ENDANGERED SPECIES ACT SECTION 7 CONSULTATION
BIOLOGICAL OPINION

ACTION:	Issuance of a shallow-set longline exempted fishing permit under the Fishery Management Plan for U.S. West Coast Highly Migratory Species Fisheries
CONSULTATION CONDUCTED BY:	National Marine Fisheries Service, Southwest Region, Protect Resources Division
FILE NUMBER:	151422SWR2007PR00268
DATE ISSUED:	NOV 28 2007

Introduction

NOAA's National Marine Fisheries Service (NMFS) is required under section 7(a)(2) of the Endangered Species Act (ESA) to conduct a consultation which considers the impacts on ESA listed species of the issuance of an Exempted Fishing Permit (EFP) which would allow fishing with shallow-set longline (SSLL) gear in the West Coast Exclusive Economic Zone (3 to 200 nautical miles (nm) from shore). Use of this type of gear in this area is currently prohibited under the Fishery Management Plan (FMP) for U.S. West Coast Fisheries for Highly Migratory Species (HMS). The EFP would authorize a single West Coast-based longline vessel to conduct tightly controlled fishing operations inside the U.S. West Coast EEZ from 40 to 200 nautical miles from shore and outside of the Southern California Bight (SCB) during the time period September-December, in the year of the authorization (expected to be 2007 or 2008). The EFP, if approved, would operate in accordance with the Pacific Fisheries Management Council's (Council) Operating Procedure for EFPs and the NMFS National EFP Guidelines. This action is consistent with goals and objectives embodied in the Fishery Management Plan (FMP) for U.S. West Coast Fisheries for Highly Migratory Species (HMS).

NMFS has determined that ESA listed leatherback sea turtles are likely to be adversely affected by the proposed action. Other ESA listed species that may occur in or near the action area are not expected to be affected or adversely affected by the proposed action.

No designated critical habitat is within the proposed action area, so critical habitat will not be considered further in this opinion.

I. CONSULTATION HISTORY

Formal consultation on the SSLL EFP proposed action was initiated by the Southwest Region (SWR) Sustainable Fisheries Division (SFD) on May 16, 2007. Prior to this, the SWR Protected Resources Division (PRD) engaged in pre-consultation technical assistance with SFD, the Pacific Fisheries Management Council's (Council) HMS Management Team (HMSMT), the Council's

Advisory Subpanel, and the EFP applicant, Mr. Peter Dupuy. The following paragraph details the Council process which staff from PRD participated in and provided technical assistance as part of pre-consultation on this action.

The EFP application was originally submitted to the Council in November 2005 by the applicant, who currently fishes with deep set tuna longline gear outside the EEZ and has also participated in the DGN fishery. At their March 2006 meeting, the Council gave preliminary approval for further consideration of the application. At a November 2–3, 2006, joint meeting of the Council's HMSMT and Advisory Subpanel (HMSAS), a range of alternatives for terms and conditions attached to the EFP was discussed and refined. These alternatives were adopted for public review by the Council at their November 12–17, 2006, meeting. The Council chose a preferred alternative at their April 1–6, 2007, meeting in Seattle, Washington, based in part on public testimony and information contained in the draft Environmental Assessment (EA) submitted as part of the consultation initiation package for this proposed action.

On May 16, 2007, PRD received a memo from SFD requesting formal consultation on the proposed action. On June 28, 2007, PRD provided a preliminary analysis of the action and anticipated interactions with ESA listed species. A key component of the proposed action is the use of take caps on species considered likely to be taken during fishery operations authorized by the EFP. PRD and SFD met on July 9, 2007, to discuss PRD's analysis which included a preliminary incidental take statement (ITS) of leatherback sea turtles. No other ESA listed species are considered likely to be adversely affected by the proposed action. PRD met with SFD on July 16, 2007, to explain methods used to quantify the anticipated level of leatherback takes and associated mortalities due to the proposed action. SFD agreed to the conservative estimate of five anticipated leatherback takes with one associated post-hooking mortality. This take and mortality estimate is included as the take cap in the proposed action which is the subject of this consultation.

In late July, SFD notified PRD that the proposed action area had been changed from 30 nm offshore to 40 nm offshore. This resulted in the proposed action area that is the subject of this consultation.

II. DESCRIPTION OF THE PROPOSED ACTION

NMFS-SWR SFD proposes to issue a one-year EFP to authorize the applicant to conduct fishing operations utilizing SSLL gear to target swordfish within a restricted area of the West Coast EEZ between September 1 and December 31. The following is a list of the terms and conditions of the proposed action:

1. One hundred percent observer coverage.
2. A single vessel participating.
3. Maximum of 14 sets per trip.
4. Maximum of four trips between September and December (up to 56 total sets and 67,200 hooks for the entire duration of the proposed EFP).
5. No fishing within 40 nm of the coastline, all fishing within the U.S. west coast EEZ (see Figure 1).

6. No fishing within the Southern California Bight as defined by the applicant (see Figure 2).
7. Utilizing shallow-set longline gear configuration:
    a. 50–100 km mainline
    b. 18 m floatline
    c. 24 m branchlines
    d. 2–8 hooks between floats
    e. 400–1,200 hooks per set
    f. Set fishing gear so hooks are at a depth of 40–45 meters below the surface
8. Use 18/0 circle hooks with a 10° offset to fish for swordfish (as described at 50 CFR 665.33(f)).
9. Use mackerel or mackerel-type bait (as described at 50 CFR 665.33(g)).
10. Allow the use of light sticks.
11. Require use of Time depth recorders (TDR) to estimate fishing depth. (The number of TDR units deployed per set and per trip would be determined by NMFS in consultation with the applicant.)
12. Gear may not be set until one hour after local sunset and must be fully deployed before local sunrise.
13. Prohibit the use of a line shooter for setting the gear.
14. Require use of a NMFS-approved dehooking device to maximize finfish (e.g., blue shark) bycatch survivability.
15. A catch cap of 12 striped marlin.
16. A take cap of one short-finned pilot whale (this species is not ESA-listed).
17. A limits or cap of five leatherback sea turtles consistent with the Incidental Take Statement (ITS) of this Biological Opinion. No other ESA-listed species are expected to be taken.
18. A cap of one captured short-tailed albatross, per U.S. Fish and Wildlife Service (USFWS) informal consultation.
19. No fishing north of 45° N latitude.
20. All observers shall carry satellite phones provided by NFMS and immediately inform NMFS of any marine mammal, sea turtle, or seabird capture or interaction.

A. Gear and methods

The applicant will deploy from 50 to 100 km of 600 to 1,200 pound test monofilament mainline per set. Mainlines will be rigged with 22-m branch lines at approximately 61-m intervals and buoyed every 1.6 km. Between 400 and 1,200 hooks will be deployed per set. The bait species will be mackerel and mackerel-type fish with various colored light sticks used to attract the target species to the bait. The mainline is deployed from 4 to 7 hours and left to drift (unattached) for 7 to 10 hours with radio beacons attached to facilitate gear recovery. Retrieval typically requires 7 to 10 hours depending on length of mainline and number of hooks deployed. The applicant will be required to set and fish during the night when more swordfish are available in surface waters which will also reduce the potential for seabird interactions.

The applicant may employ a crew of between four to six people, including the captain. A fishing trip is estimated to last up to three weeks. As is typical with most vessels engaged in this type of fishing, the vessel does not have built-in refrigeration equipment, limiting their trip length. The fish will be iced and sold as "fresh."

The proposed action is subject to all the established management requirements in the HMS FMP including longline fishery regulations at 50 CFR 660.712, which include sea turtle and seabird take mitigation measures. Additional sea turtle conservation regulations are required at 50 CFR 223.206(d)(9).

A commercial-scale longline fishery has not been previously allowed within the West Coast EEZ, so precisely how and where gear will be set can not be known. The primary target species for this proposed action is swordfish, although thresher shark may also be targeted. The migratory patterns of these species largely dictate the area in which fishing will occur. NMFS assumes that SSLL fishing under the proposed action will follow the same patterns of fishing as the drift gillnet (DGN) fishery that occurred in approximately the same area targeting swordfish. The DGN fishery is currently prohibited in the portion of the proposed fishing area north of Point Conception from August 15 to November 15. Historically, most DGN fishing occurred between August and January, based largely upon the migratory patterns of swordfish along the U.S. west coast. In the DGN fishery outside the SCB, most effort occurred from three to 150 miles offshore. Areas of fishing activity are largely dependent on oceanographic conditions and many swordfish fishermen in particular seek temperature fronts that concentrate fish which are prey for the large predatory species they are targeting (e.g., swordfish).

B. Action Area and Effort

The proposed action area is the West Coast EEZ delineated by the U.S.-Mexico border on the south, 45°N latitude on the north, and 40 nm off the U.S. West Coast to the outer boundary of the EEZ (see Figure 1). There has not been a commercial SSLL fishery in the proposed action area in the past therefore, the applicant is unable to define precisely where within the proposed action area he will be setting gear to target swordfish. In accordance with the existing regulations promulgated under the ESA (at 50 CFR 223.206) the applicant will not set any gear in such a way that would result in SSLL fishing in the high seas, west of the West Coast EEZ. The vessel will also be excluded from fishing in the SCB. The prohibition on operating more than 40 nm from the mainland coastline and outside of the SCB is intended in part to reduce gear conflicts with other commercial and recreational fishing vessels and to reduce bycatch of striped marlin. The prohibition could also reduce interactions with ESA-listed species, for example humpback whales which have been more commonly found in coastal areas during shipboard surveys (Carretta *et al.* 2007).

The SCB is a marine region including waters of the coastal areas and the Channel Islands south of Point Conception. The coastline is indented, trending to the southeast providing shelter from northwest winds that prevail during summer months. Circulation patterns and bathymetric complexity contribute to high marine biodiversity within the region. Because of its proximity to major metropolitan areas it also attracts heavy recreational use. Under the proposed EFP terms and conditions fishing would not be allowed in this region. Figure 2 shows the boundary line with coordinates as follows:

33° 57' 21" N, 120° 31' 44" W – Intersection with 40 nm mainland buffer
33° 15' 00" N, 119° 40' 00" W – State waters boundary off western tip of San Nicholas Island
31° 06' 08" N, 118° 45' 00" W – Intersection with southern EEZ boundary

A single vessel would be fishing under the proposed EFP. It would make a maximum of four trips, with each trip making a maximum of 14 sets, thus a maximum of 56 sets for the duration of the proposed action. The number of hooks will vary between 400 and 1,200 per set for a maximum of 67,200 hooks for the entire duration of the proposed EFP.

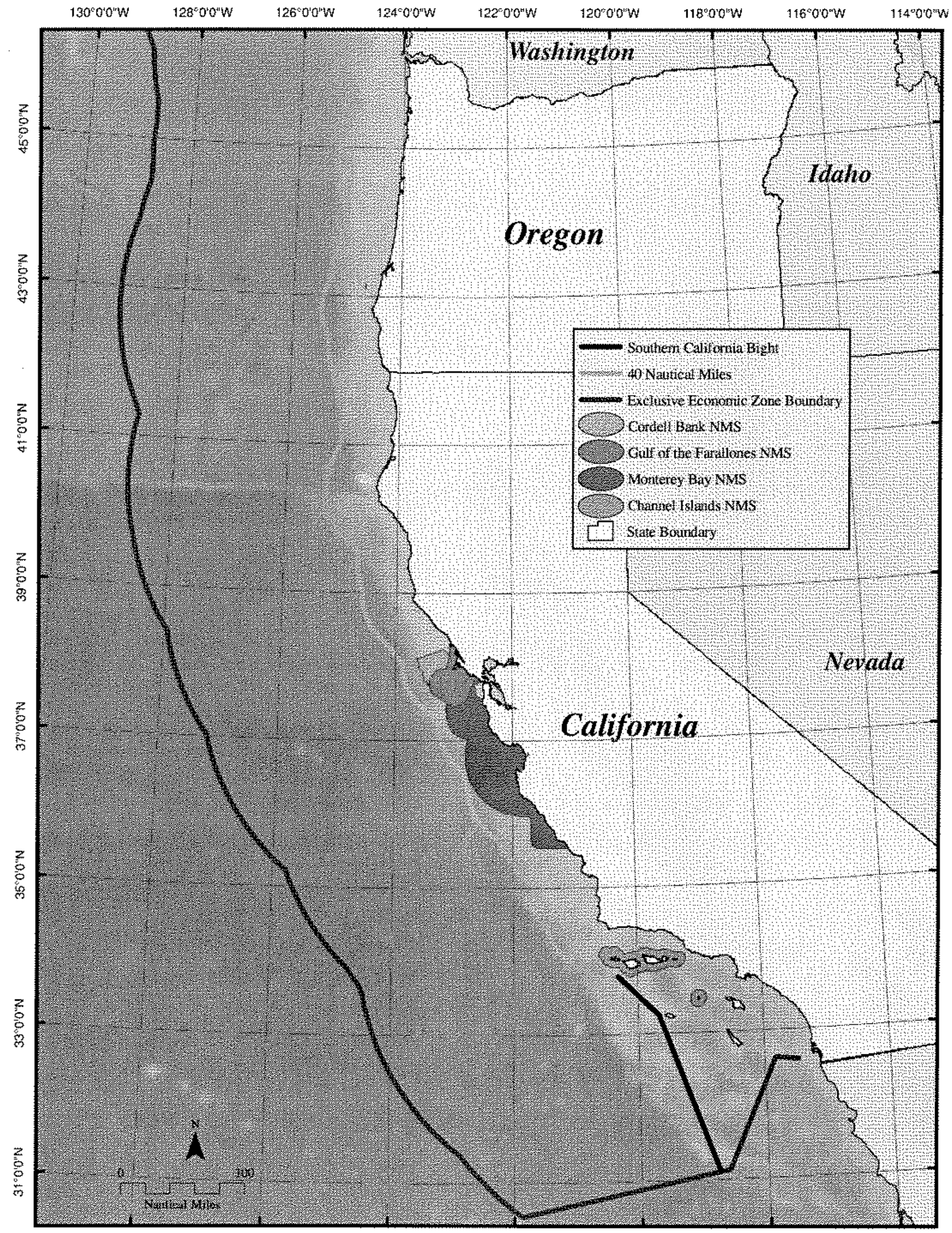


Figure 1. Boundary of proposed shallow-set longline EFP. Green line represents 40 nautical mile shoreward boundary; grey represents EEZ; black line represents SCB boundary.

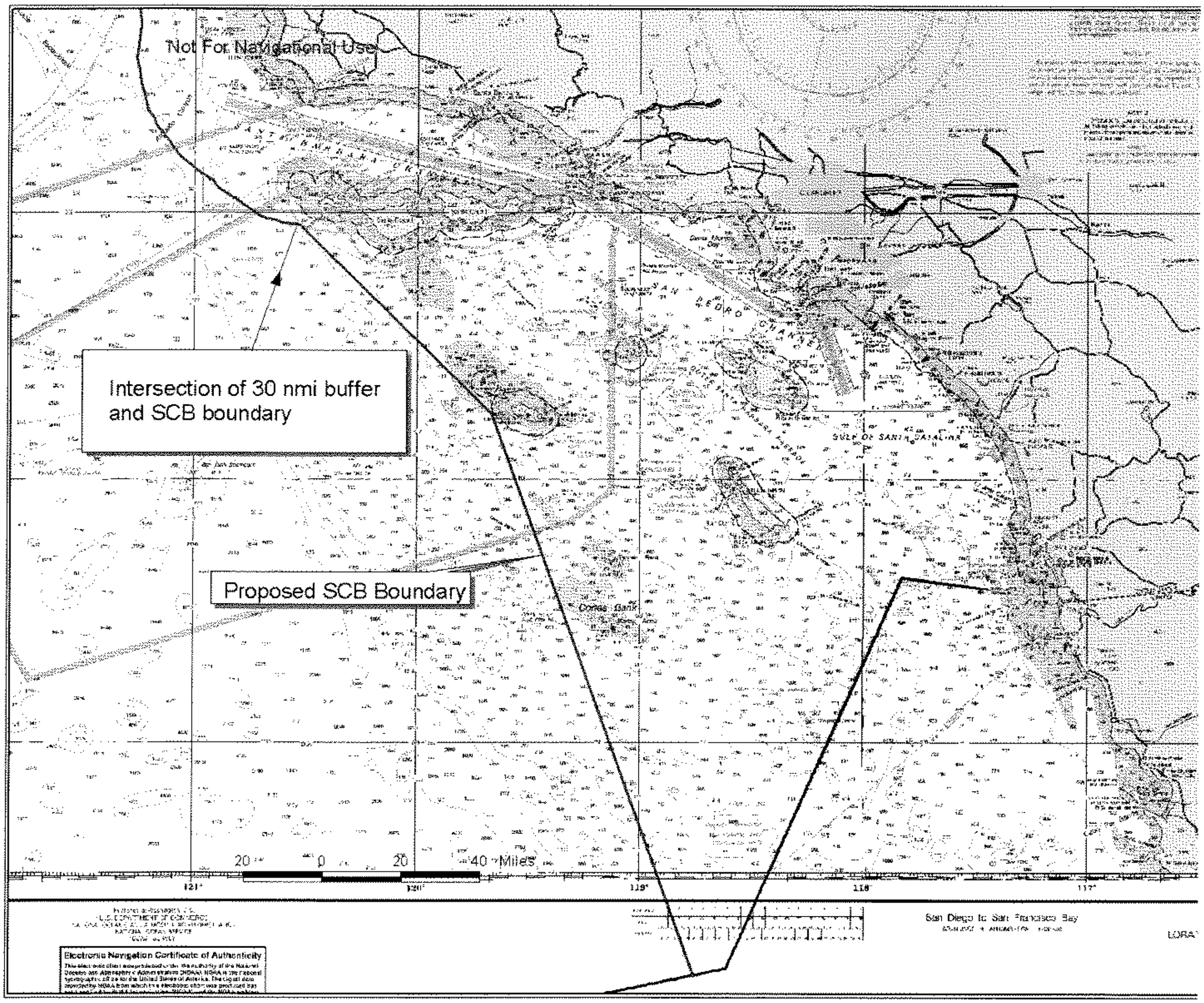


Figure 2: The Southern California Bight (SCB) as described for the proposed action. The proposed action area does not include the SCB.

C. Conservation measures included in the proposed action

In shaping its preferred alternative, the Council choose to include sea turtle conservation measures consistent with the 2004 amendment to the Hawaii based Pelagics FMP (69 FR 17329) that re-opened the SSLL fishery in the Pacific Ocean and around the Hawaiian Islands. Under the terms and conditions of the proposed EFP, the applicant would use shallow-set gear to target swordfish and would not target tuna with deep- set longline gear as part of the EFP. The application states that albacore, bigeye, yellowfin, and northern bluefin tunas may be caught in addition to swordfish. The proposed shallow-set gear configuration is typical of gear being used in Hawaii, with longer branchlines than floatline which are intended to allow any hooked or entangled sea turtles or marine mammals to reach the surface so they will not drown before the gear is retrieved. Light sticks are used. The limitation on the type of hooks and bait used are consistent with current Federal regulations applicable to vessels fishing under the Pelagics FMP. This hook and bait type has been demonstrated to reduce the number of sea turtle incidentally taken in SSLL. In the Hawaii-based fishery, reductions of 90% (loggerheads), 82.8% (leatherbacks), and 89.1% (combined turtle species) have been observed (Gilman *et al.* 2006). In the Northeast Distant (NED) experiments in the Atlantic Ocean, reductions of approximately 65% were observed with this gear configuration (Watson *et al.* 2005). All sea turtle take mitigation measures, at 660 CFR 712(b-e) would be applicable to the EFP fishery. In addition, one of the terms and conditions of the permit would require the skipper and captain to attend a protected species workshop to learn about methods to avoid interactions with turtles and marine mammals and safe handling techniques for de-hooking animals, if caught.

The requirement to set the gear at night and is intended to reduce accidental hooking and/or entanglement of seabirds. Seabirds typically get hooked when the line is being deployed off the back of the vessel while the hooks are flying through the air or on the surface of the water before the gear sinks. The birds dive for the baited hooks, get hooked, and are dragged underwater and drown. Because seabirds are less active at night, the night setting requirement reduces these interactions.

Deployment of TDRs, also required under the EFP, would provide more detailed information on fishing depth and provide additional data related to catch rates and gear interactions with protected species and finfish.

The conservation measures for the proposed action include a cap of five leatherback takes or which one take is likely to result in mortality, the capture of one short-tailed albatross, a limit or one short-finned pilot whale take and a cap of twelve striped marlin. Observers must call in any interactions with marine mammals, sea turtles and sea birds. If any of the caps is reached, fishing operations would cease pending retrieval of remaining gear in the water at which time fishing under the EFP would be terminated for the year.

D. Observer Program

The proposed action requires 100% observer coverage on all trips. All observers will be trained on species identification and appropriate data collection if an interaction occurs. While at sea, observers will, to the extent possible, collect information on observed species in the area, particularly leatherbacks and marine mammals. This information will add to the body of knowledge on the distribution of protected resources off the coasts of California and Oregon.

The observers will be responsible for notifying NMFS if any of the take caps are reached or approached. Additonally, observers will call in to report any interactions with marine mammals, sea turtles, or sea birds during fishing operations authorized by the EFP. Final determination on whether take caps have been reached and/or the EFP must be revoked will be made by the SWR.

III. APPROACH TO THE ASSESSMENT

A. Method

After receiving a complete description of the proposed action from SFD, PRD began an assessment of how best to analyze the effects of the proposed action. These steps were:

1. Deconstruct the action

Our first step was to deconstruct the proposed action and all conservation measures included in the proposed action in order to ensure that we understood what was proposed and how the action would be implemented. For this we relied primarily upon the initiation package provided by SFD, which included the "Draft Environmental Assessment on the Issuance of an Exempted Fishing Permit to Fish with Longline Gear in the West Coast EEZ" prepared by the HMS MT, PFMC staff, and NMFS (NMFS & PFMC 2007). The deconstruction of the proposed action is described in the sections above.

2. Exposure

Determining which ESA listed species were most likely to be exposed to the proposed action and adversely affected was challenging due the lack of observer data from a SSLL fishery in the proposed action area. We relied upon observer data from other fisheries that have operated in the action area, data from other SSLL fisheries, other relevant longline fisheries, and available information on the abundance and distribution of ESA-listed species within the action area and during the time year of the proposed action. Our determinations of effects on listed species is based upon the "weight of evidence" available for the analysis. Interactions between ESA-listed species and longline gear are extremely rare and difficult to predict and quantify, so our assessment includes a level of uncertainty that is higher than most section 7 consultations on fishery actions for which at least some direct data is available.

The exposure analysis to determine which species are most likely to be affected by the proposed action proved to be a challenging part of this section 7 consultation. There has not been a longline fishery within the proposed action area, the West Coast EEZ from 40 to 200 nm offshore and outside the SCB. We developed a methodology for estimating the species that are likely to be affected and adversely affected by the proposed action by using a variety of other fisheries as proxies for the SSLL EFP fishery. This method is reviewed here briefly.

We began by reviewing the DGN observer records, which we used an as indication of the presence of species in the proposed action area. We assumed that interactions between DGN fishing gear in the proposed action area and ESA-listed species could indicate a likelihood of interactions between SSLL gear and ESA-listed species, while being mindful of the differences in the types of interactions (i.e., entanglement in a DGN net of approximately one linear mile as opposed to hooking due to depredation or entanglement on longlines). We limited our review to observer records from within the proposed action area. Species that were not observed taken in the DGN fishery within the action area and had not been observed taken in other longline fisheries were determined to be not likely to be adversely affected by the proposed action, this included species such as blue whales. Some species were considered unlikely to be exposed to the proposed action based upon their biology and behavior (e.g., white abalone), others were eliminated because their range does not overlap the proposed action area (e.g., Guadalupe fur seals).

We recognized that the differences in the two gear types, DGN and SSLL, and the differences in where the two gears did and may fish are sufficiently different that using only DGN observer records to anticipate takes in the SSLL was not appropriate. Therefore, we reviewed observer records from SSLL fisheries in areas where the fishery and ESA-listed species overlap spatially and temporally, particularly in areas where the behavior (e.g., feeding or migrating) and distribution (e.g., along the continental shelf) of ESA-listed species is similar to their behavior and distribution in the proposed action area. Other variables that may affect the distribution of species were also considered, particularly the influence of El Niño or warm water events.

3. Response

The third step was considering how leatherback sea turtles would respond once exposed to the proposed action. These analyses relied upon the most recent observer information from the Hawaii SSLL fishery, the Atlantic SSLL fishery, and the NED experiments that recorded the nature of interactions between leatherbacks and SSLL gear and associated immediate and post-hooking mortality rates. The fisheries used in this analysis were chosen because they each use gear and fishing techniques similar to that in the proposed action. As described in detail in Section VI.B. none of the fisheries used to approximate leatherback responses from the proposed action were a perfect proxy, either due to differences in the fisheries such as bait types and behavior of the leatherbacks in the respective areas (e.g., whether the areas were likely to be foraging areas or migratory corridors).

4. Number of individuals exposed and risk to populations and species

Our final step in the analysis includes the results of the previous two steps and our best estimation of takes based upon the rates of takes observed in other, similar SSLL fisheries and what is known of the distribution and abundance of leatherbacks within the proposed action area. The fisheries reviewed include the Hawaii SSLL, the Atlantic SSLL, the NED experiments in the Atlantic, and the California and Hawaii SSLL that operated outside the EEZ.

We considered the effects of the proposed action within the context of the leatherbacks' current status, environmental baseline and factors affecting the species within the action area. Leatherbacks are highly migratory, we therefore considered a variety of effects both within and outside the action area that can have profound and sometimes unquantifiable effects of the species.

Our charge in this is not to identify all sources of mortalities and threats to all relevant species and rank these in order of significance. Neither is it to rank the proposed action within the existing threats. Our task is to determine if the anticipated exposure and response of species, when added to the existing and ongoing threats, conservation efforts, and species viability, would be reasonably expected to reduce the species likelihood of survival and recovery in the wild.

B. Information available for the assessment

There has not been a longline fishery in the proposed action area in the past, so there are no observer records available to project anticipated takes or species most likely to be affected.

Given the lack of direct data, a number of fisheries were reviewed and considered as proxies for the proposed action. These included the historical DGN fishery, which operated within a portion of the proposed action area (north of Point Conception) until 2001, the current DGN fishery which operates outside of the SCB, the SSLL fishery outside the EEZ which operated until 2004,.the SSLL fishery managed under the Hawaii-based Pelagics FMP and the SSLL fishery managed under the Atlantic HMS FMP. We also reviewed observer data from the bottom longline fishery in Alaska, since this is one of fisheries known to interact with, although not necessarily adversely affect, ESA-listed sperm whales. The limitations of each of these fisheries as a proxy for the proposed action are described within the exposure analysis. We also reviewed the abundance and distribution of ESA-listed species in areas outside the West Coast EEZ, where they may be exposed to SSLL gear to determine if patterns of exposure observed in other areas may be repeated in the proposed action area. We also reviewed the distribution and abundance of ESA-listed species within the action area to inform our exposure analysis and determinations on the likelihood of interactions.

