Analyses of Seabird Bycatch in Fisheries Selling Seafood in the U.S. Market

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October 30, 2012


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Suggested citation:

Wiedenfeld, D. A., S. Iudicello, N. Atkins, E. C. Bricklemyer, B. Gentner, and A. Johnson. 2012. Analyses of Seabird Bycatch in Fisheries Selling Seafood in the US Market. American Bird Conservancy, The Plains, Virginia, USA. 135 pp.

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INTRODUCTION

Seabirds are among the most threatened groups of birds on Earth. Because most seabirds live for decades and reproduce slowly, any adult mortality translates readily to population-level effects. At present, the leading cause of mortality for healthy adult seabirds is accidental death in interactions with fisheries.

Although seabirds have always followed boats, fishing gear innovations in the past decades have made the behavior particularly dangerous. Concern over seabird interactions with fisheries swelled in the 1990s with the recognition that large numbers of seabirds were being killed as bycatch during seafood harvest. The fishermen feel beleaguered by regulations, and end up resenting and resisting regulation, which slows progress towards sustainability. Partially in response to frustration with poor progress in international fishing regulations, a number of organizations have developed market or consumer-based approaches. By educating the buyers of seafood about the environmental effects of what they are purchasing, buyers using their market power can influence fishermen to improve their fishing methods and to use best practices, thereby improving the sustainability of their fisheries. Market-based incentives change the dynamic and offer an avenue for progress.

To assist buyers in knowing what fisheries are doing better with regard to sustainability, ABC has undertaken the analysis presented here, of a group of the largest fisheries bringing seafood to US markets and which also are likely to have significant impacts on seabirds through bycatch or other direct mortality. This analysis can then be used by seafood buyers to determine which fisheries are more sustainable with regards to seabirds. We are working with organizations already active in the field of sustainable seafood, such as the Sustainable Fisheries Partnership, FishWise, and the International Seafood Sustainability Foundation, to provide them with this information so they can incorporate it in their evaluations and scoring systems, and then pass it on to their corporate partners, clients, and buyers. In this way, the information can be provided at the appropriate points to be most immediately useful.

METHODS

We selected fisheries based on the overall size of the fishery in terms of total amount of seafood brought to market in the US, either landed or imported. We eliminated farm-raised seafood, because in most cases farmed seafood such as shrimp has little direct effect on seabirds (although it may impact habitat for coastal birds). We did include some fisheries that may use low-risk (to seabirds) gear, based solely on the size of the fishery, because even though they may have a low seabird mortality per set, simply because of the high amount of fishing and high number of times the gear is set, it can still have a significant impact on seabird populations.

Among the large fisheries, then, the selection of fisheries to be reviewed in-depth was made using the risk assessment tool described in the *Methodology to Assess Fisheries for Risk to Seabirds* (American Bird Conservancy 2011). That document describes in detail the methodology. In brief, each fishery is reviewed following these steps:

- Initial Risk
    - Gear Risk
    - Presence of protected, endangered, or threatened species or significant concentrations of seabirds

If the fishery was judged to have low risk to seabirds based on these criteria, it was not further evaluated. If it was judged to be potentially high risk based on these two criteria, it was passed on to the in-depth analysis. The in-depth analysis evaluated the fishery on the following criteria:

- In-depth Analysis
    - Regulations and enforcement
    - Use of effective mitigation or seabird bycatch-avoidance methods
    - Actual levels of seabird bycatch
    - Levels of observer and monitoring coverage
    - Levels of uncertainty about the actual risk to seabirds

<u>Note that these issues were only evaluated with regard to *seabird bycatch and mortality* issues</u>. The fisheries were not evaluated for any factor relating to sea turtles or sea mammals, nor fishery stock levels. In addition, the evaluation focused on seabird bycatch and not on factors of seabirds as part of the ecosystem, for example, as predators of the fishery's target species.

Following the in-depth analysis, each fishery was assigned an overall ranking, indicating their potential for risk to seabirds through bycatch, as potentially high, medium or low, and indicated by the colored seabird symbol:

These categories are considered "potentially" high, medium, or low risk, because on-the-water reality may still be different from that determined by our analysis, which is based on published sources. Fisheries determined to be potentially high risk to seabirds may, in fact, not have significant seabird bycatch or mortality, given further information. Conversely, fisheries judged potentially low risk may, upon obtaining improved information, prove to be problematic. However, this method does serve to flag fisheries which should be of greater concern with regard to their effects on seabirds.

The reports on the individual fisheries that were reviewed in-depth summarize the various components of the risk to seabirds. These are shown in the table at the top of each account. The factors are divided into three groups: Initial Risk (the two factors described above), Risk Reduction (the first four of the five factors listed above as part of the in-depth analysis) and Uncertainty (the last of the five factors). Each of these is given a score (Low, Medium, or High for Initial Risk and Uncertainty, or a numeric score for the Risk Reduction factors). The cells are color-coded according to low (green), medium (yellow), or high (red). For Initial Risk and Uncertainty each is also given a description as Low, Medium, or High, whereas Risk Reduction levels are described as Good, Fair, or Poor. Note that for the Risk Reduction factors, a higher score is better, and the factors are not equally weighted. See the *Methodology to Assess Fisheries for Risk to Seabirds* for details on scoring and weighting. The bottom row of each table gives the overall score for that set of factors (Initial Risk, Risk Reduction, or Uncertainty).

The example below shows the different possible levels.

Initial Risk		Risk Reduction				Uncertainty
Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
Low	High	Fair	Good	Good	Poor	High
1	3	14	21	32	7	3
4/6		74/100				3/3

Each fishery account also provides a list of recommendations for ways in which the fishery could reduce its effect on seabirds, along with a general description of the fishery and discussion of its implications.

The definition of what is a "fishery" is always problematic. In this document we used a common standard, that a fishery is a region that shares geographic boundaries, target species, and gear type. However, some fisheries target more than one fish species but overlap in all other respects, such as the Atlantic groundfish fisheries. These have therefore been combined into a single analysis. In addition, some fisheries are clearly distinct based on geography, but otherwise share target species and gear types, as do the international tuna fisheries or hake fisheries. These fisheries have therefore also been combined into a single analysis and appear in a single section in this document, although in subsections.

GENERAL CONCLUSIONS

A serious issue with the analysis of the large fisheries is a lack of information. Few large fisheries outside the north Pacific and Southern Oceans have any kind of comprehensive mandatory observer and data collection programs for seabird bycatch. Other regions, such as European fisheries and north Atlantic fisheries managed by the US and Canada, or New Zealand and Australia, have observation programs but at lower levels, and often the data collected disregard birds, focusing on fish bycatch, sea mammals, and sea turtles. Some gear types that may be of significant risk to seabirds, such as gillnets, are only now being recognized as a serious threat, and observation efforts have not yet been developed to obtain the needed data for those fisheries. Therefore, one of the most important needs for understanding and reducing bycatch in most fisheries is the need for better information. Without that information, it is difficult to know where and how to direct efforts to reduce seabird mortality and bycatch.

Besides the requirement for more information, many fisheries still have weak regulations, especially with regard to seabird bycatch. This often is related to the lack of information on seabird bycatch: because no seabird bycatch is recognized, fishery managers see no need to require regulation. In addition, many high seas fisheries, outside the jurisdiction of any single country, have weak management structures that do not require needed changes in their fisheries. The result is that some fisheries for which there are good seabird bycatch mitigation methods available, such as tuna longlining, require little or no use of those methods. An improvement, therefore, in regulation in these fisheries could significantly reduce seabird bycatch. Most fisheries, however, have room for improvement in regulations regarding use of mitigation methods.

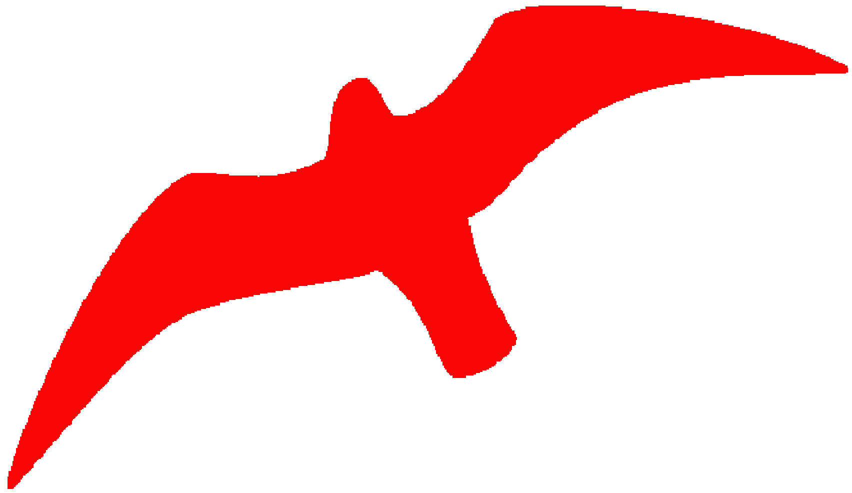
Enforcement of those regulations that do exist is also a significant issue in many fisheries. This is, of course, always an issue on operations on the high seas outside of any country's EEZ: who is responsible for enforcement? However, a lack of independent on-board observer information makes it difficult to know where enforcement needs to be improved.

An important issue that is rising to attention is seabird bycatch in gillnets. In some areas, gillnets cause significant mortality of diving seabirds. Because of low levels of observation and research data, the seriousness of this problem has not been recognized. Gillnets are extensively used in some fisheries in the north Pacific and in the North and Baltic Seas, areas where there are significant numbers of diving seabirds. Development of effective and inexpensive mitigation methods on gillnets to reduce seabird bycatch is necessary, as is requiring their use in any fisheries with diving seabirds.

In general, it is important to recognize that seabird bycatch remains a significant problem worldwide. In the last decade there have been significant victories in some areas in some fisheries, but seabird mortality and bycatch still occurs at levels that are too high to be sustainable in almost all parts of the world. Therefore, efforts must continue to address this important issue.

ACKNOWLEDGMENTS

American Bird Conservancy is very grateful for the support of this project by The Walton Family Foundation. The analyses were reviewed and improved with the assistance of Mike Parr.



FISHERIES ACCOUNTS

The following accounts describe 25 of the largest fisheries bringing seafood to US markets, either landed in the US or imported, and which also have, or are suspected to have, significant seabird bycatch and mortality. Each of these fisheries does not get its own section. For example, because international longline tuna fisheries all target the same set of species and in the same way, those were all treated in subsections of one account. This is also true of swordfish. However, US tuna fisheries, which may use other gears besides longline such as trolls and jigs, were treated in a separate section.

Each of the accounts is broken into several subsections:

- A scoring table (or tables if more than one fishery is treated in the account)
- A general description of the fishery's issues
- Recommendations
- Overview
- Tonnage and Sources
- Products and Market
- Gear, Set, and Mitigation
- Fishing Vessels and Their Countries of Origin
- Management of the fishery
- Seabird Species and Mortality, which contains most information on seabird bycatch
- Information on the fishery and how well it is covered by observation
- Certification by the Marine Stewardship Council, if any, of the fishery or any of its component fisheries
- Conclusions

The accounts are arranged from those that present greatest risk to seabirds to those that present less risk. Note that because some accounts cover more than one fishery, the risk presented by the individual fisheries may be less than for the group. For example, the US West Coast Whiting Pelagic Trawl Fishery is much lower risk than other hake fisheries.

Potentially High Risk to Seabirds

FOUR INTERNATIONAL LONGLINE TUNA FISHERIES

The tuna fisheries cover a wide range of problems and issues. These issues are usually treated by the Regional Fishery Management Organizations (RFMOs). Although the RFMOs often overlap in which species of tuna they manage, the management systems are often different. Therefore, in each of the following sections, general issues will be discussed and then the issues associated with each of the RFMOs will be addressed separately.

Inter-American Tropical Tuna Commission (IATTC)

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	High	Fair	Poor	Fair	Poor	High
3	3	9	8	13	2	3
6/6		32/100				3/3

International Commission for the Conservation of Atlantic Tunas (ICCAT)

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	High	Fair	Fair	Poor	Poor	High
3	3	14	15	9	7	3
6/6		45/100				3/3

Western and Central Pacific Fisheries Commission (WCPFC)

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	High	Fair	Poor	Fair	Poor	High
3	3	9	8	17	2	3
6/6		37/100				3/3

Indian Ocean Tuna Commission (IOTC)

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	High	Fair	Poor	Fair	Poor	High
3	3	12	8	16	5	3
6/6		41/100				3/3

None of the tuna fisheries being regulated by the RFMOs is doing a good job of reducing seabird bycatch to sustainable levels. The best of the four RFMOs analyzed here was the ICCAT, almost strictly because it has replaced the mitigation method selection from a "select one from column A and one from column B" system to a more restrictive system requiring two of the three best mitigation methods, methods which have been shown by research to be effective.

None of the four fisheries had adequate observer data; most observer data available was from observer coverage of <1% of effort. All four RFMOs have observer coverage improvements under way, usually requiring observer coverage to be no less than 5%. However, all of these observer improvement programs are taking effect at present and data are not yet available. Because of the lack of observer information, uncertainty of seabird bycatch is very high for all four RFMOs.

Regulation and enforcement are also important issues within all four RFMOs. It is not clear that any of the RFMOs has adequate enforcement of its resolutions, and many of the resolutions are not mandatory.

Although the tuna longline fisheries have not made very significant efforts to reduce seabird bycatch and mortality, their seabird bycatch is not as high as in some other fisheries. This may be largely a factor of the areas where tuna fishing takes place. Most tuna fishing occurs in warmer waters, often in tropical areas, and most seabird concentrations tend to occur in colder waters. The majority of albatross, for example, occur in the Southern Ocean, an area with little tuna fishing. However, within the areas where these four tuna RFMOs fish, they are causing significant seabird mortality and should implement the necessary requirements (mitigation methods) and enforcement of those requirements, and obtain adequate observer information to ensure that their fishing is sustainable with regard to seabirds.

Recommendations

- All RFMOs should develop and implement mitigation requirements similar to or better than those of the ICCAT, where the mitigation methods required are limited only to those methods shown to be effective, and the use of at least two methods of only three offered is required.
- Improve observer coverage and data collection and analysis, so that all large tuna fishing vessels have independent on-board observers, and smaller vessels have significant observer coverage at some level greater than 5%.
- Observer coverage should formally include information on seabird bycatch, and observers should be trained in collecting information on bird bycatch and mortality.
- Develop ways to adequately enforce the use of mitigation methods and presence of observers.
- Based on results of observer information and other sources, improve the use of mitigation methods and reduce uncertainty in the fishery.
- Reduce seabird bycatch to negligible levels, as has been done in other longline fisheries even in areas with greater seabird abundance.

Overview

Tuna fisheries in international waters are managed in the main by five Regional Fishery Management Organizations (RFMOs), of which these four will be discussed:

1. Inter-American Tropical Tuna Commission (IATTC). Established by Convention for the Establishment of an Inter-American Tropical Tuna Commission, opened for signature in May 1949) and entered into force in March 1950.
2. The International Commission for the Conservation of Atlantic Tunas (ICCAT). Established by the International Convention for the Conservation of Atlantic Tunas, opened for signature in 1966, and entered into force in 1969.
3. Western and Central Pacific Fisheries Commission (WCPFC). Established by Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western

and Central Pacific Ocean, opened for signing in September 2000, and entered into force in June 2004.

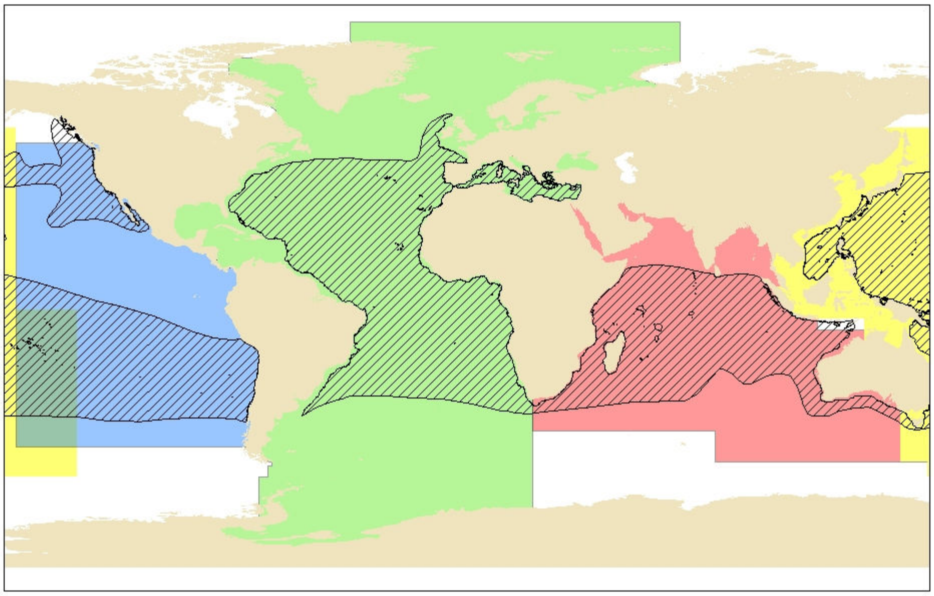
4. Indian Ocean Tuna Commission (IOTC). Established by The Agreement for the Establishment of the Indian Ocean Tuna Commission, concluded under Article XIV of the FAO Constitution, approved by the FAO Council in November 1993, and entered into force in March 1996.

These section will look at **tuna fisheries practiced within these areas using longlines** (mainly pelagic) because this gear type results in the highest known seabird bycatch numbers. At the same time, we are mindful of BirdLife International's admonition: "There should be no presumption that a particular fishing gear or method does not pose a risk to seabirds unless proven otherwise" (BirdLife International, 2010). However, while acknowledging that there may be significant mortality associated with other tuna catch gear types, we find the data there is even less available than with longline fisheries. (Note that at least in the case of the IATTC and the WCPFC, longline fisheries for billfish are also implicated in seabird incidental takes.)

For each RFMO, we will look at seabird mortality, mitigation methods recommended or required, the type of observer program in place and an admittedly coarse, qualitative judgment on the state of our knowledge of what is happening to seabirds on the water.

Tuna Species Distributions and RFMOs

The four RFMOs included in this analysis cover the world's tuna fisheries. The following maps show the areas governed by each of the RFMOs (colored ocean regions) and the distribution of four species of tuna (albacore, big eye, skipjack, and yellowfin). Note that the tuna species tend to occur in warmer, tropical waters and not in the Southern Ocean or Arctic.

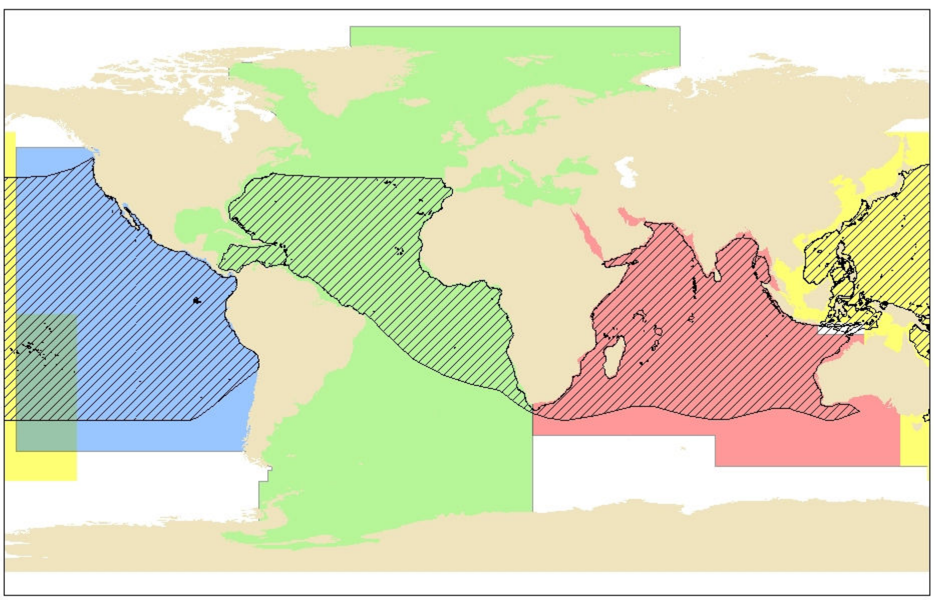


Global Distribution of Albacore Tuna, Managing Agencies and Fisheries

Albacore Tuna Distribution
IATTC (purse seine, longline)
IOTC (gillnet, longline, purse seine)
ICCAT (purse seine, longline, gillnet)
WCPFC (purse seine, longline)

Data obtained from:
FAO. © 2003-2012. Aquatic Species Distribution Maps.
In: FAO Fisheries and Aquaculture Department [online].
Rome. Updated 22 February 2012. [Cited (22/02/2012)].
www.fao.org/figis/geoserver/factsheets/species.html

0 1,050 2,100 4,200 6,300 8,400
Miles

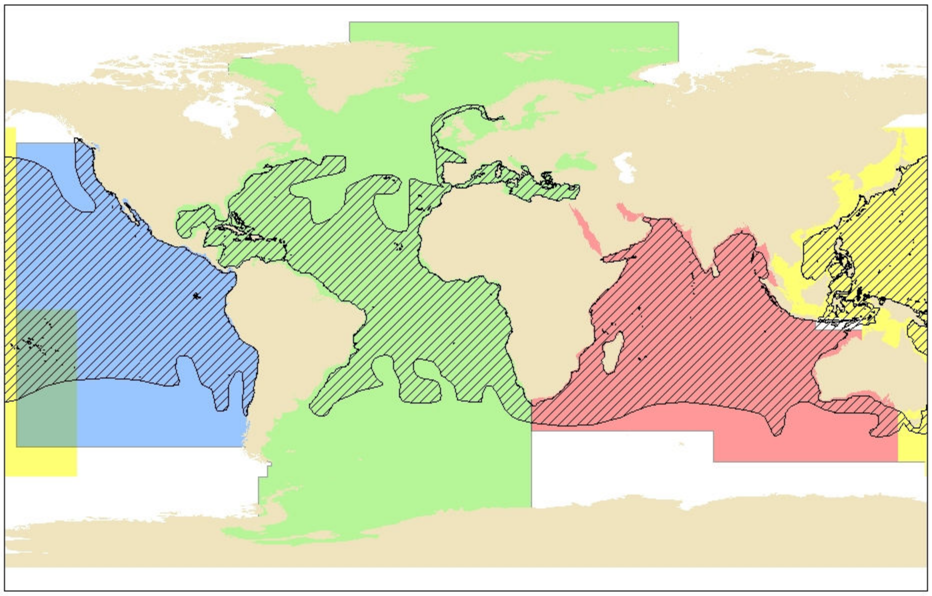


Global Distribution of Big Eye Tuna, Managing Agencies and Fisheries

Big EyeTuna Distribution
IATTC (purse seine, longline)
IOTC (gillnet, longline, purse seine)
ICCAT (purse seine, longline, gillnet)
WCPFC (purse seine, longline)

Data obtained from:
FAO. © 2003-2012. Aquatic Species Distribution Maps.
In: FAO Fisheries and Aquaculture Department [online].
Rome. Updated 22 February 2012. [Cited (22/02/2012)].
www.fao.org/figis/geoserver/factsheets/species.html

0 1,050 2,100 4,200 6,300 8,400
Miles

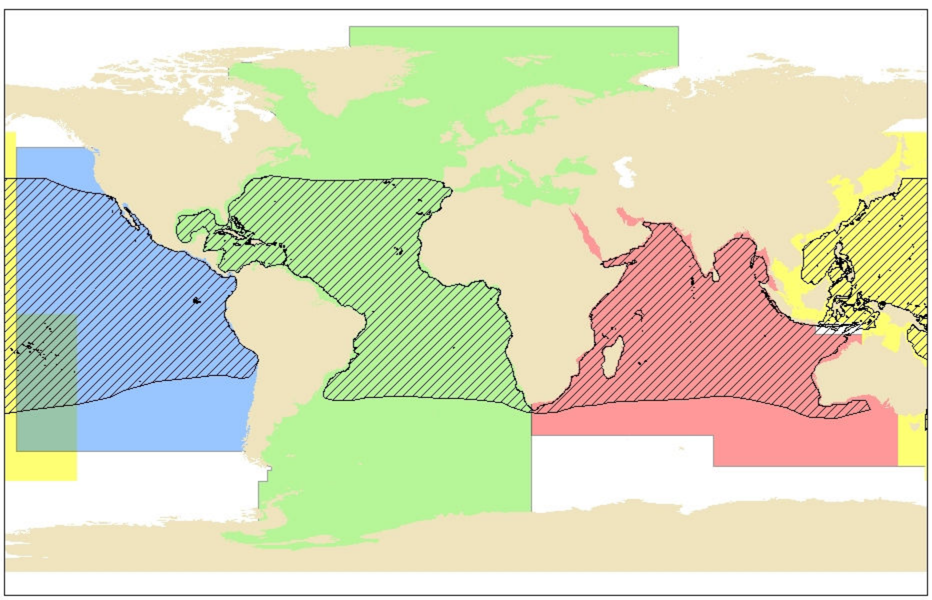


Global Distribution of Skipjack Tuna, Managing Agencies and Fisheries

Skipjack Tuna Distribution
IATTC (purse seine, longline)
IOTC (gillnet, longline, purse seine)
ICCAT (purse seine, longline, gillnet)
WCPFC (purse seine, longline)

Data obtained from:
FAO. © 2003-2012. Aquatic Species Distribution Maps.
In: FAO Fisheries and Aquaculture Department [online].
Rome. Updated 22 February 2012. [Cited (22/02/2012)].
www.fao.org/figis/geoserver/factsheets/species.html

0 1,050 2,100 4,200 6,300 8,400
Miles



Global Distribution of Yellowfin Tuna, Managing Agencies and Fisheries

Yellowfin Tuna Distribution
IATTC (purse seine, longline)
IOTC (gillnet, longline, purse seine)
ICCAT (purse seine, longline, gillnet)
WCPFC (purse seine, longline)

Data obtained from:
FAO. © 2003-2012. Aquatic Species Distribution Maps.
In: FAO Fisheries and Aquaculture Department [online].
Rome. Updated 22 February 2012. [Cited (22/02/2012)].
www.fao.org/figis/geoserver/factsheets/species.html

0 1,050 2,100 4,200 6,300 8,400
Miles

Seabird Species and Mortality

The species of seabirds most frequently caught by longliners are albatrosses and petrels in the Southern Ocean; Northern Fulmar (*Fulmarus glacialis*) (a type of petrel) in North Atlantic fisheries; and albatrosses, gulls, and fulmars in North Pacific fisheries (Brothers *et al.,* 1999). Death occurs in the longline fishery mainly due to a bird's attempt to eat the bait, becoming hooked or entangled, and drowning as the gear sinks. The health of populations of albatrosses and large petrels are most at risk from this threat (Gilman, 2006). Anderson et al. (2011) stated:

> "Bycatch in longline fisheries is believed to govern the adverse conservation status of many seabird species, but no comprehensive global assessment has been undertaken. We reviewed the extent of seabird bycatch in all longline fisheries for which data are available. Despite the many inadequacies and assumptions contained therein, we estimated that at least 160,000 (and potentially in excess of 320,000) seabirds are killed annually. Most frequently caught are albatrosses, petrels and shearwaters, with current levels of mortality liable to be unsustainable for some species and populations."

A critical reading of the papers of the most dedicated and careful scientific writers on the topic (see, for example Anderson, above) indicates that we really do not know the full magnitude of the problem. Anderson is clear on the issue: "[Two] key issues that must be addressed before global estimates of seabird bycatch can be further improved: the lack of observer programs in certain key fleets and/or inadequate spatial and temporal coverage by onboard observer programs; and the need for standardization in seabird bycatch data collection and reporting." (Anderson et al., 2011)

Gear, Set, and Mitigation

Bycatch mitigation programs until 2011 looked similar on paper for all of the tuna RFMOs. For longlines they traditionally involved requirements or admonitions to use one or more methods from a table that had columns A and B from which to choose (one or more) of the following: avoid peak bird foraging periods by setting only at night using minimal deck lighting; use of deep-water, underwater and side-setting devices; use of one or more bird scaring lines/Tori lines and or acoustic and/or towed devices to frighten and disperse birds while setting (usually presented as options in both columns); use branchline weights near hooks to speed the process of the baited hook sinking rapidly beyond the reach of the seabirds (also may be in columns A and B); offal management; color bait blue to decrease detection; and set terminal tackle and main lines beyond propeller turbulence. All these are illustrated and their efficacy discussed in a 1999 FAO Circular (FAO, 1999), again in a 2008 FAO paper (Lokkeborg, 2008), and by ACAP in 2011(ACAP, 2011). The usefulness of some of these mitigation measures (which might be appropriate for non-longline gear types, e.g. for purse seines) are now being questioned by some in tuna longline RFMOs. Recently under fire is deployment of blue-dyed squid bait, underwater line shooters and management of offal discharge especially if they are used in lieu of what are seen as more effective mitigating tools. Importantly, the ACAP has published the following:

> Recognizing that most (84%) breeding albatrosses overlap with the pelagic longline fisheries for tuna and swordfish managed by the five tuna RFMOs, the adoption of best practice seabird conservation in these fisheries is a high priority. A combination of

> weighted branchlines, bird scaring lines and night setting are best practice mitigation in reducing bycatch of seabirds to the lowest possible level in pelagic longline fisheries. These measures should be applied in high risk areas such as the high latitudes of southern hemisphere oceans to reduce the incidental mortality of seabirds to the lowest possible levels. Other factors such as safety, practicality and the characteristics of the fishery should also be recognized. Currently, no single mitigation measure can reliably prevent the incidental mortality of seabirds in most pelagic longline fisheries. The most effective approach is to use the measures described in combination (ACAP, 2011b).

ICCAT has acted on this as discussed below (requires in some areas use of two of weighted branchlines, bird scaring lines and night setting as best practice mitigation) and IOTC is poised to act similarly at their April Commission meeting.

Eric Gilman in his 2011 Marine Policy article agrees that technological solutions akin to those used for for turtles in shrimp trawls (TEDs) and for porpoise in the tuna purse seine nets are available (or can be developed) to decrease seabird bycatch, given greater political will to require and enforce them (Gilman, 2011). A final need is for quantifiable standards in order to assess the effects of the measures. Again, ACAP has set out a process that would do this, but it has yet to find broad favor (ACAP, 2009).

Information

The obvious platforms of opportunity to improve our state of knowledge are the fishing vessels themselves, but to date there has been a paucity of observers, both as to the percentage of effort in the longline fleet and geographically so as to be representative of the activity of the fleet. To that is added the sometimes only very basic observer training, the numbers of tasks observers are assigned, and the prioritization of dealing with bycatch. Studies have shown that, in the case of seabirds, 20% observer coverage (of fishing effort in number of set hooks) is required (Lawson, 2006) to obtain reliable bycatch estimates. Some RFMOs are struggling to get to 5%; and in some of those observers are in place primarily to record fish catch. Counting and identification by species of all bycatch is usually not an observer's main function and that is likely reflected in their training. Furthermore, their physical station on the vessel, required so they can observe fish landings, may interfere with their being able to accurately record bird mortality. It is thought that a significant proportion of the birds that die as bycatch fall off the hook before landing, thus not being seen or counted. For example, researchers found that in the Hawaii longline tuna fishery, 34% of seabirds caught during setting were not hauled aboard (Gilman et al., 2003; Brothers et al., 2010). Thus, if the observer cannot peer overboard during sets and/or see the lines as they are hauled in, he/she will not be able to see or count all incidental bird deaths. In fact, one set of respected researchers and writers long-versed in this field contend that the number of seabirds that die but are not counted because of loss before landing (for numerous reasons) would double current mortality estimates (Brothers et al., 2010).

Finally, observer (and other boat-generated) data collection, reporting and sharing protocols are not uniform which decreases the usefulness of what information is collected. Wolfaardt in a 2011 paper for the ACAP SBWG outlines whys and hows for a rigorous seabird bycatch observer program (from Wolfaardt, 2011):

The main objectives of collecting seabird bycatch data are:

a) To characterize and quantify seabird bycatch within a fishery.

b) To understand the nature of seabird bycatch, and the importance of the various factors that contribute to the observed level of bycatch. This is important for identifying specific mitigation solutions for the particular fishery.

c) To assess and monitor the effectiveness of seabird bycatch mitigation measures in reducing mortality.

To fulfill these objectives a number of issues need to be addressed. These include:

- The establishment and implementation of effective observer programs.
- Sufficient observer coverage of the fishing effort to quantify accurately seabird bycatch, and to scale up reliably observed bycatch to the whole fishery.
- Standardized collection of reliable seabird bycatch and associated data by well-trained observers.
- Clear and standardized requirements for reporting bycatch, and co-ordinated and preferably centralized management of bycatch data (by RFMO Secretariats or even jointly by all tuna RFMOs).

The state of our knowledge, the reliability of data on seabird mortality from tuna longline bycatch, is, to put it gently, sketchy. This reflects the immensity of the world's oceans and the breadth of these birds' ranges coupled with limited dedication to the problem in terms of resources for observation and research, limited public pressure, and little political incentive to get the facts and thus expose the magnitude of the problem.

Certification

Only one longline tuna fishery has been certified by the MSC, the Southeast US North Atlantic Big Eye Tuna and Yellowfin Tuna Fishery. The fishing area for this fishery falls under ICCAT jurisdiction.

Note, however, that some tuna fisheries that do fall within the regions of the four RFMOs in this analysis have been certified using other gear types, usually hand lines or pole and line.

The fisheries that are certified in each RFMO's regions are:

IATTC

American Albacore Fishing Association Pacific Albacore Tuna - North
American Albacore Fishing Association Pacific Albacore Tuna - South
American Western Fish Boat Owners Association (WFOA) North Pacific Albacore Tuna
Canadian Highly Migratory Species Foundation (CHMSF) British Columbia North Pacific Albacore Tuna
Mexico Baja California Pole and Line Yellowfin and Skipjack Tuna

WCPFC
Fiji Albacore Tuna Longline
New Zealand Albacore Tuna Troll
PNA Western and Central Pacific Skipjack Tuna
Tosakatsuo Suisan Pole and Line Skipjack Tuna

IOTC
Maldives Pole and Line and Handline Tuna
Maldives Pole and Line Skipjack Tuna

THE RFMOs

The following section treats each of the four RFMOs separately.

Inter-American Tropical Tuna Commission (IATTC)

Seabird Species and Mortality

These seabird species are known to overlap IATTC area and thus are probably incidentally caught: Waved Albatross, Black-footed Albatross, Chatham Albatross, Black-browed Albatross, Laysan Albatross, Antipodean Albatross, Buller's Albatross, Gray-headed Albatross, Northern Royal Albatross, Short-tailed Albatross, Wandering Albatross, White-chinned Petrel, and Sooty Shearwater (ACAP, 2008, p. 8). Salvin's Albatross, Southern Royal Albatross, Black Petrel, Gray Petrel and Westland Petrel probably should also be included (ACAP, 2008, pp. 9, 17-29).

