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Seabird Bycatch and Mitigation Efforts in Alaska Fisheries

Summary Report: 2007 through 2015

U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration
National Marine Fisheries Service

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Credit for cover photos: (Top) Observer Program and (Bottom) Rob Suryan, Oregon State University.

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NOAA FISHERIES

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LIST OF COMMON ABBREVIATIONS

ACAP	Agreement on the Conservation of Albatrosses and Petrels
ADF&G	Alaska Department of Fish and Game
AFSC	Alaska Fisheries Science Center
AMNWR	Alaska Maritime National Wildlife Refuge
BSAI	Bering Sea and Aleutian Islands
BSAI Groundfish FMP	Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area
CAS	Catch Accounting System
CP	Catcher/processor
CV	Catcher vessel
EEZ	Exclusive Economic Zone
ESA	Endangered Species Act
GOA	Gulf of Alaska
GOA Groundfish FMP	Fishery Management Plan for Groundfish of the Gulf of Alaska
IFQ	Individual Fishing Quota
IPHC	International Pacific Halibut Commission
LOA	Length overall
mt	Metric ton
nm	Nautical miles
NMFS	National Marine Fisheries Service
NOAA Fisheries	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
NPOA-Seabirds	National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries
Observer Program	NOAA Fisheries North Pacific Observer Program
USFWS	U.S. Fish and Wildlife Service

Introduction

Fishermen sometimes catch and discard animals they do not want, cannot sell, or are not allowed to keep. This is known as bycatch. In waters off Alaska, hook-and-line (sometimes called longline) fishing vessels use seabird avoidance measures that minimize seabird bycatch; no such measures are required for vessels fishing with trawl or pot gear. Despite these avoidance measures, seabirds are caught unintentionally as bycatch in certain commercial fisheries off Alaska.

NOAA's National Marine Fisheries Service (NOAA Fisheries) is responsible for managing coastal and marine habitats through statutory authorities and agency policies. Additionally, NOAA Fisheries views seabirds as important ecosystem indicators and monitors seabird bycatch in many Federal fisheries for changes of interest to scientists and managers. Seabird populations can indicate the state of marine and coastal ecosystems (North Pacific Research Board 2006). Changes in seabird bycatch could reveal long-term ecosystem effects or changes in coastal and marine habitats that seabirds depend on for various life stages. Rivera et al. (2014) state that "seabird abundance and distribution can inform scientists about qualitative and quantitative marine trophic relationships, climate change, and coastal and marine contaminants."

This report reviews seabird bycatch in commercial groundfish and halibut fisheries in the exclusive economic zone (EEZ; FIGURE 1) off Alaska from 2007 through 2015, provides recent trends in seabird bycatch estimates for these fisheries, and reviews seabird avoidance measures for these fisheries. This report also details efforts by NOAA Fisheries to understand, monitor, and minimize bycatch of the endangered short-tailed albatross in the EEZ off Alaska.

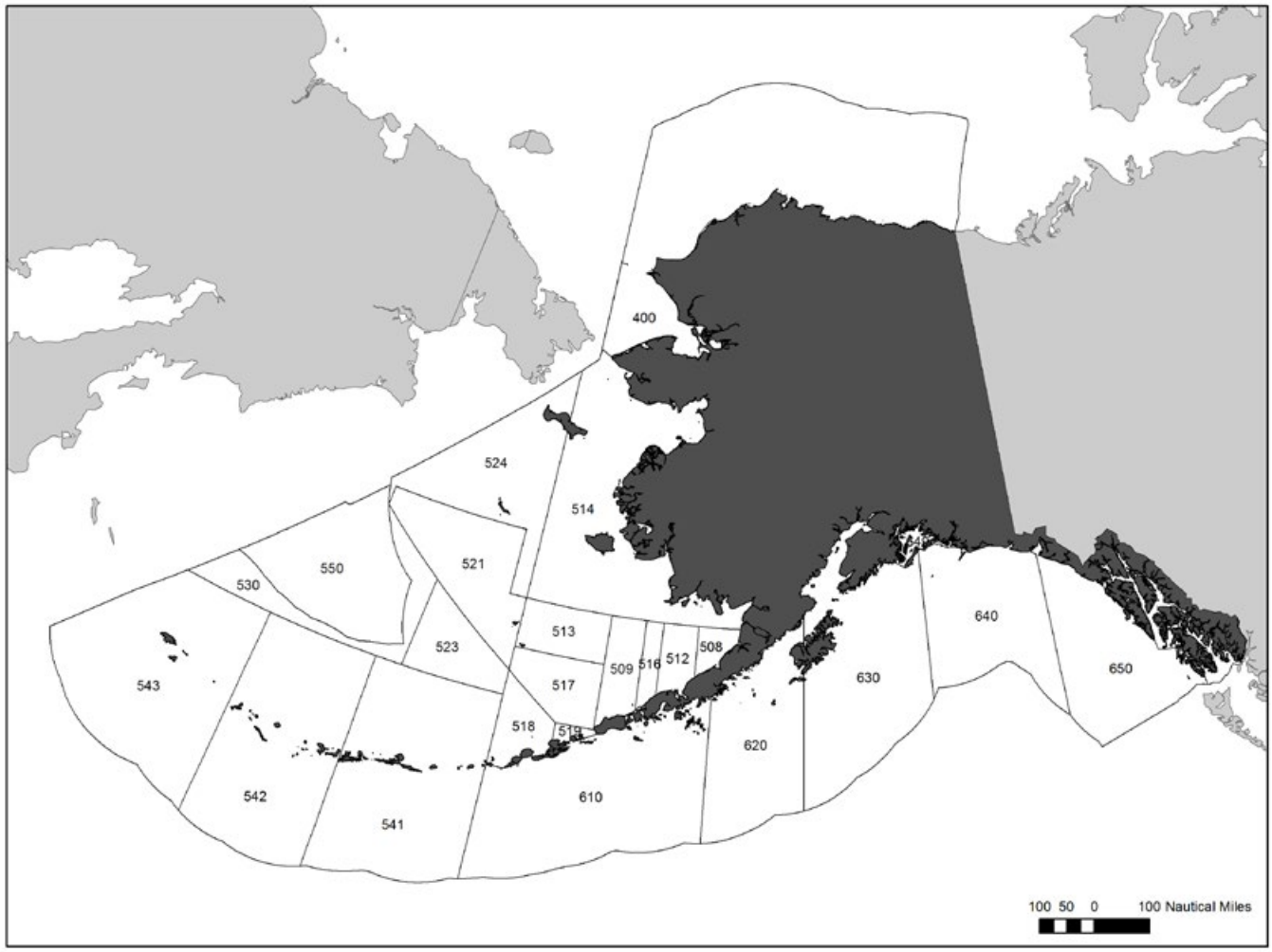


FIGURE 1. The Exclusive Economic Zone (EEZ) off Alaska including Bering Sea, Aleutian Islands, and Gulf of Alaska reporting areas.

Hook-and-line fishing vessel. Photo credit: Observer Program.

Seabird Management

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) emphasizes the importance of reducing bycatch to maintain sustainable fisheries. Although seabirds are not included within the Magnuson-Stevens Act's "bycatch" definition, efforts to reduce the incidental take of seabirds in fisheries are consistent with the Magnuson-Stevens Act's objective to conserve and manage the marine environment. In addition, the NOAA Fisheries' guidelines for implementing the Magnuson-Stevens Act's national standards for fishery conservation and management note that other applicable laws, such as the Marine Mammal Protection Act, the Endangered Species Act (ESA), and the Migratory Bird Treaty Act, require that Fishery Management Councils consider the impact of conservation and management measures on living marine resources other than fish; i.e., marine mammals and birds. Additionally, reducing the take of birds is addressed in NOAA Fisheries' Draft National Bycatch Strategy (NMFS 2016).

The primary trust responsibilities for seabirds belong to the U.S. Fish and Wildlife Service (USFWS); however, NOAA Fisheries plays a significant role by having responsibilities for managing coastal and marine habitats through statutory authorities and agency policies. These statutory authorities and agency policies include —

- Magnuson-Stevens Act,
- National Environmental Policy Act,
- ESA of 1973,
- Fish and Wildlife Coordination Act,
- National Marine Sanctuaries Act,
- U.S. National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries (NPOA-Seabirds),
- NOAA Fisheries' National Bycatch Strategy,
- Executive Order 13186 "Responsibilities of Federal Agencies to Protect Migratory Birds,"
- USFWS's List of Birds of Conservation Concern (USFWS 2008a), and
- Migratory Bird Treaty Act of 1918.

NOAA Fisheries Alaska Region and the Alaska Fisheries Science Center work to monitor, report, and, to the extent practicable, minimize seabird bycatch in Federal fisheries off Alaska.

Although not a member, the United States actively participates in the Agreement on the Conservation of Albatrosses and Petrels (ACAP). ACAP is the only multilateral agreement that coordinates international activity to mitigate threats to albatross and petrel populations. The three species of albatross found in waters off Alaska, including the endangered short-tailed albatross, are on the ACAP species list.

In 2001, the United States finalized the NPOA-Seabirds and established the NOAA Fisheries' National Seabird Program, which works domestically and internationally to address seabird bycatch issues. Focus areas for the NPOA-Seabirds and the National Seabird Program include mitigating seabird bycatch and promoting seabirds as valuable ecosystem indicators. The National Seabird Program works to minimize the direct takes of seabirds by fisheries (e.g., incidental catch or bycatch, or gear entanglement), and understand the effects of seabird bycatch on seabird populations and their marine ecosystem. These efforts are carried out by the NOAA Fisheries offices and science centers in each region.

NOAA Fisheries Alaska Region and the Alaska Fisheries Science Center (AFSC) work to monitor, report, and, to the extent practicable, minimize seabird bycatch in Federal fisheries off Alaska. Mitigating seabird bycatch and promoting seabirds as valuable ecosystem indicators are very important issues to NOAA Fisheries in Alaska.

The NOAA Fisheries North Pacific Observer Program (Observer Program) deploys NOAA Fisheries-certified observers (observers) to collect information, in part, about fisheries bycatch of seabirds on all the vessels they monitor. The Observer Program has had a vital role in the management of North Pacific groundfish fisheries since the program started over 25 years ago. The information collected by observers provides the best available scientific information to manage the fisheries and to develop measures to minimize bycatch. Observers collect biological samples and fishery-dependent information on total catch and interactions with protected species. Managers use data collected by observers to monitor quotas, manage groundfish and prohibited species catch, and document and reduce fishery interactions with protected resources. Scientists use observer-collected data for stock assessments and marine ecosystem research.

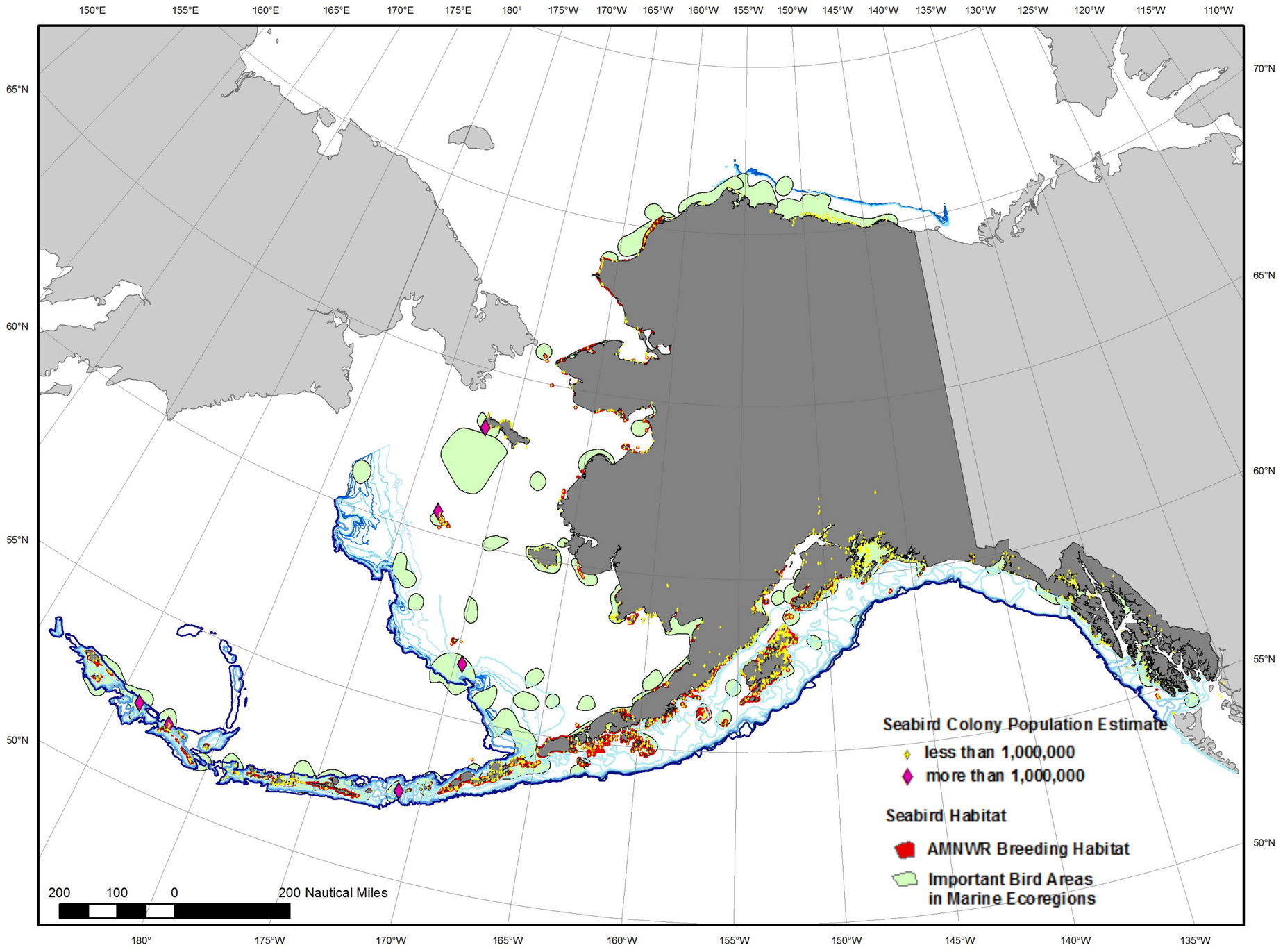


FIGURE 2. Seabird habitat on fishing grounds in Alaska. BirdLife International Important Bird Areas in Marine Ecosystems are represented with green (Audubon Alaska 2015, accessed June 20, 2016). AMNWR marine areas are represented with red (North Pacific Seabird Data Portal, accessed October 26, 2015).

Seabird Occurrence on Fishing Grounds off Alaska

Alaska's waters support extremely large concentrations of seabirds. Over 80 million seabirds are estimated to occur in Alaska annually, including 40 million to 50 million individuals from the numerous species that breed in Alaska (TABLE 1; USFWS 2009). An additional 40 million to 50 million individuals do not breed in Alaska but spend part of their life cycle there. These include short-tailed and sooty shearwaters and three albatross species: the black-footed albatross, the Laysan albatross, and the endangered short-tailed albatross (TABLE 2; USFWS 2009). Some of these species are shown in FIGURE 3.

During the summer, there are approximately 1,800 seabird breeding colonies in Alaska (FIGURE 2), which range in size from a few dozen to 3.5 million birds (USFWS 2009; North Pacific Seabird Data Portal, accessed October 26, 2015). The USFWS monitors a number of these seabird colonies to determine reproductive success and population trends to better understand ecosystem processes and potential resource issues. In 2015, data were collected throughout the summer at seven annual monitoring sites, and at other locations that are visited intermittently in the Alaska Maritime National Wildlife Refuge (AMNWR), where most seabird breeding habitat occurs (FIGURE 2; Dragoo et al. 2016; USFWS 2009).

The life history of most seabirds in Alaska is characterized by low reproductive rates, low adult mortality rates, long life spans, and delayed sexual maturity (USFWS 2009). Seabirds spend approximately 80% of their life at sea and are adapted for long periods flying above or resting on the water (USFWS 2009). These traits make seabird populations extremely sensitive to at-sea stressors and changes in adult survival. It is difficult to quickly attribute seabird population changes to specific impacts because declines may not become apparent for years or decades.

Melvin et al. (2006) provide comprehensive data on seabird occurrence on the Alaska hook-and-line fishing grounds, based on an inter-agency collaborative program that collected seabird distribution data during Pacific halibut and sablefish stock assessment surveys on hook-and-line vessels in the summers of 2002, 2003, and 2004. This study was geared more towards the scavenger seabird families (procellarids, gulls) than to other seabird families. Researchers observed a total of 230,452 birds over three years at an average of 1,456 stations surveyed each year. Seventy-one percent of all birds sighted were Northern fulmars and 13% were albatrosses.

BirdLife International has officially designated Important Bird and Biodiversity Areas in Alaska (FIGURE 2; Audubon Alaska 2015, accessed June 20, 2016). Important Bird and Biodiversity Areas must support species of conservation concern (e.g., threatened and endangered species), restricted-range species (i.e., species vulnerable because they are not widely distributed), species that are vulnerable because their populations are concentrated in one general habitat type or biome, or species or groups of similar species (such as seabirds, waterfowl, and shorebirds) that are vulnerable because they occur at high densities due to their tendency to congregate.

