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Seabird Interactions and Mitigation Efforts in Hawaii Pelagic Longline Fisheries 2022 Annual Report

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Please note: Data in this report are considered to be preliminary, and may be revised as better information becomes available. For the most current data, please contact the NMFS Pacific Islands Regional Office.

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1. INTRODUCTION

This annual report is required in the Terms and Conditions of the 2012 Biological Opinion of the U.S. Fish and Wildlife Service for the operation of Hawaii-based Pelagic Longline Fisheries (USFWS 2012).

The National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO) is responsible for minimizing, as practicable, interactions between Hawaii pelagic longline fishing operations and seabirds. NMFS monitors the fisheries to determine the effectiveness of management measures implemented to minimize interactions and the severity of interactions. NMFS documents interactions and mitigation efforts aboard vessels at sea and reports annually on fishing effort, seabird interactions, and mitigation research. View this report and similar reports from previous years online at <https://www.fisheries.noaa.gov/pacific-islands/bycatch/seabird-interactions-pelagic-longline-fishery>.

1.1 Background

NMFS and the Western Pacific Fishery Management Council (WPFMC) manage two Hawaii pelagic longline fisheries under the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific (FEP) and implementing regulations. The deep-set longline fishery targets primarily bigeye tuna at depths to 400 meters (m) and operates mainly north-northeast and southwest of the main Hawaiian Islands. The shallow-set longline fishery targets swordfish at depths to 100 m and typically operates north and east of the Hawaiian Islands. In 2022, Hawaii longline vessels ranged between 49 and 98 feet in length. The FEP contains a detailed description of the two fisheries (WPFMC 2009, as amended).

Since 1994, the Hawaii longline fleet has been limited to 164 permits, which allow fishing in both the shallow- and deep-set fisheries. Beginning in 2004, vessels were required to declare if they would be shallow or deep fishing prior to departing on a fishing trip. Activity levels in any given year since 2004 range from 11 to 35 vessels in the shallow-set fishery, and 111 to 150 vessels in the deep-set fishery. Nearly all vessels in the shallow-set fishery also participate, to some degree, in the deep-set fishery during the year. In 2022, based on preliminary data received as of February 2023, 147 vessels made 21,299 deep-sets in 1,531 trips and set 63,319,077 hooks, and 22 vessels made 856 shallow-sets in 68 trips and set 1,075,993 hooks (NMFS 2023a).

Laysan albatross, black-footed albatross, shearwaters, fulmars, boobies, and the endangered short-tailed albatross feed around the Hawaiian Islands in areas where the longline fisheries operate. During the deployment (setting) and retrieval (hauling) of longline fishing gear, hooks and line may occasionally hook or entangle seabirds that attempt to take bait or catch. Seabirds are more likely to drown when the interaction occurs during setting because the weight of the gear may pull the seabird underwater. Although some interactions are inevitable, fishermen take steps to avoid and minimize interactions.

In this report, the statistics on seabird interactions are based on observations from observers—NMFS fisheries monitors onboard fishing vessels. In 2000, NMFS estimated 2,433 seabird interactions in the Hawaii longline fisheries. Beginning in 2001, NMFS implemented a series of seabird mitigation measures, including seabird-deterrent fishing gear and techniques that have reduced interactions. In 2022, there were 110 observed interactions in the shallow-set fishery, which has 100% observer coverage, and an estimated 641 interactions in the deep-set fishery, which has approximately 20% observer coverage (McCracken and Cooper 2023).

Data summaries throughout this report and elsewhere may vary slightly depending upon the data source, including revisions. For example, observers may report seabird interactions by date of trip (departure or arrival),

set date, or haul date in a given year. NMFS typically bases observer coverage levels on the trip departure date. In 2021, the NMFS Sustainable Fisheries Observer Program began accounting for protected species interactions in their [quarterly, semiannual, and annual reports](#) based on the date that the haul on which the interaction occurred began. In previous years, interactions were based on the vessel arrival date. NMFS also provides summary reports from mandatory logbook data reported by captains.

1.2 Seabird Mitigation Measures for the Hawaii Longline Fisheries

Most of the regulations for Hawaii longline fisheries are in Title 50, Code of Federal Regulations, [Parts 600 and 665](#) (50 CFR 600 and 665). Regulations specific to the mitigation of seabird interactions and safe handling techniques are at [50 CFR 665.815](#). NMFS also provides a [regulation summary](#), a [compliance guide for reducing seabird interactions](#), and [seabird handling guidelines](#) to Hawaii longline fishermen and the general public.

The ways that fishermen implement required seabird mitigation measures depend on how and where fishermen fish. Mitigation measures to reduce seabird interactions differ between the two options of stern-setting and side-setting. The following sections describe each of the main gear and operation requirements. The 2012 Biological Opinion (USFWS 2012) also describes these measures.

Stern-Setting versus Side-Setting

Stern-setting is the most common method of deploying longline fishing gear. Crewmen employ a line shooter to set baited hooks from the back of the vessel. Crews that set gear using this method must bait hooks with thawed, blue-dyed bait; attach a weight of at least 45 g within 1 m of the hook on each branch line; strategically discharge fish, fish parts, or spent bait (together known as “offal”); and remove all hooks from offal discharge as seabird mitigation measures.

In side-setting, the crew sets baited hooks forward and close to the side of the vessel’s hull where seabirds are unable or unwilling to pursue the hooks. With required branch line weighting, the baited hooks will have sunk to a depth where seabirds cannot reach them by the time the vessel stern passes the location where baited hooks have been set (Gilman and Brothers 2006; Gilman et al. 2005, 2007a, 2007b). Additionally, deploying a required bird curtain aft of where crew is deploying the gear inhibits seabirds from landing on the water along the side of the vessel where baits are accessible.

Table 1 summarizes the number of Hawaii deep- and shallow-set vessels observed to set from the stern and from the side in 2022, with some vessels operating in both deep- and shallow-set longline fisheries. In 2022, most vessels in the deep-set fishery and all vessels in the shallow-set fishery chose to stern-set.

Table 1: Number of observed Hawaii longline vessels that side- and stern-set in 2022.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 07/05/2023

Fishery	Deck setting position	Vessels
Deep-set	Stern-setting	111
Deep-set	Side-setting	29
Shallow-set	Stern-setting	21
Shallow-set	Side-setting	0

Weighted Branch Lines

Fishermen place weights close to the hook on branch lines so baited hooks sink quickly and help prevent foraging seabirds from becoming hooked or entangled in longline gear. When deep-setting north of 23° N (either stern- or side-setting), or while shallow- side-setting anywhere, Hawaii fishermen must attach a weight of at least 45 g within 1 m of the hook to sink the branch line quickly. Fishermen commonly use weights from 45–80 g.

Thawed and Blue-dyed Bait

Dyeing bait to a specific blue color decreases visibility of the bait by reducing its contrast with the sea surface. Fishermen thaw the bait to increase sink rates and to allow a more effective penetration of the blue dye. Almost all bait used in the Hawaii longline fisheries consists of the fishes mackerel (saba), sardines, saury (sanma), and beginning in 2022, herring and milkfish. NMFS prohibits the use of squid bait in the shallow-set fishery to reduce sea turtle interactions. While fishermen may still use squid in the deep-set fishery, the squid bait costs more than some fish bait and is, thus, less preferred.

Strategic Offal Discharge

Fishermen developed the technique of strategically discharging offal on the opposite side of the vessel during fishing operations to distract seabirds from attempting to steal baits. NMFS observers in the mid-1990s noted that this technique reduced incidental hooking or entanglement of albatrosses, though recent research results indicate offal discharge can have the unintended effect of attracting more seabirds (Gilman et al. 2021). Strategic offal discharge is currently required when stern- and deep-setting north of 23° N, or stern- and shallow-setting anywhere.

Night-Setting

Night-setting as a seabird mitigation measure in the shallow-set fishery is based on the premise that seabirds cannot see baited hooks in the dark and, thus, are not attracted to them. The measure requires shallow-set fishermen, when stern-setting, to start deploying gear no earlier than one hour after local sunset and complete the set no later than the following sunrise. The measure also requires using the minimum lighting necessary to conform to navigation rules and best safety practices. Night-setting has been a very effective seabird mitigation measure, reducing seabird interactions by as much as 98% (McNamara et al. 1999, Boggs 2003).

Table 2 summarizes the seabird mitigation requirements.

Table 2: Seabird mitigation requirements for the Hawaii longline fleet.

What you need to do	Stern-setting		Side-setting	
	Shallow-set Anywhere	Deep-set North of 23° N	Shallow-set Anywhere	Deep-set North of 23° N
Deploy mainline from port or starboard side at least 1 m forward of stern corner	-	-	Yes	Yes
If line shooter is used, mount it at least 1 m forward from stern corner	-	-	Yes	Yes
Use a specified bird curtain aft of the setting station during set	-	-	Yes	Yes
Deploy gear so that hooks do not resurface	-	-	Yes	Yes

What you need to do	Stern-setting		Side-setting	
	Shallow-set Anywhere	Deep-set North of 23° N	Shallow-set Anywhere	Deep-set North of 23° N
Attach 45 g or heavier weights within 1 m of hook of each hook	-	Yes	Yes	Yes
Use a line shooter to set the mainline	-	Yes	-	-
Keep two 1-pound containers of blue-dye bait on boat	Yes	Yes	-	-
Use completely thawed and blue-dyed bait	Yes	Yes	-	-
Keep fish parts and spent bait with all hooks removed for strategic offal discard	Yes	Yes	-	-
Cut all swordfish heads in half, and use heads and livers for strategic offal discard	Yes	Yes	-	-
Night set – Begin set 1 hour after local sunset and finish 1 hour before next sunrise and keep lighting to a minimum	Yes	-	-	-

1.3 Protected Species Workshops

In addition to gear and operational mitigation measures to deter or reduce seabird interactions, owners and operators of pelagic longline vessels must complete a protected species workshop each year (50 CFR 665.814). The workshop includes training in identification, safe handling, and release techniques for sea turtles, marine mammals, and seabirds. The workshop also reviews regulatory and compliance requirements. A valid workshop certificate is necessary to obtain or renew Federal longline fishing permits, and operators must keep a copy of the certificate on board the vessel while fishing. In 2022, NMFS PIRO provided protected species workshop training for 218 Hawaii-based and 52 American Samoa-based longline vessel owners, operators and crew, and other interested individuals.

2. INTERACTIONS

2.1 Species

NMFS observers have recorded the following bird species being hooked or entangled in the longline fisheries since 1994, when NMFS began deploying observers: Laysan albatross (*Phoebastria immutabilis*), black-footed albatross (*P. nigripes*), sooty shearwater (*Puffinus griseus*), unidentified shearwaters, brown booby (*Sula leucogaster*), red-footed booby (*S. sula*), Northern fulmar (*Fulmarus glacialis*), glaucous winged gull (*Larus glaucescens*), and an unidentified gull. None of these species is listed under the Endangered Species Act (ESA). Both Hawaii longline fisheries have low levels of interactions with these species. Based on the population estimates, the fisheries likely have little-to-no effect on these populations.

Some seabirds, especially shearwaters, are difficult to identify. Table 3 provides a summary of seabird specimens that NMFS observers collected for identification and biological study after capture in the Hawaii longline fisheries in 2022. Under normal circumstances, NMFS observers retain as specimens the first dead Laysan and black-footed albatrosses recovered from each trip, any banded Laysan and black-footed albatrosses, and all

other non-Laysan and black-footed albatross species recovered dead from fishing operations. Seabird specimens are frozen and shipped to the Marine Wildlife Veterinary Care and Research Center in Santa Cruz, California. Since 2007, staff with the organization Oikonos have been collecting morphometric data on shipped specimens. However, in April 2020, NMFS suspended collection of seabird specimens because of pandemic related shipping disruptions and infrastructure modifications. While only a few seabird specimens were collected in 2021 and 2022, consistent collection resumed on October 31, 2022.

Table 3: Summary of collected seabirds from the Hawaii longline fisheries, 2022.

Note: Not all dead seabirds are collected as specimens.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 07/05/2023.

Species	Number retained
Black-footed albatross	5
Laysan albatross	3
Brown booby	0

2.2 Location and Date of Interactions

The spatial distribution of observed seabird interactions in 2022 in the deep- and shallow-set fisheries are shown in Figures 1 and 2, respectively. Most of the interactions occur north of 20° N, where seabirds are typically more abundant and fishing effort is more concentrated. Figures 3 and 4 show the quarter of the year during which observed seabird interactions occurred in 2022 and cumulatively since 2004 in the deep- and shallow-set fisheries, respectively. Most of the interactions occurred in the first and second quarters (January through June) in 2022 and since 2004, with few interactions occurring in the third quarter.

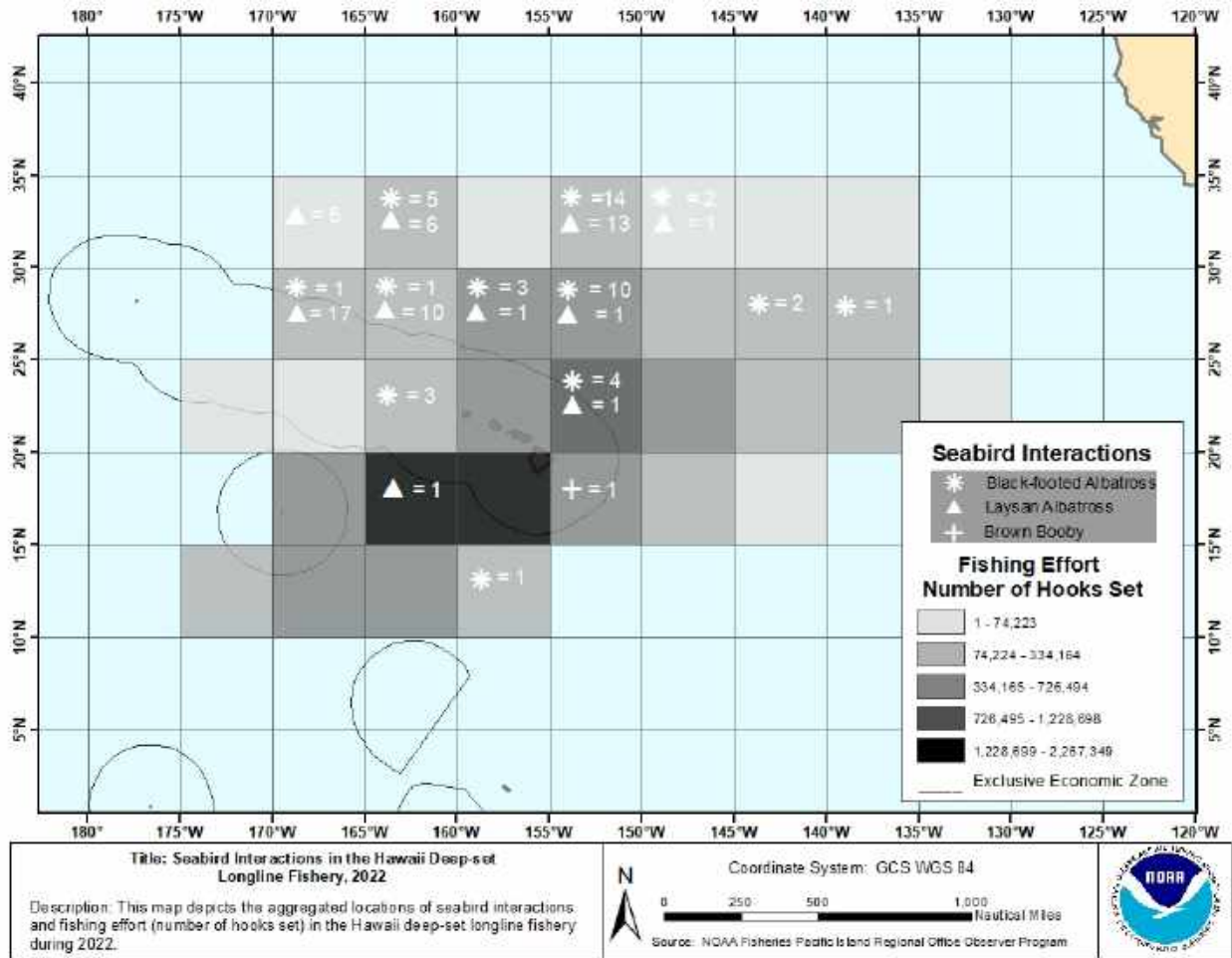


Figure 1: Locations of seabird interactions observed in Hawaii deep-set longline fishery, 2022.

Note: NMFS deployed observers on 20.22% of deep-set trips in 2022.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 07/10/2023.

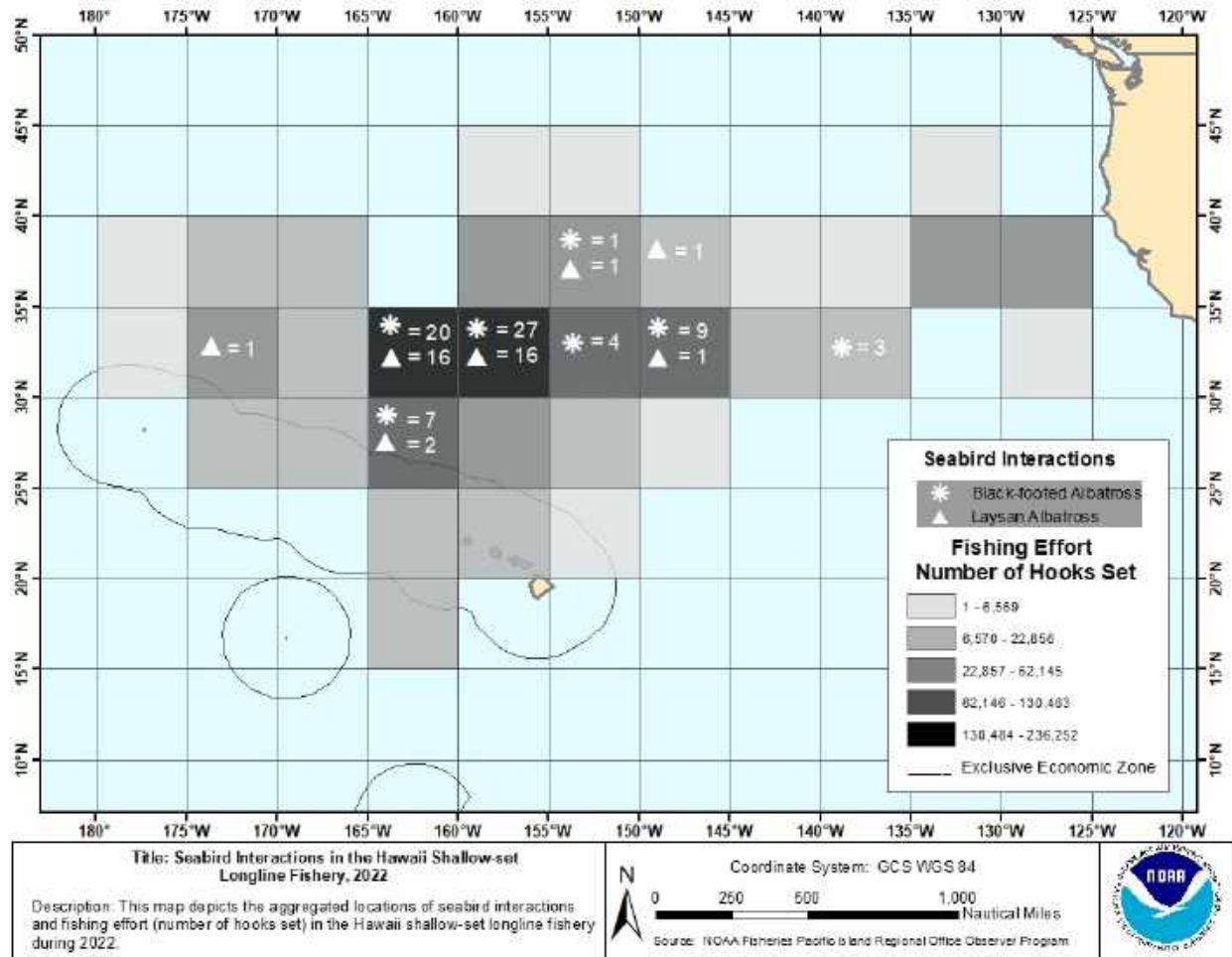


Figure 2: Locations of seabird interactions observed in Hawaii shallow-set longline fishery, 2022.

Note: NMFS deployed observers on every shallow-set trip in 2022.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 07/07/2023.

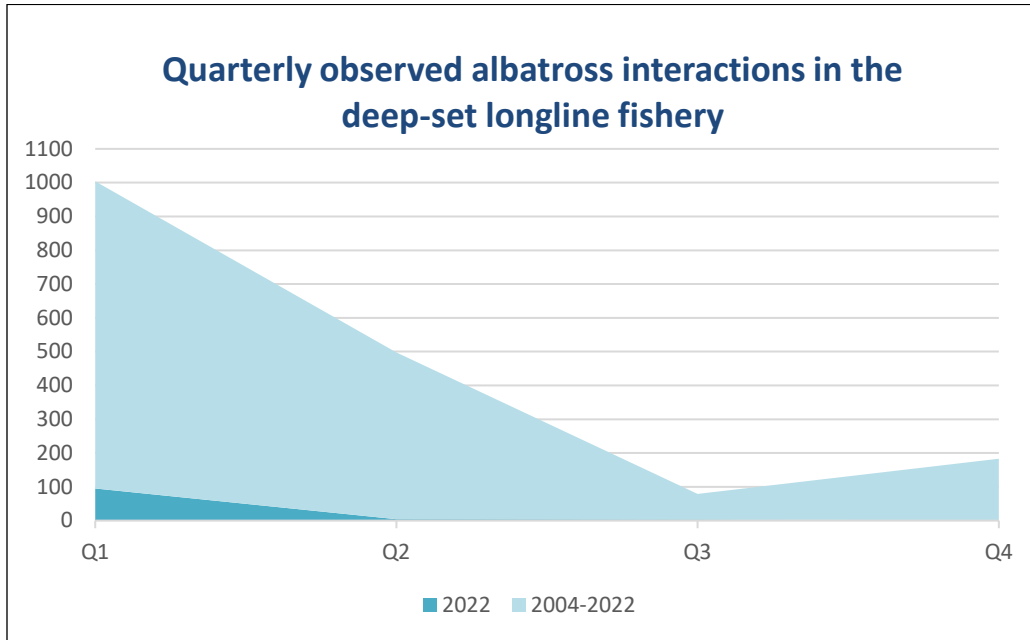


Figure 3: Number of observed seabird interactions in the deep-set longline fishery, 2004–2022 and 2022, in each date by quarter (Q).

Note: Q1 = January 1st–March 31st, Q2 = April 1st–June 30th, Q3 = July 1st–September 30th, and Q4 = October 1–December 31st.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 09/26/2023.

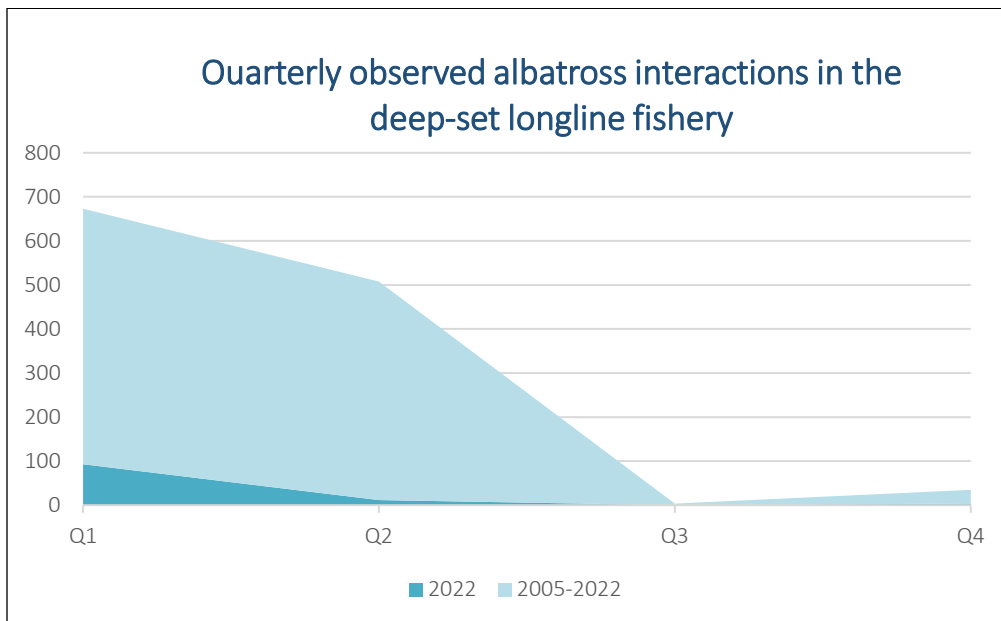


Figure 4: Number of observed seabird interactions in the shallow-set longline fishery, 2004–2022 and 2022, in each date by quarter (Q).

Note: Q1 = January 1st–March 31st, Q2 = April 1st–June 30th, Q3 = July 1st–September 30th, and Q4 = October 1–December 31st.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 09/26/2023.

2.3 Number of Interactions and Effort

Seabirds can be hooked, entangled, or both, but are most commonly hooked only. Regulations require fishermen to remove as much gear as is safely possible from any captured seabirds before releasing them. Albatross interactions are relatively rare events in the Hawaii longline fisheries. In 2022, there were no albatross interactions on 94% of observed deep-set trips and 69% of observed shallow-set trips. Table 4 summarizes the number of observed seabird interactions, the condition of the seabirds upon release, and fishing effort in both fisheries from 2004–2022.

During that period, NMFS deployed observers on 100% of shallow-set fishing trips; therefore, the number of interactions shown in Table 4 represents the fishery-wide totals. NMFS deployed observers on about 20% of deep-set trips in 2022, so we expanded the observed interactions using the observer coverage rate to estimate total interactions (Table 5). Figure 5 shows the seabird interaction rate from 2004–2022 based on the data from Table 4.

Table 4: Numbers of observed seabird catch levels, fishing effort, and interaction rates in the combined Hawaii longline fisheries, 2004–2022.

Source: Sustainable Fisheries Observer Program data (unpublished, 07/05/2023) and from the Sustainable Fisheries Observer Program annual reports (NMFS 2023b and NMFS 2023c).

Note: Observed seabird catch and effort are based on the date and time of the beginning of the haul. Interaction rates are calculated and rounded to the nearest thousandths (third decimal) place.

Deep-set Fishery

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species	Total birds observed caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2004	2	5	-	2	9	-	9	4,013,212	0.002
2005	6	11	-	1 ¹	18	-	18	9,328,681	0.002
2006	1	17	5	-	23	-	23	7,434,798	0.003
2007	7	18	-	-	25	-	25	7,728,502	0.003
2008	14	30	14	2 ²	60	4	56	8,747,946	0.007
2009	18	23	4	-	45	-	45	7,872,668	0.006
2010	39	17	1	-	57	1	56	8,161,800	0.007
2011	32	13	3	-	48	2	46	8,328,872	0.006
2012	31	36	6	-	73	5	68	8,845,848	0.008
2013	48	49	8	-	105	5	100	9,296,069	0.011
2014	12	38	1	-	51	6	45	9,556,918	0.005

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species	Total birds observed caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2015	25	101	4	2 ⁴	132	19	113	9,309,682	0.014
2016	33	104	4	3 ⁵	144	7	137	9,901,279	0.015
2017	38	103	-	1 ⁶	142	13	129	10,190,504	0.014
2018	35	190	9	2 ⁸	236	28	208	11,907,869	0.020
2019	43	145	-	1 ⁹	189	8	181	12,739,655	0.015
2020	59	95	1	1 ¹⁰	156	13	143	8,849,665	0.018
2021	38	87	-	2 ¹²	127	10	117	11,460,814	0.011
2022	56	47	-	1 ¹⁴	104	2 ¹⁵	102	12,417,687	0.008

Shallow-set Fishery

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species	Total birds caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2004	1	-	-	-	1	1	-	115,718	0.009
2005	62	7	-	-	69	47	22	1,358,247	0.051
2006	8	3	-	-	11	5	6	676,716	0.016
2007	40	8	-	-	48	40	8	1,353,761	0.035
2008	33	6	-	-	39	24	15	1,460,042	0.027
2009	81	30	1	-	112	88	24	1,694,550	0.066
2010	40	38	-	1 ³	79	61	18	1,835,182	0.043
2011	49	19	-	-	68	53	15	1,505,467	0.045
2012	62	37	-	-	99	78	21	1,476,969	0.067
2013	45	28	2	-	75	48	27	1,074,909	0.070

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species	Total birds caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2014	39	32	1	-	72	56	16	1,470,683	0.049
2015	43	38	-	-	81	65	16	1,274,805	0.064
2016	25	40	-	-	65	50	15	796,165	0.082
2017	6	53	-	1 ⁷	60	38	22	1,083,216	0.055
2018	2	7	-	-	9	7	2	486,013	0.019
2019	15	19	-	-	34	26	8	374,487	0.091
2020	26	5	-	1 ¹¹	32	32	-	624,579	0.051
2021	10	45	1	1 ¹³	57	45	12	1,026,373	0.056
2022	38	71	-	-	109	84 ¹⁵	25	1,242,997	0.088

Footnote: ¹brown booby; ²red-footed booby and unidentified seabird; ³northern fulmar; ⁴red-footed booby and unidentified shearwater; ⁵two red-footed boobies and one unidentified albatross; ⁶unidentified gull; ⁷glaucous-winged gull; ⁸one brown booby and one red-footed booby; ⁹brown booby; ¹⁰brown booby; ¹¹northern fulmar; ¹²unidentified shearwater; ¹³unidentified shearwater; ¹⁴brown booby; ¹⁵None of the seabirds released alive in 2022 had any gear attached

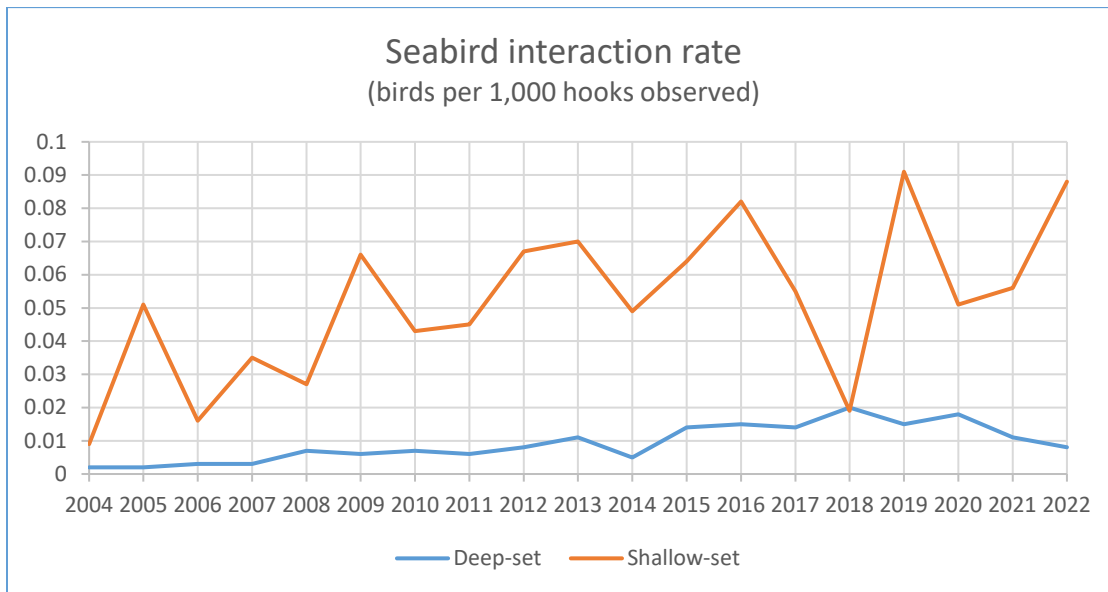


Figure 5: Seabird interaction rates in the deep-set and shallow-set longline.

Almost all interactions in the deep-set fishery occur when fishermen set gear during the day while seabirds are actively feeding. Because most seabirds are inactive at night, very few interactions occur when fishermen typically haul deep-set gear. In 2022, in the deep-set fishery, observers documented interactions with 56 Laysan albatrosses, 47 black-footed albatrosses, and 1 brown booby (Table 4). Nearly all of the seabirds observed to interact with the deep-set fishery were dead at the vessel (98%). Of those that were released alive, none had any gear left attached. Table 5 contains the total estimated number of interactions with Laysan albatrosses, black-footed albatrosses, and shearwaters based on observer records for the deep-set fishery in 2022.

Table 5: Estimated total seabird interactions in the Hawaii deep-set longline fishery, 2022.

Note: Table lists point estimates and standard error of the total number of incidental interactions by species in the Hawaii deep-set longline fishery based on observed interactions during 2022. Point estimates are based on the trip arrival date rather than haul date. Source: McCracken and Cooper 2023.

Species	Total annual estimate	Standard error
Black-footed albatross	269	109.5
Laysan albatross	366	235.3
Brown booby	6	5.4

The shallow-set fishery typically sets at night and hauls the gear during the day; therefore, most of the interactions occur when fishermen retrieve the gear and birds are actively feeding. In 2022, the shallow-set fishery interacted with 38 Laysan albatrosses and 71 black-footed albatrosses (Table 4). Nearly all of the seabirds observed to interact with the shallow-set fishery were alive at the vessel (77%). None of the seabirds released alive had any gear attached. These numbers reflect the total catch due to there being 100% observer coverage for this fishery.

When albatross interactions do occur, it is common for more than one albatross interaction to occur per trip, resulting in a large percentage of the annual albatross interactions occurring on a small number of trips. In 2022, 103 albatross in the deep-set fishery were caught over 19 individual trips, and 79 of those albatross (77%) were caught on just 3 individual trips. In the shallow-set fishery, 109 albatross were caught over 23 individual trips, and 71 of those albatross (65%) were caught on just 5 individual trips.

Table 6: Number of observed deep-set and shallow-set longline trips by the number of albatross interactions per trip, 2022. The total number of observed trips in this period was 302 for deep-set and 75 for shallow-set.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 07/05/2023.

Deep-set longline			Shallow-set longline		
Number of albatross per trip	Number of trips ¹	% of total albatross caught	Number of albatross per trip	Number of trips ¹	% of total albatross caught
0	283	0	0	52	0
1	7	6.8	1	7	6.4
2	7	13.6	2	5	9.2
3	1	2.9	3	4	11.0
4	0	0	4	1	3.7
5	0	0	5	1	4.6
>5	3	76.7	>5	5	65.1

Footnote: ¹based on begin haul date

3. ESA-LISTED SEABIRDS

There have been no observed interactions (hooking or entanglement) between the fisheries and any ESA-listed seabirds. The distributions of three seabird species that are protected under the ESA—the endangered short-tailed albatross, the Hawaiian dark-rumped petrel (*Pterodroma sandwichensis*), and the threatened Newell’s shearwater (*Puffinus newelli*)—overlap with the areas where the Hawaii longline fisheries operate. There was one sighting of a short-tailed albatross from a shallow-set vessel in 2022, but no interaction with fishing gear occurred. Figure 6 shows the location of the sighting compared to the observed fishing effort.

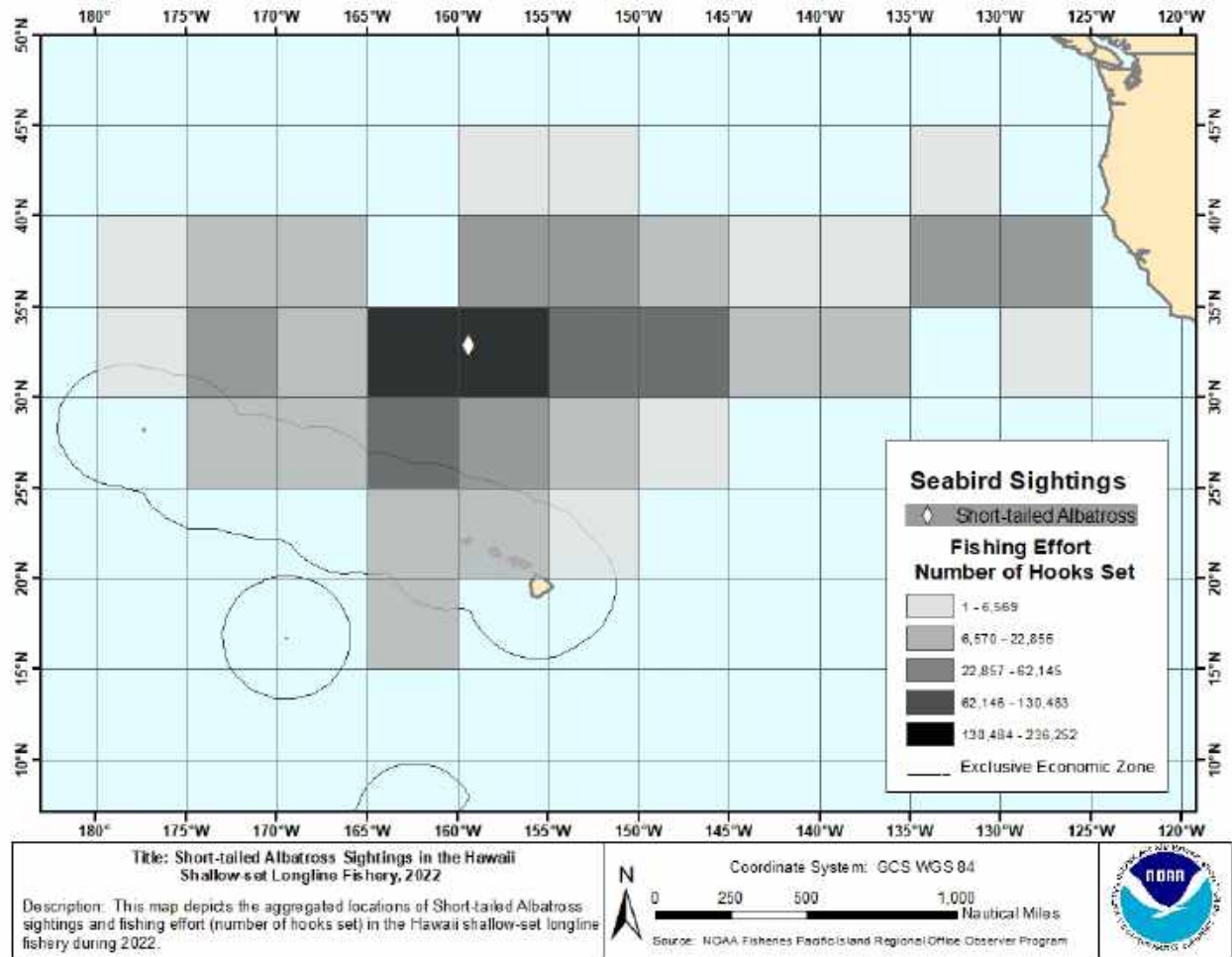


Figure 6: Short-tailed albatross sightings and fishing effort in the Hawaii shallow-set fisheries, 2022.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 07/06/2023.

4. RESEARCH AND COUNCIL ACTIONS

Since NMFS introduced seabird regulations to the Hawaii longline fishery in 2001, the overall seabird catch rate has declined; however, catch rates have been increasing since then (Figure 5). The WPFMC held workshops in 2017 and 2018 to explore the causes of higher black-footed albatross interactions as well as review seabird mitigation requirements and the best scientific information available for the Hawaii longline fishery. The workshops identified certain mitigation measures, including tori lines (bird-scaring streamers), as a high priority for further research and development due to their potential to provide an effective alternative to blue-dyed bait.

Deep-set longline

In spring 2019, the WPFMC, the Hawaii Longline Association, NMFS Pacific Islands Fisheries Science Center (PIFSC), and PIRO initiated a joint cooperative research project to design and test tori lines in the deep-set longline fishery. The statistically significant results from a 2020 study indicated that tori lines, when used in conjunction with blue-dyed bait and strategic offal discard practices, significantly reduce albatross feeding attempts and contact with longline gear. Project results also indicated that discharging offal and spent bait during setting might exacerbate rather than mitigate seabird catch risk (Gilman et al. 2021).

Additional research to test the effectiveness of tori lines without blue-dyed bait and offal discharge was conducted under a NMFS experimental fishing permit (EFP) pursuant to regulations at 50 CFR 556.17 from February to June 2021 (WPFMC 2021). The results showed that albatross attempts are 1.5 times less likely, contacts are 4 times less likely, and captures are 14 times less likely on tori line sets compared with blue-dyed bait sets (Chaloupka et al. 2021).

At its 189th meeting on December 7–9, 2021, the Council took final action and recommended regulatory amendments to improve the overall operational practicality and mitigation efficacy of required measures for the Hawaii deep-set longline fishery. Specifically, the Council recommended replacing blue-dyed thawed bait and strategic offal discharge measures required for stern-setting deep-set longline vessels with a new tori line requirement. In lieu of a regulatory requirement for a strategic offal discharge measure, the Council recommended implementing best practices training on offal management as part of the annual protected species workshop. The Council additionally recommended tori line regulatory specifications to ensure the tori lines will produce similar results to the lines tested in the two studies. The regulatory package is currently under development. The rule is expected to be effective by Jan 2024.

