

**SEABIRD, MARINE MAMMAL and OCEANOGRAPHY COORDINATED  
INVESTIGATIONS IN SITKA SOUND, ALASKA, JULY 2000**



Preliminary Cruise Report  
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John Piatt  
Alaska Biological Science Center  
U.S. Geological Survey  
1011 E. Tudor Rd.,  
Anchorage AK 99503

Don Dragoo  
Alaska Maritime National Wildlife Refuge  
U.S. Fish and Wildlife Service  
2355 Kachemak Bay Dr.,  
Homer AK 99603

**Summary:** Surveys for seabirds and marine mammals were conducted in Sitka Sound from the *M/V Tiglax* during July 12-16, 2000. The objective was to characterize the marine environment in the vicinity of St. Lazaria Island, one of nine seabird colonies monitored annually by the Alaska Maritime National Wildlife Refuge. In addition to censusing seabirds and mammals encountered on line transects, local oceanography was characterized by measuring water temperature and salinity continuously at the sea surface, and by taking profiles of the water column on a series of CTD transects. Zooplankton were sampled at the surface (neuston tows) and with vertical tows along one transect. The relative abundance of zooplankton and fish biomass was measured using a dual-frequency echosounder. Significant acoustic targets were sampled with a mid-water trawl net. Long-lines were set twice to catch and characterize diets of large demersal fish species.

**Personnel:** The following scientific personnel participated in the cruise:

*U.S. Fish and Wildlife Service:* Vernon Byrd, Don Dragoo, Jeff Williams, Susan Woodward, Leslie Slater, Doug Palmer, John Tobin, Claire Caldes

*U.S. Geological Survey:* John Piatt

*Volunteers:* Barry Sampson (Minnesota DNR), Rebecca Joyce (Sitka)

### **Methods and Preliminary Findings:**

**Oceanography:** Sea surface temperature and salinity were recorded continuously using a SEABIRD Seacat SBE21 thermosalinograph on 20 different transects, most of which ran northeast to southwest and encompassed most of inner Sitka Sound and offshore waters beyond the continental shelf (Fig. 1). A total of 33 CTD profiles were taken with a SEABIRD SBE-19 Profiler, 7 on transect # 6 north of Cape Edgecumbe, 10 on transect #11 that ran through the center of Sitka Sound, and 6 on transect #16 south of Sitka Sound. The remaining CTD casts were taken during plankton and fish tows (see below).

Preliminary analysis of sea-surface temperature (SST Fig. 2) and salinity (SSS Fig. 3) measurements suggest marked gradients in surface properties throughout the study area. Surface salinity in inner Sitka Sound was quite low, presumably reflecting river input of freshwater from Baranof Island. A sharply increasing gradient of SSS was observed at the 200 m bathymetric contour, and SSS's of greater than 31.5 ppt were observed in slope and oceanic habitats (200-2000 m depths). In general, SST's showed a similar pattern, except that surface temperatures were also warm in inner Sitka Sound. North of Cape Edgecumbe, we speculate that eddies formed downstream of the cape may pull warmer, saline oceanic water nearshore. Alternatively, or in combination, little freshwater may enter the nearshore from Kruzof Island, resulting in a much narrower band of low SSS water nearshore. Most CTD profiles remain to be analyzed. Examination of 4 casts spanning the longest CTD transect (#11) through the center of Sitka Sound showed that all waters were stratified (Fig. 4), with weakest stratification in the outer Sound-- suggesting that some mixing occurs in this transitional zone between oceanic and coastal waters. Coastal waters appear to have a thin surface layer of low salinity, warm water.

Inshore and offshore waters appear to have a thick (20 m) layer of very warm, moderately saline water overlaying cold, high salinity water.

**Plankton:** Zooplankton were sampled at 5 stations along transect #12 (Fig. 5). At each station, a surface tow was conducted with a neuston net for 10 minutes. In addition, a vertical tow was conducted using a 1m ring net (505 micron), from the bottom or 100 m. Samples were preserved in 50% alcohol solution and will be analyzed for species composition and abundance by USGS. At each station, a CTD profile to the bottom or 100 m was also obtained.

**Fish:** Relative fish abundance was determined on all transects using a dual frequency (38 and 120 kHz) Simrad EK500 echosounder. In addition, acoustic data were collected during mid-water trawls on significant fish sign (Fig. 6). The threshold for data collection was set at -80 dB. Acoustic data will be analyzed later to assess relative abundance of acoustic biomass on each transect. Absolute fish densities may be calculated where signals were ground-truthed with trawling. In general, acoustic biomass was greatest in slope habitat (>200 m), where deep layers of myctophids were observed during the day, and moved up at night (Fig. 6); in shelf habitat (100-200 m) where extended aggregations of juvenile pollock (with jellyfish, cod, etc.) were observed in mid-water to the bottom (Fig. 6), especially along the basin in the middle of Sitka Sound; and in coastal habitat where rocks and shoals provided bathymetric relief to otherwise soft bottoms.

Significant fish aggregations were fished with a modified herring mid-water trawl (Fig. 5). A total of 23,016 fish were caught on 12 trawls and catches were dominated by jellyfish and pollock. Most fish caught were juveniles and measured less than 100 mm in length. Lengths (mean in mm, stdev, n) of common taxa: pollock (45.2, 7.7, 239), myctophid spp. (39.1, 15.8, 60), Pacific cod (56.3, 3.7, 11), a variety of larval flatfish (28.5, 4.2, 41), sand lance (67.0, 19.4, 4) and prowlfish (70.5, 18.8, 4). Specimens that could not be identified on board are being identified later by USGS personnel. A total of 56 groundfish were caught during 2 long-line sets (Fig. 5), including halibut (653, 85.6, 27), quillback rockfish (375, 24.7, 15), and yellow-eyed rockfish (604, 188.6, 5). Stomachs from these groundfish were removed for later examination of stomach contents. Adult salmon that were observed jumping out of the water were recorded on bird and mammal surveys (Fig. 7). Most salmon were found in shelf habitat between the 100 and 200 m contour, and many were also observed on the sound side of Sitka Sound, generally in waters less than 100m in depth.

**Birds:** Birds were censused using line transect methods described by Gould and Forsell (1989), and employed on previous SMMOCI cruises. All birds observed on the water within 150 m on either side of the vessel were recorded continuously; flying birds were counted on 'scans' every 3 minutes. Other behaviors (feeding, carrying fish, etc.) were also noted. Data were recorded on logging computers and all records were assigned GPS positions in real time. This allowed for some preliminary analyses of bird distributions (below); however, data still need to be edited before making final estimates of bird densities and distribution.

A total of 3012 birds were counted on 19 transects that covered 597 linear km of survey. This translates into about 16.8 birds/km<sup>2</sup>. These densities are typical for SE Alaska, and much lower than observed around other seabird colonies in the Gulf of Alaska and Bering Sea. For example, estimates of seabird density from previous SMMOCI type cruises on the *M/V Tiglax* are:

<b>Colony Area</b>	<b># birds/km<sup>2</sup></b>
Cape Thompson / Chukchi Sea	54
Diomed Islands / Bering Str.	73
Pribilof Islands / Bering Sea	51
Kasatochi Island / C. Aleutians	110
Aiktak Island / Unimak Pass	38
Barrens / L. Cook Inlet 1992	174
Barrens / L. Cook Inlet 1996	126
Glacier Bay	21
St. Lazaria/ Sitka Sound	17

In contrast to some of these other regions, the bird community off Sitka was not dominated numerically by a few species; rather, diversity was high and no species comprised more than 20% of the total. Most abundant were Common Murres (18.8%), Marbled Murrelets (12.8%), Rhinoceros Auklets (12.8%), Glaucous-winged Gulls (10.3%) and Northern Fulmars (7.6%). No other species comprised more than 5% of the total. Overall, the community was dominated by Alcids (55%), Procellarids (21%) and *Larus* gulls (19%).

Habitats may be characterized with respect to bathymetry and distance from land. These characterizations reflect what we observed in Sitka Sound, but are based on work conducted elsewhere as well. This study area is interesting because a single transect of only 15-30 nm in length moves from shallow inside waters to a deep oceanic basin (>1500 m). Coastal habitat includes shallow waters of ca. <100 m, numerous islands and island passes, and numerous shoals, reefs and rocks. Shelf habitat includes waters between 100 and 200 m in depth with relatively smooth bottom, which comprises a broad band running north to south outside Sitka Sound. Shelf-edge (slope) habitat (200-1500 m) extends offshore the length of this shelf, and deep oceanic waters are found beyond about the 1500 m contour. For comparison, it would require a 300-350 nm transect to cover such a range of habitats in the SE Bering Sea, and a 120-140 nm transect in the northern Gulf of Alaska.

Seabirds can be characterized according to their distributions, which reflect their foraging behavior and feeding ecology. Coastal species (Figs. 8-9) include Pelagic Cormorants (PECO) and Marbled Murrelets (MAMU) which were found most frequently in waters less than 100 m in depth, and close to their colony or shore. Coastal/Shelf species are commonly found in both coastal and shelf habitats (Figs. 10-12), and include Common Murres (COMU), *Larus* gulls (Glaucous-winged, Herring, Mew), and Tufted Puffins (TUPU). Shearwaters (both Short-tailed and Sooty) were common in both shelf and slope habitat (Fig. 13). Commonly distributed across both slope and oceanic habitats (Figs. 14-

16) were Northern Fulmars (NOFU), Fork-tailed Storm-petrels (FTSP), and Black-footed Albatross (BFAL). Leach's Storm-petrels (not mapped) were found only in deep oceanic waters. Rhinoceros Auklets (RHAU) and Cassin's Auklets (CAAU) were unusual in spanning all habitats from coastal to oceanic (Figs. 17-18).

**Mammals:** Relatively few mammals were observed, and most were off transect. Harbor seals, sea otters, harbor porpoise, sea lions and humpback whales were observed mostly in coastal/shelf waters; other whales in shelf waters, and Dall's porpoise in shelf and slope waters.

<b>Species</b>	<b>Number</b>
Harbor Seal	1
Steller's Sea Lion	2
Sea Otter	6
Harbor Porpoise	1
Unidentified Porpoise	1
Dall's Porpoise	19
Humpback Whale	9
Sei Whale	2
Unidentified Baleen Whale	2

Table 1. Preliminary tally of fish caught on M/V Tiglax, July 2000.

