

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	Survey period	Research Institute
Norway	"Johan Hjort"	16.08 – 08.09	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	17.08 – 07.09	"
Russia	"Professor Marty"	22.08 – 08.09	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
Russia	"Pinro"	23.08-06.09	"

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 was 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 towings of 0.5 nautical miles in each of 3 depths with the headline of the trawl located at 0, 20 and 40 m. 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 in 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, 200 m 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 0-200 m 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 50-100 m 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 (0-200 m) 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 year-class 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 year-class 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 year-class (2.09) is the fifth highest in the time-series, above that of 1983, and the year-class 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 year-class 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 year-class 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 year-class 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 year-class 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 year-class 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 year-class 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

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)

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
Average 1965-1993	7.3	3.8	4.7	4.2	3.2	5.7	4.6

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

Year	Cod	Haddock	Polar cod		Redfish	Greenland 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		472	9	72
1978	106	61	107		460	35	76
1979	94	69	23		980	22	69
1980	49	54	79		651	12	108
1981	65	30	149		861	38	95
1982	114	90	14		694	17	150
1983	386	184	48		851	16	80
1984	486	255	115		732	40	70
1985	742	156	60		795	36	86
1986	434	160	111		702	55	755
1987	102	72	17		631	41	174
1988	133	86	144		949	8	72
1989	202	112	206		698	5	92
1990	465	227	144		670	2	35
1991	766	472	90		200	1	28
1992	1159	313	195		150	3	32
1993	910	240	171		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	1.7.0	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	Herring	Capelin	Cod	Haddock	Polar cod		Redfish	Greenland halibut	L.R.D.	Sandeel
					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		10.0
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	48-55	34-18	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

Appendix

Research vessel	Participants
"Professor Marty"	S. Boychuk, V. Donetskov, Yu. Garbut, A. Gordov, S. Ratushny, E. Shamray, V. Tretyak
"Pinro"	N. Chebotok, P. Duzin, E. Gusev, S. Hardin, A. Krysov, F. Minyazov, G. Polyakin
"Johan Hjort"	B. Bergflødt, I. Fjellstad, M. Fonn, A. Fotland, H. Græsdal, H. Larsen, K. Lauvås, S. Mehl, M. Mjanger, A. Næss, A. Romslo, L. Solbakken, R. Toresen, B. Kvinge
"G.O. Sars"	M. Dahl, E. Holm, A. Hysten, S. Iversen, L. Kalvenes, J. de Lange, M. Møgster, Ø. Nævdal, V. Ozhigin (PINRO), R. Pettersen, A. Raknes, N. Ushakov (PINRO), E. Øvretveit

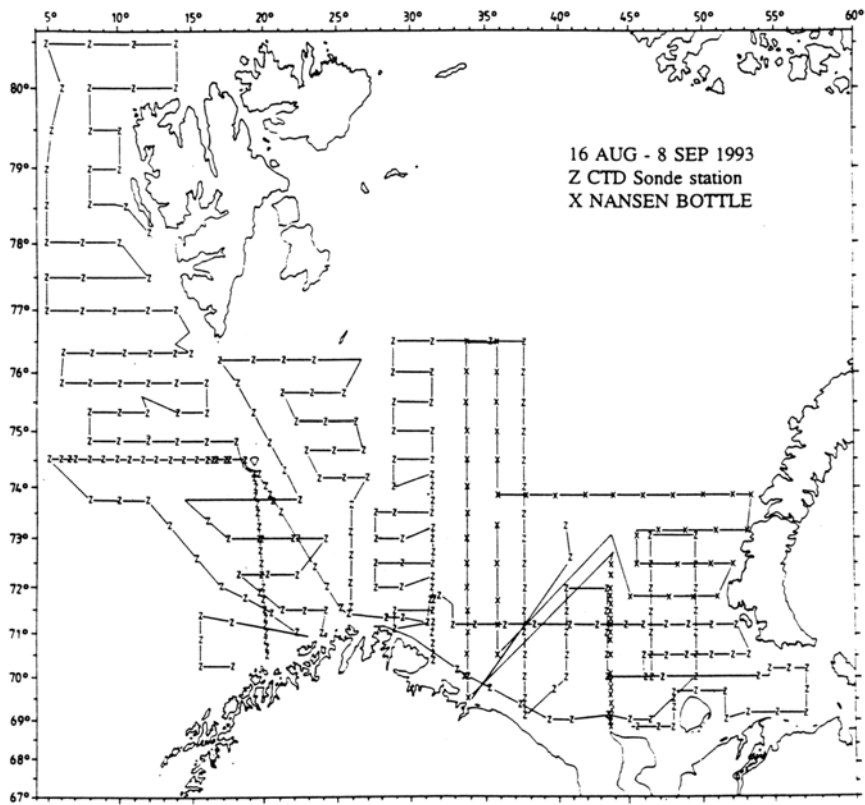


Fig. 1. Survey tracks and hydrographic stations

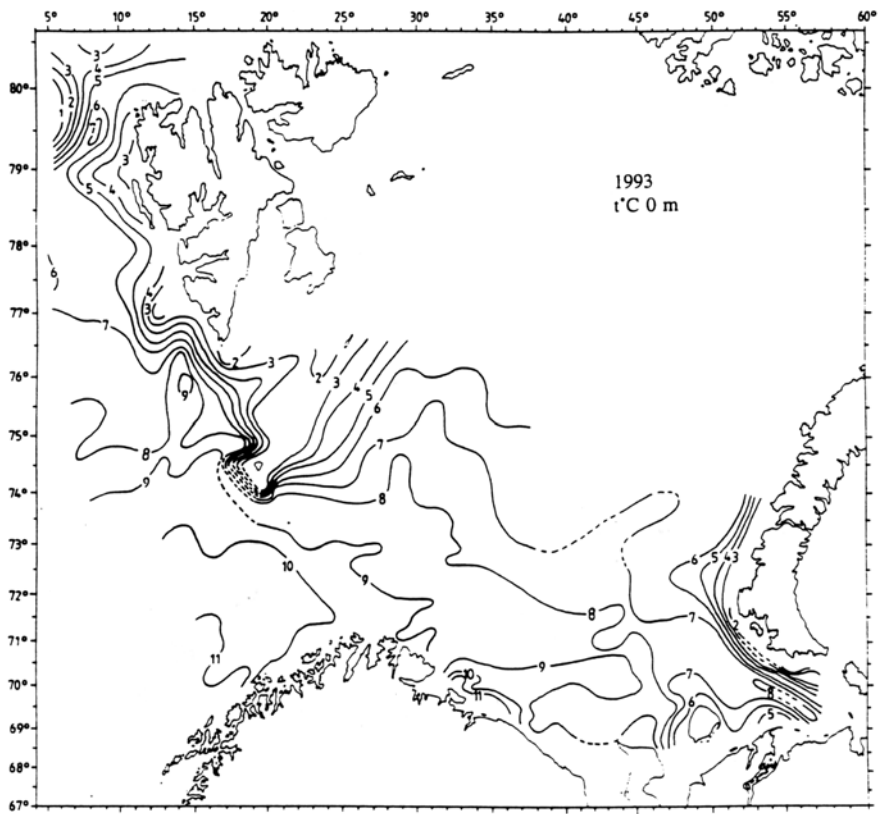


Fig. 2. Isotherms at 0 m

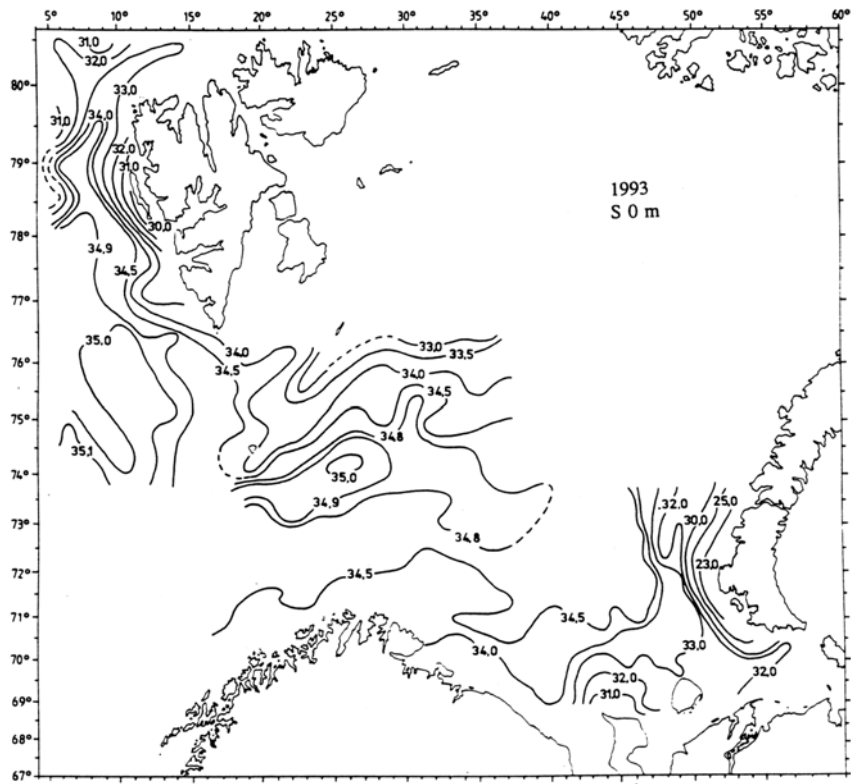


Fig. 3. Isohalines at 0 m

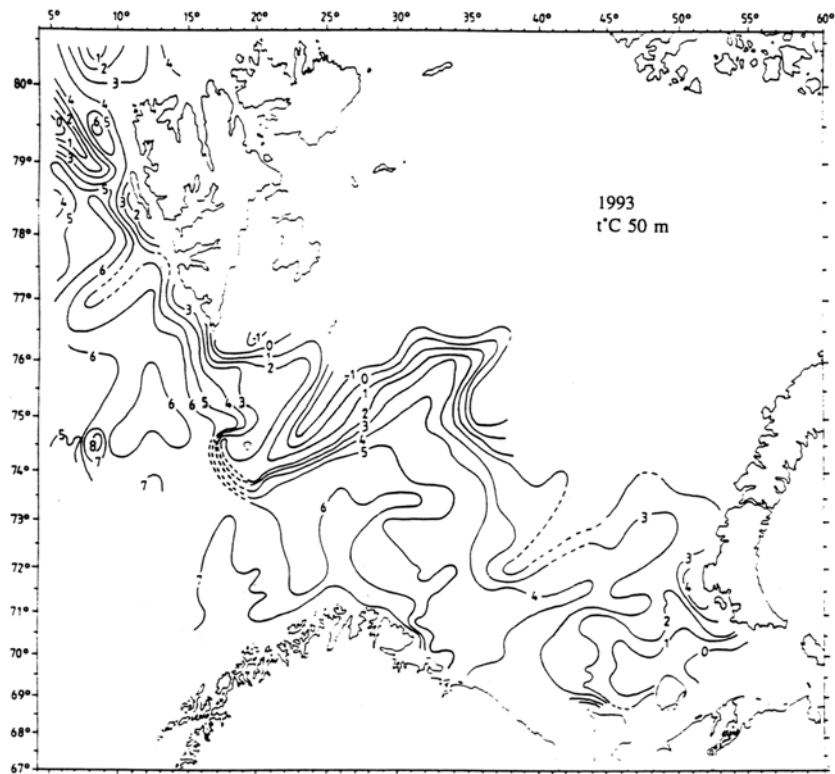


Fig. 4. Isotherms at 50 m

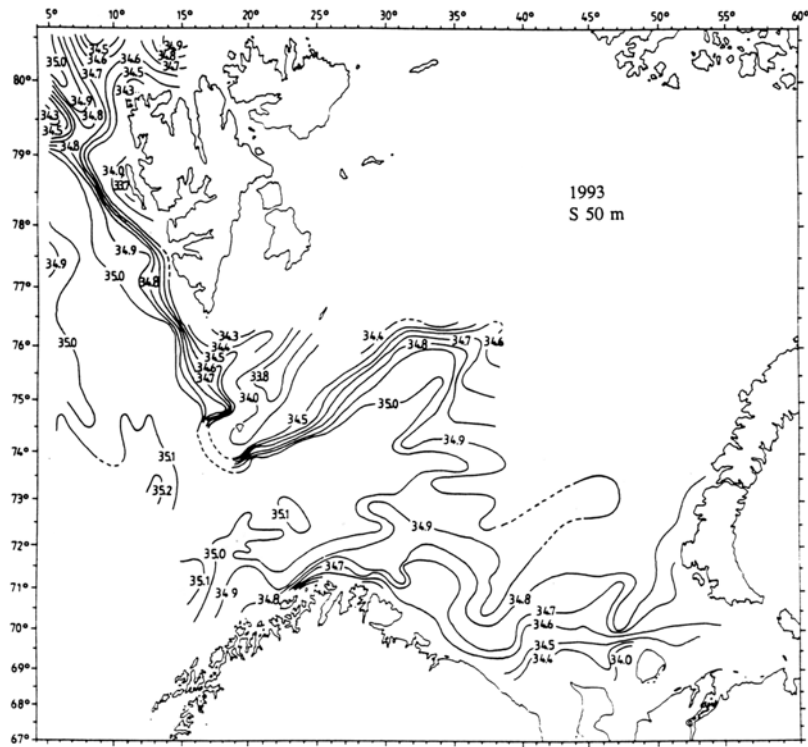


Fig. 5. Isohalines at 50 m

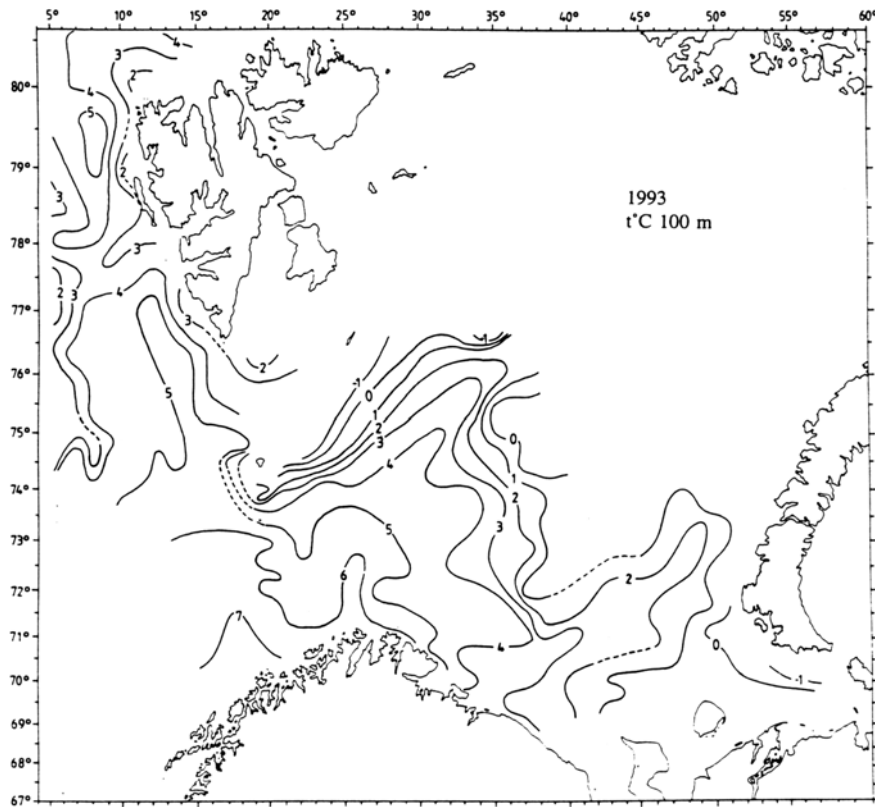


Fig. 6. Isotherms at 100 m

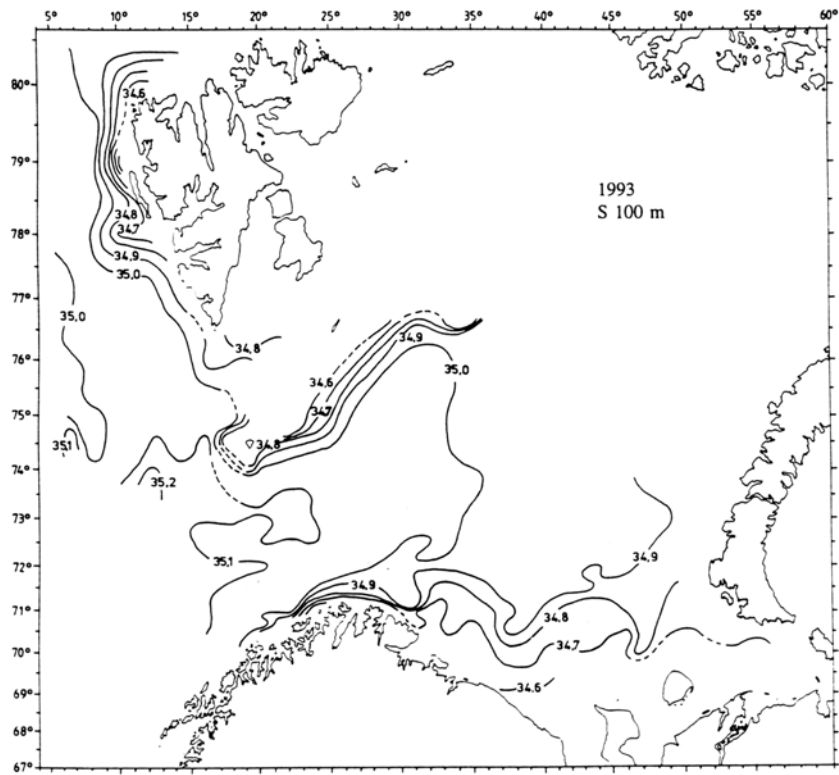


Fig. 7. Isohalines at 100 m

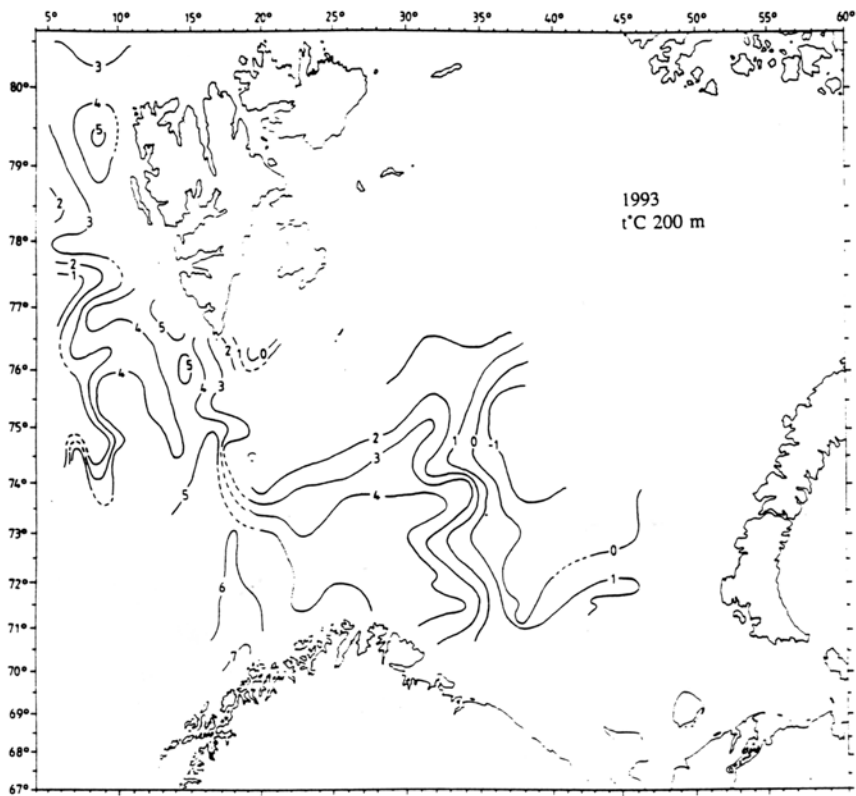


Fig. 8. Isotherms 200 m.

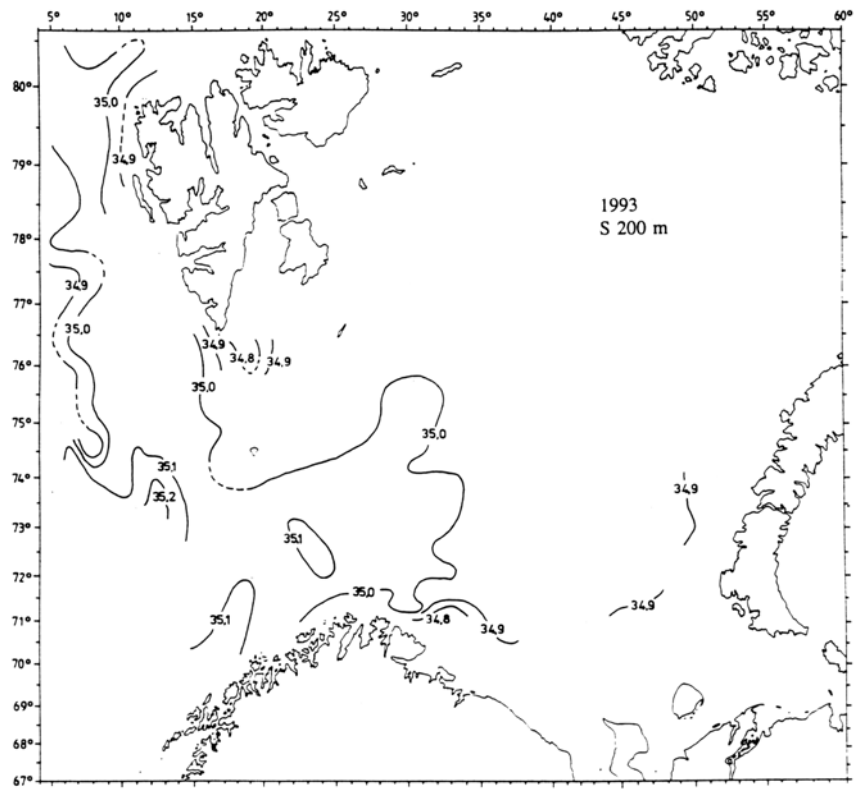


Fig. 9. Isohalines at 200 m

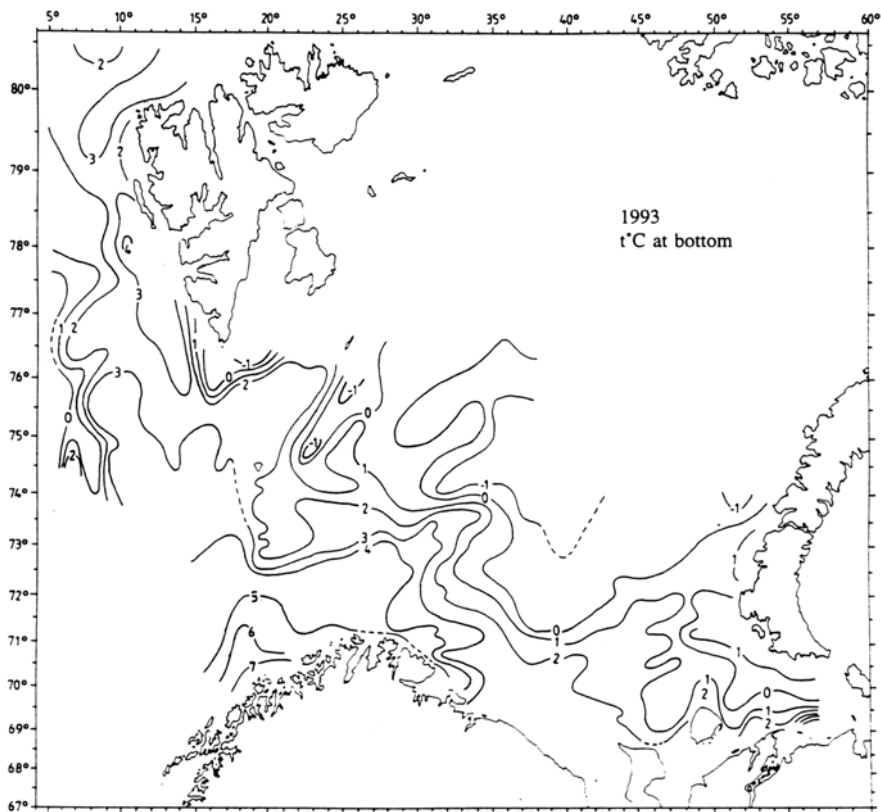


Fig. 10. Isotherms at the bottom

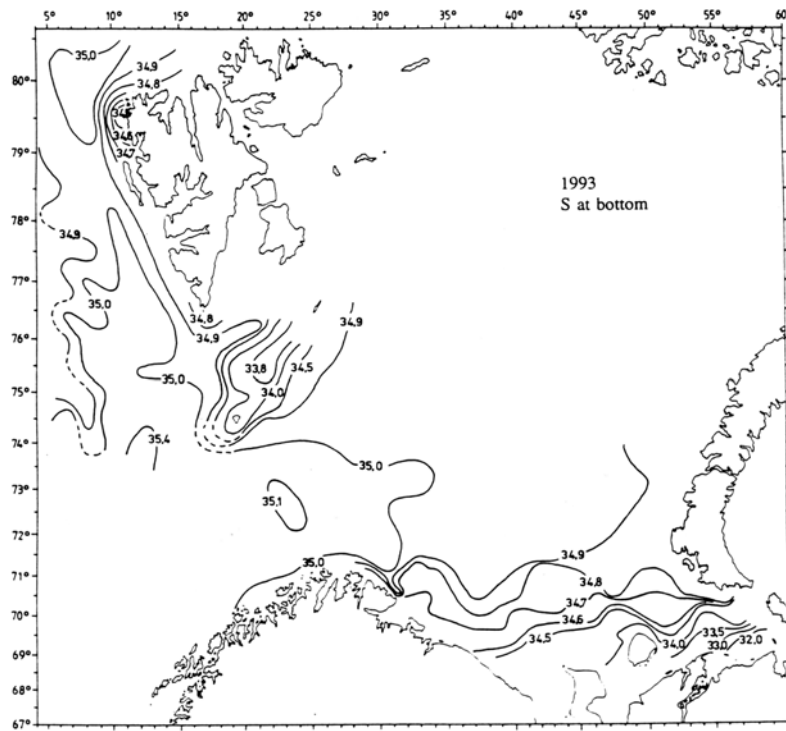


Fig. 11. Isohalines at the bottom

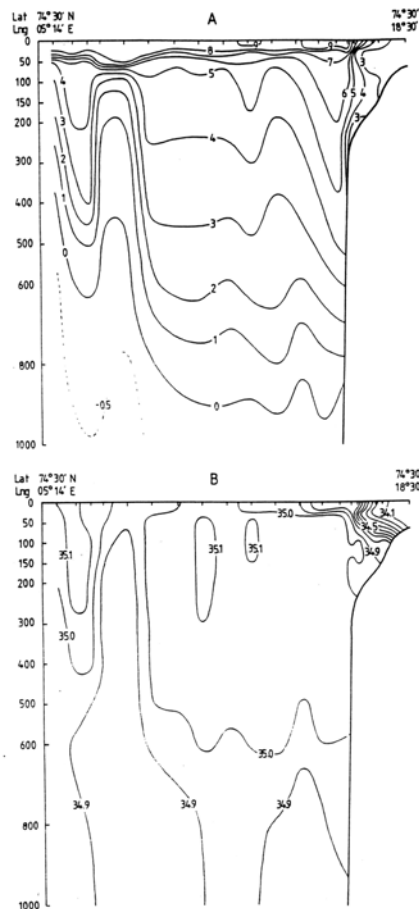


Fig. 12. Hydrographic section Bear Island-West. Temperature (A) and salinity (B)