In a paper prepared in 2009 for Birdlife International, Anderson looks at all known reports of seabird bycatch in the IATTC. Noting that the observer coverage of the fleets participating, when in existence at all, was less than 1% based on effort, he estimates that at least 4,000 seabirds are killed annually in those fisheries that report – and it is impossible to say what total is for entire IATTC area. He describes species most vulnerable:

> Analysis of albatross distribution within IATTC waters and their overlap with longline fisheries identifies that the Waved Albatross (*Phoebastria irrorata*) distribution overlaps 100% with 5x5º grid squares in which IATTC longline fishing effort took place. The IATTC area is also highly important for non-breeding Black-footed Albatross (*P. nigripes*), New Zealand albatross species (which migrate across the South Pacific to rich foraging grounds in the Humboldt Current), and Black-browed Albatross (*Thalassarche melanophrys*) breeding in Chilean waters. There are also two small populations of Laysan Albatross (*P. immutabilis*) that nest on the Mexican islands of Isla de Guadalupe (350 breeding pairs) and Isla Clarion (~50 pairs). Within the IATTC area, the overlap between seabird distribution and IATTC longline fishing effort is high for all ACAP species, with the exception of that in the far south of the IATTC area. The majority of albatross species

> are distributed widely over the Pacific, spanning both WCPFC and IATTC Convention Areas. (Anderson, 2009, p. 2)

Anderson determined that despite the many obvious caveats, his estimates seemed to suggest a significant bycatch problem within IATTC, "particularly given that a considerable proportion of the birds being caught are long-lived, slow reproducing albatrosses, such as the Critically Endangered Waved Albatross" (Anderson, 2009, p. 11). He concluded:

> Given the remaining data gaps highlighted by this review, (e.g. Chile, Ecuador, Peru, and Japan) it is not appropriate to estimate a total seabird bycatch figure for all industrial longline fisheries operating within IATTC. However, broadly speaking these results indicate that upwards of 4,000 seabirds are killed annually within those fisheries that already report bycatch data to some degree (see Table 1)…. However, without a systematic approach to data collection, it is impossible to say how far this likely minimum is from the true total bycatch for IATTC as a whole. (Anderson, 2009, p. 11, 12)

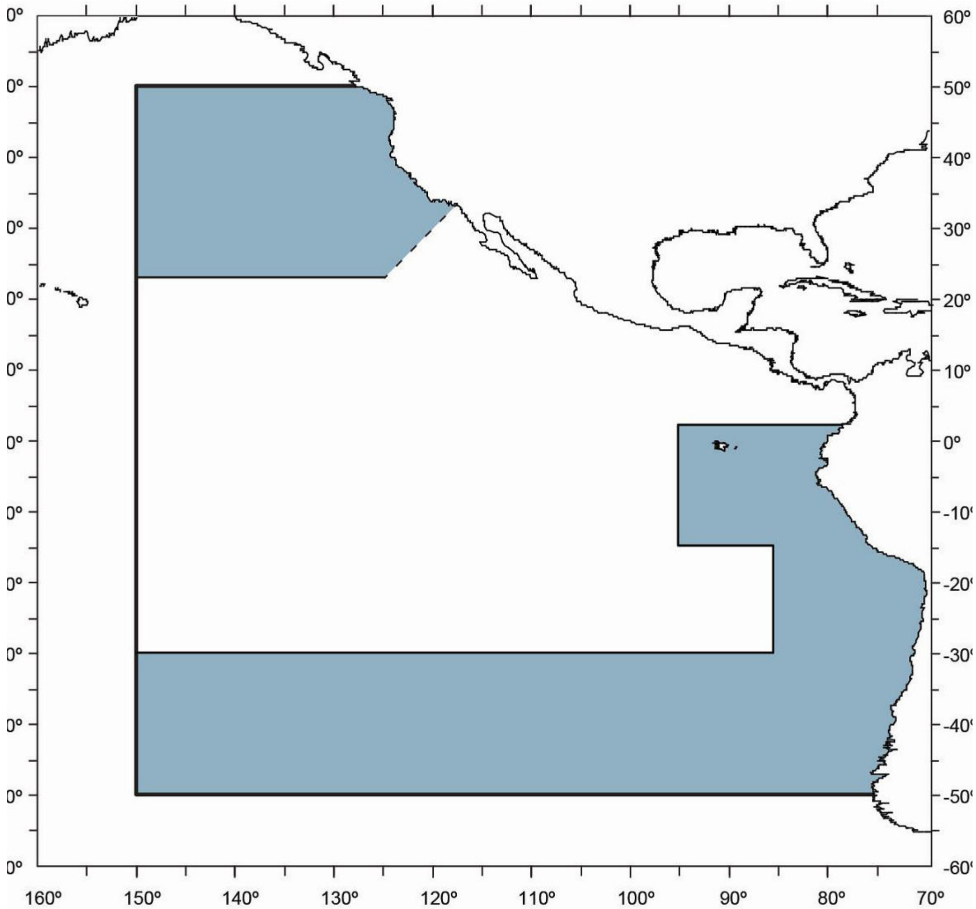
Mitigation

IATTC 2005 Resolution C-11-02, "Resolution to Mitigate the Impact on Seabirds of Fishing for Species Covered by the IATTC," requires, depending on the area fished and if boat is greater than 20 m, use two of the following mitigation measures, one from column A. If in other areas, boats are encouraged to use one of the measures:

Mitigation measures

Column A	**Column B**
Side-setting with bird curtains and weighted branch lines*	*Tori* line**
Night setting with minimum deck lighting	Weighted branch lines
Tori line	Blue-dyed bait
Weighted branch lines	Deep-setting line shooter
Underwater setting chute	
Management of offal discharge	

The areas within the eastern Pacific Ocean in which the use of at least two mitigation measures for reducing seabird bycatch is required are: north of 23° N (except in Mexican waters) and south of 30° S, plus the area bounded by the coastline at 2° N, west to 20° N - 95° W, south to 15° S - 95° W, east to 15° S - 85° W, and south to 30° S. These areas are shaded blue in the following map.



Information
IATTC 2011 Res C-11-08, "Resolution on Scientific Observers on Longline Vessels," requires that each Contracting and cooperating non-Contracting members (CPC) ensure at least 5% of the fishing effort made by its longline fishing vessels greater than 20 m length overall carry a scientific observer, beginning on 1 January 2013. The mechanism to define how to measure the 5% of fishing effort was to be determined in 2012. This observer program is obviously still in development, but is clearly envisioned as encompassing more than just counting fish catch and should include seabird bycatch.

The State of Knowledge of seabird bycatch in the IATTC region is poor, both as to total mortalities and species represented. Anderson find this to be especially true with artisanal longline and gillnet fisheries (Anderson, 2009). This may improve as the scientific observer program goes into effect and data are collected.

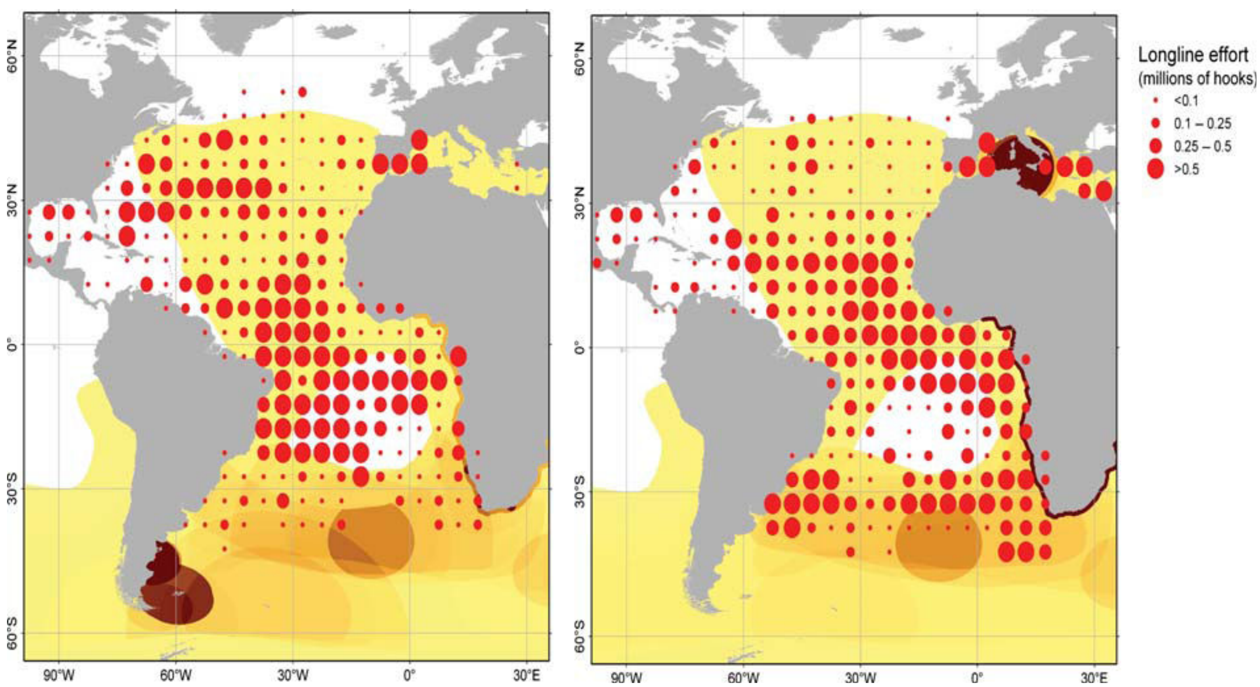
International Commission for the Conservation of Atlantic Tunas (ICCAT)

Seabird Species and Mortality
In all, 37 species of seabird have been recorded as bycatch in ICCAT fisheries (Anon., 2008). Tuck et al., writing in the ICES Journal of Marine Sciences in 2011, found that the numbers of

seabirds killed is significant, with potentially important conservation implications. “If this mortality is not reduced, the numbers of breeding birds in some populations will continue to decline, threatening their long-term viability” (Tuck et al., 2011, p. 1628). He estimated total seabird mortality in this fishery at less than 16,500 annually (Tuck et al., 2011).

While species composition of incidental take is dependent on numerous factors (e.g., region, time of year, vessel’s operational characteristics) the paper determines major bycatch species in the southern Atlantic Ocean are Wandering albatross, Tristan Albatross, Black-browed Albatross, Atlantic Yellow-nosed Albatross, *cauta*-group albatrosses (*Thalassarche cauta* and *T. steadi*), Gray-headed Albatross, and White-chinned Petrels. While Tuck found fewer data available for the North Atlantic Ocean, species documented as bycatch there include Cory’s Shearwater, Balearic Shearwater, Yelkouan Shearwater (*Puffinus yelkouan*), and Northern Fulmar (*Fulmarus glacialis*; Tuck et al. 2011., pp. 1632-1633).

Totals in the longline tuna fishery are less than 16,500 and may have decreased lately due to decreased/change in location of effort. “…[T]he greatest proportion of bycatch that could be identified to species level was that of Black-browed Albatrosses (32%), followed by Atlantic Yellow-nosed Albatrosses (17%). These populations suffered an average annual bycatch of 3,900 and 2,000 birds, respectively, between 2003 and 2006. Unspecified albatrosses accounted for an additional 6%, and other unspecified seabirds made up 42% of the total” (Tuck et al., 2011, p. 1633). The figure below, from the Tuck et al. paper, when combined with the knowledge of the propensity of the species to be opportunistic feeders on bait, illustrates the problem.



The overlap of ICCAT pelagic longline-fishing effort with the combined distribution of 22 populations (ten species) of seabird for the months January (left) and July (right). Longline fishing effort (millions of hooks) averaged over the years 2000–2005 is shown proportional to the diameter of the circle (see key). Contours of seabird density (numbers per degree square) give equal weight to each of the ten species and are illustrated as relative density. Darker shades (of brown) depict a greater density of birds.

Mitigation

ICCAT Recommendation 2007-07 "Recommendation by ICCAT on Reducing Incidental Bycatch of Seabirds in Longline Fisheries" is in effect for areas between 20° and 25° S. More importantly, in a break with tradition, at the Commission's November 2011 meeting, more specific standards for areas south of 25° S were put in place due to ICCAT Recommendation 2011-09 "Supplemental Recommendation by ICCAT on Reducing Incidental By-Catch of Seabirds in ICCAT Longline Fisheries." In this recommendation there is not a table of mitigation measures with choices from columns A and B as is used by the IATTC.

ICCAT's Standing Committee on Research Statistics found that the following measures, used simultaneously, are considered to have the strongest empirical support, to be cost-effective, safe, to have minimal negative, or to have positive effects on catch rates of target species: Tori lines (minimum aerial extent of 100 m); night setting; and weighted branchlines (minimum 60 g weight within 3 m of the baited hook)(Anon., 2010). The ICCAT Recommendation 2011-09 however does not require all three, only two. Requirements for vessels greater than or equal to 35 m fishing at or South of 25° S include:

- Deploy at least one bird-scaring line. Where practical, vessels are encouraged to use a second tori pole and bird scaring line at times of high bird abundance or activity; both tori lines should be deployed simultaneously, one on each side of the line being set.
- Aerial extent of bird-scaring lines must be greater than or equal to 100 m.
- Long streamers of sufficient length to reach the sea surface in calm conditions must be used.
- Long streamers must be at intervals of no more than 5 m.

Additional design and deployment guidelines for bird-scaring lines are provided in Annex 1 of this Recommendation, and additional technical information is given in the Annex:

Design of tori lines

1. An appropriate towed device on the section of the tori line in the water can improve the aerial extension.
2. The above water section of the line should be sufficiently light that its movement is unpredictable to avoid habituation by birds and sufficiently heavy to avoid deflection of the line by wind.
3. The line is best attached to the vessel with a robust barrel swivel to reduce tangling of the line.
4. The streamers should be made of material that is conspicuous and produces an unpredictable lively action (e.g. strong fine line sheathed in red polyurethane tubing) suspended from a robust three-way swivel (that again reduces tangles) attached to the tori line.
5. Each streamer should consist of two or more strands.
6. Each streamer pair should be detachable by means of a clip so that line stowage is more efficient.

Deployment of tori lines

1. The line should be suspended from a pole affixed to the vessel. The tori pole should be set as high as possible so that the line protects bait a good distance astern of the vessel and will not tangle with fishing gear. Greater pole height provides greater bait protection. For example, a height of around 7 m above the water line can give about 100 m of bait protection.
2. If vessels use only one tori line it should be set to the windward of sinking baits. If baited hooks are set outboard of the wake, the streamer line attachment point to the vessel should be positioned several meters outboard of the side of the vessel that baits are deployed. If vessels use two tori lines, baited hooks should be deployed within the area bounded by the two tori lines.
3. Deployment of multiple tori lines is encouraged to provide even greater protection of baits from birds.
4. Because there is the potential for line breakage and tangling, spare tori lines should be carried onboard to replace damaged lines and to ensure fishing operations can continue uninterrupted. Breakaways can be incorporated into the tori line to minimize safety and operational problems should a longline float foul or tangle with the in-water extent of a streamer line.
5. When fishers use a bait casting machine (BCM), they must ensure coordination of tori line and machine by:
    i) ensuring the BCM throws directly under the tori line protection, and
    ii) when using a BCM (or multiple BCMs) that allows throwing to both port and starboard, two tori lines should be used.
6. When casting branchlines by hand, fishers should ensure that the baited hooks and coiled branchline sections are cast under the tori line protection, avoiding the propeller turbulence which may slow the sink rate.
7. Fishers are encouraged to install manual, electric or hydraulic winches to improve ease of deployment and retrieval of tori lines.

There are no criteria given in the Recommendation for establishing performance evaluations by which to quantify what is working and what is failing. This would seem to impede progress and innovation.

Information

In 2010, ICCAT formalized requirements for observers with ICCAT Recommendation 2010-10 “Recommendation by ICCAT to Establish Minimum Standards for Fishing Vessel Scientific Observer Programs,” and reinforced this in 2011. Considering the standard for training and the lists of tasks, this program is at or above the norm for the tuna RFMOs. It requires that a Contracting and cooperating non-Contracting member’s (CPC) domestic observer program provide a minimum of 5% coverage based on effort (and that is measured in fishing days, number of sets or trips for longline vessels). Data are to be collected on target species and by-catch and reported annually. It entered into force as of August 2011, with first reports due July 31 2012. In 2011, ICCAT also passed ICCAT Recommendation 2011-10 “Recommendation by ICCAT on Information Collection and Harmonization of Data on By-catch and Discards in

ICCAT Fisheries." This is a start, but it will take some time to build a sufficient collection of useful data.

Optimal observer program criteria necessary to obtain good seabird bycatch data are discussed in a recent paper for ICCAT by BirdLife International (BirdLife, 2011).

The state of knowledge of seabird bycatch in the ICCAT region is little better than poor, and while seabird species interacting with the fishery are known, total mortalities are not. A lot of effort is going into working with limited real data; assumptions provide much of what is used for modeling. There is good circumstantial information that there are declining populations in areas where there is heavy longline activity and where some of the members of those seabird populations are recorded as bycatch. For example, it has been shown that more than 70% of the total longline fishing effort in ICCAT waters between 2000-2005 has no associated information of bird bycatch levels (ICCAT 2007), although it must also be said that reports and publications from those years seem to form most of the data analyzed by Tuck et al., resulting in their gross mortality estimates for the Atlantic Ocean. There possibly exists more literature on ICCAT seabird bycatch than on the other tuna RFMO areas.

Western and Central Pacific Fisheries Commission (WCPFC)

Seabird Species and Mortality

WCPFC has listed the following 26 seabirds as bycatch species tracked on their Bycatch Mitigation Information System (BMIS):

Buller's Albatross	*Thalassarche bulleri*
White-capped Albatross	*Thalassarche steadi* (split from *Diomedea cauta*)
Salvin's Albatross	*Thalassarche salvini*
Indian Yellow-nosed Albatross	*Thalassarche carteri* (split from *Diomedea chlororhynchos*)
Gray headed Albatross	*Thalassarche chrysostoma*
Black-browed Albatross	*Thalassarche melanophrys*
Campbell Albatross	*Thalassarche impavida*
Southern Royal Albatross	*Diomedea epomophora*
Wandering Albatross	*Diomedea exulans*
Laysan Albatross	*Phoebastria immutabilis*
Black-footed Albatross	*Phoebastria nigripes*
Light-mantled Albatross	*Phoebetria palpebrata*
White-chinned Petrel	*Procellaria aequinoctialis*
Gray Petrel	*Procellaria cinerea*
Black Petrel	*Procellaria parkinsoni*
Westland Petrel	*Procellaria westlandica*
Great-winged Petrel	*Pterodroma macroptera*
Southern Giant-Petrel	*Macronectes giganteus*
Northern Giant-Petrel	*Macronectes halli*
Cape Petrel	*Daption capense*
Wedge-tailed Shearwater	*Puffinis pacificus*
Flesh-footed Shearwater	*Puffinus carneipes*
Sooty Shearwater	*Puffinus griseus*
Short-tailed Shearwater	*Puffinus tenuirostris*
Great Skua	*Catharacta skua*
Gulls (unidentified)	*Larus spp*

As reported to the WCPFC by Inoue, et al. (2011), albatrosses and petrels observed in the WCPFC area of the southern hemisphere include Wandering Albatross *Diomedea exulans;* Black-browed Albatross *Thalassarche melanophrys;* Buller's Albatross *T. bulleri;* Shy Albatross *T. cauta;* Salvin's Albatross *T. salvini*; Indian Yellow-nosed Albatross *T. chlororhynchos;* Gray-headed Albatross *T. chrysostoma*; and Light-mantled Albatross *Phoebetria palpebrata;* Northern Giant-Petrel *Macronectes halli;* Southern Giant-Petrel *M. giganteus;* Cape Petrel *Daption capense;* Great-winged Petrel *Pterodroma macroptera;* Gray Petrel *Procellaria aequinoctialis;* White-chinned Petrel *P. cinerea;* Flesh-footed Shearwater *Puffinus carneipes*; and South Polar Skua *Catharacta maccormicki* (Inoue, et al., 2011).

Eric Gilman, in a paper for the Pacific Islands Forum Fisheries Agency investigating whether there was sufficient chance of significant seabird bycatch to require a *National Plan of Action – Seabirds*, agreed with an earlier researcher (Molony) that 1,593 (+/- 8,714 at a 95% confidence interval) seabirds were caught per year between 1990 – 2004. The large error interval around the point estimate is due to the very small sample size. No attempt to describe contribution of species to that total could be made. This figure was derived even though observer coverage of the entire western and central Pacific Ocean pelagic longline fisheries had been extremely low (< 0.1%) during those years, and the observer data that were collected were not evenly distributed among flag states, areas and seasons, which is critical for assessing whether or not seabird bycatch is problematic. This is because abundance of seabird species and seabird species complexes in different areas of the tropical Pacific exhibit high inter-annual and seasonal variability.

Mitigation

WCPFC Conservation and Management Measure 2007-04 "Conservation and Management Measure to Mitigate the Impact of Fishing for Highly Migratory Fish Stocks on Seabirds" defines a standard methodology for mitigation. As in the IATTC, for longline vessels, a table is presented of column A and column B mitigation methods, from which party must choose at least two measures in areas south of 30° S and north of 23° N including at least one from Column A.

Column A	**Column B**
Side setting with bird curtain and weighed lines	Blue-dyed bait
Night setting with minimal lighting	Deep setting line shooter
Tori lines	Underwater setting chute
Weighted branch lines	Management of offal discharge

In other areas outside the latitudinal limits, the measure *encouraged* use of one or more measures.

In areas south of 30° S and north of 23° N, annual reporting is required giving methods required/used with technical specifications and this must be annually updated. Parties should research, refine share and report on mitigation methods. The WCPFC Scientific Committee will continue to investigate and make recommendations. Efforts to release caught birds in good condition will be encouraged, and as will removing hooks when possible without jeopardizing the lives of the birds. Annual reporting of details of bird bycatch information is required.

As noted, this "traditional" method (choosing one mitigation method from each column) has been criticized by researchers as insufficient, directly by Melvin et al. (2011) and indirectly by Gilman (2011).

After working in 2009 and 2010 in South Africa, researchers from the University of Washington Sea Grant Program and the Ecologically Related Species Section of the National Research Institute of Far Sea Fisheries concluded that their "…results strongly suggest that two hybrid streamer lines together with weighted branchlines and night setting constitute best-practice seabird bycatch mitigation for the joint venture fleet operating in the South Africa EEZ and other White-chinned Petrel dominated fishing areas. These results also suggest that the Column A and Column B mitigation approach adopted by WCPFC (CMM 2007-04) and IOTC (Resolution 10/06), as currently written, would not prompt the simultaneous use of two hybrid streamer lines, branchline weighting and night setting, and therefore, fall short of the best-practice mitigation identified in this study" (Melvin et al., 2011, p. 1).

Information

WCPFC Conservation and Management Measure 2007-01 "Conservation and Management Measure for the Regional Observer Program" states that:

> Item 6. "The functions of observers operating under the Commission ROP [Regional Observer Program] shall include collecting catch data and other scientific data, monitoring the implementation of the conservation and management measures adopted by the Commission and any additional information related to the fishery that may be approved by the Commission."

As written, this measure describes a well thought-out system with published, detailed expectations. It has reportedly resulted in 100% coverage on purse seiners since January 2010 and is set to attain 5% on longline vessels in 2012. However, the last posted report by the WCPFC's Intersessional Working Group on the Regional Observer Program was in 2009.

Also informative as to some of the problems WCPFC is experiencing in implementation of the observer program is a recent paper entitled *Status of Observer Data Management* (Williams, 2011).

The state of knowledge of seabird bycatch in the WCPFC region is poor as to both species actually involved and estimates of the total that might be killed. However, as far as bycatch information accessibility on a RFMO website, WCPFC has no rival. In February 2011 it launched the Bycatch Mitigation Information System (BMIS) as a resource for fisheries managers, scientists, fishers and the general public. It is intended to be a central repository of information on the mitigation and management of bycatch in the western and central Pacific Ocean. http://bmis.wcpfc.int/index.php . This has major pages for "References," "Mitigation Methods," "Decisions and Regulations" and "Target and Bycatch Species." Unfortunately, there does not appear to be a way to tell what fishery/gear type caught which species of seabirds. The same appears to be true for Mitigation Methods; they all are listed, but not in relationship to the bycatch species they help avoid capture. However, the "References" section allows a search of 11 pages of articles on seabird mitigation measures, and the "Decisions and Regulation" section allowed a search of mitigation methods for seabirds and provided three pages of recommendations, resolutions and conservation measures across all the RFMOs (discussed and explained in more detail by Fitzsimmons, 2011).

Indian Ocean Tuna Commission (IOTC)

Seabird Species and Mortality

There is much useful information from *Appendix XXVI Executive Summary: Seabirds* in the *IOTC Scientific Committee Report on their 14th Session in December 2011* (available at http://www.iotc.org/files/proceedings/2011/sc/IOTC-2011-SC14-R%5BE%5D.pdf).; The report was produced by the IOTC Working Party on Ecosystems and Bycatch (WPEB), which advises the IOTC Scientific Committee. The following table shows all seabird species reported as caught in fisheries within the IOTC area of competence.

Common Name	**Scientific Name**	**IUCN Threat Status (2010)**
Albatross		
Atlantic Yellow-nosed Albatross	*Thalassarche chlororynchos*	Endangered
Black-browed Albatross	*Thalassarche melanophrys*	Endangered
Indian yellow-nosed Albatross	*Thalassarche carteri*	Endangered
Shy Albatross	*Thalassarche cauta*	Near Threatened
Sooty Albatross	*Phoebetria fusca*	Endangered
Light-mantled Albatross	*Phoebetria palpebrata*	Near Threatened
Amsterdam Albatross	*Diomedea amsterdamensis*	Critically Endangered
Tristan Albatross	*Diomedea dabbenena*	Critically Endangered
Wandering Albatross	*Diomedia exulans*	Vulnerable
White-capped Albatross	*Thalassarche steadi*	Near Threatened
Petrels		
Cape/Pintado Petrel	*Daption capense*	Least Concern
Great-winged Petrel	*Pterodroma macroptera*	Least Concern
Gray Petrel	*Procellaria cinerea*	Near Threatened
Northern Giant-Petrel	*Macronectes halli*	Least Concern
White-chinned Petrel	*Procellaria aequinoctialis*	Vulnerable
Others		
Cape Gannet	*Morus capensis*	Vulnerable
Flesh-footed Shearwater	*Puffinus carneipes*	Least Concern

Of these, the order Procellariiformes (albatrosses and petrels) are most susceptible to being caught as bycatch in longline fisheries (Wooller et al. 1992, Brothers et al. 1999), and therefore are most susceptible to direct interactions with IOTC fisheries.

The southern Indian Ocean is of global importance in relation to albatross distribution: seven of the 18 species of southern hemisphere albatrosses have breeding colonies on Indian Ocean islands. In addition, all but one of the 18 southern hemisphere albatrosses forage in the Indian Ocean at some stage in their life cycle. The Indian Ocean is particularly important for Amsterdam Albatross and Indian Yellow-nosed Albatross, which are endemic to the southern Indian Ocean, White-capped Albatross (breeds only in New Zealand), Shy Albatross (breeds only in Tasmania and forages in the area of overlap between IOTC and WCPFC), Wandering Albatross (74% of global breeding pairs), Sooty Albatross (39% of global breeding pairs), Light-mantled Albatross (32% of global breeding pairs), Gray-headed Albatross (20% of global breeding pairs) and Northern and Southern Giant-Petrel (26% and 30% of global breeding pairs, respectively).

The level of mortality of seabirds due to fishing gear in the Indian Ocean is poorly known, although where there has been rigorous assessment of impacts in areas south of 25° S (e.g. in South Africa), very high seabird bycatch rates have been recorded in the absence of a suite of proven bycatch mitigation measures.

IOTC Resolution 10/06 “On Reducing the Incidental Bycatch of Seabirds in Longline Fisheries” included an evaluation requirement (paragraph 8) by the Scientific Committee in time for the 2011 meeting of the Commission. However, given the lack of reporting of seabird interactions by Members and cooperating non-Members (CPCs), such an evaluation was not made. Unless IOTC CPCs become compliant with the data collection and reporting requirements for seabirds, the WPEB will continue to be unable to address this issue (IOTC 2011b, pp. 190-192).

In the absence of data from observer programs reporting seabird bycatch, risk of bycatch has been identified through analysis of the overlap between albatross and petrel distribution and IOTC longline fishing effort, based on data from the Global Procellariiform Tracking Database (ACAP 2007). A summary map indicating distribution is shown in the map below.

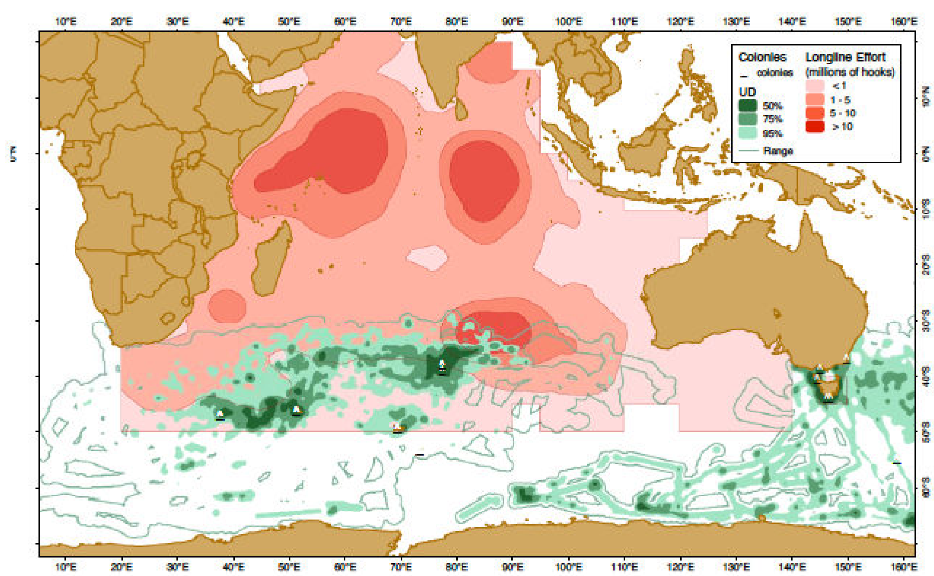


Fig. 1. Distribution of breeding albatrosses, petrels and shearwaters in the Indian Ocean (see Table 2 for a list of species included), and overlap with IOTC longline fishing effort for all gear types and fleets (average annual number of hooks set per 5° grid square from 2002 to 2005).

The overlap between seabird distribution and IOTC longline fishing effort during the breeding season is shown in the following table. Fishing data are based on the average annual number of hooks set per 5° grid square from 2002 to 2005. Overlap is expressed as the percentage of time spent in grid squares with longline effort, and is given for each breeding site as well the species' global population where sufficient data exists. Shaded squares represent species/colonies for which no tracking data were available). Distributions derived from tracking data held in the Global Procellariiform Tracking Database.

Species/Population – Breeding	**Global Population (%)**	**Overlap (%)**
Amsterdam Albatross (Amsterdam)		100
Amsterdam Island	100	100
Antipodean (Gibson's) Albatross		
Auckland Islands	59	1
Black-browed albatross		1
Iles Kerguelen	1	88
Macquarie Island	<1	1
Heard & McDonald	<1	
Iles Crozet	<1	
Buller's Albatross		2
Solander Islands	15	1
Snares Islands	27	2
Gray-headed Albatross		7
Prince Edward Islands	7	70
Iles Crozet	6	
Iles Kerguelen	7	
Indian Yellow-nosed Albatross		
Ile Amsterdam	70	100
Ile St. Paul	<1	
Iles Crozet	12	
Iles Kerguelen	<1	
Prince Edward Island	17	
Light-mantled Albatross	39	
Shy Albatross		
Tasmania	100	67
Sooty Albatross		
Iles Crozet	17	87
Ile Amsterdam	3	
Ile St. Paul	<1	
Iles Kerguelen	<1	
Prince Edward Island	21	
Wandering Albatross		75
Iles Crozet	26	93
Iles Kerguelen	14	96
Prince Edward Islands	34	96
Northern Giant-Petrel	26	
Southern Giant-Petrel	9	
White-chinned Petrel		
Iles Crozet	?	60
Iles Kerguelen	?	
Prince Edward Islands	?	
Short-tailed Shearwater		
Australia	?	3

The overlap between seabird distribution and IOTC longline fishing effort during the non-breeding season is shown in the following table. The table was produced using the same analysis as for the previous table.

Species/Population – Non-Breeding	Global Population (%)	Overlap (%)
Amsterdam Albatross (Amsterdam)		98
Amsterdam Island	100	98
Antipodean (Gibson's) Albatross		9
Antipodes Islands	41	3
Auckland Islands	59	13
Black-browed albatross		1
South Georgia	16	3
Heard & McDonald	<1	
Iles Crozet	<1	
Iles Kerguelen	1	
Buller's Albatross		2
Solander Islands	15	9
Snares Islands	27	15
Gray-headed Albatross		
South Georgia	58	16
Iles Crozet	6	
Iles Kerguelen	7	
Prince Edward Islands	7	
Indian Yellow-nosed Albatross		
Light-mantled Albatross		
Northern Royal Albatross		3
Chatham Islands	99	3
Taiaroa Head	1	1
Shy Albatross		
Tasmania	100	72
Sooty Albatross		
Southern Royal Albatross		
Wandering Albatross		59
White-capped Albatross		
Northern Giant-Petrel		
Southern Giant-Petrel		
White-chinned Petrel		
Westland Petrel		
Short-tailed Shearwater		

Another view of the species involved in Indian Ocean bycatch can be gotten from a paper Inoue et al. presented to the Seventh Session of the IOTC Working Party on Ecosystems and Bycatch (WPEB), October 2011, looking at Japanese and Taiwanese longline seabird bycatch hotspots in the area:

> In the IOTC area, 14,813,680 hooks were observed in Japanese observer data in 1992-2009. Procellariiform seabirds caught by the longline sets monitored by the observers in the IOTC area between 1992-2009 included 3 genus, 9 species and 1,730 albatross individuals; 1 genus, 2 species and 177 individuals of giant-petrels; and 3 genus, 4 species and 404 individuals of petrels. The total number of by-caught seabirds was 2,340 individuals ([table below]). Gray-headed Albatross

was the species most frequently caught in the IOTC area in 1992-2009 (n=435 / 14,813,680 hooks, [table below]), followed by 4 Black-browed Albatrosses (n=241 / 14,813,680 hooks, [table below]) and Yellow-nosed Albatross (n=234 / 14,813,680 hooks, [table below]).

Bycatch of seabirds in IOTC area during 1992-2009 (Inoue et al, 2011b):

Gray-headed Albatross	435
Other albatrosses	391
Black-browed Albatross	241
Yellow-nosed Albatross	234
Shy Albatross	191
Wandering Albatross	117
Northern Giant-Petrel	113
Royal Albatross	51
Southern Giant-Petrel	43
Light-mantled Albatross	37
Sooty Albatross	25
Other macronectes	21
Chatham Albatross	5
Buller's Albatross	3

Finally, in a paper presented to the November IOTC WPEB meeting, Delord & Weimerskirch investigated the at-sea distribution of non-breeding adults and juveniles in order to estimate overlap with IOTC fisheries. Their results showed overlap between the bycatch hotspot zones for Taiwanese and Japanese longliners (recently described in Inoue et al. 2011[discussed above]) and the distribution of albatrosses breeding on islands in the Southern Indian Ocean. They also found the Critically Endangered Amsterdam Albatross and Endangered Indian Yellow-nosed Albatross to be endemic to the IOTC area, both foraging almost exclusively in the areas targeted by longline IOTC fleets south of 20° S. They conclude these birds, especially their juveniles, are at great risk of incidental bycatch since they overlap the areas of high bycatch. In addition, they note that the IOTC area is of great importance to Wandering Albatross, Black-browed Albatross, Sooty Albatross and White-chinned Petrel during non-breeding and juvenile periods.

Mitigation

Current measures are similar to other previously discussed mitigation schemes, and IOTC has passed Resolution 10/06 on "Reducing the Incidental Bycatch of Seabirds in Longline Fisheries." The resolution states that hooklines should be made to sink as soon as possible. In longline fisheries south of 30° S, a table of mitigation methods similar to that used by other RFMOs is given, from which fishers must choose two including one from column A:

Column A	**Column B**
Night setting with minimal lighting	blue-dyed squid bait
Tori lines	offal discharge control
Weighted branch lines	line-setter/line-shooter device

In other areas north of 30° S, CPCs are *encouraged* to use one or more methods. The Scientific Committee was required to review data in 2011 and advise the Commission at the annual meeting on the data and any mitigation recommendations. As discussed below, the Scientific Committee review appears to present the possibility of a revision similar to ICCAT's system, requiring use of at least two of only three "best practices" options.