DATE	GEAR	HAUL #	SPECIES	TOTAL CATCH		SPECIMEN #	COMMENTS
				QUANTITY	WEIGHT (g)		
07/12/00	MT	1	Pollock	454	250	071200-1	
07/12/00	MT	1	Unknown Fish	3	---	071200-2	
07/12/00	MT	1	Cod?	1	---	071200-3	
07/12/00	MT	1	Flatfish spp.	1	---	071200-4	Larval
07/12/00	MT	1	Flatfish spp.	7	---	071200-5	Larval
07/12/00	MT	1	Unknown	1	---	071200-6	
07/12/00	MT	1	?	5	---	071200-7	
07/12/00	MT	1	Mixed Jellyfish	---	5,500	---	
07/12/00	MT	1	Shrimp	2	---	---	
07/12/00	MT	2	Pollock	367	182	---	
07/12/00	MT	2	Mixed Jellyfish/Salps	---	9,500	---	
07/12/00	MT	2	Cod?	1	---	---	
07/12/00	MT	2	Flatfish spp.	6	---	---	Larval
07/12/00	MT	2	Shrimp	27	---	071200-8	
07/12/00	MT	2	?	1	---	071200-9	
07/12/00	MT	2	?	1	---	071200-10	
07/13/00	LL	1	Quillback Rockfish	11	---	See Sex-Length-Weight	
07/13/00	LL	1	Halibut	18	---	See Sex-Length-Weight	
07/13/00	MT	3	Pollock	9,480	---	---	Estimated
07/13/00	MT	3	Prowfish?	1	---	071300-25	
07/13/00	MT	3	Mixed Jellyfish/Salps	---	6,500	---	
07/13/00	MT	4	Myctophidae spp.	233	---	071300-26	
07/13/00	MT	4	Pollock	4	---	---	Possibly remnant from haul 3
07/13/00	MT	4	Salps	---	3,000	---	
07/13/00	MT	4	Mixed Jellyfish	---	1,000	---	
07/13/00	MT	4	Sablefish? or Ling?	2	---	071300-27	
07/13/00	MT	4	Oneirodidae spp.?	3	---	071300-28	
07/13/00	MT	4	Pacific Lamprey?	1	---	071300-29	
07/13/00	MT	4	Flatfish spp.	1	---	071300-30	
07/13/00	MT	4	Shrimp	13	---	071300-31	
07/13/00	MT	4	Shrimp	791	---	071300-32	
07/13/00	MT	4	Squid	8	---	071300-33	
07/13/00	MT	4	Crab	2	---	071300-34	Larval
07/13/00	MT	4	Unknown	2	---	071300-36	
07/13/00	MT	4	Unknown	2	---	071300-38	
07/13/00	MT	4	Unknown	1	---	071300-39	
07/14/00	MT	5	Pollock	9,100	---	---	
07/14/00	MT	5	Squid	1	---	071400-01	Possibly remnant from haul 4
07/14/00	MT	5	Unknown	1	---	071400-02	Larval
07/14/00	MT	5	Mixed Jellyfish	---	8,500	---	
07/14/00	MT	5	Salps	8	---	---	
07/14/00	MT	6	Pollock	1,515	---	---	
07/14/00	MT	6	Pacific Cod?	6	---	071400-03	
07/14/00	MT	6	Flatfish spp.	21	---	071400-04	
07/14/00	MT	6	Prowfish?	2	---	071400-06	
07/14/00	MT	6	Unknown	1	---	071400-05	
07/14/00	MT	6	Mixed Jellyfish	---	27,500	---	
07/14/00	MT	6	Salps	---	---	---	
07/14/00	MT	6	Amphipod	5	---	071400-07	
07/14/00	MT	6	Shrimp	1	---	071400-08	
07/15/00	LL	2	Halibut	9	---	See Sex-Length-Weight	
07/15/00	LL	2	Yellow-Eye Rockfish	5	---	See Sex-Length-Weight	
07/15/00	LL	2	Quillback Rockfish	7	---	See Sex-Length-Weight	
07/15/00	LL	2	Black Rockfish	2	---	See Sex-Length-Weight	
07/15/00	LL	2	Canary Rockfish	1	---	See Sex-Length-Weight	
07/15/00	LL	2	Lingcod	2	---	---	Released
07/15/00	LL	2	Ratfish?	1	---	---	Released

Table 1. Cont'd.

DATE	GEAR	HAUL #	SPECIES	TOTAL CATCH		SPECIMEN #	COMMENTS
				QUANTITY	WEIGHT (g)		
07/15/00	MT	7	Pollock	71	---	---	
07/15/00	MT	7	Pacific Cod?	2	---	---	
07/15/00	MT	7	Flatfish spp.	1	---	071500-23	
07/15/00	MT	7	Flatfish spp.	1	---	071500-24	
07/15/00	MT	7	Flatfish spp.	1	---	071500-25	
07/15/00	MT	7	Unknown Fish	5	---	071500-26	Larval Rockfish?
07/15/00	MT	7	Unknown Fish	1	---	071500-27	Larval Herring?
07/15/00	MT	7	Unknown Fish	1	---	071500-28	Larval Cyclopteridae?
07/15/00	MT	7	Unknown Fish	1	---	071500-29	
07/15/00	MT	7	Larval Crab	1	---	071500-30	
07/15/00	MT	7	Amphipod	1	---	071500-31	
07/15/00	MT	7	Mixed Jellyfish	---	33,500	---	
07/16/00	MT	8	Myctophidae spp.	505	---	071600-01	
07/16/00	MT	8	Pollock	3	---	071600-02	
07/16/00	MT	8	Longfin Dragonfish	1	---	071600-03	
07/16/00	MT	8	Pacific Viperfish	2	---	071600-04	
07/16/00	MT	8	Unknown	4	---	071600-05	Larval
07/16/00	MT	8	Flatfish spp.	1	---	071600-06	Larval
07/16/00	MT	8	Flatfish spp.	1	---	071600-07	Larval
07/16/00	MT	8	Flatfish spp.	1	---	071600-08	Larval
07/16/00	MT	8	Squid	7	---	071600-09	
07/16/00	MT	8	Unknown Crustacean	?	---	071600-10	
07/16/00	MT	8	Unknown Crustacean	?	---	071600-11	
07/16/00	MT	8	Unknown Crustacean	?	---	071600-12	
07/16/00	MT	8	Unknown Crustacean	?	---	071600-13	
07/16/00	MT	8	Unknown Crustacean	5	---	071600-14	X-Files Aliens
07/16/00	MT	8	Shrimp	43	---	---	See sample 071300-31
07/16/00	MT	8	Shrimp	---	340	071600-15	
07/16/00	MT	8	Mixed Jellyfish	---	24,000	---	
07/16/00	MT	8	Salps	---	5,500	---	
07/16/00	MT	9	Slender Snipe Eel	2	---	071600-16	
07/16/00	MT	9	Pollock	17	---	---	
07/16/00	MT	9	Unknown	18	---	071600-17	Possibly Larval P. Herring
07/16/00	MT	9	Mixed Jellyfish	---	37,000	---	
07/16/00	MT	9	Unknown Amphipod	1	---	071600-18	
07/16/00	MT	10	Chinook Salmon	1	---	---	Released
07/16/00	MT	10	Flatfish spp.	3	---	071600-19	
07/16/00	MT	10	Unknown	8	---	---	Larval P. Herring? (see 071600-17)
07/16/00	MT	10	Pollock	3	---	---	
07/16/00	MT	10	Pacific Cod?	3	---	---	
07/16/00	MT	10	Sand Lance	1	---	071600-20	
07/16/00	MT	10	Crab	1	---	---	
07/16/00	MT	10	Mixed Jellyfish	---	17,000	---	
07/17/00	MT	11	Pollock	108	---	---	
07/17/00	MT	11	Slender Snipe Eel	1	---	---	
07/17/00	MT	11	Prowfish?	1	---	071700-01	
07/17/00	MT	11	Flatfish spp.	1	---	---	See previous hauls
07/17/00	MT	11	Mixed Jellyfish	---	9,000	---	
07/17/00	MT	12	Pollock	28	---	---	
07/17/00	MT	12	Unknown	16	---	---	Larval P. Herring? (see 071600-17)
07/17/00	MT	12	Sand Lance	3	---	---	
07/17/00	MT	12	Flatfish spp.	1	---	---	Larval
07/17/00	MT	12	Squid	1	---	---	
07/17/00	MT	12	Unknown Amphipod	1	---	---	
07/17/00	MT	12	Mixed Jellyfish	---	17,500	---	
Column Sum:				23,016	205,772		

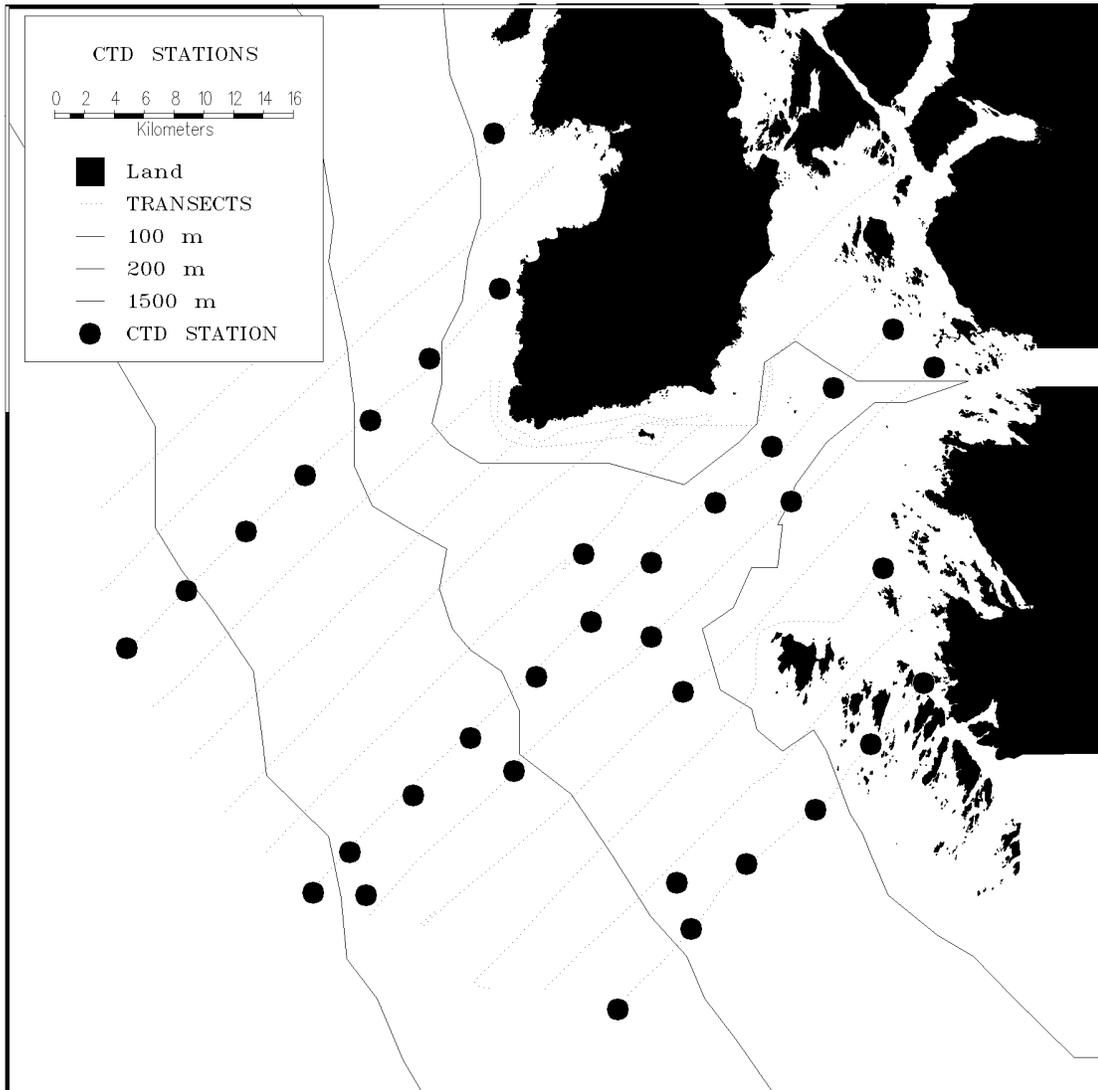


Figure 1. CTD stations and survey transects in Sitka Sound. Note approximate bathymetric contour lines for 100, 200 and 1500 m depths.

