International Council for
the Exploration of the Sea

C.M. 1996/G: 31 Ref. H
Demersal Fish Committee

Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1996

The thirty second annual International 0-group fish survey was made during the period 16 August-10 September 1996 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 - 10.09	Institute of Marine Research, Bergen
Norway	"Johan Hjort"	24.08 - 10.09	"
Norway	"G.O. Sars"	17.08 - 10.09	"
Russia	"Atlantida"	15.08 - 10.09	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
Russia	"Persey III"	24.08 - 10.09	"

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 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 distributions of 0-group fish were estimated with a small mesh midwater trawl. All vessels which participated in the survey in 1996, used the type of midwater trawl recommended in 1980 (Anon., 1983). 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 40 m.

Additional steps at 60 and 80 m for 0.5 nautical miles were made when 0-group fish layer was recorded deeper than 60m or 80m on the echo-sounder. Trawling procedure was standardized in accordance with the recommendation made in 1980.

Most of the stations worked by the Norwegians research vessels were taken at a distance of 32 nautical miles. This design differed from the survey last year in which the stations were taken at a distance of 30 nautical miles west of 20°E and 35 nautical miles east of this longitude (Anon. 1996).

Hydrographical observations were made at each trawl station and at several permanent hydrographical sections (Fig. 1). 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 hydrographical sections: Bear Island - West, Bear Island – North

Cape, Kola and Cape Kanin-North. 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. 16-27, as filled and open symbols respectively. The density grading is based on catch as number per 1.0 nautical mile trawling.

Hydrography

The temperature recordings during the 1996 0-group survey show that the temperature at 0-200 m is close to the long term average (1965-1995) in the West Spitsbergen, North Cap and Murmansk Current. (Table 1, column 7, 6 and 3). In the eastern coastal areas (Cap Kanin) the temperature at 0-bottom shows 0.9 °C above the long-term average (Table 1, column 4).

Compared to 1995 the temperature in all areas of the Barents Sea show a decrease in the deep water layers, particularly in the northern part of the Cap Kanin Section. In the surface layers the temperature conditions were approximately similar.

The vertical gradients of temperature in the standard sections were greater than last year, especially in the eastern and southern areas: probably a result of increased solar radiation. In all areas of the Barents Sea the temperature recordings since 1988 has been above the long-term average, but with a slight decreasing trend since the warm year 1989. This decreasing trend has continued in 1996 and the temperature condition is closer to a normal situation than during the last five years.

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. 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. 16)

A continuous distribution of 0-group herring was observed from 80° N along Spitsbergen, south of Bear Island and in the Barents Sea as far east as 39° E. In the Barents Sea the distribution area is limited in the north by the 75° N latitude. A large area with high abundance was observed in the central part of the Barents Sea. The abundance index shows that the 1996 year-class is at the average level of the 1988-1995 year-classes, but below the rich 1991 year-class. (Table 3).

Capelin (Fig. 17)

Concentrations of 0-group capelin was observed in a continuous layer from 76°30' N in the west and southeastward in Barents Sea to 55° E. Nine small patches with high abundance were isolated within this distribution. The area based 0-group abundance index indicates that the 1996 year-class has much higher abundance than the four previous poor year-classes, but far below the very rich 1989 year-class.

Cod (Fig. 18)

0-group cod was observed in a continuous distribution from 80° N in the west, along Spitsbergen and in the Barents Sea to about 48° E. A great area inside the Barents Sea between 18° and 46° E has high abundance. Both the area based abundance and the logarithmic abundance indices are classifying the 1996 year-class as very strong and it is the sixth strong year-class in succession. The survey did not cover the total distribution in the southwest and the 0-group was recorded down to about 150 m and four, five and even seven steps were made on some trawl stations. Both factors might have caused an underestimation of the abundance indices.

Haddock (Fig. 19)

0-group haddock was distributed in an area west of Bear Island and eastwards in the Barents Sea as far east as 43° E. Only five small patches of high abundance were observed within the area of scattered concentrations. The abundance indices indicate that the 1996 year-class is below the average strength of the 1988-1995 year-classes. A Norwegian survey in July-August observed high abundance of 0-group in the area southwest of the present survey area. However, the trawling strategy differed from that used in the 0-group survey, and the observations are not included in the present analysis. The effect might be that the year-class strength measured in the present survey is somewhat underestimated.

Polar cod (Fig. 20)

Polar cod was observed in two components. The distribution recorded off the Spitsbergen coast had low abundance, and the abundance index of the 1996 year-class, comparable with the results of similar survey area in earlier years, indicates a very poor year-class. The abundance index of 1996 year-class of the eastern component observed along Novaya Zemlya is high, indicating a rich year-class. However, caused by incomplete coverage in both areas, the abundance indices for the components are underestimated.

Saithe (Fig. 21)

A few hauls with 1-3 specimens were recorded in the area east of 16° E. 0-group saithe is at this time of the year mainly living in Norwegian coastal areas, and the observations in open sea give no indication of the year-class strength.

Redfish (Fig. 22)

0-group redfish was observed in two small patches off Spitsbergen north to 80° N and four in the central Barents Sea, all with very low abundance. Calculated abundance index indicates that the 1996 year-class is very poor, even far below the average of the poor 1991-1995-classes.

Greenland halibut (Fig. 23)

Three small patches of 0-group Greenland halibut were observed west of Spitsbergen. In the Barents Sea, only three single hauls with a catch of 1-4 specimens were recorded. The abundance index of the 1996 year-class is close to the level of the poor 1993-1995 year-classes, indicating another poor year-class.

Long rough dab (Fig. 24)

0-group long rough dab was recorded in four patches in the northern Barents Sea, represented by 1-6 specimens in the hauls. The abundance index of the 1996 year-class indicates another poor year-class.

Sandeel (Fig. 25)

0-group sandeel was as in earlier years observed in one patch of high abundance and three single hauls in the southeastern Barents Sea. In contrast to 1995, the distribution area was nearly covered.

Catfish (Fig. 26)

0-group catfish was distributed in two small patches off Spitsbergen, both with low abundance. One patch was observed south of Spitsbergen and one in the southeast Barents Sea, also with low abundance. In addition, single hauls with small numbers were recorded in the Barents Sea

Gonatus (Fig. 27)

As in earlier years, 0-group Gonatus fabricii was distributed in the western part of the survey area. However, the area was not completely covered. Survey catches were at the same level as in 1994-1995.

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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 1965-1996.

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	4.3	6.1	5.2
1996	7.6	3.7	4.7	5.2	2.9	5.8	4.7
Average 1965-1996	7.3	3.8	4.7	4.3	3.3	5.8	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 1965-1996

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	93
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		93	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
1996	291	1142	196	59		484	19	5	10

[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 1965-1996

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	0.48	1.01	0.26	0.18	0.36
1972	0.00	-	-	0.52	0.35	0.72	0.16	0.09	0.27
1973	0.00	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	0.61	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	0.19	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	2365	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	0.13	0.41
1996	0.65	0.47	0.85	2.87	2.53	3.24	0.39	0.25	0.56

[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 1996

Length (mm)	Herring	Capelin	Cod	Haddock	Polar cod	Redfish	Greenland halibut	Long rough dab	Sandeel
10-14									
15-19					0.1	2.6			
20-24					0.9	4.6		1.1	
25-29					6.4	10.1		3.3	0.1
30-34		1.3			21.4	8.5	8.7	34.9	6.8
35-39		4.8			37.6	4.6	8.7	40.0	29.6
40-44	0.2	12.5			23.0	10.4	5.8	20.7	36.7
45-49	1.4	26.6		0.1	9.1	51.3	14.5		14.2
50-54	10.7	30.7	0.2	0.1	1.5	3.3	8.7		1.6
55-59	26.0	15.6	1.4	0.2		4.6	8.7		0.1
60-64	28.6	7.3	8.0	0.3			14.5		9.9
65-69	17.2	1.2	17.5	1.0			8.7		0.1
70-74	9.0	+	21.4	1.6			14.5		0.3
75-79	3.9		17.3	4.2			7.2		0.3
80-84	1.3		12.2	5.3					0.2
85-89	0.9		8.1	8.5					0.1
90-94	0.6		6.1	7.8					
95-99	0.2		3.6	13.0					
100-104			2.4	14.3					
105-109			1.0	12.1					
110-114			0.4	10.0					
115-119			0.2	8.3					
120-124			0.1	6.5					
125-129			0.1	3.3					
130-134				2.0					
135-139				0.9					
140-144				0.5					
No. measured	5906	4529	12144	2385	2056	66	28	81	197
Total numbers	341445	278156	428828	5771	199512	153	35	365	30027
Mean Length	62.5	50.1	76.9	102.1	37.4	41.4	55.6	35.8	43.1

Appendix

Research vessel	Participants
"G. O. Sars"	J. Erices, I. Fjellstad, R. Johannessen, A. Hylen (toktleder), L. Kalvenes, J. de Lange, H. Mjanger (fra 31/8), A. Raknes, N.G. Ushakov (Russia)
"Johan Hjort"	K. Bolstad, K. Gjertsen, H. Græssdal, E. Sælen Meland, M. Møgster, Ø. Torgersen, O.J. Østvedt (toktieder)
"Michael Sars"	H. Bjørke, T.I. Halland (toktieder), B. Hoffstad, A.K. Jensen, B. Kvinge, Ø. Nævdal, E. Øvretveit
"Atlantida"	A. Abramov, M. Dvinin, V. Mamylov, A. Nikiforov, D. Prozorkevitch, F. Shevchenko, V. Shnar, V. Tataurov, S. Ustinov
"Persey III"	A. Badygin, K. Dalimaev, S. Harlin, Yu. Mulin, A. Vasiljev

