

Alaska  
Fisheries Science  
Center

National Marine  
Fisheries Service

U.S DEPARTMENT OF COMMERCE

## AFSC PROCESSED REPORT 2019-02

The 2018 Longline Survey of the Gulf of  
Alaska and Eastern Aleutian Islands on the  
*FV Alaskan Leader*: Cruise Report AL-18-01

March 2019

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This document should be cited as follows:

Malecha, P., C. Rodgveller, C. Lunsford, and K. Siwicke. 2019. The 2018 longline survey of the Gulf of Alaska and eastern Aleutian Islands on the FV *Alaskan Leader*: Cruise Report AL-18-01. AFSC Processed Rep. 2019-02, 30 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Available at <http://www.afsc.noaa.gov/Publications/ProcRpt/PR2019-02.pdf>.

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**The 2018 Longline Survey of the Gulf of Alaska and Eastern Aleutian  
Islands on the FV *Alaskan Leader*: Cruise Report AL-18-01**

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March 2019



## ABSTRACT

The Alaska Fisheries Science Center (AFSC) has annually completed a bottom longline survey in Alaska since 1978. The survey samples demersal waters of the upper continental slope and is primarily designed to assess sablefish (*Anoplopoma fimbria*), although several other groundfish species are caught in significant numbers. In 2018, the 41<sup>st</sup> annual longline survey sampled stations in the eastern and central Aleutian Islands region and the Gulf of Alaska. The primary objectives of the survey were to determine the relative abundance of sablefish and other groundfish species from catch data, determine the age composition of the sablefish population with otolith collections, and to determine movement patterns of sablefish and a subsample of other groundfish species with tagging operations.



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## INTRODUCTION

On 28 August 2018, the Alaska Fisheries Science Center (AFSC) completed the 41<sup>st</sup> annual longline survey of Alaska sablefish (*Anoplopoma fimbria*) and other groundfish resources of the upper continental slope (Fig. 1). This survey was designed to continue the time series (1978–94) of the Gulf of Alaska portion of the Japan-U.S. cooperative longline survey that was discontinued after 1994. The National Marine Fisheries Service (NMFS) has surveyed the Gulf of Alaska annually since 1987. Since 1996, the eastern and central Aleutian Islands have been surveyed in even years and the eastern Bering Sea has been surveyed in odd years. The Gulf of Alaska and the eastern and central Aleutian Islands region were sampled in 2018. The purpose of this report is to summarize raw survey data and detail survey operations. Data generated from the longline survey will be used for calculating relative population numbers and weights. This information is available by management area and station at:

<https://www.fisheries.noaa.gov/resource/map/alaska-longline-survey-data-map>.

Ultimately, the data will be used for assessing stock status of Alaska groundfish. Stock Assessment and Fishery Evaluation (SAFE) reports can be found at:

<https://www.npfmc.org/safe-stock-assessment-and-fishery-evaluation-reports>.

## METHODS

### Survey Objectives

1. Collect relative abundance and size composition data of the most commercially important groundfish species: sablefish, shortspine thornyhead (*Sebastolobus alascanus*), Greenland turbot (*Reinhardtius hippoglossoides*), Pacific cod (*Gadus*

*macrocephalus*), and rougheye (*Sebastes aleutianus*), blackspotted (*S. melanostictus*) and shortraker (*S. borealis*) rockfishes.

2. Collect relative abundance and size composition data of other groundfish species caught during the survey: arrowtooth flounder (*Atheresthes stomias*), grenadiers (Macrouridae), skates (Rajidae), and spiny dogfish (*Squalus acanthias*).
3. Collect sablefish otoliths to study the age composition of the population.
4. Tag and release sablefish, shortspine thornyhead, and Greenland turbot throughout the cruise to determine migration patterns.
5. Conduct special projects related to groundfish biology, seafloor ecology, stock assessment, and marine mammal interactions.

### **Vessel and Gear**

Survey operations were conducted using the FV *Alaskan Leader*, a chartered U.S. longline vessel. The 46-m (150 ft) long vessel carried standard longline hauling gear and was equipped with radios, radars, GPS receivers, a processing line, plate freezers, and refrigerated holds. Vessel personnel consisted of a captain, mate, cook, two engineers, two contract biologists, six fishermen, and five processors.

Gear configuration was standardized and has been consistent for all survey years since 1988. Each longline set consisted of a flag and buoy array at each end followed sequentially by varying lengths by depth of 9.5-mm diameter nylon buoyline, a 92-m (50-fm) section of 9.5-mm polypropylene floating line, a 16-kg (35-lb) piece of chain (to dampen the effect of wave surge on the buoyline), 92-m of 9.5-mm nylon line, a 27-kg (60-lb) halibut anchor, and 366 m (200 fm) of 9.5-mm nylon running line. Units of gear (skates) were 100-m (55-fm) long and contained 45 size 13/0 Mustad circle hooks. Hooks

were attached to 38-cm (15-in) gangions that were secured to beackets tied into the groundline at 2-m (6.5-ft) intervals. Five meters (16 ft) of groundline were left bare at each skate end. Gangions were constructed of medium lay #60 thread nylon, becket material was medium lay #72 thread nylon, and groundline was medium lay 9.5-mm (3/8-in) diameter nylon. The groundline was weighted with 3.2-kg (7-lb) lead balls at the end of each skate. Hooks were hand-baited with chopped squid (*Illex* sp.) at a rate of about 5.7 kg (12.5 lb) per 100 hooks. Squid heads and tentacles were not used for bait.

Total groundline set each day was 16 km (8.6 nautical miles [nmi]) long and contained 160 skates and 7,200 hooks. Two 80-skate groundlines, laid end-to-end, were set at each station along the upper continental slope. A single groundline of 80 skates was set at each station in the gullies, except Amatuli Gully (station 87) where 160 skates were set. Specific information regarding longline survey protocols and details of the survey gear can be found at: <https://www.fisheries.noaa.gov/resource/document/survey-protocol-alaska-sablefish-longline-survey>.

### **Operations**

The charter began on 31 May in Dutch Harbor, Alaska, and ended on 28 August in Dutch Harbor. The charter period was divided into seven legs (Table 1). During Leg 1, the stations along the upper continental slope of the eastern and central Aleutian Islands region were sampled (Fig. 1). During Leg 2, stations in the Gulf of Alaska were sampled near the western end of Umnak Island and extending eastward to Sand Point. At the conclusion of Leg 2, the vessel transited the Gulf of Alaska to southeastern Alaska. Leg 3 began off Dixon Entrance near the U.S.-Canada boundary and continued north and westward to Yakutat. During Leg 4, a 2-day experiment was conducted in the Yakutat

vicinity (See Appendix). During Leg 5, the area between Yakutat and Cordova was sampled, and during Leg 6 the area from Cordova to Kodiak was sampled. During Leg 7, the area from Kodiak to Sand Point was sampled.

