



**PRELIMINARY REPORT OF THE INTERNATIONAL 0-GROUP FISH SURVEY
IN THE BARENTS SEA AND ADJACENT WATERS IN AUGUST-SEPTEMBER 1993**

The twenty-ninth annual International 0-group fish survey was made during the period 16 August - 8 September 1993 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Period	Research Institute
Norway	"Johan Hjort"	16.8 - 8.9	Institute of Marine
Norway	"G.O. Sars"	17.8 - 7.9	Research, Bergen
Russia	"Professor Marty"	22.8 - 8.9	The Polar Research
Russia	"Pinro"	23.8 - 6.9	Institute of Marine Fisheries and Oce- anography, Murmansk

Names of scientists and technicians who took part on the different vessels are given in the Appendix.

Preliminary analysis of the survey data were made 5-7 October in Murmansk. Observations concerning the geographical distribution of 0-group fish and their abundance are given in this report together with a brief description of the hydrographical conditions in the area.

MATERIAL AND METHODS

The geographical distribution of 0-group fish were estimated with a small mesh midwater trawl. The vessels which participated in the survey in 1993, used the type of midwater trawl recommended by the meeting held after the survey in 1980 (Anon., 1983). The trawling procedure was standardized in accordance with the recommendation made at the same meeting. At about every 30 nautical miles sailed the trawl was towed in several depths in one haul. The standard procedure consisted of tows of 0.5 nautical mile in each of 3 depths with the headline of the trawl located at 0, 20 and 40m. An additional tow at 60 and 80m for 0.5 nautical mile was made when 0-group fish layer was recorded on the echosounder deeper than 60m.

A procedure starting with the trawl in the deepest layer would probably be preferable. The trawl would then be "fishing" more efficient throughout the whole trawl haul and maintain the correct geometry. It is recommended that this is further investigated.

Survey tracks and hydrographical stations are given in Fig. 1. Trawl stations with and without catch are indicated on the distribution charts in Figs. 16 - 27, as filled and open symbols respectively. The density grading is based on catch in number per 1.0 nautical mile trawling.

HYDROGRAPHY

Observations were made along all the survey tracks with 5 to 40 nautical miles between stations. Horizontal distributions of temperatures and salinities are shown for 0, 50, 100, 200m and bottom (Figs. 2-11). Figs. 12 - 15 show the temperature and salinity conditions along the Bear Island - West, Bear Island - North Cape, Kola and Cape Kanin sections. The mean temperatures in the main parts of these sections are presented in Table 1.

According to temperature conditions, 1993 is the fifth "warm year" in succession. However this year the mean sea temperatures from 0-200m in the Barents Sea were only 0.1-0.2°C above the long term average (1965-1993). Compared to 1992 a significant fall in temperature (0.3-0.6°C) was observed. The reduced positive anomalies in the hydrographical standard sections are mainly due to lower heat content in the layer below the seasonal thermoclyne. The temperature in 50-100m layer along the Kola section was the same as observed in 1992. Upper mixed layer temperature was significantly (0.5-1.5°C) higher than previous year. This is associated with the favourable conditions of the summer heating. In the West Spitsbergen Current (0-200m) temperature was 0.8°C above long term average and 0.4°C higher than in 1992. Upper mixed layer temperature in this area was

also 1.0-1.5°C higher than previous year. Observed thermal conditions were caused by decrease of Atlantic inflow into the Barents Sea and increase into the area west of Bear Island and West of Spitsbergen.

DISTRIBUTION AND ABUNDANCE OF 0-GROUP FISH AND *GONATUS FABRICII*

Geographical distribution of 0-group fish are shown as shaded areas in Figs. 16 - 26, and of *Gonatus fabricii* in Fig. 27. Double shading indicates dense concentrations. The criteria for discriminating between dense and scattered concentrations are the same as used in earlier reports (Anon., 1980). Abundance indices, estimated as the area of distribution with areas of high densities weighed by 10, are given in Table 2. Another set of abundance indices are given for 0-group herring, cod and haddock (Table 3) as described by Randa (1984). These are based on the number caught during a standard trawl haul of one nautical mile. Length frequency distributions of the main species are given in Table 4.

The main distribution of 0-group fish were more westerly orientated in 1993 than in previous years.

Herring (Fig. 16)

Scattered concentrations with small dense patches were observed more westerly than last year and approached 80°N west of Spitsbergen. The main concentrations were found in the central part of the Barents Sea, and herring was distributed eastwards to 38°E. The logarithmic abundance index is estimated at 0.75, which is somewhat below the 1991 and 1992 indices, but still the fourth highest in the time-series. This indicates that the 1993 yearclass is relatively strong.

Capelin (Fig. 17)

As in last year 0-group capelin was distributed mainly near Novaya Zemlya and in small quantities, and it seems to be the second very poor yearclass in succession. The length distribution indicates that this 0-group comes from summer spawners.

Cod (Fig. 18)

Along west off Spitsbergen dense concentrations were recorded in a wider area than previous year. The largest area with dense concentrations was found in the central part of the Barents Sea, from about 20-40°E and north to 76°N. In the southeastern part of the Barents Sea mainly scattered concentrations were observed. 0-group cod was absent in the south east off the

Murman coast until Kolguev island. The logarithmic abundance index for the 1993-yearclass (2.09) is the fifth highest in the time-series, above that of 1983, and the yearclass must be classified as strong.

Haddock (Fig. 19)

To the west of Spitsbergen 0-group haddock was distributed in a smaller area than last year. In the western and central part of the Barents Sea the distribution was similar to that of 1992, but with few observations east of 35°E. The logarithmic index was estimated at 0.64, which is the third highest since 1965, indicating another good yearclass of haddock.

Saithe (Fig. 20)

In the central part of the investigated area saithe was less abundant than in 1992, while to the west of Spitsbergen the species was observed over a larger area and in higher quantities. In most years there are relatively few observations of 0-group saithe in the Barents Sea and therefore no index is calculated.

Polar cod (Fig. 21)

0-group polar cod is distributed in two separate areas, with one component west and southeast of Spitsbergen and a second component in east along the western coast of Novaya Zemlya. During the 0-group survey the total area of distribution is not completely covered.

In the north-western area, the distribution was similar to previous year. The index was just a little lower than in 1992 and the 1993 yearclass of polar cod in this area seems to be of average abundance.

Dense concentrations of the eastern component were distributed over a wider area than in 1992. During the following pelagic fish survey in September it was found that this component covered a much wider area towards northeast, but since this area normally is not investigated during the 0-group survey, it was not included in the calculations of the abundance index. Still the index increased by 32% and the 1993 yearclass in the eastern area may be considered to be at least of average strength.

Redfish (Fig. 22)

Similar to 1992, 0-group redfish was only distributed in the western areas, along the western edge of the shelf and off West-Spitsbergen. The area with dense concentrations was larger this year, and the index slightly higher (8%), but still the yearclass must be considered to be poor, as in the two previous years.

Greenland halibut (Fig. 23)

Only scattered concentrations were recorded in limited patches mainly to the west of Spitsbergen. The index increased with a factor of more than 3 compared to previous year, but the yearclass is still poor (the sixth in succession).

Long rough dab (Fig. 24)

The 0-group was mainly distributed in the central part of the Barents Sea over a wider area than previous year and with some scattered patches in the eastern and southeastern areas. No dense aggregations were observed. The index increased by over 40%, but still the yearclass is considered to be another poor one.

Sandeel (Fig. 25)

Sandeel was mainly observed nearby Novaya Zemlya as in 1987, but further to the north.

Catfish (Fig. 26) and **blue whiting**.

Only a few specimens of catfish and blue whiting were caught.

Gonatus (Fig. 27)

0-group *Gonatus fabricii* was found in the western part of the investigated area, but in smaller quantities than in 1992.

REFERENCES

- Anon., 1980. Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August/September 1978. *Annls biol., Copenh.*, 35:273-280.
- Anon., 1983. Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August/September 1980. *Annls biol., Copenh.*, 37:259-266.
- Randa, K. 1984. Abundance and distribution of 0-group Arcto-Norwegian cod and haddock 1965-1982. Pp. 189-209 in Godø, O.R. and Tilseth, H. (eds.): *Reproduction and recruitment of Arctic cod*. Proceedings of the first Soviet-Norwegian symposium, Leningrad, 26-30 September 1983. Institute of Marine Research, Bergen, Norway.
- Tereshchenko, V.V. 1992. Some results from long-term oceanographic observations during 0-group surveys in the Barents Sea. ICES CM 1992/C:18.
- Toresen, R. 1985. Recruitment indices of Norwegian spring-spawning herring for the period 1965-1984 based on the international 0-group fish surveys. ICES CM 1985/H: 54.

Table 1. Mean water temperature¹ in main parts of standard sections in the Barents Sea and adjacent waters in august-September 1965 - 1993.

Year	Section ² and layer (deep in meter)						
	1	2	3	4	5	6	7
	0-50	50-200	0-200	0-bot.	0-bot.	0-200	0-200
1965	6.7	3.9	4.6	4.6	3.7	5.1	-
1966	6.7	2.6	3.6	1.9	2.2	5.5	3.6
1967	7.5	4.0	4.9	6.1	3.4	5.6	4.2
1968	6.4	3.7	4.4	4.7	2.8	5.4	4.0
1969	6.7	3.1	4.0	2.6	2.0	6.0	4.2
1970	7.8	3.7	4.7	4.0	3.3	6.1	-
1971	7.1	3.2	4.2	4.0	3.2	5.7	4.2
1972	8.7	4.0	5.2	5.1	4.1	6.3	3.9
1973	7.7	4.5	5.3	5.7	4.2	5.9	5.0
1974	8.1	3.9	4.9	4.6	3.5	6.1	4.9
1975	7.0	4.6	5.2	5.6	3.6	5.7	4.9
1976	8.1	4.0	5.0	4.9	4.4	5.6	4.8
1977	6.9	3.4	4.3	4.1	2.9	4.9	4.0
1978	6.6	2.5	3.6	2.4	1.7	5.0	4.1
1979	6.5	2.9	3.8	2.0	1.4	5.3	4.4
1980	7.4	3.5	4.5	3.3	3.0	5.7	4.9
1981	6.6	2.7	3.7	2.7	2.2	5.3	4.4
1982	7.1	4.0	4.8	4.5	2.8	5.8	4.9
1983	8.1	4.8	5.6	5.1	4.2	6.3	5.1
1984	7.7	4.1	5.0	4.5	3.6	5.9	5.0
1985	7.1	3.5	4.4	3.4	3.4	5.3	4.6
1986	7.5	3.5	4.5	3.9	3.2	5.8	4.4
1987	6.2	3.3	4.0	2.7	2.5	5.2	3.9
1988	7.0	3.7	4.5	3.8	2.9	5.5	4.2
1989	8.6	4.8	5.8	6.5	4.3	6.9	4.9
1990	8.1	4.4	5.3	5.0	3.9	6.3	5.7
1991	7.7	4.5	5.3	4.8	4.2	6.0	5.4
1992	7.5	4.6	5.3	5.0	4.0	6.1	5.0
1993	7.5	4.0	4.9	4.4	3.4	5.8	5.4
Aver. 1965- 1993	7.3	3.8	4.7	4.2	3.2	5.7	4.6

¹⁾ Earlier presented temperatures have been slightly adjusted (Tereshchenko, 1992).

²⁾ 1-3: Murmansk Current; Kola Section (70°30'N-72°30'N, 33°30'E)
 4: Cape Kanin section (68°45'N - 70°05'N, 43°15'E)
 5: Cape Kanin section (71°00'N - 72°00'N, 43°15'E)
 6: North Cape Current; North Cape - Bear Island section (71°33'N, 25°02'E - 73°35'N, 20°46'E)
 7: West Spitsbergen Current; Bear Island - West section (74°30'N, 06°34'E - 15°55'E)

Tabell 2. Abundance indices of 0-group fish in the Barents Sea and adjacent waters in 1965 - 1993.

Year	Cod	Had-dock	Polar cod		Red-fish	Green-land halibut	Long rough dab
			West	East			
1965	6	7		0	159		66
1966	1	1		129	236		97
1967	34	42		165	44		73
1968	25	8		60	21		17
1969	93	82		208	295		26
1970	606	115		197	247	1	12
1971	157	73		181	172	1	81
1972	140	46		140	177	8	65
1973	684	54		(26)	385	3	67
1974	51	147		227	468	13	83
1975	343	170		75	315	21	113
1976	43	112		131	447	16	96
1977	173	116	157	70	472	9	72
1978	106	61	107	144	460	35	76
1979	94	69	23	302	980	22	69
1980	49	54	79	247	651	12	108
1981	65	30	149	73	861	38	95
1982	114	90	14	50	694	17	150
1983	386	184	48	39	851	16	80
1984	486	255	115	16	732	40	70
1985	742	156	60	334	795	36	86
1986	434	160	111	366	702	55	755
1987	102	72	17	155	631	41	174
1988	133	86	144	120	949	8	72
1989	202	112	206	41	698	5	92
1990	465	227	144	48	670	2	35
1991	766	472	90	239	200	1	28
1992	1159	313	195	118	150	3	32
1993	910	240	171	156	162	11	55

Table 3. Estimated logarithmic indices with 90% confidence limits of year class abundance for 0-group herring, cod and haddock in the Barents Sea and adjacent waters 1965 - 1993.

Year	Herring ¹			Cod			Haddock		
	Index	Confidence limits		Index	Confidence limits		Index	Confidence limits	
1965				+					
1966	0.14	0.04	0.31	0.02	0.01	0.04	0.01	0.00	0.03
1967	0.00	-	-	0.04	0.02	0.08	0.08	0.03	0.13
1968	0.00	-	-	0.02	0.01	0.04	0.00	0.00	0.02
1969	0.01	0.00	0.04	0.25	0.17	0.34	0.29	0.20	0.41
1970	0.00	-	-	2.51	2.02	3.05	0.64	0.42	0.91
1971	0.00	-	-	0.77	0.57	1.01	0.26	0.18	0.36
1972	0.00	-	-	0.52	0.35	0.72	0.16	0.09	0.27
1973	0.05	0.03	0.08	1.48	1.18	1.82	0.26	0.15	0.40
1974	0.01	0.01	0.01	0.29	0.18	0.42	0.51	0.39	0.68
1975	0.00	-	-	0.90	0.66	1.17	0.60	0.40	0.85
1976	0.00	-	-	0.13	0.06	0.22	0.38	0.24	0.51
1977	0.01	0.00	0.03	0.49	0.36	0.65	0.33	0.21	0.48
1978	0.02	0.01	0.05	0.22	0.14	0.32	0.12	0.07	0.19
1979	0.09	0.01	0.20	0.40	0.25	0.59	0.20	0.12	0.28
1980	-	-	-	0.13	0.08	0.18	0.15	0.10	0.20
1981	0.00	-	-	0.10	0.06	0.18	0.03	0.00	0.05
1982	0.00	-	-	0.59	0.43	0.77	0.38	0.30	0.52
1983	1.77	1.29	2.33	1.69	1.34	2.08	0.62	0.48	0.77
1984	0.34	0.20	0.52	1.55	1.18	1.98	0.78	0.60	0.99
1985	0.23	0.18	0.28	2.46	2.22	2.71	0.27	0.23	0.31
1986	0.00	-	-	1.37	1.06	1.70	0.39	0.28	0.52
1987	0.00	0.00	0.03	0.17	0.01	0.40	0.10	0.00	0.25
1988	0.32	0.16	0.53	0.33	0.22	0.47	0.13	0.05	0.34
1989	0.59	0.49	0.76	0.38	0.30	0.48	0.14	0.10	0.20
1990	0.31	0.16	0.50	1.23	1.04	1.34	0.61	0.48	0.75
1991	1.19	0.90	1.52	2.30	1.97	2.65	1.17	0.98	1.37
1992	1.06	0.69	1.50	2.94	2.53	3.39	0.87	0.71	1.06
1993	0.75	0.45	1.14	2.09	1.70	2.51	0.64	0.48	0.82

¹⁾ Assessment for 1965-1984 made by Toresen (1985).

