3.6.1.4.5 Estimating the Incidental Catch of Seabirds by the Hawaii-based Longline Fishery

The NOAA Fisheries, Southwest Fisheries Science Center, Honolulu Laboratory (NOAA Fisheries, SWFSC Honolulu Laboratory [now PIFSC]) used data from observer reports and the Western Pacific Daily Longline Fishing Log to estimate the annual incidental catch of seabirds in the Hawaii longline fishery, and to describe the spatial distribution of the catch.

Fleet-wide incidental catch estimates prior to 1998, were computed using a regression tree technique and bootstrap procedure (Skillman and Kleiber, 1998). The regression tree technique revealed structure in observer data sets and was applied to an array of independent variables (e.g., month, latitude, longitude, target species, gear type, sea surface temperature and distance to seabird nesting colonies). The model was "pruned" by cross validation, meaning that only the statistically significant predictors of seabird catches were kept in the analysis. Interestingly, this analysis showed that catches of black-footed albatrosses were found to be significantly related only to proximity to nesting colonies and longitude, while catches of Laysan albatrosses were significantly related only to proximity to nesting colonies and year (Klieber, 1999). In 1999, McCracken (2000) developed a new prediction model to estimate the number of black-footed and Laysan albatrosses taken by the Hawaii longline fishery during 1999, and then re-estimated takes for earlier years, 1994-1998 (Table 3.6.1-6).

For each albatross species, a prediction model was developed that related the number of takes documented by an observer to ancillary variables recorded in the vessel's logbook or derived from such variables. The model was then used to predict the number of albatrosses taken on each unobserved trip on the basis of the predictor variables recorded in the logbooks for those trips. The total annual take for the fleet was estimated by adding the sum of predicted takes for the unobserved trips to the sum of recorded takes for the observed trips. After exploring several alternative statistical models for take estimation, a negative binomial generalized linear model was adopted. Variables well represented in the logbooks and transformations of them were considered as candidate predictors. A bootstrapping procedure that takes into account the uncertainty of the prediction model parameter estimates, and also the random variation of actual unobserved takes about the expected predicted values was used to construct approximate "prediction intervals" for take. The bootstrap analysis also produced estimates of the estimation bias; the latter was used to adjust the point estimates. Point estimates adjusted for estimation bias and approximate prediction intervals for take are given in Table 3.6.1-6. Estimates of takes for the years 1994-1998 differ from values computed and reported by P. Kleiber in 1999. The revised estimates are based on a larger accumulation of observer statistics and different prediction models.

It was estimated that between 1994 and 1999, an average of 1,175 Laysan albatrosses and 1,388 black-footed albatrosses were killed in the Hawaii longline fishery each year (Table 3.6.1-6). These average annual incidental catches represent about 0.46% and 0.05% of the estimated 1998 worldwide black-footed and Laysan albatross populations, respectively. Albatross behavior, coupled with their numbers, may explain why so many more black-footed albatrosses interact with Hawaii longline fishery than Laysan albatrosses. The world breeding population of the Laysan albatross (558,415 birds) was estimated to be roughly ten times that of the black-footed albatross (61,866 birds), yet more black-footed albatrosses were recorded to interact with the

Hawaii-based longline fishery, suggesting that the latter species was more seriously affected (Cousins and Copper, 2000). Satellite telemetry studies have shown that in general the Laysan albatrosses tend to fly to Alaska to forage whereas the black-footed albatrosses fly to the west coast continental U.S. (Anderson and Fernandez, 1998).

Table 3.6.1-6 Estimated annual total incidental catch of albatrosses in the Hawaii longline fishery based on catches recorded by NMFS observers on monitored fishing trips. Source: 1994-1999, NMFS, SWFSC Honolulu Laboratory (McCracken, 2000a). 2000 values, preliminary information (McCracken, unpubl. inf., December 2001).

Black-footed Albatross				
Year	Estimated Seabird Catch	95% Prediction Interval		Previous Estimate (P. Kleiber 1999)
		Lower Bound	Upper Bound	
1994	1,830	1,457	2,239	1,994
1995	1,134	899	1,376	1,979
1996	1,472	1,199	1,811	1,568
1997	1,305	1,077	1,592	1,653
1998	1,283	1,028	1,601	1,963
1999	1,301	1,021	1,600	—
Laysan Albatross				
Year	Estimated Seabird Catch	95% Prediction Interval		Previous Estimate (P. Kleiber 1999)
		Lower Bound	Upper Bound	
1994	2,067	1,422	2,948	1,828
1995	844	617	1,131	1,457
1996	1,154	835	1,600	1,047
1997	985	715	1,364	1,150
1998	981	679	1,360	1,479
1999	1,019	688	1,435	—

Even though no short-tailed albatrosses had been reported interacting with a Hawaii-based longline vessel or its gear, a Biological Assessment (NMFS, 1999) was initiated to assess the range of maximum annual interactions in the Hawaii longline fishery. The assessment concluded that between one to three short-tailed albatrosses may be in the area where the fishery operated, based on the at-sea sighting from aboard the NOAA FRS *Townsend Cromwell* and visitations to the NWHI. The continued sighting of the lone female short-tailed albatross on Sand Island, Midway Atoll, suggests that if the bird interacts with a Hawaii longline vessel and its gear, the interaction is not lethal. Interactions could occur with no injuries to the bird, but hooking and entanglement interactions often lead to a death. Given the historical levels of fishing effort and no interactions of short-tailed albatrosses with the Hawaii longline fishery, the probability of a single interaction was assessed to be extremely low; and this probability would be reduced if seabird mitigation techniques were employed. Based on a random distribution of the short-tailed albatrosses in the North Pacific, and the area fished by the Hawaii longline fishery, the USFWS in their 2000 BiOp estimated that 334 short-tailed albatrosses are in the area where the fishery operates and that up to 2.2 birds would be incidentally caught each year. Then on November 18, 2002, the USFWS revised the short-tailed albatross BiOp to reflect the changes in the fishery (no shallow-sets) due to the final sea turtle rules. They amended the incidental take statement for the Hawaii-based longline fishery from 2.2 short-tailed albatrosses per year to one bird per year.

