AMNWR 98/06

SEABIRD, MARINE MAMMAL, AND OCEANOGRAPHY COORDINATED INVESTIGATIONS IN THE PRIBILOF ISLANDS, ALASKA, JULY 1997 (SMMOCI 97-3)

by

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Key Words: Alaska, Bering Sea, fishes, hydroacoustics, marine mammals, oceanography, pelagic surveys, prey surveys, Pribilof Islands, salinity, seabirds, temperature, thermosalinograph

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October 1998

Cite as: Dragoo, D. E., and G. V. Byrd. 1998. Seabird, Marine Mammal, and Oceanography Coordinated Investigations in the Pribilof Islands, Alaska, in July 1997 (SMMOCI 97-3). U. S. Fish and Wildlife Service Report AMNWR 98/06.

EXECUTIVE SUMMARY

During the period 19-28 July 1997, a group of biologists from the U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Geological Survey, and the University of Alaska conducted investigations of the distribution of seabirds and marine mammals at sea, assessed prey with acoustic surveys and test fishing, and recorded oceanographic characteristics of the nearshore marine waters near the Pribilof Islands, Alaska. The studies in 1997 were part of a program begun in 1995, called "Seabird, Marine Mammal, and Oceanography Coordinated Investigations" (SMMOCI), whose purpose is to evaluate nearshore marine resources near sites where marine birds and mammals are being monitored on shore.

We observed animals on over 1,100 km of transects. The most frequently observed birds were murres, northern fulmars, and shearwaters. The highest densities of birds occurred in areas northwest of St. Paul Island and, northeast and southwest of St. George Island. We also saw four species of cetaceans during transects. The highest densities of northern fur seal were west and southwest of St. George Island.

Hydroacoustic surveys were run simultaneously with bird and marine mammal surveys on all 16 transects. The highest water column biomass occurred on a transect between St. Paul and St. George islands. The lowest biomass was on a transect southwest of St. George Island. The estimated relative density of prey was highest between about 115 m and 155 m, and lowest between about 90 m and 110 m (below the hull-mounted transducer). The existence of a strong sound-scattering layer near the Pribilof Islands was evident from our hydroacoustic data. During our surveys the depth of the layer varied, as did the depth of the water in which it was found.

We conducted neuston tows, mid-water trawls, long-line sets and bottom trawls to assess the availability and distribution of prey species, as well as to ground truth the hydroacoustics data. A variety of invertebrate and fish species were captured during this sampling effort. Young walleye pollock and jellyfish made up the bulk of the catch in the mid-water trawls.

We made 45 CTD casts and continuously recorded sea surface temperature and salinity. Water column temperatures varied more in some areas than others, indicating the existence of thermoclines at some locations. Water column temperatures ranged from 2.09°C to 10.21°C and salinity ranged from 30.77‰ to 33.76‰. Several fronts were evident where surface temperature or salinity (or both) changed rapidly in a relatively short distance. Surface water temperatures ranged from 5.95°C to 10.99°C and salinity ranged from 31.29‰ to 32.78‰.

The results from our surveys, as well as those of other researchers show that the nearshore waters of the Pribilof Islands are complex, oceanographically and biologically. The fact that the Pribilof Islands are home to one of the largest seabird colonies in the northern hemisphere, as well as a large population of northern fur seals, attests to the high productivity of the archipelago's nearshore waters. Future plans for the SMMOCI project include returning to the Pribilof Islands to assess changes that may occur in the nearshore environment and biota.

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INTRODUCTION

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Personnel

The following personnel besides the crew of the *M/V Ti_lâx* participated in the cruise:

U. S. Fish and Wildlife Service: Dan Boone, Vernon Byrd, Don Dragoo, Brenda Eliason, Glenn Elison, Doug Palmer, John Tobin, Art Wemmerus, Jeff Williams

National Marine Fisheries Service: Mike Strick

U.S. Geological Survey: John Piatt, Martin Robards, Tom Van Pelt

Univ. Of Alaska: Bob Foy

Volunteers: Mark Tasker, Brad Congdon

Cruise Schedule

Personnel boarded the *M/V Ti_lâx* at St. Paul Island on 18 July 1997. Fishing began that evening, and continued through 24 July. Transects were surveyed during the day and fishing was done at night. Individual transects also were surveyed opportunistically in the area on 25, 27, and 28 July while the ship was in transit to other locations. Specific activities were as follows:

19 July	SMMOCI party aboard *M/V Ti_lâx* Fish all night
20 July	Transects south of St. George Island all day, fish all night
21 July	Transects south of St. George Island all day, some fishing.
22 July	Transects south of St. George Island all day, fish all night
23 July	Transects south of St. George Island all day, fish all night, collect birds
24 July	Conduct transect between St. George Island and St. Paul Island on way to Walrus Island Survey seabirds and sea lions on Walrus Island

	Fish all afternoon and evening
25 July	Most of scientific crew off at St. Paul Island
	Conduct transect north of St. Paul Island on way to St. Matthew Island
27 July	Conduct transect north of St. Paul Island as vessel arrived from St. Matthew Island
28 July	Conduct transect south of St. Paul Island as vessel departed for Dutch Harbor

METHODS

Bird Observations

We followed methods described in Gould and Forsell (1989) for transects at sea. On parallel transects up to 100 km long (Fig. 2, Table 1), all birds on the water and all marine mammals were recorded to a distance of 150 m on each side of the ship by two observers located on the flying bridge. Every three minutes, flying birds seen on a 360 degree scan were recorded. Birds known to be following the ship were not counted. Information was relayed by radio to an operator who entered the data into a program called "dLog" (developed by Glenn Ford, Ecological Consulting Inc., Portland, OR). The computer was hooked to the ship's Global Positioning System (GPS) so that every observation was recorded with its exact location and time.

Hydroacoustic Surveys

Acoustics data were collected along the same transects used for bird and marine mammal observations. Transect spacing was about 20 km (Fig. 2). Surveys were conducted with the BioSonics 102 system installed on the *Ti_lâx* which has hull mounted (4 m deep) 38 and 120 kHz transducers that can be operated in the multiplexing mode or separately. We used the 120 kHz transducer for transects, all of which occurred during daylight hours. Settings for the 102 unit were: receiver gain -6 dB, TVG=20Log(R), band width 5 kHz, pulse width 0.5 ms, blanking distance 1.0 m, trigger interval 0.5 sec, and transmit power -3dB. Data were echo integrated using BioSonics ESP (version 3.2) software to a maximum depth of 300 meters. Twenty depth strata were defined for analysis, beginning at 2 m below the transducer to a depth of 202 m, in 10 m increments. The hydroacoustic survey did not sample the upper 5 m of the water column. Data were summarized as: 1) estimated water column biomass per unit surface area by transect, and 2) estimated relative density of prey by depth stratum.

Trawls

Mid-water trawls were conducted to describe prey recorded with the hydroacoustics equipment. We used a 6 m modified herring trawl towed for 10 or 15 minutes at 2-3 kts. A net minder was attached to the foot rope of the trawl to determine fishing depth. Samples collected were identified, counted, and a subsample was measured for length.

To evaluate surface prey, we towed a neuston net for 15 min at 2-3 kts in areas where birds were seen feeding on the surface. Prey were preserved for later identification.

Bottom trawls were conducted at subjectively selected locations using a 3.05 m plumb staff beam trawl with a 4 mm stretched mesh at the cod end. This device was towed for 10 min in the direction of the water current at approximately 1.5 kts. Prior to each bottom trawl, a towed video camera was deployed to evaluate the substrate. Samples were identified, counted, measured, and some were preserved for later use.

Long-line Sets

One skate of 100 hooks baited with herring was deployed for about 2 hours each day at subjectively selected sites. Fish caught were identified, measured, and their sex was determined. Stomachs were removed from Pacific cod and Pacific halibut for later prey analysis.

Oceanographic Data

A continuous record was maintained during hydroacoustic surveys with the ship's Seabird Seacat SBE 21 thermosalinograph recording surface (3 m depth) water temperature and salinity, along with GPS position, every 60 seconds. A portable conductivity, temperature and depth (CTD) recorder (Seabird Seacat SBE-19 Profiler) was deployed at the beginning and end of each transect, at the end of some fishing events (tow or long-line set), and at 20 km intervals along one selected transect (Transect 4). In this way, temperature and salinity profiles were obtained for the water column (to a maximum depth of about 145 meters, as dictated by the amount of cable available on the winch).

RESULTS

Bird and Marine Mammal Observations

We observed animals on over 1,100 km of transects (Fig. 2). Weather conditions were mostly excellent for transects south of St. George Island and between St. Paul Island and St. George Island, but rough seas hampered some of the surveys to the north of St. Paul Island (e. g., Transects 14 and 18, Appendix A). The most frequently observed birds were murres, northern fulmars, and shearwaters. The highest densities of birds occurred in areas to the northwest of St. Paul Island and, northeast and southwest of St. George Island (Fig. 3). The following annotated list summarizes our observations.

Procellariids.--A single laysan albatross was seen on Transect 1 during this survey (Table 2, Appendix B). Northern fulmars were the most numerous birds seen on our transects with 3,200 individuals observed (Table 2). The highest density of northern fulmars was southwest of St. George Island along Transect 5 (Fig. 4). Shearwaters were nearly as numerous as fulmars but were found in the highest density on Transect 14, northeast of St. Paul Island (Fig. 5). We observed 1,966 storm-petrels during the surveys (mostly fork-tailed). Nearly all storm-petrels

were observed south of St. George Island near the shelf-break, the point at which the slope of the sea floor increases abruptly (Fig. 6). The high numbers of storm-petrels we observed is especially interesting since these seabirds do not breed in the Pribilof Islands.

Cormorants.--One red-faced cormorant was observed on Transect 15 (Table 2, Appendix B).

Shorebirds.--Phalarope densities were the highest near the southeastern coast of St. Paul Island, at the northern end of Transect 16 (Fig. 7, Appendix B). Most of the identified phalaropes were red phalaropes (Table 2). Ruddy turnstones and rock sandpipers also were observed during our survey (Table 2, Appendix B).

Jaegers, Gulls (other than kittiwakes), Terns.--All three species of jaegers were observed, in low numbers, during the survey (Table 2, Appendix B). We also saw one each of Sabine's gull and arctic tern.

Kittiwakes.--The highest densities of black-legged kittiwakes occurred northeast of St. Paul Island and southwest of St. George Island near the shelf break (Fig. 8, Table 2, Appendix B). Red-legged kittiwakes were more numerous than black-legged kittiwakes on our survey (Table 2). Most of the red-legged kittiwakes we saw were south of St. George Island, with the highest concentration over the shelf-break on Transect E (Fig. 9, Appendix B).

Murres.--Since nearly half of the murres seen during our transects were not identified to species (Table 2, Appendix B), we have included a map illustrating the densities of all murres (Fig. 10). Most of the murres encountered occurred near St. George Island or south of there. This pattern held true for both common (Fig. 11) and thick-billed (Fig. 12) murres, with the exception of one area of fairly high common murre density between the two islands (Fig. 11).

Murrelets and Auklets.--We saw low numbers of ancient murrelets on the transects (Table 2, Appendix B). Figure 13 illustrates the densities of all auklets we observed during our survey. The highest auklet concentrations occurred just east and southwest of St. George Island. Least auklets were the most numerous small alcids we counted followed by parakeet, crested and Cassin's auklets (Table 2, Appendix B).

Puffins.--The densities of puffins (species combined) were highest north of St. Paul Island with one small area southwest of St. George Island (Fig. 14). Horned puffins outnumbered tufted puffins on our transects (Table 2, Appendix B).

Cetaceans.--We saw 16 fin whales on Transect 5 (Table 3, Appendix C). One minke whale and 3 killer whales also were observed during the survey. We counted 89 Dall's porpoises, mostly on Transects 1 and 6 (Table 3, Appendix C).

Pinnipeds.--One hundred seventy-two northern fur seals occurred on the survey (Table 3, Appendix C). The highest seal densities were west and southwest of St. George Island (Fig. 15).

Prey

Acoustics Surveys.--Hydroacoustic surveys were run simultaneously with bird and marine mammal surveys on all 16 transects (Table 4). The highest water column biomass occurred on Transect 19. The lowest biomass was on Transect E (Table 4, Fig. 16).

The estimated relative density of prey was highest in strata 12 and 15 (112-122 m and 142-152 m below the hull-mounted transducer, respectively). Relative prey density was lowest in strata 10 and 11 (92-102 m and 102-112 m below the hull-mounted transducer, respectively) (Table 5, Fig. 17).

Neuston Tows.--We made 2 neuston tows in areas where we observed birds feeding on the surface (Figure 18, Appendix D). Fish, invertebrates, and eggs were found (Table 6).

Mid-water Trawls.--We made 10 mid-water trawls, but the doors crossed during tow number 3 so it was not used (Figure 18, Appendix D). Age-0 pollock and jellyfish dominated the catch (Table 7). Tow number 7, in the vicinity of Transect 5, had the highest number of walleye pollock. We also caught 4 other species of fishes, squid and salps. We usually restricted mid-water tows to areas where we observed fairly strong signs of biomass on the hydroacoustics display (Fig. 19). The depth of this sound-scattering layer varied between transects and with bottom depth. However, the species composition was similar regardless of the location or depth at which it occurred.

Long-line Surveys.--We set the long-line gear 5 times (Fig. 18, Appendix D). Yellow Irish lords were the most frequently caught species (Table 8). No fish were caught on long-line number 5 near Walrus Island (east of St. Paul Island).

Bottom Trawls.--We caught a wide variety of fish and invertebrate species on the 10 bottom trawls we did in 1997 (Fig. 18, Table 9, Appendix D). Two species of sculpins, yellow Irish lord and slim sculpin, were the most numerous fishes caught. Other fish species were represented by a single specimen (Table 9).

Oceanography

CTD Casts.--We made 45 CTD casts including those on transects and those at fishing stations (Figure 20, Appendix E). Most CTD casts showed a pattern of decreasing temperatures with increasing depth. This was more pronounced in some casts than others (e.g., Station 12, Appendix F). Some casts indicated a fairly distinct thermocline (e.g., Station 10). The water column appeared to be more isothermic in other areas (e.g., Station 4). Water column temperatures ranged from 2.09°C to 10.21°C.
Salinity did not vary as much as temperature on most of our CTD casts (Appendix F). Small variations in salinity were common whereas relatively larger changes occurred in only a few casts (e.g., Station 29). Water column salinity ranged from 30.77‰ to 33.76‰.

Thermosalinograph.--On all but 1 transect we were able to record continuous (every 60 seconds) readings of the temperature and salinity of surface water (Appendix G). Both the temperature and salinity of the surface water near the Pribilof Islands varied (Appendix H). Surface water temperatures ranged from 5.95°C to 10.99°C. Salinity of surface waters ranged from 31.29‰ to 32.78‰. Several fronts were evident where temperature or salinity (or both) changed rapidly in a relatively short distance (e.g., Transects 4 and 19).

DISCUSSION

None of the birds or marine mammals sampled during this study displayed a uniform distribution. We found that all species or groups for which we produced maps exhibited a patchy distribution with a few to several higher density areas. This patchiness may be due, in part, to the occurrence of frontal systems that have been identified near the Pribilof Islands (e.g., Kinder et al. 1983, Coyle and Cooney 1993). Such fronts have been shown to affect the foraging distribution and success of seabirds feeding near the islands (Kinder et al. 1993, Schneider et al. 1990). High concentrations of murres, as well as the highest density of auklets we recorded, were found in the area of a front identified by Schneider et al. (1990) northeast of St. George Island (Figs. 10 and 13). Kinder et al. (1983) also found high concentrations of murres associated with fronts. Thermosalinograph data from transects in that area (transects 4 and 19, Appendix H) indicate that the frontal system was present during our July 1997 cruise.

As stated earlier, the highest water column prey biomass occurred on Transect 19 and the lowest was on Transect E (Table 4, Fig. 16). Transect 19 had fairly low bird density (except at the south end near St. George Island where densities of divers such as murres and auklets were high), whereas Transect E exhibited relatively high bird concentrations (Fig. 3), particularly storm-petrels and red-legged kittiwakes (Figs. 6 and 9). Storm-petrels and kittiwakes are surface-feeders and the hull-mounted hydroacoustic transducer does not sample the upper portion of the water column to which these species are restricted. Therefore, it is not surprising that hydroacoustic surveys are an imprecise predictor of the distribution of surface-feeding seabirds. The estimated relative density of prey was highest between about 115 m and 155 m depth (Table 5, Fig. 17). The prey at these depths is well within the diving range of murres (Piatt and Nettleship 1985).

The existence of a strong sound-scattering layer in the waters near the Pribilof Islands was evident from our hydroacoustic data (Figure 19). Coyle and Cooney (1993) also noted this layer of relatively concentrated biomass. During our surveys the depth of the layer varied, as did the depth of the water in which it was found. Regardless of the area, depth of the layer or the depth of the water, the species composition of organisms brought up in our mid-water tows was similar each time we fished on the sound scattering layer (Table 7). Jellyfish and young walleye pollock made up the bulk of every mid-water catch. Coyle and Cooney (1993) reported that, although walleye pollock were common in their samples, jellyfish dominated their catches in the Pribilof Islands.

The results from our surveys, as well as those of other researchers (e.g., Coyle and Cooney), show that the nearshore waters of the Pribilof Islands are complex, oceanographically and biologically. The fact that the Pribilof Islands are home to one of the largest seabird colonies in the northern hemisphere, as well as a large population of northern fur seals, attests to the high productivity of the archipelago's nearshore waters. Future plans for the SMMOCI project include returning to the Pribilof Islands to assess changes that may occur in the nearshore environment and biota.

ACKNOWLEDGMENTS

We would like to thank all of the people who helped gather the data during the 1997 Pribilof Island SMMOCI survey. Their perseverance, professionalism and good cheer were much appreciated. John Piatt gave Don Dragoo a crash course in Camris mapping techniques that was invaluable. We would also like to thank the staff of Alaska Maritime National Wildlife Refuge, Homer for their help and support, especially Belinda Dragoo who helped copy, review and compile this report. Finally, we would like to express our sincere thanks to the captain and crew of *M/V Ti_lâx* without whose enthusiasm, professionalism and patience this work would not have been possible.

LITERATURE CITED

Byrd, G. V., R. L. Merrick, J. F. Piatt, and B. L. Norcross. 1997. Seabird, marine mammal, and oceanography coordinated investigations (SMMOCI) near Unimak Pass, Alaska. Pages 351-364 *in* Forage fishes in marine ecosystems. Proceedings of the international symposium on the role of forage fishes in marine ecosystems. Alaska sea grant program report Number 97-01. University of Alaska Fairbanks.

Coyle, K. O., and R. T. Cooney. 1993. Water column sound scattering and hydrography around the Pribilof Islands, Bering Sea. Continental Shelf Research 13: 803-827.

Gould, P. J. and D. J. Forsell. 1989. Techniques for shipboard surveys of marine birds. U. S. Fish and Wildl. Serv., Fish and Wildl. Tech Rep. 25., Washington, D. C.

Kinder, T. H., G. L. Hunt, Jr., D. Schneider, and J. D. Schumacher. 1983. Correlations between seabirds and oceanic fronts around the Pribilof Islands, Alaska. Estuarine, Coastal and Shelf Science 16: 309-319.

Piatt, J. F., and D. N. Nettleship. 1985. Diving depths of four alcids. Auk 102: 293-297.

Schneider, D. C., N. M. Harrison, and G. L. Hunt, Jr. 1990. Seabird diet at a front near the Pribilof Islands, Alaska. Studies in Avian Biology 14: 61-66.

Table 1. Locations and times of surveys of transects used for bird and marine mammal observations and hydroacoustics surveys near the Pribilof Islands, Alaska, in July 1997.

Transect	Date	Start Latitude (N)	Start Longitude (W)	Stop Latitude (N)	Stop Longitude (W)	Start Time[a]	Stop Time
1	7/21	55° 36.629’	169° 10.241’	56° 25.087’	168° 35.913’	1718	2112
A	7/21	55° 39.778’	169° 27.254’	55° 36.629’	169° 10.241’	1544	1645
2	7/21	56° 28.063’	168° 52.623’	55° 39.778’	169° 27.254’	0810	1230
3	7/20	56° 31.387’	169° 09.938’	55° 42.926’	169° 43.656’	0729	1253
C	7/20	55° 42.926’	169° 43.656’	55° 46.250’	170° 00.972’	1323	1425
4	7/20	55° 46.250’	170° 00.972’	56° 34.886’	169° 26.645’	1443	2040
5	7/23	56° 34.220’	169° 44.610’	55° 49.399’	170° 17.376’	0731	1431
E	7/23	55° 49.399’	170° 17.376’	55° 52.723’	170° 34.387’	1451	1550
6	7/23	55° 52.723’	170° 34.387’	56° 41.009’	170° 00.972’	1610	2140
7	7/22	55° 56.047’	170° 51.704’	56° 44.333’	170° 18.288’	1637	2309
8	7/22	56° 47.657’	170° 35.299’	55° 59.371’	171° 08.412’	0834	1344
14	7/27	57° 48.697’	170° 48.079’	57° 13.273’	170° 24.111’	1710	2106
15	7/19	57° 08.249’	170° 20.487’	56° 41.059’	170° 01.402’	1820	2145
16	7/28	57° 11.122’	170° 06.245’	56° 38.232’	169° 44.270’	1949	2240
18	7/25	57° 12.137’	169° 51.430’	57° 54.170’	170° 20.947’	1121	1608
19	7/24	56° 35.069’	169° 26.625’	57° 11.876’	169° 51.245’	0757	1142

[a]All times are Alaska Daylight.

Table 2. Species composition and numbers of seabirds observed on 16 transects near the Pribilof Islands, Alaska during July 1997.

Species	Scientific Name	No.	% Total	Density[a]
All bird species total		17,754	100.0	51
Laysan Albatross	*Diomedea immutabilis*	1	<0.1	<1
Northern Fulmar	*Fulmarus glacialis*	3,200	18.0	9
All Shearwaters	*Puffinus* spp.	2,920	16.5	8
Sooty Shearwater	*Puffinus griseus*	54	0.3	<1
Short-tailed Shearwater	*Puffinus tenuirostris*	138	0.8	<1
All Storm-petrels	*Oceanodroma* spp.	1,966	11.1	6
Fork-tailed Storm-petrel	*Oceanodroma furcata*	1,953	11.0	6
Leach's Storm-petrel	*Oceanodroma leucorhoa*	10	<0.1	<1
Red-faced Cormorant	*Phalocrocorax urile*	1	<0.1	<1
All Phalaropes	*Phalaropus* spp.	1,156	6.5	3
Red-necked Phalarope	*Phalaropus lobatus*	66	0.4	<1
Red Phalarope	*Phalaropus fulicaria*	958	5.4	3
Ruddy Turnstone	*Arenaria interpres*	6	<0.1	<1
Rock Sandpiper	*Caladris ptilocnemis*	1	<0.1	<1
Pomarine Jaeger	*Stercorarius pomarinus*	2	<0.1	<1
Parasitic Jaeger	*Stercorarius parasiticus*	4	<0.1	<1
Long-tailed Jaeger	*Stercorarius longicaudus*	4	<0.1	<1
All Kittiwakes	*Rissa* spp.	570	3.2	2
Black-legged Kittiwake	*Rissa tridactyla*	211	1.2 <1	<1
Red-legged Kittiwake	*Rissa brevirostris*	329	1.9	1
Sabine's Gull	*Xema sabini*	1	<0.1	<1
Arctic Tern	*Sterna paradisaea*	1	<0.1	<1
Unidentified Alcid	*Alcidae*	45	0.3	<1
All Murres	*Uria* spp.	5,687	32.0	16
Common Murre	*Uria aalge*	1,604	9.0	5
Thick-billed Murre	*Uria lomvia*	1,440	8.1	4
Ancient Murrelet	*Sinthliboramphus antiquus*	26	0.2	<1
Cassin's Auklet	*Ptychoramphus aleuticus*	4	<0.1	<1
Parakeet Auklet	*Cyclorrhynchus psittacula*	386	2.2	1
Crested Auklet	*Aethia cristatella*	151	0.9	<1
Least Auklet	*Aethia pusilla*	868	4.9	3
Horned Puffin	*Fratercula corniculata*	452	2.6	1
Tufted Puffin	*Fratercula cirrhata*	288	1.6	<1

[a]Individuals/km^2.

Table 3. Species composition and numbers of marine mammals observed on 16 transects near the Pribilof Islands, Alaska during July 1997.

Species	Scientific Name	No. Observed	Density[a]
Fin Whale	*Balaenoptera physalus*	16	<1
Minke Whale	*Balaenoptera acutorostrata*	1	<1
Killer Whale	*Orcinus orca*	3	<1
Dall's Porpoise	*Phocoenides dalli*	89	<1
Northern Fur Seal	*Callorhinus ursinus*	172	<1

[a]Individuals/km^2.

Table 4. Estimated water column biomass per unit surface area by transect at the Pribilof Islands in 1997.

Transect	Water Column Biomass (kg/m^2)	Date (Time)
1 (234)[a]	0.3837 (0.9136)[b]	21 July (17:18-21:12)
A (62)	0.5759 (0.3534)	21 July (15:44-16:45)
2 (260)	0.3207 (0.3809)	21 July (08:10-12:30)
3 (323)	0.9232 (0.9232)	20 July (07:29-12:53)
C (64)	0.1095 (0.0631)	20 July (13:23-14:25)
4 (301)	0.1990 (0.3944)	20 July (14:43-20:40)
5 (296)	0.5771 (0.6381)	23 July (07:31-14:31)
E (60)	0.0217 (0.0224)	23 July (14:51-15:50)
6 (308)	1.4455 (19.3639)	23 July (16:10-17:59)
7 (303)	3.9949 (30.1239)	22 July (16:37-23:09)
8 (310)	0.5155 (0.4418)	22 July (08:34-13:44)
15 (194)	2.1375 (0.6950)	19 July (18:20-21:45)
16 (177)	1.1208 (0.3080)	28 July (19:49-22:40)
19 (225)	5.3013 (21.2819)	24 July (07:57-11:42)
14 (230)	1.7022 (0.4469)	27 July (17:10-21:06)
18 (281)	1.3221 (0.2900)	25 July (11:21-16:08)

[a]Sample size in parentheses.
[b]Standard deviation in parentheses.

Table 5. Estimated relative density of prey by depth stratum at the Pribilof Islands in 1997.

Stratum	Relative Density[a]	Number of Transects in Which Stratum Occurred
1 (2 to 12 m)[b]	0.0070 (0.0093)[c]	16
2 (12 to 22 m)	0.0072 (0.0087)	16
3 (22 to 32 m)	0.0131 (0.243)	16
4 (32 to 42 m)	0.0220 (0.0598)	16
5 (42 to 52 m)	0.0146 (0.0306)	16
6 (52 to 62 m)	0.0085 (0.0097)	16
7 (62 to 72 m)	0.0079 (0.0096)	16
8 (72 to 82 m)	0.0095 (0.140)	16
9 (82 to 92 m)	0.0085 (0.0160)	13
10 (92 to 102 m)	0.0021 (0.0020)	11
11 (102 to 112 m)	0.0027 (0.0023)	11
12 (112 to 122 m)	0.0390 (0.1185)	11
13 (122 to 132 m)	0.0158 (0.0451)	11
14 (132 to 142 m)	0.0119 (0.0324)	11
15 (142 to 152 m)	0.0359 (0.1085)	11
16 (152 to 162 m)	0.0133 (0.0373)	11
17 (162 to 172 m)	0.0180 (0.0362)	11
18 (172 to 182 m)	0.0174 (0.0346)	11
19 (182 to 192 m)	0.0193 (0.0388)	11
20 (192 to 202 m)	0.0158 (0.0320)	11

[a]Estimated water column relative prey density for the current stratum averaged over all transects.
[b]Depth range of stratum.
[c]Standard deviation in Parentheses.

Table 6. Species captured with neuston net during Pribilof SMMOCI sampling in 1997.

Species	Tow Number 1	2
Jellyfish	1	0
Polycheate Worm	1	0
Copepods	0	X[a]
Amphipods	0	X
Euphausiids	1	X
Decapods	1	0
Sea Salps	2	0
Greenling (*Hexagrammidae*)	3	0
Unidentified eggs	0	X

[a]Present but not enumerated.

