

INTER-AMERICAN TROPICAL TUNA COMMISSION
COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL

80TH MEETING

LA JOLLA, CALIFORNIA (USA)
8-12 JUNE 2009

DOCUMENT IATTC-80-08

**STATUS AND DISTRIBUTION OF SEABIRDS IN THE EASTERN PACIFIC
OCEAN, AND INTERACTIONS WITH FISHERIES**

The interaction of seabirds with fisheries (particularly those using longline gear) has become an international issue, as demonstrated by the adoption of the [FAO International Plan of Action for Reducing Incidental Catches of Seabirds in Longline Fisheries](#) (IPOA-Seabirds), and resolutions and mandatory mitigation requirements by regional fishery management organizations (RFMOs). In 2004, the [Agreement on the Conservation of Albatrosses and Petrels](#) (ACAP 2004) entered into force; it identified fishery interactions as a key threat facing these seabirds, and recommended that collaborations with RFMOs be pursued to reduce fisheries interactions.

The Indian Ocean Tuna Commission (IOTC), the Western and Central Pacific Fisheries Commission (WCPFC), and the International Commission for the Conservation of Atlantic Tunas (ICCAT) have adopted requirements for mitigation measures for tuna longline fisheries, and the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) has done so for demersal longline fisheries (Waugh *et al.* 2008). [WCPFC Conservation and Management Measure 2007-04](#) requires that vessels use at least two mitigation measures from a menu of options when fishing north of 23°N or south of 30°S. [IOTC Resolution 08/03](#) mandates similar requirements for longliners fishing south of 30°S. A Convention for the Conservation of Southern Bluefin Tuna (CCSBT) [Recommendation on Ecologically Related Species](#) supported the WCPFC and IOTC measures. [ICCAT Recommendation 07-07](#) mandates the use of bird-scaring tori lines for longliners fishing south of 20°S. [CCAMLR Resolution 25-02](#) requires night setting, weighted branch lines, tori lines, and restrictions on offal disposal.

IATTC [Resolution C-05-01](#) on incidental mortality of seabirds recommends the implementation of the IPOA; the collection of all available 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 (EPO), including an identification of the geographic areas where there could be interactions between longline fisheries and seabirds. The EPO is considered, under the Antigua Convention, to be the area between 50°N and 50°S, bounded to the west by 150°W.

Information on fishery interactions with seabirds and mitigation gear available was summarized in [Document BWG-5-05a.i](#) for the 5th meeting of the Bycatch Working Group. The [6th meeting of the IATTC's Bycatch Working Group](#), held in February 2007, recommended that the Stock Assessment Working Group suggest areas where mitigation measures for reducing seabird mortality could be most effectively adopted (*i.e.*, where bird distributions and longline effort overlap), as well as suggest possible mitigation measures in these areas of vulnerability, and that the Commission should then consider mitigation measures for reducing seabird bycatch. Information on seabirds was presented in various documents prepared for the [7th](#), [8th](#), and [9th](#) meetings of the Stock Assessment Working Group, held in May 2006, 2007, and 2008, respectively, to assess the impact of bycatches on seabird populations and identify areas of potential interactions.

At the 75th meeting of the IATTC in June 2007, the staff presented a range of potential management

actions, including mitigation measures, that could be taken by the IATTC to address seabird bycatch ([IATTC-75-07c](#)). A draft resolution by Spain that included such mitigation measures was extensively discussed, but ultimately not approved ([IATTC, minutes of the 75th meeting](#)).

A revised proposal by Spain and the United States was presented at the 78th meeting of the IATTC in June 2008 ([IATTC, minutes of the 78th meeting, Proposal F1, Appendix 3e](#)). Again, the proposal was not approved; some delegations wanted to be sure that there was a solid technical and scientific basis for adopting mitigation measures. The staff of the IATTC organized a Technical Workshop in May 2009 to address these issues.

1. POPULATION DISTRIBUTION

Figure 1 shows the distribution of fishing effort, as measured by the number of sets, during 1997-2007. During 1987-1992 IATTC observers aboard tuna purse-seine vessels recorded seabirds sighted while searching or during sets; since 1993 they record only sightings during sets. Figures 2-7 show sightings of albatrosses, petrels and shearwaters, frigatebirds, terns, boobies, and tropicbirds, respectively. The number of sightings of albatrosses is extremely small, and their distribution is extremely limited, compared to those of other seabirds. Seabird distributions in the EPO based on research-vessel data (Au and Pitman 1986; Ballance *et al.* 1997; 2006; [SAR-8-12d](#)) and radio-tracking information (Figure 8, [SAR-7-05b](#); [SAR-8-14](#); [SARM-9-11b](#)) have also been published.

2. POPULATION SIZE AND STATUS

Albatrosses and petrels have been identified as some of the most vulnerable species to bycatch in fisheries (Wooller *et al.* 1992; Brothers *et al.* 1999), and have life history characteristics that make their populations vulnerable to bycatch mortality. Albatrosses, in particular, scavenge for food, and are attracted to the baited hooks during longline setting operations. The population sizes and status of albatrosses and petrels breeding or foraging in the EPO are given in Table 1. This report presents a brief critical evaluation of the evidence about the status of the populations.

TABLE 1. Albatrosses and petrels breeding or foraging in the EPO. Data from www.birdlife.org. See <http://www.iucnredlist.org/static/introduction> for definitions of IUCN Status categories.

Common name	Scientific name	Adult population estimate	IUCN status
Antipodean albatross	<i>Diomedea antipodensis</i>	25,300	Vulnerable
Black-browed albatross	<i>Thalassarche melanophrys</i>	1,220,000	Endangered
Black-footed albatross	<i>Phoebastria nigripes</i>	64,000	Endangered
Buller's albatross	<i>Thalassarche bulleri</i>	64,000	Near threatened
Chatham albatross	<i>Thalassarche eremita</i>	11,000	Critically endangered
Grey-headed albatross	<i>Thalassarche chrysostoma</i>	250,000	Vulnerable
Laysan albatross	<i>Phoebastria immutabilis</i>	1,180,000	Vulnerable
Light-mantled albatross	<i>Phoebastria palpebrata</i>	58,000	Near threatened
Northern royal albatross	<i>Diomedea sanfordi</i>	17,000	Endangered
Salvin's albatross	<i>Thalassarche salvini</i>	61,500	Vulnerable
Short-tailed albatross	<i>Phoebastria albatrus</i>	2400	Vulnerable
Southern royal albatross	<i>Diomedea epomophora</i>	29,000	Vulnerable
Wandering albatross	<i>Diomedea exulans</i>	25,500	Vulnerable
Waved albatross	<i>Phoebastria irrorata</i>	34,700	Critically endangered
Parkinson's petrel	<i>Procellaria parkinsoni</i>	10,000	Vulnerable
Grey petrel	<i>Procellaria cineria</i>	400,000	Near threatened
White-chinned petrel	<i>Procellaria aequinoctialis</i>	7,000,000	Near threatened
Southern giant petrel	<i>Pronectes giganteus</i>	97,000	Vulnerable

