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July 15, 2014

Cruise Report ***F/V Morning Star* Cruise 201401**

May 19, 2014 - June 11, 2014

Project Title: Atka mackerel tag and release, Aleutian Islands, Alaska

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 2011, a total of approximately 110,000 tagged Atka mackerel have been released in the Seguam Pass, Tanaga Pass, Amchitka, Kiska Island and Petrel bank areas. 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.

The primary objective of the F/V Morning Star Cruise 201401 was to tag and release fish at 4 locations in the Western Aleutian Islands (Buldir Island, WAI Seamounts, Aggatu Island, and Ingenstrem Rock) as well as Seguam Pass in the Central Aleutian Islands (Figure 1). In the WAI, tagging will help to improve our understanding of the rate of exchange of Atka mackerel between fishable concentrations as well as establish baseline data for the fishable grounds after a 4 year fishing closure. We will compare results from the WAI to Seguam Pass, which has an established time series beginning in 2000. Recovery of tagged fish will be supplied by the fishery and by chartered recovery cruises scheduled for Fall 2014 and Spring 2015.

Secondary objectives included characterizing Atka mackerel habitat by taking oceanographic samples and conducting underwater camera tows at each area where fish were tagged and released. We also conducted a tag-mortality study by holding tagged Atka mackerel in tanks for a minimum of 48 hours. In addition, we collected biological samples including Atka mackerel gonads, stomachs, and otoliths. Finally, we conducted 3 Special Projects at the request of other researchers: we attempted to recover moored hydrophones for a Killer Whale Acoustic

Predation project, we collected Atka mackerel and Pacific cod samples for stable isotope and mercury analysis, and we collected incidental marine mammal and seabird observations.

ITINERARY AND ACTIVITIES

16-18 May	Vessel setup in Dutch Harbor, Alaska
19 May	Depart Dutch Harbor at 09:30
19-20 May	Transit to Seguam Pass
21-24 May	Tag release hauls at Seguam Pass
24-25 May	Transit from Seguam Pass to Buldir Island
25-26 May	Tag release hauls at Buldir Island East
27 May	Moored hydrophone buoy recovery attempt at Kiska Island
28 May	Tag release hauls at WAI Seamounts
29 May	Engine shutdown at WAI Seamounts- lost tag release day
30-31 May	Tag release hauls at WAI Seamounts
1-2 June	Tag release hauls at Buldir Island West
2-3 June	Sheltered from storm behind Aggatu Island
4-5 June	Tag release hauls at Aggatu Island
6 June	Tag release hauls at Ingenstrem Rock
7 June	Tag release hauls at Buldir Island West
8 June	Moored hydrophone buoy recovery attempt at Kiska Island
9 June	Moored hydrophone buoy recovery attempt at Ulak Island
10-11 June	Transit to Dutch Harbor
12 June	Disembark vessel in Dutch Harbor
13 June	Return to Seattle, WA

STUDY AREA

The study areas for this cruise encompassed all areas that showed historical records of commercial fishing targeting Atka mackerel in the Western Aleutian Islands (NMFS area 543) near Steller sea lion rookeries. In addition, we also released tags at Seguam Pass in the Eastern Aleutian Island (NMFS area 541), which has been used as a control site since there has been a commercial fishery throughout the last years and Steller sea lion populations are stable. Study areas are illustrated in (Figure 1).