Table 4. Length distribution of 0-group fish in percent in the Barents Sea and adjacent waters in August - September 1993.

Length (mm)	Her- ring	Cap- elin	Cod	Had- dock	Polar cod		Red- fish	Green land halib	Long roug dab	Sand- eel
					East	West				
15-19									1.1	
20-24		0.1			1.9	0.2	5.3		-	
25-29		0.4			3.7	4.9	24.4	4.3	5.7	0.8
30-34		3.3	+		10.8	29.6	45.4	-	44.3	12.3
35-39		10.0	0.1	0.1	13.3	40.5	21.0	8.7	38.6	19.9
40-44	0.1	18.8	0.2	0.1	12.6	22.0	3.8	-	10.2	17.3
45-49	0.6	21.4	0.5	0.2	18.6	2.7	0.1	8.7		9.1
50-54	3.8	14.2	1.3	0.3	22.6	0.1	+	30.4		9.2
55-59	3.8	3.0	2.0	0.4	9.7	+		30.4		10.8
60-64	8.0	5.0	3.1	0.5	6.4	+		13.0		10.8
65-69	12.1	3.3	5.9	0.8	0.3			4.3		3.5
70-74	16.7	5.8	10.7	1.1	-					3.2
75-79	25.5	4.6	15.5	2.1	+					2.3
80-84	16.8	5.0	20.2	2.9						1.4
85-89	8.8	2.3	17.1	6.3						0.1
90-94	3.0	1.9	13.5	15.1						
95-99	0.5	0.9	6.9	14.2						
100-104	0.1		2.3	15.8						
105-109	0.1		0.6	14.0						
110-114			+	13.4						
115-119			+	6.2						
120-124			+	2.3						
125-129			+	1.8						
130-134				1.2						
135-139	+			0.6						
140-144				0.5						
Total numbers	327- 193	702	134- 724	5810	278- 129	48- 055	34- 018	23	176	7431
Mean length	74.6	54.1	81.8	101.5	45.8	36.4	31.7	53.2	35.0	48.4

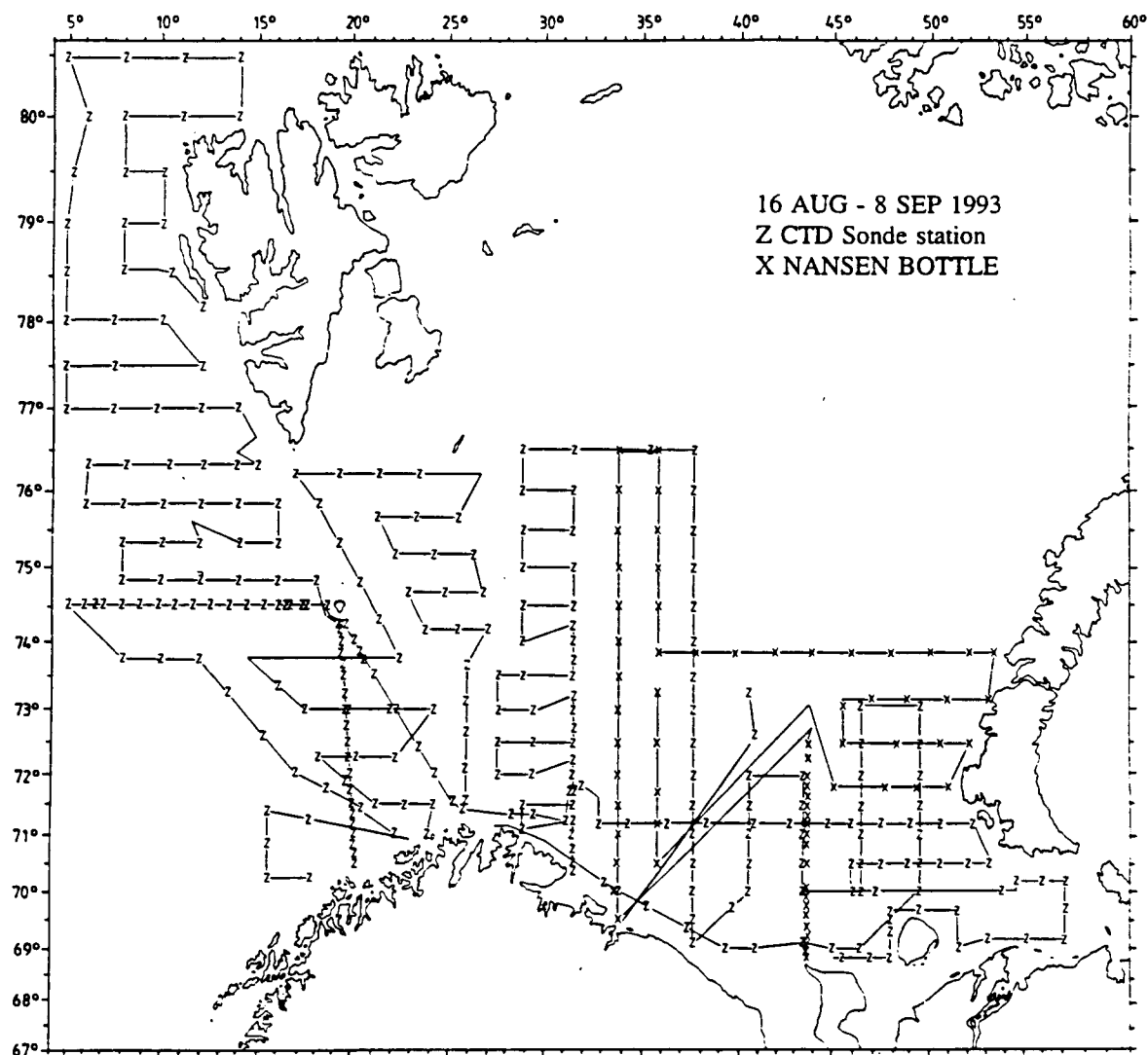


Fig. 1. Survey tracks and hydrographic stations.

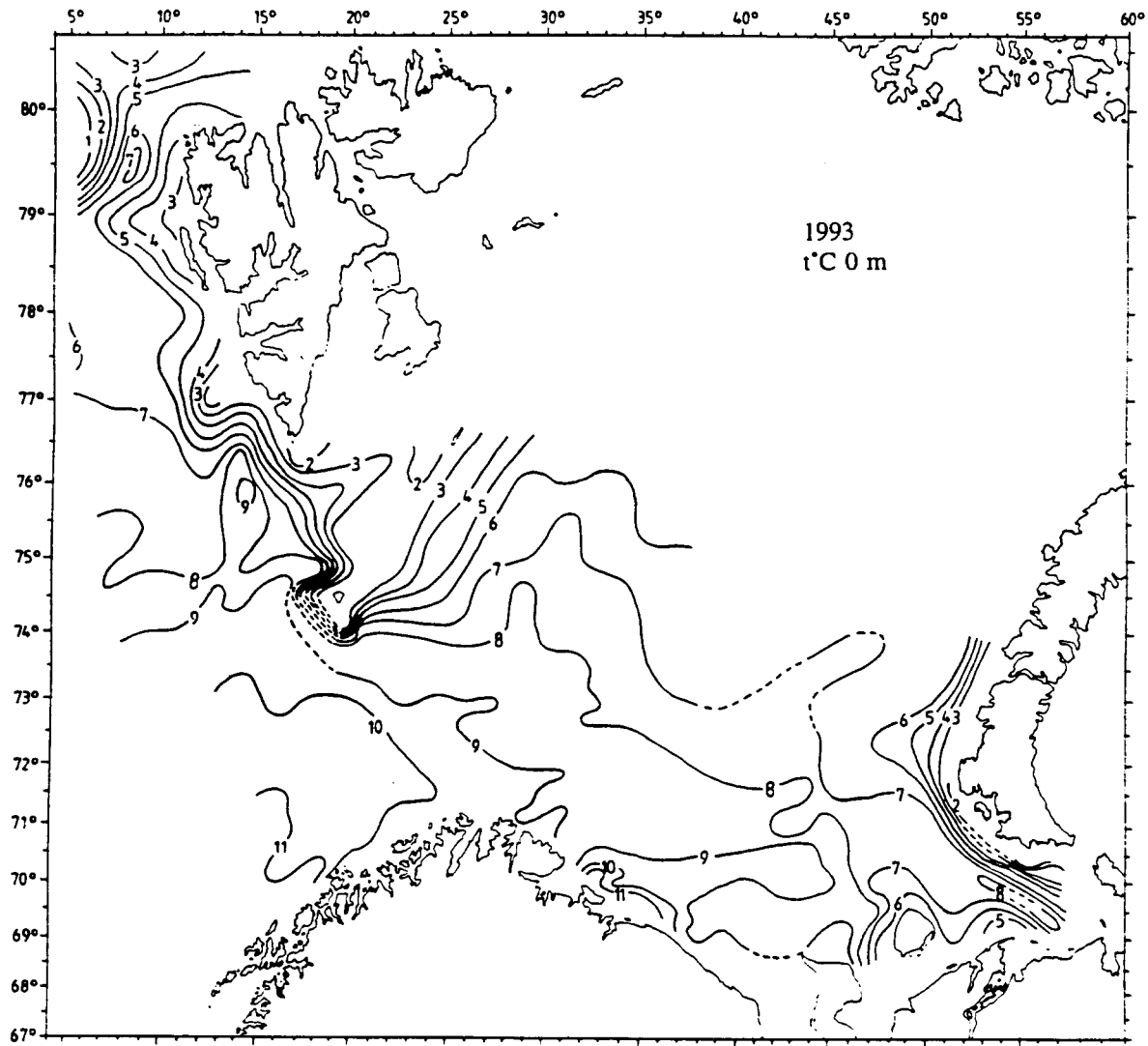


Fig. 2. Isotherms at 0 m.

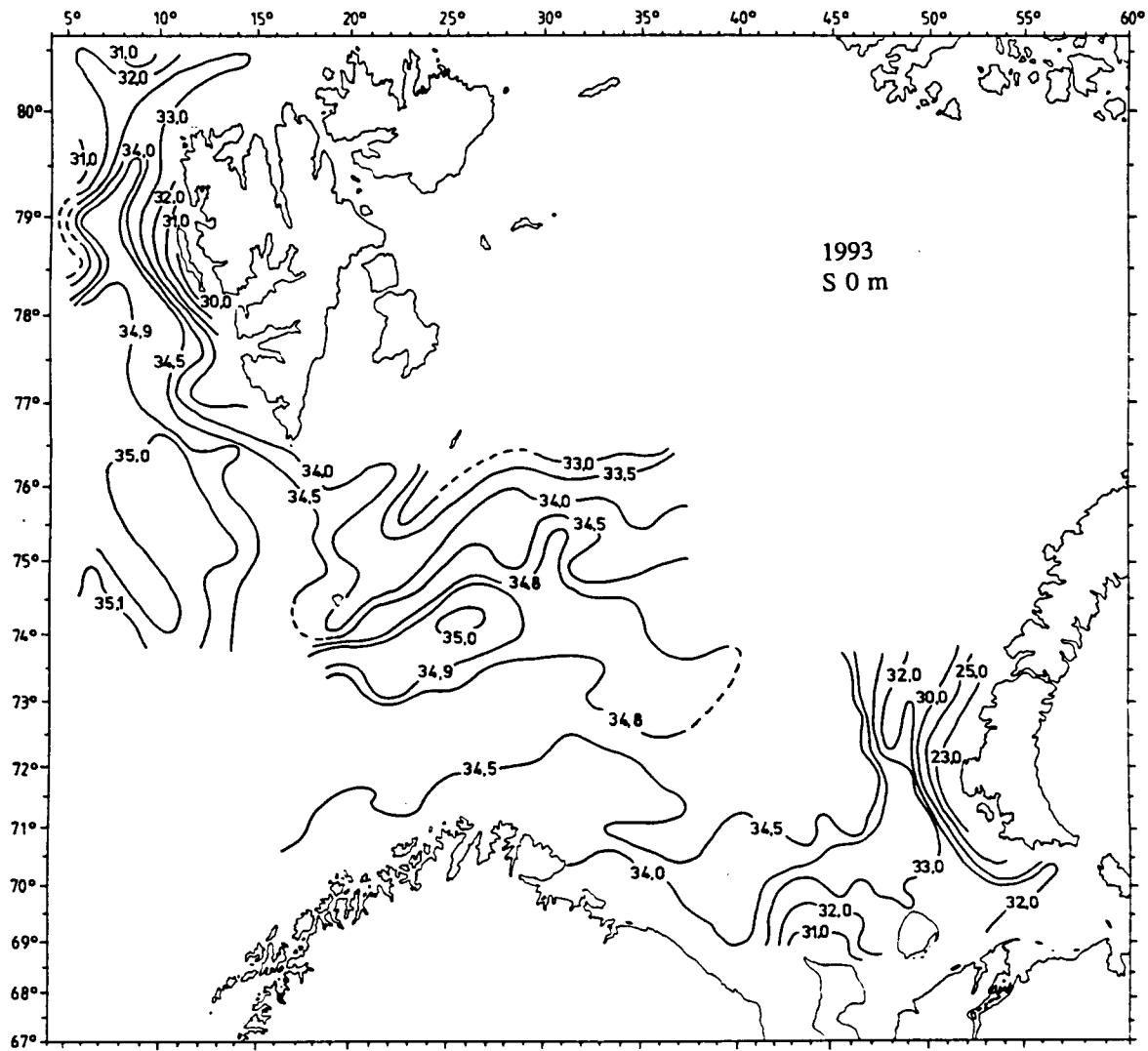


Fig. 3. Isohalines at 0 m.

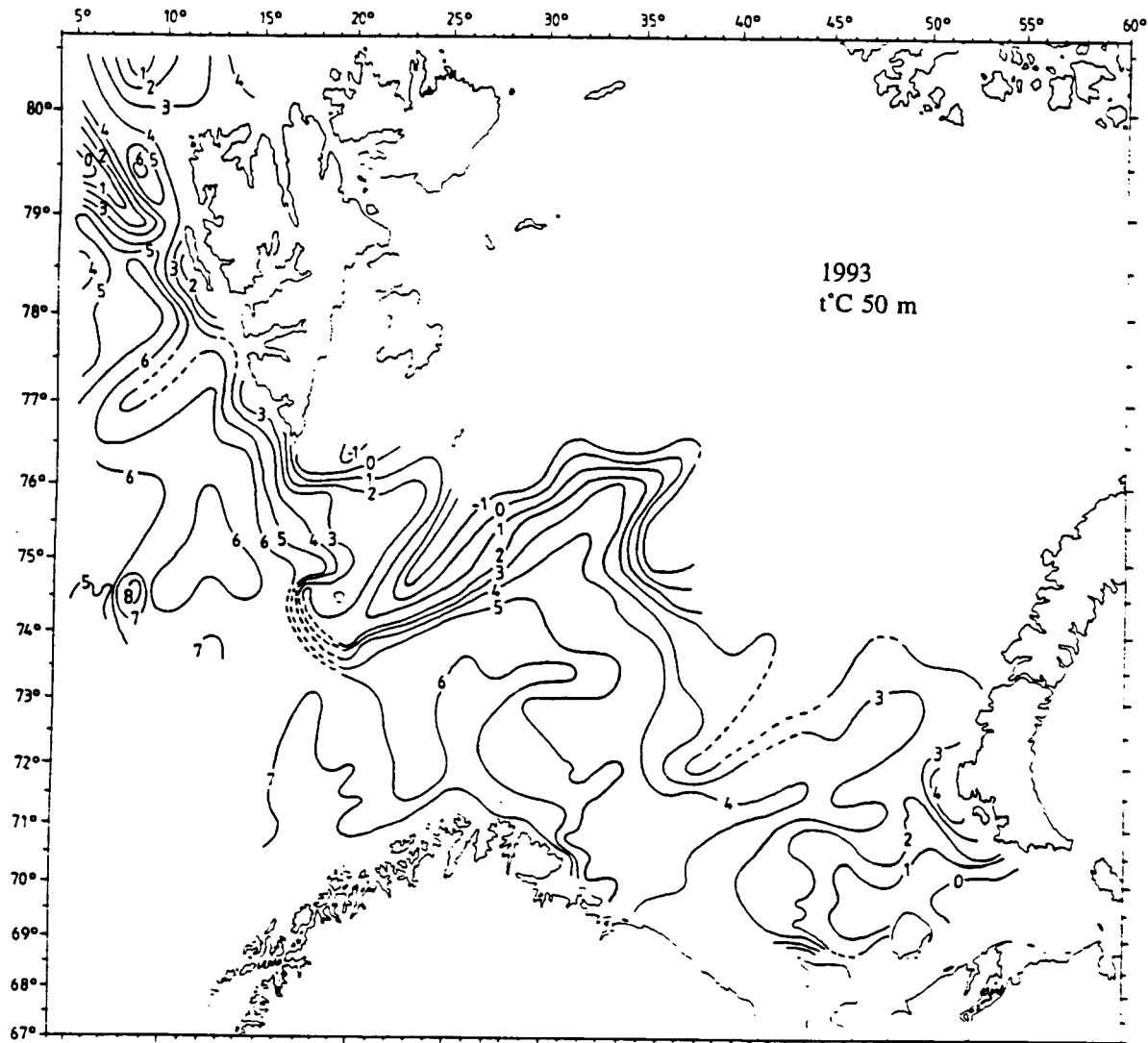


Fig. 4. Isotherms at 50 m.