Table 7. Species captured with mid-water trawl during Pribilof SMMOCI sampling in 1997.

Species	Tow Number 1	2	4	5	6	7	8	9	10	All Tows
Jellyfish	X[a]	X		X	X	X	X	X	X	X
Squid			X			X				X
Sea Salps			X		X					X
Pacific cod (*Gadus macrocephalus*)				4					4	8
Walleye pollock (*Theragra chalcogramma*)	1,700	1,350	500	3,000	1,500	10,500	96	1,945	1,200	21,791
Prowfish (*Zaprora silenus*)			1	3						4
Fourhorn Poacher (*Hypsagonus quadricornis*)								2		2
Pacific halibut (*Hippoglossus stenolepis*)								1		1

[a]Present but not enumerated.

Table 8. Species captured with long-line gear during Pribilof SMMOCI sampling in 1997.

Species	Set Number 1	2	3	4	5[a]	All sets
Pacific cod (*Gadus macrocephalus*)	3	17	0	0	0	20
Yellow Irish lord (*Hemilepidotus jordani*)	26	13	8	1	0	48
Pacific halibut (*Hippoglossus stenolepis*)	5	4	1	1	0	11

[a]No fish captured.

Table 9. Species captured with bottom trawl during Pribilof SMMOCI sampling in 1997.

Species	Tow Number 1	2	3	4[a]	5	6[b]	9	10	All Tows
Jellyfish	X[c]								X
Oysters		X							X
Amphipods	X								X
Shrimp	X	X							X
Crab (hermit)		X							X
Crab (decorator)	X	X							X
Urchins	X					X	X	X	X
Sea cucumbers	X	X				X	X	X	X
Pacific cod (*Gadus macrocephalus*)			2						2
Walleye pollock (*Theragra chalcogramma*)	1								1
Searcher (*Bathymaster signatus*)	4	3				2	1		10
Northern ronquil (*Ronquilus jordani*)							2		2
Nutcracker prickleback (*Bryozoichthys lysimus*)		3							3
Masked greenling (*Hexagrammos octogrammus*)							3		3
Red Irish lord (*Hemilepidotus hemilepidotus*)							3		3
Yellow Irish lord (*Hemilepidotus jordani*)	1				1	7	234	7	250
Northern sculpin (*Icelinus borealis*)			15	2	2		1		20

Table 9. Species captured with bottom trawl during Pribilof SMMOCI sampling in 1997 (cont.).

Species	Tow Number 1	2	3	4[a]	5	6[b]	9	10	All Tows
Pacific staghorn sculpin (*Leptocottus armatus*)	11	43	8			3	8		73
Eyeshade sculpin (*Nautichthys pribilovius*)						2	8		10
Slim sculpin (*Radulinus asprellus*)			251						251
Roughspine sculpin (*Triglops macellus*)	1								1
Ribbed sculpin (*T. pingeli*)		1						14	15
Smooth alligatorfish (*Anoplagonus inermis*)		1							1
Aleutian alligatorfish (*Aspidophoroides bartoni*)	2								2
Fourhorn poacher (*Hypsagonus quadricornis*)							4		4
Lumpsuckers/snailfish (*Cyclopteridae*)		4	2				3		9
Arrowtooth flounder (*Atherestes stomias)*				2	5				7
Flathead sole (*Hippoglossoides elassodon*)					1				1
Pacific halibut (*Hippoglossus stenolepis*)			38	2					40
Rock sole (*Pleuronectes bilineata*)			2		14	1		8	25
Triglops xenostethus							6		6

[a]Trawl probably was not on bottom during majority of tow.
[b]Trawl twisted during tow.
[c]Present but not enumerated.

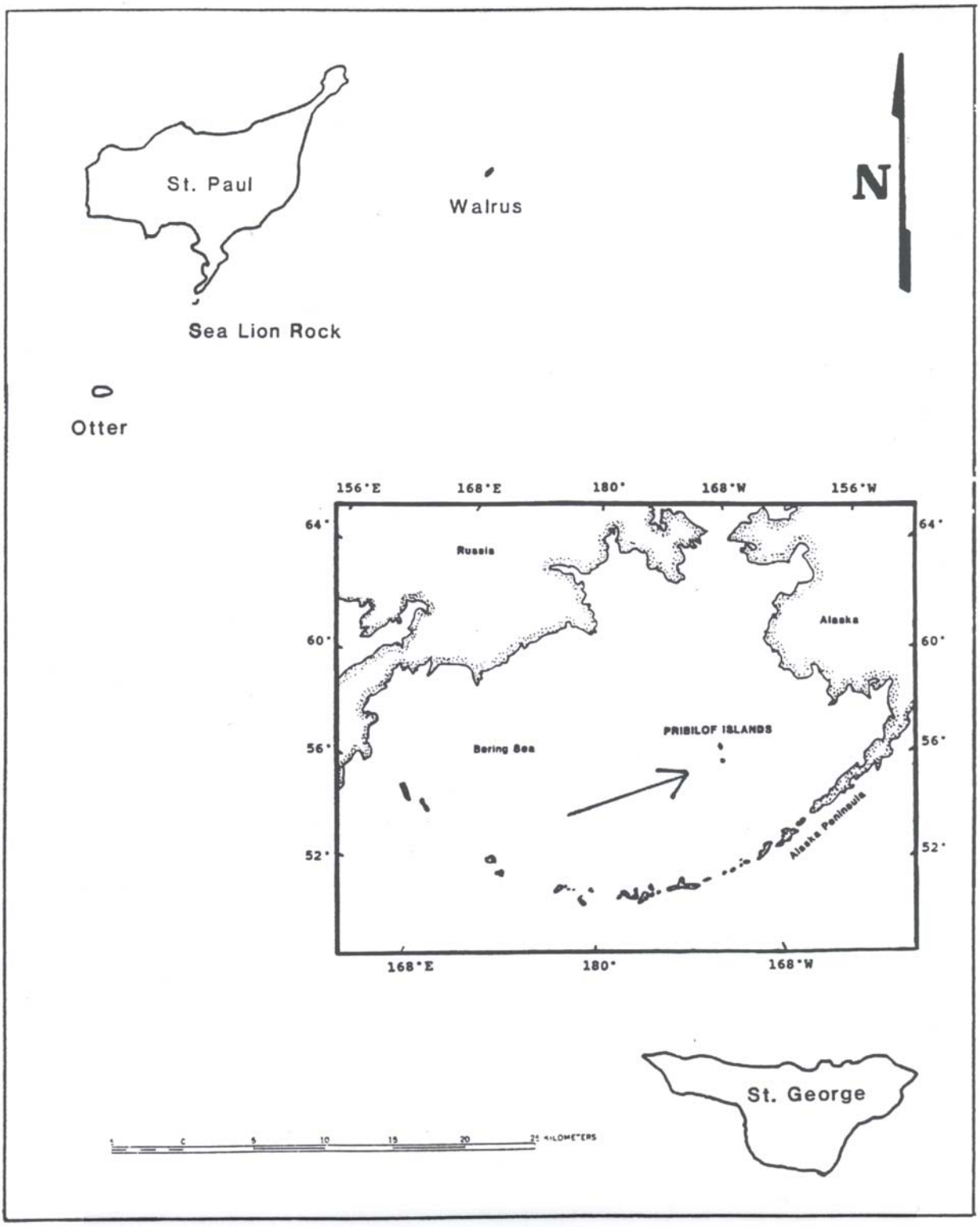


Figure 1. Map of the Pribilof Islands, Alaska, showing the study area.

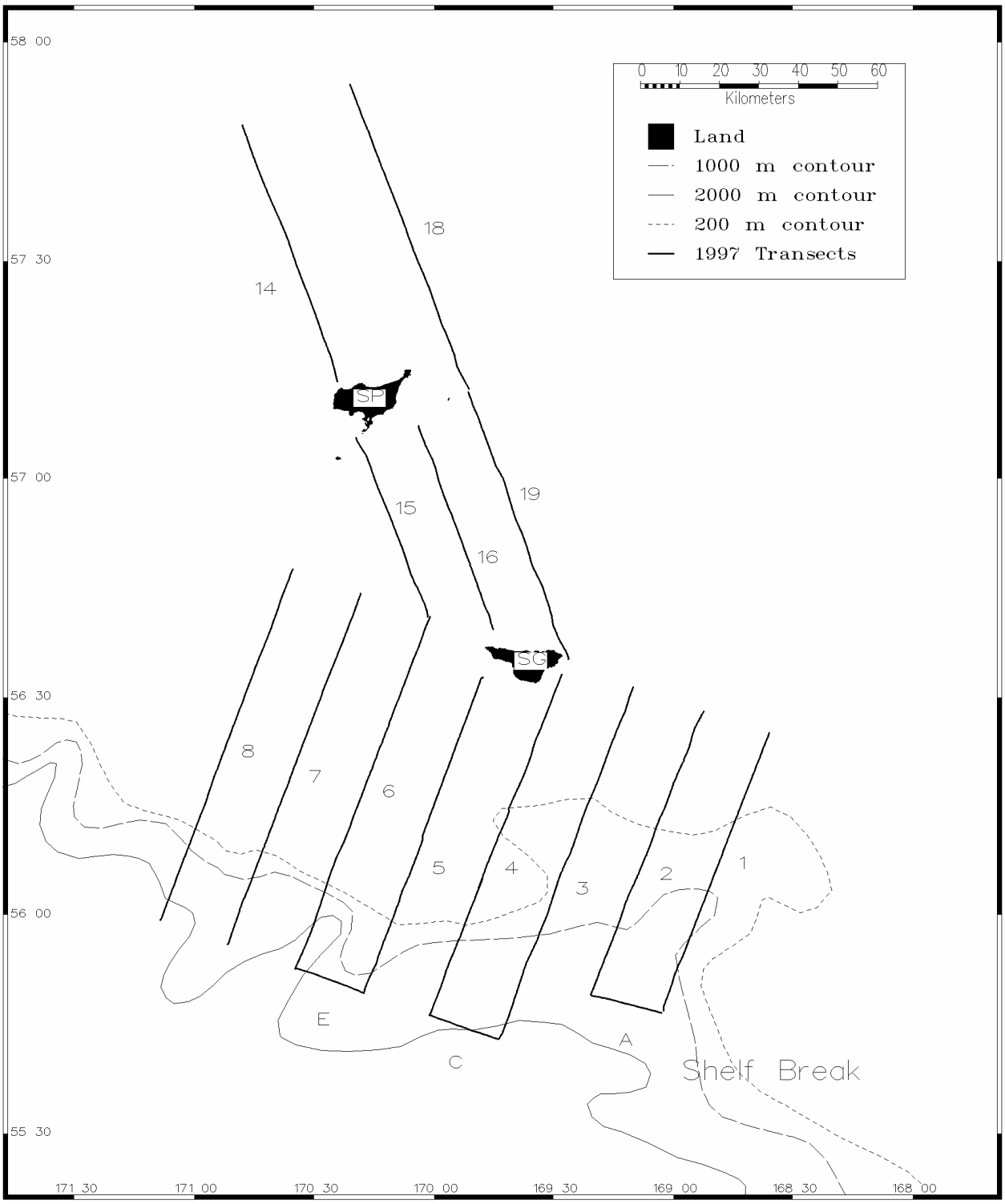


Figure 2. Map of Pribilof Island, Alaska transects surveyed in 1997.

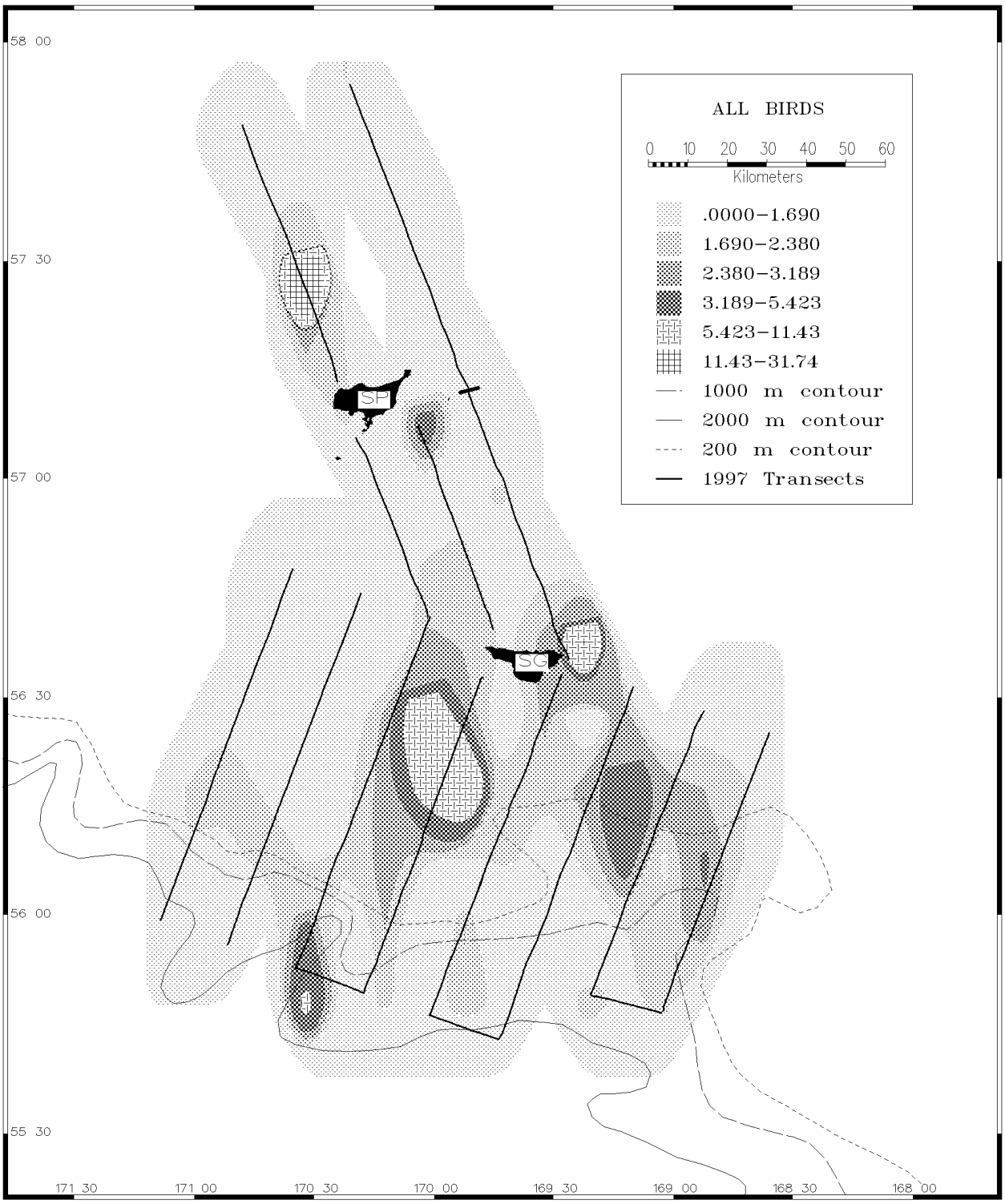


Figure 3. Densities of all birds on transects surveyed at the Pribilof Islands, Alaska in 1997.

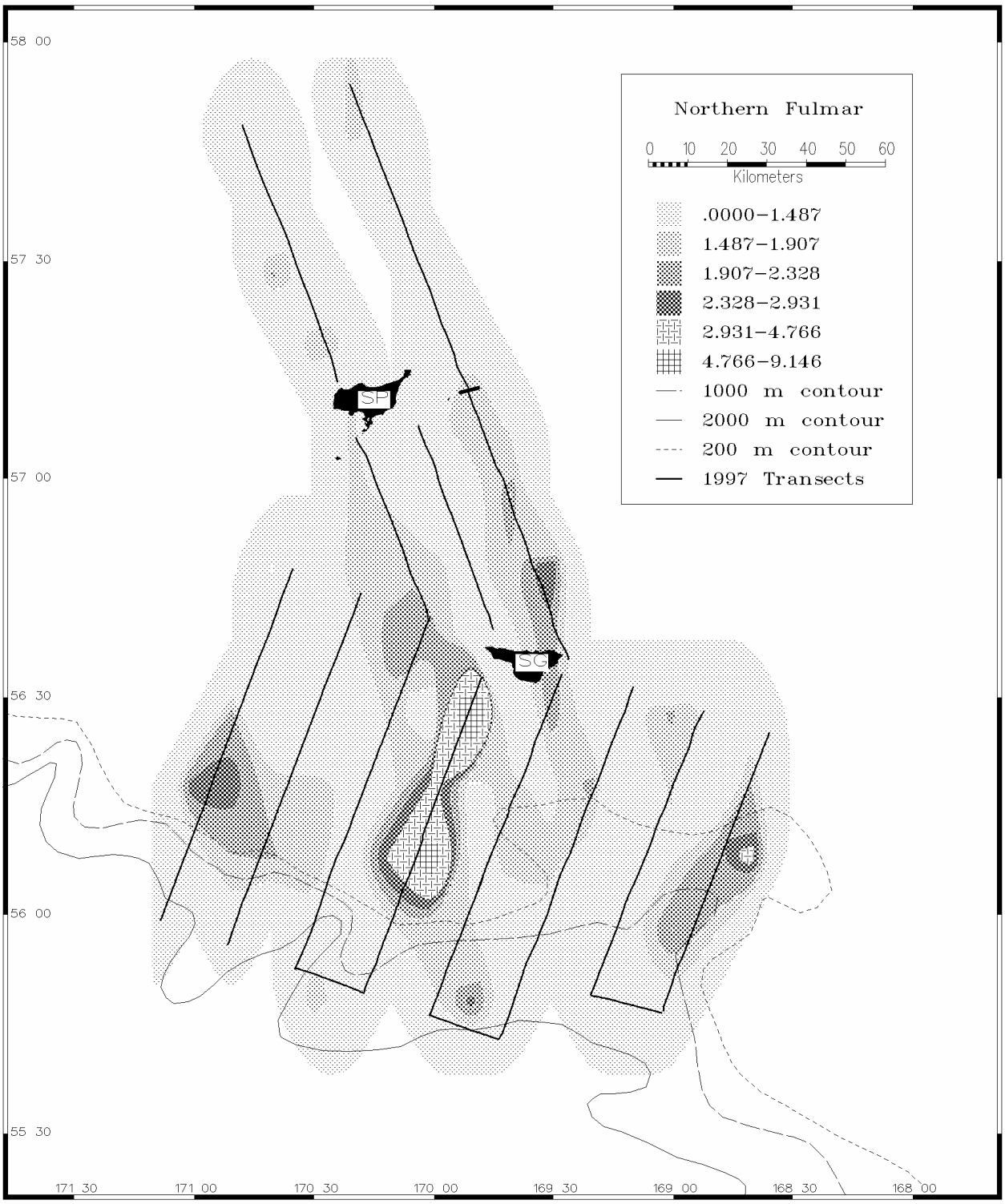


Figure 4. Densities of northern fulmars on transects surveyed at the Pribilof Islands, Alaska in 1997.

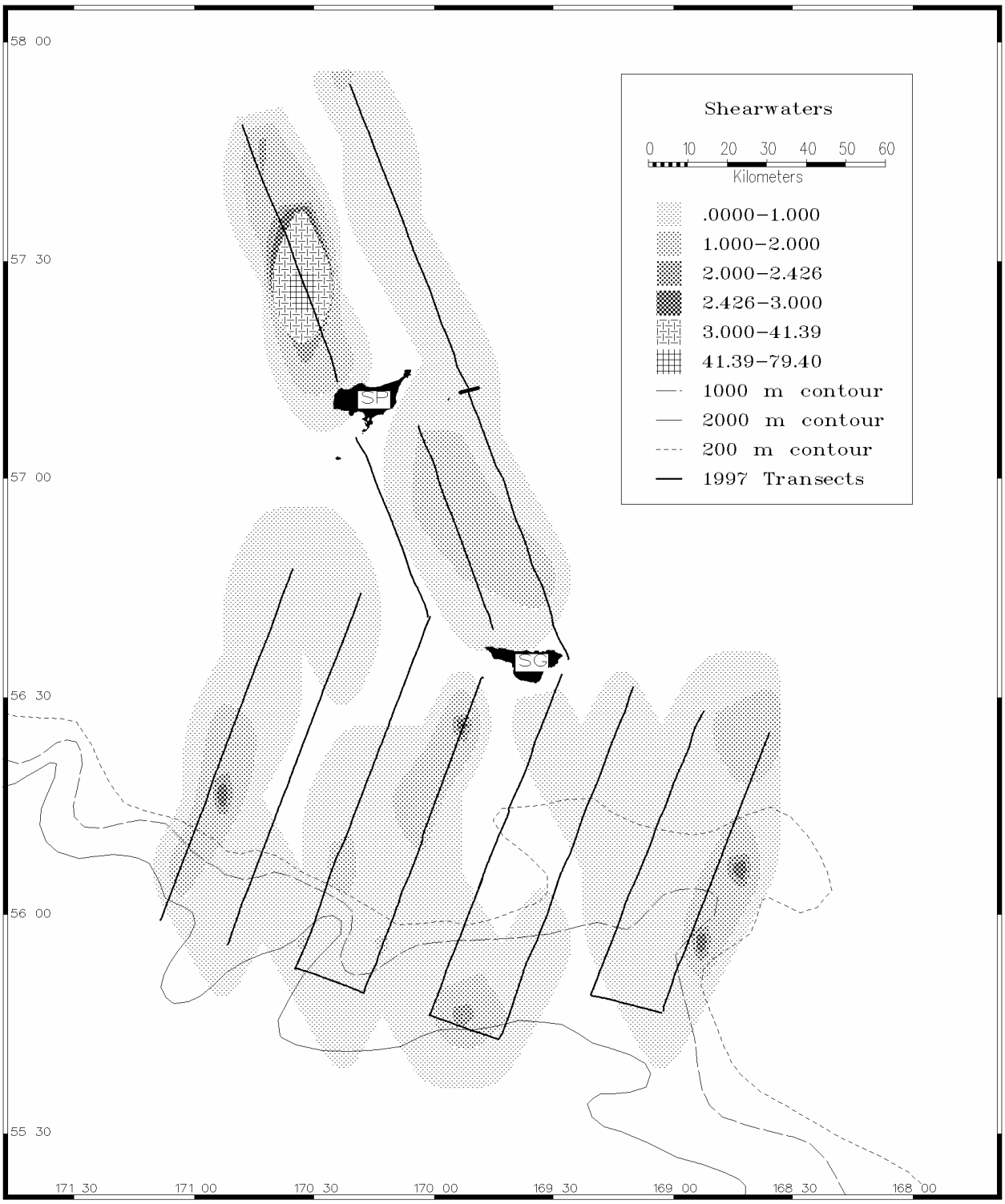


Figure 5. Densities of shearwaters on transects surveyed at the Pribilof Islands, Alaska in 1997.

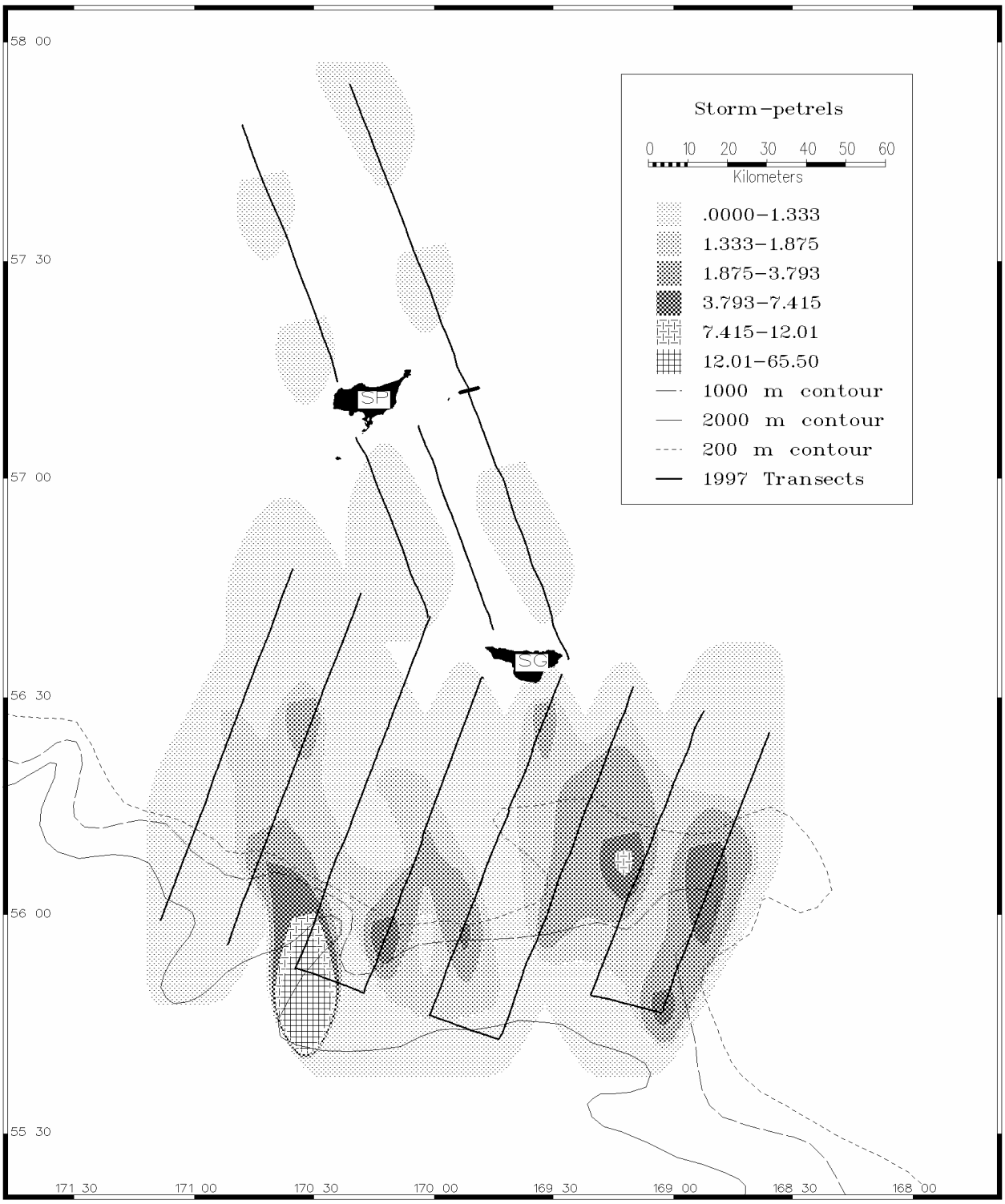


Figure 6. Densities of storm-petrels on transects surveyed at the Pribilof Islands, Alaska in 1997.