Shallow-set longline

At its 185th meeting in March 2021, the Council considered options for modifying seabird mitigation measures for the shallow-set longline fishery. Because conditions and interactions with seabirds differ between the shallow-set and deep-set longline fisheries, the Council recommended additional research under an EFP for the development of an appropriate combination of mitigation measures for the shallow-set longline fishery.

NMFS received an EFP application from the Hawaii Longline Association in November 2021 to conduct a pilot study in the shallow-set longline fishery in which the setting of two tori lines with gear will start at dusk (86 FR 71234). The Council recommended the issuance of the EFP at its 189th meeting in December 2021. NMFS issued the EFP on March 24, 2022 (87 FR 15383).

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Please note: Data in this report are considered to be preliminary, and may be revised as better information becomes available. For the most current data, please contact the NMFS Pacific Islands Regional Office.

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1. INTRODUCTION

This annual report is required in the Terms and Conditions of the 2012 Biological Opinion of the U.S. Fish and Wildlife Service for the operation of Hawaii-based Pelagic Longline Fisheries (USFWS 2012).

The National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO) is responsible for minimizing, as practicable, interactions between Hawaii pelagic longline fishing operations and seabirds. NMFS monitors the fisheries to determine the effectiveness of management measures implemented to minimize interactions and the severity of interactions. NMFS documents interactions and mitigation efforts aboard vessels at sea and reports annually on fishing effort, seabird interactions, and mitigation research. View this report and similar reports from previous years online at <https://www.fisheries.noaa.gov/pacific-islands/bycatch/seabird-interactions-pelagic-longline-fishery>.

1.1 Background

NMFS and the Western Pacific Fishery Management Council (WPFMC) manage two Hawaii pelagic longline fisheries under the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific (FEP) and implementing regulations. The deep-set longline fishery targets primarily bigeye tuna at depths to 400 meters (m) and operates mainly north-northeast and southwest of the main Hawaiian Islands. The shallow-set longline fishery targets swordfish at depths to 100 m and typically operates north and east of the Hawaiian Islands. In 2021 Hawaii longline vessels ranged between 49 and 98 feet in length. The FEP contains a detailed description of the two fisheries (WPFMC 2009, as amended).

Since 1994, the Hawaii longline fleet has been limited to 164 permits, which allow fishing in both the shallow- and deep-set fisheries. Beginning in 2004, vessels were required to declare if they would be shallow or deep fishing prior to departing on a fishing trip. Activity levels in any given year since 2004 range from 11 to 35 vessels in the shallow-set fishery, and 111 to 150 vessels in the deep-set fishery. Nearly all vessels in the shallow-set fishery also participate, to some degree, in the deep-set fishery during the year. In 2021, 146 vessels made 22,074 deep-sets in 1,679 trips and set 62,705,595 hooks, and 18 vessels made 665 shallow-sets in 55 trips and set 827,636 hooks (NMFS 2022a).

Laysan albatross, black-footed albatross, shearwaters, fulmars, boobies, and the endangered short-tailed albatross feed around the Hawaiian Islands in areas where the longline fisheries operate. During the deployment (setting) and retrieval (hauling) of longline fishing gear, hooks and line may occasionally hook or entangle seabirds that attempt to take bait or catch. Seabirds are more likely to drown when the interaction occurs during setting because the weight of the gear may pull the seabird underwater. Although some interactions are inevitable, fishermen take steps to avoid and minimize interactions.

In 2000, NMFS estimated 2,433 seabird interactions in the Hawaii longline fisheries. Beginning in 2001, NMFS implemented a series of seabird mitigation measures, including seabird-deterrent fishing gear and techniques that have reduced interactions. In this report, the statistics on seabird interactions are based on observations from NMFS fisheries monitors, also called observers. In 2021, there were 57 observed interactions in the shallow-set fishery, which has 100% observer coverage, and an estimated 789 interactions in the deep-set fishery, which has approximately 18% observer coverage (McCracken and Cooper 2022). Observer coverage in the deep-set fishery was reduced in 2021 from the usual 20% due to health, safety, and travel restrictions.

Please note that summaries throughout this report and elsewhere may vary slightly depending upon the data source, including revisions. For example, observers may report seabird interactions by date of trip (departure or arrival), set date, or haul date in a given year. NMFS typically bases observer coverage levels on the trip departure date. In 2021, NMFS Sustainable Fisheries Observer Program began accounting for protected species interactions in their [quarterly, semiannual, and annual reports](#) based on the date that the haul on which the interaction occurred began. In previous years, interactions were based on the vessel arrival date. NMFS also provides summary reports from mandatory logbook data reported by captains.

1.2 Seabird Mitigation Measures for the Hawaii Longline Fisheries

Most of the regulations for Hawaii longline fisheries are in Title 50, Code of Federal Regulations, [Parts 600 and 665](#) (50 CFR Parts 600 and 665). Regulations specific to the mitigation of seabird interactions and safe handling techniques are at [50 CFR 665.815](#). NMFS also provides a [regulation summary](#), a [compliance guide for reducing seabird interactions](#), and [seabird handling guidelines](#) to Hawaii longline fishermen and the general public.

The ways that fishermen implement required seabird mitigation measures depend on how and where fishermen fish. Mitigation measures to reduce seabird interactions differ between the two options of stern-setting and side-setting. The following sections describe each of the main gear and operation requirements. The 2012 Biological Opinion (USFWS 2012) also describes these measures.

Stern-Setting versus Side-Setting

Stern-setting is the most common method of deploying longline fishing gear. Crewmen employ a line shooter to set baited hooks from the back of the vessel. Crews that set gear using this method must bait hooks with thawed, blue-dyed bait; attach a weight of at least 45 g within 1 m of the hook on each branch line; strategically discharge fish, fish parts, or spent bait (together known as “offal”); and remove all hooks from offal discharge as seabird mitigation measures.

In side-setting, the crew sets baited hooks forward and close to the side of the vessel’s hull where seabirds are unable or unwilling to pursue the hooks. With required branch line weighting, the baited hooks will have sunk to a depth where seabirds cannot reach them by the time the vessel stern passes the location where baited hooks have been set (Gilman and Brothers 2006; Gilman et al. 2005, 2007a, 2007b). Additionally, deploying a required bird curtain aft of where crew is deploying the gear inhibits seabirds from landing on the water along the side of the vessel where baits are accessible.

Table 1 summarizes the number of Hawaii deep- and shallow-set vessels observed to set from the stern and from the side in 2021, with some vessels operating in both deep- and shallow-set longline fisheries. In 2021, most vessels in the deep-set fishery and all vessels in the shallow-set fishery chose to stern-set.

Table 1: Number of observed Hawaii longline vessels that side- and stern-set in 2021.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 09/15/2022

Fishery	Deck setting position	Vessels
Deep-set	Stern-setting	113
Deep-set	Side-setting	20
Shallow-set	Stern-setting	15
Shallow-set	Side-setting	0

Weighted Branch Lines

Fishermen place weights close to the hook on branch lines so baited hooks sink quickly and help prevent foraging seabirds from becoming hooked or entangled in longline gear. When deep-setting north of 23° N (either stern- or side-setting), or shallow- and side-setting anywhere, Hawaii fishermen must attach a weight of at least 45 g within 1 m of the hook to sink the branch line quickly. Fishermen commonly use weights from 45–80 g.

Thawed and Blue-dyed Bait

Dyeing bait to a specific blue color decreases visibility of the bait by reducing its contrast with the sea surface. Fishermen thaw the bait to increase sink rates and to allow a more effective penetration of the blue dye. Almost all bait used in the Hawaii longline fisheries consists of the fishes mackerel (saba), sardines, and saury (sanma). NMFS prohibits the use of squid bait in the shallow-set fishery to reduce sea turtle interactions. While fishermen may still use squid in the deep-set fishery, the squid bait costs more than some fish bait and is, thus, less preferred.

Strategic Offal Discharge

Fishermen developed the technique of strategically discharging offal on the opposite side of the vessel from fishing operations to distract seabirds from attempting to steal baits. NMFS observers in the mid-1990s noted that this technique reduced incidental hooking or entanglement of albatrosses, though recent experience is raising the question of whether offal discharge can have the unintended effect of attracting more seabirds. Further analysis is ongoing. Strategic offal discharge is currently required when stern- and deep-setting north of 23° N, or stern- and shallow-setting anywhere.

Night-Setting

Night-setting as a seabird mitigation measure in the shallow-set fishery is based on the premise that seabirds cannot see baited hooks in the dark and, thus, do not attack them. The measure requires shallow-set fishermen, when stern-setting, to start deploying gear no earlier than one hour after local sunset and complete the set no later than the following sunrise. The measure also requires using the minimum lighting necessary to conform to navigation rules and best safety practices. Night-setting has been a very effective seabird mitigation measure, reducing seabird interactions by as much as 98% (McNamara et al. 1999, Boggs 2003).

Table 2 summarizes the seabird mitigation requirements.

Table 2: Seabird mitigation requirements for the Hawaii longline fleet.

What you need to do	Stern-setting		Side-setting	
	Shallow-set Anywhere	Deep-set North of 23° N	Shallow-set Anywhere	Deep-set North of 23° N
Deploy mainline from port or starboard side at least 1 m forward of stern corner			Yes	Yes
If line shooter is used, mount it at least 1 m forward from stern corner			Yes	Yes
Use a specified bird curtain aft of the setting station during set			Yes	Yes
Deploy gear so that hooks do not resurface			Yes	Yes

What you need to do	Stern-setting		Side-setting	
	Shallow-set Anywhere	Deep-set North of 23° N	Shallow-set Anywhere	Deep-set North of 23° N
Attach 45 g or heavier weights within 1 m of hook of each hook		Yes	Yes	Yes
Use a line shooter to set the mainline		Yes		
Keep two 1-pound containers of blue-dye bait on boat	Yes	Yes		
Use completely thawed and blue-dyed bait	Yes	Yes		
Keep fish parts and spent bait with all hooks removed for strategic offal discard	Yes	Yes		
Cut all swordfish heads in half, and use heads and livers for strategic offal discard	Yes	Yes		
Night set – Begin set 1 hour after local sunset and finish 1 hour before next sunrise and keep lighting to a minimum	Yes			

1.3 Protected Species Workshops

In addition to gear and operational mitigation measures to deter or reduce seabird interactions, owners and operators of pelagic longline vessels must complete a protected species workshop each year (50 CFR 665.814). The workshop includes training in identification, safe handling, and release techniques for sea turtles, marine mammals, and seabirds. The workshop also reviews regulatory and compliance requirements. A valid workshop certificate is necessary to obtain or renew Federal longline fishing permits, and operators must keep a copy of the certificate on board the vessel while fishing. In 2021, NMFS PIRO provided protected species workshop training for 270 Hawaii-based and 40 American Samoa-based longline vessel owners, operators and crew, and other interested individuals.

2. INTERACTIONS

2.1 Species

NMFS observers have recorded the following bird species being hooked or entangled in the longline fisheries since 1994, when NMFS began deploying observers: Laysan albatross (*Phoebastria immutabilis*), black-footed albatross (*P. nigripes*), sooty shearwater (*Puffinus griseus*), unidentified shearwaters, brown booby (*Sula leucogaster*), red-footed booby (*S. sula*), Northern fulmar (*Fulmarus glacialis*), glaucous winged gull (*Larus glaucescens*), and an unidentified gull. None of these species is listed under the Endangered Species Act (ESA). Both Hawaii longline fisheries have low levels of interactions with these species. Based on the population estimates, the fisheries likely have very little effect on these populations.

Some seabirds, especially shearwaters, are difficult to identify. Table 3 provides a summary of seabird specimens that NMFS observers collected for identification and biological study after capture in the Hawaii longline fisheries in 2021. Under normal circumstances, NMFS observers retain as specimens the first dead Laysan and black-footed albatrosses recovered from each trip, any banded Laysan and black-footed albatrosses, and all other non-Laysan and black-footed albatross species recovered dead from fishing operations. Seabird specimens are frozen and shipped to the Marine Wildlife Veterinary Care and Research Center in Santa Cruz, California. Since 2007, staff with the organization Oikonos have been collecting morphometric data on shipped specimens. However, in April 2020, NMFS suspended collection of seabird specimens because of pandemic related shipping disruptions and infrastructure modifications. Other than a few specimens in 2021, consistent collection has not yet resumed.

Table 3: Summary of collected seabirds from the Hawaii longline fisheries, 2021.

Note: Not all dead seabirds are collected as specimens.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 9/15/2022.

Species	Number retained
Black-footed albatross	2
Laysan albatross	3
Shearwater	0

2.2 Location and Date of Interactions

Figures 1 and 2 show the spatial distribution of observed seabird interactions in 2021 in the deep- and shallow-set fisheries, respectively. Most of the interactions occur north of 20° N, where seabirds are typically more abundant and fishing effort is more concentrated. Figures 3 and 4 show the quarter of the year during which observed seabird interactions occurred in 2021 and cumulatively since 2004 in the deep- and shallow-set fisheries, respectively. Most of the interactions occurred in the first and second quarters (January through June) in 2021 and since 2004, with few interactions occurring in the third quarter.

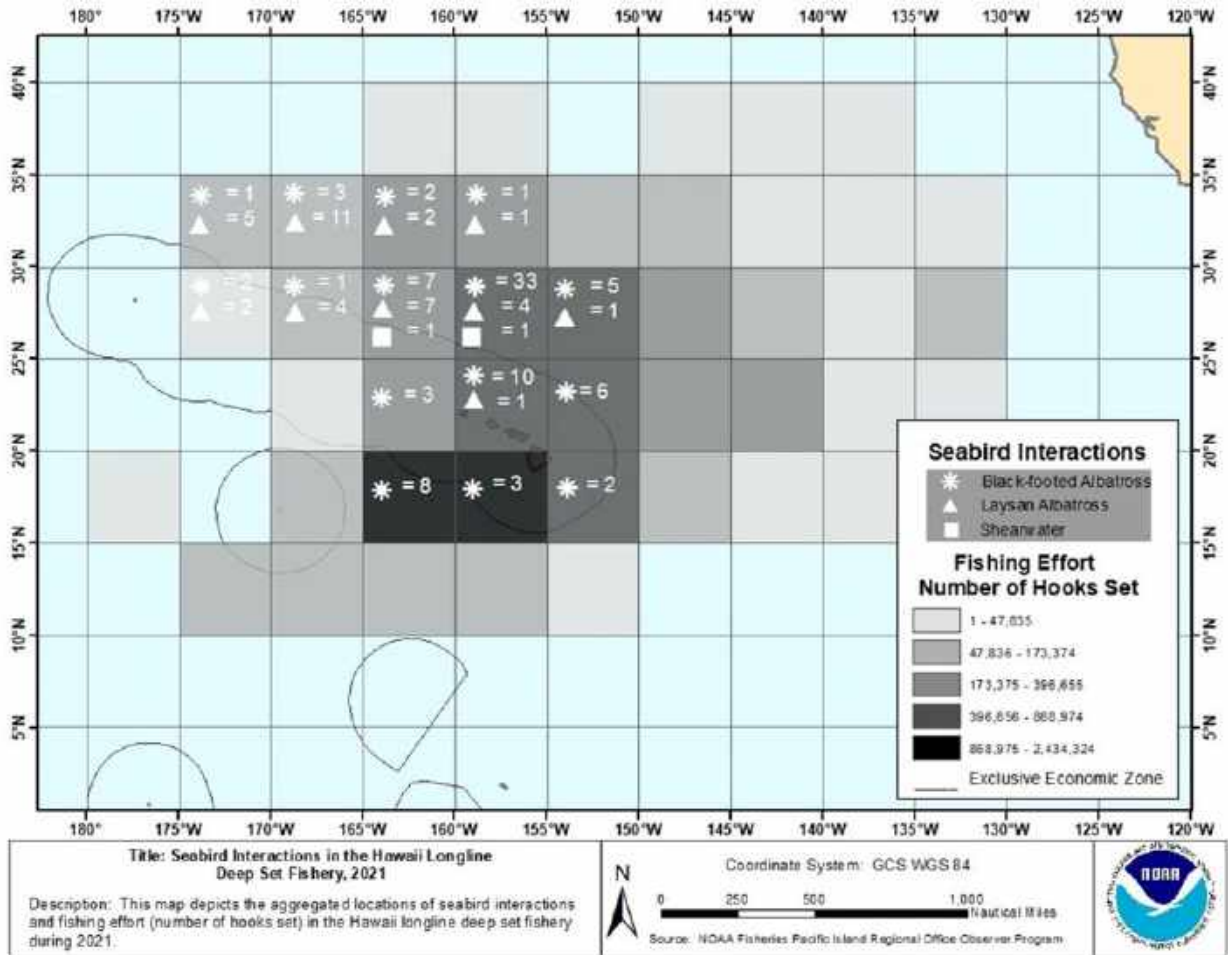


Figure 1: Locations of seabird interactions observed in Hawaii deep-set longline fishery, 2021.

Note: NMFS deployed observers on 17.84% of deep-set trips in 2021

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 08/11/2022.

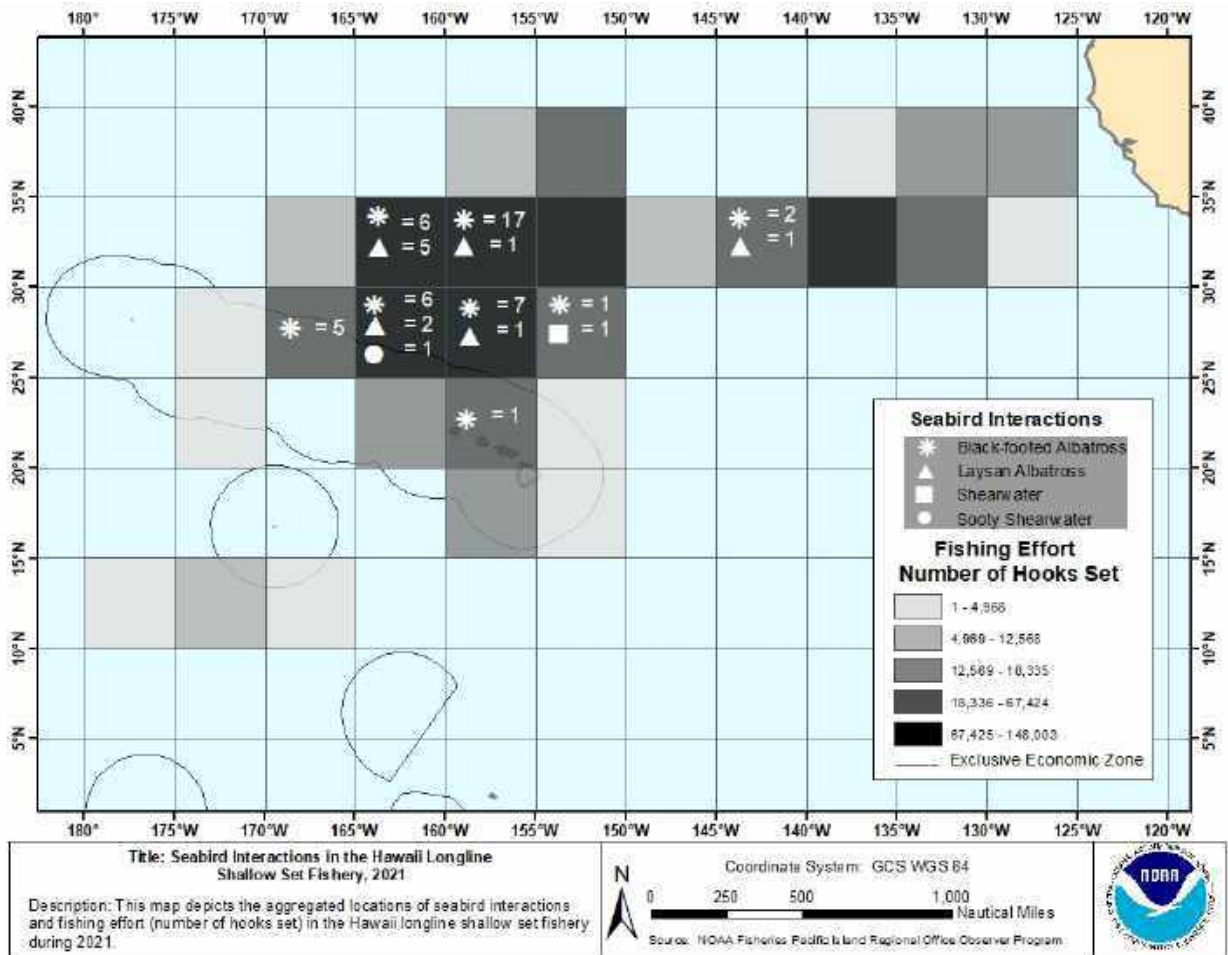


Figure 2: Locations of seabird interactions observed in Hawaii shallow-set longline fishery, 2021

Note: NMFS deployed observers on every shallow-set trip in 2021.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 08/10/2022.

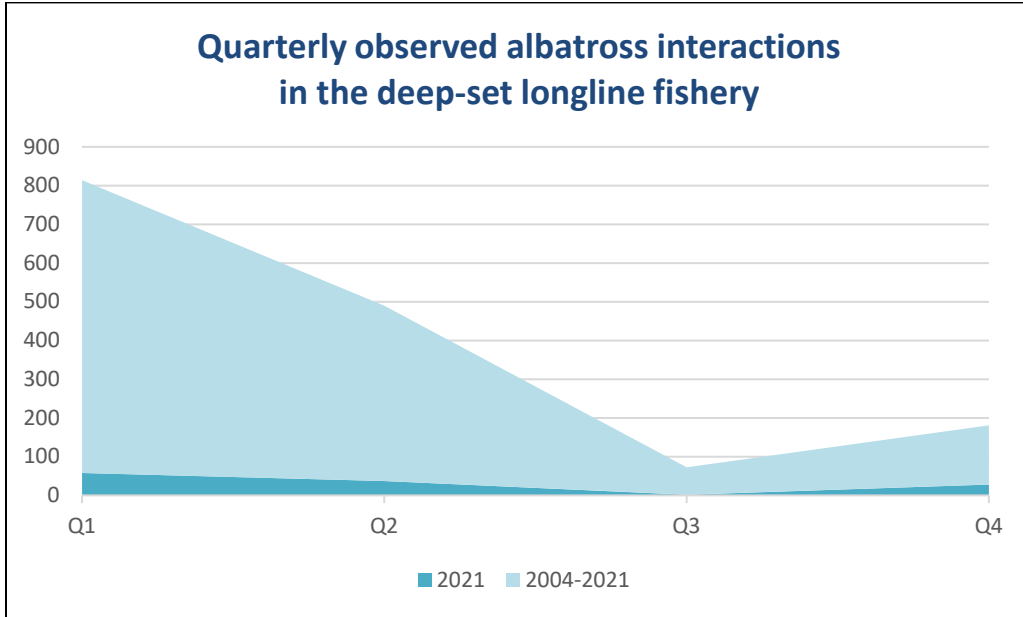


Figure 3: Number of observed seabird interactions in the deep-set longline fishery, 2004-2021 and 2021, in each date by quarter (Q).

Note: Q1 = January 1st-March 31st, Q2 = April 1st-June 30th, Q3 = July 1st-September 30th, and Q4 = October 1-December 31st.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 09/26/2022.

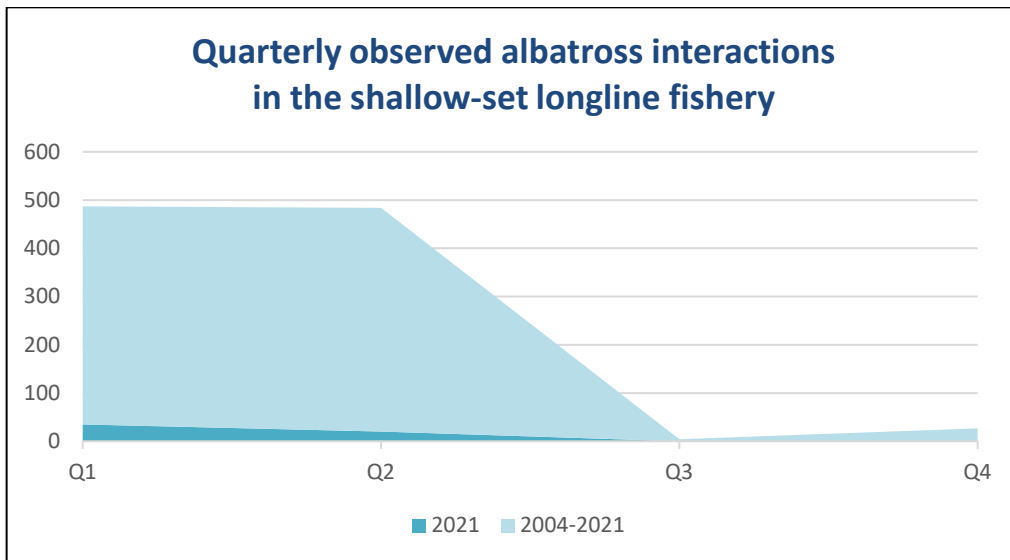


Figure 4: Number of observed seabird interactions in the shallow-set longline fishery, 2004-2021 and 2021, in each date by quarter (Q)

Note: Q1 = January 1st-March 31st, Q2 = April 1st-June 30th, Q3 = July 1st-September 30th, and Q4 = October 1-December 31st.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 09/26/2022.

2.3 Number of Interactions and Effort

Seabirds can be hooked, entangled, or both, but are most commonly hooked only. Regulations require fishermen to remove as much gear as is safely possible from any captured seabirds before releasing them. Albatross interactions are relatively rare events in the Hawaii longline fisheries. In 2021, there were no albatross interactions on 87% of observed deep-set trips and 73% of observed shallow-set trips. Table 4 summarizes the number of observed seabird interactions, the condition of the seabirds upon release, and fishing effort in both fisheries from 2004–2021.

During that period, NMFS deployed observers on 100% of shallow-set fishing trips; therefore, the number of interactions shown in Table 4 represents the fishery-wide totals. NMFS deployed observers on about 18% of deep-set trips in 2021, so we expanded the observed interactions using the observer coverage rate to estimate total interactions (Table 5). Figure 5 shows the seabird interaction rate from 2004–2021 based on the data from Table 4.

Table 4: Numbers of observed seabird catch levels, fishing effort, and interaction rates in the combined Hawaii longline fisheries, 2004-2021.

Source: Sustainable Fisheries Observer Program data (unpublished, 8/11/2021 and 9/26/2021) and from the Sustainable Fisheries Observer Program annual reports (NMFS 2022b and NMFS 2022c)

Note: Observed seabird catch and effort are based on the date and time of the beginning of the haul. Interaction rates are calculated and rounded to the nearest thousandths (third decimal) place.

Deep-set Fishery

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species	Total birds observed caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2004	2	5	-	2	9	-	9	4,013,212	0.002
2005	6	11	-	1 ¹	18	-	18	9,328,681	0.002
2006	1	17	5	-	23	-	23	7,434,798	0.003
2007	7	18	-	-	25	-	25	7,728,502	0.003
2008	14	30	14	2 ²	60	4	56	8,747,946	0.007
2009	18	23	4	-	45	-	45	7,872,668	0.006
2010	39	17	1	-	57	1	56	8,161,800	0.007
2011	32	13	3	-	48	2	46	8,328,872	0.006
2012	31	36	6	-	73	5	68	8,845,848	0.008
2013	48	49	8	-	105	5	100	9,296,069	0.011
2014	12	38	1	-	51	6	45	9,556,918	0.005
2015	25	101	4	2 ⁴	132	19	113	9,309,682	0.014

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species	Total birds observed caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2016	33	104	4	3 ⁵	144	7	137	9,901,279	0.015
2017	38	103	-	1 ⁶	142	13	129	10,190,504	0.014
2018	35	190	9	2 ⁸	236	28	208	11,907,869	0.020
2019	43	145	-	1 ⁹	189	8	181	12,739,655	0.015
2020	59	95	1	1 ¹⁰	156	13	143	8,849,665	0.018
2021	38	87	-	2 ¹²	127	10 ¹⁴	117	11,460,814	0.011

Shallow-set Fishery

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species	Total birds caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2004	1	-	-	-	1	1	-	115,718	0.009
2005	62	7	-	-	69	47	22	1,358,247	0.051
2006	8	3	-	-	11	5	6	676,716	0.016
2007	40	8	-	-	48	40	8	1,353,761	0.035
2008	33	6	-	-	39	24	15	1,460,042	0.027
2009	81	30	1	-	112	88	24	1,694,550	0.066
2010	40	38	-	1 ³	79	61	18	1,835,182	0.043
2011	49	19	-	-	68	53	15	1,505,467	0.045
2012	62	37	-	-	99	78	21	1,476,969	0.067
2013	45	28	2	-	75	48	27	1,074,909	0.070
2014	39	32	1	-	72	56	16	1,470,683	0.049
2015	43	38	-	-	81	65	16	1,274,805	0.064
2016	25	40	-	-	65	50	15	796,165	0.082

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species	Total birds caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2017	6	53	-	1 ⁷	60	38	22	1,083,216	0.055
2018	2	7	-	-	9	7	2	486,013	0.019
2019	15	19	-	-	34	26	8	374,487	0.091
2020	26	5	-	1 ¹¹	32	32	-	624,579	0.051
2021	10	45	1	1 ¹³	57	45 ¹⁴	12	1,026,373	0.056

Footnote: ¹brown booby; ²red-footed booby and unidentified seabird; ³northern fulmar; ⁴red-footed booby and unidentified shearwater; ⁵two red-footed boobies and one unidentified albatross; ⁶unidentified gull; ⁷glaucous-winged gull; ⁸one brown booby and one red-footed booby; ⁹brown booby; ¹⁰brown booby; ¹¹northern fulmar; ¹²unidentified shearwater; ¹³unidentified shearwater; ¹⁴None of the seabirds released alive in 2021 had any gear attached

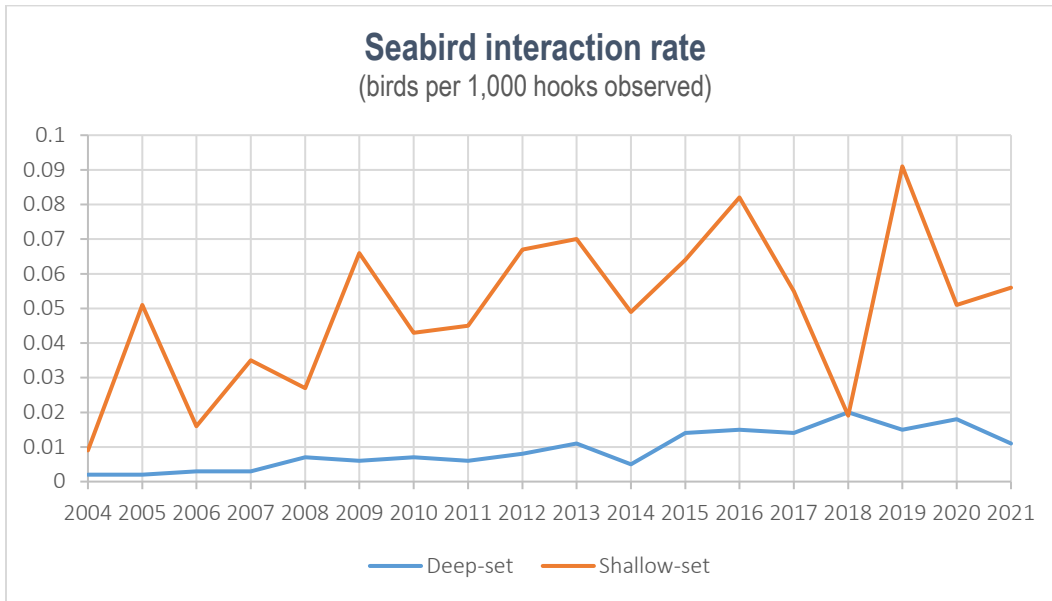


Figure 5: Seabird interaction rates in the deep-set and shallow-set longline.

Almost all interactions in the deep-set fishery occur when fishermen set gear during the day while seabirds are actively feeding. Seabirds may be hooked or entangled and then drown while the gear sinks. Because most seabirds are inactive at night, very few interactions occur when fishermen typically haul deep-set gear. In 2021, in the deep-set fishery, observers documented interactions with 38 Laysan albatrosses, 87 black-footed albatrosses, and 2 unidentified shearwaters (Table 4). Nearly all of the seabirds observed to interact with the deep-set fishery were dead at the vessel (92%). Of those that were released alive, none had any gear left

attached. Table 5 contains the total estimated number of interactions with Laysan albatrosses, black-footed albatrosses, and shearwaters based on observer records for the deep-set fishery in 2021.

Table 5: Estimated total seabird interactions in the Hawaii deep-set longline fishery, 2021.

Note: Table lists point estimates and standard error of the total number of incidental interactions by species in the Hawaii deep-set longline fishery based on observed interactions during 2021. Point estimates are based on the trip arrival date rather than haul date. Source: McCracken and Cooper 2022.

Species	Total annual estimate	Standard error
Black-footed albatross	536	132.3
Laysan albatross	244	99.6
Shearwater	9	6.9

The shallow-set fishery typically sets at night and hauls the gear during the day; therefore, most of the interactions occur when fishermen retrieve the gear and birds are actively feeding. In 2021, the shallow-set fishery interacted with 10 Laysan albatrosses, 45 black-footed albatrosses, 1 sooty shearwater, and 1 unidentified shearwater (Table 4). Nearly all of the seabirds observed to interact with the shallow-set fishery were alive at the vessel (79%). None of the seabirds released alive had any gear attached. These numbers reflect the total catch due to there being 100% observer coverage for this fishery.

When albatross interactions do occur, it is common for more than one albatross interaction to occur per trip, resulting in a large percentage of the annual albatross interactions occurring on a small number of trips. In 2021, 125 albatross in the deep-set fishery were caught over 39 individual trips, and 55 of those albatross (44%) were caught on just 4 individual trips. In the shallow-set fishery, 55 albatross were caught over 16 individual trips, and 23 of those albatross (42%) were caught on just 3 individual trips.

Table 6: Number of observed deep-set and shallow-set longline trips by the number of albatross interactions per trip, 2021. The total number of observed trips in this period was 298 for deep-set and 60 for shallow-set.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 10/04/2022.

Deep-set longline			Shallow-set longline		
Number of albatross per trip	Number of trips ¹	% of total albatross caught	Number of albatross per trip	Number of trips ¹	% of total albatross caught
0	259	0	0	44	0
1	18	14.4	1	5	9.1
2	7	11.2	2	3	10.9
3	5	12.0	3	1	5.5
4	2	6.4	4	2	14.5
5	3	12.0	5	2	18.2
>5	4	44.0	>5	3	41.8

Footnote: ¹based on begin haul date

3. ESA-LISTED SEABIRDS

There have been no observed interactions (hooking or entanglement) between the fisheries and any ESA-listed seabirds. The distributions of three seabird species that are protected under the ESA—the endangered short-tailed albatross, the Hawaiian dark-rumped petrel (*Pterodroma sandwichensis*), and the threatened Newell’s shearwater (*Puffinus newelli*)—overlap with the areas where the Hawaii longline fisheries operate. There were five sightings of short-tailed albatross on shallow-set trips in 2021 and one sighting on observed deep-set trips. Figures 6 and 7 show the locations of these sightings compared to the observed fishing effort.

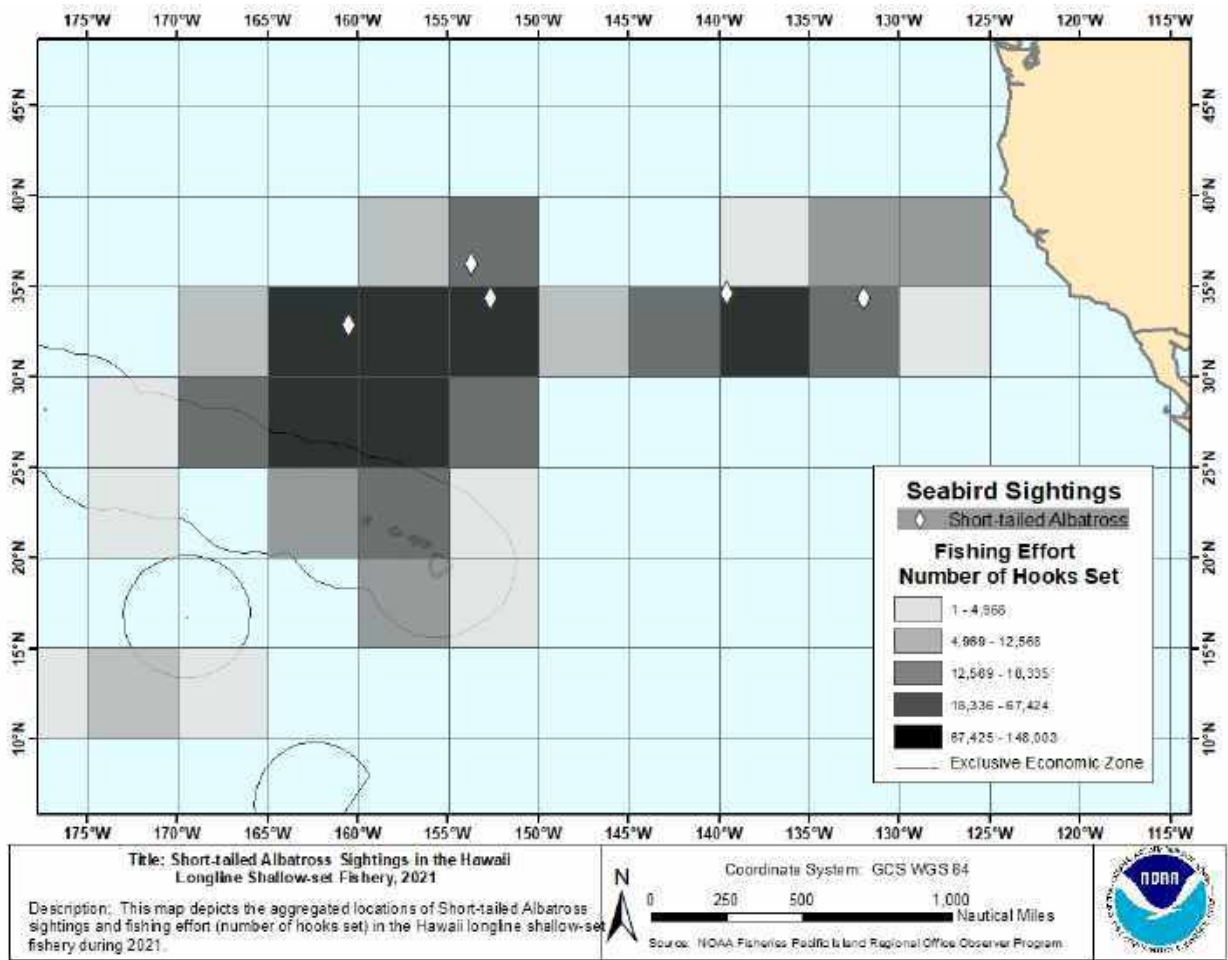


Figure 6: Short-tailed albatross sightings and fishing effort in the Hawaii shallow-set fisheries, 2021.
 Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 07/27/2022.