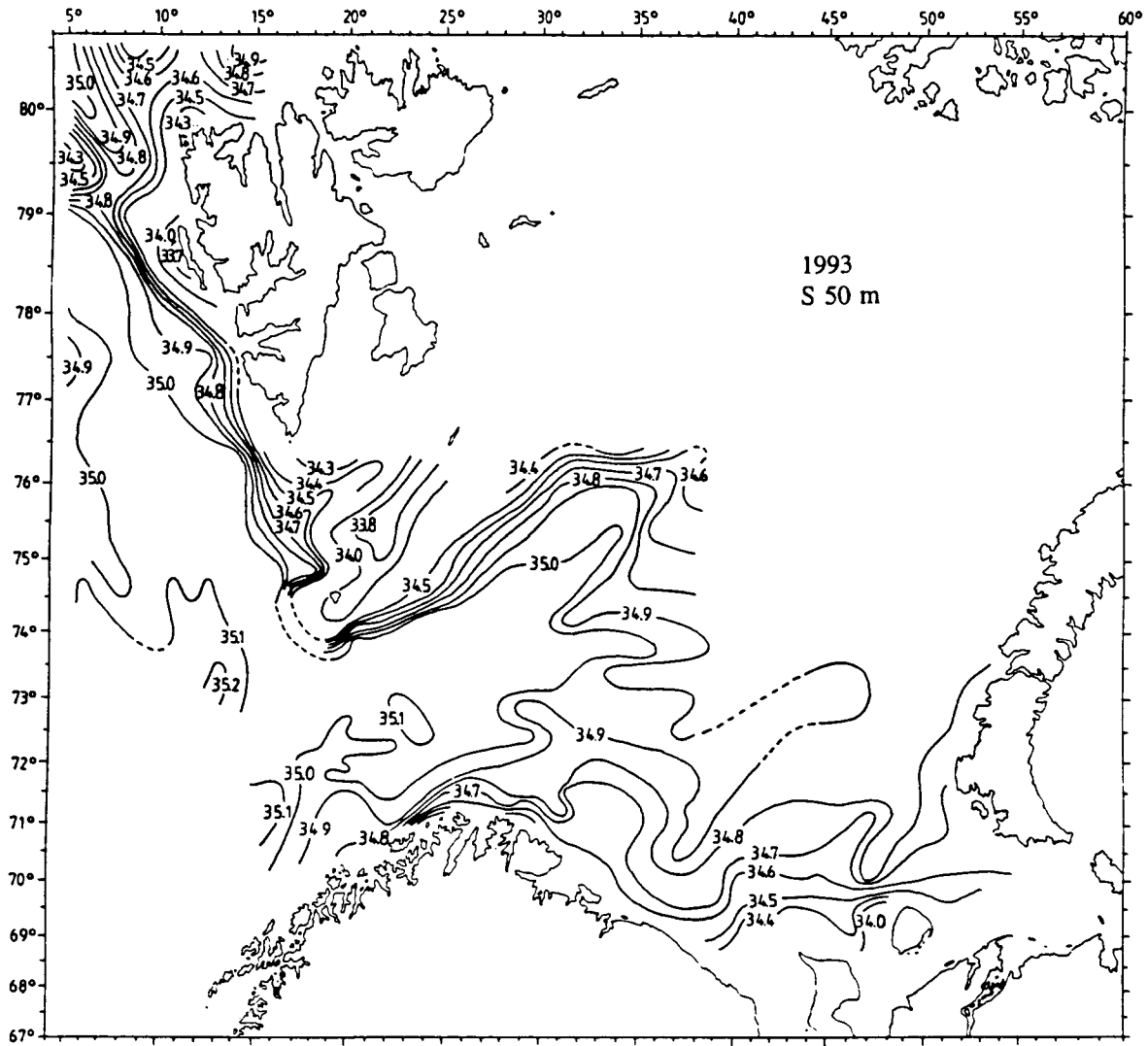


Fig. 5. Isohalines at 50 m.

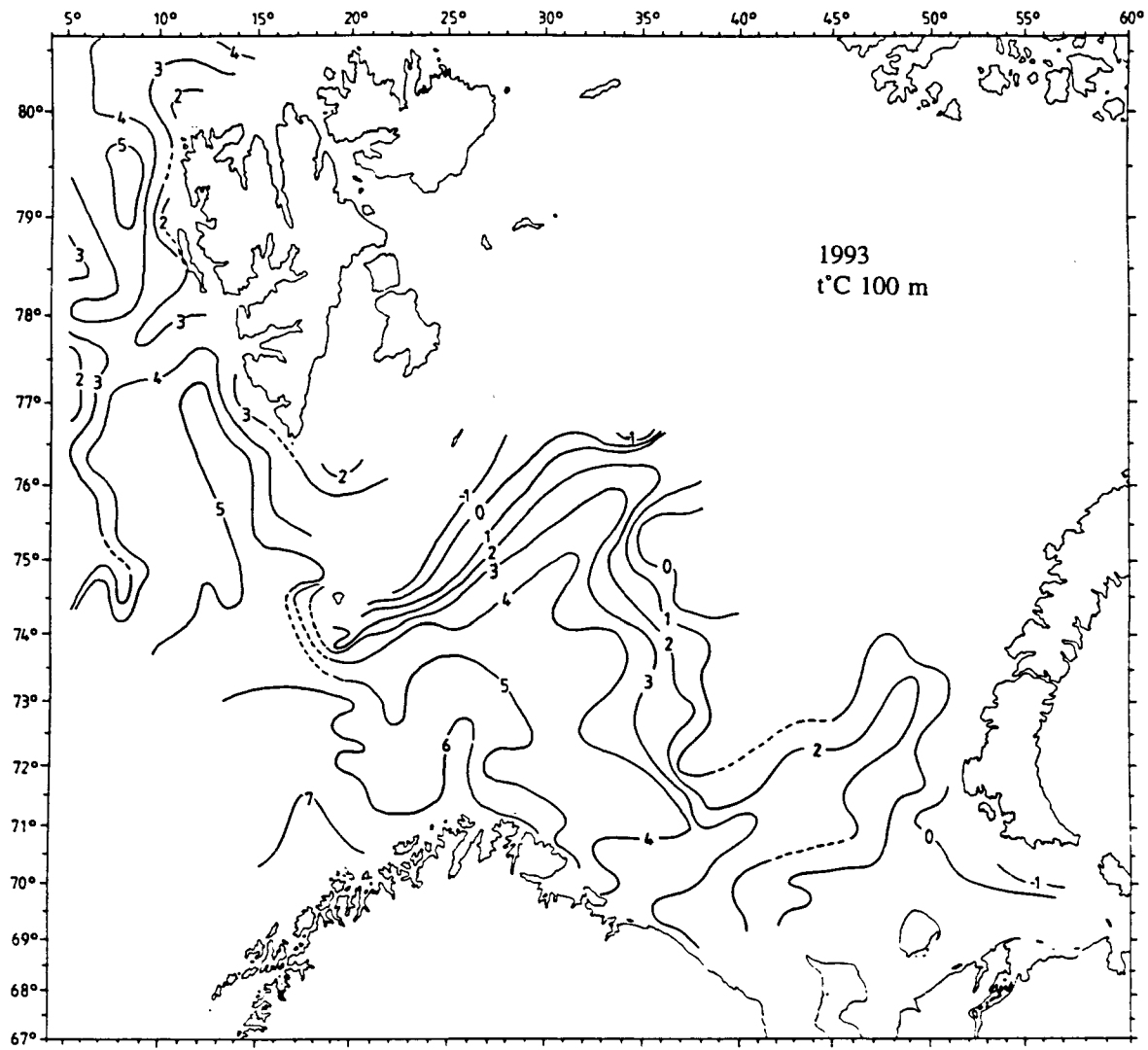


Fig. 6. Isotherms at 100 m.

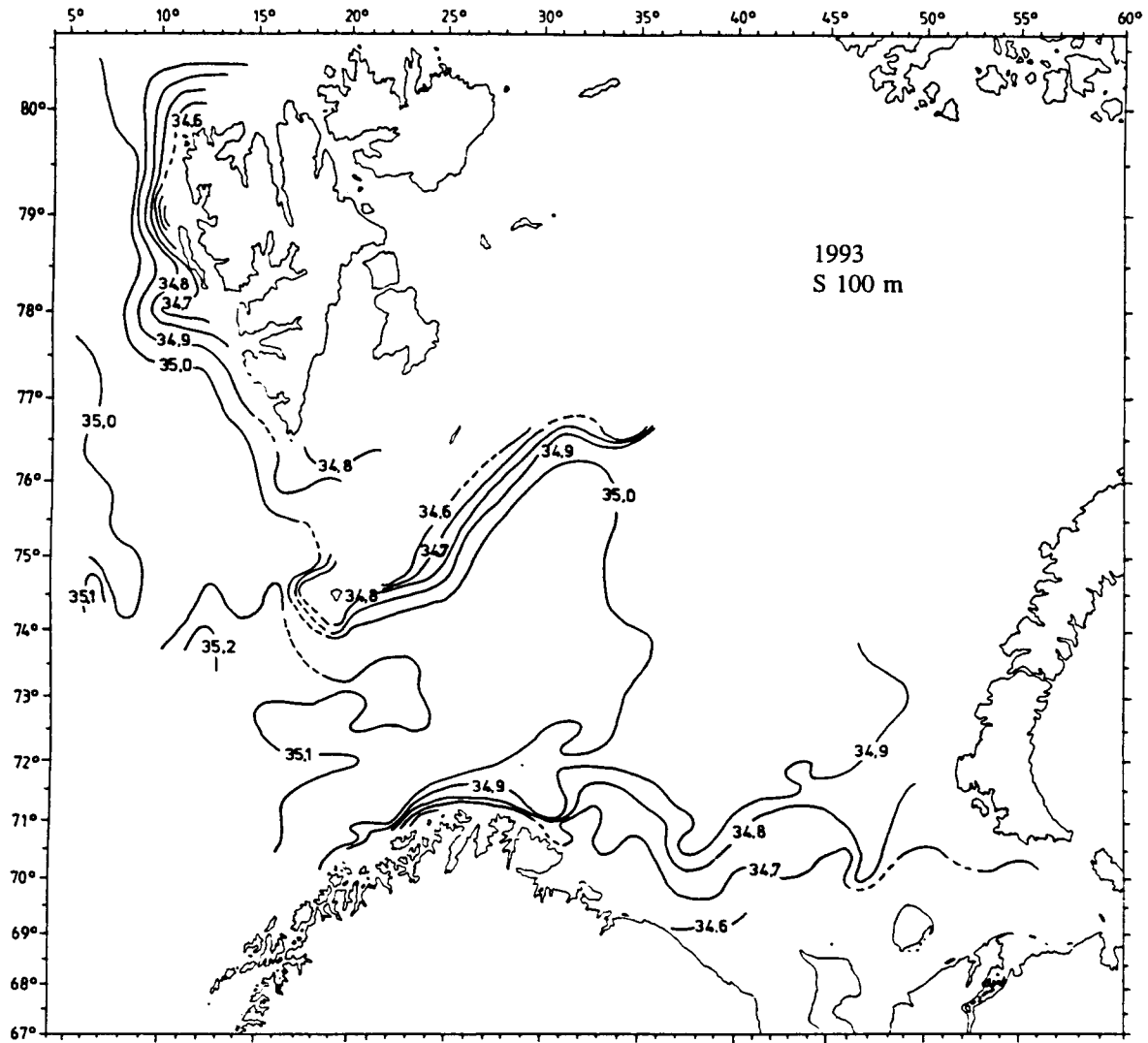


Fig. 7. Isohalines at 100 m.

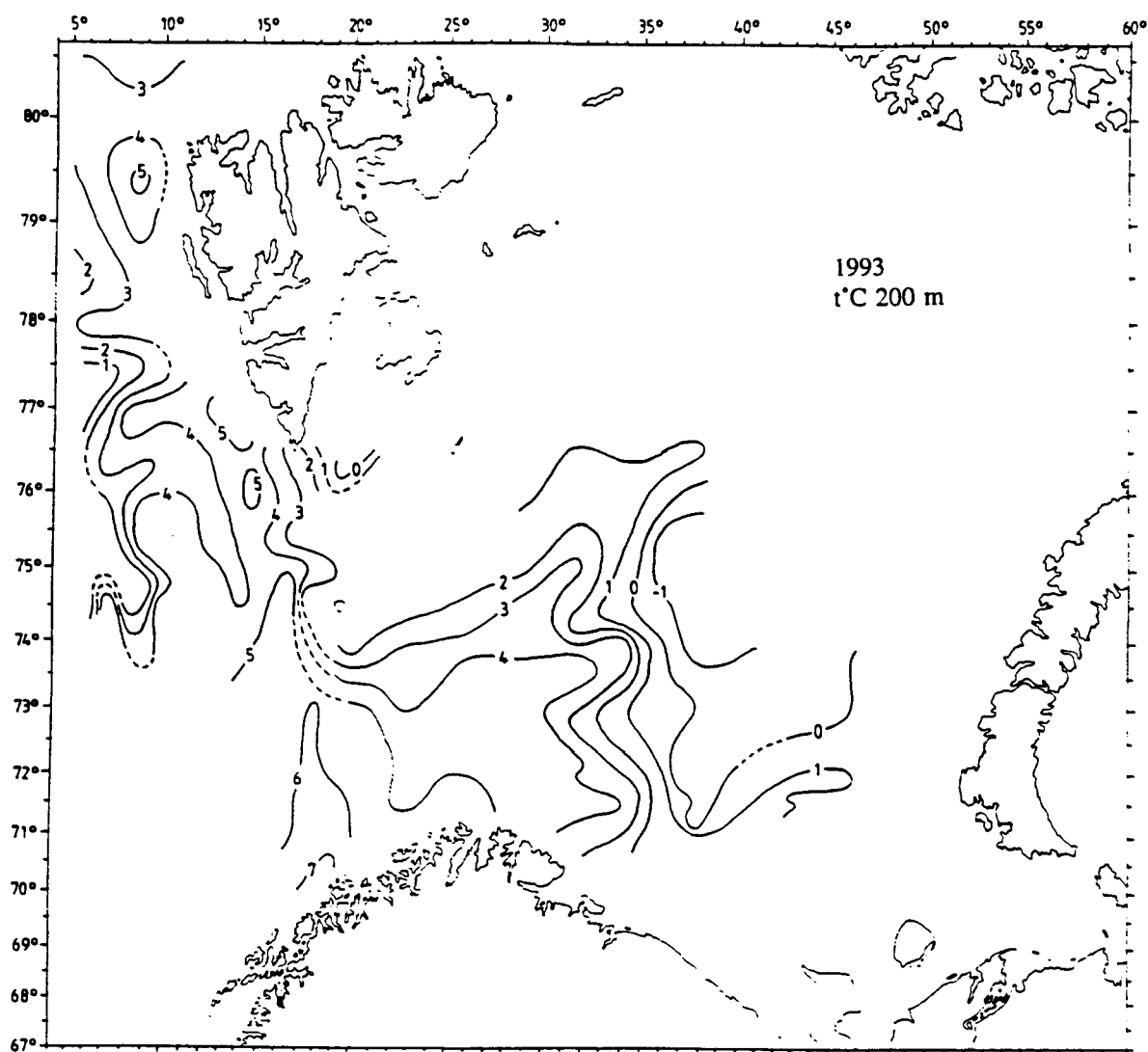


Fig. 8. Isotherms at 200 m.

