

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:

Country	Name of vessel	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
Russia	«Persey III»	15.08 - 06.09	Fisheries and Oceanography, Murmansk.

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

Preliminary analyses of the survey data were made on board "Johan Hjort" and «Atlantida» during the survey, and the 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 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 40m. Additional steps at 0.5 nautical mile at 60 and 80m were made when 0-group fish layers were recorded deeper than 60m or 80m on the echosounder. The trawling procedure was standardised 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, 200m 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 (0-50m) 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 sentral 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 distributions 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 nearshore 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 was 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 narrower than last year, resulting in an abundance index at the same level. It should however be noted that the indices 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 weak. 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 were found last year.

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Table 1. Mean water temperature¹ 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 - 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
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	Polar cod	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 (mm)	63.2	45.0	72.2	88.5	36.8	40.7	62.2	31.4	45.9

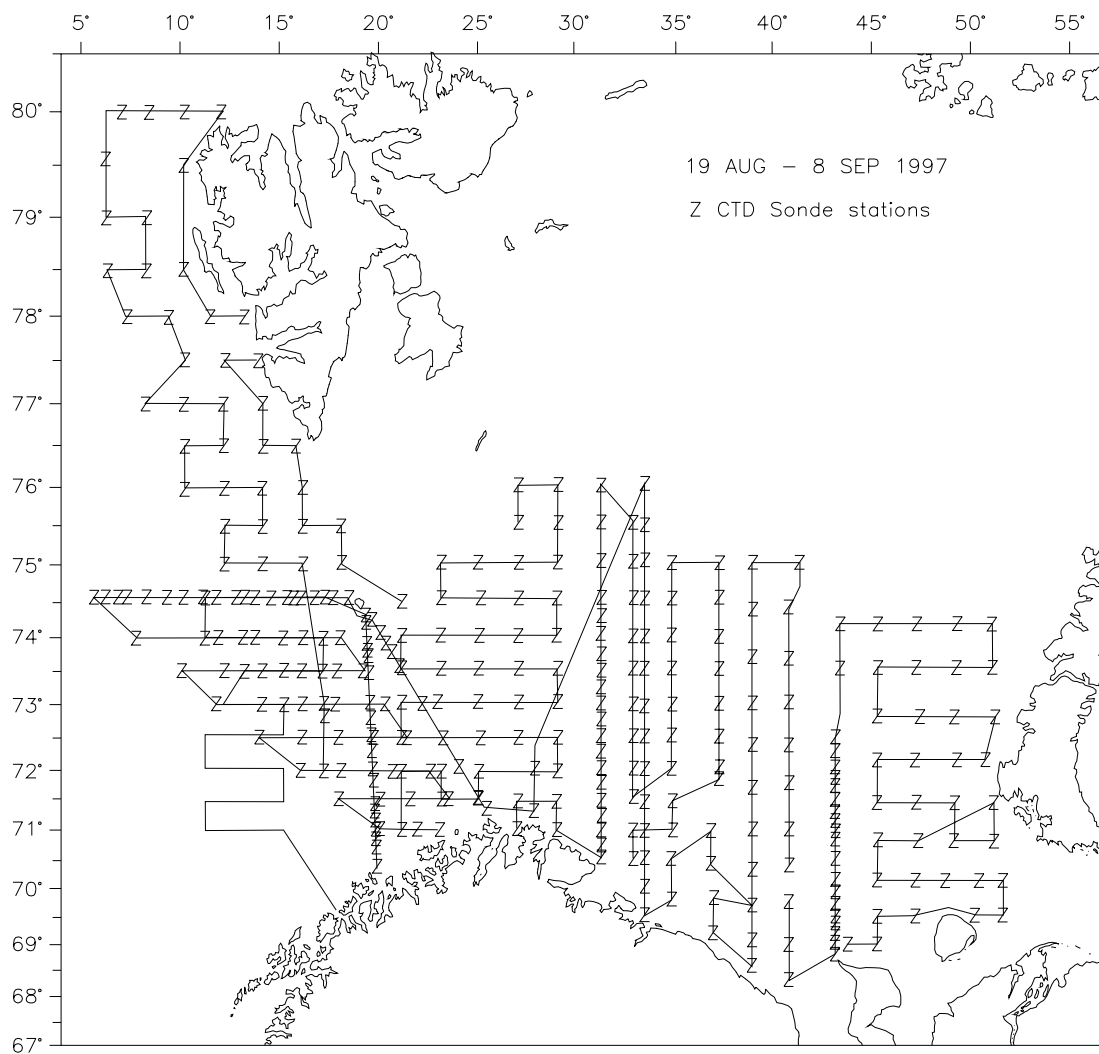


Fig. 1. Survey tracks and hydrographic stations.

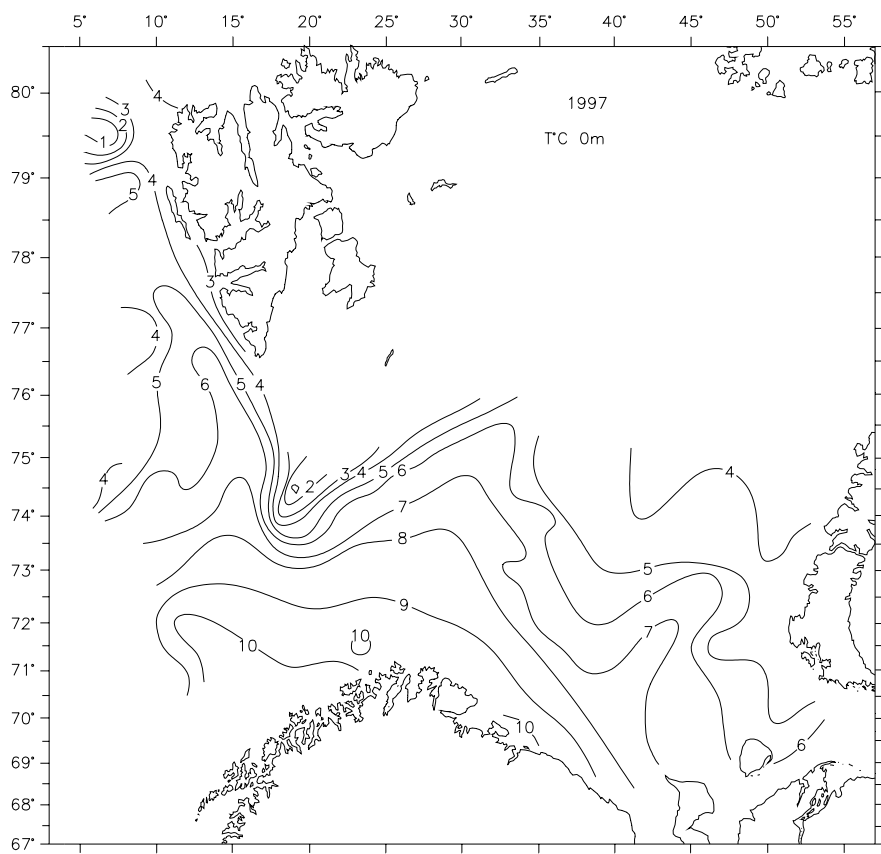


Fig. 2. Isotherms at 0m.

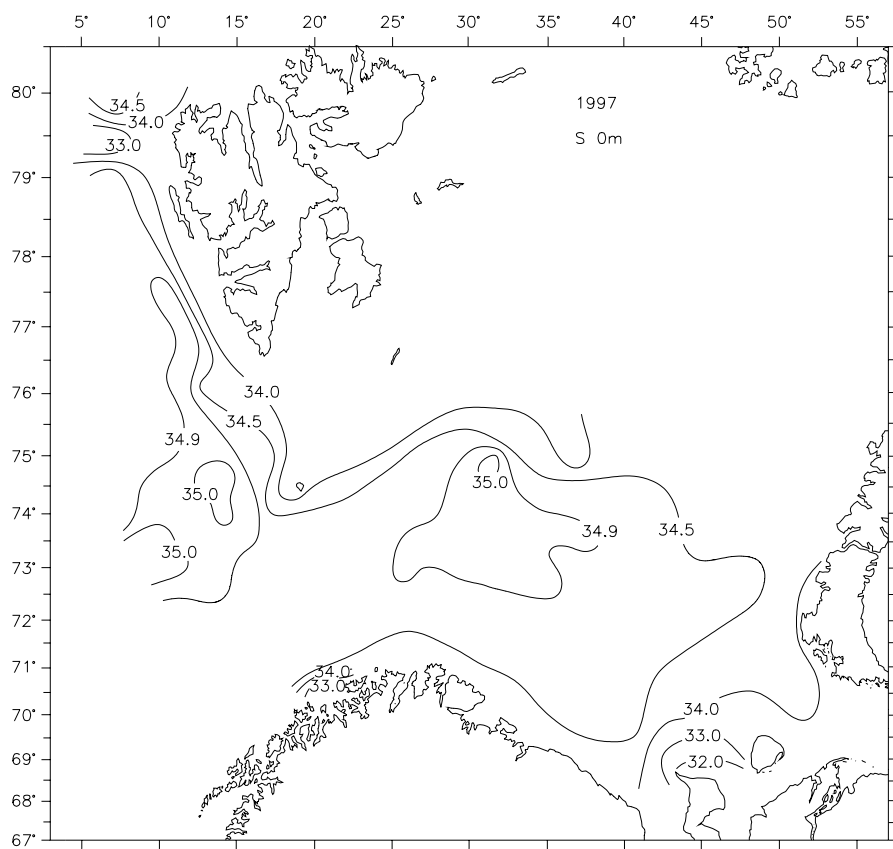


Fig. 3. Isohalines at 0m.

