NATIONAL MARINE FISHERIES SERVICE

ALASKA REGION

Copies of O/Hs used

EFFORTS TO REDUCE SEABIRD BYCATCH IN COMMERCIAL LONGLINE FISHERIES OFF ALASKA

Prepared by the National Marine Fisheries Service
for a Meeting of the
North Pacific Fishery Management Council

Anchorage, Alaska
December 7-11, 1998

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Problem:

Seabirds are attracted to 'food' (bait & offal) associated with fishing vessels. In longline operations, birds may gain access to baited hooks, become hooked, and pulled underwater and drowned with the setting gear.

Solutions:

- Reduce attractiveness of vessel to seabirds

- Prevent or distract seabirds from accessing area where gear is set

How?

- Education & outreach

- Conscientious & consistent use of effective seabird avoidance measures by fishermen

NMFS REQUIREMENTS UNDER THE ENDANGERED SPECIES ACT

The current non-discretionary measures in the U.S. Fish & Wildlife Service's (FWS) Biological Opinions for the groundfish and Pacific halibut fisheries off Alaska are as follows:

- Observer data on short-tailed albatross (STALB) sightings and groundfish fishery interactions is collected.
- Observers are trained in seabird identification and provided with instructions and materials for reporting STALB observations.
- STALB observations and interactions in the halibut fishery are reported to NMFS and FWS (via IPHC port samplers).
- Incidental take of any STALB is reported to FWS.
- Live-caught STALB are released.
- Dead STALB are tagged with complete catch information and delivered to FWS.
- An annual information program is conducted to inform fishermen about: 1) Need and possible methods for avoiding hooking of STALB in fishery gear, 2) STALB identification, and 3) ways to avoid taking STALB when they are sighted near bait.
- Vessels operators are required to use seabird bycatch avoidance devices and methods while fishing.
- A test plan to evaluate the effectiveness of seabird bycatch avoidance gear and methods shall be completed and implemented. A final report of the evaluation is due December 31, 2000.
- Prepare a plan to investigate all options for monitoring STALB take and fishery interactions in the Pacific halibut fishery; institute changes to the fishery appropriate to the results of the investigation.

INCIDENTAL TAKE STATEMENT

Through the section 7 consultation process under the Endangered Species Act, NMFS consults with USFWS to establish an incidental take limit---the take that is anticipated to occur from the fisheries. If the incidental take level is exceeded, the action causing the take to be exceeded must cease, pending reinitiation of consultation.

- <u>BSAI and GOA groundfish hook-and-line fisheries</u>:

  - Incidental take level is 4 birds for 2-year period of 1997 and 1998.
  - Zero STALB were reported taken in 1997; 2 in 1998.
  - The 1997-1998 take level will be extended into 1999, until superseded.

- <u>Pacific halibut fishery</u>:

  - Incidental take level is 2 birds for 2-year period beginning 1998.
  - Zero STALB were reported taken in 1998.

CONSERVATION RECOMMENDATIONS

FWS included the following discretionary conservation recommendations to NMFS in the 1997 amendment to the groundfish Biological Opinion:

1. In cooperation with FWS, initiate discussions with the Department of State to lead to data exchanges with other nations whose vessels fish with longline gear in the Pacific. Such data will allow us to determine the incidental take and mortality of seabirds by time and area and are essential to assess the need for additional conservation measures on an international scale.

2. Continue cooperative efforts with FWS to identify demographic parameters of the Torishima Island breeding population of short-tailed albatrosses with the goal of using these data to quantify the level of take which would appreciably reduce the survival and recovery of the species.

3. In cooperation with FWS, initiate efforts to conduct a population viability analysis using demographic data and available information on sources and magnitudes of threats to the species.

The following conservation recommendations were made in the 1998 Pacific halibut Biological Opinion:

1. Develop and/or evaluate new seabird avoidance measures.

2. Suggest to fishermen actions they may take to prevent the taking of STALB that have alighted near their longline gear.

3. Educate fishermen in the proper care of injured seabirds.

4. Consider temporary adjustments to the fishery during the times when STALB are most abundant in the areas fished by Pacific halibut longliners in waters off Alaska.

5. The FWS encourages self-reporting of STALB encounters. However, substantial evidence exists that self-reporting by itself is an inadequate method for monitoring protected species encounters in a fishery. The FWS strongly discourages the use of self-reporting as a sole method for monitoring this fishery, and strongly encourages the use of observers on Pacific halibut longline vessels over 60 ft in length.

CURRENT SEABIRD AVOIDANCE MEASURES REQUIRED OF VESSEL OPERATORS IN THE GROUNDFISH HOOK-AND-LINE FISHERIES IN THE BSAI AND GOA AND THE PACIFIC HALIBUT FISHERY OFF ALASKA
(62 FR 23176, April 29, 1997; 63 FR 11161, March 6, 1998)

1. All applicable hook-and-line fishing operations must be conducted in the following manner:

    a. Use hooks that when baited, sink as soon as they are put in the water.

    b. If offal is discharged while gear is being set or hauled, it must be discharged in a manner that distracts seabirds from baited hooks, to the extent practicable. The discharge site on board a vessel must either be aft of the hauling station or on the opposite side of the vessel from the hauling station.

    c. Make every reasonable effort to ensure that birds brought on board alive are released alive and that wherever possible, hooks are removed without jeopardizing the life of the birds.

2. All applicable hook-and-line vessels $\geq$ 26 ft LOA are required to employ one or more of the following seabird avoidance measures:

    a. Deploy gear only during hours specified in regulation (i.e. hours of darkness) using only the minimum vessel's lights necessary for safety;

    b. Tow a streamer line or lines during deployment of gear to prevent birds from taking hooks;

    c. Tow a buoy, board, stick or other device during deployment of gear at a distance appropriate to prevent birds from taking hooks. Multiple devices may be employed; or

    d. Deploy hooks underwater through a lining tube at a depth sufficient to prevent birds from settling on hooks during deployment of gear.

GROUNDFISH HOOK-AND-LINE FISHERY VESSEL EFFORT

Catcher vessels: Number of hook-and-line vessels that caught groundfish off Alaska by area and vessel length class (feet), 1993-97.[1]

	Gulf of Alaska			Bering Sea and Aleutian			All Alaska		
	Vessel length class			Vessel length class			Vessel length class		
	<60	60-124	>125	<60	60-124	>125	<60	60-124	>125
1993	998	152	1	29	29	0	1006	162	1
1994	1149	195	0	60	27	0	1165	200	0
1995	901	162	2	73	63	0	935	168	2
1996	821	148	5	59	58	2	848	150	6
1997	791	126	3	49	52	0	802	127	3

[1]Information from Table 28 in "Economic Status of the Groundfish Fisheries off Alaska, 1997" by Angie Greig, Dan Holland, Todd Lee, and Joe Terry, NMFS, AFSC, SAFE Document, November 25, 1998.

<u>Catcher/processor vessels</u>: Number of hook-and-line vessels that caught and processed groundfish off Alaska by area and vessel length class (feet), 1993-97.[1]

	Gulf of Alaska				Bering Sea and Aleutian				All Alaska			
	Vessel length class				Vessel length class				Vessel length class			
	<60	60-100	100-124	>124	<60	60-100	100-124	>124	<60	60-100	100-124	>124
Vessel Count												
1993	2	13	14	25	0	12	14	34	2	14	14	34
1994	3	13	12	24	1	15	13	28	3	16	13	28
1995	4	9	8	15	1	7	11	28	4	9	11	28
1996	4	6	8	9	1	7	10	26	4	7	10	26
1997	2	6	8	9	3	7	8	26	4	8	8	26

[1] Information adapted from Table 29 in "Economic Status of the Groundfish Fisheries off Alaska, 1997" by Angie Greig, Dan Holland, Todd Lee, and Joe Terry, NMFS, AFSC, SAFE Document, November 25, 1998.

GROUNDFISH HOOK-AND-LINE FISHERY STATISTICS

Groundfish hook-and-line target species include: BSAI--Pacific cod, sablefish, Greenland turbot, and rockfish; GOA--sablefish, Pacific cod, rockfish

1998	Total Allowable Catch (mt)			
	BSAI	GOA		
all groundfish	2.0 million	327 K		
through 11-19	116 K	25.4 K		
% H&L of Total	5.8%	7.8%		
# of permitted vessels	BSAI (only)	GOA (only)	BSAI & GOA	
<60'	25	1032	378	
≥60'	6	51	317	
total	31	1083	695	1809
# of permitted c/p's	BSAI (only)	GOA (only)	BSAI & GOA	
>60'<100'	0	0	26	
>100'<124'	0	1	14	
>124'	7	0	51	

1997	Total Catch (mt)			
	BSAI	GOA		
all groundfish	1.74 million	230 K		
H&L portion	154 K	28.4 K		
% H&L of Total	8.9 %	12.3 %		
# of permitted vessels	BSAI (only)	GOA (only)	BSAI & GOA	
<60'	23	953	343	
≥60'	6	45	274	
total	29	998	617	1644

1996	Total Catch (mt)			
all groundfish	1.75 million	202 K		
H&L portion	116 K	27.9 K		
% H&L of Total	6.6%	13.8%		
# of permitted vessels	BSAI (only)	GOA (only)	BSAI & GOA	
<60'	26	1070	386	
≥60'	2	47	315	
total	28	1117	701	1846

PACIFIC HALIBUT FISHERY STATISTICS

1998	51 million pound commercial take
1997	51 million pound commercial take
1996	47 million pound commercial take

# of vessels making halibut landings in 1998

<60'	1617
≥60'	158
total	1775

SHORT-TAILED ALBATROSS REPORTED TAKES IN ALASKA FISHERIES

- July, 1983-- north of St. Matthew Island (between 60N, 180 and 58.5N, 175W), found dead in a fish net

- October, 1987-- vessel fishing for halibut in the GOA (59 27.7N, 145 53.3W)

- August 28, 1995-- juvenile taken in the western Gulf of Alaska IFQ sablefish longline fishery south of the Krenitzin Islands (53 31N 165 38W)

- October 8, 1995--take in the IFQ sablefish fishery in the Bering Sea (57 01N, 170 39W)

- September 27, 1996-- 5-year old adult bird in a hook-and-line fishery (58 41.3N, 177 02.6W)

- September 21, 1998--8-year old adult bird in the cod hook-and-line fishery; the adult had bred successfully for the 2 previous seasons (57 30N, 173 57W)

- September 28, 1998--sub-adult bird in the cod hook-and-line fishery 58 27N, 175 16W)

Except for the 2nd take in 1998, leg bands were recovered from all of the above albatross, allowing scientists to verify identification and age. Since 1977, Dr. Hiroshi Hasegawa has banded all short-tailed albatross chicks at their breeding colony on Torishima Island, Japan.

ESTIMATED AVERAGE ANNUAL SEABIRD BYCATCH IN THE BSAI AND GOA GROUNDFISH LONGLINE FISHERIES, 1993-1996[1]

	BSAI	GOA	COMBINED
Birds taken per 1000 hooks	0.087	0.059	0.084
Number of Birds Taken By Species			
Northern Fulmar	7337	1113	8450
Gull species	2381	111	2492
Shearwater species	530	74	604
Laysan Albatross	527	411	938
Black-footed Albatross	45	493	538
Short-tailed Albatross	1	0	1
Other species	19	0	19
Total seabirds taken	10,840	2,202	13,042

Updated estimates, including 1997 data, to be provided by USFWS.

[1] Information taken from "FAO Fisheries Circular No. 937, The Incidental Catch of Seabirds by Longline Fisheries: Worldwide Review and Technical Guidelines for Mitigation", Table 7, page 27, 1998.

USE OF SEABIRD AVOIDANCE MEASURES ON HOOK-AND-LINE VESSELS IN THE GOA AND BSAI GROUNDFISH FISHERIES ON TRIPS FROM 12/31/96 THROUGH 7/17/98 AS REPORTED BY NMFS GROUNDFISH OBSERVERS[1]

Seabird Avoidance Measure	% of Observed Trips Using the Measure[2]
Buoy, board, or floating device towed behind vessel during setting	74.1
Sink baited hooks quickly	39.9
Streamer line towed behind vessel during setting of gear	20.6
Other device used[3]	9.9
Offal discharged from opposite side of vessel during setting or hauling	9.5
Offal never discharged during setting or hauling of gear	7.4
Gear set at night	6.6
Gear deployed underwater using lining tube	1.6
No device used	2.1[4]

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[1]NMFS groundfish observers began collecting this data in April 1997.

[2] Most trips used more than one device at a time.

[3] Other devices included: fire hose, bleach bottle, 'don't know', paddlewheel, chumming, plastic streamers near stern, gun, air horn

[4] 2.1% represents percent of trips after the regulation effective date of May 29, 1997 that did not use any seabird avoidance measures. 6 additional trips did not use seabird avoidance measures (4.5% of the trips observed) but these trips occurred before vessel operators were required to use seabird avoidance measures.

NMFS SEABIRD TEST PLAN

Purpose: Evaluate the effectiveness of the seabird avoidance measures that are required in Alaska's groundfish and halibut longline fisheries.

Objectives:

- Obtain high quality information on the effectiveness of seabird avoidance measures in the North Pacific.
- Reduce the bycatch of seabirds in Alaska's longline fishery.
- Minimize future risk to Alaska's longline fisheries by maximizing the effectiveness of seabird avoidance measures and reducing the likelihood of STALB mortalities.
- Continue to use a partnership approach with industry, the resource agencies and others to address the issue of seabird bycatch.

IMPLEMENTATION OF SEABIRD TEST PLAN

Test Plan focuses on 3 related components:

- Controlled, experimental testing of avoidance measures
- Collection of information on avoidance measures by observers on commercial vessels
- Solicit and gather information on effectiveness of avoidance measures from fishermen

To date, funding for experimental tests has not been identified but is being pursued.

Information collection on avoidance measures from observers and fishermen was initiated in 1997 and is continuing as well as being expanded.

WHAT WE KNOW NOW ON EFFECTIVENESS OF SEABIRD AVOIDANCE MEASURES

Buoy Bag Towed Behind Vessel During Setting of Gear (74%):

- Should be suspended directly over the fishing gear as it is being set, to prevent seabirds from accessing the 'vulnerable zone'.

- Some fishers are effectively towing 2 buoy bags (or streamer lines), one on either side of the fishing gear.

- Norwegian study indicates that towed floats (i.e. buoy bag) reduced significantly the seabird bycatch.
    - Three different avoidance measures were tested--towed floats, streamer line, and an underwater setting funnel (i.e. lining tube).
    - During 11 sets for each of these methods, 2, 0, and 6 seabirds, respectively, were caught compared to 74 seabirds when no avoidance device was used.

Sinking Baited Hooks Quickly, Through the Use of Weights applied to the Groundline (40%):

- Cause the gear to sink more quickly such that seabirds cannot reach the baited hooks.

- By sinking fishing gear quickly AND protecting the vulnerable zone behind the vessel with a buoy bag or streamer line, seabird bycatch should be significantly reduced.

- Line sink rates will vary as a function of the line weighting regime used, line setting speed, propeller turbulence, and other factors.

- Study in the demersal Patagonian toothfish fishery found that a line weighting regime of 4kg/40m was effective at sinking gear to a sufficient depth. A similar regime is being promoted in New Zealand, 5kg/40m.

- Several fishers in Alaska longline fisheries are finding that smaller weights applied more frequently (0.5kg/20m) is effectively sinking the gear to a sufficient depth.

- Seabird experts around the world believe that longline sink rate has the capacity to override in importance all other factors affecting seabird takes in demersal fisheries.

Streamer Line Towed Behind the Vessel During the Setting of Gear (21%):

- Used to prevent seabirds from accessing the 'vulnerable zone', where until baited hooks have sunk deep enough that birds cannot reach them.
- Streamer lines will have buoys and/or weights attached at the end of the line (to keep the line taut) and will have 6 to 10 paired streamers suspended from the line, over the area where the fishing gear is being deployed.
- Effectiveness directly tested in only a few experiments. More frequently, its effectiveness has been noted through the analyses of observer data, other scientific observations, and anecdotal information.
- Worldwide, it is probably the most common seabird avoidance measure in use today.

Other Devices (10%):

- Examples are spraying of fire hose, paddlewheel, plastic streamers tied near stern, gun, and air horn.
- Water cannons may be effective but distance the water reached was considered to be inadequate.
- Noise deterrents may have some limited effect if used sparingly so birds do not become habituated to the sounds.
- Little is known about the effectiveness of the other devices.

Offal Discharge Methods(7-10%):

- Discharge from the opposite side of the vessel during set or haul, or do not discharge offal at all during set or haul.

- Purpose is to minimize the attractiveness of the vessel or the gear deployment area to seabirds. Then the likelihood of snagging a bird on a baited hook is decreased greatly.

- Many vessel operators have indicated that it is not practicable to not discharge offal, particularly during haul operations.

- Some evidence suggests that discharging of homogenized offal during line settings greatly reduced the incidental of seabirds, mainly because the birds were more attracted by offal than by baited hooks.

Gear Set at Night (7%):

- Identified worldwide as the most effective measure available and capable of virtually eliminating seabird mortality in some fishing areas; still relatively unpopular among fishers.

- In high latitude areas, such as Alaska, night-setting is not possible in the summer.

- Night-setting is required by CCAMLR and is an option in Alaska and will be an option under the Australian TAP.

Gear Deployed Underwater using a Lining Tube:

- Currently, only one vessel in the Alaska longline fisheries has installed a lining tube.
- High cost (~$40K) may be prohibitive to many fishers.
- One purpose of setting gear underwater through a lining tube is to deploy the gear at a depth that is not accessible by seabirds.
- Two studies have indicated a reduction in bait loss and seabird bycatch when a lining tube is used. In both studies, fewer birds were caught with a lining tube than compared to when no avoidance was used (28:99, 6:74) but more birds were caught with a lining tube than when a streamer line was used (28:2, 6:0).
- Device may have design deficiencies compromising the essential capabilities of any underwater setting device: 1) deliver hooks deep enough, 2) withstand the substantial forces acting upon it, 3) to not create additional problems, such as increased bait loss or line wear (FAO 1998a).
- Problems noted with the line escaping from the tube, line resurfaces and seabirds are able to access the baited hooks. Design improvements to a springed locking mechanism may have resolved this problem.
- Propeller turbulence may cause the line, after it leaves the tube, to come back to the surface. This could be remedied by extending the tube beyond the propeller turbulence (if possible) or applying weights to the groundline to cause it to sink more rapidly after exiting the lining tube.
- Tests carried out on Norwegian vessels indicated that the pitch angle of the vessel affects the lining tube's efficiency. In the beginning of a trip, when the vessel has not taken on fish, the tube goes deeper into the water and works well. Once the catch is loaded (middle and forward part of vessel), the tube sets the line closer to the water's surface with loss in efficiency.
- Sea condition is also a factor that can affect the performance of the lining tube.

ANNUAL SEABIRD BYCATCH RATES AND ESTIMATES OF TOTAL SEABIRDS CAUGHT ON VESSEL WITH LINING TUBE[1]

Year	Albatross Bycatch Rate[2]	Estimate of Total No. of Albatross Caught[3]	Other Seabirds Bycatch Rate[2]	Estimate of Total No. of Other Seabirds Caught[3]
1994	0.0012	4	0.0267	77
1995	0.004	17	0.2521	1074
1996	0.0039	23	0.0937	560
1997	0 albatross caught	0	0.0401	281
1998	0.0207	106	0.2125	1086

. . . .

[1]lining tube was installed summer 1997; problems with operation of tube in fall97 & spring 98; repaired in summer 1998

[2]bycatch rate expressed as number of birds per 1000 hooks

[3]estimate of total birds caught based on total hooks set

The vessel company and Mustad (gear manufacturer) indicated that problems occurred with the groundline escaping from the lining tube. The vessel skipper noticed a greater number of birds caught during these times. Improvements were made to the lining tube in the summer of 1998; the high bycatch in 1998 may be attributable to the problems with the lining tube in the early part of the year.

SEABIRD BYCATCH RATES AS REPORTED IN FAO FISHERIES CIRCULAR No. 937, Chapter 4: Incidental Catch of Seabirds by Longline Fisheries

Geographic Area	Fishery Type and Species	Bycatch Rate (no. Birds/1000 hooks)	Seabirds Caught
Northeastern Atlantic Ocean and Mediterranean Sea (Norway study)	Demersal/cod, haddock, tusk, ling, wolffish	1.75; 0.04[1]	fulmars
Northwestern Atlantic Ocean (Canada, Greenland)	Demersal/cod, hake, haddock	not known	?
Northeastern Pacific Ocean (U.S.)	Demersal/cod, halibut, sablefish	0.08 (BSAI and GOA)	fulmars, gulls, albatross
Northwestern Pacific Ocean (China, Japan, Korea, Russia, Taiwan)	Demersal/pollock, cod	not known	?
Central and South America	Demersal/hake, kingclip, Patagonian toothfish		
Mexico and Venezuela		not known	
Brazil		0.3	albatross, petrels, shearwaters
Uruguay		0.41	albatross
Argentina		'appears high'	albatross
Chile		not known	albatross
Peru, Ecuador, Colombia		not known	
Southern Africa	Demersal/semi-pelagic/hake, kingclip	0.44; 0.043[1]	white-chinned petrel
Australasian (New Zealand)	Demersal/ling, snapper, trevalla	no rate available	albatross, petrels
Southern Ocean	Demersal/Patagonian toothfish	0.22 to 0.67	albatross, petrels, shearwaters
Atlantic Ocean & Mediterranean Sea	Pelagic/tuna, swordfish, sharks	little known	gulls, petrels, shearwaters
South Atlantic		4.7	albatross, petrels
Pacific Ocean	Pelagic/tuna	not known	?
Hawaii		0.276, 0.083	Laysan albatross, Black-footed alb.
Southern Ocean	Pelagic/tuna		
Australia		0.41	albatross, petrels
New Zealand		0.04 to 1.9	albatross, petrels

[1] First number represents rate with no mitigation measures in place; 2nd number represents rate with mitigation measures in place

FROM FAO FISHERIES CIRCULAR NO. 937

Table 12. Regulations in effect for reducing seabird catch by longline fisheries

Country or Convention	Year of adoption	Fishery type	Area of application	Mitigation measure required
Australia	1995	Pelagic (tuna)	AFZ south of 30°S	BSL
Japan	1997	Pelagic	High seas	BSL
New Zealand	1993	Pelagic	EEZ	BSL
South Africa	199?	Demersal	Sub-Antarctic EEZ	As for CCAMLR
South Africa	1998	Pelagic	EEZ	BSL, offal discharge
United Kingdom	?	Demersal	Outer fishing zone of FalklandIslands/ Malvinas	BSL, (weighted lines, night setting if instructed specifically)
U.S.A.	1997	Demersal	West Pacific EEZ	BSL, towing objects, weighted lines, offal discharge, underwater setting, night setting
U.S.A.	-	Pelagic	Hawaii EEZ (planned)	
CCAMLR	1992	Demersal	CCAMLR region	BSL, weighted lines, offal discharge, night setting

MITIGATION OPTIONS AVAILABLE 'DOWN UNDER'
AUSTRALIA'S THREAT ABATEMENT PLAN

The objective of the Threat Abatement Plan is to reduce seabird bycatch in all fishing areas, seasons or fisheries to below 0.05 seabirds per 1000 hooks, based on current fishing levels.

__Mitigation Measures to be Required in the Domestic and Foreign Pelagic Longline Fisheries__

- All vessels use a bird scaring line of approved design.
- All vessels retain all offal during line setting or hauling and discharge it when not line setting or hauling.
- All options will require monitoring by an approved observer program.

Vessel operators must adopt one of the 3 options below on an annual basis:

Option 1:

- All baits will be set at night.

Option 2:

All vessels fishing during the day will:

- Use lines which are sufficiently weighted to cause the baits to sink out of reach of diving seabirds immediately after they are set. This weight will be determined by experimental trials;
- Demonstrate an ability to thaw baits before lines are set; and
- Use thawed baits on their hooks.
- Day setting operations will require a higher level of observer coverage.

Option 3:

- Vessels which can demonstrate a technique of setting and hauling longlines which does not make the hooks/baits available to seabirds can be issued with a permit to operate without any of the restrictions in Options 1 and 2 above.

NMFS' INVOLVEMENT IN FAO INITIATIVE TO REDUCE SEABIRD BYCATCH IN LONGLINE FISHERIES

- Proposal at FAO's Committee on Fisheries (COFI) meeting in March 1997 to hold a technical consultation; Japan, US, and FAO collaborate

- Seabird Technical Working Group (STWG) meets in Tokyo in March 1998 to draft guidelines for measures to reduce seabird bycatch and a Plan of Action for implementation of the draft guidelines; NMFS and USFWS representatives on the STWG

- March - October 1998 receive input from constituents (industry, environmental non-governmental groups) in development of US position papers

- October 26-30, 1998---FAO consultation in Rome, Italy on 3 initiatives----> management of fishing capacity, shark conservation and management, and reduction of incidental catch of seabirds in longline fisheries

- Drafts of 3 non-binding global documents approved by representatives from 81 countries and the EC present at consultation

- Expected endorsement by consensus at the FAO's COFI meeting in March 1999 and adoption by the FAO Conference in November 1999

FAO'S INTERNATIONAL PLAN OF ACTION TO REDUCE INCIDENTAL CATCH OF SEABIRDS IN LONGLINE FISHERIES (IPOA-SEABIRDS)

See the IPOA-SEABIRDS for complete text. Some of the key points are:

- Objective: Reduce the incidental catch of seabirds in longline fisheries.
- The IPOA-SEABIRDS is voluntary, all States are encouraged to implement it.
- States conduct an assessment of their longline fisheries to determine if a problem exists. If yes, States should adopt a National Plan of Action (NPOA- SEABIRDS).
- The NPOA-SEABIRDS may contain the following elements:
  - Prescription of mitigation measures
  - Plans for research and development of effective mitigation measures
  - Means for education, training, and publicity
  - Data collection programs to determine seabird bycatch and the effectiveness of mitigation measures; such programs may include onboard observers
- States recognize that each longline fishery is unique and the identification of appropriate mitigation measures can only be achieved through its assessment of the concerned fisheries. Technical and operational mitigation measures are attached to the IPOA-SEABIRDS. Reference to FAO Fisheries Circular No. 937 also.
- NPOA-SEABIRDS implementation should begin no later than early 2001.
- States should cooperate through regional and subregional fisheries management organizations to reduce the incidental catch of seabirds in longline fisheries.
- States should report on their NPOA-SEABIRDS progress as part of their biennial reporting under the Code of Conduct for Responsible Fisheries.
- FAO will support States in the implementation of the IPOA-SEABIRDS.
- FAO will support development and implementation of NPOA-SEABIRDS through specific, in-country technical assistance projects with Regular Program funds and by use of available extra-budgetary funds.
- FAO will report biennially on the implementation of the IPOA-SEABIRDS.

WHERE TO NOW?

- Funding for implementation of experimental component of Seabird Test Plan

- Continue gathering of information from observers and fishermen on effectiveness of seabird avoidance measures

- Improve/revise current seabird avoidance regulations in Alaska--is it possible now?

- Participate in the implementation of the IPOA-SEABIRDS and NPOA-SEABIRDS

IMPROVE/REVISE CURRENT SEABIRD AVOIDANCE REGULATIONS IN ALASKA--IS IT POSSIBLE NOW?

- North Pacific Longline Association (NPLA) proposal:

    - BSAI and GOA freezer/longliners shall deploy baited hooks through an underwater lining tube, at a depth of not less than 1.5m, when vessel fully laden

    - weights shall be added to line, as necessary, to prevent line from resurfacing after being set

    - streamer line, bird buoy bag, or other device shall be towed at all times behind the boat over the baited line for the purpose of discouraging diving birds

    - this requirement shall apply to: a) all freezer/longliners, b) freezer/longliners ≥ 125ft, or c) freezer/longliners ≥ 100ft

- Other possible alternatives to revise current regulations:

    - all applicable longline vessels setting gear during 'daylight hours' must use a streamer line or a towed buoy bag, AND

    - add sufficient weights to the longline gear to cause baited hooks to sink to at least 1-2m before reaching the end of the towed streamer line or towed buoy bag

    - all applicable longline vessels setting gear during 'night' hours must use a streamer line or a towed buoy bag

    - towing of board, stick or 'other devices' [see 50 CFR Part 679.24(e)(3)(ii)] would no longer qualify as compliance with seabird avoidance measures

NATIONAL MARINE FISHERIES SERVICE

ALASKA REGION

EFFORTS TO REDUCE SEABIRD BYCATCH IN COMMERCIAL LONGLINE FISHERIES OFF ALASKA

Prepared by the National Marine Fisheries Service
for a Meeting of the
North Pacific Fishery Management Council

Anchorage, Alaska
December 7-11, 1998

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Problem:

Seabirds are attracted to 'food' (bait & offal) associated with fishing vessels. In longline operations, birds may gain access to baited hooks, become hooked, and pulled underwater and drowned with the setting gear.

Solutions:

- Reduce attractiveness of vessel to seabirds

- Prevent or distract seabirds from accessing area where gear is set

How?

- Education & outreach

- Conscientious & consistent use of effective seabird avoidance measures by fishermen

NMFS REQUIREMENTS UNDER THE ENDANGERED SPECIES ACT

The current non-discretionary measures in the U.S. Fish & Wildlife Service's (FWS) Biological Opinions for the groundfish and Pacific halibut fisheries off Alaska are as follows:

- Observer data on short-tailed albatross (STALB) sightings and groundfish fishery interactions is collected.
- Observers are trained in seabird identification and provided with instructions and materials for reporting STALB observations.
- STALB observations and interactions in the halibut fishery are reported to NMFS and FWS (via IPHC port samplers).
- Incidental take of any STALB is reported to FWS.
- Live-caught STALB are released.
- Dead STALB are tagged with complete catch information and delivered to FWS.
- An annual information program is conducted to inform fishermen about: 1) Need and possible methods for avoiding hooking of STALB in fishery gear, 2) STALB identification, and 3) ways to avoid taking STALB when they are sighted near bait.
- Vessels operators are required to use seabird bycatch avoidance devices and methods while fishing.
- A test plan to evaluate the effectiveness of seabird bycatch avoidance gear and methods shall be completed and implemented. A final report of the evaluation is due December 31, 2000.
- Prepare a plan to investigate all options for monitoring STALB take and fishery interactions in the Pacific halibut fishery; institute changes to the fishery appropriate to the results of the investigation.

INCIDENTAL TAKE STATEMENT

Through the section 7 consultation process under the Endangered Species Act, NMFS consults with USFWS to establish an incidental take limit---the take that is anticipated to occur from the fisheries. If the incidental take level is exceeded, the action causing the take to be exceeded must cease, pending reinitiation of consultation.

- <u>BSAI and GOA groundfish hook-and-line fisheries</u>:
  - Incidental take level is 4 birds for 2-year period of 1997 and 1998.
  - Zero STALB were reported taken in 1997; 2 in 1998.
  - The 1997-1998 take level will be extended into 1999, until superseded.

- <u>Pacific halibut fishery</u>:
  - Incidental take level is 2 birds for 2-year period beginning 1998.
  - Zero STALB were reported taken in 1998.

CONSERVATION RECOMMENDATIONS

FWS included the following discretionary conservation recommendations to NMFS in the 1997 amendment to the groundfish Biological Opinion:

1. In cooperation with FWS, initiate discussions with the Department of State to lead to data exchanges with other nations whose vessels fish with longline gear in the Pacific. Such data will allow us to determine the incidental take and mortality of seabirds by time and area and are essential to assess the need for additional conservation measures on an international scale.

2. Continue cooperative efforts with FWS to identify demographic parameters of the Torishima Island breeding population of short-tailed albatrosses with the goal of using these data to quantify the level of take which would appreciably reduce the survival and recovery of the species.

3. In cooperation with FWS, initiate efforts to conduct a population viability analysis using demographic data and available information on sources and magnitudes of threats to the species.

The following conservation recommendations were made in the 1998 Pacific halibut Biological Opinion:

1. Develop and/or evaluate new seabird avoidance measures.

2. Suggest to fishermen actions they may take to prevent the taking of STALB that have alighted near their longline gear.

3. Educate fishermen in the proper care of injured seabirds.

4. Consider temporary adjustments to the fishery during the times when STALB are most abundant in the areas fished by Pacific halibut longliners in waters off Alaska.

5. The FWS encourages self-reporting of STALB encounters. However, substantial evidence exists that self-reporting by itself is an inadequate method for monitoring protected species encounters in a fishery. The FWS strongly discourages the use of self-reporting as a sole method for monitoring this fishery, and strongly encourages the use of observers on Pacific halibut longline vessels over 60 ft in length.

CURRENT SEABIRD AVOIDANCE MEASURES REQUIRED OF VESSEL OPERATORS IN THE GROUNDFISH HOOK-AND-LINE FISHERIES IN THE BSAI AND GOA AND THE PACIFIC HALIBUT FISHERY OFF ALASKA

(62 FR 23176, April 29, 1997; 63 FR 11161, March 6, 1998)

1. All applicable hook-and-line fishing operations must be conducted in the following manner:

    a. Use hooks that when baited, sink as soon as they are put in the water.

    b. If offal is discharged while gear is being set or hauled, it must be discharged in a manner that distracts seabirds from baited hooks, to the extent practicable. The discharge site on board a vessel must either be aft of the hauling station or on the opposite side of the vessel from the hauling station.

    c. Make every reasonable effort to ensure that birds brought on board alive are released alive and that wherever possible, hooks are removed without jeopardizing the life of the birds.

2. All applicable hook-and-line vessels ≥ 26 ft LOA are required to employ one or more of the following seabird avoidance measures:

    a. Deploy gear only during hours specified in regulation (i.e. hours of darkness) using only the minimum vessel's lights necessary for safety;

    b. Tow a streamer line or lines during deployment of gear to prevent birds from taking hooks;

    c. Tow a buoy, board, stick or other device during deployment of gear at a distance appropriate to prevent birds from taking hooks. Multiple devices may be employed; or

    d. Deploy hooks underwater through a lining tube at a depth sufficient to prevent birds from settling on hooks during deployment of gear.

GROUNDFISH HOOK-AND-LINE FISHERY VESSEL EFFORT

Catcher vessels: Number of hook-and-line vessels that caught groundfish off Alaska by area and vessel length class (feet), 1993-97.[1]

	Gulf of Alaska			Bering Sea and Aleutian			All Alaska		
	Vessel length class			Vessel length class			Vessel length class		
	<60	60-124	>125	<60	60-124	>125	<60	60-124	>125
1993	998	152	1	29	29	0	1006	162	1
1994	1149	195	0	60	27	0	1165	200	0
1995	901	162	2	73	63	0	935	168	2
1996	821	148	5	59	58	2	848	150	6
1997	791	126	3	49	52	0	802	127	3

[1]Information from Table 28 in "Economic Status of the Groundfish Fisheries off Alaska, 1997" by Angie Greig, Dan Holland, Todd Lee, and Joe Terry, NMFS, AFSC, SAFE Document, November 25, 1998.

Catcher/processor vessels: **Number of hook-and-line vessels that caught and processed groundfish off Alaska by area and vessel length class (feet), 1993-97.**[1]

	Gulf of Alaska				Bering Sea and Aleutian				All Alaska			
	Vessel length class				Vessel length class				Vessel length class			
	<60	60-100	100-124	>124	<60	60-100	100-124	>124	<60	60-100	100-124	>124
Vessel Count												
1993	2	13	14	25	0	12	14	34	2	14	14	34
1994	3	13	12	24	1	15	13	28	3	16	13	28
1995	4	9	8	15	1	7	11	28	4	9	11	28
1996	4	6	8	9	1	7	10	26	4	7	10	26
1997	2	6	8	9	3	7	8	26	4	8	8	26

[1] Information adapted from Table 29 in "Economic Status of the Groundfish Fisheries off Alaska, 1997" by Angie Greig, Dan Holland, Todd Lee, and Joe Terry, NMFS, AFSC, SAFE Document, November 25, 1998.

GROUNDFISH HOOK-AND-LINE FISHERY STATISTICS

Groundfish hook-and-line target species include: BSAI--Pacific cod, sablefish, Greenland turbot, and rockfish; GOA--sablefish, Pacific cod, rockfish

1998	Total Allowable Catch (mt)			
	BSAI	GOA		
all groundfish	2.0 million	327 K		
through 11-19	116 K	25.4 K		
% H&L of Total	5.8%	7.8%		
# of permitted vessels	BSAI (only)	GOA (only)	BSAI & GOA	
<60'	25	1032	378	
≥60'	6	51	317	
total	31	1083	695	1809
# of permitted c/p's	BSAI (only)	GOA (only)	BSAI & GOA	
>60'<100'	0	0	26	
>100'<124'	0	1	14	
>124'	7	0	51	

1997	Total Catch (mt)			
	BSAI	GOA		
all groundfish	1.74 million	230 K		
H&L portion	154 K	28.4 K		
% H&L of Total	8.9 %	12.3 %		
# of permitted vessels	BSAI (only)	GOA (only)	BSAI & GOA	
<60'	23	953	343	
≥60'	6	45	274	
total	29	998	617	1644

1996	Total Catch (mt)			
all groundfish	1.75 million	202 K		
H&L portion	116 K	27.9 K		
% H&L of Total	6.6%	13.8%		
# of permitted vessels	BSAI (only)	GOA (only)	BSAI & GOA	
<60'	26	1070	386	
≥60'	2	47	315	
total	28	1117	701	1846

PACIFIC HALIBUT FISHERY STATISTICS

1998	51 million pound commercial take
1997	51 million pound commercial take
1996	47 million pound commercial take

# of vessels making halibut landings in 1998

<60'	1617
≥60'	158
total	1775

SHORT-TAILED ALBATROSS REPORTED TAKES IN ALASKA FISHERIES

- July, 1983-- north of St. Matthew Island (between 60N, 180 and 58.5N, 175W), found dead in a fish net

- October, 1987-- vessel fishing for halibut in the GOA (59 27.7N, 145 53.3W)

- August 28, 1995-- juvenile taken in the western Gulf of Alaska IFQ sablefish longline fishery south of the Krenitzin Islands (53 31N 165 38W)

- October 8, 1995--take in the IFQ sablefish fishery in the Bering Sea (57 01N, 170 39W)

- September 27, 1996-- 5-year old adult bird in a hook-and-line fishery (58 41.3N, 177 02.6W)

- September 21, 1998--8-year old adult bird in the cod hook-and-line fishery; the adult had bred successfully for the 2 previous seasons (57 30N, 173 57W)

- September 28, 1998--sub-adult bird in the cod hook-and-line fishery 58 27N, 175 16W)

Except for the 2nd take in 1998, leg bands were recovered from all of the above albatross, allowing scientists to verify identification and age. Since 1977, Dr. Hiroshi Hasegawa has banded all short-tailed albatross chicks at their breeding colony on Torishima Island, Japan.

ESTIMATED AVERAGE ANNUAL SEABIRD BYCATCH IN THE BSAI AND GOA GROUNDFISH LONGLINE FISHERIES, 1993-1996[1]

	BSAI	GOA	COMBINED
Birds taken per 1000 hooks	0.087	0.059	0.084
Number of Birds Taken By Species			
Northern Fulmar	7337	1113	8450
Gull species	2381	111	2492
Shearwater species	530	74	604
Laysan Albatross	527	411	938
Black-footed Albatross	45	493	538
Short-tailed Albatross	1	0	1
Other species	19	0	19
Total seabirds taken	10,840	2,202	13,042

Updated estimates, including 1997 data, to be provided by USFWS.

[1] Information taken from "FAO Fisheries Circular No. 937, The Incidental Catch of Seabirds by Longline Fisheries: Worldwide Review and Technical Guidelines for Mitigation", Table 7, page 27, 1998.

USE OF SEABIRD AVOIDANCE MEASURES ON HOOK-AND-LINE VESSELS IN THE GOA AND BSAI GROUNDFISH FISHERIES ON TRIPS FROM 12/31/96 THROUGH 7/17/98 AS REPORTED BY NMFS GROUNDFISH OBSERVERS[1]

Seabird Avoidance Measure	% of Observed Trips Using the Measure[2]
Buoy, board, or floating device towed behind vessel during setting	74.1
Sink baited hooks quickly	39.9
Streamer line towed behind vessel during setting of gear	20.6
Other device used[3]	9.9
Offal discharged from opposite side of vessel during setting or hauling	9.5
Offal never discharged during setting or hauling of gear	7.4
Gear set at night	6.6
Gear deployed underwater using lining tube	1.6
No device used	2.1[4]

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[1]NMFS groundfish observers began collecting this data in April 1997.

[2] Most trips used more than one device at a time.

[3] Other devices included: fire hose, bleach bottle, 'don't know', paddlewheel, chumming, plastic streamers near stern, gun, air horn

[4] 2.1% represents percent of trips after the regulation effective date of May 29, 1997 that did not use any seabird avoidance measures. 6 additional trips did not use seabird avoidance measures (4.5% of the trips observed) but these trips occurred before vessel operators were required to use seabird avoidance measures.

NMFS SEABIRD TEST PLAN

<u>Purpose</u>: Evaluate the effectiveness of the seabird avoidance measures that are required in Alaska's groundfish and halibut longline fisheries.

<u>Objectives</u>:

- Obtain high quality information on the effectiveness of seabird avoidance measures in the North Pacific.
- Reduce the bycatch of seabirds in Alaska's longline fishery.
- Minimize future risk to Alaska's longline fisheries by maximizing the effectiveness of seabird avoidance measures and reducing the likelihood of STALB mortalities.
- Continue to use a partnership approach with industry, the resource agencies and others to address the issue of seabird bycatch.

IMPLEMENTATION OF SEABIRD TEST PLAN

Test Plan focuses on 3 related components:

- Controlled, experimental testing of avoidance measures
- Collection of information on avoidance measures by observers on commercial vessels
- Solicit and gather information on effectiveness of avoidance measures from fishermen

To date, funding for experimental tests has not been identified but is being pursued.

Information collection on avoidance measures from observers and fishermen was initiated in 1997 and is continuing as well as being expanded.

WHAT WE KNOW NOW ON EFFECTIVENESS OF SEABIRD AVOIDANCE MEASURES

<u>Buoy Bag Towed Behind Vessel During Setting of Gear</u> (74%):

- Should be suspended directly over the fishing gear as it is being set, to prevent seabirds from accessing the 'vulnerable zone'.

- Some fishers are effectively towing 2 buoy bags (or streamer lines), one on either side of the fishing gear.

- Norwegian study indicates that towed floats (i.e. buoy bag) reduced significantly the seabird bycatch.
  - Three different avoidance measures were tested--towed floats, streamer line, and an underwater setting funnel (i.e. lining tube).
  - During 11 sets for each of these methods, 2, 0, and 6 seabirds, respectively, were caught compared to 74 seabirds when no avoidance device was used.

<u>Sinking Baited Hooks Quickly, Through the Use of Weights applied to the Groundline</u> (40%):

- Cause the gear to sink more quickly such that seabirds cannot reach the baited hooks.

- By sinking fishing gear quickly AND protecting the vulnerable zone behind the vessel with a buoy bag or streamer line, seabird bycatch should be significantly reduced.

- Line sink rates will vary as a function of the line weighting regime used, line setting speed, propeller turbulence, and other factors.

- Study in the demersal Patagonian toothfish fishery found that a line weighting regime of 4kg/40m was effective at sinking gear to a sufficient depth. A similar regime is being promoted in New Zealand, 5kg/40m.

- Several fishers in Alaska longline fisheries are finding that smaller weights applied more frequently (0.5kg/20m) is effectively sinking the gear to a sufficient depth.

- Seabird experts around the world believe that longline sink rate has the capacity to override in importance all other factors affecting seabird takes in demersal fisheries.

Streamer Line Towed Behind the Vessel During the Setting of Gear (21%):

- Used to prevent seabirds from accessing the 'vulnerable zone', where until baited hooks have sunk deep enough that birds cannot reach them.

- Streamer lines will have buoys and/or weights attached at the end of the line (to keep the line taut) and will have 6 to 10 paired streamers suspended from the line, over the area where the fishing gear is being deployed.

- Effectiveness directly tested in only a few experiments. More frequently, its effectiveness has been noted through the analyses of observer data, other scientific observations, and anecdotal information.

- Worldwide, it is probably the most common seabird avoidance measure in use today.

Other Devices (10%):

- Examples are spraying of fire hose, paddlewheel, plastic streamers tied near stern, gun, and air horn.

- Water cannons may be effective but distance the water reached was considered to be inadequate.

- Noise deterrents may have some limited effect if used sparingly so birds do not become habituated to the sounds.

- Little is known about the effectiveness of the other devices.

Offal Discharge Methods(7-10%):

- Discharge from the opposite side of the vessel during set or haul, or do not discharge offal at all during set or haul.

- Purpose is to minimize the attractiveness of the vessel or the gear deployment area to seabirds. Then the likelihood of snagging a bird on a baited hook is decreased greatly.

- Many vessel operators have indicated that it is not practicable to not discharge offal, particularly during haul operations.

- Some evidence suggests that discharging of homogenized offal during line settings greatly reduced the incidental of seabirds, mainly because the birds were more attracted by offal than by baited hooks.

Gear Set at Night (7%):

- Identified worldwide as the most effective measure available and capable of virtually eliminating seabird mortality in some fishing areas; still relatively unpopular among fishers.

- In high latitude areas, such as Alaska, night-setting is not possible in the summer.

- Night-setting is required by CCAMLR and is an option in Alaska and will be an option under the Australian TAP.

Gear Deployed Underwater using a Lining Tube:

- Currently, only one vessel in the Alaska longline fisheries has installed a lining tube.

- High cost (~$40K) may be prohibitive to many fishers.

- One purpose of setting gear underwater through a lining tube is to deploy the gear at a depth that is not accessible by seabirds.

- Two studies have indicated a reduction in bait loss and seabird bycatch when a lining tube is used. In both studies, fewer birds were caught with a lining tube than compared to when no avoidance was used (28:99, 6:74) but more birds were caught with a lining tube than when a streamer line was used (28:2, 6:0).

- Device may have design deficiencies compromising the essential capabilities of any underwater setting device: 1) deliver hooks deep enough, 2) withstand the substantial forces acting upon it, 3) to not create additional problems, such as increased bait loss or line wear (FAO 1998a).

- Problems noted with the line escaping from the tube, line resurfaces and seabirds are able to access the baited hooks. Design improvements to a springed locking mechanism may have resolved this problem.

- Propeller turbulence may cause the line, after it leaves the tube, to come back to the surface. This could be remedied by extending the tube beyond the propeller turbulence (if possible) or applying weights to the groundline to cause it to sink more rapidly after exiting the lining tube.

- Tests carried out on Norwegian vessels indicated that the pitch angle of the vessel affects the lining tube's efficiency. In the beginning of a trip, when the vessel has not taken on fish, the tube goes deeper into the water and works well. Once the catch is loaded (middle and forward part of vessel), the tube sets the line closer to the water's surface with loss in efficiency.

- Sea condition is also a factor that can affect the performance of the lining tube.

ANNUAL SEABIRD BYCATCH RATES AND ESTIMATES OF TOTAL SEABIRDS CAUGHT ON VESSEL WITH LINING TUBE[1]

Year	Albatross Bycatch Rate[2]	Estimate of Total No. of Albatross Caught[3]	Other Seabirds Bycatch Rate[2]	Estimate of Total No. of Other Seabirds Caught[3]
1994	0.0012	4	0.0267	77
1995	0.004	17	0.2521	1074
1996	0.0039	23	0.0937	560
1997	0 albatross caught	0	0.0401	281
1998	0.0207	106	0.2125	1086

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[1]lining tube was installed summer 1997; problems with operation of tube in fall97 & spring 98; repaired in summer 1998

[2]bycatch rate expressed as number of birds per 1000 hooks

[3]estimate of total birds caught based on total hooks set

The vessel company and Mustad (gear manufacturer) indicated that problems occurred with the groundline escaping from the lining tube. The vessel skipper noticed a greater number of birds caught during these times. Improvements were made to the lining tube in the summer of 1998; the high bycatch in 1998 may be attributable to the problems with the lining tube in the early part of the year.

SEABIRD BYCATCH RATES AS REPORTED IN FAO FISHERIES CIRCULAR No. 937, Chapter 4: Incidental Catch of Seabirds by Longline Fisheries

Geographic Area	Fishery Type and Species	Bycatch Rate (no. Birds/1000 hooks)	Seabirds Caught
Northeastern Atlantic Ocean and Mediterranean Sea (Norway study)	Demersal/cod, haddock, tusk, ling, wolffish	1.75; 0.04[1]	fulmars
Northwestern Atlantic Ocean (Canada, Greenland)	Demersal/cod, hake, haddock	not known	?
Northeastern Pacific Ocean (U.S.)	Demersal/cod, halibut, sablefish	0.08 (BSAI and GOA)	fulmars, gulls, albatross
Northwestern Pacific Ocean (China, Japan, Korea, Russia, Taiwan)	Demersal/pollock, cod	not known	?
Central and South America	Demersal/hake, kingclip, Patagonian toothfish		
Mexico and Venezuela		not known	
Brazil		0.3	albatross, petrels, shearwaters
Uruguay		0.41	albatross
Argentina		'appears high'	albatross
Chile		not known	albatross
Peru, Ecuador, Colombia		not known	
Southern Africa	Demersal/semi-pelagic/hake, kingclip	0.44; 0.043[1]	white-chinned petrel
Australasian (New Zealand)	Demersal/ling, snapper, trevalla	no rate available	albatross, petrels
Southern Ocean	Demersal/Patagonian toothfish	0.22 to 0.67	albatross, petrels, shearwaters
Atlantic Ocean & Mediterranean Sea	Pelagic/tuna, swordfish, sharks	little known	gulls, petrels, shearwaters
South Atlantic		4.7	albatross, petrels
Pacific Ocean	Pelagic/tuna	not known	?
Hawaii		0.276, 0.083	Laysan albatross, Black-footed alb.
Southern Ocean	Pelagic/tuna		
Australia		0.41	albatross, petrels
New Zealand		0.04 to 1.9	albatross, petrels

[1]First number represents rate with no mitigation measures in place; 2nd number represents rate with mitigation measures in place

FROM FAO FISHERIES CIRCULAR NO. 937

Table 12. Regulations in effect for reducing seabird catch by longline fisheries

Country or Convention	Year of adoption	Fishery type	Area of application	Mitigation measure required
Australia	1995	Pelagic (tuna)	AFZ south of 30°S	BSL
Japan	1997	Pelagic	High seas	BSL
New Zealand	1993	Pelagic	EEZ	BSL
South Africa	199?	Demersal	Sub-Antarctic EEZ	As for CCAMLR
South Africa	1998	Pelagic	EEZ	BSL, offal discharge
United Kingdom	?	Demersal	Outer fishing zone of FalklandIslands/ Malvinas	BSL, (weighted lines, night setting if instructed specifically)
U.S.A.	1997	Demersal	West Pacific EEZ	BSL, towing objects, weighted lines, offal discharge, underwater setting, night setting
U.S.A.	-	Pelagic	Hawaii EEZ (planned)	
CCAMLR	1992	Demersal	CCAMLR region	BSL, weighted lines, offal discharge, night setting

MITIGATION OPTIONS AVAILABLE 'DOWN UNDER' AUSTRALIA'S THREAT ABATEMENT PLAN

The objective of the Threat Abatement Plan is to reduce seabird bycatch in all fishing areas, seasons or fisheries to below 0.05 seabirds per 1000 hooks, based on current fishing levels.

__Mitigation Measures to be Required in the Domestic and Foreign Pelagic Longline Fisheries__

- All vessels use a bird scaring line of approved design.
- All vessels retain all offal during line setting or hauling and discharge it when not line setting or hauling.
- All options will require monitoring by an approved observer program.

Vessel operators must adopt one of the 3 options below on an annual basis:

__Option 1__:

- All baits will be set at night.

__Option 2__:

All vessels fishing during the day will:

- Use lines which are sufficiently weighted to cause the baits to sink out of reach of diving seabirds immediately after they are set. This weight will be determined by experimental trials;
- Demonstrate an ability to thaw baits before lines are set; and
- Use thawed baits on their hooks.
- Day setting operations will require a higher level of observer coverage.

__Option 3__:

- Vessels which can demonstrate a technique of setting and hauling longlines which does not make the hooks/baits available to seabirds can be issued with a permit to operate without any of the restrictions in Options 1 and 2 above.

NMFS' INVOLVEMENT IN FAO INITIATIVE TO REDUCE SEABIRD BYCATCH IN LONGLINE FISHERIES

- Proposal at FAO's Committee on Fisheries (COFI) meeting in March 1997 to hold a technical consultation; Japan, US, and FAO collaborate

- Seabird Technical Working Group (STWG) meets in Tokyo in March 1998 to draft guidelines for measures to reduce seabird bycatch and a Plan of Action for implementation of the draft guidelines; NMFS and USFWS representatives on the STWG

- March - October 1998 receive input from constituents (industry, environmental non-governmental groups) in development of US position papers

- October 26-30, 1998---FAO consultation in Rome, Italy on 3 initiatives----> management of fishing capacity, shark conservation and management, and reduction of incidental catch of seabirds in longline fisheries

- Drafts of 3 non-binding global documents approved by representatives from 81 countries and the EC present at consultation

- Expected endorsement by consensus at the FAO's COFI meeting in March 1999 and adoption by the FAO Conference in November 1999

FAO'S INTERNATIONAL PLAN OF ACTION TO REDUCE INCIDENTAL CATCH OF SEABIRDS IN LONGLINE FISHERIES (IPOA-SEABIRDS)

See the IPOA-SEABIRDS for complete text. Some of the key points are:

- Objective: Reduce the incidental catch of seabirds in longline fisheries.

- The IPOA-SEABIRDS is voluntary, all States are encouraged to implement it.

- States conduct an assessment of their longline fisheries to determine if a problem exists. If yes, States should adopt a National Plan of Action (NPOA- SEABIRDS).

- The NPOA-SEABIRDS may contain the following elements:
  - Prescription of mitigation measures
  - Plans for research and development of effective mitigation measures
  - Means for education, training, and publicity
  - Data collection programs to determine seabird bycatch and the effectiveness of mitigation measures; such programs may include onboard observers

- States recognize that each longline fishery is unique and the identification of appropriate mitigation measures can only be achieved through its assessment of the concerned fisheries. Technical and operational mitigation measures are attached to the IPOA-SEABIRDS. Reference to FAO Fisheries Circular No. 937 also.

- NPOA-SEABIRDS implementation should begin no later than early 2001.

- States should cooperate through regional and subregional fisheries management organizations to reduce the incidental catch of seabirds in longline fisheries.

- States should report on their NPOA-SEABIRDS progress as part of their biennial reporting under the Code of Conduct for Responsible Fisheries.

- FAO will support States in the implementation of the IPOA-SEABIRDS.

- FAO will support development and implementation of NPOA-SEABIRDS through specific, in-country technical assistance projects with Regular Program funds and by use of available extra-budgetary funds.

- FAO will report biennially on the implementation of the IPOA-SEABIRDS.

WHERE TO NOW?

- Funding for implementation of experimental component of Seabird Test Plan

- Continue gathering of information from observers and fishermen on effectiveness of seabird avoidance measures

- Improve/revise current seabird avoidance regulations in Alaska--is it possible now?

- Participate in the implementation of the IPOA-SEABIRDS and NPOA-SEABIRDS

IMPROVE/REVISE CURRENT SEABIRD AVOIDANCE REGULATIONS IN ALASKA--IS IT POSSIBLE NOW?

- North Pacific Longline Association (NPLA) proposal:

  - BSAI and GOA freezer/longliners shall deploy baited hooks through an underwater lining tube, at a depth of not less than 1.5m, when vessel fully laden

  - weights shall be added to line, as necessary, to prevent line from resurfacing after being set

  - streamer line, bird buoy bag, or other device shall be towed at all times behind the boat over the baited line for the purpose of discouraging diving birds

  - this requirement shall apply to: a) all freezer/longliners, b) freezer/longliners ≥ 125ft, or c) freezer/longliners ≥ 100ft

- Other possible alternatives to revise current regulations:

  - all applicable longline vessels setting gear during 'daylight hours' must use a streamer line or a towed buoy bag, AND

  - add sufficient weights to the longline gear to cause baited hooks to sink to at least 1-2m before reaching the end of the towed streamer line or towed buoy bag

  - all applicable longline vessels setting gear during 'night' hours must use a streamer line or a towed buoy bag

  - towing of board, stick or 'other devices' [see 50 CFR Part 679.24(e)(3)(ii)] would no longer qualify as compliance with seabird avoidance measures

✓ DB - friendly [illegible] to KB's motion

NATIONAL MARINE FISHERIES SERVICE

ALASKA REGION

REPORT ON SEABIRD BYCATCH ISSUES RELATING TO THE COMMERCIAL LONGLINE FISHERIES OFF ALASKA

Prepared by the National Marine Fisheries Service
for a Meeting of the
North Pacific Fishery Management Council

Anchorage, Alaska
December 7-11, 1998

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National Marine Fisheries Service Report

on Seabird Bycatch Issues Relating to the Commercial Longline Fisheries off Alaska

Purpose of Document

The purpose of this document is to report to the North Pacific Fishery Management Council (Council) on the status of current efforts to reduce seabird bycatch in the commercial longline fisheries for groundfish in the Bering Sea/Aleutian Islands (BSAI) and the Gulf of Alaska (GOA) and the Pacific halibut fishery off Alaska, as managed by the National Marine Fisheries Service (NMFS). The report provides the historical background of the seabird bycatch issue in Alaska as well as information about current seabird bycatch reduction efforts. The report is not intended to provide a comprehensive perspective of national or international efforts; such information could be drawn from the references cited here and the references found in those citations.

Introduction/Background

Millions of birds, representing over 80 species, occur over waters of the Exclusive Economic Zone (EEZ) off Alaska. The presence of "free" food in the form of offal and bait attract many birds to fishing operations. In the process of feeding, birds sometimes come into contact with fishing gear and are accidentally killed. For example, most birds taken during longline operations are attracted to the baited hooks when the gear is being set. These birds become hooked at the surface, and are then dragged underwater where they drown. The probability of a bird being caught is a function of many interrelated factors including: Type of fishing operation and gear used; length of time fishing gear is at or near the surface of the water; behavior of the bird (feeding and foraging techniques); water and weather conditions (e.g., sea state); size of the bird; availability of food (including bait and offal); and physical condition of the bird (molt, migration, health). Almost any species which occurs in these waters is susceptible to interactions with fishing gear.

NMFS began monitoring seabird/fishery interactions off Alaska in 1990 and in 1997 required that operators of hook-and-line vessels in the BSAI and GOA groundfish fisheries use seabird avoidance measures. NMFS implemented regulations for seabird avoidance measures in the Pacific halibut fishery in 1998. For a description of the fisheries and the gear used, see the analyses prepared for the rulemakings (1997, 1998a). See Table 1 for fishery catch and vessel effort information. A detailed list of the NMFS Alaska Region's involvement in seabird bycatch related activities is provided as Attachment A.

Several national and international initiatives highlight the need to address fisheries bycatch issues, including seabird bycatch. The United Nation's Food and Agriculture Organization (FAO) Code of Conduct for Responsible Fisheries was adopted in 1995 and contains an article (7.6.9) that calls for States to "take appropriate measures to minimize waste, discards, catch by lost or abandoned gear, catch of non-target species, both fish and non-fish species,...and promote, to the extent practicable, the development and use of selective, environmentally safe and cost effective gear and techniques." NMFS's recently published strategic document *Managing the Nation's Bycatch: Programs, Activities, and Recommendations for the National Marine Fisheries Service* (NMFS 1998b) includes national objectives, goals, and recommendations, all intended to address current programs and future efforts to reduce bycatch and bycatch mortality of marine resources, including protected species and seabirds. Consistent with the Code of Conduct for Responsible Fisheries, the FAO recently held a technical consultation to address seabird bycatch in longline fisheries. At this consultation, an *International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA)* was approved (discussed in detail later in this report). NMFS believes that its complementary implementation of the Code of Conduct for Responsible Fisheries, the NMFS Bycatch Plan, and the IPOA should result in the significant reduction of seabird bycatch in the Alaska longline fisheries. This will require the joint and cooperative efforts of NMFS, the North Pacific Fishery Management Council (Council), the U.S. Fish & Wildlife Service (USFWS), the effected commercial longline fishing industry, environmental non-governmental organizations, and other interested groups.

Endangered Species Act Requirements

The short-tailed albatross (*Phoebastria albatrus*) is a large pelagic bird whose current range includes the Bering Sea and the Gulf of Alaska, it once ranged throughout most of the North Pacific Ocean. Originally numbering in the millions, the worldwide population of breeding age birds is currently approximately 500 individuals and the worldwide total population is less than 1000 individuals (the population was estimated at 400 in 1988 and 700 in 1994). Breeding colonies are located on two islands in Japan, the primary colony being on Torishima Island, 370 miles south of Tokyo. The short-tailed albatross was originally designated as endangered under the Endangered Species Conservation Act of 1969 on the list of foreign-listed species. When the Endangered Species Act (ESA) replaced the 1969 Act in 1973, it was included as a foreign species but not as a native species. The USFWS is correcting this administrative error and has proposed the domestic listing of the short-tailed albatross under the ESA (63 FR 58692, November 2, 1998). See the proposed listing for detailed information on the life history, demographics, and population status of the short-tailed albatross (Attachment B). It was always the intent of the USFWS to protect the species where it occurred under the authority of the ESA, thus the USFWS and NMFS have consulted with each other since 1989 under section 7 of the ESA on the impacts of the BSAI and GOA groundfish fisheries on the short-tailed albatross.

Formal consultation was concluded on the effects of the groundfish fisheries on the short-tailed albatross and other species listed under the ESA under the jurisdiction of the USFWS on July 3, 1989. That consultation concluded that the BSAI and GOA groundfish fisheries would adversely affect the short-tailed albatross and would result in the incidental take of up to two birds per year, but would not jeopardize the continued existence of that species. The short-tailed albatross could be affected by: 1) Direct injury or mortality from fishing equipment, 2) entanglement or ingestion of plastics and other debris disposed overboard from fishery vessels, 3) injury resulting from contact with petroleum products spilled or leaked from vessels, and 4) competition for food resources. Subsequently, section 7 consultations were reinitiated for major changes to the fishery management plan (FMP) or fishery that might affect the short-tailed albatross. These were informal consultations, and concluded that no additional adverse effects beyond those in the aforementioned formal consultation would occur.

These subsequent informal consultations included: 1) 1992 BSAI and GOA total allowable catch (TAC) specifications, January 17, 1992; 2) 1993 BSAI and GOA TAC specifications, February 1, 1993, and clarified February 12, 1993; 3) delay of the second quarter pollock fishing season in the GOA, December 22, 1992; 4) careful release of halibut in hook-and-line fisheries, March 12, 1993; 5) delay of the second pollock fishing seasons in the BSAI and GOA, March 12, 1993; 6) BSAI FMP Amendment 28, April 14, 1993; 7) GOA FMP Amendment 31, July 21, 1993; 8) 1994 BSAI and GOA TAC specifications, February 14, 1994; 9) experimental trawl fishery, Kuskokwim Bay to Hooper Bay, June 22, 1994; 10) 1995 BSAI and GOA TAC specifications, February 7, 1995; and 11) 1996 BSAI and GOA TAC specifications, June 12, 1996, and clarified October 1, 1996. Although any mortality caused by commercial fishing would be a cause for concern, based on the best available information, the expected incidental take of up to two short-tailed albatrosses during harvest of 1996 groundfish TACs was not expected to jeopardize the continued existence of the listed species.

The 1989 USFWS Biological Opinion for an incidental take of two short-tailed albatrosses was based on a historical incidental take of two birds. In February 1996, NMFS requested that USFWS consider raising the incidental take of short-tailed albatross from two to four birds. In October 1996, USFWS indicated that the take level would remain at two birds and that reinitiation of section 7 consultation would be required. NMFS reinitiated consultation on the 1997 GOA and BSAI fisheries in November 1996. That consultation was concluded February 19, 1997, when USFWS issued an amendment to the 1989 Biological Opinion. The Biological Opinion was amended as follows: (1) Hereafter, the scope of section 7 consultations would be limited to the hook-and-line fisheries which are likely to adversely affect short-tailed albatrosses, (2) the incidental take was revised to four short-tailed albatrosses during the 2-year period of 1997 and 1998, and (3) two reasonable and prudent measures were added (see Table 2 for current ESA requirements). NMFS has reinitiated formal consultation with USFWS for the BSAI and GOA hook-and-line fisheries that would occur after December 31, 1998.

In 1997, NMFS initiated a section 7 consultation with USFWS on the effects of the Pacific halibut fishery off Alaska on the short-tailed albatross. USFWS issued a Biological Opinion in 1998 that concluded that the Pacific halibut fishery off Alaska was not likely to jeopardize the continued existence of the short-tailed albatross (USFWS, 1998). USFWS also issued an Incidental Take Statement of two short-tailed albatross in two years (1998 and 1999), reflecting what the agency anticipated the incidental take could be from the fishery action. Under the authority of ESA, USFWS identified non-discretionary reasonable and prudent measures that NMFS must implement to minimize the impacts of any incidental take. The combined reasonable and prudent measures from the 1998 Biological Opinion on the effects of the Pacific halibut fishery on the short-tailed albatross and the 1997 Biological Opinion on the effects of the BSAI and GOA groundfish hook-and-line fisheries on the short-tailed albatross are listed in Table 2 and discussed further in a section below. USFWS' conservation recommendations resulting from the aforementioned formal consultations are also listed in Table 2.

Reported Incidental Takes of Short-tailed Albatross: Seven short-tailed albatross takes have been reported in the Alaskan groundfish fisheries from 1983 to 1998 (Table 3). These occurred in the months of July, August, September (3), and October (2). Short-tailed albatross sightings in the BSAI and/or GOA have occurred in all months from April to November (Sherburne, 1993).

The first reported take of a short-tailed albatross in the Alaskan groundfish fisheries was in July 1983, north of St. Matthew Island (between 60°N, 180° and 58°o.5' N, 175°W). The bird was found dead in a fish net. A second take occurred in October 1987, and was caught by a vessel fishing for halibut in the GOA (59° 27.7'N, 145° 53.3'W).

A juvenile short-tailed albatross was taken in the western Gulf of Alaska IFQ sablefish longline fishery south of the Krenitzin Islands (53° 31'N, 165° 38'W) on August 28, 1995. The captain of the vessel reported that hundreds of albatrosses were caught and drowned on sets of squid-baited hooks (the others were Laysan and black-footed albatrosses). A NMFS-certified observer reported that longlines may have been inadequately weighted to assure rapid descent of baited hooks (A. Grossman, NMFS-PRMD, memo dated September 14, 1995). NMFS requested reinitiation of a formal consultation on the 1995 BSAI and GOA TAC specifications on September 8, 1995.

A take of a short-tailed albatross in the IFQ sablefish fishery occurred on October 8, 1995, in the Bering Sea (57° 01'N, 170° 39'W); NMFS was notified of the bird death on November 14 at the closure of the IFQ longline fishery. By the time USFWS confirmed the bird's identification, the groundfish TACs were reached and NMFS had closed the fisheries. The reason for the second taking was also attributed to insufficient weighting of the longlines (A. Grossman, NMFS-PRMD, memo dated February 13, 1996).

The fifth short-tailed albatross was taken September 27, 1996, in the BSAI (58° 41.3'N, 177° 02.6'W). The 5-year old adult bird was taken in a hook-and-line fishery.

The sixth and seventh short-tailed albatross were taken in the hook-and-line BSAI groundfish (Pacific cod) fishery. The sixth bird was taken on September 21, 1998 at 57°30'N, 173°57'W. It was 8 years old. In a separate incident, one short-tailed albatross was observed taken on September 28, 1998 at 58°27'N, 175°16'W but the specimen was not able to be retained. Identification of the bird was confirmed by USFWS seabird experts. The confirmation was based upon the observer's description of key characteristics that matched that of a subadult short-tailed albatross to the exclusion of all other species. A second albatross was also taken on September 28 but the species could not be confirmed (3 species of albatross occur in the North Pacific). Both vessels were using seabird avoidance measures when the birds were hooked.

Except for the second take in 1998, leg bands were recovered from all of the short-tailed albatross takes allowing scientists to verify identification and age. Since 1977, Dr. Hiroshi Hasegawa of Toho University has banded all short-tailed albatross chicks at their breeding colony on Torishima.

Efforts to Reduce Seabird Bycatch in Alaska's Longline Fisheries

In 1997, NMFS required operators of hook-and-line vessels fishing for groundfish in the BSAI and GOA and federally-permitted hook-and-line vessels fishing for groundfish in Alaska waters adjacent to the BSAI and to the GOA, to employ specified seabird avoidance measures to reduce seabird bycatch and incidental seabird mortality (62 FR 23176, April 29, 1997). Measures were necessary to mitigate longline fishery interactions with the short-tailed albatross and other seabird species. Prior to 1997, measures were not required but anecdotal information suggests that some vessel operators may have used mitigation measures voluntarily. In 1998, NMFS required seabird avoidance measures to be used by operators of vessels fishing for Pacific halibut in U.S. Convention waters off Alaska (63 FR 11161, March 6, 1998). See Table 4 for a list of these seabird avoidance measures that are required of vessel operators in the groundfish and Pacific halibut fisheries off Alaska. See the proposed rule documents for these separate rulemakings as well as the analysis completed for each rulemaking for further detailed discussion of the measures (62 FR 10016, March 5, 1997; 62 FR 65635, December 15, 1997; NMFS 1997, 1998a).

Enforcement of Seabird Avoidance Regulations: The U.S. Coast Guard assumed an aggressive and pro-active policy of educating commercial longline fishers in the months prior to regulations being effective. At-sea enforcement has continued this policy in checking for compliance with regulations during at-sea boardings. Reports of these compliance checks are made in the Coast Guard's report to the Council at each of its meetings. To date, NMFS Enforcement does not have any active cases involving violations of seabird avoidance regulations. Investigation of several NMFS observer reports of non-use of required measures is underway.

Regulations Requiring Seabird Avoidance Measures on Longline Vessels: All groundfish and Pacific halibut longline fishing operations must: 1) use baited hooks that sink as soon as they are put in the water, 2) discharge offal in a manner that distracts seabirds from baited hooks (if discharged at all during the setting or hauling of gear), and 3) make every reasonable effort to ensure that birds brought on board alive are released alive. In addition, all applicable longline vessels ≥ 26 ft length overall, must employ one or more of the following measures: 4) set gear at night (during hours specified in regulation), 5) tow a streamer line or lines during deployment of gear to prevent birds from taking hooks, 6) tow a buoy, board, stick or other device during deployment of gear at a distance appropriate to prevent birds from taking hooks, or 7) deploy hooks underwater through a lining tube at a depth sufficient to prevent birds from settling on hooks during the deployment of gear.

Fishers are provided some flexibility in choice of options such that they can select the most appropriate and practicable methods for their vessel size, fishery, and fishing operations and conditions. A similar approach allowing the choice of options will be used in Australia's Threat Abatement Plan (TAP) for the incidental catch of seabirds during oceanic longline fishing operations (Environment Australia, 1998). Although a choice of options will be available for use in pelagic longline operations, the options will be more strictly defined than those offered currently in the Alaska demersal fisheries. The TAP was written to meet the Australian government's obligations under their Endangered Species Protection Act 1992 following the listing of the incidental catch of seabirds during oceanic longline fishing operations as a key threatening process. Mitigation measures in the TAP must be implemented by 1999 by specified longline fishing operations in the Australian Fishing Zone (AFZ). This is the first time that domestic vessels in the AFZ will be required to use seabird avoidance measures. In 1995, streamer lines were required to be used on domestic vessels fishing south of 30°S and on all foreign vessels as a condition of obtaining a fishing permit for the AFZ. See later in this report for further discussion of seabird avoidance measures used in other global longline fisheries.

Use of Seabird Avoidance Measures on Observed Vessels: In 1997, NMFS observers began recording what types of seabird avoidance measures were being used on longline vessels and providing this data electronically at observer debriefing. Based on data from observed trips from 1997 through July 1998, the most commonly used mitigation measure was towing a buoy bag (74%), followed by sinking baited hooks quickly, streamer lines, offal discharge on opposite side of vessel, night setting of gear, and use of an underwater lining tube (1.6% of trips, 1 vessel) Most observed trips used more than one device at a time (see Table 5). NMFS is coordinating with USFWS to revise the observer data that is collected to more directly reflect on the effectiveness of the measures that are used.

Current Use and Effectiveness of the Required Seabird Avoidance Measures: To date, NMFS has not scientifically tested the effectiveness of required seabird avoidance measures in Alaskan fisheries. NMFS has developed a test plan to evaluate the effectiveness of these measures, but adequate funding has not thus far been identified (NMFS 1998c). See a later section for a discussion of the Seabird Test Plan. As noted above, information from observed longline vessels indicates the use of multiple measures to avoid seabird bycatch. It cannot be stressed enough that significant reduction in seabird bycatch is dependent upon the conscientious use of measures that are constructed carefully to be effective.

Effective measures or practices meet one or several of the following criteria: 1) prevent baited hooks from being visible to seabirds, 2) prevent seabirds from accessing baited hooks, and 3) decrease the incentive for seabirds to follow longline vessels. A description of each of the measures, current practices in use, what makes it effective, and information available on known effectiveness is provided below. Treatment of measures occurs in the order of most used measure to least used measure, per observer data.

Buoy Bag Towed Behind Vessel During Setting of Gear: Seventy-four percent of observed trips on longline vessels used this measure. Construction of the buoy bag varies, from one to several buoys of varied sizes being towed from the vessel's stern. The line attaching the buoy(s) to the vessel should be high enough (e.g. to a pole, the mast, baithouse, etc.) to clear 15-25ft above the sea surface at the stern. The minimum length of the line should be 150-200 ft, or approximately 2 boat lengths. These dimensions will vary according to setting speed, longer lengths required for faster setting speeds. The intent is to have the buoy bag suspended directly over the fishing gear as it is being set, preventing seabirds from accessing the 'vulnerable zone' behind the stern, that area where they could access baited hooks before the gear has had time to sink to a sufficient depth. Some fishers are towing 2 buoy bags (or streamer lines), one on either side of the fishing gear. Especially in windy conditions, at least one of the lines would be over the fishing gear. Preliminary results from an experiment conducted on a Norwegian longline vessel indicate that towed floats (i.e. buoy bag) reduced significantly the number of seabirds caught on baited hooks compared to when no seabird avoidance device was used (Løkkeborg, 1998). Three different avoidance measures were tested---towed floats, streamer line, and an underwater setting funnel (i.e. lining tube). During 11 sets for each of these methods, 2, 0, and 6 seabirds, respectively, were caught compared to 74 seabirds when no avoidance device was used.

