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Resource Ecology & Fisheries Management
7600 Sand Point Way NE, Bldg. 4
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January 21, 2015

Cruise Report **F/T Seafisher Cruise** **SF201401 (October 2-29, 2014)**

Project Title: Atka Mackerel Tag Recovery Cruise, Central and Western Aleutian Islands, Alaska

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SCIENTIFIC PURPOSE

The goal of our on-going tag release-recovery studies is to determine the efficacy of trawl exclusion zones (TEZs) as a management tool to protect critical habitat. TEZs have been established around Steller sea lion rookeries to protect sea lion habitat and prey resources, including local populations of prey such as Atka mackerel. Localized fishing may affect Atka mackerel abundance and distribution near sea lion rookeries. Our tagging experiments estimate local abundance and movement between areas open and closed to the Atka mackerel fishery. From 1999 through 2014, a total of approximately 130,000 tagged Atka mackerel have been released in the Aleutian Islands. To date, over 3,000 tagged Atka mackerel have been recovered. These data have contributed greatly to our understanding of small-scale movements and distributions of Atka mackerel around sea lion rookeries.

In May and June 2014, a cooperative venture between the North Pacific Fisheries Foundation and NMFS tagged and released approximately 21,000 fish in the Western Aleutian Islands (Buldir Island, WAI Seamounts, Aggatu Island, and Ingenstrem Rock) as well as Seguam Pass in the Central Aleutian Islands (Figures 1-2). The primary objective of the F/T Seafisher cruise was to recover tagged fish both in areas open to the Atka mackerel fishery and within trawl exclusion zones that are closed to the fishery. Recovery of tagged fish is also being augmented by the fishery outside of trawl exclusion zones.

Secondary objectives included conducting undersea camera tows near fishing locations. These tows aided in the development of cameras as a tool for identifying fish habit as well as estimating fish species composition, density, and size. In addition, Atka mackerel biological data including stomach samples, gonad samples, and age structures were collected during nearly every haul. Finally, we conducted 4 special projects at the request of other researchers: stomach collections from the predominant fish species encountered, stable isotope samples for Steller Sea lion dietary and mercury content analysis from a range of fish species, rockfish maturity samples, and Pacific cod maturity samples.

PARTICIPANTS

Susanne McDermott	Lead Scientist/NMFS
Phil Dang	Scientific Liasion/NPFF
Mike Levine	Watch leader/Contract Biologist
Troy Buckley	Factory Scientist/NMFS
Rebecca Dorff	Factory Scientist/Contract biologist
Daniella Griffay	Factory Scientist/Contract biologist
Matt McCallum	Factory Scientist/Contract biologist

CRUISE SCHEDULE

30 September-	
02 October	Vessel setup, Dutch Harbor, AK
02 October	Depart Dutch Harbor, AK
03 October	Tag recovery tows, Seguam Pass
04 October	Transit to Western Aleutian Islands
05-07 October	Tag recovery tows, Buldir West
07-10 October	Tag recovery tows, Ingenstrem Rock and Aggatu Island
10-12 October	Tag recovery tows, WAI Seamounts
12 October	Tag recovery tows, Buldir East and Kiska Island
13 October	Offload, Kiska Island
14 October	Tag recovery tows, Buldir East
15 October	Tag recovery tows, Buldir East and WAI Seamounts
16-19 October	Tag recovery tows, WAI Seamounts
20 October	Tag recovery tows, Ingenstrem Rock and Buldir West
21 October	Tag recovery tows, Buldir East
22-23 October	Offload, Adak Island; Transit to Seguam Pass
24-27 October	Tag recovery tows, Seguam Pass
28 October	Transit to Dutch Harbor; offload
29 October	Disembark vessel, Dutch Harbor

Summary of Results

During May-June 2014, we released 6411 tagged Atka mackerel at Seguam Pass and 14375 tagged Atka mackerel in the Western Aleutian Islands. The current tag recovery effort onboard the Seafisher was the first tag recovery cruise of the study, with a second cruise planned for winter/spring 2015. It was conducted both inside and outside of trawl exclusion zones (TEZs). In January 2015, the Western Aleutian Islands will be open to the Atka mackerel fishery (Area 543) for the first time since 2011; the fishery will provide another source of tag recovery in the open areas outside of the TEZs in NMFS area 541 (Seguam Pass) and 543 (Western Aleutian Islands).

During this cruise, we examined 791 metric tons of Atka mackerel for tags at Seguam Pass and 1143 metric tons of Atka mackerel for tags in the Western Aleutian Islands. Figures 1 and 2 show the locations of tag recovery and release tows. Table 1 shows the number of tows, the total Atka mackerel catch, and the total

bycatch of species other than Atka mackerel in each study area. Total bycatch was 77.9 mt in Seguam Pass and 952.5 mt in the Western Aleutian Islands.

Length-frequency distribution

Approximately 100 fish were randomly collected, sexed and lengthed per haul in all study areas for a total of 8776 lengths collected (Table 2). Figure 3 illustrates the length frequency distributions for Atka mackerel in each study area by sex. Table 2 also summarizes the average length of Atka mackerel by study area. In general, the largest Atka mackerel were found at study sites located near shore (Seguam Pass, Buldir, Kiska, and Agattu) while considerably smaller fish were found at the offshore WAI Seamounts (Tahoma Reef, Tahoma Seamount, Heck Canyon, and Walls Plateau).

Wild tag recoveries

A total of 54 wild tags were recovered. Tag recoveries are summarized by area and strata in Table 3. Area movement of tags from the time of release to recovery are in Appendix 2. ‘Wild tagged’ fish are fish that were tagged and released during the tag release cruise as opposed to tagged fish that were seeded into the catch already on board during the tag recovery cruise to obtain the tag reporting rate.

Tag reporting rate

Tag reporting rate is defined as the proportion of tagged fish caught by the vessel that are actually found and reported. To determine tag reporting rate, scientists tagged 10 Atka mackerel per haul and distributed them randomly throughout the catch. Seeded tagged fish appeared identical to wild tagged fish and could only be distinguished by their tag number. This was done for nearly all hauls during the cruise. These seeded tagged fish were recovered in the factory by the vessel and scientific crew. The tag reporting rate is summarized in Table 4. Tag reporting rates were approximately 95% for single tagged fish and 97% for double tagged fish.

