

JOINT



REPORT

**REPORT OF THE INTERNATIONAL 0-GROUP  
FISH SURVEY IN THE BARENTS SEA  
AND ADJACENT WATERS  
IN AUGUST - SEPTEMBER 1998**



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**REPORT OF THE INTERNATIONAL 0-GROUP FISH SURVEY  
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The thirty-fourth annual International 0-group Fish Survey was conducted during the period 11 August - 7 September 1998 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

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<b>State</b>	<b>Name of vessel</b>	<b>Period</b>	<b>Research Institute</b>
Norway	“Michael Sars”	25.08 – 07.09	Institute of Marine Research, Bergen
Norway	“Johan Hjort”	25.08 – 07.09	”
Norway	“G. O. Sars”	25.08 – 07.09	”
Russia	“Atlantida”	11.08 – 05.09	The Polar Research Inst. of Marine
Russia	“Fridtjof Nansen”	11.08 – 05.09	Fisheries and Oceanography, Murmansk

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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 1998 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 standardised in accordance with the recommendations made in 1980.

Most of the stations were spaced 30 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 at the 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 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 1998 (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 temperatures in the upper layer (0-50 m) were somewhat higher than the long term mean (1965-1998). In the deeper layers in the south eastern parts of the sea, Norwegian Sea Water was partly displaced by Arctic and mixed waters, which caused a temperature reduction in a large area to the east of 35° E. The temperature was 2.4°C below the long-term mean in the northern part and 2.2°C below in the southern part of the Cape Kanin Section (Table 1). Compared with 1997, the temperatures in 1998 were 0.9°C and 2.0°C lower, respectively. Such large negative anomalies have not been observed since 1978. The reason could be a redistribution of water inflow from the eastern to the northern areas in recent years, as well as a reduction in the total inflow of water from the Norwegian Sea. In the western Barents Sea, the temperatures in the 0-200 m layers were near the long term average and 0.2° - 0.3°C higher than in 1997.

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

### **Herring (Fig. 16)**

0-group herring were distributed similarly to that in 1997, but both the spatial distribution and the areas of dense concentrations were somewhat larger compared with last year. The abundance index (Table 3) is somewhat higher than last year and more in line with those for 1993 and 1996. It is somewhat higher than average for the period 1985-1998 but considerably lower than those for the strong year classes in 1983, 1991 and 1992. The estimated length distribution (Table 4) shows that 0-group herring is on average 0.8 cm larger than last year.

### **Capelin (Fig. 17)**

As was the case last year, east of 32°E 0-group capelin were distributed over a wide area between 69°N and 76°N. In contrast to 1997, 0-group capelin were not found to the west of 32°E and south of 74°N or along the western coast of Spitsbergen. Dense concentrations were observed in the southeast, but in the central Barents Sea, only some patches of dense concentrations were observed. The abundance index for capelin (Table 2) is 428, which is lower than that estimated last year but is about 1.6 times stronger than the average index during the period 1985-1998, which indicates that the 1998 year-class is a relatively strong one. The estimated length distribution (Table 4) is similar to that observed in 1997.

### **Cod (Fig. 18)**

The eastern border of the 0-group cod distribution was about 100 nautical miles farther to the west than last year. Dense concentrations occurred in smaller areas in the central Barents Sea, but were, in contrast to last year, also to the south of Spitsbergen. Both abundance indices (Tables 2 and 3) indicate that the 1998 year-class is weaker than all the other year classes in the 1990s. The logarithmic index is less than half of that obtained last year and half the average index for the period 1985-1998. The estimated mean length of 0-group cod (Table 4) is higher this year than last year.

### **Haddock (Fig. 19)**

The spatial distribution of 0-group haddock was more or less similar to that observed last year. However, dense concentrations were found over a wider area in the central Barents Sea and to the west and southwest of Spitsbergen. The abundance indices (Tables 2 and 3) both indicate a strong year class. The area-based index is the highest ever recorded and more than double the average for the period 1985-1998. The logarithmic index (0.59) is higher than average and in line with the 1993-1994 year classes. However, considerably higher indices have been observed earlier in the time series. The estimated length distribution (Table 4) shows that 0-group haddock are on average 1.5 cm larger than those measured in 1997.

### **Polar cod** (Fig. 20)

As in previous years, 0-group polar cod occurred in two areas. No polar cod were observed north of 78°N in the Spitsbergen area, but southwards the distribution was similar to that observed in previous years. The western component seems to be a bit larger than last year (Table 2). Along the Novaja Zemlja coast (the eastern component), dense concentrations were distributed near the coast as usual. The westerly extension of the distribution was, however, 50-60 nautical miles narrower than last year. The abundance index for the eastern component (Table 2) is similar to that in 1996 and 1997. It should be noted that the abundance indices of both polar cod components may be biased because of incomplete coverage of the spatial distribution towards the north.

### **Saithe** (Fig. 21)

Compared with previous years, the spatial distribution of saithe extended farther to the west and northwest. 0-group saithe were found in scattered densities over most of their distribution area. No abundance index was calculated for this species, but judged from its distribution and density, the 1998 year class seems somewhat stronger than the 1997 year class.

### **Redfish** (Fig. 22)

0-group redfish were in the central Barents Sea, to the west of 33°E and 80-100 nautical miles off the Norwegian coast. In this area, some patches of dense concentrations were observed, while to the west of Spitsbergen there were scattered concentrations. The abundance index (Table 2) was only 20% of average and indicates that the 1998 year class is the third low abundance year in a row.

### **Greenland halibut** (Fig. 23)

0-group Greenland halibut were in scattered concentrations to the west of Spitsbergen and there were 5 positive hauls between Hopen and Bear Island. This distribution resembles that observed in 1997. The abundance index (Table 2) is similar to last year and is somewhat below average.

### **Long rough dab** (Fig. 24)

As in 1997 0-group long rough dab were in scattered concentrations over two areas in the central Barents Sea. Additionally, a small area with insignificant catches was observed in the southeast. The abundance estimate for this species (Table 2) is lower than last year and only one fourth of the average value for the period 1985-1998.

### **Sandeel** (Fig. 25)

The main areas of dense concentrations of 0-group sandeel were in the southeastern Barents Sea, between 30°E and 48°E. In contrast to last year, 0-group sandeel were not found to the east of 48°E. As in 1997, scattered patches of sandeel were observed near the Norwegian coast between 17°E and 19°E. No abundance index was calculated for this species.

## Catfish (Fig. 26)

0-group catfish occurred in three areas. A patch of dense concentration was observed between Hopen and Bear Island. In the other two areas only small catches were obtained. No abundance index was calculated for this species. The total number caught was nearly 20% higher than in 1997.

## Gonatus (Fig. 27)

As in earlier years, the spatial distribution of 0-group *Gonatus fabricii* was in the western part of the survey area. However, the area of distribution was not completely covered to the west. Dense concentrations extended farther to the northwest this year and were observed to the west of Spitsbergen. This year, none were found along the northern Norwegian coast.

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Table 1. Mean water temperature<sup>1</sup> in selected subsections of the standard transects in the Barents Sea and adjacent waters during August-September 1965 - 1998.

Year	Section <sup>2</sup> 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	<sup>3)</sup>
Average 1965-1998	7.4	3.8	4.7	4.2	3.2	5.8	4.6

<sup>1)</sup> Earlier values have been slightly adjusted (Tereshchenko, 1992).

<sup>2)</sup> 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).

<sup>3)</sup> 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°



Table 2. Abundance indices for 0-group fish in the Barents Sea and adjacent waters in 1965 - 1998.

Year	Capelin <sup>1</sup>	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
Mean 1985-1998	268	691	229	102	244	410	16	125

<sup>1)</sup> 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 1965-1998.

Year	Herring <sup>1</sup>			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	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
Mean 1985-1998		0.47			1.73			0.46	

<sup>1</sup>) 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 1998.

Length (mm)	Herring	Capelin	Cod	Haddock	Polar cod	Redfish	Sandeel	Greenland halibut	Long rough dab
10- 14									
15- 19									
20- 24					1.8	0.6			1.1
25- 29		1.4			35.7	3.6		2.1	24.3
30- 34		5.5			34.6	31.0			32.9
35- 39		16.6			20.0	37.1			30.0
40- 44	0.1	44.8	0.1		7.1	20.8			11.8
45- 49	0.4	20.6	0.2		0.8	6.1	3.1	2.1	
50- 54	1.8	2.5	0.5	0.2		0.9	2.1	6.3	
55- 59	8.5	0.2	1.2	0.6			2.1	8.3	
60- 64	16.8	0.5	3.1	0.8			2.1	16.7	
65- 69	21.4	0.9	6.1	1.2			0.0	28.1	
70- 74	20.1	0.4	12.2	2.7			5.0	19.8	
75- 79	14.0	2.0	16.0	4.0			3.8	6.3	
80- 84	7.6	2.0	17.6	6.1			14.2	10.4	
85- 89	4.2	2.5	15.4	7.1			21.2		
90- 94	3.0		12.9	7.2			11.5		
95- 99	1.4		7.3	9.5			14.1		
100-104	0.4		3.3	9.7			10.1		
105-109	0.1		1.0	9.6			4.8		
110-114			1.0	10.3			2.2		
115-119			0.6	9.9			2.2		
120-124			0.6	8.5			1.6		
125-129			0.6	5.9					
130-134		0.2	0.2	3.9					
135-139	0.1		0.2	2.0					
140-144		0.1		0.8					
No. measured	8763	5187	7519	6154	1983	887	51	43	98
Total catch	561302	248669	43493	35679	77041	4239	97	44	177
Mean length	70.8	45	83.2	103.9	31.9	36.8	88.3	66.3	33.4