Sinking Baited Hooks Quickly, Through the Use of Weights applied to the Groundline: Forty percent of observed trips on longline vessels employed this method. The purpose of applying additional weights to the groundline is to cause the gear to sink more quickly such that seabirds cannot reach the baited hooks. Although albatross and most other seabirds in Alaska are surface feeders, they can still reach baited hooks 1 to 3m below the water's surface. By sinking fishing gear quickly AND protecting the vulnerable zone behind the vessel with a buoy bag or streamer line, seabird bycatch should be significantly reduced. Line sink rates will vary as a function of the line weighting regime used, line setting speed, propeller turbulence, 'line hook-ups' (when hooks snag on line setting gear as the longline is being deployed), and 'weight pull-backs' (occurs when line weights are pulled from the vessel by the drag of the line already deployed). Preliminary investigations in the demersal Patagonian toothfish fishery found that a line weighting regime of 4kg/40m was effective at sinking gear to a sufficient depth, as tested on a 150 ft autoliner vessel (Robertson 1998). A similar regime is being promoted in New Zealand, 5kg/40m (J. Molloy, pers.comm.). Several fishers in Alaska longline fisheries are finding that smaller weights applied more frequently (0.5kg/20m) is effectively sinking the gear to a sufficient depth (M. Lundsten, pers.comm.). The small weights are spliced directly into the groundline. Many seabird experts around the world believe that for demersal fisheries, sufficiently weighting the groundline may be one of the most effective and practicable methods available to significantly reduce the bycatch of seabirds (N. Brothers, pers.comm.).

Streamer Line Towed Behind the Vessel During the Setting of Gear: Twenty-one percent of observed trips on longline vessels used this measure. The purpose of towing a streamer line is like that of a buoy bag, to prevent seabirds from accessing the vulnerable zone behind a vessel, where baited hooks are still accessible until they have sunk deep enough that the birds cannot reach them. Streamer lines will have buoys and/or weights attached at the end of the line (to keep the line taut) and will have 6 to 10 paired streamers suspended from the line, over the area where the fishing gear is being deployed. Like all of the avoidance measure construction materials, a durable and sturdy material should be used. Some Alaskan fishers have used surgical tubing successfully; and some use two streamer lines, one on either side of the fishing gear (M. Lundsten, pers.comm.). The effectiveness of streamer lines at reducing seabird bycatch has been directly tested in only a few experiments (Løkkeborg 1992, 1996, 1998). More frequently, its effectiveness has been noted through the analyses of observer data, other scientific observations, and anecdotal information. Worldwide, it is probably the most common seabird avoidance measure in use today. It is required in specified fisheries by country or convention in Australia, Japan, New Zealand, South Africa, United Kingdom (Falkland Islands/Malvinas), United States (as an option), Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), and Commission for the Conservation of Southern Bluefin Tuna (CCSBT).

Other Devices: Ten percent of observed trips on longline vessels used some 'other' device--examples are fire hose, paddlewheel, plastic streamers tied near stern, gun, and air horn. The use of water cannons and acoustic deterrents has been treated elsewhere (FAO 1998a). Water cannons may be effective at reducing seabird bycatch but the distance astern to which the water reached was considered to be inadequate. Noise deterrents may have some effect, albeit very limited, if used sparingly so birds do not become habituated to the sounds. Little is known about the effectiveness of the other devices.

Offal Discharge Methods: Seven to ten percent of observed trips on longline vessels used some type of offal discharge measure, either discharging from the opposite side of the vessel during the setting or hauling of gear, or not discharging offal at all during the set or haul. The purpose of addressing offal discharge is to minimize the attractiveness of the vessel or the gear deployment area to seabirds. If seabirds are not attracted to the vessel in the first place, then the likelihood of snagging one on a baited hook is decreased greatly. Many vessel operators have indicated that it is not practicable to not discharge offal, particularly during haul operations. Some evidence suggests that discharging of homogenized offal during line settings greatly reduced the incidental of seabirds, mainly because the birds were more attracted by offal than by baited hooks (Cherel *et.al.* 1996).

Gear Set at Night: Approximately seven percent of observed trips of longline vessels used this measure. Even though this practice has been identified worldwide as the most effective measure available and capable of virtually eliminating seabird mortality in some fishing areas, it has remained relatively unpopular among fishers. In high latitude areas, such as Alaska, night-setting is not a feasible option in the summer. It can pose other restrictions to smaller-sized vessels as well. Night-setting is required by CCAMLR and is an option in Alaska and will be an option under the Australian TAP.

Gear Deployed Underwater using a Lining Tube: Currently, only one vessel in the Alaska longline fisheries has installed a lining tube. Its high cost (approximately $40,000 installed), may be prohibitive to many fishers. One purpose of setting gear underwater through a lining tube is to deploy the gear at a depth that is not accessible by seabirds. Several studies have noted a reduction in bait loss and seabird bycatch when a lining tube is used (Løkkeborg 1996, 1998). In both studies, fewer birds were caught with a lining tube than compared to when no avoidance was used (28:99, 6:74) but more birds were caught with a lining tube than when a streamer line was used (28:2, 6:0).

Current information indicates that the device has some design deficiencies compromising the essential capabilities of any underwater setting device: 1) deliver hooks deep enough, 2) withstand the substantial forces acting upon it, 3) to not create additional problems, such as increased bait loss or line wear (FAO 1998a). Problems have been noted with the line escaping from the tube, through a groove along its length (J. Silden, P. Ryan--pers.comm.). This effectively brings the line back to the surface where seabirds are able to access the baited hooks. Design improvements to a springed locking mechanism may have resolved this problem. Another concern is whether or not propeller turbulence causes the line, after it leaves the tube, to come back to the surface (Robertson, pers.comm.). This could be remedied by extending the tube beyond the propeller turbulence (if possible) or applying weights to the groundline to cause it to sink more rapidly after exiting the lining tube. Tests carried out on Norwegian vessels indicated that the pitch angle of the vessel affects the lining tube's efficiency. In the beginning of a trip, when the vessel has not taken on fish, the tube goes deeper into the water and works well. Once the catch is loaded (middle and forward part of vessel), the tube sets the line closer to the water's surface with loss in efficiency (S. Løkkeborg, pers.comm.). Sea condition is also a factor that can affect the performance of the lining tube.

The lining tube currently in use on an Alaska longline vessel was installed in the summer of 1997. A preliminary analysis of the number of albatross caught on that vessel indicate annual albatross bycatch rates (number of birds/1000 hooks) of: 0.0012, 0.004, 0.0039, 0, and 0.0207 for 1994 to 1998 (Table 6). The vessel company and Mustad (gear manufacturer) indicated that problems occurred with the groundline escaping from the lining tube. The vessel skipper noticed a greater number of birds caught during these times. Improvements were made to the lining tube in the summer of 1998; the high bycatch in 1998 may be attributable to the problems with the lining tube in the early part of the year.

At its November meeting, the Council recommended that NMFS prepare an analysis for a regulatory amendment that would require freezer/longliners to use a lining tube to deploy gear. Currently, the use of a lining tube is an option available to satisfy requirements for the use of seabird avoidance measures. Although, the device shows promise, based on the preliminary analyses of a single vessel using a lining tube in the Alaska longline fisheries and on information available from a Norwegian study and from several global seabird bycatch experts, it appears to be premature to consider requiring the installation and use of lining tubes on freezer/longliners in the BSAI and GOA. Particularly when less expensive measures may be just as effective.

<u>Observer Data Collection on Seabird Bycatch</u>

The monitoring of seabird/fishery interactions by NMFS began in 1990 and was expanded during the 1993 and 1997 seasons. The major change in 1993 was to have observers provide genus or species identifications of incidentally caught seabirds. During species composition sampling, the observer makes a reliable (to species or species group) identification and records the numbers and weights of birds in the sample. USFWS uses this incidental mortality data by seabird species to estimate total bycatch rates for both the observed and unobserved portions of the fleet. The change in 1997 was to have observers provide information about what seabird avoidance measures were being used on longline vessels. Other observer-collected information that NMFS forwards to USFWS is: Sightings of sensitive species (6 species of special concern whose populations are very small or declining), any bird/vessel interactions, document collisions of birds with the vessel superstructure, and detailed information found on the leg bands of banded seabirds. NMFS is currently coordinating with the USFWS to update the seabird section of the NMFS Observer Manual. This will include the incorporation of a standardized USFWS form for the reporting of sightings of sensitive species. This is the same USFWS form that is available to fishermen to report sightings of short-tailed albatrosses.

Number of Seabirds Taken (USFWS Analysis of Seabird Take and Estimation of Seabird Bycatch Rates): Preliminary estimates of the incidental mortality of seabirds in Alaska groundfish fisheries between 1989 and 1993 indicates that about 85 percent of the total average seabird mortality in all groundfish fisheries during this time occurred in the BSAI (Wohl et.al., 1995). This preliminary data may be an overestimate due to several factors in the BSAI: increased groundfish harvest, higher populations or concentrations of seabirds, and higher levels of observer coverage may have reflected a greater percentage of seabird mortality in the BSAI. Although 88 percent of the groundfish in the two regions is harvested by trawlers, about 88 percent of the total seabird mortality occurred in the hook-and-line fisheries (Wohl et.al., 1995).

NMFS has been coordinating with the USFWS in its development of statistically valid extrapolation procedures to estimate the total seabird bycatch in the Alaska groundfish fisheries. Preliminary estimates of the annual seabird bycatch in Alaska groundfish fisheries based on 1993 to 1996 data can be found in the FAO Fisheries Circular No. 937 (Attachment C). Preliminary estimates indicate that approximately 13,000 seabirds are taken annually in the combined BSAI and GOA groundfish fisheries at an approximate rate of 0.084 birds per 1000 hooks. Bycatch estimates are based on: Observer reports of the number of seabirds taken in observed sets, total fish catch, vessel effort information (i.e. number of hooks) for the observed and unobserved sets, and other information as known and deemed appropriate (e.g. time and area fishing effort, seabird distribution). A description of extrapolation procedures used and updated seabird bycatch estimates will be presented by USFWS staff at this meeting.

Seabird Test Plan

In 1997, NMFS implemented regulations for seabird avoidance measures in the BSAI and GOA groundfish longline fisheries. These regulations satisfied one of the reasonable and prudent measures required of NMFS by the 1997 Biological Opinion issued by USFWS, under the section 7 consultation process of the ESA. The Opinion also required NMFS to develop a plan to evaluate the effectiveness of the required seabird avoidance measures. During the public comment period of the proposed rule, critics of the proposed regulations argued that the more stringent measures required by CCAMLR in southern oceans should be adopted in Alaska's fisheries. Although similar to NMFS regulations in many ways, CCAMLR regulations are more stringent in that they require vessels to set longlines only at night, and to deploy streamer lines at all times during fishing operations. However, no scientific data currently exists on the effectiveness of any deterrent measures in Alaska's fisheries. The appropriateness of the CCAMLR measures for the conditions of the BSAI and GOA was therefore unknown. NMFS and USFWS agreed to endorse more flexible requirements initially for Alaska to allow fishers, managers and scientists to experiment with devices and determine their effectiveness. Testing the effectiveness of seabird bycatch avoidance measures will allow NMFS to better ascertain if they are effective in the Alaskan fisheries. Once measures have been tested, NMFS will be better able to revise regulations to maximize their effectiveness. This may include specific performance standards for the seabird avoidance measures, if appropriate.

In 1998, NMFS implemented seabird avoidance regulations for the Pacific halibut fishery off Alaska. The Biological Opinion issued by USFWS in 1998 on the effects of the Pacific halibut fishery off Alaska on the short-tailed albatross required NMFS to apply the plan developed to test the effectiveness of seabaird avoidance measures in the groundfish fisheries to the Pacific halibut fishery also. The plan must also be implemented and a final report on the evaluation of avoidance measures submitted to USFWS by December 31, 2000.

NMFS completed and submitted to USFWS a *Test Plan to Evaluate Effectiveness of Seabird Avoidance Measures Required in Alaska's Hook-and-Line Groundfish and Halibut Fisheries* (Test Plan, Attachment D) in April 1998. The Test Plan focuses on three key components to evaluate the effectiveness of seabird avoidance measures: 1) Experimental testing of avoidance measures (at a minimum, testing of streamer lines and buoy bags), 2) collection of information on avoidance measures by observers on commercial vessels, and 3) solicit and gather information from fishers on the effectiveness of seabird avoidance measures. To date, funds have not been obtained to carry out the experimental tests. Funding of the Test Plan is critical to making further determinations about the efficacy of measures currently being used. As noted previously, NMFS is coordinating with USFWS to revise the observer data that is collected currently to more directly reflect on the effectiveness of the measures that are used. NMFS continues to communicate with fishers to address the effectiveness of the avoidance measures they are using. A seminar on this topic was held at the 1997 Fish Expo (jointly sponsored with North Pacific Longline Association (NPLA) and USFWS) and information is being solicited at this year's Fish Expo.

Global Perspective of Incidental Catch of Seabirds in Longline Fisheries

Seabirds are being taken incidentally in various commercial longline fisheries in the world, and concerns are arising about the impacts of that incidental take. Seabird bycatch also has an adverse impact on fishing productivity and profitability. Governments, nongovernmental organizations, and commercial fishery associations are petitioning for regulatory measures to reduce the mortality of seabirds in longline fisheries in which seabirds are incidentally taken.

Seabird Bycatch Rates in Global Longline Fisheries: Longline fisheries in which seabird bycatch occurs are: tuna, broadbill (swordfish) and billfish in the South Pacific; toothfish in the Southern Ocean, and halibut, black cod, tuna, billfish, Pacific cod, Greenland halibut, cod, haddock, tusk and ling in the Northern Oceans (Pacific and Atlantic). The species of seabirds most frequently taken are albatrosses and petrels in the South Pacific and South Atlantic fisheries, Northern fulmar in the North Atlantic and albatrosses, gulls and fulmars in the North Pacific fisheries. See Chapter 4 of FAO Fisheries Circular No. 937 (Attachment C) for a detailed description of known seabird bycatch rates. See Table 7 for a summary of the bycatch rates in Chapter 4.

Seabird Avoidance Measures Currently Required in Global Longline Fisheries: Responding to the need to reduce the incidental mortality of seabirds in commercial fishing in the Southern Oceans, the CCAMLR adopted mitigation measures in 1992 to reduce seabird bycatch by its 23 member countries. Under the auspices of the CCSBT, Australia, Japan and New Zealand have studied and taken seabird mitigation measures in their southern bluefin tuna longline fishery since 1992, and in 1995 CCSBT adopted the recommendation relating to ecologically related species especially the incidental mortality of seabird by longline fishing which stipulate the policy on data and information collection, mitigation measures and education and information dissemination. The U.S. also adopted, by regulation, seabird bycatch reduction measures for its groundfish longline fisheries in the Bering Sea/Aleutian Islands and Gulf of Alaska in 1997, and for the Pacific halibut fishery off Alaska in 1998. The US is currently considering seabird bycatch mitigation measures in the Hawaiian pelagic longline fisheries. See Table 12 of FAO Fisheries Circular No. 937 (Attachment C) for an account of current regulations for reducing seabird bycatch in longline fisheries. The mitigation options available under the Australian TAP are outlined in Table 8.

NMFS's Involvement in the FAO Initiative to Reduce the Incidental Catch of Seabirds in Longline

Fisheries: One of the objectives of the Food and Agriculture Organization's (FAO) Code of Conduct for Responsible Fisheries, adopted in 1995, is to promote the protection of aquatic resources. The Code also contains an article (7.6.9) promoting management measures to minimize the catch of nontarget, non-fish species and promoting the development and use of selective, environmentally safe and cost effective gear and techniques.

Pursuant to a proposal at the 22nd Session of the FAO's Committee on Fisheries (COFI) in March 1997 that FAO organize, in collaboration with Japan and the United States, an expert consultation on the issue, representatives of FAO, the Governments of Japan and the United States agreed to organize an FAO Consultation on the subject in October 1998. The objective of the FAO Consultation was to produce an International Plan of Action (IPOA) for implementing mitigation guidelines to reduce incidental catches of seabirds in longline fisheries to be considered for adoption by the 23rd Session of COFI in February 1999.

In preparation of the FAO Consultation a group of experts from FAO, Japan, the United States and other major regions which have problems with incidental catch of seabirds was established. This group was known as the Seabird Technical Working Group (STWG). FAO appointed the 16 members of the STWG. The members of the STWG were involved in the preparation and review of three background papers on (1) a description of pelagic and demersal longline fisheries (areas, catches, technology and fishing effort) ; (2) review of the incidental catch of seabird in specific longline fisheries; and (3) a review of seabird bycatch mitigation measures and their effect on other marine species and two draft documents on (1) Guidelines for measures to reduce seabird bycatch; and (2) a Plan of Action for implementation of the proposed guidelines. The STWG met in Tokyo, Japan in March 1998. A preliminary version of the compiled background papers, *The Incidental Catch of Seabirds by Longline Fisheries: Worldwide Review and Technical Guidelines for Mitigation*, has been issued (FAO Fisheries Circular No. 937, see Attachment C) and will be finalized and published in the FAO Fisheries Technical Paper Series in 1999.

FAO distributed the STWG outputs to FAO member countries for comment. A preparatory meeting for this seabird consultation and two other consultations (management of fishing capacity, and conservation and management of shark fisheries) was held in July 1998 in Rome, Italy. Draft documents were discussed and further refined. FAO distributed revised draft plans of action in September for consideration by FAO member countries at the FAO consultations in October.

The consultation on the Management of Fishing Capacity, Shark Fisheries, and the Incidental Catch of Seabirds in Longline Fisheries was held in plenary session in Rome, Italy, October 26-30, 1998. It was attended by 81 members of FAO and by observers from a non-member nation of FAO, a specialized agency of the United Nations, as well as ten intergovernmental organizations and eight international non-governmental organizations. The United States Delegation was headed by Terry Garcia, Assistant Secretary of Commerce for Oceans and Atmosphere, and well-represented by staff from NMFS, NOAA, USFWS, Department of State and several advisors from non-governmental groups. The Draft IPOA for the Reduction of Incidental Catch of Seabirds in Longline Fisheries (see Attachment E) was approved and is summarized below. It will be considered for adoption at FAO's next COFI meeting in February 1999.

Summary of IPOA-SEABIRDS

- The objective of the IPOA-SEABIRDS is to reduce the incidental catch of seabirds in longline fisheries where it occurs.

- The IPOA-SEABIRDS is voluntary, all States are encouraged to implement it.

- The IPOA-SEABIRDS applies to States in the waters of which longline fisheries are being conducted by their own or foreign vessels and to States that conduct longline fisheries on the high seas and in the exclusive economic zones (EEZ) of other States.

- States with longline fisheries should conduct an assessment of these fisheries to determine if a problem exists. Suggestions are provided to carry out the assessment. If a seabird bycatch problem exists, States should adopt a National Plan of Action (NPOA-SEABIRDS) for reducing the incidental catch of seabirds in longline fisheries.

- Each State is responsible for the design, implementation and monitoring of its NPOA-SEABIRDS.

- The NPOA-SEABIRDS may contain the following elements:
  - Prescription of mitigation measures
  - Plans for research and development of effective mitigation measures
  - Means for education, training, and publicity
  - Data collection programs to determine the incidental catch of seabirds and the effectiveness of mitigation measures; such programs may include onboard observers

- States which determine that an NPOA-SEABIRDS is not necessary, should review that decision on a regular basis, particularly if existing fisheries are expanded or new longline fisheries are developed.

- States recognize that each longline fishery is unique and the identification of appropriate mitigation measures can only be achieved through its assessment of the concerned fisheries. Technical and operational mitigation measures presently in use or under development in some longline fisheries are attached as a Technical Note to the IPOA-SEABIRDS. A more comprehensive description and discussion of the mitigation measures can be found in FAO Fisheries Circular No. 937.

- States should start the implementation of the NPOA-SEABIRDS no later than the COFI Session in 2001.

- States should regularly, at least every four years, assess their implementation of the NPOA-SEABIRDS for the purpose of identifying cost-effective strategies for increasing the effectiveness of the NPOA-SEABIRDS.

- States should cooperate through regional and subregional fisheries management organization or arrangements, and other forms of cooperation, to reduce the incidental catch of seabirds in longline fisheries.

- In implementing the IPOA-SEABIRDS, States recognize that cooperation among States which have important longline fisheries is essential to reduce the incidental catch of seabirds given the global nature of the issue. States should strive to collaborate through FAO and through other arrangements in research, training, and the production of information and promotional material.

- States should report on the progress of the assessment, development and implementation of their NPOA-SEABIRDS as part of their biennial reporting under the Code of Conduct for Responsible Fisheries.

- FAO will, as directed by its Conference, and as part of its regular program activities support States in the implementation of the IPOA-SEABIRDS.

- FAO will, as directed by its Conference, support development and implementation of NPOA-SEABIRDS through specific, in-country technical assistance projects with Regular Program funds and by use of extra-budgetary funds made available to the Organization for this purpose.

- FAO will, through COFI, report biennially on the state of progress in the implementation of the IPOA-SEABIRDS.

Some Optional Technical and Operational Measures for Reducing the Incidental Catch of Seabirds---as attached to the IPOA-SEABIRDS

See the IPOA-SEABIRDS (Attachment E) for the complete text. Mitigation measures can be used successfully to reduce the number of encounters between seabirds and baited hooks, thus reducing seabird bycatch. It is believed that the effectiveness of mitigation measures can be improved when measures are used in combination with each other. States may find it advantageous to implement different measures that are more suitable for their conditions and reflect the needs of their specific longline fisheries. The list of mitigation measures attached to the IPOA-SEABIRDS should not be considered mandatory or exhaustive.

Technical Measures

- Increase the sink rate of baits: weighting longline gear and/or thawing bait, line-setting machine
- Below-the-water setting chute, capsule, or funnel
- Bird scaring line positioned over or in the areas where baited hooks enter the water
- Bait casting machine (pelagic fisheries)
- Bird scaring curtain
- Artificial baits or lures
- Hook modification
- Acoustic deterrent
- Water cannon
- Magnetic deterrent

Operational Measures

- Reduce visibility of bait (night setting)
- Reduce attractiveness of the vessels to the seabirds
- Area and seasonal closures

- Give preferential licensing to vessels that use mitigation measures that do not require compliance monitoring
- Release live birds

Conclusions

The reduction of seabird bycatch in Alaska longline fisheries should be possible given that practicable and cost-effective seabird avoidance measures are available. Their absolute effectiveness in Alaska demersal longline fisheries has not been demonstrated experimentally, but evidence from the use of these measures elsewhere in the world indicates that, if measures are used properly and consistently, seabird bycatch should be reduced.

Once additional information is available about the efficacy of these measures in Alaska (i.e. implementation of the three components of the Test Plan), regulations can be revised if deemed necessary. Minor revisions may be an option at this time, given some information that is newly available. In addition to any regulatory requirements and their enforcement, bycatch reduction requires education of the fleet and the conscientious and consistent application of effective measures. Fishers need to understand why catching birds should be avoided. They need to understand how to avoid the birds. Addressing these issues has come from within the industry itself---NPLA has taken a lead role in advocating education and the distribution of informational materials; Mark Lundsten of Queen Anne Fisherie, Inc. has produced an informative video showing how the avoidance measures work. Lundsten has plans for another video, the target audience being vessel crew and operators, while they are out fishing.

Upon the expected adoption of the FAO's IPOA, the United States will be responsible for assessing its longline fisheries to determine if a seabird bycatch problem exists. If so, a National Plan of Action must be designed, implemented and monitored to reduce seabird bycatch in longline fisheries. The existence of a seabird bycatch problem has already been demonstrated in Alaska and Hawaii. Steps have already been taken to address the issue and reduce seabird bycatch. Whereas to date, the seabird bycatch problem has been one of regional focus, it will take on a national perspective that will require our participation.

Table 1.

GROUNDFISH HOOK-AND-LINE FISHERY STATISTICS

Groundfish hook-and-line target species include: BSAI--Pacific cod, sablefish, Greenland turbot, and rockfish; GOA--sablefish, Pacific cod, rockfish

1998	Total Allowable Catch (mt)			
	BSAI	GOA		
all groundfish	2.0 million	327 K		
through 11-19	116 K	25.4 K		
% H&L of Total	5.8%	7.8%		
# of permitted vessels	BSAI (only)	GOA (only)	BSAI & GOA	
<60'	25	1032	378	
≥60'	6	51	317	
total	31	1083	695	1809

1997	Total Catch (mt)			
	BSAI	GOA		
all groundfish	1.74 million	230 K		
H&L portion	154 K	28.4 K		
% H&L of Total	8.9 %	12.3 %		
# of permitted vessels	BSAI (only)	GOA (only)	BSAI & GOA	
<60'	23	953	343	
≥60'	6	45	274	
total	29	998	617	1644

1996	Total Catch (mt)			
all groundfish	1.75 million	202 K		
H&L portion	116 K	27.9 K		
% H&L of Total	6.6%	13.8%		
# of permitted vessels	BSAI (only)	GOA (only)	BSAI & GOA	
<60'	26	1070	386	
≥60'	2	47	315	
total	28	1117	701	1846

PACIFIC HALIBUT FISHERY STATISTICS

1998	51 million pound commercial take
1997	51 million pound commercial take
1996	47 million pound commercial take

# of vessels making halibut landings in 1998

<60'	1617
≥60'	158
total	1775

Table 2.

NMFS REQUIREMENTS UNDER THE ENDANGERED SPECIES ACT

The current non-discretionary reasonable and prudent measures in the USFWS Biological Opinions (BO) for the groundfish (G) and Pacific halibut (H) fisheries off Alaska are as follows:

- Observer data on STALB sightings and fishery interactions is collected. Observers are trained in seabird identification and provided with instructions and materials for reporting STALB observations. (G)
- Incidental take of any STALB is reported to USFWS. (G&H)
- STALB observations are reported to USFWS. (H)
- STALB that are found in fishing equipment, but still appear healthy, are released as soon as identification is confirmed. (G)
- Dead STALB are tagged with complete catch information and delivered to USFWS. (G&H)
- An information program is conducted each year to inform fishermen about: 1) Need and possible methods for avoiding entanglement of short-tailed albatross in fishery gear, 2) request reports of STALB sightings, and 3) encourage compliance with (MARPOL) and related treaties to protect marine animals including the STALB, 4) STALB identification, and 5) ways to avoid taking STALB when they are sighted near bait. (G&H)
- Vessels operators are required to use seabird bycatch avoidance devices and methods during fishing activities. (G&H)
- A test plan to evaluate the effectiveness of seabird bycatch avoidance gear and methods shall be completed and implemented. A final report of the evaluation is due December 31, 2000. (G&H)
- NMFS shall prepare a plan to investigate all options for monitoring the Pacific halibut fishery and will institute changes to the fishery appropriate to the results of the investigation.

CONSERVATION RECOMMENDATIONS

USFWS included the following discretionary conservation recommendations to NMFS in the 1997 amendment to the groundfish Biological Opinion:

1. In cooperation with FWS, initiate discussions with the Department of State to lead to data exchanges with other nations whose vessels fish with longline gear in the Pacific. Such data will allow us to determine the incidental take and mortality of seabirds by time and area and are essential to assess the need for additional conservation measures on an international scale.

2. Continue cooperative efforts with FWS to identify demographic parameters of the Torishima Island breeding population of short-tailed albatrosses with the goal of using these data to quantify the level of take which would appreciably reduce the survival and recovery of the species.

3. In cooperation with FWS, initiate efforts to conduct a population viability analysis using demographic data and available information on sources and magnitudes of threats to the species.

The following conservation recommendations were made in the 1998 Pacific halibut Biological Opinion:

1. Develop and/or evaluate new seabird avoidance measures.

2. Suggest to fishermen actions they may take to prevent the taking of STALB that have alighted near their longline gear.

3. Educate fishermen in the proper care of injured seabirds.

4. Consider temporary adjustments to the fishery during the times when STALB are most abundant in the areas fished by Pacific halibut longliners in waters off Alaska.

5. The USFWS encourages self-reporting of STALB encounters. However, substantial evidence exists that self-reporting by itself is an inadequate method for monitoring protected species encounters in a fishery. The USFWS strongly discourages the use of self-reporting as a sole method for monitoring this fishery, and strongly encourages the use of observers on Pacific halibut longline vessels over 60 ft in length.

Table 3.

SHORT-TAILED ALBATROSS REPORTED TAKES IN ALASKA FISHERIES

- July, 1983-- north of St. Matthew Island (between 60N, 180 and 58.5N, 175W), found dead in a fish net
- October, 1987-- vessel fishing for halibut in the GOA (59 27.7N, 145 53.3W)
- August 28, 1995-- juvenile taken in the western Gulf of Alaska IFQ sablefish longline fishery south of the Krenitzin Islands (53 31N 165 38W)
- October 8, 1995--take in the IFQ sablefish fishery in the Bering Sea (57 01N, 170 39W)
- September 27, 1996-- 5-year old adult bird in a hook-and-line fishery (58 41.3N, 177 02.6W)
- September 21, 1998--8-year old adult bird in the cod hook-and-line fishery; the adult had bred successfully for the 2 previous seasons (57 30N, 173 57W)
- September 28, 1998--sub-adult bird in the cod hook-and-line fishery 58 27N, 175 16W)

Except for the 2nd take in 1998, leg bands were recovered from all of the above albatrosses allowing scientists to verify identification and age. Since 1977, Dr. Hiroshi Hasegawa has banded all short-tailed albatross chicks at their breeding colony on Torishima Island, Japan.

Table 4.

CURRENT SEABIRD AVOIDANCE MEASURES REQUIRED OF VESSEL OPERATORS IN THE GROUNDFISH HOOK-AND-LINE FISHERIES IN THE BSAI AND GOA AND THE PACIFIC HALIBUT FISHERY OFF ALASKA
(62 FR 23176, April 29, 1997; 63 FR 11161, March 6, 1998)

1. All applicable hook-and-line fishing operations must be conducted in the following manner:

   a. Use hooks that when baited, sink as soon as they are put in the water.

   b. If offal is discharged while gear is being set or hauled, it must be discharged in a manner that distracts seabirds from baited hooks, to the extent practicable. The discharge site on board a vessel must either be aft of the hauling station or on the opposite side of the vessel from the hauling station.

   c. Make every reasonable effort to ensure that birds brought on board alive are released alive and that wherever possible, hooks are removed without jeopardizing the life of the birds.

2. All applicable hook-and-line vessels $\geq$ 26 ft LOA are required to employ one or more of the following seabird avoidance measures:

   a. Deploy gear only during hours specified in regulation (i.e. hours of darkness) using only the minimum vessel's lights necessary for safety;

   b. Tow a streamer line or lines during deployment of gear to prevent birds from taking hooks;

   c. Tow a buoy, board, stick or other device during deployment of gear at a distance appropriate to prevent birds from taking hooks. Multiple devices may be employed; or

   d. Deploy hooks underwater through a lining tube at a depth sufficient to prevent birds from settling on hooks during deployment of gear.

Table 5.

USE OF SEABIRD AVOIDANCE MEASURES ON HOOK-AND-LINE VESSELS IN THE GOA AND BSAI GROUNDFISH FISHERIES ON TRIPS FROM 12/31/96 THROUGH 7/17/98 AS REPORTED BY NMFS GROUNDFISH OBSERVERS[1]

Seabird Avoidance Measure	% of Observed Trips Using the Measure[2]
Buoy, board, or floating device towed behind vessel during setting	74.1
Sink baited hooks quickly	39.9
Streamer line towed behind vessel during setting of gear	20.6
Other device used[3]	9.9
Offal discharged from opposite side of vessel during setting or hauling	9.5
Offal never discharged during setting or hauling of gear	7.4
Gear set at night	6.6
Gear deployed underwater using lining tube	1.6
No device used	2.1[4]

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[1]NMFS groundfish observers began collecting this data in April 1997.

[2] Most trips used more than one device at a time.

[3] Other devices included: fire hose, bleach bottle, 'don't know', paddlewheel, chumming, plastic streamers near stern, gun, air horn

[4] 2.1% represents percent of trips after the regulation effective date of May 29, 1997 that did not use any seabird avoidance measures. 6 additional trips did not use seabird avoidance measures (4.5% of the trips observed) but these trips occurred before vessel operators were required to use seabird avoidance measures.

Table 6.

ANNUAL SEABIRD BYCATCH RATES AND ESTIMATES OF TOTAL SEABIRDS CAUGHT ON VESSEL WITH LINING TUBE[1]

Year	Albatross Bycatch Rate[2]	Estimate of Total No. of Albatross Caught[3]	Other Seabirds Bycatch Rate[2]	Estimate of Total No. of Other Seabirds Caught[3]
1994	0.0012	4	0.0267	77
1995	0.004	17	0.2521	1074
1996	0.0039	23	0.0937	560
1997	0 albatross caught	0	0.0401	281
1998	0.0207	106	0.2125	1086

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[1]lining tube was installed summer 1997; problems with operation of tube in early 1998; repaired in summer 1998

[2]bycatch rate expressed as number of birds per 1000 hooks

[3]estimate of total birds caught based on total hooks set

Table 7. SEABIRD BYCATCH RATES AS REPORTED IN FAO FISHERIES CIRCULAR No. 937, Chapter 4: Incidental Catch of Seabirds by Longline Fisheries

Geographic Area	Fishery Type and Species	Bycatch Rate (no. Birds/1000 hooks)	Seabirds Caught
Northeastern Atlantic Ocean and Mediterranean Sea (Norway study)	Demersal/cod, haddock, tusk, ling, wolffish	1.75; 0.04[1]	fulmars
Northwestern Atlantic Ocean (Canada, Greenland)	Demersal/cod, hake, haddock	not known	?
Northeastern Pacific Ocean (U.S.)	Demersal/cod, halibut, sablefish	0.08 (BSAI and GOA)	fulmars, gulls, albatross
Northwestern Pacific Ocean (China, Japan, Korea, Russia, Taiwan)	Demersal/pollock, cod	not known	?
Central and South America	Demersal/hake, kingclip, Patagonian toothfish		
Mexico and Venezuela		not known	
Brazil		0.3	albatross, petrels, shearwaters
Uruguay		0.41	albatross
Argentina		'appears high'	albatross
Chile		not known	albatross
Peru, Ecuador, Colombia		not known	
Southern Africa	Demersal/semi-pelagic/hake, kingclip	0.44; 0.043[1]	white-chinned petrel
Australasian (New Zealand)	Demersal/ling, snapper, trevalla	no rate available	albatross, petrels
Southern Ocean	Demersal/Patagonian toothfish	0.22 to 0.67	albatross, petrels, shearwaters
Atlantic Ocean & Mediterranean Sea	Pelagic/tuna, swordfish, sharks	little known	gulls, petrels, shearwaters
South Atlantic		4.7	albatross, petrels
Pacific Ocean	Pelagic/tuna	not known	?
Hawaii		0.276, 0.083	Laysan albatross, Black-footed alb.
Southern Ocean	Pelagic/tuna		
Australia		0.41	albatross, petrels
New Zealand		0.04 to 1.9	albatross, petrels

[1]First number represents rate with no mitigation measures in place; 2[nd] number represents rate with mitigation measures in place

Table 8.

MITIGATION OPTIONS AVAILABLE 'DOWN UNDER' AUSTRALIA'S THREAT ABATEMENT PLAN

The objective of the Threat Abatement Plan is to reduce seabird bycatch in all fishing areas, seasons or fisheries to below 0.05 seabirds per 1000 hooks, based on current fishing levels.

Mitigation Measures to be Required in the Domestic and Foreign Pelagic Longline Fisheries

- All vessels use a bird scaring line of approved design.
- All vessels retain all offal during line setting or hauling and discharge it when not line setting or hauling.
- All options will require monitoring by an approved observer program.

Vessel operators must adopt one of the 3 options below on an annual basis:

Option 1:

- All baits will be set at night.

Option 2:

All vessels fishing during the day will:

- Use lines which are sufficiently weighted to cause the baits to sink out of reach of diving seabirds immediately after they are set. This weight will be determined by experimental trials;
- Demonstrate an ability to thaw baits before lines are set; and
- Use thawed baits on their hooks.
- Day setting operations will require a higher level of observer coverage.

Option 3:

- Vessels which can demonstrate a technique of setting and hauling longlines which does not make the hooks/baits available to seabirds can be issued with a permit to operate without any of the restrictions in Options 1 and 2 above.

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TIMELINE OF NMFS ALASKA REGION SEABIRD ACTIVITIES

1989 FWS issues BO under section 7 of the Endangered Species Act (ESA) that groundfish fisheries off Alaska (particularly longline and gillnet) have the potential for taking the endangered STALB. Incidental take set at 2 birds per year; this is based on what historically has been taken (take in 1983 and in 1987).

1989 First pilot NMFS observer program for high seas squid fishery in North Pacific (NP); information collected on marine mammal and bird takes. Japanese squid fishery expanding in NP in mid-70's.

1990 Squid observer training program relocated to NMFS Groundfish Observer Program (GFOP). Pat Gould brought in as Principal Investigator of seabird component of High Seas Driftnet Program. Gould recognizes need for GFOP to collect more extensive seabird bycatch data.

1992 Pilot program targeting longline fisheries initiated. Special project NMFS observers use special data forms, bird ID, take numbers, number of hooks, whether caught during set or retrieval.

1993 GFOP expands above seabird duties to all groundfish NMFS observers to include: sightings of sensitive species, sightings of miscellaneous species, bird/vessel interactions, gear-related mortality, intended and direct mortality, use of deterrent devices by the vessel, detailed information found on leg bands of banded seabirds, and Seabird Daily Notes--record notes associated with seabirds.

1994 to present: Numerous NMFS news releases, support of privately produced brochure to notify/educate public and industry about methods to reduce seabird bycatch.

1995 FWS amends BO on STALB to require that NMFS collect fishery observer data. Coordination with FWS to begin process of estimating total seabird take in groundfish fisheries.

1996 Nov: NP longline industry petitions the North Pacific Fishery Management Council (Council) for regulations to reduce seabird bycatch in longline fisheries.

1997

Feb: FWS amends BO on STALB, incidental take revised to 4 birds per 2 years; reasonable and prudent measures revised to require regulations for seabird avoidance measures and to require development of a plan to test the effectiveness of such measures; conservation recommendations added.

Mar: Proposed rule published in Federal Register that would require groundfish hook-and-line vessels to use seabird avoidance measures. (62 FR 10016)

Mar: Begin involvement in United Nation's Food and Agriculture Organization (FAO) initiative to reduce incidental catch of seabirds in global longline fisheries; NMFS and FWS are co-leads for Interagency Seabird Team.

Apr: Final rule published in Federal Register requiring groundfish hook-and-line vessels to use seabird avoidance measures. (62 FR 23176); regulations effective May 29, 1997.

Apr: GFOP begins collecting information from groundfish observers (at debriefing) on what types of seabird avoidance measures are being used by longline vessels in the GOA and BSAI groundfish fisheries.

Jun: Council recommends similar measures for Pacific halibut fishery.

Aug: NMFS and FWS, and International Pacific Halibut Commission (IPHC) staff and industry representatives observe deployment of seabird avoidance gear on F/V Frontier Spirit, a freezer-longliner, in Puget Sound.

Aug: GFOP transmits seabird bycatch data and seabird notes from observer logbooks to FWS.

Sep: NMFS staff (US co-lead) meet with FWS (US co-lead), Japan representatives, and FAO representative in Anchorage, Alaska, on FAO seabird consultation initiative.

Sep: NMFS staff attend FWS-sponsored public seminar by Dr. Hiroshi Hasegawa, world expert on the STALB; NMFS staff meet with Dr. Hasegawa, FWS, and university staff to discuss impacts to STALB population.

Nov: NMFS, FWS, and industry participation in Fish EXPO conference, "Fisherman to Fisherman: Seabird Avoidance in North Pacific Longline Fisheries"; joint sponsors for information booth.

Nov: Letters to 2500 Federal Fisheries Permit Holders asking that STALB sightings be reported to FWS. Letters enclosed laminated identification chart of NP albatrosses.

1998

Jan: NMFS distributes laminated identification chart of NP albatrosses to 6000 Individual Fishing Quota (IFQ) Permit Holders (i.e. halibut and sablefish).

Feb: NMFS publishes proposed rule in Federal Register that would require seabird avoidance measures in the Pacific halibut fishery and exempt vessels less than 26 ft LOA in this fishery and the GOA and BSAI groundfish fisheries from some of the measures (62 FR 65635).

Mar: Final rule published in Federal Register requiring vessels in Pacific halibut fisheries to use seabird avoidance measures (63 FR 11161) and exempting vessels less than 26 ft LOA in this fishery and the GOA and BSAI groundfish fisheries from some of the measures; regulations effective April 6, 1998.

Mar: IPHC News Release regarding the above regulations and notice that IPHC port samplers will interview fishermen for information on seabirds.

Mar: NMFS and FWS staff are invited to participate in the FAO's Seabird Technical Working Group (STWG) meeting in Tokyo. The STWG's objective is to draft a Plan of Action for implementing guidelines to reduce incidental catches of seabirds in longline fisheries.

Mar: NMFS staff provide script advice to New England Aquarium staff that are producing a video on fishery bycatch. Script specifically mentions incidental catch of seabirds in longline fisheries.

Apr: NMFS submits to FWS the "Test Plan to Evaluate Effectiveness of Seabird Avoidance Measures Required in Alaska's Hook-and-Line Groundfish and Halibut Fisheries", as required by the 1997 FWS BO. NMFS begins process to secure funding for Test Plan's implementation.

Jun: NMFS Seabird Coordinator hired to address seabird bycatch management issues and the requirements within section 7 consultations on effects of the groundfish and halibut fisheries off Alaska on the STALB.

Sep: NMFS transmits 1993-1997 commercial fisheries catch data to USFWS for use in extrapolation of seabird bycatch estimates for the GOA and BSAI groundfish fisheries.

Oct: NMFS staff (Hawaii and Alaska) attend "Black-footed Albatross Population Biology Workshop" co-sponsored by the Western Pacific Regional Fishery Management Council, FWS, and NMFS.

Oct: NMFS and FWS staff on the US delegation to the FAO's technical consultation on the "Reduction of Incidental Catch of Seabirds in Longline Fisheries" held in Rome, Italy.

Nov: NMFS distributes seabird bycatch information with annual mailing of NMFS groundfish fisheries permits. Information includes: info. bulletin of recent STALB takes, measures to avoid seabirds, FWS's STALB encounter form.

Nov: NMFS provides above seabird bycatch information at Fish Expo in Seattle and seeks industry comment on effective use of seabird avoidance measures.

Dec: NMFS presents Seabird Bycatch Report at North Pacific Fishery Management Council meeting.

1999

Feb: NMFS and USFWS staff participation in the symposium, *Seabird Bycatch: Trends, Roadblocks, and Solutions* at the annual meeting of the Pacific Seabird Group

TABLE C.—REQUIRED SEPARATION IN KILOMETERS (MILES) OF BASE STATION FROM PUBLIC COAST STATIONS—Continued

Base Station Characteristics					
HAAT	ERP (watts)				
Meters (feet)	400	300	200	100	50
30 (100)	154 (96)	151 (94)	145 (90)	137 (85)	130 (81)
61 (200)	166 (103)	167 (104)	161 (100)	153 (95)	145 (90)
122 (400)	187 (116)	177 (110)	183 (114)	169 (105)	159 (99)

(v) In the event of interference, the Commission may require, without a hearing, licensees of base stations authorized under this section that are located within 241 kilometers (150 miles) of a co-channel public coast, I/LT, or grandfathered public safety station licensed prior to July 6, 1998, or an international border, to reduce power, decrease antenna height, and/or install directional antennas. Mobile stations must be operated only within radio range of their associated base station.

(vi) Applicants seeking to be licensed for stations exceeding the power/antenna height limits of the table in paragraph (iv) of this section must request a waiver of that paragraph and must submit with their application an interference analysis, based upon an appropriate, generally-accepted terrain-based propagation model, that shows that co-channel protected entities, described in paragraph (iii) of this section, would receive the same or greater interference protection than the relevant criteria outlined in paragraph (iii) of this section.

4. Section 90.179 is amended by revising paragraph (a) to read as follows:

§ 90.179 Shared use of radio stations.

* * * * *

(a) Persons may share a radio station only on frequencies for which they would be eligible for a separate authorization. Licensees under Subpart R may share the use of their systems with any entity that would be eligible for licensing under § 90.523 and Federal government entities.

* * * * *

5. A new section 90.553 is added to read as follows:

§ 90.553 GNSS protection.

In order to provide adequate protection to receivers of the Global Navigation Satellite System (GNSS) which will utilize the Radionavigation-Satellite Service (space-to-Earth) band, mobile units must meet a minimum second harmonic suppression standard in the frequency range of 1559–1605 MHz of 90 dB down from the maximum effective radiated power of the carrier and handhelds and portable units must meet a minimum second harmonic suppression standard in the frequency range of 1559–1605 MHz of 80 dB down from the maximum effective radiated power of the carrier. This standard applies only to equipment operating in the frequency range of 779.5–802.5 MHz.

[FR Doc. 98–28976 Filed 10–30–98; 8:45 am]
BILLING CODE 6712–01–P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

RIN 1018–AE91

Endangered and Threatened Wildlife and Plants; Proposed Rule To List the Short-Tailed Albatross as Endangered in the United States

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: Under the authority of the Endangered Species Act (Act) of 1973, as amended, the U.S. Fish and Wildlife Service (Service) proposes to extend endangered status for the short-tailed albatross (*Phoebastria albatrus*) to include the species' range within the United States. As a result of an administrative error in the original listing, the short-tailed albatross is currently listed as endangered throughout its range except in the U.S. Short-tailed albatrosses range throughout the North Pacific Ocean and north into the Bering Sea during the non-breeding season, and breeding colonies were historically present on islands in Taiwan. Originally numbering in the millions, the worldwide population of breeding age birds is currently approximately 500 individuals and the worldwide total population is less than 1000 individuals. There are no breeding populations of short-tailed albatrosses in the U.S., but several individuals have been regularly observed during the breeding season on Midway Atoll in the Northwestern Hawaiian Islands. Current threats to the species include destruction of habitat by volcanic eruption or mud or land slides caused by monsoon rains, and demographic or genetic vulnerability due to low population size and limited breeding distribution. Longline fisheries, plastics ingestion, contaminants, and airplane strikes may also be factors affecting the species' conservation. This proposal, if made final, would implement the Federal protection and recovery provisions provided by the Act for individuals when they occur in the U.S.

DATES: Comments from all interested parties must be received by March 2, 1999. Public hearing requests must be received by December 17, 1998.

ADDRESSES: Comments and materials concerning this proposal should be sent to the Field Supervisor, Anchorage Field Office, U.S. Fish and Wildlife Service, 605 West 4th Avenue, Room G–62, Anchorage, AK 99501 (telephone 907/271–2787). Comments and materials received will be available for public inspection, by appointment, during normal business hours at the above address.

FOR FURTHER INFORMATION CONTACT: Greg Balogh, Endangered Species Biologist (telephone 907/271–2778).

SUPPLEMENTARY INFORMATION:

Background

Taxonomy

George Steller made the first record of the short-tailed albatross in the 1740s. The type specimen for the species was collected offshore of Kamchatka, Russia, and was described in 1769 by P.S. Pallas in Spicilegia Zoologica (AOU 1983). In the order of tube-nosed marine birds, Procellariiformes, the short-tailed albatross is classified within the family Diomedeidae. Until recently, it had been assigned to the genus *Diomedea*. Following the results of genetic studies by Nunn et al. (1996), the family Diomedeidae was arranged in four genera. The genus *Phoebastria*, North Pacific albatrosses, now includes the short-tailed albatross, the Laysan albatross (*P. immutabilis*), the black-footed albatross (*P. nigripes*), and the waved albatross (*P. irrorata*)(AOU 1997).

Description

The short-tailed albatross is a large pelagic bird with long narrow wings adapted for soaring just above the water surface. The bill is disproportionately large compared to other northern hemisphere albatrosses and is pink and hooked with a bluish tip, has external tubular nostrils, and a thin but conspicuous black line extending around the base. Adult short-tailed albatrosses are the only North Pacific albatross with an entirely white back. The white head develops a yellow-gold crown and nape over several years. Fledged juveniles are dark brown-black, but soon obtain pale bills and legs that distinguish them from black-footed and Laysan albatrosses (Tuck 1978, Roberson 1980).

Historical Distribution

The short-tailed albatross once ranged throughout most of the North Pacific Ocean and Bering Sea, with known nesting colonies on the following islands: Torishima in the Seven Islands of Izu Group in Japan; Mukojima, Nishinoshima, Yomeshima, and Kitanoshima in the Bonin Islands of Japan; Kita-daitojima, Minami-daitojima, and Okino-daitojima of the Daito group of Japan; Senkaku Retto of southern Ryukyu Islands of Japan, including Minami-kojima, Kobisho and Uotsurijima; Iwo Jima in the western Volcanic Islands (Kazan-Retto) of Japan; Agincourt Island, Taiwan; and Pescadore Islands, of Taiwan, including Byosho Island (Hasegawa 1979, King 1981). Other undocumented nesting colonies may have existed. For example, recent observations together with records from the 1930s, suggest that short-tailed albatross may have once nested on Midway Atoll, USA. No confirmed historical breeding accounts are available for this area, however.

Early naturalists, such as Turner and Chamisso, believed that short-tailed albatrosses bred in the Aleutian Islands because high numbers of birds were seen nearshore during the summer and fall months (Yesner 1976). Alaska Aleut lore referred to local breeding birds and explorer O. Von Kotzebue reported that Natives harvested short-tailed albatross eggs. However, while adult bones were found in Aleut middens, fledgling remains were not recorded in over 400 samples (Yesner 1976). Yesner (1976) believed that short-tailed albatrosses did not breed in the Aleutians but were harvested offshore during the summer, non-breeding season. Given the midwinter constraints on breeding at high latitudes and the known southerly location of winter breeding, it is highly unlikely that these birds ever bred in Alaska (Sherburne 1993).

Additional historical information on the species' range away from known breeding areas is scant. Evidence from archeological studies in middens suggests that hunters in kayaks had access to an abundant nearshore supply of short-tailed albatrosses from California north to St. Lawrence Island as early as 4000 years ago (Howard and Dodson 1933, Yesner and Aigner 1976, Murie 1959). In the 1880s and 1890s, short-tailed albatross abundance and distribution during the non-breeding season was generalized by statements such as "more or less numerous" in the vicinity of the Aleutian Islands (Yesner 1976). They were reported as highly abundant around Cape Newenham, in western Alaska, and Ventaiminov regarded them as abundant near the Pribilof Islands (DeGange 1981). In 1904, they were considered "tolerably common on both coasts of Vancouver Island, but more abundant on the west coast" (Kermode in Campbell et al., 1990).

Historical Population Status

At the beginning of the 20th century, the species declined in population numbers to near extinction, primarily as a result of hunting at the breeding colonies in Japan. Albatross were killed for their feathers and various other body parts. The feather down was used for quilts and pillows, and wing and tail feathers were used for writing quills; their bodies were processed into fertilizer and rendered into fat, and their eggs were collected for food (Austin 1949). Hattori (in Austin 1949) commented that short-tailed albatrosses were "...killed by striking them on the head with a club, and it is not difficult for a man to kill between 100 and 200 birds daily." He also noted that the birds were, "very rich in fat, each bird yielding over a pint."

Pre-exploitation worldwide population estimates of short-tailed albatrosses are not known; the total number of birds harvested may provide the best estimate, since the harvest drove the species nearly to extinction. Between approximately 1885 and 1903, an estimated 5 million short-tailed albatrosses were harvested from the breeding colony on Torishima (Yamashina in Austin 1949), and harvest continued until the early 1930s, except for a few years following the 1903 volcanic eruption. One of the residents on the island (a schoolteacher) reported 3,000 albatrosses killed in December 1932 and January 1933. Yamashina (in Austin) stated that "This last great slaughter was undoubtedly perpetrated by the inhabitants in anticipation of the island's soon becoming a bird sanctuary." By 1949, there were no short-tailed albatrosses breeding at any of the historically known breeding sites, including Torishima, and the species was thought to be extinct (Austin 1949).

The species persisted, however, and in 1950, the chief of the weather station at Torishima, Mr. M. Yamamoto, reported nesting of the short-tailed albatross (Tickell 1973, 1975). By 1954 there were 25 birds and at least 6 pairs (Ono 1955). These were presumably juvenile birds that had been wandering the North Pacific during the final several years of slaughter. Since then, as a result of habitat management projects, stringent protection, and the absence of any significant volcanic eruption events, the population has gradually increased. The average growth of the Torishima, Tsubamesaki colony, between 1950 and 1977 was 2.5 adults per year; between 1978 and 1991 the average population increase was 11 adults per year. An average annual population growth as high as 6 percent per year (Hasegawa 1982, Cochrane and Starfield in prep.) has resulted in a continuing increase in the breeding population to an estimated 388 breeding birds on Torishima in 1998 (H. Hasegawa, Toho University, Chiba, Japan pers. comm.). Torishima is under Japanese government ownership and management and is managed for the conservation of wildlife. There is no evidence that the breeding population on Torishima is nest site limited at this point; therefore, ongoing management efforts focus on maintaining high rates of breeding success.

Two primary activities have been undertaken to enhance breeding success on Torishima. First, erosion control efforts at the Tsubamesaki colony have improved nesting success. Second, an attempt to establish a second breeding colony on Torishima involved an experimental program for luring breeding birds to the opposite side of the island from the Tsubamesaki colony. Preliminary results of the experiment are promising; the first chick was produced in 1997. The expectation is that absent a volcanic eruption or some other catastrophic event, the population on Torishima will continue to grow, but that it will be many years before the breeding sites are limited (Hasegawa 1997).

In 1971, 12 adult short-tailed albatrosses were discovered on Minami-kojima in the Senkaku Islands, one of the former breeding colony sites (Hasegawa 1984). Aerial surveys in 1979 and 1980 resulted in observations of between 16 and 35 adults. In April 1988, the first confirmed chicks on Minami-kojima were observed, and in March 1991, 10 chicks were observed. In 1991, the estimate for the population on Minami-kojima was 75 birds and 15 breeding pairs (Hasegawa 1991). There is no information available on historical numbers at this breeding site.

Short-tailed albatrosses have been observed on Midway Atoll since the early 1930s (Berger 1972, Hadden 1941, Fisher in Tickell 1973, Robbins in Hasegawa and DeGange 1982). There is one unconfirmed report of a short-tailed albatross breeding on Midway Atoll in the 1960s (H. Hasegawa pers. comm., in a letter from Dr. Harvey Fischer), but no subsequent reports of successful breeding exist. In the years following the reported observation, tens of thousands of albatrosses were exterminated from Midway Atoll to construct an aircraft runway, and to provide safe conditions for aircraft landings and departures. It is possible that short-tailed albatrosses nesting on the island were killed during this process (E. Flint, U.S. Fish and Wildlife Service, Honolulu pers. comm.). Since the mid 1970s, short-tailed albatrosses have been observed during the breeding season on Midway Atoll. In March 1994, a courtship dance was observed between two short-tailed albatrosses (Richardson 1994), and at least one has occupied a nest site and laid an egg which did not hatch (K. Niethammer, U.S. Fish and Wildlife Service, Midway Atoll pers. comm.). Midway Atoll is currently managed by the U.S. Government as a National Wildlife Refuge.

Observations of individuals have also been made during the breeding season on Laysan Island, Green Island at Kure Atoll, and French Frigate Shoals, but there is no indication that these occurrences represent established breeding populations (Sekora 1977, Fefer 1989).

The dramatic decline during the turn of the century and recent increases in numbers of short-tailed albatrosses were reflected in observations from the non-breeding season. Between the 1950s and 1970, there were few records of the species away from the breeding grounds according to the AOU Handbook of North American Birds (Vol. 1, 1962) and the Red Data Book (Vol.2, Aves, International Union for the Conservation of Nature, Morges, Switzerland, 1966) (Tramontano 1970). There were 12 reported marine sightings in the 1970s and 55 sightings in the 1980s; over 250 sightings have been reported in the 1990s to date (Sanger 1972, Hasegawa and DeGange 1982, USFWS unpublished database). This observed increase in opportunistic sightings should be interpreted cautiously, however, because of the potential temporal, spatial, and numerical biases introduced by opportunistic shipboard observations. Observation effort, total number of vessels present, and location of vessels may have affected the number of observations independent of an increase in total numbers of birds present. Moreover, it is likely the reporting rate of observations has increased with implementation of outreach efforts by Federal agencies and fishing interest groups in the last few years.

At-sea sightings since the 1940s indicate that the short-tailed albatross, while very few in number today, is distributed widely throughout its historical foraging range of the temperate and subarctic North Pacific Ocean (Sanger 1972; USFWS unpublished data), and is found close to the U.S. coast. From December through April, distribution is concentrated near the breeding colonies in the Izu and Bonin Islands (McDermond and Morgan 1993), although foraging trips may extend hundreds of miles or more from the colony sites, if short-tailed albatross behavior is similar to black-footed and Laysan albatrosses. Recent satellite tracking of black-footed and Laysan albatrosses revealed that individuals of those species travel hundreds of miles from the breeding colonies during the breeding season (David Anderson, Wake Forest University, pers. comm.).

In summer (i.e., non-breeding season), individuals appear to disperse widely throughout the historical range of the temperate and subarctic North Pacific Ocean (Sanger 1972), with observations concentrated in the northern Gulf of Alaska, Aleutian Islands, and Bering Sea (McDermond and Morgan 1993, Sherburne 1993, USFWS unpublished data). Individuals have been recorded along the west coast of North America as far south as the Baja Peninsula, Mexico (Palmer 1962).

Current Population

A worldwide population total may be coarsely estimated by combining information from a variety of sources. Estimates of total numbers of breeding age adults and immature birds are obtained using a variety of different data and methods. The total estimates are rounded to the nearest hundred birds, reflecting the lack of precision in some of the data.

Breeding age population estimates come primarily from egg counts and breeding bird observations. There were 388 breeding adults present on Torishima in 1998, assuming 2 adults are present for each of the 194 eggs counted. The most recent population count on Minami-kojima revealed 30 breeding adults present in 1991. A conservative estimate for observed breeding birds is therefore 400. It has been noted that an average of approximately 25 percent of breeding adults may not return to breed each year, and this rate may vary between years as much as an additional 25 percent (Cochrane and Starfield in prep.). It is reasonable, therefore, to estimate that approximately 100 additional breeding age birds may not be observed on the breeding grounds. The total estimate of breeding age birds is therefore 500.

Estimates of immature birds are more difficult to calculate because these individuals are rarely seen between fledging and breeding at approximately 6 years of age. Two different methods were used to estimate the number of immature birds in the population: (1) using observational data of chicks fledged, and (2) using modeling information. Both methods yielded similar results. H. Hasegawa (pers. comm.) reports that 509 chicks were fledged from the Tsubamesaki colony on Torishima between 1992 and 1997. The only information on number of chicks from Minami-kojima is that 10 chicks were counted by H. Hasegawa (pers. comm.) in 1991. Over the past 6 years, therefore, assuming a stable population, an estimated minimum of 60 chicks may have fledged from Minami-kojima. Based on an average juvenile survival rate of 96 percent (H. Hasegawa pers. comm., Cochrane and Starfield in prep.), this technique yields an estimate of approximately 500 immature individuals in the population. Alternatively, modeling information indicates that immature birds comprise approximately 47 percent of the total population. Breeding age birds are estimated at 500; therefore, using this method immature birds also number approximately 500.

The total population of short-tailed albatross is likely to number somewhere around 1,000 birds. No numerical estimates of uncertainty are available for this estimate.

Demographic Information

Short-tailed albatrosses are long-lived and slow to mature; the average age at first breeding is 6 years old (H.

Hasegawa pers. comm.). As many as 25 percent of breeding age adults may not return to the colony in a given year (H. Hasegawa pers. comm.; Cochrane and Starfield in prep.) Females lay a single egg each year, which is not replaced if destroyed (Austin 1949). Adult and juvenile survival rates are high (96 percent), and an average of 0.24 chicks per adult bird on the colony survives to six months of age (Cochrane and Starfield in prep.), but these rates can be severely reduced in years when catastrophic volcanic or weather events occur during the breeding season.

Breeding Biology

At Torishima, birds arrive at the breeding colony in October and begin nest building. Egg-laying begins in late October and continues through late November. The female lays a single egg, incubation involves both parents and lasts for 64–65 days, eggs hatch in late December and January, and by late May or early June, the chicks are almost full grown and the adults begin abandoning their nests (H. Hasegawa pers. comm.; Hasegawa and DeGange 1982). The chicks fledge soon after the adults leave the colony, and by mid-July, the colony is totally deserted (Austin 1949). Non-breeders and failed breeders disperse from the breeding colony in late winter through spring (Hasegawa and DeGange 1982). There is no detailed information on phenology (breeding activities) on Minami-kojima, but it is likely to be similar to that on Torishima.

Short-tailed albatrosses are monogamous and highly philopatric to nesting areas, returning to the same breeding site year after year. Chicks hatched at Torishima return there to breed. However, young birds may occasionally disperse from their natal colonies to breed, as evidenced by the appearance of adult birds on Midway Atoll that were banded as chicks on Torishima (H. Hasegawa pers. comm., Richardson 1994).

Breeding Habitat

Available evidence from historical accounts, and from current breeding sites, indicates that short-tailed albatross nesting occurs on flat or sloped sites, with sparse or full vegetation, on isolated windswept offshore islands, with restricted human access (Aronoff 1960, Sherburne 1993, DeGange 1981). Current nesting habitat on Torishima is steep sites on soils containing loose volcanic ash; the island is dominated by a grass, *Miscanthus sinensis* var. *condensatus*, but a composite, *Chrysanthemum pacificum*, and a nettle, *Boehmeria biloba*, are also present (Hasegawa 1977). The grass is likely to stabilize the soil, provide protection from weather, and minimize mutual interference between nesting pairs while allowing for safe, open take-offs and landings (Hasegawa 1978). The nest is a grass or moss-lined concave scoop about 0.75 meters (m) (2 feet (ft.)) in diameter (Tickell 1975).

Marine Habitat

The common synonym of "coastal albatross" reflects the short-tailed albatross's predilection for nearshore waters. The Service's short-tailed albatross at-sea sightings database contains many observations of short-tailed albatrosses within 6 miles of shore, and several observation of birds within 3 miles of shore (Julie Michaelson, Alaska Natural Heritage Program, Anchorage, pers. comm.). Their presence may coincide with areas of high biological productivity, such as along the west coast of North America, the Bering Sea, and offshore from the Aleutians (Hasegawa and DeGange 1982).

The North Pacific marine environment of the short-tailed albatross is characterized by coastal regions of upwelling and high productivity and expansive, deep water beyond the continental shelf. The region has a clockwise, oceanic current flow with counter clockwise currents in the Gulf of Alaska and the Bering Sea (Sherburne 1993).

Diet

The diet of short tailed albatrosses includes squid, fish, flying fish eggs, shrimp and other crustaceans (Hattori in Austin 1949, H. Hasegawa pers. comm.). There is currently no information on variation of diet by season, habitat, or environmental condition.

Legal Status

The short-tailed albatross is listed as endangered on the State of Alaska's list of endangered species (State of Alaska, Alaska Statutes, Article 4. Sec. 16.20.19). This classification was supported by a letter to Commissioner Noerenberg from J.C. Bartonek (1972, in litt.) in which he recommended endangered status because the short-tailed albatross occurs or "was likely" to occur in State waters within the 3-mile limit of State jurisdiction (Sherburne 1993). The short-tailed albatross does not appear on the State list of Hawaii's list of threatened and endangered species.

The Japanese government designated the short-tailed albatross as a protected species in 1958, as a Special National Monument in 1962 (Hasegawa and DeGange 1982), and as a Special Bird for Protection in 1972 (King 1981). Torishima was declared a National Monument in 1965 (King 1981). These designations have resulted in tight restrictions on human activities and disturbance on Torishima (H. Hasegawa pers. comm.). In 1992, the species was classified as "endangered" under the newly implemented "Species Preservation Act" in Japan which makes federal funds available for conservation programs and requires that a 10-year plan be in place which sets forth conservation goals for the species. The current Japanese "Short-tailed Albatross Conservation and Management Master Plan" outlines general goals for continuing management and monitoring of the species, and future conservation needs (Environment Agency 1996). The principal management practices used on Torishima are legal protection, habitat enhancement, and population monitoring. Since 1976, Dr. Hiroshi Hasegawa has systematically monitored the breeding success and population numbers of short-tailed albatrosses breeding on Torishima.

Previous Federal Action

Currently, the short-tailed albatross is listed as endangered under the Act, throughout its range, except in the U.S. (50 CFR 17.11), and is a Candidate species in the U.S. (September 19, 1997, Candidate Notice of Review, 62 FR 49398). The species was originally listed as endangered in accordance with the Endangered Species Conservation Act of 1969 (ESCA). Pursuant to the ESCA, two separate lists of endangered wildlife were maintained, one for foreign species and one for species native to the United States. The short-tailed albatross appeared only on the List of Endangered Foreign Wildlife (35 FR 8495; June 2, 1970). When the Act became effective on December 28, 1973, it superseded the ESCA. The native and foreign lists were combined to create one list of endangered and threatened species (39 FR 1171; January 4, 1974). When the lists were combined, prior notice of the action was not given to the governors of the affected States (Alaska, California, Hawaii, Oregon and Washington), as required by the Act because available data were interpreted as not supporting resident status for the short-tailed albatross. Thus native individuals of this species were never formally proposed for listing pursuant to the criteria and procedures of the Act.

On July 25, 1979, the Service published a notice (44 FR 43705) stating that, through an oversight in the listing of the short-tailed albatross and six other endangered species, individuals occurring in the United States were not protected by the Act. The notice stated that it was always the intent of the Service that all populations and individuals of the seven species should be listed as endangered wherever they occurred. Therefore, the notice stated that the Service intended to take action to propose endangered status for individuals occurring in the U.S.

On July 25, 1980, the Service published a proposed rule (45 FR 49844; July 25, 1980), to list, in the United States, the short-tailed albatross and four of the other species referred to above. Since no final action was taken on the July 25, 1980 proposal, the Service is issuing this updated proposal. In 1996, the Service designated the species as a Candidate for listing in the U.S. (U.S. Fish and Wildlife Service in litt.).

Summary of Factors Affecting the Species

Section 4 of the Act and regulations (50 CFR part 424) promulgated to implement the listing provisions of the Act set forth the procedures for adding species to the Federal lists. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1). These factors and their application to the short-tailed albatross are as follows:

A. *The present or threatened destruction, modification, or curtailment of its habitat or range.* Short-tailed albatrosses face a significant threat to the primary breeding colony on Torishima due to the potential of habitat destruction from volcanic eruptions on the island. The threat is not predictable in time or in magnitude. Eruptions could be catastrophic or minor, and could occur at any time of year. A catastrophic eruption during the breeding season could result in chick or adult mortalities as well as destruction of nesting habitat. Significant loss of currently occupied breeding habitat or breeding adults at Torishima would delay the recovery of the species or jeopardize its continued existence.

Torishima is an active volcano approximately 394 m (1,300 ft) high and 2.6 kilometers (km) (1.6 miles) wide (H. Hasegawa pers. comm.) located at 30.48° N and 140.32° E (Simkin and Siebert 1994). The earliest record of a volcanic eruption at Torishima is a report of a submarine eruption in 1871 (Simkin and Siebert 1994), but there is no information on the magnitude or effects of this eruption. Since the first recorded human occupation on the island in 1887, there have been four formally recorded eruption events: (1) On August 7, 1902, an explosive eruption in the central and flank vents which resulted in lava flow, and a submarine eruption, and caused 125 human mortalities; (2) On August 17, 1939, an explosive eruption in the central vent which resulted in lava flow, and caused two human mortalities; (3) On November 13, 1965, a submarine eruption and; (4) On October 2, 1975, a submarine eruption 9 km (5.4 mi) south of Torishima (Simkin and Siebert 1994). There is also reference in the literature to an additional eruption in 1940 which resulted in lava flow that filled the island's only anchorage (Austin 1949).

Austin (1949) visited the waters around Torishima in 1949 and made the following observations "The only part of Torishima not affected by the recent volcanic activity is the steep northwest slopes where the low buildings occupied by the weather station staff are huddled. Elsewhere, except on the forbidding vertical cliffs, the entire surface of the island is now covered with stark, lifeless, black-gray lava. Where the flow thins out on the northwest slopes, a few dead, white sticks are mute remnants of the brush growth that formerly covered the island. Also on these slopes some sparse grassy vegetation is visible, but there is no sign of those thick reeds, or "makusa" which formerly sheltered the albatross colonies. The main crater is still smoking and fumes issue from cracks and fissures all over the summit of the island."

In 1965, meteorological staff stationed on the island were evacuated on an emergency basis due to a high level of seismic activity; although no eruption followed, the island has since been considered too dangerous for permanent human occupation (Tickell 1973). In late 1997, Hiroshi Hasegawa observed more steam from the volcano crater, a more pronounced bulge in the center of the crater, and more sulphur crusts around the crater than were previously present (R. Steiner, Alaska Sea Grant Program, pers. comm.).

The eruptions in 1902 and 1939 destroyed much of the original breeding colony sites. The remaining site used by albatrosses is on a sparsely vegetated steep slope of loose volcanic soil. The monsoon rains that occur on the island result in frequent mud slides and erosion of these soils, which can result in habitat loss and chick mortality. A typhoon in 1995 occurred just before the breeding season and destroyed most of the vegetation at the Tsubamezaki colony. Without the protection provided by vegetation, eggs and chicks are at greater risk of mortality from monsoon rains, sand storms and wind (H. Hasegawa pers. comm.). Breeding success at Tsubamezaki is lower in years when there are significant typhoons resulting in mud slides (H. Hasegawa pers. comm.).

In 1981, a project was supported by the Environment Agency of Japan and the Tokyo Metropolitan Government to improve nesting habitat by transplanting grass and stabilizing the loose volcanic soils (Hasegawa 1991). Breeding success at the Tsubamezaki colony has increased following habitat enhancement (H. Hasegawa pers. comm.). Current population enhancement efforts in Japan are concentrated on attracting breeding birds to an alternate, well vegetated colony site on Torishima which is less likely to be impacted by lava flow, mud slides, or erosion than the Tsubamezaki colony site (H. Hasegawa pers. comm.). Japan's "Short-tailed Albatross Conservation and Management Master Plan" (Environment Agency 1996) sets forth a long-term goal of examining the possibility of establishing additional breeding grounds away from Torishima once there are at least 1,000 birds on Torishima. Until other safe breeding sites are established, however, short-tailed albatross survival will continue to be at risk due to the possibility of significant habitat loss and mortality from unpredictable natural catastrophic volcanic eruptions and land or mud slides caused by monsoon rains.

B. *Over utilization for commercial, recreational, scientific, or educational purposes.* As previously mentioned, direct harvest of short-tailed albatrosses caused a catastrophic decline in population numbers (refer to Background); but today direct harvest of short-tailed albatrosses is considered rare. H. Hasegawa (pers. comm.) reports that some local Japanese fishermen in Izu and Ryukyuu Islands hunt seabirds and may take some short-tailed albatrosses, but the likelihood that short-tailed albatrosses are taken, or the level of such take is not known. There is no other known direct take of short-tailed albatrosses for commercial, recreational, scientific or educational purposes.

C. *Disease or predation.* There are no known diseases affecting short-tailed albatrosses on Torishima or Minami-kojima today. However, the world population is vulnerable to the effects of disease because of the small population size and extremely limited number of breeding sites. H. Hasegawa (pers. comm.) reports that he has observed a wing-disabled bird every few years on Torishima, but the cause of the disability is not known. An avian pox has been observed in chicks of albatross species on Midway Island, but it is unknown whether this pox infects short-tailed albatrosses or if it may have an effect on survivorship of any albatross species (T. Work, D.V.M., USGS, Hawaii).

Several parasites were documented historically on short-tailed albatrosses on Torishima: a blood-sucking tick that attacks its host's feet, a feather louse, and a carnivorous beetle (Austin 1949). However, current evidence suggests that there are no parasites affecting short-tailed albatrosses on Torishima, and there is no evidence that parasites caused mortality or had population level impacts in the past (H. Hasegawa pers. comm.).

Sharks may take fledgling short-tailed albatrosses as they desert the colony and take to the surrounding waters (Harrison 1979). Shark predation is well documented among other albatross species, but has not been documented for the short-tailed albatross. The crow, *Corvus* sp., is the only historically known avian predator of chicks on Torishima. Hattori (in Austin 1949) reported that one-third of the chicks on Torishima were killed by crows, but crows are not present on the island today (H. Hasegawa pers. comm.). Black or ship rats were introduced to Torishima at some point during human occupation; their effect on short-tailed albatrosses is unknown. Cats were also present, most likely introduced during the feather hunting period. They have caused damage to other seabirds on the island (Ono 1955), but there is no evidence to indicate an adverse effect to short-tailed albatrosses. Cats were present on Torishima in 1973 (Tickell 1975), but Hasegawa (1982) did not find any evidence of cats on the island.

D. *The inadequacy of existing regulatory mechanisms.* The purpose of this proposed rulemaking is to extend the protective status afforded by the Act to the short-tailed albatross throughout its range. The short-tailed albatross is currently listed under the Act as endangered outside of the U.S., or outside of the 200-mile limit from shore. The Service and the National Marine Fisheries Service have consulted under section 7 for federally managed "high seas" fisheries off of Alaska (i.e., between 3 and 200 miles from shore), but other protective mechanisms of the Act, such as prohibitions from direct taking, do not extend to albatrosses that occur within 200 miles from shore. Listing the species within the U.S. would provide more comprehensive and extensive protection for the species through sections 7, 9, and 10 of the Act, and through recovery planning.

Short-tailed albatrosses are currently protected from taking under the Migratory Bird Treaty Act of 1918, as amended (MBTA: 16 U.S.C. 703 *et seq.*), but MBTA jurisdiction extends only to 3 miles from shore.

