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International Council for
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PRELIMINARY REPORT OF THE INTERNATIONAL O-GROUP FISH SURVEY IN THE BARENTS SEA AND ADJACENT WATERS IN AUGUST-SEPTEMBER 1994

The thirties annual International 0-group fish survey was made during the period 16 August - 8 September 1994 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Period	Research Institute
Norway	"Michael Sars"	16.08 - 20.08	Institute of Marine
Norway	"Johan Hjort"	17.08 - 06.09	Research,
Norway	"G.O. Sars"	20.08 - 07.09	Bergen
Russia	"Professor Marty"	02.09 - 08.09	The Polar Research
Russia	"Atlantida"	24.08 - 08.09	Institute of Marine Fisheries and
Russia	"Fridtjof Nansen"	27.08 - 08.09	Oceanography, 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 on board "G.O.Sars" during the survey, and the final report was finished by correspondance. 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. Four of the five vessels which participated in the survey in 1994, used the type of midwater trawl recommended by the meeting held after the survey in 1980 (Anon., 1983). However, the Russian vessel "Fridtjof Nansen" used a trawl with 30 m vertical opening, and unknown wingspread. Two steps were trawled to cover the usual 3 step trawling. 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 towings 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 troughout the whole trawl haul and maintain the correct geometry. It is recommended that this is further investigated.

Hydrographical observations were made along all the survey tracks with 5 to 40 nautical miles between stations (Fig. 1). 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.

Trawl stations with and without catch are indicated on the distribution charts in Figs. 16 - 26, as filled and open symbols respectively. The density grading is based on catch as number per 1.0 nautical mile trawling.

HYDROGRAPHY

According to temperature conditions, 1994 is the 6. "warm year" in succession since 1989. The mean sea temperatures from 0-200 m in the Barents Sea in 1994 were 0.1-0.6°C above the long term average (1965-1994). Compared to 1993 the mean temperatures in 1994 ranged from 0.1 below to 0.6°C above. The maximum increase in water temperatures from 1993 to 1994 was recorded in the Bear Iceland - North Cape (0-200 m) and Kola (0-50 m) sections. In the eastern Barents Sea (Cape Kanin section) water temperatures were 0.2-0.4°C above the long term average and similar to those observed in 1993. In the West Spitsbergen Current (0-200 m) temperature was 0.7°C above long term average. However the distribution area of Atlantic water was more narrow than last year and associated with a decrease of 0.5-1.0°C of the upper mixed layer temperature to the north of 75°00'N. Temperature conditions in 1994 were mainly determined by a decreased Atlantic inflow to the area west of Spitsbergen and an increase inflow into the central parts of the Barents Sea, south-east of Bear Iceland, as compared with 1993.

DISTRIBUTION AND ABUNDANCE OF 0-GROUP FISH AND GONATUS FABRICII

Geographical distribution of 0-group fish are shown as shaded areas in Figs. 16 - 25, and of *Gonatus fabricii* in Fig. 26. 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. All area based abundance indices were this year estimated by using standard computer programs (Fotland *et al.* 1995). Another set of abundance indices are given for 0-group herring, cod and haddock (Table 3) calculated according to 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.

Herring (Fig. 16)

Small patches with scattered consentrations were observed west of Spitsbergen. The main concentrations with three small dense patches were found in the Central Barents Sea, eastwards to about 37°E. The logaritmic abundance index is estimated to 0,28 which is indicating that the 1994 year-class is below average during the period 1980-1994.

Capelin (Fig. 17)

Area based 0-group indices were given in the yearly 0-group reports for the period 1965-1978 (Anon. 1980). At the end of the late 1970's the survey results indicated great variations in the abundance indices, caused by variation in other factors than 0-group abundance; as weather condition during the survey. Therefore, it was decided to exclude the abundance indices for capelin from the future reports. A paper by Ushakov and Shamray (1995) gives abundance indices for the period 1965-1993. Preliminary analysis of the relation between the 0-group and the 1-group abundance indices were made by Ushakov and Shamray (1995) and Gundersen, Ushakov and Gjøsæter (1994). They concluded that the correlation between these variables is positive and highly significant. The 0-group index can therefore, be used to make an yearly forcast of the year-class abundance at the 1-group stage, although, not very accurate. On this basis the whole series of indices is included in the present report.

As in 1993 0-group capelin was distributed in patches in the Barents Sea mainly with scattered concentrations eastward to Novaya Zemlya. The 1994-year-class seems to be the third counsecutive poor year-class.

Cod (Fig. 18)

Concentrations of cod were recorded in a similar area as in 1993. Two dense patches were found west of Spitsbergen. However, the largest area with dense concentrations were recorded in the central Barents Sea from about 15 - 42°E and north to 75°N. Compared with 1993, when 0-group was observed eastward to Novaya Zembya, the 0-group was absent east of 48°E. Both the area and logaritmic abundance indices for the 1994-year-class are the third and fifth highest respectively, classifying the year-class as strong. This gives the fourth strong year-class in succession.

Haddock (Fig. 19)

0-group haddock was distributed in a narrow area west of Spitsbergen. The distribution in the western part of the Barents Sea was similar to last year. However, in 1993 the distribution in the Barents Sea was more to the west and east. Dense consentrations were recorded south of 73°N in 1994, while mostly north of 73°N last year. Both the area and the logaritmic abundance indices are the fourth highest since 1965, indicating another good year-class, the fifth in succession.

Polar cod (Fig. 20)

As in many earlier years, the total area of distribution was not completely covered. In contrast to 1993, a continuous distribution was recorded from north of Spitsbergen to Bear Island and eastward to Novaya Zemlya. The eastern component was very rich, giving the highest abundance index recorded, while the Svalbard component was at a low level.

Saithe

Only a few specimens were caugth during the survey, indicating a patchy distribution with very low abundance.

Redfish (Fig. 21)

The south-western part of the normal survey area was not covered in 1994. However, in general the distribution patteren of redfish was similar to those in 1990 and previous years. Dense consentrations were found west of Spitsbergen and in the eastward current along the Norwegian coast. The abundance index is higher than those found in the period 1991 - 1993, indicating a year-class strength close to the average.

Greenland halibut (Fig. 22)

Scattered concentrations were recorded in the area between Bear Island and Spitsbergen and off the westcoast of Spitsbergen. The abundance index was dobbled compared to the 1992 index, but still only half the high indices in the period 1984 - 1987, indicating that the abundance of the 1994-yearclass is poor to medium.

Long rough dab (Fig. 23)

Long rough dab was mainly distributed in the sentral and north-eastern part of the survey area. However, the area of distribution was not completely covered. Two patches with dense consentrations were recorded inside the relatively wide distribution area, and only the 1986 - year-class has a higher abundance index than the present, indicating a rich year-class.

Sandeel (Fig. 24)

Sandeel was mainly observed south-west of Novaya Zemlya, a little further south than in 1993.

Catfish (Fig. 25)

Catfish was distributed in the area between Bear Island and the southern part of Spitsbergen and east of Hopen Island. In addition small patches were found west of Spitsbergen and in the south-eastern part of the Barents Sea. Only a small number were caught in each haul.

Gonatus (Fig. 26)

As in earlier years, 0-group *Gonatus fabricii* was distributed in the western part of the survey area. However, the area of distribution was not completely covered. Survey catches were at the same level as in 1993.

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Table 1. Mean water temperature[1] 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
1994	7.7	3.9	4.8	4.6	3.4	6.4	5.3
Aver. 1965-1994	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)

Table 2. Abundance indices of 0-group fish in the Barents Sea and adjacent waters in 1965 - 1994.

Year	Capelin[1]	Cod	Had-dock	Polar cod		Red-fish	Green-land halibut	Long rough dab
				West	East			
1965	37	6	7	0		159		66
1966	119	1	1	129		236		97
1967	89	34	42	165		44		73
1968	99	25	8	60		21		17
1969	109	93	82	208		295		26
1970	51	606	115	197		247	1	12
1971	151	157	73	181		172	1	81
1972	275	140	46	140		177	8	65
1973	125	684	54	(26)		385	3	67
1974	359	51	147	227		468	13	83
1975	320	343	170	75		315	21	113
1976	281	43	112	131		447	16	96
1977	194	173	116	157	70	472	9	72
1978	40	106	61	107	144	460	35	76
1979	660	94	69	23	302	980	22	69
1980	502	49	54	79	247	651	12	108
1981	570	65	30	149	73	861	38	95
1982	393	114	90	14	50	694	17	150
1983	589	386	184	48	39	851	16	80
1984	320	486	255	115	16	732	40	70
1985	110	742	156	60	334	795	36	86
1986	125	434	160	111	366	702	55	755
1987	55	102	72	17	155	631	41	174
1988	187	133	86	144	120	949	8	72
1989	1300	202	112	206	41	698	5	92
1990	324	465	227	144	48	670	2	35
1991	241	766	472	90	239	200	1	28
1992	26	1159	313	195	118	150	3	32
1993	43	910	240	171	156	162	11	55
1994	58	899	282	50	448	414	20	272

[1] Assessment for 1965-1978 in Anon. 1980 and for 1979-1993 in Ushakov and Shamray 1994.

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 1965-1994.

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
1994	0.28	0.17	0.42	2.27	1.83	2.76	0.64	0.49	0.81

[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 1994.

Length (mm)	Her-ring	Cape-lin	Cod	Had-dock	Polar cod		Red-fish	Greenland halibut	Long roug dab	Sandeel
					East	West				
10-14						+				
15-19						+	+		0.1	
20-24					0.2	1.9	0.2		2.4	
25-29					2.9	23.3	0.5		20.0	
30-34		0.8	+		11.9	45.1	2.8		44.2	0.7
35-39		2.5	+		19.7	21.9	22.1	0.5	27.8	5.6
40-44	+	12.7	+	+	29.0	4.5	35.1	2.1	5.5	14.6
45-49	0.1	21.7	0.1	0.4	24.5	2.0	25.7	4.8	0.4	23.8
50-54	1.3	12.5	0.4	0.8	10.2	0.7	11.0	6.4		40.4
55-59	8.6	8.7	0.9	1.1	1.5	0.5	2.3	9.6		10.6
60-64	32.0	10.8	1.7	2.1	0.1	0.1	0.2	37.4		3.1
65-69	35.0	9.3	3.2	3.9		0.1		33.1		0.7
70-74	18.2	11.2	6.0	4.0				3.2		0.3
75-79	4.4	6.1	9.5	5.8				2.7		0.1
80-84	0.2	2.2	15.0	8.0						+
85-89	0.1	1.5	16.2	9.3						0.1
90-94	+	0.1	20.4	11.0						
95-99	+	+	14.6	12.5						
100-104		+	7.6	9.9						
105-109			2.8	8.8						
110-114			1.3	9.3						
115-119			0.2	6.4						
120-124			+	3.5						
125-129			+	2.2						
130-134			+	0.3						
135-139				0.6						
140-144				0.5						
No. measured	2324	1862	12864	3405	4574	1069	3108	66	1912	637
Total numbers	106-462	187-66	200-912	9543	174-2220	24976	181-654	187	9229	48419
Mean length	66.2	57.6	88.0	95.9	42.3	33.3	43.8	62.5	33.2	49.9

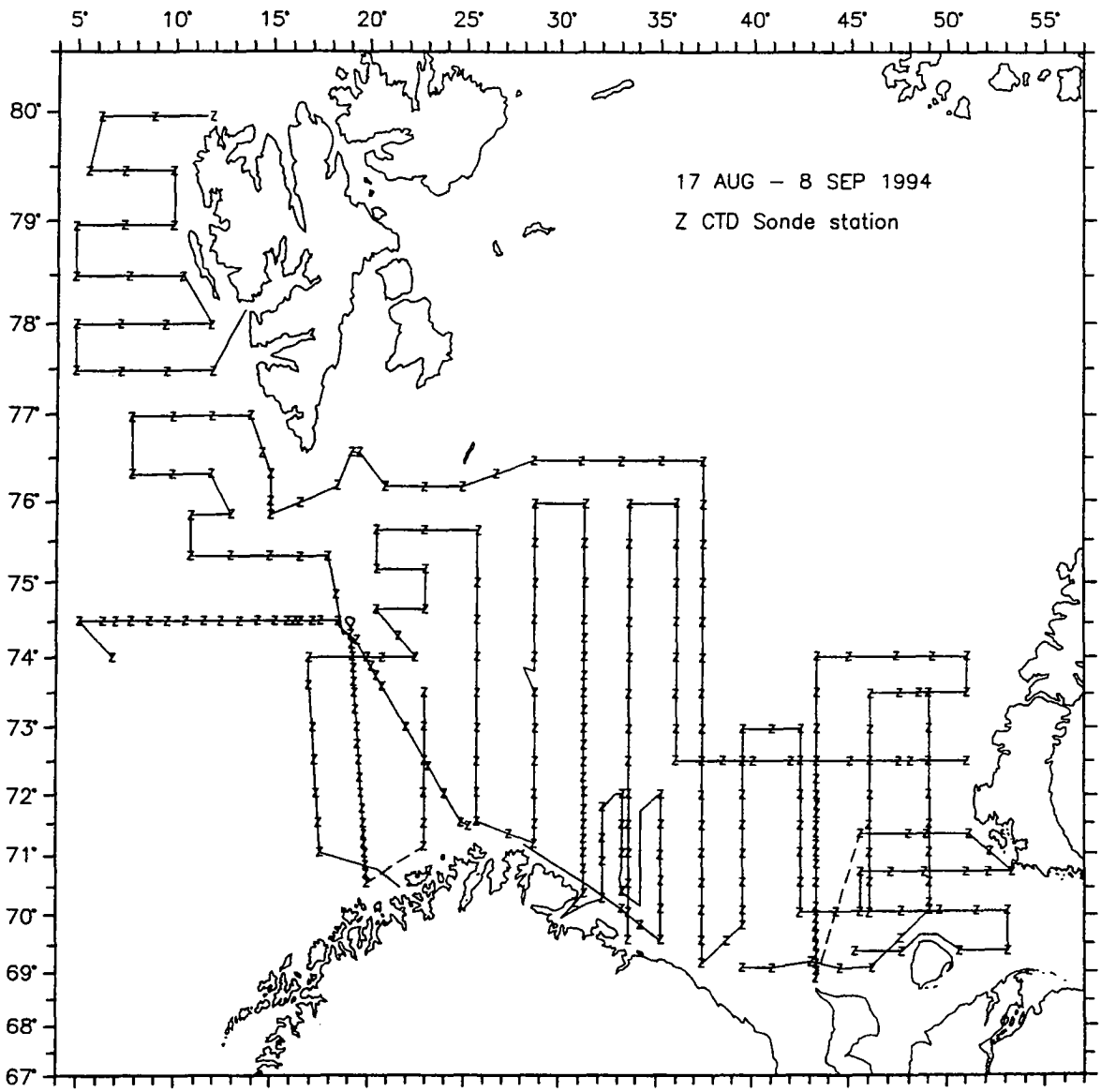

Fig. 1. Survey tracks and hydrographic stations.