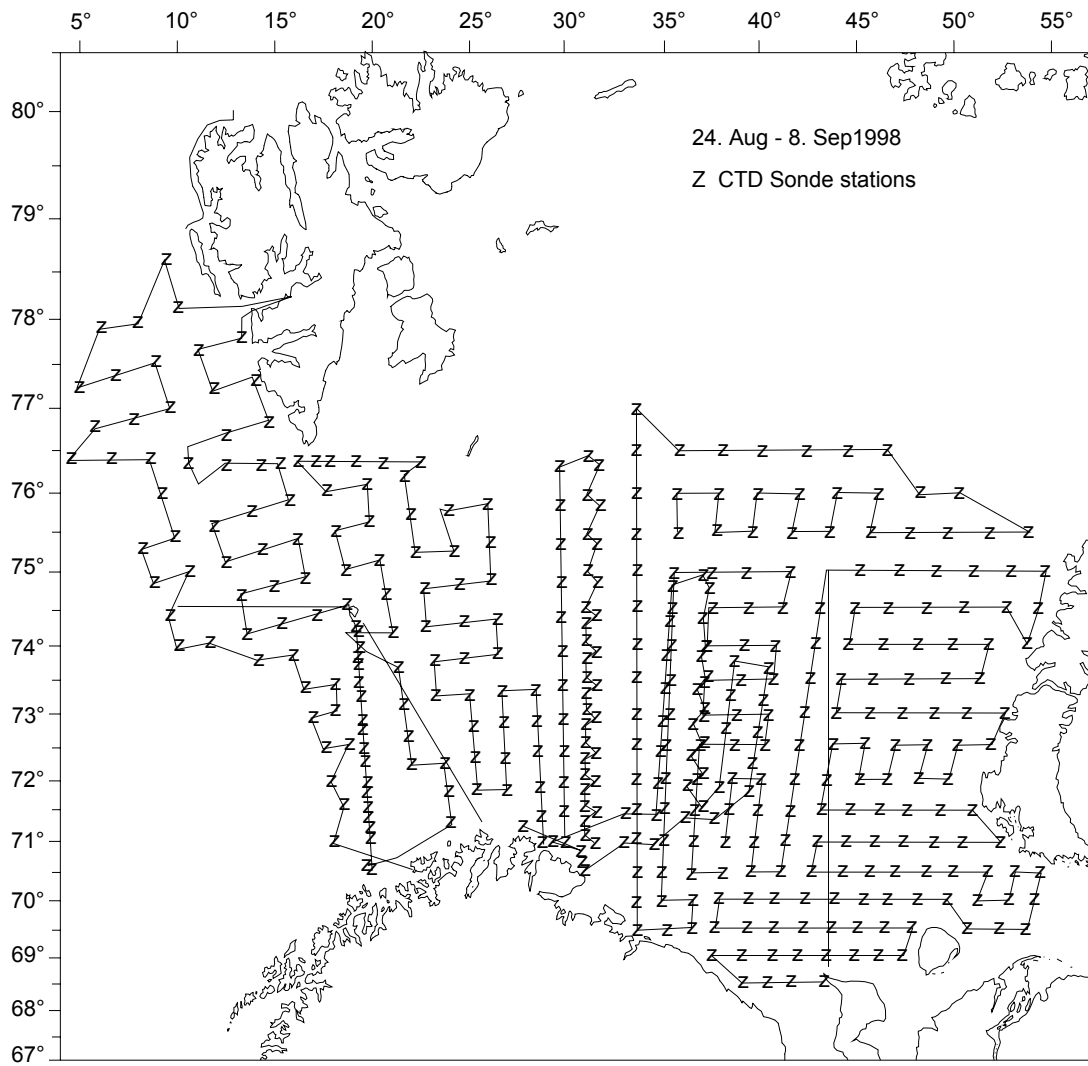


Fig. 1. Survey cruise tracks and hydrographic stations

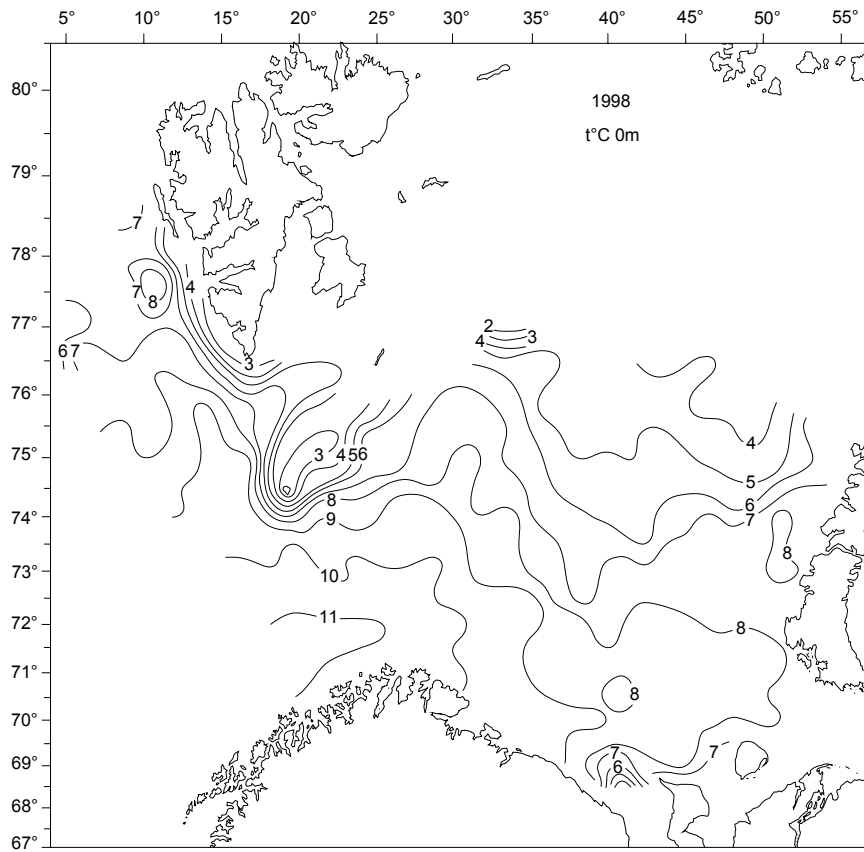


Fig. 2. Isotherms (°C) at 0m

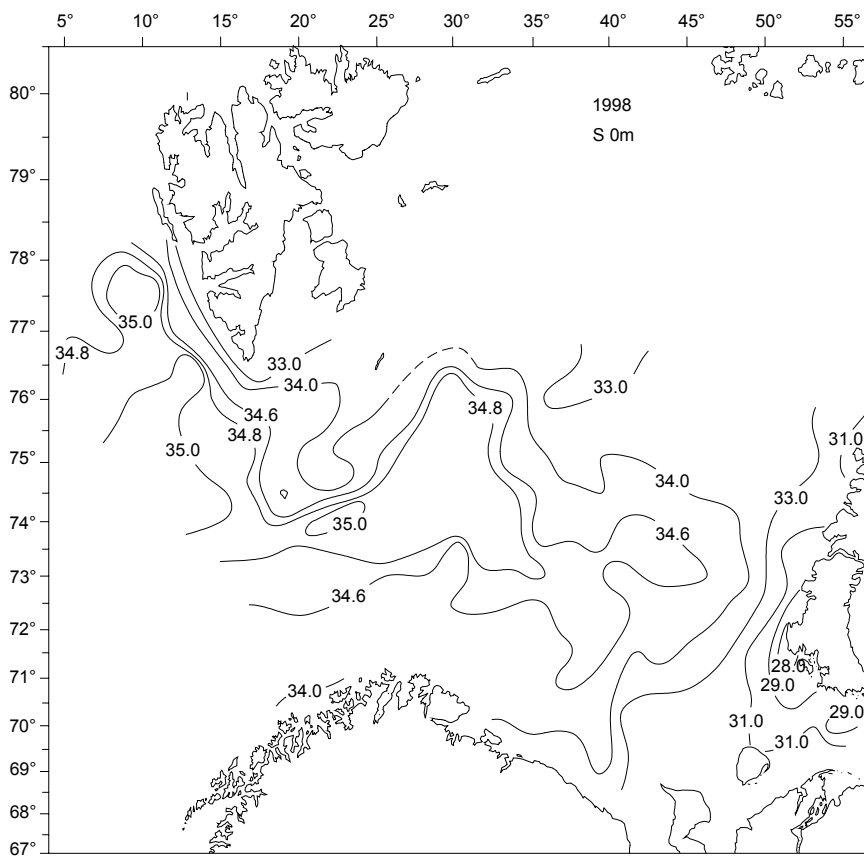


Fig. 3. Isohalines (PSU) at 0m

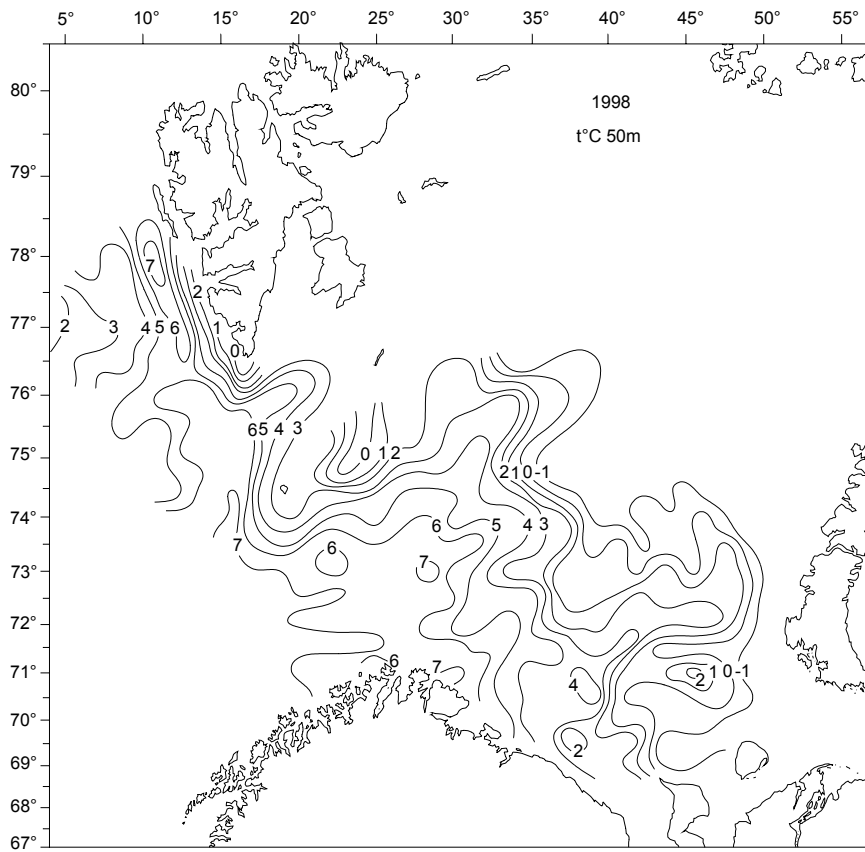


