F/V *Ocean Prowler*
Cruise Report OP-15-01
Longline Survey of the Gulf of Alaska and Eastern Bering Sea
May 26-August 28, 2015

Prepared by

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On August 28, 2015, the Alaska Fisheries Science Center (AFSC) completed the 38th annual longline survey of Alaska sablefish (*Anoplopoma fimbria*) and other groundfish resources of the upper continental slope (Figure 1). The Japan-U.S. cooperative longline survey was initiated in 1978 (experimental year) and discontinued after 1994, resulting in a time series of the Gulf of Alaska from 1979 to 1994. As a continuation of the cooperative survey, the National Marine Fisheries Service (NMFS) has surveyed the Gulf of Alaska annually since 1987, the eastern Aleutian Islands biennially since 1996, and the eastern Bering Sea biennially since 1997. The Gulf of Alaska and eastern Bering Sea were sampled in 2015.

OBJECTIVES

1. Determine the relative abundance and size composition of the most commercially important species: sablefish, shortspine thornyhead (*Sebastolobus alascanus*), Greenland turbot (*Reinhardtius hippoglossoides*), Pacific cod (*Gadus macrocephalus*),and rougheye and shortraker rockfishes (*Sebastes aleutianus* and *S. borealis*).

2. Determine the relative abundance and size composition of other groundfish species caught during the survey: arrowtooth flounder (*Atheresthes stomias*), grenadiers (Macrouridae), skates (Rajadie), and spiny dogfish (*Squalus suckleyi*).

3. Tag and release sablefish, shortspine thornyhead, and Greenland turbot throughout the cruise to determine migration patterns.

4. Collect sablefish otoliths to study the age composition of the population.

VESSEL AND GEAR

Survey operations were conducted using the F/V *Ocean Prowler*, a chartered U.S. longline vessel. The 47 m (155 ft) long vessel carried standard longline hauling gear and was equipped with radios, radars, GPS receivers, a processing line, three sets of plate freezers, and refrigerated holds. Vessel personnel consisted of a captain, an engineer, a

cook, a quality-control technician, two contract biologists, six fishermen and five processors.

Gear configuration is standardized and has been consistent for all survey years since 1988. Units of gear (skates) were 100 m (55 fm) long and contained 45 size 13/0 Mustad[1] circle hooks. Hooks were attached to 38 cm (15 in) gangions that were secured to beckets tied into the groundline at 2 m (6.5 ft) intervals. Five meters (16 ft) of groundline were left bare at each 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.

A set of gear 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 line. 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*) 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 nmi) long and contained 160 skates and 7,200 hooks except in the eastern Bering Sea where 180 skates with 8,100 hooks were set. Additional effort is placed in this region due to the lower densities of sablefish. Two eighty-skate groundlines laid end to end were set at each station along the upper continental slope. A single groundline of eighty skates was set at each station in the gullies except Amatuli Gully station 87 that consists of 160 skates. Specific information regarding longline survey protocols and details of the survey gear can be found at: http://www.afsc.noaa.gov/ABL/MESA/pdf/LSprotocols.pdf

OPERATIONS

The charter began on May 26 at Dutch Harbor, Alaska, and ended on August 28 at 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 Bering Sea were sampled (Figure 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 then 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 two-day experiment was conducted in the Yakutat vicinity (See Appendix A). 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.

[1] Citation of the above brand name does not constitute U.S. government endorsement.

From 1988 to 1990 the survey period was from June 26 to September 12, which avoided surveying the grounds when a commercial sablefish opener occurred. The survey periods in 1991 through 1994 were 2-1/2 weeks later than in 1988 through 1990. The 1991-1994 surveys were delayed to avoid the commercial trawl fishery that occurred in the Gulf beginning July 1. Starting in 1995, the survey period was moved back to near the 1988-1990 time periods because avoiding the sablefish fishery was impossible due to 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 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 present the survey starting and ending dates were several days earlier than previous years. This was done to accommodate the vessel's scheduling needs to finish to the survey as early as possible.

Survey Operations

A total of 16 stations along the upper continental slope of the eastern Bering Sea and 45 stations along the upper continental slope of the Gulf of Alaska were sampled at a rate of one station per day (Figure 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, twenty-seven 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 found in Table 2.

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 approximately 0630 hours Alaska Daylight Time. Retrieval began at approximately 0930 hours and was completed by about 1930 hours.

Data Collection

Catch data were recorded on a hand-held computer. 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 bar code based measuring board and a bar code reader connected to a ruggedized computer. Length was measured by depth stratum for sablefish, Pacific cod, giant grenadier, arrowtooth flounder, spiny dogfish, multiple rockfish species, and shortspine thornyheads. Lengths of sablefish, giant grenadier, spiny dogfish, and Pacific cod were recorded by sex. Sablefish, shortspine thornyhead, and Greenland turbot were tagged on every 20th 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 the previous surveys, the charter vessel was allowed to retain most of the catch once the scientific data were recorded.

RESULTS

One hundred fifty-two longline hauls were completed in 2015 (Table 3). Several stations were sampled out of order for various reasons including scheduling, weather, and fishing vessel interactions. Giant grenadier was the most frequently caught species, followed by sablefish, , Pacific cod, shortspine thornyhead, and Pacific halibut (Table 4). Catch of the most abundant species by station is presented in Table 5. Giant grenadier was the highest catch in weight, followed by sablefish, Pacific halibut, and Pacific cod (Table 6). Average length and weight of sablefish varied by station (Table 7).

A total of 2,502 sablefish, 871 shortspine thornyhead, and 25 Greenland turbot were tagged with external floy tags and released during the 2015 survey. Electronic archival tags were implanted in 36 Greenland turbot. Pop-up satellite tags (PSAT) were implanted in 34 sablefish. Length-weight data and otoliths were collected from 1,662 sablefish.

