

F/V *Alaskan Leader*
Cruise Report AL-14-01
Longline Survey of the Gulf of Alaska and Eastern Aleutian Islands
May 25-August 28, 2014

Prepared by

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On August 28, 2014, the Alaska Fisheries Science Center (AFSC) completed the thirty-sixth annual longline survey of Alaska sablefish (*Anoplopoma fimbria*) and other groundfish resources of the upper continental slope (Figure 1). This survey was designed to continue the time series (1979-94) 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, the eastern Aleutian Islands biennially since 1996, and the eastern Bering Sea biennially since 1997. The Gulf of Alaska and eastern Aleutian Islands were sampled in 2014.

OBJECTIVES

1. Determine the relative abundance and size composition of the most commercially important groundfish 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 (Rajidae), and spiny dogfish (*Squalus acanthias*).
3. Tag and release sablefish, shortspine thornyhead, and Greenland turbot throughout the cruise to determine migration patterns.
4. Externally tag sablefish with pop-up satellite tags that record water temperature, pressure, and location.
5. Collect sablefish otoliths to study the age composition of the population.

VESSEL AND GEAR

Survey operations were conducted using the F/V *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, three sets of plate freezers, and refrigerated holds. Vessel personnel consisted of a captain, a mate, 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 Mustad¹ circle hooks. Hooks were attached to 38 cm (15 in) gangions that were secured to becketts 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) where 160 skates were set. 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 28 in Dutch Harbor, Alaska, and ended on August 28 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 Aleutian Islands 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.

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

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.

From 1988 to 1990 the survey period was from June 26 to September 12. 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 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 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 schedule and desire to finish the survey as early as possible.

Survey Operations

A total of 14 stations along the upper continental slope of the eastern Aleutian Islands 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 150 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 in Table 2. Not all stations are used in abundance index calculations reported for sablefish, notably gully stations on the continental shelf. However, these 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 a hand-held electronic data logger. 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 (*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. 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 forty eight longline hauls were completed in 2014 (Table 3). Sablefish was the most frequently caught species, followed by giant grenadier, 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 2,735 sablefish, 738 shortspine thornyhead, and five Greenland turbot were tagged with external floy tags and released during the survey. Pop-off satellite tags were externally attached to 43 sablefish. Length-weight data and otoliths were collected from 1,780 sablefish.

Killer whales depredating on the catch occurred at three stations in the eastern Aleutian Islands, and four 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 21 stations in 2014. Sperm whales were observed depredating on the gear at one station in the Aleutian Islands, four stations in the central Gulf of Alaska, six stations in the West Yakutat region, and four 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 sablefish. 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 seven days before and three days after the planned sampling date (three days allow for survey delays). In 2014 there were two recorded interactions between survey operations and fishing vessels. Interactions occurred at station numbers 42 and 68 by two separate longline vessels. The vessels were contacted by the survey vessel and were encouraged to avoid survey stations.

Gear damage and loss occurs during survey operations and may have impacts on catch. In 2014 gear issues occurred at four stations (Table 3). Eighty skates, running line, and buoy line were lost on the second set of station 61 due to strong currents sinking the buoy and flags; the last ten skates (71-80) were lost on the first set of station 61; the line parted on the first set of station 69 (skate 53) and two skates were lost; the line parted on the first set of station 74 (skate 3) and 20 skates were lost; two skates (11-12) were lost on the first set of station 103. Additionally, no scientific data except for the catch tally was collected on the last eighteen skates (62-80) of the second set at station 66 because the survey vessel abandoned hauling operations to assist a vessel in distress and the final eighteen skates weren't hauled until hours later.

For further information contact:

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17109 Pt. Lena Loop Road, Juneau, AK 99801 Telephone (907) 789-6001

Table 1. Leg numbers, dates, and personnel for the 2014 NMFS longline survey.

Leg	Dates	Personnel	Affiliation
1	May 25 - June 14	Dana Hanselman	ABL
		Kari Fenske	UAF
		Jason Wright	Contract Biologist
		Aidan Hutchins	Contract Biologist
2	June 14 - July 3	Dave Csepp	ABL
		Jason Wright	Contract Biologist
		Aidan Hutchins	Contract Biologist
3	July 5 - July 19	Pete Hulson	ABL
		Jane Sullivan	UAF
		Jason Wright	Contract Biologist
		Aidan Hutchins	Contract Biologist
4*	July 20 - July 22	Pat Malecha	ABL
		Nate Raring	RACE
		Jason Wright	Contract Biologist
		Aidan Hutchins	Contract Biologist
5	July 23 - Aug 2	Chris Lunsford	ABL
		Nate Raring	RACE
		Jason Wright	Contract Biologist
		Aidan Hutchins	Contract Biologist
6	Aug 4 - Aug 15	Cindy Tribuzio	ABL
		Kalei Shotwell	ABL
		Jason Wright	Contract Biologist
		Aidan Hutchins	Contract Biologist
7	Aug 16- Aug 28	Pete Hulson	ABL
		Brad Robbins	ADFG
		Jason Wright	Contract Biologist
		Aidan Hutchins	Contract Biologist