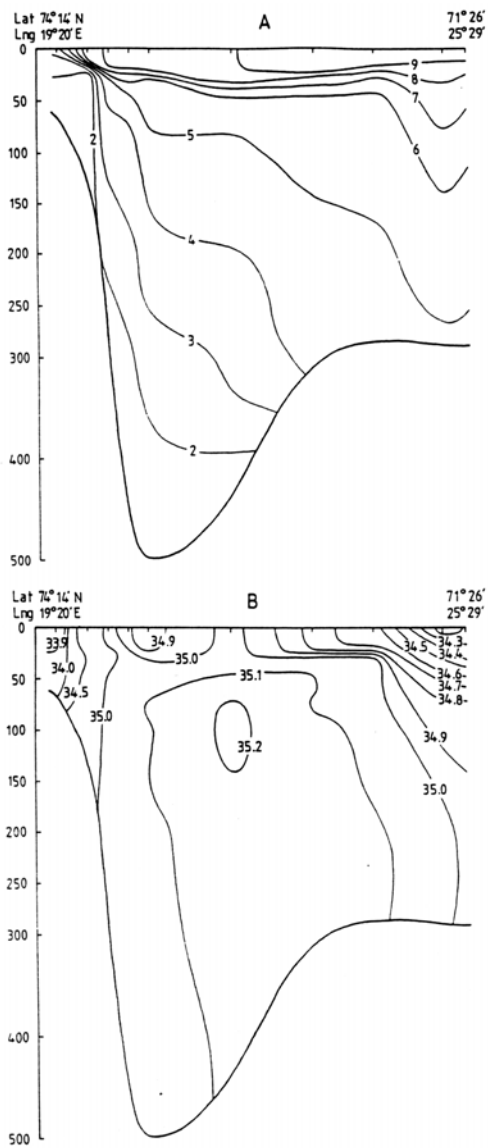


Fig. 13. Hydrographic section North Cape-Bear Island. Temperature (A) and salinity (B)

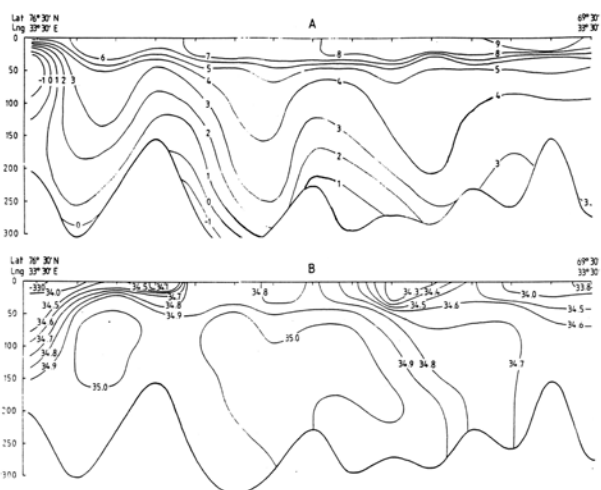


Fig. 14. Hydrographic section along the Kola meridian. Temperature (A) and salinity (B)

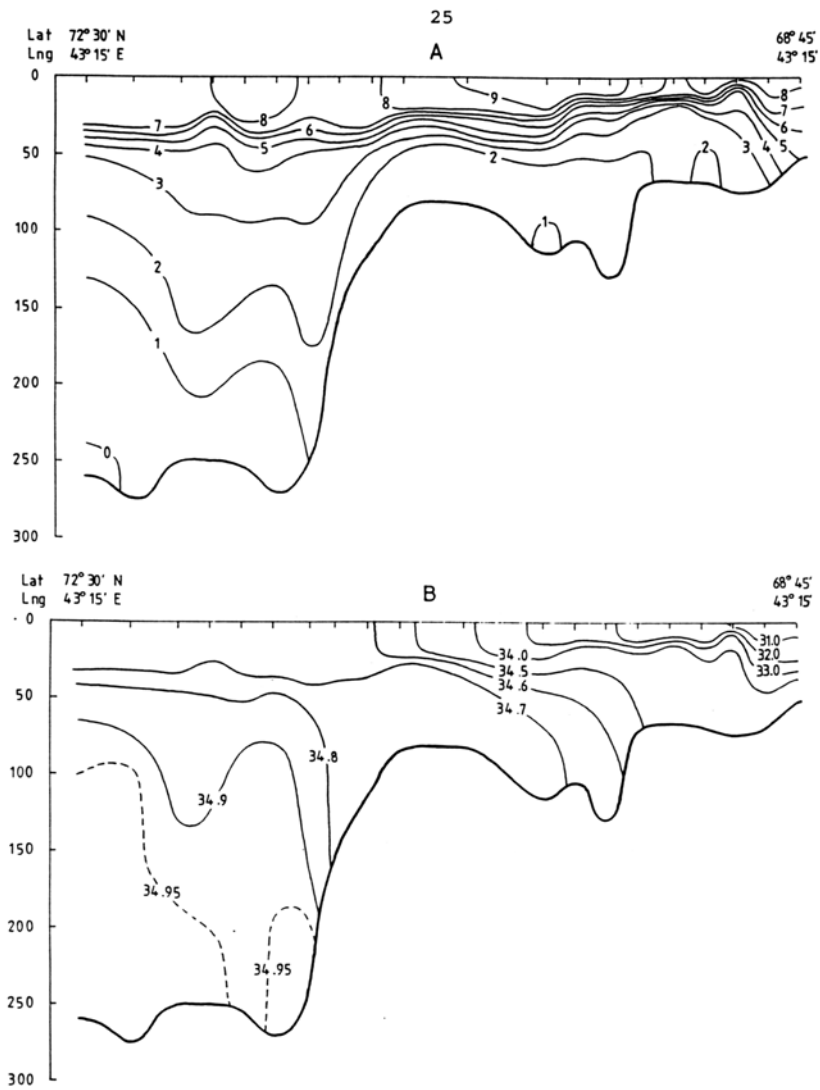


Fig. 15. Hydrographic section Cape Kanin-North. Temperature (A) and salinity (B)