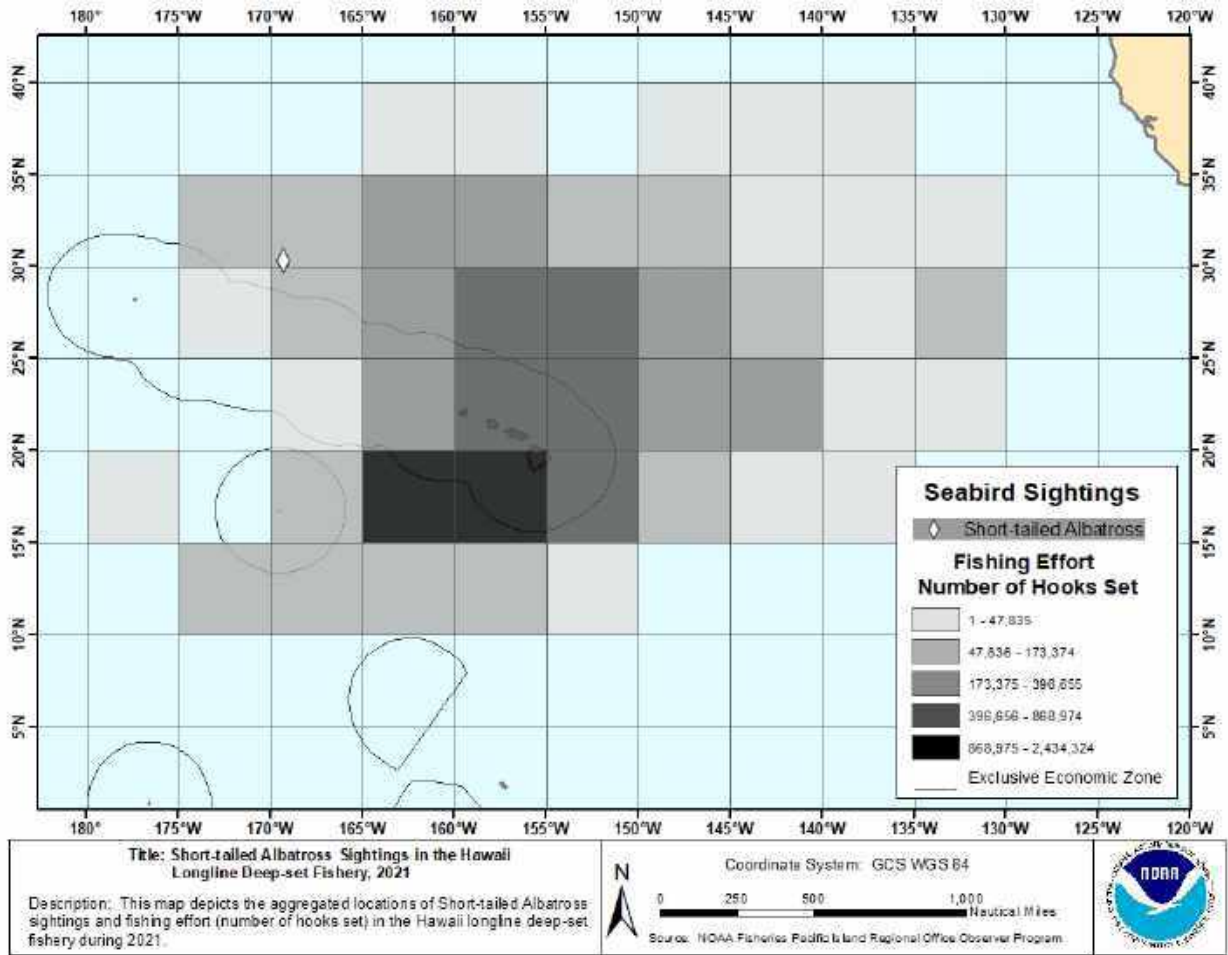


Figure 7: Short-tailed albatross sightings and fishing effort in the Hawaii deep-set fisheries, 2021.
 Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 07/27/2022.

4. RESEARCH AND COUNCIL ACTIONS

Since NMFS introduced seabird regulations to the Hawaii deep-set fishery in 2001, the overall seabird catch rate has declined, with the exception of black-footed albatross catch rates. These rates have been increasing over the past decade. The WPFMC held workshops in 2017 and 2018 to explore the causes of higher black-footed albatross interactions as well as review seabird mitigation requirements and the best scientific information available for the Hawaii longline fishery. The workshops identified certain mitigation measures, including tori lines (bird-scaring streamers), as a high priority for further research and development due to their potential to provide an effective alternative to blue-dyed bait.

In spring 2019, the WPFMC, the Hawaii Longline Association, NMFS Pacific Islands Fisheries Science Center (PIFSC), and PIRO initiated a joint cooperative research project to design and test tori lines in the deep-set longline fishery. The statistically significant results from a 2020 study indicated that tori lines, when used in conjunction with blue-dyed bait and strategic offal discard practices, significantly reduce albatross feeding attempts and contact with longline gear. Project results also indicated that discharging offal and spent bait during setting might exacerbate rather than mitigate seabird catch risk (Gilman et al. 2021).

The WPFMC identified the need for additional research to test the effectiveness of tori lines without blue-dyed bait and offal discharge (WPFMC 2021). This research was conducted under a NMFS experimental fishing permit pursuant to regulations at 50 CFR 556.17 from February to June 2021. The 2021 study conducted a direct comparison of blue-dyed bait and tori lines on Hawaii deep-set longline trips, with offal withheld during the set. The results showed that albatross attempts are 1.5 times less likely, contacts are 4 times less likely, and captures are 14 times less likely on tori line sets compared with blue-dyed bait sets (Chaloupka et al. 2021). Based on the results from these studies, NMFS met with USFWS to discuss how to incorporate the findings into the regulatory process.

At its 189th meeting on December 7–9, 2021, the Council took final action and recommended regulatory amendments to improve the overall operational practicality and mitigation efficacy of required measures for the Hawaii deep-set longline fishery. Specifically, the Council recommended replacing blue-dyed thawed bait and strategic offal discharge measures required for stern-setting deep-set longline vessels with a new tori line requirement. In lieu of a regulatory requirement for a strategic offal discharge measure, the Council recommended implementing best practices training on offal management as part of the annual protected species workshop. The Council additionally recommended tori line regulatory specifications to ensure the tori lines will produce similar results to the lines tested in the two studies. The regulatory package is currently under development.

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Seabird Interactions and Mitigation Efforts in Hawaii Longline Fisheries

2020 ANNUAL REPORT



NOAA
FISHERIES

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2020 ANNUAL REPORT

November 2021

Pacific Islands Regional Office
NOAA National Marine Fisheries Service
1845 Wasp Blvd.
Honolulu, HI 96818
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Please note: Data in this report are considered to be preliminary, and may be revised as better information becomes available. For the most current data, please contact the NMFS Pacific Islands Regional Office.

Front cover: A pair of black-footed albatross. Credit: NOAA Fisheries.

Back cover: Red-footed booby landing on a railing of a fishing vessel. Credit: NOAA Fisheries.



Hawaii longline vessels docked at Pier 17, Honolulu. Credit: NOAA Fisheries.

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1. Introduction

This annual report is required in the Terms and Conditions of the 2012 Biological Opinion of the U.S. Fish and Wildlife Service for the Operation of Hawaii-based Pelagic Longline Fisheries (USFWS 2012).

The National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO) is responsible for minimizing, as practicable, interactions between Hawaii pelagic longline fishing operations and seabirds. NMFS monitors the fisheries to determine the effectiveness of management measures implemented to minimize interactions and the severity of interactions. NMFS documents interactions and mitigation efforts aboard vessels at sea and reports annually on fishing effort, seabird interactions, and mitigation research. View this report and similar reports from previous years online at <https://www.fisheries.noaa.gov/pacific-islands/bycatch/seabird-interactions-pelagic-longline-fishery>.

1.1 Background

NMFS and the Western Pacific Fishery Management Council (WPFMC) manage two Hawaii pelagic longline fisheries under the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific (FEP) and implementing regulations. The deep-set longline fishery targets primarily bigeye tuna at depths to 400 meters (m) and operates mainly north-northeast and southwest of the main Hawaiian Islands. The shallow-set longline fishery targets swordfish at depths to 100 m and typically operates north and east of the Hawaiian Islands. The FEP contains a detailed description of the two fisheries (WPFMC 2009, as amended).

Since 1994, the Hawaii longline fleet has been limited to 164 permits. Permits allow fishing in both the shallow- and deep- set longline fisheries. Activity levels in any given year since 2004 range from 11 to 35 vessels in the shallow-set fishery, and 111 to 150 vessels in the deep-set fishery. Nearly all vessels in the shallow-set fishery also participate, to some degree, in the deep-set fishery during the year.

Laysan albatross, black-footed albatross, shearwaters, fulmars, boobies, and the endangered short-tailed albatross feed around the Hawaiian Islands in areas where the longline fisheries operate. During the deployment (setting) and retrieval (hauling) of longline fishing gear, hooks and line may occasionally hook or entangle seabirds that attempt to take bait or catch. Seabirds are more likely to drown when the interaction occurs during setting because the weight of the gear may pull the seabird underwater. Although some interactions are inevitable, fishermen take steps to avoid and minimize interactions.

In 2000, NMFS estimated 2,433 seabird interactions in the Hawaii longline fisheries. Beginning in 2001, NMFS implemented a series of seabird mitigation measures, including seabird-deterrent fishing gear and techniques that have reduced interactions. In 2020, there were 32 observed interactions in the shallow-set fishery, which has 100% observer coverage, and an estimated 917 interactions in the deep-set fishery, which has approximately 15% observer coverage (McCracken and Cooper 2021). Observer coverage in the deep-set fishery was reduced in 2020 from the usual 20% due to health, safety, and travel restrictions.

1.2 Seabird Mitigation Measures for the Hawaii Longline Fisheries

Most of the regulations for Hawaii longline fisheries are in Title 50, Code of Federal Regulations, [Parts 600](#) and [665](#) (50 CFR Parts 600 and 665). Regulations specific to the mitigation of seabird interactions and safe handling techniques are at [50 CFR 665.815](#). NMFS also provides a regulation summary and seabird handling guidelines to Hawaii longline fishermen and the general public at <https://www.fisheries.noaa.gov/pacific-islands/bycatch/seabird-interactions-pelagic-longline-fishery>.

The ways that fishermen implement required seabird mitigation measures depend on how and where fishermen fish. Mitigation measures to reduce seabird interactions differ between the two options of stern-setting and side-setting. The following sections describe each of the main gear and operation requirements. The 2012 Biological Opinion (USFWS 2012) also describes these measures.

Stern-Setting versus Side-Setting

Stern-setting is the most common method of deploying longline fishing gear. Crewmen employ a line shooter to set baited hooks from the back of the vessel. Crews that set gear using this method must bait hooks with thawed, blue-dyed bait; attach a weight of at least 45 grams (g) within 1 m of the hook on each branch line; strategically discharge fish, fish parts, or spent bait (together known as “offal”); and remove all hooks from offal discharge as seabird mitigation measures.

In side-setting, crewmen set baited hooks forward and close to the side of the vessel’s hull where seabirds are unable or unwilling to pursue the hooks. With required branch line weighting, the baited hooks will have sunk to a depth where seabirds cannot reach them by the time the vessel stern passes the location where baited hooks have been set (Gilman and Brothers 2006; Gilman et al. 2005, 2007a, 2007b). Additionally, deploying a required bird curtain aft of where crew is deploying the gear inhibits seabirds from landing on the water along the side of the vessel where baits are accessible.

Table 1 summarizes the number of Hawaii deep- and shallow-set vessels observed to set from the stern and from the side in 2020, with some vessels operating in both deep- and shallow-set longline fisheries. In 2020, most vessels in the deep-set fishery and all vessels in the shallow-set fishery chose to stern-set.

Table 1. Number of observed Hawaii longline vessels that side- and stern-set in 2020.

Fishery	Deck setting position	Vessels
Deep-set	Stern-setting	105
Deep-set	Side-setting	21
Shallow-set	Stern-setting	15
Shallow-set	Side-setting	0

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 10/15/2021.

Weighted Branch Lines

Fishermen place weights close to the hook on branch lines so baited hooks sink quickly and help prevent foraging seabirds from becoming hooked or entangled in longline gear. When deep-setting north of 23° N (either stern- or side-setting), or shallow- and side-setting anywhere, Hawaii fishermen must attach a weight of at least 45 g within 1 m of the hook to sink

the branch line quickly. Fishermen commonly use weights from 45–80 g.

Thawed and Blue-dyed Bait

Dyeing bait to a specific blue color decreases visibility of the bait by reducing its contrast with the sea surface. Fishermen thaw the bait to increase sink rates and to allow a more effective penetration of the blue dye. Almost all bait used in the Hawaii longline fisheries consists of the fusiform fishes mackerel (saba), sardines, and saury (sanma). NMFS prohibits the use of squid bait in the shallow-set fishery to reduce sea turtle interactions. While fishermen may still use squid in the deep-set fishery, the squid bait costs more than some fish bait and is, thus, less preferred.

Strategic Offal Discards

Fishermen developed the technique of strategically discarding offal on the opposite side of the vessel from fishing operations to distract seabirds from attempting to steal baits. NMFS observers in the mid-1990s noted that this technique reduced incidental hooking or entanglement of albatrosses, though recent experience is raising the question of whether offal discard can have the unintended effect of attracting more seabirds. Further analysis is ongoing. Strategic offal discard is currently required when stern- and deep-setting north of 23° N, or stern- and shallow-setting anywhere.

Night-Setting

Night-setting as a seabird mitigation measure in the shallow-set fishery is based on the premise that seabirds cannot see baited hooks in the dark and, thus, do not attack them. The measure requires shallow-set fishermen, when stern-setting, to start deploying gear no earlier than one hour after local sunset and complete the set no later than the following sunrise. The measure also requires using the minimum lighting necessary to conform to navigation rules and best safety practices. Night-setting has been a very effective seabird mitigation measure, reducing seabird interactions by as much as 98% (McNamara et al. 1999, Boggs 2003).

Table 2 summarizes the seabird mitigation requirements.

Table 2. Seabird mitigation requirements for the Hawaii longline fleet.

What you need to do	Stern-setting		Side-setting	
	Shallow-Set Anywhere	Deep-Set North of 23° N	Shallow-Set Anywhere	Deep-Set North of 23° N
Deploy mainline from port or starboard side at least 1 m forward of stern corner	-	-	Yes	Yes
If line shooter is used, mount it at least 1 m forward from stern corner	-	-	Yes	Yes
Use a specified bird curtain aft of the setting station during the set	-	-	Yes	Yes
Deploy gear so that hooks do not resurface	-	-	Yes	Yes
Attach 45 g or heavier weights within 1 m of hook of each hook	-	Yes	Yes	Yes
Use a line shooter to set the mainline	-	Yes	-	-
Keep two 1-pound containers of blue-dye on boat	Yes	Yes	-	-
Use completely thawed and blue-dyed bait	Yes	Yes	-	-
Keep fish parts and spent bait with all hooks removed for strategic offal discard	Yes	Yes	-	-
Cut all swordfish heads in half, and use heads and livers for strategic offal discard	Yes	Yes	-	-
Night Set - begin set 1 hour after local sunset and finish 1 hour before next sunrise and keep lighting to a minimum	Yes	-	-	-



Black-footed albatross biting on baited hook. Credit: NOAA Fisheries.

Figure 1. Illustrated seabird handling guidelines developed for use and distribution in protected species workshops.

**Seabird Handling Guidelines
Hawaii Pelagic Longline Fisheries**

YOU WILL NEED → towel, bolt/wire cutter or pliers, dip net, gloves, safety glasses, safe enclosure for bird

- 1.** Stop vessel to reduce tension on line. Wear gloves, safety glasses, and arm covers for protection. Use dip net to bring bird onto vessel.
- 2.** Hold bird by bill without covering nostrils. Fold wings into bird's body.
- 3.** Cover bird with towel to protect and calm it. Straddle bird if necessary.
- 4.** Remove any entangled lines. *NOTE: If the bird is an albatross with a bright pink bill, it may be a short-tailed albatross (STAL). See reverse side for the rest of the STAL handling requirements as per (50 CFR 665.815(b)).*
- 5.** If you can handle hook but cannot see barb: Push hook through skin to expose barb. Use pliers to flatten barb or bolt cutters to cut off barb. Back hook out.
- 6.** If you cannot handle hook (it's deeply ingested): Cut as much line off as possible and leave hook in bird.
- 7.** Leave bird to recover in safe enclosed space. Do not provide food or water to bird.
- 8.** Bird can be released to sea surface when: Feathers are dry (approximately 1/2 to 4 hours), Bird is alert and head is erect, Breathes without noise, Wings can flap and retract onto back, Stands on both feet with toes forward.
- 9.** If bird has not recovered after 4 hours, either Release bird to sea surface or call nearby bird rescue center for guidance (vessels 1-2 days from port): Honolulu (808-884-5000), Los Angeles (310-514-2573), San Francisco (707-207-0380)

Please report all banded birds: 1-800-327-BAND (2263) or www.pwrc.usgs.gov/bbl
 Questions? Call NMFS Pacific Islands Regional Office, Sustainable Fisheries Division at (808) 725-5000

12/2017

1.3 Protected Species Workshops

In addition to gear and operational mitigation measures to deter or reduce seabird interactions, owners and operators of pelagic longline vessels must complete a protected species workshop each year (50 CFR 665.814). The workshop includes training in identification, safe handling, and release techniques for sea turtles, marine mammals, and seabirds (Figure 1). The workshop also reviews regulatory and compliance requirements. In a classroom setting, fishermen learn from oral presentations, hands-on demonstrations, videos, and printed reference materials. NMFS also offers the workshops online for those who have completed at least one in-person workshop training within the past 3 years. A valid workshop certificate is necessary to obtain or renew Federal longline fishing permits, and operators must keep a copy of the certificate on board the vessel while fishing.

Table 3. Hawaii deep- and shallow-set longline fisheries effort and observer coverage, 2019 and 2020.

2019					
Fishery	Number of vessels	Trips	Sets	Hooks	Observer coverage
Deep-set	150	1,724	22,513	63,174,971	20.54%
Shallow-set	15	28	312	374,487	100%
2020					
Fishery	Number of vessels	Trips	Sets	Hooks	Observer coverage
Deep-set	146	1,645	20,785	59,668,443	15.25%
Shallow-set	15	37	479	624,579	100%

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished shallow-set data, 10/15/2021, and NMFS 2021a and NMFS 2020.

In 2020, NMFS PIRO provided protected species workshop training for 267 Hawaii-based and 39 American Samoa-based longline vessel owners, operators and crew, and other interested individuals. Starting in March 2020, NMFS live webinar format has increased convenience and accessibility to vessel owners and operators. In addition, NMFS PIRO completed an illustrated guide for proper handling, release, and identification of protected species and, with the WPFMC, translated the guide into languages commonly spoken by operators (Vietnamese) and crew (Tagalog, Indonesian). NMFS distributed all language version copies to all workshop students.

1.4 Fishing Effort and Observer Coverage

Please note that summaries throughout this report and elsewhere may vary slightly depending upon the data source, including revisions. For example, observers may report seabird interactions by date of trip (departure or arrival), set date, or haul date in a given year. NMFS typically bases observer coverage levels on the trip departure date. Alternatively, the NMFS Sustainable Fisheries Observer Programs accounts for protected species interactions based on the vessel arrival date in quarterly, semiannual, and annual reports, <https://www.fisheries.noaa.gov/pacific-islands/fisheries-observers/pacific-islands-longline-quarterly-and-annual-reports>. NMFS also provides summary reports from mandatory logbook data reported by captains.

Table 3 summarizes fishing effort data and observer coverage from 2019 and 2020 by haul date. Observer placement aboard deep-set longline vessels halted temporarily in early 2020 in consideration of COVID-19 and the health and safety of fishermen and observers. NMFS waived placement of observers on 43 trips in the Hawaii deep-set fishery that would typically have carried observers. With enhanced health and safety protocols, observer assignments resumed in May 2020 for the deep-set Hawaii longline fisheries. In the shallow-set fishery, there was no disruption in observer coverage and observers were present on all shallow-set trips. From 2019 to 2020, deep-set fishing trips decreased by 4.6% and shallow-set fishing trips increased by 32.1%.

2. Interactions

2.1 Species

NMFS observers have recorded the following bird species being hooked or entangled in the longline fisheries since 1994, when NMFS began deploying observers: Laysan albatross (*Phoebastria immutabilis*), black-footed albatross (*P. nigripes*), sooty shearwater (*Puffinus griseus*), unidentified shearwaters, brown booby (*Sula leucogaster*), red-footed booby (*S. sula*), Northern fulmar (*Fulmarus glacialis*), glaucous winged gull (*Larus glaucescens*), and an unidentified gull (Table 4). None of these species is listed under the Endangered Species Act (ESA). Both Hawaii longline fisheries have low levels of interactions with these species. Based on the population estimates, the fisheries likely have very little effect on these populations.

Table 4. Species recorded hooked or entangled in Hawaii longline fisheries.

Species	Global population estimate	Demographic information
Laysan albatross	806,693 breeding pairs (ACAP 2021)	The Northwestern Hawaiian Islands (NWHI) has the world's largest colonies and more than 99% of the global breeding population (ACAP 2012a)
Black-footed albatross	70,524 pairs (ACAP 2021)	More than 95% of the population breeds in the NWHI (ACAP 2012b)
Northern fulmar	7 million individuals (Birdlife 2021a)	Located throughout the North Atlantic and North Pacific
Red-footed booby	More than 1 million birds (Birdlife 2020a)	Winter on tropical islands in most oceans
Brown booby	More than 200,000 adults (Birdlife 2020b)	Located throughout the pan-tropical oceans
Sooty shearwater	8,800,000 adults (Birdlife 2021b)	Nest in Australia, New Zealand, and southern South America
Glaucous-winged gull	More than 570,000 individuals (Birdlife 2020c)	Located along the Pacific coast of North America to the northern coast of Japan

Some seabirds, especially shearwaters, are difficult to identify. Table 5 provides a summary of seabird specimens that NMFS observers collected for identification and biological study after capture in the Hawaii longline fisheries in 2020. NMFS observers retain specimens of the first dead Laysan and black-footed albatrosses recovered from each trip, any banded Laysan and black-footed albatrosses, and all other non-Laysan and black-footed albatross species recovered dead from fishing operations. Seabird specimens are frozen and shipped to the Marine Wildlife Veterinary Care and Research Center in Santa Cruz, California. Since 2007, staff with the organization

Oikonos have been collecting morphometric data on shipped specimens.

Table 5. Summary of collected seabirds from the Hawaii longline fisheries, 2020.

Species	Number retained
Black-footed albatross	30
Laysan albatross	22
Brown booby	1

Note: Not all dead seabirds are collected as specimens
 Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 10/18/2021.

2.2 Location of Interactions

Figures 2 and 3 show the spatial distribution of observed seabird interactions in 2020 in the deep- and shallow-set fisheries, respectively. Most of the interactions occur north of 20° N, where seabirds are typically more abundant and fishing effort is more concentrated.

Figure 2. Locations of seabird interactions observed in Hawaii deep-set longline fishery, 2020.

Note: NMFS deployed observers on 15.25% of deep-set trips in 2020.
 Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 10/12/2021.

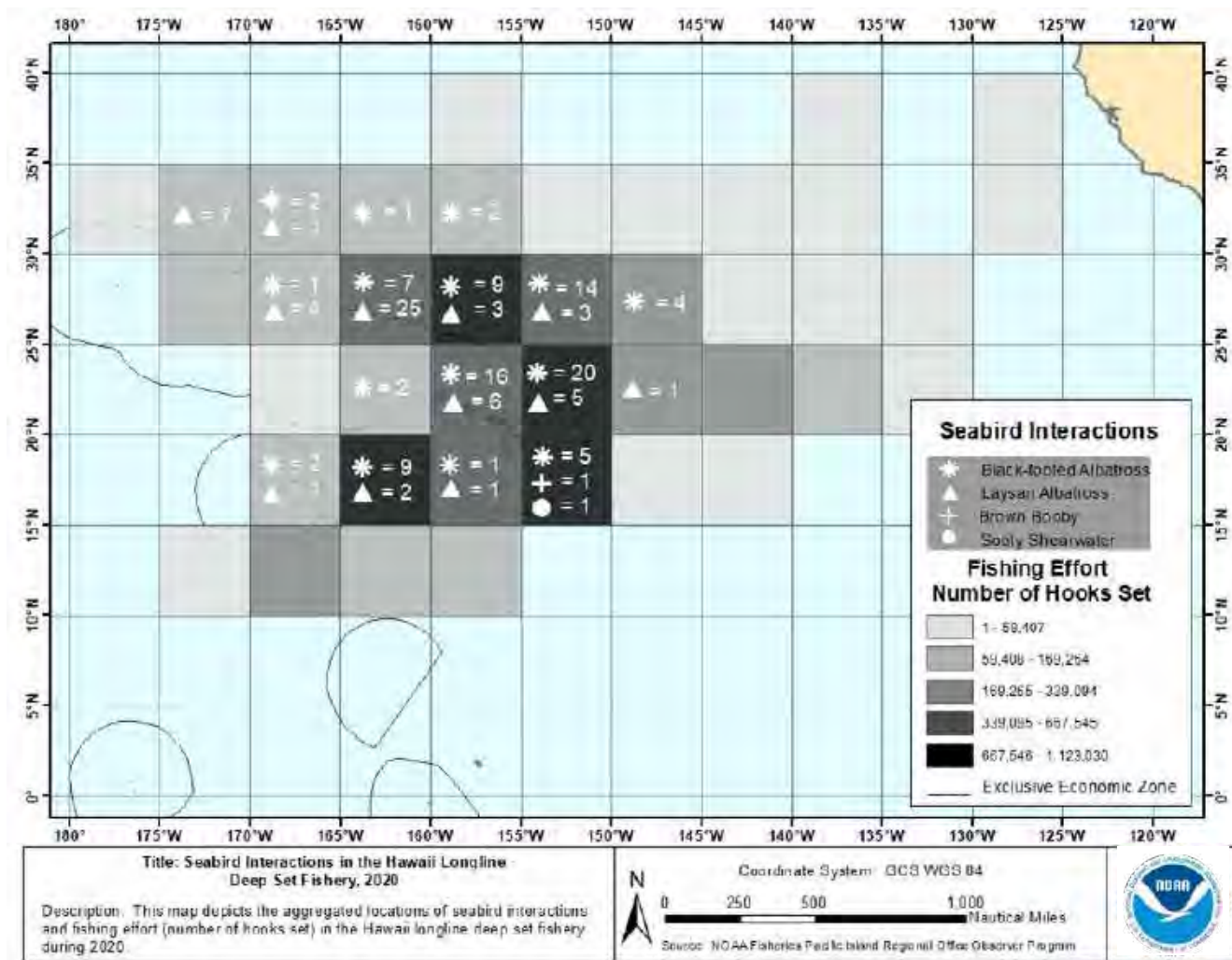
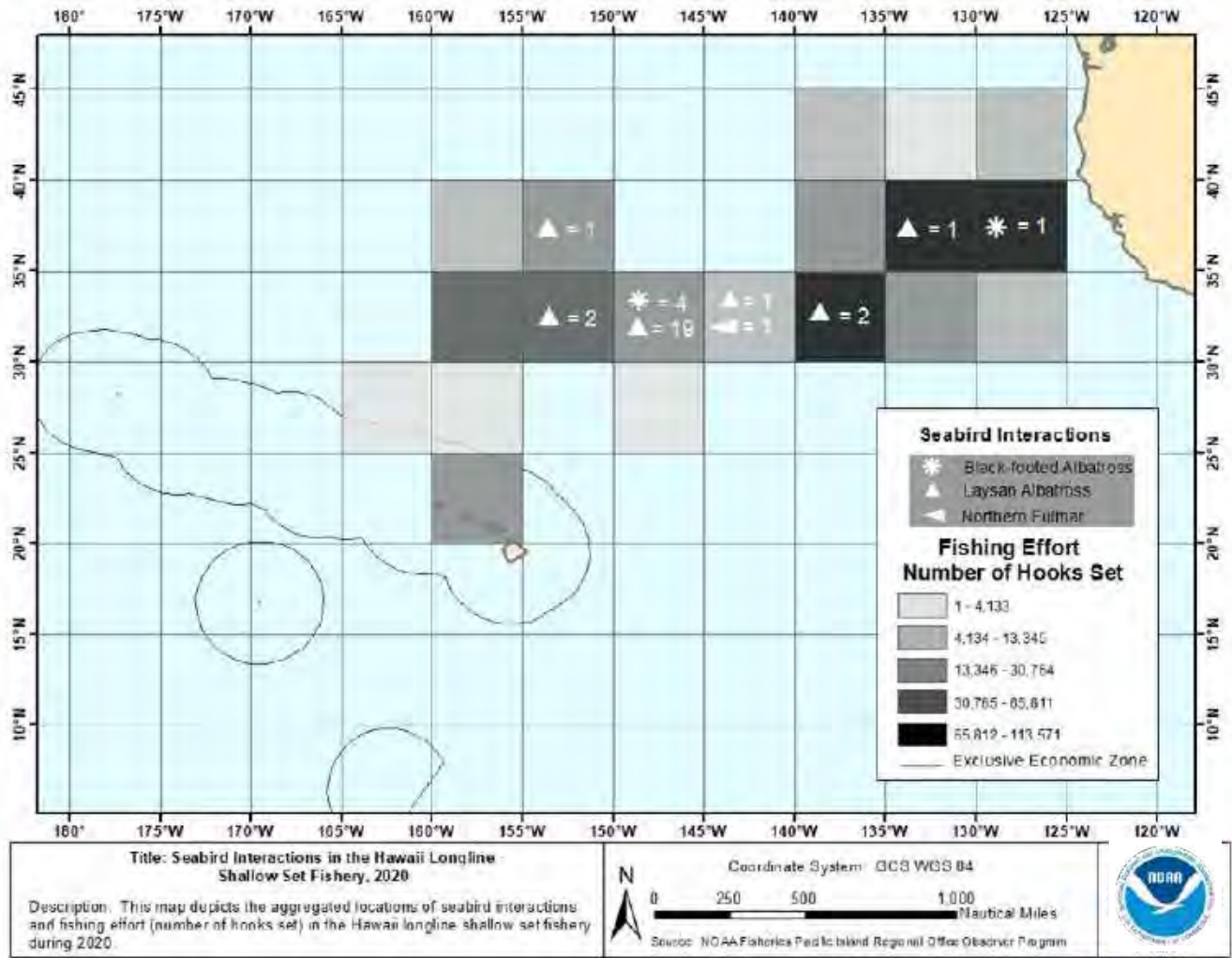


Figure 3. Locations of seabird interactions observed in Hawaii shallow-set longline fishery, 2020.

Note: NMFS deployed observers on every shallow-set trip in 2020.
 Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 10/12/2021.



2.3 Number of Interactions

Table 6 summarizes observed seabird interactions in both fisheries from 2004–2020. During that period, NMFS deployed observers on 100% of shallow-set fishing trips; therefore, the number of interactions shown in Table 6 represents the fishery-wide totals. NMFS deployed observers on 15.25% of deep-set trips in 2020, so we expanded the observed interactions using the observer coverage rate to estimate total interactions (Table 7). Figure 4 shows the seabird interaction rate from 2004–2020 using the data from Table 6.

Almost all interactions in the deep-set fishery occur when fishermen set gear during the day while

seabirds are actively feeding. Seabirds may be hooked or entangled and then drown while the gear sinks. Because most seabirds are inactive at night, very few interactions occur when fishermen typically haul deep-set gear. In 2020 in the deep-set fishery, observers documented interactions with 59 Laysan albatrosses, 95 black-footed albatrosses, 1 brown booby, and 1 sooty shearwater (Table 6). Nearly all of the seabirds observed to interact with the deep-set fishery were dead (92%). Table 7 contains the total estimated number of interactions with Laysan albatrosses, black-footed albatrosses, brown boobies, and sooty shearwaters based on observer records for the deep-set fishery in 2020.

Table 6. Numbers of observed seabird catches, fishing effort, and interaction rates in the combined Hawaii longline fisheries, 2004-2020.

Deep-set Fishery

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species caught	Total birds observed caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2004	2	5	-	2	9	-	9	7,900,681	0.001
2005	6	11	-	1 ¹	18	-	18	9,360,671	0.002
2006	1	17	5	-	23	-	23	7,540,286	0.003
2007	7	18	-	-	25	-	25	7,620,083	0.003
2008	14	30	14	2 ²	60	4	56	8,775,951	0.007
2009	18	23	4	-	45	-	45	7,877,861	0.006
2010	39	17	1	-	57	1	56	8,184,127	0.007
2011	32	13	3	-	48	2	46	8,260,092	0.006
2012	31	36	6	-	73	5	68	8,768,728	0.008
2013	48	49	8	-	105	5	100	9,278,133	0.011
2014	12	38	1	-	51	6	45	9,608,244	0.005
2015	25	101	4	2 ⁴	132	19	113	9,393,234	0.014
2016	33	104	4	3 ⁵	144	7	137	9,882,920	0.015
2017	38	103	-	1 ⁶	142	13	129	10,148,195	0.014
2018	35	190	9	2 ⁸	236	28	208	11,751,242	0.020
2019	43	145	-	1 ⁹	189	8	181	12,948,077	0.015
2020	59	95	1	1 ¹⁰	156	13	143	8,738,011	0.018

Shallow-set Fishery

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species caught	Total birds observed caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2004	1	-	-	-	1	1	-	76,750	0.013
2005	62	7	-	-	69	47	22	1,328,806	0.052
2006	8	3	-	-	11	5	6	745,125	0.015
2007	40	8	-	-	48	40	8	1,292,036	0.037
2008	33	6	-	-	39	24	15	1,350,127	0.029
2009	81	30	1	-	112	88	24	1,767,128	0.063
2010	40	38	-	1 ³	79	61	18	1,828,529	0.043
2011	49	19	-	-	68	53	15	1,611,395	0.042
2012	62	37	-	-	99	78	21	1,418,843	0.070
2013	45	28	2	-	75	48	27	1,000,084	0.075
2014	39	32	1	-	72	56	16	1,509,727	0.048
2015	43	38	-	-	81	65	16	1,286,628	0.063
2016	25	40	-	-	65	50	15	830,177	0.078
2017	6	53	-	1 ⁷	60	38	22	1,051,426	0.057
2018	2	7	-	-	9	7	2	546,371	0.016
2019	15	19	-	-	34	26	8	374,487	0.091
2020	26	5	-	1 ¹¹	32	32	-	588,481	0.054

¹brown booby; ²red-footed booby and unidentified seabird; ³northern fulmar; ⁴red-footed booby and unidentified shearwater; ⁵two red-footed boobies and one unidentified albatross; ⁶unidentified gull; ⁷glaucous-winged gull; ⁸one brown booby and one red-footed booby; ⁹brown booby; ¹⁰brown booby; ¹¹northern fulmar.

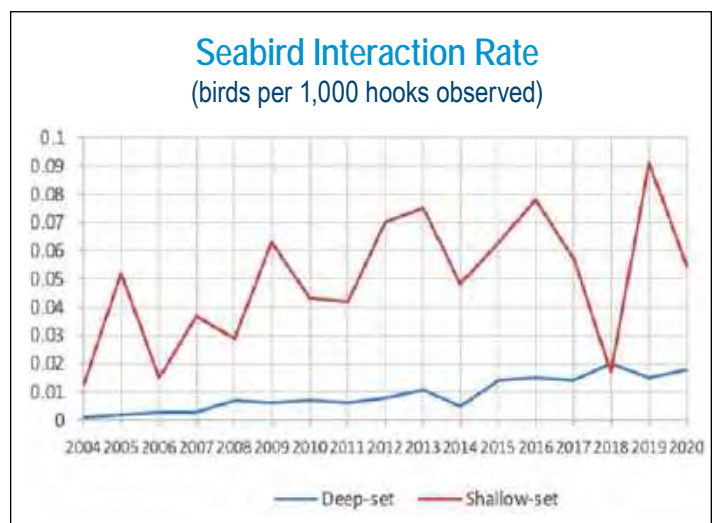
Note: Sustainable Fisheries Observer Program data (unpublished, 10/18/2021) are based on the date and time of the beginning of the haul, with the exception of the total observed effort (hooks), which is based on arrival date from the Sustainable Fisheries Observer Program annual reports (NMFS 2021b and NMFS 2021c). Interaction rates are calculated and rounded to the nearest thousandths (third decimal) place.

Table 7. Estimated total seabird interactions in the Hawaii deep-set longline fishery, 2020.

Species	Total annual estimate
Black-footed albatross	590
Laysan albatross	315
Brown booby	5
Sooty Shearwater	7

Note: Table lists point estimates of the total number of incidental interactions by species in the Hawaii deep-set longline fishery based on observed interactions during 2020. Point estimates are based on the trip arrival date rather than trip haul date. Source: McCracken and Cooper 2021.

Figure 4. Seabird interaction rates in the deep-set and shallow-set longline fisheries, 2004-2020.



The shallow-set fishery typically sets at night and hauls the gear during the day; therefore, most of the interactions occur when fishermen retrieve the gear and birds are actively feeding. In 2020, the shallow-set fishery interacted with 26 Laysan albatrosses, 5 black-footed albatrosses, and 1 Northern fulmar (Table 6). Fishermen released all seabirds alive.

Seabirds can be hooked, entangled, or both. Table 8 provides a summary of capture and release conditions in 2020. Regulations require fishermen to remove as much gear as safely possible from any seabirds captured before releasing the seabirds.

Table 8. Capture details by species for seabird interactions on observed trips in the Hawaii longline fisheries, 2020.

	MANNER OF INTERACTION			
	Hooked only	Entangled only	Both hooked and entangled	Not known or not recorded
Laysan albatross	74	5	6	0
Black-footed albatross	85 ¹	3	12	0
Brown booby	1	0	0	0
Sooty Shearwater	0	1	0	0
Northern Fulmar	1	0	0	0

Note: Regardless of species or manner of capture, all seabirds which were released alive were released without any gear attached to the bird. ¹One dead black-footed albatross (included here) was recorded as hooked, and it was unknown if it was also entangled.

Recovered Seabird Bands

State and Federal agencies and other groups attach identification bands to the legs of birds to study bird movement, survival, and other characteristics. Table 9 provides a summary of observed seabirds with leg bands from Hawaii longline fisheries interactions in 2020.

Most of the recovered bands were from albatrosses banded on French Frigate Shoals in the Northwestern Hawaiian Islands and caught incidentally in the first half of the year.

Table 9. Observed interactions of seabirds with bands in the shallow-set and deep-set Hawaii longline fisheries, 2020.

Species	Disposition	Band(s) recovery date	Date banded	Location banded	Age at banding (yr)	Age at recovery (yr)
Laysan Albatross	Dead	1/18/2020	5/27/1994	French Frigate Shoals (Tern Island)	<1	26
Laysan Albatross	Dead	1/19/2020	6/6/2003	French Frigate Shoals (Tern Island)	<2	17
Black-footed Albatross	Dead	1/30/2020	5/20/2008	French Frigate Shoals (Tern Island)	<1	12
Black-footed Albatross	Dead	1/23/2020	12/28/2003	French Frigate Shoals (Tern Island)	>3	>20
Laysan Albatross	Dead	2/3/2020	12/21/2005	French Frigate Shoals (Tern Island)	<1	15
Black-footed Albatross	Dead	2/8/2020	6/5/2002	French Frigate Shoals (Tern Island)	<1	18
Laysan Albatross	Dead	2/5/2020	5/29/2009	Kauai (Kilauea Point)	<1	11
Black-footed Albatross	Dead	2/6/2020	5/22/2019	Oahu (Kahuku)	<1	1
Black-footed Albatross	Injured	2/12/2020	1/2/2007	Midway Atoll (Eastern Island)	>1	>13
Black-footed Albatross	Dead	2/26/2020	11/29/2005	French Frigate Shoals (Tern Island)	>1	>15

Species	Disposition	Band(s) recovery date	Date banded	Location banded	Age at banding (yr)	Age at recovery (yr)
Black-footed Albatross	Dead	2/6/2020	6/15/2010	French Frigate Shoals (Tern Island)	<1	10
Black-footed Albatross	Dead	2/6/2020	5/31/2002	French Frigate Shoals (Tern Island)	<1	18
Laysan Albatross	Dead	2/8/2020	6/5/1990	French Frigate Shoals (Tern Island)	<1	30
Laysan Albatross	Dead	2/8/2020	12/14/2011	Kauai	>1	>9
Black-footed Albatross	Dead	2/9/2020	2/1/1998	French Frigate Shoals (Tern Island)	>1	>22
Laysan Albatross	Dead	2/10/2020	12/9/2002	French Frigate Shoals (Tern Island)	>3	>21
Laysan Albatross	Dead	2/10/2020	1/15/1981	French Frigate Shoals (Tern Island)	>3	>39
Black-footed Albatross	Dead	2/27/2020	6/16/2010	French Frigate Shoals (Tern Island)	<1	10
Laysan Albatross	Dead	2/19/2020	6/14/2001	French Frigate Shoals (Tern Island)	<1	19
Laysan Albatross	Dead	2/19/2020	5/14/1992	French Frigate Shoals (Tern Island)	<1	28
Laysan Albatross	Dead	3/5/2020	12/9/2002	French Frigate Shoals (Tern Island)	>3	>21
Black-footed Albatross	Dead	3/7/2020	12/9/2015	Midway Atoll (Eastern Island)	>1	>6
Black-footed Albatross	Dead	3/16/2020	6/5/2006	French Frigate Shoals (Tern Island)	<1	14
Black-footed Albatross	Dead	6/7/2020	5/16/2010	French Frigate Shoals (Tern Island)	<1	10
Laysan Albatross	Dead	6/11/2020	4/16/2007	Oahu (Kaena Point)	<1	13

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 10/19 /2021.



Banded Laysan albatross in flight. Credit: NOAA Fisheries.