However, the IOTC is on the verge of a new mitigation system.

The 2011 Seventh Session of the IOTC WPEB meeting in October 2011 agreed with the assessment by Melvin et al. (2011): "…[T]hese results [Melvin et al.'s, 2011] also suggest that the Column A and Column B mitigation approach adopted by WCPFC (CMM 2007-04) and IOTC (Resolution 10/06 *On reducing incidental bycatch of seabirds in longline fisheries*), as currently written, would not prompt the simultaneous use of two hybrid streamer lines, branchline weighting and night setting, and therefore, falls short of the best-practice mitigation identified in this study." (IOTC, 2011, p. 37)."

Similarly, WPEB accepted as best practices the use of the three mitigation measures presented in a paper to them by ACAP (see ACAP 2011b) and recommended that IOTC's Resolution 10/06 be so amended including removing blue-dyed squid bait, offal discharge control and use of a line shooting device which they agreed are not considered to be effective mitigation measures (IOTC, 2011, p. 38-39, 73).

The IOTC Scientific Committee's 14th Session in December 2011, followed the WPEB October's meeting and built upon it. In its *Appendix XXVI Executive Summary: Seabirds* the SC provides this recommendation (IOTC 2011b, p. 191):

- The available evidence indicates considerable risk to the status of seabirds in the Indian Ocean.
- The primary source of data that drive the ability of the WPEB to determine a status for the Indian Ocean, total interactions by fishing vessels, is highly uncertain and should be addressed as a matter of priority.
- Current reported interactions are known to be a severe underestimate.
- That more research be conducted on the identification of hot spots of interactions between seabirds and fishing vessels.
- Maintaining or increasing effort in the Indian Ocean without refining and implementing appropriate mitigation measures, will likely result in further declines in biomass.
- That appropriate mechanisms are developed by the Compliance Commission to ensure CPCs comply with their data collection and reporting requirements for seabirds.
- Resolution 10/06 on reducing the incidental bycatch of seabirds in longline fisheries includes an evaluation requirement (para. 8) by the Scientific Committee in time for the 2011 meeting of the Commission, noting that this deadline is now overdue.

The Scientific Committee then provides supporting information, beginning with a discussion of best practices for seabird bycatch mitigation measures including a reference to the new, no column A and B mitigation measures just then (November 2011) passed by ICCAT, and the ACAP best practices paper and Melvin et al.'s (2011) work in South Africa. They even add a statement that reduction of seabird bycatch may bring benefits to fishing operations, for example by reducing the loss of bait to seabirds as is preliminarily indicated by recent research in Brazil (IOTC 2011b, p. 191-192). They follow with information on seabird vulnerability, provided hereinabove in the mortality section.

Given these apparent strong winds of change, there is a proposal by the European Union and France to do in certain IOTC waters just what ICCAT has done, what the WPEB has advised and the Scientific Committee seems to recommend: to replace current seabird bycatch mitigation measures in at least the most problematic of the IOTC area. While IOTC-2012-S16-PropD[E] "On Reducing the Incidental Bycatch of Seabirds in Longline Fisheries" still only requires two measures, it does away with the "Table 1., Category A and B choices," eliminating colored bait, offal control and line setter/line-shooter options entirely. It lists only use of nighttime setting with low lighting, tori poles and branchline weighting. It is on the agenda to be considered at the 16th Meeting of the Commission, 22-26 April 2012 in Australia (EU and France, 2012).

Information

Just in its incipiency is IOTC's 2011 Resolution 11/04 "On a Regional Observer Scheme." Its objective is to collect verified catch data and other scientific data related to the fisheries for tuna and tuna–like species in the IOTC area:

10. Observers shall:
    - a) Record and report fishing activities, verify positions of the vessel;
    - b) Observe and estimate catches as far as possible with a view to identifying catch composition and monitoring discards, by-catches and size frequency;
    - c) Record the gear type, mesh size and attachments employed by the master;
    - d) Collect information to enable the cross-checking entries made to the logbooks (species composition and quantities, live and processed weight and location, where available); and
    - e) Carry out such scientific work (for example, collecting samples), as requested by the IOTC Scientific Committee."

Beginning in 2011, if a vessel is 24 m overall length, there must be observers for at least 5% of the number of operations/sets for each gear type by the fleet of each CPC; if under 24 m if they fish outside their EEZs they shall also be covered by this observer scheme, achieved progressively by January 2013. The IOTC Scientific Committee has been directed to prepare an observer working manual, a template to be used for reporting (including minimum data fields) and a training program, based on the experience of other tuna RFMOs. For observers to better identify bycatch species and to better report on the level of bycatch by species, the Secretariat has completed identification cards for seabirds (and marine turtles, and has almost completed doing so for sharks). Observers must report seabirds caught within 150 days. IOTC-2012-S16-PropD[E] "On Reducing the Incidental Bycatch of Seabirds in Longline Fisheries" includes having observers (as established by Conservation and Management Measure 11/04) record more specific information about the seabirds caught.

The state of knowledge for the IOTC area provides a mixed picture. Information on species is accessible, with much interest in the situation reflected by Scientific Committee report. Nonetheless, there is still not very much observer data to substantiate any assumptions on bycatch mortality. As the IOTC Scientific Committee is quoted above as stating: "…the level of mortality of seabirds due to fishing gear in the Indian Ocean is poorly known."

Conclusion: Seabird Bycatch in Tuna Longline Regional Fishery Management Organization Areas

Mitigation

Mitigation tools and procedures must be tested and found workable fishery by fishery, region by region, even season by season and tradeoffs acknowledged and weighed. Gilman (2011) points out two of these. First, by setting at night, bycatch of daylight foraging seabirds like albatrosses and petrels will be decreased, but there may be an increase in catch of night foraging seabirds. The second example, involves considering the seabird species complex involved and their behavioral interactions. For example, what worked in the Hawaii's pelagic longline fishery (use of an underwater setting chute avoiding seabird captures) has been less promising in Australia, where a deep diving shearwater species brings baited hooks to the surface making them available to larger albatrosses and petrels, whereas deep diving seabirds rarely interact with the Hawaii fleet. At the same time, Gilman (2011) reminds that there will be instances where a technology or approach will probably work similarly across fisheries, "where the measure's efficacy is only nominally affected by various differences between fisheries. For instance, a minimum branchline weighting design or a performance standard for baited hook sink rate, and night setting, might be globally relevant across seabird assemblages, longline fisheries, and regions to reduce the bycatch of surface diving and nocturnal-foraging seabird species, respectively."

ABC found no discussion of area or seasonal closures, although that technique has worked to decrease bycatch elsewhere.

Finally, there must be performance criteria so that there is a way to tell if mitigation is working, or how it can be changed to be more effective.

Information

Observer coverage must be increased both in proportion of fishing trips or sets are covered, as well as over a larger proportion of the geographic range covered by tuna longlining, to be representative of the practice of the fishery. Observers must have bycatch data recording as one of their main tasks (or in the case of scientific observers, the primary task) and be adequately trained to be able to satisfactorily carry that out. Data gathering and reporting protocols must be made more uniform across RFMOs and sharing protocols enacted so that the knowledge of what is occurring to seabirds throughout the tuna longline fishery is better understood. As Anderson

(2009) concluded, these issues must be addressed before global estimates of seabird bycatch can be further improved.

As to both seabird bycatch mitigation and observation, it is the quality of the training and the dedication to the job that will make the difference in the implementation. It is the desire to succeed that counts, in this case to reduce seabird bycatch in tuna longline fisheries. The "whole community" concept has never been more relevant than it is here. From fishers and observers, captains and corporate boat owners, to bureaucrats at national government desks and ones at RFMOs, to the scientists at the universities, the ones on the water and those who come together in groups like ACAP's Seabird Working Group and IOTC's Working Party on Ecosystems and Bycatch, to activists at NGOs such as BirdLife International and American Bird Conservancy, to those who write about the topic, and finally, to members of the fish-eating public (and even those who don't) who, once informed, push to see change – all must work together to see through this process of increased recognition of the problem and the moves needed to solve it. There are, as Eric Gilman says, proven ways to substantially reduce needless seabird deaths in longline fisheries. It just needs to happen, and before we lose species such as the Waved Albatross or the Amsterdam Albatross.

Suzanne Iudicello, Natasha Atkins, Eugene C. Bricklemyer, Brad Gentner, David A. Wiedenfeld, and Ashley Johnson, 3 September 2012

Potentially High Risk to Seabirds

NORTHWEST AND NORTHEAST PACIFIC SALMON FISHERIES

Northwest Pacific (Japanese and Russian) Salmon Fisheries

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	High	Fair	Poor	Poor	Poor	High
3	3	8	1	8	3	3
6/6		20/100				3/3

Northeast Pacific (US and Canadian) Salmon Fisheries

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	High	Good	Poor	Fair	Fair	High
3	3	18	1	18	8	3
6/6		45/100				3/3

The Pacific salmon fishery consists of two, very different fisheries. In the eastern north Pacific (Alaska, the US west coast, and British Columbia), the fishing is all relatively close to shore, and most is carried out with seines and gillnets. In the western north Pacific, the fisheries carried out by Japan and Russia are almost entirely gillnets and usually carried out far from shore using high seas drift gillnets. Both use a high risk gear type as one of their most common gears: gillnets. Although some anecdotal information suggests that few birds are caught and killed in the US and Canadian salmon fisheries, including gillnets, large numbers of birds, especially shearwaters and alcids, have been recorded killed in the Japanese and Russian fisheries of the western Pacific. However, there is little observer information on seabird bycatch in any of the fisheries, and it is unclear if the estimates are valid. It is likely that seabird bycatch is very high, especially in the Japanese and Russian fisheries. Although most of the species caught are now common, some species, especially alcids are also Protected, Endangered, or Threatened, and therefore are of conservation concern.

Recommendations

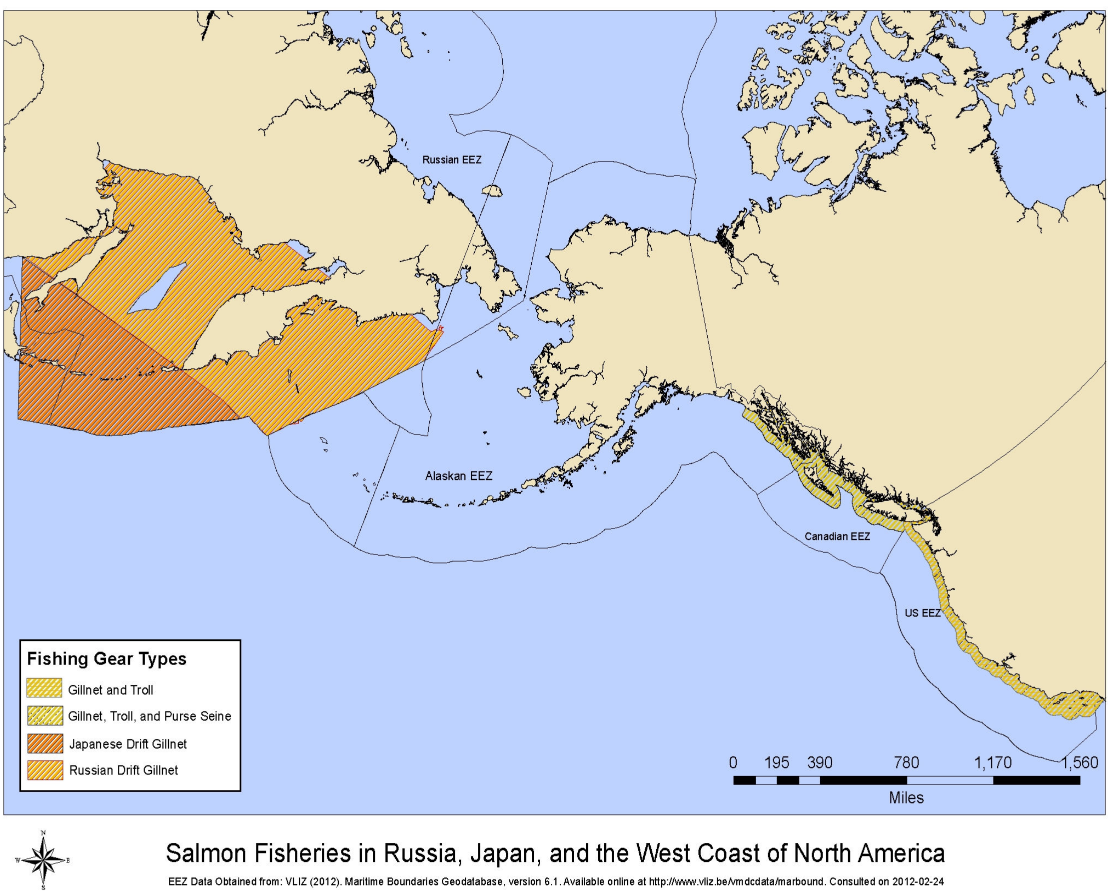
- Obtain observer information on seabird bycatch in all salmon fisheries. This will require regulation and training of observers in how to identify birds and what to watch for in the way of bycatch. Observers should cover at least 5% (and better, up to 20%) of fishing trips.
- Based on observer data, develop national and international regulations and incorporate seabird bycatch issues in Fishery Management Plans.
- Work on development of mitigation methods for reduction of seabird bycatch in gillnets. Once developed, these methods should be required of all fishers.

Overview

The Pacific salmon fishery consists of two, very different fisheries. In the eastern north Pacific (Alaska, the US west coast, and British Columbia), the fishing is all relatively close to shore, and most is carried out with seines and gillnets. In the western north Pacific, the fisheries carried out by Japan and Russia is almost entirely gillnets and usually carried out far from shore using high seas drift gillnets. Anecdotally, the US and Canadian fisheries have low seabird bycatch, whereas the Japanese and Russian fisheries have very significant levels of bycatch, with as many as 94,000 seabirds killed per year, mainly shearwaters and alcids. In both regions and all countries, a significant issue is the lack of actual data obtained from observers. Obtaining useful observer data from a reasonable proportion of vessels and sets is absolutely necessary. In addition, it is necessary to develop effective methods of mitigation to reduce seabird bycatch in gillnets, and to implement those methods to reduce seabird mortality.

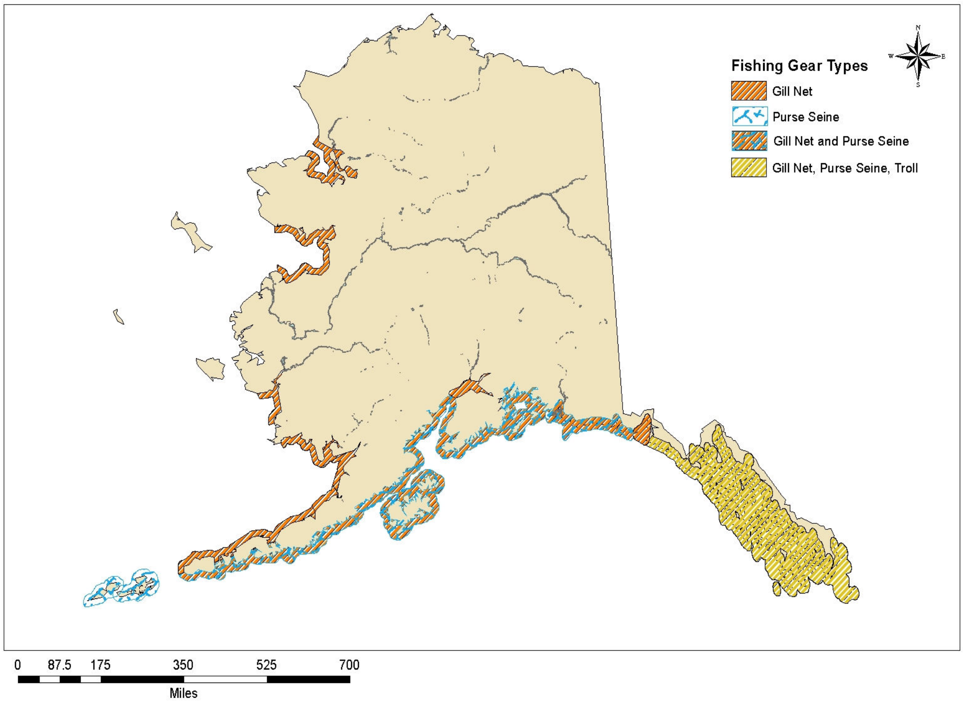
Tonnage and Sources

Pacific salmon come into the US market from landings from US waters, with the bulk from Alaska but also the west coast of the US. They are imported from Canadian waters off of British Columbia, and from the Russian EEZ caught by Russian and Japanese fishers (see maps below). Off the coast of North America, the fishing tends to be relatively close to shore. In the western north Pacific, high seas drift gillnets are used, and fishing occurs over a much larger area.



Salmon Fisheries in Russia, Japan, and the West Coast of North America

EEZ Data Obtained from: VLIZ (2012). Maritime Boundaries Geodatabase, version 6.1. Available online at http://www.vliz.be/vmdcdata/marbound. Consulted on 2012-02-24



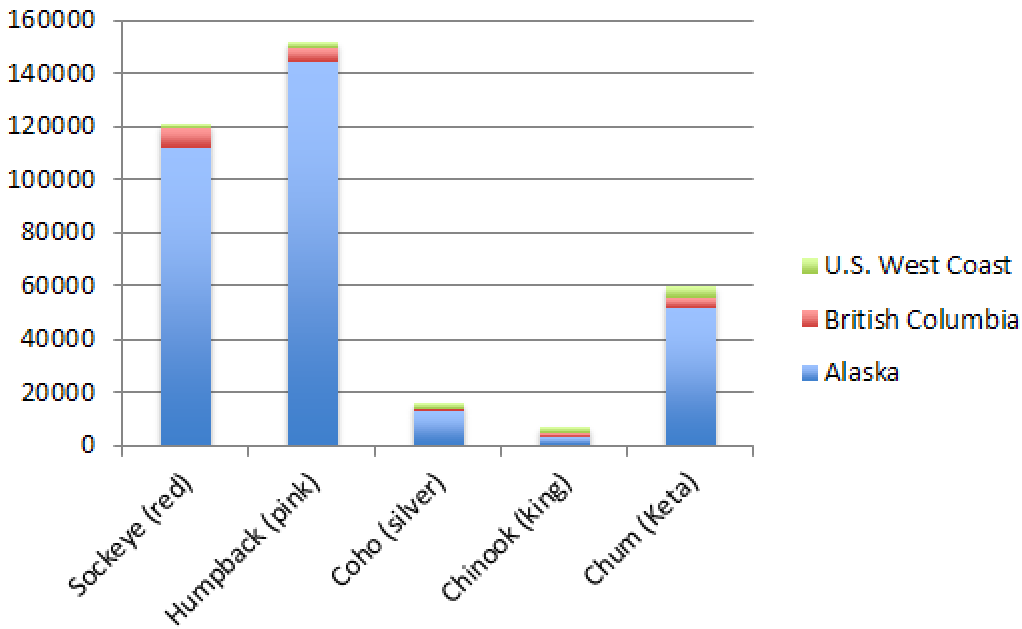
Each of the four areas/fisheries (US west coast, Canadian waters off of British Columbia, Japanese fishery and Russian fishery) will be discussed separately in each of the following sections.

US (Alaska and West Coast)
The five-year average tonnage landed in the US from Alaska and the West Coast of the US is 346,068 mt. The large majority of this is from Alaska, and primarily from two species, sockeye and humpback (or pink) salmon.

Tonnage of salmon caught in the gillnet, troll, and purse seine fisheries of Alaska and the US West Coast.

Fish	Region	Tonnage (mt)
Sockeye (red)	Alaska	111,884
	West Coast	1,439
Pink (humpback)	Alaska	143,984
	West Coast	1,725
Coho (silver)	Alaska	13,076
	West Coast	1,915
Chinook (king)	Alaska	3,150
	West Coast	2,671
Chum (Keta)	Alaska	51,190
	West Coast	4,696

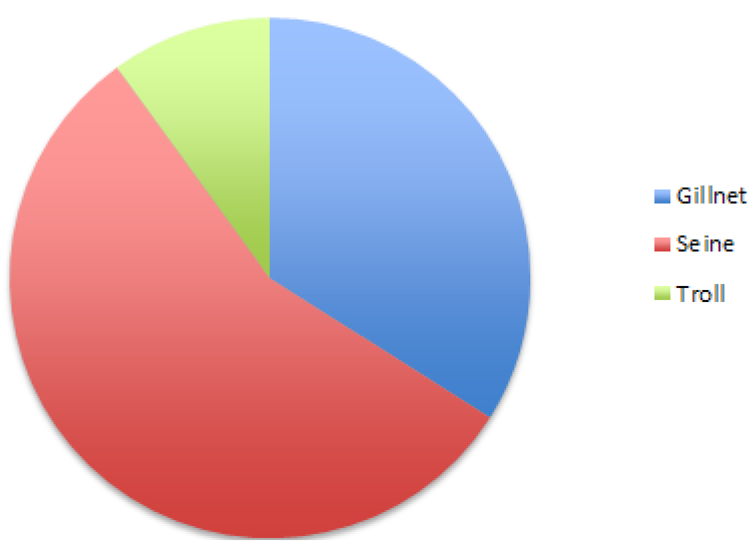
Including salmon imported to the US from Canadian waters off of British Columbia increases the totals only slightly.



Pacific Salmon 5-year average region landings by species in metric tons.

Canada

The tonnage of salmon landed in British Columbia and then imported into the US is not high, only about 18,000 mt. About two-thirds of the salmon caught in British Columbia waters is caught using seines and trolls, and about one-third is caught in gillnets (see figure below).



British Columbia salmon landings by gear type 2010.

Japan and Russia
The Japanese pursue a driftnet salmon fishery that falls mainly within the Russian EEZ. This fishery imports about 13,800 mt to the US annually. Russia also pursues its own driftnet salmon fishery within its own EEZ. This fishery imports to the US about 6,700 mt annually. The tonnage of each species imported to the US can be seen in the following table.

All imported wild-caught salmon imported to the US from the western Pacific primarily in the Russian EEZ.

Fish	Tonnage (mt)
Sockeye (red)	6,976
Pink (humpback)	5,540
Coho (silver)	621
Chinook (king)	1,302
Chum (Keta)	3,951

Products and Market
All types of salmon are available as fresh, frozen, or canned. Most of the salmon consumed in the US is either fresh or frozen and the predominant market form in retail stores and restaurants is fillets or steaks. About one fourth or less of the wild domestic salmon catch is canned, and most canned salmon is pink, chum, or sockeye. Some imported canned salmon is also available in US markets. Smoked salmon is also produced in the US and some is imported. Cold smoked salmon, marketed as "lox" or "nova lox," is a lightly salted, smoked and partially cooked ready-to-eat product that is sold in retail stores and restaurants as an appetizer or as an ingredient in other dishes. Hot smoked salmon is also lightly salted and fully cooked. Most smoked products are made from Atlantic, chinook, or coho salmon.

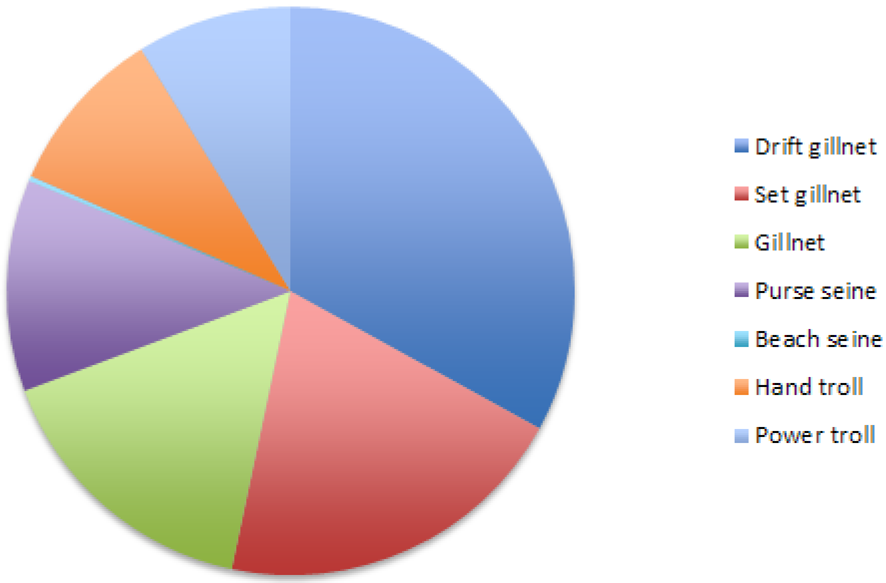
Gear, Set, and Mitigation
US (Alaska and West Coast)
Most US salmon is caught using gillnet, troll, and purse seine, although a small amount is caught in traps or fish wheels. In general, no mitigation methods are used to prevent seabird bycatch, although some mitigation methods exist. A study in 1997 in Puget Sound analyzed the effectiveness of several seabird bycatch reduction tools including visual barriers, switching away from monofilament nets, eliminating change-of-light sets and restricting fishing to daylight hours in years of high murre abundance.

Canada (British Columbia)
As in the US, Canadian fishers primarily use gillnets and seines. Mitigation methods are in development

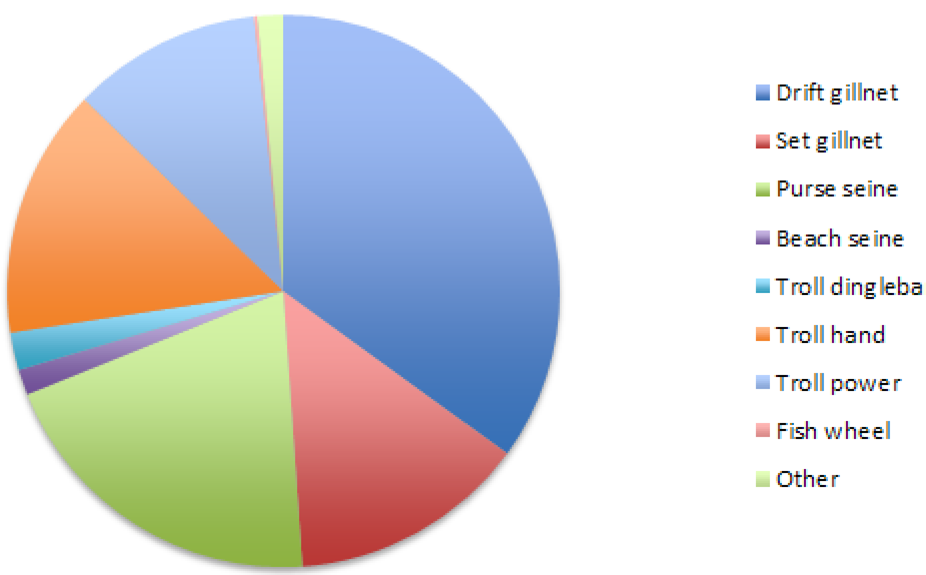
Japan
The Japanese fleet is capable of setting 78,000 km of high seas driftnets. They use no seabird mitigation methods.

Russia
The Russian fleet is composed of specialized mid-sized vessels developed for salmon driftnetting and capable of setting 20,300 km of high seas driftnets. As with the Japanese fleet, they use no seabird mitigation methods.

Fishing Vessels and Their Countries of Origin
The large majority of salmon fishing vessels are small. Alaska provides 10,912 salmon permits for a variety of gear types, although more than three-quarters of permits are for gillnets and seines (see figures below).



Permits by gear for salmon vessels Alaska 2010.



Allowable salmon gear for licensed vessels in Alaska 2010.

On the west coast of the US the number of vessels is much smaller, with only 112 salmon vessels in Washington, 370 in Oregon, and 215 in California.

In British Columbia, there are 1,500 salmon vessels.

Management

US (Alaska and West Coast)

Pacific salmon management encompasses many stocks originating from various rivers and jurisdictions. The Pacific Fishery Management Council (PFMC), in cooperation with the states and tribal fishery agencies, manages ocean fisheries for chinook and coho salmon under a framework fishery management plan (FMP). The most recent amendment to the plan, adopted in 2011, established annual catch limits and accountability measures for the fisheries. Within Puget Sound and the Columbia River, the states and tribes manage fisheries for these two species. The Pacific Salmon Commission (PSC), the State of Washington, and tribal fishery agencies primarily manage fisheries for pink, chum, and sockeye salmon. Fisheries are managed using a variety of regulations. Ocean fisheries are managed mainly through gear restrictions, minimum size limits, and time and area closures, although harvest quotas have been in place for individual fisheries in recent years.

Canada (British Columbia)

British Columbia has an integrated salmon management plan that provides for consideration of the role of wild salmon in the ecosystem, to First Nations, and internationally. Conservation and management measures are provided in an FMP and include objectives to rebuild specific stocks, allocate fishing among First Nations, commercial and recreational fisheries, and manage for escapement targets. In season management is based on stock assessments and run size and timing. Harvest is regulated through season length, timed openings, gear and area restrictions, quotas, non-retention of certain species and allocation limits.

Japan

Sources provide conflicting information on the origin of the agreement to allow Japan to use driftnets in the Russian EEZ. The "experimental" fishery is attributed to 1) financial compensation so the Russian Federation had resources to develop salmon farming; 2) a deal to dissuade the Japanese from high seas salmon fishing; or 3) sought as compensation when the Japanese were no longer able to fish for salmon in the US EEZ. Procedures are defined on an annual basis according to annual Protocols set by the Russian-Japanese Commission, which is not a transparent body. Decisions on allocation of these or the other fishing quotas are not subject to state impact assessment procedures. Some sources claim that allocation of areas for drift-net fishing is done in violation of Russian laws, or that illegal fishing occurs without any allocation agreement.

Russia

According to FAO, the Russian federal fishery law requires setting TACs for specific stocks and promulgation of local fishing rules. Pacific salmon, however are managed by regulation of fishing effort. Experimental fisheries may fall under the exception for "special fishery for scientific, educational and replenishment purposes" noted in the law. WWF Russia reports that the Federal Fisheries Agency of Russian Federations justifies growth in the Russian salmon fleet as "monitoring to compensate for Russian drift-net fisheries operation costs." Total catch by the Russian drift-net fishing fleet grows steadily from year to year, and already in 2003 exceeded the harvest by Japanese fleet. At the same time, attempts to increase drift-net fishing quotas continue, as well as the attempts to reallocate salmon fishing en mass to the ocean waters, according to WWF Russia.

Seabird Species and Mortality

US (Alaska and West Coast)

Capture of seabirds in salmon gillnets was reported as early as 1995 for fisheries in Puget Sound, throughout the Pacific Northwest and Alaska (Melvin 1995). Mortality of Marbled Murrelets, listed as threatened under the ESA, led to action to mitigate net entanglement. The Point Reyes Bird Observatory, in its California Current Marine Bird Conservation Plan, reports bird interactions with salmon gillnets in Puget Sound and Vancouver, and likely seabird bycatch in salmon drift gillnets in the lower Columbia River, Willapa Bay, and Grays Harbor, and in salmon troll fisheries of California, Oregon, and Washington. Seabird species documented by observations include Common Murre, Rhinoceros Auklet, Pigeon Guillemot, and Marbled Murrelet. Environmental analyses accompanying the Pacific salmon FMP state that "high mortality in gillnet fishing" is a contributing factor to population decline of Common Murres. In contrast, the National Bycatch Report states that for salmon fisheries of the west coast, "direct impacts on seabirds are also minimal to non-existent." Seabird bycatch is not reported for Alaska salmon fisheries in the report, either, though it has been documented by bird researchers since the 1990s.

Canada (British Columbia)

Seabird by-catch has been reported in all types of fisheries in British Columbia as well as in fisheries of neighboring Alaska and Washington State. However, the extent of entanglement in today's BC salmon gill net fishery, and its impact on local seabird populations, is not well documented.

Japan

Prior to the UN Moratorium on High Seas Driftnet Fishing, a land-based Japanese fleet targeted salmon using driftnets in the North Pacific east of the Sea of Japan. DeGange and Day (1991) reported that this fishery killed more than 160,000 birds annually.

During the monitoring of Japanese driftnet harvest of salmon in the Russian EEZ in 1993-2001, 183,646 dead marine birds were collected from the nets and 31 different species were identified. Shearwaters (*Puffinus* sp., predominantly Short-tailed Shearwaters) accounted for 32.1% of all the dead birds; 28.3% were murres (*Uria* sp., mainly Thick-billed Murres); 19.3% were Tufted Puffins; 11.4% were Crested Auklets; 5.7% were fulmars; and 1.2% were Horned Puffins, with remaining 2% being composed of various other species. The frequency of occurrence of marine bird bycatch in Japanese driftnets varied from 0 to 89.6 birds per 1 km of nets. On the whole, birds were killed more frequently near the Kuril Islands and in the Bering Sea than in the Sea of Okhotsk. Overall, during the period of intensive Japanese driftnet fishing for salmon in the

Russian EEZ in 1992-2008, over 1,600,000 marine birds died in the nets, which amounts to an average of 94,330 (CI 70,183-118,478) birds per year. Short-tailed Shearwaters suffered the highest death toll (32,500 per year on average), followed by Thick-billed Murres (23,300), Tufted Puffins (15,300), Crested Auklets (12,700), and fulmars (5,700).

Russia
Observations of the Russian driftnet salmon harvest in the Russian EEZ between 1996 and 2005 yielded a total count of 18,689 marine birds belonging to 20 species. As in the case of Japanese harvest, most of them were alcids and shearwaters. More than a third (34.8%) of all dead birds were shearwaters (*Puffinus* sp., predominantly Short-tailed Shearwaters). Tufted Puffins made up more than a quarter (28.7%), with murres (18.3%), Crested Auklets (6.9%), and fulmars (5.2%). The frequency of by-catch in the Russian driftnets varied from 0 to 20.2 individuals per 1 km of deployed nets (median = 2.250). Birds would perish more frequently in the Pacific waters off the northern Kuril Islands and southeastern Kamchatka than in the Bering and Okhotsk Seas. The total number of marine birds killed by the Russian driftnet salmon harvest in the Russian Federation EEZ between 1995 and 2008 was 645,000, averaging 46,099 (CI 39,254-52,944) birds per year. The highest annual death toll was suffered by the Short-tailed and Sooty shearwaters (16,000 total), Tufted Puffins (13,200), Thick-billed and Common murres (8,400 total), Crested Auklets (3,200), and fulmars (2,400).

Information

US (Alaska and West Coast)
The amount of information available on US salmon fisheries and their seabird bycatch is moderate. While the NOAA seabird program monitors the groundfish fisheries, there is minimal coverage on salmon fisheries through the marine mammal observer program (2-8%), and seabird bycatch was not reported in the National Bycatch Report. Improvements in seabird estimates are called for in the recommendations. Seabird bycatch was not estimated for Pacific coast salmon fisheries in reliance upon a 2000 supplemental EIS that declares no significant impact. However, the EIS claim is not supported with observer, logbook or other data, and goes only to the issue of "significant impact" on Endangered and Threatened species. The Section 7 consultation upon which the "no significant impact" finding was made was based on information that has not been updated since before 2000, and gave only consideration to the lack of competition for prey species, not entanglement in gear.

Canada (British Columbia)
Environment Canada began a study in 2011 to assess the impact of salmon gillnet fishing on local seabird populations. In addition to preparing a Best Management Practices document, the agency will estimate incidental take, link seabird mortality with specific fishing activities and provide bycatch estimates by effort.

Japan and Russia
We have no information from Japan or Russia beyond the already-cited sources.

Certification

Five of the Pacific salmon fisheries are certified as sustainable by the Marine Stewardship Council, four in the eastern Pacific and one in the western Pacific. They are:

- British Columbia Pink Salmon Seine, Troll and Gillnet Fishery
- British Columbia Sockeye Salmon Fishery
- Alaska Salmon Fishery
- Annette Islands Reserve Salmon Fishery (Alaska)
- Iturup Island Pink and Chum Salmon (Russia)

In an in-depth analysis of these fisheries, the two British Columbia fisheries were determined to be likely high risk to seabirds. The Alaska fishery was medium risk. The Annette Islands Reserve and Iturup Island fisheries were considered low risk. Both are very small. The Iturup Island fishery uses only stationary fish traps.

