INTER-AMERICAN TROPICAL TUNA COMMISSION
COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL

WORKING GROUP TO REVIEW STOCK ASSESSMENTS
7TH MEETING

LA JOLLA, CALIFORNIA (USA)
15-19 MAY 2006

DOCUMENT SAR-7-05c

SEABIRDS and FISHERIES in the IATTC AREA

Compiled by
Kim S. Rivera
NOAA Fisheries National Seabird Coordinator
NOAA Fisheries
Alaska Region, Juneau, AK, USA

Introduction:

The interaction of seabirds with fisheries (particularly longline gear) is an international issue as demonstrated by the adoption of: an international plan of action for reducing the incidental catch of seabirds in longline fisheries (IPOA) (FAO 1999, Brothers et al 1999), resolutions by numerous regional fishery management organizations (RFMO) (CCAMLR, ICCAT, WCPFC, IOTC), and mandatory mitigation requirements by some RFMOs (CCAMLR, CCSBT). Additionally, some of the RFMO member countries have developed national plans of action (NPOA) to address seabird bycatch.

An international albatross agreement [Agreement on the Conservation of Albatrosses and Petrels (ACAP)] entered into force in 2004. ACAP is a multilateral agreement which seeks to conserve albatrosses and petrels by coordinating international activity to mitigate known threats to albatross and petrel populations. ACAP is the first multilateral agreement which seeks an integrated and holistic approach to the conservation of albatrosses and petrels, which are among the most threatened birds in the world. The Agreement provides a focus for international cooperation and exchange of information and expertise towards the conservation of these declining seabirds. It aims to establish an enhanced understanding of the conservation status of albatrosses and petrels and their susceptibility to a range of threats and effective means to mitigate these threats. IATTC members that are also parties to ACAP are: Ecuador, France, Peru, and Spain. ACAP has identified fishery interactions as a key threat facing this taxa of seabirds and has identified that collaborations with RFMOs may be a way to effectively address fisheries interactions with seabird species protected by ACAP (ACAP 2004a, 2005).

The IATTC Resolution on Incidental Mortality of Seabirds (C-05-01) recommends the implementation of the IPOA; the collection of all information on interactions with seabirds, including incidental catches in all fisheries under the purview of IATTC; and for the Working Group on Stock Assessment to assess the impact of incidental catch of seabirds resulting from the activities of all the vessels fishing for tunas and tuna-like species, in the eastern Pacific Ocean, including an identification of the geographic areas where there could be interactions between longline fisheries and seabirds. This document summarizes recent efforts by the USA to address the issue of seabird interactions with fisheries in the Pacific Ocean, and with the IATTC in particular, where that information is available.

SEABIRDS and FISHERIES in the PACIFIC: This report will address the following key topics:

- Indirect fishery effects on seabirds
- Direct fishery effects on seabirds
- Affected bird species (species profiles, life history information, population status and trends);
- Monitoring bycatch
- Bycatch estimates
- Bird distribution as it overlaps with longline fisheries
- Mitigation research

- Seabird priorities for scientific research activities

Indirect Fishery Effects on Seabirds---Prey Availability

Whereas much of the treatment of seabirds and fisheries has focused on direct effects, such as bycatch or incidental catch, fisheries and removal of harvested target species from the ecosystem do impact other components of the ecosystem, particularly those species that depend on associations with the harvested target species. Distinct seabird species assemblages form and feeding occurs in flocks, in association with subsurface predators (Au and Pitman 1986). The subsurface predators are primarily spotted and spinner dolphins (*Stenella attenuata* and *S. longirostris*, respectively) and yellowfin and skipjack tuna (*Thunnus albacares* and *Katsuwonus pelamis*, respectively), which force prey to the surface. Seabirds depend upon these predators to make prey available and they form flocks as a consequence of feeding over these distinct patches (Ballance et al 1997). This illustrates the single most important foraging strategy for tropical seabirds. In the Pacific, these feeding opportunities support, at least in part, a majority of species, possibly a majority of individuals for some species, indirectly determining abundance and distribution, and providing a resource around which a complex community with a predictable structure is built. This degree of dependence has not been found in non-tropical seabirds (Ballance and Pitman 1999).

Survey cruises on NOAA research vessels were conducted in the eastern tropical Pacific (ETP) from 1976 through 1988 (Au and Pitman 1986, Ballance et al 1997). Cruise areas varied but overall covered an area from 30°N to 20°S from the coast of Central and South Americas to 170°W, broadly sampling the main yellowfin tuna fishing grounds in the ETP. The predominant observed species and species groups were: Boobies (*Sula* spp), wedge-tailed shearwater (*Puffinus pacificus*), sooty tern (*Sterna fuscata*), jaegers (*Stercorarius* ssp), noddies and other terns, frigatebirds (*Fregata* spp), other shearwaters (*Puffinus* spp), and *Pterodrama* petrels. This differs slightly from the most commonly reported species observed by IATTC observers during purse-seine sets, 1997-2004 (frigatebirds, boobies, shearwaters, petrels, and terns) (IATTC, Document SAR-7-10, 2006). It's possible that the fishery observer sightings are biased in that fishermen seek out frigatebird flocks, knowing of their associations with dolphins and tunas.

This strong association between certain seabird species and tuna species is illustrated in the following two studies. In one study, over 95% of feeding petrels observed were in association with subsurface predators. Dark-rumped petrels (*P. phaeopygia* and *P. sandwichensis*) almost always fed in flocks in association with yellowfin and skipjack tuna. Seasonal shifts in petrel distribution were also seen to mirror seasonal shifts in the distribution of surface tuna schools and reproductive success for petrels was lowest when tuna abundance indices were lowest (Pitman and Ballance, unpublished paper). A study of the masked booby (*S. dactylatra*) of Clipperton Island highlights that tuna abundance in the ETP may have implications for booby diversity and abundance on a global scale. The ETP has the most diverse sulid assemblage to be found anywhere in the world, with six resident species of boobies and the largest colonies in the world for all six of these species. The masked booby is the largest tropical seabird, takes the largest prey, and associates with yellowfin tuna, another large species feeding on relatively large prey. The abundance of surface-feeding tunas in the ETP likely explains the remarkable growth and size of the masked booby population at Clipperton, and is probably a major contributing factor in the ETP being the center of sulid abundance and diversity worldwide (Pitman et al, in revision 2006). This highlights the significance of the yellowfin tuna as a keystone species in the ETP. It follows that activities that directly impact tuna stock or biomass (i.e. harvest strategies) can be expected to indirectly affect the seabird species that closely associate with and depend upon them.

Direct Fishery Effects on Seabirds As many as 24 seabird species are documented as bycatch, or incidental catch, in both demersal and pelagic longline fisheries in the North Pacific Ocean (16 distinct species plus 8 separate species groups; Fitzgerald, NMFS, Alaska Fisheries Science Center, pers. comm; Busscher, NMFS, Pacific Islands Region, pers. comm.). This report will focus on those species taken in the pelagic longline fisheries.

