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SEABIRD, FISH, MARINE MAMMAL AND OCEANOGRAPHY COORDINATED INVESTIGATIONS (SMMOCI) IN THE CENTRAL ALEUTIAN ISLANDS, ALASKA, JULY 2009

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Executive Summary

We conducted surveys of seabirds, fish, marine mammals and oceanographic conditions in the central Aleutian Islands, Alaska from the *M/V Tiĝlax̂* during 16-21 July 2009 as part of the Seabird, Fish, Marine Mammal and Oceanography Coordinated Investigations (SMMOCI) project. The primary objective was to characterize the marine environment in the vicinity of Kasatochi, Koniuji and Ulak islands, which together form one of nine seabird colonies monitored annually by the Alaska Maritime National Wildlife Refuge. We also assessed the short-term impacts of the August 2008 eruption of Kasatochi Volcano on the nearshore environment around the island. The study area in 2009 was similar to that in 1996 and 2003, except that we added transects that extended through Atka, Fenimore and Tagalak passes in 2003 and 2009.

In addition to surveying seabirds and marine mammals on transects, we characterized local oceanography by measuring water temperature and salinity continuously at the sea surface and by taking profiles of the water column.

We measured the relative abundance of zooplankton and fish biomass using a dual-frequency echosounder and sampled with a mid-water trawl net to help determine which species were associated with observed acoustic sign. We set longlines to catch large demersal fish species, used bottom trawls to describe the bottom fauna and sampled plankton at several sites.

In 2009 we counted a total of 19,400 birds on 26 transects covering 425 linear km of surveys, resulting in an average density of approximately 124 birds/km^2 over an area of 157 km^2; similar to the density found during the 1996 and 2003 surveys.

The northern fulmar was the most numerous bird species seen during our survey, followed by crested, least and whiskered auklets, and tufted puffins. The greater numbers of whiskered and least auklets counted in 2003 and 2009 compared to 1996 were likely the result of our surveying through the passes (an area not covered in 1996) and the high concentrations of these two species in and near the passes.

As was the case in 1996 and 2003, we found that the highest acoustic biomass occurred in the deeper waters north of Kasatochi Island as well as in the passes. We captured no fish during longline operations near Kasatochi Island in 2009, likely due to the deposition of volcanic material from the 2008 eruption onto the seabed around the island, thereby reducing or eliminating suitable habitat for large demersal fishes or their prey near Kasatochi Island.

The CTD profiles along transects 9, 12 and 26 in 2009 were similar to those from 2003, and profiles from all years indicated a generally more stratified water column in the north and more mixed waters to the south. The patterns of sea surface temperature and salinity also were similar in all three sample years; warmer, less saline conditions to the north and colder, more saline waters near the passes to the south, indicating upwelling of north Pacific water through the passes.

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Introduction

We conducted surveys of seabirds, fish, marine mammals and oceanographic conditions in the central Aleutian Islands, Alaska (Figures 1 and 2) from the *M/V Tiĝlax̂* during 16-21 July 2009 as part of the Seabird, Fish, Marine Mammal and Oceanography Coordinated Investigations (SMMOCI) project. The objective was to characterize the marine environment in the vicinity of Kasatochi, Koniuji and Ulak islands, which together form one of nine seabird colonies monitored annually by the Alaska Maritime National Wildlife Refuge (Dragoo et al. 2010). Kasatochi Island erupted on 7 August 2008 and buried the island under several meters of ash. In addition to surveying seabirds and marine mammals on transects, we characterized local oceanography by measuring water temperature and salinity continuously at the sea surface and by taking profiles of the water column at numerous stations on a series of CTD (conductivity, temperature and depth) transects. The relative biomass of zooplankton and fish was measured with a dual-frequency echosounder, and a mid-water trawl was used to identify species associated with the acoustic signal. We set longlines to catch large demersal fish species, used bottom trawls to describe the bottom fauna and sampled plankton at several sites. This report summarizes the data collected from the 2009 SMMOCI cruise to the central Aleutian Islands.

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Methods

Bird and Marine Mammal Observations

We counted birds and marine mammals using strip transect methods described by Gould and Forsell (1989), and employed on previous SMMOCI cruises. Two observers, stationed on the flying bridge of the *M/V Tiĝlax̂* (one on each side of the ship), continuously recorded all birds observed on the water within 150 meters on either side of, and 300 meters in front of, the vessel, while the vessel traveled at 9-10 knots. Flying birds were counted on 180° "scans" 150 m forward of and 150 m to each side of the vessel's bow every 30 seconds. We radioed observations to data recorders who logged data into computers using dLog2 (R. G. Ford Consulting, Portland, OR), which assigned all records GPS positions in real time.

We conducted surveys on 26 transects, which included circumnavigations of Kasatochi, Koniuji and Ulak islands at approximately 1.9 km (1 nm) offshore, and surveys through Atka, Fenimore and Tagalak passes (Table 1, Figure 3). Data were used to map bird and marine mammal distributions and estimate corresponding densities.

Hydroacoustic Surveys

Acoustic data from a dual frequency (38 and 120 kHz) Simrad EK500 echosounder were used to assess potential pelagic prey abundance along the same transects and concurrently with marine bird and mammal observations (Figure 3). The threshold for data collection was set at -80 dB. We echo-integrated acoustic data to a maximum depth of 250 m, excluding the surface bubble layer (top 10 m), bad data regions and the bottom. Data were exported into 1 minute by 50, 100 and 250 m depth bins. Only data from the 120 kHz transducer were integrated and summarized for this report because this frequency tends to highlight the size range of typical seabird prey species; 38 kHz data were archived but are not reported here.

Fishing

In general, approximately one-third of the preliminary target areas, primarily in the eastern portion of the study area, were not sampled during the SMMOCI fishing effort in 2009 due to stormy weather. Several of the specimens captured during this study represent range extensions that will be subsequently reported in the formal literature.

Trawls and Tows.— We conducted several types of trawls to relate midwater and shallow nearshore community composition with the hydroacoustic record of biomass. Midwater tows used a 6-m modified herring trawl (with a PVC collecting bucket containing 1-mm mesh), towed for about 10 to 20 minutes at 2–3 kts over ground. A depth sounder attached to the headrope of the midwater trawl provided real-time feedback on fishing depth. A temperature-depth recorder (TDR) attached to the headrope provided water temperature at the fished depth. Midwater trawl collections were identified to the lowest practical taxonomic level, invertebrates and fishes counted, and total length of fishes (nearest mm) measured.

Bottom trawling involved a 3.05-m plumb staff beam trawl, with a cod end of 4-mm stretched mesh, towed for five to 10 minutes at approximately 1.5 kts in the direction of the water current. A TDR attached to the trawl headrope recorded temperature and depth. Catch was identified to the lowest practical taxonomic level, enumerated, and fishes measured for total length (nearest mm).

Longline Sets.— For each longline set, we deployed a single skate with a target of about 100 hooks (size 15/0), baited with salted herring and soaked for about two hours. Catch was identified to species, sampled for total length (nearest mm), sex and weight (nearest 0.1 kg), and stomachs removed and frozen for diet analysis.

Plankton Hauls—While the vessel was drifting following some trawl tows, we sampled plankton in the water column by vertical hauls of a 0.5-m plankton net (0.5 m mouth and 505 µm mesh) from the shallower of either near-bottom or 100 m. Catch was preserved in 10% formalin until subsequent identification. The hauls probably underestimated the relative abundance of some zooplankton species, particularly larger animals (e.g., shrimps and krill) that swim strongly enough to avoid the net (B. Holladay, University of Alaska Fairbanks, pers. comm.).

Oceanographic Data

Water Column Temperature and Salinity Profile.—We deployed a portable CTD (Sea-Bird Seacat SBE-19 Profiler) at the start and end of all transects, approximately every 3.7 km (2 nm) along transect lines 09, 12 and 26 (Figure 3), and at the end of each fishing event (trawl, tow or longline set) to obtain temperature and salinity profiles from the surface to the shallower of either near-bottom or approximately 100 m. We analyzed data using VG gridding with Ocean Data View® (Schlitzer 2004).

Sea Surface Temperature and Salinity.—Sea surface temperature and salinity were continuously recorded while underway using a Sea-Bird Seacat SBE21 thermosalinograph. We used VG gridding in Ocean Data View® (Schlitzer 2004) to generate temperature and salinity contour maps as a way of illustrating the occurrence of surface structures such as fronts.

Results

Bird and Marine Mammal Observations

In 2009 we counted a total of 19,400 birds on 26 transects covering 425 linear km of surveys (Table 2), resulting in an average density of approximately 124 birds/km^2 over an area of 157 km^2.

Procellariids.—Almost all of the Laysan and black-footed albatrosses were encountered over the relatively deep water north of the 50 fathom (91.4 m) depth contour (Figure 4). Most mottled petrels occurred between Kasatochi and Koniuji islands (Figure 5). Northern fulmars were widely distributed throughout the survey area, with highest concentrations near Fenimore Pass and Ulak Island (Figure 5). All but one of the shearwaters identified to species were short-tailed shearwaters (Table 2). Shearwaters were widely distributed, but most occurred over relatively deep waters (Figure 6). The majority of storm-petrels were observed over water deeper than 50 fathoms (91.4 m), primarily between Kasatochi and Koniuji islands (Figure 7).

Cormorants.—Cormorants were seen inshore and in the passes (Figure 8).

Shorebirds.—We saw one least sandpiper (Table 2). Phalaropes (almost entirely red phalaropes) were widely distributed, especially in the passes and the eastern part of the survey area (Figure 9).

Gulls and Kittiwakes.—Glaucous-winged gulls and black-legged kittiwakes were seen over both deep and relatively shallow waters throughout the survey area (Figure 10).

Murres and Guillemots.—We found murres to be patchily distributed, with concentrations near Koniuji and Ulak islands as well as in the passes (Figure 11). Most of the murres identified to species were thick-billed murres (Table 2). We observed pigeon guillemots almost entirely in the passes (Figure 12).

Murrelets and Auklets.—Most ancient murrelets occurred in the western portion of the study area, especially north of Ulak Island (Figure 12). Crested auklets were the most numerous auklets observed (Table 2) and, along with least auklets, were found throughout the study area, with concentrations near Kasatochi and Koniuji islands and in the passes. We found the highest concentrations of Cassin's and whiskered auklets in or near the passes, with other auklet species more widely distributed (Figures. 13-15).

Puffins.— Tufted puffins, which substantially outnumbered horned puffins (Table 2), occurred over most of the study area with higher concentrations associated with islands and passes (Figure 16). Horned puffins had a patchy distribution throughout the survey area (Figure 16).

Marine Mammals.—We saw many groups of Dall's porpoise on transects, almost all over relatively deep water (Table 2, Figure 17).

Prey

Acoustic Surveys.—In general, acoustic biomass was greatest near the islands, in passes and in deeper waters in the northern portion of our study area (Figures 18-20).

Mid-water Trawls.— We conducted three mid-water trawls in 2009 (Table 3, Figure 21). Krill (euphausiids) was the most numerous invertebrate, followed by jellyfish (Table 4). The most numerically abundant fishes captured were juveniles, typically larval stages (Tables 4 and 5).

Bottom Trawls.— The ten bottom trawls conducted in 2009 (including one repeat tow: BT09b) yielded a wide variety of invertebrate and fish species (Table 3, Figure 21). Yellow-legged Pandalid shrimp was the most abundant species (n=1,723), with large catches in tows BT02 and BT09b (Table 6). Other invertebrates for which one hundred or more individuals were caught included Atlantic daisy brittle star, northern crangon, circumpolar shrimp, slenderbeak coastal shrimp and Aleutian urchin (Table 6). Several of the invertebrates captured were colonial organisms (e.g., hydroids and bryozoans) and are only documented here as being "present" rather than our attempting to quantify abundances.

Among bottom trawl tows, fewer than 10 specimens were caught for 75% of the fish species captured. Northern rock sole, the most abundant fish species caught (n=168), occurred in over half of the tows but was most abundant in tow BT03 (Table 6). Length data were collected from 23 fish species, although many of these species were represented by only a single specimen (Table 5). For most species caught, including the three most abundant species, northern rock sole, fourhorn sculpin and northern sculpin, specimen size was generally 100 mm or less in total length (Figure 22).

Longline Sets.— Two longline sets were made in 2009 (Table 3, Figure 21). The first set, involving 79 hooks fished near Ulak Island, caught 7 Pacific cod, 12 Pacific halibut, and 18 Yellow Irish lord (Table 7). The second longline set, 100 hooks placed near Kasatochi Island, generated no catch. Specimens caught on longlines ranged from 353 mm to 1,004 mm in total

length, with relative sizes generally being Pacific halibut > Pacific cod > yellow Irish lord (Table 8, Figure 23). The majority of the specimens were male fish.

Shrimp comprised the bulk (percent frequency of occurrence and count) of the diet of Pacific cod caught on longlines (Table 9). Atka mackerel and other fishes constituted the majority of cod diet by weight. Fish remains comprised the majority of the diet of the Pacific halibut captured on longlines (Table 10). Yellow Irish lord exhibited a varied diet dominated by brittle stars (Table 11).

Plankton Tows.—We conducted three vertical plankton tows in 2009 (Table 3, Figure 21). Copepods, mostly *Eucalanus bungii* and *Neocalanus plumchrus*, were the most abundant catch among tows (Table 12).

Oceanography

Water Column Profile.—Profiles from a total of 47 casts (Table 13, Figure 24) generally indicated a stratified water column in the north with mixed water nearer the passes. Intrusions of cooler, more saline water from below occurred in places and probably were associated with local bathymetry and currents (Figures 25 and 26).

Sea Surface Temperature and Salinity.— Surface waters over the deeper, offshore areas to the north tended to be relatively warm and less saline whereas cooler, more saline conditions predominated in the shallower portions and passes of the southern part of the study area (Figure 27).

Discussion

The study area for our 2009 central Aleutian Island SMMOCI cruise was similar to that in 1996 and 2003 (Drew et al. 2003, Dragoo 2007), including the transects that were added in 2003 extending through Atka, Fenimore and Tagalak passes. Overall seabird density in the central Aleutian Islands in 2009 was similar to that found in 1996 and 2003 (Table 14).

The northern fulmar was the most numerous bird species seen during our survey, followed by crested, least and whiskered auklets, and tufted puffins. The greater numbers of whiskered and least auklets counted in 2003 and 2009 compared to 1996 were likely the result of our surveying through the passes (an area not covered in 1996) and the high concentrations of these two species in and near the passes.

As was the case in 1996 and 2003 (Drew et al. 2003, Dragoo 2007), we found that the highest acoustic biomass occurred in the deeper waters north of Kasatochi Island as well as in the passes. We captured no fish during longline operations near Kasatochi Island in 2009, likely due to the deposition of volcanic material from the 2008 eruption onto the seabed around the island, thereby reducing or eliminating suitable habitat for large demersal fishes or their prey near Kasatochi Island.

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conditions to the north and colder, more saline waters near the passes to the south, indicating upwelling of north Pacific water through the passes.

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Table 1. Locations, dates and times of surveys used for bird and marine mammal observations, and hydroacoustics surveys in the central Aleutian Islands, Alaska in 2009.

