear type description for the deep set Hawaii longline fishery above.

Category II, CA yellowtail, barracuda, white seabass, and tuna drift gillnet fishery (>3.5 and <14 in mesh)

Note: ~~This fishery has developed recently as an offshoot of the "**CA other species, large mesh (>3.5 in) set gillnet fishery**" (see Category I fishery section above).~~ Fishermen use the same gear as in the set gillnet fishery (typically 6.5 inch mesh nets, 100-200 fathoms in length, except that they instead utilize drifting nets to target white seabass and yellowtail. Albacore tuna and barracuda are also targeted in this fishery.

Number of permit holders: There are approximately 24 active permit holders in this fishery.

Total effort: From ~~2002-2006~~ 2003-2007, there were ~~221, 193, 120, 184, and 175~~ 201, 124, 191, 216, and 304 small-mesh drift gillnet sets fished, respectively, as determined from California Department of Fish and Game logbook data.

Geographic range: This drift gillnet component of this fishery operates primarily south of Point Conception. Observed sets have been clustered around Santa Cruz Island, the east Santa Barbara Channel, and Cortez and Tanner Banks. Some effort has also been observed around San Clemente Island and San Nicolas Island.

Seasons: This fishery operates year round. Targeted species is typically determined by market demand on a short-term basis.

[3] K.A. Forney 2004. Estimates of cetacean mortality and injury in two U.S. Pacific longline fisheries, 1994-2002. Southwest Fisheries Science Center Administrative Report LJ-04-07, available from Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037. 17 pp.

Gear type and fishing method: Typical gear used for this fishery is a 150-200 fathom gillnet, which is allowed to drift. The mesh size depends on the target species but typical values observed are 6.0 and 6.5 inches.

Regulations: This fishery is managed by the California Dept. of Fish and Game in accordance with state and federal laws.

Management type: This fishery is a limited entry fishery with gear restrictions and area closures.

Comments: This fishery primarily targets white seabass and yellowtail, but also targets barracuda and albacore tuna. From 2002-2004, there have been 63 sets observed from 17 vessel trips. Marine mammal mortality includes two long-beaked common dolphin and 3 California sea lions. Also, 4 California sea lions were entangled and released alive during this period. In 2003, there was one coastal bottlenose dolphin stranded with 3.5-inch gillnet wrapped around its tailstock, the responsible fishery is unknown. Observer coverage in this fishery was 12% in 2002, 10% in 2003, and 17% in 2004. This fishery has not been observed since 2004.

Category II, CA ~~swordfish~~ pelagic longline fishery

Number of permit holders: As recently as 2004, there were 20-30 vessels participating in the fishery. Only one vessel was active in ~~2005~~ 2007 and 2008. This decline in participation is due to the prohibition of shallow set swordfishing east of W150 longitude, implemented in 2004.

Number of active permit holders: In ~~January 2006~~ 2007 and 2008, there was only one vessel participating in this fishery, which fished for tuna using deep set methods outside the U.S. EEZ. The remaining vessels from this fishery now participate in the Hawaii longline fishery.

Total Effort: An estimated 1 - 1.5 million hooks were fished annually when 20-30 California-based vessels participated in the fishery. In 2005, there were only two trips fished by one vessel. Ten sets were observed in the first trip and it is unknown how many sets were made during the second trip because no observer was present.

Geographic range: ~~The fishery management plan (FMP) for highly migratory species prohibits targeting swordfish with shallow set fishing methods east of W150 longitude. In March 2006, the Pacific Fishery Management Council approved an application for an exempted fishing permit (EFP) that would allow one vessel to utilize shallow set longline methods within the U.S. EEZ, with the same shallow set regulations used in the Hawaii fishery (circle hooks and fish bait). An environmental assessment of this proposal will be prepared by the Highly Migratory Species Management Team (HMSMT) for review at a future Council meeting. This EFP would be effective no sooner than 2007 if it receives final approval.~~ Currently, one vessel participates in this fishery and operates outside of the U.S. EEZ.

Seasons: The fishery operates year-round.

Gear type: Typically, vessels fish 24-72 km of mainline, rigged with 22 m gangions at approximately 60 m intervals. Anywhere from 800 to 1,300 hooks are deployed in a set, with large squid (Illex sp.) used for bait. Variously colored lightsticks are used, for fishing takes place primarily during the night, when more swordfish are available in surface waters. The mainline is deployed in 4-7 hours and left to drift unattached for 7-10 hours. Retrieval typically takes about 7-10 hours. A description of the gear used for deep sets targeting tuna is given in the Hawaii longline fishery section.

Regulations: Longline vessels are prohibited from operating within the 200 nmi limit, but may unload their catch in California ports and are required to have a California state commercial fishing license.

Management type: The California pelagic longline fishery is managed under a Highly Migratory Species Fishery Management Plan (FMP) developed by the Pacific Fishery Management Council and NMFS. . The FMP was partially approved by NMFS on February 4, 2004. NMFS published a final rule on March 11, 2004 which prohibits shallow longline sets of the type normally targeting swordfish on the high seas in the Pacific Ocean east of 150˚ W. longitude. A mandatory observer program became effective for this fishery in August 2002.

Comments: Between October 2001 and February 2004, 23 trips were observed by California-based longline observers, with 469 sets observed (<15% observer coverage). Between October 2001 and November 2003 the longline observer program reported one injured Risso's dolphin and one unidentified dolphin killed. Examination of photographs of the dead dolphin led marine mammal identification experts to conclude that the animal was most likely a striped dolphin. The fishery responsible for this bycatch was closed in 2004.

Category II, California Anchovy, Mackerel, and Sardine Purse Seine Fishery. [4]

Number of permit holders: There are 63 limited entry permits (Pacific Fishery Management Council. 2005. Status of the Pacific Coast coastal pelagic species fishery and recommended acceptable biological catches. Stock Assessment and Fishery Evaluation Report 2005).

Number of active permit holders: There are 61 vessels actively fishing.

Total effort: The fishery is managed under a capacity goal, with gross tonnage of vessels used as a proxy for fishing capacity. Capacity for the fleet is approximately 5,400 gross tons. Harvest guidelines for sardine and mackerel are also set annually.

Geographic range: These fisheries occur along the coast of California predominantly from San Pedro, including the Channel Islands, north to San Francisco.

Seasons: This fishery operates year round. Targeted species vary seasonally with availability and market demand.

Gear type and fishing method: Purse seine, drum seine and lampara nets utilizing standard seining techniques.

Regulations: This is a limited entry fishery.

Management type: The fishery is managed under a Coastal Pelagic Species Fisheries Management Plan developed by the Pacific Fishery Management Council and NMFS.

A NMFS pilot observer program began in July 2004 and continued through January 2006. A total of 93 sets have been observed. Observed marine mammal interactions with the fishery have included one California sea lion killed, 54 sea lions released alive, and one sea otter released alive. Under the MMAP self-reporting program, the following mortality was reported: In 2003, four California sea lions drowned after chewing through a bait barge net used by the anchovy lampara net fishery.

Category II, California tuna purse seine fishery.

Note: This fishery was previously included in the CA anchovy, mackerel, and sardine purse seine fishery (see above). Vessels in the anchovy, mackerel, and sardine fishery target tuna when oceanographic conditions result in an influx of tuna into southern California waters. Data for this fishery were obtained from the 'Status of the U.S. West Coast Fisheries for Highly Migratory Species through 2004', available at the Pacific Fishery Management Council website (http://www.pcouncil.org).

Number of permit holders: There are 63 limited entry permits (Pacific Fishery Management Council. 2005. Status of the Pacific Coast coastal pelagic species fishery and recommended acceptable biological catches. Stock Assessment and Fishery Evaluation Report 2005).

[4] Information for this fishery came from the following sources: Pacific Fishery Management Council. 2005. Status of the Pacific Coast coastal pelagic species fishery and recommended acceptable biological catches. Stock assessment and fishery evaluation – 2005; California Coastal Pelagic Species Pilot Observer Program Informational Report 12 October 2005 (NMFS SW Region, unpublished); Lyle Enriquez NMFS Southwest Regional Office (personal communication) and the Marine Mammal Authorization Program, Registration and Reporting System. This fishery was formerly known as the "CA anchovy, mackerel, and tuna purse seine fishery" and was renamed in the NMFS MMPA List of Fisheries for 2007 (Federal Register Volume 72, No. 59, 14466). The "tuna" component of this fishery was designated as a separate fishery in the 2007 List of Fisheries and is named the "CA tuna purse seine fishery" (see fishery description below).

Number of active permit holders: Between one and 23 vessels actively purse seined for tunas during the period 2000-2004.

Total effort: The number of vessels landing bluefin, yellowfin, skipjack, and albacore between 2000-2004 varied between one and 23. Logbooks are not required for this fishery and the overall number of sets fished is unknown.

Geographic range: Observed sets in this fishery have occurred in the southern California Bight.

Seasons: Observed sets occurred in August and September. The timing of fishing effort varies with the availability of tuna species in this region.

Gear type and fishing method: Small coastal purse seine vessels with a <640 mt carrying capacity target bluefin, yellowfin, albacore and skipjack tuna during warm water periods in southern California.

Regulations: This is a limited entry fishery.

Management type: This fishery is managed under a Highly Migratory Species Management Plan developed by the Pacific Fishery Management Council and NMFS.

Comments: A pilot observer program for this fishery began in July 2004 and ended in January 2006. A total of 9 trips and 15 sets were observed with no marine mammal interactions.

Category II, WA Puget Sound Region salmon drift gillnet fishery.

Number of permit holders: This commercial fishery includes all inland waters south of the US-Canada border and east of the Bonilla/Tatoosh line, at the entrance to the Strait of Juan de Fuca. Treaty Indian salmon gillnet fishing is not included in this commercial fishery. In 1999, the U.S. and Canada reached an agreement that significantly reduced the U.S. share of sockeye salmon. In order to compensate the non-treaty U.S. fishermen for the impact of this reduction, a federally funded buyback program was established. By the 2001 fishing season, the number of available drift gillnet permits had been reduced from 675 (1999) to 216. The intent of the buyback program was to reduce the number of drift gillnet permits to 200 (pers. comm., David Cantillon, NMFS, Northwest Region).

Number of active permit holders: Under the cooperative program that integrates issuance of Marine Mammal Authorization Certificates into the existing State license process, NMFS receives data on vessels that have completed the licensing process and are eligible to fish. These vessels are a subset of the total permits extant (725 in 2001), and the remainder of the permits are inactive and do not participate in the fishery during a given year. The number of "active" permits is assumed to be equal to or less than the number of permits that are eligible to fish. From 1997-2001, the number of active permits was 633, 559, 199, 248, and 182, respectively.