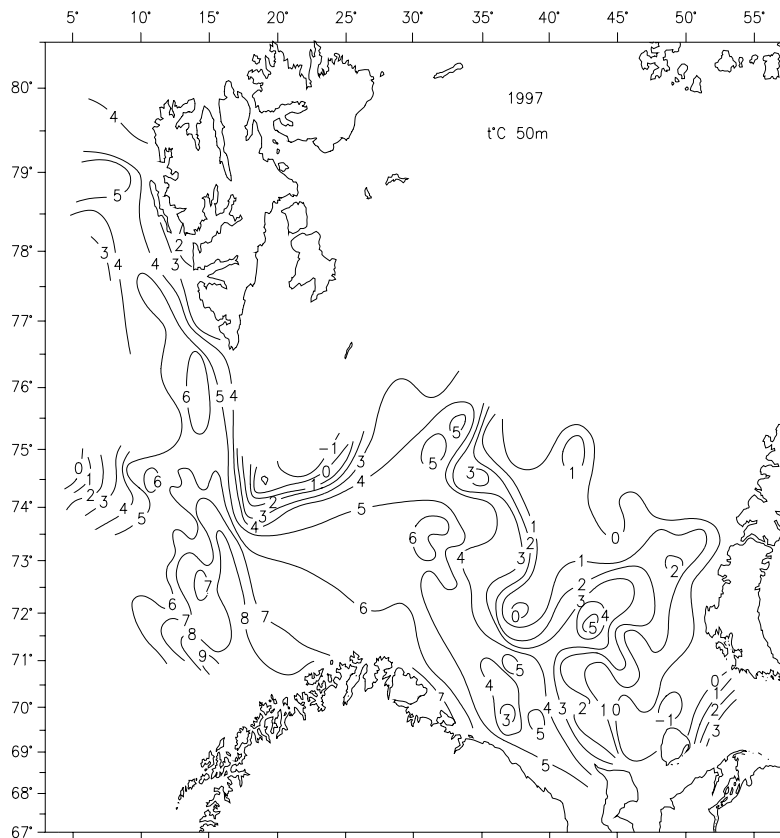


Fig. 4. Isotherms at 50m.

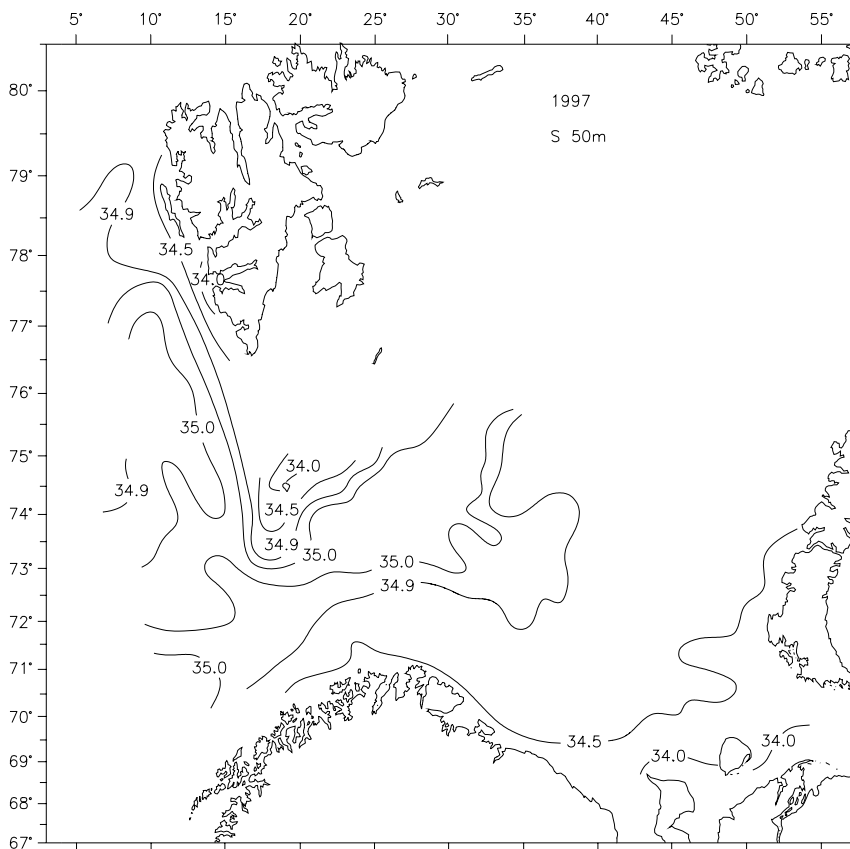


Fig. 5. Isohalines at 50m.

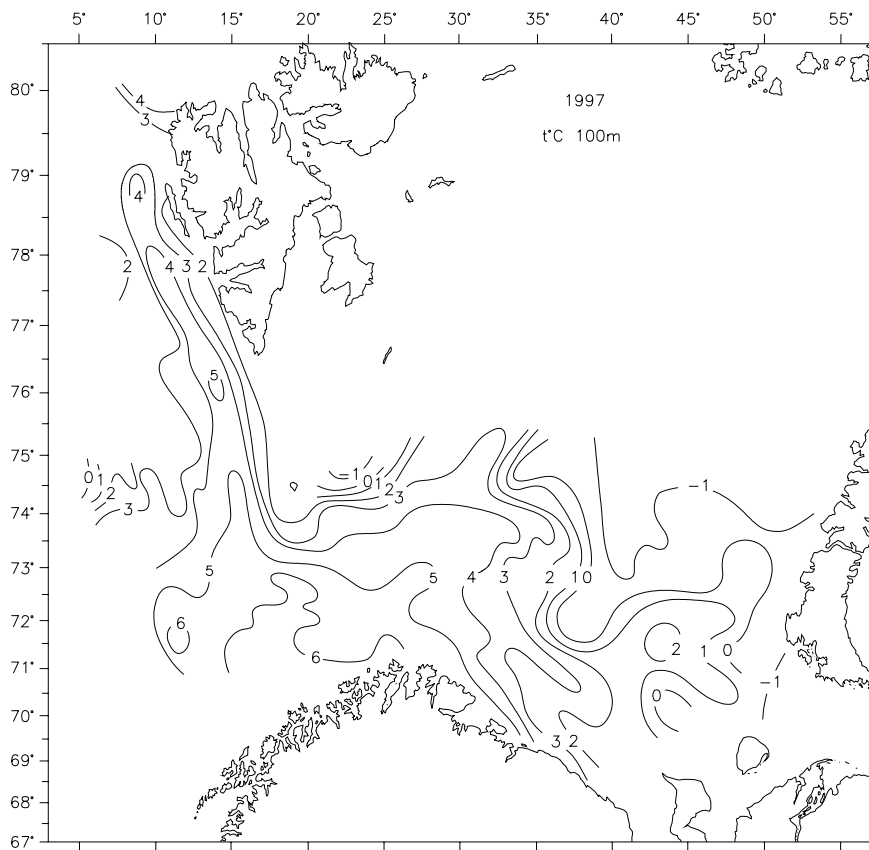


Fig. 6. Isotherms at 100m.