Fig.4. Isotherms (°C) at 50m depth

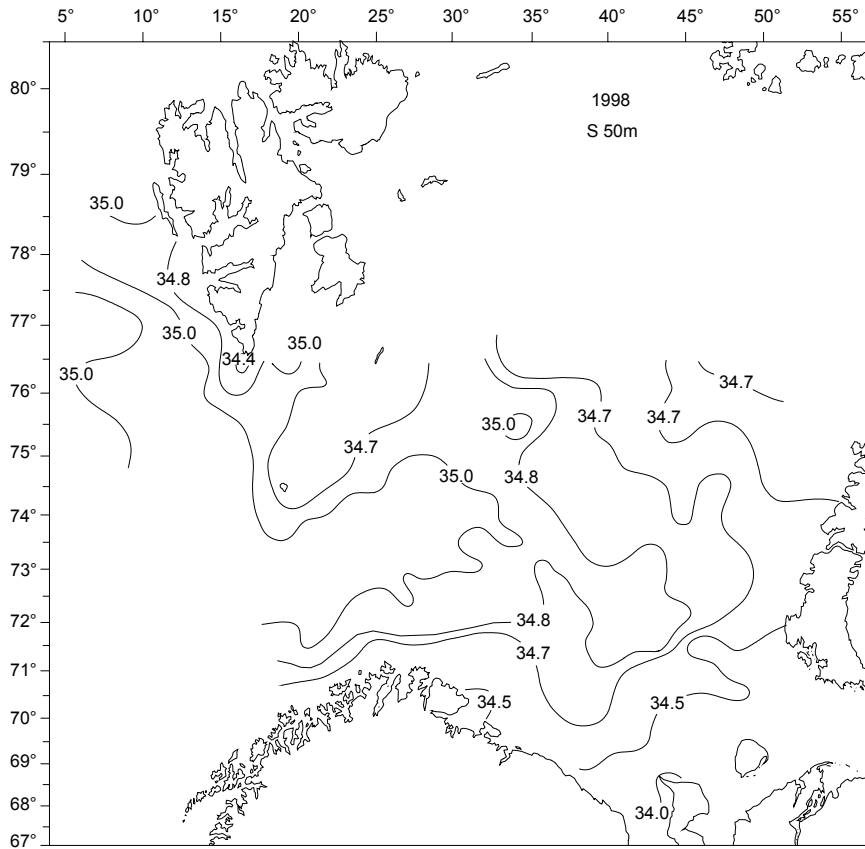


Fig. 5. Isohalines at 50m depth

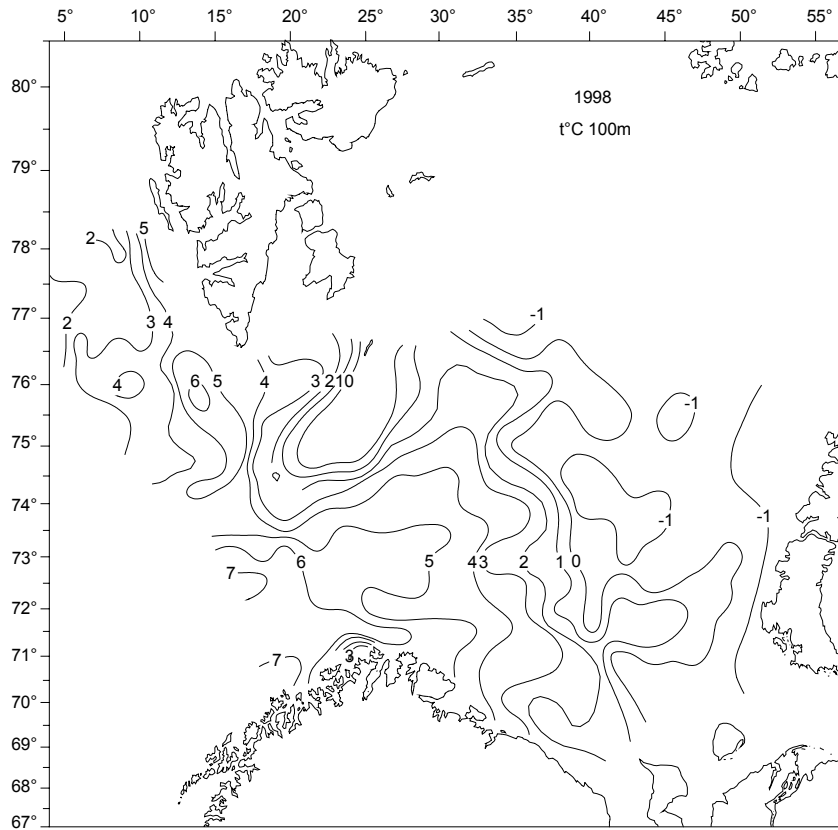


Fig. 6. Isotherms (°C) at 100m depth

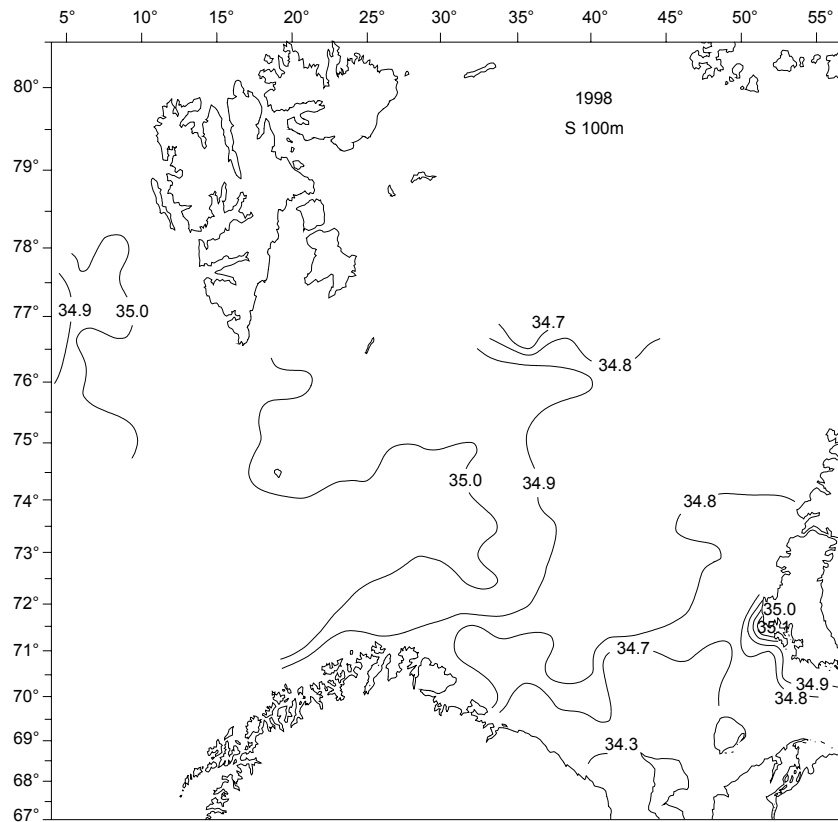


Fig. 7. Isohalines (PSU) at 100m depth

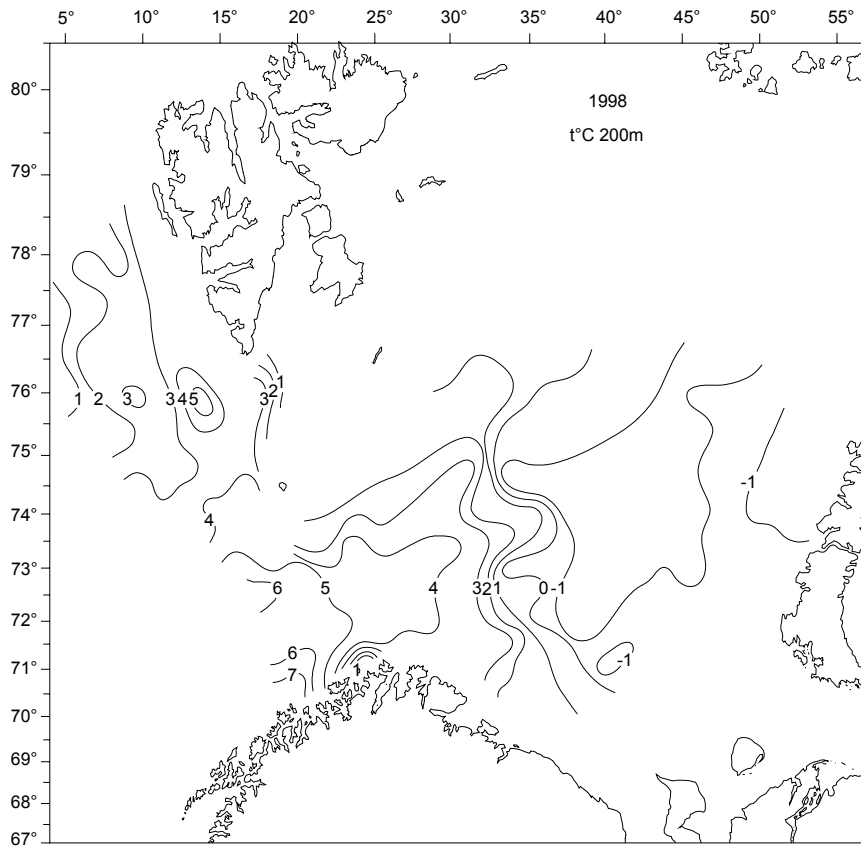