Data collected by the NOAA Observer Program show that when Hawaii-based longline vessels target swordfish the incidental catch of seabirds is far higher than when vessels target tuna (Table 3.6.1-7). One reason for this is that vessels targeting swordfish are more likely to operate within the foraging range of the seabirds. Black-footed and Laysan albatrosses nesting in the NWHI forage predominantly to the north and northeast of the Hawaiian Archipelago, flying as far as Alaska or the western coast of the contiguous U.S. (Anderson and Fernandez, 1998). The region of greatest interaction between seabirds and the longline fishery as it operated in 1998 is a latitudinal band between 25°N and 40°N stretching from the international dateline to about 150°W (Figure 3.6.1-9). This band, referred to as the North Pacific Transition Zone, contains a broad, weak, eastward flowing surface current composed of a series of fronts situated between the Subtropical Gyre to the south and Subarctic Gyre to the north (Roden, 1980; Polovina, 2000; Seki et al., 2002). The convergent fronts are zones of enhanced trophic transfer with high concentrations of phytoplankton, zooplankton, jellyfish and squid (Bakun, 1996; Olson et al., 1994). The increased level of biological productivity in these zones attracts, in turn, higher trophic level predators such as swordfish, sea turtles and seabirds. Hawaii longline vessels that targeted swordfish set their lines where the fish are believed to be moving south through the fronts following squid, the primary prey of swordfish (Seki et al., 2002.). Squid is also the primary prey item for the albatrosses (Harrison et al., 1983). Hence, the albatrosses and the longline vessels targeting swordfish are often present at the same time in the same northern front of high biological productivity.

Figure 3.6.1-9 Observed interactions of black-footed albatrosses (top) and Laysan albatrosses (bottom) between 1994-1999 in the Hawaii longline fishery (Source: NOAA Fisheries Observer Program, unpubl. info.).

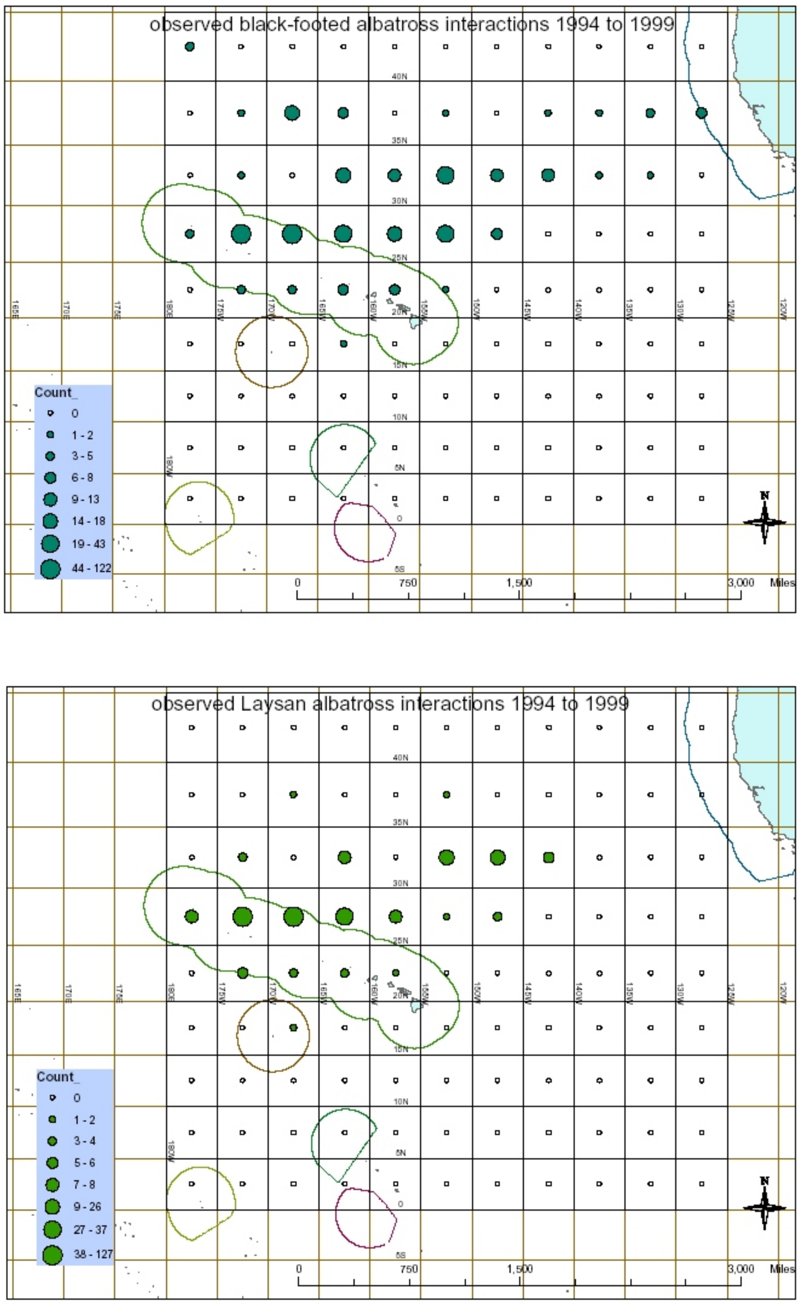


Table 3.6.1-7 Incidental catch of albatrosses in the Hawaii longline fishery by set type based on NMFS observer records from 1994-1998 (Source: NOAA Fisheries, SWFSC Honolulu Laboratory, unpubl. data).