Conclusions

The Pacific salmon fisheries use high risk gillnets as one of their most common gear types. Although some anecdotal information suggests that few birds are caught and killed in the US and Canadian salmon fisheries, large numbers of birds are killed in the Japanese and Russian fisheries. However, there is little observer information on seabird bycatch in any of the fisheries.

Therefore, it is absolutely necessary to obtain observer information on seabird bycatch in all salmon fisheries. This will require regulation and training of observers in how to identify birds and what to watch for in terms of bycatch. Observers should cover 5% of fishing trips. Based on this observer data, it will be necessary to develop national and international regulations and incorporate seabird bycatch issues in Fishery Management Plans. Finally, it is also imperative to develop mitigation methods to reduce seabird bycatch in gillnets. Once developed, these methods should be required of all fishers.

Suzanne Iudicello, Natasha Atkins, Eugene C. Bricklemyer, Brad Gentner, David A. Wiedenfeld, and Ashley Johnson, 5 October 2012

Potentially High Risk to Seabirds

FIVE HAKE FISHERIES

West Coast Whiting Pelagic Trawl

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
Medium	High	Good	Poor	Good	Good	Low
2	3	19	1	32	19	1
5/6		71/100				1/3

Spanish Hake Longline Gran Sol (North-East Atlantic)

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	Medium	Poor	Poor	Poor	Poor	High
3	2	7	1	8	5	3
5/6		21/100				3/3

Namibian Hake Trawl

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
Medium	High	Fair	Fair	Poor	Fair	High
2	3	8	15	10	8	3
5/6		41/100				3/3

South African Hake Trawl

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
Medium	High	Fair	Good	Fair	Fair	High
2	3	14	18	18	14	3
5/6		64/100				3/3

Argentine Hake Trawl and Longline

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	High	Poor	Fair	Fair	Poor	High
3	3	7	9	13	7	3
6/6		36/100				3/3

Hake for the US market are caught and landed primarily from the west coast of the US, and imported from the Atlantic. The fish are caught primarily using trawls, which are moderate risk for seabirds, but a smaller but significant proportion are caught on longlines, which are high risk for seabirds. The US fishery is well-regulated, has good observer coverage, and has low seabird bycatch. The South African hake trawl is fairly well regulated, but it is not clear that enforcement has been adequate, although seabird bycatch and mortality is fairly low. The Spanish Gran Sol fishery, which has been identified previously as one of the worst as far as seabird mortality, and the Argentine hake trawl, are two fisheries with high seabird mortality and poor enforcement of what regulations exist. In both, mitigation methods that have been known to be effective are not used. Those two fisheries have significant seabird bycatch issues.

Recommendations

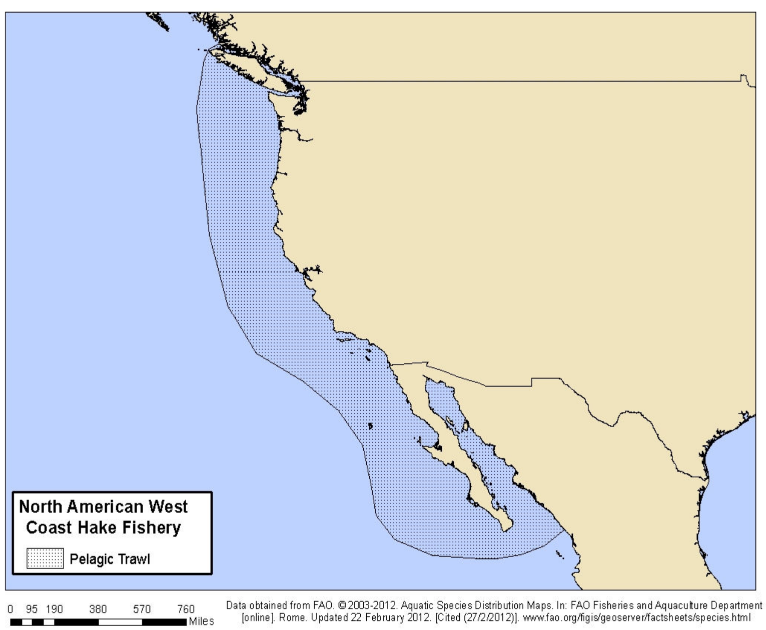
- Observer coverage needs to be increased from near zero in the Spanish Gran Sol, Namibia hake trawl, and Argentine hake trawl and longline fisheries to levels that are adequate to monitor levels of seabird mortality and bycatch.
- Better regulations are needed in all of the fisheries except the West Coast Whiting and to a lesser extent the South African hake trawl fishery.
- Use of mitigation methods must be an important part of the regulations.
- Strong and energetic enforcement of regulations is required, as the Spanish Gran Sol fishery, South Africa hake trawl, and especially the Argentine hake trawl and longline fisheries have reputations for avoiding or not meeting requirements.

Overview

There are five main hake fisheries bring seafood to the US, catching a variety of similar species of fish of the genera *Merluccius*, *Urophycis*, or *Melanogrammus*. Four of these fisheries bring in imported fish, but hake are also landed in the US from a fishery off the US west coast. The four fisheries bringing imported fish are all in the Atlantic. Hake fishing occurs almost entirely on the continental shelf, not in deep water.

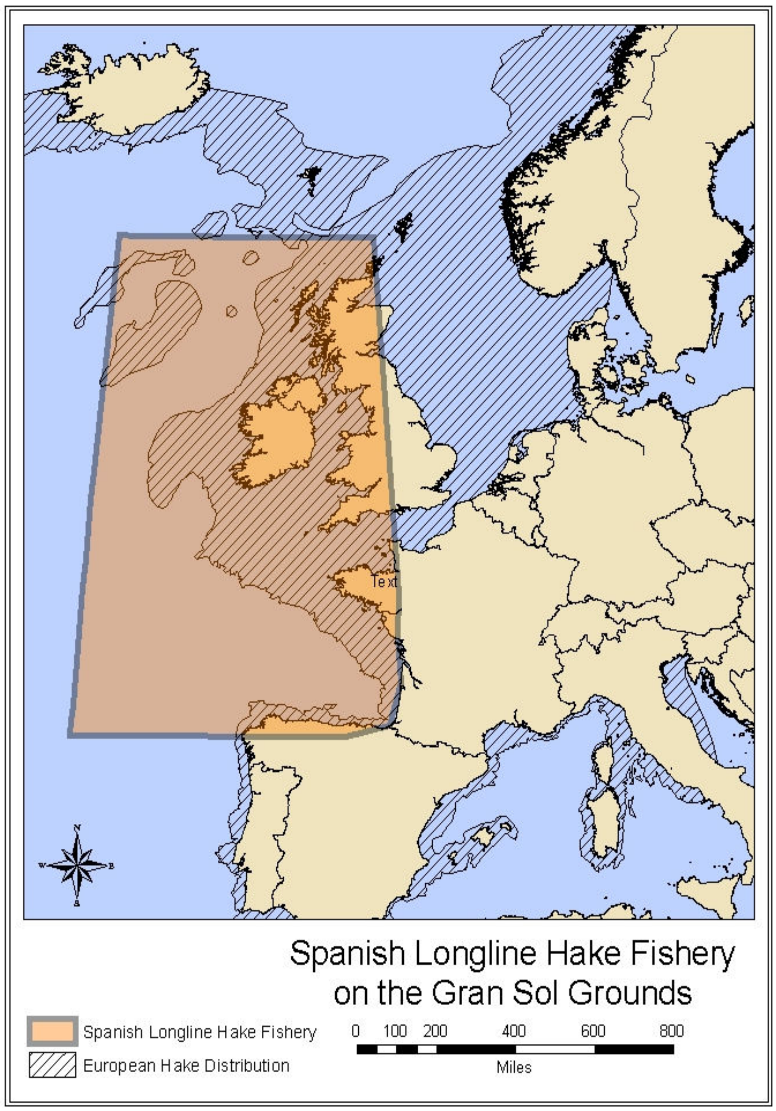
US-landed

The West Coast Whiting Pelagic Trawl occurs primarily in the US EEZ off of Washington, Oregon, and California, but also has some fishing that takes place in the Canadian EEZ off of Vancouver Island and some in the Mexican EEZ around the Baja California Peninsula (see map below).



Imported

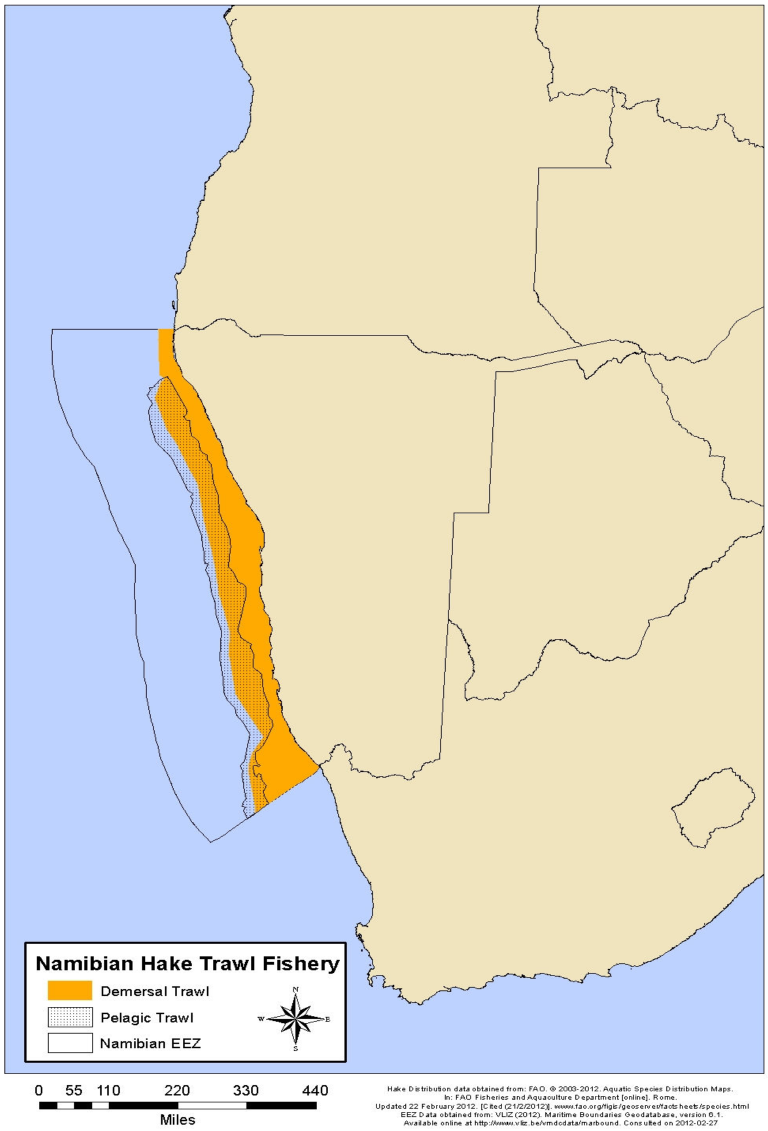
The Spanish Hake Longline Gran Sol (North-East Atlantic) fishery occurs primarily to the north of Spain and much of it around the British Isles (see map below).



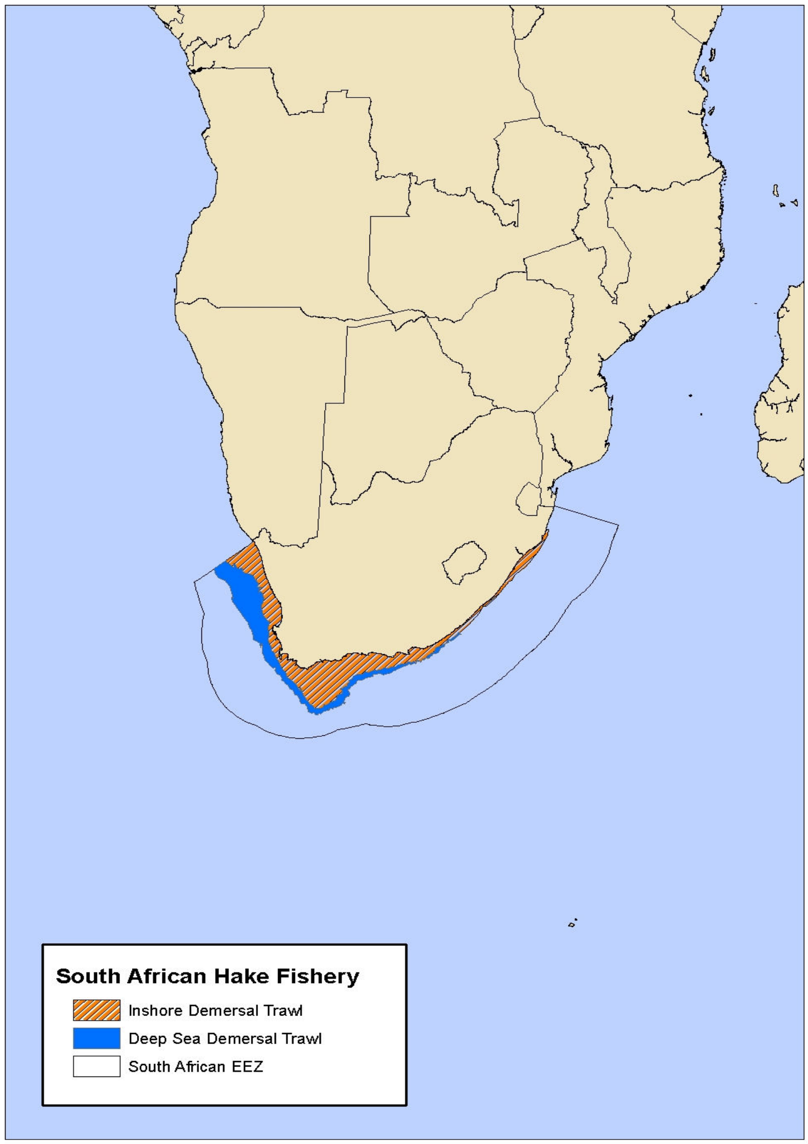
Hake Distribution data obtained from: FAO. © 2003-2012. Aquatic Species Distribution Maps.
In: FAO Fisheries and Aquaculture Department [online]. Rome.
Updated 22 February 2012. [Cited (21/2/2012)]. www.fao.org/figis/geoserver/factsheets/species.html

Namibian Hake Trawl

The Namibian Hake Trawl takes place entirely within the Namibian EEZ, and mostly fairly close inshore (see map below).

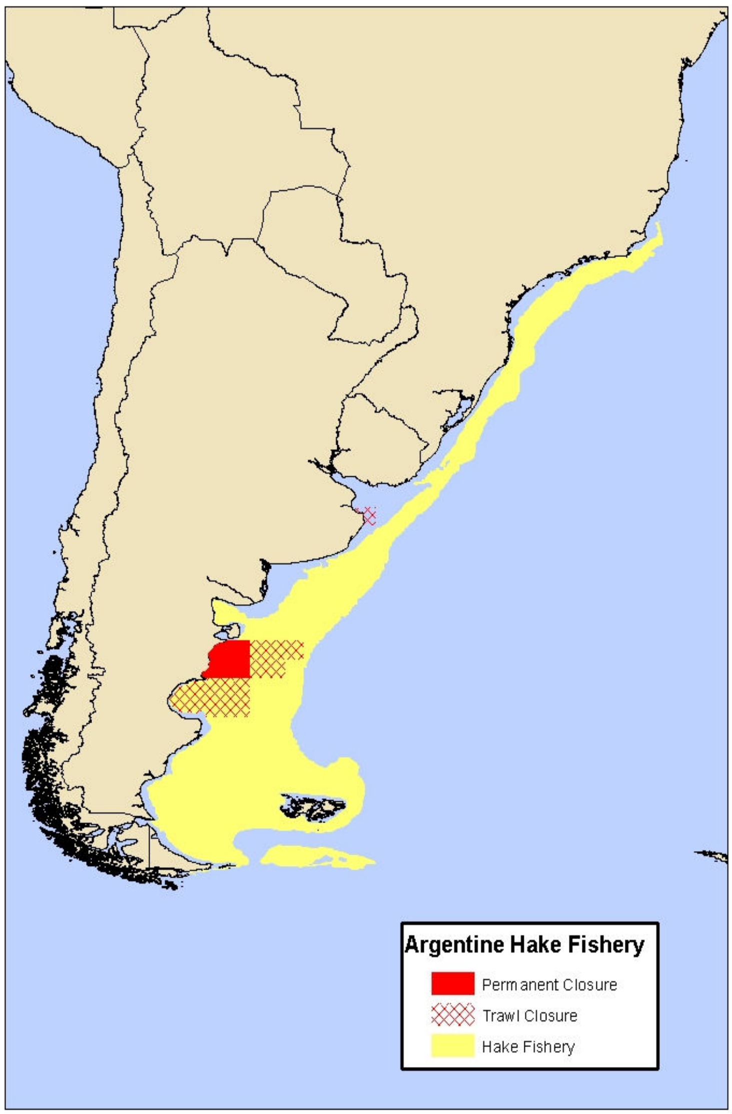


South African Hake Trawl
Like the Namibian Hake Trawl, the South African hake trawl takes place entirely within the South African EEZ and mostly close inshore (see map below).



Argentine Hake Trawl and Longline

The Argentine hake trawl and longline fishery is divided into two sections for management purposes, at 41° S. Fishing takes place from off the coasts of Brazil and Uruguay, but most fishing actually takes place further south, near the Falkland Islands (see map below).



Tonnage and Sources
The five fisheries have very different quantities of hake that are caught and brought to markets in the US.

Fishery	Tonnage (mt)
West Coast whiting pelagic trawl	205,739
Spanish hake longline Gran Sol (North-East Atlantic)	40,000 – 50,000
Namibian hake trawl	460,000
South African hake trawl	150,000
Argentine hake trawl and longline	250,000 – 400,000

Products and Market
West Coast Whiting Pelagic Trawl
The fish formally called the hake northern stock (Pacific or white hake), is sold under names such as whiting, Pacific whiting, California hake, or Pacific hake. Several other species are also marketed as whiting. Most commonly used in the production of surimi, the minced fish product used to make imitation crab and other products, although the market for whiting fillets is now growing. Pacific whiting fillets are marketed fresh and frozen.

Spanish Hake Longline Gran Sol (North-East Atlantic)
The Spanish hake is silver, red, or offshore hake. Silver hake is commonly referred to as "whiting," while red hake is sometimes referred to as "ling" or "squirrel" hake. Red, silver, and offshore hake are marketed fresh, dried/salted, smoked, and frozen. Some small fish are used for fishmeal. The majority of exports go to Europe.

Namibian Hake Trawl
Hake from this fishery are exported to Spain and elsewhere either fresh or frozen.

South African Hake Trawl
Hake from this fishery are sold whole, headed & gutted, as fillets, steaks, portions, minced, chilled, coated, frozen block, marinated, loins, pickled, ready meal, and smoked. The majority is exported to Europe.

Argentine Hake Trawl and Longline
Most Argentine hake is exported to Europe, frozen and fresh.

Gear, Set, and Mitigation
West Coast Whiting Pelagic Trawl
US hake fisheries on the west coast use midwater trawls. They use no mitigation methods to reduce seabird bycatch.

Spanish Hake Longline Gran Sol (North-East Atlantic)
The Spanish hake longline fishery uses longlines almost exclusively. BirdLife International reports reluctance to employ mitigation actions, even though called for in regulations.

Namibian Hake Trawl
The Namibian hake fishery uses both trawls and longlines. Tori lines are deployed behind hake trawlers, above and on either side of the trawl warps during trawling, to prevent albatrosses and petrels, attracted by fish offal in the water, from getting entangled in the warps and drowning.

South African Hake Trawl
This is a trawl fishery. Measures to reduce excessive seabird bycatch include: (1) the use of bird-scaring lines on all vessels; (2) restricting the setting of lines to times of least bird activity; (3) minimum use of deck lighting during setting; and (4) control of offal discharge.

Argentine Hake Trawl and Longline
The Argentine hake fishery uses both trawl and longline. In the trawl fishery, a warp cable modification reduced by 89% the interaction and mortality of seabirds (Gonzaléz Zevallos et al. 2007).

Fishing Vessels and Their Countries of Origin

Fishery	Vessels
West Coast Whiting Pelagic Trawl	8 to 14 catcher-processor vessels and motherships
Spanish Hake Longline Gran Sol (North-East Atlantic)	35 vessels, 16 operating at one time; setting 55,860,119 hooks/yr
Namibian Hake Trawl	22 demersal freezer trawlers; 90 wetfish trawl vessels; 30 longline vessels setting approximately 120 million hooks/yr
South African Hake Trawl	61 deep sea and 29 inshore vessels 20 - 90 m in length
Argentine Hake Trawl and Longline	700+/- Vessels vary among inshore/offshore fleet. Some artisanal, others with freezer capacity; 20 m up to 70 m long factory vessels

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Management
West Coast Whiting Pelagic Trawl
The fishery is managed through the use of TACs, a cooperative quota program, closed seasons, gear rules, and full-catch accounting. The allocation between US and Canada is managed by Pacific Fishery Management Council (PFMC); the PFMC, state, local and tribal management agencies manage local fisheries.

Spanish Hake Longline Gran Sol (North-East Atlantic)
The Spanish Gran Sol fishery is managed through TAC levels. The fishery has a recovery plan.

Namibian Hake Trawl
The Namibian Hake Trawl fishery is mainly operated as a joint venture with Spain, giving Spanish vessel access to the Namibian EEZ. It is managed through TAC levels, individual quotas, gear regulations, and area restrictions. Namibia has a National Plan of Action-Seabirds.

South African Hake Trawl
The South African Hake Trawl is currently undertaking a rebuilding program. The fishery is regulated using TAC levels, habitat protection areas, and bycatch monitoring.

Argentine Hake Trawl and Longline
The northern part of the Argentine hake fishery is under emergency closure. It has operated with TAC limits and individual quotas. The southern part of the fishery is under a Fishery Improvement Plan, which requires achieving improvements in compliance. It also operates under TAC limits, but has still been exceeding the TAC. The fishery also has significant problems with IUU fishing.

Seabird Species and Mortality
West Coast Whiting Pelagic Trawl
The west coast hake trawl operates with high levels of observer coverage, which has indicated that there is generally low levels of actual seabird bycatch. However, it is not clear if the numbers reported include estimates of seabird interactions with trawl warps, or only of seabirds in the haul. The list of seabirds can be seen in the following table.

Year	Species	Management Area	Total Bycatch Estimate	Number Observed[a]
2003	Black Footed Albatross	Columbia	3.0	1
		Total	3.0	1
2004	Black Footed Albatross	Total		0
	Auklet/Murrelet Unid	Columbia	3.0	1
		Total	3.0	1
	Common Murre	Vancouver	3.0	1
		Total	3.0	1
	Northern Fulmar	Vancouver	18.0	5
		Columbia	3.0	1
		Total	21.0	6
	Shearwater Unid	Vancouver	2.0	1
		Columbia	6.0	2
		Total	8.0	3
2005	Black Footed Albatross	Columbia	2.0	1
		Total	2.0	1
	Common Murre	Columbia	2.0	1
		Total	2.0	1
	Northern Fulmar	Columbia	2.0	1
		Total	2.0	1
	Sea Birds Unid	Columbia	2.0	1
		Total	2.0	1
	Sooty Shearwater	Eureka	2.0	1
		Total	2.0	1
2006	Black Footed Albatross	Columbia	2.0	1
		Total	2.0	1

[a]This is the actual number of takes observed and recorded in the data.

Bycatch estimates of seabird takes in the at-sea hake fishery 2002-2006. Source: NWFSC 2008.

Spanish Hake Longline Gran Sol (North-East Atlantic)
This fishery is estimated to have among the highest average annual mortality of seabirds in any fishery in the world based on data collected in 2006 to 2007. Data reviewed by Anderson indicate that Northern Fulmar, Great Shearwater and White-chinned Petrel are among those caught in the highest numbers. BirdLife International (2009) collated data on bycatch in the Gran Sol fishery from A. Barros, who conducted the majority of surveys. A bycatch rate of 1.008 birds per 1,000 hooks was reported, with total estimated mortality of ca. 56,307 birds per year. The majority of birds caught in this fishery are Great Shearwaters, a species not currently believed to have a declining global population (though few relevant data exist). Nevertheless, the sheer scale of the numbers caught is cause for concern. The number of seabird mortalities can be seen in the following table.

Species	Scientific name	Birds /1000 hooks	Estimated bycatch/year
Northern fulmar	*Fulmarus glacialis*	0.277	9493
Great shearwater	*Puffinus gravis*	0.546	39908
Sooty shearwater	*Puffinus griseus*	0.034	1303
Northern gannet	*Morus bassanus*	0.038	1331
Great black-backed gull	*Larus marinus*	0.004	158
Black-legged kittiwake	*Rissa tridactyla*	0.109	4114
TOTAL		**1.008**	**56307**

Seabird bycatch rates in the Gran Sol fishery, 2006-2007. Source: BirdLife International

Namibian Hake Trawl
In the longline component of the fishery, according to Anderson (2011), White-chinned Petrels were the dominant species caught (95%), followed by Atlantic Yellow-nosed Albatross (3%) and Cape Gannet (2%). The total bycatch rate obtained (from 66 birds caught) was 0.145 birds per 1,000 hooks. Petersen (2008) estimated total seabird bycatch for the fishery in 2006 to be 20,200 birds per year. Anderson extrapolated total petrel bycatch of ca. 19,190 birds and albatross bycatch of ca. 606 birds per year. However, bycatch estimates are highly variable for the fleet, and Petersen et al. (2007) provided a total estimate of 30,650 birds per year. Anderson includes that figure as an upper range on the estimated total bycatch for this fishery.

South African Hake Trawl
Seabird by-catch (identified for the first time during the certification process) has fallen from 18,000 birds per year to 200 birds per year following the introduction of mitigation measures (MSC 2004). However, there remains concern about the fishery. During the first certification period, the fishery implemented mitigation methods that reduce its impact on seabirds (use of bird-scaring lines and offal management, development of observer program). However, it is still

not clear if the mitigation methods are as effective as they were originally supposed to be. The fishery was re-certified despite concern that the observer program is not meeting its targets for coverage and quality of information, and that the mitigation methods might be less effective than supposed. The problem the fishery has, therefore, is a lack of information on seabirds.

Argentine Hake Trawl and Longline

The hake trawl fishery interacts with Kelp Gull, Black-browed Albatross, White-chinned Petrel, Great Shearwater, Imperial Cormorant, and Magellanic Penguin (González-Zevallos & Yorio 2006). A study of interactions between birds and hake trawlers off central Patagonia found that Black-browed Albatrosses, White-chinned Petrels, Southern Giant-Petrels, and Southern Royal Albatrosses were the most abundant species interacting with trawlers. Confirmed mortalities of Black-browed and Southern Royal Albatrosses were the result of collisions and entanglement with the warp cable while birds were scavenging. The estimated total mortality rate was 0.017 birds per hour and 0.105 birds per vessel per day (Favero 2010). Sullivan et al. (2006) estimate that >1,500 seabirds, predominantly Black-browed Albatross, were killed by finfish trawlers in the Falklands 2002-2003. Significant levels of mortality were recorded on the Patagonian Shelf, north of the islands, as shown in the following table.

Species	Frequency of occurrence	Mean
Kelp gull *Larus dominicanus*[a]	98.9	207.0 (0–1600)
Black-browed albatross *Thalassarche melanophrys*	98.9	94.2 (0–600)
White-chinned petrel *Procellaria aequinoctialis*	91.0	8.4 (0–100)
Great shearwater *Puffinus gravis*	88.8	38.2 (0–800)
Southern giant petrel *Macronectes giganteus*[a]	83.1	1.6 (0–15)
Imperial cormorant *Phalacrocorax atriceps*[a]	77.5	19.1 (0–200)
Sooty shearwater *Puffinus griseus*	50.6	2.7 (0–100)
Magellanic penguin *Spheniscus magellanicus*[a]	49.4	8.2 (0–200)
Antarctic skua *Catharacta antarctica*[a]	47.2	0.4 (0–8)
South American tern *Sterna hirundinacea*[a]	39.3	1.7 (0–40)
Wilson's storm-petrel *Oceanites oceanicus*	18.0	0.6 (0–12)
Cayenne tern *Sterna eurygnatha*[a]	13.5	1.1 (0–45)
Royal albatross *Diomedea epomophora*	9.0	0.04 (0–1)
Sheathbill *Chionis alba*	2.2	0.01 (0–1)
Mean number of species per haul		5.9 (0–10)
Mean number of birds per haul		383.3 (0–2012)

[a]Species that breed in Patagonia; n = 89 hauls

Frequency of occurrence and mean numbers per haul of seabirds in the Argentine Hake fishery, Golfo San Jorge. Source: González-Zevallos

Information

West Coast Whiting Pelagic Trawl

For this fishery there is an observer program that records information specifically for seabird interaction, and seabird observers are on all vessels. To estimate the total seabird bycatch in the at-sea hake fishery, all of the sampled tows were used as the seabirds were mixed in with the fish catch. Once the bycatch of seabirds is calculated for the sampled tows, the estimate is estimated for the entire fleet. Approximately 99% of the tows in the fishery were sampled. This method for calculating seabird bycatch is the same as the method for calculating fish bycatch in the at-sea hake fishery.

Spanish Hake Longline Gran Sol (North-East Atlantic)

The total fishing effort was extrapolated from 238,025 hooks observed, which equates to ca. 0.4% of the fishery observed. Total seabird mortality was estimated based on bycatch rates when full deck lighting was in use (as is the current norm in this fishery). On days when the observer asked for deck lighting to be switched off as an experiment, bycatch was virtually eliminated (BirdLife International 2009). Further study is required to verify that the bycatch rate is routinely of this magnitude. Given the low levels of observer coverage in this fleet, Anderson (2011) assigned it a data reliability score of 'Poor.' For this fishery it is necessary to educate fishermen, run trial mitigation measures, use night setting, improve observer coverage, and carry out a compliance assessment by EU Fisheries Commission

Namibian Hake Trawl

The Namibian hake trawl has some onboard observers. There is also catch and compliance monitoring. Large vessels are also required to have Vessel Monitoring System (VMS).

South African Hake Trawl

A Scientific Observer Program monitors 15-20% of all trips, although the observers are not well-trained. In the second Marine Stewardship Council certification period, the fishery still lacks quantitative information on seabird mortality. The fishery has not been meeting its observer coverage goals (although those goals are higher than would be expected of most fisheries), and the resulting lack of information gives rise to considerable uncertainty. The information is required to ensure that the mitigation methods are adequate (that the bird-scaring lines are effective, that the appropriate offal mitigation method is effective) and that use of those methods is enforced. This will likely require increased observer coverage and especially improved observer training.

Argentine Hake Trawl and Longline

Monitoring and compliance regimes are weak. Rarely are independent observers placed on board, and "reports indicate many on-board inspectors are frequently bribed to 'look away from the net.'" (FishSource 2012). Most bycatch information is obtained through self-reporting.

Certification

There are three hake fisheries certified by the Marine Stewardship Council:

- South Africa Hake Trawl Fishery
- Pacific Hake (*Merluccius productus*) Mid-Water Trawl Fishery
- Grupo Regal Spain Hake Longline Fishery

In an in-depth review of these fisheries (ABC 2012), the first two of these were considered to be of potentially medium risk to seabirds, while the last was considered to be of low risk.

The Pacific Hake fishery was only considered to be of medium risk because the fishers do not use mitigation methods. However, their actual bycatch is low.

The Grupo Regal Spain Hake Longline Fishery was considered to be low risk to seabirds, but this is problematic. The Grupo Regal fishery includes only four boats, which are indeed using the best techniques and themselves have very low risk to seabirds. However, they are part of the larger Spain Gran Sol fishery, which in general does have very high risk to seabirds, low compliance with regulations, and poor observer coverage. Therefore, although the four Grupo Regal boats can be considered low risk, the Spanish hake fishery is among the highest risk to seabirds.

Conclusions

The US fishery is well-regulated, has good observer coverage, and has low seabird bycatch. The South African hake trawl is fairly well regulated, but it has not been clear that enforcement has been adequate, although seabird bycatch and mortality is fairly low.

The remaining three fisheries in this analysis, the Spanish Gran Sol fishery, which has been identified previously as one of the worst for seabird mortality, Namibian hake trawl, and the Argentine hake trawl and longline are fisheries with high seabird mortality and poor enforcement of what regulations exist. Mitigation methods that have been known to be effective are not used. To rectify these problems, observer coverage needs to be significantly improved in these fisheries, regulations needs to be improved, including required use of effective mitigation methods that are already available. Most importantly, strong and energetic enforcement of regulations is required, to ensure that these fisheries reduce their high seabird bycatch and mortality, which is a significant problem.

Suzanne Iudicello, Natasha Atkins, Eugene C. Bricklemyer, Brad Gentner, David A. Wiedenfeld, and Ashley Johnson, 26 October 2012

Potentially Medium Risk to Seabirds

FIVE ATLANTIC AND PACIFIC SWORDFISH FISHERIES

Atlantic Longline Swordfish Fisheries Managed by US

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	Medium	Good	Poor	Good	Fair	Medium
3	2	18	1	30	12	2
5/6		61/100				2/3

West Coast Swordfish Gillnet and Harpoon Fisheries

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	Medium	Good	Poor	Good	Fair	Medium
3	2	18	1	25	10	2
5/6		54/100				2/3

Hawaii Swordfish Pelagic Shallow Set Longline Fishery

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	Medium	Good	Good	Good	Good	Low
3	2	18	22	30	20	1
5/6		90/100				1/3

Atlantic Longline and Driftnet Swordfish Fisheries Managed by ICCAT

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	Medium	Fair	Poor	Fair	Poor	High
3	2	8	5	16	5	3
5/6		34/100				3/3

Pacific Longline and Driftnet Fisheries Managed by IATTC and the WCPFC

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	Medium	Fair	Poor	Fair	Fair	High
3	2	8	5	16	8	3
5/6		37/100				3/3

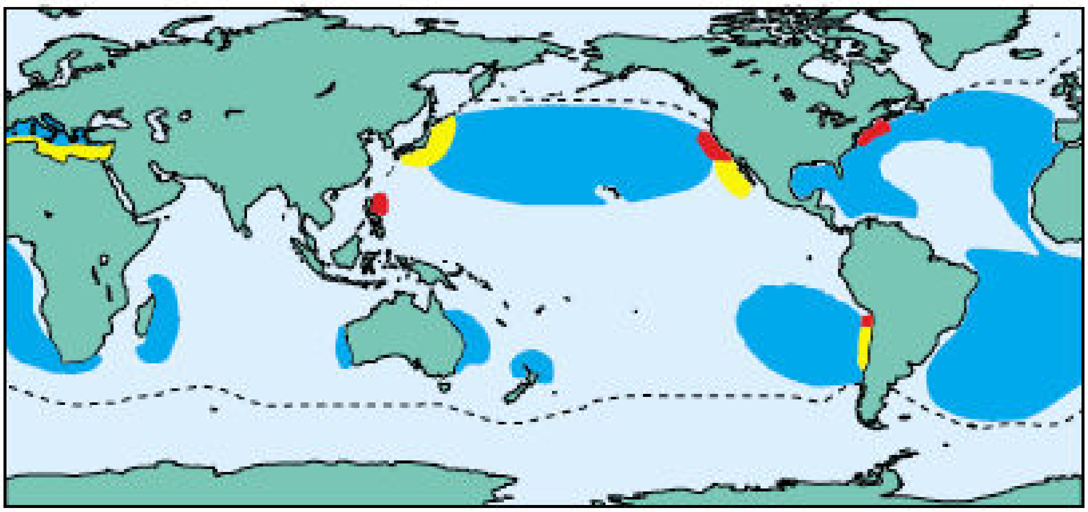
Most swordfish are caught using pelagic longlines, a gear type that is of high risk to seabirds. Only in the Hawaiian fishing area are mitigation methods required. However, observer coverage of the US-managed longline fisheries is reasonably high, and the data show that relatively few seabirds are caught and killed. This appears to be largely a result of where swordfish fishing is carried out, which tends to be in areas with relatively few seabirds. Observation of the fisheries not managed by the US is poorer although improving, and they have fewer requirements for use of mitigation methods. Regulation of the fisheries is generally well-done, especially in the US-managed fisheries, but the non-US fisheries regulated by the RFMOs are less-well controlled and monitored. The RFMOs do not have robust seabird bycatch mitigation requirements.