Transect	Start Latitude (°N)	Start Longitude (°W)	Stop Latitude (°N)	Stop Longitude (°W)	Date	Start Time[a]	Stop Time[a]
1	52.0412°	175.9412°	52.1712°	176.0010°	7/16	16:14	17:08
2	52.1718°	176.0013°	52.1712°	175.8342°	7/16	17:23	18:02
3	52.1755°	175.8288°	52.0127°	175.8367°	7/18	10:05	11:09
4	52.0142°	175.8365°	51.9852°	175.7525°	7/18	11:22	11:45
5	51.9878°	175.6695°	51.9865°	175.7460°	7/19	13:40	13:59
6	52.1967°	175.6546°	51.9862°	175.6631°	7/18	14:12	15:35
7	52.1935°	175.6605°	52.2267°	175.5002°	7/18	18:23	19:03
8	52.2282°	175.4997°	52.1972°	175.5057°	7/18	19:16	19:30
9	52.1497°	175.5058°	52.0088°	175.5022°	7/19	09:11	10:40
10	52.0098°	175.5068°	51.9957°	175.3817°	7/19	10:52	11:23
11[b]	52.0437°	175.3395°	52.0267°	175.3628°	7/20	16:13	16:28
12	52.2488°	175.3395°	52.0458°	175.3375°	7/20	13:30	16:01
13	52.2585°	175.2045°	52.2498°	175.3307°	7/20	12:43	13:15
14	52.0788°	175.1665°	52.2815°	175.1667°	7/20	11:00	12:18
15	52.1187°	174.9980°	52.0808°	175.1562°	7/20	10:08	10:48
16	52.3168°	174.9922°	52.1208°	175.0003°	7/20	08:41	09:56
17	52.0203°	175.9123°	52.0208°	175.9122°	7/16	13:25	14:20
18	51.9890°	175.7517°	52.1797°	175.7512°	7/18	11:57	13:27
19[c]	51.9755°	175.5815°	52.1992°	175.5817°	7/18	16:14	17:41
19[d]	51.9867°	175.7453°	51.9762°	175.5840°	7/19	14:04	15:50
20	52.1447°	175.5025°	52.1445°	175.5058°	7/19	07:48	0858
21	52.0018°	175.4182°	52.2498°	175.4163°	7/19	16:43	18:08
22	52.2628°	175.2495°	52.0728°	175.2503°	7/21	12:42	14:03
23	52.2135°	175.1005°	52.2138°	175.1010°	7/21	10:32	11:30
24	52.1742°	175.8277°	52.1847°	175.7508°	7/16	18:21	18:40
25	52.0037°	175.3720°	51.9865°	175.6645°	7/19	12:14	13:33
26	52.0590°	175.9077°	52.1723°	175.9162°	7/18	08:13	09:26

[a]All times are Aleutian Daylight (Universal Coordinated Time minus 9 hours).
[b]Transect not finished due to rough seas.
[c]Straight line portion of transect 19.
[d]Portion of transect 19 that traversed Fenimore and Tagalak passes.

Table 2. Species composition and numbers of seabirds and marine mammals observed on 26 transects in the central Aleutian Islands, Alaska in 2009.

Species	Scientific Name	No. Observed	Density[a]	% Total
All Bird Species Total		19,400	123.57	100.00
Common eider	*Somateria mollissima*	2	0.01	0.01
Laysan albatross	*Phoebastria immutabilis*	49	0.31	0.25
Black-footed albatross	*Phoebastria nigripes*	8	0.05	0.04
Northern fulmar	*Fulmarus glacialis*	5073	32.31	26.15
Mottled petrel	*Pterodroma inexpectata*	5	0.03	0.03
Sooty shearwater	*Puffinus griseus*	1	0.01	0.01
Short-tailed shearwater	*Puffinus tenuirostris*	354	2.25	1.82
Unidentified shearwater	*Puffinus* sp.	352	2.24	1.81
Fork-tailed storm-petrel	*Oceanodroma furcata*	91	0.58	0.47
Leach's storm-petrel	*Oceanodroma leucorhoa*	8	0.05	0.04
Unidentified storm-petrel	*Oceanodroma* sp.	4	0.03	0.02
Red-faced cormorant	*Phalacrocorax urile*	25	0.16	0.13
Pelagic cormorant	*Phalacrocorax pelagicus*	1	0.01	0.01
Unidentified cormorant	*Phalacrocorax* sp.	8	0.05	0.04
Least sandpiper	*Calidris minutilla*	1	0.01	0.01
Red-necked phalarope	*Phalaropus lobatus*	27	0.17	0.14
Red phalarope	*Phalaropus lobatus*	1095	6.97	5.64
Unidentified phalarope	*Phalaropus* sp.	4	0.03	0.02
Glaucous-winged gull	*Larus glaucescens*	353	2.25	1.82
Black-legged kittiwake	*Rissa tridactyla*	63	0.40	0.32
Pomarine jaeger	*Stercorarius pomarinus*	1	0.01	0.01
Long-tailed jaeger	*Stercorarius longicaudus*	1	0.01	0.01
Common murre	*Uria aalge*	30	0.19	0.15
Thick-billed murre	*Uria lomvia*	226	1.44	1.16
Unidentified murre	*Uria* sp.	172	1.10	0.89
Pigeon guillemot	*Cepphus columba*	26	0.17	0.13
Ancient murrelet	*Synthliboramphus antiquus*	115	0.73	0.59
Cassin's auklet	*Ptychoramphus aleuticus*	212	1.35	1.09
Parakeet auklet	*Aethia psittacula*	350	2.23	1.80
Least auklet	*Aethia pusilla*	1916	12.20	9.88
Whiskered auklet	*Aethia pygmaea*	2322	14.79	11.97
Crested auklet	*Aethia cristatella*	3509	22.35	18.09
Unidentified auklet	*Aethia* sp.	921	5.87	4.75
Unid. small dark alcid	*Alcidae* sp.	24	0.15	0.12

Table 2. Species composition and numbers of seabirds and marine mammals observed on 26 transects in the central Aleutian Islands, Alaska in 2009 (continued).

Species	Scientific Name	No. Observed	Density[a]	% Total
Horned puffin	*Fratercula corniculata*	82	0.52	0.42
Tufted puffin	*Fratercula cirrhata*	1894	12.06	9.76
Dall's porpoise	*Phocoenoides dalli*	75	0.48	0.39

[a]Individuals/km^2. A total of approximately 157 km^2 was surveyed.

Table 3. Location, time and depth for fishing efforts in the central Aleutian Islands, Alaska in 2009.

Set[a]	Date	Time set[b]	Duration (minutes)[c]	Start Latitude (N)	Start Longitude (W)	End Latitude (N)	End Longitude (W)	Bottom Depth (m)	Gear Depth (m)	Water Temperature (°C)
BT01	7/16	11:17	14	52.0667°	175.8833°	ND[d]	ND	78-100	78-100	4.6-5.4
LL01	7/16	12:45	135	52.0333°	175.9167°	52.0167°	175.9467°	25-65	25-61	ND
BT02	7/16	20:35	10	52.0500°	175.9333°	ND	ND	77-84	77-84	5.0-5.4
BT03	7/17	15:50	10	52.0483°	175.9733°	52.0483°	175.9800°	--	32-38	5.5-6.4
BT04	7/18	20:08	10	52.1505°	175.4933°	52.1483°	175.4950°	--	20-26	5.2-5.9
BT05	7/18	21:02	10	52.1378°	175.4817°	52.1408°	175.4850°	--	45-64	4.7-5.0
VT01	7/18	21:19	--	52.1408°	175.4850°	--	--	26	20	ND
BT06	7/18	22:28	11	52.1355°	175.5010°	52.1310°	175.4997°	--	46-49	4.7-4.9
VT02	7/18	22:45	--	52.1328°	175.4953°	--	--	50	40	ND
BT07	7/19	01:14	10	52.1522°	175.5492°	52.1482°	175.5468°	79-89	51-91	5.0-5.2
MW01	7/19	04:20	20	52.1650°	175.8528°	52.1635°	175.8728°	570	5-34	6.0-7.6
LL02	7/19	19:30	--	52.1567°	175.5408°	52.1625°	175.5403°	29-33	29-33	ND
MW02	7/19	20:00	10	52.2038°	175.4732°	52.1920°	175.4550°	25-75	6-65	5.2-6.8
MW03	7/20	00:13	11	52.1610°	175.3757°	52.1580°	175.3632°	217-245	4-30	5.1-7.6
VT03	7/20	00:46	--	52.1612°	175.3667°	--	--	263	100	ND
BT08	7/20	02:08	10	52.1963°	175.1553°	52.1943°	175.1667°	--	101-151	3.6-4.3
BT09	7/20	03:18	10	52.1985°	175.1237°	52.1992°	175.1297°	127-126	94-109	4.1-4.5
BT09b	7/20	04:20	11	52.1960°	175.1167°	52.1962°	175.1053°	130-141	130-139	3.8-4.1

[a] MW = Midwater trawl, BT = Bottom trawl, LL = Longline set, VT = Vertical plankton tow

[b] All times are Aleutian Daylight (Universal Coordinated Time minus 9 hours).

[c] Time at target depth.

[d] ND = no data.

Table 4. Species composition and numbers of specimens captured with mid-water trawls during SMMOCI sampling in the central Aleutian Islands, Alaska in 2009.

Common name	Scientific name	Tow number MT01	MT02	MT03	Species Total
	Invertebrates				
Jellies					
Bubble Jelly	*Aequorea victoriae*	3	8	--	11
Jellyfish unid.	Medusa unid.	2	3	27	32
Larvacean	*Oikopleura* sp.	--	1	--	1
Eggyolk jelly	*Phacellophora camtschatica*	--	1	2	3
Thimble jellyfish	*Sarsia* sp.	24	89	16	129
Moon Jelly	*Aurelia labiata*	1	--	2	3
Lion's mane jelly	*Cyanea capillata*	--	--	3	3
Other invertebrates					
Arrow Worm	*Eukrohnia hamata*	--	1	--	1
Hyperiid Amphipod	*Hyperia medusarum*	1	2	--	3
Gammarid Amphipod	Pardaliscidae unid.	--	1	--	1
Athecata hydroid unid.	Anthomedusae unid.	36	3	--	39
Squid Unid	Teuthidae unid.	9	2	--	11
Neocalanus copepod	*Neocalanus plumchrus*	--	320	27	347
Eucalanus copepod	*Eucalanus bungii*	--	68	--	68
Krill	*Thysanoessa longipes*	14,121	31	5	14,157
Crab megalops	Cheiragonidae unid.	--	1	--	1
	Vertebrates				
Pacific cod	*Gadus macrocephalus*	--	--	1	1
Cod larvae unid.	Gadidae unid.	--	1	--	1
Atka mackerel	*Pleurogrammus monopterygius*	--	--	1	1
Poacher juvenile unid.	Agonidae unid.	1	--	--	1
Fish larvae unid.	Teleost unid.	4	--	--	4
	Other items caught				
Brown algae unid.	Laminariales unid.	--	--	P[a]	P
	Trawl Total	14,202	532	84	14,818

[a] P = present but not enumerated.

Table 5. Total lengths (mm) of fish species captured with (A) mid-water trawls and (B) bottom trawls during SMMOCI sampling in the central Aleutian Islands, Alaska in 2009.

	Mean	Standard Deviation	Range	Sample size
A. Midwater Trawl				
Pacific cod	1,080.0	NA[a]	NA	1
Gadidae juvenile	17.3	1.5	16-19	3
Atka mackerel	232.0	NA	NA	1
B. Bottom Trawl				
Alaska skate	270.0	NA	NA	1
Darkblotched rockfish	85.6	21.4	74-138	8
Sebastes unid. juvenile	69.6	11.6	53-84	14
Kelp greenling	82.5	0.7	82-83	2
Scalybreasted sculpin	49.9	10.4	34-76	19
Scissortail sculpin	119.0	60.8	76-162	2
Spectacled sculpin	33.0	12.7	24-42	2
Ribbed sculpin	105.5	41.9	56-150	6
Butterfly sculpin	85.0	NA	NA	1
Yellow Irish lord	169.3	87.2	118-270	3
Northern sculpin	66.5	11.4	50-102	20
Fourhorn sculpin	44.3	8.1	32-64	39
Eyeshade sculpin	83.0	NA	NA	1
Darkfin sculpin	43.5	0.7	43-44	1
Alligator fish	116.0	NA	NA	1
Sturgeon poacher	25.0	NA	NA	1
Pacific spiny lumpsucker	26.0	NA	NA	1
Marbled snailfish	70.0	NA	NA	1
Lobefin snailfish	55.0	2.6	53-58	3
Searcher	123.0	NA	NA	1
Arrowtooth flounder	110.0	NA	NA	1
Northern rock sole	78.4	78.3	18-422	167

[a]Not applicable.

Table 6. Species composition and numbers of specimens captured with bottom trawls during SMMOCI sampling in the central Aleutian Islands, Alaska in 2009.

Common name	Scientific name	Tow number										Species
		BT01	BT02	BT03	BT04	BT05	BT06	BT07	BT08	BT09a	BT09b	Total
Invertebrates												
Sponges and Cnidarians												
Scapula sponge unid.	Demospongia unid.	--	P[a]	--	--	--	--	--	--	--	--	P
Sponge unid.	*Halichondria* sp.	--	P	--	--	--	--	--	--	--	--	P
Orange papillated sponge	*Inflatella* sp.	--	2	--	--	--	--	--	--	--	--	2
Mycale sponge unid.	*Mycale* sp.	--	P	--	--	--	--	--	--	--	--	P
Orange finger sponge	*Neoesperiopsis rigida*	--	--	--	--	--	P	--	--	--	--	P
Sponge unid.	*Plakina* sp.	--	P	--	--	--	--	--	--	--	--	P
Hairy urn sponge	*Scypha ciliata*	P	--	--	--	--	--	--	--	--	--	P
Hermit sponge	*Suberites ficus*	--	2	1	--	--	1	--	--	--	--	4
Sea strawberry	*Gersemia rubiformis*	--	--	--	--	1	--	--	--	--	--	1
Hydroid unid.	Hydroida unid.	P	--	--	--	--	P	P	P	P	P	P
Sea fir	*Abietinaria* sp.	--	P	--	--	P	P	P	P	P	P	P
Annelids												
Polychaete unid.	Phyllodocidae unid.	7	--	--	--	--	--	--	--	--	--	7
Scaleworm unid.	Polynoid unid.	3	5	--	--	--	--	--	--	--	--	8
Serpulid unid.	*Serpula* sp.	1	--	--	--	--	--	--	--	--	--	1
Jellyfishes												
Moon jelly	*Aurelia labiata*	--	--	--	1	--	--	--	1	--	--	2
Jellyfish unid.	Medusa unid.	1	--	--	--	--	--	--	1	--	--	2
Thimble jellyfish	*Sarsia* sp.	4	--	--	75	--	--	--	--	2	--	81
Bivalves												
Rock jingle	*Pododesmus macroschisma*	--	2	--	--	--	--	--	--	--	--	2
Arctic hiatella	*Hiatella arctica*	1	--	--	--	--	--	--	--	1	--	2
British Columbia cranella	*Megacranella columbiana*	1	7	--	--	--	--	--	--	--	3	11
Northern horse mussel	*Modiolus modiolus*	--	4	--	--	--	--	--	--	--	--	4
Pink scallop	*Chlamys rubida*	1	9	--	--	--	--	--	--	--	--	10
Alaska glass scallop	*Parvamussium alaskense*	5	27	--	--	--	--	--	--	--	--	32
Gastropods												
Clark's Buccinum sp. C	*Buccinum* sp.	--	--	--	--	--	1	--	--	--	--	1
Hall's colus	*Colus halli*	1	--	--	--	--	--	--	--	--	--	1

Table 6. Species composition and numbers of specimens captured with bottom trawls during SMMOCI sampling in the central Aleutian Islands, Alaska in 2009 (continued).