Torishima and Minami-kojima are the only two confirmed breeding sites for short-tailed albatrosses, and both are under Japanese ownership and management. Of concern is that Minami-kojima has also been claimed by the Nationalist Republic of China and the People's Republic of China. The situation may present logistical and diplomatic problems in attempts to implement protection for the colony on the island (Tickell 1975).

On July 1, 1975, the short-tailed albatross was included in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES is a treaty established to prevent international trade that may be detrimental to the survival of plants and animals. Generally, both import and export permits are required from the importing and exporting countries before an Appendix I species may be shipped, and Appendix I species may not be imported for primarily commercial purposes. CITES export permits may not be issued if the export will be detrimental to the survival of the species or if the specimens were not legally acquired. However, CITES does not itself regulate take or domestic trade.

E. *Other natural or manmade factors affecting its continued existence.* Other factors potentially represent threats to the species; however, no information is available to assess the probability of any one factor occurring in a way that will threaten the species with extinction. Nor is it possible to assess the potential extent or magnitude of the threat posed, because these will likely vary depending on the occurrence of any one threat in combination with other perturbations.

One of these factors is small population size. The worldwide breeding-age population of short-tailed albatrosses numbers approximately 500 individuals. A significant proportion of these individuals nest in the Tsubamezaki colony on Torishima. The remaining small number of breeding birds nest on Minami-kojima. Because the population size is small, and breeding is limited to two islands, a catastrophic volcanic or weather event on Torishima has the potential not only to significantly reduce the numbers of birds in the world, it also could reduce the worldwide breeding population to a level where the risk of extinction is high. Genetic diversity of the worldwide population may also be cause for concern since the species experienced a severe bottleneck during the middle of this century.

The risk of extinction caused by a catastrophic event at the breeding colony is buffered by adult and immature non-breeding birds. An average of 25 percent of breeding age adults do not return to breed each year (H. Hasegawa pers. comm.), and immature birds do not return to the colony to breed until at least 6 years after fledging (H. Hasegawa pers. comm.). As much as 50 percent of the current total worldwide population may be immature birds. If suitable habitat were still available on Torishima, these birds could recolonize in years following a catastrophic event.

Another potential threat is damage or injury related to oil contamination, which could cause physiological problems from petroleum toxicity and by interfering with the bird's ability to thermoregulate. Oil spills can occur in many parts of the short-tailed albatrosses' marine range. Oil development has been considered in the past in the vicinity of the Senkaku Islands (Hasegawa 1981, in litt.). Future industrial development would introduce the risk of local marine contamination, or pollution due to blow-outs, spills, and leaks related to extraction, transfer and transportation. Historically short-tailed albatrosses rafted together in the waters around Torishima (Austin 1949) and small groups of individuals have occasionally been observed at sea (USFWS unpublished data). An oil spill in an area where individuals were rafting could affect the population significantly. The species' habit of feeding at the surface of the sea makes them vulnerable to oil contamination. Dr. Hiroshi Hasegawa (pers. comm.) has observed some birds on Torishima with oil spots on their plumage.

Consumption of plastics may also be a factor affecting the species' survival. Albatrosses often consume plastics at sea, presumably mistaking the plastics for food items, or consuming marine life such as flying fish eggs that are attached to floating objects. Dr. Hiroshi Hasegawa (pers. comm.) reports that short-tailed albatrosses on Torishima commonly regurgitate large amounts of plastics debris. Plastics ingestion can result in injury or mortality to albatrosses if sharp plastic pieces cause internal injuries, or through reduction in ingested food volumes and dehydratio (Sievert and Sileo in McDermond and Morgan 1993). Young birds may be particularly vulnerable to potential effects of plastic ingestion prior to developing the ability to regurgitate (Fefer 1989, in litt.). Auman (1994) found that Laysan albatross chicks found dead in the colony had significantly greater plastics loads than chicks injured by vehicles, a sampling method presumably unrelated to plastics ingestion, and therefore representative of the population. Dr. Hiroshi Hasegawa has observed a large increase in the occurrence of plastics in birds on Torishima over the last 10 years (R. Steiner pers. comm.), but the effect on survival and population growth is not known.

Another potential threat is short-tailed albatross mortality that is incidental to longline fishing in the North Pacific and Bering Sea. Short-tailed albatross mortalities occur in longline fisheries as a result of baited longline hooks that are accessible to foraging albatrosses during line setting and hauling. Five short-tailed albatrosses are known to have been taken by longline fisheries in Alaska from 1983–1996. The Service, in consultation with the National Marine Fisheries Service, determined that the Alaskan groundfish and halibut fisheries are likely to adversely affect short-tailed albatrosses, but are not likely to result in an appreciable reduction in the likelihood of survival and recovery of the species (USFWS 1989 and amendments, USFWS 1998). Consultation under section 7 of the Act has not been conducted for the Hawaiian longline fishery; the amount and likelihood of take in this fishery is difficult to determine because of the low rate of observer coverage (5 percent of fishing time is observed). There have been no reported takes of short-tailed albatrosses. Black-footed albatrosses and Laysan albatrosses are taken in this fishery (E. Flint pers. comm.). The magnitude of impacts caused by international longline fisheries is unknown.

Hasegawa (pers. comm.) reports that 3–4 birds per year on Torishima come ashore entangled in fishing gear, some of which die as a result. He also stated that some take by Japanese handliners may occur near the nesting colonies, although no such take has been reported. There is no additional information on the potential effects of fisheries near Torishima on the species.

At the current population level and growth rate, the level of mortality resulting from longline fisheries is not thought to represent a threat to the species' continued survival. However, in the event of a major population decline as a result of a natural environmental catastrophe or an oil spill, the effects of longline fisheries on short-tailed albatrosses could be significant.

Another potential source of mortality is collision with aircraft on Midway Atoll. The current short-tailed albatross nest on Midway Atoll is located next to an active airplane runway. Black-footed and Laysan albatross mortalities occur periodically as a result of airplane strikes. It is possible, therefore, that short-tailed albatrosses could also be killed as a result of air traffic (Kevin Foster, U.S. Fish and Wildlife Service, Honolulu pers. comm.).

Summary

The worldwide population of short-tailed albatrosses continues to be in danger of extinction throughout its range due to natural environmental threats, small population size and the small number of breeding colonies. Longline fishing, plastics pollution, oil contamination, or airplane strikes are not likely to represent significant threats today, but any of these factors in combination with a catastrophic event on Torishima, could threaten future survival and recovery of the species. Most of the world's breeding population nests on Torishima in the Tsubamezaki colony. These individuals and the breeding habitat are at risk of measurable or significant population level impacts from a volcanic eruption on the island. The habitat at Tsubamezaki is further threatened by continued erosion and mud slides from monsoon rains despite the reduction of risk through habitat management. The only other known breeding location is on Minami-kojima, which is threatened by political unrest and internationally disputed ownership. Establishment of additional breeding colonies may be problematic. First, enough birds must be available to disperse to other sites. Second, colonization of Midway Island, the only recognized potential breeding site in the United States, may be compromised by take in longline fisheries and airplane strikes.

The Service has carefully assessed the best scientific and commercial information available regarding the past, present, and future threats faced by this species in determining to propose this rule. Based on this evaluation, the preferred action is to extend the listing of the short-tailed albatross as endangered to its U.S. range. The Service is also correcting the information in the Historic Range column of the short-tailed albatross entry in the list of endangered and threatened species (50 CFR 17.11(h)). The information in this column currently indicates the species' historic range includes the North Pacific Ocean and Bering Sea, and lands and waters of Japan, China, Russia, and the United States. The Service will correct this to include Taiwan and Canada. This column is nonregulatory in nature and is provided for the information of the reader.

Critical habitat is not being proposed at this time for the short-tailed albatross for reasons discussed in the "Critical Habitat" section of this proposal.

Critical Habitat

Critical habitat is defined in section 3 of the Act as: (i) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. "Conservation" means the use of all methods and procedures needed to bring the species to the point at which listing under the Act is no longer necessary.

Section 4(a)(3) of the Act, as amended, and implementing regulations (50 CFR 424.12) require that, to the maximum extent prudent and determinable, the Secretary designate critical habitat at the time the species is determined to be endangered or threatened. The Service finds that designation of critical habitat is not prudent for the short-tailed albatross at this time. Service regulations (50 CFR 424.12(a)(1)) state that designation of critical habitat is not prudent when one or both of the following situations exist: (i) The species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of threat to the species, or (ii) such designation of critical habitat would not be beneficial to the species.

Critical habitat is not being proposed for the short-tailed albatross based on the Service's analysis and determination that such designation would not be beneficial to the species. Habitats outside of the U.S. are not eligible for critical habitat designation. Habitat within the U.S. used by short-tailed albatrosses include coastal waters of Alaska and Hawaii, and potential nesting habitat on Midway Atoll in the Hawaiian Islands.

Short-tailed albatrosses occur and forage throughout the coastal regions of the North Pacific Ocean and Bering Sea during the non-breeding season, and throughout the Northwestern Hawaiian Islands during the breeding season. Although foraging areas are essential to the conservation of short-tailed albatrosses, there is currently no information to support a conclusion that any specific areas within U.S. jurisdiction are uniquely important. More importantly, adverse effects on the species occurring in the marine environment are a result of activities that threaten individual albatrosses rather than albatross habitat. These include incidental mortality in longline fisheries, and mortality or injury associated with plastics pollution and oil spills. These effects can be adequately addressed through the jeopardy standard of section 7 of the Act and through the section 9 prohibitions of the Act. With regard to foraging areas in U.S. waters, there would be no additional benefit or protection conferred through the destruction or adverse modification standard for critical habitat under section 7 of the Act.

The future potential for the Midway Atoll National Wildlife Refuge to serve as a geographically distinct breeding colony to recover the species is best realized through implementation of refuge system management planning. A management goal for Midway Atoll Refuge is to manage for the conservation and recovery of threatened and endangered species. Future project proposals which might adversely affect short-tailed albatrosses will be adequately addressed through the jeopardy standard of section 7 consultation and section 9 prohibitions of the Act. With regard to breeding areas and potential breeding areas within the U.S., there would be no additional benefit or protection conferred through the designation of critical habitat on the Midway Atoll Refuge over that conferred through the jeopardy standard of section 7 of the Act. Therefore, the Service finds that designation of critical habitat for the short-tailed albatross is not prudent.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain activities. Recognition through listing encourages and results in conservation actions by Federal, State and local agencies, private organizations and individuals. The protection required of Federal agencies and the prohibitions against taking and harm are discussed, in part, below.

Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is being designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(4) requires Federal agencies to confer informally with the Service on any action that is likely to jeopardize the continued existence of a proposed species or result in destruction or adverse modification of proposed critical habitat. If a species is listed subsequently, section 7(a)(2) requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Service.

Federal agency actions that may require conference and/or consultation as described in the preceding paragraph include National Marine Fisheries Service Fishery Management Plans, management practices at the Midway Atoll National Wildlife Refuge, permits or authorization for oil tankering within the range of short-tailed albatrosses, and oil spill contingency plans.

The Act and its implementing regulations found at 50 CFR 17.21 set forth a series of prohibitions and exceptions that apply to all endangered species of wildlife. All prohibitions of section 9(a)(1) of the Act, implemented by 50 CFR 17.21, apply. These prohibitions, in part, make it illegal for any person subject to the jurisdiction of the United States, to take (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, or collect; or to attempt to engage in any of these), import or export, ship in interstate commerce in the course of a commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. It is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies.

Permits may be issued to carry out otherwise prohibited activities involving endangered wildlife species under certain circumstances. Regulations governing permits for endangered wildlife are at 50 CFR 17.22 and 17.23. Such permits are available for scientific purposes, to enhance the propagation or survival of the species, and/or for incidental take in connection with otherwise lawful activities. Information collections associated with these permits are approved under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.*, and assigned Office of Management and Budget Clearance number 1018–0094.

It is the policy of the Service (59 FR 34272) to identify to the maximum extent practicable at the time a species is listed those activities that would or would not constitute a violation of section 9 of the Act. The intent of this policy is to increase public awareness of the effect of the listing on proposed and ongoing activities within a species' range. The only known non-federal activities which may result in incidental take of short-tailed albatrosses are State managed hook-and-line longline fisheries. Activities which are not expected to result in any take of short-tailed albatrosses include: (1) fishing activities in Alaska and Hawaii other than hook-and-line longline fishing; (2) lawfully conducted vessel operations such as transport, tankering and barging; and (3) harbor operations or improvements. Questions regarding whether other specific activities will constitute a violation of section 9 should be directed to the Field Supervisor of the Anchorage Field Office (See ADDRESSES section).

Public Comments Solicited

The Service requests comments on the proposed listing of the U.S. population of the short-tailed albatross on the List of Endangered and Threatened Wildlife and the clarity of this proposal, pursuant to Executive Order 12866, which requires agencies to write clear regulations.

Proposed Listing

The Service intends that any final action resulting from this proposal will be as accurate and as effective as possible. Therefore, comments or suggestions from the public, other concerned governmental agencies, the scientific community, industry, or any other interested party concerning this proposed rule are hereby solicited. Comments particularly are sought concerning:

(1) Biological, commercial trade, or other relevant data concerning any threat (or lack thereof) to this species;

(2) The location of any additional populations of this species and the reasons why any habitat should or should not be determined to be critical habitat as provided by section 4 of the Act;

(3) Additional information concerning the range, distribution, and population size of this species; and

(4) Current or planned activities in the subject area and their possible impacts on this species.

Final promulgation of the regulations on this species will take into consideration the comments and any additional information received by the Service, and such communications may lead to a final regulation that differs from this proposal.

The Act provides for a public hearing on this proposal, if requested. Requests must be received within 45 days of the date of publication of this proposal. Such requests must be made in writing and addressed to the Anchorage Field Supervisor (see ADDRESSES section).

Executive Order 12866

Executive Order 12866 requires each agency to write regulations that are easy to understand. The Service invites your comments on how to make this rule easier to understand including answers to the following: (1) Are the requirements of the rule clear? (2) Is the discussion of the rule in the "Supplementary Information" section of the preamble helpful in understanding the rule? What else could we do to make the rule easier to understand?

Send a copy of any comments that concern how we could make this rule easier to understand to: Office of Regulatory Affairs, Department of the Interior, Room 7229, 1849 C Street, NW, Washington, DC 20240. You may also e-mail the comments to this address: Exsec@ios.doi.gov.

Paperwork Reduction Act

This rule does not contain any new collections of information other than those already approved under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.*, and assigned Office of Management and Budget clearance number 1018–0094. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid control number. For additional information concerning permit and associated requirements for endangered species, see 50 CFR 17.22.

National Environmental Policy Act

The Fish and Wildlife Service has determined that an Environmental Assessment or Environmental Impact Statement, as defined under the authority of the National Environmental Policy Act of 1969, need not be prepared in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act. A notice outlining the Service's reasons for this determination was published in the **Federal Register** on October 25, 1983 (48 FR 49244).

Listing Priority Guidance

Processing of this proposed rule conforms with the Service's Listing Priority Guidance for Fiscal Years 1998 and 1999, published on May 8, 1998 (63 FR 25502). The guidance clarifies the order in which the Service will process rulemakings giving highest priority (Tier 1) to processing emergency rules to add species to the Lists of Endangered and Threatened Wildlife and Plants (Lists); second priority (Tier 2) to processing final determinations on proposals to add species to the Lists, processing new proposals to add species to the Lists, processing administrative findings on petitions (to add species to the Lists, delist species, or reclassify listed species), and processing a limited number of proposed or final rules to delist or reclassify species; and third priority (Tier 3) to processing proposed or final rules designating critical habitat. Processing of this proposed rule is a Tier 2 action.

References Cited

A complete list of all references cited herein, as well as others, is available upon request from the Anchorage Field Office, U.S. Fish and Wildlife Service (see ADDRESSES section).

Author. The primary author of this proposed rule is Janey Fadely, Migratory Bird Management, U.S. Fish and Wildlife Service, 3000 Vintage Park Blvd., Suite 240, Juneau, Alaska 99801, (907) 586–7240.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

For the reasons set out in the preamble, the Service is proposing to amend part 17, subpart B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—[AMENDED]

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361-1407; 16 U.S.C. 1531-1544; 16 U.S.C. 4201-4245; Pub. L. 99-625, 100 Stat. 3500, unless otherwise noted.

2. In section 17.11(h), the table entry for "Albatross, short-tailed", under BIRDS, is revised to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Verebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
*	*	*	*	*	*	*	
BIRDS							
*	*	*	*	*	*	*	
Albatross, short-tailed	*Phoebastria* (=Diomedia) *albatrus*.	North Pacific Ocean: Japan, Taiwan, Russia, Canada, U.S.A. (AK, CA, HI, OR, WA).	Entire	E	3,—	NA	NA
*	*	*	*	*	*	*	

Dated: September 15, 1998.

Jamie Rappaport Clark,

Director, Fish and Wildlife Service.

[FR Doc. 98–29174 Filed 10–30–98; 8:45 am]

BILLING CODE 4310–55–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Parts 222 and 227

[I.D. 101498D]

Listing Endangered and Threatened Species and Designating Critical Habitat: Petition To List the Swordfish as Endangered and Designate Critical Habitat Under the Endangered Species Act Throughout the North Atlantic Ocean

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notification of finding.

SUMMARY: NMFS has received a petition to list the swordfish (*Xiphias gladius*) as endangered and to designate critical habitat in the North Atlantic Ocean under the Endangered Species Act (ESA). NMFS finds that the petition does not present substantial scientific information indicating that the petitioned action may be warranted.

DATES: This petition finding was made on October 27, 1998.

ADDRESSES: Copies of the petition may be obtained from the Endangered Species Division, Office of Protected Resources, NMFS, 1315 East West Highway, Silver Spring, MD 20910.

FOR FURTHER INFORMATION CONTACT: Terri Jordan or Marta Nammack, NMFS, Office of Protected Resources, (301) 713–1401.

SUPPLEMENTARY INFORMATION:

Background

Section 4(b)(3) of the ESA contains provisions concerning petitions from interested persons requesting the Secretary of Commerce (Secretary) to list species under the ESA. Section 4(b)(3)(A) requires that, to the maximum extent practicable, within 90 days after receiving such a petition, the Secretary make a finding whether the petition presents substantial scientific information indicating that the petitioned action may be warranted. Section 424.14(b)(1) of NMFS' ESA implementing regulations define "substantial information" as the amount of information that would lead a reasonable person to believe that the measure proposed in the petition may be warranted (See 50 CFR 424.14). Section 424.14(b)(2) of these regulations contains factors the Secretary considers in evaluating a petitioned action.

On July 14, 1998, the Secretary received a petition dated July 13, 1998, from Messrs. Jonah Crawford and Max Strahan of Greenworld to list swordfish as endangered and to designate critical habitat in the North Atlantic Ocean. T. petitioner cites commercial over-utilization of swordfish and the inadequacy of existing regulatory mechanisms as reasons for population decline. However, the petitioner does not present substantial information with regard to these claims.

NMFS has reviewed the petition and information available in NMFS files. Although fisheries data available to NMFS provide evidence of some decline, (the North Atlantic stock is at 58 percent of its maximum sustainable yield (MSY)) no substantial evidence to indicate that the species may be threatened or endangered exists. The stock is overfished, but this only means that the current biomass cannot produce MSY on a continuing basis. Fishing quotas have been reduced in order to allow the stock to rebuild. Therefore, NMFS finds that the petition does not present substantial information indicating that listing the North Atlantic swordfish may be warranted.

Authority: The authority for this action is the Endangered Species Act (16 U.S.C. 1531 *et seq.*).

Dated: October 27, 1998.

Andrew A. Rosenberg,

Deputy Assistant Administrator for Fisheries, National Marine Fisheries Service.

[FR Doc. 98–29278 Filed 10–28–98; 2:51 pm]

BILLING CODE 3510–22–F

FAO Fisheries Circular No. 937

FIIT/C937

ISSN 0429-9329

AGENDA B-5
DEC. 1998
ATTACHMENT C

PRELIMINARY VERSION

THE INCIDENTAL CATCH OF SEABIRDS BY LONGLINE FISHERIES: WORLDWIDE REVIEW AND TECHNICAL GUIDELINES FOR MITIGATION

Food and Agriculture Organization of the United Nations

PRELIMINARY VERSION

THE INCIDENTAL CATCH OF SEABIRDS BY LONGLINE FISHERIES: WORLDWIDE REVIEW AND TECHNICAL GUIDELINES FOR MITIGATION

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, September 1998

PREPARATION OF THIS DOCUMENT.

At the 22nd session of FAO's Committee on Fisheries in March 1997 it was proposed that FAO should organize, using extra-budgetary funds, an expert consultation to develop guidelines leading to a plan of action aimed at reducing the incidental catch of seabirds in longline fisheries. The Governments of the USA and Japan agreed to fund and collaborate with FAO in organizing such a consultation. A three-step process including (i) establishing, and a meeting of, a steering committee with representatives from the funding Governments and FAO, (ii) forming, and a meeting of, a Technical Working Group (TWG) of FAO appointed experts and finally, (iii) a FAO Consultation which should consider and eventually approve a plan of action. The process has been coordinated with simultaneous FAO efforts to prepare plans of action for management of sharks and fishing capacity.

The steering committee decided on content and lead authorship of three background papers to be prepared for review by the Technical Working Group:

- A description of pelagic and demersal longline fisheries (*Svein Løkkeborg*)
- The bycatch of seabirds in specific longline fisheries: A worldwide review (*John Cooper*)
- A review of longline seabird bycatch mitigation measures and their effect on other marine species (*Nigel Brothers*)

The TWG at its meeting in Tokyo, 25-27 March 1998, decided to compile the contents of the three papers into one publication, which was subsequently done under the leadership of one of the authors, John Cooper. This draft document was later edited by the Fishing Technology Service of the Fisheries Department of FAO under the leadership of John W. Valdemarsen.

The document is intended to provide participants in the FAO Consultation with relevant information about longline fisheries around the world, the associated incidental catch of seabirds and how the problem can be minimized and partly solved by using technical mitigation measures.

The present version should be considered as a draft as the information about all relevant longline fisheries is incomplete and the document has only been reviewed by the lead authors and FAO staff.

ACKNOWLEDGEMENTS

Acknowledgements are given to the many people who supplied unpublished and "grey" literature and fishery statistics, commented on the drafts and shared their knowledge and insight with the lead authors. Such thanks are particularly addressed to the fellow members of the TWG and to separate reports prepared by M. Sigler (ground fish in Alaska), B. Trumble (Pacific halibut) and Y. Uosumi (Japanese tuna longline fishery).

The FAO Fisheries Circular is a vehicle for the distribution of short or ephemeral notes, lists, etc., including provisional versions of documents to be issued later in other series.

Brothers, N.P.; Cooper, J.; Løkkeborg, S.
The incidental catch of seabirds by longline fisheries: worldwide review and technical guidelines for mitigation. Preliminary version.
FAO Fisheries Circular. No. 937. Rome, FAO. 1998. 99p.

ABSTRACT

The content of this report was originally prepared as three separate background papers describing longline fisheries of the world, the nature and extent of incidental catch of seabirds in those fisheries and a description of technical and operational measures that can mitigate such incidental catch. An FAO appointed Technical Working Group (TWG) of experts in the field of fishing technology, seabird biology and fisheries management reviewed the content and decided to compile it into one document.

The report, first in general terms, describes the interaction of seabirds with longline fisheries with reference to typical behaviour patterns of seabirds and why and how the incidental longline catch of seabirds has become an international issue.

The various longline fisheries (demersal and pelagic) of the world are described with regard to technology and effort. The pelagic fisheries, which mainly target tunas, swordfish and billfishes are operated widely from temperate to tropical waters in all oceans. The most important demersal fisheries are found in the North Atlantic and the North Pacific but a longline fisheries for Patagonian tootfish has been developed in the Southern Ocean over the last few years.

Certain longline fisheries result in large numbers of seabirds being hooked on setting lines. The major "problem" fisheries are the demersal fisheries of the Northeast Pacific, North Atlantic, Southern Ocean and the Atlantic coast of South America, and the tuna pelagic fisheries of cool temperate seas in the North Pacific and the Southern Ocean. However, data on the incidental catch of seabirds are lacking for a number of longline fisheries , including the Pacific coast of South America, the Mediterranean Sea and in tropical waters of all oceans. Species of seabirds most commonly taken are the albatrosses and large petrels of the family Procellariidae.

A comprehensive number of mitigation measures for reducing the incidental catch of seabirds in longline fisheries has been developed during the past 5-10 years. These are all described in detail in the report. With widespread use of such mitigation measures, a significant reduction in incidental catch of seabirds is achievable at a minimal cost and with much potential financial benefit to longline fisheries.

Distribution:

Participants in Consultation on the Management of Fishing Capacity, Shark Fisheries and Incidental Catch of Seabirds in Longline Fisheries, FAO Rome, October 1998
Members of Seabird Technical Working Group, Tokyo, March 1998

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1. GENERAL INTRODUCTION

Seabirds, here defined as those species that habitually obtain their food from the sea below the low water mark, are found in all the world's oceans and seas. Generally speaking the numbers of individuals and species are higher in colder, more productive waters, as are found in upwelling situations on continental shelves, at oceanic fronts and in high latitudes. Tropical oceans away from land masses generally support low densities of relatively few species of seabirds. There is thus a broad matching of seabird abundance with the world's most fished seas: both seabirds and fishing vessels concentrate in areas of high biological productivity. Because all seabirds need to return to land to breed, and often to localities where they are safe from terrestrial predators, seabird numbers are often highest in the vicinity of coastal cliffs and offshore and oceanic islands. However, large foraging ranges and deferred maturity, coupled with ocean-wide migration and dispersal patterns, mean that many seabirds, especially prebreeders that may form 50% of the population, range over huge areas of ocean.

Interactions between seabirds and fisheries have existed since humans first went to sea to catch fish. In the last quarter century concerns have been expressed on the deleterious effects of various types of fishing activities on seabirds (e.g. King *et al.* 1979, Duffy & Schneider 1994, Dunn 1995, Hilden 1997). The sometimes huge numbers of seabirds killed by high-seas drift nets (e.g. Northridge 1991, DeGange *et al.* 1993, Johnson *et al.* 1993, Ogi *et al.* 1993) contributed to their banning in 1993. Longlining, by contrast with drift-netting, has been regarded as a species and size-selective fishing technique which is "environmentally friendly" (Bjordal & Løkkeborg 1996, but see Hinman *et al.* 1998 for a contrary view).

With notable exceptions among the penguins, alcids (auks and allies) and cormorants, seabirds are primarily surface foragers, taking their prey from the top few metres of the sea only (Ashmole 1971, Harper *et al.* 1985). As well as being predators of marine life, many seabirds are also scavengers, taking dead and moribund fish, squid and other animals found floating on the sea surface. Surface-scavenging makes seabirds "preadapted" to supplement their food requirements from that available from fishing vessels, either as discards (e.g. Camphuysen *et al.* 1995) or by stealing baits from hooks. It is the latter behaviour that leads to seabird mortality, especially from longline fishing operations. Seabirds that are commonly hooked in this way are albatrosses, petrels, shearwaters, gulls and skuas. Deep-diving and non-scavenging species, such as penguins, cormorants and auks, are rarely caught on longlines. Seabird size is also of relevance: the smaller seabirds (e.g. terns, storm petrels and auklets) are unable to swallow such large food items as longline baits, and as a consequence, they are rarely found captured in this way.

Longliners may operate up to 35 000 hooks/day. Typically, longlines are set from the vessel's stern while it moves forward at three to six knots. Baited hooks do not always sink immediately on reaching the sea surface, being kept afloat for a varying period of time by tension on the line and by turbulence from the stern and propeller. It is during this time that seabirds may seize the bait, with some becoming hooked. Normally, the weight of the line drags hooked birds below the sea surface and drowns them. Some (but far fewer) birds may be caught during hauling, mainly by entanglement as they try to take still-baited hooks or by flying into the line (e.g. Huin & Croxall 1996). The fact that seabirds (especially those that scavenge) have large gapes and are thus able to swallow large food items whole makes them also liable to get caught on longlines.

Recently, growing concern has been expressed over the numbers of seabirds, especially but not only the albatrosses of the Southern Ocean, that are killed by longlines (e.g. Tennyson 1990, Brothers 1991, Gales 1993, Kalmer *et al.* 1996, Alexander *et al.* 1997, Croxall in press, Croxall & Gales in press, Weimerskirch *et al.* in press). A number of field and modelling studies (e.g. Weimerskirch & Jouventin 1987, Croxall *et al.* 1990, de la Mare & Kerry 1994, Moloney *et al.* 1994, Prince *et al.* 1994, Tuck & Polacheck 1995, Croxall *et al.* 1996, Woehler 1996, Weimerskirch *et al.* 1997, Croxall *et al.* in press Weimerskirch & Jouventin in press) has shown that many southern albatross populations are in decline, at least partially because of longline-induced mortality.

As a consequence of this concern, fishing nations, fishing industry, intergovernmental bodies (such as international fishing commissions) and non-governmental organizations have commenced studies of the levels of seabird mortality caused by longline fisheries and how mortality rates may be reduced to improve the conservation status of the affected species (e.g. Bergin 1997, Haward *et al.* in press). Examples of such activities are the national research efforts and mitigatory regulations of countries such as Australia, France, Japan, New Zealand, Norway, South Africa, United Kingdom and the USA (e.g. Evans 1996, CCSBT 1997, National Marine Fisheries Service 1997a,b, Environment Australia 1998, Fadely *et al.* 1998); several attempts to develop underwater setting devices by industry (Barnes & Walshe 1997, Løkkeborg 1997, Smith & Bentley 1997), the work of scientific committees and working groups of the Commissions for the Conservation of Antarctic Marine Living Resources and for the Conservation of Southern Bluefin Tuna; and the Seabird Conservation Programme of BirdLife International (Wanless & Cooper 1998).

An important impetus for action was the resolution "Incidental Mortality of Seabirds in Longline Fisheries" adopted by the World Conservation Union (IUCN) at its First World Conservation Congress in Montreal, Canada in October 1996. This resolution *inter alia* called upon states to reduce seabird mortality to "insignificant levels for affected species" (IUCN 1997). Further, in April 1997 at the instigation of Australia and The Netherlands with earlier support from South Africa and Uruguay (Barea *et al.* 1994) the world's albatrosses were listed in the Appendices of the Convention on the Conservation of Migratory Species of Wild Animals (CMS or the Bonn Convention), leading the way for a range-state Agreement to improve their poor conservation status (CMS 1997a,b, B. Baker *in litt.*, G. Boere *in litt.*). Longline-induced mortality formed a significant part of the justification for this listing.

In this technical report, longline fishing methods are described in section 2, and the major longline fisheries of the world are described in section 3. Demersal and pelagic longlining are treated separately. The incidental catch of seabirds caused by longline fisheries is reviewed in section 4. Technical guidelines in place or recommended to reduce seabird bycatch are described in detail in section 5.

2. A DESCRIPTION OF LONGLINE FISHING METHODS

2.1 GENERAL DESCRIPTION OF LONGLINE FISHING

Longline fishing is one of the world's major methods of catching fish. Baited longlines are used in all oceans and seas, from small-scale artisanal fishing to modern mechanised longline operations, and large proportions (15-90%) of several of the most important fish resources are caught by longlines (Bjordal & Løkkeborg 1996). Notwithstanding bird mortality, longlining has commonly been regarded as a comparatively environmentally friendly fishing method, and thus the use of longlines is being encouraged by fisheries management authorities (e.g. Sutterlin *et al.* 1982). The operation of longline gear causes no destructive effects on bottom habitats, discards of undersized and unwanted fish can be comparatively low when compared with some other fishing methods (but see Hinman *et al.* 1998) and fish of high quality are captured at low fuel consumption.

Longline is a passive fishing technique, in that it is primarily the swimming activity of the target fish that brings them into contact with the gear, although pelagic longlines do drift in the water. The catching success of baited hooks is based on the target species' demand for food, and fish are caught on longlines because the bait releases odours that are dispersed by the water current. The fish regard the bait as food, and the scent and taste of the bait trigger the fish to search for and ingest the baited hook. Vision presumably also plays a role in bait location. Once the baited hook has been located and ingested, the catching success is determined by the ability of the hook to prevent the fish from escaping.

Longline fishing is a very versatile fishing method that is used from small open boats operating in shallow coastal waters and from large ocean-going vessels operating on high-seas fishing grounds at depths down to 3000 m. The gear can be set throughout the water column, on the seabed (demersal longlining), floated off the bottom at various fishing depths (semipelagic longlining) or suspended from floats drifting freely at the surface (pelagic longlining). In this way longlines can be used to target a great variety of fish species from bottom-dwelling species such as halibut to the highly migratory tunas of the open seas.

Demersal (bottom) longline fishing takes place on the relatively shallow waters of the continental shelves and slopes of all continents, around some oceanic islands, and over sea mounts. Some demersal longline fisheries are artisanal in nature, taking place from small, sometimes open, vessels. Others are more industrialized, taking place from large deep-water vessels which process their catch aboard. Many demersal longline fisheries take place in cold, upwelling waters at relatively high latitudes. These are commonly regions where large numbers of seabirds are present, allowing scope for interactions and incidental mortality to occur.

Pelagic (surface) longline fishing takes place in deep water generally off continental shelves. Pelagic longlining concentrates on tuna and billfish species and is operated widely from temperate to tropical waters in all oceans. Species targeted by pelagic longlining include Northern Bluefin Tuna *Thunnus thynnus*, Southern Bluefin Tuna *T. maccoyii*, Bigeye Tuna *T. obesus*, Yellowfin Tuna *T. albacares*, Albacore *T. alalunga* and Broadbill Swordfish *Xiphias gladius*. Sharks; marlins, sailfish and spearfish (family Istiophoridae) and tuna-related species

(Family Scombridae) may form a significant part of the directed catch or bycatch in some regions.

Longline fishing is regarded to be a species- and size selective fishing technique and this property may mainly be attributed to the versatility of the longline gear both in construction and way of operation. Longlining can take advantages of species-specific habitat preferences by setting the baited lines over selected fishing grounds or at specific depths.

The distribution of tuna species in the water column is influenced by their preferred temperature. Bigeye tuna *Thunnus obesus*, which is distributed deeper than other tunas, is caught by using a 'deep longline' developed to target the species (Suzuki *et al.* 1977, Yang & Gong 1988, Gong *et al.* 1989). Another example of how species selectivity in longlining may be effected by gear characteristics is the choice of bait type. Because feeding stimulants have been shown to be species specific (Carr 1982, Mackie 1982, Carr & Derby 1986), fishing experiments testing various bait types have demonstrated the effect of bait type on species compositions of longline catches (Martin & McCracken 1954, Imai 1972, Imai & Shirakawa 1972).

Bait size is an important gear parameter affecting the size of fish caught by longlines (McCracken 1963, Johannessen 1983, Løkkeborg 1990), whereas the effect of hook size on size selectivity has been less clearly demonstrated (Ralston 1982, Løkkeborg & Bjordal 1992). Species and size selectivity in longline fishing has been reviewed by Løkkeborg & Bjordal (1992).

2.2 DESCRIPTION OF GEAR CONFIGURATION AND OPERATION

All longline gear used in the world-wide fishery is based on a basic unit, consisting of four parts: the mainline (groundline), the snood (gangion or branch line), the hook and the bait (Fig. 1). The mainline, which varies in length according to the type of fishing, is rigged with a certain number of hooks off the branch line. Variations are found in terms of type, length and dimension of snood and mainline, type of hook and bait, in the way the snood is attached to the mainline, and in the presence and amounts of weights attached to the line. There are also great variations in setting and hauling devices, and in the way the gear is operated. A detailed description of longline gear construction and operation is provided in Bjordal & Løkkeborg (1996).

Polyamide (nylon) and polyester are the most common materials used for snood and mainline. Both multifilament and monofilament lines are used, the former is used for demersal longlining for groundfish due to its high breaking strength and resistance to chafing, whereas the latter is preferred for pelagic and semipelagic longlining for tuna and related species because the catching performance of monofilament lines has been shown to be superior to that of multifilament ones.

The snood may be attached to the mainline in one of three ways. Traditionally, snoods have been tied to the mainline, but more recently snap fasteners and swivels have replaced traditional snood attachment in several longline fisheries. Snap fasteners are commonly used in longlining for tuna and Pacific Halibut *Hippoglossus stenolepis*, and swivels in fisheries for various demersal species.

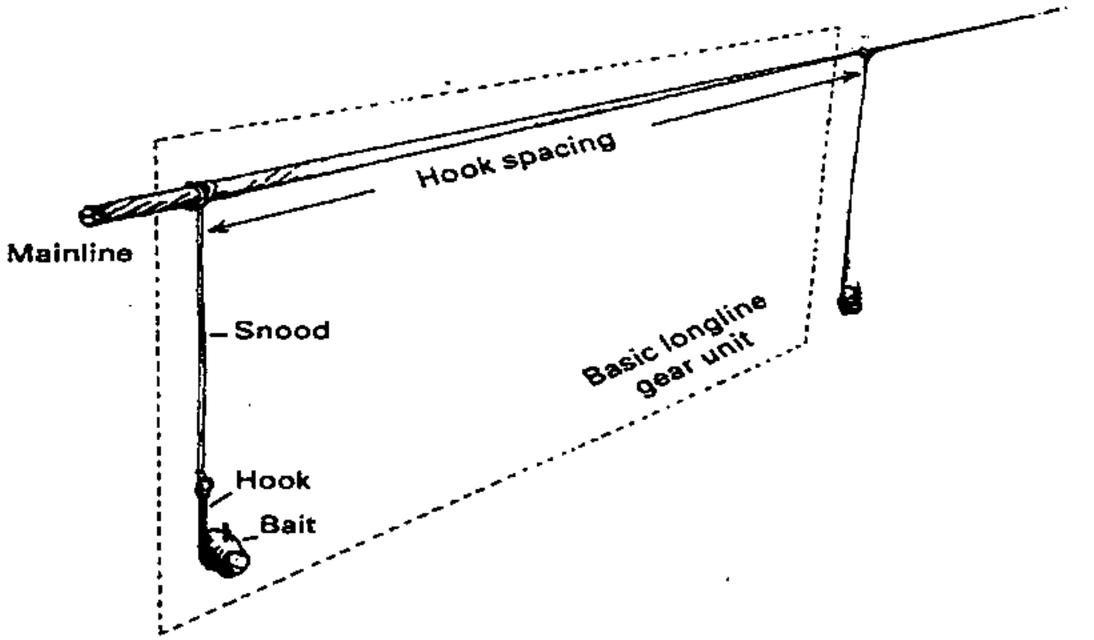

Figure 1. The basic unit of longline gear: mainline, snood hook and bait. Redrawn from Bjordal &Lokkeborg (1996)

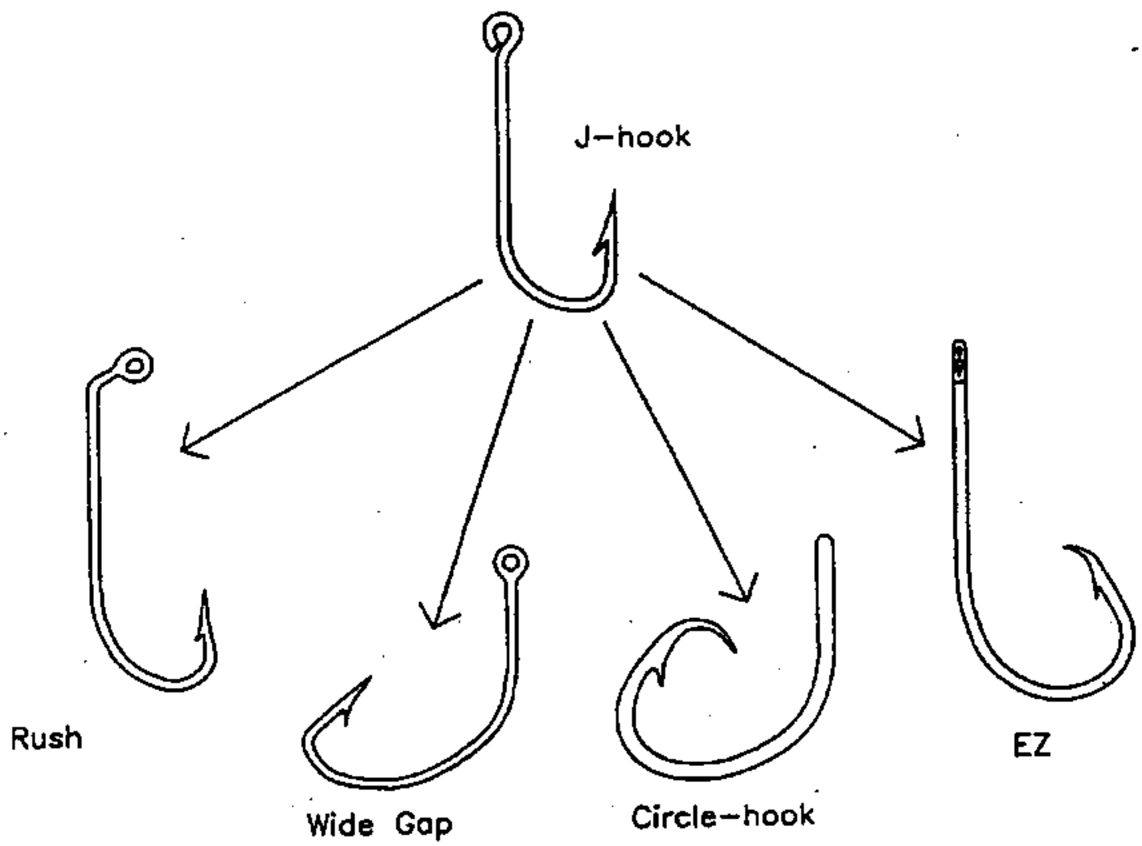

Figure 2. Development of new hook designs showing the traditional J-hook and the more effective new hook types (Redrawn from Bjordal & Lokkeborg (1996)

Until recently the traditional J-shaped hook was most commonly used for longlining. Fishing experiments have shown that considerable increases in catch rates can be obtained by using improved hook designs. These new hook types have entirely replaced the traditional J-hook in several longline fisheries (Fig. 2). The circle hook is used in tuna longlining and in the fisheries for demersal species in the northeastern Pacific and northwestern Atlantic Oceans. The EZ-baiter hook is commonly used in the fishery for demersal fish in the northeastern Atlantic Ocean.

Longlines are baited either manually by hand or mechanically by baiting machines. Hand baiting is predominant and on small vessels is done onshore, whereas on larger vessels baiting is undertaken at sea. However, an increasing number of larger longline vessels ("autoliners") targeting demersal species use automatic baiting machines. The high-sea fishing fleet in the northeastern Atlantic Ocean is dominated by autoliners which also are common in the longline fishery in the northeastern Pacific Ocean and in the fishery for Patagonian Toothfish *Dissostichus eleginoides* in the Southern Ocean.

Longlines are usually set from the stern, and during this part of the longline catching cycle, the baited hooks are available to foraging seabirds. During setting, the baited hooks remain at or near the surface for a short while before they start sinking, and seabirds feeding on baits may occasionally become hooked. The distance over which the longline is floating during setting varies with gear configuration and way of setting, but might be as long as 100 m or more. In demersal longlining, this distance is shorter for longlines baited by hand and set from tubs than for longlines set from autoliners. When longlines are set from tubs, the tension on the line is low and weights are normally used to increase the sinking speed, making it more difficult for birds to take baits. In mechanized longlining, hooks are pulled through the baiting machine where they briefly become snagged as they are automatically baited. This process cause additional tension on the line and line sinking is delayed. The sinking speed in mechanized bottom longlining has been measured as 13 cm s^{-1} (Engås & Løkkeborg 1994). In tuna longlining, a line shooter is used and the lines can therefore be set slack with no tension. During the first several minutes after setting tuna longlines, the sinking speed of the hooks ranged from 20 to 40 cm s^{-1} (M. Okazaki unpubl. data). A line shooter is currently being developed for mechanized demersal longline operation, and may prove to increase sinking speed.

The time of day when longlines preferably are set varies between and within the various longline fisheries, and setting time is another important factor of longline operation that may affect the availability of baited hooks to seabirds. Because several fish species exhibit diel rhythms in feeding activity with an increase in activity at dawn (Fernö *et al.* 1986, Løkkeborg *et al.* 1989, Løkkeborg & Fernö in press), setting times affect longline catch rates (Løkkeborg & Pina 1997). Thus fishers, particularly when targeting demersal species, often set their lines before sunrise. This means that the lines are set in darkness, and night setting has been proposed as a simple solution to reduce the incidental catch of seabirds (Brothers 1991). However, in longlining for tunas which are visual feeders (Atema 1980), the lines are often set under light conditions that allow birds to take baits.

There are three main methods of setting longlines although there are different variants of each method. Bottom set longlines (demersal longlining) are most common and used by fishers targeting demersal species. The baited lines are set on the sea bed with an anchor, buoy line, buoy and marker buoy at either end (Fig. 3). Semi-pelagic longlines are anchored to the sea bed like bottom set longlines, but the mainline is floated off the bottom at variable fishing depths in accordance with the vertical distribution of the target species (Fig. 4). This setting method is used to target hake *Merluccius* spp., and is also used seasonally for other demersal species that show a semi-pelagic distribution at specific time periods. Pelagic longlines are the third setting method, in tuna longlining. The baited longlines are suspended from surface floats and drift freely in the sea (Fig. 5).

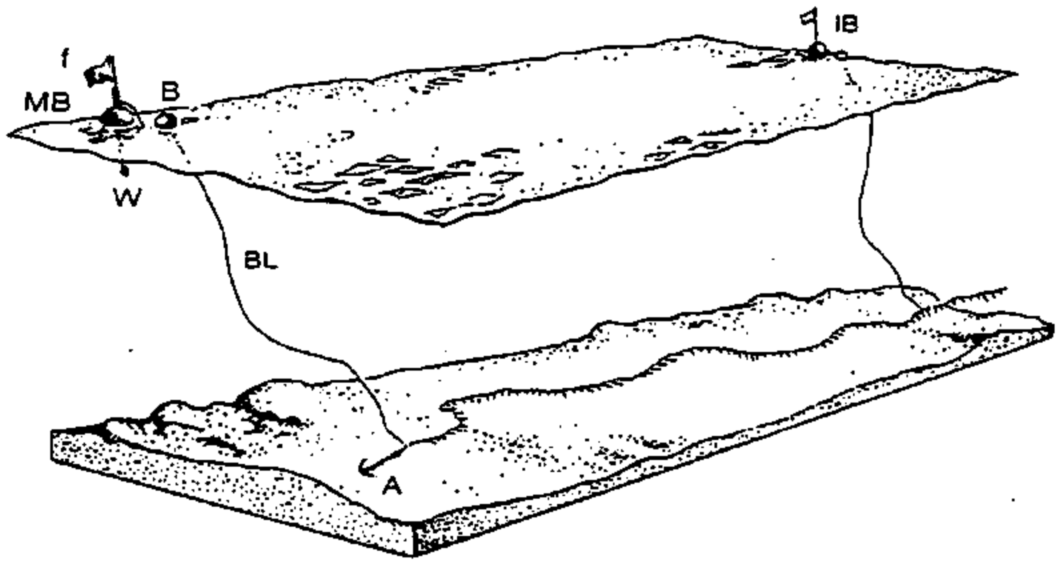

Figure 3. Demersal (bottom-set) longline with anchor (A), buoy line (BL), bouys (B) marker buoys (MB) with weights (W) and pole and flag (f). Redrawn after Bjordal & Løkkeborg 1996).

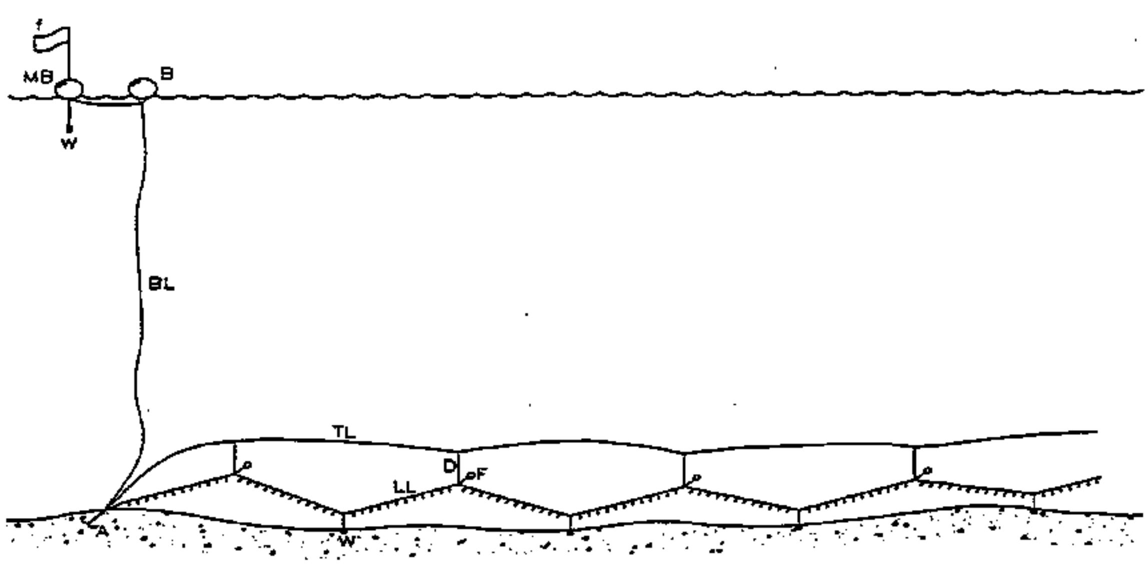

Figure 4 Semipelagic longline with anchor (A), buoy line (BL), buoys (B), marker buoy (MB), with weight (W), pole and flag (f), longline (LL), float (F), dropper (D) and topline (TL).

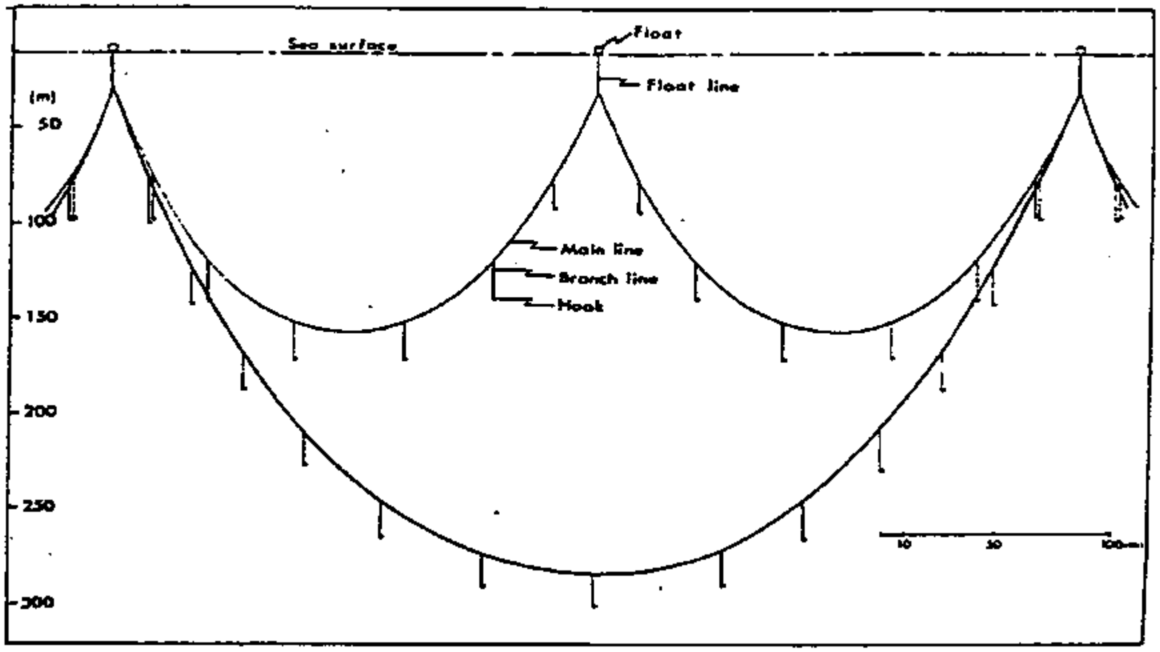

Figure 5. Pelagic longlines showing the shape of regular tuna longline with 6 branch lines between the floats (above) and deep tuna longline with 13 branch lines between the floats (below). Redrawn from Suzuki *et al* (1977).

Fishers are aware that seabirds taking bait during line setting both cause incidental mortality and affect longline catchability and profitability, and they therefore take action to reduce this problem. In the demersal longline fisheries in the North Atlantic and North Pacific, fishers traditionally use a scaring device to prevent seabirds from taking bait. This device is a line with floats attached to its end, and the line is towed during setting with the floats moving in the area where birds may take bait. Preliminary results of an ongoing scientific study have shown that the device reduces seabird catches significantly.

3. DESCRIPTION OF THE WORLD'S MAJOR LONGLINE FISHERIES

On a global scale there is a great variety of longline fishing methods, and it would be difficult to make a comprehensive description that includes all longline fisheries of the World. This section provides an overview of the most important fisheries and to cover the major regions fished by longlines (Table 1). For each fishery, vessels, gear and fishing method are described, and catch and effort statistics are given. A standardised presentation of the information was aimed at, but was found difficult because data collected by the various national management bodies come in different formats.

Table 1. **Regions, main target species and fishing methods of the world's major longline fisheries**

Area	Main target species	Longline fishing method
Northeastern Atlantic	Cod, haddock, tusk, ling, wolffish	Demersal
Northwestern Atlantic	Cod, hake, haddock	Demersal
Northeastern Pacific	Cod, halibut, sablefish	Demersal
Northwestern Pacific	Walleye pollock, cod	Demersal
South America	Hake, kingklip, Patagonian toothfish	Demersal
Southern Africa	Hake, kingklip	Semipelagic
Australasia	Kingklip ("Ling"), Snapper, Trevalla	Demersal
Southern Ocean	Patagonian Toothfish	Demersal
All oceans	Tuna and allied species, swordfish, sharks	Pelagic

3.1 NORTHEASTERN ATLANTIC OCEAN AND MEDITERRANEAN SEA DEMERSAL LONGLINE FISHERIES

Most longlining in the northeastern Atlantic Ocean is for demersal species, although Japanese longliners have from 1994 fished as far north as the Faeroes and Iceland for tuna (ICCAT 1997, B. Olson pers. comm. to E. Dunn.). Longline vessels in the northeast Atlantic region operate both on coastal and high-sea fishing grounds, moving seasonally between fishing grounds targeting different species (Dunn 1994, Fig. 6). In the Mediterranean Sea both demersal and pelagic longlining takes place. Demersal longlining is undertaken by Norway, Iceland, the Faeroes, Ireland, the United Kingdom, France, Spain and Portugal (including the Azores Archipelago and Madeira). The Norwegian, Icelandic and Faeroese fleets dominate the industry, catching Atlantic cod *Gadus morhua*, haddock *Melanogrammus aeglefinus*, tusk *Brosme brosme*, ling *Molva molva*, blue ling *M. dipterigya*, Atlantic halibut *Hippoglossus hippoglossus*, wolffish *Anarhichas lupus*, redfish *Sebastes mentella* and sharks on the shelf and shelf edge to the north of the United Kingdom (P. Large *in litt.* to E. Dunn). UK longliners (mainly small and inshore) target cod and ling, as well as elasmobranch fish species (spiny dogfish and rays) (Dunn 1994, Camphuysen *et al.* 1995).

The Norwegian longline fleet was made up of 813 vessels in 1996, excluding vessels that landed less than 10 tonnes, of which 79 are above 25 m and landed 60% of the total catch. There are 61 autoliners in the Norwegian fleet, and this part of the fleet was estimated to set 476 million hooks. In the Icelandic fleet, 805 vessels were registered in 1996 of which 475 were open and 331 were decked vessels; the latter landing 84% of the total longline catches. Total effort in terms of numbers of hook was 230 million for the Icelandic fleet in 1996. The Icelandic and Norwegian longline fleets landed 69 000 (US$ 68 million) and 144 000 tonnes (US$ 152 million), respectively in 1996, mainly Atlantic cod, haddock and tusk (Table 3).

The coastal fishery is conducted by relative small vessels, and the lines are baited onshore by hand and coiled into tubs or baskets. The vessels, depending on size and number of crew members, bring from a few and up to 100 tubs of 300-400 hooks each, and stay at sea for one or two days to set and retrieve the baited lines. The catch is landed fresh and processed onshore. Larger vessels that operate farther off shore and on high seas fishing grounds use the Mustad autoline system. These vessels set 30 000–35 000 hooks each day, and a trip may last six to seven weeks. The catch is headed, gutted and frozen onboard.

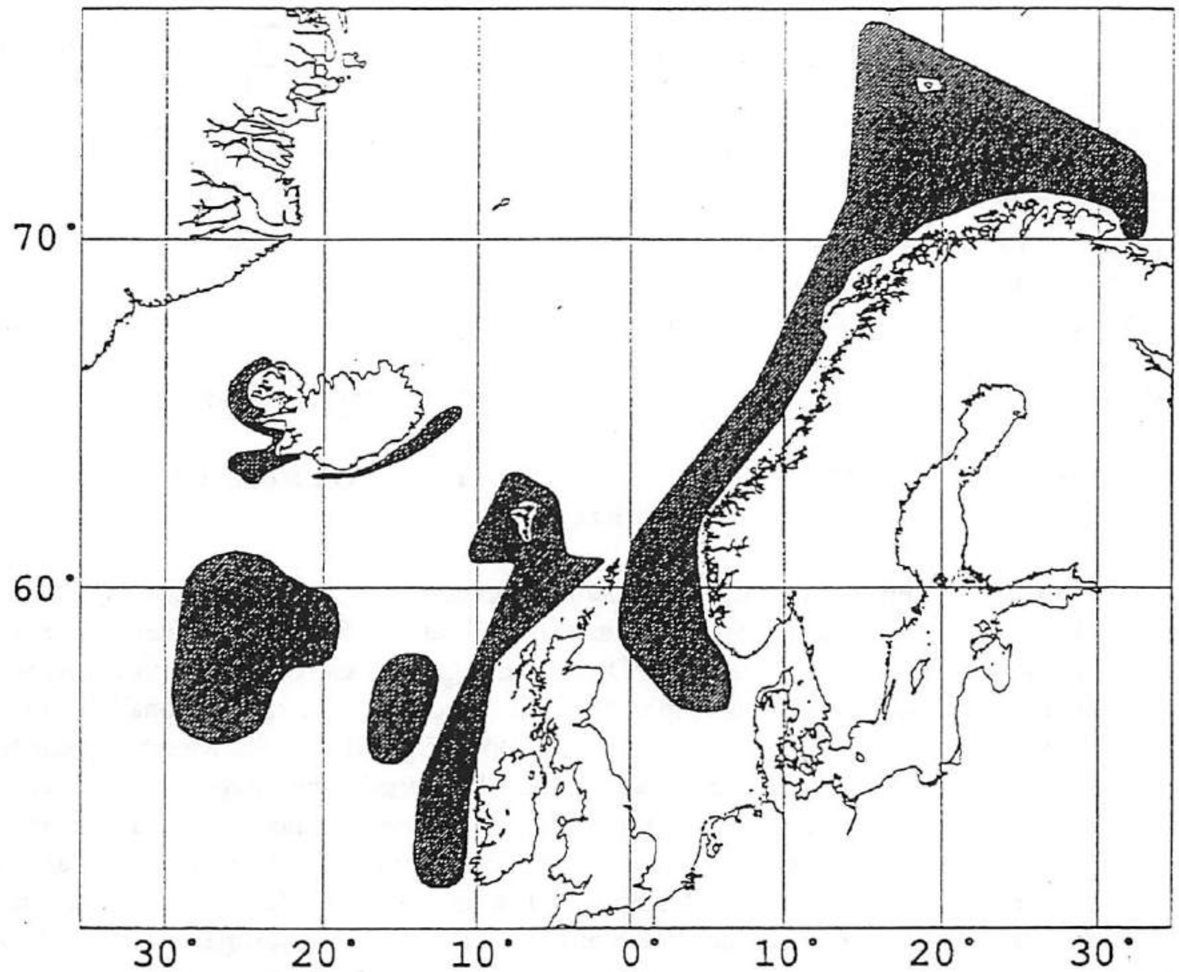

Figure 6. The main fishing grounds operated by longline vessels in the northeastern Atlantic Ocean

Table 2. Annual longline landings (tonnes) of groundfish in Norway and Iceland in 1996

Country	Cod	Haddock	Tusk	Ling	Wolffish	Greenland halibut	Total
Norway	63897	29670	17564	14497	5829	6151	144146
Iceland	38967	7524	4933	1393	11083	2447	69018

The fishery authorities in Iceland and Norway occasionally send observers onboard fishing vessels to inspect logbooks and catch compositions (size and species). This inspection is conducted to assess whether total catches and proportions of undersized fish and bycatch species are in accordance with legislation. Because there are no regulations in this region for seabird catch reduction, the observers do not record seabird catches.

Hake *Merluccius merluccius*, as well as ling and tusk, are caught to the west and south of the United Kingdom by Spanish vessels, some based in Ireland as a joint venture, others fishing under the UK flag (Fahy & Geeson 1992, Perez *et al.* nd, E. Dunn *in litt.*). From 1991 this fishery concentrated on deep-water sharks, but returned to hake in 1995 (E. Dunn *in litt.*).

Inshore/artisanal longline fisheries by Spain exist for sharks in the Bay of Biscay and for blackspot or red sea bream *Pagellus bogaraveo* in the Gulf of Cadiz (E. Dunn *in litt.*). Small vessel/artisanal fisheries exist off the coast of mainland Portugal for sea breams and other species (Erzini *et al.* 1996), for at least 50 species, including blackspot seabream, by *c.* 45 small vessels around the Azores (Santos *et al.* 1995, G. Menezes pers. comm. to L. Monteiro) and around Madeira for black scabbardfish *Aphanopus carbo* and sharks (Martins & Ferreira 1995, P. Large *in litt.* to E. Dunn).

Small-scale longline fisheries of France and Spain catch hake in the Gulf of Lions in the northwestern Mediterranean (Aldebert & Recasens 1996).

3.2 NORTHWESTERN ATLANTIC OCEAN DEMERSAL LONGLINE FISHERIES

Demersal longlining in the northwestern Atlantic Ocean has been conducted by Canada fishing off Nova Scotia, Newfoundland and Labrador and in the Gulf of St. Lawrence from the early 1960s (Fig. 7). Species caught included Atlantic cod, haddock, Greenland halibut *Reinhardtius hippoglossoides*, tusk (or cusk), American plaice *Hippoglossoides platessoides*, saithe *Pollachius virens* and white hake *Urophycis tenuis*, known collectively as "groundfish" (Kenchington *et al.* 1994, Halliday & Clark 1995). The total mean annual landing from 1987 to 1991 was 71 879 tonnes. In 1992 a moratorium on groundfish (primarily for cod) fishing came into force in Canadian Atlantic waters. In 1997 a limited commercial longline fishery for cod commenced around Newfoundland by domestic vessels (Bakken & Falk 1998).

The Canadian longline fleet is dominated by small vessels compared to the Norwegian and Icelandic fleets operating in the northeastern Atlantic. The majority of the Canadian catches are taken in the Nova Scotia area (65%), and 809 vessels were active in this area in 1990 (Kenchington *et al.* 1994). Only 11 of these vessels were above 65 feet in length, and 749 were below 45 feet. The smaller vessels bait their lines onshore by hand. The large vessels (>45 feet) also bait by hand, but stay at sea for several days.

Observers have been deployed in the Canadian demersal longline fishery since 1988. However, coverage levels are low, with less than 5% of the trips covered (i.e. 50-100 trips/year). Information is collected on the fishing vessel, gear and fishing set. Observers record estimates of catch and discard weight for each longline string, and length frequencies are collected routinely. Seabird takes are not currently recorded by all observers.

Longlining off Greenland concentrates on Greenland Halibut in fjords and off the northwestern and southern coasts (Bakken & Falk 1998). The fishery in the fjords is conducted by a domestic fleet of small vessels, whereas Norwegian autoliners operate on the offshore fishing grounds. The catches and fishing effort in the waters around Greenland are, however, negligible compared to the Canadian fishery.

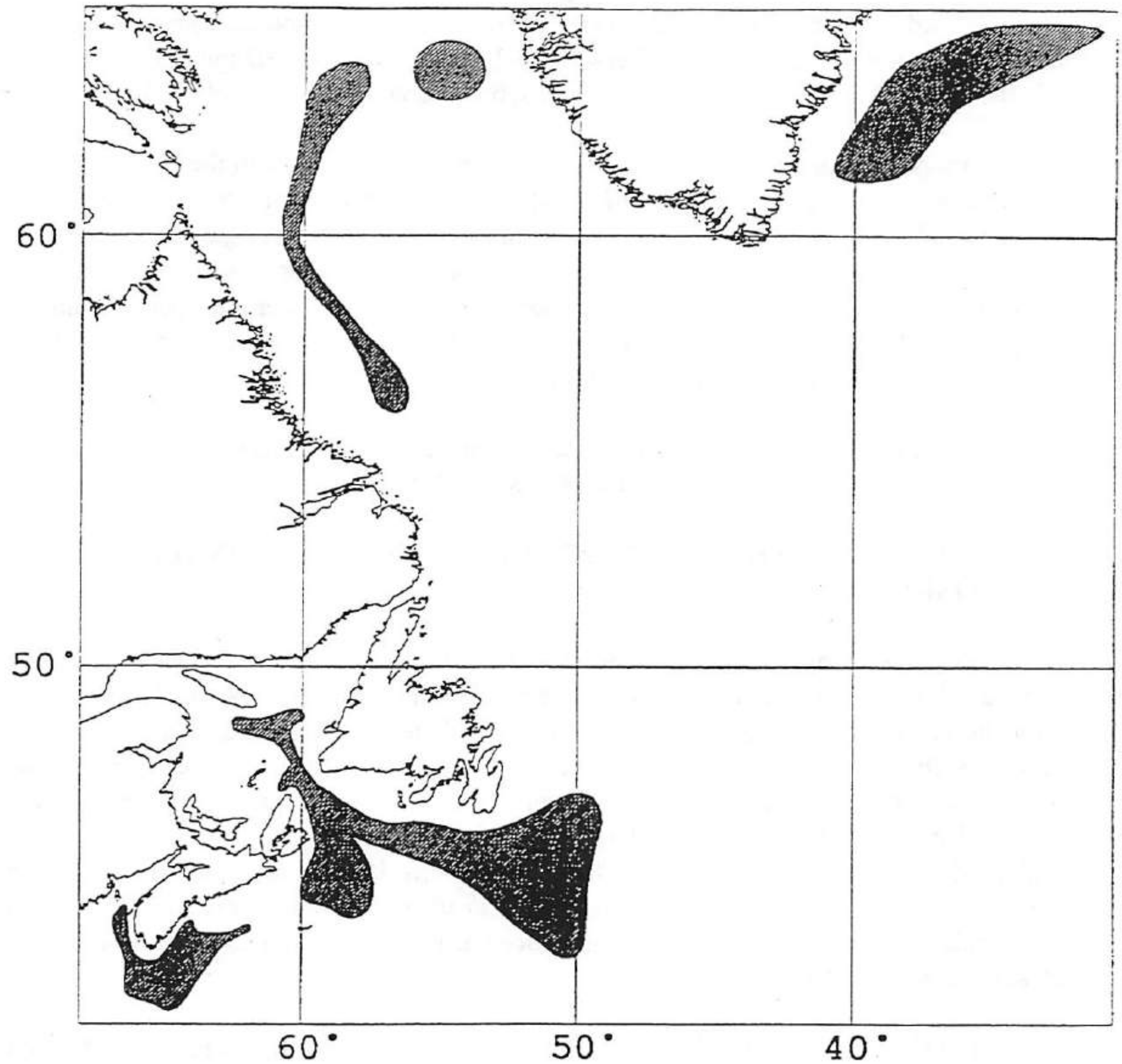

Figure 7. The main fishing grounds operated by longline vessels in the northwestern Atlantic Ocean.

3.3 NORTHEASTERN PACIFIC OCEAN DEMERSAL LONGLINE FISHERIES

The longline fleet in the northeast Pacific Oceans consists entirely of domestic vessels of the U.S.A. and Canada. This region is divided into three areas, Alaska (Gulf of Alaska and Bering Sea), Canada (British Colombia) and Washington-Oregon-California, from which catch statistics are collected separately. The most important fishing grounds are found in the Alaskan waters, and consequently the fishing activity is much higher in this area (Fig. 8).

Californian longlines target rockfish, sablefish *Anoplopoma fimbria*, and sharks; off Oregon and Washington rockfish, sablefish and spiny dogfish are caught (National Marine Fisheries Service 1995). Off British Columbia longlining takes Pacific halibut *Hippoglossus stenolepis*, redfish *Sebastes marinus* and *Hexagrammus* sp. (International Pacific Halibut Commission 1996, G. Kaiser *in litt.*). The Bering Sea and Gulf of Alaska groundfish fisheries, managed by the North Pacific Fisheries Management Council of the USA, are large with up to two million tonnes taken, mainly of Walleye pollock *Theragra chalcogramma* and Pacific cod *Gadus macrocephalus*, as well as sablefish, Greenland turbot *Psetta maximus*, arrowtooth flounder and rockfish (National Marine Fisheries Service 1997a, Bakken & Falk 1998). This figure does not include the Pacific halibut longline fishery, which has been managed separately since 1923 by the International Pacific Halibut Commission of Canada and the USA (McCaughran & Hoag 1992). Pacific halibut is fished from northern California, USA to the Bering Sea (International Pacific Halibut Commission 1996).

The vessels range in size from small boats in the several metre range to vessels of 70 m. The larger vessels are operating in Alaskan waters, whereas relatively small vessels fish off Canada and Washington-Oregon-California. Several of the Alaskan vessels targeting Pacific cod and sablefish have automatic baiting systems. A total of 2646 vessels was registered and 15 million hooks were set in the Pacific Halibut fishery in 1996. Of these 2145 were based in Alaska. In the Alaskan longline fishery for other groundfish species, 1281 vessels participated and 201 million hooks were set. Some of these vessels were registered also in the Pacific halibut fishery. About 500 vessels are licensed in Canada (excluding vessels with a halibut license). In the Washington-Oregon-California area, 173 vessel with longline permits landed groundfish in 1996. In addition, non-permit vessels can participate in the longline fishery in this area. Although 1316 vessels were registered in this group, they landed only about 40% of the groundfish catches.

The Pacific halibut fishery was open access until the 1990s when an individual vessel quota system was put into effect in Alaskan and Canadian waters (in 1995 and 1991, respectively). As a result of individual quota programmes, the fishing activity in this region changed. Numbers of active vessels declined, and the halibut fishery now lasts for eight months (mid March to mid November) rather than the one to three days typical of the open-access period.

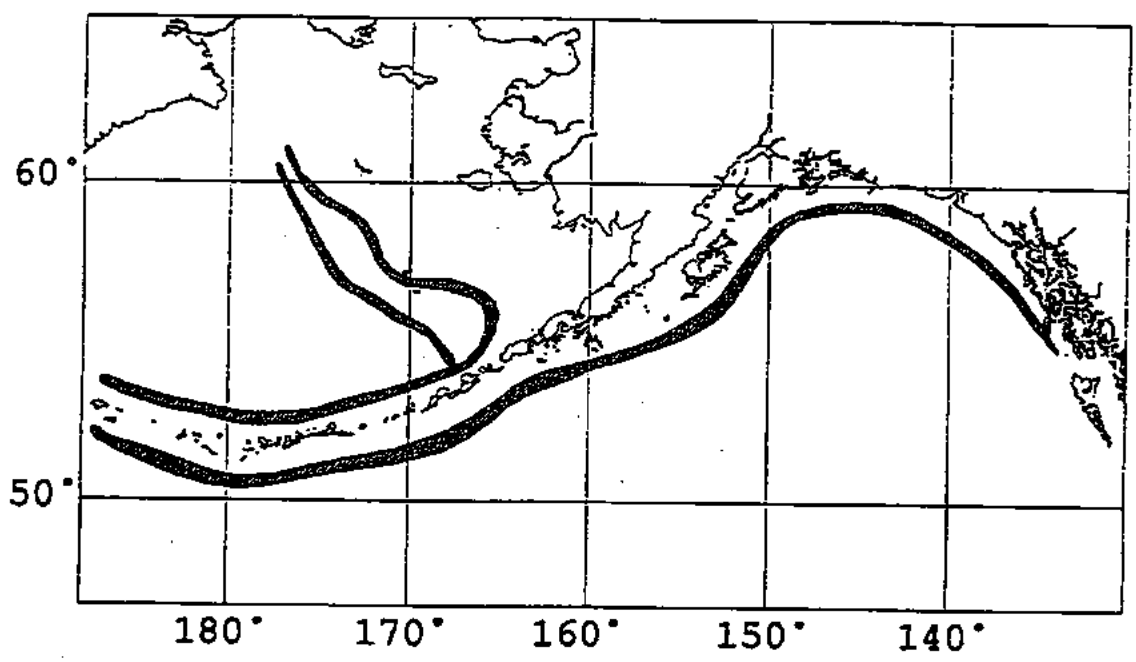

Figure 8. The main fishing grounds operated by longline vessels in the northeastern Pacific Ocean.

Also, nearly all halibut fishers baited their longlines onshore when the fishery was open access, but trips now last for several days and longlines are baited at sea. The Washington-Oregon-California portion of the Pacific halibut fishery has remained open access.

Alaskan fisheries dominate the harvest and account for all the Pacific cod landings and approximately 80% of the Pacific halibut landings (Table 3). Canadian landings represent most of the remaining halibut harvest, with small catches taken in the Washington-Oregon-California area. In total, 29 400 tonnes (US$ 105 million) of halibut were landed (mean annual catches, 1994-1996). In the Alaskan fisheries for other demersal species, 149 300 tonnes (US$ 140 million, excluding the value of species reported as "other" in Table 3) were landed. The total catches of groundfish (excluding halibut) taken off British Columbia, Canada and Washington-Oregon-California in 1996 were 7 908 tonnes (US$ 13 million) and 6 611 tonnes (US$ 17 million), respectively.