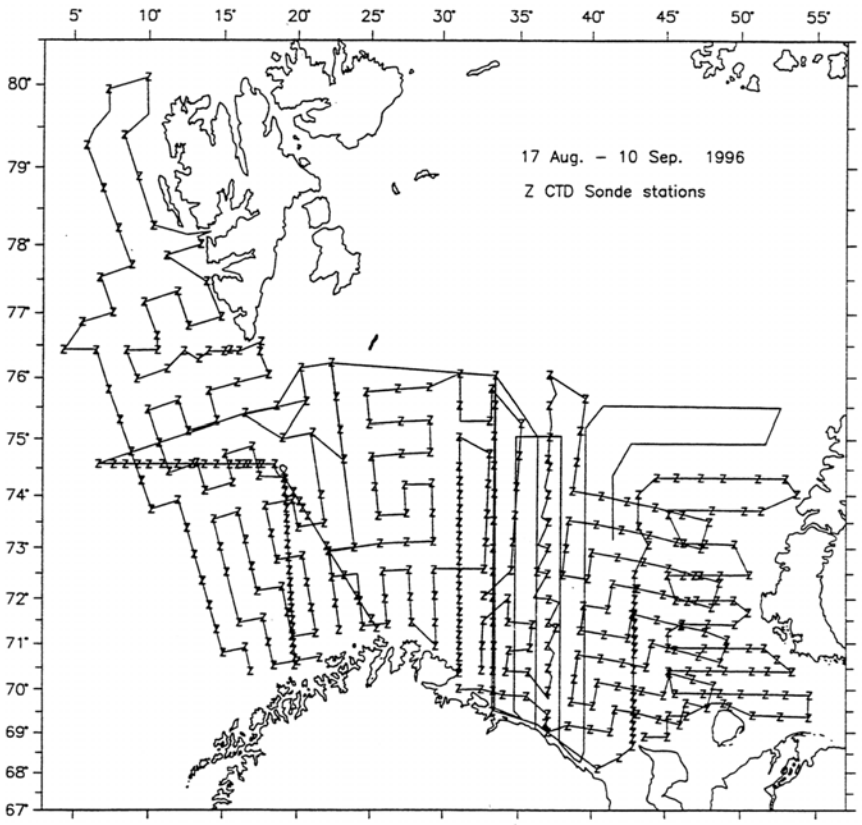

Fig. 1. Survey tracks and hydrographic stations

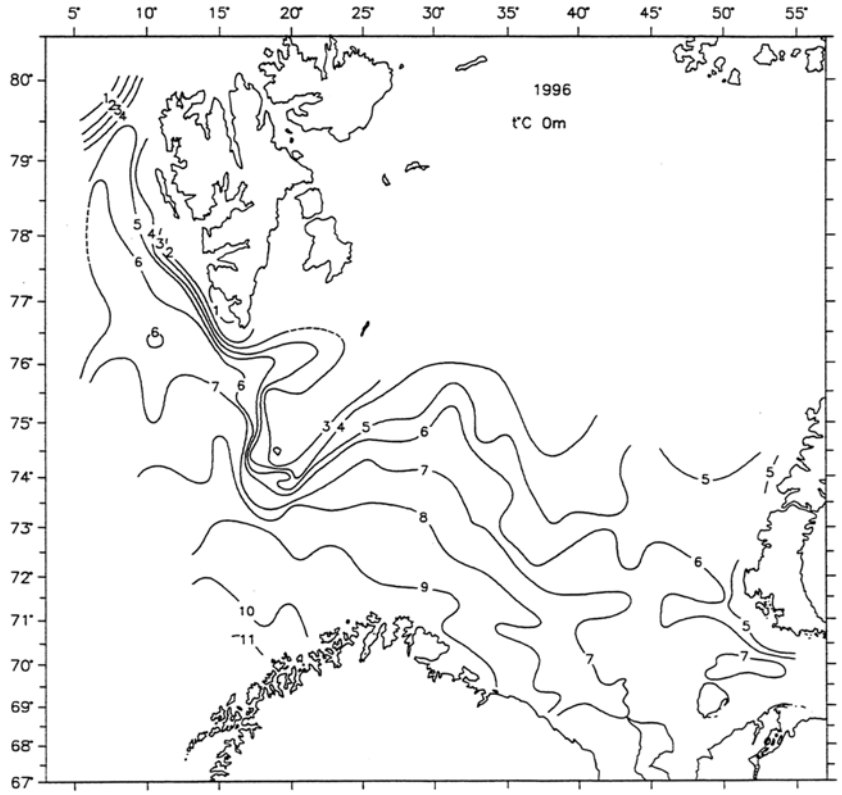

Fig. 2. Isotherms at 0 m

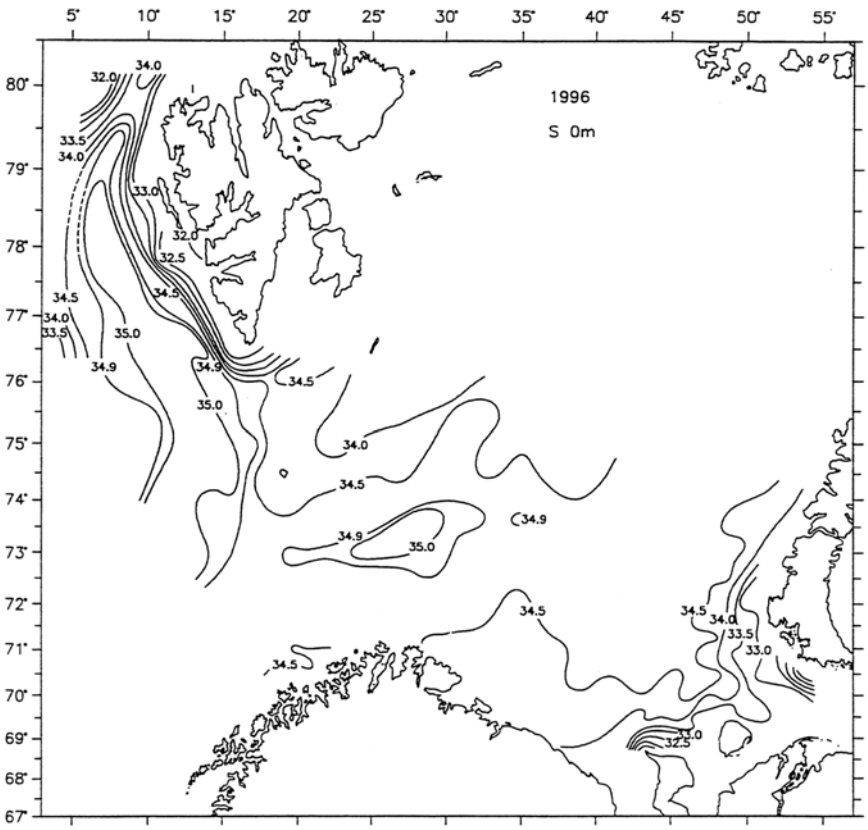

Fig. 3. Isohalines at 0 m

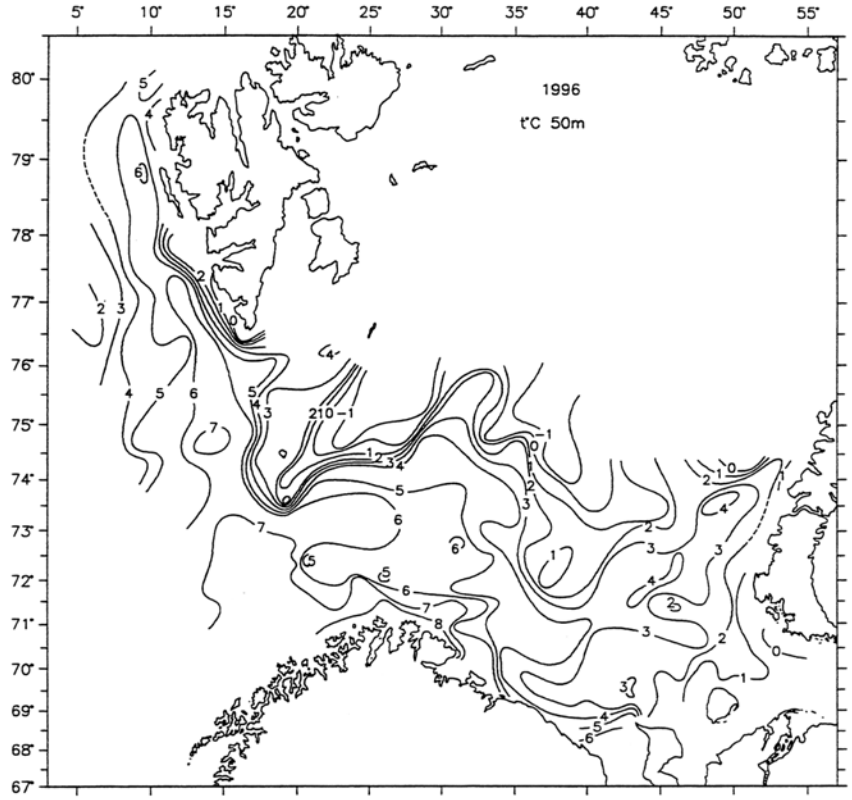

Fig. 4. Isotherms at 50 m

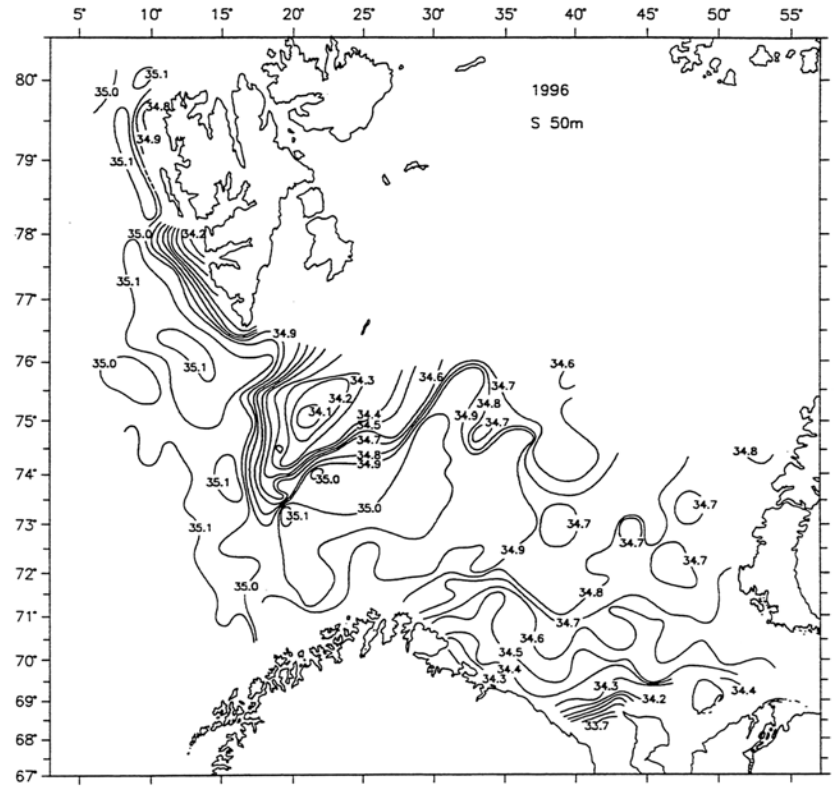

Fig. 5. Isohalines at 50 m

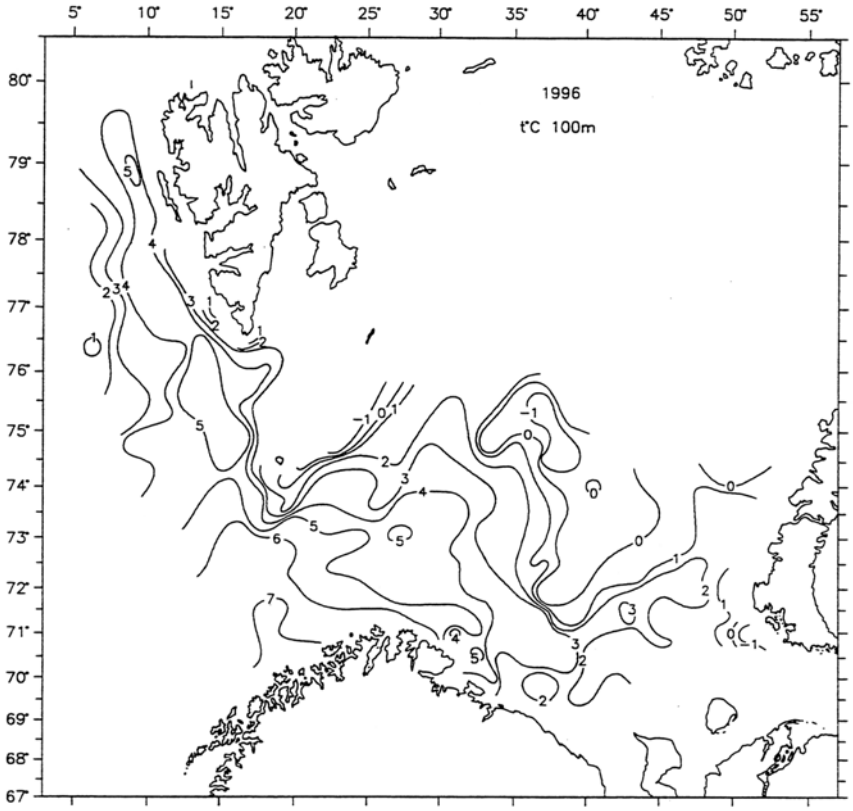

Fig. 6. Isotherms at 100 m

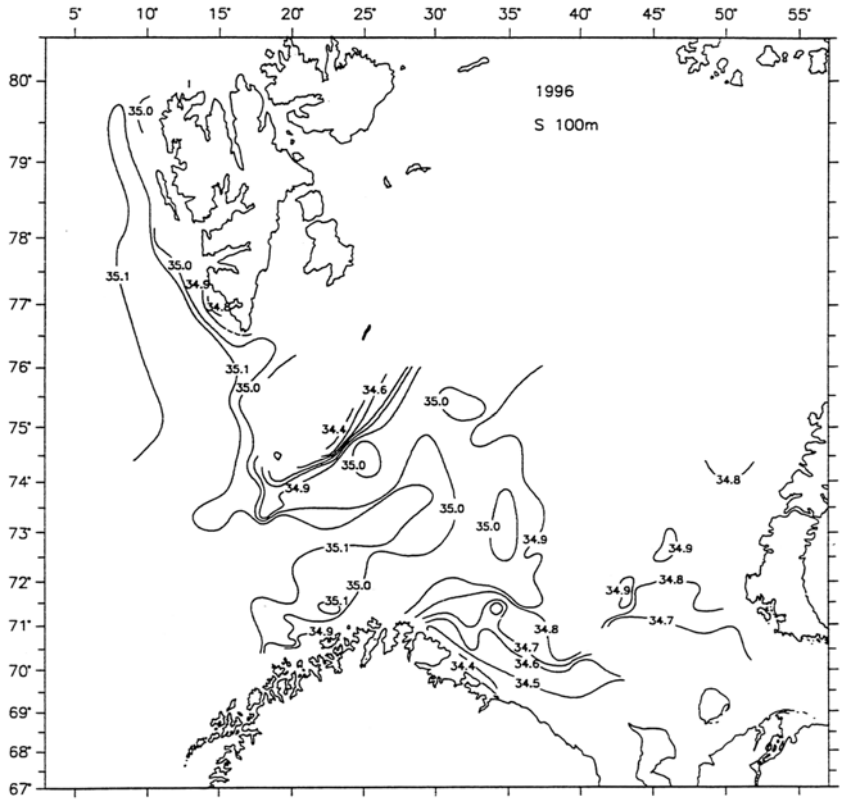

Fig. 7. Isohalines at 100 m

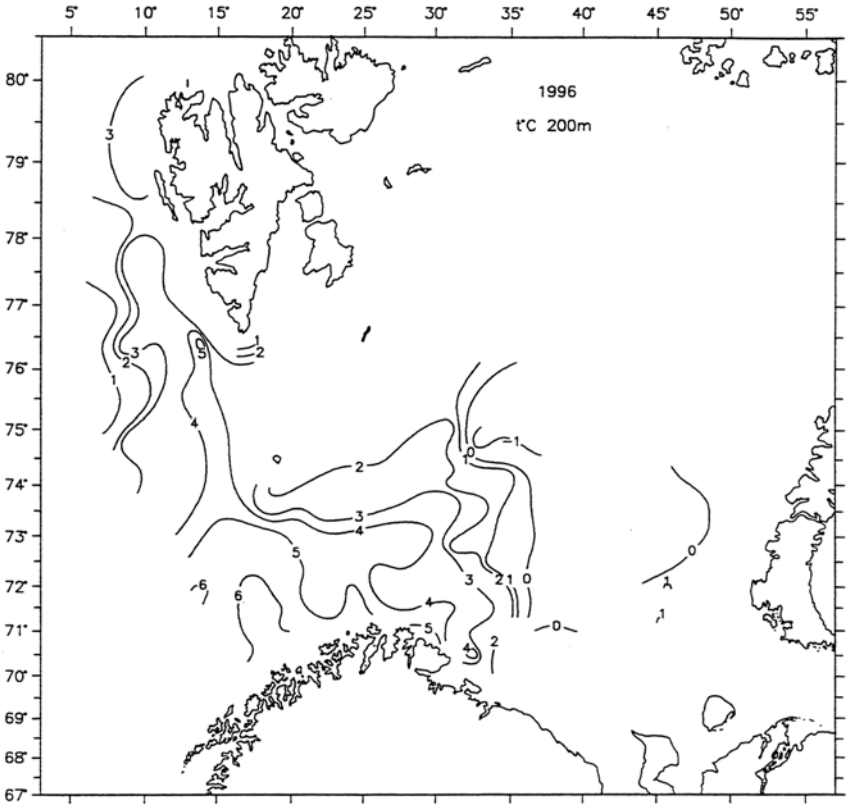

Fig. 8. Isotherms 200 m

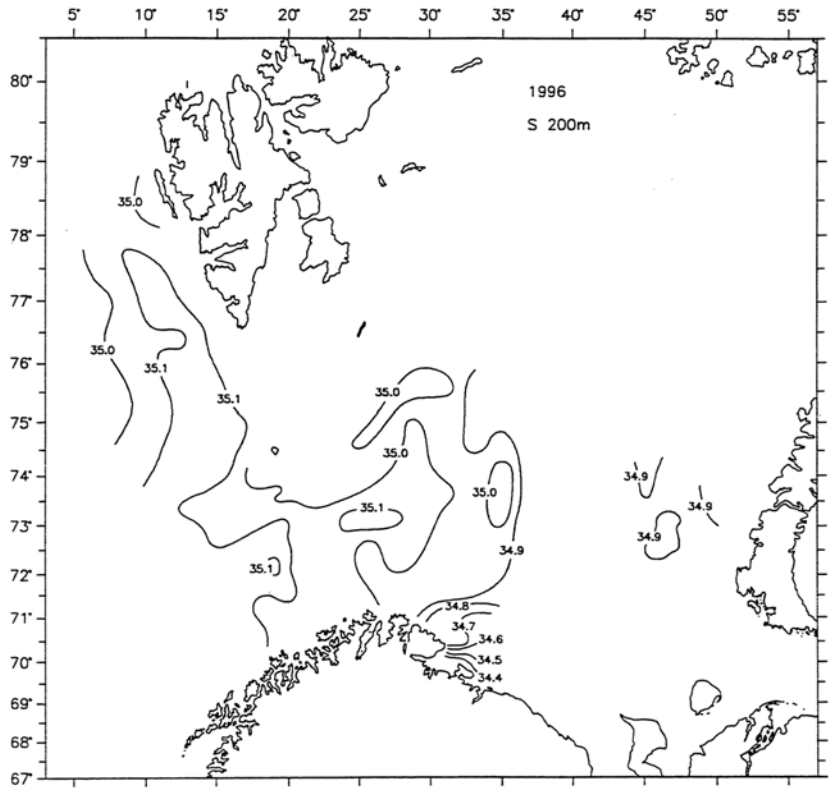

Fig. 9. Isohalines at 200 m

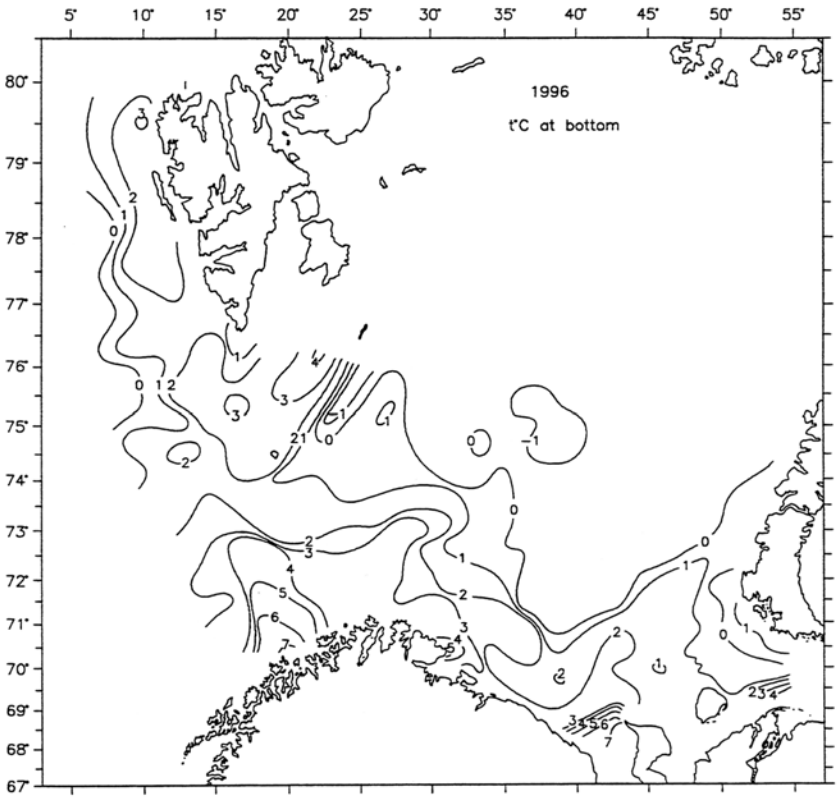

Fig. 10. Isotherms at the bottom

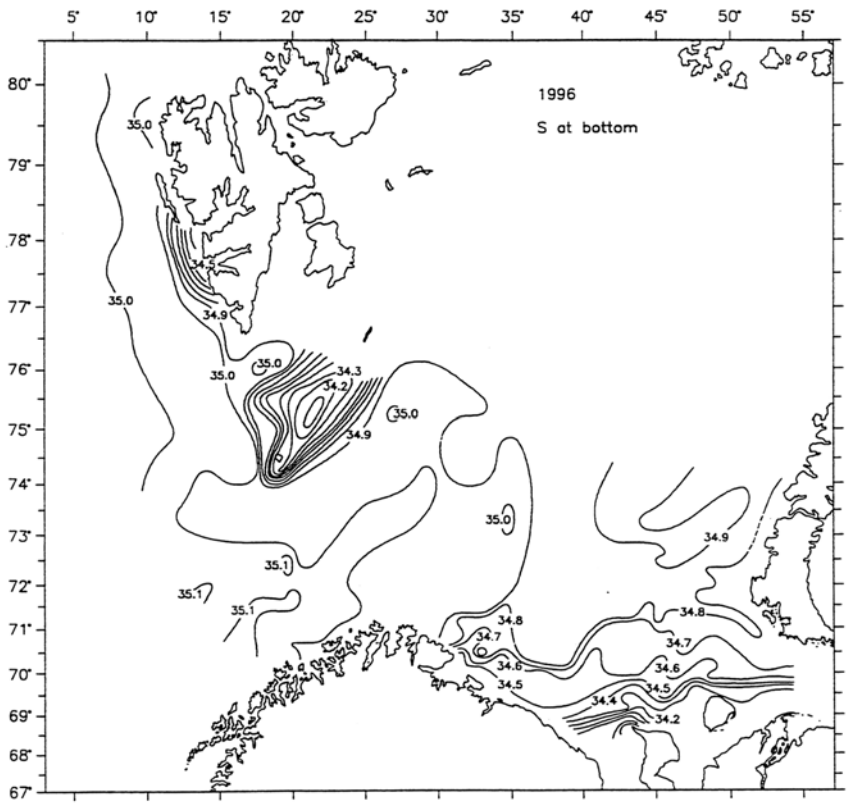

Fig. 11. Isohalines at the bottom

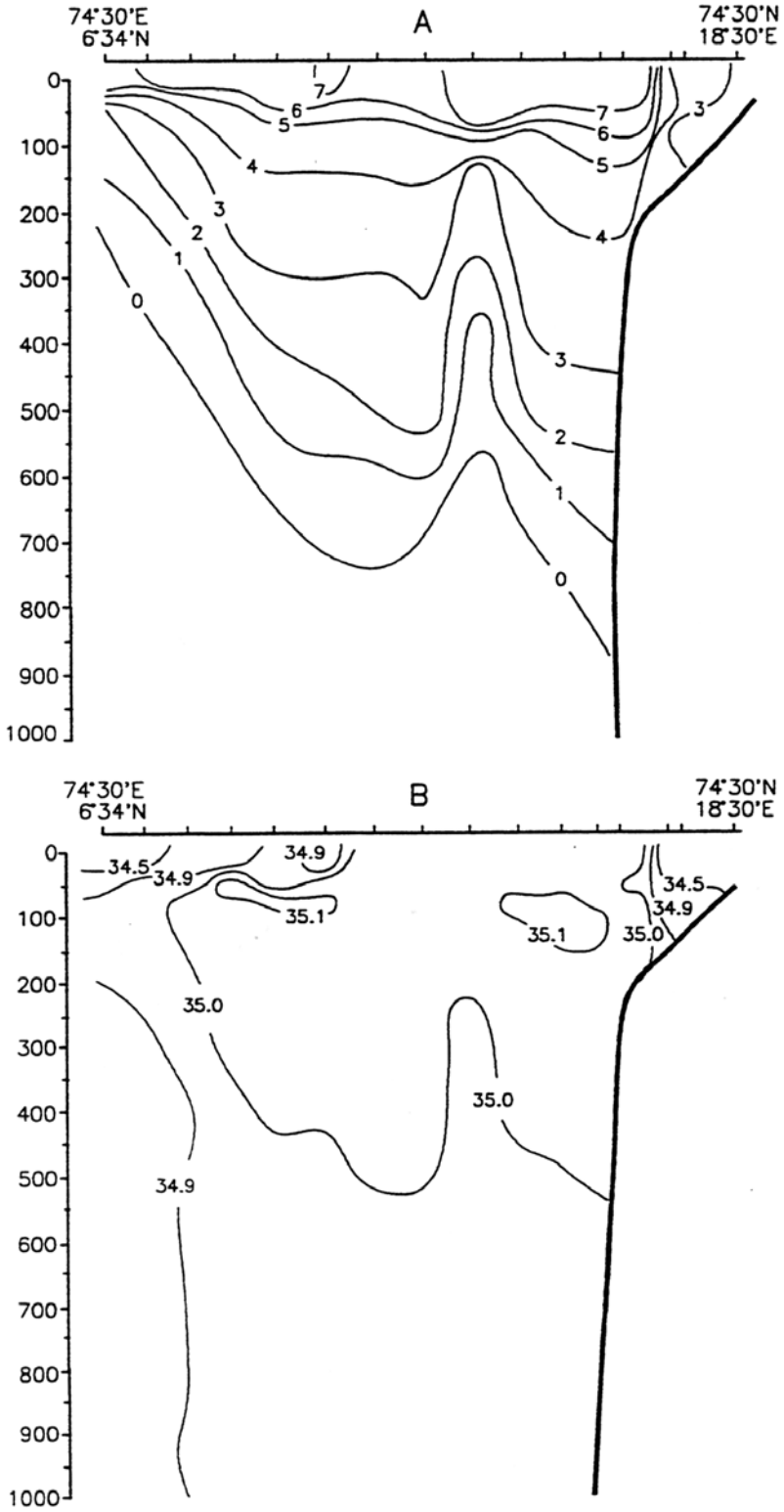

Fig. 12. Hydrographic section Bear Island-West. Temperature (A) and salinity (B)

