Black Cod Almanac

MESA Program, Auke Bay Laboratories, NMFS, Juneau, AK January 2016

Greetings!

We hope this New Year finds you in good health and thinking about the upcoming fishing season. This is the 3rd installment of the Black Cod Almanac which we started to improve communication and increase dialogue between scientists and members of the industry. The intent is to provide updates on relevant research, summarized highlights of both Groundfish Plan Team and the North Pacific Fishery Management Council meetings, and news that may be of interest to those involved with the federal sablefish fishery. Please feel free to pass on, or send us email addresses of others who may appreciate receiving these newsletters.

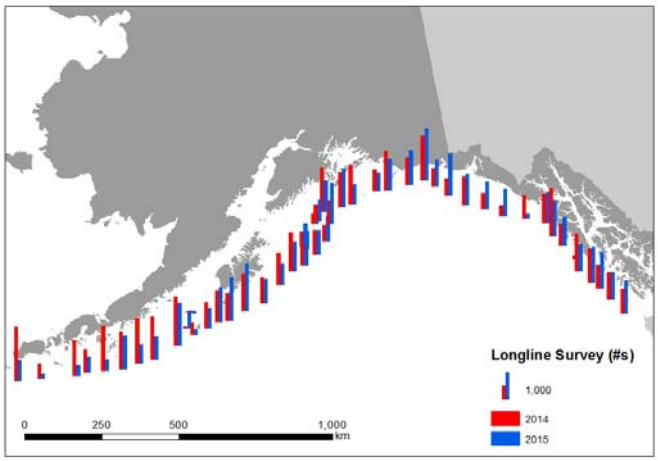
Crew member on the longline survey gaffing a sablefish to be sampled.

Inside This Issue

2015 NMFS Longline Survey

The 2015 NMFS longline survey sampled waters throughout the entire Gulf of Alaska (GOA) and in the Bering Sea, from June 2015 – August 2015. During the survey catch is recorded, a subset of sablefish otoliths are collected for age reading, sablefish are lengthed, and a subset of sablefish are tagged for movement research. The results of this survey are the most influential data source used in the sablefish assessment model, which estimates spawning biomass and is used to set harvest limits.

- LL Survey Relative Population Numbers (RPNs; area weighted measures of the numbers of fish) were down from 2014 in the western GOA, the Aleutian Islands and the Bering Sea combined, and up in the eastern GOA. The central GOA was stable.



Catch in number of fish at each slope station of the longline survey in the GOA for years 2014 and 2015.

- Sperm whale depredation was up in the Gulf of Alaska; Killer whale depredation was down in the Bering Sea but up in the western GOA
- Total tagged fish: 2,503 sablefish, 871 shortspine thornyhead, 26 Greenland turbot, plus 35 sablefish with pop-off satellite tags

2015 November Groundfish Plan Team Meeting Highlights

http://www.npfmc.org/fishery-management-plan-team/goa-bsai-groundfish-plan-team/

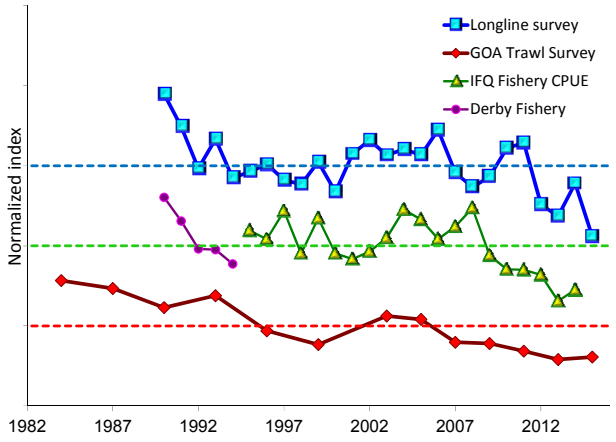
Dana Hanselman presented the sablefish assessment during the November 2015 NPFMC Groundfish Plan Team meeting that was held at the Alaska Fisheries Science Center in Seattle, WA, November 16 – 20, 2015.

The 2016 assessment included the following new data:

- Catch: updated catch for 2014, new 2015-2017 estimates
- Relative abundance: 2014 longline fishery, 2015 longline survey, 2015 GOA trawl survey
- Ages: 2014 longline survey, 2014 fixed gear fishery
- Lengths: 2014 fixed gear fishery, 2015 longline survey, 2014 trawl fishery, and 2015 GOA trawl survey

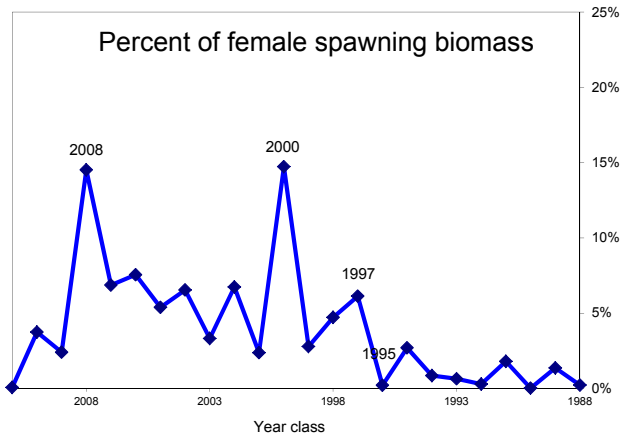
Summarized results:

- **Abundance indices:** The 2014 fishery abundance index was up 6%, the longline survey abundance index was down 21%, and the GOA trawl survey was up 12% from last year



- With the exception of the 2008 year class, **year classes** between 2001 and 2010 have been **below average, which contribute to the low abundance levels.** The former heavily contributing 1997 year class is predicted to comprise < 7% of the 2016 spawning biomass, both the 2000 and 2008 year classes ~15%. See the following figure.

Plan Team cont.