ABL - Auke Bay Laboratories Division, Alaska Fisheries Science Center

RACE - Resource and Conservation Engineering Division, Alaska Fisheries Science Center

UAF - University of Alaska Fairbanks

ADFG - Alaska Department of Fish and Game

* 2-day experiment

Table 2. Stations fished in 2014 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
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
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

Station Number	Sablefish Management Area	Station Type	Abundance Calculations
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
143	East Yakutat/Southeast	Deep Gully	Yes
144	East Yakutat/Southeast	Deep Gully	Yes

Station Number	Sablefish Management Area	Station Type	Abundance Calculations
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 station and haul for the 2014 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	1-Jun	82	53.03	-170.11	53.06	-170.22	174	191
35	2	1-Jun	80	53.06	-170.20	53.09	-170.30	181	634
37	3	2-Jun	80	52.28	-173.49	52.34	-173.49	154	600
37	4	2-Jun	80	52.35	-173.50	52.41	-173.51	626	762
38	5	3-Jun	80	52.25	-174.86	52.30	-174.80	191	596
38	6	3-Jun	80	52.31	-174.78	52.34	-174.70	335	810
39	7	4-Jun	80	52.15	-175.68	52.17	-175.76	109	386
39	8	4-Jun	80	52.15	-175.68	52.17	-175.76	517	627
40	9	5-Jun	80	51.97	-176.45	52.03	-176.44	108	621
40	10	5-Jun	80	52.04	-176.41	52.06	-176.33	645	782
54	11	6-Jun	80	51.76	-178.16	51.75	-178.25	90	435
54	12	6-Jun	80	51.74	-178.28	51.73	-178.38	398	572
42	13	7-Jun	82	51.78	-178.96	51.72	-178.90	174	485
42	14	7-Jun	80	51.72	-178.89	51.66	-178.83	480	711
53	15	8-Jun	80	51.41	-178.63	51.35	-178.57	206	546
53	16	8-Jun	80	51.35	-178.56	51.37	-178.47	419	546
55	17	9-Jun	80	51.59	-177.61	51.55	-177.69	237	289
55	18	9-Jun	80	51.55	-177.71	51.53	-177.80	347	810
57	19	10-Jun	80	51.73	-176.00	51.66	-176.01	180	361
57	20	10-Jun	80	51.65	-176.02	51.59	-176.06	403	748
58	21	11-Jun	82	51.85	-175.13	51.78	-175.13	173	353
58	22	11-Jun	80	51.78	-175.10	51.71	-175.10	369	700
59	23	12-Jun	80	51.88	-174.33	51.83	-174.40	127	517
59	24	12-Jun	80	51.82	-174.41	51.78	-174.48	489	1061
60	25	13-Jun	80	51.92	-173.50	51.88	-173.61	119	275
60	26	13-Jun	80	51.88	-173.61	51.87	-173.73	221	631
² 61	27	14-Jun	70	52.44	-170.32	52.40	-170.40	247	528
^{1,2} 61	28	14-Jun	0	n/a	n/a	n/a	n/a	n/a	n/a
<u>Gulf of Alaska</u>									
65	29	16-Jun	80	53.58	-165.73	53.51	-165.73	123	286
65	30	16-Jun	80	53.51	-165.73	53.45	-165.79	302	457
62	31	17-Jun	80	52.66	-169.00	52.62	-169.09	134	640
62	32	17-Jun	80	52.61	-169.12	52.56	-169.20	361	727
63	33	18-Jun	80	52.97	-168.14	52.91	-168.20	109	415
63	34	18-Jun	80	52.91	-168.22	52.84	-168.24	381	736
64	35	19-Jun	80	53.19	-166.86	53.12	-166.89	218	315
64	36	19-Jun	78	53.11	-166.90	53.05	-166.95	330	890