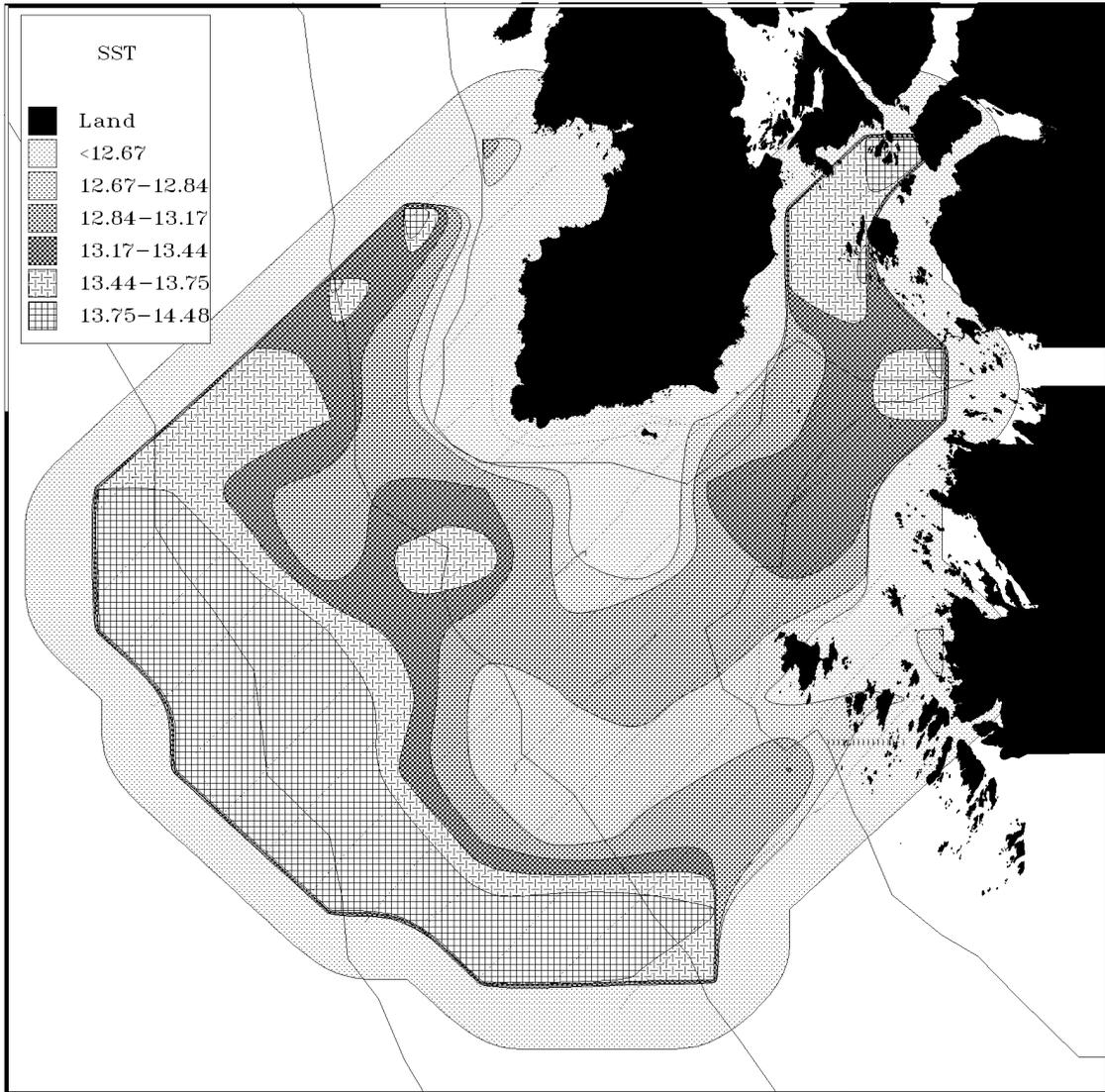


Figure. 2. Sea surface temperatures interpolated from thermosalinograph records. Note that contour mapping created artificial lower temperature band around high temperature areas offshore.

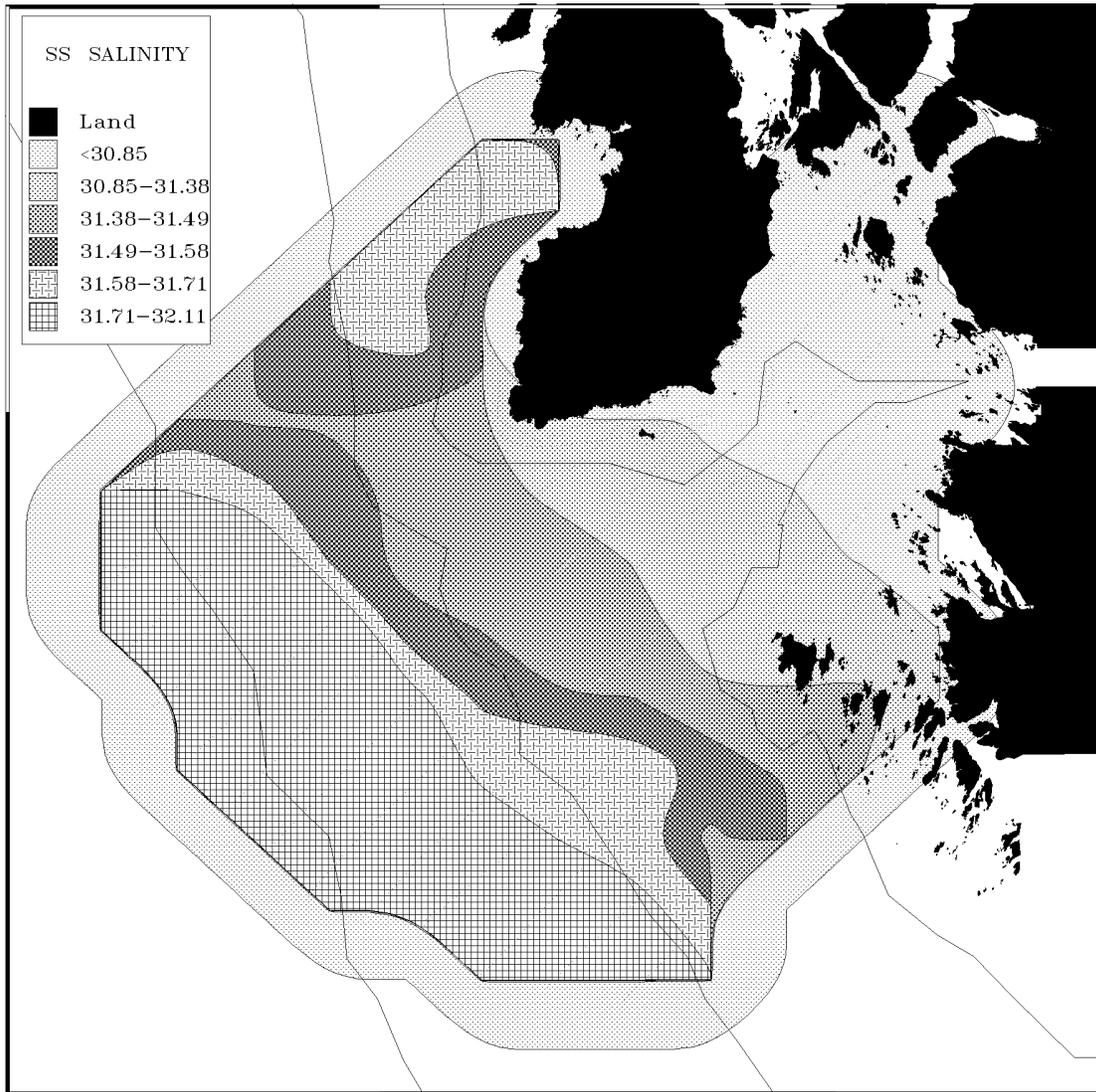


Figure. 3. Sea surface salinities interpolated from thermosalinograph records. Note that contour mapping created artificial lower salinity band around high salinity areas offshore.

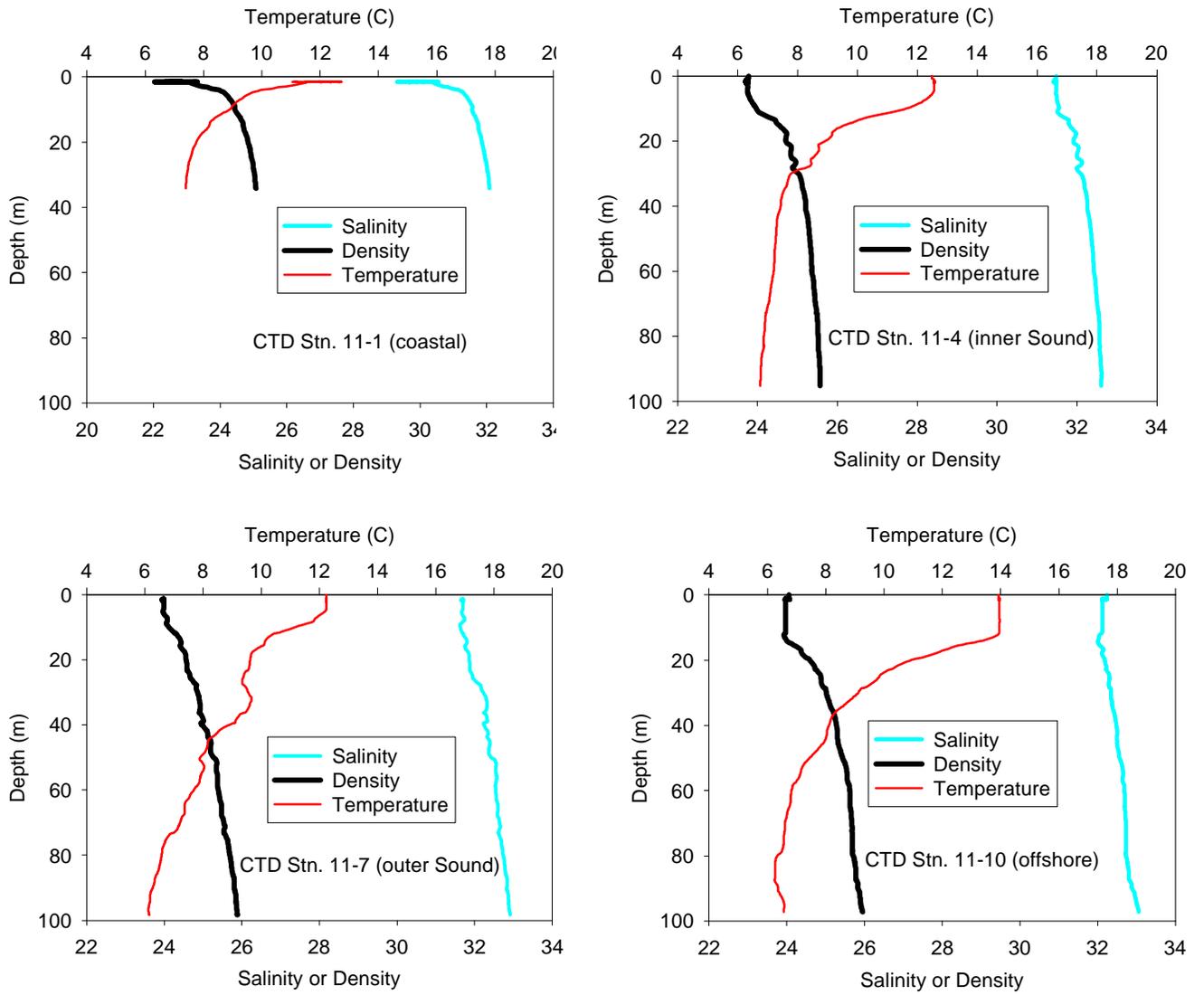


Figure 4. CTD profiles obtained from Sitka Sound transect #11.