Killer whales depredating on the catch occurred at nine stations in the Bering Sea and five 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 observations have been recorded during the longline survey since 1998. Sperm whales were observed during survey operations at 25 stations in 2015 (Table 9). Sperm whales were observed depredating on the gear at six stations in the central Gulf of Alaska, six stations in the West Yakutat region, and seven stations in the East Yakutat/Southeast region (Table 9). Apparent sperm whale depredation is defined as sperm whales being present with the occurrence of damaged fish. Longline survey catch rates and abundance indices are not adjusted for sperm whale depredation.

NMFS has requested the assistance of the fishing fleet to avoid the annual sablefish longline survey since the inception of sablefish IFQ management in 1995. We requested that fishermen stay at least five nautical miles away from each survey station for 7 days before and 3 days after the planned sampling date (3 days allow for survey delays). In 2015 there were five recorded interactions between survey operations and fishing vessels. Interactions occurred at station numbers 33, 71, 73, 84, and 88 by longline vessels. In all cases the vessels were contacted by the survey vessel and were encouraged to avoid

survey stations. At stations 71 and 84 the survey vessel altered the station trackline slightly to avoid potential interactions.

Gear damage and loss occurs during survey operations and may have impacts on catch. In 2015 gear issues occurred at seven stations. Two skates of gear were lost at station 32 during the 2015 survey. The gear parted at stations 32, 74, 144, 97, 98, and 124 but all gear was successfully retrieved by hauling the gear in reverse order.

Several special projects were conducted during the 2015 longline survey. Satellite pop-up tags were deployed on sablefish throughout the Gulf of Alaska. Information from these tags will be used to investigate movement patterns within and out of the Gulf of Alaska and potentially help identify spawning areas for sablefish. Livers, ovaries, and maturity stage information were collected from all sablefish sampled for specimen data. This information will be used to help evaluate sablefish maturity and to validate visual maturity stage classifications recorded during the survey. Finally, opportunistic photo identification of both sperm and killer whales were collected for use in whale identification projects.

For further information contact

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Table 1. Leg numbers, dates, and personnel for the 2015 NMFS longline survey.

Leg	Dates	Personnel	Affiliation
1	May 26 - June 14	Pat Malecha	ABL
		Jason Wright	Contract Biologist
		Alexandra Feck	Contract Biologist
2	June 14 - July 3	Pete Hulson	ABL
		Jason Wright	Contract Biologist
		Alexandra Feck	Contract Biologist
3	July 5 - July 19	Chris Lunsford	ABL
		Phillip Ganz	UAF
		Jason Wright	Contract Biologist
		Alexandra Feck	Contract Biologist
4*	July 20 - July 22	Cindy Tribuzio	ABL
		Jared Siegel	UAF
		Alexandra Feck	Contract Biologist
5	July 23 - August 2	Cindy Tribuzio	ABL
		Beth Matta	REFM
		Jason Wright	Contract Biologist
		Alexandra Feck	Contract Biologist
6	August 4 - August 15	Karson Coutre	ABL
		Andrew Diamond	Contractor
		Jason Wright	Contract Biologist
		Alexandra Feck	Contract Biologist
7	August 16- August 29	Katy Echave	ABL
		Andrew Diamond	Contractor
		Jason Wright	Contract Biologist
		Alexandra Feck	Contract Biologist

ABL - Auke Bay Laboratories, Alaska Fisheries Science Center
UAF – University of Alaska Fairbanks
REFM – Resource Ecology and Fisheries Management, Alaska Fisheries Science Center
* Two-day experiment

Table 2. Stations fished in 2015 NMFS longline survey. Sablefish management area refers to the North Pacific Fisheries 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
1	Bering Sea	Slope	Yes
2	Bering Sea	Slope	Yes
4	Bering Sea	Slope	Yes
6	Bering Sea	Slope	Yes
8	Bering Sea	Slope	Yes
10	Bering Sea	Slope	Yes
12	Bering Sea	Slope	Yes
13	Bering Sea	Slope	Yes
15	Bering Sea	Slope	Yes
17	Bering Sea	Slope	Yes
18	Bering Sea	Slope	Yes
20	Bering Sea	Slope	Yes
22	Bering Sea	Slope	Yes
32	Bering Sea	Slope	Yes
33	Bering Sea	Slope	Yes
34	Bering Sea	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
84	Central Gulf of Alaska	Slope	Yes
85	Central Gulf of Alaska	Slope	Yes

Station Number	Sablefish Management Area	Station Type	Abundance Calculations
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
124	Central Gulf of Alaska	Gully	No
125	Central Gulf of Alaska	Gully	No
126	Central Gulf of Alaska	Gully	No
127	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
142	East Yakutat/Southeast	Deep Gully	Yes

Station Number	Sablefish Management Area	Station Type	Abundance Calculations
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

Table 3. Set information by set and haul for the 2015 NMFS longline survey. Positions are in decimal degree (DD) format.