Targeted Fish During Set	Observed Bird Catch	Number of Observed Sets	Bird Catch/Set
Swordfish	300	488	0.615
Mixed[a]	446	948	0.470
Tuna	16	1,252	0.012

[a] Some longline sets target both swordfish and bigeye tuna and are called "mixed" sets. These sets are typically made with a modified swordfish gear configuration and without the use of a line-shooter.

A second reason that longline vessels targeting swordfish incidentally caught a larger number of seabirds than vessels targeting tuna relates to differences in gear configuration and the depth and time of gear deployment. Longline gear targeting swordfish generally consists of fewer hooks between floats (3-5), branch line (gangion) weights attached further from the hooks and buoyant chemical light sticks. During swordfish fishing the longline is set at a shallow depth (5-60 m), and the line and baited hooks sink comparatively slowly. Consequently, albatrosses following behind a vessel targeting swordfish have a greater opportunity to dive on hooks and become caught. In addition, vessels targeting swordfish often set their lines in the late afternoon or at dusk when the foraging activity of seabirds may be especially high.

Vessels targeting tuna differ from those targeting swordfish in that they generally operate in warm waters further south and set their lines at a relatively deep depth (15-180 m or greater). To facilitate the deployment of fishing gear at these depths vessels usually increase the longline sink rate by employing a hydraulic line-setting machine (line-shooter or line-setter) and branch lines with 40-80 gram weights attached close (20-90 cm) to the hooks. The use of a line-setting machine and weighted branch lines to increase the longline sink rate also reduces the incidental catch of seabirds by decreasing the time that baited hooks are near the surface and accessible to feeding seabirds.

Since December 1999, the Hawaii longline fishery was subject to a range of measures arising from litigation concerning sea turtle interactions in this fishery. These methods included time-area closures, fishing effort limits, and a ban on shallow longline sets, and were designed to minimize interactions between the longline fishery and sea turtles. A consequence of these various methods to reduce sea turtle takes also affected the level of seabird incidental catch by the Hawaii longline fishery. In particular, the ban on the use of shallow longline sets greatly reduced the incidental catch of black-footed and Laysan albatrosses (Table 3.6.1-8).

In 2000, the Hawaii-based longline fishery operated under two different management regimes: 1) between January 1 - August 24, 2000, the Hawaii-based longline fleet was prohibited from fishing within a box (termed "Area A") which was bounded by 28°N, 44°N, 150°W and 168°W (Figure 2.2-5); between August 25 - December 31, 2000, the fleet continued to be prohibited from fishing within Area A, but was also limited to no more than 154 sets (with 100% observer coverage) within the area on either side of Area A and bounded by 28°N and 44°N and between 173°E and 168°W ("Area B" Figure 2.2-5). Further, targeting of swordfish (shallow-setting) was prohibited in waters between the equator and 28°N, from 173°E to 137°W ("Area C" Figure 3.6.1-10).

Total fleet wide incidental catches of seabirds during the two time periods in 2000 were estimated using a prediction model that related observer recorded catch to ancillary (predictor) variables recorded in logbooks (McCracken, 2001). The incidental seabird catch for unobserved trips was predicted by applying the model to the predictor variables recorded in the logbooks for those trips. The catch rates were then calculated as the bird catch per set (fleet wide catches/fleet wide effort).

Table 3.6.1-8 Estimated fleet-wide seabird takes in the Hawaii-based longline fishery between 2000 and 2001 (source: McCracken, 2001).

Year	Black-footed Albatross		Laysan Albatross	
	Estimated Catch	95% CI	Estimated Catch	95% CI
2000[a]	272	212-373	155	108-215
2001[b]	58	Not available	62	Not available

[a] Year 2000 was calculated as the time period between August 25, 2000 and March 31, 2001.
[b] Year 2001 was calculated as the time period between July 1, 2001 and June 30, 2002.

A comparison of seabird incidental catch rates between 1999 (Table 3.6.1-8), and the two management regimes in 2000 (Table 3.6.1-9), reveals that area closures and a prohibition on shallow-setting greatly reduced the incidental seabird catch rates. The area closure alone may not have been effective at reducing the incidental catch of seabirds by the Hawaii longline fleet because the result of the closure (implemented to afford protection to sea turtles) tended to push fishing effort towards the breeding colonies on the NWHI. Earlier analysis of NOAA Fisheries observer data showed that catches of black-footed and Laysan albatrosses were found to be significantly related to the proximity to nesting colonies (Skillman and Kleiber, 1998).

Table 3.6.1-9 Estimated fleet wide seabird catch rates during two periods in 2000 for the Hawaii-based longline fishery based on NOAA Fisheries observer records (BF=black-footed albatross; LA=Laysan albatross).