Total effort: Effort in the Puget Sound salmon drift gillnet fishery is regulated by systematic openings and closures that are specific to area and target salmon species. Since 1994, the number of active vessels in the Puget Sound drift gillnet fishery has declined. In addition, at least one major portion of the fishery, the previously observed sockeye fishery in areas 7 and 7A, has experienced reductions in available fishing time (openings). The number of days and total number of hours that the sockeye fishery remained open, approached the 1994 level only once (1997) in the period from 1995 through 1998. In the remaining years the available sockeye fishing time was less than half of the 1994 level. In recent years, poor sockeye returns and market conditions have combined to reduce participation in the fishery beyond the reductions created originally by the federal buyback program. In 2001, drift gillnets fished for only one opening and 182 gear units were fished in all areas as compared to the 559 cited for 1998. Owing to the buyback program and reduced salmon runs, it is expected that the number of active permits will remain low.

Geographic Range: The fishery occurs in the inland marine waters south of the U.S./Canada border and east of the Bonilla/Tatoosh line at the entrance to the Strait of Juan de Fuca. The inland waters are divided into smaller statistical catch areas which are regulated independently.

Seasons: This fishery has multiple seasons throughout the year that vary among local areas dependent on local salmon runs. The seasons are managed to access harvestable surplus of robust stocks of salmon while minimizing impacts on weak stocks.

Gear type and fishing methods: Vessels operating in this fishery use a drift gillnet of single web construction, not exceeding 300 fathoms in length. Minimum mesh size for gillnet gear varies by target species. Fishing directed at sockeye and pink salmon are limited to gillnet gear with a 5 inch minimum mesh and a 6 inch maximum, with an additional "bird mesh" requirement that the first 20 meshes below the corkline be constructed of 5 inch opaque white mesh for visibility; the chinook season has a 7 inch minimum mesh; the coho season has a 5 inch minimum mesh; and the chum season has a 6 to 6.25 inch minimum mesh. The depth of gillnets can vary depending upon the fishery and the area fished. Normally they range from 180 to 220 meshes in depth, with 180 meshes as a common depth. It is the intention of the fisher to keep the net off the bottom. The vessel is attached to one end of the net and drifts with the net. The entire net is periodically retrieved onto the vessel and catch is removed. Drift times vary depending on fishing area, tidal condition and catch.

Regulations: The fishery is a limited entry fishery with seasonal openings, area closures, and gear restrictions.

Management type: The fishery occurs in State waters and is managed by the Washington Department of Fish and Wildlife consistent with the U.S.-Canada Pacific Salmon Commission management regimes and the ocean salmon management objectives of the Pacific Fishery Management Council. U.S. and Canadian Fraser River sockeye and pink salmon fisheries are managed by the bilateral Fraser Panel in Panel Area waters. This includes the entire U.S. drift gillnet fishery for Fraser sockeye and pink salmon. For U.S. fisheries, Fraser Panel Orders are given effect by federal regulations that consist of In-season Orders issued by the NMFS Regional Administrator of the NMFS Northwest Region. These regulations are filed in the Federal Register post-season.

Comments: In 1993, observers were placed onboard vessels in a pilot program to monitor seabird and marine mammal interactions with fishing effort for several target salmon species in a number of areas throughout the Puget Sound region. In 1994 observer effort was concentrated in the sockeye fishery in areas 7 and 7A, where interactions with seabirds and marine mammals were most likely to occur. Incidental takes of harbor porpoise, Dall's porpoise and harbor seals have been documented in the fishery. The overall take of marine mammals for the salmon drift gillnet fisheries in Puget Sound is unlikely to have increased since the fisheries were last observed, owing to reductions in the number of participating vessels and available fishing time.

Category II, OR swordfish surface longline fishery.

Number of permit holders: The number of permits issued annually from 2000-2005 has ranged between one and seven (pers. comm., Jean McCrae, Oregon Department of Fish and Wildlife, Marine Resources Program).

Number of active permit holders: Based on landings of swordfish with this gear type, there were no active permit holders in this fishery from 2000-2005.

Total effort: From 2000-2005, there were no reported swordfish landings using longline gear.

Geographic range: The Fishery Management Plan prohibits targeting highly migratory species such as swordfish with longlines within the U.S. EEZ, thus any fishing would have to occur outside the EEZ. However, shallow set methods used for swordfish are also prohibited east of W150 longitude.

Seasons: This fishery could occur year-round, however, effort would generally terminate by late fall.

Gear type: Fishing gear consists of a buoyed mainline fitted with leaders and baited hooks. The mainline is fished near the surface suspended from buoys (rather than anchored to the bottom as in groundfish longline fisheries). Swordfish longlines may not exceed 1000 fathoms in length and must be attached at one end to the vessel when fishing. The gear is typically set in the evening and retrieved in the morning.

Regulations: The fishery is a limited entry fishery with gear and bycatch restrictions.

Management type: The fishery is managed under a Highly Migratory Species Fisheries Management Plan developed by the Pacific Fishery Management Council and NMFS.

Category II, OR blue shark surface longline fishery.

Number of permit holders: The number of Oregon Developmental Fishery Permits for fishing blue shark using a floating longline is limited to 10. From 2000-2005, there were fewer than 5 permits issued annually for this fishery (pers. comm., Jean McCrae, Oregon Department of Fish and Wildlife, Marine Resources Program).

Number of active permit holders: There were no active permits in the blue shark longline fishery off Oregon from 2000-2005. The effort in this fishery prior to 1998 was estimated to be low based on the number of permits issued and very limited landings.

Total effort: From 2000-2005, there were no reported landings of blue shark using longline gear.

Geographic range: This fishery occurs off the coast of Oregon. The Fishery Management Plan prohibits targeting highly migratory species such as blue sharks with longlines within the U.S. EEZ, thus any fishing would have to occur outside the EEZ.

Seasons: This fishery occurs year-round, however, effort in this fishery generally terminates by late fall.

Gear type: Fishing gear consists of a buoyed mainline fitted with leaders and baited hooks. The mainline is fished near the surface suspended from buoys (rather than anchored to the bottom as in groundfish longline fisheries). Shark longlines must be marked at each terminal surface end with a pole and flag, an operating light, a radar reflector, and a buoy showing clear identification and gear owner. The gear is typically set in the evening and retrieved in the morning.

Regulations: The fishery is a limited entry fishery with gear and bycatch restrictions.

Management type: The fishery is managed under a Highly Migratory Species Fisheries Management Plan developed by the Pacific Fishery Management Council and NMFS.

Category II, CA squid purse seine fishery.[5]

Number of Permit Holders: A permit has been required to participate in the squid fishery since April 1998. Originally, only two types of permits were issued, either a vessel or light boat permit during the moratorium period from 1998 to 2004. Since the adoption of the Market Squid Fishery Management Plan (MSFMP) in 2005, a total of seven different permit types are now allowed under the restricted access program. Permit types include both transferable and non-transferable vessel, brail and light boat permits whose qualifying criteria are based on historical participation in the fishery during the moratorium period. Market squid vessel and brail permits allow a vessel to use lights to attract and capture squid using either purse seines or brail gear. Light boat owner permits only allow the use of attracting lights to attract and aggregate squid. In addition, three experimental non-transferable permits are allowed for vessel fishing outside of historical fishing areas north of San Francisco. In the 2006/2007 season there were 91 vessel permits, 14 brail permits, 64 light boat permits and 3 experimental permits issued. A permit is not required when fishing for live bait or when landing two short tons or less, which is considered incidental.

Number of Active Permit Holders: The number of active permits varies by year depending on market conditions and availability of squid. During the 2006/2007 season (1 April 2006 – 31 March 2007) there were approximately 84 vessels active during some portion of the year. Twenty-nine vessels harvested 86% of the total landings greater than two tons. The 1999/2000 season had the highest squid landings to date (115,437mt), with 132 vessels making squid landings.

[5]This fishery description was provided by Dianna Porzio and Dale Sweetnam, California Department of Fish and Game. Details of marine mammal interactions with this fishery were obtained from NOAA Fisheries, Southwest Regional Office.

Total Effort: Logbooks have been mandatory for the squid fishery since May 2000. Results for the 2006 calendar year indicate that each hour of fishing required 1.4 hours of search time by light boats. Combined searching and fishing effort resulted in 6.9 metric tons (mt) of catch per hour. In the 2006/2007 season, the fishery made 1,611 landings. This is a 47% decrease from the previous season. In addition, the average landing decreased from 23.9 mt to 21.7 mt.

Geographic Range: Since the 1960's there have been two distinct fisheries in operation north and south of Point Conception. Since the mid-1980's the majority of the squid fishing harvest has occurred in the southern fishery, with efforts focused around the Channel Islands and along the mainland from Port Hueneme to La Jolla. In the 2006/2007 season, the southern fishery landed 98% of the catch with the majority of landings occurring around the northern Channel Islands. In contrast, during the 2005/2006 season, landings in the southern fishery were primarily around Catalina Island. The northern fishery, centered primarily in Monterey Bay, has been in operation since the mid-1860's and has historical significance to California. During the 2002/2003 season, a moderate El Niño condition resulted in nearly 60% of the catch being landed in northern California.

Seasons: The fishery can occur year-round; however, fishing efforts differ north and south of Point Conception. Typically, the northern fishery operates from April through September while the southern fishery is most active from October through March. El Niño conditions generally hamper the fishery in the southern fishery and squid landings are minimal during these events. In contrast, landings in the northern fishery often increase during El Niño events, and then are depressed for several years after.

Gear Type: There are several gears employed in this fishery. From 1996 to 2006, the vast majority (95%) of vessels use either purse (69%) or drum (26%) seine nets. Other types of nets used include brail (5%) and lampara nets (<1%). Another gear type associated with the fishery is attracting lights (30,000 watts maximum) that are used to attract and aggregate spawning squid in shallow waters.

Regulations: Since March 2005, the fishery operates under a restricted access program that requires all vessels to be permitted. A mandatory logbook program for fishing and lighting vessels has been in place since May 2000. A /monitoring program has been in place since 2000 that samples the landings is designed to evaluate the impact of the fishery on the resource. Attracting lights were regulated with each vessel restricted to no more than 30,000 watts of light during fishing activities. These lights must also be shielded and oriented directly downward to reduce light scatter. The lighting restrictions were enacted to avoid risks to nesting brown pelicans and interactions with other seabird species of concern. A seabird closure area restricting the use of attracting lights for commercial purposes in any waters of the Gulf of the Farallones National Marine Sanctuary was enacted. A seasonal catch limitation of 107,047 mt (118,000 short tons) was established to limit further expansion of the fishery. Commercial squid fishing is prohibited between noon on Friday and noon on Sunday of each week to allow an uninterrupted consecutive two-day period of spawning. Additional closure areas to the fishery to protect squid spawning habitat include the Channel Islands Marine Protected Areas (MPAs) and the newly established MPAs along the central California coast as well areas closed to the use of purse seine gear including the leeward side of Catalina Island, Carmel and Santa Monica Bays.