Common name	Scientific name	Tow number										Species Total
		BT01	BT02	BT03	BT04	BT05	BT06	BT07	BT08	BT09a	BT09b	
Gastropods (cont.)												
Oregon triton	*Fusitriton oregonensis*	--	68	--	--	1	5	--	--	--	--	73
Nut whelk	*Liomesus ooides*	--	--	3	--	--	--	--	--	--	--	3
Margarites snail unid.	*Margarites* unid.	1	--	--	--	--	--	--	--	--	--	1
Thick-ribbed whelk	*Neptunea brevicauda*	--	1	--	--	--	--	--	--	--	--	1
Sandpaper trophon	*Scabrotrophon* sp.	1	--	--	--	--	--	--	--	--	--	1
Velvet snail	*Velutina* sp.	--	3	--	--	--	--	--	--	--	--	3
Nudibranchs												
Aeolis unid.	*Dendronotus* sp.	--	2	--	--	--	--	--	--	--	--	2
Aeolis unid.	*Flabellina* sp.	--	--	1	--	--	--	--	--	--	--	1
Sea clown triopha	*Triopha catalinae*	--	3	--	--	--	--	--	--	--	--	3
Sea clown triopha	*Triplax* sp.	--	3	--	--	--	--	--	--	--	--	3
Nudibranch unid.	Tritoniidae unid.	--	18	--	--	--	--	--	--	--	1	19
Misc. Molluscs												
Octopus unid.	Octopoda unid.	--	1	--	--	--	--	--	--	--	--	1
Crabs												
Pygmy rock crab	*Cancer oregonensis*	--	--	--	--	--	1	--	--	--	--	1
Red hermit	*Elassochirus gilli*	--	--	--	--	--	2	--	--	--	--	2
Widehand hermit	*Elassochirus tenuimanus*	--	--	--	--	9	48	1	--	--	--	58
Soft crab	*Hapalogaster grebnitzkii*	--	--	--	--	--	3	--	--	--	--	3
Pacific lyre crab	*Hyas lyratus*	--	4	--	--	--	--	--	--	--	--	4
Splitnose crab	*Oregonia bifurca*	--	1	--	--	--	--	--	--	--	--	1
Decorator crab	*Oregonia gracilis*	--	96	--	--	7	7	--	1	1	15	127
Sponge hermit	*Pagurus brandtii*	--	33	--	--	--	1	1	--	--	--	35
Blue spined hermit	*Pagurus kennerleyi*	--	1	--	--	--	--	--	--	--	--	1
Alaska hermit	*Pagurus ochotensis*	--	--	33	--	--	--	--	--	--	--	33
Alaska hermit	*Pagurus stevensae*	--	--	--	--	--	1	--	--	--	--	1
Fuzzy hermit	*Pagurus trigonocheirus*	--	51	--	--	--	5	--	--	--	1	57
Red king crab	*Paralithodes camtschatica*	--	1	--	--	--	--	--	--	--	--	1

Table 6. Species composition and numbers of specimens captured with bottom trawls during SMMOCI sampling in the central Aleutian Islands, Alaska in 2009 (continued).

Common name	Scientific name	Tow number										Species
		BT01	BT02	BT03	BT04	BT05	BT06	BT07	BT08	BT09a	BT09b	Total
Shrimps												
Rough argid	*Argis crassa*	1	6	--	--	--	61	--	--	--	--	68
Smooth argid	*Argis laevior*	--	--	3	--	--	--	--	--	--	--	3
Split-eye argid	*Argis ovifer*	--	--	--	--	--	--	--	--	--	5	5
Northern crangon	*Crangon alaskensis*	--	--	153	--	1	--	--	23	--	--	177
Dall's crangon	*Crangon dalli*	--	--	--	--	--	--	--	--	--	6	6
Barbed eualid	*Eualus barbatus*	--	--	--	--	--	--	--	--	--	22	22
Circumpolar shrimp	*Eualus gaimardii*	--	121	--	--	--	--	--	--	--	--	121
Eualid unid.	*Eualus* sp. 1	--	--	--	--	--	--	--	1	--	2	3
Eualid undesc.[b]	*Eualus* sp. 2	--	--	--	--	--	--	--	6	--	24	30
Townsend eualid	*Eualus townsendi*	--	15	--	--	--	--	--	5	--	22	42
Northern coastal shrimp	*Heptacarpus camtschaticus*	--	21	--	--	--	--	--	--	--	--	21
Slenderbeak coastal shrimp	*Heptacarpus flexus*	--	107	--	--	--	--	--	3	--	3	113
Threespine coastal shrimp	*Heptacarpus tridens*	1	--	--	--	--	--	--	--	--	--	1
Clown shrimp	*Lebbeus acudactylus*	--	--	--	--	--	--	--	1	--	1	2
Northern spinyhead	*Mesocrangon intermedia*	--	--	--	--	1	--	--	4	1	7	13
Mysid shrimp unid.	*Mysid* sp.	--	--	5	--	--	--	--	--	--	--	5
Humpy shrimp	*Pandalus goniura*	1	--	--	--	--	--	--	--	--	--	1
Rough-patch shrimp	*Pandalus stenolepis*	--	30	--	--	--	--	--	--	--	--	30
Yellow-legged Pandalid	*Pandalus tridens*	9	1,335	--	--	--	--	--	31	1	347	1,723
Saddle-back shrimp	*Rhynocrangon alata*	--	21	--	--	--	--	--	--	--	--	21
Sharp's saddle-back shrimp	*Rhynocrangon sharpi*	4	78	--	--	--	--	--	1	--	9	92
Rathbuns's bladed shrimp	*Spirontocaris arcuata*	--	31	--	--	--	--	--	--	--	--	31
Oval blade shrimp	*Spirontocaris ochotensis*	6	2	--	--	--	--	--	16	1	39	64
Deep blade shrimp	*Spirontocaris prionota*	1	1	--	--	--	--	--	--	--	--	2
Krill												
Euphausiids	*Thysanoessa longipes*	1	--	--	--	--	--	--	4	3	--	8
Isopods												
Sea cockroach	*Rocinela angustata*	--	1	--	--	--	1	--	--	--	--	2

Table 6. Species composition and numbers of specimens captured with bottom trawls during SMMOCI sampling in the central Aleutian Islands, Alaska in 2009 (continued).

Common name	Scientific name	Tow number										Species
		BT01	BT02	BT03	BT04	BT05	BT06	BT07	BT08	BT09a	BT09b	Total
Amphipods												
Amphipod unid.	Amphipoda unid.	--	1	--	--	--	--	--	--	--	--	1
Arcturid unid.	*Arcturid* sp.	--	--	--	--	--	--	--	--	--	1	1
Amphipod unid.	Ischyrocirdae unid.	--	--	--	1	--	--	--	--	--	--	1
Gammarid amphipod unid.	*Monoculoides* sp.	--	--	--	1	--	5	2	--	--	--	8
Pleustoid amphipod unid.	Pleustoidia unid.	2	--	P	--	--	--	--	--	--	--	2
Sea stars												
Orange cookie star	*Ceramaster patagonicus*	1	3	--	--	--	--	--	--	--	--	4
Common rose star	*Crossaster papposus*	--	12	--	--	--	--	--	--	--	--	12
Spiny Henricia	*Henricia spiculifera*	--	3	--	--	--	--	--	--	--	--	3
Fat Henricia	*Henricia tumida*	--	--	--	--	--	--	--	1	--	--	1
Greenland star	*Leptasterias groenlandica*	--	7	--	--	--	--	--	--	--	--	7
Black spined star	*Lethasterias nanimensis*	--	3	--	--	--	--	--	--	--	--	3
Atlantic daisy brittle star	*Ophiopholis aculeata*	--	310	--	--	--	--	--	--	--	--	310
Japanese daisy brittle star	*Ophiopholis japonica*	2	--	--	--	--	26	--	--	--	--	28
Long-spined Ophiopholis	*Ophiopholis longispina*	--	5	--	--	--	--	--	--	--	--	5
Basket star	*Ophiura quadrispina*	--	7	--	--	--	--	--	--	--	--	7
Notched brittle star	*Ophiura sarsi*	1	--	--	--	--	1	--	1	--	4	7
Prickly cushion star	*Pteraster marsippus*	--	3	--	--	--	--	--	--	--	--	3
Obscure cushion star	*Pteraster obscurus*	--	1	--	--	--	--	--	--	--	--	1
Tesselated slime star	*Pteraster tesselatus*	--	1	--	--	--	--	--	--	--	--	1
Sea star unid.	Solaster sp.	--	4	--	--	--	--	--	--	--	--	4
Other Echinoderms												
Pale sea football	*Cucumaria fallax*	--	--	--	--	--	1	--	--	--	--	1
Challenger cucumber	*Synallectes challengeri*	--	6	--	--	--	--	--	--	--	--	6
Pink-orange urchin	*Strongylocentrotus fragilis*	--	1	--	--	--	--	--	--	--	--	1
Aleutian urchin	*Strongylocentrotus polycanthus*	2	136	--	--	5	17	--	--	--	--	160
Northern sand dollar	*Echincarachnius parma*	--	--	25	--	--	--	--	--	--	--	25
Bryozoans												
Smooth leather byrozoan	*Alcyonidium produnculata*	--	P	--	--	--	--	--	--	--	--	P
Bryozoan unid.	*Alcyonidium* sp.	P	P	--	--	--	--	--	--	--	--	P

Table 6. Species composition and numbers of specimens captured with bottom trawls during SMMOCI sampling in the central Aleutian Islands, Alaska in 2009 (continued).

Common name	Scientific name	Tow number										Species
		BT01	BT02	BT03	BT04	BT05	BT06	BT07	BT08	BT09a	BT09b	Total
Bryozoans (cont.)												
Fan bryozoan	*Dendrobeania* sp.	P	P	--	--	--	--	--	P	P	P	P
Nodding head unid.	*Entoprocta* sp.	P	--	--	--	--	--	--	--	--	--	P
Nodding head unid.	*Eualus* cf *pusiolus*	1	--	--	--	--	--	--	--	--	--	1
Fluted byrozoan unid.	*Hippodiplosia* sp.	P	--	--	--	--	--	--	--	--	--	P
Stick bryozoan	*Microporina* sp.	P	--	--	--	--	--	--	--	--	--	P
Lacy bryozoan	*Phidolopora pacifica*	1	P	--	--	--	--	--	P	P	--	1
Ribbed bryozoan	*Rhamphostomella costata*	--	P	--	--	--	--	--	--	--	--	0
Other invertebrates												
Striped sea leech	*Notostomum cyclostomum*	--	1	--	--	--	--	--	5	--	--	6
Sea spider	*Nymphon* cf *pixellae*	--	28	--	--	--	--	--	--	--	3	31
Urochordates												
Colonial ascidian	Urochordata unid.	--	2	--	--	--	--	--	--	--	--	2
Sea peach	*Halocynthia aurantium*	--	2	--	--	--	--	--	--	--	--	2
Sea onion (not baltanic)	*Synoicum sp.*	--	14	--	--	--	--	--	--	--	3	17
Tunicate unid.	Urochordata unid. sp. 1	--	--	--	--	--	--	--	--	--	3	3
Tunicate unid.	Urochordata unid. sp. 2	--	--	--	--	--	--	--	--	--	2	2
Tunicate unid.	Urochordata unid. sp. 3	--	--	--	--	--	--	--	--	--	3	3
Tunicate unid.	Urochordata unid. sp. 4	--	--	--	--	--	--	--	--	--	4	4
Tunicate unid.	Urochordata unid.	--	2	--	--	--	--	--	--	--	--	2

Table 6. Species composition and numbers of specimens captured with bottom trawls during SMMOCI sampling in the central Aleutian Islands, Alaska in 2009 (continued).

Common name	Scientific name	Tow number										Species
		BT01	BT02	BT03	BT04	BT05	BT06	BT07	BT08	BT09a	BT09b	Total
Vertebrates												
Skates												
Alaska skate	*Bathyraja parmifera*	--	--	--	--	1	--	--	--	--	--	1
Rockfishes												
Darkblotched rockfish	*Sebastes crameri*	--	--	--	--	--	--	--	--	--	8	8
Rockfish juv. unid.	*Sebastes* sp.	--	14	--	--	--	--	--	--	--	--	14
Greenlings												
Kelp greenling	*Hexagrammos decagrammos*	--	--	--	2	--	--	--	--	--	--	2
Sculpins												
Yellow Irish lord	*Hemilepidotus jordani*	--	1	--	--	--	3	--	--	--	--	4
Butterfly sculpin	*Hemilepidotus papilio*	--	--	--	--	--	--	--	--	--	1	1
Northern sculpin	*Icelinus borealis*	2	10	--	--	1	--	--	2	--	7	22
Darkfin sculpin	*Malacocottus zonurus*	--	1	--	--	--	--	--	1	--	--	2
Eyeshade sculpin	*Nautichthys pribilovius*	--	1	--	--	--	--	--	--	--	--	1
Ribbed sculpin	*Triglops pingelii*	--	--	--	--	--	6	--	--	--	--	6
Scissortail sculpin	*Triglops forficatus*	--	2	--	--	--	--	--	--	--	1	3
Spectacled sculpin	*Triglops scepticus*	--	--	2	--	--	--	--	--	--	--	2
Scalybreasted sculpin	*Triglops xenostethus*	--	--	--	--	--	19	--	--	--	--	19
Sculpin unid.	Cottoidea unid.	--	--	--	--	--	5	--	--	--	1	6
Poachers												
Alligatorfish	*Aspidophoroides monopterygius*	--	1	--	--	--	--	--	--	--	--	1
Fourhorn poacher	*Hypsagonus quadricornis*	--	39	--	--	--	--	--	--	--	--	39
Sturgeon poacher	*Podothecus accipenserinus*	--	--	1	--	--	--	--	--	--	--	1
Lumpsucker and Snailfishes												
Pacific spiny lumpsucker	*Eumicrotremus orbis*	--	2	--	--	--	--	--	--	--	1	3
Marbled snailfish	*Liparis dennyi*	--	--	--	--	--	--	--	--	--	1	1
Lobefin snailfish	*Liparis greeni*	--	--	--	3	--	--	--	--	--	--	3
Flatfishes												
Arrowtooth flounder	*Atheresthes stomias*	--	--	--	--	1	--	--	--	--	--	1
Northern rock sole	*Lepidopsetta polyxystra*	--	1	143	1	10	12	1	--	--	--	168

Table 6. Species composition and numbers of specimens captured with bottom trawls during SMMOCI sampling in the central Aleutian Islands, Alaska in 2009 (continued).

Common name	Scientific name	Tow number										Species
		BT01	BT02	BT03	BT04	BT05	BT06	BT07	BT08	BT09a	BT09b	Total
Ronquils												
Searcher	*Bathymaster signatus*	--	17	--	--	--	1	--	--	--	--	18
		Other items in catch										
Three-ribbed kelp	*Cymathere triplicata*	--	--	--	P	--	--	--	--	--	--	P
Brown algae unid	Laminariales unid.	--	--	--	P	--	--	--	--	--	--	P
Red algae unid.	Rhodophyta unid.	--	--	--	P	--	--	--	--	--	--	P
Rocks	Rocks	--	--	--	P	--	P	P	--	--	--	P
Shells	Shells	--	P	--	--	--	P	--	--	--	--	P
	Trawl Total	63	2,754	370	86	38	233	5	108	10	550	4,217

[a]P – present but not enumerated.
[b]Possibly a previously undescribed species.

Table 7. Species composition and numbers of fishes captured with longline gear during SMMOCI sampling in the central Aleutian Islands, Alaska in 2009.

