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REPORT OF THE INTERNATIONAL 0-GROUP FISH SURVEY IN THE BARENTS SEA AND ADJACENT WATERS IN AUGUST - SEPTEMBER 1999

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REPORT OF THE INTERNATIONAL O-GROUP FISH SURVEY IN THE BARENTS SEA AND ADJACENT WATERS IN AUGUST - SEPTEMBER 1999

The thirty-fifth annual International 0-group Fish Survey was conducted during the period 13. August - 7 September 1999 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Period	Research Institute
Norway	"Johan Hjort"	20.08 – 07.09	Institute of Marine Research, Bergen
Norway	"G. O. Sars"	24.08 – 07.09	"
Russia	"AtlantNIRO"	13.08 – 04.09	The Polar Research Inst.of Marine
Russia	"Persey-4"	12.08 – 04.09	Fisheries and Oceanography, Murmansk

Names of scientists and technicians who participated are given in the Appendix.

Preliminary analysis of the survey data were made on board the "Johan Hjort", 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 survey area.

MATERIAL AND METHODS

The geographical distributions of 0-group fish were estimated based on samples from a small mesh midwater trawl. All vessels that participated in the survey in 1999 used a type of midwater trawl recommended in 1980 (Anon. 1983). The standard procedure consisted of tows of 0.5 nautical mile at each of 3 depths with the headline of the trawl located at 0, 20 and 40m, respectively. Additional steps at 60 and 80m per 0.5 nautical mile were made when the 0-group fish layer was recorded deeper than 60m or 80m on the echo-sounder. Trawling procedures were standardized in accordance with the recommendations made in 1980.

Most of the stations were spaced 35 nautical miles apart. 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, 200m and bottom in 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 in Table 1.

Trawl stations with and without catch are indicated on the distribution charts (Figs. 16–27) as filled and open symbols, respectively. The density grading is based on catch in numbers per 1.0 nautical mile trawling. 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 are given in Table 2. All area based abundance indices were estimated using standard computer programs (Fotland *et al*. 1995). Logarithmic transformed abundance indices are given for 0-group herring, cod and haddock (Table 3), calculated according to Randa (1984). These are based on the number of fish caught during a standard trawl haul of one nautical mile. Mean values of the abundance indices were only calculated for the period 1985 to 1999 (Table 2), since Nakken and Raknes (1996) show that previous surveys might not be comparable for methodological reasons. Estimated length frequency distributions for the main species are given in Table 4.

HYDROGRAPHY

The surface water temperature in the western and central Barents Sea was on average, 0.5°C higher than the long-term mean. In the eastern Barents Sea, it was colder than usual. The 6°C isotherm did not extend farther east than 48°E. Due to increased advection of warm water by the North Atlantic Current since spring-summer 1999, the warmest water was in the West-Spitsbergen and North Cape Currents. The positive anomalies were from 0.4°C to 1.0°C in the 0-200m layer. The temperature of the Murman Current in the central part of the Barents Sea and the Novaja Zemlja Current in the east were close to their long-term mean. The temperature of the Kanin Current remained lower than the long-term mean (Table 1). These water masses are influenced by cold arctic water from the North and East regions of the Barents Sea. The temperature of the upper 50m layer in 1999 was approximately 0.6-0.9°C lower than in 1999, but beneath the upper layers the temperature in the entire Barents Sea was approximately one

degree warmer than in the previous year. The surface waters in the eastern part were fresher than normal as was the case in 1998.

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

Herring (Fig. 16)

The distribution of 0-group herring in 1999 was similar to its spatial distribution 1998, but more extended to the southeast. In the central Barents Sea, there were some small areas with dense concentrations, but to a much smaller extent than last year. In the northwest, the border of the 0-group herring spatial distribution was not found. The abundance index seems to be lower than in 1998, but comparable to the index in 1997 and the long-term mean (Table 3). The estimated mean length of 0-group herring was 91.2 mm, which is 20 mm larger than the mean length estimated in 1998 and one of the largest ever recorded.

Capelin (Fig. 17)

In the central and eastern Barents Sea, 0-group capelin were more widely distributed than last year in the region between 69°N and 76°N. Large, dense concentrations were found east and south of Hopen and in the southeastern part of the survey area. The abundance index was 722, which is higher than in the last two years, and the 1999 year-class is the second strongest on record, only 1989 is higher (Table 2). It should be noted that the abundance index might be biased because of incomplete coverage towards the north. The estimated mean length was somewhat larger than last year (Table 4).

Cod (Fig. 18)

In the northeast and eastern Barents Sea, a further decrease from 1998 in the extent of the 0-group cod distribution was observed. In the central and western areas the spatial distribution of 0-group cod was more or less similar to that observed in 1998. However, dense concentrations occurred only in several small patches. Both indices (Table 2 and 3) were smaller than last year, and the 1999 year-class is weaker than all year-classes in the 1990s. The estimated mean length was somewhat higher than in 1998 (Table 4).

Haddock (Fig. 19)

The spatial distribution of 0-group haddock was almost the same as last year. However, dense concentrations were found in a smaller area than last year in the central Barents Sea. To the west and southwest of Spitsbergen, dense concentrations were not observed. Both indices are smaller than last year, and the 1999 year-class may be characterized as average (Table 2 and 3). The estimated mean length of 0-group haddock was similar to that in 1998 (Table 4).

Polar cod (Fig. 20)

As last year, there were two separate areas (components) of 0-group polar cod. Near Spitsbergen (the western component), the distribution of 0-group polar cod was approximately similar to that observed in previous years. But dense concentrations were located in more coastal waters. The abundance index of this component was average (Table 2). Along Novaja Zemlja (the eastern component), dense concentrations extended farther west and north than normal, and the year-class can be characterized as strong (Table 2). The abundance index for both polar cod components may be biased because of incomplete coverage of the spatial distribution towards the north. The estimated mean length of polar cod is 5 mm longer than last year (Table 4).

Saithe (Fig. 21)

0-group saithe were in scattered areas over most of the southern part of the survey area. In contrast to last year, it did not extend as far to the northwest, but had a more widespread distribution towards the east. No abundance index was calculated, but based on the total spatial distribution, it seems that the 1999 year-class might be at the same level or somewhat higher than in 1998.

Redfish (Fig. 22)

0-group redfish were scattered in localized areas to the west of Spitsbergen and east of Bear Island. The abundance index is extremely low (Table 2) and continues the series of very poor year-classes since 1995.

Greenland halibut (Fig. 23)

0-group Greenland halibut were only in scattered concentrations in two small areas - to the west of Spitsbergen and to the southeast of Spitsbergen towards Hopen. The abundance index (Table 2) is similar to those in the last few years and is at an average level. The estimated mean length of 0-group Greenland halibut was close to last year's estimate.

Long rough dab (Fig. 24)

0-group long rough dab were mainly in scattered concentrations. Compared to last year, a wider spatial distribution was observed in the western Barents Sea and south of Spitsbergen. Two patches of long rough dab was in the central part of the survey area and in the southeastern Barents Sea. To the south of the latter area, there was one large catch. The abundance index for 0-group long rough dab (Table 2) increased somewhat from last year but is lower than the average for 1985-1999. The estimated length distribution was similar to that in 1998.

Sandeel (Fig. 25)

The main distribution of 0-group sandeel was in the southeastern Barents Sea in scattered concentrations and there was only one large catch. The spatial distribution was smaller than last year. No abundance index was calculated for this species.

Catfish (Fig. 26)

0-group catfish were in as several, small, scattered concentrations in the northwest and southeast Barents Sea. Only one large catch was taken in the area between Hopen and Bear Island. No abundance index was calculated for this species.

Gonatus (Fig. 27)

0-group *Gonatus fabricii* were distributed similarly to previous years. They occurred in the western part of the survey area from the Norwegian coast to Spitsbergen. No abundance index was calculated for this species.

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Table 1. Mean water temperature[1] in selected sub-sections of the standard transects in the Barents Sea and adjacent waters during August-September 1965 - 1999.

Year	Section[2] and layer (depth 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
1998	8.4	3.4	4.7	2.1	1.9	6.0	[3]
1999	7.4	3.8	4.7	3.8	3.1	6.2	5.3
Average 1965-1999	7.4	3.8	4.7	4.2	3.2	5.8	4.6

[1] Earlier presented values 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).

[3] In 1998 only the central branch and the eastern branch of the West Spitsbergen Current were covered, and the mean temperatures were 5.4 and 4.5°C, respectively.

Table 2. Abundance indices for 0-group fish in the Barents Sea and adjacent waters in 1965 - 1999.

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	0	220	15	66
1996	291	1142	196	59	484	19	5	10
1997	522	1077	150	129	453	50	13	42
1998	428	576	593	144	457	78	11	28
1999	722	194	184	116	696	27	13	66
Mean 1985-1999	298	658	226	109	274	384	16	121

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

Table 3. Logarithmic abundance indices along with 90% confidence limits for 0-group herring, cod and haddock in the Barents Sea and adjacent waters 1965-1999.

	Herring[1]			Cod			Haddock		
Year	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	1.53	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
1998	0.59	0.40	0.82	0.68	0.48	0.91	0.59	0.44	0.76
1999	0.41	0.25	059	0.21	0.11	0.34	0.25	0.11	0.44
Mean 1985-1999		0.46			1.63			0.44	

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

Table 4. Length distribution (%) of 0-group fish in the Barents Sea and adjacent waters in August - September 1999.