Of particular concern is the waved albatross, an endemic species that nests in the Galapagos Islands and forages only in the EPO (Figure 8). In addition, the EPO is important for species which predominantly

breed outside the EPO, but use the area extensively for foraging. This includes Laysan and black-footed albatrosses, which breed in the Northwest Hawaiian Islands, the black-browed albatross, which breeds in southern Chile, and the Chatham, Buller's, and Salvin's albatrosses, which breed in New Zealand. The areas where albatross distributions overlap with industrial longline fishing effort in the EPO have been described previously ([BWG-5-05a.i](#)).

2.1. Waved albatross

The species is listed as critically endangered under the International Union for the Conservation of Nature (IUCN) criteria, based on its very small breeding range and declining population (IUCN 2008). The waved albatross breeds almost exclusively on Isla Española, Galápagos, Ecuador (Anderson *et al.* 2002). In that paper, Anderson *et al.*, stated that the “overall population has changed little” since the 1970 survey by Harris (1973), and that high levels of abundance observed in 1994 were anomalous, and probably a consequence of an El Niño event. However, this conclusion was rejected by Awkerman *et al.* (2006), who reported a “recent and dramatic shrinkage of the population”, and concluded, on the basis of the lack of response by the population to the 2002 El Niño, that El Niño events seem to have little effect on the population of waved albatross. However, this conclusion is questionable, since El Niño events are very heterogeneous, both in their spatial extent and in their effects on populations. If the population peak in 1994 was anomalous, and is therefore excluded from the analysis, a comparison of the data from 1970 and 2001-2007 does not show any clear trend. Surveys at two principal breeding sites indicate an increase in the number of eggs laid at the larger of the two (Punta Cevallos) during that period, while the other (Punta Suarez) shows a decrease during the same period (Anderson *et al.* 2008; Figure 3). Surveys of nesting areas have been incomplete, covering only some of the colonies, and it is recognized that different colonies have different trends in abundance, both in sign and magnitude.

The claim that there was a decline caused by incidental mortality in the fisheries is based in part a model that has a error in one of the parameters, acknowledged and corrected in Anderson *et al.* (2008). Also, albatrosses were tagged for that study, and this may itself have led to increased mortalities, since the possibility of a reward for recovering a tag may have led to increases in intentional catches of albatrosses by fishers. No incidental mortality was observed in the 30 trips monitored in that study, nor by other observer programs in the area.

Tracking data during the April-December breeding season (Figure 7) reveal that foraging is focused in the upwelling area between the Galapagos Islands and the coast of Peru (Anderson *et al.* 1998; 2003). Few observations of waved albatross have been made outside this area (Tickell 2000; [SAR-7-10](#)), and sightings indicate that the highest aggregations of waved albatross on the Peruvian continental shelf occur during the non-breeding season (Goya and Cardenas 2003), suggesting that this area is highly important for this species.

The lack of evidence provided by observers at sea may indicate that bycatch rates are really very low, or that the bycatches occur in different fisheries or areas from those monitored. For example, it has been established that there are some directed takes of waved albatrosses for human consumption in some artisanal fisheries around Salaverry (Peru), but their level is not known. Also, in some bottom-longline fisheries in shallow waters, when the catch is abundant, the line may rise to the surface, and there are unconfirmed reports that interactions with albatrosses do occur in these circumstances.

There is a critical need for annual surveys of the entire nesting population in Isla Española to establish the existence, sign, and magnitude of the population trend. What is very clear from the scientific evidence is that the population size is small, that almost all the nesting colonies are located in that one island of the Galapagos Archipelago, and that a significant portion of their foraging activities takes place in a limited coastal region of the eastern Pacific. All these factors point to a very careful management approach, based on a cautious assessment of the risks, rather than focusing on the weakness of some of the data available.

2.2. Laysan albatross

The IUCN lists the Laysan albatross as vulnerable, based on a > 30% decline over 84 years, although populations may have rebounded somewhat in recent years (IUCN 2008). Virtually all (~99.9%) of the world's Laysan albatross breed in the Northwestern Hawaiian Islands, with other small breeding sites are in Japan and Mexico. The current world population is estimated at 3.4 million individuals (NMFS 2005a, b).

Tracked Laysan albatrosses from the small breeding population on Isla de Guadalupe, Mexico (350 breeding pairs, BirdLife International 2004), remained almost entirely within the EPO. Laysan albatross tracked from Tern Island (Hawaii) and the Aleutian Islands did not forage in the EPO, but data from the Tagging of Pacific Pelagics (TOPP) Program indicate that Laysan albatross do disperse into the EPO during the non-breeding season (S. Shaffer, cited in SAR-7-05c).

2.3. Black-footed albatross

The IUCN lists the black-footed albatross as endangered, on the basis of a projected future decline of more than 60% over the next 56 years (IUCN 2008). Most of the world's black-footed albatross (96%) breed in the Northwestern Hawaiian Islands, with other breeding sites in Japan and Mexico. At Midway Atoll, the December 2005 count marked the fifth consecutive year of increased numbers of black-footed albatross nests, after fairly steep declines in the 1990s (J. Klavitter, cited in SAR-07-05c). The current world population of black-footed albatross is approximately 300,000 individuals (NMFS 2005a).

Tracking data show that 36% of the black-footed albatross distribution during the breeding season was within the EPO.

2.4. Black-browed albatross

The black-browed albatross is listed by IUCN as endangered, based on past and projected population declines (IUCN 2008). The Chilean population comprises 18% of the world's population (Birdlife International 2004). This population forages along the edge of the continental shelf, spending 19% of its time within the EPO during the breeding season (October until March) and 65% during the non-breeding season, when its range extended northwards into areas of longline fishing effort.