Fig. 8. Isotherms (°C) at 200 m depth

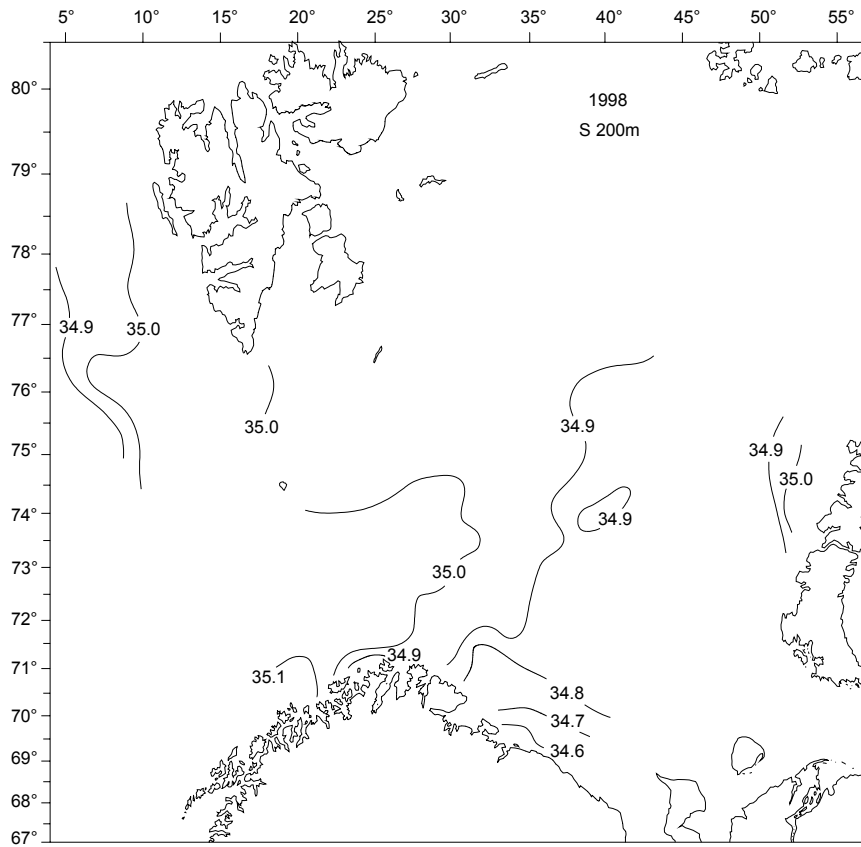


Fig. 9. Isohalines (PSU) at 200m depth



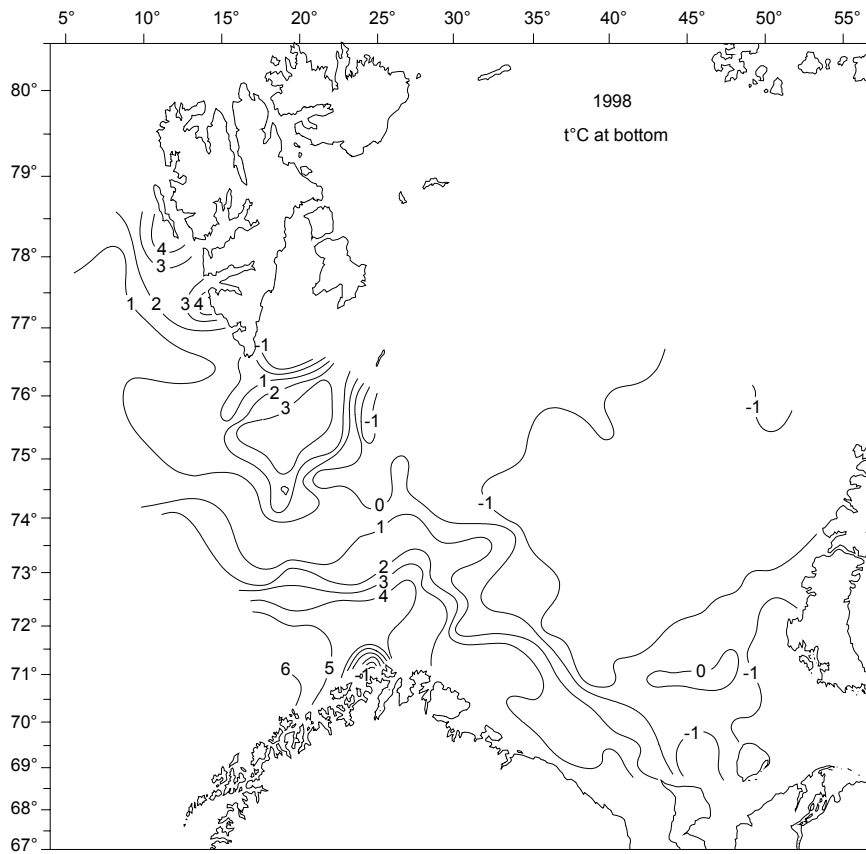


Fig. 10. Isotherms (°C) at the bottom

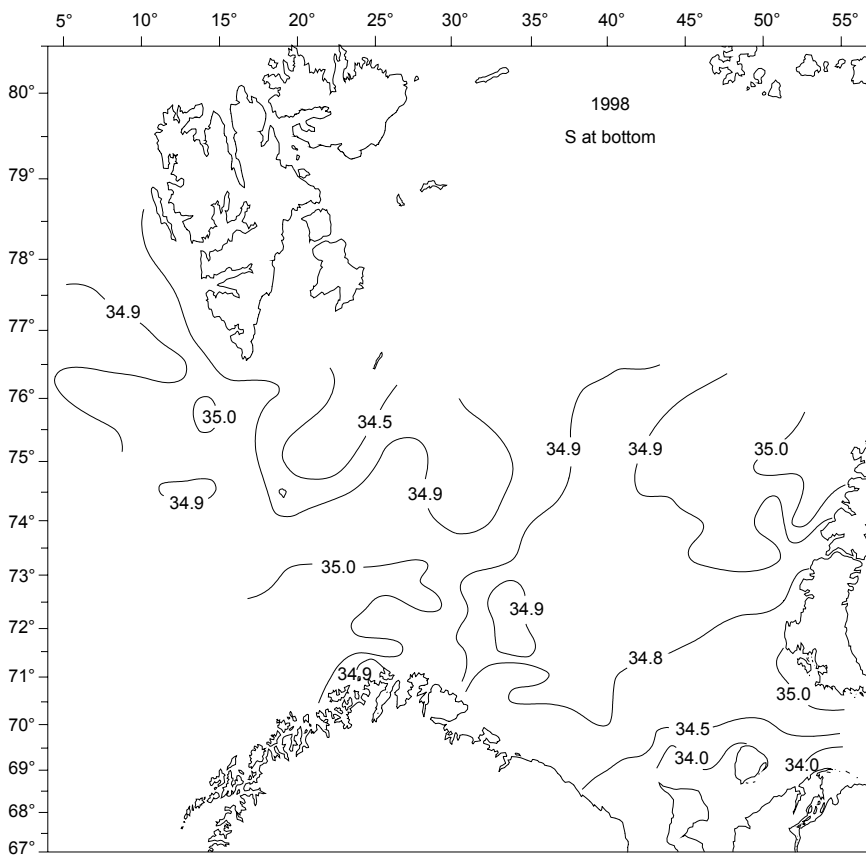


Fig. 11. Isohalines (PSU) at the bottom