Station	Haul	Date	# Skates Retrieved	Start Latitude	Start Longitude	End Latitude	End Longitude	Start Depth (m)	End Depth (m)
66	37	6/20/2014	80	53.74	-164.47	53.68	-164.55	135	294
66	38	6/20/2014	80	53.68	-164.52	53.63	-164.65	305	615
67	39	6/21/2014	80	53.97	-163.26	53.90	-163.33	114	480
67	40	6/21/2014	80	53.90	-163.34	53.86	-163.45	467	744
68	41	6/22/2014	80	54.11	-161.97	54.10	-161.88	135	315
68	42	6/22/2014	80	54.09	-161.75	54.06	-161.86	300	890
² 69	43	6/23/2014	78	54.32	-161.06	54.26	-161.14	175	385
69	44	6/23/2014	80	54.27	-161.15	54.21	-161.23	372	850
70	45	6/24/2014	80	54.36	-160.24	54.29	-160.29	141	343
70	46	6/24/2014	80	54.30	-160.30	54.22	-160.31	305	667
71	47	6/25/2014	80	54.51	-159.25	54.44	-159.31	139	283
71	48	6/25/2014	80	54.44	-159.32	54.38	-159.39	267	802
72	49	6/26/2014	80	54.63	-158.58	54.56	-158.64	132	436
72	50	6/26/2014	80	54.57	-158.65	54.50	-158.71	344	830
73	51	6/27/2014	80	54.85	-157.74	54.79	-157.82	187	390
73	52	6/27/2014	80	54.80	-157.82	54.72	-157.86	338	630
² 74	53	6/28/2014	60	55.24	-156.68	55.17	-156.74	176	333
74	54	6/28/2014	80	55.17	-156.75	55.09	-156.75	304	820
75	55	6/29/2014	80	55.64	-155.85	55.57	-155.86	140	214
75	56	6/29/2014	80	55.73	-155.86	55.49	-155.80	214	231
148	57	7/5/2014	80	54.65	-132.84	54.61	-132.93	146	380
149	58	7/5/2014	80	54.60	-133.01	54.60	-133.15	393	416
108	59	7/6/2014	80	54.47	-133.92	54.50	-134.02	250	650
108	60	7/6/2014	80	54.50	-134.01	54.56	-134.07	359	801
107	61	7/7/2014	80	54.90	-134.29	54.96	-134.36	222	550
107	62	7/7/2014	80	54.95	-134.36	55.01	-134.45	420	833
106	63	7/8/2014	80	55.35	-134.74	55.39	-134.83	372	577
106	64	7/8/2014	80	55.40	-134.83	55.39	-134.95	465	806
105	65	7/9/2014	80	55.56	-134.97	55.57	-135.05	215	605
105	66	7/9/2014	80	55.58	-135.04	55.62	-135.13	518	900
144	67	7/10/2014	80	55.93	-134.90	56.01	-134.91	211	363
145	68	7/10/2014	80	56.03	-134.93	56.09	-135.02	353	380
104	69	7/11/2014	80	55.98	-135.44	56.03	-135.54	332	607
104	70	7/11/2014	80	56.03	-135.54	56.09	-135.63	641	900
² 103	71	7/12/2014	78	56.39	-135.35	56.38	-135.49	153	188
103	72	7/12/2014	80	56.38	-135.50	56.37	-135.62	189	251
102	73	7/13/2014	80	56.85	-136.00	56.90	-136.10	217	683
102	74	7/13/2014	80	56.90	-136.10	56.98	-136.12	730	910
101	75	7/14/2014	80	57.19	-136.24	57.22	-136.34	224	763
101	76	7/14/2014	80	57.22	-136.33	57.29	-136.39	548	1045

Station	Haul	Date	# Skates Retrieved	Start Latitude	Start Longitude	End Latitude	End Longitude	Start Depth (m)	End Depth (m)
100	77	7/15/2014	80	57.62	-136.54	57.62	-136.65	213	800
100	78	7/15/2014	80	57.62	-136.64	57.66	-136.75	632	952
142	79	7/16/2014	80	57.92	-137.01	57.92	-137.15	393	445
143	80	7/16/2014	80	57.97	-137.06	57.97	-137.22	219	421
99	81	7/17/2014	80	57.88	-137.38	57.88	-137.51	214	630
99	82	7/17/2014	80	57.88	-137.51	57.89	-137.64	614	860
98	83	7/18/2014	80	58.14	-138.73	58.16	-138.86	225	854
98	84	7/18/2014	80	58.15	-138.87	58.18	-138.98	450	936
97	85	7/19/2014	80	58.47	-139.47	58.46	-139.60	195	550
97	86	7/19/2014	80	58.46	-139.61	58.42	-139.70	472	912
138	87	7/24/2014	80	59.42	-140.95	59.43	-141.10	205	300
139	88	7/24/2014	80	59.41	-141.17	59.36	-141.25	319	325
96	89	7/25/2014	80	58.68	-140.64	58.69	-140.79	249	620
96	90	7/25/2014	80	58.69	-140.78	58.73	-140.90	455	750
95	91	7/26/2014	80	59.05	-141.34	59.05	-141.49	306	543
95	92	7/26/2014	80	59.05	-141.49	59.05	-141.64	527	880
94	93	7/27/2014	80	59.39	-142.16	59.43	-142.29	231	422
94	94	7/27/2014	80	59.46	-142.30	59.49	-142.40	413	850
93	95	7/28/2014	80	59.55	-142.57	59.59	-142.69	130	600
93	96	7/28/2014	80	59.59	-142.68	59.58	-142.80	565	637
136	97	7/29/2014	80	59.76	-143.70	59.75	-143.56	162	305
137	98	7/29/2014	80	59.72	-143.51	59.68	-143.41	299	312
92	99	7/30/2014	80	59.56	-143.67	59.56	-143.82	203	616
92	100	7/30/2014	80	59.57	-143.82	59.59	-143.95	489	823
91	101	7/31/2014	80	59.52	-144.72	59.48	-144.85	183	498
91	102	7/31/2014	80	59.48	-144.85	59.45	-144.99	475	829
90	103	8/1/2014	80	59.50	-145.53	59.52	-145.67	160	808
90	104	8/1/2014	80	59.52	-145.68	59.52	-145.81	523	823
89	105	8/2/2014	80	59.27	-146.86	59.22	-146.97	194	601
89	106	8/2/2014	80	59.22	-146.98	59.17	-147.08	651	807
134	107	8/5/2014	80	59.61	-146.99	59.55	-147.05	211	214
135	108	8/5/2014	80	59.53	-147.15	59.46	-147.15	213	216
88	109	8/6/2014	80	59.16	-147.62	59.08	-147.61	227	513
88	110	8/6/2014	80	59.08	-147.63	59.01	-147.63	488	890
87	111	8/7/2014	80	59.12	-148.65	59.05	-148.65	156	200
87	112	8/7/2014	80	59.05	-148.65	58.98	-148.65	210	240
132	113	8/8/2014	80	59.08	-149.41	59.03	-149.53	181	226
133	114	8/8/2014	80	58.95	-149.51	58.92	-149.65	235	240
130	115	8/9/2014	80	58.73	-149.19	58.77	-149.08	178	215
131	116	8/9/2014	80	58.80	-149.04	58.84	-148.94	231	252