Recommendations

- Improve use of mitigation methods for longline fisheries. Effective mitigation methods exist, but fishermen are often not required to use them.
- Improve requirements and regulations in the fisheries managed by the RFMOs with regard to use of seabird bycatch mitigation methods.

Overview

Swordfish, like tuna, are fished all over the world (see figure below), primarily using longlines, but also a variety of other gears, including hand lines and harpoons.



Worldwide swordfish fisheries. Blue indicates areas with use of swordfish-targeted longlines; red areas are swordfish harpoon fisheries, and yellow marks areas of driftnet use. The dotted line denotes the limit of distribution. Source: Pelagic Fisheries Research Program Newsletter, October - December 2000

Swordfish in the US markets comes primarily from five fisheries, three managed by the US and two bringing in imported fish and managed by Regional Fishery Management Organizations (RFMOs). These are:

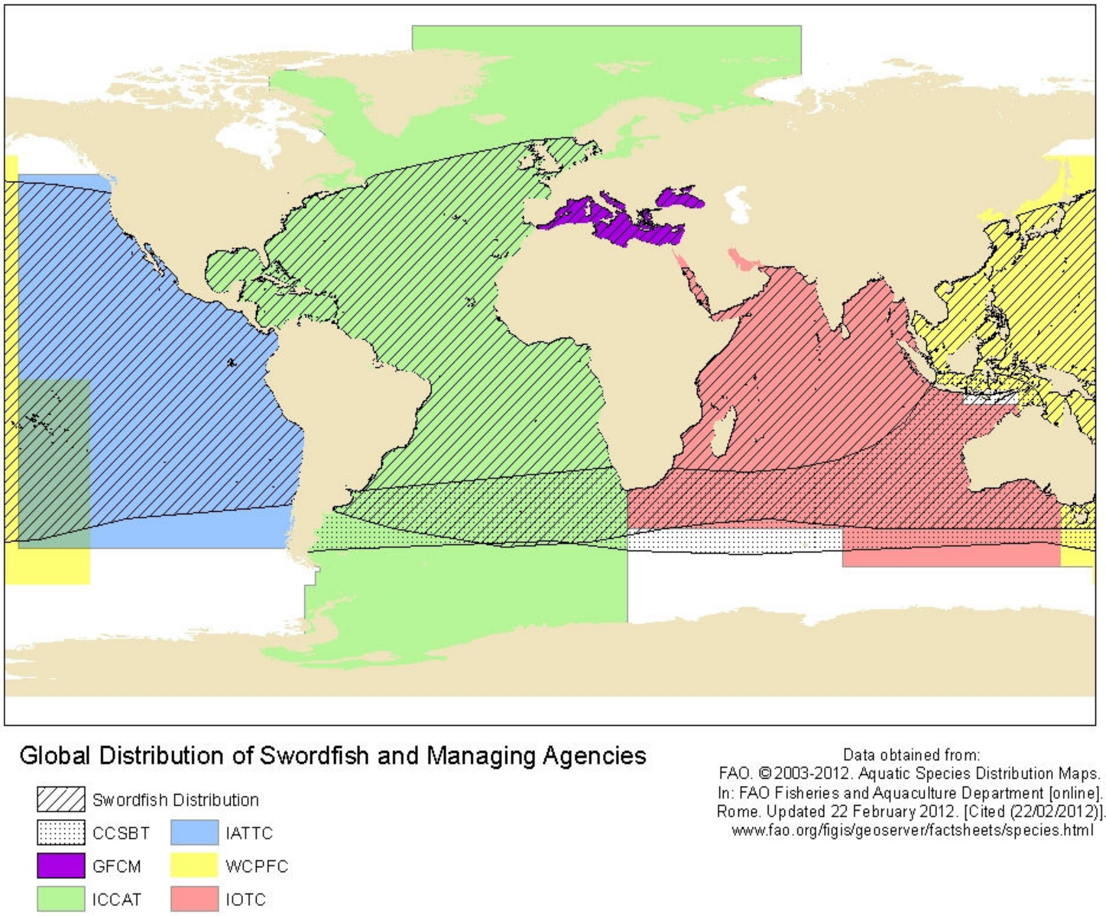
US-managed

- Atlantic longline swordfish fisheries managed by US
- West Coast swordfish gillnet and harpoon fisheries
- Hawaii swordfish pelagic shallow set longline fishery

Imported

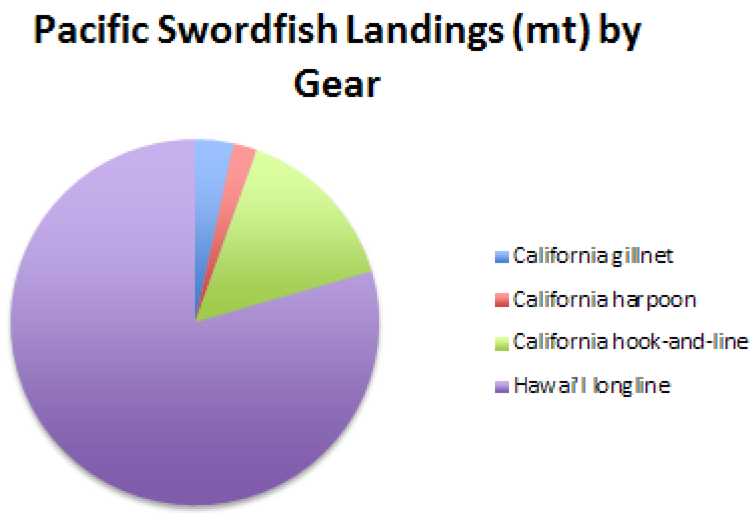
- Atlantic longline and driftnet swordfish fisheries managed by ICCAT (International Commission for the Conservation of Atlantic Tunas)
- Pacific longline and driftnet fisheries managed by IATTC (Inter-American Tropical Tuna Commission) and the WCPFC (Western and Central Pacific Fisheries Commission).

The distribution of swordfish and of the RFMOs that regulate them can be seen in the map below.



Tonnage and Sources

The US-managed Atlantic longline swordfish fisheries land about 2,401 mt per year. In the Pacific, the west coast swordfish gillnet and harpoon fisheries land about 479 mt and the Hawaii swordfish pelagic shallow set longline fishery lands about 1,430 mt.



Source: Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division, Silver Spring, MD

Products and Market

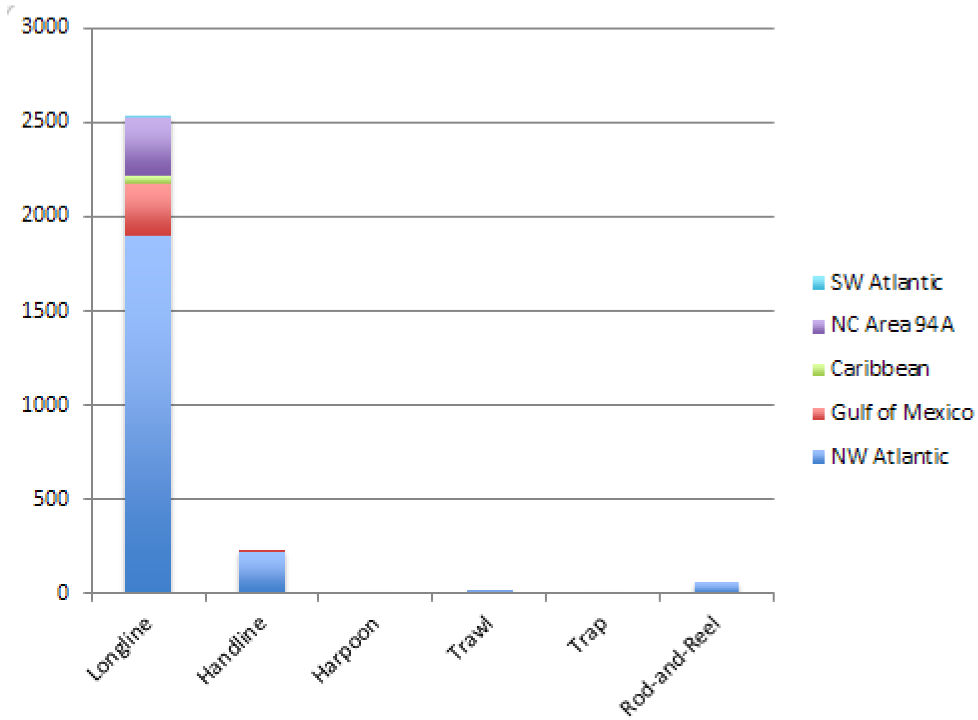
North Atlantic swordfish is also known as broadbilled swordfish, broadbill, espada, and emperado. More than 90% of the swordfish landed in Atlantic Canada is exported to the United States. All products are shipped to fresh markets in headed and gutted (H&G) form. Fresh, whole swordfish that have been headed and gutted are known as "bullets." Swordfish is available as fresh or frozen steaks, fillets, and loins. Frozen sashimi-quality fish are known as "clipper" swordfish (Pacific Seafood Group 2001).

Gear, Set, and Mitigation

Atlantic Longline Swordfish Fisheries Managed by US

These fisheries primarily use pelagic longline gear, which presents high risk to seabirds. The average hooks per set in 2010 was 759 hooks.

The fisheries also use low risk gears such as rod-and-reel, harpoon, handline, bandit, and handgear buoy, but the large majority of fish are caught on longlines (see figure below). There is also a significant regional difference; the large majority of swordfish in these fisheries are caught in the northwest Atlantic (see also figure below). No mitigation to reduce seabird bycatch is used in any of the fisheries.



Landings by gear type in mt. Source: 2011 Annual Report of the United States to ICCAT.

West Coast Swordfish Gillnet and Harpoon Fisheries
The primary gear type used in the eastern Pacific is drift gillnet, but harpoons are also used. Gillnets present high risk to seabirds. Pelagic longlines are used only outside the US EEZ. No mitigation to reduce seabird bycatch is used.

Hawaii Swordfish Pelagic Shallow Set Longline Fishery
In the shallow set longline fishery, seabird interactions have been reduced with gear innovations and fishing practice modifications. Effective strategies include the use of mackerel bait instead of squid bait, the use of circle hooks, night setting, and side-setting (deploying baited longline gear from the side of the boat rather than the stern, which allows the baited hooks to sink faster, resulting in fewer interactions).

Atlantic Longline and Driftnet Swordfish Fisheries Managed by ICCAT
Following ICCAT rules for tuna, longline fishers are required to use two mitigation methods to reduce seabird bycatch south of 25° S latitude. However, there is little swordfish fishing in that area.

Fishing Vessels and Their Countries of Origin
Atlantic Longline Swordfish Fisheries Managed by US
The Atlantic swordfish fisheries have 323 swordfish permits with 427 vessels longer than 20 m LOA.

West Coast Swordfish Gillnet and Harpoon Fisheries
There are 78 permits for swordfish in west coast swordfish fisheries.

Hawaii Swordfish Pelagic Shallow Set Longline Fishery
There are 164 swordfish permit holders, using vessels 50 to 100 ft LOA.

Management

Atlantic Longline Swordfish Fisheries Managed by US
Swordfish are managed under the Fisheries Management Plan (FMP) for Atlantic Highly Migratory Species (HMS). The US manages swordfish inside its EEZ, in cooperation with the states, and in accordance with ICCAT measures. Fishing for swordfish with pelagic longline gear is permitted under a limited access program for directed swordfishing. In 2010 there were 178 directed and 67 incidental permits for swordfish longlining. Management measures include a quota for the North Atlantic; a TAC of 13,700 mt in 2010; restrictions on minimum size of fish retained; vessel monitoring systems (VMS) required on all vessels; requiring a declaration of target species based on gear; a statistical documentation program; reporting and logbook requirements; gear and bait restrictions; and discrete time and area closures in the US EEZ to reduce bycatch of marine turtles and to comport with marine protected areas created by fishery management councils in the Gulf and South Atlantic. US flagged vessels, including the distant water fleet in the northwest Atlantic, take 23% of the North Atlantic swordfish catch allowed by ICCAT. No US flag vessels fish in the South Atlantic. Commercial HMS fisheries are monitored through a combination of vessel logbooks, dealer reports, port sampling, cooperative agreements with states, scientific observer coverage, and vessel monitoring systems. Logbooks are required to contain information on fishing vessel activity, including dates of trips, number of sets, area fished, number of fish, and other marine species caught, released, and retained. In 2010 the US swordfish fleet was subject to 8% random observer coverage.

West Coast Swordfish Gillnet and Harpoon Fisheries
The Pacific Fishery Management Council manages Pacific swordfish under the FMP for West Coast Fisheries for Highly Migratory Species. The FMP was adopted in 2004 to coordinate state, federal, and international management of a number of billfish, tuna, and shark stocks. State and federal permits are required for harpoon and drift gillnet gears in California. In 2010 there were a total of 1,970 permits for HMS on the west coast. Allowed gear in the federal fishery includes harpoon, surface hook-and-line, drift gillnet (West Coast EEZ only), purse seine, and pelagic longline (high seas only). Longline fishing is prohibited in the West Coast EEZ, and shallow-set longline fishing on the high seas is allowed only with a Hawaii longline limited-entry permit. A time and area closure was adopted to protect marine turtles. The FMP contains annual catch limits and accountability measures. All commercial fishing operations conducted with FMP approved gear, including HMS recreational charter vessels, are required to maintain logbooks. All US fishing vessels operating in HMS fisheries (including catcher/processors, at-sea processors, and vessels that embark from a port in Washington, Oregon, or California and land catch in another area), may be required to carry a NMFS-certified observer on board to collect scientific data when directed to do so by the NMFS Regional Administrator. Observer coverage in 2010 was 12% on drift gillnet trips and 100% on pelagic tuna longline sets.

Hawaii Swordfish Pelagic Shallow Set Longline Fishery
The Hawaii longline fishery is the largest US producer of swordfish. The Western Pacific Regional Fishery Management Council regulates swordfish in the EEZ of the Pacific Islands and high seas through the FMP for Pelagic Fisheries of the Western Pacific Region. The plan requires permits for longline swordfish and limits permits; places annual catch limits and accountability measures; requires VMS on all vessels; and requires onboard observers. The fishery was closed from 2001 to 2004 because of sea turtle bycatch, and now operates using gear modifications and changes in operating procedures to avoid sea turtle takes, including use of circle hooks, squid bait, and turtle release protocols. The FMP calls for additional gear restrictions to minimize seabird interactions. A complete list of rules is available from the NOAA Pacific Islands Regional Office website at www.fpir.noaa.gov/SFD/SFD_regs_2.html.

Pacific Longline and Driftnet Fisheries Managed by IATTC and WCPFC
Both the West Coast and Hawaii FMPs and associated fisheries are affected by the conservation and management measures adopted by the RFMOs, in particular, those adopted by the IATTC and the WCPFC. The US cooperates with IATTC and WCPFC on HMS management, including measures that limit on number vessels fishing for swordfish south of 20° S latitude, and a limit on the amount of swordfish per contracting party. The IATTC and WCPFC also require measures to reduce seabird interactions.

Seabird Species and Mortality
Atlantic Longline Swordfish Fisheries Managed by US
Gannets, gulls, Greater Shearwaters, and storm-petrels are occasionally hooked by Atlantic pelagic longline fishers. According to the annual report to ICCAT, depending on modeling approach, total estimated US seabird bycatch ranged from 26 to 122 seabirds in 2010 in the Atlantic pelagic longline fleet. Extrapolated estimates of seabird bycatch have varied substantially since 1992. Live discards ranged from zero to 486 per year, averaging 60 per year. Estimates of dead discards of seabirds ranged from zero to 623 per year, averaging 150 per year. The annual bycatch rate of birds discarded dead ranged from zero to 0.015 birds per 1,000 hooks, while the rate of total seabird catch ranged from zero to 0.106 birds per 1,000 hooks. See table below.

The following table gives observed seabird bycatch in the US Atlantic pelagic longline fishery, 2004-2010. Abbreviations in the “Area” column refer to NMFS Statistical Areas: MAB = Mid-Atlantic Bight; NEC = Northeast Coastal; SAB = South Atlantic Bight; GOM = Gulf of Mexico. NED denotes a specific survey, the Northeast Distant Fishery Experiment, conducted on the Grand Banks off Newfoundland.

Year	Month [1]	Area	Type of Bird	Number observed	Status
2004	1	MAB	Gull	5	dead
2004	3	MAB	Shearwater greater	1	alive
2004	3	MAB	Shearwater greater	4	dead
2004	4	NED	Seabird	1	dead
2005	1	SAB	Gull herring	1	dead
2005	1	SAB	Shearwater spp	1	dead
2005	3 [2]	NEC	Shearwater greater	1	alive
2005	3 [2]	NEC	Shearwater greater	1	dead
2006	4	MAB	Shearwater greater	1	dead
2006	4	NEC	Shearwater spp	1	alive
2006	4	NED	Shearwater greater	1	dead
2007	1	MAB	Gull blackbacked	6	dead
2008	2	GOM	Pelican brown	1	alive
2009	1	MAB	Northern gannet	2	alive
2009	1	MAB	Northern gannet	1	dead
2009	2	GOM	Brown pelican	1	dead
2009	3	MAB	Shearwater greater	3	dead
2009	3	MAB	Unid	1	dead
2010	4	MAB	Gull herring	1	dead

Observed Seabird Bycatch in the US Atlantic Pelagic Longline Fishery, 2004-2010. Source: NMFS, 2008; NMFS PLL [pelagic longline] fishery observer program data.

West Coast Swordfish Gillnet and Harpoon Fisheries
Longline vessels infrequently encounter a number of sea birds, including the endangered Short-tailed Albatross.

Hawaii Swordfish Pelagic Shallow Set Longline Fishery
The observer program on Hawaii shallow-set and deep-set longline fisheries began in 1994, when no mitigation measures were in effect. In 2000, an estimated 2,433 seabirds were incidentally taken in both fisheries. The shallow-set fishery was closed in 2001 because of incidental takes of endangered turtles. In that period, observer coverage was about 4% of shallow-set and deep-set longlines. Seabird captures occurred at an order of magnitude higher in the shallow-set fishery than in the deep-set fishery. Observed interactions were with Laysan and Black-footed Albatrosses, Sooty or Short-tailed Shearwaters, one Brown Booby and one Red-footed Booby. The observations are summarized in the table below. In June 2001, a suite of seabird measures became mandatory in the Hawaii longline fishery. The swordfish fishery remained closed throughout 2002 and 2003. Since 2004, nominal seabird catch rates dropped

93% in the shallow-set and 81% in the deep-set longline fisheries. The number of seabirds incidentally taken in the Hawaii longline fisheries has continued to remain low under more recent mitigation measures implemented in 2006.

Year	No. of active vessels	No. of sets	Total effort (no. of hooks)	No. Laysan albatross	No. black-footed albatross	No. Sooty shear-waters	No. other bird species	Total no. of birds	Estimated Total seabirds plus drop-offs (employing 31% drop-off rate)	Laysan albatross interaction rate (no. birds per 1000 hooks)	Black-footed albatross interaction rate (no. birds per 1000 hooks)	Nominal seabird interaction rate (no. birds per 1000 hooks)
2004	7	11	115,718	1	0	0	0	1	1	0.009	0.000	0.009
2005	33	109	1,358,247	62	7	0	0	69	90	0.046	0.005	0.051
*2006	35	57	676,716	8	3	0	0	11	14	0.012	0.004	0.016
2007	28	88	1,353,761	40	8	0	0	48	63	0.030	0.006	0.035
2008	27	93	1,460,042	33	6	0	0	39	51	0.023	0.004	0.027
2009	28	112	1,694,550	81	30	1	0	112	147	0.048	0.018	0.066
2010	28	108	1,832,471	40	38	0	1	79	103	0.022	0.021	0.043
Total	**NA**	**NA**	**8,491,505**	**265**	**92**	**1**	**1**	**359**	**470**	**0.031**	**0.011**	**0.042**
Ave.	**27**	**83**	**1,213,072**	**38**	**13**	**0.14**	**0.14**	**51**	**67**	**0.039**	**0.006**	**0.050**

Seabird interactions in Hawaii shallow set longline fishery 2004 – 2010. Source: Annual Report on Seabird Interactions and Mitigation Efforts in the Hawaii Longline Fisheries for 2009. Summary of seabird interactions and nominal rates in the Hawaii longline shallow-set swordfish fishery, 2004-2010. Data source is NMFS observer program with 100% coverage. Data are based on the date for the beginning of the haul and are not fleet-wide extrapolations.

Information

Atlantic Longline Swordfish Fisheries Managed by US

Seabird bycatch in longline fisheries is to be assessed as one of the actions under the US National Plan of Action-Seabirds (NPOA-S). A seabird bycatch assessment was to have been completed within two years of adoption of the NPOA-S, or in 2003. However, the only reports so far are for Alaska and Hawaii fisheries; no report has been made in either the annual bycatch reports or annual bycatch engineering reports for other pelagic longline fisheries. Reports on specific projects are available, but not in the form of an assessment. See table below for observer coverage.

The following table gives observer coverage of the US Atlantic pelagic longline fishery. “NED” is the Northeast Distant Fishery Experiment, conducted on the Grand Banks off Newfoundland. “EXP” refers to other experimental fishing.

Year	Number of Sets Observed			Percentage of Total Number of Sets		
1999	420			3.8%		
2000	464			4.2%		
2001*	Total	Non-NED	NED	Total	Non-NED	NED
	584	398	186	5.4%	3.7%	100%
2002*	856	353	503	8.9%	3.9%	100%
2003*	1,088	552	536	11.5%	6.2%	100%
	Total	Non-EXP	EXP	Total	Non-EXP	EXP
2004**	702	642	60	7.3%	6.7%	100%
2005**	796	549	247	10.1%	7.2%	100%
2006	568	-	-	7.5%	-	-
2007	944	-	-	10.8%	-	-
2008	1,190	-	101***	13.6%	-	100%***
2009	1,588	1,376	212***	17.3%	15.0%	100%***
2010	884	725	159***	11.0%	9.7%	100%***

Observer coverage of the pelagic longline fishery. Source: NMFS 2011 SAFE Report, Chapter 4.
*In 2001, 2002, and 2003, 100% observer coverage was required in the NED research experiment.
** In 2004 and 2005,there was 100% observer coverage in experimental fishing (EXP).
*** In 2008-2010, 100% observer coverage was required in experimental fishing in the FEC [Florida East Coast], Charleston Bump [area from the Florida Straits north to the bend in the Gulf Stream off Charleston, South Carolina], and GOM [Gulf of Mexico], but these sets are not included in extrapolated bycatch estimates because they are not representative of normal fishing.

West Coast Swordfish Gillnet and Harpoon Fisheries
More work is needed to better understand possible impacts of the HMS fisheries on protected species of sea turtles, birds, and marine mammals. For example, there is a need to investigate the post-release survivorship of protected species, such as turtles and seabirds that are caught as bycatch in the HMS fisheries (NMFS 2011).

Hawaii Swordfish Pelagic Shallow Set Longline Fishery
The Hawaiian longline fisheries now have 100% observer coverage.

Atlantic Longline and Driftnet Swordfish Fisheries Managed by ICCAT
The lack of adequate bycatch data from RFMOs, including ICCAT, is the key obstacle to current scientific efforts to quantify the scale of bycatch of seabirds. A recent paper aimed at evaluating

seabird bycatch rates in the ICCAT region was severely hampered by a lack of data, with temporal and spatial extrapolations forced from the limited datasets available (Klaer. 2009). At present ICCAT has not adopted a Regional Observer Program for the collection of scientific data, although a program for documenting transhipment activities in large scale longline vessels was adopted in 2006 [Rec. 06-11]. The need for a scientific observer program has been raised at numerous meetings of ICCAT's Sub-committee on Ecosystems (SCECO) and the Scientific Committee on Research and Statistics (SCRS; ICCAT 2007, 2008, 2010).

Certification

The Marine Stewardship Council has certified three swordfish fisheries:

- North Atlantic Swordfish Canadian Pelagic Longline Fishery
- North West Atlantic Canada Harpoon Swordfish
- Southeast US North Atlantic Swordfish Pelagic Longline and Handgear Buoy Line Fishery

In an in-depth review of these fisheries (ABC 2012), the first of these was considered to be of potentially medium risk to seabirds, while the last two were considered to be of low risk.

Conclusions

Most swordfish are caught using pelagic longlines, a gear type that is of high risk to seabirds. Data show that relatively few seabirds are caught and killed, largely a result of where swordfish fishing is carried out. However, it is still necessary to improve the use of mitigation methods for longline fisheries. Effective mitigation methods exist, but fishermen are often not required to use them in the swordfish fisheries. In addition, it is necessary to improve requirements and regulations in the fisheries managed by the RFMOs with regard to use of seabird bycatch mitigation methods.

Suzanne Iudicello, Natasha Atkins, Eugene C. Bricklemyer, Brad Gentner, David A. Wiedenfeld, and Ashley Johnson, 15 October 2012

Potentially Medium Risk to Seabirds

BERING SEA / ALEUTIAN ISLANDS AND GULF OF ALASKA POLLOCK PELAGIC TRAWL FISHERY

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
Medium	High	Good	Poor	Good	Fair	Medium
2	3	20	1	26	11	2
5/6		58/100				2/3

The BS/AI pollock fishery uses a medium-risk gear type, midwater trawl, but operates in an area with threatened Short-tailed Albatross and many large concentrations of seabirds. Regulation and enforcement of the fishery is good. Although observer coverage is high, observers do not apparently record data on seabird mortality not resulting in the dead bird showing up in the net, that is, mortalities caused by warp strikes. As a result, uncertainty about seabird mortality is high. Although seabird bycatch does appear to be fairly low, at least on a basis of per ton of fish caught, the immense scale of the fishery and the lack of information on non-captured mortalities of seabirds indicate that this fishery is potentially of medium risk to seabirds.

Recommendations

- Obtain improved data on seabird mortality and bycatch. The results should include birds not captured in the net nor landed, but also probable injuries and mortalities from non-recovered warp strikes or striking other equipment. Individual birds should be identified to species.
- Mitigation methods now in development should be implemented to reduce bird strikes and mortalities. These may include technical solutions such as streamer lines to reduce warp strikes or use of wireless or paravane-mounted monitoring systems.
- If the information obtained warrants it, stronger mitigation methods should be implemented.

Overview

This fishery uses midwater, trawls to target pollock *Theragra chalcogramma*. Fishing is carried out in the Bering Sea and Aleutian Islands (FAO Statistical Area 67) in the US EEZ, and is managed by the managed by the North Pacific Fishery Management Council (NPFMC).

This fishery has been certified as sustainable by the Marine Stewardship Council.

Tonnage and Sources

The Eastern Bering Sea and Gulf of Alaska pollock fishery is the largest fishery by volume in the United States. About 86% of the U.S. catch is taken from the Eastern Bering Sea, the remainder from the Gulf of Alaska. The fishery is not only significant for the US—this species comprises more than one-half of the entire volume of groundfish landed, and makes up more than 40% of global whitefish production (National Marine Fisheries Service 2012). Other pollock catches are taken in the Northwest Pacific fisheries of the Okhotsk Sea, Sea of Japan, and Western Bering Sea, by Russia, Japan, Korea, and Poland.

From 1977-2010 the catch of eastern Bering Sea pollock averaged 1.17 million tons (North Pacific Fishery Management Council 2011), but since 2001, the annual average has been more than 1.28 million tons. Stock declines and resulting reductions in allowable harvest levels have reduced the annual average catch in 2009 and 2010 to 0.81 million tons.

Although the fishery is cited as one of the "cleanest" with regard to bycatch, note that a bycatch analysis by gear type did not account for the magnitude of midwater trawl gear in the pollock fishery, stating that, although the per unit effects of midwater trawls "are low compared to other gears, the size of this fishery will tend to magnify even small impacts" (Chuenpagdee 2003).

Products and Market

The primary markets for Alaska pollock products are Japan, the US, and Europe. Japan is the principal market for surimi and roe products. The US and Europe are the main markets for fillet-type products. Fillets are used for fish and chips, fish sandwiches, frozen fish items, and fish fingers. Other product forms include whole, roe, headed and gutted, gutted, steaks, portions, chilled, coated, frozen block, individually quick frozen, loins, marinated/pickled, nuggets, ready meals, salads, skewered, and smoked (Marine Stewardship Council 2012). Fishmeal and oil are produced from fish parts and non-saleable fish as a result of full retention (no discard) policy.

Gear and Set

Midwater trawl is the dominant gear type. Pollock is also caught with non-pelagic trawls, jigs, pots, hook and line, but not in the volume of mid-water trawl gear. Midwater trawl is a medium-risk gear type.

Up to the present, no mitigation methods have been used to avoid seabird mortalities. However, in 2011 NMFS established projects over the next four years to develop mitigation gear to reduce seabird bycatch in Alaska trawl fisheries and explore the role of vessel attraction. Among techniques examined were the use of paravanes, a type of net monitoring device employed by groundfish trawl vessels. Using three mitigation measures (third-wire snatch block, streamer lines, and warp booms) researchers compared the deterrent-equipped vessel with another catcher processor using no deterrents. The study found that streamer lines reduced heavy seabird strikes with cables, but other techniques were not as effective.

Fishing Vessels and Their Countries of Origin

Because this fishery is within the US EEZ, all vessels are US flag.

In 2003, there were two vessels in the 60-124 foot length class, 42 in the 125-230 foot length class, and 332 vessels greater than 230 feet in length, operating as mother ships and catcher-processors (Hiatt et al. 2008).

Management

This fishery is managed by the North Pacific Fishery Management Council (NPFMC). Pollock management measures are components of two separate fishery management plans: 1) the Fishery Management Plan for the Bering Sea/Aleutian Islands Groundfish, implemented in 1982; and 2) the Fishery Management Plan for Groundfish of the Gulf of Alaska, implemented in 1978.

Under these management plans, the fishing season is divided into “A” and “B” seasons: January 20 to mid-April (or when the TAC is reached) and from June 10 to November 1. The fishery is also subject to time and area closures for restricted and protected species.

Internationally (that is, outside this fishery but potentially affecting it through cumulative impacts), northern Pacific pollock fishing is regulated by the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea (the “Pollock Convention”). The convention has been described as oriented mainly to the allocation of fishing rights among the signatory countries, rather than to conservation (Weber 1998).

Species

Through the FMPs, the fishing season is divided into “A” and “B” seasons: January 20 to mid-April (or when the TAC is reached) and from June 10 to November 1. Although time and area closures specified in the fishery management plans were devised to protect Steller’s sea lions and prohibited fish species (target stocks of other fisheries), the season and area may contribute to avoidance of some seabird interactions.

The Bering Sea supports vast populations of 50 species of seabirds, including nearly 10 million murres and auklets. The Pribilof Islands are home to one of the world’s largest seabird colonies, which is composed of an estimated 2.5 million birds. Valuable habitats along the coastal fringe, such as eelgrass beds, coastal lagoons, deltas, wetlands, and estuaries, support an abundance and diversity of waterfowl and shorebirds. The 53-mile-wide Bering Strait, which connects the Bering Sea to the Arctic Ocean, is critical to marine life migrating to and from summering grounds in the Chukchi Sea and elsewhere in the Arctic Ocean.

From 2001-2005, seabird mortality in the BS/AI pollock trawl fishery was 324 individuals:

- 179 Northern Fulmars
- 65 unidentified alcids
- 39 unidentified seabirds
- 27 unidentified shearwaters
- 13 unidentified gulls, other seabirds, Red-legged Kittiwake, and unidentified shearwaters and petrels
- 1 Laysan Albatross

However, see “Information,” below.

Information

Under the FMPs, observer coverage was required to be 100% of the Bering Sea pollock fishery by 2011, and 100% of the Gulf of Alaska fleet is required by 2014. During the period 1998-2005, coverage ranged from 66% to 92%.

Observation coverage is paid by the fishery. There is also weekly catch reporting.

Observer data quality of seabird bycatch data, however, is low. Standard observer sampling accounts only for birds included with fish catch in a trawl cod end. Melvin et al. (2011) showed that fisheries observers missed net mortalities, detecting only three mortalities in 200 trawls; trained seabird observers detected 17 in 170 of those same trawls. “Clearly, existing catch sampling is inadequate for quantifying seabird mortalities in the net or from cable strikes in Alaska trawl fisheries” (Melvin et al. 2011).

Studies of seabird mortality in Alaskan trawl fisheries acknowledge that the estimates are low. Uncertainty derives from (1) poor observer coverage, (2) poor detection of seabird mortality by observers, and (3) absence of information on mortality due to cable strikes.

No estimates of mortality from strikes have been derived, but according to the National Bycatch Report, in some sectors of the Alaska trawl fleet, ad hoc reports indicate that seabird mortalities from interactions not accounted for by standard sampling may be substantial. Dietrich and Melvin (2007) report a high rate of “heavy strikes” on cables, strikes most likely to cause injury or mortality. For third wires, average heavy strike rates were 45.2 strikes per hour during the tow and 66.2 strikes per hour during shortwiring, when the codend is hauled to the surface but not onto the boat.

In 2011 NMFS established projects over the next four years to enhance bycatch monitoring. Among techniques to be examined are use of observer monitoring information to evaluate sources of seabird mortality and ascribe those sources to fleet components, areas, and geographic regions.

Certification

This fishery in its entirety has been certified as sustainable by the MSC. The fishery was originally certified as sustainable on 14 February 2005 and re-certified on 14 December 2010. No conditions of certification regarding seabirds were placed on the fishery in either the original or re-assessment certification.

Conclusions

The pollock fishery appears to have a low impact on seabirds on a per-ton-of-fish-caught basis. However, because of the enormous scale of the fishery, it may still have a significant effect on seabird populations, just because of the large number of sets and tows. In addition, although observers are placed on a high percentage of vessels, their observation does not include lethal interactions with gear, such as warp strikes, but only includes monitoring of birds brought on board in the net. Therefore, the actual level of mortality of birds caused by the fishery is likely much higher than is reported.

This fishery therefore needs to ensure that it is not causing significant mortality to seabirds, either through capture in the net or strikes with gear. This will require modifying monitoring protocols to obtain data on strikes. Data should also be collected to record which species are being caught or killed, not only recording mortality by groups such as “alcids” or “shearwaters.”

Suzanne Iudicello, Natasha Atkins, Eugene C. Bricklemyer, Brad Gentner, and David A. Wiedenfeld, 21 May 2012

Potentially Medium Risk to Seabirds

PACIFIC COD FISHERY

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	High	Good	Good	Fair	Fair	Medium
3	3	17	18	18	14	2
6/6		67/100				2/3

This fishery has been significantly improved with regards to seabird bycatch since the 1990s. The fishery is very large, covering most of the northern Pacific, and includes various gear types. Most cod, however, are caught with trawls (medium risk gear-type to seabirds), although demersal longlines (high risk to seabirds) are used to catch significant numbers of fish. There are protected, endangered, or threatened albatross species present as well as many other non-threatened species. Regulation and enforcement is good through NMFS. Mitigation methods are required, and compliance with their use is high. Bycatch however, remains significant, primarily because of the large scale of the fishery. As many as 5,000 birds were killed per year 2007-2010 over the entire region, with the large majority of these being Northern Fulmars and gulls. Alcid bycatch mortality is very low. Observer coverage is reasonably good, with the caveat that seabird data are not always recorded to species. An important issue with the fishery is a medium level of uncertainty, arising from the incomplete observation data. Although this fishery does not apparently have high seabird bycatch or mortality on a per hook or per set basis, the large size of the fishery, in number of boats fishing and sets, is still causing significant bycatch.