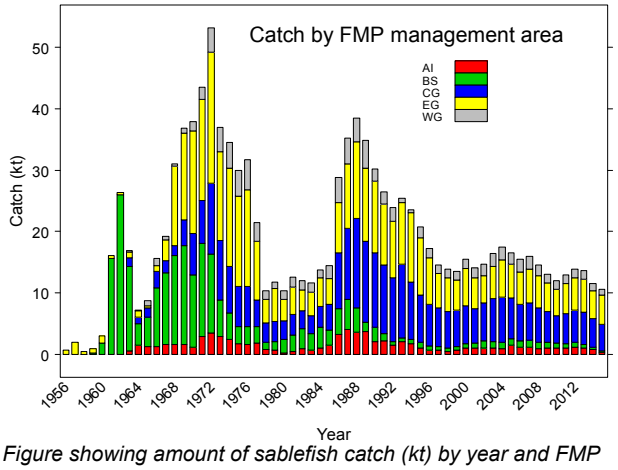
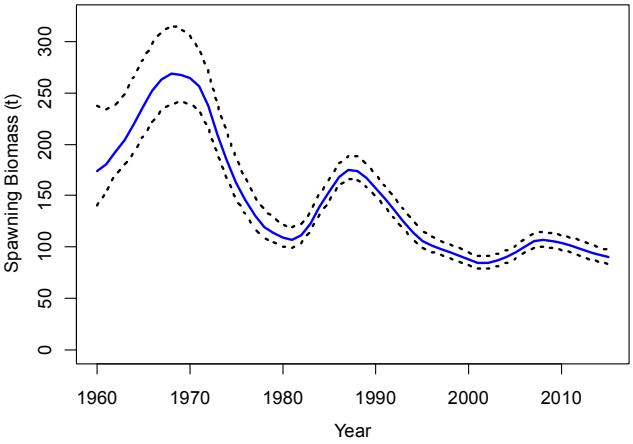


Figure showing amount of sablefish catch (kt) by year and FMP management area: Aleutian Islands (AI), Bering Sea (BS), Central Gulf of Alaska (CG), Eastern Gulf of Alaska (EG), and Western Gulf of Alaska (WG).

- **Model results:** spawning biomass is projected to decline for several years; **author recommended 2016 ABC (quota) was 11,795 t,** this is a 14% decrease.



- **Apportionment:** The Plan Teams recommended following the authors' continued approach of a fixed apportionment of ABC as an interim measure (-13.6% across all areas to reduce overall ABC variability).

December 2015 NPFMC Meeting Highlights

The December NPFMC meeting was held in Anchorage, AK, December 7-15, 2015.

http://www.npfmc.org/wp-content/PDFdocuments/newsletters/news1215.pdf

2016/2017 GOA Groundfish Specifications

The Council concurred with the author's recommended final catch specifications for the 2016 groundfish fisheries. Sablefish overfishing limits (OFL), acceptable biological catches (ABC), and total allowable catches (TAC) by area for 2016 are below:

Area	OFL (t)	ABC/TAC (t)
Gulf of Alaska	10,326	9,087
Western		1,272
Central		4,023
W. Yakutat		1,475
SE Outside		2,317
Bering Sea	1,304	1,151
Aleutians	1,766	1,557

IFQ Program Review

A document to the Council and the Council's IFQ Implementation Committee describing a proposed annotated outline for a comprehensive halibut/sablefish IFQ program review was presented. Among an analysis of the 10 original objectives of the IFQ program, the Council supported the intent to consider entry-level opportunity as a common discussion point. The Council did not make a motion, but supported the direction of the analytical scope. This outline is the first step in a process to establish direction for a program review.

2015 Sablefish Tag Program Recap

2015 NUMBER OF TAGS RETURNED:

- 648 sablefish
- 9 shortspine thornyheads
- 1 Pacific sleeper shark

Photo of tagged Greenland turbot.

OF THOSE SABLEFISH TAGS:

- Greatest time at liberty: 13,103 days (~36 yrs)
- Shortest time at liberty: 8 days
- Greatest distance traveled: 1,730 nmi (archival tagged fish tagged in the Aleutian Islands and recovered 5 years later south of Queen Charlotte Islands)

Don't forget to get those tags turned in for the 2015 Sablefish Tag Reward drawing, to be held in March. Look at the end of the newsletter for an address and information requested.

New Publication

Age at maturity, skipped spawning, and fecundity of female sablefish (*Anoplopoma fimbria*) during the spawning season.
http://fishbull.noaa.gov/1141/rodgveller.pdf

Accurate maturity-at-age data are necessary for estimating spawning stock biomass and setting reference points for fishing. This study is the first on age at maturity of female sablefish (*Anoplopoma fimbria*) sampled in Alaska during their winter spawning period, when maturity is most easily assessed. Skipped spawning, the situation where fish that have spawned in the past do not spawn during the current season, was documented in female sablefish for the first time. Determination of age at maturity was heavily influenced by whether these fish that would skip spawning were classified as mature or immature; age at 50% maturity was 6.8 years when fish that would skip spawning were classified as mature, and 9.9 years when classified as immature. Skipped spawning was more common on the continental shelf, and rates of skipped spawning increased with age through age 15. Estimates of age at maturity were similar for samples collected in winter and summer, when fish that would skip spawning sampled during winter were classified as mature. When fish that would skip spawning were considered immature in the sablefish population model for Alaska, estimates of spawning biomass decreased. Relative fecundity did not change with size and age, verifying the assumption made in the Alaska sablefish stock assessment that relative reproductive output is linearly related to female spawning biomass.

Ongoing Research

Apportionment:

- **Problem- Apportionment has become too variable.** Changes in apportionment are probably too large to reflect actual distributional shifts, and the current approach does not take into account measurement error. Therefore, very rapid changes occur in some area estimates leading to large swings in apportionments.

Apportionments are based on survey and fishery information	2014 ABC Percent	2015 Survey RPW	2014 Fishery RPW	2016 ABC Percent	2015 ABC	2016 ABC	Change
Total					13,657	**11,795**	-14%
Bering Sea	10%	15%	16%	10%	1,333	**1,816**	36%
Aleutians	13%	13%	15%	13%	1,802	**1,627**	-10%
Gulf of Alaska	77%	72%	69%	77%	10,522	**8,352**	-21%
Western	14%	14%	13%	14%	1,473	**1,136**	-23%
Central	44%	43%	36%	44%	4,658	**3,451**	-26%
W. Yakutat*	15%	16%	17%	15%	1,567	**1,374**	-12%
E. Yakutat / Southeast*	27%	27%	34%	27%	2,823	**2,391**	-15%

Comparison of ABC standard apportionment.