From 1988 to 1990 the survey period was from 26 June to 12 September. The survey periods in 1991 through 1994 were 2½ weeks later than in 1988 through 1990. The 1991–1994 surveys were delayed to avoid the commercial trawl fishery that started 45 days later than in 1988 through 1990. Starting in 1995, the survey period was moved back to near the 1988–1990 time periods because of the extensive increase in length of the fishing season resulting from the implementation of the Individual Fishing Quota (IFQ) system in the sablefish and Pacific halibut (*Hippoglossus stenolepis*) longline fisheries. Beginning in 1998 the order in which the stations were sampled was changed to avoid conflicting with an early July rockfish fishery in the central Gulf of Alaska. Instead of continuing to sample in an easterly direction from Sand Point to Dixon Entrance, the survey vessel transited to Dixon Entrance during early July and resumed sampling in a westerly direction going from Dixon Entrance to Sand Point. Sampling order has been the same since 1998. From 2009 to the present the survey starting and ending dates were several days earlier than previous years. This was done to accommodate the vessel's schedule and desire to finish the survey as early as possible.

In 2018, a total of 14 stations along the upper continental slope of the eastern and central Aleutian Islands region and 47 stations along the upper continental slope of the Gulf of Alaska were sampled at a rate of one station per day (Fig. 1). Surveyed depths ranged from approximately 200 to 1,000 m, although at some stations depths less than 200 m or more than 1,000 m were sampled. In addition, 23 stations were sampled in gullies at the rate of one or two stations per day. The sampled gullies were Shelikof

Trough, Amatuli Gully, W-grounds, Yakutat Valley, Spencer Gully, Ommaney Trench, and Dixon Entrance. One station (103) was sampled on the continental shelf off Baranof Island. A list of stations and which management areas they correspond to, what type of habitat type they represent, and whether or not they were used in abundance index calculations is presented in Table 2. Not all stations are used in abundance index calculations reported for sablefish, notably gully stations on the continental shelf. However, abundance calculations are performed for all species at all stations and are available at the station level for slope and gully stations.

The gear was set from shallow to deep and was retrieved in the same order, except on occasions when groundlines parted or sea conditions dictated that it be pulled from the opposite direction. Setting began at about 0630 hours Alaska Daylight Time. Retrieval began at about 0930 hours and was completed by about 1930 hours.

### **Data Collection**

Catch data were recorded on hand-held ruggedized computers. During gear retrieval a scientist stationed at the vessel's rail recorded the species of each hooked fish and the condition of each unoccupied hook (baited or ineffective [i.e., absent, straightened, broken, or tangled]). Time of day was recorded as each hook was tabulated and depth was entered when the first hook of each fifth skate was retrieved or when crossing into a new depth interval (0–100 m, 101–200 m, 201–300 m, 301–400 m, 401–600 m, 601–800 m, 801–1,000 m, and 1,001–1,200 m).

Length data were collected with a barcode-configured measuring board and barcode readers connected to ruggedized computers. Length was recorded by depth stratum for sablefish, Pacific cod, giant grenadier (*Albatrossia pectoralis*), arrowtooth

flounder, Greenland turbot, shortspine thornyhead, spiny dogfish, and multiple rockfish species. Lengths of sablefish, giant grenadier, spiny dogfish, and Pacific cod were recorded by sex. Sablefish, shortspine thornyhead, and Greenland turbot were tagged on every 20<sup>th</sup> skate starting on skate 10 of every set. Pacific halibut were counted and released at the rail without measuring. Catch and length frequency data were transferred to a computer and electronic backup media twice a day. As in previous surveys, the charter vessel was allowed to retain most of the catch once the scientific data were recorded.

## **RESULTS AND DISCUSSION**

One hundred and forty-eight longline hauls were completed during normal survey operations in 2018 (Table 3); four additional hauls (91-94) were completed during a special 2-day experimental leg in July (see Appendix). During normal survey operations, sablefish was the most frequently caught species, followed by giant grenadier, shortspine thornyhead, Pacific cod, and roughey/blackspotted rockfish (Table 4). Catch of the most abundant species by station is presented in Table 5. Sablefish was also the highest catch by weight, followed by giant grenadier, Pacific halibut, and Pacific cod (Table 6). Average length and weight of sablefish varied by station (Table 7).

A total of 3,602 sablefish, 738 shortspine thornyhead, and 4 Greenland turbot were tagged with external Floy tags and released during the survey. Otoliths and length-weight data were collected from 2,248 sablefish.

Killer whales (*Orcinus orca*) depredating on the catch occurred at two stations in the Aleutian Islands and two stations in the western Gulf of Alaska (Table 8). Since 1990,

portions of the gear affected by killer whale depredation during domestic longline surveys have been excluded from the analysis of the survey data.

Sperm whale (*Physeter macrocephalus*) observations have been recorded during the longline survey since 1998. Sperm whales were observed during survey operations at 24 stations in 2018 (Table 9). Sperm whales were observed depredating on the gear at 4 stations in the central Gulf of Alaska and 10 stations in the East Yakutat/Southeast region. Sperm whales were observed at 10 stations in the West Yakutat region, but depredation was observed at only seven of those stations. Apparent sperm whale depredation is defined as sperm whales being present with the occurrence of damaged sablefish. Longline survey catch rates and abundance indices are not adjusted for sperm whale depredation in the survey.

NMFS has requested the assistance of the fishing fleet to avoid the annual longline survey stations since the inception of sablefish IFQ management in 1995. Fishermen are requested to stay at least 5 nmi away from each survey station for 7 days before and 3 days after the planned sampling date (3 days allow for survey delays). Survey calendars are mailed to each IFQ holder before the beginning of each fishing season. Additionally, the skipper of the survey vessel makes daily announcements on the radio detailing the planned set locations for the upcoming days. Vessels observed near stations are contacted by the survey vessel and are asked to report recent fishing activities that may affect survey catch rates. The vessels are also encouraged to avoid survey stations prior to the arrival of the survey vessel. However, in 2018 there were a high number of recorded vessel interactions with the survey. One vessel was contacted or observed by the survey vessel in the Aleutian Islands and 11 in the Gulf of Alaska. Of these, three were bottom trawlers, three were longliners targeting halibut, and six were

longliners targeting sablefish. At station 86, the standard survey sets were moved to avoid gear already placed at the station by a sablefish longliner. Additionally, data from 27 skates were removed from the abundance calculations at station 86 due to the close proximity of the previously placed gear. One longline vessel targeting sablefish appeared to be fishing at or near survey stations 2–3 days prior to the arrival of the survey. The skipper of the vessel was not forthcoming when contacted on the radio for details of his set locations. Thus, it is unknown whether the sets made by the vessel may have impacted survey catches. Data was not removed from the abundance calculations at these locations.

Gear damage and loss occurs during survey operations and may have impacts on catch. In 2018, the gear parted at eight stations (35, 54, 53, 55, 57, 61, 97, and 128). All gear was retrieved by hauling from the opposite end of the set except at stations 53 and 61, where 75 and 26 skates of gear were lost, respectively (Table 3). At station 39, the first 49 skates were extremely snarled and the data from those skates were excluded from abundance calculations.

Seven pop-up satellite tags were deployed on sablefish in the Aleutian Islands and seven additional tags were deployed in the central Gulf of Alaska. The tags were placed on adult fish > 75 cm that were presumably mature females. The satellite tags were programmed to pop-up during the winter months in an attempt to identify spawning locations and behavior. Ten pop-up satellite tags and 31 standard tags were deployed on spiny dogfish in the West Yakutat area. Data from these tags, along with blood chemistry sampled from the fish at the time of capture, will be used to characterize discard mortality and stress response to capture.