Station	Haul	Date	# Skates Retrieved	Start Latitude	Start Longitude	End Latitude	End Longitude	Start Depth (m)	End Depth (m)
17	1	30-May	90	56.04	-169.62	55.99	-169.73	189	406
17	2	30-May	90	55.99	-169.74	55.98	-169.89	422	873
12	3	31-May	90	56.63	-172.36	56.57	-172.44	191	592
12	4	31-May	90	56.57	-172.44	56.50	-172.51	586	689
8	5	1-Jun	90	57.63	-174.16	57.70	-174.24	136	452
8	6	1-Jun	90	57.70	-174.24	57.78	-174.30	377	839
2	7	2-Jun	90	58.62	-176.64	58.58	-176.76	148	504
2	8	2-Jun	90	58.58	-176.77	58.55	-176.91	531	941
1	9	3-Jun	90	58.78	-177.58	58.81	-177.71	153	411
1	10	3-Jun	90	58.82	-177.72	58.86	-177.84	445	684
4	11	4-Jun	90	58.50	-175.65	58.48	-175.79	220	440
4	12	4-Jun	90	58.48	-175.79	58.50	-175.92	448	739
6	13	5-Jun	90	58.33	-174.31	58.40	-174.37	167	493
6	14	5-Jun	90	58.41	-174.38	58.38	-174.49	413	646
10	15	6-Jun	90	56.83	-173.38	56.90	-173.41	206	487
10	16	6-Jun	90	56.91	-173.41	56.97	-173.46	391	609
13	17	7-Jun	90	56.49	-171.45	56.47	-171.57	169	409
13	18	7-Jun	90	56.47	-171.57	56.46	-171.70	392	632
15	19	8-Jun	90	56.16	-170.67	56.13	-170.77	139	409
15	20	8-Jun	90	56.13	-170.78	56.16	-170.91	436	821
18	21	9-Jun	90	56.24	-169.18	56.18	-169.28	175	655
18	22	9-Jun	92	56.18	-169.28	56.13	-169.38	663	851
20	23	10-Jun	90	55.81	-168.80	55.85	-168.93	202	623
20	24	10-Jun	88	55.85	-168.94	55.93	-169.00	500	709
22	25	11-Jun	90	55.46	-168.01	55.43	-168.14	157	269
22	26	11-Jun	90	55.42	-168.14	55.39	-168.28	283	590
34	27	12-Jun	90	53.35	-168.98	53.30	-168.89	629	802
34	28	12-Jun	90	53.29	-168.89	53.28	-168.81	529	761
33	29	13-Jun	91	53.59	-168.33	53.61	-168.20	118	823
33	30	13-Jun	90	53.61	-168.19	53.62	-168.06	118	781
32	31	14-Jun	87	53.77	-167.33	53.72	-167.38	117	436
32	32	14-Jun	90	53.71	-167.39	53.69	-167.46	314	582
64	33	16-Jun	80	53.19	-166.85	53.12	-166.89	214	314
64	34	16-Jun	80	53.12	-166.89	53.06	-166.95	322	802
62	35	17-Jun	80	52.66	-168.99	52.62	-169.08	134	568
62	36	17-Jun	80	52.62	-169.09	52.57	-169.17	418	763
63	37	18-Jun	80	52.97	-168.14	52.91	-168.21	109	432
63	38	18-Jun	80	52.91	-168.21	52.85	-168.24	355	420

Station	Haul	Date	# Skates Retrieved	Start Latitude	Start Longitude	End Latitude	End Longitude	Start Depth (m)	End Depth (m)
65	39	19-Jun	80	53.58	-165.69	53.51	-165.73	355	420
65	40	19-Jun	80	53.51	-165.73	53.44	-165.78	124	300
66	41	20-Jun	80	53.74	-164.47	53.68	-164.55	315	491
66	42	20-Jun	80	53.68	-164.54	53.63	-164.64	137	278
67	43	21-Jun	80	53.97	-163.26	53.91	-163.32	283	575
67	44	21-Jun	80	53.91	-163.33	53.87	-163.43	116	358
68	45	22-Jun	80	54.13	-161.63	54.09	-161.71	323	652
68	46	22-Jun	80	54.09	-161.72	54.07	-161.82	137	357
69	47	23-Jun	80	54.31	-161.06	54.26	-161.15	269	753
69	48	23-Jun	80	54.26	-161.16	54.21	-161.23	176	375
70	49	24-Jun	80	54.37	-160.25	54.30	-160.29	384	792
70	50	24-Jun	80	54.30	-160.29	54.23	-160.31	149	285
71	51	25-Jun	80	54.50	-159.26	54.44	-159.32	313	596
71	52	25-Jun	80	54.43	-159.32	54.38	-159.40	148	271
72	53	26-Jun	80	54.63	-158.57	54.57	-158.61	292	708
72	54	26-Jun	80	54.57	-158.65	54.50	-158.70	137	362
73	55	27-Jun	80	54.85	-157.74	54.79	-157.81	367	878
73	56	27-Jun	80	54.79	-157.81	54.73	-157.85	193	368
74	57	28-Jun	80	55.24	-156.67	55.18	-156.74	354	625
74	58	28-Jun	80	55.17	-156.74	55.10	-156.76	185	335
75	59	29-Jun	80	55.64	-155.85	55.57	-155.86	311	705
75	60	29-Jun	80	55.56	-155.86	55.49	-155.83	143	211
148	61	5-Jul	80	54.65	-132.84	54.60	-132.94	214	228
149	62	5-Jul	80	54.60	-133.02	54.60	-133.15	145	378
108	63	6-Jul	80	54.46	-133.92	54.49	-134.01	410	417
108	64	6-Jul	80	54.50	-134.01	54.55	-134.07	255	668
107	65	7-Jul	80	54.90	-134.29	54.96	-134.35	443	878
107	66	7-Jul	80	54.96	-134.35	55.01	-134.43	221	623
106	67	8-Jul	80	55.35	-134.73	55.40	-134.83	456	738
106	68	8-Jul	80	55.40	-134.84	55.39	-134.95	380	626
105	69	9-Jul	80	55.56	-134.97	55.58	-135.06	514	825
105	70	9-Jul	80	55.59	-135.06	55.63	-135.15	215	607
144	71	10-Jul	80	55.93	-134.90	56.01	-134.91	539	926
145	72	10-Jul	80	56.03	-134.93	56.08	-135.01	201	362
104	73	11-Jul	80	55.99	-135.45	56.03	-135.54	353	384
104	74	11-Jul	80	56.03	-135.54	56.09	-135.61	369	639
103	75	12-Jul	80	56.38	-135.35	56.38	-135.48	566	786
103	76	12-Jul	80	56.38	-135.49	56.37	-135.62	145	186
102	77	13-Jul	80	56.86	-136.00	56.90	-136.09	188	246
102	78	13-Jul	80	56.90	-136.09	56.96	-136.12	283	846