Seabird Species	Approximate number of breeders in Alaska
Northern Fulmar (*Fulmarus glacialis*)	1,400,000
Storm-Petrel	
Fork-tailed (*Oceanodroma furcata*)	3,200,000
Leach's (*Oceanodroma leucorhoa*)	3,500,000
Cormorant	
Brandt's (*Phalacrocorax penicillatus*)	Less than 100
Pelagic (*Phalacrocorax pelagicus*)	44,000
Red-faced (*Phalacrocorax urile*)	20,000
Double-crested (*Phalacrocorax auritus*)	6,100
Jaeger	
Pomarine (*Stercorarius pomarinus*)	Uncommon[2]
Parasitic (*Stercorarius parasiticus*)	Common[2]
Long-tailed (*Stercorarius longicaudus*)	Common[2]
Gull	
Mew (*Larus canus*)	14,400 (coast only)[2]
Herring (*Larus argentatus*)	1,600 (coast only)[2]
Bonaparte's (*Larus philadelphia*)	Uncommon[2]
Slaty-backed (*Larus schistasagus*)	Less than 100
Glaucous-winged (*Larus glaucescens*)	250,000
Glaucous (*Larus hyperboreus*)	100,000
Sabine's (*Xema sabini*)	Uncommon[2]
Kittiwake	
Black-legged (*Rissa tridactyla*)	1,300,000
Red-legged (*Rissa brevirostris*)	210,000
Tern	
Caspian (*Hydroprogne caspia*)	Uncommon[2]
Arctic (*Sterna paradisaea*)	11,000 (coast only)[2]
Aleutian (*Onychoprion aleutica*)	9,500
Murre	
Common (*Uria aalge*)	2,800,000
Thick-billed (*Uria lomvia*)	2,200,000
Guillemot	
Black (*Cepphus grylle*)	700
Pigeon (*Cepphus columba*)	49,000
Murrelet	
Marbled (*Brachyramphus marmoratus*)	859,000[3]
Kittlitz's (*Brachyramphus brevirostris*)	9,000–25,000[3]
Ancient (*Synthliboramphus antiquus*)	300,000
Auklet	
Least (*Aethia pusilla*)	5,500,000–9,000,000[3]
Whiskered (*Aethia pygmaea*)	116,000[3]
Crested (*Aethia cristatella*)	3,000,000
Cassin's (*Ptychoramphus aleuticus*)	473,000
Parakeet (*Aethia psittacula*)	1,000,000[3]
Puffins	
Rhinoceros Auklet (*Cerorhinca monocerata*)	180,000
Horned (*Fratercula corniculata*)	900,000
Tufted (*Fratercula cirrhata*)	2,300,000
Dovekie (*Alle alle*)	Less than 100
Eiders	
Common (*Somateria mollissima*)	3,100–5,300[4]
King (*Somateria spectabilis*)	10,000[5]
Spectacled (*Somateria fischeri*)	8,000[6]
Steller's (*Polysticta stelleri*)	500[7] breeding individuals in Alaska

TABLE 1. Seabird species and their approximate number of breeders in Alaska.[1]

For species without a numerical estimate, *common* equals hundreds of thousands of individuals and *uncommon* equals one hundred to tens of thousands of individuals.

1 Population numbers taken from Birds of North America Online - Species Accounts; Kushlan et al. (2002)

2 Populations are given for colonial breeders in Alaska on the coast; *coast only* means additional birds nest inland.

3 Populations are based on total individuals, not total breeders.

4 Petersen and Flint (2002)

5 ADF&G (2000)

6 ADF&G (2016)

7 USFWS (2011)

FIGURE 3. Some seabird species that occur on Alaska fishing grounds.

TABLE 2. Seabird species in Alaska that breed elsewhere and their approximate number of breeders throughout their range.

Seabird Species	Approximate population size
Albatrosses	
Short-tailed (*Phoebastria albatrus*)	5,144 (estimated)[1]
Black-footed (*Phoebastria nigripes*)	61,700[2] breeding pairs
Laysan (*Phoebastria immutabilis*)	590,000[2] breeding pairs
Shearwaters	
Short-tailed (*Puffinus tenuirostris*)	23,000,000[3] worldwide
Sooty (*Puffinus griseus*)	20,000,000[3] worldwide

1 For the 2016-17 breeding season, the best estimate of the total population size is 5,144 (Sievert unpubl. population model). Short-tailed albatross are long-lived and first breed at age five or six years, with females laying one egg each year; breeders are also known to take years off (USFWS 2008b).

2 Naughton et al. (2007).

3 Denlinger (2006)

Albatross Species in Alaska

Three species of albatross forage in waters off Alaska (FIGURE 4). Albatross are large pelagic birds in the order Procellariiformes (tube-nosed marine birds) that live about 50 years. Albatross mate for life and do not start reproducing until they are 5 years to 10 years old when they lay one egg per year, at most.

Laysan Albatross

The USFWS (2008a) lists Laysan albatross as a bird of conservation concern. This means that without additional conservation efforts, Laysan albatross are likely to become candidates for listing under the ESA.

Nearly all the breeding population is found in the Northwestern Hawaiian Islands, though when not breeding, their distribution extends to Japan, the Bering Sea, and south as far as 15°N latitude.

Current threats to Laysan albatross include vulnerability to hook-and-line fisheries, non-native vegetation marring nesting sites, ingestion of plastics, sea-level rise, and chick lead poisoning from old buildings at Midway Atoll rookery (Naughton et al. 2007).

Black-footed Albatross

The USFWS (2008a) lists black-footed albatross as a bird of conservation concern. NOAA Fisheries is interested in the status of black-footed albatross because some of the major colonies may be decreasing, and the species is caught on hook-and-line gear on Alaska fishing grounds.

World population estimates range from 275,000 to 327,753 individuals (Brooke 2004), with a total breeding population of 61,700 pairs (Naughton et al. 2007). Like Laysan albatross, most of the black-footed albatross population (96%) breeds in the Hawaiian Islands (Naughton et al. 2007). Black-footed albatross occur in Alaska waters in the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) (Gutowsky et al. 2014, Kuletz et al. 2014, Melvin et al. 2006, Suryan and Fischer 2010).

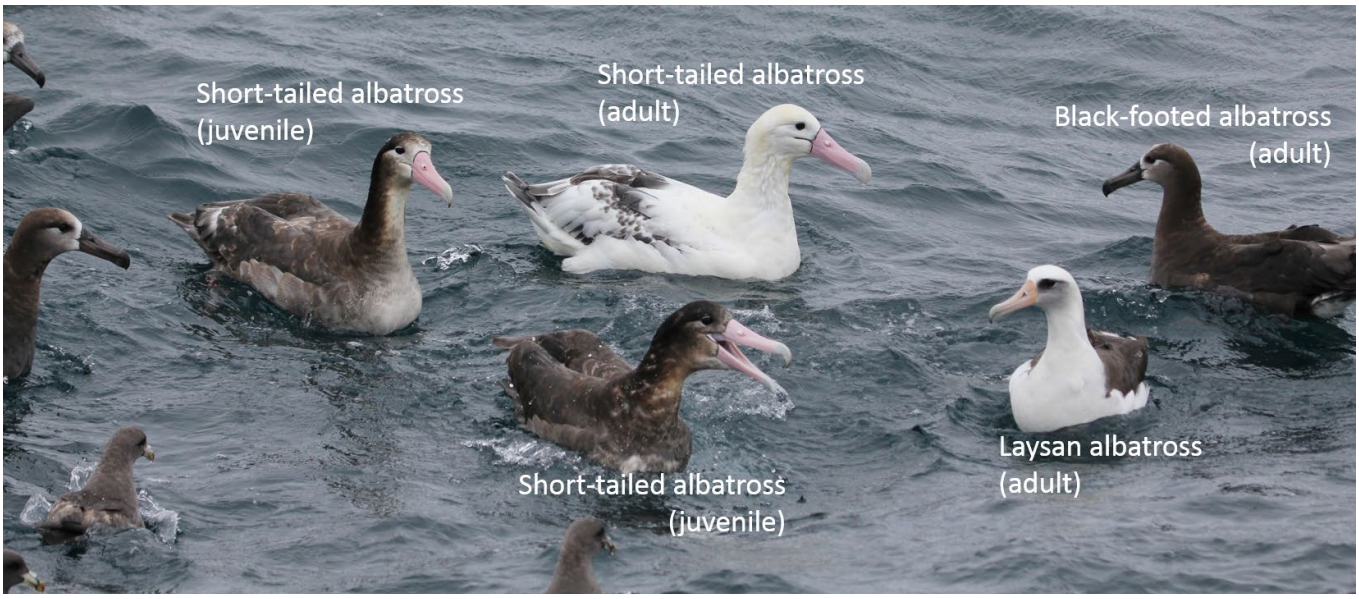


FIGURE 4. North Pacific albatross species that forage in Alaska waters. Photo credit: Rob Suryan, Oregon State University.

Tuna and swordfish pelagic hook-and-line fisheries in the North Pacific, including the Hawaiian hook-and-line fishery, and to a lesser extent the Alaska groundfish hook-and-line fishery, are responsible for incidental take of black-footed albatross (Naughton et al. 2007). Other threats for black-footed albatross include organochlorine contaminants such as PCBs and DDE, which are known to reduce avian fecundity; ingestion of plastics; and sea-level rise (Naughton et al. 2007).

Short-tailed Albatross

In 1970, the short-tailed albatross was listed as endangered under the ESA (35 FR 8495, June 2, 1970). However, due to an administrative error, the listing included the entire range of the species except the United States (50 CFR 17.11). The USFWS corrected the listing through a final rule in 2000 that listed the short-tailed albatross as endangered throughout its range (65 FR 46643, July 31, 2000). No critical habitat has been designated for the short-tailed albatross in the United States.

Though the short-tailed albatross was reported extinct in 1949 primarily due to over-harvest for their feathers, by 1954 there were 25 birds seen on Torishima Island, Japan (presently the primary nesting colony site). Prohibition of hunting and habitat enhancement work by the Yamashita Institute for Ornithology and Hiroshi Hasegawa has allowed the species to recover at a 7% to 8% annual growth rate (Hasegawa 2012). For 2016 to 2017, the world population of the endangered short-tailed albatross is estimated at approximately 5,144 individuals (Sievert unpubl. population model).

Most nesting (80% to 85%) occurs at a colony subject to erosion and mudslides on Torishima Island, an active volcano in Japan (USFWS 2008a). Smaller numbers nest in the Senkaku Islands where political uncertainty and the potential for oil development exist (USFWS 2008a). Some breeding and nesting behavior now also occurs on Mukojima, Japan, and in the Northwestern Hawaiian Islands.

During the non-breeding season, short-tailed albatross range across the North Pacific from the Bering Sea to the coast of Japan and eastern Russia, and as far south as the Channel Islands on the U.S. West Coast. Short-tailed albatross are frequently observed on Alaska fishing grounds and have been taken in the hook-and-line fisheries.

Groundfish and Halibut Fisheries Management

NOAA Fisheries Alaska Region and the North Pacific Fishery Management Council (NPFMC) manage hook-and-line, trawl, and other groundfish fisheries under area-specific fishery management plans. The Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI Groundfish FMP) (NPFMC 2015a) and the Fishery Management Plan for Groundfish of the Gulf of Alaska (GOA Groundfish FMP) (NPFMC 2015b) are available online. NOAA Fisheries manages halibut fisheries under an Individual Fishing Quota (IFQ) system. More information on IFQ is available at https://alaskafisheries.noaa.gov/fisheries/ifq.

The BSAI management area is defined as the U.S. EEZ of the eastern Bering Sea and that portion of the North Pacific Ocean adjacent to the Aleutian Islands that is west of 170° W longitude, extending to the United States-Russian Convention Line of 1867 (FIGURE 1). Target species managed in the fishery under the BSAI Groundfish FMP include walleye pollock (pollock), Pacific cod, sablefish, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, flathead sole, Alaska plaice, other flatfish,[1] Pacific ocean perch, northern rockfish, shortraker rockfish, rougheye rockfish, other rockfish,[2] Atka mackerel, squid, sharks, skates, sculpins, and octopus (NPFMC 2015a).

The GOA is defined as the U.S. EEZ of the North Pacific Ocean, exclusive of the Bering Sea, between the eastern Aleutian Islands at 170° W longitude and Dixon Entrance at 132° 40' W longitude (FIGURE 1). Target species managed in the fishery under the GOA Groundfish FMP include pollock, Pacific cod, sablefish, shallow- and deep-water flatfish, rex sole, flathead sole, arrowtooth flounder, Pacific ocean perch, northern rockfish, shortraker and rougheye rockfish, other slope rockfish,[3] pelagic shelf rockfish, demersal shelf rockfish, thornyhead rockfish, Atka mackerel, squid, sculpin, sharks, octopus, and skates (NPFMC 2015b).

1 Other flatfish includes all flatfish species, except for halibut, flathead sole, Greenland turbot, rock sole, yellowfin sole, arrowtooth flounder, Kamchatka flounder, and Alaska plaice (81 FR 14773, March 18, 2016; see Table 1).

2 Other rockfish includes all *Sebastes* and *Sebastolobus* species except for Pacific ocean perch, northern rockfish, shortraker rockfish, and rougheye rockfish (81 FR 14773, March 18, 2016; see Table 1).

3 Other rockfish in the GOA are described in Table 1 of the GOA 2016 and 2017 harvest specifications for groundfish (81 FR 14740, March 18, 2016; see page 14745).

Catch Estimation

Total catch estimates in the groundfish and halibut fisheries off Alaska are generated by the NOAA Fisheries Alaska Region Catch Accounting System (CAS) and are used to manage about 600 separate groundfish quotas in the BSAI and GOA. The CAS uses information from multiple data sources to provide an estimate of total groundfish and halibut catch, including at-sea discards, and estimates of bycatch of other species and seabirds. Data from the Observer Program, dealer landing reports (also known as fish tickets), and at-sea production reports are combined to provide an integrated source for fisheries monitoring and inseason decision-making.

At-sea observer data are a key part of the CAS and allow the agency to gain an independent measurement of the amount and types of species caught in the commercial groundfish and halibut fisheries in the BSAI and GOA. Observer data provide a direct estimate of species composition and weight, as well as a means to calculate catch and bycatch rates for unobserved fishing vessels (FIGURE 5).

All observers entering the Observer Program receive training on seabird data collection and identification, as well as specific information regarding species

The observer information from the at-sea samples is used to create bycatch rates that are applied to unobserved vessels. For trips that are unobserved, the bycatch rates are applied to industry supplied landings of retained catch.

FIGURE 5. Observer monitoring catch. Photo credit: Observer Program.

of interest, which include short-tailed albatross, red-legged kittiwake, Steller's and spectacled eiders, and marbled and Kittlitz's murrelets.

NOAA Fisheries has estimated seabird bycatch using the CAS in the BSAI and GOA groundfish fisheries since 2007 and in the halibut fisheries since 2013 (Fitzgerald et al. 2013; AFSC 2014). Seabird bycatch estimates are based on at-sea sampling by observers during their sampling period (AFSC 2015). In the CAS, observer data are used to create seabird bycatch rates (a ratio of the estimated bycatch to the estimated total catch in sampled hauls).

The observer information from the at-sea samples is used to create bycatch rates that are applied to unobserved vessels. For trips that are unobserved, the bycatch rates are applied to industry supplied landings of retained catch. Expanding on the observer data that are available, bycatch rates from observed vessels are extrapolated to unobserved vessels. For extrapolation, data are matched based on processing sector (e.g., catcher/processors or catcher vessel), week, target fishery, gear, and Federal reporting area. A more detailed explanation of these estimation methods is available in Cahalan et al. (2014).

Seabird takes can also be recorded by observers outside of their sampling period. A record of these takes by observers is opportunistic since they occur outside of the random sampling protocol; thus, their inclusion in the total seabird estimate across all fisheries would be inappropriate. Observers generally do not record information for a seabird outside of their sample unless it is banded, collected as part of the AFSC-contracted necropsy program, or is a species of interest or an ESA-listed species (e.g., the endangered short-tailed albatross).

It is important to note that short-tailed albatross takes recorded by observers, whether during or outside of their sampling period, are counted towards the combined incidental take statement for the groundfish hook-and-line and trawl fisheries that exempts the take of six short-tailed albatross from the ESA take prohibitions in a 2-year period (USFWS 2015).

At each data run, the CAS produces estimates based on current data sets that may have changed over time. Changes in the data are due to errors that were discovered during observer debriefing, data quality checks, and analysis. Examples of the possible changes in the underlying data are changes in species identification, deletion of data sets where data collection protocols were not properly followed, and changes in the landing or at sea production reports where data entry errors were found.

The totals provided in this report include some changes from previous reporting, but are the most recent product of the CAS. Bycatch estimates for 1993 through 2006 have been previously reported in Fitzgerald et al. (2008) and subsequently updated in the Ecosystem Considerations Report within the annual Stock Assessment and Fishery Evaluation reports. Bycatch estimates for 2007 through 2013 have been previously reported by AFSC (2014).

This report provides estimates of seabirds caught as bycatch in commercial groundfish fisheries operating in the EEZ off Alaska from 2007 through 2015 and in the halibut fishery from 2013 through 2015. The groundfish fishery includes the gear types hook-and-line, pot, pelagic trawl, and non-pelagic trawl. Seabird bycatch estimates for pot gear are not a focus of this report because the USFWS in its February 19, 1997, biological opinion amendment determined that groundfish fishing activities by vessels using pot gear are not likely to adversely affect the short-tailed albatross and Steller's eider (USFWS 2003a). Additionally, the estimates provided here do not apply to gillnet, seine, troll, or jig gear. Data collection on the Pacific halibut hook-and-line fishery began in 2013 when NOAA Fisheries restructured the Observer Program to improve observer data quality, more equitably distribute the industry's observer coverage costs, and expand observer coverage to vessels less than 60 ft length overall (LOA) and the commercial halibut sector (77 FR 70062, November 21, 2012).

Groundfish and Halibut Harvest

Authorized gear types for groundfish in the BSAI and GOA are pelagic and non-pelagic trawls, hook-and-line (demersal), pot, jig, and other gear as defined in regulations at 50 CFR 679.2. Authorized gear types for halibut in the BSAI and GOA are hook-and-line (demersal) and jig. As discussed previously, the estimates provided in this report only apply to hook-and-line, trawl, and pot gear.

TABLE 3 shows the number of vessels in the BSAI and GOA using hook-and-line, trawl, and pot gear from 2009 through 2015. Most were vessels using hook-and-line gear in the GOA. From 2009 through 2012 and from 2013 through 2015, the number of groundfish hook-and-line vessels decreased slightly in the BSAI and GOA. Halibut data were added starting in 2013. The number of trawl and pot gear vessels remained relatively consistent in the BSAI and GOA from 2009 through 2015.

TABLE 3. Number of vessels using each gear type in BSAI and GOA groundfish and halibut fisheries, 2009 through 2015. Halibut fisheries information is only reflected in the hook-and-line gear data, 2013 through 2015 only. The total represents the number of unique vessels (i.e., vessels fishing in two areas were not double-counted). Data are from the CAS.