2.5. Chatham albatross

The Chatham albatross is listed by IUCN as critically endangered, because it is a single, small breeding population and there are concerns about habitat deterioration of the breeding grounds, but the population trend is currently stable (IUCN 2008). Tracking data for the non-breeding distribution of this species indicate that over 50% of its at-sea time is within the EPO. The Chatham albatross migrates across the Pacific at or below 40°S between January to April and then moves north along the Humboldt Current into Peruvian coastal waters, wintering in a area north of 20°S, in areas which also overlaps with longline fishing effort in the EPO. Birds then return to their breeding colony between July and September, following a more northerly route (Robertson *et al.* 2000).

2.6. Buller's albatross and Salvin's albatross

Buller's albatross is listed by IUCN as near threatened due to the small breeding area, although the population is stable (IUCN 2008). Salvin's albatrosses are listed as vulnerable due to a small breeding area and an unknown population trend. Both species breed in New Zealand, yet commonly forage off the South American coast (Jehl 1973; Stahl *et al.* 1998; Robertson *et al.* 2003; Spear *et al.* 2003; Goya and Cardenas 2003). Most albatrosses observed from ship surveys were within 200 km of shore (Spear *et al.* 2003). Salvin's albatross are abundant between 10 and 40°S, and Buller's albatross are most abundant below 30-40°S (Jehl 1973; Stahl *et al.* 1998, Spear *et al.* 2003). These observations indicate some likely spatial overlap with longline fisheries.

2.7. Short-tailed albatross

The IUCN lists the short-tailed albatross as vulnerable because it has a very small population and a limited breeding range (IUCN 2008; USFWS 2005; P. Sievert, cited in SAR-7-05c). The species breeds exclusively in Japan. As of 2005, 80-85% of the known breeding population uses a single colony on Torishima, an active volcanic island. Conservation efforts have resulted in a steady population increase (7.3% per annum) and an improvement in its conservation status (IUCN 2008). It is listed here because of the species' vulnerable status and because it is uncertain how extensively its range overlaps with the EPO.

2.8. Parkinson's (or Black) petrel

The Parkinson's petrel 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 2008). This petrel breeds exclusively on two islands off New Zealand (BirdLife International 2006). The world population numbers about 10,000 individuals and is believed to be stable (IUCN 2008). It is listed here because black petrels migrate from breeding sites off New Zealand to the eastern Pacific Ocean between the Galapagos Islands, southern Mexico, and northern Peru (Pitman and Ballance 1992) and have been documented as bycatch by New Zealand longliners (Brothers *et al.* 1999).

2.9. Antipodean, southern royal, and northern royal albatrosses

The antipodean and southern royal albatrosses are listed as vulnerable by the IUCN due to small breeding areas, with the antipodean albatross declining in numbers and the southern royal albatross stable (IUCN 2008). The northern royal albatross is listed as endangered due to small breeding areas subject to habitat destruction and declining productivity. These species also migrate across the Pacific from their breeding grounds in New Zealand to the coast of South America, where they remain largely south of 40°S, and generally forage south of longline fishing areas.

3. SEABIRD BYCATCH IN TUNA AND SWORDFISH FISHERIES

3.1. EPO tuna purse-seine fishery

IATTC observers are not required to record seabird mortalities during purse-seine sets because staff and observer experience indicates that they occur exceedingly rarely, if at all.

3.2. Industrial longline fisheries

Seabirds can comprise significant bycatches in longline fisheries (Melvin and Parrish 2001; Brothers *et al.* 1999). However, there may be a large variability in bycatch depending on the vessel size and setting technique and fishing area. Techniques that result in rapid line sinkage close to the hull, for example, limit the exposure of the baited hooks to seabirds and reduce bycatch.

Information on longline bycatch in the North-central and Northeast Pacific comes from the US pelagic longline fishery ([SAR-7-05c](#); [SAR9-11a](#)). The observed fishing effort in the Hawaii deep-set tuna fishery ranged from 40°N to 0° and 180° to 135°W, and the shallow-set swordfish fishery ranged from 40°N to 15°N and 180° to 135°W, overlapping with the EPO. Historically, higher levels of seabird bycatch occur in the swordfish fishery than the tuna fishery. The predominant seabird species taken in these fisheries are the black-footed and Laysan albatrosses. The estimated level of albatross bycatch has decreased since 1999 and 2000, reflecting increased use of bycatch mitigation measures, and seabird mitigation measures have been required in these fisheries since 2002.

The Hawaii-based pelagic tuna longline fleet was estimated to have taken approximately 0.004 albatross per 1,000 hooks in 2005, while the shallow-set swordfish fishery, which has 100% observer coverage, took approximately 0.04 albatross per 1,000 hooks. The total estimated take for both fisheries was 89 and 73 black-footed and 105 and 15 Laysan albatrosses in 2005 and 2006, respectively.

During 2001-2004, NMFS observers monitored the US West Coast pelagic longline swordfish fleet in an

area that overlapped with the EPO (SAR-7-05c), and reported 65 black-footed and 7 Laysan albatross mortalities, and 7 black-footed albatross released injured (a take rate of 0.23 birds per 1,000 hooks) (Petersen *et al.* 2003; L. Enriquez, cited in SAR-7-05c). Seabird mitigation measures were not required during this time period.

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 Chinese Taipei fleets operating in the central North Pacific, it was estimated that 5,000 to 14,000 black-footed albatross could be taken annually in the Northeast Pacific (Lewison and Crowder 2003). However, the assumption that the Hawaii fleet and the Japanese and Chinese Taipei fleets have similar bycatch rates may not be valid (NMFS 2005c), a view shared by the IATTC staff.

Interviews with experts in the regional fisheries and seabirds suggested that there are generally low levels of bycatch of seabirds in pelagic longline fisheries in the tropical Pacific (Watling 2002).

An observer aboard a Chinese longline vessel that deployed 300,000 hooks reported mortality of fewer than six birds (storm petrels and blue-footed boobies) ([SAR-7-05e](#)). Spain reported a preliminary estimate of about 0.04 seabird mortalities per 1000 hooks in the EPO (Mejuto *et al.* 2007; [BYC-6-INF A](#)). Of the species listed in Table 1, interactions were recorded with Buller's and black-browed albatrosses and white-chinned and grey petrels. Observers aboard Chinese Taipei longliners reported bycatch rates of 0.003-0.016 seabirds per 1000 hooks in the EPO, mainly albatrosses and petrels ([SAR-8-12e](#)). The use of bird-scaring lines was found to reduce bycatch by more than half ([SAR-9-11c](#)).

Integrated population modeling has been developed for black-footed and Laysan albatross populations (Goodman and Lebreton, 2005; Maunder and Hoyle 2005; Véran and Lebreton 2008). Fishery bycatch has been found to significantly affect black-footed albatross populations through lowered adult survivorship (Véran *et al.* 2007).