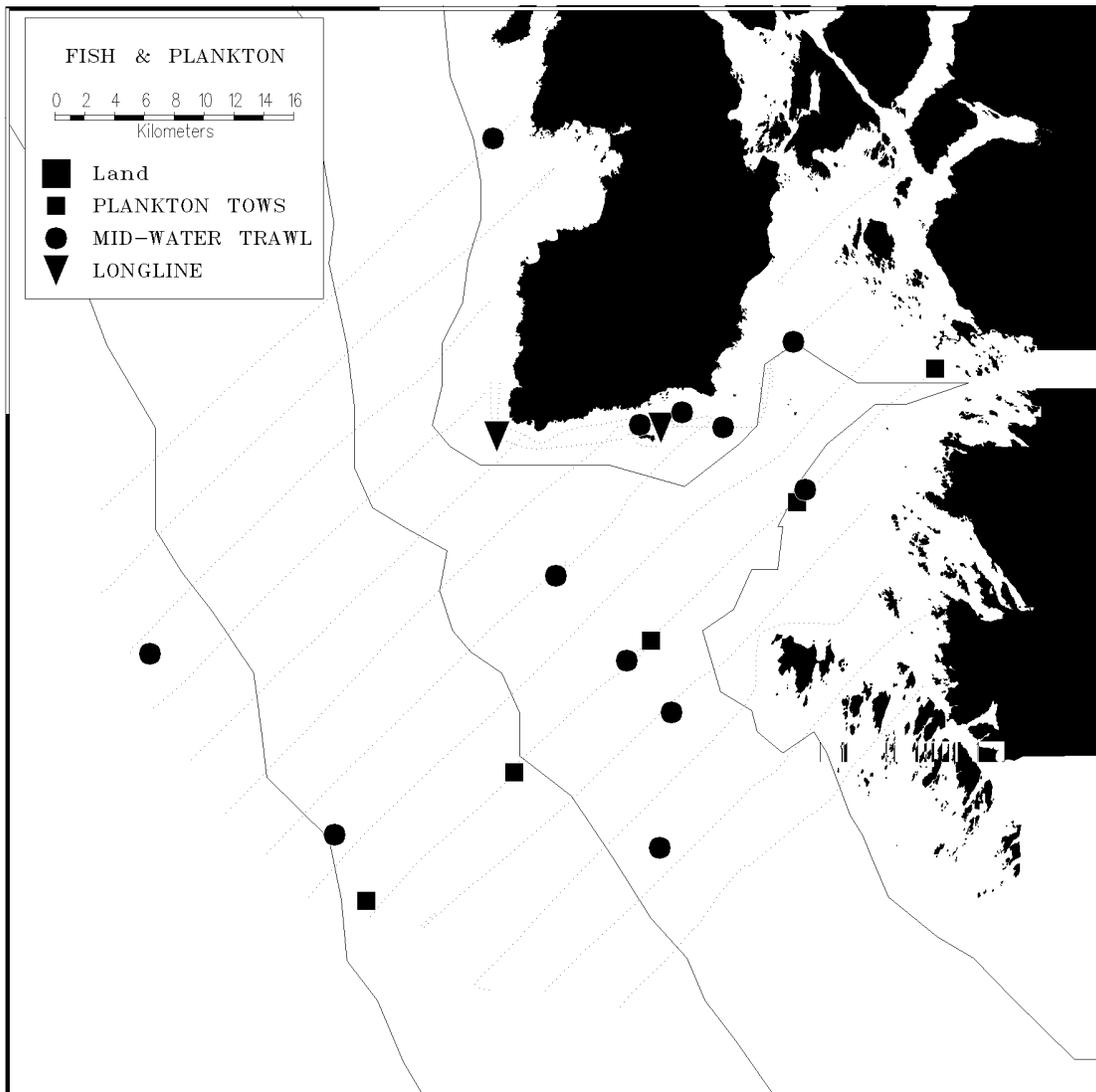


Figure 6. Locations of plankton tows, mid-water trawls and long-line sets.

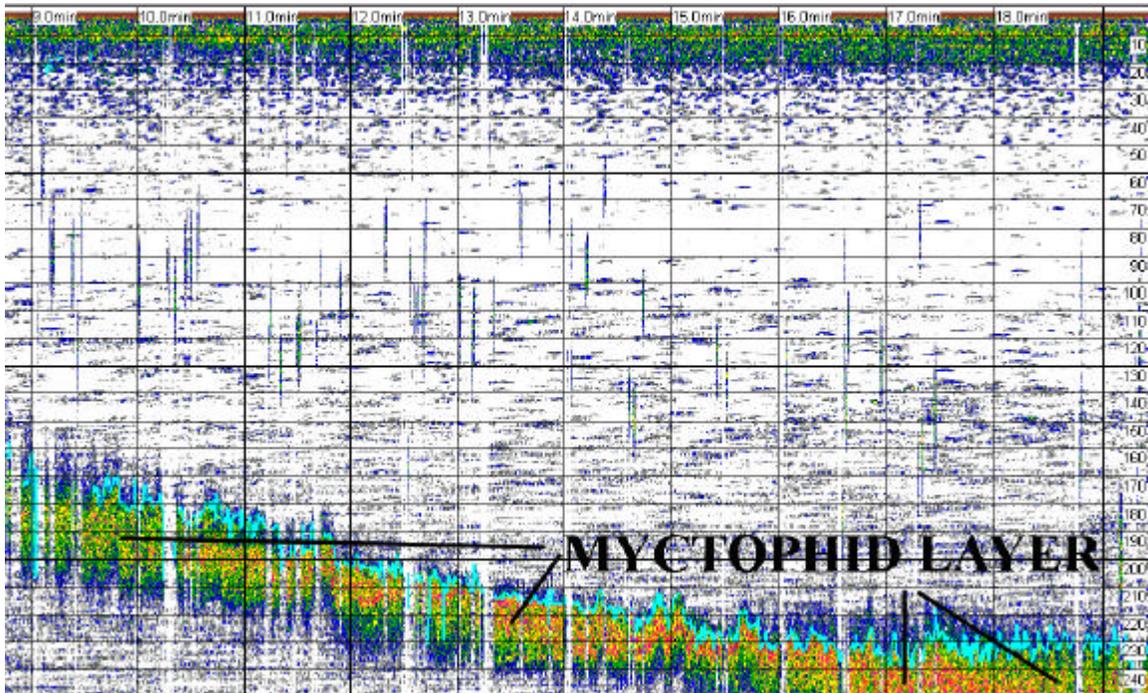
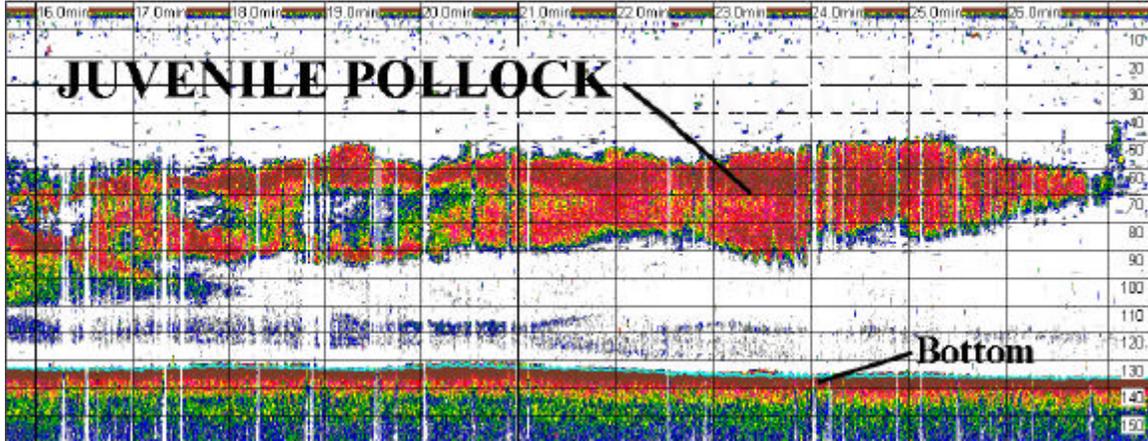


Figure 6. Examples of echograms obtained from the Simrad EK500, showing pollock (above) and myctophid (below) concentrations.

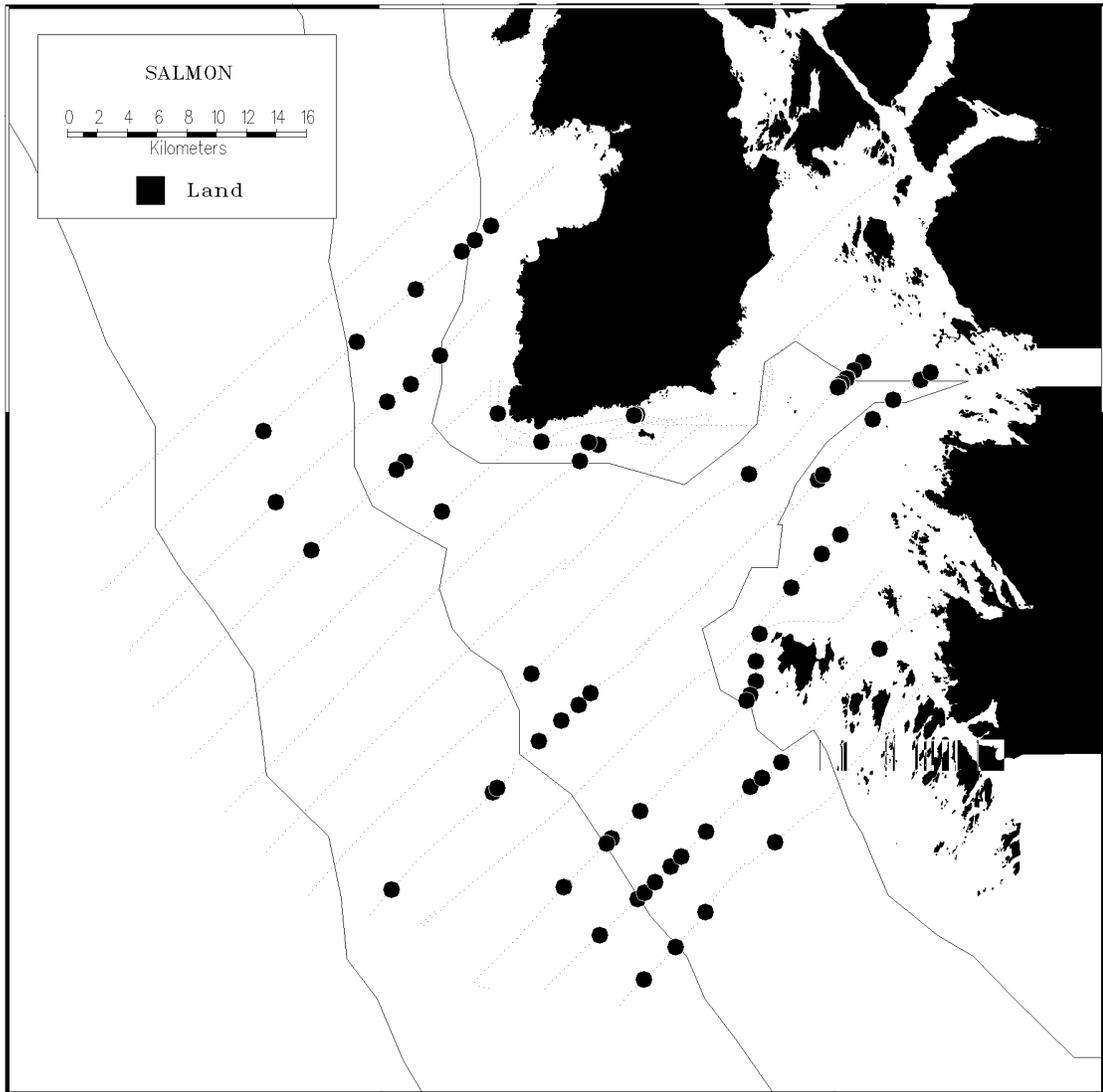


Figure 7. Distribution of adult salmon observed jumping out of the water on transects.