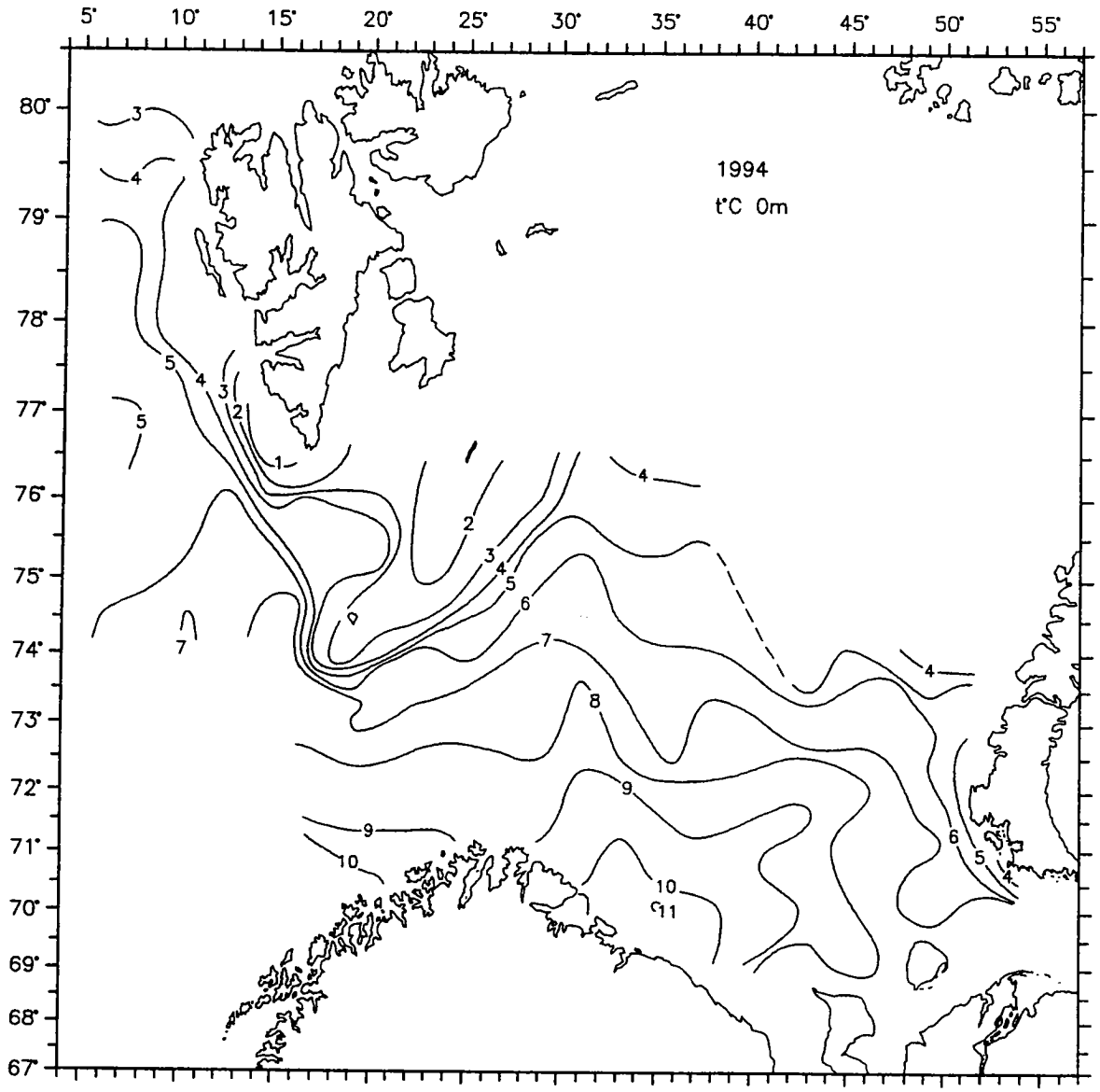

Fig. 2. Isotherms at 0 m.

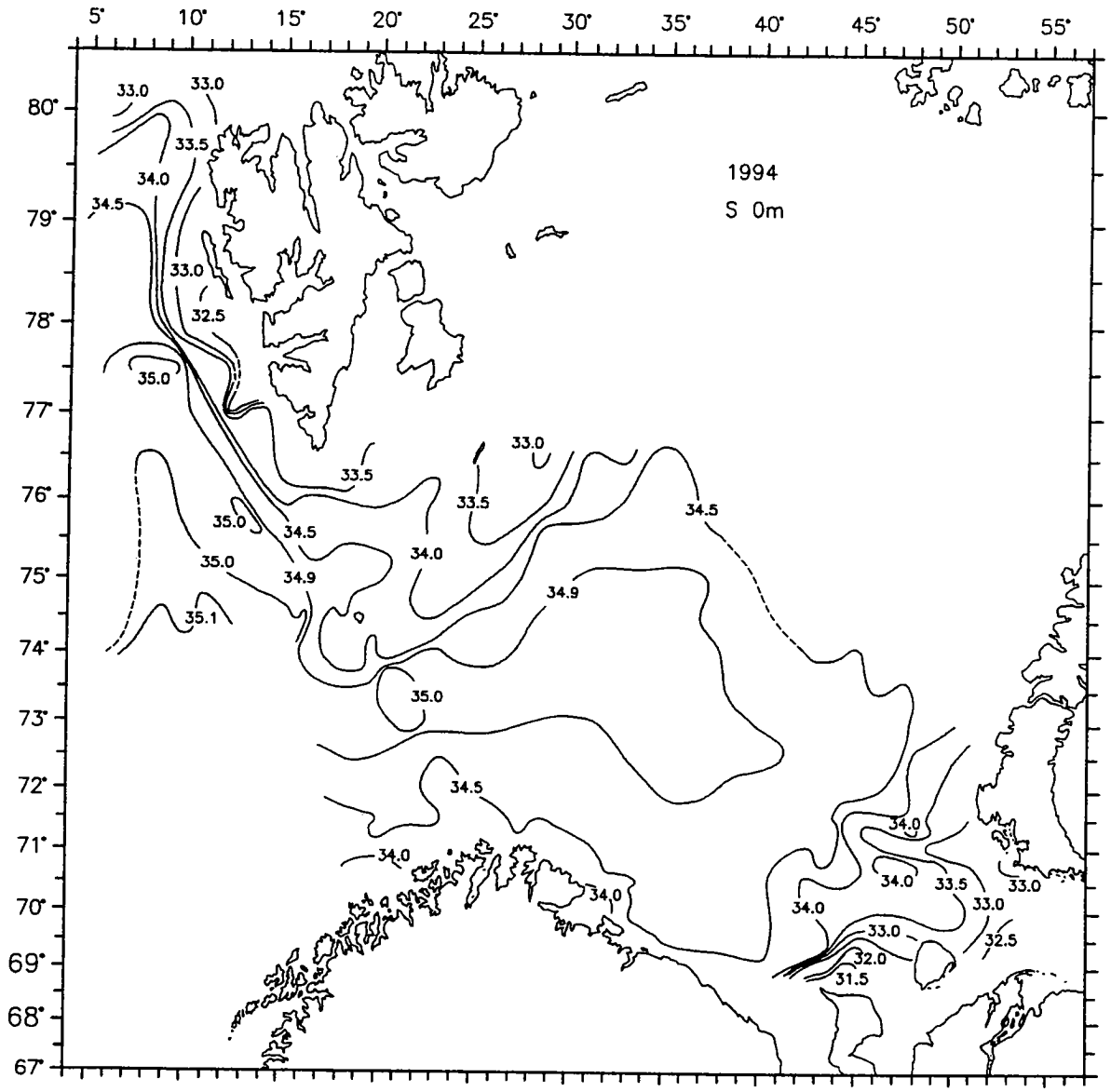

Fig. 3. Isohalines at 0 m.

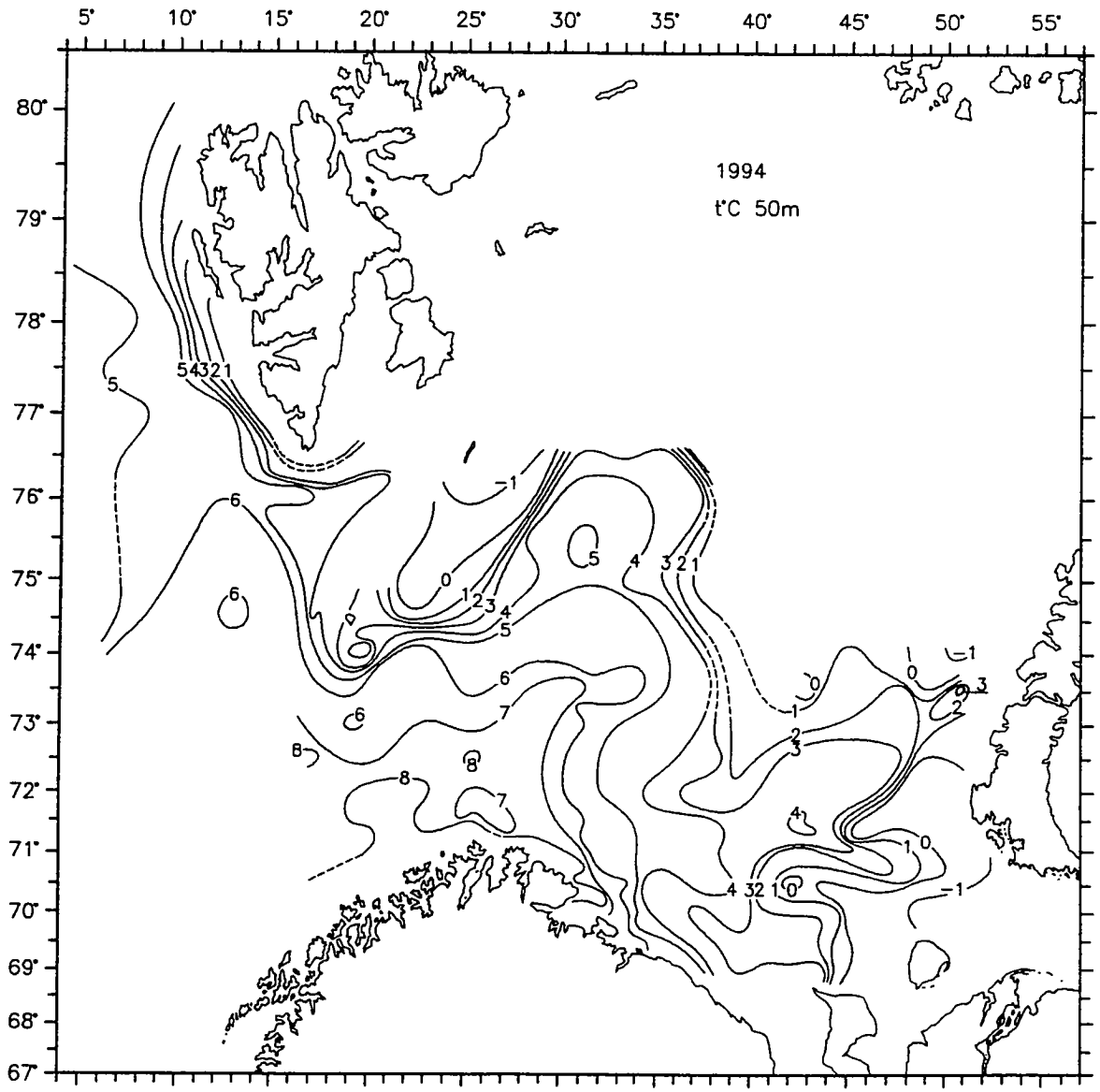

Fig. 4. Isotherms at 50 m.