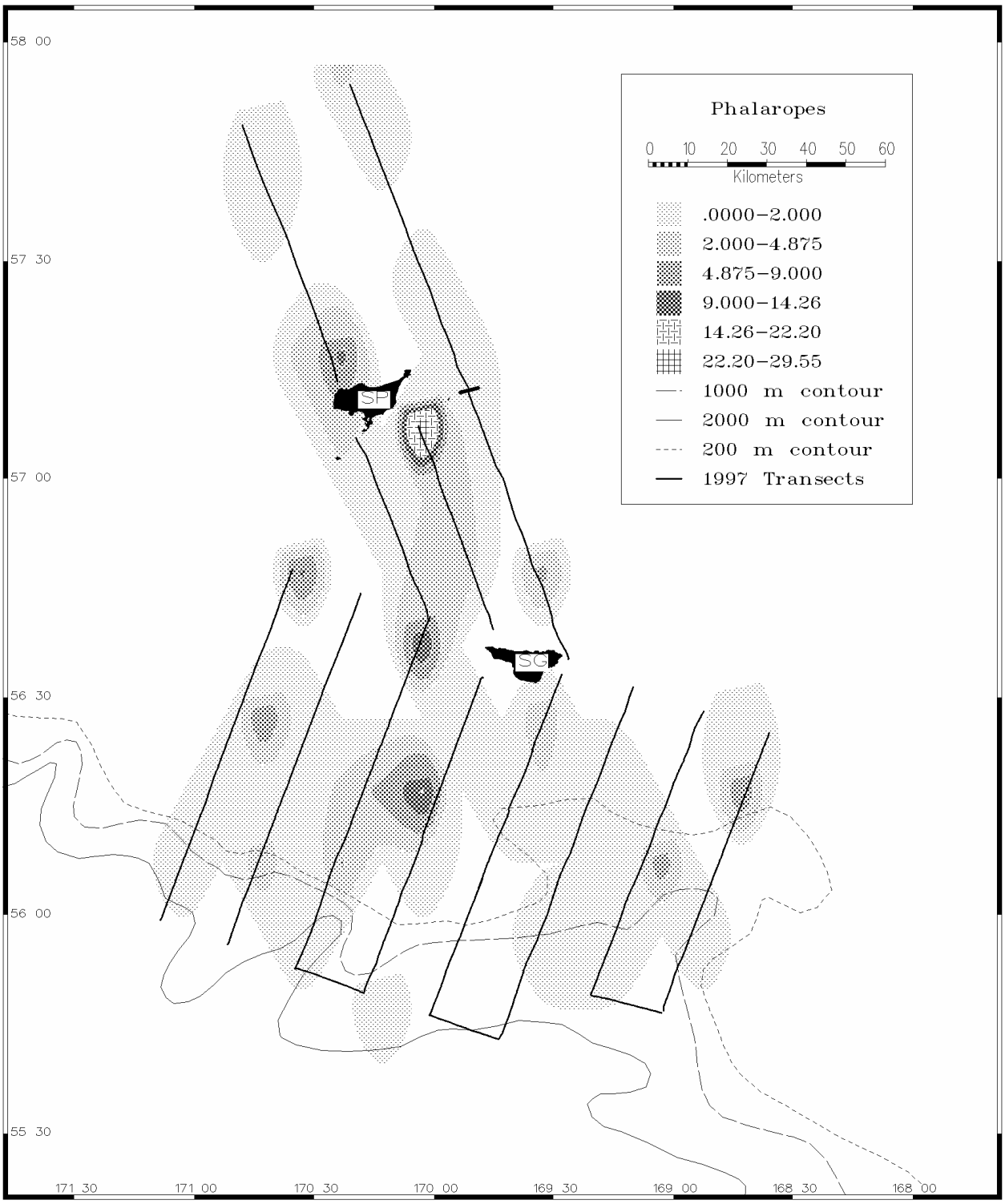


Figure 7. Densities of phalaropes on transects surveyed at the Pribilof Islands, Alaska in 1997.

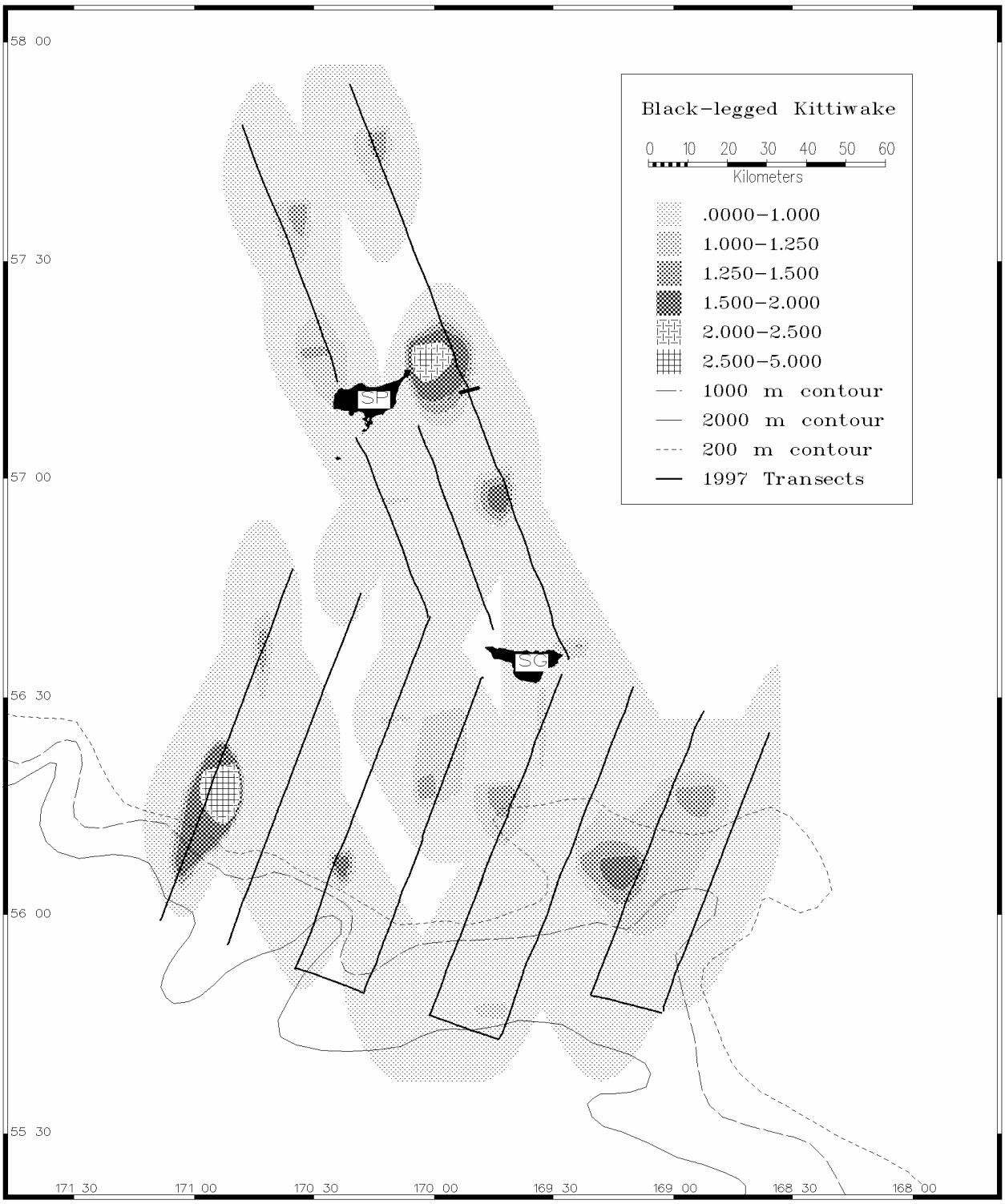


Figure 8. Densities of black-legged kittiwakes on transects surveyed at the Pribilof Islands, Alaska in 1997.

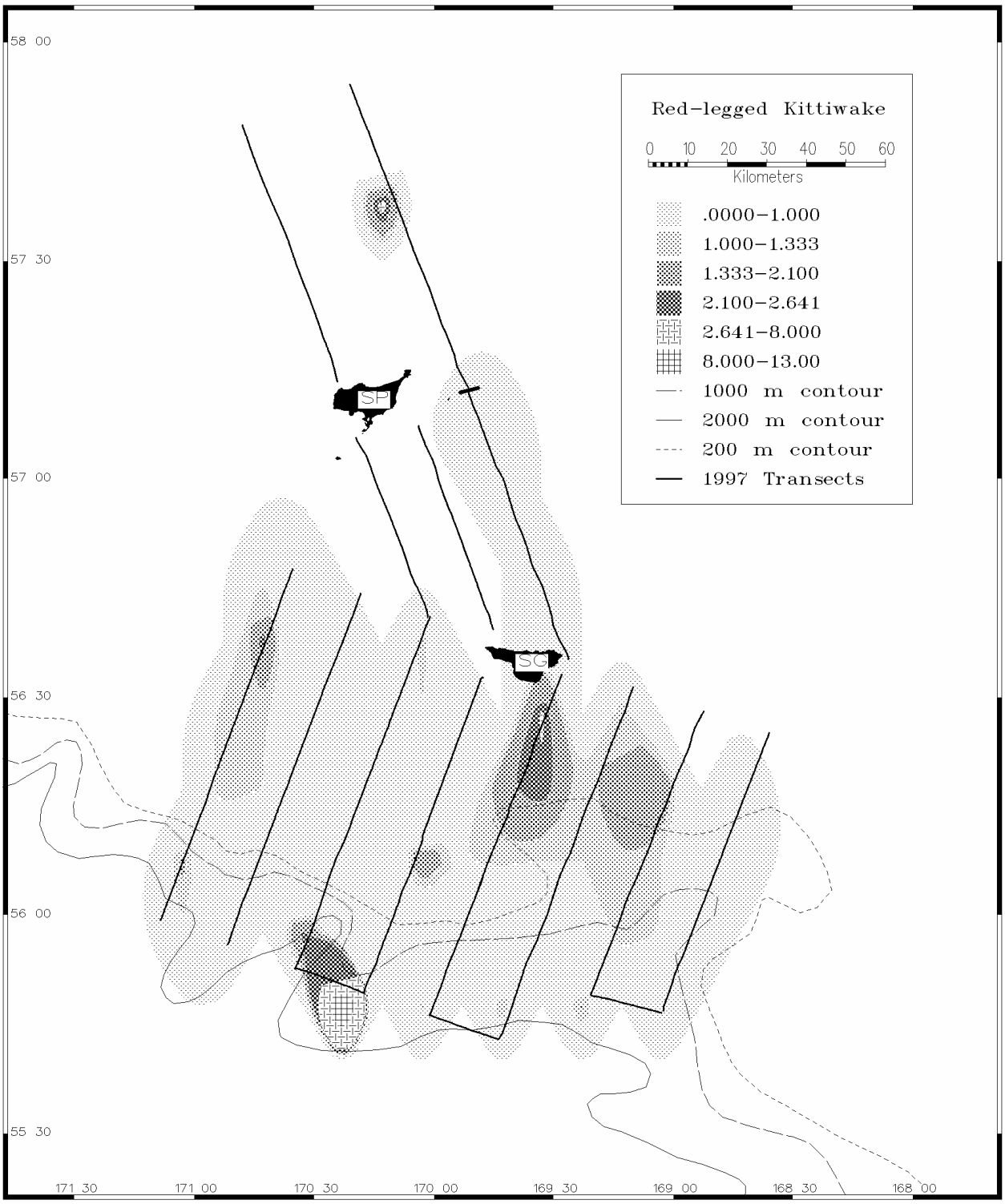


Figure 9. Densities of red-legged kittiwakes on transects surveyed at the Pribilof Islands, Alaska in 1997.

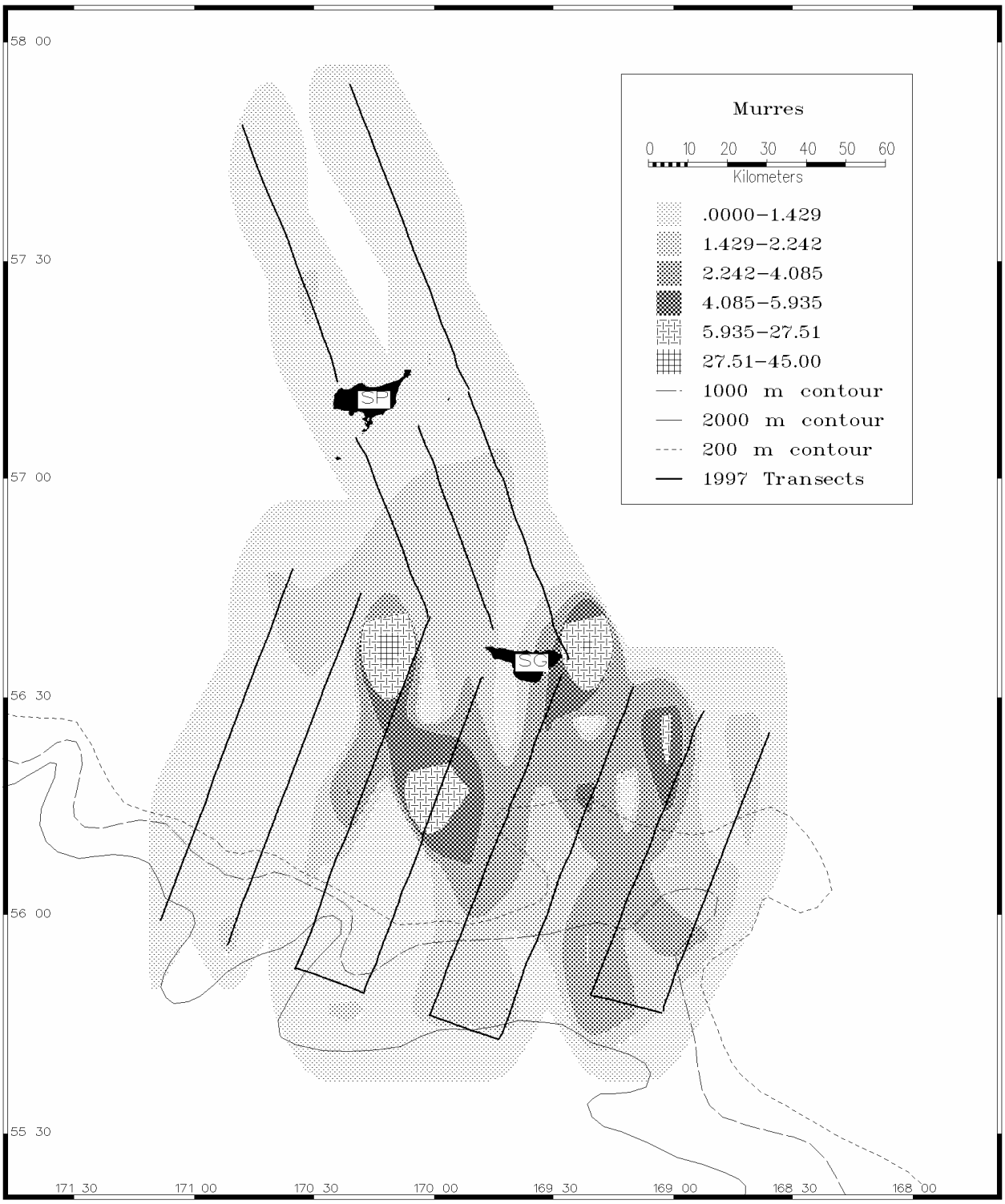


Figure 10. Densities of murres on transects surveyed at the Pribilof Islands, Alaska in 1997.

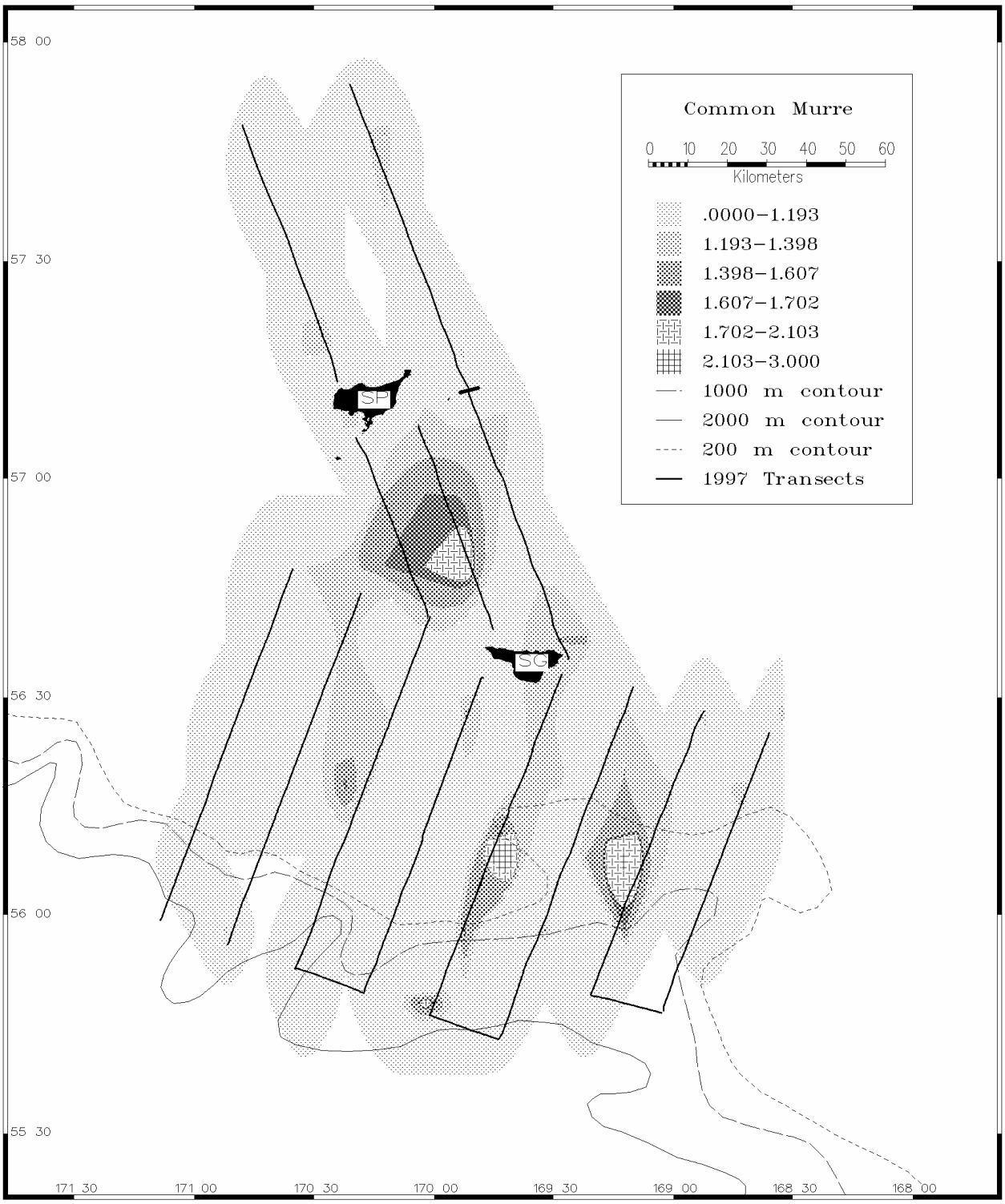


Figure 11. Densities of common murres on transects surveyed at the Pribilof Islands, Alaska in 1997.

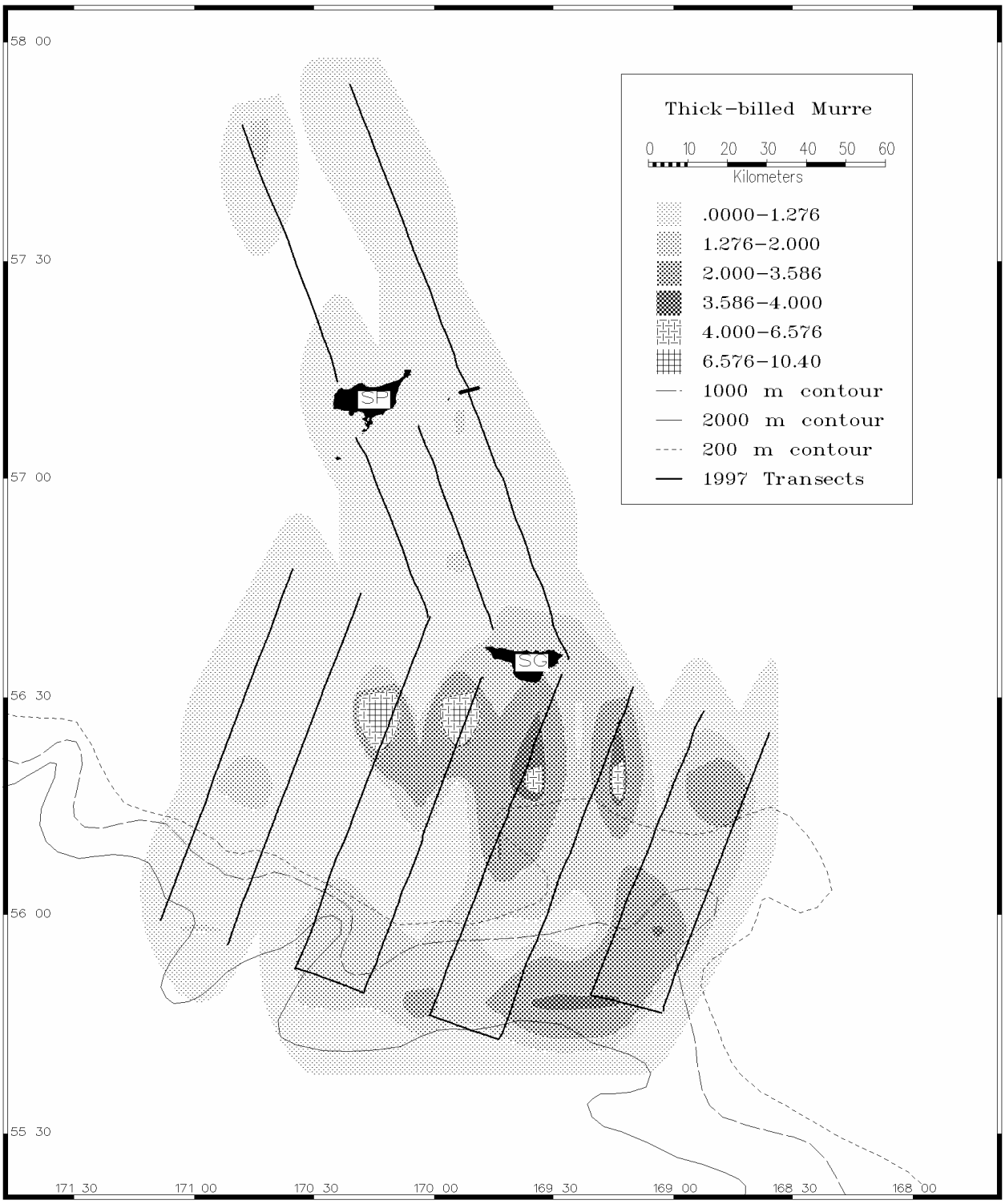


Figure 12. Densities of thick-billed murres on transects surveyed at the Pribilof Islands, Alaska in 1997.

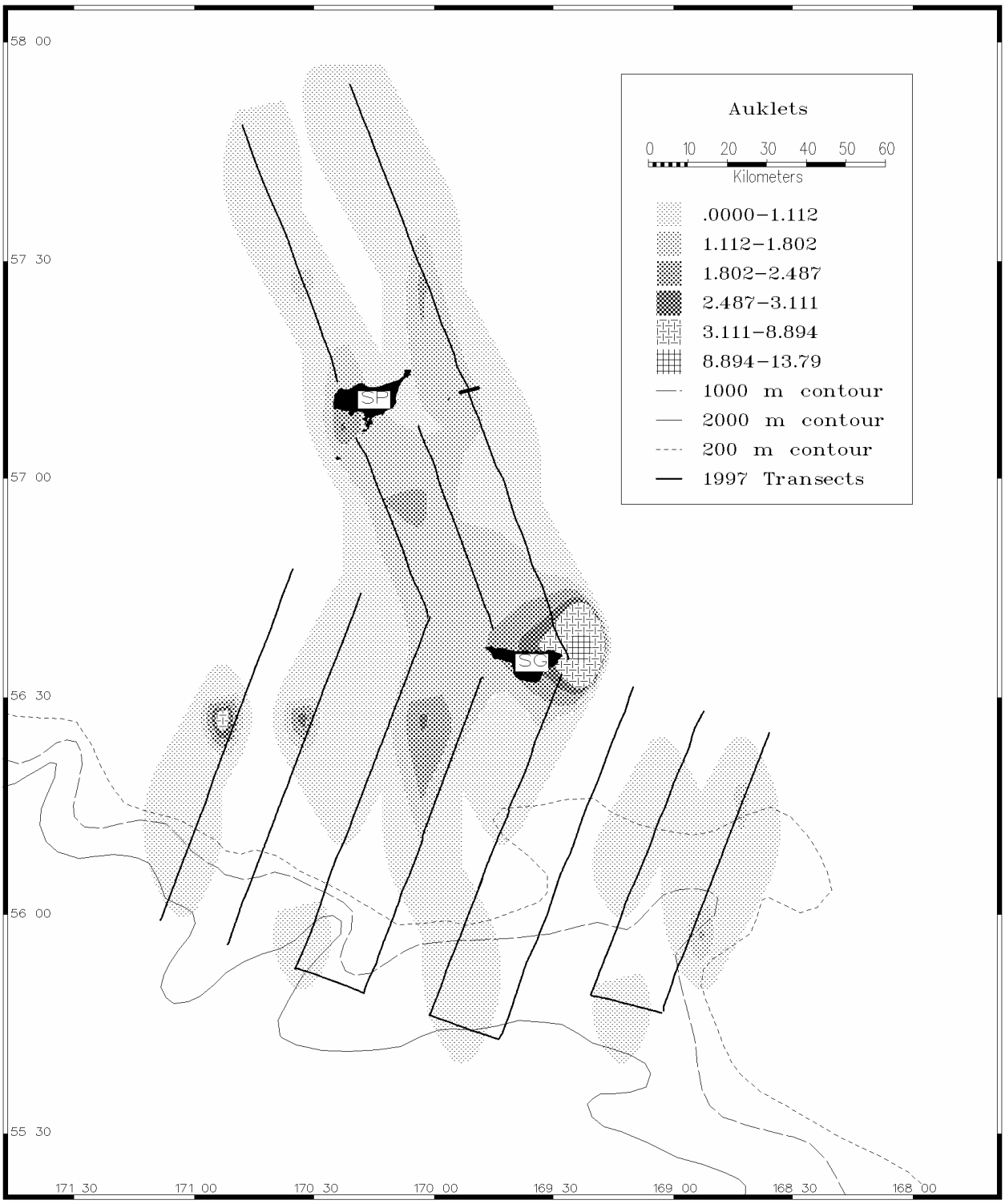


Figure 13. Densities of auklets on transects surveyed at the Pribilof Islands, Alaska in 1997.

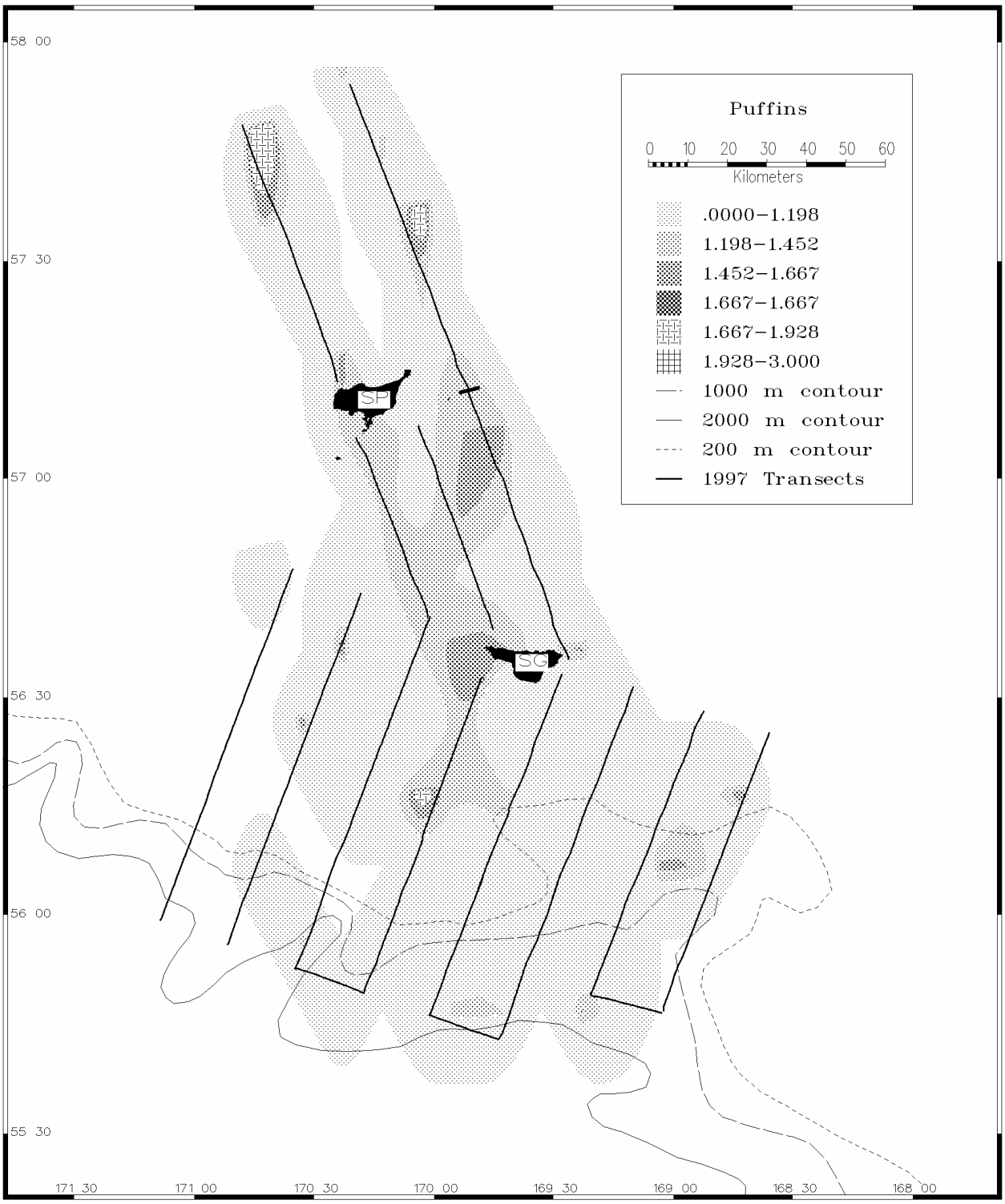


Figure 14. Densities of puffins on transects surveyed at the Pribilof Islands, Alaska in 1997.