Recommendations

- Obtain more information on seabird bycatch, by improving the on-board observer program. The program should require identification of by-caught birds to species level. This may require training of observers.
- Using that information, make any changes to the fishery that would be needed to reduce seabird bycatch to acceptable levels.
- Continue to monitor the fishery to ensure that seabird bycatch and mortality remains low

Overview

The Pacific cod (*Gadus macrocephalus*) is called in various markets, cod, Alaska cod, gray cod, true cod, and treska. Pacific cod is a transoceanic species, occurring at depths from shoreline to 500 m. The southern limit of the species's distribution is about 34° N, with a northern limit of about 63° N. The trawl fishery is concentrated immediately north of Unimak Island, in the Bering Sea, and around the Shumagin Islands and south of Kodiak in the Gulf of Alaska. The longline fleet is distributed along the shelf edge to the north and west of the Pribilof Islands in the Bering Sea, and around the Shumagins in the Gulf of Alaska (Fishery Management Plan Appendices).

The trawl fishery operates early in the year. Longline vessels may run throughout the year, depending on whether the fishery is closed when limits on prohibited species are reached. The inshore pot and jig fisheries inside state waters around Kodiak and in Cook Inlet occur intermittently from March through December.

Tonnage and Sources

Pacific cod has grown in popularity in North America and elsewhere with the decline of Atlantic cod landings from North America, Iceland, and elsewhere in Europe (Hiatt et al. 2011). More than 96% of the cod harvested in the United States is Pacific cod, most of which comes from Alaska waters with a small percentage coming from the US west coast. The second largest fishery after pollock, Alaskan Pacific cod now accounts for more than two-thirds of the world's Pacific cod supply, and represented 16% of the total Alaska groundfish catch in 2010 (NMFS 2012). The five-year average of Alaska annual landings for Pacific cod (2005–2010) is about 279,000 mt (see table below). Excluding Alaska, the five-year average for landings on the west coast including British Columbia is only about 1,800 mt.

Time Period	Alaska (mt)	Washington (mt)	Oregon (mt)	British Columbia (mt)	Russian Federation (mt)
5-year average landings	278,964	312.5	117.5	1,377.6	No data
2009-2010 landings	233,447	280.0	52.0	2,000.0	53,000

Canadian fishing for Pacific cod occurs mainly in Hecate Strait, with additional small fisheries in Queen Charlotte Sound and off the lower west coast of Vancouver Island (Beamish 2008). The total cod catch from British Columbia in 2010 was 2,000 mt (DFO 2012).

The Russian Federation reported landings of 53,000 mt in 2009 (FAO online query) but this fishery does not have a significant impact on the American market. The cod fishery is primarily in the Sea of Okhotsk and the Bering Sea. The Russian Federation exports the majority of its seafood products to China, Japan, and South Korea (FAO 2007). Although there is also a Chinese fishery for Pacific cod, there is no readily available information on this fishery. South Korean and Japanese catches of Pacific cod likely do not end up in the US market (Vaisman 2001).

Products and Market

Pacific cod comes in many product forms including fresh and frozen fillets, frozen whole fish, breaded fillets, or in portions, smoked, dried, salted and canned products. Cod is one of the types of groundfish used in traditional "fish and chips."

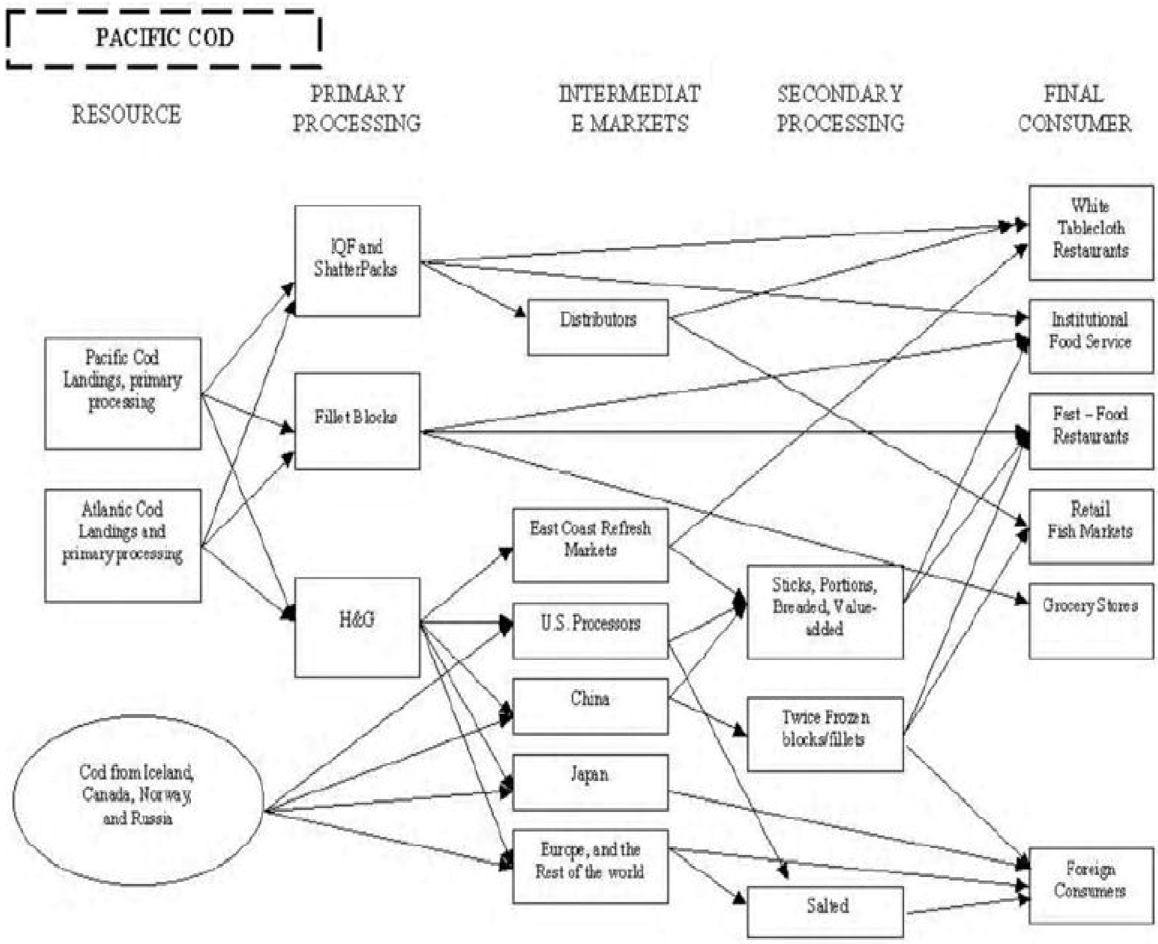
The primary markets for Alaska groundfish products are domestic, Asian and European consumers, as well as secondary processing in China and Europe. Pacific cod has become increasingly considered an acceptable substitute for Atlantic cod, because of worldwide shortages of Atlantic cod. It is a popular item in the food service sector and is used in finer and casual restaurants, institutions, and retail fish markets (Alaska Groundfish Market Profiles in Hiatt et al. 2007). Pacific cod is processed as either headed and gutted ("H&G"), fillet blocks, or individually frozen fillets, which are either individually quick-frozen or processed into shatter-pack or layer pack (Alaska Groundfish Market Profiles in Hiatt et al. 2007). Seafood Business reports that High Liner Foods USA in Danvers, Massachusetts, is the largest purchaser of cod in North America, dealing in both Atlantic and Pacific cod (Friedrich 2010).

In an unpublished paper presented to the North Pacific Council, Knapp (cited in Hiatt et al. 2008) reported that the decline of Atlantic cod (*G. morhua*) harvests had dramatically changed product flows for Pacific cod. For example, buyers from Norway and Portugal are now purchasing Pacific cod from Alaska for the first time, and the Netherlands and UK have become more important buyers in recent years.

Most domestically produced Pacific cod fillets are destined primarily for use in the domestic foodservice industry. However, Pacific cod harvested in Alaska groundfish fisheries and processed as H&G primarily enters the international market. China is a major importer of H&G cod, reprocessing it into other forms—filleted and refrozen, or processed into salt cod (Hiatt et al. 2011).

The diagram below illustrates the product flows of Pacific and Atlantic cod from U.S. fisheries.

Figure 31. Product Flow and Market Channels for Pacific Cod.

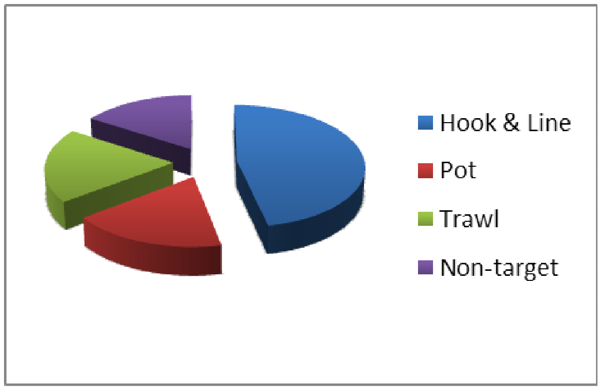


Source: NMFS (2001)

Gear, Set, and Mitigation
American fleets have landed Pacific cod since the late 1950s and early 1960s, but the fishery developed significantly after foreign fleets departed US waters in the late 1970s.

After an allocation to the community-development-quota program comes off the top of the total allowable catch (TAC), the allowable catch of Bering Sea/Aleutian Islands (BSAI) and Gulf of Alaska (GOA) Pacific cod is apportioned seasonally, to areas, among the different gear sectors, and between inshore and offshore processors. Bottom or demersal trawls that are targeting flatfish are also allocated a total catch for Pacific cod.

The groundfish fleet employs trawl, longline, pot, and jig gears to target Pacific cod. The figure below shows the relative proportions of the 2010 catch (both areas combined) by gear type. (Hook & Line includes both longline and jig gears, and non-target catch represents Pacific cod caught by vessels targeting flatfish, pollock, and other groundfish species.)



Seabird catch mitigation measures are required for most longline vessels but regulation varies by vessel size and fishing area.

Seabird interaction with longline gear results from the birds being attracted to baited hooks. As in longline fisheries elsewhere, streamer lines are particularly effective at deterring albatrosses (NMFS 2011) and have also been effective at reducing mortality for other species. A recent study using integrated weights in conjunction with paired streamer lines ("Integrated Weight/Paired Streamers;" IWPS) reduced mortality among surface-feeding birds (Northern Fulmars and gulls [*Larus* species]) by 91-100%. Although somewhat less effective for diving species such as shearwaters, IWPS reduced mortality in these species by 80-97% (Dietrich et al. 2008).

Fishing Vessels and Their Countries of Origin
The Alaska cod fisheries in the BSAI and GOA are carried out by US flag vessels. Alaska vessels accounted for the majority of the Pacific cod catch, with residents of Washington, Oregon, and California participating in the fishery as well.

The table below shows the number of vessels, by type, area, and gear targeting Pacific cod in 2010.

	Gulf of Alaska		Bering Sea & Aleutian Islands		All Alaska		
Gear	Catcher vessels	Catcher processors	Catcher vessels	Catcher processors	Catcher vessels	Catcher processors	Total
Hook & Line	9	8	1	89	9	98	107
Pot	20	0	17	3	37	3	40
Trawl	21	1	28	30	49	31	80

Management

The National Marine Fisheries Service (NMFS) in consultation with the Northern Pacific Fisheries Management Commission (NPFMC) manages 27 groundfish fisheries. Pacific cod management measures are components of two separate fishery management plans: (1) the Fishery Management Plan (FMP) for the Bering Sea/Aleutian Islands Groundfish, implemented in 1982; and (2) the Fishery Management Plan for Groundfish of the Gulf of Alaska, implemented in 1978. Both FMPs have been amended substantially since they were first implemented.

The four goals described by the North Pacific Council for all its fishery management plans are: (1) to promote conservation while providing for optimum yield; (2) to promote efficient use of fishery resources, but not solely for economic purposes; (3) to promote fair resource allocation without allowing excessive privileges; and (4) to use the best scientific data available (NPFMC 2011). Included in a list of secondary objectives are precautionary measures, including the flexibility to respond to unpredictability, providing for a "safety margin" when the quality of information is questionable, and the design of fishing strategies that minimize the effects of fishing on the environment (NPFMC 1999b).

The BSAI FMP outlines management measures for Alaska groundfish stocks in the US EEZ of the Bering Sea, including Bristol Bay and Norton Sound, and the portion of the North Pacific Ocean adjacent to the Aleutian Islands, between 170º W longitude and the US-Russian Convention line of 1867. The area's northern limit is the Bering Strait. The GOA FMP regulates catch of groundfish within the US EEZ, exclusive of the Bering Sea, between the eastern Aleutian Islands at 170º W longitude and Dixon Entrance at 132º E latitude 40º W longitude).

For several groundfish stocks, including cod, fisheries occur in both federal and state waters. These "parallel" groundfish fisheries are conducted with the same time and area restrictions and under the same total allowable catches as established for federal fisheries.

Elements of the two FMPs include limited entry, annual catch limits, and various accountability measures: full retention of catch; closure of the fishery for a target species when the TAC for that species has been attained; observer coverage; bycatch limits; and time and area closures for restricted and protected species. Both also have a complex scheme of allocation of the total allowable catch of Pacific cod among seasons, gears, areas, sectors and processors. These allocations may be adjusted in season to accommodate catches of prohibited or non-target species. Although the time and area closures were devised to protect Steller sea lions, sensitive habitat areas, and prohibited fish species (target stocks of other fisheries), the season and area closures may avert some seabird interactions (NPFMC 2011).

According to the US National Bycatch Report, NMFS and the NPFMC have worked to address bycatch concerns in the region's fisheries, but the issue is complex "due to multispecies interactions, the use of quotas to allocate fishing privileges, and the large scale (both in harvesting capacity and geographic extent) of the fisheries" (Karp et al. 2011). The NPFMC and NMFS have supported numerous actions to establish areas with special bycatch limits, reduce incentives to discard fish, and improve the selectivity of fishing gear. One recent change, according to the report, is that observers now collect and individually record at least three samples for species composition from each sampled haul or fishing event (previously, samples were pooled).

Seabird Species and Mortality

The Bering Sea supports vast populations of 50 species of seabirds, including nearly 10 million murres and auklets (NPFMC 2011). The Pribilof Islands, often referred to as the "Galapagos of the North" because of the exceptional abundance of marine organisms they support, are home to one of the world's largest seabird colonies, which is composed of an estimated 2.5 million birds (Iudicello 2002). Valuable habitats along the coastal fringe, such as eelgrass beds, coastal lagoons, deltas, wetlands, and estuaries, support an abundance and diversity of waterfowl and shorebirds. The 53-mile-wide Bering Strait that connects the Bering Sea to the Arctic Ocean is critical to marine life migrating to and from summering grounds in the Chukchi Sea and elsewhere in the Arctic Ocean.

The National Bycatch Report identified key stocks as "those that have high bycatch levels, have special importance to management, and/or for which there are stock status concerns" (Karp et al. 2011). All ESA-listed species were considered key stocks, including in the Alaska Region the Short-tailed Albatross (*Phoebastria albatrus*), as well as the Black-footed Albatross (*P. nigripes*) and Red-legged Kittiwake (*Rissa brevirostris*).

The longline fishery for Pacific cod is cited in the National Bycatch Report as the US fishery with the highest seabird bycatch estimate.

Seabird mortality in longline fisheries occurs when birds are attracted to baited hooks or to offal being discharged, and the birds become hooked and drown. Seabird mortality estimates include fisheries that target Pacific cod, turbot, and sablefish in the Gulf of Alaska and the Bering Sea/Aleutian Islands areas. When it announced final rules in 2007, NMFS estimated that 4,000 to 19,000 seabirds had been hooked each year in Alaska, during the past three years. Fulmars and gulls made up 75% of dead seabirds.

Catch rates in the demersal longline fisheries, and notably for albatrosses, plummeted after 2000, due to adoption of mitigation measures. Nonetheless, despite mitigation implementation, approximately 5,000 seabirds were killed annually in Bering Sea fisheries during 2002-2006 (see table below), and smaller numbers are killed in the AI and GOA areas (Fitzgerald et al. 2008, Fitzgerald 2011). Preliminary results for 2007-2011 are higher (see second table below), although the increase may be due to new methodology that better extrapolates data to areas lacking direct observation (Fitzgerald et al. 2011).

Average estimated annual seabird take in Alaska demersal groundfish longline fisheries during 2002–2006, 95% confidence interval, and percentage of hooks observed:

Area	Avg. ann. est.	95% CI	% Hooks observed
Aleutian Is	185	149 - 231	18.4
Bering Sea	4522	4260-4801	21.0
Total BSAI	**4707**	**4409-5032**	
Gulf of Alaska	430	346-535	6.2

Seabird mortality in Alaska demersal groundfish longline fisheries, 2007-2010 by species. Numbers are averages of annual estimates; range is highest and lowest annual estimate:

Species	Time Period	Aleutian Islands / Bering Sea	Gulf of Alaska
Laysan Albatross	2007-2010	125 (17-257)	78 (0-163)
	2001-2005	147	21
Black-footed Albatross	2007-2010	10 (5-18)	158 (35-283)
	2001-2005	6	61
Short-tailed Albatross	2007-2010	0	4 (0-15)
	2001-2005		0
Unidentified Albatross	2007-2010	0	4 (0-16)
	2001-2005	3	4
Northern Fulmar	2007-2010	3230 (1751-6699)	609 (34-968)
	2001-2005	2741	110
Shearwaters	2007-2010	1279 (492-2848)	4 (0-27)
	2001-2005	432	11
Unidentified Procellarids	2007-2010	0	0
	2001-2005		0
Gulls	2007-2010	851 (471-1298)	321 (105-554)
	2001-2005	2001	77
Alcids	2007-2010	7 (5-13)	0
	2001-2005	15	10
Kittiwakes*	2007-2010	5 (0-20)	0
	2001-2005	3	0
Other / Unidentified	2007-2010	155 (15-450)	0
Totals		5657(2751-11,565)	1539 (174-2011)

* Data for 2007-2010 do not differentiate between Black-legged and Red-legged Kittiwakes. Data for 2001-2005 list Red-legged Kittiwakes only.

Northern Fulmars (*Fulmarus glacialis*) account for about half of mortality. Other species regularly killed include Glaucous-winged Gull (*Larus glaucescens*), Short-tailed Shearwater (*Puffinus tenuirostris*), and two species of albatross: Black-footed and Laysan (*P. immutabilis*) (Stehn et al. 2001). In 2010, two Short-tailed Albatross were also taken, the first since 1998 (Fitzgerald 2011). Protected species ("key stocks") that are taken in these fisheries are Black-footed Albatross, Short-tailed Albatross, and Red-legged Kittiwakes.

Information

US fishing vessels that catch groundfish in the EEZ, or receive groundfish caught in the EEZ, and shoreside processors that receive groundfish caught in the EEZ, are required to accommodate NMFS-certified observers as specified in regulations, in order to verify catch composition and quantity, including at-sea discards, and collect biological information on marine resources.

Currently all vessels over 60 ft require some level of observer coverage. Vessels under 125 ft in length require 30% coverage of fishing days and vessels 125 ft or longer require 100% coverage. Additional regulations for observer coverage on vessels shorter than 60 ft (to document salmon bycatch) were proposed in December 2011 (76 Federal Register 77757-77765). Vessels operating in the catch-share program under the American Fisheries Act or Community Development Quota program must carry two observers. In addition, federal regulations (50 CFR parts 600 and 679) require observers at shore-side plants harvesting or processing groundfish species within the US EEZ (that is, 3–200 nm offshore).

It is widely acknowledged that estimates are low because birds that drop off the hook underwater are not recorded. Moreover, mortality estimates include totals for the cod, sablefish, and turbot fisheries, but the directed halibut is not observed (Karp et al. 2011). According to Melvin et al. (2006b) the magnitude of seabird mortality in the Pacific halibut longline fishery is unknown because systematic at-sea monitoring of catch is lacking.

In 2004, groundfish observers began to record use of seabird avoidance measures on vessels >60 ft length. As of 2006, observers had checked 66% of longline sets and observed near-total compliance; 96.1% of sets checked used single or double streamer lines (Fitzgerald et al. 2008). However, observation for seabird mortality is much weaker, as indicated by the percentage of hooks observed (see table above). The observed take of two Short-tailed Albatross in the GOA in 2010 resulted in an estimated take of 15. The US Biological Opinion on Short-tailed Albatross allows for incidental take of four birds every two years in this fishery, but this number is based not on estimated take but on observed take. This could be problematic given the low observation rates, especially in the Gulf of Alaska. Moreover, the bulk of the Alaskan longline fleet consists of small vessels; although regulations requiring mitigation measures on vessels <60 feet were passed in 2009, and some gear modifications have been made available to the small-boat fleet through SeaGrant (Melvin et al. 2006a), few of these vessels carry observers. According to the public certification report for the cod fishery, "While the overall level of observer coverage in the Pacific cod fishery is considered to be good there are deficiencies and recognized concerns with the level of observer coverage for vessels <60' and in the 60'-125' sector. These are being addressed by the Council" (Mohn et al. 2010). The report also indicated shortcomings in data collection, saying that the scoring (for sustainability certification) "would have been higher if the observer program recorded bird by-catch to the species level." One requirement in the certification stipulates that the Alaska Fisheries Development Foundation "Provide quantitative information on the accidental bycatch of seabirds to the species level. It is required that this Condition is met by the second annual surveillance audit." Nonetheless, two of four online recruiting descriptions of observer duties in these fisheries do not mention data collection on seabirds.

Certification
The Bering Sea and Aleutian Islands Pacific Cod Fishery and the Gulf of Alaska Pacific Cod Fishery are both certified as sustainable by the Marine Stewardship Council. Both fish in US EEZ waters.

Conclusions
This fishery appears to have low bycatch on a per hook or per set basis. However, the very large size of the fishery and high number of seabirds present means that there is still significant seabird bycatch. The observer system is not recording bycatch data to the level of detail that is required to fully assess the impact on seabirds, especially not recording bycatch to the species level. Regulators at NMFS and the FMP by the NPFMC have addressed many issues, and improvements continue to be made, both in requirements for use of mitigation methods and in improved observer coverage. The cooperation, although perhaps not entirely voluntary, by the fishers has generally made this fishery successful in reducing its bycatch.

It is probably not possible to achieve zero bycatch, but further information is needed to assess the actual levels of bycatch are sustainable, and whether they can be reduced further.

Because of weakness in observer information down to the species level, this fishery should be carefully evaluated and watched by outside parties to ensure that the fishery maintains its level of compliance, continues to reduce its levels of bycatch, and that those levels of bycatch are actually sustainable.

Suzanne Iudicello, Natasha Atkins, Eugene C. Bricklemyer, Brad Gentner, and David A. Wiedenfeld, 28 September 2012

Potentially Medium
Risk to Seabirds

ATLANTIC GROUNDFISH FISHERIES

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
Medium	High	Fair	Poor	Fair	Poor	Medium
2	3	14	1	18	3	2
5/6		36/100				2/3

US Atlantic groundfishing is a large scale fishery. Because it operates under US regulation, and enforcement, where appropriate regulations exist they usually do control seabird bycatch. Because most of the fishing is done with trawls, the seabird bycatch is generally not very high. Especially with changes to gillnet setting beginning in about 2000, seabird bycatch has been fairly low. However, a very significant issue is that observer overage, especially of observers recording seabird bycatch and mortality, is very low. Observer coverage must be improved.

The groundfish fisheries importing seafood into the US are primarily from the northeast Atlantic and Iceland. Those fisheries have the same strength (good enforcement of the regulations that exist) and the same issue as the US fisheries: very poor observer coverage. In addition, those fisheries are catching significant numbers of seabirds.

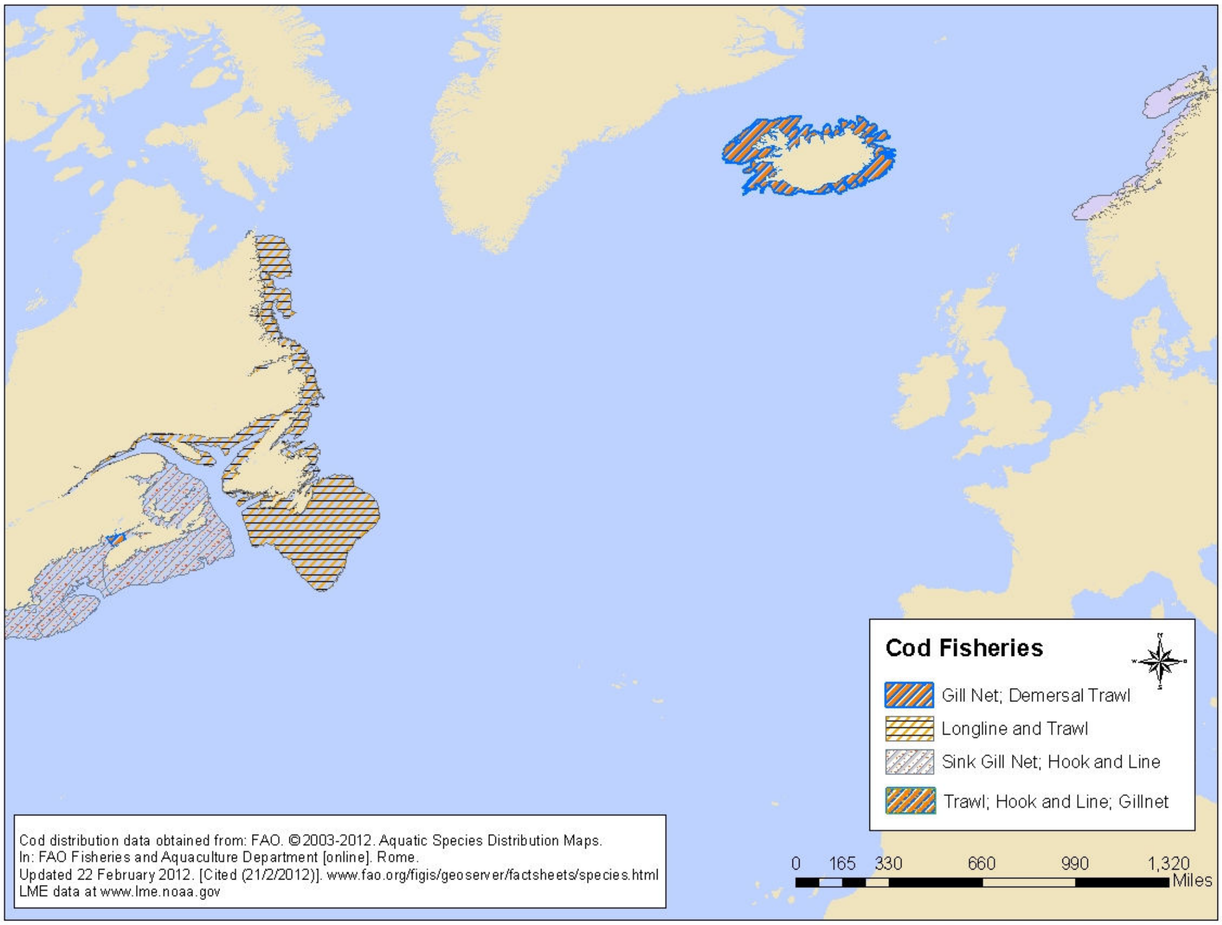
In both US-landed and imported fisheries, the gear type apparently causing the greatest seabird bycatch is gillnets, followed by longlines. Effective mitigation measures already exist for longlines, and their use must be mandated and enforced. For gillnets, some measures exist and efforts should be made to require and enforce their use, but development of new, effective measures is still required. Because gillnets are the source of such a significant amount of seabird bycatch and mortality, discovering a solution to this problem is imperative.

Recommendations

- Improve observer coverage of all groundfish fisheries in the Atlantic. This will require increasing the proportion of sets observed, but also improving data collection on seabird bycatch and mortality. This in turn may require training of observers in the appropriate methods.
- Require and enforce use of already-developed, effective mitigation methods on longline fisheries.
- Require and enforce use of mitigation methods on gillnet fisheries. This in turn will require development of more effective mitigation methods than are now available.

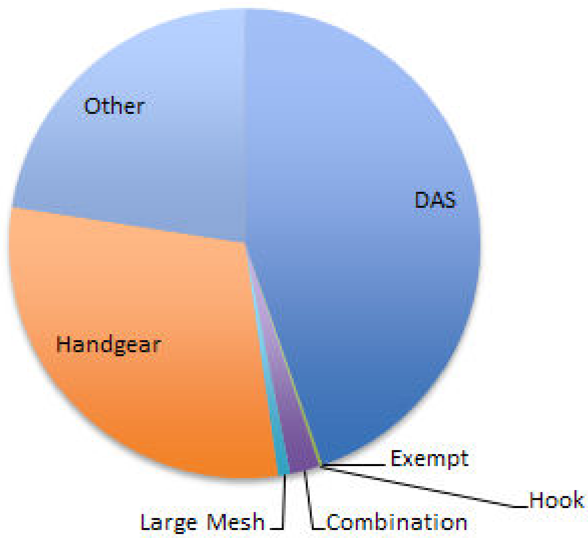
Overview

The Atlantic Groundfish Fisheries have both a US-landed component and an imported component. These are usually the same species, but they may not be captured using the same gear types, may have different management systems, and may have different effects on seabirds as bycatch. Therefore, in this report, the US-landed and imported fish and fisheries are treated separately.



Tonnage and Sources
The Atlantic groundfish reported here are caught entirely in colder North Atlantic waters.

Fish	Region and Gear	Tonnage (mt)
	US Landings	
Cod	New England multispecies groundfish trawl and gillnet	53,802
Haddock	New England multispecies groundfish trawl and gillnet	6
Groundfish NSPF	New England bottom trawl	81,983
	New England sink gillnet	25,169
	Imports to US	
Haddock	Gillnet and trawl fisheries in the Baltic and North Seas	28,261
Tusk	Gillnet and trawl fisheries in the Baltic and North Seas	720
Hake	Gillnet and trawl fisheries in the Baltic and North Seas	2,847



Total Groundfish Landings by Gear/Permit Category – 2009. DAS = Days At Sea Allowance.

Products and Market

Groundfish landed or imported into the US are sold as fresh or frozen fillets, frozen whole fish, breaded fillets or portions, smoked, dried, salted and canned products.

Gear, Set, and Mitigation

US-Landed Fishery:

The large majority of groundfish landed in the US are harvested using demersal trawls, especially otter trawl. Fish are caught also using sink gillnet and hook and line.

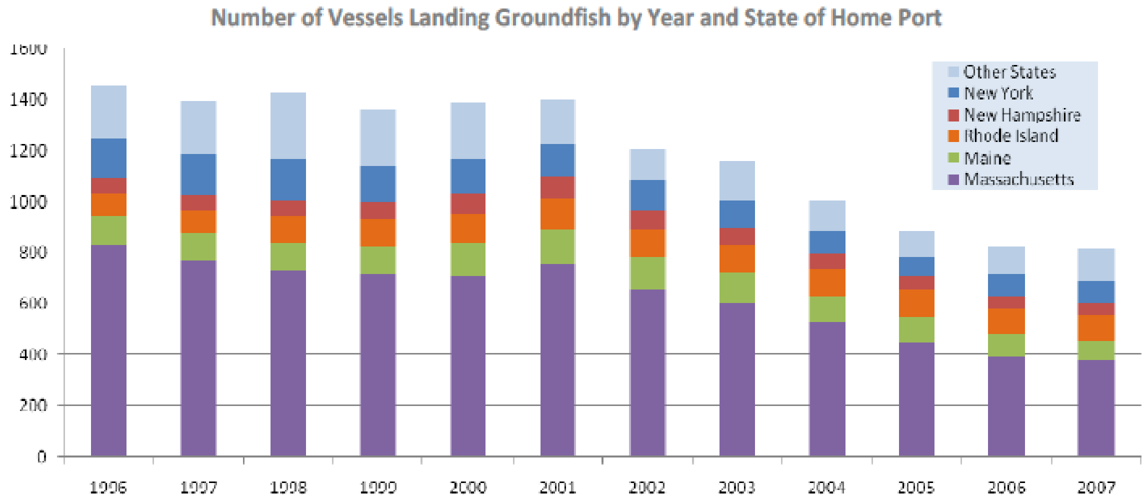
Import Fishery:

Imported groundfish are mostly caught with various bottom trawls, but also set and drift gillnets, longlines, seines, and hand lines.

In none of these fisheries or gear types are mitigation methods specifically for seabirds used, although they may be used by some fishers.

Fishing Vessels and Their Countries of Origin

The US groundfish fishing fleet has diminished significantly over the past half-century. The decline has been seen throughout the region (New England), as can be seen in the figure following.



Source: Current Level of Consolidation of the New England Multispecies Groundfish Fishery. CapLog Group, May 2010.

Management

US-Landed Fishery:

The Northeast Multispecies Fishery Management Plan (FMP) specifies the management measures for thirteen groundfish species (cod, haddock, yellowtail flounder, pollock, plaice, witch flounder, white hake, windowpane flounder, Atlantic halibut, winter flounder, yellowtail flounder, ocean pout, and Atlantic wolffish) off the New England and Mid-Atlantic coasts. The FMP was updated in 2010 to place annual catch limits and accountability measures on fisheries that previously had been managed without a Total Allowable Catch (TAC) limit, using fish sizes, gear and time restrictions, days-at-sea allowances, and some year-round closures. A program of catch shares allocated to sectors of the fishery was adopted in 2010. Neither the management plan nor framework documents contain any provisions to avoid bycatch of seabirds. Observers are required to monitor and report fish catches in order to ensure compliance with the TAC and allocations to sectors.

Import Fishery:

The import fisheries in Europe are managed with TACs, discard prohibition, using fish sizes, season and area closures, minimum mesh size, Vessel Monitoring Systems (VMS), catch reporting, license limitations, and landings and shipment tracking.

Seabird Species and Mortality

US-Landed Fishery:

Though seabird mortality in New England groundfish fisheries is not reported in the National Bycatch Report, a method for estimation is under development. Other sources provide estimates for incidental catches of shearwaters, gulls and gannets in gillnets (NMFS 1998); Common and Red-throated Loons in gillnets (Warden 2010); Red-throated Loons, Common Loons, Northern Gannets, Double-crested Cormorants, Surf Scoters, Black Scoters, and Red-breasted Mergansers in gillnets (Forsell 1999); shearwaters, gulls, gannets, fulmars, storm-petrels, loons, alcids, and other species in gillnets, bottom and mid-water trawls, longlines and scallop dredges (Soczek 2006). See the following table for seabird bycatch estimates for the period 1994-2003, the last for which there are data. Note the difference in bird mortalities between the two time periods 1994-1999 and 2000-2003, which largely results from a decline in numbers of shearwaters caught.

Species group	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Shearwaters	183	138	17	60	24	103	3	4	6	9
Gulls	17	9	4	0	2	1	3	0	1	1
N. Gannets	1	5	1	2	3	0	0	0	1	0
N. Fulmars	7	0	0	0	0	0	0	0	1	0
Loons	6	3	2	10	2	1	8	0	0	1
Alcids	0	7	2	2	0	1	0	1	0	2
Others	4	2	4	0	1	0	0	0	0	1
Unidentified	2	0	3	0	0	0	0	1	1	0
Total	220	164	33	74	32	106	14	6	10	14

Estimated annual average total bycatch of frequently caught species groups by year in New England Sink Gillnet Commercial Fisheries, 1994 - 2003. Source: Soczek (2006)

The following table shows the same information, although broken down by gear type. Note that sink gillnet had the highest bycatch in all cases.