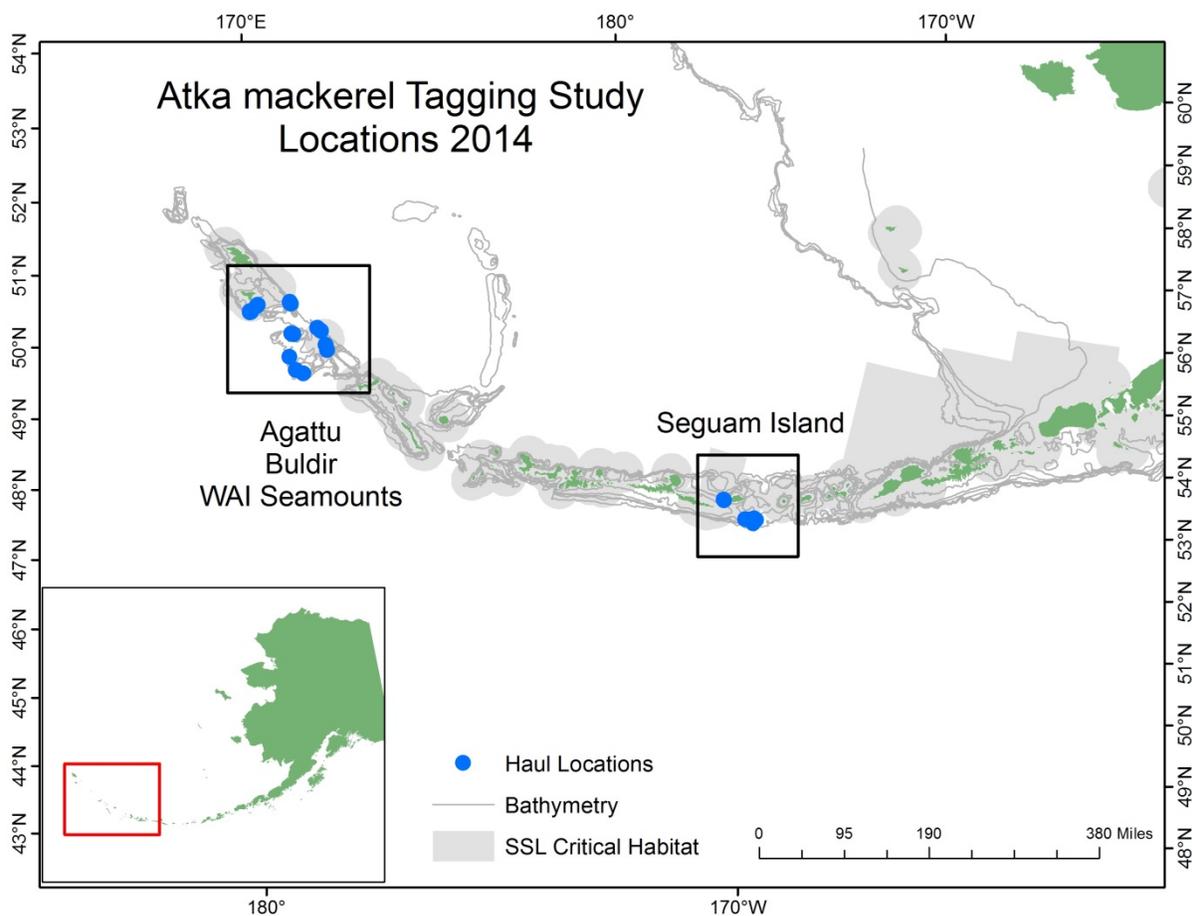


Figure 1. Overview of tagging locations.

RESULTS

Tagged Atka mackerel

20,786 Atka mackerel were tagged and released on this cruise. Table 1 shows the number of Atka mackerel tagged and released in each study area and each stratum within the study areas. Trawl tows locations where Atka mackerel were caught for tagging are shown in Figures 2-4.

Table 1. Number of Atka mackerel tagged by area and stratum.

Area	Stratum	Number of tagged fish released
Seguam	1	2135
	4	4276
Buldir East	1	913
	2	1143
Buldir West	3	2449
	4	1951
Tahoma Reef	1	211
Tahoma Seamount	2	551
Walls Plateau	4	3009
Ingenstrem Rock	1	1888
Aggatu	1	1663
	2	597
Total		20786

Haul locations and depths

Table 2 shows the latitude, longitude and depth of all successful trawl tows where Atka mackerel were caught for tagging at each study area. Of the 44 total trawl tows, 34 contained Atka mackerel that were tagged and released. No Atka mackerel were tagged from 10 other tows. This was due to mechanical problems (tows 1 and 18), net hang-ups on rocky bottom preventing towing (tows 15 and 17), or low numbers of Atka mackerel in the catch (tows 9, 12, 19, 20, 21, and 41). Trawl tow locations are shown in Figures 2-4.

Table 2. Locations of tag release hauls at each study area. Latitude and longitude are in decimal degrees.