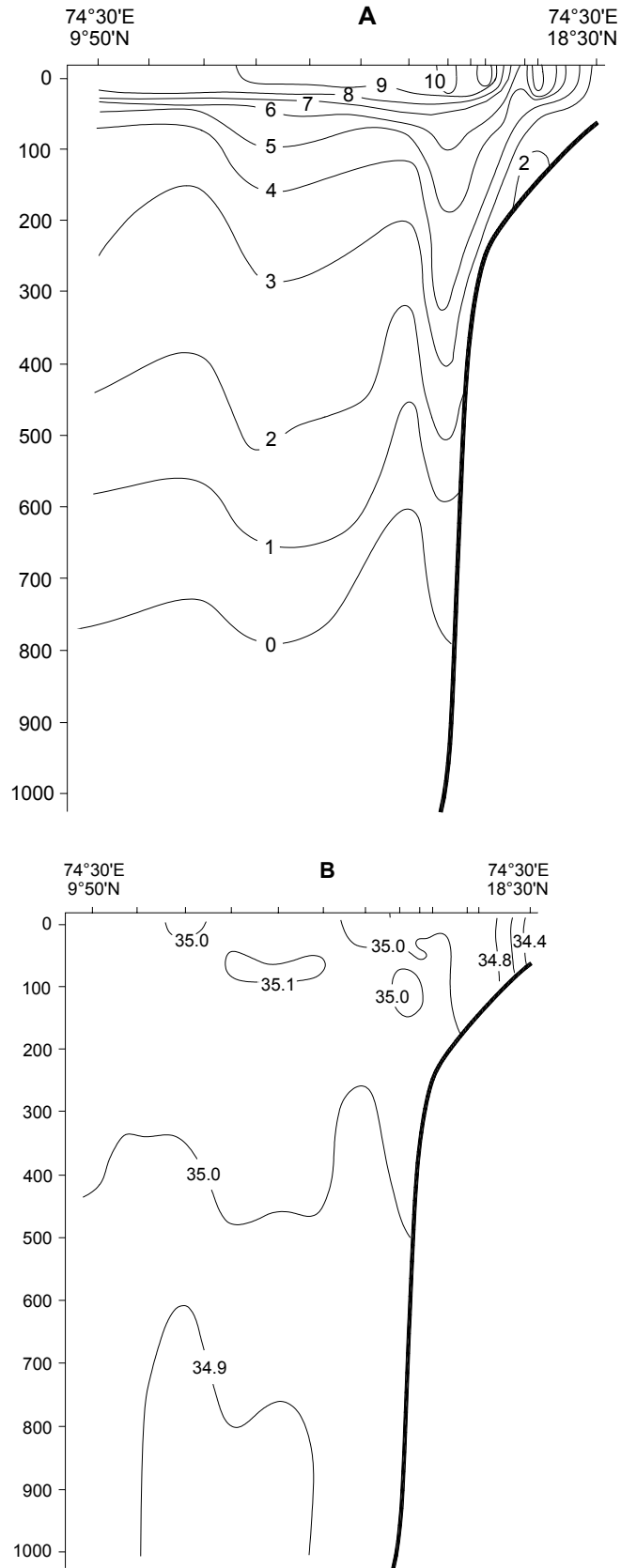


Fig. 12. Temperature (A) and salinity (B) through the hydrographic section Bear Island - West

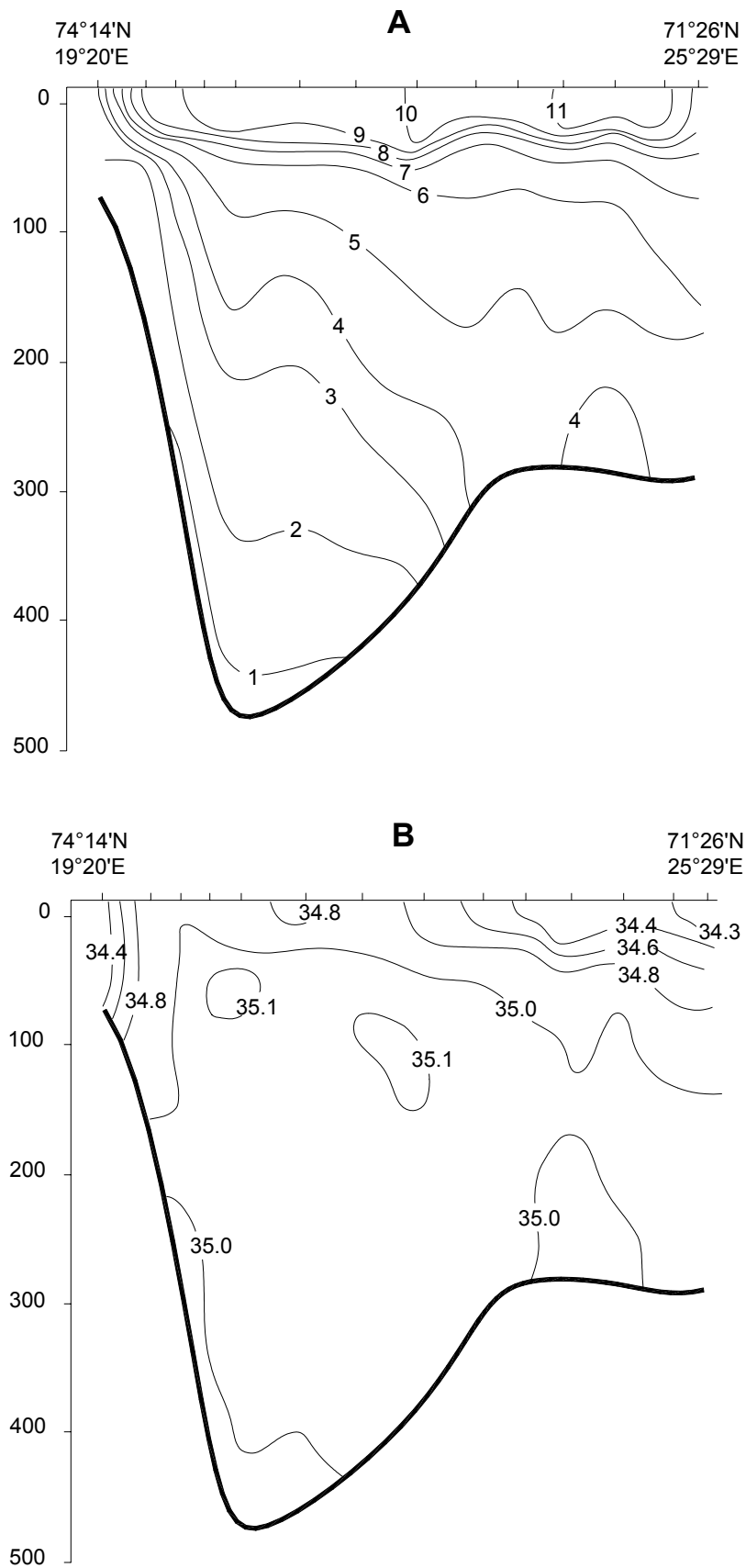


Fig. 13. Temperature (A) and salinity (B) through the hydrographic section North Cape - Bear Island