Station	Haul	Date	# Skates Retrieved	Start Latitude	Start Longitude	End Latitude	End Longitude	Start Depth (m)	End Depth (m)
101	79	14-Jul	80	57.19	-136.24	57.22	-136.34	241	727
101	80	14-Jul	80	57.22	-136.34	57.28	-136.37	650	921
100	81	15-Jul	80	57.62	-136.54	57.62	-136.67	273	712
100	82	15-Jul	80	57.62	-136.68	57.67	-136.77	662	926
142	83	16-Jul	80	57.92	-137.01	57.92	-137.14	394	446
143	84	16-Jul	80	57.97	-137.07	57.97	-137.20	263	422
99	85	17-Jul	80	57.88	-137.38	57.89	-137.49	212	729
99	86	17-Jul	80	57.89	-137.50	57.88	-137.62	546	847
98	87	18-Jul	80	58.14	-138.73	58.16	-138.86	231	819
98	88	18-Jul	80	58.16	-138.86	58.18	-138.98	500	809
97	89	19-Jul	80	58.47	-139.47	58.46	-139.61	189	552
97	90	19-Jul	80	58.46	-139.61	58.42	-139.70	509	781
96	95	24-Jul	80	58.68	-140.64	58.69	-140.79	273	634
96	96	24-Jul	80	58.70	-140.79	58.74	-140.90	469	764
95	97	25-Jul	80	59.06	-141.34	59.05	-141.48	291	509
95	98	25-Jul	80	59.05	-141.49	59.05	-141.63	532	844
138	99	26-Jul	80	59.42	-140.92	59.43	-141.08	201	294
139	100	26-Jul	80	59.41	-141.17	59.35	-141.26	321	329
94	101	27-Jul	80	59.39	-142.18	59.42	-142.30	245	558
94	102	27-Jul	80	59.43	-142.31	59.47	-142.40	539	946
93	103	28-Jul	80	59.55	-142.57	59.59	-142.69	129	609
93	104	28-Jul	80	59.59	-142.69	59.57	-142.80	580	643
136	105	29-Jul	80	59.68	-143.38	59.72	-143.49	297	313
137	106	29-Jul	80	59.75	-143.59	59.76	-143.71	159	299
92	107	30-Jul	80	59.56	-143.66	59.56	-143.80	207	798
92	108	30-Jul	80	59.57	-143.81	59.59	-143.93	563	701
91	109	31-Jul	80	59.52	-144.72	59.48	-144.85	184	472
91	110	31-Jul	80	59.48	-144.85	59.45	-144.98	484	839
90	111	1-Aug	80	59.50	-145.54	59.53	-145.68	160	803
90	112	1-Aug	80	59.53	-145.69	59.52	-145.81	536	741
89	113	2-Aug	80	59.26	-146.86	59.22	-146.97	196	615
89	114	2-Aug	80	59.21	-146.98	59.17	-147.07	623	910
134	115	5-Aug	80	59.51	-146.97	59.56	-147.07	209	215
135	116	5-Aug	80	59.52	-147.15	59.44	-147.15	209	218
88	117	6-Aug	80	59.16	-147.60	59.10	-147.62	247	495
88	118	6-Aug	80	59.08	-147.62	59.01	-147.63	522	890
87	119	7-Aug	80	59.13	-148.65	59.06	-148.65	154	192
87	120	7-Aug	80	59.05	-148.65	58.98	-148.65	199	240
132	121	8-Aug	80	59.08	-149.40	59.04	-149.51	182	227
133	122	8-Aug	80	58.95	-149.51	58.92	-149.63	238	244

Station	Haul	Date	# Skates Retrieved	Start Latitude	Start Longitude	End Latitude	End Longitude	Start Depth (m)	End Depth (m)
130	123	9-Aug	80	58.73	-149.19	58.77	-149.08	177	216
131	124	9-Aug	80	58.80	-149.04	58.84	-148.92	236	253
86	125	10-Aug	80	58.69	-148.33	58.62	-148.33	285	461
86	126	10-Aug	80	58.62	-148.33	58.56	-148.34	464	818
85	127	11-Aug	80	58.29	-148.62	58.22	-148.66	245	523
85	128	11-Aug	80	58.22	-148.66	58.14	-148.70	545	847
84	129	12-Aug	80	57.97	-149.17	57.91	-149.26	173	496
84	130	12-Aug	80	57.91	-149.26	57.85	-149.34	517	958
128	131	13-Aug	80	57.98	-149.97	58.00	-149.83	220	264
129	132	13-Aug	80	58.08	-149.91	58.07	-150.03	295	307
83	133	14-Aug	80	57.63	-149.92	57.57	-149.95	390	547
83	134	14-Aug	80	57.56	-149.95	57.50	-149.98	557	839
82	135	15-Aug	80	57.40	-150.58	57.33	-150.59	217	490
82	136	15-Aug	80	57.34	-150.49	57.28	-150.57	535	717
81	137	17-Aug	80	57.12	-151.21	57.05	-151.27	251	528
81	138	17-Aug	80	57.05	-151.28	56.97	-151.28	564	837
80	139	18-Aug	80	56.48	-152.21	56.42	-152.30	160	495
80	140	18-Aug	80	56.42	-152.31	56.34	-152.36	450	612
79	141	19-Aug	80	56.30	-153.08	56.26	-153.20	246	586
79	142	19-Aug	80	56.26	-153.21	56.21	-153.29	571	854
78	143	20-Aug	80	55.99	-154.02	55.92	-154.02	239	484
78	144	20-Aug	80	55.92	-154.02	55.85	-154.05	520	870
77	145	21-Aug	80	56.05	-154.58	55.98	-154.58	227	507
77	146	21-Aug	80	55.97	-154.58	55.90	-154.58	546	884
76	147	22-Aug	80	55.76	-155.14	55.70	-155.18	165	325
76	148	22-Aug	80	55.69	-155.18	55.64	-155.25	365	577
126	149	23-Aug	80	57.35	-155.04	57.35	-155.17	238	240
127	150	23-Aug	80	57.35	-155.25	57.33	-155.38	246	259
124	151	24-Aug	80	56.99	-155.06	57.00	-155.19	175	233
125	152	24-Aug	80	57.00	-155.31	57.04	-155.41	253	266
122	153	25-Aug	80	56.19	-155.97	56.19	-156.09	200	239
123	154	25-Aug	80	56.23	-156.13	56.25	-156.24	247	266
120	155	26-Aug	80	55.79	-156.08	55.77	-156.19	203	237
121	156	26-Aug	80	55.75	-156.20	55.73	-156.33	243	252

Table 4. Total estimated catch (numbers) of major species (> 100 individuals) caught in 2015 NMFS longline survey. These estimates are for all fish landed including fish tagged and released.