Haul	Area	Starting Latitude N	Starting Longitude	Longitude E or W	Starting Depth	Ending Latitude N	Ending Longitude	Longitude E or W	Ending Depth (m)
2	Seguam	52.01	-171.88	W	148	52.02	-171.86	W	139
3	Seguam	52.07	-171.82	W	142	52.09	-171.83	W	146
4	Seguam	52.09	-171.88	W	142	52.10	-171.88	W	128
5	Seguam	52.04	-172.03	W	110	52.04	-172.05	W	120
6	Seguam	52.04	-172.10	W	120	52.04	-172.09	W	114
7	Seguam	52.24	-172.78	W	141	52.25	-172.78	W	133
8	Seguam	52.24	-172.77	W	139	52.24	-172.76	W	148
10	Buldir East	52.27	176.00	E	131	52.27	176.00	E	130
11	Buldir East	52.21	176.10	E	131	52.21	176.09	E	132
13	Tahoma Reef	51.69	175.81	E	132	51.70	175.83	E	128
14	Tahoma Reef	51.69	175.59	E	143	51.68	175.60	E	150
16	Tahoma Seamount	51.84	175.30	E	114	51.82	175.30	E	127
22	Walls Plateau	52.19	175.06	E	149	52.20	175.10	E	143
23	Walls Plateau	52.19	175.08	E	149	52.20	175.13	E	137
24	Walls Plateau	52.20	175.13	E	146	52.20	175.16	E	154
25	Walls Plateau	52.19	175.08	E	149	52.20	175.12	E	141
26	Walls Plateau	52.19	175.09	E	150	52.20	175.16	E	155
27	Buldir West	52.46	175.61	E	119	52.46	175.63	E	122
28	Buldir West	52.46	175.61	E	121	52.46	175.62	E	124
29	Agattu	52.20	173.84	E	96	52.30	173.82	E	98
30	Agattu	52.20	173.85	E	93	52.20	173.83	E	97
32	Agattu	52.21	173.87	E	96	52.20	173.87	E	96
33	Agattu	52.19	173.85	E	96	52.19	173.82	E	98
34	Agattu	52.20	173.87	E	96	52.20	173.86	E	94
35	Agattu	52.33	173.93	E	109	52.30	173.91	E	102
36	Agattu	52.35	173.94	E	101	52.35	173.94	E	102
37	Agattu	52.33	173.94	E	106	52.35	173.93	E	102
38	Agattu	52.35	173.94	E	101	52.33	173.92	E	108
39	Ingenstrom Rock	52.64	174.65	E	115	52.63	174.67	E	122
40	Ingenstrom Rock	52.62	174.70	E	116	52.62	174.70	E	116
41	Ingenstrom Rock	52.62	174.70	E	115	52.63	174.69	E	116
42	Ingenstrom Rock	52.63	174.66	E	116	52.64	174.66	E	115
43	Buldir West	52.44	175.73	E	130	52.44	175.75	E	123
44	Buldir West	52.44	175.72	E	130	52.44	175.73	E	131

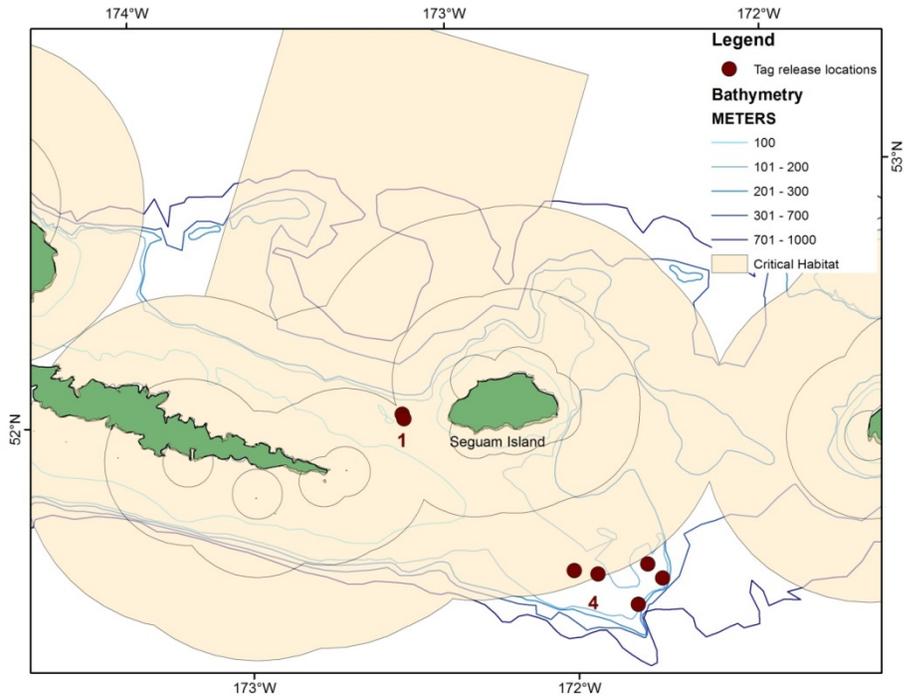


Figure 2. Tag release locations and stratum numbers near Seguam Pass. Critical habitat is denoted with lines at its 3mi, 10nmi, and 20nmi extent.