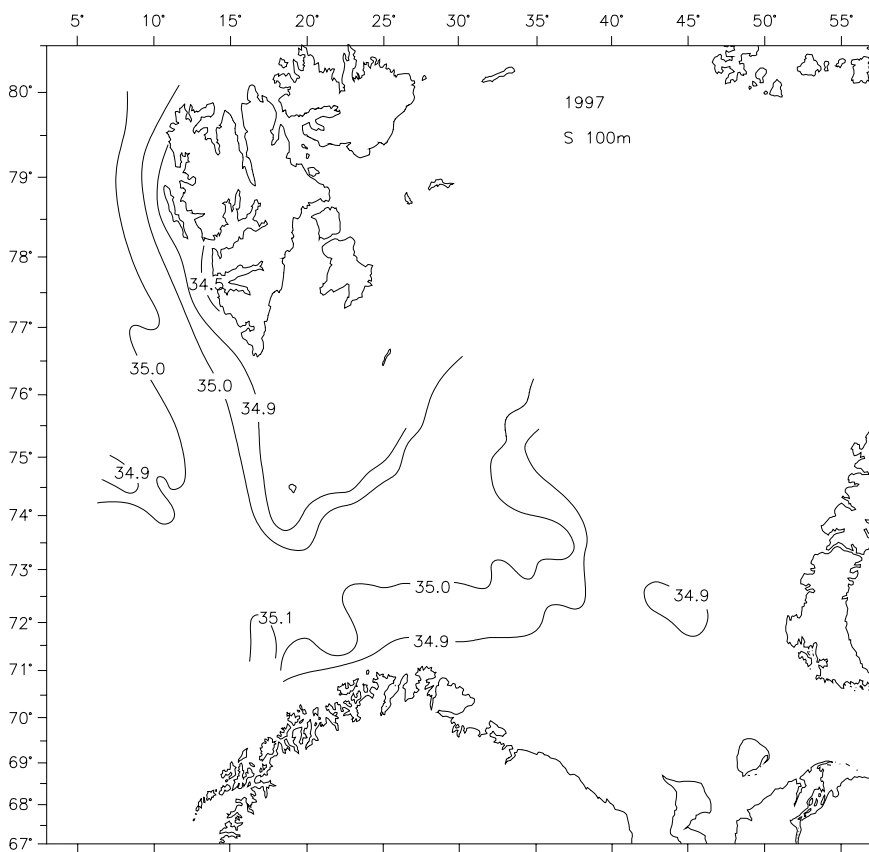


Fig. 7. Isohalines at 100m.

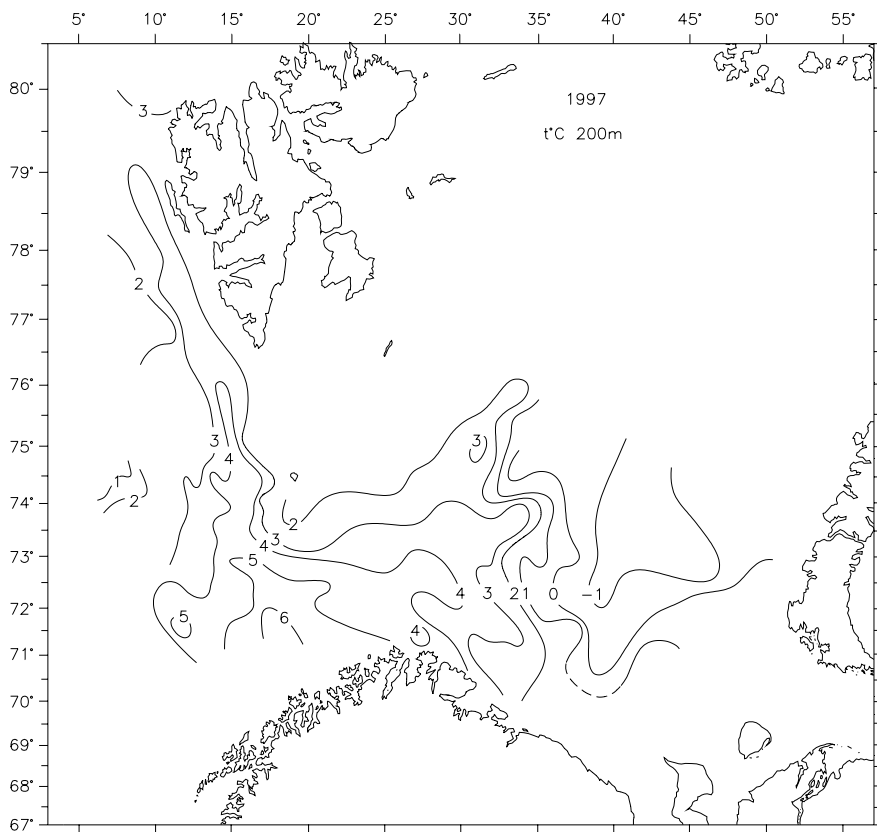


Fig. 8. Isotherms at 200m.

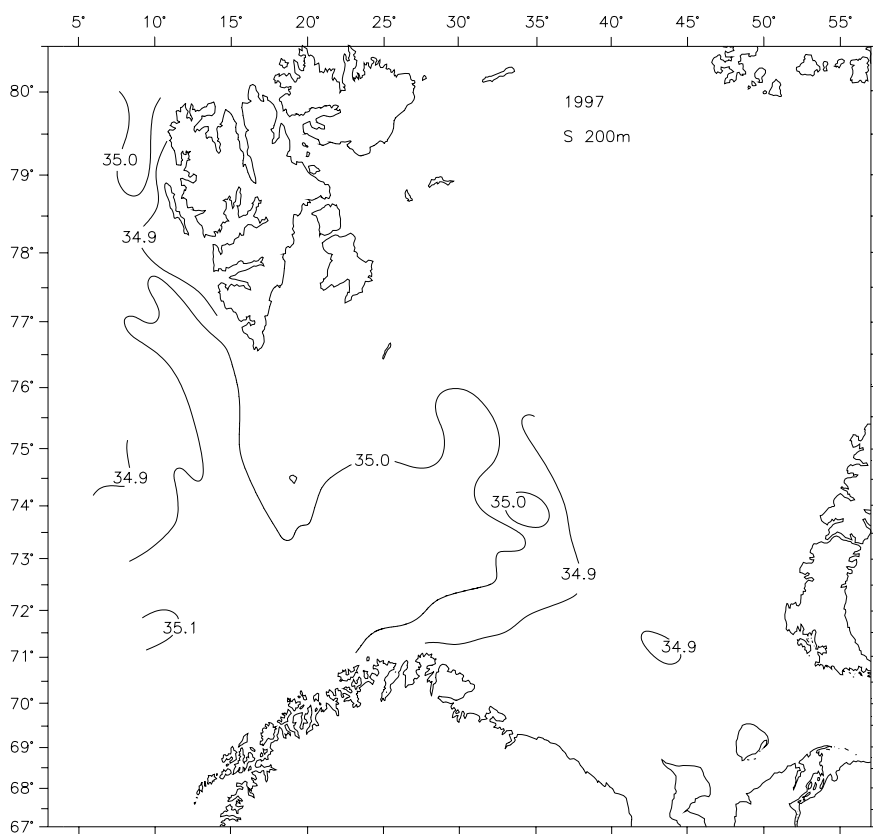


Fig. 9. Isohalines at 200m.

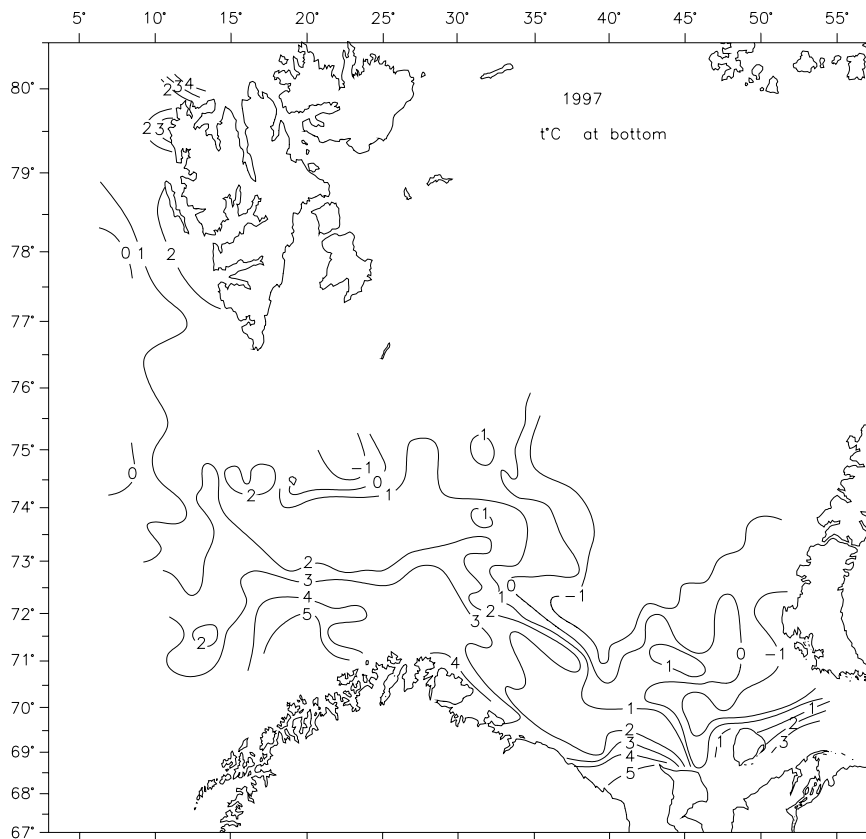


Fig. 10. Isotherms at the bottom.