Several special projects were conducted during the 2018 longline survey. Throughout the survey, stereo cameras were installed outboard of the hauling station to



collect imagery that will be used for the refinement of electronic monitoring. The imagery will be used as a training dataset to develop machine learning for length measurements and species identification. Additionally, a multispectral camera was used on the 2-day experimental leg to take detailed images of rougheye and blackspotted rockfish. These images will be used, along with DNA samples taken from the fish, to develop and verify algorithm-based species identifications for potential use during electronic monitoring.

Yelloweye rockfish (*Sebastes ruberrimus*) samples were collected for a study examining reproductive life history. Hormone concentrations, extracted from growth increments within their opercula, will be used to reconstruct individual reproductive life histories (e.g., age at maturity and spawning frequency). This information may be used to refine the parameters and results of the Southeast Alaska yelloweye rockfish stock assessment. Additionally, samples were collected for a genetics study aimed at examining yelloweye population structure from California up to Alaska.

Rare observations on the 2018 survey included the following: 1) the sighting of an ocean sunfish (*Mola mola*) on the surface near station 107 in Southeast Alaska; 2) the presence of pyrosomes, colonial tunicates, within the stomach contents of sablefish at several stations off Southeast Alaska; 3) two blue sharks (*Prionace glauca*) were caught on successive days off Southeast Alaska at stations 100 and 101; and 4) a pair of Sabine's gulls (*Xema sabini*) were observed southeast of Kodiak Island at station 80.

Table 1. -- Leg numbers, dates, and personnel for the 2018 NMFS longline survey.

Leg	Dates	Personnel	Affiliation
1	31 May – 19 June	Kari Fenske Grant Voirol (partial) Sabrina Cobb Beth DeLong	AFSC – ABL University Miami Contract Biologist Contract Biologist
2	19 June – 4 July	Pete Hulson Sabrina Cobb Beth DeLong	AFSC – ABL Contract Biologist Contract Biologist
3	4 July – 19 July	Kari Fenske Keven McNeel Sabrina Cobb Beth DeLong	AFSC – ABL ADFG Contract Biologist Contract Biologist
4*	20 July – 23 July	Kalei Shotwell Braden Moore Sabrina Cobb Beth DeLong	AFSC – ABL AFSC - FMA Contract Biologist Contract Biologist
5	23 July – 3 Aug.	Cindy Tribuzio Rachel Cashman Sabrina Cobb Beth DeLong	AFSC – ABL Volunteer Contract Biologist Contract Biologist
6	4 Aug. – 16 Aug.	Dana Hanselman Curry Cunningham Sabrina Cobb Beth DeLong	AFSC – ABL AFSC – ABL Contract Biologist Contract Biologist
7	16 Aug.- 28 Aug.	Pat Malecha Kevin Siwicke Sabrina Cobb Beth DeLong	AFSC – ABL AFSC – ABL Contract Biologist Contract Biologist

\* 2-day experimental leg.

AFSC – ABL – Alaska Fisheries Science Center – Auke Bay Laboratories.

AFSC – FMA – Alaska Fisheries Science Center – Fisheries Monitoring and Analysis Division.

Table 2. -- Stations fished in 2018 NMFS longline survey. Sablefish management area refers to the North Pacific Fishery Management Council areas, station type refers to station habitat type, and abundance calculations indicates whether or not station catches were used in abundance index calculations.

Station number	Sablefish management area	Station type	Abundance calculations
35	Aleutian Islands	Slope	Yes
37	Aleutian Islands	Slope	Yes
38	Aleutian Islands	Slope	Yes
39	Aleutian Islands	Slope	Yes
40	Aleutian Islands	Slope	Yes
54	Aleutian Islands	Slope	Yes
42	Aleutian Islands	Slope	Yes
53	Aleutian Islands	Slope	Yes
55	Aleutian Islands	Slope	Yes
57	Aleutian Islands	Slope	Yes
58	Aleutian Islands	Slope	Yes
59	Aleutian Islands	Slope	Yes
60	Aleutian Islands	Slope	Yes
61	Aleutian Islands	Slope	Yes
62	Western Gulf of Alaska	Slope	Yes
63	Western Gulf of Alaska	Slope	Yes
64	Western Gulf of Alaska	Slope	Yes
65	Western Gulf of Alaska	Slope	Yes
66	Western Gulf of Alaska	Slope	Yes
67	Western Gulf of Alaska	Slope	Yes
68	Western Gulf of Alaska	Slope	Yes
69	Western Gulf of Alaska	Slope	Yes
70	Western Gulf of Alaska	Slope	Yes
71	Western Gulf of Alaska	Slope	Yes
72	Central Gulf of Alaska	Slope	Yes
73	Central Gulf of Alaska	Slope	Yes
74	Central Gulf of Alaska	Slope	Yes
75	Central Gulf of Alaska	Slope	Yes
76	Central Gulf of Alaska	Slope	Yes
77	Central Gulf of Alaska	Slope	Yes
78	Central Gulf of Alaska	Slope	Yes
79	Central Gulf of Alaska	Slope	Yes
80	Central Gulf of Alaska	Slope	Yes
81	Central Gulf of Alaska	Slope	Yes
82	Central Gulf of Alaska	Slope	Yes
83	Central Gulf of Alaska	Slope	Yes

Table 2. -- Cont.

Station number	Sablefish management area	Station type	Abundance calculations
84	Central Gulf of Alaska	Slope	Yes
85	Central Gulf of Alaska	Slope	Yes
86	Central Gulf of Alaska	Slope	Yes
87	Central Gulf of Alaska	Gully	No
88	Central Gulf of Alaska	Slope	Yes
89	West Yakutat	Slope	Yes
90	West Yakutat	Slope	Yes
91	West Yakutat	Slope	Yes
92	West Yakutat	Slope	Yes
93	West Yakutat	Slope	Yes
94	West Yakutat	Slope	Yes
95	West Yakutat	Slope	Yes
96	West Yakutat	Slope	Yes
97	East Yakutat/Southeast	Slope	Yes
98	East Yakutat/Southeast	Slope	Yes
99	East Yakutat/Southeast	Slope	Yes
100	East Yakutat/Southeast	Slope	Yes
101	East Yakutat/Southeast	Slope	Yes
102	East Yakutat/Southeast	Slope	Yes
103	East Yakutat/Southeast	Shelf	No
104	East Yakutat/Southeast	Slope	Yes
105	East Yakutat/Southeast	Slope	Yes
106	East Yakutat/Southeast	Slope	Yes
107	East Yakutat/Southeast	Slope	Yes
108	East Yakutat/Southeast	Slope	Yes
120	Central Gulf of Alaska	Gully	No
121	Central Gulf of Alaska	Gully	No
122	Central Gulf of Alaska	Gully	No
123	Central Gulf of Alaska	Gully	No
128	Central Gulf of Alaska	Gully	No
129	Central Gulf of Alaska	Gully	No
130	Central Gulf of Alaska	Gully	No
131	Central Gulf of Alaska	Gully	No
132	Central Gulf of Alaska	Gully	No
133	Central Gulf of Alaska	Gully	No
134	Central Gulf of Alaska	Gully	No
135	Central Gulf of Alaska	Gully	No
136	West Yakutat	Gully	No
137	West Yakutat	Gully	No
138	West Yakutat	Gully	No
139	West Yakutat	Gully	No

Table 2. -- Cont.