Length (mm)	Herring	Capelin	Cod	Haddock	Polar cod	Redfish	Sandeel	Greenland halibut	Long rough dab
10- 14						0.86			
15- 19					0.02	4.31			
20- 24		0.01			0.53	18.10	0.09		
25- 29		0.45			7.58	20.69	0.18	1.72	3.11
30- 34		10.11			27.60	13.79	40.74	0	36.27
35- 39		17.16	0.02		36.33	23.28	32.25	1.72	47.66
40- 44		20.98	0.08	0.02	19.40	15.52	11.49	0	11.40
45- 49	0.37	15.87	0.31	0.22	7.40	3.45	12.04	0	1.30
50- 54	1.12	8.34	0.70	0.31	1.14		2.76	6.90	0.26
55- 59	1.65	5.50	1.87	0.52			0	18.97	
60- 64	1.47	6.89	2.92	1.34			0	36.21	
65- 69	1.05	5.35	3.90	1.95			0	8.62	
70- 74	1.97	5.16	4.74	1.43			0.09	12.07	
75- 79	5.65	3.66	8.04	2.66			0.09	12.07	
80- 84	8.86	0.52	8.97	3.83			0.09	1.72	
85- 89	17.37		11.34	5.05			0.09		
90- 94	21.16		15.77	9.27			0		
95- 99	15.24		14.97	8.97			0		
100-104	12.03		15.17	14.89			0		
105-109	6.98		7.86	13.05			0		
110-114	4.92		2.93	16.94			0		
115-119	0.16		0.41	9.01			0		
120-124				4.68			0.09		
125-129				3.35					
130-134				1.70					
135-139				0.64					
140-144				0.17					
No. measured	3624	6255	1276	1562	2517	76	83	41	107
Total catch	62420	324331	4843	4539	234861	116	1012	58	381
Mean length, mm	91.2	48.3	89.5	102.5	36.7	31.6	37.4	63.1	35.6