Affected Seabird Species The four albatross species of the north and equatorial Pacific are of concern in relation to direct interactions with fisheries. They are the black-footed albatross (*Phoebastria nigripes*), Laysan albatross (*P. immutabilis*), short-tailed albatross (*P. albatrus*), and waved albatross (*P. irrorata*). Albatrosses are in the *Procellariiformes* taxon and all species are highly migratory, long-lived, and display low reproductivity (small clutches, moderate breeding success, low breeding frequency), low reproductive rates (delayed sexual maturity, long generation times), high adult survival rates, high mate fidelity (ie low divorce rate), and high site fidelity (ie distinct population structure). These life history attributes are such that their populations are relatively robust to interannual variation in breeding success; but highly sensitive to slight changes in adult mortality which can potentially have profound effects on the populations. Poor reproduction must be long term and extensive to decrease populations. When such effects do occur they often lag well behind the environmental perturbations that influence annual production. (Montevecchi 2002). The USFWS Seabird Conservation Plan—Pacific Region includes species profiles for three of these species (USFWS 2005a).

Black-footed Albatross In the United States, the black-footed albatross (BFAL) is designated by the US Fish and Wildlife Service (USFWS) as a 'bird of conservation concern' (USFWS 2002). Birds on this list are high priority species that without additional conservation actions are likely to become candidates for listing under the US Endangered Species Act (ESA). In September 2004, several environmental groups filed a petition with the USFWS to list the BFAL under the Endangered Species Act. The USFWS is currently undertaking a formal review of the petition (Freifeld, USFWS, pers. comm). The International Union for the Conservation of Nature (IUCN) lists the BFAL as endangered, uplisted in 2004 on the basis of a projected future decline of more than 60% over the next three generations (56 years) (IUCN 2004). Recently completed population assessments of the BFAL and Laysan albatross are currently being reviewed by USFWS and will be distributed for peer review in the near future (Naughton, USFWS, pers. comm.)

The Northwestern Hawaiian Islands serve as breeding sites to approximately 96% of the world's BFAL, estimated at 61,141 breeding pairs as of the Hatch Year 2005 count (Flint 2005). Other breeding sites are in Japan and Mexico. At one of the Hawaiian breeding sites, Midway Atoll, the December 2005 BFAL count marked the fifth consecutive year of increased numbers of BFAL nests, after fairly steep declines in the 1990s (Klavitter, USFWS, pers. comm.) The current world population of BFAL is approximately 300,000 individuals (NMFS 2005a).

Laysan Albatross In the United States, the Laysan albatross (LAAL) is designated by the US Fish and Wildlife Service (USFWS) as a 'bird of conservation concern' (USFWS 2002). Birds on this list are high priority species that without additional conservation actions are likely to become candidates for listing under the US Endangered Species Act (ESA). The IUCN lists the LAAL as vulnerable, the first time for this species to be listed. It is classified as vulnerable on the basis of a > 30% decline over three generations (84 years) (IUCN 2004). Recently completed population assessments of the BFAL and Laysan albatross are currently being reviewed by USFWS and will be distributed for peer review in the near future (Naughton, USFWS, pers. comm.) Integrated population modeling for BFAL and LAAL populations is underway to assess whether pas and present levels of bycatch are likely to affect significantly the populations of these species (H. Freifeld, pers.comm.).

The Northwestern Hawaiian Islands serve as breeding sites to approximately 99.9% of the world's LAAL, estimated at 590,683 breeding pairs as of the Hatch Year 2005 count (Flint 2005). Other breeding sites are in Japan and Mexico. The largest breeding colony is at Midway Atoll and the December 2005 nest count tallied almost 500,000 nests. When unmated birds at the colony are included, a LAAL count would be over 1 million individuals. The current world population of LAAL is estimated at 3.4 million individuals (NMFS 2005a).

Short-tailed Albatross The short-tailed albatross (STAL) breeds exclusively in Japan. As of 2005, 80-85% of the known breeding STAL use a single colony, Tsubame-zaki, on Torishima, an active volcanic island. In the United States, the short-tailed albatross (STAL) is listed as endangered under the ESA. The USFWS established an international recovery team for this species and as required by US law, issued a draft recovery plan for the STAL (USFWS 2005b). Tasks and actions for the recovery of the species are identified and prioritized. Some of these actions include: ongoing population monitoring and habitat management on Torishima, establishment of one or more nesting colonies on non-volcanic islands, telemetry studies to identify important foraging areas or areas where birds may congregate, and continued work on seabird/fishery interactions. Updates on two of the priority recovery plan actions (new colony establishment and telemetry studies) were provided at the North Pacific Albatross Working Group meeting held in conjunction with the Pacific Seabird Group's annual meeting in Girdwood, Alaska, February 2006 (Suryan et al 2006, G. Balogh and P. Sievert , pers. comm.). The IUCN lists the STAL as vulnerable because it has a very small population and breeding range, limited to Torishima and the Senkaku Islands, Japan. Conservation efforts have resulted in a gradual population increase and an improvement in its threatened status (IUCN 2004).

The total world population of short-tailed albatrosses is approximately 2,000 individuals, with the Torishima population growing exponentially at about 7.3% (USFWS 2005b; Sievert, pers.com.)

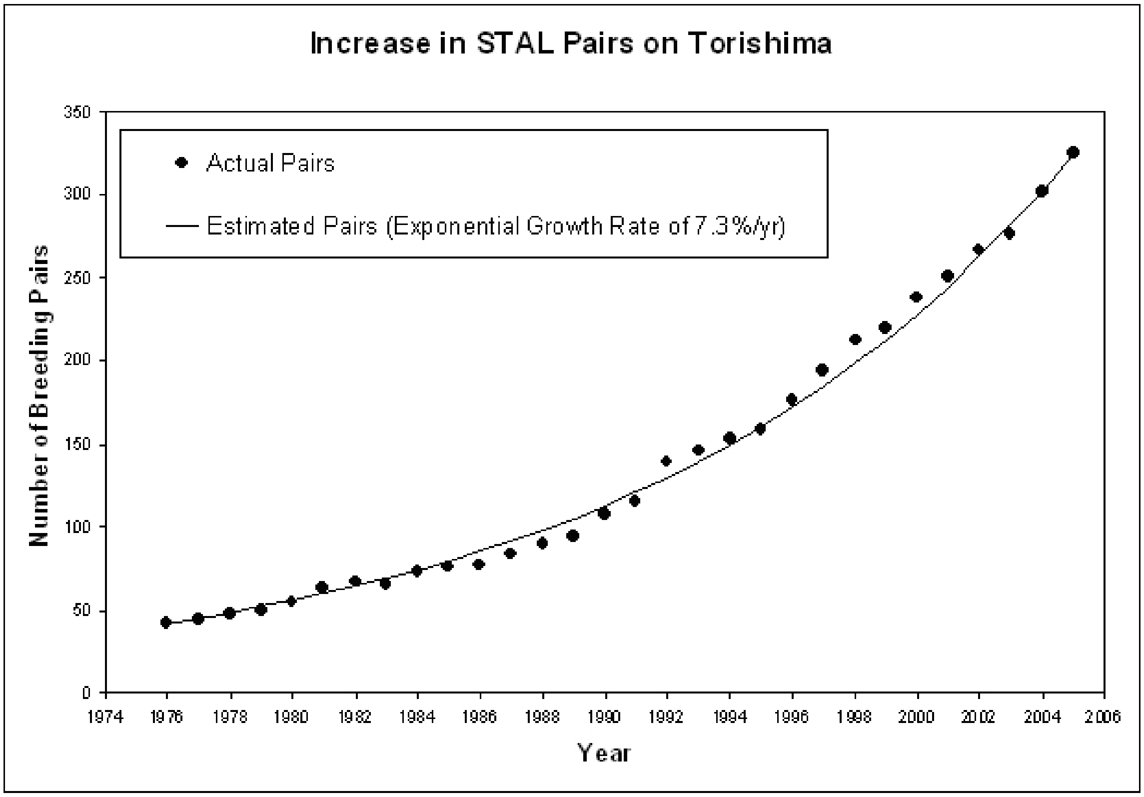

Figure 1. Annual number of breeding pairs of short-tailed albatross on Torishima Island, Japan. (Paul Sievert, 2006 pers. comm.)