A substantial amount of research has been done to better understand the western Pacific populations of leatherbacks. Populations in the eastern Pacific have been much more extensively studied, in part due to the accessibility of the major nesting sites, located primarily in Mexico and Costa Rica, both which have well identified and monitored nesting beaches. In the western Pacific, two major nesting sites have been identified, at Jamursba-Medi, in Papua, Indonesia, where the highest numbers of nesters have been recorded in the months of June, July and August (Austral winter), and in Wermon, Papua, Indonesia, where the highest number of nesters have been recorded in the months of November through February (Austral summer) (Wermon has only recently been monitored and only year round monitoring for the past three years). These beaches in north Papua may be the largest extant nesting population of leatherbacks in the Pacific. The remoteness of many nesting sites throughout Asia has made it difficult to fully assess the status of leatherbacks in the western Pacific. In 2004, a number of researchers from the U.S. and Asia met to coordinate research and information and shared data on the location of 25 nesting sites, previously unidentified in the published literature on western Pacific leatherbacks. However, there is no information on the status of the populations at these beaches or the trends in their respective sites. Other new information available for this analysis includes six years of satellite tagging of leatherbacks leaving nesting beaches in Indonesia and summer feeding areas in California. The post-nesting behavior of tagged leatherbacks indicates that these turtles travel along a variety of different routes and the animals do not share one pattern of dispersement. Further, it appears that nesting females may utilize more than one nesting site, indicating lower nesting site fidelity than other sea turtle species. All new information on the status of leatherbacks is provided in the status section of this opinion. Much of this new information is just recently published. This new data provides future opportunities for research and suggests that the western Pacific nesting population may be larger and more geographically dispersed than previously published reports indicate.

IV. STATUS OF THE SPECIES

The following ESA listed species under NMFS jurisdiction may occur in the action area:

Marine Mammals		**Status**
Blue whale *(Balaenoptera musculus)*		Endangered
Fin whale *(Balaenoptera physalus)*		Endangered
Humpback whale (*Megaptera novaeangliae*)		Endangered
Sei whale (*Balaenoptera borealis*)		Endangered
Sperm whale (*Physeter macrocephalus*)		Endangered
Steller sea lion - eastern distinct population segment (DPS) (*Eumetopias jubatus*)		Threatened
Killer whales - southern resident DPS (*Orcinus orca*)		Endangered
Northern Right Whale (*Eubalaena glacialis*)		Endangered
Guadalupe fur seals, (*Arctocephalus townsendi)*		Threatened
Sea turtles		
Leatherback turtle (*Dermochelys coriacea*)		Endangered
Loggerhead turtle (*Caretta caretta*)		Threatened
Olive ridley (*Lepidochelys olivacea*)		Endangered/threatened
Green turtle (*Chelonia mydas*)		Endangered/Threatened
Marine fish		
Green Sturgeon, southern DPS (*Acipenser medirostris*)		Threatened
Salmonids		
Chinook (*Oncorhynchus tshawytscha*)	Sacramento River winter, evolutionarily significant unit (ESU)	Endangered
	Central Valley Spring ESU	Threatened
	California Coastal ESU	Threatened
	Snake River Fall ESU	Threatened
	Snake River Spring/Summer ESU	Threatened
	Lower Columbia River ESU	Threatened
	Upper Willamette River ESU	Threatened
	Upper Columbia River Spring ESU	Endangered
	Puget Sound ESU	Threatened
Chum (*Oncorhynchus keta*)	Hood Canal Summer Run ESU	Threatened
	Columbia River ESU	Threatened
Coho (*Oncorhynchus kistuch*)	Central California Coastal ESU	Endangered
	S. Oregon/N. CA Coastal ESU	Threatened
	Lower Columbia River ESU	Threatened
Sockeye (*Oncorhynchus nerka*)	Snake River ESU	Endangered
	Ozette Lake ESU	Threatened
Steelhead (*Oncorhynchus mykiss*)	Southern California DPS	Endangered
	South-Central California DPS	Threatened

	Central California Coast DPS	Threatened
	California Central Valley DPS	Threatened
	Northern California DPS	Threatened
	Upper Columbia River DPS	Endangered
	Snake River Basin DPS	Threatened
	Lower Columbia River DPS	Threatened
	Upper Willamette River DPS	Threatened
	Middle Columbia River DPS	Threatened

A. Species considered not likely to be affected by the proposed action

There have been no observed takes of salmon, steelhead, or green sturgeon in the DGN fishery and no record could be found of takes of these species on pelagic longline gear in the Pacific. Therefore, NMFS reasons that theses species (the ESUs and DPSs of salmon and steelhead) are not likely to be adversely affected by the action and these species will not be considered further in this opinion.

Sei whales, northern right whales, and Guadalupe fur seals are not expected to be affected by the action. Aerial and ship based surveys conducted throughout the area indicate that these species are rarely observed in the West Coast EEZ (Carretta *et al.* 2007). These species have not been observed incidentally taken in the DGN fishery which operated within the proposed action area of the SSLL EFP. Therefore, NMFS reasons that these species are not likely to be adversely affected by the proposed action and they will not be considered further in this opinion.

B. Species that may be affected by the action, but considered unlikely to be adversely affected

A number of ESA-listed marine mammals and sea turtles could be affected by the proposed action. As described above, we used information from a variety of sources to identify which species are most likely to be exposed to the proposed action. We begin this section with a review of marine mammal interactions with DGN and SSLL fishing gears.

Gillnet gear has been identified as a major source of anthropogenic mortality for marine mammals species globally (Perrin *et al.* 1994). The cause of entanglements in gillnets is usually attributed to marine species being unable to detect the net and becoming entangled. This is supported by the substantial decline of marine mammal entanglements in the DGN fishery during field testing of pingers (Barlow and Cameron 2003) and following the implementation of the Pacific Offshore Cetacean Take Reduction Plan (POCTRP) which includes a requirement that acoustic pingers be attached to DGN nets (62 FR 51805). By contrast, marine mammal takes in longlines are generally attributed to depredation by odontocetes, either feeding on the bait or fish caught on the hooks although entanglements are also possible (Gilman *et al.* 2006a). Takes of small toothed whales or dolphins (e.g., short-finned pilot whales, false killer whales, and Risso's dolphins) occur at high rates in some SSLL fisheries. Entanglements of ESA-listed odontocetes and large baleen whales have been recorded in the Hawaii based SSLL fishery although they are not common and do not always lead to serious injury or mortality (Forney 2004).

The DGN observer records provided us with a means to assess whether ESA-listed species may be in the proposed action area and could be exposed to gear (based upon the assumption that species entangled in DGN gear would also interact with SSLL gear). We tried to quantify the differences between rates of marine mammal take in the two fisheries, but a direct comparison could not be made for this consultation as no comparable fishery records could be found of gillnets and longline occurring in the same area, time, and target species. In the Atlantic, a DGN fishery and a longline fishery both targeting swordfish, operated in more or less the same areas, although effort in the year round Atlantic longline fishery was much higher than DGN effort, which was limited to short seasons of 14 days or less. Despite these differences the number of species of marine mammals observed taken in the DGN fishery is much higher than the number observed in the longline fishery. This is consistent with a review of the observer records from California, Hawaii, and the Atlantic longline observer records which suggest that entanglements of most ESA-listed marine mammals are generally quite low in longline fisheries. Therefore, it is likely that the number of species incidentally taken in the proposed action will be lower than the number observed in the DGN fishery. The numbers of ESA listed marine mammals observed taken in the DGN fishery are provided in Table 1.

Table 1. ESA-listed marine mammals observed taken in the DGN fishery, 7,721 sets

Species	Total observed	Observed in proposed action area
Sea Lion, Steller	2	0
Whale, Fin	1	0
Whale, Humpback	3	0
Whale, Sperm	8	6

1. ESA-listed baleen whales

The lack of observed takes of ESA-listed baleen whales in the DGN fishery that operated in the proposed action area suggests that takes are very unlikely (as noted above the limited information available suggests that marine mammals are generally more likely to interact with DGN gear than longline gear). Several species of large baleen whales, blue, fin, and humpback whales, spend the summer and fall feeding the in waters off California and Oregon within the EEZ which places them in the area of the proposed action. Feeding aggregations have been observed in the summer and fall in central California and the waters around the Channel Islands and migrate south in the late fall and winter (Carretta *et al.* 2007). A number of individuals from ESA-listed whale species migrate through the action area in the fall (including humpbacks that spend their summers feeding off Oregon, Washington, and British Columbia, Canada). For the species that utilize the action area for feeding and as a migratory corridor, exposure to and entanglement in longline gear is possible. Because there is no direct information on interactions between ESA-listed marine mammals and a longline fishery within the EEZ, other sources of information were used to evaluate the likelihood of interaction with these species.

All observed takes of humpback and fin whales in the DGN fishery within the west coast EEZ occurred within the SCB, which is not a part of the proposed action area. When considering the DGN observer data it must be remembered that it is possible that these large species (up to 100 foot long blue whales) may have interacted with gear, but were able to "burst" through the DGN gear before becoming entangled. So, the observed interactions may not include all incidents of interactions. Observer data from the California-based SSLL outside the EEZ was reviewed and indicated that no ESA-listed baleen whales were observed taken during that fishery. This data may not directly reflect the likelihood of interactions with ESA-listed baleen whales, since it does not include the nearshore migratory corridors or feeding areas utilized during the summer and fall by listed whales. Surveys conducted in the West Coast EEZ suggest that humpback whales generally stay nearshore, often within 40 miles of shore and in the SCB, thus out of the action area. Fin whale distribution extends beyond the EEZ and overlaps areas of the SSLL on the high seas, therefore observer records from the SSLL fishery could be used as a proxy to assist in determining the likelihood of fin whales interacting with this gear type. There have been no takes of fin whales observed in the SSLL fishery on the high seas adjacent to the West Coast EEZ.

In order to assess likelihood of interactions within a similar environment (i.e., baleen whale feeding area and migratory corridor), information from the Atlantic HMS observed program was reviewed. The fishery has been observed for twelve years (at approximately five percent annually) and there are no records of entanglements between ESA listed whales commonly found in the area (e.g., sei, blue, humpback, fin) and the commercial pelagic longline fishery along the Atlantic coast (NMFS 2004d). There was one account of an unidentified large whale entangled in gear during the Northeast Distant (NED) experiments testing modified longline gear (circle hooks) and methods. While the animal could not be positively identified, it was likely a listed species based upon the known distribution of whale species in the NED (Watson *et al.* 2006). The animal was released unharmed without any trailing gear (NMFS 2004d).

As a final step, the Hawaii based SSLL records were observed, although it should be noted that the timing of the much of the effort in the SSLL fishery, the first and second quarter of the year, is a time when many humpbacks move into the waters off Hawaii to calf and mate, so observed interactions in that area may not necessarily compare to humpback and other baleen whales in their foraging areas. In the Hawaii SSLL fishery, only one humpback whale has been observed entangled in SSLL gear (in 2006) during 2,631 observed sets and 2,150,681 hooks since 2004 (NMFS, Pacific Islands Regional Office (PIRO) observer program). The whale entangled in 2006 was released alive, although final assessment of its condition (i.e., seriously injured or not) has not been made (Yates 2007). In the Hawaii based SSLL fishery from 1994-2002, there were no observed takes of ESA listed baleen whales (Forney 2004).

The data we reviewed suggests that takes of large baleen whales is unlikely in the proposed action. As a final step, we considered the relative populations of species in the Atlantic, around Hawaii, and the West Coast EEZ. NMFS assumes that higher populations of species may result in higher potential instances of interactions with fishing gear. The N (min), which is the minimum population estimates of the marine mammal populations in these different regions, are not so dissimilar that the relative populations would make comparisons to the West Coast EEZ unreasonable. Table 2 below provide the most recently published population estimates for four species of ESA-listed whales that could interact with the proposed action. We also include estimates of takes in 100 sets based upon observed take rates in the Hawaii SSLL fishery, since there have been no observed takes in the Atlantic HMS fishery and one take in the NED experiments, but the animal freed itself from the gear before it could be identified and was considered not seriously injured (Lawson 2007). As described previously, takes of most species of marine mammals is very rare in longline fishing and projecting anticipated take levels based upon very rare events is difficult. Nonetheless, the marine mammal take rates shown in Table 2 add to the weight of evidence that the likelihood of ESA-listed whales being incidentally taken in the proposed action is very low (the proposed action includes a maximum of 56 sets).

Table 2. Observed takes in SSLL fisheries and minimum population estimates for ESA-listed whales that may be affected by SSLL EFP.

Species	Observed takes in HI SSLL	Takes per 100 sets	N(min) (HI stock)	Observed takes in Atlantic SSLL	N(min) (Atlantic stock)	N(min) (US west coast stock)
Humpbacks	1	.0005	1,234	0	647	1,396
Fin	0	0	174	0	2,362	3,454
Blue	0	0	308	0	unknown	1,384
Sperm	2	.0713	7,082	0	3,539	2,265

Based upon the rarity of observed interaction between DGN gear and large baleen whales and the rarity of entanglements in SSLL fisheries in Hawaii and the Atlantic, and the distribution and relative population size of the species within the action area, it is considered very unlikely that the fishing that would occur under the EFP would adversely affect ESA listed baleen whales, blue, fin, or humpback whales.

2. Sperm whales
Sperm whales are listed as endangered and are found throughout the California Current off the West Coast, reaching peak abundances off of California from April to mid-June and the end of August through mid-November (Rice 1974) demonstrating seasonal movements but not a clear migration common among most large baleen whales. There have been eight observed takes of sperm whales in the 16 years of the DGN fishery observer program. The takes occurred within two relatively limited areas; one area is around 36° N latitude and 122° W longitude (south and west of Monterey Canyon), where six animals have been observed taken in the DGN, including one haul with three animals in the net and the other around 32° N latitude and 120° W longitude (southwest of the Channel Islands and near Cortes Bank), where two animals were observed taken in one haul. Six of the eight observed takes occurred in El Niño years (1992 and 1993). It is not known how or if the unusually warm water off the West Coast affected the whales' behavior or made them more susceptible to exposure to DGN gear. At this time, El Niño conditions are not expected through the end of 2007.

Sperm whales are more abundant in waters around Hawaii than the West Coast EEZ; therefore, a review of the Hawaii-based SSLL observer records was done. There have been no observed entanglements in the SSLL fishery as it has been operating since 2004 (2,631 observed sets and 2,150,681 hooks) (NMFS, Pacific Islands Region observer program). There has been only one observed take from1994 through 2002 and the animal was not seriously injured (Forney 2004). One sperm whale was observed taken in an experimental fishery outside the Hawaii EEZ, but an assessment of its condition (i.e., seriously injured or not) could not be made (Carretta *et al.* 2007).

The Atlantic SSLL was reviewed as a possible proxy for the SSLL EFP fishery since SSLL effort and sperm whale feeding areas overlap temporally and spatially in the Atlantic, similar to the proposed action area. Although both the Atlantic SSLL fishery and sperm whales utilize the same regions (100, 200 and 1000 meter isobath) sperm whales have not been observed taken in the fishery, despite high levels of effort. There were over one million SSLL hooks set in the regions of sperm whale feeding, primarily the Mid-Atlantic Bight (MAB) and Northeast Coastal (NEC) (Fairchild-Walsh and Garrison 2007).

To complete our review of sperm whale takes in other fisheries, we reviewed observer data from the California based SSLL adjacent to the West Coast EEZ and there were no reports of interactions.

The rarity of observed sperm whale takes in the historical DGN fishery, the Atlantic and Hawaii SSLL fisheries, and California based SSLL fishery suggests that entanglements in longline gear are rare events and at the level of effort in the proposed action, entanglements are considered very unlikely.

Sperm whales have been observed interacting with longline fisheries in Alaska, feeding on sablefish that have been caught on bottom longlines. In 2000, one animal was observed with trailing longline gear attached and was determined to be seriously injured due to the amount of gear observed on the animal (Angliss and DeMaster 1997). No other serious injuries were recorded during this time, 1999–2003 (Angliss and Outlaw 2006). Sperm whales feed primarily on large and medium-sized squids, although the list of documented food items is fairly long and diverse. Prey items include other cephalopods, such as octopuses, and medium- and large-sized demersal fishes, such as rays, sharks, and many teleosts (Berzin 1972; Clarke 1977, 1980; Rice 1989). The diet of large males in some areas, especially in high northern latitudes, is dominated by fish (Rice 1989), which may explain the depredation events (removing fish off hooks) observed in the Alaska longline fisheries. All observed depredation events were done by males (Hill *et al.* 1999).

It is not impossible that sperm whales may begin a pattern of depredation on longlines within the proposed action area, although this is considered unlikely to occur during the four months of 2007 in which this proposed action is to occur. The causes for sperm whales and other odontocetes depredation on longline gear are not known but the animals are likely to become familiar with the sounds of the fishery (e.g., boat engines and gear hydraulics) and associate the sounds with feeding opportunities (Gilman *et al.* 2006). There is also evidence that the same individual whales will feed on longline (Hill *et al.* 1999) suggesting that this is a learned and specialized behavior. NMFS considers it unlikely that sperm whale depredation will develop over the short time, four months, of the proposed SSLL EFP since this does appear to be a specialized and learned behavior that is likely developed over time and exposure to the fishery. The relatively low level of effort of the proposed action is unlikely cause a change in sperm whale behavior. Also, the fishing activity will occur over a very large geographical area and sperm whales are believed to use passive acoustics to locate longline vessels, particularly during hauling operations. The distances at which the vessels can be heard by sperm whales is not known although sperm whales have been observed not reacting to longline vessel sounds over 10 miles away, that is in an area of Alaska where depredation is common, sperm whales did not swim towards longline vessels hauling their gear is the vessels were far away (NMFS 2006). Based upon the low amount of effort it is quite likely that the fishing operations will be outside of the hearing range of sperm whales. If the SSLL fishery were to expand, additional analysis of potential of depredation may be necessary, but as described in Hill *et al.* (1999) and Angliss and Outlaw (2006) high levels of depredation on the sablefish bottom longline fishery was not correlated with high levels of serious injury or mortality, sperm whales were very effective at removing fish from lines without entangling in the gear. In Hill *et al.* (1999), no serious injuries or mortalities were observed; in the 2000 through 2004 fishing seasons, the estimated rate of serious injuries or mortalities is 0.45 animals annually.

Due to the overlap of sperm whale distribution and the proposed action, it is not impossible that sperm whales may be exposed to the proposed action, but given our review of other SSLL, the relative abundances of these sperm whale stocks in areas with longline fisheries, and the relatively low level of effort anticipated in the proposed action, NMFS considers it very unlikely that sperm whales would be adversely affected by the action, either by entangling in lines while depredating or getting caught on line or hooks while moving through an area.

3. Steller sea lions

Steller sea lions may be exposed to the longline fishery although NMFS considers this unlikely. Incidents of observed entanglements in DGN are extremely rare, only two observed entanglements in 16 years of observations. This lack of observed takes is consistent with surveys conducted in the fall and late summer that indicate a nearshore distribution of Steller sea lions, generally within 20 miles of shore (Forney 2007) and thus out of the area of most DGN fishing and not within the proposed action area. This distribution is consistent with the distribution of Steller lions off the coast of California and Oregon. Males and females will congregate at rookeries with most breeding activity occurring in May through early July. Rookeries near the proposed action area are at Año Nuevo, Southeast Farallon Island, and Sugarloaf Island and Cape Mendocino, and St. George Reef within waters off California and Rogue River and Orford Reef off of Oregon, all of which are inshore of the proposed action area. Based upon the timing of the proposed action it is unlikely that Steller sea lions will be within the proposed action area. Males typically leave the rookeries soon after mating, traveling north to waters off of Washington state and British Columbia (NMFS 2007). Studies from western Pacific Steller sea lions in Alaskan waters indicate that females with young pups generally stay within 20 km of haul-out sites (Raum-Suryam 2002). Weaned juveniles less than three years old will also stay close to shore, with 90% of foraging occurring within 15 km of nearshore haul-out sites (Raum-Suryam 2002). It is possible that females without pups may be within the proposed action area but based upon surveys conducted during the fall and Steller sea lions' tendency for forage nearshore and over the continental shelf (Reeves *et al.* 1992), it is unlikely.

Steller sea lions have been observed taken in Alaska fisheries; one western Pacific Steller sea lion was been observed incidentally taken and killed in the Alaska Pacific cod longline fishery (estimated mean annual mortality of 0.74) and one eastern Pacific Steller sea lion in the sablefish longline fishery (estimated mean annual mortality of 1.37) (Angliss and Outlaw 2007)). However, the Alaska longline fisheries may not be reflective of what may be anticipated in the proposed action. The target species, cod and sablefish, are identified prey species of Steller sea lions in the area, swordfish and sharks are not identified prey species for Steller sea lions off the waters of California and southern Oregon (NMFS 2007). Also, the Alaskan longline fisheries operate in areas known to be foraging areas for Steller sea lions, as described above, the proposed action is not likely to be a foraging area for Steller sea lions based upon their utilization of the habitat at the time of the proposed action.

Due to the low probability of Steller sea lions being within the proposed action area, based upon their life history and surveys from the area, and the rarity of observed takes within DGN fishery, and the low likelihood that Steller sea lions in the area would depredate on swordfish, NMFS reasons that Steller sea lions are unlikely to be affected by the proposed action.

4. Killer whales

One stock of killer whales is listed as endangered, the Eastern North Pacific (ENP) southern residents. These animals have been observed feeding primarily on salmon and are thought to be fish eaters (as opposed to transients that prey primarily on marine mammals and other non-fish species). The fall distribution of this stock is not precisely known. There have been no sightings of this population in the action area during the months of September through December. During this time, sightings of this stock are most common within the inland waters of Washington State. The late fall and winter distribution of this stock is not well known although within the proposed action area, the ENP southern residents have been observed five times in central California, generally near Monterey Bay from December through February (NMFS 2006). In Alaska, killer whales have been observed predating on longline fisheries in the Bering Sea and Gulf of Alaska (Sigler *et al.* 2003). Recent genetics studies indicate that it is the resident killer whales that depredate on longlines targeting cod and flatfish (which may be part of their normal diet) while transients predate on fisheries targeting pollock (usually trawls) (Angliss and Outlaw 2006). The most recent data indicates one observed mortality of a resident killer whale in the cod longline fishery in 2003 (Angliss and Outlaw 2006). In the historical DGN fishery, there was one observed take of a transient killer whale. Swordfish, the target species of the proposed fishery, are unlikely to be a prey species for the endangered killer whale population since they feed primarily on salmon (NMFS 2006b). Due to the rarity of this population in the area, the extremely rare occurrence of killer whale takes in the DGN observer records, and the low likelihood that this population would depredate on swordfish or tuna, NMFS reasons that the likelihood of interaction in the proposed EFP fishery is very low to non-existent.

5. Sea turtles

Similar to the analysis of marine mammals, we begin with the historic DGN observer data to identify the species in the proposed action area that may be exposed to the proposed action. Data on the observed takes of ESA-listed sea turtles is provided in Table 3.

Table 3. Observed sea turtle takes in the DGN fishery (7,721 observed sets from 1990 to 2005)

Species	Observed takes	Observed takes in the proposed action area
Green	1	0
Olive Ridley	1	0
Loggerhead	14	2
Leatherback	23	19

a. Green and olive ridley sea turtles

There has been only one observed take of a green turtle and one observed take of an olive ridley in the DGN fishery since 1990. Generally, both greens and olive ridleys are found in warm waters, greater than 18° C, which is warmer than the targeted sea surface temperature (SST) identified by the applicant. Further, the observed takes of these species both occurred in southern California during a period of a warm water intrusion from Baja, California, Mexico, which is believed to have brought individual sea turtles into the SCB (NMFS 2004). No observer records of take of these two sea turtles species in fisheries in the proposed action area could be found. There have been a very low number of greens and olive ridley strandings in the West Coast EEZ (NMFS SWR and NWR stranding data bases). But generally, these two species are considered constrained by their preferred temperature of greater than 18° C which is most commonly observed, during the time of the proposed action, only within the SCB. The available information suggests that it is very unlikely that greens or olive ridleys will be affected by the proposed action.

b. Loggerhead sea turtles

In order to determine whether or not loggerhead sea turtles may be affected by the proposed action observer records were reviewed along with an extensive review of the literature on loggerhead distribution within the north Pacific. Loggerhead sea turtles have not been observed incidentally taken in the DGN fishery north of Point Conception, fifteen loggerheads have been observed taken south of Point Conception. All but one observed takes of loggerheads occurred during years in which an El Niño had been declared and all but two occurred within the SCB. As described in the proposed action section above, there will be no SSLL fishing in the SCB under this EFP. The observed takes of loggerheads in the SCB by the DGN fishery are likely related to oceanographic conditions and its effects on the distribution of loggerheads. The waters off Baja, California, Mexico, have been identified as a key feeding area for juvenile and sub-adult loggerheads where they feed on their primary prey, red crab, which are found in high concentrations in coastal warm waters off Baja. Observer records from the DGN fishery strongly suggest that juvenile loggerheads only move into the waters off California during El Niño years and are generally found within the SCB, where SSLL fishing will not occur under the proposed action. During public comments received on this proposed EFP concerns were expressed that loggerhead sea turtles may be adversely affected by the proposed action. Therefore, to better understand the distribution of loggerheads throughout the Pacific and particularly differences in the likelihood of exposure in the proposed SSLL fishery a review of the recent literature was conducted, with particular focus on the Hawaii based SSLL fishery.

Satellite tracking of loggerheads has provided insights into their behavior and distribution in the Pacific. Loggerheads exhibit shallow dive patterns with >90 percent of their dives within the top 40 m of water (Polovina *et al.* 2004), which is similar to the hook depth range of the proposed fishing gear (hook depths of 40–45 meters below the water's surface). Genetic analysis of loggerheads that may be exposed to the longline gear in the North Pacific indicate that they are likely to be from nesting beaches in Japan and forage off Baja California (Bowen *et al.* 1995) and the Central North Pacific. Satellite tracking of loggerheads indicates that they occupy a wide range of SST from 15–25° C while in the Central North Pacific, although tracks of turtles within narrowly defined temperature bounds were also observed (Polovina *et al.* 2004). The published temperature range is within the applicant's stated preferred water temperature for fishing under the proposed action. However, based upon recent satellite tracking and ongoing studies it does not appear that the waters of the West Coast EEZ are utilized by loggerheads. Satellite tracking indicates that loggerheads tagged and released from north Pacific fisheries and from Japan travel in the North Pacific Transition Zone (NPTZ) and the Kuroshio Extension Current perhaps spending years as juveniles feeding in these large Pacific currents (Polovina *et al.* 2004, Polovina *et al.* 2006). Satellite tracks of juvenile loggerheads in the NPTZ end at approximately 130° W longitude (Polovina *et al.* 2004), which is the eastern boundary of the Subarctic and Subtropical gyre in which the NPTZ is found. This area is west of the proposed action area and on the western edge of the California Current. It has been speculated that when the gyre meets the south-moving California Current, objects in the gyre, including juvenile loggerheads, are moved into the waters off Baja (Nichols *et al.* 2000). After spending years in the nearshore environment feeding, loggerheads head back across the Pacific to nesting beaches in Japan. Limited satellite tracking of loggerheads tagged in Baja indicate a due east movement that suggests that they may be utilizing the subtropical front at 25°–30° N latitude on their eastward migration (Nichols *et al.* 2000).