3.3. Artisanal longline fisheries

Indirect evidence of mortality of albatrosses in fisheries off South America, obtained mostly from interviews with fishers or tag recoveries, was reported by Jahncke *et al.* (2001), Goya and Cardenas (2003), G. Merlen (cited in Anderson *et al.*), and Awkerman *et al.* (2006). Jahncke *et al.* (2001) reported bycatch rates of 1 to 2 albatrosses per 1000 hooks, but these high rates have not been substantiated by reports from observers aboard fishing vessels. Awkerman *et al.* (2006) reported that less than 1% of banded waved albatrosses were recovered from artisanal gillnet and longline fisheries, although details about the targets of these fisheries were not reported. However, observers aboard artisanal longliners from a variety of programs, organized by the Asociación Peruana para la Conservación, by Pro-Delphinus, and by the WWF sea turtle observer program, and fisheries, including tuna fisheries, reported no bycatch of waved albatross in 1,652 trips (3,258,000 hooks set) during 2004-2009, and little bycatch of other seabirds ([IATTC Working Group on Bycatch, minutes of the 6th meeting](#)). This is likely due to the characteristics of these fisheries that prevent seabird bycatch: side setting, setting at night, and vessels with low gunwales that facilitate getting the bait under the water quickly. The reports by Pro-Delphinus indicated that most of the mortalities were not the result of incidental catches, but of intentional catches for human consumption. It is possible that expectations of rewards for recovery of the tags may have acted as an incentive for the captures. There are, however, several important caveats: a) most of the data comes from surface longline fisheries, and other fisheries of the region are not well covered by observers; b) the data reflect the fishing patterns in recent years only, and these very mobile fleets change fishing grounds frequently, according to target availability, *etc.*; c) there could be local gaps in observer coverage, because the various programs were not designed to systematically cover all areas and time periods; d) there are very few data from distant-water fleets operating in the region.

Bycatch mortalities of two tagged Laysan albatrosses off Mexico have also been reported for vessels setting 10,000 hooks or less ([SARM-9-11a](#)).

REFERENCES

- ACAP. 2004. Text of the Agreement on the Conservation of Albatrosses and Petrels. http://www.acap.aq/index.php/acap/text_of_the_agreement
- Anderson, D., A. Schwanndt, and H. Douglass, 1998. Foraging ranges of waved albatrosses in the eastern Tropical Pacific Ocean. pages 180-185 in G. Robertson and R. Gales (eds) *Albatross Biology and Conservation*. Surrey Beatty and Sons, Chipping Norton, Australia.
- 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.
- Anderson D.J., K.P. Huyvaert, J.A. Awkerman, C.B. Proaño, W.B. Milstead, G. Jiménez-Uzcátegui, S. Cruz, and J.K. Grace. 2008. Population status of the Critically Endangered waved albatross *Phoebastria irrorata*. *Endangered Species Research* 5:185-192.
- 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.A. Shigueto, and D.J. Anderson. 2006. Incidental and intentional catch threatens Galápagos waved albatross. *Biological Conservation* 133:483-489.
- 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.
- [Ballance, L.T., R.L. Pitman, and P.C. Fiedler. 2006. Oceanographic influences on seabirds and cetaceans of the eastern tropical Pacific: A review. *Progress in Oceanography* 69:360-390.](#)
- 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. 100 pp. <http://www.birdlife.org/action/science/species/seabirds/tracking.html>
- BirdLife International. 2006. Species factsheet: *Procellaria parkinsoni*. <http://www.birdlife.org>
- Brothers, N.P., 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. 101 pp. http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/005/w9817e/w9817e00.htm
- 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. 4 pp. http://www.soest.hawaii.edu/PFRP/protected_species/goodman.html
- Goya, E., and G. Cardenas. 2003. Longline fisheries and seabirds in Peru. Pages 14-15 in S. Lokkeborg and W. Thiele (eds) Report of the FAO/Birdlife South American Workshop on Implementation of NPOA-Seabirds and Conservation of Albatrosses and Petrels, Valdivia, Chile, 2-6 December 2003. FAO Fisheries Report No. 751 FIIT/R751 (En). FAO, Rome. <ftp://ftp.fao.org/docrep/fao/007/y5742e/y5742e00.pdf>
- Harris, M.P. 1973. The biology of the waved albatross *Diomedea irrorata* of Hood Island, Galápagos. *Ibis* 115:483-510.
- IUCN. 2008. 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.
- Jehl, J.R. 1973. The distribution of marine birds in Chilean waters in winter. *Auk* 90: 114-135.
- Lewis, R.L., and L.B. Crowder. 2003. Estimating fishery bycatch and effects on a vulnerable seabird population. *Ecol. Appl.* 13:743-753.
- Maunder, M., and S. Hoyle. 2005. A generally Bayesian integrated population dynamics model for protected species. Progress report 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. 5 pp. http://www.soest.hawaii.edu/PFRP/protected_species/maunder.html
- J. Mejuto, B. García-Cortés, A. Ramos-Cartelle and J. Ariz. 2007. Preliminary overall estimations of bycatch landed by the Spanish surface longline fleet targetting swordfish (*Xiphias gladius*) in the Pacific Ocean and interaction with marine turtles and sea birds: Years 1990-2005. Document BYC-6-INF A presented at the Sixth meeting of the IATTC Bycatch Working Group, La Jolla, California. 19 pp. <http://www.iatcc.org/PDFFiles2/BYC-6-INF-A-ESP-SWO-fishery-bycatch.pdf>
- Melvin, E.F., and J.K. Parrish (eds.). 2001. Seabird Bycatch: Trends, Roadblocks, and Solutions. University of Alaska Sea Grant. Fairbanks, Alaska. 204 pp.
- 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.
- Petersen D., L. Enriquez, and S. Fougner. 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.
- Robertson, C.J.R., E Bell, and D.G. Nicholls. 2000. The Chatham Albatross (*Thalassarche eremita*): At home and abroad. Notornis 47: 174.
- Robertson, C.J.R., E.A. Bell, N. Sinclair, and B.D. Bell. 2003. Distribution of seabirds from New Zealand that overlap with fisheries worldwide. Science for Conservation 233. Department of Conservation, New Zealand. 102 pp. <http://www.doc.govt.nz/Publications/004~Science-and-Research/Science-for-Conservation/PDF/sfc233.pdf>
- Spear, L.R., D.G. Ainley, and S.W. Webb. 2003. Distribution, abundance and behaviour of Buller's, Chatham Island and Salvin's Albatrosses off Chile and Peru. Ibis 145: 253-269.
- Stahl, J.C., J.A. Bartle, N.G. Cheshire, C. Petyt, and P.M. Sagar. 1998. Distribution and movements of Buller's albatross (*Diomedea bulleri*) in Australian seas. New Zealand Journal of Zoology 25:109-137.
- Tickell, W.L.N. 2000. Albatrosses. Pica Press, Sussex, UK. 448 pp.
- USFWS. 2005. Short-tailed Albatross Draft Recovery Plan. Anchorage, AK. 62 pp. http://ecos.fws.gov/docs/recovery_plans/2005/051027.pdf
- Véran, S., O.Gimenez, E.Flint, W.L. Kendall, P.F. Doherty Jr., and J.D. Lebreton. 2007. Quantifying the impact of longline fisheries on adult survival in the Black-footed Albatross. J Appl.Ecol. 44:942-952. <http://www3.interscience.wiley.com/cgi-bin/fulltext/117972427/PDFSTART>
- Véran, S. and J.D. Lebreton. 2008. The potential of integrated modelling in conservation biology: A preliminary case study with the Black-footed Albatross *Phoebastria nigripes*. Can J.Stat. 36:85-98. <http://archimede.mat.ulaval.ca/cjs/indexec.html>
- Watling, D. 2002. Interactions between seabirds and Pacific Islands' Fisheries, particularly the tuna fisheries. Report for the Secretariat of the Pacific Community by Environmental Consultants, Fiji.. 37 pp. <http://www.spc.int/coastfish/Reports/HOF3/E-IP10-HOF3.pdf>
- Wagh, S.M., G.B. Baker, R. Gales, J.P. Croxall. 2008. CCAMLR process of risk assessment to minimise the effects of longline fishing mortality on seabirds. Marine Policy 32:442-454.
- Wooller, R.D., J.S. Bradley, and J.P. Croxall, J.P. 1992. Long-term population studies of seabirds.