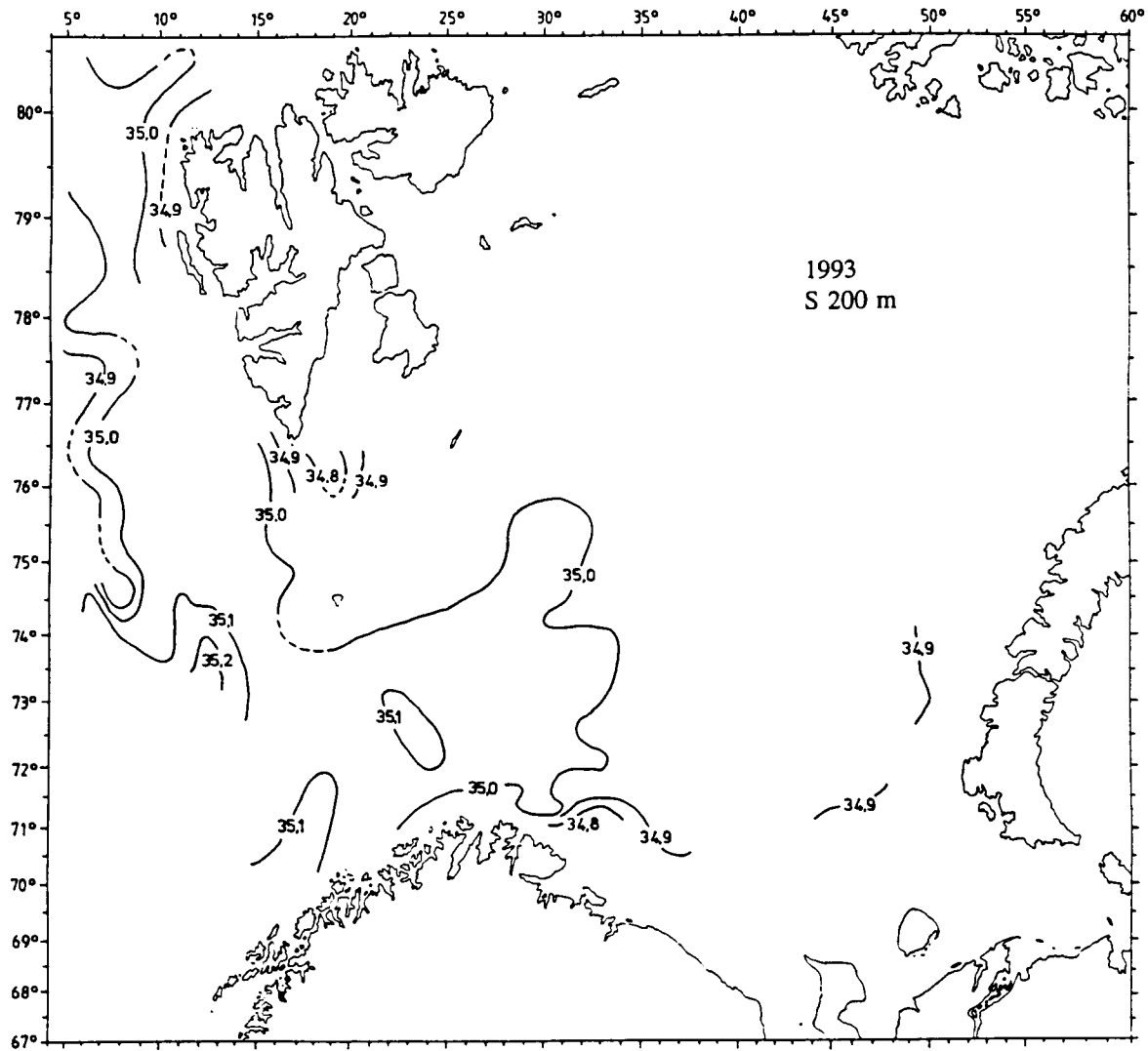


Fig. 9. Isohalines at 200 m.

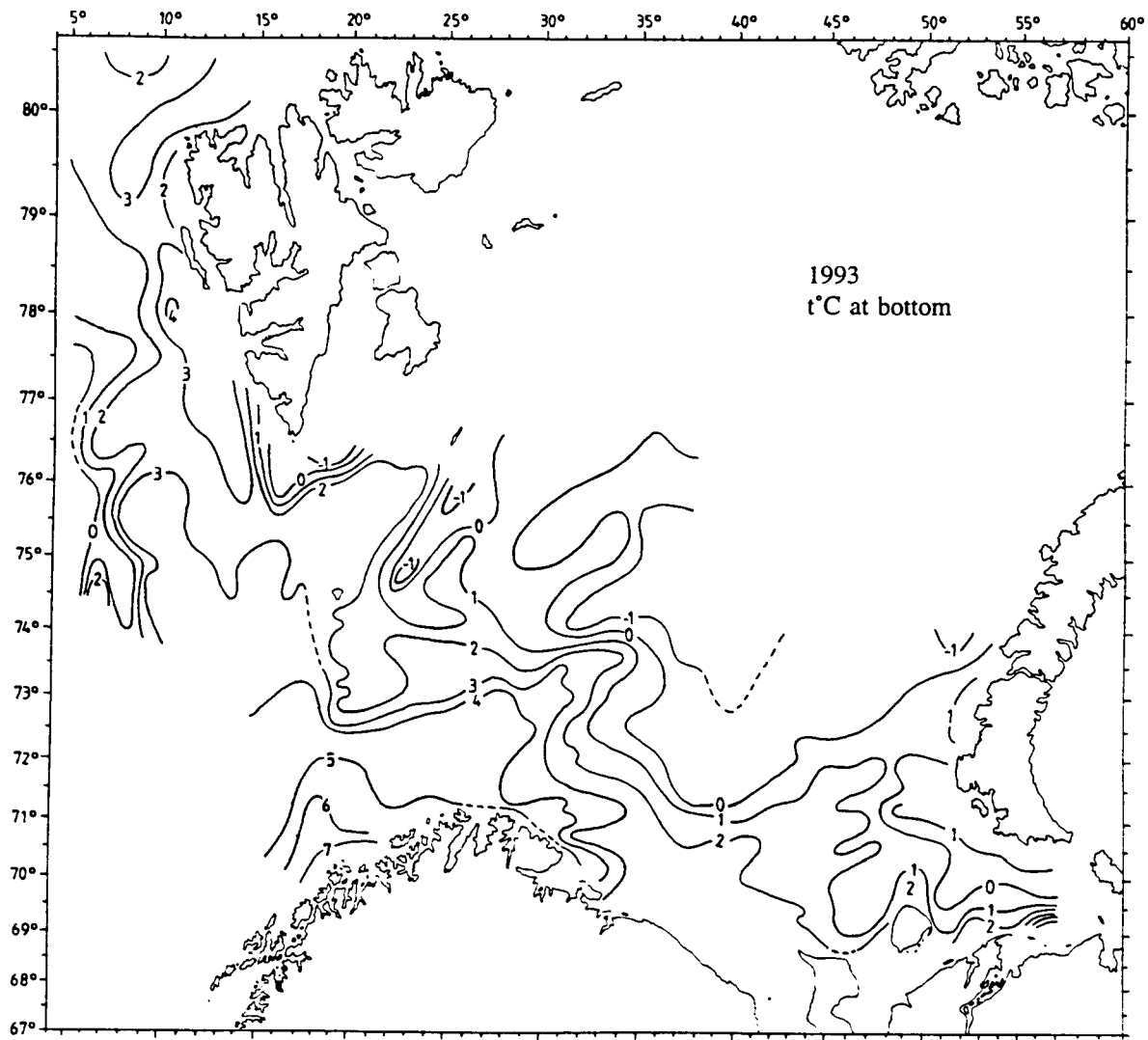


Fig. 10. Isotherms at the bottom.

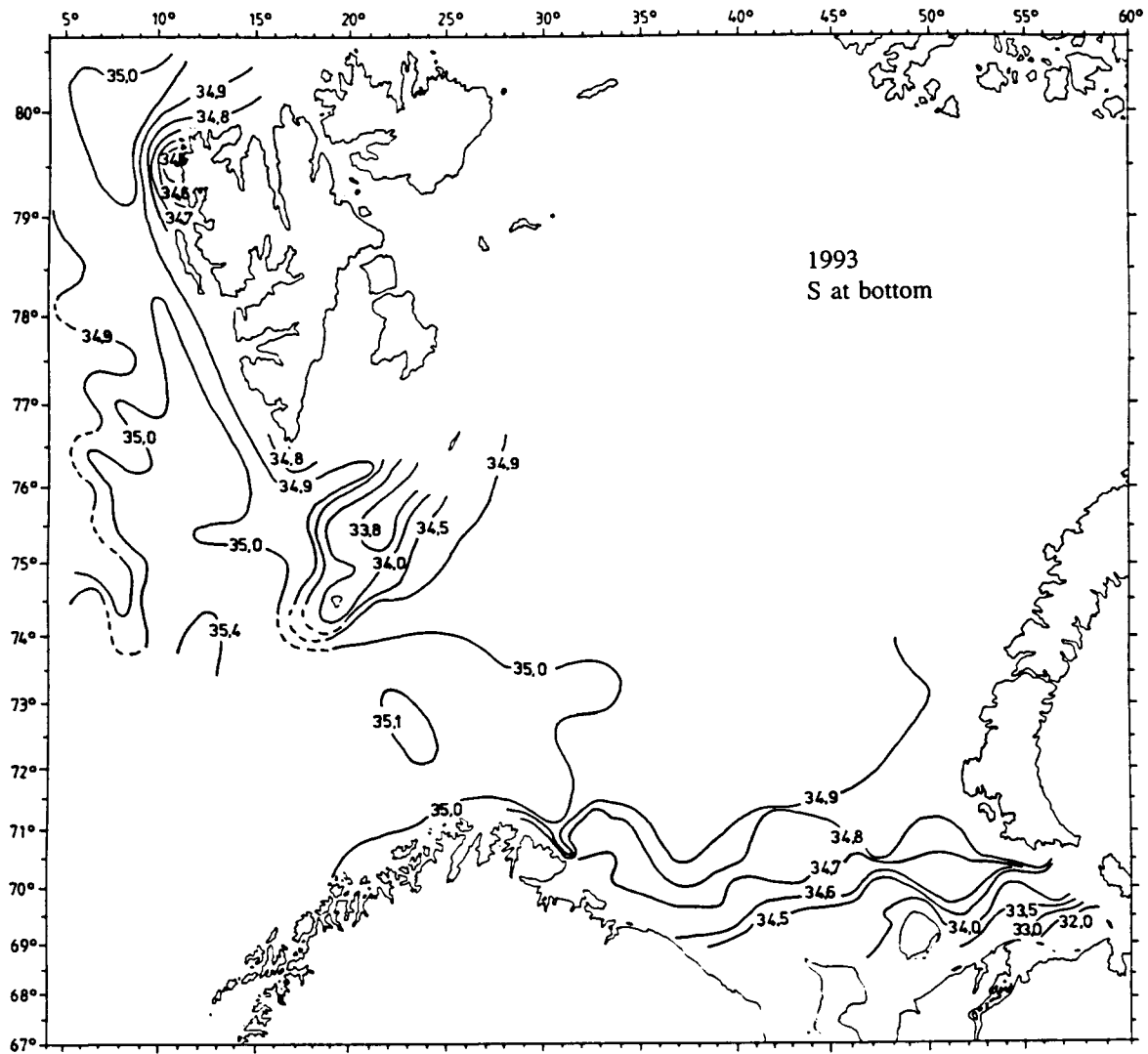


Fig. 11. Isohalines at the bottom.

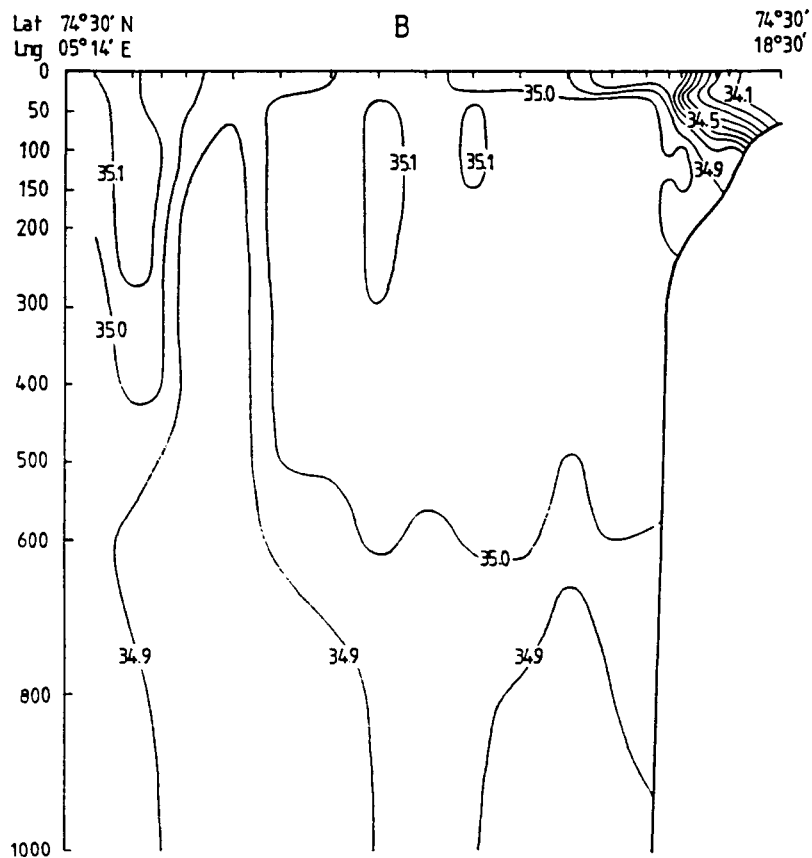
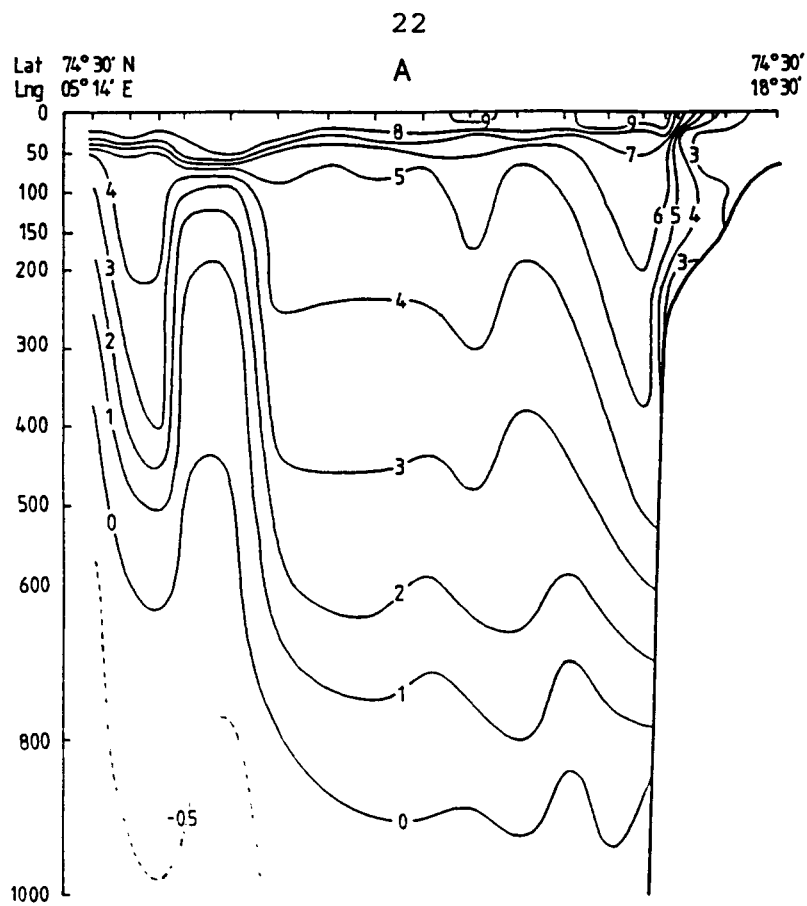


Fig. 12. Hydrographic section Bear Island - West.
Temperature (A) and salinity (B).