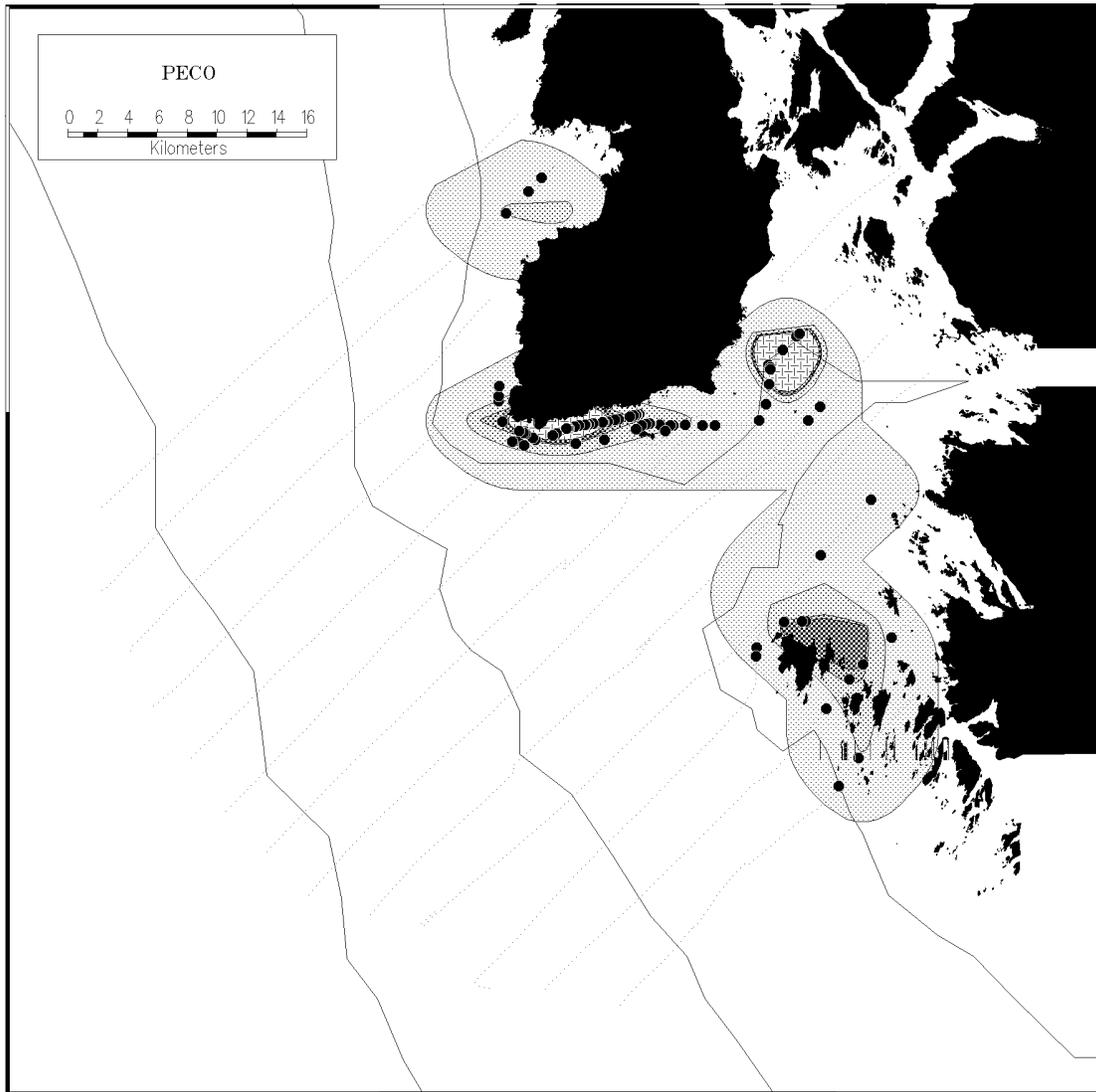


Figure 8. COASTAL species: Distribution of Pelagic Cormorants.

Note for this and subsequent maps: Dots indicate position of bird sighting (without regard to how many birds were seen, i.e., flock size). Shaded contour intervals provide graphic interpolation of bird distribution based on locations and flock sizes of species. Both dots and contours include all birds on water and flying.

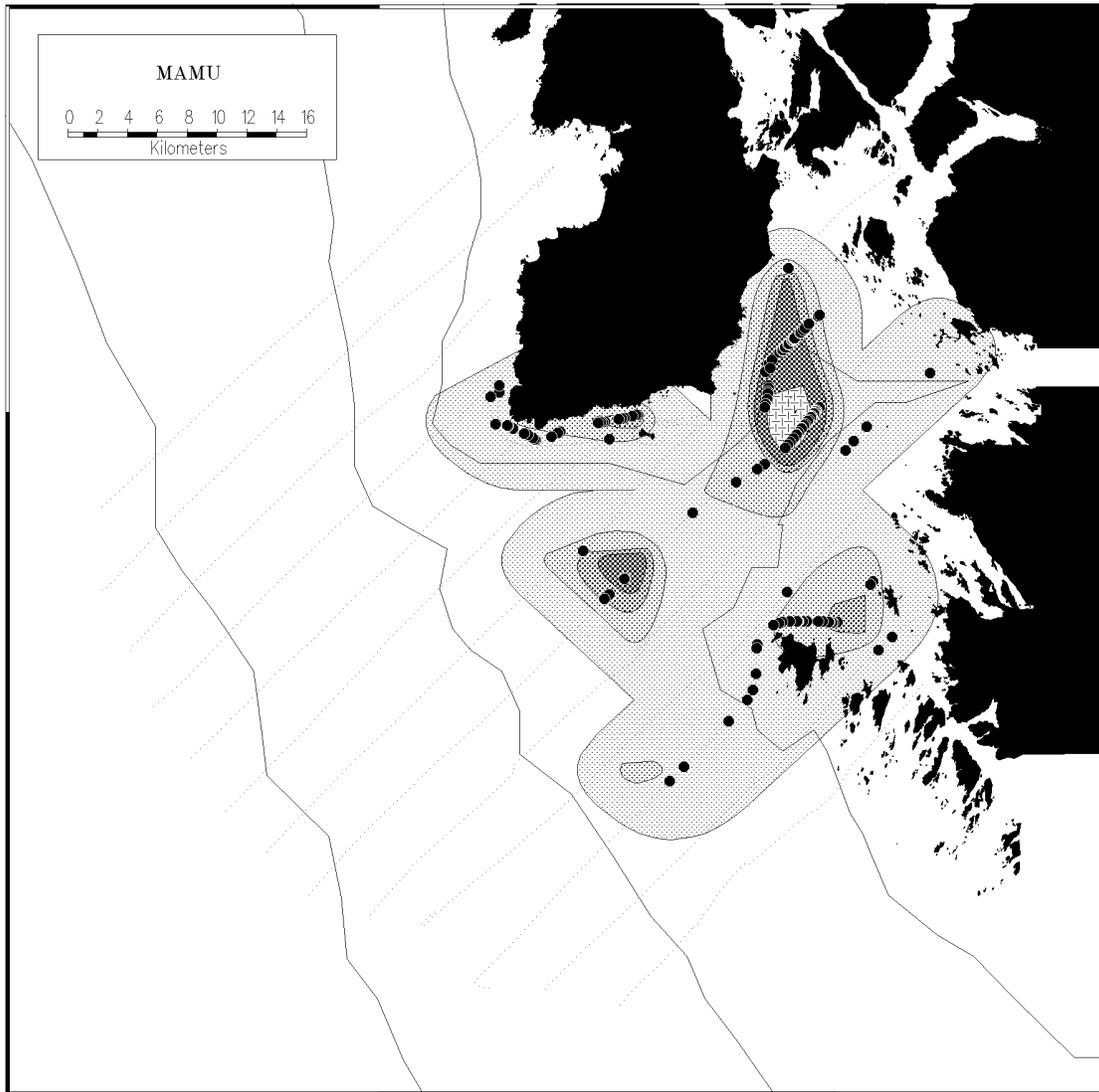


Figure 9. COASTAL species: Distribution of Marbled Murrelets.