Common name	Scientific name	LL01 (79)[a] Ulak I.	LL02 (100)[a] Kasatochi I.
Pacific cod	*Gadus macrocephalus*	7	0
Yellow Irish lord	*Hemilepidotus jordani*	18	0
Pacific halibut	*Hippoglossus stenolepis*	12	0
	Total	37	0

[a]Number of hooks set in parentheses.

Table 8. Lengths and weights of species captured with longline gear during SMMOCI sampling in the central Aleutian Islands, Alaska in 2009.

		Total length (mm)				Weight (kg)			
Common name	Sex	Mean	SD[a]	Range	n[a]	Mean	SD	Range	n
Pacific cod	Male	666.1	45.1	612-737	7	3.0	0.8	2.1-4.5	7
	Female	NA[b]	NA	NA	0	NA	NA	NA	0
	All	666.1	45.1	612-737	7	3.0	0.8	2.1-4.5	7
Pacific halibut	Male	846.4	72.2	723-937	10	5.7	1.6	3.3-8.5	10
	Female	892.5		781-1004	2	6.9	3.7	4.2-9.5	2
	All	854.1	82.7	723-1004	12	5.9	1.9	3.3-9.5	12
Yellow Irish lord	Male	481.8	27.1	420-522	18	1.3	0.3	0.8-1.9	17
	Female	353.0	NA	NA	1	0.5	NA	NA	1
	All	474.7	40.2	353-522	18	1.2	0.3	0.5-1.9	18

[a]SD = Standard deviation, n = Sample size.
[b]Not applicable.

Table 9. Prey composition of stomach samples taken from Pacific cod caught during longline sets in the central Aleutian Islands, Alaska in 2009 (n = 6 non-empty stomachs).

Prey Name	%FO[a]	%C[a]	%WT[a]
Gastropoda (snail)	33.3	9.4	1.9
Octopoda (octopus)	33.3	6.3	4.7
Isopoda (isopod)	16.7	3.1	0.6
Gammaridea (amphipod)	16.7	12.5	0.8
Natantia (shrimp)	16.7	3.1	0.1
Caridea (shrimp)	83.3	50.0	14.5
Purple hermit (*Elassochirus cavimanus*)	16.7	3.1	13.8
Teleostei (fish)	16.7	3.1	11.1
Non-gadoid fish remains	16.7	6.3	2.1
Atka mackerel (*Pleurogrammus monopterygius*)	16.7	3.1	50.6

[a]%FO = Percent frequency of occurrence, %C = Percent of count, %WT = Percent total weight.

Table 10. Prey composition of stomach samples taken from Pacific halibut caught during longline sets in the central Aleutian Islands, Alaska in 2009 (n = 7 non-empty stomachs).

Prey Name	%FO[a]	%C[a]	%WT[a]
Gastropoda (snail)	14.3	12.5	4.3
Reptantia (crab)	14.3	12.5	2.6
Teleostei (fish)	42.9	37.5	30.0
Non-gadoid fish remains	28.6	25.0	14.8
Gadus macrocephalus (Pacific cod)	14.3	12.5	48.2

[a]%FO = Percent frequency of occurrence, %C = Percent of count, %WT = Percent total weight.

Table 11. Prey composition of stomach samples taken from yellow Irish lord caught during longline sets in the central Aleutian Islands, Alaska in 2009 (n = 8 non-empty stomachs).

Prey Name	%FO[a]	%C[a]	%WT[a]
Polychaeta (polychaete)	37.5	1.5	0.3
Polynoidae (polychaete)	12.5	0.5	0.0
Mollusca	25.0	2.0	3.2
Gastropoda (snail)	25.0	3.6	6.2
Buccinidae (snail)	12.5	0.5	2.0
Pandalus sp.	12.5	0.5	0.6
Paguridae (hermit crab)	25.0	1.0	0.2
Rhinolithodes wosnessenskii (Rhinoceros crab)	25.0	1.5	13.4
Oregonia gracilis (Graceful decorator crab)	12.5	0.5	2.3
Ophiuridae (brittle star)	87.5	87.8	71.1
Non-gadoid fish remains	12.5	0.5	0.7

[a]%FO = Percent frequency of occurrence, %C = Percent of count, %WT = Percent total weight.

Table 12. Counts of individuals captured with plankton tows during SMMOCI sampling in the central Aleutian Islands in 2009.

		Tow Number			Species
Type	Scientific Name	VT01	VT02	VT03	Total
Annelida: Polychaeta	Syllidae family	--	1	--	1
Chaetognatha	*Eukrohnia hamata*	9	12	34	55
Chaetognatha	*Sagitta elegans*	--	--	1	1
Cnidaria: Hydrozoa	*Sarsia* sp.	--	P	--	P
Mollusca: Gastropoda	*Limacina helicina*	--	4	2	6
Crustacea: Amphipoda	*Hyperia medusarum*	1	1	21	23
Crustacea: Anomura	Anomuran zoea	--	3	--	3
Crustacea: Brachyura	Brachyuran zoea	--	6	--	6
Crustacea: Brachyura	Cheiragonidae megalopae unid.	--	1	--	1
Crustacea: Caridea	Caridean zoea	--	1	--	1
Crustacea: Caridea	*Pasiphaea pacifica*	--	3	--	3
Crustacea: Caridea	Pandalidae post larva	1	--	--	1
Crustacea: Caridea	Shrimp zoea	1	--	--	1
Crustacea: Cirripedia	Barnacle cyprid larvae	--	4	--	4
Crustacea: Copepod	*Acartia longiremis*	--	16	--	16
Crustacea: Copepod	*Acartia* sp.	--	--	496	496
Crustacea: Copepod	*Eucalanus bungii*	43	435	1411	1889
Crustacea: Copepod	*Neocalanus plumchrus*	168	187	722	1077
Crustacea: Copepod	*Neocalanus* sp.	--	15	--	15
Crustacea: Euphausiacea	Euphausiid unid. (juv.)	21	19	220	260
Crustacea: Euphausiacea	*Thysanoessa longipes*	1	2	--	3
Chordata: Larvacea	*Oikopleura* sp.	--	54	121	175
Chordata: Teleost	Fish egg	--	2	--	2
	Trawl Total	245	766	3028	4039

Table 13. Locations, times and dates of CTD casts made in the central Aleutian Islands, Alaska in 2009.

Cast	Latitude (N)	Longitude (W)	Date	Time[a]	Depth[b] (m)	Notes[c]
00	52.0761°	175.8946°	16 July	11:52	90 (94)	BT01
01	52.1733°	176.0000°	16 July	17:09	100 (1400)	TX 01, north end
02	52.1707°	175.8318°	16 July	18:03	100 (1195)	TX 02, east end
03	52.1862°	175.7484°	16 July	18:42	100 (700)	TX 24, east end
04	52.0536°	175.9335°	16 July	20:50	70 (78)	BT02
06	52.0483°	175.9783°	17 July	16:09	16 (--[d])	BT03
07	52.0588°	175.9081°	18 July	07:50	100 (101)	TX 26, Sta. 1 (south end)
08	52.1052°	175.9137°	18 July	08:32	80 (88)	TX 26, Sta. 2
09	52.1377°	175.9147°	18 July	08:58	80 (84)	TX 26, Sta. 3
10	52.1752°	175.8313°	18 July	09:52	100 (800)	TX 03, north end
11	52.0127°	175.8373°	18 July	11:08	100 (105)	TX 03, south end
12	51.9848°	175.7529°	18 July	11:44	90 (93)	TX 18, south end
13	52.1810°	175.7518°	18 July	13:27	100 (800)	TX 18, north end
14	52.1963°	175.6568°	18 July	14:00	100 (>1000)	TX 06, north end
16	51.9846°	175.6638°	18 July	15:34	50 (54)	TX 06, south end
17	51.9747°	175.5822°	18 July	16:02	35 (40)	TX 19, south end
18	52.2016°	175.5822°	18 July	17:40	100 (1020)	TX 19, north end
19	52.2270°	175.4990°	18 July	19:02	100 (>1000)	TX 08, north end
21	52.1483°	175.4952°	18 July	20:26	20 (25)	BT04
22	52.1408°	175.4850°	18 July	21:19	20 (26)	BT05, VT01
23	52.1329°	175.4953°	18 July	22:45	40 (50)	BT06, VT02
24	52.1488°	175.5432°	19 July	01:29	50 (57)	BT07
25	52.1635°	175.8728°	19 July	05:00	100 (>250)	MW01
26	52.1490°	175.5010°	19 July	08:58	15 (19)	TX 09, Sta. 1 (north end)
27	52.1077°	175.5057°	19 July	09:26	50 (58)	TX 09, Sta. 2
28	52.0737°	175.5053°	19 July	09:50	60 (62)	TX 09, Sta. 3
29	52.0397°	175.5008°	19 July	10:17	68 (79)	TX 09, Sta. 4
30	52.0075°	175.5020°	19 July	10:39	60 (61)	TX 09, Sta. 5 (south end)
32	51.9950°	175.3800°	19 July	11:23	36 (40)	TX 10, east end
33	52.0017°	175.4207°	19 July	16:32	40 (45)	TX 21, south end
34	52.2510°	175.4163°	19 July	18:08	100 (>1000)	TX 21, north end
35	52.1932°	175.4393°	19 July	20:54	50 (300)	MW02
36	52.1623°	175.5417°	19 July	22:09	30 (36)	LL02
37	52.1612°	175.3667°	20 July	00:39	100 (263)	MW03, VT03
38	52.1969°	175.1577°	20 July	02:31	100 (171)	BT08
39	52.1978°	175.1237°	20 July	03:44	100 (128)	BT09

Table 13. Locations, times and dates of CTD casts made in the central Aleutian Islands, Alaska in 2009 (continued).

Cast	Latitude (N)	Longitude (W)	Date	Time[a]	Depth[b] (m)	Notes[c]
40	52.3153°	174.9940°	20 July	08:27	100 (>1000)	TX 16, north end
41	52.1197°	175.0007°	20 July	09:55	76 (82)	TX 16, south end
42	52.0804°	175.1583°	20 July	10:47	80 (83)	TX 15, west end
43	52.2823°	175.1673°	20 July	12:17	100 (953)	TX 14, north end
44	52.2495°	175.3330°	20 July	13:15	100 (1600)	TX 12, Sta. 1 (north end)
45	52.2129°	175.3412°	20 July	13:42	100 (1262)	TX 12, Sta. 2
46	52.1793°	175.3375°	20 July	14:07	100 (660)	TX 12, Sta. 3
47	52.1445°	175.3382°	20 July	14:34	100 (168)	TX 12, Sta. 4
48	52.1122°	175.3370°	20 July	15:00	100 (120)	TX 12, Sta. 5
49	52.0788°	175.3368°	20 July	15:32	90 (103)	TX 12, Sta. 6
50	52.0450°	175.3380°	20 July	15:59	60 (70)	TX 12, Sta. 7 (south end)

[a]All times are Aleutian Daylight (Universal Coordinated Time minus 9 hours).
[b]Depth of cast. Values in parentheses are bottom depth at cast location.
[c]TX = Transect, MW = Mid-water Trawl, BT = Bottom Trawl, VT = Vertical Plankton Tow, LL = Longline Set.
[d]No data.

Table 14. Estimates of at-sea densities of seabirds near colonies at several Alaskan sites. Data are from cruises similar to the 2009 cruise discussed here and were gathered using similar procedures.

Colony Area	# birds/km^2	Reference
Cape Thompson / Chukchi Sea	54	Piatt et al. 1990
Norton Sound / Northeastern Bering Sea	13	Dragoo 2006*b*
Pribilof Islands / Southeast Bering Sea (1997)	51	Dragoo and Byrd 1998
Pribilof Islands / Southeast Bering Sea (2005)	65[a]	Dragoo 2009
Buldir Island / Western Aleutians	145	Dragoo and Byrd 1999
Kasatochi Island / Central Aleutians (1996)	110	Drew et al. 2003
Kasatochi Island / Central Aleutians (2003)	118	Dragoo 2007
Kasatochi Island / Central Aleutians (2009)	**124**	**This Study**
Aiktak Island / Unimak Pass, Eastern Aleutians	38	Byrd et al. 1997
Semidi Islands / Northern Gulf of Alaska (2001)	93[b]	Dragoo 2006*a*
Semidi Islands / Northern Gulf of Alaska (2004)	68	Dragoo 2006*a*
Barren Islands / Lower Cook Inlet (1992)	174	Piatt 1994
Barren Islands / Lower Cook Inlet (1996)	126	Piatt 2003
Glacier Bay/ Southeast Alaska	21	Robards et al. 2003
St. Lazaria/ Sitka Sound, Southeast Alaska	18	Piatt and Dragoo 2005

[a]Does not include the circumnavigation of St. George Island. Bird density including St. George Island circumnavigation was 99 birds/km^2.

[b]Does not include a flock of approximately 50,000 shearwaters observed on transect. Bird density including this large flock of shearwaters was 476 birds/km^2.

Figure 1. Map of Alaska showing the location of the central Aleutian Islands study area (red dot).

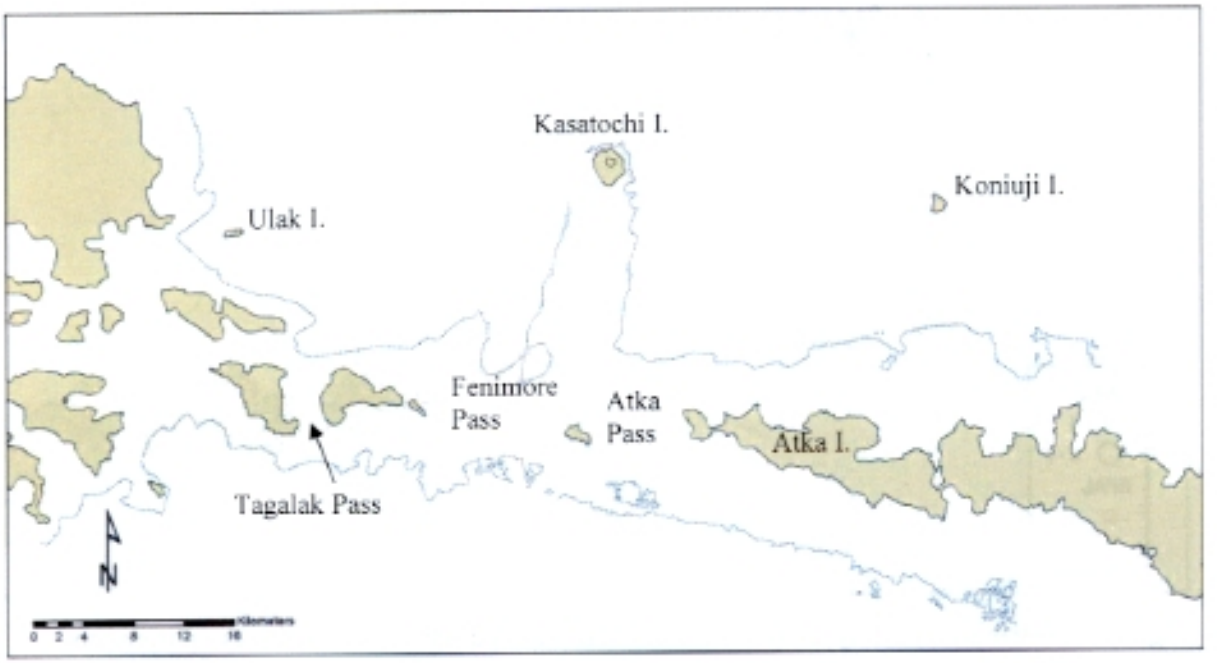

Figure 2. Map of central Aleutian Islands study area. Dotted line represents the 50 fathom (91.4 m) depth contour.