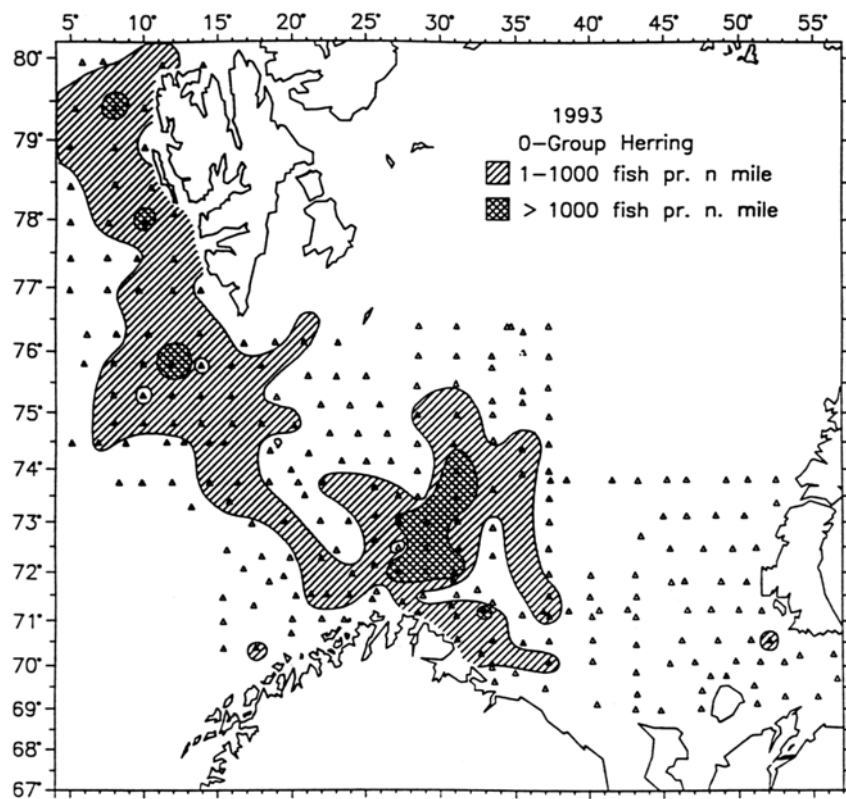


Fig. 16. Distribution of 0-group herring

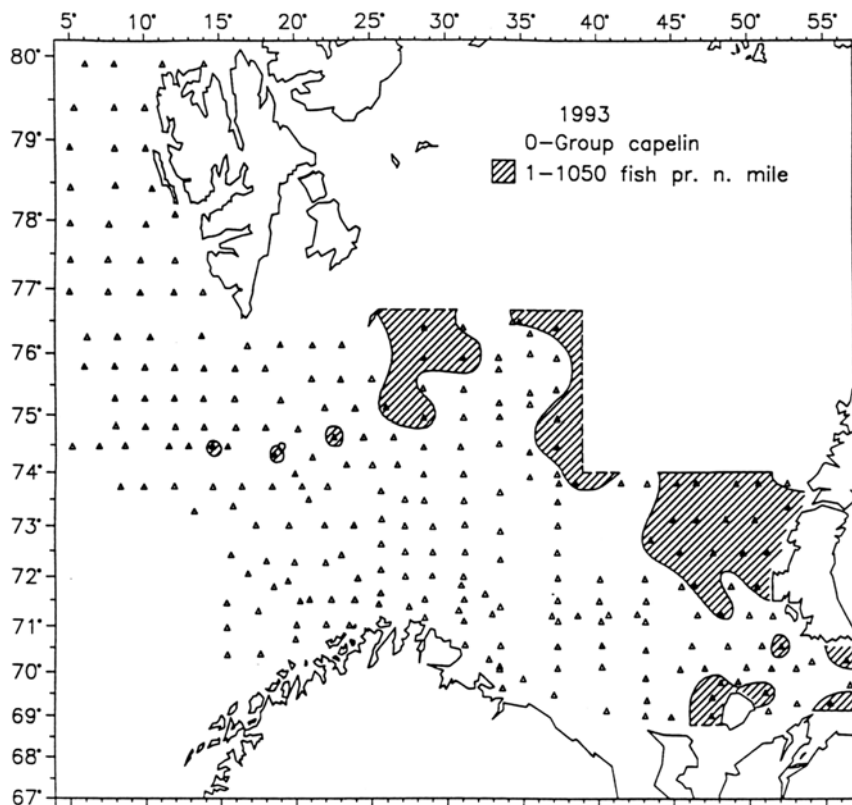


Fig. 17. Distribution of 0-group capelin

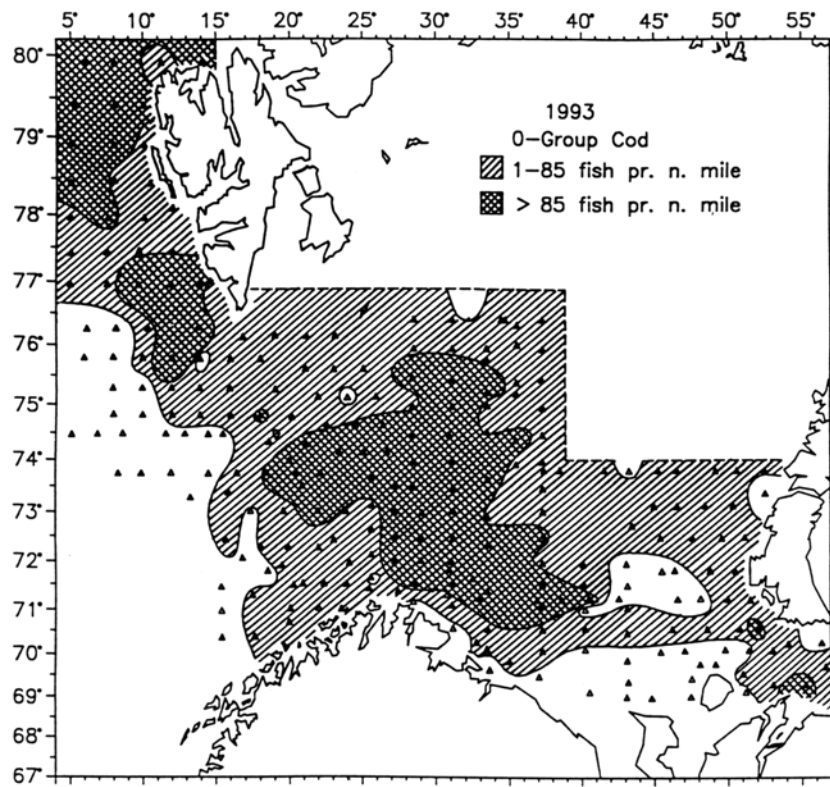


Fig. 18. Distribution of 0-group cod

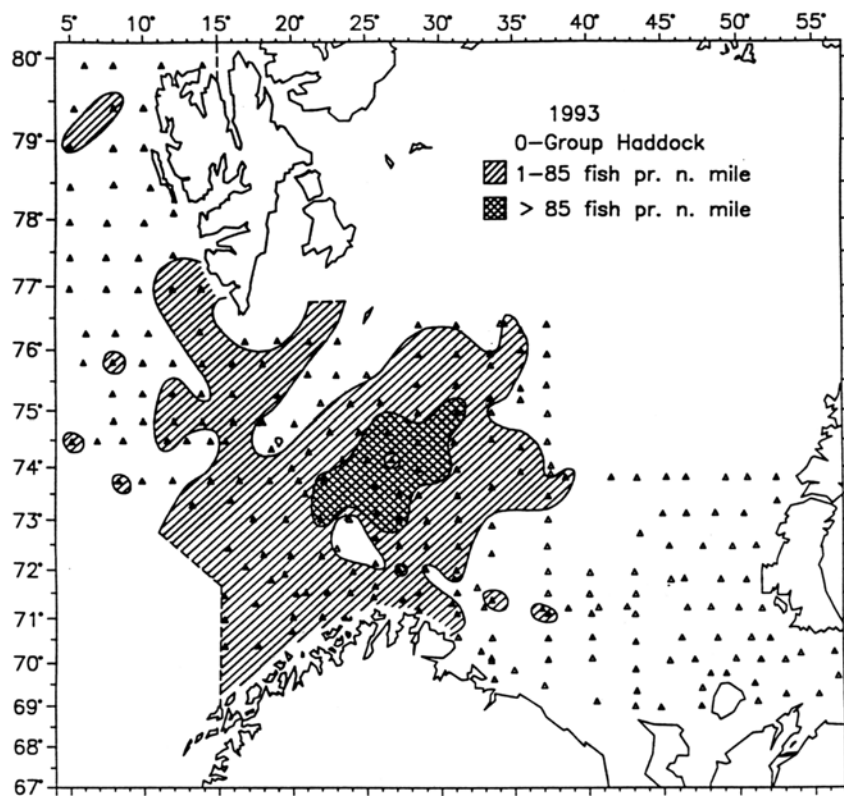


Fig. 19. Distribution of 0-group haddock

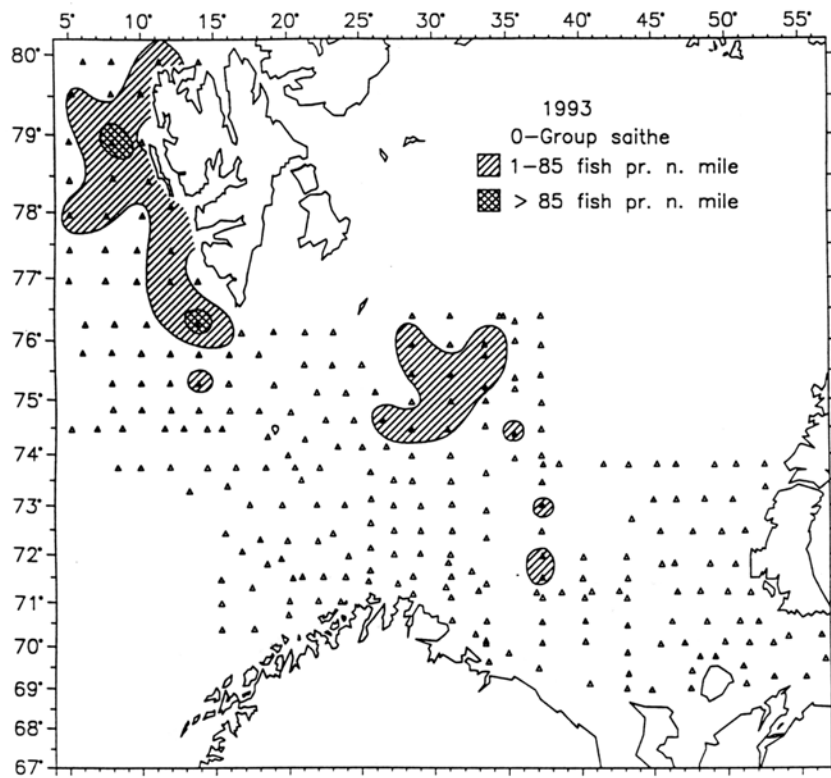


Fig. 20. Distribution of 0-group saithe

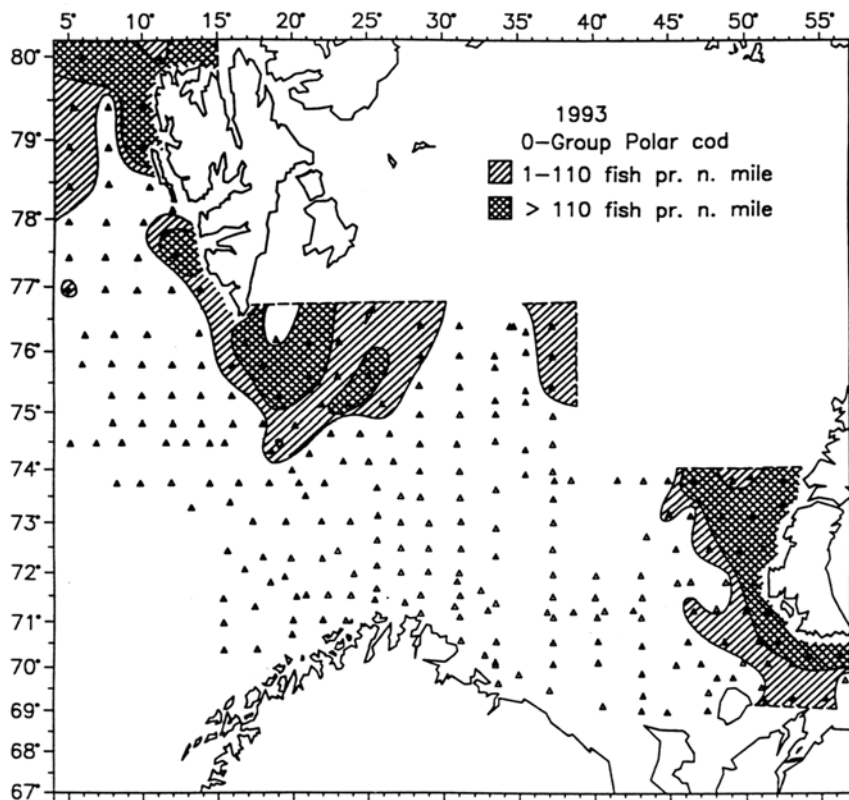


Fig. 21. Distribution of 0-group polar cod

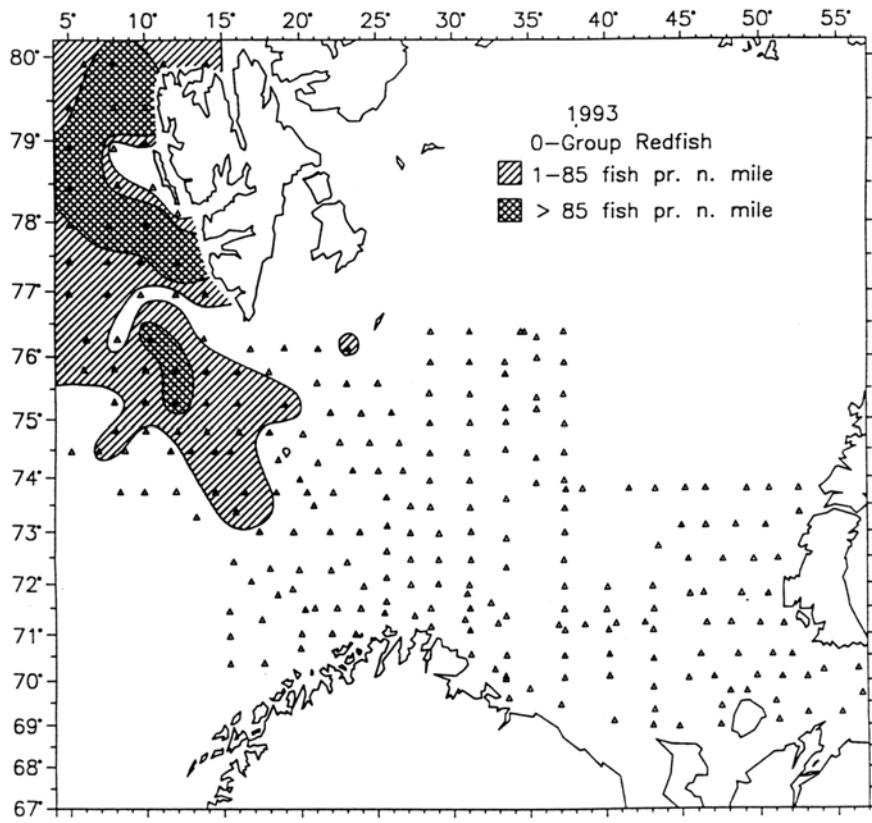


Fig. 22. Distribution of 0-group redfish

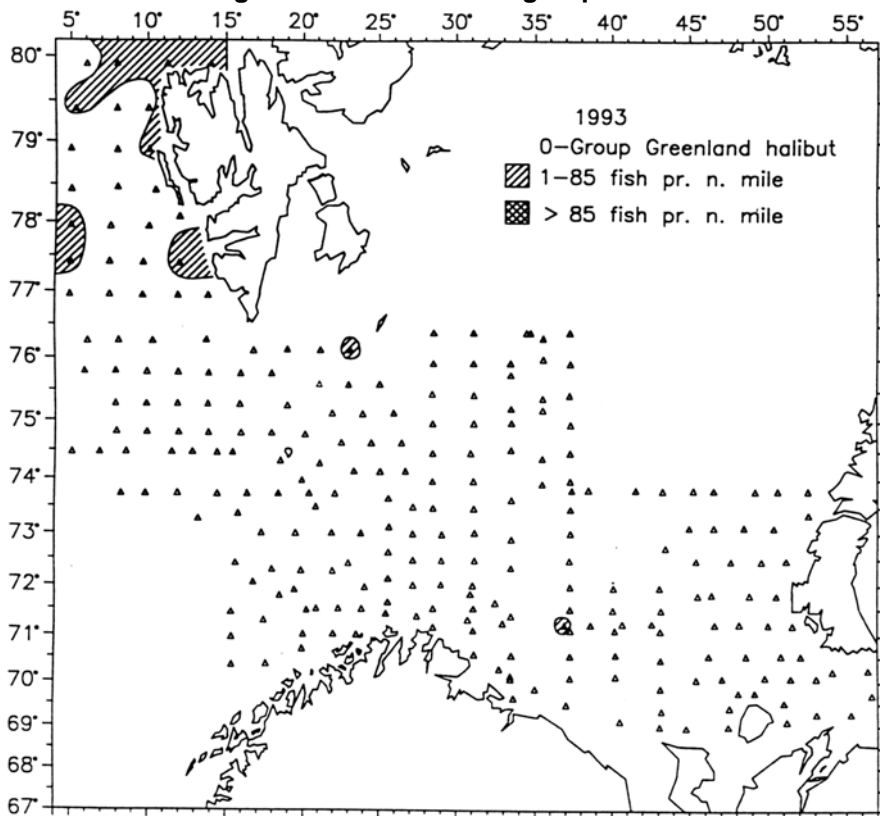


Fig. 23. Distribution of 0-group Greenland halibut

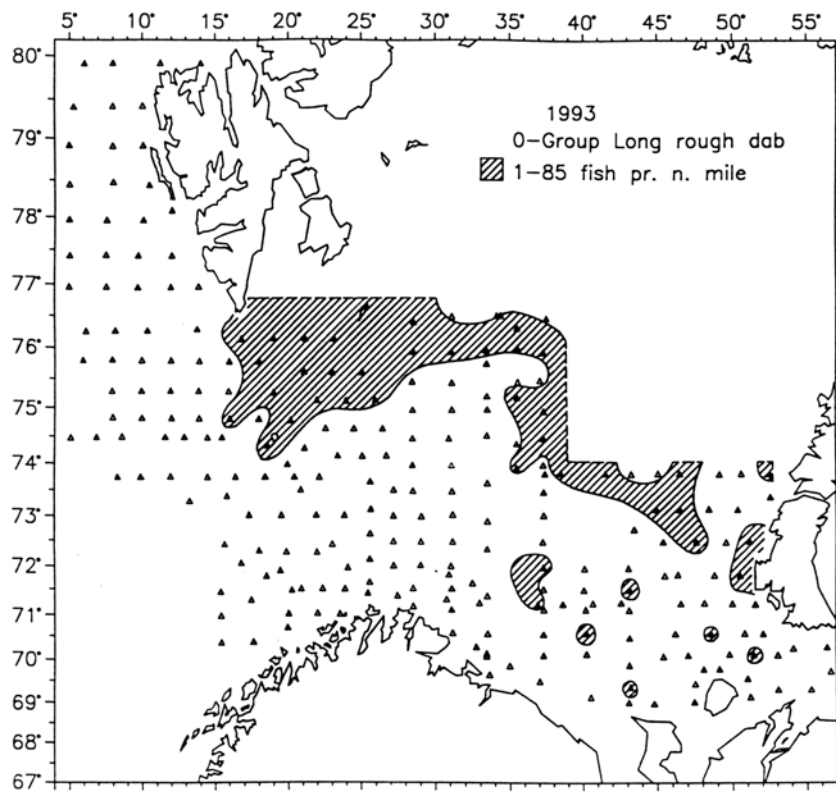


Fig. 24. Distribution of 0-group long rough dab

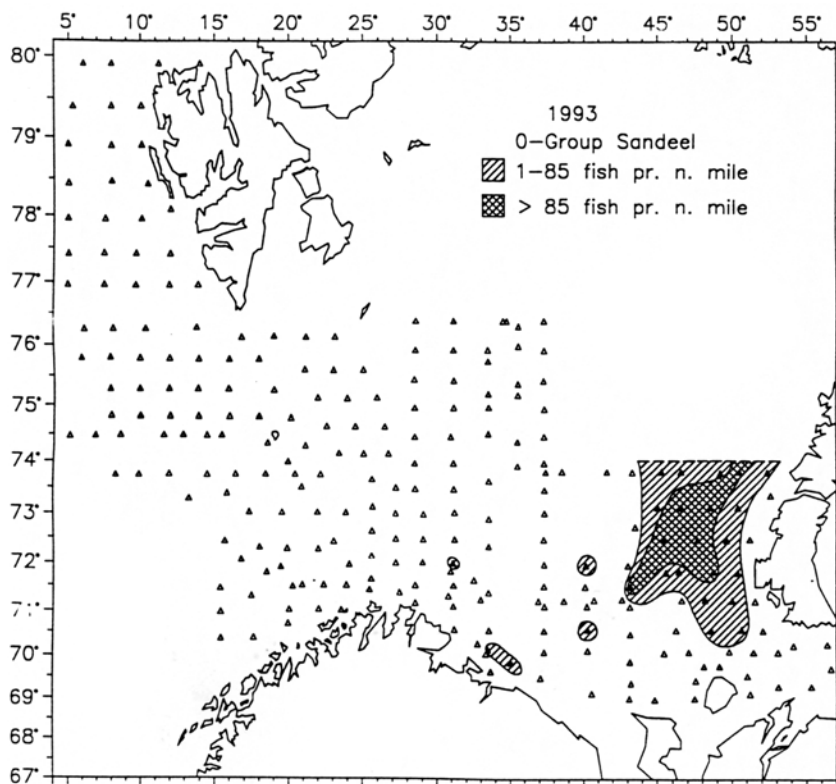


Fig. 25. Distribution of 0-group sandeel

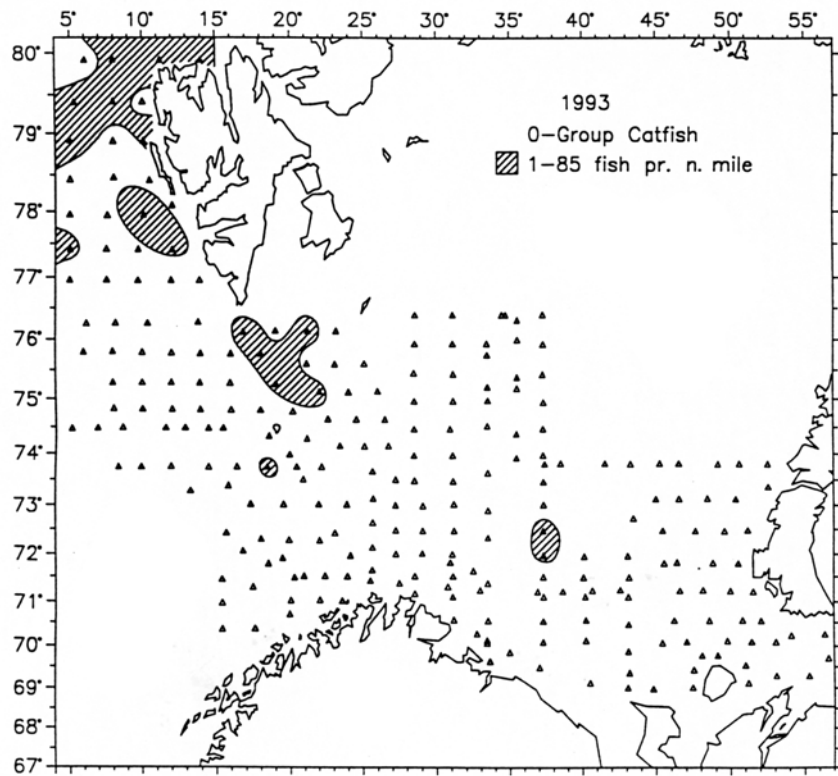


Fig. 26. Distribution of 0-group catfish

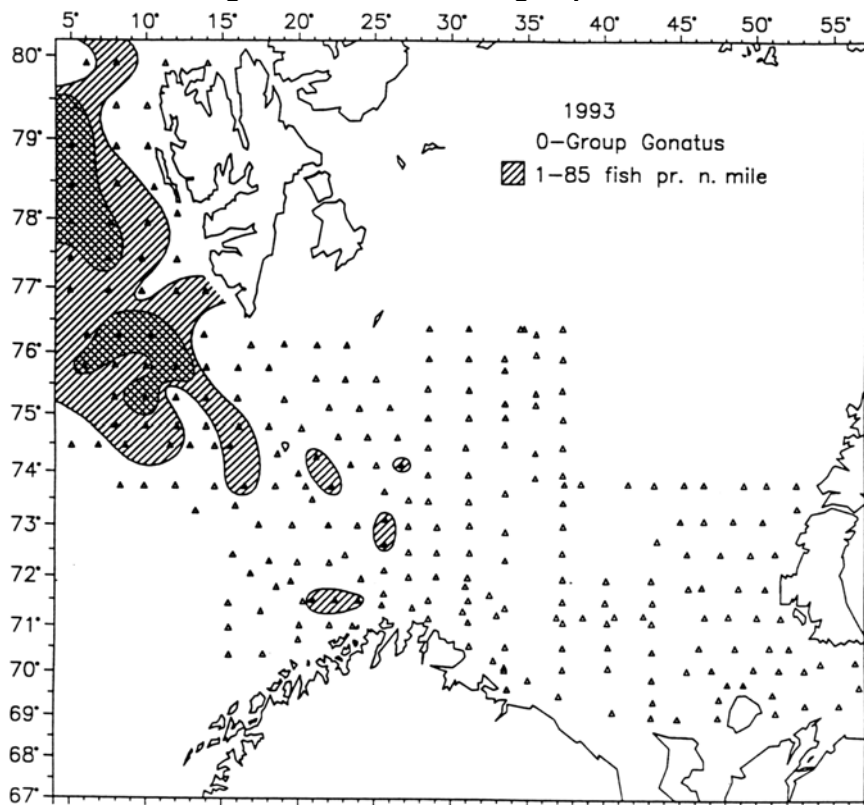


Fig. 27. Distribution of 0-group Gonatus fabricii

Preliminary report
of the international 0-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 17 August-8 September 1994 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey period	Research Institute
Norway	"Johan Hjort"	17.08 - 06.09	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	20.08 - 07.09	"
Russia	"Professor Marty"	02.09 - 08.09	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
Russia	"Atlantida"	24.08 - 08.09	"
Russia	"Fridtjof Nansen"	27.08 - 08.09	"

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

Preliminary analysis of the survey data was made 4-6 October in Hammerfest. 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.

Hydrography

Observations were made along all the survey trace with 5 to 40 nautical miles between stations. Horizontal distributions of temperatures and salinities are shown for 0, 50, 100, 200 m and bottom (Figs. 2-11). Figs. 12-15 show the temperature and salinity conditions along the Bear Iceland-West, Bear Iceland-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, 1994 is "warm year" in succession, was observed since 1989. This year the mean sea temperatures from 0-200 m in the Barents Sea were 0.1-0.6 °C above the long term average (1965-1994). Compared to 1993 the temperature differences varied from minus 0.1 till 0.6 °C. The maximum increase water temperature was recorded on Bear Iceland - North Cape (0-200 m) and Kola (0-50 m) sections. On the East of Barents Sea (Cape Kanin section) water temperatures were 0.2-0.4 °C above long term average and was the same as observed in 1993. In the West Spitsbergen Current (0-200 m) temperature was 0.7 °C above long-term average. However the Atlantic water distribution area was narrow then last year and was associate with decrease on 0.5-1.0 °C upper mixed layer temperature to north 75°00' N. The temperature conditions 1994 were determine by decrease of Atlantic inflow into the area West Spitsbergen and increase into central part of Barents Sea south-eastward Bear Island.

Table 1. Mean water temperature¹ in main parts of standard sections in the Barents Sea and adjacent waters in August-September 1965-1994

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

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

*) Assessed at 07.09.1994

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

Appendix

Research vessel	Participants
"G.O. Sars"	V. Anthonypillai, H. Hammer, J. Hamre, A. Hysten, L. Kalvenes, H. Larsen, E. Molvær, A. Raknes, K. Strømsnes, A. Slatte»N. Ushakov (PINRO)
"Michael Sars"	B.K. Berntsen, T.I. Halland, K. Korsbrekke, T. Mørk, J.E. Nygaard.
"Johan Hjort"	J. de Lange, P. Fossum, H. Græsdal, S.A. Iversen, E. Meland, O. Nakken, Ø. Nævdal, R. Pedeen, A. Romslo, U. Schauer(Tyskl.)
"Professor Marty"	V. Chixhikov, M. Ermolchev, A. Nkiforov, 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