Species/Complex	Bering Sea	Western GOA	Central GOA	West Yakutat	East Yakutat Southeast	Total
Giant grenadier	19,713	18,507	23,119	3,488	3,569	68,396
Sablefish	1,925	4,808	23,206	12,034	16,091	58,064
Pacific cod	10,816	5,016	10,150	699	551	27,232
Shortspine thornyhead	2,359	2,962	6,298	2,877	3,599	18,095
Pacific halibut	2,706	1,558	7,250	1,941	1,503	14,958
Arrowtooth flounder	2,502	774	4,400	500	569	8,745
Rougheye rockfish	447	1,497	1,008	943	2,285	6,180
Shortraker rockfish	884	469	503	1,053	1,450	4,359
Aleutian/Bering/Alaska Skate Complex	1,922	288	1,560	113	138	4,021
Walleye pollock	2,407	390	762	61	12	3,632
Spiny dogfish	0	7	2,061	100	211	2,379
Pacific grenadier	60	4	986	429	273	1,752
Longnose skate	0	218	580	310	391	1,499
Lips or Jaws - Whale Predation	1,051	108	31	28	21	1,239
Redbanded rockfish	0	5	329	124	632	1,090
Sea anemone unident.	72	87	223	124	238	744
whiteblotched skate	698	0	0	0	0	698
Greenland turbot	682	0	0	0	0	682
Yelloweye rockfish	0	125	22	55	440	642
commander skate	546	8	4	2	18	578
Brittlestarfish	28	93	355	19	27	522
Sea pen or Sea Whip	18	20	364	17	9	428
Flathead sole	252	36	32	4	1	325
Dover sole	0	18	194	36	74	322
Spotted ratfish	0	0	0	0	205	205
Sponge, unidentified	40	69	36	6	28	179
Starfish unident.	9	19	59	25	23	135
Pacific Ocean Perch	83	2	11	2	6	104

Table 5. Catch in number by species for the 2015 NMFS longline survey. SF = sablefish, PC = Pacific cod, GR = giant grenadier, PH = Pacific halibut, ATF = arrowtooth flounder, GT = Greenland turbot, RF = rougheye and shortraker rockfish, ST = shortspine thornyheads, SK = skate, OS = other species.

Station	SF	PC	GR	PH	ATF	GT	RF	ST	SK	OS
1	70	316	1473	74	137	128	6	117	190	686
2*	10	425	2564	12	35	9	64	4	211	429
4*	12	191	1334	41	55	12	38	30	187	654
6*	9	889	608	26	80	0	92	2	304	248
8*	87	694	1537	317	246	18	161	100	176	134
10	97	711	1390	177	213	23	154	134	358	228
12*	5	1033	2467	119	111	10	34	96	188	230
13	115	1574	1772	220	209	16	110	201	205	150
15	102	617	2384	105	98	12	101	201	55	183
17*	26	715	1095	5	65	13	50	119	162	205
18*	35	303	1493	13	168	49	5	150	301	259
20	315	175	559	983	491	194	105	144	301	120
22*	21	1566	75	42	202	24	11	99	271	338
32^{+}	851	586	404	543	257	125	78	338	137	82
33*	71	1021	463	27	48	12	318	294	62	200
34*	99	0	95	2	87	37	15	330	142	245
62*	75	593	2854	9	4	0	202	226	27	119
63	361	921	1943	132	31	0	498	269	96	173
64*	364	44	1134	153	319	0	430	532	45	60
65*	411	553	2140	76	38	0	5	344	166	236
66	767	556	2462	24	42	0	37	282	31	90
67	218	1091	1725	552	25	0	217	53	29	233
68*	380	325	1540	162	67	0	399	665	31	73
69	570	71	2207	30	28	0	50	217	12	71
70*	424	160	2125	238	82	0	33	222	40	150
71	1238	702	377	182	138	0	95	152	43	81
72	711	755	797	395	118	0	119	168	29	73
73	861	171	1802	127	107	0	67	153	44	51
74	1562	8	1984	49	56	0	34	544	24	71
75	218	1619	0	1287	250	0	45	3	172	181
76	748	296	1621	255	120	0	66	156	139	231
77	1253	17	2731	16	95	0	23	294	4	313
78	1609	3	2162	18	65	0	110	302	5	384
79	1759	0	1114	54	123	0	28	768	1	61
80	907	182	741	360	84	0	143	493	8	97