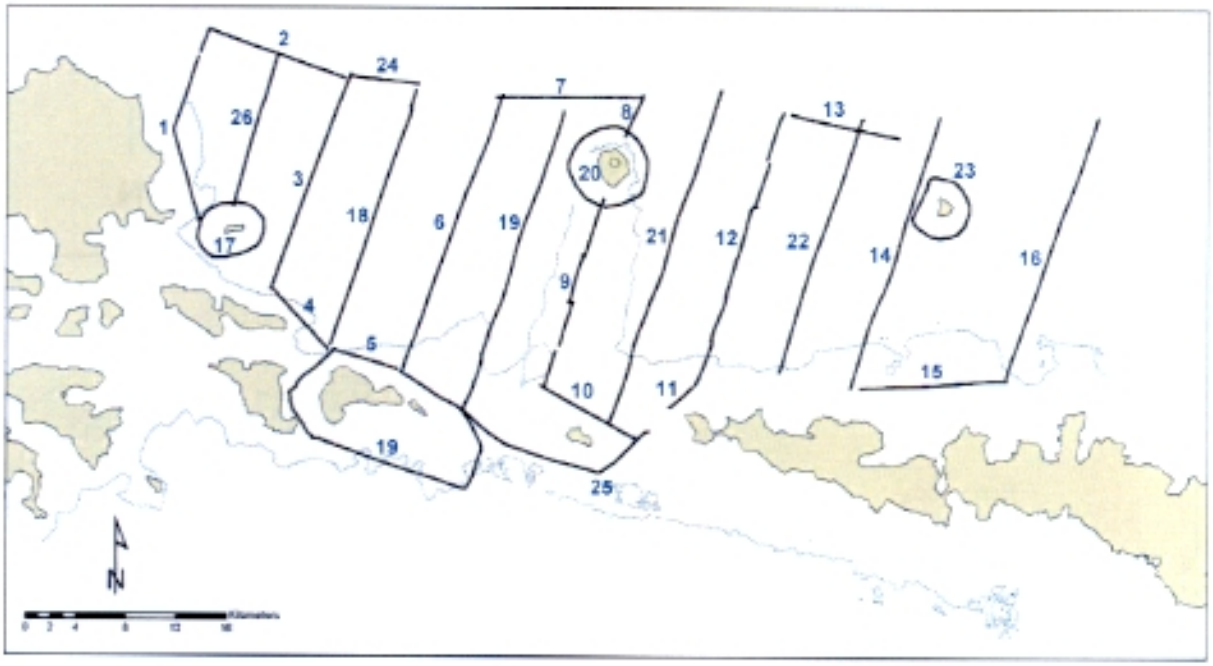

Figure 3. Map of transects surveyed near Ulak, Kasatochi and Koniuji islands, Alaska in 2009. Transects shown were derived from GPS positions recorded during surveys.

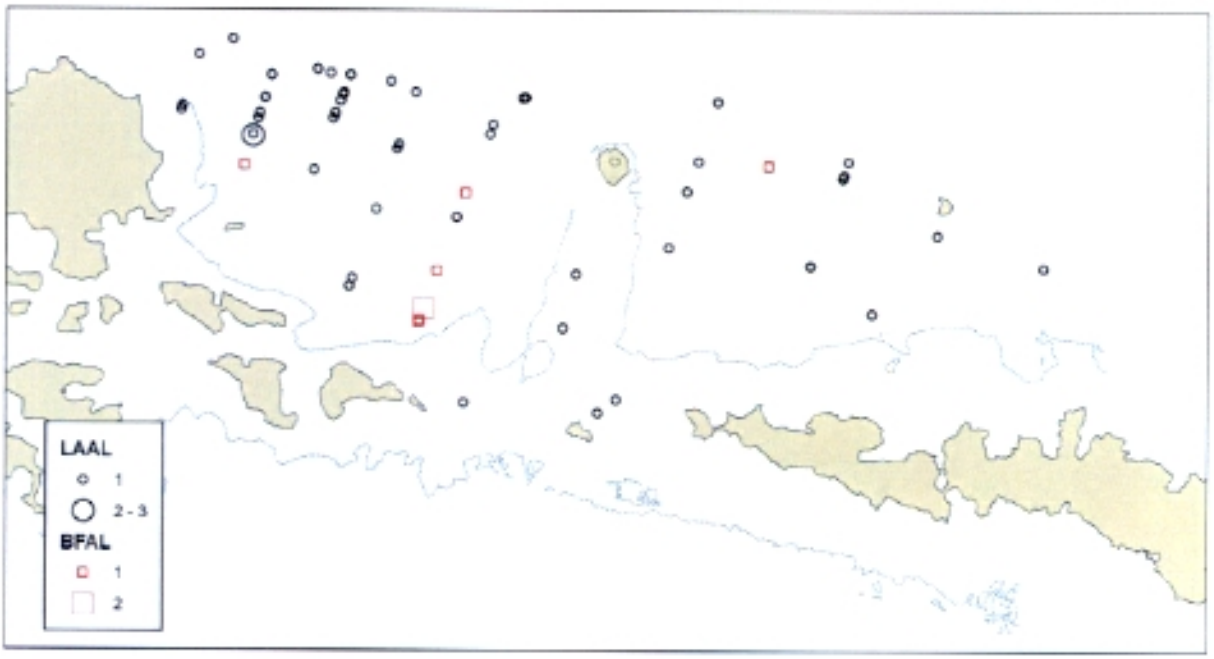

Figure 4. Distribution of Laysan (LAAL) and black-footed (BFAL) albatrosses on transects surveyed in the central Aleutian Islands, Alaska in 2009. Includes birds on water and flying.

Figure 5. Distribution of mottled petrels (MOPE) and northern fulmars (NOFU) on transects surveyed in the central Aleutian Islands, Alaska in 2009. Includes birds on water and flying.

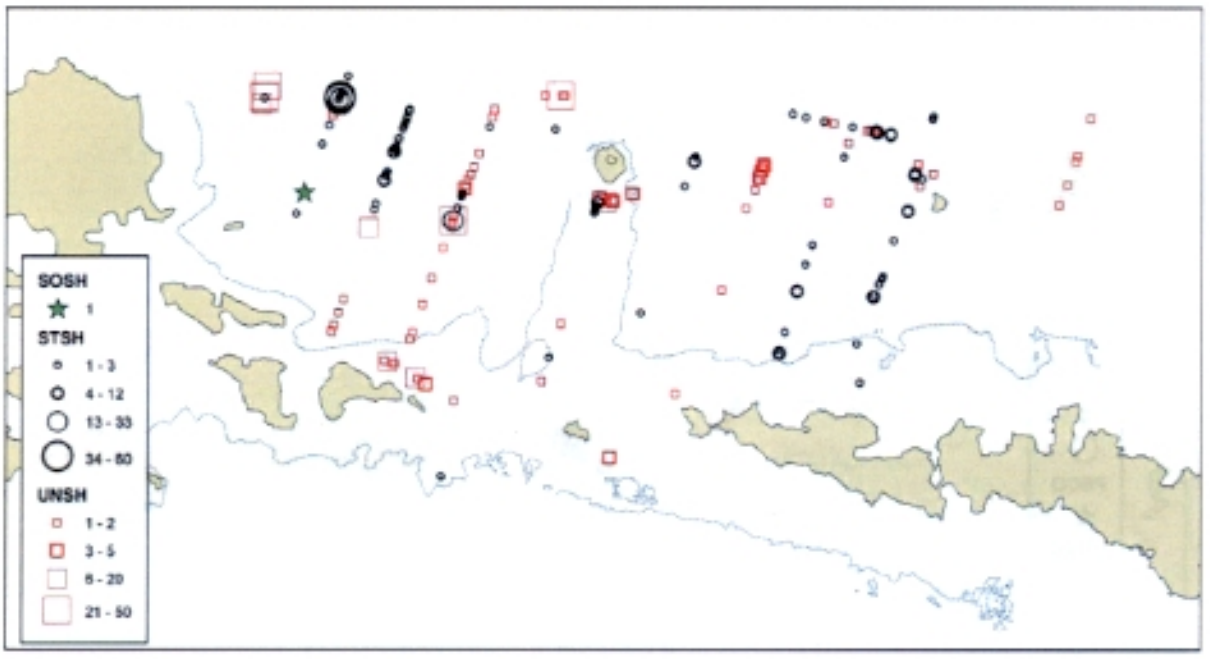

Figure 6. Distribution of sooty (SOSH), short-tailed (STSH) and unidentified (UNSH) shearwaters on transects surveyed in the central Aleutian Islands, Alaska in 2009. Includes birds on water and flying.

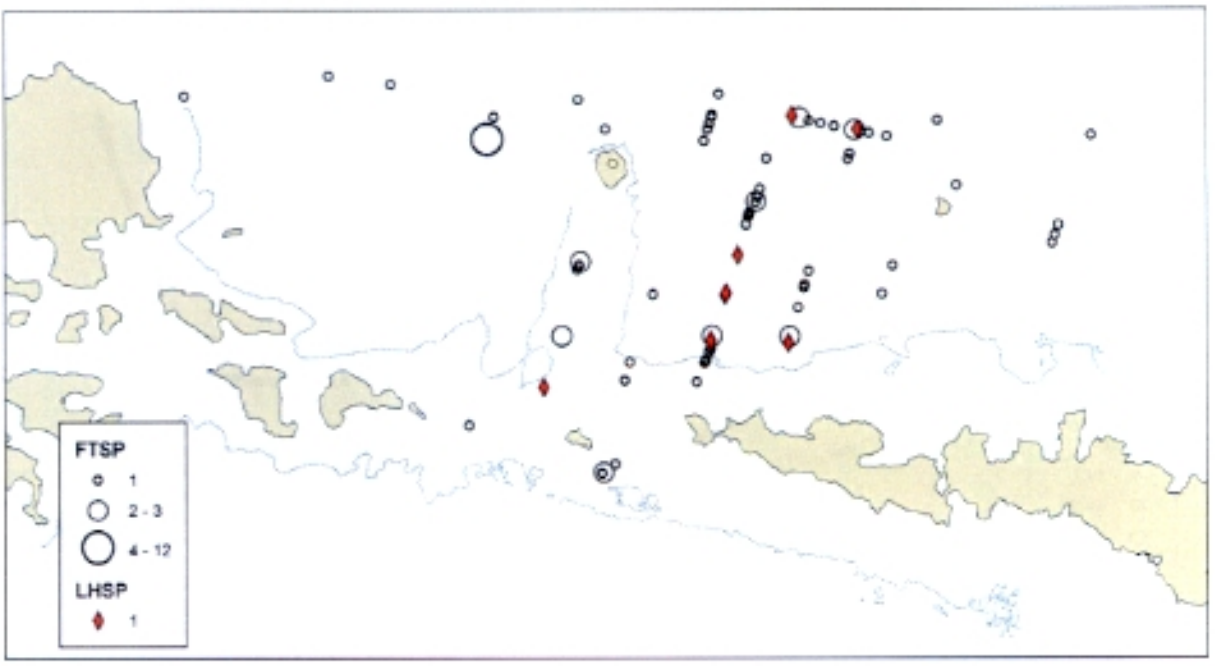

Figure 7. Distribution of fork-tailed (FTSP) and Leach's (LHSP) storm-petrels on transects surveyed in the central Aleutian Islands, Alaska in 2009. Includes birds on water and flying.

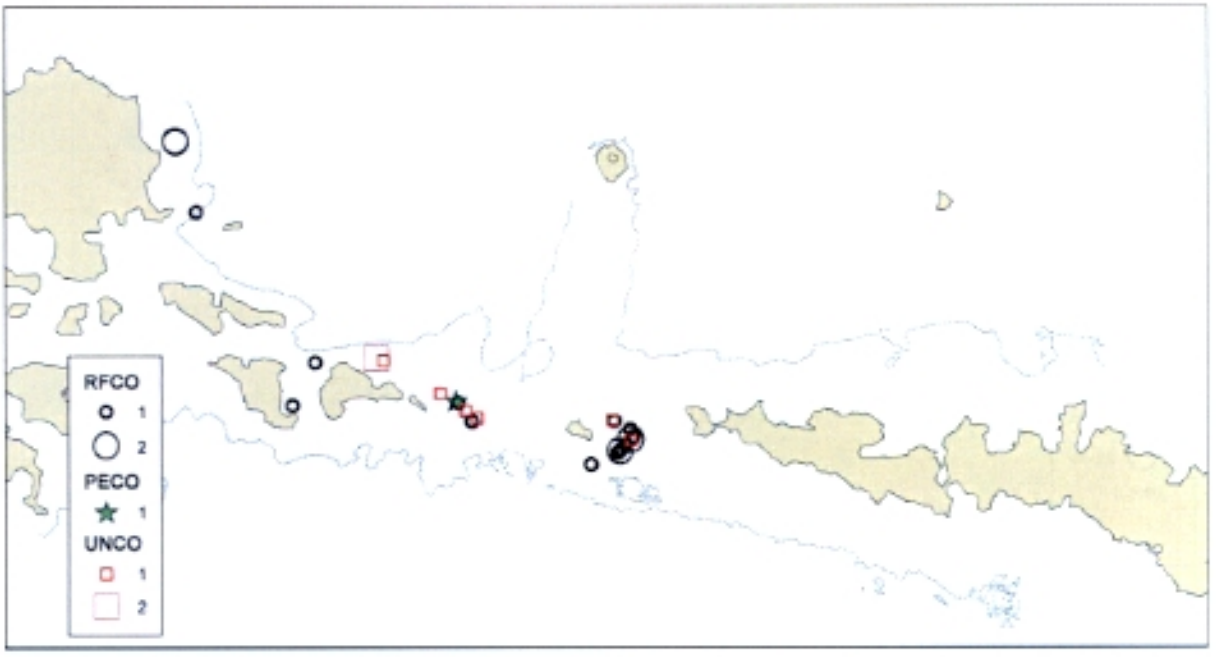

Figure 8. Distribution of red-faced (RFCO), pelagic (PECO) and unidentified (UNCO) cormorants on transects surveyed in the central Aleutian Islands, Alaska in 2009. Includes birds on water and flying.