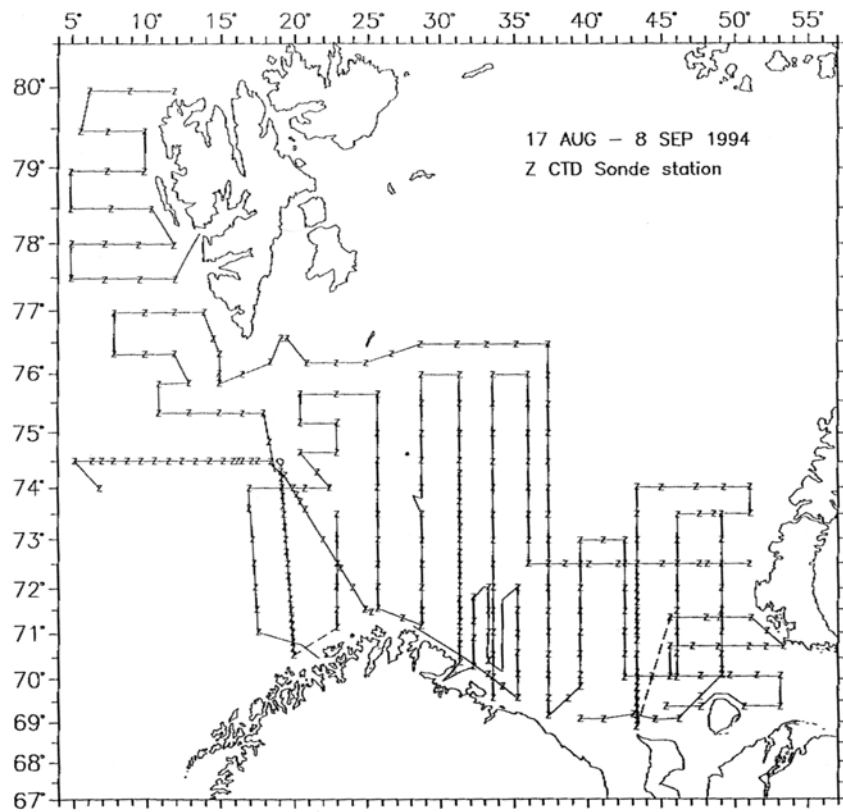


Fig. 1. Survey tracks and hydrographic stations

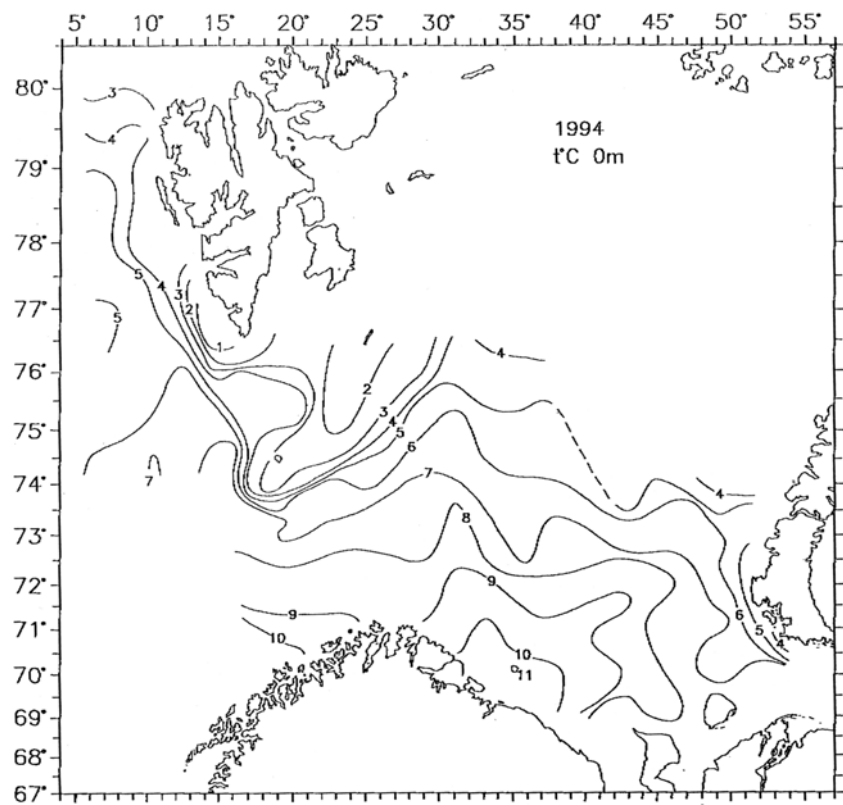


Fig. 2. Isotherms at 0 m

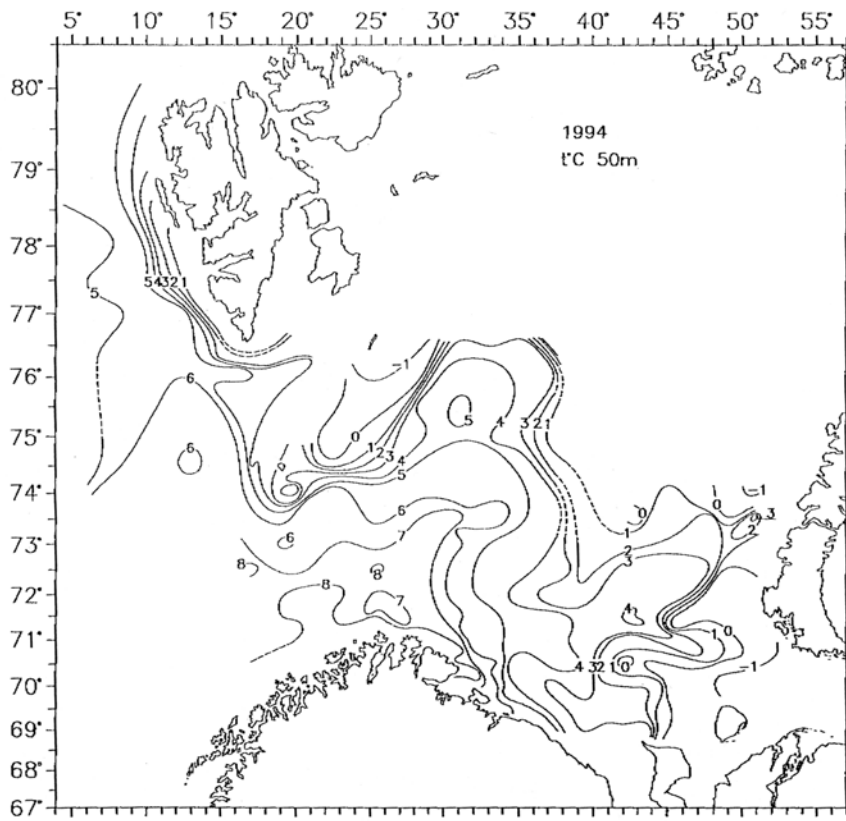


Fig. 3. Isotherms at 50 m

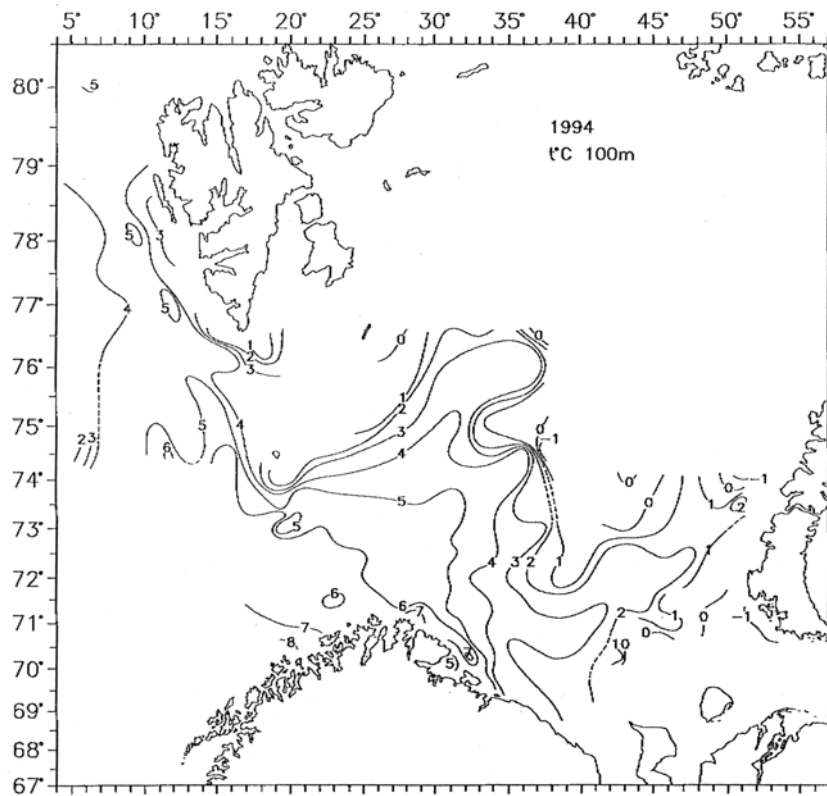


Fig. 4. Isotherms at 100 m

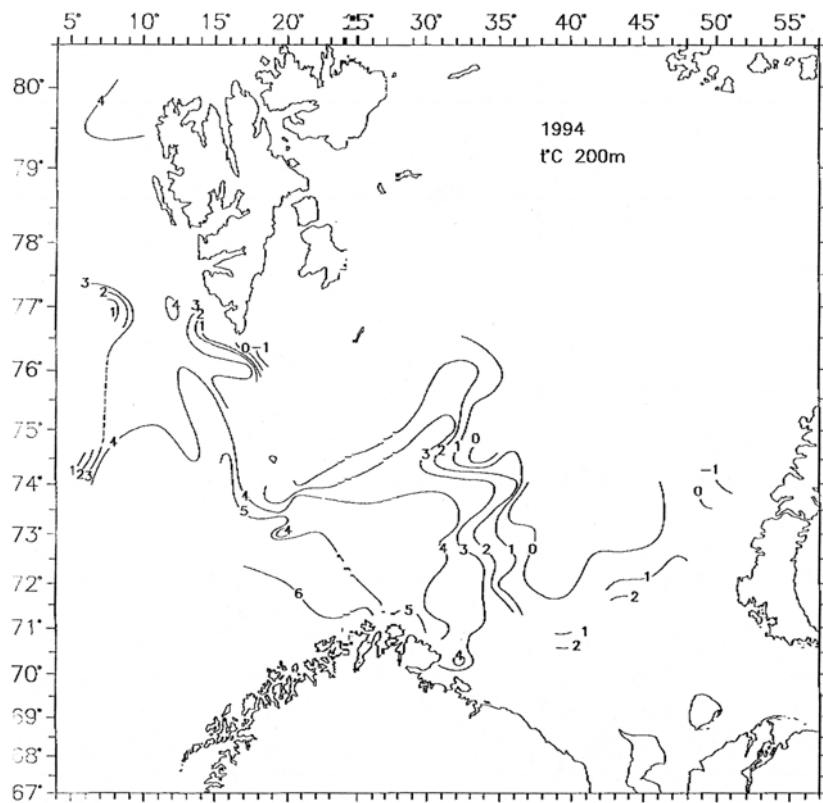


Fig. 5. Isotherms 200 m

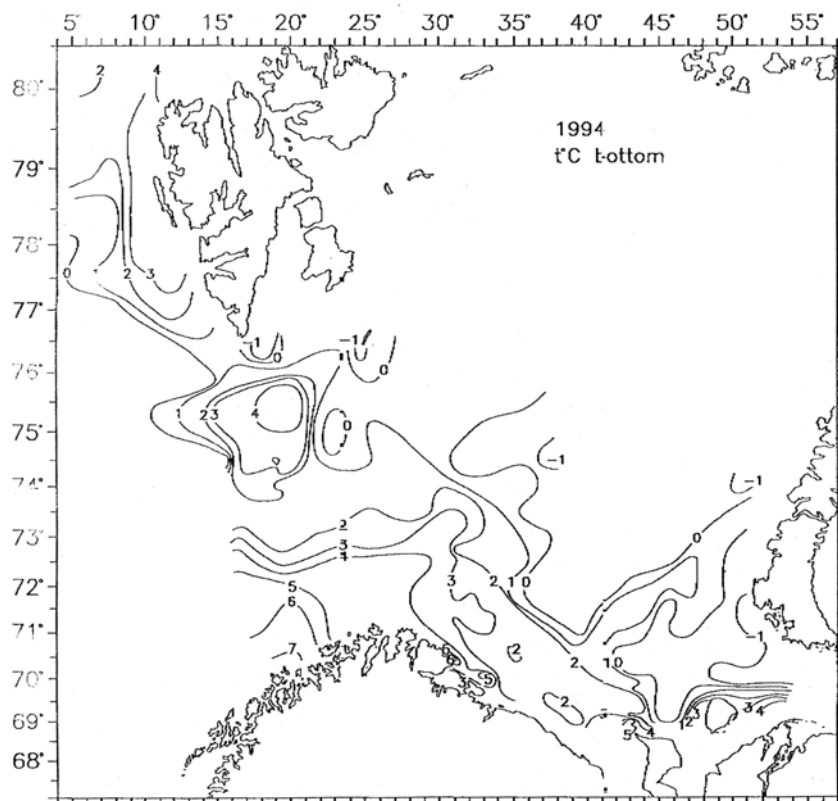


Fig. 6. Isotherms at the bottom

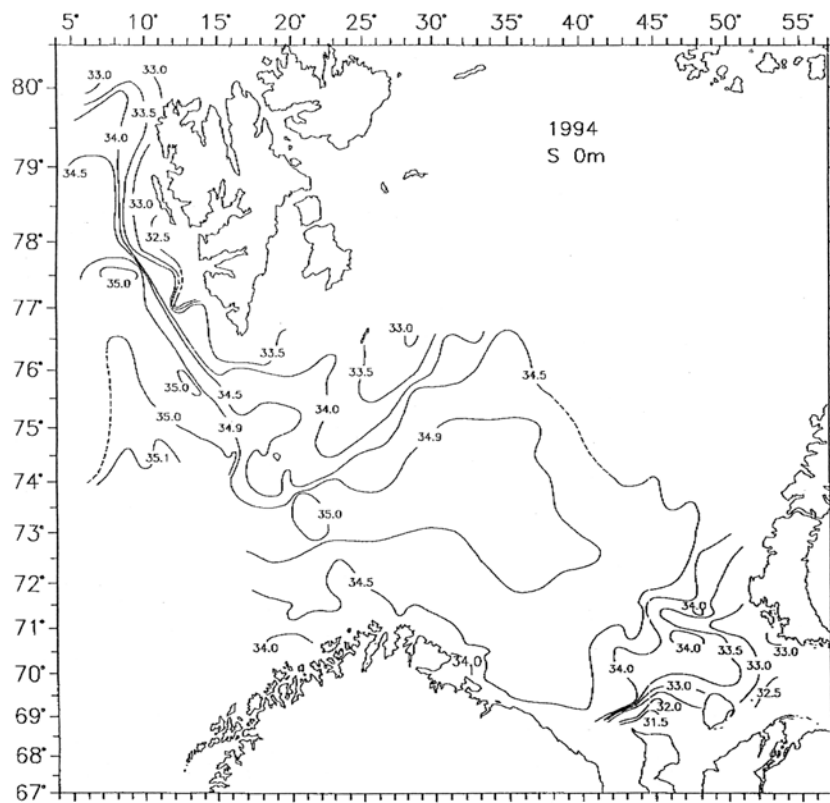


Fig. 7. Isohalines at 0 m

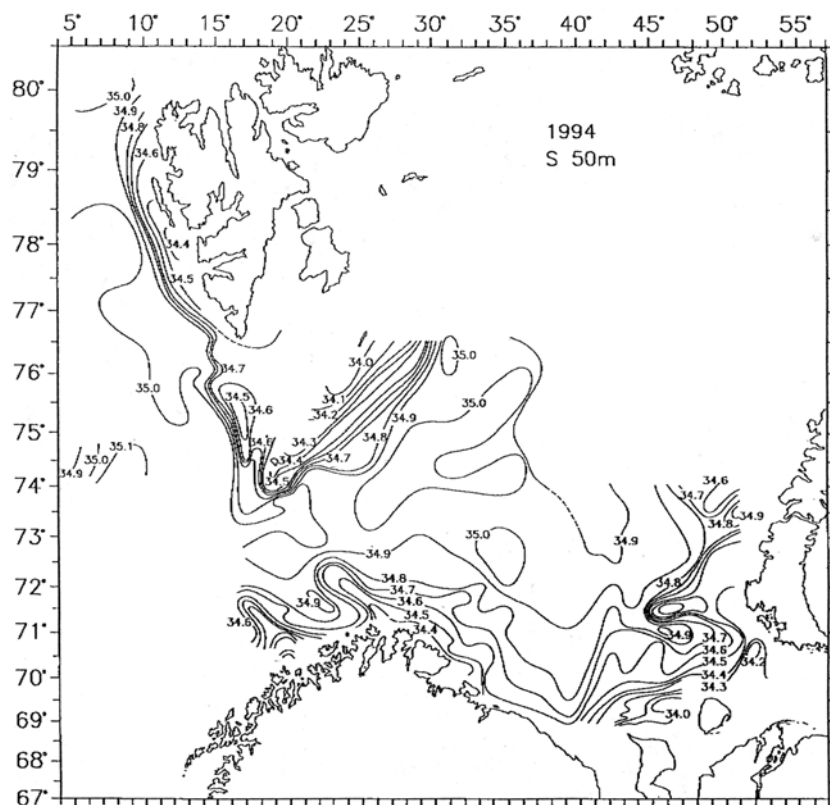


Fig. 8. Isohalines at 50 m

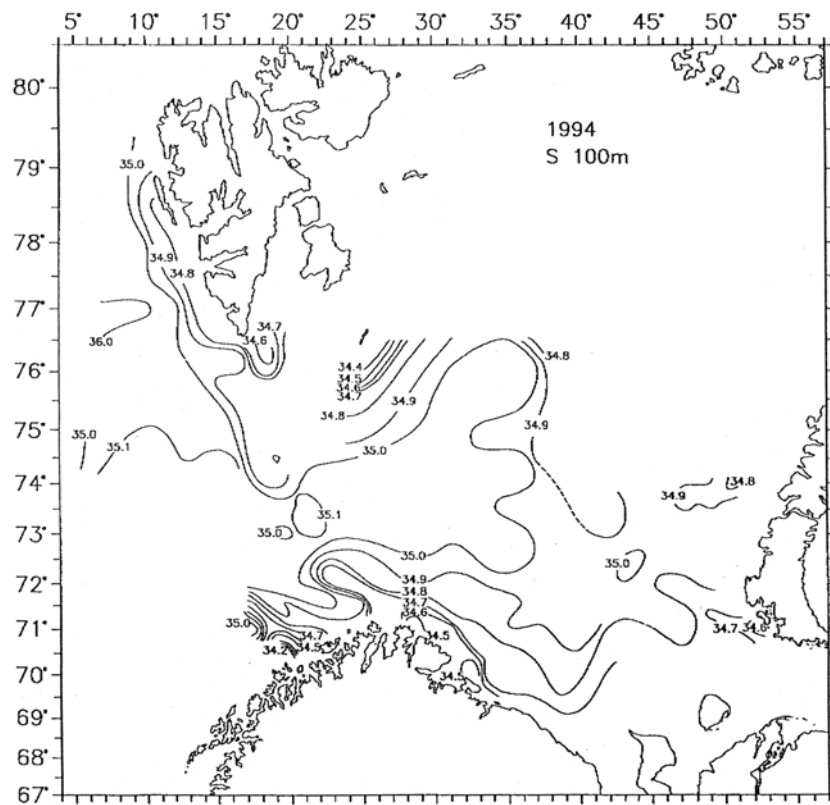


Fig. 9. Isohalines at 100 m

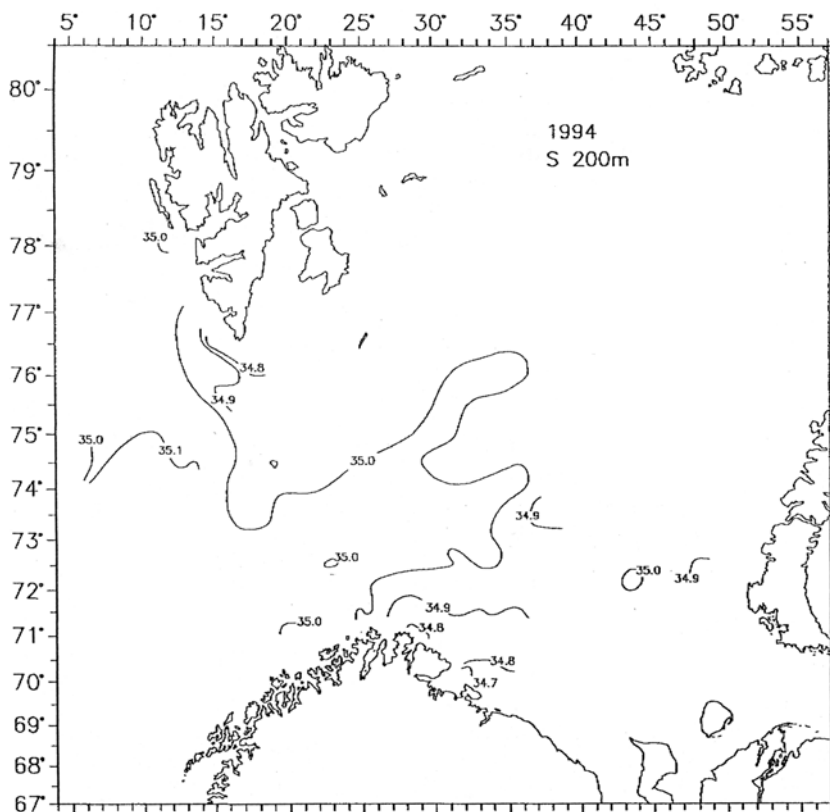


Fig. 10. Isohalines at 200 m

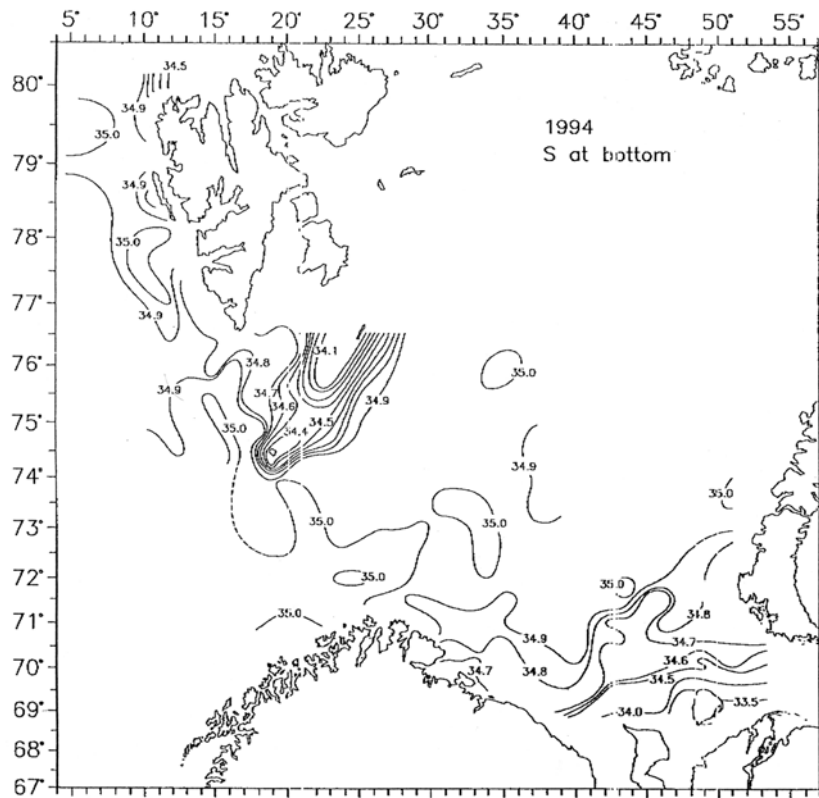


Fig. 11. Isohalines at the bottom

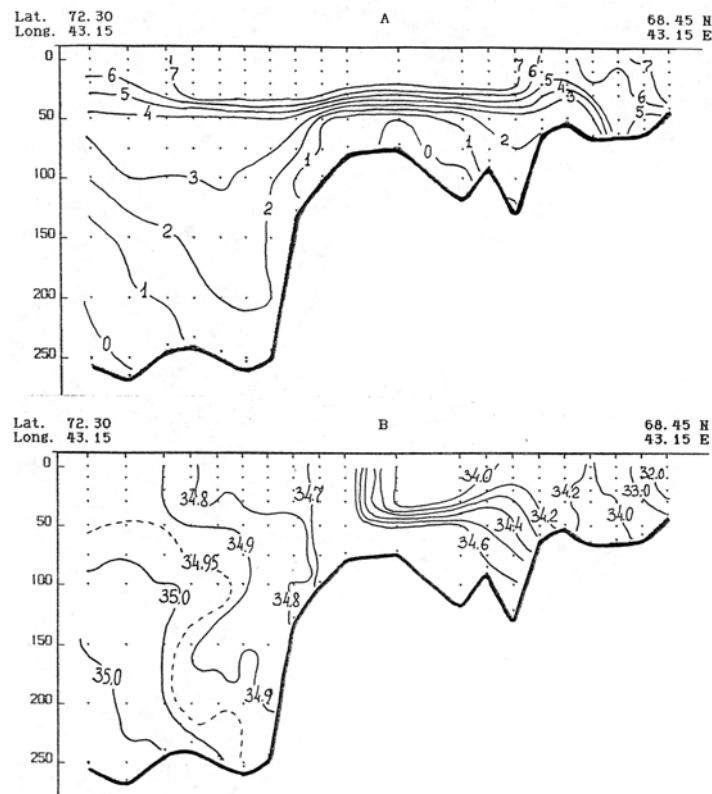


Fig. 12. Hydrographic section Cape Kanin-North. Temperature (A) and salinity (B)

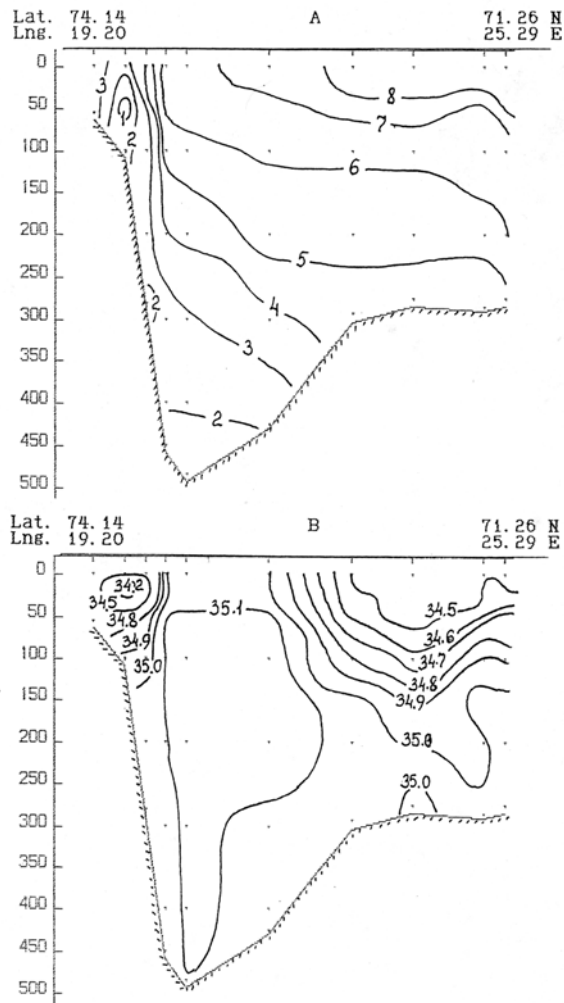


Fig. 13. Hydrographic section North Cape-Bear Island. Temperature (A) and salinity (B)

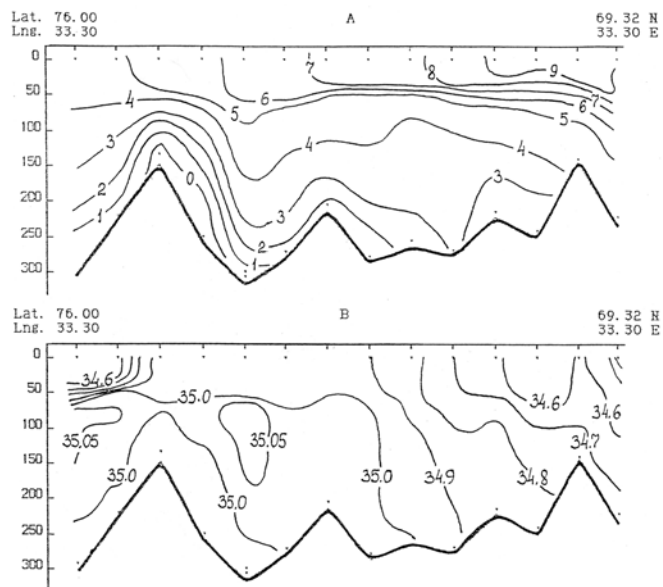


Fig. 14. Hydrographic section along the Kola meridian. Temperature (A) and salinity (B)

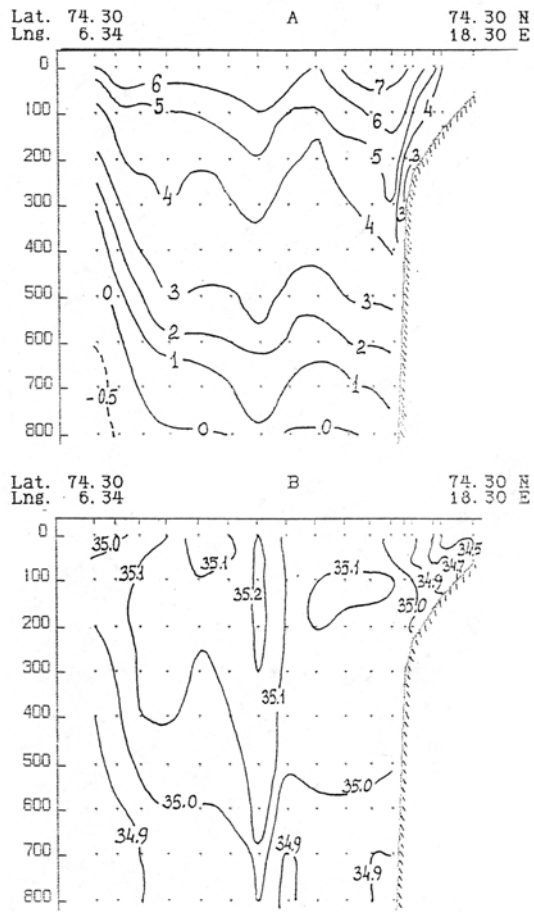


Fig. 15. Hydrographic section Bear Island-West. Temperature (A) and salinity (B)