Area	2015 ABC	Standard apportionment for 2016 ABC	Recommended fixed apportionment for 2016 ABC*	Difference from 2015
Total	13,657	11,795	**11,795**	-13.6%
Bering Sea	1,333	1,816	**1,151**	-13.6%
Aleutians	1,802	1,627	**1,557**	-13.6%
Gulf of Alaska (subtotal)	10,522	8,352	**9,087**	-13.6%
Western	1,473	1,136	**1,272**	-13.6%
Central	4,658	3,451	**4,023**	-13.6%
W. Yakutat	1,567	1,374	**1,353**	-13.6%
E. Yak. / Southeast**	2,823	2,391	**2,438**	-13.6%

The recommended and approved ABC apportionment, continuing with the fixed apportionment from the 2015 fishery.

- **Solution-** We have developed a spatial model to evaluate **apportionment strategies** which will consider spawning biomass, catch variability, and economic yield to help the Council make an informed decision on changes if any to the current apportionment strategy.
- **Industry input on apportionment objectives is WANTED.**

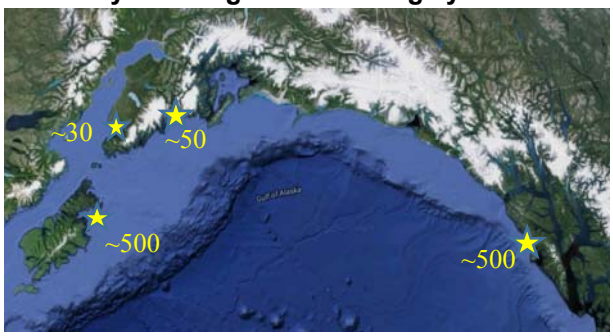
Whale Depredation:

- Better estimates of sperm whale effect on ***survey*** catch rates: a **12% average reduction** when sperm whales are **present** at a station (publication coming)
- New estimates of the sperm whale effect on ***fishery*** catch rates: 23% - 29% average reduction when depredating sperm whales present (publication coming)
- In progress: a) estimate additional sablefish mortality (mt) associated with whale depredation on the commercial ***fishery***, and b) identify fishery or environmental factors that affect depredation rates

Ongoing Research cont.

Strong Recruitment Event?

Several reports Gulfwide of young of the year sablefish in 2014, and age-1 in 2015, led to opportunities to tag juvenile sablefish in Kachemak and Resurrection Bays on the Kenai Peninsula, and various bays on Kodiak Island during the summer of 2015. While juvenile sablefish have consistently been tagged in St. John Baptist Bay, a shallow bay near Sitka, no other locations have been found to consistently hold juvenile sablefish. Therefore, movement and possible nursery grounds of juvenile fish from areas other than the eastern Gulf of Alaska are unknown. Without specific reports on sablefish catch locations from the public (sport and commercial fishermen), the opportunity to tag sablefish in these areas would have been missed. These rare reports indicate that **2014 may be a larger than average year class.**



General locations and approximate numbers of tagged juvenile sablefish in 2015.

Photo of young of the year sablefish consumed by a coho salmon during late summer 2014.

A tagged juvenile sablefish. These fish are generally about a foot long when tagged as 1-year olds.

Ongoing Research cont.

Maturity:

We continue to conduct research to obtain up-to-date estimates of the proportion of fish that are mature at each age.

Summer Longline Survey- ovaries, livers, and otoliths were collected from all specimen samples to be aged.

December 2015 Maturity Cruise- ovaries, livers, and otoliths were collected during a special cruise off of Kodiak. The timing of this cruise was critical in order to collect maturity samples as close to spawning as possible.

Goals-

1. Validate utility of visual determinations of maturity during the summer
2. Compare estimates of maturity from samples collected in the summer and winter
3. Look for further evidence that sablefish can skip a year of spawning (first documented in December 2011)
4. Look for other indications of maturity, such as energy storage in the liver
5. Tag sablefish in order to track movement during the spawning season.

Donated Fish-

Approximately 4,000 lbs (round) of sablefish and shortraker and rougheye rockfish were donated from the December 2015 maturity cruise to the Food Bank of Kodiak. These are fish that would have been discarded at sea under normal scientific cruise operation.

Big thanks to the crew of the **F/V Gold Rush** for coordinating the donation logistics, and to the **Trident** plant in Kodiak for the donated processing time. Many families in need were able to have a happier holiday due to the efforts and sacrifice of these generous folks.

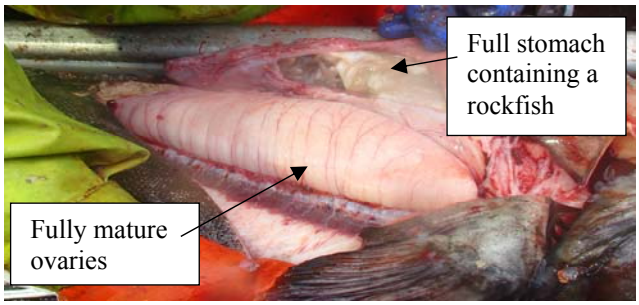


Photo of fully mature prespawning sablefish with full stomach, proving that sablefish eat during the spawning season.

Ongoing Research cont.

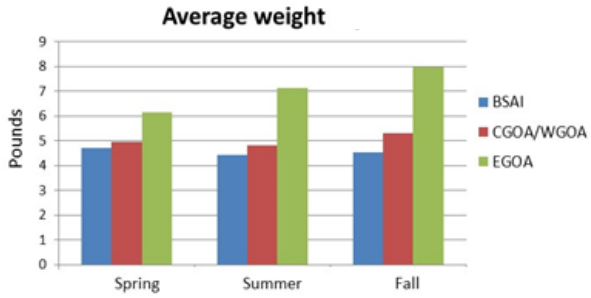
Maturity cont.

Photo of a typical pair of ovaries seen on the summer LL survey. This maturity state would be classified as "maturing," and may not be a good indicator of whether this fish would be spawning that year or not.