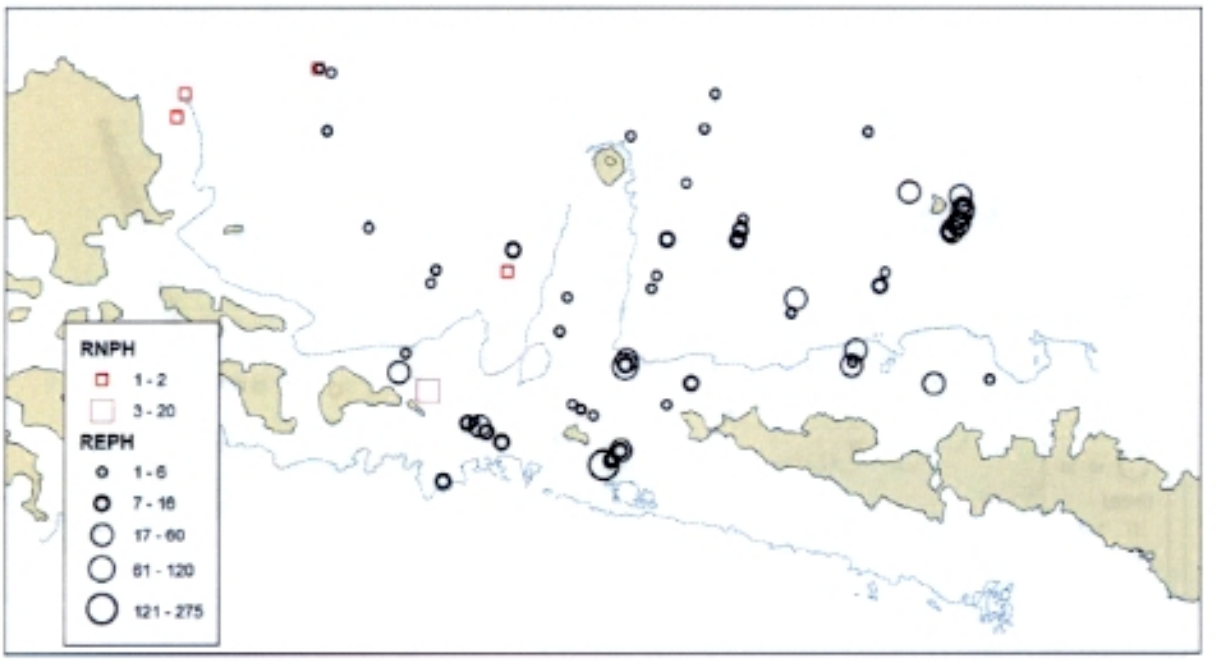

Figure 9. Distribution of red-necked (RNPH) and red (REPH) phalaropes on transects surveyed in the central Aleutian Islands, Alaska in 2009. Includes birds on water and flying.

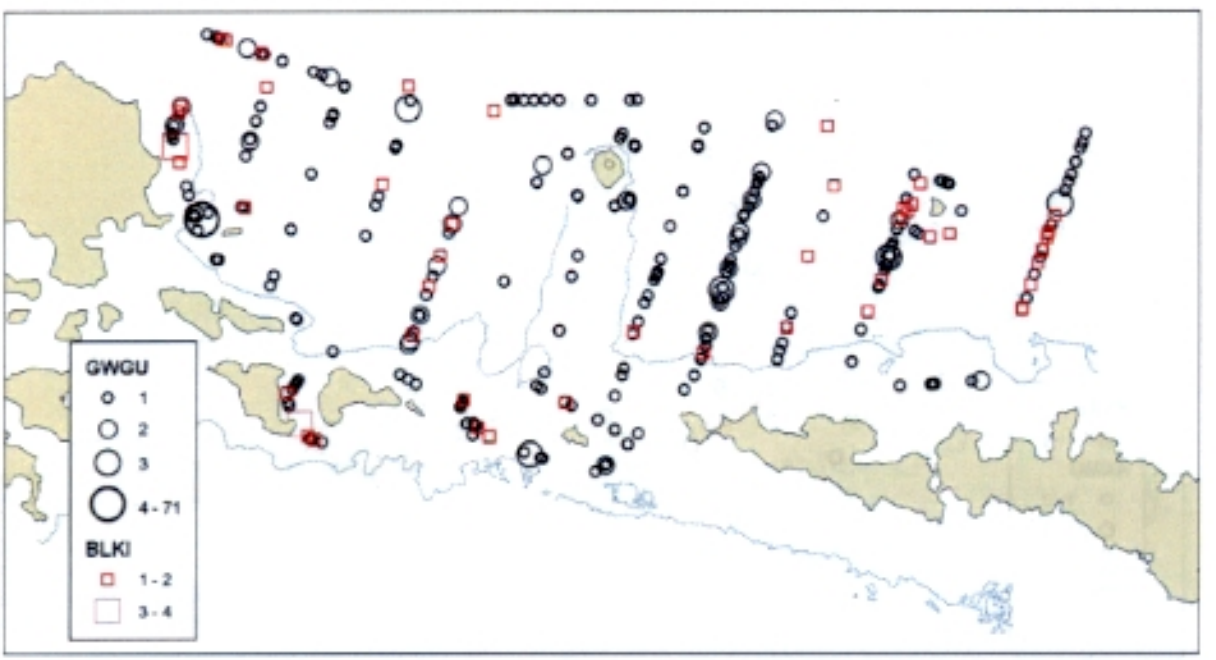

Figure 10. Distribution of glaucous-winged gulls (GWGU) and black-legged kittiwakes (BLKI) on transects surveyed in the central Aleutian Islands, Alaska in 2009. Includes birds on water and flying.

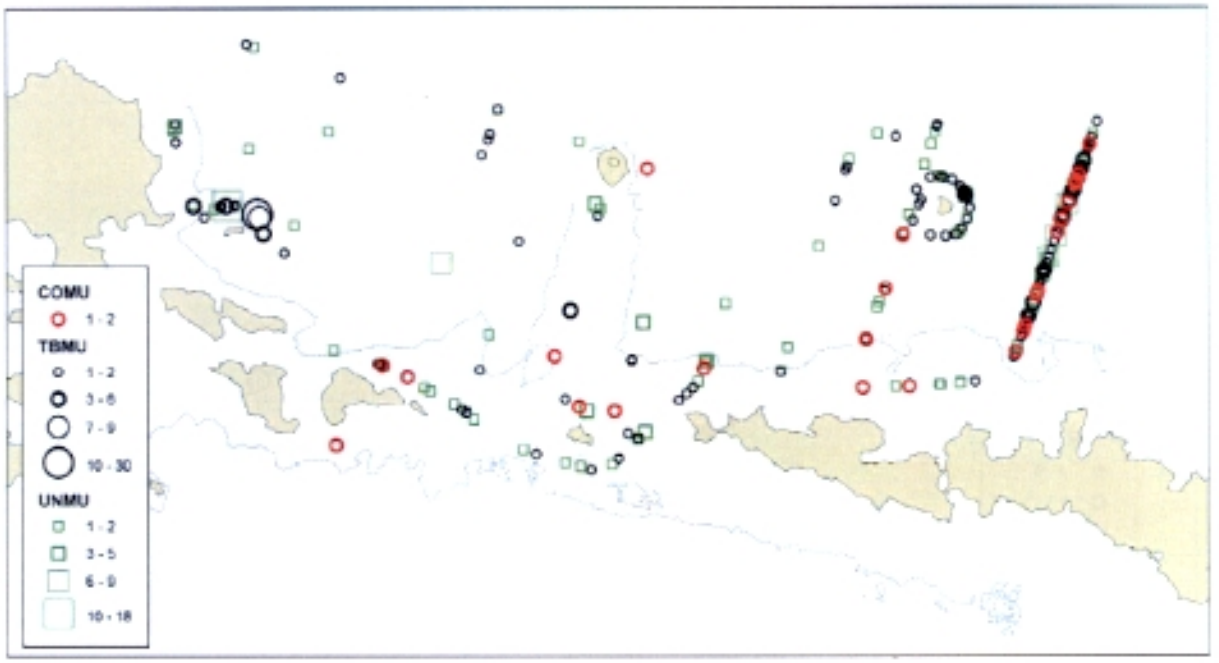

Figure11. Distribution of common (COMU), thick-billed (TBMU) and unidentified (UNMU) murres on transects surveyed in the central Aleutian Islands, Alaska in 2009. Includes birds on water and flying.

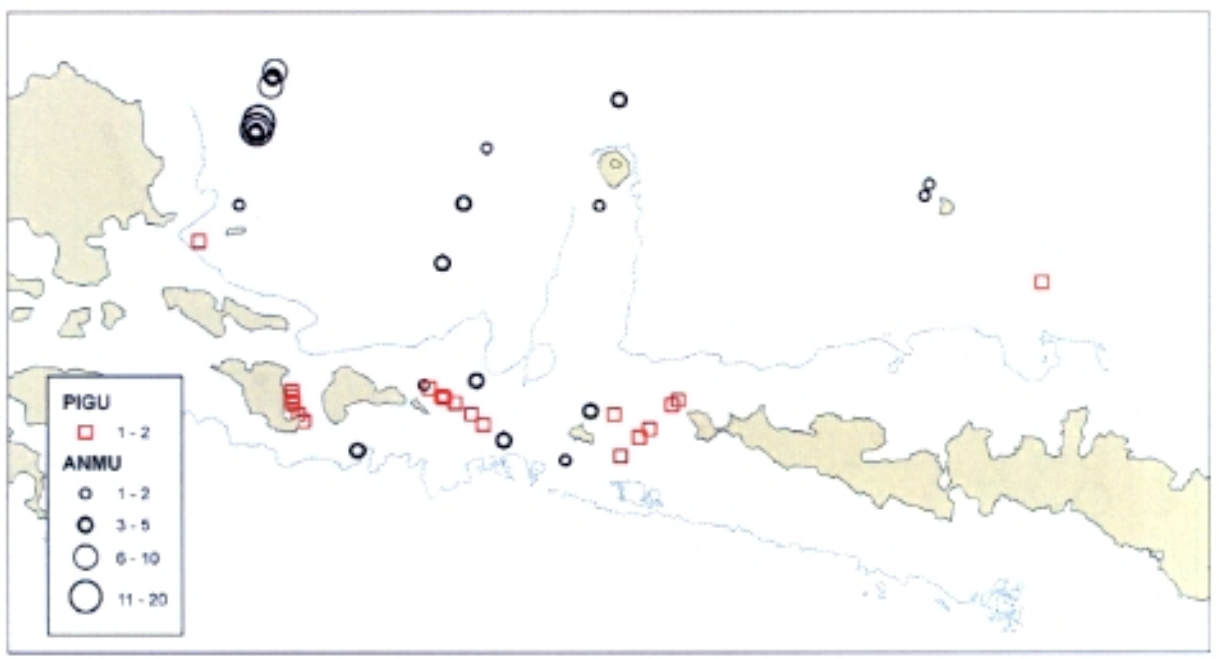

Figure12. Distribution of pigeon guillemots (PIGU) and ancient murrelets (ANMU) on transects surveyed in the central Aleutian Islands, Alaska in 2009. Includes birds on water and flying.

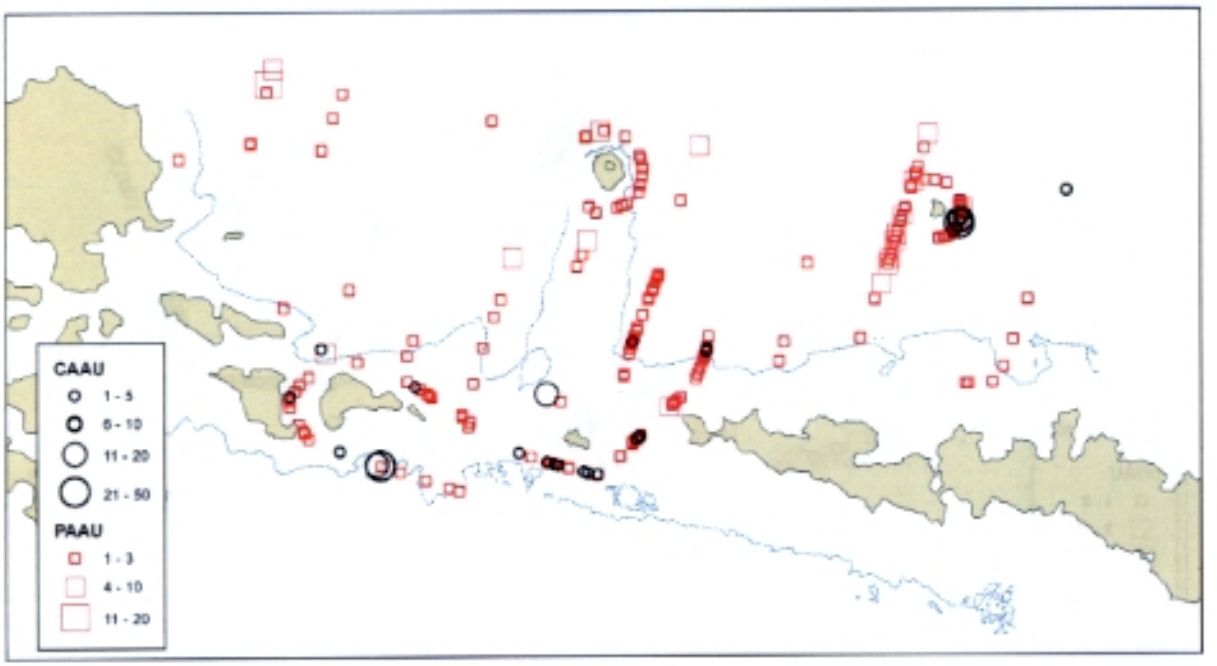

Figure 13. Distribution of Cassin's (CAAU) and parakeet (PAAU) auklets on transects surveyed in the central Aleutian Islands, Alaska in 2009. Includes birds on water and flying.

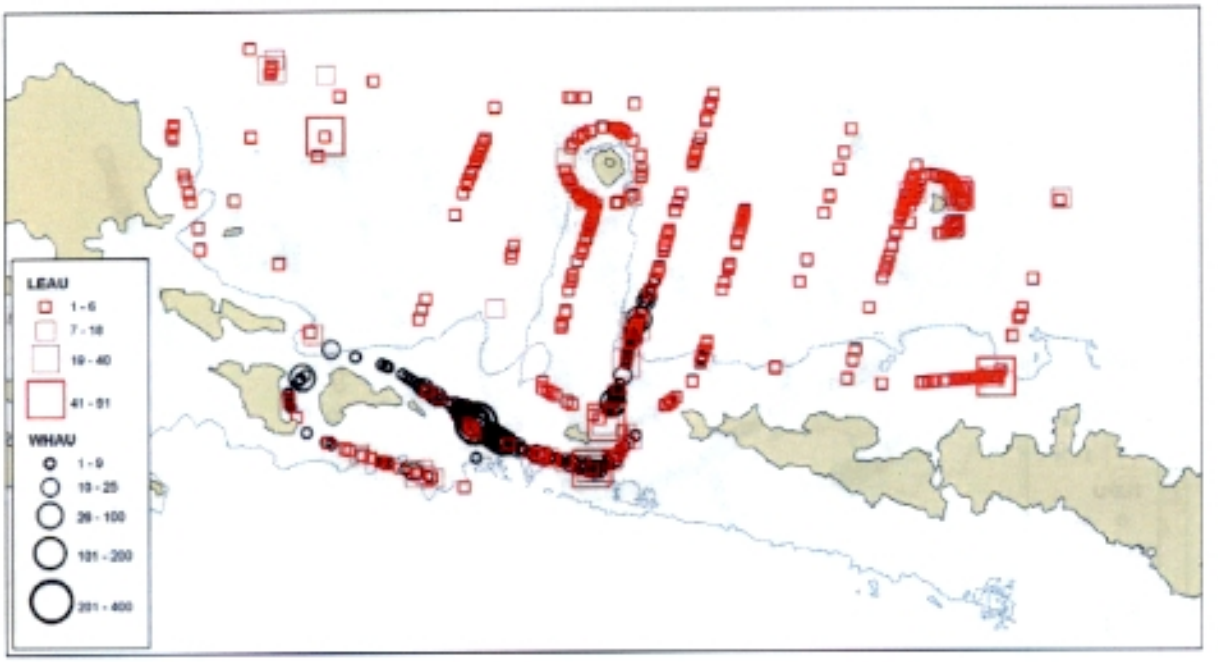

Figure 14. Distribution of least (LEAU) and whiskered (WHAU) auklets on transects surveyed in the central Aleutian Islands, Alaska in 2009. Includes birds on water and flying.