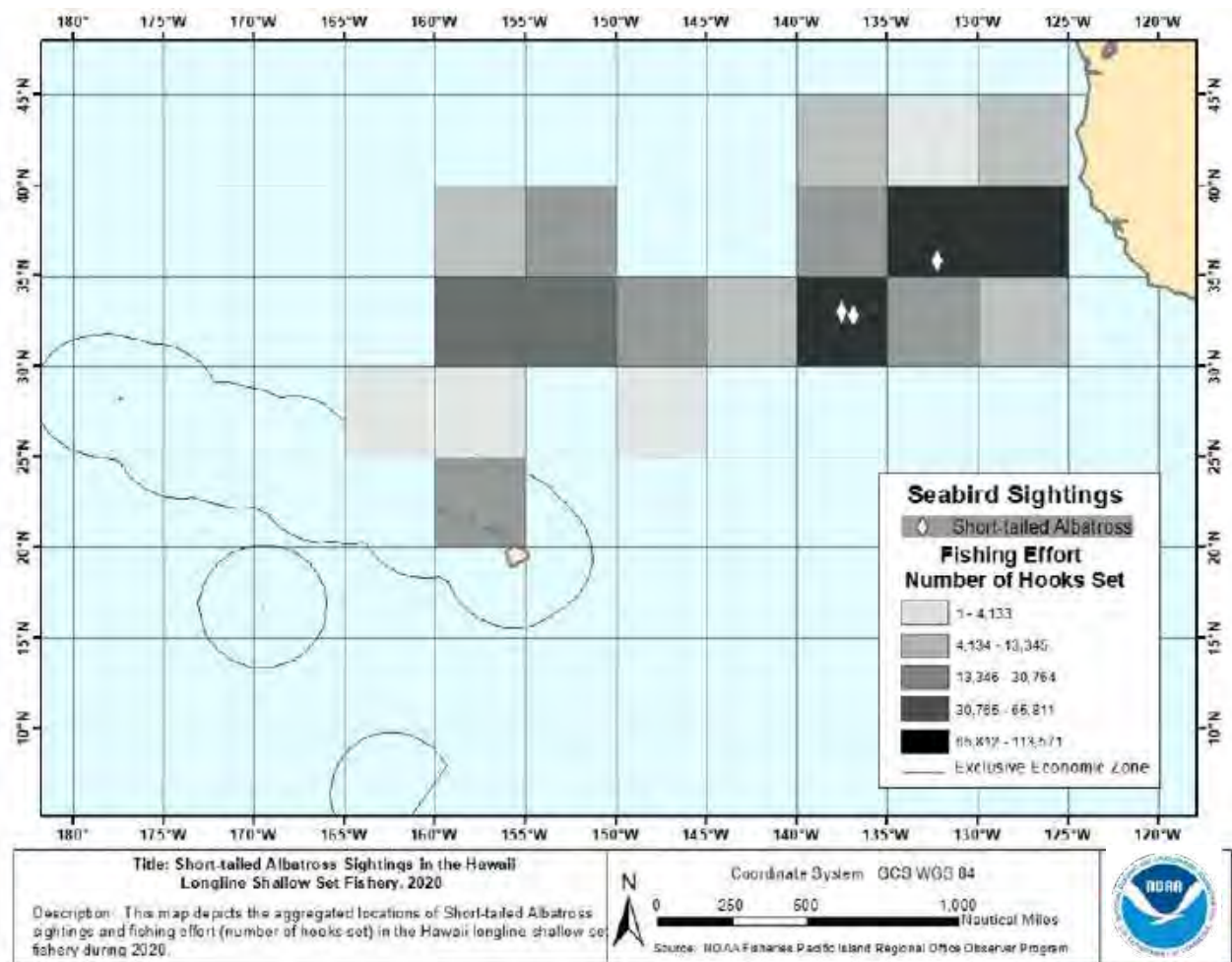
3. ESA-listed Seabirds

There have been no observed interactions (hooking or entanglement) between the fisheries and any ESA-listed seabirds. Three ESA-listed seabird species can be found in areas where the Hawaii longline fisheries operate and are protected under the ESA. These species are the endangered short-tailed albatross (*Phoebastria albatrus*), the Hawaiian dark-rumped

petrel (*Pterodroma sandwichensis*), and the threatened Newell’s shearwater (*Puffinus newelli*). There were four sightings of short-tailed albatross on shallow-set trips in 2020 and no sightings on observed deep-set trips. Figure 5 shows the locations of these sightings compared to the observed fishing effort.

Figure 5. Short-tailed albatross sightings and fishing effort in the Hawaii shallow-set fisheries, 2020.

Note: Two short-tailed albatross sightings occurred on the same haul and in the same geographic area. These sightings are represented together as one diamond.
 Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 10/12/2021.



4. Research

Since NMFS introduced seabird regulations to the Hawaii deep-set fishery in 2001, the overall seabird catch rate has declined, with the exception of black-footed albatross catch rates. These rates have been increasing over the past decade and in 2017, the WPFMC held a workshop to explore the cause of increased interactions with black-footed albatross. The workshop suggested this increase may be due to a positive (warm) Pacific Decadal Oscillation—with its cooler sea surface in the Western Pacific and stronger westerly winds—that may increase the overlap of fishing effort and black-footed albatross foraging grounds. In 2018, the WPFMC held a workshop to review seabird mitigation requirements and identify research needed to inform future fishing requirements that would reduce interactions with seabirds. That workshop identified certain mitigation measures, including tori lines, as a high priority for further research and development due to their potential to provide an effective alternative to blue-dyed bait.

In spring 2019, the WPFMC, the Hawaii Longline Association, NMFS Pacific Islands Fisheries Science Center (PIFSC), and PIRO initiated a joint cooperative research project to design and test tori lines in the deep-set longline fishery. The team researched potential tori line materials and designs and discussed tori line preferences and experiences with longline fishermen. In September 2019, the WPFMC convened a meeting with New Zealand and Japanese tori line experts who provided valuable input on tori line design for vessels similar to the Hawaii longline fishery. With that guidance, the project team developed a tori line with a 50 m-long aerial section with a “light” ultra-high molecular weight polyethylene (UHMWPE) backbone with two 50 cm-long streamers attached every 1 m along the aerial section. The tori line also has a non-anchored 55 m-long drag section consisting of braided ¼” co-polymer “blue steel” line to be used during ocean trials.

Between February and July 2020, four commercial longline vessels conducted ocean trials, deploying 175 longline sets during 17 trips. Trial sets included control sets with blue-dyed bait and strategic offal discards, and experimental sets with tori lines in conjunction with blue-dyed bait and strategic offal



Tori lines deployed from a fishing vessel. Credit: NOAA Fisheries.

discards (Gilman et al. 2021). Control and experimental trials utilized electronic monitoring (EM) technology and stern “bird cam” video for data acquisition and posttrip review analysis and verification. The statistically significant results from the 2020 study indicated that tori lines, when used in conjunction with blue-dyed bait and strategic offal discard practices, significantly reduce albatross feeding attempts and contact with longline gear.

On tori line sets, 99.7% of the attempts and contacts by Laysan and black-footed albatrosses occurred within the aerial section of the tori line. Albatross attempts to contact baited hooks were two times less likely for sets equipped with tori lines rather than without tori lines, and contacts with baited hooks were three times less likely for tori line-equipped sets. Albatrosses were also less likely to be captured in tori line sets, but captures during the study were too few to support strong inference compared with the contact

rates. Project results also indicated that discharging offal and spent bait during setting might exacerbate rather than mitigate seabird catch risk. Offal discharge during setting was associated with higher seabird interactions—but that inference was not strong since offal discharge and blue-dyed bait were confounded treatments in some sets (Gilman et al. 2021).

The project results led the WPFMC to identify the need for additional research to test the effectiveness of tori lines without blue-dyed bait and offal discharge (WPFMC 2021). That research began in January 2021 under an experimental fishing permit issued by NMFS pursuant to regulations at 50 CFR 556.17.

5. Summary

Table 10 compares the 2019 and 2020 observed interactions in the two fisheries. The interaction rate from 2019 to 2020 increased for the deep-set fishery and decreased for the shallow-set fishery. In 2019, the shallow-set fishery interacted with 34 seabirds (15 Laysan albatrosses and 19 black-footed albatrosses). In 2020, it interacted with 32 seabirds (26 Laysan albatrosses, 5 black-footed albatrosses, and 1 Northern fulmar). In 2019, observers in the deep-set fishery documented interactions with 189 seabirds (43 Laysan albatrosses, 145 black-footed albatrosses, and 1 brown booby). In 2020, observers in that fishery documented interactions with 156 seabirds (59 Laysan albatrosses, 95 black-footed albatrosses, 1 brown booby, and 1 sooty shearwater) (see Table 6).

Table 10. Comparison of observed interactions in Hawaii longline fisheries, 2019 and 2020.

Observed Interactions	2019	2020
Seabirds observed in deep-set fishery	189	156
Seabirds observed in shallow-set fishery	34	32
Deep-set interaction rate (birds per 1,000 hooks observed)	0.015	0.018
Shallow-set interaction rate (birds per 1,000 hooks observed)	0.091	0.054

Note: There was 20.54% and 15.25% observer coverage in the deep-set longline fishery in 2019 and 2020, respectively, and 100% coverage in the shallow-set longline fishery.

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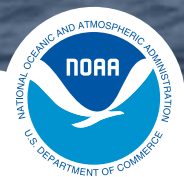
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Seabird Interactions and Mitigation Efforts in Hawaii Longline Fisheries

2019 ANNUAL REPORT



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April 2021

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Please note: Data in this report are considered to be preliminary, and may be revised as better information becomes available. For the most current data, please contact the NMFS Pacific Islands Regional Office.

*Front cover: Endangered Hawaiian dark-rumped petrel spotted flying above two black-footed albatrosses.
Credit: NOAA Fisheries/Hollyann Naholowaa*

*Back cover: Looking to the future. A tori line design flies behind a vessel during a research trial at sea.
Credit: WPFMC/Hollyann Naholowaa*



*Black-footed albatross pair preening at sea.
Credit: NOAA Fisheries/Hollyann Naholowaa*

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1. Introduction

The National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO) is responsible for minimizing, as practicable, interactions between Hawaii pelagic longline fishing operations and seabirds. To minimize interactions and their severity, NMFS monitors the fisheries to determine the effectiveness of the management measures implemented. NMFS documents interactions and mitigation efforts aboard vessels at sea, and it reports annually on fishing effort, seabird interactions, and mitigation research.¹ [View this report, and similar reports from previous years online.](#)

1.1 Background

NMFS and the Western Pacific Fishery Management Council (WPFMC) manage two Hawaii pelagic longline fisheries under the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific (FEP) and implementing regulations. The deep-set longline fishery targets primarily bigeye tuna at depths to 400 meters (m) and operates mainly north-northeast and southwest of the main Hawaiian Islands. The shallow-set longline fishery targets swordfish at depths to 100 m and typically operates north and east of the Hawaiian Islands. The FEP contains a detailed description of the two fisheries (WPFMC 2009, as amended).

Since 1994, the Hawaii longline fleet has been limited to 164 permits; a permit allows fishing in both the shallow- and deep-set fisheries. Activity levels in any given year since 2004 range from 11 to 35 vessels in the shallow-set fishery and 111 to 150 vessels in the deep-set fishery. Nearly all vessels in the shallow-set fishery also participate, to some degree, in the deep-set fishery.

Laysan albatrosses, black-footed albatrosses, shearwaters, fulmars, boobies, and endangered short-tailed albatrosses feed around the Hawaiian Islands in areas where the longline fisheries operate. During the deployment (setting) and retrieval (hauling) of longline fishing gear, hooks and line may occasionally hook or entangle seabirds that attempt to take bait or catch. Seabirds are more likely to drown when the interaction occurs during setting because the weight of the gear may pull the seabird underwater. Although some interactions are inevitable, fishermen take steps to avoid and minimize interactions.

In 2000, NMFS estimated that there were 2,433 seabird interactions in the Hawaii longline fisheries. Beginning in 2001, NMFS implemented a series of seabird mitigation measures, including seabird-deterrent fishing gear and techniques, that have reduced interactions. In 2019, there were 34 observed interactions in the shallow-set fishery, which has 100 percent observer coverage, and an estimated 1,002 interactions in the deep-set fishery, which has approximately 20 percent observer coverage.

¹This annual report is required in the Terms and Conditions of the 2012 Biological Opinion of the U.S. Fish and Wildlife Service for the operation of Hawaii-based Pelagic Longline Fisheries (USFWS 2012).



Hawaii pelagic longline fishing vessels in port. Credit: NOAA Fisheries

1.2 Seabird Mitigation Measures for the Hawaii Longline Fisheries

Most of the regulations for Hawaii longline fisheries are identified in Title 50, Code of Federal Regulations, Parts [600](#) and [665](#) (50 CFR Parts 600 and 665). NMFS also provides a [regulation summary and compliance guides](#) to Hawaii longline fishermen and the general public.

Regulations specific to the mitigation of seabird interactions and safe handling techniques are at 50 CFR 665.815. The ways that fishermen implement required seabird mitigation measures depend on their fishing methods and locations. Mitigation measures to reduce seabird interactions differ between stern-setting and side-setting. The following sections describe each of the main gear and operation requirements. The 2012 Biological Opinion (USFWS 2012) also describes these measures.

Side-Setting

Side-setting involves deploying the gear from the side of the vessel, compared with the conventional method of setting from the stern. In side-setting, crewmen set baited hooks forward and close to the side of the vessel's hull, where seabirds are unable or unwilling to pursue the hooks. With required branch line weighting, the baited hooks will have sunk to a depth where seabirds cannot reach them by the time the vessel stern passes the location where baited hooks have been set (Gilman and Brothers 2006; Gilman et al. 2005, 2007a, 2007b). Additionally, deploying a required bird curtain aft of where crew is deploying the gear inhibits seabirds from landing on the water along the side of the vessel where baits are accessible.

Table 1 summarizes the number of Hawaii deep- and shallow-set vessels observed to set from the stern and from the side in 2019, with some vessels operating in both deep- and shallow-set longline fisheries. In 2019, most vessels in the deep-set fishery and none in the shallow-set fishery chose to stern-set.

Table 1. Number of observed Hawaii longline vessels that side- and stern-set in 2019.

Fishery	Deck setting position	Vessels
Deep-set	Stern-setting	115
Deep-set	Side-setting	25
Shallow-set	Stern-setting	15
Shallow-set	Side-setting	0

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 5/12/2020.

Weighted Branch Lines

Fishermen place weights close to the hook on branch lines so that baited hooks sink quickly. This helps prevent foraging seabirds from possibly becoming hooked or entangled in longline gear. When deep-setting north of 23° N (either stern- or side-setting), or shallow- and side-setting anywhere, Hawaii fishermen must attach a weight of at least 45 g within 1 m of the hook to sink the branch line quickly. Fishermen commonly use weights from 45 to 80 g.



Black-footed albatross feeding on strategic offal discard.
Credit: NOAA Fisheries/Hollyann Naholowaa

Thawed and Blue-dyed Bait

Dyeing bait to a specific blue color reduces visibility by reducing contrast with the sea surface. Fishermen first thaw the bait to increase sink rates and to allow a more effective penetration of the blue dye. Almost all bait used in the Hawaii longline fisheries consists of the fusiform fishes mackerel (saba), sardines, and saury (sanma). To reduce sea turtle interactions, NMFS prohibits the use of squid bait in the shallow-set fishery. Fishermen may still use squid in the deep-set fishery, but the squid bait costs more than some fish bait, making it less preferred.

Strategic Offal Discards

Strategically discarding offal (swordfish heads and livers) on the opposite side of the vessel from fishing operations distracts seabirds from attempting to steal baits. Fishermen developed this technique and NMFS observers in the mid-1990s noted that it reduced

incidental hooking or entanglement of albatrosses. Strategic offal discard is now required when stern- and deep-setting north of 23° N, or stern- and shallow-setting anywhere.

Night-Setting

Night-setting as a seabird mitigation measure in the shallow-set fishery is based on the premise that seabirds cannot see baited hooks in the dark. The measure requires shallow-set fishermen, when stern-setting, to start deploying gear no earlier than one hour after local sunset and complete the set no later than the following sunrise. The measure also requires using the minimum lighting necessary to conform to navigation rules and best safety practices. Night-setting has been a very effective seabird mitigation measure, reducing seabird interactions as much as 98% (McNamara et al. 1999, Boggs 2003).

Table 2 summarizes the seabird mitigation requirements.

Table 2. Seabird mitigation requirements for the Hawaii longline fleet.

Mitigation Method	Stern-setting		Side-setting	
	Shallow-Set Anywhere	Deep-Set North of 23° N	Shallow-Set Anywhere	Deep-Set North of 23° N
Deploy mainline from port or starboard side at least 1 m forward of stern corner	-	-	Yes	Yes
If line shooter is used, mount it at least 1 m forward from stern corner	-	-	Yes	Yes
Use a specified bird curtain aft of the setting station during the set	-	-	Yes	Yes
Deploy gear so that hooks do not resurface	-	-	Yes	Yes
Attach 45 g or heavier weights within 1 m of hook of each hook	-	Yes	Yes	Yes
Use a line shooter to set the mainline	-	Yes	-	-
Keep two 1-pound containers of blue-dye on boat	Yes	Yes	-	-
Use completely thawed and blue-dyed bait	Yes	Yes	-	-
Keep fish parts and spent bait with all hooks removed for strategic offal discard	Yes	Yes	-	-
Cut all swordfish heads in half, and use heads and livers for strategic offal discard	Yes	Yes	-	-
Night Set - begin set 1 hour after local sunset and finish 1 hour before next sunrise and keep lighting to a minimum	Yes	-	-	-

1.3 Protected Species Workshops


In addition to gear and operational mitigation measures to deter or reduce seabird interactions, owners and operators of pelagic longline vessels must complete a protected species workshop each year (50 CFR 665.814). The workshop includes training in identification, safe handling, and release techniques for sea turtles, marine mammals, and seabirds (Fig. 1). The workshop also reviews regulatory and compliance requirements. In a classroom setting, fishermen learn from oral presentations, hands-on demonstrations, videos, and printed reference materials. NMFS also offers the workshops online for those who have taken a classroom workshop within the past three years. Owners and operators must have a valid workshop certificate to obtain or renew Federal longline fishing permits, and they must keep a copy of it on board the vessel.

In 2019, NMFS PIRO provided protected species workshop training for 283 Hawaii-based and 39 American Samoa-based longline vessel owners, operators and crew, and other interested individuals.




Protected species workshop in-person training. Credit: NOAA Fisheries

Figure 1. Illustrated seabird handling guidelines developed for use and distribution in protected species workshops.




Seabird Handling Guidelines


Hawaii Pelagic Longline Fisheries




YOU WILL NEED → towel




bolt/wire cutter or pliers




dip net






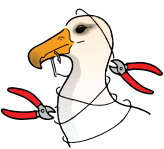
gloves



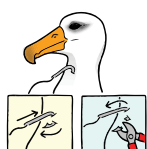
safety glasses




safe enclosure for bird

- 
 - Stop vessel to reduce tension on line.
 - Wear gloves, safety glasses, and arm covers for protection.
 - Use dip net to bring bird onto vessel.
- 
 - Hold bird by bill without covering nostrils.
 - Fold wings into bird's body.
- 
 - Cover bird with towel to protect and calm it.
 - Straddle bird if necessary.
- 

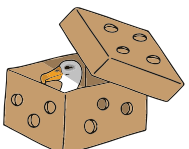

Remove any entangled lines.

NOTE: If the bird is an albatross with a bright pink bill, it may be a short-tailed albatross (STAL). See reverse side for the rest of the STAL handling requirements as per (50 CFR 665.815(b)).
- 


If you can handle hook but cannot see barb:

 - Push hook through skin to expose barb.
 - Use pliers to flatten barb or bolt cutters to cut off barb.
 - Back hook out.
- 

If you cannot handle hook (it's deeply ingested):

 - Cut as much line off as possible and leave hook in bird.
- 
 - Leave bird to recover in safe enclosed space.
 - Do not provide food or water to bird.
- 

Bird can be released to sea surface when:

 - Feathers are dry. (approximately 1/2 to 4 hours)
 - Bird is alert and head is erect.
 - Breathes without noise.
 - Wings can flap and retract onto back.
 - Stands on both feet with toes forward.
- 

If bird has not recovered after 4 hours, either

Release bird to sea surface or call nearby bird rescue center for guidance (vessels 1-2 days from port):

 - Honolulu (808-884-5000)
 - Los Angeles (310-514-2573)
 - San Francisco (707-207-0380)

Please report all banded birds: 1-800-327-BAND (2263) or www.pwrc.usgs.gov/bbi

Questions? Call NMFS Pacific Islands Regional Office, Sustainable Fisheries Division at (808) 725-5000

1.4 Fishing Effort and Observer Coverage

Table 3 summarizes fishing effort data from 2018 and 2019 by haul date. From 2018– to 2019, the number of deep-set fishing trips increased by 5.0% and shallow-set fishing trips decreased by 6.7%.

Please note that other summaries throughout this report and elsewhere may vary slightly depending upon the data source, including revisions. For example, observers may report seabird interactions by date of trip (departure or arrival), set date, or haul date in a given year. NMFS typically bases observer coverage levels on the trip departure date. The NMFS Sustainable Fisheries Observer Program typically bases protected species interactions on vessel arrival date in their [quarterly, semiannual, and annual reports](#). NMFS also provides summary reports from mandatory logbook data reported by captains.

Table 3. Hawaii deep- and shallow-set longline fisheries effort and observer coverage, 2018 and 2019.

2018		
	Deep-set	Shallow-set
Number of vessels	143	11
Trips	1,642	30
Sets	20,994	420
Hooks	58,500,893	486,013
Observer coverage	20.36%	100%

2019		
	Deep-set	Shallow-set
Number of vessels	150	15
Trips	1,742	28
Sets	22,513	312
Hooks	63,174,971	374,487
Observer coverage	20.54%	100%

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished shallow-set data, 5/12/2020, and NMFS 2020a and NMFS 2020b.



Fisheries Observer Hollyann Naholowaa demonstrates proper handling of a black-footed albatross before successfully releasing it back to the wild after an interaction. Credit: NOAA Fisheries



Black-footed albatross. Credit: NOAA Fisheries/Hollyann Naholowaa

2. Interactions

2.1 Species

NMFS observers have recorded the following bird species being hooked or entangled in the longline fisheries since 1994, when NMFS began deploying observers: Laysan albatross (*Phoebastria immutabilis*), black-footed albatross (*P. nigripes*), sooty shearwater (*Puffinus griseus*), unidentified shearwaters, brown booby (*Sula leucogaster*), red-footed booby (*S. sula*), Northern fulmar (*Fulmarus glacialis*), glaucous winged gull (*Larus glaucescens*), and an unidentified gull (Table 4). None of these species is listed under the Endangered Species Act (ESA) and both Hawaii longline fisheries have a low level of interactions with these species. Based on the population estimates, the fisheries likely have very little effect on these populations.

Table 4. Species recorded hooked or entangled in Hawaii longline fisheries.

Species	Global population estimate	Demographic information
Laysan albatross	666,658 breeding pairs (ACAP 2017)	The Northwestern Hawaiian Islands (NWHI) has the world's largest colonies and more than 99% of the global breeding population (ACAP 2012a)
Black-footed albatross	69,969 pairs (ACAP 2017)	More than 95% of the population breeds in the NWHI (ACAP 2012b)
Northern fulmars	20 million individuals (Birdlife 2020a)	Located throughout the North Atlantic and North Pacific
Red-footed booby	More than 1 million birds (Birdlife 2020b)	Winters on tropical islands in most oceans
Brown booby	More than 200,000 adults (Birdlife 2020c)	Located throughout the pan-tropical oceans
Sooty shearwaters	8,800,000 adults (Birdlife 2020d)	Nest in Australia, New Zealand, and southern South America
Glaucous-winged gull	More than 570,000 individuals (Birdlife 2020e)	Located along the Pacific coast of North America to the northern coast of Japan



Sooty shearwater. Credit: NOAA Fisheries/Hollyann Naholowaa

Some seabirds, especially shearwaters, are difficult to identify. Table 5 provides a summary of seabird specimens that NMFS observers collected for identification and biological study after capture in the Hawaii longline fisheries in 2019. NMFS observers retain as specimens the first dead Laysan and black-footed albatrosses recovered from each trip, any banded Laysan and black-footed albatrosses, and all other non-Laysan and black-footed albatross species recovered dead from fishing operations. NMFS freezes and ships seabird specimens to the Marine Wildlife Veterinary Care and Research Center in Santa Cruz, California. Since 2007, staff with the organization Oikonos have been collecting morphometric data on shipped specimens.

Table 5. Summary of collected seabirds from the Hawaii longline fisheries, 2019.

Species	Number retained
Black-footed albatross	55
Laysan albatross	32
Brown booby	1

Note: Not all dead seabirds are collected as specimens. Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 5/12/2020.

2.2 Location of Interactions

Figs. 2 and 3 show the spatial distribution of observed seabird interactions in deep- and shallow-set fisheries, respectively, based on observations of seabirds in 2019. Most of the interactions occur north of 20° N, where seabirds are typically more abundant and fishing effort is more concentrated.

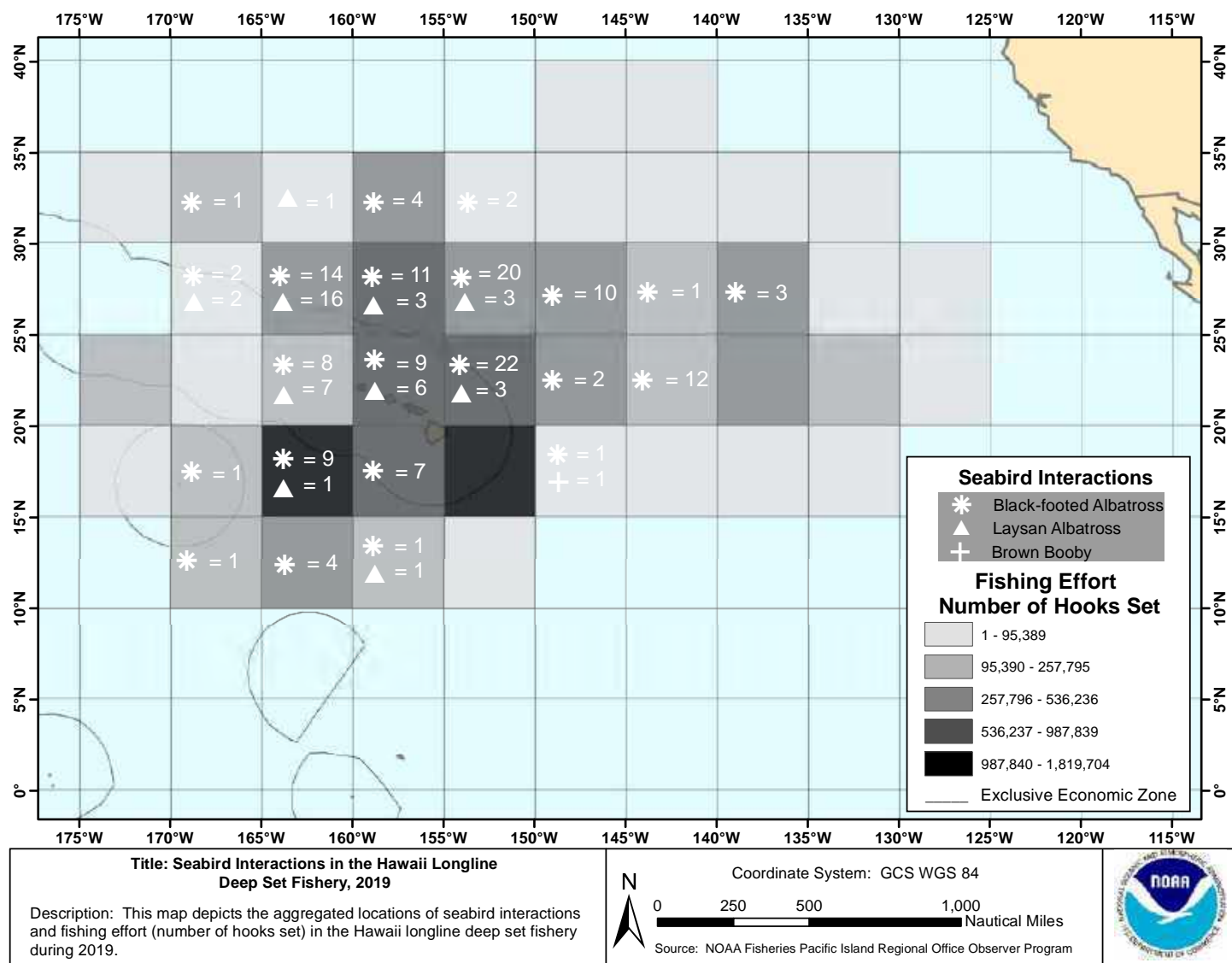


Figure 2. Locations of seabird interactions observed in Hawaii deep-set longline fishery, 2019.

Note: NMFS deployed observers on 20.54% of deep-set trips in 2019.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 5/12/2020.

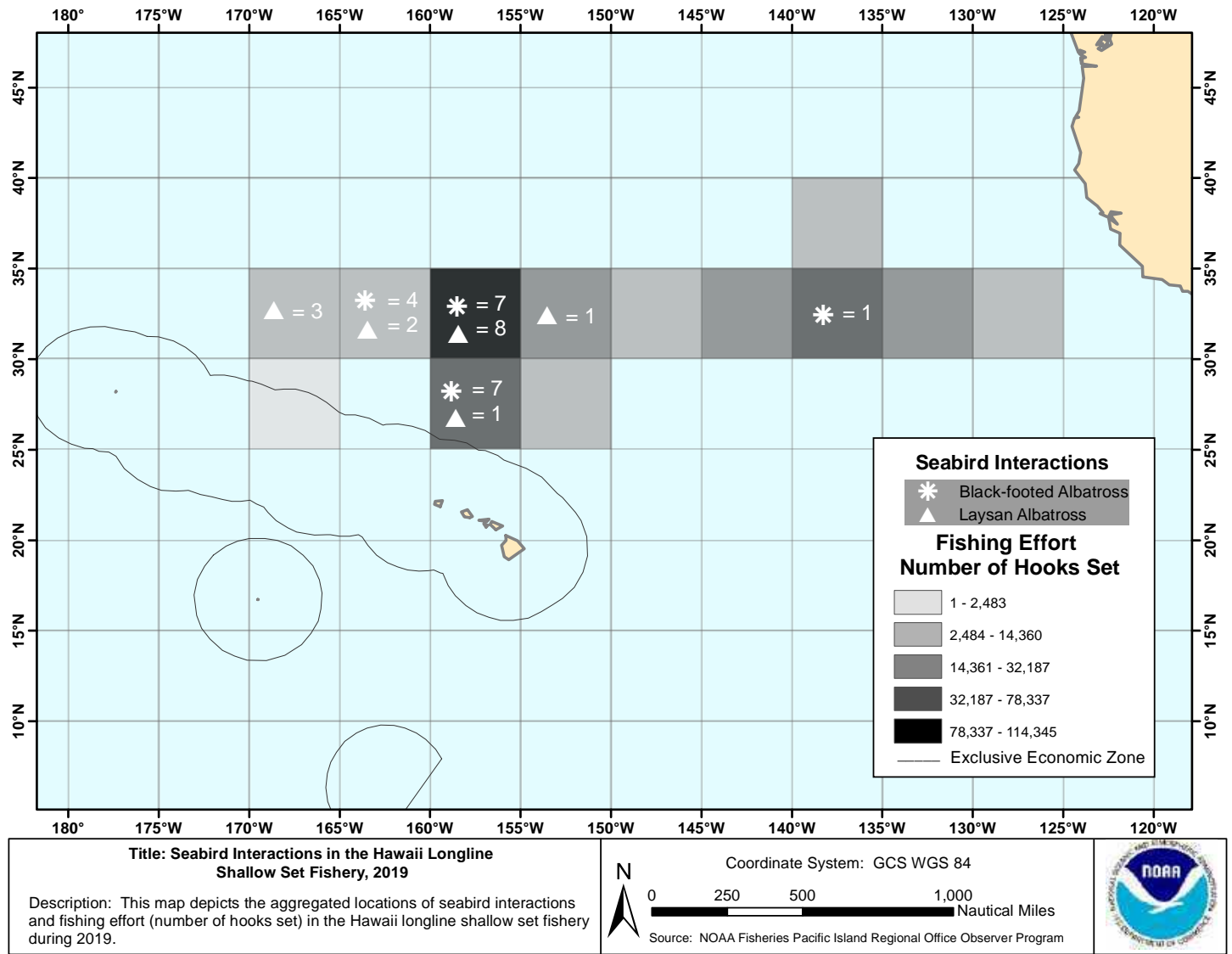


Figure 3. Locations of seabird interactions observed in Hawaii shallow-set longline fishery, 2019.

Note: NMFS deployed observers on every shallow-set trip in 2019.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 5/12/2020.

2.3 Number of Interactions

Table 6 summarizes the number of observed seabird interactions, condition of the seabirds upon release, and fishing effort in both fisheries from 2004-2019. During that period, NMFS deployed observers on 100% of shallow-set fishing trips; therefore, the number of interactions shown in Table 6 represents the fishery-wide totals. NMFS deployed observers on 20.54% of deep-set trips in 2019, so we expanded the observed interactions using the observer coverage rate to estimate total interactions (Table 7). Fig. 4 shows the seabird interaction rate from 2004-2019 from Table 6.

Almost all interactions in the deep-set fishery occur when fishermen set gear during the day, when seabirds are actively feeding. Seabirds may be hooked or entangled, and then drown while the gear sinks. Because most seabirds are inactive at night, very few interactions occur when fishermen typically haul deep-set gear. In 2019 in the deep-set fishery, observers documented interactions with 43 Laysan albatrosses, 145 black-footed albatrosses, and 1 brown booby (Table



Black-footed albatross interacting with a baited hook.
Credit: NOAA Fisheries/Hollyann Naholowaa

6). Nearly all of the seabirds observed to interact with the deep-set fishery were dead (96%). Table 7 contains the total estimated number of interactions with Laysan albatross, black-footed albatross, and brown booby based on observer records for the deep-set fishery in 2019.

Table 6. Numbers of observed seabird catch levels, fishing effort, and interaction rates in the combined Hawaii longline fisheries, 2004-2019.

Deep-set Fishery

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species caught	Total birds observed caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2004	2	5	-	2	9	-	9	7,900,681	0.001
2005	6	11	-	1 ¹	18	-	18	9,360,671	0.002
2006	1	17	5	-	23	-	23	7,540,286	0.003
2007	7	18	-	-	25	-	25	7,620,083	0.003
2008	14	30	14	2 ²	60	4	56	8,775,951	0.007
2009	18	23	4	-	45	-	45	7,877,861	0.006
2010	39	17	1	-	57	1	56	8,184,127	0.007
2011	32	13	3	-	48	2	46	8,260,092	0.006
2012	31	36	7	-	74	5	67	8,768,728	0.008
2013	48	49	8	-	105	5	100	9,278,133	0.011
2014	12	38	1	-	51	6	45	9,608,244	0.005
2015	25	101	4	2 ⁴	132	19	113	9,393,234	0.014
2016	33	104	4	3 ⁵	144	7	137	9,882,920	0.015
2017	38	103	-	1 ⁶	142	13	129	10,148,195	0.014
2018	35	190	9	2 ⁸	236	28	208	11,751,242	0.020
2019	43	145	-	1 ⁹	189	8	181	12,948,077	0.015

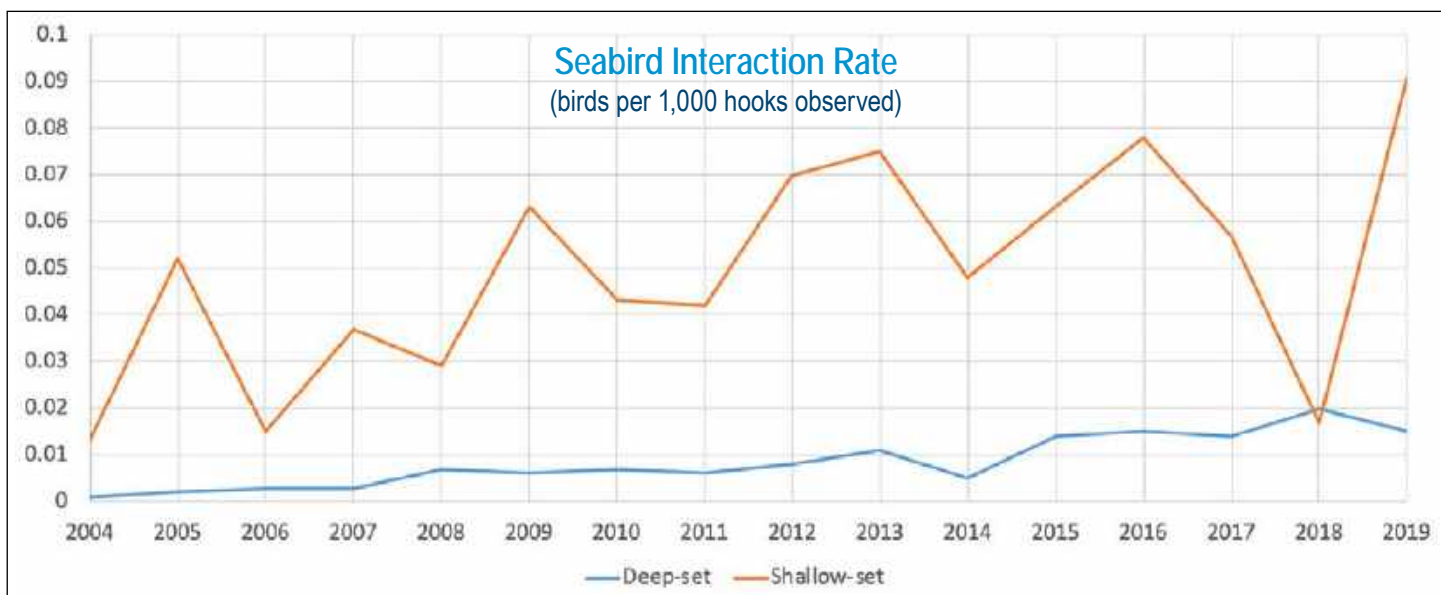
Shallow-set Fishery

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species caught	Total birds observed caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2004	1	-	-	-	1	1	-	76,750	0.013
2005	62	7	-	-	69	47	22	1,328,806	0.052
2006	8	3	-	-	11	5	6	745,125	0.015
2007	40	8	-	-	48	40	8	1,292,036	0.037
2008	33	6	-	-	39	24	15	1,350,127	0.029
2009	81	30	1	-	112	88	24	1,767,128	0.063
2010	40	38	-	1 ³	79	61	18	1,828,529	0.043
2011	49	19	-	-	68	53	15	1,611,395	0.042
2012	62	37	-	-	99	77	21	1,418,843	0.070
2013	45	28	2	-	75	48	27	1,000,084	0.075
2014	39	32	1	-	72	56	16	1,509,727	0.048
2015	43	38	-	-	81	65	16	1,286,628	0.063
2016	25	40	-	-	65	50	15	830,177	0.078
2017	6	53	-	1 ⁷	60	38	22	1,051,426	0.057
2018	2	7	-	-	9	7	2	546,371	0.016
2019	15	19	-	-	34	26	8	374,487	0.091

¹brown booby; ²red-footed booby and unidentified seabird; ³northern fulmar; ⁴red-footed booby and unidentified shearwater; ⁵two red-footed boobies and one unidentified albatross; ⁶unidentified gull; ⁷glaucous-winged gull; ⁸one brown booby and one red-footed booby; ⁹brown booby.

Note: Sustainable Fisheries Observer Program data (unpublished, 5/12/2020) are based on the date and time of the beginning of the haul, with the exception of the total observed effort (hooks), which is based on arrival date from the Sustainable Fisheries Observer Program annual reports (NMFS 2020c and NMFS 2020d). Interaction rates are calculated and rounded to the nearest thousandths (third decimal) place.

Figure 4. Seabird interaction rates in the deep-set and shallow-set longline fisheries, 2004-2019.





Juvenile masked booby stretching its wings after resting on a fishing vessel. Credit: NOAA Fisheries/Hollyann Naholowaa

Fishermen in the shallow-set fishery typically set at night and haul gear during the day; therefore, most seabird interactions occur when fishermen retrieve the gear and birds are actively feeding. In 2019, the shallow-set fishery interacted with 15 Laysan albatrosses and 19 black-footed albatrosses (Table 6). Fishermen released approximately 76% of seabirds alive.

Seabirds can be hooked, entangled, or both. Table 8 provides a summary of capture and release conditions in 2019. Regulations require fishermen to remove as much gear as is safely possible from any seabirds captured before releasing the seabirds.

Table 7. Estimated total seabird interactions in the Hawaii deep-set longline fishery, 2019.

Species	Total annual estimate
Black-footed albatross	767
Laysan albatross	231
Brown booby	4

Note: Table lists point estimates of the total number of incidental interactions by species in the Hawaii deep-set longline fishery based on observed interactions during 2019. Point estimates are based on the trip arrival date rather than trip haul date. Source: McCracken and Cooper 2020.