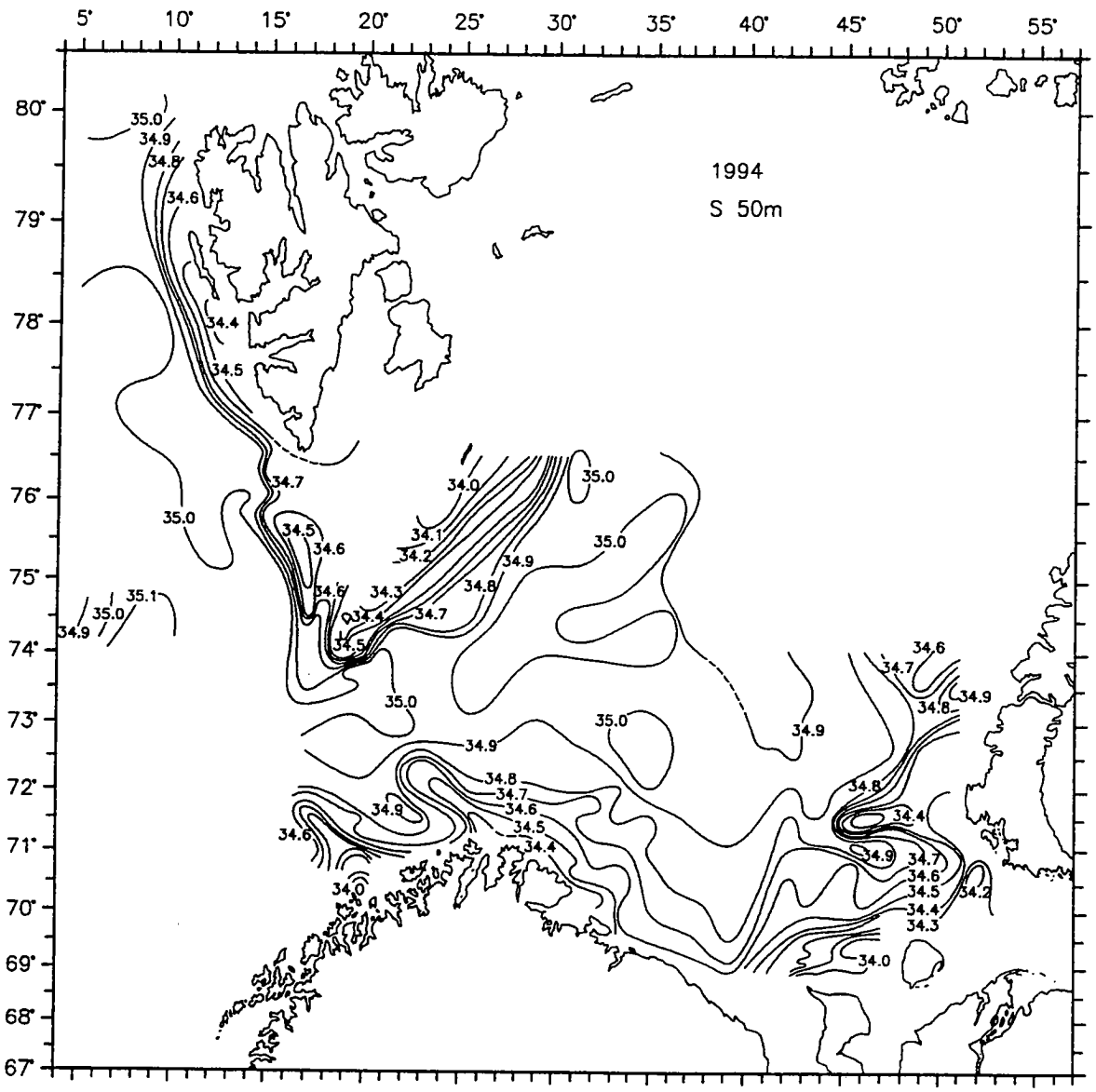

Fig. 5. Isohalines at 50 m.

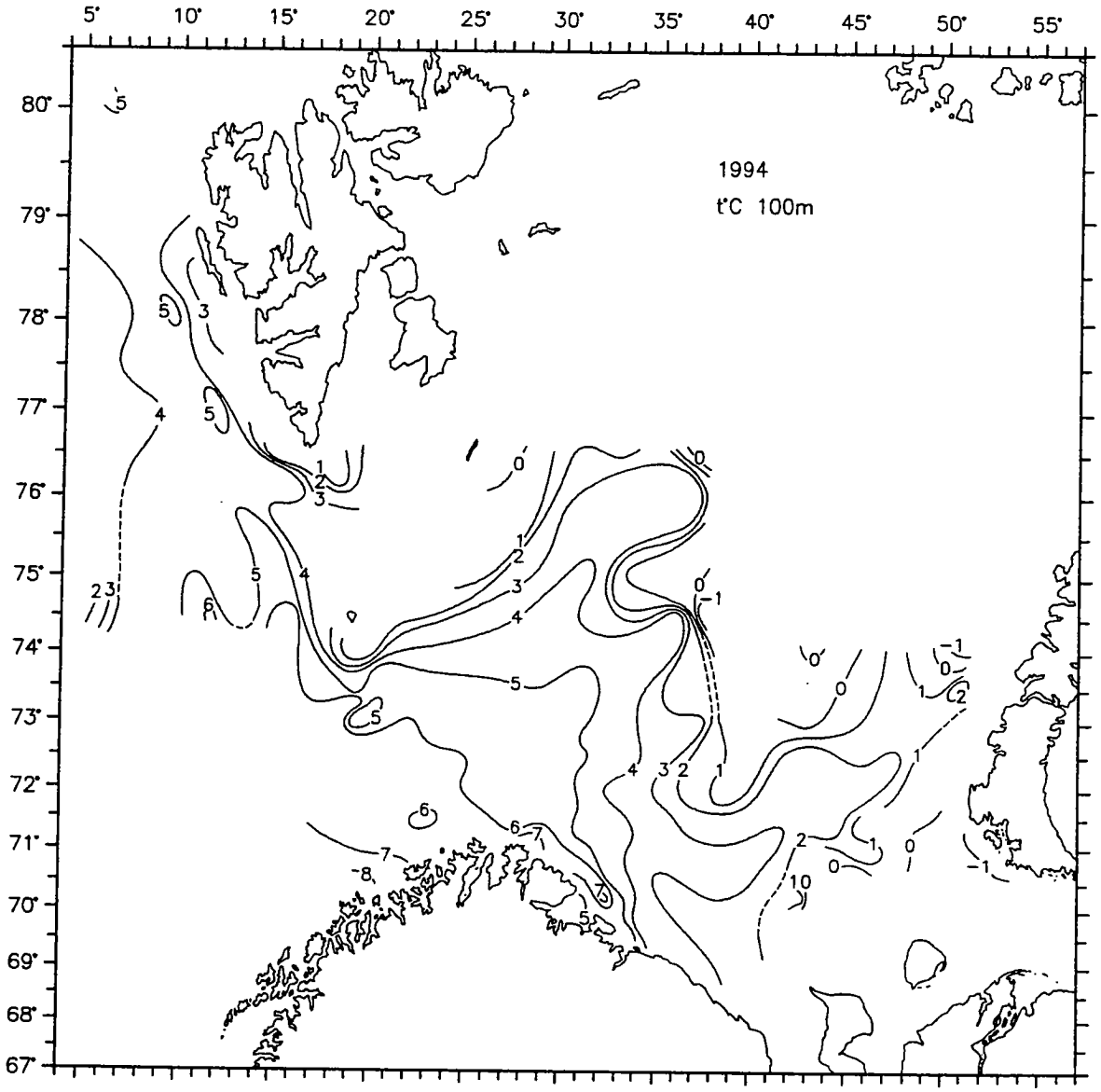

Fig. 6. Isotherms at 100 m.

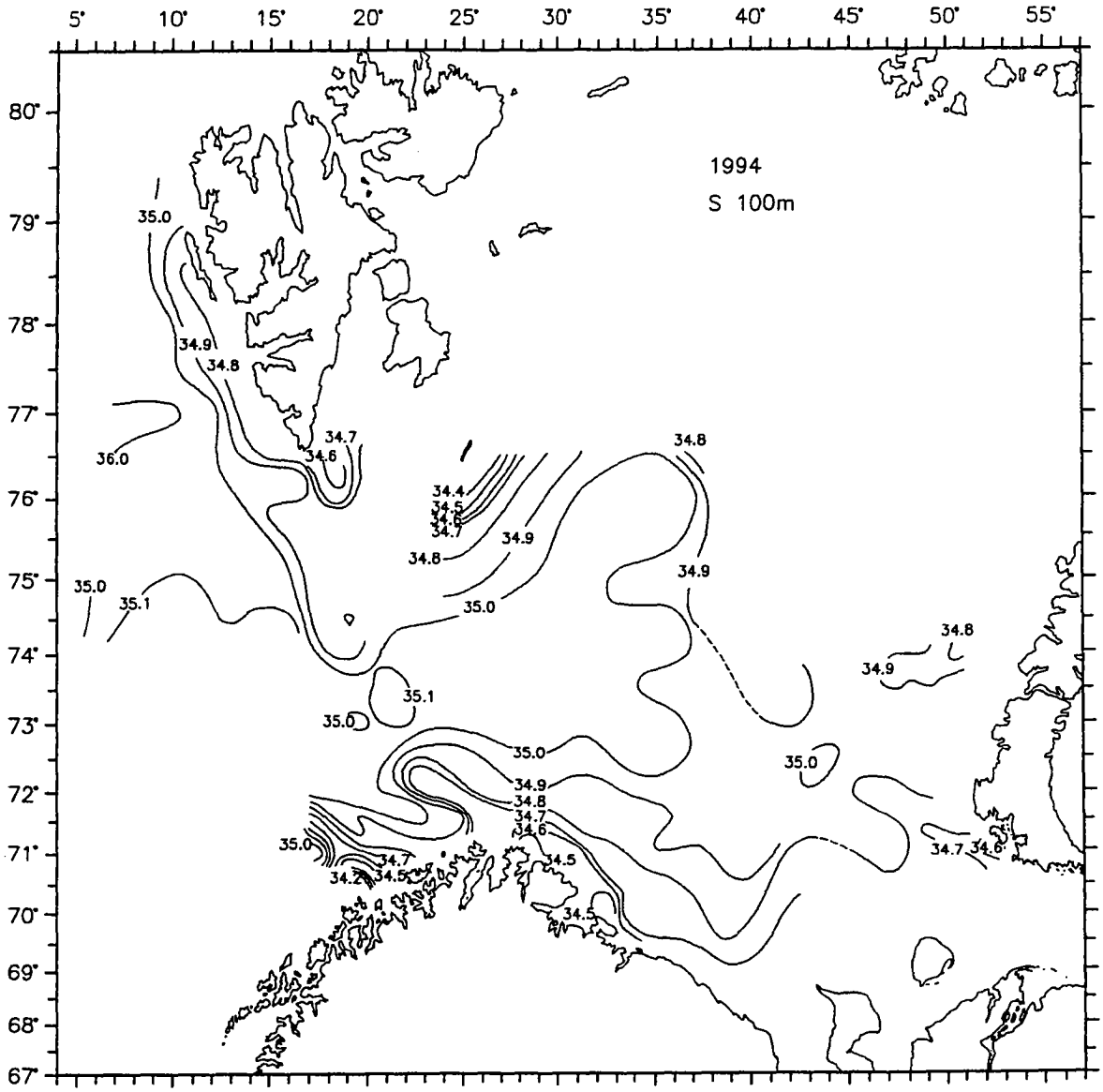

Fig. 7. Isohalines at 100 m.

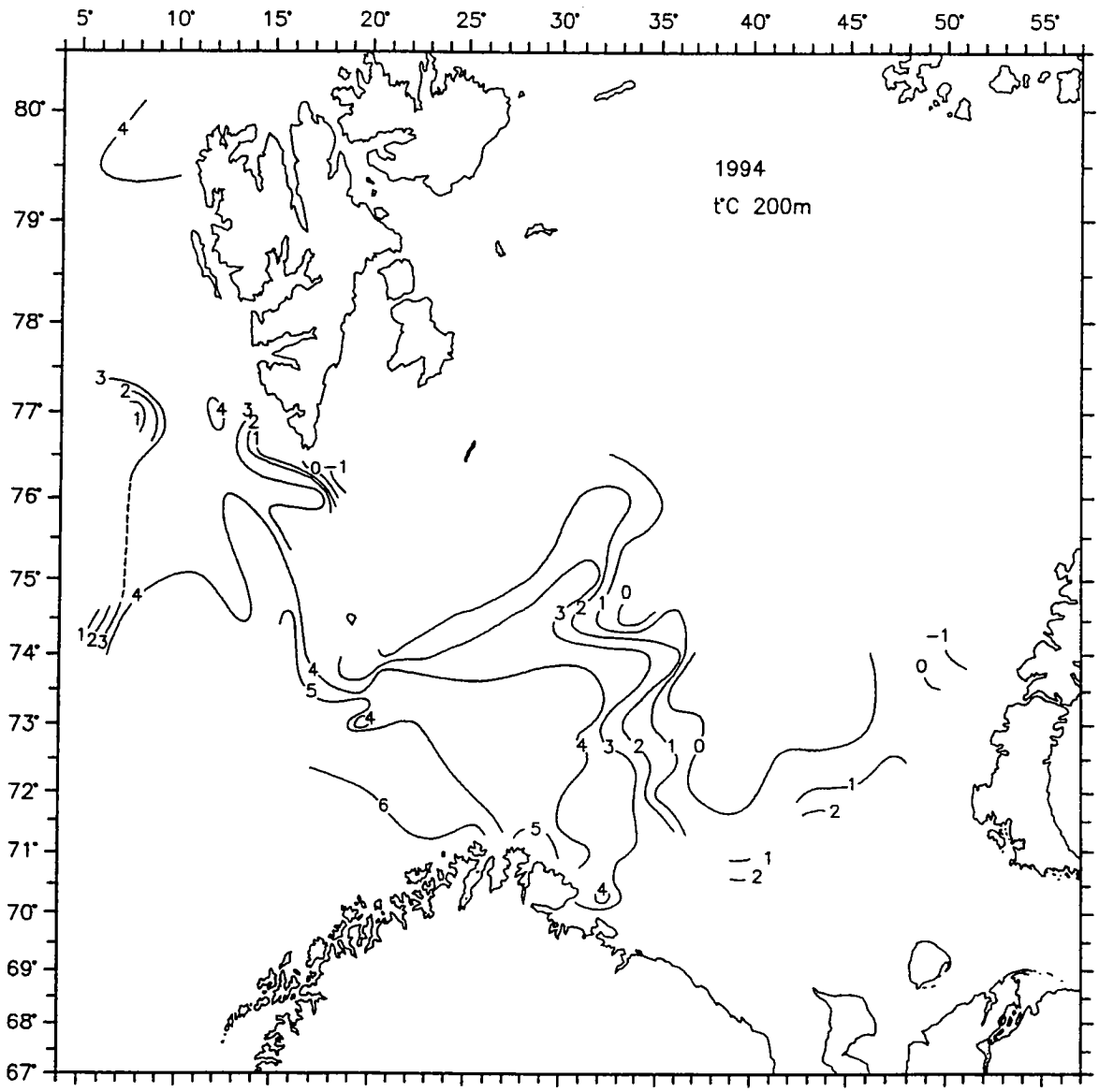

Fig. 8. Isotherms at 200 m.