Biological samples

Table 5 summarizes the biological samples taken from Atka mackerel during the tag recovery cruise. Gonad, stomach, and otolith samples were randomly collected from 10 fish (5 females and 5 males) from almost every tow for a total of 737 biological samples collected. In addition, we noted male spawning coloration for every lengthed male Atka mackerel. Males in full spawning coloration were noted most commonly at Agattu, with comparatively few males in spawning coloration noted elsewhere (Figures 4 and 5).

Species Catch Composition

A total of 122 other species or species groups were caught during the hauls in each of the study areas (Appendix 1). The most abundant bycatch species were northern rockfish (454.9 mt), Pacific ocean perch (372.9 mt), and Pacific cod (123.7 mt). Approximately 97% of the bycatch consisted of these three species.. The total catch of all species is summarized in Table 1 and Appendix 1.

Special projects

We conducted four special projects at the request of other researchers. The species and sample size for each collection is summarized in Table 6. A brief outline of each project follows below:

1. Aleutian Islands Stomach Collection

Requested by:
Troy Buckley
Alaska Fisheries Science Center
Troy.Buckley@noaa.gov

Stomach samples were collected from a variety of species, especially the Aleutian Island core species of walleye pollock, Pacific cod, arrowtooth flounder, Pacific Ocean perch, and Northern rockfish. These samples were especially valuable as they were taken during the fall season, when few stomach samples from the Aleutian Islands have been collected.

2. Maturity collections for female rockfish in the Aleutian Islands

Requested by:

Todd Tenbrink
Alaska Fisheries Science Center
Todd.Tenbrink@noaa.gov

This project is part of a larger study focusing on data-poor commercial rockfish species in the Aleutian Islands. We collected ovary and otolith samples from female blackspotted, harlequin, shortraker, and shortspine thornyhead rockfish. This information will help to improve the understanding of age and length at maturity for these rockfish species.

3. Stable isotope and mercury analysis

Requested by:

Lori Rea
University of Alaska Fairbanks
ldrea@alaska.edu

This collection was part of an ongoing project in the Aleutian Islands. The goal of this project is to improve the ability to model the diet composition of Steller sea lion females in the Aleutian Islands using stable isotopes, and to understand which potential prey species may be contributing to accumulation of high mercury concentrations in some sea lions in the western Aleutian Islands.

4. Pacific cod maturity collection

Requested by:

Sandi Neidetcher
Alaska Fisheries Science Center
Sandi.Neidetcher@noaa.gov

This collection was part of an ongoing project in the Aleutian Islands. The goal of this project is to improve knowledge of the spawning strategy along with rates of maturation, and the location and phenology of Pacific cod spawning.

Underwater Camera tows

During this cruise we conducted underwater camera tows to identify fish species composition and size as well as fish association with differing substrate types. This ongoing project aims to establish methods for estimating relative fish abundance in non-trawlable areas. The camera system was towed via a winch by the

drifting vessel, with hauls of approximately 15 minutes being made near the location of trawl hauls. The camera system consists of an analog “driving camera” with a direct feed through a cable to the vessel, two side-by-side digital GOPRO cameras, and three lights (Figures 6 and 7). The “driving camera” was viewed live and allowed us to navigate up and down to stay as close as possible to the bottom, while the side-by-side digital cameras record a high-quality image for later viewing and analysis. Their stereo arrangement also allows for fish to be measured during analysis using methods developed at the AFSC.

The entire Seafisher crew, especially Phil Dang and chief engineer Mike Gest, were invaluable in the development and troubleshooting of the camera system during this cruise. We were able to conduct 22 camera tows in total. Locations of the camera tows are illustrated in Figures 8 and 9.

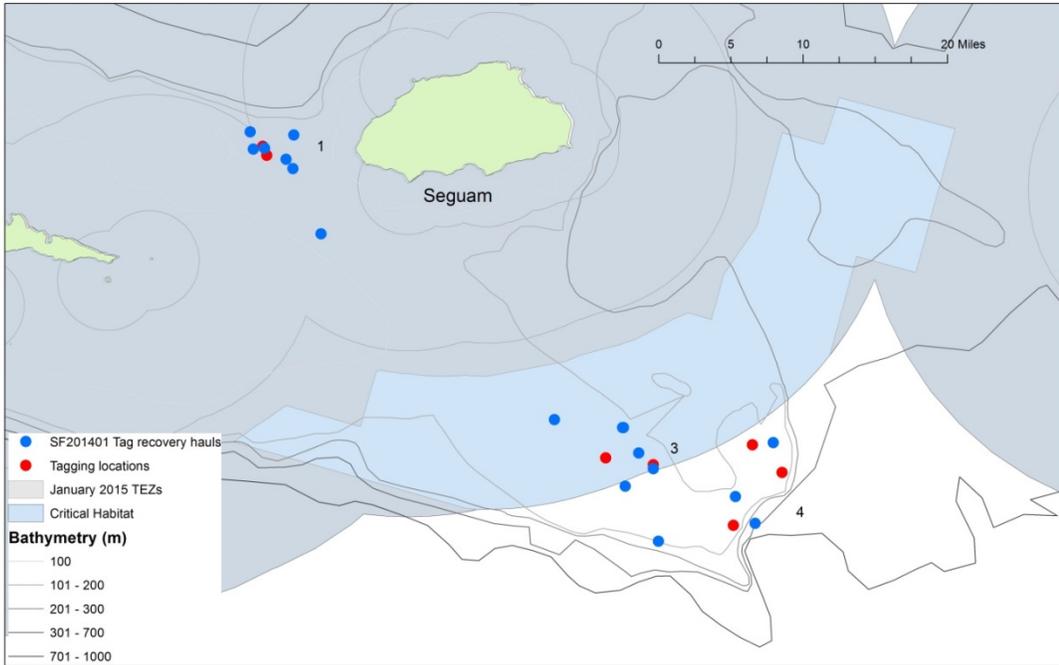


Figure 1. Location of tag recovery hauls (blue) and tag release locations (red) near Seguam Pass (Area 541). Numbers on map indicate research strata.