Table 8. Capture and release details by species for seabird interactions in the Hawaii longline fisheries, 2019.

	Hooked only	Entangled only	Both hooked and entangled	Not known or not recorded
Laysan albatross	45	8	5	0
Black-footed albatross	140	14	9	1
Brown booby	1	0	0	0

Note: None of the seabirds released alive had any gear attached. One black-footed albatross (dead) was recorded as entangled, but it was unknown if it was also hooked. It is included in the Entangled only column here.

Recovered Seabird Bands

State and Federal agencies and other groups attach identification bands to the legs of birds to study bird movement, survival, and other characteristics. Table 9 provides a summary of observed seabirds with leg bands from Hawaii longline fisheries interactions in 2019. Most of the recovered bands were from albatrosses banded on French Frigate Shoals in the NWHI and caught incidentally in the first half of the year.

Table 9. **Observed interactions of seabirds with bands in the shallow-set and deep-set Hawaii longline fisheries, 2019.**

Species	Disposition	Band(s) recovery date	Date banded	Location banded	Age at banding (yr)	Age at recovery (yr)
Black-footed Albatross	Dead	1/4/2019	6/3/2003	French Frigate Shoals (Tern Island)	<1	16
Black-footed Albatross	Dead	1/14/2019	6/5/2002	French Frigate Shoals (Tern Island)	<1	17
Laysan Albatross	Dead	1/14/2019	6/3/2002	French Frigate Shoals (Tern Island)	<1	17
Black-footed Albatross	Dead	1/17/2019	12/14/2011	Laysan Island	>1	>8
Black-footed Albatross	Dead	1/18/2019	5/2/2008	French Frigate Shoals (Tern Island)	<1	11
Laysan Albatross	Dead	1/21/2019	5/27/1997	French Frigate Shoals (Tern Island)	<1	22
Laysan Albatross	Dead	1/22/2019	6/5/1984	French Frigate Shoals (Tern Island)	<1	35
Black-footed Albatross	Dead	1/20/2019	6/12/2010	French Frigate Shoals (Tern Island)	<1	9
Laysan Albatross	Dead	1/25/2019	6/28/2010	French Frigate Shoals (Tern Island)	<1	9
Black-footed Albatross	Dead	1/28/2019	6/4/2007	Kure Atoll (Green Island)	<1	12
Laysan Albatross	Dead	1/23/2019	6/17/2004	French Frigate Shoals (Tern Island)	<1	15
Laysan Albatross	Dead	1/26/2019	6/20/2007	French Frigate Shoals (Tern Island)	<1	12
Black-footed Albatross	Dead	2/3/2019	2/26/1998	Oahu (Waialua)	>2	>23
Laysan Albatross	Injured	2/16/2019	5/26/1994	French Frigate Shoals (Tern Island)	<1	25
Black-footed Albatross	Dead	2/28/2019	12/26/2007	French Frigate Shoals (Tern Island)	>1	>12
Laysan Albatross	Injured	2/9/2019	6/9/2005	French Frigate Shoals (Tern Island)	<1	14
Black-footed Albatross	Dead	2/27/2019	5/22/2007	French Frigate Shoals (Tern Island)	<1	12
Black-footed Albatross	Dead	3/3/2019	6/2/2003	French Frigate Shoals (Tern Island)	<1	16
Black-footed Albatross	Dead	3/12/2019	6/4/2008	French Frigate Shoals (Tern Island)	<1	11
Black-footed Albatross	Dead	3/18/2019	5/7/2010	French Frigate Shoals (Tern Island)	<1	19
Black-footed Albatross	Dead	3/20/2019	6/4/2009	Laysan Island	<1	10
Black-footed Albatross	Dead	3/20/2019	5/30/2002	French Frigate Shoals (Tern Island)	<1	17
Laysan Albatross	Dead	3/23/2019	1/26/2004	Kauai (Kilauea Point)	>3	>18
Laysan Albatross	Injured	3/23/2019	5/14/2014	Kauai (Kilauea Point)	<1	5
Black-footed Albatross	Injured	5/18/2019	5/14/1992	French Frigate Shoals (Tern Island)	<1	27
Black-footed Albatross	Dead	5/18/2019	4/22/2011	French Frigate Shoals (Tern Island)	<1	8
Black-footed Albatross	Dead	5/29/2019	6/7/1999	French Frigate Shoals (Tern Island)	<1	20
Laysan Albatross	Dead	5/31/2019	6/4/2003	French Frigate Shoals (Tern Island)	<1	16
Black-footed Albatross	Injured	6/11/2019	6/9/2004	French Frigate Shoals (Tern Island)	<1	15
Laysan Albatross	Dead	6/18/2019	4/10/2015	Lehua Island, HI	<1	4
Laysan Albatross	Dead	6/17/2019	4/14/2008	Oahu (Kaena Point)	>1	>11

Source: USGS, USFWS, and NMFS, unpublished data, received 5/12/2020.

3. ESA Listed Seabirds

There have been no observed interactions (hooking or entanglement) between the fisheries and any ESA-listed seabirds. The distributions of three seabird species that are protected under the ESA— the endangered short-tailed albatross, the Hawaiian dark-rumped petrel (*Pterodroma sandwichensis*), and the threatened Newell’s shearwater (*Puffinus newelli*)—overlap with the areas where the Hawaii longline fisheries operate. There were six sightings of short-tailed albatross on shallow-set trips in 2019 and no sightings on observed deep-set trips. Fig. 5 shows the locations of these sightings compared with the observed fishing effort.



Endangered short-tailed albatross juvenile spotted with a group of black-footed albatrosses. Credit: NOAA Fisheries

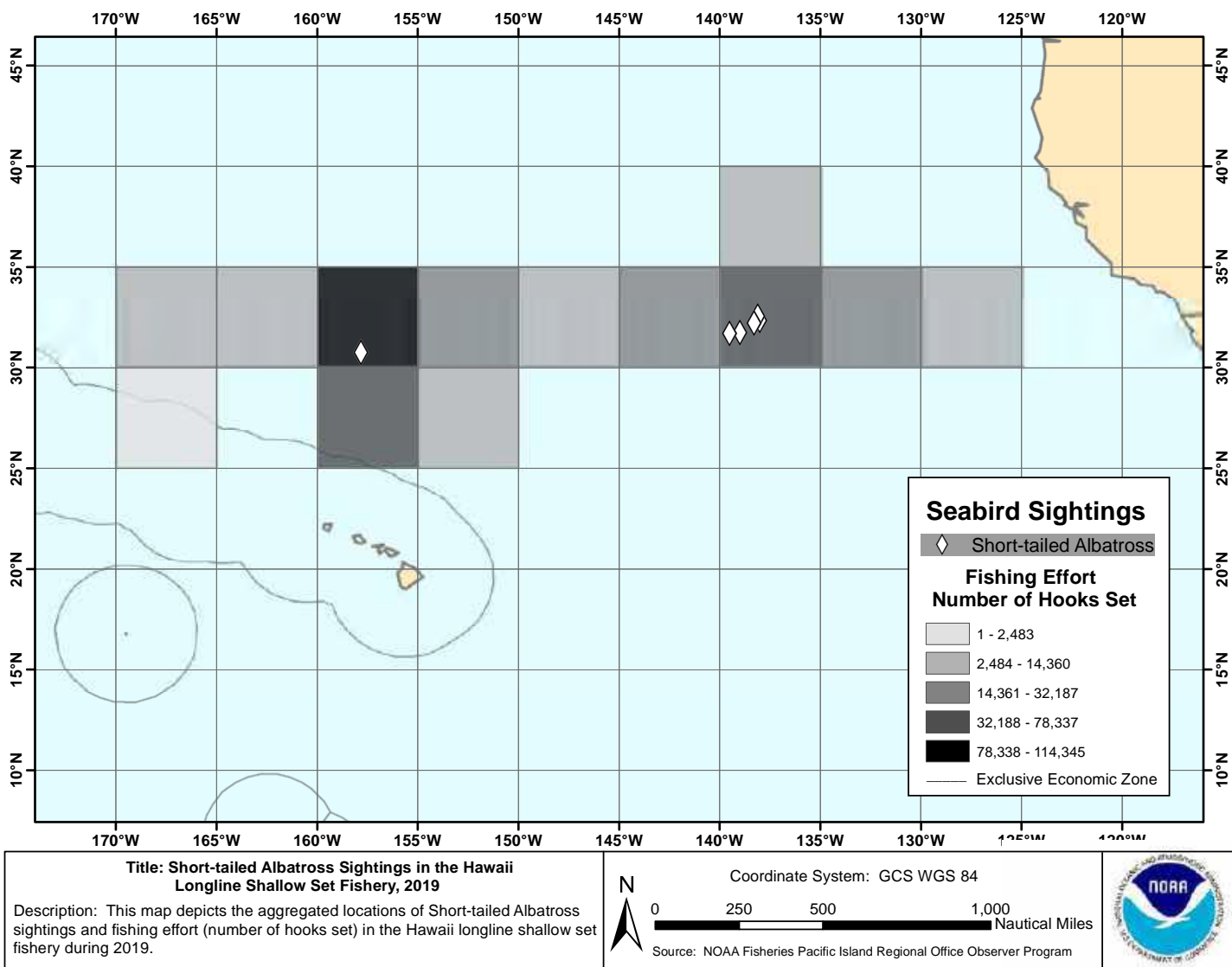


Figure 5. **Short-tailed albatross sightings and fishing effort in the Hawaii shallow-set fisheries, 2019.**

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 5/12/2020.

4. Research

Since NMFS introduced seabird regulations in the Hawaii deep-set fishery in 2001, the overall seabird catch rate had declined, with the exception of black-footed albatross catch rates that have been increasing over the past decade. In 2017, the WPFMC held a workshop to explore the cause of increased interactions with black-footed albatrosses. The workshop suggested that a positive (warm) Pacific Decadal Oscillation, with its cooler sea surface in the western Pacific and stronger westerly winds, may increase the overlap of fishing effort and black-footed albatross foraging grounds, leading to more seabird interactions in the fishery. In 2018, the WPFMC held a workshop to review seabird mitigation requirements and identify research needed to inform future fishing requirements to reduce interactions with seabirds. That workshop identified certain mitigation measures, including tori lines, as a high priority for further research and development due to their potential to provide an effective alternative to blue-dyed bait.

Tori lines were tested in the Hawaii longline fisheries in 1999, but they were considered impractical at that time due to gear entanglement problems. Subsequent trials and broad industry use of tori lines in other longline fisheries have identified tori line designs and materials that reduce the incidence of entanglement with gear and improve durability. The 2018 workshop participants agreed that tori line trials in Hawaii and the development of minimum standards would now be useful (WPFMC 2018). They also identified blue-dyed bait as a candidate for removal from the existing suite of seabird mitigation measures due to concerns with efficacy and practicality (WPFMC 2018).

In Spring 2019, the WPFMC, the Hawaii Longline Association, PIFSC, and PIRO initiated a joint research project to design and test tori lines in the deep-set longline fishery. The team researched potential tori line materials and designs, and they discussed preferences and experiences with tori lines with longline fishermen. In September 2019, the WPFMC convened a meeting with tori line experts from New Zealand and Japan who provided valuable input on tori line design for vessels similar to those in the Hawaii longline fishery. With that guidance, the Hawaii team developed alternative designs for the



The 50m tori line in its bin (one that was chosen to use during the phase 2 portion of project). Credit: WPFMC/Hollyann Naholowaa

aerial (suspended) section and determined the most appropriate design for the drag (submerged) section of the tori line. The team then conducted land and ocean trials to determine ideal aerial and drag section combinations.

Ocean trials under the joint research project continued through 2019 and into 2020. The results indicate that tori lines, when used in conjunction with blue-dyed bait, significantly reduce albatross feeding attempts and contact with longline gear. They also indicate the potential for offal discharge to increase bird interactions during gear setting. The project results led the WPFMC to identify the need for additional research to test the effectiveness of tori lines without blue-dyed bait and offal discharge (WPFMC 2021). That research is set to begin in 2021 under an experimental fishing permit issued by NMFS pursuant to regulations at 50 CFR 556.17.



Colby Brady and Hollyann Naholowaa conducting tori line land trials to determine the necessary drag for each aerial section design under consideration. Credit: NOAA Fisheries/ Sarah Ellgen



Juvenile red-footed booby. Credit: NOAA Fisheries/ Hollyann Naholowaa

5. Summary

Table 10 compares the 2018 and 2019 observed seabird interactions in the two fisheries. The observed interactions and interaction rate from 2018 to 2019 decreased for the deep-set fishery and increased for the shallow-set fishery. In 2018, the shallow-set fishery interacted with nine seabirds (two Laysan albatrosses and seven black-footed albatrosses). In 2019, it interacted with 34 seabirds (15 Laysan albatrosses and 19 black-footed albatrosses). In 2018, observers in the deep-set fishery documented interactions with 236 seabirds (35 Laysan albatrosses, 190 black-footed albatrosses, nine sooty shearwaters, one brown booby, and one red-footed booby). In 2019, observers in that fishery documented interactions with 189 seabirds (43 Laysan albatrosses, 145 black-footed albatrosses, and one brown booby) (see Table 6).

Table 10. Comparison of observed interactions in Hawaii longline fisheries, 2018 and 2019.

Observed Interactions	2018	2019
Seabirds observed in deep-set fishery	236	189
Seabirds observed in shallow-set fishery	9	34
Deep-set interaction rate (birds per 1,000 hooks observed)	0.020	0.015
Shallow-set interaction rate (birds per 1,000 hooks observed)	0.016	0.091

Note: There was 20.39% and 20.54% observer coverage in the deep-set longline fishery in 2018 and 2019, respectively, and 100% coverage in the shallow-set longline fishery.

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Sighting of a banded Laysan albatross at sea. Credit: NOAA Fisheries/Hollyann Naholowaa



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Seabird Interactions and Mitigation Efforts in Hawaii Longline Fisheries

2018 ANNUAL REPORT



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2018 ANNUAL REPORT

March 2020

Pacific Islands Regional Office
NOAA National Marine Fisheries Service
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Please note: Data in this report are considered to be preliminary, and may be revised as better information becomes available. For the most current data, please contact the NMFS Pacific Islands Regional Office.

Cover image: Black footed albatross



Black-footed albatross with a petrel.

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1. Introduction

The National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO) is responsible for minimizing, as practicable, interactions between Hawaii pelagic longline fishing operations and seabirds. NMFS monitors the fisheries to determine the effectiveness of management measures implemented to minimize interactions and the severity of interactions. NMFS documents interactions and mitigation efforts aboard vessels at sea, and reports annually on fishing effort, seabird interactions, and mitigation research.¹ [View this report, and similar reports from previous years online.](#)

1.1 Background

NMFS and the Western Pacific Fishery Management Council (WPFMC) manage two Hawaii pelagic longline fisheries under the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific (FEP) and implementing regulations. The deep-set longline fishery targets primarily bigeye tuna at depths to 400 m and operates mainly north-northeast and southwest of the main Hawaiian Islands (Fig. 1). The shallow-set longline fishery targets swordfish at depths to 100 m and typically operates north and east of the Hawaiian Islands (Fig. 2). The FEP contains a detailed description of the two fisheries (WPFMC 2009, as amended).

Since 1994, the Hawaii longline fleet has been limited to 164 permits; a permit allows fishing in both fisheries, shallow- and deep-set. Activity levels in any given year since 2004 range from 11 to 35 vessels in the shallow-set fishery, and 111 to 142 vessels in the deep-set fishery. Nearly all vessels in the shallow-set fishery also participate, to some degree, in the deep-set fishery during the year.

Laysan albatross, black-footed albatross, shearwaters, fulmars, boobies, and the endangered short-tailed albatross feed around the Hawaiian Islands in areas where the longline fisheries operate. During the deployment (setting) and retrieval (hauling) of

longline fishing gear, hooks and line may occasionally hook or entangle seabirds that attempt to take bait or catch. Seabirds are more likely to drown when the interaction occurs during setting because the weight of the gear may pull the seabird underwater. Although some interactions are inevitable, fishermen take steps to avoid and minimize interactions. By using safe handling and release techniques, fishermen help many seabirds survive their interactions.

Effective management of the fisheries has greatly minimized interactions with seabirds. In 2000, NMFS estimated 2,433 seabird interactions in the Hawaii longline fisheries. From 2001 – 2006, NMFS implemented seabird mitigation measures. These measures have reduced interactions and are described in Section 1.2.

NMFS places observers on every shallow-set longline trip, resulting in 100% coverage. In 2018, there were nine observed interactions in the shallow-set fishery. NMFS places observers on approximately 20 percent of deep-set trips. For the 2018, we expanded the observed interactions and estimated 1,139 interactions in the deep-set fishery. Credit for this successful reduction in interactions is mostly due to the fishermen, who understand and implement the seabird mitigation measures. The measures include training in seabird identification, seabird-deterrent fishing gear and techniques, and special handling and release of incidentally-caught seabirds.



Red-footed booby.

¹This annual report is required in the Terms and Conditions of the 2012 Biological Opinion of the U.S. Fish and Wildlife Service for the operation of Hawaii-based Pelagic Longline Fisheries (USFWS 2012).

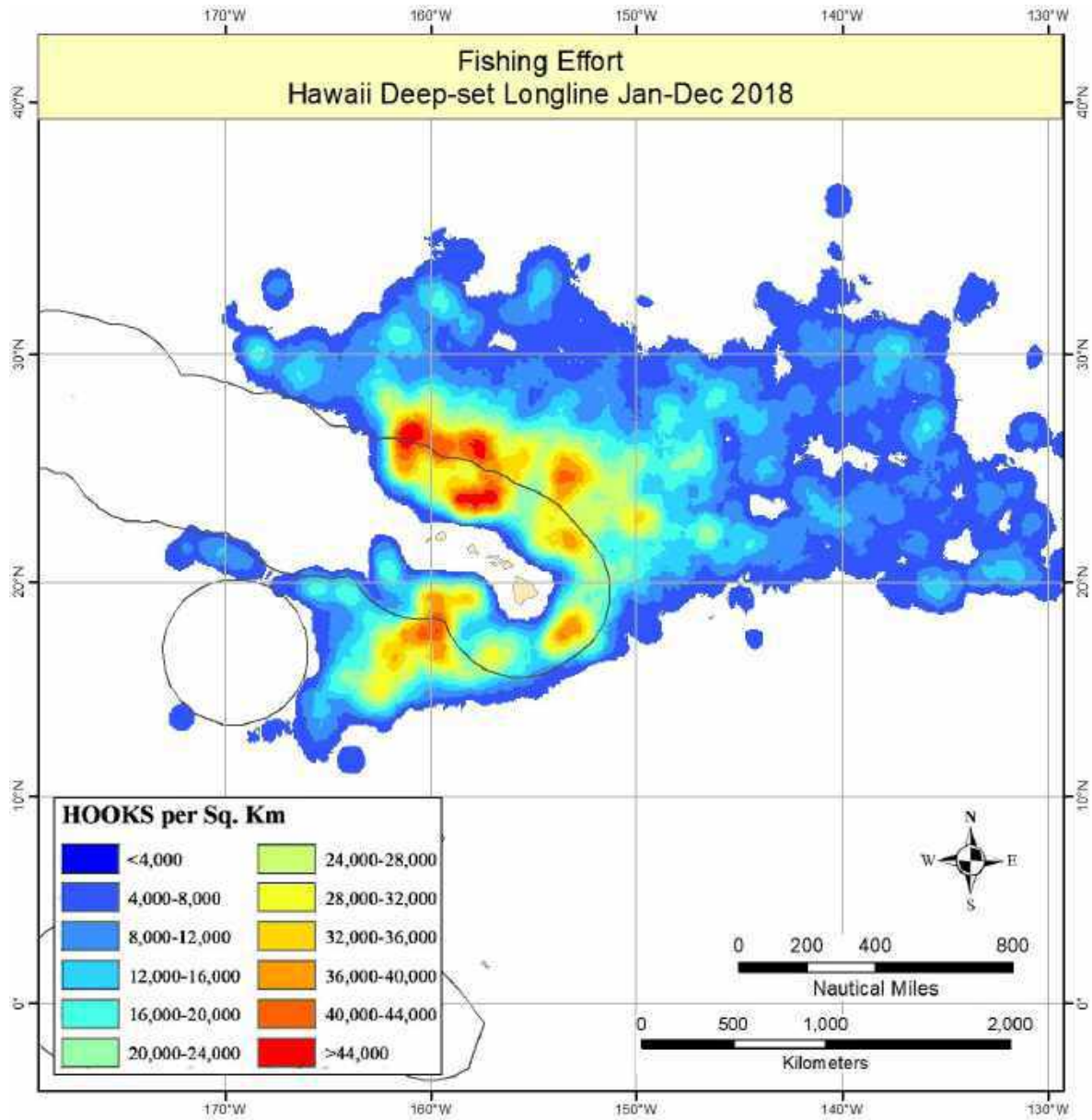


Figure 1. Spatial distribution of fishing effort by the Hawaii deep-set longline fishery, 2018.

Source: NMFS Pacific Islands Fisheries Science Center (PIFSC) logbook, unpublished data, received 1/27/2020.

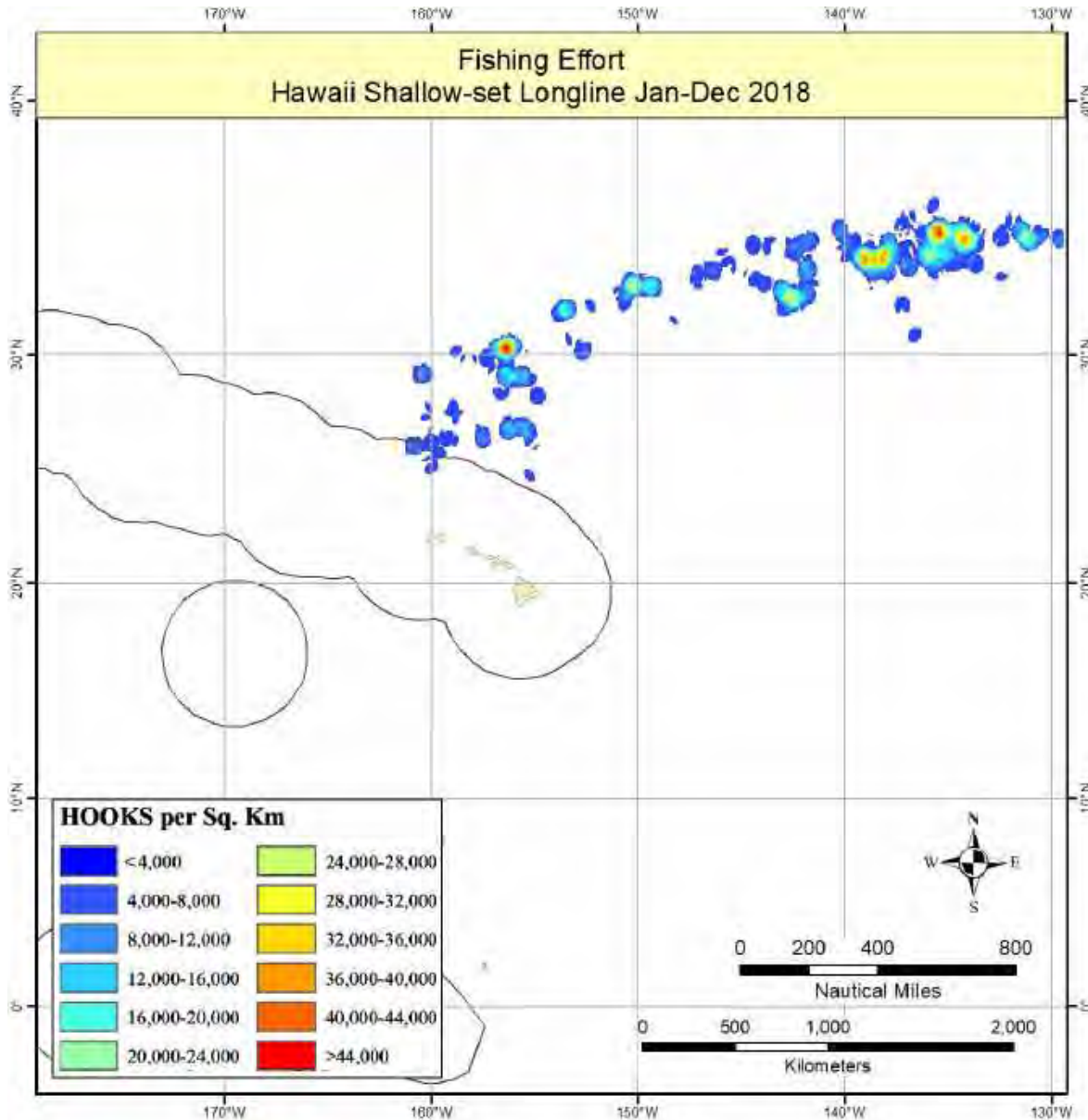


Figure 2. **Spatial distribution of fishing effort by the Hawaii shallow-set longline fishery, 2018.**

Source: NMFS PIFSC logbook, unpublished data, received 1/16/2020.

1.2 Seabird Mitigation Measures for the Hawaii Longline Fisheries

Most of the regulations for Hawaii longline fisheries are identified in Title 50, Code of Federal Regulations, Parts [600](#) and [665](#) (50 CFR Parts 600 and 665). NMFS also provides a [regulation summary and compliance guides](#) to Hawaii longline fishermen and the general public, available from <https://www.fisheries.noaa.gov/pacific-islands/resources-fishing/regulation-summaries-and-compliance-guides-pacific-island-fisheries>.

Regulations specific to the mitigation of seabird interactions and safe handling techniques are at 50 CFR 665.815. The ways that fishermen implement required seabird mitigation measures depend on how and where fishermen fish. Mitigation measures to reduce seabird interactions differ between the two options of stern-setting and side-setting. The following sections describe each of the main gear and operation requirements. The 2012 Biological Opinion (USFWS 2012) also describe these measures.

Side-Setting

Side-setting involves deploying the gear from the side of the vessel, compared to the conventional method of setting from the stern. In side-setting, crewmen set baited hooks forward and close to the side of the vessel's hull where seabirds are unable or unwilling to pursue the hooks. With required branch line weighting, by the time the vessel stern passes the location where baited hooks have been set, the baited hooks will have sunk to a depth where seabirds cannot reach them (Gilman and Brothers 2006; Gilman et al. 2005, 2007a, 2007b). Additionally, deploying a required bird curtain aft of where crew is deploying the gear inhibits seabirds from landing on the water along the side of the vessel where baits are accessible.

Table 1 summarizes the number of Hawaii deep- and shallow-set vessels observed to set from the stern and from the side in 2018, with some vessels operating in both deep- and shallow-set longline fisheries. In 2018, most vessels in the deep-set fishery and all but one vessel in the shallow-set fishery chose to stern-set.

Table 1. Number of observed Hawaii longline vessels that side- and stern-set in 2018.

Fishery	Deck setting position	Vessels
Deep-set	Stern-setting	109
Deep-set	Side-setting	24
Shallow-set	Stern-setting	11
Shallow-set	Side-setting	0

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 7/24/2019.

Weighted Branch Lines

Fishermen place weights close to the hook on branch lines so baited hooks sink quickly and help prevent foraging seabirds from possibly becoming hooked or entangled in longline gear. To sink the branch lines quickly, Hawaii longline fishermen must attach a weight of at least 45 g within 1 m of the hook in the following situations: deep-setting from either the stern or the side north of 23° N, and shallow-setting from the side anywhere. Fishermen commonly use weights from 45 to 80 g.

Thawed and Blue-dyed Bait

Dyeing bait to a specific blue color reduces visibility by reducing contrast with the sea surface. Fishermen thaw the bait to increase sink rates and to allow a more effective penetration of the blue dye. Almost all bait used in the Hawaii longline fisheries consists of the fusiform fishes mackerel (saba), sardines, and saury (sanma). NMFS prohibits the use of squid bait in the shallow-set fishery to reduce sea turtle interactions. While fishermen may still use squid in the deep-set fishery, the squid bait costs more than some fish bait and is, thus, less preferred.

Strategic Offal Discards

Fishermen developed the technique of strategically discarding offal to distract seabirds from attempting to steal baits from hooks before the branch lines are retrieved. Fishermen discard swordfish heads and livers on the opposite side of the vessel from fishing operations to distract birds away from the baited hooks. NMFS observers in the mid-1990s noted that strategically discarding offal reduced incidental hooking or entanglement of albatrosses, and it is now

a requirement². When seabirds are present around the vessel, fishermen that are stern- and deep-setting north of 23° N., or stern- and shallow-setting anywhere, are required to use strategic offal discards as a seabird mitigation measure when setting from the stern.

Night-Setting

Night-setting as a seabird mitigation measure requires shallow-set fishermen, when stern-setting, to start deploying gear no earlier than one hour after local sunset and complete the set no later than the following sunrise. The measure also requires using the minimum lighting necessary to conform to navigation rules and best safety practices. The night-set measure is based on the premise that seabirds cannot see baited hooks in the dark and, thus, do not attack them. Night-setting has been a very effective seabird mitigation measure, reducing seabird interactions as much as 98% (McNamara et al. 1999, Boggs 2003). Table 2 summarizes the seabird mitigation requirements.



Bird curtain that has been deployed to prevent seabirds from landing on the water where bait is accessible.

Table 2. Seabird mitigation requirements for the Hawaii longline fleet.

What you need to do	Stern-setting		Side-setting	
	Shallow-Set Anywhere	Deep-Set North of 23° N	Shallow-Set Anywhere	Deep-Set North of 23° N
Deploy mainline from port or starboard side at least 1 m forward of stern corner	-	-	Yes	Yes
If line shooter is used, mount it at least 1 m forward from stern corner	-	-	Yes	Yes
Use a specified bird curtain aft of the setting station during the set	-	-	Yes	Yes
Deploy gear so that hooks do not resurface	-	-	Yes	Yes
Attach 45 g or heavier weights within 1 m of hook of each hook	-	Yes	Yes	Yes
Use a line shooter to set the mainline	-	Yes	-	-
Keep two 1-pound containers of blue-dye on boat	Yes	Yes	-	-
Use completely thawed and blue-dyed bait	Yes	Yes	-	-
Keep fish parts and spent bait with all hooks removed for strategic offal discard	Yes	Yes	-	-
Cut all swordfish heads in half, and use heads and livers for strategic offal discard	Yes	Yes	-	-
Night Set - begin set 1 hour after local sunset and finish 1 hour before next sunrise and keep lighting to a minimum	Yes	-	-	-

²Removing and splitting swordfish heads, and using heads and livers for strategic offal discards is a requirement for all stern-setting vessels.

Figure 3. Illustrated seabird handling guidelines developed for use and distribution in protected species workshops.

Seabird Handling Guidelines
Hawaii Pelagic Longline Fisheries

YOU WILL NEED → towel, bolt/wire cutter or pliers, dip net, gloves, safety glasses, safe enclosure for bird

- 1.** Stop vessel to reduce tension on line. Wear gloves, safety glasses, and arm covers for protection. Use dip net to bring bird onto vessel.
- 2.** Hold bird by bill without covering nostrils. Fold wings into bird's body.
- 3.** Cover bird with towel to protect and calm it. Straddle bird if necessary.
- 4.** Remove any entangled lines. *NOTE: If the bird is an albatross with a bright pink bill, it may be a short-tailed albatross (STAL). See handling side for the rest of the STAL handling requirements as per (50 CFR 665.815(b)).*
- 5.** If you can handle hook but cannot see barb: Push hook through skin to expose barb. Use pliers to flatten barb or bolt cutters to cut off barb. Back hook out.
- 6.** If you cannot handle hook (it's deeply ingested): Cut as much line off as possible and leave hook in bird.
- 7.** Leave bird to recover in safe enclosed space. Do not provide food or water to bird.
- 8.** Bird can be released to sea surface when: Feathers are dry (approximately 1/2 to 4 hours), Bird is alert and head is erect, Breathes without noise, Wings can flap and retract onto back, Stands on both feet with toes forward.
- 9.** If bird has not recovered after 4 hours, either Release bird to sea surface or call nearby bird rescue center for guidance (vessels 1-2 days from port): Honolulu (808-884-5000), Los Angeles (310-514-2573), San Francisco (707-207-0380)

Please report all banded birds: 1-800-327-BAND (2263) or www.pwrc.usgs.gov/bbl
Questions? Call NMFS Pacific Islands Regional Office, Sustainable Fisheries Division at (808) 725-5000

12/2017

1.3 Protected Species Workshops

In addition to gear and operational mitigation measures to deter or reduce seabird interactions, owners and operators of pelagic longline vessels must complete a protected species workshop each year (50 CFR 665.814). The workshop includes training in the identification, safe handling, and release techniques for sea turtles, marine mammals, and seabirds (Fig. 3). The workshop also reviews regulatory and compliance requirements. In a classroom setting, fishermen learn from oral presentations, hands-on demonstrations, videos, and printed reference materials. NMFS also offers the workshops on line for those who have taken a classroom workshop within the past three years. A valid workshop certificate is necessary for owners to obtain or renew Federal longline fishing permits. Longline vessel operators must also have on board the vessel a valid protected species workshop certificate issued by NMFS to the operator of the vessel.

In 2018, NMFS PIRO provided protected species workshop

Table 3. Hawaii deep- and shallow-set longline fisheries effort and observer coverage, 2017 and 2018.

2018					
Fishery	Number of vessels	Trips	Sets	Hooks	Observer coverage
Deep-set	143	1,642	20,994	58,500,893	20.36%
Shallow-set	11	30	420	486,013	100%
2017					
Fishery	Number of vessels	Trips	Sets	Hooks	Observer coverage
Deep-set	145	1,539	19,674	53,554,046	20.39%
Shallow-set	21	72	1,005	1,083,216	100%

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished shallow-set data, 7/24/2019, and NMFS 2019a and NMFS 2019b.

training for 265 Hawaii-based longline vessel owners and operators, and other interested individuals. Another 39 vessel owners, operators, and crewmembers completed the protected species workshop training in American Samoa with assistance from the PIRO Sustainable Fisheries Observer Program.

1.4 Fishing Effort and Observer Coverage

Table 3 summarizes effort data from 2017 and 2018 by haul date. From 2017 to 2018, deep-set fishing trips increased by 6.6% and shallow-set fishing trips decreased by 140%.

Please note that other summaries throughout this report and elsewhere may vary slightly depending upon the data source, including revisions. For example, observers may report seabird interactions by date of trip (departure or arrival), set date, or haul date in a given year. NMFS typically bases observer coverage levels on the trip departure date. The NMFS Sustainable Fisheries Observer Program typically bases protected species interactions in their quarterly, semiannual, and annual reports on vessel arrival date <https://www.fisheries.noaa.gov/pacific-islands/fisheries-observers/pacific-islands-longline-quarterly-and-annual-reports>. NMFS also provides summary reports from mandatory logbook data reported by captains.

2. Interactions

2.1 Species

NMFS observers have recorded the following bird species being hooked or entangled in the longline fisheries since 1994, when NMFS began deploying observers: Laysan albatross (*Phoebastria immutabilis*), black-footed albatross (*P. nigripes*), sooty shearwater (*Puffinus griseus*), unidentified shearwaters, brown booby (*Sula leucogaster*), red-footed booby (*S. sula*), Northern fulmar (*Fulmarus glacialis*), glaucous winged gull (*Larus glaucescens*), and an unidentified gull (Table 4). None of these species is listed under the Endangered Species Act (ESA). Both Hawaii longline fisheries have a low level of interactions with these species. Based on the population estimates, the fisheries likely have very little effect on these populations.

Some seabirds, especially shearwaters, are difficult to identify. Table 5 provides a summary of seabird

specimens that NMFS observers collected for identification and biological study after capture in the Hawaii longline fisheries in 2018. Most seabird specimens are frozen and shipped to the Marine Wildlife Veterinary Care and Research Center in Santa Cruz, California. Since 2007, staff with the organization Oikonos have been collecting morphometric data on shipped specimens.

Table 4. **Species recorded hooked or entangled in Hawaii longline fisheries.**

Species	Global population estimate	Demographic information
Laysan albatross	666,658 breeding pairs (ACAP 2017)	The Northwestern Hawaiian Islands (NWHI) has the world's largest colonies and more than 99% of the global breeding population (ACAP 2012a)
Black-footed albatross	69,969 pairs (ACAP 2017)	More than 95% of the population breeds in the NWHI (ACAP 2012b)
Northern fulmars	20 million individuals (Birdlife 2019a)	Located throughout the North Atlantic and North Pacific
Red-footed booby	More than 1 million birds (Birdlife 2019b)	Winters on tropical islands in most oceans
Brown booby	More than 200,000 adults (Birdlife 2019c)	Located throughout the pan-tropical oceans
Sooty shearwaters	8,800,000 adults (Birdlife 2019d)	Nest in Australia, New Zealand, and southern South America
Glaucous-winged gull	More than 570,000 individuals (Birdlife 2019e)	Located along the Pacific coast of North America to the northern coast of Japan

Table 5. **Summary of collected seabirds from the Hawaii longline fisheries, 2018. Note: Not all dead seabirds are collected as specimens.**

Species	Number retained
Black-footed albatross	152
Laysan albatross	25
Sooty shearwater	9
Brown booby	1
Red-footed booby	1

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 7/24/2019.

2.2 Location of Interactions

Figs. 4 and 5 show the spatial distribution of observed seabird interactions in deep- and shallow-set fisheries, respectively, based on observations of seabirds in 2018. Most of the interactions occur north of 20° N, where seabirds are typically more abundant, and where fishing effort is more concentrated.

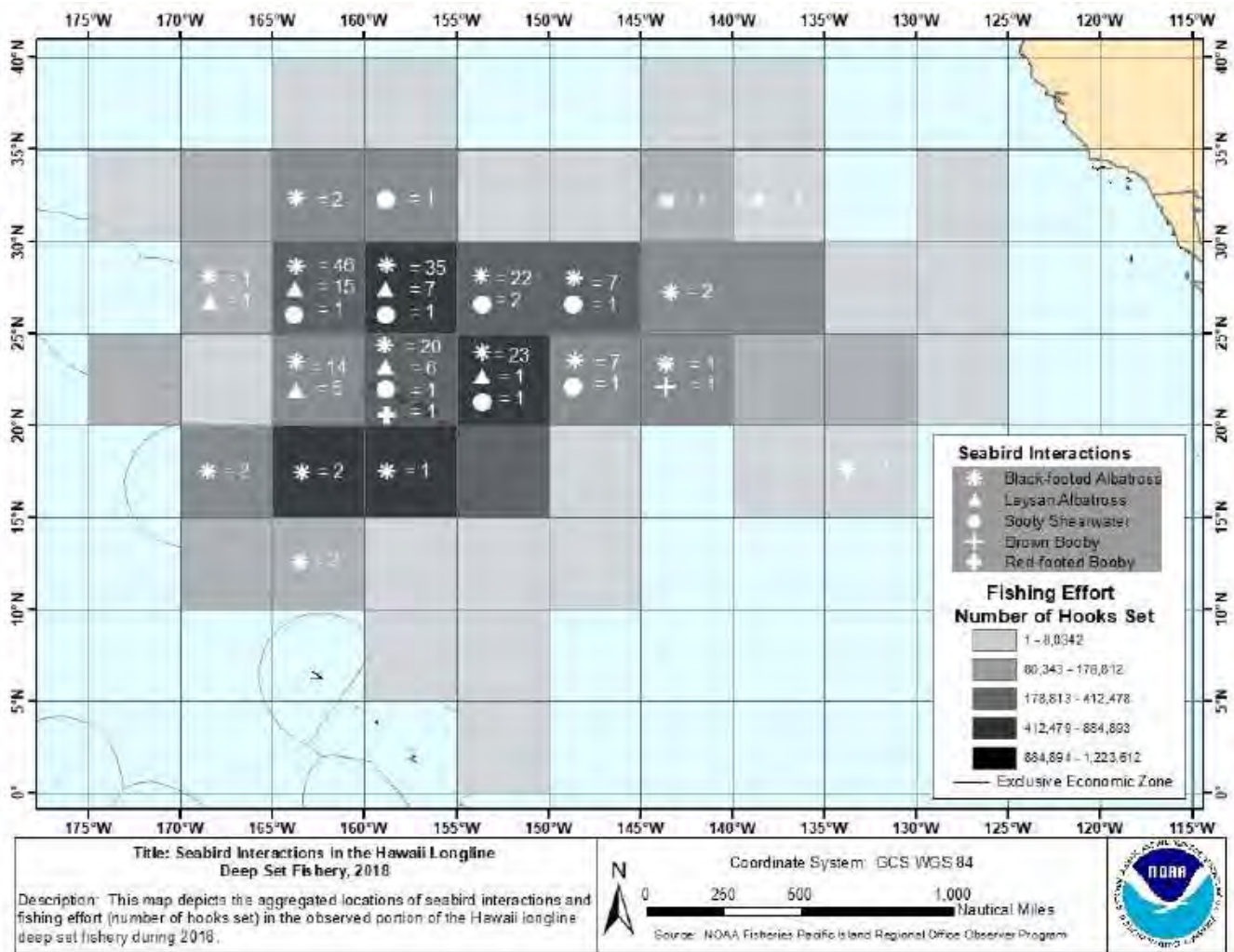


Figure 4. Locations of seabird interactions observed in Hawaii deep-set longline fishery, 2018.