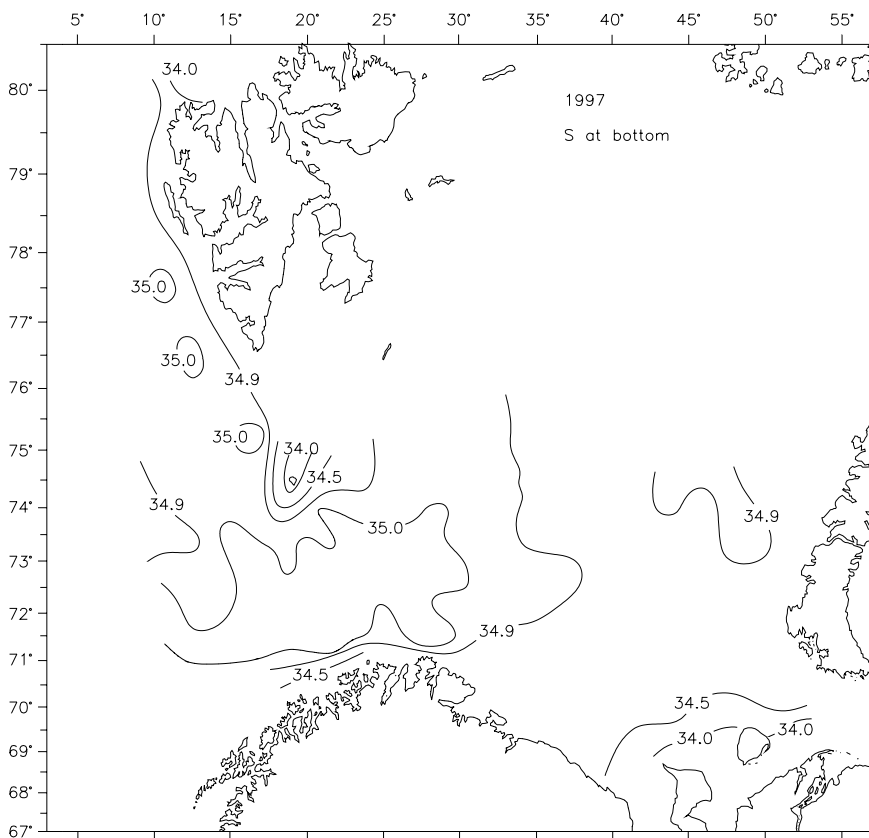


Fig. 11. Isohalines at the bottom.

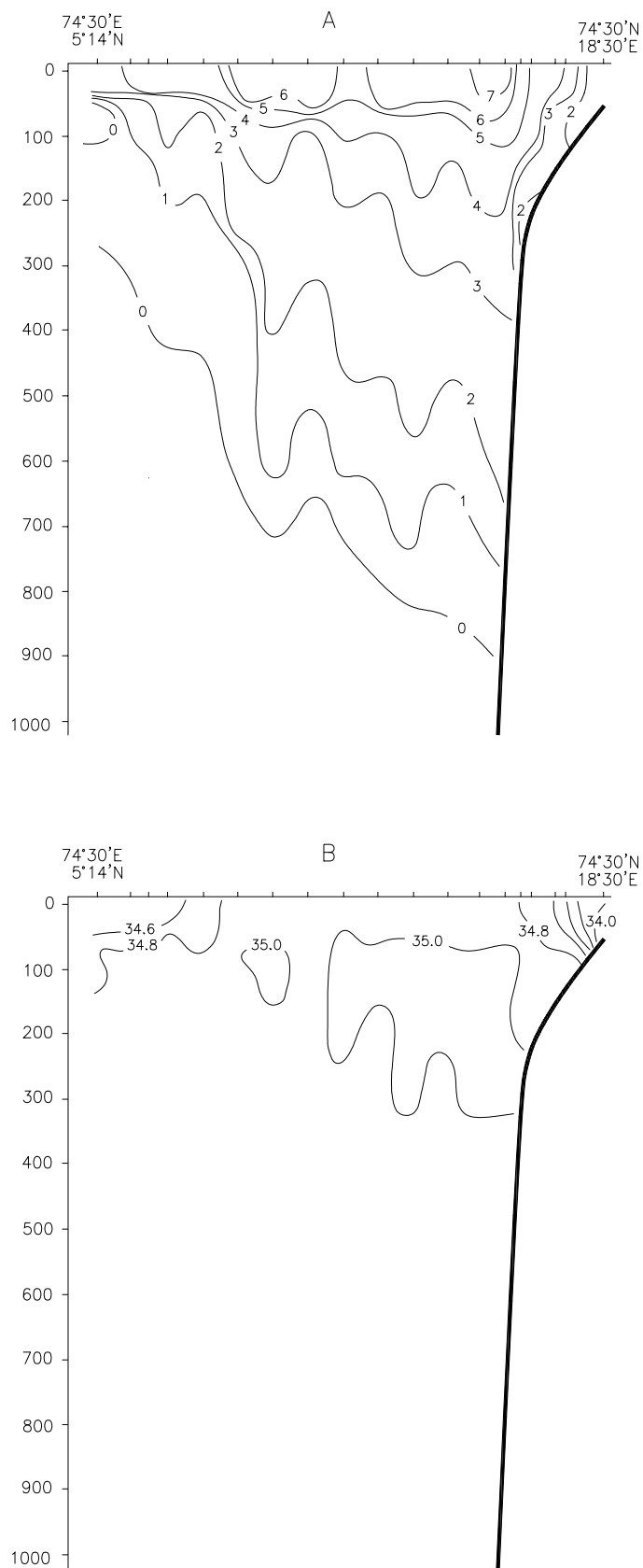


Fig. 12. Hydrographic section
Bear Island - West
Temperature (A) and salinity (B).

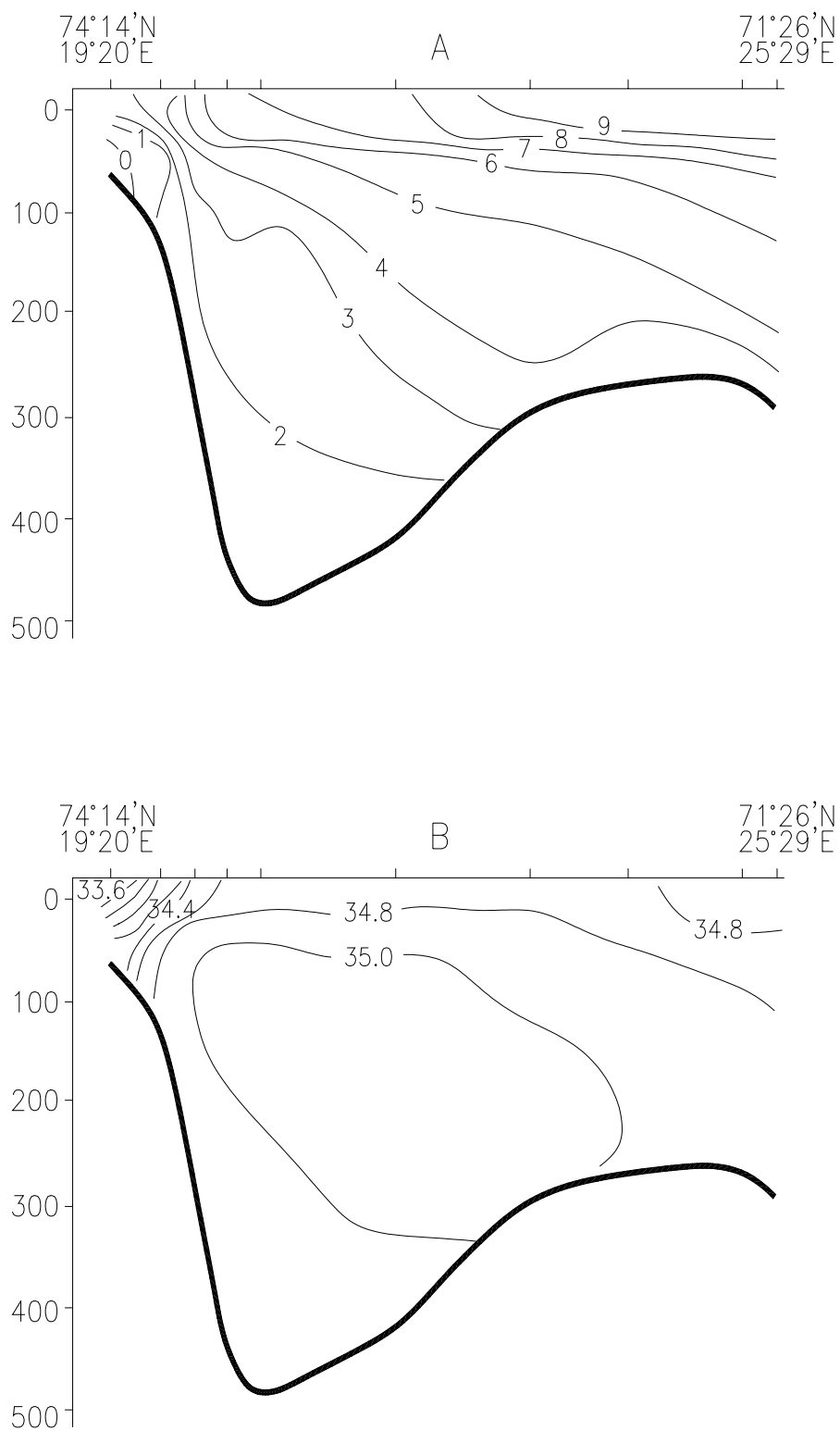


Fig. 13. Hydrographic section
North Cape - Bear Island
Temperature (A) and salinity (B).