Station number	Sablefish management area	Station type	Abundance calculations
142	East Yakutat/Southeast	Deep Gully	Yes
143	East Yakutat/Southeast	Deep Gully	Yes
144	East Yakutat/Southeast	Deep Gully	Yes
145	East Yakutat/Southeast	Deep Gully	Yes
148	East Yakutat/Southeast	Deep Gully	Yes
149	East Yakutat/Southeast	Deep Gully	Yes
523	Central Gulf of Alaska	Slope	No
525	Central Gulf of Alaska	Slope	No

Table 3. -- Set information by station and haul for the 2018 NMFS longline survey. Positions in decimal degree (DD) format.

Station	Haul	Date	# Skates retrieved	Start latitude	Start longitude	End latitude	End longitude	Start depth (m)	End depth (m)
<u>Aleutian Islands</u>									
35*	1	6/1	80	5301.8	17006.2	5303.4	17011.1	172	178
35*	2	6/1	80	5303.7	17012.0	5305.8	17017.8	182	630
37	3	6/2	80	5216.8	17329.8	5220.5	17329.7	160	612
37	4	6/2	80	5221.3	17330.1	5225.3	17330.3	628	778
38	5	6/3	80	5215.1	17450.6	5218.4	17447.0	177	410
38	6	6/3	80	5218.9	17446.4	5220.3	17440.9	397	830
39 <sup>+</sup>	7	6/4	80	5207.8	17534.3	5208.9	17540.8	109	515
39	8	6/4	80	5209.3	17540.7	5210.6	17546.7	430	860
40	9	6/5	80	5158.2	17627.0	5201.9	17625.6	108	617
40	10	6/5	80	5202.1	17624.5	5204.2	17618.4	595	940
54	11	6/6	80	5145.8	17809.9	5144.3	17815.9	90	467
54	12	6/6	80	5144.4	17816.7	5143.9	17823.6	557	680
42	13	6/7	80	5146.4	17857.8	5143.1	17853.8	154	451
42	14	6/7	80	5143.0	17853.5	5139.7	17849.5	489	705
53	15	6/8	80	5124.3	17837.6	5121.2	17833.5	237	520
53	16	6/8	5	5121.1	17833.0	5122.0	17827.1	535	671
55	17	6/9	80	5135.5	17737.0	5132.9	17742.6	198	321
55	18	6/9	80	5132.8	17743.2	5131.6	17749.8	441	791
57*	19	6/10	80	5144.0	17559.6	5139.7	17600.1	185	371
57*	20	6/10	80	5139.2	17600.6	5135.0	17602.6	410	820
58	21	6/11	80	5150.9	17508.0	5146.5	17508.1	178	365
58	22	6/11	80	5146.6	17506.2	5142.2	17506.2	361	794
59	23	6/12	80	5152.9	17420.3	5149.5	17424.2	123	360
59	24	6/12	80	5149.2	17424.6	5146.5	17430.3	320	860
60	25	6/13	80	5155.2	17330.1	5152.9	17335.6	112	187
60	26	6/13	80	5152.7	17335.9	5152.2	17342.6	163	650
61	27	6/14	80	5222.9	17017.6	5222.8	17024.6	233	549
61	28	6/14	54	5222.5	17024.6	5222.5	17031.2	486	606
<u>Gulf of Alaska</u>									
64*	29	6/16	80	53.19	-166.85	53.13	-166.87	223	316
64*	30	6/16	80	53.12	-166.88	53.06	-166.91	339	593
62*	31	6/17	80	52.66	-169.00	52.62	-169.09	141	498
62*	32	6/17	80	52.62	-169.10	52.56	-169.20	348	375
63*	33	6/18	80	52.97	-168.14	52.92	-168.20	112	420
63*	34	6/18	80	52.92	-168.21	52.85	-168.22	316	656
65	35	6/19	80	53.58	-165.68	53.52	-165.72	123	259
65	36	6/19	80	53.51	-165.73	53.45	-165.77	300	496

Table 3. Cont.

Station	Haul	Date	# Skates retrieved	Start latitude	Start longitude	End latitude	End longitude	Start depth (m)	End depth (m)
66	37	6/20	80	53.74	-164.47	53.69	-164.55	139	286
66	38	6/20	80	53.68	-164.57	53.63	-164.66	327	636
67	39	6/21	80	53.97	-163.26	53.91	-163.31	118	328
67	40	6/21	80	53.91	-163.33	53.87	-163.42	375	623
68	41	6/22	80	54.13	-161.64	54.09	-161.72	125	316
68	42	6/22	80	54.09	-161.74	54.06	-161.85	248	676
69	43	6/23	80	54.31	-161.07	54.26	-161.15	182	396
69	44	6/23	80	54.26	-161.17	54.20	-161.24	411	904
70	45	6/24	80	54.37	-160.23	54.31	-160.28	141	280
70	46	6/24	80	54.30	-160.27	54.23	-160.30	356	648
71	47	6/25	80	54.50	-159.26	54.44	-159.30	156	285
71	48	6/25	80	54.44	-159.34	54.38	-159.40	291	614
72	49	6/26	80	54.63	-158.58	54.57	-158.64	134	391
72	50	6/26	80	54.57	-158.66	54.50	-158.72	330	782
73	51	6/27	80	54.87	-157.74	54.79	-157.81	191	389
73	52	6/27	80	54.85	-157.74	54.79	-157.81	357	682
74	53	6/28	80	55.24	-156.67	55.18	-156.73	161	350
74	54	6/28	80	55.18	-156.74	55.12	-156.74	335	682
75	55	6/29	80	55.64	-155.85	55.58	-155.86	150	217
75	56	6/29	80	55.56	-155.86	55.50	-155.83	219	217
148	57	7/5	80	54.65	-132.83	54.60	-132.91	148	377
149	58	7/5	80	54.60	-133.03	54.59	-133.15	409	395
108	59	7/6	80	54.46	-133.92	54.49	-134.01	336	425
108	60	7/6	80	54.50	-134.01	54.55	-134.07	435	661
107	61	7/7	80	54.90	-134.29	54.96	-134.35	230	576
107	62	7/7	80	54.96	-134.36	55.01	-134.45	452	875
106	63	7/8	80	55.35	-134.73	55.39	-134.70	307	580
106	64	7/8	80	55.40	-134.83	55.39	-134.94	443	818
105	65	7/9	80	55.56	-134.98	55.58	-135.06	241	507
105	66	7/9	80	55.59	-135.07	55.63	-135.15	486	774
144	67	7/10	80	55.93	-134.91	56.00	-134.91	198	355
145	68	7/10	80	56.04	-134.93	56.09	-135.02	366	352
104	69	7/11	80	55.98	-135.44	56.02	-135.53	336	636
104	70	7/11	80	56.03	-135.53	56.07	-135.60	576	788
103	71	7/12	80	56.39	-135.35	56.38	-135.48	155	187
103	72	7/12	80	56.39	-135.49	56.37	-135.61	191	250
102	73	7/13	80	56.85	-136.00	56.89	-136.09	246	750
102	74	7/13	80	56.91	-136.10	56.97	-136.13	636	912
101	75	7/14	80	57.19	-136.24	57.22	-136.34	234	753

Table 3. Cont.