Due to a lack of satellite tracks of loggerheads east of 130° W longitude, a review of observer records from the California based SSLL fishery outside the EEZ and stranding records were reviewed for indications of loggerheads in the proposed action area. The California-based SSLL was observed for three years and high concentrations of loggerhead takes occurred between 140°–150° W longitude. Data from the Hawaii-based SSLL fishery, observed from 1997–2001, were also reviewed. The total number of observed SSLL sets in the California based and Hawaii-based SSLL fisheries is 586 sets. In this data set, there were no observed takes of loggerhead at or east of 130° W longitude (NMFS, SWR observer program). This lack of observed loggerhead takes in an area adjacent to the proposed action area suggests that loggerheads are unlikely to be in area and therefore not likely to be exposed to the proposed action.

To further assess the likelihood of interactions between the proposed action and loggerheads, records from the SWR stranding database were reviewed. The majority of strandings occurred in counties bordering the SCB (i.e., Los Angeles, Orange, and San Diego counties). Less than five strandings were recorded north of the SCB. This is consistent with oceanographic differences between the two areas, with warmer waters to the south of Point Conception and colder waters to the north. The available data suggests that while loggerheads may be occasionally found in waters north of Point Conception and west of the SCB, it is considered quite rare based upon fishery observer records, stranding records, along with the preferred temperature range identified for the species. Given all these lines of evidence, NMFS finds that loggerheads are unlikely to be found in the proposed action area and are unlikely to be affected by the proposed action.

C. Species likely to be adversely affected by the proposed action

NMFS anticipates that leatherback sea turtles are likely to be exposed to the proposed action and adversely affected. This determination is based upon the number of observed takes in the DGN fishery that operated within the proposed action area and takes of leatherbacks in the SSLL fishery in areas near the west coast EEZ. Also, over the past few years, much information has been gained on the distribution and foraging patterns of Pacific leatherbacks. The California coast has been identified as a foraging area for leatherbacks from the Western Pacific nesting population (Benson *et al.* 2007a). More information on this will be provided below.

Based upon our analysis of the available data, the weight of evidence suggests that only leatherback sea turtles are likely to be adversely affected by the proposed action.

For the purposes of this consultation, this opinion focuses on the effects of the proposed SSLL EFP on 1) leatherback nesting aggregations most likely to be affected by the proposed action, 2) leatherback populations in the Pacific Ocean, as distinct from their global distribution, and 3) the leatherbacks as they are listed globally. NMFS reasons that the loss of leatherback populations in the Pacific Ocean would result in a significant gap in the distribution of this species and would reduce the numbers of the species such that the species likelihood of survival and recovery could be affected. Substantial new information on leatherbacks in the Pacific, particularly those nesting in the western Pacific, has become available in the past five years. This opinion incorporates the best available information on the status of western Pacific leatherbacks, including recently published and unpublished data provided directly from scientists in the field. This opinion will highlight new information relevant to the analysis at hand. For a comprehensive review of the status of leatherbacks, please see NMFS 2004 biological opinion on the HMS FMP.

This section will provide a brief leatherback species description and life history, population status and trends (as available), threats to the species and conservation actions.

1. Leatherback sea turtles

a. Species description and life history

Leatherback turtles are the largest of the marine turtles, with a curved carapace length (CCL) often exceeding 150 cm and front flippers that are proportionately larger than in other sea turtles and may span 270 cm in an adult (NMFS and USFWS 1998). In view of its unusual ecology, the leatherback is morphologically and physiologically distinct from other sea turtles and easily identifiable on land and at sea.

Leatherbacks are widely distributed throughout the oceans of the world. The species is found in four main regions of the world: the Pacific, Atlantic, and Indian Oceans, and the Caribbean Sea. Leatherbacks also occur in the Mediterranean Sea, although they are not known to nest there. The four main regional areas may further be divided into nesting aggregations. Leatherback turtles are found on the western and eastern coasts of the Pacific Ocean, with nesting aggregations primarily in Mexico and Costa Rica (eastern Pacific) and primarily in Malaysia, Indonesia, the Solomon Islands, Papua New Guinea, and Vanuatu (western Pacific). In the Atlantic Ocean, leatherback nesting aggregations have been documented in Gabon, Sao Tome and Principe, French Guiana, Suriname, and Florida. In the Caribbean, leatherbacks nest in the U.S. Virgin Islands and Puerto Rico. In the Indian Ocean, leatherback nesting aggregations are reported in India and Sri Lanka.

Leatherbacks have the most extensive range of any living reptile and have been reported circumglobally from 71°N to 47°S latitude in the pelagic Pacific and in all other major pelagic ocean habitats (NMFS and USFWS 1998). For this reason, however, studies of their abundance, life history and ecology, and pelagic distribution are exceedingly difficult. Leatherback turtles lead a completely pelagic existence, foraging widely in temperate waters except during the nesting season, when gravid females return to tropical beaches to lay eggs. Males are rarely observed near nesting areas, and it has been proposed that mating most likely takes place outside of the tropical waters, before females move to their nesting beaches (Eckert and Eckert, 1988).

Leatherbacks are highly migratory, exploiting convergence zones and upwelling areas in the open ocean, along continental margins, and in archipelagic waters (Morreale *et al.*. 1994; Eckert 1998; Eckert 1999a). In a single year, a leatherback may swim more than 10,000 kilometers (Eckert 1998). Recent satellite tagging by the SWFSC indicates that post-nesting females leave the beaches of Papua, Indonesia and travel across the Pacific to feed in upwellings off the coast of the contiguous U.S.

Ongoing work has provided insights into leatherback migration and foraging behavior. Satellite telemetry studies indicate that adult leatherback turtles follow bathymetric contours over their long pelagic migrations and typically feed on cnidarians (jellyfish and siphonophores) and tunicates (pyrosomas and salps), and their commensals, parasites and prey (NMFS and USFWS 1998). Because of the low nutritive value of jellyfish and tunicates, it has been estimated that an adult leatherback would need to eat about 50 large jellyfish (equivalent to approximately 200 liters) per day to maintain its nutritional needs (Duron 1978, *in* Bjorndal 1997). Compared to greens and loggerheads, which consume approximately 3-5% of their body weight per day, leatherback turtles may consume perhaps 20-30% of their body weight per day (Davenport and Balazs 1991). Leatherbacks have been observed at or near the surface feeding at upwelling relaxations in the waters off central California (Benson *et al.* 2007a). However, satellite tagging suggests deeper dives, likely for feeding once the animals move offshore (generally in October and November) (Benson, 2006).

Surface feeding by leatherbacks has been reported in U.S. waters, especially off the West Coast (Eisenberg and Frazier 1983), but foraging may also occur at depth. Based on offshore studies of diving by adult females nesting on St. Croix, U.S. Virgin Islands, Eckert *et al.* (1989) proposed that observed internesting[1] dive behavior reflected nocturnal feeding within the deep scattering layer (strata comprised primarily of vertically migrating zooplankton, chiefly siphonophore and salp colonies, as well as medusae). Hartog (1980, *in* NMFS and USFWS 1998) also speculated that foraging may occur at depth, when nematocysts from deep water siphonophores were found in leatherback stomach samples. Davenport (1988, *in* Davenport and Balazs 1991) speculated that leatherback turtles may locate pyrosomas at night due to their bioluminescence; however direct evidence is lacking. This tendency to feed at night may make leatherbacks more susceptible to exposure to SSLL gear as the gear is set at night.

The maximum dive depths for post-nesting female leatherbacks in the Caribbean have been recorded at 475 meters and over 1,000 meters, with routine dives recorded at between 50 and 84 meters. The maximum dive length recorded for such female leatherback turtles was 37.4 minutes, while routine dives ranged from 4-14.5 minutes (*in* Lutcavage and Lutz 1997). Leatherback turtles also appear to spend almost the entire portion of each dive traveling to and from maximum depth, suggesting that maximum exploitation of the water column is of paramount importance to the leatherback (Eckert *et al*, 1989).

Migrating leatherback turtles also spend a majority of time at sea submerged, and they display a pattern of continual diving (Standora *et al.* 1984, *in* Southwood *et al.* 1999). Based on depth profiles of four leatherbacks tagged and tracked from Monterey Bay, California in 2000 and

[1]Internesting – time spent between laying clutches of eggs during a single nesting season.

2001, using satellite-linked dive recorders, most of the dives were to depths of less than 100 meters and most of the time was spent shallower than 80 meters. Based on preliminary data analysis, 75-90% of the time the leatherback turtles were at depths less than 80 meters (P. Dutton, NMFS, personal communication, January 2004). This area of the water column is where most SSLL gear will be found (with the hook depth estimated to average 40 to 45 meters) meters).

Migratory routes of leatherback turtles originating from eastern and western Pacific nesting beaches are not entirely known. However, satellite tracking of post-nesting females and foraging males and females, as well as genetic analyses of leatherback turtles caught in U.S. Pacific fisheries or stranded on the West Coast of the U.S. present some strong insight into at least a portion of their routes and the importance of particular foraging areas. Aerial surveys conducted during the late summer and fall months of 1990-2003 reveal that leatherbacks forage off central California, generally at the end of the summer, when upwelling relaxes and sea surface temperatures increase. Leatherbacks were most often spotted off Point Reyes, south of Point Arena, in the Gulf of the Farallon, and in Monterey Bay. These areas are upwelling "shadows," regions where larval fish, crabs, and jellyfish are retained in the upper water column during relaxation of upwelling. Researchers estimated an average of 178 leatherbacks (CV=0.15) were present between the coast and roughly the 50 fathom isobath off California. Abundance over the study period was variable between years, ranging from an estimated 20 leatherbacks (1995) to 366 leatherbacks (1990) (Benson *et al.* 2007a). Other observed areas of summer leatherback concentration include northern California and the waters off Washington through northern Oregon, offshore from the Columbia River plume. Seasonal abundance of prey due to upwelling relaxations appear to attract foraging leatherbacks to central California and other areas on the west coast. For example, in 2003 and 2005, females tagged at Jamursba-Medi were observed heading north into waters off Washington and British Columbia, Canada. These two turtles, one each year, were recorded within 50 km and 220 km within shore (http://las.pfeg.noaa.gov/TOPP/TOPP_tracks.html, accessed August 9, 2006). Further, in 2006, no leatherback sea turtles were observed in the waters around Monterey Bay, where leatherbacks have been tracked and satellite tagged by the SWC since 2000 (leatherbacks commonly use central California as an area for summer foraging). No leatherback foraging habitat studies have been conducted across the U.S. west coast, however, stranding data and satellite tagging suggest that leatherbacks utilize a wide range of the waters off the US West Coast. Leatherbacks originating from the eastern Pacific have not been tracked moving into the water off the U.S. West Coast; tracks from turtles with attached satellite tags indicate that post-nesting, leatherbacks at Mexican and Costa Rican beaches all move south and southwest, away from the U.S. West Coast.

The leatherback life cycle is broken into seven stages (1) egg/hatchling; (2) neonate; (3) warm water juvenile, (4) cool water juvenile, (5) immature, (6) sub-adult, and (7) adult. Unlike most other sea turtle species, sexual maturity occurs relatively early for leatherbacks. Using a small sample size of leatherback sclerotic ossicles, analysis by Zug and Parham (1996) suggested that mean age at sexual maturity for leatherback turtles is around 13 to 14 years, giving them the highest juvenile growth rate of all sea turtle species. Zug and Parham (1996) concluded that for conservation and management purposes, 9 years is a likely minimum age for maturity of leatherback turtles, based on the youngest adult in their sample. A presentation at the 27th

Annual Symposium on Sea Turtle Biology and Conservation reported the findings of skeletochronological analysis of leatherbacks in the Western North Atlantic suggesting that animals within this population do not reach reproductive maturity until 29 (95% CI 26-32) years old (Avens and Goshe 2007). Because sampling of Pacific leatherbacks has not occurred as part of the work presented, the estimates in Zug and Parham (1996) are considered the most appropriate for Pacific leatherbacks by the lead researcher on the Atlantic leatherback study (Larisa Avens, NMFS, personal communication, July 2007). The natural longevity of leatherback turtles has not been determined (NMFS and USFWS 1998), although there are recorded documentations of post-maturation survival on the order of about 20 years (Pritchard 1996).

Adult and sub-adult female leatherbacks have been observed migrating long distances between foraging and breeding grounds, at intervals of typically two or four years (García and Sarti 2000, Benson *et al.* 2007c). Spotila *et al.* (2000), found the mean re-nesting interval of females on Playa Grande, Costa Rica to be 3.7 years, while in Mexico, 3 years was the typical reported interval (L. Sarti, Universidad Naçional Autonoma de Mexico (UNAM), personal communication, 2000). Leatherbacks in the western Pacific nesting aggregations may have a re-migration interval of approximately 2.5 years, consistent with Atlantic and Caribbean leatherbacks, although at this time there is insufficient information to state this with certainty (P. Dutton, NMFS, personal communication, April, 2006). Determining more precisely the re-migration interval for western Pacific leatherbacks is key to estimating the nesting population (which is used to monitor trends in the population). The migratory patterns of males are poorly understood. Males have been observed taken in commercial fisheries in the north Pacific. Males have also been captured in the study being carried out by the SWFSC in the waters off central California.

The distribution of juvenile leatherback turtles has long been a mystery. However, compilation and analysis of sighting and stranding data for the species has provided some insight into the developmental habitats of this species at earlier life stages. It appears that young leatherback turtles (carapace length <100 cm) reside only in waters warmer than 26°C (Eckert 1999b; Eckert 2002), which should generally place them outside of areas in which SSLL EFP gear will operate under the proposed action. This is consistent with observer records of adult and sub-adult leatherbacks being entangled in DGN gear within the proposed action area.

Because leatherback turtles spend most of their lives in pelagic environments, it is very difficult to gather the basic information on their abundance, life history and ecology, and pelagic distribution. The data that are available suggest that leatherback turtles follow patterns that are similar to other long-lived species that delay the age at which they become mature (Chaloupka 2001, 2002; Crouse 1999; Heppell *et al.*. 1999; Spotila *et al.* 1996, 2000). That is, leatherback turtles can be expected to have low and variable survival in the egg and hatchling stages and high and relatively constant annual survival in the subadult and adult life stages (Heppell *et al.* 2003 *in* Lutz *et al.* 2003).

In addition, growth rates of leatherback turtle populations are probably more sensitive to changes in the survival rate of juvenile, sub-adult, and adult turtles than other stages. As a result, the survival rate of reproductive adults, sub-adults, and juvenile leatherback turtles will largely determine the growth, decline, or maintenance of the population (Crouse 1999; Heppell *et al.* 1999, 2003; Spotila *et al.* 1996, 2000). Conversely, the population's rates of increase or decrease would be relatively insensitive to changes in the survival rates of eggs or hatchlings; this does not imply that other life stages can be disregarded, but does imply that the species has evolved to withstand low survival rates at these stages as well as large amounts of year-to-year variation (Heppell *et al.*. 2003 *in* Lutz *et al.* 2003). However, the importance of nest protection and increases in hatchling production should not be dismissed. In the Caribbean, long-term studies of female leatherbacks on Sandy Point, St. Croix, U.S. Virgin Islands, indicate an increase in the number of nesters of approximately 13% annually since the early 1990s. Aggressive beach protection actions and egg relocation (resulting in higher egg success rates) appear to be the drivers of the increasing leatherbacks (Dutton *et al.* 2005). Similarly, nesting site protection (including limiting or eliminating hunting on nesting beaches, collection of eggs, and egg relocation) has been credited as a contributing factor in the observed increases of green turtles in Tortuguero, Costa Rica (Troeng and Rankin 2005) and Hawaii (Balazs and Chaloupka 2004). Nest protection and increasing the number of hatchlings have been identified as key elements for the survival and recovery of western Pacific leatherbacks (Bellagio 2004)

Finally, like other sea turtles, female leatherbacks exhibit nesting site fidelity. However, unlike hard shelled species which appear to return to the same beach throughout their lives for nesting, leatherbacks appear to have a large home range and may nest at more than one beach in a single season (Lutz *et al.* 2003). This has been observed in the western Pacific, one female observed on Jamursba-Medi was observed nesting on Wermon a few weeks later (Benson *et al.* 2007c). There is insufficient information on the internesting behavior and distribution of female leatherbacks, particularly in the western Pacific, to determine whether it is reasonable to state that once a nesting aggregation declines to a few individuals or becomes extinct, it will not be "rescued" by adult females from other nesting aggregations. However, given the genetic isolation and observed differences in behavior, it may be appropriate to state that loss of a geographical population (e.g., Malaysian leatherbacks) is final and irreversible. Also, different leatherback populations exhibit different nesting timing. Timing of nesting, at least in the western Pacific, appears to be tied to available nesting habitat. Monsoons and severe weather make certain beaches unavailable at different times of the year.

As described above, due to the pelagic nature of leatherbacks, information on populations and trends of various populations is based upon counts of females when they come onshore to nest. As a result, it is difficult to estimate the total population including the number of males within a population or the age-structure of the population. Leatherbacks are identified by the nesting beaches used by adult and sub-adult females. The following sections provide status information for various populations of leatherbacks based upon the available information.

b. Population status and trends

The leatherback turtle is listed as endangered under the ESA throughout its global range. Increases in the number of nesting females have been noted at some sites in the Atlantic, but these are far outweighed by local extinctions, especially of island populations, and the demise of once large populations throughout the Pacific, such as in Malaysia and Mexico. Spotila *et al.* (1996) estimated the global population of female leatherback turtles to be only 34,500 (confidence limits: 26,200 to 42,900) nesting females; however, the eastern Pacific population has continued to decline since that estimate, leading some researchers to conclude that the eastern Pacific leatherback may now on the verge of extinction in the Pacific Ocean (e.g., Spotila *et al.* 1996; Spotila, *et al.*, 2000). However, the status of Western Pacific leatherbacks appears to be less dire. Recently published estimates of breeding females suggest that the Western Pacific population is 2,700 to 4,500 (Dutton *et al.* 2007). This number is substantially higher than the population estimate of 1,775 to 1,900 Western Pacific breeding females published in 2000 (Spotila 2000). The larger population is due to adding in the number of nesting females from beaches that were not previously included in population estimates. The authors caution that their estimate of adult nesting females should not be viewed as a population estimate due to uncertainties in the basic information needed to develop population level estimates from nesting counts; this includes a lack of information on the number of nests laid per female in the region and uncertainties associated with the nest counts themselves. The author suggest improved monitoring of the region, including aerial surveys to identify nesting sites, is needed before estimates of the total Western Pacific population can be made with confidence.

Leatherback turtles are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, and Indian Oceans, the Caribbean Sea, and the Gulf of Mexico (Ernst and Barbour 1972). Globally, leatherback turtle populations have been decimated worldwide. In 1980, the leatherback population was estimated at approximately 115,000 (adult females) globally (Pritchard 1982). However, this number should be viewed with caution since it was based in part upon a one year aerial survey of Mexican nesting beaches in 1980, which may have had an unusually high nesters (Pritchard 1996). The 1980 survey did record the killing of females on the beaches and removal of eggs from the nests – two factors that could have decimated the populations (Pritchard 1996). By 1995, this global population of adult females was estimated to be 34,500 (Spotila *et al.* 1996). Populations have been observed to have declined in Mexico, Costa Rica, Malaysia, India, Sri Lanka, Thailand, Trinidad, Tobago, and Papua New Guinea. Throughout the Pacific, leatherbacks have declined over the past three decades at all observed major nesting beaches. The decline can be attributed to many factors, including fisheries interactions, direct harvest, egg collection, and degradation of habitat. On some beaches, nearly 100% of the eggs laid have been harvested. Eckert (1996) and Spotila *et al.* (1996) note that adult mortality is likely to have increased from the 1980's to the 1990's as a result of driftnet and longline fisheries. However, the ban on large-scale drift gillnets in 1992 likely reduced the level of bycatch. Further, U.S. shallow set longline fisheries on the Pacific high seas have implemented gear restrictions that have been shown to reduce the level of sea turtle bycatch and mortalities (Gilman *et al* 2006). Similar regulations have been implemented in the U.S. Atlantic pelagic longline fisheries to protect turtles. In additional, numerous countries in the Pacific are either experimenting with modified gear (e.g., circle hooks) or have implemented this gear type in their fisheries in order to reduce sea turtle bycatch and mortality. (Read 2007).

<u>Atlantic Ocean/Caribbean Sea</u>
In the Atlantic and Caribbean, the largest nesting assemblages of leatherbacks are found in the U.S. Virgin Islands, Puerto Rico, and Florida. Since the early 1980s, nesting data has been collected at these locations. Of the six major management units (units are based upon the geographical range of the nesters), five of the six showed a positive population growth trend,

only the western Caribbean nesting population did not show a positive population trend (TEWG 2007). Despite these encouraging trends, it is certain that some nesting populations (*e.g.*, St. John and St. Thomas, U.S. Virgin Islands) have been extirpated (NMFS and USFWS 1995). The largest leatherback nesting site in the western North Atlantic remains along the northern coast of South America in French Guiana and Suriname. An overall trend in the population is difficult to assess, but based upon a recent population of 20,000 to 56,000 adult females (TEWG 2007), the Atlantic leatherback population is in much better condition than the Pacific leatherbacks. Leatherbacks are exposed to commercial fisheries in many areas of the Atlantic Ocean and it is estimated that hundreds die annually in nets. Recent satellite tagging work in the eastern Atlantic indicates that post-nesting females travel in a number of different area in the Atlantic, with some individuals making pan-oceanic movements from nesting beaches in the Caribbean and French Guiana to the waters off Africa, others travel into the central north Atlantic, and others move into the waters of the U.S. East Coast (Hays *et al.* 2004; Ferraroli *et al.* 2004) In some countries, females are killed for their meat when they come ashore to nest.

Indian Ocean

Surveys conducted during 2000-01 at the Nicobar Islands provided an estimate of approximately 845 nesting females on Great Nicobar Island and a minimum of 82 females on Little Nicobar Island. Andrews *et al.* (2001) (*in* Andrews and Shanker 2002) estimated approximately 150 nesting females on the Andaman Islands and other Nicobar islands. Threats include egg predation by feral dogs and pigs and occasional predation on adults by saltwater crocodiles (Andrews and Shanker 2002). In Sri Lanka, Godawaya beach hosts the largest nesting population of leatherbacks in the country. In 2001, an estimated 170 adult females comprised the nesting population in this area; however, only 2 females nested in 2005. The 2004 tsunami may be partly responsible for this low nesting, since much sand erosion occurred. Other nesting beaches have not been adequately monitored to estimate leatherback nesting populations. Threats to leatherbacks in this area include killing of adults for meat, illegal poaching of eggs, beach erosion, fisheries bycatch (431 leatherbacks estimated entangled, based on a survey of turtle bycatch conducted between 1999 and 2000), habitat loss due to tourism, and natural predators (feral dogs, jackals, wild boars, mongooses, ants, and crabs) (Kapurusinghe 2006).

Pacific Ocean

There are two major population groups within the Pacific leatherback population, the eastern and western Pacific. These populations are distinguished by the areas in which the females nest and can be identified genetically.

Eastern Pacific

Leatherback nesting populations are declining at a rapid rate along the Pacific coast of Mexico and Costa Rica. Three countries which are important to leatherbacks nesting in the eastern Pacific are Costa Rica, which has the highest abundance and density in this area, Mexico, with several important nesting beaches, and Nicaragua, with two important nesting areas. Leatherbacks have been documented nesting as far north as Baja California Sur, Mexico and as far south as Panama, with few areas of high nesting (Sarti 2002). Detailed descriptions of this population can be found in the 2004 HMS FMP opinion. That information is summarized briefly here with latest information provided as available.

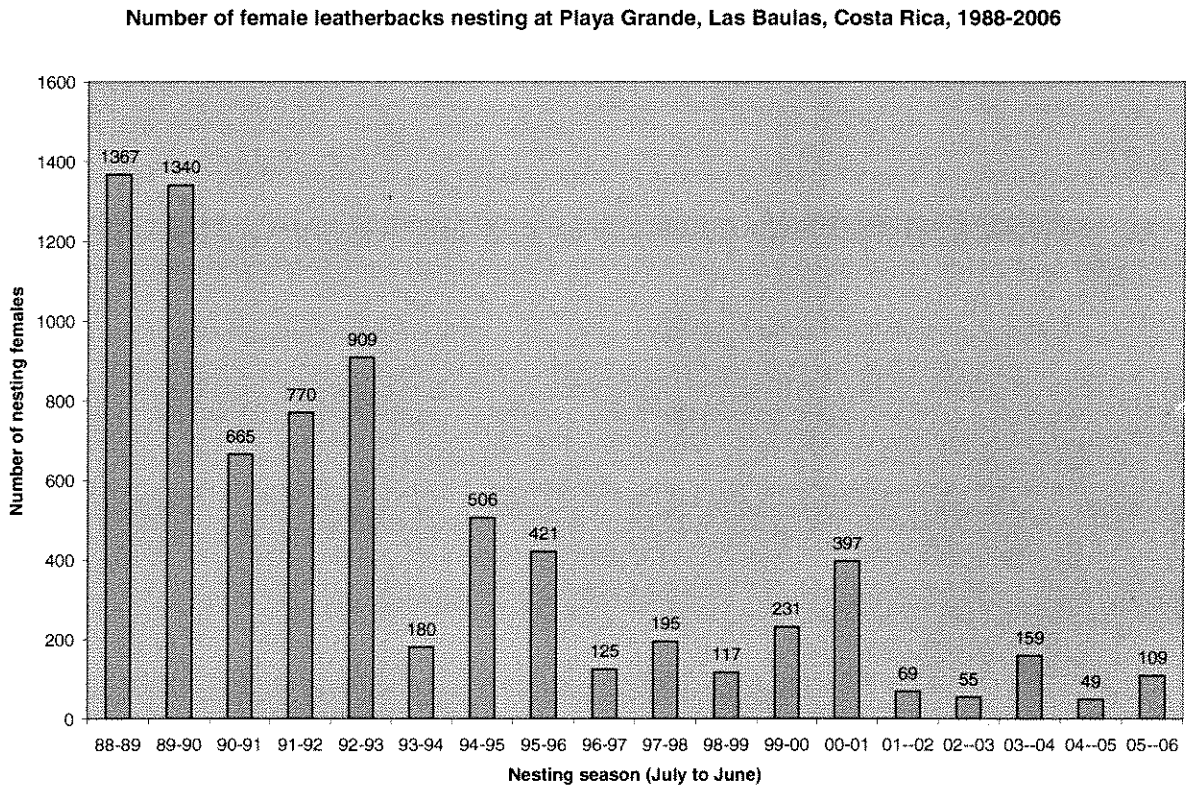
Satellite tagged post nesting females at Mexiquillo Beach, Mexico and Costa Rica, the two major nesting sites of eastern Pacific leatherbacks, indicate that animals followed precisely defined, long-distance migratory pathways, moving into fishing grounds of large commercial gillnet fishing fleets south of the equator (Eckert 1997; Morreale *et al.* (1994)). Most of these eastern Pacific nesting stocks migrate south, although a genetic sample from one leatherback turtle caught south of the main Hawaiian Islands by the Hawaii-based longline fishery indicated that the animal was from the eastern Pacific population (P. Dutton, NMFS, personal communication, October 2002).