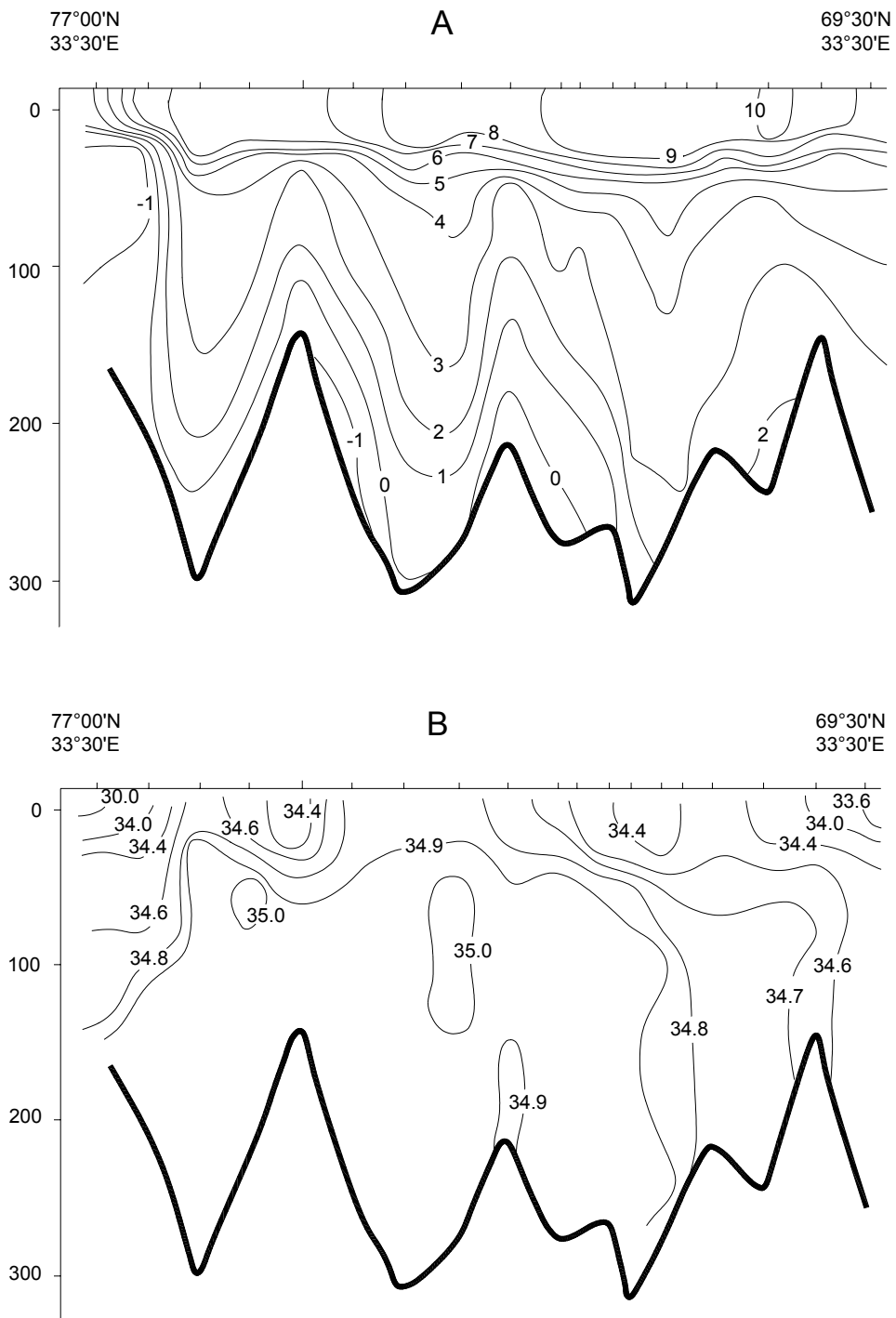


Fig. 14. Temperature (A) and salinity (B) through the hydrographic section along the Kola meridian

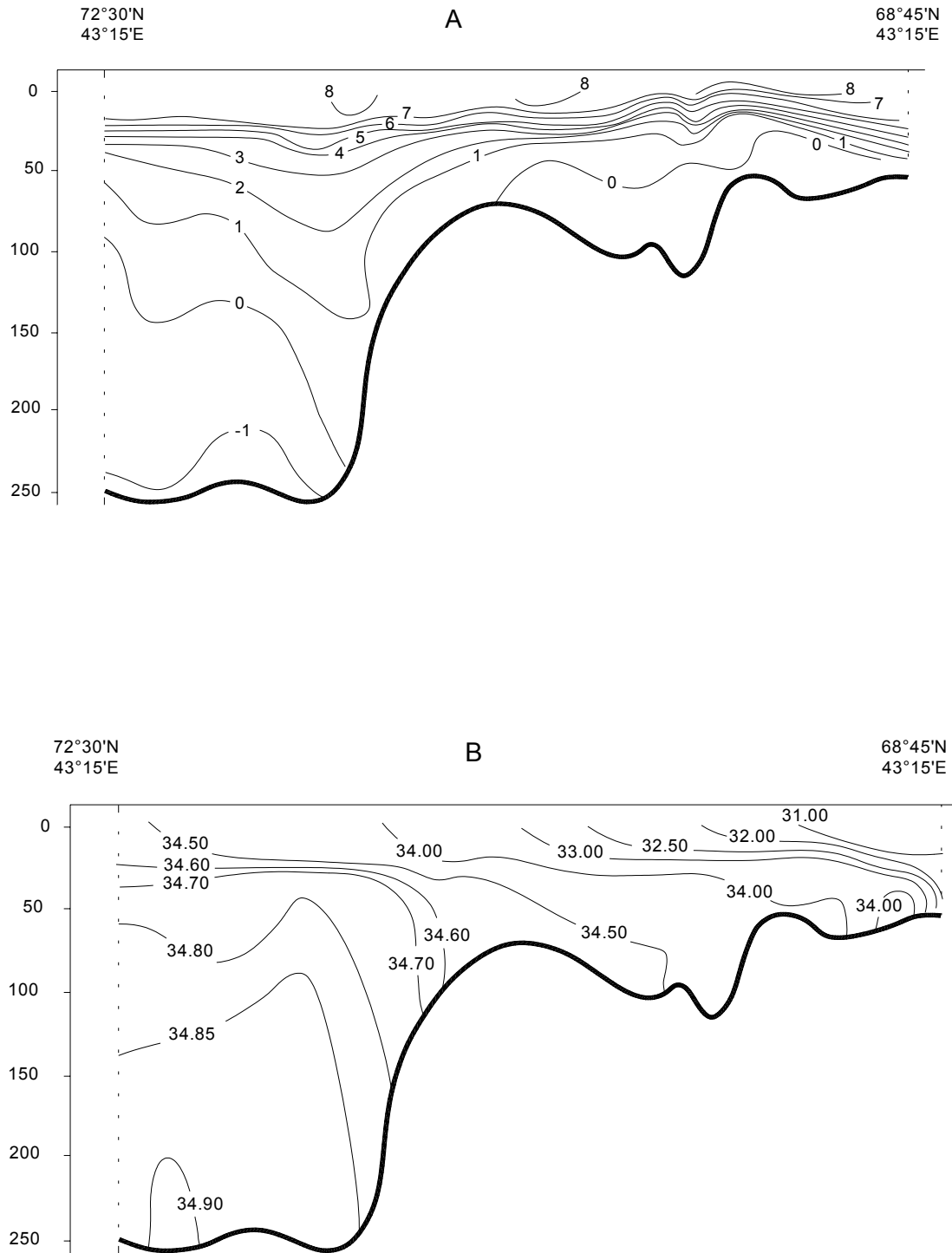


Fig. 15. Temperature (A) and salinity (B) through the hydrographic section Cape Kanin - North