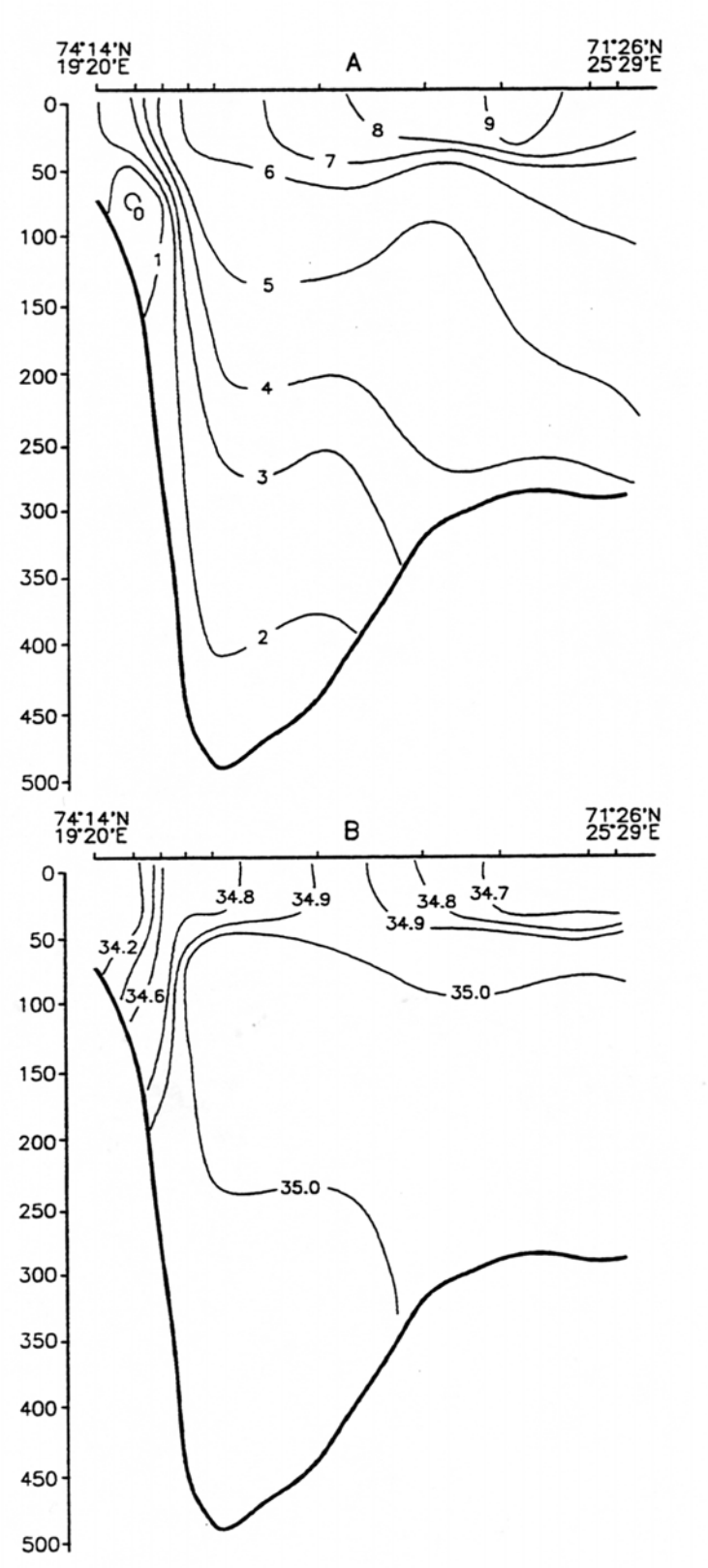

Fig. 13. Hydrographic section North Cape-Bear Island. Temperature (A) and salinity (B)

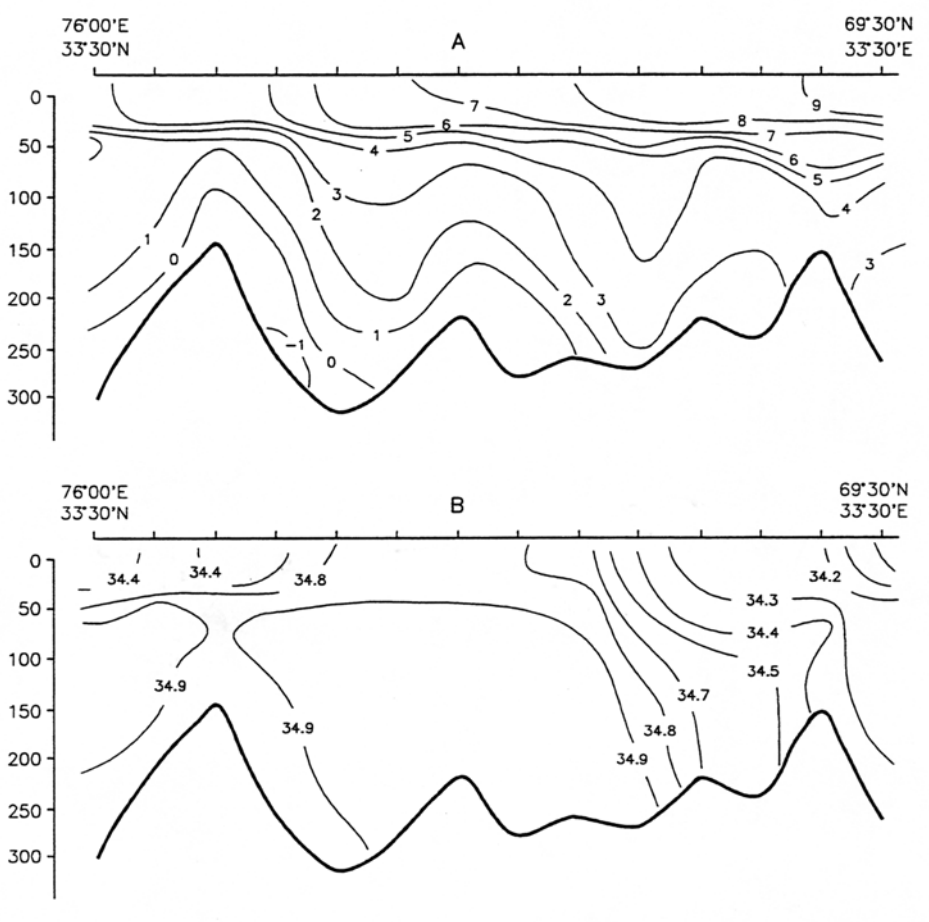

Fig. 14. Hydrographic section along the Kola meridian. Temperature (A) and salinity (B)

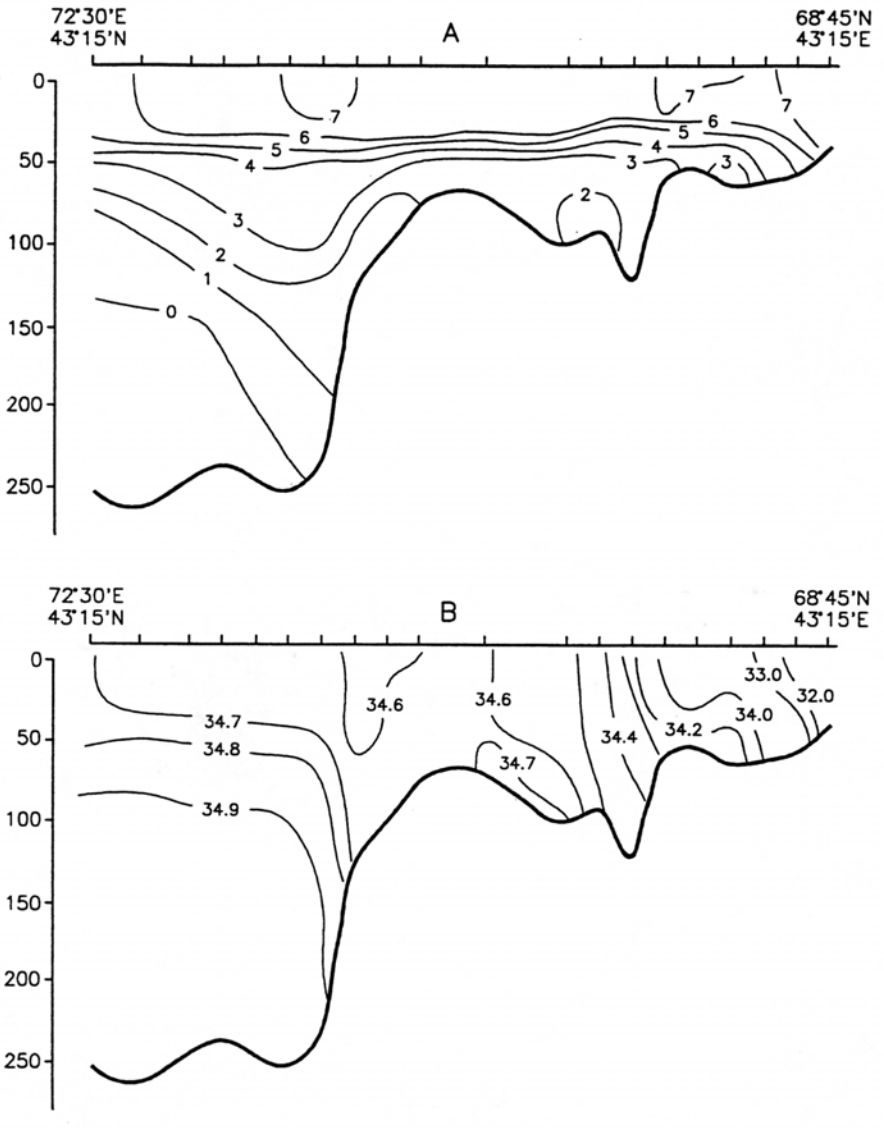

Fig. 15. Hydrographic section Cape Kanin-North. Temperature (A) and salinity (B)