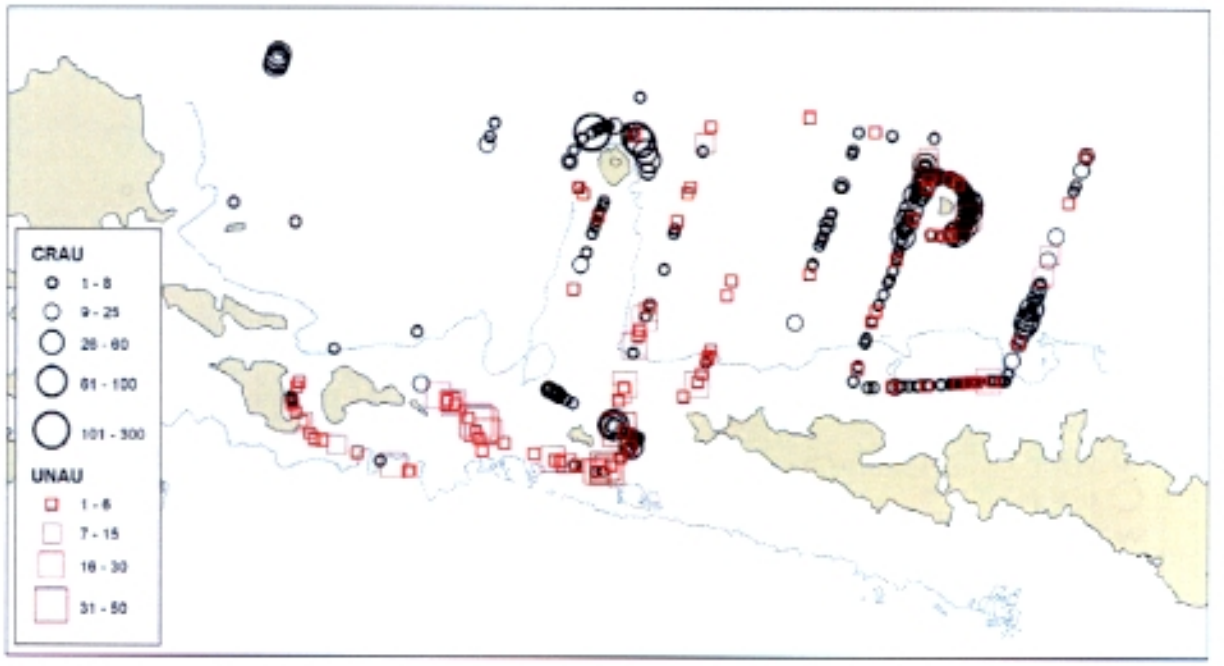

Figure 15. Distribution of crested (CRAU) and unidentified (UNAU) auklets on transects surveyed in the central Aleutian Islands, Alaska in 2009. Includes birds on water and flying.

Figure 16. Distribution of horned (HOPU) and tufted (TUPU) puffins on transects surveyed in the central Aleutian Islands, Alaska in 2009. Includes birds on water and flying.

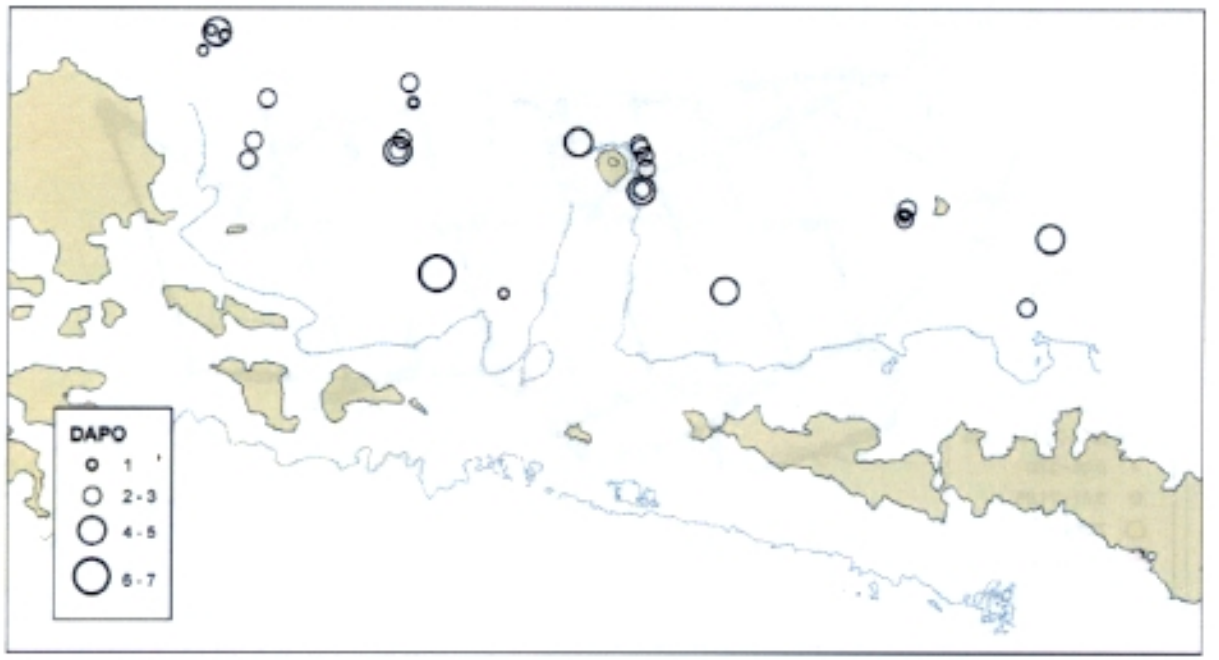

Figure 17. Distribution of Dall's porpoise (DAPO) on transects surveyed in the central Aleutian Islands, Alaska in 2009.

Figure 18. Distribution of prey in the water column (10-50 m) based on acoustic surveys in the central Aleutian Islands, Alaska in 2009 (NASC = Nautical Area Scattering Coefficient – m^2/nautical $mile^2$).

Figure 19. Distribution of prey in the water column (10-100 m) based on acoustic surveys in the central Aleutian Islands, Alaska in 2009 (NASC = Nautical Area Scattering Coefficient – m^2/nautical $mile^2$).

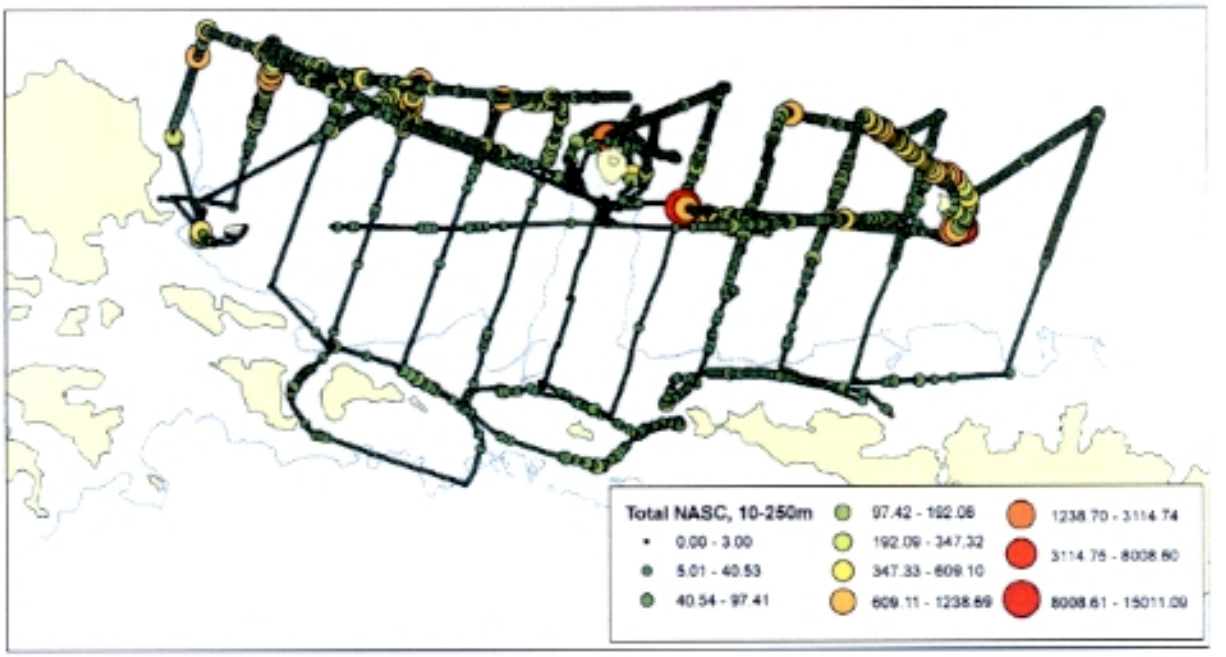

Figure 20. Distribution of prey in the water column (10-250 m) based on acoustic surveys in the central Aleutian Islands, Alaska in 2009 (NASC = Nautical Area Scattering Coefficient – m^2/nautical $mile^2$).

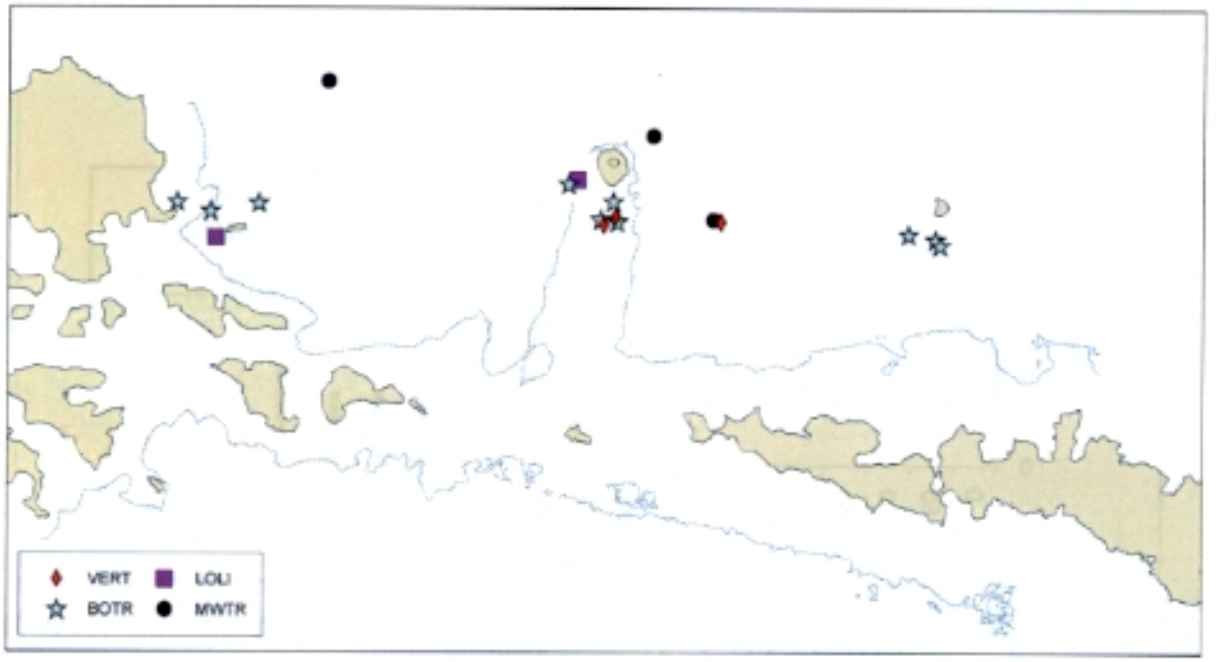

Figure 21. Locations of fishing efforts in the central Aleutian Islands, Alaska in 2009. VERT = vertical plankton tow, LOLI = longline, BOTR = bottom trawl, MWTR = mid-water trawl.

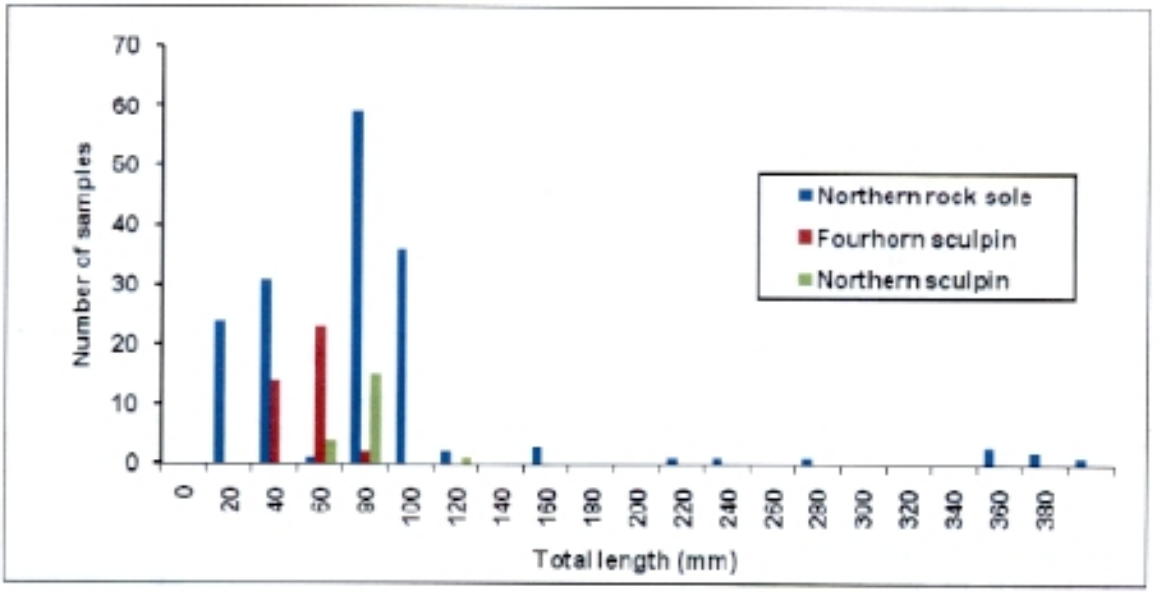

Figure 22. Size distribution of the three most abundant fish species caught with bottom trawl during SMMOCI sampling in the central Aleutian Islands, Alaska in 2009.

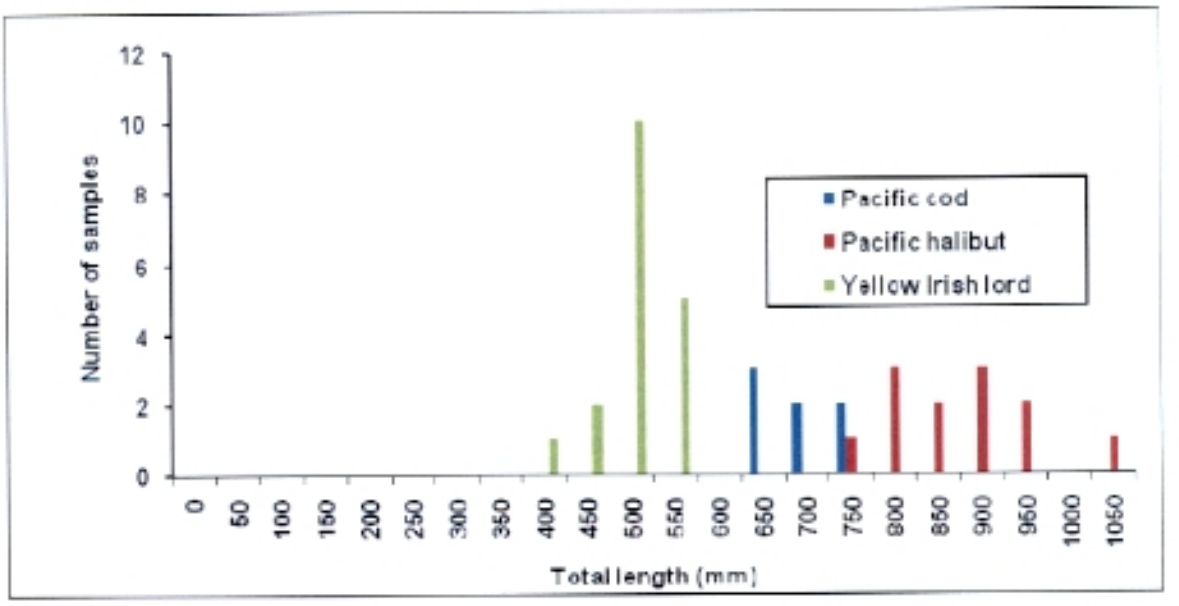

Figure 23. Size distribution of the three species caught with longlines during SMMOCI sampling in the central Aleutian Islands, Alaska in 2009.