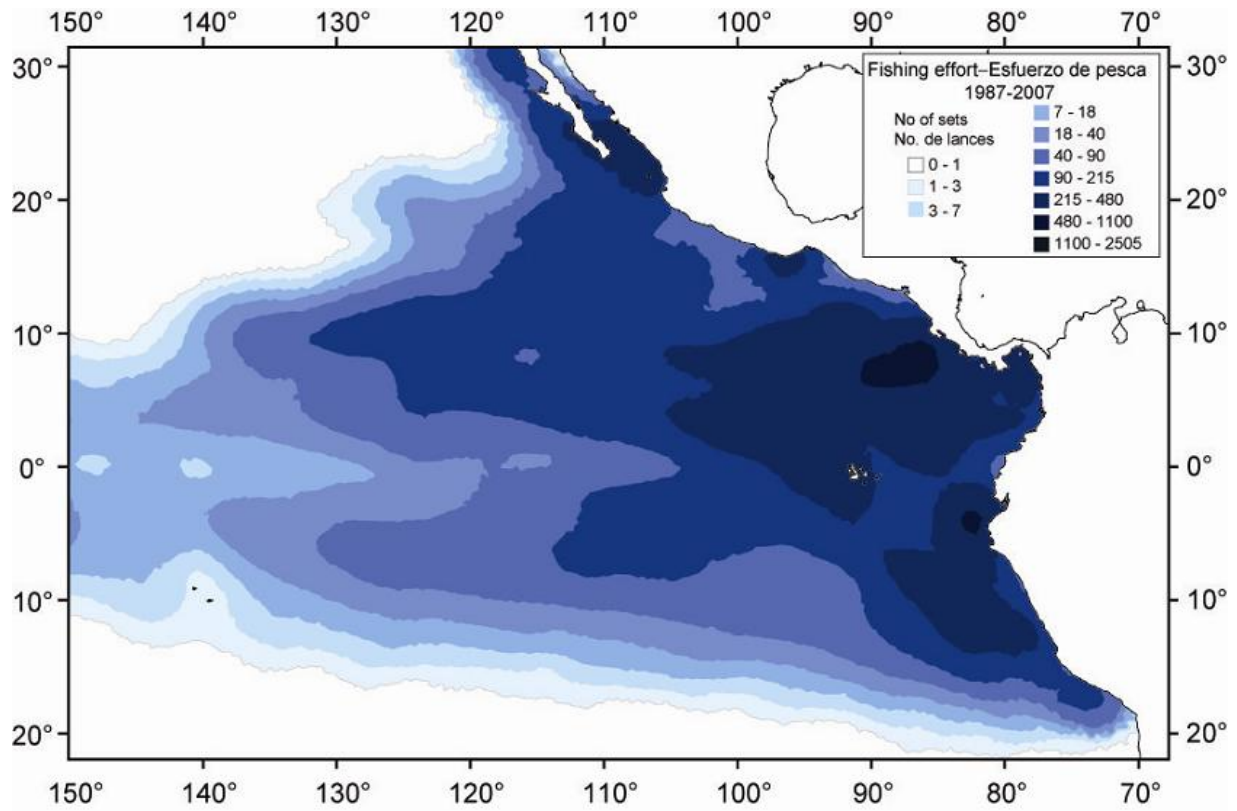


FIGURE 1. Contour map of purse-seine fishing effort, in number of sets, in the eastern Pacific Ocean, 1987-2007. Data collected by both IATTC and national observer programs made available to the IATTC. This map is used as the background in Figures 2-7.