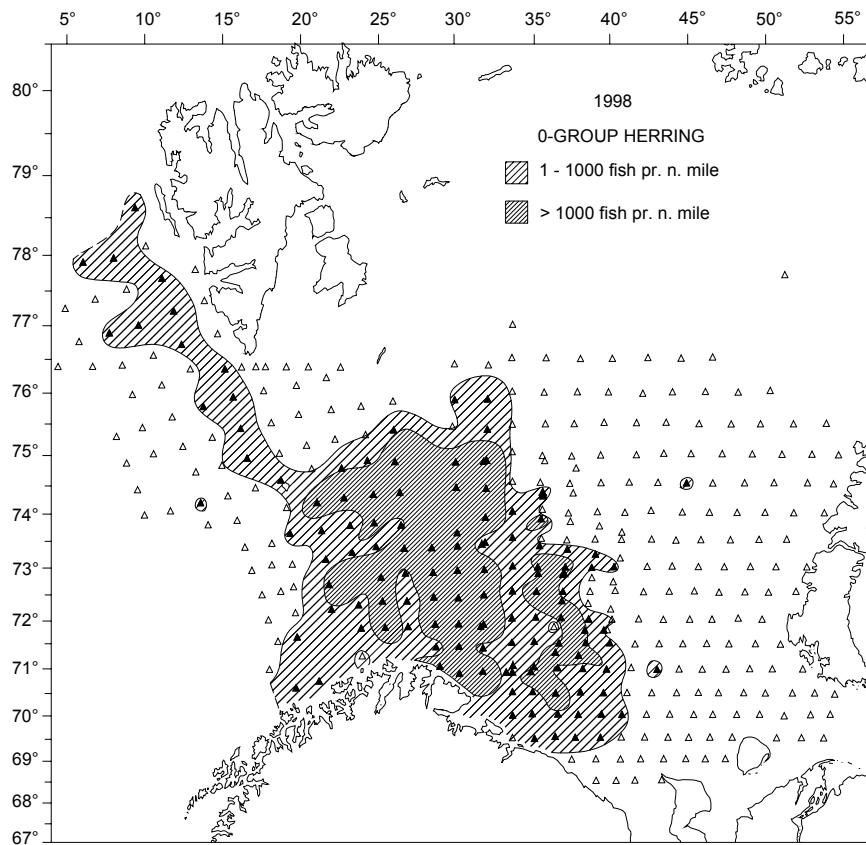


Fig. 16. Distribution of 0-group herring

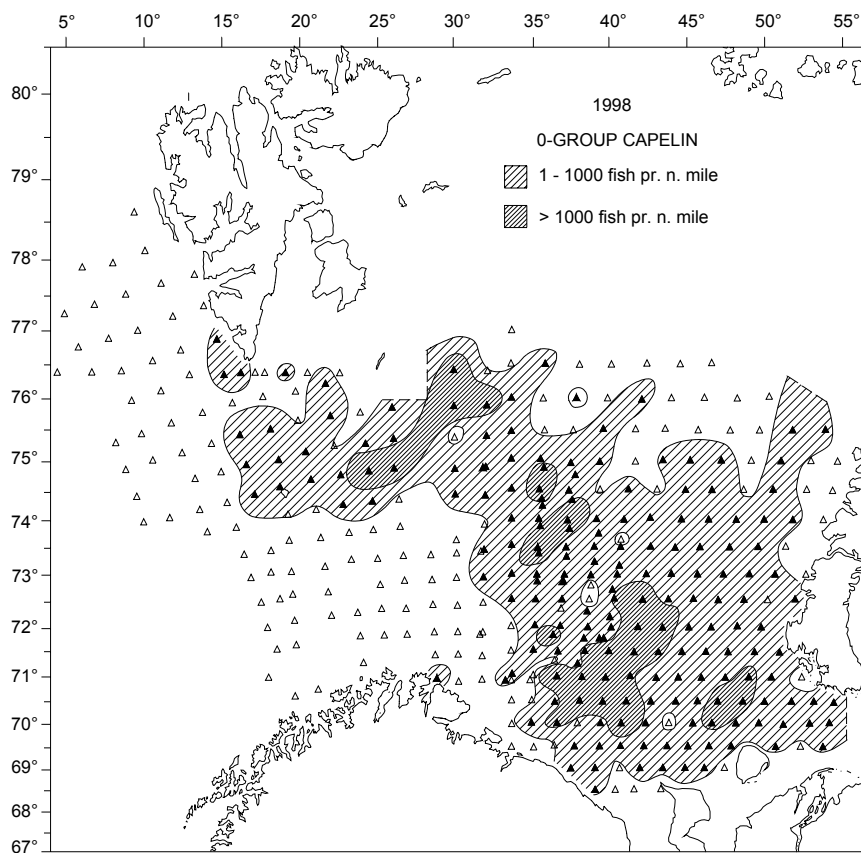


Fig. 17. Distribution of 0-group capelin

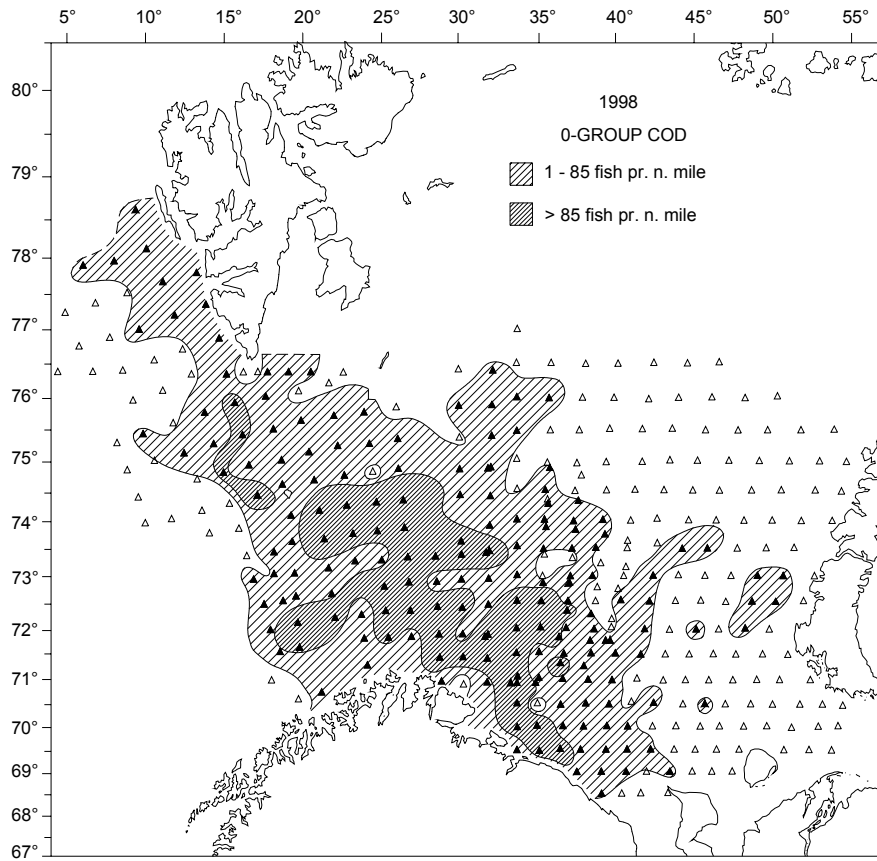


Fig. 18. Distribution of 0-group cod

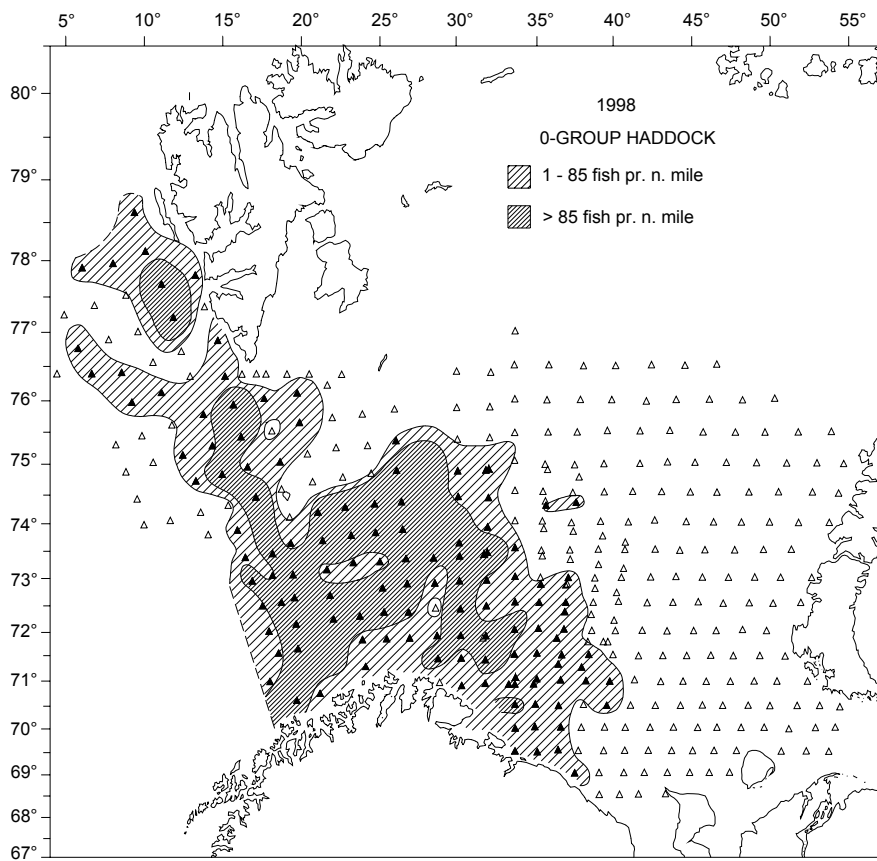


Fig. 19. Distribution of 0-group haddock

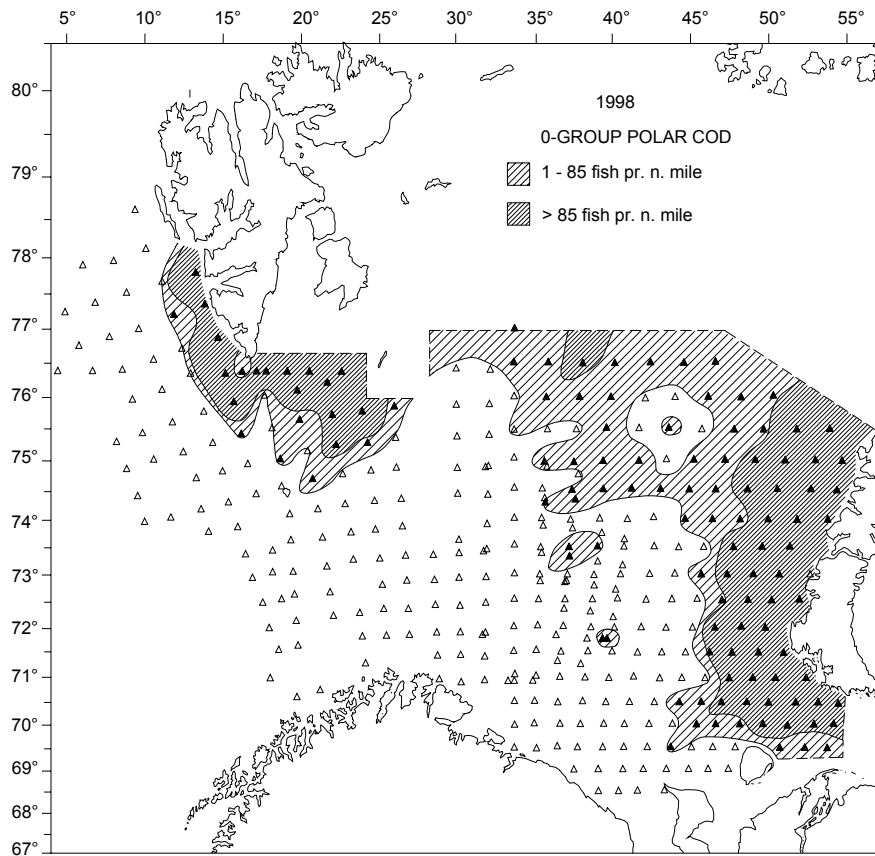