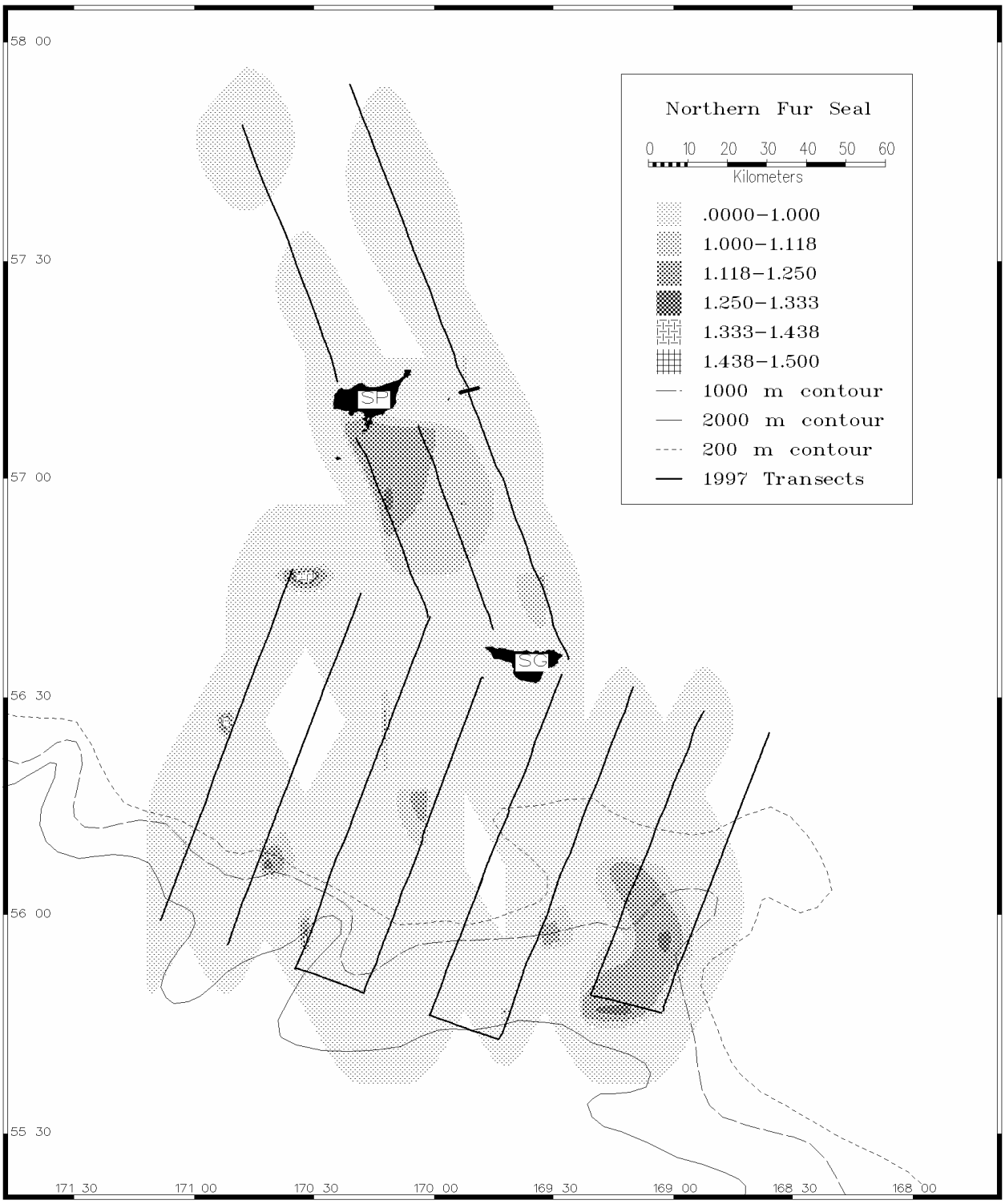


Figure 15. Densities of northern fur seals on transects surveyed at the Pribilof Islands, Alaska in 1997.

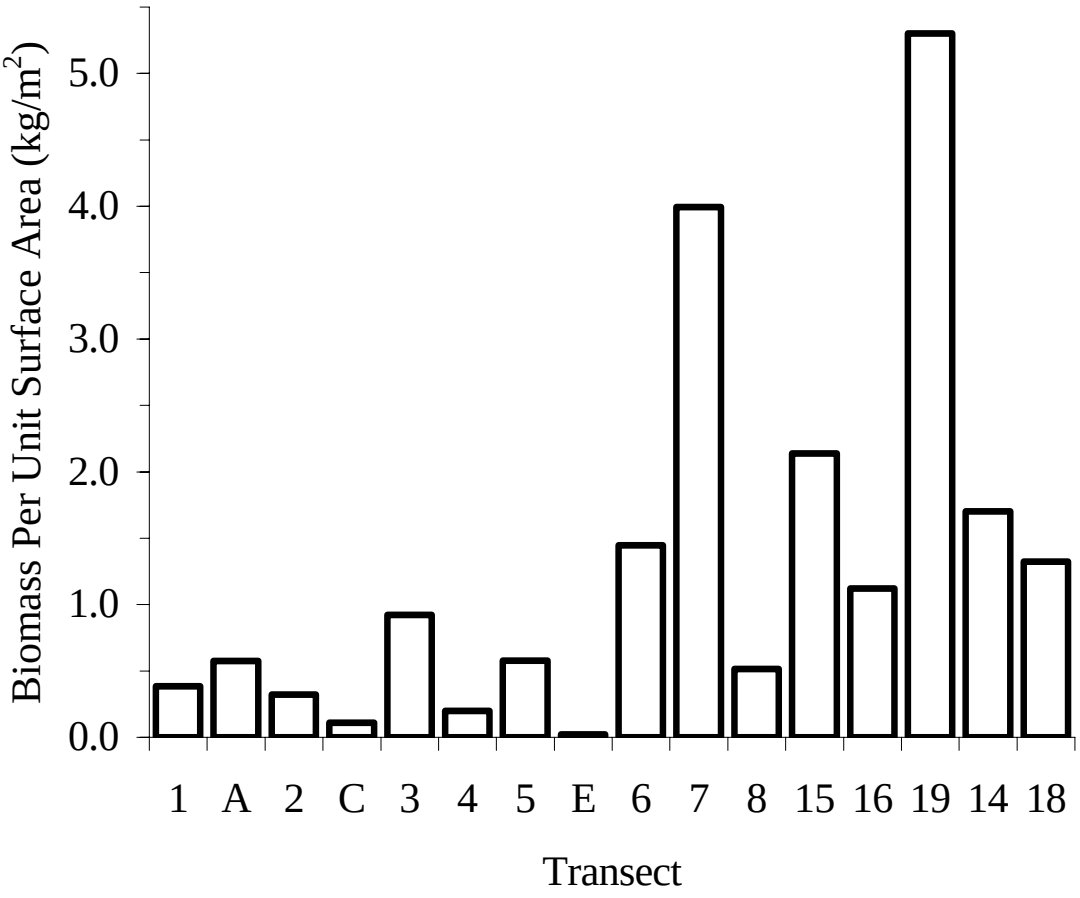


Figure 16. Average prey biomass per unit surface area detected by hydroacoustics gear on transects surveyed at the Pribilof Islands, Alaska in 1997.

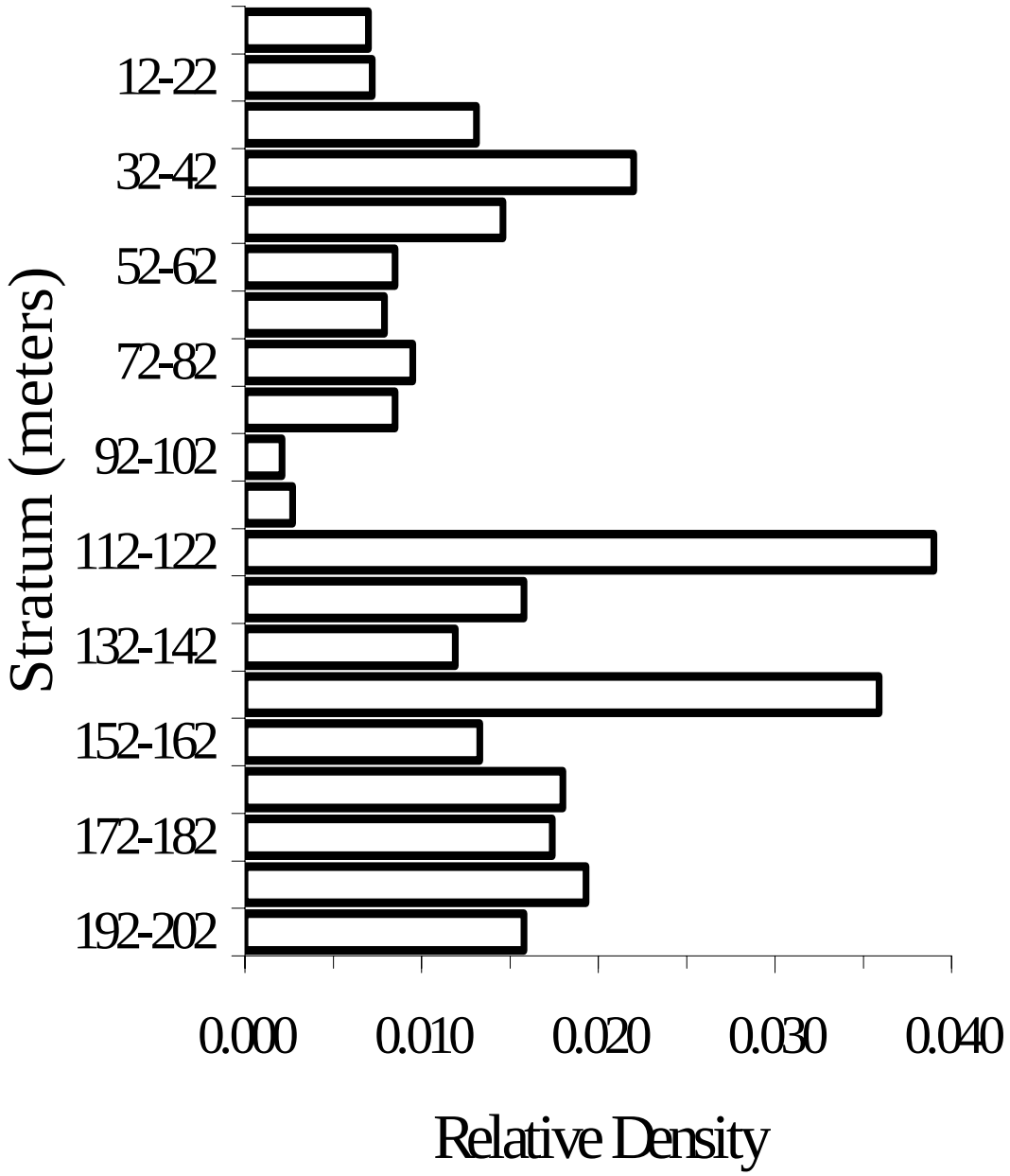


Figure 17. Relative density of prey by depth stratum on transects surveyed at the Pribilof Islands,
Alaska in 1997. Depth in meters.

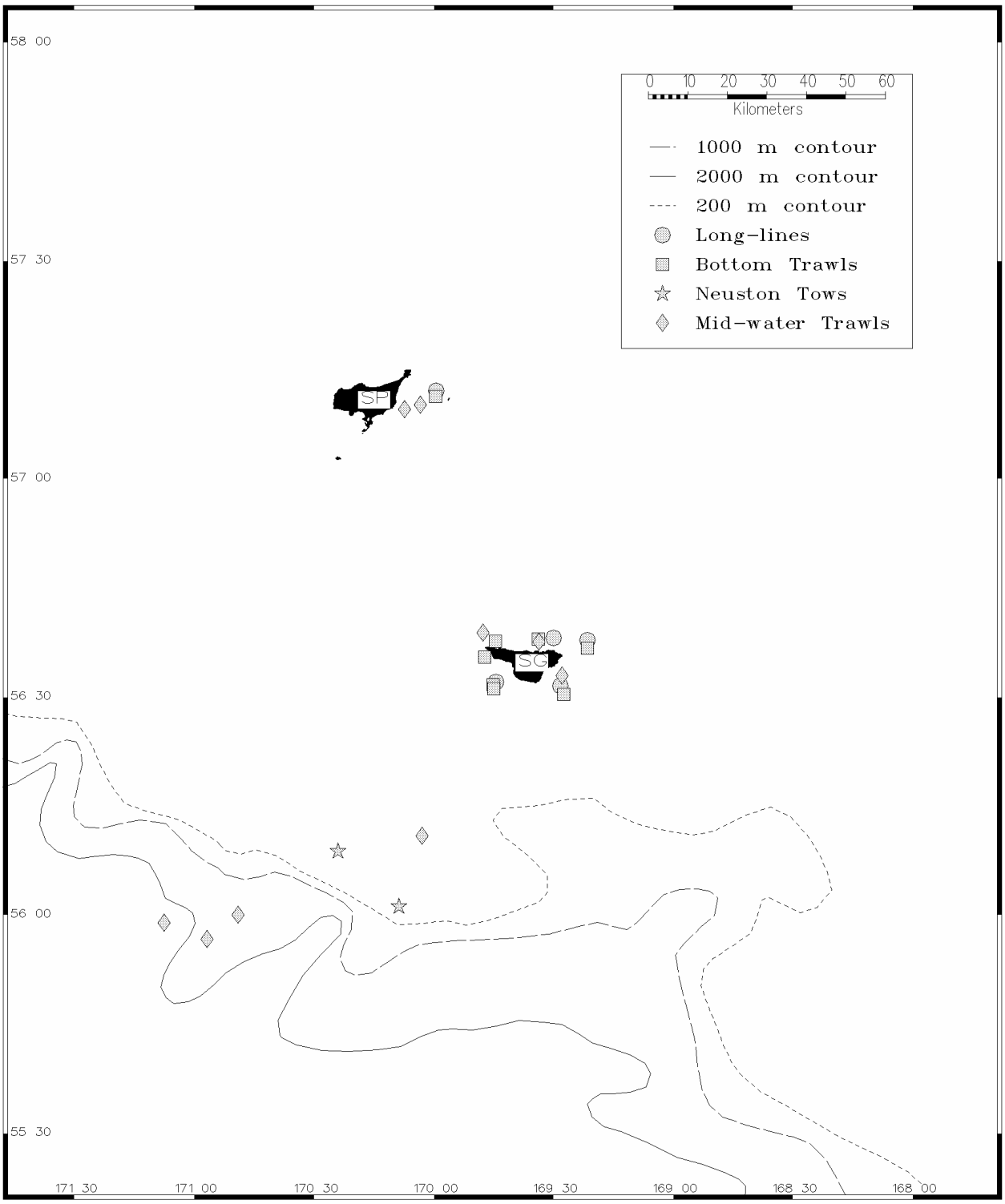


Figure 18. Locations of fishing efforts at the Pribilof Islands, Alaska in 1997.

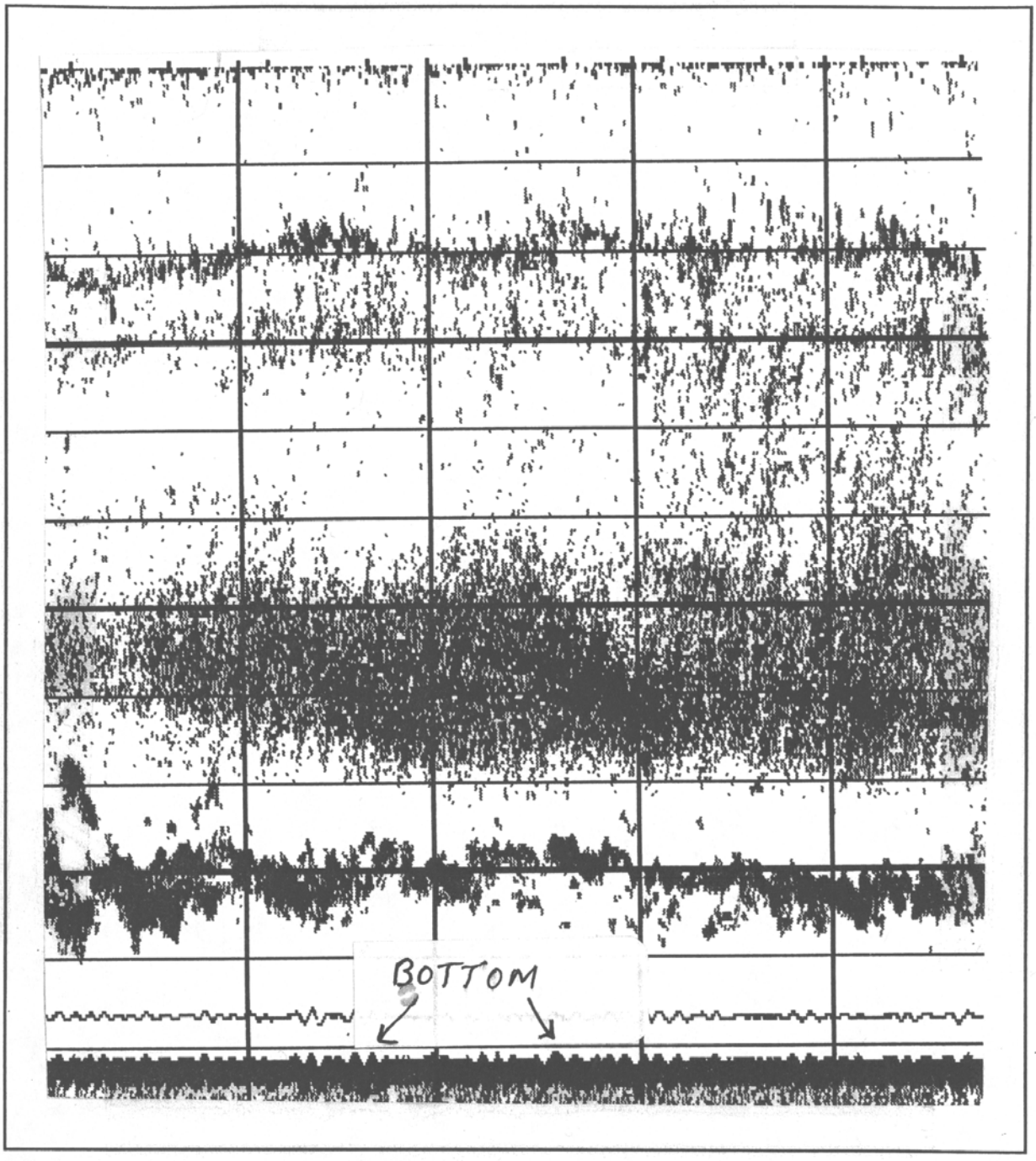


Figure 19. Example of printout from the hydroacoustics chart recorder from data collected at the Pribilof Islands, Alaska, in 1997. The darkest band indicates the sea floor, the dark bands in the water column represent signs of biomass that prompted us to do mid-water tows.

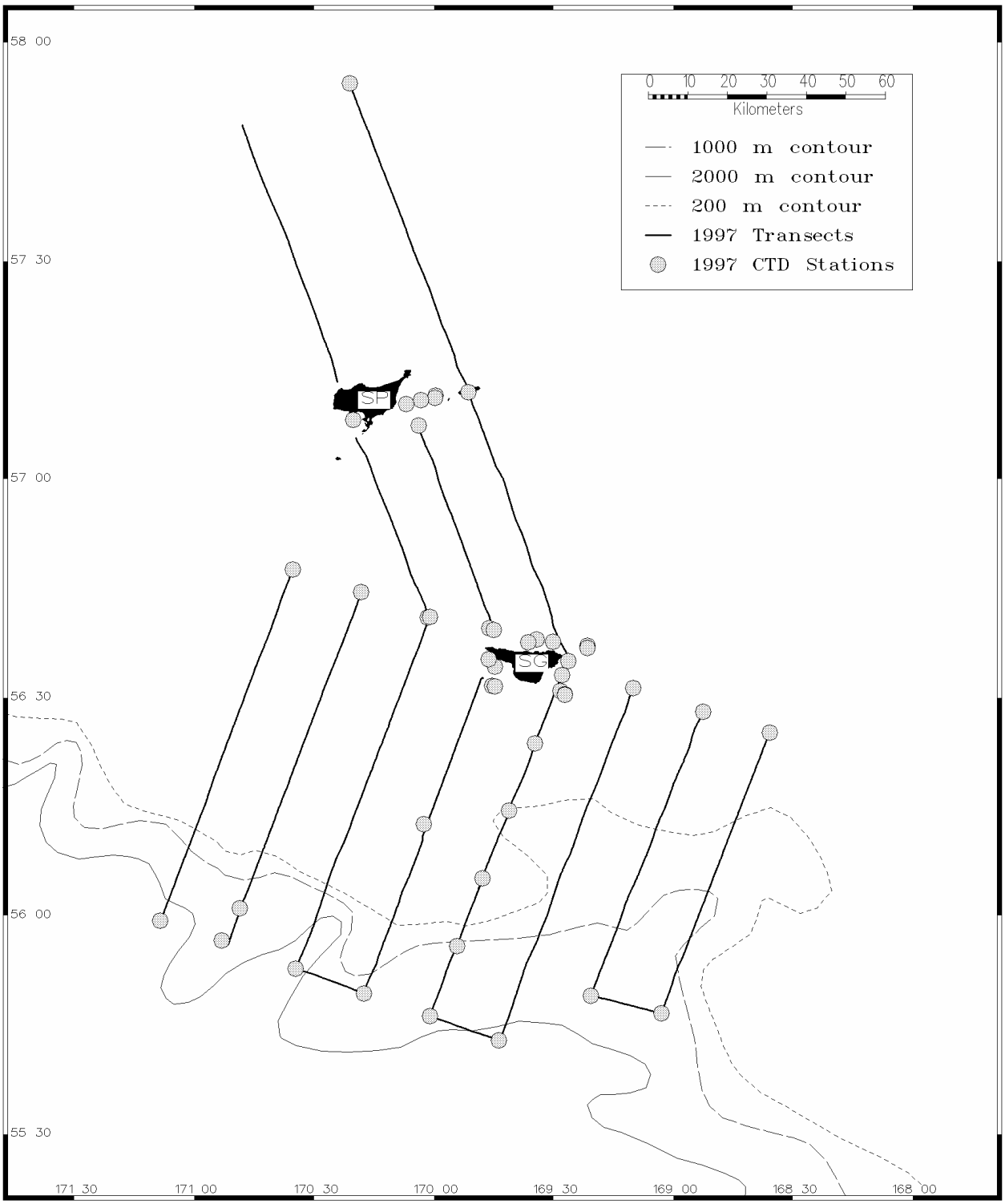


Figure 20. Locations of CTD stations sampled at the Pribilof Islands, Alaska in 1997.

Appendix A. Transect log for SMMOCI cruise near the Pribilof Islands, Alaska in 1997.

Date	Area	Transect No.	HydroAc File	dLog File	Time Start	Time Stop	Notes
7/16/97	St. George	13 + 20 miles	SG771613.dat	SG771613.srv	20:58		Too rough for bird obs.
7/19/97	St. George	14 + 20 miles	SG771914.dat	SG771914.srv	8:25	14:06	ThermoSal. not working
7/19/97	St. George	15	SG771915.dat	SG771915.srv	18:20	21:45	Transect 15 North to South
7/20/97	St. George	MWTR 01	SGMWTR01.dat	FISHPRIB	4:45	5:08	North of St. George
7/20/97	St. George	3	SG772003.dat	SG772003.srv	7:29	12:53	South of St. George
7/20/97	St. George	C	SG7720C.dat	SG7720C.srv	13:23	14:25	Dogleg between transects 3 and 4
7/20/97	St. George	4a	SG77204A.dat	SG772004.srv	14:43	15:47	First 10 miles of transect 4 (South to North)
7/20/97	St. George	4b	SG77204B.dat	SG772004.srv	16:04	17:03	Second 10 miles of transect 4 (South to North)
7/20/97	St. George	4c	SG77204C.dat	SG772004.srv	17:16	18:17	Third 10 miles of transect 4 (South to North)
7/20/97	St. George	4d	SG77204D.dat	SG772004.srv	18:31	19:29	Fourth 10 miles of transect 4 (South to North)
7/20/97	St. George	4e	SG77204E.dat	SG772004.srv	19:44	20:40	Last 10 miles of transect 4 (South to North)
7/20/97	St. George	MWTR 02	SGMWTR02.dat	FISHPRIB	21:08	21:29	Last leg of transect 4
7/21/97	St. George	2	SG772102.dat	SG772102.srv	8:10	12:30	Transect 2 (North to South) --40 miles long
7/21/97	St. George	A	SG7721A.dat	SG7721A.srv	15:44	16:45	Dogleg between transects 1 and 2
7/21/97	St. George	1	SG772101.dat	SG772101.srv	17:18	21:12	Transect 1 (South to North)
7/22/97	St. George	8	SG772208.dat	SG772208.srv	8:34	13:44	Transect 8 (N. to S.)--Problem w/ chart recorder in middle of tx.
7/22/97	St. George	MWTR 04	SGMWTR04.dat	FISHPRIB	14:10	14:47	
7/22/97	St. George	MWTR 05	SGMWTR05.dat	FISHPRIB	15:36	16:07	
7/22/97	St. George	7a	SG77227A.dat	SG772207.srv	16:37	17:17	
7/22/97	St. George	MWTR 06	SGMWTR06.dat	FISHPRIB	17:49	18:18	Total tow time:29 min.--tow time @ 60m depth:15 min.
7/22/97	St. George	7b	SG77227B.dat	SG77227.srv	18:45	23:09	Note filename change in dLOG for 7a (SG772207) and 7b (SG77227)
7/23/97	St. George	5a	SG77235A.dat	SG772305.srv	7:31	10:11	Stopped to do midwater trawl.
7/23/97	St. George	MWTR 07	SGMWTR07.dat	FISHPRIB	10:28	11:00	
7/23/97	St. George	5b	SG77235B.dat	SG772305.srv	11:46	12:43	Stopped to do neuston trawl.
7/23/97	St. George	5c	SG77235C.dat	SG772305.srv	13:12	14:31	Last leg of transect 5.
7/23/97	St. George	E	SG7723E.dat	SG7723E.srv	14:51	15:50	Transect connecting south end of Transects 5 and 6.
7/23/97	St. George	6a	SG77236A.dat	SG772306.srv	16:10	17:59	South to north--Stopped for neuston tow.
7/23/97	St. George	6b	SG77236B.dat	SG772306.srv	18:22	21:40	Last leg of transect 6.
7/23/97	St. George	MWTR 08	SGMWTR08.dat	FISHPRIB	22:53	23:11	15 min. tow at 15 m (total tow time = 18 min.).
7/24/97	St. George	19	SG772419.dat	SG772419.srv	7:57	11:42	South to north
7/24/97	St. George	MWTR 09	SGMWTR09.dat	FISHPRIB	19:11	19:30	15 min. tow at 15 m.
7/24/97	St. George	MWTR 10	SGMWTR10.dat	FISHPRIB	20:05	20:25	15 Min. tow at 16 m.
7/25/97	St. George	18	SG772518.dat	SG772518.srv	11:21	16:08	Transect 18
7/25/97	St. George	none	none	FURSEAL1.srv	16:10		Fur seal sightings.
	to St. Matt.						
7/25/97	St. George	18 (cont.)	SM7725.dat	FURSEAL1.srv	17:13		
	to St. Matt.						
7/27/97	St. George	14 (cont.)	SG7727.dat	FURSEAL1.srv	15:10	17:10	Start 20 miles north on furseal transect.
7/27/97	St. Paul	14	SG772714.dat	SG772714.srv	17:10	21:06	
7/28/97	St. Paul	16	SG772812.dat	SG772816.srv	19:49	22:40	Transect 16 (inadvertantly marked "12").