Table 3. Annual longline landings (tonnes) of groundfish in Northeast Pacific by areas. (Landings in Canada and Washington/Oregon/California (WOC) except for Pacific halibut, are given for 1996, all other landings are means for 1994-1996)

Area	Pacific Cod	Pacific Halibut	Sablefish	Greenland Halibut	Rockfish	Other
Alaska	104300	23361	19800	4300	2800	18100
Canada	-	5864	498	-	1628	5782
WOC	-	194	2554	-	2797	1260

U.S. Federal regulations require onboard observers for the groundfish fisheries off Alaska, but not onboard vessels fishing for Pacific halibut unless they also land groundfish. Vessels longer than 38 m require an onboard observer 100% of the time, vessels from 18.3-38 m require an observer onboard 30% of the time and smaller vessels carry observers only when requested. Most halibut vessels fall into the unobserved and 30% categories. Seabird catches are recorded by the observers. No observers are required on longliners fishing in the Canadian and Washington-Oregon-California areas.

3.4 NORTHWESTERN PACIFIC OCEAN DEMERSAL LONGLINE FISHERIES

Demersal longlining in the northwestern Pacific Ocean is primarily conducted by vessels from China, Japan, the Republic of Korea, Russia and Taiwan Province of China. Catch statistics have, however, only been obtained from Japan. Japanese longliners operate on coastal and high-sea fishing grounds around Japan. Both demersal and pelagic longlines are used in this fishery which is classified into three categories, coastal, offshore and high-seas. This fishery is dominated by small boats operating on coastal fishing grounds. A total number of 11 952 vessels was registered in 1995. Of these, 9887 boats were smaller than 5 GRT, 1972 boats were between 5-20 GRT, and 93 were larger than 20 GRT. No observers are required on longliners fishing within the Japanese EEZ.

The total annual landings in 1995 were 64 673 tonnes, with 38 813 tonnes taken in the coastal fishery, 19 448 tonnes in the offshore fishery and 6412 tonnes in the high seas fishery. The most important species are Walleye pollock (16 095 tonnes), Pacific cod (12 279 tonnes) and Pacific halibut (K. Miyauchi in litt.).

Russia longlines for Pacific cod and Pacific halibut in the northwest Pacific Ocean, particularly off the Kamchatka Peninsula (Dunn 1995, Anon. 1997a). Some vessels have automatic baiting machines (Anon. 1997a).

Artisanal longlining takes place for croaker (Sciaenidae) in the Gulf of Bengal by Bangladesh (Huq *et al.* 1993). Experimental longlining for sharks has taken place off the west coast of India (George *et al.* 1991). Information on artisanal and demersal longline fisheries still needs to be obtained from countries such as China, Indonesia, the Republic of Korea, the Philippines and Taiwan Province of China, as well as for other Asian countries.

3.5 CENTRAL AND SOUTH AMERICAN DEMERSAL LONGLINE FISHERIES

Demersal longline fisheries exist in the waters of most if not all Central and South American countries. Available information is summarized by country.

Mexico: Longlining by Japanese vessels has been reported from the Gulf of California but the type of fishing is unspecified (Everett & Anderson 1991).

Venezuela: Longlining takes place for snapper and grouper (D. Weidner *in litt.*) and for sharks (Alio *et al.* 1993).

Brazil: Demersal longlining catches tilefish *Lopholatilus villarii*, namorado *Pseudopercis numida*, groupers *Epinephelus* spp. and sharks 150 to 320 km off Sao Paulo and Parana States, southern Brazil (Olmos 1997, Neves & Olmos in press).

Uruguay: Argentine hake or merluza *Merluccius hubbsi* and rays are caught by longliners of the mouth of the Rio de la Plata (Stagi *et al.* in press). The fishery commenced in 1994 with one vessel, being joined by a Korean boat in 1995.

Argentina: Demersal longlining in 1995 was undertaken by 19 vessels based in Patagonian harbours on the shelf and shelf break in two distinct areas, between 43°-50°S and 54°-57°S, the southern region comprising 64% of hooks set (Schiavini *et al.* in press). The northern region on the Patagonian Shelf targets South American kingklip *Genypterus blacodes*, Argentine hake and round skate and commenced in 1992 (Maeda *et al.* 1994, Anon. 1995, Schiavini *et al.* in press). The southern region from 1994 has caught Patagonian toothfish *Dissostichus eleginoides* over the shelf break. Argentinian vessels fishing for toothfish within the CCAMLR area are considered separately below.

Chile: A demersal longlining fishery has recently commenced in domestic waters on the continental slope (Spear *et al.* 1995). In southern Chile species longlined are Patagonian hake *Merluccius australis* and South American kingklip (Arana *et al.* 1989). Chilean vessels fishing for Patagonian toothfish in the CCAMLR area are considered separately in the Southern Ocean demersal section below.

Peru, Ecuador and Colombia: Artisanal longlining takes place for sharks and rays (Van Waerebeek *et al.* 1997, D. Weidner *in lit*

3.6 SOUTHERN AFRICAN DEMERSAL LONGLINE FISHERIES

Demersal (or semi-pelagic) longlining commenced in South African continental shelf waters (mainly in the southwestern Atlantic Ocean) in 1983, initially targeted at the hakes *Merluccius capensis* and *M. paradoxus* (Japp 1993). Interest soon swung to fishing for the more valuable kingklip *Genypterus capensis* (Badenhorst 1988). The catches of kingklip peaked in 1986 at 8684 tonnes, and the catches of hake reached a peak in 1988 of 5514 tonnes. By 1990 kingklip had been over-exploited by this method and the longline fishery was closed (Walker 1991). In 1994 an experimental longline fishery for hake was started with kingklip being allowed as a bycatch, concentrated on the west and south coasts of the Western Cape Province (Anon. 1996a). This fishery has become a commercial one in 1998, with regulations produced for its management. To date, however, no mitigation measures to reduce bird incidental catch are in force (C.L. Moloney pers. comm.).

The vessels participating in the hake longline fishery range in size from 8 to 30 m, and most are 18-22 m. The Spanish semipelagic longline gear with safety lines (toplines) are used by these vessels (Fig. 4). Catch and effort data for the experimental fishery are given in Table 4, and the main fishing ground are shown in Figure 9. The observer coverage in the fishery is low as only 12-20 trips per year have observers onboard.

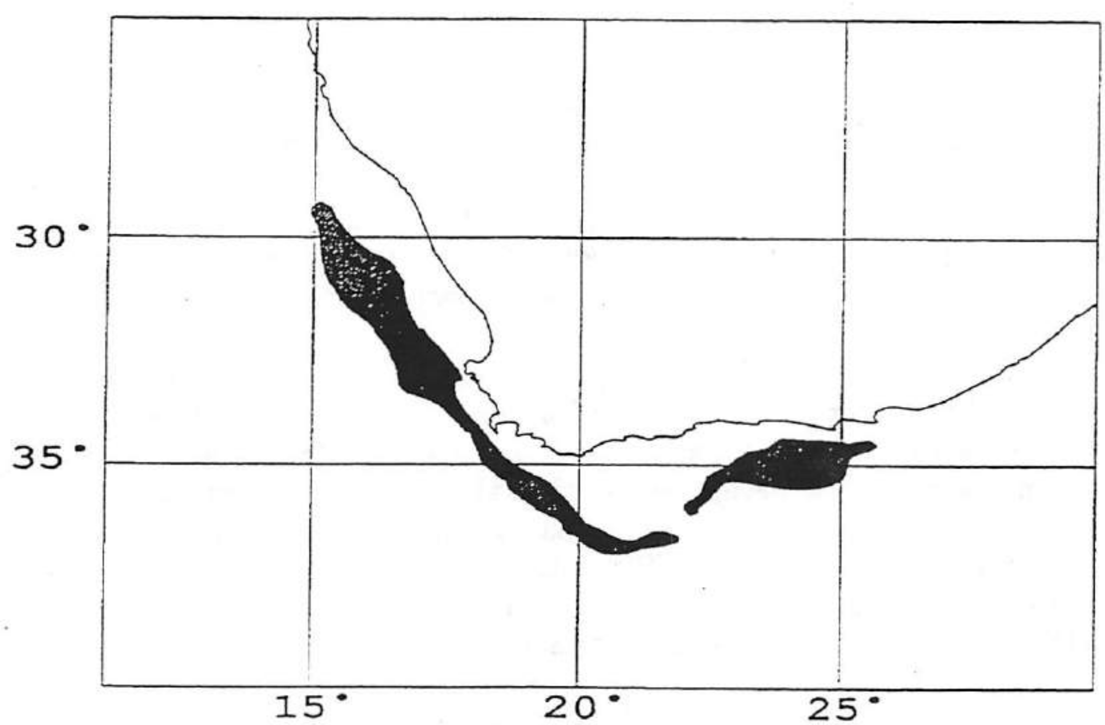

Figure 9. The main fishing grounds operated by longline vessels off southern Africa. Modified after Badenhorst (1988)

Small-scale demersal longlining for shark also takes place in southern African waters (Japp 1993, M. Kreuse pers. comm.). Longlining for hake and kingklip has taken place in Namibian waters (Adams 1992).

Table 4. Number of vessels, fishing effort and landings in the South-African experimental longline fishery, 1994-1997. (*Effort is probably underestimated because some vessels did not return their reports, especially in 1994 and 1997).

		Effort*	Landings (tonnes)	
Year	**No. of vessels**	**(1000 hooks)**	**Hake**	**Kingklip**
1994	41	4721	2248	140
1997.	31	2507	1607	113
1996	71	9536	4240	232
1997	68	9337	3784	250

3.7 AUSTRALASIAN DEMERSAL LONGLINE FISHERIES

Demersal longlining takes place around New Zealand for snapper *Pagrus auratus* and ling (=South American kingklip) *Genypterus blacodes*, and in Australian waters for snapper, ling, Deep Sea trevalla or Antarctic butterfish *Hyperoglyphe antarctica* and sharks (Otway *et al.* 1996, Anon. 1997b, Alexander *et al.* 1997, Environment Australia 1998). The New Zealand ling fishery is concentrated on the Chatham Rise and around the southern islands. Observer programmes are in place in the New Zealand Ling fishery but not yet in the *c.* 200-vessel Snapper fishery or in the Australian fisheries (Alexander *et al.* 1997, Brothers 1998, L. Robinson *in litt.*).

3.8 SOUTHERN OCEAN DEMERSAL LONGLINE FISHERIES

Longline fishing in the Southern Ocean commenced in the 1988/89 austral summer by the then Soviet Union, directed at Patagonian toothfish *Dissostichus eleginoides* in the area of South Georgia (Dalziell & de Poorter 1993, Croxall & Prince 1996). The species has a circumpolar distribution south of 55°S, being found around many of the islands of the Southern Ocean (Gon & Heemstra 1990). Longlining started around the Kerguelen Islands in 1990/91 (Duhamel *et al.* 1997). Chilean and Bulgarian vessels joined the fishery in 1991/92 (Dalziell & Porter 1993). Fishing is conducted off the southern part of South America (Argentina, Falkland Islands/Maldinas and Chile) and around many of the islands of the Southern Ocean, especially those of the South Atlantic and southern Indian Oceans (South Georgia, South Sandwich, Bouvet, Prince Edward, Crozet and Kerguelen Islands). The fishery is carried out by large mechanized vessels that operate in very deep waters down to 3000 m.

The fishery is regulated by the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) with annual regional quotas set, but in the last two years much unregulated (by non-CCAMLR-flagged vessels) and illegal (by CCAMLR-flagged vessels) fishing has taken place, especially around the Indian Ocean islands (e.g. Album 1997, Anon. 1997c, Lugten 1997, Ryan & Boix-Hinzen 1997, ISOLFICH 1998). The regulated fishery in the CCAMLR Convention area reached a peak in the 1991/92 season at 12 500 tonnes, and 10 250 tonnes for the 1996/97 season (*CCAMLR Statistical Bulletin*, Vol. 9, 1997, CCAMLR 1997). The majority of the regulated catch in the CCAMLR Convention area is landed by vessels from France, Chile and Ukraine. The total reported catch of Patagonian toothfish from the CCAMLR Convention area, and from EEZs outside this area, was 32 991 tons in 1996/97.

Countries that conducted longlining for Patagonian toothfish in 1996/97 included Argentina, Australia, Chile, France, Japan, Korea, Namibia, New Zealand, South Africa, Spain, Ukraine and the U.S.A. Previously, Germany and Russia have longlined for toothfish. In addition, Norway has expressed an interest in commencing fishing in the 1997/98 austral summer season (information supplied by CCAMLR). This list of countries does not include those of unregulated vessels (see ISOLFICH 1998). The unregulated fishery has been estimated at between 107 000 and 115 000 tonnes (*CCAMLR Newsletter* No. 19, December 1997, p.2), about ten times as much as the regulated catch.

CCAMLR collects and analyses data on seabird mortality on an annual basis through its Ad Hoc Working Group on Incidental Mortality arising from Longline Fishing (CCAMLR-IMALF) which first met in 1994 (CCAMLR 1994).

Longlining for Patagonian toothfish also occurs outside the CCAMLR Convention area, in the Falkland Islands/Malvinas "Outer Fishing Zone" and on the Patagonian Shelf by Argentina, Chile and the UK since 1994 (Brothers 1995a, Schiavini *et al.* in press, CCAMLR Secretariat *in litt.*).

3.9 PELAGIC LONGLINE FISHERIES: AN OVERVIEW

Japan, Taiwan Province of China and the Republic of Korea are the major operators in the tuna longline fisheries. Countries such as Spain, U.S.A., Canada, Portugal, Italy, Greece and Brazil carry out pelagic longline fishery in the Atlantic Ocean and Mediterranean Sea and target mainly Swordfish. Indonesia, Mozambique and Yemen are major countries in the Indian Ocean in addition to the three Asian countries. In the Pacific Ocean, China, Australia, Fiji, New Caledonia, French Polynesia and the U.S.A. carry out pelagic longlining for tuna. The three Asian countries land 79% of the total pelagic longline catches in the Atlantic Ocean, 56% in the Indian Ocean and 83% in the Pacific Ocean (Table 5). These countries land, however, only 23% of the swordfish catches in the Atlantic and 50% in the Pacific Oceans.

The species composition of the tuna longline fishery by oceans is shown in Table 6 and in Fig. 10 for the Japanese fishery. Bigeye and yellowfin tunas are major species in the Pacific and Indian Oceans. Bigeye tuna is also an important species in the Atlantic Ocean where swordfish constitutes a relative large proportion of the catches. The catches of Northern and Southern bluefin tunas are relatively small, but the prices of these species in the Japanese sashimi (raw fish) market are substantially higher than for other species. Almost all catches of bluefin and bigeye tunas are exported to the Japanese sashimi market, whereas the catches of albacore are supplied to the European and North American canning industries. Swordfish is mainly consumed in Europe and the U.S.A.

Table 5. The percentages of tuna catches landed by vessels from Japan, Taiwan Province of China and the Republic of Korea by oceans and species (1994)

Ocean	Bigeye	Yellowfin	Albacore	Southern Bluefin	Northern Bluefin	Swordfish	Total
Pacific	90.4	73.7	93.2	44.6	98.0	50.0	83.4
Atlantic	97.3	100.0	100.0	100.0	46.2	23.4	79.0
Indian	72.2	38.6	91.2	65.5	-	69.6	55.6

Table 6. Annual catches (tonnes) in the global tuna longline fishery by oceans and species (1994)

Ocean	Bigeye	Yellowfin	Albacore	Southern Bluefin	Northern Bluefin	Swordfish	Total
Pacific	128 445	64 000	44 948	5 558	2 380	16 020	261 351
Atlantic	88 743	8 488	30 005	833	9 606	38 194	175 860
Indian	66 493	104 795	17 435	5 243	-	7 307	201 273
Total	28 681	177 283	92 388	11 634	11 986	61 521	638,484

Japanese tuna longline vessels can be classified into three categories, coastal, offshore and distant water longliners. There are about 700 coastal vessels (10-20 GRT), 200 offshore vessels (20-120 GRT) and 750 distant water vessels (120-500 GRT). The operational area for coastal and offshore vessels is restricted to the northwestern Pacific Ocean by Japanese regulations. The total number of vessels has decreased gradually by about 20% in the recent two decades, and the decrease has been highest for the offshore vessels which has decreased by 40% in this period (Fig. 11).

Taiwanese tuna longline vessels can be classified into three types in accordance with the forms of their catch; albacore, deep-frozen sashimi and fresh sashimi longlining. Albacore longlining was once the most important tuna fishery with its peak of over 600 vessels. The fleet size of Albacore longliners in 1997 was 236 vessels, of which 92 operated in the Atlantic Ocean, 66 in the Indian Ocean, 37 in the Pacific Ocean, and 41 shifted to shark longlining in Indonesian waters. There are 332 longliners operating in the deep frozen sashimi tuna fishery. The most important fishing ground of this fleet is the Indian Ocean with 213 vessels. There are 108 vessels in the Atlantic Ocean and 11 in the Pacific Ocean. The fleet of longliners that is landing fresh sashimi tuna consists of smaller vessels (60-100 GRT), and currently it is estimated that there are about 150 Taiwanese longliners operating in the southwestern Pacific and Indian Oceans.

The Republic of Korea tuna longline fishery commenced in 1958, and grew rapidly to 589 vessels by 1975. The number of vessels has decreased gradually to 192 vessels in 1997. The great majority of the Korean vessels operates in the Pacific Ocean. The numbers of vessels from China, Indonesia and other countries are increasing, although there is insufficient information for these countries.

The geographical distribution of the total Japanese pelagic longlining effort is shown in Figure 12. The mean effort of the Japanese fleet in terms of number of hooks was 481 million hooks per year (1992-1996, not including the coastal fishery); 301 million were set in the Pacific Ocean, 103 million in the Atlantic Ocean and 78 million in the Indian Ocean. The fishing effort of the Taiwanese tuna fleet was 406 million hooks in 1995.

In the Atlantic Ocean, the major fishing grounds are located in the northwest where swordfish and yellowfin, bigeye and Northern bluefin tunas are targeted, and in the central tropical waters where bigeye tuna and swordfish are the main species caught. In the Mediterranean Sea, Northern bluefin tuna and swordfish are targeted by several of the bordering countries. In the Indian Ocean, the most important fishing grounds are found in northern waters where yellowfin and bigeye tunas constitute the main species caught. In the Pacific Ocean, there are several important fishing grounds (off Japan, northern water off Hawaii, western and eastern tropical waters, Tasmanian Sea) for bigeye, albacore and yellowfin tunas. Southern bluefin tuna is targeted in temperate waters at around 40°S in all oceans.

The Japanese fleet used to target mainly yellowfin and albacore tunas from the 1950s to mid 1970s to supply the U.S.A. canning industry. The fleet gradually switched to bigeye, Northern and Southern bluefin tunas to supply the Japanese sashimi market. The Republic of Korean and the Taiwanese tuna longline industry also developed in two stages, but the shift from supplying the canning industry to mainly fishing tuna for sashimi occurred later than it did in Japan. The Republic of Korean fleet now mainly targets bigeye tuna for export to Japan. The Taiwanese fleet is currently changing from targeting mainly albacore to bigeye tuna and other highly priced tuna species. This shift was driven by economic and market forces because bigeye and bluefin tuna fetch a higher price than do yellowfin tuna and albacore in the sashimi market. Tuna prices at the sashimi market vary substantially, not only between species, but also within a species, due to the quality of the fish as this market has very stringent quality requirements. The European and North American fleets have traditionally targeted swordfish and there is no significant change in these fisheries.

Accompanying the shift in the most important target species, a 'deep longline' to target bigeye tuna was developed in the mid 1970s. Bigeye tuna is distributed deeper in the water column (about 300 m) than are yellowfin tuna and albacore which both occur at a depth shallower than 200 m. The depth of the gear is usually adjusted by changing the number of branch lines (snoods) between two floats (i.e. number of branch lines per basket), as well as the mainline length. The deep longline has more hooks per basket and sinks deeper than the regular gear (Fig. 5). An increase of one hook per basket has been shown to increase the depth of the gear by about 10 m (Uozumi & Okamoto 1997). The longline fishery targeting swordfish is conducted at night when the fish migrate to the surface layer, and surface longline gear with three to four branch lines per basket is usually used. The depth of the hooks of surface, regular and deep longline gears range between 30-60 m, 50-120 m and 50-250 m, respectively. More important in regard to incidental catch of seabirds is the sinking speed of the hooks. However, the sinking speed through the surface layer (down to 50 m) does not seem to be affected by the number of hooks per basket (Uozumi & Okamoto 1997).

In the last few years new materials have been introduced into the Japanese tuna longline fishery of which braided nylon has become dominant. Although information on catching performance is scarce, the efficiency of these new gears seems to be better than that of the traditional ones. The type of material does not seem to affect the sinking speed of the hooks.

Management and assessment studies on tuna are conducted by several international fishery organizations including the International Commission for the Conservation of Atlantic Tunas (ICCAT), Inter-American Tropical Tuna Commission (IATTC), South Pacific Commission (SPC) and the Commission for the Conservation of Southern Bluefin Tuna (CCSBT). These bodies have recognized the necessity for observer programmes.

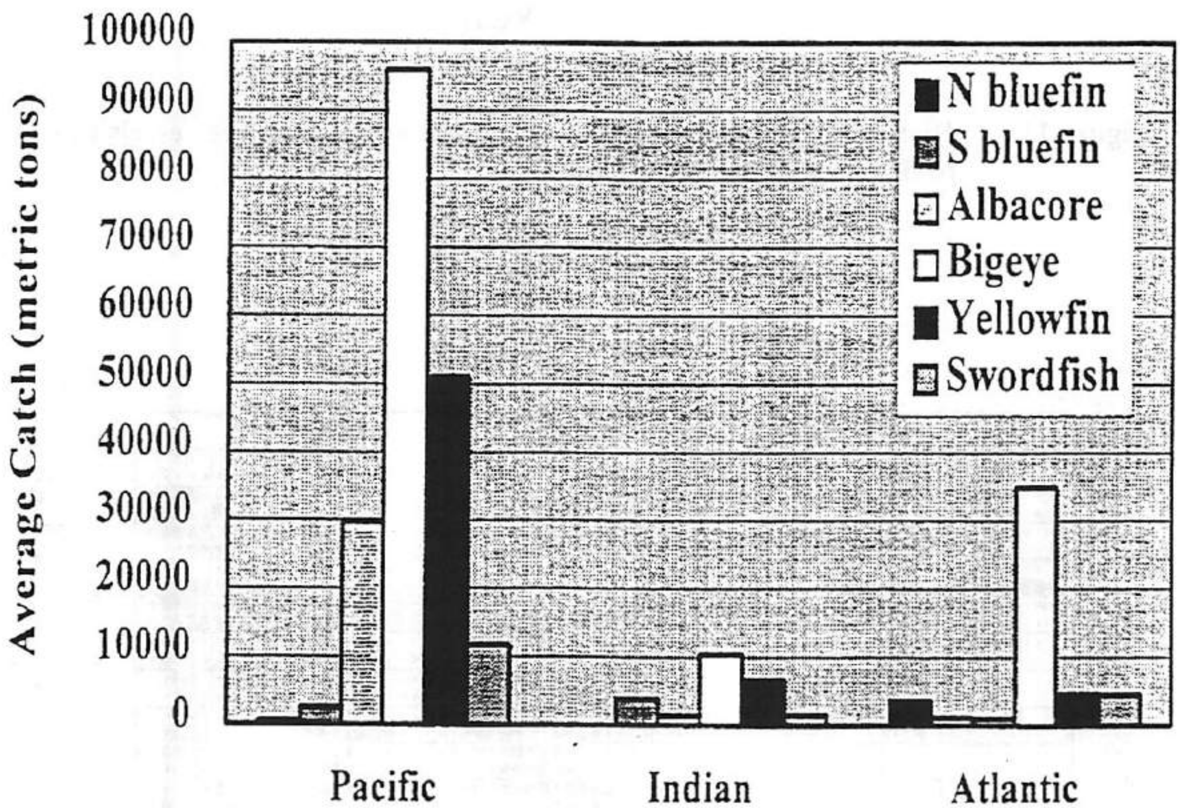

Figure 10. Average catch of Japanese tuna longline fishery by oceans (1992-96)

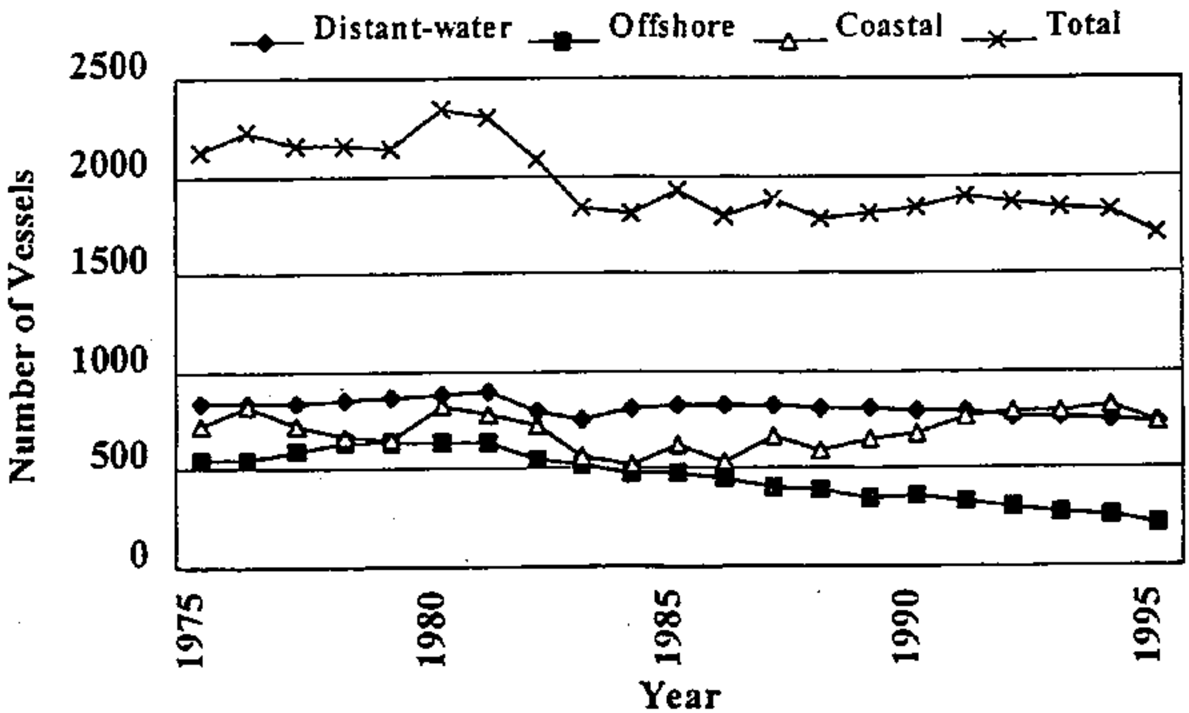

Figure 11. Historical change in number of Japanese tune longline vessels in relation to fishing distance form shore

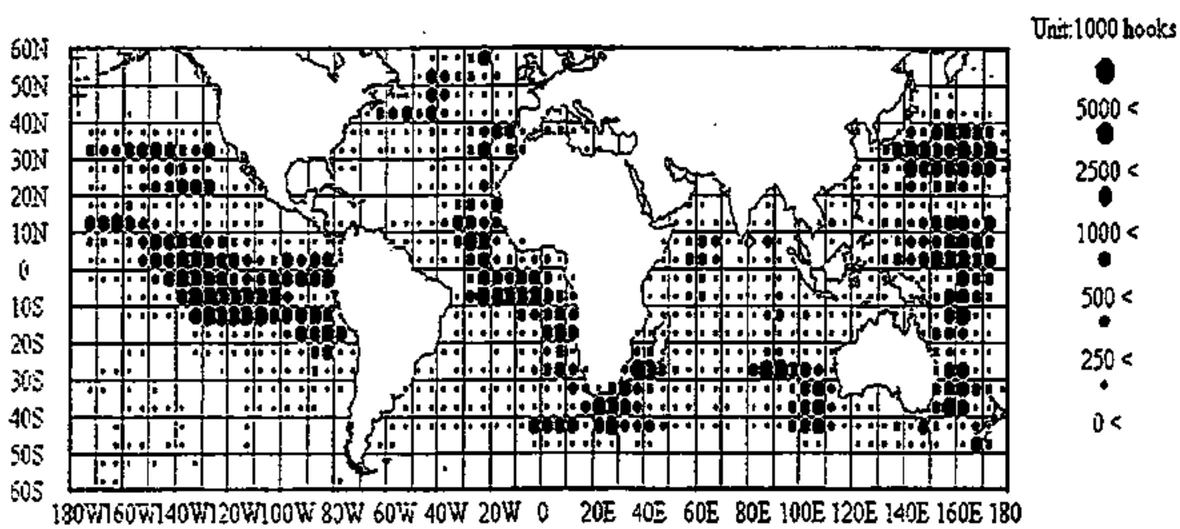

Figure 12. Geographical distribution of the effort of Japanese tuna longline fishery in terms of average number of hooks, 1992-96.

3.10 ATLANTIC OCEAN AND MEDITERRANEAN SEA PELAGIC LONGLINE FISHERIES

Pelagic longlining in the Atlantic Ocean (including the Gulf of Mexico and the Caribbean Sea) and Mediterranean Sea is undertaken by a number of bordering countries, as well as by Japan, the Republic of Korea and Taiwan Province of China. Fishing for tuna and billfish including swordfish, (Brewster-Geisz *et al.* 1997, Folsom 1997a,b, Folsom et al. 1997, Weidner ms a,b) is regulated, including the setting of quotas, by the 23-member International Commission for the Conservation of Atlantic Tunas (ICCAT), which was established in 1966 (ICCAT 1985, see also Gaski 1993). Fishing for tuna takes place between 60°N and 50°S. It is to be noted that the most southerly fishing for southern bluefin tuna is considered in the Southern Ocean section below.

Pelagic longlining takes place on the high seas and also within EEZs: for example around Ascension Island in the South Atlantic where 50 Japanese vessels fished under license in 1989/90 (Ashmole *et al.* 1994).

In the past pelagic longlining took place for Atlantic salmon *Salmo salar* off the Norwegian coast by Norway and Denmark as well as around the Faeroes, but is now prohibited (Brun 1979, Follestad & Strann 1991, B. Olsen pers. comm. to E. Dunn).

3.11 INDIAN OCEAN PELAGIC LONGLINE FISHERIES

Information on pelagic longlining for tuna and related species in the Indian Ocean has been collated by the Indo-Pacific Development and Management Programme (IPTP) of the FAO since its inception in 1982. The IPTP is being replaced in 1998 by the 15-member Indian Ocean Tuna Commission (IOTC) which has managerial responsibilities and powers (Anon. 1997d). Commercial and artisanal longlining for tuna, tuna-like species, billfish, including swordfish, (Folsom 1997, Folsom *et al.* 1997, Wildman 1997), and sharks takes place by countries bordering the Indian Ocean (importantly India, Indonesia, Pakistan, Sri Lanka and Thailand) and by Japan, the Republic of Korea and Taiwan Province of China. Fishing for Southern bluefin tuna in the Indian Ocean is considered in the Southern Ocean pelagic section below.

3.12 PACIFIC OCEAN PELAGIC LONGLINE FISHERIES

Commercial and artisanal longlining in the tropical and temperate Pacific Ocean for tuna, tuna-like species, billfish and sharks is undertaken by Australia, Chile, China, Colombia, Ecuador, Japan, Korea, Peru, Taiwan Province of China and the USA (including Hawaii), as well as by a number of Pacific Ocean island states (Brewster-Geisz *et al.* 1997, Folsom *et al.* 1997, Nakano & Bayliff 1992, Bailey *et al.* 1996, Weidner & Serrano 1997, C.F. Heberer *in litt.*, J. Jahncke *in litt.*).

The Inter-American Tropical Tuna Commission (IATTC), established in 1950, studies and regulates tuna and billfish fishing in the eastern Pacific Ocean (east of 150°W) (Peterson & Bayliff 1985). The South Pacific Commission (SPC), which has no management responsibility, collates data on the tuna fisheries of the western and central Pacific Ocean (west of 120°W). It commenced an observer programme, which records bycatch, in 1995. The observer programme of SPC covered 38 trips in 1995 and 17 trips in 1996. Tuna fishing within the Federated States of Micronesia waters is managed by the Micronesian Maritime Authority which operates an observer scheme (Heberer 1994, C.F. Heberer *in litt.*). The Hawaiian domestic 120-vessel longline fishery for bigeye tuna, swordfish and sharks in the central North Pacific Ocean falls outside the geographical scope of both the IATTC and the SPC, and is managed by the U.S. Western Pacific Regional Fisheries Management Council (WPRFMC) (Pacific Seabird Group 1997). An estimated 7 million hooks were set in the first half of 1991, when the fleet was made up of 151 vessels (McDermond & Morgan 1993). An observer programe has operated since 1994.

3.13 SOUTHERN OCEAN PELAGIC LONGLINE FISHERIES

Pelagic longline fishing in the southern Atlantic, Indian and Pacific Oceans (here defined as the Southern Ocean) has been undertaken primarily for Southern bluefin tuna since 1955 with subsequent large fluctuations in the size of the fishery and its geographical scope (Polachek & Tuck 1995, Tuck & Polacheck 1997). Other species of tuna and swordfish may also be caught. Fishing takes place in international waters and in the EEZs of South Africa, Australia and New Zealand. Within EEZs fisheries may be domestic, joint-venture or foreign, with a trend towards a reduction of licensed foreign vessels and an increase in domestic fishing. Major countries involved are Australia, Indonesia, Japan, the Republic of Korea, New Zealand and Taiwan Province of China (Bergin & Haward 1994).

The Commission for the Conservation of Southern Bluefin Tuna (CCSBT), established in 1994, sets quotas and collects information through an observer programme, both on the high seas and within national EEZs (Bergin & Haward 1994, CCSBT 1996). Members of the CCSBT are Australia, New Zealand and Japan, so the fishing efforts of the Republic of Korea and Taiwan Province of China in the Southern Ocean are not regulated by this commission (Hayes 1997). Prior to 1994 the three member countries acted cooperatively in the management of Southern bluefin tuna under trilateral agreements. The CCSBT has established an Ecologically Related Species Working Group (CCSBT-ERS) which considers seabird mortality. It first met in late 1995.

A Real Time Monitoring Programme (RTMP) for the Southern Bluefin Tuna fishery was established in 1991, which includes observations of incidental catch of birds by both Australia and Japan (Tuck *et al.* 1997, Uozumi *et al.* 1997). The observers record detailed information such as description of mitigation devices, weather condition and number of birds around the vessel during line setting, and seabirds caught are sampled for identification of species.

Because most seabirds killed by the Southern bluefin tuna fishery breed with the area covered by CCAMLR (although they are caught north of it), close links between the two Commissions are being fostered, including at the level of the CCAMLR-IMALF and the CCSBT-ERS. The recent development of the longline fishery for Patagonian toothfish within CCAMLR (see relevant section above) has increased the need for such collaboration, because there is a large overlap in the seabird species taken as incidental catch by the two fisheries

4. INCIDENTAL CATCH OF SEABIRDS BY LONGLINE FISHERIES

4.1 NORTHEASTERN ATLANTIC OCEAN AND MEDITERRANEAN SEA DEMERSAL LONGLINE FISHERIES

Studies of the relationships between seabirds and fisheries in the northeastern Atlantic Ocean have concentrated on the utilization of discards from trawl fisheries and incidental takes in nets (Camphuysen *et al.* 1995, Bakken & Falk 1998), and little is known about seabird incidental catch from longline fisheries, with practically no quantitative information available. Lack of regulations, mitigatory measures or observer programmes specifically related to seabird mortality are noticeable features of longline fisheries in this region, with few exceptions. The following information has been gathered to date, much of it of a preliminary nature from personal contacts.

The longline fisheries of Norway, Iceland and the Faeroes in the North and Norwegian Seas take mainly fulmars as well as gannets, Great Skuas *Catharacta skua* and Glaucous, Great Black-backed, Lesser Black-backed and Herring Gulls *Larus hyperboreus*, *L. marinus*, *L. fuscus* and *L. argentatus* (Follestad & Strann 1991, Follestad & Runde 1995, Løkkeborg 1997, Bakken & Falk 1998). Information from the Faeroes and Iceland is non-quantitative and largely based on the recovery of small numbers of banded birds, although it is considered large numbers of fulmars are taken by both nations' longline fleets (Bakken & Falk 1998, A. Petersen *in litt.*, B. Olsen pers. comm. to E. Dunn).

The only quantitative information, and that limited, comes from the Norwegian longline fishery. Longliners losing 70% of their bait to birds during setting has been reported (Løkkeborg 1997). Experimental longlines set without mitigation measures in May 1996 caught 99 birds, the great majority (95%) fulmars, at a rate of 1.75 birds/1000 hooks set (Løkkeborg 1997, see also Løkkeborg & Bjordal 1992). Use of a bird-scaring line reduced mortality to 0.04 birds/1000 hooks (two birds killed). Underwater-setting through a funnel gave a mortality rate of 0.49 birds/ 1000 hooks (28 birds killed) (Løkkeborg 1997). One vessel with an observer aboard caught a reported 10 fulmars in October 1997, during the boreal autumn, giving a far lower take of 0.02 birds/1000 hooks set. No other seabird species was taken on this fishing trip. Take in summer is thought to be several times higher than in winter (Løkkeborg 1997, C. Steel *in litt.*). The whole Norwegian fishing fleet (813 vessels, of which 61 autoliners set *c.* 476 million hooks in 1996) may thus kill a large number of fulmars a year, to which would need to be added the takes of the Faeroese (240 vessels in 1997) and Icelandic (805 vessels setting 230 million hooks in 1996) longline fleets (A. Petersen *in litt.*, B. Olsen pers. comm. to E. Dunn).

Divers or loons *Gavia* spp. have been reported as being entangled in small numbers in fishing gear, including longlines, in the past in the Baltic Sea (Bakken & Falk 1998, M. Hario *in litt.*).

The Spanish longline fishery for hake catches few birds, according to Perez *et al.* (nd) who reported only two fulmars and one Manx Shearwater *Puffinus puffinus* taken during 1994. Whereas these numbers are most likely to be under-representations (E. Dunn *in litt.*) they certainly reflect the paucity of fulmars in waters south-west and south of the United

Kingdom where the Spanish fishery concentrates, when compared to farther north (Stone *et al.* 1995, M.L. Tasker *in litt.*).

Little information on seabird bycatch is currently available for the artisanal/inshore fisheries of France, Spain and Portugal in the Northeast Atlantic and Mediterranean Oceans. North Atlantic Gannets have been caught by longliners in Portuguese waters (A. Texeira in Dunn 1994). A few birds are known to be taken around the Azores: during the four years 1993-1997 150 sets (*c.* 500 000 hooks) by a research vessel caught a presumed Cory's Shearwater *Calonectris diomedea* and three gulls *Larus* sp. (G. Menezes pers. comm. to L. Monteiro).

4.2 NORTHWESTERN ATLANTIC OCEAN DEMERSAL LONGLINE FISHERIES

Very little information is available. A Canadian observer scheme with a low level of coverage (<5% of trips) in operation from 1988 until the moratorium in 1992 did not regularly record, or identify to species seabirds caught (M. Showell *in litt.* to S. Løkkeborg). Although therefore an under-representation, the *c.* 100 records made might suggest that mortality rates were low. The 1997 Newfoundland fishery is not close to seabird breeding colonies (Bakken & Falk 1998). No information on seabird mortality is currently available for the Greenland longline fishery.

4.3 NORTHEASTERN PACIFIC OCEAN DEMERSAL LONGLINE FISHERIES

No information is to hand on any seabirds killed by longline fisheries off the coasts of California, Oregon or Washington. Apparently, few birds are killed by the British Columbian longline fisheries: two records of Black-footed Albatrosses *Phoebastria nigripes*, one banded, are known (A.E. Burger *in litt.*, J. Kaiser *in litt.*) The Canadian Wildlife Service intends studying longlining mortality of seabirds off British Columbia (K.H. Morgan *in litt.*).

The longline fisheries for groundfish (excluding the separately managed Pacific Halibut fishery) in the Gulf of Alaska and Bering Sea are known to kill large numbers of birds, and relative to nearly all other demersal longline fisheries, incidental mortality has been well studied. Between 1989 and 1993 Bakken & Falk (1998) estimated annual mortality as 8670 birds (7250 in the Bering Sea, 1420 in the Gulf of Alaska). Interest existed due to the very large numbers of seabirds, especially albatrosses and shearwaters, which were killed by high-seas drift nets in the north Pacific in the 1980s and until the 1992 moratorium (e.g. Johnson *et al.* 1993). The IUCN vulnerable status (Croxall & Gales in press) of the rare Short-tailed Albatross *Phoebastria albatrus* (Sherburne 1993) also was significant in arousing interest and action (T. Smith *in litt.*).

Data on incidental mortality of seabirds are collected by observers and maintained by the National Marine Fisheries Service and the U.S. Fish & Wildlife Service (Bakken & Falk 1998). Observed numbers of seabirds killed are now available from 1989 to 1996 (National Marine Fisheries Service 1995, 1997a,b, R. Stehn *in litt.* to K. Wohl). Numbers of observed mortalities varied from six (in 1989, when there were only 78 days of observations) to an estimated 10 000 in 1991 (4721 days' observation). More birds were observed killed in the Bering Sea/Aleutian Islands region than in the Bering Sea (Table 7). In 1993-1996 an average of 2876 birds was observed killed annually at an overall rate of 0.08 birds/1000 hooks set (Bering Sea 0.09 birds/1000 hooks and Gulf of Alaska 0.06/1000 hooks) (R. Stehn *in litt.* to K. Wohl). The form of the information obtained to date does not allow an analysis of changes in this rate over the time period of observations.

Table 7. Estimated average annual bycatch of seabirds in the monitored Northeast Pacific longline fishery, 1993-1996

	REGION		
	Bering sea	Gulf of Alaska	Combined
Catch (tonnes) in observed sets	26.738	3.867	30.603
Total catch (tonnes)	110.633	33.184	143.817
Ratio of catch observed	0,2417	0,1165	0,2128
Rising factor	4,1479	8,5814	4,6994
Observed hooks (in 1000)	29.957	4.315	34.272
Estimated total hook effort	123.959	37.028	160.987
Average observed birds caught	2.620	256	2.876
Birds caught/1000 hooks	0,087	0,059	0,084
Birds caught/tonnes	0,098	0,066	0,093
Estimated annual bycatch of seabirds:			
Northern Fulmar	7.337	1.113	8.450
Gull species	2.381	111	2.492
Shearwaters	530	74	604
Laysan Albatross	527	411	938
Black-footed Albatross	45	493	538
Short-tailed Albatross	1	0	1
Other Species	19	0	19
Total seabird caught	10.840	2.202	13.042

Based on the sizes of the groundfish fisheries, R. Stehn (*in litt.* to K. Wohl) has estimated the numbers of seabirds killed annually over the period 1993-1996 as 13 042, higher than the annual estimate of 8670 birds over the overlapping period 1989-1993 (Wohl *et al.* 1995, National Marine Fisheries Service 1997a). The Northern Fulmar was the species most commonly taken during 1993-1996, followed by gulls *Larus* sp. (including Glaucous-winged *L. glaucescens* and Herring Gulls and Blacklegged Kittiwakes; National Marine Fisheries Service 1997c), Laysan Albatrosses *Phoebastria immutabilis* and shearwaters *Puffinus* spp. (Table 7). Species taken in the Bering Sea region only were unidentified guillemots or murres and auklets (Alcidae) in small numbers (National Marine Fisheries Service 1995). In the period 1983 to 1996 five Short-tailed Albatrosses, all banded juveniles of known age, are known to have been taken by North Pacific groundfish longliners, including from the Pacific Halibut fishery (Cochrane & Starfield 1997, Mendenhall & Fadely 1997, National Marine Fisheries Service 1997a,b).

No quantitative information is available on seabird mortality from the important Pacific Halibut fishery of Canada and the USA (Wohl *et al.* 1995, National Marine Fisheries Service 1997b). It is known that birds have been killed, including at least one Short-tailed Albatross in October 1987 (Mendenhall & Fadely 1997, National Marine Fisheries Service 1997a,b), presumably including most of the species killed by the North Pacific groundfish fisheries.

4.4 NORTHWESTERN PACIFIC OCEAN DEMERSAL LONGLINE FISHERIES

No information has yet been found on incidental mortality of seabirds from demersal longline fisheries in the northwestern Pacific Ocean.

4.5 CENTRAL AND SOUTH AMERICAN DEMERSAL LONGLINE FISHERIES

The little information to hand is given by country.

Mexico and Venezuela: no information.

Brazil: A total of 81 seabirds was caught on 19 demersal longline cruises of a research vessel in 1994/95, 160-320 km offshore from 24°-28°S at a rate of almost 0.3 birds/1000 hooks set (Neves & Olmos in press). Of the 49 birds identified, six were Yellow-nosed Albatrosses *Thalassarche chlororhynchos*, one Black-browed Albatross *T. melanophrys*, six White-chinned Petrels *Procellaria aequinoctialis*, two Spectacled Petrels *P. conspicillata* and 34 Great Shearwaters *Puffinus gravis* (Neves & Olmos in press). These are all species commonly observed from demersal longliners in Brazilian waters (Olmos 1997). Studies of incidental mortality of seabirds by this fishery are ongoing (F. Olmos *in litt.*) but no new information is as yet to hand.

The Spectacled Petrel is a recently proposed species with a small population at only one breeding locality and an endangered status (Ryan 1998). More information is critically needed on its current population size to assess the conservation risk from longlining to the species.

Uruguay: Information is currently only available for incidental mortality of albatrosses, although it is assumed that other species of seabirds have also been killed in demersal longline operations. Two fishing trips in 1995 killed a minimum of 83 Black-browed Albatrosses, at a rate of 0.41 birds/1000 hooks set (calculated from Stagi *et al.* in press).

Argentina: Only anecdotal reports of seabird mortality are so far available, but it would appear mortality is high, with fishing captains reporting up to 50 birds a day being killed (Schiavini *et al.* in press). Based on mortality rates in the literature, Schiavini *et al.* (in press) roughly estimated that 3832-13 514 birds were killed in the 18-month period in 1993 to 1995 in the Argentinean demersal fishery on the Patagonian Shelf.

Chile: No information. Spear *et al.* (1995) suggest that visiting populations of Buller's *Thalassarche bulleri*, Chatham *T. eremita* and Salvin's *T. salvini* Albatrosses could be impacted.

Peru, Ecuador and Colombia: No information is as yet to hand, other than Gales (1993) who states "there is a developing longline industry in Peru which apparently has a problem with bird bycatch (species unknown)". The coastal waters of these countries are visited by Waved Albatrosses *Phoebastria irrorata* breeding in the Galapagos Islands but the species does not normally approach and scavenge from fishing vessels and has therefore thought not to be at risk from longlining (Anderson *et al.* in press; but see Merlen (1996) and Pacific Ocean Pelagic Section below).

4.6 SOUTHERN AFRICAN DEMERSAL LONGLINE FISHERIES

Detailed information is only available for the hake longline fishery of the 1990s. However, it is known that the earlier hake and kingklip fisheries of the 1980s did result in the incidental mortality of seabirds, with up to 10 (average one to three) White-chinned Petrels as well as albatrosses being taken per set (Ryan & Rose 1989, Adams 1992).

Barnes *et al.* (1997) reported that the only bird species hooked on hake longlines was the White-chinned Petrel. Small numbers of Pintado or Cape Petrels *Daption capense* and Great Shearwaters were reported killed by collisions with gear during hauling. Using 1994 data from both direct observations and fishing logs the annual mortality for the whole fishery was estimated as 8000$\pm$6400 White-chinned Petrels at a rate of 0.44 birds/1000 hooks set. The partial adoption of recommended mitigation measures (Barnes *et al.* 1997) by the fishery subsequently reduced mortality ten-fold to 0.043 White-chinned Petrels per 1000 hooks set in 1996-97 (Ryan & Boix-Hinzen 1997). An estimated 499 birds were killed by 75 vessels setting 11.7 million hooks. Catch rates were greater during the austral winter, reflecting the greater abundance of White-chinned Petrels in South African waters during that season.

No quantitative information is currently available on incidental mortality of seabirds in the South African shark longline fishery. M. Kreuse (pers. comm. to R.M. Wanless) believes no birds are caught because the lines sink immediately on setting.

Unregulated longlining for hake off a newly independent Namibia resulted in the recovery of *c.* 600 hooks in two years' accumulation of guano at a breeding colony of Cape Gannets *Morus capensis* on Ichaboe Island in May 1991 (Williams 1991, Adams 1992). It was thought that the birds had taken discarded heads which still retained the hooks, which were later regurgitated. It is unknown how much mortality occurred, although it was considered a substantial number of gannets must have died at sea.

4.7 AUSTRALASIAN DEMERSAL LONGLINE FISHERIES

Practically nothing is currently known about seabird mortality from the New Zealand snapper longline fishery, although take of *Procellaria* petrels, including the rare Black Petrel *P. parkinsoni*, is expected off New Zealand, according to L. Robinson (*in litt.*). One "large seabird" was reported captured in 1996/97 by this fishery (Anon. 1997b). However, Alexander *et al.* (1997) listed Northern and Southern Giant Petrels *Macronectes halli* and *M. giganteus*, Great-winged Petrels *Pterodroma macroptera*, Sooty Shearwaters *Puffinus griseus*, Flesh-footed Shearwaters *P. carneipes* and Subantarctic Skuas *Catharacta antarctica* as being caught, although this information has been queried (J. Molloy pers. comm.).

The observer programme for the New Zealand ling fishery reported 37 seabirds caught over the four-year period (Anon. 1997b). This figure is considered to be an underestimate because observers did not watch a 100% of the time (J. Molloy *in litt.*). Preliminary observer data for the 1996/97 fishing year showed that one vessel caught 11 seabirds, including four Critically Endangered Chatham Albatrosses. Black-browed Albatrosses (*sensu lato*) are also known to be taken by this fishery (Alexander *et al.* 1997). Fishers are obliged to report incidental captures of incidental species: in 1996-97 a total of 93 seabirds (42 as albatrosses or large seabirds, 51 as petrels or small seabirds) was reported. No mitigation measures are currently in force, but some ling vessels use bird-scaring lines (Anon. 1997b).

Little information on the Australian demersal longline fisheries is available although Environment Australia (1998) states that seabird incidental catch has been documented.

4.8 SOUTHERN OCEAN DEMERSAL LONGLINE FISHERIES

The first information on seabird mortality from the Patagonian toothfish longline fishery of the Southern Ocean has come from the finding of albatrosses at their birding sites with attached or nearby regurgitated hooks (e.g. Cooper 1995), as well as from recoveries of banded birds captured by longliners. Many of the hooks found at southern albatross breeding sites and recovered bands, (Croxall & Prince 1990) have been from tuna fisheries, but the smaller hooks used for toothfish have also been found in the last few years (Cooper 1995, Ryan *et al.* 1997). Among the first direct observations were those of Dalziell & de Poorter (1993) who observed longline hauling by two Soviet vessels in the vicinity of South Georgia in March 1991. They recorded six dead seabirds on three lines: one Black-browed Albatross, four White-chinned Petrels and one unidentified albatross, and calculated catch rate to be *c.* 0.67 birds/1000 hooks. Based on an estimated 5 229 000 hooks set in 1990/91, Dalziell & de Poorter (1993) suggested that as many as 2301 White-chinned Petrels and 1150 albatrosses had been killed by the Patagonian Toothfish longline fishery.

Catch rates have ranged from 0.22 to 0.67 birds/1000 hooks set. Species caught include albatrosses (mainly Grey-headed *Thalassarche chrysostoma* and Yellow-nosed), giant petrels, White-chinned Petrel, Grey Petrel *Procellaria cinerea*, Pintado Petrel and Subantarctic Skua. A few penguins (Gentoo *Pygoscelis papua* and Macaroni *Eudyptes chrysolophus*) have been reported caught alive, thought to have become entangled during line-hauling (Moreno *et al.* 1996, Ryan *et al.* 1997). The White-chinned Petrel has been the most abundantly taken species in several studies in widely separate regions of the Southern Ocean (Cherel *et al.* 1996, Moreno *et al.* 1996, Williams & Capdeville 1996, Ryan *et al.* 1997). Information exists for a skewed sex ratio, with male Grey-headed and Yellow-nosed Albatrosses and White-chinned Petrels being taken in significantly larger numbers than females around the Prince Edward Islands in the southern Indian Ocean (Ryan & Boix-Hinzen in press). White-chinned Petrels are taken in numbers from night sets (Ashford *et al.* 1995, Ryan *et al.* 1997). Seabird bycatch varied seasonally (higher in the austral summer), with distance from breeding site (highest closest to land) and with time of day (other than White-chinned Petrels fewer caught at night) in one of the most comprehensive analyses undertaken to date (Ryan *et al.* 1997). Importantly, birds taken by the Prince Edward Islands fishery were nearly all adults of breeding age.

A lack of knowledge of the size of the unregulated/illegal fishery, along with no information of the incidental mortality of seabirds it causes makes it difficult to assess the overall effect of the Patagonian toothfish fishery on seabirds. Ryan *et al.* (1997) point out that the unregulated/illegal fishery is unlikely to have adopted mitigation measures, so its catch rates of seabirds may be assumed to be higher than those recorded in the regulated fishery. However, based on indirect knowledge of the size of the unregulated fishery from fish landings, Ryan *et al.* (1997) have estimated that overall bird bycatch in the vicinity of the Prince Edward Islands may have been five to 20 times that reported (923 birds) by observers in the regulated fishery, giving a total bycatch of 5000 to 20 000 birds. It was considered that the unregulated fishery bycatch is at least one order of magnitude higher than that of the regulated fishery in the same areas by the CCAMLR Working Group on Fish Stock Assessment at its 1997 meeting (CCAMLR 1997). Based on information presented to the Working Group it can be roughly estimated that up to 145 000 birds were killed by the total (regulated plus unregulated/illegal) Patagonian toothfish fishery during the 1996/97 season.

Based on evidence to hand (see also Alexander *et al*, 1997, Ryan *et al.* 1997, Croxall & Gales in press, Gales in press) the CCAMLR WG-FSA noted that such levels of incidental catch of birds, representing 1-16% of annual breeding populations of several species of albatrosses, giant petrels and Whitechinned Petrels, were not sustainable and will lead to population decreases, most especially at the sub-Antarctic islands of the southern Indian Ocean (CCAMLR 1997). The affected albatrosses are all regarded as globally threatened or near-threatened (Croxall & Gales in press).

Outside the CCAMLR Area, Falkland Islands/Malvinas and Patagonian Shelf toothfish fisheries kill primarily Black-browed Albatrosses, with fewer Grey-headed Albatrosses, giant petrels, White-chinned Petrels, Pintado Petrels and Sooty Shearwaters (Brothers 1995a, Cielniaszek & Croxall 1997, Schiavini *et al.* in press). In 1996/97 the catch rate around the Falklands was 0.34 birds/1000 hooks for a total reported mortality of 103 birds (Cielniaszek & Croxall 1997).

4.9 ATLANTIC OCEAN AND MEDITERRANEAN SEA PELAGIC LONGLINE FISHERIES

Very little is known about incidental mortality of seabirds currently caused by pelagic longlining in the Atlantic Ocean and Mediterranean Sea. ICCAT has established a Sub-Committee on By-Catch and a Shark Working Group, but apparently does not collect data on mortality of seabirds (A. Penney pers. comm.). An observer programme commenced in 1996.

According to Dunn (1995), Cory's Shearwaters are taken by tuna fisheries in Macaronesian waters (off northwest Africa), but this may not be by longlining (L. Monteiro *in litt.*). Artisanal longlining for tuna out of Sao Tomé and Principé (Gulf of Guinea) has caught Brown Boobies *Sula leucogaster* (R. Corvas pers. comm. to R.M. Wanless).

In the North Atlantic limited information comes from the USA longline fishery (298 vessels setting *c.* 10 million hooks in 1995) for tuna, swordfish and sharks in the western North Atlantic, Caribbean and Gulf of Mexico (National Marine Fisheries Service 1997d). In the six years 1992 to 1997 a total of 38 birds was reported killed with an observer coverage of *c.* 5%, suggesting on average that *c.* 130 birds were killed annually. Species recorded were

Great Black-backed Gull (3), Herring Gull (7), unidentified gulls (8), Great Shearwater (10) unidentified shearwaters (3), Wilson's Storm Petrel *Oceanites oceanicus* (1) and unidentified seabirds (6) (calculated from National Marine Fisheries Service 1997d). In addition, a few Great Shearwaters, North Atlantic Gannets and gulls were caught alive. In apparent contradiction to the above information, Foster (1996) states that according to National Marine Fisheries Service observer data 150-3456 birds were killed in 1992 and 57-706 birds in 1993 by the US North Atlantic longline fishery for swordfish. Further, D. Weidner (*in litt.*) cites data received from John Hoey, U.S. National Fisheries Institute that 2900 observed sets in the U.S. swordfish fishery in the Gulf of Mexico, Caribbean Sea and Atlantic seaboard yielded 40 seabird mortalities, mostly shearwaters along the mid-Atlantic coast of the U.S.A. These three data sets need to be reconciled.

The Venezuelan swordfish fishery within the Caribbean Sea does not seem to catch birds, based on communications with observers, perhaps due to the fact that line-setting takes place at night (Weidner ms a, D. Weidner *in litt.*).

In the South Atlantic information is available for pelagic longlining off South America. Vaske (1991) reported 58 White-chinned Petrels, six Spectacled Petrels, four Wandering Albatrosses *Diomedea exulans*, two Black-browed Albatrosses and one Antarctic Fulmar *Fulmarus glacialoides* (total 71 birds) taken during 52 fishing days off the coast of southern Brazil from 1987 to 1990. He estimated that *c.* 2650 birds may be killed annually by tuna longlining in the region. Daily catch rates were high, ranging from 0.8 to 15 birds/1000 hooks, with most mortality occurring during times of full moon. In a more recent study Neves & Olmos (in press) report 118 birds killed, nearly all in winter, by the Swordfish longlining fishery in Brazilian waters in 1994/95. Birds identified were Wandering Albatross (1), Black-browed Albatross (33, 32 of which were juveniles), Yellow-nosed Albatross (17, 89% juveniles), White-chinned Petrel (6), Spectacled Petrel (6) and one Great Shearwater. Both Black-browed and Yellow-nosed Albatrosses showed a skewed sex ratio, with females predominating. The Spectacled Petrel is considered to be Endangered (Ryan 1998, see South American demersal section above). The relatively low catch rates in this study were attributed to the fact that the swordfish-directed fishing vessels set their longlines at night (see Weidner ms b).

Stagi *et al.* (in press) made observations during nine fishing trips of the Uruguayan tuna and swordfish fishery in 1993-1994, showing that 277 albatrosses were killed at an overall catch rate of 10.5 birds/1000 hooks, or 4.7/1000 hooks, if the first trip when unweighted swivels were used is omitted. Black-browed Albatrosses (265) were the species most commonly caught. Utilizing what is apparently the same data set, Barea *et al.* (1994) reported in addition to the predominating Black-browed Albatrosses, six Wandering Albatrosses, one Yellow-nosed Albatross, one White-chinned/Spectacled Petrel and Great Shearwaters (no numbers given, reported as occasionally caught during line hauling). Of 37 Black-browed Albatrosses, 35 were females.

No quantitative information is available from elsewhere in the South Atlantic Ocean (not counting that for the Southern Ocean, see below). Ryan & Boix-Hinzen (1998) have highlighted the need for an observer programme and mitigatory measures for the licensed Japanese (30) and Taiwanese (90) tuna and swordfish longliners fishing within South Africa's Exclusive Economic Zone in both the Atlantic and Indian Oceans, because interviews with 25

Taiwanese fishing captains revealed that seabird mortalities occur, including of albatrosses, giant petrels, Pintado Petrels and White-chinned Petrels. This fishery will include 30 South African longliners from 1998 when some mitigation measures are expected to be enforced (Penney 1996, Anon. 1998, Ryan & Boix-Hinzen 1998, C.L. Moloney pers. comm.).

The Endangered Tristan Albatross *Diomedea dabbenena* and the Atlantic Yellow-nosed Albatross *Thalassarche chlororhynchos* of the Tristan da Cunha and Gough Islands in the central South Atlantic Ocean are caught by longliners, based on a few band recoveries (Cooper & Fraser 1986, Cooper 1988, 1994, Croxall & Gales in press, unpublished records).

4.10 INDIAN OCEAN PELAGIC LONGLINE FISHERIES

No information has as yet been found on seabird bycatch from longline fisheries in the Indian Ocean, other than by the Southern bluefin tuna fishery (see Southern Ocean pelagic section below). Apparently, the IPTP has never collected information on seabird mortality.

4.11 PACIFIC OCEAN PELAGIC LONGLINE FISHERIES

Studies of bycatch by the IATTC in the eastern Pacific Ocean have been restricted to the problem of cetaceans trapped by purse-seine nets (Peterson & Bayliff 1985) and bycatch of birds has not been studied by the Commission (M.A. Hall *in litt.*). However, some species of albatrosses may be at risk from pelagic longlining off the Pacific coasts of South America and around the Galapagos (Spear *et al.* 1995, see also South American demersal section above). A newly commenced artisanal fishery for dorado or dolphin *Coryphaena hippurus* in Peruvian waters has reportedly taken Waved Albatross and Blue-footed Booby *Sula nebouxii* (J. Jahncke *in litt*). A banded juvenile Chatham Albatross was taken by a swordfish longliner off the coast of Chile in 1995 (Gales in press).

Based on observer data, Bailey *et al.* (1996) reports no seabird mortality from the longline fishery for tuna in the tropical western Pacific Ocean. Garnett (1984) found no records of incidental mortality from commercial tuna longlining in the South Pacific, defined as between 160°E and 125°W. Information from the temperate western Pacific Ocean off Australia and New Zealand is discussed below in the Southern Ocean region. Heberer (1994) reports only one bird caught out of 700 000 observed hooks on 51 fishing trips in the Federated States of Micronesia tuna fishery in the tropical Pacific Ocean during the period 1993-1994.

In the central North Pacific Ocean, Laysan, Black-footed and Short-tailed Albatrosses have been at risk from longlining since at least the early 1960s, when hundreds of banded birds of both species were being caught on Japanese and Soviet Union tuna longlines and in nets (Fisher & Fisher 1972, Robbins & Rice 1974, King *et al.* 1979, see also the account above on demersal longline fisheries in the North Pacific). More recently, several articles have highlighted this continuing mortality (Nitta & Henderson 1993, Anon 1996b, Kalmer *et al.* 1996, Pacific Seabird Group 1997, Paul 1997, Skillman & Flint 1997). Information from National Marine Fisheries Service observers on Hawaiian pelagic longliners (4% observer coverage) recorded catch rates of 0.113 Laysan Albatrosses/1000 hooks and 0.152 birds/1000 hooks for Black-footed Albatrosses, leading to estimates of total take of 1020 ± 639 for 1994 and 1942 ± 2435 in 1995 for the Laysan Albatross and 2135 ± 970 and 1796 ± 1498 for the

Black-footed Albatross for the same years (Skillman & Flint 1997). Estimated total takes for 1996 for the same fishery are 625 Laysan Albatrosses (0.276 birds/1000 hooks) and 1189 Blackfooted Albatrosses (0.083 birds/1000 hooks), based on an observer coverage of *c.* 5%. For the first nine months of 1997 estimated takes were 1628 and 2908 for the two species, respectively, showing an increase over the previous year (E.N. Flint *in litt.*). The Western Pacific Regional Fisheries Management Council will hold a workshop in October 1998 to evaluate the effects of the Hawaiian pelagic longline fishery on the population status of the Black-footed Albatross, the rarer of the two species affected (E.N. Flint & K.M. Simmonds *in litt.*). This species has been accorded the IUCN conservation status of Vulnerable, based on observed rates of decline (Croxall & Gales in press).

Little information has been obtained on the incidental mortality of seabird species other than albatrosses in the domestic Hawaiian longline fishery. In four years of the mandatory observation programme only two unidentified shearwaters were reported, from south of Hawaii (E.N. Flint *in litt.*).

4.12 SOUTHERN OCEAN PELAGIC LONGLINE FISHERIES

Information on seabird mortality caused by the Southern Bluefin Tuna fishery currently comes from three main sources: domestic observer programmes of Australia and New Zealand and from that on the high seas administered by the CCSBT. There is currently no observer programme for the fishery within the South African EEZ (Anon. 1998, Ryan & Boix-Hinzen 1998, J. Augustyn pers. comm.). Information is also available from band recoveries, including from prior to observer programmes (e.g. Robertson & Kinsky 1972, Croxall & Prince 1990, Battam & Smith 1993, Gales & Brothers 1995).

The first quantitative information on seabird mortality (which was seminal in raising concern generally) is that of Brothers (1991) who estimated that Japanese longlining activities in the Southern Ocean south of 30°S (107.9 million hooks a year) caused the death annually of up to 44 000 albatrosses in the 1980s, calculated from an observed average catch rate of 0.41 birds/1000 hooks within the 200-nautical mile Australian Fishing Zone (AFZ) off Tasmania in 1988. The Blackbrowed Albatross was the species most abundantly taken. Other species observed caught on longlines were Wandering Albatross (*sensu lato*), Grey-headed Albatross, Shy Albatross *Thalassarche cauta* (*sensu lato*) Light-mantled Albatross *Phoebetria palpebrata* and Southern Giant Petrel. Juvenile albatrosses predominated.

Brothers & Foster (1997) give limited data for the Australian domestic fishery within the AFZ for 1994/95. Mean catch rate was 0.92 birds/1000 hooks. The Shy Albatross (n = 7) was the species most commonly taken of 11 birds identified. Other species were Greatwinged Petrel and the Short-tailed Shearwater *Puffinus tenuirostris*. Information for domestic vessels in the AFZ is also given by Whitelaw (1995, 1997). Only three petrels were killed in 1994-1996 out of 74 753 hooks observed. Reid & James (in press) record Chatham Albatrosses interacting with longliners off Tasmania.

Information from Japanese vessels fishing within the AFZ is given by Klaer & Polacheck (1995, 1997a,b). The total estimated catch of seabirds was 1217 for 1991, 2981 for 1992, 3590 for 1993 and 2817 for 1994. Estimates for 1995 are 1085 birds and for 1996, 1503. For these three years 1992-1994, 78% (n = 513) were albatrosses, primarily Black-browed and Shy, but also Wandering, Royal *Diomedea epomophora* (*sensu lato*), Grey-headed, Yellow-nosed, Light-mantled Sooty and Sooty *Phoebetria fusca* Albatrosses. Other species identified were Southern and Northern Giant Petrels, White-chinned Petrel, Grey Petrel *Procellaria cinerea*, Fleshfooted and Sooty Shearwaters *Puffinus griseus* and Subantarctic Skua. Species identification was not available for 1995 and 1996. Catch rates varied from 0.10 birds to 0.24 birds/1000 hooks. Summer catch rates were generally higher than in winter. The above totals and catch rates do not include hooked birds lost during hauling, thought to be as much as 27% (Brothers 1991). Information for this fishery based in recovered corpses, including of banded birds, is also given by Gales & Brothers (1995) and Gales *et al*. (1998). Black-browed Albatrosses formed a quarter of the 571 corpses identified in their 1995 study.

Early information for New Zealand waters is given by Bartle (1990) who reported Grey Petrels (16; of which 15 were females), Campbell Albatrosses *Thalassarche impavida* (8) and one Antipodean Albatross *Diomedea antipodensis* taken by tuna longliners in June 1989. Parrish (1991) reports a tuna-hooked Buller's Albatross *T. bulleri* (*sensu lato*) found on a New Zealand beach in July 1991. Quantitative information from New Zealand waters is given by Murray *et al.* (1993) for the period 1988-1992 and by Imber (1994a,b) from two separate cruises. Estimated mortality decreased from 3652 birds in 1988 to 360 in 1992 (Murray *et al.* 1993). Fourteen species of albatrosses and petrels were identified from 135 birds collected, of which 50 were petrels, nearly all Grey Petrels, and 85 albatrosses (including endemic species). Capture rates varied from 0.04 to 1.90 birds/1000 hooks geographically and decreased over the time period. More recent data for New Zealand waters are given by Anon. (1997b), covering the period 1987 to 1995 for 24 species. A total of 783 birds was observed caught by licensed foreign, chartered (both categories Japanese) and domestic vessels. The most commonly caught of 18 species identified (n = 413) were White-capped *Thalassarche steadi* (22%) and Buller's (11%) Albatrosses, both New Zealand endemics, and Grey Petrels (31%) (Table 8). In the 1996/97 year, 280 birds were observed captured, including for the first time one individual of the rare Chatham Albatross, whose IUCN conservation status is Critically Endangered (Croxall & Gales in press). This species was also taken by demersal longliners in the same year (see Australasian Demersal section above). The rare endemic and Vulnerable Westland and Black Petrels *Procellaria westlandica* and *P. parkinsoni* were also reported caught, although in small numbers (Table 8).

Catch rates over the period 1987 to 1995 varied from 0.02 to 1.37 birds/1000 hooks (Anon 1997b), and also varied geographically and with phase of the moon for night sets (see also Duckworth 1995). Bartle (1995), utilizing observer data from the New Zealand tuna fishery from 1987 to 1994, estimated that the licensed Japanese fleet killed 11 700 birds, of which 7500 were albatrosses. He also estimated that 20 000 Grey Petrels had been killed by this fishery since 1973, mainly (89%) breeding females. However, Baird (1996) using the observer data from 1987 to 1995 estimated that only 9036 seabirds had been caught by Japanese tuna longliners in New Zealand waters, with a decrease from 3979 in 1989 to 167 in 1995, due both to a decrease in effort and in catch rate.

Table 8. Numbers of seabirds landed dead and returned for identification by the combined tuna fleet in New Zealand waters, 1988-1996.

Species	No seabirds returned for identification						
	Japanese vessels		Chartered Japanese		NZ vessels		% Total
	N	S	N	S	N	S	
New Zealand White-capped albatross (*Thalassarche Steadi*)	1	5		83			22
Southern Buller's albatross (*Thalassarche bulleri*)		17		25		3	11
Campbell albatross (*Thalassarche impavida*)	16	6	7	6			8
Auckland Island wandering albatross (*Diomedea gibsoni*)	10		8	4			5
Southern black-browed albatross (*Thalassarche melanophrys*)	11				2		4
Wandering albatross (*Diomedea exulans* ssp)	3	2		7			3
Antipodes Islands wandering albatross (*Diomedea antipodensis*)	7			1			2
Southern royal albatross (*Diomedea epomophora*)		3		5			2
Grey-headed albatross (*Thalassarche chrysostoma*)	1	5					2
Salvin's albatross (*Thalassarche salvini*)	3						1
Light-mantled sooty albatross (*Phoebetria palpebrata*)				3			1
Grey petrel (*Procellaria cinerea*)	118	1	3	1	4		31
White-chinned petrel (*Procellaria aequinoctialis*)		2		31			8
Sooty Shearwater (*Puffinus griseus*)				3			1
Southern giant petrel (*Macronectes giganteus*)	2						<1
Black petrel (*Procellaria parkinsoni*)					2		<1
Northern giant petrel (*Macronectes halli*)				1			<1
Westland petrel *Procellaria westlandica*)		1					<1
Total of all species	172	42	18	170	8	3	100

N = North S = South

No quantitative information is available for fishing for Southern bluefin tuna in the South African EEZ although bird mortality does occur (Ryan & Boix-Hinzen 1998, see Atlantic Ocean pelagic section above). RTMP data collected by Australian observers on the high seas for 1995 recorded 208 albatrosses and 37 petrels by eight vessels, with catch rates of 0.01 to 1.52 birds/1000 hooks (Tuck *et al.* 1997). No species identifications were made. Equivalent Japanese data (but representing only 2-3% of fishing effort) for two of the main fishing regions west of Australia and south of Africa are of 1568 birds of 17 species (nine albatross species) caught from 1992 to 1996 (Uozumi *et al.* 1997, see also Takeuchi *et al.* 1997). Together, Black-browed, Grey-headed and Shy Albatrosses (*sensu lato*) and White-chinned Petrels formed 77%. Catch rates were in the range <0.1 to 0.4 birds/1000 hooks. Ryan & Boix-Hinzen (1998), utilizing Japanese RTMP data, have roughly calculated that 20 000 birds may be killed annually off Africa on the high seas.

For the Southern bluefin tuna longline fishery as a whole, it is thought (e.g. Murray *et al.* 1993, Polacheck & Tuck 1995) that the introduction of various mitigation measures such as night setting and the use of streamer lines (not here discussed in detail, but see Klaer & Polacheck 1997c) has led to a reduction in catch rate from that first reported by Brothers (1991). However, in order to make an estimate of the annual bycatch for the fishery as a whole more information is needed from observer programmes, including for the currently large Taiwanese fishing fleet (Tuck & Polacheck 1997, Ryan & Boix-Hinzen 1998).

Observer programmes do not record all birds killed, so species rarely caught may be overlooked. This is of significance when the species itself is very rare. For example, the

Amsterdam Albatross *D. amsterdamensis*, with an estimated population of less than 100 birds, has been taken by a longliner at least once, in 1992 (Gales 1993, Weimerskirch *et al.* 1997, Gales in press). This single-island endemic species has been accorded the IUCN conservation status of Critically Endangered (Croxall & Gales in press).

4.13 SEABIRDS AT RISK FROM LONGLINING

Based on the current review a total of 61 species of seabirds has been recorded as killed by longline operations on at least one occasion (Table 9). For some species the level of incidental mortality so caused is considered not to be sustainable, and their populations are in decline. Partially as a consequence, 25 (39%) of the 62 affected seabird species have been accorded a threatened status by the World Conservation Union as either Critically Endangered, Endangered or Vulnerable, most importantly the albatrosses (Table 9).

Regionally, incidental mortality of seabirds is most severe, with catch rates exceptionally approaching or even exceeding 10 birds/1000 hooks set, at high latitudes in the cold fish- and bird-rich waters off the North and South Atlantic, North Pacific and Southern Oceans. Very little mortality seems to occur in the tropical Atlantic, Indian and Pacific Oceans but data are mostly lacking. An exception is the mortality of Laysan and Blackfooted Albatrosses in the Pacific Ocean in the vicinity of Hawaii from longline fishing for tuna and broadbill swordfish.