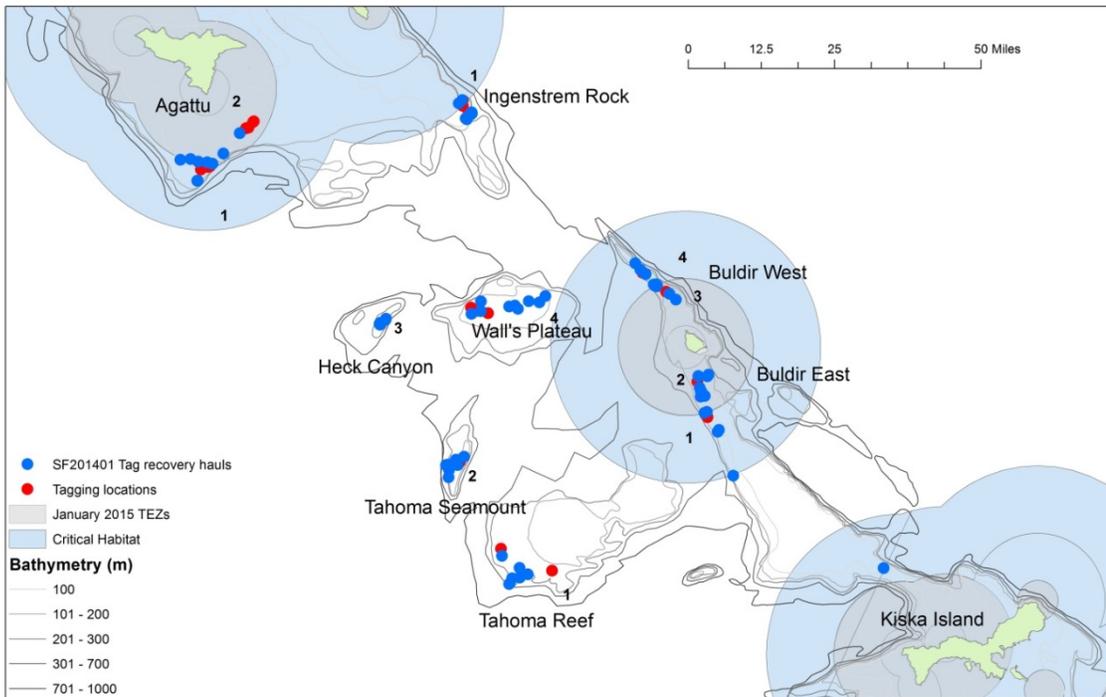


Figure 2. Location of tag recovery hauls (blue) and tag release locations (red) in the Western Aleutian Islands (area 543). Numbers on map indicate research strata.

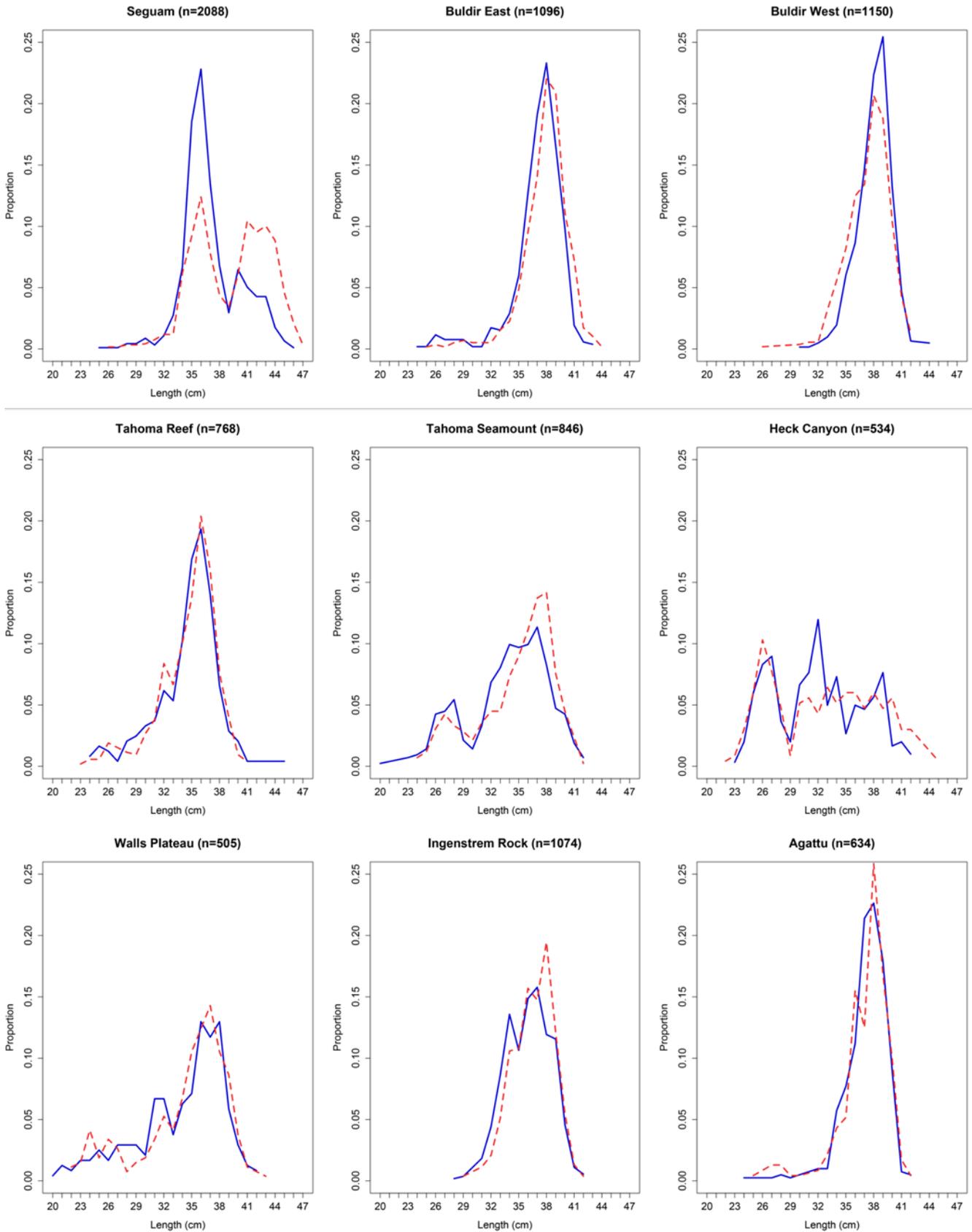


Figure 3. Proportion of male (blue) and female (red) by length at each study area. Kiska Island is not presented due to low sample size.