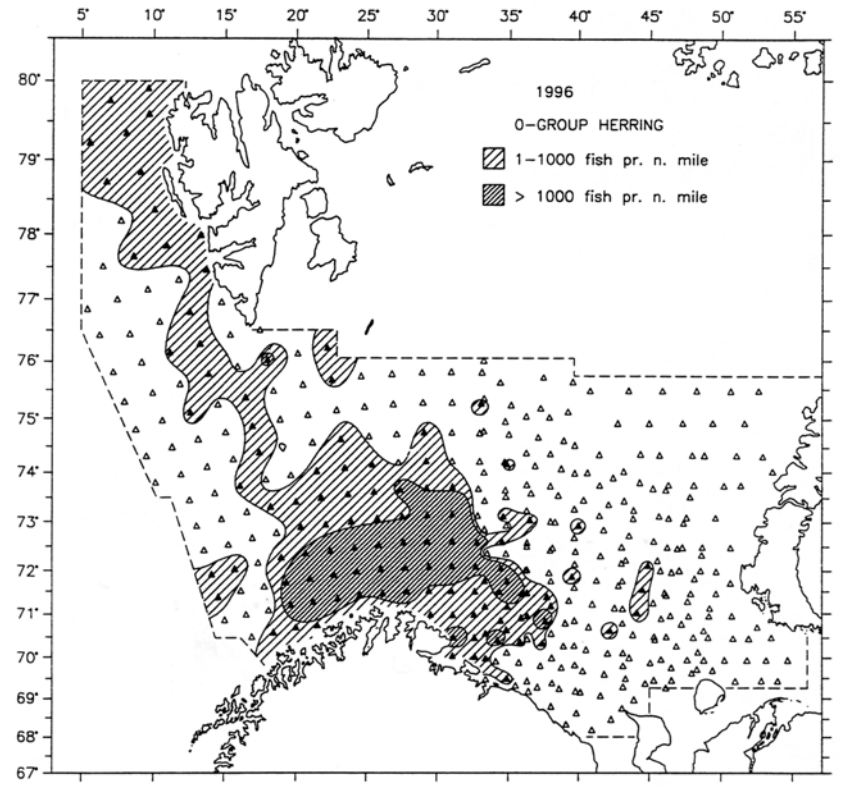

Fig. 16. Distribution of 0-group herring

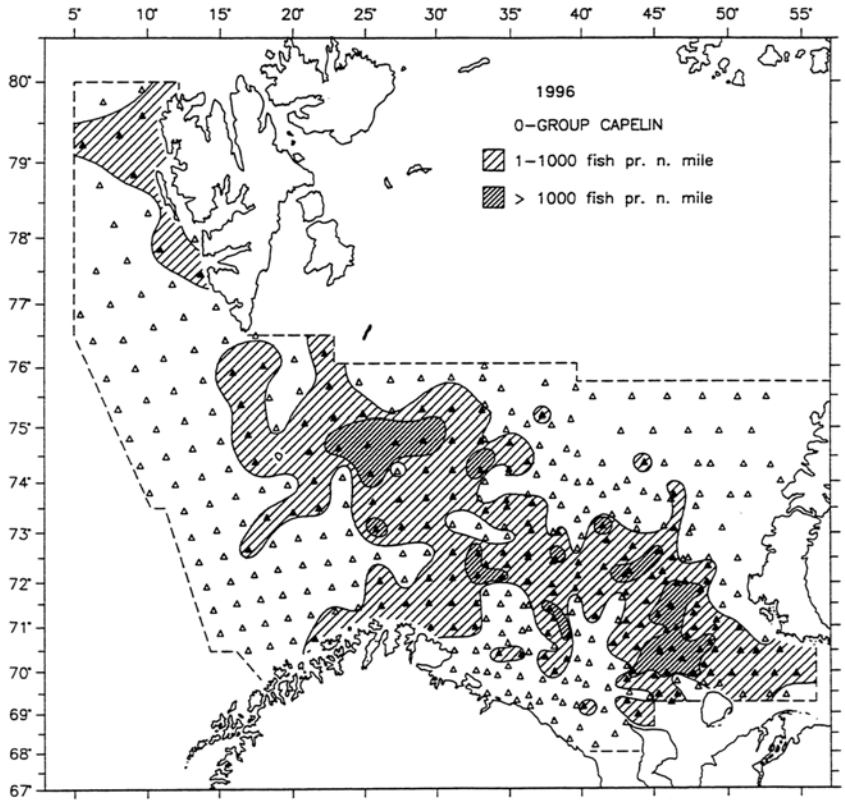

Fig. 17. Distribution of 0-group capelin

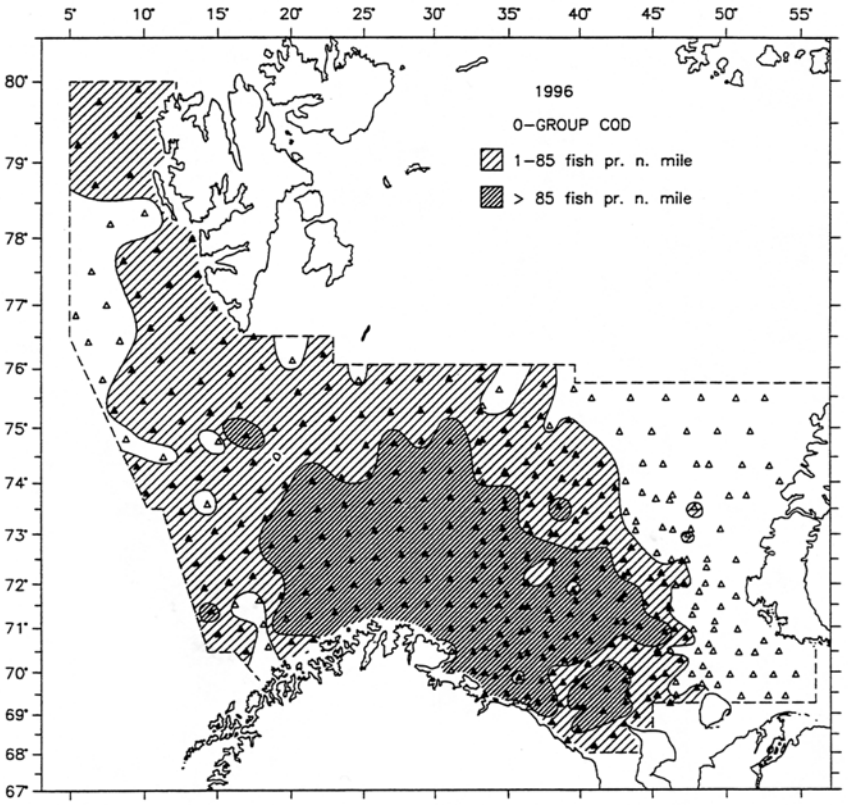

Fig. 18. Distribution of 0-group cod

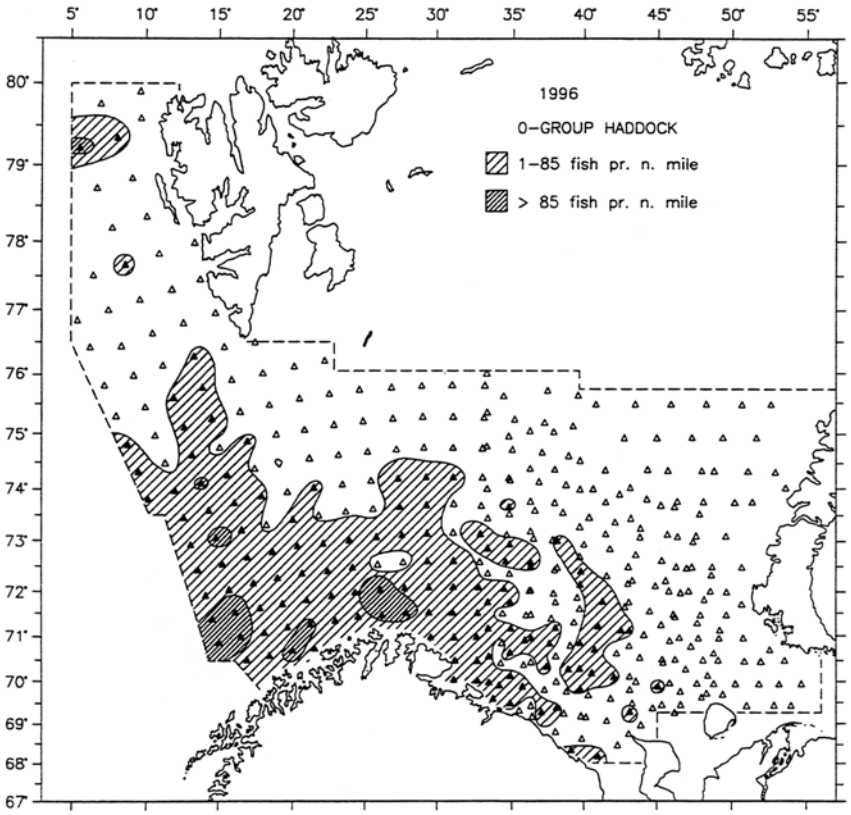

Fig. 19. Distribution of 0-group haddock

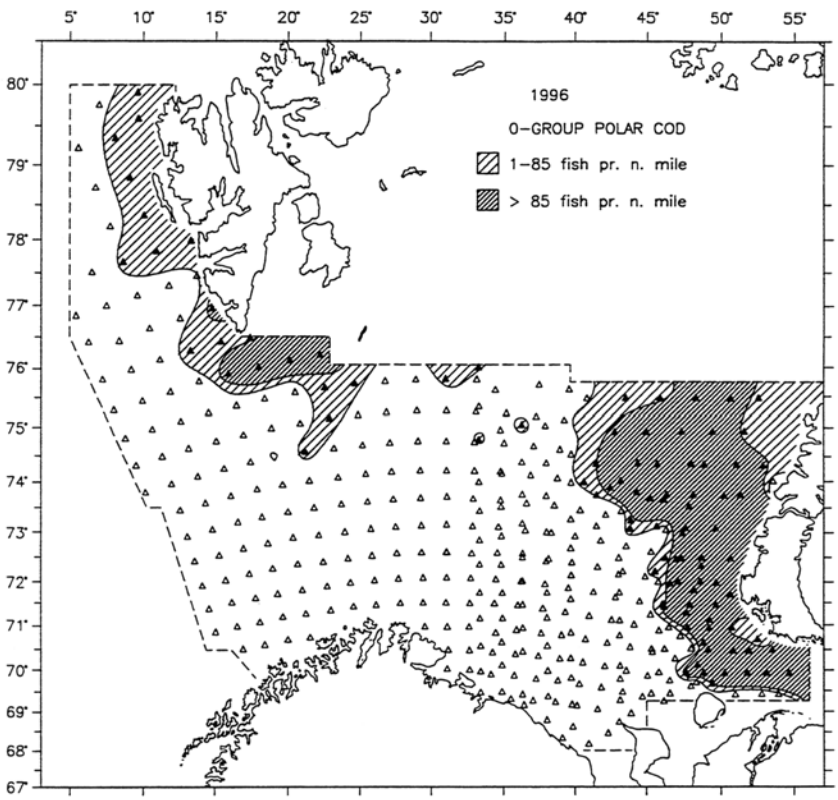

Fig. 20. Distribution of 0-group polar cod

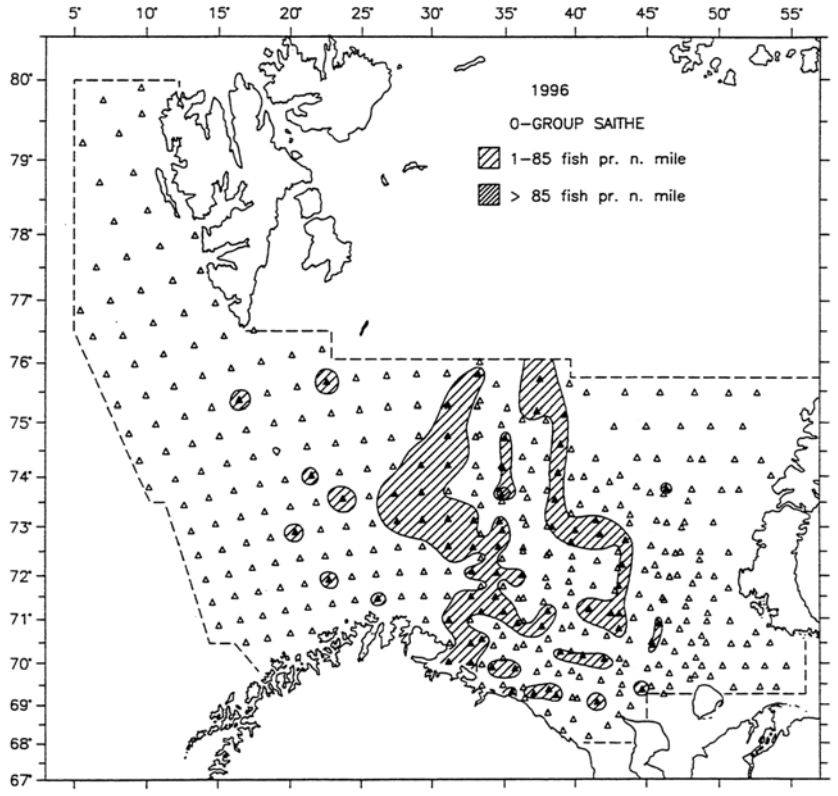

Fig. 21. Distribution of 0-group saithe

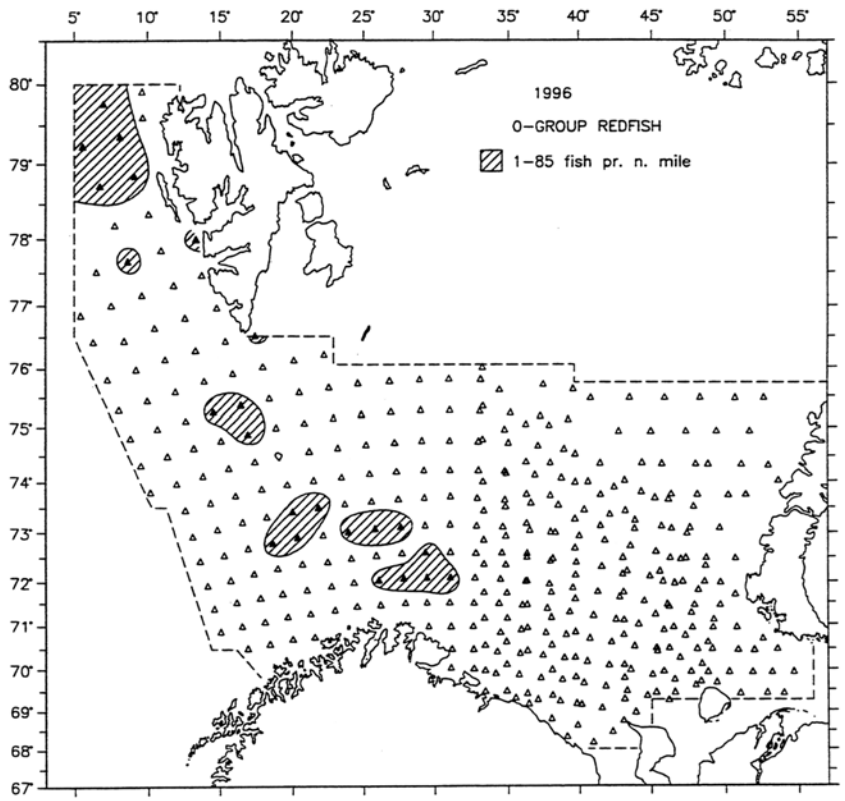

Fig. 22. Distribution of 0-group redfish

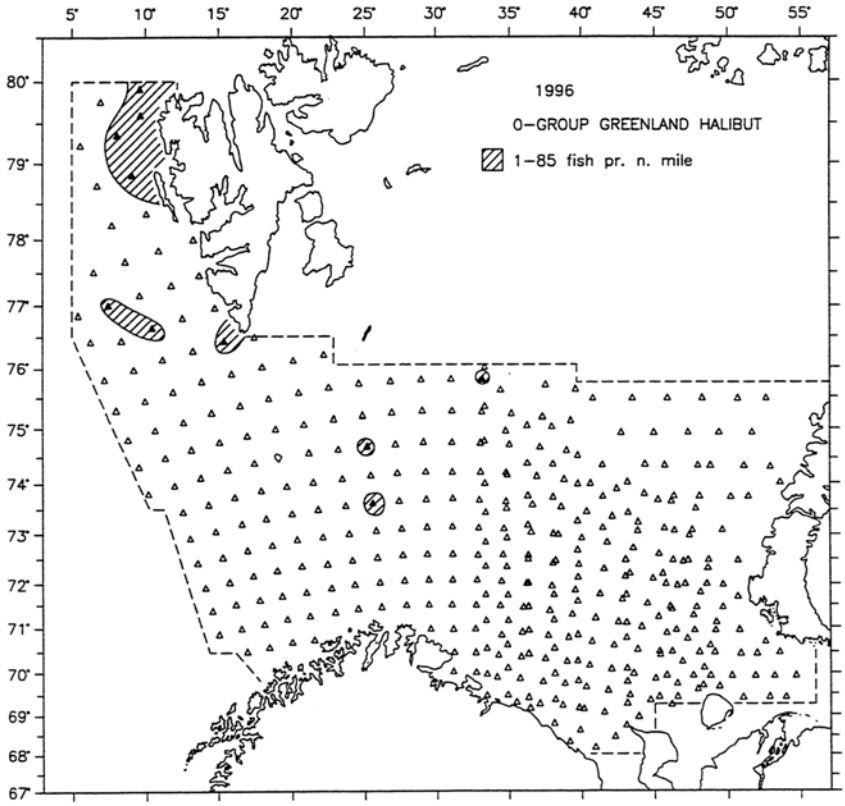

Fig. 23. Distribution of 0-group Greenland halibut

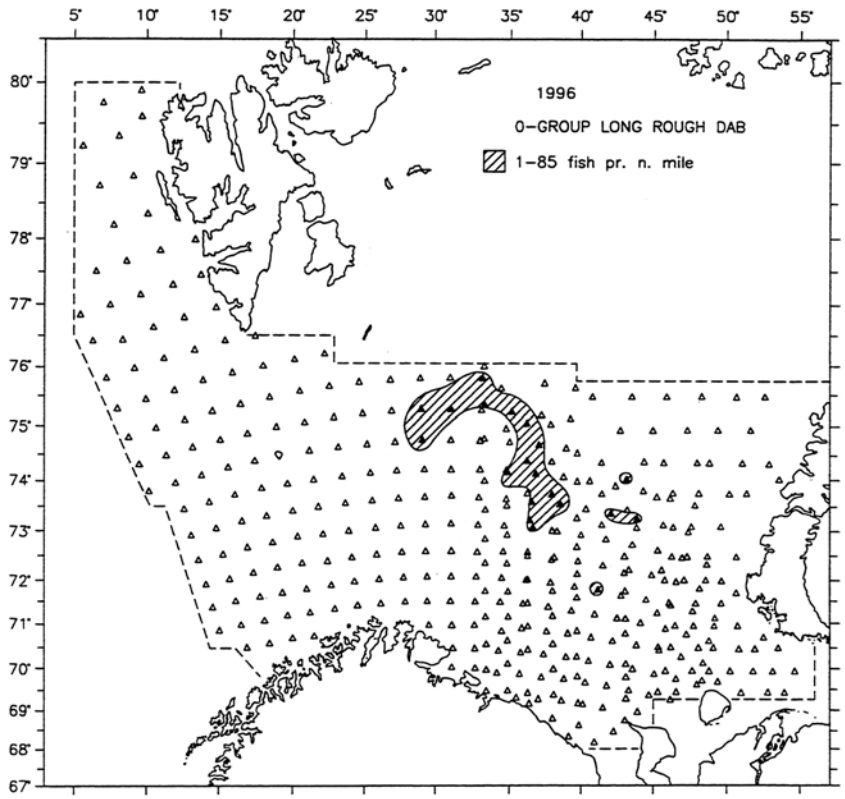

Fig. 24. Distribution of 0-group long rough dab

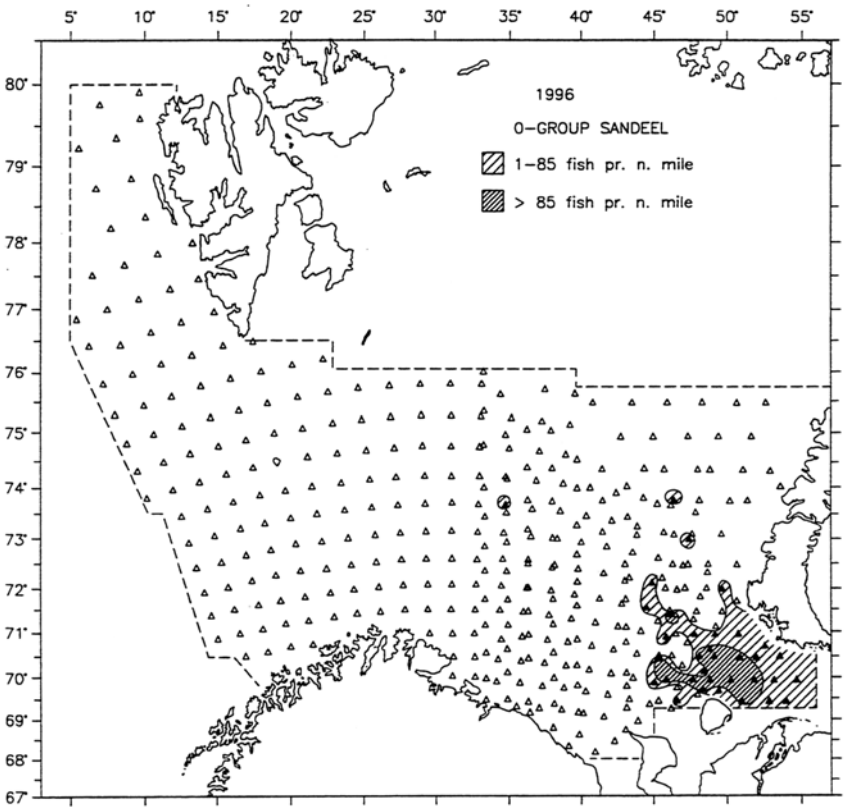

Fig. 25. Distribution of 0-group sandeel

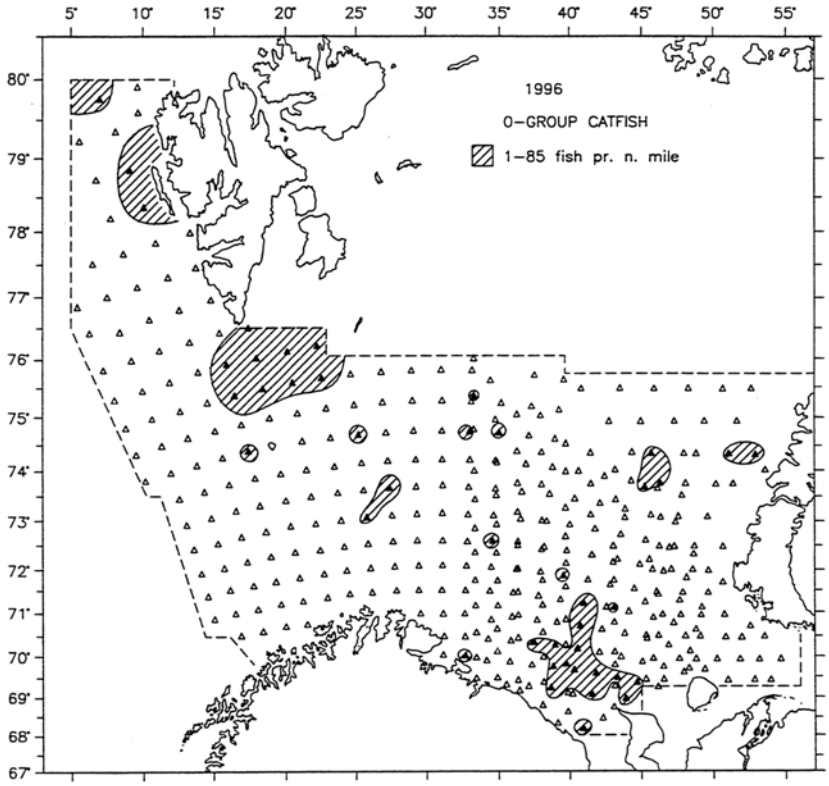

Fig. 26. Distribution of 0-group catfish

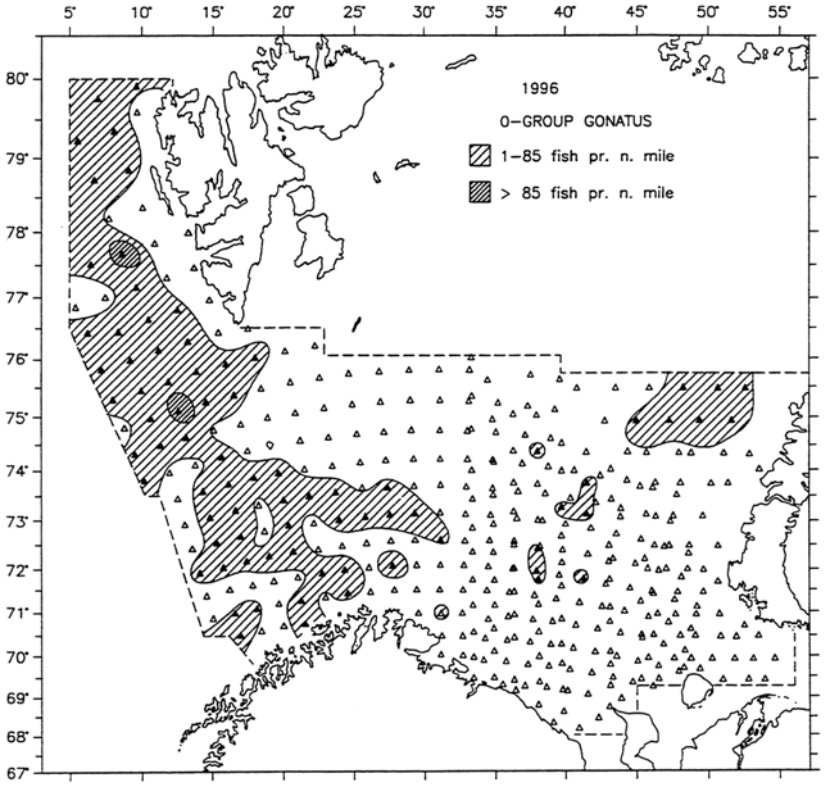

Fig. 27. Distribution of 0-group Gonatus fabricii

International Council for the Exploration of the Sea

C.M. 1998/G: Ref. H
Demersal Fish Committee

Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1997

The thirty third annual International 0-group fish survey was made during the period 15 August-08 September 1997 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"	20.08-08.09	Institute of Marine Research, Bergen.
Norway	"G.O. Sars"	19.08-08.09	"
Russia	"Atlantida"	21.08-06.09	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
Russia	"Persey III"	15.08-06.09	"

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

Preliminary analysis of the survey data were made on board "Johan Hjort" and "Atlantida" during the survey, and the 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 distributions of 0-group fish were estimated with a small meshed midwater trawl. All vessels which participated in the survey in 1997, used the type of midwater trawl recommended in 1980 (Anon., 1983). The standard towing procedure consisted of hauls of 0.5 nautical mile in each of 3 depths with the headline of the trawl located at 0. 20 and 40 m. Additional steps at 0.5 nautical miles at 60 and 80 m were made when 0-group fish layers were recorded deeper than 60m or 80m on the echo-sounder. The trawling procedure was standardized in accordance with the recommendation made in 1980.