Appendix B. Numbers of seabirds observed on 16 transects near the Pribilof Islands, Alaska during July 1997.

Species/ Transect Number	1	A	2	3	C	4	5	E	6	7	8	15	16	19	14	18
Laysan Albatross	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Northern Fulmar	244	59	168	198	39	329	680	75	295	185	254	143	41	337	88	65
Sooty Shearwater	0	0	1	1	0	0	2	0	0	0	4	0	3	0	43	0
Short-tailed Shearwater	11	3	1	4	0	1	15	1	5	2	20	0	3	3	56	13
Unidentified Shearwater	16	1	8	1	5	4	10	0	6	4	6	0	37	1	2627	2
Fork-tailed Storm-petrel	426	11	217	160	5	227	139	135	359	160	53	54	0	2	2	3
Leach’s Storm-petrel	0	0	5	3	0	1	0	1	0	0	0	0	0	0	0	0
Unidentified Storm-petrel	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Red-faced Cormorant	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Red-necked Phalarope	0	0	8	0	0	2	0	0	5	0	10	40	0	1	0	0
Red Phalarope	13	0	3	5	0	30	154	0	187	8	13	40	334	46	101	24
Unidentified Phalarope	0	0	0	1	0	0	46	0	2	1	2	67	13	0	13	0
Ruddy Turnstone	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Rock Sandpiper	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Pomarine Jaeger	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parasitic Jaeger	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Long-tailed Jaeger	0	0	1	1	0	0	1	0	0	2	0	0	0	0	0	0

Appendix B. Numbers of seabirds observed on 16 transects near the Pribilof Islands, Alaska during July 1997 (continued).

Species/ Transect Number	1	A	2	3	C	4	5	E	6	7	8	15	16	19	14	18
Black-legged Kittiwake	12	3	28	17	5	17	17	0	16	4	16	23	4	15	23	11
Red-legged kittiwake	10	2	25	50	2	133	7	13	29	8	35	0	0	12	0	3
Unidentified Kittiwake	2	0	3	12	1	5	1	0	0	3	0	3	0	0	0	0
Sabine's Gull	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Arctic Tern	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Common Murre	25	0	75	132	1	73	71	1	32	67	65	362	285	218	69	128
Thick-billed murre	116	38	191	135	5	263	213	17	87	37	47	62	58	106	9	56
Unidentified Murre	75	12	303	385	4	209	649	5	172	37	37	64	187	439	25	41
Ancient Murrelet	3	0	0	0	0	3	14	0	4	0	0	0	0	0	2	0
Cassin's Auklet	1	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0
Parakeet Auklet	0	0	1	0	0	14	23	0	35	0	1	18	39	143	41	71
Crested Auklet	2	0	0	0	0	6	28	0	1	3	1	8	9	93	0	0
Least Auklet	5	1	2	0	0	9	26	0	2	1	4	139	10	615	41	13
Horned Puffin	0	1	0	12	0	10	132	1	9	4	1	58	39	146	10	29
Tufted Puffin	12	3	14	10	6	34	57	0	26	16	0	24	17	29	15	25
Unidentified Alcid	1	0	0	3	0	0	1	0	0	0	0	14	1	21	3	0

Appendix C. Numbers of marine mammals observed on 16 transects near the Pribilof Islands, Alaska during July 1997

Species/ Transect Number	1	A	2	3	C	4	5	E	6	7	8	15	16	19	14	18
Fin Whale	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0
Minke Whale	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Killer Whale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
Dall's Porpoise	35	0	0	19	0	0	6	0	22	5	0	0	0	2	0	0
Northern Fur Seal	10	0	0	19	0	0	21	0	31	11	0	0	48	22	10	0

Appendix D. Fishing log for SMMOCI cruise near the Pribilof Islands, Alaska in 1997.

Date	Location	Gear Type*	Set No.	Time In	Time Out	Latitude (N)	Longitude(W)	Gear Depth	Composition & Comments
7/20/97	St. George	LOLI	01	0:24	/////////	56 38.165	169 29.918	32 m	
/////////				/////////	2:52	56 37.743	169 30.130		4 Halibut/Irish Lords/Cod
7/20/97	St. George	BOTR	01	1:22	/////////	56 38.016	169 33.730	64 m	Aleutian alligatorfish, Irish lords, 1 Pollock
/////////				/////////	1:29	56 37.962	169 34.530	63 m	
7/20/97	St. George	BOGR	01	1:45	1:46	56 37.989	169 33.974	63 m	
7/20/93	St. George	MWTR	01	4:42	/////////	56 37.598	169 33.706	7.6 m to 9.5 m	Mostly larval YOY Pollock (~800) + Jellyfish
/////////				/////////	5:08	56 37.539	169 35.576		SGMWTR01.dat**
7/20/97	St. George	MWTR	02	21:09	/////////	56 32.93	169 27.84	25 m	~1000 YOY Pollock + Jellyfish SGMWTR02.dat
/////////				/////////	21:30	56 32.55	169 26.94		(CTD is last of Transect 4)
7/21/97	St. George	LOLI	02	0:35	/////////	56 31.57	169 28.29	70 m	Start Set
/////////				/////////	2:45	56 30.98	169 28.28	70 m	End set - Not logged in dLOG. 17 Cod, 4 Halibut, 19 (?) Sculpin.
7/21/97	St. George	BOTR	02	1:50	/////////	56 30.34	169 27.43	80 m	Set trawl - Begin fishing.
/////////				/////////	1:54	56 30.26	169 27.53	81 m	End trawl - Hung up net.
7/21/97	St. George	BOGR	02	1:25	1:27	56 30.55	169 27.38	83 m	Bottom grab - Shell, mud, sand.
7/21/97	St. George	MWTR	03	13:02	/////////	55 49.697	169 20.118	105 m + 150 m	Fished sign at 3 diff. levels. Doors crossed – NO CATCH.
/////////				/////////	13:32	55 50.77	169 19.31	+ 180 m.	SGMWTR03.dat
7/22/97	St. George	MWTR	04	14:10	/////////	55 58.97	171 07.60	60 - 65 m	~250-'0+' Pollock, 1 Prowfish, 100 Squid, Jellyfish, Salps.
/////////				/////////	14:47	55 58.51	171 05.79		SGMWTR04.dat
7/22/97	St. George	MWTR	05	15:36	/////////	55 56.687	170 56.777	35 - 55 m	~2500-'0+' Pollock, 5-'0+' P. cod, 4 Prowfish, Squid, Jellyfish, Salps.
/////////				/////////	16:07	55 56.638	170 53.157		SGMWTR05.dat
7/22/97	St. George	MWTR	06	17:45	/////////	56 00.04	170 49.00	60 m	~1500-'0+' Pollock, 312 Salps, Jellyfish.
/////////				/////////	18:14	56 00.99	170 48.67		SGMWTR06.dat
7/23/97	St. George	BOTR	03	1:33	/////////	56 35.484	169 47.155	40 - 59 m	
/////////				/////////	1:48	56 35.276	169 46.260		
7/23/97	St. George	BOGR	03	2:08	2:10	56 35.34	169 46.69	53 m	BOTR3
7/23/97	St. George	LOLI	03	2:52	/////////	56 32.06	169 44.46	77 m	Start
/////////				/////////	05:??	56 31.56	169 44.58	81 m	End
7/23/97	St. George	BOTR	04	3:45	/////////	56 31.72	169 45.16	81 m	Start--No BOGR on BOTR4
/////////				/////////	4:01	56 31.241	169 44.975	83 m	End -- Nearly empty-- 1 Sculpin, 1 ATF (arrow-toothed flounder?)
7/23/97	St. George	BOTR	05	4:14	/////////	56 31.12	169 44.99	80 m	Start
/////////				/////////	4:24	56 31.60	169 45.33	80 m	End

Appendix D. Fishing log for SMMOCI cruise near the Pribilof Islands, Alaska in 1997 (continued).

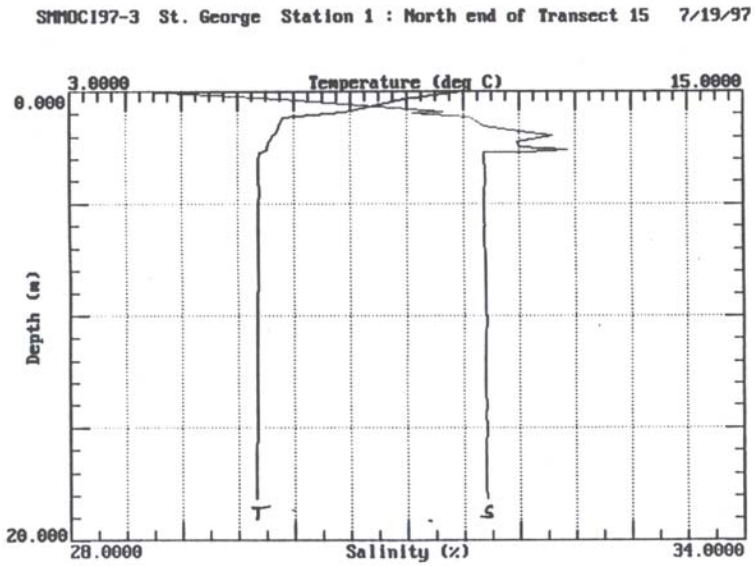
Date	Location	Gear Type*	Set No.	Time In	Time Out	Latitude (N)	Longitude(W)	Gear Depth	Composition & Comments
7/23/97	St. George	BOGR	04	4:43	4:55	56 31.61	169 45.29	82 m	BOTR5
7/23/97	St. George	MWTR	07	10:28	/////////	56 10.191	170 02.85	90 m	~10,500 - '0+' Pollock, 1 Squid, 50 Jellyfish, NO Salps.
/////////				/////////	11:00	56 12.603	170 02.482		SGMWTR07.dat
7/23/97	St. George	NEUS	01	12:49	/////////	56 01.20	170 08.66	Surface	Went through 3 flocks of 150 FTSP each
/////////				/////////	13:02	56 01.465	170 07.64		Little in net: 3 fish, polychete, jellies, crab zoea.
7/23/97	St. George	NEUS	02	18:06	/////////	56 08.82	170 24.01	Surface	Through FTSP feeding flocks (20, 3, 2).
/////////				/////////	18:19	56 08.978	170 23.449		
7/23/97	St. George	MWTR	08	22:53	/////////	56 38.83	169 47.63	22 m	~50-'0+' Pollock + Jellyfish.
/////////				/////////	23:10	56 39.35	169 46.64		
7/24/97	St. George	BOTR	06	0:07	/////////	56 37.69	169 44.48	62 m	
/////////				/////////	0:17	56 37.70	169 44.99	62 m	BAD TOW--Cod end problems.
7/24/97	St. George	BOTR	07	0:36	/////////	56 37.74	169 44.42	64 m	
/////////				/////////	0:46	56 37.78	169 44.99	64 m	BAD TOW--Cod end problems.
7/24/97	St. George	BOTR	08	2:28	/////////	56 38.62	169 23.89	70 m	
/////////				/////////	2:40	56 38.36	169 23.45	70 m	BAD TOW--Net problems.
7/24/97	St. George	LOLI	04	3:13	/////////	56 37.82	169 21.51	76 m	Start
/////////				/////////	05:??	56 37.36	169 21.40	56 m	End
7/24/97	St. George	BOTR	09	3:59	/////////	56 36.72	169 21.44	52 m	Start
/////////				/////////	4:09	56 36.37	169 21.42	55 m	End
7/24/97	St. George	BOGR	05	4:55	4:57	56 36.73	169 21.44	55 m	BOTR9
7/24/97	Walrus I.	LOLI	05	15:55	/////////	57 12.10	169 59.38	50 m	Start
/////////				/////////	18:00	57 11.66	169 59.45	48 m	End
7/24/97	Walrus I.	BOTR	10	17:22	/////////	57 11.32	169 59.51	43 m	Start
/////////				/////////	17:33	57 11.10	169 59.87	48 m	End
7/24/97	Walrus I.	BOGR	06	17:55	17:58	57 11.19	169 59.76	43 m	BOTR10
7/24/97	Walrus I.	MWTR	09	19:15	/////////	57 10.154	170 03.406	32 m	Start ~1500-'0+' Pollock, 1 larval Flounder, Jellyfish.
/////////				/////////	19:30	57 10.760	170 03.106	33 m	End
7/24/97	St. Paul	MWTR	10	20:11	/////////	57 09.539	170 07.371	21 m	Start ~1200-'0+' Pollock + Jellyfish.
/////////				/////////	20:26	57 10.303	170 06.874	16 m	End

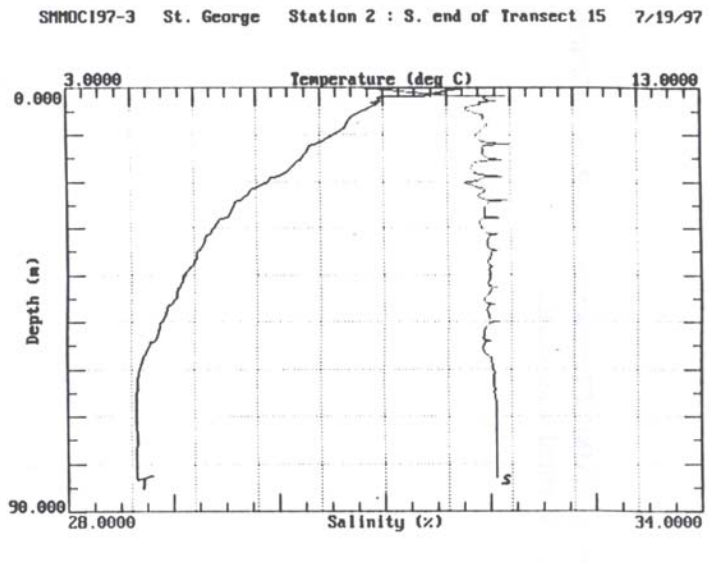
*LOLI = Longline, MWRT = Mid-water Trawl (Modified herring), BOGR = Bottom Grab, BOTR = Bottom Trawl, NEUS = Neuston Tow.
**Hydroacoustic filename = *.dat; dLOG filename = FISHPRIB

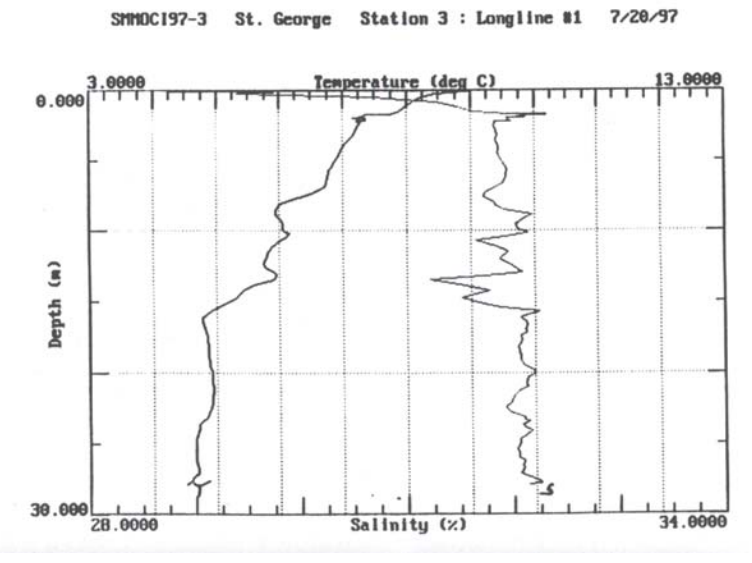
Appendix E. CTD log for SMMOCI cruise near the Pribilof Islands, Alaska in 1997.

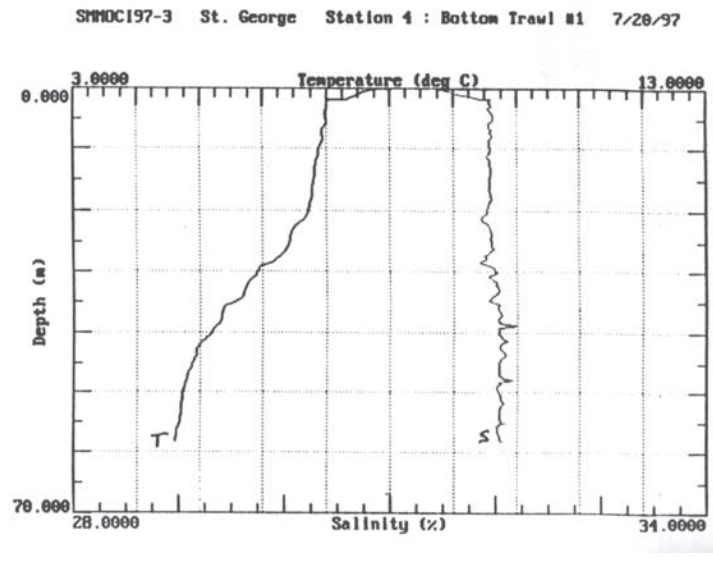
Date	Station No.	Time	Latitude(N)	Longitude(W)	Bottom Depth	Download Filename	Comments
7/19/97	1	18:30	57 08.24	170 20.48	18 m	SGCTD00.hex	Start of transect 15.
7/19/97	2	21:50	56 41.01	170 01.49	92 m	SGCTD01.hex	End of Transect 15.
7/20/97	3	0:45	56 37.721	169 30.149	32 m	SGCTD02.hex	Longline set #1.
7/20/97	4	2:01	56 37.99	169 34.17	62 m	SGCTD03.hex	Bottow trawl #1.
7/20/97	5	5:28	56 37.60	169 36.39	57 m	SGCTD04.hex	Mid-water trawl #1
7/20/97	6	7:22	56 31.38	169 09.97	92 m	SGCTD05.hex	North end of transect #3.
7/20/97	7	12:59	55 42.89	169 43.66	2420 m	SGCTD06.hex	South end of transect #3.
7/20/97	8	14:26	55 46.21	170 01.07	~1200 m	SGCTD07.hex	South end of transect #4.
7/20/97	9	15:47	55 55.83	169 54.26	700 m	SGCTD08.hex	10 miles into transect #4.
7/20/97	10	17:03	56 05.08	169 47.75	125 m	SGCTD09.hex	20 miles into transect #4.
7/20/97	11	18:17	56 14.44	169 41.21	296 m	SGCTD10.hex	30 miles into transect #4.
7/20/97	12	19:34	56 23.74	169 34.58	116 m	SGCTD11.hex	40 miles into transect #4.
7/20/97	13	20:43	56 33.09	169 27.86	63 m	SGCTD12.hex	North end of transect #4. Also Mid-water trawl #1.
7/21/97	14	0:00	56 30.86	169 28.26	65 m	SGCTDA00.hex	Longline #2. dLOG did not take record.
7/21/97	15	2:28	56 30.41	169 27.34	82 m	SGCTDA01.hex	Bottom trawl #2.
7/21/97	16	3:38	56 30.98	169 28.28		SGCTDA02.hex	End of longline set.
7/21/97	17	7:57	56 28.025	168 52.564	108 m	SGCTDA03.hex	North end of transect #2.
7/21/97	18	12:34	55 49.09	169 20.615	~1000 m	SGCTDA04.hex	South end of transect #2.
7/21/97	19	16:48	55 46.59	169 02.91	~1000 m	SGCTDA05.hex	South end of transect #1.
7/21/97	20	21:15	56 25.17	168 35.81	120 m	SGCTDA06.hex	North end of transect #1.
7/22/97	21	8:25	56 47.58	170 35.33	106 m	SGCTDB00.hex	North end of transect #8.
7/22/97	22	13:45	55 59.31	171 08.00	>1000 m	SGCTDB01.hex	South end of transect #8.
7/22/97	23	16:17	55 56.62	170 53.14	>1000 m	SGCTDB02.hex	South end of transect #7. Also Mid-water trawl #5.
7/22/97	24	18:24	56 01.06	170 48.66	>1000 m	SGCTDB03.hex	Mid-water trawl #6.
7/22/97	25	23:10	56 44.45	170 18.27	101 m	SGCTDB04.hex	North end of transect #7.
7/23/97	26	4:32	56 31.61	169 45.35	82 m	SGCTDB06.hex	Bottom trawl #5.
7/23/97	27	5:08	56 31.58	169 44.63	82 m	SGCTDB07.hex	Longline set #3.
7/23/97	28	7:22	56 34.25	169 44.74	53 m	SGCTDB08.hex	North end of transect #5.
7/23/97	29	11:16	56 12.60	170 02.48	117 m	SGCTDB09.hex	Mid-water trawl #7.
7/23/97	30	14:33	55 49.29	170 17.49	>1000 m	SGCTDB10.hex	South end of transect #5.
7/23/97	31	16:10	55 52.71	170 34.65	>1000 m	SGCTDB11.hex	South end of transect #6.
7/23/97	32	21:42	56 41.12	170 00.91	90 m	SGCTDB12.hex	North end of transect #6.
7/23/97	33	23:19	56 39.57	169 46.12	72 m	SGCTDB13.hex	Mid-water trawl #8.
7/24/97	34	3:24	56 37.10	169 21.43	56 m	SGCTDB14.hex	Longline set #4.
7/24/97	35	4:47	56 36.80	169 21.42	52 m	SGCTDB15.hex	Bottom trawl #9.
7/24/97	36	7:51	56 35.060	169 26.254	37 m	SGCTDB16.hex	South end of transect #19.
7/24/97	37	11:46	57 11.94	169 51.281	48 m	SGCTDB17.hex	North end of transect #19.
7/24/97	38	16:06	57 11.52	169 59.50	48 m	SGCTDB18.hex	Longline set #5.
7/24/97	39	17:46	57 11.20	169 59.66	42 m	SGCTDB19.hex	Bottom trawl #10.
7/24/97	40	19:40	57 10.916	170 03.256	32 m	SGCTDB20.hex	Mid-water trawl #9.
7/24/97	41	20:29	57 10.30	170 06.87	16 m	SGCTDB21.hex	Mid-water trawl #10.
7/23/97	42	1:58	56 35.28	169 46.26	40 m	SGCTDB05.hex	Bottom trawl #3.
7/25/97	43	16:08	57 54.38	170 20.96	74 m	SGCTDC00.hex	North end of transect #18.
7/28/97	44	19:40	57 07.38	170 03.73	22 m	SGCTDC01.hex	North end of transect #16.
7/28/97	45	22:44	56 39.29	169 45.00	72 m	SGCTDC02.hex	South end of transect #16.

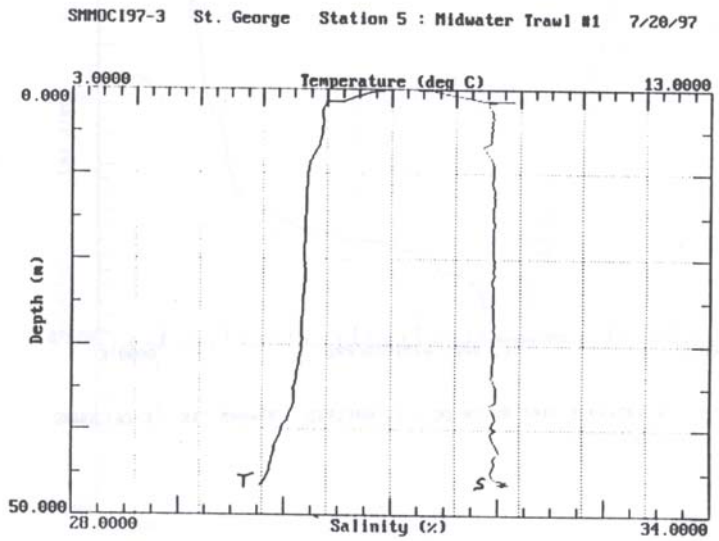
Appendix F. Graphs of CTD casts from the SMMOCI cruise near the Pribilof Islands, Alaska in 1997. Vertical scale varies.