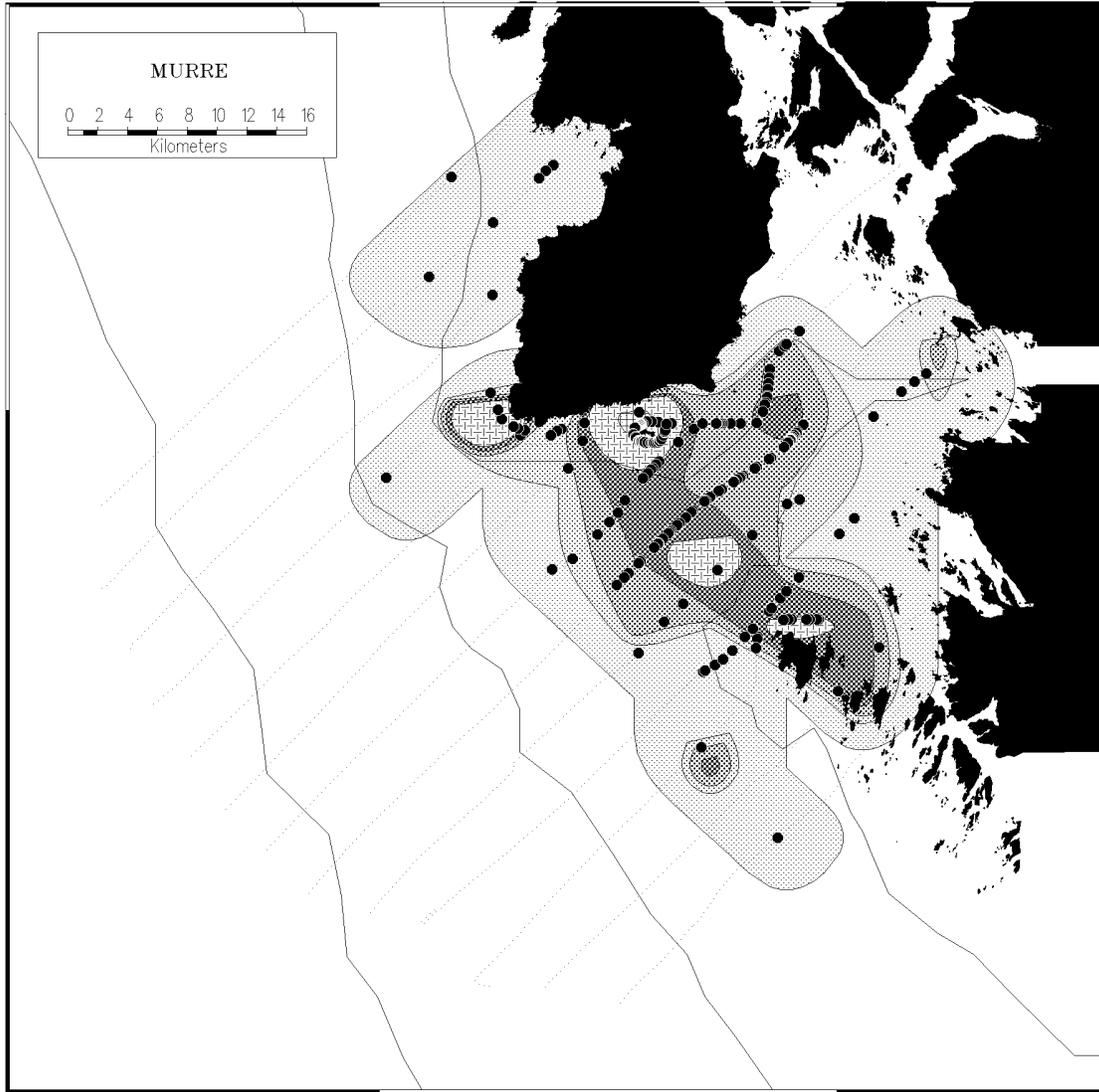


Figure 10. COASTAL/SHELF species: Distribution of Common Murres.



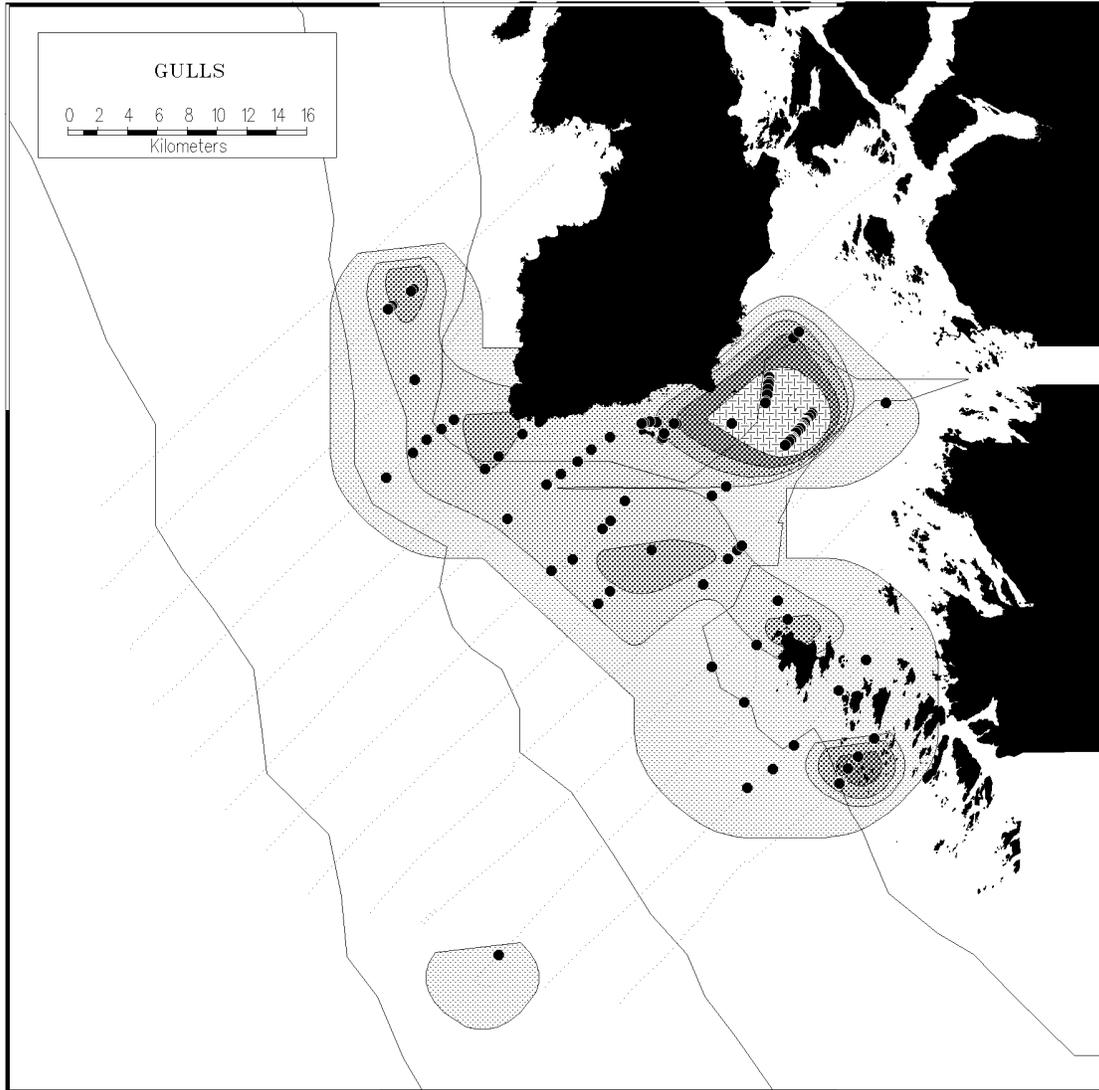


Figure 11. COASTAL/SHELF species: Distribution of *Larus* gulls.



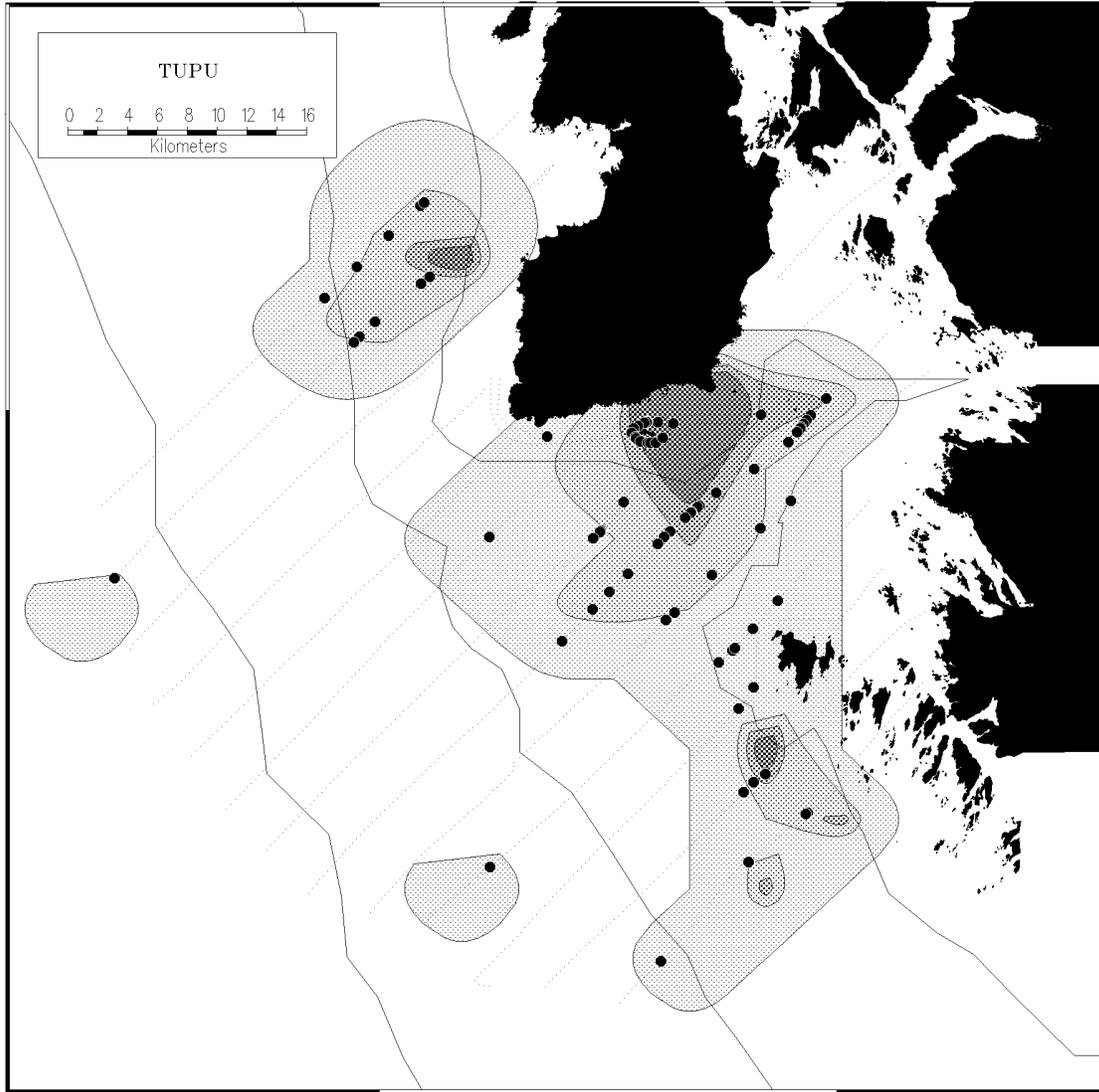


Figure 12. SHELFS species: Distribution of Tufted Puffins.