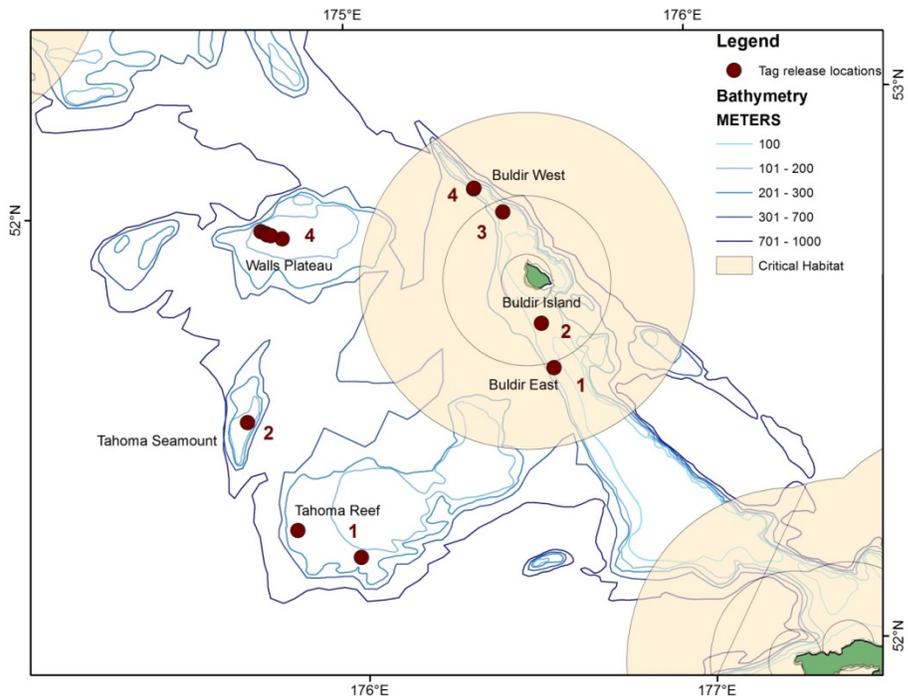


Figure 3. Tag release locations and stratum numbers near Buldir Island and in the WAI Seamounts. Critical habitat is denoted with lines at its 3mi, 10nmi, and 20nmi extent.

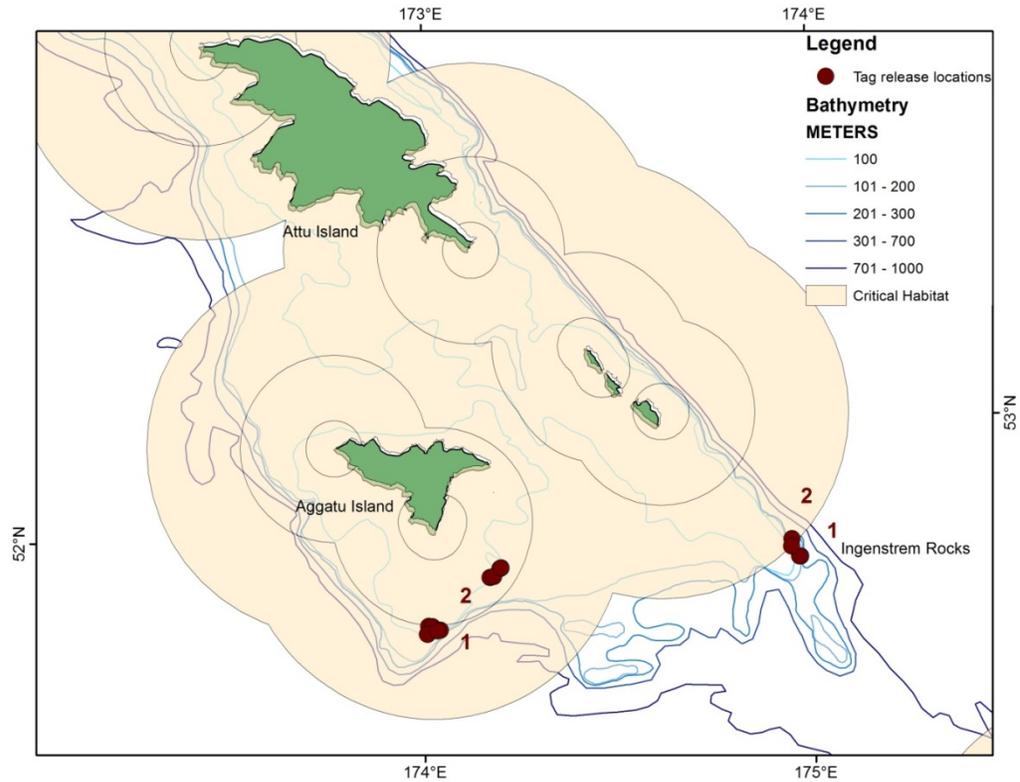


Figure 4. Tag release locations and stratum numbers near Aggatu Island and at Ingenstrem Rock area. Critical habitat is denoted with lines at its 3mi, 10nmi, and 20nmi extent.

Camera tows

An underwater video camera was deployed near a number of successful haul locations. The camera was lowered to near the bottom with an electric winch while the ship drifted. A live video feed allowed the camera operator to keep the camera near the bottom during towing. Camera tows were used to document bottom type, and the presence of invertebrates and fish. Table 3 lists the locations of camera tows at each study area and Figures 5-7 show camera tow locations.