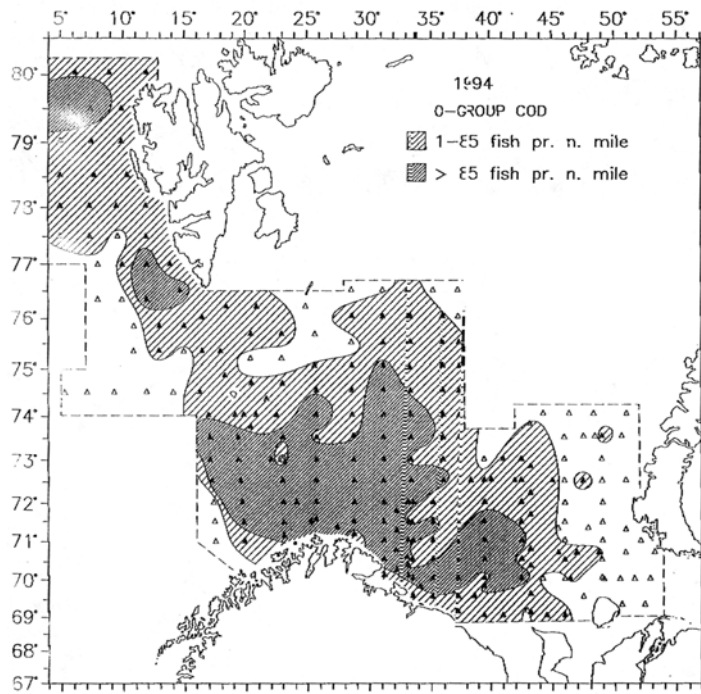


Fig. 16. Distribution of 0-group cod

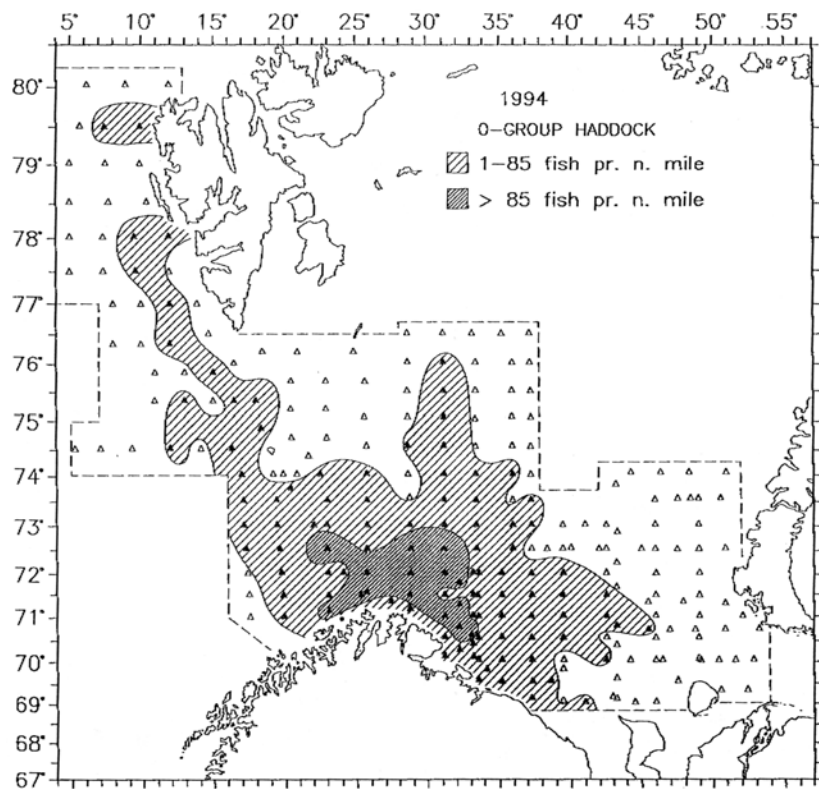


Fig. 17. Distribution of 0-group haddock

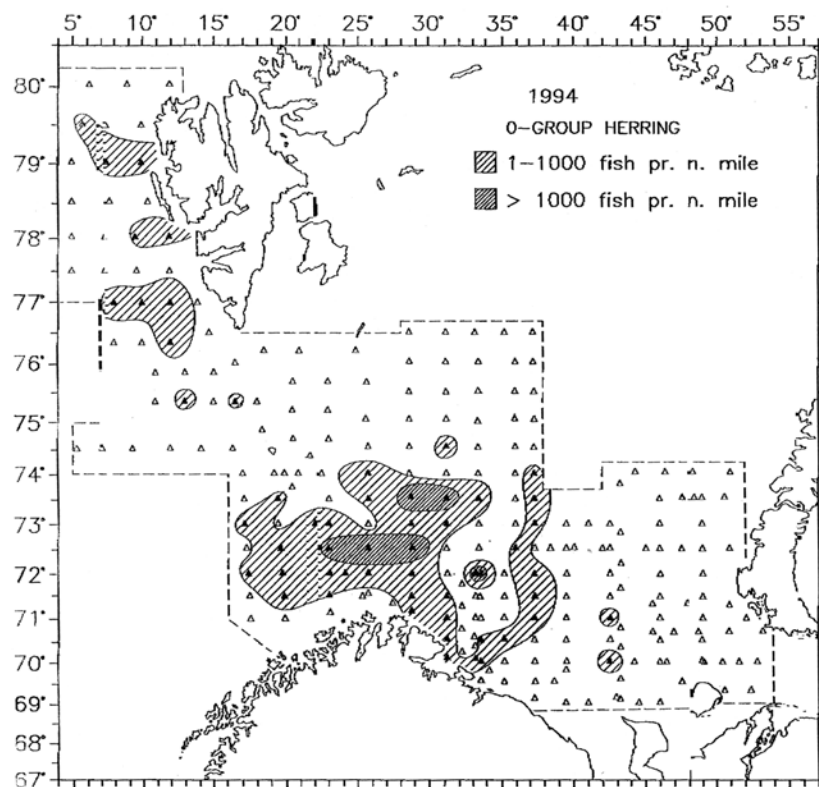


Fig. 18. Distribution of 0-group herring

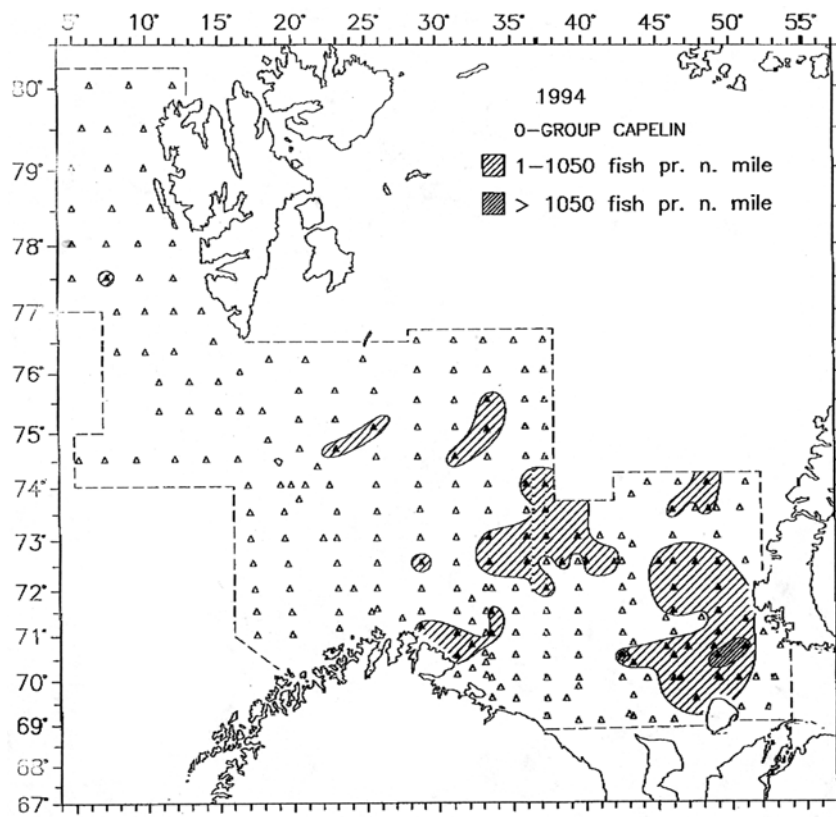


Fig. 19. Distribution of 0-group capelin

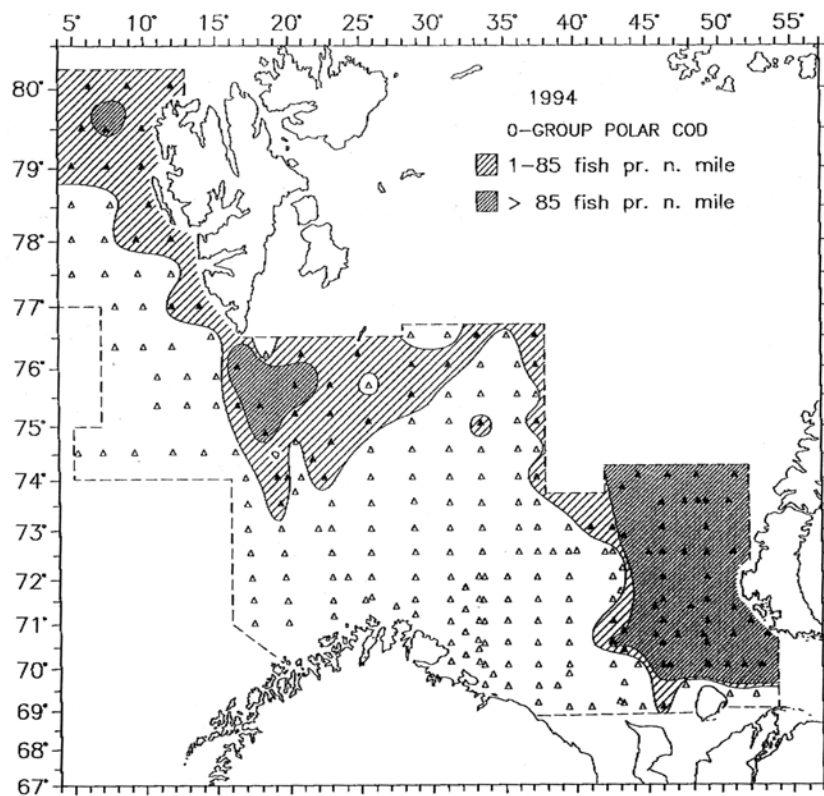


Fig. 20. Distribution of 0-group polar cod

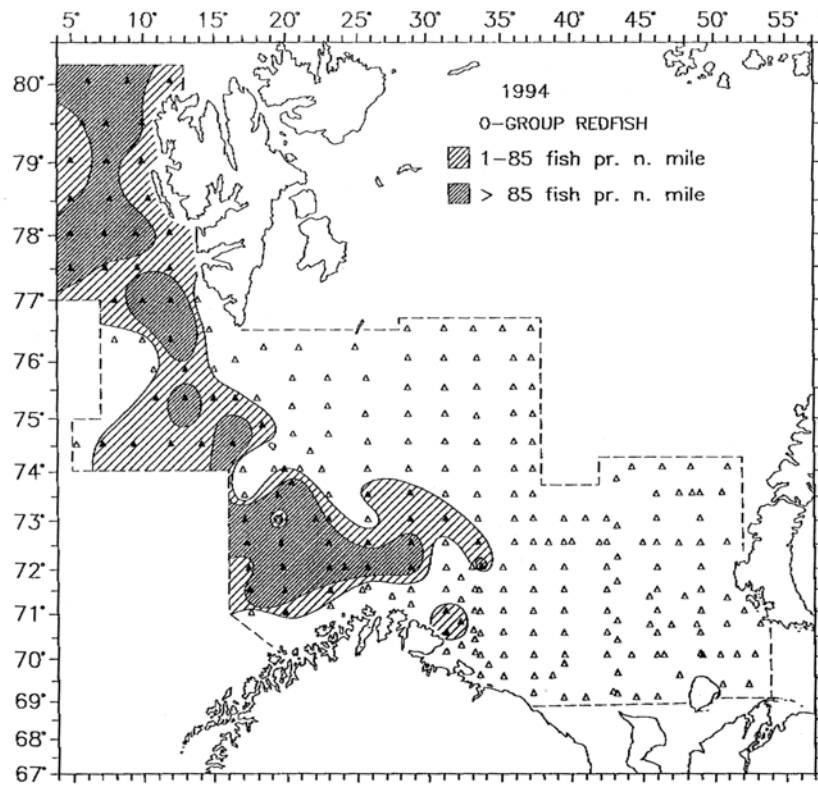


Fig. 21. Distribution of 0-group redfish

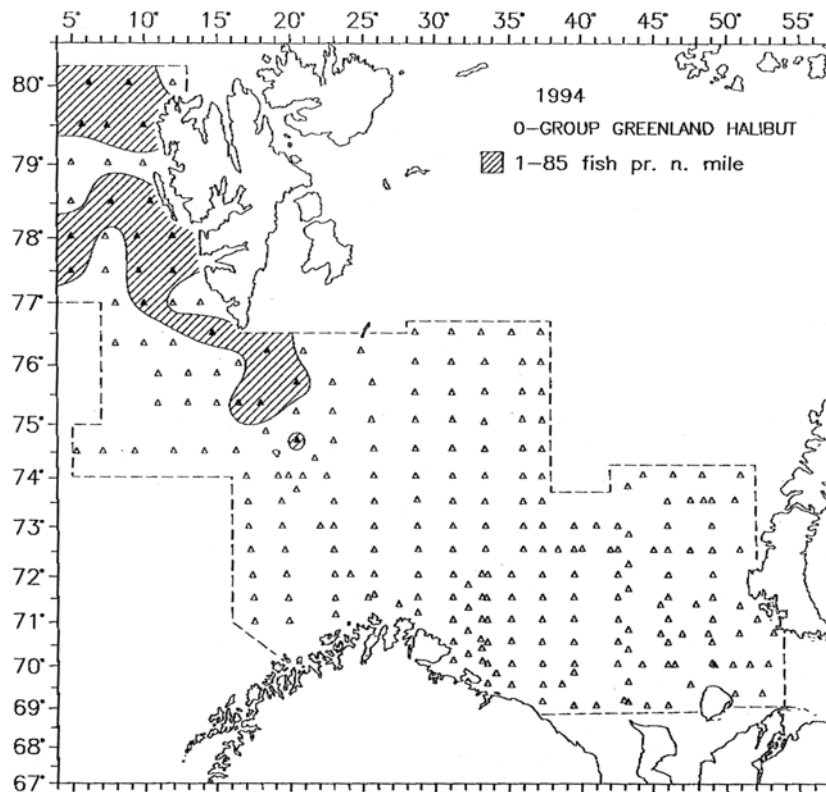


Fig. 22. Distribution of 0-group Greenland halibut

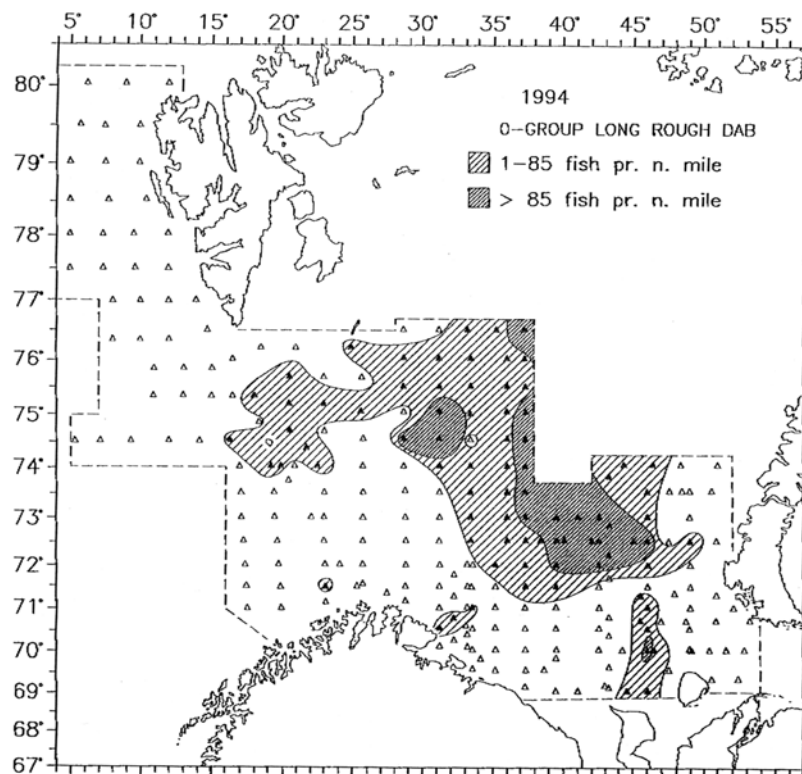


Fig. 23. Distribution of 0-group long rough dab

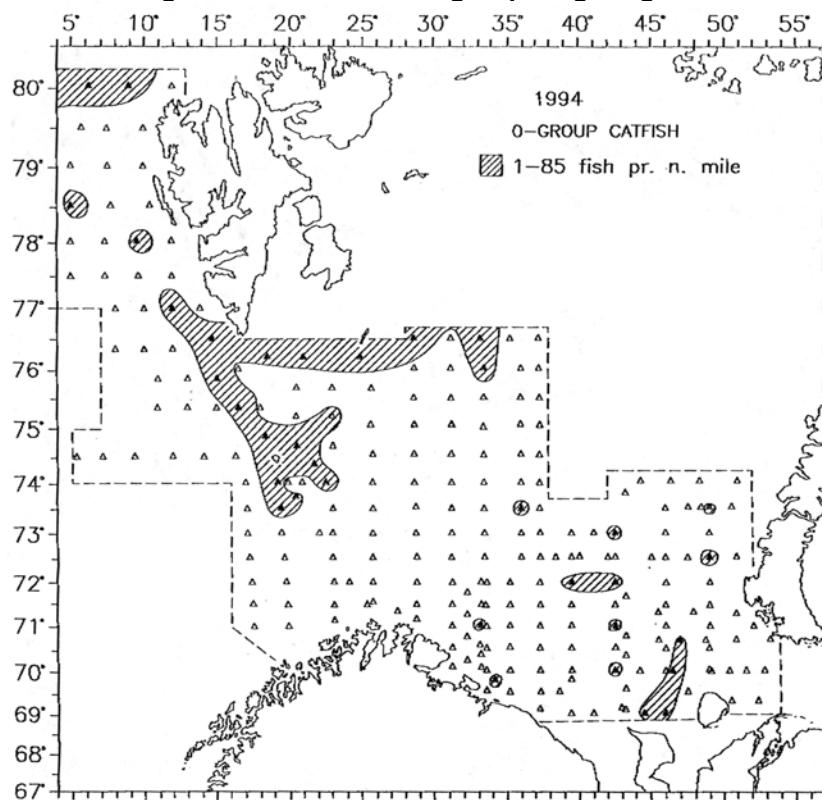


Fig. 24. Distribution of 0-group catfish

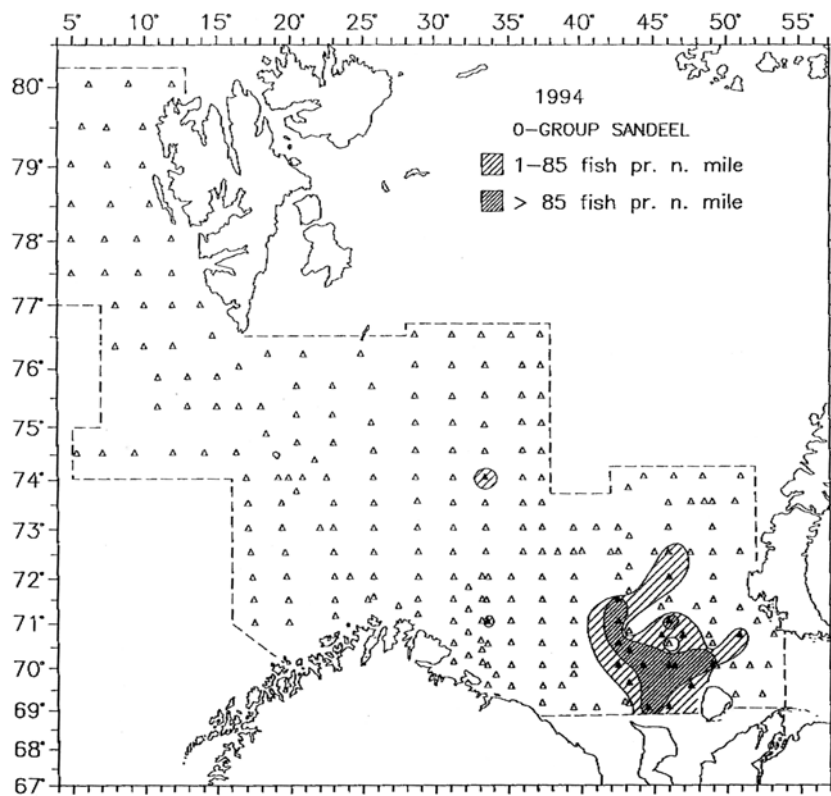


Fig. 25. Distribution of 0-group sandeel

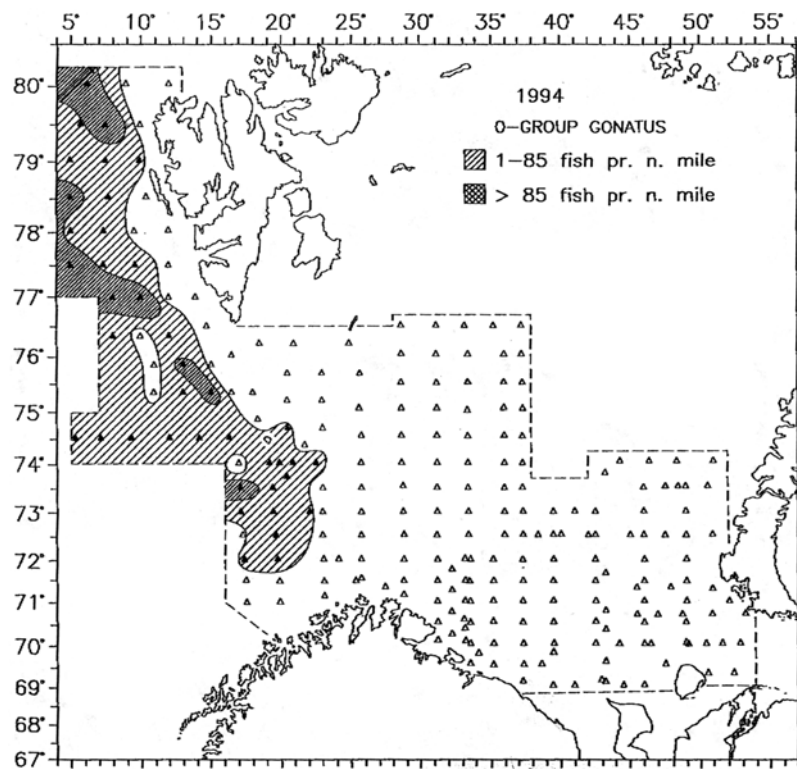


Fig. 26. Distribution of 0-group Gonatus fabricii

Preliminary report
of the international 0-group fish survey in the
Barents Sea and adjacent waters in August-September 1995

The thirty first annual International 0-group fish survey was made during the period 16 August-11 September 1995 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey period	Research Institute
Norway	"Michael Sars"	22.08 - 09.09	Institute of Marine Research, Bergen
Norway	"Johan Hjort"	25.08 - 10.09	"
Norway	"G.O. Sars"	16.08 - 10.09	"
Russia	"Professor Marty"	05.09 - 11.09	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
Russia	"Fridtjof Nansen"	26.08 - 11.09	"

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 correspondence. 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 was estimated with a small mesh midwater trawl. Four of the five vessels, which participated in the survey in 1995, used the type of midwater trawl recommended in 1980 (Anon., 1983). The standard procedure consisted of tows of 0.5 nautical miles in each of 3 depths with the headline of the trawl located at 0, 20 and 40 m. Additional tows at 60 and 80 m for 0.5 nautical mile was made when 0-group fish layer was recorded on the echo-sounder deeper than 60 m and 80 m. Trawling procedure was standardized in accordance with the recommendation made in 1980. However, the Russian research vessel "Professor Marty" used a trawl with 30m vertical opening and unknown wingspread. Two steps were trawled to cover the usual 3 step trawling, 0.5 nautical miles in each depth.

West of 20° E most of the stations were taken by R/V "G.O. Sars" and R/V "Johan Hjort" at a distance of 30 nautical miles. This was a too ambitious program, and the distance between stations was increased to 35 nautical miles east of 20° E for the Norwegian research vessels. This design differed from earlier surveys in which the stations were taken at about each 30 nautical miles sailed.

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, 200 m and bottom (Figs. 2-11). Figs. 12-19 show the temperature and salinity conditions along the hydrographical sections: Bear Island - West, Bear Island – North Cape, Kola and Cape Kanin. 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. 20-31, 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 condition, 1995 is the seventh "warm year" in succession since 1989. The mean water temperatures at 0-200 m in the Barents Sea in 1995 were 0.2-1.0 °C above the long-term average (1965-1995). Compared to 1994, the anomalies of water temperatures ranged from 0.4 below to 1.2 °C above. From 1994 to 1995 the highest increase in water temperatures was recorded in the Kola meridian (50-200 m) and Cape Kanin – North sections, where the anomalies of water temperature constituted 1.1 and 1.6 °C respectively. On the North Cape - Bear Island section (0-200 m) the anomaly of water temperature decreased with 0.3 °C. In the west Spitsbergen current (0-200 m) the temperature was 0.6 °C above the long-term average, but 0.1 °C lower than last year. The overall decrease in water temperatures in the upper layers in the west and south areas of the Barents Sea were determined by low insolation compared to last year. The vertical gradients of water temperatures in the standard sections were scattered and lower than last year. The bottom layer of the coastal current has increased the inflow of Atlantic water at least eastward to the Cape Kanin - North section, where the anomaly of water temperature was 3.0 °C above the long-term average (0 °C). It was an effect of extra high level of atmospheric activity with powerful and prolonged air transport from west and south-west during the previous spring. The observed temperature conditions in the Barents Sea seem to be close to those observed in 1983 and 1991.

Distribution and abundance of 0-group fish and *Gonatus fabricii*

Geographical distribution of 0-group fish are shown as shaded areas in Figs. 20-30, and of *Gonatus fabricii* in Fig. 31. 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 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. 20)

The present survey did not cover the 0-group distribution in the northwestern corner of the survey area. Two main concentrations were observed west of northern Spitsbergen and from south of Bear Island and eastwards to about 43° E. Only scattered concentrations were observed, indicating a poor to below average 1995 year-class strength.

Capelin (Fig. 21)

As in 1993 and 1994, 0-group capelin had a patchy distribution in the eastern Barents Sea, mainly with scattered concentrations. However, the survey did not cover the eastern and northeastern part of the distribution. The area based 0-group abundance index indicates that the 1995 year-class is the fourth consecutive poor year-class.

Cod (Fig. 22)

The 0-group cod was distributed along Spitsbergen to the Norwegian coast and eastwards, close to Novaya Zemlya. However, the survey did not cover the total distribution of 0-group cod in the northwestern and eastern part of the distribution area. During the survey, 0-group cod was observed a little deeper than in most of the previous years, and four and even five trawling steps had to be made on some stations. Even so, 0-group cod was recorded on the echo-sounder deeper than 100 m. Both factors have caused an underestimation of the abundance index. The area based abundance and the logarithmic abundance indices are classifying the 1995 year-class as very strong and the fifth strong year-class in succession.

Haddock (Fig. 23)

The present survey covered to a great extent the distribution area along Spitsbergen and in the western and central Barents Sea. Only two small patches of dense concentrations were observed inside the area of scattered concentrations. The indices indicate that the strength of the 1995 year-class is about average.

Polar cod (Fig. 24)

A continuous distribution was only recorded along the west coast of Spitsbergen. The total area of distribution was not covered, which would affect the abundances indices of both the western and the eastern component. Compared to 1994, the abundance index was much less in the area north of Bear Island, and the year-class strength in the western component was recorded as the poorest in the period 1977-1995. No indication of the year-class abundance of the eastern component can be given, caused by the lack of area coverage.

Saithe (Fig. 25)

A continuous area of distribution, with low abundance, was observed in the central Barents Sea and in the western part of the survey area northwards to about 78° N. Single hauls with one or two specimens were observed in the more eastern part of the Barents Sea. 0-group saithe is at this time of the year to a great extent living inside the Norwegian coastal waters, and the observations in open sea give no indication of the year-class strength.