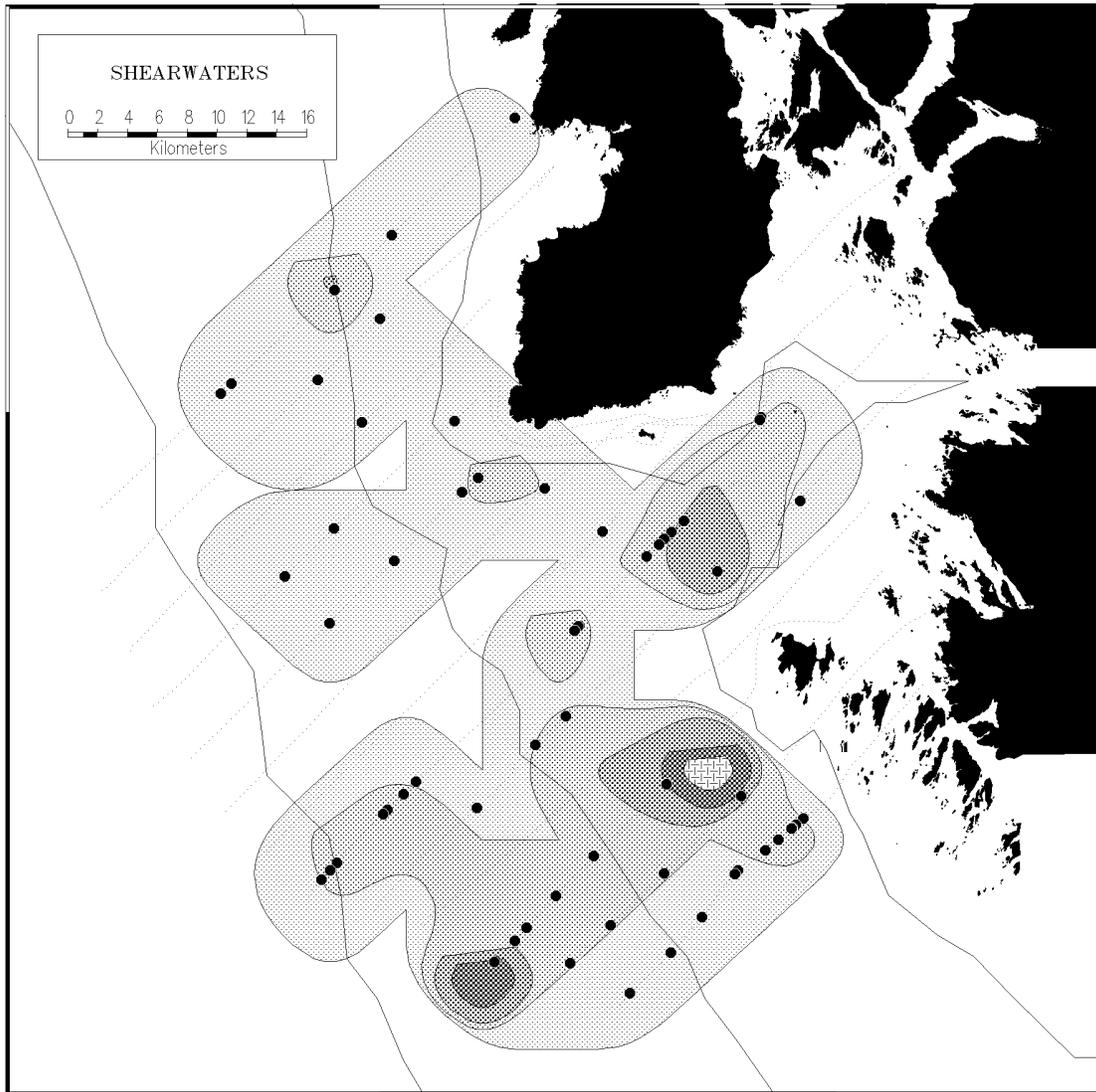


Figure 13. SHELF/SLOPE species: Distribution of shearwaters.

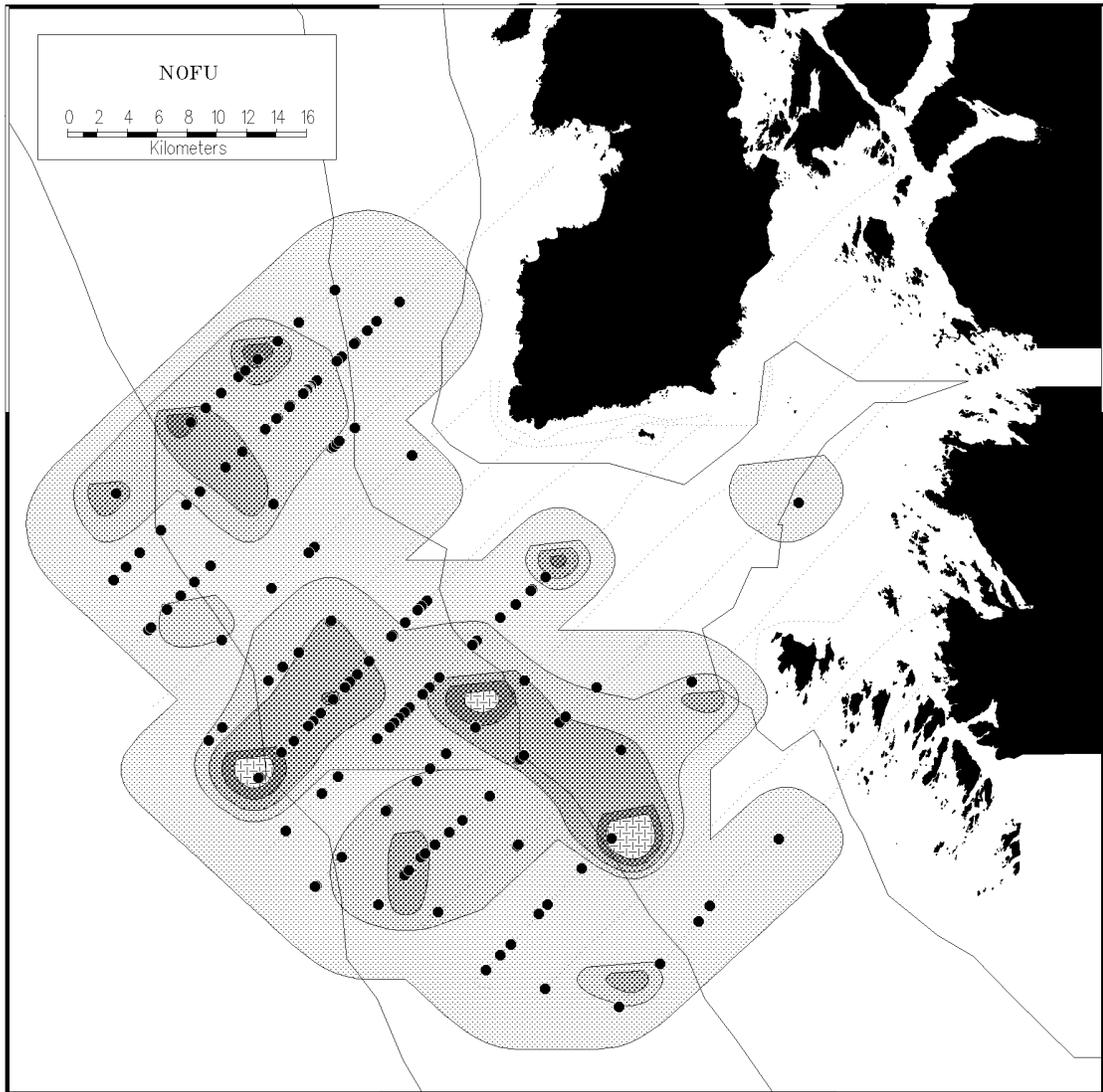


Figure 14. SLOPE/OCEANIC species: Distribution of Northern Fulmars.



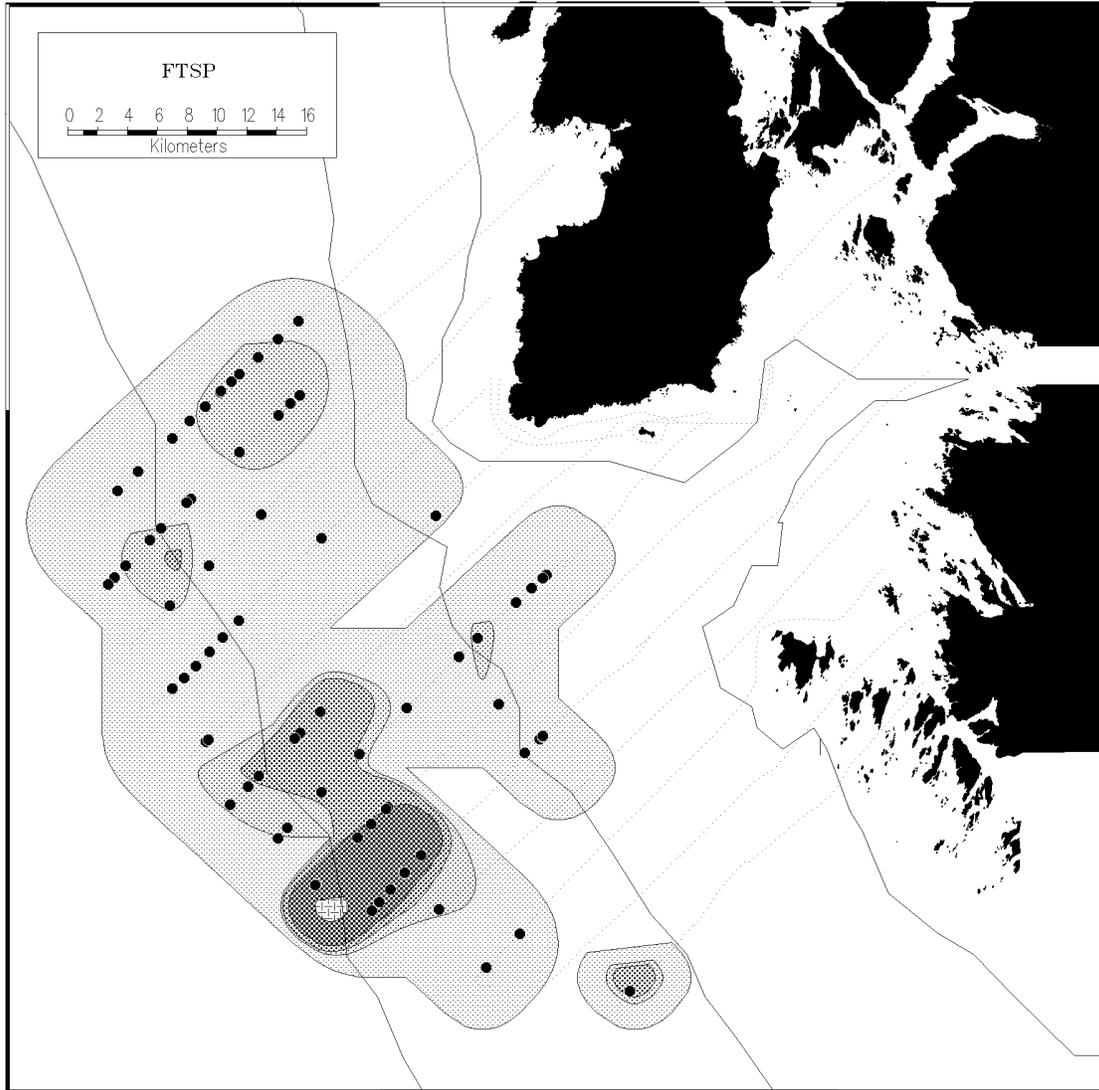
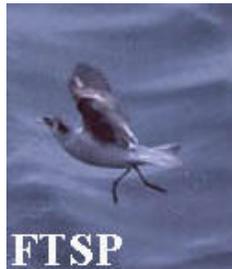


Figure 15. SLOPE/OCEANIC species: Distribution of Fork-tailed Storm-petrels.