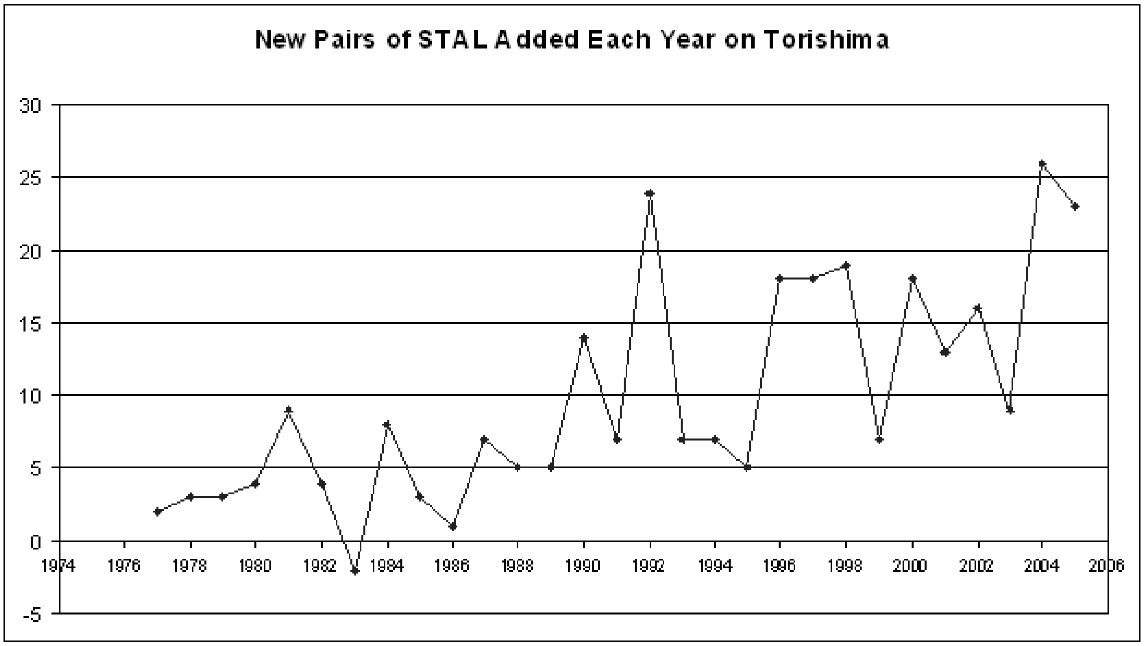

Figure 2. Annual number of new pairs of short-tailed albatross. (Paul Sievert 2006, pers.comm.)

<u>*Waved Albatross*</u> The waved albatross (WAAL) breeds almost exclusively on Isla Española, Galápagos, Ecuador (Anderson et al. 2002) and is included as a protected species under ACAP's Annex 1 (ACAP 2004b). The species is listed as 'Vulnerable' under the IUCN criteria, based on its very small breeding range (IUCN 2004). In the United States, the WAAL does not have any conservation designations under US law. Satellite tracking studies identified the principal foraging area of the WAAL as the tropical Peruvian upwelling (Anderson et al. 2003), located between the Galápagos and eastward to the Perú coastline. An estimate from a 2001 assessment indicates the world population consists of approximately 31,000 to 35,000 adults (breeding and non-breeding individuals) (Anderson et al. 2002). Recent analysis indicates estimates of annual adult survival since 1999 were distinctly lower than estimates for this same population in the 1960s, suggesting a marked decline in breeding population size between 1994 and 2001 (Awkerman et al., submitted 2006) (Figure 3).

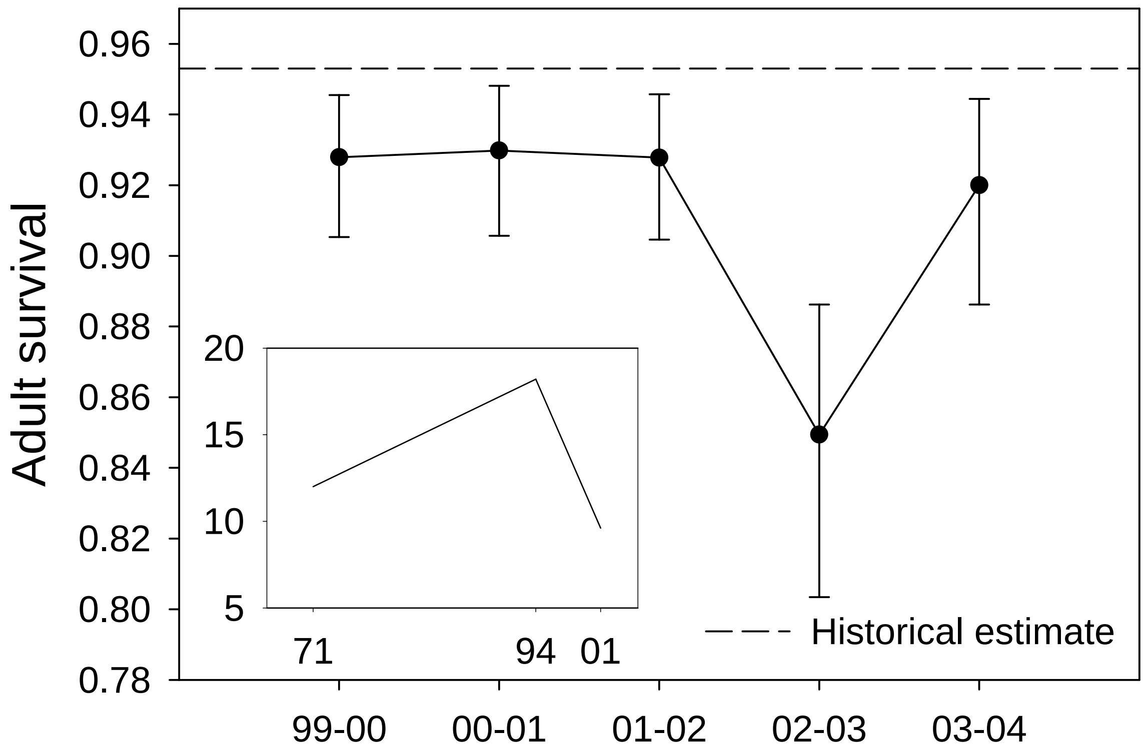

Figure 3. Parameter estimates and 95% confidence limits of annual adult survival for adult waved albatrosses based on model averaging of top two CJS models of band-resight histories. Approximations of the lower binomial 95% confidence limit of the historical estimate range from 0.940-0.941 and do not include any of our estimates. Inset: Time course of the three population counts for this species, expressed as thousands of breeding pairs for estimates in 1971 (*5*), 1994 (*2*) and 2001(*2*). The same methods were used in the last two counts, and did not permit estimation of confidence intervals.