	2009	2010	2011	2012	2013	2014	2015
Hook-and-Line Gear (No. Vessels)							
BSAI	73	66	67	64	255	186	164
GOA	398	398	377	367	931	918	875
TOTAL	432	421	406	404	1,113	1,035	967
Trawl Gear (No. Vessels)							
BSAI	146	138	141	146	136	134	127
GOA	90	85	86	88	84	81	79
TOTAL	186	178	178	183	178	180	172
Pot Gear (No. Vessels)							
BSAI	55	54	58	57	62	59	51
GOA	119	107	146	132	107	99	117
TOTAL	158	144	186	174	151	149	154

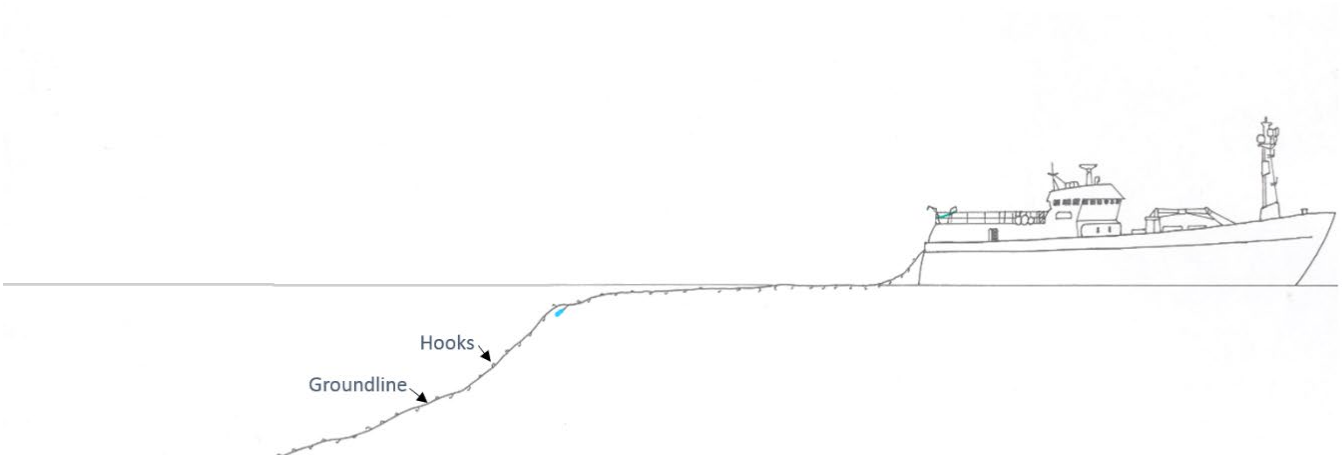


FIGURE 6. Drawing of a hook-and-line vessel.

Demersal hook-and-line vessels off Alaska fish with hooks strung along a ground line (FIGURE 6). The ground line can be several miles long, and can have thousands of baited hooks attached. The hook-and-line fleet is composed of catcher vessels (CVs) and catcher/processors (CPs). CVs deliver their catch to either a shoreside processing facility or a vessel with the ability to process fish; CPs catch and process fish while at sea. Vessels using hook-and-line gear target Pacific cod, Pacific halibut, sablefish, turbot, and some rockfish species (AFSC 2015).

Trawl gear consists of a cone or funnel-shaped net that is towed through the water by one or more vessels (FIGURE 7). Trawls are designed to capture and trap the target species inside the codend as the net is hauled through the water. Non-pelagic trawls have floats attached to the headrope, which is the top of trawl opening, while weights and special gear are attached to the footrope, which is the bottom of the trawl opening, to keep the net open as it moves through the water across the ocean floor. A sweep attached to the net's footrope collects marine animals as they lie on the bottom or gather before the trawl opening. The mesh is designed to confine fish inside the net, trapping them in the codend as the trawl is hauled to the surface. The trawl gear may be constructed and rigged for various target species over different types of bottom surfaces. Regulations that define non-pelagic trawl gear are specified at 50 CFR 679.2.

Pelagic trawl nets vary in length, mesh size, material, and tow speed depending on target species, but most are constructed of four mesh panels sewn together. Beam trawls consist of a cone-shaped net with a horizontal opening that narrows to the codend. Otter trawls use boards, called doors, secured at the mouth of the net to ensure that the net remains open throughout the trawl. Regulations that define pelagic trawl gear are specified at 50 CFR 679.2.

Pots are submerged, three-dimensional wire devices that permit marine animals to enter the enclosure, but make escape extremely difficult or impossible. Bait is commonly secured in the pot to lure the animals inside, where they are trapped until fishermen return to retrieve the catch and re-bait the pots. Most pots are attached by a rope to a buoy on the surface of the water. Pots can be set individually or in a long continuous series at depths up to 2,400 ft (732 m). Regulations that define pot gear are specified at 50 CFR 679.2.

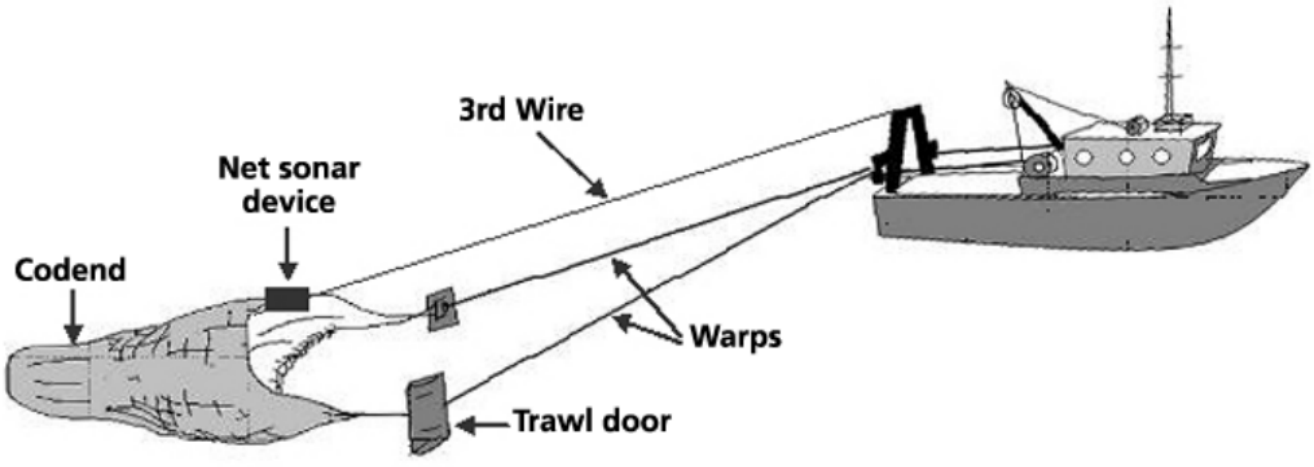


FIGURE 7. Schematic of trawl fishing vessel net gear that could potentially interact with seabirds (Dietrich and Melvin 2007).

Seabirds as Bycatch

Some seabird species are more susceptible to fishery bycatch. The probability of a bird being caught by fishing gear 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). Surface feeders, such as most procellariiforms (albatrosses, fulmars, and shearwaters) and gulls, are attracted to fishing vessels' offal discharge and bait on hook-and-line gear. Nearshore foragers, such as cormorants, terns, guillemots, murrelets, and puffins, are less likely to interact with offshore groundfish and halibut fisheries. Other species such as the threatened Steller's and spectacled eiders do not spatially overlap with the groundfish or halibut fisheries. Additionally, their nearshore preferences, foraging techniques, diet composition, and that they do not follow fishing vessels or congregate around them, reduce their likelihood of becoming bycatch in the groundfish or halibut fisheries.

Most observed seabird bycatch in fisheries occurs in the hook-and-line fisheries; however, small numbers of bycatch have been observed in trawl and other fisheries. Observer protocols are not set up to monitor trawl fisheries in the same way that hook-and-line fisheries are monitored. Trawl bycatch is difficult to quantify (NMFS 2015a; Fitzgerald et al. in prep) and is discussed in the section "Seabird Bycatch in Trawl Fisheries."

Catch accounting data from 2007 through 2015 attribute 88% of seabird bycatch in the groundfish and halibut fisheries (hook-and-line, trawl, and pot gear, combined) to hook-and-line fisheries, 10% to trawl fisheries, and 2% to pot fisheries. However, there are some biases with these numbers, which are discussed below. The target species with the highest amount of seabird bycatch was Pacific cod (73%), followed by sablefish (13%), Greenland turbot (4%), halibut (4%; when considering 2013 through 2015 only), and pollock (3%).

From 2007 through 2015, estimates of annual seabird bycatch from hook-and-line, trawl, and pot gear in the BSAI and GOA ranged from 2,444 to 10,749 seabirds, with an annual average of 6,855. Seabird bycatch was largely Northern fulmars, followed by gulls, shearwaters, unidentified birds, black-footed albatross, and Laysan albatross (TABLE 4). However, large inter-annual variation in seabird bycatch was common.

Observers collect seabird bycatch (FIGURE 8) and return the specimens to the AFSC-contracted necropsy program for scientific examination to determine age and sex, confirm species identification, measure morphometrics, collect samples, examine ingested plastics, and evaluate food habits. To date, over 2,500 carcasses have been examined, including 622 Laysan and black-footed albatrosses and 4 short-tailed albatross (S. Fitzgerald, personal communication, AFSC, August 5, 2016). Results from the most recent published examination (Beck and Hester 2015) describe demographics of 362 seabird carcasses collected in the Observer Program in Alaska and the Pacific Islands Regional Office Observer Program in Hawai'i from 2010 through 2015. In Alaska, bycatch of Laysan and black-footed albatrosses, as well as Northern fulmars were primarily adults and male; these biases in age and sex may suggest that these birds are more vulnerable to fisheries bycatch (Beck and Hester 2015).

Seabird Bycatch in Hook-and-Line Fisheries

In addition to being attracted to hook-and-line vessels discarding offal, seabirds are most vulnerable to gear interactions during gear deployment when they actively attempt to eat bait from hooks at the surface (FIGURE 10). While feeding on the line, birds sometimes get caught on the hooks at the water's surface or even down to a depth of two meters (Melvin et al. 2001).

As previously discussed, data are collected from the onboard observers who record seabird bycatch and from industry reports of catch and production; however, the bycatch estimates provided in this report are based on data from the observer's species composition sample. Certain observer sampling biases are known to exist with commercial fisheries (Gilman et al. 2013; Fitzgerald et al. in prep). For example, in the hook-and-line fisheries, seabirds may fall off a hook underwater without being seen by the observer. Birds that fall off the hooks alongside the vessel are recorded if they occur within the observer sampling period.

TABLE 4. Total estimated seabird bycatch in Federal groundfish and halibut fisheries, BSAI and GOA Groundfish FMP areas (hook-and-line, trawl, and pot gear), from 2007 through 2015. Halibut fisheries 2013 through 2015 only.

Species/Species Group	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	Annual Average
Unidentified Albatrosses	17				10		28	33		88	10
Short-tailed Albatross				15	5			9		29	3
Laysan Albatross	13	226	80	222	206	141	200	99	223	1,412	157
Black-footed Albatross	201	303	56	71	222	141	444	297	371	2,106	234
Northern Fulmar	4,701	3,332	7,758	2,474	6,330	3,148	3,180	811	3,551	35,284	3,920
Shearwaters	3,586	1,224	620	657	263	585	253	186	383	7,757	862
Storm Petrels	1	44								45	5
Gulls	1,217	1,550	1,268	1,173	2,225	897	579	730	1,249	10,889	1,210
Kittiwakes	10		16		6	5	3	9	12	62	7
Murres	6	6	13	102	14	6	3	47		197	22
Puffins				9						9	1
Auklets		3				7	4	107	69	190	21
Other Alcids			105					38		144	16
Cormorants									31	31	3
Other Birds			136							136	15
Unidentified Birds	515	541	696	270	387	343	296	77	190	3,314	368
Grand Total	10,266	7,230	10,749	4,994	9,668	5,273	4,990	2,444	6,079	61,693	6,855

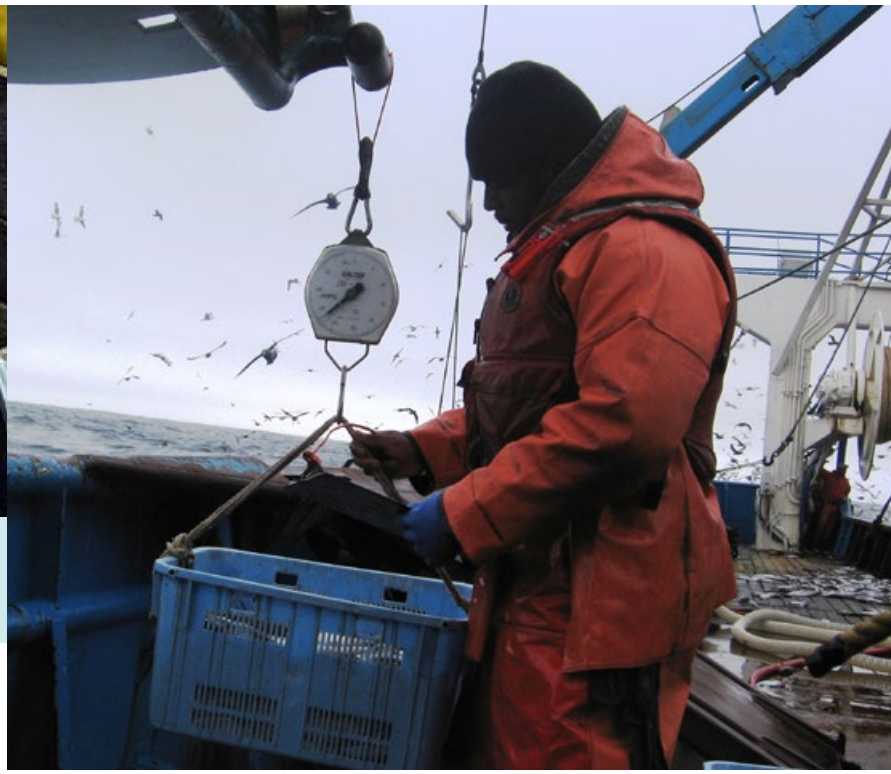


FIGURE 8. Observers monitoring catch.
Photo credits: Observer Program.

Estimates of the annual seabird bycatch from 2007 through 2015 indicate that roughly 6,000 seabirds were taken annually in the BSAI and GOA groundfish and halibut hook-and-line fisheries. Total seabird bycatch is small in comparison to seabird population sizes in Alaska.

For the combined groundfish and halibut fisheries in both the BSAI and the GOA, the Northern fulmar was the predominant seabird taken (shown in green) followed by gulls (shown in purple) (FIGURE 9). In both the BSAI and the GOA, the Northern fulmar was the predominant seabird taken in the groundfish fisheries (hook-and-line, trawl, and pot gears). Approximately half (50.1%) of the total hook-and-line seabird bycatch off Alaska was Northern fulmars taken in the BSAI. Gulls were the predominant seabird taken in the halibut fishery.

The remaining seabird species varied by region. In the GOA, black-footed albatross were 19.9% of the seabird bycatch, and Laysan albatross were 6.1% of the bycatch. In the BSAI, shearwaters were 14.7% of the bycatch, and all albatross species combined were only 1.9%.

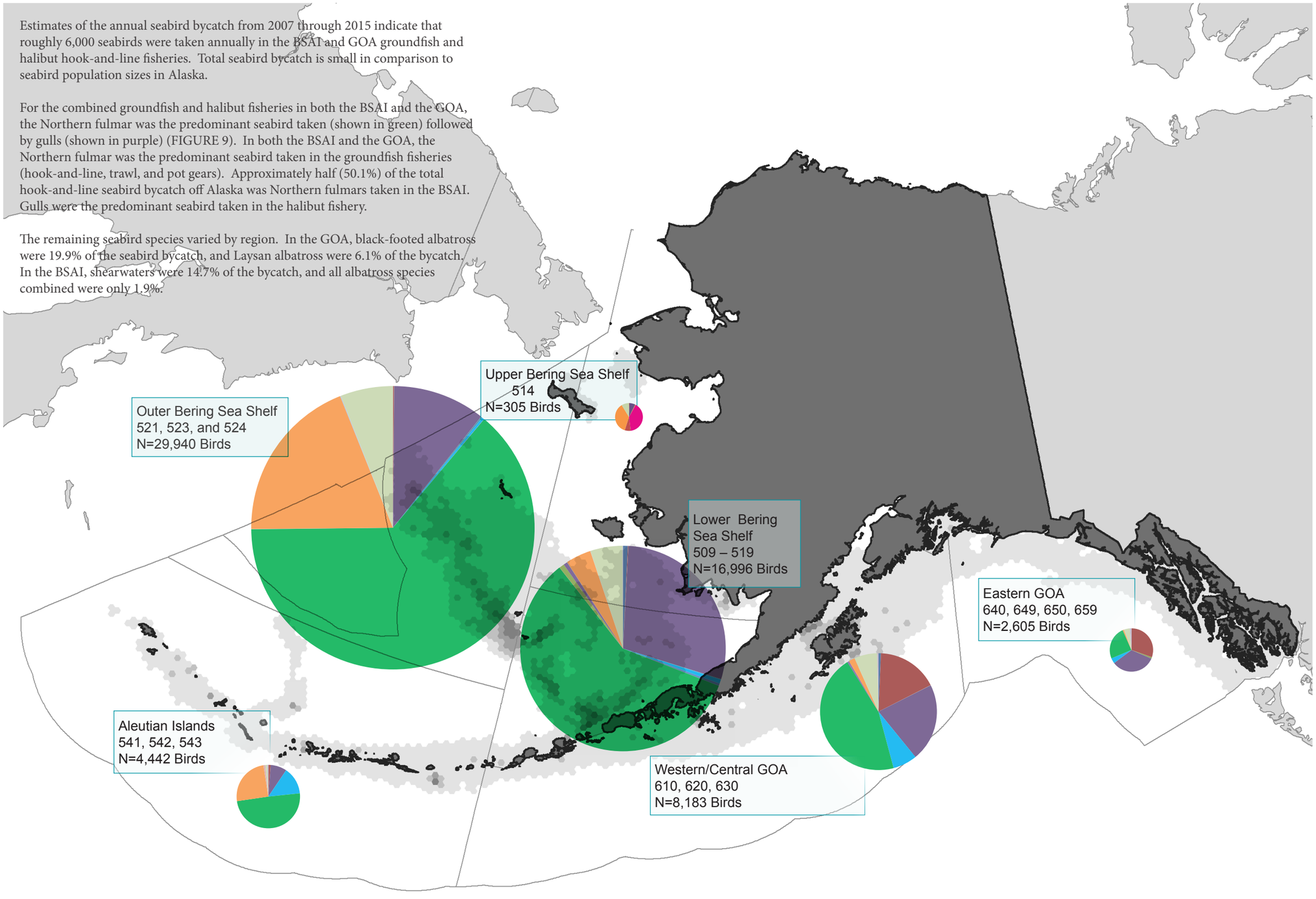


FIGURE 9. The pie charts represent the proportion of total birds taken as bycatch in fishery reporting areas from 2007 through 2015. Relative total groundfish and halibut catch in 2015 from the groundfish fisheries (hook-and-line, trawl, and pot gears) and halibut fishery, combined, are represented in gray scale.