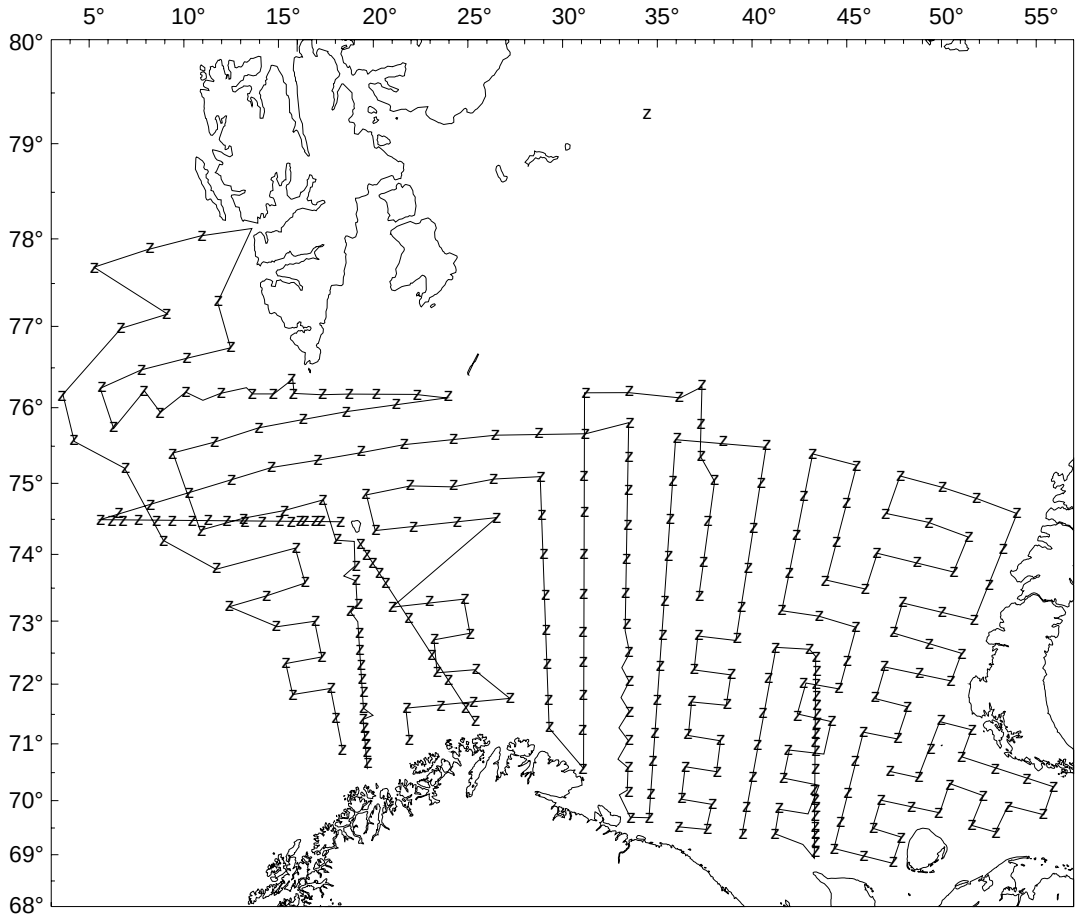

Fig. 1. Survey cruise tracks and hydrographic stations

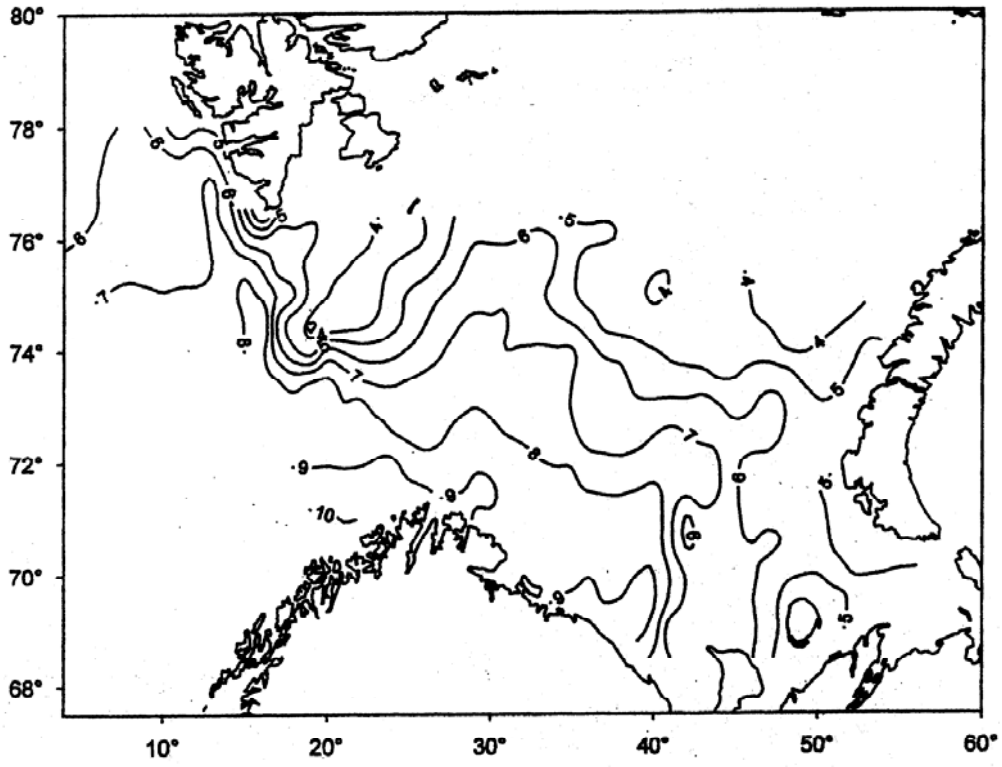

Fig. 2. Isotherms (°C) at 0m

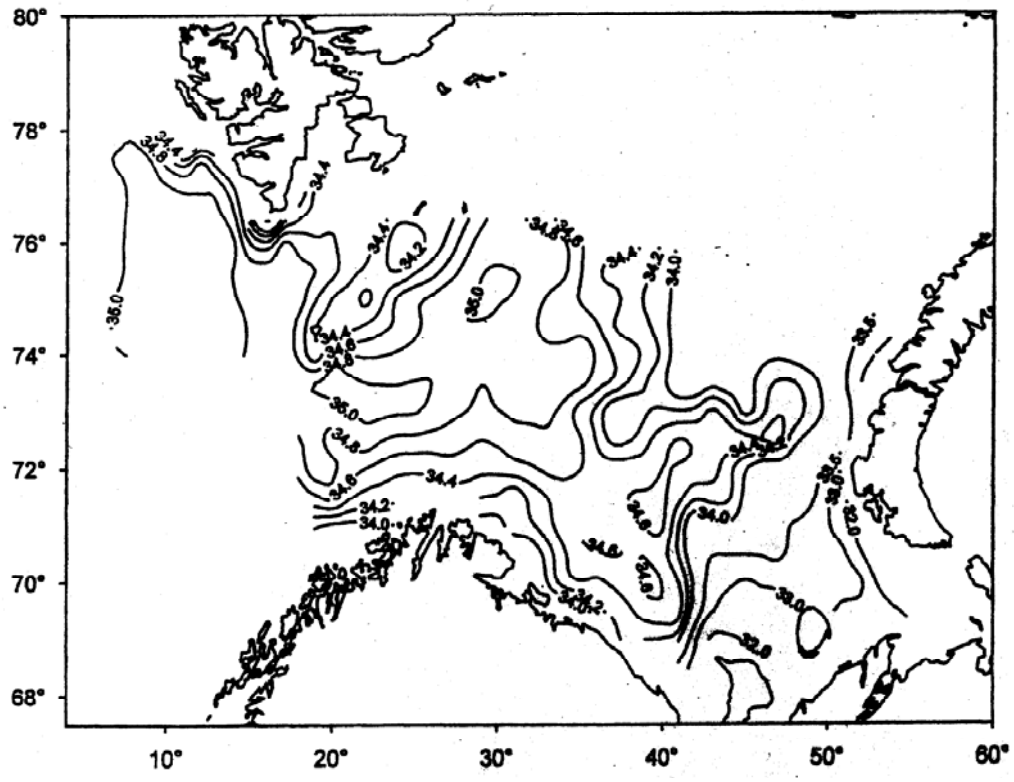

Fig. 3. Isohalines (PSU) at 0m

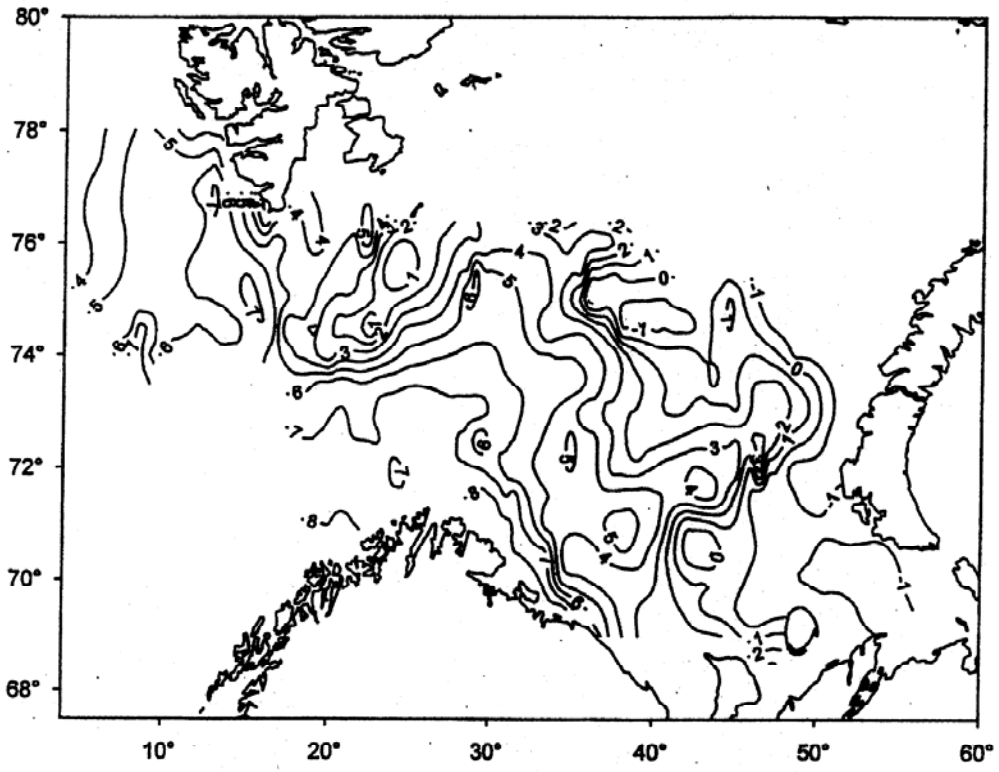

Fig. 4. Isotherms (°C) at 50m depth

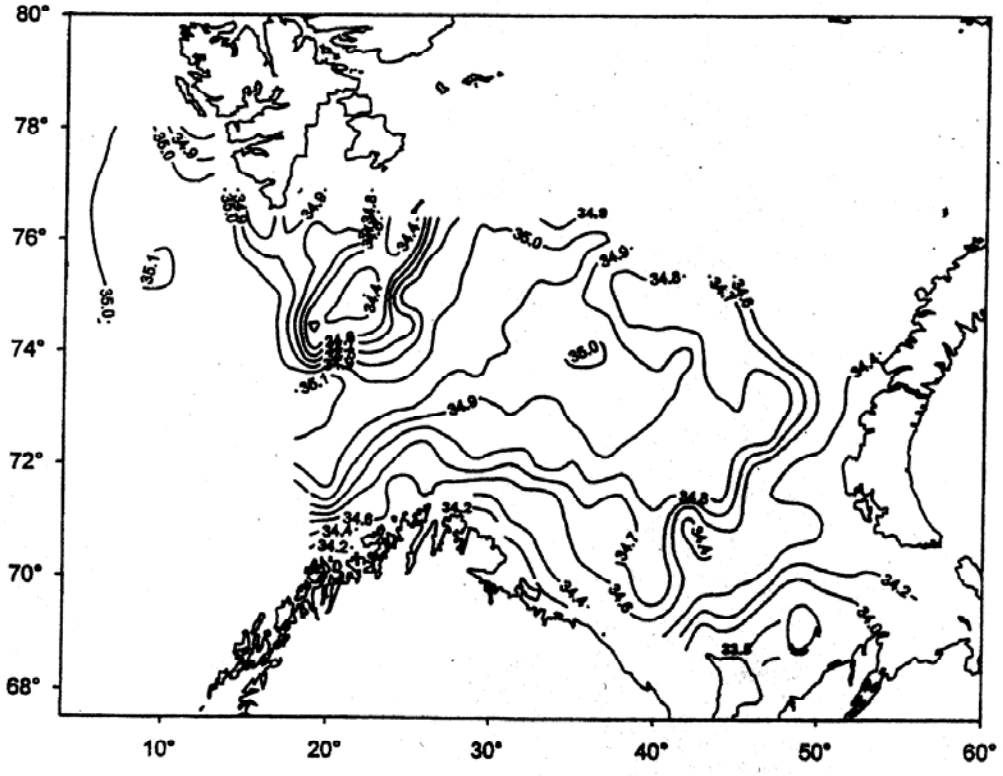

Fig. 5. Isohalines (PSU) at 50m depth

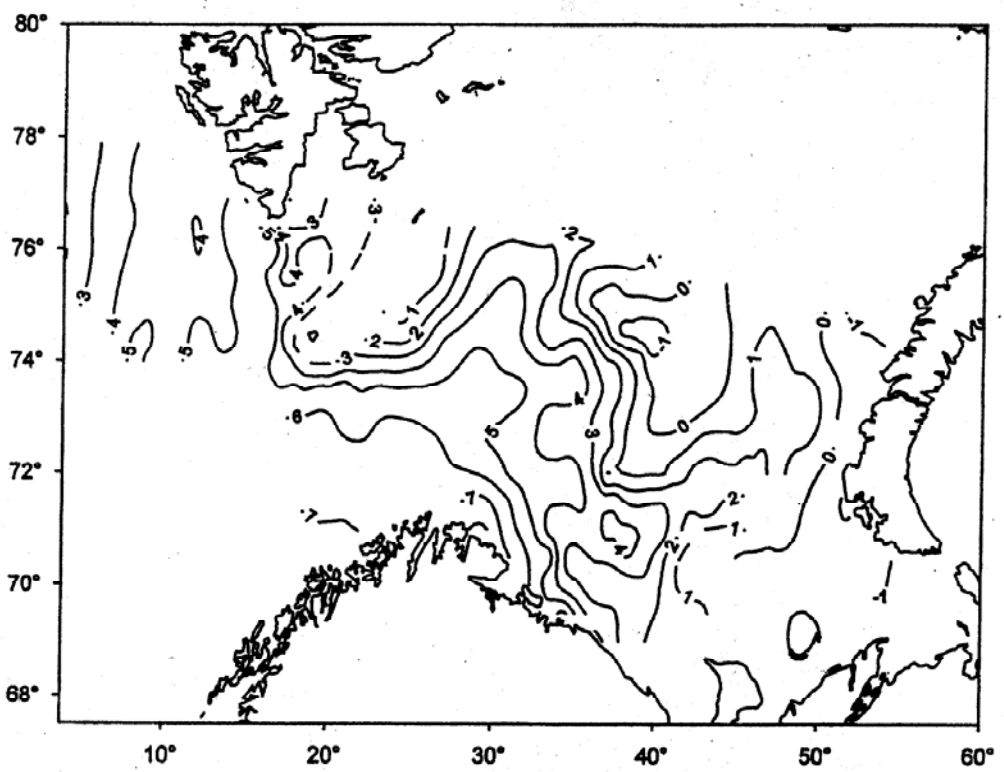

Fig. 6. Isotherms (°C) at 100m depth

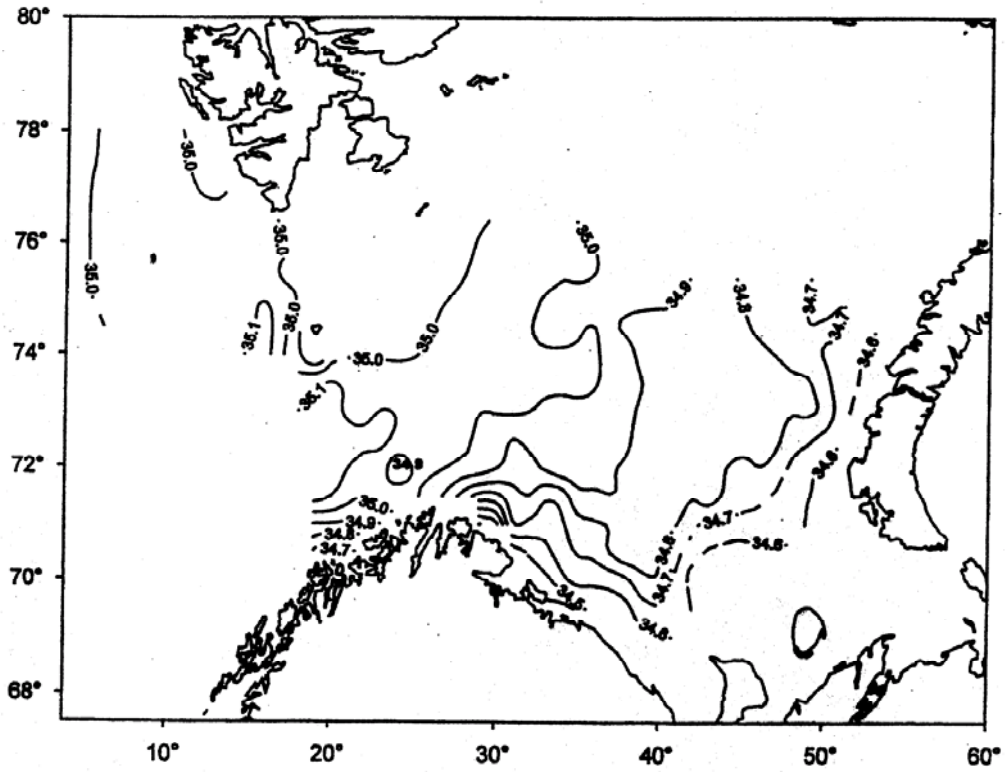