Photo of a pair of ovaries collected from a sablefish in early December when fish should be preparing to spawn. Note visible eggs in upper right.

Sablefish Logbook Program

Fishery data (collected in logbooks and by observers) are used in the sablefish stock assessment in calculations of abundance and apportionment of catch. The majority of fishery data comes from logbooks that are collected by the International Halibut Commission (IPHC). Logbook data is weighted more heavily in calculations than observer data. In 2014, approximately 900 logs with sablefish directed sets were collected from 208 vessels. **In future logs, when possible, record catch in both weight and numbers. This will allow us to track seasonal and annual changes in fish size.** **THANK YOU** for voluntarily working with the IPHC to enable our use of this data. **Vessel size, name, and owner and operator are all masked from NMFS and only data summarized by NMFS areas (e.g. central GOA) are shared with the public.**



Average fish weight in lbs by area and season, collected from logbook data. Is this a result of growth throughout the year or changes in fishing depth?

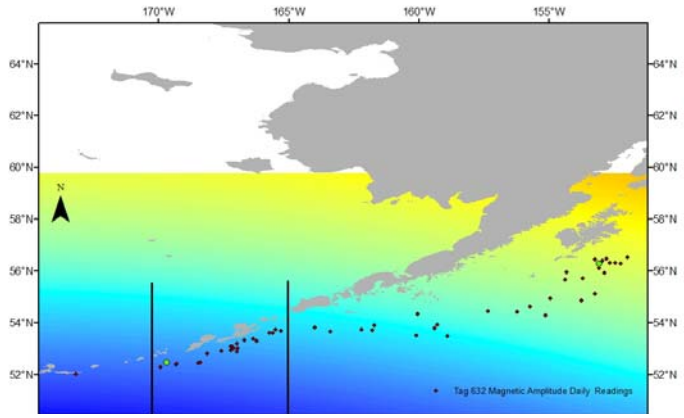
Ongoing Research cont.

Sablefish Satellite Tagging Recap

Sablefish have been tagged with pop-off satellite tags since 2012 on the summer longline surveys, and during the 2011 and 2015 winter maturity studies. These tags are being used to help determine if and where spawning grounds occur for sablefish. Tags are programmed to release from the fish during the spawning season in the winter, and archived data (including estimated geolocation, temperature, and depth) are received by passing satellites. The following is an example of the data received from one tag, and how it may be utilized.

Tag 632

The following is a figure showing the **estimated** daily locations of tagged fish #632, overlayed on a heat map of the earth's magnetic field. Green dots are the release and pop off locations. The bars indicate the area where the fish was located during suspected time of spawning. This fish was tagged just southeast of Kodiak Island on 8/24/2014, and was programmed to release from the fish on 1/1/2015.

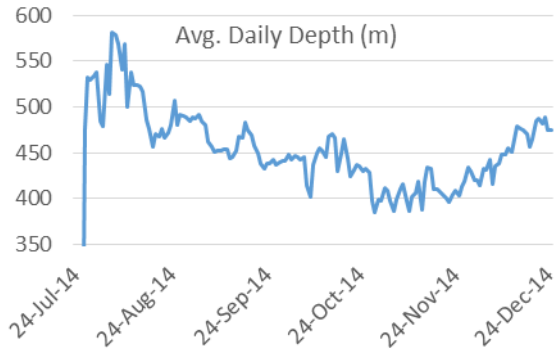


Estimated daily location (black dots) of tagged fish #632. These geolocations were estimated from collected geomagnetic field data. Green dots are the tag release and tag pop off locations. The bars indicate the bounded area where the fish was located during suspected time of pre spawning/spawning.

The fish exhibits constant daily movement from its release location off the coast of Kodiak toward its end location in the Aleutians (note there are days with missing data). Movement remains consistent until around mid-November through the end of December. At this time (presumably the time in which the fish is preparing to spawn), daily movement following the shelf break towards the Aleutians ceases. The fish remains within a bounded location displaying sporadic movement. Look at the following figure of the average daily depth (m) of the fish and note the depth distribution during the suspected "pre spawning" time as well.

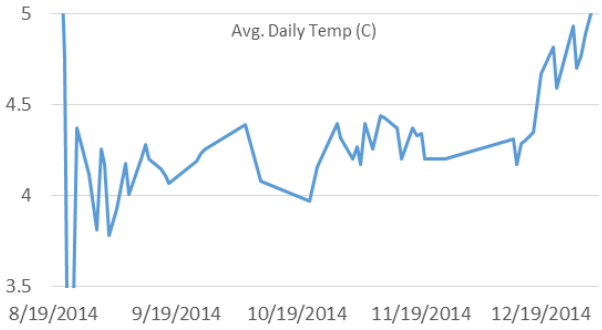
Ongoing Research cont.

Sablefish Satellite Tagging cont.



Daily average depth (m) readings collected by tag #632.

The fish displays movement towards shallower depths during the assumed pre spawning period, with a return to deeper depths following this time period. The shallow movements may represent pre spawning to spawning behavior. The following figure displays the average daily temperatures from tag #632.



Daily average temperature (C) readings collected by tag #632. The fish, on average, stayed in temperatures between 4 and 4.5 degrees C. These are typical bottom temperatures in this area.

Photo of sablefish with attached pop-off satellite tag (PSAT) prior to deployment on the summer longline survey. This tag was programmed to remain on the fish for close to one year, releasing in the winter during the presumed spawning season.

Contacts

Phil Rigby; MESA Program Manager and primary contact regarding any questions or concerns
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Cara Rodgveller; Sablefish assessment author
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Katy Echave; Sablefish Tag Program
katy.echave@noaa.gov

ATTENTION

Public visitors to AFSC in Seattle (Sand Point) for meetings are now required to present one of the following forms of identification:

- State issued Real ID Compliant Driver's Licenses and Identification Cards (**old Alaska driver's licenses will be accepted until Oct. 10, 2016; new AK licenses are compliant**)
- **Enhanced Driver's License**, and Identification Cards from the states of **Washington**, Minnesota, and New York
- U.S. Passport
- U.S. Passport Card
- U.S. Veterans ID

For more info see:

http://www.wrc.noaa.gov/NewIdRequirements.htm

or

http://www.dhs.gov/current-status-states-territories

Calendar of Events

Sablefish Tag Reward Drawing

Ted Stevens Marine Research Institute, Juneau, AK
March 1, 2016 @ 10:00 am
Drawing held from all of the 2015 sablefish tag returns for cash rewards: 1st place - $1,000; 2nd place - $500; 3rd and 4th place - $250. Do not need to be present to collect reward.