Species of special concern include the Endangered (World Conservation Union criteria) Spectacled Petrel, which is taken in numbers off the Atlantic coast of South America and is a single-island endemic with a small population. Other rare and threatened species known to be taken by longliners are the Vulnerable Short-tailed Albatross of the North Pacific and the Critically Endangered Amsterdam, Endangered Tristan and Northern Royal and Critically Endangered Chatham Albatrosses of the Southern Ocean. The situation with the Vulnerable Waved Albatross of the Pacific Ocean requires investigation.

Other species of serious concern are the remaining albatrosses Diomedeidae, the Southern and Northern Giant Petrels. and the Whitechinned and Grey Petrels of the Southern Ocean, which are taken in their hundreds or thousands by the large longline fisheries for Southern bluefin tuna and Patagonian toothfish.

Although the Northern Fulmar may be taken in large numbers its very large population which numbers in the millions suggests it is not a conservation risk, although more information is required.

It is clear that very little is known about the incidental mortality of seabirds in most of the world's longline fisheries. Quantitative data amenable to statistical analysis are available from only a handful of fisheries, and for many if not most longline fisheries even anecdotal information appears lacking.

Table 9. Conservation status of seabirds caught on longlines (CE=Critically Endangered, E=Endangered, V=Vulnerable, NT=Near Threatened, LR=Low Risk and DD=Data Deficient)

Species	IUCN status
Macaroni Penguin *Eudyptes chrysolophus*	V
Gentoo Penguin *Pygoscelis papua*	
Divers *Gavia* sp.	
Wandering Albatross *Diomedea exulans*	V
Tristan Albatross D. dabbenena	E
Antipodean Albatross *D. antipodensis*	V
Gibson's Albatross *D. gibsoni*	V
Southern Royal Albatross *D. epomophora*	V
Northern Royal Albatross *D. sanfordi*	E
Amsterdam Albatross *D. amsterdamensis*	CE
Short-tailed Albatross *Phoebastria albatrus*	V
Waved Albatross *P. irrorata*	V
Laysan Albatross *P. immutabilis*	LR
Black-footed Albatross *P. nigripes*	V
Black-browed Albatross *Thalassarche melanophrys*	LR
Campbell Albatross *T. impavida*	V
Buller's Albatross *T. bulleri*	V
Pacific Albatross *T.* nov. sp.	V
Shy Albatross *T. cauta*	V
Chatham Albatross *T. eremita*	CE
Atlantic Yellow-nosed Albatross *T. chlororhynchos*	DD
Indian Yellow-nosed Albatross *T. carteri*	V
Grey-headed Albatross *T. chrysostoma*	V
Sooty Albatross *Phoebetria fusca*	V
Light-mantled Sooty Albatross *P. palpebrata*	DD
Southern Giant Petrel *Macronectes giganteus*	
Northern Giant Petrel *M. halli*	NT
Northern Fulmar *Fulmarus glacialis*	
Antarctic Fulmar *F. glacialoides*	
Cape/Pintado Petrel *Daption capense*	
Great-winged Petrel *Pterodroma macroptera*	
Grey Petrel *P. cinerea*	
White-chinned Petrel *P. aequinoctialis*	
Spectacled Petrel *P. conspicillata*	E
Black Petrel *P. parkinsoni*	V
Westland Petrel *P. westlandica*	V
Cory's Shearwater *Calonectris diomedea*	
Flesh-footed Shearwater *Puffinus carneipes*	
Great Shearwater *P. gravis*	
Sooty Shearwater *P. griseus*	
Short-tailed Shearwater *P. tenuirostris*	
Manx Shearwater *P. puffinus*	
Wilson's Storm Petrel *Oceanites oceanicus*	
Cormorants *Phalacrocorax* sp.	
North Atlantic Gannet *Morus capensis*	
Cape Gannet *M. capensis*	NT
Blue-footed Booby *Sula nebouxii*	
Brown Booby *S. leucogaster*	
Great Skua *Catharacta skua*	
Subantarctic Skua *C. antarctica*	
Herring Gull *Larus argentatus*	
Lesser Black-backed Gull *L. fuscus*	
Great Black-backed Gull *L. marinus*	
Glaucous-winged Gull *L. glaucescens*	
Glaucous Gull *L. hyperboreus*	
Black-legged Kittiwake *Rissa tridactyla*	
Common Guillemot/Murre *Uria aalge*	
Brunnich's Guillemot/Thick-billed Murre *U. lomvia*	
Atlantic Puffin *Fratercula arctica*	

5. TECHNICAL GUIDELINES TO REDUCE SEABIRD INCIDENTAL CATCH BY LONGLINE FISHERIES

5.1 INTRODUCTION

This section is a comprehensive review of seabird mitigation measures in place, being tested or recommended for reducing the incidental catch of seabirds by longline fisheries. Previous reviews have been undertaken by Alexander *et al.* (1997) who summarized the contribution of participants at a workshop on the subject and by Bergin (1997). Published and unpublished information, and contributions solicited from various experts have been taken into account.

Why seabirds are killed and what measures can be used to prevent this in longline fisheries has been under investigation for the past 10 years. A variety of mitigation measure options was identified at the outset of these investigations (e.g. Brothers 1991). Development of appropriate mitigation measures, effective because fishers do not need to be forced to adopt them are essential. It is also necessary to examine the potential mitigation measures which benefit birds only and which as a consequence may be less readily adopted by fishers. Such measures may have a short-term role of mitigation while other options more favourable to industry are pursued.

Regardless of the measure, the necessity for bird catch reduction is essential. Killing seabirds whatever the consequences to particular species, is undesirable and fortunately this view is shared by some fishers. However, in reality the only serious effort by fishers so far to address the problem has been precipitated by actions external to their industry. But ignorance of the extent of the problem, and not knowing what to do about it is arguably justification for past inactions and recent slow progress. The role of education in relation to mitigation measures and an understanding of seabird bycatch can therefore be an important component of solving the problem.

Development of mitigation measures and their use by fishers has been constantly changing. Highly effective measures already exist but fishers either do not know about them, find them unsuitable for a variety of reasons, or simply cannot be bothered with them. Concepts of methods more convenient for fishers do exist but these seem to be more complex, expensive and slow to develop. Even more effective methods may be discovered in the future. Therefore, the current confusion about what measure, or suite of measures to use, how to apply them, and when to apply them may be ongoing until more satisfactory methods have taken their place. Understanding this dilemma necessitates flexibility, particularly in relation to regulations about mitigation measures.

A mutually beneficial solution to the seabird problem is clearly achievable but will require an ongoing co-operative commitment to mitigation measure development and the widespread use of these measures. There are however, divided opinions on the most effective course to overcome incidental mortality of seabirds during longline fishing operations. The options are to work with fishing industries to develop solutions or to use political pressure and legislation with or without these solutions. To be realistic, whatever the process it will most likely necessitate development of measures that are economically or operationally advantageous to fishers.

Perhaps there are simply too many unforeseen circumstances in longline fishing that will always compromise the effectiveness of mitigation measures, such as line tangles, main line jams during setting, not enough bait thawed for a set so frozen bait is used, setting lines during daylight to avoid losing a fishing opportunity to approaching bad weather, or a whole hook box lost overboard leaving up to 100 baited hooks exposed on the sea surface. To take account of the unexpected does narrow down options that will be effective. The time is fast approaching when all currently feasible options of mitigation measure development will have been exhausted. If in the end these are unsuccessful because fishers have failed to use them, will the next option in mitigation development be a consideration of fishing practices other than longlining to catch fish such as tuna?

Lastly, not every longline fishery requires the adoption of mitigation measures because incidental catch of seabirds does not universally occur (see section 4 above).

5.2 WHAT IS A MITIGATION MEASURE?

A mitigation measure, in this instance can best be described as a modification to fishing practices and/or equipment that reduces the likelihood of seabird incidental catch. This description includes all the strategies that can be employed for the purpose of reducing seabird mortality, ranging from fishing area or season closures to subtle adjustments in fishing equipment. Modifications, new fishing practices and equipment are more acceptable to fishers than are fishing area or season closures and therefore here lies the greatest potential for solution. Such measures are the focus here. Education focused on describing the issue of seabird incidental catch to fishers, including economic as well as biological and social impacts and suggested mitigation measures, can also be a powerful tool for institutionalizing mitigation measures in longline fisheries.

Measures of this type fall into two categories, those that exist and are currently in use and those that are only concepts requiring investigation and development. The aim of both is to alter the circumstances that lead to birds being killed. This is achieved by the following processes: preventing baited hooks being visible to birds; preventing access to baited hooks; reducing the potential of hooks to kill birds that take them; and decreasing the incentive for birds to follow longline vessels. How the measures or combinations of these measures function are described separately for each.

5.3 HOW BIRDS GET CAUGHT ON LONGLINES

Understanding the circumstances that lead to the death of birds in longline fisheries is essential in the process of determining how mortality can be prevented. Describing these circumstances will provide a clearer understanding of how and when a mitigation measure can reduce mortality. Summarized here, these circumstances are also noted in each mitigation measure description.

Perhaps the biggest influence on this aspect of the problem and therefore on solution options is the actual type of longline fishing concerned. Of most relevance is the variation in equipment type and usage between longlines that are designed to set and catch fish in the mid-water (pelagic longlining), and those set for catching fish on the ocean floor (demersal longlining). It is essential to maintain the distinction between demersal and pelagic longlining in terms of mitigation measures. This is because measures appropriate for one are sometimes inappropriate or less effective for the other. But because the basic reasons for bird problems are the same in all longline fisheries, many preventative measures will be universally appropriate. It is important to remember this so as to avoid time wasted re-inventing methods or re-assessing catch rate response. In general the most effective of the measures do universally apply (Table 10).

Longline methods other than those with the general titles of pelagic or demersal, such as droplines, have different bird problems unrelated to the issues discussed in this report, and they have therefore not been dealt with here.

The most common cause of incidental mortality is that birds take baited hooks during the process of putting hooks in the water (line setting) and drown. Birds have access to baited hooks because of how hooks are set or their descent rate in the water. In a similar way birds are also caught during the process of getting the hooks out of the water (line hauling) but are less often killed. Despite the fact that many seabirds caught during the line hauling stage may be released alive, the goal is still to prevent their capture.

Further bird mortalities occur from hooks remaining in released birds or hooks being ingested in discarded offal and fish bycatch. Also, in certain circumstances birds become entangled in line sections or are impaled on hooks incidentally. Apart from these accidental deaths, deliberate killing to stop birds taking bait or to use them for food also occurs. Shooting is a method commonly employed in these instances.

5.4 THE EFFECTIVENESS OF MITIGATION MEASURES

Although this subject is dealt with in more detail for each mitigation measure separately below it is both a complicated and vital aspect for consideration. Firstly, there are the ways in which each separate measure could be effective singly and in combination. Unravelling the complexities can only be achieved by having a clear definition of the goal. Is it simply to reduce the numbers of birds that are killed irrespective of other consequences? Is it to do this but at no expense to the fishers? Or is there some room for compromise? Perhaps there is even a way that is in all respects effective - financially, environmentally and operationally.

The next complication is to demonstrate or quantify the degree of effectiveness and this depends on what the goal really is. The goal may be set to an appropriately quantified bird catch rate against which to measure performance. Alternatively, having an objective of zero birds caught, provided this is actually achievable, can simplify the whole process considerably. Quantifying effectiveness is impossible if there is any uncertainty about measures being used consistently or correctly. One way of defining an effective measure may be to describe it as one that will be used regardless of compliance considerations.

In addition to the above difficulties it is also necessary to consider the results of work that have attempted to define the effectiveness of mitigation measures. Any such study must

Table 10 Summary table of mitigation measures

	Type of Measure	Fishery suitability		Stage of development	Compliance monitoring needs	Relative cost initital or ongoing	Safety factor for crew	Negative impact on		Seabird catch reduction efficiency
		Demersal	Pelagic					Target catch	Non-bird by catch	
A1a	Weighting the longline gear	good	moderate	partly developed	Low	high initial, low ongoing	caution needed	reduction concerns	specific problem potential	very high
A1b	Thawing bait and/or puncturing swim bladder	poor	good	part development and tested	high at present	low ongoing	safe	no	no	moderate potential
A1c	Line-setting machine	moderate	moderate	developed, partly tested	None	moderate initial, low on-going	safe	no	no	moderate potential
A2	Below-the-water setting	moderate	moderate	under development,	None	high initial	safe	no	no	total
A3	Bird scaring line (Streamers lines, buoy lines)	good	moderate	developed, tested, refinement needed	variable, by observation	low ongoing	safe	no	no	high but variable
A4	Bait Casting Machine	none	poor	developed, partly tested	None	high initial	to consider	no	no	moderate potential
A5	Brickle curtain	good	good	developed	variable, by observation	low	safe	no	no	very high
A6	Artificial baits or lures	poor	poor	concept only	None	high initial low ongoing	safe	unknown	unknown	high potentia

	Type of Measure	Fishery suitability		Stage of development	Compliance monitoring needs	Relative cost initial or ongoing	Safety factor for crew	Negative impact on		Seabird catch reduc efficiency
		Demersal	Pelagic					Target catch	Non-bird by catch	
A7	Hook modi-fications	poor	good	at concept stage	None	moderate initial	safe	unknown	unknown	moderate potential
A8	Acoustic deterrent	moderate	poor	limited testing	High	low initial	to consider	no	no	unknown, but very likelihood
A9	Water cannon	moderate	poor	limited testing	High	moderate initial	safe	no	no	unknown but low likelihood
A10	Magnetic deterrent	moderate	poor	limited testing	Low	moderate initial	to consider	no	no	very low likelihoo-
B1	Reduce visibility of bait (e.g. night setting)	good	good	currently in use in some fisheries.	moderate by observation	widely none, locally high initial	safe	reduction concerns	increase potential	very high
B2	Reduce the attractiveness of the vessel (e.g. reduce offal discharge)	good	moderate	developed	None	moderate initial	safe	no	no	very high (line hauling)
B3	Area and seasonal closures	poor	poor	not used	High	unknown	safe	reduction concerns	no	high potential
B4	Preferential licensing for vessels	good	good	concept	Variable	unknown	safe	no	no	high
B5	Release live birds	moderate	moderate	developed	None	no	safe	no	no	moderate potential

be used with the utmost caution because results can be misleading and precipitate highly inaccurate interpretation. Despite having perhaps the most comprehensive data set available anywhere from which to attempt measurement of mitigation effectiveness and the potential influence of other variables on seabird mortality, Brothers *et al.* (submitted ms) had limited success. The limitations of using such techniques for reducing bird incidental catch must be recognised. If not, the danger of being obsessed with the requirement for small coefficients of variation in the measurement of mitigation performance will undoubtedly subject fishers to many years of confusion, governments to many years of expensive monitoring and seabird populations to further unnecessary declines. There is a need to verify or quantify the effectiveness of mitigation measures and whereas statistical verification seems unavoidable there is clearly a strong need for pragmatism.

In all probability those measures requiring extensive evaluation to determine their effectiveness will be the ones to require enforced compliance. And, whereas this is undesirable or perhaps impossible in the long-term, measures of this nature may have a role in the short-term. It is here that accelerating progress of evaluation and adoption can be important. For this, controlling or manipulating the normal routine of fishing may prove highly effective. "Experimental fishing" is perhaps the only means of rapidly and precisely evaluating the contribution of alternatives to fishing equipment or techniques for bird incidental catch reduction, among all other variables.

Results from conventional investigative means that have been used to answer such questions (e.g. Murray *et al* 1993, Klaer & Polacheck 1995, Brothers *et al.* submitted ms) indicate that regardless of being able to manipulate variables more strictly, a large amount of data may still be required to provide meaningful results. And ultimately, even the most favourable results from such processes may do nothing to persuade fishers to adopt the measure. Also, in a process of this sort it is essential to remember the earlier warning about misguiding results. Here the development of bird-scaring lines serves as a good example (see below).

5.5 A BRIEF HISTORY OF MITIGATION MEASURES

Longline fishing has reached a peak in the level of technological sophistication to catch fish and only recently have fishers realized they can no longer afford to disregard the destructive capacity for target fish, let alone bycatch. In the past fishers have been unaware of their effect on seabird populations; nearly 30 years of catching albatrosses and other seabirds elapsed before anyone became aware that this was a potentially serious matter. Fishing technology has continually changed, in pursuit of higher profits, irrespective of bird catch rates and only recently has there been any need or incentive for fishers to consider how to avoid catching birds. There is no doubt that fishers need to understand the importance of not catching birds because if they had enough incentive to prevent bird deaths they would be quite capable of developing fishing practices that did this.

However, fishers were not totally unaware of a bird problem. Prior to 1988 when the problem first became widely known, losing bait to birds and having less bait for fish was something to avoid in order to maximise profits from fishing effort. Fishers had no concept (and many still do not) of bird populations and the consequences of catching a few individuals. After all, each fishing vessel may catch only one or two birds a day, sometimes none for many days and each day the impression is of just as many birds flying around the ship. It is understandable that fishers had no perception of a problem. Further, they have little understanding of the population biology of seabirds and why their practice threatens the survival of albatrosses. Concepts such as delayed maturity, year-long breeding cycles, biennial breeding and long life spans were not known.

The financial incentive of preventing birds taking bait has not always been sufficient for fishers to take action. There have been changes in the past to fishing equipment and its use that have coincidentally reduced bird catch rates. At the same time some changes to fishing equipment have increased bird catch rates. These changes occurred for economic reasons and. bird catch rates were not usually a consideration. It is unclear whether the changes in equipment and techniques have resulted in an overall increase or decrease in seabird mortality. However, anecdotal information from fishers suggests that bird catch rates are lower now than a decade or two ago.

In the past, the less-mechanised operations meant fishers caught fewer fish. With gear and vessel refinement fishing effort capacity increased, distribution and persistence of the fishing effort expanded, particularly into higher latitudes with their relatively high bird populations. Mechanization enabled fishing effort to increase (more effort, more birds) but apart from this impact on seabird catch rates mechanization in other ways reduced bird catch rates. Branch line coiling machines for example brought about a dramatic reduction in the catch rate of birds. But, lighter, more buoyant lines were introduced and these have the capacity to kill more birds.

Most mitigation measures and regulations that have been adopted by various fisheries or nations originated from work undertaken in the Japanese tuna longlining fishery in the Australian sector of the Southern Ocean. From the start, in 1988 this work (Brothers 1988a, 1991) prescribed the following to reduce bird mortality and improve fishing efficiency: use of bird-scaring lines, mechanizing bait throwing, sinking hooks faster by adding weight and confining line setting to night. The Japanese tuna longline industry has been very much involved in this work and deserve credit for the progress of mitigation measure developments that are progressively being adopted world-wide. These same measures are still prescribed today and have been further developed or refined to offer greater options and or combinations of options for various fisheries. These are described below.

5.6 LINE SETTING AT NIGHT

Description

Night setting alone as a mitigation measure can virtually eliminate seabird mortality in some fishing grounds and in others will assist greatly in minimising mortalities because most of the seabirds that are caught mainly forage during the day. Darkness also affords baited hooks additional protection by concealing them from birds which is particularly beneficial if slow sinking baits are being set and if bird scaring lines are not in use.

History

Confining line setting to night time was first proposed in 1988 as the simplest solution to overcome seabird mortalities (Brothers 1991). Since then, this strategy has been widely promoted and also prescribed in regulations (see section on process of adoption) for several demersal as well as pelagic longline fisheries. However, night setting remains unpopular among fishers (see section on effectiveness).

As early as 1990 Japanese tuna vessels fishing in the New Zealand and Australian regions responded to concerns over high bird catches with a trend toward setting more hooks at night but it was not until the measure was regulated in New Zealand that night-setting operations prevailed there. However the proportion of hooks that are set at night time in the Australian Fishing Zone has remained at less than 20% (Gales *et al.* 1998). Domestic fishery vessels in Australian waters and no doubt elsewhere have of their own volition in recent times tended toward a predominance of night setting in bird-problem waters.

Effectiveness

Bird catch rate reductions due to night setting reach 60-96% (Murray *et al.* 1993, Klaer & Polacheck 1995, Cherel *et al.* 1996, Brothers *et al.* submitted ms). Effectiveness varies between fisheries and seasonally within a fishing region due to some birds (e.g. White-chinned Petrels) being more active than others during the night. Ashford *et al.* (1995) and Barnes *et al.* (1997) reported only White-chinned Petrels caught on hooks set during the night and Brothers (1995a), when few White-chinned Petrels were present observed no birds at all killed on night-set lines. Even when this species is common less will be killed by night-set hooks compared to day-set hooks (Gales *et al.* in press).

Night setting is less effective during bright moonlight and in high latitudes during summer, when hours of darkness are few or even absent. Birds are three to six times more likely to be caught in bright moonlight than when there is no moon and hooks set during a full moon resulted in 2.1 times more bird mortalities than during a new moon (Duckworth 1995, Moreno *et al.* 1996, Barnes *et al.* 1997, Brothers *et al.* submitted ms).

Further improvement to the night-setting catch rate reduction may also be possible if the findings of Barnes *et al.* (1997) are widely applicable, indicating birds are more susceptible to being caught in the period two to five hours before sunrise.

Despite such occasions of higher catch rate potential during night setting, it is essential to remember that catch rates will still be much less for all species than if setting had occurred in the daytime. Such instances simply highlight the need for consideration of combining other strategies with night setting for prevention of bird catch when required (e.g. appropriate line weighting, use of bird-scaring lines and bait-casting machines).

Effects on other marine species

As with any change of this nature to fishing operations, an impact on catch rates of target species and perhaps bycatch species, such as turtles, is a potential consequence. So far data from fisheries observations have been inadequate to answer such questions as whether night setting diminishes fish catch rates (Klaer & Polacheck 1995). Because the type of data currently being collected for answering such questions is likely always to be deficient an "experimental approach" has been proposed. To allay the apprehensions of fishers that night setting will affect catch rates of target and bycatch (e.g. shark) species.

To assist further in accelerating our understanding of how to maximise catch rate potential through operational change (night setting) much can be learned from appropriate integrated application of technology such as:

1. Time depth recorders (TDRs) - to measure line performance, sink rates and , set depth (Pemberton *et al* 1995)
2. Archival tags - to measure diurnal activity pattern in relation to depth of fish.
3. Hook monitors - to ascertain precisely when it is that fish strike baits.

With or without this technological proof many fishers already use night setting successfully to catch target species and to avoid birds. If research did determine that catch rates of target species decline with night setting this may simply mean that adjustments must also be made to the fishing gear and how it is used (setting depth, bait types, etc.). If night setting caused some reduction in target species catch rate, there should be opportunities in properly managed fisheries to offset this by extending the fishing season, fishing effort limits or TACs within the fixed time-frame of a prescribed fishing season.

Costs

In financial terms it is not possible to calculate the impact of a change to night setting at present. The problem is a general perception that it could only be detrimental to profitability and this may well not be the case. If it is, the cause may be easily solved (see above).

In high latitude regions, if fishing is to take place in summer then night setting may not be a feasible option (insufficient or no darkness). Consideration of alternative measures or combining seasonal closure of a fishing ground (see area closure) to allow night setting becomes relevant. But for the majority of fishing grounds there are sufficient hours of darkness in all seasons to permit maintenance of a night-setting routine. More efficient, faster setting methods then have greater appeal for prolonging the maintenance of a night-setting routine. Such methods can entail more expensive establishment or gear conversion costs. There is the question of economic viability from restricting operations to seasons when night setting can be maintained (weather unfavourable, fish absent, etc).

Most vessels have been rigged with lighting (intensity, placement) that in all probability illuminates baited hooks for birds to locate in the water astern of the vessel. Minor modifications at low cost in most instances would be adequate to remedy this problem.

A regulatory obligation to night set can compromise the fishing efficiency of smaller vessels that (due to size-related seaworthiness and catch and fuel-carrying capacity) must maximise each fishing opportunity no matter how brief this may be. And, whereas in this instance there is the option to buy a more capable vessel, economic reality, at least in the short term, dictates that an alternative of equivalent efficacy to night setting may at times have to be considered.

Whereas the cost to fishing efficiency by not having hooks in the water at the best time of the day heads the fisherman's list of reasons against night setting, others include crew safety, and the imposition to long-established traditions. Again, costs of such are incalculable but the factor of safety must itself be questioned: a day-time setting routine ensures on many vessels that up to three times more crew are at work and exposed to the more considerable hazards of night-time hauling, a situation contrary to crew safety being a realistic consideration against night-setting.

Process of adoption

Although in some fishing grounds ensuring compliance with a night-setting requirement would be feasible, in most it is not. But, unlike many other mitigation measures, night setting has the advantage in that compliance by few vessels could precipitate compliance by many. This is because of the necessity for vessels to be coordinated and cooperative when operating in the confines of fishing grounds as is often the case. A night-setting requirement could also avoid coordination problems of vessels from different nations attempting to fish together.

In the regulations pertaining to CCAMLR waters in the Southern Ocean night setting is a requirement (CCAMLR 1996) whereas in the northeastern Pacific Ocean demersal fisheries (NMFS 1997a,b) as in the draft Threat Abatement Plan for seabirds (Environment Australia 1997) it is presented as an option only.

The greatest impediment to widespread adoption is the fear of negative impact on target species catch rates and there has been no progress to settle this uncertainty or to overcome any possible impacts. Also, any impact may not be consistent between fishing grounds. Simple, universally applicable rules are most attractive. If night setting is compromised by different rules, mitigation to an acceptable level may not be attainable.

Research and development needs

1. With persistent opposition to adoption of this measure due to fear of catch-rate reduction, undertake specific research aimed at demonstrating the effectiveness of night setting for birds and for fish.
2. Use of TDRs, archival tags, hook monitors specifically to accelerate understanding of best line-setting strategy in conjunction with a night-setting routine.
3. Monitor for potential deleterious night setting consequences to bycatch. Compromising the conservation status of one species (a fish) for the sake of another (a bird) should be avoided.
4. Further improve night-setting performance by promoting the installation (for new vessels in particular) of appropriate lighting for optimum crew safety but minimum baited hook illumination, including separate light switching circuitry.

5.7 UNDERWATER SETTING

Description

There are at least four methods that have been or are being developed to set lines underwater. This is achieved in the same way by all devices, delivering baited hooks from the ship during setting so that they first emerge in the water out of sight and reach by diving seabirds. Three of the four devices are add-on attachments to the stern of a vessel, the fourth is a system of integration within the vessel's hull.

Even in their present stages of development, there would be few impediments to ensuring that these devices are suitable for vessels of all sizes. There are problems with all devices due to the gear complexities of pelagic longlining and twin line demersal operations. Considerations of this nature are described separately for each device as follows:

Mustad underwater setting funnel

This is the only underwater setting device that is at present commercially available (O. Mustad & Son, Gjovik). As an attachment to the vessel's stern for use in single line demersal fisheries this device is manoeuvred hydraulically from its stern-facing setting position to stowing position against the hull (Anon. 1997e, Figs 13 & 14). The setting pipe or funnel can be of sufficient diameter to permit the line, hooks, buoys, etc. to pass down it and exit underwater astern or have a slotted side for external deployment of buoys, weights, etc.

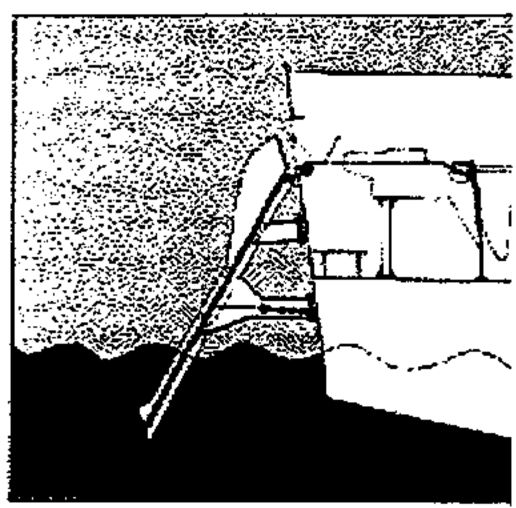

Figure 13. Mustad, stern attachment underwater setting funnel for demersal operations.

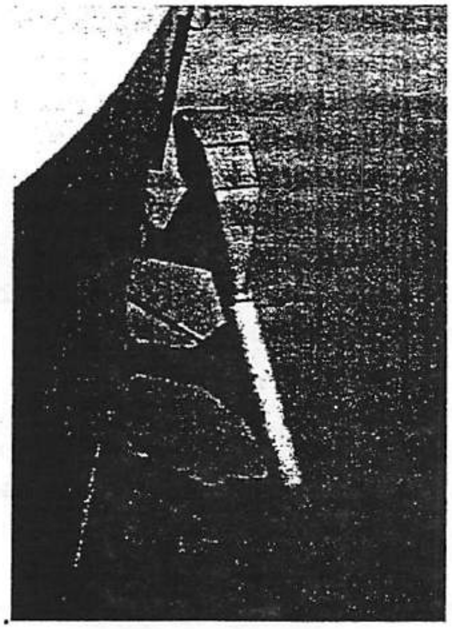

Figure 14. **An underwater setting funnel, when not in use is turned and stowed against the hull**

Currently, it would seem this device has some design deficiencies compromising the following essential capabilities of any underwater setting device i) to deliver hooks deep enough; ii) withstand the substantial forces acting upon it; iii) to not create additional problems, such as increased bait loss or line wear. Problems of this nature are to be expected with development of new equipment and effort is currently being directed at rectifying them. Of greatest concern is the uncertainty as to whether it is possible to use such a concept (in an engineering sense) to set hooks deep enough to avoid birds in all weather conditions. In its present form it delivers baits only about 1.5 m below the surface in calm seas, insufficient considering the potential sink rate of this gear, the reduction in setting depth in rough seas and seabird diving abilities, especially in the Southern Ocean where pursuit divers, such as the White-chinned Petrel, are commonly caught on longlines.

Underwater setting chute

A device that is now well advanced in development and performance assessment by New Zealand (Department of Conservation, fishing industry and private engineering consultants). Although similar to the previous device, the chute system (Barnes & Walshe 1997, Figs 15 & 16) is considerably different in that it has the potential to be applied to demersal as well as pelagic operations. This is because the small-diameter pipe is not fully rounded, having a continuous slot along its entire length. This provides the opportunity if needed for externally deploying radio beacons, line floats, weights, etc. while the line and hooks attached remain within the chute (demersal gear). Or, conversely the only items to travel within the slotted pipe would be the baited hooks (pelagic gear). Also, the chute system relies upon being withdrawn from the water when not in use because it is flexibly mounted, unlike the pipe system. This is a feature of great relevance to stress considerations associated with hanging comparatively fragile items off big ships in rough weather.

To achieve and maintain its setting depth of three metres the chute system relies upon a winch/paravane mechanism. A combination of water injection and venturi force accelerate baited hook passage down the chute. Conceivably it would be possible to ensure rapid, simple chute withdrawal, a facility essential to cope with unexpected events such as main line jamming that necessitates rapid vessel manoeuvring. Overall the chute is a device with considerable potential and like the pipe system is attractive in its simplicity.

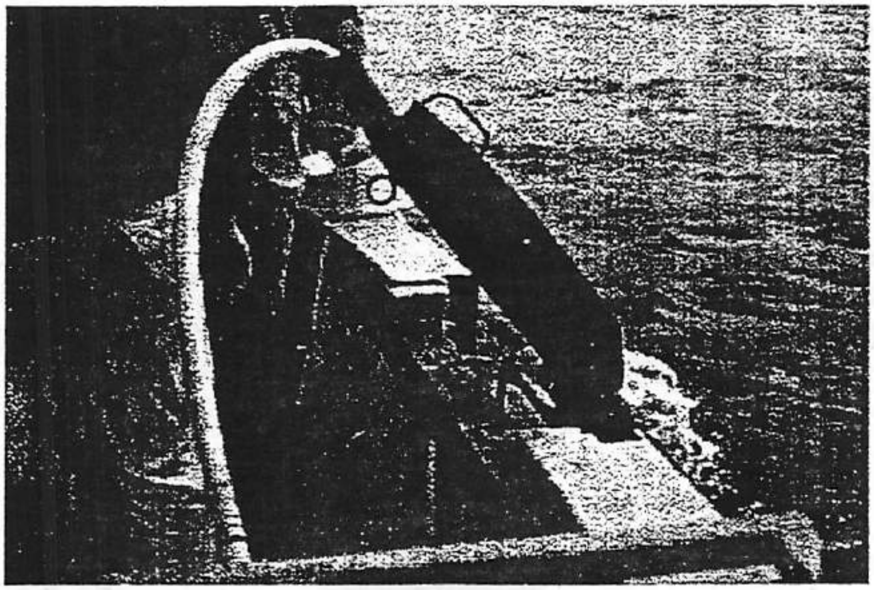

Figure 15. Underwater setting chute (New Zealand development system) the upper, bait entry section at the stern rail.

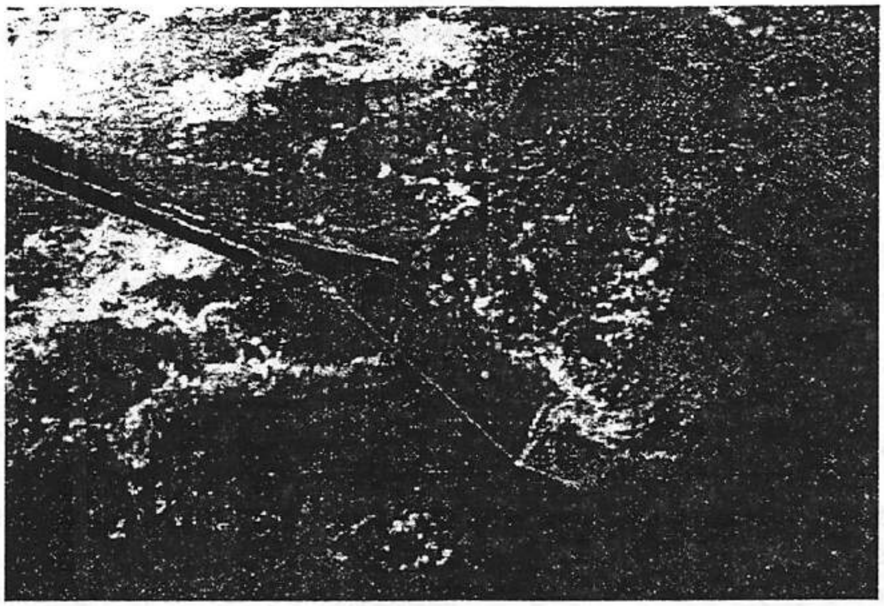

Figure 16. The underwater, end section of the chute.

Hull integrated underwater setting systems

Although several companies in Australia, and perhaps elsewhere, are pursuing this modification for existing vessels or for incorporation into new vessel design and construction, the system remains a concept only. And, whereas this may ultimately be the most efficient, cost-effective and successful means of all to mitigate bird problems (particularly with new ship construction) this will never be determined with certainty until it is tried, which will entail radical vessel redesign. Consequently, there has been reluctance or insufficient incentive for a prospective developer to carry out the modification.

An integrated underwater setting system would entail the construction of a tunnel through the ship that emerges at or near the keel (Gorman 1996, Fig. 17). Greater depth and propeller clearance could be attained with a telescopic extension). It is perhaps too costly as a modification for existing vessels but not in new vessel construction, with the added advantage of the potential to combine the space needed for line hauling with that for line setting. Alternatively, a slotted hull section within or added to the side of the hull leading aft and downward (not unlike a chute system but as part of the hull itself) could be constructed. This concept would better suit modification of existing vessels at lower cost.

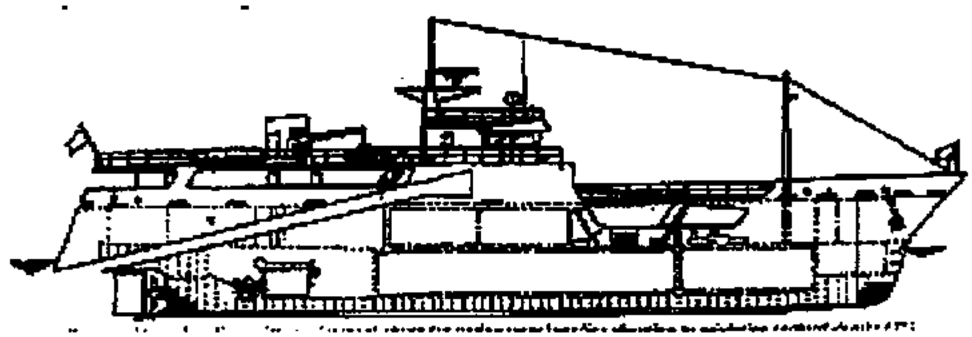

Figure 17. Illustration of a hull integrated concept for underwater setting (from Gorman 1996).

Underwater setting capsule

Unlike the previous three systems that use a passive means of transporting baited hooks underwater, this one is an active system. The baited hook is transported within a retrievable capsule to a predetermined depth where it is released (Smith & Bentley 1997, Fig. 18). Suitable only for pelagic systems, it has the added advantage of being compact and easily fitted to any size vessel, irrespective of associated gear configuration but has potential disadvantages inherent in any equipment with many moving parts. Also, the depth to which it can deliver baits is more versatile than the previous systems (but nevertheless regulated by cycle time demands that are unavoidably related to fishing effort from hook distance interval and vessel speed). A working prototype is at present being re-engineered and is ultimately envisaged to be electronically controlled and include a performance-monitoring capability (Smith & Bentley 1997).

History

The Mustad underwater setting pipe has been available commercially for several years. O. Mustad & Son now the patent holders, market the device world-wide and are considering redevelopments (Anon. 1997).

The chute and the capsule are concepts for development that were inspired by the Department of Conservation (DOC) of New Zealand in collaboration (and with financial input) with the New Zealand fishing industry. Both devices are at present undergoing development to meet operational requirements unless, in the process it is revealed that this is not achievable. Several 'public' demonstrations of prototype devices in operation have already occurred, the most recent in late 1997. Developmental work is now being funded jointly from New Zealand and Australian government sources.

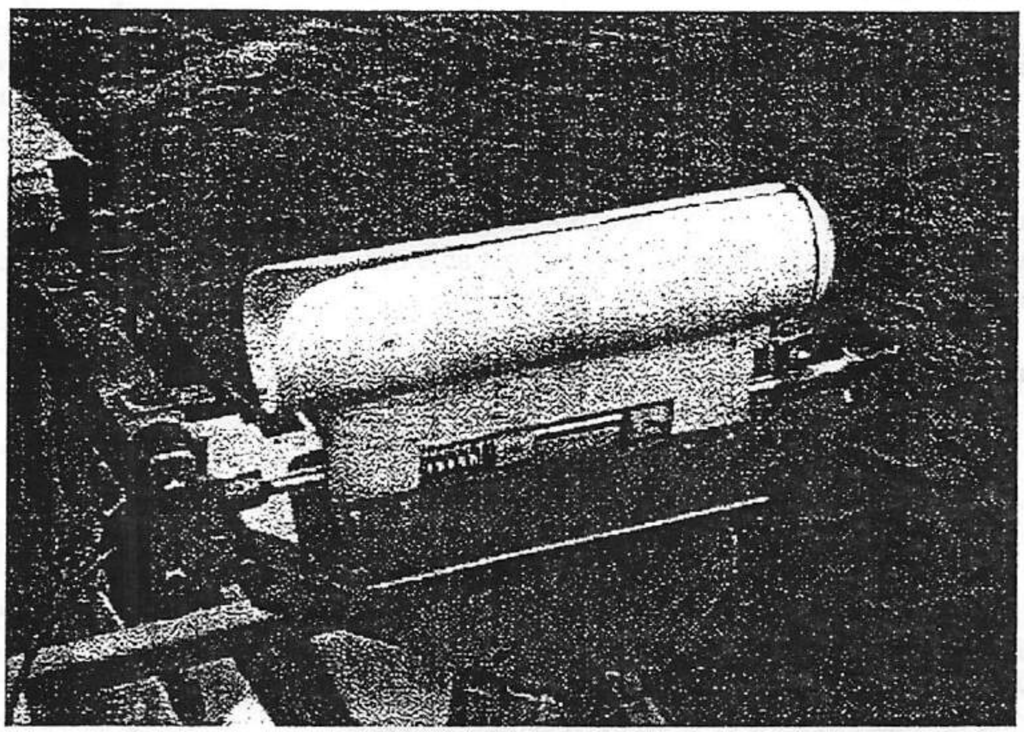

Figure 18. Underwater setting capsule (New Zealand development system) ready for launching on its retrieval cable off the mounting rack at stern rail of pelagic longliner.

Effectiveness

The only underwater setting device in commercial use which has been evaluated for its contribution to reducing seabird mortality is the Mustad funnel (Løkkeborg 1996, 1997). This assessment indicated that although a significant reduction in bird catch rate could be achieved (see section 3) a large number of birds can still be caught. It must not be assumed from this that underwater setting as a mitigation device is inadequate, but that further development is required, especially as the above study only involved the Northern Fulmar, largely a surface feeder. A proportion of the bird catch reduction achieved was perhaps not so much a product of underwater setting but of reducing the time (and distance) taken for hooks to get into the water and commence sinking. Because seabird species vary considerably in their diving capacity, and fishing grounds may only have certain species present, the capabilities of underwater setting devices need not be identical to achieve similar levels of effectiveness. Further tests are planned (E. Dunn, S. Løkkeborg, P.G. Ryan & C. Steel *in litt.*).

There are two factors that may influence effectiveness: i) the influence of propeller turbulence on bait retention if bait enters the water immediately astern; and ii) how far underwater it is that baits need to be released before all or most birds cannot get them (three metres is here assumed to be adequate).

The reality of underwater setting is that of all known mitigation measures it is, on its own and irrespective of concurrent use of other measures, the only one with the potential to avoid incidental catch of seabirds, to have no deleterious consequences (save perhaps for enhanced bait loss) and require no monitoring or compliance processes to ensure its use. However, economics and the time involved for development and widespread use indicate that other measures must be adopted in the interim. There is a need for protection of seabirds while more expensive but better technology (perhaps not even underwater setting) become available and in common use. Ships equipped with the latest capabilities can take many years to saturate all fisheries, including the ones least able or inclined to afford interim measures to reduce bird problems.

Effects on other marine species

Less bait lost to birds should lead to higher catches and increased profitability.

Costs

Precise figures are unavailable and will vary considerably depending on the type of setting device, and whether it is to be fitted to a new or an old vessel. Cost-effective devices should only be an outcome expected from well funded research and development initiatives exploring the many options of underwater setting concepts.

Process of adoption

On the assumption that underwater setting devices will be successfully developed, this improved method of fishing is most likely to be automatically adopted by fisheries over time. Accelerating this adoption process can be achieved by consideration of using such incentives as preferential licensing for those that have such capability (remembering here that other mitigation strategies may prove equally effective).

Research and development needs

i) Funds provided to assist in any vessel conversions or gear developments in order to accelerate learning of the full potential of this mitigation measure.
ii) Incentive offer such as licensing preference to promote use.

iii) Vessel builders and gear manufacturers - development prize incentive offer to attract interest.

5.8 LINE WEIGHTING

Description

Because the hooks that are set by most vessels in all longline fisheries commence their descent from the sea surface, each one is potentially available to birds. It is the amount of time that a baited hook remains near the sea surface or how fast it is sinking that determines the likelihood of it being taken. If the position and amount of weight on lines were correct, bird problems could be largely avoided in all longline fisheries (e.g. Brothers 1995b).

Precisely how fast a bait needs to sink (the faster the better) so that birds cannot take it is governed by three factors: i) whether additional bait protection such as a bird-scaring line is being used; ii) the vessels' line-setting speed; and iii) the foraging capabilities of the seabirds present. A vessel setting at three knots provides a baited hook with protection for longer than does one setting at 10 knots and so can afford to have slower sinking baits.

Foraging capabilities of seabird species vary. Some are only capable of surface feeding. Some have poor diving capability (to about one metre) and others are proficient divers (to 20 m or more but still largely reliant upon visual detectability from the surface so sink rate of baits is still critical). To account for these variables and to achieve consistent, reliable benefit from appropriate line weighting necessitates a generalized approach - the faster the better by putting on the line as much weight as often as possible within the limits of feasibility. How this can be done is different in each of the longline fisheries according to the method and gear used.

Pelagic longlining

Pelagic longlines are usually unweighted or weighted 7-10 m from the hook with a 30-80-g swivel. Brothers (1995b) showed by sink-rate measurements that 70 g at this distance was desirable. Unweighted hooks sink too slowly and the addition of a 20-g weight at or near the hook can almost double the sink rate to 0.5 m/s (Brothers *et al.* 1995b, Pemberton *et al.* 1995). Vessels are known to use successfully (in terms of target species catch rates) fixed or free-moving lead sinkers of either 10 g or 20 g at the hook and others to use up to 80 g five metres from the hook (Duckworth & Wells 1995, Figs 19 & 20). To date, the amount and position of weights used has been determined by fishers' perceptions of:

a) line sinking characteristics and propensity to tangle.
b) bait attractiveness to target species - more visible due to proximity of a swivel (for example), motionless or moving because of attached weight.
c) attaining and remaining at (or near) the target hook depth.
d) gear loss cost (more weighted swivels, more cost).
e) logistic complications of a heavy object (e.g. in situation of snood bin use where tangling rate can be exacerbated).
f) crew safety aspects.

Appropriate line weighting is particularly important with monofilament lines, otherwise three to seven times more birds may be killed (Brothers *et al.* submitted ms). Although 200-g lead sinkers are used regularly along monofilament lines their position on the main line (up to 40 m from the nearest hook and perhaps 200 m from the most distant hook) is of little consequence to hook sink rate and bird problems. In fisheries where monofilament line and light gear are extensively used lack of any line weight can cause problems to birds but is also likely to affect fish catches because hooks do not maintain desired setting depths. It is also important whether the weights (swivels, etc.) that help to sink the baited hooks are thrown into the water before or after the bait. If after, then affect on bait sink rate will be slowed and the farther weights are from hooks the slower.

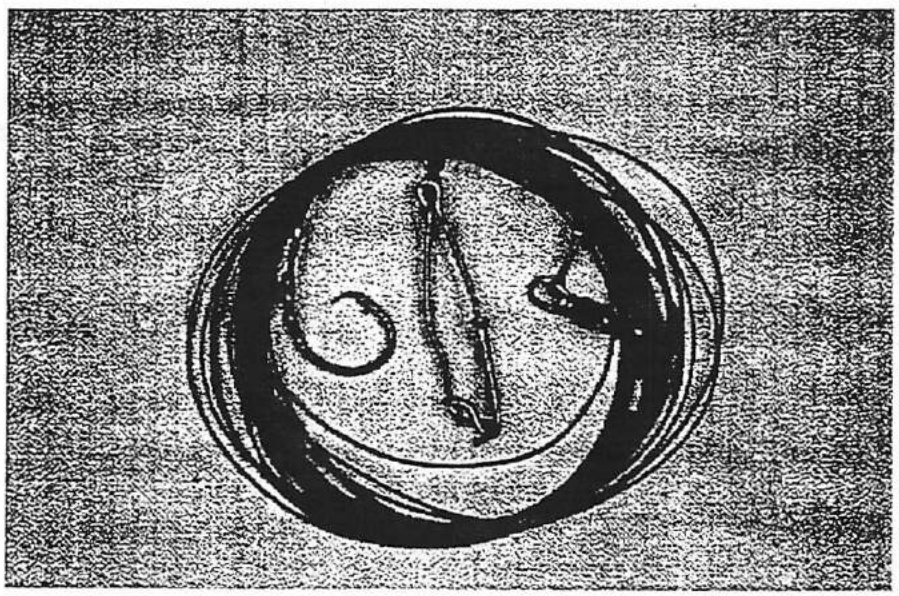

Figure 19. Pelagic longline fishery branch line with a clip and 80 g swivel, 5m from a heavy hook, contributing to rapid sink rate (FV "Kariqa", M. Wells New Zealand)

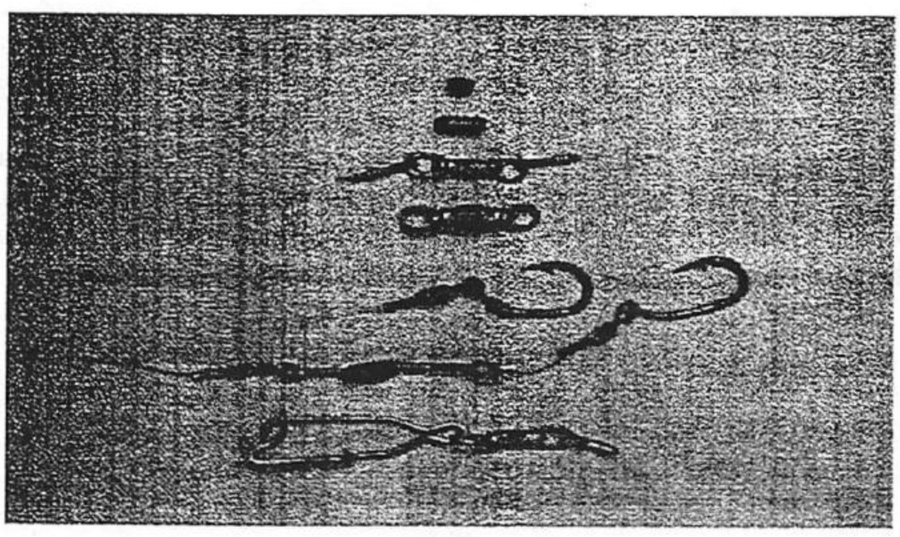

Figure 20. A variety of weighted gear used in pelagic fisheries to increase sinking rates of hooks (80g, 38g, 20g and 10g weights are illustrated)

Demersal longlining

In demersal longlining the consequence of weighting lines is totally different to that in pelagic operations. Because demersal gear actually sets on the ocean floor, in theory the only limitations on attaching weights is hydraulic hauler capacity and the method of weight attachment and detachment. There is an incentive to attach additional weights to reduce descent time where the ocean floor can be up to 2500 m away. Weights additional to the actual line mass are not always used to accelerate sink rates and if they are, not with consideration to reducing bird catch. The additional advantage in demersal longlining is that snoods or branch lines (the line that attaches each hook to the main line) are generally less than 1 metre in length so irrespective of where a weight is attached it will have an immediate impact on hook sink rate (provided the distance between each weight is not too great). An investigation of appropriate line weighting in the Spanish twin line system (Brothers 1995a) prescribed attachment of 6-kg weights at 20-m intervals (Figs 21 & 22). Regardless of how heavy or how frequently attached, weights must be pushed from the vessel to avoid line tension astern exposing hooks to birds for longer.

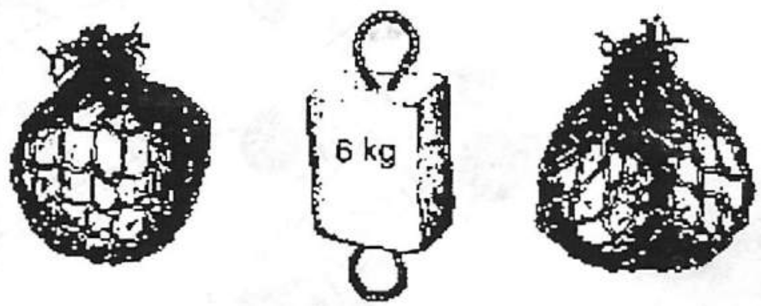

Figure 21. Recommended weights for twin line demersal longlines

Unlike the above twin-line system in which deliberately buoyant lines are used and therefore must essentially be weighted so they sink, the single line systems such as the Mustad Autoline use negatively buoyant line material. Because this inbuilt sinking capability is limited and there are practical complications to adding more weight (F. Pedersen *in litt.*), bird problem potential is high (contrary to Gorman 1996). In fact, the sink rate by this system (for 7-mm diameter line) has been measured to be alarmingly slow, with baits accessible to birds for more than 25 s after being set (N.P. Brothers & W. Baker unpubl. data). There are no solutions available at present to overcome this deficiency despite commercially available weighted line material being available (F. Pedersen *in litt.*).. Other solutions such as underwater setting may ultimately prove more acceptable or feasible than increasing line sink rate in autolining.

To complicate matters more, in both single and twin-line demersal systems line buoyancy is radically increased when line floats are used to alter setting characteristics for targeting certain species. The sink rate influence of line floats has been measured (N.P. Brothers & W. Baker unpubl. data) on a 7-mm diameter, single line system with 3 kg of buoyancy floats. Hooks remained within two metres of the surface for five minutes, ideal for catching large numbers of birds. Increasing sink rate by adding weights would simply defeat the purpose of the line float. So, the only option to overcome this is for the lines attaching floats to the hook line to be a minimum of three metres in length (they are usually only one metre or less in length). This will ensure that hooks descend unimpeded to avoid bird problems in the critical first three metres.

For other methods of demersal longlining such as trot-lines, drop lines and the more conventional single or twin-line systems using automated or manual baiting, similar attention to appropriate weighting can virtually eliminate bird problems encountered during line setting.

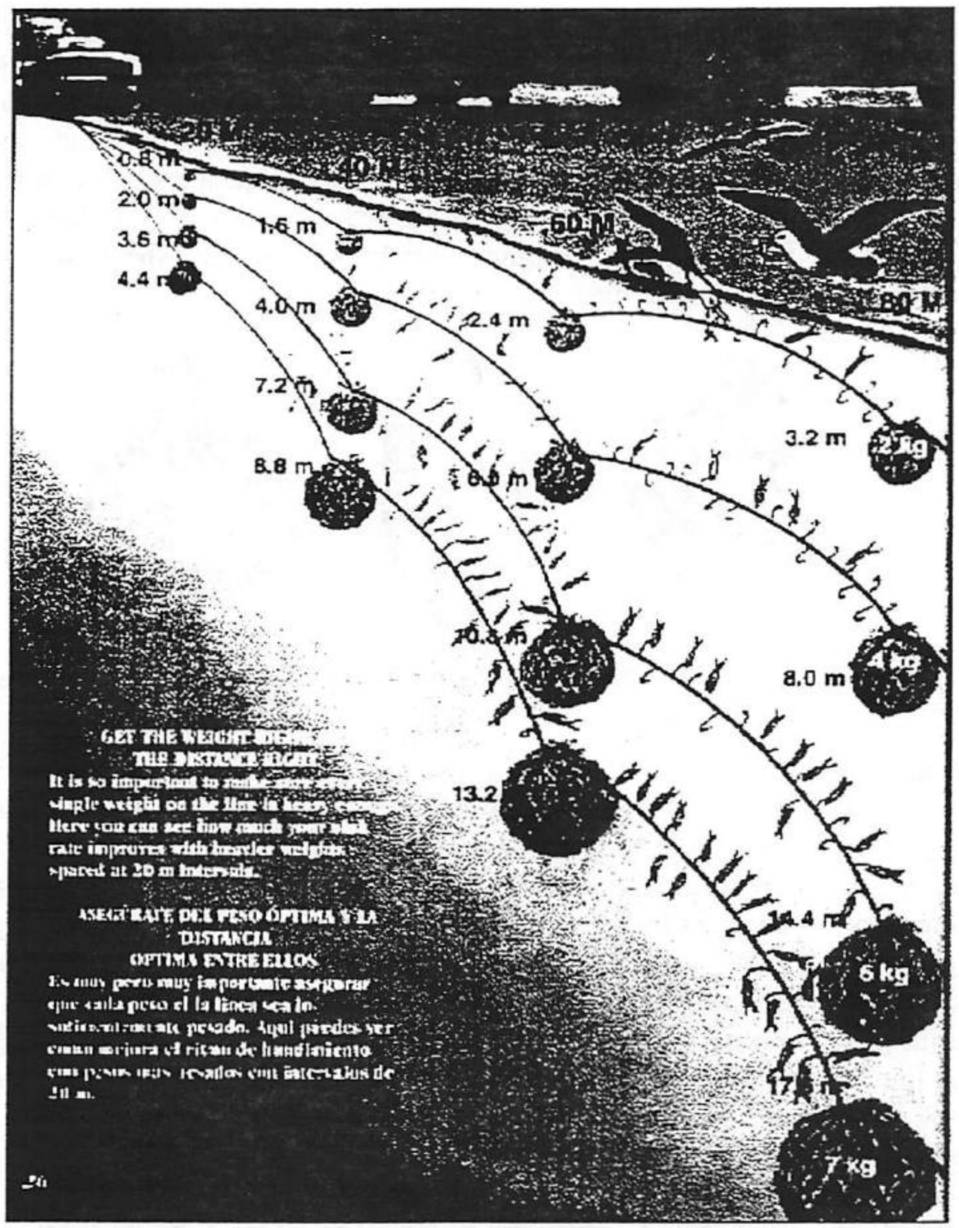

Figure 22. **Illustrating the benefit to line sink rate from weight increase in demersal longline fisheries.**

History

Although no observations describing the nature of seabird interactions in longline fisheries 20 or 30 years ago exist, it is likely that the factor of sink rate was not then so acute. This is because gear, in the past was heavier. More sophisticated metal use has produced stronger but lighter hooks, heavy wire hook traces have been replaced by light monofilament line; line manufacturing technology has pursued strength increase with material weight decrease (from multi-strand, heavy natural fibre line to synthetic multi strand to single strand light synthetic materials). Also driving these changes has been the economics of balancing actual material cost with its durability and increased catch rate, irrespective of any associated problems such as catching more birds.

In 1988 Brothers (1991) advocated appropriate line weighting for pelagic longlining. Ashford *et al.* (1995) and Barnes *et al.* (1997) identified this to be important in demersal fisheries using twin-line systems. After investigating the potential of using an appropriate amount of weight at optimum spacing to prevent seabird deaths in fisheries using this line system (Brothers 1995c), CCAMLR recommended the findings to fishers in 1996 and formalised these by regulation in 1997 CCAMLR Conservation Measure 29/XVI). The U.S. National Marine Fisheries Service has also incorporated line weighting in its regulations for its Pacific groundfish fishery (NMFS 1997a,b). The draft Threat Abatement Plan (Environment Australia 1998) provides for selection of appropriate line weighting as a mitigation measure option in the Australian Fishing Zone.

Effectiveness

Although bird problems could be largely overcome by weighting lines adequately, there are few data to substantiate this A strong inverse relationship was found between weight and bird catch rate in twin-line demersal fishing (Brothers 1995a). And, in pelagic fishing three to seven times more birds may be caught on lighter gear (Brothers *et al.* submitted ms).

Differences of opinion regarding how much weight and where it should be placed will influence effectiveness and may dictate that to achieve desired levels of bird mortality reduction, combining with other mitigation measures (e.g. use of a bird-scaring line) may be essential.

Certainly, catch rate assessment is urgently required to measure the effectiveness of the line weighting prescriptions that are being promoted (Brothers 1996) and considerable scope for further refinement to improve the effectiveness of this measure remains (see research and development needs).

Effects on other marine species

Although no studies have yet been undertaken, alterations such as making fishing gear heavier has the potential to change catch rates of both target and bycatch species. Preliminary results of measuring the effect of line weighting on seabird catch rates in a pelagic fishery do however suggest that a significant reduction occurs. And, owing to the indication from TDR measurements that hooks may not set at the optimum depth to catch fish if unweighted (N.P.

Brothers unpubl. data) it is not surprising that the same preliminary data suggest catch rates of tuna are higher on weighted lines (Brothers *et al.* 1998).

However, there is perhaps a conservation dilemma over the weight of lines used. Y. Kawai (pers. comm.) reports that in some pelagic longline fishing grounds turtles drown when they are pulled under by longlines made from heavy materials, so in these fishing grounds there is an incentive to use light lines. The same vessels are likely to fish elsewhere where turtles do not occur but seabirds do. In fact seabirds when caught on light longlines are often retrieved alive, although the lighter lines are capable of catching and killing more birds (Brothers *et al.* submitted ms).

Costs

Many fishers believe that the cost of using more heavily weighted lines is lost fishing efficiency. Not all fishers subscribe to this belief because appropriately weighted lines are already successfully used.

In pelagic longlining how much weight, how it is attached and where it is in relation to the hook is an important cost consideration. If attached adjacent to the hook then loss rate of weights can be high when lines are inadvertently cut by bycatch (especially sharks). The same applies if free-sliding sinkers are used. The cost significance of these losses must of course be considered with respect to increasing target species catch rates by preventing bait loss to birds. It would take the loss of considerable quantities of lead centre swivels (for example), to equal the value of just one more tuna caught.

In demersal longlining the consequence of appropriate line weighting on costs is not so uncertain. There do not appear to be concerns about target species catch rate reduction potential; in fact heavier lines are thought by some to catch more fish because more hooks actually remain on the ocean floor where the fish occur (most pertinent in twin-line system).

There have been concerns over the dangers to crew of weighted lines. In all probability the risk is likely to be greatest if a branch line (pelagic gear) under tension suddenly falls slack (e.g. a shark severs the line) when being hauled aboard. A New Zealand fisher has been killed by a heavy lead centre swivel (J. Molloy pers. comm.). But, not forgetting fishers are killed by many means in their occupation, prescribing weighted lines may have a legal cost consequence. The crew safety aspect of weighted lines must not be ignored as it alone can determine use by some fishers.

Process of adoption

If fishing gear changes of this nature were prescribed in regulations then the logistic difficulties for fishers not complying would be a lot more obvious (and therefore compliance more likely) than for other potential mitigation measures. Irrespective of this, considerable potential yet remains in the area of experimentation and evaluation to demonstrate the advantages of weighting lines. This should lead to willing compliance accelerated by appropriate education/promotion. So far, line weighting has become an established regulatory requirement in two demersal fisheries and is proposed for one pelagic fishery (see history section).

Research and development needs

1. Further evaluation of line weighting benefits, including where and how much weight for optimum performance (some ongoing research by the Tasmanian Parks & Wildlife Service).
2. Urgent attention required by fishing equipment manufacturers for autoline system sink rate improvement
3. Evaluation of crew safety consideration: is more weight more dangerous; does how and where a weight is attached determine its lethal potential; some fishermen use protective head gear and face shields against hooks mostly - are there other risk reduction devices?
4. Existing statistics on vessel performance (catch rates) in relation to gear configuration (how much weight and where it is in relation to the hook) need to be analysed.
5. Promotion of appropriate line-weighting procedures and their benefits.

5.9 BAIT CONDITION

Description

There are two features of a bait that can affect its buoyancy and therefore its availability to birds. A frozen bait will float or sink slowly as will one that has sufficient air retained in its swim bladder (Brothers *et al.* 1995, Fig. 23). With the exception of those fisheries in which artificial lures or live baits are used, all longline bait is stored frozen and may or may not be used on hooks in this state deliberately, or accidentally. The proportion of bait fish used that has sufficient air retained in swim bladders so that they float is highly variable. One reason is because this problem is, to a certain extent species specific i.e. more prevalent in certain bait species (Brothers *et al.* 1995).

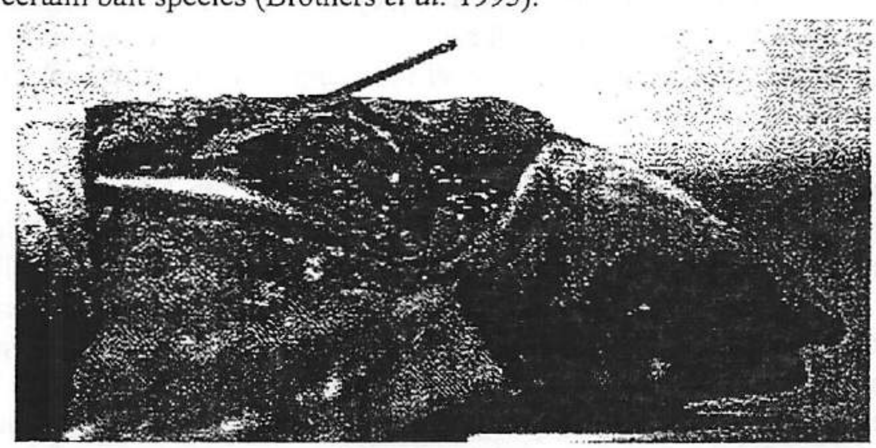

Figure 23. A bait fish dissected to expose its unpunctured swim bladder

For pelagic longlining each hook is manually baited with a whole fish such as a pilchard, sardine, mackerel or squid and then thrown to port or starboard clear of the ship's stern. The line to the hook is used to swing the bait to a preferred distance away from the vessel which can jeopardise bait retention on the hook, more-so if the bait is soft rather than frozen or partially thawed. There is thus an incentive to use frozen bait to avoid such loss but as a result equivalent or greater losses then occur to birds as these baits float for longer astern.

Although hooks weighing 20 g are most commonly used, 10-g hooks are also used in pelagic longlining with usually no other additional weight used near the hook. Therefore frozen baits and baits similarly buoyant because they have air retained in swim bladders are at greater risk of being taken by a bird.

Generally, it would seem fishermen remain ignorant or indifferent to the importance of bait condition in relation to bird problems or general fishing efficiency and their daily operations are characterised by a highly variable bait state. This may be driven by the following:

a) removal of bait from freezers prior to line setting is often inadequate. It is also unrelated to bait-thawing facilities being available and thaw factors such as air temperature.
b) lack of consistent attention to bait thawing during each line setting - thawed baits and frozen baits get used indiscriminately.
c) frozen baits are difficult to apply to hooks and when they are, the hook can withdraw easily i.e. incentive to thaw.
d) thawed baits pull off hooks more easily when they are thrown from the ship ie. incentive to keep frozen.
e) those crew actually applying baits to hooks find discomfort in having to persistently handle frozen bait i.e. some incentive to thaw.
f) inadequate thawing facilities discourage crew to be thorough and consistent.
g) on many vessels 15 or more individuals are on separate occasions responsible for bait thawing which leads to inconsistencies (more problems educating).
h) last-minute bait quantity short-fall during setting is met by using more, direct from freezers.

The most significant finding of the study by Brothers *et al.* (1995) was that regardless of whether a bait was thawed it may still sink too slowly because of air in the swim bladder. Adding as little as 20 g (lead sinker or swivel for example) to a baited hook can significantly increase its sink rate.

These same features of a bait that affect its sink rate have considerably different potential to affect bird catch rates in demersal longlining. For demersal longlining using the autoline method whole baits must first be at least part-thawed before it is possible for them to be sliced into sections by the automated baiting system. With other demersal fishing methods, whole fish in varying state of thaw (difficult to control where the air temperature can be at or below zero) and baits with swim bladder intact are used, yet the associated problems are overcome by the line sink rate due to regularly attached weights. Further, the time interval between hook baiting and hook setting where baits are manually applied to hooks (e.g. Spanish twin-line system) is unavoidably long enough to ensure thawing is complete, unless prevented by very low air temperatures.

History

1988 First identified as an important factor contributing to the availability of baited hooks to birds in pelagic longlining for tuna in reports to CCSBT and CCAMLR (Brothers 1988, 1991) and promoted as a mitigation measure for pelagic longline operations by Brothers (1994a, 1995b, 1996).

1991 CCAMLR regulations prescribed thawed bait use.
1995 Investigations that attempted to define the degree of influence thawed state and swim bladder in various bait species have on sink rates (Brothers *et al.* 1995).
1997 NMFS prescribes thawing bait and/or weighting guidelines so that baited hooks sink as they are put in the water (NMFS 1997a,b).

Effectiveness

Three studies have examined the potential benefit of using thawed bait in pelagic longline fisheries. None has addressed the additional complication of swim bladders contributing to a reduction in bait sink rate and so the assessments of thawed bait remain flawed. Duckworth (1995) reported a 69% reduction in catch rates when thawed baits rather than frozen baits were used, Klaer & Polacheck (1995) and Brothers *et al.* (submitted ms) also found that using thawed bait decreased seabird catch in summer. Data deficiencies preclude any determination from records of observations of fishing during winter (and also limits the usefulness of the summer assessments too because of poor data collection protocols, discussed in Brothers *et al.* (submitted ms). The frozen bait catch rate was 1.13 birds/1000 hooks, fairly thawed 0.63 and well thawed 0.27 birds/1000 hooks (Brothers *et al.* submitted ms). Although thawing bait and puncturing swim bladders has benefits, the same effect can be achieved by adding line weights (Brothers *et al.* 1995). Bait thawing in demersal longline fisheries is not considered necessary (Brothers 1995a).

Effects on other marine species

None known.

Costs

To a fisher who believes that using thawed bait increases bait loss there is the reduction in fishing potential to consider. Convincing otherwise is not necessarily achievable but the option exists to use a bait-casting machine (BCM) with thawed bait and not increase loss rate or reduce throwing efficiency . Alternatively, a fisher who considers frozen bait is best must consider the necessity to overcome slow sink rate by adding appropriate weight, which bears a cost.) The use of inexpensive purpose-built bait thawing racks incorporatimg a sprinkler system has been advocated (Brothers 1995b, 1996, Fig. 24). On vessels where space permits, such a system can ensure all baits are treated appropriately with minimum effort by crew.

Using added weight near each hook to counteract the buoyant effect of swim bladders in bait is applicable. Expelling air from baits by use of a spiking device used concurrent with hook attachment and air evacuation during bait packaging are uncosted concepts.

The possibility that the swim bladder problem is more prevalent in certain bait species is suspected (Brothers *et al.* 1995) but requires further investigation.

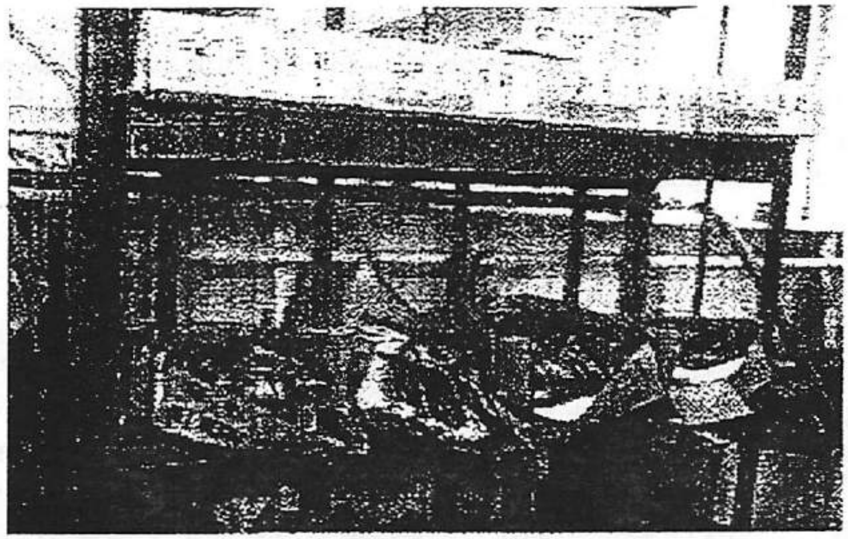

Figure 24. Bait rack and water sprinkler system for efficient bait thawing.

Process of adoption

The only fisheries which make reference in their regulations to the importance of thawing bait are the demersal fishery of the Southern Ocean (CCAMLR Conservation Measure 29/XVI) and the US groundfish and Pacific Halibut fisheries (NMFS 1997a,b) which note both weighting lines and thawing bait as measures to increase the sink rate of baited hooks.

In its draft Threat Abatement Plan (Environment Australia 1997) Australia proposes a combination of the following measures:

- use lines which are sufficiently weighted.
- demonstrate an ability to thaw baits before lines are set.
- use thawed baits on hooks.

In pelagic longlining baits tend to sink too slowly irrespective of thaw state or swim bladder inflation. Although attention to thaw state and swim bladders will greatly reduce the likelihood of baits being taken by a bird, advocating this degree of fine-tuning in longline fisheries for mitigation is of limited value unless bait sink rates are generally improved and other appropriate measures (such as bird lines) are also employed. It remains to be seen whether such measures in combination will actually be used and if so whether their bird mortality reduction capacity is great enough. To facilitate this by regulatory processes has obvious limitations or uncertainties as does using voluntary adoption for which education would play an important part.

Research and development needs

1. Examine the potential for removal of air from bait fish swim bladders during bait-packaging procedures.
2. Evaluate mechanisms for expulsion of swim bladder air from bait at the hook-baiting stage.

3. Hook sink rate improvements.
4. Ship builders and fishing equipment manufacturers to take account of the necessity for suitability appointed bait-thawing racks on all vessels.
5. Education material, crew-awareness training.

5.10 BIRD-SCARING LINES

Description

A bird-scaring line (BSL) is here defined as any device that when deployed astern during line setting deters birds from taking baited hooks. BSLs are either lines with suspended streamers, as used in tuna longline and demersal fisheries in the Southern Hemisphere, or towed objects such a "buoy bags", as used in the Alaskan fisheries (e.g. Anon. 1991, Brothers 1994b, 1996, CCAMLR 1996, NMFS 1997a,b).

With the recommended and commonly used streamer BSL (Brothers 1994b, Fig. 25), a mounting pole on the vessel's stern should be used to gain sufficient height above the sea surface. The higher the mounting position, the greater the distance of bait protection. It is important to minimise the need for bait protection over a great distance by appropriate hook-line weighting. Correct height also prevents the fishing longline interfering with the bird line. The mounting position must ensure that the bird line with streamers attached is towed astern directly above the area where baits enter the water (Fig. 25). Construction materials are very important to operating efficiency. Appropriate materials will help prevent birds becoming used to a BSL, reduce line stress on the pole, cross wind effects, tangles with fishing gear and also make setting and retrieval easier. Japanese fishers used these principles to design their pole and line design ("tori" poles) for pelagic longlining.

Tension is required to keep a BSL correctly positioned, irrespective of weather conditions, best done by line drag alone, which can be increased by using larger diameter line from aft of the point where the BSL enters the water (about 100 m if mounting height is adequate). If line retrieval is mechanised by use of a hydraulic or electric winch (Fig 26) it no longer matters how much line is needed to produce the correct amount of drag. In demersal fisheries the usually central line-setting position makes the deployment of two BSLs feasible (Fig. 27).

History

Prior to 1988, the year in which the usefulness of BSLs for reducing bird mortality was first documented (Brothers 1991) small numbers of Japanese pelagic longliners were using this system to reduce bait loss. Already BSLs had become quite sophisticated and in the ensuing six years the effectiveness of this style of line or variations on it were noted. During this period and more recently deploying BSLs has been made compulsory in some fisheries. Its popularity (as a measure to prescribe) most likely stemmed from the fact that, of all mitigation devices BSLs were seen to be least likely to disrupt or antagonise fishers.