Hydrographic observations were made at each trawl station and at several permanent hydrographical sections (Fig. 1). Horizontal distributions of temperatures and salinities are shown for 0, 50, 100, 200 m and bottom (Figs. 2-11). Figs. 12-15 show temperature and salinity distribution along the hydrographical sections: Bear Island - West, Bear Island – North Cape, Kola and Cape Kanin-North. Mean temperatures in standard parts of these sections are presented in Table 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

The temperatures in the upper layer (0-50 m) were close to the long-term average (1965-1997). In the deeper layers temperatures had continued to decrease since last years observations and were now well below the long term average in all areas; 0.5 °C below in the Bear Island – West section and in the northern part of the Cape Kanin section and 0.2-0.4 °C below average in the central and southern areas (Table 1). 1997 is the first year since 1988 that negative anomalies in temperature were recorded in the deeper layers over the entire area of investigation, and it is probably a combined effect of more severe winter cooling within the Barents Sea and reduced inflow of heat from the Norwegian Sea in recent years. In the southern and eastern parts the vertical gradients in temperature were larger in 1997 than in 1996, indicating that the solar radiation during spring and summer to some extent had compensated the heat loss in the upper layers.

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 multiplied by 10. are given in Table 2. All area-based abundance indices were estimated by 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. For comparisons mean values of abundance indices were calculated for the period 1985 - 1997. Indices obtained prior to 1985 should be corrected for capture efficiency of the trawls used. before mean values for the whole time series are made (Nakken and Raknes 1996). Length frequency distributions of the main species are given in Table 4.

Herring (Fig. 16)

0-group herring was observed in scattered concentrations along West-Spitsbergen and over wide areas in the Barents Sea from 18° E in the coastal areas. Areas of high abundance were more westerly and of slightly less extent than observed in 1996 resulting in a lower abundance index than last year and close to the 1985-1997 mean value (Table 3). The distribution map indicate that smaller amounts of herring in the Bear Island - Spitsbergen region might have been distributed outside the area of coverage. The mean length was similar to that found in 1996 and the smaller fish were observed at the eastern and northern boundaries of the distribution area.

Capelin (Fig. 17)

0-group capelin was observed all over the investigated area except in near shore waters and in the most southwestern parts. Dense concentrations appeared between 20° and 39°E in the central part of the Barents Sea and small patches of high abundance were observed up to 54° E in the southeastern parts. The abundance index of the 1997 year-class was the highest since 1989 and approximately 2 times the average value for the period 1985-1997 (Table 2).

The mean length was about 45 mm and substantially less than last year (50 mm) indicating that large amounts of the 0-group originated from the summer spawning in 1997.

Cod (Fig. 18)

The distribution of cod was similar to last year but the areas of dense concentrations were slightly more westerly. As in most recent years dense concentrations were absent in the Spitsbergen area. The abundance index (Table 2 and 3) indicate a year class strength of the same level as in the past 5-6 years and at about the average of 1985-1997.

The mean length in 1997 (72 mm) is below the 1996-value (77 mm).

Haddock (Fig. 19)

0-group haddock was observed in scattered concentrations eastward to 35° E with a narrow belt somewhat farther east along the Murman coast. Dense concentrations but very limited in extent occurred in the south and southwestern part. Compared with 1996 the distribution of scattered concentrations along West-Spitsbergen were wider in 1997. The abundance index was below the 1996 value and well below the average of 1985-1997. Mean lengths increased from 80 mm in the western part of the area to more than 90 mm at the east and north-eastern borders. The overall mean length of 0-group haddock, 89 mm, was substantially less than in 1996 (102 mm).

Polar cod (Fig. 20)

As usual 0-group polar cod were found in two separated areas. In the Spitsbergen area the distribution extended farther offshore than in 1996 resulting in a slightly higher abundance index in 1997 than in 1996. The southern part of the eastern component was wider than in 1996 but farther north, between 72° and 75° N the distribution area was more narrow than last year, resulting in an abundance index at the same level. It should however be noted that the indicies in both areas are underestimates due to incomplete coverage of the distribution areas. The mean length was 37 mm, which is the same as in 1996.

Saithe(Fig.21)

0-group saithe was observed in slightly higher densities and over a somewhat wider area than in 1996. Altogether 469 specimens were caught with a mean length of 72 mm.

Redfish (Fig. 22)

Compared with last year there was an increase of distribution area and abundance index. However, the abundance index for 1997 amounts to about 10 percent of the average 1985-1997 average value (Table 2), indicating that also this year class is very week. The mean length (41 mm) was equal to that in 1996 (40 mm).

Greenland halibut (Fig. 23)

0-group Greenland halibut was recorded in 5 hauls to the southeast and east of Bear Island and in most hauls off northwestern Spitsbergen. Catches were low, mainly 1-3 specimens per nautical mile towed. The index of abundance is somewhat higher than in 1996 and near the average for the period 1985-1997. However, it should be noted that this average is for a period with extremely low abundance indices in most years as compared with the levels experienced during 1978-1987 (Table 2).

The mean length (62 mm) was slightly higher than in 1996 (56 mm).

Long rough dab (Fig. 24)

The 0-group was observed over a larger area than in 1996 and the index of abundance is higher than last year, but considerably below the average for 1985-1997. Mean length was 31 mm and lower than last year (36 mm).

Sandeel (Fig. 25)

In addition to the usual area in southeast, 0-group sandeel was also recorded in the central and southwestern areas. Mean length in western and central areas were 87-88 mm while the fish in the southeastern area had a mean length of 43 mm.

Catfish (Fig. 26)

0-group catfish (not identified to species) was found in small numbers in isolated patches within the entire area of investigation. Total catch was 189 specimens and the mean length was about 45 mm.

Gonatus fabricii (Fig. 27)

As in most previous years Gonatus fabricii ranging 15-80 mm in length was caught in the western parts of the area. No observations were made in the eastern region where scattered concentrations of the species was found last year.

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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 1965-1997

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	4.3	6.1	5.2
1996	7.6	3.7	4.7	5.2	2.9	5.8	4.7
1997	7.3	3.4	4.4	4.2	2.8	5.6	4.1
Average 1965-1997	7.4	3.8	4.7	4.3	3.3	5.8	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 1965-1997

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	93
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		93	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
1996	291	1142	196	59		484	19	5	10
1997	522	1077	150	129		453.	50	13	42
Mean 1985-1997	256	700	201	106		247	436	17	132

[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 1965-1997

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	0.48	1.01	0.26	0.18	0.36
1972	0.00	-	-	0.52	0.35	0.72	0.16	0.09	0.27
1973	0.00	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	0.61	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	0.19	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	2.37	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	0.13	0.41
1996	0.65	0.47	0.85	2.87	2.53	3.24	0.39	0.25	0.56
1997	0.39	0.25	0.54	1.60	1.35	1.86	0.21	0.12	0.31
Mean 1985-1997	0.46			1.72			0.46		

[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 1997

Length, mm	Herring	Capelin	Cod	Haddock	Polarcod	Redfish	Greenland halibut	Long rough dab	Sandeel
10-14						0.1			
15-19						0.9			
20-24					0.3	3.4		11.1	
25-29		0.4			3.8	7.1		30.3	
30-34		6.5			36.1	8.2		33.3	4.7
35-39	0.6	20.5		+	33.1	20.8	2.6	20.7	30.4
40-44	4.7	24.7	+	0.2	23.0	33.4	2.6	3.8	21.9
45-49	3.0	32.7	0.3	0.5	3.4	23.4	5.3	0.8	24.4
50-54	5.1	8.7	1.3	1.3	0.2	2.5	13.2		9.0
55-59	16.8	1.8	4.5	1.4	+	0.3	21.1		2.6
60-64	29.2	0.8	12.2	3.2		0.3	15.8		0.3
65-69	20.5	0.9	21.9	5.0		0.3	21.1		0.5
70-74	12.4	1.1	25.1	7.0		0	7.9		0.1
75-79	5.1	0.9	18.9	9.4		0.3	0		0.5
80-84	2.5	0.8	9.0	12.1			10.5		1.0
85-89	0.1	0.2	4.4	15.3					1,5
90-94			1.5	11.9					1.4
95-99			0.6	10.5					0.8
100-104			0.2	7.8					0.5
105-109			0.1	5.1					0.1
110-114			+	4.3					+
115-119				2.9					
120-124				0.8					
125-129				0.9					
130-134				0.4					
135-139				+					
140-144									
No. measured	4862	6164	10026	2648	3173	230	32	459	263
Total numbers	356030	369805	424460	4603	142892	1152	38	637	4956
Mean length	63.2	45.0	72.2	88.5	36.8	40.7	62.2	31.4	45.9

Appendix

Research vessel	Participants
"G.O. Sars"	H. Græsdal, H. Hammer, B. Hoffstad, J. Home (from 29/8), R. Ingvaldsen (until 29/8), R. Johannessen, J. de Lange, H. Loeng (until 29/8), K. Michalsen (cruiseleader), H. Sagen (until 29/8)
"Johan Hjort"	K. Gjertsen (until 30/8), A. Haugsdal, E. Holm, Å. Husebø (from 30/8), R. Korneliussen, E. Molvær, O. Nakken (cruiseleader), L. Solbakken (from 30/8), Ø. Torgersen
"Atlantida"	A. Bendick, S. Harlin, V. Hlivnoy, V. Iljin, V. Kiselev, D. Prozorkevitch, S. Ustinov, T. Yusupov, G. Zuikov
"Persey III"	I. Dolgolenko, V. Kapralov, V. Shevchenko, N. Vovchuck, V. Zshuck