North Pacific Fishery Management Council Meetings

Portland, OR
February 1-9, 2016

Anchorage, AK
April 4-12, 2016

Kodiak, AK
June 6-14, 2016

Industry Town Hall Meeting (with DFG)

University of Alaska Sitka Campus, Room 106
1332 Seward Ave., Sitka, AK
February 19, 2016, 12:30 – 5 PM
The Alaska Department of Fish and Game (ADF&G) will meet with Southeast Alaska sablefish stakeholders and interested members of the public

Sablefish CIE Review

Ted Stevens Marine Research Institute (TSMRI)
Juneau, AK
May 10-12, 2016

Sablefish CIE Review:

TSMRI, Juneau, AK, May 10-12, 2016

The Center for Independent Experts (CIE) will conduct independent peer reviews of the Alaska sablefish assessment and potential improvements. These changes include development of a new fishery CPUE index, incorporation of estimates of whale depredation, and alternatives to the methods for apportionment of catch by area. **These meetings are open to the public and industry attendance is encouraged.** For more information, please contact Dana Hanselman.

REWARD

FOR TAGGED SABLEFISH

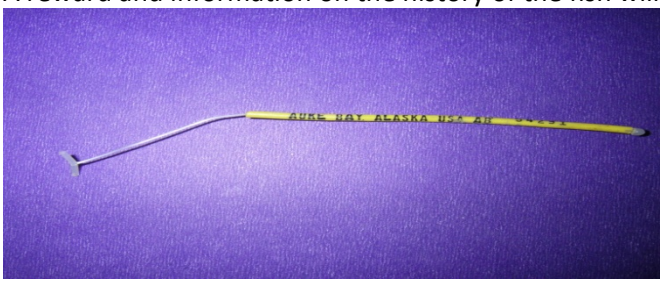
The U.S. National Marine Fisheries Service Auke Bay Laboratory in Juneau, AK tags sablefish (blackcod) in the Gulf of Alaska, Bering Sea and Aleutian Islands in order to study distribution and migration.

Tags may be yellow, red, or orange and are usually located below the first dorsal fin on the left side of the fish. In addition, sablefish are being tagged with ¾ inch diameter x 2 ¼ inch long electronic tags placed inside the fish with a 3 inch long fluorescent green and pink tag located near the dorsal fin of the fish. The external tag reads – "Reward for Depth Sensor Inside Fish." These electronic tags are worth monetary rewards of up to $500 if returned.

Postage-paid envelopes are available in most areas. Please send tags with as much of the following information as possible:

- Name of vessel
- Location of recovery
- Fork length (from tip of snout to fork in tail)
- Depth fished
- Date of recovery
- Sex of the fish
- Round weight
- Type of gear

A reward and information on the history of the fish will be sent for each tag returned to:



Sablefish Tag Program

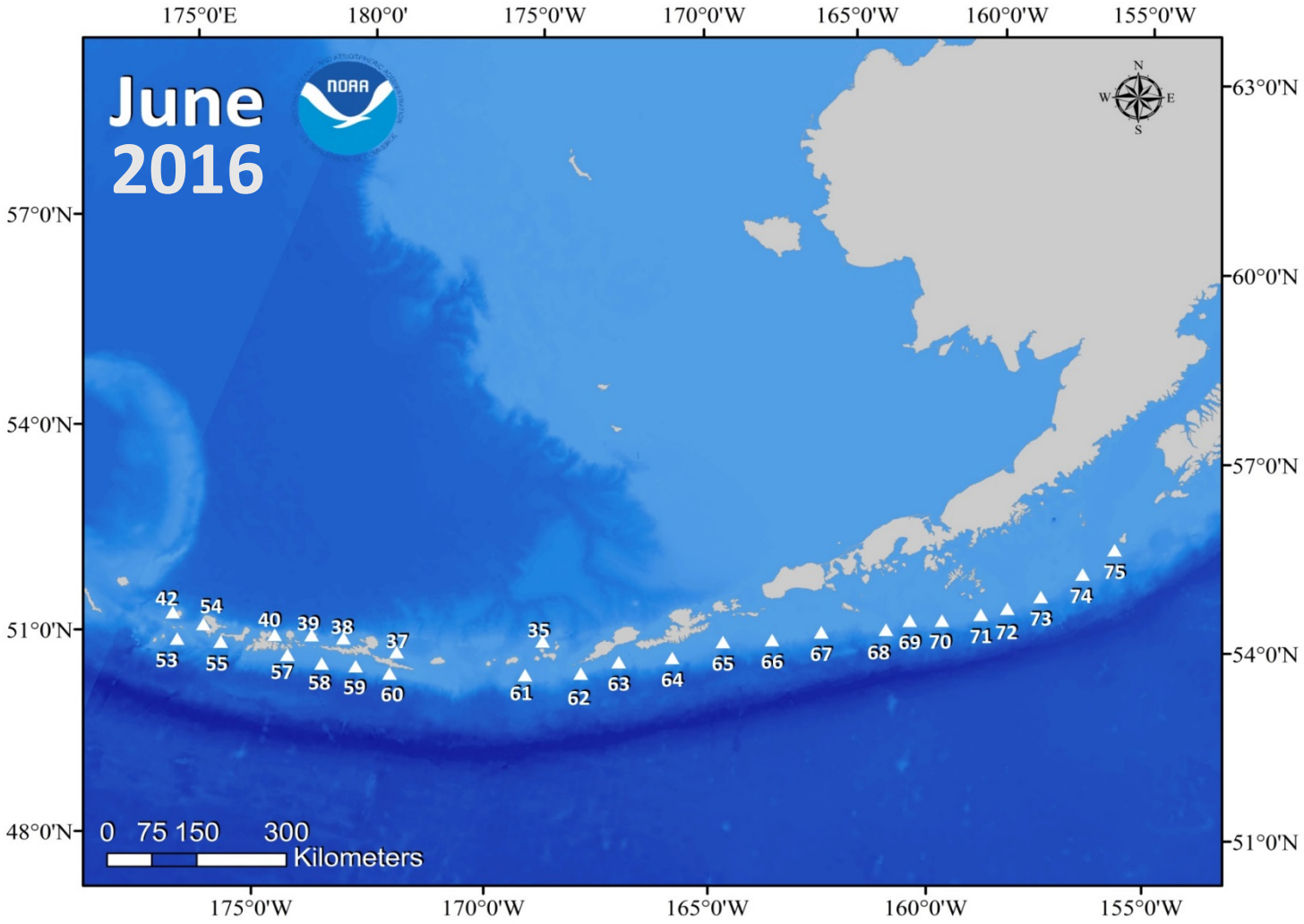
NOAA/NMFS Auke Bay Laboratories

17109 Pt. Lena Loop Rd.

Juneau, AK 99801

June 2016

Sun	*Mon*	*Tues*	*Wed*	*Thurs*	*Fri*	*Sat*
			1 **Station 35** 53°01.8'x170°06.2' 53°03.4'x170°11.1'	2 **Station 37** 52°16.8'x173°29.8' 52°20.5'x173°29.7'	3 **Station 38** 52°15.1'x174°50.6' 52°18.4'x174°47.0'	4 **Station 39** 52°07.8'x175°34.3 52°09.0'x175°41.0'
5 **Station 40** 51°58.2'x176°27.2' 52°01.9'x176°25.6'	6 **Station 54** 51°4582'x178°09.9' 51°44.3'x178°15.9'	7 **Station 42** 51°4648'x178°57.8' 51°43.1'x178°53.8'	8 **Station 53** 51°24.3'x178°37.6' 51°21.2'x178°33.5'	9 **Station 55** 51°35.5'x177°37.0' 51°32.9'x177°42.6'	10 **Station 57** 51°44.0'x175°59.6' 51°39.7'x176°00.1'	11 **Station 58** 51°46.6'x175°06.2' 51°46.5'x175°08.1'
12 **Station 59** 51°52.9'x174°20.3' 51°49.5'x174°24.2'	13 **Station 60** 51°55.2'x173°30.1' 51°52.9'x173°35.6'	14 **Station 61** 52°26.5'x170°18.6' 52°24.1'x170°23.8'	15 In Port Dutch Harbor	16 **Station 62** 52°39.6'x169°00.2' 52°34.0'x169°10.2'	17 **Station 63** 52°57.9'x168°08.1' 52°51.3'x168°12.6'	18 **Station 64** 53°11.5'x166°51.3' 53°03.0'x166°56.0'
19 **Station 65** 53°35.0'x165°41.1' 53°26.7'x165°46.8'	20 **Station 66** 53°44.2'x164°28.1' 53°37.6'x164°39.3'	21 **Station 67** 53°58.2'x163°15.8' 53°51.8'x163°24.1'	22 **Station 68** 54°08.0'x161°38.2' 54°03.5'x161°51.5'	23 **Station 69** 54°18.9'x161°03.6' 54°12.6'x161°13.2'	24 **Station 70** 54°21.9'x160°14.1' 54°13.9'x160°18.8'	25 **Station 71** 54°30.6'x159°15.3' 54°22.3'x159°25.9'
26 **Station 72** 54°38.0'x158°34.8' 54°29.5'x158°42.2'	27 **Station 73** 54°51.1'x157°44.2' 54°43.3'x157°51.6'	28 **Station 74** 55°14.4'x156°40.4' 55°06.6'x156°44.6'	29 **Station 75** 55°38.5'x155°50.9' 55°30.0'x155°50.0'	30 Travel to Ketchikan		


June
2016
NOAA
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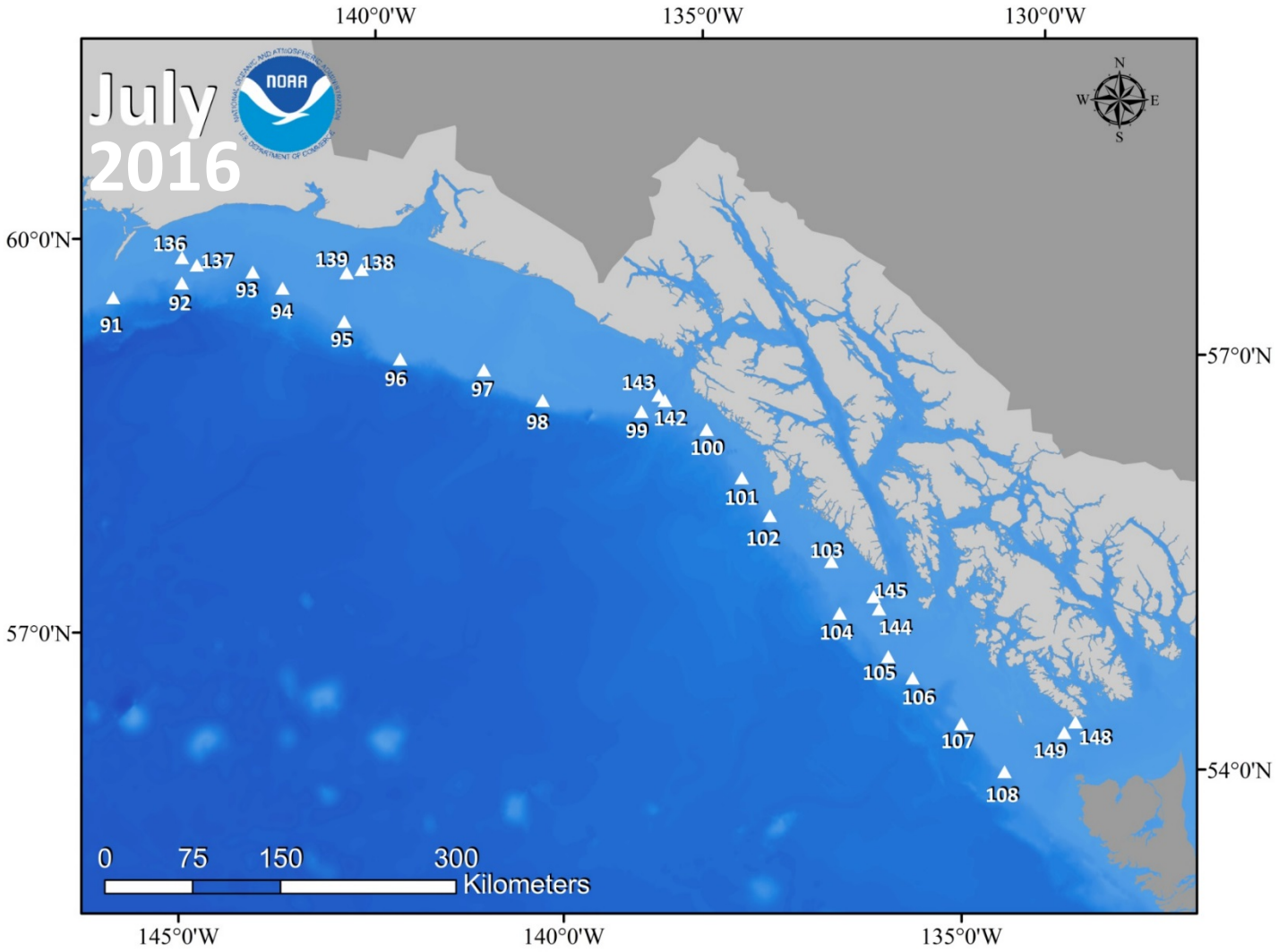
July 2016