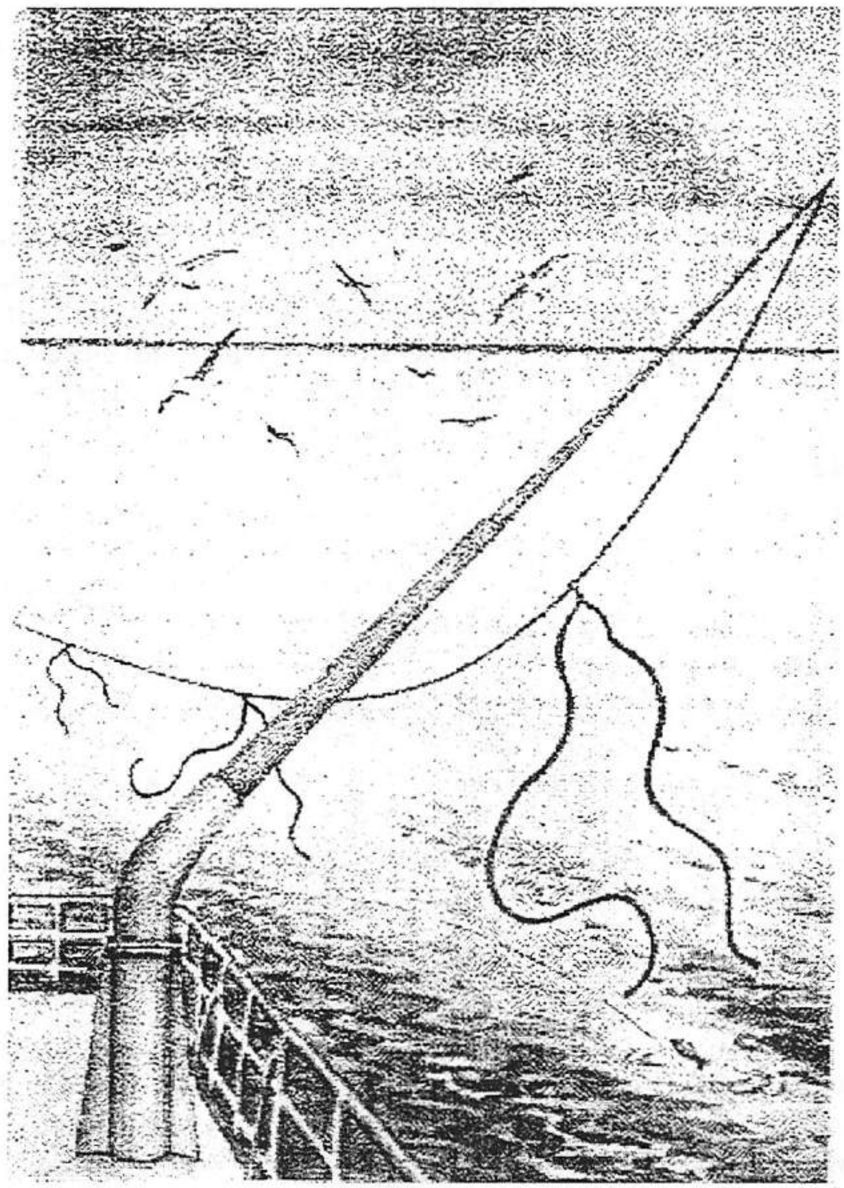

Figure 25. A bird line in use on a pelagic longline vessel, the pole keeping streamers over the position to where baited hooks are thrown.

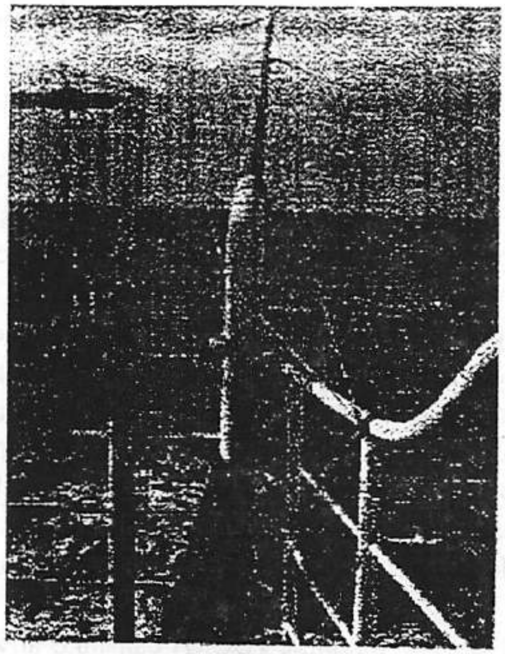

Figure 26. BSL pole with setting and retrieval winch alongside for maximum efficiency.

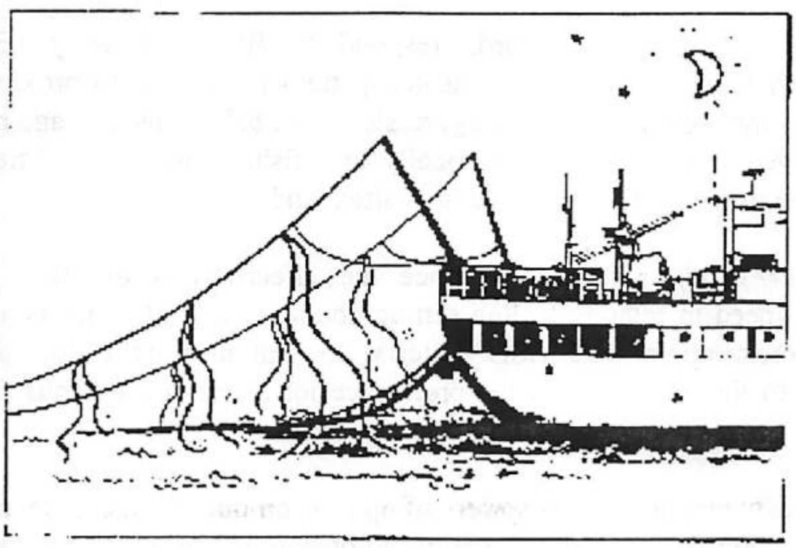

Figure 27. For demersal operations, a twin-line system of BSL for maximum protection.

Effectiveness

The overall effectiveness of BSLs for reducing seabird catch rates and the degree to which different attributes may affect BSL performance have been discussed in detail (Brothers *et al* submitted ms). It should be noted that catch rate reduction is not the same as bait loss reduction which has seldom been quantified (see Brothers 1991, Løkkeborg & Bjordal 1992a,b). Considering all sources of catch rate assessment, BSL can reduce bird mortality by between 30% to 70% in pelagic longline fisheries (Brothers 1991, Klaer & Polacheck 1995). But, in most instances these estimates are conservative because inferior BSLs are often used. Brothers *et al* (submitted ms) highlights the need for careful thinking if

BSLs are to be effective, and the importance of not solely relying on statistical analyses of data to interpret mitigation performance. Other studies have also emphasised the importance of a satisfactory BSL design (e.g. Ashford *et al.* 1995, Duckworth 1995).

It is more difficult for a BSL to be as effective in pelagic compared to demersal longline fisheries. Baited hooks in pelagic fisheries generally sink more slowly and are thus exposed to birds for longer and because these are on long branch lines thrown away from the vessel it is more difficult to protect them with a BSL. So it is not surprising that Løkkeborg (1996) reports a higher protection potential in a demersal fishery (90-98%). Ashford *et al.* (1994) and Moreno *et al.* (1996) also report catch rate reduction by by use of BSLs in demersal longliner fisheries. The aspects of demersal operations that are different to pelagic provide for the opportunity to use BSL designs with even greater bait protection ability. For example, the capacity to use not one but two lines (Brothers 1996). Shorter BSLs may be used successfully because baits can be made to sink faster. Attention to hook sink rate therefore has considerable influence upon BSL design requirements.

The use of a bait-casting machine (BCM) can take advantage of a two BSL system because the versatility of bait throwing direction is utilised to further reduce bird interference (see below). In addition, the consistently accurate bait throwing capacity of a BCM also improves BSL performance because all baits can be placed under the BSL.

Different species of seabirds respond to BSL differently (Brothers 1991), a consequence of their varying agility, search pattern in relation to proximity of the vessel, diving performance and interspecific aggression. So, bait protection against some species is not so effective. This may vary seasonally in a fishing ground or differ between fishing grounds and be influenced by species composition and abundance.

Weather conditions also influence the effectiveness of BSL, particularly wind direction and speed in relation to line setting course. This influence is an important factor determining most appropriate BSL material to minimise deflection by wind but with consideration to line strength and the preference for a less conspicuous (habituation factor) line.

Previously mentioned was variety of opinion on line design. Effectiveness in terms of catch rate reduction potential and suitability to operational factors (vessel size, setting speed) seem to be the chief concerns. It will however take a long time to measure the effectiveness of all BSL designs because of the complications already discussed pertaining to the variables and interaction of variables influencing catch rates, compounded further by habituation over time to variations on the same device.

Effects on other marine species

Use of BSLs can increase fish catch by reducing bait loss, valued at A$4.9 million annually in one pelagic fishery (Brothers 1991). Bait loss can also be of economic importance in demersal fisheries with up to 445 baits lost to birds from one line set (Brothers 1995a).

Costs

Materials most suitable for constructing BSLs (Brothers 1995a, 1996) may not be readily available on all vessels, requiring their purchase. Commercially-produced BSLs range in cost from $A200-300. Commercial availability may displace the current trend of constructing lines from less-suitable materials such as longlines and plastic packaging straps from bait boxes. BSLs wear out and can be inadvertently cut during fishing so spares should be carried.

A further expense associated with BSL is the mounting ("tori") pole. Style and materials are highly variable but Japanese vessels prefer commercially-available telescopic 11-metre trolling poles made of fibreglass which cost around A$1100. To avoid this cost longline vessels should be constructed with mounting poles. Installation of a setting and retrieval winch (Fig. 26) also entails a cost.

Process of adoption

There are now six separate regulatory processes in which BSL use is prescribed and in a number of other fisheries use is highly recommended. In Australia the use of BSLs has been a highly recommended measure for saving bait and birds since 1988. Prior to this, profitability of fishing, not saving birds, was probably the only motivation and use was confined to days of severe bait loss to birds. Despite being only a recommendation, Japanese vessels fishing not only in the Australian Fishing Zone but also on the high seas progressively adopted this measure. From 1988 to 1995 the number of Japanese vessels in Australian waters carrying bird poles and streamer lines increased, from one to all ships. Of the seventeen vessels whose fishing operations were observed (Australian Fishing Management Authority observer programme) all used BSLs in 1995. However, characteristics of lines and poles on vessels indicated that equipment quality and use was inadequate. These deficiencies were comparatively minor problems compared to lack of any progress with pole and line use to avoid catching seabirds by Australian domestic longliners even by 1995. The introduction in 1996 of mandatory use of BSLs in the Australian Fishing Zone for all vessels fishing south of 30°S (Australian Fishing Management Authority regulations) led to efforts to ensure vessels were properly equipped, including port visits by Japanese Tuna Fisheries Co-operative Associations officials for vessel briefing and supervised construction of BSLs with appropriate materials.

CCAMLR was the first regulatory body to prescribe BSLs for use in a demersal fishery (Conservation Measure 29/XVI). New Zealand prescribed BSLs, following CCAMLR specifications, for vessels within its EEZ in 1992 (Duckworth 1995).

There was a high level of BSL use by Japanese vessels in the Australian Fishing Zone prior to it being a regulatory requirement, in 1993 77%, 1994 73%, and 1995 91% (Brothers *et al.* submitted ms). In 1996 more than 99% of observed line sets occurred with BSLs deployed (Brothers *et al.* 1998 However, in fishing controlled by CCAMLR regulations poor levels of compliance persist (CCAMLR 1997). Australian domestic vessels rarely comply, using night-setting as a justification. Half of the few occasions when no BSLs by Japanese vessels were used in 1996 coincided with night-time line setting (Brothers *et al.* 1998).

Inevitably, with high levels of mitigation measure use the opportunities to undertake assessments of a comparative nature regarding efficacy are lost (Brothers *et al* submitted ms). This has also been a consequence of prescribing specific BSL design so, unless an experimental approach is pursued (and this is of questionable value anyway, see earlier reference to this) further improvement to such mitigation measures is unlikely.

In the Falkland Island/Malvinas Outer Fishing Zone BSL regulations also apply (P. Brickle *in litt.*) but it would seem that such regulations do not extend into adjacent waters of South America (C. Moreno *in litt.*). BSL use has been recommended elsewhere (e.g. in South African waters, Barnes *et al.*(1997). Perhaps the recent announcement (late 1997) by the Japanese Fisheries Agency that all Japanese vessels must now use BSLs will encourage similar bird bycatch reduction initiatives by other nations.

Research and development needs.

1. Ongoing assessment of BSL efficacy, particularly with respect to suitability of design for different fisheries.
2. Solicit co-operation from fishing vessel and gear manufacturers to ensure that all vessels are equipped to use BSL most efficiently and effectively: correct pole(s) design and placement, mechanised set and retrieval facility, integrated installation of other equipment to ensure optimum performance eg. position of line shooter and BCM.
3. Assist in promotion of BSL supply outlets.

5.11 BAIT-CASTING MACHINES

Description

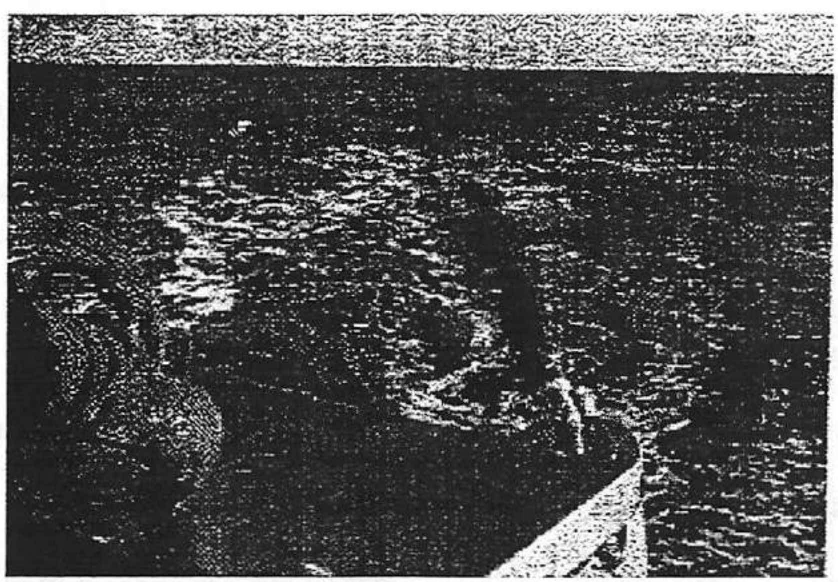

Figure 28. Bait casting machine for pelagic line setting.

Bait-casting machines (BCMs) are used in pelagic longlining where hooks are attached to long branch lines necessitating placed in the water at a distance from the longline to which they are attached to minimise line tangles. It is particularly desirable on larger vessels to put baits in the water outside propeller and hull turbulence. To achieve this each bait is thrown by hand from the port-side stern corner, as far out away from the vessel as possible.

The concept of BCM development was motivated by two potential benefits: reducing both the effort of bait casting and bird catches. For the former this requires i) a cycle time of less than 5 s to match existing bait setting frequency of *c.* 6 s; ii) versatility of casting to either port or starboard; iii) a casting distance of at least 10 m; and iv) integration and operation without disruption to existing line-setting procedures.

Studies from 1988 to 1992 (Brothers 1991) have shown that increased loss of bait to birds and death of birds is aggravated by factors relating to the manual throwing of baits. These are:

1). Baits that are thrown less than five metres from the ship are five times more likely to be taken by birds. More than 20% of baits can be at greater risk of being taken by birds for this reason. Those that are not thrown clear of the ship are more likely to be taken by birds because of turbulent water created by the ship keeping them near the surface of the sea for longer.
2). Because all baits are thrown to the same area in the water, seabirds concentrate their search in this area so few baits escape detection if they are accessible.
3). Whereas all baits should be thrown to the same position, this is not sufficiently accurate (crew ability, weather influence) to ensure that all fall directly under a bird-scaring line.
4). It is necessary that baits are thrown clear of the ship and for efficient manual bait throwing, crew are restricted to throwing off the port side of the ship. Therefore, on occasions when wind strength above 20 knots and/or rough sea conditions onto the ships' port side occur (the side to which baits are thrown), loss to birds increases significantly (30%) as do branch line tangles (Brothers 1993).

With consideration to the above deficiencies of manual throwing the BCM evolved with the following facilities: i) 3.5-4.0 s cycle time, ii) immediate direction reversal switching in order to permit port or starboard side throwing, iii) immediate distance dial facility for varying throw distance according to requirements of weather, BSL placement etc. to maximum distance of 23 m, iv) low arc of throw coupled with gimbal rotation to contend with ship movement in rough conditions and minimise any consequential interference of bird-scaring lines to the fishing line.

Achieving these capabilities necessitated the development of complex (and therefore costly) hydraulic components (by the late Mr M Brooks). However, several hundred units were rapidly produced to fill orders, principally for Japanese and Republic of Korea vessels. This BCM, engineered and distributed by the Australian Company Gyrocast Pty Ltd was soon displaced by machines produced by the Japanese companies Izui Iron Works and Kitagawa Kogyu Co. Ltd. Regrettably these cheaper (and so, more marketable) replacement models were manufactured only with the basic labour saving functions of mechanised throwing. Gone were the additional facilities that really gave the device the potential for huge savings (bait, birds, line tangles). These new machines cannot vary throwing distance or direction and do not integrate well with bird-scaring lines owing to unsatisfactory arc of throw, gimbal facility and no distance variability. This is an example of improvements to fishing efficiency where the only motivation has been short-term economic gain, and the potential for long-term savings and benefits has been lost.

History

The problems associated with how baited hooks are set from pelagic longliners was observed in 1988 (Brothers 1991) and resulted in a commitment to overcome these problems by mechanising the process. This was achieved from 1989 to 1992 by collaboration between Australian engineers and government agencies and the Japanese ship owner Kiichiro Yorozuya, his fishing master Koji Ito (the first to use BSLs and BCMs) and the Japan Tuna Fisheries Cooperative Associations (Brothers 1993).

Distribution of machines on a commercial basis followed almost immediately and by 1996 over 200 machines had been sold to three nations. Redevelopment of this machine commenced in 1996, with a view to improve reliability, cost competitiveness and adaptability to any size of vessel. Performance assessments are currently underway on Korean vessels (Gyrocast Aust. pers. comm.).

The advent of inadequate models has severely curtailed the rapid, earlier rate of uptake of Gyrocast machines. Legal proceedings pertaining to matters of patent ownership etc. (Gyrocast Aust. pers. comm.) are also interfering with BCM sales.

Effectiveness

Data are available regarding the effectiveness of BCMs to reduce bird mortalities but it is necessary to remember that no data exist pertaining to performance assessment of a BCM used to the full extent of its capacity.

BCMs can reduce potential bait loss to birds by half (Brothers 1993). Bait loss without BCMs from a sample observed of 174 873 hooks was 8.5/1000 and with BCMs was 2.7/1000 from a sample of 136 980. One of the biggest uncertainties here is to what extent bait condition can be an influence. This is the only data that attempt to relate BCM use to bait loss rates. Bait loss rates cannot be calculated from data sets which relate BCM use to bird catch rates. A correlation between bird catch rates and bait loss rates may not exist.

Duckworth (1995) and Klaer & Polacheck (1995) found bird catch rate reduction occurs with BCM use but contrary results have also been presented (Brothers *et al.* submitted ms). Evidence of these data being inadequate for meaningful evaluation is apparent and further affirmed by more conflicting results in Brothers *et al.* (1998).

If correctly used, BCM can do nothing but overcome a number of the factors that increase seabird mortality. Measuring its relative contribution to catch rate reduction, although desirable has not been useful to date and might be impractical given the strong influence of other factors that affect catch rates. Also, of all mitigation devices BCM is the only one that, irrespective of regulations will be consistently used owing to its other beneficial attributes. Therefore some level of bird mortality reduction will always be achieved.

Effects on other marine species

Using a BCM keeps more bait on hooks and so of course a potential for increased catch rate exists for target as well as bycatch fish. A deleterious impact is unlikely.

Costs

The original Australian manufactured BCM model cost around $A20 000 whereas the Japanese-made devices were around half this amount. The new generation of Australian BCMs will be similar in cost to these (Gyrocast Aust. pers. comm.).

The cost of the machine is offset by the potential financial benefit from BCM performance in improving fishing efficiency. Estimates of cost saving or profit increase (Brothers 1993) are considerable: up to $A2.6 million annually (depending on how BCM efficiency is utilized) per vessel in the 300-400-tonne range.

Further cost savings and benefits from the BCM are i) machine throwing does not transfer line tension to the baited hook (unlike by manual deployment) which means that less baits are lost in setting and there is no need to use frozen bait; and ii) learning to throw competently is not easy whereas even inexperienced crew can use BCMs with obvious cost-saving potential.

Process of adoption

BCMs may always remain a device considered by fishermen only for its economic attributes, other than to reduce bird catch rates. In view of this and because maximum bird benefit can only come from appropriate use and in combination with other measures (BSL, night setting, appropriate line weighting, consideration to bait condition) regulations are inappropriate.

In the AFZ 3% of observed fishing operations by Japanese vessels occurred with BCM use in 1993 and by 1995 this had risen to 44% (Brothers *et al.* submitted ms) and to 70% in 1996 (Brothers *et al.* 1998). Between one third and one half of Japan's high seas pelagic tuna longliners are now equipped with BCM (Gyrocast Aus pers. comm.), of which less than half of these are thought to be the Gyrocast model.

Research and development needs

1. Promote integrated installation of BCM with other fishing equipment to ensure optimum performance which will benefit fishing efficiency considerably.
2. Discourage manufacture of BCM with inadequate performance.
3. Encourage utilisation of full range of features of BCM.
4. Further attempt to quantify BCM performance for bird catch rate reduction and increased fishing profits.

5.12 FISHING SEASON AND AREA CLOSURES

Where and when fishing occurs may be more important than the actual amount of fishing. For example, to reduce the total fishing effort (de la Mare & Kerry 1994) and have no regard for when and where fishing will take place could conceivably increase bird bycatch. Closing waters south of 30°S would benefit Southern Ocean seabirds considerably, but fishing effort displacement could affect species elsewhere.

For regions where vulnerable species are particularly abundant, as in the New Zealand EEZ (Gaskin *et al.* 1991) there may be clear benefits from area/season closures. The quite small amount of fishing effort here, redirected from such an area of very high bird catch rate potential will contribute comparatively little to total catch increase elsewhere. The issue of bird catch appears to have already caused a significant decrease in fishing effort around New Zealand (Alexander *et al.* 1997).

Croxall & Prince (1996) considered area/season closures in terms of proximity and time of fishing in relation to a species' breeding timetable: concentrated activity of adult birds near their breeding colonies can lead to unacceptably high mortality if fishing occurs at the same time. But, if fishing activity is terminated and it is not known to where that fishing effort will shift, advantages to total catch reduction or species plus age relatedness of catch composition are uncertain.

Trawling is permitted near Australian sub-Antarctic Macquarie Island because to longline fish here would put small populations of several seabird species at greater risk (AFMA 1996). But restricted application of this measure to protect such vulnerably low populations is likely to be inadequate because the birds in question roam farther afield where longlining still occurs. Thus improvement of the longline fishing method is the most appropriate option for overcoming bird catch. The fact that longlining kills seabirds should not be used to give preference to trawling and its generally greater destructive capacity (e.g. Safina 1995). It is therefore important to demonstrate that catching birds on longlines can be avoided. Area/season closures in specific circumstances can arguably be beneficial but are inadequate as a mitigation measure for general use.

The sub-Antarctic Heard and McDonald Islands sector of the Australian Fishing Zone is another example of a fishing ground in which longlining fishing is prohibited (AFMA 1997). There are also those sectors of the Southern Ocean over which CCAMLR rules apply: unless the designated sector has been identified in a nation's notification of intent to fish then fishing is prohibited unless specific conservation measures are adopted.

In addition to the previous descriptions of occasions when area/season closures may be applied the following provides an example of one in which birds and fishermen could benefit from this strategy. In the southeastern Indian Ocean from August to November Whitechinned Petrels occur in low numbers throughout. However, on about the 1 November very large numbers arrive here and are responsible for a substantial reduction in the viability of operations by taking vast quantities of bait from hooks set for Southern Bluefin Tuna (N.P. Brothers unpubl. data). With a minor adjustment to the annual operations routine this problem could be largely avoided. Although such refinements can produce significant benefits it is not so easy to identify when and where opportunities of this nature exist or how stable they are.

5.13 ADDITIONAL MITIGATION MEASURES

There are features of line setting and hauling not yet discussed that can contribute significantly to bird problems. Often minor alterations to gear or technique are sufficient to rectify the trouble. Also described below are the various other methods of mitigation that have been attempted and discarded, or those under development or awaiting development effort.

Line tension prevention

In pelagic fisheries a main line can be set slack (no tension astern) with the aid of a line shooter (Fig. 29) whereas in demersal operations line shooters have yet to be developed. In demersal operations line tension astern keeps baits available to birds for longer and line sinking is delayed. The higher a line departs the ship above the water the worse the problem becomes. This is where setting funnels can be of added benefit.

If weights are being used to sink the line (Spanish twin-line system for example) they must never be left to be pulled off astern by line tension, but pushed off to avoid increased line tension which dislodges bait and also allows birds to be caught more easily. Line tension frequently occurs in the auto line system simply because hooks snag briefly in the auto-baiter or because line loops from hook magazines have become crossed over. Careful attention to gear maintenance and its correct use and training of inexperienced crew is essential. The fishing equipment manufacturing company Mustad, is endeavouring to develop a line shooter for demersal gear which will be a major asset to improving fishing efficiency.

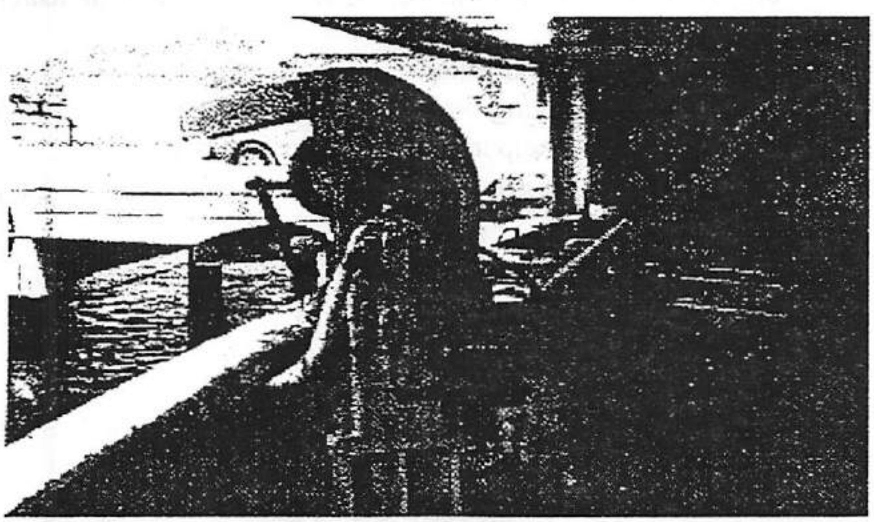

Figure 29. A line shooter for pelagic line setting

Line-hauling problems

Birds can be caught during line hauling, though less frequently than in line setting, and often then come aboard alive, when they can be released. There are a number of reasons why fatalities during hauling occur. In pelagic fisheries long branch lines, after being unclipped from the main line are either pulled aboard manually or with snood pullers or branch line coilers (Fig. 30). Manual recovery is slow and leaves any baited hooks exposed on the surface for birds to eat. If mechanising line recovery is not an option then consideration to branch line length in relation to the distance between the hauling position and the stern of the vessel can help. Provided branch line length is the same or less than this distance baited hooks usually receive adequate protection from the hull of the vessel. A vessel being driven faster than the rate crew can haul in branch lines aggravates the above problem because baited hooks trail astern for longer.

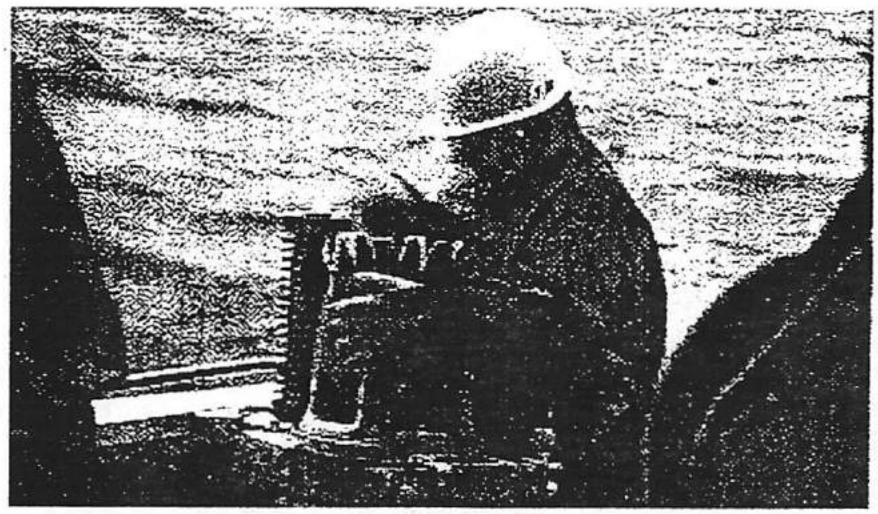

Figure 30. Snood pullers and branch line coilers for pelagic longline fisheries.

If an unweighted demersal line breaks, sections can float to the surface and be dragged through concentrations of accompanying birds. In such instances rapid line retrieval should be a priority. A Brickle Curtain can help in thus situation (see below).

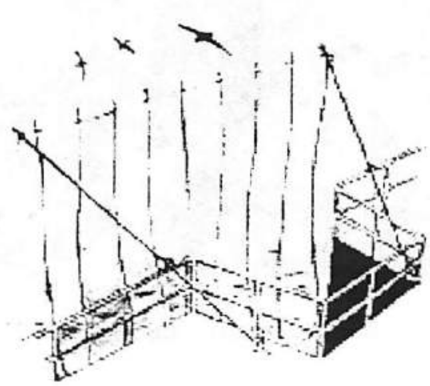

Figure 31. Brickle curtain for demersal longline fisheries

Offal and bycatch discharge and bird-attraction reduction

To reduce numbers of following birds, discarding any item of an edible nature, even cardboard packaging from bait boxes, must be avoided during line setting. Containment of loose bait particles from auto-baiting devices is also necessary. Dumping offal and bycatch during setting can distract birds from baited hooks (Cherel & Weimerskirch 1995), but this practice has the disadvantage of attracting birds to the vessel, potentially increasing bird catch, and so has not been generally recommended.

Longliners can produce large quantities of offal, often discharged continuously during hauling. Hauling is often done at a slow speed enabling discharged offal to remain near the discharge outlet usually located immediately adjacent to the line haul position. Large numbers of birds are then attracted to the immediate vicinity of incoming hooks and can get caught (Brothers 1995a, Moreno *et al.* 1996). An exclusion device such as the Brickle Curtain (Fig. 31) reduces the problem.

Ensuring minimum opportunities for birds to obtain food must be the objective. If any material edible or otherwise must be discharged then a once-only event each night, preferably not during hauling or setting, would be the most appropriate strategy. This method should reduce the additional problem of birds ingesting hooks in offal or discard fish. With this system of disposal a Brickle Curtain may be needed as incoming hooks with bait remaining or lost bycatch will still be available and attract some birds. Yet to be demonstrated is whether offal discharge (from the opposite side to where line hauling occurs) during hauling is the better procedure, not only because of the above situation but as a further distraction when whole sections of hook line float after a breakage. Regulations pertaining to offal discharge already apply in some fisheries so resolving such uncertainties is important.

Research and development needs for offal discharge include: i) Evaluation of most appropriate offal discharge practice; and ii) Factory longliner conversion to offal discharge only on opposite side to line haul which is generally forward of amidship on starboard side.

Artificial baits, lures and live bait

Artificial baits may be made of waste fish material still scent-attractive to target species or synthetic baits (lures) that use visual stimulus as an attractant. The former type, made of waste fish and offal (e.g. Anon. 1997f), has not yet been assessed for its affect on seabird catch rates, although it is being used commercially in a number of demersal longline fisheries. Seabirds rely heavily upon vision to locate food sources, so dyeing artificial bait to make it less visible should be tested. Also, the potential to manipulate the buoyancy of artificial bait in order to accelerate sink rates should be explored.

Synthetic baits or lures are commonly used in pelagic fisheries either on their own at hooks or combined with a baited hook. Generally they are crude imitations of natural bait items such as fish or squid. Considerable potential exists to develop lures that may be more effective and less costly than natural baits. Seabirds are generally highly discerning of food items and synthetic lures would therefore pose little threat. As yet there are no records of seabirds having been caught on synthetic lures in longline fisheries (N.P. Brothers unpubl. data) although lures that are trolled do attract and catch birds.

Although no assessments have been undertaken of live bait anecdotal reports by Australian fishers suggest that seabird bycatch does not occur because such bait descends rapidly by active swimming.

Research and development needs are i) establish whether artificial bait in demersal longlining affects bird catch rate; if more determine whether processes such as dyeing may reduce bird catch; and ii) assess the feasibility of lures.

Hook design

In demersal longlining hook shape and diameter may affect bird catch rate (Brothers 1995, Moreno *et al.* 1996). Smaller hooks may more easily catch smaller species (Brothers & Foster in press). Hook size (weight) will influence bait sink rate (Brothers *et al.* 1995). The development of hooks with disarming mechanisms that would delay the catching ability to a predetermined time or depth is under investigation in Australia (Munro Engineers and Grandson Pty Ltd).

Research and development needs: i) Completion of research into hooks with disarming mechanisms; Further understanding of the roles that hook size, shape and particularly weight play in catching seabirds.

Water cannons

The use of water from a vessel as a means of concealing baited hooks may reduce bait loss and incidental catch of birds, providing baits do not remain accessible too far astern. In 1997 the Japan Tuna Fisheries Co-operative Assoiciations tested a high-pressure fire hose (Fig. 32) that directed high-pressure water above baited hooks. Non-quantified observations suggested a reduction in seabird interactions, although the distance astern to which the water reached was considered inadequate. The cannon was switched off because cold, wind-driven water adversely affected the crew (S. Lake, Australian Fisheries Management Authority observer pers. comm).

Acoustic deterrents

A sudden loud noise (e.g. firearm discharge or hitting steel hull) may cause nearby seabirds to fly away, a technique erratically used by fishers. to frighten birds. However, loud noises frighten seabirds only briefly and at close range. Also, the more often the frightening sound is produced, the less effect it has due to rapid habituation, as with gas guns in agricultural situations. Other commercially available acoustic bird-scaring devices emit high frequency and loud noises or distress calls. These may be effective if used sparingly to avoid habituation.

In 1996 albatrosses in a breeding colony were subjected to high-frequency and loud noise as well as distress calls with no detectable response (N.P. Brothers unpubl. data). Tests from a vessel to which a variety of seabird species was attracted by fish offal discharge showed most birds ignored sounds, although occasionally the sudden commencement of sound emission caused a bird to fly off a short distance. Further investigation of acoustics as an effective mitigation measure was then regarded as futile. Despite the lack of response generally the frequency of bait taking in fisheries would necessitate such regular sound emissions that habituation would be rapid, as would annoyance to the crew.

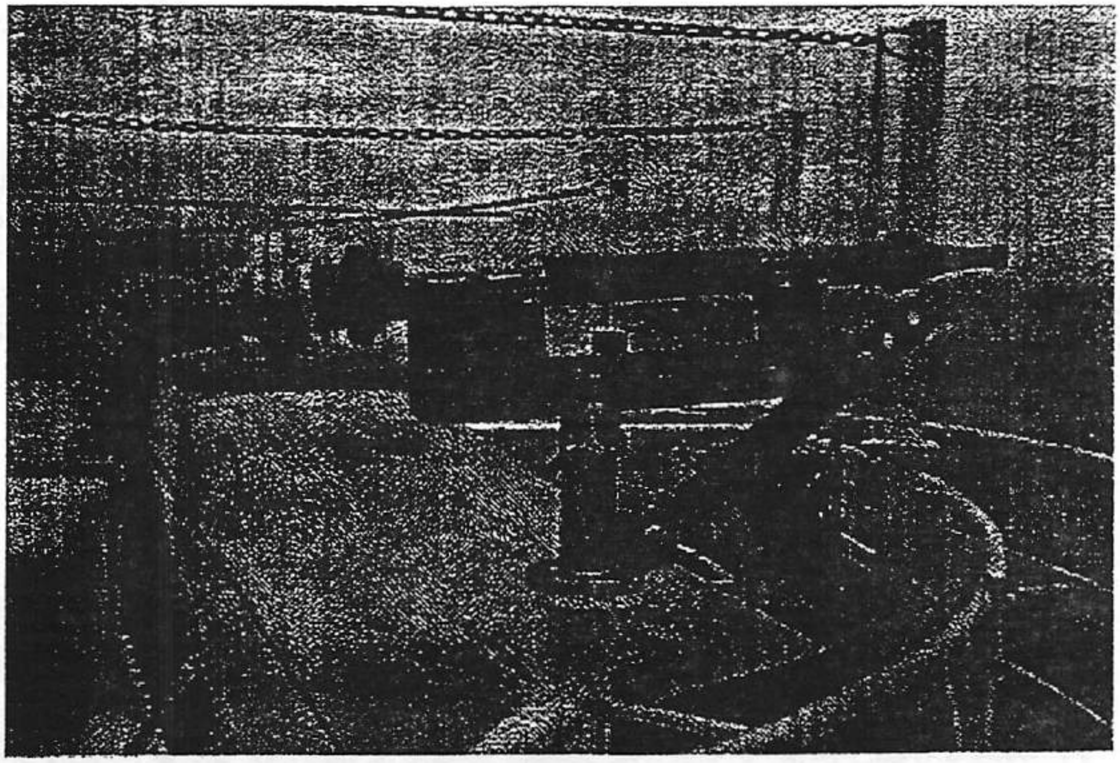

Figure 32. Experimental water cannon on a pelagic longliner (courtesy S. Lake).

Magnetic deterrents

Several commercially available bird scaring devices produce a magnetic field, claimed to interfere with receptors that birds have for detecting such forces. A wind-driven propeller with attached magnets tested by the Japan Tuna Fisheries Co-operative Associations on pelagic longliners in 1993/94 had no significant effect on seabird catch (Brothers *et al.* submitted ms). The same device in an albatross breeding colony was either ignored or pecked inquisitively (N.P. Brothers, JFA unpubl data). A literature search failed to indicate that a device of this nature could be effective as a bird scarer. Magentic deterrents are unlikely to offer protection to the 100 m or more astern required with present line-setting methods. More powerful super conducting or electromagnetic devices have not be assessed.

Smoke deterrents

In favourable conditions (line setting against the wind) smoke emitted from refuse disposal incinerators has been reported to have a discouraging effect on seabirds astern (T. Arimoto *in litt.*). Inability to control wind direction makes this most unlikely to be of value as a deterrent.

Education

Fishers need to understand why catching birds should be avoided. in the past there has been insufficient financial incentive alone but with additional incentives now emerging the process of resolution is perhaps unavoidably reliant on cooperative strategies. This is why a process of information gathering about fishing and bird interactions evolved for fishers who have the incentive and knowledge to solve the problem - for their own sake as well as for the birds. The first educative booklet was published in Japanese with English and Indonesian summaries (Brothers 1994a, Fig. 33), 2000 of which were distributed by the Japan Tuna Fisheries Co-operative Associations to all Japan's vessels and their owners. This booklet was the basis of an English version (Brothers 1995b), 3000 of which were distributed by the Australian Fisheries Management Authority to all vessels and fisheries officers in Australia with further copies provided for distribution in New Zealand and elsewhere upon request. This version has since been translated and distributed to Vietnamese and Korean longline operators (E. Flint *in litt.*). It also formed the basis for a CCAMLR booklet (CCAMLR 1996) distributed to CCAMLR member nations in English, French, Russian and Spanish versions.

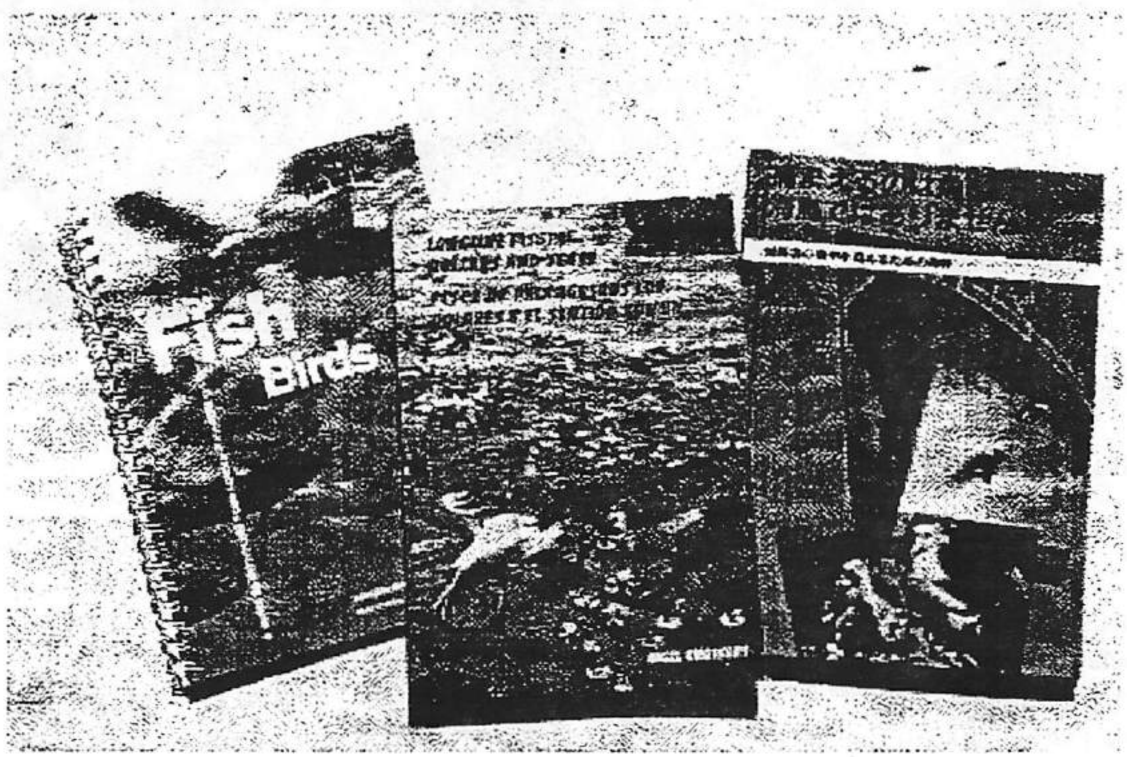

Figure 33. Books for fishermen describing mitigation methods and giving information about seabirds

A more comprehensive edition of Brothers (1995b) for all longline methods was produced in combined English and Spanish (Brothers 1996). Of the 4500 distributed mostly to fishers worldwide, 3000 of these were ordered by the North Pacific Longline Association. An Afrikaans translation, as yet unpublished, has been made for use in South Africa's domestic longline fisheries (P.G. Ryan pers. comm.). Other educational products include articles in fishing and environmental magazines and pamphlets (e.g. Anon. 1991, Anon. 1997e, Duckworth & Wells 1995) and videos produced for the North Pacific demersal longline fisheries (T. Smith *in litt.*) and for the Spanish twin-line system by N.P. Brothers and distributed throughout South America.

For many years the Japan Tuna Fisheries Co-operative Associations have disseminated information directly to Japanese longline vessels, placing this fleet well ahead of most in awareness of bird problems and the solutions available. Similarly active are international and several national fisheries and nature conservation bodies.

A balanced attitude is desirable. Too much pressure where concerted efforts are already being made by fishers is potentially destructive to the adoption of mitigation measures Fisheries and nature conservation managers should be aware of appropriate mitigation regulations.

Research and development needs

1. Maintain and improve education/information dissemination and extend to all longline fishing nations.
2. Preparation of appropriate materials to incorporate in training courses for fishers.
3. Preparation of appropriate materials for distribution to equipment and vessel manufacturers in order to stimulate development of new mitigation measures.

Stock enhancement

The term stock assessment is taken to mean the managing or manipulation of existing seabird populations with the intention of their increasing abundance and or distribution. If killing seabirds on hooks threatened populations then achieving population increases could conceivably be a mitigation measure (one that could also absolve fishers from having to use alternative methods of mitigation). Perhaps the best relevant example of such a process is that to assist recovery of Short-tailed albatrosses (Hasegawa in Gales 1993). In this instance, the species natural rate of recovery was assisted by nesting habitat improvement and relocation to more secure habitat using decoy birds. However. the fixed life-strategies (e.g. high fidelity to breeding site, fixed clutch size, etc.) of most seabird species affected suggests that success potential is likely to be very low

5.14 PRESCRIBING MITIGATION MEASURES

This is not an easy task particularly because the following points must be considered.

i) suitability and effectiveness of existing devices has been poorly demonstrated.
ii) uncertainty of options given that a number of these have yet to be developed.
iii) effectiveness of an option is closely related to the degree of need for monitoring to ensure that it is being used.

To complicate matters further there is the prospect of combining use of certain measures to improve overall mitigation performance. Take for example just the following six measures, bait-scaring lines, night setting, line weighting, bait quality, Bait-casting machines and underwater setting. There are 30 combinations in which these measures can be applied with varying consequence to bird catch rate reduction.

Further, the degree of benefit can also vary depending upon the longline method. This is illustrated in Table 11, assuming that underwater setting alone would avoid bird mortality totally and that all measures or combinations of measures are to be consistently and correctly used.

Apart from the preceding considerations to mitigation measure selection there is also the need to include suitability criteria. These can be safety aspects, set up and operating costs, impact on catch rates (other than bird), all of which can determine whether a measure will be used irrespective of its bird-catch rate reduction performance - the unavoidable problem of compliance.

5.15 IMPEDIMENTS TO MITIGATION

Practical complications have already been covered in this report but there can be other impediments to progress. Internationally recognised experts were asked what impediments they saw to mitigation measure progress. Their answers are summarised below. Assessing such issues can be important for determining an effective mitigation process. Opinions were sought from 11 persons from seven nations and they identified five key problem areas.

Lack of education was the most frequently mentioned deficiency, followed by issues relating to compliance. Lack of general awareness of the issue, excessive pressure on fishermen to perform, and inadequate mitigation measure development were all considered important.

Compliance with the use of mitigation measures

Already discussed is the probability that an effective mitigation measure is only one that will be used without the need for monitoring or regulations. So far, it would seem measures of this nature are either yet to evolve, be widely available or be widely used. Inevitably regulatory processes have therefore been adopted in an attempt to ensure compliance and to date apply to measures that fishermen cannot be bothered to use or have preconceived ideas about economic or logistic consequences. Regulations pertaining to bird mortality reduction now exist for the longline fisheries of a number of nations and also apply to vessels of one nation (Japan) irrespective of whose regulatory influence the waters being fished are under. There is also one convention (CCAMLR) to which many nations are signatories where regulations apply. The nature of these regulations are summarised in Table 12.

No other nations are known to have applied regulations and with the exception of Japanese vessels all other vessels to which regulations apply need not comply if fishing beyond their EEZs. New Zealand is apparently investigating this deficiency for application to its own vessels. The status (in a regulatory sense) of instructions to Republic of Korea vessels is uncertain.

Table 11 An example of the complexities in application of mitigation measures and how effectiveness can vary with longline method (catch reduction figures have been estimated)

Mitigation Measures for Line Setting	Seabird Catch Rate Reduction Estimate (%)	
	Longline Method	
	Demersal	Pelagic
Underwater setting	100	100
Night setting	90	80
Night setting + BSL	95	90
Night setting + line weight	100	90
Night setting + bait quality	90	85
Night setting + BCM	N/A	85
Night setting + BSL + line weight	100	95
Night setting + BSL + bait quality	95	80
Night setting + BSL + BCM	N/A	95
Night setting + line weight + bait quality	100	95
Night setting + line weight + BCM	N/A	95
Night setting + bait quality + BCM	N/A	95
Night setting + BSL + line weight + bait quality	100	95
Night setting + BSL + line weight + BCM	N/A	95
Night setting + BSL + line weight + bait quality + BCM	N/A	98
BSL	80	70
BSL + line weight	90	85
BSL + bait quality	80	80
BSL + BCM	N/A	75
BSL + line weight + bait quality	90	90
BSL + line weight + BCM	N/A	85
BSL + BCM + bait quality	N/A	80
BSL + line weight + bait quality + BCM	N/A	90
Line weight	80	60
Line weight + Bait quality	80	75
Line weight + BCM	N/A	70
Line weight + Bait quality + BCM	N/A	80
BCM	N/A	40
BCM + bait quality	N/A	50
Bait quality	0	20

Table 12. **Regulations in effect for reducing seabird catch by longline fisheries**

Country or Convention	Year of adoption	Fishery type	Area of application	Mitigation measure required
Australia	1995	Pelagic (tuna)	AFZ south of 30°S	BSL
Japan	1997	Pelagic	High seas	BSL
New Zealand	1993	Pelagic	EEZ	BSL
South Africa	199?	Demersal	Sub-Antarctic EEZ	As for CCAMLR
South Africa	1998	Pelagic	EEZ	BSL, offal discharge
United Kingdom	?	Demersal	Outer fishing zone of FalklandIslands/ Malvinas	BSL, (weighted lines, night setting if instructed specifically)
U.S.A.	1997	Demersal	West Pacific EEZ	BSL, towing objects, weighted lines, offal discharge, underwater setting, night setting
U.S.A.	-	Pelagic	Hawaii EEZ (planned)	
CCAMLR	1992	Demersal	CCAMLR region	BSL, weighted lines, offal discharge, night setting

5.16 THE FUTURE

Alexander *et al* (1997) provide a list of international treaties, conventions, agreements and international multilateral agencies with a relevant management role in this issue. To add to this list are processes that have occurred or have been planned to address the problem such as a Workshop on the Incidental Mortality of Albatrosses in Longline Fisheries (a by-product of the First International Conference on the Biology and Conservation of Albatrosses, 1995), a London workshop on environmental science, comprehensive and consistency in global decision on ocean issues (Dunn 1995), the establishment of the International Southern Oceans Longline Fisheries Information Clearing House (1997), and the FAO consultation for developing draft mitigation guidelines and a Plan of Action (FAO 1998).

Other activities underway that involve development or assessment work related to seabird mortality reduction include:

NMFS, USFWS & IPHC	research plan to test effectiveness of the required mitigation measures.
WPRFMC	seabird workshop and research planning meeting and recent funding to conduct studies on effectiveness of seabird avoidance measures (1998)
IMR	project to develop an effective, cheap and easy to use device and demonstrate efficacy (1998)
EA	TAP process to formulate mitigation measures and a process of efficacy assessment and further developments (Environment Australia 1997).

NMFS	National Marine Fisheries Service (USA)
USFWS	U.S. Fish & Wildlife Service
IPHC	International Pacific Halibut Commission
WPRFMC	Western Pacific Regional Fisheries Management Council (USA)
IMR	Institute of Marine Research (Norway)
EA	Environmental Australia

There are other similar processes underway or planned, many of which have been specified within this report's separate discussions on each different mitigation measure.

The fishing industry often finds it difficult to see any benefit from most of these processes because it bears the brunt of criticism and condemnation irrespective of individual efforts made toward mitigation. This in turn can result in a reluctance to embrace the need for mitigation, but the fishing industry can benefit from the injection of ideas and developments that result from an increased awareness of the issue of seabird incidental catch from longlining.

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AGENDA B-5
DECEMBER 1998
ATTACHMENT D

Test Plan
to Evaluate Effectiveness of Seabird Avoidance Measures Required in Alaska's Hook-and-Line Groundfish and Halibut Fisheries

April 1998

Prepared by: National Marine Fisheries Service: Protected Resources Division, Alaska Regional Office; Sustainable Fisheries Division, Alaska Regional Office; Alaska Fisheries Science Center, Auke Bay Laboratory

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U.S. Fish and Wildlife Service, Endangered Species/Ecological Services; U.S. Fish and Wildlife Service, Migratory Bird Management; International Pacific Halibut Commission; Washington Sea Grant Program.

Authors: Janey Fadely, Kim Rivera, Mike Sigler, John Karinen, Jeff Fujioka.

Note: This test plan is a working document which will be updated and amended as needed. Comments should be directed to: Dr. Steve Zimmerman, Assistant Administrator for Protected Resources, National Marine Fisheries Service, P.O. Box 21668, Juneau, AK 99802

Definitions of some terms are provided in Appendix E

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INTRODUCTION

Seabird bycatch in longline fisheries is a global problem, and has received considerable attention in recent years from resource agencies, industry and the environmental community. "Seabird bycatch" in longline fisheries is the incidental mortality of seabirds on longline hooks. Mortality occurs if seabirds attempt to steal bait from longline hooks as the line is being deployed from the stern of the fishing vessel. Until the line sinks below a depth at which it is accessible to surface feeding seabirds, it attracts birds; birds that attempt to take bait off the line can be hooked, dragged underwater and drowned. Seabird bycatch occurs internationally, but the magnitude of the problem in fisheries around the North Pacific has only recently become evident.

Longline fisheries in Alaska's waters are demersal longline fisheries, and in general use three types of longline gear: autoline, fixed and snap gear. Autoline gear consists of a machine that baits the hooks as they are set, and racks the hooks in a magazine upon retrieval. Fixed gear consists of sections of groundline that get baited, tied together, set, and retrieved by crew members. Snap gear is groundline wound on a drum such that baited hooks are snapped onto the line as it spools off the drum, and unsnapped as the drum retrieves the line. Autoline gear is used almost exclusively by large freezer vessels which fish for Pacific cod and sablefish. Fixed gear is used by freezer longliners, by some other vessels fishing for groundfish, and by most halibut and sablefish vessels. Snap gear is used by smaller halibut and groundfish vessels, by inexperienced crews, or in regions that prefer the gear for other reasons.

In all cases, the gear interacts with the water in a similar manner (Figure 1). Gear on fixed gear vessels is set off the stern over a chute that uses centrifugal force to straighten out the gangion and drop the bait away from the groundline to minimize tangles. The groundline and bait float for a

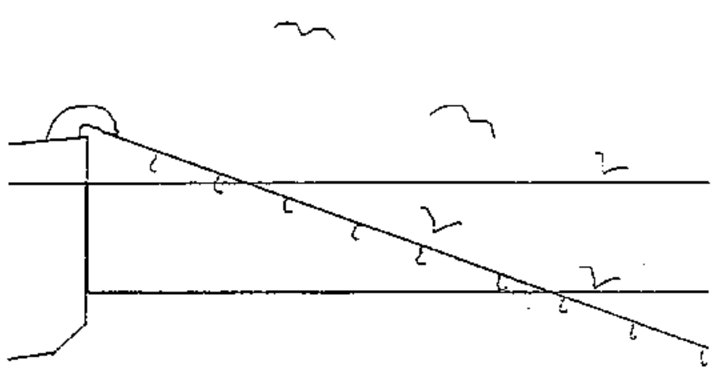

Figure 1. Illustration showing longline gear deployment from the stern of a longline fishing vessel. Shaded area represents the "vulnerable zone" within which seabirds can access baited hooks.

few seconds before sinking as a result of anchors attached (about 20 kg) at the beginning of the set, and sometimes additional weights (0.5-2 kg) on the groundline. The groundline will sink at various rates depending on vessel speed, groundline weighting, and weather.

Bird mortality from longlines occurs in three steps. First, birds must land in the vicinity of the longline gear. Second, birds must then attack the bait before it sinks out of range. Third, birds must take the hook, get caught, dragged underwater and drown. Each of these steps offers an opportunity to decrease the vulnerability of birds to longline mortality.

Conversations with fishermen indicate that the bait and groundline sink below seabird attack range within about 25-30 m (about one boat length) after the line enters the water, and that birds will only attack bait when they are within 3-6 m laterally of the groundline. In windy conditions, birds land only on the down wind side of the groundline, as the birds must fly into the wind to land.

Techniques have been developed by fishery managers around the world to minimize seabird bycatch in longline fisheries. These range from very inexpensive measures (attaching weights to the groundline or flying tori lines over the groundline) to moderately expensive measures (refitting vessels with tubes that permit underwater deployment of the line). Studies have shown that some measures significantly reduce bait loss/seabird mortality; for example bait loss was reduced by up to 69% with the use of a tori line (see Appendix E for definitions of terms) during a study on a Japanese longline vessel off the Tasmanian coast (Brothers 1991).

In Southern Oceans, use of specific deterrent methods is required by regulation; in other fisheries, the use of deterrent devices has been promoted by outreach and education efforts that emphasize the reduction in bait loss resulting from correctly deployed deterrent devices and methods.

Seabird bycatch occurs in Alaska's longline fisheries: mortalities have been documented by fishery observers in the groundfish fishery, and are also likely to occur in the halibut fishery due to similarity in fishing gear, techniques and areas. The magnitude of seabird bycatch in the Pacific halibut fishery is unknown because most of the fishing effort is currently unobserved. Preliminary estimates by the U.S. Fish and Wildlife Service (USFWS; R. Stehn, pers. comm.) for groundfish observer data collected and summarized by the NMFS Observer Training Center indicate that the rate of take may be close to one bird mortality for every 10,000 hooks set. Given that approximately 15 million hooks are set annually in the halibut fishery and approximately 201 million hooks are set annually in the groundfish fishery in Alaska (excluding halibut), the number of seabirds potentially killed as bycatch of longline fishing in Alaska could be significant at the population level for species at low abundance or species facing significant threats. Analyses are currently being conducted by the USFWS to estimate numbers of birds, by species, that have been taken annually in Alaska's groundfish fisheries. Once these analyses are complete, this information may be used in developing or refining methodology for the test program.

In recognition of the seabird bycatch problem in Alaska, the National Marine Fisheries Service

(NMFS) recently issued regulations that require operators of groundfish longline vessels in Alaska to employ seabird bycatch avoidance gear and methods intended to reduce seabird bycatch and incidental seabird mortality. Promulgation of these regulations was expedited in Alaska by the need to reduce the likelihood of "take" of the endangered short-tailed albatross (*Phoebastria albatrus*), but reducing mortality of other unlisted seabirds is also a recognized goal. The regulations were based on a request from longline fishermen to the North Pacific Fishery Management Council, who recognized that seabird bycatch, especially of the endangered short-tailed albatross, could have negative implications for the future of the fishery if unaddressed. In March 1998, the requirements for seabird avoidance measures were expanded to include vessels in the Pacific halibut fishery.

To reduce the incidental take of seabirds in the Bering Sea/Aleutian Islands (BSAI) and Gulf of Alaska (GOA) groundfish longline fisheries and the Pacific halibut fishery, vessels are required to:

(1) Use hooks that when baited, sink as soon as they are put into the water.

(2) Discharge offal from vessels in a manner that distracts seabirds, to the extent practicable, from baited hooks while gear is being set or hauled. The discharge site on board a vessel must either be aft of the hauling station or on the opposite side of the vessel from the hauling station.

(3) Make every reasonable effort to ensure that birds brought on board alive are released alive and that wherever possible, hooks are removed without jeopardizing the life of the birds.

(4) Employ one or more of the following seabird avoidance measures:

  (a) Tow streamer line or lines during deployment of gear to prevent birds from taking hooks;

  (b) Tow a buoy, board, stick or other device during deployment of gear, at a distance appropriate to prevent birds from taking hooks. Multiple devices may be employed;

  (c) Deploy hooks underwater through a lining tube at a depth sufficient to prevent birds from settling on hooks during deployment of gear; or

  (d) Deploy gear only during specified hours of darkness, using only the minimum vessel lights necessary for safety.

Vessels less than 26 feet length overall are exempt from the requirements under number (4) above.

Critics of these regulations have argued that the more stringent measures required by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR 1996) in southern oceans (Appendix A) should be adopted in Alaska's fisheries. Although similar to NMFS regulations in many ways, CCAMLR regulations are more stringent in that they require vessels to set longlines only at night, and to deploy tori lines at all times during fishing operations. However, there are currently no data on the effectiveness of any deterrent measures in Alaska's fisheries. The appropriateness of the CCAMLR measures for the conditions of the Gulf of Alaska and Bering Sea is therefore unknown. NMFS and USFWS agreed to endorse more flexible requirements initially for Alaska to allow fishermen, managers and scientists to experiment with devices and determine their effectiveness. Testing the effectiveness of seabird bycatch avoidance measures will allow NMFS to better ascertain if they are effective in the Alaskan fisheries. Once measures have been tested, NMFS will be better able to revise regulations to maximize their effectiveness. This may include specific performance standards for the seabird avoidance measures, if appropriate.

Studies in southern oceans have indicated that restricting longline sets to hours of darkness can significantly reduce bait loss and therefore reduce seabird mortalities (Brothers 1991). However, before such a measure could be employed in Alaska's fisheries, a careful evaluation of the feasibility of conducting all sets during darkness must be undertaken. In the Bering Sea for example, a requirement for setting during hours of darkness could prohibit fishing during summer months. If other methods are available to effectively reduce seabird mortalities during the times of year and in areas where there is little or no darkness, those methods should be employed first. Additionally, the potential affect on night-foraging seabird species in this oceanic region would also need to be evaluated.

Under the Endangered Species Act of 1973, as amended (ESA), the short-tailed albatross is afforded certain protections. Under section 7(a)(2) of the ESA, any agency that authorizes, funds or carries out an activity that may affect a listed species must ensure that the action is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. Compliance with section 7(a)(2) for endangered or threatened seabirds is accomplished through interagency consultation with the USFWS.

Biological Opinions prepared by USFWS on the effects of the groundfish and halibut fisheries on the endangered short-tailed albatross determined that the fisheries are not likely to jeopardize the continued survival and recovery of the species. The accompanying incidental take statements authorize incidental take of up to 4 short-tailed albatrosses (as reported by fishery observers) every 2 years in the groundfish fishery, and up to 2 short-tailed albatrosses every 2 years in the halibut fishery. Included in these authorizations, however, are mandatory "reasonable and prudent measures" which NMFS is required to undertake to minimize mortality of short-tailed albatrosses in the fisheries. These direct NMFS to : 1) require the use of seabird deterrent devices, 2) develop a plan to test the effectiveness of the required seabird bycatch avoidance gear and methods, and 3) implement the test plan. The ESA also requires, under section 7(a)(2) that federal agencies utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of listed species. This research plan has been prepared in compliance with section 7 of the ESA.

Biology of Affected Species in the Gulf of Alaska and Bering Sea/Aleutian Islands

In Alaska's longline fisheries, which occur in the GOA and BSAI areas, mortalities have been reported for the following species of seabirds at levels which cause concern: short-tailed albatrosses, black-footed albatrosses (*Diomedea nigripes*), Laysan albatrosses (*Diomedea immutabilis*), northern fulmars (*Fulmarus glacialis*), shearwaters, and gulls. Preliminary analyses of groundfish fishery observer data on seabird mortalities conducted by USFWS indicate that norther fulmars are the species most frequently caught on Alaska groundfish fishery longlines with an estimated annual take of 8,450 northern fulmars in the GOA and BSAI annually between 1993 and 1996. The preliminary estimates for annual mortalities for short-tailed, black-footed and Laysan albatrosses during the same period were 1 bird, 538 birds, and 938 birds respectively. The preliminary estimate for total annual bird mortalities was 13,042 birds including fulmars, gulls, shearwaters and albatrosses. The following summaries provide some information on population status and distribution of the affected species.

Short-tailed albatross

Short-tailed albatrosses were once considered the most common albatross ranging over the United States continental shelf (Sherburne 1993). Reports of the species in the late 1800s and early 1900s characterized the species as "more or less numerous" in the vicinity of the Aleutian Islands (Yesner 1976), abundant around Cape Newenham in western Alaska (Turner in DeGange 1981), and abundant near the Pribilof Islands (Ventaiminov in DeGange 1981). Remains of short-tailed albatrosses found in middens suggest that hunters in kayaks had access to an abundant nearshore supply of the species from California north to St. Lawrence Island (Howard and Dodson 1933, Murie 1959, Yesner and Aigner 1976).

Historically, short-tailed albatrosses nested on numerous Japanese islands in the Western Pacific Islands but the breeding range for the world's population is now restricted to two islands: the main colony on Torishima Island and a very small colony on Minami-Kojima Island. The ownership of Minami-kojima is disputed between Japan, the Peoples Republic of China, and the Nationalist Republic of China (Sherburne 1993). These two islands are remnant populations of the numerous historic breeding sites known during the 1800s. The species is a Special National Monument in Japan, and Torishima Island is a Japanese Nature Reserve National Monument (Hiroshi Hasegawa, Toho Univ. 1997, pers. comm.)

Short-tailed albatross are thought to have historically numbered in the low millions (Hasegawa and DeGange 1982). Over 5 million short-tailed albatrosses were harvested between 1885 and 1903 from breeding colonies in Japan (Sherburne 1993) for down (used in pillows and quilts), feathers (used for writing quills), and for use in fertilizer and other products (Yamashina in Austin 1949). In addition, the largest colony at Torishima Island in Japan, was inundated by volcanic lava and ash in 1903 and 1939; this colony, also heavily harvested, was reduced to less than 50 birds, which apparently represented the world population of short-tailed albatrosses at that time (Tickell 1975). The population on Torishima Island had increased to at least 100 birds by 1951 (Environment Agency 1980).

Over the past several decades, significant efforts by Japanese scientists and the Japanese government have resulted in a steady increase in the number of short-tailed albatrosses on Torishima Island. The adverse effects of mudflows have been somewhat mitigated by habitat restoration work on the island. Current population enhancement efforts are focused on attracting breeders to an alternate breeding site on Torishima that is less likely to be decimated by mudflows.

The population of short-tailed albatrosses on Torishima Island continues to grow. Nevertheless, the world population remains perilously low; the breeding population is currently fewer than 400 individuals, and the total world population numbers fewer than 1000 birds.

Short-tailed albatrosses are listed under the ESA as endangered outside the United States (listing within the U.S. was excluded due to an administrative oversight, but the USFWS is currently preparing a proposal to apply the endangered status throughout the range of the species). This species is considered by the IUCN to be endangered (80% decline in the past 10 years or three generations, whichever is longer), with criteria C1 (number of mature individuals <250 with a decline of 25% in the past three years or 1 generation, whichever is longer; World Conservation Monitoring Centre 1998).

The USFWS short-tailed albatross observation database documents the location of short-tailed albatrosses opportunistically observed at sea in the GOA and BSAI since the late 1940s (Figure 2). Many of these observations came from observers or fishermen on fishing vessels; distribution information may therefore be biased towards locations where vessels fish. The temporal distribution of short-tailed albatross observations by fishery observers in Alaskan waters since 1990, corrected for variation in observer coverage in each month (called the abundance index; Stehn, pers. comm., USFWS 1998), shows a definite seasonality to the species presence in Alaskan waters (Figure 3). These data suggest that short-tailed albatrosses are far more abundant in waters off Alaska between May and September, their nonbreeding season.

Five short-tailed albatrosses are known to have been taken by longline fisheries in Alaska from 1983-1996. It is likely that additional birds have been taken but were either not reported, fell off the hook before haul, or were not correctly identified by observers or crew. Although the world population of short-tailed albatrosses is slowly increasing despite take associated with longline fishing, the population is vulnerable to catastrophic losses from monsoon rains, volcanic activity, oil spills or other factors. If the recovery of the species were slowed due to catastrophic events or other factors, actions required for conservation of this species could adversely affect the fishing industry. The best defense against this possibility is to ensure that bycatch of seabirds is reduced as much as possible through aggressive and consistent use of deterrent measures during longline fishing.

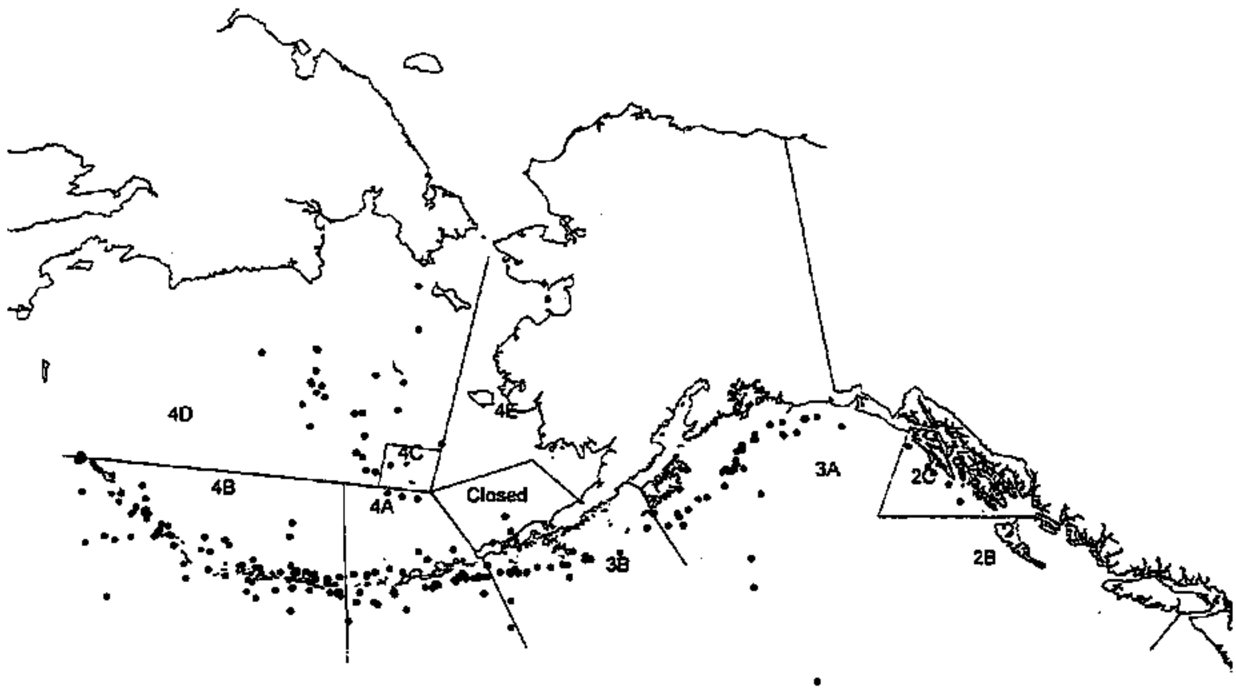

Figure 2. Location of short-tailed albatross sightings in the U.S. Fish and Wildlife Service short-tailed albatross database. Points are overlaid on a map of IPHC regulatory zones. Locations may partially represent distribution of groundfish and research vessels within the albatross' range.

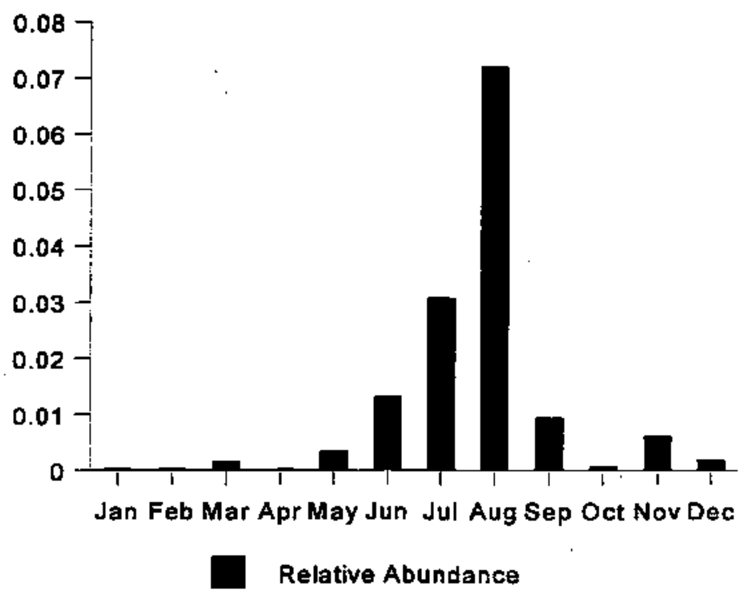

Figure 3. Abundance index for short-tailed albatross in waters off Alaska. Generated from groundfish observer data adjusted for observer effort.

Black-footed albatross

Black-footed albatrosses breed in numerous colonies on islands in the Hawaiian chain, and in several small colonies on islands south of Japan. They range throughout the North Pacific north into the Bering Sea (McDermond and Morgan 1993). As a result of surveys conducted between 1979 and 1982, the world's breeding population of black-footed albatrosses was estimated at 50,000 pairs with an estimated total population of 200,000 birds (McDermond and Morgan 1993).

Black-footed albatrosses are regular non-breeding visitors to the Gulf of Alaska, but are uncommon in the Bering Sea (Gould et al. 1982). In Eastern Pacific waters, black-footed albatrosses outnumber Laysan albatrosses, but Laysan albatrosses tend to outnumber black-footed albatrosses in the Western Pacific and Bering Sea (Gould et al. 1982). During shipboard and aerial surveys in the 1970s, black-footed albatrosses were observed from March through November over the deeper waters of the GOA; monthly frequency and relative abundance were high from June through October, and peaked in September (Gould *et al.* 1982). Black-footed albatrosses were uncommon in the Bering Sea and were restricted to deep waters near the Aleutian Islands (Gabrielson and Lincoln 1959); sightings in the Bering Sea occurred between July and October (Gould et al. 1982, Schneider and Shuntov 1993). Black-footed albatrosses are surface feeders, feed both day and night, and their diet includes squid, crustaceans, and offal (Shuntov in Schneider and Shuntov 1993).

Laysan albatross

Laysan albatrosses breed in numerous colonies on the Hawaiian Islands, in two small colonies off Baja California, and in one small colony on Torishima Island south of Japan (Gould and Hobbs 1993, McDermond and Morgan 1993). Surveys between 1979 and 1982 indicated a total breeding population of 380,000 breeding pairs and a world population of approximately 2.5 million birds (Fefer et al. in McDermond and Morgan 1993). Comparison with historical numbers appears to indicate an increasing trend in the population, but differences in census techniques could account for this difference (McDermond and Morgan 1993).