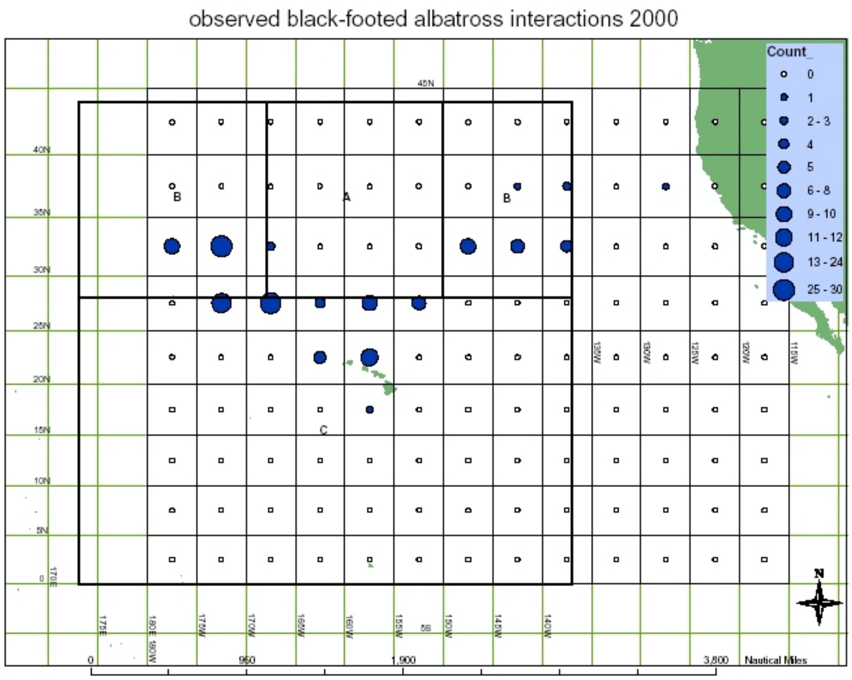
Period	Observer Coverage (% of trips)	Total Fleet Wide Effort (# of sets)	Estimated Fleet Wide Seabird Catch Rate (bird catch/set)	
			BF	LA
January 1, 2000 to August 24, 2000	4.4	9,156	0.13	0.12
August 25, 2000 to December 31, 2000	21.3	3,827	0.02	0.00

Further regulatory changes were made on June 12, 2001. Of most relevance to seabird catch was the continued prohibition on shallow-setting for all Hawaii-based longline vessels fishing north of the equator, as well as requirements that all bait be dyed blue and that strategic offal discards be used to mitigate seabird interactions. The low numbers of observed seabirds caught by the Hawaii longline fleet during 2001 (Figure 3.6.1-10), suggests that the prohibition on shallow-setting continued to maintain the fleet's reduced seabird incidental catch (Table 3.6.1-10). It was estimated that in 2001 the Hawaii longline fishery interacted with 250 black-footed albatrosses and 252 Laysan albatrosses (HLA and WPRFMC, 2004). These interaction levels were further reduced to an estimated 65 black-footed albatrosses and 51 Laysan albatrosses in 2002 (HLA and WPRFMC, 2004).

Table 3.6.1-10 Observed number of seabirds caught by Hawaii-based longline vessels between 2001 and 2003 (Source: NOAA Fisheries Observer Program, unpubl. info.).

Seabird Species	2001			2002			2003		
	Released Alive	Returned Dead	Total	Released Alive	Returned Dead	Total	Released Alive	Returned Dead	Total
Black-footed Albatross	6	76	82	1	17	18	1	23	24
Laysan Albatross	13	63	76	3	13	16	0	44	44
Sooty Shearwater	0	2	2	0	0	0	0	0	0
Unidentified Shearwater	0	1	1	0	0	0	0	0	0
Total	19	142	161	4	30	34	1	67	68

Figure 3.6.1-10 Observed interactions of black-footed albatrosses (top map) and Laysan albatrosses (bottom map) between August 25, 2000 and March 31, 2001, in the Hawaii longline fishery (Source: NOAA Fisheries Observer Program, unpubl. info.).