Black Petrel (*Procellaria parkinsoni*) This species breeds exclusively on two islands off of New Zealand (Taylor 2000) and is included as a protected species under ACAP's Annex 1 (ACAP 2004b). The species is listed as 'Vulnerable' under the IUCN criteria, because of its limited breeding range and the potential threat of introduced predators at the colonies (IUCN 2004). In the United States, the black petrel does not have any conservation designations under US law. On research cruises in the ETP, black petrels were observed near shore from southern Mexico (ca. 15°N) to northern Peru (ca. 5°S), and along a broad seaward extension that continued west of the Galapagos Islands to 110°W (Pitman and Ballance 1992). Unlike numerous other tropical species that associate with sub-surface predators such as dolphins and tunas, black petrels occurred in association with melon-headed whale (*Peponocephala electra*) and the false killer whale

(*Pseudorca crassidens*). The petrels were uniquely adapted for recovering well below the surface the food scraps left behind by the whales. Black petrels have been documented as bycatch by New Zealand commercial longliners (Brothers et al 1999). The world population numbers about 10,000 individuals and is believed to be stable (IUCN 2004).

Monitoring Direct Fishery Impacts--Bycatch Monitoring bycatch of protected species in longline fisheries was the subject of a NMFS-sponsored workshop at the International Fisheries Observer Conference held in Sydney, Australia in November 2004. One of the workshop's objectives was to recommend best practices for observer data collection in longline fisheries that would facilitate research and analysis to reduce bycatch of protected species, in the form of a prioritized list of variable and consistent procedures (Dietrich et al 2005). The recommended minimum variables to be collected in longline fisheries included several categories of data: temporal, spatial, physical and environmental, vessel and fishing information, gear, target fish catch, non-target bycatch. The bycatch variables were: species identification, disposition of bycatch, and condition of bycatch upon release. Several variables, specific to bycatch species, were also identified to optimize data collections: collection of whole carcasses or parts, photographs, age, gender, sightings of protected species during set/haul, tags (e.g. bird bands), and use of mitigation deterrents (presence/absence by set/haul).

US observer programs collect seabird bycatch data. The level of detail for seabird bycatch data collection varies regionally and depends upon identified priorities. The observer programs in Hawaii and Alaska collect many of the optimal data collections noted above.

Bycatch Estimates

US West Coast Pelagic Longline Bycatch

In July 2001, the NOAA Fisheries Southwest Region established a voluntary observer program to monitor the US West Coast pelagic longline fishery. The program became mandatory in August 2002. Observers completed 23 trips between October 2001 and February 2004. All trips targeted swordfish, using 4 to 5 hooks per float, squid bait, lightsticks, and no line shooter. Observers collected data on 469 sets during 962 days at sea, totaling 348,914 hooks observed. During that time 79 seabird encounters were reported: 65 BFAL returned dead, 7 LAAL returned dead, and 7 BFAL returned injured. The observed albatross take rate was 0.23 birds per 1,000 hooks (NMFS 2003 and L. Enriquez, pers. com) (Figure 4).

With the adoption of new regulatory requirements in April 2004, the US West Coast pelagic longline fishery is prohibited in the US EEZ (both shallow and deep sets). West of 150°W, shallow sets are essentially prohibited. East and west of 150°W and north of 23°N deep sets for tuna may occur provided that required seabird avoidance measures are used. Since April 2004, only one vessel has fished pelagic longline gear out of California. This vessel is targeting tuna with deep-set gear. The observer data is not yet available.

Four observer trips on purse-seine vessels occurred from September 2004 to September 2005, observing 14 sets. No seabird takes or observations were observed. A pilot observer program has been initiated for the North Pacific albacore fishery. Vessels use either troll or pole and line gear. From August 2004 through October 2005, 7 trips have been observed with no seabird takes or interactions observed (L. Enriquez, pers.com.).

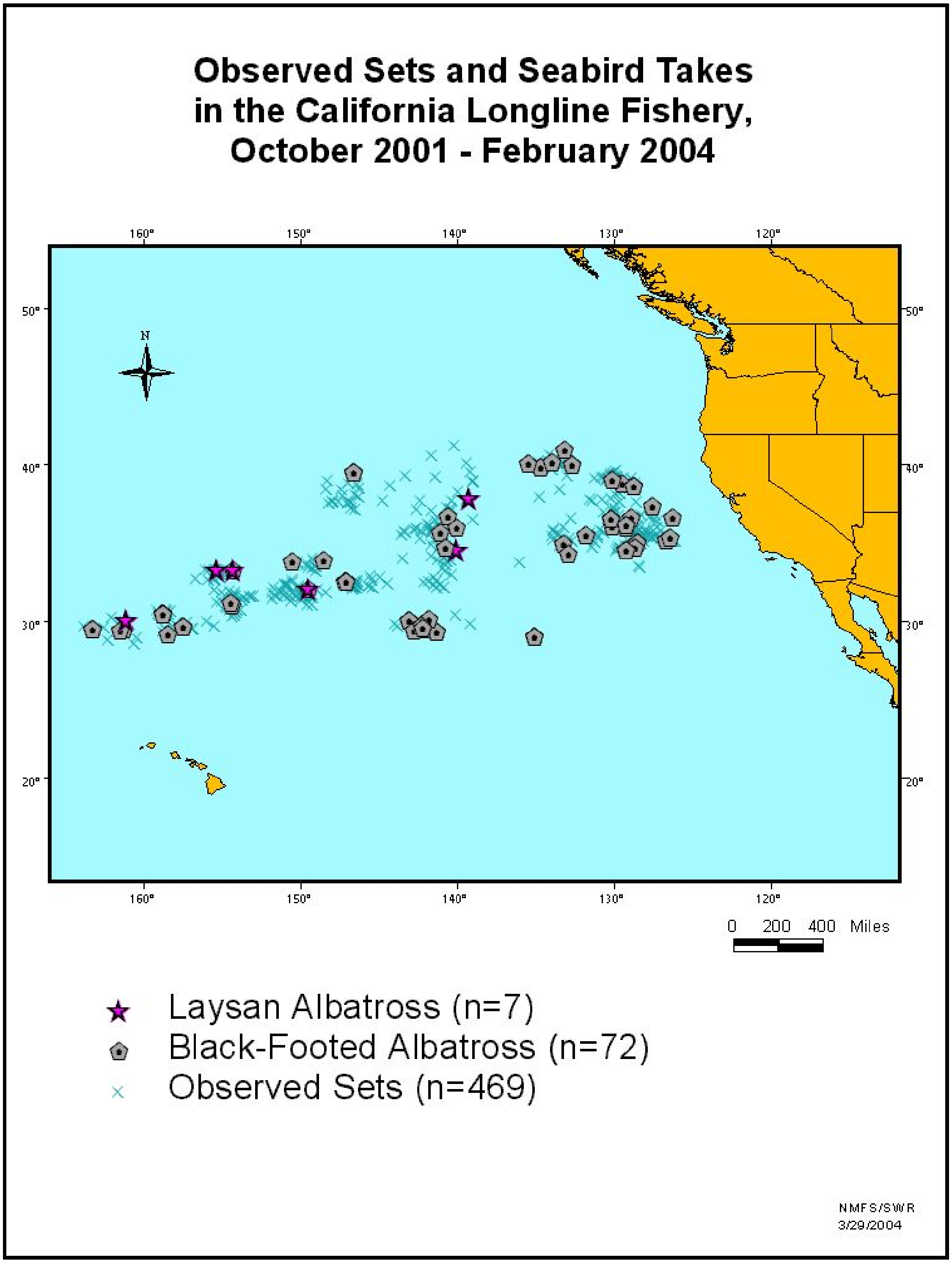

Figure 4. Observed sets and seabird takes in the U.S. West Coast pelagic longline fishery, October 2001-February 2004. NOAA Fisheries, Southwest Region Observer Program, Long Beach, CA.