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
					1 Travel to Ketchikan	**2** Travel to Ketchikan
3 Travel to Ketchikan	**4** In Port Ketchikan	**5** **Station 148** 54°38.9'x 132°50.3' 54°36.0'x 132°56.0' **Station 149** 54°35.9'x 133°01.4' 54°35.8'x 133°09.4'	**6** **Station 108** 54°27.0'x 133°55.8' 54°32.2'x 134°04.1'	**7** **Station 107** 54°54.0'x 134°17.2' 55°00.8'x 134°27.1'	**8** **Station 106** 55°20.8'x 134°44.1' 55°23.3'x 134°56.8'	**9** **Station 105** 55°33.5'x 134°58.0' 55°37.5'x 135°07.8'
10 **Station 144** 55°55.8'x 134°54.1' 56°00.0'x 134°54.8' **Station 145** 56°02.0'x 134°55.6' 56°05.6'x 135°01.7'	**11** **Station 104** 55°59.0'x 135°26.2' 56°04.8'x 135°38.0'	**12** **Station 103** 56°23.0'x 135°20.9' 56°22.1'x 135°36.8'	**13** **Station 102** 56°51.1'x 135°59.8' 56°57.4'x 136°06.2'	**14** **Station 101** 57°11.3'x 136°14.1' 57°14.9'x 136°24.7'	**15** **Station 100** 57°37.1'x 136°32.2' 57°38.5'x 136°44.1'	**16** **Station 142** 57°54.9'x 137°00.6' 57°55.2'x 137°08.4' **Station 143** 57°58.0'x 137°04.6' 57°58.2'x 137°12.6'
17 **Station 99** 57°52.7'x 137°22.7' 57°53.4'x 137°37.4'	**18** **Station 98** 58°08.4'x 138°43.8' 58°10.3'x 138°55.9'	**19** **Station 97** 58°28.1'x 139°28.0' 58°24.9'x 139°42.5'	**20** In Port Yakutat	**21** Research experiment near Yakutat	**22** Research experiment near Yakutat	**23** In Port Yakutat
24 **Station 138** 59°25.0'x 140°56.2' 59°25.6'x 141°04.6' **Station 139** 59°24.8'x 141°10.1' 59°21.5'x 141°14.9'	**25** **Station 96** 58°41.1'x 140°38.4' 58°43.4'x 140°52.4'	**26** **Station 95** 59°03.0'x 141°20.6' 59°02.9'x 141°38.1'	**27** **Station 94** 59°23.3'x 142°09.8' 59°28.1'x 142°24.3'	**28** **Station 93** 59°33.0'x 142°33.8' 59°34.8'x 142°47.4'	**29** **Station 136** 59°44.8'x 143°35.2' 59°45.7'x 143°42.3' Station 137 59°40.4'x 143°22.9' 59°43.1'x 143°29.8'	**30** **Station 92** 59°33.3'x 143°39.1' 59°35.1'x 143°57.1'