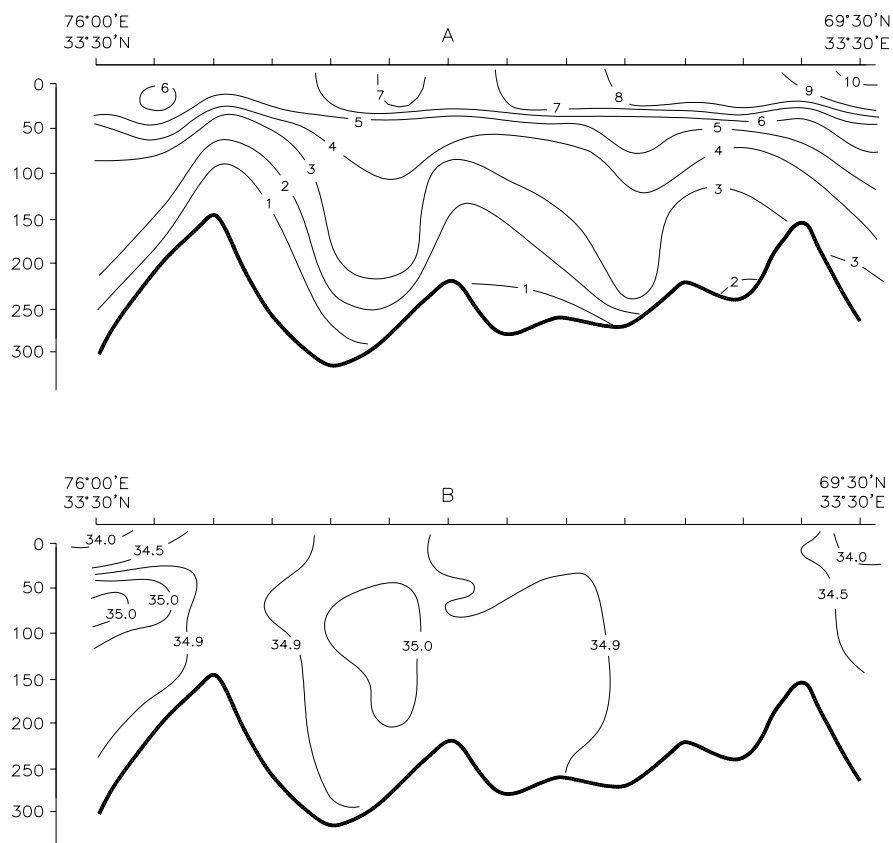


Fig. 14. Hydrographic section along the Kola meridian
Temperature (A) and salinity (B).

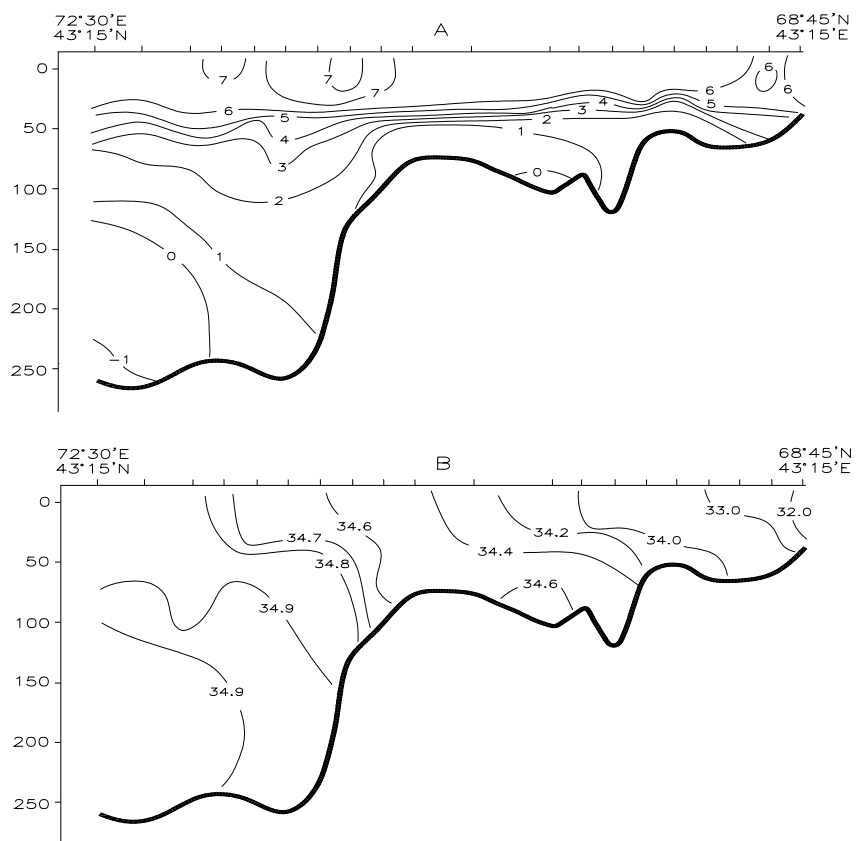


Fig. 15. Hydrographic section Cape Kanin - North
Temperature (A) and salinity (B).

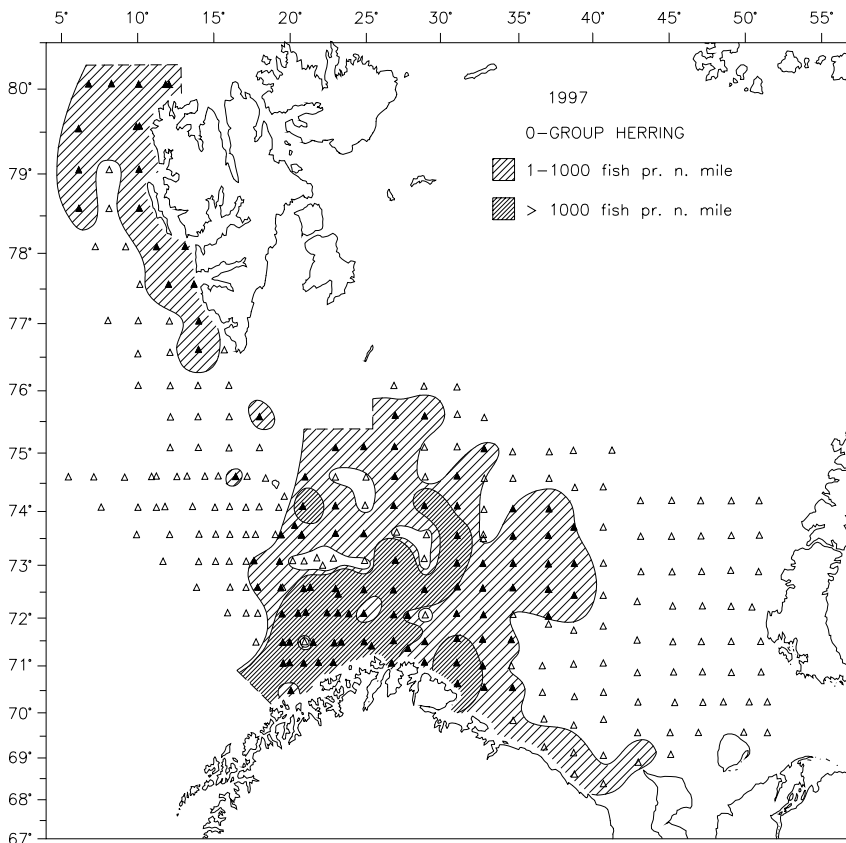


Fig. 16. Distribution of 0-group herring.