Management Type: The market squid fishery is under California State management. The fishery was largely unregulated until 1998 when it came under regulatory control of the California Fish and Game Commission and the Department of Fish and Game. The MSFMP was enacted on March 28, 2005. The MSFMP was developed to ensure sustainable long-term conservation and to be responsive to environmental and socioeconomic changes. Market squid is also considered a monitored species under the Pacific Fishery Management Council's (PFMC) Coastal Pelagic Species Fishery Management Plan.

Comments: During the 1980's, California's squid fishery grew rapidly in fleet size and landings when international demand for squid increased due to declining fisheries in other parts of the world. In 1997 industry sponsored legislation halted the growth of fleet size with a moratorium on new permits. Landing records were set several times during the 1990's, but landings seem to fluctuate with changing environmental and atmospheric conditions of the California current. Encounters with marine mammals and sea birds are documented in logbooks. Seal bombs are used regularly, but fishermen report that they no longer have an effect. A pilot observer program began in July 2004 and has documented one unidentified common dolphin mortality in 135 sets through January 2006. In addition, there have been 96 California sea lions and three harbor seals released alive (NMFS, Southwest Region, unpublished data). In addition to the observed mortality, there were three strandings of Risso's dolphin from 2002-2003 where evidence of gunshot wounds was confirmed, suggesting interaction with this fishery (NMFS Southwest Regional Office, unpublished data). The squid fishery operates primarily at night and targets spawning aggregations of adult squid. Although, in recent years, the amount of daylight fishing has increased, especially in Monterey, in part due to better sonar gear, but also to reduce interactions with California sea lions. The PFMC adopted the egg escapement method to monitor the impact of market squid fishery since no reliable biomass estimate has been developed. It is a proxy for Maximum Sustainable Yield (MSY), setting an egg escapement threshold level at which to evaluate the magnitude of fishing mortality on the spawning potential of the squid stock. The egg escapement method was developed on conventional spawning biomass "per-recruit" theory. In general, the MSY Control Rule for market squid is based on evaluating levels of egg escapement associated with the exploited population. The egg escapement threshold, initially set at 30%, represents a biological reference point from which to evaluate fishery related impacts.

Category ~~III~~ II, CA Dungeness crab pot

Notes: NMFS ~~is~~ reviewed ~~ing~~ several pot and trap fisheries along the U.S. west coast, in response to entanglements of humpback whales in pot and trap gear. ~~An update on these fisheries will appear in the MMPA Proposed List of Fisheries for 2009.~~ As a result of this review, several pot and trap fisheries were reclassified from Category III to Category II fisheries (73 FR 73032-73076, Dec. 1, 2008). For all commercial pot and trap fisheries in California, a general trap permit is required, in addition to any specific permits required for an individual fishery. All traps are required to be tended and serviced at least every 96 hours, weather permitting. Descriptions of those pot and/or trap fisheries for which interactions with marine mammals have been documented or suspected are included in this Appendix.

Number of permit holders: The Dungeness crab fishery is a limited access fishery requiring a vessel-based permit that is transferable. This program was initiated in 1994 based on landing histories. The number of vessels participating on an annual basis does vary, but approximately 400 vessels have been landing crab in recent years.

Number of active permit holders: Approximately 400 vessels have been landing crab in recent years.

Total effort: There is no restriction on the number of traps that may be fished at one time by a single vessel. Some vessels use as many as 1000 or more traps at the peak of the season (December/January).

Geographic range: This fishery operates in central and northern California.

Seasons: The fishery is divided into two management areas. The central region (south of the Mendocino-Sonoma county line) fishery opens November 15 and continues through June 30. The northern region (north of the Mendocino-Sonoma county line) is annually scheduled to open on December 1, but may be delayed by CDF&G based on the condition of market size crabs, and continues until July 15.

Gear type: For each trap fished there is one vertical line in the water, though only in the northern region, is fishing strings illegal. All traps are required to be marked with buoys bearing the commercial fishing license number. The normal operating depth for Dungeness crab is between 35 and 70 m. Traps are typically tended on a daily basis.

Regulations: There is no daily logbook requirement for the commercial Dungeness crab fishery. There is a recreation fishery for Dungeness crab, which allows for 10 crab per day to be harvested except when fishing on a commercial passenger fishing vessel (CPFV) in central California, the limit is 6 crab per person. There is no reliable estimate for the effort or landings in the sport fishery except that CPFVs are required to track catch and effort by species.

Management type: The Dungeness crab pot fishery is managed by the California legislature, CDF&G and also by the tri-state committee for Dungeness, which includes the states of Oregon and Washington.

Comments: Humpback whale entanglements with Dungeness crab gear have not been confirmed, but are suspected as the responsible fishery based on the location and timing of fishing effort and observed humpback entanglements.

Category ~~III~~ II, OR Dungeness crab pot

Notes: Dungeness crab is the most significant pot/trap fishery in the state of Oregon. Over the long term, the fishery has averaged around 10 million lb of landings per year; although since 2003, annual landings have been approximately 25 to 30 million lb. This fishery requires an Oregon issued limited entry permit, which is transferable.

Number of permit holders: There were 433 permit holders in 2006.

Number of active permit holders: A total of 364 vessels landed more than $500 worth of crab in 2006.

Total effort: In 2006, the fishery made a transition to a three-tiered pot limitation program which allows a maximum of 200, 300, or 500 pots to be fished at any one time depending on previous landing history. The pot limitation is implemented through a buoy tag requirement. All Dungeness crab pots require buoy tags with the identifying associated permit attached. The expected result of the buoy tags and tier limits is to reduce the number of pots in Oregon waters down from 200,000 to approximately 150,000.

Geographic range: Oregon waters.

Seasons: The Dungeness crab season runs from December 1 to August 14. The highest landings are always recorded in December through February, at the beginning of the season.

Gear type: Pots.

Regulations: All Oregon pot/trap gear must be marked on its terminal ends with pole and flag, light, radar reflector, and buoy with the owner/operator number clearly marked. By law, gear may not be left unattended for more than seven days. All vessel operators and deck hands must have a commercial fishing license or crewmembers license.

Management type: State management, Oregon Department of Fish and Wildlife.

Comments: Humpback whale entanglements with Dungeness crab gear have not been confirmed, but are suspected as the responsible fishery based on the location and timing of fishing effort and observed humpback entanglements.

Category ~~III~~ II, CA spot prawn fishery

Number of permit holders: A three-tiered limited access permit system is used in this fishery to accommodate changes in the fishery that occurred when trawling methods were banned and replaced with trap fishing in 2003. Permits are linked to the vessel owner and only Tier 1 permits are transferable. Tier 1 permits allow a maximum of 500 traps in use at a time. Eighteen vessels had Tier 1 permits in 2007. Tier 2 permits allow 150 traps in use at a time. There were three vessels utilizing Tier 2 permits in 2007. Tier 3 permits were issued to allow vessels that previously used trawl gear to switch to trap gear to target spot prawn. There were nine Tier 3 permits issued in 2007. Information on 2007 license statistics was obtained from the CA Department of Fish and Game website, http://www.dfg.ca.gov/licensing/statistics/statistics.html.

Number of active permit holders: A total of 30 vessels participated in this fishery in 2007.

Total effort: Landings have increased every year since 2003. The total number of traps set is unknown, although the theoretical maximum number of traps that may be fished annually is approximately 13,000.

Geographic range: The fishery operates from Monterey south. Over half of the landings are made in Los Angeles and San Diego. Traps are typically set in waters of 182 m (100 fathoms) or more. South of Point Arguello, traps must be fished in waters 91 m (50 fathoms) or deeper.

Seasons: North of Point Arguello, the fishery is open from February 1 to October 30. North of Point Arguello, the open season is August 1 to April 30.

Gear type: Strings of 25 to 50 traps are fished in deep waters (>182 m).

<u>Regulations:</u> For all commercial pot and trap fisheries in California, a general trap permit is required, in addition to any specific permits required for an individual fishery. All traps are required to be tended and serviced at least every 96 hours, weather permitting. There is a daily logbook requirement in this fishery. There is no buoy marking requirement and no recreational fishery for this species.

<u>Management type:</u> This fishery is managed under state authority by the California Department of Fish and Game.

<u>Comments:</u> One humpback whale was seriously injured in 2006 as a result of entanglement in spot prawn trap gear.

Category ~~III~~ II, WA/OR/CA sablefish pot

<u>Notes:</u> Sablefish is likely the most commonly targeted groundfish caught in pot gear in off the U.S. west coast.
<u>Number of permit holders:</u> There are 32 limited entry permits (LEPs) to catch sablefish with pot gear. Open access privileges are also available to fishermen.

<u>Number of active permit holders:</u> Including all vessels which made landings with an LEP or under open access rules, a total of about 150 vessels participated in this fishery in 2007. This total fluctuates on an annual basis.
<u>Total effort:</u> Estimated annual landings indicate usually over 1 million lbs of sablefish are landed per year in this fishery.

<u>Geographic range:</u> The fishery is well distributed from central California north to the U.S./Canadian border. Most of the effort occurs out in deeper waters (200-400 m).

<u>Seasons:</u> Most fishing effort occurs January through September.

<u>Gear type:</u> Traps <6 ft. in any dimension.

<u>Regulations:</u> A general trap permit is all that is required for open access to this fishery by the states along the U.S. west coast. LEPs are divided into a three-tiered system which allocates annual landing limits to individual permits based on the status of the stock. Daily logbook reporting is required.

<u>Management type:</u> Sablefish is managed under the federal Groundfish Fishery Management Plan. This is the only trap fishery regulated by the federal government; all others are managed by the states.

<u>Comments:</u> One humpback whale was seriously injured in 2006 as a result of entanglement in sablefish trap gear.

Category III, CA spiny lobster, coonstripe shrimp, rock crab, tanner crab pot or trap fishery.

<u>Number of permit holders:</u> ~~There were 134 permits issued in 2007.~~ The 2009 List of Fisheries provides an estimate of 530 participants in this fishery.

<u>Number of active permit holders:</u> Unknown, but it is likely that most issued permits are active.

<u>Total effort:</u> Annual landings averaged approximately 1 million pounds from 2000 to 2005.

<u>Geographic range</u>: The fishery operates throughout California waters. Most landings are made south of Morro Bay, California, with approximately 65% of all landings coming from the Santa Barbara area.