Seabird Bycatch Estimates in the Hook-and-Line Fisheries

As stated previously, most seabird bycatch off Alaska occurs in hook-and-line fisheries. Estimates of the annual seabird bycatch for the hook-and-line fisheries in the BSAI and GOA ranged from 2,090 to 9,563 seabirds from 2007 through 2015, with an annual average of 6,037. Seabird bycatch was largely composed of Northern fulmars, followed by gulls, shearwaters, unidentified birds, black-footed albatross, and Laysan albatross (TABLE 5).

Estimated seabird bycatch taken in the four largest hook-and-line fisheries—Pacific cod, sablefish, Pacific halibut, and Greenland turbot—is presented in this report. It is important to note that these estimates do not represent the total seabird bycatch in the groundfish and halibut fisheries off Alaska for 2007 through 2015. The monitoring data for all federally managed hook-and-line fisheries off Alaska will be provided in a separate annual seabird bycatch report.

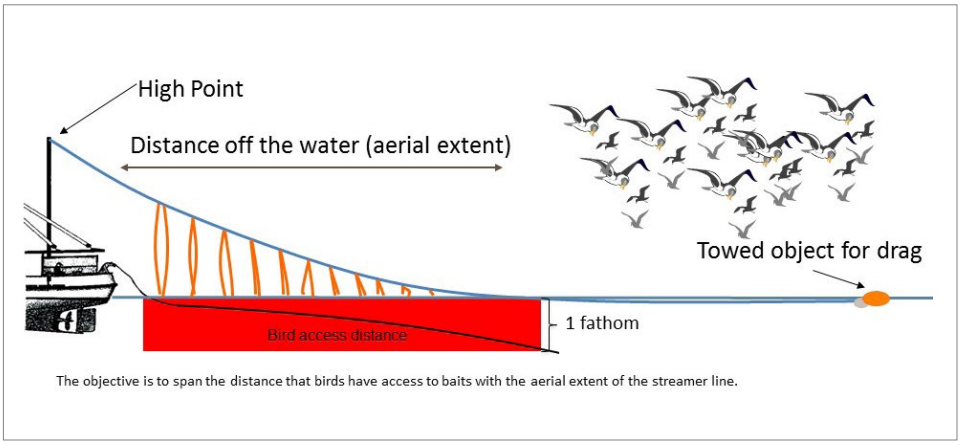


FIGURE 10. A depiction of where seabirds may get caught on hooks and how streamers work to reduce bycatch. Source: Melvin (2000).

TABLE 5. Summary of estimated seabird bycatch in the hook-and-line groundfish and halibut fisheries, BSAI and GOA Groundfish FMP areas, 2007 through 2015. Halibut fisheries 2013 through 2015 only.

Species/Species Group	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	Annual Average
Unidentified Albatrosses	17				10		28	33		88	10
Short-tailed Albatross				15	5			9		29	3
Laysan Albatross	13	226	71	222	206	141	200	99	223	1,403	156
Black-footed Albatross	201	303	56	71	222	81	444	297	371	2,046	227
Northern Fulmar	3,678	2,761	7,000	1,902	5,964	2,851	2,697	715	2,892	30,460	3,384
Shearwaters	2,860	1,211	574	502	260	529	195	114	321	6,567	730
Gulls	914	1,481	1,186	1,116	2,224	897	576	730	1,249	10,374	1,153
Kittiwakes	10		10		6	5	3	9	12	56	6
Murres	5	6	13			6				29	3
Puffins				9						9	1
Auklets						7		6	11	25	3
Cormorant									28	28	3
Unidentified Birds	498	541	652	267	387	322	296	77	184	3,225	358
Grand Total	8,195	6,530	9,563	4,105	9,284	4,840	4,439	2,090	5,292	54,337	6,037

Pacific Cod Hook-and-Line Fishery

From 2007 through 2015, 80% of the hook-and-line seabird bycatch in the BSAI and GOA was from trips targeting Pacific cod.

Approximately 90% of the Pacific cod hook-and-line fishery (FIGURE 11) occurs in the BSAI with the remainder in the GOA (FIGURE 12). From 2007 through 2015, this fishery had an average of 138 boats ranging in size from 19 ft to 196 ft. Over that same period the average annual catch in this fishery was approximately 152,000 mt.

FIGURE 11. Pacific cod hook-and-line fishing vessel. Photo credit: Observer Program.

From 2007 through 2015, estimates of the annual seabird bycatch in the BSAI and GOA in this fishery ranged from 1,382 to 8,415 seabirds, with an annual average of 4,816. Seabird bycatch largely included Northern fulmars, followed by gulls, shearwaters, and unidentified birds (TABLE 6). Estimated bycatch of short-tailed albatross is discussed in detail in the section "Bycatch of Short-tailed Albatross."

TABLE 6. Estimated bycatch of seabird species in the Pacific cod hook-and-line fishery, 2007 through 2015, as reported in the CAS.

Species/Species Group	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	Annual Average
Unidentified Albatrosses					10			10		19	2
Short-tailed Albatross				15	5			3		23	3
Laysan Albatross	3	25	13	51	28	34	4	21	38	217	24
Black-footed Albatross	18	7	5	18				8		58	6
Northern Fulmar	2,382	2,432	6,369	1,687	4,642	2,497	2,493	583	2,706	25,790	2,866
Shearwaters	2,710	1,211	504	492	126	490	135	43	233	5,945	661
Gulls	451	1,428	883	879	1,681	859	435	623	958	8,198	911
Kittiwakes			5		6	5	3	9	12	42	5
Murres	5	6	13			6				29	3
Puffins				9						9	1
Auklets						7		6	11	25	3
Unidentified Birds	445	487	622	249	378	308	271	77	152	2,989	332
Grand Total	6,014	5,597	8,415	3,402	6,875	4,205	3,342	1,382	4,111	43,343	4,816

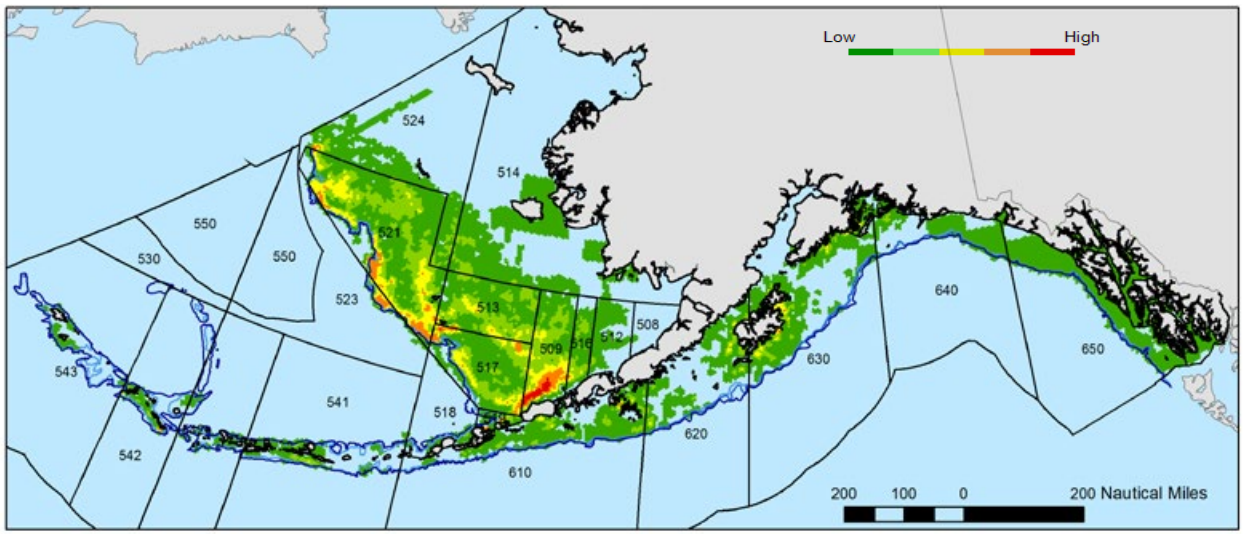


FIGURE 12. Average annual targeted harvest of Pacific cod in the commercial hook-and-line fishery, 2011 through 2015. Colors represent volume of catch from the NOAA Fisheries Alaska Region Catch-in-Areas database. This scale is not comparable among different target species. Bathymetry is depicted by blue lines that darken color with deeper depths.

Sablefish Hook-and-Line Fishery

The sablefish fishery tends to occur on the shelf break in the GOA and Bering Sea (FIGURE 14). From 2007 through 2015, the sablefish hook-and-line fishery had an average of 312 boats ranging in size from 16 ft to 180 ft. Over that same period the average annual catch in this fishery was approximately 12,900 mt (FIGURE 13).

Most (83%) of the sablefish hook-and-line fishery seabird bycatch occurred in the GOA; the remainder occurred in the BSAI. From 2007 through 2015, estimates of the annual seabird bycatch in the BSAI and GOA in this fishery ranged from 227 to 1,868 seabirds, with an annual average of 858. Seabird bycatch is largely Northern fulmars, followed by black-footed albatross, gulls, and Laysan albatross (TABLE 7).

FIGURE 13. Sablefish harvest. Photo credit: Ed Melvin, Washington Sea Grant.

TABLE 7. Estimated bycatch of seabird species in the sablefish hook-and-line fishery, 2007 through 2015, as reported in the CAS.

Species/Species Group	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	Annual Average
Unidentified Albatrosses	17						28	23		68	8
Laysan Albatross	3	201	48	172	174	107	179	79	145	1,107	123
Black-footed Albatross	182	295	51	52	222	81	393	228	371	1,876	208
Northern Fulmar	1,050	82	84	44	823		138	58	128	2,407	267
Shearwaters	31			6	97			71	32	237	26
Gulls	463	53	299	220	544	39	46	8	148	1,819	202
Cormorants									28	28	3
Unidentified Birds	53	54	26	6	9				28	177	20
Grand Total	1,800	686	508	501	1,868	227	785	467	880	7,720	858

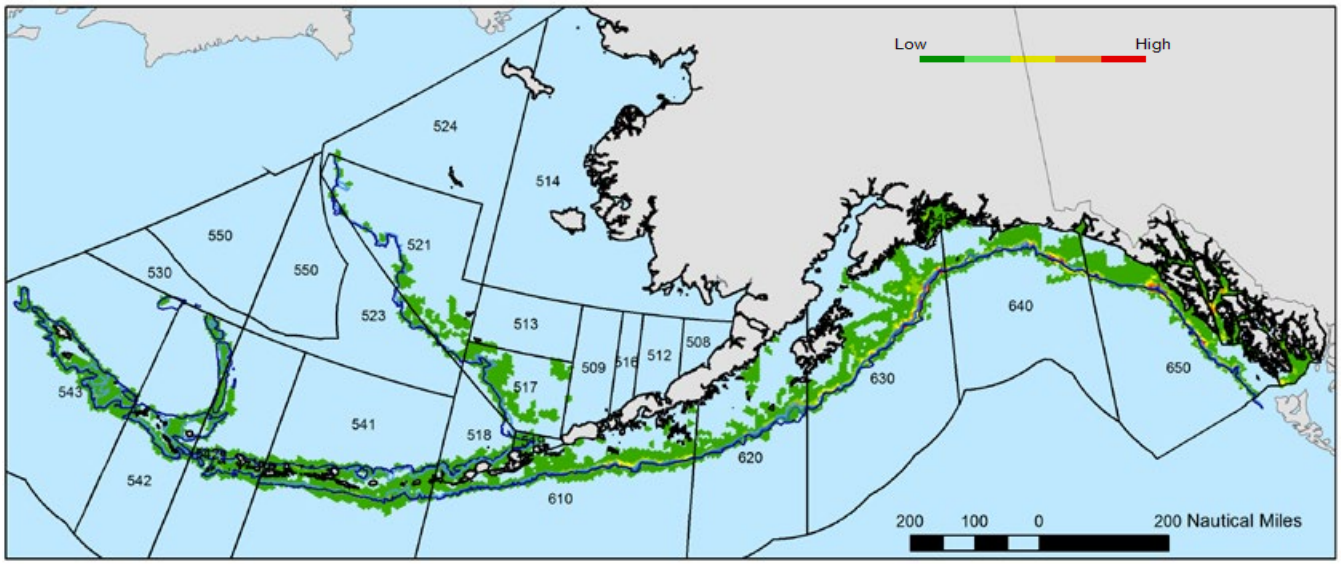


FIGURE 14. Average annual targeted harvest of sablefish in the commercial hook-and-line fishery, 2011 through 2015. Colors represent volume of catch from the NOAA Fisheries Alaska Region Catch-in-Areas database. This scale is not comparable among different target species. Bathymetry is depicted by blue lines that darken color with deeper depths.

Pacific Halibut Hook-and-Line Fishery

Starting in 2013, NOAA Fisheries has been able to estimate seabird bycatch in the Pacific halibut hook-and-line fishery. Previous to 2013, there were no observer coverage requirements for the halibut fleet. In January 2013, NOAA Fisheries implemented the restructured Observer Program to improve observer data quality, more equitably distribute the industry's observer coverage costs, and expand observer coverage to vessels less than 60 ft LOA and the commercial halibut sector (77 FR 70062, November 21, 2012).

The Pacific halibut hook-and-line fishery primarily occurs in the central GOA (FIGURE 16). From 2013 through 2015, this fishery had an average of 943 boats ranging in size from 14 ft to 176 ft (FIGURE 15). Over that same period the average annual catch in this fishery was approximately 24,000 mt.

FIGURE 15. Baiting hooks on a hook-and-line vessel. Photo credit: Amanda Gladics, Oregon State University.

Most (83%) of the Pacific halibut hook-and-line fishery seabird bycatch occurred in the GOA and the rest occurred in the BSAI. From 2013 through 2015, estimates of the annual seabird bycatch off Alaska ranged from 176 to 225 seabirds, with an annual average of 193. Seabird bycatch largely included gulls, black-footed albatross, Northern fulmar, and Laysan albatross (TABLE 8).

Species/Species Group	2013	2014	2015	Total	Annual Average
Laysan Albatross	17		40	57	19
Black-footed Albatross	51	61		113	38
Northern Fulmar		19	41	60	20
Gulls	89	99	144	331	110
Unidentified Birds	19			19	6
Grand Total	176	179	225	580	193

TABLE 8. Estimated bycatch of seabird species in the Pacific halibut hook-and-line fishery, 2013 through 2015, as reported in the CAS.

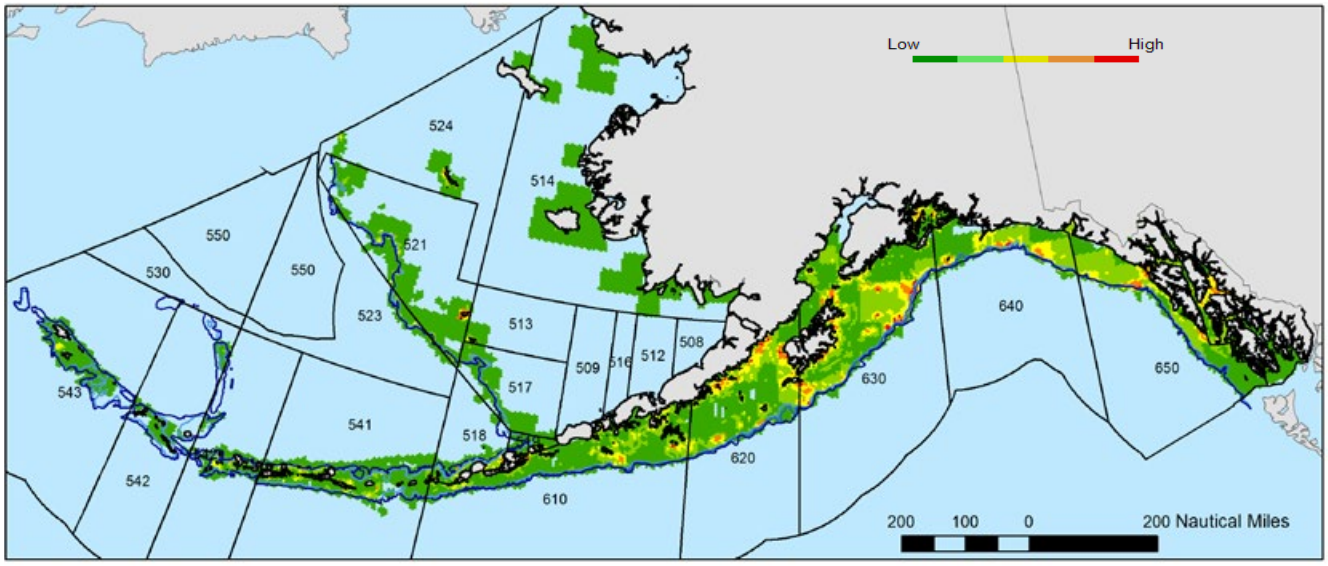


FIGURE 16. Average annual targeted harvest of Pacific halibut in the commercial hook-and-line fishery, 2011 through 2015. Colors represent volume of catch from the NOAA Fisheries Alaska Region Catch-in-Areas database. This scale is not comparable among different target species. Bathymetry is depicted by blue lines that darken color with deeper depths.

Greenland Turbot Hook-and-Line Fishery

The Greenland turbot fishery (FIGURE 17) occurs primarily along the Eastern Bering Sea shelf break (FIGURE 18), which is an important horizontal and vertical mixing ground where seabirds including short-tailed albatross congregate. From 2007 through 2015, the Greenland turbot hook-and-line fishery had an average of seven boats ranging in size from 59 ft to 180 ft. Over that same period the average annual catch in this fishery was approximately 1,800 mt.