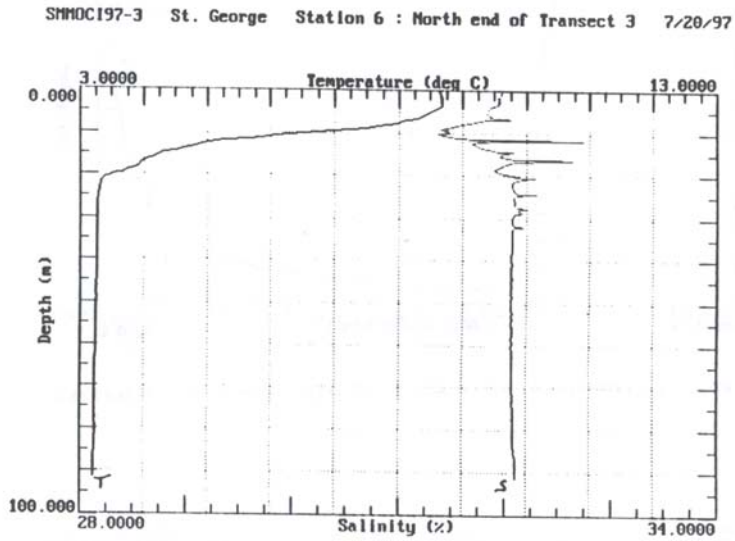

SMMOCI97-3 St. George Station 1 : North end of Transect 15 7/19/97
3.0000
Temperature (deg C)
15.0000
0.000
Depth (m)
20.000
28.0000
Salinity (%)
34.0000
T
S

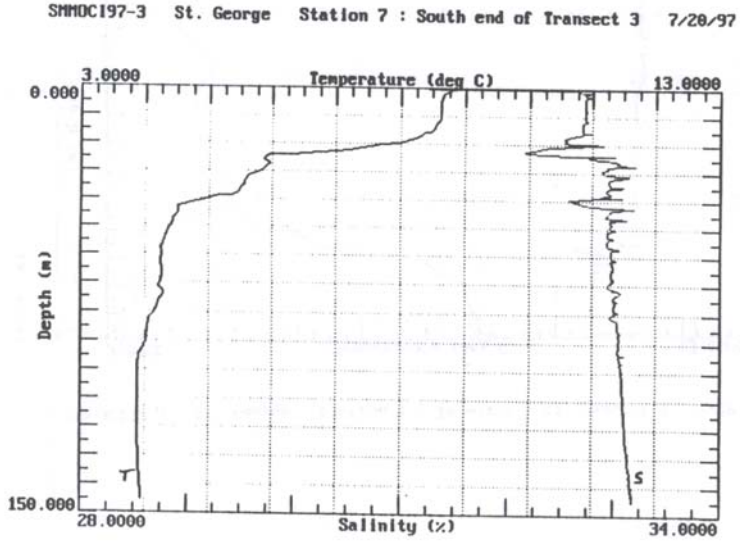

SMMOCI97-3 St. George Station 2 : S. end of Transect 15 7/19/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
90.000
28.0000
Salinity (%)
34.0000
T
S

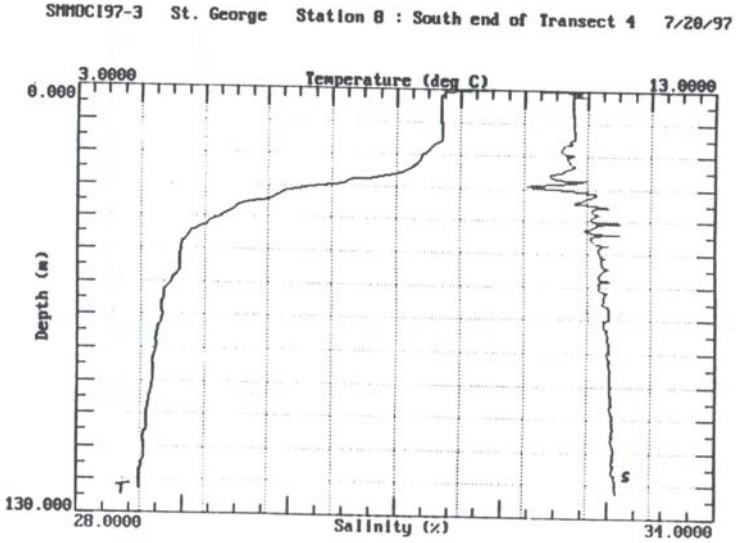

SMMOCI97-3 St. George Station 3 : Longline #1 7/20/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
30.000
28.0000
Salinity (%)
34.0000
T
S

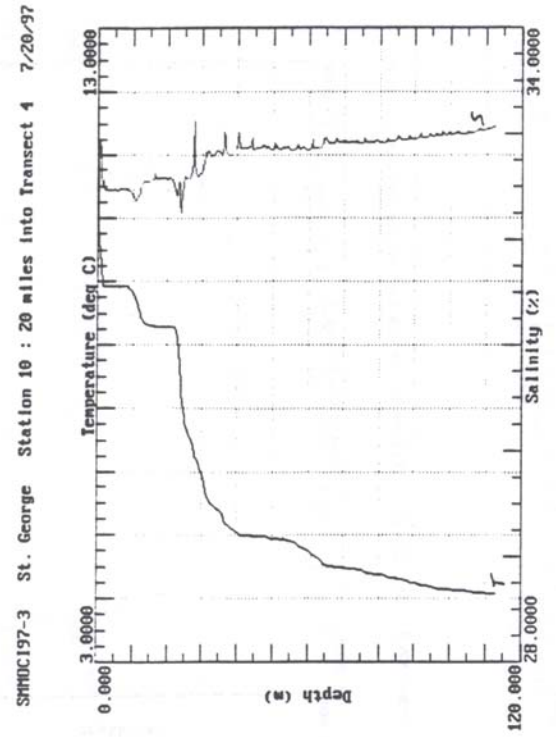

SMMOCI97-3 St. George Station 4 : Bottom Trawl #1 7/20/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
70.000
28.0000
Salinity (%)
34.0000
T
S

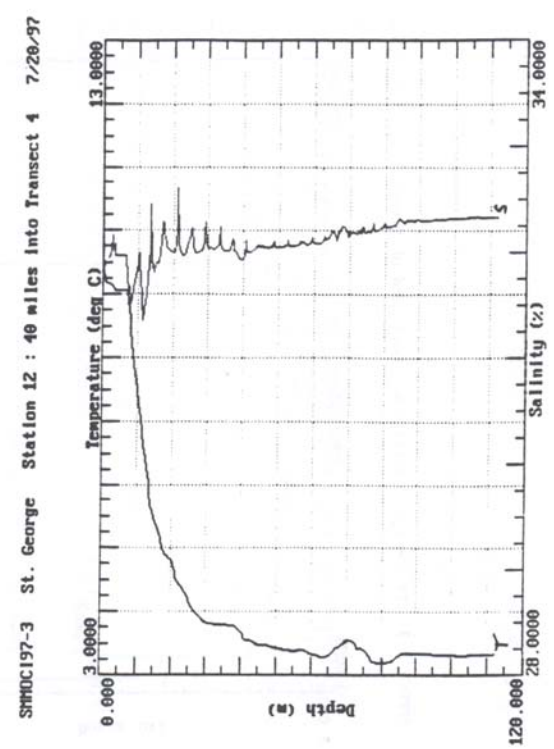

SMMOCI97-3 St. George Station 5 : Midwater Trawl #1 7/20/97
Temperature (deg C)
3.0000
13.0000
0.000
50.000
Depth (m)
28.0000
Salinity (%)
34.0000
T
S

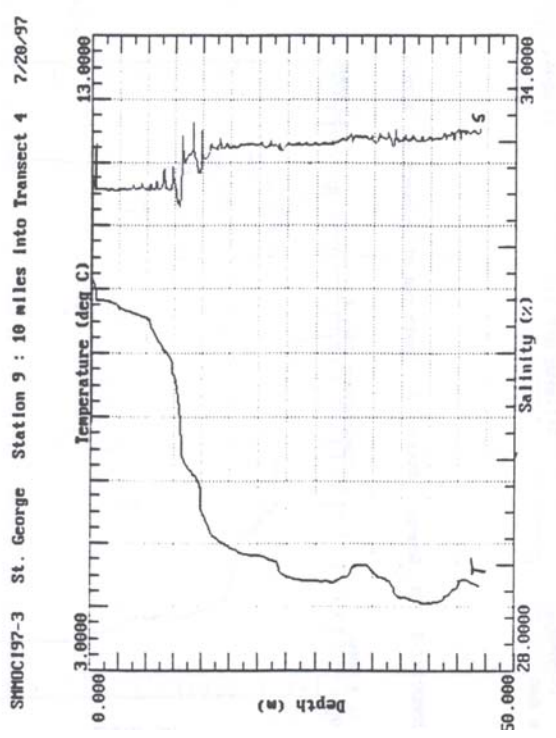

SMMOCI97-3 St. George Station 6 : North end of Transect 3 7/20/97
Temperature (deg C)
3.0000
13.0000
0.000
100.000
Depth (m)
28.0000
Salinity (%)
34.0000
T
S

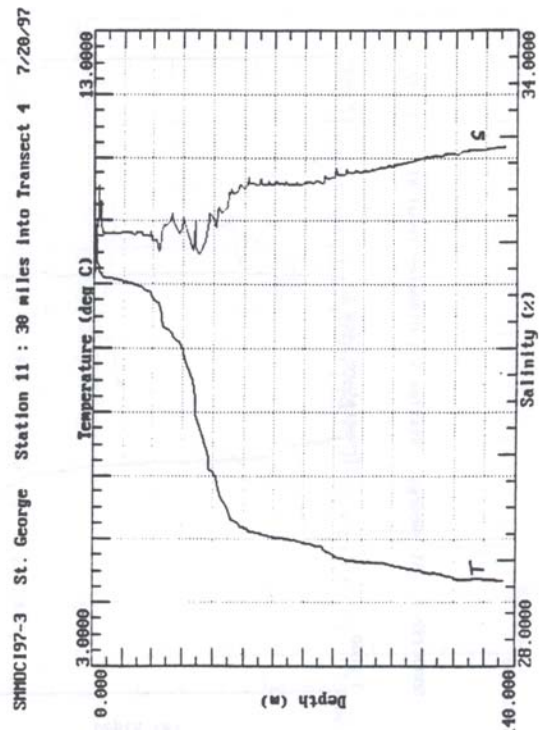

SMMOCI97-3 St. George Station 7 : South end of Transect 3 7/20/97
Temperature (deg C)
3.0000
13.0000
0.000
150.000
Depth (m)
28.0000
Salinity (%)
34.0000
T
S

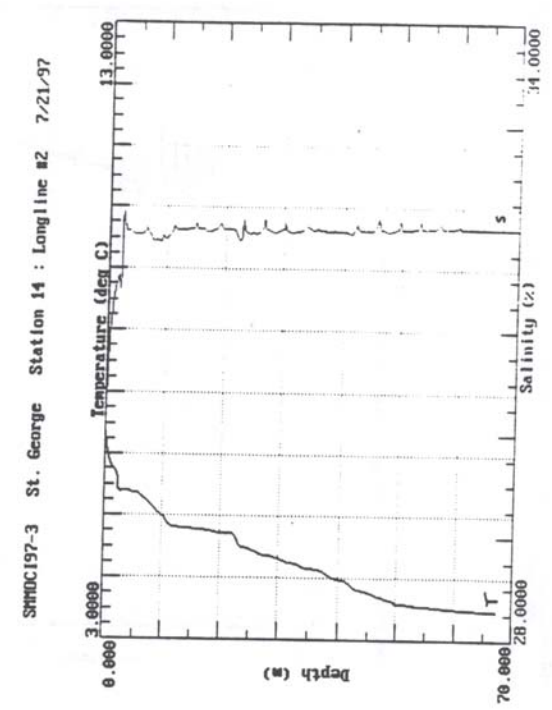

SMMOCI97-3 St. George Station 8 : South end of Transect 4 7/20/97
Temperature (deg C)
3.0000
13.0000
0.000
130.000
Depth (m)
28.0000
Salinity (%)
34.0000
T
S

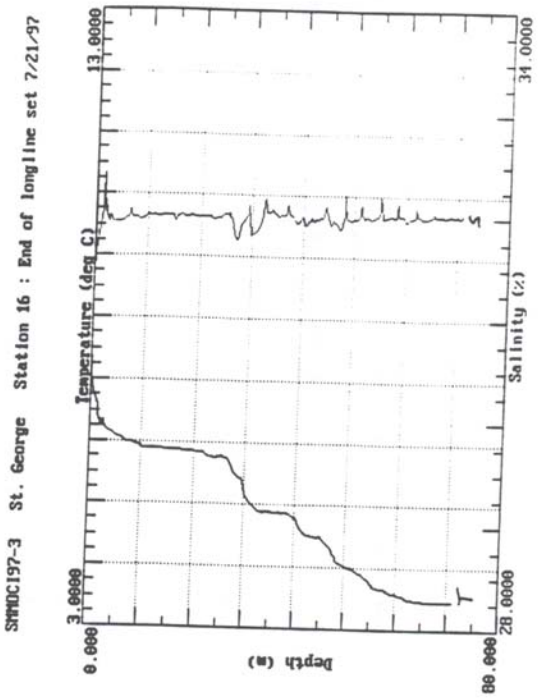

SMMDC197-3 St. George Station 10 : 20 miles into Transect 4 7/20/97
Temperature (deg C)
Salinity (‰)
Depth (m)
3.0000
13.0000
34.0000
0.000
28.0000
120.000
T
S

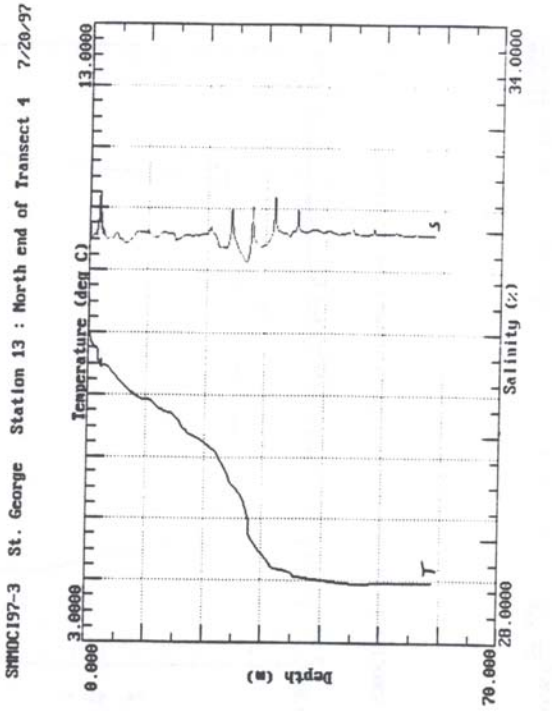

SMMDC197-3 St. George Station 12 : 40 miles into Transect 4 7/20/97
Temperature (deg C)
Salinity (‰)
Depth (m)
3.0000
13.0000
34.0000
0.000
28.0000
120.000
T
S

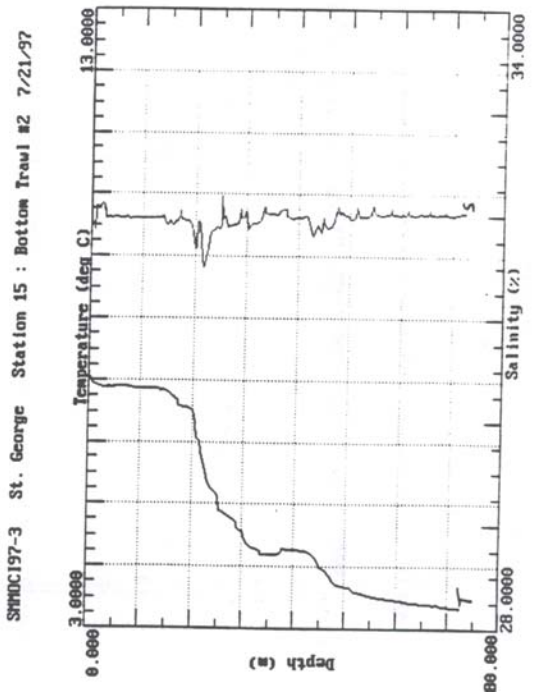

SMMDC197-3 St. George Station 9 : 10 miles into Transect 4 7/20/97
Temperature (deg C)
Salinity (‰)
Depth (m)
3.0000
13.0000
34.0000
0.000
28.0000
50.000
T
S

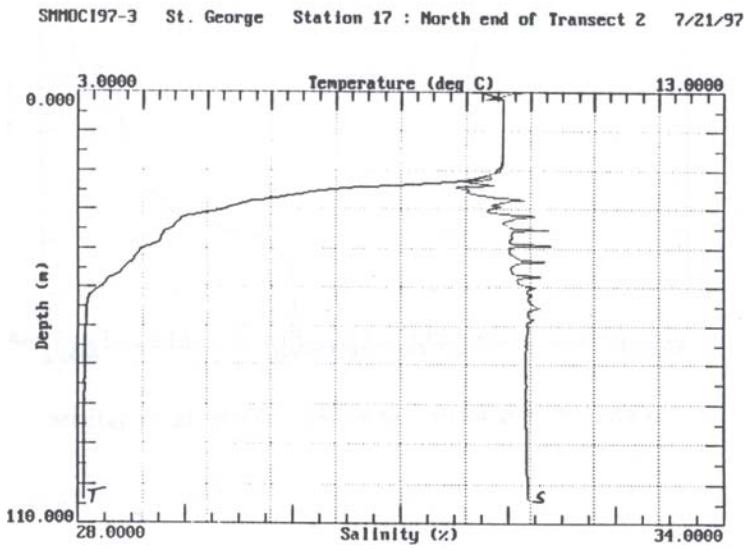

SMMDC197-3 St. George Station 11 : 30 miles into Transect 4 7/20/97
Temperature (deg C)
Salinity (‰)
Depth (m)
3.0000
13.0000
34.0000
0.000
28.0000
40.000
T
S

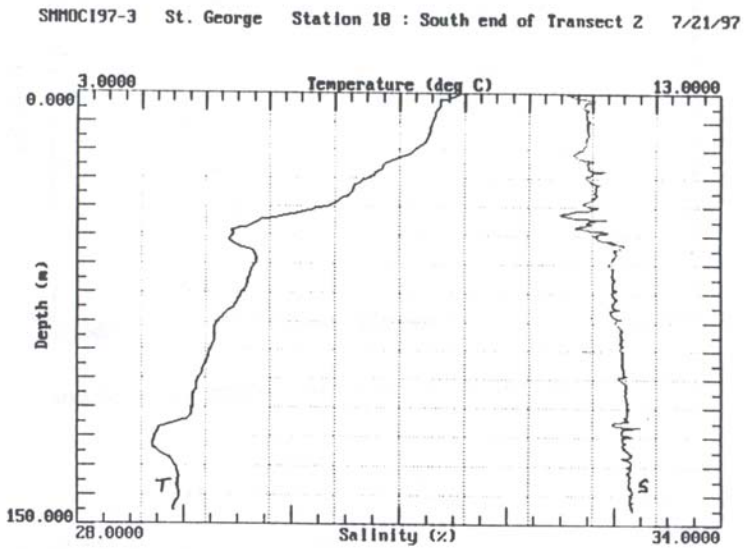

SMMDC197-3 St. George Station 14 : Longline #2 7/21/97
Temperature (deg C)
Salinity (%)
Depth (m)
3.0000
13.0000
34.0000
0.000
70.000
28.0000
T
S

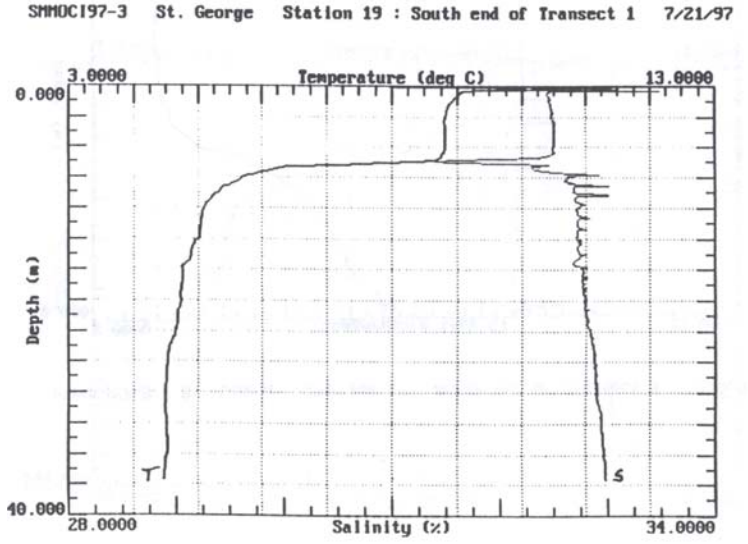

SMMDC197-3 St. George Station 16 : End of longline set 7/21/97
Temperature (deg C)
Salinity (%)
Depth (m)
3.0000
13.0000
34.0000
0.000
80.000
28.0000
T
S

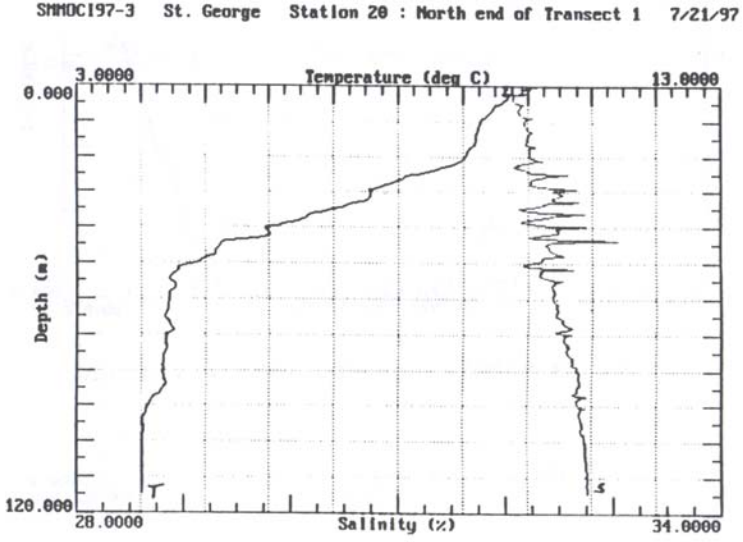

SMMDC197-3 St. George Station 13 : North end of Transect 1 7/20/97
Temperature (deg C)
Salinity (%)
Depth (m)
3.0000
13.0000
34.0000
0.000
70.000
28.0000
T
S


SMMDC197-3 St. George Station 15 : Bottom Trawl #2 7/21/97
Temperature (deg C)
Salinity (%)
Depth (m)
3.0000
13.0000
34.0000
0.000
80.000
28.0000
T
S

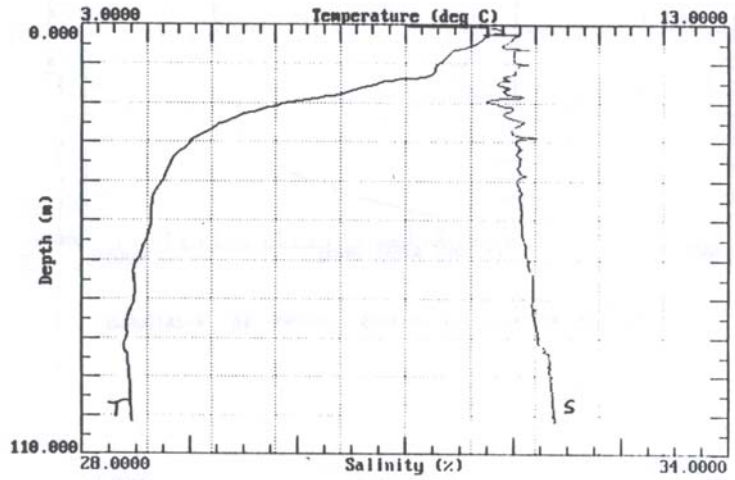

SMMOCI97-3 St. George Station 17 : North end of Transect 2 7/21/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
110.000
28.0000
Salinity (%)
34.0000
T
S


SMMOCI97-3 St. George Station 18 : South end of Transect 2 7/21/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
150.000
28.0000
Salinity (%)
34.0000
T
S

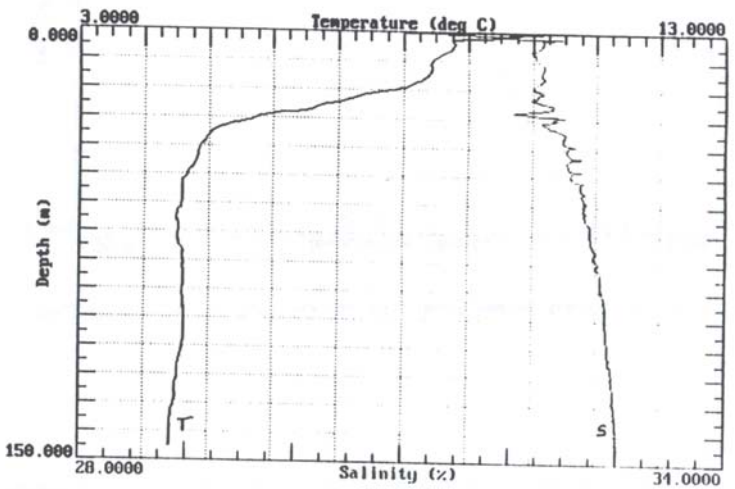

SMMOCI97-3 St. George Station 19 : South end of Transect 1 7/21/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
40.000
28.0000
Salinity (%)
34.0000
T
S


SMMOCI97-3 St. George Station 20 : North end of Transect 1 7/21/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
120.000
28.0000
Salinity (%)
34.0000
T
S

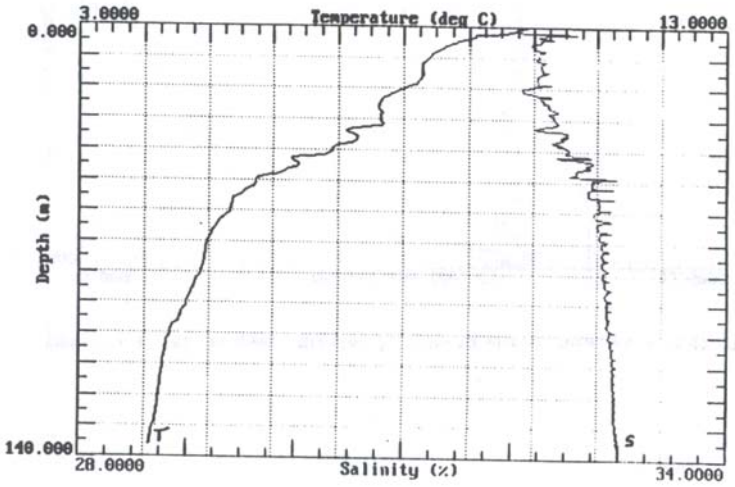
SMMOCI97-3 St. George Station 21 : North end of Transect 8 7/22/97



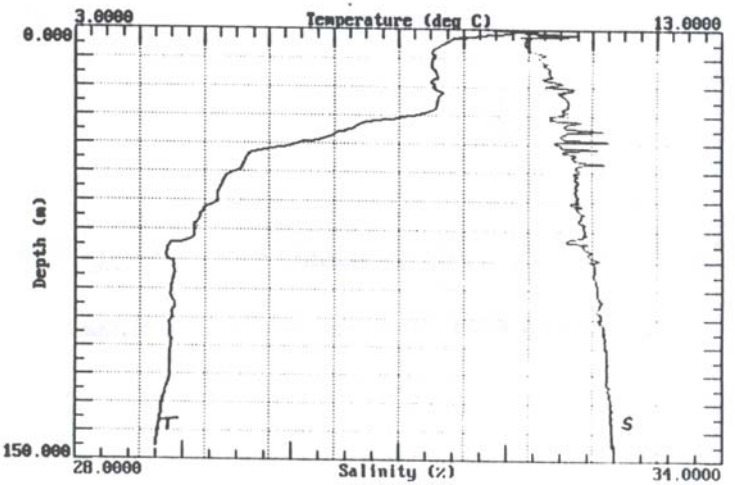
SMMOCI97-3 St. George Station 22 : South end of Transect 8 7/22/97

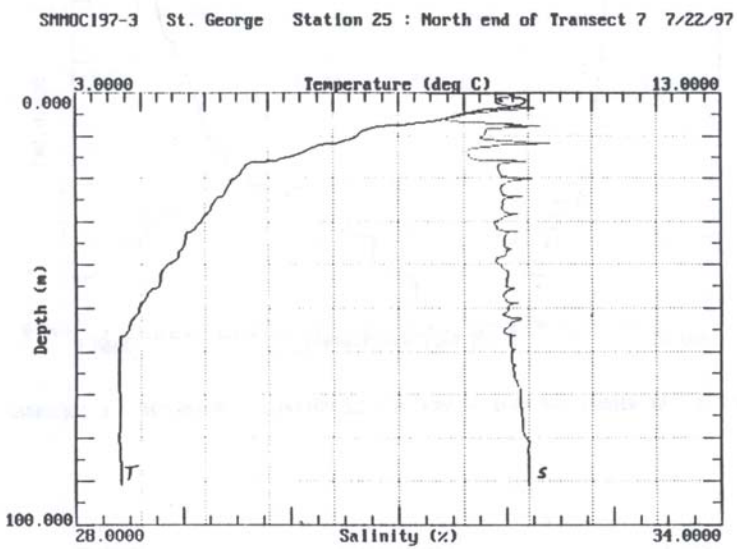


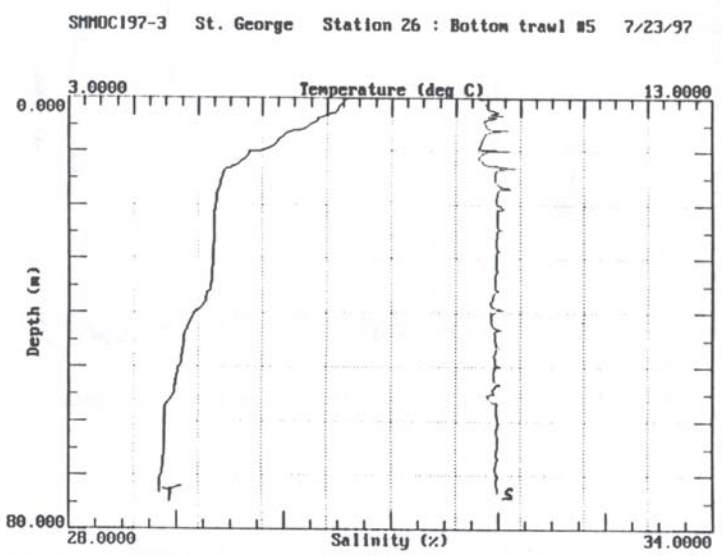
SMMOCI97-3 St. George Station 23 : S. end of Transect 7/MWTR #5 7/22/97