Laysan albatrosses are more abundant in the Bering Sea than in the Gulf of Alaska (Gould *et al.* 1982). In the Bering Sea, they outnumber and occur farther north than black-footed albatrosses (Gould et al. 1982). In winter, distribution is restricted to more southern locations in the Bering Sea (Schneider and Shuntov 1993). In the Gulf of Alaska, observations were recorded from March through November throughout deeper waters during shipboard and aerial surveys in the 1970s; monthly frequency and relative abundance were highest in September and October in the Gulf (Gould et al. 1982). Most sightings in the Gulf of Alaska were near s waters in the western half of the area (Gould et al. 1982). Laysan albatrosses are surface feeders and feed both day and night (Schneider and Shuntov 1993).

Northern Fulmar

Northern fulmars breed on offshore islands in the Bering Sea and eastern GOA, and are found year round throughout the Bering Sea and along the coast as far south as southeast Alaska. They are crepuscular surface feeders with a diet concentrated on fish and invertebrates that rise to the surface at night, but they also feed offal from factory ships (Schneider and Shuntov 1993; Schneider et al. 1986, Hunt et al. 1988). In the Bering Sea, they are uncommon over waters greater than 50m deep except along the 200m isobath between Unimak Pass and the Pribilof Islands (Gould et al. 1982). Northern fulmars are also resident throughout the Gulf of Alaska with numbers at sea highest in or near s habitats (Gould et al. 1982).

Northern fulmars are "strongly attracted" to ships which they will "follow for extended periods of time feeding on garbage or offal thrown overboard" (Gould et al. 1982).

Shearwaters

Shearwater species most common in the North Pacific and therefore most likely to be caught on longline hooks in Alaska's fisheries are sooty shearwaters (*Puffinus griseus*) and short-tailed shearwaters (*Puffinus tenuirostris).* Sooty and short-tailed shearwaters occur in the Bering Sea and GOA during the summer and fall (Gould et al. 1982). Diets of these shallow-diving feeders includes fish and zooplankton. Other shearwaters that may be caught on longlines includes flesh-footed shearwaters (*Puffinus carneipes*) and pink-footed shearwaters (*Puffinus creatopus*).

Gulls

Gull species most common in pelagic waters of the GOA and BSAI, and therefore most likely to be caught on longline hooks in Alaska's fisheries are glaucous gulls (*Larus hyperboreus*) and glaucous-winged gulls (*Larus glaucescens*). In the Bering Sea, both species are found over s habitats between the eastern Aleutian and Pribilof Islands; glaucous-winged gulls are also common over bay and continental shelf habitats in the same area (Gould et al. 1982).

OBJECTIVES

The objectives of this test plan are to:

1. Obtain high quality information on the effectiveness of seabird deterrent devices in North Pacific waters on which to base future amendments to the regulations requiring the use of seabird deterrent devices in Alaska's longline fisheries;

2. Minimize the bycatch of seabirds in Alaska's longline fishery;

3. Ensure that the fisheries and the agencies are in compliance with the Endangered Species Act and the Migratory Bird Treaty Act;

4. Minimize future risk to the groundfish and halibut fishery by maximizing the effectiveness of seabird deterrent devices and reducing the likelihood of short-tailed albatross mortalities.

5. Continue to use a partnership approach with industry, the resource agencies, and others to address the issue of seabird bycatch.

IMPLEMENTATION SCHEDULE

This Plan outlines a process by which mitigation measures for Alaska's longline fisheries will be evaluated. An effective program of evaluation cannot be based on one approach; information must be collected and evaluated through a variety of mechanisms. The elements of the plan have been outlined for implementation in phases. This will allow for incorporation of results from tasks in phase I to be incorporated in subsequent phases, and will allow for some flexibility in timing of implementation to accommodate resource constraints. Further changes in scheduling may be required if the resources to implement the plan on the identified schedule are not obtained, or if unanticipated resources become available. The implementation schedule is as follows:

Phase I (1998-2000)

A. Comprehensive Literature Review: complete a report analyzing existing information, both domestic and international, on the effectiveness of seabird deterrent devices on longline fishing vessels globally.

B. Report on Night Fishing: complete a report analyzing existing information on the potential conservation benefits for seabirds, and feasibility of implementing, a requirement for night setting for longline fishing in the GOA and BSAI areas. If the report indicates that implementation of night fishing should be considered, experimental tests of the effectiveness of night fishing in reducing seabird bycatch should be planned.

C. Methodology Development: develop methodologies for: 1) designed experiments to test effectiveness of specific deterrent measures and, 2) data collection by observers on the effectiveness of deterrent measures used aboard observed vessels.

D. Fishing Industry Input/Data: continue to solicit and gather information from fishermen on effectiveness of seabird deterrent measures they have used. Conduct public meetings and attend association meetings to solicit input on specific measures, and compile input into annual reports.

Phase II (1999-2000)

A. Experimental Testing: conduct designed experiments to evaluate, as a minimum, the effectiveness of tori lines and bird buoys in deterring seabirds from baited longlines. Complete a report on the results of the experimental testing and make recommendations for: 1) any changes needed to the existing regulations on seabird deterrent measures, 2) need for further testing, and 3) any changes in methodology for future testing.

B. Special Project Seabird Observers: deploy a limited number of fishery observers in both the groundfish and halibut fisheries (approximately five 3-week observer trips in each fishery) for a special project to observe and record information on deterrent devices and seabirds. Complete a report on the results of the observer project and make recommendations for: 1) any changes needed to the existing regulations on seabird deterrent measures, 2) need for further testing, and 3) any changes in methodology for future testing.

C. Fishing Industry Input/Data: continue to solicit and gather information from fishermen on what seabird deterrent measures are effective. Conduct public meetings and attend association meetings to solicit input on specific measures, and compile input into annual reports.

Phase III (2000-2002)

As recommended by reports, or determined necessary, conduct additional experiments, continue deployment of special project observers, and continue to solicit and compile input from industry.

Specific objectives, materials and methods, and reporting plans will be organized by the implementation schedule outline for the remainder of this document.

PHASE I

A. Comprehensive literature review

Limited information exists on the effectiveness of seabird deterrent devices worldwide, and no scientifically collected information exists to evaluate the use of specific deterrent devices in the North Pacific. The first step of the test plan is to compile all available information, from both scientific reports, education and outreach materials, anecdotal reports, and any other source into a report. Much of this information has recently been compiled by several authors into reports for the Food and Agriculture Organization's international consultation on the global seabird bycatch problem. Once these reports become available outside the FAO seabird bycatch technical committee, the information should be synthesized into a literature review.

B. Report on Night Fishing

Information from other fisheries globally indicates that night fishing may be one of the most effective ways to reduce seabird bycatch on longlines. Night fishing is required in CCAMLR regulations, but was included only as one option in Alaska's regulations. Critics of Alaska's regulations have argued that night fishing should be more stringently required in Alaska. However, it is unclear whether night fishing would be an effective seabird deterrent measure in Alaska. Laysan albatrosses and northern fulmars are known to feed at night in the North Pacific. In addition, at least in certain areas during summer months, there is little or no darkness available. Therefore, a report should be prepared which analyzes the potential benefits and the potential problems that are associated with night setting in Alaska's fisheries.

C. Methodology development for experiments and observers

The NMFS Auke Bay Laboratory, in cooperation with the Juneau Sustainable Fisheries Division, developed a proposed protocol (hereafter referred to as the Auke Bay protocol) for the seabird test plan (Appendix B). Sections of the Auke Bay protocol have been incorporated into this Plan; the remainder of the Auke Bay protocol can be used as a helpful reference in developing the specific methodologies for the test plan.

The goal of the methodology development phase of the project is to develop protocols for both research cruises and for dedicated seabird observer projects. The effectiveness of seabird deterrent devices is difficult to measure because of the many factors that contribute to the number of seabirds that are attracted to baited hooks or hooked during a given longline set. Therefore, sampling protocols must be developed carefully, and with adequate input from experts in sampling design for fisheries/seabird interactions. This document does not outline specific protocols, but rather provides guidance for development and implementation. A contract should be issued to an appropriate contractor to develop methodologies for hypothesis testing, data gathering and analyses. Methodology development will include at-sea testing of proposed protocol; opportunity will be provided for agency and industry personnel to participate in one or more days of the at-sea tests.

Contractors for design and implementation of the experiments should include individuals with substantial experience and skills in the following areas: 1) design and implementation of quantitative seabird surveys at sea, 2) identification and censusing of seabirds from a shipboard platform, 3) quantifying and distinguishing seabird behaviors, 3) sampling design for field experiments, 4) quantitative analyses of survey results, 5) commercial longlining techniques.

Experiments should be designed to yield statistically sound sample sizes given the specifics of the conditions in which they will be conducted.

Before experiments are implemented, application should be made to USFWS (Greg Balogh, USFWS, Anchorage Field Office, 907-271-2778) for an endangered species research or incidental take permit to authorize any incidental take of short-tailed albatrosses during the study. Application must also be made to USFWS (Karen Laing, USFWS, Migratory Bird Management, 907-786-3459) and the State of Alaska for collecting permits.

D. Fishing Industry Data

The use of information from fishermen about the effectiveness of deterrent devices is critical to the success of the evaluation program in improving the effectiveness of seabird deterrent measures. The current regulations incorporate some flexibility to allow fishermen to experiment with different methods and determine what works under their specific fishing conditions. Some individuals are devoting considerable effort to developing the most effective methods possible on their vessels; their methods and successes should be recorded. This information can be used by other fishermen to improve their bycatch reduction, and by the agencies in evaluating potential changes to the regulations.

Input from the fishing community must be actively sought by NMFS through public meetings, and through other opportunities to meet with fishing associations or groups. Public meetings will be held once or twice a year by NMFS representatives to solicit input on all available methods. Announcements for public meetings should be published in the Federal Register and planned at a time of year when fishermen are available. NMFS representatives should attend Fish Expo and Comm Fish meetings annually and either co-host or host a seabird bycatch booth and a seminar on seabird bycatch to solicit input.

All input received from meetings, seminars or other sources should be compiled into an annual report.

PHASE II

A. Experimental Testing

The first year of experimental testing will be conducted to obtain information on the effectiveness of at least two specific methods used to discourage or prevent seabirds from accessing baited hooks including tori lines and bird buoys. If resources allow, the effectiveness of weighting lines, other gear modifications, or changes to fishing procedures such as offal dumping techniques should also be evaluated. Once these experiments are complete, the results of all elements of phases I and II of the plan should be evaluated to determine if additional experimental testing of these or other measures is warranted (Phase III). Important considerations for methodology are discussed here, and some specific approaches are outlined in the Auke Bay protocol (Appendix B) which can be used as a reference for methodology development. Contractors or individuals to implement the experimental phase of the Plan should have the same qualifications outlined under Phase IC.

Factors that can be used to evaluate the effectiveness of deterrent devices will be evaluated during methodology development and include:

1. Number of seabirds, by species, in the vicinity of the vessel at set intervals during line setting;
2. Number of seabirds within the zone where the line is accessible to them (the "vulnerable zone") during set intervals during line setting;
3. Number of seabird feeding attempts on baited hooks during line setting;
4. Number of seabirds observed hooked during setting;
5. Number of seabirds retrieved dead on hooks during line hauling.

Risk to a seabird occurs any time a bird can access a baited hook. Bait can be accessed by a bird any time it is between the stern of the vessel and the point where it sinks beyond the diving depth of the bird. This area can be called the "vulnerable zone". If the vulnerable zone can be identified, the effectiveness of a seabird deterrent measure could be evaluated based on numbers of birds inside or outside the vulnerable zone. The zone may be defined using instruments such as time-depth recorders, through observations from a skiff behind the vessel, from behavioral observations of seabirds following the vessel, or through other methods. For example, at a constant speed, the rollers in the wake occur at a fixed distance behind the vessel. Using laser range finders, calibrated tow lines or other measures, roller characteristics (first trough, second peak, etc.) could be converted into distance, and used to identify the boundaries of the vulnerable zone.

The size and distance astern of the vulnerable zone depends on a number of factors including gear type, vessel, weather, sea state, the weight of the groundline and amount of weight added to the groundline. Gear configuration (except deterrent device) should be standardized for all treatments including line weights, length of line, number of hooks, hook spacing, anchoring, and speed of set.

The most direct measure of effectiveness of a seabird deterrent device is the number of seabird mortalities resulting with or without the use of that device. This approach has been used in several studies in other fisheries (Murray et al. 1993, Duckworth 1995). However, captures usually are rare (preliminary estimates for mortality rates in Alaska's groundfish fishery is 1 bird per 10,000 hooks), requiring large sample sizes for experiments with enough power to differentiate treatments. Based on an initial study, Melvin et al. (1997) estimated that at least 150 sets would be required per gear treatment to detect significant differences in bird entanglement rates among factors.

Alternatively, or in addition to number of mortalities, the level of risk to seabirds can be assessed by the proportion or number of seabirds who can access the baited hooks (those who are in the vulnerable zone), or by the number of attempts made by seabirds to take bait from hooks. These approaches have been used in other studies of seabird incidental take (Brothers 1991, Cherel et al. 1996) and should require smaller sample sizes. Numbers of birds or numbers of feeding attempts can be compared between treatments and control sets to compare mortality risk with or without seabird deterrent measures.

Indexing the numbers and species of birds during each treatment likely will be important for evaluating results of the experiments. The number of birds following a specific longline vessel in Alaska's fisheries is likely to range from several to hundreds of individuals. Accurate censusing and identification of seabirds during deployment is likely to be challenging because birds following a vessel are constantly moving, may move in and out of view behind ocean swells, and may occur in large numbers within a small area behind the vessel. Brothers (1991) visually counted albatrosses during deployment at half-hour intervals. Cherel et al. (1996) found that it was not possible to count total numbers during deployment because most birds were very active; counts were made following deployment when seabirds were relatively quiet. Censusing methods for this project must be carefully evaluated, and may include scanning surveys to estimate total abundance and abundance in the vulnerable zone, or focal animal surveys to track behavior of individual birds. Census counts and bait attack counts may be conducted simultaneously if two observers are used, or may be alternated by skates during a set.

Data recording can be accomplished in a number of ways; manual recording, direct entry of data into laptop computers, the use of a global positioning system, and audio recording of data on portable tape recorders should all be evaluated. The Auke Bay protocol specified use of video to record numbers of seabirds and seabird interactions behind the vessel. There is contention by some experts that video may not be a viable data recording method for this project. The practicality and efficacy of using video should be evaluated during the research cruise.

Environmental factors, time of day and year, vessel configuration, geographic location, condition and number of seabirds following the vessels and other factors can affect the level of risk to seabirds and the performance of seabird deterrent devices. These factors should be standardized in the experimental design so that the only factor varying is the presence or absence and type of deterrent device. Standardization of these factors through analysis is difficult due to the number of factors and the interaction of the factors' effects; an alternate approach is to pair all treatments in the field experiment. An experimental replicate would consist of a longline deployment of treatment A, the longline would be hauled, followed by longline deployment of treatment B, the longline would be hauled, etc., until all treatments have been deployed. A second experimental replicate would consist of the same treatments with treatment order systematically re-ordered. Although field conditions may differ between replicates, field conditions will tend to be the same through the course of a single replicate, thus separating the field condition effects from treatment effects (removing their effect from each replicate). The location and timing of replicates should be determined solely by the experimental design of this project.

Specific information to be collected during each set, and any analyses that might be conducted with this information, should be established during the methodology development project. Information collected by observers and during test experiments may include: time of day, hours from sun rise, geographic location, vessel name, vessel size, observer name(s), weather, wind velocity and direction, sea state, seabird abundance, seabird species composition, characteristics of the set (hook spacing, hook size, length of line, length of gangions), method of line baiting and deployment, deterrent measures employed, and duration of setting.

Comparing the magnitude of risk to seabirds with or without seabird deterrent devices by conducting trials with or without the measures employed could represent significant risk of seabird mortality. During the methodology development project, the option of using hooks without tips should be explored. If tipless hooks can be created in such a way as to hold bait as securely as hooks with tips, then they should be considered. This approach would remove the option of using number of seabirds hooked as a measure of effectiveness, but sample sizes required for statistically valid comparisons of mortality between sets with or without deterrent devices may have already precluded the use of mortality as a measure of effectiveness. All possible precautionary measures should be taken to minimize any seabird bycatch except where necessary for adequate scientific evaluation of measures. Before experiments are implemented, application should be made to USFWS for an endangered species research or incidental take permit to authorize any incidental take of short-tailed albatrosses during the study.

The sampling protocol is likely to include a requirement for observers and researchers to estimate distances. The methodology development project should include testing and/or recommendations for types of equipment to use for estimating distances, and recommendations for training and standardizing estimations of distances. For example, if observers record the number of birds within a given distance of the groundline, the method with which they will identify that distance during each observation, and the method with which they will practice estimation of that distance against some objective measure, should be determined during the methodology development cruise. Potential tools for distance estimation may include: 1) laser range finder, 2) calibrated tori line, and 3)vessel wake, 4) military binoculars with range finding graticules.

A report will be prepared which summarizes the results of the experimental tests performed.

B. Special Project Seabird Observers

Special observers will collect quantitative data on seabird numbers, seabird feeding attempts, and incidental take of seabirds during commercial longline fishing. All variables that may affect incidental take will be recorded for each set, including location, target species of the fishery, type of gear, speed of setting, type of deterrent and manner in which it is deployed, weather and ocean conditions, and any discharge of offal.

Special observers will be deployed in selected areas chosen to represent the full range of conditions in each fishery. The exception is that special observers will be assigned to times and areas where seabird numbers are relatively high. In the first year of the special seabird observer project, ten three-week observer trips will be completed (five in the groundfish fishery and five in the halibut fishery).

The goals of the seabird observer project are to:

1. Collect data on the effectiveness of deterrent measures over a longer or different period and a wider or different area than will be covered by the experiments;
2. Provide opportunity to collect data on the effectiveness of deterrent measures for a wider range of gear types and deterrent types than will be covered by the experiment;
3. Look for variables that may increase or decrease the incidental take of seabirds (e.g. size
4. Provide data on the variance of important variables that may affect incidental take of seabirds.

Methods may be similar to those used for data gathering during designed experiments, but will emphasize recording as much information as possible on the methods used, and the number of seabird interactions with the bait. Whereas the first part of the study tests the effectiveness of measures in a relatively controlled experimental setting, this portion of the study would provide some ground truthing as to the practical applications of the seabird avoidance measures and their effectiveness in commercial fishing operations.

Specific methodology for seabird observers will be determined during the methodology development phase; information collected will be similar in scope and content to that collected in the experimental study. The data recording sheet developed by Vivian Mendenhall of the USFWS can be used as a starting point in developing data sheets for the special observers (Appendix C). Vessel participation may be on a volunteer basis or by charter. If adequate vessel time is not available with these arrangements, a requirement for observer coverage for observing the effectiveness of seabird deterrent measures will need to be considered. Early indications are that there will be an adequate number of vessels willing to participate in the test program. Seabird observer deployments should be scheduled to stratify coverage by fishery and season so that as many as possible are covered (e.g. sablefish and halibut -spring, summer, and fall; Pacific cod-winter and fall, Greenland turbot-spring etc.).

Methodology will include specific plans for training of observers prior to deployments. Videos of longline setting operations, available at Auke Bay Laboratory or other sources (an excellent video is available from Mark Lundsten, Seattle), can be used for informational or observer training purposes (See Mike Sigler and John Karinen for access to ABL for videos.)

PHASE III

Additional experiments, continued deployment of special project observers, and continued compiling of input from industry should be planned if recommended in the reports produced during Phase II of the test plan.

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BUDGET

The budget figures below represent preliminary estimates for total costs for each portion of the test plan. After completion of the methodology development phase, budget figures may change based on recommended changes in the protocol, need for or scope of contracts, sample sizes, number of observers deployed, the length of cruises or deployments, administrative approaches used (i.e. administered by agency staff or administered by an independent contractor), or other factors. Therefore, these figures should be considered preliminary. Budget projections have been made for phases I and II only; if phase III is recommended following completion of phases I and II, a budget will be outlined at that time.

PHASE I

		$ Amount (1000s)
A. Comprehensive literature review		
Contract cost for report		**5**
B. Night Fishing Report		
Contract cost for report		**3**
C. Methodology Development		
Contract salary, travel and overhead	15	
Equipment and supplies	3	
Vessel charter	10	
TOTAL for Methodology Development		**28**
D. Fishing Industry Data		
Travel for agency representatives to attend public meetings		**10**
TOTAL for PHASE I		**46**

PHASE II

A. Experimental Testing

	$Amount (1000's)	
Administrative costs and travel to implement test plan, procure and administer contract, and consult with contract scientists.	25	
Contract or salary for principle investigator and cooperators	50	
University or firm overhead	15	
Chartered longliner and crew to conduct setting experiments Estimate 4K/day for 20 days	80	
Equipment and supplies Binoculars, cameras, video, avoidance gear, supplies	25	
TOTAL for experimental tests		**190**

B. Special Project Seabird Observers

The following budget is estimated for a total of 10 observer trips (5 on a groundfish vessel and 5 on a halibut vessel) during the first year of the special seabird observer project. Duration of each trip is estimated at 2-3 weeks. Vessel cost has not been factored in based on the assumption that vessel time will be provided on a voluntary basis by vessel owners or captains.

	$ Amount (1000s)	
Observer salary, insurance, and overhead (30 weeks @ 1000.00)	30	
Observer Travel (10 RT tickets Seattle to ports @ 1500.00)	15	
Equipment and supplies	13	
Travel for agency staff	5	
Contract/administrative cost for project leader/report writer	15	
Total for Special Seabird Observers:		**78**

C. Fishing Industry Input/Data

Travel for agency representatives to attend public meetings	**10**
TOTAL for PHASE II	**278**

APPENDICES

APPENDIX A

Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) Regulations

Conservation Measure 29/XV[1,2]
Minimisation of the Incidental Mortality of Seabirds in the Course of Longline Fishing or Longline Fishing Research in the Convention Area

The Commission,

Noting the need to reduce the incidental mortality of seabirds during longline fishing by minimising their attraction to fishing vessels and by preventing them from attempting to seize baited hooks, particularly during the period when the lines are set,

Adopts the following measures to reduce the possibility of incidental mortality of seabirds during longline fishing.

6. Fishing operations shall be conducted in such a way that the baited hooks sink as soon as possible after they are put in the water[3].

7. Longlines shall be set at night only (i.e. during the hours of darkness between the times of nautical twilight[4])[5]. During longline fishing at night, only the minimum ship's lights necessary for safety shall be used.

8. The dumping of offal shall be avoided as far as possible while longlines are being set or hauled; if discharge of offal is unavoidable, this discharge shall take place on the opposite side of the vessel to that where longlines are set or hauled.

9. Every effort should be made to ensure that birds captured alive during longlining are released alive and that wherever possible, hooks are removed without jeopardising the life of the bird concerned.

10. A streamer line designed to discourage birds from settling on baits during deployment of longlines shall be towed. Specification of streamer line and its method of deployment is given in the Appendix to this Measure. Details of the construction relating to the number and placement of swivels may be varied so long as the effective sea surface covered by the streamers is no less than that covered by the currently specified design. Details of the device dragged in the water in order to create tension in the line may also be varied.

11. Other variations in the design of streamer lines may be tested on vessels carrying two observers, at least one appointed in accordance with the CCAMLR Scheme of

International Scientific Observations, providing that all other elements of this Conservation Measure are complied with[6].

Footnotes:

1 Except for waters adjacent to the Kerguelen and Crozet Islands.

2 Except for waters adjacent to the Prince Edwards Islands.

3 For vessels using the Spanish method of longline fishing, weights should be released before line tension occurs; wherever possible, weights of at least 6 kg mass should be used, spaced at 20m intervals.

4 The exact times of nautical twilight are set forth in the Nautical Almanac tables for the relevant latitude, local time, and date. All times whether for ship operations or observer reporting shall be referenced to GMT.

5 Wherever possible, setting of lines should be completed at least three hours before sunrise (to reduce loss of bait/catches of white-chinned petrels).

6 The streamer lines under test should be constructed and operated taking full account of the principles set out in WG-IMALF-94/19 (available from the CCAMLR Secretariat); testing should be carried out independently of actual commercial fishing and in a manner consistent with the spirit of Conservation Measure 65/XII.

APPENDIX B

Draft National Marine Fisheries Service Auke Bay Protocol
January 1998 Draft (document and attachments A and B).
Prepared by Mike Sigler and John Karinen

Research Plan to Evaluate Effectiveness of Required Seabird Avoidance Measures in the Bering Sea/Aleutian Islands (BSAI) and Gulf of Alaska (GOA) Hook-and-Line Groundfish Fisheries

Prepared by: National Marine Fisheries Service
Alaska Fisheries Science Center, Auke Bay Laboratory
Sustainable Fisheries Division, RO
Observer Program Office, AFSC

INTRODUCTION

PURPOSE OF RESEARCH PLAN

The seabird bycatch problem in longline fisheries has reached a heightened awareness worldwide. NMFS has issued regulations that require operators of groundfish longline vessels in Alaska to employ seabird bycatch avoidance gear and methods intended to reduce seabird bycatch and incidental seabird mortality.

Pursuant to the Endangered Species Act (ESA), the short-tailed albatross is afforded certain protections that are outlined in the section 7 consultation NMFS undertakes with the U.S. Fish & Wildlife Service (USFWS) regarding the Alaskan groundfish fisheries. Recently, the USFWS amended its Biological Opinion on the impacts of the groundfish fisheries on the endangered short-tailed albatross and now has required that NMFS develop a research plan outlining specific plans for testing the effectiveness of the required seabird bycatch avoidance gear and methods by January 1, 1998.

Testing the effectiveness of seabird bycatch avoidance gear and methods that historically have been used in southern hemisphere fisheries will allow NMFS to better ascertain if these measures are effective in the Alaskan fisheries.

The current regulations are of a flexible nature that would allow fishermen certain options when using required seabird avoidance measures. Once measures have been tested for effectiveness, NMFS will be better able to revise regulations to include specific performance standards for the seabird avoidance measures, if appropriate. Currently, no scientific data exists regarding the effectiveness of these measures in Alaskan fisheries.

The development of a research plan outlining specific plans for testing the effectiveness of the required seabird bycatch avoidance gear and methods will include:

A. Identification of qualitative and quantitative data sources.
B. Design of statistically valid experiments to test the effectiveness of the required gear and methods.
C. Identification of resources necessary to carry out the research plan.

CURRENT REGULATIONS FOR BSAI AND GOA GROUNDFISH LONGLINE FISHERIES

To reduce the incidental take of seabirds in the BSAI and GOA groundfish longline fisheries, the vessels are required to:

(1) Use hooks that when baited, sink as soon as they are put into the water.

(2) Any discharge of offal from a vessel must occur in a manner that distracts seabirds, to the extent practicable, from baited hooks while gear is being set or hauled. The discharge site on board a vessel must either be aft of the hauling station or on the opposite side of the vessel from the hauling station.

(3) Make every reasonable effort to ensure that birds brought on board alive are released alive and that wherever possible, hooks are removed without jeopardizing the life of the birds.

(4) Employ one or more of the following seabird avoidance measures:
   - (a) Tow streamer line or lines during deployment of gear to prevent birds from taking hooks;
   - (b) Tow a buoy, board, stick or other device during deployment of gear, at a distance appropriate to prevent birds from taking hooks. Multiple devices may be employed;
   - (c) Deploy hooks underwater through a lining tube at a depth sufficient to prevent birds from settling on hooks during deployment of gear; or
   - (d) Deploy gear only during specified hours of darkness, using only the minimum vessel lights necessary for safety.

RESEARCH PLAN

A. <u>Identification of Data Sources</u>.

The USFWS Biological Opinion provided under the section 7 consultation process of the ESA requires that NMFS evaluate the effectiveness of seabird bycatch avoidance measures required in the BSAI and GOA groundfish longline fisheries. The obvious data sources are from: (1) designed experiments performed by qualified scientists, (2) special seabird observers aboard fishing vessels deploying the required gear, (3) fleetwide groundfish observer data, and (4) observations volunteered by industry on the use of required deterrents or other methods they may use to reduce the incidental catch of seabirds.

<u>Seabird Data Collected by NMFS Groundfish Observers</u>

At this time, the general consensus is that the available seabird data collected by NMFS groundfish observers probably will be of minimal value in evaluating the effectiveness of seabird avoidance measures used in the past by BSAI and GOA groundfish longline vessels. Information on avoidance measures has not been routinely collected until late 1997. The evaluation of the past observer data indicates that some reports by observers have useful information on bird behavior; but generally, the data collected during normal observer activities has only minimal application to the present plan. Therefore, further detailed evaluation of fleetwide seabird observations would not be productive for the purposes of this plan. In late 1997, observers will be required to collect data on which types of seabird avoidance measures are being used on the vessels. These data could be used in recommendations for future gear testing or desirable and necessary observer data collections. NMFS recognizes that the groundfish observers are fully utilized at this time and requiring additional seabird data collection would necessitate eliminating other essential duties that they perform. NMFS does not recommend this approach at this time.

B. Scope and Design of Experiments to Test the Effectiveness of the Required Gear and Methods.

Given that resource constraints and necessary periodic analyses of initial test results will require some flexibility in the plan design, the plan will be for a multi-year period. The plan and the measures tested will require evaluation as research results are obtained, therefore a first-year Pilot Study seems appropriate. Subsequent years of the plan are expected to be of similar scale as the Pilot Study. Measures that are known to be used in the Alaskan fisheries and that have a low impact on cost and operations of the fishing vessels will be examined first. More impacting measures could be examined in the future if low impact measures are not effective. NMFS recommends that the contractor for the first-year Pilot Study be responsible for evaluation of the experimental results and development of a recommended plan for the following year. This plan would be reviewed and approved by NMFS staff.

The scope of the plan is: (1) Test the effectiveness of some of the currently required seabird avoidance measures the first year and (2) Collect information on behavioral responses of birds to the gear. This would require determinations of: What data is collected, how the data is collected, how much data must be collected to provide valid statistical results, how the data is analyzed, and how the analysis is used. Plans to test other required methods or others that are easily and economically applied or test other more costly methods showing promise may be developed and tested in future years.

Suggested experiments and data collection for the first-year Pilot Study are:

(1) Conduct gear-setting experiments to determine necessary performance criteria for the following required measures:
   (a) Sinking baited hooks (i.e. how far and fast do baited hooks have to sink to prevent birds from reaching the baited hooks?), and
   (b) Towing of streamer lines or buoys (i.e. how effective are the streamer lines and buoys at preventing birds from stealing the bait?) (see Scientific Operations Plan- Attachment A).

(2) Conduct a separate experiment for observing bird behavior during setting of gear. Using commercial longline vessels and selected seabird observers, we recommend that a series of observations be conducted to gather data on bird behavior and bird deterrent effectiveness during longline setting operations aboard commercial vessels. In preparation for these evaluations, a review of available videos of longline setting operations is recommended. (See Observations of Bird Behavior- Attachment B)

C. Identification of Resources Necessary to Carry out the Research Plan

Item		$Amount (1000's)
1. Experimental Tests of Effectiveness of Seabird Avoidance Measures - contract University or Research Firm (see Attachment A for itemized budget details)	Subtotal	235
2. Special seabird observers to observe bird behavior during setting of gear (see Attachment B for itemized budget details)	Subtotal	64
BUDGET COSTS FOR ATTACHMENTS A & B (NO TENSION TAGS)	TOTAL	299
Tension/depth tags		150
TOTAL ESTIMATED COST FOR FIRST-YEAR PILOT STUDY		449

EVALUATION OF EXPERIMENTS AND COMPLETION OF RESEARCH PLAN

As stated previously, NMFS recommends that the contractor for the first-year Pilot Study be responsible for evaluation of the experimental results and development of a recommended plan for the following year. This plan would be reviewed and approved by NMFS staff. See Attachments A and B for specific experimental evaluation methods. Initial results from the Pilot Study could determine what studies may be necessary for subsequent years. Research Plan results may indicate that revisions to the current seabird avoidance measures are appropriate.

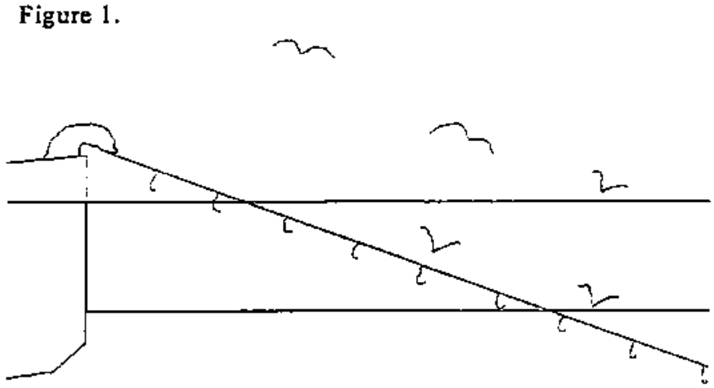
Attachment A.

SCIENTIFIC OPERATIONS PLAN TO TEST THE EFFECTIVENESS OF REQUIRED SEABIRD AVOIDANCE MEASURES USED IN THE BSAI AND GOA LONGLINE FISHERIES

PURPOSE

Test the effectiveness of two methods, streamer lines and buoys, at reducing the incidental take of seabirds in BSAI and GOA longline fisheries.

Figure 1.



OBJECTIVES

1. Determine the zone where seabirds are vulnerable to capture by longline.
2. Determine the effectiveness of streamer lines and buoys to prevent seabird feeding attempts in this zone.

RATIONALE FOR EXPERIMENTAL APPROACH

The experiment's purpose is to test methods to reduce seabird incidental take by longline, as measured by seabird feeding attempts at the baited hooks. The usual experimental approach is to test several streamer line, buoy and line weighting configurations. This approach is time-consuming if more than a few treatments are tested. For example, Brothers (1991) conducted a 17-day cruise to test one configuration of streamer line; Cherel et al. (1996) conducted a 13-day cruise to test the effectiveness of offal dumping. Lokkeborg (1996) conducted a 12-day cruise to test one configuration of streamer line and a setting funnel. This approach also limits conclusions to only the tested designs. An alternate approach is to determine where seabirds are vulnerable to longline capture and to test methods to prevent seabird feeding attempts in this zone. To address the first objective, the longline will be deployed with no streamer line or buoy in place. The depth of the longline during deployment will be measured with time-depth recorders. Seabird feeding attempts will be recorded relative to longline position to locate the zone where seabirds are vulnerable to capture (Figure 1). To address the second objective, a streamer line or buoy will be placed over the vulnerable zone to determine if it effectively prevents seabird feeding attempts in this zone.

This approach should remove the need to test multiple lengths of streamer line and buoy line. This approach will provide a performance-based criteria (e.g. that the streamer line must prevent seabird feeding attempts in areas where the longline is less than 4 m from the water surface). In this way, the desired performance of preventing seabird feeding attempts is measured and what methods are effective is determined. Specific information on the device's length or other configuration charteristics given different fishing practices (e.g. line weighting frequency, vessel setting speed, number or length of streamers) can then be determined by the vessel operator or through further experimentation, although the latter is not explicitly required with this approach except to provide guidance on deterrent construction and deployment to vessel operators.

The usual data collected is the number of seabird captures, particularly for observations from commercial fishing (Murray et al. 1993, Duckworth 1995). Captures usually are rare, requiring large sample sizes for experiments with enough power to differentiate treatments. Based on an initial study, Melvin et al. (1997) estimated that at least 150 sets would be required per gear treatment to detect significant differences in bird entanglement rates among factors. An alternate approach is to record a more common seabird behavior. Seabird feeding attempts are commonly observed during longline deployment in the northeast Pacific and are a reasonable measure of seabird susceptibility to longline capture. Collecting data on seabird feeding attempts should require smaller sample sizes. Seabird feeding attempts were recorded in other studies of seabird incidental take (Brothers 1991, Cherel et al. 1996).

The ocean is a variable place where sea and wind conditions can change. Factors such as wind strength and direction and sea condition (Brothers 1991) and setting across heavy winds (Lokkeborg 1996) may affect the seabird incidental take by longline. The number and species composition of the birds following the vessel may increase over the course of a day, perhaps even decreasing later as birds become satiated with food. These factors should be accounted for in any field experiment such as proposed here. Accounting for these factors by analysis is difficult due to the number of factors and the interaction of the factors' effects. An alternate approach is to pair all treatments in the field experiment. An experimental replicate would consist of a longline deployment of treatment A, the longline would be hauled, followed by longline deployment of treatment B, the longline would be hauled, etc., until all treatments have been deployed. A second experimental replicate would consist of the same treatments with treatment order systematically re-ordered. Although field conditions may differ between replicates, field conditions will tend to be the same through the course of a single replicate, thus separating the field condition effects from treatment effects (removing their effect from each replicate).

EXPERIMENTAL DESIGN

Two experiments will be conducted. The first experiment will measure the zone where seabirds are vulnerable to capture by longline. The second experiment will rely on the results of the first experiment. The second experiment will evaluate streamer line and buoy effectiveness to prevent seabird feeding attempts in that zone.

Seventeen charter days are necessary for both experiments, one day each for loading and unloading the vessel, three days at-sea for measuring the zone where seabirds are vulnerable to longline capture, nine days at-sea for testing streamer line and buoy effectiveness, and three days for foul weather (Table 1). Weather days may be necessary if there is to be a weather limit on data collection or the charter vessel is small.

Table 1.

Day	Purpose	Design
1	Load vessel	
2-4	Measure the zone where seabirds are vulnerable to longline capture.	Deploy longline about 9 times per day for 3 days.
5-13	Determine the effectiveness of streamer line and buoy for deterring seabirds from the zone where they are vulnerable to longline capture.	Deploy longline about 9 times per day for 9 days, alternating no deterrent, streamer line and buoy each set.
14-16	Weather days	
17	Unload vessel	

The remainder of this plan is organized as follows: brief description of the two experiments, details on vessel and fishing gear, experimental gear, and data collection and analysis.

Experiment 1: Measure vulnerable zone

The objective of Experiment 1 is to determine the zone where seabirds are vulnerable to capture by longline. The longline will be deployed with no streamer line or buoy in place. The number of seabird feeding attempts will be counted and it's position relative to the longline measured. Brothers (CCAMLR, 1996) stated that most seabird feeding attempts occur where the longline is up to 4 m deep and 50 m astern.

A longline will be deployed, then immediately retrieved. Longline setting will last about 10 minutes, retrieval about 45 minutes. Allowing time to return to the setting start and for vessel maneuvering, one replicate for Experiment 1 will last about 75 minutes for about nine replicates per 12 hour workday. Each deployment will be separated by 1 km to provide some similarity in the independence of the deployments. The longline will be deployed approximately 27 times during experiment 1; approximately 3 days will be necessary to complete Experiment 1 (Table 1).

The choice of sample size is relatively arbitrary. Some considerations were the standard rule-of-thumb of twenty for a sample size and in Experiment 2, trying to set sample size each day at some multiple of 3, the number of treatments tested in Experiment 2 (no deterrent, streamer line and buoy). Given that the first year is a pilot study, we expect that the results will be used to determine sample size requirements for future years' testing.

Experiment 2: Evaluate streamer line and buoy effectiveness

The results of Experiment 1 (identification of the zone where seabirds are vulnerable to longline capture) will be needed to conduct Experiment 2 . The approximate distance astern where seabirds are vulnerable to longline capture will be identified in Experiment 1 and this information used in applying treatments in Experiment 2. The objective of Experiment 2 is to determine the effectiveness of streamer lines and buoys to prevent seabird feeding attempts in this zone. The longline will be deployed using 3 treatments: no deterrent, a streamer line, and a buoy. The number of seabird feeding attempts will be counted and it's position relative to the longline and deterrent measured.

All treatments will be paired to remove effects of time of day, weather, etc. Melvin et al. (1997) also paired gear treatments in a study of experimental gillnets to reduce seabird bycatch. In one experimental replicate, a longline will be set with treatment A, the longline will be hauled, then the longline will be set with treatment B, the longline will be hauled, etc., until all of the treatments are deployed. A second experimental replicate will consist of the same treatments with treatment order systematically re-ordered. Order of treatment (A=no deterrent, B=streamer line, C=buoy) is systematically reordered (group 1: A, B, C; group 2: B, C, A; group 3: C, A, B; etc.).

The longline will be deployed about 27 times with no deterrent, about 27 times with streamer line and about 27 times with a buoy. Each group is geographically separated from other groups by 1 km.

VESSEL AND FISHING GEAR

Scientific operations will be conducted using a chartered U.S. longline vessel. The vessel will carry standard longline setting and hauling gear. The standard sablefish longline survey gear consists of a groundline with 2 m spacing of circle hooks baited with squid (Sigler and Zenger, 1994). This gear is suggested as an experiment standard. It probably is not necessary to follow exactly this standard for the experiment, but certainly the gear should be standardized within the experiment. Skates of gear are 100 m (55 fm) long and contain forty-five size 13/0 Mustad[1] circle hooks. Hooks are attached to 38 cm (15 in, tied length; untied length 74 cm [29 in]) gangions secured to 46 cm (18 in) beckets tied into the groundline at 2 m (6.5 ft) intervals. Gangion eyes are 10 cm (4 in). Hooks are hung by inserting the tied end of the gangion through the eye face closest to the hook tip (the inside of the hook). The groundline of each skate is marked with bright-colored flagging and red ink at the first and last beckets, and with red ink at the remaining beckets. Five meters (16 ft) of groundline are left bare on each end. Gangion, becket, and groundline materials are medium lay #60 thread, medium lay # 72 thread, and soft medium lay 9.5 mm (3/8 in) American Line SSR 100[1] (or equivalent nylon line), respectively.

Hook tips will be removed to minimize seabird captures during the experiment. The part of the hook between the tip and the barb will be removed. The barb will be left intact to help hold

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Citation of the above brand names does not constitute U.S. government endorsement.

the bait on the hook. Three mm of material past the barb will be left intact and the cut end will be left dull.

Each end of a set starts with a flag and buoy array, followed by a buoyline made of 92 m (50 fm) of American Line and 92 m (50 fm) of 9.5 mm (3/8 in) polypropylene line, a 27 kg (60 lb) halibut anchor, 366 m (200 fm) American Line, and finally the groundline with hooks. A set contains 540 hooks, 1.2 km (656 fm) long.

Anchors at each end of the groundline sink the line. Additional weights often are attached to the longline at several intermediate points to ensure that the line stays in one spot after reaching bottom and also falls in to any nooks and crannies on rough bottom. These weights also increase sinking rate, especially for any part of the groundline not near the anchor. The likelihood of successful feeding attempts and subsequent hooking should decrease with increased sinking rate, particularly if the baits sink below the depth accessible to seabirds within the area astern that is protected by a streamer line (Brothers et al. 1995). However, the geometry of the longline is complicated by the use of intermediate weights and therefore more difficult to measure due to the irregular slope of the longline (a series of inverted U's when weights are attached). Therefore, no intermediate weights will be used in the experiment to simplify measurement of the position of the longline during deployment. This does not mean that intermediate weights should not be used during commercial fishing, but that for purposes of the experiment, it will be easier to estimate the depth of the vulnerable zone if the longline geometry is simple to measure.

Each hook is hand baited with chopped herring. The head will not be used for bait, only the body. This is not standard commercial practice, but is recommended for this experiment to standardize bait shape. Also, bait loss will be used as a measure of deterrent effectiveness and the head is harder to remove. For baiting, the herring body should be cut into pieces each 4-5 cm (1.5-2 in) long.

The gear will be maintained to the following standard. If the groundline is worn, the line will be replaced by splicing such that the replacement line maintains hook spacing of 2 m. A splice will consist of 3 tucks for each line end.

The vessel owners will supply all longline gear including flags, buoys, radio beacons, buoylines, running lines, floating lines, and anchors. In addition, the vessel owners will supply the bait.

EXPERIMENTAL GEAR

A streamer line and a buoy will be tested. The configuration of the streamer line is described in 62 FR 10016, March 5, 1997.

NMFS revised the guidelines on streamer line construction published in the preamble to the March 5, 1997 proposed rule based on information that indicates streamer line construction should account for variable vessel sizes and gear deployment speeds (New Zealand Department of Conservation, 1997). Large vessels equal to or greater than 125 ft (38.1 m) length overall (LOA) deploying gear at approximately 5 knots may require a thicker dimension of streamer line (e.g., 8 millimeters (mm)), compared to smaller vessels less than 125 ft (38.1 m) LOA deploying gear at faster speeds of 7 to 8 knots that may require streamer lines constructed of material only 5 mm in diameter. The key characteristics of an effective streamer line are:

1. All materials used to construct the streamer line and to hold the streamer line in

place are strong enough to withstand all weather conditions in which hook-and-line fishing activity is likely to be undertaken;

2. The streamer line is attached to a pole at the stern of the vessel and positioned such that it will be directly above the baited hooks as they are deployed;
3. The height of the streamer line at the point of attachment is 4 to 8 m above sea level;
4. The streamer line for all vessel sizes is constructed of material that is between 5 and 8 mm in diameter;
5. Length of streamer line is a minimum of 150 to 175 m for all vessel sizes;
6. Number of streamers attached to a streamer line is 6 to 10 pairs;
7. Streamers made of a heavy, flexible material that will allow the streamers to move freely and flop unpredictably (for example, streamer cord inserted inside a red polyurethane tubing);
8. Streamer pairs attached to the bird streamer line using a 3-way swivel or an adjustable snap;
9. Streamers should just skim above the water's surface over the baited hooks.

The key characteristics of an effective buoy are not described in the literature. As a starting point, the streamer line recommendations are modified for the experimental buoy and are:

1. All materials used to construct the buoy line and to hold the buoy line in place are strong enough to withstand all weather conditions in which hook-and-line fishing activity is likely to be undertaken;
2. The buoy line is attached to a pole at the stern of the vessel and positioned such that it will be directly above the baited hooks as they are deployed;
3. The height of the buoy line at the point of attachment is 4 to 8 m above sea level;
4. The buoy line for all vessel sizes is constructed of material that is 9.5 mm (3/8") in diameter;
5. Length of buoy line is a minimum of 150 to 175 m for all vessel sizes.

DATA COLLECTION

Measuring the Vulnerable Zone

The vulnerable zone will be estimated from seabird surface activity relative to longline position and depth. Seabird feeding attempts are evidence that seabirds are vulnerable to capture by the longline. Longline depth where seabirds are attempting to feed will be used as a proxy for the depth of the vulnerable zone. The assumption is that seabirds will not attempt to feed unless the baited longline is visible and there is some probability of feeding success greater than zero. Two approaches are described to measure the area where seabirds are vulnerable to capture by longline.

Approach A--Time-depth recorders: Time-depth recorders attached to the longline every 300 m will measure longline depth. Combined with data on vessel speed, longline position and depth will be estimated.

Approach B--Data storage tags, an alternate method: Data storage tags attached to individual fish have been used to record temperature and depth (Metcalfe and Arnold 1997). It is possible to develop a data storage tag which records tension and depth (Keith, Lotek, pers. comm.). Tension-depth data storage tags attached at the base of each gangion will document seabird attacks by a direct method. Some seabird feeding attempts missed by visual sightings from the stern of the vessel will be recorded, for example those hidden by a wave. Conversely, some seabird feeding attempts may not result in attacks on baited hooks when a seabird tries to reach a visible bait below the bird's diving depth or when the bird takes a bait which has been lost from a hook. Comparing the empty hooks when the line is retrieved with observed diving attempts and the tension record for each hook will allow an estimate to be made of numbers of baits lost during setting. The depth of the vulnerable zone will be accurately estimated since only bait attacks will be recorded. Attempts will be made to differentiate between bait attacks by albatross and smaller bird species (fulmars and shearwaters). However, interactions of species may affect the numbers of bait stealing attempts by albatross, therefore it is important to record the composition and numbers of all species. For example, large numbers of fulmars may cause reduced attempts by albatross, compared to when the same numbers of albatross are present with fewer fulmars. The approximate price for design and production of 100 tension-depth data storage tags is $150,000 (Keith, Lotek, pers. comm.).

<u>Measuring Effectiveness of Seabird Avoidance Measures via Seabird Observations</u>

The effectiveness of the tested seabird avoidance measures at reducing incidental take of seabirds will be measured using two seabird observation approaches: (1) Quantifying seabird feeding attempts as it relates to the seabird's ability to access the vulnerable zone, i.e. the bait, and (2) Quantifying the amount of bait loss, i.e. how successful seabirds were at entering the vulnerable zone and taking bait.

<u>Seabird Feeding Attempts</u>: Seabird feeding attempts will be recorded by voice onto a video camera facing aft during longline deployment. The seabird feeding attempts will be confirmed by video playback. During video playback, distance astern and lateral distance from the streamer or buoy line of seabird feeding attempts will be computed. Distance astern will be measured by comparing bird position to marks on the buoy line or streamer line. Lateral distance will be measured using a lateral range finder within the field of view of the camera and accounting for the seabird's distance astern.

Indexing the numbers and species of birds during each treatment likely will be important for evaluating the experiment, but accurate, live counts of seabirds during deployment are difficult to make. Brothers (1991) visually counted albatross during deployment at half-hour intervals, but mean daily counts per voyage averaged only 8-14 albatross. Cherel et al. (1996) found that it was not possible to count total numbers during deployment because most birds were very active; counts were made following deployment when seabirds were relatively quiet, averaging 323. Albatross counts in the northeast Pacific will range from dozens to hundreds. One problem with Cherel's approach is that the fraction of satiated or uninterested seabirds following deployment may vary by deployment and thus not be a good index of seabirds vulnerable to capture during deployment. An alternate approach, instead of live counts during deployment, is counts from the video tape of the deployment period at one-minute intervals.

The video camera will be mounted on a stand with gimbals or hand-held to compensate for the ship's motion so that the camera's field of view will continuously record the zone where seabirds are vulnerable to capture. If the camera is hand-held, two people will be needed during longline deployment, one to hold the camera, the other to spot and call out seabird feeding attempts.

The video tapes will be played back aboard ship the same day as recorded. The number of seabird feeding attempts will be recorded electronically during playback to track experiment progress and to check data collection quality. Further analysis of the video tapes will be completed on land.

Bait Loss: Whether or not a deterrent is effective also will be estimated from observed bait loss. The choice of bait type is important for this approach. Lokkeborg (1996) tested two baits, mackerel and squid. Mackerel bait loss was 13.1% with a deterrent and 19.5% without. Squid bait loss was 21.1% with a deterrent and 17.2% without. The lesser difference in squid bait retention was probably due to squid being a tough bait which is difficult for seabirds to remove from the hook. In contrast, there were differences in bait retention for mackerel, probably because, unlike squid, it is less tough and easier to remove from the hook. Squid and herring are common longline baits in the northeast Pacific. Herring seems suitable for this experiment because it is easy to tear off when used. Use frozen herring. Bait the hooks with bait that is partially thawed; the semi-frozen bait is firmer and makes baiting the gear easier. Wait to set the gear until the bait is fully thawed. Fully thawed bait is softer and more easily lost. Don't salt the herring, as is sometimes done, because this toughens the bait.

DEFINITIONS AND CATEGORIES OF SEABIRD FEEDING ATTEMPTS

This section needs input from a seabird biologist to define "seabird feeding attempt" and the different types of "seabird feeding attempts". For example, a "seabird feeding attempt" could be classified as "head underwater", "diving", etc.

SPECIFIC DATA TO RECORD

During longline deployment:

1. Record to video tape the species and approximate distance astern seabird feeding attempts;
2. Record sea height and direction and wind speed and direction relative to vessel setting speed and direction;
3. Record weather conditions.

During video analysis at sea:

1. Count the number of seabird feeding attempts and determine their approximate maximum distance astern.
2. Check the quality of the video record of the deployment.

During video analysis on land:

1. Verify the number and species of seabird feeding attempts and measure and record their distance astern of the vessel and lateral distance from the streamer line or buoy line;
2. Record the number and species composition of seabirds within visual range and astern of the vessel.

SEABIRD OBSERVATION PRIORITIES

Recording albatross feeding attempts is the first priority during longline deployment because the endangered status of short-tailed albatross prompted this study.

ANALYSIS OF DATA

The analysis will be based on the number of seabird feeding attempts and bait loss. Seabird feeding attempts will be compared to longline depth and streamer line and buoy line

position. Measuring performance based on relative position of the streamer line to the longline should eliminate the need to test various lengths of streamer line. The number of seabird feeding attempts and bait loss will be compared with and without a deterrent.
Measurement of a Vulnerable Zone: Compute the cumulative number of seabird feeding attempts as a function of longline depth.
Effectiveness of Seabird Avoidance Measures: Compare the number of seabird feeding attempts with and without a streamer line or buoy by a statistical test based on paired differences. To compute a paired difference, compute difference between seabird feeding attempts for streamer line and no deterrent and for buoy and no deterrent. Test for differences significantly different from zero by, for example, analysis of variance.

ESTIMATED COSTS

Item	$Amount
1. Experimental Tests of Effectiveness of Seabird Avoidance Measures - contract University or Research Firm	(1000's)
A. Government costs to develop a work plan, procure and administer contract, and evaluate contract performance	
COTR staff time and travel	25
Time and travel of gov't scientists to consult with contract scientists.	5
B. Contract Cost	
Contract or salary for project leader/analyst/report writer	50
Chartered longliner and crew to conduct setting experiments @5K/day, 17 days	85
Processing of video recordings (technician's time)	10
Seabird expert for ID, and behavioral observations during experiment - contract or provided by FWS.	10
Travel and Overtime	10
Equipment - dataloggers, binoculars, cameras, video processor	15
Supplies, avoidance gear, longline gear and bait	10
University or firm overhead	15
Subtotal	235

REFERENCES

Brothers, N. 1991. Albatross mortality and associated bait loss in the Japanese longline fishery in the Southern Ocean. Biological Conservation 55: 255-268.
Brothers, N. 1995. The influence of bait quality on the sink rate of bait used in the Japanese longline tuna fishing industry: an experimental approach. CCAMLR Science 2:123-129.
CCAMLR, 1996. Fish the Sea Not the Sky: How to avoid by-catch of seabirds when fishing with bottom longlines. CCAMLR Hobart, Tasmania, Australia, 46 pp.
Cherel, Y., H. Weimerskirch and G. Duhamel. 1996. Interactions between longline vessels andseabirds in Kerguelen waters and a method to reduce seabird mortality. Biological Conservation 75: 63-70.
Duckworth, K. 1995. Analyses of factors which influence seabird bycatch in Japanese southern

bluefin tuna longline fishery in New Zealand waters, 1989-93. New Zealand Fisheries Assessment Research Document 95/26.

Lokkeborg, S. 1996. Seabird bycatch and bait loss in longlining using different setting methods. CCAMLR WG-FSA-96/6.

Melvin, E. F., L. L. Conquest and J. K. Parrish. 1997. Seabird bycatch reduction: new tools for Puget Sound drift gillnet salmon fisheries. Washington Sea Grant Program.

Metcalfe, J. D. and Arnold, g. P. 1997. Tracking fish with electronic tags. Nature, London, 387, 665-666.

Murray, T. E., J. A. Bartle, S. R. Kalish and P. R. Taylor. 1993. Bird Conservation International 3:181-210.

Sigler, M. F. and H. H. Zenger. 1994. Relative abundance of sablefish and other groundfish in the Gulf of Alaska based on the domestic longline survey, 1989. NOAA Technical Memorandum NMFS-AFSC-40. 79p.

Attachment B.

OBSERVATIONS OF SEABIRD BEHAVIOR DURING LONGLINE OPERATIONS

We recommend conducting a separate experiment to observe bird behavior during the deployment of gear during commercial operations using various seabird avoidance measures. Selected seabird observers (in addition to any required groundfish observer) on commercial longline vessels would gather data on bird behavior and ascertain the effectiveness of seabird avoidance measures using the same or similar methods as used in the the first part of the pilot study (see Attachment A). Whereas the first part of the study tests the effectiveness of measures in a relatively controlled experimental setting, this portion of the study would provide some groundtruthing as to the practical applications of the seabird avoidance measures and their effectiveness in commercial fishing operations. Vessels would volunteer to assist in the study, but selection would be stratified by fishery and season so that all are covered (e.g sablefish and halibut -spring, summer, and fall; Pacific cod- winter and fall, Greenland turbot-spring etc.).

Objectives:

(1) Preliminary evaluation of effectiveness of current practices used to reduce the incidental take of seabirds.

(2) Look for important variables which may increase or decrease the incidental take of seabirds (e.g. Size and speed of vessel, rate gear is set, bird species and relative numbers, type of deterrent and dimensions, effects of offal discharge on bird numbers near gear, etc).

(3) Determine the effectiveness of the deterrent method for various fishing vessel sizes and types, and fishing practices.

(4) Provide a database necessary for the expansion of the experimental data (Attachment A) to the fishery.

Methods: Use a handheld video camera off the stern of the vessel to record seabird activity during longline setting, similar to the procedure used in the scientific experiment. Record:

(1) Number, species composition, and behavior of seabirds in the vicinity,
(2) Number, distance astern and relative position of species making bait catching attempts during setting of the gear,
(3) Number, species, and distance astern of the vessel for seabirds that grab a bait,
(4) Sea height and direction and wind speed and direction relative to vessel setting speed and direction,
(5) Weather conditions,
(6) Line weighting,if any
(7) Type and geometry of deterrent gear deployed, and
(8) Numbers of birds caught on the gear.

Document by voice the bait catching attempts as the video is being recorded. View videos immediately following the set and determine species, numbers and relative position with respect to the groundline at one minute intervals as in the scientific experiment in Attachment A. Take a random sample of the sets; a minimum of 3 sets each for numerous, moderate, and few birds present. Data will be processed as in the scientific experiment. A review of available videos of longline setting operations is recommended during detailed planning for the observation experiments. (See Mike Sigler and John Karinen at ABL for videos.)

Estimated Costs

		$ Amount (1,000's)
A.	Government costs to develop a work plan, procure a vessel, procure and administer contract, and evaluate contract performance.	
	Vessel cost for 30 days (10 days during 3 periods)	6
	Per Diem for observer	2
	Travel for observer	6
	Equipment for observer-binoculars, camera, video processor	10
	COTR staff time and travel	15
	Time and travel of gov't scientist to consult with contract observer	5
B. Contract Cost		
	Contract or salary for observer/project leader/report writer	10
	Film and Processing of video recordings	10
	Subtotal	64

REFERENCES

Fahy, C. C., 1997. North Pacific longline seabird bycatch deterrent evaluation: Pilot project. Letter to Vivian Mendenhall from C.C. Fahy, May 26, 1997.

Mitchell, Elizabeth, 1997, Draft Report of Seabird Deterrent. Draft sent to John F. Karinen, October 10, 1997.

APPENDIX C

Data recording sheet designed by Vivian Mendenhall, U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 E. Tudor Road, Anchorage, AK 99503

NORTH PACIFIC LONGLINE SEABIRD BYCATCH DETERRENT EVALUATION: PILOT PROJECT

These observations are voluntary and are not an official project of the U. S. Fish and Wildlife Service. We thank you for your help.

SHEET 1: Vessel, fishing, and deterrent data. (Fill in one sheet for each set observed.)

Date [ ] Vessel: Name [ ] Length [ ] Observer [ ]

FISHING INFORMATION

Set time: Start [ ] End [ ] This is set [ ] of [ ] today. Vessel course: [ ]

Set start: Latitude: [ ] Deg. [ ] Min. End: Lat.: [ ] Deg. [ ] Min.

Longitude: [ ] Deg. [ ] Min. [E/W] Long.: [ ] Deg. [ ] Min. [E/W]

Target species [ ] Number of hooks in set [ ]

Baits used [ ] Auto baiter? [Y / N] Bait thrower? [Y / N]

Offal being discharged? [Y / N] Where? [ ]

WEATHER AND SEA DATA

Wind speed (kt) [ ] Direction [ ] Sea state: Wave ht. (ft.) [ ] Swell ht. (ft.) [ ]

Clouds (% cover) [ ] Light: [Day/ Twilight/ Night] Moon: [None/ <1/2 / 1/2 to full]

DETERRENT GEAR USED DURING SET (Check 1 or more heavy boxes and add details)

None [ ] Towed object [ ] : Type [ ]

Weights [ ] : Number of weights [ ] Weight used [ ]

Streamer line [ ] : Number of streamer pairs [ ] Distance between pairs (m) [ ]

Forward end of main line: Ht. above deck (m) [ ] Distance from vessel stern (m) [ ]

Lower ends of streamers should swing near baits; give usual range of:

Distance above water (m) [ ] Horizontal distance from baits (m) [ ]

Other deterrents [ ] : Describe [ ]

COMMENTS

Record bird observations on Sheet Number 2.

Please return forms to: V.M. Mendenhall, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503-6199. (907) 786-3517.

Comments on observations or design of data protocol are welcomed.

NORTH PACIFIC LONGLINE SEABIRD BYCATCH DETERRENT EVALUATION: PILOT PROJECT

These observations are voluntary and are not an official project of the U. S. Fish and Wildlife Service. We thank you for your help.

SHEET 2: Seabird observations. (Fill in one or more sheets for each set observed. Also fill in Sheet 1 for each set.)

Date [ ] Vessel name [ ] Observer [ ] This is set [ ] of [ ] today

Set time: Start [ ] End [ ] Period observed (if not whole set): Start [ ] End [ ]

BIRDS IN VICINITY OF LINE DURING SETTING

Count birds at 15-minute intervals out to 300 m astern and 300 m each side of longline.

Time							
Short-tailed Albatross[1]							
Laysan Albatross							
Black-footed Albatross							
Northern Fulmar							
Total gulls							
Dark shearwaters							
All others							

BIRDS ATTEMPTING TO TAKE BAIT. Record all birds that attack bait during set.

Species/taxonomic group[1]	Number	Took bait?	Bird caught?	Reaction to deterrents/ notes

BYCATCH DURING RETRIEVAL OF SET

Species/taxonomic group[1]	Number	Age (STA)	Where hooked	Band no.	Specimen?[2]

[1]Note your criteria for ID's of birds on back of this form, especially for albatrosses.
[2]Label specimen with date, location, vessel, & observer; freeze.

Return forms to V.M. Mendenhall, U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, AK 99503, (907) 786-3517.

APPENDIX D

Contacts for the issue of seabird bycatch in Alaska's fisheries

National Marine Fisheries Service, Alaska Region
Kim Rivera, Sustainable Fisheries, RO, Juneau
Dr. Brian Fadely, Protected Resources, RO, Juneau
Sue Salveson, Sustainable Fisheries, RO, Juneau
Dr. Steve Zimmerman, Protected Resources, RO, Juneau

National Marine Fisheries Service, Seattle
Shannon Fitzgerald, Observer Program

U.S. Fish and Wildlife Service, Region 7 (Alaska)
Ecological Services/Endangered Species
- Greg Balogh, Anchorage Field Office, Anchorage
- Teresa Woods, RO, Anchorage

Migratory Bird Management
- Kent Wohl, RO, Anchorage
- Dr. Vivian Mendenhall, RO, Anchorage
- Janey Fadely, Juneau

United States Geological Survey
Dr. Patrick Gould, Anchorage

North Pacific Longline Association
Thorn Smith, Seattle, WA

International Pacific Halibut Commission
Bob Trumble, Seattle, WA
Tracee Geernaert, Seattle, WA

University of Washington
Ed Melvin, Seattle (Washington Sea Grant Program)
Dr. Julia Parrish, Univ. of Washington

Other
Mark Lundsten, Seattle, WA
Dr. Elizabeth Flint, USFWS, Hawaii
Kevin Foster, USFWS, Hawaii

APPENDIX E

Definitions of terms

Seabird Bycatch: Incidental mortality of seabirds during fishing operations.

Seabird deterrent methods: Any method used to distract seabirds away from baited longline hooks as they are set, or prevent seabirds from accessing the hooks. Methods include deployment of bird scaring devices such as tori lines and bird buoys, and use of methods such as night fishing or underwater deployment of longlines. Also called: seabird bycatch avoidance methods.

Bird Scaring Device: A device such as a tori line or a bird buoy, deployed behind a vessel during longline setting to keep birds away from the groundline thereby preventing accidental hookings and mortalities.

Tori Line: A line of streamers deployed above the groundline during setting which has numerous streamers attached to it. The streamers are generally constructed of a material which flops and moves unpredictably with the movement of the vessel and wind. When the tori line is constructed and deployed properly, the movement of the streamers keeps seabirds from accessing the baited hooks while the hooks are at or close to the surface of the water. Also called: Streamer Line, Bird Scaring Line.

Night setting: Setting between the hours of nautical twilight to avoid attracting seabird to a longline vessels during setting.

Groundline: The main line set behind a vessels, to which are attached branch lines, or gangions.

Gangions: Branch lines attached to the groundline. Each gangion has a baited hook attached at the end. The length of gangions varies depending on the type of fishing. Gangions in Alaska's longline fisheries are typically relatively short.

AGENDA B-5
DEC. 1998
ATTACHMENT E

CONSULTATION ON THE MANAGEMENT OF FISHING CAPACITY, SHARK FISHERIES AND INCIDENTAL CATCH OF SEABIRDS IN LONGLINE FISHERIES

Rome, 26-30 October 1998

APPENDIX E

INTERNATIONAL PLAN OF ACTION FOR REDUCING INCIDENTAL CATCH OF SEABIRDS IN LONGLINE FISHERIES

Introduction

1. Seabirds are being incidentally caught in various commercial longline fisheries in the world, and concerns are arising about the impacts of this incidental catch. Incidental catch of seabirds may also have an adverse impact on fishing productivity and profitability. Governments, non-governmental organizations, and commercial fishery associations are petitioning for measures to reduce the mortality of seabirds in longline fisheries in which seabirds are incidentally taken.

2. Key longline fisheries in which incidental catch of seabirds are known to occur are: tuna, swordfish and billfish in some particular parts of oceans; Patagonian toothfish in the Southern Ocean, and halibut, black cod, Pacific cod, Greenland halibut, cod, haddock, tusk and ling in the northern oceans (Pacific and Atlantic). The species of seabirds most frequently taken are albatrosses and petrels in the Southern Ocean, northern fulmars in the North Atlantic and albatrosses, gulls and fulmars in the North Pacific fisheries.

3. Responding to the need to reduce the incidental catch of seabirds in commercial fisheries in the Southern Ocean, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) adopted mitigation measures in 1992 for its 23 member countries to reduce incidental catch of seabirds.

4. Under the auspices of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT), Australia, Japan and New Zealand have studied and taken seabird mitigation measures in their southern bluefin tuna longline fishery since 1994, and in 1995 CCSBT adopted the recommendation relating to ecologically related species, including the incidental mortality of seabirds by longline fishing. The recommendation stipulates the policy on data and information collection, mitigation measures, as well as education and information dissemination. All member nations of CCSBT have made the use of bird scaring lines (tori poles) mandatory in their fisheries.

5. The United States of America also adopted, by regulation, measures for reducing incidental catch of seabirds for its groundfish longline fisheries in the Bering Sea/Aleutian Islands and Gulf of Alaska in 1997, and for its halibut fishery in 1998. The United States is currently developing measures to mitigate the incidental catch of seabirds in the Hawaiian pelagic longline fisheries. Several other countries with longline fisheries have likewise adopted similar mitigation measures.

Origin

6. Noting an increased awareness about the incidental catch of seabirds in longline fisheries and its potential negative impacts on seabird populations, a proposal was made at the Twenty-second Session of the Committee on Fisheries (COFI) in March 1997 that FAO organize an expert consultation, using extra-budgetary funds, to develop Guidelines leading to a Plan of Action to be submitted at the next Session of COFI aiming at a reduction in such incidental catch.

7. The *International Plan of Action for reducing incidental catch of seabirds in longline fisheries* (IPOA-SEABIRDS) has been developed through the meeting of a Technical Working Group in Tokyo 25-27 March 1998[1] and the Consultation on the Management of

[1] See: "Report of the Technical Working Group on Reduction of Incidental Catch of Seabirds in Longline Fisheries. Tokyo, Japan, 25–27 March 1998. FAO Fisheries Report No. 585

Fishing Capacity, Shark Fisheries and Incidental Catch of Seabirds in Longline Fisheries held 26-30 October 1998 and its preparatory meeting held in Rome 22-24 July 1998[2].

8. The IPOA-SEABIRDS is to be implemented in a manner consistent with the FAO Code of Conduct for Responsible Fisheries[3] and any applicable rules of international law and in conjunction with relevant international organizations.

Objective

9. The objective of the IPOA-SEABIRDS is to reduce the incidental catch of seabirds in longline fisheries where this occurs.

Implementation

10. The IPOA-SEABIRDS is voluntary. All concerned States[4] are encouraged to implement it.

11. The IPOA-SEABIRDS applies to States in the waters of which longline fisheries are being conducted by their own or foreign vessels and to States that conduct longline fisheries on the high seas and in the exclusive economic zones (EEZ) of other States.

12. In implementing the IPOA-SEABIRDS States should carry out a set of activities. The exact configuration of this set of activities will be based on an assessment of the incidental catch of seabirds in longline fisheries.

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[2] See report: "Preparatory Meeting for the Consultation on the Management of Fishing Capacity, Shark Fisheries and Incidental Catch of Seabirds in Longline Fisheries". Rome, 22–24 July, 1998. FAO Fisheries Report No. 584.

[3] Article 7.6.9 of the Code provides that States should take appropriate measures to minimize waste, discards, catch by lost or abandoned gear, catch of non-target species, both fish and non-fish species, and negative impact on associated or dependent species in particular endangered species. It further provides that States and sub-regional or regional fisheries management organizations and arrangements should promote, to the extent practicable, the development and use of selective, environmentally safe and cost effective gear and techniques. Article 8.5 of the Code provides guidance on the role of fishing gear selectivity in responsible fisheries.

[4] In this document the term "State" applies *mutatis mutandis* also to "fishing entities" other than States and to any other entity, or organization, to which countries have transferred their right to set policies and manage fisheries.

13. States with longline fisheries should conduct an assessment of these fisheries to determine if a problem exists with respect to incidental catch of seabirds. If a problem exists, States should adopt a National Plan of Action for reducing the incidental catch of seabirds in longline fisheries (NPOA-SEABIRDS). (See the attached "Technical Note on developing a National Plan of Action for reducing the incidental catch of seabirds in longline fisheries".) When developing the NPOA-SEABIRDS experience acquired in regional management organizations should be taken into account as appropriate. FAO should provide a list of experts and a mechanism of technical assistance to countries in connection with development of NPOA-SEABIRDS.

14. States which determine that an NPOA-SEABIRDS is not necessary should review that decision on a regular basis, particularly taking into account changes in their fisheries, such as the expansion of existing fisheries and/or the development of new longline fisheries. If, based on a subsequent assessment, States determine that a problem exists, they should follow the procedures outlined in paragraph 13, and implement an NPOA-SEABIRDS within two years.

15. The assessment should be included as a part of each relevant State's NPOA-SEABIRDS.

16. Each State is responsible for the design, implementation and monitoring of its NPOA-SEABIRDS.

17. States recognize that each longline fishery is unique and the identification of appropriate mitigation measures can only be achieved through on-the-spot assessment of the concerned fisheries. Technical and operational mitigation measures are presently in use or under development in some longline fisheries where incidental catch of seabirds occurs. Measures developed by different States are listed in the Technical Note attached to this document. This list does not prejudice the right of States to decide to use any of these or other suitable measures that may be developed. A more comprehensive description and discussion of the mititagion measures currently used or under development can be found in FAO Fisheries Circular No. 937.

18. States should start the implementation of the NPOA-SEABIRDS no later than the COFI Session in 2001.

19. In implementing their NPOA-SEABIRDS States should regularly, at least every four years, assess their implementation for the purpose of identifying cost-effective strategies for increasing the effectiveness of the NPOA-SEABIRDS.

20. States, within the framework of their respective competencies and consistent with international law, should cooperate through regional and subregional fisheries management organizations or arrangements, and other forms of cooperation, to reduce the incidental catch of seabirds in longline fisheries.

21. In implementing the IPOA-SEABIRDS States recognize that cooperation among States which have important longline fisheries is essential to reduce the incidental catch of seabirds given the global nature of the issue. States should strive to collaborate through FAO and through other arrangements in research, training and the production of information and promotional material.

22. States should report on the progress of the assessment, development and implementation of their NPOA-SEABIRDS as part of their biennial reporting under the Code of Conduct for Responsible Fisheries.

Resource requirements for FAO

23. FAO will, as directed by its Conference, and as part of its regular programme activities support States in the implementation of the IPOA-SEABIRDS.

24. FAO will, as directed by its Conference, support development and implementation of NPOA-SEABIRD through specific, in-country technical assistance projects with Regular Programme funds and by use of extra-budgetary funds made available to the Organization for this purpose.

25. FAO will, through COFI, report biennially on the state of progress in the implementation of the IPOA-SEABIRDS.

Technical Note on developing a National Plan of Action for reducing the incidental catch of seabirds in longline fisheries (NPOA-SEABIRDS)

This is not an exclusive or necessarily all-encompassing list but provides guidance for preparation of the NPOA-SEABIRDS.

The NPOA-SEABIRDS is a plan that a State designs, implements and monitors to reduce the incidental catch of seabirds in longline fisheries.

I. Assessment

1. The purpose of the assessment is to determine the extent and nature of a State's incidental catch of seabirds in longline fisheries where it occurs.

2. The assessment may include, but is not limited to, the collection and analysis of the

- Criteria used to evaluate the need for an NPOA-SEABIRDS
- Fishing fleet data (numbers of vessels by size).
- Fishing techniques data (demersal, pelagic, methods).
- Fishing areas.
- Fishing effort by longline fishery (seasons, species, catch, number of hooks/year/fishery).
- Status of seabird populations in the fishing areas, if known.
- Total annual catch of seabirds (numbers per 1000 hooks set/species/longline fishery.
- Existing mitigation measures in use and their effectiveness in reducing incidental catch of seabirds.
- Incidental catch of seabirds monitoring (observer program, etc).
- Statement of conclusions and decision to develop and implement an NPOA-SEABIRDS.

II. NPOA - SEABIRDS

The NPOA-SEABIRDS may contain the following elements:

1. Prescription of mitigation measures

- The NPOA-SEABIRDS should prescribe appropriate mitigation methods. These should have a proven efficiency, and be cost-effective for the fishing industry. If effectiveness of mitigation measures can be improved by combining different mitigation measures or devices, it is likely that each State will find it advantageous to implement a number of different measures that reflect the need and particular circumstances of their specific longline fishery.