Fig. 7. Isohalines (PSU) at 100m depth

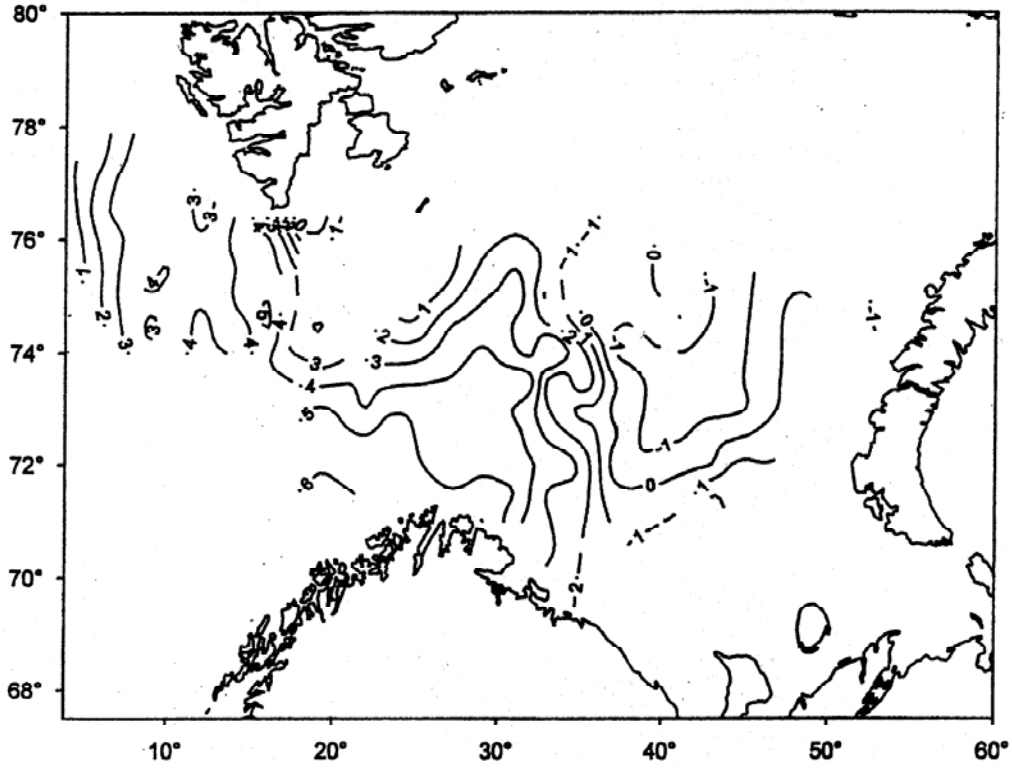

Fig. 8. Isotherms (°C) at 200m depth

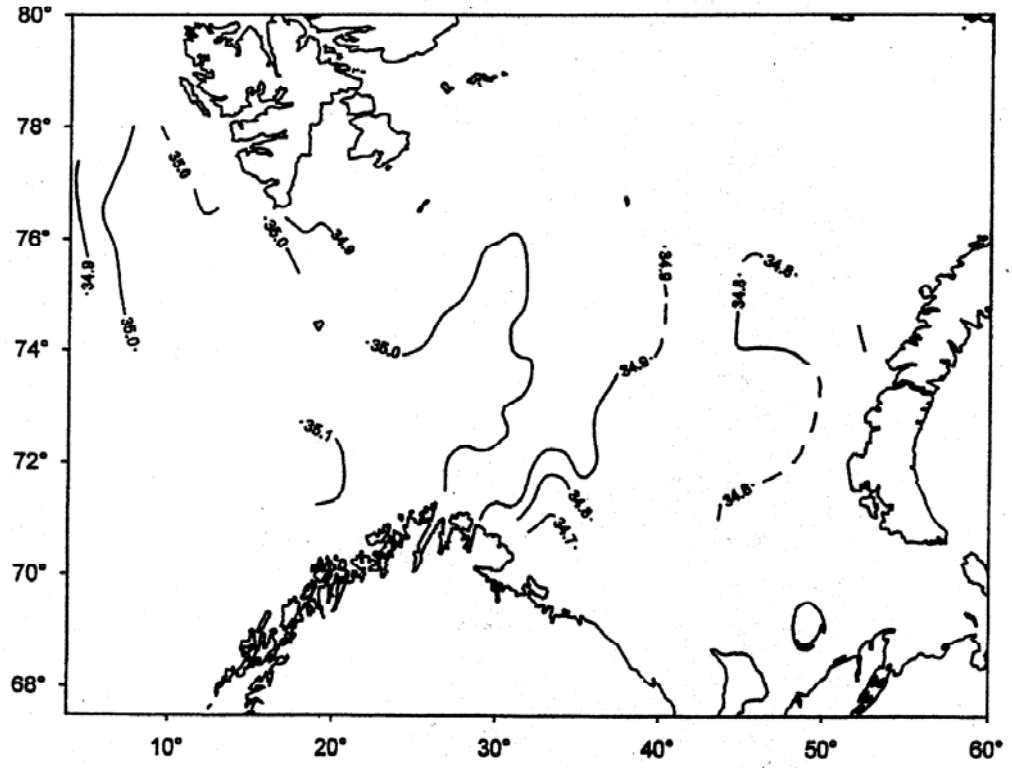

Fig. 9. Isohalines (PSU) at 200m depth

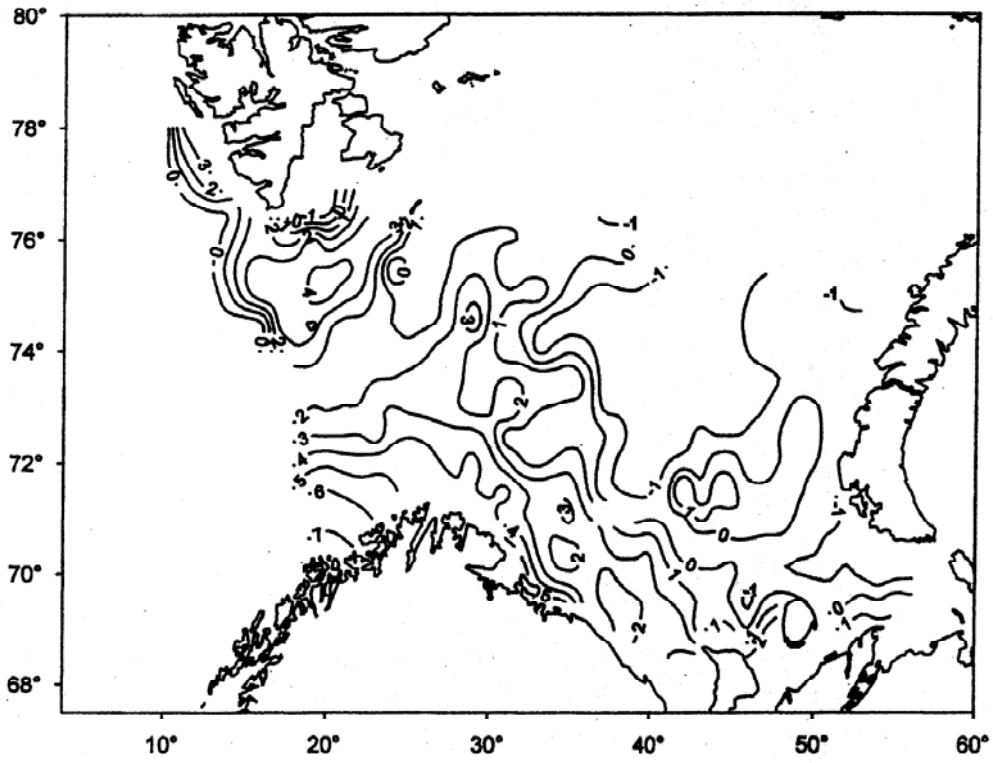

Fig. 10. Isotherms (°C) at the bottom

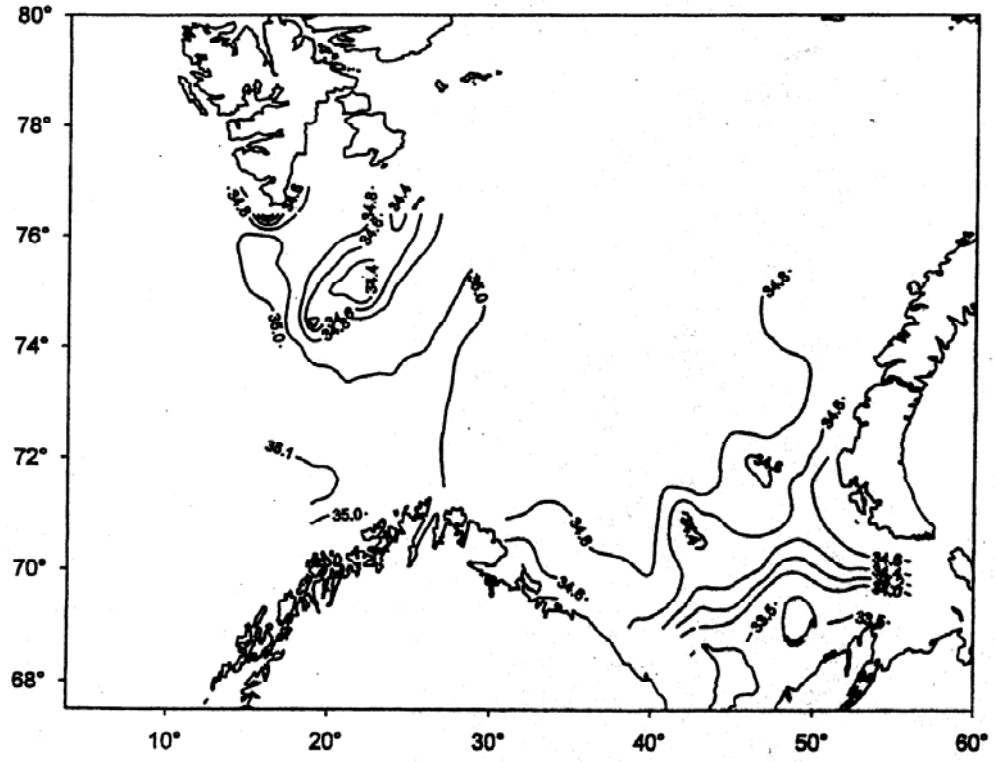

Fig. 11. Isohalines (PSU) at the bottom

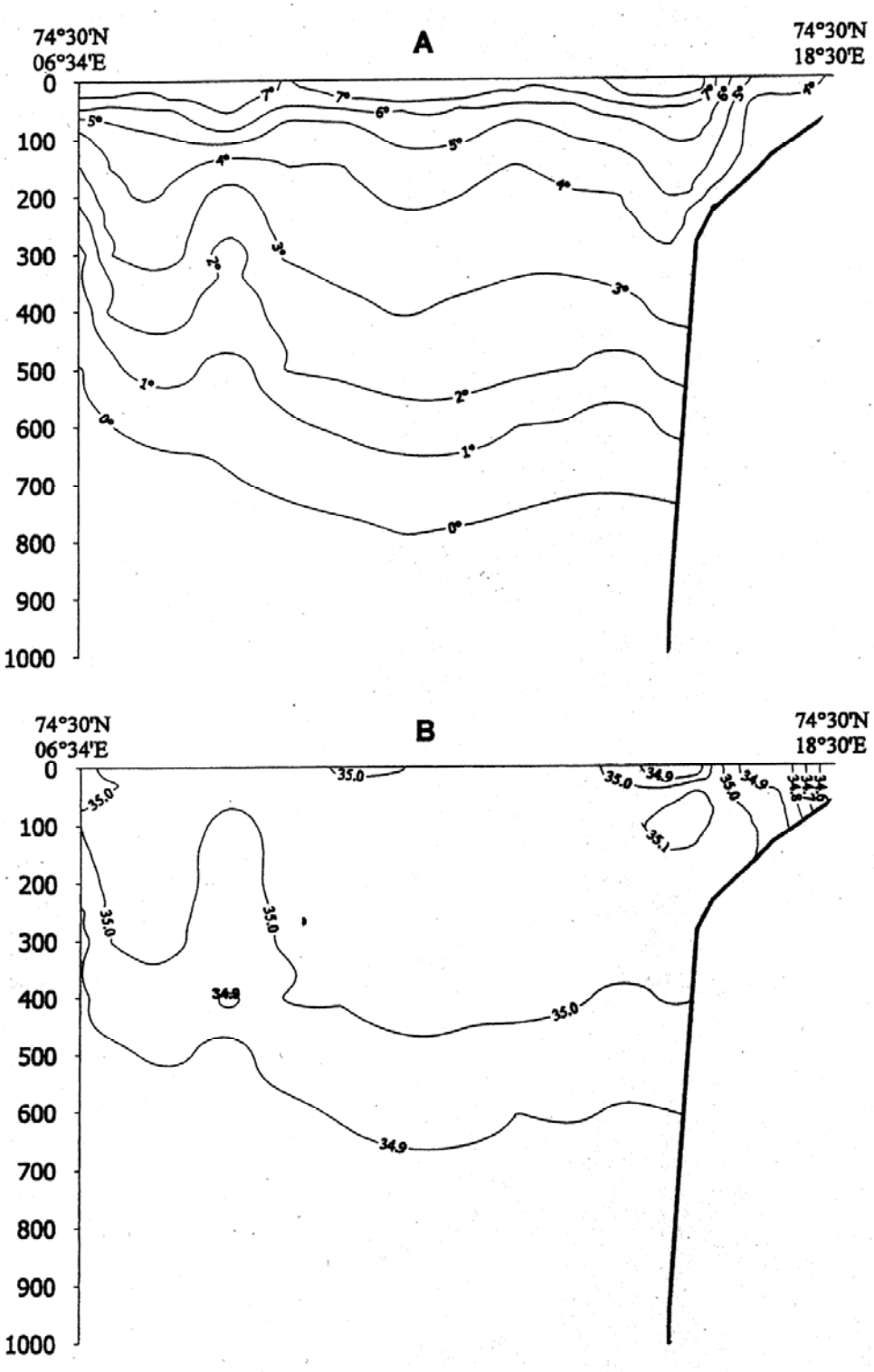

Fig. 12. Temperature (A) and salinity (B) through the hydrographic section Bear Island - West