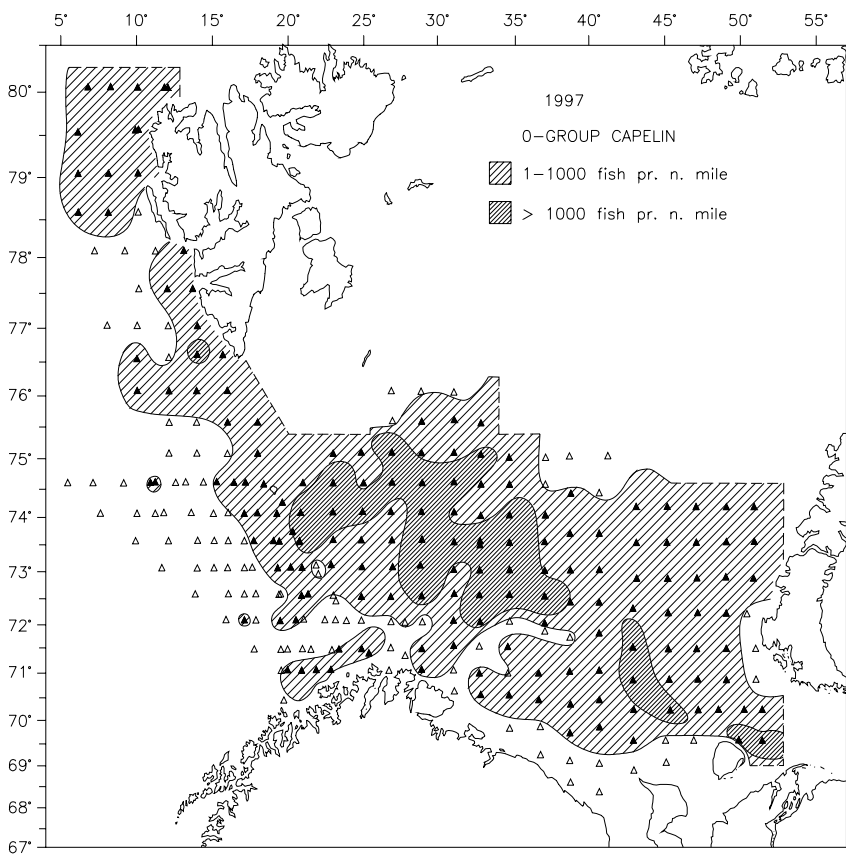


Fig. 17. Distribution of 0-group capelin.

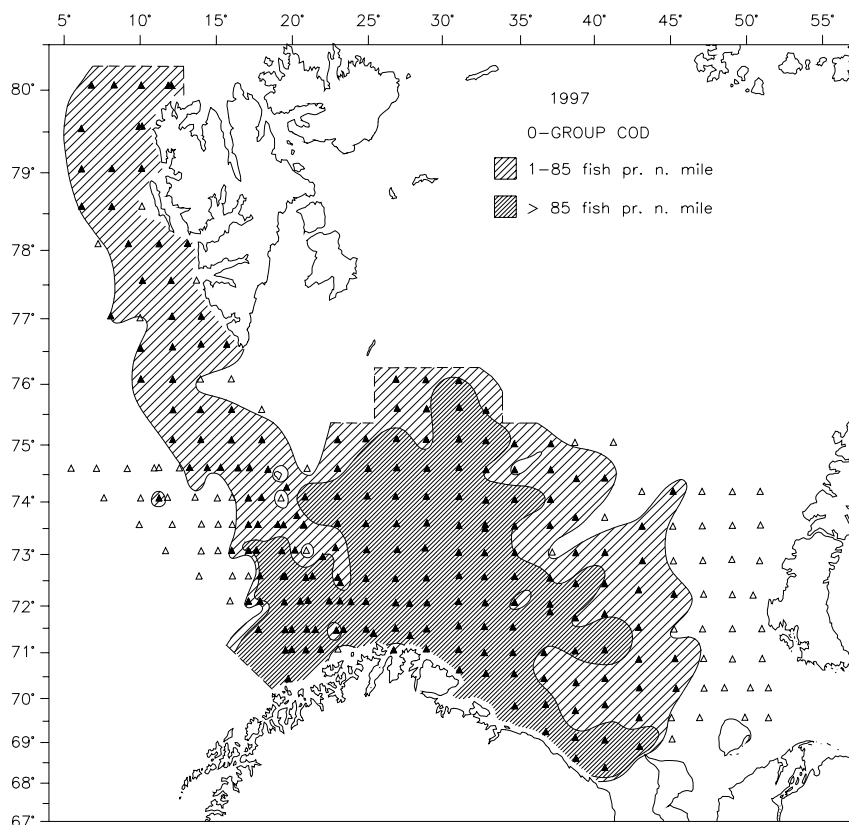


Fig. 18. Distribution of 0-group cod.

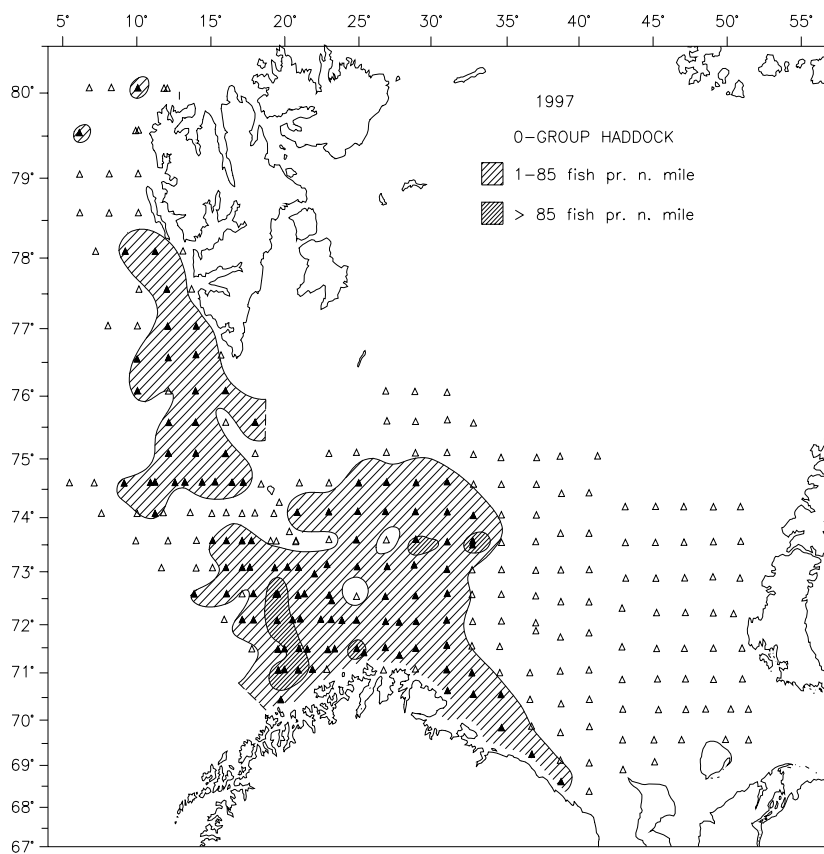


Fig. 19. Distribution of 0-group haddock.

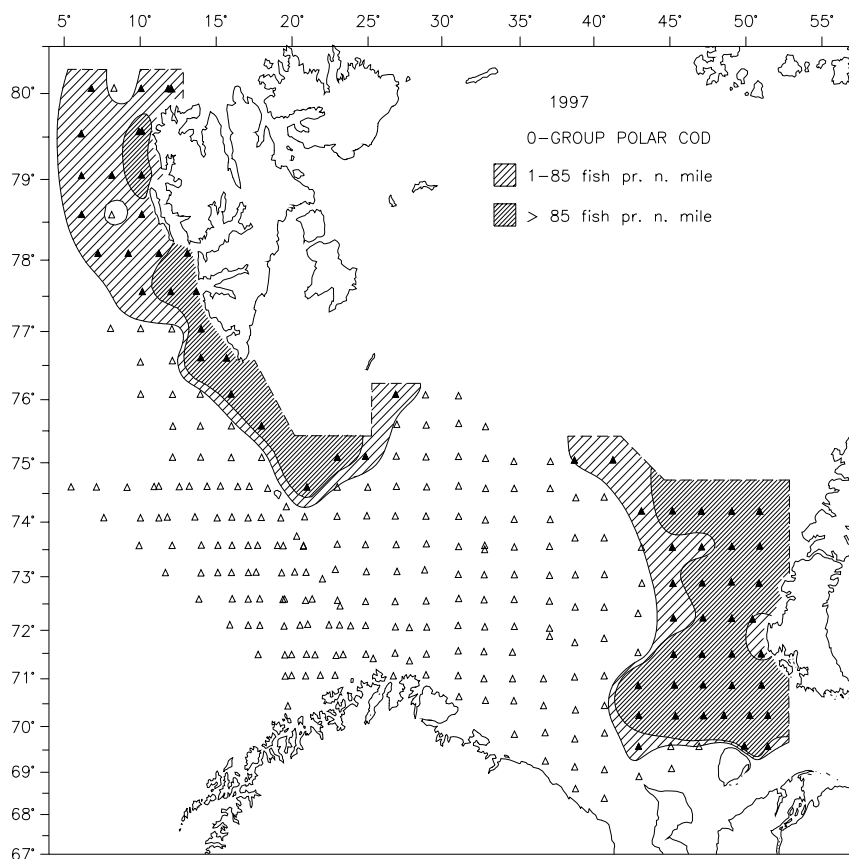


Fig. 20. Distribution of 0-group polar cod.