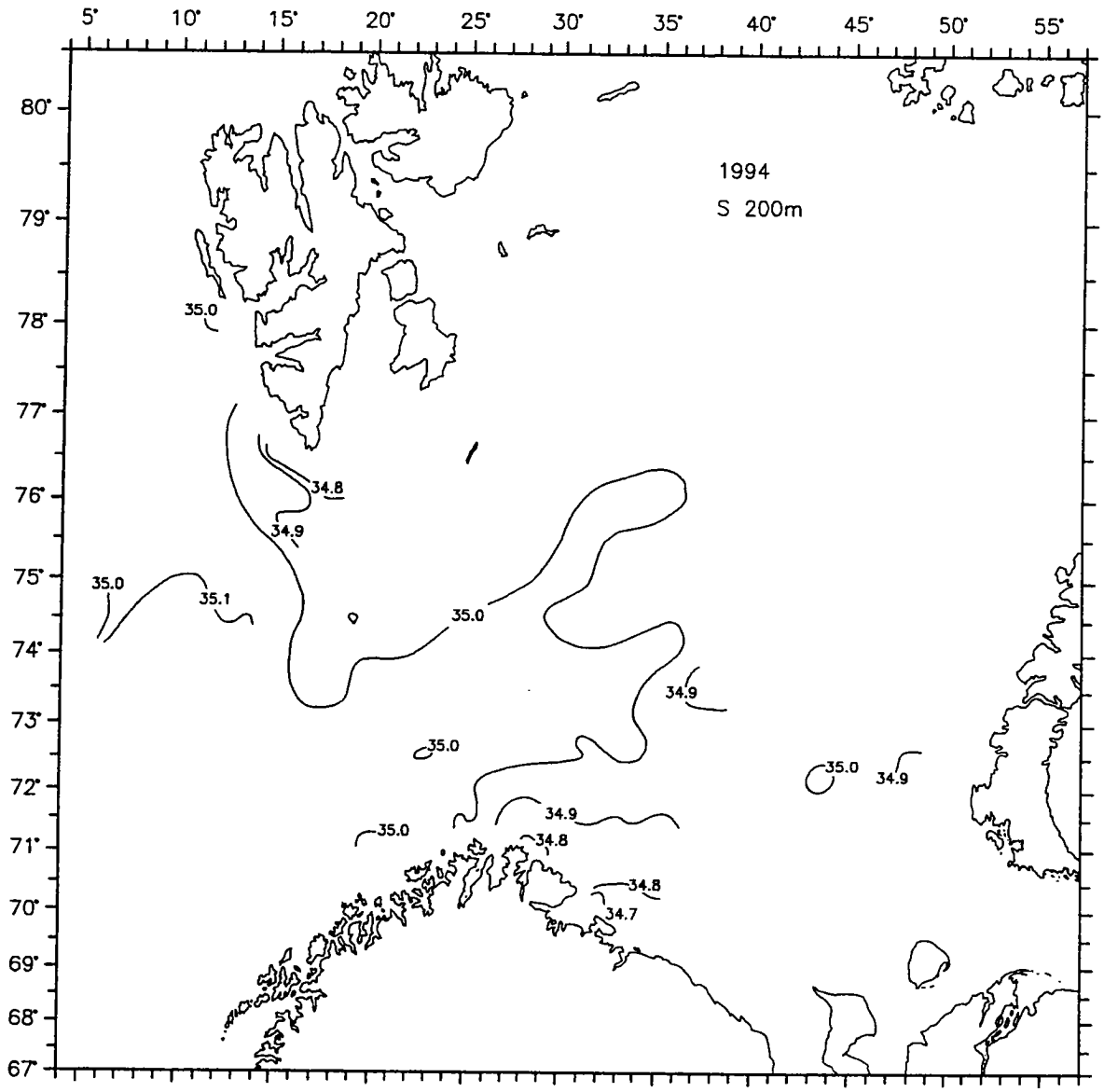

Fig. 9. Isohalines at 200 m.

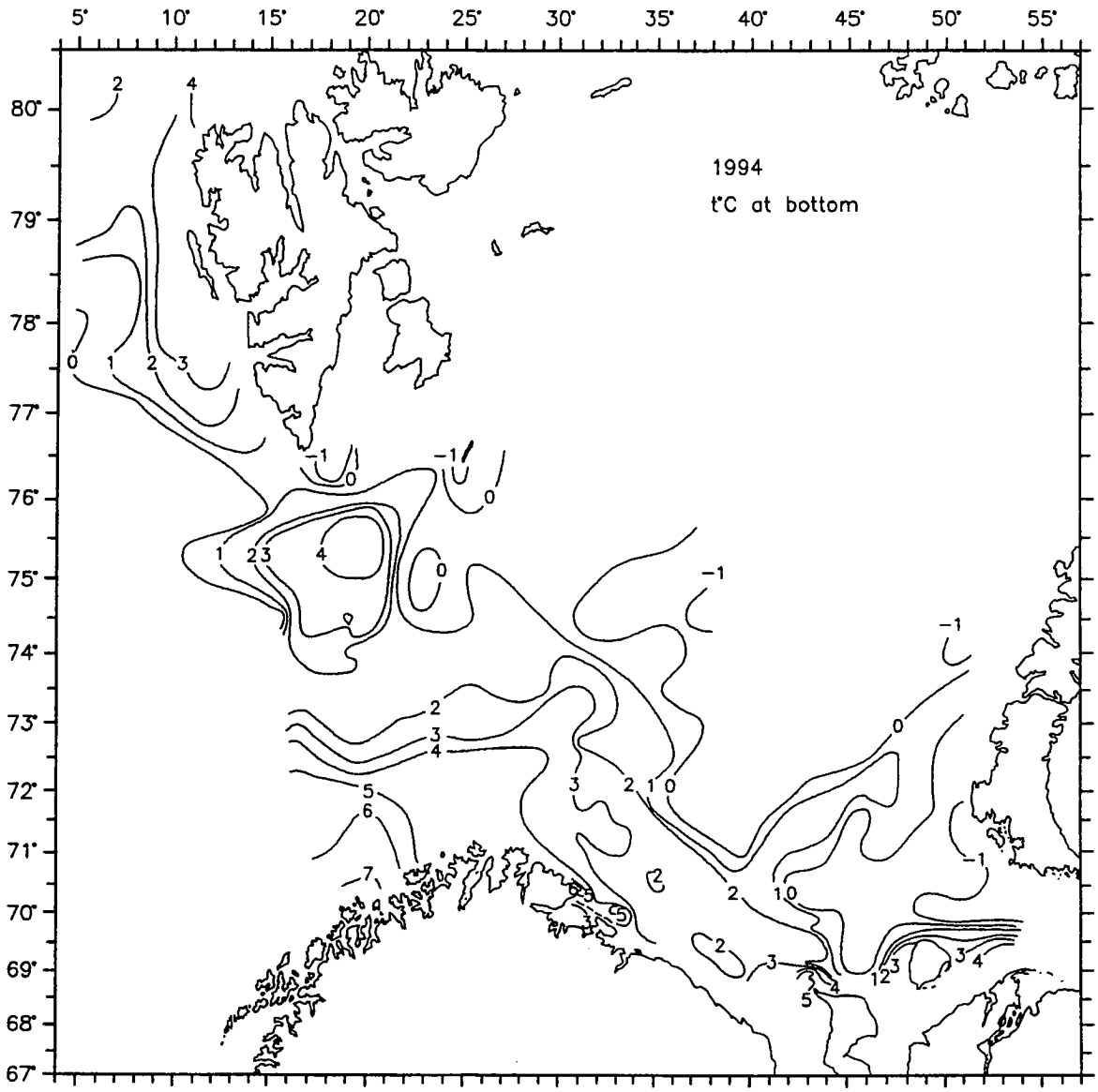

Fig. 10. Isotherms at the bottom.

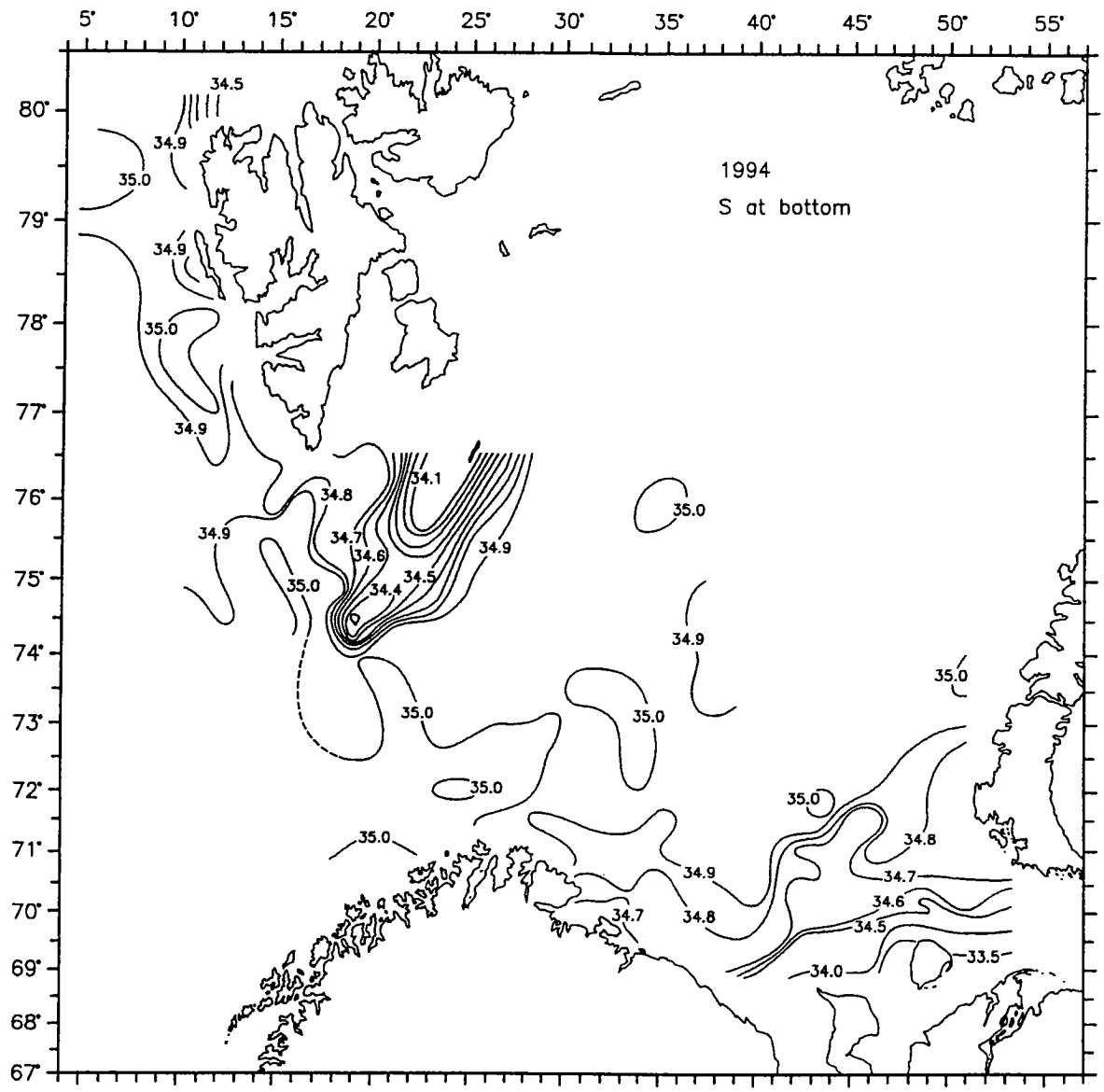

Fig. 11. Isohalines at the bottom.

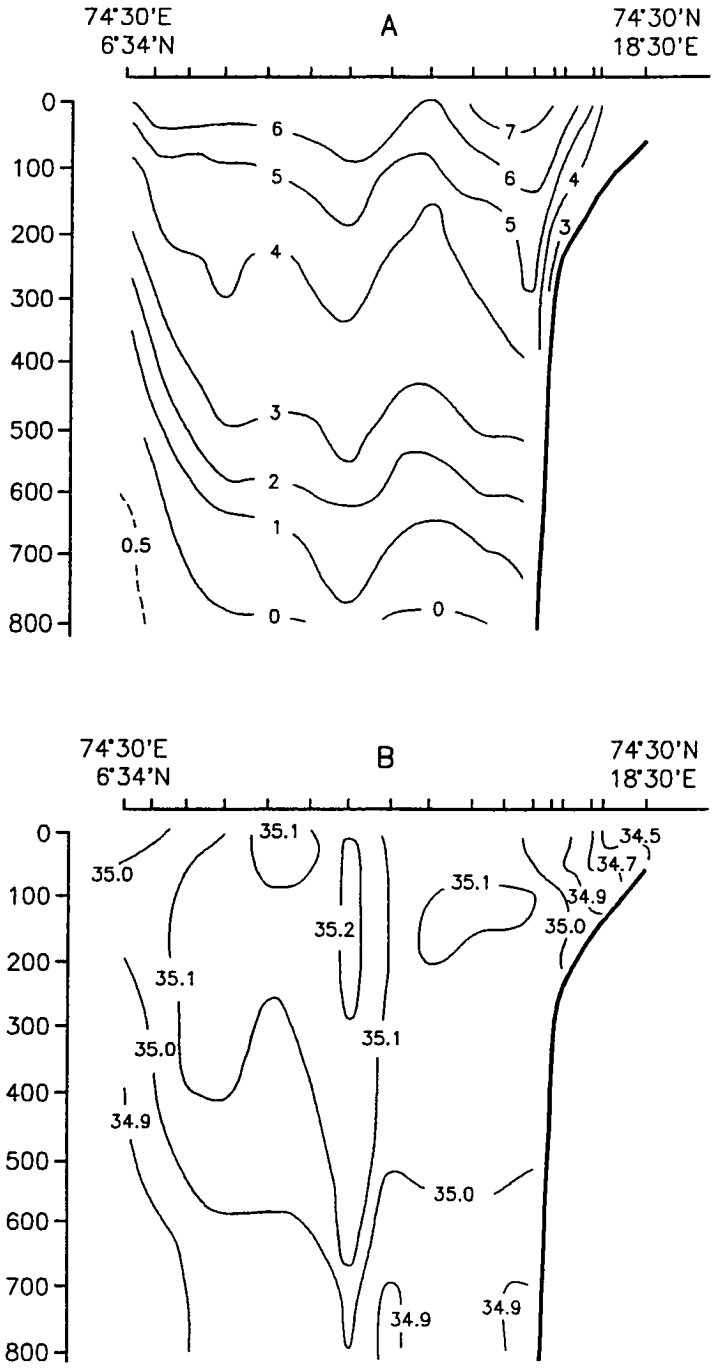

Fig. 12. Hydrographic section Bear Island - West. Temperature (A) and salinity (B).