<u>Seasons:</u> There are no seasonal restrictions, though some area closures exist.

<u>Gear type:</u> There is no restriction on the number of traps that may be fished at one time by the vessel but the typical number of traps operated at any given time is less than 200. Traps are usually buoyed singularly or in pairs, but fishing strings (multiple traps attached together between two buoys) is allowed. Buoys are required to be marked with the license number of the operator. The normal working depth of traps in this fishery is 10 to 35 fathoms.

Regulations: There is no daily logbook requirement for the commercial rock crab fishery.

Management type: The fishery is managed by the California Department of Fish and Game.

Comments: The recreational bag limit is 35 crabs per day, but there is no reliable estimate of the effort or landings in the sport fishery.

Category III, CA halibut bottom trawl.

Notes: This is a newly-listed fishery in the 2007 MMPA NMFS List of Fisheries (Federal Register Volume 72, No. 59, 14466). Information on fishing effort was provided by Stephen Wertz, California Department of Fish and Game.

Number of permit holders: There were 60 permits issued in 2006.

Number of active permit holders: There were 31 active permit holders in 2006.

Total effort: Thirty one vessels made 3,711 tows statewide in 2006, totaling 3,897 tow hours, in 332 days of fishing effort.

Geographic range: The fishery operates from Bodega Bay in northern California to San Diego in southern California, from 3 to 200 nautical miles offshore. Trawling is prohibited in state waters (0 to 3 nmi offshore) and within the entire Monterey Bay, except in the designated "California halibut trawl grounds", between Point Arguello and Point Mugu beyond 1 nautical mile from shore. Trawls used in this region must have a minimum mesh size of 7.5 in and trawling is prohibited here between 15 March and 15 June to protect spawning adults.

Seasons: Fishing is permitted year-round, except in state waters. State waters are closed between 15 March and 15 June.

Gear type: Otter trawls, with a minimum mesh size of 4.5 inches are required in federal waters, while fishing in state waters has a 7.5 inch mesh size requirement.

Regulations: Fishing in state waters is limited to the period 14 March – 16 June in the 'California halibut trawl grounds' in southern California between Point Arguello and Point Mugu. All other fishing must occur in federal waters beyond 3 nautical miles from shore.

Management type: The fishery is managed by the California Department of Fish and Game.

Comments: No marine mammal interactions have been documented for this fishery, but the gear type and fishing methods are similar to the WA/OR/CA groundfish trawl fishery (also category III), which is known to interact with marine mammals.

Category III, CA herring gillnet fishery.[6]

The herring fishery is concentrated in four spawning areas which are managed separately by the California Department of Fish and Game (CDFG); catch quotas are based on population estimates derived from acoustic and spawning-ground surveys. The largest spawning aggregations occur in San Francisco Bay and produces more than 90% of the herring catch. Smaller spawning aggregations are fished in Tomales Bay, Humboldt Bay, and Crescent City Harbor. During the early 1990's, there were 26 round haul permits (either purse seine or lampara nets). Between 1993 and 1998, all purse seine fishers converted their gear to gillnets with stretched mesh size less than 2.5 inches (which are not known to take mammals) as part of CDFG efforts to protect herring resources. The fishery is managed through a limited-entry program. The California Department of Fish and Game website lists a total of 447 herring gillnet permits for 2005 (http://www.dfg.ca.gov/mrd/herring/index.html). Of these, 406 permits exist for San Francisco Bay, 34 in Tomales Bay, 4

[6] Pers. Comm. Becky Ota, State Herring Manager, Senior Biologist.

in Humboldt Bay, and 3 in Crescent City Harbor. This fishery begins in December (San Francisco Bay) or January (northern California) and ends when the quotas have been reached, but no later than mid-March.

Category III, WA Willapa Bay salmon drift gillnet fishery.

Number of permit holders: The total number of permit holders for this fishery in 1995 and 1996 was 300 but this number has declined in subsequent years. In 1997 there were 264 total permits and 243 in 1998. The NMFS 2001 List of Fisheries lists an estimate of 82 vessels/persons in this fishery.

Number of active permit holders: The number of active permit holders is assumed to be equal to or less than the number of permits eligible to fish in a given year. The number of permits renewed and eligible to fish in 1996 was 300 but declined to 224 in 1997 and 196 permits were renewed for 1998. The 1996-98 counts do not include permits held on waivers for those years, but do include permits that were eligible to fish at some point during the year and subsequently entered into a buyback program. The number of permits issued for this fishery has been reduced through a combination of State and federal permit buyback programs. Vessels permitted to fish in the Willapa Bay are also permitted to fish in the lower Columbia River drift gillnet fishery.

Total effort: Effort in this fishery is regulated through area and species openings. The fishery was observed in 1992 and 1993 when fishery opening were greater than in recent years. In 1992 and 1993 there were 42 and 19 days of open fishing time during the summer "dip-in" fishery. The "dip-in" fishery was closed in 1994 through 1999. Available openings have also declined in the fall chinook/coho fisheries. In 1992/93 respectively there were 44 and 78 days of available fishing time. There were 43, 45, 22 and 16.5 available open fishing days during 1995 through 1998.

Geographic range: This fishery includes all inland marine waters of Willapa Bay. The waters of the Bay are further divided into smaller statistical catch areas.

Seasons: Seasonal openings coincide with local salmon run timing and fish abundance.

Gear type: Fishing gear used in this fishery is a drift gillnet of single web construction, not exceeding 250 fathoms in length, with a minimum stretched mesh size ranging upward from 5 inches depending on target salmon species. The gear is commonly set during periods of low and high slack tides. It is the intention of the fisher to keep the net off the bottom. The vessel is attached to one end of the net and drifts with the net. The entire net is periodically retrieved onto the vessel and catch is removed. Drift times vary depending on fishing area, tidal condition, and catch.

Regulations: This fishery is a limited entry fishery with seasonal openings and gear restrictions.

Management type: The salmon drift gillnet fishery is managed by the Washington Department of Fish and Wildlife.

Comments: Observers were placed onboard vessels in this fishery to monitor marine mammal interactions in the early 1980s and in 1990-93. Five incidentally taken harbor seals were recovered by observers in the fishery from 1991through 1993 (3 in ‘92 and 2 in ‘93). Two incidentally taken northern elephant seals were recovered by observers from the fishery in 1991 but no takes of this species were observed. The summer fishery (July- August) in Willapa Bay has been closed since it was last observed in 1993 and available fishing time declined from 1996 through 1998.

Category III, WA Grays Harbor salmon drift gillnet fishery.

Number of permit holders: This commercial drift gillnet fishery does not include Treaty Indian salmon gillnet fishing. The total number of permit holders for this commercial fishery in 1995 and 1996 was 117 but this number has declined in subsequent years. In 1997 there were 101 total permits and 87 in 1998.

Number of active permit holders: The NMFS 2001 List of Fisheries lists a total of 24 vessels/persons operating in this fishery. The number of active permit holders is assumed to be equal to or less than the number of permits eligible to fish in a given year. The number of permits renewed and eligible to fish in 1996 was 117 but declined to 79 in 1997 and 59 permits were renewed for 1998. The 1996-98 counts do not include permits held on waivers for those years but do include permits that were eligible to fish at some point during the year and subsequently entered a buyback program. The number of permits issued for this fishery has been reduced through a combination of State and federal permit buyback programs. Vessels permitted to fish in Grays Harbor are also permitted to fish in the lower Columbia River salmon drift gillnet fishery.

Total effort: Effort in this fishery is regulated through area and species openings. The fishery was observed in 1992 and 1993 when fishery openings were greater than in recent years. In 1992 and 1993 there were 42 and 19 days of open fishing time during the summer "dip-in" fishery. The "dip-in" fishery was closed in 1994 through 1999. Available openings have also declined in the fall chinook/coho fisheries. There were 11, 17.5, 9 and 5 available open fishing days during the 1995 through 1998 fall season.

Geographic range: Effort in this fishery includes all marine waters of Grays Harbor. The waters are further divided into smaller statistical catch areas.

Seasons: This fishery is subject to seasonal openings which coincide with local salmon run timing and fish abundance.

Gear type: Fishing gear used in this fishery is a drift gillnet of single web construction, not exceeding 250 fathoms in length, with a minimum stretched mesh size ranging of 5 inches depending on target salmon species. The gear is commonly set during periods of low and high slack tides and retrieved periodically by the tending vessel. It is the intention of the fisher to keep the net off the bottom. The vessel is attached to one end of the net and drifts with the net. The entire net is periodically retrieved onto the vessel and catch is removed. Drift times vary depending on fishing area, tidal condition, and catch.

Regulations: The fishery is a limited entry fishery with seasonal openings and gear restrictions.

Management type: The salmon drift gillnet fishery is managed by the Washington Department of Fish and Wildlife.

Comments: Observers were placed onboard vessels in this fishery to monitor marine mammal interactions in the early 1980s and in 1990-93. Incidental take of harbor seals was observed during the fishery in 1992 and 1993. In 1992, one harbor seal was observed entangled dead during the summer fishery and one additional seal was observed entangled during the fall fishery but it escaped uninjured. In 1993, one harbor seal was observed entangled dead and one additional seal was recovered by observers during the summer fishery. The summer fishery (July-August) in Grays Harbor has been closed since it was last observed in 1993. Available fishing time in the fall chinook fisheries declined from 1996 through 1998.

Category III, WA, OR lower Columbia River salmon drift gillnet fishery.

Number of permit holders: The total number of permit holders was 856 (344 from Oregon and 512 from Washington) when the fishery was last observed in 1993. In 1995 through 1998 the number of permits was 747, 693, 675 and 620 respectively. The number of permits issued for this fishery by Washington has been reduced through a combination of State and federal buy-back programs. This reduction is reflected in the overall decline in the total number of permits.

Number of active permit holders: The number of active permits is a subset of the total permits issued for the fishery. For example, in 1995, 110 vessels (of the 747 vessels holding permits) landed fish in the mainstem fishery.

Total effort: Effort in this fishery is regulated through species related seasonal openings and gear restrictions. The fishery was observed in 1991, 1992 and 1993 during several seasons of the year. The winter seasons (openings) for 1991 through 1993 totaled 13, 9.5, and 6 days respectively. The winter season has subsequently been reduced to remnant levels to protect upriver ESA listed salmon stocks. In 1995 there was no winter salmon season, in 1996 the fishery was open for 1 day. In 1997 and 1998 the season was shifted to earlier in the year and gear restrictions were imposed to target primarily sturgeon. The fall fishery in the mainstem was also observed 1992 and 1993 as was the Young's Bay terminal fishery in 1993, however, no marine mammal mortality was observed in these fisheries. The fall mainstem fishery openings varied from 1 day in 1995 to just under 19.5 days in 1997 and 6 days in 1998. The fall Youngs Bay terminal fishery fluctuated between 60 and 70 days for the 1995 through 1998 period which was similar to the fishery during the period observed.