Fishery and years averaged [a]	Shearwaters	Gulls	Northern Gannets	Loons	Others	Total
1994–1999						
Sink gillnet	1510	100	40	70	95	1815
Bottom trawl	10	40	30		10	90
Midwater trawl	35		35			70
Scallop dredge	70	50				120
Pelagic longline [b]	65	65				130
Total	1690	255	105	70	105	2225
2000–2003						
Sink gillnet	200	35	15	40	50	340
Bottom trawl	10	40	30		10	90
Midwater trawl	35		35			70
Scallop dredge	70	50				120
Pelagic longline [b]	65	65				130
Total	380	190	80	40	60	750

a Separate estimates are provided for 1994–1999 and 2000–2003 because analyses indicated significant differences between these two time periods for the sink gillnet fishery. Estimates for other fisheries are averages across the entire 10-year study period and are the same for both time periods.
[b] Total bycatch in the longline fishery was assumed to be comprised of equal numbers of shearwaters and gulls, per U.S. report to ICCAT (NMFS 2004d).

Estimated annual average total bycatch of frequently caught species groups by gear type in New England Commercial Fisheries, 1994 - 2003. Source: Soczek (2006)

Import Fishery:
Bycatch mortality of seabirds has been reported in gillnet fisheries in the Baltic and North Seas and has been the subject of ICES advice for several years. In 2010, ICES estimated the mortality of seabirds in coastal gillnet fisheries in the Baltic and North Sea between 100,000 and 200,000 birds (ICES 2010). Seabird advocates have pressed the EU to adopt a plan of action and recently commented on means to improve the proposed National Plan of Action-Seabirds (NPOA-S). Among documented interactions are Common Murre (=Common Guillemot, *Uria aalge*) in cod gillnets (Osterblom 2002); fulmars in longlines (Dunn 2001); and shearwaters, petrels, fulmars, gannets, gulls, sea ducks, divers, auks, and grebes in gillnet and longline fisheries (Chardine 2000). An ICES synthesis of available information and estimates was completed by the Working Group on Seabird Ecology in 2011. See the following table.

Species	ICES Region										
	I	II	III	IV	V	VI	VII	VIII	IX	X	Total
Divers (loons)			2500-6500	300							2,800-6,800
Northern Fulmar					43,000	12,000					55,000
Great Shearwater							56,000				56,000
Sooty Shearwater						1,600					1,600
Shearwater spp.									>4000		>4,000
Great Cormorant			9,000		1000s						>10000
Northern Gannet								Mod-High	>3000		>>3000
Common Eider			300-400		1000s						>1,400
Great Black-backed Gull						1,200					1,200
Black-legged Kittiwake						5,000					5,000
Sandwich Tern									750		750
Common Guillemot (Murre)			500-6,500	1,200	1000s	1,600					4,300->10300
Razorbill				1,200	1000s	750			130		>22880
Total	0	0	12,300 - 22,400	2,700	> 47,000	22,150	56,000	Mod-High	> 7,880	0	> 167930 – > 177930

Estimated annual bycatch of seabirds in ICES regions. Source: ICES WGSE Report 2011. Data from ICES (2008) updated with Zydelis et al. (2009), Garcia-Barcelona (2009) and Anderson (2011). Area III, North Sea; IV, Baltic; V, Norwegian; VI, NE Atlantic; VII, Gran Sol; VIII & X encompass waters off Spain.

Information

US-Landed Fishery:

The amount and quality of data for the US-landed fishery, off the coast of New England, is poor. Although observers are required to monitor fish catches for sector allocation and TAC limits, the coverage averages about 25 to 30% of trips by sectors. Acquisition of information on birds is not noted in any of the management documents. Fishery observers are tasked with collecting scientific samples of incidental take species such as birds, but this is considered “above and beyond the basics” (Northern Economics Inc. 2011). They are trained in marine mammal identification and necropsy, but not seabirds (Northern Economics Inc. 2011).

Import Fishery:

Likewise, in the fisheries from which Atlantic groundfish are imported, the information quantity and quality is poor. “ICES advises that there is an immediate and critical need for more systematic data collection of seabird bycatch data throughout EU waters and for a standard protocol and format for recording these data. It is impossible to accurately assess the extent of seabird bycatch within EU waters without these developments. These deficiencies can cause gross underestimation of the actual amounts of seabird bycatch” (ICES 2008).

Certification

At least 18 Atlantic groundfish fisheries have been certified or are in the late stages of certification by the Marine Stewardship Council. All are in the northeast Atlantic (Baltic Sea, North Sea, Iceland, Arctic Sea north of Norway) except one, in Canada near the Bay of Fundy. None lands fish directly into the US; any of these fish reaching the US would have to be imported. Fourteen of the fisheries were reviewed by ABC (2012) and judged to be likely Medium Risk or Low Risk to seabirds. They are:

- Atlantic Cod and Haddock Longline, Handline, and Danish Seine Fisheries
- Canada Scotia-Fundy Haddock
- Comapêche and Euronor Cod and Haddock
- Dutch Fisheries Organization (DFO) Gill Net Sole Fishery
- Ekofish Group-North Sea Twin Rigged Otter Trawl Plaice
- Fiskbranschens Sweden Eastern Baltic Cod Fishery
- Germany Eastern Baltic Cod
- Hastings Fleet Dover Sole Trammel Net Fishery
- Hastings Fleet Dover Sole Trawl and Gill-Net
- Küstenfischer Nord eG Heiligenhafen Eastern Baltic Cod
- Norway North East Arctic Haddock Fishery
- Norwegian North East Arctic Cod Fishery
- Osprey Trawlers North Sea Twin-Rigged Plaice
- Scottish Fisheries Sustainable Accreditation Group (SFSAG) North Sea Haddock

During the review, an additional four fisheries were judged to be potentially High Risk to seabirds. These four are:

- DFPO Denmark Eastern Baltic Cod Fishery
- DFPO Denmark North Sea Plaice Fishery
- IGP Icelandic Cod Fishery
- IGP Icelandic Haddock Fishery

Conclusions

US Atlantic and Atlantic import groundfish fisheries are all very large scale. Because most of the fishing is done with trawls, the risk to seabirds is generally not very high. The result is that seabird bycatch is not very high. However, a very significant issue is that observer overage, especially of observers recording seabird bycatch and mortality, is very low. Observer coverage must be improved. This will require increasing the proportion of sets observed, but also improving data collection on seabird bycatch and mortality. This in turn may require training of observers in the appropriate methods. In addition, solutions need to be found for the problems with gillnets. Once found, mitigation methods on gillnet fisheries will have to be required and enforced.

Suzanne Iudicello, Natasha Atkins, Eugene C. Bricklemyer, Brad Gentner, David A. Wiedenfeld, and Ashley Johnson, 5 October 2012

Potentially Medium Risk to Seabirds

THREE NORTH ATLANTIC AND NORTH PACIFIC HERRING FISHERIES

Pacific Herring Gillnet and Purse Seine Fisheries

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
Medium	High	Poor	Poor	Fair	Poor	High
2	3	7	1	13	5	3
5/6		26/100				3/3

Atlantic Herring Gillnet, Trawl, and Seine Fisheries

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
Medium	Medium	Fair	Poor	Fair	Fair	Medium
2	2	11	1	16	14	2
4/6		42/100				2/3

Atlantic Herring Gillnet, Trawl, and Seine Fisheries of the Baltic, North Sea and West of Scotland

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
Medium	Medium	Good	Poor	Fair	Poor	Medium
2	2	15	1	13	7	2
4/6		36/100				2/3

The herring fisheries in both the north Atlantic and Pacific have very little observer information. Although the gear type used is not usually of high risk to seabirds, the lack of information presents significant difficulties for determining the impact of the herring fisheries on seabirds through bycatch. In addition, because seabirds have been thought to not be a significant issue in the herring fisheries, regulating authorities have not made efforts to control bycatch or to require and enforce use of mitigation methods to reduce seabird bycatch. Therefore, it is necessary to obtain high quality information on seabird bycatch, then to use that information to develop regulations and requirements to reduce it.

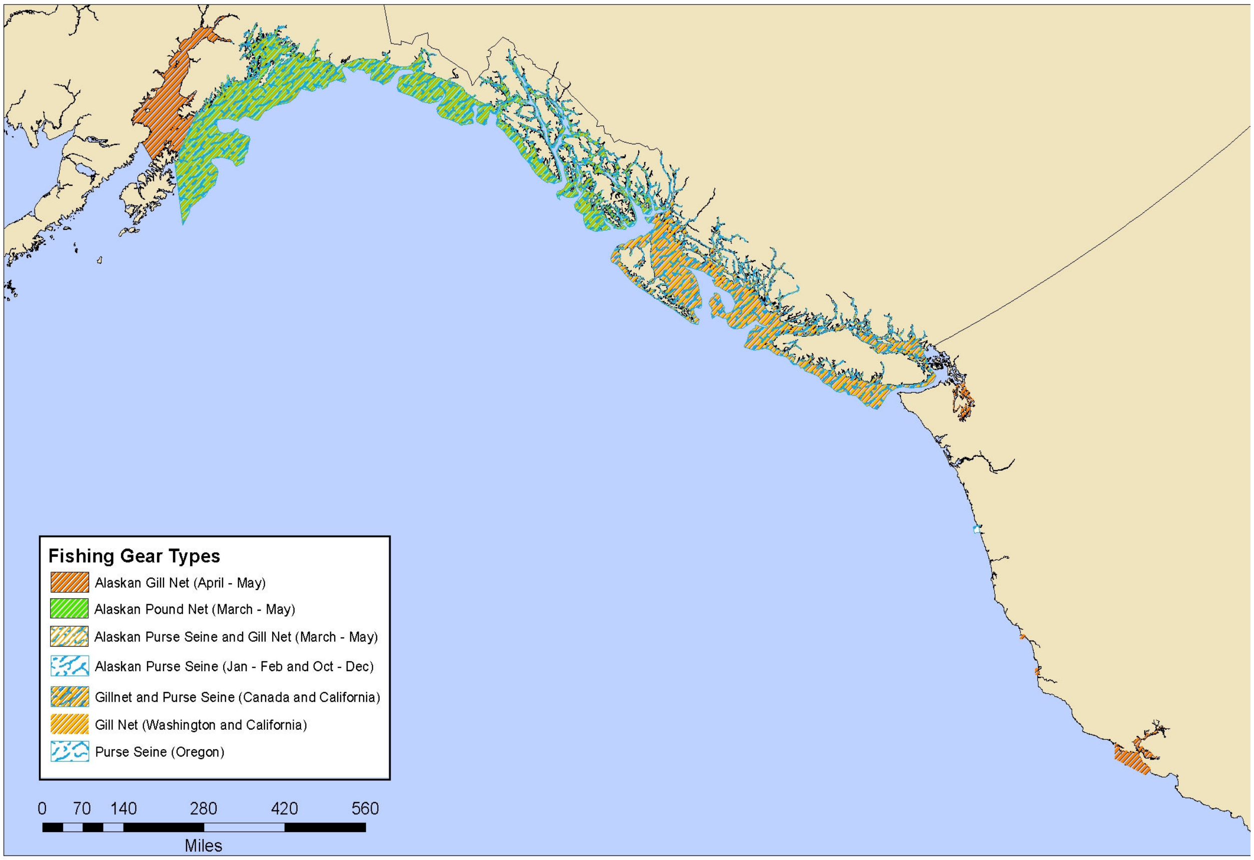
Recommendations

- Obtain high quality observer information on seabird bycatch by establishing and maintaining on-board observer programs. This will require training observers to identify seabirds and to record information on seabird bycatch and interactions.
- Develop regulations and requirements for fishers to use appropriate mitigation methods to reduce seabird bycatch.

Overview

Herring fisheries bringing fish into the US market are all from northern seas and primarily from the north Atlantic, although there is a fishery off of Alaska and British Columbia.

Pacific Herring Gillnet and Purse Seine Fisheries
Fish are caught in gillnets, pound nets (a type of trap), and purse seines. Fishing is all fairly close inshore.



Pacific Herring Fisheries along the West Coast of North America

Herring distribution data obtained from: FAO. © 2003-2012. Aquatic Species Distribution Maps.
In: FAO Fisheries and Aquaculture Department [online]. Rome.
Updated 22 February 2012. [Cited (21/2/2012)]. www.fao.org/figis/geoserver/factsheets/species.html

Atlantic Herring Gillnet, Trawl, and Seine Fisheries
This fishery operates in the northwest Atlantic, and is under jurisdiction of US and Canadian authorities and operates within the US and Canadian EEZs.

Atlantic Herring Gillnet, Trawl, and Seine Fisheries of the Baltic, North Sea and West of Scotland
These fisheries operate in the northeast Atlantic, in the area around Iceland, the North Sea, and Baltic Sea, and under the authority of European governments and agencies.

Products and Market
Pacific Herring Gillnet and Purse Seine Fisheries
Pacific herring is used for bait, roe, and food. Japan is the major market for roe. Herring is canned, frozen, fresh or salted whole. Herring also produce spawn-on-kelp products (spawned eggs attached to kelp), although these are not fished. Japan is also the principal market for spawn-on-kelp.

Atlantic Herring Gillnet, Trawl, and Seine Fisheries
Atlantic herring is used for lobster bait; salted or barreled; in fresh or frozen products; canned as "sardines" for human consumption on the US market; and frozen whole for food export (ASMFC 2006). Cans of "sardines" can actually contain a variety of different herring-like species from around the world, but the sardine cans in New England grocery stores most likely contain young Atlantic herring. Sardines purchased on the West Coast are more likely to be Pacific sardines, not Atlantic herring (GMA 2007c). Beginning in 2007, Amendment 2 to the herring Fishery Management Plan (FMP) prohibits using Atlantic herring for fishmeal and fish oil (ASMFC 2006). Herring scales are used for women's cosmetics and pearlescent paints (GMA 2007a).

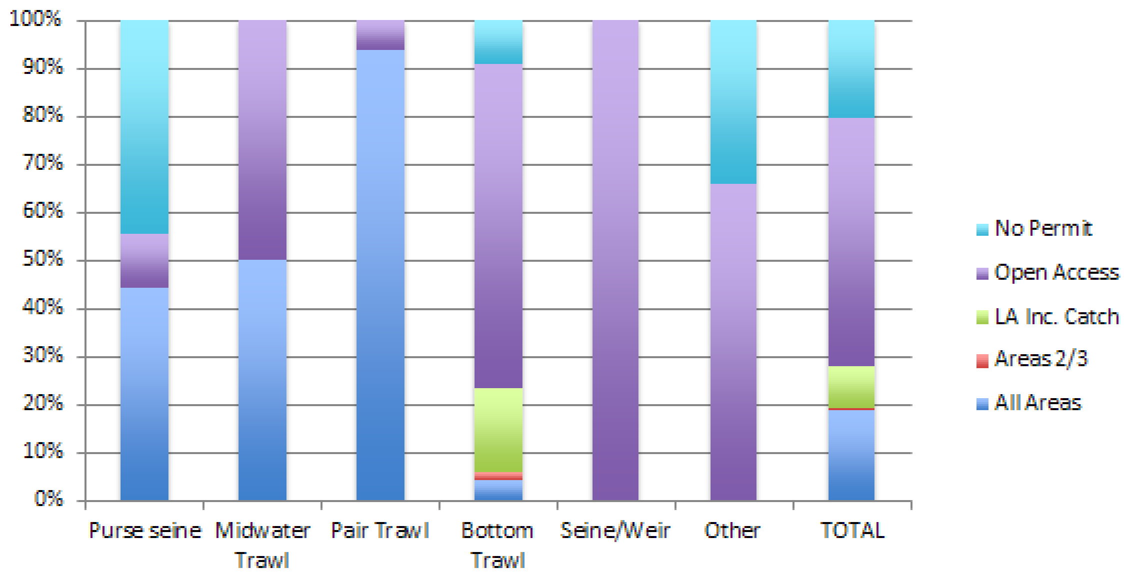
Gear, Set, and Mitigation
Most herring are caught in purse seines and gillnets, although a variety of gears are used.

Fishery	Gear
Pacific Herring Gillnet and Purse Seine Fisheries	Weir and pound net, purse seine, dip net, gillnet
Atlantic Herring Gillnet, Trawl, and Seine Fisheries	Purse seine, midwater trawl and pair trawl, weir, gillnet, bottom trawl
Atlantic Herring Gillnet, Trawl, and Seine Fisheries of the Baltic, North Sea and West of Scotland	Sink gillnet, pelagic trawl, purse seine

None use any mitigation methods for reducing seabird mortality.

Fishing Vessels and Their Countries of Origin
Pacific Herring Gillnet and Purse Seine Fisheries
There are 100+ California permits, and 9-10 for Oregon. Washington state has open access, so the number of vessels varies depending on demand and price. In British Columbia there are 13 vessels with 46 licenses. In Alaska the number of vessels varies by fishery, with 40-100 permits depending on area, and whether the fishery is for bait, food, sac roe, or spawn on kelp.

Atlantic Herring Gillnet, Trawl, and Seine Fisheries
Limited access permits were issued in 2009 to 41 vessels for all areas; 4 vessels for areas 2 & 3; 54 vessels for incidental catch, and 2,272 permits to open access vessels. The figure below shows the types of permits by gear in 2008.



Atlantic Herring Permits by Gear 2008. Source: Final 2010-2012 Specifications, NEFMC.

Atlantic Herring Gillnet, Trawl, and Seine Fisheries of the Baltic, North Sea and West of Scotland
Because of the large diversity of fisheries in the northeast Atlantic herring fisheries, we were unable to determine number of vessels or permits targeting herring.

Management
Pacific Herring Gillnet and Purse Seine Fisheries
Herring are fished commercially for bait in Alaska, British Columbia, Washington, Oregon and California. The value of the spawn on kelp and roe herring fisheries has led to innovative inshore (state) management practices for discrete areas such as bays and estuaries. Management measures include TACs, permits, closed seasons, area closures, gear restrictions, and catch reporting.

Atlantic Herring Gillnet, Trawl, and Seine Fisheries
Atlantic herring is managed cooperatively by the Canadian Department of Fisheries and Oceans (DFO) and provincial authority in New Brunswick, by the Atlantic States Marine Fisheries Commission, New England and Mid-Atlantic Fishery Management Councils and the states. Measures include seasonal closures, TACs distributed to four areas, catch and discard reporting, and requirements for observer monitoring.

Atlantic Herring Gillnet, Trawl, and Seine Fisheries of the Baltic, North Sea and West of Scotland
European herring fisheries are managed by EU Common Fisheries Policy; ICES (International Council for the Exploration of the Sea) advice documents. Management measures include TAC requirements, catch monitoring, and catch reporting.

Pacific Herring Gillnet and Purse Seine Fisheries

The herring fisheries in the Pacific have almost no observer information nor studies of seabird bycatch, and levels of seabird mortality are unknown.

Atlantic Herring Gillnet, Trawl, and Seine Fisheries

Although the management analysis notes that herring are forage species for seabirds, incidental catch of birds in gear is not mentioned in the environmental assessment. Entanglement of 40 Northern Gannets was reported by the Northeast Fisheries Observer Program (NEFOP) in 2008. The National Bycatch Report notes that the Atlantic Red-throated Loon was added during the qualitative process due to concerns over high levels of bycatch. The Red-throated Loon is also on the USFWS list of Birds of Conservation Concern. Warden (2010) reports bycatch of Common and Red throated Loons in gillnet fisheries in the Atlantic region, including herring nets; for data on Common Loons, see following table.

Year	Landings (t)		Observer coverage (%)	Common loon bycatch			
	Total	Observed		Ob-served	Estimated total	CV	CI
1996	8350	360	4.3	2	44	0.56	(16, 123)
1997	8400	460	5.5	10	49	0.31	(27, 88)
1998	9310	540	5.8	2	98	0.49	(39, 243)
1999	8560	480	5.6	1	107	0.70	(31, 370)
2000	7900	380	4.8	8	95	0.79	(24, 372)
2001	7990	250	3.1	0	32	0.42	(15, 72)
2002	8680	240	2.8	0	158	0.61	(52, 476)
2003	9040	330	3.7	1	47	0.51	(18, 122)
2004	13 430	650	4.8	3	194	0.86	(45, 829)
2005	6900	530	7.7	1	20	0.44	(9, 46)
2006	7920	400	5.0	0	10	0.43	(4, 22)
2007	8050	700	8.7	3	37	0.54	(14, 98)
Mean annual					74	0.51	(29, 189)
Total	104 530	5320	5.1	31	891	0.51	(347, 2286)

Estimated bycatch of Common Loons in Atlantic gillnet fisheries. Source: Warden (2010).

Souczek (2006) estimates that midwater single and pair trawls could catch up to 400 seabirds per year. Souczek (2006) also estimates that bycatch in sink gillnets could have been as high as 1,300 individuals per year (upper confidence limit) from 2000 to 2003. See table below.

Year	Total Seabirds		Shearwaters		Gulls		Northern Gannets		Loons	
	Est.	95% CI [a]	Est.	95% CI	Est.	95% CI	Est.	95% CI	Est.	95% CI
1994	3143	644–8002 B	2638	541–6717 B	245	50–624 B	14	3–37 B	87	18–220 B
1995	3280	333–9032 B	2760	280–7600 B	180	18–496 B	100	10–275 B	60	6–165 B
1996	825	33–2040 B	468	19–1156 B	110	4–272 B	28	1–68 B	55	2–136 B
1997	1233	203–3161 B	1000	164–2563 B	0		33	5–85 B	167	27–427 B
1998	640	32–1645 B	480	24–1234 B	40	2–103 B	60	3–154 B	40	2–103 B
1999	1767	106–6960 B	1717	103–5792 B	17	1–56 B	0		17	1–56 B
2000	233	14–682 B	50	3–146 B	50	3–146 B	0		133	8–390 B
2001	150	6–451 B 63–298 P	120	5–361 B 51–238 P	0		0		0	
2002	500	10–1345 B 256–869 P	333	7–897 B 170–580 P	56	1–149 B 28–97 P	56	1–149 B 28–97 P	0	
2003	467	14–1287 B 269–747 P	300	9–827 B 173–480 P	33	1–92 B 19–53 P	0		33	1–92 B 19–53 P

[a] Confidence intervals based on the Poisson distribution are provided only for those years in which Goodness-of-fit tests indicated that this distribution assumption was valid. Bootstrap methods make no distribution assumptions and are provided for all years. B = Bootstrap method, P = Poisson method.

Estimated bycatch of seabirds in Atlantic sink gillnet fishery. Sum of observed trips and estimates for unobserved trips. Source: Soczek (2006).

Information

Pacific Herring Gillnet and Purse Seine Fisheries

There is almost no information on seabird bycatch in the Pacific herring fisheries, as a result of lack of observers or studies.

Atlantic Herring Gillnet, Trawl, and Seine Fisheries

According to the Herring Alliance, monitoring and bycatch data collection on midwater trawl vessels averages only 4% of fishing trips (see table below). Seabirds have been reported entangled in nets, but are not part of the observer data collected. All discards are required to be reported, including "protected species," and NEFOP observers are to report seabird information. However, no method for estimation of seabird bycatch was reported in the National Bycatch Report. The Warden (2010) study is described as "a first step at addressing the lack of comprehensive Atlantic seabird bycatch estimates by examining bycatch of wintering Common and Red-throated Loons in gillnets off of the USA Atlantic coast from 1996 to 2007."

Year	Gear Type	Total Trips	Total Days	Total Herring Landed	Obs Trips	Obs Days	Obs Herring Kept	% trips obs	% days obs	% herring obs
2007	OTF	357	633	10,354,058	12	15	411,751	3%	2%	4%
2007	OTM	137	457	17,489,210	10	40	1,918,285	7%	9%	11%
2007	PTM	240	860	74,401,385	14	58	6,910,185	6%	7%	9%
2007	PUR	345	733	70,082,994	10	23	2,122,267	3%	3%	3%
2008	OTF	90	241	4,603,190	4	4	70,409	4%	2%	2%
2008	OTM	28	103	8,816,600	15	58	3,081,669	54%	56%	35%
2008	PTM	269	1042	110,452,566	44	170	27,293,511	16%	16%	25%
2008	PUR	230	542	58,942,542	27	64	6,941,134	12%	12%	12%
2009*	OTF	100	245	6,949,390	7	11	451,112	7%	4%	6%
2009*	OTM	22	123	3,048,675	7	32	650,071	32%	26%	21%
2009*	PTM	164	660	47,986,029	24	91	12,822,033	15%	14%	27%

**through April 2009*
Pair trawl operations counted as 1 trip and weight is total for the operation
Herring is Atl Herring or Unk Herring
Day defined as (date land - date sail) + 1
Landings data from Vessel Trip Reports

Observer coverage rates on Atlantic herring vessels 2007-2009. Source: Final 2010-2012 Specifications. Source: NEFMC

Certification
The Marine Stewardship Council has certified or has in late stages of assessment the following list of herring fisheries, all from the northeast Atlantic. In an in-depth review of these fisheries (ABC 2012), four of the MSC-certified fisheries were considered to be of potentially medium risk to seabirds:

- Astrid Fiske North Sea Herring Fishery
- Hastings Fleet Pelagic Herring and Mackerel Fishery
- Scottish Pelagic Sustainability Group Ltd. Atlanto-Scandian Herring Fishery
- Scottish Pelagic Sustainability Group Ltd. North Sea Herring Fishery

The remaining fisheries were judged to be of low risk to seabirds:

- CSHMAC Celtic Sea herring, sprat & sardine Trawl
- Danish Pelagic Producers Organisation Atlanto Scandian herring
- Danish Pelagic Producers Organisation North Sea Herring
- Faroese Pelagic Organization (FPO) Atlanto-Scandian Herring
- Norway North Sea and Skagerrak Herring
- Norway Spring Spawning Herring
- Pelagic Freezer-Trawler Association Atlanto-Scandian Herring Pelagic Trawl
- Pelagic Freezer-Trawler Association North Sea Herring
- SPPO North Sea Herring
- SPSG West of Scotland Herring Pelagic Trawl

Conclusions

The herring fisheries in both the north Atlantic and Pacific have very little observer information. Although the gear type used is not usually of high risk to seabirds, the lack of information presents significant difficulties for determining the impact of the herring fisheries on seabirds through bycatch. In addition, because seabirds have been thought to not be significant issue in the herring fisheries, regulating authorities have not made efforts to control bycatch or to require and enforce use of mitigation methods to reduce seabird bycatch. Therefore, it is necessary to obtain high quality observer information on seabird bycatch by establishing and maintaining on-board observer programs. This will require training observers to identify seabirds and to record information on seabird bycatch and interactions. Based on this information, it will be necessary to develop regulations and requirements for fishers to use appropriate mitigation methods to reduce seabird bycatch.

Suzanne Iudicello, Natasha Atkins, Eugene C. Bricklemyer, Brad Gentner, David A. Wiedenfeld, and Ashley Johnson, 26 October 2012

Potentially Medium Risk to Seabirds

NORTHEAST ATLANTIC, SOUTHEAST ATLANTIC, AND EASTERN PACIFIC SQUID FISHERIES

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
Low	Medium	Fair	Poor	Good	Poor	High
1	2	8	1	25	3	3
3/6		37/100				3/3

The squid fisheries bringing food to US markets are not large. However, almost nothing is known of the effects of squid fishing on seabirds. Most of the gear used for squid fishing is of low risk to seabirds, but apparently no mitigation methods are used to reduce seabird bycatch, and there is very little observer information and few studies on seabird bycatch. Because of this, uncertainty about the impact of the squid fisheries remains very high.

Recommendations

- Obtain observer data on seabird bycatch from the squid fisheries. This will require not only placing observers, but observers will also have to be trained in seabird identification and recording of seabird interactions.
- Once information has been obtained, act on that information to reduce seabird bycatch and mortality.

Overview

Squid are fished worldwide, for human food but also for other purposes, especially bait. Many of the fisheries are small and local, especially those for human food, and use a diversity of gears for catching squid. There are six major fisheries that bring squid into the US market:

US-landed

The Hawaii pelagic longline squid
California market squid purse seine fishery
Northern longfin squid net and trawl fisheries
Atlantic shortfin squid trawl fishery

Imported

Argentine-Patagonia squid trawl fishery
Japanese flying squid driftnet and jig fishery

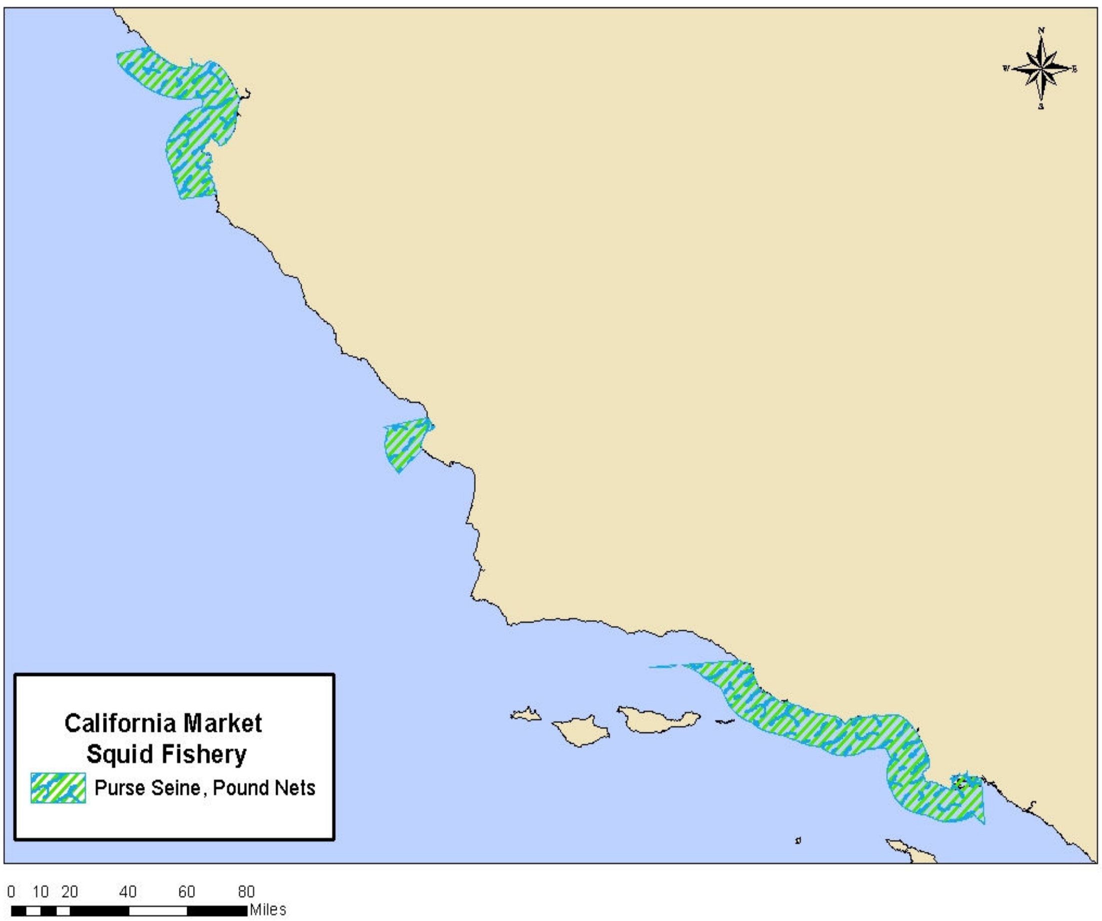
Tonnage and Sources

US squid landings are small, not usually surpassing 20,000 mt. However, imports usually increase the US market to approximately 100,000 mt.

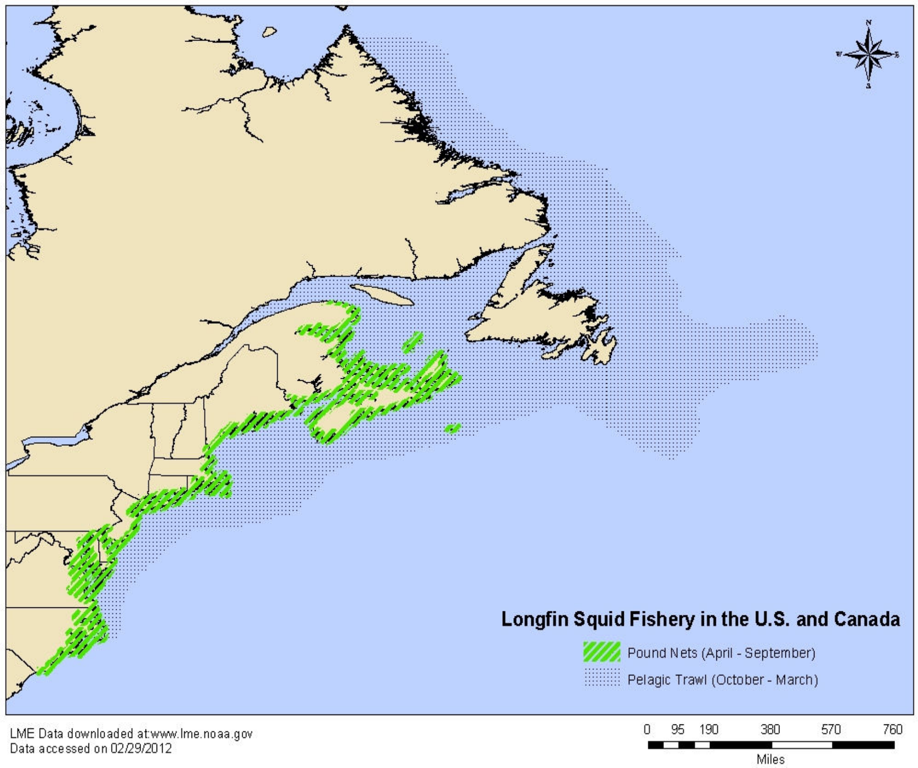
US-landed Squid Fishery	Tonnage (mt)
Hawaii pelagic longline squid	134
California market squid purse seine fishery	29
Northern longfin squid net and trawl fisheries	11,121
Atlantic shortfin squid trawl fishery	6,497

The sources of imported squid are not easy to track. The average overall tonnage in the past five years was 62,886 mt, far larger than the amount landed in the US.

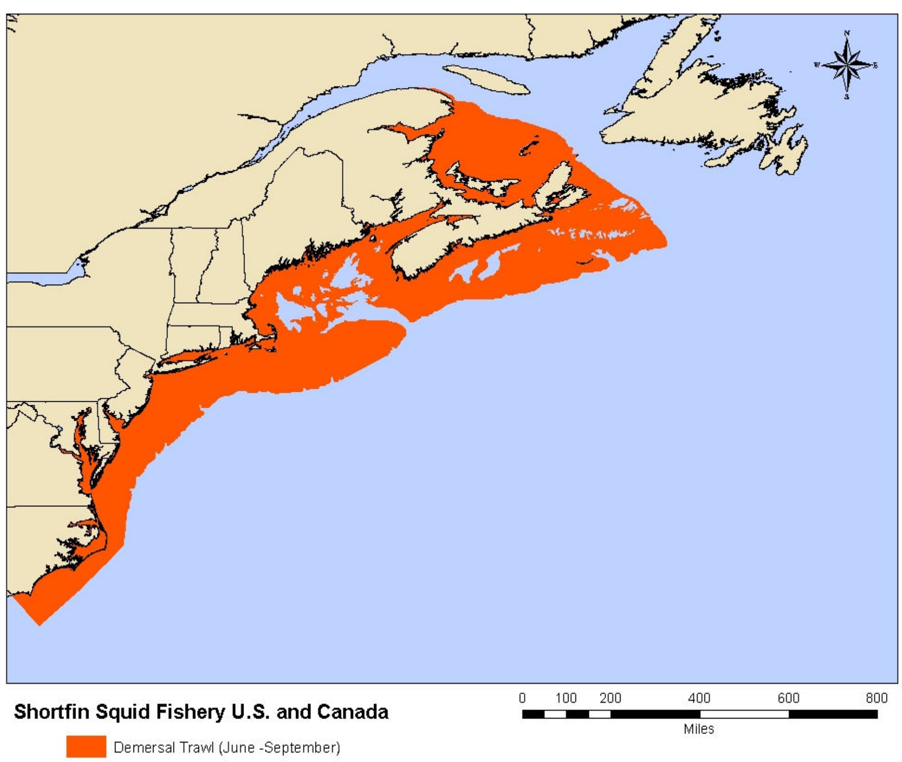
The fishing areas for squid are indicated in the following maps.