Although the causes of the decline in the eastern Pacific nesting populations are not entirely clear, Sarti *et al.* (1998) surmises that the decline could be a result of intensive egg poaching on the nesting beaches, incidental capture of adults or juveniles in high seas and artisanal fisheries, and natural fluctuations due to changing environmental conditions, however, one recent hypothesis on the lack of recovery of this population focuses on their at-sea movements. As described above, eastern Pacific leatherbacks show little variation in their post-nesting movements, with all turtles traveling in the same direction at virtually the same time. The eastern Pacific foraging areas often have low productivity due to El Niño events (Dutton 2006). By comparison, Atlantic leatherbacks in the Caribbean and western Pacific leatherbacks utilize a variety of foraging areas post-nesting, which may buffer the population from anthropogenic impacts (e.g., fisheries) and natural perturbations (Dutton 2006). The lack of diverse foraging strategies may be part of the reason that protections on eastern Pacific nesting beaches have not been as successful as those carried out in the Caribbean (Dutton *et al.* 2005). Some eastern Pacific leatherbacks are also believed to experience a level of at-sea incidental mortality that is keeping the population suppressed despite years of conservation actions on the beaches, although the increases in hatching success is credited with maintaining the population and slowing its decline (Santidrian-Tomillo *et al.* 2007).

Costa Rica

The number of nesters has declined substantially at Playa Grande, Las Baulas, Costa Rica and has been highly variable the past two decades. These trends are likely due to high female mortalities between breeding intervals (Spotila 2000) and high embryonic death and low hatchling success in this population (Bell *et al.* 2003). There have been anecdotal reports of leatherbacks nesting at Playa Caletas and Playa Coyote. Leatherbacks also nest in small numbers on the Osa Peninsula (Bedoya and Nahill 2005).

Figure 3. Number of female leatherbacks nesting at Playa Grande (Las Baulas, Costa Rica) from 1988-2006. (Source: R. Reina and P. Tomillo, Drexel University, personal communications, 2003-2006).



Mexico

The decline of the eastern Pacific leatherback subpopulations is even more dramatic off the Pacific coast of Mexico. One survey was conducted in 1980 that suggested an eastern Pacific Mexican population of adult female leatherback turtles of approximately 70,000[2] (Pritchard 1982, *in* Spotila *et al.*. 1996). If this survey is indeed representative of the population in the early 1980s, then the population suffered a significant decline through the early 2000s. Since the very low nestings in 2001-2003, there has been a positive trend in the population, which could be due to increased conservation efforts both at sea and on the nesting beaches (García *et al.* 2004)

[2]This estimate of 70,000 adult female leatherback turtles comes from a brief aerial survey of beaches by Pritchard (1982), who has commented: "I probably chanced to hit an unusually good nesting year during my 1980 flight along the Mexican Pacific coast, the population estimates derived from which (Pritchard, 1982b) have possibly been used as baseline data for subsequent estimates to a greater degree than the quality of the data would justify" (Pritchard, 1996).

Table 4. Annual number of estimated leatherback nestings (# nests) from 2000-2005 on index beaches and total nesting beaches.

Index beach	2000-01	2001-02[1]	2002-03[2]	2003-04[3]	2004-05[4]	2005-06[4]
Primary Nesting Beaches (40-50% of total nesting activity)						
Mexiquillo	624	20	36	528	42	190*
Tierra Colorada	535	49	8	532	57	292*
Cahuitan	539	52	73	349	31	230*
Barra de la Cruz	146	67	3	275	28	121*
Total - primary index beaches	**1,957**	**188**	**120**	**1,684**	**158**	**833***
Total - Mexican Pacific	**4,513**	**658**	**n/a**	**4,045**	**n/a**	**n/a**

[1]Source: Sarti, pers. comm, March, 2002 – index beaches; Sarti *et al.*, 2002 for totals;
[2]Source: Sarti, pers. comm, December, 2003 – index beaches, totals.
[3]Source: García *et al.* 2004.
[4]Source: Sarti, pers. comm., May, 2006 [*note that these numbers are preliminary]

Most conservation programs aimed at protecting nesting sea turtles in Mexico have continued since the early 1980s. Since protective measures have been in place, particularly emergency measures recommended by a joint U.S./Mexico leatherback working group meeting in 1999, there has been greater nest protection and nest success.

Very limited leatherback nesting has also been observed in Nicaragua and Guatemala. In both countries, poaching of nests is substantial thus few hatchlings are believed to be contributing to the eastern Pacific population.

Western Pacific

Satellite tagging and genetic sampling suggest that the leatherbacks found in the proposed action area are likely western Pacific leatherbacks. This is based upon satellite tags of turtles in the western and eastern Pacific and leatherback samples, either from the SWFSC tagging program in central California or samples from observers in the DGN fishery, which were all were determined to be from the western Pacific aggregation (Peter Dutton, SWC, personal communication, August 2006). Only one eastern Pacific leatherback has been identified from genetic samples from fishery observers; it was in the Hawaii longline fleet fishing south of the main Hawaiian Islands. This is consistent with satellite tagging data that suggests that there may be a seasonal feeding area in the central Pacific that both eastern and western Pacific leatherbacks utilize, particularly in the winter months. The weight of evidence suggests that any leatherbacks exposed to the SSLL gear used in the proposed action from September 1 through December 31 will be from the western Pacific population. Therefore, in the sections below, we focus our analysis and discussion on the western Pacific leatherback population and provide more data on recent trends in this population, as compared to the eastern Pacific leatherback population.

Similar to their eastern Pacific counterparts, leatherbacks originating from the western Pacific are also threatened by poaching of eggs, killing of nesting females, human encroachment on nesting beaches, incidental capture in fishing gear, beach erosion, and egg predation by animals. Less is known about the status and trends of the western Pacific leatherback nesting populations, but once major leatherback nesting assemblages are have declined, some to the point of extirpation.

In May, 2004, researchers, managers and tribal community members with extensive knowledge of local leatherback nesting beach populations and activities in Papua (Indonesia), Papua New Guinea, the Solomon Islands and Vanuatu assembled in Honolulu, Hawaii to identify nesting beach sites, and share abundance information based on monitoring and research, as well as anecdotal reports. Dutton *et al.* (2007) report that there may be 1,100 to 1,800 females nesting annually at 25 nesting sites in the western Pacific. Calculations using the same methods used by Spotila *et al.* (1996) yields a minimum total estimate of nesting females in this area of approximately 2,700 to 4,500 animals (taking into account an estimated re-nesting interval of 2.5 years, Spotila *et al.* (1996)). The actual re-nesting interval for western Pacific leatherbacks may vary from this estimate.

Malaysia

The decline of leatherback turtles is severe at one of the most significant nesting sites in the western Pacific region - Terengganu, Malaysia, with current nesting representing less than 2 percent of the levels recorded in the 1950s, and there are no signs of a population increase. In the 1960s, the leatherback turtles nesting on the beaches in Terengganu represented one of the largest remaining nesting aggregations for this species in the Pacific Ocean. Since then, the population has declined to a handful of individual, nesting females. The nesting population at this location has declined from 3,103 females estimated nesting in 1968 to 2 nesting females in 1994. The causes for the decline in this population include: many years of excessive egg harvest, egg poaching, the direct harvest of adults in this area. Incidental takes in fisheries that developed during the 1970's and 1980's likely helped fuel the population decline, particularly the high seas Japanese squid fishery and gillnets and pot fisheries near Terangganu (Chan and Liew 1996), A report published in 2006 by the United Nations Environmental Programme (UNEP) suggests that the Malaysia population is effectively extinct (www.bernama.com, accessed 8/14/06). Some scientists working within Malaysia dispute this, citing leatherback nests found annually, albeit at very low abundances in areas other than the sanctuary at Rantau Abang (e.g., five nests found in 2006) (http://www.malaysiakini.com/rentakini/55145; accessed 8/16/06). Conservation measures began in 1961 and focused on trying to increase the number of new recruits into the population through hatcheries. However, these efforts were largely ineffective due to poor hatchery practices and a very high proportion of females hatchlings (due to high incubation temperatures at hatcheries) (Chan and Liew 1996). Hatchery practices have been improved as of the late 1980's and additional conservation measures were implemented, including designation of the Rantau Abang Turtle Sanctuary and development of the Turtle Sanctuary Advisory Council in 1988 (Chan and Liew 1996). Despite fishing regulations to limit coastal fisheries and protection of some nesting beaches, only ten nests were counted in 2006, although a number of smaller nest sites are believed to exist in Malaysia. There is particular concern over the fate of this population because for the past six years, hatcheries have had low to zero hatching success (www.bernama.com, accessed 8/14/06). This may be due to the lack of males in the population available to fertilize eggs.

Western Pacific and eastern Pacific leatherbacks can be identified through genetic markers. All leatherbacks captured off central California (n=40) have been found to originate from western Pacific nesting beaches, based on genetic analyses (P. Dutton, NMFS, personal communication, 2006). The Malaysian nesting population, a portion of the western Pacific population, has unique genetic markers and none were identified in the leatherbacks sampled. This may be related to the extremely small extent nesting population; only two to ten females have been recorded nesting at Terengganu since 1994.

Indonesia

In Indonesia, leatherbacks have been protected since 1978 and low density nesting occurs along western Sumatra (200 females nesting annually) and in southeastern Java (50 females nesting annually), although these estimates are from the early 1980s (*in* Suarez and Starbird, 1996a; Dermawan 2002). Nesting beaches in East Java are monitored generally by National Park officers; there is sporadic low nesting on Suka Made (Meru Betiri National Park) and higher levels of nesting at Alas Purwo National Park (~4,500 eggs laid in 2000) (Adnyana 2006).

The largest leatherback rookery is at the north coast of Papua. Leatherback nesting generally takes place on two major beaches, located 30 km apart, on the north Vogelkop coast of the State of Papua: Jamursba-Medi (18 km) and Wermon beach (6 km) (Starbird and Suarez 1994; Hitipeuw *et al.* 2007). Declines in annual nests largely due to commercial exploitation of eggs led to beach protections being implemented in 1992. No clear trend in the population since 1993 can be detected from the available information; however, it is clear from discussions with locals that the number of leatherbacks observed nestings at these beaches has declined substantially since the 1970s and 1980s.

Leatherbacks nest on Jamursba-Medi during April through September, with a peak in June, July and August (Suarez *et al.* 2000; Hitipeuw *et al.* 2007. A summary of data collected from leatherback nesting surveys from 1981 to 2005 for Jamursba-Medi has been compiled, re-analyzed, and standardized and is shown in Table 5 (Hitipeuw and Maturbongs 2002; Hitipeuw 2003b; Hitipeuw *et al.* 2007).

Table 5. **Estimated numbers of female leatherback turtles nesting on Jamursba-Medi Beach, along the north coast of the State of Papua (Summarized by Hitipeuw and Maturbongs, 2002 and Hitipeuw, 2003b; Hitipeuw *et al.* 2007)**

Survey Period	# of Nests	Adjusted # Nests	Estimated # of Females[3]
Jamursba-Medi Beach:			
September, 1981	4,000+	7,143[1]	1,232 - 1,623
April - Oct. 1984	13,360	13,360	2,303 - 3,036
April - Oct. 1985	3,000	3,000	658 - 731
June - Sept. 1993	3,247	4,091[2]	705 - 930
June - Sept. 1994	3,298	4,155[2]	716 - 944
June - Sept. 1995	3,382	4,228[2]	729 - 961
June - Sept., 1996	5,058	6,373[2]	1,099 -- 1,448
May - Aug., 1997	4,001	4,481[4]	773 -- 1,018
May - Sept. 1999	2,983	3,251	560 – 739
April - Dec., 2000	2,264	No	390 – 514
March - Oct., 2001	3,056	No	527 – 695
March - Aug., 2002	1,865	1,921	331 – 437
March – Nov., 2003	3,601	2,904	621 – 818
March – Aug., 2004	3,183	3,871	667 – 879
April – Sept., 2005	2,666	2,562	441 - 582

[1]The total number of nests reported during aerial surveys was adjusted to account for loss of nests prior to the survey. Based on data from other surveys on Jamursba-Medi, on average 44% of all nests are lost by the end of August.
[2]The total number of nests have been adjusted based on data from Bhaskar's surveys from 1984-85 from which it was determined that 26% of the total number of nests laid during the season (4/1-10/1) are laid between April and May.
[3]Based on Bhaskar's tagging data, an average number of nests laid by leatherback turtles on Jamursba-Medi in 1985 was 4.4 nests per female. This is consistent with estimates for the average number of nests by leatherback turtles during a season on beaches in Pacific Mexico, which range from 4.4 to 5.8 nests per female . The range of the number of females is estimated using these data.
[4]Number adjusted from Bhaskar (1984), where percentage of nests laid in April and September is 9% and 3%, respectively, of the total nests laid during the season.

Nesting of leatherbacks on Wermon beach primarily takes place during the austral summer, but occurs throughout the year, from October through September, with a peak in December through March (Thebu and Hitipeuw 2005). In recent years, the beach has been monitored during much of the nesting season, including the peak period, and researchers have documented approximately 2,000 – 3,000 nests per year (Thebu and Hitipeuw 2005; Hitipeuw *et al.* 2007), which may equate to several hundred females nesting per year (given 4.4 to 5.8 nests per female). Given shorter monitoring periods in past studies, it is difficult to analyze any trends for this nesting beach (see Table 5).

Table 6. Number of leatherback turtle nests observed along Wermon Beach

Monitoring Period	# nests	Source
Nov. 23-Dec. 20, 1984 and Jan. 1-24, 1985	1,012	Starbird and Suárez, 1994; Suárez *et al.*, 2000
Dec. 6-22, 1993	406	Starbird and Suárez, 1994; Suárez *et al.*, 2000
Nov., 2002 - June, 2003	1,442	Hitipeuw, 2003b
Nov., 2003 – Sept., 2004	2,881	Thebu and Hitipeuw, 2005
Oct. 2004 – Sept. 2005	1,980	Hitipeuw, WWF, pers. comm., 2006

The leatherback turtles nesting on the beaches in the State of Papua represent one of the largest remaining nesting aggregations for this species in the Pacific Ocean. The nesting aggregation appears to be relatively large and has fluctuated between 400 and 1,000 individuals annually throughout most of the 1990s and early 2000s although there is insufficient data available to determine if the population growth is positive, negative, or stable.

Recently, attention at these nesting beaches has turned to a study of hatchling success. In 2005 a pilot study was conducted to quantify hatchling success at four primary nesting beaches, three at Jamursba-Medi and one at Wermon. Hatchling success at the three beaches of Jamursba-Medi was significantly lower than at Wermon, 25.5% (SD = 32%, range = 0% - 85%) n=48 and 47.1% (SD = 23.6%, range = 3.8% - 100%) n = 52, respectively (Tapilatu and Tiwari 2007). The mean hatching success rates for the individual beaches of Jamursba-Medi in 2005 were calculated to be the following: Wembrak: 9.2%, Batu-Rumah: 44.7%, and Warmamedi: 31.4% (Tapilatu and Tiwari 2007). High rates of tidal inundation, animal predation, and possible temperature effects were cited as likely causes for the low hatchling success (Tapilatu and Tiwari 2007). Low hatching success among leatherbacks in other areas has been documented in the past (Bell *et al.* 2003) and reliable data on the past hatching success in Indonesia is not available. The results from 2005 and 2006 nesting seasons at these two sites point to the need for further research to understand the variables affecting hatching success. The need for long-term stable funding to, among other objectives, protect nesting sites and potentially develop hatcheries to improve hatchling success in the Western Pacific, was one of the key recommendations of the recent Bellagio Sea Turtle Conservation Initiative meeting held in Terengganu, Malaysia, July 17-20, 2007.

<u>Papua New Guinea</u>

In Papua New Guinea, leatherbacks nest primarily along the coast of the Morobe Province, mostly between November and March, with a peak of nesting in December. Researchers are analyzing all known data to determine status and trends. Aerial surveys in Papua New Guinea have been flown for the last three years (2004-2006) during the peak of the leatherback nesting season (January). Results from the January, 2005 survey estimated 1,195 leatherback nests in an area covering 2,692 kilometers of coastline, including the Madang, Morobe and Oro provinces (north coast of mainland PNG), New Britain, Bougainville, Buka, and the southwestern coast of New Ireland (Benson *et al.* 2007c).

Solomon Islands

In the Solomon Islands, the rookery size has been estimated to be less than 100 females nesting per year (D. Broderick, personal communication, *in* Dutton, *et al.* 1999); however recent reports indicate considerable scattered nesting around the islands and that there may be on the order of hundreds of females, rather than tens of females (Dutton *et al.* 2007).

Vanuatu

Leatherbacks have been reported nesting on some of the over 80 islands in Vanuatu. Because this country consists of many remote islands, there is still much to be learned regarding the importance of the beaches of Vanuatu to western Pacific leatherbacks. Currently, Epi Island has the largest number of nests, with approximately 20-30 nesting females on the southwestern beaches and a smaller number on the east coast. There is scattered nesting on the other islands, based on survey data and anecdotal reports.

There is also very limited leatherback nesting activity in Viet Nam, Thailand, Fiji, and Australia.

While the trend of leatherback nestings on western Pacific beaches has not shown the precipitous collapse that has been observed on the eastern Pacific nesting beaches, there are obviously fewer females nesting than were observed in the early to mid-1980s. Nesting beach conservation programs have been established in a number of countries, such measures include bans on egg collection, reduction of egg predation, and protection of the nesting beach from coastal development. Efforts have also been made to reduce the harvest of subadult and adult leatherbacks, and many Pacific Rim countries have worked hard in recent years to reduce bycatch of leatherbacks in their fisheries, and improve survival. These sustained efforts may help to reverse or slow any declining trend, but there likely needs to be more effort to understand and address all threats to this population, if feasible. The impact of coastal artisanal fisheries on leatherbacks is largely unknown, and global climate change, pollution, and marine debris may also be impacting the population. Continued monitoring, protection and research of these nesting populations throughout its range will be necessary to ensure its recovery.

c. Factors affecting leatherbacks

Nesting aggregations of leatherbacks that may interact with the SSLL EFP have been declining over time. These population declines are primarily the result of a wide variety of human activities, including legal harvests and illegal poaching of adults, immatures, and eggs; incidental capture in fisheries (coastal and high-seas); and loss and degradation of nesting and foraging habitat as a result of coastal development, including predation by domestic dogs and pigs foraging on nesting beaches associated with human settlement and commercial development of coastal areas (Heppell *et al.* 2003a, Lutcavage *et al.* 1997). Increased environmental contaminants (e.g. sewage, industrial discharge) and marine debris, which adversely impact nearshore ecosystems that turtles depend on for food and shelter, including sea grass and coral reef communities, also contribute to the overall decline. In addition to anthropogenic factors, natural threats to nesting beaches and marine habitats such as coastal erosion, seasonal storms, predators, temperature variations, and phenomena such as El Niño also affect the survival and recovery of leatherback populations. More information on the status of leatherbacks along with an assessment of overall impacts are found in this section as well as the Pacific Sea Turtle Recovery Plans (NMFS and USFWS 1998a), NMFS and USFWS five year review (NMFS/USFWS 2007), and are reviewed extensively in Eckert (1993). While turtle biologists and others generally accept that these factors are the primary cause of leatherback population declines, the limited amount of quantitative data on the risks posed by these different activities makes it difficult to rank the absolute risks these different activities pose to leatherbacks.

Leatherback sea turtles are highly migratory, which makes them susceptible to being incidentally caught by fisheries operating throughout the Pacific Ocean. The following section details fisheries, outside the action area, that are known to interact with Pacific leatherbacks.

1. Fisheries impacts

A number of U.S. fisheries outside the proposed action area are known to entangle and kill leatherbacks. All of these have undergone ESA section 7 consultations.

a. The DGN fishery

The DGN fishery operates outside the leatherback conservation area, primarily south of Point Conception. Participation has declined from 78 active vessels in 2000 to 39 in 2005 (the number of CDFG permits has declined from 127 in 2000 to 96 in 2005). There is no opportunity for growth in this fishery, as it is a limited entry fishery. Permits may be transferred but only under strict guidelines administered through CDFG that ensure no increase in permit holders. The number of sets made in 2001 was 1,665, in 2004, 1,084 sets were made. Using a five year average, it is expected that 1,463 sets will be made in the DGN fishery during the 2007-2008 fishing year (April through March). This fishery is observed at approximately 20% annually.

The DGN fishery typically begins in late May and continues through the end of January, although 90 percent of the fishing effort typically occurs from mid-August to the end of December. Effort in the fishery is initially concentrated in the southern portion of the fishing grounds, historically expanding to its full range by October before retreating back to the south because of the dissipation of oceanographic water temperature breaks caused by storm systems moving down from the north. However, the majority of fishing effort is concentrated south of Pt. Conception due to the current leatherback closure limitations. Some limited effort does take place to the south and west of the closure, in international waters off of Mexico and the U.S. EEZs, and north of the closure.

Vessel size in the DGN fishery currently ranges from 30–85 ft, with 60 percent of the vessels less than 50 ft in total length. Fishers use nets constructed from 3-strand twisted nylon, tied to form meshes that range from 16 to 22 inches stretched, and average 19 inches stretched. The depth of a drift gillnet is measured in meshes. They usually range from 95 to 155 meshes deep with the majority between 125 and 140 meshes deep. Nets are hung with the apex of the square meshes oriented vertically. Although termed "gillnets," the nets actually entangle fish, rather than trap them by the gills. Nets are also size selective; large fish such as swordfish get entangled while smaller fish pass through the mesh. Net length ranges from 4,500 ft to 6,000 ft and averages 5,760 ft and net depth ranges from 145 ft to 165 ft and averages 150 ft. The top of the net is attached to a float line and the bottom to a weighted lead line.

The 2004 opinion includes an ITS of three leatherbacks taken annually in the DGN fishery, of which two are likely to be killed. There have been no observed takes of leatherbacks in the DGN fishery since the leatherback conservation area closure was put in place in 2001.

b. Hawaii pelagics fisheries

In 2004, the Hawaii based shallow longline fishery was re-opened under strict sea turtle mitigation measures and caps on the levels of take and mortalities of loggerhead and leatherback sea turtles. In 2004 and 2005, the fishing year was completed without reaching the turtle caps. However, in 2006, an unexpected high level of loggerhead takes occurred, forcing the fishery to be shut down on March 20, 2006 (see Table 7). At the time of its closure, the Hawaii based shallow set longline fishery had taken one leatherback sea turtle, which was released alive.

Table 7. Leatherback and loggerhead turtle interactions in the shallow-set Hawaii-based longline fishery

	Observer coverage	Leatherbacks	Loggerheads
Annual limits		*16*	*17*
Interactions in 2007*	100%	5	15
Interactions in 2006	100%	1	17**
Interactions in 2005	100%	8	12
Interactions in 2004	100%	1	1

*As of October 1, 2007
**Fishery was closed on March 20, 2006 when it reached the 2006 annual limit for loggerhead takes.

The Hawaii based deep-set fishery has been observed taking ESA listed species, including leatherbacks and other sea turtles. Interaction numbers are given in Table 8.

Table 8. ESA listed species interactions in the Hawaii-based deep-set longline fishery targeting tuna

	Observer coverage	Leatherbacks	Other species
Interactions in 2007*	7.0%	1	2 – olive ridleys 1 - loggerhead
Interactions in 2006	21.2%	2	2 - green sea turtles 11 - olive ridleys
Interactions in 2005	26.1%	1	4 – olive ridley sea turtles
Interactions in 2004	24.6%	3	13 – olive ridley sea turtles 1 – green sea turtle

*As of October 16, 2007

Since October 2003, the Hawaii-based bottomfish fishery has been monitored under a mandatory observer program administered through the Pacific Islands Regional Office. Observer coverage in 2004 was 18.3% and in 2005 it was 25.0%. No ESA listed sea turtles or marine mammals were observed taken in this fishery. There are no observers in the Hawaii handline, pole, or troll fisheries and no data on turtle interactions, however the 2004 ITS for this component of the fishery is one leatherback take. An observer program commenced in 2006 for the American Samoa based longline fishery, 3 green turtles were observed (8.1% coverage) all dead. No other sea turtle species were observed taken.

For most of fishing fleets throughout the world, little or no data exists regarding the incidental take of leatherbacks or other ESA listed species. Without such information, it is difficult to assess the impacts of these fisheries on populations. Given their highly migratory behavior, leatherback turtles are the species under consideration in this opinion that are most likely to interact with fisheries on the high seas or foreign fisheries. Some limited bycatch information, including survival rates following entanglements, collected by observers and through fisher self-reporting does exist for some fisheries in the Pacific Ocean. The following sections present leatherback bycatch information for known fisheries, including some of which are likely to have significant impacts on sea turtle populations, simply due to the enormous amount of effort, the broad areas fished and the basic nature of the fishing strategy.

c. Longline fisheries in the western and central Pacific Ocean

The western and central Pacific Ocean (area west of 150°W longitude, and between 10°N and 45°S) contains the largest industrial tuna fisheries in the world. Much of the effort takes place in the EEZs of Pacific island countries, in the western tropical Pacific area (10°N - 10°S). Annual tuna catches in this area have averaged around 1.5 million metric tons, with around 60% of the catch taken by purse seine vessels, and the rest taken by longline vessels and other gears (e.g. pole-and-line, troll, ring-net).

The tuna fisheries are regulated by a number of international bodies and individual countries. The two main international regulatory bodies are the Inter-American Tropical Tuna Commission (IATTC) and the Western and Central Pacific Fisheries Commission. Both of these commissions have adopted management measures or resolutions designed to limit the amount of tuna fishing effort in the Pacific.

Approximately 5,000 commercial longliners operate throughout the western and central Pacific (45°N to 45°S), using up to 3,000 baited hooks per line to catch tuna. The proportion of the number of vessels originating from countries throughout the world have changed in the past decade and may consist of large freezer vessels that undertake long voyages and operate over large areas of the region to smaller domestically-based vessels operating in more tropical areas. The distant-water fleets operate throughout the western and central Pacific Ocean, targeting bigeye and yellowfin in tropical waters and albacore in the subtropical waters. Meanwhile, the offshore fleets generally fish in the tropical waters of the Federated States of Micronesia, Indonesia, Marshall Islands, Palau, and Solomon Islands and the adjacent international waters, where they will target bigeye and yellowfin tuna (Oceanic Fisheries Programme 2001).