Note: NMFS deployed observers on 20.36% of deep-set trips in 2018.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 7/24/2019.

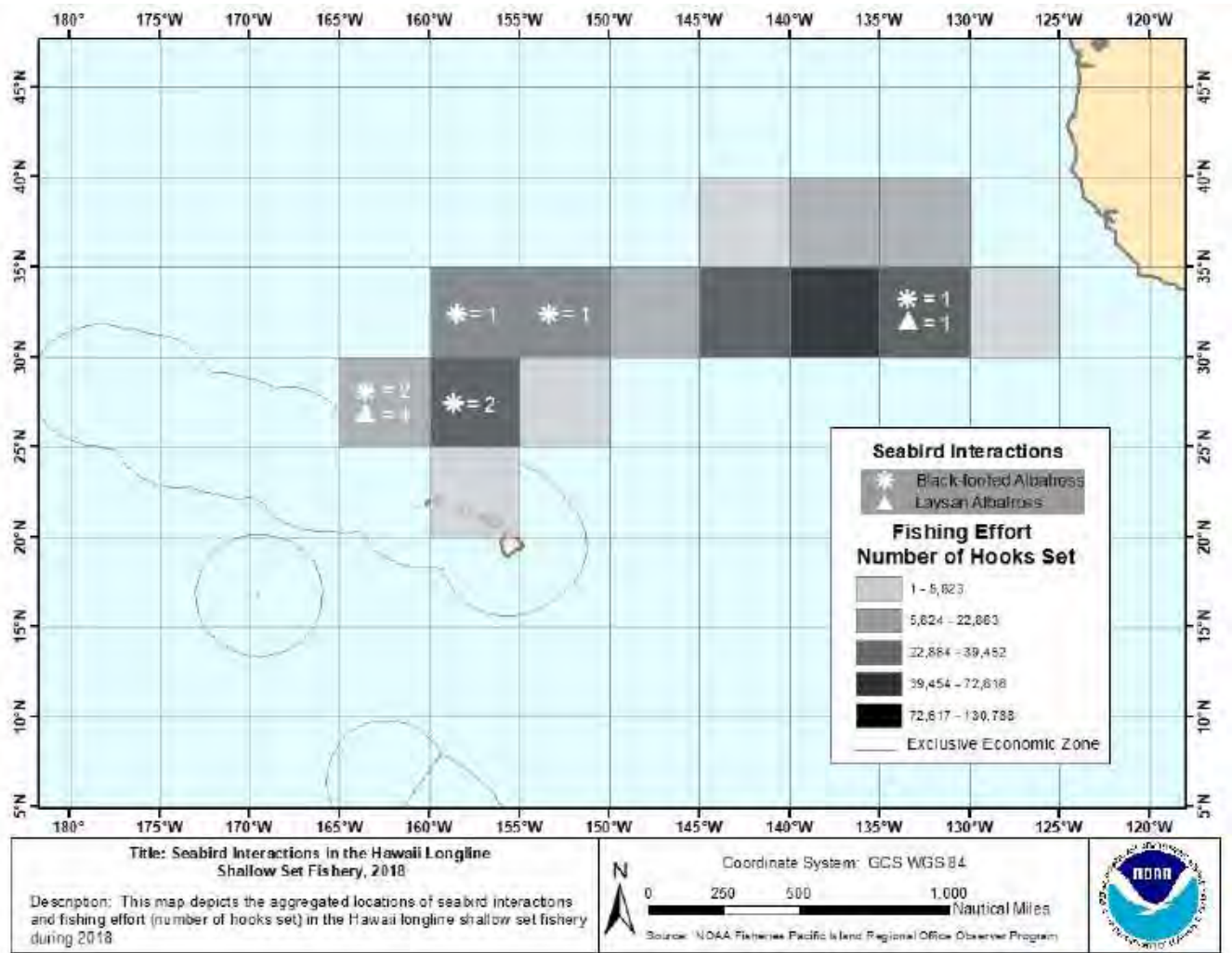


Figure 5. Locations of seabird interactions observed in Hawaii shallow-set longline fishery, 2018.

Note: NMFS deployed observers on every shallow-set trip in 2018.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 7/24/2019.

2.3 Number of Interactions

Table 6 summarizes the number of observed seabird interactions, and the condition of the seabirds upon release, and fishing effort in both fisheries from 2004 – 2018. During that period, NMFS deployed observers on 100% of shallow-set fishing trips; therefore, the number of interactions shown in Table 6 represents the fishery-wide totals. NMFS deployed observers on 20.36% of deep-set trips in 2018, so we expanded the observed interactions using the observer coverage rate to estimate total interactions (Table 7). Fig. 5 shows the seabird interaction rate from 2004 to 2018 from Table 6. In recent years, the seabird interaction rates have increased.

Almost all interactions in the deep-set fishery occur when fishermen set gear during the day while seabirds are actively feeding. Seabirds may be hooked or entangled, and then drown while the gear sinks. Because most seabirds are inactive at night, very few interactions occur when fishermen typically haul

deep-set gear. In 2018 in the deep-set fishery, observers documented interactions with 35 Laysan albatrosses, 190 black-footed albatrosses, nine sooty shearwaters, one red-footed booby, and one brown booby (Table 6). Nearly all of the seabirds observed to interact with the deep-set fishery were dead (87%). Table 7 contains the total estimated number of interactions with Laysan albatross, black-footed albatross, shearwaters, red-footed booby, and brown booby based on observer records for the deep-set fishery in 2018.

The shallow-set fishery typically sets at night and hauls the gear during the day; therefore, most of the interactions occur when fishermen retrieve the gear and birds are actively feeding. In 2018, the shallow-set fishery interacted with two Laysan albatrosses and seven black-footed albatrosses (Table 6). Fishermen released approximately 78% of seabirds alive.

Table 6. Numbers of observed seabird catch levels, fishing effort, and interaction rates in the combined Hawaii longline fisheries, 2004-2018.

Deep-set Fishery

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species caught	Total birds observed caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2004	2	5	-	2	9	-	9	7,900,681	0.001
2005	6	11	-	1 ¹	18	-	18	9,360,671	0.002
2006	1	17	5	-	23	-	23	7,540,286	0.003
2007	7	18	-	-	25	-	25	7,620,083	0.003
2008	14	30	14	2 ²	60	4	56	8,775,951	0.007
2009	18	23	4	-	45	-	45	7,877,861	0.006
2010	39	17	1	-	57	1	56	8,184,127	0.007
2011	32	13	3	-	48	2	46	8,260,092	0.006
2012	31	36	7	-	74	5	67	8,768,728	0.008
2013	48	49	8	-	105	5	100	9,278,133	0.011
2014	12	38	1	-	51	6	45	9,608,244	0.005
2015	25	101	4	2 ⁴	132	19	113	9,393,234	0.014
2016	33	104	4	3 ⁵	144	7	137	9,882,920	0.015
2017	38	103	-	1 ⁶	142	13	129	10,148,195	0.014
2018	35	190	9	28	236	28	208	11,751,242	0.020

Shallow-set Fishery

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species caught	Total birds observed caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
2004	1	-	-	-	1	1	-	76,750	0.013
2005	62	7	-	-	69	47	22	1,328,806	0.052
2006	8	3	-	-	11	5	6	745,125	0.015
2007	40	8	-	-	48	40	8	1,292,036	0.037
2008	33	6	-	-	39	24	15	1,350,127	0.029
2009	81	30	1	-	112	88	24	1,767,128	0.063
2010	40	38	-	1 ³	79	61	18	1,828,529	0.043
2011	49	19	-	-	68	53	15	1,611,395	0.042
2012	62	37	-	-	99	77	21	1,418,843	0.070
2013	45	28	2	-	75	48	27	1,000,084	0.075
2014	39	32	1	-	72	56	16	1,509,727	0.048
2015	43	38	-	-	81	65	16	1,286,628	0.063
2016	25	40	-	-	65	50	15	830,177	0.078
2017	6	53	-	1 ⁷	60	38	22	1,051,426	0.057
2018	2	7	0	0	9	7	2	546,371	0.016

¹brown booby; ²red-footed booby and unidentified seabird; ³northern fulmar; ⁴red-footed booby and unidentified shearwater; ⁵two red-footed boobies and one unidentified albatross; ⁶unidentified gull; ⁷glaucous-winged gull; ⁸one brown booby and one red-footed booby.

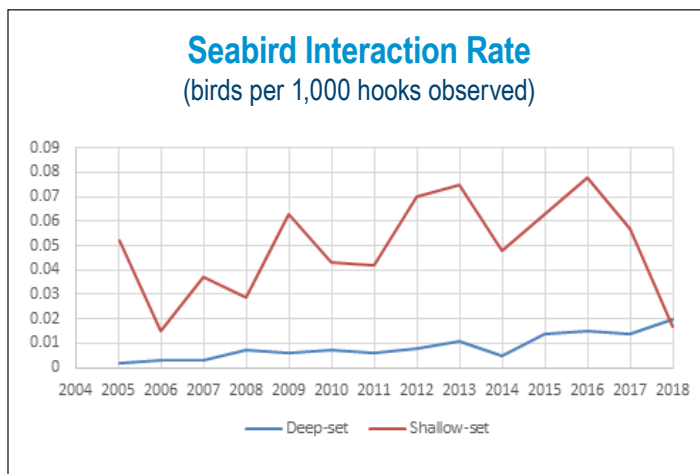
Note: Sustainable Fisheries Observer Program data (unpublished, 7/24/2019) are based on the date and time of the beginning of the haul, with the exception of the total observed effort (hooks), which is based on arrival date from the Sustainable Fisheries Observer Program annual reports (NMFS 2019c and NMFS 2019d). Interaction rates are calculated and rounded to the nearest thousandths (third decimal) place.

Table 7. Estimated total seabird interactions in the Hawaii deep-set longline fishery, 2018.

Species	Total annual estimate
Black-footed albatross	931
Laysan albatross	157
Shearwaters	40
Red-footed booby	5
Brown booby	6

Note: Table lists point estimates of the total number of incidental interactions by species in the Hawaii deep-set longline fishery based on observed interactions during 2018. Point estimates are based on the trip arrival date rather than trip haul date. Source: McCracken 2019.

Figure 6. Seabird interaction rates in the deep-set and shallow-set longline fisheries, 2004-2018.



Seabirds can be hooked, entangled, or both. Table 8 provides a summary of capture and release conditions in 2018. Regulations require fishermen to remove as much gear as safely possible from any seabirds captured before the seabirds are released.

Table 8. Capture and release details by species for seabird interactions in the Hawaii longline fisheries, 2018.

	Hooked only	Entangled only	Both hooked and entangled	Not known or not recorded
Laysan albatross	26	6	5	0
Black-footed albatross	172	9	15	1
Brown booby	0	0	1	0
Red-footed booby	1	0	0	0

Note: None of the seabirds released alive had any gear attached. Two black-footed albatross (dead) were recorded as hooked, but were unknown if they were also entangled. Included in hooked only column here. Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 7/24/2019.



Laysan albatross interacting with a baited hook.

Recovered Seabird Bands

State and Federal agencies and other groups attach identification bands to the legs of birds to study bird movement, survival, and other characteristics. Table 9 provides a summary of observed seabirds with leg bands from Hawaii longline fisheries interactions in 2018. Most of the recovered bands were from albatrosses banded on French Frigate Shoals in the NWHI and caught incidentally in the first half of the year.

Table 9. Observed interactions of seabirds with bands in the shallow-set and deep-set Hawaii longline fisheries, 2018.

Species	Disposition	Band(s) recovery date	Date banded	Location banded	Age at banding (yr)	Age at recovery (yr)
Laysan Albatross	Dead	2/5/2018	6/9/2005	French Frigate Shoals (Tern Island)	<1	13
Black-footed Albatross	Dead	2/9/2018	6/10/2008	French Frigate Shoals (Tern Island)	<1	10
Laysan Albatross	Dead	2/9/2018	6/5/1998	French Frigate Shoals (Tern Island)	<1	20
Black-footed Albatross	Dead	2/13/2018	1/27/2000	French Frigate Shoals (Tern Island)	>1	>18
Black-footed Albatross	Dead	3/1/2018	6/15/2004	French Frigate Shoals (Tern Island)	<1	14
Black-footed Albatross	Dead	3/10/2018	5/24/2007	French Frigate Shoals (Tern Island)	<1	11
Black-footed Albatross	Dead	3/22/2018	6/3/2003	French Frigate Shoals (Tern Island)	<1	15
Black-footed Albatross	Dead	3/25/2018	6/5/1996	French Frigate Shoals (Tern Island)	<1	22

Species	Disposition	Band(s) recovery date	Date banded	Location banded	Age at banding (yr)	Age at recovery (yr)
Black-footed Albatross	Dead	3/30/2018	12/29/2008	French Frigate Shoals (Tern Island)	<1	10
Black-footed Albatross	Dead	3/22/2018	5/26/2006	French Frigate Shoals (Tern Island)	<1	12
Black-footed Albatross	Dead	3/30/2018	6/5/1998	French Frigate Shoals (Tern Island)	<1	20
Black-footed Albatross	Dead	3/24/2018	5/26/2007	French Frigate Shoals (Tern Island)	<1	11
Laysan Albatross	Dead	4/8/2018	1/25/2012	Oahu (Waialua)	<1	6
Black-footed Albatross	Dead	4/23/2018	6/19/2010	French Frigate Shoals (Tern Island)	<1	8
Black-footed Albatross	Dead	5/19/2018	6/8/2002	Kure Atoll (Green Island)	<1	17
Black-footed Albatross	Injured	5/7/2018	5/21/2008	French Frigate Shoals (Tern Island)	<1	11
Black-footed Albatross	Dead	5/13/2018	5/30/1999	French Frigate Shoals (Tern Island)	>1	>28
Laysan Albatross	Dead	5/22/2018	6/8/2002	French Frigate Shoals (Tern Island)	<1	17
Black-footed Albatross	Dead	5/18/2018	1/6/2005	French Frigate Shoals (Tern Island)	>1	>13
Black-footed Albatross	Dead	5/19/2018	6/9/2007	French Frigate Shoals (Tern Island)	<1	11
Black-footed Albatross	Dead	5/20/2018	6/13/2006	French Frigate Shoals (Tern Island)	<1	12
Black-footed Albatross	Dead	5/20/2018	6/8/2007	French Frigate Shoals (Tern Island)	<1	11
Black-footed Albatross	Dead	5/24/2018	5/18/2010	French Frigate Shoals (Tern Island)	<1	8
Black-footed Albatross	Injured	5/25/2018	12/23/1997	French Frigate Shoals (Tern Island)	<1	21
Laysan Albatross	Dead	5/25/2018	6/4/2003	French Frigate Shoals (Tern Island)	<1	15
Black-footed Albatross	Dead	6/7/2018	6/15/2007	Laysan Island	<1	11
Black-footed Albatross	Dead	6/26/2018	6/9/2004	French Frigate Shoals (Tern Island)	<1	14
Black-footed Albatross	Dead	6/23/2018	6/9/2004	French Frigate Shoals (Tern Island)	>1	>14
Black-footed Albatross	Dead	6/19/2018	5/29/2007	French Frigate Shoals (Tern Island)	<1	11
Black-footed Albatross	Dead	6/7/2018	6/15/2007	Laysan Island	<1	11
Laysan Albatross	Dead	11/13/2018	5/23/2008	French Frigate Shoals (Tern Island)	<1	10
Black-footed Albatross	Dead	11/15/2018	6/5/2006	French Frigate Shoals (Tern Island)	<1	12
Laysan Albatross	Dead	12/17/2018	2/1/2018	Zapato (S of Guadalupe Island), MX	<1	1
Laysan Albatross	Dead	12/18/2018	1/11/2005	French Frigate Shoals (Tern Island)	>3	>16

Source: USGS, USFWS, and NMFS, unpublished data, received 7/24/2019.

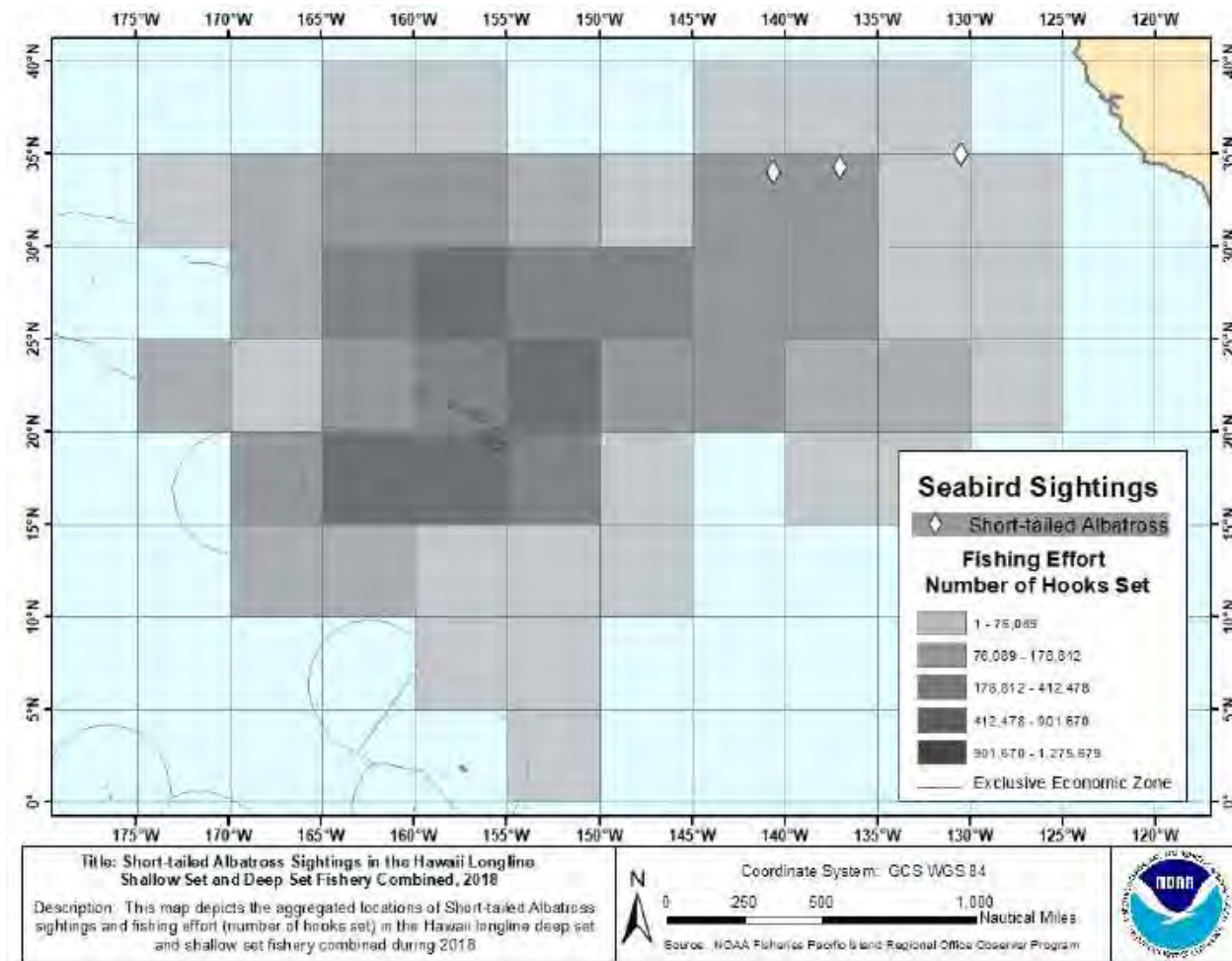


Figure 7. Short-tailed albatross sightings and fishing effort in the Hawaii deep and shallow-set fishery, 2018.

Source: NMFS PIRO Sustainable Fisheries Observer Program, unpublished data, 12/13/2019.

3. ESA Listed Seabirds

There have been no observed interactions (hooking or entanglement) between the fisheries and any ESA-listed seabirds. The distributions of three seabird species that are protected under the ESA overlap with the areas where the Hawaii longline fisheries operate: the endangered short-tailed albatross and Hawaiian dark-rumped petrel (*Pterodroma sandwichensis*), and the threatened Newell’s shearwater (*Puffinus newelli*). There were two sightings of short-tailed albatross on shallow-set trips in 2018 and one on an observed deep-set trip. Fig. 7 shows the locations of these sightings compared to the observed fishing effort.



A rare sighting of a short-tailed albatross.

4. Management

In May 2015, consistent with the Migratory Bird Treaty Act, the USFWS issued a Special Purpose Permit to NMFS for the shallow-set fishery. The permit authorized the incidental take of a limited number of migratory birds in the shallow-set fishery until March 31, 2018. The permit included short-tailed albatross, black-footed albatross, Laysan albatross, sooty shearwater, and northern fulmar. In December 2017, the U.S. 9th Circuit Court of Appeals reversed a District Court's judgment affirming FWS's decision to issue the Special Purpose Permit to NMFS (*Turtle Island Restoration Network; Center for Biological Diversity vs. National Marine Fisheries Service, 12-cv-00594, D-Haw*). Specifically, the 9th Circuit Court concluded that the FWS's grant of an incidental take permit to the NMFS in reliance on the "special purpose permit" provision in 50 CFR. § 21.27 was arbitrary and capricious because the FWS's interpretation of § 21.27 does not conform to either the MBTA's conservation intent or the plain language of the regulation. The Court explained its conclusion by discussing the other "form" permits authorized under the MBTA for discrete types of takings (scientific collection, taxidermy, and rehabilitation), and then stated that the FWS's new interpretation of § 21.27's special purpose activity exception as applying to basic commercial activities like fishing that have no articulable special purpose is, therefore, inconsistent with the existing permitting scheme that the FWS has enacted.

5. Research

Shallow-set Fishery

Effective management in the Hawaii shallow-set fishery has greatly reduced seabird interactions, primarily through mitigation measures required during gear setting. Since effective implementation of these measures in 2001, approximately 75% of the remaining seabird interactions occur during gear hauling (Gilman et al. 2014). Because most shallow-set fishermen choose the option to stern set at night, they haul their gear primarily during the day when seabirds are more likely to be foraging. In a review of observer

data from 2004 to 2012, Gilman et al. (2014) found an increasing temporal trend of albatrosses attending vessels during hauling, which may have been one of the factors that results in the observed increasing trend in the seabird standardized haul catch rate during this time.

The highest relative standardized seabird catch rates from January through March corresponded with brooding and chick rearing for mature Laysan and black-footed albatrosses, when the albatrosses forage in areas that overlap with the shallow-set fishery. The lowest live seabird catch rates occurred during the non-breeding season in August and September, when albatross foraging areas overlap less with the fishery (Gilman et al. 2014).

Deep-set Longline Fishery

Since NMFS introduced seabird regulations in 2001 in the Hawaii deep-set fishery, the overall seabird catch rate had declined. However, catch levels of the black-footed albatross have been steadily increasing in the Hawaii deep-set longline fishery over the past decade. In November 2017, the WPFMC in coordination with NMFS Pacific Islands Regional Office and Pacific Islands Fisheries Science Center, convened a workshop to explore the potential drivers, and implications of the higher albatross interaction rates observed in 2015–2016, in the context of longer-term oceanographic variability, shifts in fishery effort and distribution, changes in albatross at-sea distribution, and albatross demography and population trends. The rise in catch rates may have been due to variability in the temporal and spatial distribution of fishing effort, a unique captain effect (i.e., seabird catch rates are significantly explained by which person is the captain), an increase in the number of albatrosses attending Hawaii longline vessels, and a shift in the relative use of seabird bycatch mitigation methods. There was also increased use of blue-dyed fish bait and decreased use of the more effective side setting. While the black-footed albatross population size has not changed significantly in the last decade, their distribution and attendance at longline vessels changed in response to inter-annual (El Niño – Southern Oscillation) and decadal (Pacific Decadal Oscillation) climate variability in the north Pacific Ocean (WPFMC 2018).

In September 2018, the WPFMC held a workshop to review seabird bycatch mitigation measures in the longline fisheries. Participants evaluated the relative promise of a comprehensive suite of alternative seabird bycatch mitigation methods for use in Hawaii's longline fisheries. These included methods currently prescribed in the Hawaii longline seabird regulations, seabird measures adopted by Pacific tuna regional fisheries management organizations (Inter-American Tropical Tuna Commission, Western and Central Pacific Fisheries Commission) and methods identified as best practice by the Agreement for the Conservation of Albatrosses and Petrels. Participants reviewed 35 measures designed to mitigate seabird bycatch and assessed them against criteria on efficacy, cross-taxa conflicts, practicality, economic viability, safety, durability and ability to facilitate compliance monitoring (WPFMC 2018).

Workshop participants recognized that combinations of methods are prescribed, in Hawaii and elsewhere, to obtain desired reductions in seabird bycatch rates. Participants identified tori (streamer) lines, which are not part of the Hawaii seabird regulations, as having high potential for use in Hawaii's deep-set longline fishery as they are likely to be highly effective and potentially more practical to use than existing regulatory options. Tori lines, which were tested in Hawaii's fisheries in 1999 prior to the adoption of seabird regulations, were not considered practical at that time due to gear entanglement problems. Subsequently, through trials and broad industry use of tori lines in other longline fisheries, researchers have identified tori line designs and materials that reduced the incidence of entanglement with gear and improved durability. Participants agreed that tori line trials in Hawaii and development of minimum standards would now be useful (WPFMC 2018).

At the October 2018 meeting, the Council received a report of the September 2018 Workshop and recommended:

1. Enhance outreach and training efforts to ensure proper application of existing seabird mitigation measure requirements;
2. NMFS provide support for research and development for alternative measures with potential to replace blue-dyed bait, with high

priority placed on identifying suitable designs for tori lines; and

3. Encourage submission of Experimental Fishing Permit applications for testing alternative measures without the use of blue-dyed bait to allow comparison of measure effectiveness with and without blue-dyed bait.



Ed Melvin, formerly with Washington Sea Grant and affiliate professor at the University of Washington at the September 2018 workshop demonstrating tori lines utilized in the Alaskan and West Coast bottom longline fisheries.



Blue-dyed bait being prepared.

6. Summary

Table 10 compares the 2017 and 2018 observed interactions in the two fisheries. The observed interactions and interaction rate from 2017 to 2018 increased for the deep-set fisheries and decreased for the shallow-set fishery. In 2017, the shallow-set fishery interacted with 60 seabirds (six Laysan albatrosses, 53 black-footed albatrosses, and one glaucous winged gull). In 2018, the shallow-set fishery interacted with nine seabirds (two Laysan albatrosses and seven black-footed albatrosses). In 2017, observers in the deep-set fishery documented interactions with 142 seabirds (35 Laysan albatross, 190 black-footed albatrosses, nine sooty shearwaters, one brown booby, and one red-footed booby) (see Table 6).

Table 10. Comparison of observed interactions in Hawaii longline fisheries, 2017 and 2018.

Observed Interactions	2017	2018	% Change
Seabirds observed in deep-set fishery	142	236	66%
Seabirds observed in shallow-set fishery	60	9	-85%
Deep-set interaction rate (birds per 1,000 hooks observed)	0.014	0.020	43%
Shallow-set interaction rate (birds per 1,000 hooks observed)	0.057	0.016	-72%

Note: There was 20.36% and 20.39% observer coverage in the deep-set longline fishery in 2017 and 2018, respectively, and 100% coverage in the shallow-set longline fishery.

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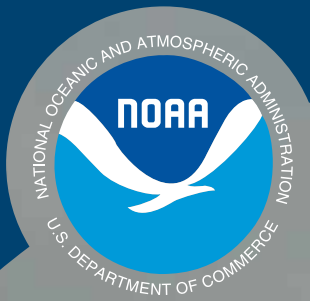
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Pacific Islands Regional Office

Seabird Interactions and Mitigation Efforts in Hawaii Longline Fisheries

2016 ANNUAL REPORT

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Please note: Data in this report are considered to be preliminary, and may be revised as better information becomes available. For the most current data, please contact the NMFS Pacific Islands Regional Office.

Cover image: Black-footed albatross



Red-footed booby

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1. Introduction

The National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO) attempts to reduce, as practicable, interactions between Hawaii pelagic longline fishing operations and seabirds. NMFS monitors the fisheries to determine the effectiveness of management measures implemented to reduce interactions and the severity of interactions. NMFS documents interactions and mitigation efforts aboard vessels at sea, and reports annually on fishing effort, seabird interactions, and mitigation research.¹ You may view this report, and similar reports from previous years, at www.fpir.noaa.gov.

1.1 Background

NMFS and the Western Pacific Fishery Management Council (WPFMC) manage two Hawaii pelagic longline fisheries under the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific (FEP) and implementing regulations. The deep-set longline fishery targets primarily bigeye tuna at depths to 400 m and operates mainly north-northeast and southwest of the main Hawaiian Islands (Fig. 1). The shallow-set longline fishery targets swordfish at depths to 100 m and typically operates north and east of the Hawaiian Islands (Fig. 2). The FEP contains a detailed description of the Hawaii longline fisheries (WPFMC 2009, as amended).

Since 1994, the Hawaii longline fleet has been limited to 164 permits. Activity levels in any given year since 2004 range from 11 to 35 vessels in the shallow-set longline fishery, and 122 to 139 vessels in the deep-set longline fishery. Nearly all vessels in the shallow-set longline fishery

also participate, to some degree, in the deep-set longline fishery during the year.

Laysan albatross, black-footed albatross, shearwaters, fulmars, boobies, and the endangered short-tailed albatross feed around the Hawaiian Islands in areas where the longline fisheries operate. During the deployment (setting) and retrieval (hauling) of longline fishing gear, hooks, and line may occasionally hook or entangle seabirds that attempt to take bait or catch. Seabirds are more likely to drown when the interaction occurs during setting because the weight of the gear may pull the seabird underwater. Although some interactions are inevitable, fishermen take steps to avoid and minimize interactions. By using safe handling and release techniques, fishermen help many seabirds survive their interactions.

Effective management of the fisheries has greatly minimized interactions with seabirds. In 2000, NMFS estimated 2,433 seabird interactions in the Hawaii longline fisheries. From 2001 – 2006, NMFS implemented seabird mitigation measures. These measures have significantly reduced interactions and are described below. In 2016, there were 65 interactions in the shallow-set longline fishery. For the 2016 deep-set longline fishery, we expanded the observed interactions using the observer coverage rate and estimated 691 interactions in the deep-set longline fishery. Credit for this successful reduction in interactions is mostly due to the fishermen, who understand and implement the seabird mitigation measures. The measures include training in seabird identification, seabird-deterrent fishing gear and techniques, and special handling and release of incidentally-caught seabirds.



Northern fulmar in flight.

¹This annual report is required in the Terms and Conditions of the 2012 Biological Opinion of the U.S. Fish and Wildlife Service for the operation of Hawaii-based Pelagic Longline Fisheries (USFWS 2012).

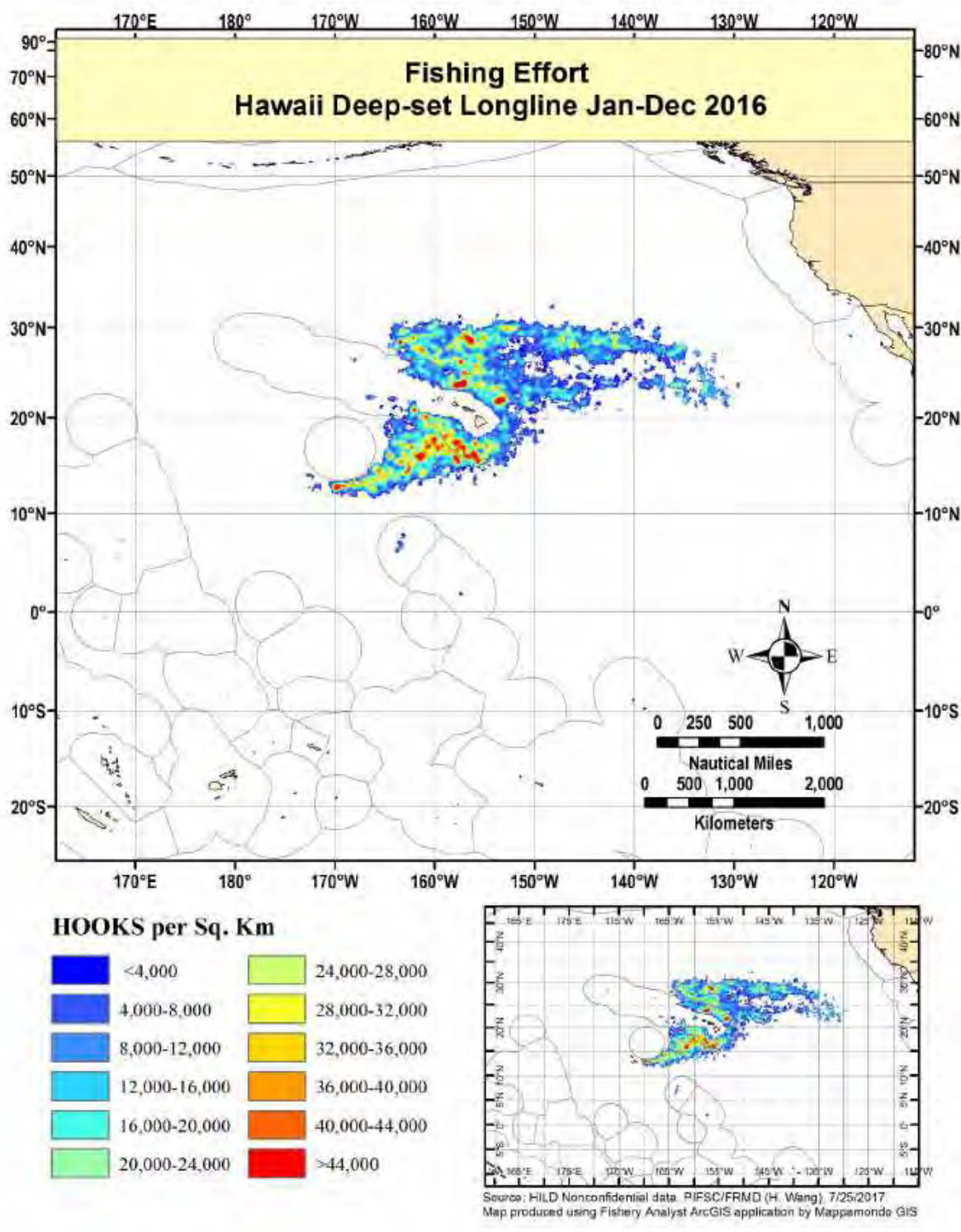


Figure 1. Spatial distribution of fishing effort by the Hawaii deep-set longline fishery, 2016.

Source: NMFS Pacific Islands Fisheries Science Center (PIFSC) logbook, unpublished data, received 7/25/2017.

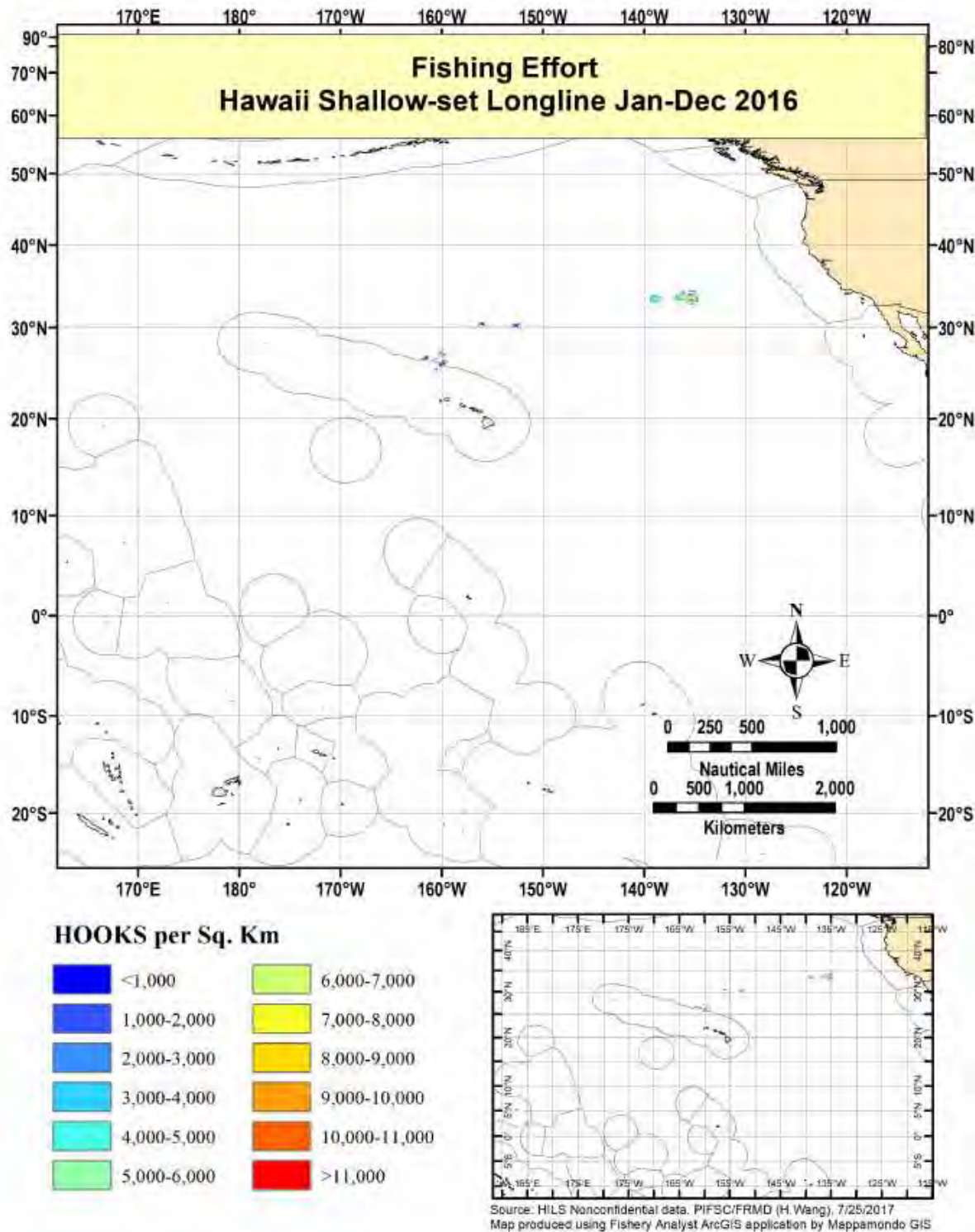


Figure 2. Spatial distribution of fishing effort by the Hawaii shallow-set longline fishery, 2016.

Source: NMFS PIFSC logbook, unpublished data, received 7/25/2017.

1.2 Seabird Mitigation Measures for the Hawaii Longline Fisheries

Most of the regulations for the Hawaii longline fisheries are identified in Title 50 of the Code of Federal Regulations **Part 600** and **Part 665** (50 CFR Parts 600 and 665). NMFS also provides a [regulation summary and compliance guides](http://www.fpir.noaa.gov/SFD/pdfs/seabird-compliance-guide_(rev.7-8-14).pdf) to Hawaii longline fishermen and the general public, available from [http://www.fpir.noaa.gov/SFD/pdfs/seabird-compliance-guide_\(rev.7-8-14\).pdf](http://www.fpir.noaa.gov/SFD/pdfs/seabird-compliance-guide_(rev.7-8-14).pdf). Regulations specific to the mitigation of seabird interactions and safe handling techniques are at 50 CFR 665.815. The ways that fishermen implement required seabird mitigation measures depend on how and where fishermen fish. Mitigation measures to reduce seabird interactions differ between the two options of stern-setting and side-setting. The following sections describe each of the main gear and operation requirements. The 2012 Biological Opinion (USFWS 2012) also describe these measures.



Black-footed albatross competing for a bite of strategic offal discards.

Side-Setting

Side-setting involves deploying the gear from the side of the vessel, compared to the conventional method of setting from the stern. In side-setting, crew set baited hooks forward and close to the side of the vessel's hull where seabirds are unable or unwilling to pursue the hooks. With required branch line weighting, by the time the vessel stern passes the location where baited hooks have been set, the baited hooks will have sunk to a depth where seabirds cannot reach them (Gilman and Brothers 2006; Gilman et al. 2005, 2007a, 2007b). Additionally, deploying a required bird curtain aft of where crew is deploying the gear inhibits seabirds from landing on the water along the side of the vessel where baits are accessible.