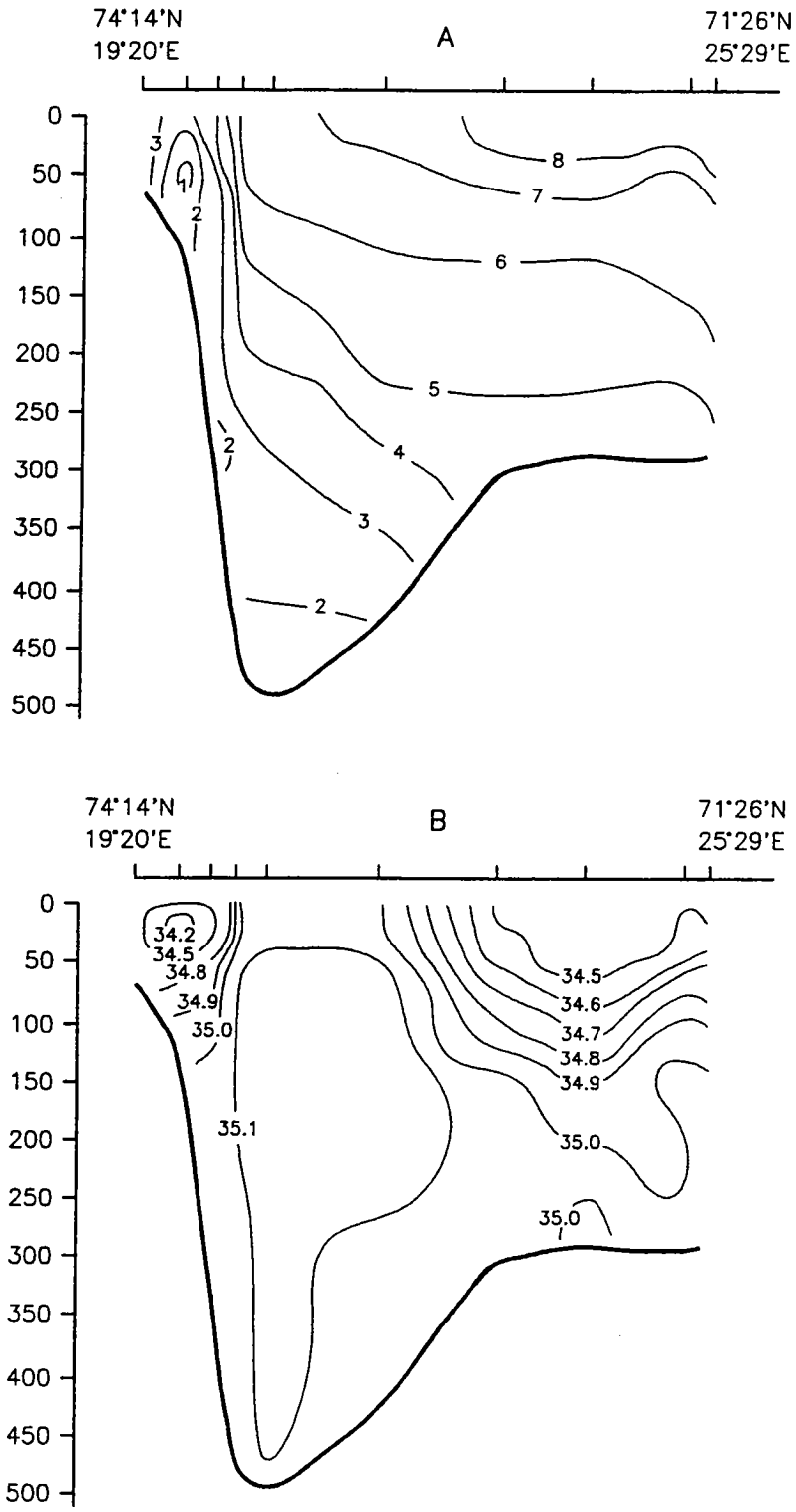

Fig. 13. Hydrographic section North Cape - Bear Island.
Temperature (A) and salinity (B).

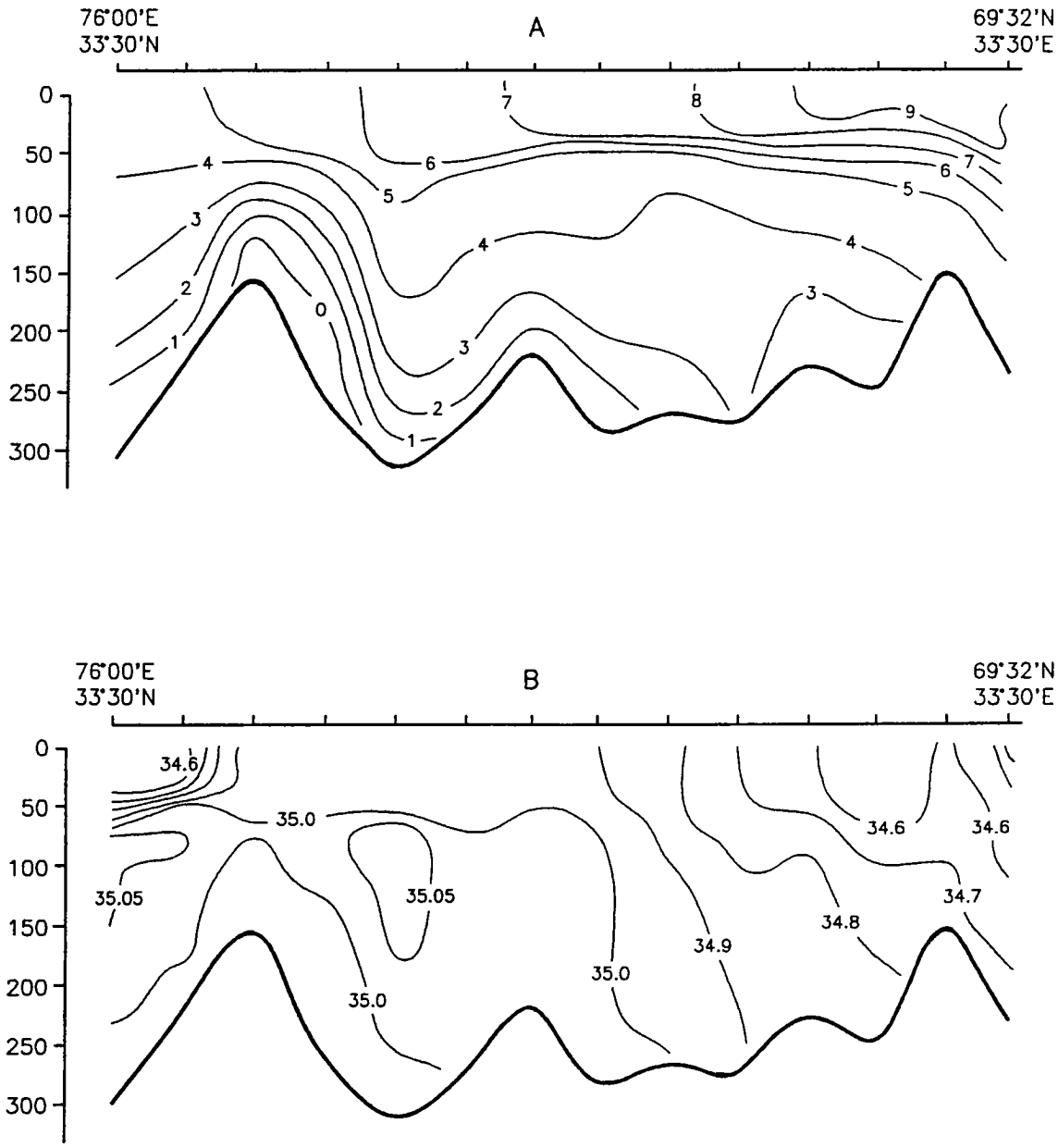

Fig. 14. Hydrographic section along the Kola meredian.
Temperature (A) and salinity (B).

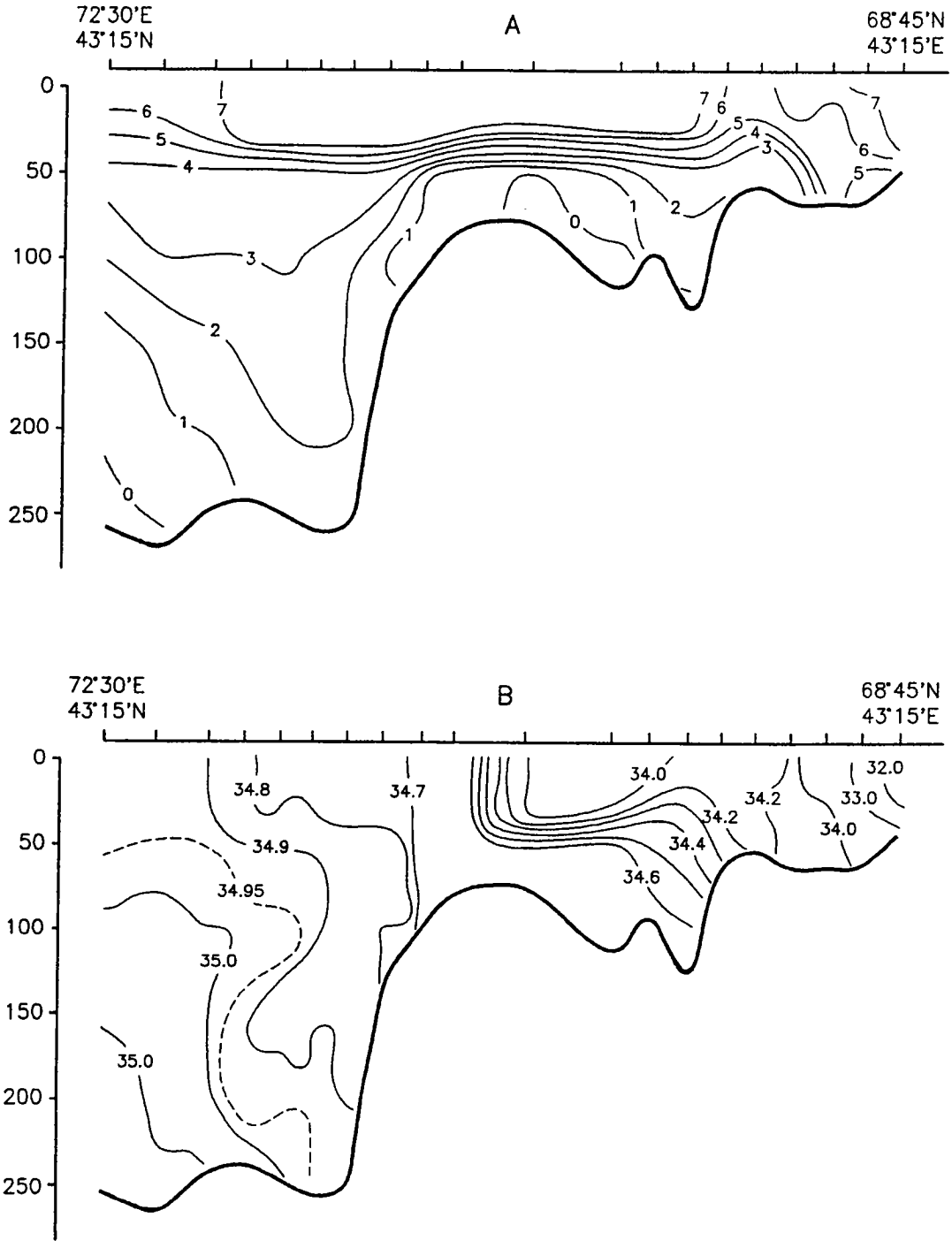

Fig. 15. Hydrographic section Cape Kanin - North.
Temperature (A) and salinity (B).