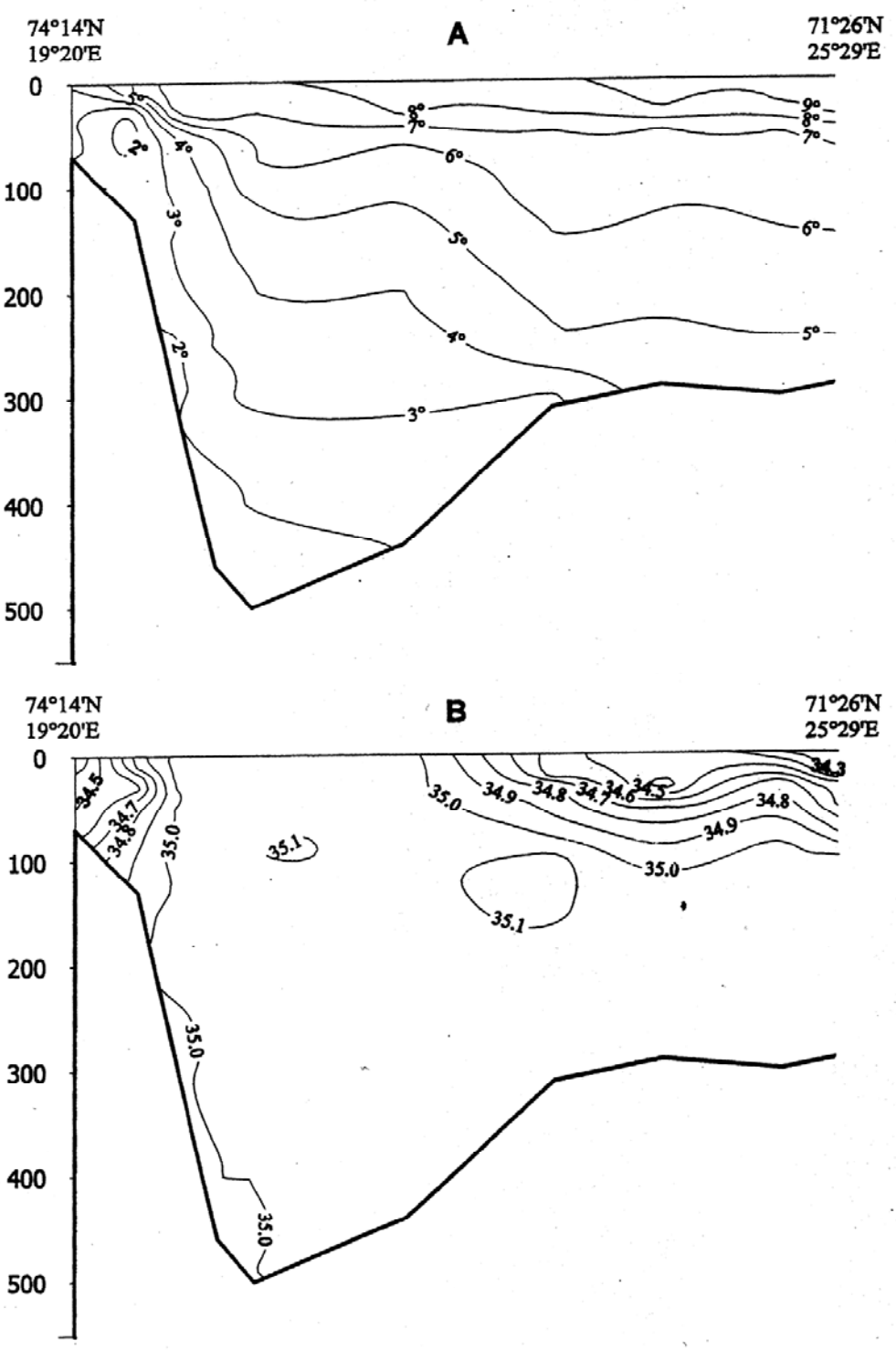

Fig. 13. Temperature (A) and salinity (B) through the hydrographic section North Cape – Bear Island

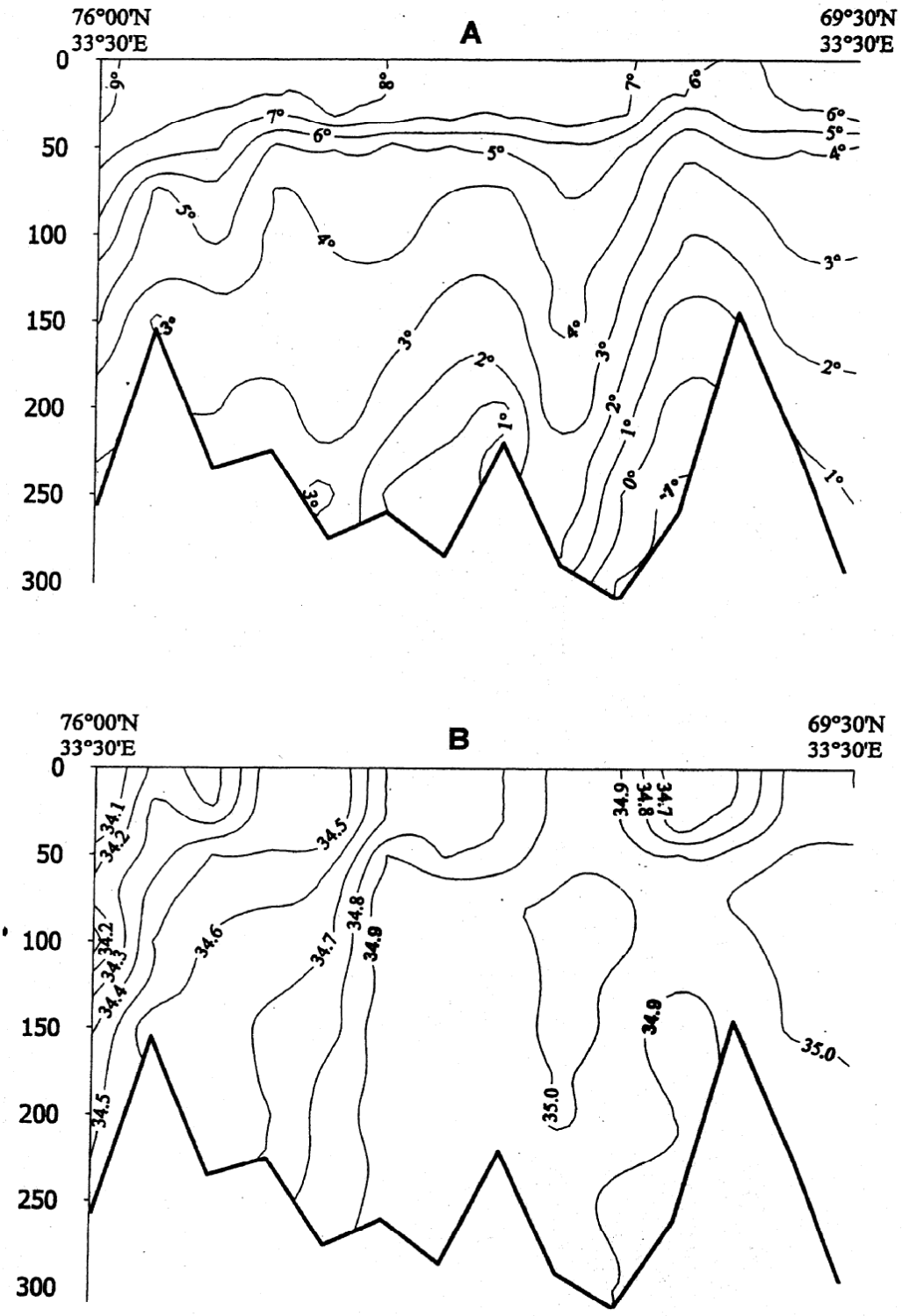

Fig. 14. Temperature (A) and salinity (B) through the hydrographic section along the Kola meridian