Station	Haul	Date	# Skates Retrieved	Start Latitude	Start Longitude	End Latitude	End Longitude	Start Depth (m)	End Depth (m)
86	117	8/10/2014	80	58.69	-148.33	58.61	-148.33	275	479
86	118	8/10/2014	80	58.61	-148.34	58.53	-148.34	447	875
85	119	8/11/2014	80	58.29	-148.62	58.22	-148.66	138	533
85	120	8/11/2014	80	58.22	-148.67	58.14	-148.71	520	830
84	121	8/12/2014	80	57.97	-149.17	57.92	-149.25	165	476
84	122	8/12/2014	80	57.92	-149.26	57.86	-149.34	469	885
128	123	8/13/2014	80	58.00	-149.84	57.99	-149.95	220	270
129	124	8/13/2014	80	58.08	-149.90	58.07	-150.01	293	305
83	125	8/14/2014	80	57.63	-149.92	57.57	-149.94	397	554
83	126	8/14/2014	80	57.57	-149.95	57.50	-149.98	545	777
82	127	8/15/2014	80	57.40	-150.58	57.33	-150.59	208	495
82	128	8/15/2014	80	57.33	-150.60	57.26	-150.60	504	717
81	129	8/17/2014	80	57.12	-151.23	57.05	-151.27	258	528
81	130	8/17/2014	80	57.05	-151.28	56.98	-151.28	555	811
80	131	8/18/2014	80	56.48	-152.20	56.42	-152.30	160	539
80	132	8/18/2014	80	56.42	-152.29	56.35	-152.36	343	819
79	133	8/19/2014	80	56.31	-153.08	56.26	-153.19	222	496
79	134	8/19/2014	80	56.27	-153.20	56.21	-153.29	523	680
78	135	8/20/2014	80	55.98	-154.02	55.91	-154.02	265	554
78	136	8/20/2014	78	55.91	-154.03	55.84	-154.06	567	936
77	137	8/21/2014	80	56.04	-154.57	55.97	-154.57	233	525
77	138	8/21/2014	82	55.97	-154.58	55.91	-154.58	523	881
76	139	8/22/2014	80	55.77	-155.13	55.70	-155.18	157	322
76	140	8/22/2014	80	55.69	-155.19	55.63	-155.27	349	598
120	141	8/23/2014	80	55.79	-156.08	55.76	-156.21	204	238
121	142	8/23/2014	80	55.75	-156.20	55.73	-156.33	239	250
122	143	8/24/2014	80	56.19	-155.96	56.18	-156.08	194	237
123	144	8/24/2014	80	56.23	-156.13	56.25	-156.24	244	262
124	145	8/25/2014	80	56.99	-155.07	57.00	-155.20	179	234
125	146	8/25/2014	80	57.00	-155.31	57.04	-155.39	251	260
126	147	8/26/2014	80	57.35	-155.04	57.35	-155.18	236	242
127	148	8/26/2014	80	57.35	-155.25	57.33	-155.39	246	257

¹Entire set was lost prior to retrieval because buoy's were swept under the surface and not recovered.

² Station catch partially impacted by gear loss

Table 4. Total estimated catch in numbers of major species (>100 individuals) caught in the 2014 NMFS longline survey by management area.