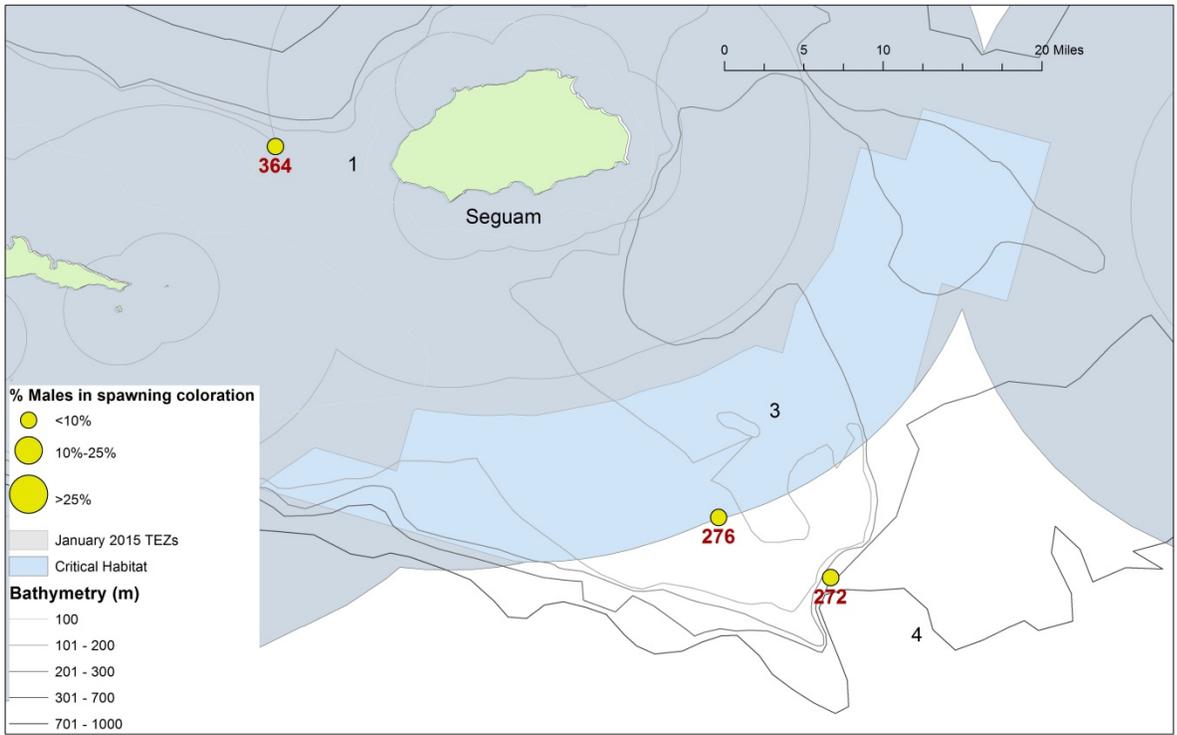


Figure 4. Percentage of males in spawning coloration within each area and stratum at Seguam Pass. Strata numbers are in black; sample sizes are noted in red.

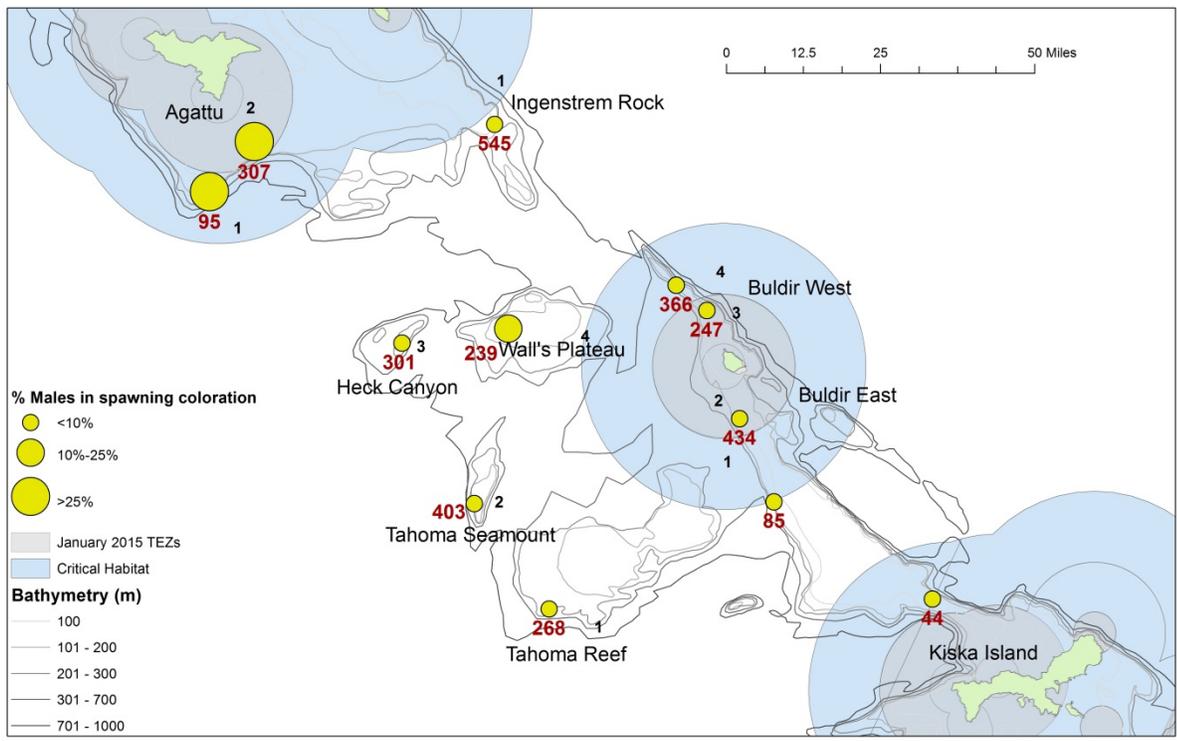


Figure 5. Percentage of males in spawning coloration within each area and stratum at various islands. Strata numbers are in black; sample sizes are noted in red.