Geographic range: This fishery occurs in the main stem of the Columbia river from the mouth at the Pacific Ocean upstream to river mile 140 near the Bonneville Dam. The lower Columbia is further subdivided into smaller statistical catch areas which can be regulated independently.

Seasons: This fishery is subject to season and statistical area openings which are designed to coincide with run timing of harvestable salmon runs while protecting weak salmon stocks and those listed under the Endangered Species Act. In recent years, early spring (winter) fisheries have been sharply curtailed for the protection of listed salmon species. In 1994, for example, the spring fishery was open for only three days with approximately 1900 fish landed. In 1995 the spring fishery was closed and in 1996 the fishery was open for one day but fishing effort was minimal owing to severe flooding. Only 100 fish were landed during the one day in 1996.

Gear type: Typical gear used in this fishery is a gillnet of single web construction, not exceeding 250 fathoms in length, with a minimum stretched mesh size ranging upwards from 5 inches depending on target salmon species. The gear is commonly set during periods of low and high slack tides. It is the intention of the fisher to keep the net off the bottom. The vessel is attached to one end of the net and drifts with the net. The entire net is periodically retrieved onto the vessel and catch is removed. Drift times vary depending on fishing area, tidal condition, and catch.

Regulations: The fishery is a limited entry fishery with seasonal openings, area closures, and gear restrictions.

Management type: The lower Columbia River salmon drift gillnet fishery is managed jointly by the Washington Department of Fish and Wildlife and the Oregon Department of Fish and Wildlife.

Comments: Observers were placed onboard vessels in this fishery to monitor marine mammal interactions in the early 1980s and in 1990-93. Incidental takes of harbor seal and California sea lion were documented, but only during the winter seasons (which have been reduced dramatically in recent years to protect ESA listed salmon). No mortality was observed during the fall fisheries.

Category III, WA, OR salmon net pens.

Number of permit holders: There were 12 commercial salmon net pen ("grow out") facilities licensed in Washington in 1998. There are no commercial salmon net pen or aquaculture facilities currently licensed in Oregon. Non-commercial salmon enhancement pens are not included in the list of commercial fisheries.

Number of active permit holders: Twelve salmon net pen facilities in Washington.

Total effort: The 12 licensed facilities on Washington operate year-round.

Geographic range: In Washington, net pens are found in protected waters in the Straits (Port Angeles), northern Puget Sound (in the San Juan Island area) as well as in Puget Sound south of Admirality Inlet. There are currently no commercial salmon pens in Oregon.

Seasons: Salmon net pens operate year-round.

Gear type: Net pens are large net impoundments suspended below a floating dock-like structure. The floating docks are anchored to the bottom and may also support guard (predator) net systems. Multiple pens are commonly rafted together and the entire facility is positioned in an area with adequate tidal flow to maintain water quality.

Regulations: Specific regulations unknown.

Management type: In Washington, the salmon net pen fishery is managed by the Washington Department of Natural Resources through Aquatic Lands Permits as well as the Washington Department of Fish and Wildlife.

Comments: Salmon net pen operations have not been monitored by NMFS for marine mammal interactions, however, incidental takes of California sea lions and harbor seals have been reported.

Category III, WA, OR, CA groundfish trawl.

Approximate number of vessels/persons: In 1998, approximately 332 vessels used bottom and mid-water trawl gear to harvest Pacific coast groundfish. This is down from 383 vessels in 1995. The NMFS List of Fisheries for 2001 lists 585 vessels as participating in this fishery. Groundfish trawl vessels harvest a variety of species including Pacific hake, flatfish, sablefish, lingcod, and rockfish. This commercial fishery does not include Treaty Indian fishing for groundfish.

All observed incidental marine mammal takes have occurred in the mid-water trawl fishery for Pacific hake. The annual hake allocation is divided between vessels that harvest and process catch at sea and those that harvest and deliver catch to shore-based processing facilities. At least one NMFS-trained observer is placed on board each at-sea processing vessel to provide comprehensive data on total catch, including marine mammal takes. In the California, Oregon, and Washington range of the fishery, the number of vessels fishing ranged between 12 and 16 (all with observers) during 1997-2001. Hake vessels that deliver to shore-based processors are issued Exempted Fishing Permits that requires the entire catch to be delivered unsorted to processing facilities where State technicians have the opportunity to sample. In 1998, 13% of the hake deliveries landed at shore-based processors were monitored. The following is a description of the commercial hake fishery.

Number of permit holders/active permit holders: A license limitation ("limited entry") program has been in effect in the Pacific coast groundfish fishery since 1994. The number of limited entry permits is limited to 404. Non-tribal trawl vessels that harvest groundfish are required to possess a limited entry permit to operate in the fishery. Any vessel with a federal limited entry trawl permit may fish for hake, but the number of vessels that do is smaller than the number of permits. In 1998, approximately 61 limited entry vessels, 7 catcher/processors and 50 catcher vessels delivering to shoreside and mothership processors, made commercial landings of hake during the regular season. In addition, 6 unpermitted mothership processors received unsorted hake catch.

Total effort: The hake allocation continues to be fully utilized. From 1997 to 1999 the annual allocation was 232,000 mt/year, this is an increase over the 1996 allocation of 212,000 mt and the 1995 allocation of 178,400 mt. In 1998, motherships vessels received 50,087 mt of hake in 17 days, catcher/processors took 70,365 mt of hake in 54 days and shore-based processors received 87,862 mt of hake over a 196 day period.

Geographic range: The fishery extends from northern California (about 40^{o} 30' N. latitude) to the U.S.-Canada border. Pacific hake migrate from south to north during the fishing season, so effort in the south usually occurs earlier than in the north.

Seasons: From 1997 to 1999, season start dates have remained unchanged. The shore-based season in most of the Eureka area (between 42^{O}- 40^{O}30' N latitude) began on April 1, the fishery south of 40^{O}30' N latitude opened April 15, and the fishery north of 42^{O} N latitude started on June 15. In 1998, the primary season for the shore-based fleet closed on October 13, 1998. The primary seasons for the mothership and catcher/processor sectors began May 15, north of 42^{0} N. lat. In 1998, the mothership fishery closed on May 31, the catcher/processor fishery closed on August 7.

Gear type: The Pacific hake trawl fishery is conducted with mid-water trawl gear with a minimum mesh size of 3 inches throughout the net.

Regulations/Management type: This fishery is managed through federal regulations by the Pacific Fishery Management Council under the Groundfish Fishery Management Plan.

Comments: Since 1991, incidental takes of Steller sea lions, Pacific white-sided dolphin, Dall's porpoise, California sea lion, harbor seal, northern fur seal, and northern elephant seal have been documented in the hake fishery. From 1997-2001, 4 California sea lions, 2 harbor seals, 2 northern elephant seals, 1 Pacific white-sided dolphin, and 6 Dall’s porpoise were reported taken in California/Oregon/Washington regions by this fishery.

Category III, Hawaii gillnet fishery.[7]

Number of active permit holders: In 1997 there were 129 active commercial fishers. In 1995 there were approximately 115.

Total effort: In 1997 there were 2,109 trips for a total catch of 864,194 pounds with 792,210 pounds sold. This fishery operates in nearshore and coastal pelagic regions.

Seasons: This fishery operates year-round with the exception of Juvenile big-eyed scad less than 8.5 inches which cannot be taken from July through October.

Gear type: Gillnets of stretched mesh greater than 2 inches and stretched mesh size greater than 2.75 inches for stationary gillnets. Stationary nets must be inspected every 2 hours and total soak time cannot exceed four hours in the same location. New restrictions implemented in 2002 include that nets may not: 1) be used more than once in a 24-hour period; 2) exceed a 12 ft stretched height limit; 3) exceed a single-panel; 4) be used at night; 5) be set within 100 ft. of another lay net; 6) be set in more than 80 ft depths; 7) be left unattended for more than ½ hour; 8) break coral during retrieval and nets must be 1) registered with the Division of Aquatic Resources; 2) inspected within two hours after being set; 2) tagged with two marker buoys while fished. In addition to these gear restrictions, non-commercial users of lay nets may not use a net longer than 500 ft, while commercial users may use nets up to 1200 ft in length. Additional mesh restrictions are in place for taking the big-eyed scad.

Regulations: Gear and season restrictions (see above).

Management type: Managed by the State of Hawaii Division of Aquatic Resources.

Comments: The principle catches include reef fishes and big-eyed scad (akule) and mackerel scad (opelu). Interactions have been documented with bottlenose dolphin and spinner dolphin.

Category III, Hawaii lobster trap fishery.[8 9]

Note: The portion of this fishery managed by the State of Hawaii and operating in the MHI is about 1% of the size (total pounds of lobster caught) of the federally managed fishery operating primarily in the NWHI. The description that follows refers to the NWHI fishery unless stated otherwise.

Number of permit holders: There are 15 permit holders under a (1991) federal limited access program.

Number of active permit holders: In 1998 and 1999 there were 5 and 6 vessels that participated respectively. In the MHI there were 5 active fishers in 1997.

Total effort: The number of trap hauls for 1999 is not available at this time. However, the majority of the effort took place in the 4 harvest guideline areas; Necker Bank, Gardner Pinnacles and Maro Reef, with the remaining effort spread out over 10 unique areas. In 1998 171,000 trap hauls were made by the 5 vessels during 9 trips and in 1997 a total of 177,700 hauls were made. In the MHI 19 trips were made in 1997.

Geographic range: Lobster permits allow fishing operations in the US EEZ from 3 to 200 nmi offshore American Samoa, Guam and Hawaii (including the EEZ areas of the NWHI and MHI). However, no vessels have operated in the EEZ's of American Samoa or Guam since 1983.

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[7]Descriptions of Hawaii State managed fisheries provided by William Devick, State of Hawaii, Department of Land and Natural Resources, Division of Aquatic Resources, Honolulu Hawaii.
[8]Kawamoto, K. and Samuel G. Pooley. 1999. Draft Annual report of the 1998 western pacific lobster fishery.
[9]Kawamoto, K. 1999. Summary of the 1999 NWHI Lobster Fishing Season. NMFS Honolulu Laboratory.

Seasons: This fishery operates under a seasonal harvest guideline system opening on July 1. The season ends once the harvest guideline is met, but no later than December 31. In 1998, the harvest guideline was divided into the 4 areas mentioned above with total lobster catch set at (in thousands) 70, 20, 80, and 116, respectively. Area closure occurs once an area's harvest guideline is met. In the MHI, open season is from September through April.