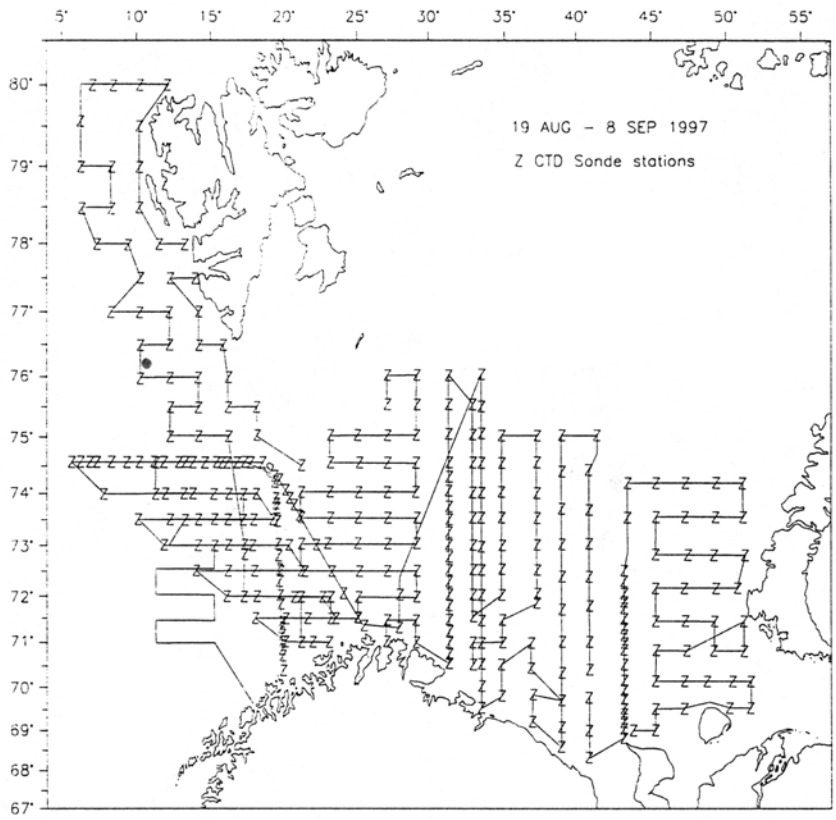

Fig. 1. Survey tracks and hydrographic stations

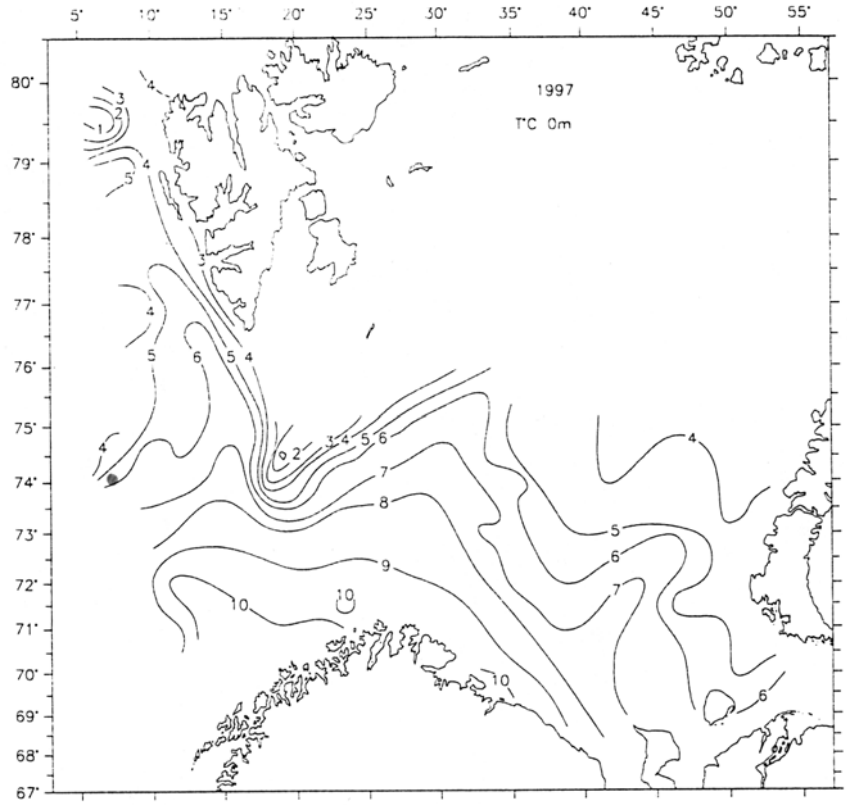

Fig. 2. Isotherms at 0 m

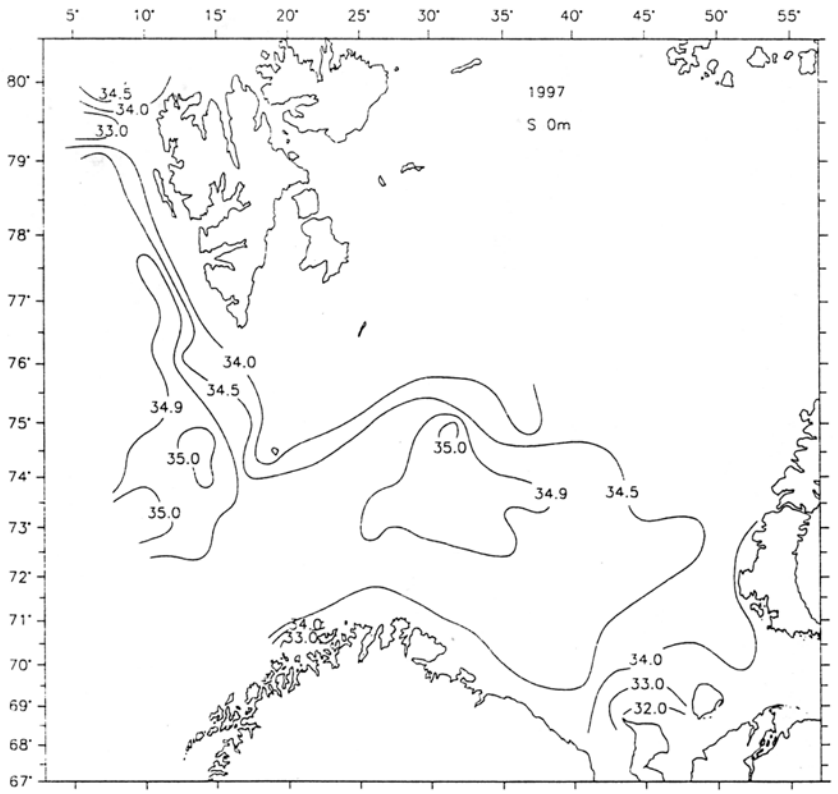

Fig. 3. Isohalines at 0 m

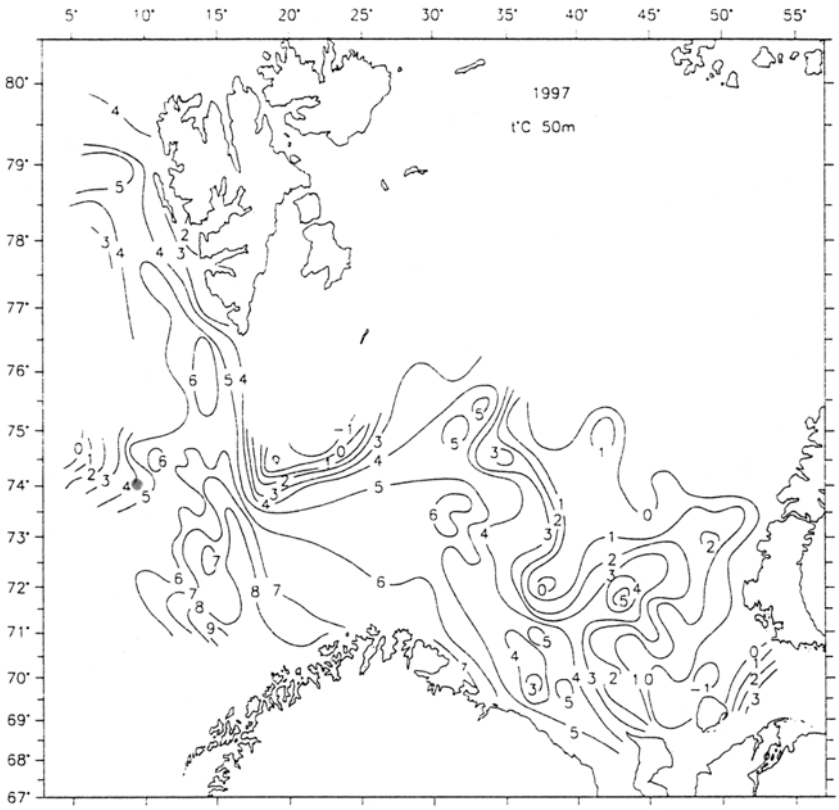

Fig. 4. Isotherms at 50 m

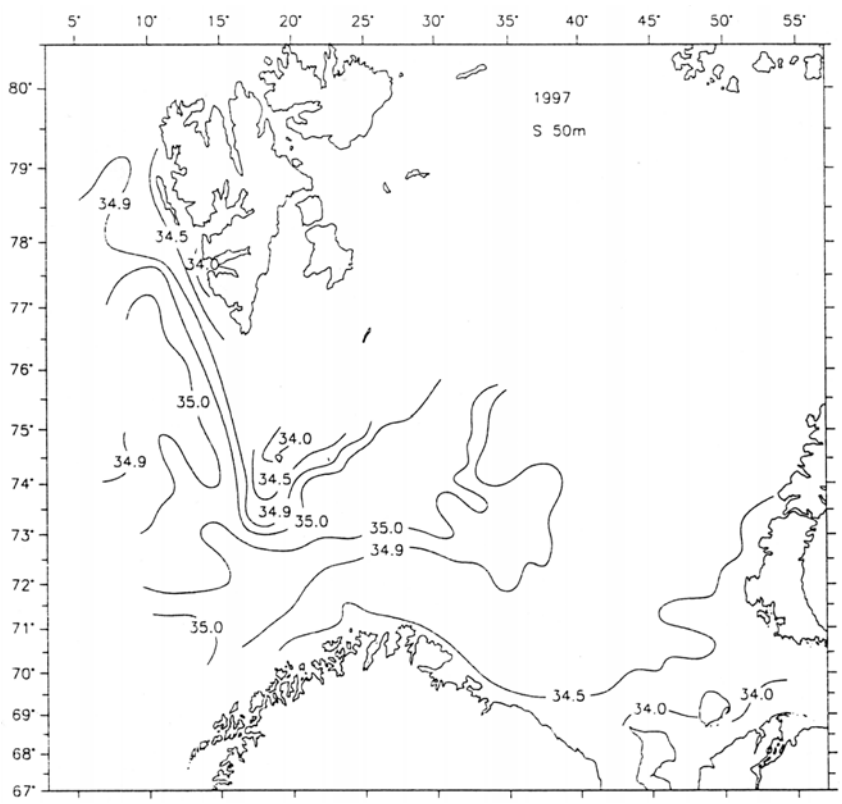

Fig. 5. Isohalines at 50 m

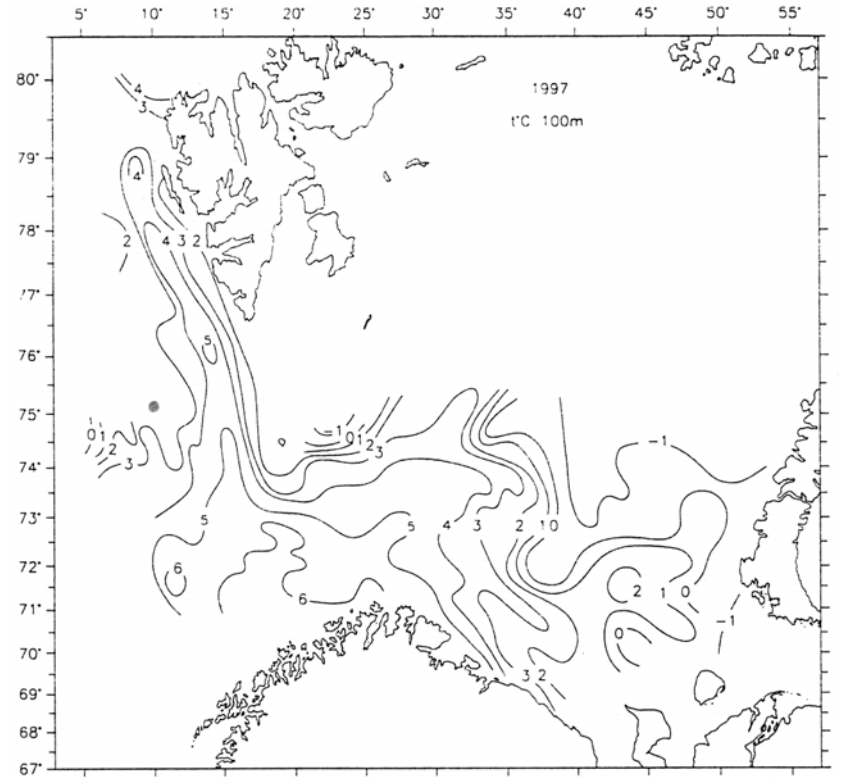

Fig. 6. Isotherms at 100 m

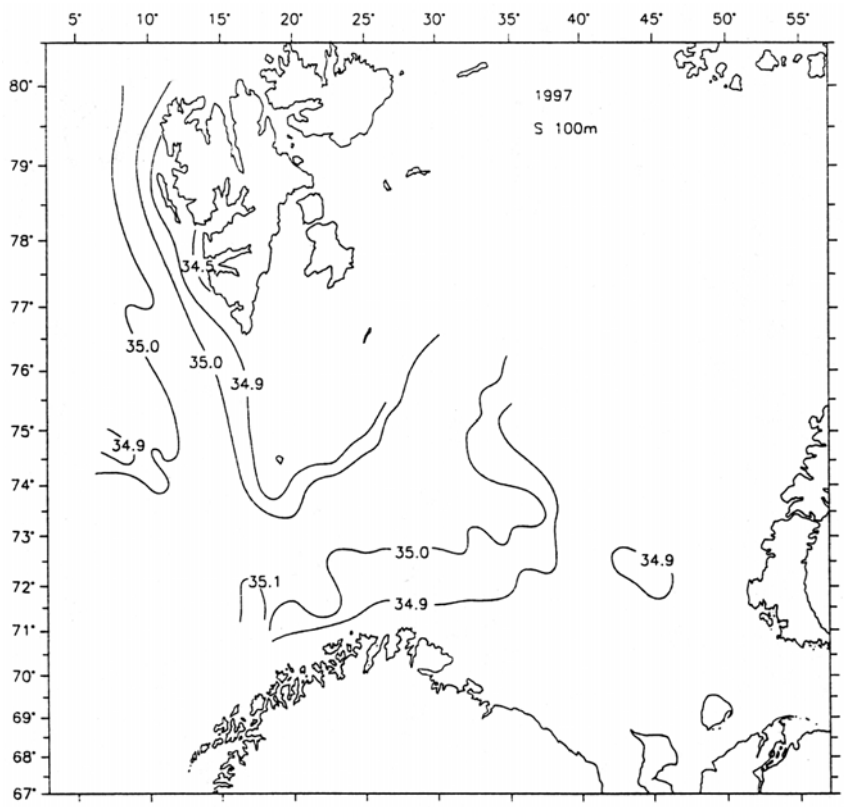

Fig. 7. Isohalines at 100 m

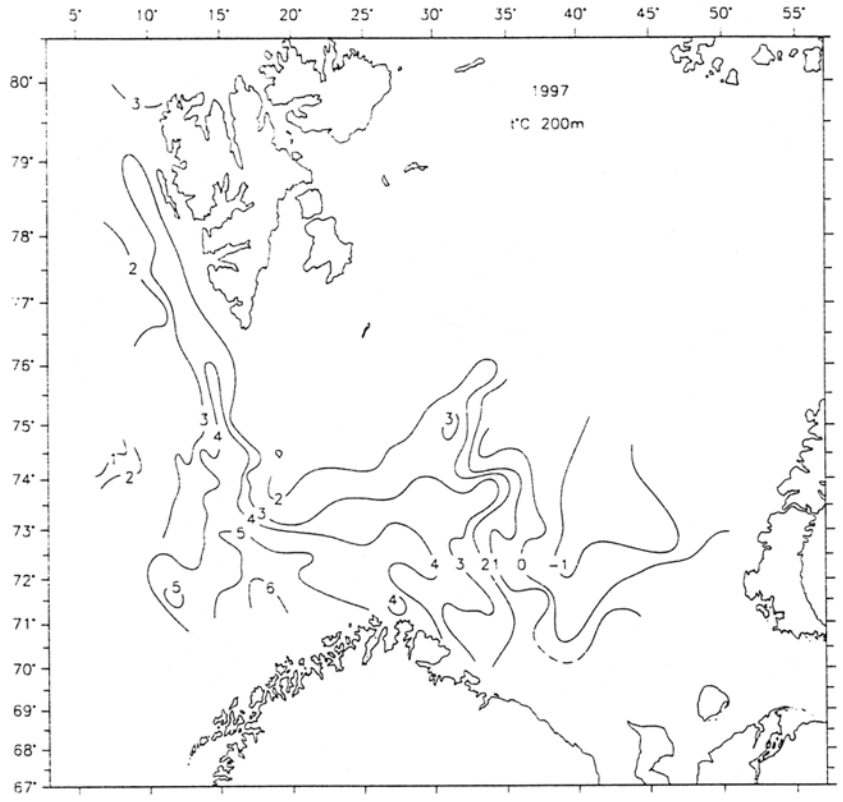

Fig. 8. Isotherms 200 m

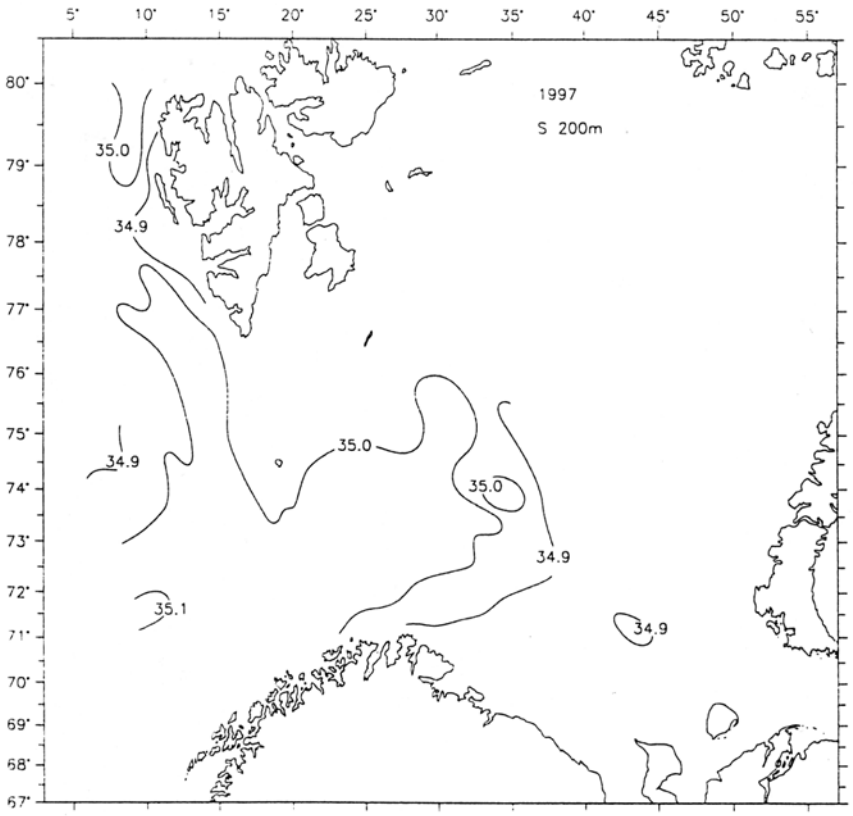

Fig. 9. Isohalines at 200 m