Redfish (Fig. 26)

The observed distribution of redfish is an almost complete coverage of the 0-group. In general, the distribution pattern was similar to those after 1990. Dense concentrations were only recorded in five small patches within the distribution area from north of Spitsbergen to the area between Bear Island and the Norway coast. The abundance index indicates a year-class strength far below the average, but about the average of the poor 1991-1995 year-classes.

Greenland halibut (Fig. 27)

A continuous distribution of 0-group Greenland halibut was observed along Spitsbergen, only with low abundance. In addition, three small patches of low abundance were observed in the northeastern Barents Sea. The abundance index of the 1995 year-class is close to the abundance level of the 1993-1994 year-classes and a little higher than the five preceding ones. However, the 1995 year-class is recorded as poor.

Long rough dab (Fig. 28)

0-group long rough dab was mainly observed in the eastern part of the Barents Sea, only with low abundance. However, the total area of distribution was not covered in the eastern Barents Sea. Only two positive hauls were made close to the southern part of Spitsbergen. The abundance index indicate a poor 1995 year-class.

Sandeel (Fig. 29)

As in 1994, the 0-group sandeel was mainly observed in the southeastern Barents Sea. However, the distribution area was not covered in the east.

Catfish (Fig. 30)

0-group catfish was distributed in a narrow area north of Bear Island and along Spitsbergen to at least 80° N. Two small patches were recorded in the central Barents Sea, and only a small number were caught in each haul.

Gonatus (Fig. 31)

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 to the west. The level of survey catches were at a lower level than in the 1994 survey.

References

- Anon., 1980. Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August/September 1978. Annl. 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. Annl. biol., Copenh., 37: 259-266.
- Fotland, Å., Mehl, S. and Sunnanå, K. 1995. Methods of index calculation and presentation of fish abundance data using standard computer programs. Pp.209-216 in Hysten, A. (ed): Precision and relevance of prerecruit studies for fishery management related to fish stocks in the Barents Sea and adjacent waters. Proceedings of the sixth PINRO - IMP symposium. Bergen, 14-17 June 1994. Institute of Marine research, Bergen, Norway.
- 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.
- Ushakov, N.G. and Shamray, E.A. 1995. The effect of different factors upon the Barents Sea capelin year-classes. Pp.75-84 in Hysten, A. (ed): Precision and relevance of

prerecruit studies for fishery management related to fish stocks in the Barents Sea and adjacent waters. Proceedings of the sixth PINRO - IMP symposium. Bergen, 14-17 June 1994. Institute of Marine research, Bergen. Norway.

Table 1. Mean water temperature¹ in main parts of standard sections in the Barents Sea and adjacent waters in August-September 1965-1995

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
1995	7.6	4.9	5.6	5.9	4.7	6.1	5.2
Average 1965-1995	7.3	3.8	4.7	4.3	3.3	5.8	5.2

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 1965-1995

Year	Capelin ¹	Cod	Haddock	Polar cod		Redfish	Greenland 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		472	9	72	
1978	40	106	61	107		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
1995	43	1069	148	6		-	220	15	66

¹⁾ Assessment for 1965-1978 in Anon. 1980 and for 1979-1993 in Ushakov and Shamray 1995.

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 1965-1995

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
1995	0.16	0.07	0.29	2.40	1.97	2.88	0.25	0.16	0.40

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 1995

Length, mm	Herring	Capelin	Cod	Haddock	Polar cod West	Redfish	Greenland halibut	Long rough dab	Sandeel
10-14						+			
15-19						0.2			
20-24						0.9			
25-29		0.1			1.0	2.2		0.5	
30-34	+	0.9			10.3	12.5		14.8	
35-39	0.6	2.5		+	39.2	21.7		45.5	1.3
40-44	0.7	16.0	+	0.5	27.5	24.2	3.5	31.3	8.2
45-49	2.7	45.7	+	0.4	8.3	24.8	0.9	7.6	22.5
50-54	5.1	32.3	+	0.4	1.5	10.7	11.6	0.1	33.7
55-59	15.5	2.2	0.1	0.6	1.0	2.4	10.1		9.1
60-64	24.4	0.2	0.3	0.3	2.0	0.4	22.8		4.2
65-69	33.7	0.2	1.1	1.7	3.4		33.0		4.0
70-74	15.0		3.3	1.3	2.5		4.7		7.5
75-79	2.2		8.1	2.8	2.9		11.3	0.1	5.6
80-84	0.1		16.8	3.9	0.5		0.9		3.0
85-89			20.6	5.3				0.1	1.0
90-94			20.2	11.2			0.9		0.1
95-99			15.7	14.6					
100-104			9.2	14.7					
105-109			3.6	12.0					
110-114			0.7	10.2					
115-119			0.3	9.9					
120-124			+	4.8					
125-129				4.5					
130-134				1.0					
135-139				+					
140-144									
No. measured	1563	843	11025	1090	159	2420	44	541	818
Total numbers	6763	7307	393-497	2563	204	66128	106	1108	19968
Mean length	63.5	45.3	89.4	101.5	42.4	41.8	63.8	38.6	55.5