Gear type: One string consists of approximately 100 Fathom-plus plastic lobster traps. About 10 such strings are pulled and set each day. Since 1987 escape vents that allow small lobsters to escape from the trap have been mandatory. In 1996, the fishery became "retain all", i.e. there are no size limits or prohibitions on the retention of berried female lobsters. The entry-way of the lobster trap must be less than 6.5 inches to prevent monk seals from getting their heads stuck in the trap. In the MHI, rigid trap materials must have a dimension greater than 1 inch by 2 inches, with the trap not exceeding 10 feet by six feet.

Regulations: Season, gear and quota restrictions (see above) for the NWHI were formulated by the Western Pacific Regional Fishery Management Council and implemented by NMFS. The MHI fishery is managed by the State of Hawaii, Division of Aquatic Resources with season and gear restrictions (see above).

Management type: Limited access program with bank specific quotas and closures. In the MHI, open access.

Comments: The NWHI fishery targets the red spiny lobster and the common slipper lobster. The ridgeback slipper lobster is also taken. Protected species of concern include monk seals (mentioned above) and turtles. There have been no interactions with these species since 1995 but they have been seen in the vicinity of the fishing gear.

Category III, Hawaii inshore handline fishery.

In 1997 a total 750 fishers made 8,526 fishing trips in the main Hawaiian Islands and caught 531,449 pounds and sold 475,562 pounds for an ex-vessel landing value of $1,010,758. This fishery occurs in nearshore and coastal pelagic regions. The principal catches include reef fishes and big-eyed scad (akule) and mackerel scad (opelu). In 1995 approximately 650 fishers were active. Interactions have been documented for bottlenose dolphin.

Category III, Hawaii deep sea bottomfish handline and jig fishery.

Note: There are two commercial bottomfish fisheries in Hawaii: a distant water Northwestern Hawaiian Islands (NWHI) limited entry fishery under federal jurisdiction and the main Hawaiian Islands bottomfish fishery primarily under the State of Hawaii jurisdiction.

Number of permit holders: The main Hawaiian Islands fishery is open access with close to 2,000 bottomfish vessels registered with the State of Hawaii, whereas the NWHI is restricted to a maximum of 17 vessels.

Number of active permit holders: In 1997 in the MHI a total of 750 fishers were active. The NWHI are divided into the Mau Zone (closer to MHI) and the Hoomalu Zone. The Hoomalu Zone is a limited entry zone with 6 vessels participating in 1998, 7 vessels fished the Mau Zone in the same year. Restrictions on new entry into the Mau Zone were implemented in 1998.

Total effort: In 1998 in the MHI approximately 8,500 trips were made with a total catch of 424,000 pounds for an ex-vessel landing value of $1,336,000. This fishery occurs primarily in offshore banks and pinnacles. In the NWHI 332,000 pounds ($894,000) were caught in 1998, below average since 1990.

Seasons: Year round.

Gear type: This fishery is a hook-and-line fishery that takes place in deep water. In the NWHI fishery, vessels are 30 ft or greater and conduct trips of about 10 days. In the MHI the vessels are smaller than 30 ft and trips last from 1 to 3 days.

Regulations: In the MHI, the sale of snappers (opakapaka, onaga and uku) and jacks less than one pound is prohibited. In June of 1998, Hawaii Division of Aquatic Resources (HDAR) closed 19 areas to bottomfishing and regulations pertaining to seven species (onaga, opakapaka, ehu, kalekale, gindai, hapuupuu and lehi) were enacted.

Management type: The MHI is managed by the HDAR with catch, gear and area restrictions (see above) but no permit limits. The NWHI is a limited access federal program.

Comments: The deep-slope bottomfish fishery in Hawaii concentrates on species of eteline snappers, carangids, and a single species of grouper concentrated at depths of 30-150 fathoms. These fish have been fished on a subsistence basis since ancient times and commercially for at least 90 years. NMFS is considering the possibility of re-categorizing the NWHI bottomfish fishery from Category III to Category II due to concerns for potential interactions between bottomfish fishing vessels and Hawaiian monk seals, although there were none observed during 26 NWHI bottomfish trips during 1990-1993, and none reported. On 12 of the 26 trips, bottlenose dolphins have been observed stealing fish from the lines, but not hookings or entanglements occurred. Effort in this fishery increases significantly around the Christmas season because a target species, a true snapper, is typically sought for cultural festivities.[11] No data is collected for recreational or subsistence fishermen, but their MHI catch is estimated to be about equal to the MHI commercial catch.

Category III, Hawaii tuna handline and jig fishery.

In 1997 a total of 543 fishers made 6,627 trips in the MHI and caught 2,014,656 pounds and sold 1,958,759 pounds for an ex-vessel value of $3,788,391. This fishery occurs around offshore fish aggregating devices and mid-ocean seamounts and pinnacles. The principal catches are small to medium sized bigeye, yellowfin and albacore tuna. There are several types of handline methods in the Hawaiian fisheries. Baited lines with chum are used in day fishing operations (palu-ahi), another version uses squid as bait during night operations (ika-shibi), and an operation called “danglers” uses multiple lines with artificial lures suspended or dangled over the water. Interactions have been documented for rough-toothed dolphin, bottlenose dolphin, and Hawaiian monk seal.

~~**Table 1. The number of animals injured and/or killed reported to the Marine Mammal Authorization Program (MMAP) compared with data reported from the NMFS Observer Program for the California large mesh drift gillnet swordfish fishery between 2000-2004. The drift gillnet fishery had 20% observer coverage during this period.**~~

	2000		2001		2002		2003		2004	
	MMAP	NMFS	MMAP	NMFS	MMAP	NMFS	MMAP	NMFS	MMAP	NMFS
Species										
Gray whale	-	-	-	-	-	-	-	-	-	-
Humpback whale	-	-	-	-	-	-	-	-	-	1
Short-finned pilot whale	-	-	-	-	-	-	-	1	-	-
Pacific white-sided dolphin	11	2	-	2	-	1	-	-	-	-
Bottlenose dolphin	-	-	1		-	-	-	-	-	-
Common dolphin spp	17	25	7	7	4	11	7	17	3	7
Risso's dolphin	2	-	-	-	-	-	-	4	-	-
Northern right whale dolphin	4	-	1	5	2	2	0	1	1	1
Unidentified small cetacean	2	-	4	-	2	-	2	-	-	-
California sea lion	13	13	3	2	16	18	4	4	1	7
Steller's sea lion	-	-	-	-	-	-	-	-	1	-
Northern elephant seal	2	6	-	1	-	1	-	1	-	-
Unidentified seal	1	-	-	-	-	-	-	-	-	-
Unidentified sea lion	-	-	-	-	1	-	-	-	-	-
Unidentified baleen whale	-	-	-	-	-	-	-	1	-	-
Total Occurrences Reported	52	46	16	17	25	33	13	29	6	16

Table ~~2~~ 1. Strandings reported to the ~~NMFS~~ California Marine Mammal Stranding Network ~~2000-2004.~~ in 2006 and 2007. ~~hr = human-related strandings.~~ Total stranding numbers obtained from NMFS Southwest Regional Office, Protected Resources Division (http://swr.nmfs.noaa.gov/psd/strand/strandings.htm).

Marine Mammal Strandings reported in California in 2006	Total Strandings	Human-Related Strandings
PINNIPEDS		
California Sea Lion	2943	232
Northern Elephant Seal	749	13
Harbor Seal	557	42
Steller Sea Lion	22	0
Unidentified Pinniped	199	3
Northern Fur Seal	82	4
Guadalupe Fur Seal	21	3
Unidentified Sea Lion	4	0
CETACEANS		
Harbor Porpoise	26	4
Long-Beaked Common Dolphin	25	8
Short-Beaked Common Dolphin	8	2
Unidentified Common Dolphin	9	0
Bottlenose Dolphin	16	0
Risso’s Dolphin	7	1
Northern Right Whale Dolphin	6	0
Dall’s Porpoise	3	0
Pacific White-Sided Dolphin	2	1
Gray Whale	14	5
Humpback Whale	10	10
Blue Whale	4	4
Unidentified Dolphin	8	2
Unidentified Whale	9	9
Cuvier’s Beaked Whale	2	0
Minke Whale	1	0
Pygmy Sperm Whale	1	0
Unidentified Cetacean	2	0

Table ~~3~~ 2. Characteristics of Category I and Category II gillnet fisheries in California.

Fishery	Species	Mesh Size	Water Depth	Set Duration	Deployment	Miscellaneous
Category I CA/OR thresher shark and swordfish drift gillnet fishery	swordfish/shark	14 to 22 inches	Ranges from 90 to 4600 meters	Typically 8 to 15 hrs	Drift net only	Nets 500 to 1800 meters in length; other species caught: opah, louver, tuna, thresher, blue shark, mako shark
Category II CA halibut and white seabass set gillnet fishery (>3.5 inch mesh)	Halibut	8.5 inch	< 70 meters	24 hrs	Set net	
	Barracuda	3.5 inch		< 12 hrs	Drift net	April – July
	Leopard Shark	7.0 to 9.0 inch	< 90 meters			Fished similar to halibut.
	Perch/Croaker	3.5 to 4.0 inch	< 40 meters	< 24 hrs	Set net	Few boats target these species
	Rockfish	4.5 to 7.5 inch	> 90 meters	12 to 18 hrs	Set net	Net lengths 450 to 1800 meters. Soupfin shark is major bycatch.
	Soupfin shark/white seabass	6.0 to 8.5 inch	> 50 meters	24 hrs	Set net	Few boats target this species.
	Miscellaneous shark	6.0 to 14 inch	< 70 meters	8 to 24 hrs	Drift, some set net	Species include thresher and swell sharks.
Category II CA Yellowtail, barracuda, white seabass, and tuna drift gillnet fishery	White seabass, yellowtail, barracuda, white seabass, and tuna	Typically 6.5 inch	15 to 90 meters	8 to 24 hrs	Mostly drift net	White seabass predominant target species.