Station	SF	PC	GR	PH	ATF	GT	RF	ST	SK	OS
81	768	4	2263	42	160	0	17	182	4	111
82	1088	38	1716	213	56	0	121	233	3	68
83	918	0	2078	21	33	0	2	333	4	344
84	891	319	898	431	181	0	46	484	18	357
85	902	125	1075	93	249	0	66	520	10	65
86	1497	71	398	287	73	0	134	465	10	150
87	1139	464	0	508	144	0	9	88	95	112
88	1390	147	1739	56	61	0	371	329	9	213
89	740	128	650	43	39	0	87	267	11	277
90	687	54	648	164	20	0	178	145	41	186
91	1170	119	762	219	67	0	349	190	34	145
92	1267	38	404	186	35	0	42	208	21	71
93	1907	19	247	104	14	0	53	539	8	85
94	982	68	146	214	92	0	224	357	58	58
95	1515	61	248	123	18	0	259	518	44	93
96	1122	0	383	39	47	0	573	260	29	114
97	1004	8	95	60	47	0	760	315	16	82
98	998	0	532	14	7	0	261	98	4	52
99	213	4	338	125	19	0	103	78	9	126
100	1141	4	350	26	17	0	63	187	7	83
101	1279	17	637	25	36	0	154	324	6	82
102	1056	10	457	24	26	0	106	248	4	96
103	114	228	0	697	93	0	0	16	81	735
104	998	1	271	5	13	0	414	326	22	65
105	1313	10	178	41	17	0	314	301	23	182
106	1350	3	179	1	10	0	437	383	13	64
107	990	25	146	17	14	0	508	245	24	121
108	1222	12	339	4	5	0	339	151	11	203
120	308	1269	0	340	129	0	1	6	167	70
121	577	467	0	655	223	0	4	24	129	122
122	80	1081	0	64	395	0	1	0	156	64
123	43	797	0	48	442	0	0	5	169	58
124	5	146	0	248	99	0	1	1	180	27
125	16	458	0	96	119	0	0	0	136	31
126	82	414	0	136	63	0	0	0	67	18
127	13	625	0	49	90	0	0	0	144	16
128	699	230	0	398	229	0	5	55	9	35
129	870	5	0	369	70	0	42	93	24	47
130	283	9	0	51	38	0	0	78	15	6
131	801	78	0	150	155	0	36	183	28	55

Station	SF	PC	GR	PH	ATF	GT	RF	ST	SK	OS
132	296	203	0	92	50	0	0	35	71	66
133	416	24	0	219	251	0	2	225	124	84
134	101	20	0	17	33	0	8	61	116	1251
135	395	105	0	106	39	0	11	17	86	893
136	510	115	0	631	34	0	8	113	78	109
137	212	15	0	50	7	0	43	190	14	42
138	597	82	0	84	57	0	138	34	44	30
139	1325	0	0	84	70	0	42	56	59	7
142	913	0	41	53	9	0	18	182	4	9
143	1015	3	6	106	47	0	31	86	27	41
144	124	105	0	107	141	0	164	303	61	73
145	907	0	0	30	26	0	61	83	19	121
148	610	120	0	100	40	0	2	159	119	280
149	844	1	0	68	2	0	22	114	118	97
Total	58,064	27,232	68,396	14,958	8,745	682	10,573	18,095	6,979	15,131

* Station catch was entirely or partially impacted by killer whale depredation.
\+ Station catch was partially impacted by gear loss or fishing vessel interactions.

Table 6. Total estimated catch in weight (kg) of major species (>100 kg) caught by management area in the 2015 NMFS longline survey. Weight is derived from length-weight relationship when lengths available. For all other species, an average weight was used to estimate total weight from catch in numbers. These estimates are for all fish landed including fish tagged and released.

Species/Complex	Bering Sea	Western GOA	Central GOA	West Yakutat	East Yakutat Southeast	Total
Giant grenadier	82,320	58,313	72,154	10,938	11,963	235,688
Sablefish	5,471	10,443	64,515	39,781	54,522	174,732
Pacific halibut	15,968	9,194	42,782	11,454	8,869	88,267
Pacific cod	32,395	11,981	24,896	1,629	1,318	72,220
Arrowtooth flounder	4,886	1,191	7,186	894	944	15,099
Shortspine thornyhead	2,836	1,868	4,075	1,833	2,632	13,245
Longnose skate	0	1,625	4,324	2,311	2,915	11,175
Rougheye rockfish	673	2,150	1,351	1,313	4,186	9,673
Shortraker rockfish	1,499	631	825	2,080	2,363	7,398
Walleye pollock	3,420	554	1,083	87	17	5,161
Spiny dogfish	0	27	4,018	219	572	4,837
whiteblotched skate	3,760	0	0	0	0	3,760
Greenland turbot	2,482	0	0	0	0	2,482
Redbanded rockfish	0	9	584	220	1,122	1,935
Yelloweye rockfish	0	361	63	159	1,269	1,852
commander skate	1,740	25	13	6	57	1,842
Pacific grenadier	56	5	963	420	243	1,686
Spotted ratfish	0	0	0	0	746	746
big skate	0	10	439	150	30	628
Dover sole	0	27	289	54	110	479
Octopus	19	353	76	0	0	448
Skates unidentified	183	15	56	5	46	304
Lingcod	0	0	33	181	82	296
Flathead sole	180	26	23	3	1	232
Pacific sleeper shark	116	0	58	0	58	231
Sea anemone unident.	20	24	62	34	66	206
Coho salmon	0	0	79	61	27	167
Pacific Ocean Perch	128	3	17	3	9	161
Blue shark	0	0	26	53	53	132
Dusky rockfish	8	53	4	46	5	116
mud skate	102	7	0	0	0	108

Table 7. Mean length, round weight, mean dressed weight, number, and estimated total round weight of sablefish by station for the 2015 NMFS longline survey.