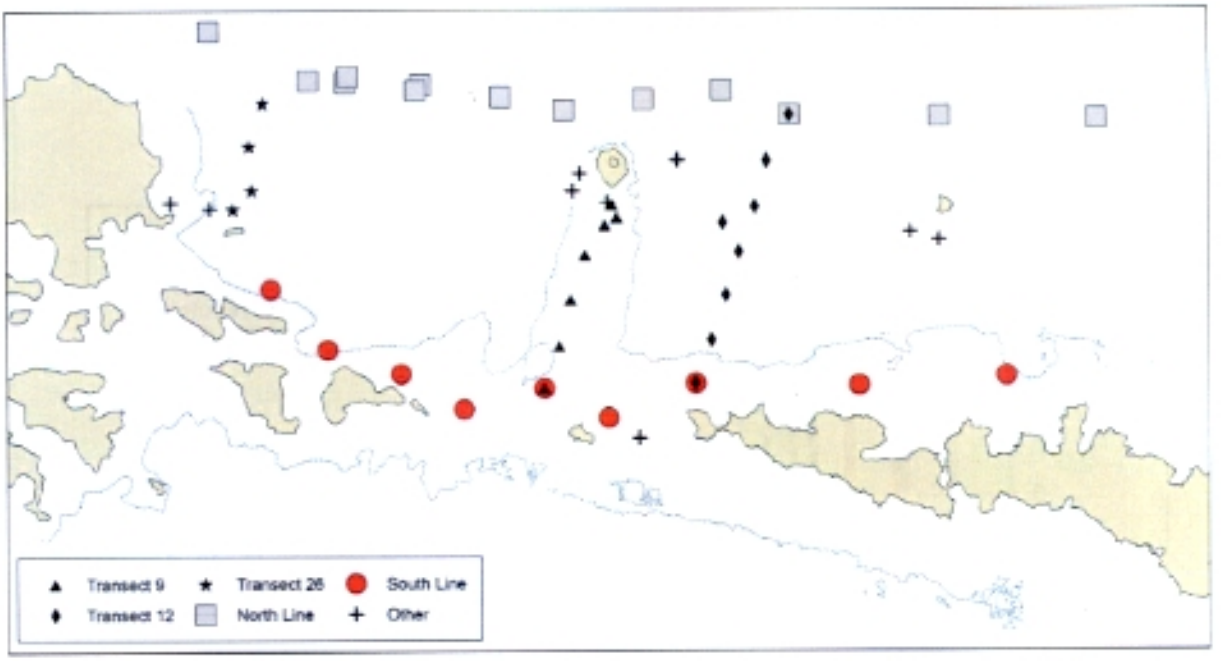

Figure 24. Locations of CTD stations sampled in the central Aleutian Islands, Alaska in 2009. Dotted line represents the 50 fathom (91.4 m) depth contour.

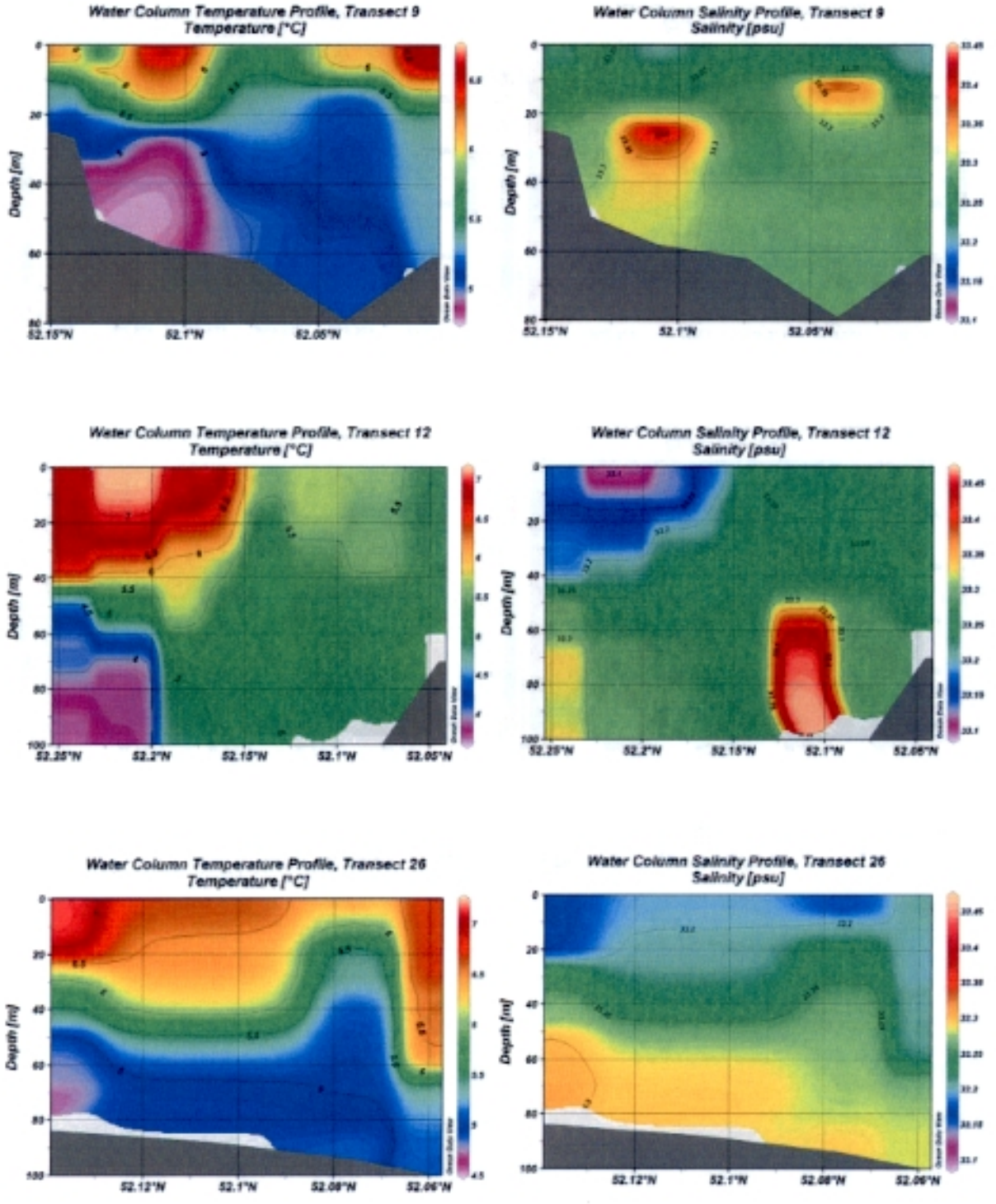

Figure 25. CTD temperature (left) and salinity (right) profiles obtained from central Aleutian Islands, Alaska transect 9 (top), transect 12 (middle) and transect 26 (bottom) in 2009.

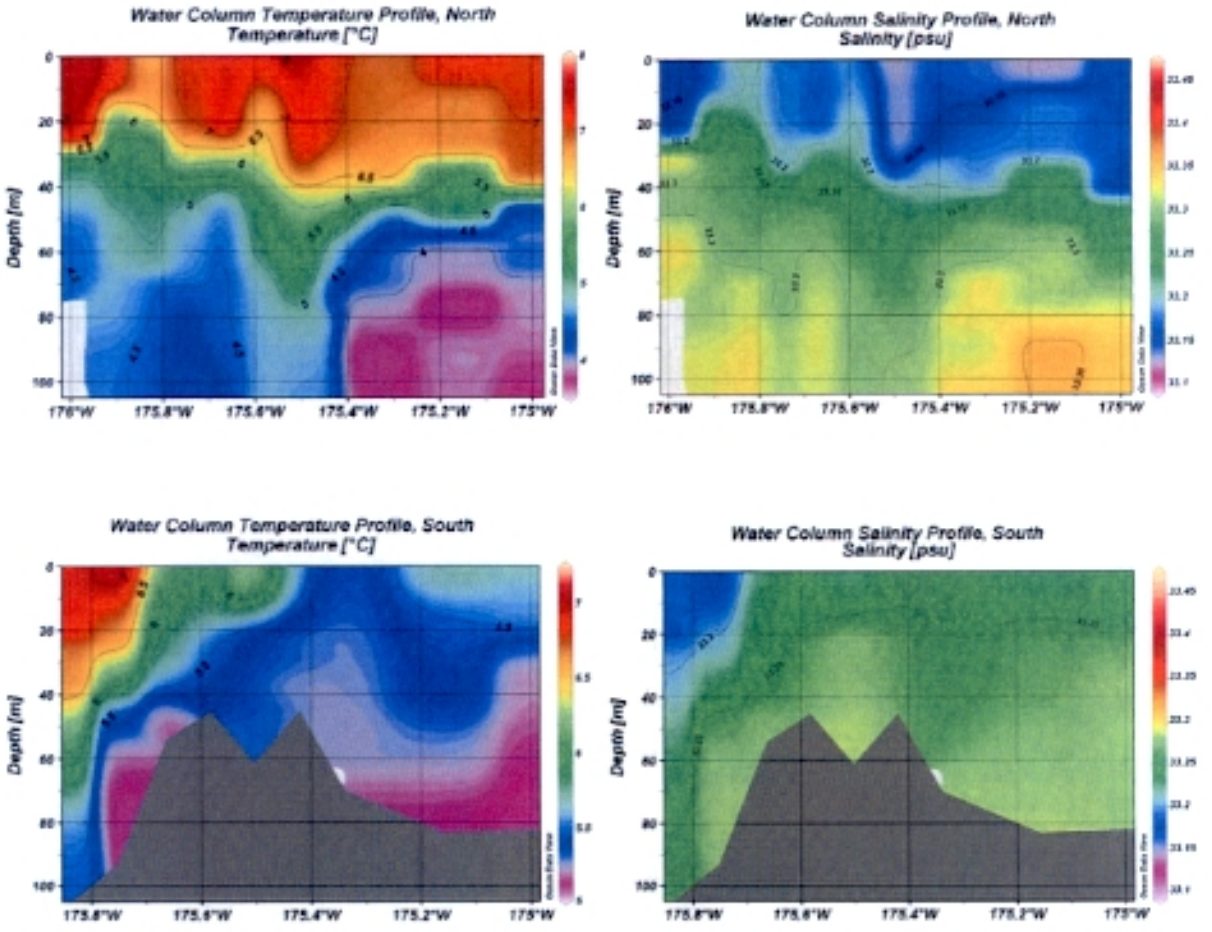

Figure 26. CTD temperature (left) and salinity (right) profiles obtained from central Aleutian Islands, Alaska north (top) and south (bottom) lines in 2009.

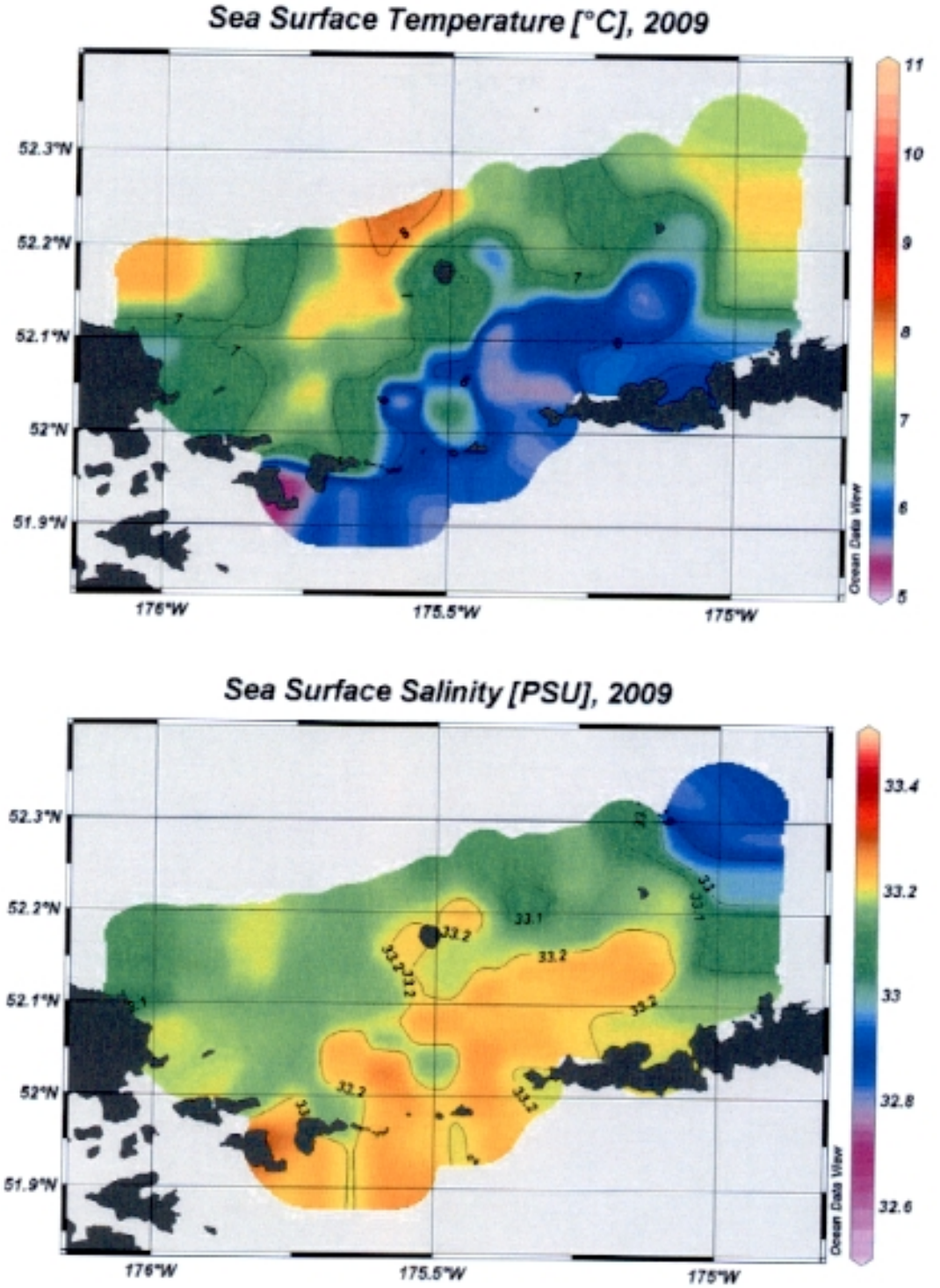

Figure 27. Sea surface temperature (top) and salinity (bottom) interpolated from thermosalinograph records on transects surveyed in the central Aleutian Islands, Alaska in 2009.