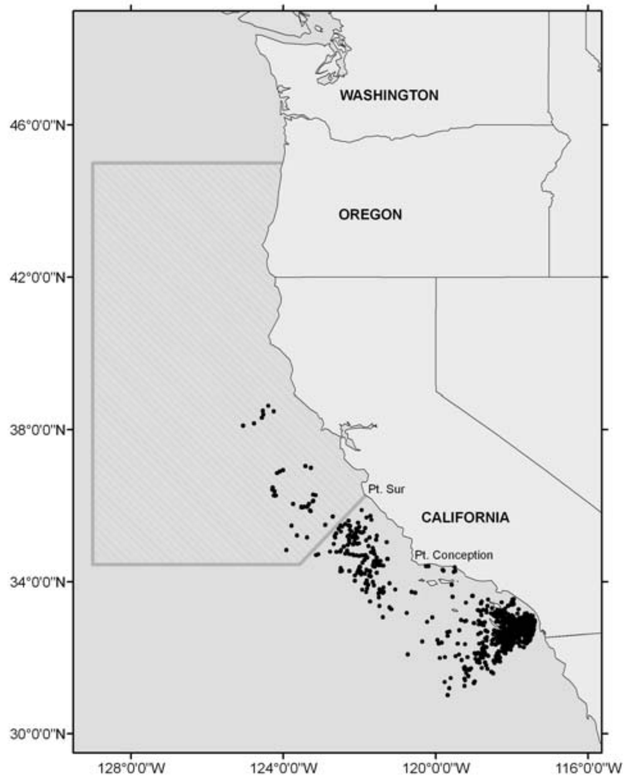

Figure 1. Locations of ~~7,660~~ 1,248 sets observed in the California/Oregon large-mesh drift gillnet fishery for thresher shark and swordfish, ~~1990-2006~~ 2003 through early 2008. This represents approximately 20% of total fishing effort (~6,300 sets) during this period. The cross-hatched area has been closed to gillnetting from 15 August to 15 November each year since 2001 to protect leatherback turtles. The outer dashed line represents the U.S. Exclusive Economic Zone. ~~Total estimates of fishing effort over this period are approximately 48,000 sets~~.

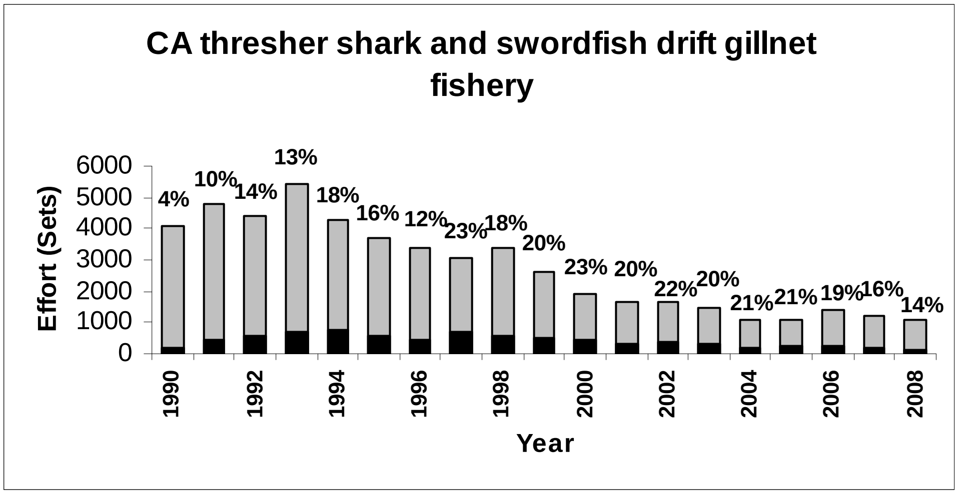

Figure 2. Estimated (gray) and observed (black) days of fishing effort for 1990-~~2007~~ 2008 in the California/Oregon thresher shark/swordfish drift gillnet fishery (≥ 14 inch mesh). One fishing day is equal to one set in this fishery. Percent observer coverage for each year is shown above the bars.

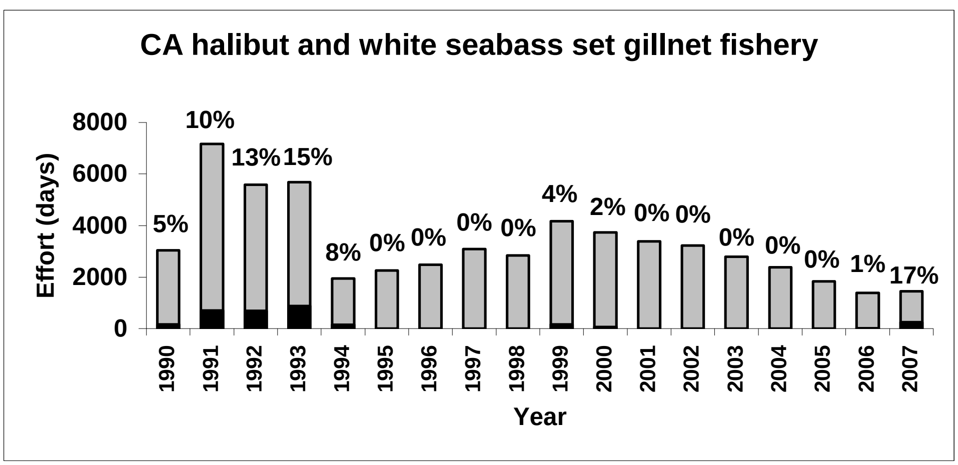

Figure 3. Estimated (gray) and observed (black) days of fishing effort for 1990 - 2007 in the California halibut/white seabass set gillnet fishery (> 3.5 inch mesh). The fishery has been observed only sporadically since 1994. Percent observer coverage for each year is shown above the bars. The observer coverage estimate for 2007 is based on the number of sets observed in 2007 (n=248 sets) and fishing effort obtained from logbooks (n = 1,448 sets).

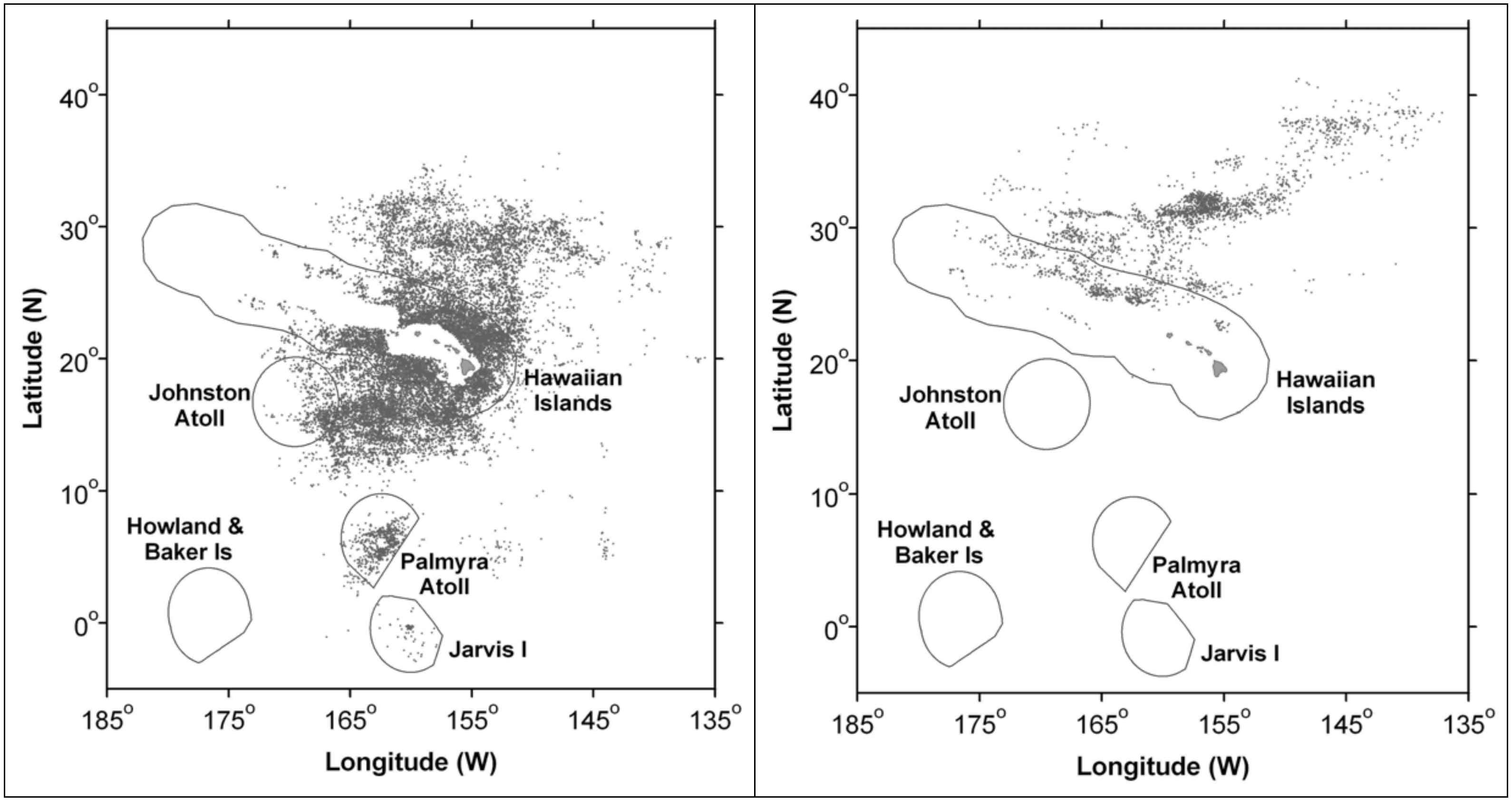

Figure 4. Observed set locations in the Hawaii-based deep-set (left) and shallow-set (right) longline fisheries, 2002-2006.

Appendix 3. 2009 Draft Pacific Marine Mammal Stock Assessment Reports summary.
Shaded lines indicate reports revised in 2009.