Table 3. Locations of successful camera tows. Latitude and longitude are in decimal degrees.

Haul	Area	Starting Latitude N	Starting Longitude	Longitude E or W
108	Seguam	52.17	-173.06	W
116	Tahoma Seamount	51.83	175.28	E
124	Walls Plateau	52.19	175.07	E
129	Aggatu	52.20	173.84	E
136	Aggatu	52.35	173.94	E
138	Aggatu	52.35	173.94	E
139	Ingenstrem Rock	52.63	174.67	E
141	Ingenstrem Rock	52.62	174.70	E
143	Buldir	52.44	175.73	E
144	Buldir	52.44	175.72	E
145	Heck Canyon	52.10	174.79	E

Biological samples

Otoliths, gonads and stomachs were sampled from 197 Atka mackerel captured in 21 hauls. We generally sampled otoliths, gonads, and stomachs from 5 males and 5 females in each haul; in a small number of hauls, we sampled fewer than 10 total fish. To maximize the number of tagged and released fish in hauls where the Atka catch was minimal, no biological samples were taken from 13 small hauls. Despite this limitation, biological samples were still collected from each study area.

Length frequency

In order to examine any bias in the length selection of the tagged fish, it was necessary to obtain length frequencies from the total catch. In larger hauls (containing approximately 500 or more Atka mackerel), approximately 100 non-tagged fish were sacrificed for length frequencies. In smaller hauls (approximately 500 or fewer Atka mackerel), 40-80 non-tagged fish were sacrificed. A total of 1498 fish were sacrificed for length frequencies. Results of the length frequencies by study areas are presented in Figure 5.

In addition, gonad maturity state was assessed visually and male color code was recorded for every sampled fish. Males with immature, developing, and mature gonad states were sampled. Males of all color codes (1: Males same color as females, 2: Males yellow, but not in full nest guarding coloration, 3: Males in full nest guarding coloration.) were sampled, with the majority of fish displaying the same color as females. Sampled females were either immature or had yolked ovaries.

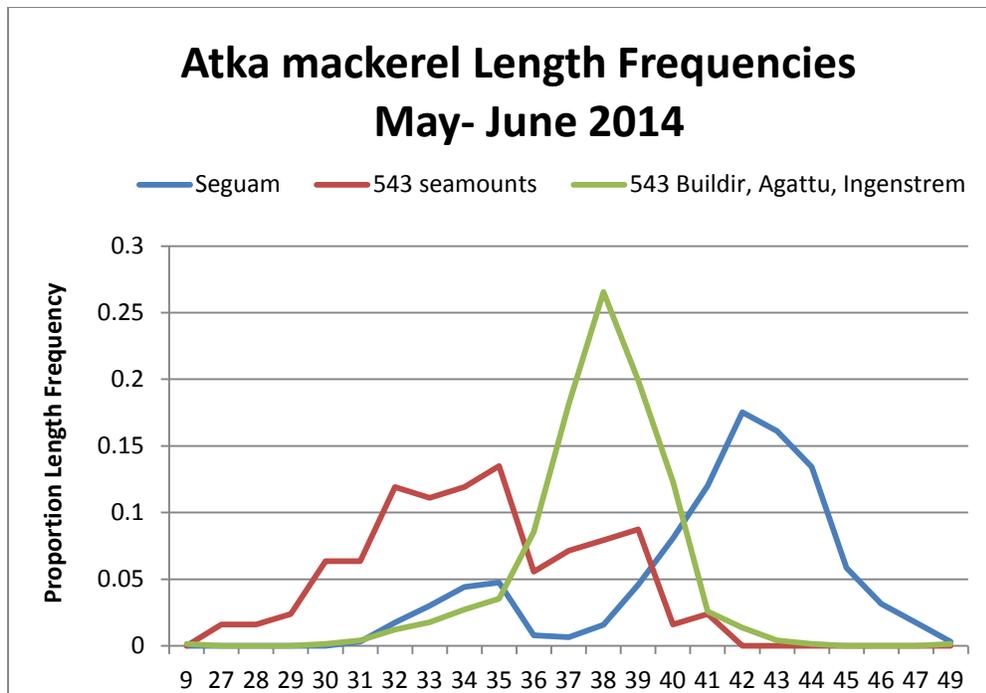


Figure 5: Proportion of Atka mackerel length frequencies in the different study areas. Data for Buildir, Agattu, and Ingenstrem were pooled since they were very similar.