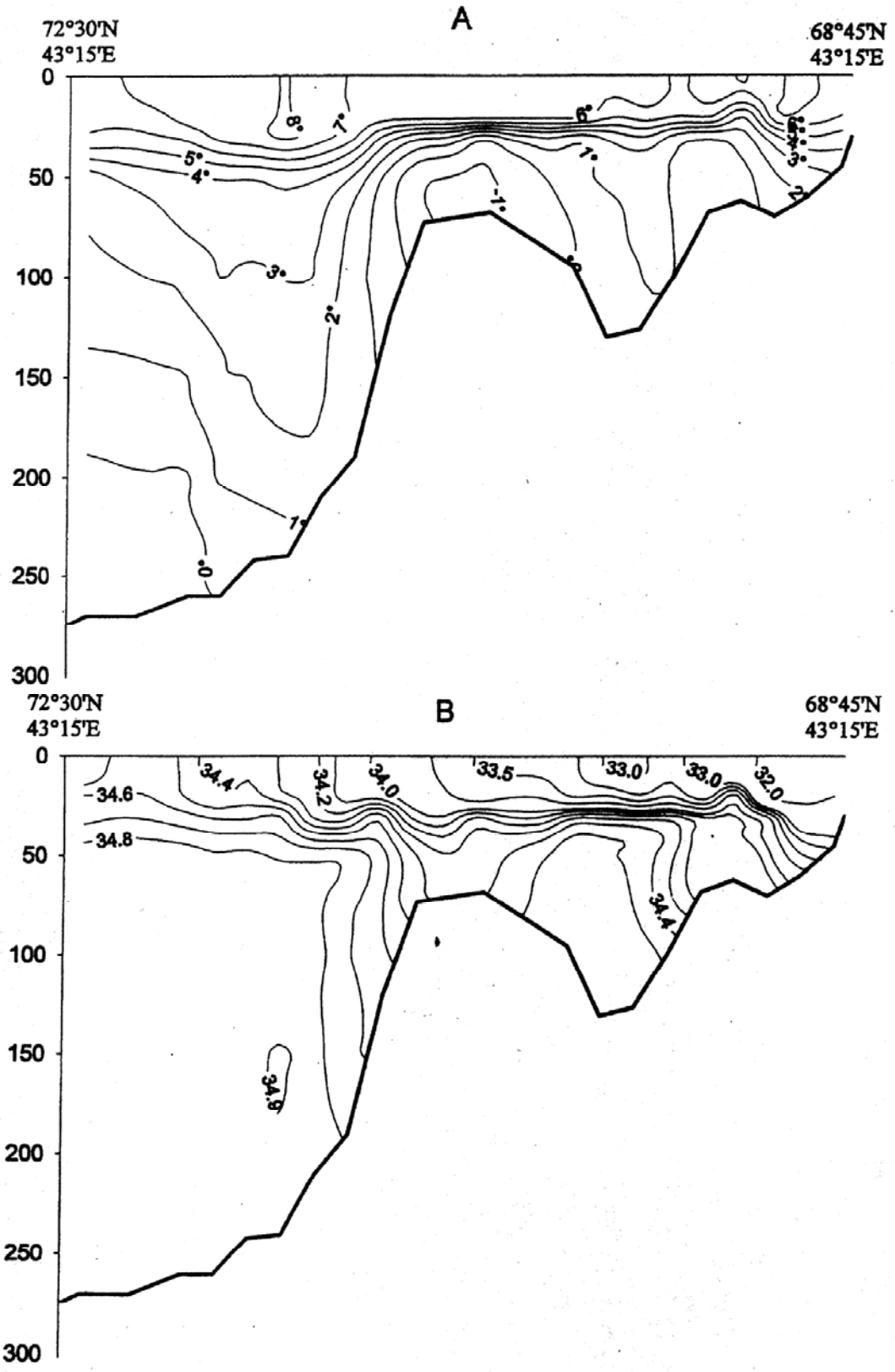

Fig. 15. Temperature (A) and salinity (B) through the hydrographic section Cape Kanin - North