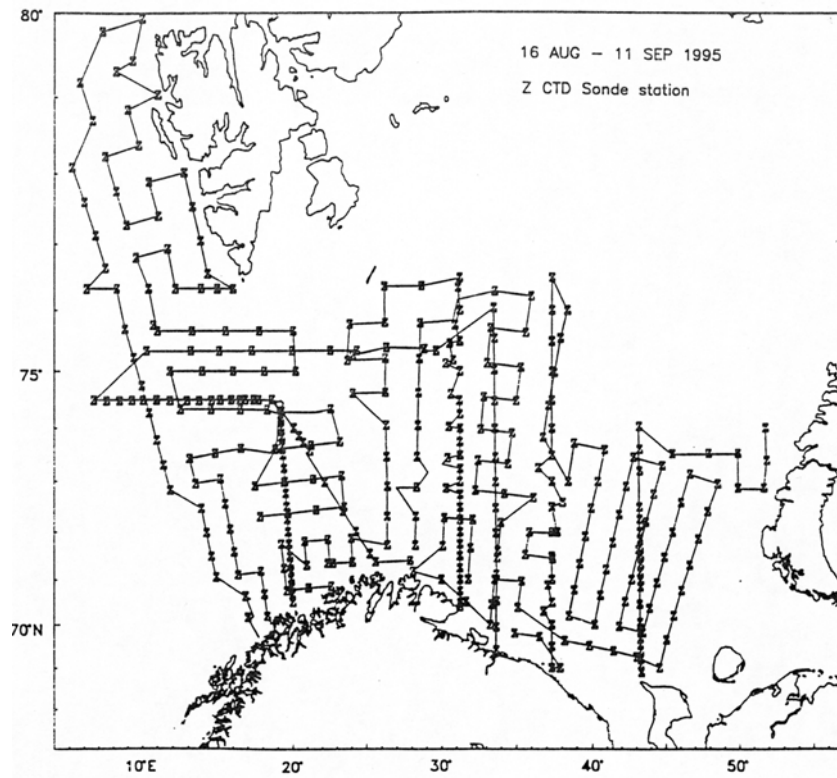


Fig. 1. Survey tracks and hydrographic stations

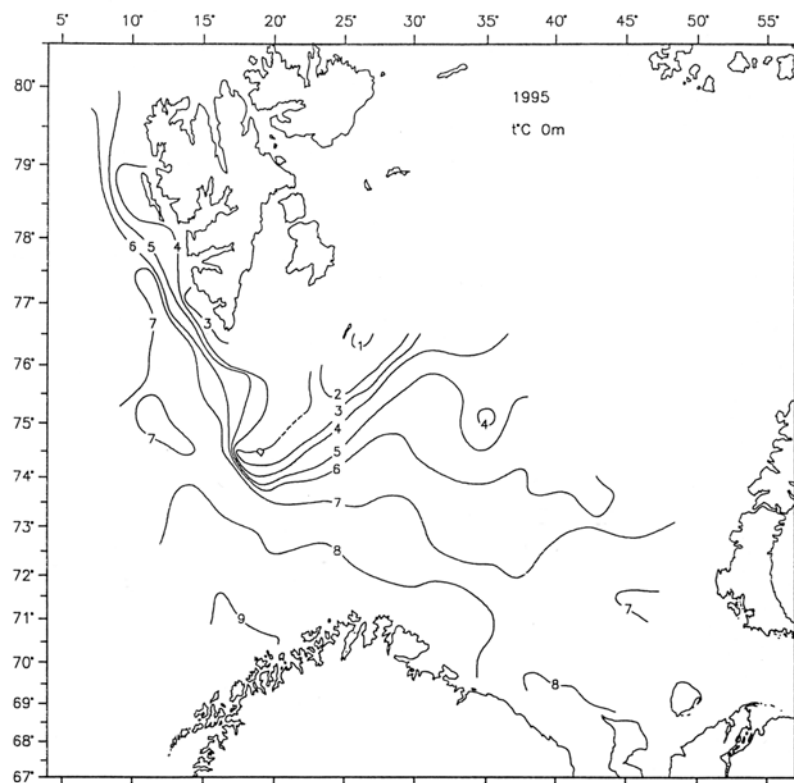


Fig. 2. Isotherms at 0 m

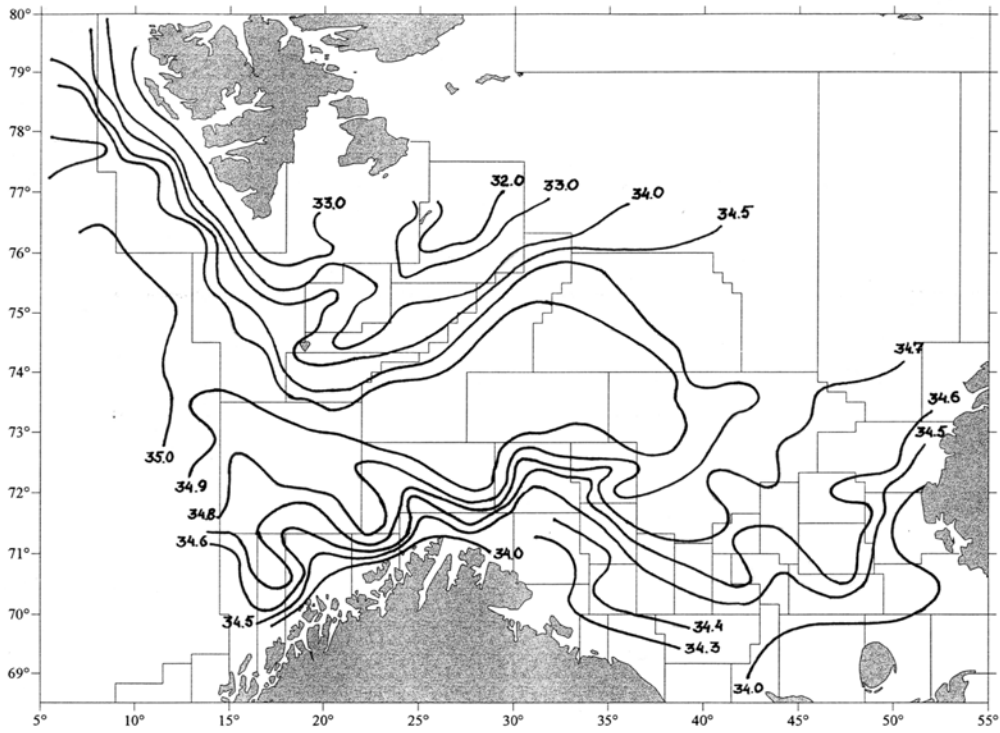


Fig. 3. Isohalines at 0 m

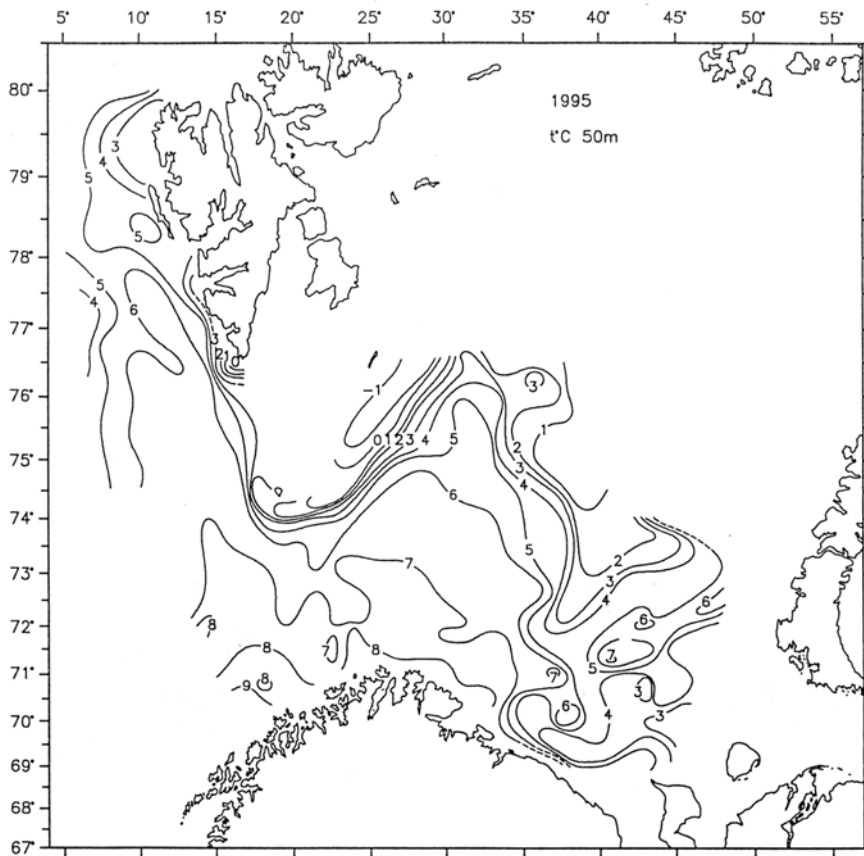


Fig. 4. Isotherms at 50 m

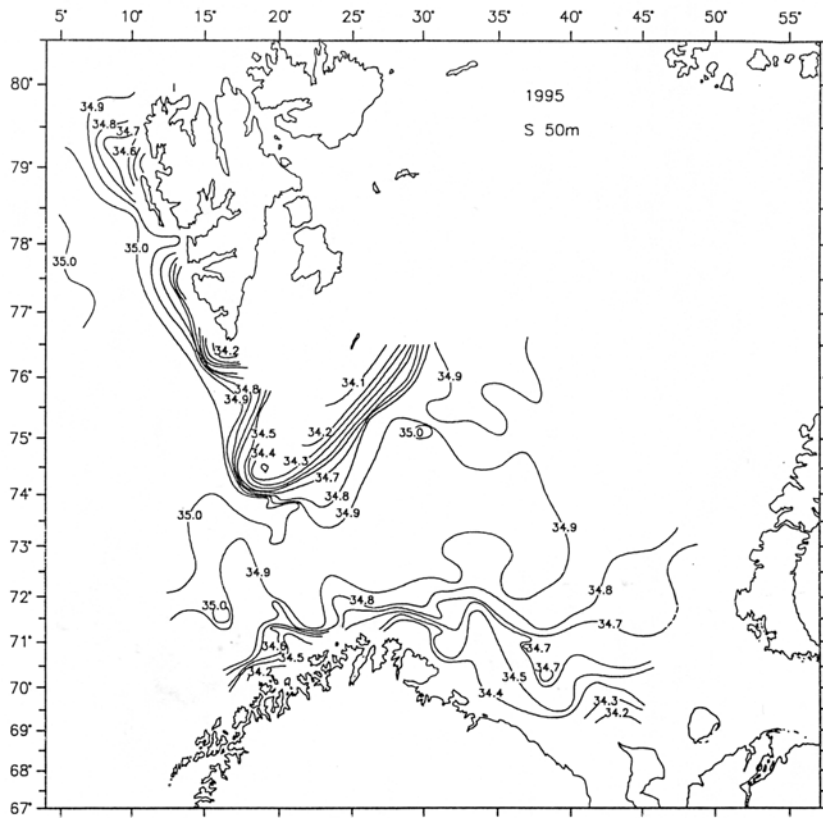


Fig. 5. Isohalines at 50 m

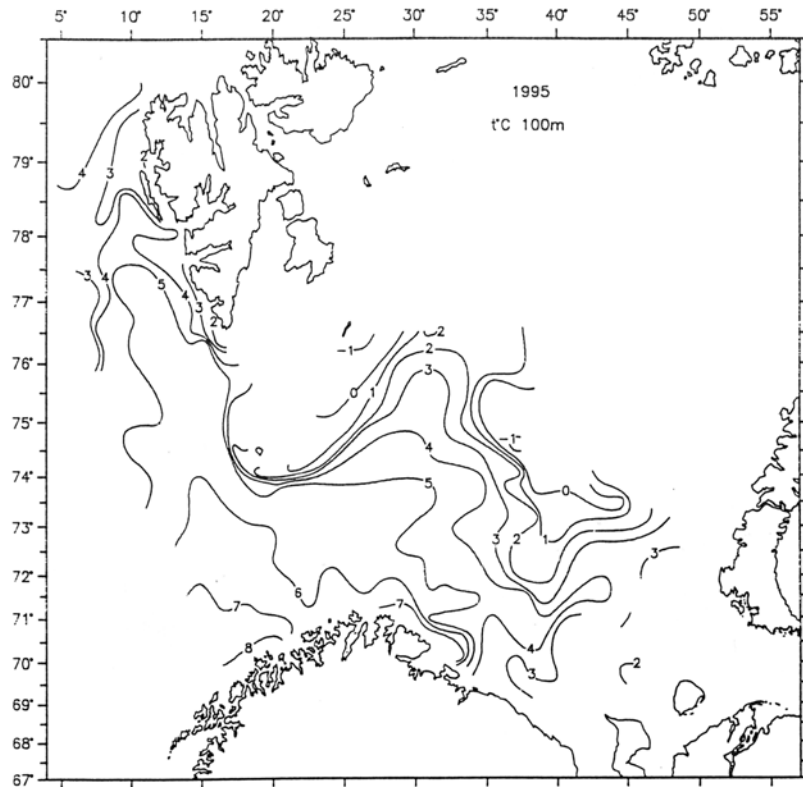


Fig. 6. Isotherms at 100 m

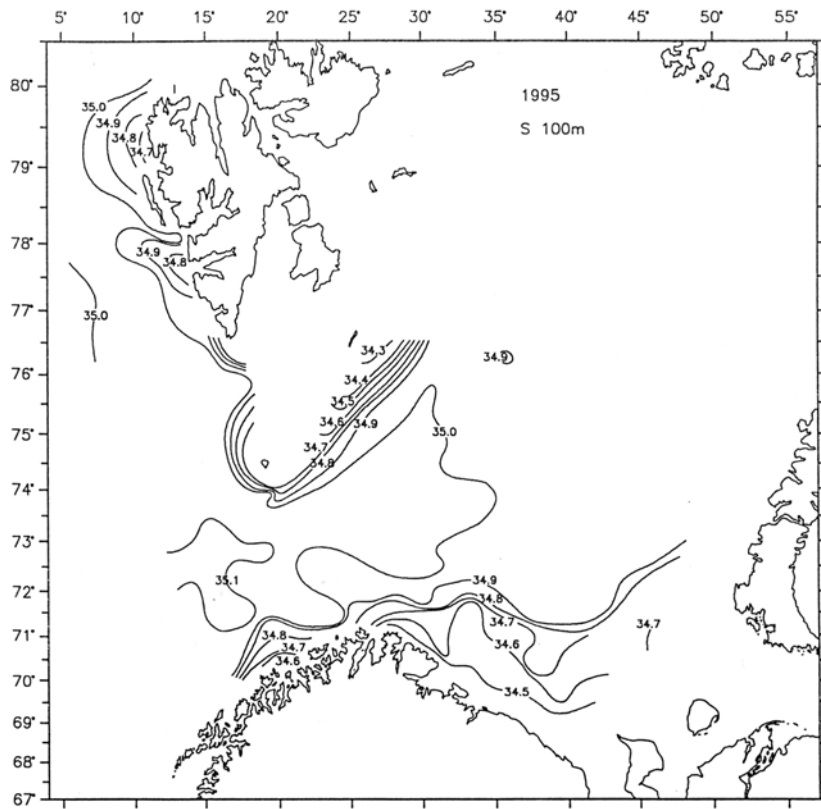


Fig. 7. Isohalines at 100 m

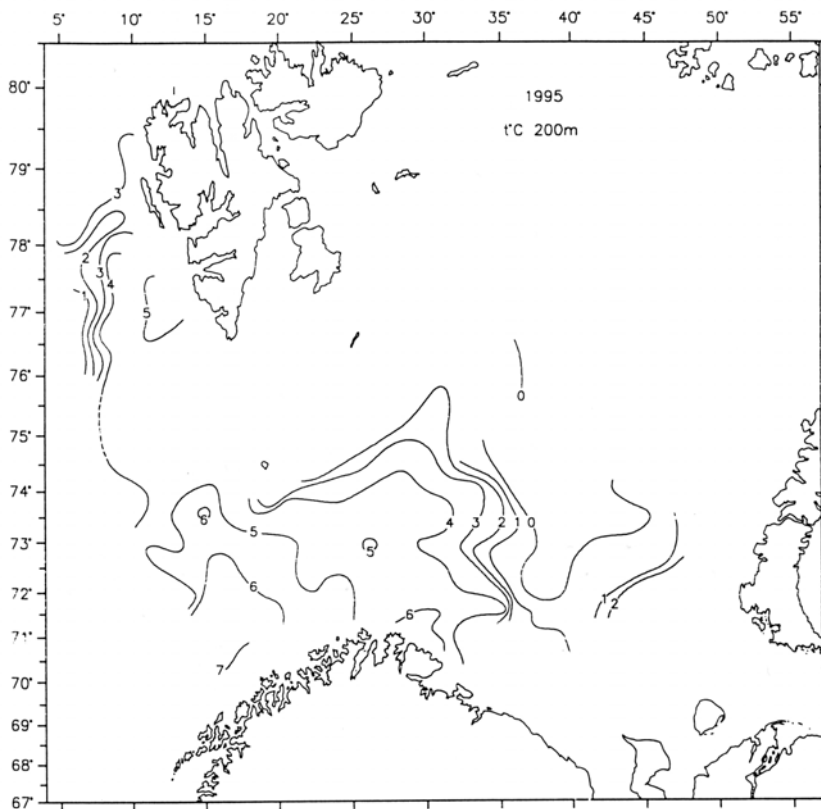


Fig. 8. Isotherms 200 m

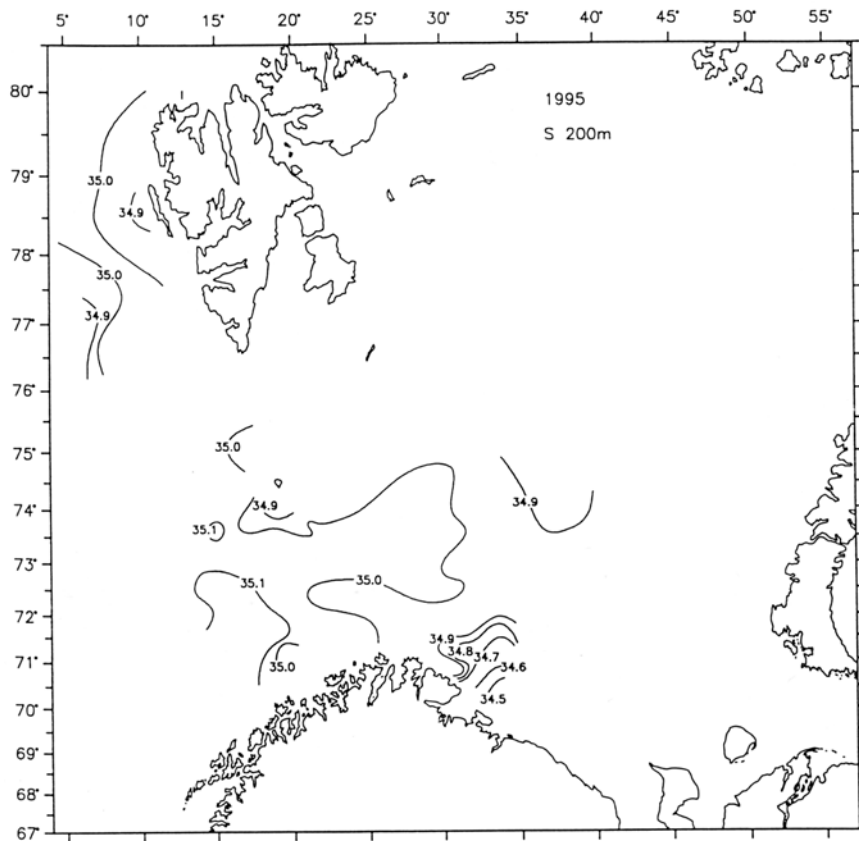


Fig. 9. Isohalines at 200 m

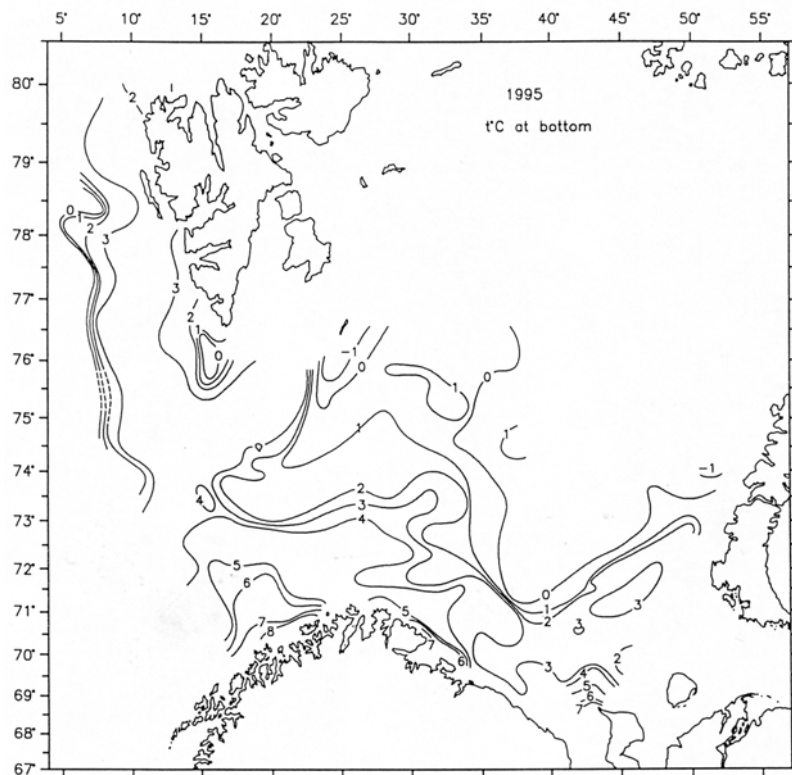


Fig. 10. Isotherms at the bottom

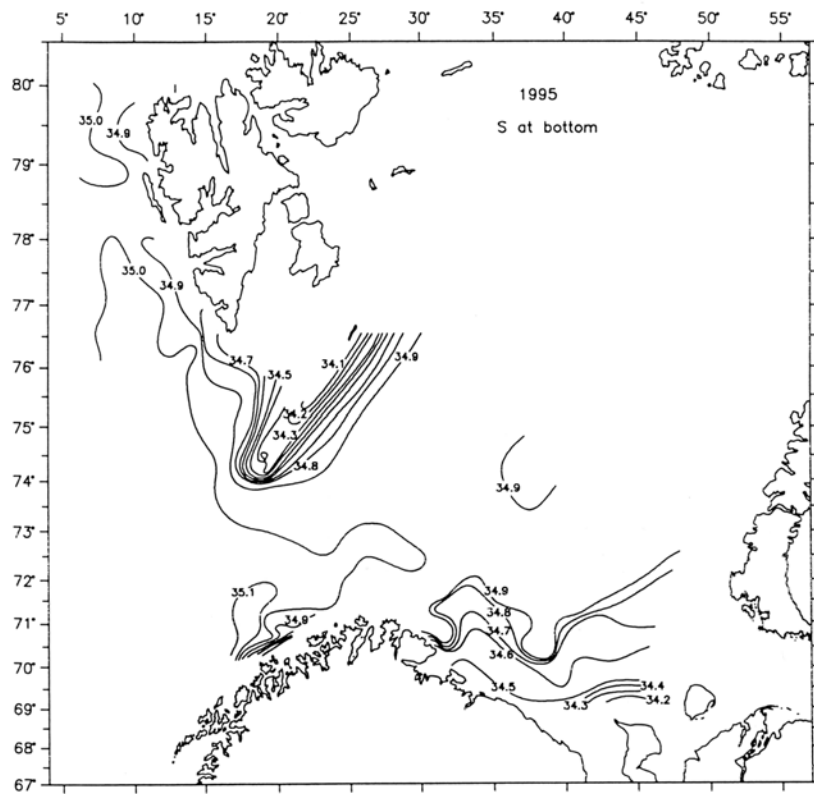


Fig. 11. Isohalines at the bottom

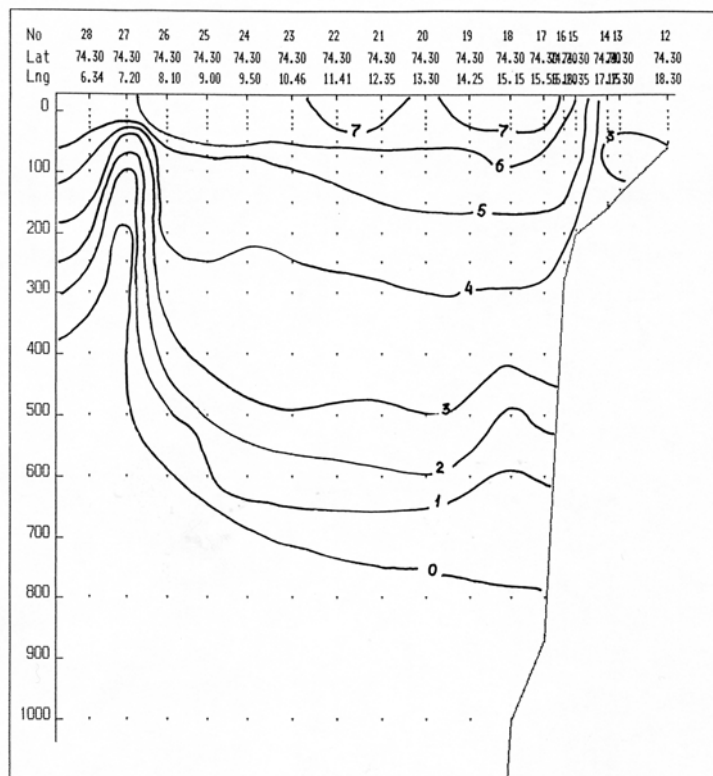


Fig. 12. Hydrographic section Bear Island-West. Temperature

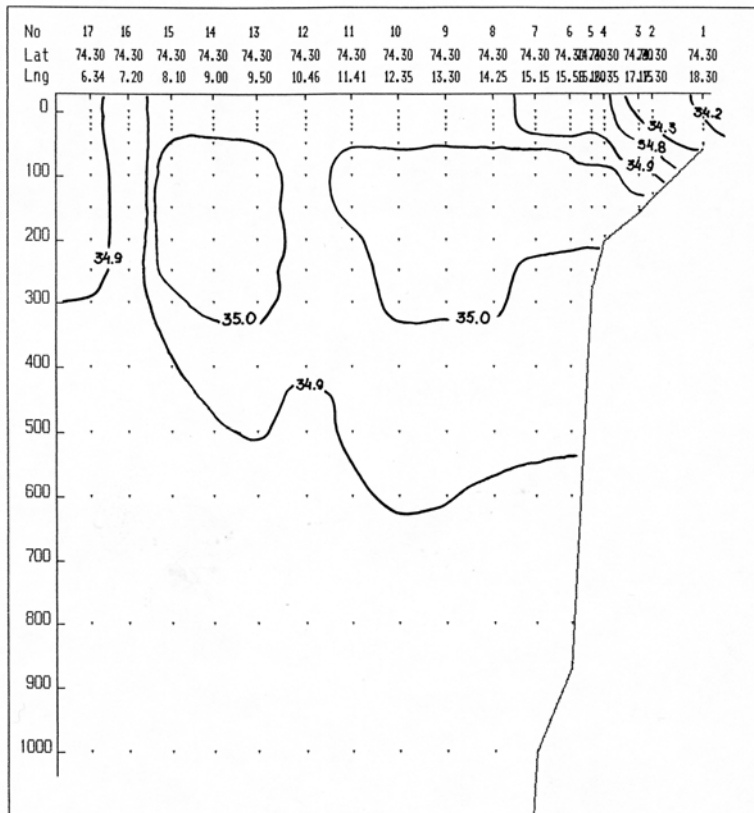


Fig. 13. Hydrographic section Bear Island-West. Salinity

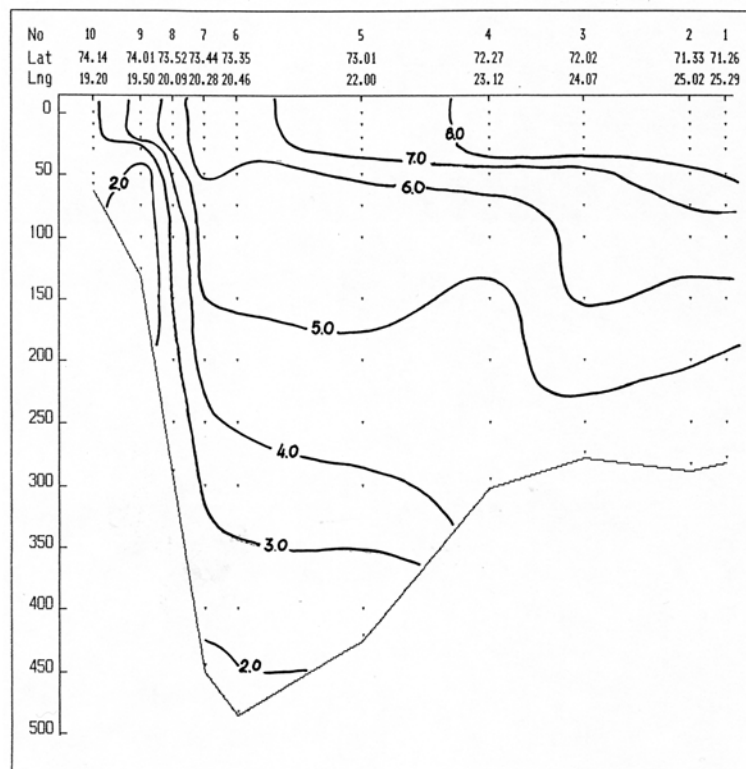


Fig. 14. Hydrographic section North Cape-Bear Island. Temperature

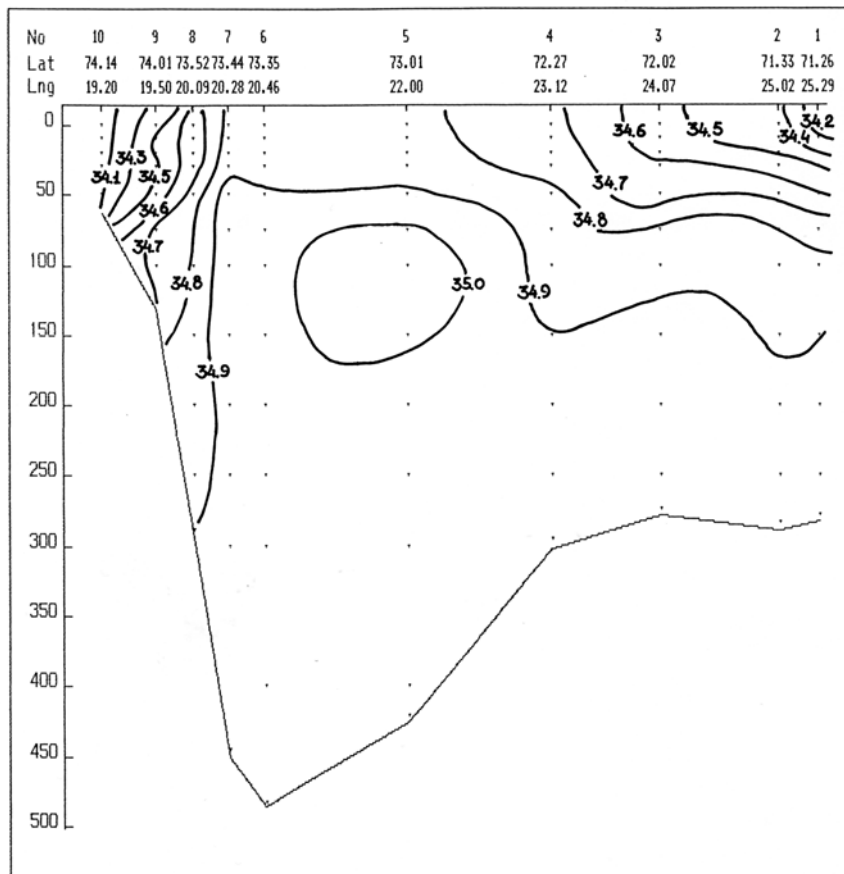


Fig. 15. Hydrographic section North Cape-Bear Island. Salinity

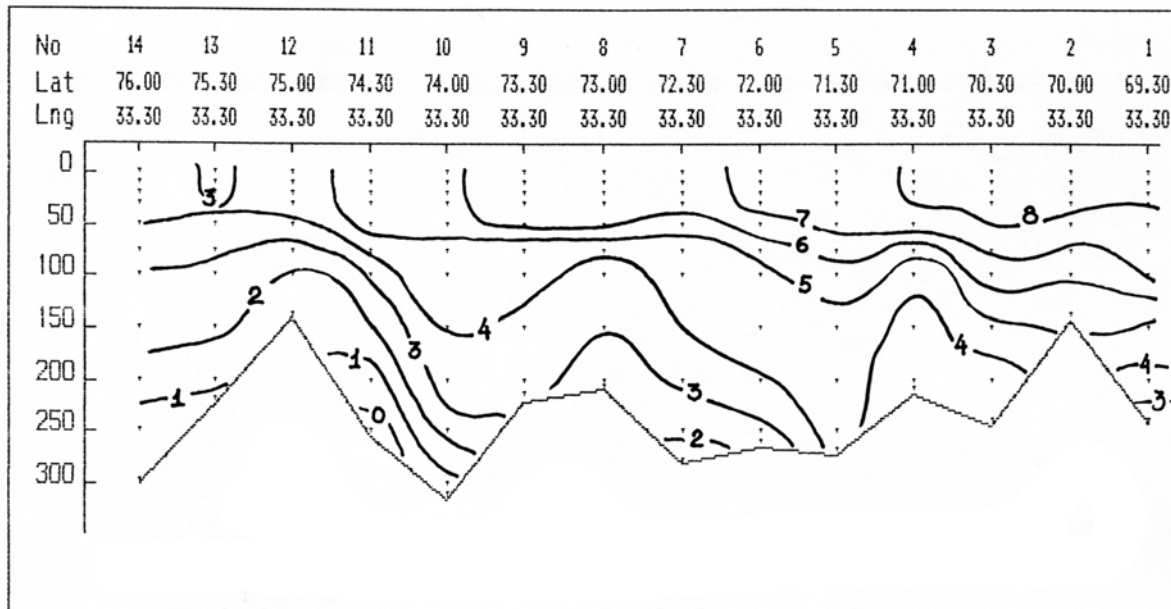


Fig. 16. Hydrographic section along the Kola meridian. Temperature