Station	Mean Length	Mean Round Weight(kg)[1]	Mean Dressed Weight(lbs)[2]	Number of Sablefish	Est. Total Round Weight(kg)[3]
1	67.83	3.35	4.65	70	235
2*	59.83	3.82	5.31	10	38
4*	47.47	2.61	3.63	12	31
6*	56.28	2.51	3.48	9	23
8*	69.04	3.56	4.94	87	310
10	69.5	3.65	5.07	97	354
12*	64.6	2.84	3.95	5	14
13	68.45	3.46	4.81	115	398
15	69.08	3.65	5.07	102	372
17*	66.25	3.11	4.32	26	81
18*	67.22	3.26	4.53	35	114
20	65.31	2.99	4.16	315	943
22*	61.01	2.7	3.75	21	57
32[+]	61.33	2.45	3.4	851	2081
33*	59.01	2.22	3.08	71	158
34*	62.57	2.66	3.69	99	263
62*	61.49	2.58	3.58	75	194
63	64.64	2.99	4.15	361	1078
64*	53.39	1.55	2.15	364	564
65*	59.85	2.25	3.12	411	923
66	58.11	2.04	2.83	767	1563
67	64.1	2.88	4	218	627
68*	63.72	2.77	3.85	380	1053
69	53.81	1.61	2.23	570	916
70*	56.47	1.87	2.59	424	792
71	59.36	2.21	3.07	1238	2734
72	56.67	1.91	2.65	711	1355
73	58.14	2.06	2.86	861	1771
74	63.29	2.7	3.76	1562	4225
75	53.83	1.63	2.26	218	355
76	59.88	2.27	3.15	748	1698
77	63.43	2.78	3.87	1253	3489
78	65.48	3.06	4.25	1609	4919
79	68.02	3.48	4.83	1759	6122
80	67.65	3.4	4.73	907	3087
81	60.77	2.39	3.33	768	1839

Station	Mean Length	Mean Round Weight(kg)[1]	Mean Dressed Weight(lbs)[2]	Number of Sablefish	Est. Total Round Weight(kg)[3]
82	64.08	2.89	4.01	1088	3141
83	66.65	3.34	4.64	918	3065
84	63.57	2.83	3.93	891	2522
85	64.2	2.89	4.01	902	2604
86	67.54	3.45	4.8	1497	5169
87	62.71	2.64	3.67	1139	3006
88	68.16	3.5	4.86	1390	4868
89	66.46	3.24	4.51	740	2401
90	67.34	3.42	4.75	687	2350
91	68.88	3.68	5.11	1170	4304
92	67.76	3.55	4.94	1267	4502
93	68.7	3.68	5.11	1907	7021
94	66.28	3.29	4.57	982	3232
95	71.01	4.1	5.7	1515	6215
96	68.67	3.68	5.11	1122	4125
97	68.72	3.69	5.13	1004	3709
98	72.32	4.44	6.17	998	4434
99	69.12	3.75	5.2	213	798
100	65.03	3.08	4.28	1141	3519
101	67.73	3.51	4.87	1279	4486
102	70.84	4.11	5.71	1056	4343
103	58.58	2.27	3.16	114	259
104	63.65	2.84	3.95	998	2836
105	67.84	3.52	4.89	1313	4626
106	65.34	3.1	4.3	1350	4184
107	67.94	3.58	4.98	990	3547
108	70.84	4.09	5.68	1222	4999
120	56.1	1.85	2.57	308	571
121	56.22	1.85	2.57	577	1067
122	55.73	1.81	2.51	80	145
123	56.3	1.86	2.58	43	80
124	30.6	0.4	0.56	5	2
125	55.56	1.75	2.44	16	28
126	53.85	1.56	2.17	82	128
127	52.17	1.46	2.03	13	19
128	61.02	2.42	3.37	699	1695
129	62.81	2.6	3.61	870	2264
130	59.39	2.23	3.09	283	630

Station	Mean Length	Mean Round Weight(kg)[1]	Mean Dressed Weight(lbs)[2]	Number of Sablefish	Est. Total Round Weight(kg)[3]
131	64.42	2.87	3.98	801	2297
132	59.47	2.23	3.1	296	660
133	58.7	2.13	2.96	416	886
134	51.68	1.41	1.96	101	142
135	54.4	1.69	2.34	395	666
136	58.37	2.17	3.02	510	1109
137	63.71	2.76	3.84	212	586
138	53.24	1.59	2.2	597	948
139	59.67	2.26	3.13	1325	2989
142	64.55	2.92	4.06	913	2670
143	62.4	2.59	3.6	1015	2632
144	66.54	3.48	4.84	124	432
145	65.3	3.06	4.26	907	2779
148	63.79	2.79	3.88	610	1704
149	65.5	3.04	4.22	844	2567

* Station catch was entirely or partially impacted by killer whale depredation.
+ Station catch was partially impacted by gear loss or fishing vessel interactions.

[1] Mean weight was estimated by applying a length-weight relationship to the length frequency distribution from each station.

[2] Mean dressed weight was estimated using a recovery rate of 0.6 of round weight in pounds.

[3] 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 tagged and released.

Table 8. - Stations and skates depredated by killer whales during the 2015 NMFS longline survey. Number of skates affected refers to skates determined to be depredated and were removed from abundance calculations.

Station	Region	Number of Skates Affected	Number of Skates Fished
2	Bering Sea	180	180
4	Bering Sea	141	180
6	Bering Sea	165	180
12	Bering Sea	139	180
17	Bering Sea	149	180
18	Bering Sea	161	182
22	Bering Sea	89	180
33	Bering Sea	180	182
34	Bering Sea	161	180
62	Western Gulf of Alaska	143	160
64	Western Gulf of Alaska	89	160
65	Western Gulf of Alaska	80	160
68	Western Gulf of Alaska	87	160
70	Western Gulf of Alaska	83	160

Table 9. Stations that had sperm whales present during hauling operations in the 2015 NMFS longline survey. Depredation is defined as sperm whales being present with the occurrence of damaged fish on the line.