Species/Complex	Aleutian Islands	Western GOA	Central GOA	West Yakutat	East	Total
					Yakutat Southeast	
Sablefish	3,386	10,136	23,409	9,961	15,917	62,809
Giant grenadier	19,348	13,722	17,219	4,898	3,086	58,273
Pacific cod	5,556	4,059	6,322	211	700	16,848
Shortspine thornyhead	1,584	2,323	5,083	2,848	3,819	15,657
Pacific halibut	2,939	1,679	4,429	868	1,332	11,247
Rougheye rockfish	1,900	1,877	1,074	1,103	3,107	9,060
Arrowtooth flounder	1,445	713	4,142	965	785	8,050
Shorthead rockfish	968	468	702	1,314	1,455	4,908
Aleut/Bering/AK Skate Complex	946	252	2,511	82	142	3,933
Spiny dogfish	1	13	1,762	79	978	2,833
Longnose skate	1	314	495	280	608	1,698
Whiteblotched skate	1,602	9	-	-	-	1,611
Walleye pollock	165	382	891	47	56	1,541
Redbanded rockfish	8	33	167	105	1,012	1,325
Yellow Irish lord	1,240	18	-	-	-	1,258
Sea anemone unident.	52	140	448	89	470	1,199
Pacific grenadier	218	1	465	168	78	930
Brittle star, unident.	152	257	414	15	49	887
Sea pen or sea whip	19	3	551	6	18	597
Basket star unident.	38	6	420	3	10	477
Sponge, unidentified	247	117	65	5	19	453
Yelloweye rockfish	-	142	17	22	253	434
Darkfin sculpin	422	4	-	-	-	426
Dover sole	1	15	235	49	125	425
Mud skate	336	1	-	-	-	337
Lips or Jaws - Whale Predation	147	74	43	35	27	326
Commander skate	309	9	1	-	4	323
Gorgonian coral unident.	269	13	7	7	18	314
Invertebrate unident.	138	43	52	16	32	281
Hydrocoral unident.	223	6	9	2	5	245
Greenland turbot	237	-	-	-	-	237
Dusky rockfish	1	179	3	-	13	196
Spotted ratfish	-	-	-	-	192	192
Skates unidentified	161	13	8	2	2	186
Hydroid	79	33	19	4	6	141
Canary rockfish	-	-	-	-	134	134
Crinoid, unidentified	5	3	109	2	14	133
Flathead sole	31	25	62	1	-	119

Table 5. Catch in number by station for major species in the 2014 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 thornyhead, SK = skate, OS = Other Species.

Station	SF	PC	GR	PH	ATF	GT	RF	ST	SK	OS
Aleutian Islands										
35 ¹	10	1,265	544	418	117	2	55	-	1,146	360
37	763	190	2,064	137	248	117	18	30	321	155
38	256	639	1,907	150	160	41	128	255	78	71
39	327	563	2,829	636	132	14	49	49	33	310
40	321	106	2,049	194	105	40	35	200	100	103
42	113	232	2,000	105	77	2	137	29	435	241
53 ¹	386	4	1,316	30	48	-	95	228	73	188
54	158	869	427	144	373	17	251	74	156	621
55	142	258	1,717	148	47	1	57	228	134	358
57	157	145	1,404	121	24	-	71	69	284	153
58	192	163	1,166	195	35	-	150	231	261	37
59	105	304	1,287	333	39	1	303	68	162	666
60 ¹	300	810	470	279	33	-	1,506	6	70	449
61 ²	156	8	168	49	7	2	17	117	142	122
Gulf of Alaska										
62 ¹	644	369	2,241	40	29	-	387	300	17	126
63 ¹	289	934	924	222	48	-	569	245	100	200
64 ¹	590	12	343	139	160	-	427	319	44	42
65	900	594	1,842	181	79	-	19	99	158	66
66	1,996	301	1,570	45	30	-	21	133	42	205
67	565	873	1,522	355	69	-	220	101	52	475
68	1,313	9	700	190	39	-	518	589	14	81
69 ^{1,2}	842	174	2,354	109	31	-	69	210	13	108
70	1,637	212	1,093	210	133	-	50	174	86	292
71	1,360	581	1,133	188	95	-	65	153	72	68
72	1,668	163	1,613	53	92	-	113	214	11	68
73	1,576	203	1,509	109	86	-	33	121	36	64
74 ²	1,810	1	637	61	42	-	33	640	23	58
75	473	1,626	-	567	205	-	47	17	171	231
76	977	271	897	216	160	-	35	203	137	529
77	1,170	-	1,825	7	78	-	35	346	8	642
78	1,001	-	1,246	30	40	-	339	354	11	640
79	1,400	-	1,063	35	141	-	92	356	4	41
80	968	8	1,177	194	99	-	215	364	6	73
81	1,168	1	1,943	56	129	-	49	161	7	100
82	1,431	19	643	133	103	-	96	152	4	72
83	847	-	1,840	4	22	-	4	247	-	192
84	909	188	826	156	103	-	35	305	22	111
85	593	107	560	51	272	-	77	351	19	186