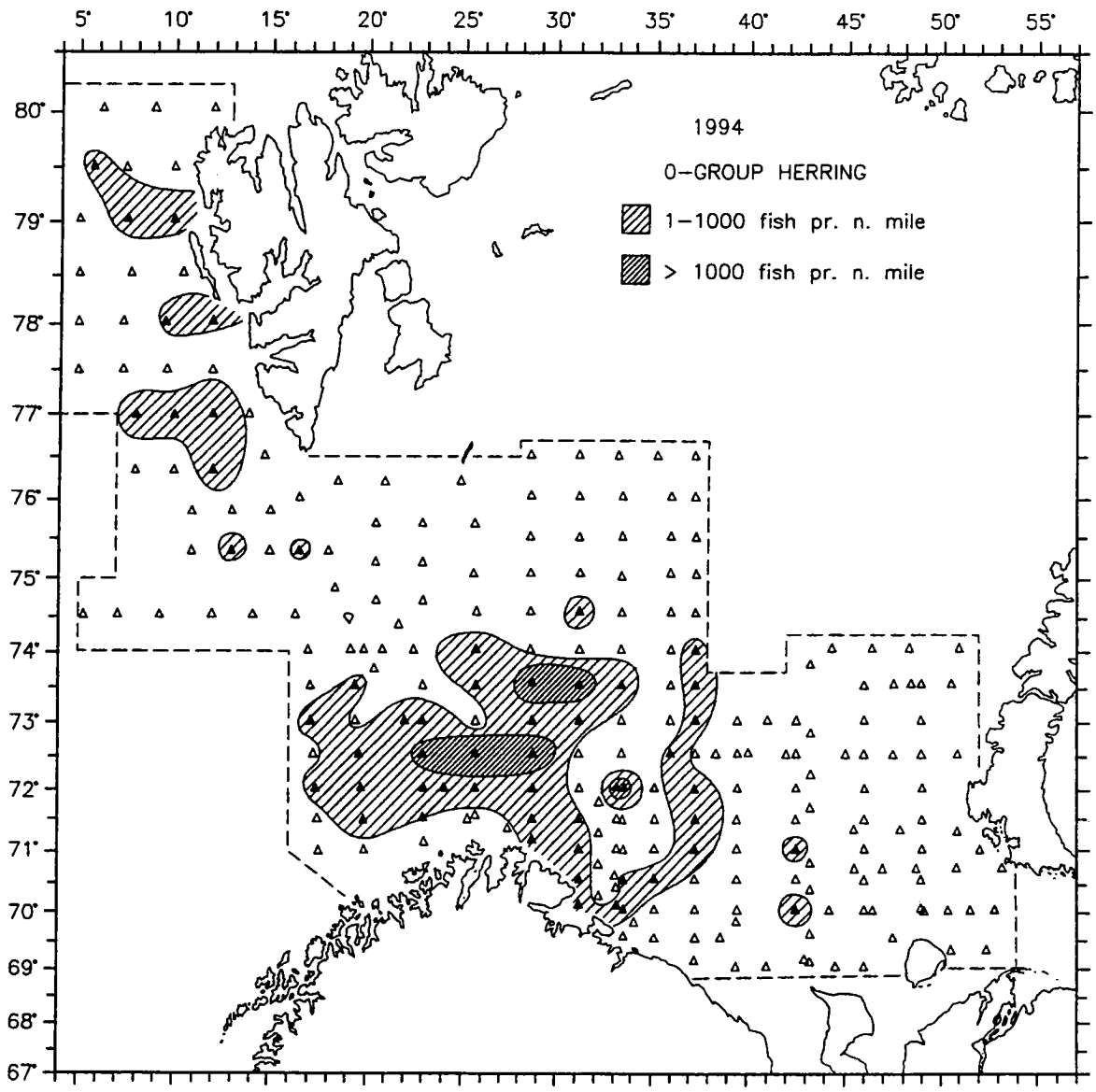

Fig. 16. Distribution of 0-group herring.

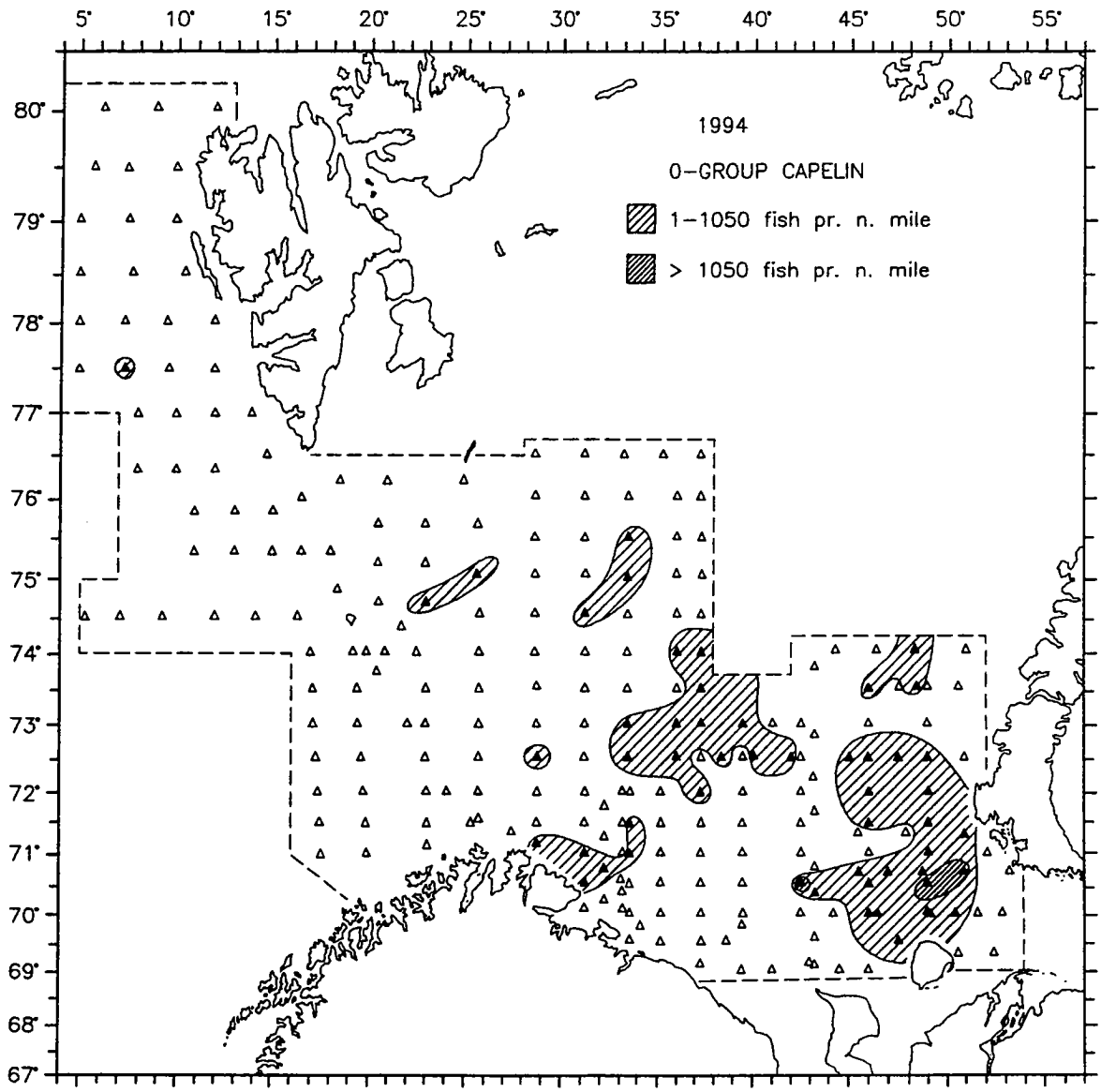

Fig. 17. Distribution of 0-group capelin.

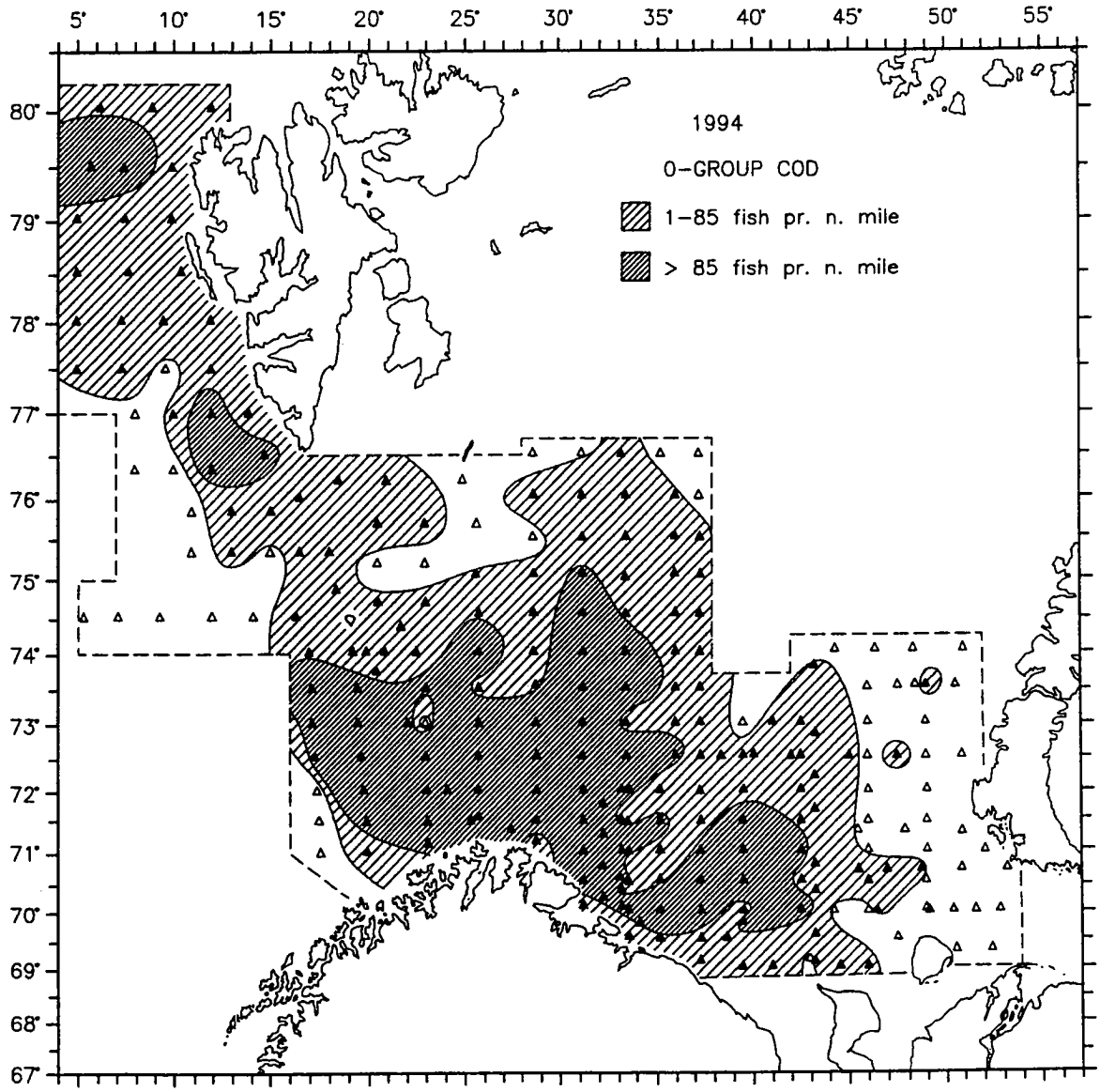

Fig. 18. Distribution of 0-group cod.

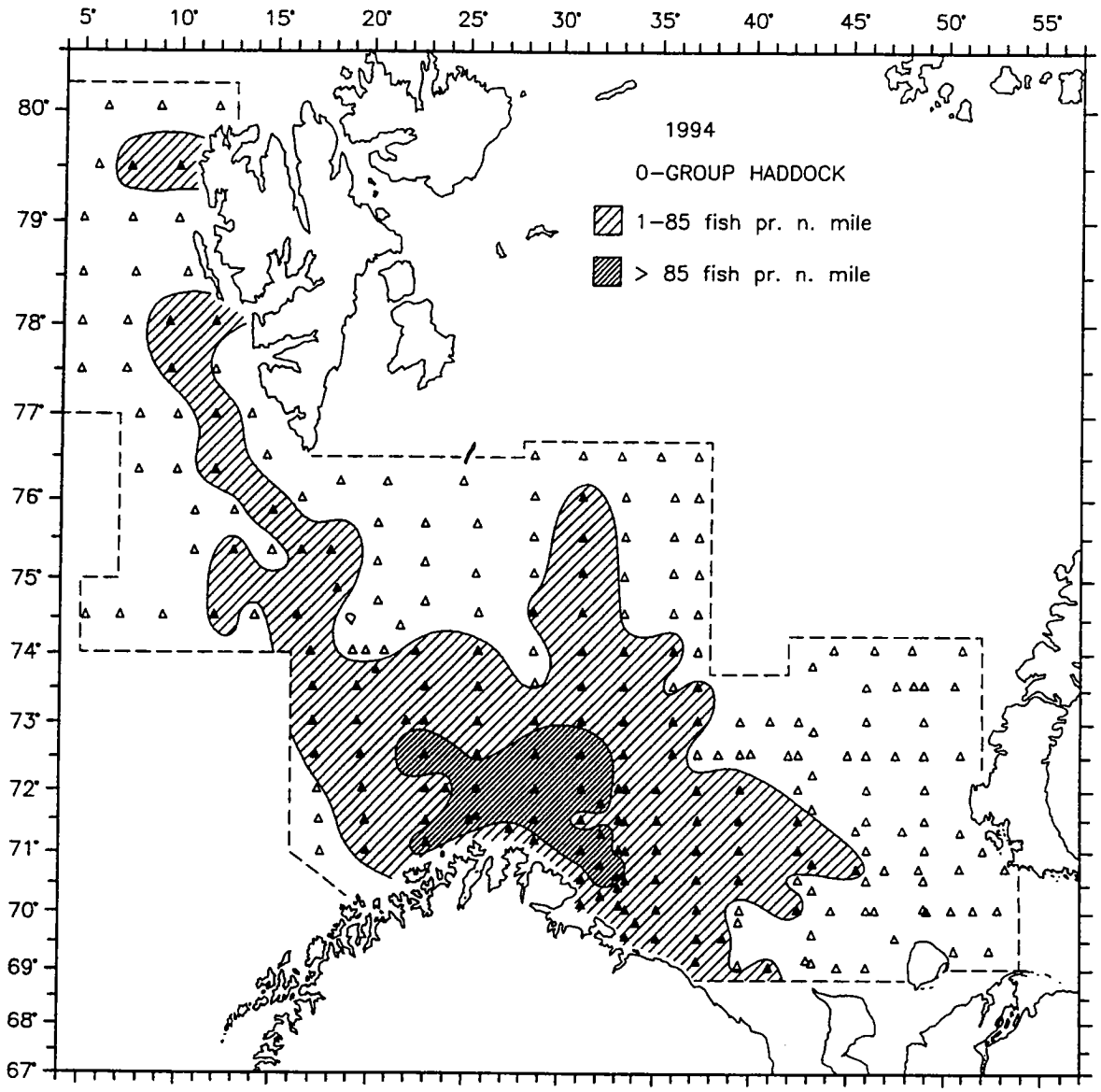

Fig. 19. Distribution of 0-group haddock.