Species catch and composition estimates

Since the focus of this study was to tag and release wild fish it was essential to handle the fish as delicately as possible. Therefore we did not weigh the codend to get total catch weight, as this would have resulted in high fish mortality due to the pressure on the fish in the codend while hanging from a scale. For the same reason, species composition was not quantitatively estimated for each haul. The estimates of Atka mackerel and bycatch species captured during this study presented here are therefore based on qualitative visual estimates of catch. Because catch size and composition varied considerably between Seguam Pass (NMFS Area 541) and the WAI (NMFS Area 543), catch for each area was estimated separately. We assumed that catch size was on the average 1.5 mt in NMFS Area 541 and 1.0 mt in NMFS Area 543, with the catch of the entire cruise totaling 37.5 mt. Of the total catch of Atka mackerel of 24.08 mt, approximately 14.45 mt (60%) was released alive, assuming an average fish weight of 700 g.

Table 4. Species composition and catch weight estimates in NMFS Areas 541 and 543.

NMFS Area 541

Species	% of total catch	Weight per haul (mt)	Total catch (mt)
Atka mackerel	75%	1.13	7.88
Northern Rockfish	10%	0.15	1.05
Pacific Ocean Perch	10%	0.15	1.05
Pacific Cod	2%	0.03	0.21

Other species	3%	0.05	0.32
Total Catch	100%	1.50	10.50

NMFS Area 543

Species	% of total catch	Weight per haul (mt)	Total catch (mt)
Atka mackerel	60%	0.60	16.20
Northern Rockfish	15%	0.15	4.05
Pacific Ocean Perch	15%	0.15	4.05
Pacific Cod	7%	0.07	1.89
Other species	3%	0.03	0.81
Total Catch	100%	1.00	27.00

Mortality study

In 25 hauls spread across all fishing areas, approximately 1% of fish were randomly selected and placed into flow-through seawater tanks. Fish were kept for at least 48 hours to assess mortality rate following capture, handling, and tagging. 5 experiments were conducted over the course of the cruise. In 2 experiments, some fish experienced holding times of much greater than 96 hours and dense crowding. At this point, fish developed lesions and heavy bruising. It is likely these effects, which only appeared after multiple days of holding, reflected crowded tank conditions as opposed to capture and tagging stress. Therefore, we only assessed mortality within 96 hours of capture. Of the 156 fish participating in the experiments, a total of 11 died within 96 hours of capture, a mortality rate of 7.05%.

Oceanography

Temperature, salinity and depth data were collected with a calibrated Seabird SBE19*plus* SEACAT CTD deployed at tagging haul locations (Table 5 and Figures 6-8). Temperature-depth data were also collected with a Seabird SBE39 microbathythermograph (MBT) mounted on the net. Temperature-salinity data were also collected with a Shlumberger Water Services CTD-Diver mounted on the net.

Continuous data on surface temperature, salinity, fluorescence (a measure of chlorophyll), date, time and position was collected using the SBE45 Micro TSG, a GPS and an interface box. The system is made of these instruments feeding data into a ruggedized laptop. Data was collected 24 hours a day from May 19, 2014 until June 7, 2014. Transects spaced at 3 nmi apart were run at night by the vessel crew in all study areas.

Table 5. Locations of Seabird SBE19*plus* SEACAT CTD deployment at each study area. Latitude and longitude are in decimal degrees.

Cast	Area	Latitude N	Longitude	Longitude E or W	Bottom depth (m)
1	Seguam	52.10	-171.89	W	133
2	Seguam	52.04	-172.02	W	96
3	Seguam	52.05	-172.12	W	118
4	Seguam	52.25	-172.78	W	136
5	Seguam	52.26	-172.76	W	149
6	Buldir East	52.28	176.00	W	132
7	Buldir East	52.21	176.11	E	120
8	Tahoma Reef	52.69	175.60	E	143
9	Tahoma Seamount	52.83	175.31	E	118
10	Walls Plateau	52.19	175.08	E	145
11	Walls Plateau	52.19	175.12	E	140
12	Walls Plateau	52.20	175.09	E	145
13	Walls Plateau	52.20	175.15	E	147
14	Buldir West	52.46	175.61	E	118
15	Buldir West	52.46	175.60	E	127
16	Agattu	52.20	173.84	E	96
17	Agattu	52.20	173.87	E	94
18	Agattu	52.18	173.83	E	96
19	Agattu	52.31	173.92	E	102
20	Agattu	52.33	173.93	E	102
21	Agattu	52.33	173.95	E	110
22	Ingenstrom Rock	52.63	174.67	E	116
23	Ingenstrom Rock	52.62	174.70	E	118
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26	Buldir West	52.44	175.73	E	127