Station	Haul	Date	# Skates retrieved	Start latitude	Start longitude	End latitude	End longitude	Start depth (m)	End depth (m)
101	76	7/14	80	57.24	-136.34	57.29	-136.38	610	863
100	77	7/15	80	57.62	-136.54	57.62	-136.65	242	682
100	78	7/15	80	57.62	-136.68	57.66	-136.76	690	625
142	79	7/16	80	57.92	-137.01	57.92	-137.13	446	407
143	80	7/16	80	57.97	-137.08	57.97	-137.21	421	246
99	81	7/17	80	57.95	-137.38	57.88	-137.49	211	708
99	82	7/17	80	57.89	-137.51	57.89	-137.61	682	666
98	83	7/18	80	58.14	-138.74	58.15	-138.85	309	769
98	84	7/18	80	58.16	-138.86	58.18	-138.97	545	539
97	85	7/19	80	58.47	-139.47	58.46	-139.58	196	542
97	86	7/19	80	58.46	-139.61	58.42	-139.69	459	630
138	91	7/24	80	59.42	-140.94	59.43	-141.08	205	299
139	92	7/24	80	59.42	-141.17	59.36	-141.25	326	330
96	93	7/25	80	58.68	-140.64	58.68	-140.76	284	744
96	94	7/25	80	58.69	-140.78	58.72	-140.88	563	795
95	95	7/26	80	59.05	-141.35	59.05	-141.48	296	521
95	96	7/26	80	59.05	-141.51	59.05	-141.63	580	841
94	97	7/27	80	59.39	-142.18	59.42	-142.29	246	480
94	98	7/27	80	59.43	-142.31	59.47	-142.40	434	966
93	99	7/28	80	59.55	-142.57	59.59	-142.68	136	589
93	100	7/28	80	59.60	-142.70	59.57	-142.80	582	673
137	101	7/29	80	59.67	-143.39	59.71	-143.49	299	316
136	102	7/29	80	59.75	-143.57	59.76	-143.71	165	308
92	103	7/30	80	59.56	-143.66	59.56	-143.79	175	739
92	104	7/30	80	59.57	-143.82	59.58	-143.94	608	679
91	105	7/31	80	59.52	-144.72	59.48	-144.84	187	509
91	106	7/31	80	59.48	-144.86	59.45	-144.96	539	759
90	107	8/1	80	59.50	-145.54	59.51	-145.67	166	638
90	108	8/1	80	59.52	-145.69	59.52	-145.81	696	552
89	109	8/2	80	59.26	-146.87	59.22	-146.97	202	607
89	110	8/2	80	59.21	-147.00	59.17	-147.08	555	884
134	111	8/5	80	59.62	-146.97	59.56	-147.04	216	215
135	112	8/5	80	59.52	-147.15	59.45	-147.15	223	215
88	113	8/6	80	59.15	-147.60	59.09	-147.61	271	530
88	114	8/6	80	59.08	-147.62	59.00	-147.63	530	943
87	115	8/7	80	59.13	-148.65	59.05	-148.65	159	204
87	116	8/7	80	59.04	-148.65	58.97	-148.65	231	250
132	117	8/8	80	59.08	-149.41	59.04	-149.52	190	231
133	118	8/8	80	58.95	-149.51	58.93	-149.61	248	243



Table 3. Cont.

Station	Haul	Date	# Skates retrieved	Start latitude	Start longitude	End latitude	End longitude	Start depth (m)	End depth (m)
130	119	8/9	80	58.73	-149.19	58.77	-149.08	180	220
131	120	8/9	80	58.80	-149.05	58.84	-148.93	241	256
86	121	8/10	80	58.69	-148.33	58.62	-148.33	286	466
86	122	8/10	80	58.64	-148.29	58.58	-148.28	438	950
85	123	8/11	80	58.29	-148.62	58.22	-148.66	261	516
85	124	8/11	80	58.21	-148.67	58.15	-148.70	550	839
84	125	8/12	80	57.97	-149.17	57.91	-149.25	182	502
84	126	8/12	80	57.91	-149.30	57.85	-149.35	514	873
128	127	8/13	80	58.00	-149.84	57.99	-149.97	227	269
129	128	8/13	80	58.08	-149.90	58.07	-150.03	299	306
83	129	8/14	80	57.63	-149.92	57.56	-149.95	416	566
83	130	8/14	80	57.55	-149.96	57.49	-149.99	584	891
82	131	8/15	80	57.40	-150.57	57.33	-150.59	227	505
82	132	8/15	80	57.32	-150.61	57.26	-150.60	516	711
535	133	8/17	80	57.36	-150.67	57.29	-150.67	225	501
535	134	8/17	80	57.28	-150.68	57.20	-150.67	511	780
523	135	8/18	80	57.22	-151.04	57.15	-151.04	195	568
523	136	8/18	80	57.14	-151.05	57.07	-151.05	559	596
81	137	8/19	80	57.12	-151.05	57.12	-151.22	266	525
81	138	8/19	80	57.05	-151.29	56.98	-151.28	575	840
80	139	8/20	80	56.48	-152.22	56.42	-152.28	148	588
80	140	8/20	80	56.42	-152.31	56.35	-152.36	401	601
79	141	8/21	80	56.30	-153.09	56.26	-153.18	257	708
79	142	8/21	80	56.27	-153.20	56.22	-153.28	478	829
78	143	8/22	80	55.99	-154.03	55.93	-154.02	246	464
78	144	8/22	80	55.92	-154.03	55.86	-154.02	507	864
77	145	8/23	80	56.04	-154.58	55.98	-154.57	237	505
77	146	8/23	80	55.97	-154.59	55.90	-154.57	573	889
76	147	8/24	80	55.76	-155.14	55.71	-155.16	170	299
76	148	8/24	80	55.69	-155.18	55.64	-155.20	339	636
122	149	8/25	80	56.18	-155.97	56.18	-156.08	199	241
123	150	8/25	80	56.23	-156.13	56.25	-156.25	251	270
120	151	8/26	80	55.79	-156.08	55.76	-156.19	209	241
121	152	8/26	80	55.75	-156.20	55.73	-156.32	245	255

\*Station catch was entirely or partially impacted by killer whale depredation.

<sup>+</sup>Forty-nine skates removed from abundance calculations due to extreme snarling of gear.

Table 4. -- Total estimated catch in numbers of major species (> 100 individuals) caught in the 2018 NMFS longline survey by management area.