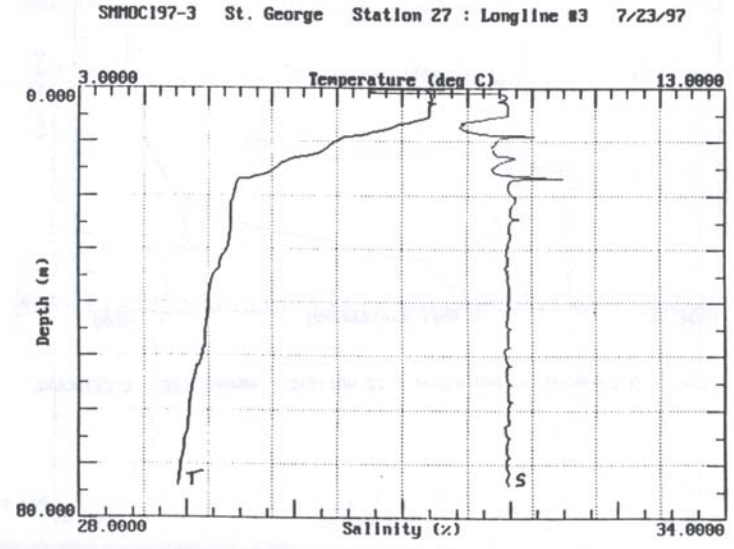


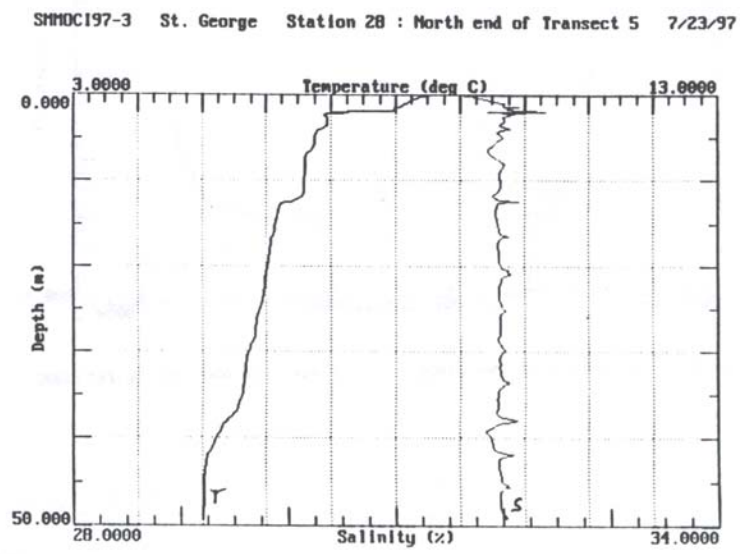
SMMOCI97-3 St. George Station 24 : Mid-water Trawl #6 7/22/97

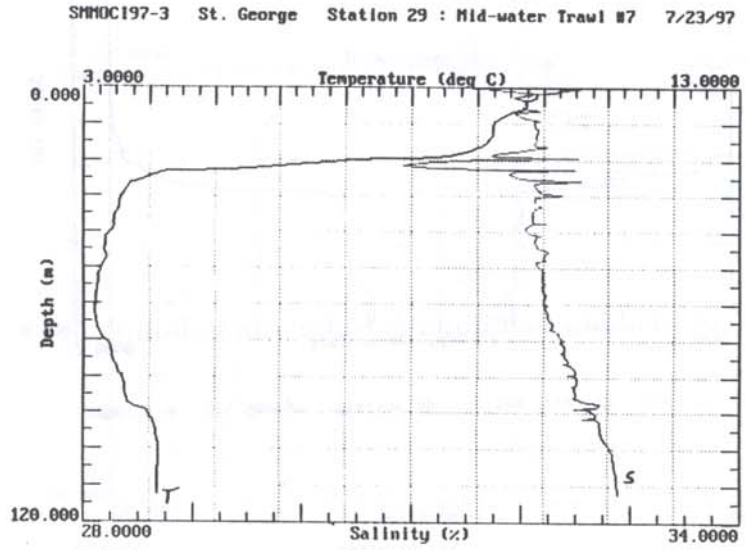


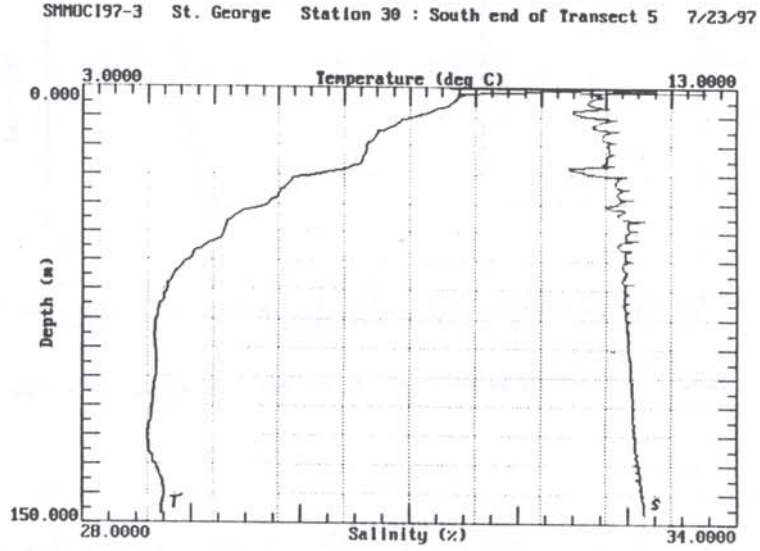

SMMOC197-3 St. George Station 25 : North end of Transect 7 7/22/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
100.000
28.0000
Salinity (%)
34.0000
T
S

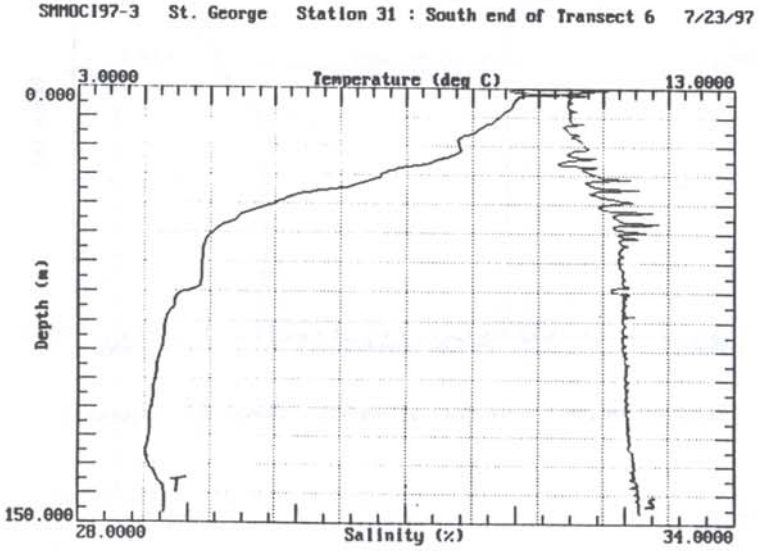

SMMOC197-3 St. George Station 26 : Bottom trawl #5 7/23/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
80.000
28.0000
Salinity (%)
34.0000
T
S

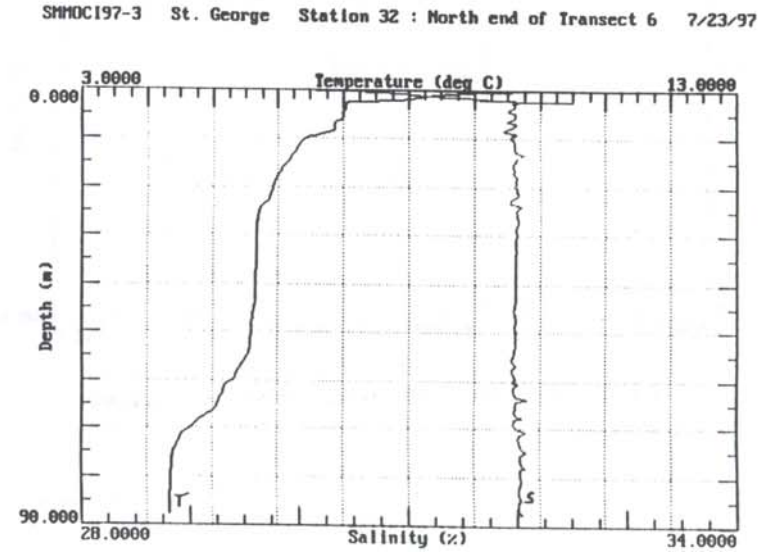

SMMOC197-3 St. George Station 27 : Longline #3 7/23/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
80.000
28.0000
Salinity (%)
34.0000
T
S

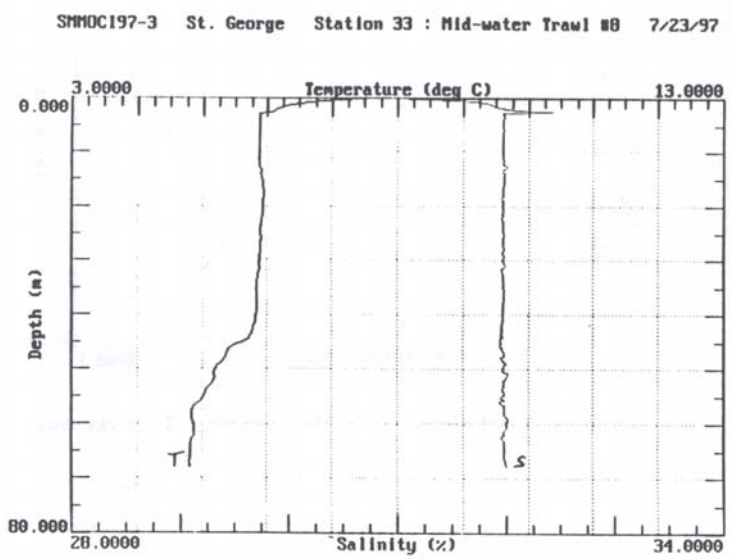

SMMOC197-3 St. George Station 28 : North end of Transect 5 7/23/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
50.000
28.0000
Salinity (%)
34.0000
T
S

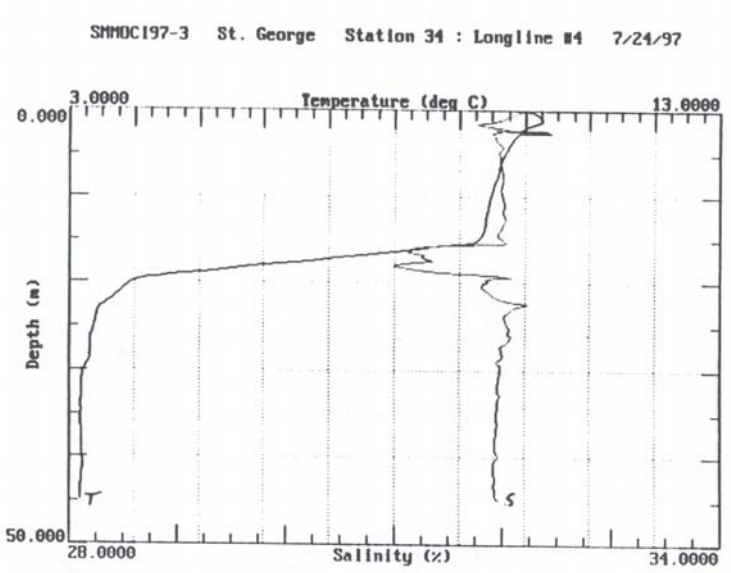

SMMOCI97-3 St. George Station 29 : Mid-water Trawl #7 7/23/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
120.000
28.0000
Salinity (%)
34.0000
T
S

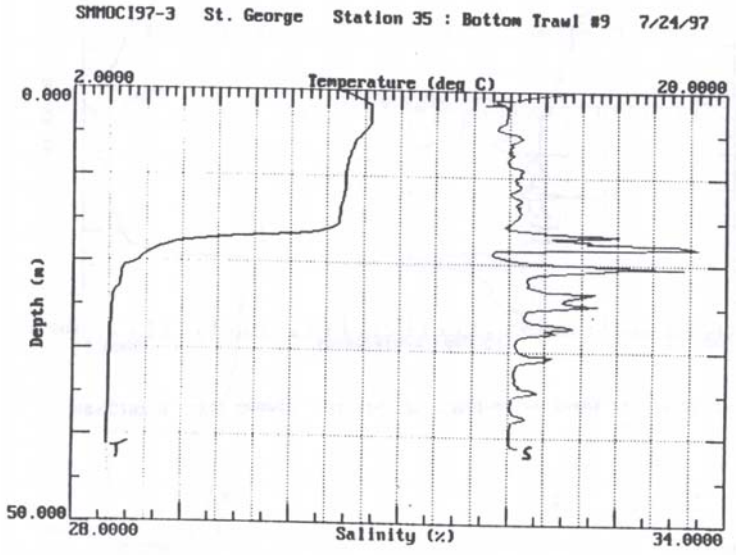

SMMOCI97-3 St. George Station 30 : South end of Transect 5 7/23/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
150.000
28.0000
Salinity (%)
34.0000
T
S

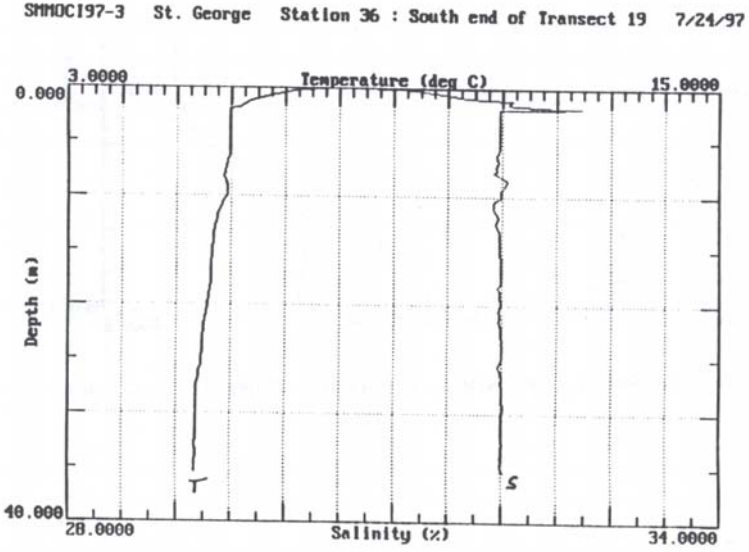

SMMOCI97-3 St. George Station 31 : South end of Transect 6 7/23/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
150.000
28.0000
Salinity (%)
34.0000
T
S


SMMOCI97-3 St. George Station 32 : North end of Transect 6 7/23/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
90.000
28.0000
Salinity (%)
34.0000
T
S

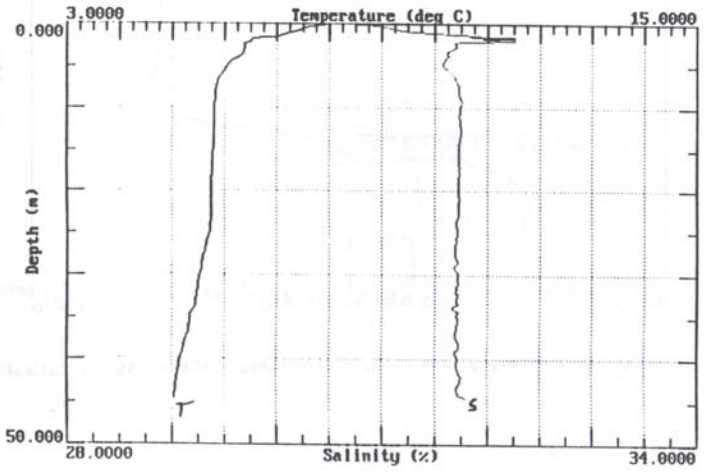

SMMOC197-3 St. George Station 33 : Mid-water Trawl #8 7/23/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
80.000
28.0000
Salinity (%)
34.0000
T
S


SMMOC197-3 St. George Station 34 : Longline #4 7/24/97
3.0000
Temperature (deg C)
13.0000
0.000
Depth (m)
50.000
28.0000
Salinity (%)
34.0000
T
S

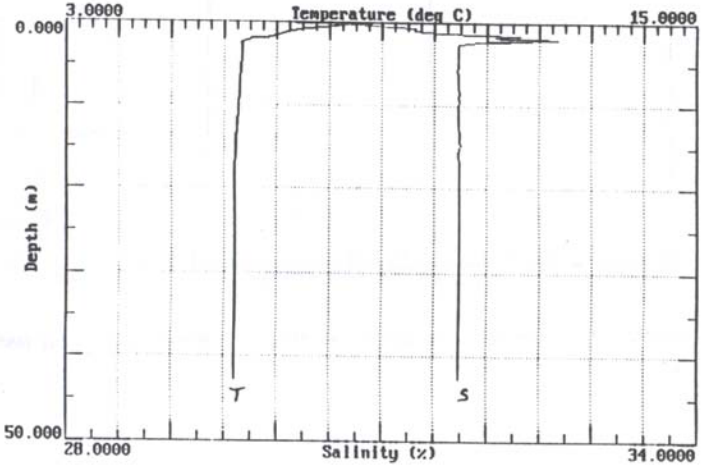

SMMOC197-3 St. George Station 35 : Bottom Trawl #9 7/24/97
2.0000
Temperature (deg C)
20.0000
0.000
Depth (m)
50.000
28.0000
Salinity (%)
34.0000
T
S


SMMOC197-3 St. George Station 36 : South end of Transect 19 7/24/97
3.0000
Temperature (deg C)
15.0000
0.000
Depth (m)
40.000
28.0000
Salinity (%)
34.0000
T
S

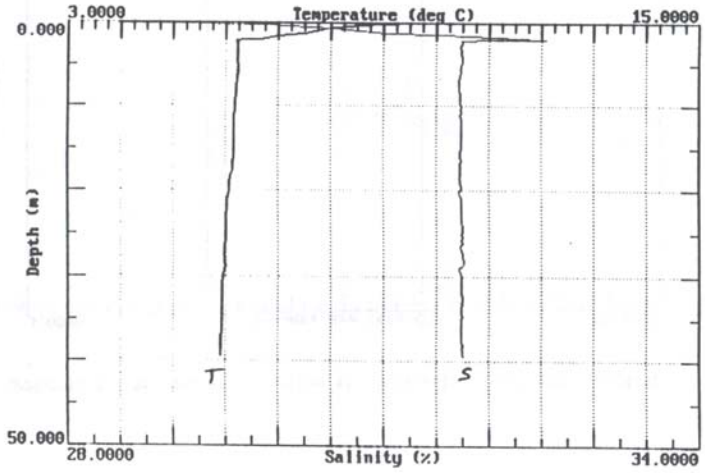
SMMOC197-3 St. George Station 37 : North end of Transect 19 7/24/97



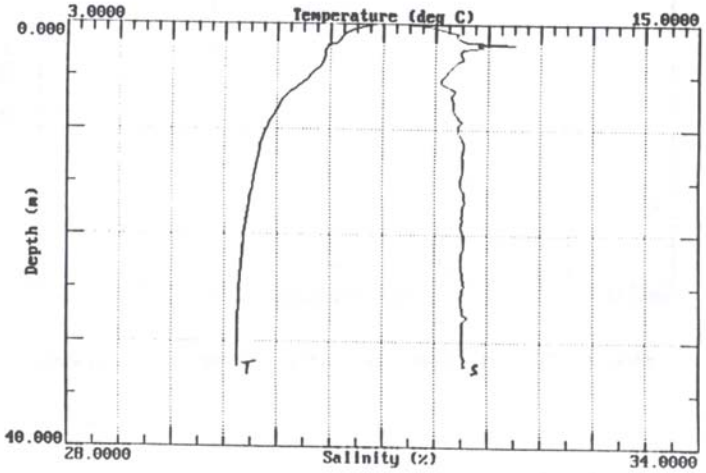
SMMOC197-3 St. George Station 38 : Longline #5 7/24/97

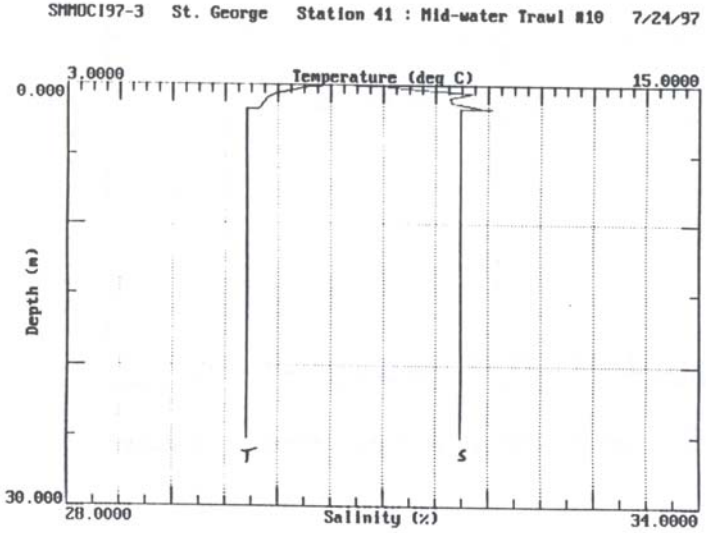


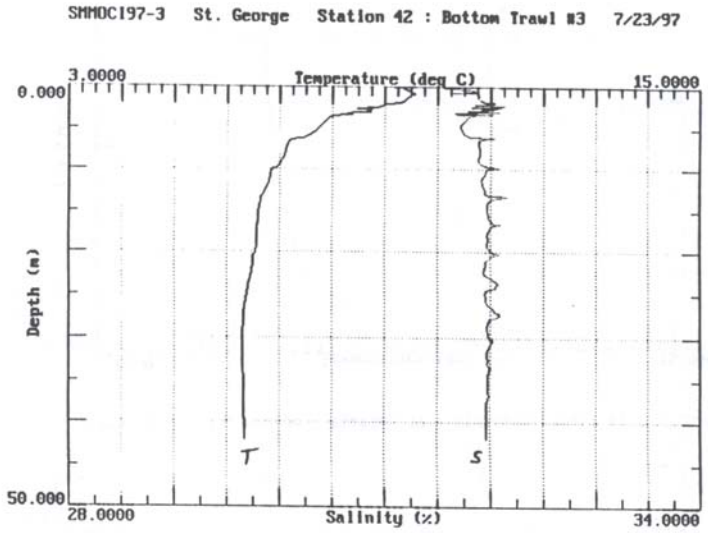
SMMOC197-3 St. George Station 39 : Bottom Trawl #10 7/24/97

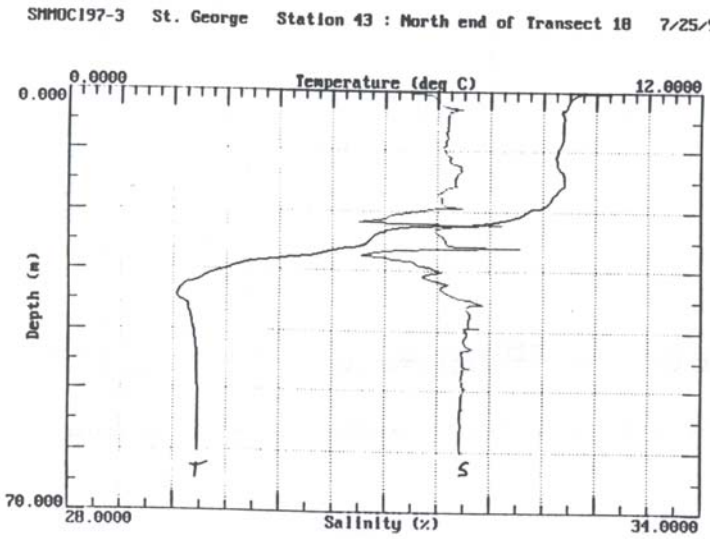


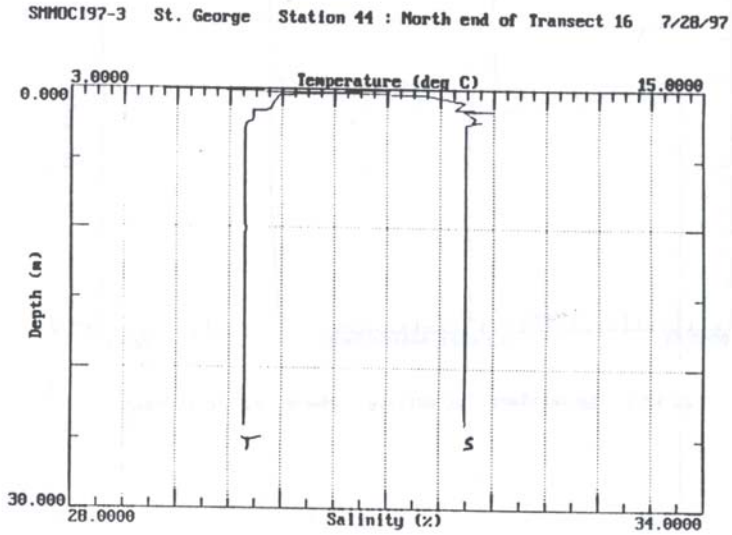
SMMOC197-3 St. George Station 40 : Mid-water Trawl #9 7/24/97



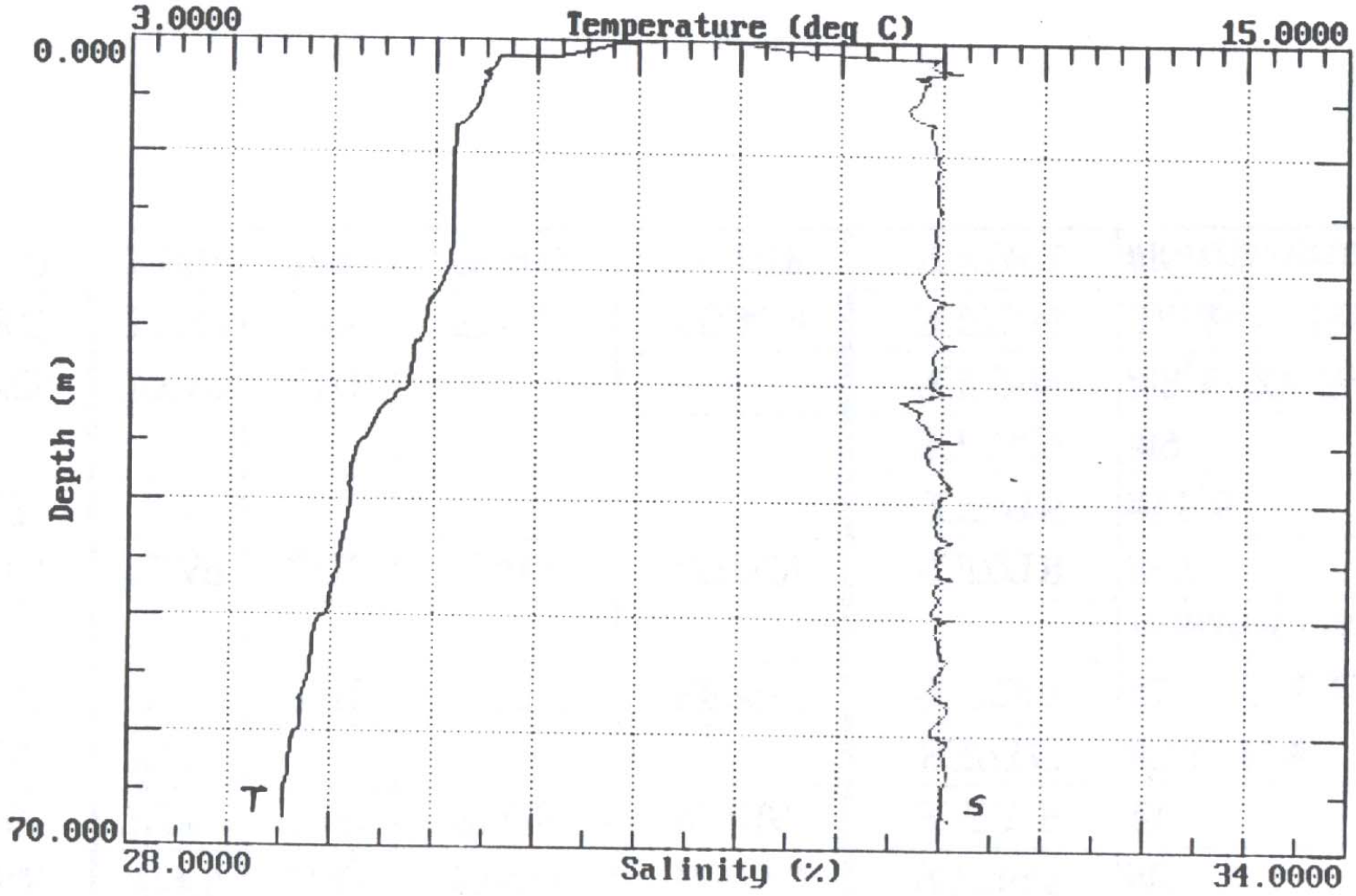

SMMOCI97-3 St. George Station 41 : Mid-water Trawl #10 7/24/97
Temperature (deg C)
3.0000
15.0000
0.000
30.000
Depth (m)
28.0000
Salinity (%)
34.0000
T
S