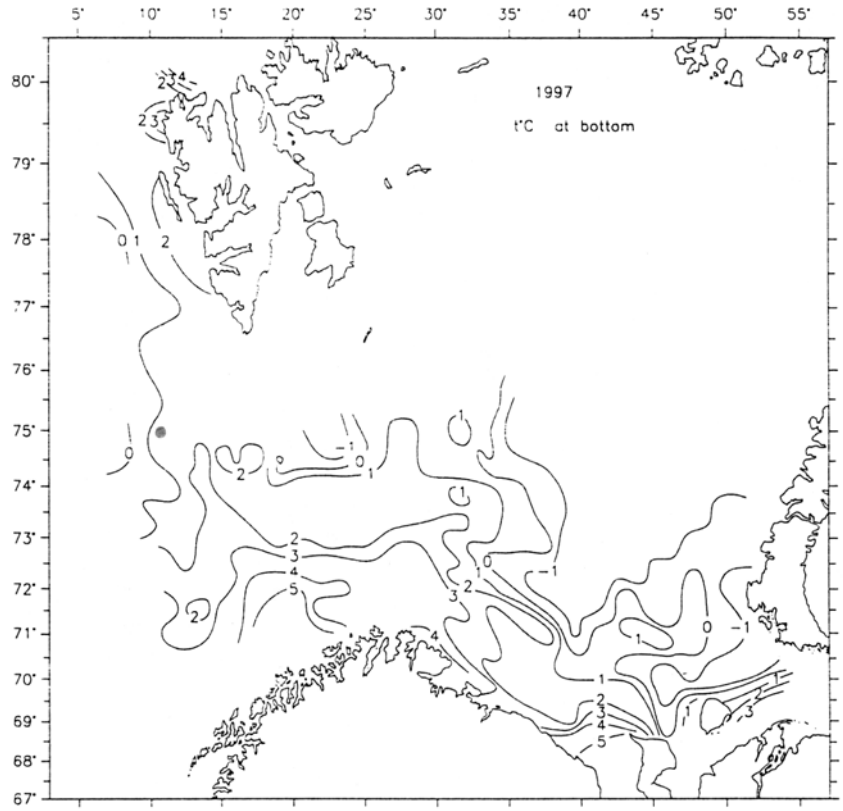

Fig. 10. Isotherms at the bottom

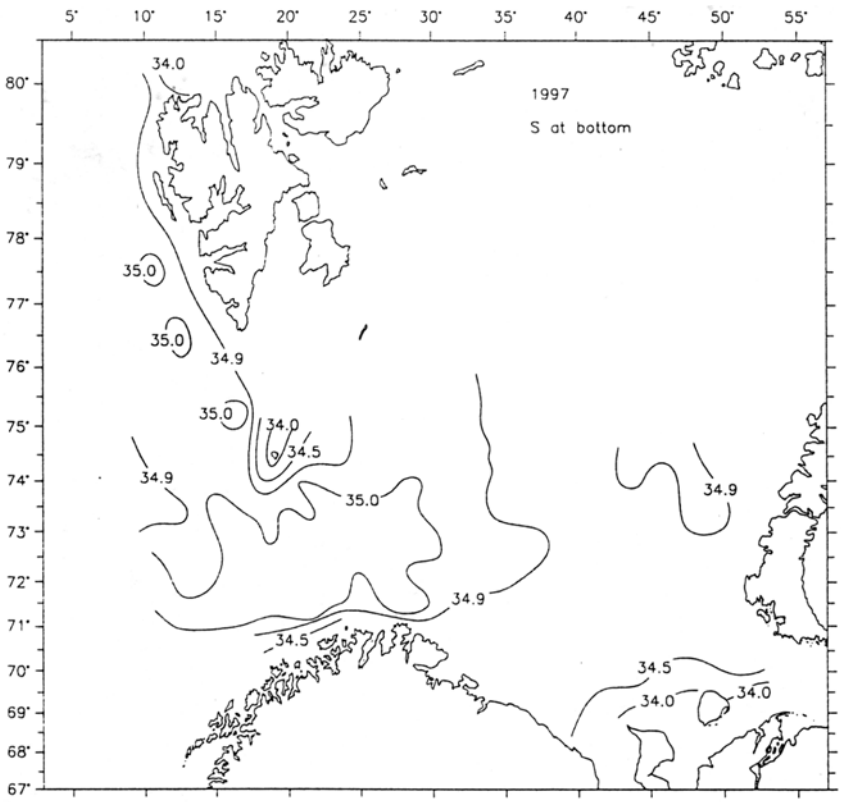

Fig. 11. Isohalines at the bottom

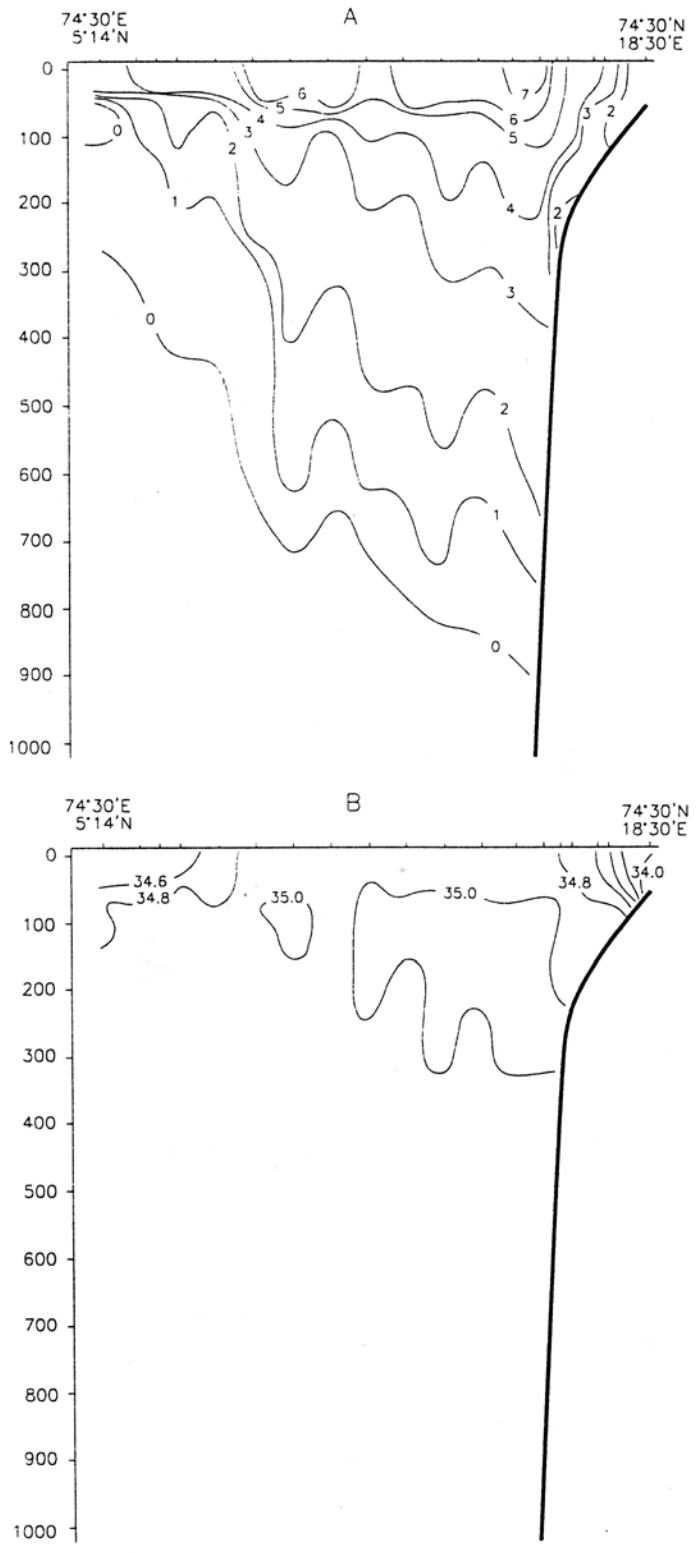

Fig. 12. Hydrographic section Bear Island-West. Temperature (A) and salinity (B)

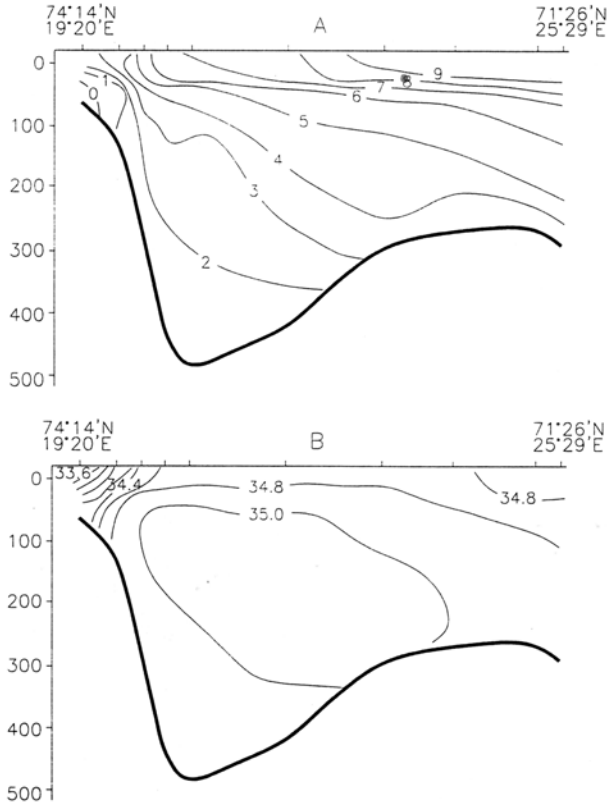

Fig. 13. Hydrographic section North Cape-Bear Island. Temperature (A) and salinity (B)

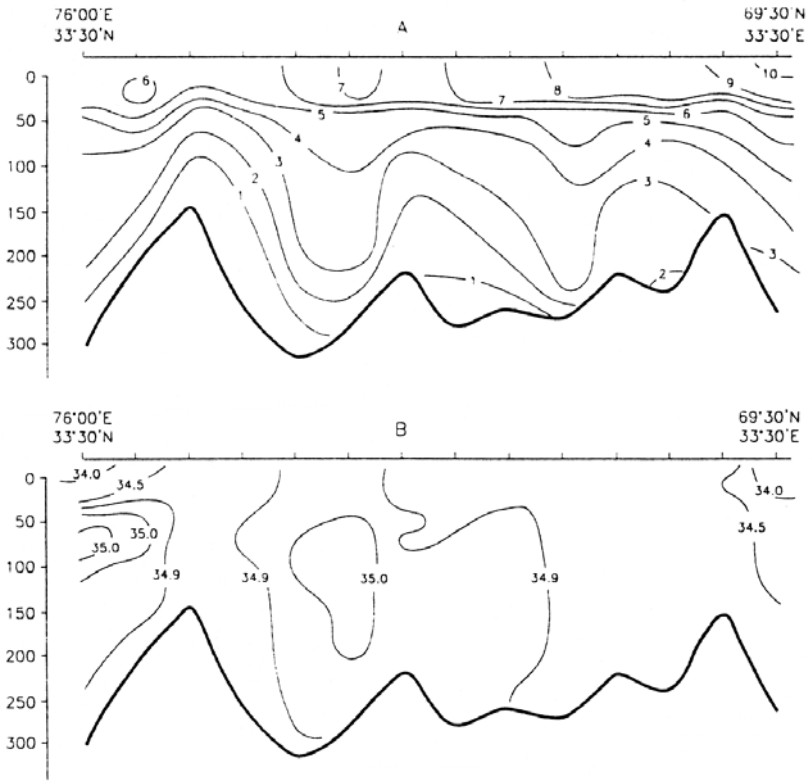

Fig. 14. Hydrographic section along the Kola meridian. Temperature (A) and salinity (B)

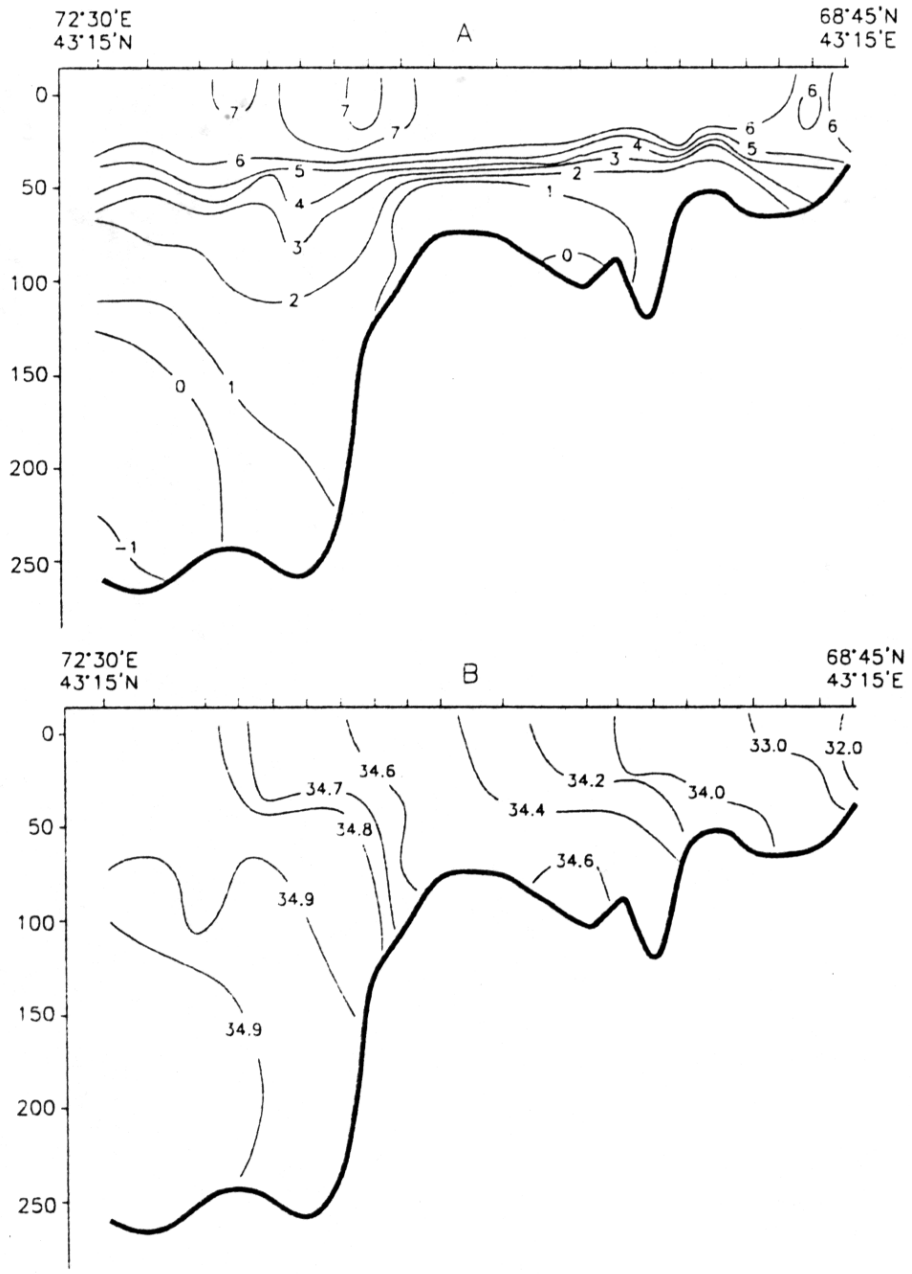

Fig. 15. Hydrographic section Cape Kanin-North. Temperature (A) and salinity (B)