Station	SF	PC	GR	PH	ATF	GT	RF	ST	SK	OS
86	874	62	608	270	238	-	223	307	8	141
87	1,616	124	-	223	146	-	1	53	95	103
88	1,304	214	832	110	151	-	308	285	17	106
89	1,459	84	461	135	226	-	65	294	25	34
90	783	59	316	80	44	-	183	335	37	215
91	1,455	56	479	179	160	-	181	252	13	85
92	1,008	-	1,382	3	113	-	64	121	4	14
93	1,656	-	508	69	79	-	93	469	12	44
94	658	6	585	103	152	-	574	349	52	41
95	611	-	572	97	13	-	603	333	59	78
96	1,055	-	595	19	63	-	628	197	25	59
97	578	3	588	37	125	-	163	178	20	109
98	403	-	406	17	31	-	637	50	7	76
99	889	1	215	12	13	-	111	137	20	119
100	1,082	8	291	8	10	-	37	172	7	126
101	1,755	22	586	4	56	-	123	307	6	113
102	790	11	362	15	25	-	132	231	5	136
103 ²	144	203	0	717	25	-	-	9	57	1,329
104	1,373	-	151	16	6	-	320	428	16	84
105	1,274	63	168	72	27	-	89	383	42	260
106	894	2	59	6	25	-	625	394	21	108
107	997	37	76	28	66	-	1,157	217	40	193
108	903	14	70	54	42	-	798	139	10	258
120	287	625	-	111	95	-	1	7	146	106
121	62	35	-	90	64	-	1	18	97	54
122	33	952	-	54	58	-	2	-	171	55
123	35	197	-	46	108	-	-	1	173	59
124	10	372	-	474	252	-	7	2	198	92
125	13	386	-	328	171	-	-	1	219	52
126	7	190	-	241	107	-	-	-	347	44
127	64	226	-	179	68	-	1	-	667	55
128	600	218	-	272	160	-	10	35	19	61
129	564	3	-	147	238	-	7	121	49	31
130	387	14	-	41	70	-	-	27	25	66
131	607	17	-	55	130	-	13	121	27	88
132	288	68	-	46	83	-	-	72	112	331
133	209	27	-	39	399	-	3	127	72	134
134	131	3	-	16	25	-	3	48	80	751
135	327	2	-	15	7	-	16	27	45	625
136	248	3	-	39	16	-	2	95	23	83
137	696	-	-	46	5	-	6	183	8	20
138	15	3	-	55	75	-	66	167	51	48

Station	SF	PC	GR	PH	ATF	GT	RF	ST	SK	OS
139	317	-	-	43	19	-	34	53	58	32
142	969	-	79	32	21	-	29	224	12	19
143	1,383	-	35	85	18	-	21	46	17	34
144	241	25	-	70	155	-	252	370	63	109
145	618	-	-	25	55	-	33	212	47	212
148	658	310	-	77	66	-	14	135	216	452
149	966	1	-	57	19	-	22	187	166	125

¹ Station catch was entirely or partially impacted by killer whale depredation.

² Station catch was partially impacted by gear loss.

Table 6. Total estimated catch in weight (kg) of major species (>100 kg) caught in the 2014 NMFS longline survey by management area. Weight 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	Total
					Yakutat Southeast	
Giant grenadier	73,023	43,885	56,151	15,301	11,170	199,530
Sablefish	9,385	24,356	67,733	35,547	60,047	197,068
Pacific halibut	17,343	9,908	26,136	5,122	7,860	66,369
Pacific cod	18,667	12,209	19,046	544	1,571	52,037
Arrowtooth flounder	4,090	1,137	7,617	1,718	1,387	15,948
Rougeye rockfish	2,055	2,492	1,423	1,558	5,768	13,296
Longnose skate	7	2,341	3,690	2,087	4,533	12,659
Shortspine thornyhead	1,812	1,730	3,317	1,818	2,745	11,422
Whiteblotched skate	8,629	48	-	-	-	8,677
Shorthead rockfish	883	635	1,149	2,532	2,471	7,670
Spiny dogfish	2	42	4,324	246	2,897	7,512
Redbanded rockfish	14	59	296	186	1,797	2,352
Walleye pollock	234	543	1,266	67	80	2,190
Yelloweye rockfish	-	410	49	63	730	1,252
Mud skate	1,138	3	-	-	-	1,141
Yellow Irish lord	1,039	15	-	-	-	1,054
Commander skate	985	29	3	-	13	1,029
Skates unidentified	817	66	41	10	10	944
Pacific grenadier	214	1	429	189	69	902
Greenland turbot	793	-	-	-	-	793
Spotted ratfish	-	-	-	-	699	699
Dover sole	1	22	350	73	186	632
Pacific sleeper shark	-	231	116	58	116	520
Darkfin sculpin	370	4	-	-	-	373
Sea anemone unident.	14	39	124	25	130	332
Octopus	139	120	63	-	-	322
Dusky rockfish	1	241	4	-	18	264
Canary rockfish	-	-	-	-	246	246
Lingcod	-	-	8	74	131	214
Silvergray rockfish	-	2	2	19	128	151
Roughtail skate	82	-	3	6	44	135
Giant wrymouth	-	-	132	-	-	132
Sponge, unidentified	71	34	19	1	5	130
Big skate	-	-	100	10	20	130
Pacific ocean perch	56	28	26	6	6	122

Table 7. Mean length, round weight, mean dressed weight, number, and estimated total round weight of sablefish by station caught during the 2014 NMFS longline survey.