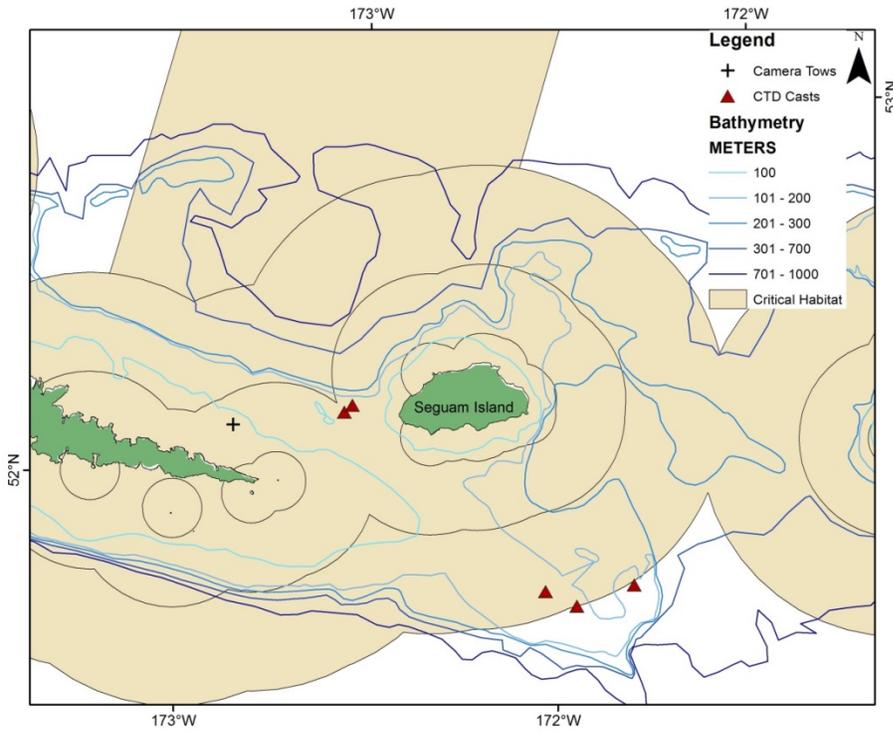


Figure 6. CTD casts and camera tows near Segum Island. Critical habitat is denoted with lines at the 3mi, 10mi, and 20mi extent.

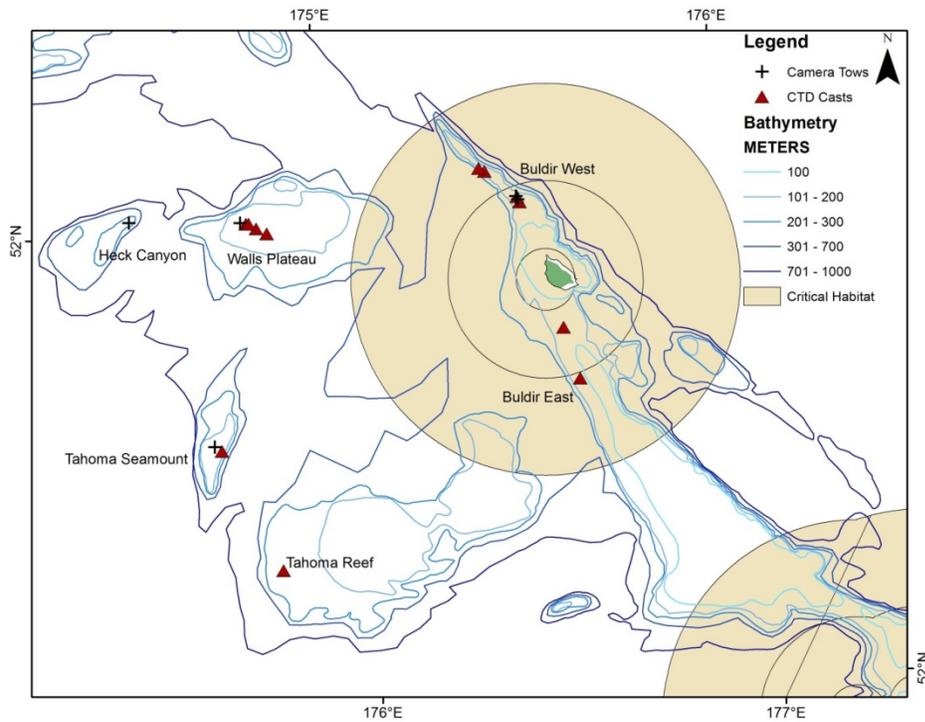


Figure 7. CTD casts and camera tows near Buldir Island and in the WAI Seamounts. Critical habitat is denoted with lines at the 3mi, 10mi, and 20mi extent.