FIGURE 17. Greenland turbot. Photo credit: Anne Richards, Northeast Fisheries Science Center, NOAA Fisheries.

All of the Greenland turbot seabird bycatch occurred in the BSAI. From 2007 through 2015, estimates of the annual seabird bycatch off Alaska ranged from 62 to 639 seabirds, with an annual average of 298. Seabird bycatch largely included Northern fulmar and shearwaters (TABLE 9). Estimated bycatch of short-tailed albatross is discussed in detail in the section "Bycatch of Short-tailed Albatross."

TABLE 9. Estimated bycatch of seabird species in the Greenland turbot hook-and-line fishery, 2007 through 2015, as reported in the CAS.

Species/Species Group	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	Annual Average
Short-tailed Albatross								6		6	1
Laysan Albatross	2		10		5					17	2
Northern Fulmar	243	247	548	170	498	354	65	55	17	2,199	244
Shearwaters	119		69	4	38	40	60		55	385	43
Gulls			4	17						20	2
Kittiwakes	10		4							14	2
Unidentified Birds			4	11		15	5			36	4
Grand Total	374	247	639	202	542	409	131	62	72	2,678	298

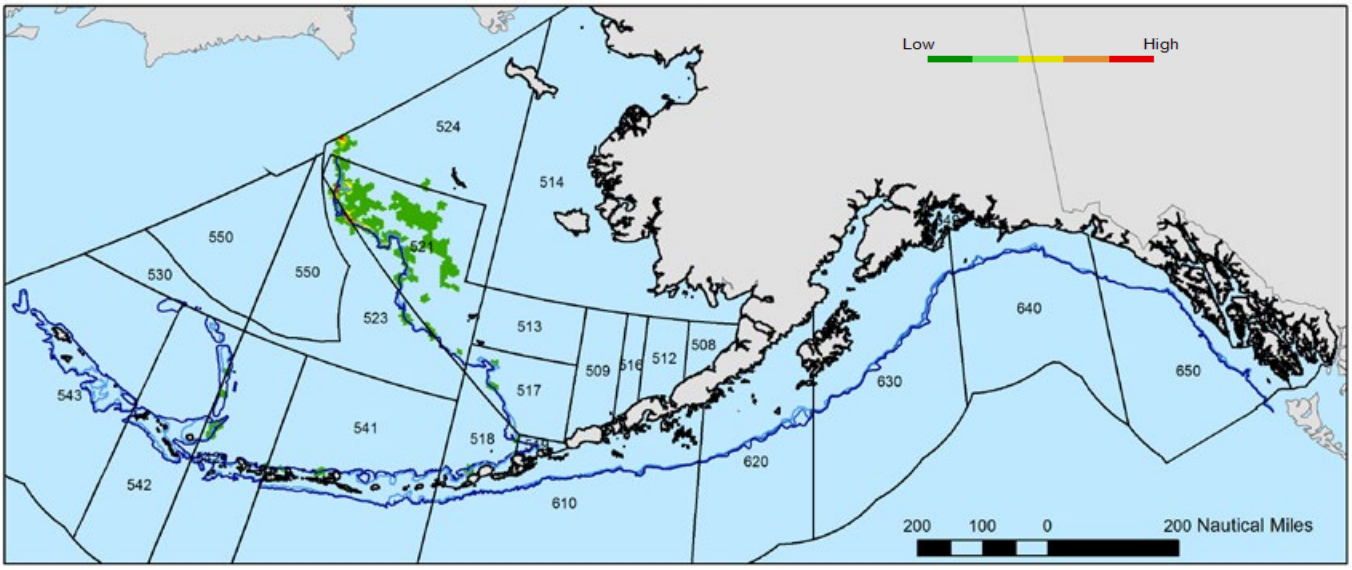


FIGURE 18. Average annual targeted harvest of Greenland turbot in the commercial hook-and-line fishery, 2011 through 2015. Colors represent volume of catch from the NOAA Fisheries Alaska Region Catch-in-Areas database. This scale is not comparable among different target species. Bathymetry is depicted by blue lines that darken color with deeper depths.

Bycatch Rates in Hook-and-Line Fisheries

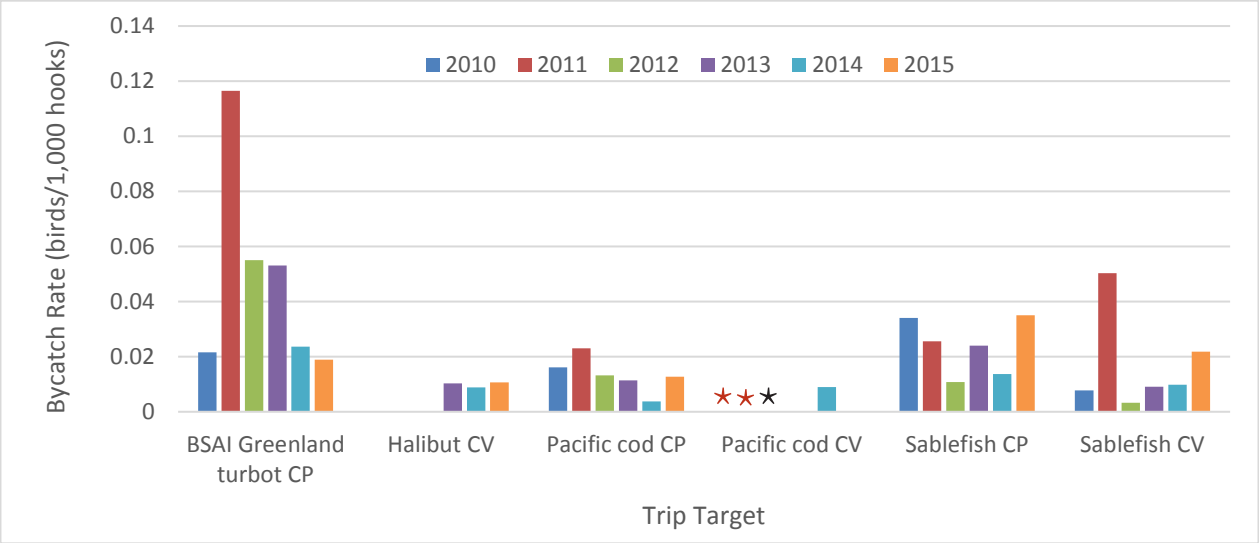


FIGURE 19. Preliminary estimates of the number of seabirds caught per 1,000 hooks by target fishery, 2010 through 2015. Halibut fisheries 2013 through 2015 only. In instances where there were too few vessels or too few samples, a rate is not reported and is indicated by a black asterisk or a red asterisk, respectively. Rates provided by Melvin et al. (2015).

While reviewing the total numbers of seabirds taken as bycatch in a fishery is noteworthy, comparing bycatch across fisheries or across time in the same fishery using a rate of bycatch (i.e., number of birds caught normalized with some measure of effort) can provide further insights. The CAS can provide a seabird bycatch rate as birds per metric ton of groundfish harvested; however, the international standard for these rates in hook-and-line fisheries is birds per 1,000 hooks.

Melvin et al. (2015) used observer sample data supplied by the Observer Program to calculate standardized rates (i.e., number of birds per 1,000 hooks), which are shown in FIGURE 19. Mean rates were weighted using the number of hooks sampled as the weighting factor. Sets with less than 20% of the deployed hooks sampled by the observer were excluded. Three years of Pacific cod CV data were not reported due to data constraints; in 2010 and 2011 the sample size was too low, and in 2012 there were too few vessels.

FIGURE 19 shows that the highest seabird bycatch rates are for the Greenland turbot and sablefish fisheries. Both tend to occur on the shelf break (FIGURE 14, FIGURE 18), as opposed to the Pacific cod and Pacific halibut fisheries, which occur on the shelf break and on the shelf (FIGURE 12, FIGURE 16).

The USFWS (2009) characterizes the shelf break as an area where birds from the outer continental shelf and oceanic waters congregate frequently because water mixing brings in a high density of prey resources. Northern fulmars, shearwaters, albatrosses, and petrels forage in these areas. As discussed previously, albatrosses, fulmars, and shearwaters are more likely to be taken as bycatch in the hook-and-line fisheries due to their feeding behavior. The spatial juxtaposition of preferred seabird habitat and high fishing effort is likely a contributing factor to a higher bycatch rate in some fisheries.

Nearshore foragers, such as cormorants, terns, guillemots, murrelets, and puffins are less likely to interact with offshore groundfish fisheries (NMFS 2004). The halibut fishery primarily occurs offshore in the central GOA but can occur nearshore where the potential to interact with nearshore foragers exists.

During the breeding season (spring and summer for most Northern hemisphere seabirds and the opposite for most Southern hemisphere seabirds), seabirds are more closely tied to their colonies and depend on one or more oceanographic features or processes to concentrate their prey for more efficient foraging trips.

Occurrence and density of seabird species at sea vary greatly by space and time according to their habits, breeding activities, migration, habitats, abundance, and the movements of forage species. During the breeding season (spring and summer for most Northern hemisphere seabirds and the opposite for most Southern hemisphere seabirds), seabirds are more closely tied to their colonies and depend on one or more oceanographic features or processes to concentrate their prey for more efficient foraging trips. These features and processes include upwellings, stratification, ice and shelf edges, passes, fronts, and tidal currents (USFWS 2009). Therefore, a higher incidence of bycatch could be expected in fisheries that occur at a higher frequency in those locations, such as the Greenland turbot and sablefish fisheries.

The high seabird bycatch rate in the Greenland turbot hook-and-line fishery for 3 of the 6 years presented (FIGURE 19) might also be explained by the small number of vessels in this fishery. The small number of vessels makes it possible for high seabird bycatch by a single vessel to greatly influence CAS seabird bycatch estimates for the whole fishery.

Albatross bycatch rates in the hook-and-line fisheries are low relative to that of all seabirds (FIGURE 19, FIGURE 20). The sablefish fishery has the highest albatross bycatch rate, which is most likely due to the location of the fishery overlapping with prime habitat for albatross along the continental shelf break. This is discussed in the section "Interactions between Albatross Species and Alaska Fisheries."

Temporal Aspects of Seabird Bycatch and Fishery Effort

Bycatch of seabirds other than albatross peaks in the winter, specifically November (FIGURE 21). We do not know the cause of this increase in November but the primary fishery at that time is the Pacific cod hook-and-line fishery in the Bering Sea. A reasonable explanation is that these boats could be swamped by seabirds because few other fisheries are open at that time. With fewer "free" food sources from other fishing vessels, including trawl vessels, the seabirds around the remaining hook-and-line vessels could become more aggressive, which could result in a higher bycatch rate.

Seabird migration patterns may also play a role in the species present. As discussed previously, seabirds are more closely tied to their colonies in spring and summer to lay eggs and rear chicks. In winter, marine birds use sheltered, ice-free, southern waters around Alaska (USFWS 2009). The higher bycatch rates among hook-and-line fisheries in the winter, despite lower total effort, could suggest that shifting to wintering areas may present a greater risk of bycatch in fisheries. Another possibility is an increase in bird density given all the young of the year that have come off the nest.

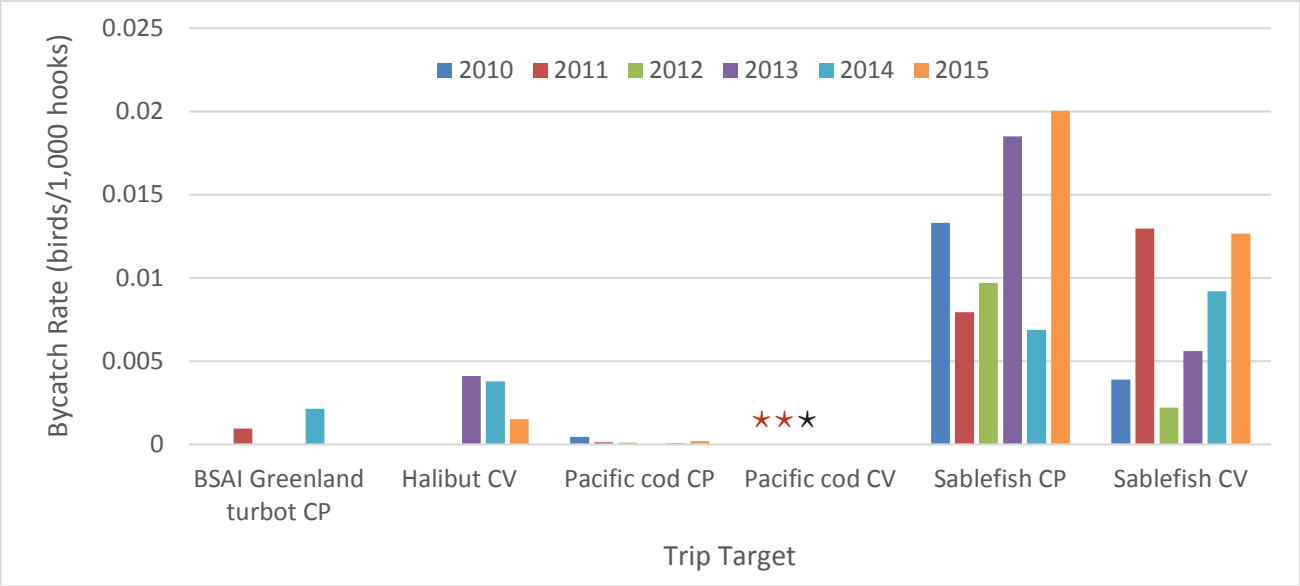


FIGURE 20. Preliminary estimates of the number of albatrosses caught per 1,000 hooks by target fishery, 2010 through 2014. Halibut fisheries 2013 through 2015 only. In instances where there were too few vessels or too few samples, a rate is not reported and is indicated by a black asterisk or a red asterisk, respectively. Rates provided by Melvin et al. (2015).

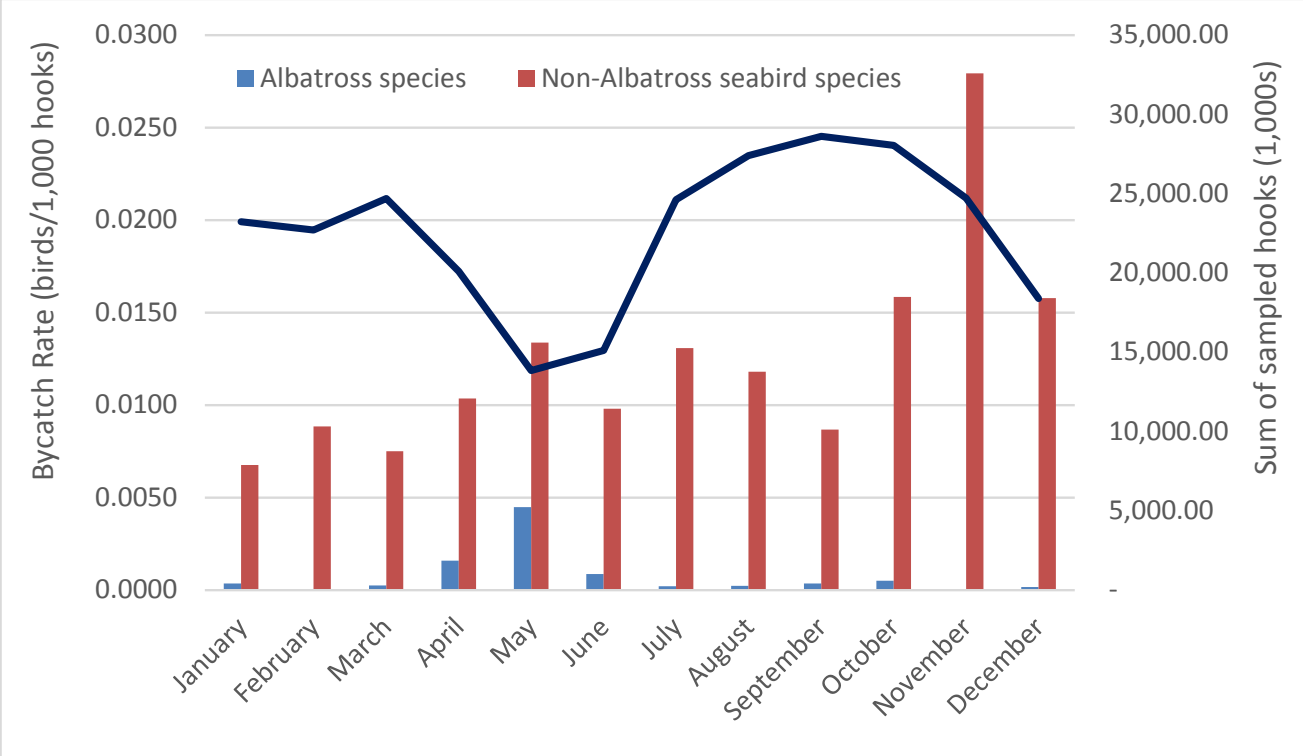


FIGURE 21. Preliminary estimates of the number of seabirds caught per 1,000 hooks by month from 2010 through 2015 in the groundfish and halibut hook-and-line fisheries. Rates provided by Melvin et al. (2015). Halibut fisheries 2013 through 2015 only.

Seabird Bycatch in Trawl Fisheries

Seabird bycatch estimates derived from the observer species composition sample are biased low because observer sampling focuses on catch from the codend. However, on trawl vessels, seabirds can strike net monitoring equipment, such as paravanes or third wires, strike the trawl warp cables, or get caught in the net wings and thus not be brought on board with the fish so are not available to the observer during the species composition sampling period.

Seabirds can interact with trawl fishing vessels in several ways including getting caught in the trawl net or vessel wires and striking the vessel infrastructure (FIGURE 7). Birds foraging at the water's surface or in the water column are sometimes caught in the trawl net as it is brought back on board. No short-tailed albatross have been observed taken in trawl gear, but Laysan albatross mortalities have been observed.

While trawl vessels do not offer any attraction from bait, they may produce a great amount of offal if the vessel is a CP. Birds are attracted to the net when it is being deployed and retrieved. Also, whole fish may be discarded as decks and equipment are washed or fish spill overboard when the codend is emptied.