Species/Complex	Aleutian Islands	Western GOA	Central GOA	West Yakutat	East Yakutat Southeast	Total
Sablefish	7955	16820	33778	8052	14260	80865
Giant grenadier	14184	12556	18440	3092	2816	51088
Shortspine thornyhead	1340	2165	5455	3564	3616	16140
Pacific cod	9171	1890	953	59	159	12232
Rougheye/blackspotted rockfish	1592	1535	1157	797	2542	7623
Pacific halibut	1458	692	2574	1260	779	6763
Shortraker rockfish	837	652	745	796	1106	4136
Arrowtooth flounder	883	260	1120	210	108	2581
Aleutian/Bering/Alaska Skate Complex	641	147	790	100	99	1777
Yellow Irish lord	1637	27	0	0	0	1664
Sea anemone	14	96	381	191	805	1487
Whiteblotched skate	1451	0	0	0	2	1453
Redbanded rockfish	6	31	263	171	843	1314
Longnose skate	3	159	295	231	340	1028
Pacific grenadier	113	3	536	231	47	930
Spiny dogfish	1	6	250	25	526	808
Sea pen or sea whip	53	10	668	22	9	762
Dover sole	0	5	282	73	157	517
Yelloweye rockfish	1	121	26	50	274	472
Commander skate	430	2	1	0	15	448
Brittle star	38	66	228	8	99	439
Spotted ratfish	0	0	0	0	400	400
Sponge	240	97	35	1	6	379
Bryozoan	260	59	21	1	7	348
Starfish	33	9	85	35	116	278
Basket star	46	4	153	18	11	232
Darkfin sculpin	193	4	2	0	0	199
Gorgonian coral	160	16	4	1	10	191
Hydrocoral	147	9	12	1	5	174
Crinoid	6	2	139	4	8	159
Longspine thornyhead	1	0	37	8	76	122
mud skate	119	0	0	0	1	120
Greenland turbot	118	0	0	0	0	118
Lips or Jaws - whale predation	52	6	10	23	22	113

Table 5. -- Catch in numbers by station for major species in the 2018 NMFS longline survey. SF = sablefish, PC = Pacific cod, GR = giant grenadier, PH = Pacific halibut, ATF = arrowtooth flounder, GT = Greenland turbot, RF = rougheye, blackspotted, and shorttraker rockfish, ST = shortspine thornyhead, SK = skate, OS = Other Species.

Station	SF	PC	GR	PH	ATF	GT	RF	ST	SK	OS
<u>Aleutian Islands</u>										
35*	56	1733	268	57	5	1	91	0	662	344
37	1367	430	1769	59	86	18	3	16	207	67
38	851	1004	1149	244	79	19	197	145	51	45
39	1039	466	1530	275	133	8	9	23	32	344
40	975	231	1399	124	93	34	71	93	140	113
42	483	843	602	96	71	10	202	67	444	139
53	656	59	240	21	11	2	72	299	27	66
54	328	924	959	162	259	23	267	113	265	630
55	617	576	1461	44	25	1	32	141	73	254
57*	252	177	1024	40	24	0	54	87	121	79
58	237	305	1300	39	20	0	113	106	92	39
59	269	778	982	137	57	0	234	74	193	692
60	262	1315	171	97	17	1	1022	31	264	467
61	563	330	1330	63	3	1	62	145	138	100
<u>Gulf of Alaska</u>										
62*	853	397	2706	40	31	0	719	139	28	58
63*	1281	218	2049	69	65	0	316	282	18	35
64*	485	46	1554	20	5	0	245	239	12	96
65	1121	661	2339	86	7	0	17	123	54	80
66	1590	112	2052	34	28	0	110	185	37	41
67	1594	251	967	126	76	0	612	359	65	86
68	1093	354	714	170	114	0	613	781	46	105
69	1704	138	2170	32	34	0	96	192	25	18
70	1105	545	2064	116	32	0	10	140	52	80
71	617	291	1629	116	15	0	103	151	46	81
72	1706	84	1700	88	47	0	102	213	16	31
73	1156	31	1229	28	25	0	242	137	36	25
74	1625	10	1049	69	53	0	27	374	16	138
75	404	245	0	513	27	0	10	8	79	118
76	996	154	745	68	39	0	50	208	38	431
77	1452	34	2384	8	23	0	46	342	9	154
78	1368	14	1530	160	28	0	147	359	7	369
79	2034	0	1160	7	34	0	95	354	0	52
80	1503	29	529	87	71	0	200	350	7	99
81	1890	0	1106	34	84	0	45	204	4	210
82	1825	5	908	278	73	0	106	257	5	45
83	1043	0	1667	2	3	0	13	94	0	129
84	1480	53	552	194	44	0	52	166	28	182
85	1066	6	559	24	67	0	56	438	7	109
86	1275	9	231	214	37	0	298	332	10	101
87	1271	15	0	273	31	0	1	110	71	116

Table 5. -- Cont.

Station	SF	PC	GR	PH	ATF	GT	RF	ST	SK	OS
88	529	2	873	98	62	0	218	332	20	189
89	571	28	981	175	15	0	61	206	41	172
90	977	3	185	106	10	0	219	301	36	130
91	1057	18	450	102	13	0	142	425	45	109
92	1500	3	458	146	8	0	19	266	25	22
93	756	0	174	199	9	0	20	800	20	93
94	516	0	69	98	8	0	149	386	16	147
95	837	0	286	174	38	0	333	501	32	101
96	679	0	489	22	21	0	530	267	24	135
97	1125	3	520	15	6	0	194	325	15	223
98	1270	0	273	3	3	0	204	177	3	75
99	1135	0	131	5	9	0	106	228	11	202
100	718	5	238	4	3	0	27	239	8	70
101	1208	0	351	4	2	0	166	271	4	116
102	848	0	615	6	5	0	95	280	9	137
103	210	33	0	387	10	0	0	4	42	657
104	703	0	144	16	2	0	332	275	27	136
105	476	4	95	24	5	0	319	170	18	209
106	1060	0	103	2	0	0	551	249	11	98
107	568	0	74	8	2	0	1020	144	17	253
108	836	0	127	5	2	0	374	301	22	305
120	1008	99	0	40	20	0	0	3	83	16
121	716	0	0	51	23	0	0	8	93	17
122	966	150	0	149	55	0	1	1	104	22
123	791	20	0	80	51	0	0	0	150	11
128	546	26	0	120	41	0	3	74	21	21
129	743	0	0	48	33	0	7	77	29	6
130	482	2	0	45	15	0	4	83	34	47
131	429	0	0	28	22	0	22	299	21	80
132	437	25	0	118	16	0	3	88	98	76
133	236	1	0	49	13	0	4	109	32	47
134	290	0	0	4	2	0	28	112	53	67
135	304	0	0	1	0	0	1	12	33	22
136	267	4	0	92	11	0	10	110	12	34
137	263	1	0	53	1	0	17	98	14	5
138	361	2	0	67	35	0	57	97	19	33
139	268	0	0	26	41	0	36	107	47	12
142	813	0	107	7	7	0	52	222	5	4
143	1034	0	37	29	18	0	26	121	27	75
144	435	16	0	132	9	0	87	258	43	76

Table 5. -- Cont.

Station	SF	PC	GR	PH	ATF	GT	RF	ST	SK	OS
145	247	0	1	37	1	0	85	94	12	324
148	668	98	0	73	22	0	9	157	92	486
149	906	0	0	22	2	0	1	101	94	202
523	1480	4	1449	90	42	0	25	160	6	33
535	1480	0	512	134	101	0	71	203	1	107

\*Station catch was entirely or partially impacted by killer whale depredation.

Table 6. -- Total estimated catch in weight (kg) of major species (> 100 kg) caught in the 2018 NMFS longline survey by management area. Weight (kg) derived from length-weight relationship when lengths available. For all others an average weight proxy from longline fisheries was applied to numbers caught.