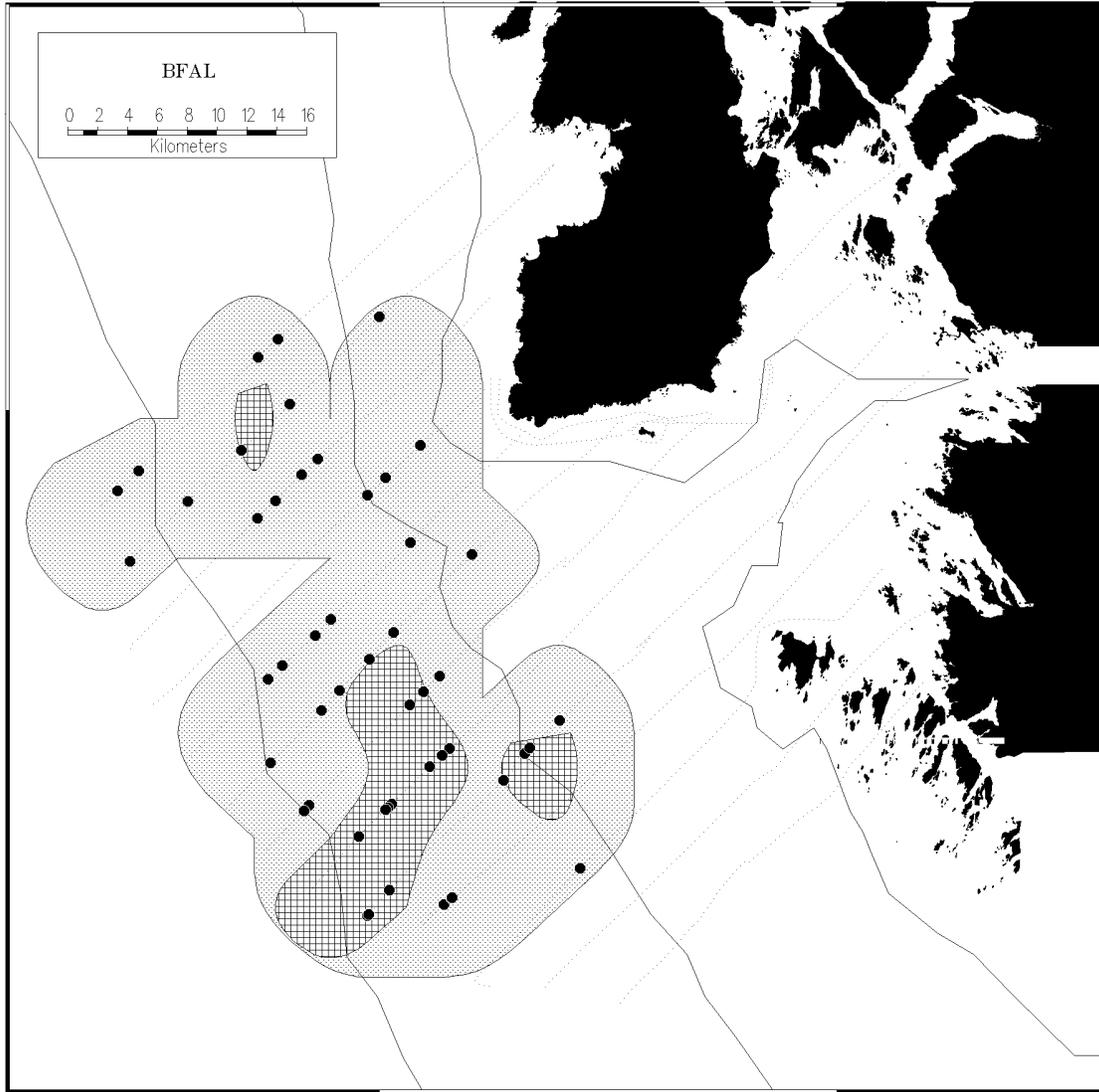


Figure 16. SLOPE/OCANIC species: Distribution of Black-footed Albatross.



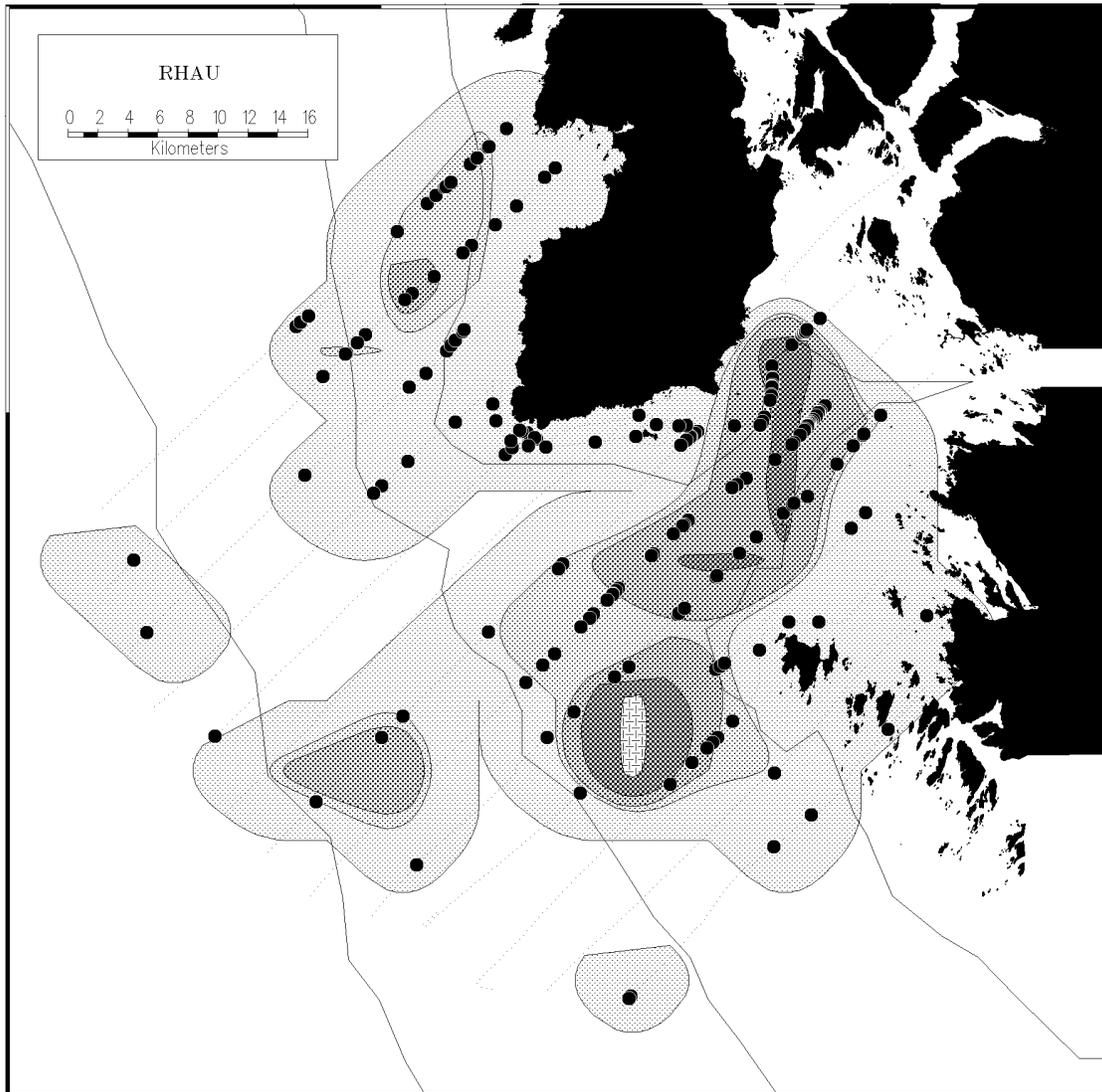


Figure 17. COASTAL/SHELF/SLOPE species: Distribution of Rhinoceros Auklets.



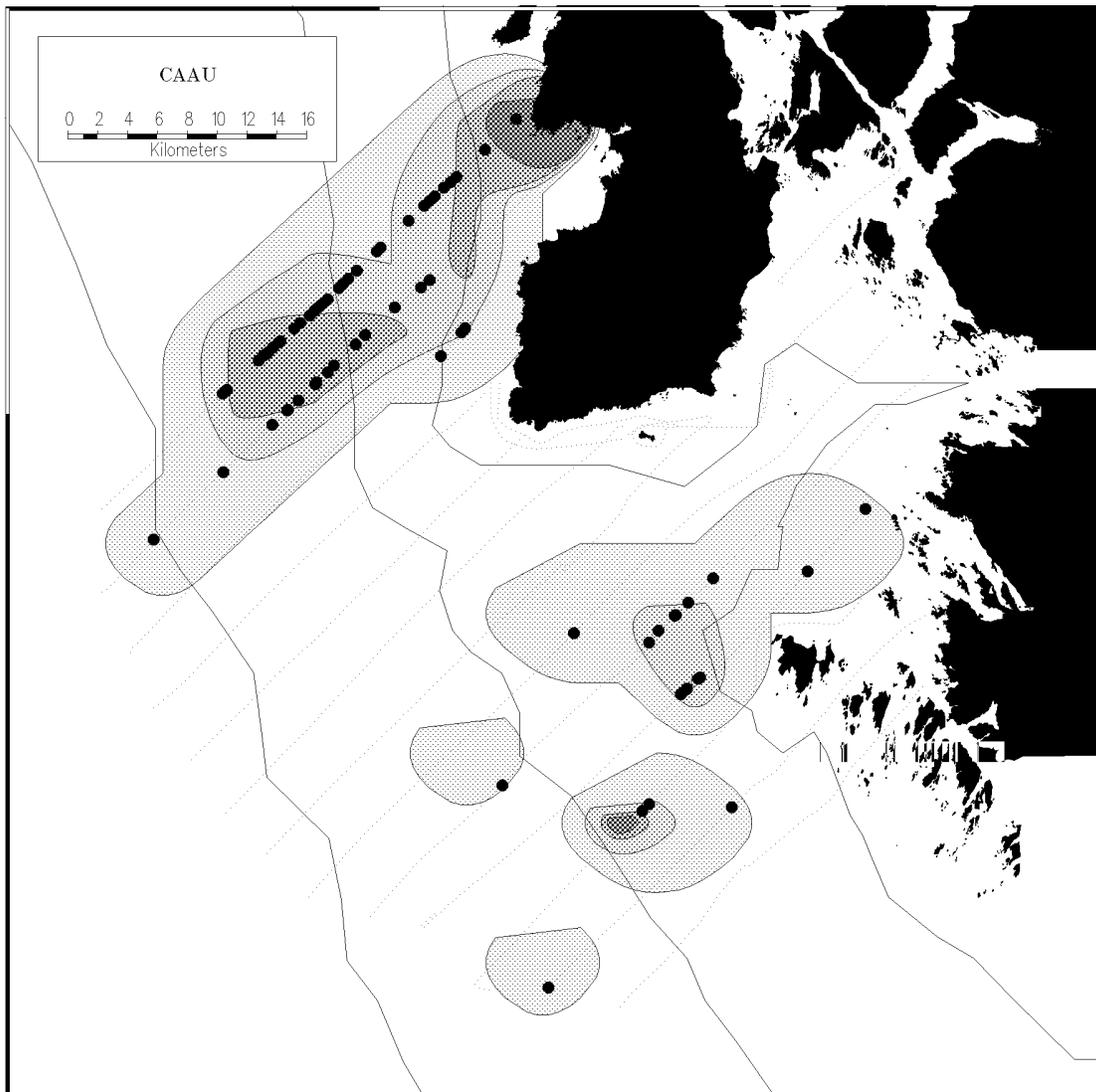


Figure 18. COASTAL/SHELF/SLOPE species: Distribution of Cassin's Auklet.



Appendix: Some fish pictures by Jeff Williams