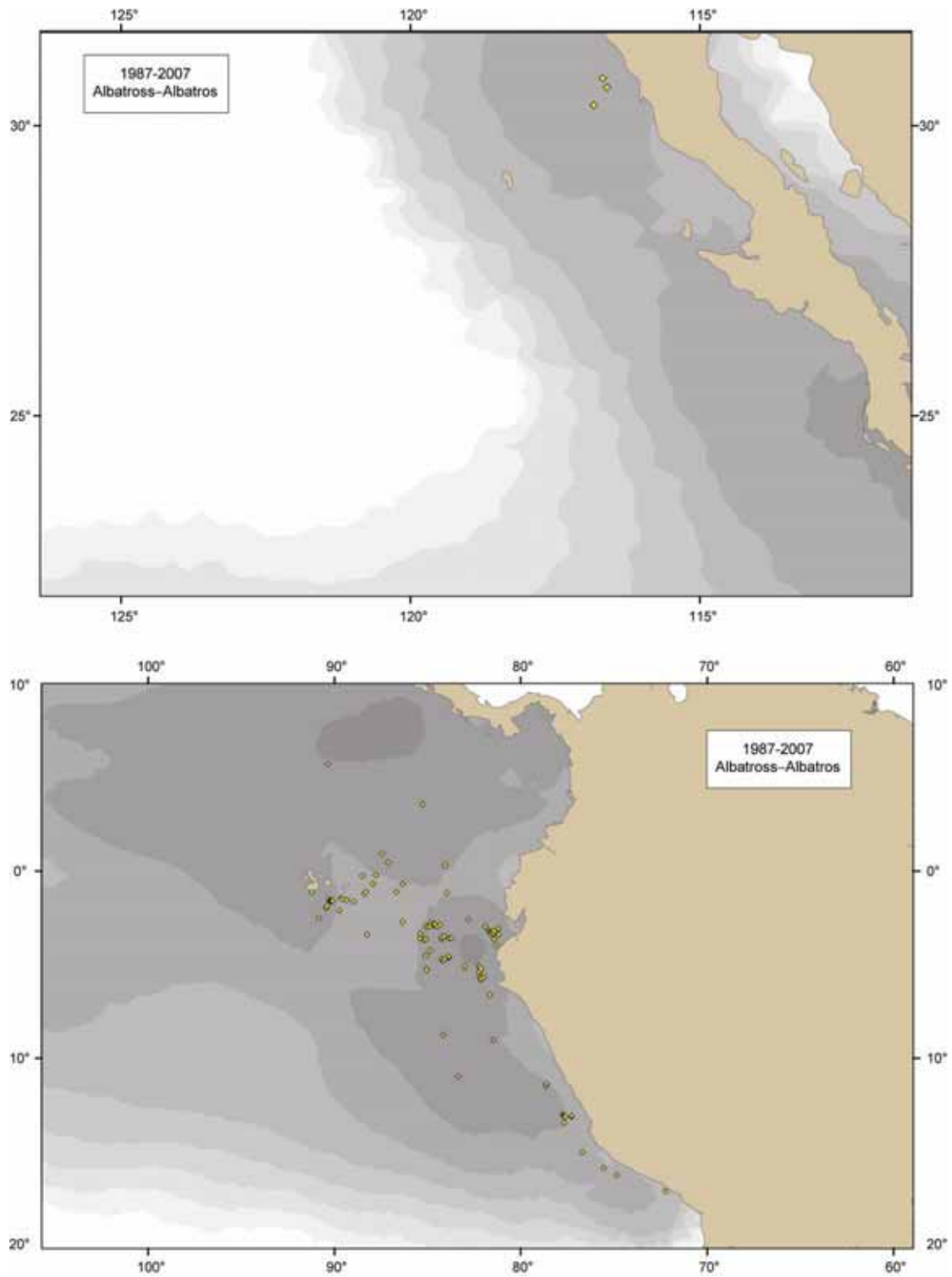


FIGURE 2. Sightings of albatrosses recorded by observers aboard purse seiners fishing in the eastern Pacific Ocean, 1987-2007. Data collected by both IATTC and national observer programs made available to the IATTC. Data from 1987-1992 include sightings recorded while searching or during sets; data from 1993-2007 included only sightings recorded during sets.

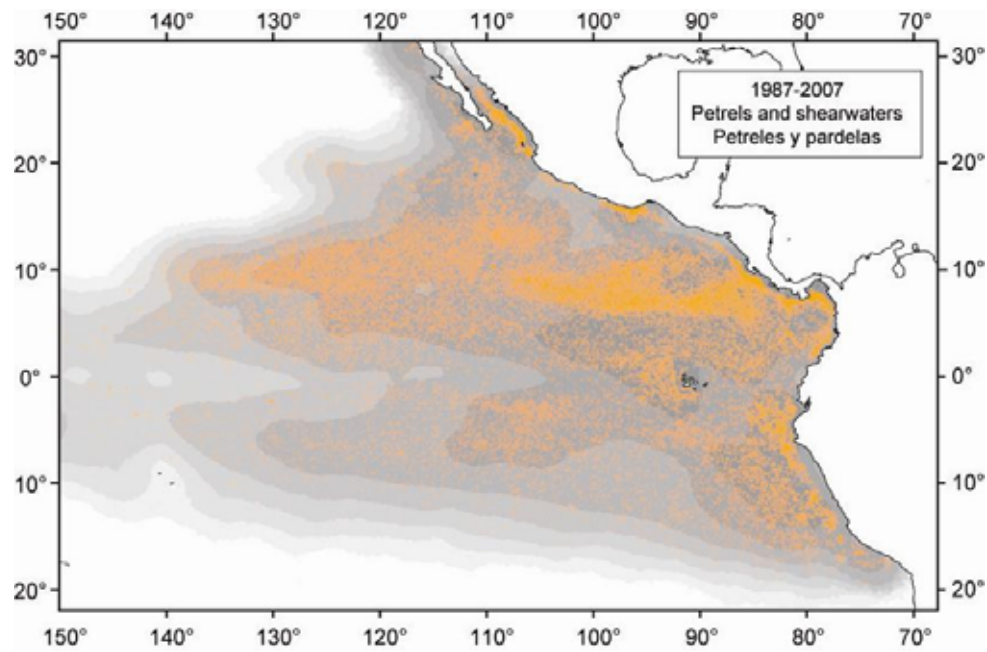


FIGURE 3. Sightings of petrels and shearwaters recorded by observers aboard purse seiners fishing in the eastern Pacific Ocean, 1987-2007. Data collected by both IATTC and national observer programs made available to the IATTC. Data from 1987-1992 include sightings recorded while searching or during sets; data from 1993-2007 included only sightings recorded during sets. Petrels and shearwaters are combined due to the difficulty of distinguishing these taxonomic groups at sea.