The non-pelagic and pelagic trawl fisheries differ in the types and biomass of discards, which can play a role in the type of seabird attracted to vessels (McElderry et al. 2004). The non-pelagic trawl fishery discards a greater biomass than does the pelagic trawl fishery even though it has a smaller amount of total catch than the pelagic trawl fishery. This is due in part to the ability of the larger pelagic trawl CPs to have a fish meal plant on board.

Overall seabird bycatch in recent years is nearly an order of magnitude less in the trawl fishery than in the hook-and-line fishery, based on the observer sample. However, sampling bias is known to exist with commercial trawl fisheries and is discussed below.

Seabird bycatch estimates derived from the observer species composition sample are biased low because observer sampling focuses on catch from the codend. However, on trawl vessels, seabirds can strike net monitoring equipment, such as paravanes or third wires, strike the trawl warp cables, or get caught in the net wings and thus not be brought on board with the fish so are not available to the observer during the species composition sampling period (Fitzgerald et al. in prep). Trawl-induced seabird mortality is difficult to quantify because birds that strike the cables may fall into the water and go unobserved (Dietrich and Melvin 2007; Zador and Fitzgerald 2008). Studies in the southern hemisphere also note these additional sources of mortality in trawl fisheries (Weimerskirch et al. 2000; Sullivan et al. 2006; Bull 2009). In the Alaska groundfish trawl fisheries, these additional mortalities were only noted on an ad-hoc basis by observers for many years (Labunski and Kuletz 2004; Fitzgerald et al. in prep).

The AFSC completed a multi-year observer special project in 2009 that compared observed seabird bycatch from the haul-level estimate, derived from the standard species composition sample, to seabird mortality from the supplemental sample of trawl gear (net wings, trawl warps, and third wires) (unpublished data in Fitzgerald et al. in prep). The study showed that there were 3.5 times as many birds in the supplemental sample than in the standard sample for the 9,395 hauls observed. The supplemental sample included six Laysan albatross while the standard sample did not have any, although the bycatch rate (0.0006 birds per haul) for the observed hauls was extremely low.

Based on this special project, in 2010 the Observer Program implemented standardized data recording measures for these additional sources of mortality, although the observer's ability to complete sampling for these data is constrained by matters of safety and other duties. While these data have been collected since 2010, the estimation procedures have not yet been developed so that they can be included in the annual bycatch report. However, work is underway to determine the best way to monitor and include these in annual estimates (AFSC 2014).

FIGURE 22. Fishing vessel with trawl gear. Photo credit: Rob Suryan, Oregon State University.

Seabird Bycatch Estimates in the Trawl Fisheries

Catch accounting data from 2007 through 2015 attribute 10% of all estimated seabird bycatch in the groundfish and halibut fisheries (hook-and-line, trawl, and pot gear, combined) to the trawl fisheries (FIGURE 22). Thirty-two percent of this bycatch is from trawl fisheries targeting pollock, 21% from Atka mackerel, and 14% from yellowfin sole. From 2007 through 2015, the annual average of seabirds taken as bycatch in the trawl fisheries off Alaska was 691 seabirds (TABLE 10).

Estimated seabird bycatch taken in the largest trawl fishery, the pollock fishery, is presented in this report. The monitoring data for all federally managed trawl fisheries off Alaska will be provided in a separate annual seabird bycatch report.

TABLE 10. Estimated seabird bycatch for groundfish trawl fisheries, including all pelagic and non-pelagic gear, in the BSAI and GOA Groundfish FMP areas, 2007 through 2015, as reported in the CAS.

Species/Species Group	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	Annual Average
Laysan Albatross			9							9	1
Black-footed Albatross						60				60	7
Northern Fulmar	652	537	633	503	329	297	463	85	463	3,963	440
Shearwaters	726	13	41	155	3	56	1	72	62	1,129	125
Storm Petrels	1	44								45	5
Gulls	303	9	82	57	1		3			455	51
Kittiwakes			6							6	1
Murres	2			102	14		3	47		168	19
Auklets		3					4	66		73	8
Other Alcids			105							105	12
Cormorants									3	3	0
Other Birds			136							136	15
Unidentified Birds	16		44	3					6	69	8
Grand Total	1,700	606	1,057	821	347	413	474	270	534	6,222	691

Pollock Trawl Fishery

Thirty-two percent of the trawl seabird bycatch in the BSAI and GOA was from trips targeting pollock, which primarily occur in the Bering Sea (FIGURE 24). From 2007 through 2015, the pollock trawl fishery had an average of 162 boats ranging in size from 57 ft to 376 ft. Over that same period the average annual catch in this fishery was approximately 1.2 million mt (FIGURE 23).

From 2007 through 2015, estimates of the annual seabird bycatch in this fishery off Alaska ranged from 57 to 601 seabirds, with an annual average of 224 seabirds. Seabird bycatch largely included Northern fulmar (TABLE 11).

FIGURE 23. Pollock harvest. Photo credit: Ed Melvin, Washington Sea Grant.

TABLE 11. Estimated bycatch of seabird species in the pollock trawl fishery, 2007 through 2015 as reported in the CAS.

Species/Species Group	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	Annual Average
Northern Fulmar	552	290	300	69	214	90	123	51	112	1,800	200
Shearwaters	21	13	3	22	3	12	1	3	6	85	9
Storm Petrels	1									1	0
Gulls	9	9	3		1		3			25	3
Kittiwakes			6							6	1
Murres	2				14		3	3		22	2
Auklets		3					4			7	1
Cormorants									3	3	0
Other Birds			3							3	0
Unidentified Birds	16		36	3					6	61	7
Grand Total	601	315	351	94	232	102	134	57	127	2,012	224

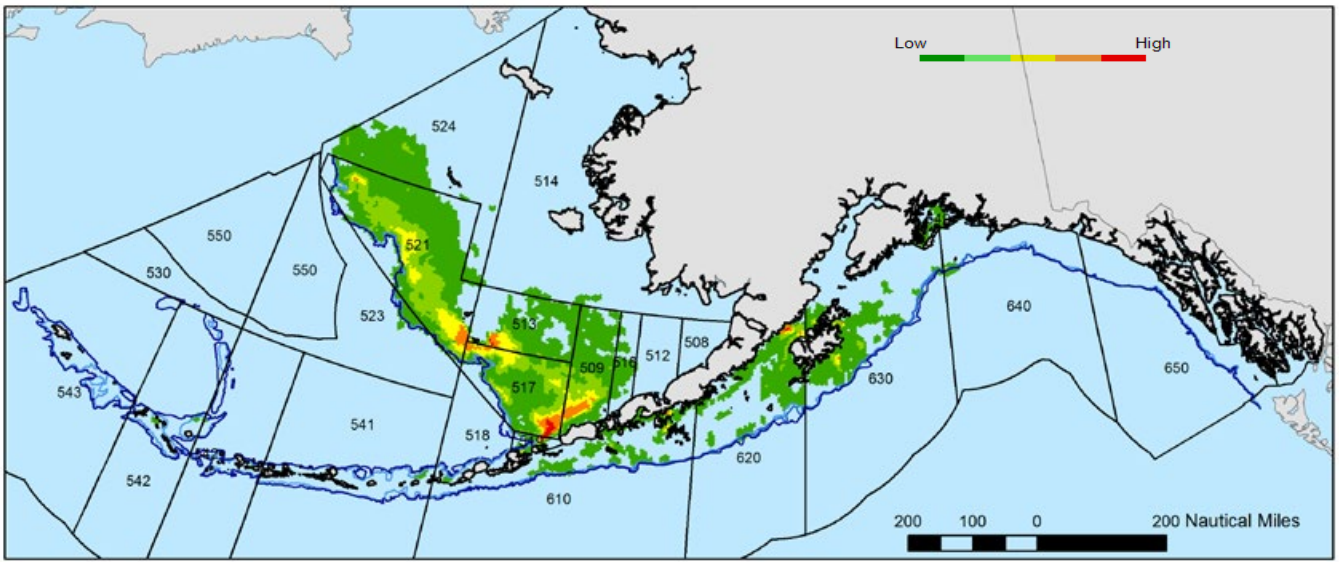


FIGURE 24. Average annual targeted harvest of Walleye pollock in the commercial trawl fishery, 2011 through 2015. Colors represent volume of catch from the NOAA Fisheries Alaska Region Catch-in-Areas database. This scale is not comparable among different target species. Bathymetry is depicted by blue lines that darken color with deeper depths.

History of Seabird Avoidance Measures in Alaska Groundfish and Halibut Fisheries

Seabird avoidance measures in the Alaska fisheries have been revised numerous times, as NOAA Fisheries Alaska Region has used adaptive management to refine and improve the efficacy and efficiency of these regulations.

May 1997 — Groundfish hook-and-line fisheries were required to conduct fishing operations in a specified manner, and to employ specified bird avoidance techniques to reduce seabird bycatch and incidental seabird mortality (62 FR 23176, April 29, 1997). A wide variety of measures were allowed under this initial requirement.

April 1998 — Pacific halibut fisheries in U.S. Convention waters off Alaska were required to conduct fishing operations in a specified manner and to employ specified measures intended to reduce seabird bycatch and incidental seabird mortality. This rule also amended the regulations requiring seabird bycatch avoidance measures in the hook-and-line groundfish fisheries of the BSAI and the GOA to exempt small vessels from some of the requirements and to clarify that if offal is discharged while gear is being hauled, it must be discharged in a manner that distracts seabirds, to the extent practicable, from baited hooks (63 FR 11161, March 6, 1998).

1999–2000 — Field studies investigating seabird mitigation measures, including streamer lines, were led by Washington Sea Grant at the University of Washington (Washington Sea Grant) and supported by NOAA, USFWS, University of Washington, and fishing industry associations (Melvin et al. 2001).

2002 — The commercial fishing industry's (predominantly the North Pacific Longline Association) widespread voluntary usage of the streamer lines developed during the Washington Sea Grant field studies resulted in a precipitous drop in seabird bycatch.

February 2004 — Seabird avoidance measures were revised for the Alaska hook-and-line groundfish and halibut fisheries. This rule required the use of streamer lines with performance standards of proven effectiveness, strengthened gear standards for small vessels, and eliminated certain seabird avoidance requirements that were not needed (69 FR 1930, January 13, 2004).

April 2009 — Seabird avoidance requirements for the hook-and-line groundfish and halibut fisheries in International Pacific Halibut Commission (IPHC) Area 4E were revised. This rule eliminated seabird avoidance requirements for hook-and-line vessels less than or equal to 55 ft LOA in portions of Area 4E in the eastern Bering Sea (74 FR 13355, March 27, 2009).

See 50 CFR 679.24(e) and 679.51(e)(1)(viii)(F) for complete seabird avoidance requirements for vessels fishing with hook-and-line gear; see 50 CFR 679.24(e)(1) for applicable fisheries (74 FR 13355, March 27, 2009; Table 20 to 50 CFR part 679). A summary of the requirements for the current seabird avoidance program follows.

Fisheries Management Measures That Mitigate Seabird Bycatch

In Alaska, seabird avoidance measures are required to be used by operators of all vessels greater than 26 ft LOA using hook-and-line gear while fishing for 1) IFQ halibut, Community Development Quota halibut, or IFQ sablefish in the EEZ off Alaska or State of Alaska (State) waters (0 to 200 nm [nautical miles] combined); or 2) groundfish in the EEZ off Alaska (3 to 200 nm). Vessels greater than 55 ft LOA in the EEZ must use a minimum of a single (if using snap gear) or paired (if using other than snap gear) streamer line of a specified performance and material standard. Vessels greater than 26 ft LOA and less than or equal to 55 ft LOA must use a minimum of a single streamer line or, in limited instances, a minimum of one buoy bag line. An exemption from seabird avoidance regulations exists for operators of vessels in certain locations as well as for operators of vessels less than or equal to 32 ft LOA using hook-and-line gear in IPHC Area 4E in waters shoreward of the EEZ (TABLE 12, FIGURE 25, FIGURE 26). Additionally, for crew safety, allowances are made to use a single streamer line or no streamer line under specific weather conditions. Other than noted above, vessel operators using hook-and-line gear and fishing for groundfish in State waters must comply with State regulations (see 5AAC 28.055).

Offal discharged while gear is being set or hauled should be discharged in a manner that distracts seabirds from baited hooks, to the extent practicable (50 CFR part 679.24(e)(2)(v)). Hooks should be removed from any offal that is discharged. The discharge site on board a vessel must be either aft of the hauling station or on the opposite side of the vessel from the hauling station. Directed discharge of residual bait or offal through chutes or pipes should not occur over sinking hook-and-line gear while gear is being deployed.

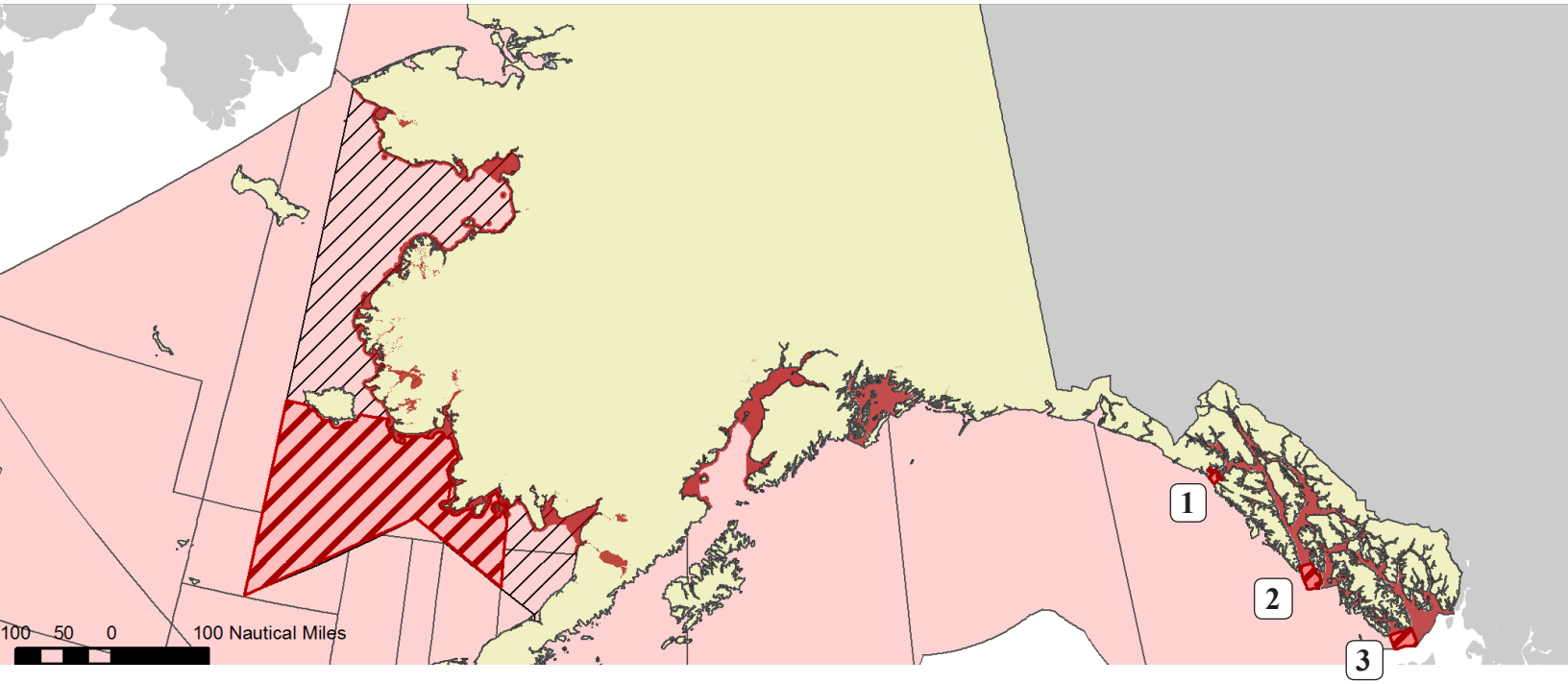


FIGURE 25. Areas where hook-and-line vessels are and are not exempt from the use of seabird avoidance requirements in the EEZ off Alaska. Hook-and-line vessels greater than 26 ft LOA are exempt from the use of seabird avoidance requirements in dark red areas (described in detail in the legend and 50 CFR 679.24(e)(3)(i) and 50 CFR 679.24(e)(6)). For more detail of 1) Cross Sound, 2) Chatham Strait, and 3) Dixon Entrance, see FIGURE 26.

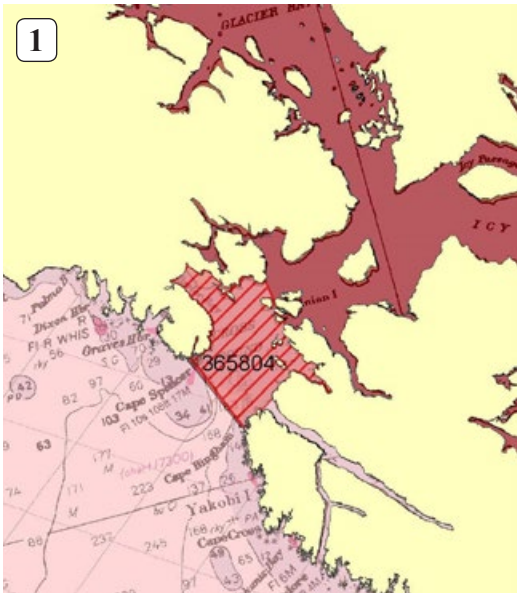
Exclusive Economic Zone (EEZ)

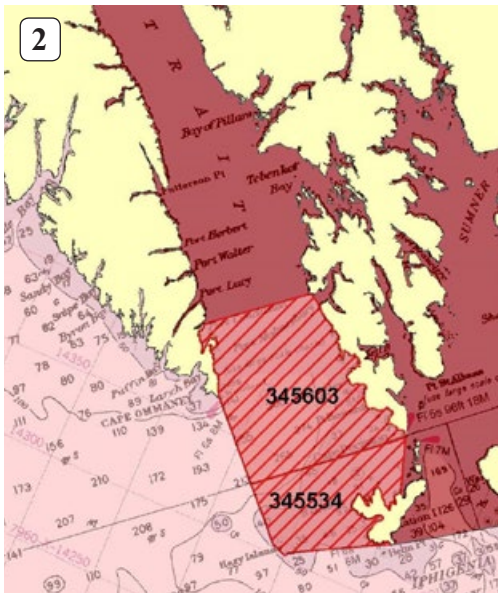
Exempt: State waters of Cook Inlet; Prince William Sound; Southeast Alaska; and <32 ft LOA in State waters of IPHC Area 4E

IPHC Area 4E, ≤55 ft LOA exempt

IPHC Area 4E, ≤55 ft LOA not exempt; Southeast Alaska transition areas; seabird avoidance measures required

FIGURE 26. Hook-and-line vessels greater than 26 ft LOA are exempt from the use of seabird avoidance requirements in Southeast Alaska in NMFS Reporting Area 659 (dark red areas), excluding transition areas. Hook-and-line vessels greater than 26 ft LOA must use seabird avoidance measures in transition areas (red-striped areas). Described in detail at 50 CFR 679.24(e)(3)(i). Maps are of 1) Cross Sound, 2) Chatham Strait, and 3) Dixon Entrance.