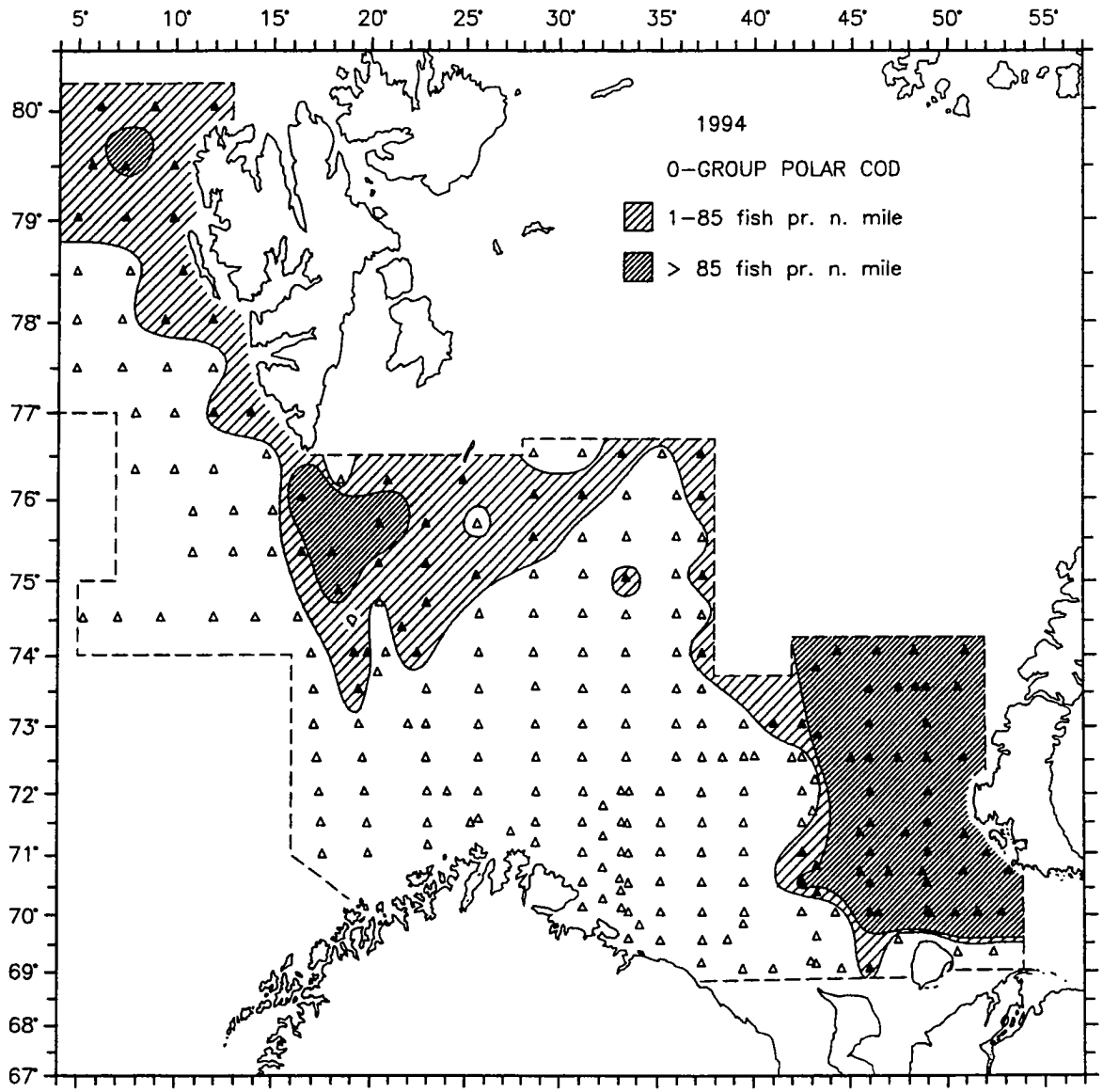

Fig. 20. Distribution of 0-group polar cod.

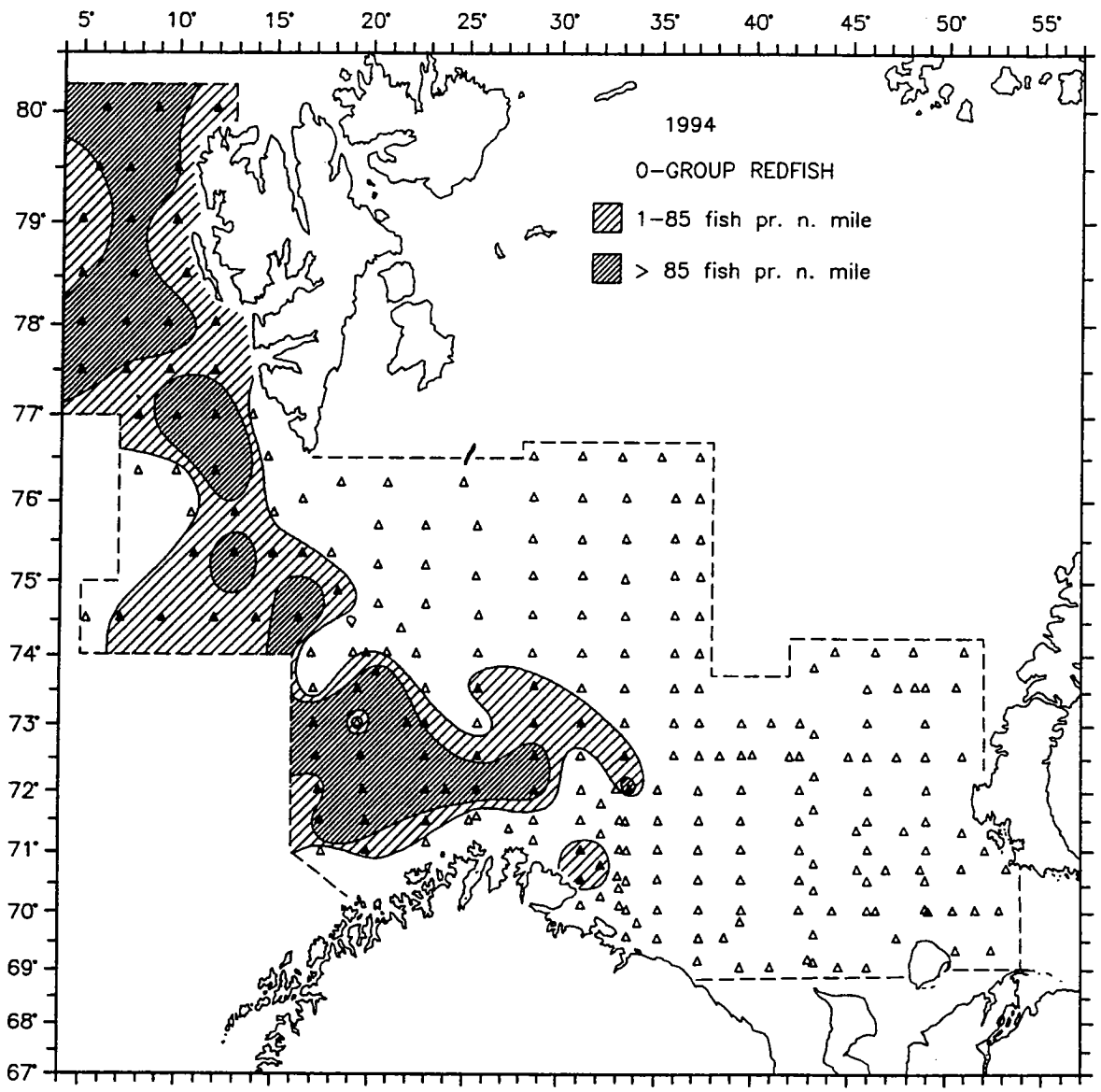

Fig. 21. Distribution of 0-group redfish.

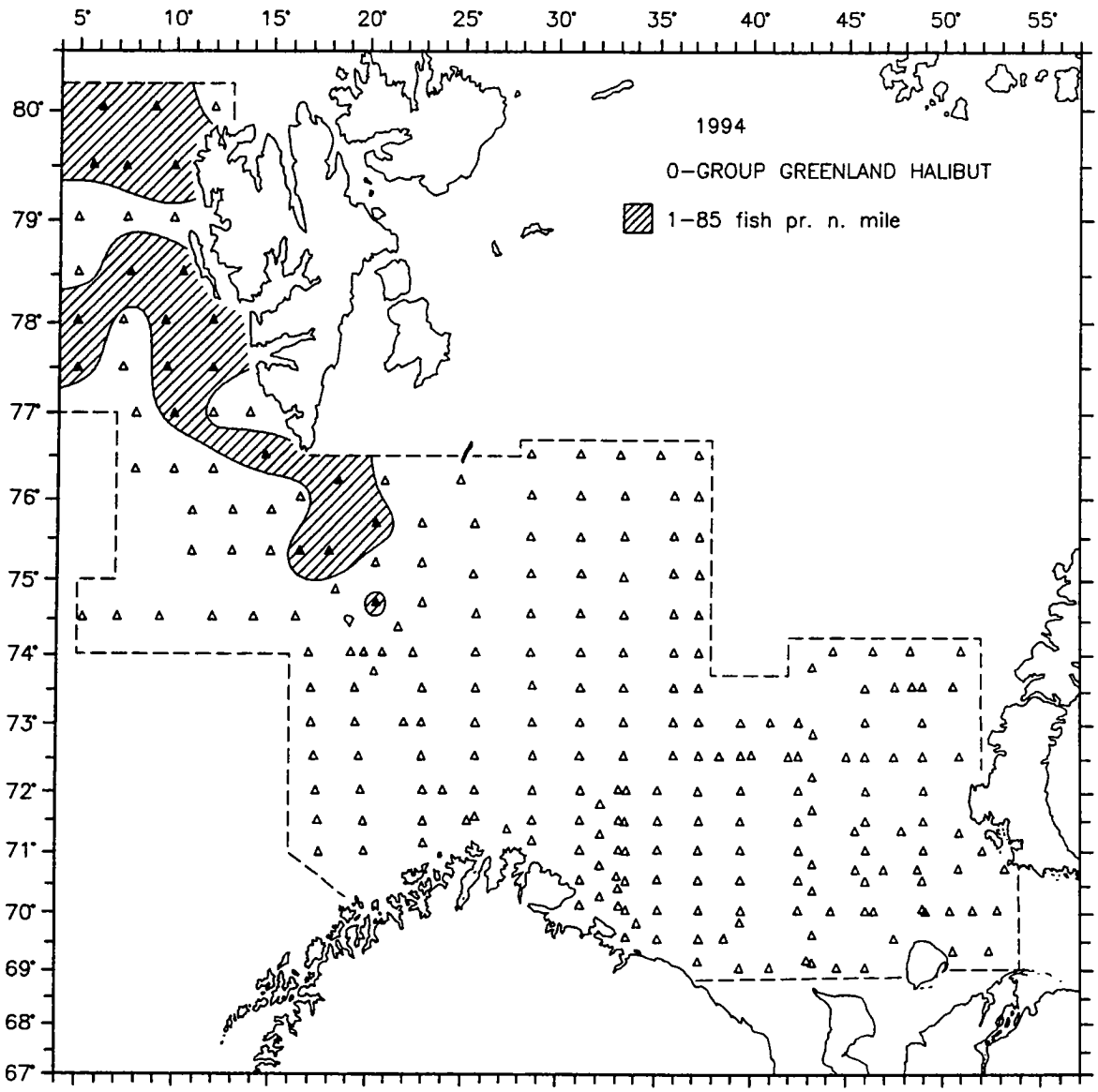

Fig. 22. Distribution of 0-group Greenland halibut.

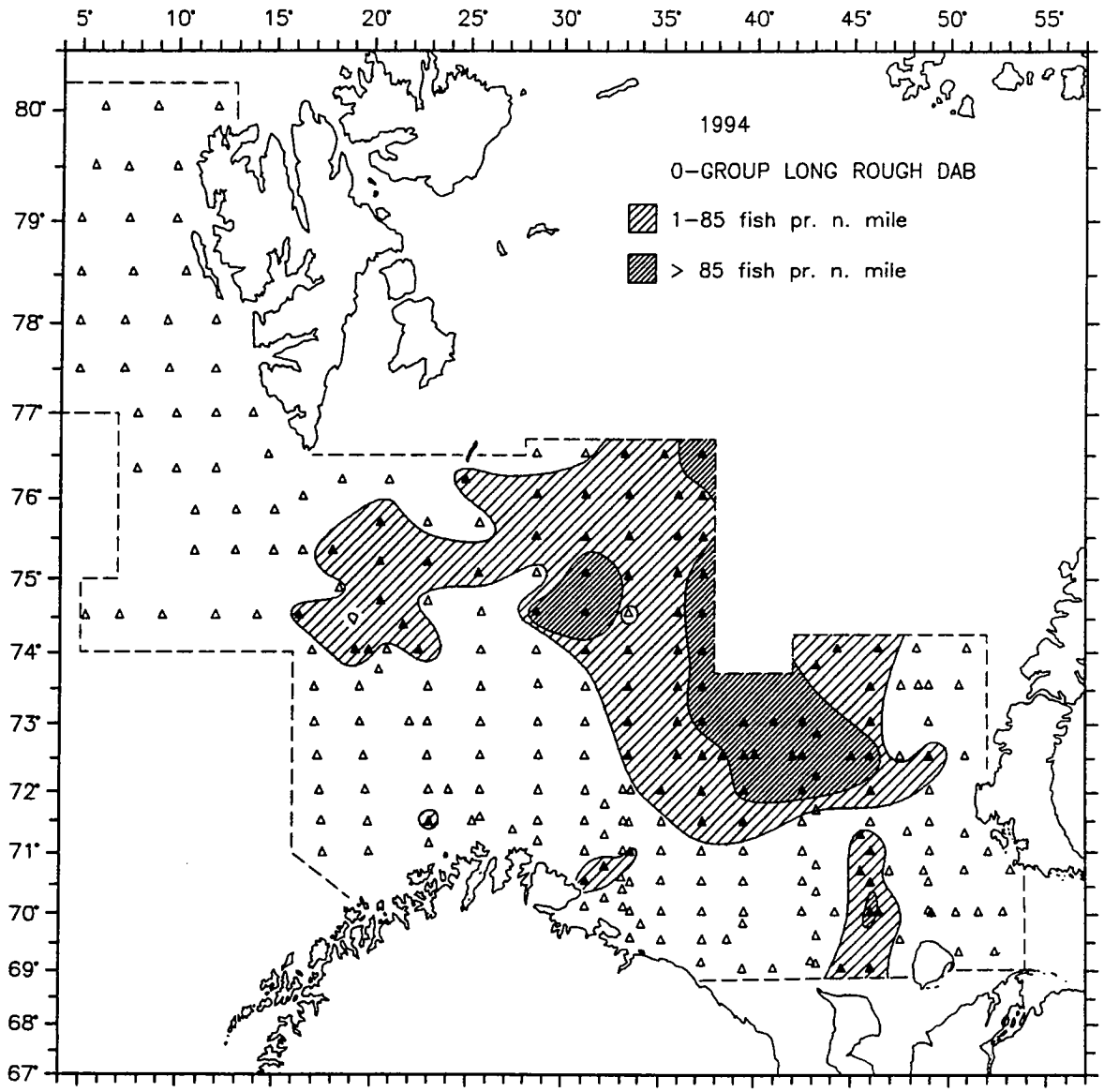

Fig. 23. Distribution of 0-group long rough dab..