Species/Complex	Aleutian Islands	Western GOA	Central GOA	West Yakutat	East Yakutat Southeast	Total
Sablefish	14829	31200	69908	21628	37522	175088
Giant grenadier	45159	33509	52323	8029	8356	147376
Pacific halibut	8604	4083	15189	7435	4597	39908
Pacific cod	23617	6310	3247	219	453	33846
Rougheye/blackspotted	1533	1985	1556	1023	4362	10459
Shortspine thornyhead	1351	1367	3088	1976	2405	10187
Whiteblotched skate	7816	0	0	0	11	7826
Longnose skate	22	1185	2199	1722	2535	7664
Shortraker rockfish	710	793	1149	1403	1712	5766
Arrowtooth flounder	2115	512	2356	480	204	5667
Redbanded rockfish	11	55	467	304	1497	2333
Spiny dogfish	2	13	514	41	1336	1907
Spotted ratfish	0	0	0	0	1456	1456
Commander skate	1370	6	3	0	48	1428
Yellow Irish lord	1372	23	0	0		1395
Yelloweye rockfish	3	349	75	144	790	1361
Pacific grenadier	103	4	445	190	38	779
Dover sole	0	7	419	109	234	769
Sea anemone	4	27	106	53	223	412
Mud skate	403	0	0	0	3	406
Greenland turbot	367	0	0	0	0	367
Skate unidentified	223	0	0	0	0	223
Lingcod	0	0	41	57	99	197
Darkfin sculpin	169	4	2	0	0	174
Sea pen or sea whip	10	2	127	4	2	144
Pacific sleeper shark	0	0	58	0	58	116
Sponge unidentified	69	28	10	0	2	109
Silvergray rockfish	0	0	2	68	39	109
Pacific ocean perch	36	19	39	5	6	104

Table 7. -- Mean length round weight mean dressed weight number and estimated total round weight of sablefish by station for the 2018 NMFS longline survey.

Station	Mean length	Mean round weight (kg) <sup>a</sup>	Mean dressed weight (lbs) <sup>b</sup>	Number of sablefish	Est. total round weight (kg) <sup>c</sup>
<u>Aleutian Islands</u>					
35*	52.43	1.43	1.99	56	80
37	54.02	1.6	2.22	1367	2185
38	55.38	1.75	2.42	851	1486
39	56.62	1.88	2.61	1039	1952
40	56.28	1.86	2.58	975	1813
42	57.78	2.10	2.91	483	1013
53	58.53	2.09	2.91	656	1374
54	61.13	2.59	3.60	328	851
55	52.83	1.51	2.09	617	929
57*	52.16	1.42	1.97	252	357
58	53.84	1.59	2.21	237	377
59	57.28	2.03	2.82	269	546
60	62.01	2.57	3.58	262	675
61	58.36	2.12	2.94	563	1192
<u>Gulf of Alaska</u>					
62*	55.06	1.77	2.46	876	1552
63*	56.68	1.93	2.67	1333	2566
64*	51.46	1.4	1.94	2010	2804
65	55.65	1.78	2.48	1605	2861
66	56.17	1.86	2.58	2077	3858
67	54.01	1.67	2.31	1453	2422
68	60.41	2.41	3.35	1488	3588
69	58.68	2.2	3.05	1733	3809
70	56.75	1.90	2.64	1847	3514
71	55.48	1.76	2.45	2398	4226
72	59.00	2.17	3.02	1756	3818
73	55.7	1.81	2.51	2345	4240
74	59.33	2.21	3.07	2244	4961
75	49.43	1.20	1.66	1557	1864
76	56.50	1.90	2.64	1275	2428
77	60.54	2.46	3.42	1210	2978
78	62.65	2.78	3.86	1009	2802
79	59.09	2.29	3.18	1757	4028

Table 7. -- Cont.

Station	Mean length	Mean round weight (kg) <sup>a</sup>	Mean dressed weight (lbs) <sup>b</sup>	Number of sablefish	Est. total round weight (kg) <sup>c</sup>
80	60.82	2.52	3.51	1422	3590
81	56.91	2.02	2.81	1166	2358
82	59.55	2.33	3.23	1465	3408
83	60.17	2.46	3.41	1043	2564
84	59.83	2.44	3.38	1480	3606
85	59.95	2.37	3.30	1066	2529
86	60.62	2.45	3.41	1275	3128
87	54.43	1.68	2.34	1271	2141
88	52.71	1.62	2.24	529	854
89	55.39	1.91	2.65	571	1088
90	61.60	2.75	3.82	977	2684
91	64.25	3.04	4.22	1057	3214
92	62.48	2.79	3.87	1500	4180
93	64.48	3.03	4.21	756	2289
94	60.94	2.63	3.66	516	1358
95	67.63	3.58	4.98	837	2999
96	60.02	2.56	3.55	679	1737
97	66.31	3.30	4.58	1125	3710
98	62.22	3.00	4.16	1270	3807
99	64.20	3.27	4.55	1135	3715
100	61.43	2.63	3.66	718	1892
101	62.75	2.90	4.02	1208	3499
102	65.53	3.26	4.52	848	2761
103	49.87	1.44	2.00	210	303
104	55.49	1.85	2.58	703	1304
105	57.36	2.11	2.93	476	1002
106	62.63	2.78	3.86	1060	2946
107	64.30	3.09	4.29	568	1753
108	61.69	2.67	3.70	836	2230
120	55.09	1.70	2.36	1008	1713
121	56.64	1.85	2.57	716	1326
122	55.81	1.78	2.48	966	1724
123	56.06	1.80	2.50	791	1424
128	56.18	1.85	2.58	546	1013
129	60.31	2.29	3.18	743	1702



Table 7. -- Cont.

Station	Mean length	Mean round weight (kg) <sup>a</sup>	Mean dressed weight (lbs) <sup>b</sup>	Number of sablefish	Est. total round weight (kg) <sup>c</sup>
130	51.99	1.47	2.05	482	710
131	61.34	2.48	3.45	429	1065
132	55.63	1.82	2.52	437	794
133	60.77	2.37	3.29	236	558
134	46.70	1.01	1.40	290	292
135	46.86	1.00	1.40	304	305
136	56.33	2.03	2.82	267	542
137	61.97	2.55	3.54	263	671
138	47.00	1.02	1.41	361	367
139	55.19	1.86	2.59	268	500
142	59.05	2.18	3.02	813	1768
143	58.98	2.17	3.02	1034	2248
144	46.80	1.76	2.45	435	767
145	63.00	2.85	3.96	247	704
148	55.82	1.83	2.54	668	1223
149	58.38	2.09	2.90	906	1890
523	55.86	1.86	2.58	1480	2753
535	58.06	2.18	3.03	1480	3230

\*Station catch was entirely or partially impacted by killer whale depredation.

<sup>a</sup> Mean weight was estimated by applying a length-weight relationship to the length frequency distribution from each station.

<sup>b</sup> Mean dressed weight was estimated using a recovery rate of 0.6 of round weight (in pounds).

<sup>c</sup> Estimated total round weight is the product of mean round weight and the number of hooked sablefish that came to the surface including a small percentage that were lost during landing and fish that were tagged and released.

Table 8. -- Stations and skates depredated by killer whales during the 2018 NMFS longline survey. Number of skates affected refers to skates determined to be depredated and removed from abundance calculations.

Station	Region	Number of skates affected	Number of skates fished
35	Aleutian Islands	160	160
57	Aleutian Islands	91	160
62	Western Gulf of Alaska	10	160
63	Western Gulf of Alaska	10	160

Table 9. -- Stations that had sperm whales present during hauling operations in the 2018 NMFS longline survey. Depredation is defined as sperm whales being present with the occurrence of damaged fish on the line.