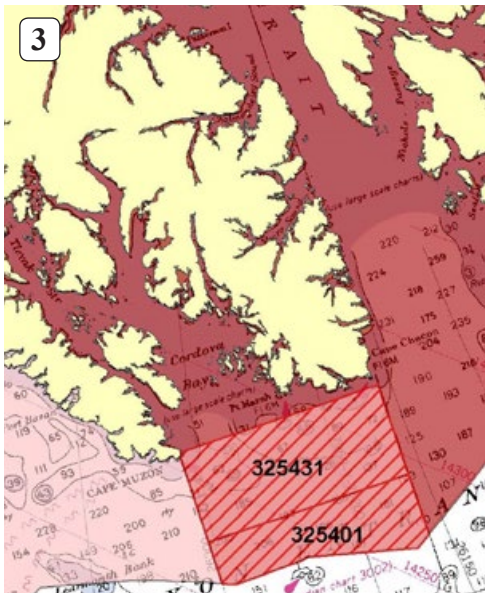


TABLE 12. Seabird avoidance requirements for hook-and–line vessels based on area, gear, and vessel type. See 50 CFR 679.24(e) for complete performance standards.

If you operate a vessel deploying hook-and-line gear, other than snap gear, in waters specified at § 679.24(e)(3), and your vessel is...	**then you must use this seabird avoidance gear in conjunction with requirements at § 679.24(e)...**
>26 ft to ≤55 ft LOA and without masts, poles, or rigging	minimum of one buoy bag line
>26 ft to ≤55 ft LOA and with masts, poles, or rigging	minimum of a single streamer line of a standard specified at § 679.24(e)(4)(ii)
>55 ft LOA	minimum of a paired streamer line of a standard specified at § 679.24(e)(4)(iii)
If you operate a vessel deploying hook-and-line gear and use snap gear in waters specified at § 679.24(e)(3), and your vessel is...	**then you must use this seabird avoidance gear in conjunction with requirements at § 679.24(e)...**
>26 ft to ≤55 ft LOA and without masts, poles, or rigging	minimum of one buoy bag line
>26 ft to ≤55 ft LOA and with masts, poles, or rigging	minimum of a single streamer line of a standard specified at § 679.24(e)(4)(iv)
>55 ft LOA	minimum of a single streamer line of a standard specified at § 679.24(e)(4)(iv)
If you operate any of the following hook-and-line vessels...	**then...**
<32 ft LOA in the State waters of IPHC Area 4E	you are exempt from seabird avoidance measures.
in NMFS Reporting Area 649 (Prince William Sound)	
in State waters of Cook Inlet	
in NMFS Reporting Area 659 (Eastern GOA Regulatory Area, Southeast Inside District), but not including waters in the areas south of a straight line at 56°17.25 N. lat. between Point Harris and Port Armstrong in Chatham Strait, State statistical areas 325431 and 325401, and west of a straight line at 136°21.17 E. long. from Point Wimbledon extending south through the Inian Islands to Point Lavinia	
≤55 ft LOA in IPHC Area 4E but not including waters south of 60°00.00 N. lat. and west of 160°00.00 W. long.	

Enforcement of Seabird Protection Measures

During at-sea boardings, the U.S. Coast Guard and NOAA Fisheries Enforcement check compliance with regulatory requirements for seabird protection measures. Observer Program observers are trained on these regulatory requirements and directed to spot-check as many sets as possible while they are on board, as other priorities and required duties allow.

Observers record whether paired, single, or no streamer lines were deployed. As noted above, flying a single streamer line or not deploying any streamer lines is acceptable under specific weather conditions. Of the 58,566 sets that observers checked from 2007 to 2012, 97.7% had either a paired or single streamer line. Observers checked 61.6% of sets made while on board.

If an observer believes a vessel is not in compliance with regulations, they note the circumstances and fill out an affidavit upon their return. Observers are directed to first work with the vessel captain to address apparent lapses in compliance whenever possible. All affidavits are forwarded to the NOAA Fisheries Alaska Enforcement Division for processing.

Streamer lines have been shown to deter seabird attacks on bait on large hook-and-line vessels and their use resulted in a sharp decline in seabird bycatch in 2002.

FIGURE 27. Streamer lines deployed on a trawl vessel showing seabird avoidance behavior similar to that seen on hook-and-line vessels. Photo credit: Ed Melvin, Washington Sea Grant.

Streamer Lines

Through a collaborative process where Washington Sea Grant led field studies supported by NOAA, USFWS, University of Washington, and fishing industry associations, bycatch mitigation measures were tested in 1999 and 2000 and approved by the NPFMC in 2001. Streamer lines were very effective in deterring seabird attacks on bait on the large hook-and-line vessels (Melvin et al. 2001; FIGURE 28). Free streamer lines (FIGURE 27) were first made available with funding from USFWS in 1999 and distributed with the assistance of the Pacific States Marine Fisheries Commission. When the seabird avoidance regulations that required streamer lines were implemented in 2004, additional vessels obtained these free lines and used them as well. After this success in Alaska, free streamer lines were made available in the West Coast fisheries (NMFS 2013). A limited number of streamer lines are available again to fishermen using hook-and-line gear in groundfish and halibut fisheries off Alaska (for more information, contact the Alaska Regional Office at 907-586-7228). Streamer lines are available for purchase at LFSI Commercial Fishing Gear & Supplies locations in Alaska and Washington (http://www.lfsinc.com/commericalfishinggear/).

The type of streamer line required depends on the area fished, the vessel length, the superstructure of the vessel, and the type of hook-and-line gear (see TABLE 12). Vessels greater than 55 ft LOA in the EEZ must use a minimum of a paired streamer line of a specified performance and material standard (if using other than snap gear); for crew safety, allowances are made to use a single streamer line or no streamer line as weather conditions worsen. For vessels using paired streamer lines in conditions of wind speeds exceeding 30 knots (near gale or Beaufort 7 conditions), but less than or equal to 45 knots, a single streamer must be deployed from the windward side of the vessel. In winds exceeding 45 knots (storm or Beaufort 9 conditions), the use of streamer lines is discretionary. A minimum of a single streamer line or, in limited instances, a minimum of one buoy bag line must be used by vessels 1) greater than 26 ft LOA and less than or equal to 55 ft LOA, and 2) greater than 55 ft LOA using snap gear. In winds exceeding 45 knots (storm or Beaufort 9 conditions), the use of a single streamer line is discretionary. See TABLE 12 and the regulations at 50 CFR part 679.24(e)(2) for more specific requirements.

FIGURE 28. Streamer line deployed. Photo credit: Rob Suryan, Oregon State University.

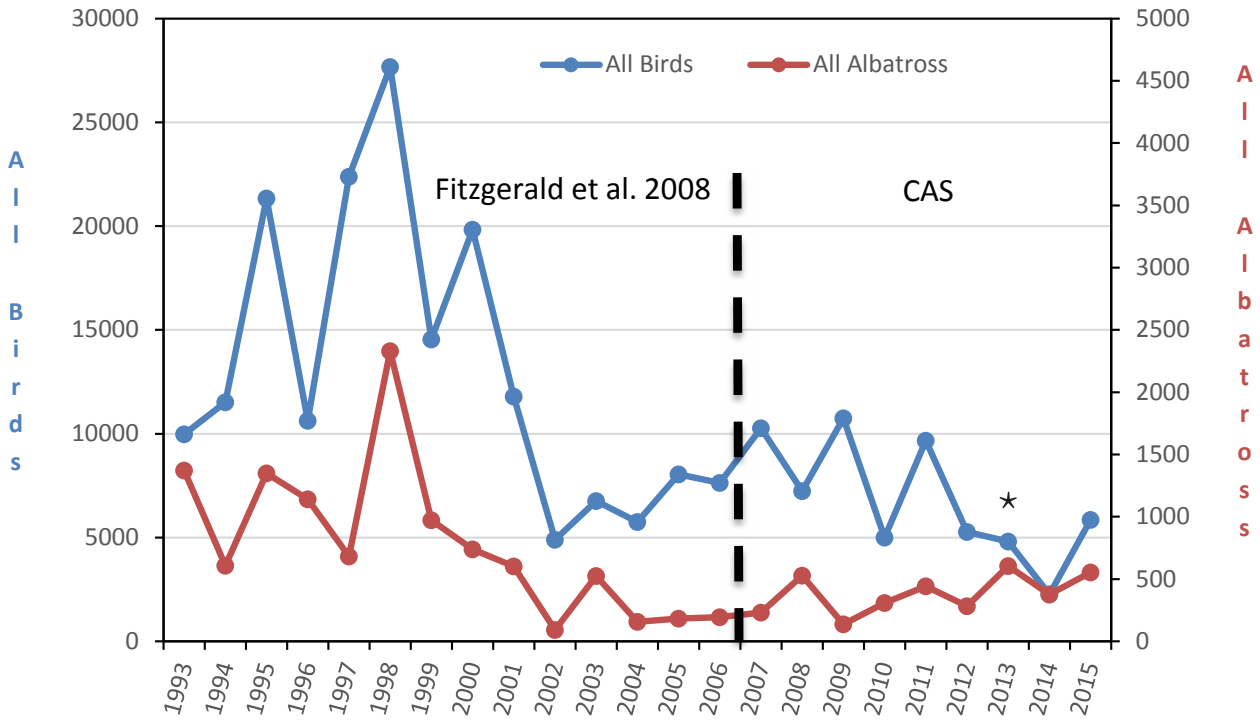


FIGURE 29. Seabird bycatch in Alaska groundfish fisheries (hook-and-line, trawl, and pot) from 1993 through 2015, noting bycatch estimates for all birds (left indices) and for albatross only (right indices). Note the difference in scale. Different data analysis methodologies are separated with a dashed line (data from 1993 through 2006 are described in Fitzgerald et al. 2008; data from 2007 through 2015 are from the CAS). *The Observer Program was restructured in 2013.

Trends in Seabird Bycatch

From 1993 through 2000, the estimated seabird mortality from groundfish fisheries showed an increasing trend (FIGURE 29). Most of this bycatch was attributed to the Pacific cod hook-and-line (sometimes called longline or freezer longline) fleet. Despite early versions of seabird mitigation measures being required in 1997, bycatch remained high and actually peaked at 27,662 birds in 1998. All parties were very concerned and entered into collaborative work to resolve this problem.

During 1999 and 2000, studies led by Washington Sea Grant were conducted with the Pacific cod and sablefish hook-and-line fleets where a variety of mitigation measures were tested under commercial fishery conditions (Melvin et al. 2001). Based on findings from the study, in 2001 the NPFMC recommended and adopted the use of paired streamer lines for vessels over 55 ft LOA using other than snap gear. The sharp decline around 2002 in both the number of all birds and of albatross species taken as bycatch in Alaska groundfish fisheries reflects the voluntary implementation of streamer lines on hook-and-line vessels (FIGURE 29).

Despite regulations requiring the use of streamer lines, estimates of albatross bycatch appear to have increased from 2002 through 2015, although a statistical comparison of these data is not appropriate because different methodologies were used to calculate bycatch rates prior to 2007. We do not know what is causing the recent increase in albatross bycatch. Fluctuating environmental conditions could play a role (Zador 2015). For example, changes in prey availability or seabird reproductive status may influence the amount of time seabirds spend near fishing vessels and thus their exposure to bycatch risk. Regardless of the cause, it is important that fishermen continue to deploy the required seabird mitigation measures for their vessel.

Interactions between Albatross Species and Alaska Fisheries

All three species of albatross occur throughout Alaska fishing grounds in waters beyond 3 nm from shore (Gutowsky et al. 2014, Kuletz et al. 2014, Melvin et al. 2006, Suryan and Fischer 2010). From 2002 through 2004, vessel-based sightings of the endangered short-tailed albatross were extremely rare (0.03% of all sightings) and had a similar distribution to Laysan albatross: rare or absent east and south of the Western GOA and most abundant in the Aleutian Islands (Melvin et al. 2006). Black-footed albatross were observed in all outside waters (Melvin et al. 2006). Albatrosses and other tubenose species (fulmars and shearwaters) were not observed in Prince William Sound, and geographically limited in Southeast Alaska to the entrance of Cross Sound, the mouth of Chatham Strait, and Dixon Entrance (Melvin et al. 2006; FIGURE 26).

Multiple sources of sightings data were compiled to show the distribution of short-tailed albatross in FIGURE 30 (Deguchi et al. 2014, O'Connor 2013, Suryan and Fischer 2010, Suryan et al. 2006b, Suryan et al. 2008). Sources included: 1988 through 2004 records from seabird observers on the USFWS's research vessel R/V *Tiglax*; incidental sightings by biologists, fishermen, seamen, fisheries observers, and birdwatchers provided to the USFWS; the Yamashina Institute for Ornithology; Oregon State University; the IPHC; the Alaska Natural Heritage Program; historical sightings documented in published literature; and from the North Pacific Pelagic Seabird Database. Researchers analyzed numerous sightings, the majority of which were located on the continental shelf edge off Alaska, abundance being diminished along the east GOA coast and south to Southeast Alaska (FIGURE 30).

The short-tailed albatross is consistently associated with upwelling in Aleutian passes and along continental shelf margins throughout the northern GOA and Bering Sea (Piatt et al. 2006; USFWS 2009). These data suggest that the albatrosses appear persistently and predictably in some marine hotspots characterized by vertical mixing and upwelling caused by currents and bathymetric relief and which persist over time (Piatt et al. 2006). The continual upwelling brings food to the surface and, thus, draws seabirds back for repeated foraging, especially albatross species, which forage at the surface due to their limited diving ability (Hyrenbach et al. 2002). In addition to Ingenstrem Rocks and Seguam Pass, important hotspots for short-tailed albatross in the Aleutians included Near Strait, Samalga Pass, and the shelf-edge south of Umnak/Unalaska islands. In the Bering Sea, hotspots were located along margins of Zhemchug, St. Matthews, and Pervenets Canyons (Piatt et al. 2006). For illustrative purposes, these hotspot areas are generally represented by yellow circles on FIGURE 30.

Similar findings in Byrd et al. (2005) confirm the frequent presence of surface-feeding piscivores near the medium and large passes that create the bathymetric conditions for vertical mixing and upwelling. Suryan et al. (2006a) also concluded that short-tailed albatross most often frequent continental shelf break and slope regions, which are used extensively by commercial fishing vessels. Based on fishing effort from May through November of 2002 and 2003, Suryan et al. (2006b) concluded that short-tailed albatross had the greatest potential interaction with sablefish, flounder, and rockfish fisheries based on spatial, depth, and temporal overlap. CAS reported bycatch of Laysan and black-footed albatrosses every year from 2007 through 2015 in the sablefish fishery. However black-footed albatross were only taken in 2012 in the rockfish fishery (no Laysan albatross take), and neither species has been observed taken in the arrowtooth flounder fishery.

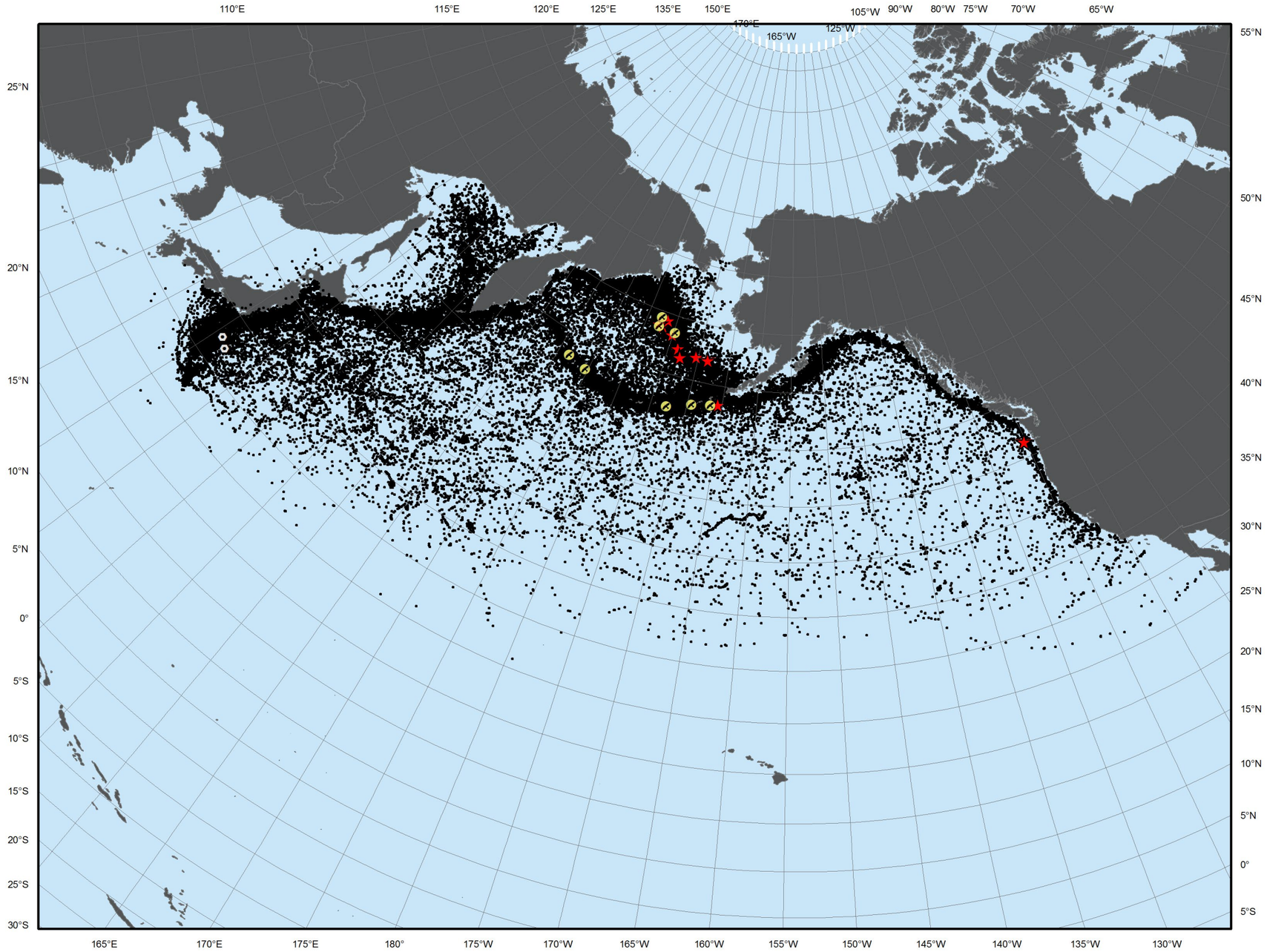


FIGURE 30. Black dots indicate location of short-tailed albatross (from multiple sources of sightings data) on the map; data from 2002, 2003, 2005 through 2006, and 2008 through 2013 (data provided by the Yamashina Institute for Ornithology, Oregon State University, U.S. Fish and Wildlife Service). Short-tailed albatross bycatch locations (TABLE 13, excluding Russian fisheries) are depicted by red stars on the map. Short-tailed albatross hotspot locations (Piatt et al. 2006) are depicted by yellow circles on the map.