Hawaii Albatross Bycatch—BFAL,LAAL The observed fishing effort in the 1994-2005 Hawaii deep-set (tuna) fishery ranged from 40°N to 0°N and 180°W to 135°W and the shallow-set (swordfish) fishery ranged from 40°N to 15°N and 180°W to 135°W, thus some overlap with the IATTC Area. The predominate seabird species taken in the Hawaii-based pelagic longline fishery are the BFAL and LAAL. STAL have not been documented taken in this fishery and they are rarely even observed from the Hawaii-based pelagic longline vessels. Observer data indicates two unidentified shearwaters were taken in 2004 and one brown booby in 2005. The estimated level of albatross bycatch has steadily decreased since 1999 and 2000 when over 1000 of each BFAL and LAAL were taken (Figure 5). Historically, higher levels of seabird bycatch occur in the swordfish (shallow sets) fishery than the tuna (deep sets) fishery. During 2004, the Hawaii-based pelagic tuna longline fleet was estimated to have incidentally interacted with 16 BFAL and 10 LAAL and the total take in the Hawaii-based longline swordfish fishery was zero BFAL and one LAAL (NMFS 2005b). During 2005, the total estimated take of albatrosses in the tuna fishery (deep set) was 82 BFAL and 43 LAAL (Table 1) (approximately 0.004 albatross per 1,000 hooks). The total observed take of albatrosses in 2005 in the swordfish fishery (shallow set) was 69 (62 LAAL and 7 BFAL) (approximately 0.04 albatross per 1,000 hooks). Because the swordfish fishery has 100% observer coverage (i.e. all hooks observed), the observed takes represent the total take as well. Thus, the total estimated 2005 take for the Hawaii fishery was 89 BFAL and 105 LAAL (Figure 5). A detailed description of the estimation analysis procedures can be found in Appendix 1 of NMFS 2006a.

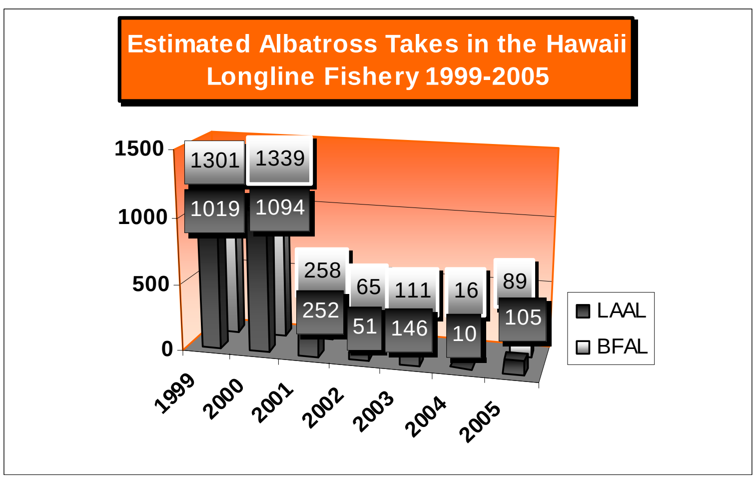

Figure 5: Estimated fleet-wide incidental take of black-footed and Laysan albatrosses in the Hawaii longline fishery during, 1999-2005.
(Source: NMFS PIRO)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual Total
Species	Point Estimate, C.I.	Point Estimate, C.I.	Point Estimate, C.I.	Point Estimate, C.I.	
Black-footed Albatross	68, [25,115]	11, [2,37]	0, [0,10]	3, [1,18]	82
Laysan Albatross	43, [11,85]	0, [0,19]	0,[0,10]	0, [0,15]	43

Table 1. Interaction estimates with incidentally caught albatrosses and corresponding 95% confidence intervals (C.I.) for the Hawaii deep-set longline fishery in 2005. Source: PIFSC, unpublished data.

Alaska Albatross Bycatch—BFAL, LAAL, STAL The Alaska groundfish demersal longline fisheries in the Bering Sea, Aleutian Islands, and Gulf of Alaska have documented bycatch of BFAL, LAAL, and STAL (Table 2). Additionally, 26 LAAL were estimated to have been taken annually from 2000 to 2004 in the Aleutian Islands trawl groundfish fishery. Although these are not pelagic longline fisheries, the bycatch information is included in this report. This highlights that fisheries other than pelagic longline are known to take albatrosses in the North Pacific. The average annual incidental catch rate for all birds taken in 2000 to 2004 for the respective areas of the Bering Sea, Aleutian Islands, and Gulf of Alaska is 0.036, 0.035 and 0.010 birds/1,000 hooks (NMFS 2006b).

Fishery Area	Estimated Number of Albatrosses Taken				
	STAL[1]	LAAL	BFAL	UNID ALB	TOTAL
Bering Sea	0	126 (99-160)	6 (3-13)	4 (2-9)	136
Aleutian Islands	0	111 (86-145)	2 (1-7)	1 (0-5)	114
Gulf of Alaska	0	42 (26-67)	88 (57-137)	4 (1-17)	134
TOTAL	0	279	96	9	384

Table 2. Average annual estimates for 2000 to 2004 of albatross bycatch in Alaska demersal groundfish fisheries. Numbers in parentheses are 95% confidence intervals. (From Fitzgerald, NMFS Alaska Fisheries Science Center, 2006). [1]One STAL was in the observed sample in 1996 and 2 STAL in the observed sample in 1998.

Perú Albatross Bycatch—WAAL In 1999, interviews were conducted with 29 longline fishermen in 5 fishing towns in northern Perú. Questions asked were: fish species caught, hook effort, interactions with seabird species, and bait used (Jahncke et al. 2001). Fish species reported caught were: common dolphin fish (*Coryphaena hippurus*), blue shark (*Prionace glauca*), smalltooth thresher (*Alopias pelagicus*), and shortfin mako (*Isurus oxyrinchus*), ray species (*Myliobatidae)*, and tunas (*Thunnus* spp.). All 29 fishermen said they've observed seabirds scavenging for bait near their vessels, 90% of them reported catching seabirds on their hooks at least once, and albatrosses were the primary species caught. Other seabirds mentioned caught were: shearwaters (*Puffinus* spp), boobies (*Sula* spp), Peruvian pelicans (*Pelecanus thagus*), and gulls (*Larus* spp). It appears that birds were caught incidentally and a few fishermen reported consuming caught birds. Given assumptions that the seabird catch and catch composition by these fishermen is representative of the Peruvian artisanal longline fleet, the authors estimated that 2,370 to 5,610 albatrosses may be taken annually (Jahncke et al. 2001). The most common albatross off northern Perú is the WAAL and another albatross of special concern in these waters is the Chatham Island albatross (*Thalassarche eremita*).