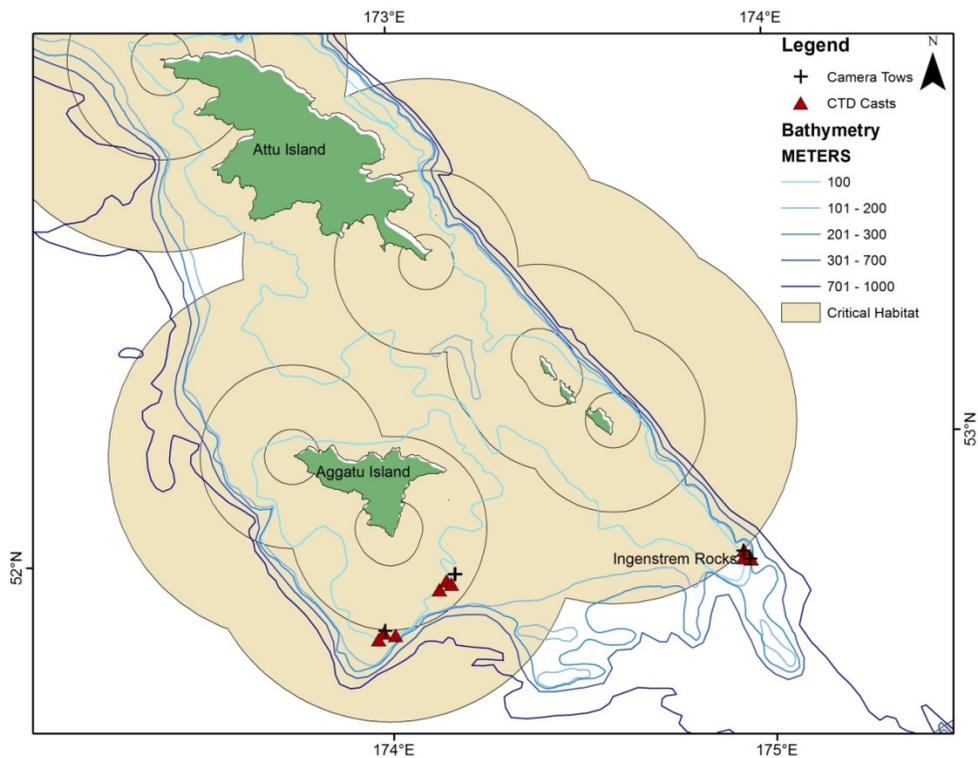


Figure 8. CTD casts and camera tows near Aggatu Island and at the Ingenstrem Rocks. Critical habitat is denoted with lines at the 3mi, 10nmi, and 20nmi extent.

Special projects

Three special projects were collected at the request of other scientists. Each is summarized below.

Special project 1: Recovering moored hydrophones for Killer Whale Acoustic Predation project

Paul Wade, NOAA National Marine Mammal Laboratory, deployed acoustic moored hydrophones at Cape St. Stevens, Kiska Island and Ulak Island in October 2012. Previous attempts to recover these hydrophones in summer 2013 were unsuccessful. We attempted to retrieve the hydrophone at Kiska Island on 05/27/2014 and 06/08/2014, and the hydrophone at Ulak Island on 06/09/2014. On each attempt, we first used vessel Sonar equipment to attempt to identify moored hydrophones and areas of interest. We then used a grapple, mounted and towed from the trawl main wire, to make a series of passes at and near the deployment location of the hydrophone. Despite many attempts at each location, we were unable to locate or recover either moored hydrophone.

Special project 2: Request for fish samples for stable isotope and mercury analysis

Lorrie Rea, University of Alaska Fairbanks, is examining carbon and nitrogen stable isotopes and mercury concentrations of Steller sea lion prey species in the Aleutian Islands. We collected muscle and liver samples from approximately 50 Atka mackerel and 50 Pacific cod for this analysis. Fish were collected at all Study sites in NMFS area 543 as well as at Segum Pass in NMFS area 541.

Special project 3: Incidental Wildlife Observations

Marine mammals, including Dall's porpoise and Orca whales, were seen opportunistically. Sightings were generally made while in the wheelhouse. The species and number of marine mammals observed was recorded, along with the date, time and location.

Adult and sub-adult Short-tailed albatross were also seen opportunistically, usually during camera tows and tag release activities. An especially high concentration was noted in Segum Pass on 05/22/2014, when 3 adult and 8 sub-adult Short-tailed albatross were seen at one time. The age and number of the albatross were recorded, along with the date, time and location.

SCIENTIFIC STAFF

<u>Name</u>	<u>Sex/Natl.</u>	<u>Position</u>
1. Susanne McDermott	F/USA	Field Party Chief
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3. Mike Levine	M/USA	Contract Biologist
4. Kali Turner	F/USA	Contract Biologist
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