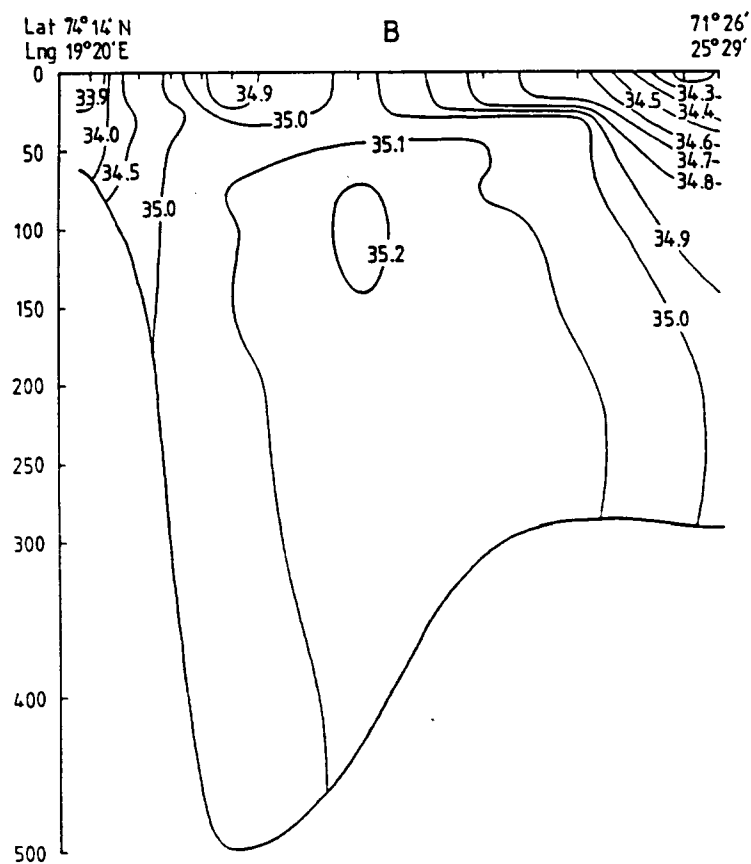
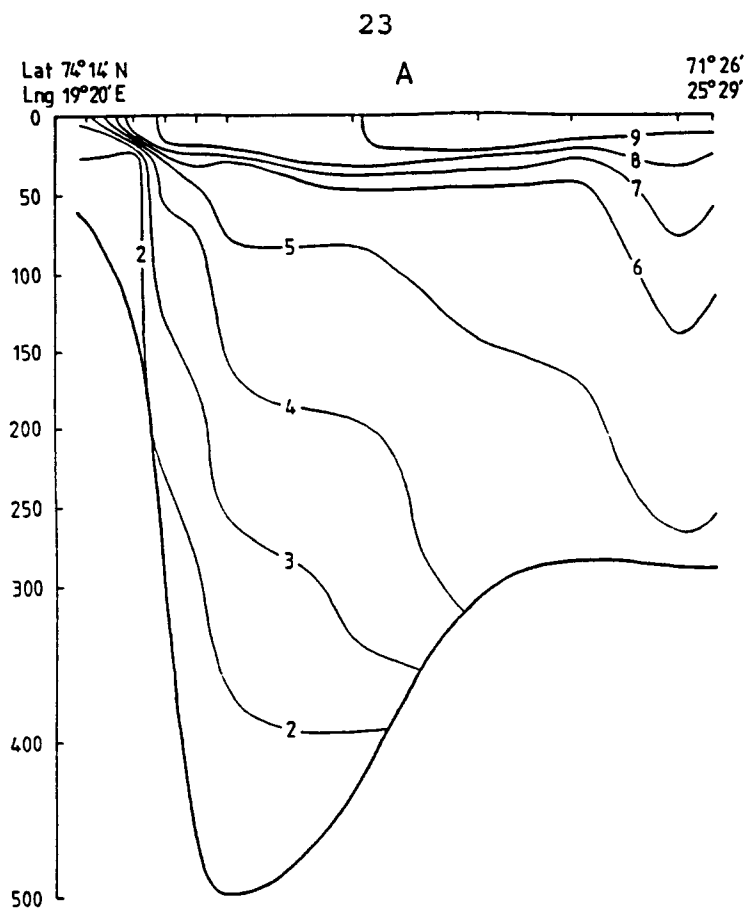


Fig. 13. Hydrographic section North Cape - Bear Island.
Temperature (A) and salinity (B).

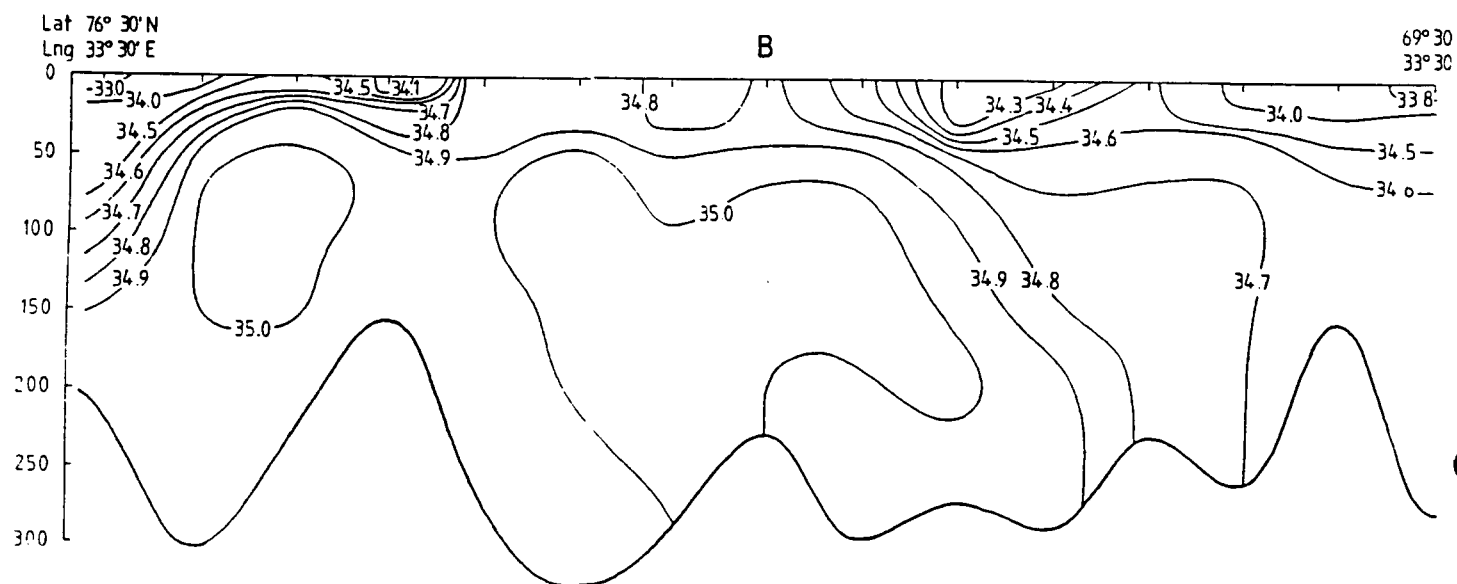
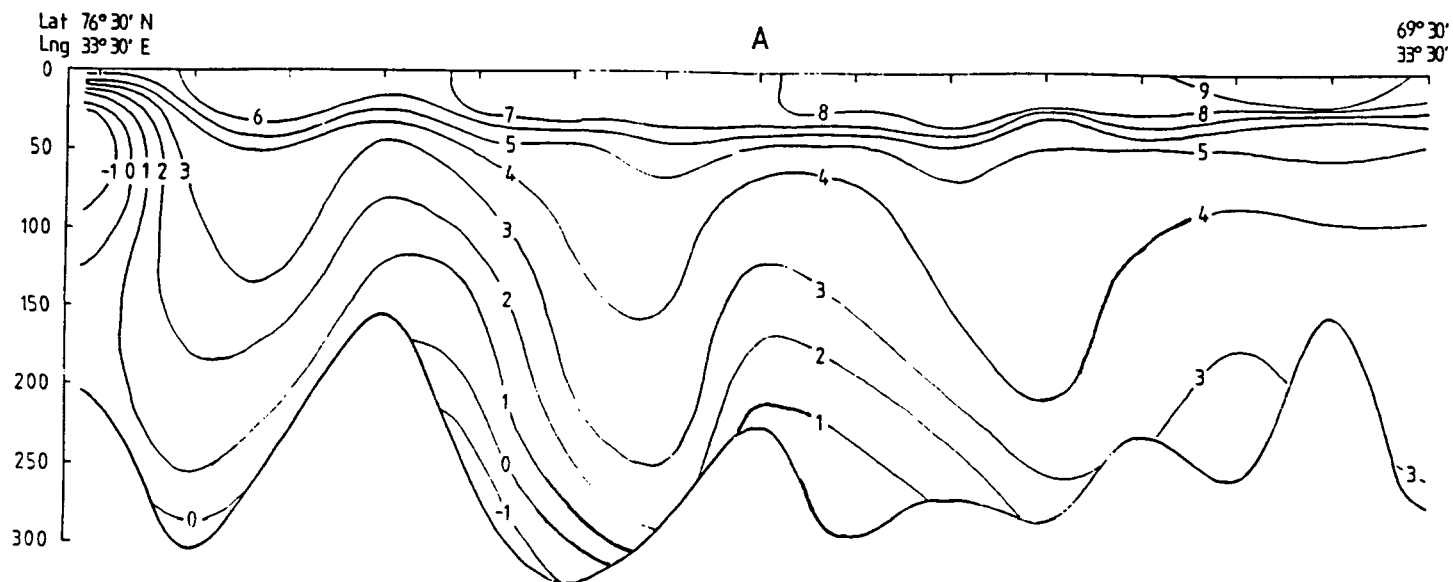
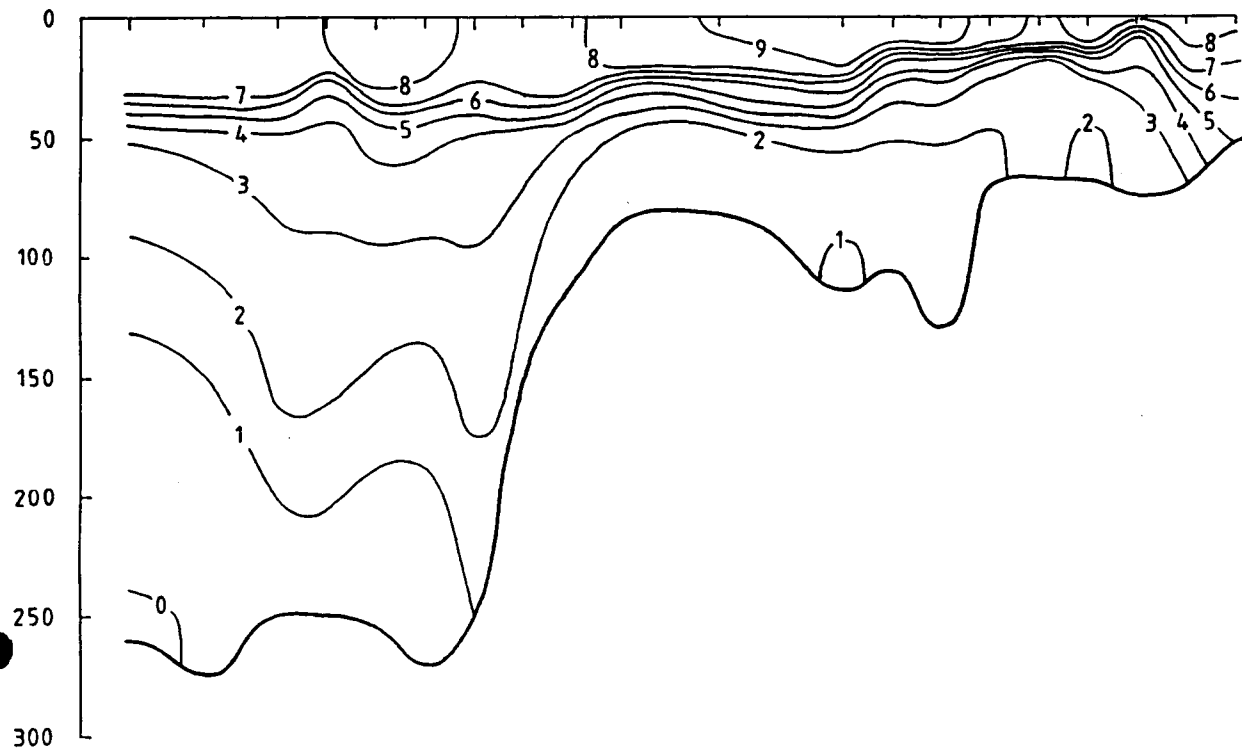


Fig. 14. Hydrographic section along the Kola meridian.
Temperature (A) and salinity (B).

Lat 72° 30' N
 Lng 43° 15' E

68° 45'
 43° 15'

A



Lat 72° 30' N
 Lng 43° 15' E

68° 45'
 43° 15'

B

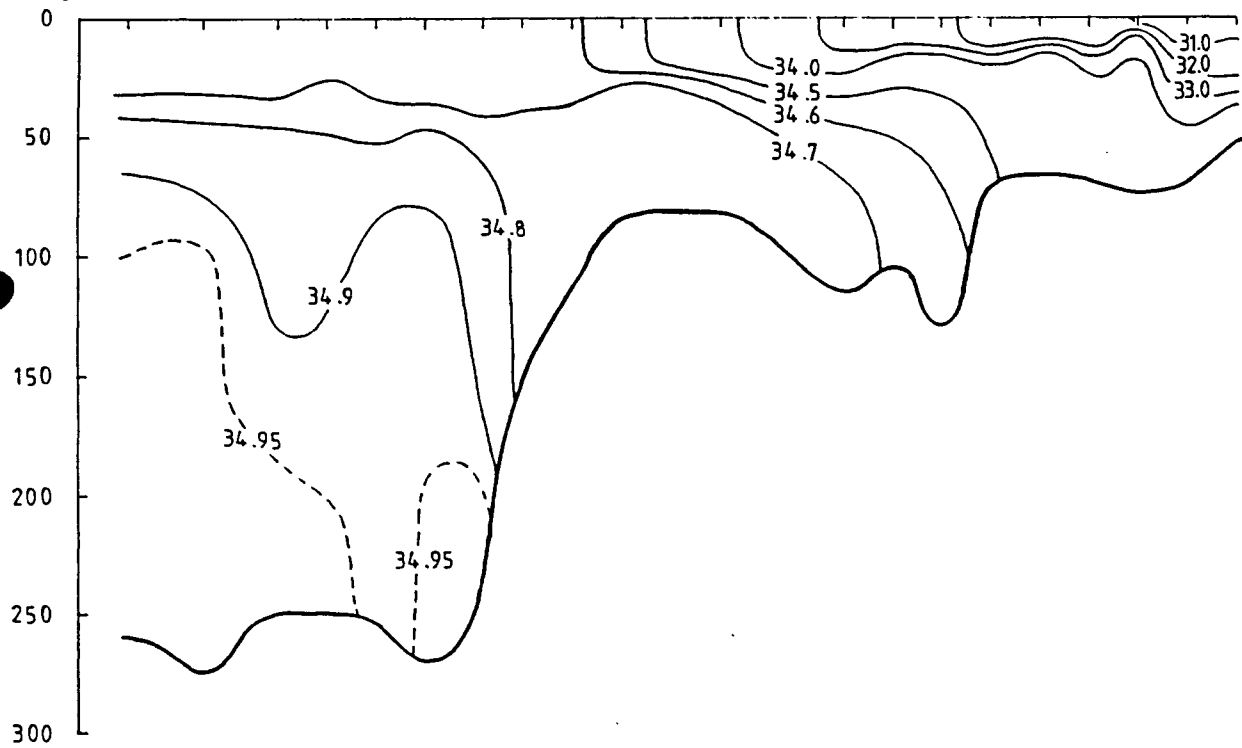


Fig. 15. Hydrographic section Cape Kanin - North.
 Temperature (A) and salinity (B).