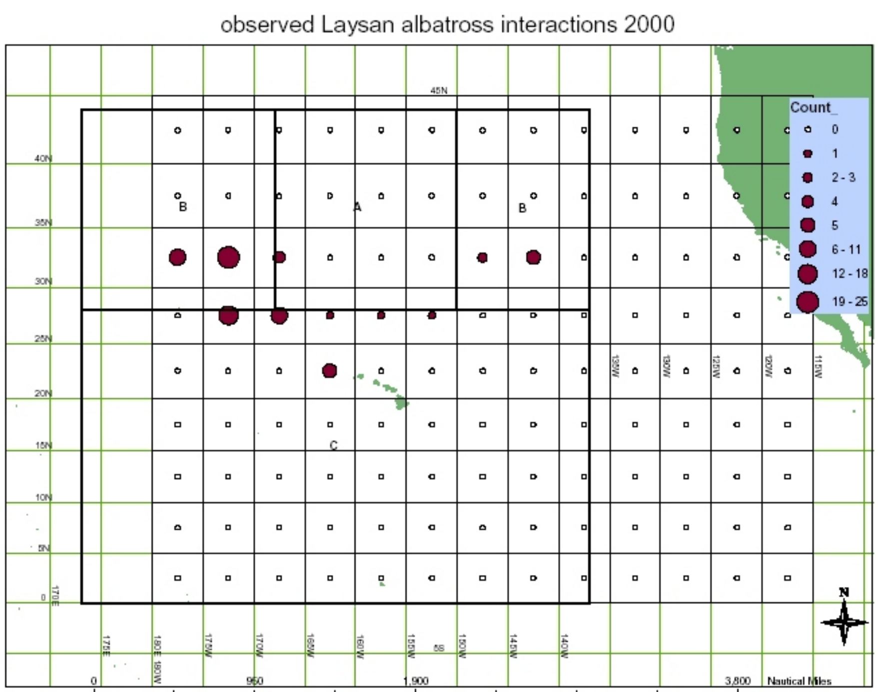
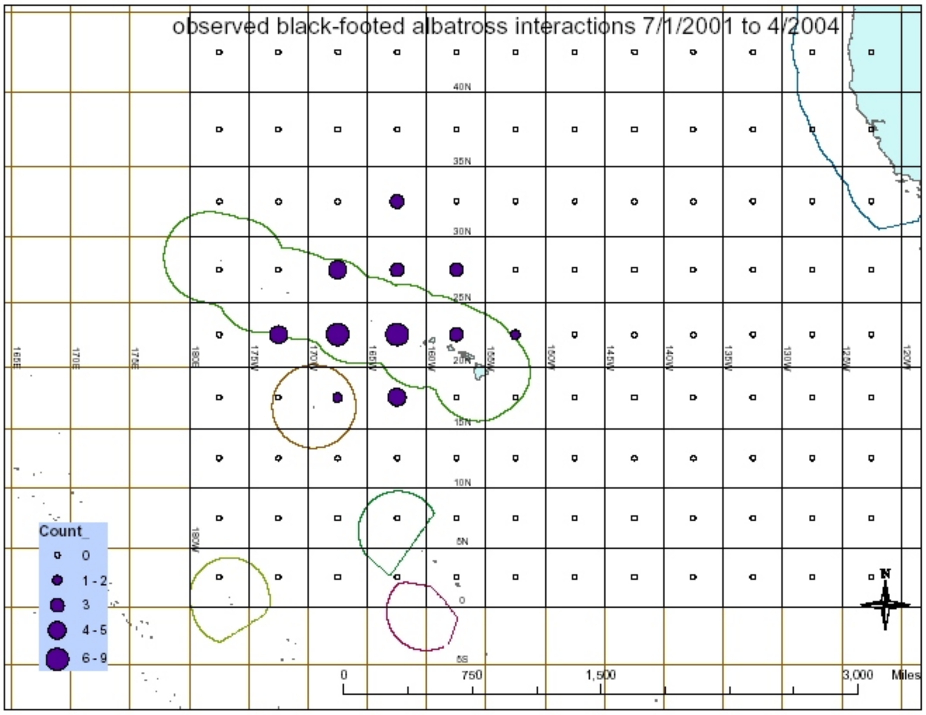
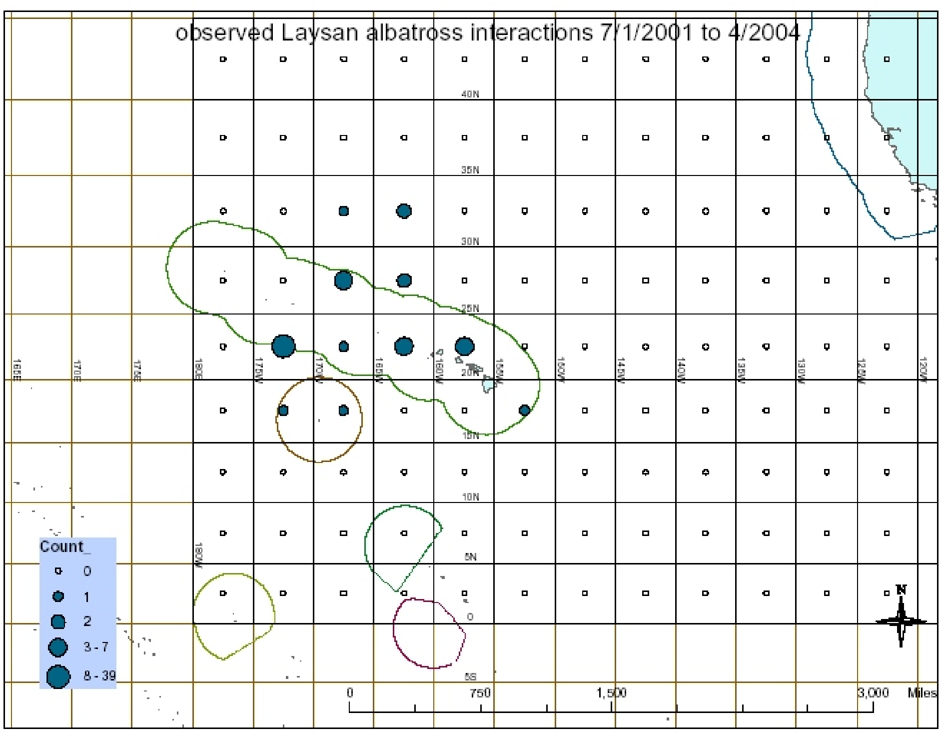


Figure 3.6.1-11 Observed interactions of black-footed albatrosses (top map) and Laysan albatrosses (bottom map) from July 1, 2001 to July 4, 2004 in the Hawaii longline fishery (Source: NOAA Fisheries Observer Program, unpubl. info.).





3.6.2 Sea Turtles

The Pelagics SEIS (WPRFMC, 2004) described sea turtle species present in the region in some detail. Much of that and other current information on these species is contained in Appendix C. The following sections briefly describe the current status of these species.

3.6.2.1 Leatherback Turtle (*Dermochelys coriacea)*

Leatherback turtles are widely distributed throughout the oceans of the world, however, populations have been severely reduced. In 1980, the leatherback population was estimated at approximately 115,000 (adult females) globally (Pritchard, 1982). A 1996 publication estimated the global population of nesting female leatherbacks at 26,200 to 42,900 (Spotila et al., 1996).

The leatherback turtle is listed as endangered under the ESA throughout its global range. Furthermore, the Red List 2000 of the IUCN has classified the leatherback as "critically endangered"[10] due to "an observed, estimated, inferred or suspected reduction of at least 80% over three generations" based on: (a) direct observation; (b) an index of abundance appropriate for the taxon; and (c) actual or potential levels of exploitation.

Leatherback turtles are the largest of the marine turtles, with a CCL (curved carapace length) often exceeding 150 cm and sometimes spanning 270 cm in an adult (NMFS and USFWS, 1998c). Befitting its unusual ecology, the leatherback is morphologically and physiologically distinct from other sea turtles. Its streamlined body, with a smooth, dermis-sheathed carapace and dorso-longitudinal ridges may improve laminar flow of this highly pelagic species. Its front flippers are proportionately larger than in other sea turtles.