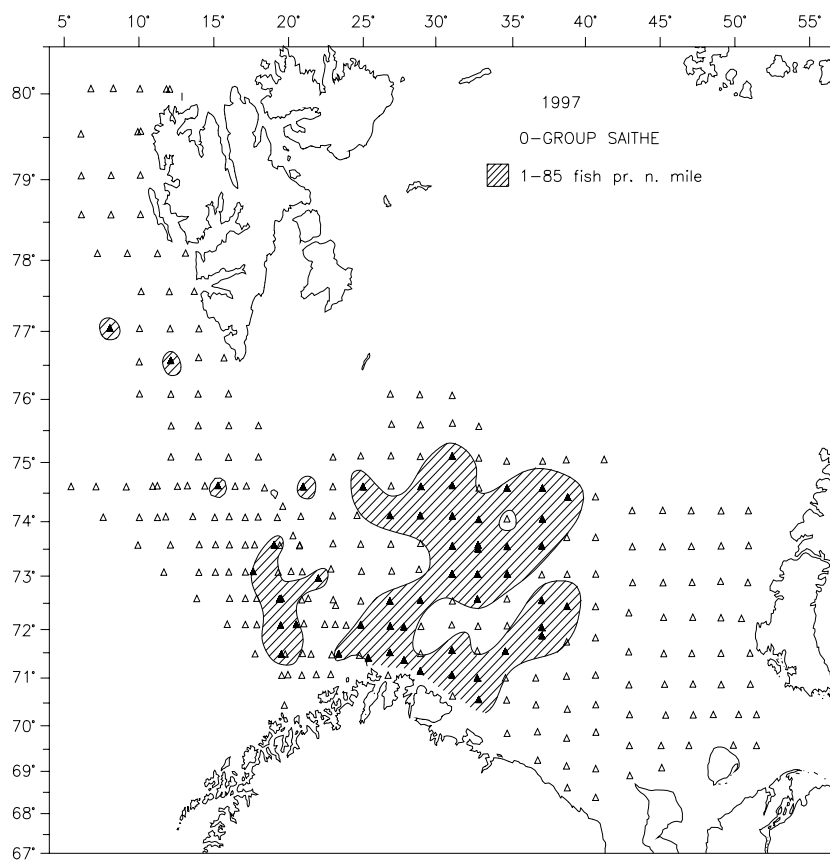


Fig. 21. Distribution of 0-group saithe.

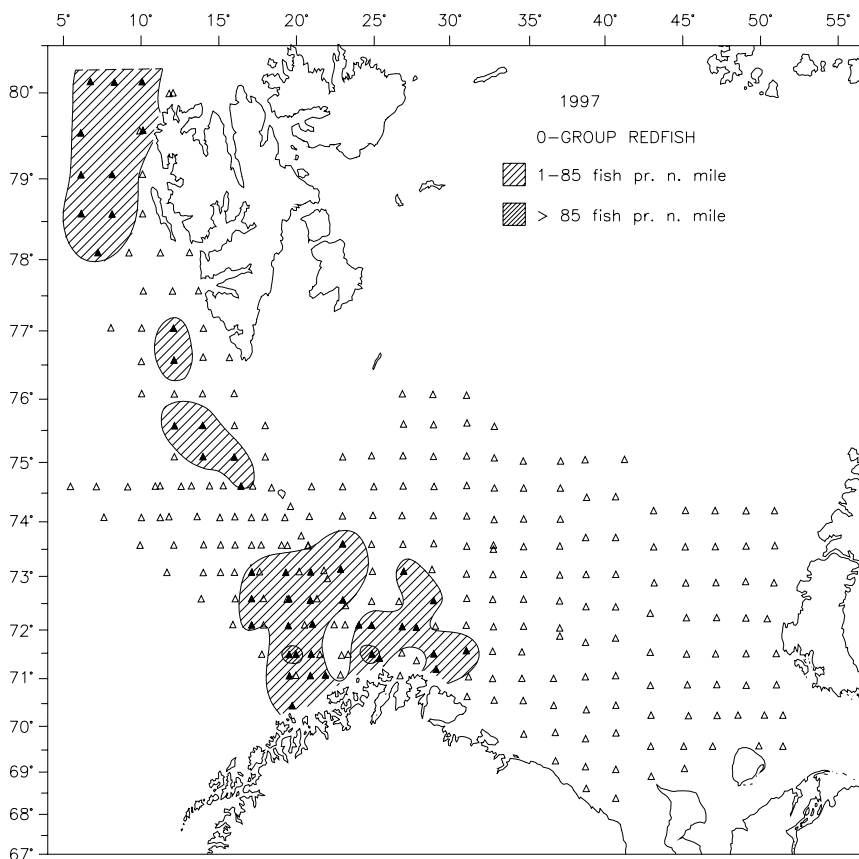


Fig. 22. Distribution of 0-group redfish.

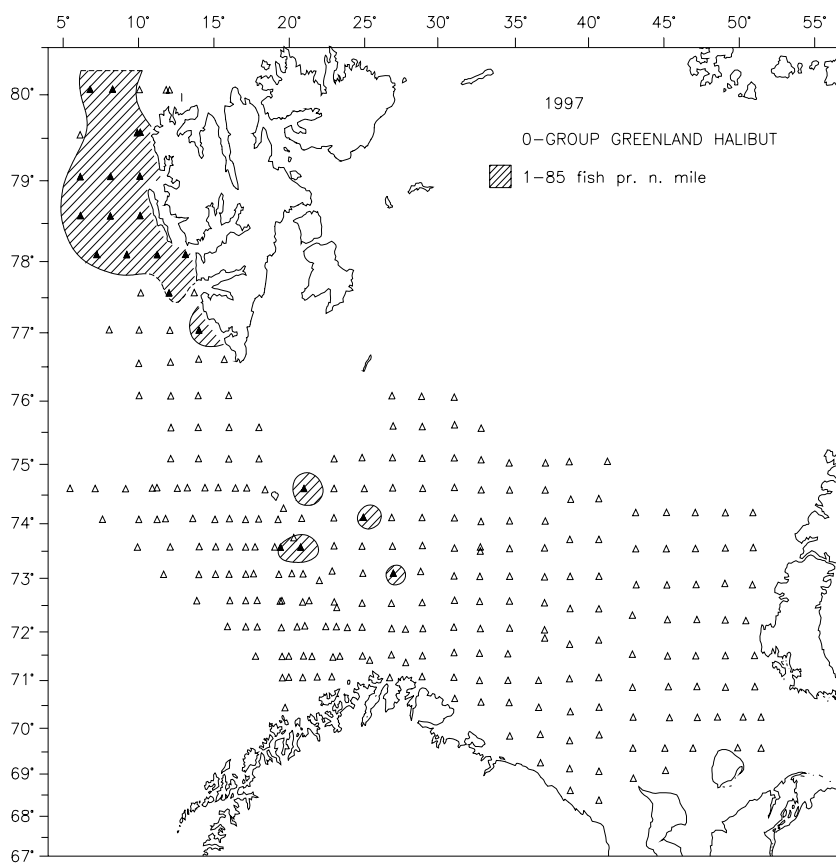


Fig. 23. Distribution of 0-group Greenland halibut.

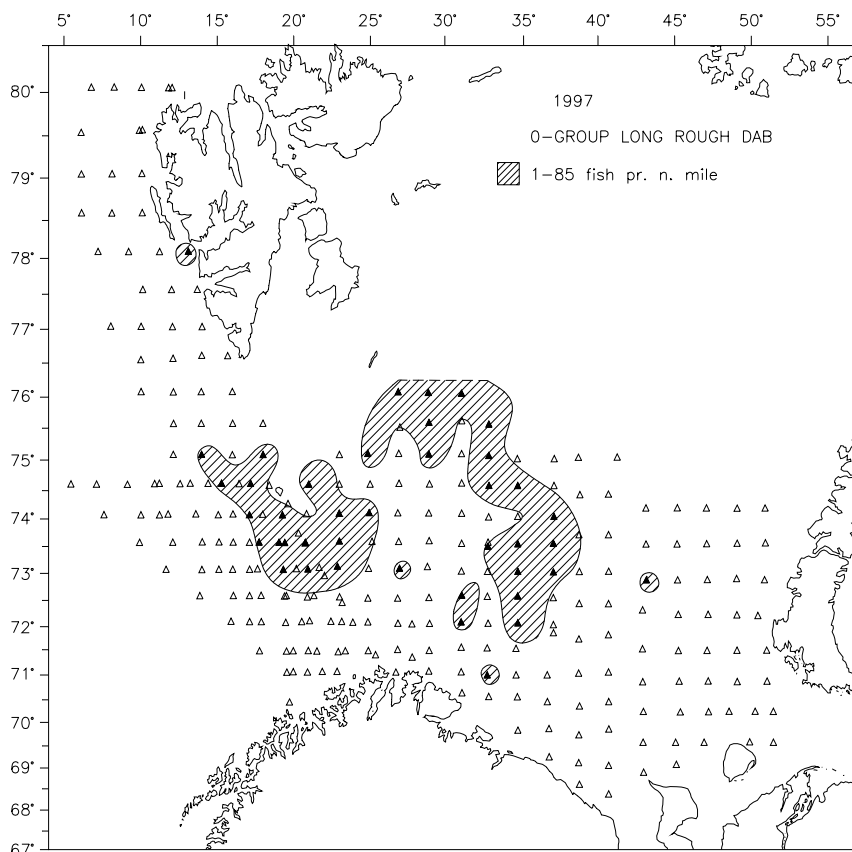


Fig. 24. Distribution of 0-group long rough dab.