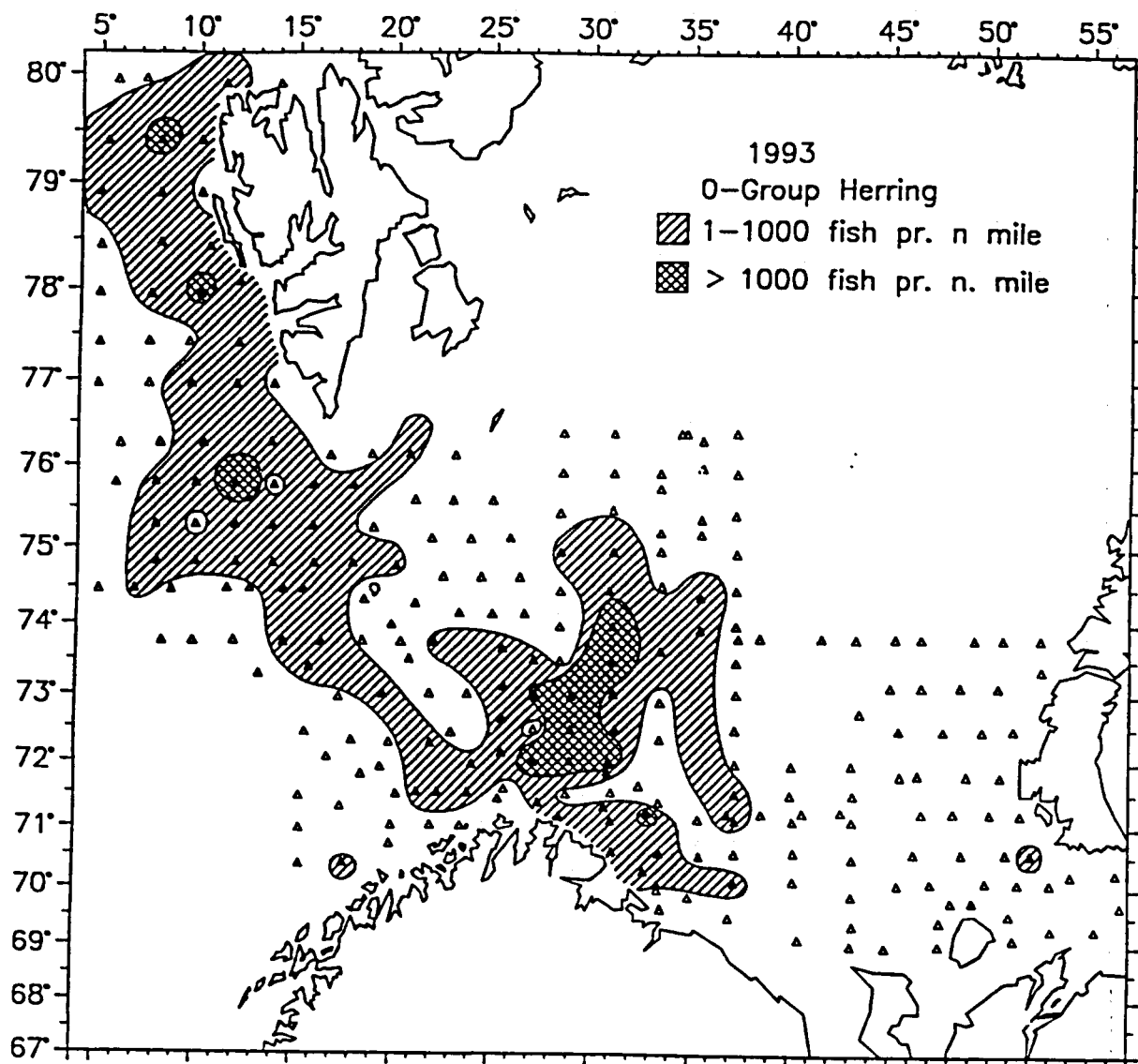


Fig. 16. Distribution of 0-group herring.

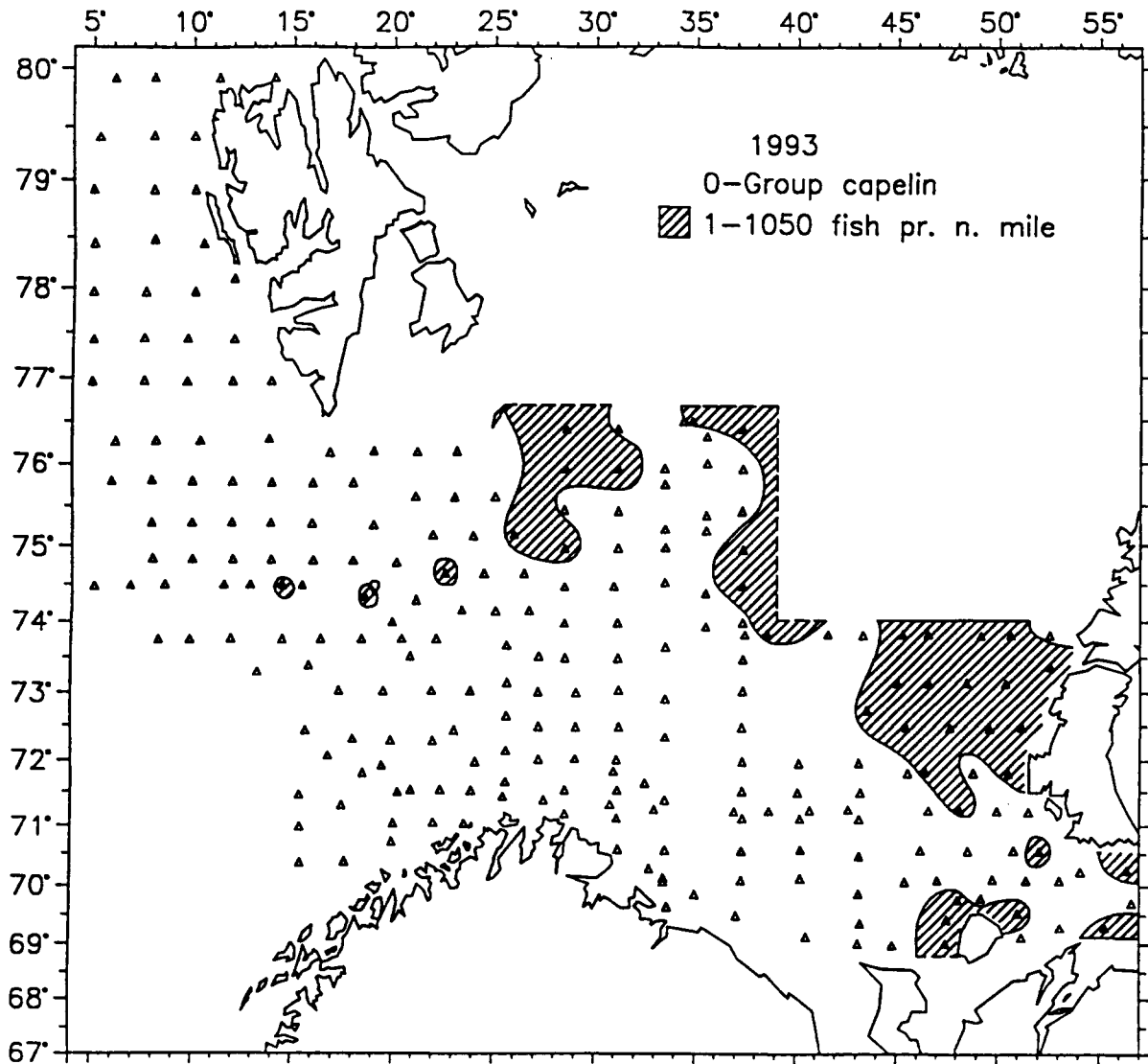


Fig. 17. Distribution of 0-group capelin.

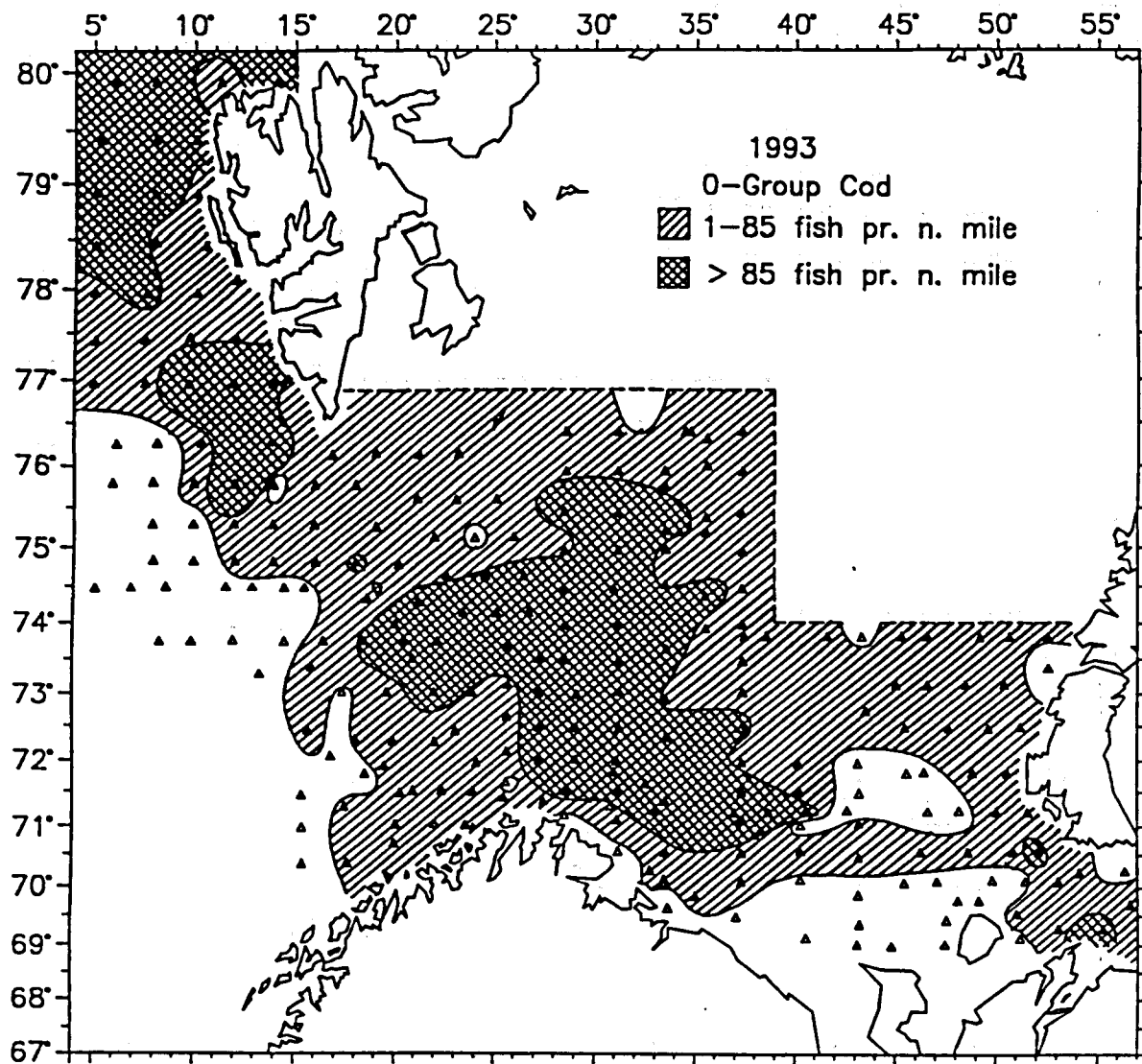


Fig. 18. Distribution of 0-group cod.

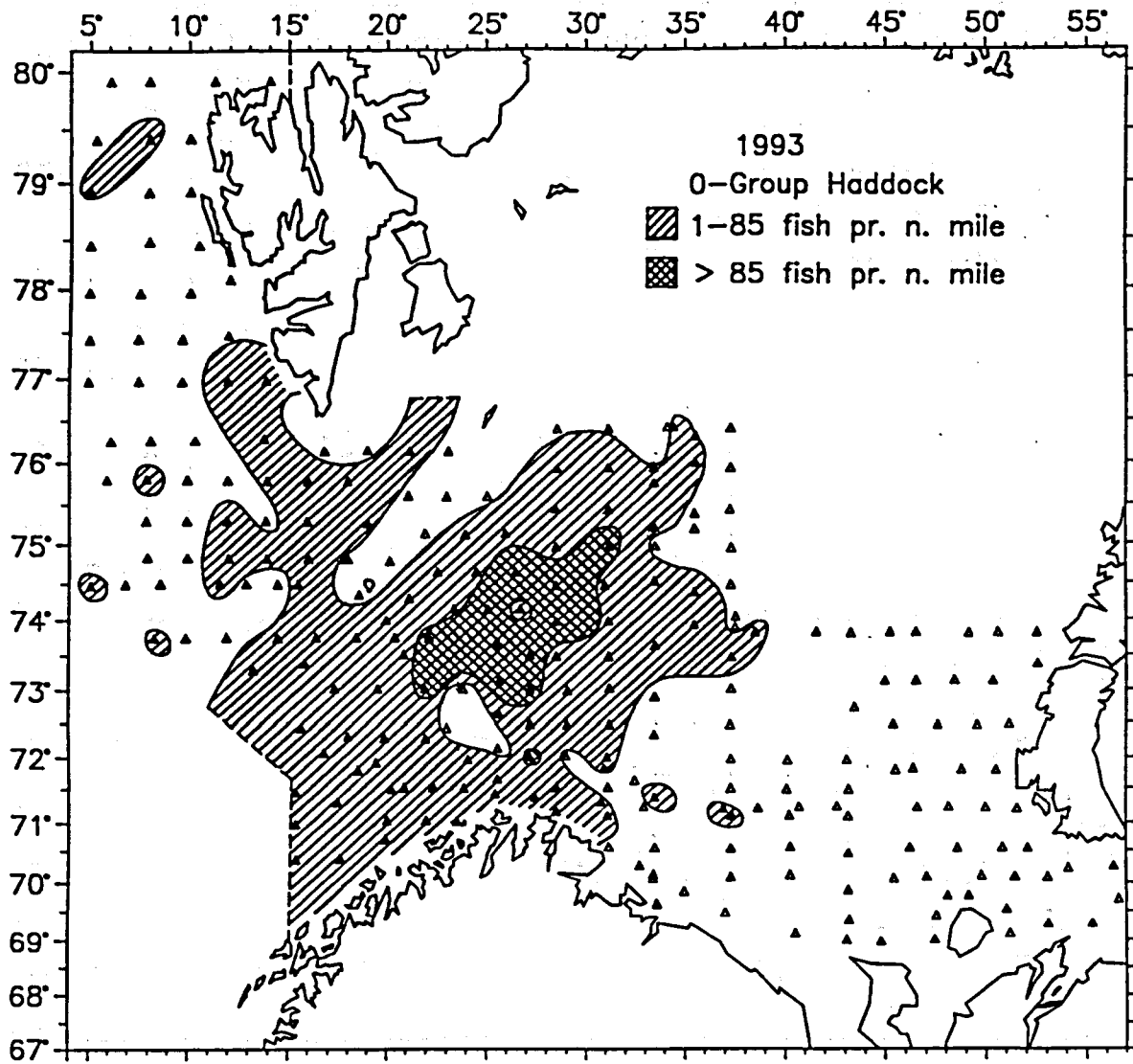


Fig. 19. Distribution of 0-group haddock.