Primary threats to the species are the incidental killing of turtles by coastal and high seas fishing and to a lesser extent the killing of nesting females, collection of eggs at the nesting beaches (Eckert and Sarti, 1997; NMFS and FWS, 1998d; Spotila et al., 2000; Wetherall et al., 1993) and degradation of habitat. On some beaches, nearly 100% of the eggs are harvested.

There are no nesting populations of the leatherback turtle in areas under U.S. jurisdiction in the Pacific; however, there are important foraging areas off the west coast of the continental United States and on the high seas near the Hawaiian islands.

The diet of the leatherback turtle generally consists of cnidarians (i.e., medusae and siphonophores) in the pelagic environment (for a review see Bjorndal, 1997). Surface jellyfish feeding is reported in waters under U.S. jurisdiction, especially off the western coast of the continental United States (Eisenberg and Frazier, 1983; Starbird et al., 1993). While Monterey Bay and the Farallon islands in California (Starbird et al., 1993) and the southwest Pacific off Chile and Peru (Eckert, 1999b; Eckert, unpub. data) appear to be important seasonal foraging areas for the leatherback, there has been no systematic study of leatherback turtle foraging grounds in the Pacific (NMFS and FWS, 1998a).

[10]Taxa are categorized as critically endangered when they are facing an extremely high risk of extinction in the wild in the immediate future.

3.6.2.2 Loggerhead Turtle (*Caretta caretta*)

The loggerhead turtle is listed as threatened under the ESA throughout its range, primarily due to direct take, incidental capture in various fisheries, and the alteration and destruction of its habitat. The loggerhead is categorized as endangered by the International Union for Conservation of Nature and Natural Resources (IUCN), where taxa so classified are considered to be facing a very high risk of extinction in the wild in the near future. Loggerhead turtles are a cosmopolitan species inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters.

The loggerhead is characterized by a reddish brown, bony carapace, with a comparatively large head, up to 25 cm wide in some adults. Adults typically weigh between 80 and 150 kg, with average curved carapace length (CCL) measurements for adult females worldwide between 95-100 cm CCL (*in* Dodd, 1988) and adult males in Australia averaging around 97 cm CCL (Limpus, 1985, *in* Eckert, 1993). Juveniles found off California and Mexico measured between 20 and 80 cm (average 60 cm) in length (Bartlett, 1989, *in* Eckert, 1993).

There are no records of nesting loggerhead turtles in the Hawaiian Islands (Balazs, 1982a), or in any of the islands of Guam, Palau, the Northern Mariana Islands, Marshall Islands (Thomas, 1989), the Federated States of Micronesia (Pritchard, 1982a), or American Samoa (Tuatoʻo-Bartley et al., 1993). There are very few records of loggerheads nesting on any of the many islands of the central Pacific, and the species is considered rare or vagrant on islands in this region (NMFS and FWS, 1998d). Pacific populations of loggerhead turtles found in U.S. jurisdictions are thought to originate from Japanese nesting areas (NMFS and FWS, 1998d).

For their first years of life, loggerheads forage in open ocean pelagic habitats. Both juvenile and subadult loggerheads feed on pelagic crustaceans, mollusks, fish, and algae. The large aggregations of juveniles off Baja California have been observed foraging on dense concentrations of the pelagic red crab, *Pleuronocodes planipes* (Pitman, 1990; Nichols, et al., 2000b).

The transition from hatchling to young juvenile occurs in the open sea, and evidence is accumulating that this part of the loggerhead life cycle may involve trans-Pacific developmental migration (Bowen et al.,1995).

3.6.2.3 Green Turtle (*Chelonia mydas*)

Green turtles are listed as threatened under the ESA, except for breeding populations found in Florida and the Pacific coast of Mexico, which are listed as endangered. The IUCN has classified the green turtle as endangered due to an "observed, estimated, inferred or suspected reduction of at least 50% over the last 10 years or three generations, whichever is longer," based on: (a) direct observation; (b) an index of abundance appropriate for the species; and (c) actual or potential levels of exploitation. Using a conservative approach, Seminoff (2002) estimates that the global green turtle population has declined by 34% to 58% over the last three generations (approximately 150 years) although actual declines may be closer to 70% to 80%. Causes for this decline include harvest of eggs, subadults and adults, incidental capture by fisheries, loss of habitat, and disease.

Green turtles are distinguished from other sea turtles by their smooth carapace with four pairs of lateral scutes, a single pair of prefrontal scutes, and a lower jaw-edge that is coarsely serrated. Adult green turtles have a light to dark brown carapace, sometimes shaded with olive, and can exceed one meter in carapace length and 100 kilograms (kg) in body mass.

Green turtles are found throughout the world, occurring primarily in tropical, and to a lesser extent, subtropical waters. The species is considered to consist of five main populations: the Pacific Ocean, Atlantic Ocean, Indian Ocean, Carribean Sea, and Mediterranean Sea.

The genus *Chelonia* is composed of two taxonomic units at the population level, the eastern Pacific green turtle (referred to by some as "black turtle," *C. mydas agassizii*), which ranges (including nesting) from Baja California south to Peru and west to the Galapagos Islands, and the nominate *C. m. mydas* in the rest of the range (insular tropical Pacific, including Hawaii).

Green turtles are thought to be declining throughout the Pacific Ocean, with the exception of Hawaii, as a direct consequence of a historical combination of overexploitation and habitat loss (Eckert, 1993; Seminoff, 2002).