In conjunction with a mark-recapture study of WAAL undertaken to estimate adult survival, a survey of 37 major fishing communities in Perú was initiated in 2003 and collected band recovery information in eight of these ports. Primary fish species caught were shark (winter months) and mahi-mahi (summer months). In the year following the banding of 2550 birds in 2004, fishers reported capturing 0.93% of these birds in artisanal gillnets and on longlines and acknowledged catching some intentionally for consumption (Awkerman et al., submitted 2006). This percentage represents a minimum estimate of fishery mortality, and even at this level can explain a substantial amount of the difference in annual survival observed between the 1970s and recent years (see Figure 3).

Central Pacific Estimate of BFAL Bycatch

Given concerns for the BFAL population and possible implications of overlap with pelagic longline fisheries and bycatch, a case study was undertaken to attempt to estimate potential bycatch levels from international fleets in the North Pacific (Lewison and Crowder 2003). Using known bycatch rates from the US pelagic fishery based in Hawaii (1994-2000 data) and the spatial distribution of fishing effort by Japanese and Taiwanese fleets operating in the central North Pacific (data from Ocean Fisheries Programme, Secretariat of the Pacific public domain database), a scenario analysis was conducted to estimate bycatch levels. Estimates of 5,000 to 14,000 individuals taken annually indicate that population-level declines may be likely (Lewison and Crowder 2003). Note, bycatch rates of the Hawaii-based fishery have been drastically reduced since the 1994-2000 time period; but it is not known to what extent the actual bycatch rates in other North Pacific pelagic longline fisheries may have followed this trend. Many assumptions regarding operational characteristics of the various fisheries, areas fished, gear used, time of day fished, bait used, etc. had to be made and could impact the results and conclusions of this case study (NMFS 2005c).

An ongoing effort is underway to develop integrated population modeling for BFAL and LAAL populations and to assess whether past and present levels of bycatch are likely to affect significantly the populations of these species. While the BFAL population size is about one-tenth of LAAL's, the ratio of bycatch in longline fisheries is higher. This suggests a relatively higher impact of longline fishing on BFAL, with potential biologically significant consequences (Goodman and Lebreton, 2005). Through modeling, the analysts will attempt to estimate a threshold level of bycatch that would, at a specified level of certainty, allow a sustainable growth rate for the albatross populations.

<u>Bird Distribution as it Overlaps with IATTC Fisheries</u>

Over 90% of the world's remote-tracking data of albatrosses and petrels has been submitted by scientists from around the world to a Global *Procellariiform* Tracking Database, coordinated by BirdLife International, including tracking data on the four Pacific albatross species (STAL, BFAL, LAAL, WAAL) (BLI 2006). Particularly for fisheries where bycatch data is not collected or is not available, knowing where bird distribution overlaps with fishing effort can aid in identifying potential areas of bycatch or fishery interaction. Such an effort was undertaken by BirdLife International (BLI) in its presentation of the overlap of the distribution of albatrosses and petrels in the Pacific with IATTC fisheries (BirdLife International 2006). Given the overlap of albatross distribution with IATTC fishing effort (IATTC, Document SAR-7-10, 2006), it is likely that bycatch is occurring, particularly if effective seabird avoidance measures are not being used.

<u>TOPPS Program</u> The Tagging of Pacific Pelagics (TOPP) program has tracked both LAAL and BFAL at two sites for the past four seasons (2002-2006) (S. Shaffer, pers.comm.). At Tern Island, French Frigate Shoals, Northwest Hawaiian Islands, both species were tracked using satellite tracking tags, light-based archival data loggers, and GPS tags. At Guadalupe Island, Baja, Mexico, LAAL were tracked with satellite tracking tags and light-based archival data loggers. To date, a total of 233 individuals have been tracked with satellite tags during the incubation, brooding, and early chick rearing stages. Additionally, 72 individuals have been tracked with light-based archival data loggers during the post-breeding phase (6-12 months deployments). In addition to the tracking effort, blood samples are being collected for 1) contaminants, 2) stable isotopes, and 3) population dynamics, and diet samples from chicks and adults. Current plans are to continue this effort in 2006-2007 to maintain/build a longer term time series records of the foraging ecology of North Pacific albatrosses.

In addition to tracking albatrosses, TOPP researchers have also tracked 20 sooty shearwaters during breeding (2003 & 2005) and the post-breeding migration (2005 only) using light-based archival tags. Another 10 sooty shearwaters, caught at sea off California, have also been tracked using satellite tracking tags in 2005. Finally, 10 pink-footed shearwaters have been tracked during breeding (2003 & 2005) and post-breeding migration (2005 only) from the Juan Fernandez Islands, Chile, using light-based archival tags. In addition to location, the archival tags also provide information on diving depths and environmental temperatures.

Another investigation looked at movements of 18 BFAL during the post-breeding period and tagged within the Cordell Bank National Marine Sanctuary, California. All birds ventured outside of the US EEZ, with one individual traveling more than 7300 km from the tagging site to Hokkaido, Japan. Overall, five birds traveled west of the international dateline, and three birds ventured into territorial waters of four other nations (Canada, Japan, Mexico, and Russia). On average, birds spent greater than 50% of their time in the high seas (Hyrenbach et al 2006).

A joint US/Japan effort has been satellite-tagging STAL albatrosses both on Torishima Island and at at-sea locations off the Aleutian Islands in Alaska. The at-sea work has also included taggings of BFAL and LAAL, to monitor these species during the non-breeding period (June to September), when they are most common in Alaska waters. The goal of the project is to compare the marine habitat use of all three species of albatrosses in Alaska and the spatial and temporal interactions with commercial fisheries. Satellite transmitters were attached to 10 BFAL, 10 LAAL, and 2 STAL. Deployment durations ranged from 13 to 106 days. In general, STAL remained nearest the Aleutian Island archipelago, followed by LAAL, which ranged a bit further south and north of the Islands. BFAL ranged much more widely, with some birds traveling into the Gulf of Alaska, British Columbia, and the transition domain between Alaska and Hawaii (ca. 35 to 40°N) (Suryan and Balogh 2005).

Mitigation Requirements and Mitigation Research

Side-Setting: Recent sea trials and experimental fishing trips testing the efficacy of several mitigation methods and devices (underwater setting chute, blue-dyed bait, side-setting) (Gilman et al 2003, Gilman et al, In Press 2006) have resulted in regulatory changes for the Hawaii-based pelagic longline fleet and a technical assistance program to convert vessels to side-setting operations (Brothers and Gilman 2006). When deep-setting (tuna) or shallow-setting (swordfish) north of 23°N or shallow-setting south of 23°N, owners and operators of vessels registered for use under a Hawaii longline limited access permit, must either side-set (according to specified standards) or must use an alternative suite of measures including: strategic offal discharge, removing all hooks from fish etc, thawed and blue-dyed bait, and setting basket-style longline gear slack. Vessels engaged in deep-setting using a monofilament main longline north of 23°N that do not side-set must also employ a line shooter and attach a weight of at least 45 g to each branch line within 1 m of the hook. In addition to the above requirements, shallow-setting vessels that do not side-set must also deploy gear at least 1 hour after local sunset and complete the deployment no later than local sunrise. (Vol 70 Federal Register 75080, December 19, 2005; see Table 3).