Bycatch of Short-tailed Albatross

Recorded takes of the endangered short-tailed albatross are provided in TABLE 13. Short-tailed albatross takes recorded by observers, whether during or outside of their sampling period, are counted towards the incidental take statement for the groundfish hook-and-line and trawl fisheries (USFWS 1998, 2003b, 2015). The incidental take statements in the USFWS biological opinions on the effects of the groundfish fisheries off Alaska (USFWS 1998, 2003b, 2015) use the actual observed takes of short-tailed albatross, not the extrapolated numbers.

The seabird bycatch estimates presented in this report are the CAS-extrapolated observer estimates. For example, two short-tailed albatross were recorded taken in the observer sample in the Pacific cod hook-and-line fishery in 2010. When the CAS expanded these takes to all unsampled hooks in the haul and all unsampled events across fisheries, the estimated take across the Pacific cod hook-and-line fishery was 15 short-tailed albatross (TABLE 6). Of the two short-tailed albatross recorded taken in the Greenland turbot hook-and-line fishery in 2014, only one was in the observer sample. When expanded by the CAS to all unsampled hooks in the haul and all unsampled events across fisheries, the estimated take across the Greenland turbot fishery was six short-tailed albatross (TABLE 9).

Short-tailed Albatross Protection under the ESA

Short-tailed albatross are listed as endangered under the ESA.

The USFWS recently consulted with NOAA Fisheries Alaska Region under section 7 of the ESA on the effects of the groundfish fisheries on the endangered short-tailed albatross. In its 2015 biological opinion, the USFWS determined the groundfish fisheries off Alaska are likely to adversely affect short-tailed albatross, but they are not likely to jeopardize its continued existence (USFWS 2015). This biological opinion included an incidental take limit of six short-tailed albatross every two years in the groundfish fisheries off Alaska, either by hook-and-line gear or trawl gear.

In 1998, the USFWS issued a biological opinion for the Pacific halibut hook-and-line fishery off Alaska, which includes an incidental take limit of two short-tailed albatross in a 2-year period (USFWS 1998). In instances where the amount or extent of incidental take is exceeded, reinitiation of formal ESA consultation is required.

For over 26 years, NOAA Fisheries has formally consulted with the USFWS regarding the short-tailed albatross, and to date none of the incidental take limits have been reached within the specified periods. Reported takes of short-tailed albatross are listed in TABLE 13. Since 1993, NOAA Fisheries and the USFWS have coordinated their response to these takes to comply to the fullest extent with ESA requirements to protect and recover this species.

In 2016, NOAA Fisheries formed the Alaska Groundfish and Halibut Seabird Working Group. This working group will serve as an advisory body to NOAA Fisheries and the USFWS for the purposes of reducing groundfish and halibut fisheries bycatch of short-tailed albatross and other seabirds. This working group will facilitate adaptive management to minimize and avoid take of short-tailed albatross and other seabirds in the Alaska groundfish fisheries, as prescribed by the 2015 USFWS biological opinion (USFWS 2015; Consultation # 07CAAN00-2015-F-014). The working group will review any new information and develop recommendations regarding changes to the Alaska groundfish and halibut fisheries that will reduce risk of harm to short-tailed albatross and other seabirds (FIGURE 31). The working group anticipates the need to seek input from non-members with experience and expertise regarding the reduction of seabird bycatch in the fisheries (e.g., stakeholders, academic researchers, and fishery participants). The working group's recommendations for mitigating short-tailed albatross bycatch, and other seabird bycatch as applicable, will be made available to NOAA Fisheries, the USFWS, and the NPFMC.

FIGURE 31. Short-tailed albatrosses following hook-and-line fishing vessel. Photo credit: Rob Suryan, Oregon State University.

TABLE 13. Reported incidental bycatch of short-tailed albatross. Bycatch locations from this table are depicted by red stars on the map in FIGURE 30.

Date	Fishery	Observer Program	In sample*	Bird age	Location	Source
7/15/1983	Net	No	n/a	4 months	Bering Sea	USFWS (2014)
10/1/1987	Halibut	No	n/a	6 months	GOA	USFWS (2014)
8/28/1995	IFQ sablefish	Yes	No	1 year	Aleutian Islands	USFWS (2014)
10/8/1995	IFQ sablefish	Yes	No	3 years	Bering Sea	USFWS (2014)
9/27/1996	Hook-and-line CP targeting Pacific cod	Yes	Yes	5 years	Bering Sea	USFWS (2014)
4/23/1998	Russian salmon drift net	n/a	n/a	Hatch-year	Bering Sea, Russia	USFWS (2014)
9/21/1998	Hook-and-line CP targeting Pacific cod	Yes	Yes	8 years	Bering Sea	USFWS (2014)
9/28/1998	Hook-and-line CP targeting Pacific cod	Yes	Yes	Sub-adult	Bering Sea	USFWS (2014)
7/11/2002	Russian**	n/a	n/a	3 months	Sea of Okhotsk, Russia	USFWS (2014)
8/29/2003	Russian demersal hook-and-line	n/a	n/a	3 years	Bering Sea, Russia	USFWS (2014)
8/31/2006	Russian**	n/a	n/a	1 year	Kuril Islands, Russia	USFWS (2014)
8/27/2010	Hook-and-line CP targeting Pacific cod	Yes	Yes	7 years	BSAI	USFWS (2014)
9/14/2010	Hook-and-line CP targeting Pacific cod	Yes	Yes	3 years	BSAI	USFWS (2014)
4/11/2011	Sablefish demersal hook-and-line	Yes	Yes	1 year	Pacific Ocean, Oregon	USFWS (2014)
10/25/2011	Hook-and-line CP targeting Pacific cod	Yes	Yes	1 year	Bering Sea	USFWS (2014)
5/24/2013	Hook-and-line, seabird bycatch mitigation research	No	n/a	1 year	Pacific Ocean, Japan	USFWS (2014)
9/7/2014***	Hook-and-line CP targeting Greenland turbot	Yes	No	5 years	Bering Sea	NOAA Fisheries (NMFS 2014b); S. Fitzgerald, personal communication, NOAA Fisheries AFSC, June 2015
9/7/2014***	Hook-and-line CP targeting Greenland turbot	Yes	Yes	Sub-adult	Bering Sea	NOAA Fisheries (NMFS 2014a); S. Fitzgerald, personal communication, NOAA Fisheries AFSC, June 2015
12/16/14***	Hook-and-line CP targeting Pacific cod	Yes	Yes	Immature	Bering Sea	NOAA Fisheries (NMFS 2015b); S. Fitzgerald, personal communication, NOAA Fisheries AFSC, June 2015

* *In sample* refers to whether a specimen was in a sample of catch analyzed by a fisheries observer.
**Specifics regarding the type of fishery are unknown.
***This data was not included in USFWS (2014).

Recommended Additional Mitigation Measures

Experts advise that maintaining aerial extent of streamer lines, achieved by maximizing the height of the attachment point to the vessel and applying sufficient drag using towed objects, is key to their effectiveness.

Large flocks of short-tailed albatross, consisting of as many as 70 birds, were reported near the vessel that took the two short-tailed albatross in September 2014 (see TABLE 13). As part of an information bulletin to the fleet after these takes, NOAA Fisheries encouraged vessel operators to consider not deploying gear amid aggregations of endangered birds and if possible, to move to a location where short-tailed albatross are not observed (NMFS 2015b; FIGURE 32).

Ed Melvin, a seabird mitigation gear researcher and specialist from Washington Sea Grant, advises the distances astern that streamers are in the air — the aerial extent — are key to their effectiveness (E. Melvin, personal communication, Washington Sea Grant, August 2, 2016). Aerial extent requirements are specified in Federal regulations (50 CFR part 679.24(e)(4)). Maximizing the height of the attachment point to the vessel and applying sufficient drag using towed objects maximizes the aerial extent and effectiveness. A 10-lb weight fixed to the nose of a skid buoy has proven consistently effective. Round buoys tend to move erratically when used as drag on a streamer line and should be avoided. Individual streamers should be long enough to extend to the water. Given that all vessels are different, Melvin recommends that each vessel keep extra tubing on board to adjust streamer length as necessary and to make repairs if streamers are damaged. In windy conditions, the streamer line and its towed object should be positioned windward of the groundline to maintain streamers over the sinking groundline. If positioned leeward of the groundline, baited hooks can be unprotected. Each crew should have one person responsible for setting, positioning, hauling, and maintaining streamer lines.

FIGURE 32. Seabirds near a fishing vessel. Photo credit: Observer Program.

What to Do if You Encounter an Endangered Short-tailed Albatross?

If a short-tailed albatross is hooked and there is a fisheries observer on board the vessel, the observer will report the short-tailed albatross take to NOAA Fisheries. The USFWS will be notified of the take within 48 business hours. If there is not a fisheries observer on board the vessel, NOAA Fisheries requests that the albatross be retained and reported immediately to NOAA Fisheries or the USFWS.

As specified at 50 CFR 679.24(e)(2)(vi), regulations require that every reasonable effort be made to ensure that short-tailed albatross brought on board alive are released alive. The 2015 USFWS biological opinion (2015) states that birds should be released on site if they meet certain criteria (TABLE 14).

If you hook a bird while hauling gear and it comes on board alive, make every reasonable effort to ensure that it is released alive. Whenever possible, remove hooks without jeopardizing the life of the bird. Wrap the bird's wings and feet with a clean towel to protect its feathers from oils or damage. Protect yourself from the bird's beak; wear eye protection and heavy gloves.

- If the hook is visible, use pliers or bolt cutters to cut off the hook or flatten the barb. Pull the hook back out of the bird. (FIGURE 33, Image A)

- If the hook is swallowed and removal is not possible, cut the line as close to the point of entry as possible and leave the hook in the bird. (FIGURE 33, Image B)

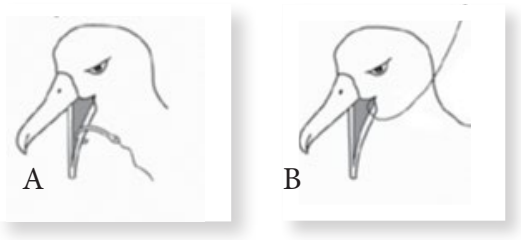


FIGURE 33. Diagrams of hooked birds where A) the hook is visible, or B) the hook is swallowed and removal is not possible. Photo credit: Pacific Islands Regional Office, NOAA Fisheries.

- If an injured or sick short-tailed albatross is encountered, NOAA Fisheries observers or boat captains (if no observer is on board) are responsible for carrying out these instructions.

1. Call Alaska SeaLife Center hotline at 1-888-774-7325 or 907-224-6395.
2. Report to the U.S. Fish and Wildlife Service at 1-800-858-7621 or 907-271-3063.
3. Retain live birds in a safe location.
4. Surrender it as soon as possible (alive or dead) as directed by the USFWS.

If a dead short-tailed albatross is encountered, NOAA Fisheries observers or boat captains (if no observer is on board) are responsible for carrying out these instructions.

5. Call NOAA Fisheries at 1-800-853-1964 or 907-586-7228, or
6. Call the U.S. Fish and Wildlife Service at 1-800-858-7621 or 907-271-3063.
7. Immediately freeze any dead short-tailed albatross. If freezing is not available, keep it as cold as possible.
8. Label it with vessel name, latitude and longitude where hooked, and the numbers and colors of any leg bands. Leg bands must be left attached.

FIGURE 34. Short-tailed albatross. Photo credit: Rob Suryan, Oregon State University.

TABLE 14. A short-tailed albatross that has been hooked may be released if the bird meets ALL of the following criteria:

Looks normal (FIGURE 34)
Capable of holding its head erect
Responds to noise and motion stimuli
Breathes without noise
Can flap both wings, and it can retract the wings to a normal folded position on the back
Capable of elevating itself to stand on both feet, with its toes pointed in the proper forward position
Bird is dry

Seabird Bycatch Outreach to Alaska Hook-and-Line Fisheries

As mentioned above, Washington Sea Grant led field studies supported by NOAA, USFWS, University of Washington, and fishing industry associations, to develop bycatch mitigation measures which were approved by the NPFMC in 2001, adopted by a large sector of the fishery in 2002, and implemented in 2004. Initial studies by Ed Melvin (Washington Sea Grant) and others demonstrated that the use of paired streamer lines in the Alaska groundfish fishery reduced seabird bycatch by over 90% in some circumstances (Melvin et al. 2001). Prior to the implementation of seabird bycatch deterrents in Alaska hook-and-line fisheries, seabird bycatch ranged from 10,000 to 28,000 birds per year. After fleet-wide use of deterrents in 2002, bycatch was reduced by 80% to 5,000 birds per year.

However, over the next decade, seabird bycatch (including albatrosses) in Alaska hook-and-line fisheries showed some increase, but also considerable variability, indicating the need to review existing data to identify potential causes and the need for re-engagement with the fleet to promote seabird safe fishing practices. Furthermore, recent changes to the Observer Program provided data from the previously unobserved halibut fishery and vessels less than 60 ft LOA, and highlighted the need for seabird bycatch reduction outreach to this fleet.

Oregon State University in partnership with Washington Sea Grant, NOAA Fisheries, and the IPHC will analyze the complete 20-year time series of Observer Program data to identify key sectors needed for outreach, conduct targeted port visits to engage the fleet, and provide seabird bycatch reduction training sessions (project funding from the National Fish and Wildlife Foundation and the David and Lucile Packard Foundation). The goals of this effort will be to reduce and maintain albatross and all seabird bycatch at or below the lowest levels observed. Workshops and meetings have occurred in the Alaska ports of Kodiak, Homer, and Seward in April 2015; at IPHC annual meetings and Pacific Marine EXPO in 2015 and 2016; and at Fishermen's Association meetings in Kodiak and Sitka in 2016 (FIGURE 35, FIGURE 36). For more information on meetings see http://seabirdbycatch.washington.edu/.

As discussed previously, the NOAA Fisheries Alaska Groundfish and Halibut Seabird Working Group will serve as an advisory body to NOAA Fisheries and the USFWS for the purposes of reducing groundfish and halibut fisheries bycatch of short-tailed albatross and other seabirds. The working group will review any new information and develop recommendations regarding changes to the Alaska groundfish and halibut fisheries that will reduce risk of harm to short-tailed albatross and other seabirds. The working group's recommendations for mitigating short-tailed albatross bycatch, and other seabird bycatch as applicable, will be made available to NOAA Fisheries, USFWS, and the NPFMC.

FIGURE 35. Outreach meeting led by Oregon State University and Washington Sea Grant. Photo credit: Rob Suryan, Oregon State University.

FIGURE 36. Outreach on the docks led by Oregon State University and Washington Sea Grant. Photo credit: Rob Suryan, Oregon State University.

Next Steps

Implementation of mitigation measures in 2002 in groundfish fisheries correlated with a substantial decrease in numbers of seabird bycatch. Since that time, estimates of seabird bycatch have remained low. These mitigation measures have been reviewed and updated in recent years to more closely align what is known about seabird distribution, fishing effort, and previously observed bycatch. The Observer Program and CAS regularly provide estimates of seabird bycatch for monitoring and analysis. NOAA Fisheries and USFWS continue to monitor the endangered short-tailed albatross taken as bycatch and the impact that has on the short-tailed albatross population.

NOAA Fisheries Alaska Region will continue to monitor seabird bycatch and provide an annual seabird bycatch report. Seabirds are also discussed in the Ecosystem Considerations Report within the annual Stock Assessment and Fishery Evaluation reports (http://www.afsc.noaa.gov/REFM/stocks/assessments.htm). Nationally, seabird bycatch numbers are reported in the NOAA Fisheries National Bycatch Report (NMFS 2011).

Additional Resources

More information on seabirds in the EEZ off Alaska may be found at:

NOAA Fisheries Alaska Regional Office
- https://alaskafisheries.noaa.gov/pr/seabird-bycatch

NOAA Fisheries Alaska Fisheries Science Center
- http://www.afsc.noaa.gov/refm/reem/Seabirds/Default.php

NOAA Fisheries National Seabird Program
- http://www.st.nmfs.noaa.gov/marine-mammals-turtles/other-protected-species/national-seabird-program

Washington Sea Grant
- http://seabirdbycatch.washington.edu/

Alaska SeaLife Center
- http://www.alaskasealife.org/

Seabirds in Alaska (U.S. Fish and Wildlife Service)
- http://alaska.fws.gov/mbsp/mbm/seabirds/species.htm

U.S. Fish and Wildlife Service Birds of Conservation Concern, 2008
- https://www.fws.gov/migratorybirds/pdf/grants/BirdsofConservationConcern2008.pdf

Black-footed albatross. Photo credit: Rob Suryan, Oregon State University.

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