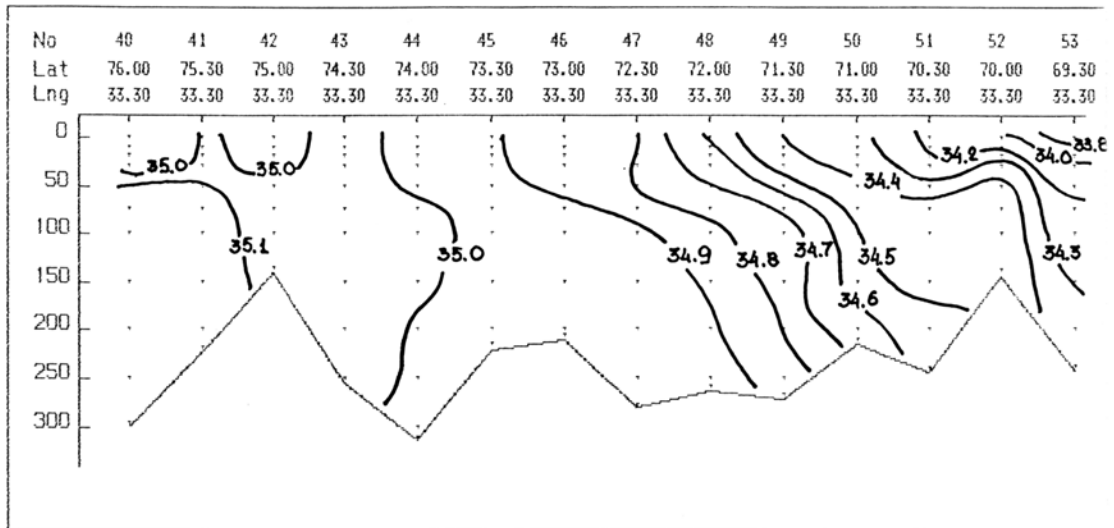


Fig. 17. Hydrographic section along the Kola meridian. Salinity

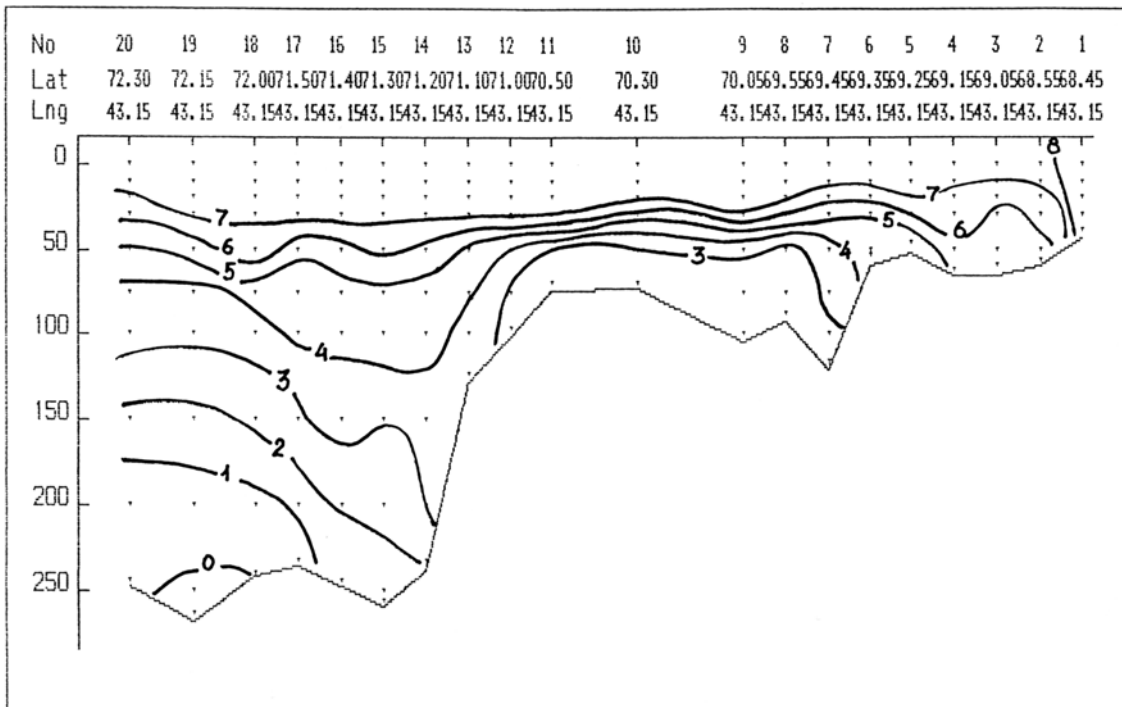


Fig. 18. Hydrographic section Cape Kanin-North. Temperature

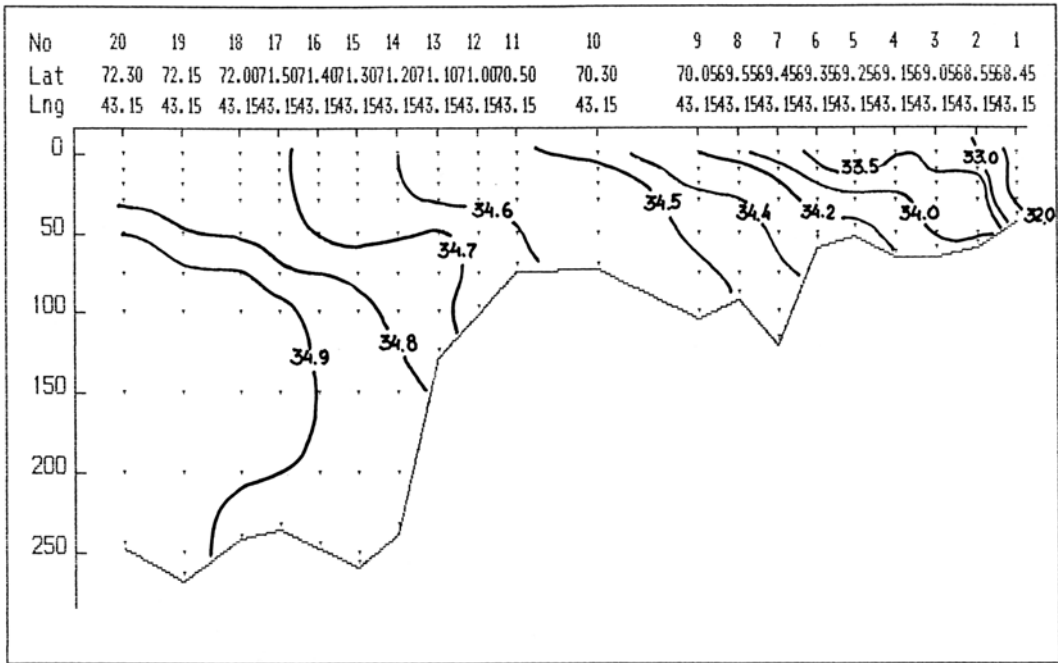


Fig. 19. Hydrographic section Cape Kanin – North. Salinity

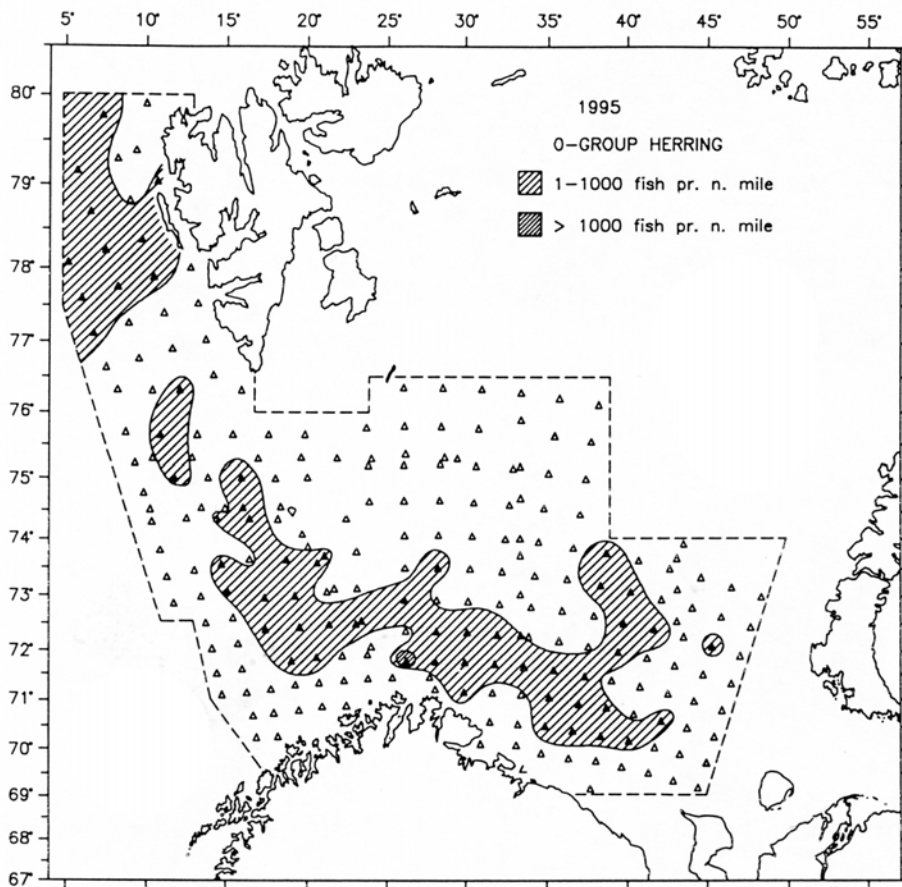


Fig. 20. Distribution of 0-group herring

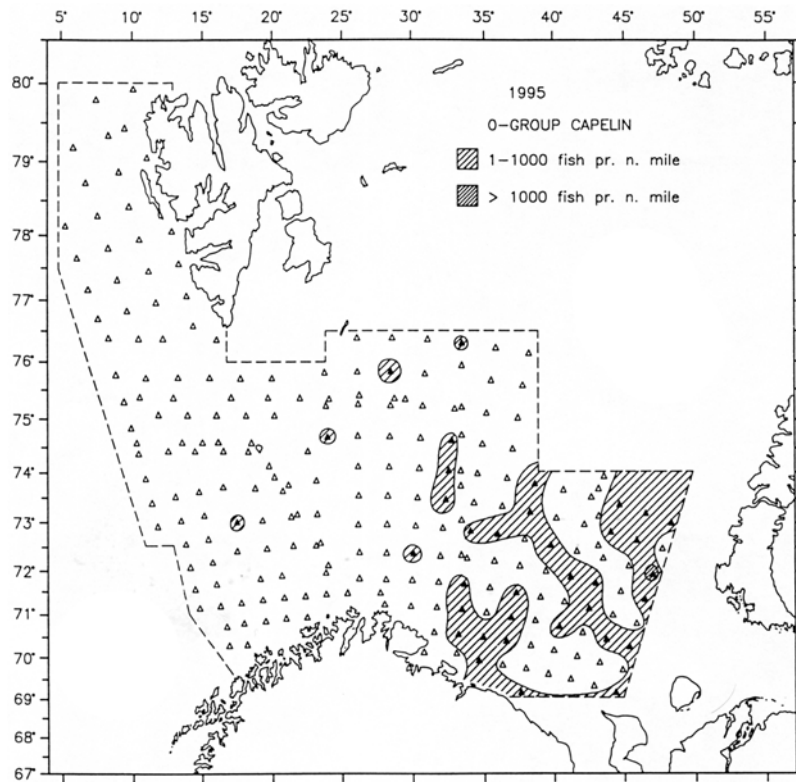


Fig. 21. Distribution of 0-group capelin

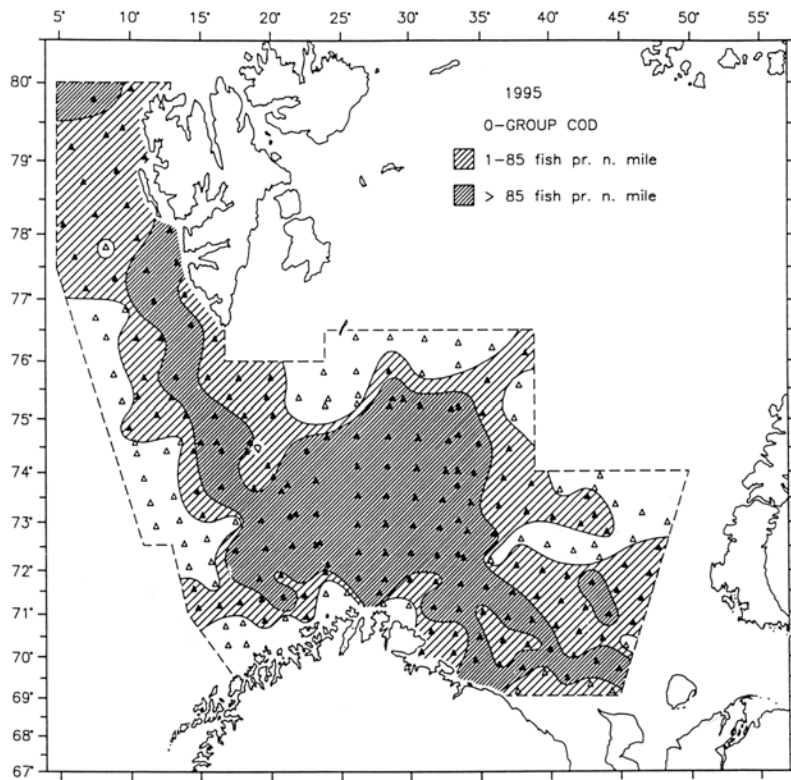


Fig. 22. Distribution of 0-group cod

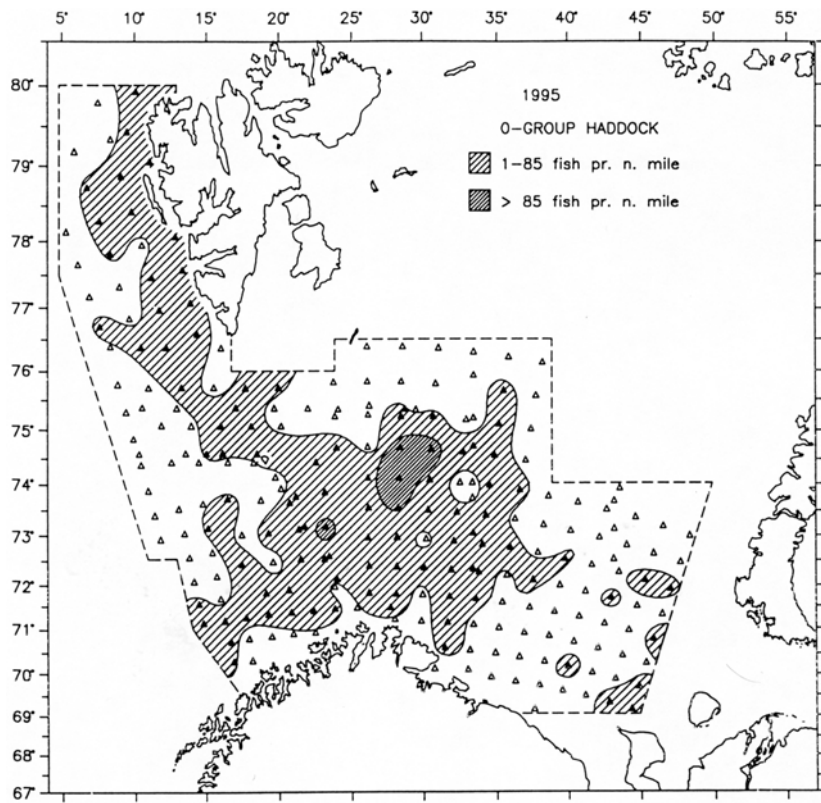


Fig. 23. Distribution of 0-group haddock

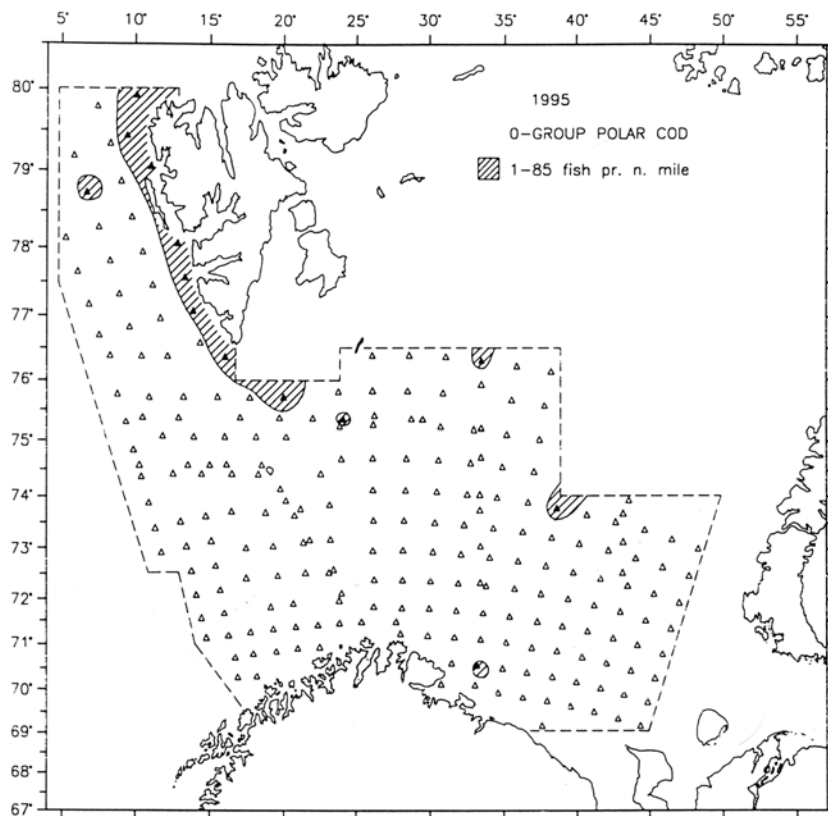


Fig. 24. Distribution of 0-group polar cod

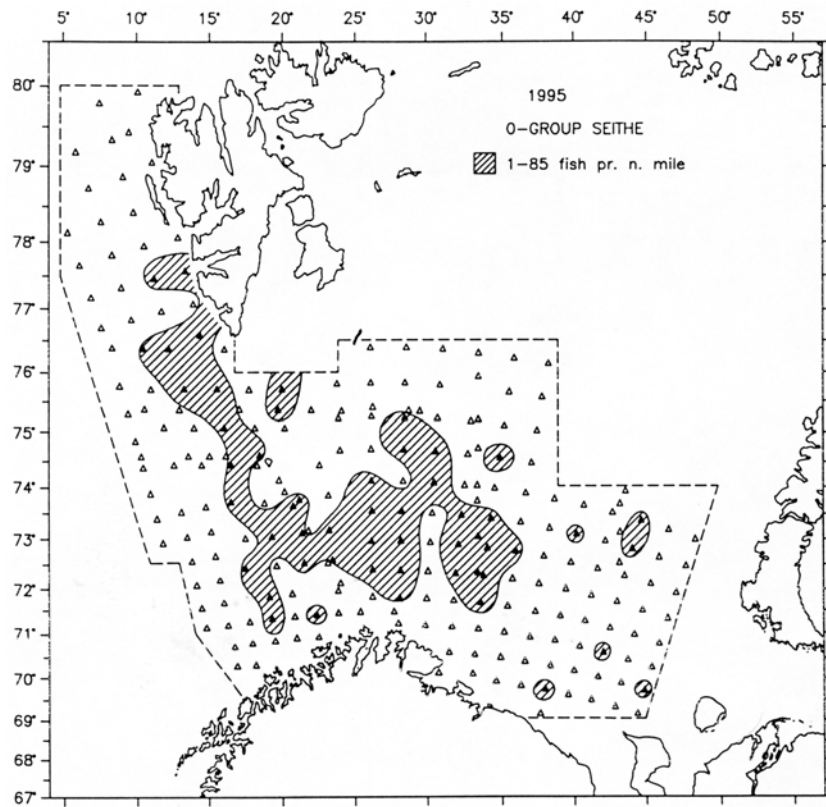


Fig. 25. Distribution of 0-group saithe

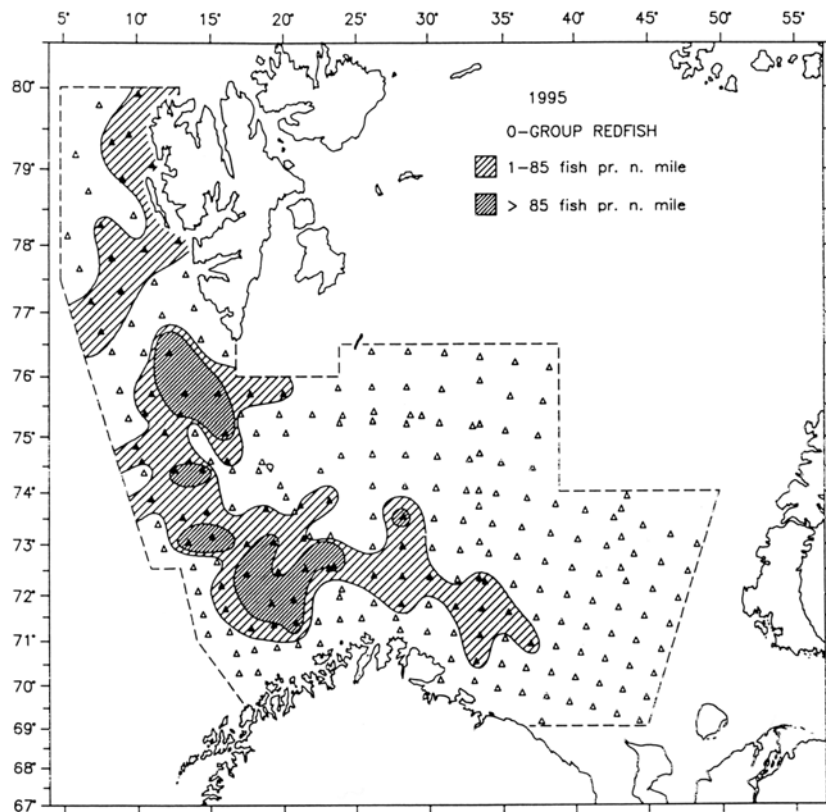


Fig. 26. Distribution of 0-group redfish

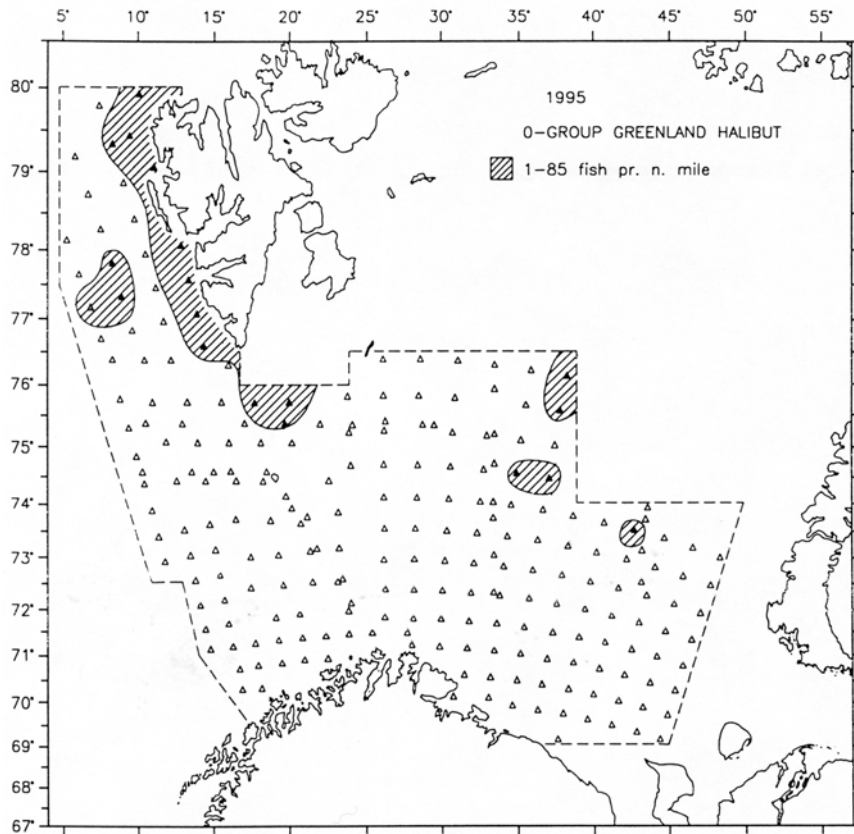


Fig. 27. Distribution of 0-group Greenland halibut

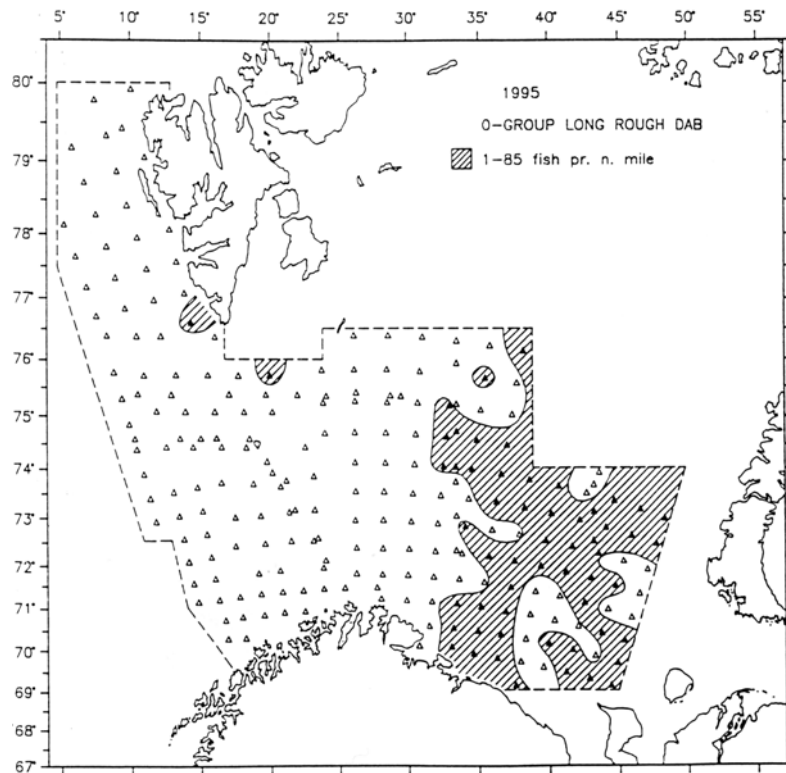


Fig. 28. Distribution of 0-group long rough dab

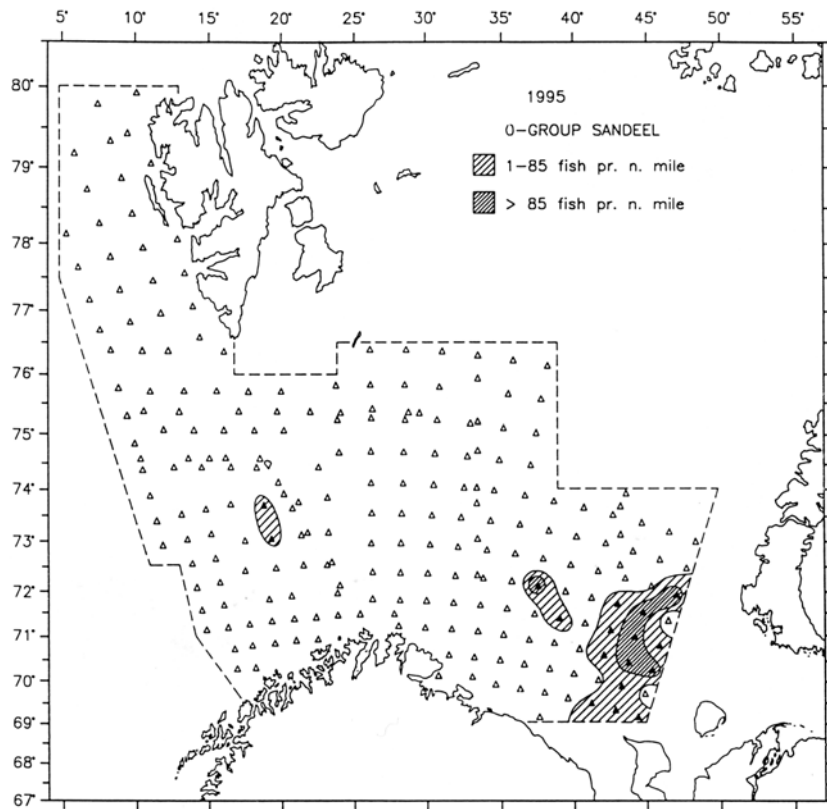


Fig. 29. Distribution of 0-group sandeel

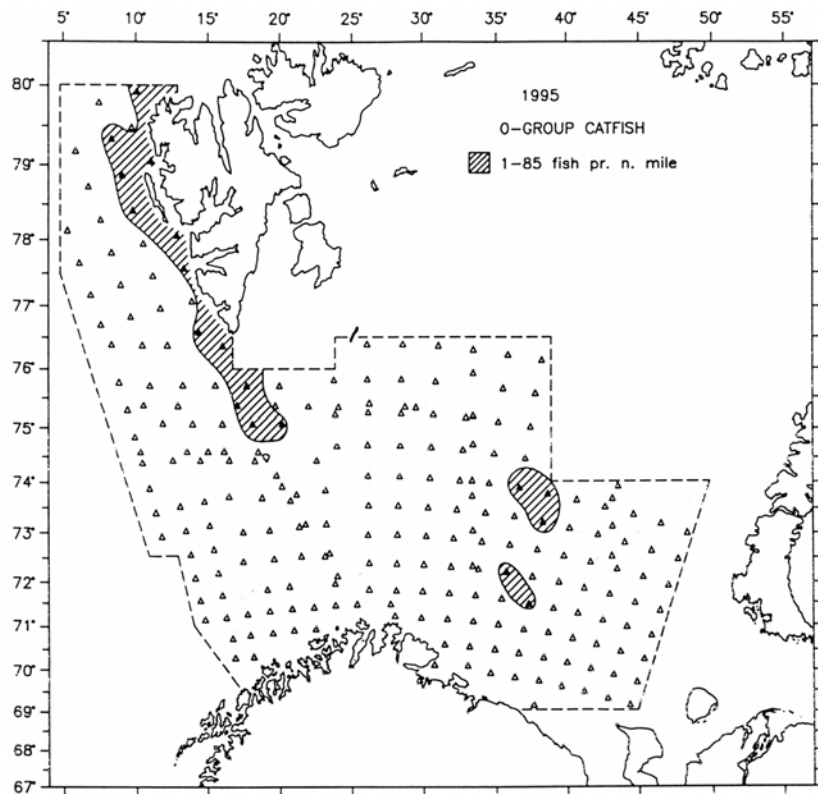


Fig. 30. Distribution of 0-group catfish

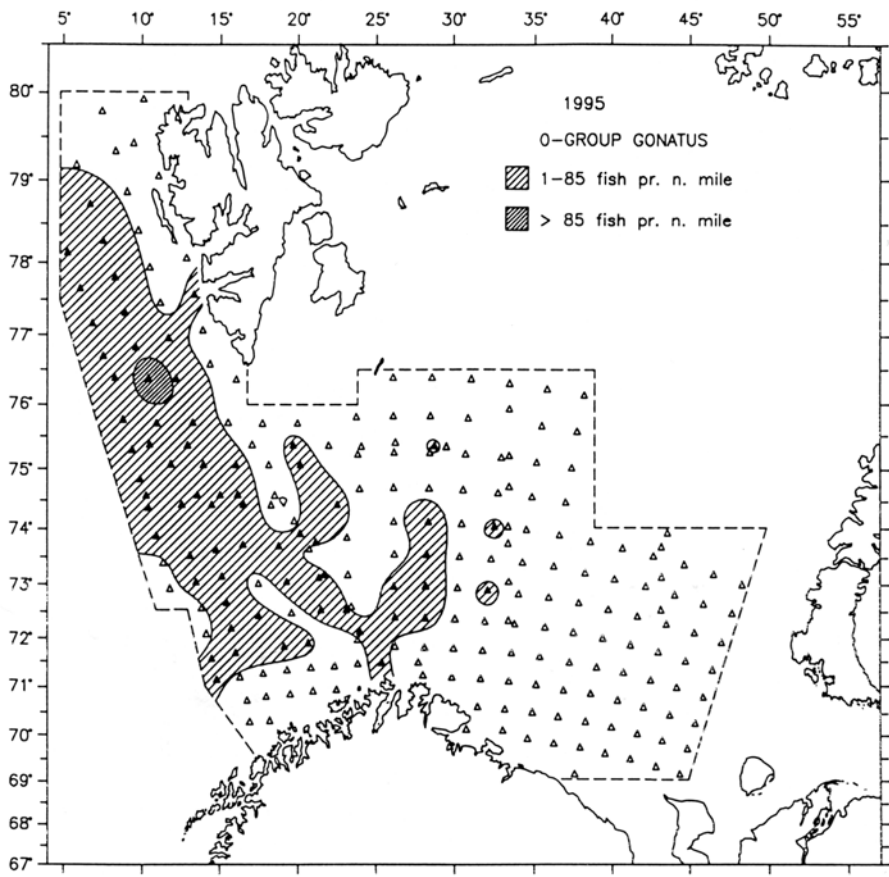


Fig. 31. Distribution of 0-group Gonatus fabricii