Station	Region	Depredation
79	Central Gulf of Alaska	Yes
81	Central Gulf of Alaska	Yes
88	Central Gulf of Alaska	Yes
523	Central Gulf of Alaska	Yes
89	West Yakutat	Yes
90	West Yakutat	Yes
91	West Yakutat	Yes
92	West Yakutat	Yes
93	West Yakutat	Yes
94	West Yakutat	Yes
95	West Yakutat	No
96	West Yakutat	Yes
136	West Yakutat	No
137	West Yakutat	No
97	East Yakutat/Southeast	Yes
99	East Yakutat/Southeast	Yes
100	East Yakutat/Southeast	Yes
101	East Yakutat/Southeast	Yes
103	East Yakutat/Southeast	Yes
104	East Yakutat/Southeast	Yes
105	East Yakutat/Southeast	Yes
107	East Yakutat/Southeast	Yes
142	East Yakutat/Southeast	Yes
143	East Yakutat/Southeast	Yes

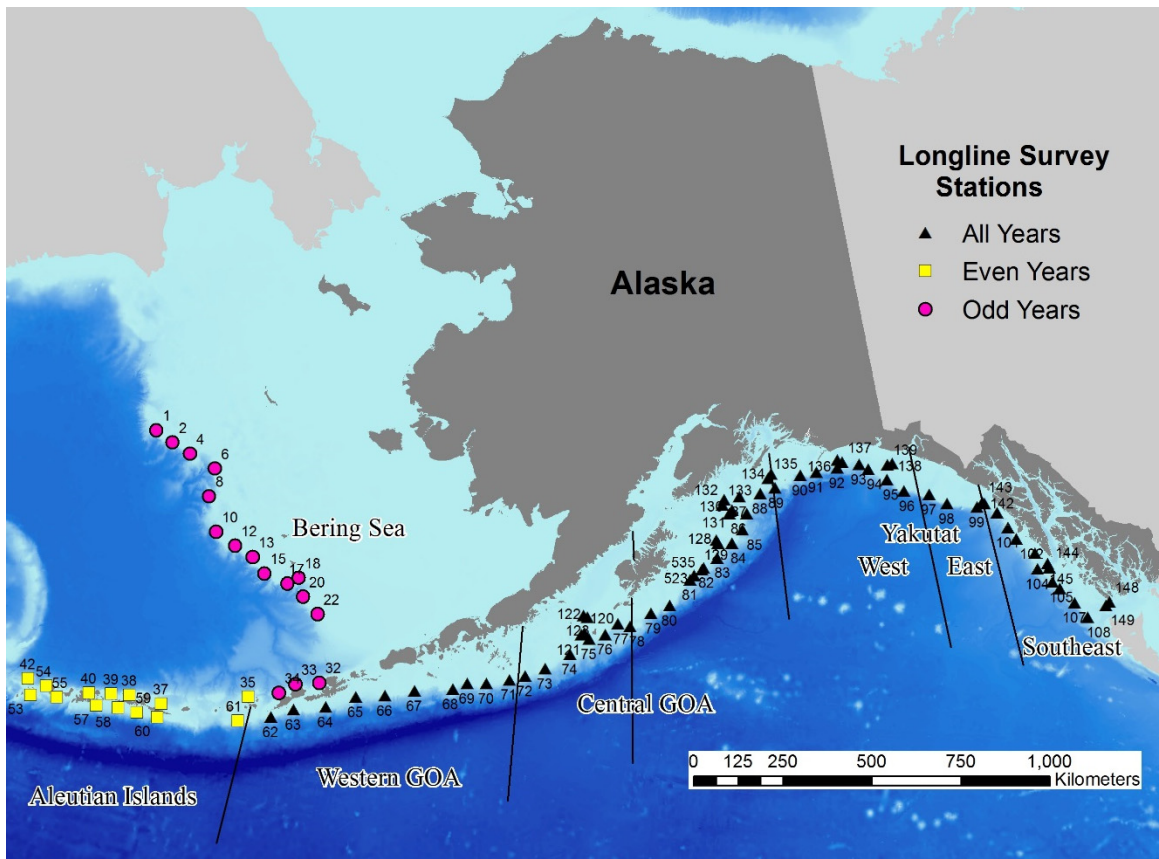


Figure 1. -- Map of NMFS longline survey station locations. Bering Sea stations are sampled in odd years; stations in the eastern and central Aleutian Islands are sampled in even years; Gulf of Alaska (GOA) stations are sampled every year.

## **APPENDIX: Squid Versus Pollock Bait**

A 2-day experiment was conducted near Yakutat from 21 to 22 July to compare the catch rates of two types of bait, squid, and pollock. The longline survey has used squid as bait since the survey's inception. However there is some belief among sablefish fishers that pollock is a better bait because it attracts fewer grenadier. If true hook competition between sablefish and grenadier may be reduced leaving more hooks available to sablefish. Furthermore grenadiers are very rarely retained so if pollock bait catches fewer grenadier then bycatch and discards would also be reduced.

During the 2-day experiment, two sets were made each day for a total of four sets (Appendix Table A-1). The stations were located in the West Yakutat management region. The experimental sets were made between 360 and 775 m depth. Efforts were made to place the groundline in habitats similar to standard survey stations. Each set consisted of 80 skates. All gear characteristics were identical to standard survey sets except for the bait. Squid and pollock bait was interspersed within a set in groupings of 10 skates each (e.g., skates 1–10 squid; skates 11–20 pollock; skates 21–30 squid; etc.). This resulted in a total of 80 skates baited with squid and 80 skates baited with pollock per station/day.

During the 2-day experiment the survey encountered many issues that may have affected catch rates and will likely complicate data analyses: 1) there were two longline vessels fishing in the vicinity of hauls 87 and 88, 2) sperm whales were observed depredating on the longline on all 4 hauls, 3) the groundline hung up on the bottom and parted on haul 90 (all hooks were eventually retrieved however from the opposite end) and, 4) a considerable amount of derelict gear was retrieved on haul 89 that appeared to

strip all catch from the hooks as it slid down the line during retrieval. On all sets combined 1755 sablefish 724 shortspine thornyhead and 720 giant grenadier were caught during the two-day experiment in 2018.

In addition to the bait experiment the Fisheries Monitoring and Analysis (FMA) Division of the Alaska Fisheries Science Center (AFSC) conducted an electronic monitoring (EM) experiment. For this experiment spectral imaging stereo cameras recorded images of rougheye blackspotted and shortraker rockfish. Tissue samples were collected for each specimen imaged as a means for verifying species identifications genetically. This project was designed to evaluate the efficacy of using spectral imaging and machine learning to positively identify species that are difficult to distinguish.

Appendix Table A-1. -- Set information by station and haul for the 2018 NMFS longline survey 2-day experiment. Positions in decimal degree (DD) format.

Station	Haul	Date	Start latitude	Start longitude	End latitude	End longitude	Start depth (m)	End depth (m)
999	87	21-Jul	58.78	-140.92	58.82	-141.02	360	725
999	88	21-Jul	58.82	-140.94	58.87	-141.03	370	727
1000	89	22-Jul	58.27	-139.18	58.29	-139.29	490	725
1000	90	22-Jul	58.29	-139.29	58.31	-139.40	557	775