Observers have been placed on both purse seiners and longliners in this area, and operate and report to the Oceanic Fisheries Programme of the Secretariat of the Pacific Community (SPC). Considering the low observer coverage (<1%) for the longline fisheries, patterns of observed interactions show that sea turtles are more likely to encounter gear in tropical waters and that they are much more likely (by an order of magnitude) to encounter gear that is shallow-set versus deep-set. When encountered on deep-set gear, sea turtles were likely to be taken on the shallowest hooks.

From available observer data, the longline fisheries operating in the western and central Pacific are estimated to take 2,182 sea turtles per year, with 500-600 expected to die as a result of the encounter (23-27% mortality rate). Based on the data, 1,490±376 turtles (0.06 turtles/1,000 hooks) are estimated taken by offshore/fresh tuna vessels using shallow-night sets, 129±79 turtles (0.007 turtles/1,000 hooks) are estimated taken by offshore/fresh tuna vessels on deep-day sets, and 564±345 turtles (0.007 turtles/1,000 hooks) are estimated taken by distant water freezer vessels on deep-day sets. The species observed taken include (ranked by highest occurrence first): olive ridley, green, leatherback, loggerhead and hawksbill. Given the low observer coverage, this estimate has very wide confidence intervals (Oceanic Fisheries Programme 2001).

Over the past several years, new gear technology has developed for longline fisheries that have been documented to reduce sea turtle bycatch and mortalities (Watson *et al.* 2005; Gilman et al 2006; Read 2007). It has been found that the use of 18/0 circle hooks with mackerel bait significantly reduce sea turtle interactions (65% to 90%) and the U.S. has implemented regulation to require the use of circle hooks in the Hawaii based shallowest longline fishery and the Atlantic pelagic longline fishery. Experiments on and use of this gear are being carried out by a number of countries fishing in the Pacific (Read 2007). It is believed that the adoption of modified gear in Pacific fisheries could substantial lower the impact of longline fisheries on sea turtles, including leatherbacks. The use of modified gear is required in the proposed action that is the subject of this biological opinion.

d. Australian longline fishery in and beyond the Australian Fishing Zone

Australia has two fisheries that target pelagic fish within and beyond its Australian Fishing Zone (AFZ) using longlines: (1) the Eastern Tuna and Billfish Fishery (ETBF), which extends along the east coast of Australia from Cape York, Queensland to the South Australia-Victorian border, targeting yellowfin tuna, bigeye tuna, and swordfish; and (2) the Southern and Western Tuna and Billfish Fishery (SWTBF), which extends from Cape York, Queensland across the northern coastline, down the western coastline of Western Australia and east to the South Australian-Victorian border, also targeting bigeye, yellowfin, and swordfish. Hooks are often set around sea mounts. Since Japanese longliners were denied access to fishing within the AFZ since 1997, both fleets have developed rapidly. In 2001, the ETBF consisted of approximately 150 active vessels, which deployed 11,250,000 hooks, while during that same year, the SWTBF consisted of 44 active vessels deploying 6,183,000 hooks. Both fisheries generally set shallow, at maximum depths of between 20 and 100 meters, although occasionally gear is set to depths greater than 150 meters (Robins *et al.* 2002a).

Sea turtle catch rate estimates in these two fisheries were calculated using data from skipper logbooks and interviews. Since 1997, Australian pelagic longline skippers have been required to log all sea turtle interactions. From 1997 to 2001, skippers logged a total of 272 turtles taken in both fisheries. Without verified catch data, however, it was difficult for researchers to determine the accuracy of the data. In 2001, skippers were interviewed regarding their sea turtle bycatch, and through these interviews, researchers determined that logbook data was likely inadequate, since very few fishers indicated that they had never caught sea turtles (Robins *et al.* 2002a).

Sea turtle catch rates and total turtle take by both fisheries were estimated from fisher interviews. The average sea turtle catch rate was 0.024 turtles/1,000 hooks, with a standard deviation of 0.027. Given this catch rate and the amount of effort in the fishery yields an estimated total of 402 sea turtles (95% confidence limits of 360 to 444) taken by the ETBF and SWTBF. Of the sea turtles identified to species, leatherbacks were most commonly reported as taken, with 66% in the ETBF and 90% in the SWTBF. However, 70% and 41% of all reported turtles were not reported to species in the ETBF and SWTBF, respectively. Therefore, these percentages may be underestimates. Because of the greater difficulties in identifying hard-shelled species, the proportion of other species composition in these fisheries was undeterminable (Robins *et al.*, 2002a).

e. *Japanese tuna longliners in the eastern tropical Pacific*

The most recent sea turtle bycatch information for Japanese tuna longliners is based on data collected during 2000. At a bycatch working group meeting of the IATTC, held in Kobe, Japan on January 14-16, 2004, a member of the Japanese delegation stated that based on preliminary data from 2000, the Japanese tuna longline fleet in the eastern tropical Pacific was estimated to take approximately 6,000 turtles, with 50 percent mortality. Little information on species composition was given; however, all species of Pacific sea turtles were taken, mostly olive ridleys, and of an estimated 166 leatherbacks taken, 25 were dead (Meeting Minutes, 4th Meeting of the Working Group on Bycatch, IATTC, January 14-16, 2004).

f. *Costa Rican longline fisheries*

Several studies have been undertaken in recent years in order to document the incidental capture of sea turtles in Costa Rican longline fisheries. The longline fleet consists of a "medium" artisanal fishery, which targets mahi mahi and tunas within the country's EEZ, and an "advanced" fleet, which targets billfish and tunas within and outside the EEZ.

Two studies in 1997 and 1998 on two longline fishing cruises (one experimental) documented a high incidental take of sea turtles. On one cruise east of the Galapagos Islands targeting billfish and shark (mean depth of 25-50 meters), a total of 34 turtles (55% olive ridleys and 45% east Pacific green turtles) were taken on two sets containing 1,750 hooks (19.43 turtles per 1,000 hooks). Mortality was 8.8%. One additional set caught two leatherbacks. The second cruise took place within the EEZ of Costa Rica and targeted billfish and mahi mahi. Researchers documented the incidental take of 26 olive ridleys, with 1,804 hooks deployed (14.4 turtles per 1,000 hooks). Mortality was 0%; however, of the turtles captured, 88.5% were hooked in the mouth (Arauz *et al.* 2000).

An observer program was put in place on advanced artisanal vessels from August, 1999 through February, 2000 within the EEZ of Costa Rica. In this fishery, "mother lines" are set from between 12 and 15 miles with hooks attached every 5 to 10 meters, for a total of 400-800 hooks/set. Seventy seven longline sets were observed on 9 cruises; seven of the cruises targeted mahi mahi (daytime soak) and 2 of the cruises targeted yellowfin tuna (night-time soak). Of the nearly 40,000 hooks deployed, turtles represented 7.6% of the total catch, with olive ridleys constituting the second most abundant species captured (catch per unit effort of 6.364 turtles/1,000 hooks). No leatherbacks were observed taken during the artisanal fishery.

g. Peruvian artisanal longline fishery for shark and mahi mahi

The fishing industry in Peru is the second largest economic activity in the country, and over the past few years, the longline fishery has rapidly increased. Currently, nearly 600 longline vessels fish in the winter and over 1,300 vessels fish in the summer. An observer program was initiated in 2003 to document sea turtle bycatch in the artisanal longline fishery.

From September, 2003 to November, 2004, observers were placed on artisanal longline vessels operating out of the port of Ilo, home to one of the largest year-round artisanal longline fleets. There are two seasons for this fleet: from December through March, the fleet targets mahi mahi, making up to 6-day trips, in an area 20-70 nm from the coast; and from April through November, the fleet targets mako and blue shark, making up to 20-day trips, in an area 250-500 nm from the coast. The fleet uses surface longlines.

During the observation period, 588 sets were observed during 60 trips, and 154 sea turtles were taken as bycatch. Loggerheads were the species most often caught (73.4%), followed by green turtles (18.2%), olive ridleys (3.8%), and leatherbacks (2.6%). Species were most often entangled (74%); the rest were hooked. Of the loggerheads taken, 68% were entangled, 32% were hooked. Of the two fisheries, sea turtle bycatch was highest during the mahi mahi season, with 0.597 turtles/1,000 hooks, while the shark fishery caught 0.356 turtles/1,000 hooks (Alfaro-Shigueto *et al.*, 2005). Sea turtles are rarely released into the sea after being caught as bycatch in this fishery; therefore, the mortality rate in this artisanal longline fishery is likely high because sea turtles are retained for future consumption or sale.

h. Mexican longline fisheries

The Mexican longline fishery for sharks has been observed since at least 1994 with no record of leatherback takes. There is also a Mexican longline fishery for swordfish, but little is known regarding the incidence of sea turtle bycatch. In 1999 and 2000, observers recorded target species and bycatch species on board drift gillnet and longline vessels targeting swordfish off Baja California, Mexico. During 26 trips and 132 sets, observers recorded 10,774 organisms, with 0.44% comprised of sea turtles, all of which were released without apparent harm (Instituto Nacional de la Pesca, 2001). Levels of take in the Mexican longline and drift gillnet fishery are not known, although levels of marine mammal take may be similar to these fisheries observed off the US West Coast (Carretta *et al* 2006).

i. *Tuna purse seine fishery in the eastern tropical Pacific*

The international purse seine fleet in the eastern tropical Pacific Ocean (ETP) represents the majority of the fishing effort and carrying capacity in the ETP tuna fishery, with much of the total capacity consisting of purse seiners greater than 400 short tons (st) (363 mt). The latest information from the Inter-American Tropical Tuna Commission (IATTC) shows that the number of active purse seiners of all sizes is 239 vessels, with Mexico and Ecuador comprising the majority of the fleet (66 and 86 vessels, respectively) (Source: IATTC, 2005 (www.iattc.org)).

The most recent data from the IATTC indicate that between approximately 17 and 172 total sea turtles per year were killed by vessels over 400 st (364 mt) in the ETP purse seine fishery from 1993-2004. The primary species taken were olive ridleys (Table 8; M. Hall, IATTC, personal communication, 2006), likely because they are proportionately more abundant than any other sea turtle species in the ETP and they have been observed to have an affinity for floating objects (Arenas and Hall, 1992). The mortality estimates contain fractions because while the IATTC has a known number of sets and turtle mortality from their observer database, they only have a known number of sets (not turtle mortality) from the national observer programs. Therefore, the mortality is pro-rated to make up for the sets for which the IATTC has no known turtle mortality data. The numbers of sea turtles killed by the fishery dropped significantly in 2002, and the years following, likely as a result of increased awareness by fishermen through educational seminars given by the IATTC and conservation measures implemented through Resolutions adopted by the IATTC. In 2007, the IATTC passed an even stronger Resolution on Bycatch, so sea turtle mortalities in this fishery should continue to decrease.

Table 9. Estimated sea turtle mortality by species for the ETP tuna purse seine fishery (including US) from 1994 to 2005. Includes only large (364 metric ton capacity and greater) vessels.

Name	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Green	16.1	13.0	12.0	13.0	9.0	10.9	6.1	7.8	2.1	0.0	0.0	1.4
Hawksbill	1.8	0.0	1.0	0.0	3.0	2.0	1.0	1.3	0.0	0.0	0.0	0.0
Leatherback	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loggerhead	1.8	2.0	0.0	4.6	1.0	4.0	1.8	1.3	0.0	0.0	0.0	0.0
Olive Ridley	80.1	91.3	65.8	93.8	107.6	109.1	92.1	74.2	30.7	17.1	11.0	149.0
Unidentified	45.3	34.0	37.6	42.0	41.0	46.2	29.4	55.3	13.8	9.1	5.9	11.1
Total	**146.3**	**140.3**	**116.4**	**153.4**	**161.6**	**172.2**	**130.4**	**139.9**	**46.6**	**26.2**	**16.9**	**27.5**

[Source: M. Hall, IATTC, 2006]

The data contained in Table 9 indicates that some sea turtles killed by the ETP purse seine fishery were "unidentified," although the reasons for this were not given. Assuming that these unidentified turtle mortalities occurred in the same proportions as the identified turtle mortalities, 86% would be olive ridleys, 10.8% would be green turtles, 2.1% would be loggerheads, 1% would be a hawksbill, and 0.1% would be leatherbacks.

As mentioned, the US fleet (large vessels only) has 100 percent observer coverage; therefore, the fate of every sea turtle taken is documented. Because the US fleet does not set on dolphins, sea turtles are taken in school sets and log/FAD sets. The fate of sea turtles that interact with the US purse seine fleet during such sets may only be comparable to the non-U.S. fleet that sets on logs/FADs and tuna schools. Table 9 shows sea turtle interactions with the US purse seine fleet from 1998 through 2004. Similar to the entire purse seine fleet (Table 9), the majority of the sea turtles taken by the fishery are olive ridleys, and as shown in Table 10, most sea turtles are released unharmed.

Table 10. Sea turtle interactions with the US tuna purse seine fleet (large (>363 mt (400 st)) vessels only) in the ETP, 1998-2005.

Name	Fate	1998	1999	2000	2001	2002	2003	2004	2005
Green	Released unharmed	3	5	2	2	1	5	0	1
Hawksbill	Released unharmed	0	0	0	1	1	0	0	0
Loggerhead	Released unharmed	0	1	5	0	0	0	0	0
Olive Ridley	Released unharmed	38	27	3	16	10	34	23	7
	Escaped/evaded net	0	0	1	0	0	0	0	0
	Light injuries*	4	6	2	0	0	7	1	1
	Grave injuries**	1	0	0	3	0	0	0	0
	Killed	0	0	0	0	0	1	0	0
Unidentified	Released unharmed	2	0	3	6	1	10	5	0
	Escaped/evaded net	2	1	1	0	0	0	0	0
	Light injuries*	0	0	0	1	0	0	0	0
	Other/Unknown	1	0	0	0	0	1	0	0
	Killed	0	0	0	0	0	0	0	1
Total		**51**	**40**	**17**	**29**	**13**	**58**	**29**	**10**

*Light injuries are considered to be non-lethal injuries.
**Grave injuries are considered to be eventually lethal to the turtle.
[Source: M. Hall, IATTC, 2005]

Since 1999, seminars have been given by the IATTC to skippers and their crews to educate them on, among other issues, status of sea turtles, and handling and recovery of turtles taken by purse seiners in the ETP. In addition, during the 69th meeting of the IATTC held in Manzanillo, Mexico from June 26-28, 2002, the IATTC passed a Resolution on Bycatch C-02-05. The Resolution has been reaffirmed and strengthened over the years. At the 70th meeting of the IATTC held in Antigua, Guatemala, from June 24-27, 2003, a Consolidated Resolution on Bycatch was adopted. Under the resolution, purse seine fishermen are required to promptly release unharmed, to the extent practicable, all sea turtles. In addition, crews are required to be trained in techniques for handling turtles to improve survival after release. Vessels should be encouraged to release sea turtles entangled in FADs and recover FADs when they are not being used in the fishery. Specific to the purse seine fishery operation, whenever a sea turtle is sighted in the net, all reasonable efforts should be made to rescue the turtle before it becomes entangled, including, if necessary, the deployment of a speedboat. If a sea turtle is entangled in the net, net roll should stop as the turtle comes out of the water and should not start again until the turtle has been disentangled and released. If a turtle is brought aboard the vessel, all appropriate efforts to assist in the recovery of the turtle should be made before returning it to sea (IATTC Resolution C-04-05, Action #4).

j. Purse seine fisheries in the western tropical Pacific Ocean (WTP)

There are nearly 400 active purse seine vessels originating from a variety of countries and operating nearly exclusively in tropical waters of the central and western Pacific Ocean. The purse seine fishery in the WTP is observed, and observer effort generally covers the extent of the fleet's activity. Although there has been less than 5% observer coverage for the entire fishery, the US fleet has maintained up to 20% coverage since the mid-1990s. For the purse seine fisheries operating in the WTP, an estimated 105 sea turtles are taken per year, with approximately 17% mortality rate (less than 20 sea turtles dead per year). The species included green turtles, hawksbills and most often olive ridleys. Encounters with sea turtles appeared to be more prevalent in the western areas of the WTP, where log sets are more prevalent. However, observer data for both the Philippines and Indonesia, which both fish in the east, were unavailable. These countries have purse seiners and ring-net fleets that fish predominantly on a variety of anchored FADs in this area (Oceanic Fisheries Programme, 2001); therefore, the sea turtle take estimate in this fishery is likely underestimated and incomplete.

Animal-associated, drifting log and anchored-FAD sets had the highest incidence of sea turtle encounter (1.115, 0.807, and 0.615 encounters per 100 sets, respectively). In contrast, drifting FAD sets were observed to have only 0.07 encounters per 100 sets. With less than 5% observer coverage, confidence intervals for these estimates are also very wide (Oceanic Fisheries Programme, 2001).

k. Mexican (Baja California) fisheries and direct harvest

Sea turtles have been protected in Mexico since 1990, when a federal law decreed the prohibition of the "extraction, capture and pursuit of all species of sea turtle in federal waters or from beaches within national territory ... [and a requirement that] ... any species of sea turtle incidentally captured during the operations of any commercial fishery shall be returned to the sea, independently of its physical state, dead or alive" (*in* Garcia-Martinez and Nichols, 2000). Despite the ban, studies have shown that sea turtles continue to be caught, both indirectly in fisheries and by a directed harvest of eggs, immatures, and adults. Turtles are principally hunted using nets, longlines and harpoons. While some are killed immediately, others are kept alive in pens and transported in trucks, pick-ups, or cars. The market for sea turtles consists of two types: the local market (consumed locally) and the export market (sold to restaurants in cities such as Tijuana, Ensenada, Mexicali, and U.S. cities such as San Diego and Tucson). Consumption is highest during holidays such as Easter and Christmas (Wildcoast *et al.* 2003).

Based on a combination of analyses of stranding data, beach and sea surveys, tag-recapture studies and extensive interviews, all carried out between June, 1994 and January, 1999, Nichols (2002) conservatively estimated the annual take of sea turtles by various fisheries and through direct harvest in the Baja California, Mexico region. Although there are no solid estimates of fisheries-related sea turtle mortality rates for the region, sea turtles are known to interact with (and be killed by) several fisheries in the area. As in other parts of the world, shrimp trawling off Baja California is a source of sea turtle mortality, although since 1996, shrimp fishermen are required to use TEDs. Prior to this requirement, Figueroa *et al.* (1992 *in* Nichols, 2002) reported that nearly 40% of known mortality of post-nesting green turtles tagged in Michoacán was due to shrimp trawlers. Based on stranding patterns, Nichols, *et al.* (2000) speculated that mortality of loggerheads due to local fishing in Baja California may primarily be due to a net-based fishery, likely the halibut (*Paralichthys californicus*) gillnet fishery, which reports regular loggerhead bycatch and coincides with the movement of pelagic red crab into the shallower continental shelf. Fishermen also report the incidental capture of sea turtles, primarily loggerheads, by pelagic longlines and hook sets used to catch sharks and pelagic fish. Lastly, sea turtles have occasionally been found by fishermen entangled in buoy and trap lines, although this is apparently a rare occurrence (Nichols 2002). Although fishermen may release sea turtles alive after being entangled in or hooked by their gear, based on information on the directed harvest and estimated human consumption of sea turtles in this region, incidentally caught sea turtles are likely retained for later consumption.

Sea turtle mortality data collected between 1994 and 1999 indicate that over 90% of sea turtles recorded dead were either green turtles (30% of total) or loggerheads (61% of total) (Table 11), and signs of human consumption were evident in over half of the specimens. Most of the loggerheads were immature, while size ranges for both green and olive ridleys indicated representation from both immature and mature life stages (Nichols 2002).

Table 11. Recorded sea turtle mortality by species during 1994-1999 on the Gulf of California coast and the Pacific coast of Baja California, Mexico.

Species	Gulf of California	Pacific	Totals
green turtle	30	276	**306**
leatherback	1	0	**1**
loggerhead	3	617	**620**
olive ridley	1	35	**36**
unidentified	0	57	**57**
Total	**35**	**985**	**1,020**

Source: Nichols (2002).

A more focused study was conducted from June to December, 1999 in Bahia Magdalena, a coastal lagoon to determine the extent of sea turtle mortality. Researchers searched for sea turtle carapaces in local towns and dumps as well as coastal beaches. The majority (78%) of the carapaces were found in towns and dumps and green and loggerhead turtles most frequently observed. Both species found were generally smaller than the average size of nesting adults. Researchers estimated that the minimum sea turtle mortality rate for the Bahía Magdalena region was 47 turtles per month, or 564 turtles per year. Based on observations, approximately 52% were green turtles, 35% were loggerheads, 2% olive ridleys, and 1% hawksbills (10% unidentified) (Gardner and Nichols 2002). A study conducted from 1995 to 2002 in Bahía de Los Angeles, a large bay that was once the site of the greatest sea turtle harvest in the Gulf of California, revealed that the populations of green turtles in the area had decreased significantly since the early 1960s. Despite the 1990 ban, sea turtle carcasses were found at dumpsites, so human activities continue to impact green turtles in this important foraging site (Seminoff *et al.* 2003).

Based on surveys conducted in coastal communities of Baja California, extrapolated to include the entire coastal peninsula, Nichols (2002) estimated the annual mortality of green turtles in this region to be *greater* than 7,800 turtles, impacting both immature and adult turtles. Mortality of loggerhead turtles, based on stranding and harvest rates, is estimated at 1,950 annually, and affects primarily immature size classes. The primary causes for mortality are the incidental take in a variety of fishing gears and direct harvest for consumption and [illegal] trade. With the local declines of green turtles, a market for loggerhead meat has developed in several Pacific communities. Olive ridleys are not found as commonly in Baja California waters as loggerheads and greens; however, they are consumed locally and occasionally strand on beaches. No annual mortality estimates of olive ridleys in the area were presented. Lastly, anecdotal reports of leatherbacks caught in fishing gear or consumed exist for the region; however, these instances are rare, and no annual mortality estimates of leatherbacks were presented (Nichols, 2002). A recent estimate by Wildcoast *et al.* (2003) reiterates that there is likely high mortality of turtles in the Californias (defined here is the region encompassing the Gulf of California including the coast of Sonora and Sinaloa, Mexico; Baja California and Baja California Sur, Mexico, and California, USA) estimating 15,600 to 31,200 sea turtles consumed annually (no differentiation between species).

The latest research on fisheries mortality and poaching of sea turtles in Mexico focused again on the Bahia Magdalena region of Baja California. In this area, small-scale artisanal fisheries are very important. The most commonly used fishing gear are bottom set gillnets and have been documented interacting at high rates with loggerheads and green turtles. From April 2000 to July, 2003 throughout this region (including local beaches and towns), Koch *et al.* (2006) found 1,945 sea turtle carcasses. Of this total, 44.1% were loggerheads and 36.9% were green (also known as "black") turtles. Of the sea turtle carcasses found, slaughter for human consumption was the primary cause of death for all species (91% for green turtles, 63% for loggerheads). Mortality due to fisheries bycatch was difficult to document, simply because evidence of trawl and gillnet interactions is rarely seen on a sea turtle carapace. Less than 1% of mortality was documented as due to fisheries bycatch. Over 90% of all turtles found were juveniles or subadults. Koch *et al.* (2006) estimate conservatively that at least 15,000 sea turtles are killed per year for the Baja California peninsula. Again, no differentiation is made between species; however, the percentages of the various sea turtle species found in Bahia Magdalena may provide an idea of the species composition taken throughout the peninsula.

l. Directed capture/trade of sea turtles in Southern Peru

Sea turtles have been protected in Peru since 1977; however, there is little governmental control over the illegal taking and killing of sea turtles. Researchers focused observations on the Pisco-Paracas area of southern Peru to determine the extent of the hunting and trade of sea turtles, as it is a recognized foraging area for sea turtles and is also a known area for the sea turtle trade, particularly the San Andrés port. Fishermen sell sea turtle (sometimes alive) for its meat, oil, or shell to a dealer, who may sell in the nearby market of Pisco. The observation period occurred from July, 1999 through June, 2000. An estimated 204 ±17.6 sea turtles were killed at San Andrés. Species composition was: 67.8% green turtles, 27.7% olive ridleys, and 2.9% leatherbacks. Peak captures were during the Peruvian spring (October – December), while leatherbacks were only captured in December and February. This estimate is considered a minimum since sea turtles are not always butchered on the beach and therefore may not be observed by researchers. Sea turtles were most often taken by fishermen and retained for future sales. Most of the animals were caught in a medium sized (600 m x 10m) multifilament nylon drift gillnet set for small sharks and rays, with a stretched mesh size up to 20 cm (de Paz *et al.* 2005).

The fishing industry in Peru is the second largest economic activity in the country, and over the past few years, the longline fishery has rapidly increased. Currently, nearly 600 longline vessels fish in the winter and over 1,300 vessels fish in the summer. An observer program was initiated in 2003 to document sea turtle bycatch in the artisanal longline fishery.

From September, 2003 to November, 2004, observers were placed on artisanal longline vessels operating out of the port of Ilo, home to one of the largest year-round artisanal longline fleets. There are two seasons for this fleet: from December through March, the fleet targets mahi mahi, making up to 6-day trips, in an area 20-70 nm from the coast; and from April through November, the fleet targets mako and blue shark, making up to 20-day trips, in an area 250-500 nm from the coast. The fleet uses surface longlines.

During the observation period, 588 sets were observed during 60 trips, and 154 sea turtles were taken as bycatch. Loggerheads were the species most often caught (73.4%), followed by green turtles (18.2%), olive ridleys (3.8%), and leatherbacks (2.6%). Species were most often entangled (74%); the rest were hooked. Of the loggerheads taken, 68% were entangled, 32% were hooked. Of the two fisheries, sea turtle bycatch was highest during the mahi mahi season, with 0.597 turtles/1,000 hooks, while the shark fishery caught 0.356 turtles/1,000 hooks (Alfaro-Shigueto *et al.* 2005). Sea turtles are rarely released into the sea after being caught as bycatch in this fishery; therefore, the mortality rate in this artisanal longline fishery is likely high because sea turtles are retained for future consumption or sale.

2. Scientific research permits

a. Scientific Research Permit #1514
This permit allows Pacific Islands Region staff to measure, photograph, tissue sample, flipper tag, PSAT tag, release, salvage (if dead) of sea turtles incidentally taken during longline fishing operations carried out under the Western Pelagic fishery management plan. Takes of these animals is covered under the ITS issued in the 2004 biological opinion on the FMP.

b. Scientific Research Permit #1596
The permit was issued under Section 10 of the ESA to the Southwest Region and authorized the annual non-lethal take of up to 78 leatherbacks. The research area is an important forage area for leatherbacks in the Pacific. The purpose of the research activities is to continue long-term monitoring of the status of the species off the coasts of California, Oregon, and Washington. The research will study the species to determine their abundance, distribution, size ranges, sex ratio, health status, diving behavior, local movements, habitat use, and migration routes. Animals will be located through aerial surveys at a high altitude to prevent harassment and subsequently captured by hoop net from a research vessel. The primary goal is to address priorities outlined in the U.S. Pacific leatherback Recovery Plan. The Permit Holder will identify critical forage habitats, genetic stock structure, migratory corridors and potential fishery impacts on this species in the Pacific. This information is necessary to make informed management decisions concerning these turtles and their habitat.