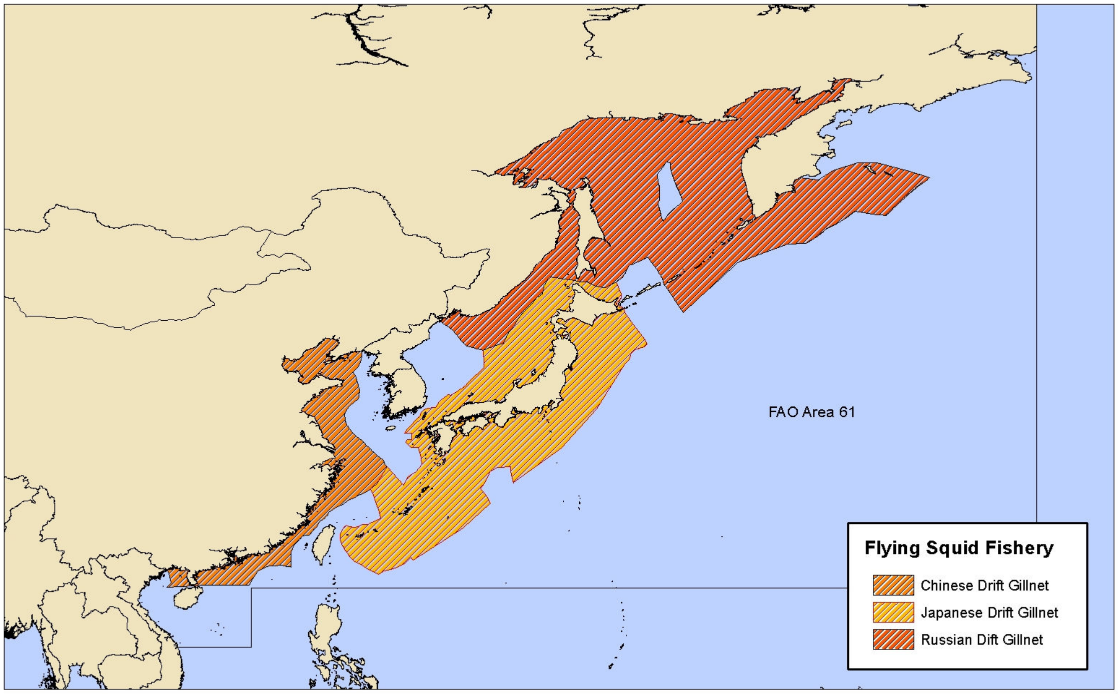
California market squid purse seine fishery and pound net fishery. Pound nets are a type of trap using small-mesh nets attached to upright stakes driven into the seafloor in shallow water. The fishery occurs from north of Los Angeles to Monterrey Bay.



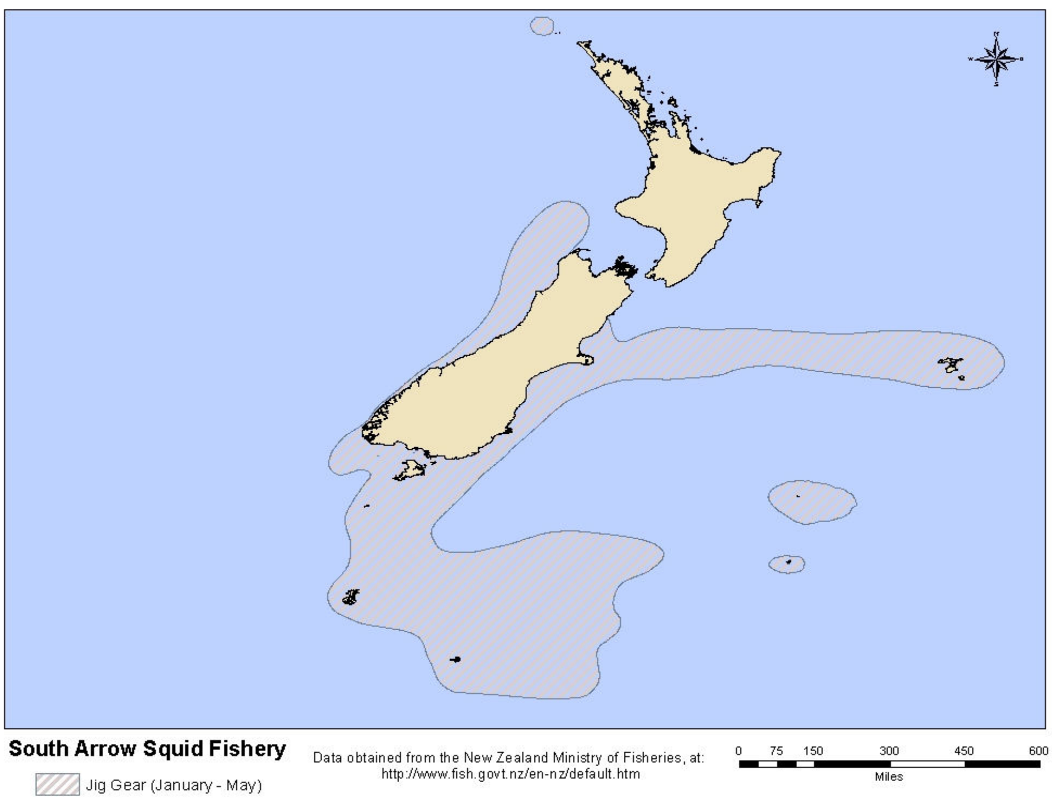
Area of the northern longfin squid net and trawl fisheries. Pound nets are a type of trap using small-mesh nets attached to upright stakes driven into the seafloor in shallow water.



Area of the Atlantic shortfin squid trawl fishery



Japanese flying squid driftnet and jig fishery occurs in the Japanese, Russian, and to a growing extent, Chinese, EEZs.



South arrow squid are fished in the New Zealand EEZ.

Argentine-Patagonia Squid Trawl Fishery
The Patagonian longfin squid (*Loligo gahi*) fleet targets two cohorts (autumn and spring) of the squid in their feeding grounds off the east coast of Patagonia and the Falkland Islands, at depths of 120–250 m.

Products and Market
Hawaii Pelagic Longline Squid
The squid are frozen whole in blocks or tubes.

California Market Squid Purse Seine Fishery
Most California market squid is frozen for human consumption, although small amounts are sold fresh or canned. Market squid is also sold frozen or live as bait for commercial and recreational fisheries.

Northern Longfin Squid Net and Trawl Fisheries
Long-finned squid are available fresh and frozen. Long-finned squid is fished all year and thus is available year-round.

Atlantic Shortfin Squid Trawl Fishery
Short-finned squid is also available fresh and frozen. It caught primarily between June and September; thus fresh short-finned squid is available only in summer and fall, but can be found as a frozen product almost all year.

Gear, Set, and Mitigation
The Hawaiian longline fishery has a subfishery for squid, which are used as bait on the longlines. These squid are caught using jigs. Most other squid are caught in seines or trawls, although some maybe caught in pound nets, a type of trap, or in gillnets. No mitigation methods are used to reduce seabird bycatch in any squid fishery, although most of these gear types are not high risk to seabirds.

Fishing Vessels and Their Countries of Origin
The Hawaiian pelagic longline squid fishery has four large jigging vessels and numerous small hand-line vessels. The California market squid purse seine fishery has 93 vessels registered, all small.

Management
Hawaii Pelagic Longline Squid
The Western Pacific Fishery Management Commission's (WPFMC) Pelagics Fishery Management Plan (FMP) was amended to include squid, and requires that vessels greater than 50 ft in length overall that fish for pelagic squid in US EEZ of the western Pacific obtain federal permits. They are required to carry federal observers if requested by NMFS, and to report any

Pacific pelagic squid catch and effort either in federal logbooks or via existing local reporting systems.

California Market Squid Purse Seine Fishery
This fishery is managed by California Department of Fish and Game through gear limits and time/area closures. Monitoring is maintained through logbooks, observers, and port samplers.

Northern Longfin Squid Net and Trawl Fisheries and **Atlantic Shortfin Squid Trawl Fishery**
These two fisheries are managed through limiting the number of licenses, annual catch limits (ACLs), and limitation on season and gear types. The fishery has a FMP through the Mid Atlantic Council.

Japanese Flying Squid Driftnet and Jig Fishery
An international, large-scale squid jigging fishery (multi-species) exists on the Pacific high seas. This includes both foreign and a few domestic (US-flagged) fishing vessels. The Japanese jigging fleet was dominant in the North Pacific, but is rivaled now by a rapidly growing Chinese fleet. The fishery is seasonal with most vessels switching to the Southern Hemisphere during the antipodean summer (October – February). Three domestic squid jig vessels fished for squid in the North Pacific for a month or less in the summer of 2003, catching *O. bartramii*, (red flying squid) on the high seas and offloading it in Japan.

Seabird Species and Mortality
There is almost no information on seabird mortality resulting from directed squid fishing. Logbooks and anecdotal reports from limited squid jigging in the North Pacific by four US vessels provide no evidence of any interactions with seabirds. According to Sullivan et al. (2006), in the Argentine-Patagonia squid trawl fishery, “due to the typically homogenous nature of *Loligo* [longfin squid] catches and processing practices, whereby the fish are packed whole for freezing, there is relatively little offal discharge produced in this fishery compared to finfish trawlers. There is therefore a significantly reduced mean hourly rate of contacts between seabirds and warp cables, which greatly reduces the likelihood of mortality.”

Information
There is very little observer information from any directed squid fishery. In the Hawaii pelagic longline squid fishery, observers are placed on boats, but it is not clear if the observers record seabird bycatch or only that of sea turtles. The boats must also maintain a logbook. In the California market squid purse seine fishery there has been a preliminary assessment of data from at-sea observers, with little result. None of the other fisheries have anything beyond single short-term studies.

Certification
The Marine Stewardship Council has certified no squid fisheries.

Conclusions

Almost nothing is known of the effects of squid fishing on seabirds. Most of the gear used for squid fishing is of low risk to seabirds, but apparently no mitigation methods are used to reduce seabird bycatch. Because of the very large gap in observer information the level of uncertainty of the impact of the squid fisheries is very high. Therefore, it is imperative to obtain observer data on seabird bycatch from the squid fisheries. This will require not only placing observers, but observers will also have to be trained in seabird identification and recording of seabird interactions. Once this information has been obtained, it will be necessary to act rapidly on that information to reduce seabird bycatch and mortality.

Suzanne Iudicello, Natasha Atkins, Eugene C. Bricklemyer, Brad Gentner, David A. Wiedenfeld, and Ashley Johnson, 19 October 2012

Potentially Medium Risk to Seabirds

PATAGONIAN TOOTHFISH / CHILEAN SEA BASS LONGLINE FISHERY

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	High	Good	Good	Good	Good	Medium
3	3	16	23	27	17	2
6/6		83				2/3

In the 1990s the toothfish fishery was one of the worst transgressors with regard to seabird bycatch. Regulations and enforcement of use of effective mitigation methods by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and adoption of those mitigation methods in non-CCAMLR areas has greatly reduced seabird bycatch, by about 99%. The fishery must still be considered possibly medium risk to seabirds, however, because of the unknown impact of IUU (Illegal, Unregulated, or Unreported) fishing, which is estimated at about 4% of the total catch of toothfish.

Recommendations

- Reduce IUU fishing through improved enforcement.
- Continue monitoring of all toothfish fisheries, to ensure that compliance with CCAMLR and national regulations is maintained, and that seabird bycatch does not increase.

Overview

Two related species from the Southern Ocean are known as the Patagonian toothfish (*Dissostichus eleginoides*) and the Antarctic toothfish (*Dissostichus mawsoni*). These fish are usually caught using demersal longlines.

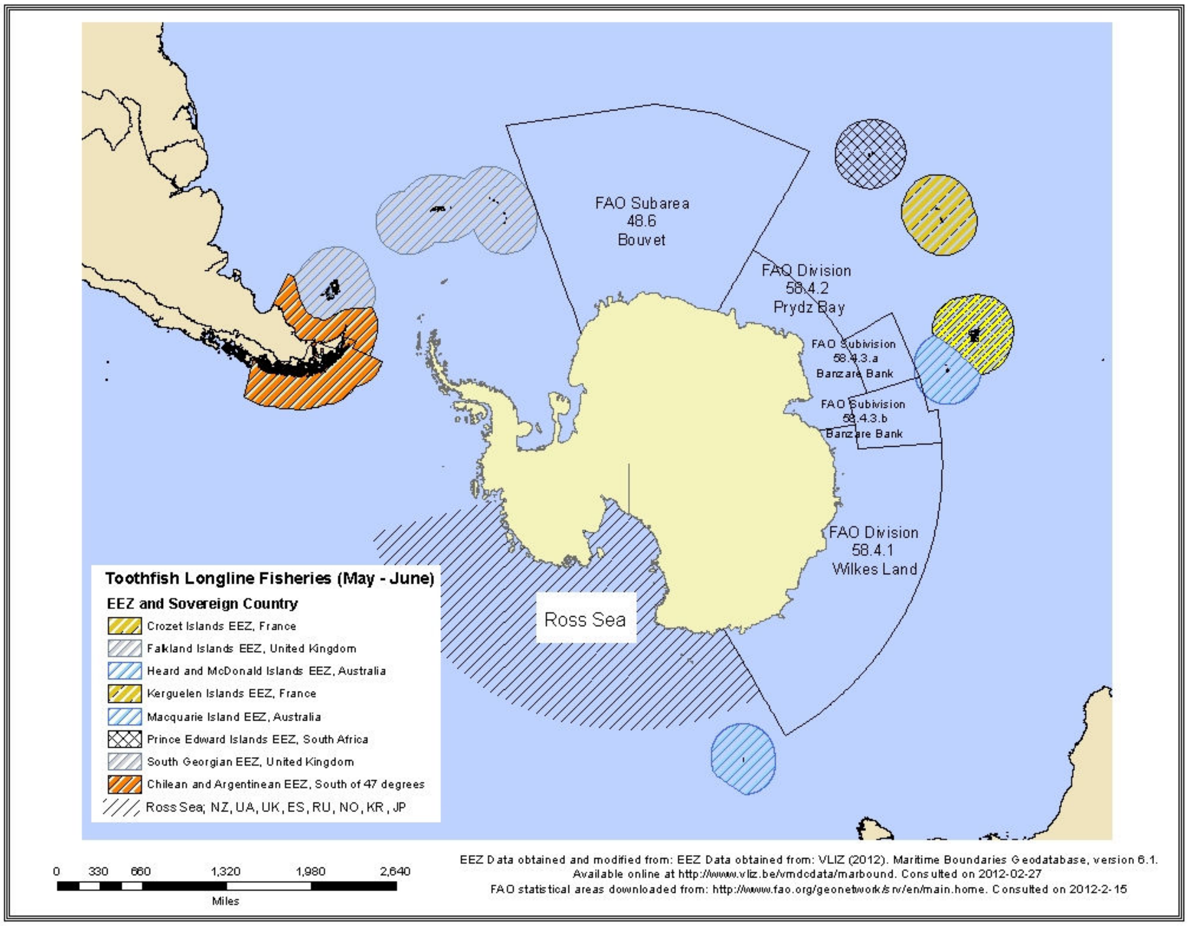
The Australian Heard Island & McDonald Islands Patagonian Toothfish and Macquarie Island Toothfish fisheries, Ross Sea Toothfish Longline Fishery, and South Georgia Patagonian Toothfish Longline Fishery have been certified as sustainable by the Marine Stewardship Council.

Tonnage and Sources

Patagonian toothfish occupy the deep-water shelves and banks around South America and the sub-Antarctic islands. Although the species occurs all around the Antarctic, the main stocks occur around the continental and islands shelves of the Atlantic and southern Indian Oceans:

- Atlantic:
    - Argentina (coastal waters)
    - Falkland Islands and South Georgia (UK)
- Indian Ocean:
    - Prince Edward and Marion Islands (South Africa)
    - Crozet Island and Kerguelen Island (France)
    - Heard and McDonald Islands (Australia)
- Pacific Ocean:
    - Chile (coastal waters)
    - Macquarie Island (Australia)

The fishery areas can be seen in the map, below.



In the 2009-2010 season, 67 vessels landed 14,462 mt of a TAC of 20,296 mt. The greatest tonnages were from vessels from Chile (4,242 mt), Kerguelen Islands (2,977 mt), South Georgia (2,522 mt), and those fishing in the Ross Sea (2,428 mt).

Toothfish catches by IUU vessels, while greatly reduced, remain at approximately 4% of the legal harvest (COLTO 2011). Despite the great decline in IUU harvest, IUU vessels have proven very adaptable to enforcement actions (High Seas Task Force 2006, Österblom et al. 2010), meaning that serious questions remain about the actual level of IUU catch. Without monitoring of these vessels, levels of seabird bycatch in IUU fisheries, while greatly reduced in the past decade, are still unknown.

Products and Market

The US and Japan are the top importers of toothfish, for white tablecloth restaurants and sashimi.

In 2010 the US imported 7,905 mt of toothfish, or 40% of the legal catch (CCAMLR 2011). In 2011 the U.S. imported 9,885 mt of toothfish. The five-year average imports were 18,939.3 mt.

Toothfish is marketed as Patagonian toothfish, Antarctic toothfish, Chilean sea bass, Antarctic cod, black hake, Antarctic or Patagonian blenny, and icefish. In the US it is sold as frozen whole fish (headed and gutted), frozen fillets, and fresh fillets.

Gear and Set

Almost all toothfish are caught using demersal longlines, although a small amount is caught by midwater trawl, mostly by Australian boats.

Mitigation measures required or used in the CCAMLR area include use of streamer lines, night setting, prohibition of discharge of offal and other waste, seasonal restrictions during bird breeding, incentives to extend fishing if bird mitigation criteria are met, required reporting of interactions with seabirds within 24 hours of occurrence, and immediate development and implementation of a response plan to minimize further interactions, and delineation of permanent protected areas. In the trawl fisheries, third-wire cables are banned.

Fishing Vessels and Their Countries of Origin

In the EEZ waters of each country, vessels are restricted to home-country flag. However, vessels fishing in CCAMLR waters include those of US, Japan, Korea, Norway, Russia, and Spain.

Country	No. Vessels	Size (LOA)
Australia	3	87 m
Chile	11	48 - 56 m
Japan	1	47.2 m
Korea	4	48 – 61 m
New Zealand	4	46 – 62 m
Norway	1	46.58
France	1	56.4 m
Russia	3	48 – 49 m
South Africa	2	45 – 57 m
Spain	1	55 m
U.K.	3	46.58 m

Management

The longline fisheries in FAO Areas 48, 58, and 88 are managed by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). Fisheries in the EEZs of Argentina, Australia, Chile, and the Falkland Islands are managed by national fishery authorities, applying standards established by the CCAMLR. Minimal catches are also taken in the national waters of New Zealand and South Africa.

Because most Patagonian and Antarctic toothfish occur in marine areas under CCAMLR's jurisdiction, it serves as the world's primary toothfish management body (Monterey Bay Aquarium 2006, 2011). Management of the various toothfish fisheries occurs in accordance with measures developed under the convention. Member nations are responsible for enforcing CCAMLR measures on their respective flag vessels.

In addition to general policies such as precautionary approach and conservation of the stocks, specific toothfish conservation and management measures include:

- Season (see below for areas where seasons are set and the seasons), area, and gear restrictions
- Annual licensing of individual vessels to specific areas
- Annual catch quotas
- Catch documentation scheme
- Observers
- Vessel monitoring system requirement
- Aerial monitoring and enforcement patrols
- Marine protected areas
- Required environmental-impact review before undertaking new toothfish fisheries
- Closures of areas south of Australia to longlining in order to protect seabirds.

The fishing season is dependent on ice conditions and is set for specific areas. In 2010 those were:

- South Georgia: May–Aug
- Falkland Islands: Year-round
- South Africa: Year-round
- Heard Island/McDonald Island (Australia): May–September
- Macquarie Island (Australia): April until TAC reached

Chile and Australia are responsible for toothfish fisheries in their own territorial waters north of CCAMLR's zone of authority. Their management systems closely follow and adhere to CCAMLR policies and requirements.

As a member of CCAMLR, the US enacted regulations to implement provisions preventing US imports of toothfish caught by illegal, unreported, or unregulated (IUU) fisheries. Among other provisions, these rules:

- Lengthen permits to enter CCAMLR Ecosystem Monitoring Program (CEMP) sites from one to five years – possibly as a reward for those who fish in properly designated areas;

- Define the CCAMLR fishing season as December 1 through November 30 (i.e. year-round) for US vessels fishing for Antarctic marine living resources – currently there are only three US vessels and none of them actually fish for toothfish;
- Require US vessels harvesting Antarctic marine living resources in areas of CCAMLR to use an automated satellite-linked vessel monitoring system;
- Require foreign entities to designate and maintain a registered agent to act as a business liaison within the US;
- Prohibit the import of toothfish species caught in areas outside CCAMLR-monitored areas;
- Prohibit the import of toothfish that have been seized or confiscated from illegal catches, even if they have been issued a Specially Validated Dissostichus Catch Document;
- Institute a preapproval system for US seafood receivers and importers/re-exporters of toothfish species.

Species
Affected seabird species include:
- Gray-headed Albatross (*Thalassarche chrysostoma*)
- Yellow-nosed Albatross (*T. chlororhynchos*)
- Black-browed Albatross (*T. melanophris*)
- Southern Giant-Petrel (*Macronectes giganteus*)
- Northern Giant-Petrel (*M. halli*)
- White-chinned Petrel (Procellaria aequinoctialis)
- Gray Petrel (*P. cinerea*)
- Cape Petrel (*Daption capense*)
- Brown Skua (*Stercorarius antarcticus*)

Prior to the implementation of conservation and mitigation measures in the late 1990s, catch rates ranged from <0.10 to 0.67 birds/1000 hooks set. In one of the first comprehensive analyses, seabird bycatch varied seasonally, with distance from breeding site, and with time of day, and in the case of the Prince Edward Islands fishery, nearly all were adults of breeding age. Estimated mortality from IUU fisheries may have been as much as 20 times the observed incidental take in the legal fisheries.

Recent data (2009/2010 season), however, show bycatch was very low (CCAMLR 2012):

Area	**Mortalities**
South Georgia	2 (1 Gray-headed Albatross and 1 Black-browed Albatross)
South Sandwich Islands	None
Kerguelen Islands	60 (42 White-chinned Petrels, 15 Gray Petrels, 1 Northern Giant-Petrel, and 1 unidentified bird)
Heard Island / McDonald Island	2 Cape Petrels
Crozet Island	24 White-chinned Petrels
Prince Edward Island	None. This is the fifth consecutive year of no observed seabird bycatch in this fishery.

No new estimates of potential seabird removals by IUU fishing have been calculated recently.

The MSC, the Coalition of Legal Toothfish Operators (COLTO), and BirdLife International report significant reductions in seabird mortality following the implementation of mitigation measures in CCAMLR toothfish fisheries. "Seabird deaths around South Georgia in the CCAMLR zone of the Southern Ocean have declined by 99% since regulations were enforced," according to a news post in September 2011 (BirdLife International 2011).

The Coalition reports that in the Ross Sea, fisheries have had no bird mortality for more than a decade (COLTO 2011). "Although seabird mortality as a result of fishing was relatively high before the year 2000 strong management measures including a restriction on daytime setting, the discarding of any offal with hooks, and control of IUU fishing have reduced these numbers to almost zero" (COLTO 2011).

Information
Compliance with mitigation methods required by the CCAMLR is very high, as there are two observers on each vessel with 100% coverage of all fishing activities (the observers monitor TAC compliance, non-target species caps, and the bycatch of marine mammals and seabirds). In addition, automated satellite monitoring systems are required on each boat, providing position data on a regular basis to the management agencies and CCAMLR (data can be collected to every 30 seconds for position; Marine Stewardship Council 2012).

Certification
The Australian Heard Island & McDonald Islands Patagonian Toothfish and Macquarie Island fisheries, Ross Sea Toothfish Longline Fishery, and South Georgia Patagonian Toothfish Longline Fishery have all been certified by MSC as sustainable. The Kerguelen and Crozet fisheries are under assessment.

Conclusions
Good governance, specifically CCAMLR's leadership on development and implementation of seabird mitigation and other management measures and its coordination with fishing nations adjacent to the Convention area, has been remarkably successful at reducing seabird mortality in the Southern Ocean toothfish fisheries. Nonetheless, toothfish catches by IUU vessels, while greatly reduced, remain a significant issue, even at approximately 4% of the legal harvest. Without getting control over these vessels and monitoring their bycatch, levels of seabird bycatch in IUU fisheries, while greatly reduced in the past decade, will remain a significant problem.

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Potentially Medium Risk to Seabirds

US TUNA ATLANTIC PELAGIC LONGLINE FISHERY

Gear	Birds Present	Regulations	Mitigation	Bycatch	Observation	Uncertainty
High	High	Fair	Poor	Good	Fair	Medium
3	2	11	1	25	9	2
5/6		46/100				2/3

The US component of Atlantic tuna pelagic longline fishery is small. It occurs in an area where few threatened seabird species occur, and actual seabird bycatch appears to be generally low, although no seabird-specific mitigation methods are required. Management within US waters is good, and outside US waters the fishery is regulated by the International Commission for the Conservation of Atlantic Tunas (ICCAT). ICCAT requires seabird-specific mitigation methods in other parts of its coverage area, but not in the area of the US fishery. Observer coverage is at an acceptable level, above 10% in recent years. However, an assessment required under the National Plan of Action-Seabirds has not been completed in the specified time.

Recommendations

- Fulfill the requirements of the National Plan of Action-Seabirds to fully assess seabird bycatch. Fulfilling this requirement has been postponed for too long.
- Maintain observer coverage above 10%.
- Observers should be trained to identify seabirds and to properly record seabird bycatch and mortality.
- Require mitigation methods for seabirds. The most effective methods are bird-scaring (tori) lines. The ICCAT already requires use of bird-scaring lines in some areas; this requirement should be applied to the entire ICCAT region, which includes the US Atlantic pelagic longline fishery.

Overview

The US component of the Atlantic pelagic longline fishery is small, fishing for all tuna, but primarily albacore, skipjack, yellowfin, and bigeye tunas. It falls under regulation of the ICCAT, and the National Plan of Action-Seabirds, as well as US federal and sometimes state regulations. There is no component of the fishery that is certified by the Marine Stewardship Council, although the Southeast US North Atlantic Big Eye Tuna and Yellowfin Tuna Fishery is currently in assessment.

Tonnage and Sources

The amount of tuna landed by US <u>Atlantic</u> pelagic <u>longline</u> fishing boats has averaged about 1,440 mt over the last five years. Note that a large portion of tuna eaten in the US is imported.

Products and Market

Americans eat about 380,000 mt/yr of tuna from all sources, including US landed and imported, all forms, including fresh and canned, and from all gear types.

Albacore tuna is sold as "white" tuna, while skipjack and yellowfin are sold as "light" tuna. Albacore tuna is the only species authorized to be labeled "white meat tuna" in the United States. The canned tuna sold in supermarkets or in foodservice outlets, delis, or in tuna sandwiches is either albacore or a mixture of skipjack and yellowfin tuna. "Light tuna" which consists mostly of skipjack and small amounts of yellowfin is the less expensive product and represents the largest portion of canned tuna sales in the US. Fresh or frozen tuna loins or steaks sold in retail stores and restaurants are generally yellowfin, bigeye, or albacore tuna. High quality or "sushi grade" bigeye and bluefin tuna are delicacies that are usually used in sushi and sashimi dishes. Yellowfin caught in purse seines is primarily used for canning, while yellowfin caught with longlines is used for sashimi (Hall 1998; Beverly 2002). Yellowfin is also sold fresh, frozen, or smoked. Bigeye is sold fresh, frozen, and canned (Froese and Pauly 2005). The higher value, longline-caught bigeye is often used for sashimi. The majority of albacore is processed for canning. Albacore is also sold fresh, smoked, and deep frozen (Froese and Pauly 2005), and is often used for sushi and sashimi.

Gear and Set

In the US northwest Atlantic fishery, the majority of tunas are caught using pelagic longlines, although the overall amount is relative small, about 1,440 mt. In 2010, these pelagic longline fishermen averaged 837 hooks per set.

No mitigation was used specifically for seabirds, but in the International Commission for the Conservation of Atlantic Tunas (ICCAT) area pelagic longline vessels may only fish if they observe strict circle hook and bait restrictions and use approved sea turtle release gear in accordance with release and handling protocols.

Management

NMFS manages Highly Migratory Species (HMS) at the international, national, and state levels, coordinating management of HMS fisheries in federal waters and the high seas (international) while individual states establish regulations for HMS in state waters. In 2006 the agency consolidated swordfish, tunas, sharks and billfish into one Fishery Management Plan (FMP). The Atlantic pelagic longline fishery targeting species managed by the ICCAT, such as bigeye, albacore, skipjack and yellowfin tunas, is subject to several discrete time/area closures to reduce all bycatch (e.g., undersized swordfish, billfish, etc.). The U.S. Atlantic pelagic longline fishery for tuna operates under limited access permits—about 240 permits in 2011. Other regulations include minimum sizes for yellowfin tuna, bigeye tuna, and bluefin tuna; bluefin tuna target catch requirements; shark quotas; protected species incidental take limits; reporting requirements (including logbooks); gear and bait requirements; limited access vessel permits, and mandatory workshop requirements.

Seabird Species and Mortality

Gannets, gulls, shearwaters, and storm-petrels are occasionally hooked by Atlantic pelagic longline fishers. According to the annual report to ICCAT, depending on modeling approach, the total estimated US seabird bycatch ranged from 26 to 122 seabirds in 2010 in the Atlantic pelagic longline fleet. Extrapolated estimates of seabird bycatch have varied substantially since 1992. Live discards ranged from zero to 486 per year, averaging 60 per year. Estimates of dead discards of seabirds ranged from zero to 623 per year, averaging 150 per year. The annual bycatch rate of birds discarded dead ranged from zero to 0.015 birds per 1,000 hooks, while the rate of total seabird catch ranged from zero to 0.106 birds per 1,000 hooks.

The following table gives observed seabird bycatch in the US Atlantic pelagic longline fishery, 2004-2010. Abbreviations in the "Area" column refer to NMFS Statistical Areas: MAB = Mid-Atlantic Bight; NEC = Northeast Coast; SAB = South Atlantic Bight; GOM = Gulf of Mexico. NED denotes a specific survey, the Northeast Distant Fishery Experiment, conducted on the Grand Banks off Newfoundland.

Year	Month [1]	Area	Type of Bird	Number observed	Status
2004	1	MAB	Gull	5	dead
2004	3	MAB	Shearwater greater	1	alive
2004	3	MAB	Shearwater greater	4	dead
2004	4	NED	Seabird	1	dead
2005	1	SAB	Gull herring	1	dead
2005	1	SAB	Shearwater spp	1	dead
2005	3 [2]	NEC	Shearwater greater	1	alive
2005	3 [2]	NEC	Shearwater greater	1	dead
2006	4	MAB	Shearwater greater	1	dead
2006	4	NEC	Shearwater spp	1	alive
2006	4	NED	Shearwater greater	1	dead
2007	1	MAB	Gull blackbacked	6	dead
2008	2	GOM	Pelican brown	1	alive
2009	1	MAB	Northern gannet	2	alive
2009	1	MAB	Northern gannet	1	dead
2009	2	GOM	Brown pelican	1	dead
2009	3	MAB	Shearwater greater	3	dead
2009	3	MAB	Unid	1	dead
2010	4	MAB	Gull herring	1	dead

Information

Commercial HMS fisheries following ICCAT rules are monitored through a combination of vessel logbooks, dealer reports, port sampling, scientific observer coverage, and vessel monitoring systems. Logbooks contain information on fishing vessel activity, including dates of trips, number of sets, area fished, number of fish, and other marine species caught, released, and retained.

Seabird bycatch in longline fisheries is to be assessed as one of the actions under the US National Plan of Action—Seabirds (NPOA-S). Seabird bycatch assessment was to have been completed within two years of adoption of the NPOA-S, or in 2003. However, the only reports are for Alaska and Hawaii fisheries; no report has been made in either the annual bycatch reports or annual bycatch engineering reports for other pelagic longline fisheries. Reports on specific projects are available, but not in the form of an assessment.

The observer coverage of the longline fishery in the Atlantic has generally been less than 10% of sets, although recent years (2007 - 2010) have all had coverage greater than 10%, reaching a high proportion of 17% in 2009.

The following table gives observer coverage of the US Atlantic pelagic longline fishery. "NED" is the Northeast Distant Fishery Experiment, conducted on the Grand Banks off Newfoundland. "EXP" refers to other experimental fishing.

Year	Number of Sets Observed			Percentage of Total Number of Sets		
1999	420			3.8%		
2000	464			4.2%		
	Total	Non-NED	NED	Total	Non-NED	NED
2001*	584	398	186	5.4%	3.7%	100%
2002*	856	353	503	8.9%	3.9%	100%
2003*	1,088	552	536	11.5%	6.2%	100%
	Total	Non-EXP	EXP	Total	Non-EXP	EXP
2004**	702	642	60	7.3%	6.7%	100%
2005**	796	549	247	10.1%	7.2%	100%
2006	568	-	-	7.5%	-	-
2007	944	-	-	10.8%	-	-
2008	1,190	-	101***	13.6%	-	100%***
2009	1,588	1,376	212***	17.3%	15.0%	100%***
2010	884	725	159***	11.0%	9.7%	100%***

Observer coverage of the pelagic longline fishery. Source: NMFS 2011 SAFE Report, Chapter 4.

*In 2001, 2002, and 2003, 100% observer coverage was required in the NED research experiment.

** In 2004 and 2005,there was 100% observer coverage in experimental fishing (EXP).

*** In 2008-2010, 100% observer coverage was required in experimental fishing in the FEC [Florida East Coast], Charleston Bump [area from the Florida Straits north to the bend in the Gulf Stream off Charleston, South Carolina], and GOM [Gulf of Mexico], but these sets are not included in extrapolated bycatch estimates because they are not representative of normal fishing.

Certification

Three US tuna fisheries have been certified by the MSC and a fourth is in assessment, falling under the jurisdiction of two Regional Fishery Management Organizations (RFMOs), the Inter-American Tropical Tuna Commission (IATTC) and the International Commission for the Conservation of Atlantic Tunas. Only one of these uses a gear type that is high risk to seabirds, longline.

Certified Fishery	**Gear Type**	**RFMO**
American Albacore Fishing Association Pacific Albacore Tuna – North (certified)	Pole and line, troll and jig	IATTC
American Albacore Fishing Association Pacific Albacore Tuna – South (certified)	Pole and line, troll and jig	IATTC
American Western Fish Boat Owners Association (WFOA) North Pacific Albacore Tuna (certified)	Pole and line, troll and jig	IATTC
Southeast US North Atlantic Big Eye Tuna and Yellowfin Tuna Fishery (in assessment)	Longline	ICCAT

Conclusions

Although the US Atlantic pelagic longline fishery occurs in an area where few threatened seabird species occur, and actual seabird bycatch appears to be generally low, there is still some uncertainty. Part of this arises from the fact that the assessment required under the NPOA-S has not been completed in the specified time. In addition, no seabird-specific mitigation methods are required in the fishery, although ICCAT requires seabird-specific mitigation methods (use of bird-scaring lines) in other parts of its coverage area.

To ensure that this fishery is not causing significant seabird mortality or bycatch, it is necessary to finalize the seabird bycatch assessment required under the NPOA-S. Observer coverage and training can also be improved, and should remain above 10% of sets.

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