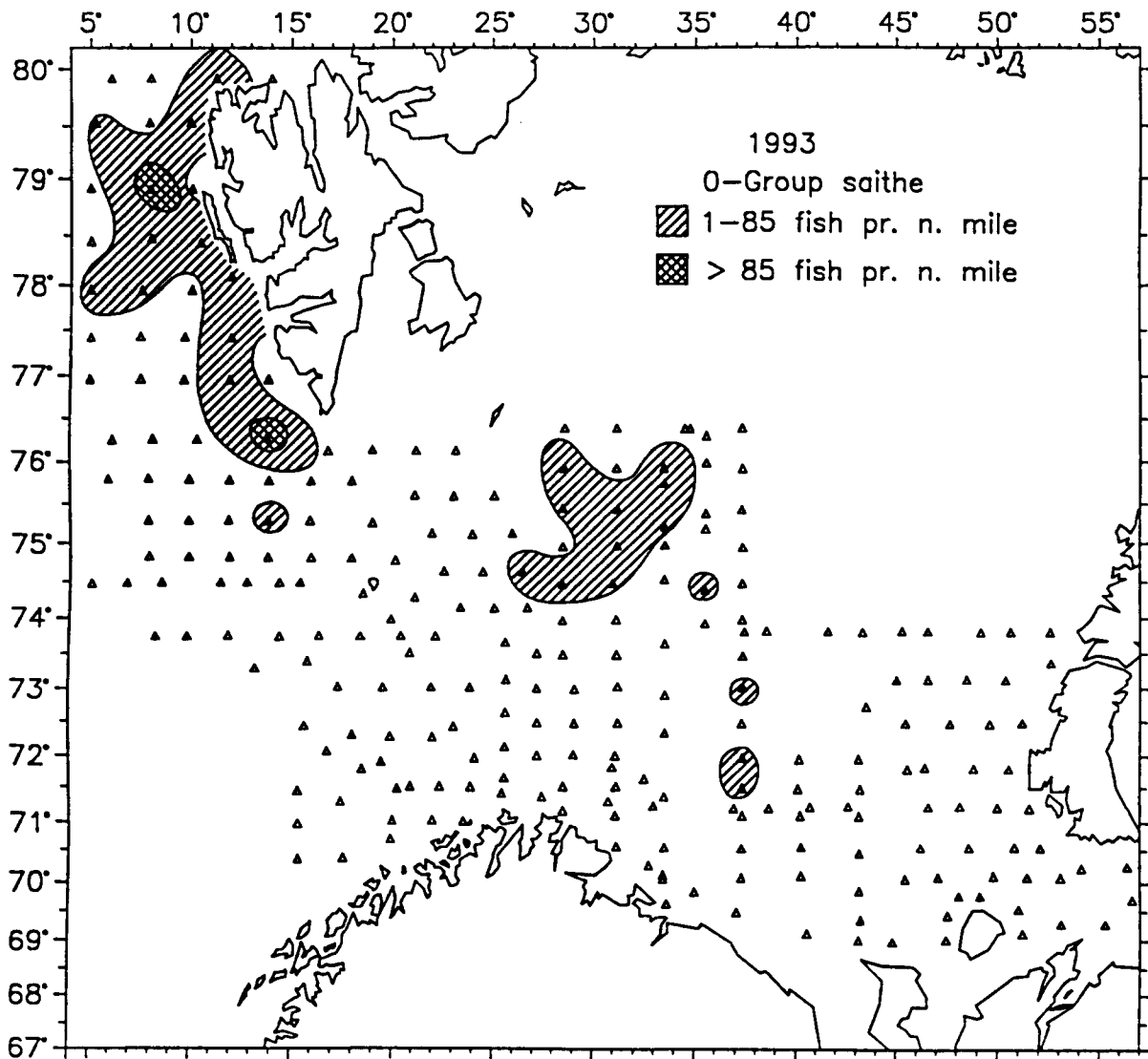


Fig. 20. Distribution of 0-group saithe.

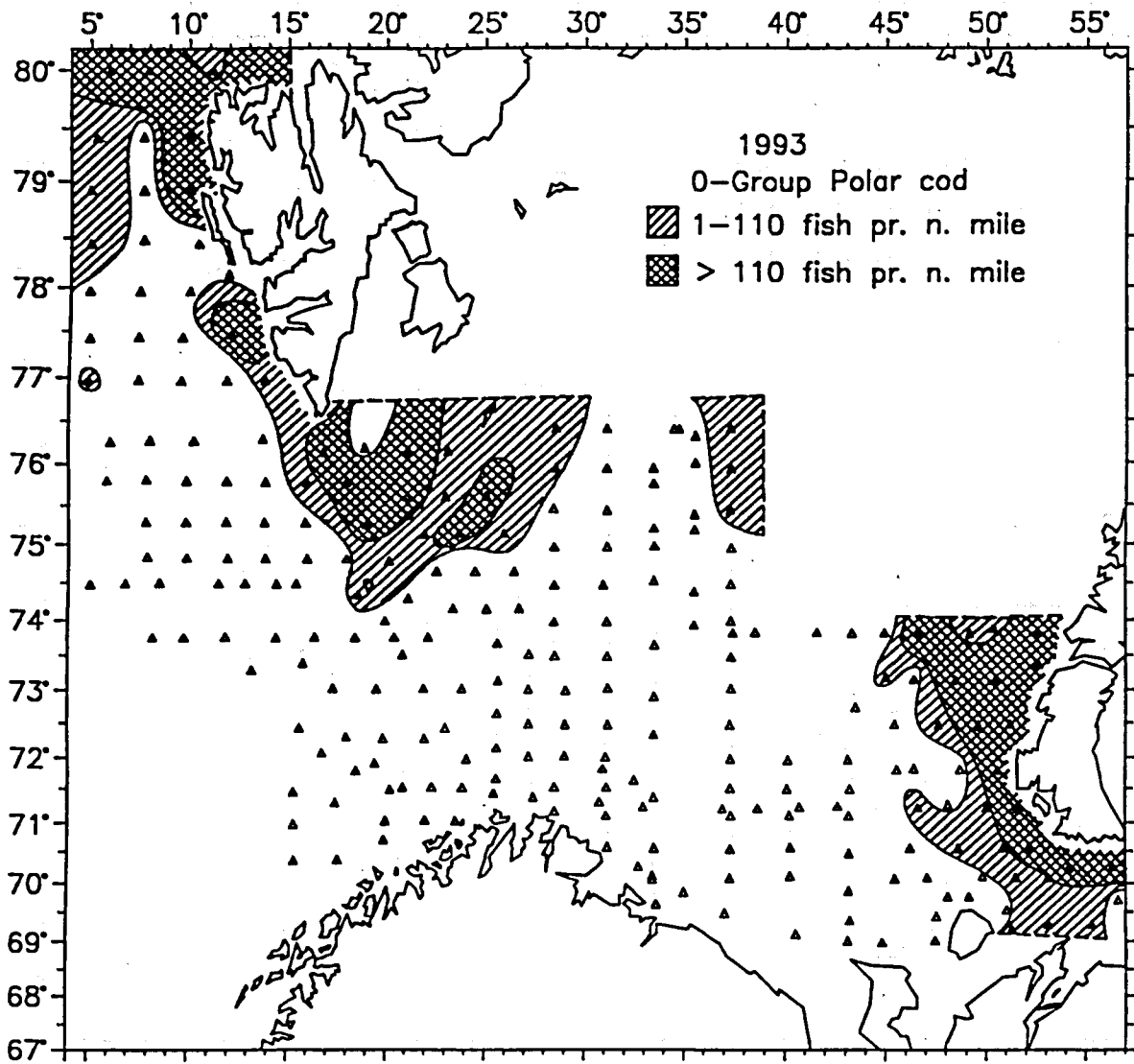


Fig. 21. Distribution of 0-group polar cod.

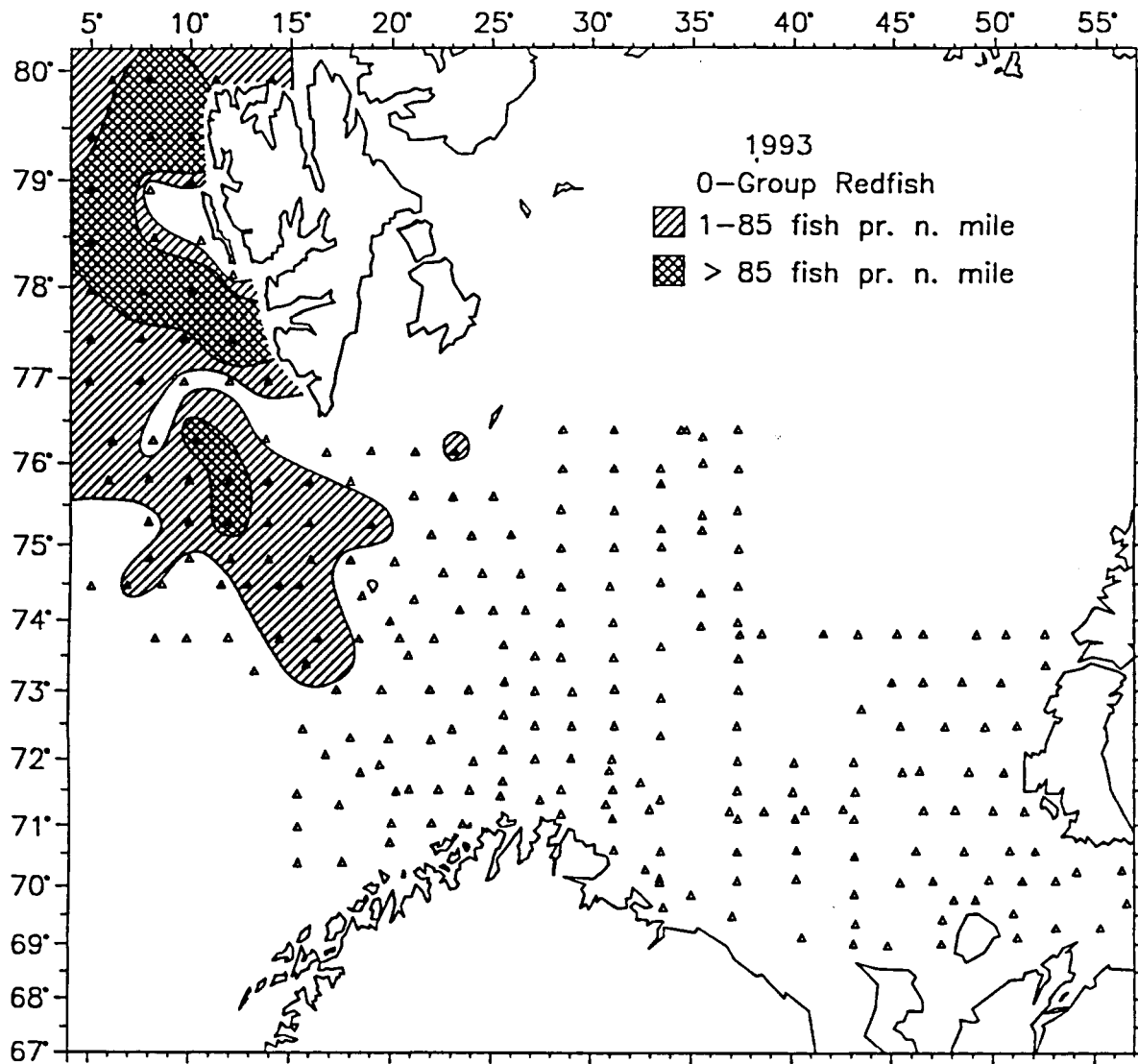


Fig. 22. Distribution of 0-group redfish.

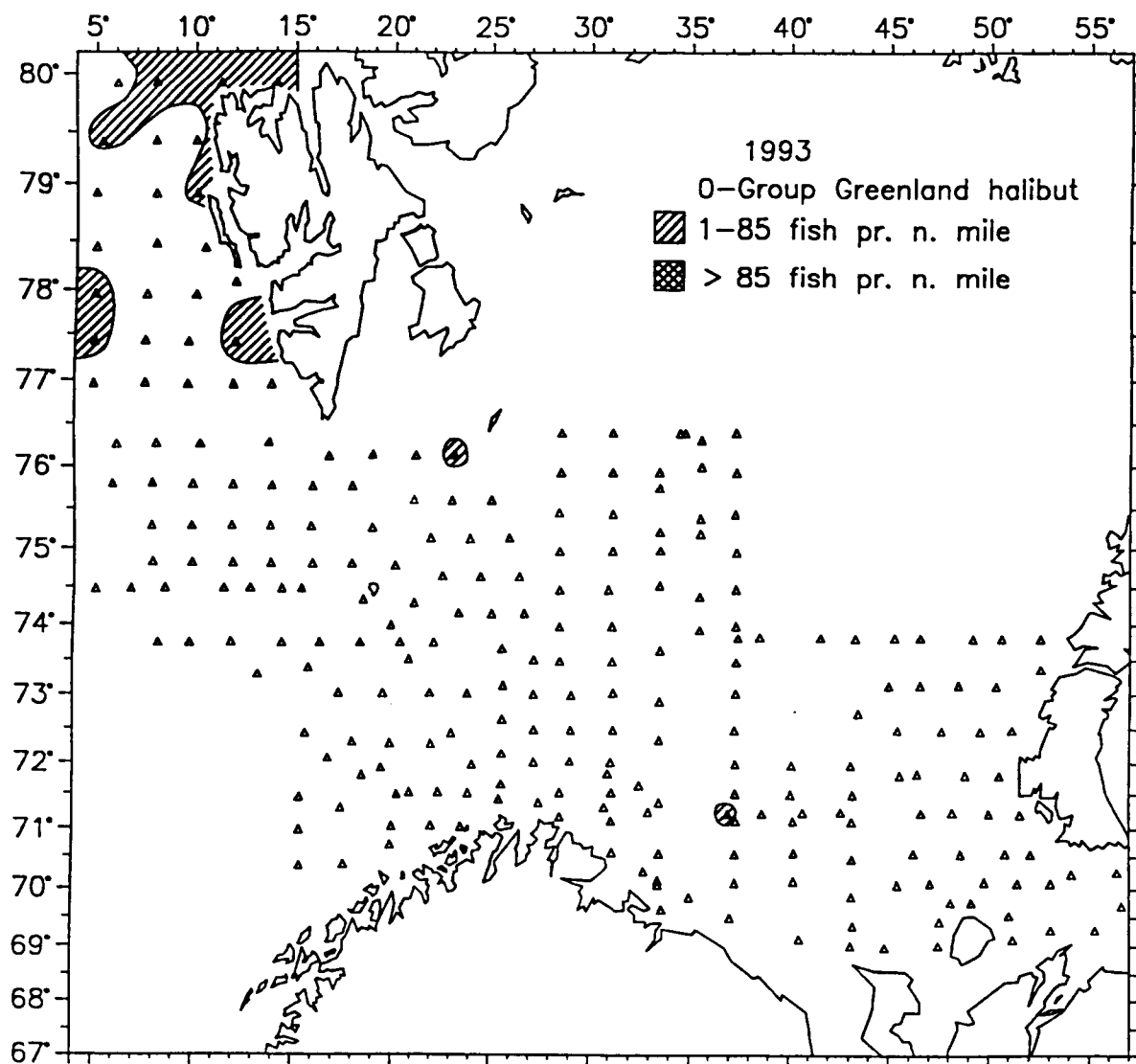


Fig. 23. Distribution of 0-group Greenland halibut.