Station	Mean Length	Mean Round Weight(kg) ^a	Mean Dressed Weight(lbs) ^b	Number of Sablefish	Est. Total Round Weight(kg) ^c
<u>Aleutian Islands</u>					
35 ¹	62.78	2.70	3.74	10	27
37	58.91	2.13	2.96	763	1,625
38	62.07	2.57	3.57	256	659
39	61.58	2.49	3.46	327	814
40	65.08	3.04	4.22	321	975
42	64.85	2.99	4.15	113	338
53 ¹	60.81	2.38	3.31	386	919
54	75.33	4.96	6.89	158	784
55	61.55	2.51	3.49	142	357
57	60.82	2.39	3.32	157	375
58	60.43	2.36	3.28	192	454
59	69.39	3.83	5.32	105	402
60 ¹	71.96	4.16	5.78	300	1,248
61 ²	62.67	2.61	3.63	156	408
<u>Gulf of Alaska</u>					
62 ¹	59.24	2.19	3.04	644	1,408
63 ¹	59.35	2.21	3.07	289	638
64 ¹	56.88	1.88	2.61	590	1,107
65	59.74	2.22	3.08	900	1,994
66	58.83	2.10	2.92	1,996	4,191
67	65.40	3.04	4.22	565	1,718
68	67.94	3.43	4.76	1,313	4,499
69 ^{1,2}	59.18	2.16	3.00	842	1,819
70	60.69	2.35	3.26	1,637	3,846
71	60.43	2.31	3.20	1,360	3,137
72	62.31	2.55	3.54	1,668	4,253
73	59.47	2.21	3.07	1,576	3,480
74 ²	63.76	2.81	3.90	1,810	5,083
75	57.89	2.01	2.79	473	951
76	59.12	2.25	3.13	977	2,198
77	65.07	3.04	4.22	1,170	3,556
78	68.54	3.60	5.00	1,001	3,605
79	66.23	3.17	4.41	1,400	4,441
80	67.29	3.33	4.63	968	3,227
81	66.07	3.18	4.42	1,168	3,720
82	65.65	3.11	4.32	1,431	4,447

Station	Mean Length	Mean Round Weight(kg) ^a	Mean Dressed Weight(lbs) ^b	Number of Sablefish	Est. Total Round Weight(kg) ^c
83	69.04	3.68	5.11	847	3,119
84	67.48	3.41	4.74	909	3,104
85	66.41	3.17	4.41	593	1,881
86	66.42	3.18	4.42	874	2,782
87	61.32	2.42	3.36	1,616	3,907
88	68.94	3.64	5.06	1,304	4,752
89	68.24	3.53	4.90	1,459	5,145
90	67.91	3.45	4.79	783	2,702
91	68.57	3.60	5.00	1,455	5,237
92	67.14	3.38	4.70	1,008	3,410
93	69.84	3.84	5.33	1,656	6,352
94	67.33	3.52	4.89	658	2,318
95	71.25	4.07	5.66	611	2,488
96	71.84	4.42	6.15	1,055	4,668
97	74.40	4.82	6.70	578	2,787
98	76.38	5.26	7.31	403	2,120
99	76.02	5.06	7.03	889	4,501
100	72.30	4.32	6.00	1,082	4,677
101	72.08	4.26	5.92	1,755	7,477
102	70.37	3.91	5.43	790	3,088
103 ²	62.36	2.76	3.83	144	397
104	66.53	3.27	4.55	1,373	4,496
105	71.92	4.21	5.85	1,274	5,365
106	68.24	3.56	4.95	894	3,184
107	71.72	4.24	5.88	997	4,223
108	67.54	3.46	4.81	903	3,128
120	60.80	2.35	3.26	287	674
121	61.65	2.47	3.43	62	153
122	62.10	2.59	3.59	33	85
123	59.12	2.29	3.18	35	80
124	69.21	3.56	4.95	10	36
125	64.18	2.80	3.89	13	36
126	66.14	3.12	4.34	7	22
127	62.86	2.63	3.66	64	169
128	62.23	2.58	3.59	600	1,549
129	64.20	2.82	3.92	564	1,593
130	63.43	2.71	3.76	387	1,049
131	64.05	2.80	3.89	607	1,699
132	61.16	2.42	3.36	288	696
133	60.71	2.37	3.29	209	496

Station	Mean Length	Mean Round Weight(kg) ^a	Mean Dressed Weight(lbs) ^b	Number of Sablefish	Est. Total Round Weight(kg) ^c
134	57.94	2.01	2.78	131	263
135	57.30	1.92	2.66	327	627
136	60.33	2.38	3.31	248	591
137	62.41	2.59	3.59	696	1,800
138	68.31	3.59	4.98	15	54
139	61.38	2.47	3.43	317	782
142	66.22	3.21	4.46	969	3,112
143	64.30	2.88	4.00	1,383	3,985
144	71.29	4.13	5.73	241	995
145	69.66	3.89	5.41	618	2,407
148	62.42	2.58	3.59	658	1,700
149	61.68	2.49	3.46	966	2,404

¹ Station catch was entirely or partially impacted by killer whale depredation.

² Station catch was partially impacted by gear loss.

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

^b Mean dressed weight was estimated using a recovery rate of 0.6 of round weight (in pounds).

^c 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 2014 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
35	Aleutian Islands	162	162
53	Aleutian Islands	143	160
60	Aleutian Islands	46	160
62	Western Gulf of Alaska	111	160
63	Western Gulf of Alaska	81	160
64	Western Gulf of Alaska	136	158
69	Western Gulf of Alaska	79	158

Table 9. Stations that had sperm whales present during hauling operations in the 2014 NMFS longline survey. Depredation is defined as sperm whales being present with the occurrence of damaged fish on the line.