Station	Region	Depredation
74	Central Gulf of Alaska	No
80	Central Gulf of Alaska	No
81	Central Gulf of Alaska	Yes
84	Central Gulf of Alaska	Yes
85	Central Gulf of Alaska	Yes
88	Central Gulf of Alaska	Yes
89	West Yakutat	Yes
90	West Yakutat	Yes
93	West Yakutat	Yes
94	West Yakutat	Yes
95	West Yakutat	Yes
96	West Yakutat	Yes
98	East Yakutat/Southeast	Yes
99	East Yakutat/Southeast	Yes
100	East Yakutat/Southeast	Yes
101	East Yakutat/Southeast	Yes
102	East Yakutat/Southeast	No
104	East Yakutat/Southeast	Yes
105	East Yakutat/Southeast	Yes
106	East Yakutat/Southeast	Yes
128	Central Gulf of Alaska	Yes
129	Central Gulf of Alaska	Yes
133	Central Gulf of Alaska	No
144	East Yakutat/Southeast	No
145	East Yakutat/Southeast	No

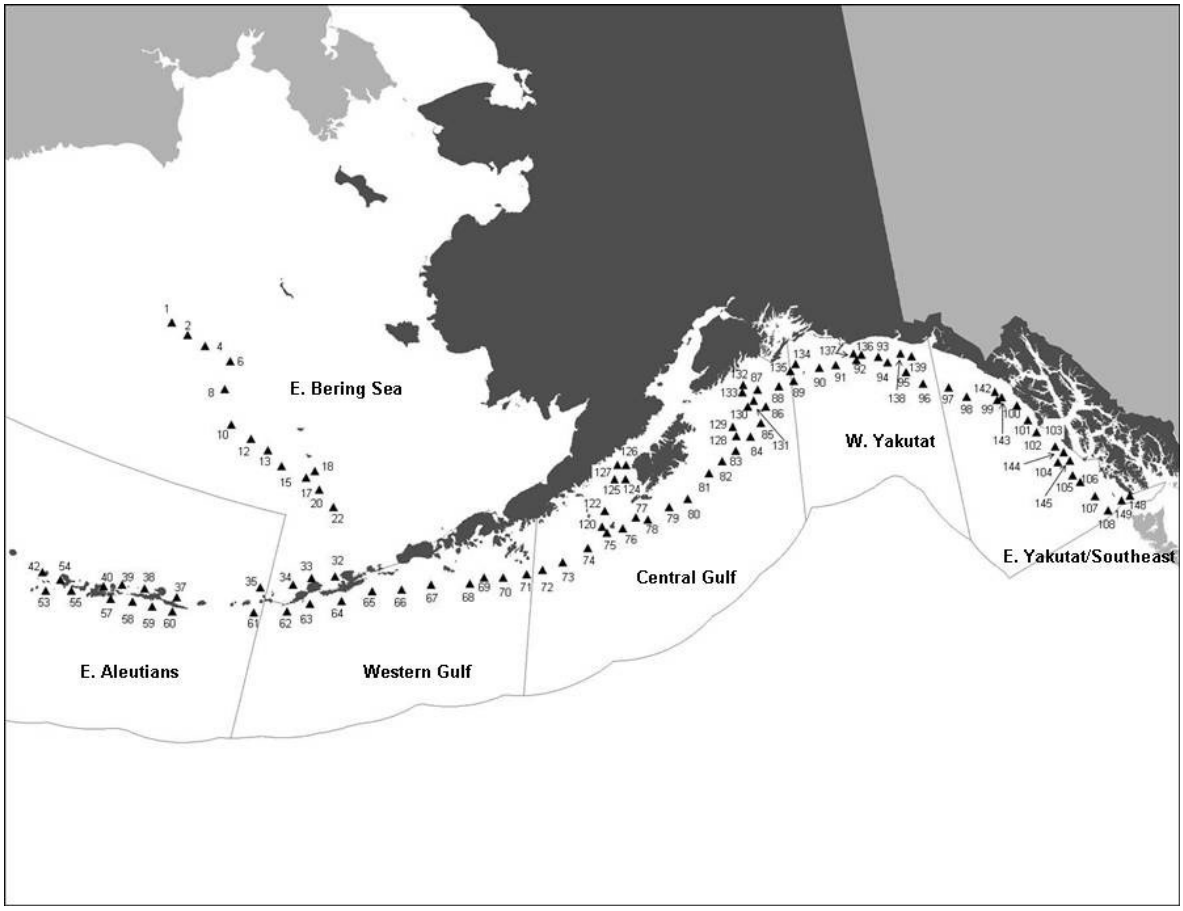

Figure 1. Map of NMFS longline survey station locations and corresponding management areas. Bering Sea stations are sampled in odd years; Aleutian Islands stations are sampled in even years; Gulf of Alaska stations are sampled every year.

APPENDIX A: Electronic Data Collection and Hook Tension Device Experiment

A hook type experiment was conducted near Yakutat from July 21-22 to test the catching efficiency of E-Z-baiter (auto-baiter) circle hooks versus hand-bait circle hooks. Mustad brand E-Z-Baiter circle hooks (Mustad #39961) were fished as well as the standard survey Mustad circle hook (Mustad #39965). The autobait hook is larger (size (14/0) while the standard survey hook is (13/0)) and the autobait hook has a longer shank and does not have an offset tip. The experiment to test hook types was designed as part of a broader question to answer why earlier studies found differences in catch rates between standard survey hand-bait gear and auto-bait gear.

During the two-day experiment, two sets were made each day for a total of four sets (Table A1). Each set consisted of 80 skates. The two hook types were interspersed during a set in groupings of 10 skates each (e.g., skates 1-10 auto-bait hook; skates 11-20 hand-bait hook...). This resulted in a total of 40 skates with auto-bait hooks and 40 skates with hand-bait hooks per set. On all sets combined, 3,549 sablefish were caught in 2015. Results from 2014 and 2015 will be tabulated and used to determine CPUE for each hook type.

During the two-day experiment four sets were completed (Table A1).

Table A1. Set information by station and haul for the 2015 NMFS longline survey 2-day experiment. Positions in decimal degree (DD) format.

Haul	Date	Start Lat	Start Lon	End Lat	End Lon	Start Depth (m)	End Depth (m)
1	21-Jul	58.91	-141.05	58.96	-141.12	294	760
2	21-Jul	58.98	-141.13	58.98	-141.19	548	673
3	22-Jul	59.26	-141.92	59.26	-142.02	232	491
4	22-Jul	59.36	-142.04	59.13	-142.11	527	737