3. Other impacts

Threats to leatherbacks are described above and include nesting habitat destruction, poaching of adults and eggs at nesting beaches, entanglements and mortalities in fishery gear, directed harvest, pollution, marine debris (see USFWS and NMFS 1998; NMFS 2004 HMS BiOp). The following provides summary information on the impacts of the December 2004 Tsunami, which impacted areas utilized by leatherbacks along with a brief review of possible impacts of climate change and variability on leatherbacks.

a. Effects of the December 26, 2004 Tsunami on Sea Turtles

The tsunami that occurred on December 26, 2004 affected many nations in the Indian Ocean basin. Many of these nations - including Indonesia, Malaysia, Thailand, India, and Sri Lanka - contain important areas for sea turtle foraging and nesting. The effects of the December 2004 tsunami have been provided in a report by the signatory states to the Indian Ocean and Southeast Asia Marine Turtle Memorandum of Understanding (Hamann *et al.* 2006)). The report's assessment of effects on leatherbacks in the region are briefly summarized here.

The tsunami hit the northern coast of Indonesia, the country with perhaps the largest nesting populations of leatherbacks in the Pacific. However, the area hit was not a major nesting area. Low nesting densities have been observed in Sumatra, but nesting does not occur in December, thus immediate effects were not recorded although it wasn't reported how changes in the beach may affect leatherback use. The tsunami did not hit the area where leatherbacks in Malaysia nest. A number of research and conservation centers in Thailand were lost (including the loss of two young volunteers). A small number of leatherbacks nest in the winter along the Indian Ocean in Thailand. Eggs from nests laid before and after the tsunami likely did not survive.

Reports in the media shortly after the tsunami suggest that long-term there may be some benefit to sea turtles, as previously developed beaches have returned to conditions closer to pristine. New building regulations may prevent the development of these beaches, thus adding to usable nesting habitat, but at this point such suggestions are speculative. Research is planned by conservation groups in Thailand to assess the longer-term effects of the tsunami on nesting and foraging of sea turtles in the area. In India, all leatherback nests laid were likely lost to the tsunami (which occurred during the nesting season). Some of the most important nesting sites have been severely damaged, although new nest sites may develop due to the creation of new beaches.

The longer terms effects of the tsunami are at this point speculative, but loss of nesting habitat is a clear concern, along with loss of beach vegetation (vegetation helps prevent beach erosion and provide shade to nest sites). The effects of the tsunami on foraging habitats in all areas are not known, although loss of seagrass, mangroves, and coral reefs has been reported. Fortunately, the major leatherback nesting areas were not affected by the tsunami. Perhaps the greatest loss is within the research and conservation community, which lost not only members, but also facilities, data, and animals. Most organizations are currently trying to re-build their operations.

At the most recent Sea Turtle Symposium a presentation was given on actions being taken to assess the long term impacts of the Tsunami and plans for coastal re-development, including impacts on sea turtles in terms of foraging and nesting habitats. The project is a joint effort between the United Nations and local environmental organizations in India (Shanker et al 2007).

b. Climate effects

The effects of climate on sea turtles are just beginning to be studied and are largely still speculative. Some effects have already been observed and others are considered likely in the future. These effects range from relatively short term effect from El Niños to longer term climatic changes to the ocean environment. Long-term changes in climate could have a profound effect of leatherbacks and other sea turtles. Changes in temperature (rising air temperatures) may affect nesting success; very high temperatures while eggs are incubating in the sand may kill the offspring. The sex of turtles is temperature dependent, that is, eggs incubated at higher temperatures produce more females while eggs incubated at lower temperatures result in more males (Chan and Liew 1996). Increased air temperatures may result in a bias of the sex ratio of offspring, which over the long-term could lead to reduced nesting success (insufficient males to fertilize eggs). Thus, while the number of nesting females may be stable or increasing now, the eggs may not be viable or the hatchling output may not produce a balanced sex ratio necessary for future successful reproduction.

The climate may also affect turtle nesting habitat. Long-term climate change (e.g., rising average temperatures) will likely result in rising sea levels due to loss of glaciers and snow caps coupled with thermal expansion of warming ocean water which may lead to the loss of usable beach habitat. (Baker *et al.* 2006). Studies suggest that leatherbacks do not have the same high level of nesting site fidelity as hard shelled turtles, so they may be able to better adapt to the loss of habitat by seeking out new nesting areas. Similarly, short-term climate variability may cause in increase in storm or tidal activity that causes inundation of nesting sites in the short-term, causing loss of nesting habitat or loss of that season's nests.

Oceanographic changes due to climate may also affect leatherback sea turtle prey availability, migration and nesting. Leatherbacks that may be exposed to the SSLL EFP are believed to travel across the Pacific for large concentrations of prey, particularly jellyfish. Short term variability in climate such as El Niño events may limit prey due to a reduction in upwellings brought by warm surface waters and limited or no wind. Over the longer term, climate models suggest a number of possible changes in oceanographic conditions, including the slowing down of the thermohaline circulation, higher precipitation storms, rising sea surface temperatures and rising sea levels (IPCC 2001). Also, as temperature patterns change in oceans, current foraging habitats may shift (McMahon and Hays 2006). There is already evidence to suggest that some sea turtles' re-migration periods are being affected by variations in SST (Solow *et al.* 2002; Chaloupka 2001). Finally, loss of nesting habitat due to rising sea levels is an obvious concern (Baker *et al.* 2006).

Additional study will be necessary to determine how climate may be affecting leatherbacks and the entire marine eco-system in the Pacific and elsewhere (Kintisch 2006). The possible effects are included here to provide a very brief review of possible effects and areas of necessary additional study in the field. These effects are likely over the long-term and immediate effects are not known or quantified. Further, the possible effects of climate variability or change are likely to have little detectable influence on the proposed action, which is a four month action from September to December of 2007.

d. Recent conservation efforts for Pacific leatherbacks

For the past several years, the Western Pacific Fishery Management Council (WPFMC) has worked with NMFS' Pacific Island Fishery Science Center (PIFSC), Pacific Islands Region (PIR), and the SWFSC have worked together to identify priorities for regional sea turtles conservation efforts. The priorities for this program are: data management to fill information gaps; conservation measures to reduce direct harvest of sea turtles and protect nesting beach habitat; education and outreach about sea turtle conservation; international management and networking; and fishery mitigation through research and transfer of gear technologies designed to reduce bycatch of sea turtles to foreign fisheries. These include more extensive surveys, beach monitoring and protection programs, observer training programs for fisheries, and education and outreach programs for local communities.

Information on these projects comes from the 2005 biological opinion on the continued authorization of the Hawaii-based Pelagic, Deep-Set, Tuna Longline Fishery based on the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region and is provided in Appendix 1.

Within the five areas of concentration, six projects have been implemented and have reached completion. In addition to the projects listed below, numerous meetings and workshops regarding and sea turtle conservation planning and strategizing and reducing sea turtle bycatch in the world's fisheries have been supported by either the WPFMC or NMFS. These efforts were developed and initiated with the overall goal of increasing the capacity for sea turtle recovery in the Pacific and are anticipated to result in beneficial effects for sea turtle populations in the Pacific Ocean.

The Southwest Regional Office funds several sea turtle conservation projects each year, depending on the available funding. In 2007, the office provided funds to: (1) War Mon Smolbag Theatre for monitoring and protecting leatherback nesting beaches in Vanuatu; (2) Aquatic Adventures for support towards experiments to reduce sea turtle bycatch in gillnets and longlines; and (3) Earth Resource Foundation for support towards outreach in southern California to reduce the introduction of plastic into the marine environment.

Conservation efforts at nesting beaches are being carried out in the eastern and western Pacific. During the last few years conservation effort at nesting beaches in Mexico and Costa Rica have led to increased survival of eggs, and therefore greater hatchling production per nesting female. This has the potential for increasing future recruitment if post-hatchling survival is not further reduced; however, since numbers of nests are so low, and post-hatchling and juvenile natural mortality are assumed to be high, this increase in hatchling production may only result in the addition of a few adults annually. However, the increases in numbers of adult leatherbacks and greens following years of aggressive beach and nest protection suggest that this is an important area for conservation efforts.

In addition to direct conservation measures, a number of international agreements have been signed over the past several years that are designed to benefit sea turtles, including leatherbacks, in the Pacific. These include the adoption in 2003 of the Bellagio Blueprint, a multinational effort to help save Pacific sea turtles; a Memorandum of Understanding signed by Indonesia, Papua New Guinea, and the Solomon Islands to coordinate efforts to protect and save sea turtles in their collective countries and the Indian Ocean and Southeast Asia Memorandum of Understanding. In 2007, the Inter-American Tropical Tuna Commission adopted a resolution to address sea turtle bycatch in fisheries for tuna and tuna-like species in the eastern tropical Pacific (Resolution C-07-03).

Conclusion of Status of leatherbacks

It is difficult to provide a summary of the status of leatherbacks given all of the unknowns associated with this species and its populations. It is undeniable that the available information indicates a major decline in Pacific leatherbacks at their nesting beaches over the past 30 years. The status of eastern Pacific leatherbacks seems particularly dire. The numbers of nesters at the major leatherback nesting sites in Mexico and Costa Rica have declined significantly over the past 30 years. It has been estimated that the Mexican leatherback nesting population may have been as high as 70,000 adult females in 1980 and recent nest counts since 2000 have ranged from 120 to nearly 2,000. In Costa Rica, the numbers of nesting females in 1988-1990 were over 1,300; in the past five years the numbers have ranged from approximately 50 to 160. The reasons for the declines include incidental take in fisheries, harvest of eggs, direct harvest especially females at nesting beaches, and beach habitat degradation. In both Mexico and Costa Rica, important conservation measures have recently been implemented. In Mexico, Protyecto Laud coordinates efforts to protect nesting habitat at the four index beaches, including protecting nesting females from poaching and protecting nests with a goal of increasing the number of hatchlings that survive and emerge (Martinez *et al.* 2007). In Costa Rica, ongoing beach protection and monitoring occurs at major nesting sites including a recent commitment to fully protect Las Baulas National Marine Park, the site of the two largest nesting aggregations on the Pacific coast of Costa Rica.

Most of the Western Pacific populations have not experienced the same level of decline. Recent studies conducted by scientists from the SWFSC and their colleagues in Asia suggest that the western Pacific leatherbacks have life history traits (e.g., variation in nesting areas, timing of nesting activity, foraging patterns) that may make them more resilient to population level perturbations and perhaps more abundant than previously thought.

As described above, in 2004, researchers, managers and tribal community members with extensive knowledge of local leatherback nesting beach populations and activities in Papua (Indonesia), Papua New Guinea, the Solomon Islands and Vanuatu assembled in Honolulu, Hawaii to identify nesting beach sites, and share abundance information based on monitoring and research, as well as anecdotal reports. Dutton *et al.* 2007 report that there may be a minimum of 1,100 to 1,800 females nesting annually at 28 nesting sites in the western Pacific. Using the same assumptions used in Spotila *et al.* (1996), including five nests per female per nesting season and 2.5 years between nestings, yields an estimated 2,700 to 4,500 adult females in the western Pacific population, which is substantially higher than previously published estimates.

Although it can not at this time be proven, based upon the limited observations of leatherbacks utilizing a variety of nesting beaches, sometimes within the same season, this population may be more resilient to losses at individual beaches than other sea turtle species or other leatherbacks. Most of the western Pacific leatherbacks share a haplotype. This suggests that there may be mingling within the nesting sites throughout the region, thus the distribution of this population is quite large and may not be isolated to specific beaches. Western Pacific leatherbacks also show a wider range of migratory patterns than eastern Pacific leatherbacks (which all follow the same post-nesting route). The variation in foraging areas may help make this population less vulnerable to environmental perturbations. Leatherbacks in the Atlantic, which generally have positive population growth trends, exhibit a similar pattern of exploiting many foraging areas post-nesting. The plasticity exhibited by this population may help it overcome environmental stochasticity, but many of the at-sea threats to leatherbacks persist and remain unquantified (largely due to a lack of observers on foreign fleets).

Western Pacific leatherbacks appear to utilize a variety of beaches throughout Southeast Asia and have been observed nesting in a number of countries including Malaysia, Indonesia, Papua New Guinea, the Solomon Islands, Vanuatu, Viet Nam, Thailand, Fiji, and Australia. Major nesting sites are known, although leatherbacks will utilize a number of beaches and have been observed nesting on different beaches within a single season, thus, perhaps, limiting the vulnerability of eggs placed at only one location. Leatherbacks are not limited to one season of nesting, with nesting activity having been observed in both winter and summer months at some beaches. These factors, which suggest a greater resilience to one time threats, also make it difficult to estimate the population or trends, as females may move from beach to beach. Recent genetic work indicates a shared haplotype among most western Pacific leatherbacks. This may suggest that most western Pacific leatherbacks can mate with one another, thus limiting the threat of small populations and restricted gene pools, although the genetic diversity may be limited.

One Western Pacific population that has shown significant decline is the Malaysian nesting population. Numbering over 3,000 nesting females in the 1960s, this population has been labeled functionally extinct with less than ten females returning to nest annually. This population is genetically unique from the rest of the Western Pacific populations and does not share the common haplotype found in the other western Pacific leatherback populations. Conservation efforts continue to sustain this population, but years of poor hatchery practices may have skewed the sex ratios resulting in too few males to mate with the remaining females. The decline in this population coincided with the development of large fisheries in the high seas and in coastal waters near nesting beaches, which likely affected the population. This population was also likely affected by the many years of very high levels of nest poaching, which likely severely limited the number of new recruits into the population. This population may serve as an example of better practices for conserving leatherbacks in other areas, including taking actions to improve the status of leatherbacks before the population reaches very low levels; in Malaysia no conservation measures were taken until the late 1980's when annual number of nestings was under 300.

In the Atlantic, the population of leatherbacks is estimated to be between 34,000 and 94,000 with most rookeries increasing (TEWG 2007). The reasons for the differences in leatherback abundance and population trends in the Atlantic and Pacific oceans is unknown. However, it has been suggested that due in part to the variation in nesting sites and foraging areas, that Atlantic leatherbacks are more likely to respond to nesting conservation efforts, in part because they are less susceptible to environmental perturbations or human impacts such as fishing. Two nesting beaches in the Atlantic, St. Croix and Tongaland, KwaZulu-Natal, South Africa, have both seen dramatic increasing in nesting females following years of aggressive nesting beach protection.

Leatherbacks still face many threats to the species' survival. Leatherbacks still experience harvests of their eggs, they are still killed for subsistence purposes, their beaches continue to erode, and adult and sub-adult leatherback turtles are still captured and killed in fisheries interactions. Two recent papers attempt to evaluate threats to leatherbacks, both globally and in the Pacific. Lewison *et al.* (2004) attempted to quantify leatherback bycatch globally in longline fisheries, relying upon a model which used catch data and bycatch rates from a limited number of fisheries and extrapolating these globally. The model predicted that tens of thousands of leatherbacks may encounter longline gear annually, although not all encounters result in mortalities. The model results are provocative, but like all models, are limited by the available data. Large data gaps exist for longline effort and bycatch rates. The paper points out the limitations of making large scale assessments of impacts due to lack of observers and monitoring of longline effort. The level of extrapolation necessary in this model makes the results questionable, but point to the need for more monitoring of longline vessels globally. Kaplan (2005) also relies upon a model and extrapolates longline effort and leatherback bycatch across the entire Pacific region, but also considers the impact of coastal fisheries and direct harvest of females and eggs at nesting beaches. As with all models, the quality of the output is limited by the quality and availability of data, which is quite limited for Pacific populations. Nonetheless, these two papers highlight the need for additional monitoring and data on the status and threats to leatherbacks internationally.

The threats to leatherbacks due to climate change and variability have been getting more attention in the scientific community as evident in the rise in published papers on the topics. The predictions of sea level rise and associated increases in beach erosion and inundation present new risks to this species at their nesting beaches. In addition, temperature changes may affect the sex and hatchling success of leatherback nests and may alter foraging migrations.

It is clear that much has been learned about leatherbacks, particularly the western Pacific over the past few years. However, in order to fully assess the status of leatherbacks in the Pacific, many more years of data are necessary as well as more extensive monitoring programs. Basic information such as the re-migration interval of various nesting aggregations, inter-nesting behavior, migration and seasonal distribution, and stage structure of all age groups of leatherback populations will be necessary to fully understand the status of this species. In this opinion we rely upon the best available data at this time to assess the status of Pacific leatherbacks.

V. ENVIRONMENTAL BASELINE

A. Federal fisheries in the action area of the proposed SSLL EFP

Within the West coast EEZ four federal fisheries are prosecuted under FMPs, the HMS fishery (which includes recreational fishers), the coastal pelagic species (CPS) fishery, the salmon fishery and the groundfish fishery. All of these fisheries occur both within and outside the proposed action area. NMFS has observed the CPS, salmon, and groundfish fisheries and has recorded no incidental takes of ESA-listed whales or sea turtles during fishing operations.

The HMS FMP includes a number of fisheries and authorizes the use of many gear types to fish on HMS species. No takes of ESA-listed species have been recorded in the harpoon, surface hook-and-line, tuna purse seine. One olive ridley sea turtle was observed taken in the pelagic deep-set longline fisheries authorized through the HMS FMP. The take was not covered under the existing ITS for the HMS FMP and formal section 7 consultation on this fishery is currently on-going.

Sea turtles are rarely documented interacting with albacore troll gear and there have been no recorded interactions with marine mammals. There have been anecdotal reports of sea turtles being snagged by troll lines off California (NMFS 2004). Since most gear is retrieved nearly immediately, any sea turtle snagged is likely to be released alive and unharmed, provided the hook and line are removed. Observer coverage on this fishery is approximately 1% annually.

B. State fisheries within the action area

1. California Angel Shark/Halibut and Other Species Large Mesh (>3.5") Set Gillnet

This fishery operates year-round and is managed by the CDFG in accordance with state and federal laws. Under California law, this fishery may not operate within state waters. The state maintains regulatory authority over this fishery which occurs in federal waters adjacent the California state waters. This fishery was not incorporated into the HMS FMP. Angel shark and 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. No interactions with listed marine mammal species have been observed in any of these fisheries.

The California set gillnet fishery for angel shark/halibut has been observed to take sea turtles and marine mammals. In July, 1990, NMFS implemented an observer program for this fishery in order to monitor marine mammal bycatch. NMFS observer coverage ranged from 0% to 15.4% between July, 1990, and July, 1994. The observer program for the set gillnet fishery was terminated in July, 1994, because of a significant decrease in fishing effort in that fishery (due to regulations that restricted areas open to gillnet fishing) (Julian and Beeson 1998) and after area closures were implemented in 1994, which prohibited gillnets within 3 mile of the mainland and within 1 mile 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 (*Phocoena phocoena*) mortality. In the autumn of 2000, due to concerns for high incidental catch of seabirds, the CDFG implemented the first in a series of emergency area closures to set gillnets within 60 fathoms along the central California coast, from Point Sal to Point Arguello and between Point Reyes and Yankee Point. A ban on gill and trammel nets inside of 60 fathoms from Point Reyes to Point Arguello became effective in September 2002.

Overall, the current number of legal permit holders for gill and trammel nets, excluding swordfish drift gillnets and herring gillnets has declined since 1998 (CDFG website http://www.dfg.ca.gov/licensing). Mortality of marine mammals continues in this fishery, as evidenced by fisher self-reports under the Marine Mammal Authorization Program, from 2000-2005. Under the authority of the MMPA, NMFS is reinitiating an observer program for this fishery and placing observers on vessels in southern California in the summer of 2006, with approximately 10-20% coverage (L. Enriquez, NMFS, personal communication, 2006).

2. Pot gear fisheries

Since 2000, humpbacks, unidentified whales, and leatherbacks have been observed entangled in various type of pot gear (e.g., crab pots) off the coast of California. Most pot and fish trap fisheries are regulated by the states, although sablefish pot gear (fished off the coast of California) is part of the groundfish FMP. Sightings of marine mammal and leatherback entanglements are detailed in Table 12. All of these are opportunistic sightings from the California Marine Mammal Stranding Network Database. Sighting data includes whether the animal was dead when observed and likely killed as a result of the entanglement (i.e., body not in a state of decomposition), if the animal was released alive without injury, or if the status of the animal could not be determined or was not recorded (i.e., "unknown"). There is no way to extrapolate an annual average mean take from pot gear. There is also no way to estimate mortality due to entanglements due to limited information and lack of repeated sightings of individuals.

Table 12. Numbers of pot/fish trap gear entanglement incidents reported to NMFS (2000-2005)

	2000	2001	2002	2003	2004	2005
Alive	0	1	0	1	0	0
Unknown	0	0	0	0	0	0

D. Status of the species within the action area

Leatherbacks are highly migratory and based upon recent satellite tagging, travel great distances between nesting and foraging areas. Leatherbacks have been observed at high densities in the nearshore, neritic zone (approximately 0 to 30 miles from shore) with highest densities in central California at approximate latitudes of 37° N to 39° N (Benson *et al.* 2007a). These leatherbacks have been observed feeding on the seasonally abundant jellyfish in the nearshore upwelling relaxation zones. This area is outside of the action area of the proposed action. Satellite tracking indicates that concurrent with upwelling beginning to subside, generally in late September and October, leatherbacks begin to move offshore, thus placing them in the areas where fishing activity is likely to be occurring under the proposed action. Leatherbacks may also be feeding in the waters of the proposed action. Future research and analysis of leathererbacks' utilization of the nearshore waters, beyond the neritic zone are planned, but at this point, it is not known if leatherbacks utilize the deep waters off the continental shelf for feeding. Recent studies in the Atlantic have shown the leatherbacks utilize both shelf and slope waters for feeding throughout the summer and early fall (James 2005). It is possible that leatherbacks are using the West Coast EEZ in a similar manner, but data are currently lacking to support or refute this.

The SWFSC has been capturing and tagging leatherbacks off the coast of California since 2000 and no clear pattern of sex ratios has emerged, but both adult and sub-adult females and males have been captured and tagged. It is unlikely that younger leatherbacks would be in the area, as they are most often found in water temperatures over 26 degrees Celsius (Eckhert 2002). In a recently published paper, the average annual number of leatherbacks observed in the nearshore waters off California is 178 (Benson *et al.* 2007a). This number likely underestimates the number of leatherbacks in the West Coast EEZ, since the study was limited to the waters off California and do not include Oregon, Washington or Canada. Leatherbacks show a high degree on inter-annual variation in terms of feeding locations. Satellite tracks show that some animals will head farther north than central California. In 2006, a female was tracked in Washington state and into British Columbia, Canada. Also in 2006, no leatherbacks were observed in the Monterey Bay area that been used by SWFSC staff since 2000 for capturing and tagging turtles. The reason for this shift in what is considered normal summer and fall leatherback distributions is unknown although the low level of primary production during the summer in waters off California may contributed. The presence and abundance of leatherbacks in the action area is likely related to oceanographic conditions that cause prey species to be available in sufficient quantities. A recently published paper showed a positive correlation between positive Northern Oscillation Index (NOI) and abundance of leatherbacks in the nearshore (Benson *et al.* 2007a). Positive NOI is characterized by strong upwelling and wind (Schwing 2003), conditions that lead to high primary and secondary production, particularly in nearshore waters.

E. Factors affecting species within the action area

Leatherbacks within the action area are vulnerable to a variety of threats. These include entanglements and mortality in fishing operations within the action area, although no interaction between leatherbacks and fishing gear have been observed or reported to NMFS since the leatherback conservation zone for the DGN fishery was implemented in 2001. Between 2000 and 2005, there have been three boat collisions with leatherbacks recorded in NMFS SWR stranding data base. One report was from a salmon troller, although stranding responders at the scene could not find the animal. The stranding records from the other two incidents did not indicate whether the animals were killed by the collision with the boat, although both clearly showed damage to the carapace, head, or flippers. Ship strikes likely go largely unreported although may pose a significant threat to leatherbacks in foraging areas such as the Gulf of the Farallones (Benson *et al.* 2007a). Other threats to sea turtles within the action area are less easily identified or as tangible. For example, marine debris has been identified as a cause of sea turtle mortality or illness (ingesting objects such as plastic bags).

VI. EFFECTS OF THE ACTION

A. Exposure

Based upon past interactions in the historic DGN fishery and the known distribution of leatherbacks within the proposed action area, it is likely that leatherbacks will be affected by the proposed SSLL EFP. Determining the number of individual leatherback taken and associated mortalities is difficult because there has not been a SSLL fishery in the proposed action area, so there are no observer records from area-specific longline fisheries that can be utilized to make projections. In contrast, a DGN fishery operates in the proposed action area and targets swordfish, the target species of the proposed EFP. As described previously, comparing one set of DGN gear to one set of SSLL gear is not considered a reasonable means of estimating bycatch given the differences in the gear and the lack of evidence to support an assumption that the gear types are comparable. We attempted to find an example where longline and DGN gear had been used to target the same species in the same time and area, but none could be found. Therefore, rather than rely on DGN gear interaction rates to estimate SSLL anticipated takes, we used data from other longline fisheries in the U.S.

The Hawaii-based SSLL, which re-opened in April 2004 was considered as a possible proxy for estimating the likely number of leatherbacks that may be captured during fishing operations authorized by the EFP. The annual CPUEs of leatherbacks in the Hawaii-based SSLL fishery were highly variable from 2004 through 2006, ranging from 0.0027 to .013 per 1,000 hooks, reflective of the dynamic nature of interactions between sea turtles and fishing gear. These CPUEs applied to the proposed action (maximum number of hooks of approximately Using 67,000 hooks) yields an anticipated take of one or less leatherbacks. CPUEs from Hawaii may not be appropriate to the West Coast EEZ given the differences in fishery effort (2,120 sets in the HI based SSLL and 56 sets anticipated in the SSLL EFP) and leatherback behavior in the two areas (the waters off Hawaii have been identified as migratory and perhaps feeding areas, whereas the areas of the West Coast EEZ have been identified as foraging areas for western Pacific leatherbacks). However, if the leatherback CPUE used in the 2004 biological opinion for the Hawaii pelagics FMP (NMFS 2004c) is applied to the level of effort proposed in the SSLL EFP, the anticipated rate of captures is extremely low, approximately one leatherback during the entire four month season. This estimate of captures likely does not accurately reflect the dynamics of leatherback behavior within the proposed action area and likely interactions with SSLL gear.

Recent work from the East Coast suggests that leatherbacks of the northeast coast of the U.S. and southeast coast of Canada utilize shelf and slope waters during the summer as foraging areas. Two areas in particular, the Northeast Coast (NEC) and Mid-Atlantic Bight (MAB) may most closely resemble some of the foraging areas on the West Coast, particularly central California. Leatherbacks were satellite tagged (n=38) between 1999-2003 off Nova Scotia, Canada (within the NEC) (James et al 2005). Tracks from the tags indicate that leatherbacks travel extensively in the shelf and slope waters (James et al 2005). On the water observations of "prey handling" at the surface of the water and dive patterns suggest that the NEC and MAB are high-use foraging areas for western Atlantic leatherbacks (James and Herman 2001). Recent work by staff at the SWFSC indicates that some areas of the West Coast are utilized by leatherbacks in a similar manner as in the Atlantic, that is, leatherbacks migrate into the area seasonally to forage on abundant gelatinous plankton and jellyfish, the primary prey of leatherbacks in these areas (Benson *et al.* 2007a).