Based on limited data, green turtle populations in the Pacific islands have declined dramatically, due foremost to harvest of eggs and adults by humans. In the green turtle recovery plan (NMFS and USFWS, 1998), directed take of eggs and turtles was identified as a "major problem" in American Samoa, Guam, Palau, CNMI, Federated States of Micronesia, Republic of the Marshall Islands, Wake, Jarvis, Howland, Baker, and Midway Islands, Kingman Reef, Johnston and Palmyra Atoll. Severe over harvests have resulted in modern times from a number of factors: 1) the loss of traditional restrictions limiting the number of turtles taken by island residents; 2) modernized hunting gear; 3) easier boat access to remote islands; 4) extensive commercial exploitation for turtle products in both domestic markets and international trade; 5) loss of the spiritual significance of turtles; 6) inadequate regulations; and 7) lack of enforcement (NMFS and USFWS, 1998a).

In Hawaii, green turtles nest on six small sand islands at French Frigate Shoals, a crescent-shaped atoll situated in the middle of the Hawaiian Archipelago (Balazs, 1995). Green turtles in Hawaii are considered genetically distinct and geographically isolated although recently a nesting population at Islas Revillagigedos in Mexico has been discovered to have some animals with the same mtDNA haplotype that commonly occurs in Hawaii. Ninety percent of the nesting and breeding activity of the Hawaiian green turtle occurs at French Frigate Shoals, where 200-700 females are estimated to nest annually (NMFS and USFWS, 1998a). Important resident areas have been identified and are being monitored along the coastlines of Oahu, Molokai, Maui, Lanai, Hawaii, and at large nesting areas in the reefs surrounding French Frigate Shoals, Lisianski Island, and Pearl and Hermes Reef (Balazs, 1982; Balazs et al., 1987). Since the establishment of the ESA in 1973, and following years of exploitation, the nesting population of Hawaiian green turtles has shown a gradual, but definite increase (Balazs, 1996). For example, the number of green turtles nesting at an index study site at East Island has tripled since systematic monitoring began in 1973 (NMFS and USFWS, 1998a).

Most green turtles appear to have a nearly exclusive herbivorous diet, consisting primarily of sea grass and algae (Wetherall et al., 1993; Hirth, 1997), those along the east Pacific coast seem to have a more carnivorous diet.

The nonbreeding range of green turtles is generally tropical, and can extend thousands of miles from shore in certain regions. Hawaiian green turtles monitored through satellite transmitters were found to travel more than 1,100 km from their nesting beach at French Frigate Shoals, south and southwest against prevailing currents to numerous distant foraging grounds within the 2,400 kilometer span of the archipelago (Balazs, 1994; Balazs et al., 1994; Balazs and Ellis, 1996). Three green turtles outfitted with satellite tags on Rose Atoll (the easternmost island at the Samoan Archipelago) traveled on a southwesterly course to Fiji, approximately 1,500 km distance (Balazs et al., 1994).

3.6.2.4 Olive Ridley Turtle (*Lepidochelys olivacea*)

The olive ridley is listed as threatened under the ESA throughout the Pacific, except for the Mexican nesting population, which is listed as endangered, primarily because of over-harvesting of females and eggs. The olive ridley is categorized as endangered by the IUCN, where taxa so classified are considered to be facing a very high risk of extinction in the wild in the near future (IUCN Red List, 2000).

The olive ridley is one of the smallest living sea turtles (carapace length usually between 60 and 70 cm and rarely weighing over 50 kg) and is regarded as the most abundant sea turtle in the world. They are olive or grayish green, with a greenish white underpart, and adults are moderately sexually dimorphic (NMFS and USFWS, 1998e).

Olive ridley turtles occur throughout the world, primarily in tropical and sub-tropical waters. The species is divided into three main populations in the Pacific Ocean, Indian Ocean, and Atlantic Ocean. In the western Pacific, olive ridleys are not as well documented as in the eastern Pacific, nor do they appear to be recovering as well.

The olive ridley turtle is omnivorous and identified prey include a variety of benthic and pelagic prey items such as shrimp, jellyfish, crabs, snails, and fish, as well as algae and sea grass (Marquez, 1990).

Olive ridley turtles lead a primarily pelagic existence (Plotkin et al., 1993), migrating throughout the Pacific, from their nesting grounds in Mexico and Central America to the north Pacific. While olive ridleys generally have a tropical range, with a distribution from Baja California, Mexico to Chile (Silva-Batiz et al., 1996), individuals do occasionally venture north, some as far as the Gulf of Alaska (Hodge and Wing, 2000). Surprisingly little is known of their oceanic distribution and critical foraging areas, despite being the most populous of north Pacific sea turtles.

3.6.2.5 Hawksbill (*Eretmochelys imbricata)*

The hawksbill turtle is listed as endangered under the ESA and in the International Union for the Conservation of Nature (IUCN) Red Data Book. Under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the hawksbill is identified as "most endangered." Anecdotal reports throughout the Pacific indicate that the current population is well below historical levels. In the Pacific, this species is rapidly approaching extinction primarily due to the harvesting of the species for its meat, eggs, and shell, as well as the destruction of nesting habitat by human occupation and disruption (Meylan and Donnelly, 1999; NMFS, 2001)

Hawksbill turtles are circumtropical in distribution, generally occurring from latitudes 30°N to 30°S within the Atlantic, Pacific and Indian Oceans and associated bodies of water (NMFS and FWS, 1998c). Adult and immature hawksbill turtles are found in Hawaiian waters, but they are uncommon. There are no reports of interactions between this species and the Hawaii-based longline fishery, although the potential for interaction exists.

Hawksbills are recognized by their relatively small size (carapace length less than 95 cm), narrow head with tapering "beak," overlapping scutes, and strongly serrated posterior margin of the carapace.