Table 1 summarizes the number of Hawaii pelagic longline deep- and shallow-set vessels observed to set from the stern and from the side in 2016, with some vessels operating in both deep- and shallow-set longline fisheries. In 2016, most vessels in the deep-set longline fishery and all vessels in the shallow-set longline fishery chose to stern-set.

Table 1. Number of observed Hawaii longline vessels that side- and stern-set in 2016.

Fishery	Deck setting position	Vessels
Deep-set	Stern-setting	103
Deep-set	Side-setting	26
Shallow-set	Stern-setting	13
Shallow-set	Side-setting	0

Source: NMFS PIRO Observer Program, unpublished data, 9/18/2017

Weighted Branch Lines

Fishermen place weights close to the hook on branch lines so baited hooks sink quickly and help prevent foraging seabirds from possibly becoming hooked or entangled in longline gear. When required, Hawaii longline fishermen must attach a weight of at least 45 g within 1 m of the hook to sink the branch line quickly. Fishermen commonly use weights from 45 to 80 g.

Thawed and Blue-dyed Bait

Dyeing bait to a specific blue color reduces visibility by reducing contrast with the sea surface. Fishermen thaw the bait to increase sink rates and to allow a more effective penetration of the blue dye. Almost all bait used in the Hawaii longline fisheries consists of the fusiform fishes mackerel (saba), sardines, and saury (sanma). NMFS prohibits the use of squid bait in the shallow-set longline fishery to reduce sea turtle interactions. While fishermen may still use squid in the deep-set longline fishery, the squid bait costs more than some fish bait and is, thus, less preferred.

Strategic Offal Discards

Fishermen developed the technique of strategically discarding offal to distract seabirds from attempting to steal baits from hooks before the branch lines are retrieved. Fishermen discard swordfish heads and livers on the opposite side of the vessel from fishing operations to distract birds away from the baited hooks. NMFS observers in the mid-1990s noted that strategically discarding offal reduced incidental hooking or entanglement of albatrosses, and it is now a requirement. When seabirds are present

around the vessel, fishermen that are deep-setting north of 23° N., or shallow-setting anywhere, are required to use strategic offal discards as a seabird mitigation measure when setting from the stern.

Night Setting

Night-setting as a seabird mitigation measure requires shallow-set longline fishermen, when stern-setting, to start deploying gear no earlier than one hour after local sunset and complete the set no later than the following sunrise. The measure also requires using the minimum lighting necessary to conform to navigation rules and best safety practices. The night-set measure is based on the premise that seabirds cannot see baited hooks in the dark and, thus, do not attack them. Night-setting has been a very effective seabird mitigation measure, reducing seabird interactions as much as 98% (McNamara et al. 1999, Boggs 2003).

Table 2 summarizes the seabird mitigation requirements.

Table 2. Seabird mitigation requirements for the Hawaii longline fleet.

What you need to do	Stern-setting		Side-setting	
	Shallow-Set Anywhere	Deep-Set North of 23° N	Shallow-Set Anywhere	Deep-Set North of 23° N
Deploy mainline from port or starboard side at least 1 m forward of stern corner	-	-	Yes	Yes
If line shooter is used, mount it at least 1 m forward from stern corner	-	-	Yes	Yes
Use a specified bird curtain aft of the setting station during the set	-	-	Yes	Yes
Deploy gear so that hooks do not resurface	-	-	Yes	Yes
Attach 45 g or heavier weights within 1 m of hook of each hook	-	Yes	Yes	Yes
Use a line shooter to set the mainline	-	Yes	-	-
Keep two 1-pound containers of blue-dye on boat	Yes	Yes	-	-
Use completely thawed and blue-dyed bait	Yes	Yes	-	-
Keep fish parts and spent bait with all hooks removed for strategic offal discard	Yes	Yes	-	-
Cut all swordfish heads in half, and use heads and livers for strategic offal discard	Yes	Yes	-	-
Night Set - begin set 1 hour after local sunset and finish 1 hour before next sunrise and keep lighting to a minimum	Yes	-	-	-

1.3 Protected Species Workshops

In addition to gear and operational mitigation measures to deter or reduce seabird interactions, owners and operators of pelagic longline vessels must complete a protected species workshop each year (50 CFR 665.814). The workshop includes training in the identification, safe handling, and release techniques for sea turtles, marine mammals, and seabirds. The workshop also reviews regulatory and compliance requirements. In a classroom setting, fishermen learn from oral presentations, hands-on demonstrations, videos, and printed reference materials. NMFS also offers the workshops on line. A valid workshop certificate is necessary for owners to obtain or renew Federal longline fishing permits. Longline vessel operators must also have on board the vessel a valid protected species workshop certificate issued by NMFS to the operator of the vessel.

In 2016, NMFS PIRO provided protected species workshop training for 263 Hawaii-based longline vessel owners and operators, and other interested individuals. Another 62 vessel owners, operators, and crewmembers completed the training in American Samoa with assistance from the PIRO Observer Program.



An example of the types of gear that are required aboard Hawaii-based longline vessels. This gear assists the crew with the release of seabirds and other protected species that become unintentionally hooked or entangled in longline fishing gear.

1.4 Fishing Effort and Observer Coverage

Table 3 summarizes effort data from 2015 and 2016 by haul date. From 2015 to 2016, effort in the deep-set longline fishery increased, and effort in the shallow-set longline fishery decreased. Deep-set fishing trips increased by 2% and shallow-set fishery trips decreased by 34%.

Please note that other summaries throughout this report and elsewhere may vary slightly depending upon the data source, including revisions. For example, observers may report seabird interactions by date of trip (departure or arrival), set date, or haul date in a given year. NMFS typically bases observer coverage levels on the trip departure date. The NMFS Observer Program typically bases protected species interactions in their quarterly, semiannual, and annual reports on vessel arrival date (http://www.fpir.noaa.gov/OBS/obs_qrtrly_annual_rprts.html). NMFS also provides summary reports from mandatory logbook data reported by longline captains.

Table 3. Hawaii deep- and shallow-set longline fisheries effort and observer coverage, 2015 and 2016.

2016					
Fishery	Number of vessels	Trips	Sets	Hooks	Observer coverage
Deep-set	141	1,476	19,344	51,015,174	20.13%
Shallow-set	13	46	727	796,165	100%

2015					
Fishery	Number of vessels	Trips	Sets	Hooks	Observer coverage
Deep-set	141	1,444	18,433	47,409,044	20.6%
Shallow-set	23	70	1,156	1,274,805	100%

Source: NMFS PIRO Observer Program, unpublished data, 9/18/2017, and NMFS PIFSC unpublished data, 8/31/2017.

2. Interactions

2.1 Species

NMFS observers have recorded the following bird species being hooked or entangled in the longline fisheries since 1994, when NMFS began deploying observers: Laysan albatross (*Phoebastria immutabilis*), black-footed albatross (*P. nigripes*), sooty shearwater (*Puffinus griseus*), unidentified shearwaters, brown booby (*Sula leucogaster*), red-footed booby (*S. sula*), and northern fulmar (*Fulmarus glacialis*) (Table 4). None of these species is listed under the Endangered Species Act (ESA). Both Hawaii longline fisheries have a low level of interactions with these species. Based on the population estimates, the fisheries likely have very little effect on these populations.



Brown booby

Table 4. Species recorded hooked or entangled in Hawaii longline fisheries

Species	Global Population estimate	Demographic information
Laysan albatross	666,658 breeding pairs (ACAP 2017)	The Northwestern Hawaiian Islands (NWHI) has the world's largest colonies and more than 99% of the global breeding population (ACAP 2012a)
Black-footed albatross	69,969 pairs (ACAP 2017)	More than 95% of the population breeds in the NWHI (ACAP 2012b)
Northern fulmars	20 million individuals (Birdlife 2017a)	Located throughout the North Atlantic and North Pacific
Red-footed booby	More than 1 million birds (Birdlife 2017b)	Winters on tropical islands in most oceans
Brown booby	More than 200,000 adults (Birdlife 2017c)	Located throughout the pan-tropical oceans
Sooty shearwaters	20 million (Birdlife 2017d)	Nest in Australia, New Zealand, and southern South America (Birdlife 2017d)

Some seabirds, especially shearwaters, are difficult to identify. Table 5 provides a summary of seabird specimens that NMFS observers collected for identification and biological study after capture in the Hawaii longline fisheries in 2016. Most seabird specimens are frozen and shipped to the Marine Wildlife Veterinary Care and Research Center in Santa Cruz, California. Since 2007, staff with the organization Oikonos have been collecting morphometric data on shipped specimens.

Table 5. Summary of collected seabirds from the Hawaii longline fisheries, 2016.

Species	Number retained
Black-footed albatross	85
Laysan albatross	24
Sooty shearwater	4
Red-footed booby	1

Note: Not all dead seabirds are collected as specimens.
Source: NMFS PIRO Observer Program, unpublished data, 9/18/2017.

2.2 Location of Interactions

Figs. 3 and 4 show the spatial distribution of observed seabird interactions in deep- and shallow-set longline fisheries, respectively, based on observations of seabirds in 2016. Most of the interactions occur north of 25° N, where seabirds are typically more abundant, and where fishing effort is more concentrated.

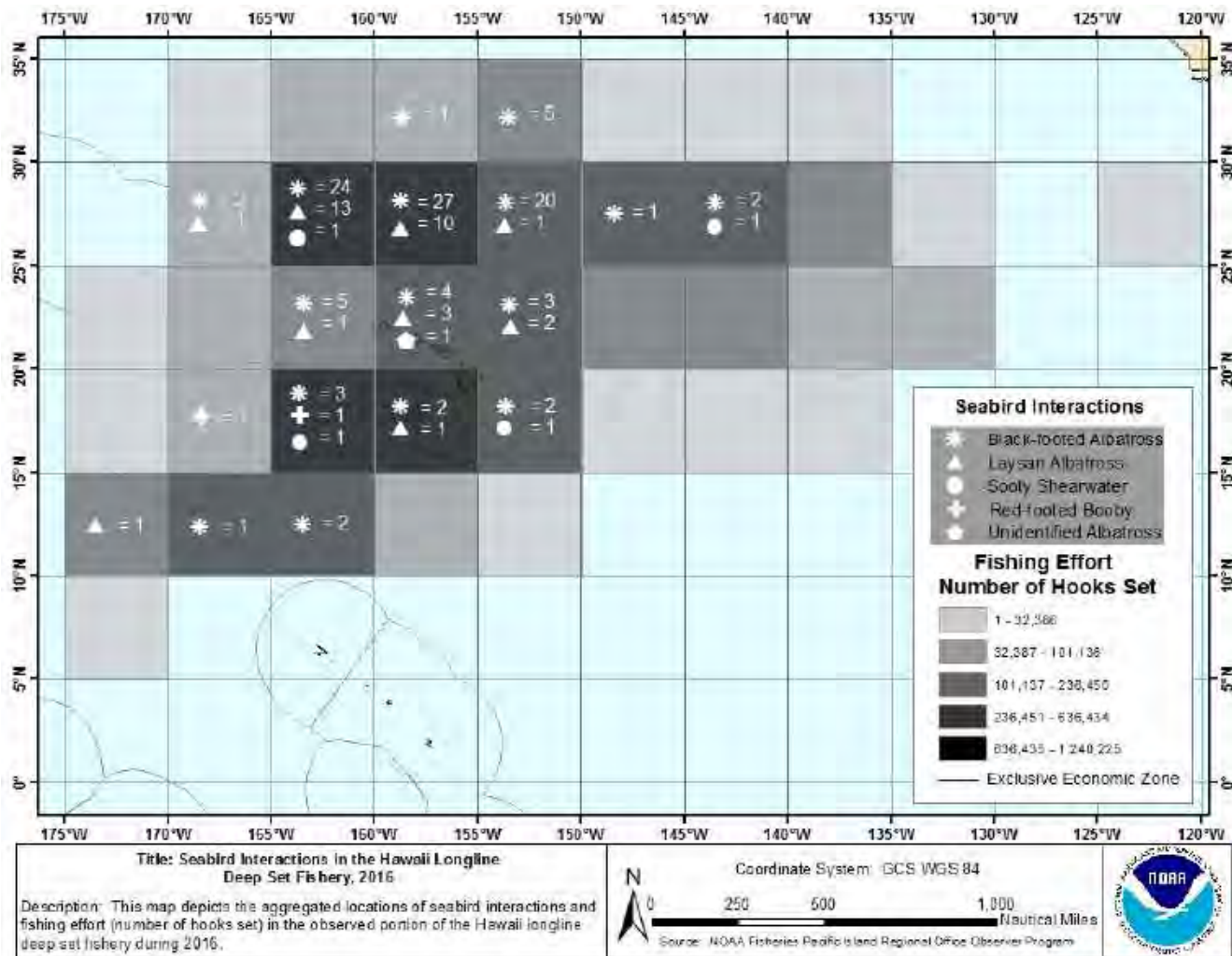


Figure 3. Locations of seabird interactions observed in Hawaii deep-set longline fishery, 2016.

Note: NMFS deployed observers on 20.13% of deep-set trips in 2016. Source: NMFS PIRO Observer Program, unpublished data, 8/3/2017.

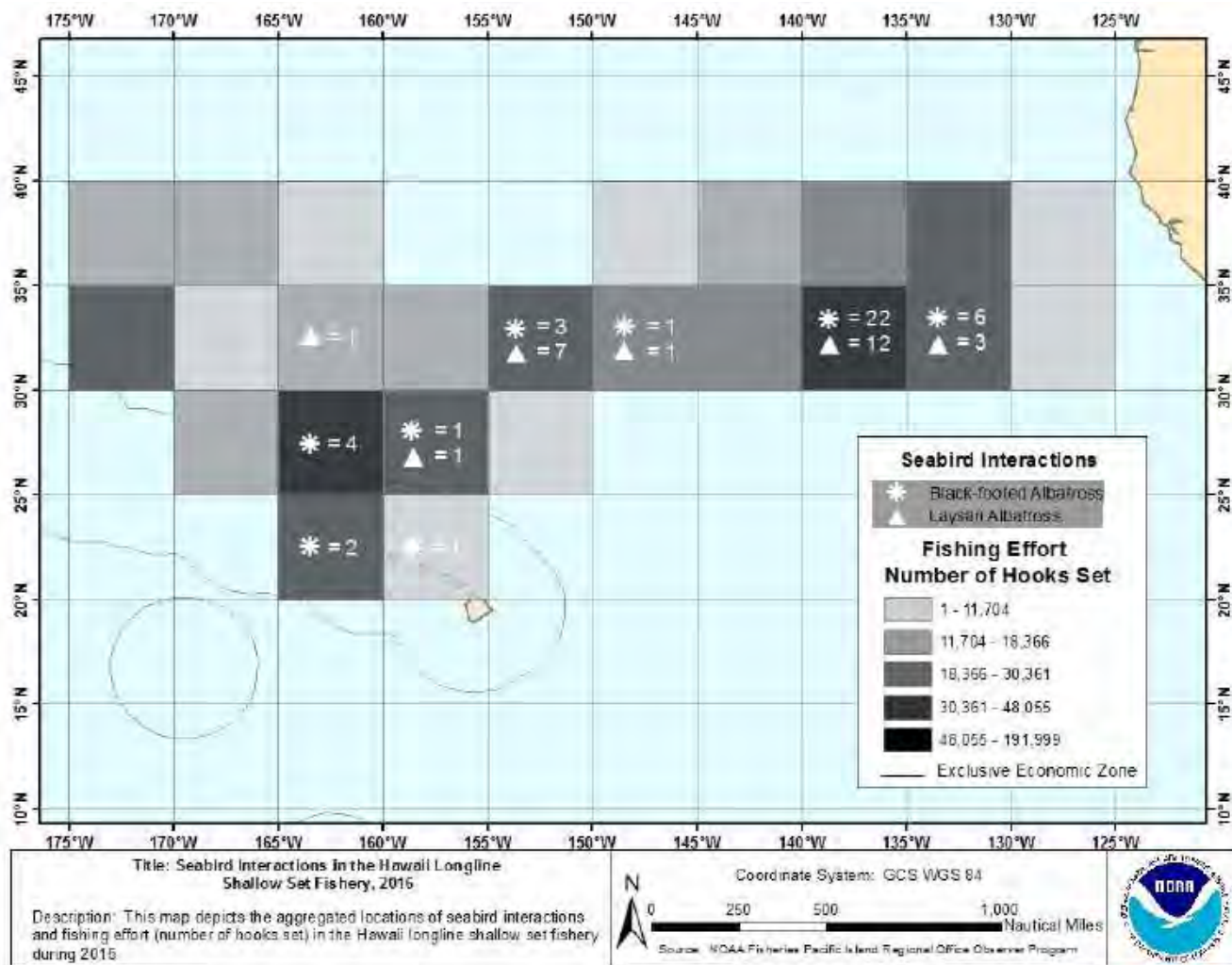


Figure 4. Locations of seabird interactions observed in Hawaii shallow-set longline fishery, 2016.

Note: NMFS deployed observers on every shallow-set trip in 2016. Source: NMFS PIRO Observer Program, unpublished data, 8/3/2017.

2.3 Number of Interactions

Table 6 summarizes the number of observed seabird interactions, and the condition of the seabirds upon release, and fishing effort in both longline fisheries from 2004 – 2016. During that period, NMFS deployed observers on 100% of shallow-set longline fishing trips; therefore, the number of interactions shown in Table 6 represents the fishery-wide totals. NMFS deployed observers on 20.13% of deep-set trips in 2016, so we expanded the observed interactions using the observer coverage rate to estimate total interactions (Table 7).

Table 6. Numbers of observed seabird catch levels, fishing effort, and interaction rates in the combined Hawaii longline fisheries, 2004-2016.

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species caught	Total birds observed caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
DEEP-SET FISHERY									
2004	2	5	-	2	9	-	9	7,900,681	0.001
2005	6	11	-	1 ¹	18	-	18	9,360,671	0.002
2006	1	17	5	-	23	-	23	7,540,286	0.003
2007	7	18	-	-	25	-	25	7,620,083	0.003
2008	14	30	14	2 ²	60	4	56	8,775,951	0.007
2009	18	23	4	-	45	-	45	7,877,861	0.006
2010	39	17	1	-	57	1	56	8,184,127	0.007
2011	32	13	3	-	48	2	46	8,260,092	0.006
2012	31	36	7	-	74	5	67	8,768,728	0.008
2013	48	49	8	-	105	5	100	9,278,133	0.011
2014	12	38	1	-	51	6	45	9,608,244	0.005
2015	25	101	4	2 ⁴	132	19	113	9,393,234	0.014
2016	33	104	4	3 ⁵	144	7	137	9,882,920	0.015
SHALLOW-SET FISHERY									
2004	1	-	-	-	1	1	-	76,750	0.013
2005	62	7	-	-	69	47	22	1,328,806	0.052
2006	8	3	-	-	11	5	6	745,125	0.015
2007	40	8	-	-	48	40	8	1,292,036	0.037
2008	33	6	-	-	39	24	15	1,350,127	0.029
2009	81	30	1	-	112	88	24	1,767,128	0.063
2010	40	38	-	1 ³	79	61	18	1,828,529	0.043
2011	49	19	-	-	68	53	15	1,611,395	0.042
2012	62	37	-	-	99	77	21	1,418,843	0.070
2013	45	28	2	-	75	48	27	1,000,084	0.075
2014	39	32	1	-	72	56	16	1,509,727	0.048
2015	43	38	-	-	81	65	16	1,286,628	0.063
2016	25	40	-	-	65	50	15	830,177	0.078

Note: Observer Program data (unpublished, 9/18/2017) are based on the date and time of the beginning of the haul, with the exception of the total observed effort (hooks), which is based on departure date from the Observer Program annual reports (NMFS 2017a and NMFS 2017b). Interaction rates are calculated and rounded to the nearest thousandths (third decimal) place. Footnote: ¹ brown booby, ² red-footed booby and unidentified seabird, ³ northern fulmar, ⁴ red-footed booby and unidentified shearwater, ⁵ two red-footed boobies and one unidentified albatross.

Fig. 5 shows the seabird interaction rate from 2004 to 2016 from Table 6. In recent years, the seabird interaction rates have increased.



Figure 5. Seabird interaction rates in the deep-set and shallow-set longline fisheries, 2004-2016.

Almost all interactions in the deep-set longline fishery occur when fishermen set gear during the day while seabirds are actively feeding. Seabirds may be hooked or entangled, and then drown while the gear sinks. Because most seabirds are inactive at night, very few interactions occur when fishermen typically haul deep-set longline gear. In 2016 in the deep-set longline fishery, observers documented interactions with 33 Laysan albatrosses, 104 black-footed albatrosses, four sooty shearwaters, and two red-footed boobies, and one unidentified albatross (Table 6). Nearly all of the seabirds observed to interact with the deep-set longline fishery were dead (95%). Table 7 contains the total

estimated number of interactions with Laysan albatross, black-footed albatross, shearwaters, and red-footed booby based on observer records for the deep-set fishery in 2016.

Table 7. Estimated total seabird interactions in the Hawaii deep-set longline fishery, 2016.

Species	Total annual estimate
Black-footed albatross	485
Laysan albatross	166
Unidentified albatross	7
Shearwaters	21
Red-footed booby	12

Note: Table lists point estimates of the total number of incidental interactions by species in the Hawaii deep-set longline fishery based on observed interactions during 2016. The estimate for shearwaters represents an estimate for the number of incidental interactions by the group of species considered shearwaters. Source: McCracken 2017.

The shallow-set longline fishery typically sets at night and hauls the gear during the day; therefore, most of the interactions occur when fishermen retrieve the gear and birds are actively feeding. In 2016, the shallow-set longline fishery interacted with 25 Laysan albatrosses and 40 black-footed albatrosses (Table 6). Fishermen released approximately 77% of seabirds alive.

Seabirds can be hooked, entangled, or both. Table 8 provides a summary of capture details in 2016. Regulations require fishermen to remove as much gear as safely possible from any seabirds captured before the seabirds are released.

Table 8. Summary of capture details by species for seabird interactions in the Hawaii longline fisheries, 2016.

Species	Hooked only	Entangled only	Both hooked and entangled	Not known or not recorded
Laysan albatross	46	6	5	1
Black-footed albatross	121	4	19	0
Sooty shearwater	3	1	0	0
Red-footed booby	2	0	0	0

Note: None of the seabirds released alive had any gear attached. Source: NMFS PIRO Observer Program, unpublished data, 7/18/2017.

Recovered Seabird Bands

State and Federal agencies and other groups attach identification bands to the legs of birds to study bird movement, survival, and other characteristics. Table 9 provides a summary of observed seabirds with leg bands from Hawaii longline fisheries interactions in 2016. Most of the recovered bands were from albatrosses banded on French Frigate Shoals in the NWHI and caught incidentally in the first half of the year.

Table 9. Observed interactions of seabirds with bands in the shallow-set and deep-set Hawaii longline fisheries, 2016.

Species	Disposition	Date banded	Band(s) recovery date	Location banded	Age at banding (yr)	Age at recovery (yr)
Black-footed albatross ¹	Dead	6/8/2010	5/13/2015	French Frigate Shoals (Tern Island)	<1	5
Black-footed Albatross	Dead	1/1/2001	1/17/2016	French Frigate Shoals (Tern Island)	>1	>15
Black-footed Albatross	Dead	6/28/2004	1/20/2016	Laysan Island	<1	12
Black-footed Albatross	Dead	1/4/2007	1/22/2016	Laysan Island	>1	>9
Laysan Albatross	Dead	6/9/2008	1/22/2016	French Frigate Shoals (Tern Island)	<1	8
Laysan Albatross	Dead	6/13/2006	1/23/2016	French Frigate Shoals (Tern Island)	<1	10
Black-footed Albatross	Dead	5/28/2007	1/25/2016	French Frigate Shoals (Tern Island)	<1	9
Laysan Alabtross	Dead	4/5/2005	1/26/2016	Kauai (Kilauea Point)	>1	>11
Laysan Alabtross	Dead	4/8/2015	1/28/2016	Oahu (Kaena Point)	>1	>2
Black-footed Albatross	Dead	5/22/2008	1/29/2016	French Frigate Shoals (Tern Island)	<1	8
Black-footed Albatross	Dead	12/12/1997	2/5/2016	French Frigate Shoals (Tern Island)	>3	>22
Black-footed Albatross	Dead	6/8/2002	2/10/2016	French Frigate Shoals (Tern Island)	<1	14
Laysan Alabtross	Dead	5/30/2002	2/12/2016	Kauai (Kilauea Point)	<1	14
Black-footed Albatross	Dead	12/16/2006	2/15/2016	French Frigate Shoals (Tern Island)	>1	>10
Laysan Alabtross	Dead	6/21/2006	2/25/2016	French Frigate Shoals (Tern Island)	<1	10
Black-footed Albatross	Injured	5/16/2010	2/27/2016	French Frigate Shoals (Tern Island)	<1	6
Black-footed Albatross	Dead	5/21/2008	2/28/2016	French Frigate Shoals (Tern Island)	>1	7
Laysan Albatross	Injured	5/14/2007	3/3/2016	Punta Sur, Guadalupe Island, Baja California, MX	<1	9
Black-footed Albatross	Dead	1/3/1998	3/13/2016	French Frigate Shoals (Tern Island)	>3	>21
Black-footed Albatross	Dead	6/6/2008	3/15/2016	French Frigate Shoals (Tern Island)	<1	8
Black-footed Albatross	Injured	5/22/2006	4/12/2016	French Frigate Shoals (Tern Island)	<1	10
Black-footed Albatross	Dead	1/29/1998	4/19/2016	French Frigate Shoals (Tern Island)	>2	>20
Black-footed Albatross	Dead	6/11/2004	5/14/2016	French Frigate Shoals (Tern Island)	<1	12
Black-footed Albatross	Dead	5/31/1995	6/4/2016	French Frigate Shoals (Tern Island)	<1	21
Black-footed Albatross	Dead	5/18/2009	7/2/2016	French Frigate Shoals (Tern Island)	<1	7
Black-footed Albatross	Dead	6/8/2007	12/17/2016	French Frigate Shoals (Tern Island)	<1	>9

¹Inadvertently excluded from 2015 seabird interactions report.

Source: USGS, USFWS, and NMFS, unpublished data, received 7/18/2017.

3. ESA-listed Seabirds

There have been no observed interactions (hooking or entanglement) between the fisheries and any ESA-listed seabirds. The distributions of three seabird species that are protected under the ESA overlap with the areas where the Hawaii longline fisheries operate: the endangered short-tailed albatross and Hawaiian dark-rumped petrel (*Pterodroma sandwichensis*), and the threatened Newell's shearwater (*Puffinus auricularis newelli*). There were no sightings of short-tailed albatross on observed deep-set and shallow-set longline trips in 2016.



Short-tailed albatross

4. Management

In May 2015, consistent with the Migratory Bird Treaty Act, the USFWS issued a Special Purpose Permit to NMFS for the shallow-set longline fishery. The permit authorized the incidental take of a limited number of migratory birds in the shallow-set longline fishery until March 31, 2018. The permit included short-tailed albatross, black-footed albatross, Laysan albatross, sooty shearwater, and Northern fulmar. For further information, please visit the USFWS website (<http://www.fws.gov/pacific/migratorybirds/nepa.html>).

In December 2017, the U.S. 9th Circuit Court of Appeals reversed a District Court's judgment affirming FWS's decision to issue the Special Purpose Permit to NMFS (*Turtle Island Restoration Network; Center for Biological Diversity vs. National Marine Fisheries Service, 12-cv-00594, D-Haw*). Specifically, the 9th Circuit Court concluded that the FWS's grant of an incidental take permit to the NMFS in reliance on the special purpose permit provision in 50 CFR 21.27 was arbitrary and capricious because the FWS's interpretation of § 21.27 does not conform to either the MBTA's conservation intent or the plain language of the regulation. The Court explained its conclusion by discussing the other "form" permits authorized under the

MBTA for discrete types of takings (scientific collection, taxidermy, and rehabilitation), and then stated that the FWS's new interpretation of § 21.27's special purpose activity exception as applying to basic commercial activities like fishing that have no articulable special purpose is, therefore, inconsistent with the existing permitting scheme that the FWS has enacted.

5. Research

Shallow-set Fishery

Effective management in the Hawaii shallow-set fishery has greatly reduced seabird interactions, primarily through mitigation measures required during gear setting. Since effective implementation of these measures in 2001, approximately 75% of the remaining seabird interactions occur during gear hauling (Gilman et al. 2014). Because most shallow-set longline fishermen choose the option to stern set at night, they haul their gear primarily during the day when seabirds are more likely to be foraging. In a review of observer data from 2004 to 2012, Gilman et al. (2014) found an increasing temporal trend of albatrosses attending vessels during hauling, which may have been one of the factors that results in the observed increasing trend in the seabird standardized haul catch rate during this time.

The highest relative standardized seabird catch rates from January through March corresponded with brooding and chick rearing for mature Laysan and black-footed albatrosses, when the albatrosses forage in areas that overlap with the shallow-set longline fishery. The lowest live seabird catch rates occurred during the non-breeding season in August and September, when albatross foraging areas overlap less with the fishery (Gilman et al. 2014).

In 2016 and 2017, Eric Gilman, with funding from the National Fish and Wildlife Foundation, conducted commercial demonstrations of a bird curtain that could reduce haul interactions in the shallow-set longline fishery. Gilman interviewed Hawaii longline swordfish captains on potential haulback mitigation techniques. He asked captains to rate the following in terms of potential effectiveness: bird curtain, towed buoy, maximized crew branchline coiling rate, refraining from flicking spent bait during hauling, attaching weighted swivels close to the hook, positioning crew further forward on deck, adjusting the vessel hauling speed, and using a water spray. Gilman used the captains' responses to select the bird curtain option as the mitigation option to employ during a demonstration during three fishing trips. After the demonstration, Gilman interviewed the vessel captain and observers to document the economic viability, practicality, and safety of the bird curtain. Results

suggest that the bird curtain continues to hold promise at being both effective at avoiding bird captures during haulback and being commercially viable (Gilman and Musyl 2017). Indeed, bird curtains and side-setting are part of the suite of seabird mitigation requirements in the longline fisheries.

Deep-set Fishery

Since NMFS introduced seabird regulations in 2001 in the Hawaii deep-set longline fishery, the seabird catch rate had declined. Over the past decade, however, seabird catch levels have increased with increasing fishing effort and interaction rates. Decreasing ocean productivity in recent years may have contributed to the increasing trend in the nominal seabird interaction rate. In a review of observer data from 2004 to 2014, Gilman et al. (2016) found the bird catch rate significantly increased as annual mean multivariate El Niño Southern Oscillation index values increased. This result suggests that the decreasing ocean productivity observed in recent years in the central North Pacific may have contributed to the increasing catch rate. Higher numbers of albatrosses attending vessels, possibly linked to declining regional ocean productivity and increasing absolute abundance of black-footed albatrosses, may also have contributed to the increasing rate.

Gilman et al. (2016) found the largest opportunities for bycatch reductions are through increased efficacy of seabird mitigation measures north of 23° N, where mitigation methods are required, and during setting instead of during hauling. Both options for meeting regulatory requirements, side vs. stern setting, and blue-dyed vs. untreated bait, significantly reduced the seabird catch rate. However, side-setting had a significantly lower seabird catch rate than blue-dyed bait. There was significant spatio-temporal and seasonal variation in the risk of seabird capture with the highest catch rates in April and May, and to the northwest of the main Hawaiian Islands.

NMFS is working with the Council on investigating seabird interactions, in particular black-footed albatrosses in the deep-set longline fishery. In 2017, a student in the Ernest F. Hollings Scholarship Program worked with NMFS staff and external partners on analyzing the demographics of black-footed albatross takes in the deep-set longline fishery. Her work was included in a workshop hosted by the Council on factors influencing albatross interactions in the Hawaii longline fishery in November 2017. Workshop results will be published in Spring 2018.

6. Summary

Table 10 compares the 2015 and 2016 observed interactions in the two fisheries. The observed interactions and interaction rate for the shallow-set and deep-set longline fisheries increased from 2015 to 2016. In 2015, the shallow-set longline fishery interacted with 81 seabirds (43 Laysan albatrosses and 38 black-footed albatrosses). In 2016, the shallow-set longline fishery interacted with 65 seabirds (25 Laysan albatrosses and 40 black-footed albatrosses). In 2015, observers in the deep-set longline fishery documented interactions with 132 seabirds (25 Laysan albatross, 101 black-footed albatrosses, four sooty shearwaters, one unidentified shearwater, and one red-footed booby). In 2016, observers in the deep-set longline fishery documented interactions with 144 seabirds (33 Laysan albatrosses, 104 black-footed albatrosses, four sooty shearwaters, two red-footed boobies, and one unidentified albatross) (see Table 6).

Table 10. Comparison of observed interactions in Hawaii longline fisheries, 2015 and 2016.

Observed Interactions	2015	2016	% Change
Seabirds observed in deep-set fishery	132	144	9%
Seabirds observed in shallow-set fishery	81	65	-20%
Deep-set interaction rate (birds per 1,000 hooks observed)	0.014	0.015	7%
Shallow-set interaction rate (birds per 1,000 hooks observed)	0.063	0.078	24%

Note: There was 20.6% and 20.13% observer coverage in the deep-set longline fishery in 2015 and 2016, respectively, and 100% coverage in the shallow-set longline fishery.

Acknowledgements

The NMFS PIRO Sustainable Fisheries Division prepared this report, with contributions from C. Tokita, H. Wang, and M. McCracken at the NMFS Pacific Islands Fisheries Science Center, and J. Peschon, and L. Rassel at the NMFS PIRO Observer Program. For more information, please contact Sarah Ellgen, PIRO Sustainable Fisheries Division, at Sarah.Ellgen@noaa.gov.



Black-footed albatross

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U.S. Secretary of Commerce
Wilbur Ross

**Assistant Secretary of Commerce for Oceans and
Atmosphere and Acting Under Secretary of Commerce
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January 2018

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National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
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150404SWR2013SF00065:TD

Dr. Guillermo Compeán, Director
Inter-American Tropical Tuna Commission (IATTC)
8604 La Jolla Shores Drive
La Jolla, California 92037-1508

Re: Submission of the Annual Seabird Reports on Implementation of Mitigation Measures and Bycatch Data

Dear Dr. Compeán:

This letter is submitted pursuant to the *Resolution to Mitigate the Impacts on Seabirds of Fishing for Species Covered by the IATTC (Resolution C-11-02)*. Please see the attached *2015 Annual Report: Seabird Interactions and Mitigation Efforts in Hawaii Longline Fisheries (Annual Report)* for information on the implementation of mitigation measures. Please note that portions of the Annual Report represent activities in both the IATTC and Western and Central Pacific Fisheries Commission Convention areas; thus, the annual bycatch estimates in this report do not reflect interactions solely in the IATTC Convention Area. The 2015 and 2016 seabird bycatch estimate data for U.S. vessels in the IATTC Convention Area are attached.

Please contact Taylor Debevec at 562-980-4066 or at Taylor.Debevec@noaa.gov if there are any questions regarding the United States data reporting in accordance with Resolution C-11-02.

Sincerely,

A handwritten signature in blue ink that reads "Heidi Taylor" with a long horizontal flourish extending to the right.

Heidi Taylor
Highly Migratory Species Branch Chief

cc w/ enclosure:

Barry Thom, U.S. Commissioner to the IATTC
David Hogan, U.S. Department of State
William Fox, U.S. Commissioner
Donald Hansen, U.S. Commissioner
Edward Weissman, U.S. Alternate Commissioner to the IATTC
Christopher Boggs, NMFS, Pacific Islands Fisheries Science Center

Enclosure



Table 1. Estimates of the number of incidental interactions of seabirds for the Hawaii deep-set longline fishery in 2015 and 2016. Estimates are provided for all species with an observed interaction in 2015 or 2016. Estimates are given for the entire fishing grounds and for waters within the IATTC Convention Area.

Species of Seabird	Year	Observed Takes	Point Estimates	Standard Error
Within IATTC Convention Area				
Laysan Albatross	2016	0	0	8.43
	2015	0	0	8.35
Black-footed Albatross	2016	3	12	7.08
	2015	29	153	42.83
Shearwaters	2016	1	5	4.44
	2015	0	0	4.08
Red-footed Booby	2016	0	0	2.48
	2015	0	0	2.34
Unidentified Albatross	2016	0	0	2.06
	2015	0	0	1.67

Table 2. Number of observed incidental interactions of seabirds for the Hawaii shallow-set longline fishery in 2015 and 2016, where the Hawaii shallow-set longline fishery had 100% observer coverage. Counts are provided for all species with an observed interaction in 2015 and 2016. Counts are given for waters within the IATTC Convention Area.

Species of Seabirds	Year	Observed Takes
Within IATTC Convention Area		
Laysan Albatross	2016	17
	2015	7
Black-footed Albatross	2016	29
	2015	4

Table 3. Number of trips, sets, and hooks recorded in the vessel logbook database (Fisheries Monitoring and Analysis Program, 2017) and Longline Observer Data System (LODS, Pacific Islands Regional Observer Program, 2017) for the Hawaii deep-set longline fishery in 2015 and 2016. Total counts are given for waters within the IATTC Convention Area.

Source of Counts	Year	Trips	Sets	Hooks
Within IATTC Convention Area				
Number recorded in logbooks	2016	358	4,325	11,924,491
	2015	443	5,287	14,013,240
Number recorded in LODS	2016	62	749	1,984,712
	2015	88	1,065	2,732,152

Table 4. Number of trips, sets, and hooks recorded in the Longline Observer Data System (Pacific Islands Regional Observer Program, 2017) for the Hawaii shallow-set longline fishery (fishery has 100% observer coverage) in 2015 and 2016. Total counts are given for the waters within the IATTC Convention Area.

Source of Counts	Years	Trips	Sets	Hooks
Within IATTC Convention Area				
Number recorded in LODS	2016	26	417	447,627
	2015	43	707	770,887

2015 ANNUAL REPORT

Seabird Interactions and Mitigation Efforts in Hawaii Longline Fisheries



NOAA
FISHERIES
Pacific Islands
Regional Office

2015 ANNUAL REPORT

Seabird Interactions and Mitigation Efforts in Hawaii Longline Fisheries

January 2017

Pacific Islands Regional Office
NOAA National Marine Fisheries Service
1845 Wasp Blvd.
Honolulu, HI 96818
www.fpir.noaa.gov

Please note: Data in this report are considered to be preliminary, and may be revised as better information becomes available. For the most current data, please contact the NMFS Pacific Islands Regional Office.

Cover image: Black-footed albatross, Lisianski Island.



Nesting albatross, Midway Island.

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1. Introduction

Among many management objectives, the National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO) attempts to reduce, as practicable, interactions between Hawaii pelagic longline fishing operations and seabirds. NMFS monitors the fisheries to determine the effectiveness of management measures to reduce interactions and the severity of interactions that do occur. NMFS documents interactions and mitigation efforts aboard vessels at sea, and reports annually on fishing effort, seabird interactions, and mitigation research.¹ You may view this report, and similar reports from previous years, at www.fpir.noaa.gov.

1.1 Background

NMFS and the Western Pacific Fishery Management Council (WPFMC) manage two Hawaii pelagic longline fisheries under the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific Region (FEP) and implementing regulations. The deep-set fishery primarily targets bigeye tuna at depths to 400 m, and operates over broad areas mainly to the north-northeast and southwest of the main Hawaiian Islands (Fig. 1). The shallow-set fishery targets swordfish at depths to 100 m, and typically operates over a large area north and east of the Hawaiian Islands (Fig. 2). The FEP contains a detailed description of the Hawaii longline fisheries (WPFMC 2009).

Since 1994, the Hawaii longline fleet has been limited to 164 permits. Activity levels in any given year since 2004 range from 11 to 35 active vessels in the shallow-set fishery, and 122 to 139 active vessels in the deep-set fishery. Nearly all vessels in the shallow-set fishery also participate in the deep-set fishery during the year.

Seabirds that feed around the Hawaiian Islands in areas where the longline fisheries operate include Laysan albatross, black-footed albatross, shearwaters, fulmars, boobies, and the endangered short-tailed albatross. During the deployment (setting) and retrieval (hauling) of longline fishing gear, hooks and line may occasionally hook or entangle seabirds that attempt to take bait or catch. Seabirds are more likely to drown when the interaction occurs during setting because the weight of the gear may pull the seabird underwater. Although some interactions are inevitable, fishermen take steps to avoid and minimize interactions so that seabird populations remain healthy, and fishermen can pursue their livelihood. By using safe handling and release techniques, fishermen help many seabirds survive their interactions.

Effective management of the fisheries has greatly minimized interactions with seabirds. In 2000, NMFS estimated 2,433 seabird interactions in the Hawaii longline fisheries. By 2004, NMFS had fully implemented safe seabird handling and mitigation measures which have significantly reduced interactions. In 2015, there were 81 interactions in the shallow-set fishery. For the deep-set fishery, we expanded the observed interactions using the observer coverage rate and estimated 687 interactions in 2015 (see Tables 5 and 6). Credit for this successful reduction in interactions over the years is mostly due to the fishermen, who understand and routinely implement the seabird mitigation requirements. The requirements include training in seabird identification, seabird deterrent fishing gear and techniques, and special handling and release of incidentally-caught seabirds.