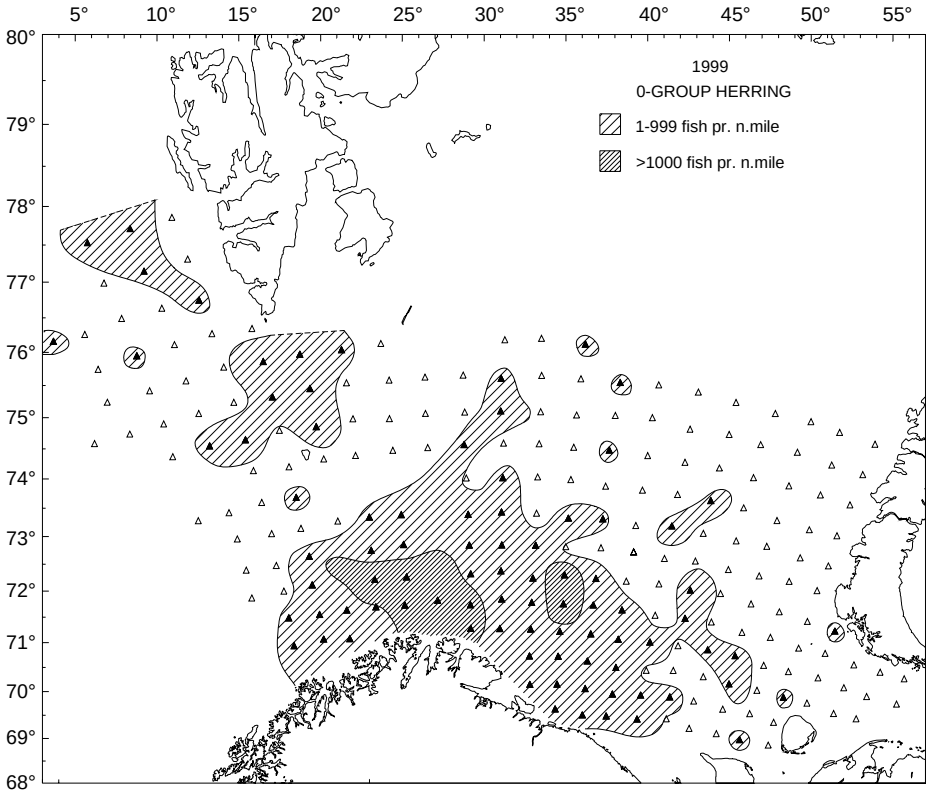

Fig. 16. Distribution of 0-group herring

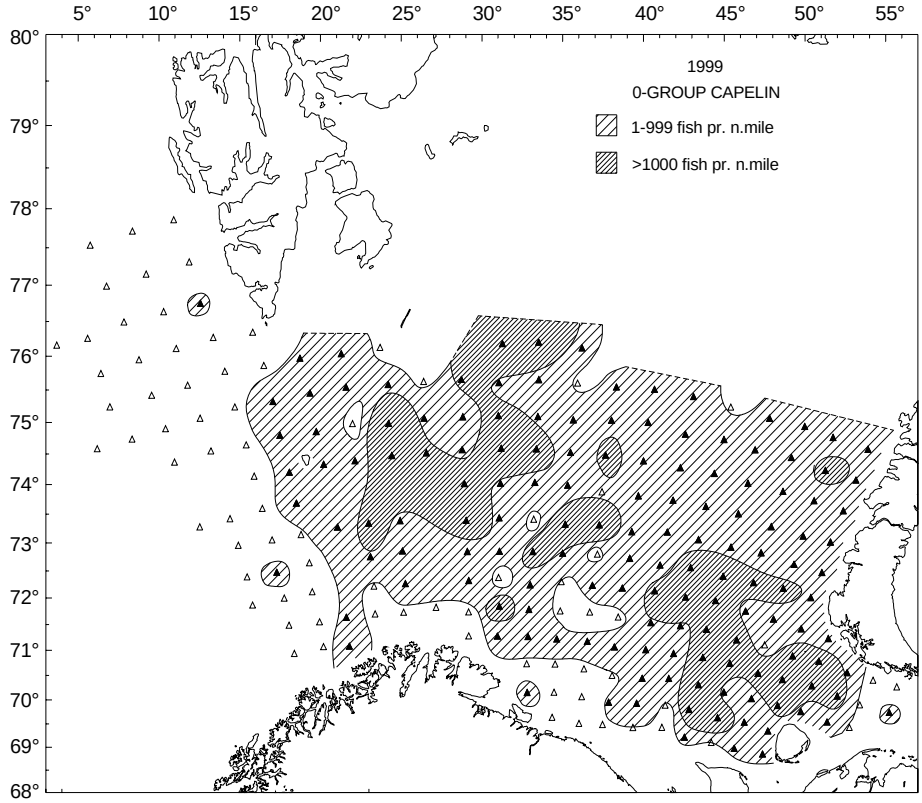

Fig. 17. Distribution of 0-group capelin

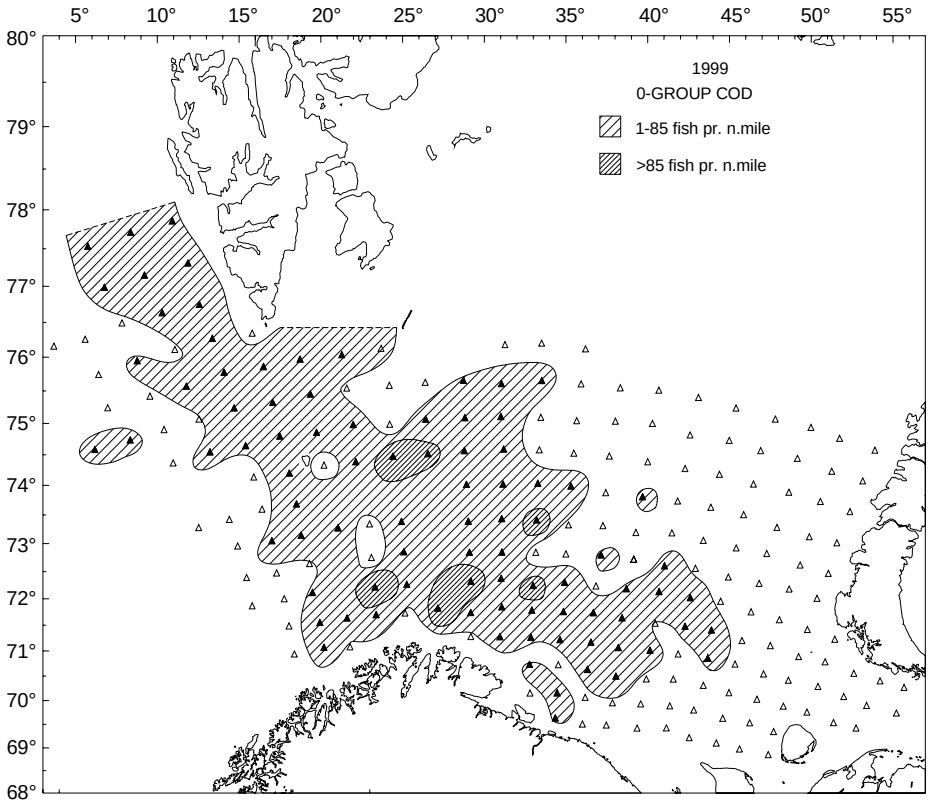

Fig. 18. Distribution of 0-group cod

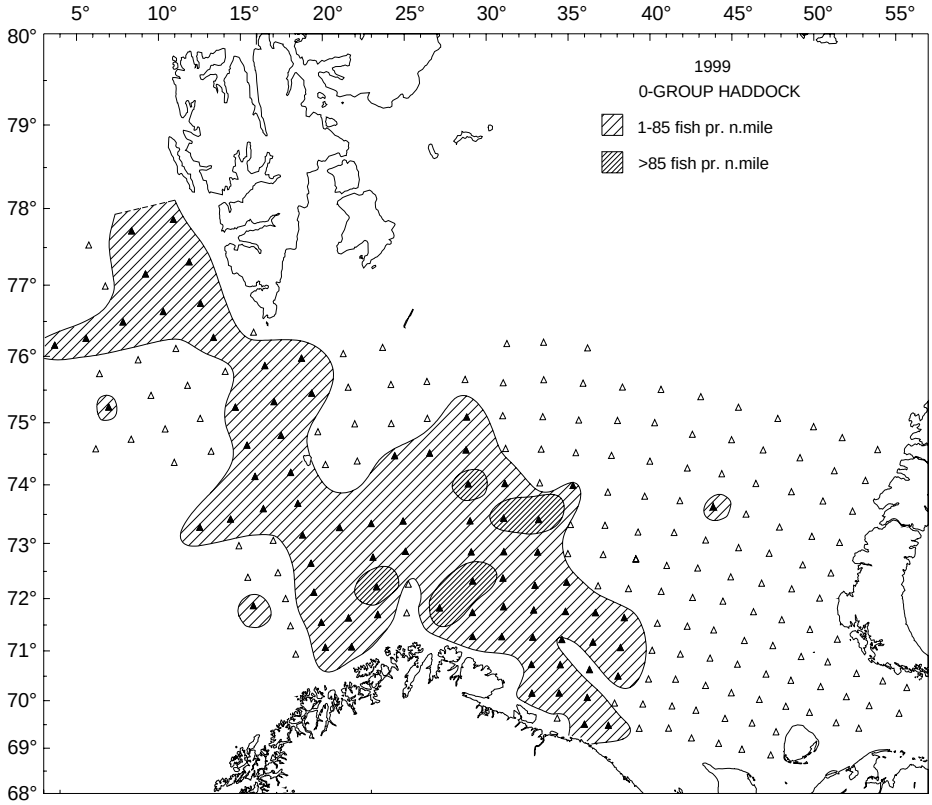

Fig. 19. Distribution of 0-group haddock

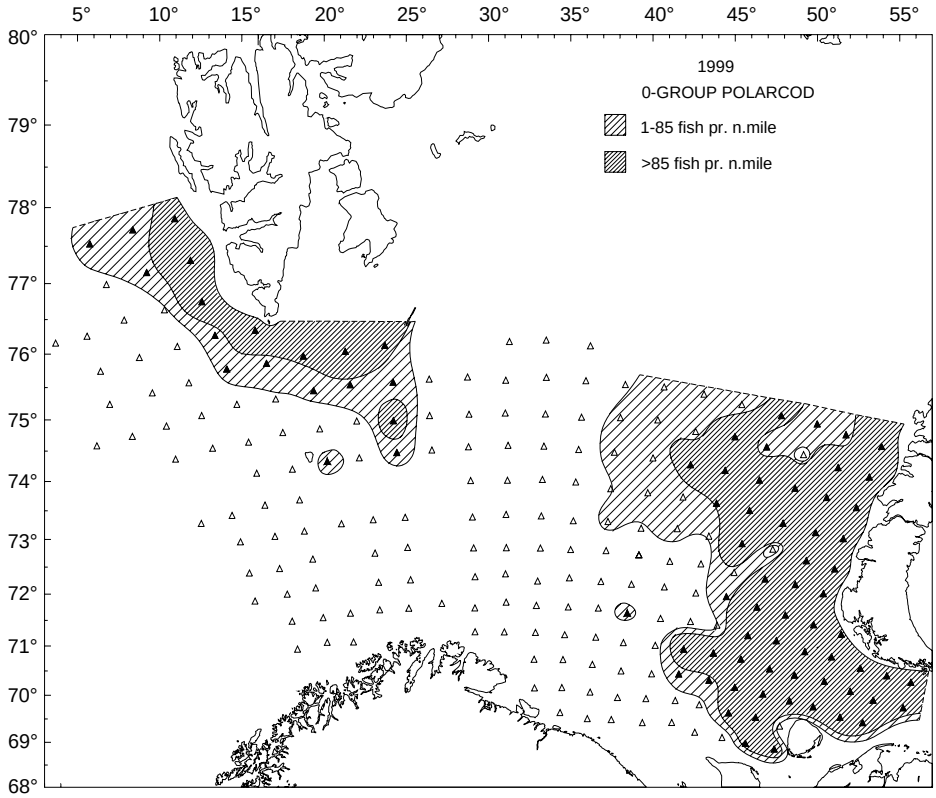

Fig. 20. Distribution of 0-group polar cod

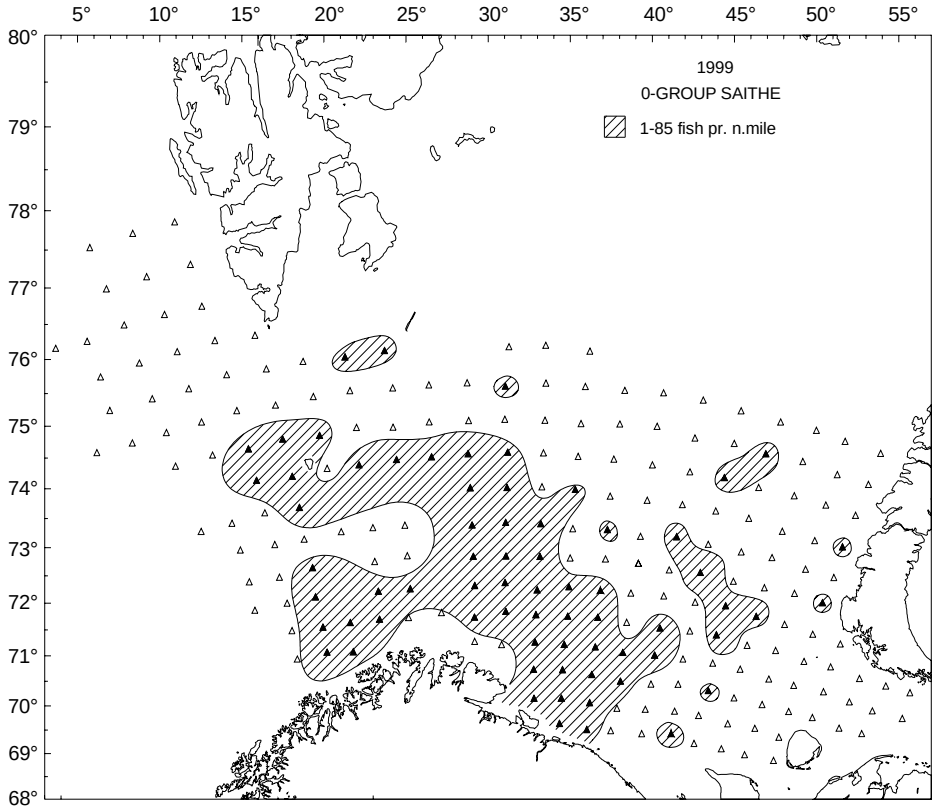

Fig. 21. Distribution of 0-group saithe

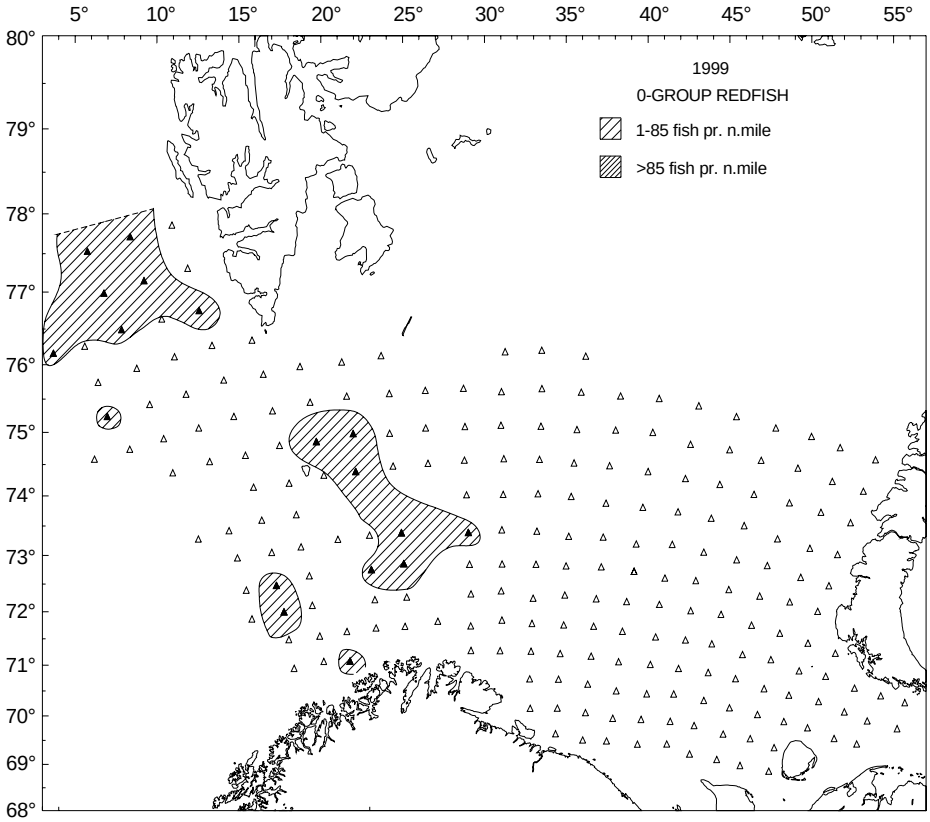

Fig. 22. Distribution of 0-group redfish

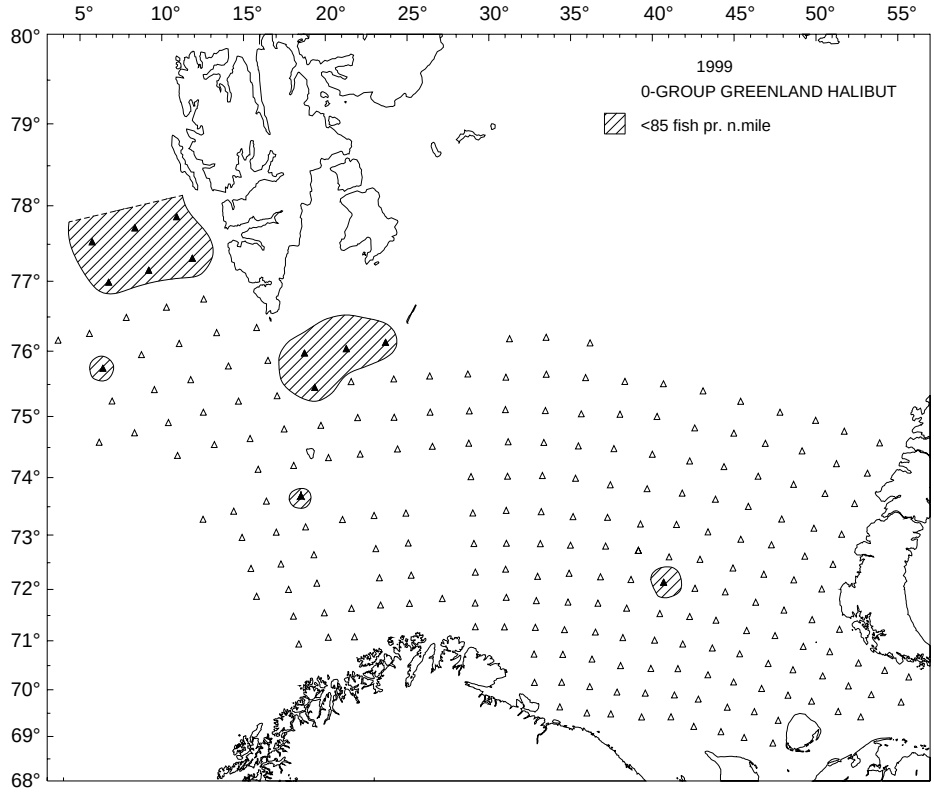

Fig. 23. Distribution of Greenland halibut

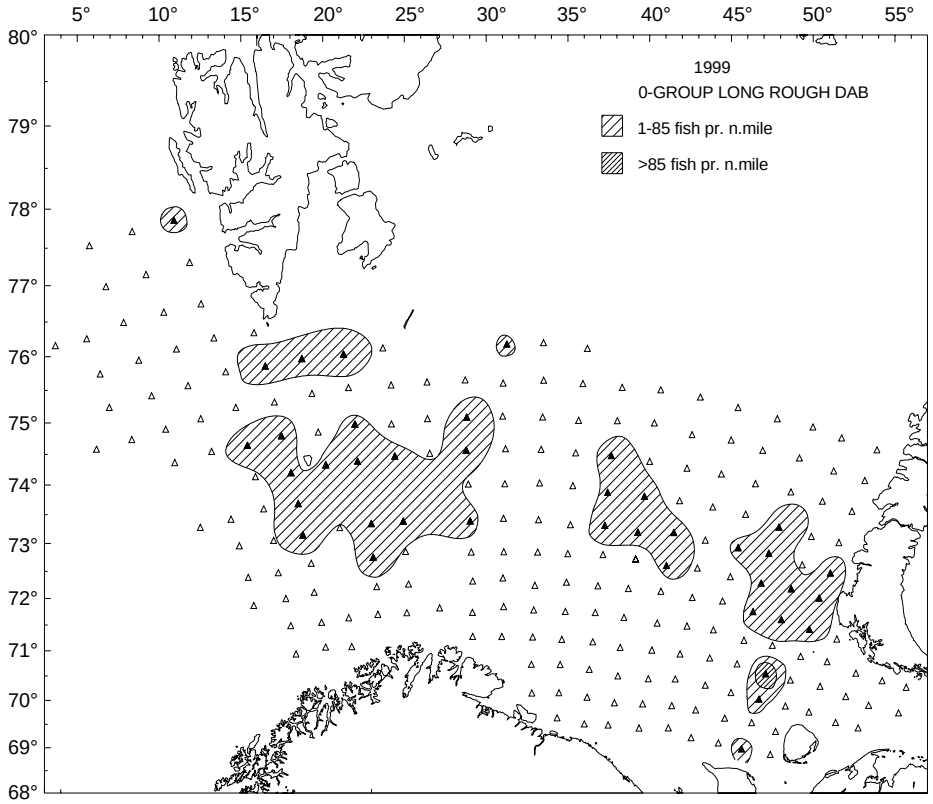

Fig. 24. Distribution of 0-group long rough dab

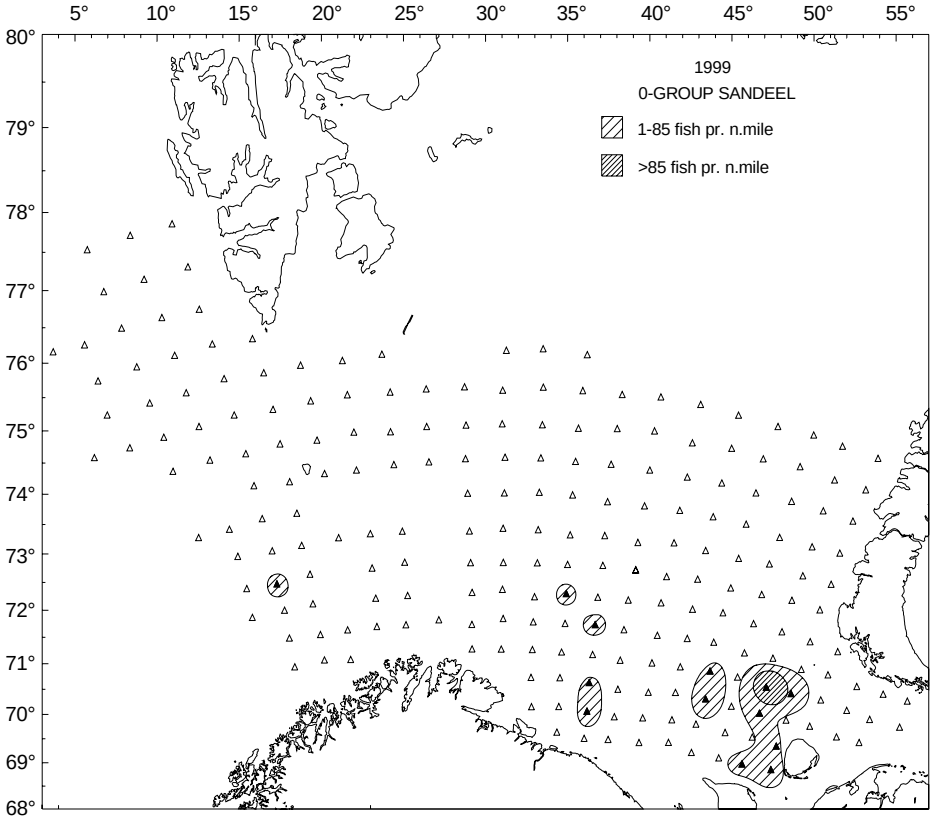

Fig. 25. Distribution of 0-group sandeel

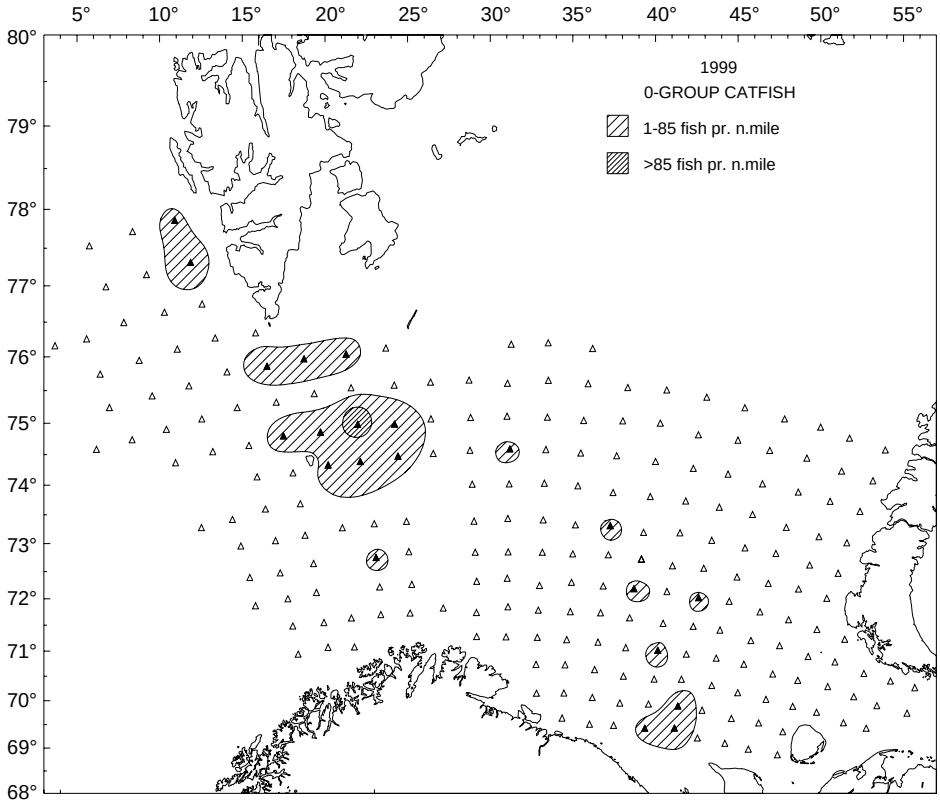

Fig. 26. Distribution of 0-group catfish