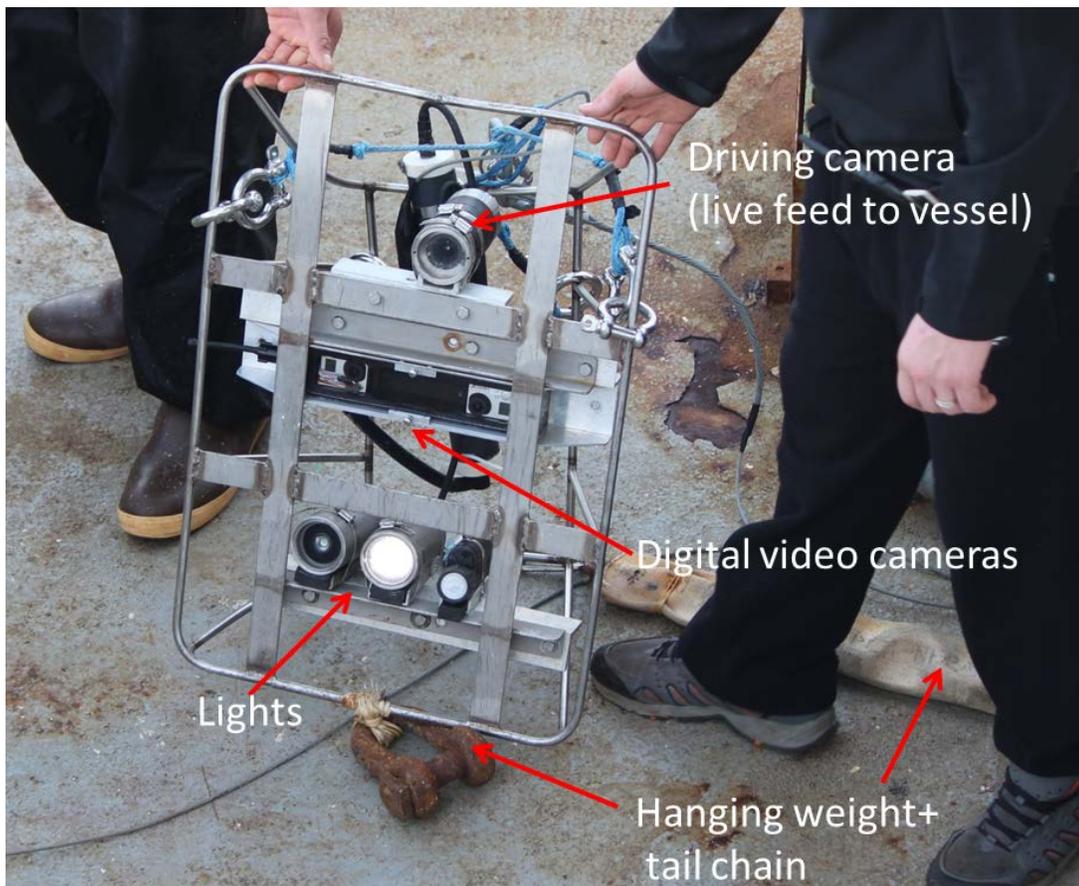


Figure 6. Undersea camera system.



Figure 7. Example of undersea camera footage.

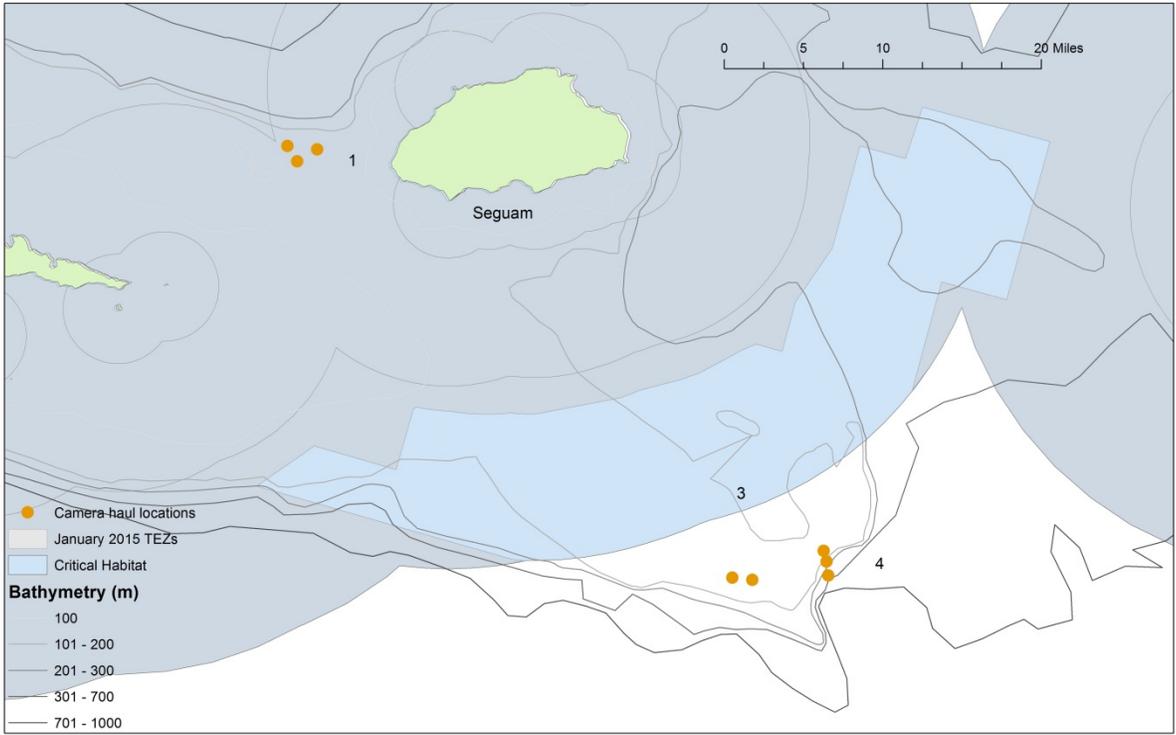


Figure 8. Location of camera hauls near Seguam Pass. Numbers on map indicate research strata.