Laysan albatross attempting to feed on longline bait.

¹This annual report is required in the Terms and Conditions of the 2012 Biological Opinion of the U.S. Fish and Wildlife Service for the operation of Hawaii-based Pelagic Longline Fisheries (USFWS 2012).

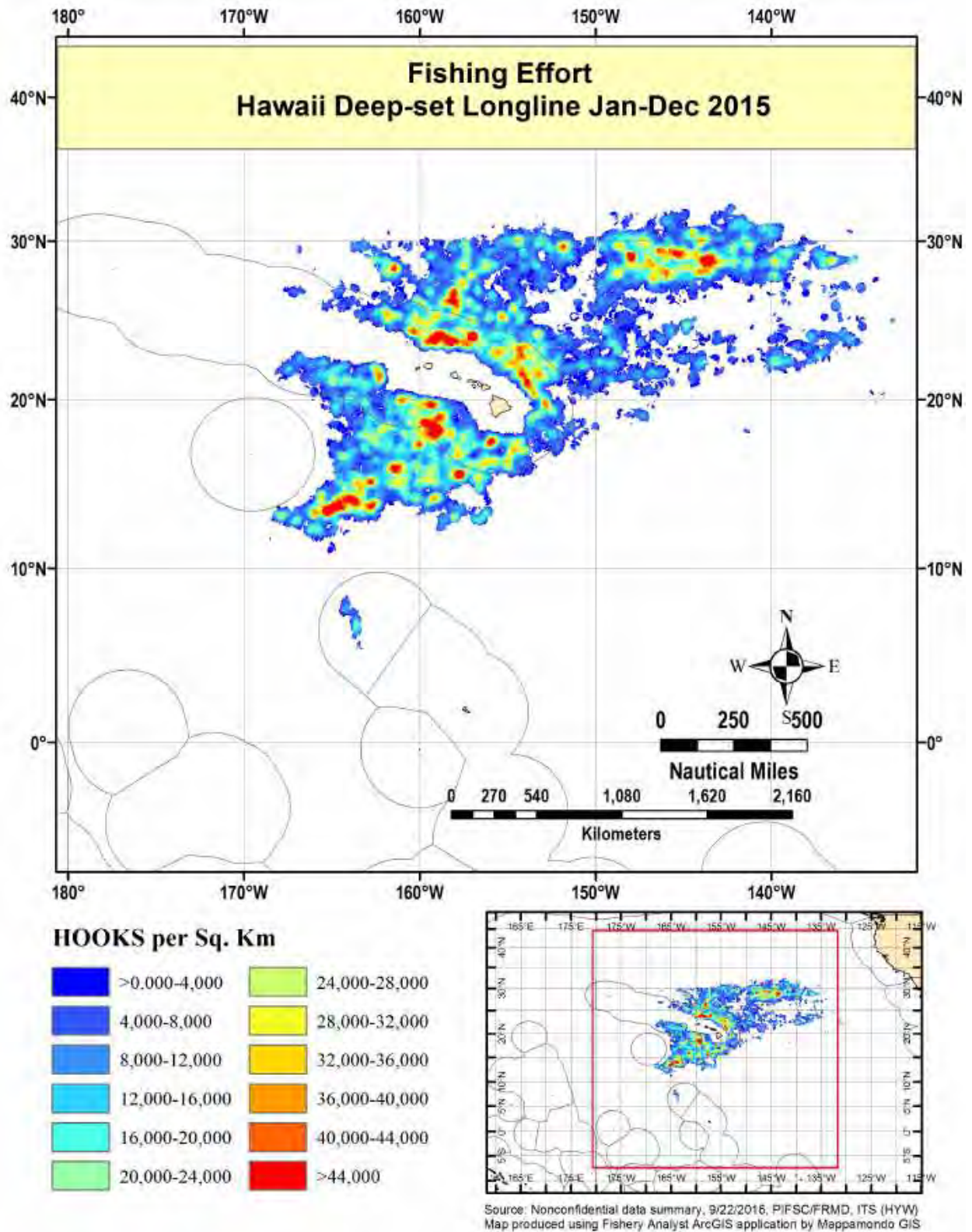


Figure 1. Spatial distribution of fishing effort by the Hawaii deep-set longline fishery, 2015.

Source: NMFS unpublished logbook data, received 12/9/2016.

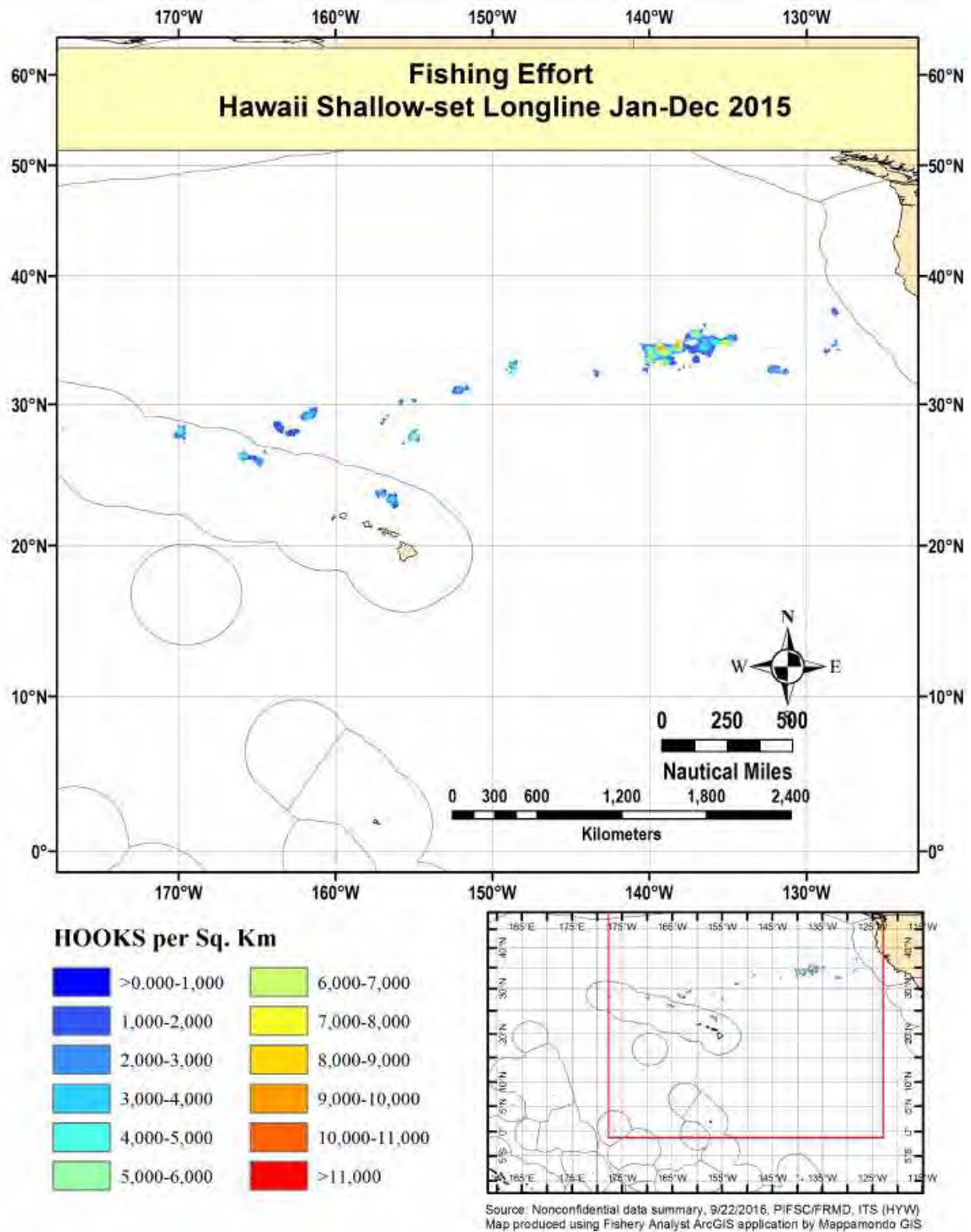


Figure 2. Spatial distribution of fishing effort by the Hawaii shallow-set longline fishery, 2015.

Source: NMFS unpublished logbook data, received 12/9/2016.

1.2 Seabird Mitigation Measures for the Hawaii Longline Fisheries

Most of the regulations for the Hawaii longline fisheries are identified in Title 50 of the Code of Federal Regulations **Part 600** and **Part 665** (50 CFR Parts 600 and 665). NMFS also provides a [regulation summary and compliance guides](#) to Hawaii longline fishermen and the general public. Regulations specific to the mitigation of seabird interactions and safe handling techniques are at **50 CFR 665.815**. The ways that fishermen implement required seabird mitigation measures depend on how and where fishermen fish. Mitigation measures to reduce seabird interactions differ between the two options of stern-setting and side-setting. The following sections describe each of the main gear and operation requirements. The *Biological Opinion of the U.S. Fish and Wildlife Service for the operation of the Hawaii-based pelagic longline fisheries, shallow-set and deep-set, Hawaii* (USFWS 2012) also describe these measures.

Side-Setting

Side-setting involves deploying the gear from the side of the vessel, compared to the conventional method of setting from the stern. In side-setting, crew set baited hooks forward and close to the side of the vessel's hull where seabirds are unable or unwilling to pursue them. With required branch line weighting (see below), by the time the vessel stern passes the location where baited hooks have been set, the baited hooks will have sunk to a depth where seabirds, such as albatrosses, cannot reach them (Gilman and Brothers 2006; Gilman et al. 2005, 2007a, 2007b).

Additionally, deploying a required bird curtain aft of where crew is deploying the gear inhibits the ability of seabirds to land on the water along the side of the vessel where baits are accessible.

Table 1 summarizes the number of Hawaii pelagic longline deep- and shallow-set vessels observed to set from the stern and from the side in 2015, with some vessels operating in both deep- and shallow-set fisheries. In 2015, the majority of vessels in the deep-set fishery and all of the vessels in the shallow-set fishery chose to stern-set.

Table 1. Number of observed Hawaii longline vessels that side- and stern-set in 2015.

Fishery	Deck setting position	Vessels
Deep-set	Stern-setting	97
Deep-set	Side-setting	32
Shallow-set	Stern-setting	23
Shallow-set	Side-setting	0

Source: NMFS unpublished observer data, 10/4/2016.

Weighted Branch Lines

Fishermen place weights close to the hook on branch lines so baited hooks sink quickly and help prevent foraging seabirds from possibly become hooked or entangled in longline gear. When required, Hawaii longline fishermen must attach a weight of at least 45 g within 1 m of the hook to sink the branch line quickly. Fishermen commonly use weights from 45 to 80 g.



Blue-dyed bait.

Thawed and Blue-dyed Bait

Dyeing bait to a specific blue color is a means to reduce visibility by reducing contrast with the sea surface. Fishermen thaw the bait to increase sink rates and to allow a more effective penetration of the blue dye. Almost all bait used in the Hawaii longline fisheries consists of the fusiform fishes mackerel (saba), sardines, and saury (sanma). NMFS prohibits the use of squid bait in the shallow-set fishery to reduce sea turtle interactions. While fishermen may still use squid in the deep-set fishery, it costs more than some fish bait and is, thus, less preferred.

Strategic Offal Discards

Fishermen developed the technique of strategically discarding offal to distract albatrosses from attempting to steal baits from hooks before the branch lines are retrieved. Fishermen discard swordfish heads and livers on the opposite side of the vessel from fishing operations to distract albatrosses away from the baited hooks. NMFS observers in the mid-1990s noted that strategically discarding offal reduced incidental hooking or entanglement of albatrosses, and it is now a requirement. When seabirds are present around the vessel, fishermen that are deep-setting north of 23° N., or shallow-setting anywhere, are required to use strategic offal discards as a seabird mitigation measure when setting from the stern.

Night Setting

Night-setting as a seabird mitigation measure requires shallow-set fishermen, when stern-setting, to start deploying gear no earlier than one hour after local sunset and complete the set no later than the following sunrise. The measure also requires using the minimum lighting necessary to conform to navigation rules and best safety practices. The requirement to night-set is based on the premise that seabirds cannot see baited hooks in the dark and, thus, do not attack them. Night-setting has been a very effective seabird mitigation measure, reducing seabird interactions as much as 98% (McNamara et al. 1999, Boggs 2003). Table 2 summarizes the seabird management measures.

Table 2. Seabird bycatch mitigation requirements for the Hawaii longline fleet.

What you need to do	Stern-setting		Side-setting	
	Shallow-Set Anywhere	Deep-Set North of 23° N	Shallow-Set Anywhere	Deep-Set North of 23° N
Deploy mainline from port or starboard side at least 1 m forward of stern corner			Yes	Yes
If line shooter is used, mount it at least 1 m forward from stern corner			Yes	Yes
Use a specified bird curtain aft of the setting station during the set			Yes	Yes
Deploy gear so that hooks do not resurface			Yes	Yes
Attach 45 g or heavier weights within 1 m of hook of each hook		Yes	Yes	Yes
Use a line shooter to set the mainline		Yes		
Keep two 1-pound containers of blue-dye on boat	Yes	Yes		
Use completely thawed and blue-dyed bait	Yes	Yes		
Keep fish parts and spent bait with all hooks removed for strategic offal discard	Yes	Yes		
Cut all swordfish heads in half, and use heads and livers for strategic offal discard	Yes	Yes		
Night Set - begin set 1 hour after local sunset and finish 1 hour before next sunrise and keep lighting to a minimum	Yes			

1.3 Protected Species Workshops

In addition to gear and operational requirements to reduce or deter seabird interactions, owners and operators of pelagic longline vessels must complete a protected species workshop each year (50 CFR 665.814). The workshop includes training in the identification, safe handling, and release techniques for sea turtles, marine mammals, and seabirds. The workshop also reviews regulatory and compliance requirements. In a classroom setting, fishermen learn from oral presentations, hands-on demonstrations, videos, and printed reference materials. NMFS also offers the workshops on line. A valid workshop certificate is necessary for owners to obtain and annually renew Federal longline fishing permits. Longline vessel operators must also have on board the vessel a valid protected species workshop certificate issued by NMFS to the operator of the vessel.

In 2015, NMFS PIRO provided protected species workshop training for 264 Hawaii-based longline vessel owners and operators, and other interested individuals. Another 56 vessel owners, operators, and crewmembers completed protected species workshop training in American Samoa with assistance from the PIRO Observer Program.



Protected Species Workshop, NOAA Honolulu Service Center at Pier 38.

1.4 Fishing Effort and Observer Coverage

From 2014 to 2015, fishing effort in the deep-set fishery increased, and effort in the shallow-set fishery decreased (Table 3). In 2015, NMFS placed observers on 20.6% of deep-set fishing trips and on 100% of shallow-set fishing trips. NMFS provides summary reports from mandatory logbook data reported by longline captains.

Table 3 summarizes effort data for 2015 by haul date. Please note that other summaries throughout this report and elsewhere may vary slightly depending upon the data source, including revisions. For example, observers may report seabird interactions by date of trip (departure or arrival), set date, or haul date in a given year. NMFS typically bases observer coverage levels on the trip departure date. Protected species interactions reported in the observer program quarterly, semiannual, and annual reports are typically based on vessel arrival date.

Table 3. Hawaii deep- and shallow-set fisheries effort and observer coverage, 2014 and 2015.

2015					
Fishery	Number of vessels	Trips	Sets	Hooks	Observer coverage
Deep-set	141	1,444	18,433	47,409,044	20.6%
Shallow-set	23	70	1,156	1,274,805	100%

2014					
Fishery	Number of vessels	Trips	Sets	Hooks	Observer coverage
Deep-set	139	1,350	17,702	45,517,150	20.8%
Shallow-set	20	81	1,334	1,466,866	100%

Source: NMFS unpublished observer data, 10/4/2016, and unpublished logbook data, 12/1/2016.

2. Interactions

2.1 Species

NMFS observers have recorded the following species being hooked or entangled in the longline fisheries since 1994, when NMFS began deploying observers: Laysan albatross (*Phoebastria immutabilis*), black-footed albatross (*P. nigripes*), sooty shearwater (*Puffinus griseus*), unidentified shearwaters, brown booby (*Sula leucogaster*), red-footed booby (*S. sula*), and Northern fulmar (*Fulmarus glacialis*). These species are not listed under the Endangered Species Act (ESA).

The Laysan albatross population estimate is 656,000 breeding pairs (ACAP 2016). The low coral islands of the Northwestern Hawaiian Islands (NWHI) have the world's largest colonies, and together support more than 99% of the global breeding population (ACAP 2012a). The estimated global breeding population of black-footed albatross is 69,900 pairs (ACAP 2016), with more than 95% breeding in the NWHI (ACAP 2012b). Northern fulmars are located throughout the North Atlantic and North Pacific. The estimated worldwide population is 15 to 30 million individuals (Birdlife 2016a). The red-footed booby winters on tropical islands in most oceans, and its total population estimate is more than 1 million birds (Birdlife 2016b). The brown booby are located throughout the pan-tropical

oceans, with a population estimate of more than 200,000 adults (Birdlife 2016c). The estimated total world population of sooty shearwaters is more than 20 million adults. These birds nest in Australia, New Zealand, and southern South America (Birdlife 2016d). Both Hawaii longline fisheries have a low level of interactions with these species; and based on the population estimates, the fisheries likely have very little effect on these populations.

Some seabirds, especially shearwaters, are difficult to identify. Table 4 provides a summary of seabird specimens that NMFS observers collected for identification and biological study after capture in the Hawaii longline fisheries in 2015. Most seabird specimens are frozen and shipped to the Marine Wildlife Veterinary Care and Research Center in Santa Cruz, California. Since 2007, staff with the organization Oikonos have been collecting morphometric data on shipped specimens.

Table 4. Summary of collected seabirds from the Hawaii longline fisheries, 2015.

Species	Number retained
Black-footed albatross	77
Laysan albatross	24
Sooty shearwater	4

Note: Not all dead seabirds are collected as specimens. Source: NMFS unpublished observer data, 10/4/2016.



Black-footed albatross, Pearl and Hermes Reef.

2.2 Location of Interactions

Figs. 3 and 4 show the spatial distribution of observed seabird interactions in deep- and shallow-set fisheries, respectively, based on observations of seabirds in 2015. Most of the interactions occur north of 25° N, where seabirds are typically more abundant, and where fishing effort is more concentrated.

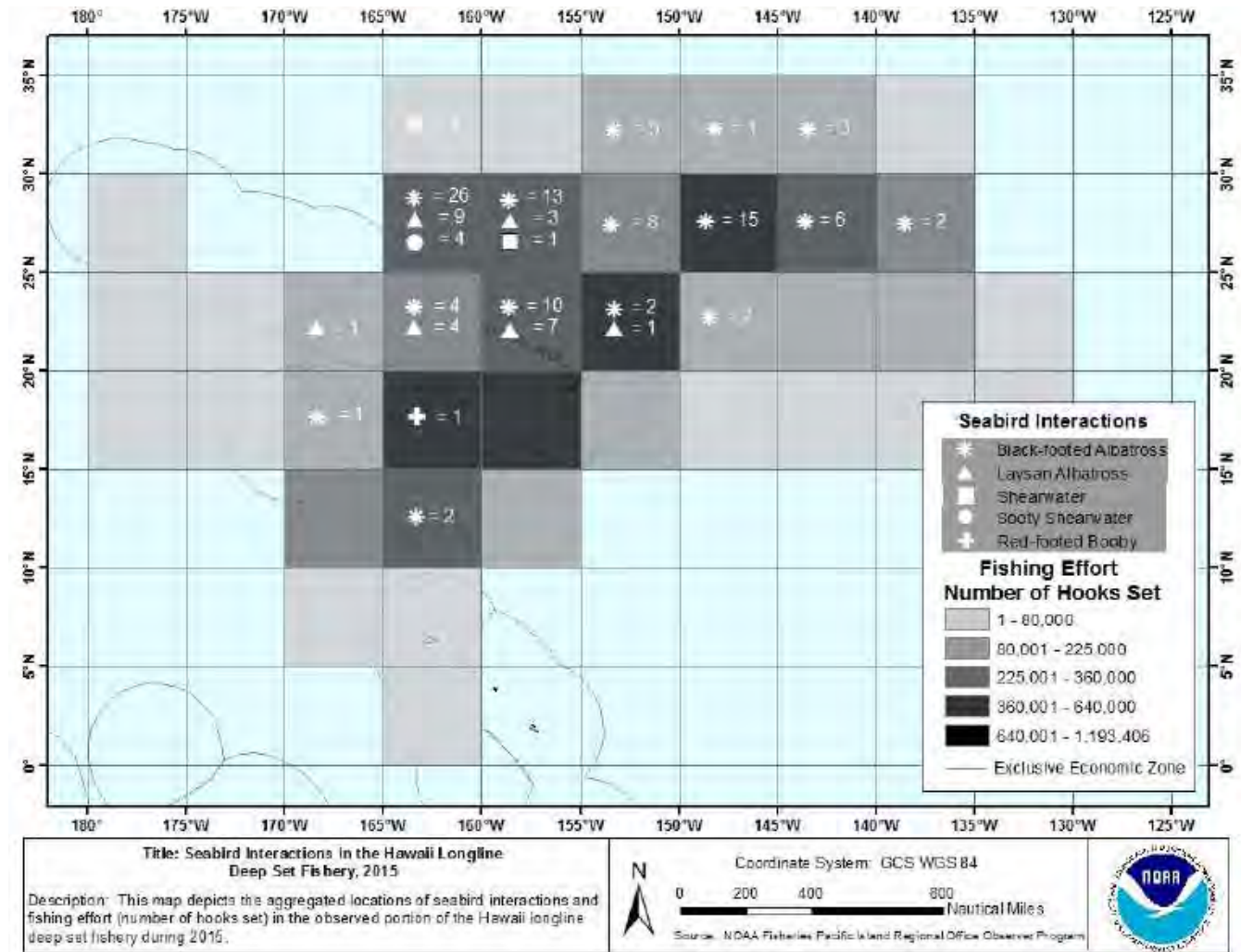


Figure 3. Locations of seabird interactions observed in Hawaii deep-set longline fishery, 2015.

Note: NMFS deployed observers on 20.6% of deep-set trips in 2015. Source: NMFS unpublished observer data, 11/23/2016.

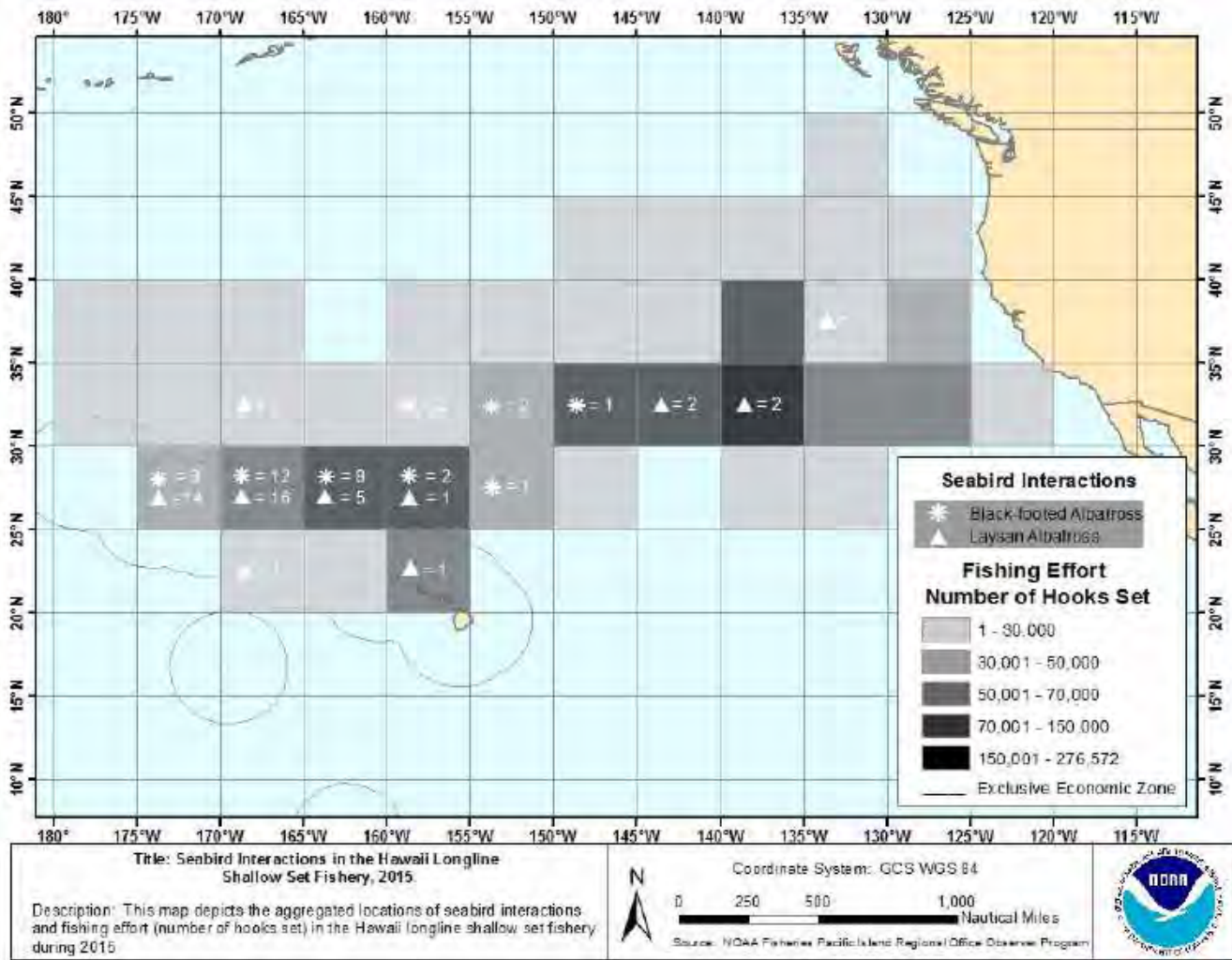


Figure 4. Locations of seabird interactions observed in Hawaii shallow-set longline fishery, 2015.

Note: NMFS deployed observers on every shallow-set trip in 2015. Source: NMFS PIRO Observer Program, unpublished data, 11/23/2016.

2.3 Number of Interactions

Table 5 summarizes the number of observed seabird interactions, including the condition of seabirds upon release, and fishing effort in both longline fisheries from 2004 to 2015. During this period, NMFS deployed observers on 100% of shallow-set fishing trips; therefore, the number of interactions shown in Table 5 represents the fishery-wide totals. NMFS deployed observers on 20.6% of deep-set trips in 2015, so we expanded the observed interactions using the observer coverage rate to estimate total interactions (Table 6).

Table 5. Numbers of observed seabird catch levels, fishing effort, and nominal interaction rates in the Hawaii longline fisheries, 2004-2015.

Year	Laysan albatross	Black-footed albatross	Sooty shearwater	Other or unidentified bird species caught	Total birds observed caught	Birds released injured and alive	Birds released dead	Total observed effort (hooks)	Seabird interaction rate (birds per 1,000 hooks observed)
DEEP-SET FISHERY									
2004	2	5		2	9		9	7,900,681	0.001
2005	6	11		1*	18		18	9,360,671	0.002
2006	1	17	5		23		23	7,540,286	0.003
2007	7	18			25		25	7,620,083	0.003
2008	14	30	14	2**	60	4	56	8,775,951	0.007
2009	18	23	4		45		45	7,877,861	0.006
2010	39	17	1		57	1	56	8,184,127	0.007
2011	32	13	3		48	2	46	8,260,092	0.006
2012	31	36	7		74	5	67	8,768,728	0.008
2013	48	49	8		105	5	100	9,278,133	0.011
2014	12	38	1		51	6	45	9,608,244	0.005
2015	25	101	4	2***	132	19	113	9,393,234	0.014
SHALLOW-SET FISHERY									
2004	1				1	1		76,750	0.013
2005	62	7			69	47	22	1,328,806	0.052
2006	8	3			11	5	6	745,125	0.015
2007	40	8			48	40	8	1,292,036	0.037
2008	33	6			39	24	15	1,350,127	0.029
2009	81	30	1		112	88	24	1,767,128	0.063
2010	40	38		1****	79	61	18	1,828,529	0.043
2011	49	19			68	53	15	1,611,395	0.042
2012	62	37			99	77	21	1,418,843	0.070
2013	45	28	2		75	48	27	1,000,084	0.075
2014	39	32	1		72	56	16	1,509,727	0.048
2015	43	38	0		81	65	16	1,286,628	0.063

Note: NMFS unpublished observer data (10/4/2016) are based on the date and time of the beginning of the haul, with the exception of the total observed effort (hooks), which is based on departure date from the Observer Program annual reports (NMFS 2016a and NMFS 2016b). Interaction rates are calculated and rounded to the nearest thousandths (third decimal) place. Footnote: *brown booby; **red-footed booby and unidentified seabird; ***red-footed booby and unidentified shearwater; ****Northern fulmar

Almost all interactions in the deep-set fishery occur when fishermen set gear during the day while seabirds are actively feeding. Seabirds may be hooked or entangled, and then drown while the gear sinks. Because most seabirds are inactive at night, very few interactions occur when fishermen typically haul deep-set gear. In 2015 in the deep-set fishery, observers documented interactions with 25 Laysan albatrosses, 101 black-footed albatrosses, four sooty shearwaters, one unidentified shearwater, and one red-footed booby (Table 5). Nearly all of the seabirds observed to interact with the deep-set fishery were dead (86%). Table 6 contains the total estimated number of interactions with Laysan albatross, black-footed albatross, and shearwaters based on observer records for the deep-set fishery in 2015.

Table 6. Estimated number of total seabird interactions in the Hawaii deep-set longline fishery, 2015.

Species	Total annual estimate	95% confidence interval
Black-footed albatross	541	387-682
Laysan albatross	119	53-177
Shearwater	21	6-49
Red-footed booby	6	1-21

Note: Table lists point estimates of the total number of incidental interactions by species, and corresponding 95% confidence intervals, in the Hawaii deep-set longline fishery from observed interactions during 2015. The estimate for shearwaters represents an estimate for the number of incidental interactions by the group of species considered shearwaters. Source: McCracken 2016.

The shallow-set fishery typically sets at night and hauls the gear during the day; therefore, most of the interactions occur when fishermen retrieve the gear and birds are actively feeding. In 2015, the shallow-set fishery interacted with 43 Laysan albatrosses and 38 black-footed albatrosses (Table 5). Fishermen released approximately 80% of seabirds alive.

Seabirds can be hooked, entangled, or both. Table 7 provides a summary of capture and release conditions in 2015. Regulations require fishermen to remove as much gear as safely possible from any seabirds captured before they are released.



Hooked Laysan albatross.

Table 7. Capture and release details by species for seabird interactions in the Hawaii longline fisheries, 2015.

Number for each species/group	MANNER OF INTERACTION				GEAR ATTACHED UPON RELEASE ¹			
	Hooked only	Entangled only	Both hooked and entangled	Not known or not recorded	Line only	Hook only	Hook and line	No gear attached ²
Laysan albatross	52	9	7	0	0	0	0	40
Black-footed albatross	110	13	14	2	0	0	0	43
Sooty Shearwater	4	0	0	0	0	0	0	1

¹ Released seabirds are those that were released alive.

² This column does not include seabirds with unknown or unrecorded manner of capture.

Source: NMFS unpublished observer data, 10/4/2016.

Recovered Seabird Bands

State and Federal agencies and other groups attach identification bands to the legs of birds to study bird movement, survival, and other characteristics. Table 8 provides a summary of observed seabirds with leg bands from Hawaii longline fisheries interactions in 2015. Most of the recovered bands were from albatross banded on French Frigate Shoal in the NWHI and incidentally caught in the first half of the year.

Table 8. Seabirds observed with bands from interactions with the shallow-set and deep-set Hawaii longline fisheries, 2015.

Species	Disposition	Date banded	Band(s) recovery date	Location banded	Age at banding (yr)	Age at recovery (yr)
Black-footed Albatross	Dead	6/9/2008	1/1/2015	French Frigate Shoals (Tern Island)	<1	7
Black-footed Albatross	Dead	5/26/2007	1/17/2015	Lehua Island, HI	<1	8
Laysan Albatross	Dead	5/30/2007	2/14/2015	Kauai (Kilauea Point)	>1	19
Laysan Albatross	Dead	4/11/2007	2/21/2015	Kauai (Kilauea Point)	>1	>/=9
Black-footed Albatross	Dead	1/4/2007	2/23/2015	Laysan Island	>1	>/=9
Laysan Albatross	Dead	5/27/1997	2/18/2015	French Frigate Shoals (Tern Island)	<1	18
Laysan Albatross	Dead	1/16/2008	2/28/2015	Kauai (Kilauea Point)	>1	>/=8
Black-footed Albatross	Dead	6/12/2004	3/25/2015	French Frigate Shoals (Tern Island)	<1	11
Black-footed Albatross	Injured	6/21/2001	3/18/2015	French Frigate Shoals (Tern Island)	<1	14
Laysan Albatross	Dead	6/5/1989	4/1/2015	French Frigate Shoals (Tern Island)	<1	26
Black-footed Albatross	Dead	12/27/2007	4/5/2015	Laysan Island	>/=1	>/=8
Laysan Albatross	Injured	4/14/2005	4/13/2015	Kauai (Kilauea Point)	<1	10
Laysan Albatross	Injured	6/8/2005	4/20/2015	French Frigate Shoals (Tern Island)	<1	10
Laysan Albatross	Injured	5/30/1991	4/30/2015	French Frigate Shoals (Tern Island)	<1	24
Black-footed Albatross	Injured	6/5/1998	5/4/2015	French Frigate Shoals (Tern Island)	<1	17
Black-footed Albatross	Injured	6/1/1995	5/4/2015	French Frigate Shoals (Tern Island)	<1	20
Black-footed Albatross	Injured	6/7/2015	5/6/2015	French Frigate Shoals (Tern Island)	<1	15
Black-footed Albatross	Injured	6/8/2001	5/9/2015	French Frigate Shoals (Tern Island)	<1	14
Laysan Albatross	Dead	6/22/2014	5/10/2015	French Frigate Shoals (Tern Island)	<1	11
Black-footed Albatross	Dead	12/9/2003	5/7/2015	French Frigate Shoals (Tern Island)	<1	12
Black-footed Albatross	Dead	6/7/1999	5/29/2015	French Frigate Shoals (Tern Island)	<1	16
Laysan Albatross	Dead	6/5/1996	6/2/2015	French Frigate Shoals (Tern Island)	<1	19
Black-footed Albatross	Dead	6/8/2001	6/6/2015	French Frigate Shoals (Tern Island)	<1	13
Black-footed Albatross	Dead	6/8/2001	6/6/2015	French Frigate Shoals (Tern Island)	<1	13
Black-footed Albatross	Dead	6/3/2005	6/6/2015	French Frigate Shoals (Tern Island)	<1	10
Black-footed Albatross	Dead	Unknown	6/8/2015	Unknown	Unknown	Unknown
Black-footed Albatross	Injured	Unknown	6/8/2015	Unknown	Unknown	Unknown
Laysan Albatross	Dead	6/1/1995	6/14/2015	French Frigate Shoals (Tern Island)	<1	20
Black-footed Albatross	Dead	6/4/2003	6/24/2015	French Frigate Shoals (Tern Island)	<1	12
Black-footed Albatross	Dead	6/14/2004	5/18/2015	French Frigate Shoals (Tern Island)	<1	11
Black-footed Albatross	Dead	5/30/2002	7/15/2015	French Frigate Shoals (Tern Island)	<1	13

Source: USGS, USFWS, and NMFS unpublished observer data, 10/4/2016.

3. ESA-Listed Seabirds

The distributions of three seabird species that are protected under the ESA overlap with the areas where the Hawaii longline fisheries operate: the endangered short-tailed albatross and Hawaiian dark-rumped petrel (*Pterodroma sandwichensis*), and the threatened Newell's shearwater (*Puffinus auricularis newelli*). There have been no observed interactions (hooking or entanglement) between the fisheries and any ESA-listed seabirds. There were no sightings of short-tailed albatross on observed deep-set and shallow-set trips in 2015.

4. Management

In May 2015, under the Migratory Bird Treaty Act, the USFWS issued a Special Purpose Permit to NMFS for the shallow-set fishery. The permit authorizes the incidental take of a limited number of migratory birds in the shallow-set longline fishery until March 31, 2018, including short-tailed albatross, black-footed albatross, Laysan albatross, sooty shearwater, and Northern fulmar. For further information, please visit the USFWS website (<http://www.fws.gov/pacific/migratorybirds/nepa.html>).

5. Research

Analysis of Seabird Interactions in the Hawaii Shallow-set Fishery

Since NMFS introduced seabird regulations in 2001, in the Hawaii shallow-set fishery the seabird catch rate has declined approximately 91%, primarily through mitigation measures required during longline gear setting (gear deployment). Since effective implementation of these measures, approximately 75% of the remaining seabird interactions occur during gear hauling (Gilman et al. 2014). As most shallow-set fishermen choose the option to stern set at night, they haul their gear primarily during the day when seabirds are more likely to be foraging. In a review of observer data from 2004 to 2012, Gilman et al. (2014) found an increasing temporal trend of albatrosses attending vessels during hauling, which may have been one of the factors that results in the observed increasing trend in the seabird standardized haul catch rate during this time.

The highest relative standardized catch rates from January to March corresponded with brooding and chick rearing for mature Laysan and black-footed albatrosses, when the albatrosses forage in areas that overlap with the shallow-set fishery. The lowest live seabird catch rates occurred during the non-breeding season in August and September,

when albatross foraging areas overlap less with the fishery (Gilman et al. 2014). Eric Gilman with the Safina Center is currently conducting commercial demonstrations of a bird curtain that could reduce haul interactions in the shallow-set fishery.

Analysis of Seabird Interactions in the Hawaii Deep-set Fishery

Since NMFS introduced seabird regulations in 2001, in the Hawaii deep-set fishery the seabird catch rate has declined approximately 74% (Gilman et al. 2016). Over the past decade, however, seabird catch levels have increased due to increasing trends in both effort and nominal seabird catch rates.

Decreasing ocean productivity in recent years may have contributed to the increasing trend in the nominal seabird catch rate. In a review of observer data from 2004 to 2014, Gilman et al. 2016 found the catch rate significantly increased as annual mean multivariate El Niño Southern Oscillation index values increased. This result suggests that the decreasing ocean productivity observed in recent years in the central north Pacific may have contributed to the increasing catch rate. Higher numbers of albatrosses attending vessels, possibly linked to declining regional ocean productivity and increasing absolute abundance of black-footed albatrosses, may also have contributed to the increasing rate.

Gilman et al. 2016 found the largest opportunities for catch reductions are through increased efficacy of seabird mitigation north of 23° N where mitigation methods are required and during setting instead of during hauling. Both options for meeting regulatory requirements, side vs. stern setting and blue-dyed vs. untreated bait, significantly reduced the seabird catch rate. However, side-setting had a significantly lower seabird catch rate than blue-dyed bait. There was significant spatio-temporal and seasonal variation in the risk of seabird capture with the highest catch rates in April and May, and to the northwest of the main Hawaiian Islands.

NMFS is working with the WPFMC on investigating seabird interactions, in particular black-footed albatross, in the deep-set fishery. In Summer 2017, NMFS may also host a scholar under the Ernest F. Hollings Scholarship Program to study seabird interactions.

6. Summary

Table 9 compares the 2014 and 2015 observed interactions in the two fisheries. The observed interactions and interaction rate for the shallow-set and deep-set fisheries increased from 2014 to 2015.

In 2014, the shallow-set fishery interacted with 72 seabirds — 39 Laysan albatrosses, 32 black-footed albatrosses, and one sooty shearwater. In 2015, the shallow-set fishery interacted with 81 seabirds — 43 Laysan albatrosses and 38 black-footed albatrosses.

In 2014, observers in the deep-set fishery documented interactions with 51 seabirds — 12 Laysan albatrosses, 38 black-footed albatrosses, and one sooty shearwater. In 2015, observers documented interactions with 132 seabirds — 25 Laysan albatross, 101 black-footed albatrosses, four sooty shearwaters, one unidentified shearwater, and one red-footed booby (see Table 5).

Table 9. Comparison of observed interactions in Hawaii longline fisheries, 2014 and 2015.

Observed Interactions	2014	2015
Seabirds observed in deep-set fishery	51	132
Seabirds observed in shallow-set fishery	72	81
Deep-set interaction rate (birds per 1,000 hooks observed)	0.005	0.014
Shallow-set interaction rate (birds per 1,000 hooks observed)	0.048	0.063

Note: There was 20.8% and 20.6% observer coverage in the deep-set fishery in 2014 and 2015, respectively, and 100% coverage in the shallow-set fishery.

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