Station	Region	Depredation
42	Aleutian Islands	Yes
108	East Yakutat/Southeast	Yes
107	East Yakutat/Southeast	No
106	East Yakutat/Southeast	No
105	East Yakutat/Southeast	No
104	East Yakutat/Southeast	No
102	East Yakutat/Southeast	Yes
101	East Yakutat/Southeast	No
100	East Yakutat/Southeast	Yes
99	East Yakutat/Southeast	Yes
96	West Yakutat	No
95	West Yakutat	Yes
94	West Yakutat	Yes
93	West Yakutat	Yes
92	West Yakutat	Yes
91	West Yakutat	Yes
90	West Yakutat	Yes
86	Central Gulf of Alaska	Yes
85	Central Gulf of Alaska	Yes
84	Central Gulf of Alaska	Yes
83	Central Gulf of Alaska	Yes

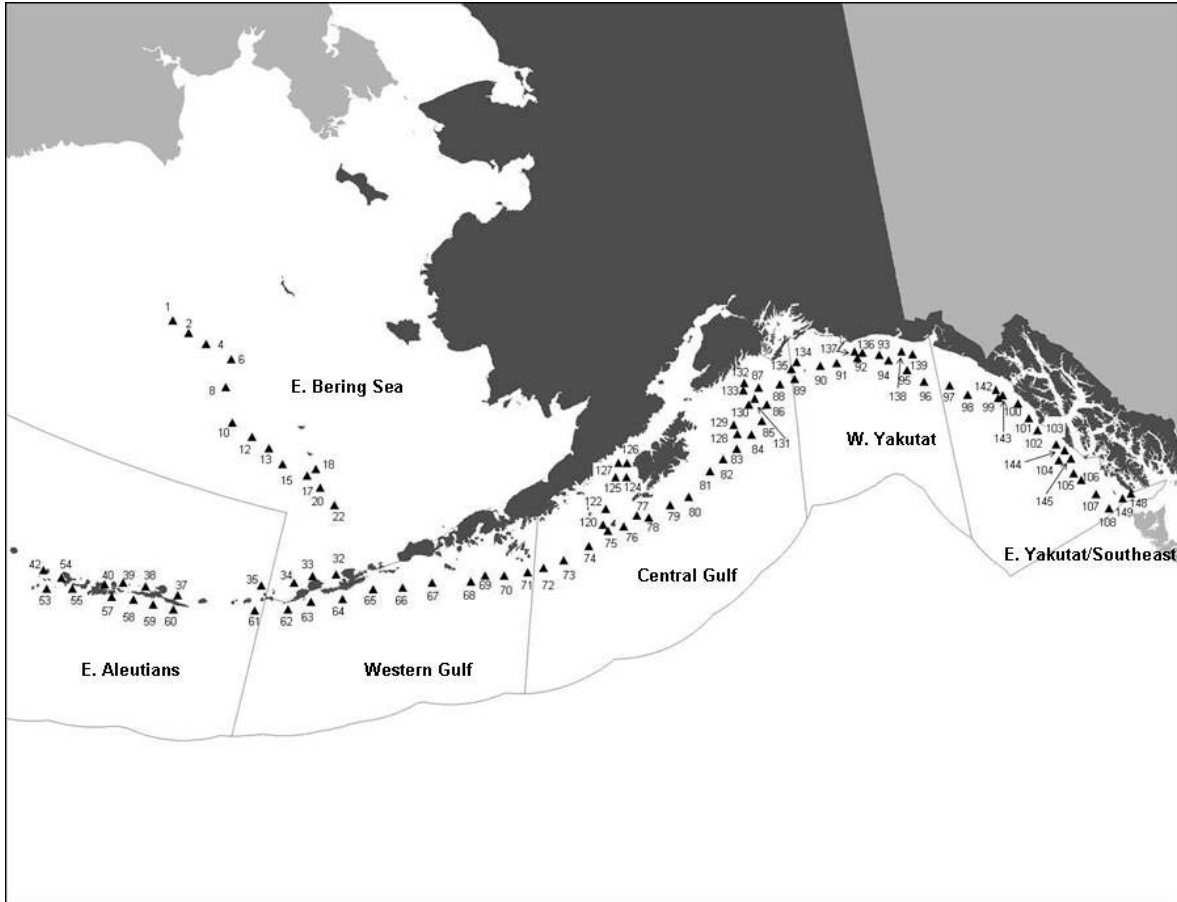


Figure 1. Map of NMFS longline survey station locations and corresponding management areas. Bering Sea stations are sampled in odd years; Aleutian Islands Region stations are sampled in even years; Gulf of Alaska stations are sampled every year.

APPENDIX A: Hook Type 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, 1,828 sablefish were caught in 2014; the experiment will be repeated in 2015. Results from both years will be tabulated and used to determine CPUE for each hook type.

Table A1. Set information by station and haul for the 2014 NMFS longline survey 2-day experiment. Positions in decimal degree (DD) format.

Set	Date	Start Lat	Start Lon	End Lat	End Lon	Start Depth (m)	End Depth (m)
1	21-Jul	58.98	-141.17	58.97	-141.27	696	800
2	21-Jul	58.94	-141.08	58.98	-141.16	674	820
3	22-Jul	58.86	-141.05	58.92	-141.08	700	806
4	22-Jul	58.77	-140.97	58.86	-141.04	674	900