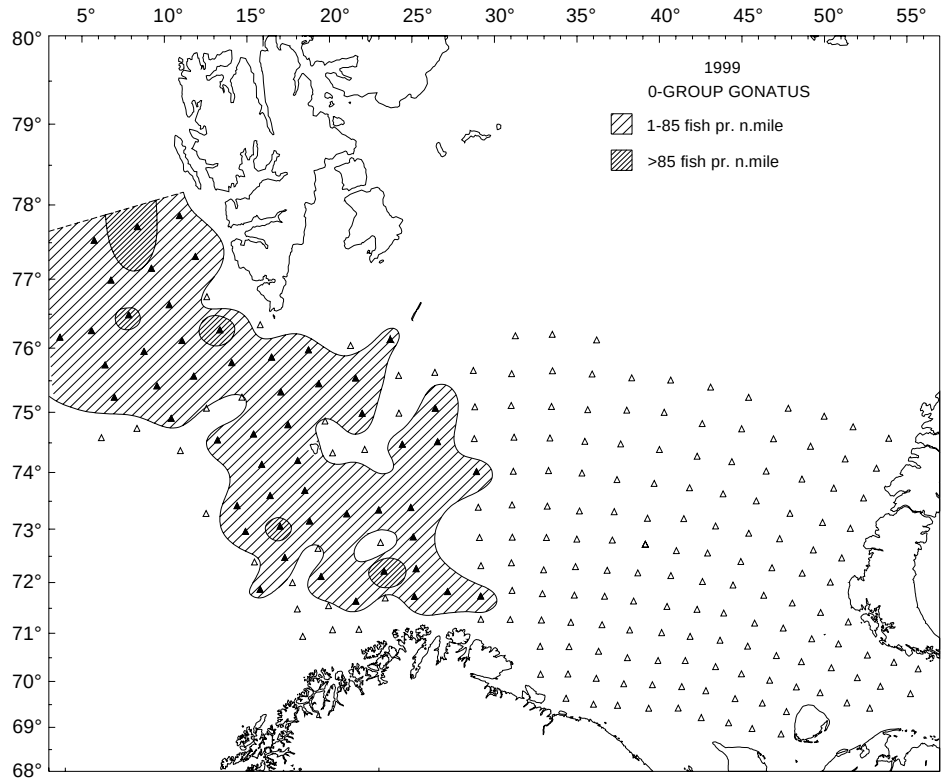

Fig. 27. Distribution of *Gonatus fabricii*

APPENDIX

Research vessel	Participants
"G. O. Sars"	P. Fossum (cruise leader), I.M. Beck, H. Bjørke, J. Erices, H. Gill, A.L. Johnsen, K. Hansen, R. Johannesen
"Johan Hjort"	H. Sagen (cruise leader), B. Endresen, K. Gjertsen, H. Græsdal, J. Horne, R. Ingvaldsen (cruise leader), E. Meland, T. Nilsen, A. Romslo, N. Ushakov,
"AtlantNIRO"	A. Bendik, T. Gavrilik, V. Mamylov, D. Prozorkevich (cruise leader), S. Ratushniy, E. Sentjabov, E. Tereschenko, T. Yusupov
"Fr. Nansen "	I. Dolgolenko (cruise leader), V. Kapralov, A. Karsakov, V. Komlichenko, J. Zhak, N. Vovchuk

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Anon. 2001. Report of the international 0-group fish survey in the Barents Sea and adjacent waters in August – September 1998. IMR/PINRO Joint Report Series. No. 2/2001. ISSN 1502-8828. 26 pp.

JOINT

REPORT

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