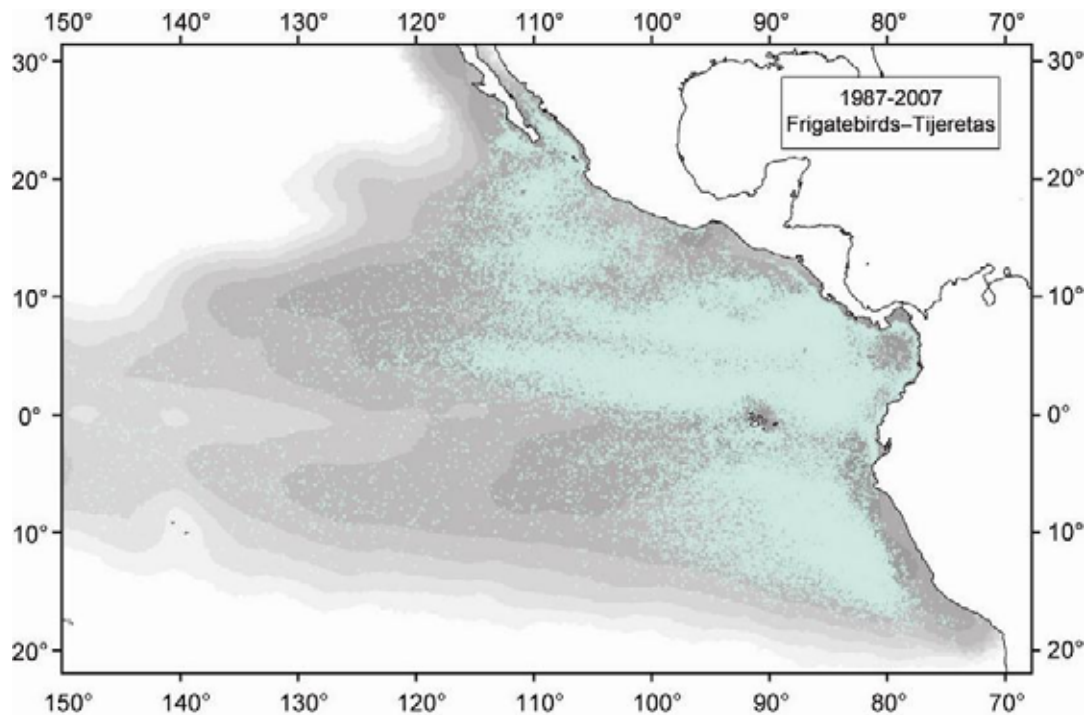


FIGURE 4. Sightings of frigatebirds recorded by observers aboard purse seiners fishing in the eastern Pacific Ocean, 1987-2007. Data collected by both IATTC and national observer programs made available to the IATTC. Data from 1987-1992 include sightings recorded while searching or during sets; data from 1993-2007 included only sightings recorded during sets.

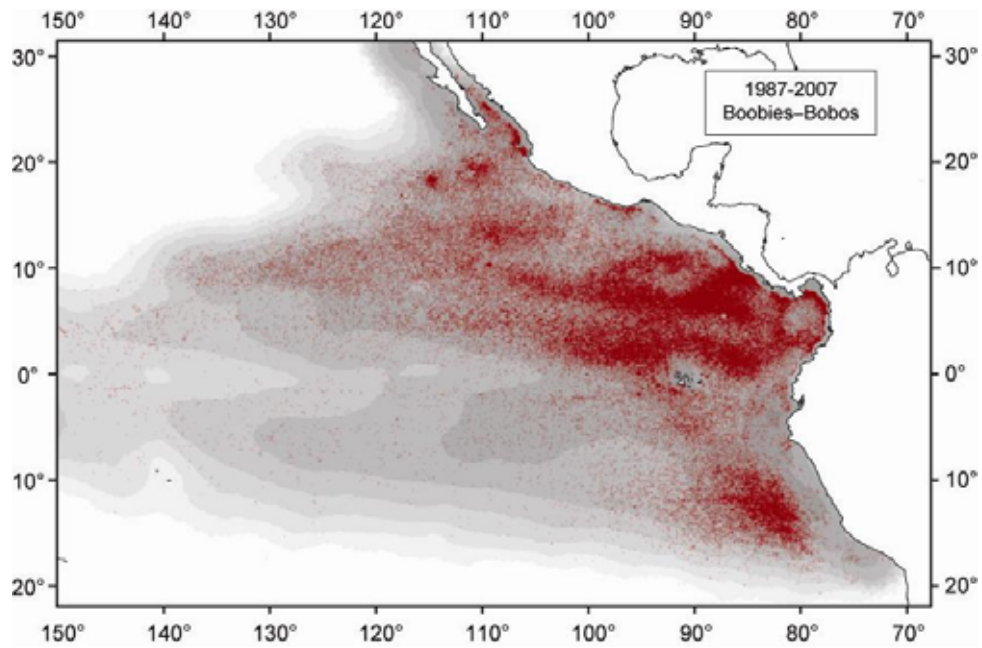


FIGURE 5. Sightings of boobies recorded by observers aboard purse seiners fishing in the eastern Pacific Ocean, 1987-2007. Data collected by both IATTC and national observer programs made available to the IATTC. Data from 1987-1992 include sightings recorded while searching or during sets; data from 1993-2007 included only sightings recorded during sets.

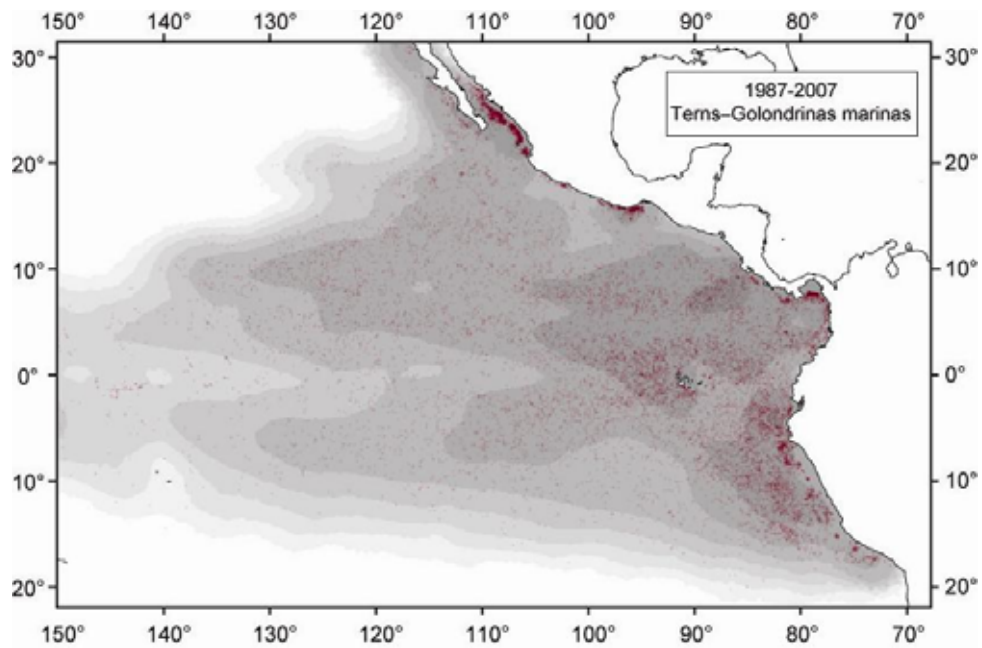


FIGURE 6. Sightings of terns recorded by observers aboard purse seiners fishing in the eastern Pacific Ocean, 1987-2007. Data collected by both IATTC and national observer programs made available to the IATTC. Data from 1987-1992 include sightings recorded while searching or during sets; data from 1993-2007 included only sightings recorded during sets.