July
2016
NOAA
140°0'W
135°0'W
130°0'W
60°0'N
57°0'N
54°0'N
145°0'W
N
S
E
W
136
137
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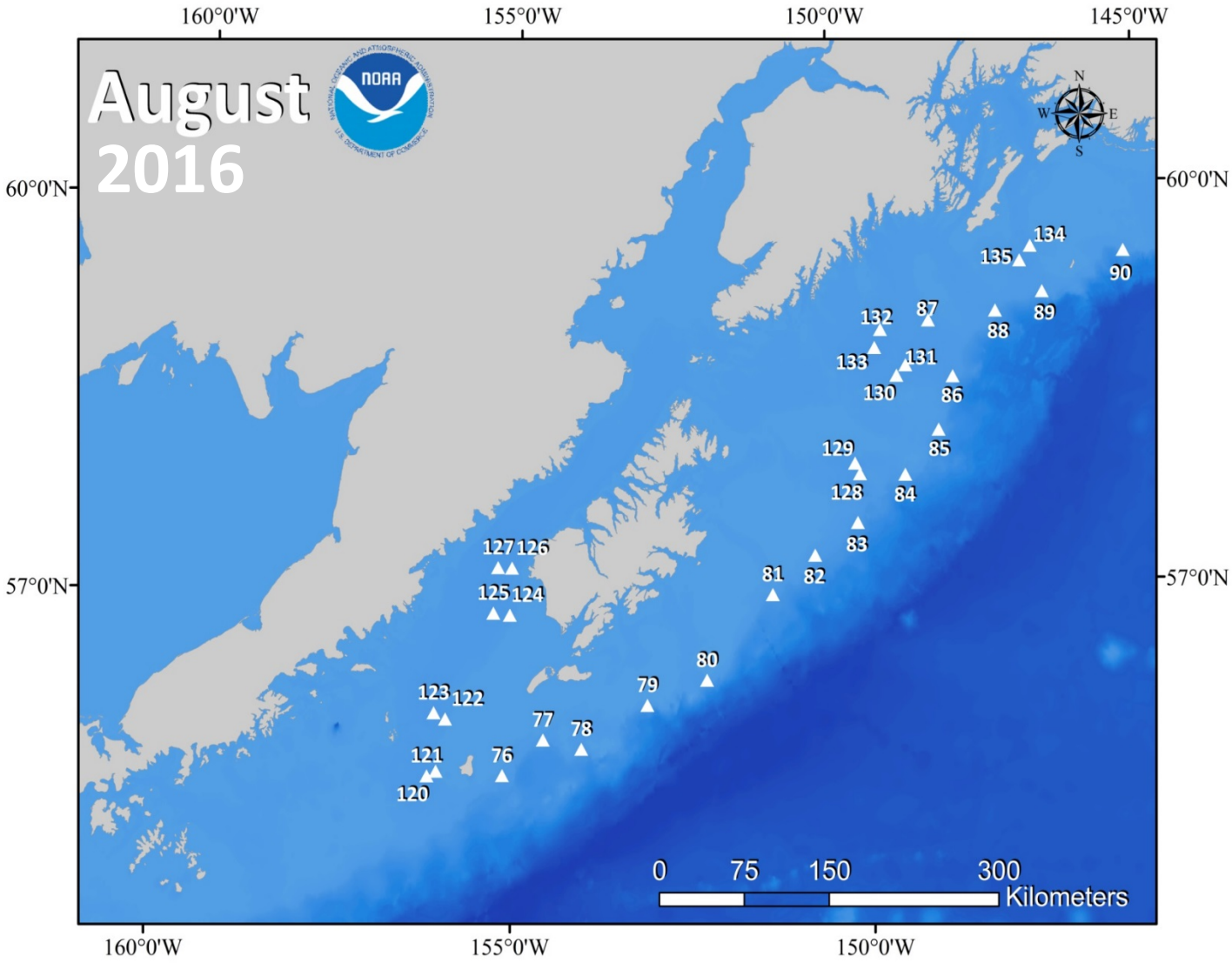
0 75 150 300
Kilometers

August 2016

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
July 31 **Station 91** 59°31.3'x 144°42.7' 59°26.8'x 144°57.5'	**1** **Station 90** 59°30.0'x 145°31.5' 59°30.2'x 145°49.7'	**2** **Station 89** 59°15.8'x 146°51.1' 59°09.7'x 147°04.5'	**3** In Port Cordova	**4** In Port Cordova	**5** **Station 134** 59°36.9'x 146°58.0' 59°33.3'x 147°03.2' **Station 135** 59°30.9'x 147°09.2' 59°27.1'x 147°09.0'	**6** **Station 88** 59°09.3'x 147°36.2' 58°59.6'x 147°37.8'
7 **Station 87** 59°07.6'x 148°39.0' 58°58.5'x 148°39.0'	**8** **Station 132** 59°05.0'x 149°24.0' 59°02.0'x 149°31.9' **Station 133** 58°57.0'x 149°30.5' 58°55.2'x 149°38.1'	**9** **Station 130** 58°43.6'x 149°11.8' 58°46.1'x 149°04.9' **Station 131** 58°48.1'x 149°02.9' 58°50.6'x 148°55.3'	**10** **Station 86** 58°41.3'x 148°20.4' 58°32.5'x 148°19.0'	**11** **Station 85** 58°17.6'x 148°37.0' 58°08.2'x 148°42.1'	**12** **Station 84** 57°58.3'x 149°10.0' 57°50.9'x 149°20.0'	**13** **Station 128** 58°00.0'x 149°50.5' 57°59.0'x 149°58.3' **Station 129** 58°05.0'x 149°54.5' 58°04.0'x 150°02.1'
14 **Station 83** 57°37.9'x 149°55.0' 57°28.0'x 149°59.0'	**15** **Station 82** 57°24.1'x 150°34.4' 57°15.0'x 150°35.9'	**16** In Port Kodiak	**17** **Station 81** 57°07.1'x 151°13.3' 56°58.2'x 151°17.6'	**18** **Station 80** 56°29.1'x 152°12.8' 56°21.1'x 152°21.0'	**19** **Station 79** 56°18.2'x 153°04.6' 56°13.3'x 153°16.4'	**20** **Station 78** 55°58.4'x 154°01.3' 55°49.9'x 154°01.9'
21 **Station 77** 56°02.5'x 154°34.0' 55°53.6'x 154°34.5'	**22** **Station 76** 55°46.0'x 155°08.3' 55°37.9'x 155°15.7'	**23** **Station 122** 56°11.2'x 155°57.8' 56°11.0'x 156°04.6' **Station 123** 56°13.9'x 156°07.8' 56°15.2'x 156°14.6'	**24** **Station 126** 57°20.8'x 155°02.4' 57°21.0'x 155°10.2' **Station 127** 57°20.9'x 155°14.7' 57°19.6'x 155°22.9'	**25** **Station 124** 56°59.3'x 155°03.8' 57°00.0'x 155°11.8' **Station 125** 57°00.1'x 155°18.2' 57°02.6'x 155°24.2'	**26** **Station 120** 55°47.3'x 156°04.6' 55°45.8'x 156°11.9' **Station 121** 55°45.0'x 156°12.1' 55°43.8'x 156°20.0'	**27** Travel to Dutch Harbor
28 Unload vessel Dutch Harbor	**29**	**30**	31			


August
2016
160°0'W
155°0'W
150°0'W
145°0'W
60°0'N
57°0'N
N
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134
135
90
89
87
88
132
133
131
130
86
85
129
128
84
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121
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120
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75
150
300
Kilometers