A number of different approaches for applying data from the Atlantic to the proposed action to in order to estimate leatherback captures were considered. First we calculated a simple CPUE based upon total number of observer leatherback captures divided by the total number of observed hooks in the NEC and MAB in 2005 and 2006 and applied this to the anticipated maximum 67,200 hooks in the SSLL EFP. The result was an estimated capture of four leatherbacks. Second, using observer fishing records from 2006 only, which is the most complete fishing year (i.e., regulations had been in place in the fishery for over a year and there were no effects of the 2005 hurricanes on the fishing effort), we calculated a CPUE for the MAB and NEC during the quarters when leatherbacks are found in highest concentrations. Based on this approach, we estimate that the proposed action may capture up to five leatherbacks. This second method may be more appropriate for the proposed action as it uses data from time periods in which leatherbacks in the Atlantic are most likely to be exposed to the longline fishery as they forage in the area and move out of nearshore foraging areas. This is similar to the proposed action, which will occur from September through December. As described above, leatherbacks have been observed utilizing the proposed action area during the late summer and fall, particularly September and October, as they move through the EEZ, likely moving offshore from nearshore foraging areas. However, it is possible that this may over-estimate the likely takes, since it is not clear if all nearshore areas along the California and southern Oregon are utilized to the same extent as nearshore areas in the MAB and NEC.

Similar to other SSLL fisheries that were considered as possible proxies for the SSLL EFP, there are a number of problems with using the Atlantic bycatch data and applying it to the Pacific. One of the key problems is the differences in scale in terms of leatherback populations and fishing effort. Satellite tracking work done by James et al (2005) indicates that leatherbacks moving into the NEC and MAB foraging areas are from western Atlantic nesting beaches. The most recent population estimate for adult females from the western Atlantic nesting beaches is 10,000 to 31,000 (TEWG 2007). Satellite tracking indicates that western Atlantic nesting females migrate north into the waters of the NEC and MAB and waters off Nova Scotia, Canada, to forage (James 2005), thus a high abundance and density of leatherbacks is likely to be present in the waters where SSLL fishing is occurring in the Atlantic. Also, effort in known leatherback foraging areas is high; in 2005, the logbook reported level of effort in the third and fourth quarters in the MAB and NEC was 945,700 hooks, in 2006 the effort was 1,158,100 hooks. By comparison, the most recent population estimate of the entire Western Pacific leatherback adult females is 2,700 to 4,500 (Dutton *et al.* 2007). Of these adult females, satellite tracks suggest that females from a specific region, Jamursba-Medi, Papua, Indonesia, travel across the Pacific and forage in the West Coast EEZ (Benson *et al.* 2007b) although not all tagged females have been tracked moving towards the U.S. West Coast. The precise number of leatherbacks in the Jamursba-Medi nesting aggregation is not known, but it is estimated to be between 933 and 1801 (based upon 373 to 720 female nesters annually) thus the number of leatherbacks likely to be exposed to SSLL fishing under the proposed EFP is a sub-set of the entire Western Pacific population. Based upon the available data, the abundance and density of leatherbacks in the proposed action area is likely much lower than the abundance and density of leatherbacks exposed to the Atlantic SSLL, so the level of interactions are likely lower. Also, the much lower total number of hooks anticipated to be set in the SSLL EFP, 67,200 over four months, is much lower than the approximately one million hooks set in the Atlantic SSLL in just two regions in six months. It is reasonable to assume that the relative population of stock of animals will affect the CPUE. For example, in the DGN fishery, CPUEs are highest for species known to have the highest overall abundance, e.g., short-beaked common dolphins and CA sea lions, whereas CPUEs of lower population stocks, e.g., long-beaked common dolphins, are much lower. The population of Atlantic leatherbacks is at least an order a magnitude higher than the Pacific leatherbacks, so applying CPUEs from the Atlantic may over-estimate the expected captures.

Finally, observer data from the SSLL fishery outside the West Coast EEZ was examined, along with estimated CPUEs developed by the SWFSC for the Council in 2003. In order to best approximate the areas likely to be fished under the SSLL EFP, data from east of 130° W longitude was reviewed. This area is closest to the West Coast EEZ and included sets made by California- (2001–03) and Hawaii- (1997–2001) based vessels. Utilizing the CPUE developed for the SSLL fisheries, as it operated in this area at that time, and applying it to the maximum number of hooks in the SSLL EFP yields an expected capture of four leatherbacks. However, the SWFSC's report also calculated expected captures if gear and bait modifications similar to those tested in the NED experiments were applied to the SSLL fishery CPUEs. Assuming an approximately 65 percent decline in leatherbacks takes (Watson et al. 2005), yields an estimated take in the SSLL EFP of three turtles (with a range of two to four). If most fishing effort in the SSLL EFP occurs between 33° and 38° N latitude and offshore, than this estimate may be the most reasonable approximation of what may occur during fishing operation authorized by the SSLL EFP. However, there is insufficient refinement on the proposed area that will be fished to determine how closely it will follow the historical SSLL effort off the West Coast EEZ. Reviewing these records and using them to calculate a range of anticipated takes in the SSLL EFP does again suggest that the levels of take are likely to be quite low, if we assume that records from a nearby area can be reliably used to project takes.

Based upon a review of relevant other SSLL fisheries and the known distributions and abundance of leatherbacks exposed to these fisheries, we took a precautionary approach in estimating the anticipated level of leatherback takes. It is reasonable to assume that rates of take in the SSLL EFP will be higher than rates of take in the Hawaii-based SSLL since leatherbacks distribution and fishing effort do not appear to overlap in the Hawaii-based fishery to the extent of overlap in the proposed action. Using the take rates calculated for some parts of the Atlantic SSLL fishery, where leatherbacks are knows to forage, may more closely approximate the proposed action area, but may over-estimate take rates based upon the relative abundance and densities of leatherbacks in the two areas. Finally, the anticipated leatherback takes calculated using the historic SSLL just off the West Coast EEZ may slightly underestimate the anticipated takes within the proposed action area, as leatherbacks may be more densely aggregated in the EEZ than outside, as they migrate through the area or possibly feed. Due to the uncertainties in estimating anticipated takes in a fishery without historic observer records and in an area known as a foraging area for some individuals from the Western Pacific leatherback population, we took a very precautionary approach in our estimation of takes. We estimate that up to five leatherbacks may be taken in the SSLL EFP. This is slightly higher than the high range of takes estimated using the observed leatherback CPUE of the SSLL east of 130° W longitude (range of two to four) and consistent with the rate estimated using the Atlantic SSLL data for 2006 (which is a more complete data set than the 2005 data). This number may over-estimate the actual amount of leatherback take, but is a good conservative estimate based on the available information. As described previously, take rates of sea turtles in fisheries are highly variable among years, seasons, and areas, thus any projection of takes based upon observer data from the past is difficult to make with accuracy. In light of this, a conservative approach was taken in the development of the anticipated take in the SSLL EFP in which there is no observer data and there has been no historic fishery.

Any estimate of leatherback takes must be considered with caution, particularly given the high inter-annual variability of take. The reasons for the variability and possible correlations between turtle distribution and oceanographic conditions are a topic of on-going studies by NMFS. A recently published paper described the positive relationship between years with positive

Northern Oscillation Index (NOI) and higher abundance within the neritic zone off California, north of Point Conception (Benson *et al.* 2007a). A similar pattern could not be found between NOI conditions and leatherback takes in the DGN fishery, but work in this area will continue.

In the last six years, researchers have documented movements of leatherback turtles between nesting beaches in the Western Pacific and the U.S. West Coast. Observations of tracked leatherbacks captured and tagged off the West Coast have revealed an important migratory corridor from central California, to the south of the Hawaiian Islands, leading to Western Pacific nesting beaches. Researchers have also begun to track female leatherbacks tagged on Western Pacific nesting beaches, both from Jamursba-Medi and Wermon, Papua, Indonesia, and from the Morobe coast of Papua New Guinea. Most of the females that have been tagged in Jamursba-Medi, Papua, where nesting has been observed year round, with peak activity between May and September (Hitipeuw *et al.* 2007), have been tracked heading on an easterly pathway, towards the West Coast or heading north toward foraging areas off the Philippines and Japan. In addition, one female that was captured in central California in 2005 still had a tracking device that had been attached to her on Jamursba-Medi, confirming this trans-Pacific migration (P. Dutton, NMFS, personal communication, 2005). Research and tagging of leatherbacks is part of ongoing work by the SWFSC.

From the available data we anticipate that any leatherbacks exposed to the proposed action likely originate from western Pacific beaches, and primarily from Jamursba-Medi, Papua, Indonesia. It is important to note that not all leatherbacks found off the U.S. West Coast come from all leatherback nesting subpopulations in the western Pacific. Nesting female leatherbacks in the western Pacific exhibit varying seasonal, migratory, and behavioral differences, depending on the rookery at which they nest. Based upon satellite tagging studies conducted to date, most (if not all) of the female leatherbacks found off central California probably originate from the Jamursba-Medi nesting beaches. The Jamursba-Medi nesting site is one of the largest in the western Pacific. It is estimated that between 1,000 and 2,000 females make up the Jamursba-Medi nesting population. However, in 2004, year round monitoring at Wermon beach showed that leatherbacks nesting activity year round with peak activity between October and March (Hitipeuw *et al.* 2007). At this point, there are no satellite tracks to determine if these austral winter nesters may travel across the Pacific and forage off the US West Coast. The first satellite transmitters were put on post-nesting females at Wermon in August 2006 (Benson 2006) which will help to determine if these animals follow the same foraging migration as the austral winter nesters at Jamursba-Medi. It is also not known to what extent male leatherbacks utilize the proposed action area. The migratory routes of males are not as well known as those of females (Benson 2006) and the sex ratio of this population is also not unknown. Staff from the SWFSC have been sampling leatherbacks off the central California coast for over five years and annually the sex ratio of animals captured varies. Pooling all samples, n=40, the sex ratio is 2:1, females to males. Dutton *et al.* 2007 also report that, based on genetic analyses from limited samples from Malaysia and other nesting females throughout the western Pacific, that the haplotype frequencies for Terengganu, Malaysia are significantly different from the four western rookeries. This indicates that the Malaysian population is distinct from the western Pacific populations of Papua, PNG, Solomon Islands, and Vanuatu. None of the leatherbacks sampled off the central California coast had the Malaysian haplotype. We therefore assume that leatherbacks exposed to the proposed action will be from the western Pacific population and are likely to be from the

Jamursba-Medi nesting population.

B. Response

Potential impacts from the proposed action on leatherbacks will generally be related to injury or mortality, although any entanglement or hooking, whether or not it develops into an injury or mortality, may also impact sea turtles due to the forced submergence, and/or impairment or wounds suffered as a result of entanglement. Observer records from Hawaii and the Atlantic of SSLL using similar gear and configuration recorded 0% and 1% immediate mortality, respectively (Gilman et al 2006; Fairfield-Walsh and Garrison 2007). Therefore any mortalities in this fishery are likely to occur after the animal is released; whether a sea turtle dies will depend on the nature of the injury and/or whether gear remains on the animal and the amount of gear on the animal.

Leatherbacks, like all sea turtles, are prone to entanglement as a result of their body configuration and behavior (Balazs 1985). Records of stranded or entangled sea turtles reveal that fishing debris can wrap around the neck or flipper, or body of a sea turtle and severely restrict swimming or feeding. Over time, if the sea turtle is entangled when young, the fishing line will become tighter and more constricting as the sea turtle grows, cutting off blood flow and/or causing deep gashes. Sea turtles have also been found trailing gear that has been snagged on the bottom, thus causing them to be anchored in place (Balazs 1985). It is difficult to estimate whether leatherbacks entangled or hooked and released from SSLL gear would be caught again. Presumably, however, a leatherback recovering from a forced submergence would most likely remain resting on the surface, which would reduce the likelihood of being entangled or hooked again on SSLL gear. Recapture would also depend on the condition of the turtle and the intensity of fishing pressure in the area. There will be only one fisherman engaged in SSLL, so the likelihood of recapture in this type of gear is likely to be low although other fisheries may occur in the area.

Once entangled or hooked, factors such as size, activity, water temperature, and biological and behavioral differences between species bear directly on metabolic rates and aerobic dive limits and will therefore also influence survivability. For example, larger sea turtles are capable of longer voluntary dives than small turtles, so juveniles may be more vulnerable to the stress of forced submergence than adults.

1. *Hooking (Longline Gear)*
Sea turtles are either hooked externally - generally in the flippers, head, beak, or mouth - or internally, where the animal has attempted to forage on the bait, and the hook is ingested into the gastro-intestinal tract, often a major site of hooking (E. Jacobson, in Balazs, et al., 1995). Even if the hook is removed, which is often possible with a lightly hooked (i.e. hooked in the beak) turtle, the hooking interaction is believed to be a significant event. Like most vertebrates, the digestive tract of the sea turtle begins in the mouth, through the esophagus, and then dilates into the stomach. The esophagus is lined by strong conical papillae, which are directed caudally towards the stomach (White, 1994). The existence of these papillae, coupled with the fact that the esophagus snakes into an s-shaped bend further towards the tail make it difficult to see hooks, especially when deeply ingested. Not surprisingly, and for those same reasons, a deeply

ingested hook is also very difficult to remove from a turtle's mouth without significant injury to the animal. The esophagus is attached fairly firmly to underlying tissue; therefore, when a hook is ingested, the process of movement, either by the turtle's attempt to get free of the hook or by being hauled in by the vessel, can traumatize the internal organs of the turtle, either by piercing the esophagus, stomach, or other organs, or by pulling the organs from their connective tissue. Once the hook is set and pierces an organ, infection may ensue, which may result in the death of the animal. If a hook does not become lodged or pierce an organ, it can pass through to the colon, or even be expelled through the turtle (E. Jacobson in Balazs, et al., 1995). In such cases, sea turtles are able to pass hooks through the digestive track with little damage (Work, 2000). Of 38 loggerheads deeply hooked by the Spanish Mediterranean longline fleet and subsequently held in captivity, six loggerheads expelled hooks after 53 to 285 days (average 118 days; Aguilar, et al. 1995). If a hook passes through a turtle's digestive tract without getting lodged, the chances are good that less damage has been done. Tissue necrosis that may have developed around the hook may also get passed along through the turtle as a foreign body (E. Jacobson, in Balazs, *et al.*, 1995). Since implementation of the requirement to use of 18/0 circle hooks in fisheries in the Atlantic and Pacific, no leatherbacks have been observed deeply hooked.

In SSLL fisheries, most leatherbacks are lightly hooked, usually externally in the shell, flipper, or shoulder. In the Atlantic, about two-thirds of observed interactions are lightly hooked leatherbacks, with the other third being entangled only (no hooking) (Fairfield-Walsh and Garrison 2006). Hooking can occur as a result of a variety of scenarios, some of which will depend on foraging strategies and diving and swimming behavior of the various species of sea turtles. For example, necropsied olive ridleys have been found with bait in their stomachs after being hooked; therefore, they most likely were attracted to the bait and attacked the hook. In addition, leatherbacks, loggerheads and olive ridleys have all been found foraging on pyrosomas which are illuminated at night. If lightsticks are used on a shallow set at night to attract the target species, the turtles could mistake the lightsticks for their preferred prey and get hooked externally or internally by a nearby hook. Similarly, a turtle could concurrently be foraging in or migrating through an area where the longline is set and could be hooked at any time during the setting, hauling, or soaking process. Based upon data from the Atlantic pelagic longline fishery, it is considered likely that the majority (two thirds) of leatherbacks that interact with SSLL gear in the U.S. EEZ will be lightly hooked and the remaining one third will be entangled only, not hooked.

2. *Trailing Gear*

Trailing line is line that is left on a turtle after it has been captured and released, particularly line trailing from an ingested hook. Turtles are likely to swallow line trailing from an ingested hook, which may occlude their gastrointestinal tract, preventing or hampering the turtle when it feeds. As a result, trailing line can eventually kill a turtle shortly after the turtle is released or it may take a while for the turtle to die. Trailing line can also become snagged on a floating or fixed object, further entangling sea turtles or the drag from the float can cause the line to constrict around a turtle's appendages until the line cuts through the appendage. With the loss of a flipper a turtle's mobility is reduced, as is its ability to feed, evade predators, and reproduce. Observers on the vessel operating under the EFP will be directed to release any turtles captured (hooked) by cutting the line as close to the hook as possible in order to minimize the amount of trailing gear. This is difficult with larger turtles, such as the leatherback, which often cannot practicably be brought on board the vessel, or in inclement weather, when such action might place the observer or the vessel and its crew at risk.

Based upon the amount of trailing gear observed on vessels in the Atlantic, it is likely that leatherbacks that interact with this fishing gear will have most if not all trailing gear removed. As part of the terms and conditions of this proposed action, the applicant must carry, and use, equipment to remove gear from turtles and must attend a PRD workshop to learn how to properly use the equipment. These measures should increase the likelihood that all gear will be removed.

3. *Post-hooking Survival*
Research has been conducted in both the Atlantic and the Pacific to estimate post-hooking survival and behavior of sea turtles captured by longline gear. NMFS has hosted two workshops to analyze the post-hooking survival rates of hard-shelled and leatherback sea turtles (Long and Schroeder 2004; Ryder 2006). The most recent post-hooking mortality rates, based upon the nature of the interaction with longline gear, can be found in Table 13.

In addition, two recent papers have examined post-hooking mortality of turtles by utilizing pop-off satellite archival tags and these studies suggest a low level of post-hooking mortalities (Sasso and Epperly 2007; Swimmer *et al.* 2006)

4. *Forcible Submergence*
Sea turtles can be forcibly submerged by longline gear. Forcible submergence may occur through a hooking or entanglement event, where the turtle is unable to reach the surface to breathe. This can occur at any time during the set, including the setting and hauling of the gear, and generally occurs when the sea turtle encounters a net or line that is too deep below the surface, or is too heavy to be brought up to the surface by a swimming sea turtle. For example, a sea turtle that is hooked on a 3 meter branchline attached to a mainline set at depth by a 6 meter floatline will generally not be able to swim to the surface unless it has the strength to drag the mainline approximately 3 more meters (discussed further below). When interacting with longline gear, hooked sea turtles will sometimes drag the clip, attached to the branch line, along the main line. If this happens, the potential exists for a turtle to become entangled in an adjacent branch line which may have another species hooked such as a shark, swordfish, or tuna. According to observer reports, most of the sharks and some of the larger tuna such as bigeye are still alive when they are retrieved aboard the vessel, whereas most of the swordfish are dead. If a turtle were to drag the branch line up against a branch line with a live shark or bigeye tuna attached, the likelihood of the turtle becoming entangled in the branch line is greater. If the turtle becomes entangled in the gear, then the turtle may be prevented from reaching the surface. The potential also exists, that if a turtle drags the dropper line next to a float line, the turtle may wrap itself around the float line and become entangled. Due to the lightness of the gear and length of the branch lines to be used in the proposed action and the size and power of leatherbacks, it is probable that turtles will not be forcibly submerged and will be able to get to the surface to breath.

5. *Survival of Sea Turtles that Interact With Longline Gear*
In 2003, NMFS' Office of Protected Resources was charged with conducting a review of NMFS' February 2001 post-hooking mortality criteria and recommending if and how the earlier criteria

should be modified. As part of that review, the Office of Protected Resources convened a Workshop on Marine Turtle Longline Post-Interaction Mortality on 15-16 January 2004, during which seventeen experts in the areas of biology, anatomy/physiology, veterinary medicine, satellite telemetry and longline gear deployment presented and discussed the more recent data available on the survival and mortality of sea turtles subsequent to being hooked by fishing gear. Proceedings from that workshop and revised criteria for assessment of post-hooking mortality were published in 2006 (Ryder *et al.* 2006). The revised criteria are provided in Table 13.

Table 13. Post-hooking mortality rates of hardshell and leatherback sea turtles in longline gear.

Nature of interaction	Released with hook and line ≥ half the length of the carapace	Release with hook and line < half the length of the carapace	Release with all gear removed
Hooked externally with or without entanglement	20 (30)*	10 (15)	5 (10)
Hooked in lower jaw with or without entanglement	30 (40)	20 (30)	10 (15)
Hooked in cervical esophagus, glottis, jaw joint, soft palate, or adnexa with or without entanglement	45 (55)	35 (45)	25 (35)
Hooked in esophagus at or below level of the heart with or without entanglement	60 (70)	50 (60)	n/a
Entanglement only	50 (60)	50 (60)	1 (2)
Comatose/resuscitated	n/a	n/a	60 (70)

*Hardshell (leatherback rates are in parenthesis)

In order to estimate likely mortality associated with the incidental take of five leatherbacks, observer records from other SSLL fisheries were again reviewed. In the Hawaii-based and Atlantic fisheries, there were 0 percent and less than 1 percent immediate mortality rates, respectively. Based upon these rates, it is very unlikely that any leatherbacks taken in the SSLL EFP will be killed immediately. However, post-hooking mortality is a concern and the NMFS post-hooking mortality matrix (Ryder *et al.* 2006) was used in this assessment. Observer records from the Hawaii-based based SSLL after regulations indicate that all leatherbacks (n=10), were alive and lightly hooked when retrieved from the gear. All species of sea turtles taken in the Hawaii-based SSLL fishery following the 2004 regulations were alive when brought to the vessel (i.e., no immediate mortalities from drowning on SSLL gear) (Gilman *et a*l. 2006c). Leatherbacks lightly hooked with all gear removed have a post-hooking mortality rate ranging from 10 to 15 percent; if the hook is not removed and gear is left on the leatherback, post-hooking mortality rates range from 15 to 40 percent (Ryder *et al.* 2006). As shown in Table 14, in the Hawaii-based based SSLL fishery, 30 percent of leatherbacks were released without any gear attached, and 70 percent were released with gear attached (Gilman *et al.* 2006c). There is insufficient detail in the records from the Hawaii-based SSLL to link the observed takes to the post-hooking mortality matrix. Therefore, the larger data set of the NED experiments on modified gear (Watson *et al.* 2005), was considered for estimating mortality rates.

Table 14. Post-hooking condition of leatherbacks caught in Hawaii SSLL, 2004-2006, n=10

	Lightly hooked	Post hooking mortality
All gear removed	30%	10 - 15%
Released with gear attached	70%	15 – 40%

There is insufficient detail in the records from the Hawaii-based SSLL to link the observed takes to the post-hooking mortality matrix. Therefore, the larger data set of the NED experiments on modified gear (Watson et al 2005), was considered for estimating mortality rates. In the NED experiment, with high levels of observer coverage, most leatherbacks had most, if not all gear removed and most were externally hooked (i.e., hooked in the shoulder, flipper, or shell), which reduces the likelihood of post-hooking mortalities, compared to swallowed hooks (Fairfield-Walsh and Garrison 2007; Watson *et al.* 2005). Proper and complete, or near complete, removal of SSLL gear was tied to the training received by the participants and the willingness to use the gear and release tools (NMFS 2004). Approximately one third of the leatherbacks incidentally taken in the Atlantic SSLL fishery were entangled, while none of the leatherbacks observed in the Hawaii-based SSLL fishery were recorded as entangled. This may simply be related to the differences in sample sizes; in the Hawaii-based SSLL the number of observed takes over three years is 10, in the Atlantic the number of takes was 103 (NMFS 2004). If we assume that the larger sample size better reflects the nature of the interactions between leatherbacks and SSLL gear and that post-hooking removal of gear will be comparable to the trained vessel crew in the NED experiments, then the calculated leatherback post-hooking mortality rate developed for the Atlantic HMS is appropriate to use, that is 13.1 percent (NMFS 2004). The low rate of post-hooking mortality is likely due in part to the nature of the hookings (externally hooked) and removal of trailing gear. This low rate of post-hooking mortality is consistent with studies of turtles released from longlines and equipped with pop-up satellite archival tags (Sasso and Epperly 2007, Swimmer *et al.* 2006). Results from these experiments suggest a post-hooking mortality as low as approximately 9%. NMFS reasonably assumes that a similar situation will occur in the SSLL EFP since attending a PRD workshop is a term and condition of the proposed action; therefore, anticipated post-hooking mortality associated with the five takes is one leatherback. Based upon very low observed immediate mortality rates in the Hawaii based and Atlantic SSLL fisheries, 0 and less than 1%, respectively, no immediate mortalities are anticipated.

Table 15. Estimated post-hooking mortalities in the NED experiments based upon condition of incidentally taken leatherbacks (n=103) (from NMFS 2004)

Externally hooked			Hooked in lower jaw			Hooked in upper mouth or throat			Hooked deep in esophagus	
Hook,line ≥ .5 CL	Hook, line < .5 CL	All gear removed	Hook,line ≥ .5 CL	Hook, line < .5 CL	All gear removed	Hook,line ≥ .5 CL	Hook, line < .5 CL	All gear removed	Hook ,line ≥ .5 CL	Hook, line <.5 CL
7	20	32	0	0	1	0	1	8	0	0
2.1	3	3.2	0	0	0.15	0	0.45	2.8	0	0

Entangled only		Comatose and resuscitated		Dead	*Total*
Released entangled	Disentangled	Hook, line < .5 CL	All gear removed		
2	32	0	0	0	*103*
1.2	0.64	0	0	0	*13.1%*

Table provides the total number of injuries/interactions observed and percentage of total observed interactions.

C. Risk to individuals and populations

To analyze the impacts of five captures of leatherbacks (total post-hooking mortality of one) on the Pacific population, we began by identifying the population from which the leatherbacks are most likely to have come. As described in section IV, leatherbacks utilizing the U.S. West Coast as a foraging area are likely to have originated from the western Pacific population. Although we can not completely eliminate the possibility that an eastern Pacific leatherback may be exposed to the proposed action, the weight of evidence suggests that western Pacific leatherbacks are much more likely to be captured and possibly killed by the proposed action and the probability of an eastern Pacific leatherback being captured is very low. Based upon satellite tagging of post-nesting females and turtles tagged in central California, and the timing of the arrival of leatherbacks into the U.S. west coast, post-nesting (Benson *et al.* 2007b) it appears likely that leatherbacks taken in the proposed action come from the Jamursba-Medi nesting aggregation.

Based upon the carapace lengths of leatherbacks entangled in DGN gear fished in the proposed action area and leatherback field studies being conducted in central California by the SWFSC, adult and sub-adult leatherbacks are the age-class most likely to be affected by the proosed action. The available data do not allow us to determine with certainty the sex ratio of leatherbacks likely to be exposed to the SSLL gear. Studies on leatherbacks in the central California area since 2000 have shown annual variations in the sex ratio of animals caught, although when pooling all leatherbacks captured by the SWFSC, the sex ratio is 2:1 females to males (27 and 13, females and males, respectively). Given this, it appears that of five leatherbacks taken, three would be females, however, given the limited data available to identify sex ratios, we considered that the all leatherbacks captured could be all males, all females, or 3:2 females to males or males to females. Based upon a total anticipated mortality rate of 13.1% and that both male and female turtles could be captured, we considered the impacts to the Western Pacific population from the loss of one male or one female.