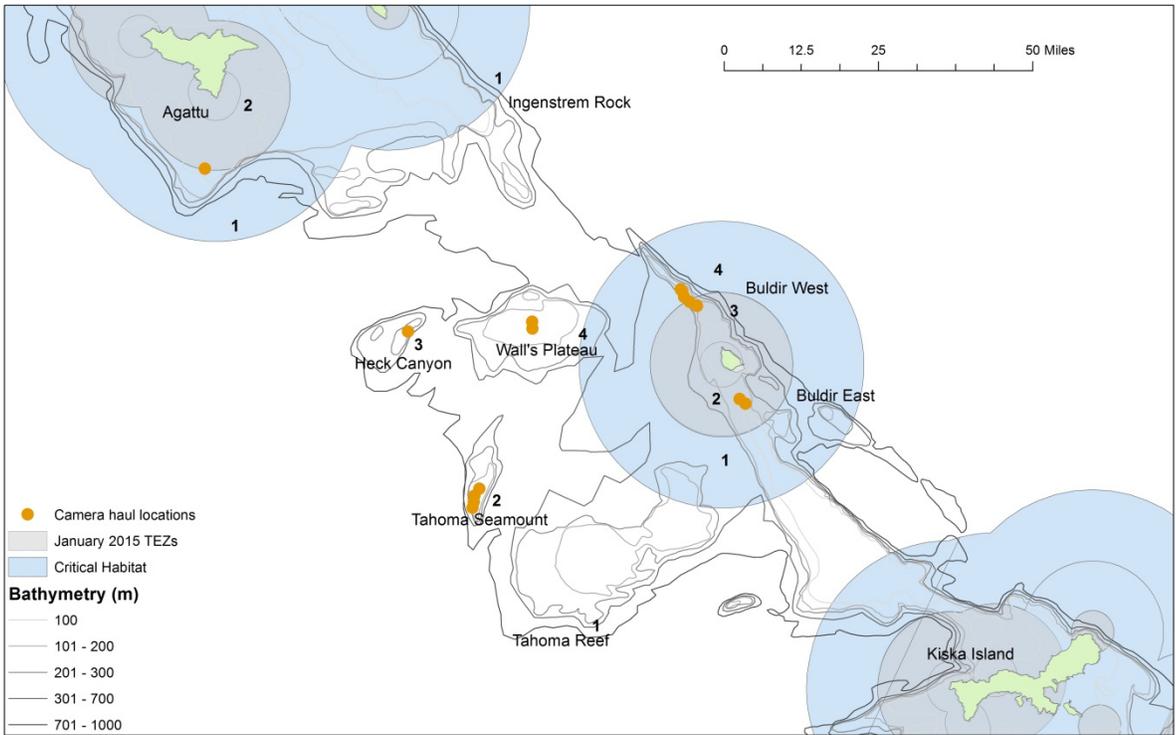


Figure 9. Location of camera hauls in the Western Aleutian Islands. Numbers on map indicate research strata.

Table 1. Haul numbers, Atka mackerel catch, and other species catch.

Area	Stratum	No. of Hauls	Atka mackerel catch	Other Species	Total catch	% Atka mackerel
			(mt)	(mt)	(mt)	in catch
Agattu	1	3	78.2	33.3	111.4	70.1
	2	6	59.5	117.7	177.3	33.6
Buldir East	1	5	3.9	60.0	63.9	6.1
	2	9	202.3	91.0	293.3	69.0
Buldir West	3	5	89.0	81.9	170.8	52.1
	4	6	163.3	64.5	227.9	71.7
Heck Canyon	3	5	90.9	26.7	117.7	77.3
Ingenstrem Rock	1	11	223.3	126.6	349.9	63.8
Kiska Island	1	1	2.7	7.3	10.0	27.1
Seguam	1	8	413.8	18.9	432.7	95.6
	3	5	173.0	35.1	208.1	83.1
	4	6	204.4	23.9	228.3	89.5
Tahoma Reef	1	7	122.3	140.9	263.2	46.5
Tahoma Seamount	2	8	92.5	155.1	247.6	37.4
Walls Plateau	4	9	15.7	47.6	63.3	24.8
Total		94	1934.9	1030.4	2965.3	65.3

Table 2. Male, female, and combined average lengths of Atka mackerel in each study area. n= number of Atka mackerel measured.

Area	Male		Female		Combined	
	Length (cm)	n	Length (cm)	n	Length (cm)	n
Agattu	37.3	402	37.0	232	37.2	634
Buldir East	37.2	519	37.8	577	37.5	1096
Buldir West	38.0	613	37.4	537	37.8	1150
Heck Canyon	32.0	301	32.4	233	32.2	534
Ingenstrem Rock	36.1	545	36.5	529	36.3	1074
Kiska Island	38.0	44	38.1	37	38.0	81
Seguam	37.0	912	39.2	1176	38.3	2088
Tahoma Reef	34.6	243	34.8	525	34.7	768
Tahoma Seamount	33.9	423	34.7	423	34.3	846
Walls Plateau	33.8	239	34.2	266	34.0	505

Table 3. Number of tags released in May-June 2014 and number of tags recovered in each study area during the current tag recovery trip. For area movement of tags, see Appendix 2.

Area	Stratum	Tags released	Tags recovered
Agattu	1	1663	2
	2	597	3
Buldir East	1	913	1
	2	1143	10
Buldir West	3	2449	12
	4	1951	10
Heck Canyon	3	0	1
Ingenstrem Rock	1	1888	4
Kiska Island	1	0	0
Seguam	1	2135	3
	3	0	1
	4	4276	2
Tahoma Reef	1	211	1
Tahoma Seamount	2	551	4
Walls Plateau	4	3009	0
Total		20786	54

Table 4. Tag reporting rate for all areas.

Tags	Number released	Number recovered	Percent recovered
Single pink tag	549	522	95.08
Double pink tag	61	59	96.72

Table 5. Number of biological samples in each study area. Each sample consisted of a stomach, gonad, and otolith collection.

Area	Stratum	Number of biological samples
Agattu	1	15
	2	40
Buldir East	1	40
	2	80
Buldir West	3	33
	4	49
Heck Canyon	3	40
Ingenstrem Rock	1	95
Kiska Island	1	0
Sequam	1	74
	3	41
	4	60
Tahoma Reef	1	70
Tahoma Seamount	2	60
Walls Plateau	4	40
Total		<i>737</i>

Table 6. Special project specimen collection. Numbers are total number of samples collected per species across all study areas.

Species	Stomach	Rockfish maturity	Stable isotope	Pacific cod maturity
Arrowtooth flounder	1		10	
Atka mackerel	See Table 2		60	
Blackspotted rockfish	9	1		
Light dusky rockfish	29			
Harlequin rockfish	14	30		
Kamtchatka flounder	6		5	
Northern rockfish	194			
Pacific cod	39		10	18
Pacific Ocean Perch	170			
Pollock	70			
Prowfish	3			
Redbanded rockfish	2			
Shorthead rockfish		2		
Shortspine Thornyhead	3	20		
Squid (unidentified sp.)			27	
Walleye pollock			10	
Yellow Irish Lord	9		10	
Total	549	53	132	18

Appendix 1. Total catch in each study area.