SMMOCI97-3 St. George Station 42 : Bottom Trawl #3 7/23/97
Temperature (deg C)
3.0000
15.0000
0.000
50.000
Depth (m)
28.0000
Salinity (%)
34.0000
T
S


SMMOCI97-3 St. George Station 43 : North end of Transect 18 7/25/97
Temperature (deg C)
0.0000
12.0000
0.000
70.000
Depth (m)
28.0000
Salinity (%)
34.0000
T
S


SMMOCI97-3 St. George Station 44 : North end of Transect 16 7/28/97
Temperature (deg C)
3.0000
15.0000
0.000
30.000
Depth (m)
28.0000
Salinity (%)
34.0000
T
S

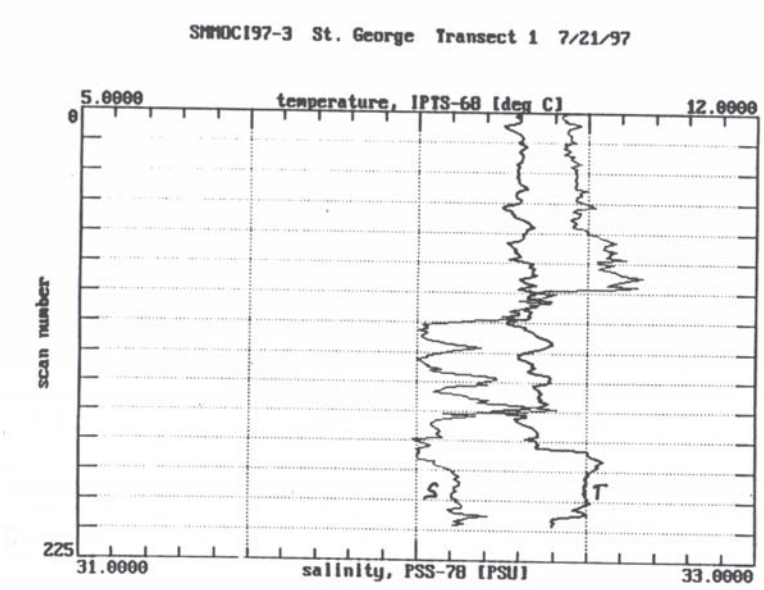
SMMOC197-3 St. George Station 45 : South end of Transect 16 7/28/97

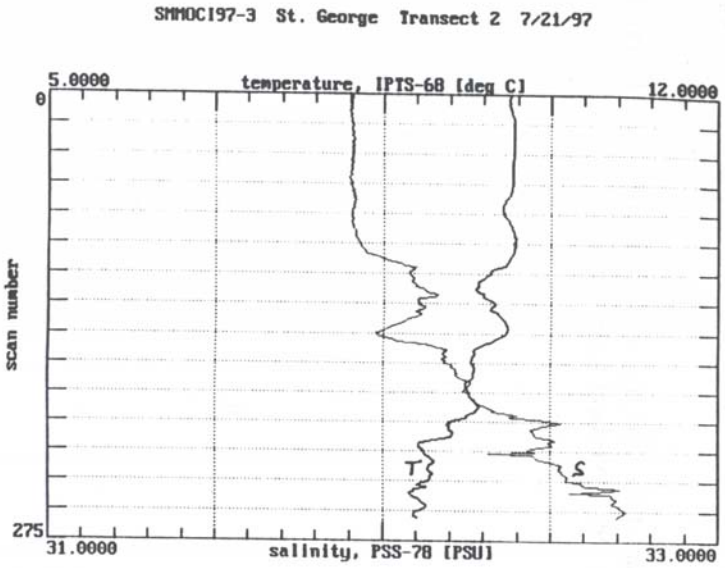


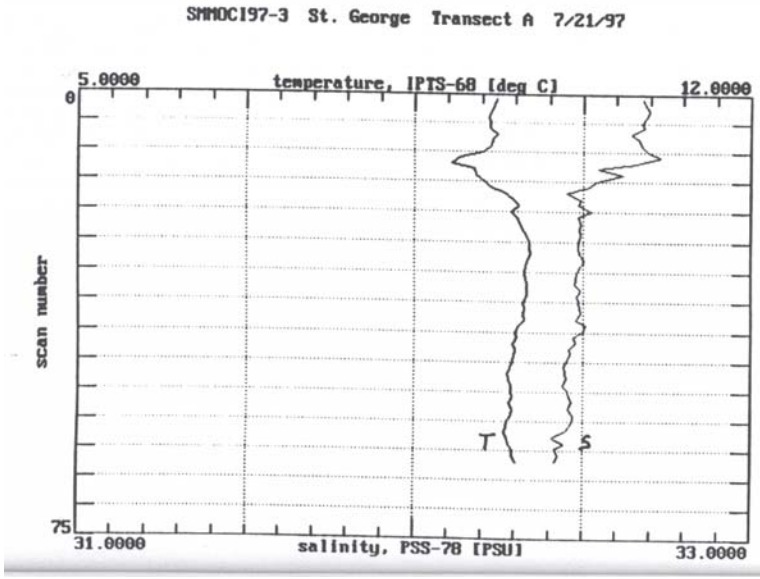
Appendix G. Thermosalinograph log for SMMOCI cruise near the Pribilof Islands, Alaska in 1997.

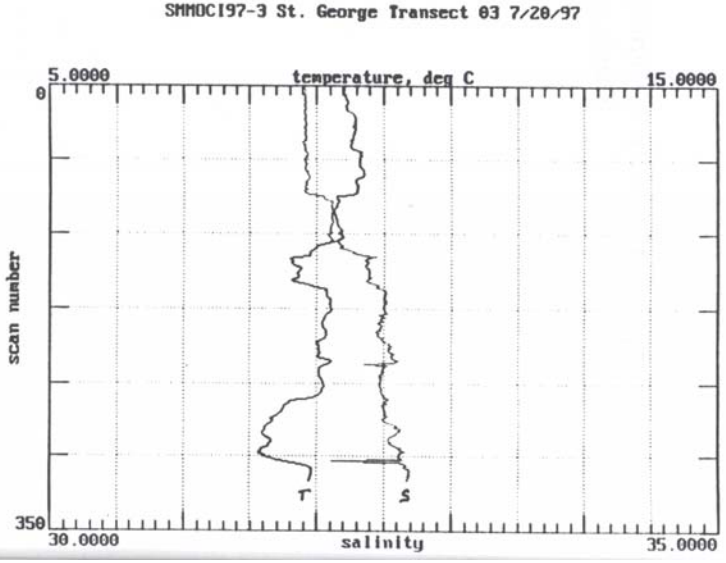
DATE	TIME	POSITION ON		DATE	TIME	POSITION OFF		FILE NAME	Transects included
ON	ON	Latitude (N)	Longitude (W)	OFF	OFF	Latitude (N)	Longitude (W)	*.hex	in file
7/16/97	20:58	57 02.45	170 31.38	7/17/97				SG771613	#13 plus 20 miles
7/19/97	8:25	58 06.00	171 01.00	7/19/97	14:06	57 13.40	170 23.00	Not Working	#14 plus 20 miles
7/19/97	~18:20	57 08.24	170 20.48	7/19/97	21:45	56 41.05	170 01.40	SG771915	#15
7/20/97	7:29	56 31.38	169 09.97	7/20/97	12:53	55 42.89	169 43.66	SG772003	#3
7/20/97	13:23	55 42.89	169 43.66	7/20/97				SG7720C	#C, 4a, 4b, 4c
7/21/97	8:00	56 28.03	168 52.47	7/21/97	21:12	56 25.29	168 35.67	SG772102	#2, A, 1 (long stop to retrieve
//////////									crossed net, restart transects @15:40
7/22/97	8:20	56 47.10	170 35.00	7/22/97	23:12	56 44.52	170 18.21	SG772208	#8, 7
7/23/97	7:30	56 34.27	169 44.77					SG772305	#5, E, 6
7/24/97								SG772419	#19
7/25/97	9:30	57 07.094	170 19.628	7/26/97	~21:00			SG772518	#18 plus 20 miles and to St. Matthew
7/27/97	15:10	58 06.69	171 00.06	7/27/97	21:06	57 13.16	170 24.19	SG772714	20 miles, north end furseal plus #14
7/28/97	18:24	57 07.461	170 19.107	7/28/97	22:40	56 39.41	169 45.08	SG772812	#16 north to south (watch filename!)

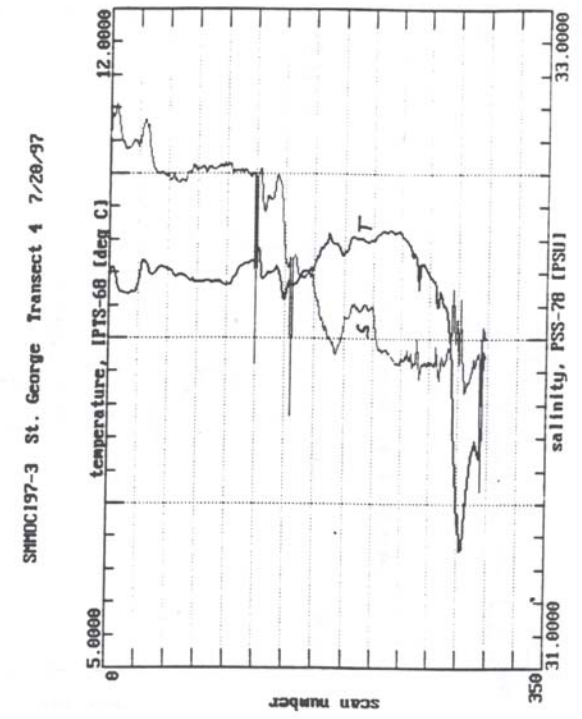
Appendix H. Graphs of thermosalinograph data from the SMMOCI cruise near the Pribilof Islands, Alaska in 1997. Vertical scale varies.

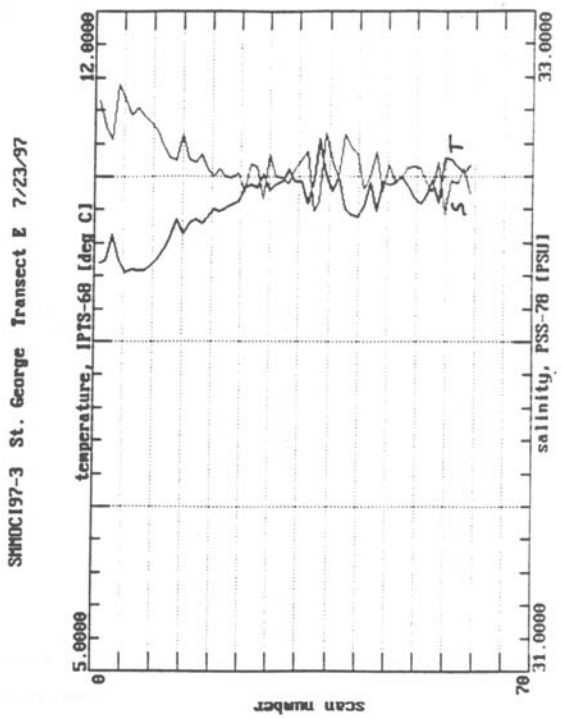

SMMOCI97-3 St. George Transect 1 7/21/97
5.0000
temperature, IPTS-68 [deg C]
12.0000
0
scan number
225
31.0000
salinity, PSS-78 [PSU]
33.0000
S
T

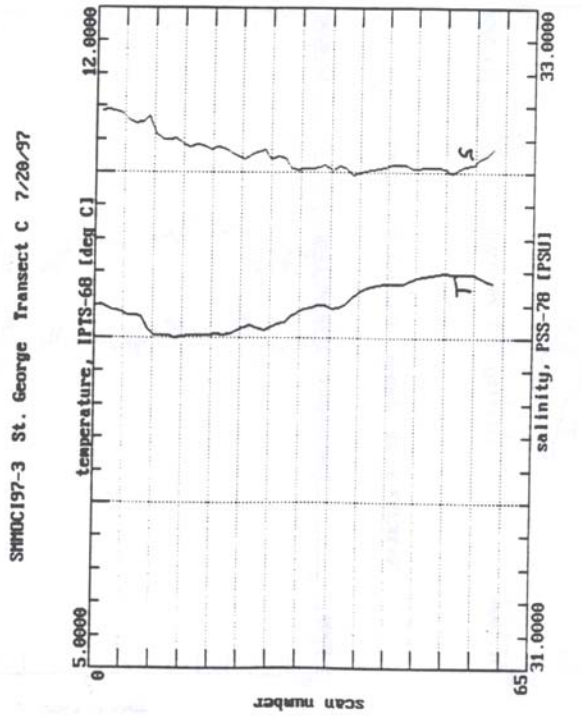

SMMOCI97-3 St. George Transect 2 7/21/97
5.0000
temperature, IPTS-68 [deg C]
12.0000
0
scan number
275
31.0000
salinity, PSS-78 [PSU]
33.0000
T
S

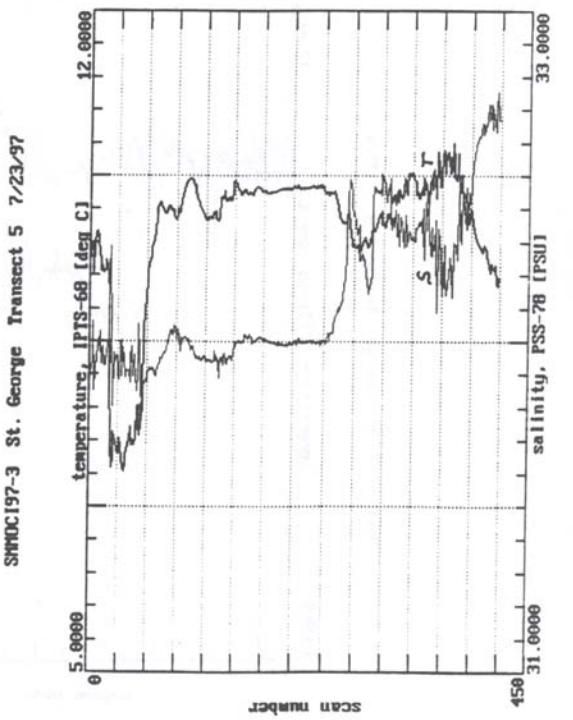

SMMOCI97-3 St. George Transect A 7/21/97
5.0000
temperature, IPTS-68 [deg C]
12.0000
0
scan number
75
31.0000
salinity, PSS-78 [PSU]
33.0000
T
S

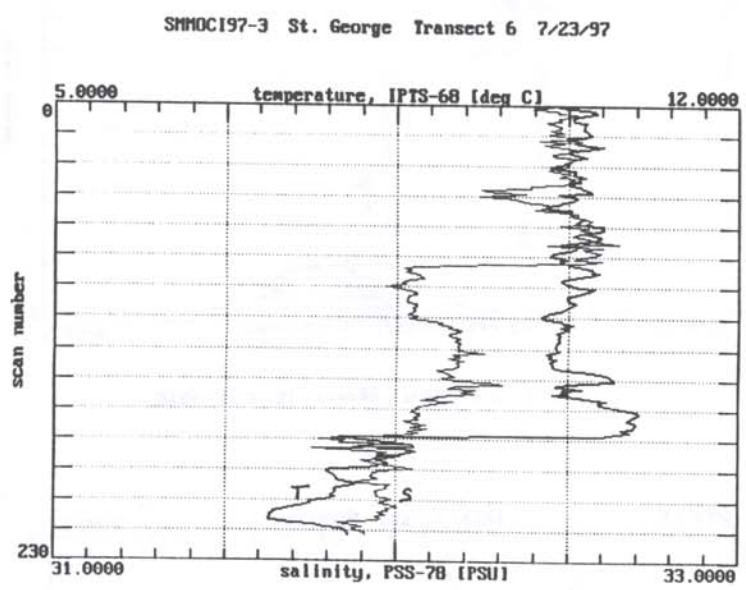

SMMOCI97-3 St. George Transect 03 7/20/97
5.0000
temperature, deg C
15.0000
0
scan number
350
30.0000
salinity
35.0000
T
S

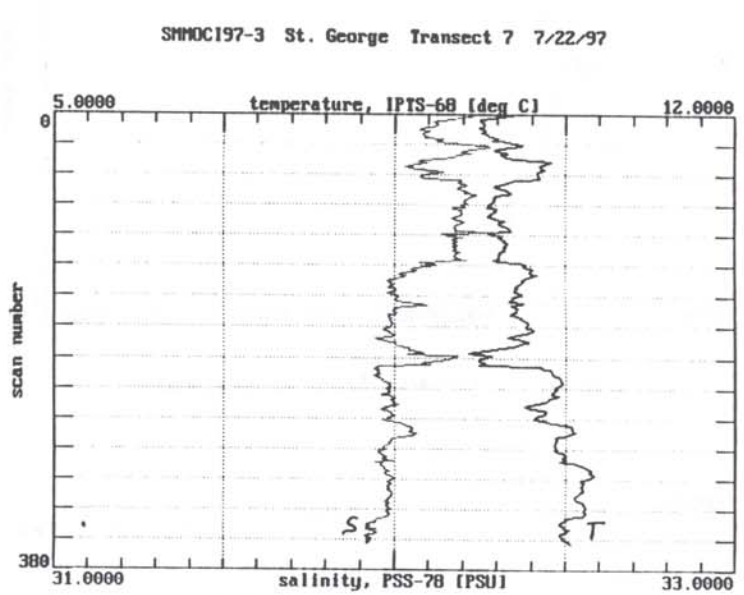

SMMDC197-3 St. George Transect 4 7/20/97
temperature, IPTS-68 [deg C]
salinity, PSS-78 [PSU]
scan number
5.0000
12.0000
31.0000
33.0000
0
350
T
S

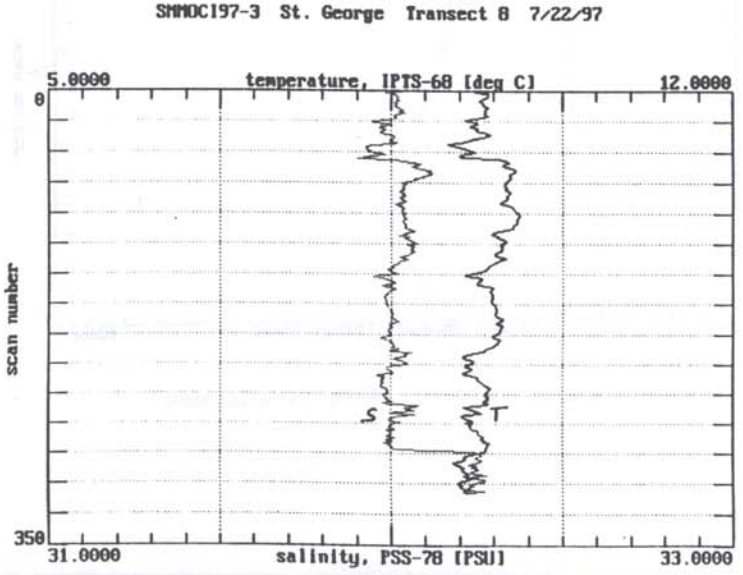

SMMDC197-3 St. George Transect E 7/23/97
temperature, IPTS-68 [deg C]
salinity, PSS-78 [PSU]
scan number
5.0000
12.0000
31.0000
33.0000
0
70
T
S

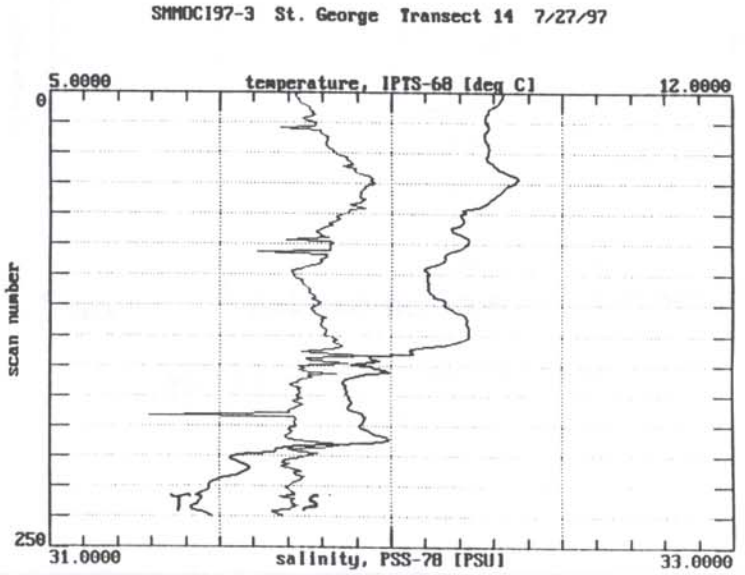

SMMDC197-3 St. George Transect C 7/20/97
temperature, IPTS-68 [deg C]
salinity, PSS-78 [PSU]
scan number
5.0000
12.0000
31.0000
33.0000
0
65
S
T

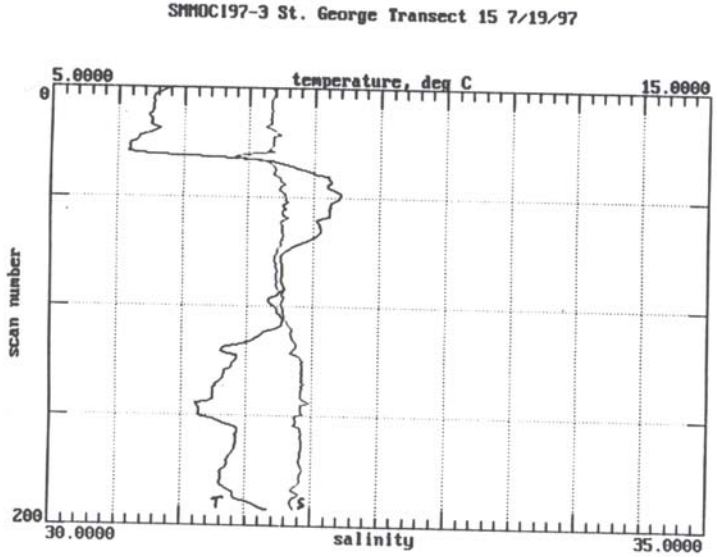

SMMDC197-3 St. George Transect 5 7/23/97
temperature, IPTS-68 [deg C]
salinity, PSS-78 [PSU]
scan number
5.0000
12.0000
31.0000
33.0000
0
450
T
S

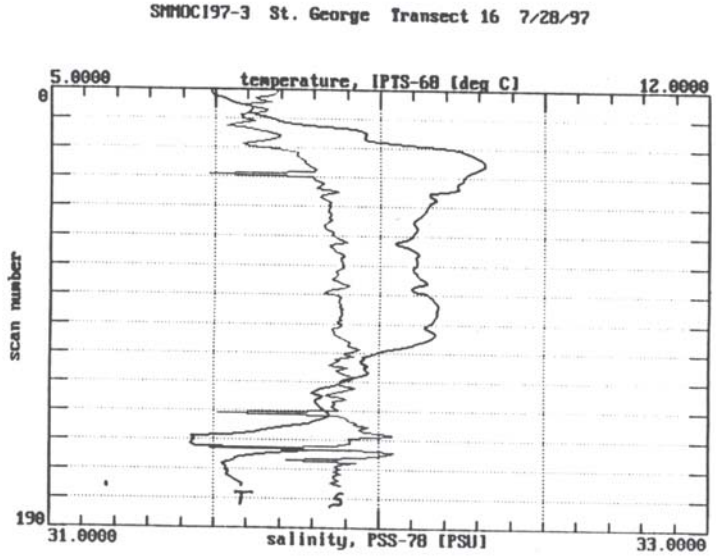

SMMOC197-3 St. George Transect 6 7/23/97
5.0000
temperature, IPTS-68 [deg C]
12.0000
0
scan number
230
T
S
31.0000
salinity, PSS-78 [PSU]
33.0000

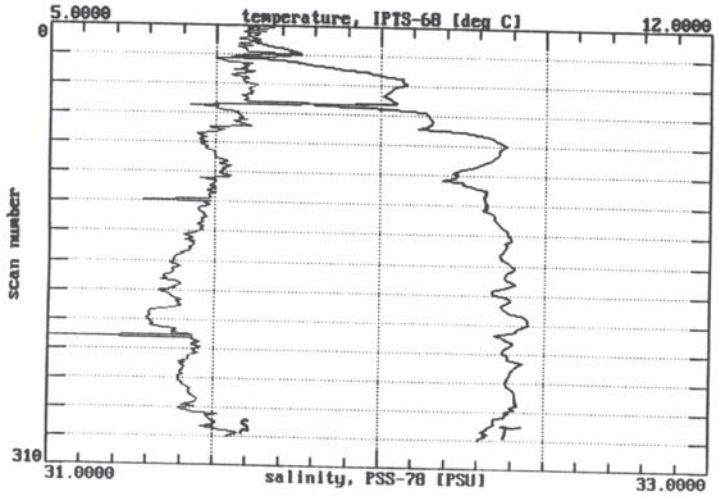

SMMOC197-3 St. George Transect 7 7/22/97
5.0000
temperature, IPTS-68 [deg C]
12.0000
0
scan number
380
S
T
31.0000
salinity, PSS-78 [PSU]
33.0000

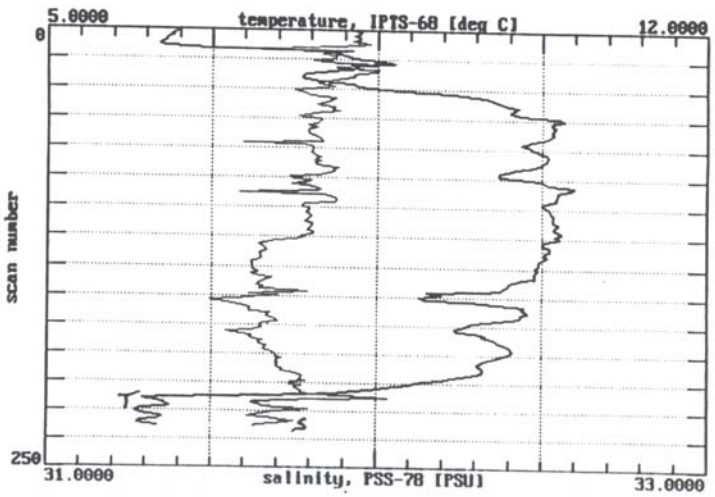

SMMOC197-3 St. George Transect 8 7/22/97
5.0000
temperature, IPTS-68 [deg C]
12.0000
0
scan number
350
S
T
31.0000
salinity, PSS-78 [PSU]
33.0000


SMMOC197-3 St. George Transect 14 7/27/97
5.0000
temperature, IPTS-68 [deg C]
12.0000
0
scan number
250
T
S
31.0000
salinity, PSS-78 [PSU]
33.0000


SMMOC197-3 St. George Transect 15 7/19/97
5.0000
temperature, deg C
15.0000
0
scan number
200
30.0000
salinity
35.0000
T
S


SMMOC197-3 St. George Transect 16 7/28/97
5.0000
temperature, IPTS-68 [deg C]
12.0000
0
scan number
190
31.0000
salinity, PSS-78 [PSU]
33.0000
T
S


SMMOC197-3 St. George Transect 18 7/25/97
5.0000
temperature, IPTS-68 [deg C]
12.0000
0
scan number
310
31.0000
salinity, PSS-78 [PSU]
33.0000
S
T


SMMOC197-3 St. George Transect 19 7/24/97
5.0000
temperature, IPTS-68 [deg C]
12.0000
0
scan number
250
31.0000
salinity, PSS-78 [PSU]
33.0000
T
S