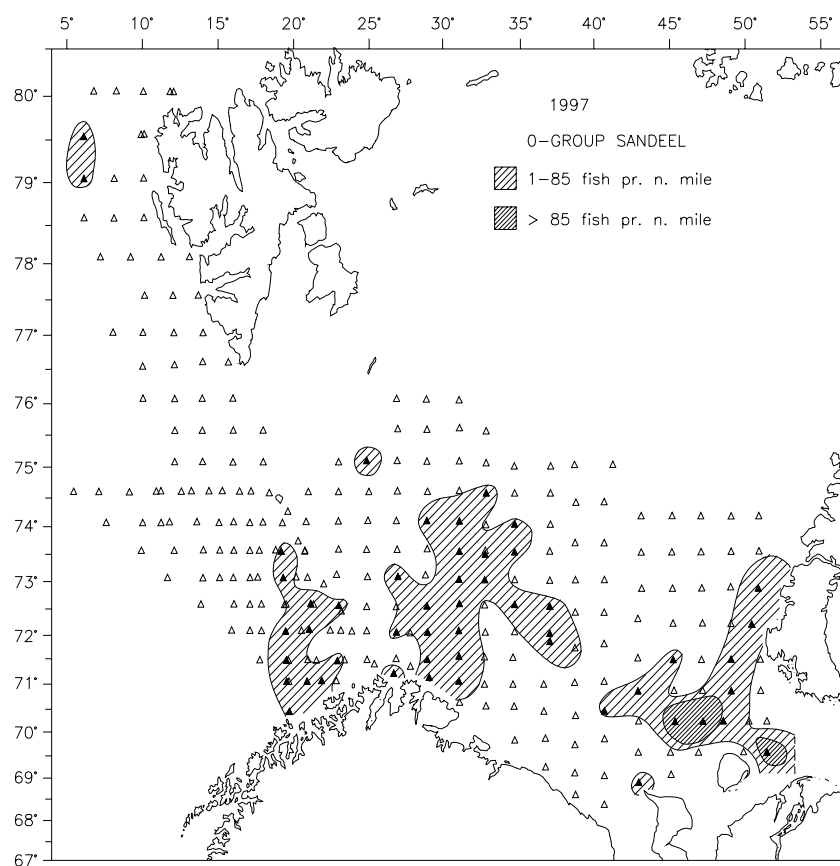


Fig. 25. Distribution of 0-group sandeel.

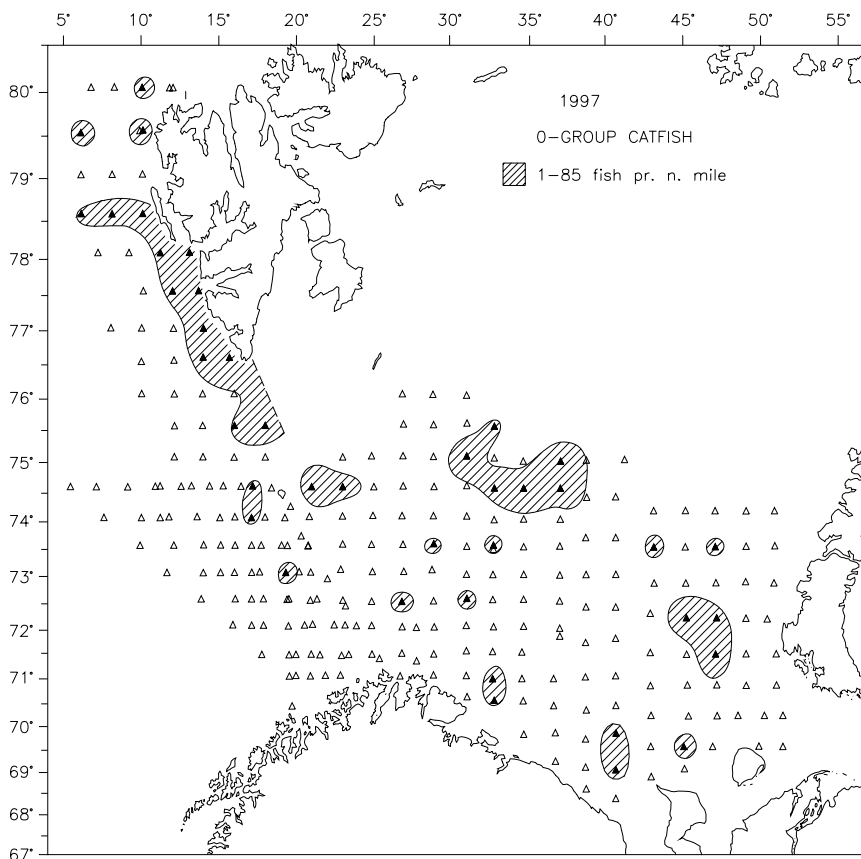


Fig. 26. Distribution of 0-group catfish.

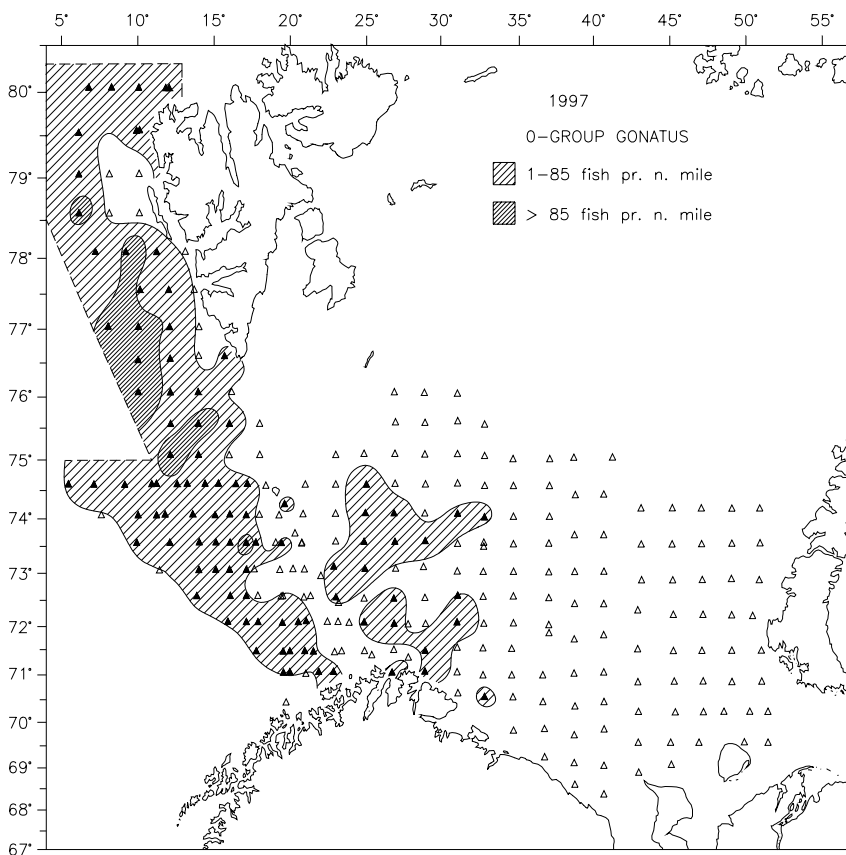


Fig. 27. Distribution of 0-group *Gonatus fabricii*.

APPENDIX

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«G. O. SARS»	H. Græsdal, H. Hammer, B. Hoffstad, J. Horne (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).
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«ATLANTIDA»	A. Bendick, S. Harlin, V. Hlivnoy, V. Iljin, V. Kiselev, D. Prozorkevitch, S. Ustinov, T. Yusupov, G. Zuikov.
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