Species	Stock Area	NMFS Center	N est	CV N est	N min	R max	Fr	PBR	Total Annual Mortality + Serious Injury	Annual Fishery Mortality + Serious Injury	Strategic Status	Recent Abundance Surveys			SAR Last Revised
California sea lion	U.S.	SWC	238,000	n/a	141,842	0.12	1	8,511	≥232	≥159	N	2003	2004	2005	2007
Harbor seal	California	SWC	34,233	n/a	31,600	0.12	1	1,896	≥389	389	N	1995	2002	2004	2005
Harbor seal	Oregon/Washington Coast	AKC	24,732	0.12	22,380	0.12	1	1,343	≥15.2	≥13	N	1999			2007
Harbor seal	Washington Inland Waters	AKC	14,612	0.15	12,844	0.12	1	771	≥34	≥30	N	1999			2003
Northern Elephant Seal	California breeding	SWC	124,000	n/a	74,913	0.117	1	4,382	≥10.4	≥8.8	N	2001	2002	2005	2007
Guadalupe Fur Seal	Mexico to California	SWC	7,408	n/a	3,028	0.12	0.5	91	0	0	Y	1993			2000
Northern Fur Seal	San Miguel Island	AKC	9,424	n/a	5,096	0.086	1	219	≥1.0	≥1.0	N	2003	2004	2005	2006
Monk Seal	Hawaii	PIC	~~1,208~~	n/a	~~1,183~~	0.07	0.1	undet	unk	unk	Y	2004	2005	2006	2009
			1,146		1,129										
Harbor porpoise	Morro Bay	SWC	~~1,656~~	~~0.39~~	~~1,206~~	0.04	~~0.4~~	~~10~~	~~4.5~~	~~4.5~~	N	1999	2002	2007	2009
			2,044	0.40	1,478		0.5	15	0	0					
Harbor porpoise	Monterey Bay	SWC	~~1,613~~	~~0.42~~	~~1,149~~	0.04	~~0.45~~	~~10~~	~~9.5~~	~~9.5~~	N	1999	2002	2007	2009
			1,492	0.4	1,079		0.5	11	≥1.0	≥1.0					
Harbor porpoise	San Francisco – Russian River	SWC	~~8,521~~	0.38	~~6,254~~	0.04	0.5	~~63~~	~~≥0.8~~	~~≥0.8~~	N	1999	2002	2007	2009
			9,189		6,745			67	0	0					
Harbor porpoise	Northern CA/Southern OR	SWC	~~17,763~~	0.39	~~12,940~~	0.04	1	~~259~~	~~≥0~~	~~≥0~~	N	1999	2002	2007	2009
			39,581		28,833			577	≥4	≥4					
Harbor porpoise	Northern Oregon/Washington Coast	AKC	~~37,745~~	~~0.38~~	~~27,705~~	0.04	0.5	~~277~~	~~0.6~~	~~0.6~~	N	1991	1997	2002	2009
			15,674	0.39	11,383			114	≥1.0	≥0.8					
Harbor porpoise	Washington Inland Waters	AKC	10,682	0.38	7,841	0.04	0.4	63	15.2	15.4	N	1996	2002	2003	2006
Dall's porpoise	California/Oregon/Washington	SWC	48,376	0.24	39,709	0.04	0.4	318	1.6	1.4	N	1996	2001	2005	2008
Pacific white-sided dolphin	California/Oregon/Washington	SWC	20,719	0.22	17,201	0.04	0.45	155	1.4	1.4	N	1996	2001	2005	2008
Risso's dolphin	California/Oregon/Washington	SWC	11,621	0.17	10,054	0.04	0.4	80	4.9	4.9	N	1996	2001	2005	2008
Bottlenose dolphin	California Coastal	SWC	323	0.13	290	0.04	0.5	2.4	0.2	0.2	N	2000	2004	2005	2008
Bottlenose dolphin	California/Oregon/Washington Offshore	SWC	3,495	0.31	2,706	0.04	0.5	27	0.2	0.2	N	1996	2001	2005	2008
Striped dolphin	California/Oregon/Washington	SWC	17,925	0.37	13,251	0.04	0.5	132	0	0	N	1996	2001	2005	2008
Common dolphin, short-beaked	California/Oregon/Washington	SWC	392,733	0.18	338,708	0.04	0.5	3,387	77	77	N	1996	2001	2005	2008
Common dolphin, long-beaked	California/Oregon/Washington	SWC	15,335	0.56	9,880	0.04	0.48	95	12.5	12.5	N	1996	2001	2005	2008
Northern right whale dolphin	California/Oregon/Washington	SWC	12,876	0.30	10,031	0.04	0.4	80	3.8	3.8	N	1996	2001	2005	2008
Killer whale	Eastern North Pacific Offshore	SWC	353	0.29	278	0.04	0.5	2.8	0	0	N	1996	2001	2005	2008
Killer whale	Eastern North Pacific Southern Resident	AKC	~~86~~	und	~~86~~	0.04	0.1	0.17	0.2	0	Y	2004	2006	2008	2009
			85		85										
Short-finned pilot whale	California/Oregon/Washington	SWC	245	0.97	123	0.04	0.4	0.98	1	1	Y	1996	2001	2005	2008
Baird's beaked whale	California/Oregon/Washington	SWC	540	0.54	353	0.04	0.5	3.5	0.2	0	N	1996	2001	2005	2008
Mesoplodont beaked whales	California/Oregon/Washington	SWC	1,024	0.77	576	0.04	0.5	5.7	0	0	N	1996	2001	2005	2008
Cuvier's beaked whale	California/Oregon/Washington	SWC	2,830	0.73	1,629	0.04	0.4	13	0	0	N	1996	2001	2005	2008
Pygmy Sperm whale	California/Oregon/Washington	SWC	unk	unk	unk	0.04	0.5	undet	≥0.2	≥0.2	N	1996	2001	2005	2008
Dwarf sperm whale	California/Oregon/Washington	SWC	unk	unk	unk	0.04	0.5	undet	0	0	N	1996	2001	2005	2008

unk = unknown; undet = undetermined; n/a = not applicable

Sperm whale	**California/Oregon/Washington**	**SWC**	**2,853**	**0.25**	**2,326**	**0.04**	**0.2**	**9.3**	**0.2**	**0.2**	**Y**	**1996**	**2001**	**2005**	**2008**
Humpback whale	**California/Oregon/Washington**	**SWC**	**1,391**	**0.13**	**1,250**	**0.08**	**0.1**	**2.5**	~~**≥ 2.6**~~	~~**≥ 2.6**~~	**Y**	**1996**	**2001**	**2005**	**2009**
									≥ 3.6	**≥ 3.6**					
Blue whale	**Eastern North Pacific**	**SWC**	~~**1,368**~~	~~**0.22**~~	~~**1,136**~~	**0.04**	**0.1**	~~**1.0**~~	~~**0.6**~~	**0**	**Y**	**1996**	**2001**	**2005**	**2009**
			2,842	**0.41**	**2,039**			**2.0**	**1.2**						
Fin whale	**California/Oregon/Washington**	**SWC**	**2,636**	**0.15**	**2,316**	**0.04**	**0.3**	**14**	**1.4**	**0**	**Y**	**1996**	**2001**	**2005**	**2008**
Sei whale	**Eastern North Pacific**	**SWC**	**46**	**0.61**	**28**	**0.04**	**0.1**	**0.05**	**0**	**0**	**Y**	**1996**	**2001**	**2005**	**2008**
Minke whale	**California/Oregon/Washington**	**SWC**	**806**	**0.63**	**495**	**0.04**	**0.5**	**5.0**	**0**	**0**	**N**	**1996**	**2001**	**2005**	**2008**

unk = unknown; undet = undetermined; n/a = not applicable

Appendix 3. 2009 Draft Pacific Marine Mammal Stock Assessment Reports summary.
Shaded lines indicate reports revised in 2009.

Species	Stock Area	NMFS Center	N est	CV N est	N min	R max	Fr	PBR	Total Annual Mortality + Serious Injury	Annual Fishery Mortality + Serious Injury	Strategic Status	Recent Abundance Surveys			SAR Last Revised
Rough-toothed dolphin	Hawaii	SWC	19,904	0.52	13,184	0.04	0.5	132	unk	unk	N		2002	2004	2004
Risso's dolphin	Hawaii	SWC	2,351	0.65	1,426	0.04	0.5	14	unk	unk	N		2002	2004	2004
Bottlenose dolphin	Hawaii	SWC	3,263	0.60	2,046	0.04	0.5	20	≥0.2	≥0.2	N		2002	2004	2006
Pantropical spotted dolphin	Hawaii	SWC	10,260	0.41	7,362	0.04	0.5	74	≥0.8	≥0.8	N		2002	2004	2004
Spinner dolphin	Hawaii	SWC	2,805	0.66	1,691	0.04	0.5	17	0	0	N		2002	2004	2004
Striped dolphin	Hawaii	SWC	10,385	0.48	7,078	0.04	0.5	71	unk	unk	N		2002	2004	2004
Fraser's dolphin	Hawaii	SWC	16,836	1.11	7,917	0.04	0.5	79	unk	unk	N		2002	2004	2004
Melon-headed whale	Hawaii	SWC	2,947	1.11	1,386	0.04	0.5	14	unk	unk	N		2002	2004	2004
Pygmy killer whale	Hawaii	SWC	817	1.12	382	0.04	0.5	3.8	unk	unk	N		2002	2004	2004
False killer whale	Hawaii Pelagic	SWC	484	0.93	249	0.04	~~0.45~~	~~2.2~~	~~5.7~~	~~5.7~~	Y		2002	2004	2009
							0.5	2.5	7.4	7.4					
False killer whale	Palmyra Atoll	SWC	1,329	0.65	806	0.04	~~0.45~~	~~7.2~~	~~1.2~~	~~1.2~~	N			2005	2009
							0.4	6.4	0.3	0.3					
False killer whale	Hawaii Insular	SWC	123	0.72	76	0.04	0.5	0.8	0	0	N	2000	2002	2004	2009
Killer whale	Hawaii	SWC	430	0.72	250	0.04	0.5	2.5	unk	unk	N		2002	2004	2004
Pilot whale, short-finned	Hawaii	SWC	8,846	0.49	5,986	0.04	0.5	60	0.8	0.8	N		2002	2004	2006
Blainville's beaked whale	Hawaii	SWC	2,138	0.77	1,204	0.04	0.4	9.6	0.8	0.8	N		2002	2004	2004
Longman's Beaked Whale	Hawaii	SWC	766	1.05	371	0.04	0.5	3.7	unk	unk	N		2002	2004	2004
Cuvier's beaked whale	Hawaii	SWC	12,728	0.83	6,919	0.04	0.5	69	unk	unk	N		2002	2004	2004
Pygmy sperm whale	Hawaii	SWC	7,251	0.77	4,082	0.04	0.5	41	unk	unk	N		2002	2004	2004
Dwarf sperm whale	Hawaii	SWC	19,172	0.66	11,555	0.04	0.5	116	unk	unk	N		2002	2004	2004
Sperm whale	Hawaii	SWC	7,082	0.30	5,531	0.04	0.1	11	0	0	Y		2002	2004	2004
Blue whale	Hawaii	SWC	unk		unk	0.04	0.1	undet	unk	unk	Y		2002	2004	2004
Fin whale	Hawaii	SWC	174	0.72	101	0.04	0.1	0.2	unk	unk	Y		2002	2004	2004
Bryde's whale	Hawaii	SWC	493	0.34	373	0.04	0.5	3.7	unk	unk	N		2002	2004	2004
Sei whale	Hawaii	SWC	77	1.06	37	0.04	0.1	0.1	unk	unk	Y		2002	2004	2004
Minke whale	Hawaii	SWC	unk		unk	0.04	0.5	undet	unk	unk	N		2002	2004	2004
Humpback whale	American Samoa	SWC	unk		150	0.106	0.1	0.4	0	0	Y	2006	2007	2008	2009

unk = unknown; undet = undetermined; n/a = not applicable