Species	Area 541	Area 543									Grand Total
	Seguam	Kiska Island	Buldir East	Buldir West	Tahoma Seamount	Tahoma Reef	Heck Canyon	Walls Plateau	Agattu	Ingenstrem Rock	
Grand Total	869.1	10.0	357.2	398.7	247.6	263.2	117.7	63.3	288.7	349.9	2965.3
Atka mackerel	791.2	2.7	206.2	252.3	92.5	122.3	90.9	15.7	137.7	223.3	1934.9
northern rockfish	22.4	4.6	105.6	89.2	15.1	22.6	16.4	8.8	96.5	73.8	454.9
Pacific ocean perch	15.5	0.0	15.6	21.9	133.6	112.1	8.4	29.7	7.2	28.8	372.9
Pacific cod	23.6	2.2	17.1	25.7	0.0	0.0	<1 MT	<1 MT	39.0	15.4	123.7
sponge unident.	2.3	<1 MT	5.4	3.0	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	12.6
prowfish	<1 MT	0.0	<1 MT	<1 MT	2.4	1.8	<1 MT	2.1	<1 MT	<1 MT	8.8
yellow Irish lord	<1 MT	<1 MT	<1 MT	0.0	4.6	<1 MT	6.7				
whiteblotched skate	4.7	0.0	<1 MT	0.0	0.0	<1 MT	0.0	0.0	0.0	<1 MT	4.9
Alaska skate	<1 MT	0.0	<1 MT	1.7	0.0	<1 MT	0.0	<1 MT	<1 MT	<1 MT	4.0
walleye pollock	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	2.6	3.8				
Aleutian skate	0.0	0.0	<1 MT	1.5	<1 MT	<1 MT	0.0	<1 MT	0.0	0.0	3.5
invertebrate unident.	<1 MT	0.0	3.5	<1 MT	0.0	0.0	0.0	0.0	<1 MT	0.0	3.5
light dusky rockfish	2.4	0.0	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	0.0	<1 MT	3.3
bigmouth sculpin	<1 MT	0.0	0.0	0.0	<1 MT	0.0	0.0	2.0	<1 MT	<1 MT	3.0
arrowtooth flounder	<1 MT	0.0	0.0	<1 MT	0.0	<1 MT	<1 MT	0.0	<1 MT	1.2	2.4
darkfin sculpin	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	2.4				
dusky rockfish unident.	1.8	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	<1 MT	<1 MT	2.3
Pacific halibut	<1 MT	0.0	0.0	<1 MT	0.0	0.0	0.0	<1 MT	<1 MT	<1 MT	2.0
harlequin rockfish	<1 MT	0.0	<1 MT	0.0	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	2.0
Kamchatka flounder	<1 MT	0.0	<1	0.0	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	1.1	1.8

Species	Area 541	Area 543									Grand Total
	Seguam	Kiska Island	Buldir East	Buldir West	Tahoma Seamount	Tahoma Reef	Heck Canyon	Walls Plateau	Agattu	Ingenstrem Rock	
blackspotted rockfish	<1 MT	0.0	MT <1 MT	0.0	<1 MT	<1 MT	0.0	<1 MT	0.0	0.0	1.5
basketstarfish unident.	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	0.0	<1 MT	<1 MT	<1 MT	1.1
northern rock sole	<1 MT	0.0	<1 MT	<1 MT	0.0	<1 MT	0.0	<1 MT	<1 MT	<1 MT	1.0
Aglaophenia sp.	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
Atka mackerel eggs	<1 MT	0.0	0.0	0.0	<1 MT	0.0	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT
barnacle unident.	0.0	0.0	<1 MT	<1 MT	0.0	<1 MT	0.0	0.0	<1 MT	0.0	<1 MT
Bathymasteridae	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT	0.0	0.0	0.0	<1 MT
Bathyraja sp.	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	<1 MT
Bering skate	0.0	0.0	0.0	0.0	<1 MT	<1 MT	0.0	<1 MT	0.0	0.0	<1 MT
black rockfish	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT	<1 MT
blackfin sculpin	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
blotched snailfish	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
blue king crab	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT
brittlestarfish unident.	<1 MT	0.0	0.0	<1 MT	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT
brown king crab	0.0	0.0	<1 MT	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	<1 MT
bryozoan unident.	<1 MT	0.0	<1 MT	<1 MT	<1 MT	<1 MT	0.0	0.0	<1 MT	0.0	<1 MT
bubblegum coral	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	0.0	<1 MT	<1 MT	<1 MT	<1 MT
cephalopod unident.	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
champagne flute hydroid	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
chinook salmon	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT
chum salmon	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	<1 MT	0.0	<1 MT

Species	Area 541	Area 543									Grand Total
	Seguam	Kiska Island	Buldir East	Buldir West	Tahoma Seamount	Tahoma Reef	Heck Canyon	Walls Plateau	Agattu	Ingenstrem Rock	
coho salmon	<1 MT	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
coral unident.	<1 MT	0.0	<1 MT	<1 MT	0.0	<1 MT	0.0	<1 MT	0.0	0.0	<1 MT
dark dusky rockfish	<1 MT	0.0	<1 MT	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	<1 MT
Decorator crab	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
Dover sole	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	<1 MT
feathery bryozoan	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
flatfish unident.	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	<1 MT
flathead sole	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT	<1 MT	<1 MT
Gorgonacea (order)	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT
great sculpin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	<1 MT	<1 MT
Greenland turbot	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	<1 MT
grenadier unident.	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	<1 MT
Hemilepidotus sp.	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	<1 MT
hippolytid shrimp unident.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT
Hippolytidae (family)	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
horsehair crab	0.0	0.0	<1 MT	0.0	0.0	0.0	<1 MT	<1 MT	0.0	0.0	<1 MT
hydrocoral unident.	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	0.0	<1 MT	<1 MT
hydroid unident.	<1 MT	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
Hydrozoa (class)	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	<1 MT
Icelus uncinialis	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
Irish lord	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
jellyfish unident.	<1 MT	0.0	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT

Species	Area 541	Area 543									Grand Total
	Seguam	Kiska Island	Buldir East	Buldir West	Tahoma Seamount	Tahoma Reef	Heck Canyon	Walls Plateau	Agattu	Ingenstrem Rock	
kelp greenling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	<1 MT
lanternfish unident.	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
leafy bryozoan	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
longfin Irish lord	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	0.0	<1 MT	0.0	0.0	0.0	<1 MT
longfin sculpin	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	<1 MT
lumpsucker unident.	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
mud skate	<1 MT	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT	<1 MT	<1 MT
Myctophidae	0.0	0.0	<1 MT	<1 MT	0.0	0.0	<1 MT	<1 MT	0.0	0.0	<1 MT
Myoxocephalus sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT
nudibranch unident.	<1 MT	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
octocoral unident.	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
Octopus dofleini	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	<1 MT
Octopus sp.	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	<1 MT	0.0	<1 MT
Oregon triton	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
Pacific saury	0.0	0.0	<1 MT	<1 MT	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT
Pacific spiny lumpsucker	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
Paralomis multispina	0.0	<1 MT	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
pearly prickleback	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
poacher unident.	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	<1 MT
Psolus sp.	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	<1 MT
red Irish lord	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
red tree coral	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT
redbanded rockfish	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	<1 MT

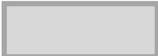
Species	Area 541	Area 543									Grand Total
	Seguam	Kiska Island	Buldir East	Buldir West	Tahoma Seamount	Tahoma Reef	Heck Canyon	Walls Plateau	Agattu	Ingenstrem Rock	
rex sole	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	<1 MT	<1 MT	<1 MT	<1 MT
rock	<1 MT	0.0	<1 MT	<1 MT	0.0	<1 MT	0.0	<1 MT	<1 MT	0.0	<1 MT
rockfish unident.	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	<1 MT
ronquil unident.	<1 MT	0.0	<1 MT	<1 MT	<1 MT	0.0	<1 MT	<1 MT	0.0	0.0	<1 MT
rougeye rockfish	0.0	0.0	<1 MT	<1 MT	0.0	<1 MT	0.0	<1 MT	0.0	0.0	<1 MT
roughskin sculpin	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT
sawback poacher	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	<1 MT	0.0	0.0	<1 MT
scaled crab	0.0	<1 MT	0.0	0.0	<1 MT	<1 MT	0.0	<1 MT	<1 MT	0.0	<1 MT
scarlet king crab	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT
sculpin unident.	<1 MT	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
sculptured shirmp	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
sea anemone unident.	<1 MT	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	<1 MT
sea cucumber unident.	0.0	<1 MT	<1 MT	0.0	<1 MT	<1 MT	0.0	0.0	<1 MT	0.0	<1 MT
Sea slug	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
sea urchin unident.	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT
sea whip unident.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	<1 MT
searcher	0.0	0.0	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	0.0	<1 MT	<1 MT
seaweed	<1 MT	0.0	<1 MT	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	<1 MT
shortraker rockfish	0.0	0.0	0.0	<1 MT	<1 MT	0.0	0.0	0.0	0.0	0.0	<1 MT
shortspine thornyhead	0.0	0.0	0.0	<1 MT	<1 MT	<1 MT	0.0	<1 MT	0.0	<1 MT	<1 MT
shrimp unident.	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	0.0	0.0	<1 MT	0.0	0.0	<1 MT

Species	Area 541 Seguam	Area 543									Grand Total
		Kiska Island	Buldir East	Buldir West	Tahoma Seamount	Tahoma Reef	Heck Canyon	Walls Plateau	Agattu	Ingenstrem Rock	

T	Tags Recoverd										
skate egg case unident.	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	<1 MT	0.0	0.0	<1 MT
snail (gastropod) eggs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	<1 MT
snail shell	<1 MT	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	<1 MT
snail unident.	0.0	0.0	<1 MT	<1 MT	<1 MT	<1 MT	0.0	<1 MT	0.0	0.0	<1 MT
snailfish unident.	0.0	0.0	<1 MT	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
Solaster sp.	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	<1 MT	0.0	<1 MT
spiny lumpsucker	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
sponge sculpin	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT	0.0	0.0	<1 MT
squid unident.	0.0	<1 MT									
starfish unident.	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT	<1 MT
Stylaster sp	<1 MT	0.0	<1 MT	<1 MT	0.0	0.0	0.0	<1 MT	<1 MT	0.0	<1 MT
trash	<1 MT	0.0	<1 MT	<1 MT	<1 MT	0.0	0.0	<1 MT	0.0	0.0	<1 MT
Triglops sp.	<1 MT	0.0	<1 MT	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT
Tritonia diomedea	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
Tritonia sp.	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	<1 MT
tunicate unident.	0.0	0.0	<1 MT	<1 MT	0.0	<1 MT	0.0	0.0	0.0	0.0	<1 MT
vase sponge	<1 MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<1 MT
whelk unident.	0.0	0.0	0.0	0.0	<1 MT	0.0	0.0	0.0	0.0	0.0	<1 MT

		Agattu	Agattu	Buldir E	Buldir E	Buldir W	Buldir W	Heck	Ing.Rock	Kiska	Seguam	Seguam	Seguam	Tahoma Reef	Tahoma Seamount	Wall's
<i>Stratum</i>		<i>1</i>	<i>2</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>3</i>	<i>1</i>	<i>1</i>	<i>1</i>	<i>3</i>	<i>4</i>	<i>1</i>	<i>2</i>	<i>4</i>
Agattu	<i>1</i>		2													
Agattu	<i>2</i>	2														
Buldir E	<i>1</i>				1		1									
Buldir E	<i>2</i>			1	4	2										
Buldir W	<i>3</i>				4	9	8									
Buldir W	<i>4</i>						1									
Heck	<i>3</i>															
Ing.Rock	<i>1</i>				1	1		1	4							
Kiska	<i>1</i>															
Seguam	<i>1</i>										2					
Seguam	<i>3</i>															
Seguam	<i>4</i>										1	1	2			
Tahoma Reef	<i>1</i>															
Tahoma Seamount	<i>2</i>														4	
Wall's	<i>4</i>													1		

Appendix 2. Area movement from tag release (area, stratum) to tag recovery (area, stratum). Stratum numbers are in italics.

 = No movement from tag release to recovery