2. Research and development

- The NPOA-SEABIRDS should contain plans for research and development, including those aiming: (i) to develop the most practical and effective seabird deterrent device; (ii) to improve other technologies and practices which reduce the incidental capture of seabirds; and (iii) undertake specific research to evaluate the effectiveness of mitigation measures used in the longline fisheries, where this problem occurs.

3. Education, training and publicity

- The NPOA-SEABIRDS should prescribe means to raise awareness among fishers, fishing associations and other relevant groups about the need to reduce the incidental catch of seabirds in longline fisheries where this occurs; National and International Plans of Action and other information on the incidental catch of seabirds in longline fisheries; and to promote the implementation of the NPOA-SEABIRDS among national industry, research and its own administration.

- Provide information about technical or financial assistance for reducing the incidental catch of seabirds.

- Preferably design and implementation of outreach programmes for fishers, fisheries managers, gear technologists, maritime architects, shipbuilders, and conservationists and other interested members of the public should be described in the plan. These programmes should aim at improving the understanding of the problem resulting from incidental catch of seabirds and the use of mitigation measures. The outreach programme may include educational curricula, and guidelines disseminated through videos, handbooks, brochures and posters. The programme should focus on both the conservation aspects of this issue and on the economic benefits of expected increased fishing efficiency *inter alia* by eliminating bait loss to seabirds.

4. Data Collection

- Data collection programmes should collect reliable data to determine the incidental catch of seabirds in longline fisheries and the effectiveness of mitigation measures. Such programmes may make use of onboard observers.

Technical note on some optional technical and operational measures for reducing the incidental catch of seabirds

I. Introduction

To reduce the incidental catch of seabirds, it is essential to reduce the number of encounters between seabirds and baited hooks. It should be noted that, if used in combination, the options could improve mitigation effectiveness.

For each of the measures, the effectiveness and the cost involved for fishers are briefly presented. In this presentation, "effectiveness" is defined as to what extent the measures reduces incidental catch of seabirds; "cost" is defined as the initial cost or investment and any ongoing operational costs.

Other technical options are currently under development and fishers and researchers in the field may develop new mitigation measures, so the list of measures is likely to increase over time.

If effectiveness of mitigation measures can be improved by combining different mitigation measures or devices, each State may find it advantageous to implement different measures that are more suitable for their conditions and reflect the needs of their specific longline fisheries.

The list below should not be considered mandatory or exhaustive and FAO shall maintain a data base of measures that are in use or under development.

II. Technical measures

1. Increase the sink rate of baits

a. Weighting the longline gear

Concept: Increase the sinking speed of baited hooks and reduce their exposure time to seabirds.
Effectiveness: Studies have shown that appropriate line-weighting can be highly effective in avoiding bait loss to birds.
Cost: The cost is the initial purchase of the weighting material (either heavier gear or weights) and any ongoing replacement of weights lost during fishing.

b. Thawing bait

Concept: Overcome buoyancy problems in bait by thawing and/or puncturing swim bladders
Effectiveness: Rate of incidental catch of seabirds is reduced when thawed baits are used. It has also been shown that bait fish with deflated swim bladders sink more quickly than those with inflated swim bladders did.

Cost: Possible costs include bait thawing rack, or extra weight to compensate flotation resulting from the air bladder.

c. Line-setting machine

Concept: Increase line sinking rate by removing line tension during gear deployment
Effectiveness: Although no quantitative assessments have been done, this practice would result in the line sinking more rapidly thereby reducing availability of baited hooks to seabirds.
Cost: For some fisheries, initial costs may include purchase of a line-setting device.

2. Below-the-water setting chute, capsule, or funnel

Concept: Prevent access by seabirds to baited hooks by setting line under water.
Effectiveness: Underwater setting devices are still under development but could have high effectiveness.
Cost: Initial cost would include purchase of the underwater setting device.

3. Bird-scaring line positioned over or in the area where baited hooks enter the water

Concept: Prevent seabirds access to baited hooks where they enter the water. The bird scaring line is designed to discourage birds from taking baited hooks by preventing their access to baited hooks. Design specifications may vary by vessel, fishing operation, and location and are critical to its effectiveness. Streamer lines and towing buoys are examples of these techniques.
Effectiveness: A number of studies and anecdotal observations have demonstrated significant effectiveness of these devices when properly designed and used.
Cost: Low initial cost for the purchase and installation of bird scaring line.

4. Bait casting machine

Concept: Places bait in area protected by a bird scaring line and outside the turbulence caused by the propeller and the ships wake.
Effectiveness: Deployment of bait under the protection zone of the bird-scaring line reduces the availability of baited hooks to seabirds. The extent to which bait loss is reduced by the use of bait casting machines, used either without a bird-scaring line or in such a manner that baits are not protected by a bird-scaring line, is yet to be determined.
Cost: High, initial costs may include purchase of a bait-casting device.

5. Bird scaring curtain

Concept: To deter seabirds from taking baited hooks during the haul by using a bird scaring curtain.
Effectiveness: Anecdotal evidence indicates that the bird-scaring curtain can effectively discourage birds from seizing baits in the hauling area.
Cost: Low, cost for materials.

6. Artificial baits or lures

Concept: Reduce palatability or availability of baits.
Effectiveness: New baits are still under development and effectiveness has yet to be resolved.
Cost: Currently unknown

7. Hook modification

Concept: Utilize hook types that reduce the probability of birds getting caught when they attack a baited hook.
Effectiveness: Hook size might effect the species composition of incidental caught seabirds. The effect of modification of hooks is, however, poorly understood.
Cost: Unknown.

8. Acoustic deterrent

Concept: Deterring birds from the longline using acoustic signals, such as high frequency, high volume, distress call, etc
Effectiveness: Low probability of being effective as background noises are loud and habituation to noises is common among seabirds.
Cost: Unknown

9. Water cannon

Concept: Concealing baited hooks by using high pressure water.
Effectiveness: There is no definite conclusion about the effectiveness of this method.
Cost: Unknown.

10. Magnetic deterrent

Concept: Perturbing the magnetic receptors of the birds by creating magnetic fields.
Effectiveness: No indication of effect in practical experiments.
Cost: Unknown.

III. Operational Measures

1. Reduce visibility of bait (Night setting)

Concept: Set during hours of darkness and reduce illumination of baited hooks in the water.
Effectiveness: This method is generally recognized as being highly effective. However, effectiveness can vary between fishing grounds and also seasonally according to the seabird species. Effectiveness of this measure may be reduced around the full moon.
Cost: A restriction of line setting to the hours of darkness may affect fishing capacity, especially for smaller longliners. Small costs may be incurred to make vessel lighting appropriate.
Such restriction can also entail investing in costly technology for maximizing fishing efficiency in a shorter period of time.

2. Reduce the attractiveness of the vessels to seabirds

Concept: Reducing the attractiveness of vessels to seabirds will reduce the potential for seabirds being incidentally caught. Materials (e.g. fish discards, garbage) discharged from vessels should be at a time or in a way that makes them least available to birds or least likely to cause them harm. This includes avoidance of the dumping of discarded fish, offal, fish heads, etc. with embedded hooks. If dumping offal is unavoidable, it should be done on the opposite side of the vessel to where lines are being set or in such a manner that birds are not attracted to the vessel (e.g. at night).
Effectiveness: The issue of offal discharge is a complex one, and there have been conflicting results regarding effects of various procedures in the studies done to date.
Cost: Low; in some situations costs may be associated with providing for offal containment or reconfiguration of offal discharge systems on the vessel.

3. Area and seasonal closures

Concept: Reduce incidental catch of seabirds when concentrations of breeding or foraging seabirds can be avoided.
Effectiveness: Area and seasonal closures could be effective (such as in high density foraging areas or during the period of chick care when parental duties limit the distances adults can fly from breeding sites) although displacement of fishing fleet to other seabird areas needs to be considered.
Cost: Unknown, but a restriction on fishing by area or season may effect fishing capacity.

4. Give preferential licensing to vessels that use mitigation measures that do not require compliance monitoring

Concept: Incentive provided for effective use of mitigation measures that do not require compliance monitoring.
Effectiveness: May be highly effective in stimulating the use of mitigation measures and development of fishing systems that reduce incidental catch of seabirds
Cost: Unknown.

5. Release live birds

Concept: If despite the precautions, seabirds are incidentally caught, every reasonable effort should be made to ensure that birds brought onboard alive are released alive and that when possible hooks should be removed without jeopardizing the life of the birds
Effectiveness: Depends on the number of birds brought onboard alive and this is considered small by comparison to the numbers killed in line setting.
Cost: Unknown

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Press Release 98/64

INTERNATIONAL CONFERENCE APPROVES DRAFT DOCUMENTS ON THE MANAGEMENT OF FISHING CAPACITY, SHARKS AND SEABIRD BYCATCH

Rome, 3 November - The drafts of three non-binding global documents aiming at a more sustainable management of vulnerable fisheries resources were approved by representatives from 81 countries and the European Community attending an international conference on fisheries, the UN Food and Agriculture Organization (FAO) announced today.

The draft documents "International Guidelines/Plan of Action for the Management of Fishing Capacity", the "International Plan of Action for the Conservation and Management of Sharks" and the "International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries" will be submitted to the FAO Committee on Fisheries in February 1999 for final adoption.

With the consensus approval of the texts, the countries have now prepared the ground for the formal joint declaration of their political commitment next February to take concrete actions in order to better manage fisheries at the national and international levels with respect to the three major issues requiring urgent attention.

The participating countries expressed their concern about excess capacity in world fisheries, "a problem that among others, contributes substantially to overfishing, the degradation of marine fisheries resources, the decline of food production potential, and significant economic waste".

The conference approved draft voluntary International Guidelines/Plan of Action for the Management of Fishing Capacity with the objective of achieving "an efficient, equitable and transparent management of fishing capacity". According to the draft document, "where capacity is undermining achievement of long term sustainability outcomes" countries implementing the Guidelines/Plan of Action, "should endeavour initially to limit at present level and progressively reduce the fishing capacity applied to affected fisheries".

Countries emphasized the need to improve data (information) on fishing capacity, especially as regards the characteristics of fleets, their mobility, and their effect on the sustainability of the stocks which they exploit. The conference approved related measures as well as the timely undertaking of diagnoses which would allow the systematic identification of fisheries requiring urgent measures.

The draft document approved by the conference foresees the voluntary adoption of national plans of action for the management of fishing capacity as well as a range of complementary measures aimed at strengthening regional collaboration and reducing fishing capacity applied to overfished stocks.

The conference considered many of the complex issues related to excess fishing capacity, its causes and its management such as, the case of the small-scale fisheries and the effects of fleet mobility, conditions of access to fisheries, subsidies, fisheries management methods and fleet reduction measures. The document approved by the conference provides guidance on some of these issues and contains provisions for further collaborative work to be undertaken with the assistance of FAO on developing a better understanding of the management of fishing capacity.

Several delegations disputed the listing in the working document of a number of fishery resources which FAO Secretariat considered significantly overfished, stating that the information regarding some commercial fish stocks was inaccurate and that the management efforts taken by states in recent years and their positive results should have been taken into account.

The countries also expressed their "concern over the increase of shark catches and the consequences which this has for the populations of some shark species in several areas of the world's oceans". The conference approved a draft voluntary International Plan of Action for the Conservation and Management of Sharks which says "that it is necessary to better manage directed shark fisheries and certain multispecies fisheries in which sharks constitute a significant bycatch. In some cases the need for management may be urgent."

According to the non-binding Plan of Action, "management and conservation strategies should aim to keep total fishing mortality for each stock within sustainable levels." It should be recognized "that in some low-income food-deficit regions and countries shark fisheries are a traditional and important source of food, employment and income. Such fisheries should be managed on a sustainable basis to provide a continued source of food, employment and income to local communities".

The countries implementing the voluntary Plan of Action would commit themselves to regularly assess the status of stocks and "to adopt a national plan of action for conservation and management of shark stocks (Shark-plan)" if necessary. The Plan provides that "states should strive to have a Shark-plan by the year 2001".

The plan will aim "to ensure that catches are sustainable, to assess threats to shark populations, and to minimize incidental catches as well as waste and discards from shark fisheries." At least every four years states would assess the implementation of their Shark-plan.

In addition, FAO would report every two years on the progress made in the implementation of the International Plan of Action. According to FAO, the more countries implement the Plan of Action, the more will be known about shark stocks so that appropriate management action can be taken to protect those whose catch is or becomes unsustainable.

The conference also approved a draft International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries. The voluntary Plan says that "States with longline fisheries should assess these fisheries to determine if a problem exists with respect to incidental catch of seabirds." If such is the case states should adopt a national Plan of Action for reducing bycatches of seabirds.

Countries are expected to start the implementation of the national Plan of Action by the year 2001. States should regularly, at least every four years, assess the implementation of their Plans to identify "cost-effective strategies for increasing effectiveness". FAO will report every two years on the progress made.

The incidental bycatch of seabirds, which affects, among others, the albatrosses and petrels of the Southern Ocean, could be significantly reduced by mitigation measures such as setting catch lines under water so that baited hooks are out of reach to seabirds, using bird-scaring lines or setting lines at night.

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For further information please contact the FAO Homepage (http://www.fao.org/WAICENT/FAOINFO/FISHERY/faocons/faocons.htm) or Erwin Northoff, Media Officer, tel: 0039-06-5705 3105; fax: 0039-06-5705 4975; e-mail: Erwin.Northoff@FAO.Org.

Preliminary Results of Seabird Observations and Bycatch Reported By Fishermen to IPHC Samplers in Alaskan and Canadian Ports in 1998

by

Robert J. Trumble and Tracee Geernaert
International Pacific Halibut Commission
December 1998

ABSTRACT

Regulations implemented in 1997 for groundfish and in 1998 for Pacific halibut to require seabird avoidance devices in Alaskan longline fisheries also required monitoring of the effects of the regulations. The lack of observer coverage on halibut vessels precludes direct observations of seabird bycatch. At the request of the U.S. Fish and Wildlife Service (FWS) and the U.S. National Marine Fisheries Service, the staff of the International Pacific Halibut Commission (IPHC) interviewed Pacific halibut longline fishermen in Alaska and British Columbia to collect data concerning bycatch of seabirds and observations of short-tailed albatross. Tori lines and towed buoy bags were the most common avoidance devices, and had bird bycatch rates among the lowest of devices used. The reported seabird bycatch rates for the halibut fishery in 1998, after implementation of the avoidance regulations, were about 10-15 percent of the rates reported by FWS for the groundfish fisheries before the avoidance regulations. Either the avoidance regulations worked, the fishermen underreported seabird bycatch, seabird bycatch rates are different for the two fisheries, or all three. Highest reported seabird bycatch in May and reported sightings of short-tailed albatross through the summer were consistent with previous reports. However, fishermen in some areas reported no seabird bycatch, a likely indicator of underreporting.

INTRODUCTION

The endangered status of the short-tailed albatross (*Phoebastria albatrus*) has prompted international action to reduce threats to the survival of the species. Seabird bycatch in general has raised concerns for longline fisheries in waters of the northeast Pacific Ocean. The U.S. National Marine Fisheries Service (NMFS) implemented regulations for Alaskan waters requiring bird avoidance devices for vessels 26 feet or longer in the longline fishery for groundfish (May 29, 1997) and for Pacific halibut (*Hippoglossus stenolepis*) (April 6, 1998). In March 1998, the U.S. Fish and Wildlife Service (FWS) and the NMFS completed a consultation on the effects of the Pacific halibut fishery on short-tailed albatross, as required under Section 7 of the Endangered Species Act. Among other things, the Section 7 Consultation required that NMFS must include reporting and monitoring requirements that assure adequate action agency oversight of any incidental take. No on-board observer program occurs for the halibut fishery, so monitoring cannot take place in the traditional way. No bird avoidance regulations apply to Canadian fishermen.

At a request from NMFS and FWS, the International Pacific Halibut Commission (IPHC) staff agreed to monitor sightings of short-tailed albatross and incidental catch of seabirds by Pacific halibut fishermen during 1998. IPHC port samplers interviewed fishermen for information on seabirds. Halibut fishermen were requested to maintain records of sightings and incidental catch in their logbooks to help ensure completeness and accuracy. The commercial halibut fishery in Alaska and Canada extends from March 15 through November 15 each year.

The FWS used NMFS observer data to calculate average seabird bycatch for 1993-1996 from the groundfish fisheries (not including halibut or sablefish) (Stehn USFWS, unpub.). FWS estimated seabird bycatch rates in the range of 59-87 seabirds caught per million hooks. In the absence of an observer program for the halibut fishery, information gathered by the IPHC port samplers would be the best available information. The FWS also requested that fishermen record behavior, identifying characteristics, and any other information when they see short-tailed albatross. The IPHC port samplers provided a telephone number, FAX number, or self-addressed, stamped envelopes from FWS to any fisherman who wanted to provide additional information on short-tailed albatross to FWS.

METHODS

The IPHC staff constructed a seabird observation form so that all port samplers could obtain the information in a consistent manner. IPHC port samplers interviewed captains of vessels landing halibut, including vessels that fished primarily for sablefish (*Anaplopoma fimbria*). IPHC port samplers asked for the following information: catch and date of short-tailed albatross by IPHC area; sightings of short-tailed albatross, including date and location; and number and dates of other bird by major groups (albatrosses, fulmars, shearwaters, and others) caught in the IPHC areas.

While the primary focus was on Alaskan waters, port samplers in Canadian ports also inquired about short-tailed albatross and other seabirds. To increase awareness of the project, the IPHC staff sent out a news release and talked to various members of the media. All fishermen licensed for longline fishing in Alaska and British Columbia received a placard with identification characteristics for short-tailed albatross, laysan albatross, and black-footed albatross.

IPHC port samplers regularly collect logbook data from fishermen to determine gear specification, location, catch per skate, and fish ticket weight. The total poundage of halibut represented in the seabird data queries was obtained by adding up fish ticket weights. Data in this report were truncated in early October to allow time for analysis. The total number of hooks fished was obtained by dividing total halibut fish ticket weight in an IPHC regulatory area (Fig. 1) by the average halibut catch per unit effort (CPUE) in that area. CPUE is not calculated by month or season and was not available for avoidance device types. In these cases, halibut pounds landed substituted for halibut CPUE as an indicator of seabird bycatch rates.

RESULTS

Through early October 1998, IPHC port samplers conducted 805 interviews from 252 vessels at Canadian ports and 3,018 interviews from 873 vessels in Alaskan ports (Fig. 2). Vessels interviewed accounted for 70 % (9.09 million pounds) of the 13 million pound quota in Canada, and 56% (32.43 million pounds) of the 58 million pound quota in Alaska. The reported seabird bycatch totaled 28 black-footed albatross, 56 northern fulmar, and eight shearwaters and gulls combined (Table 1). No short-tailed albatross bycatch was reported.

Alaska regulations allow a number of bird avoidance measures. The port sampling interviews documented four primary methods and a series of minor methods (Fig. 3). Towed buoys (typically known as bird bags), Tori lines, multiple devices (two or more of the devices from Fig. 3), and weighted lines accounted for the majority of devices. These devices also caught more seabirds than were caught by the minor methods. Bird bags and Tori lines had among the lowest rates (birds per million pounds) of bird bycatch (Fig. 4). Measures that intuitively seemed beneficial – fishing in the dark and using multiple devices – had the highest reported rates. Casting offal as a distraction and weighted lines fell in an intermediate range. Fishermen using no bird avoidance device reported low seabird bycatch.

The central Gulf of Alaska had the highest reported seabird bycatch rates (Fig. 5). No seabirds were reported caught from the Bering Sea or Aleutian Islands. Reported seabird bycatch rates ranged from 0 in the Bering Sea and southeast Alaska, 4-5 per million hooks in British Columbia waters and along the Alaska Peninsula, to 12 per million hooks in the central Gulf of Alaska. For areas with reported seabird bycatch, British Columbia fishermen reported the highest albatross catch, while the highest fulmar catch occurred in the central Gulf of Alaska (Fig. 6).

By far the most seabirds were reported caught in May (Fig. 7), followed by April and June. No bird bycatch was reported in July and no fulmar bycatch reported in August. The pounds of halibut harvest represented by the interviews was comparable for May through September, suggesting that the bycatch rate peaks in the spring, and rapidly falls in the summer and fall.

Halibut fishermen interviewed reported 159 sightings of the endangered short-tailed albatross, with May through August the peak period for sightings (Fig. 8). We cannot determine if these sightings represent unique individuals, as multiple sightings of individual birds could occur. Sightings appear to decline in the fall, but October observations were too few to confirm the pattern. Short-tailed albatross first appeared in April. This pattern contrasts with the bycatch of other seabirds, which peak in spring and decline through summer and fall.

The most short-tailed albatross sightings occurred in the central Gulf of Alaska (Fig. 9), the region with the highest pounds of halibut landed and the largest number of vessels. The fewest sightings occurred in southeast Alaska and British Columbia waters, even though these areas had relatively large halibut harvest and number of vessels fishing. The Bering Sea and Aleutian Islands had intermediate levels.

DISCUSSION

The seabird bycatch rate in the halibut fishery calculated from the IPHC interviews, in the range of 4-12 per million hooks, is substantially lower than the 59-87 seabirds per million hooks calculated by the FWS using observer data from the Alaskan groundfish fishery (unpub. FWS Memo from Bob Stehn to Kent Wohl and Pat Gould, Jan. 6, 1998). The halibut data came from a period when seabird avoidance measures were required, while the groundfish data were collected before the requirement for avoidance devices. One may conclude that the bird avoidance measures are working to reduce seabird bycatch, that fishermen underreport seabird bycatch, that seabird bycatch is for between groundfish and halibut fisheries, or a combination of the three. We have no information to tell if bird bycatch rates differ for halibut and groundfish fisheries, but halibut fisheries generally use larger hooks (16/0 hooks) than the groundfish fisheries (13/0 or 14/0 hooks).

Relying on fishermen to report actions that may have adverse effects must be done with caution. Longline fishermen in Alaska are generally aware of the potential fishery closures that may occur from bycatch of the short-tailed albatross, and that members of conservation communities have concerns for other seabird bycatch. Fishermen have an incentive to underreport seabird bycatch. The incentive is greatest for bycatch of the short-tailed albatross on unobserved vessels. No management actions occur for bycatch of other seabird species, so the incentive to underreport other seabirds is clearly less than for short-tailed albatross.

IPHC port samplers report that some fishermen refused to answer questions. One could surmise that these fishermen are more likely to have higher seabird bycatch, but some fishermen also object to providing information. Other fishermen who answered the interview questions did so without apparent reservation. In general, the port samplers felt that participating fishermen did so willingly.

The pattern of reported seabird bycatch and short-tailed albatross sightings is consistent with other available information. The Section 7 Consultation on effects of the halibut fishery on the short-tailed albatross shows highest abundance during summer, the same pattern documented from the IPHC interviews with fishermen. Conversations with longline fishermen indicate that seabirds are most aggressive and most often caught during spring, especially in May, when the seabirds typically arrive in Alaska at the completion of migration. May was the month of highest reported seabird bycatch.

Some data reported to IPHC port samplers, however, seem erroneous. Zero seabird bycatch in the Bering Sea, Aleutian Islands, and southeast Alaska, zero short-tailed albatross observed in the Bering Sea and Aleutian Islands, and one short-tailed observed in southeast Alaska seem extraordinarily low. Some seabirds were almost certainly caught in these areas. If so, then the overall average seabird bycatch rates are too low.

Bycatch rates by bird avoidance device are not consistently believable. Multiple devices and setting during darkness had the highest bycatch rates among the various methods used. A combination of buoy and tori line, the most common multiple device and the combination of two of the individually lowest-rate devices, should make a very effective combination. Fishing in the dark is prescribed as a preferred method in the federal regulations. These could be examples of fishermen mis-reporting device type. However, if an incentive exists to underreport, high reported bycatch rates are hard to understand for devices expected to have low rates.

A number of fishermen in Alaska reported using no device, but reported only one seabird caught. The single seabird caught while fishing without a device is nearly impossible if these vessels are representative of the fleet as a whole. Vessels smaller than 26 ft in length do not require bird avoidance measures. Most of the vessels that did not use a device fished in the inside waters of southeast Alaska, where many small vessels typically fish. We cannot confirm until more data are processed if only small vessels fish without devices. Alternatively, larger vessels may not use a device, but report no seabird catch.

Seabird bycatch and short-tailed albatross sightings were collected by IPHC port samplers at the request of NMFS and FWS. The IPHC staff will rely on these agencies and other reviewers with an interest in seabird bycatch to evaluate the effectiveness of the interview program. If sufficient interest develops for the interview data, the IPHC staff will continue to collect the data.

Table 1. Summary of data from IPHC seabird bycatch interviews.

Data	2A	2B	2C	3A	3B	Area 4	Total
Interviewed vessels	29	805	807	1522	315	374	3852
Interviewed pounds (millions)	0.4	9.1	3.9	15.6	7.0	6.1	42.1
Interviewed hooks (millions)	0.2	4.2	1.9	4.4	1.5	3.2	15.4
Birds caught/million hooks	0	4.2	0	12.8	4.8	0	6.0
Birds caught/million pounds	0	2.8	0	3.9	1.0	0	2.2
Short-tailed albatross observed	0	4	1	82	37	0	124
Black-footed albatross caught	0	17	0	10	1	0	28
Northern fulmars caught	0	2	0	48	6	0	56
Shearwaters caught	0	2	0	1	0	0	3
Others caught	0	4	0	1	0	0	5

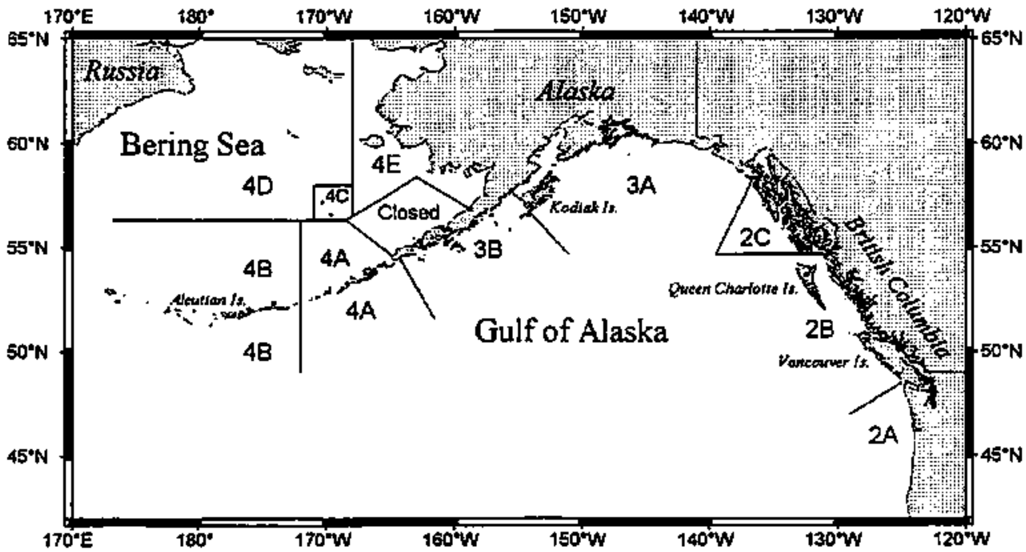


Figure 1. International Pacific Halibut Commission regulatory areas.

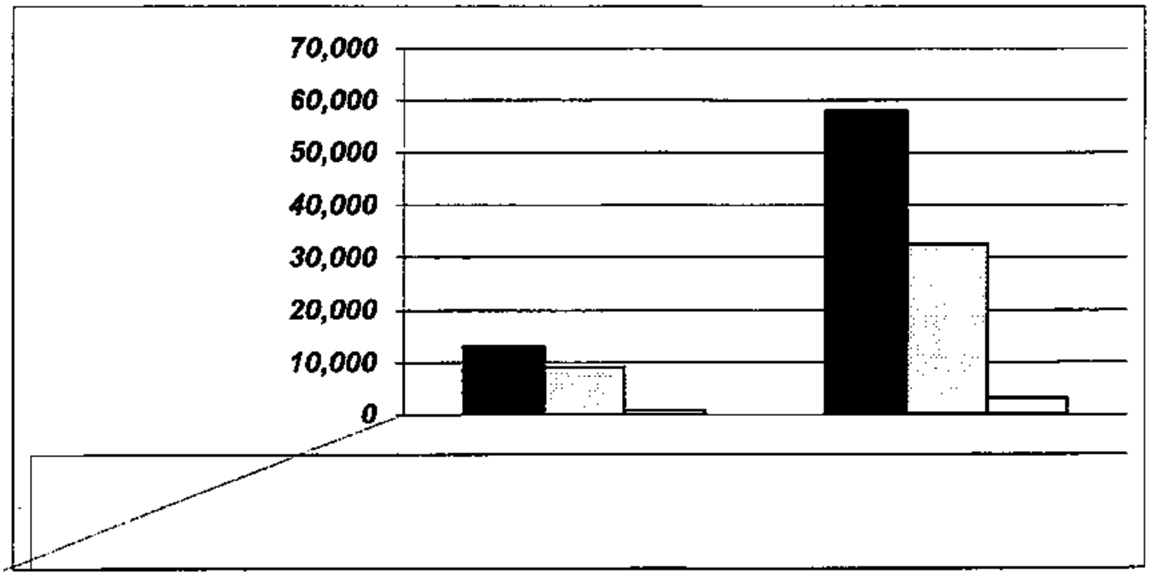


Figure 2. Data breakdown by country.

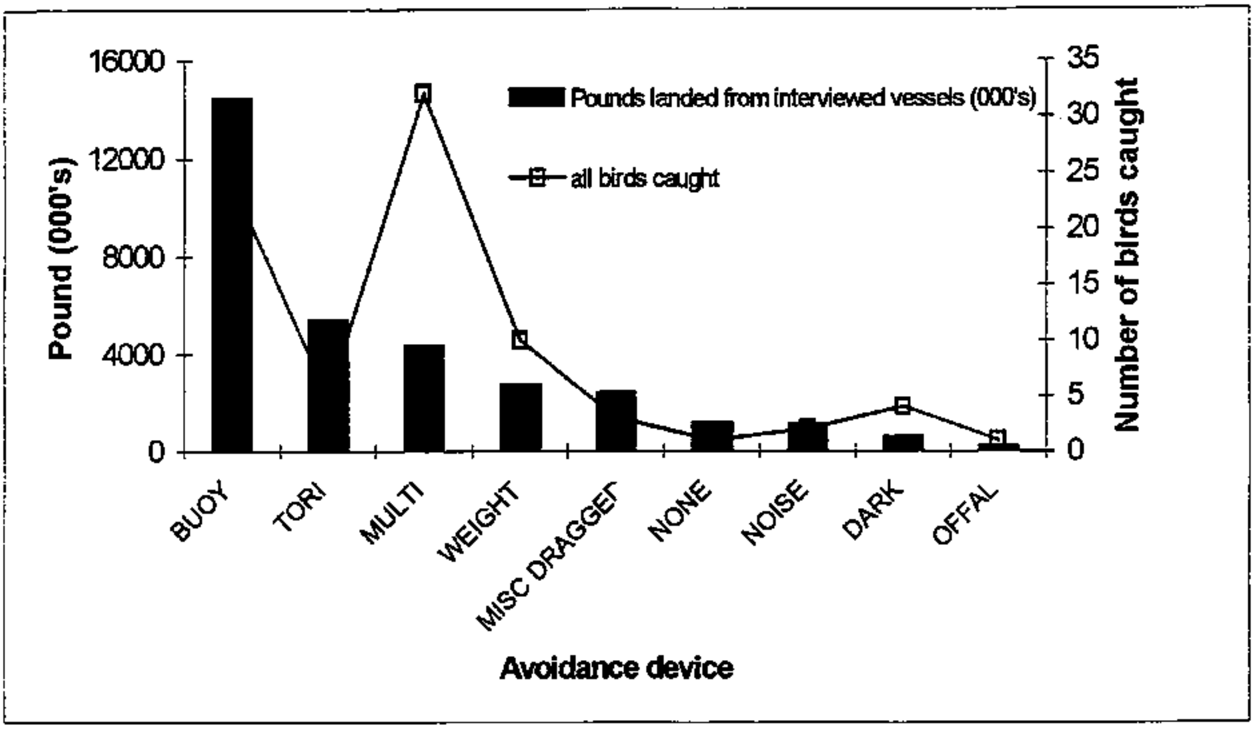


Figure 3. Bird catch and poundage landed by avoidance device.

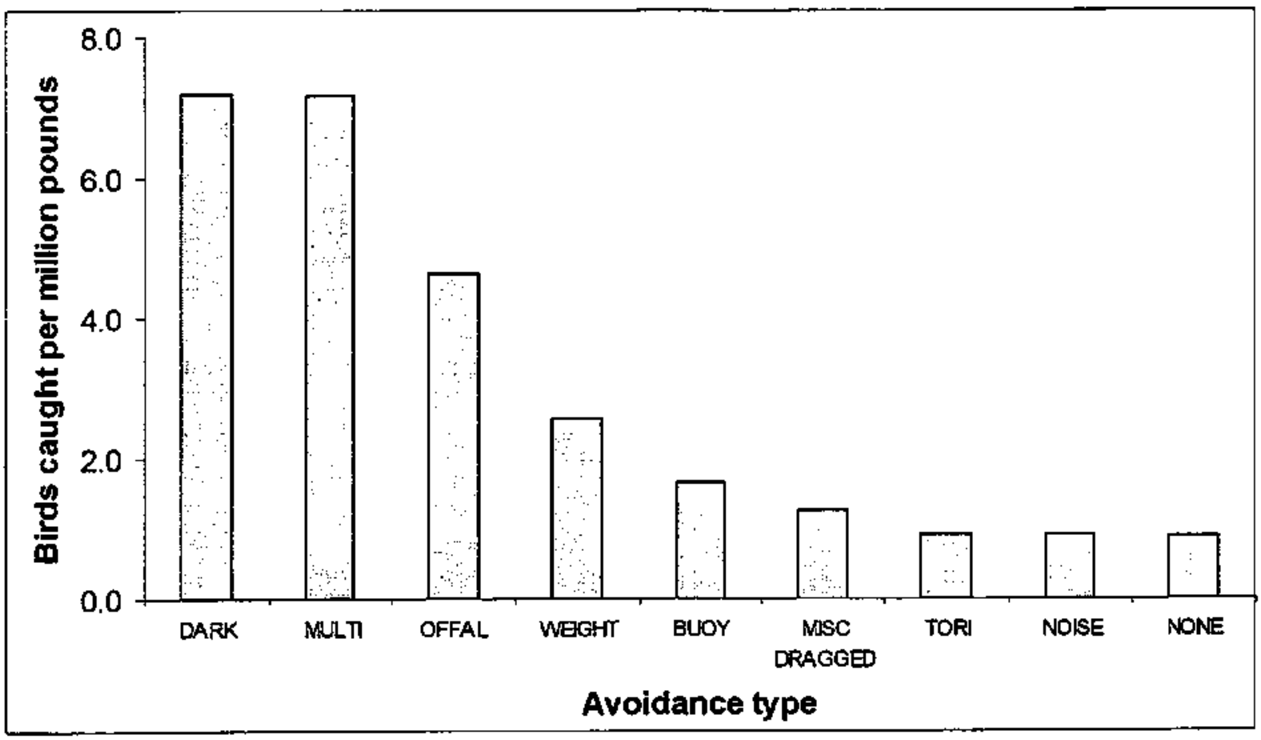


Figure 4. Birds caught per million pounds by avoidance device.

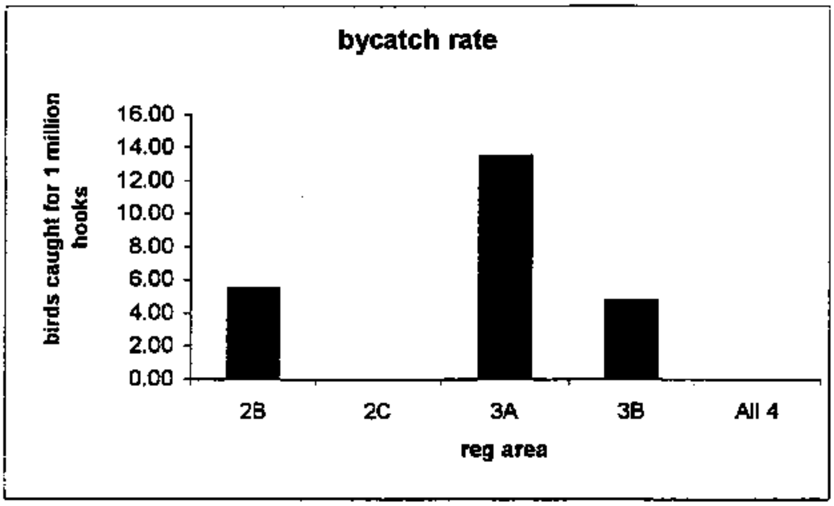


Figure 5. Birds caught per millions hooks by IPHC regulatory area.

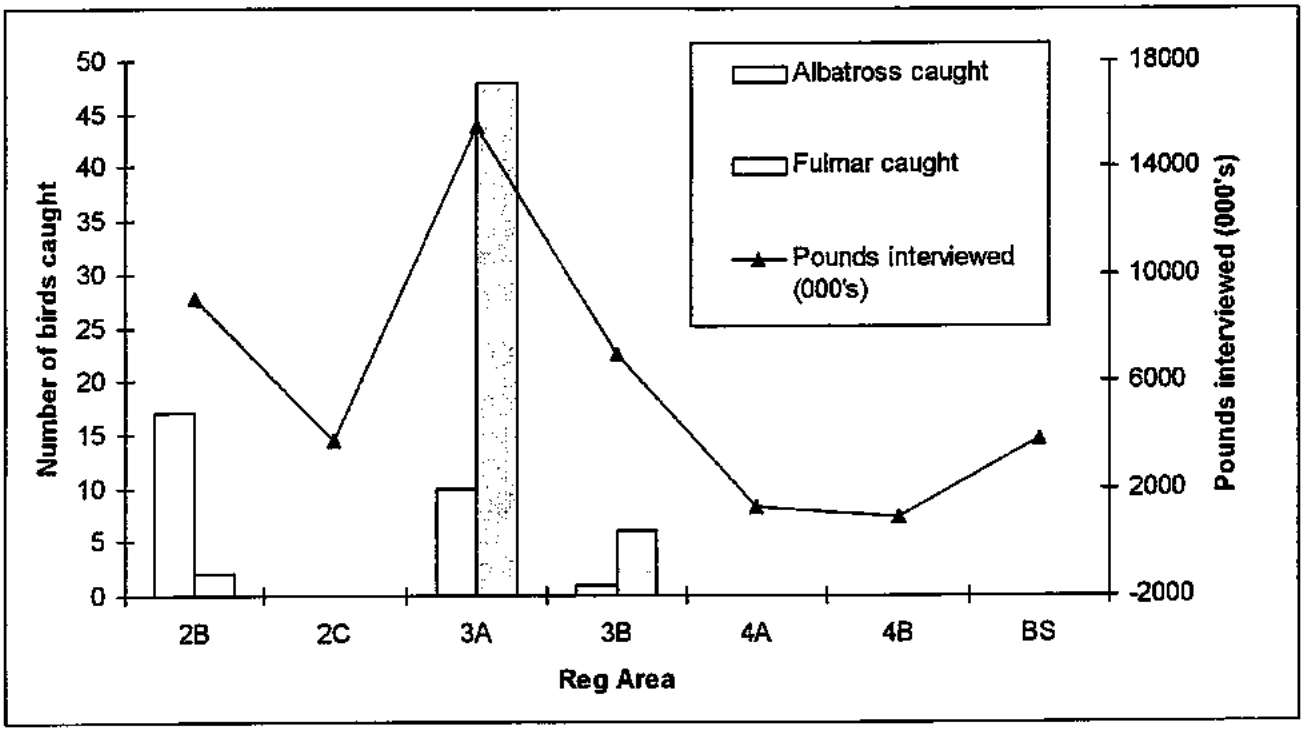


Figure 6. Albatross and fulmar caught and pounds interviewed by IPHC regulatory area.

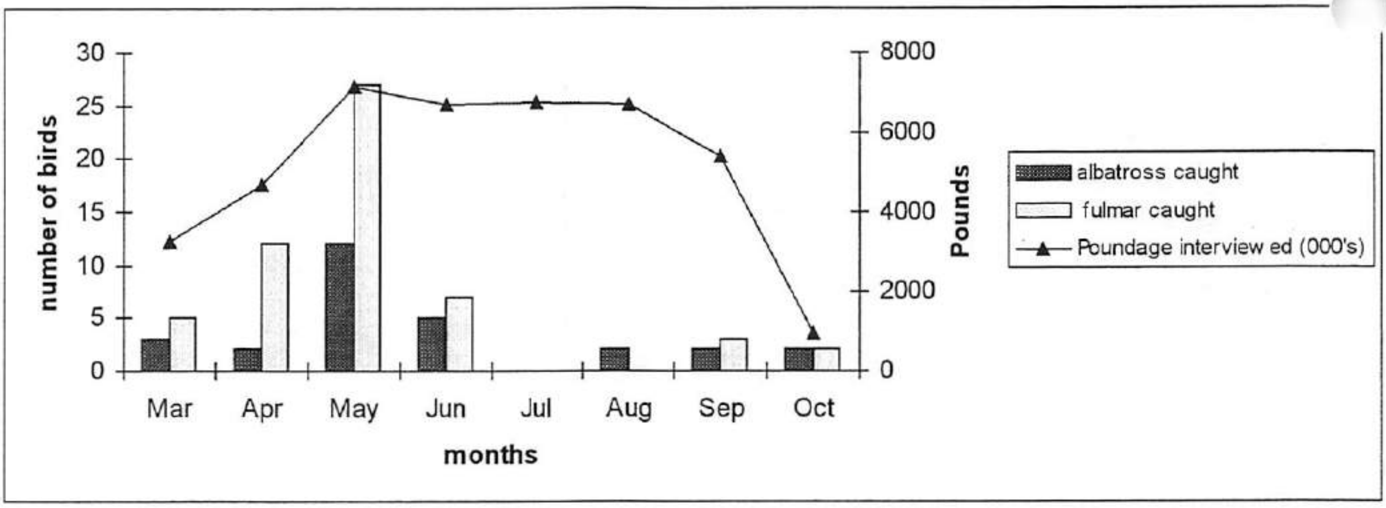


Figure 7. Albatross and Fulmar caught and pounds interviewed by month.

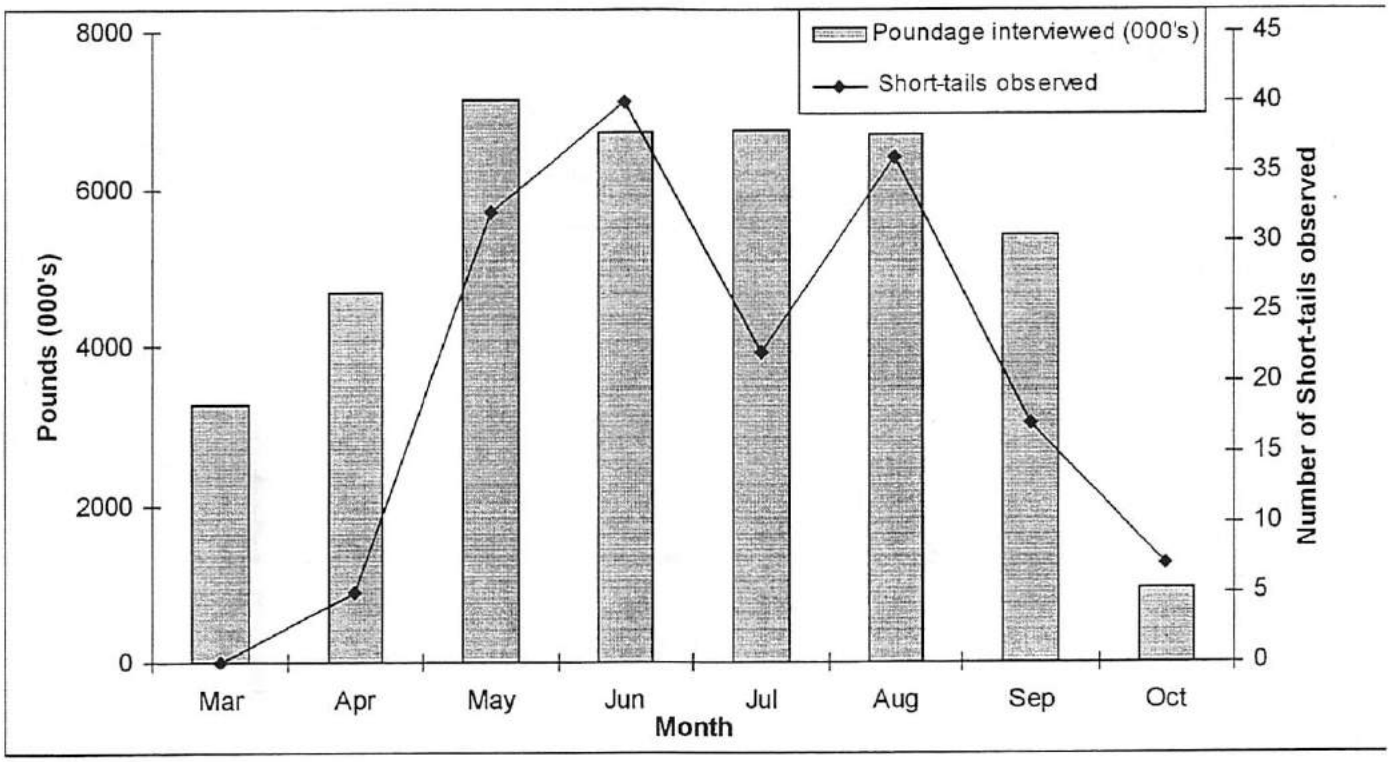


Figure 8. Short-tailed albatross observed and poundage interviewed by month.

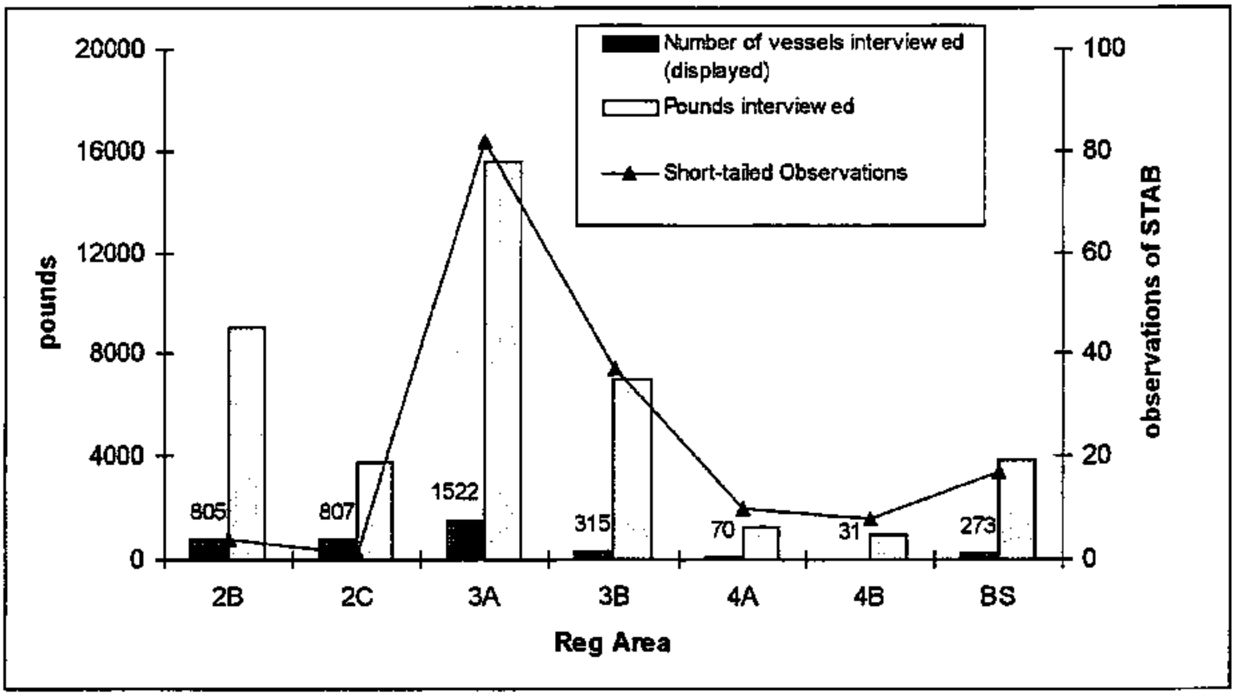
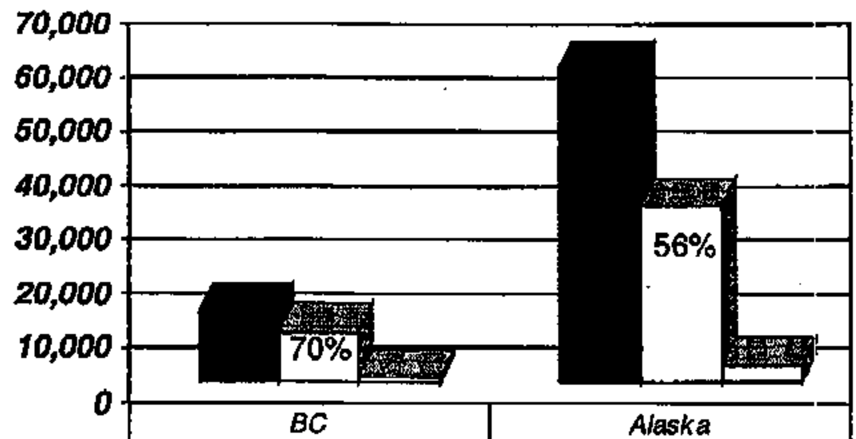


Figure 9. Short-tailed Albatross observered, number of vessels and pounds interviewed by IPHC regulatory area.

REPLACEMENT FIGURE

Please replace Figure 2 in the IPHC document,

"Preliminary Results of Seabird Observations and Bycatch Reported By Fishermen to IPHC Samplers in Alaskan and Canadian Ports in 1998"



	BC	Alaska
Total quota	13,000	58,000
Pounds Interviewed (000's)	9,049	32,429
Number of Vessels Interviewed	605	3,018

Figure 2. Data breakdown by country.

Experiments with a Bird Avoidance Device During
International Pacific Halibut Commission Longline Surveys

by

Robert J. Trumble
International Pacific Halibut Commission
December 1998

ABSTRACT

From July 31 through August 8, the International Pacific Halibut Commission (IPHC) conducted longline surveys in the Central Gulf of Alaska to compare catch rates of halibut using standard halibut gear with catch rates using sablefish gear. During the surveys, IPHC staff alternated deployment of a bird bag with no bird bag as a pilot experiment to evaluate methods that might be employed in a larger comparison of effectiveness of bird avoidance devices. Thirteen sets, six with bird bag deployment and seven without, caught no seabirds. The pilot experiment determined that predicted methods to estimate distance behind the vessel did not work, and that binoculars made observations more difficult than using the naked eye. Actual measurements of distance to a distinct target with a laser range finder proved very effective. Seabirds attacked longline gear about half as often when a seabird avoidance device was used compared to sets without a device. Longline sets made with the bird bag had proportionately more birds flying than sitting in the vicinity of the longline gear.

INTRODUCTION

The International Pacific Halibut Commission (IPHC) submitted in April 1998 a proposal for Saltonstall-Kennedy (S-K) funding to conduct an evaluation of the effectiveness of seabird avoidance devices in the North Pacific longline fisheries. During the summer of 1998, the IPHC conducted a series of longline surveys, and performed some tests of methodology for evaluating seabird avoidance devices. These tests will allow the IPHC staff to improve the seabird avoidance device experiment, should S-K funding become available. Application to the Fish and Wildlife Service (FWS) and to the Alaska Department of Fish and Game (ADFG), and an informal consultation with FWS under Section 7 of the Endangered Species Act, resulted in necessary permits to conduct operations that may kill seabirds (Appendix I).

The protocol in the S-K proposal calls for: 1) defining a vulnerable zone in which seabirds can access bait, 2) making counts of birds by species in the vicinity of the vessel and counts of birds by species following the vessel prior to setting, and 3) making counts of birds by species in the vulnerable zone and counts of attacks by bird species on baits during setting. The pilot experiment intended to evaluate methodology and logistics required for the protocol.

METHODS

From July 31 to August 8, 1998, the IPHC conducted longline surveys in the Central Gulf of Alaska to compare catch rates of halibut using standard halibut gear with catch rates using sablefish gear. Fishing occurred on July 31, August 1 and 2, and August 7 and 8. The vessel's crew alternated a skate of halibut gear (1500-ft groundline with 83 16/0 circle hooks at 18-ft spacing, baited with chum salmon) with a skate of sablefish gear (1200-ft groundline with 350 14/0 circle hooks at 3.4-ft spacing, baited with herring). A set consisted of either four or eight skates—two or four pairs. The vessel towed an oblong buoy, generally known as a bird bag, as a bird avoidance device. During the surveys, IPHC staff alternated deployment of the bird bag with no bird bag as a pilot experiment to evaluate methods that might be employed in a larger comparison of effectiveness of bird avoidance devices.

The protocol called for measuring the width and length of the vulnerable zone. We anticipated that rollers from the wake would be a consistent distance from the vessel. We planned to use a laser range finder to measure the peaks and troughs of the rollers. As a back up, we would mark known distances on a line or pay out a buoy for a laser range finder target to measure peaks and troughs. We planned to rig a buoy off the side of the vessel to measure width of the wake.

In all but one case, sets with and without a bird bag occurred as pairs. The experiment consisted of thirteen sets, six with bird bag deployment and seven without. The odd set without a bird bag occurred on a day when only three sets were made, at which time the crew threw over squid to allow observation of chumming to distract the birds from the longline gear. The first four sets, on the first day, were used for general observations and no measurements were made. For each set, a vicinity count and follower count was made. The vicinity count consisted of a snapshot count of birds by species in the quadrant from the bow to 90-degrees on the right side of the vessel. The vicinity count occurred just as the vessel started to make a turn to start the set. The follower count consisted of all birds by species flying immediately behind the vessel when the crew deployed the anchor for the longline, but before any baited hooks went over. For this experiment, attacks were defined as aggressive diving behavior, in which birds tipped up with flapping wings and usually went completely underwater. Bird counts during setting, attacks on bait, and other observations were recorded on a hand-held tape recorder.

RESULTS

Seabird bycatch.

No seabirds were caught or injured during the experiment.

Species composition.

Northern fulmars dominated the species composition of seabirds observed during the experiment. The abundance of seabirds was low during the experiment (Table 1). Vicinity counts were all 0 except for one set with two fulmars. Ship followers ranged from less than 5 fulmars on several sets to 70-90 fulmars on several others. Laysan and black-footed albatross and shearwaters occurred occasionally throughout the experiment, and several gulls appeared on the last day, at stations close to shore.

Defining the vulnerable zone.

We intended to define the vulnerable zone by using wake characteristics of the vessel. However, the vessel did not make rollers in the wake at setting speed. The only reference point behind the vessel was the bird bag. A laser range finder worked very effectively to measure distance to the bird bag. Distances forward and aft of the bird bag were estimated as multiples of the bird bag distance (e.g. 2/3 of the bird bag distance, 1.5 of the bird bag distance). These measurements were difficult when the bird bag was deployed. When the bird bag was not deployed, the measurements were made by memory of where the bird bag had been located. These measurements were even more difficult.

We did not try to measure distance to individual birds using the laser range finder. Range finder measurements on individual birds may be a way to confirm estimated distances. However, laser range finder measurements of individual birds is not practical for a single observer collecting counts of attacks on baited hooks or counts of flying or sitting birds.

For the first four sets, the bird bag was deployed 57 m behind the vessel. During the fourth set, the bag tangled with the longline gear, and the line to the bird bag was cut. No measurements occurred during the first four sets. For subsequent sets, the bag was set 27 m behind the vessel. All measurements were made relative to the 27-m bird bag. Attacks on bait occurred to a maximum distance of 2-2.5 times the distance of the bag, or 55 to 70 m behind the vessel.

We also examined using wake characteristics to measure distance lateral from the midline of the vessel. We rigged a buoy on a line through a pulley that allowed us to place the buoy at various points in the wake. We could then measure the distance from the midline of the vessel to the pulley to determine the width of the wake. As the wake got wider with distance aft of the vessel, the lateral measurements were ineffective without reference points such as rollers in the wake. Fortunately, the birds further than about 2 m from the gear showed almost no interest in the bait, so lateral measurements had little role. This may not be the case in areas with hungrier birds or more numerous birds that may be more competitive for baits.

Bird attacks.

Two hundred nine attacks on baited hooks were observed on 14 sets. Attacks occurred from shortly after the bait entered the water to about 70 m aft of the vessel. In many cases, birds attacked bait or bait pieces lost from the hook; these attacks were not counted. In some cases, attacks on lost bait or baited hooks were easy to distinguish. If the groundline was visible, bird activity more than 1.5 m (the maximum length of a gangion) from the groundline was attributed to lost bait. As the attacks occurred further aft, however, distinguishing lost bait from baited hooks became more difficult, so all attacks were assumed on baited hooks. Attacks ranged from 0 to 20 per skate (Table 1). As distance was difficult to estimate, the distribution of attacks by distance is not presented. We originally planned to use binoculars to observe attacks, but inability to estimate distance with the binoculars and the ability to see birds with the naked eye caused us to abandon the binoculars. With the bird bag deployed, attacks averaged 3.2 per skate for the sablefish gear and 1.9 for the halibut gear (Table 2). Without the bird bag, attacks averaged 6.5 and 3.6 per skate for sablefish and halibut gear, respectively. Sablefish gear experienced about twice the number of attacks per skate as did halibut gear, both with and without the bird bag, even though the sablefish gear has over four times as many hooks.

Percent sitting birds.

During the first day of observations, seabirds hovered over the bird bag, but rarely landed near or in front of the bag. Birds then settled on the water behind the bag. In the absence of the bird bag, seabirds settled on the water shortly behind the entry of the groundline into the water. Counts of birds flying and counts of birds sitting in front of the bag appeared as a potential alternative to bait attacks as an index of bird bag effectiveness. At the end of each set, a count was made of flying birds, of birds sitting adjacent to the gear, and of birds sitting well back of the gear beyond an opportunity to attack the baits. Birds adjacent to the gear and flying birds were considered to be the total birds potentially likely to impact the baits. Several different count procedures were tried during the experiment, but insufficient consistent counts were made to draw quantitative conclusions. Qualitatively, the number of birds sitting in the vicinity of the gear was smaller with the bird bag deployed than without the bird bag.

Chumming.

On one set, which did not have a pair, we did not deploy a bird bag, but chummed with semi-frozen squid to see if chumming would distract the birds. A crewman threw several squid at a time for the duration of the set.

DISCUSSION

Abundance of seabirds during the experiment was lower than typical of many areas fished by the longline fleets. Up to 90 birds, mostly northern fulmars, followed the vessel as it prepared to make a set, but almost no birds were observed ahead of the boat. Thus, comparing bird attacks or percent of sitting birds with background density of birds is not possible. Depending on weather, the number of ship followers increased or decreased. Dense fog occurred on the first day of observations half way through the first set, and few birds appeared after the first set. Twenty to 90 followers per set occurred the next two days in mild, calm, sunny weather. The last two days of the experiment occurred in cloudy, windy, and rough weather, and less than 10 followers were observed. Even at the level of 50 birds flying, sitting, and attacking baits, counts were difficult to make. Additional training in seabird counting will improve data reliability if future experiments occur.

Seabirds observed during this trip followed a consistent behavioral pattern. Most birds started out around the flagpole where we started the set. As the gear was set and baited hooks went out, the birds would fly back toward the boat, hover, settle on the water, and drift back. Sitting birds may attack the baited hooks or bait debris. When bait sunk to a level that it no longer attracted the birds, the birds flew back to the boat and started the process over. Bird bags reduce the number of birds that settle and sit on the water near the gear. Birds did not attack the baits if they did not land. If future work of this sort is conducted, counts of birds sitting in the vicinity of the gear compared to counts of flying birds should be a good measure of effectiveness of bird avoidance devices. A consistent definition of "vicinity" is needed, and to do so requires a reliable method of estimating distance behind the vessel so that counts occur in the same area. I recommend the zone in front of the bird bag (or a multiple of this zone). If a bird bag is not deployed, then the position where the bag would be needs to be estimated.

Attacks on baited hooks are hard to distinguish from attacks on lost bait or bait debris. However, we did not lose much bait on halibut gear, about one bait per skate (83 hooks). We lost several baits, about 2-10, per sablefish skate (350 hooks). Scraps of bait regularly flew off during setting, especially from a batch of undressed salmon—gonad and intestine pieces often stuck to the bait pieces until whipped over the side during setting. Attacks were counted for fully submerged birds, or if an attack occurred on a visible bait. Bird attacks occurred about twice as often without a bird bag as with.

Chumming has potential as a bird avoidance measure, based on the single observation made during the trip. The semi-frozen squid sunk fairly rapidly, and the birds seemed to have a hard time seeing it. Birds swarmed to the squid thrown out as chum during setting, if the birds were close enough to see the chum. Nearly all birds in the vicinity joined the chum attack, and drifted far back behind the boat. When the chum was eaten or had sunk, the birds flew back to the boat. If we threw the chum too soon, the birds would not see it, and would attack the baited hooks. If we threw the chum too late, the birds would attack the gear without moving to the chum. Floating chum thrown at regular intervals could be an effective measure, especially if used in combination with a bird bag or other bird avoidance device.

Measurements of distance behind the vessel proved to be the least successful part of the experiment. While the laser range finder very effectively measured distance to targets such as the bird bag, no technique was found to adequately estimate distance in the absence of the bird bag or at distance beyond the bird bag. Perhaps practice with several reference buoys towed at several distances at the beginning of a survey and periodically after could provide for adequate distance measurements. Laser range finder measurements on individual birds may also help refine distance measurements. Perhaps more boats generate rollers in the wake, and a different vessel or vessels would have allowed the proposed method to work.

This short experiment demonstrated that the methodology in the IPHC S-K proposal would likely provide good data and opportunity to evaluate the effectiveness of bird avoidance devices. However, methods of distance measurements and of making bird counts need improvement and practice before a full survey takes place.

Table 1. Sea bird data collected during the IPHC seabird avoidance device experiment. Each line of data represents one skate of halibut gear and one skate of sablefish gear. For example, Set 53 contains 4 skates (2 pairs) while Set 56 contains 8 skates (4 pairs). Vicinity and follower bird counts were made only at the start of a set.

Date	Set	Bird Bag	Vicinity Birds	Follower Birds	Attacks on Sablef. Gear	Attacks on Halibut Gear
1-Aug	53	n	0	20	17	No. Data
1-Aug	53	n			20	17
1-Aug	54	y	2	90	5	6
1-Aug	54	y			8	8
2-Aug	55	y	0	75	5	1
2-Aug	55	y			5	4
2-Aug	55	y			6	1
2-Aug	55	y			3	2
2-Aug	56	n	0	70	4	0
2-Aug	56	n			3	4
2-Aug	56	n			8	9
2-Aug	56	n			9	11
7-Aug	58	y	0	1	0	0
7-Aug	58	y			1	1
7-Aug	58	y			1	0
7-Aug	58	y			0	0
7-Aug	59	n	0	1	1	1
7-Aug	59	n			4	2
7-Aug	59	n			10	0
7-Aug	59	n			2	0
8-Aug	60	n	0	4	1	0
8-Aug	60	n			4	1
8-Aug	60	n			5	1
8-Aug	60	n			3	1
8-Aug	61	y	0	8	1	0
8-Aug	61	y			4	0
8-Aug	61	y			5	1
36015	61	y			1	2

Table 2. Summary of results with and without a bird bag for number of attacks on baited hooks.

	Sablefish Gear		Halibut Gear	
Bird Attacks	No Bird Bag	Bird Bag	No Bird Bag	Bird Bag
No. Observations	14	14	14	14
Ave. Attacks/Skate	6.5	3.2	3.6	1.9
Std. Dev.	5.8	2.5	5.4	2.5

North Pacific Longline Association

RECEIVED
NOV 25 1998
N.P.F.M.C

<u>**Agenda B-5**</u>

November 25, 1998

Mr. Richard B. Lauber, Chariman
North Pacific Fishery Management Council
605 West 4th Avenue
Anchorage, AK

RE: Seabird Avoidance - Lining Tubes on Freezer-Longliners

Dear Rick:

At the last Council meeting I testified that my Board of Directors had reviewed seabird bycatch on freezer-longliners in the fall BSAI fishery for cod, and found it unacceptable in view of the severe limitation on permissible takings of short-tailed albatrosses (four in two years). For whatever reason the present seabird avoidance regime is not working adequately in the freezer-longliner fleet, and we see no point in additional "outreach" to try to make it work - it is time to move on.

The Board reviewed the construction, utilization and performance of lining tubes at great length with a technical expert (line shooters were also considered), and determined that lining tubes should be required on freezer-longliners immediately. Given the performance of the lining tube on the freezer/longliner **Norton Sound** this fall in the Bering Sea cod fishery - no albatrosses were taken - they are convinced that this technology offers the best opportunity to eliminate or virtually eliminate seabird bycatch. Please note that on the attached FAO table of mitigation measures, below-the-water setting is the only measure which has the potential to <u>totally</u> eliminate seabird bycatch.

Two other devices must be used in conjunction with the lining tube. Under certain sea conditions it is possible that the line may rise to the surface after being set through a tube. In these conditions it is necessary to use weights to prevent the line from broaching. In order to avoid diving birds (albatrosses do not dive) it is best to drag a streamer line, bird buoy, or other device behind the vessel - the **Norton Sound** had success with this method this fall.

Lining tubes are expensive - as much as $40,000, installed. We are hopeful that that we may be able to find a way to help defray the cost. In any event the cost of a lining tube is nothing compared with the cost of a fishery closure.

4209 21st Avenue West, Suite 300, Seattle, Washington 98199
TEL: 206-282-4639; FAX: 206-282-4684

At its November meeting the Council approved a motion by Kevin O'Leary that the issue be taken up for action in December, final action in February. Kevin made his motion because time is of the essence - we are playing Russian roulette with our fishery until the lining tubes are installed.

We wish to make the following proposal for Council action and analysis:

FREEZER-LONGLINERS SHALL DEPLOY BAITED HOOKS THROUGH A LINING TUBE, AT A DEPTH NOT LESS THAN 1.5 METERS WHEN THE VESSEL IS FULLY LADEN.

WEIGHTS SHALL BE ADDED TO THE LINE AS NECESSARY TO PREVENT IT FROM RESURFACING AFTER BEING SET.

AT ALL TIMES A STREAMER LINE, BIRD BUOY OR OTHER DEVICE SHALL BE TOWED BEHIND THE BOAT OVER THE BAITED LINE FOR THE PURPOSE OF DISCOURAGEING DIVING BIRDS.

THIS REQUIREMENT SHALL APPLY TO:

1) ALL FREEZER-LONGLINERS;

2) ALL FREEZER-LONGLINERS 125' IN LENGTH OR GREATER; OR

3) ALL FREEZER-LONGLINERS 100' IN LENGTH OR GREATER.

Time is of the essence. We had hoped and expected that NMFS would present an initial analysis at this (December) meeting, so the Council could take final action in February.

Thank you for your attention.

Sincerely,

Thorn

Thorn Smith

Table 10 Summary table of mitigation measures

	Type of Measure	Fishery suitability		Stage of development	Compliance monitoring needs	Relative cost initital or ongoing	Safety factor for crew	Negative impact on		Seabird reductic efficien
		Demersal	Pelagic					Target catch	Non-bird by catch	
A1a	Weighting the longline gear	good	moderate	partly developed	Low	high initial, low ongoing	caution needed	reduction concerns	specific problem potential	very hi
A1b	Thawing bait and/or puncturing swim bladder	poor	good	part development and tested	high at present	low ongoing	safe	no	no	modera potenti
A1c	Line-setting machine	moderate	moderate	developed, partly tested	None	moderate initial, low on-going	safe	no	no	modera potenti
A2	Below-the-water setting	moderate	moderate	under development,	None	high initial	safe	no	no	total
A3	Bird scaring line (Streamers lines, buoy lines)	good	moderate	developed, tested, refinement needed	variable, by observation	low ongoing	safe	no	no	high but vari
A4	Bait Casting Machine	none	poor	developed, partly tested	None	high initial	to consider	no	no	modera potenti
A5	Brickle curtain	good	good	developed	variable, by observation	low	safe	no	no	very hi
A6	Artificial baits or lures	poor	poor	concept only	None	high initial low ongoing	safe	unknown	unknown	high po

AMERICAN BIRD CONSERVANCY

CONSERVING WILD BIRDS AND THEIR HABITATS THROUGHOUT THE AMERICAS

December 7, 1998

LATE COMMENT

Mr. Clarence Pautzke
Executive Director
North Pacific Regional Fisheries Management Council
605 W. 4th Ave. Suite 306
Anchorage, AK 99501

Dear Mr. Pautzke:

On behalf of the American Bird Conservancy (ABC), I write to urge you and the North Pacific Regional Fishery Management Council (NPRFMC)to require the expeditious implementation of more effective seabird avoidance techniques in the longline fisheries in the waters of Alaska. Substantial mortality of seabirds in Alaskan longline fisheries continues to be documented in the Alaskan longline fisheries. These unnecessary deaths include the killing of two globally endangered Short-tailed Albatrosses (Diomedea albatrus) in the Bering Sea/Aleutian Islands groundfish fishery. These occurred on September 21 and September 28, 1998. Thousands of Northern Fulmars and other seabirds such as Laysan and Black-footed Albatrosses, Black-legged Kittiwakes, and shearwaters continue to be killed in the Alaskan longline fisheries. We request that this letter be brought before the NPFMC at its meeting this week.

We are quite concerned that the current regulations have not been effective in preventing the killing of Short-tailed Albatrosses and the other seabirds. NMFS data indicates that 74% of vessels are deploying a buoy, board or other floating device towed from the stern as the primary or only seabird avoidance measure under the regulations. Information we have received from observers and vessel captains clearly indicates that this is not effective in avoiding seabird mortality. The recent killing of Short-tailed Albatrosses and the continued killing of thousands of other seabirds clearly indicate the currently deployed measures are not working well. We urge you, working with NMFS, to adopt new regulations that will require both the use of tori poles with bird scaring lines and the use of weights on all longlines to assurer rapid sinking of baits. The setting of lines at night should also be required--modified, of course, for Alaskan summers.

NMFS developed and published a Test Plan to Evaluate Effectiveness of Seabird Avoidance Measures Required in Alaska's Hook-and-Line Groundfish and Halibut Fisheries on April 15, 1998. This was done to comply with the terms and conditions of the U.S. Fish and Wildlife Service's Biological Opinion dated February 19, 1997 on Alaskan longline fisheries and the Short-tailed Albatross. The BO requires NMFS to both complete such a research plan outlining specifics for evaluating seabird bycatch avoidance gear and to implement such a plan. We are concerned that the Plan was developed three and one-half months beyond the date specified in the BO and that the Plan for evaluating the effectiveness of the current regulations has not been implemented. The Plan notes at page 2 that "...the number of seabirds potentially killed as bycatch of longline fishing in Alaska could be significant" for certain species. We do not think it fair or advisable to refuse to revise the apparently ineffective current regulations due to the failure of NMFS to implement this Plan.

ABC urges the North Pacific Regional Fisheries Management Council and NMFS to adopt the proven and cost-effective measures of bird-scaring lines, weighted lines, and night setting for all ground fishing

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longline vessels in Alaskan waters. Documentation now exists of the killing of seven Short-tailed Albatrosses in the Alaskan longline fishery, two in 1995, one in 1996, and two in 1998. These are the observed and positively identified kills of this rare seabird. Most hooks set are not observed by NMFS observers and the halibut fishery is virtually unobserved. The potential is great that more Short-tailed Albatrosses are killed in Alaskan longlines fisheries than observed. This species is listed as endangered internationally with less than 1,000 of these birds in existence. The implementation of these techniques will greatly reduce if not eliminate the taking of Short-tailed Albatrosses and other seabirds. These same techniques will increase the efficiency of the fishing vessels as more bait is kept on hooks and albatrosses and other seabirds are kept from the bait and hooks.

ABC is a national organization dedicated to the conservation of wild birds in the Americas. Our Policy Council consists of 75 member organizations many of whom are quite concerned over the unnecessary deaths of seabirds. These groups include the Pacific Seabird Group, Center for Marine Conservation, Environmental Defense Fund, Defenders of Wildlife, National Audubon Society, and the World Wildlife Fund. ABC and several of these member groups were advised at the time of the adoption of the existing regulations that the full CCAMLR regulations were not being adopted because flexibility was being given to the fishermen and there would be an evaluation of the effectiveness of the measures being employed with necessary changes in the regulations after that review. The research plan is not being implemented, has not been funded, and I have received no information from NMFS (despite repeated requests) on the efficacy of the regulations.

We firmly believe that a significant majority of seabird mortality--approaching 95% or better--could be avoided with cost effective measures that could be readily implemented in the Alaskan longline demersal fishery. The FAO Technical Guidelines attached to an international agreement on seabird bycatch, are contained in FAO Circular 937. They were developed with the support of the U.S. and NMFS. These well-researched data clearly indicate that just the proper employment of a tori pole towing a bird scaring line (with no other avoidance measure employed) can reduce seabird killing by 90-98% in demersal fisheries, citing Lokkeborg (1996). (see page 68 of FAO Circular 937). In table 11 of the Circular at page 83, the author notes that the literature indicates that, overall, these bird scaring lines reduce seabird kills by 80% but when employed with properly weighted lines the reduction is 90%. Add night setting, and seabird kills are reduced to zero in demersal fisheries.

Towing buoys, boards or other floating devices is an unproven method that was placed in the Alaskan regulations solely based on some anecdotal comments from fishermen in Alaskan waters. We have found no substantiation that this method works well and the recent kills of the Short-tailed Albatrosses seem to indicate that this method is not highly effective.

We urge prompt action to implement the seabird avoidance measures we have cited herein in Alaskan waters. If the U.S. can exercise leadership in this fishery in successfully requiring the implementation of effective avoidance measures, we can serve as a role model for the rest of the fishing nations on Earth.

Sincerely,

Gerald W. Winegrad
Vice President for Policy
American Bird Conservancy