Recall that albatross bycatch levels in the Hawaii pelagic longline fleet in 2005 increased from the 2004 levels. The above side-setting regulations became effective January 18, 2006 and of the 44 (out of 124) vessels that are currently side-setting, no albatrosses were caught in 2005 on these side-setting vessels. It is not known how many vessels in non-US fleets have converted to side-setting as a means to reduce the bycatch of seabirds. Japan indicated plans for side-setting experiments on larger pelagic vessels (ISC 2006).

With the adoption of new regulatory requirements in 2004, the US West Coast pelagic longline fishery is prohibited in the US EEZ (both shallow and deep sets). West of 150°W, shallow sets are essentially prohibited. East and west of 150°W and north of 23°N deep sets for tuna may occur provided that required seabird avoidance measures are used (Vol 69 Federal Register 18444, April 7, 2004).

Other Mitigation Efforts An underwater bait-setting capsule has been under development through New Zealand and Australia efforts and is currently being considered for testing in Australia's Eastern tuna-billfish fishery (G. Robertson, pers.comm.). Another international effort is considering the development of a streamer line system with specified standards for application to world high-seas pelagic longline fisheries (E. Melvin, pers.comm.)

Table 3. Summary of seabird regulations for the Hawaii longline fleet, effective as of January 18, 2006. (Source: NMFS PIRO)

Effective Date: January 18, 2006 **X = Required Measure**		**Side Setting**			**Stern Setting**	
	Shallow Set	Deep Set >23°N	Deep Set <23°N	Shallow Set	Deep Set >23°N	Deep Set <23°N
45 g weights	**X**	**X**			**X**	
Weights within 1m of the hook	**X**	**X**			**X**	
Blue-dyed bait (thawed)				**X**	**X**	
2 (1 lb) containers of blue dye				**X**	**X**	
Set from port or starboard side	**X**	**X**				
Setting station at least 1 m forward of stern corner	**X**	**X**				
Line shooter at least 1 m forward of stern corner (if used)	**X**	**X**				
Deploy gear so that hooks do not resurface	**X**	**X**				
Bird curtain	**X**	**X**				
Use line shooter					**X**	
Retain fish parts and spent bait (hooks removed)				**X**	**X**	
Retain and prepare swordfish head and liver				**X**	**X**	
Begin set 1 hr after sunset/complete before dawn				**X**		
Follow seabird handling procedures	**X**	**X**	**X**	**X**	**X**	**X**

Seabird Priorities for Scientific Research Activities

- Observer collection of seabird bycatch data. Variables could include: species identification, disposition of bycatch, and condition of bycatch upon release. Optimal data collections could include: collection of whole carcasses or parts, photographs, age, gender, sightings of protected species during set/haul, tags (e.g. bird bands), and use of mitigation deterrents (presence/absence by set/haul).

- Further data analysis of strip transect research surveys on seabird species flocks and associations with tuna schools in the ETP.

- Improved understanding of the movements and the overlap of albatrosses with fisheries. While much colony-based satellite tracking has taken place during the winter / spring breeding season, the movements and habitats of the species during other periods (summer / fall) and life-history stages (pre-breeders) are poorly-understood. For STAL, some specific research questions are identified in the STAL Recovery Plan (USFWS 2005b).

- Continued development of seabird mitigation measures for pelagic longline vessels, particularly those that may have broad geographic applications to distant water fleets, e.g. underwater bait-setting capsule, streamer lines.

ACKNOWLEDGEMENTS

Many thanks to the many contributors to this summary paper: Dave Anderson (Wake Forest University), Lisa Ballance (NMFS—Southwest Fisheries Science Center), Greg Balogh (USFWS), Anik Clemens (NMFS—Pacific Islands Region Office), Lyle Enriquez (NMFS—Southwest Region), Shannon Fitzgerald (NMFS—Alaska Fisheries Science Center), Beth Flint (USFWS), Holly Freifeld (USFWS), Eric Gilman (Blue Oceans Institute), Alvin Katekaru (NMFS—Pacific Islands Region Office), Ed Melvin (Washington Sea Grant Program), Maura Naughton (USFWS), Bob Pitman (NMFS—Southwest Fisheries Science Center), Allison Routt (NMFS—Southwest Region), Scott Shaffer (University of California at Santa Cruz), Paul Sievert (USGS—Massachusetts Cooperative Fish and Wildlife Research Unit), Cleo Small (BirdLife International), and Rob Suryan (Oregon State University).

REFERENCES

ACAP. 2004a. Report of the First Meeting of the Parties to the Agreement on the Conservation of Albatrosses and Petrels. ACAP Secretariat, Hobart, Australia, 10-12 November 2004, http://www.acap.aq/index.php/acap/meetings_of_the_parties

ACAP 2004b. Text of the Agreement on the Conservation of Albatrosses and Petrels. http://www.acap.aq/index.php/acap/text_of_the_agreement

ACAP. 2005. Report of the First Meeting of the Advisory Committee to the Agreement on the Conservation of Albatrosses and Petrels, ACAP Secretariat, Hobart, Australia , 20-22 July 2005. http://www.acap.aq/index.php/acap/advisory_committee/advisory_committee_meeting_1/ac_1_english/ac_1_meeting_papers

Anderson, D.J., K.P. Huyvaert, V. Apanius, H. Townsend, C.L. Gillikin, L.D Hill, F. Juola, E.T. Porter, D.R. Wood, C. Lougheed, and H. Vargas. 2002. Population size and trends of the waved albatross *Phoebastria irrorata*. Marine Ornithology 30:63-69.

Anderson D.J., K.P. Huyvaert, D.R. Wood, C.L. Gillikin, B.J. Frost, and H. Mouritsen. 2003. At-sea distribution of waved albatrosses and the Galapagos marine Reserve. Biological Conservation. 110:367-373.

Au, D.W.K., and R.L. Pitman. 1986. Seabird interactions with tuna and dolphins in the eastern tropical Pacific. Condor 88:304-317.

Awkerman, J.A., K.P. Huyvaert, J. Mangel, J. Alfaro Shuigeto, and D.J. Anderson. 2006. Incidental and intentional catch threatens Galapagos waved albatross. Manuscript submitted.

Ballance, L.T. and R.L. Pitman. 1999. Foraging ecology of tropical seabirds. Proceedings of the 22nd International Ornithological Congress, Durban: 2057-2071. Adams, N. and R. Slotow (eds.). Johannesburg: BirdLife South Africa.

Ballance, L.T., R.L. Pitman, and S.B. Reilly. 1997. Seabird community structure along a productivity gradient: importance of competition and energetic constraint. Ecology 78:1502-1518.

BirdLife International 2004. Tracking Ocean Wanderers: the global distribution of albatrosses and petrels. Results from the Global Procellariiform Tracking Workshop, 1-5 September 2003, Gordon's Bay, South Africa. Cambridge, UK, BirdLife International. http://www.birdlife.org/action/science/species/seabirds/tracking.html

BirdLife International 2006. Analysis of albatross and petrel distribution within the IATTC area: results from the Global *Procellariiform* Tracking Database. Submitted to IATTC's Stock Assessment Working Group Meeting, La Jolla, CA, USA, 15-19 May 2006.

Brothers, NP, J. Cooper, and S. Lokkeborg. 1999. The incidental catch of seabirds by longline fisheries: worldwide review and technical guidelines for mitigation. FAO Fisheries Circular No. 937, FIIT/C937. FAO, Rome.