The hawksbill occurs in tropical and subtropical seas of the Atlantic, Pacific and Indian Oceans. In the U.S. Pacific Ocean, there have been no hawksbill sightings off the west coast (Meylan and Donnelly, 1999). Hawksbills have been observed in the Gulf of California as far as 29°N, throughout the northwestern states of Mexico, and south along the Central and South American coasts to Columbia and Ecuador (Meylan and Donnelly, 1999). In the Hawaiian Islands, hawksbill turtles nest in the main islands, primarily on several small sand beaches on the Islands of Hawaii and Molokai. Two of these sites are at a remote location in the Hawaii Volcanos National Park.

Hawksbills appear to be declining throughout their range. By far the most serious problem hawksbill turtles face is the harvest by humans, while a less significant threat, but no less important, is loss of habitat due to expansion of resident human populations and/or increased tourism development.

There is limited information on the biology of hawksbills, probably because they are sparsely distributed throughout their range and they nest in very isolated locations (Eckert, 1993). Hawksbills have a relatively unique diet of sponges (Meylan, 1985; 1988). While data are somewhat limited on diet in the Pacific, it is well documented in the Caribbean where hawksbill turtles are selective spongivores, preferring particular sponge species over others (Dam and Diez, 1997b).

3.6.2.6 Interactions of the Hawaii-based Longline Fleet with Sea Turtles

Port departures by Hawaii-based longline vessels numbered 1,128 during 2002, of which 278 carried observers. This represented about 24.6% observer coverage. Total observed fishing effort was approximately 6,786,303 hooks and 3,523 sets. There were 14 sea turtle interactions observed. Five sea turtles were released alive or injured and nine were released dead. Table 3.6.2-1 summarizes the observed interactions.

Table 3.6.2-1 Observed longline gear/turtle interactions, 2002

Turtle Species	Condition		
	Released Alive/Injured	Dead	Total
Loggerhead	3	1	4
Olive Ridley	0	7	7
Leatherback	2	0	2
Unidentified Hardshell	0	0	0
Green	0	1	1
Hawksbill	0	0	0
Total	5	9	14

3.6.3 Marine Mammals

Stock assessment information presented below for both listed and non-listed marine mammal species comes primarily from NOAA's *U.S. Pacific Marine Mammal Stock Assessments: 2002* (Carretta et al., 2002) and the draft 2003 updates (Carretta et al., 2003) available on NMFS' Office of Protected Resources web site.

The most recent information on cetacean abundance in Hawaiian waters is the report by Barlow (2003) that summarizes the results of a NOAA survey conducted in August-November 2002. Two NOAA research vessels surveyed the entire EEZ around the Hawaiian Islands along parallel transects spaced 85 km apart (outer EEZ stratum) and 42.5 km apart within 140 km of the MHI (main island stratum). Both visual observations and acoustic detections were employed. Twenty-four species of cetaceans were seen, including two species (Fraser's dolphin and sei whale) that had not been previously documented to occur in Hawaiian waters. The most abundant large whales were sperm whales and Bryde's whales. The most abundant delphinids were rough-toothed dolphins and Fraser's dolphins. Dwarf and pygmy sperm whales and Cuvier's beaked whales were estimated to be quite abundant. Accurate estimates of abundance for migrating whales were not possible as the survey did not take place during periods of their highest abundance in Hawaiian waters. Nevertheless, abundance estimates were possible for 21 other species. The overall density of cetaceans was low, especially for delphinids. The precision of density and abundance estimates was generally low for all species due to the small number of sightings. Table 3.6.3-1 summarizes the sightings data, calculated abundances and densities, and the coefficients of variation (CV) from Barlow (2003).

Table 3.6.3-1 Sightings and Estimated Abundances of Cetaceans in the Hawaii EEZ from Research Cruises in 2002.

Species	Main Island Stratum		Outer EEZ Stratum		Overall		
	#Sightings	Abundance	#Sightings	Abundance	Abundance	Individuals/ km^2	CV
offshore spotted dolphin	6	4931	2	5329	10260	0.0042	0.41
striped dolphin	1	508	10	9877	10385	0.0042	0.48
rough-toothed dolphin	7	3860	7	16044	19904	0.0081	0.52
bottlenose dolphin	5	525	4	2738	3263	0.0013	0.6
Risso's dolphin	2	594	3	1757	2351	0.001	0.65
Fraser's dolphin	0	0	1	16836	16836	0.0069	1.11
melon-headed whale	0	0	1	2947	2947	0.0012	1.1
pygmy killer whale	1	817	0	0	817	0.0003	1.12
false killer whale	0	0	1	268	268	0.0001	1.08
short-finned pilot whale	7	3131	7	5715	8846	0.0036	0.49
killer whale	0	0	2	430	430	0.0002	0.72
sperm whale	2	56	16	7026	7082	0.0029	0.3
pygmy sperm whale	0	0	2	7251	7251	0.003	0.77
dwarf sperm whale	0	0	3	19172	19172	0.0078	0.66
unidentified beaked whale	1	330	0	0	330	0.0001	1.05
Blaineville's beaked whale	0	0	1	2138	2138	0.0009	0.77
Cuvier's beaked whale	0	0	2	12728	12728	0.0052	0.83
Longman's beaked whale	0	0	1	766	766	0.0003	1.05
Bryde's whale	0	0	8	493	493	0.0002	0.34
sei whale	1	77	0	0	77	0	1.06
fin whale	0	0	2	174	174	0.0001	0.72
spinner dolphin	3	2036	1	768	2804	0.0011	0.66
DELPHINIDS POOLED	32	16403	39	62709	79112	0.0323	
BEAKED WHALES POOLED	1	330	4	15632	15962	0.0065	