As described previously in the *Status of Species* section, there are fundamental life history parameters that are unknown for the western Pacific leatherback population, therefore developing quantitative models for this population is difficult. Also, existing quantitative models used in previous biological opinions considered only the effects on the female nesting populations and may not be sensitive enough to detect changes in population extinction probabilities when very small numbers of individuals are removed from the population. Model results could be interpreted to suggest that either small losses do not affect population viability or are indicative that the power of the model may be insufficient to detect population level effects from small losses even if such effect would occur. Thus, one line of evidence would indicate that the loss of one female leatherback would not impact the viability of the western Pacific population. Due to the lack of basic life history data on male turtles, existing models can not be used to evaluate the impacts of the removal of males from the population. Given the uncertainty in relying on strictly quantitative methods and the limitations of these methods in terms of impacts on males, we therefore base our risk analysis upon what is known about the strengths and vulnerabilities in the dynamics of the population most likely to be affected and consider case studies of other relevant sea turtle populations.

Population Dynamics

In general, very little is known about the population dynamics of Pacific leatherbacks, such as the number of individuals at various age stages, whether the sex ratio is skewed, and fecundity of individuals and the population. In order to answer some of these basic questions, many years of research and an extensive tagging program will be necessary. Some basic life history information is available that suggests that the Jamursba-Medi nesting aggregation and entire western Pacific population appear to have qualities that may make this population resilient to the one time loss of up to one individual or other impacts. As described in the *Status of the Species* section, western Pacific leatherbacks exhibit variations in migration patterns, timing of nesting activity, nesting areas, and foraging areas. These types of life history patterns may better reflect a population's likelihood of survival, than just numbers of individuals. While populations are generally monitored by the number of individuals in the population, methods that consider the overall fitness of the population are also useful. Measures of a population's health, beyond counts of individuals, include the geographical distribution of individuals in the population, the genetic diversity, the growth rate of the population, the diversity in reproductive strategies, and differences in foraging strategies. Western Pacific leatherbacks appear to utilize a variety of beaches throughout Southeast Asia and have been observed nesting in a number of countries including Malaysia, Indonesia, Papua New Guinea, the Solomon Islands, Vanuatu, Viet Nam, Thailand, Fiji, and Australia. Major nesting sites are known, although leatherbacks will utilize a number of beaches and have been observed nesting on different beaches within a single season; thus, perhaps, limiting the vulnerability of eggs placed at only one location. Leatherbacks are not limited to one season of nesting, with nesting activity having been observed in both winter and summer months at some beaches. These factors, which offer a greater resilience to one time threats, also make it difficult to estimate the population or trends, as females may move from beach to beach. Based upon limited satellite tagging that has been done at nesting beaches, post-nesting leatherbacks exhibit differences in foraging patterns (Benson *et al.* 2007b). Leatherbacks in the Caribbean exhibit a similar post-nesting strategy of utilizing a variety of foraging areas.

This strategy may buffer this subpopulation against environmental perturbations or anthropogenic threats. In contrast, the eastern Pacific leatherbacks generally utilize the same foraging areas at the same time, exposing this subpopulation to the same threats (Dutton 2006). Leatherbacks in the Caribbean have responded well to conservation measures at beaches and it has been suggested that the at-sea diversity of foraging areas may have contributed to this success, so it seems reasonable that this trait in western Pacific leatherbacks may contribute to the success of programs to increase the population through beach conservation measures.

Recent genetic work indicates a shared haplotype among most western Pacific leatherbacks. The Malaysian population is the only one that does not share the haplotype. This may suggest that most western Pacific leatherbacks mate with one another, thus limiting the threat of small populations and restricted gene pools, although the genetic diversity may be limited. Conversely, it has been speculated that one of the reasons for the lack of recovery of Malaysian leatherbacks is the lack of males within the small population, thus eggs over the past several years have not have been fertilized.

While nesting counts at the Jamursba-Medi nesting beach have been relatively stable (that is, numbers have not plummeted over the past few decades, as has been observed in the eastern Pacific), it is currently not possible to determine if new breeders are moving into the population or if the same females are returning to nesting areas. Obtaining this type of information will require extensive tagging of adult females and monitoring throughout the nesting areas. As noted above, it is also very difficult to detect trends in the western Pacific leatherback population based solely on nesters, since females do not exhibit high levels of site fidelity (e.g., females that do not return to a beach to nest may have simply nested at another beach) and re-migration intervals are not known for this population (for the western Pacific or for the Jamursba-Medi population). However, if it is assumed that each leatherback lays five nests per season and the period between nesting is on average 2.5 years (consistent with leatherback populations in the Caribbean), then the total number of nesting females in the western Pacific population is estimated to be between 2,700 and 4,500 western Pacific nesting females and Jamursba-Medi (currently the largest nesting aggregation in the western Pacific population) is estimated to be between 933 and 1803 adult nesting females.

The western Pacific leatherback population faces a number of threats at nesting beaches and at sea. The major threats at the nesting beaches are predation of eggs and hatchling, beach erosion resulting in loss of usable habitat or nest inundation, and logging, which compromises the availability of the nesting beach habitat. A recently detected concern is the low level of hatching success at Jamursba-Medi and Wermon (25.5% and 47.1%, respectively, for nests that had not been disturbed due to predation). Many of these threats are being addressed through conservation measures. As detailed in Appendix A, NMFS is involved in many of these efforts. They include aerial surveys, satellite tagging, nesting beach management and protection and outreach to fishermen to reduce interactions with leatherbacks. As described in the *Status* section, there are a number of recent cooperative management agreements that have gone into effect over the past few years to protect western Pacific leatherbacks. At a recent meeting of turtle experts at the Bellagio Sea Turtle Conservation Initiative, one of the key recommendations was long-term funding for research and habitat protection at nesting beaches in the Western Pacific to help increase the hatchling success in this population. Although funding for this and other actions under the Bellagio Blueprint has not been secured, the plan highlights the need for these actions, which if taken, may significantly contribute to the recovery of western Pacific leatherbacks.

The major at-sea threat to this population continues to be incidental capture in fisheries. As described in the *Status of the Species* section, the development of numerous fisheries in the 1970s through the 1990s, is believed to be one of the major factors leading to the rapid decline of the once large Malaysian leatherback population. There is no indication from the international bodies regulating high seas fisheries that fishing effort will increase and indeed a number of resolutions and management actions suggest that high seas tuna fishing should remain stable or decline. However, coastal fisheries still remain an unknown impact.

There are reasons to believe that conservation efforts or changes in fisheries over the past 15 years will begin to be detected through increases in the number of nesters in the western Pacific population. For example, eggs harvest was common in Papua, Indonesia for many years but was effectively eliminated with the implementation of nightly beach patrols in 1993 (Hitipeuw *et al.* 2007). This work closely coincides with the 1992 ban on large scale drift gillnet in the high seas. While the level of leatherback bycatch in many fisheries is unknown, it has declined in U.S. fisheries such as the California and Hawaii longline over historical levels, and fishing techniques (e.g., circle hooks) are now required in the Hawaii based shallow set longline fishery. For example, in 2004, 2005, and 2006, leatherback captures in the Hawaii shallow-set longline fishery were 1, 8, and 1, respectively, with zero mortality.

These measures are in contrast with conditions in Malaysia, which once had over 10,000 nests laid annually on its beaches, (Chan and Liew 1996), but now have only around ten females returning to nest (P. Dutton, NMFS, personal communication, 2006). This population is now considered functionally extinct. The dramatic loss of this population was due to a variety of factors including near complete harvest of eggs in the 1950's and 1960's and incidental capture in commercial fisheries, particularly the Japanese squid fishery which is estimated to have taken over 500 leatherbacks in 1989 and 1990 (Chan and Liew 1996). In addition, poor hatchery practices produced exclusively females for years and all eggs collected for the past six years have been infertile. By comparison, no new fishing effort is expected in the high seas; egg poaching is illegal; there is no indication of a lack of males (e.g., no data to indicate a high level of infertile eggs). Finally conservation measures did not begin until the nesting population had reached low numbers, approximately 60, which may have limited the population's ability to respond to conservation measures. By contrast, there are likely still thousands of females nesting in the western Pacific.

Aggressive beach monitoring (and either limiting or eliminating egg harvest and poaching of adults) has led to increases in annual leatherbacks nest counts in the Caribbean (Dutton *et al.* 2004) and in Tongaland, KwaZulu-Natal, South Africa (Hughes, 1996). Nesting beach protection is credited with increasing green turtle nesters at Tortuguero (Bjorndal *et al.* 1999) and Hawaii (Balazs and Chaloupka 2004). Based upon these case studies and recent conservation activities in the western Pacific, NMFS expects that increases in the western Pacific population are likely to occur. It has been approximately 15 years since egg protection and fishery reduction measures began, so this expectation can be tested in the next few years as monitoring efforts improve and the turtles hatched in those early years begin to return as mature adults.

All populations experience some variation in their numbers due to environmental and demographic stochasticity, and populations are usually able to sustain themselves through these periods. When populations reach low numbers, their ability to recovery from these perturbations may be compromised. Roberts and Hawkins (1999) described various characteristics of marine species that tend to make them more or less vulnerable to extinction or extirpation. These include traits related to population turnover, reproduction, range and distribution. Leatherbacks have various traits that lend resilience or vulnerability to viability of their populations in the face of human or natural disturbance. For example, their long lives and large size at sexual maturity are indicative of a species that faces high extinction risks at low population abundances (Pimm *et al.* 1988). On the other hand, the species' range in the western Pacific for both foraging and nesting areas provides a buffer against local disturbances that could extirpate small endemic populations of a long-lived, large size species.

Because the leatherback (like most species) has characteristics that can work for or against its chances of survival, care must be taken when assessing the implications of human actions. Evidence provided by the case studies discussed above shows that when human intervention occurs at the right time and scale, turtle populations can rebound. However, in instances where intervention is too late or does not consider the underlying status of the population (*e.g.* little or no males left in the Malaysian population), population collapse may still occur. Based on what we know or expect for the western Pacific population of leatherbacks, we expect that ongoing conservation and impact minimization measures will result in an increase in adult female population numbers measured at the nesting beaches. However, given the potential future effects of climate change, which include possible reductions in hatching rates, skewed sex ratios of hatchlings, nesting beach temperature effects on the current and future production of male leatherbacks, and reduced available nesting habitat, we cannot say if the expected increase in numbers will equate to a temporary increase before population numbers decline again or an increase in the viability of the population.

The proposed action is projected to result in the death of one leatherback. As discussed earlier, because we cannot determine the sex of the affected turtle, this analysis considers the loss of either one male or one female leatherback. We expect, given the observed sex ratio in the waters off of California, that it is more likely the proposed action will incidentally capture and kill a female leatherback. If the killed leatherback is a male, it is not possible to assess the impact of losing one adult male leatherback in any quantitative manner, since the number of males in the total population is not known. Once hatched, males do not return to land for the rest of their lives, so there is no reliable means of assessing their population. The little that is known about male leatherbacks is based upon limited in-water surveys. It is known that males and females do not develop long-term pair bonds and that males may mate with a number of females, although the number of males needed to sustain a genetically healthy and diverse population is not known (Hamann *et al.* in Lutz *et al.* 2003). Also, changes in sex-ratios based upon temperature changes at beaches may cause the overall proportion of males within a population to decline (hatchling sex is determined by the temperature of eggs while in the nest (Chan and Liew 1996)), with more males being produced in cool nests and more females being produced in warm nests. Currently, nesting beach temperatures at Jamursba-Medi are within ranges expected to produce more females than males. Conversely, at Wermon, nesting beach temperatures are such that more males than females are likely to be produced. We do not know if the production at both beaches results in overall balanced production of males and females. Finally, we expect that the measures taken in various fisheries to reduce incidental capture and related injury and mortality of leatherbacks also improve the survival of the current population of adult and sub-adult males. Given the weight of the evidence on the current status of the species and the lower likelihood that the captured and killed leatherback will be a male, we do not find it reasonable to expect that the death of one male leatherback will have a detectable effect on the western Pacific population.

Based upon what is known of the reproductive behavior of leatherbacks, we expect that the females are of most value to the population and the loss of one adult female represents the worse case scenario of impacts from this proposed action. We considered the potential effects of the loss of one adult or sub-adult in one year, relying upon published reports, case studies, and our knowledge of population dynamics of the western Pacific population of leatherbacks. If we assume that the population is increasing or stable, it is reasonable to assume that the loss of up to one adult female in one year would be insufficient to detect a change in the reproductive output of the population from which she came. In other words, an increasing or stable population would likely not be affected by the loss of one adult female in one year. If the population is declining, the loss of one female would be more likely to have an effect. While it is clear that the number of leatherbacks in both the western and eastern Pacific population has declined in the past 30 years, the decline has continued steadily and dramatically in the eastern Pacific, but there is no evidence of a similar rate of decline in the western Pacific. The growth rate of western Pacific leatherback populations is not currently known. Researchers at the SWFSC are attempting to estimate a population level trend from the available data, but this is not likely to be available for years.

Therefore, we consider the impact to the female population in terms of the characteristics of the population that may make it more, or less, able to withstand the loss of one adult female in one year, and not have an effect on the viability of the population. Currently, the abundance of the western Pacific population is estimated to be several thousand breeding females, although there is uncertainty associated with the abundance counts based on the methods used for estimation. Western Pacific leatherback females utilize a variety of nesting beaches and nest throughout the year, providing some population resilience to localized impacts. Nest counts have not shown a significant decline in recent years and may be stable since the 1990's. As discussed above, the production of female hatchlings has increased as a result of nesting beach temperatures at some beaches, although more males are produced at other beaches. Sub-adult and adult females also forage in several areas of the Pacific Ocean, further buffering the sub-adult and adult life stages against localized impacts. In addition, we project that nesting beach adult counts may increase in the future as a result of protective measures taken at the nesting beaches and in ocean fisheries. Given these population and biological characteristics, we do not expect that the one time loss of an adult or sub-adult female leatherback would have a detectable effect on the western Pacific population.

As a result, NMFS does not expect that the impacts of the death of up to one adult male or female leatherback in the proposed SSLL EFP fishery, scheduled to last up to four months, are sufficient to reduce appreciably both the likelihood of survival and recovery of either the Jamursba-Medi nesting aggregation or Western Pacific population of leatherbacks. Because we expect no reductions in the likelihood of survival and recovery to the Western Pacific leatherback population, we therefore also expect no impacts to the leatherback sea turtle species as globally listed.

VII. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this opinion (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

On-going threats to endangered leatherbacks are described in the status of the species section and factors affecting species in the action area section are expected to continue. NMFS is unaware of any human-related actions or natural changes (including variation in SST) occurring within the action area over the next year that would substantially change the impacts of the proposed action on the marine mammals and leatherbacks covered in this opinion.

VIII. CONCLUSION

After reviewing the available scientific and commercial data, current status of leatherback turtles, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is NMFS' biological opinion that the shallow set longline fishing that would be conducted under issuance of an exempted fishing permit through the Highly Migratory Species Fishery Management Plan, is not likely to jeopardize the continued existence of endangered leatherback sea turtles. No other ESA-listed species under NMFS's jurisdiction are considered likely to be adversely affected by the proposed action.

IX. INCIDENTAL TAKE STATEMENT

Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. NMFS further defines "harm" as an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and 7(o)(2), taking that is incidental to and not the purpose of the proposed action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are nondiscretionary, and must be undertaken by NFMS for the exemptions in section 7(o)(2) to apply. NMFS has a continuing duty to regulate the activity covered by this incidental take statement. If NMFS (1) fails to assume and implement the terms and conditions the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, NMFS must monitor the progress of the action and its impact on the species as specified in the incidental take statement. (50 CFR §402.14(I)(3))

Section 7(b)(4) of the ESA requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA and the proposed action may incidentally take individuals of listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species. It also states that reasonable and prudent measures, and terms and conditions to implement the measures, be provided that are necessary to minimize such impacts. Only incidental take resulting from the agency action and any specified reasonable and prudent measures and terms and conditions identified in the incidental take statement are exempt from the taking prohibition of section 9(a), pursuant to section 7(o) of the ESA.

A. Amount or Extent of Take

Mortality and interaction rates of leatherbacks have been calculated using a number of other fisheries to approximate the likely effects of the proposed action, since no observer data is available as there has not been a SSLL fishery within the proposed action area. The latest information on the distribution and abundance of leatherbacks in the proposed action area was also reviewed and factored into the estimated takes and mortalities. A turtle cap of five leatherbacks or one mortality is part of the proposed action, therefore if five leatherbacks are observed taken or one observed killed due to interactions with the proposed action, the fishery will immediately cease for the year.

The numbers below are for the proposed time period of the SSLL EFP, September 1 through December 31.

Table 16. Anticipated incidental takes of leatherbacks in the proposed action

Species	Captured	Killed
Leatherback	5	1

This proposed action is for 2007 only. If the applicant applies for an exempted fishing permit again in 2008, a new consultation will be required.

B. Effect of the Take

In the accompanying biological opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the leatherback sea turtle.

C. Reasonable and Prudent Measures

NMFS believes the following reasonable and prudent measures, as implemented by the terms and conditions are necessary and appropriate to minimize impacts to ESA-listed species considered in this opinion. The measures described below are non-discretionary, and must be undertaken by NMFS for the exemption in section 7(o)(2) to apply. If NMFS fails to adhere to the terms and conditions of the incidental take statement, the protective coverage of section

7(o)(2) may lapse. Thus, the following reasonable and prudent measures must be implemented to allow activities under the SSLL EFP.

1. NMFS shall require that sea turtles captured alive be released from fishing gear in a manner that minimizes injury and the likelihood of further gear entanglement.

2. NMFS shall require that, if practicable, comatose or lethargic sea turtles be retained on board, handled, resuscitated, and released according to the procedures outlined at 50 CFR 223.206 (d)(1).

3. NMFS shall require that dead sea turtles be disposed of at sea unless an observer requests retention of the carcass for sea turtle research.

4. NMFS shall continue to collect data on capture, injury, and mortality of any ESA-listed species encountered during fishing operations authorized by the EFP in addition to life history information.

D. Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, NMFS must comply or ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above, and apply to the proposed action. These terms and conditions are non-discretionary.

1. The following terms and conditions implement reasonable and prudent measure No. 2.

   1A. Any incidentally taken ESA-listed animal shall be handled with due care to prevent injury to live animals, observed for activity, and returned to the water as soon as practicable.

   1B. Any ESA-listed animal shall be freed of all gear, ensuring the least harm possible to the animal.

   1C. The following release gear shall be required onboard the vessel while engaging in fishing under the EFP:
   1. Long-handled de-hooker for ingested hooks (hook removal device plus extended reach handle)
   2. Long-handled line-cutter
   3. Long-handled devise to pull an "inverted V"

   1D. ESA-listed species shall be released away from the gear and vessel in an area where they are unlikely to be recaptured and with the engine gears in neutral position.

   1E. Any ESA-listed species brought on board must not be dropped on to the deck.

1F. The vessel owner and operators of the vessel shall be required to attend training provided by the SWR Protected Resources Division on the safe handling and release of sea turtles and training on require release gear.

2. The following term and condition implements reasonable and prudent measure No. 3.

2A The vessel owner and the operators of the vessel must receive training on sea turtle resuscitation requirements, as outline at 50 CFR 223.206(d)(1).

2B Vessel operators shall bring comatose or lethargic leatherbacks on board, if practicable, and perform resuscitation techniques according to the procedures described at 50 CFR 223.206(d)(1).

3. The following term and condition implements reasonable and prudent measure No. 4.

3A Dead sea turtles may not be consumed, sold, landed, offloaded, transshipped or kept below deck. Dead sea turtles must be returned to the ocean after identification unless the observer requests the turtle remain onboard for further study.

4. The following terms and conditions implement reasonable and prudent measure No. 5.

4A. NMFS shall continue to collect data on any incidental take of marine mammals, sea turtles, and other protected species (in addition to those considered in this opinion) through its observer program. A report summarizing protected species bycatch data taken during EFP fishing shall be prepared and disseminated to the NMFS Southwest Region – Protected Resources Division following fishing authorized by the EFP.

4B. NMFS shall continue to collect life history information on sea turtles, such as species identification, measurements, condition, skin biopsy samples, and the presence or absence of tags, through its observer program. NMFS observers shall directly measure or visually estimate tail length on any leatherbacks caught during the fishing under the EFP.

XI. REINITIATION NOTICE

This concludes formal consultation on the action outlined above. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of the incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. If the incidental take causes the termination of the SSLL EFP fishery, then reinitiation of consultation will not be necessary, as the action will have ceased.

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Appendix A

Recently completed Sea Turtle Projects in the Western Pacific Region			
Project Name	**Region**	**Funding Agency**	**Purpose**
Education to Reduce Adverse Interactions Between Commercial Fishing Operations and Sea Turtles	Federated States of Micronesia (FSM)	PIR (S-K grant)	To improve the capabilities of observers in recognizing, handling, and reporting interactions between turtles and commercial tuna fisheries in FSM
Leatherback satellite tagging (March 2003: 10 ARGOS and 4 PAT satellite tags deployed)	Papua New Guinea (PNG)	PIR/SWFSC	To provide clues to additional nesting sites, and will be used as a basis to design aerial surveys.
Sea turtle in-water survey	Confederated States of Northern Mariana Islands (CNMI)	PIR	Population assessments, capacity building
Tagging & surveys	Guam	DAWR/PIR	Population assessments, capacity building
Tagging & surveys	America Samoa	DMWR/PIR	Population assessments, capacity building
Cultural survey	Republic of the Marshal Isl. (RMI)	MIRFA/GPA/ PIR	Define parameters for potential research. ID past and ongoing research; literature search; feasibility and logistics study

Recently completed Sea Turtle Projects in the Western Pacific Region			
Project Name	**Region**	**Funding Agency**	**Purpose**
International Meetings 1) 2nd International Fishers Forum -IFF 2) 23rd Annual Sea Turtle Symposium 3) Japan Fisheries Agency 4) People & the Sea Conference 5) Bellagio, Italy 6) IATTC Bycatch (PIRO) Other A) www.seaturtle.org Server fund donation B) Marine Turtle Newsletter (MTN) – Publication support	Liaison & Networking: 1) Hawaii, U.S.A. 2) Malaysia 3) Japan 4) Amsterdam, Netherlands 5) Bellagio, Italy 6) Japan	WPFMC	1) IFF2: Forum for fishermen and scientists to exchange information and ideas on technologies and strategies to mitigate sea turtle and seabird interactions with longline fisheries. 2) 23rd Sea Turtle Symp.: Travel support to Kuala Lumpur for 30 Pacific Islanders and Asian participants. 3) Japan Fisheries Agency: Liaison & collaboration activities to develop sea turtle mitigation measures 4) People & the Sea: (Sept.2003) Increase awareness of Pacific Island sea turtle issues 5) Bellagio, Italy: (Nov. 2003) Conservation and sustainable management of sea turtles in the Pacific Ocean 6) IATTC Bycatch: (Jan 2004) Sea Turtle working group meeting in Kobe, Japan
Hawksbill Simulation Model	Pacific Oceanic Region	WPFMC	To develop an interactive simulation model of hawksbill turtle population dynamics for stocks exposed to various mortality risks in the Oceania region.
Tagging & surveys	Federated States of Micronesia (FSM)	MIRFA/GPA/ PIR	Yap tagging and monitoring program, re-initiate genetic stock identification.
Ostional Wildlife Refuge – workshops	Costa Rica	WPFMC	Fishermen Workshops to increase awareness to reduce sea turtle mortality
Transfer sea turtle conservation technology	PNG & MI	PIR/NFA	Efforts to take the FSM "success" on the road to transfer conservation technology and assist with observer training implementation

Ongoing WPFMC and PIR funded Sea Turtle Projects in Progress since 2004			
Project Name	**Region**	**Funding Agency**	**Purpose**
Leatherback Aerial Survey	PNG	PIR/SWFSC	Four year study to quantify leatherback nesting stocks of the W. Pac. Region. Year one (Jan –Feb 2004): logistics & feasibility
Leatherback satellite tagging	PNG	PIR/SWFSC	To fill information gaps regarding migratory movements.
Green & hawksbill turtle survey	Palau	PMRD/PSC/TNC/PIR	Population assessment, education & outreach
Education & Outreach	Guam	WPFMC	Education Poster
Regional Tagging Database	Western Pacific Region (SPREP)	WPFMC	Rehabilitate SPREP's tagging database in collaboration with five international colleagues
Policy Post-Doc	Pacific Ocean basin	SWFSC/PIR	A two-year post-doctoral position in the economics of sea turtle conservation.
Wermon Beach	Papua	WPFMC	Leatherback nesting beach management: Dec 2003 – Oct. 2004
Kei Islands	Western Papua	WPFMC	To study and reduce direct harvest pressure of leatherbacks in foraging grounds. Nov 2003 – Oct 2004
Kamiali Wildlife Area	Papua New Guinea	WPFMC	Leatherback nesting beach management: Nov 2003 – April 2004
Japan Loggerheads	Japan	WPFMC	Loggerhead nesting beach management to save doomed eggs at four sites: May – Sept 2004
Baja, Mexico Loggerheads	Baja, Mexico	WPFMC	Measure to reduce incidental capture of juvenile loggerheads in the halibut gillnet fishery: March – Sept 2004

Ongoing WPFMC and PIR funded Sea Turtle Projects in Progress since 2004			
Project Name	**Region**	**Funding Agency**	**Purpose**
TED Introduction - Observer Training and Capacity Building	PNG	PIR/NFA	Measure to implement TED's in the shrimp fishery in the Gulf of Papua, PNG
Mitigation of sea turtle bycatch	Ecuador	WPFMC	To introduce mitigation measures (circle hooks/mackerel bait) to artesinal longline fishers to reduce interaction rates.
International Meetings (Liaison & Networking)	1) Costa Rica 2) Bangkok 3) Second WPFMC Sea Turtle Workshop	WPFMC	1) 24th Annual Sea Turtle Symp – Feb. 22-29, 2004 2) 2nd IOSEA MoU meeting Conference support, Bangkok -March 16, 2004 3) WPFMC office – Hawksbill & Leatherbacks May 17-21, 2004
Capacity building, assessments	Guam, CNMI Am. Samoa,	PIR/PIFSC	Year 2 - Continue beach monitoring, tracking, education and outreach
Observer Training and Capacity Building	WWF-Bali, Indonesia	PIR	Application being processed by the NOAA GMD - expected start in fourth calendar quarter of 2004
Observer Training and Capacity Building	Solomon Is.	SWFSC	Evaluation of the longline regulatory impacts
Observer Training and Capacity Building	Marshall Islands	PIR	Field work under way as of August 2004