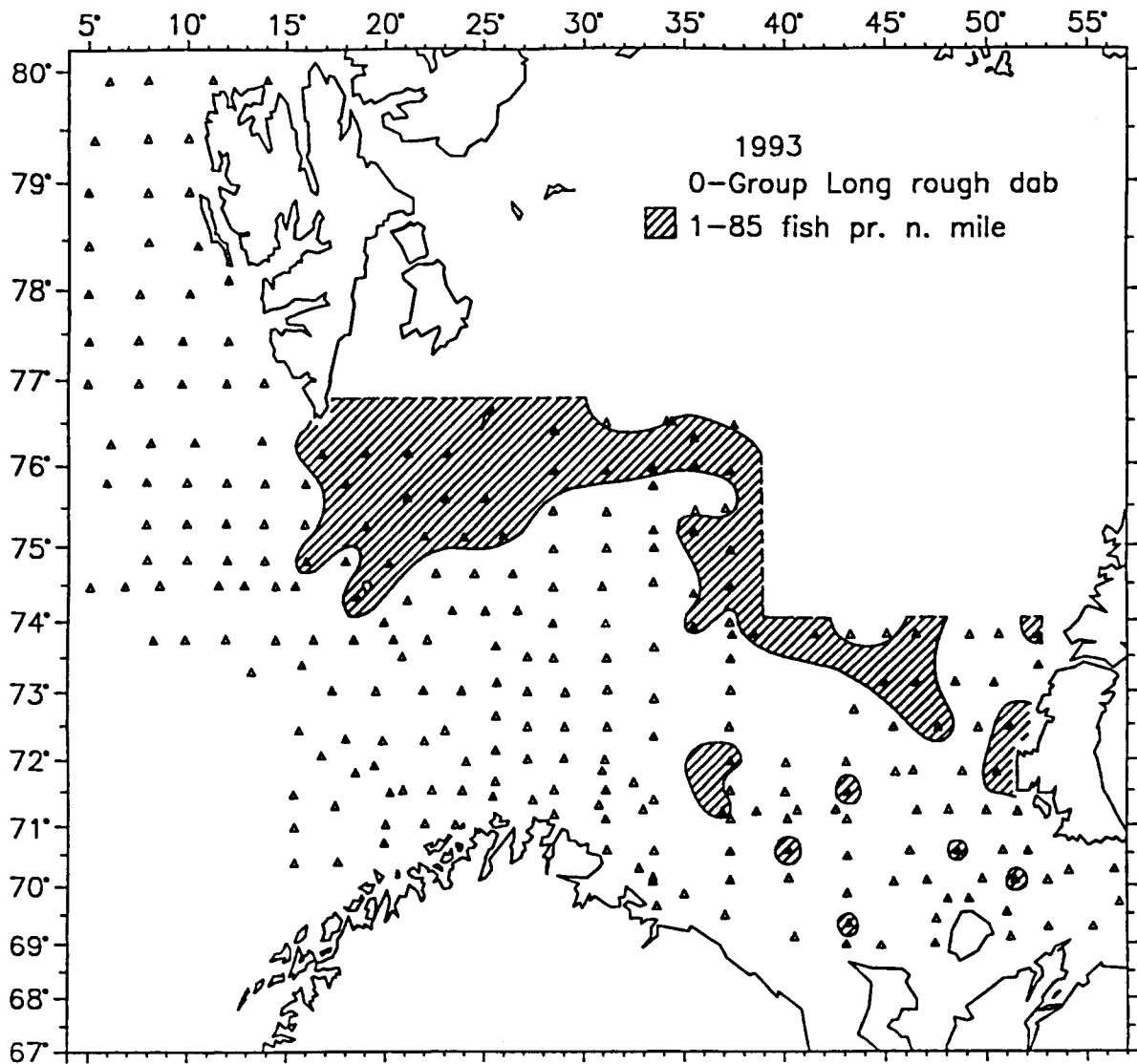


Fig. 24. Distribution of 0-group long rough dab.

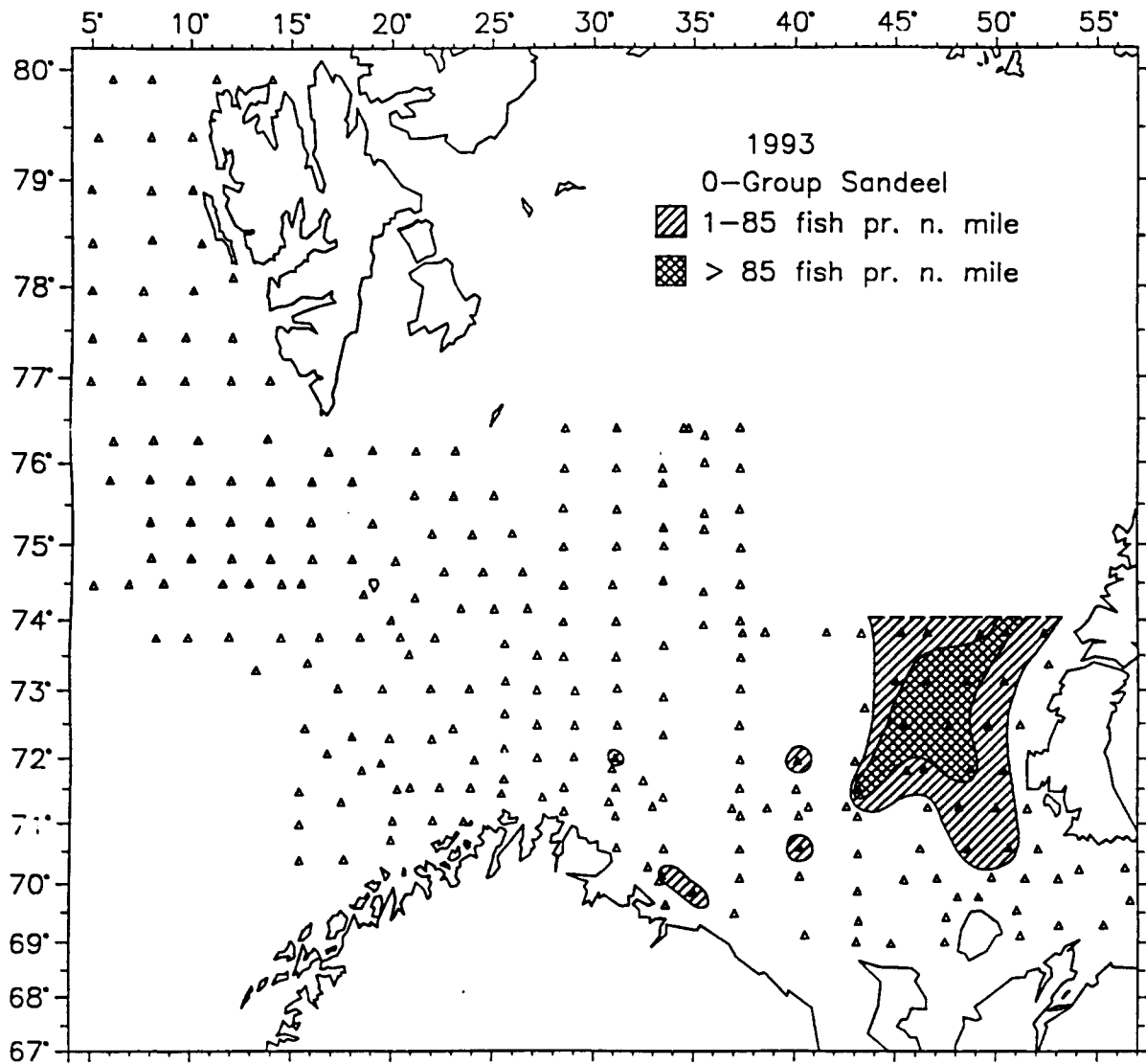


Fig. 25. Distribution of 0-group sandeel.

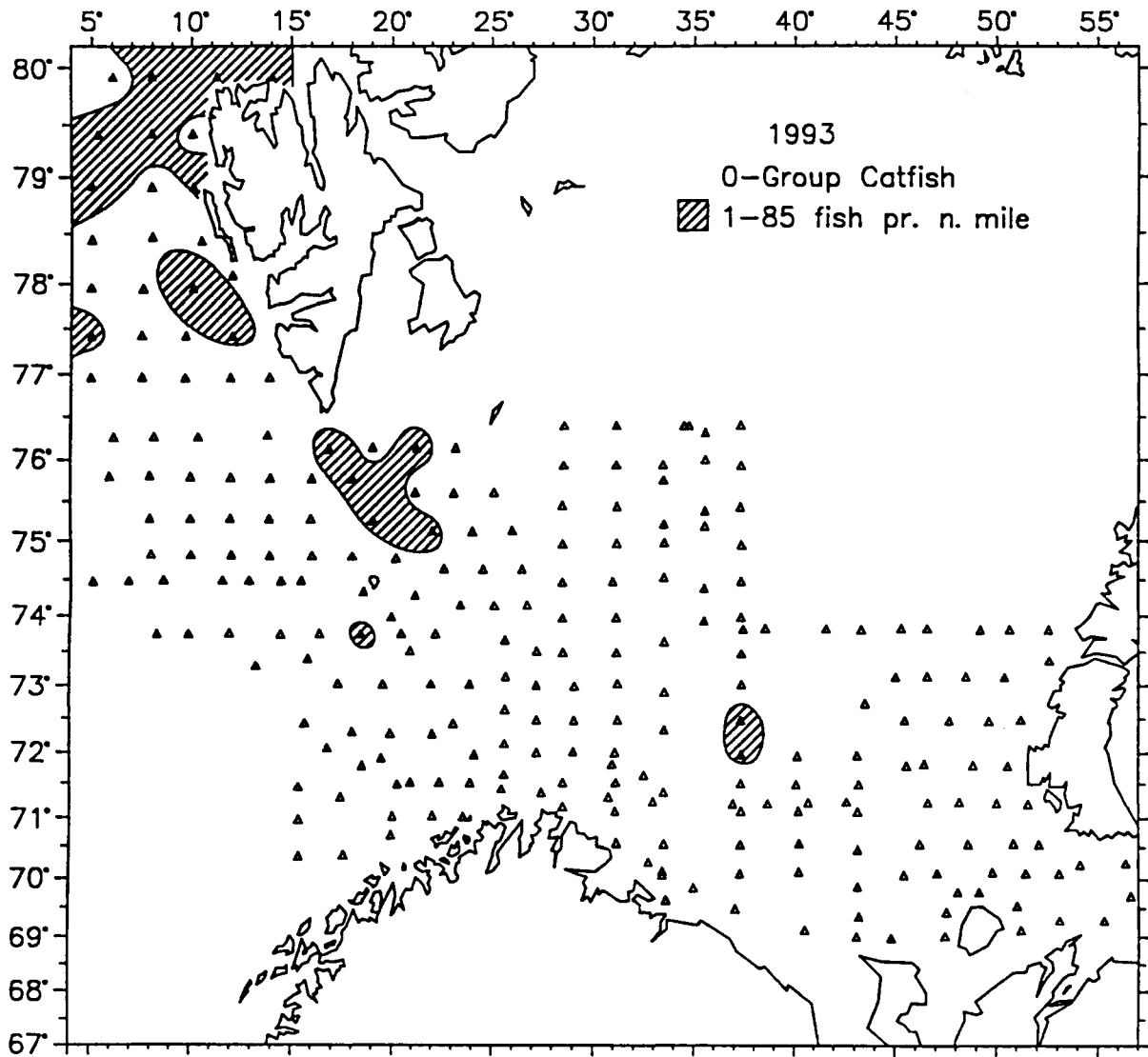


Fig. 26. Distribution of 0-group catfish.

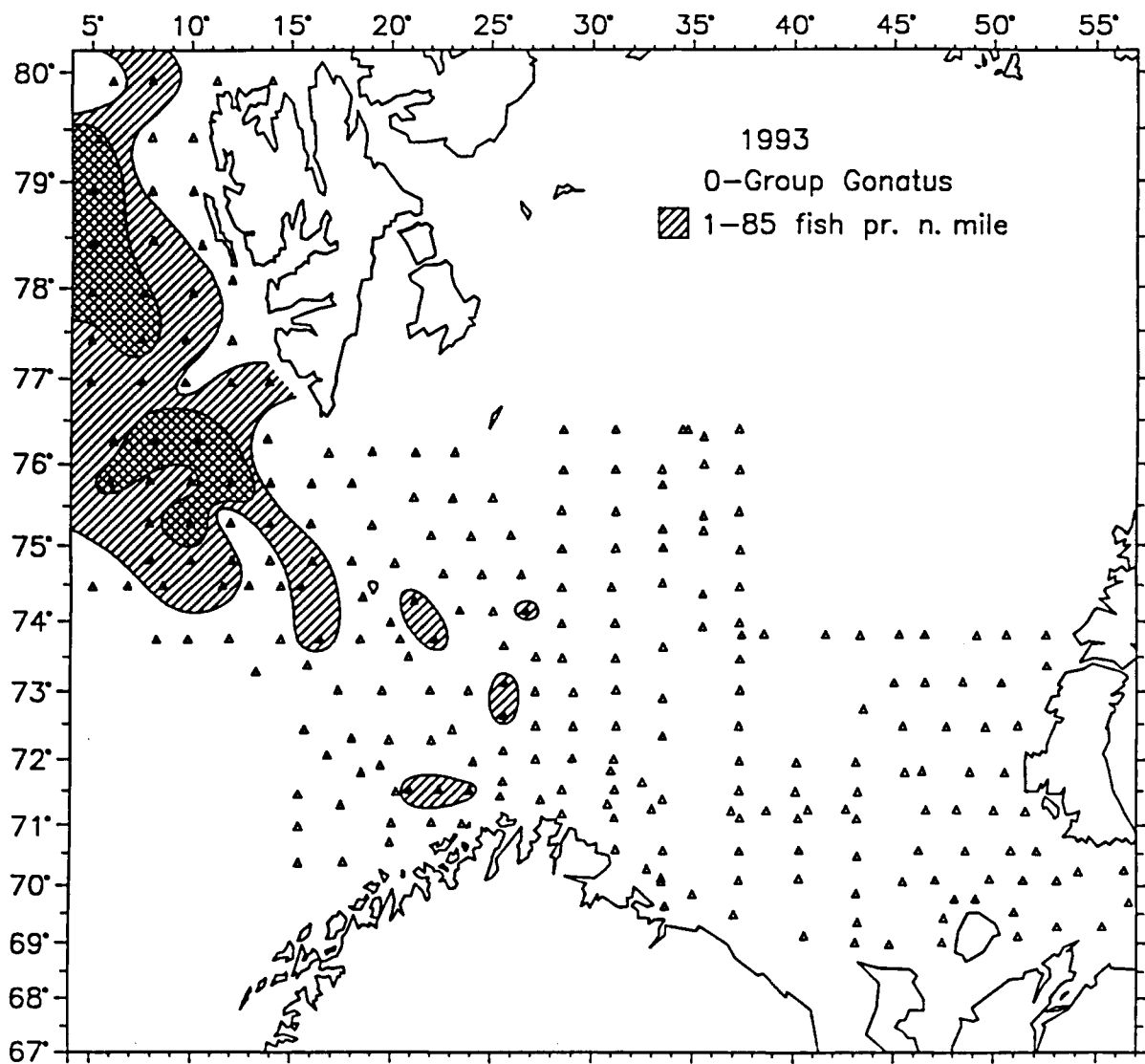


Fig. 27. Distribution of 0-group *Gonatus fabricii*.

APPENDIX

Research vessel	Participants
"Professor Marty"	S.Boychuk, V.Donetskov, Yu.Garbut, A.Gordov, S.Ratushny, E.Shamray, V.Tretyak
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