Brothers, N. and E. Gilman. 2006. Technical assistance for Hawaii pelagic longline vessels to change deck design and fishing practices to side set. February 2006. Prepared for the Hawaii Longline Association, US NOAA Fisheries, and Western Pacific Regional Fishery Management Council.

Dietrich, K.S., K. Rivera, V. Cornish, and T. Conant. 2005. Development of best practices for the collection of longline data to facilitate research and analysis to reduce bycatch: Draft executive summary from the report of a workshop held at the International Fisheries Observer Conference, November 8, 2004, Sydney, Australia. NMFS-sponsored Workshop.

FAO 1999. The International Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries. http://www.fao.org/figis/servlet/static?xml=ipoa_seabirds.xml&dom=org&xp_nav=1

Flint, Beth. 2005. Hawaiian Islands National Wildlife Refuge and Midway Atoll National Wildlife Refuge—Annual Nest Counts through Hatch Year 2005. USFWS, Pacific Remote Islands National Wildlife Refuge Complex, 20pp.

Gilman, E., Boggs, C., and N. Brothers. 2003. Performance assessment of an underwater setting chute to mitigate seabird bycatch in the Hawaii pelagic longline tuna fishery. Ocean & Coastal Management 46:985-1010.

Gilman, E., N. Brothers, and D.R. Kobayashi. 2006. Comparison of three seabird bycatch avoidance methods in Hawaii pelagic longline fisheries. In press. Fisheries Science.

Goodman, D. and J-D. Lebreton. 2005. Integrated modeling for Hawaiian albatross populations. Progress reports submitted to Joint Institute for Marine and Atmospheric Research (JIMAR), School of Ocean and Earth Science and Technology, University of Hawaii at Manoa, Honolulu, Hawaii. http://www.soest.hawaii.edu/PFRP/protected_species/goodman.html

Hyrenbach, K.D., C. Baduini, M. Hester, C. Keiper, H. Nevins, and J. Adams. 2006. Post breeding movements and fisheries overlap of black-footed albatross (2004-2005). Abstract from 33rd Annual Meeting of the Pacific Seabird Group, Girdwood, Alaska, 15-19 February, 2006.

ISC. 2006. Report of the Sixth Meeting of the International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean. Plenary Session, March 23-27, 2006. Annex 9: Report of the Bycatch Working Group Meeting, March 20-22, 2006, La Jolla, California, USA.

IUCN. 2004. International Union for the Conservation of Nature (IUCN) Red List of Threatened Species, 2004. http://www.redlist.org/info/categories_criteria

Jahncke, J., E. Goya, and A. Guillen. 2001. Seabird by-catch in small-scale longline fisheries in Northern Peru. Waterbirds 24:137-141.

Lewison, R.L. and L.B. Crowder. 2003. Estimating fishery bycatch and effects on a vulnerable seabird population. Ecol. Appl. 13:743-753.

Montevecchi, W.L. 2002. Interactions between fisheries and seabirds. In: Biology of Marine Birds, ed. E.A. Schreiber and Joanna Burger, CRC Marine Biology Series, Peter L. Lutz, Editor, CRC Press, NY, pages 527-557.

NMFS 2003. Information on incidental mortality of seabirds and other protected species in the US west coast pelagic longline fishery. Unpublished report prepared by D Petersen, L Enriquez, and S Fougner. Submitted to CCAMLR, WG-FSA-03/39.

NMFS. 2005a. Final Environmental Impact Statement: Seabird Interaction Avoidance Methods under the Fishery Management Plan on Pelagics Fisheries of the Western Pacific Region and Pelagic Squid Fishery Management under the Fishery Management Plan for the Pelagics Fisheries Of The Western Pacific Region and the High Seas Fishing Compliance Act. NMFS Pacific Islands Region Office (PIRO), April 2005. http://swr.nmfs.noaa.gov/pir/feis/feis.htm

NMFS 2005b. Annual report on seabird interactions and mitigation efforts in the Hawaii-based longline fishery for calendar year 2004. Pacific Islands Regional Office. Administrative Report AR-PIR-04-05, 27 pp. http://swr.nmfs.noaa.gov/pir/2004_Seabird_Annual_Report.pdf

NMFS 2005c. Final Environmental Impact Statement: seabird interaction avoidance methods under the Fishery Management Plan for the Pelagic Fisheries of the Western Paacific Region and Pelagic Squid Fishery Management under the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region and the High Seas Fishing Compliance Act. NOAA, NMFS, PIRO, Honolulu, Hawaii, April 2005.

NMFS 2006a. Annual report on seabird interactions and mitigation efforts in the Hawaii-based longline fishery for 2005. Pacific Islands Regional Office. Administrative Report AR-PIR-05-06, 33 pp.

NMFS 2006b. Summary of seabird bycatch in Alaskan groundfish fisheries, 1993 through 2004. Alaska Fisheries Science Center. http://www.afsc.noaa.gov/refm/reem/doc/Seabird%20bycatch%20tables%201993-2004_13April2006.pdf

Petersen D, Enriquez L, Fougner S. 2003. Information on incidental mortality of seabirds and other protected species in the US West Coast pelagic longline fishery. CCAMLR WG-FSA-03/39.

Pitman, R.L. and L.T. Ballance. 1992. Parkinson's petrel distribution and foraging ecology in the eastern Pacific: aspects of an exclusive feeding relationship with dolphins. Condor 94:825-835.

Pitman, R.L. and L.T. Ballance. Feeding ecology of dark-rumped petrels (*Pterodrama phaeopygia* and *P. sandwichensis*) in the eastern Pacific (unpublished paper).

Pitman, R.L. et al. The masked boobies (Sula dactylatra) of Clipperton Island: recovery and status of the world's largest population. Auk. (In revision).

Small, C. 2005. Distribution of albatrosses and petrels in the Western & Central Pacific & overlap with WCPFC longline fisheries. Prepared for the first meeting of the WCPFC Ecosystems & Bycatch Specialist Working Group, Nouemea, 13 August 2005. BirdLife International Global Seabird Programme.

Suryan, R.M. and G.R. Balogh. 2005. Marine habitats of endangered short-tailed albatrosses and spatial and temporal interactions with North Pacific commercial fisheries. Draft final report to the North Pacific Research Board, Anchorage, Alaska.

Suryan, R.M., F. Sato, G. Balogh, K.D. Hyrenbach, P.R. Sievert, and K. Ozaki. 2006. Foraging destinations and marine habitat use of short-tailed albatrosses; a multi-scale approach using first-passage time analysis. Deep-Sea Research II. In Press.

USFWS. 2002. Birds of Conservation Concern 2002. US Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia, December 2002, 105 pp. http://www.fws.gov/migratorybirds/reports/BCC2002.pdf

USFWS. 2005a. Regional Seabird Conservation Plan, Pacific Region. U.S. Fish and Wildlife Service, Migratory Birds and Habitat Programs, Pacific Region, Portland, Oregon.
http://www.fws.gov/pacific/migratorybirds/Seabird_Conservation_Plan_Webpages/Complete_USFWS_Seabird_Conservation_Plan.pdf

USFWS. 2005b. Short-tailed Albatross Draft Recovery Plan. Anchorage, AK. 62 pp.
http://ecos.fws.gov/docs/recovery_plans/2005/051027.pdf