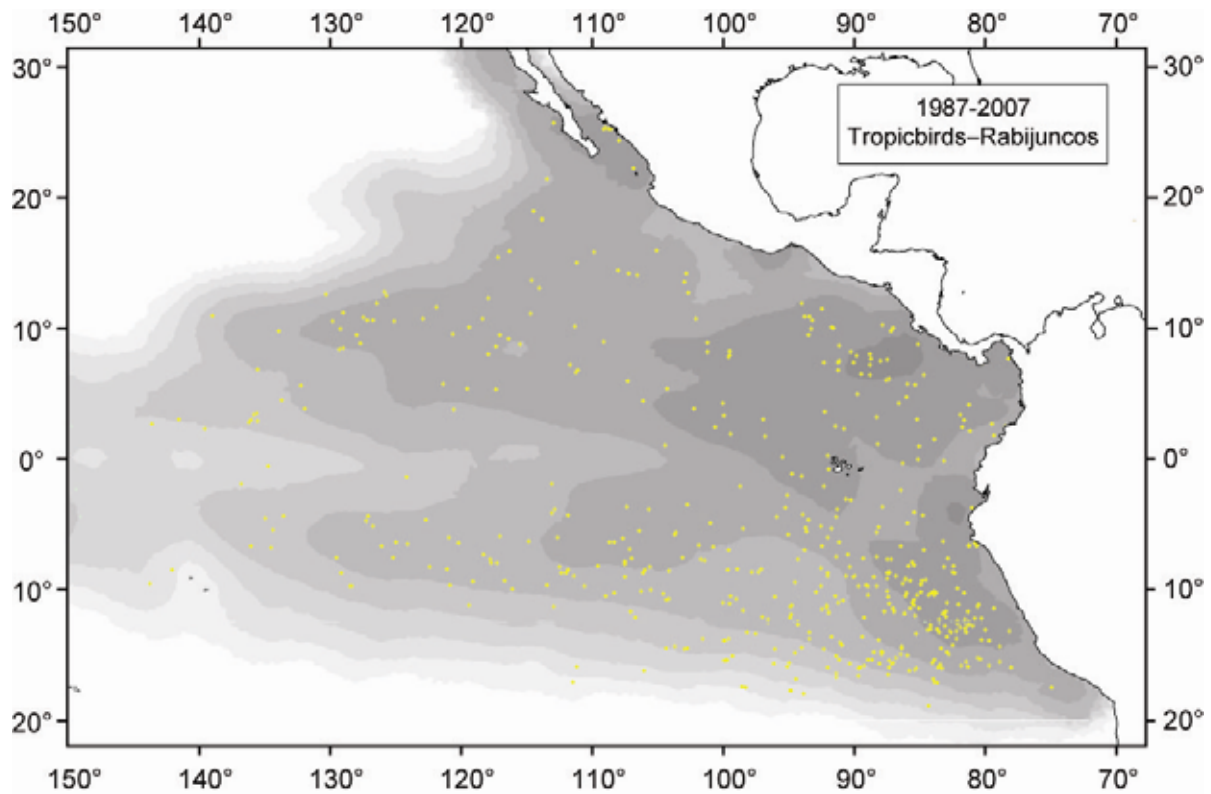


FIGURE 7. Sightings of tropicbirds recorded by observers aboard purse seiners fishing in the eastern Pacific Ocean, 1987-2007. Data collected by both IATTC and national observer programs made available to the IATTC. Data from 1987-1992 include sightings recorded while searching or during sets; data from 1993-2007 included only sightings recorded during sets

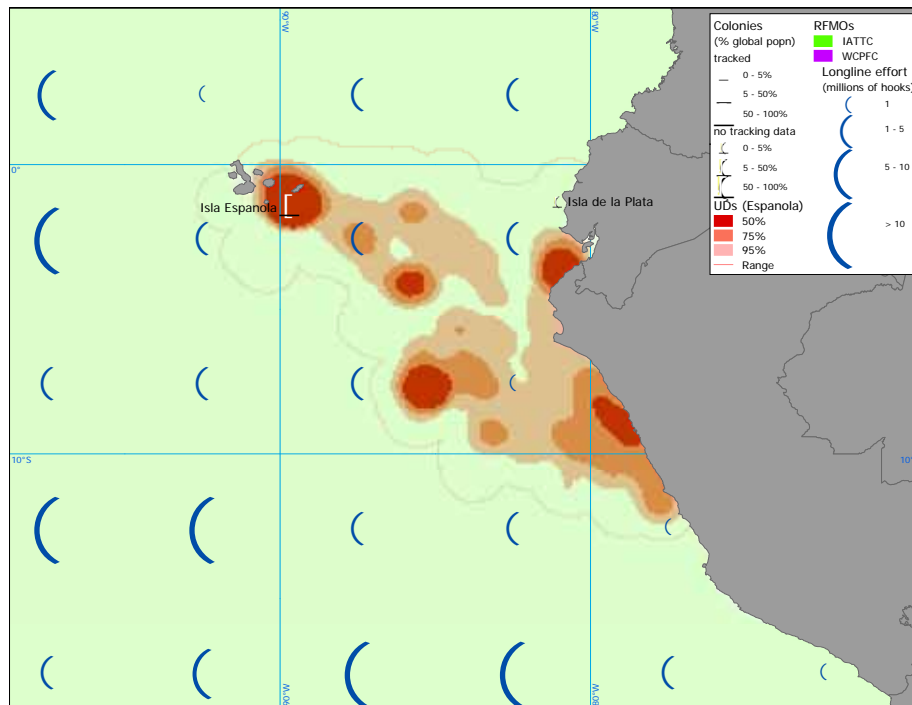


FIGURE 8. Distributions of waved albatrosses during the breeding season, tracked from Isla Española (>99% population), and longline fishing effort from some industrial fleets in the eastern Pacific Ocean, in hooks set per 5° square, 1997-2004. Tracking data presented in this report are from the Global *Procellariiform* Tracking Database and the tracking plots extracted from SAR-7-05b. Original data from D. Anderson and J. Awkerman, Wake Forest University.