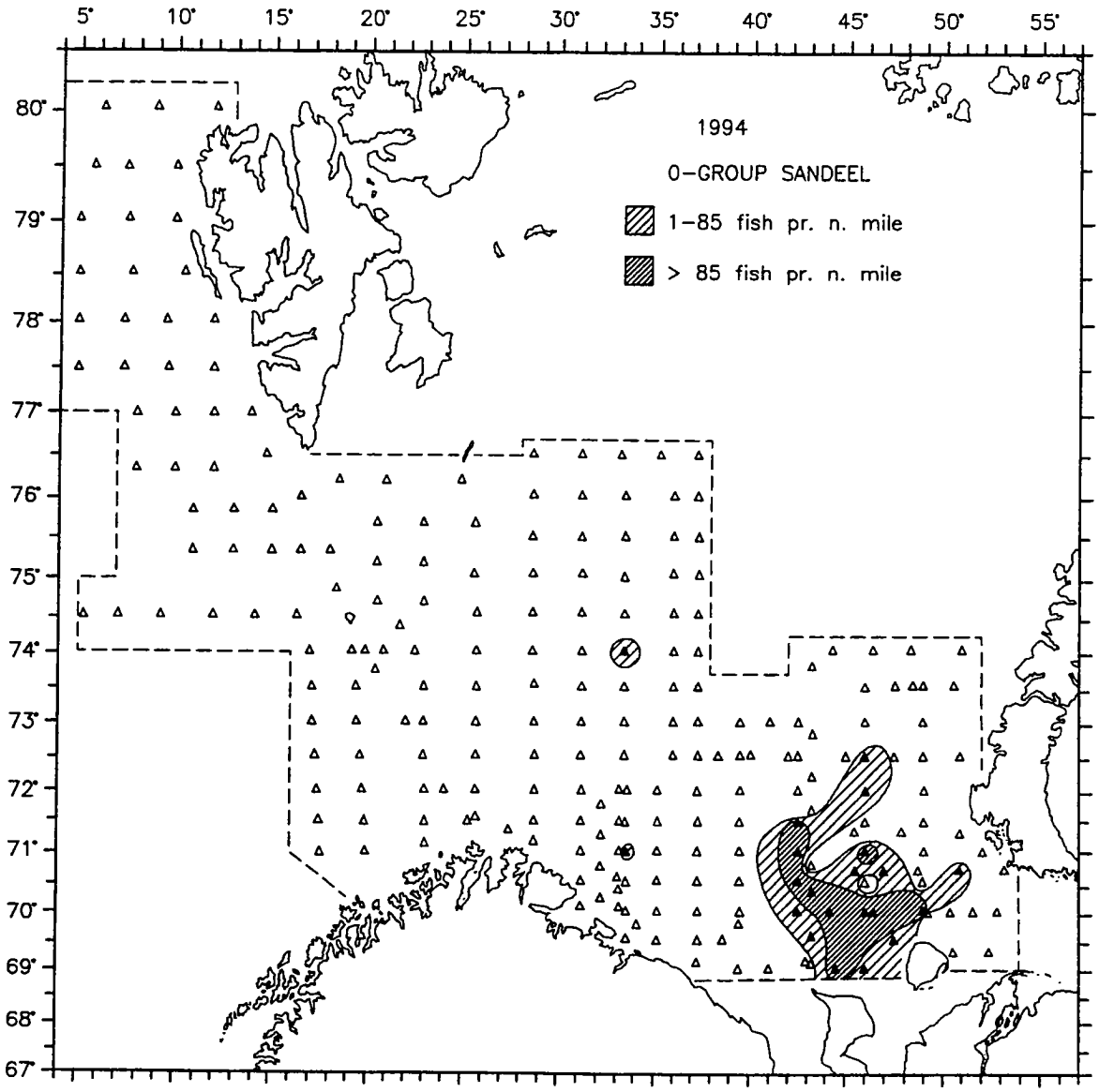

Fig. 24. Distribution of 0-group sandeel.

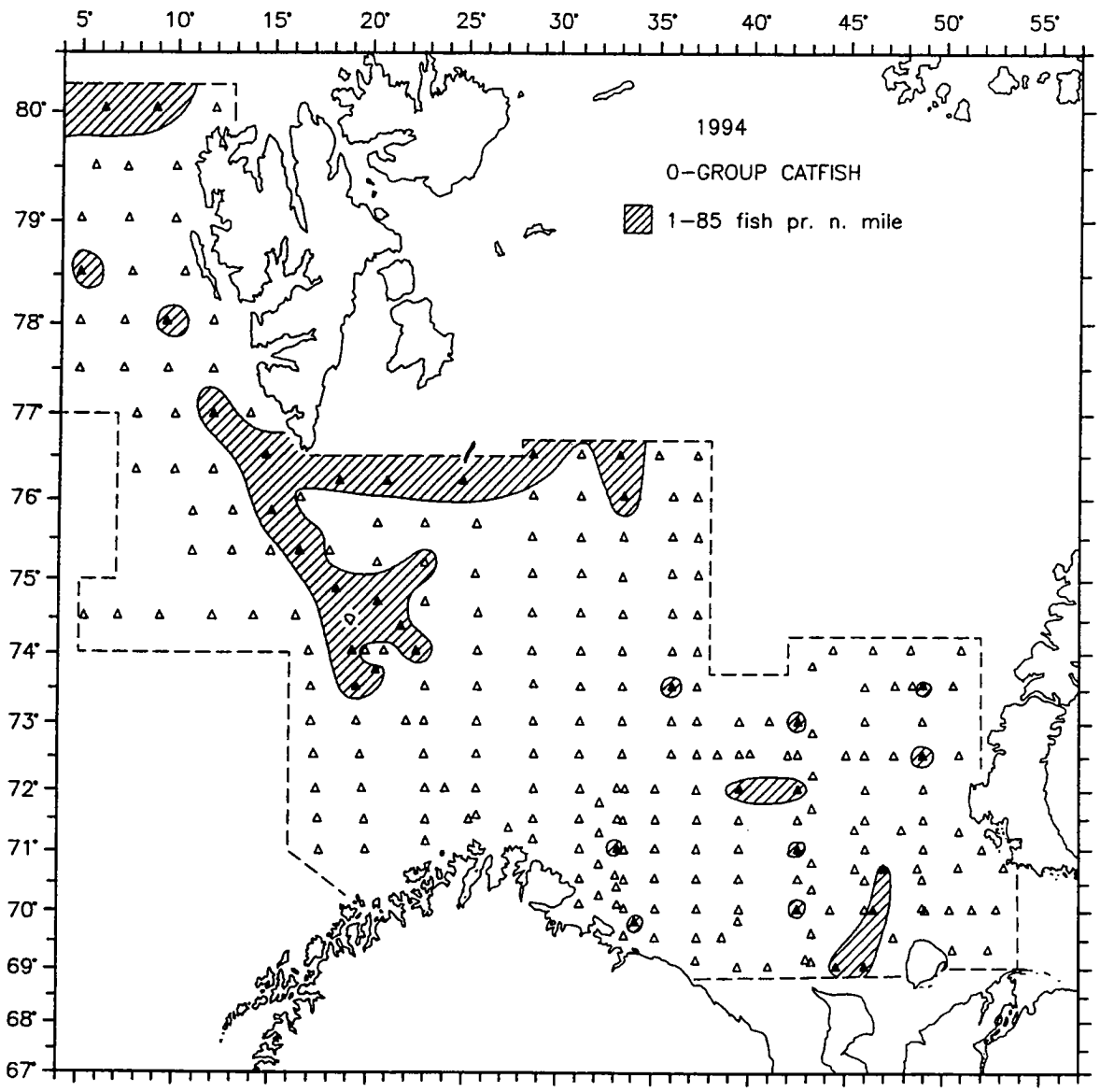

Fig. 25. Distribution of 0-group catfish.

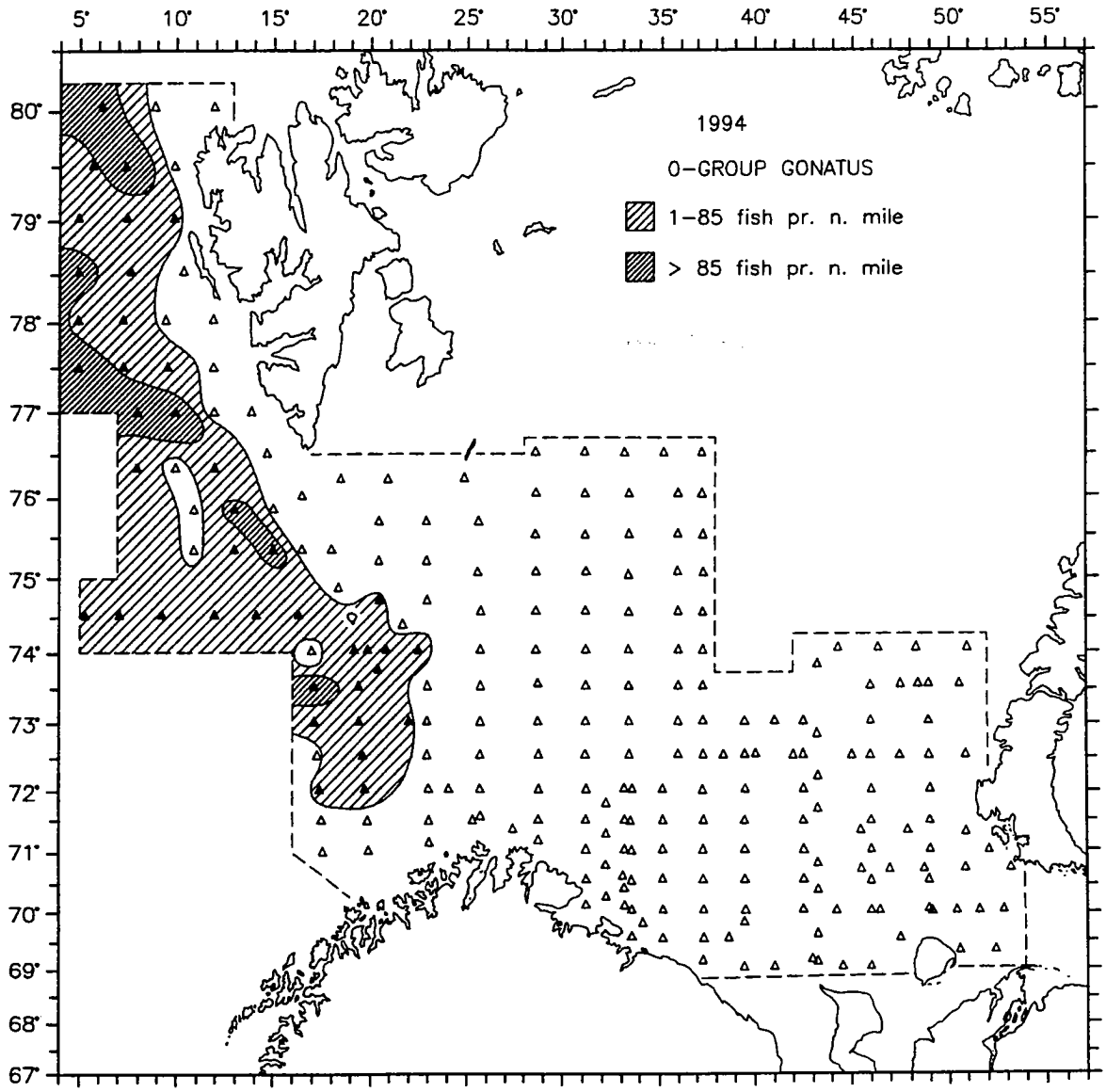

Fig. 26. Distribution of 0-group Gonatus fabricii.

APPENDIX

Research vessel	Participants
"G.O. Sars"	V.Anthonypillai, H.Hammer, J.Hamre, A.Hylen, L.Kalvenes, H.Larsen, E.Molvær, A.Raknes, K.Strømsnes, A.Slotte, N.Ushakov (PINRO).
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"Johan Hjort"	J.de Lange, P.Fossum, H.Græsdal, S.A.Iversen, E.Meland, O.Nakken, Ø.Nævdal, R.Pedersen, A.Romslo, U.Schauer (~~Tyskl.~~).(Germany).
"Professor Marty"	V.Chixhikov, M.Ermolchev, A.Nikiforov, D.Prozorkevich, S.Ratushnyy, E.Shamray, E.Tereshchenko, A.Vakulenko, N.Vovchuk.
"Fridtjof Nansen"	A.Badigin, S.Boichuk, S.Gotovtsev, T.Sergeeva, V.Tataurov, S.Ustinov, T.Yusupov.
"Atlantida"	I.Dolgolenko, T.Gavrilik, V.Ignashkin, V.Mamylov, A.Pedchenko, A.Sagaydachny, V.Tretjak, V.Zhuk.