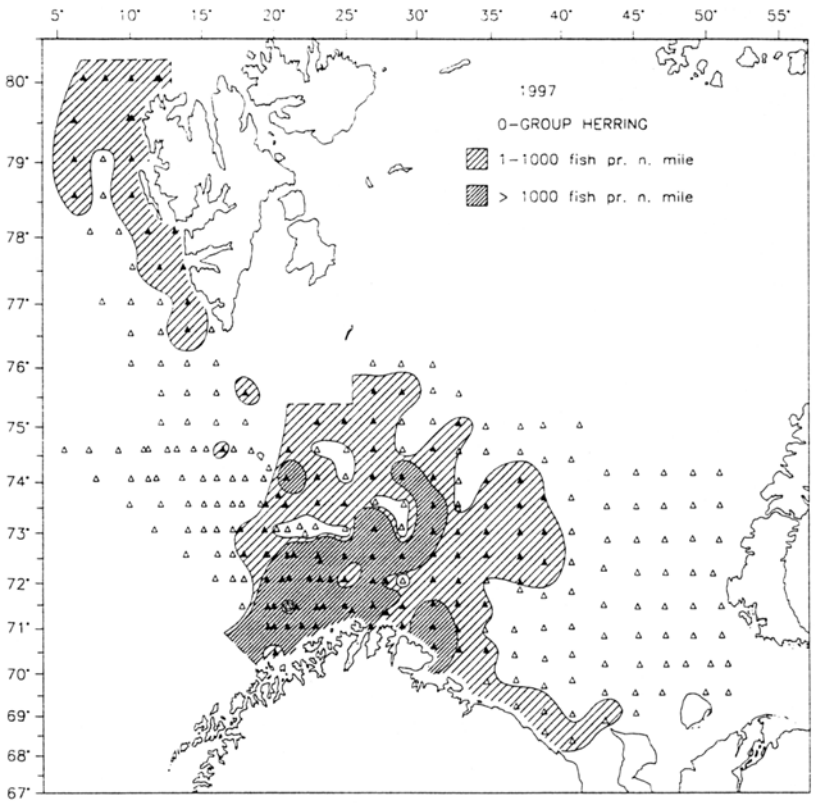

Fig. 16. Distribution of 0-group herring

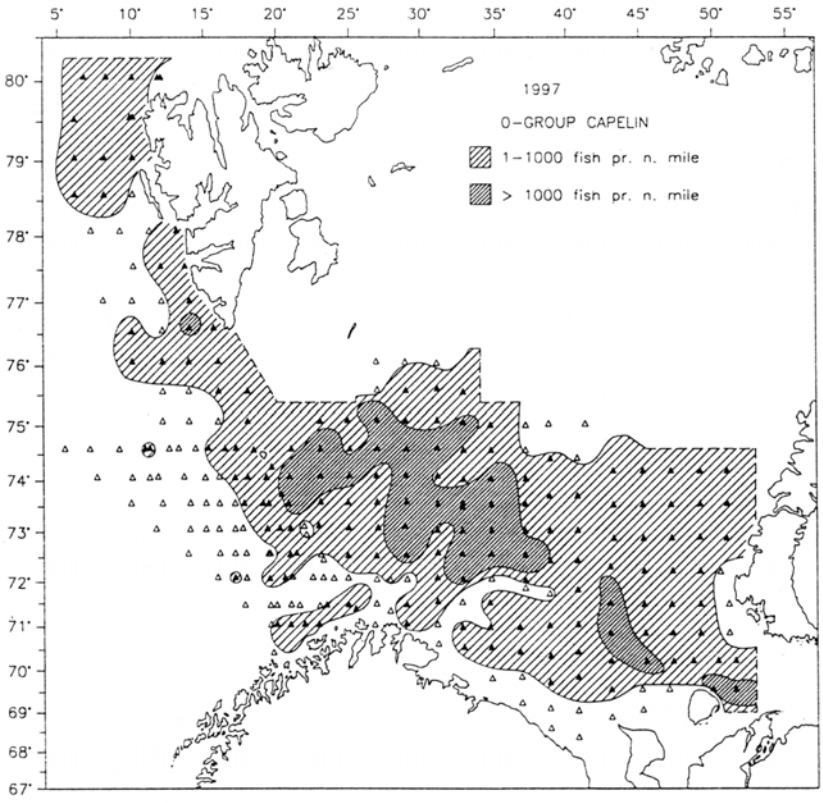

Fig. 17. Distribution of 0-group capelin

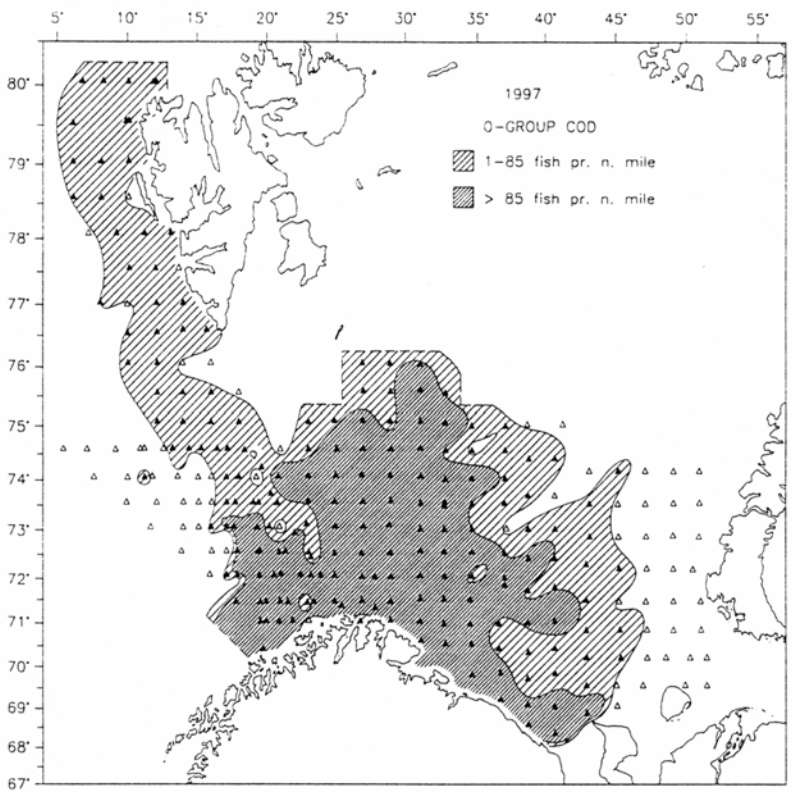

Fig. 18. Distribution of 0-group cod

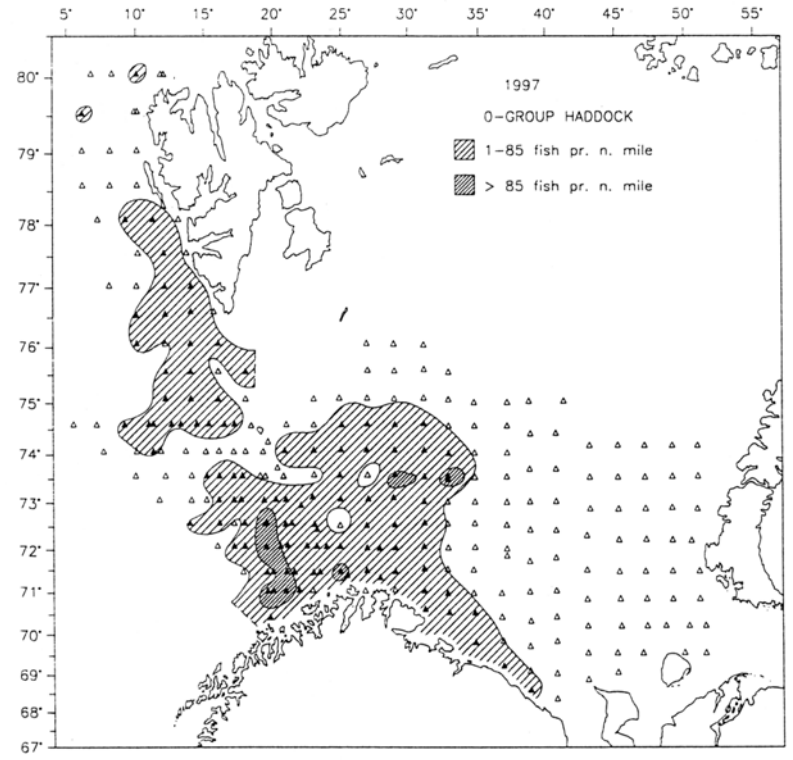

Fig. 19. Distribution of 0-group haddock

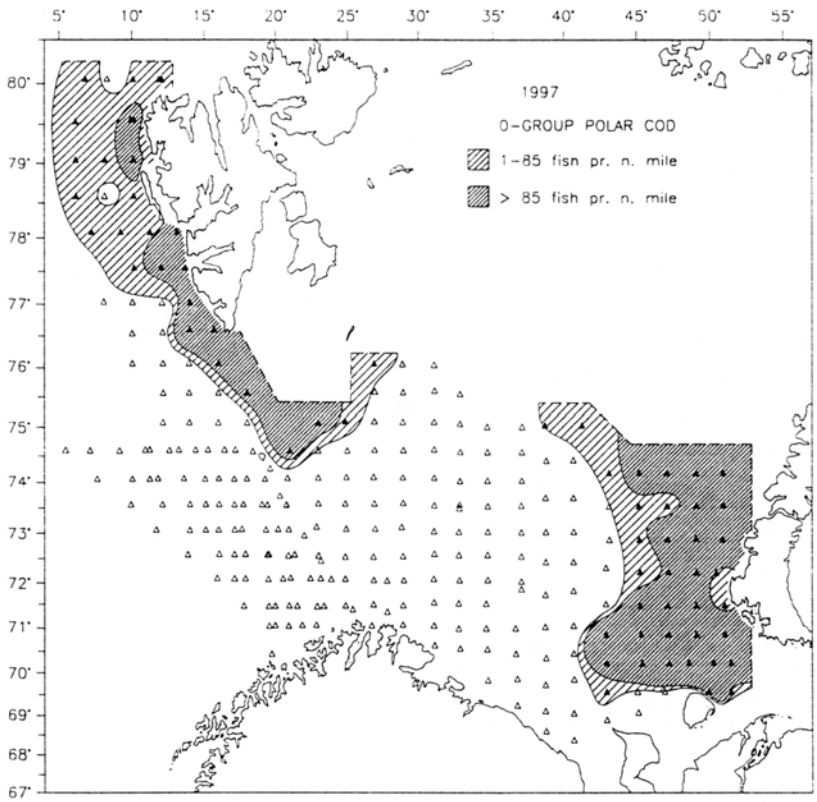

Fig. 20. Distribution of 0-group polar cod

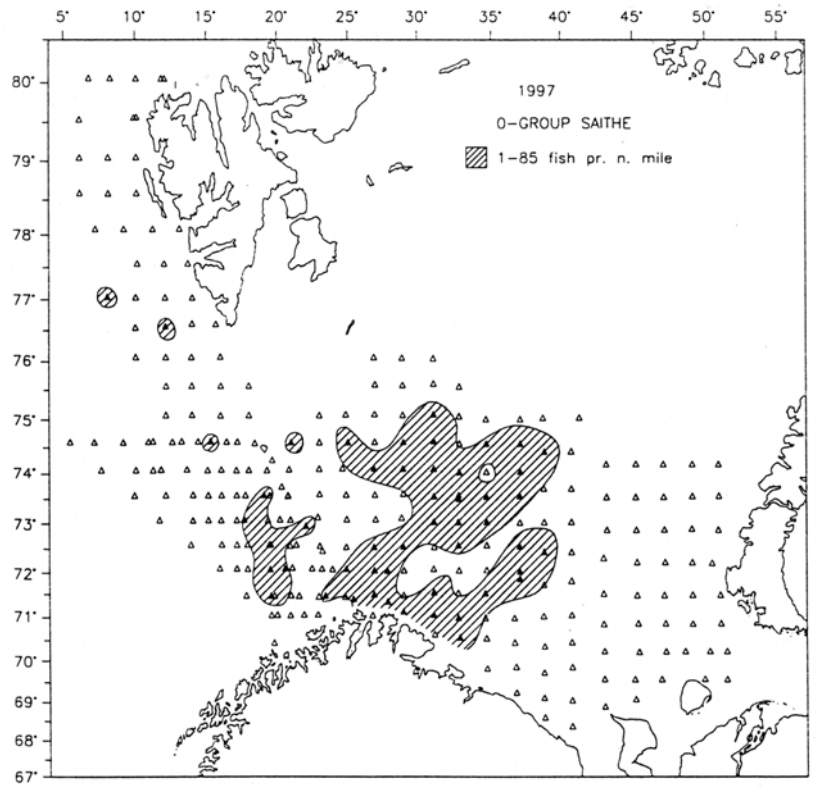

Fig. 21. Distribution of 0-group saithe

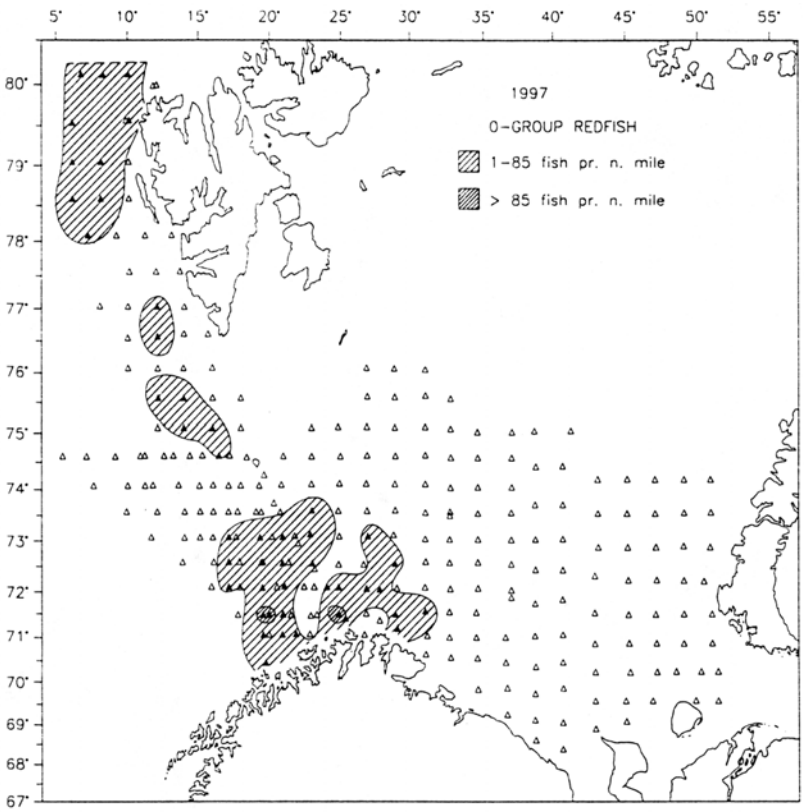

Fig. 22. Distribution of 0-group redfish

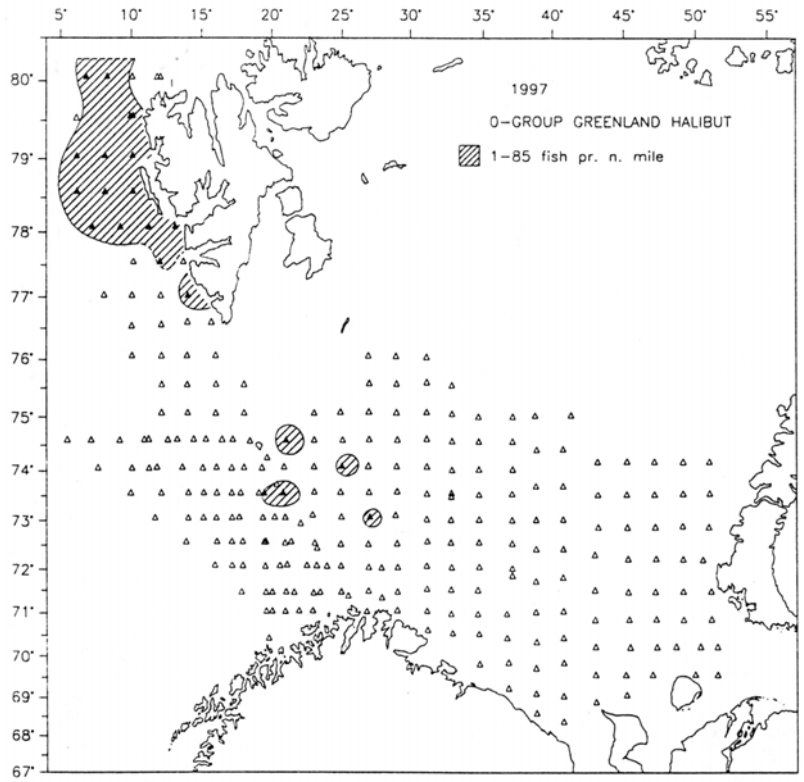

Fig. 23. Distribution of 0-group Greenland halibut

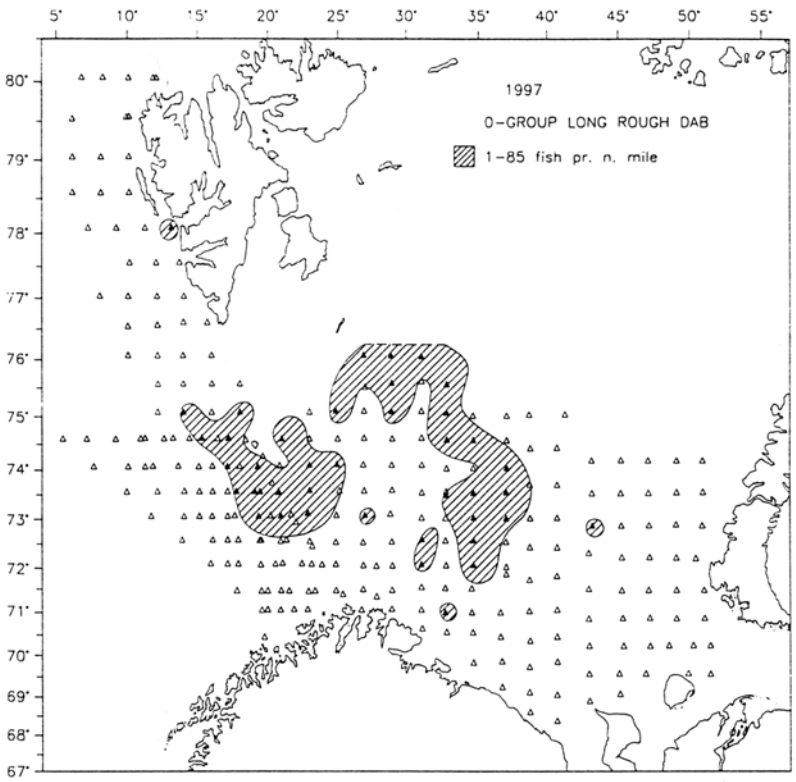

Fig. 24. Distribution of 0-group long rough dab

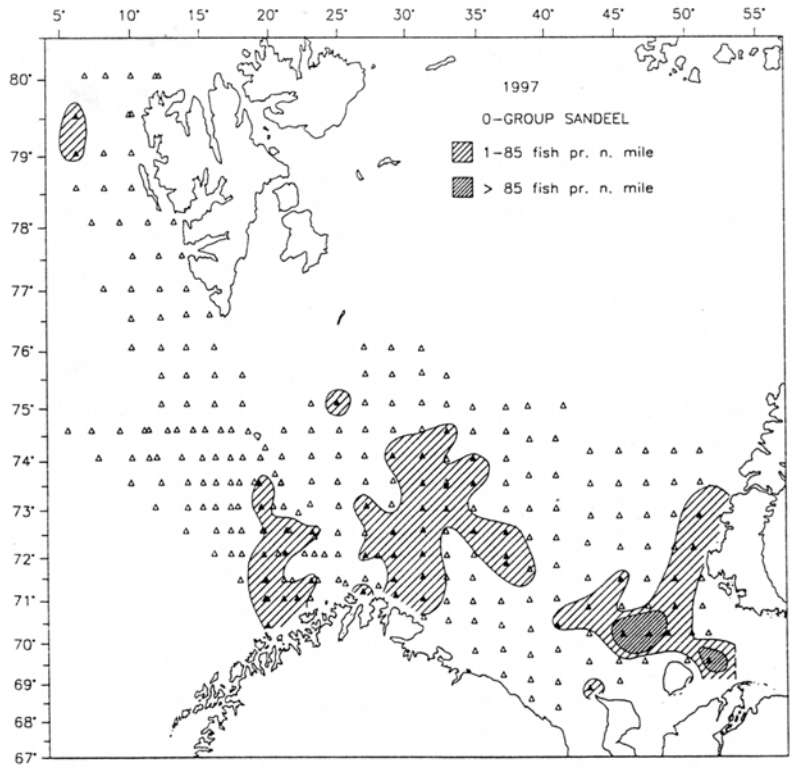

Fig. 25. Distribution of 0-group sandeel

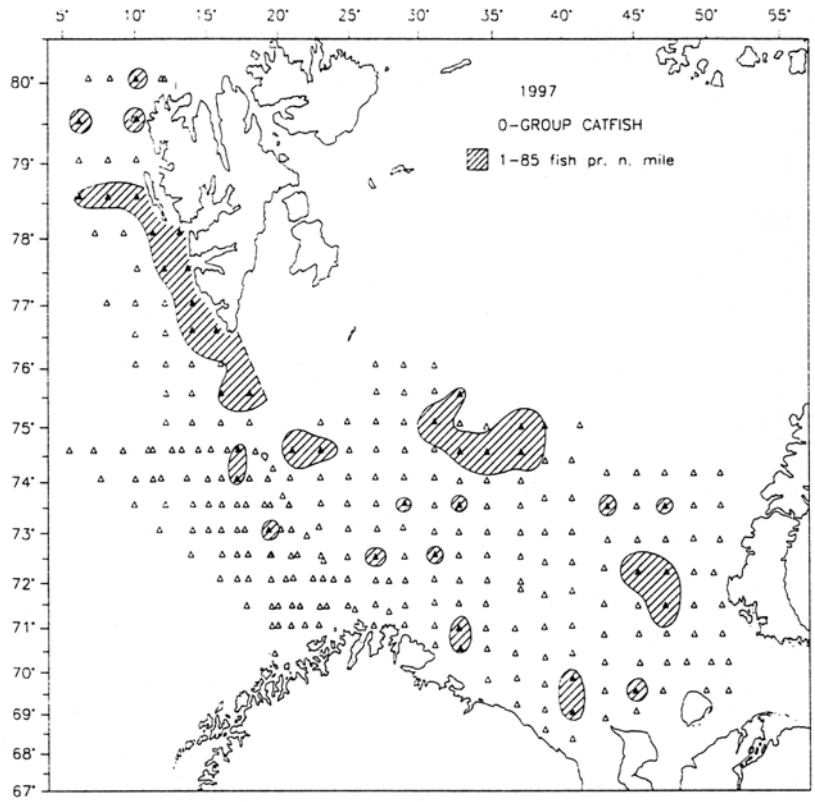

Fig. 26. Distribution of 0-group catfish

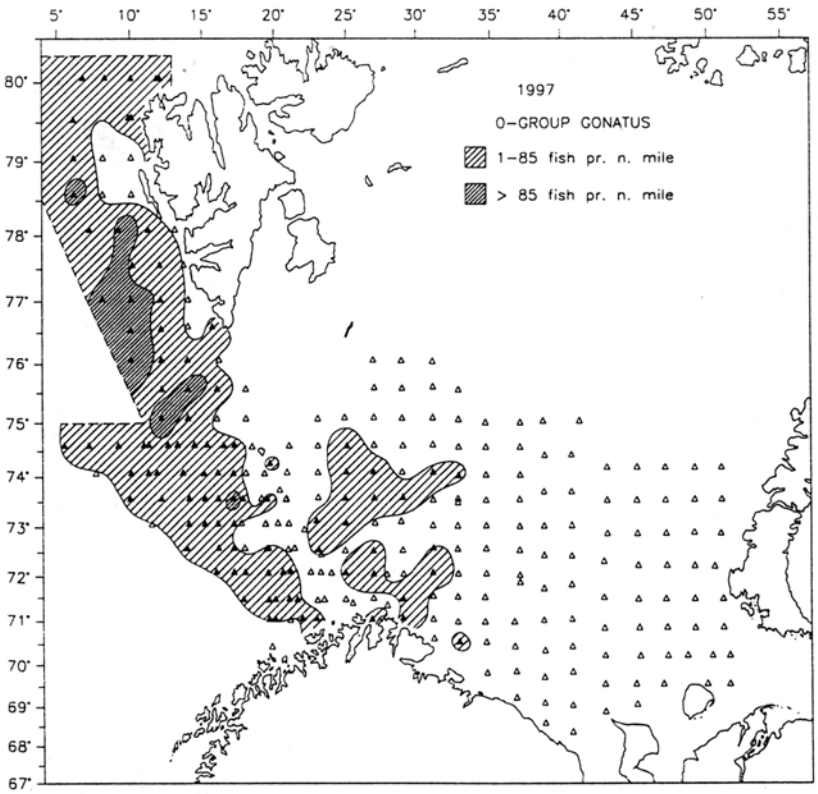

Fig. 27. Distribution of 0-group Gonatus fabricii