Fig. 20. Distribution of 0-group polar cod

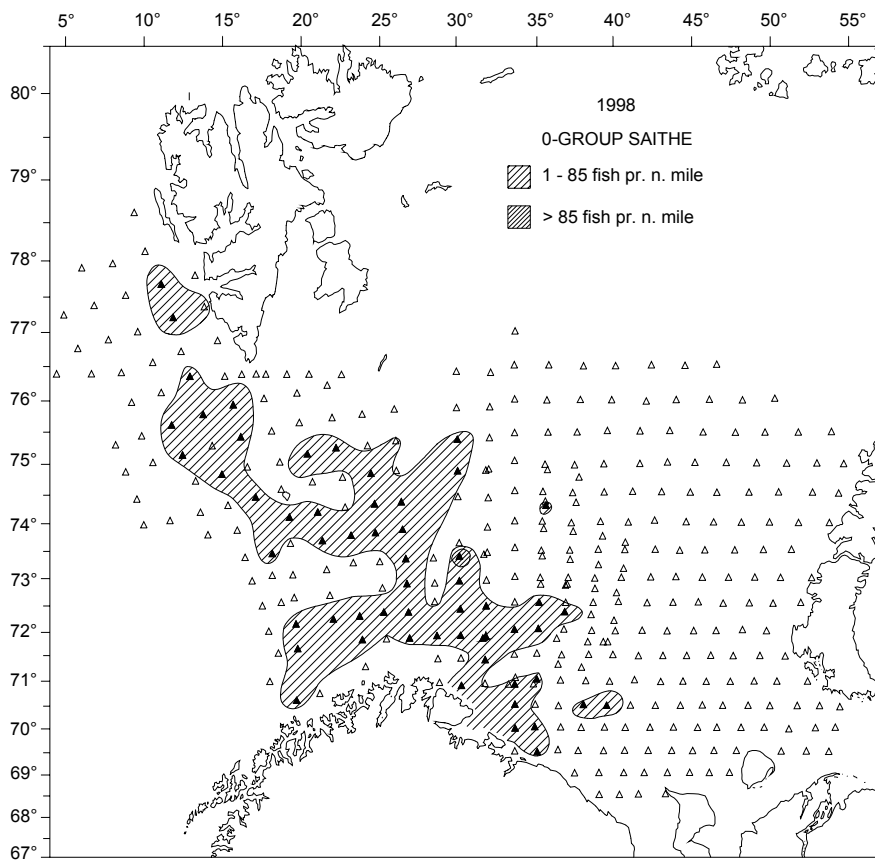


Fig. 21. Distribution of 0-group saithe



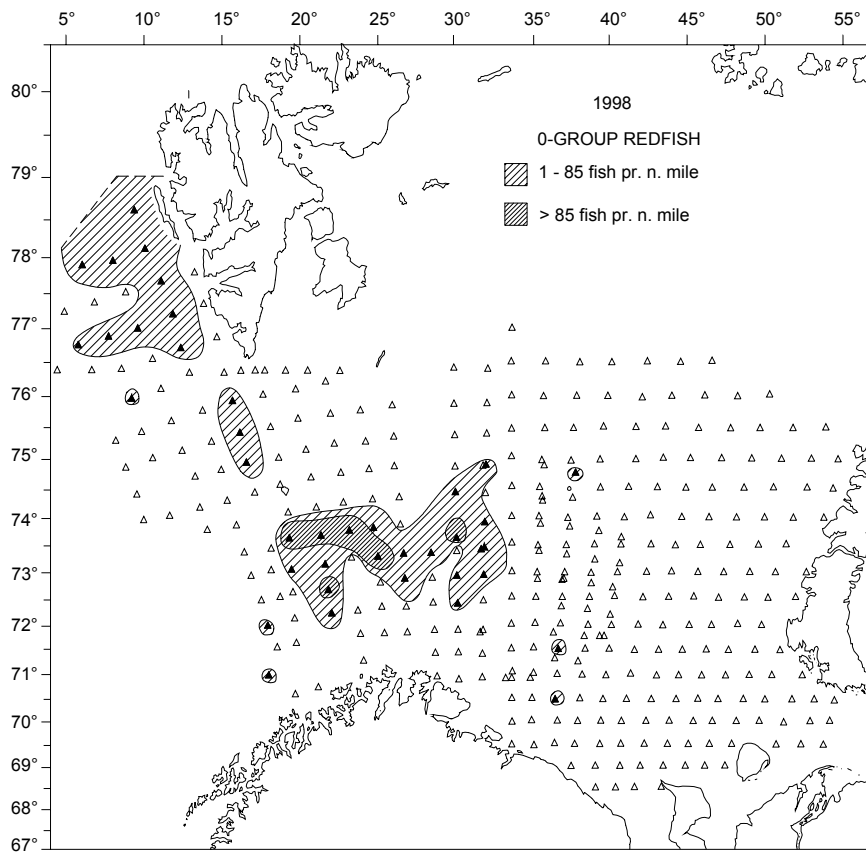


Fig. 22. Distribution of 0-group redfish

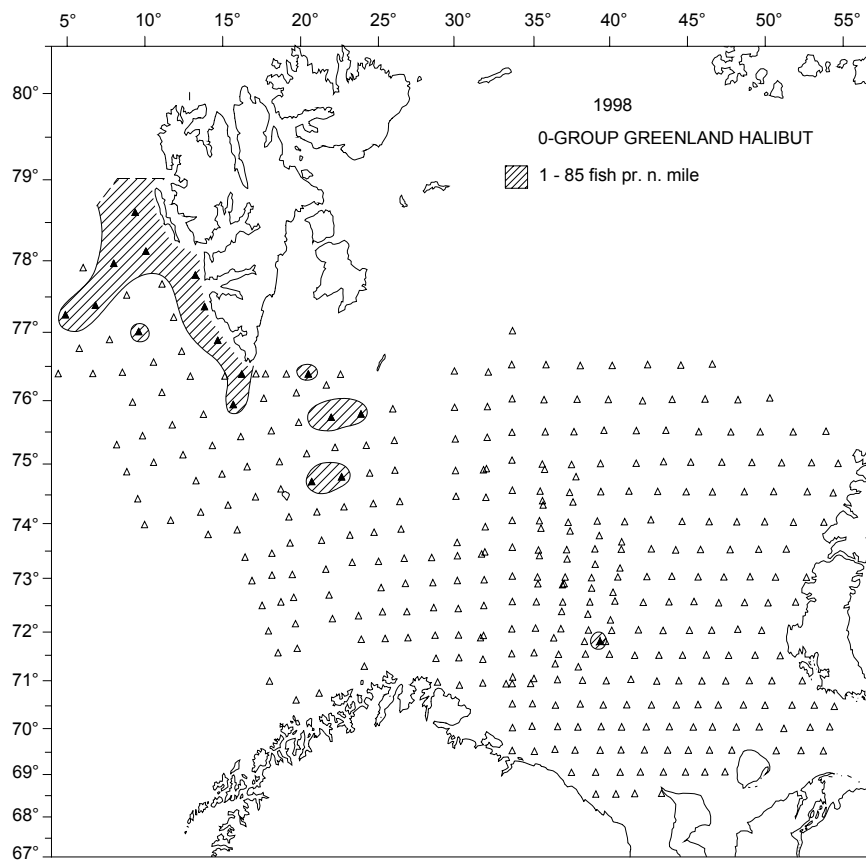


Fig. 23. Distribution of Greenland halibut

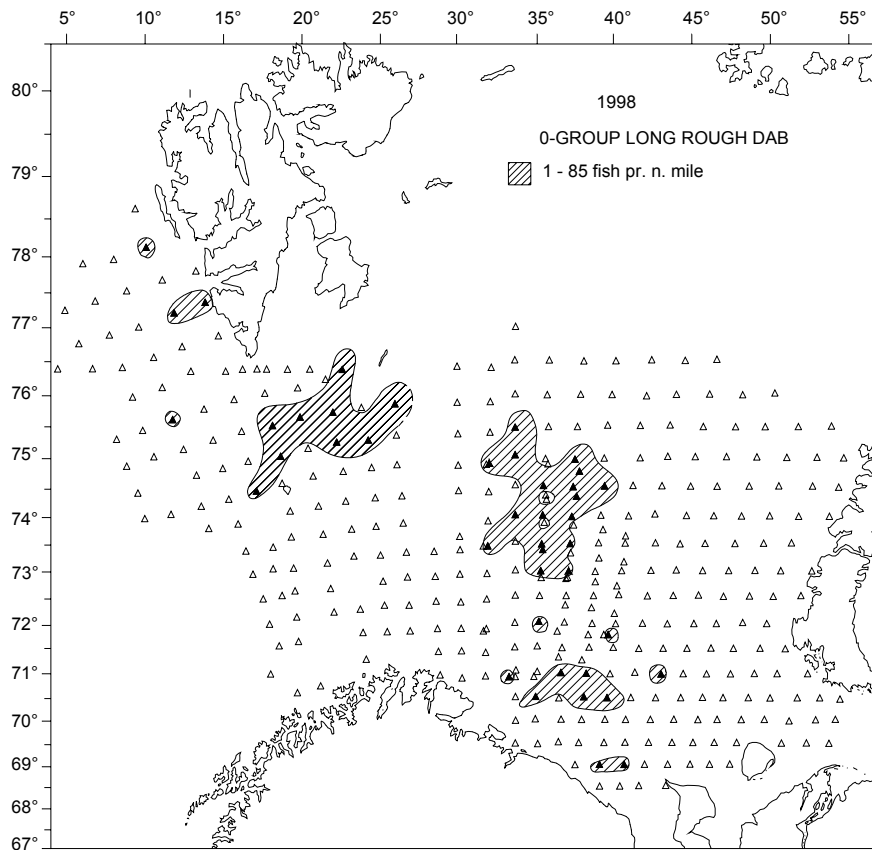


Fig. 24. Distribution of 0-group long rough dab

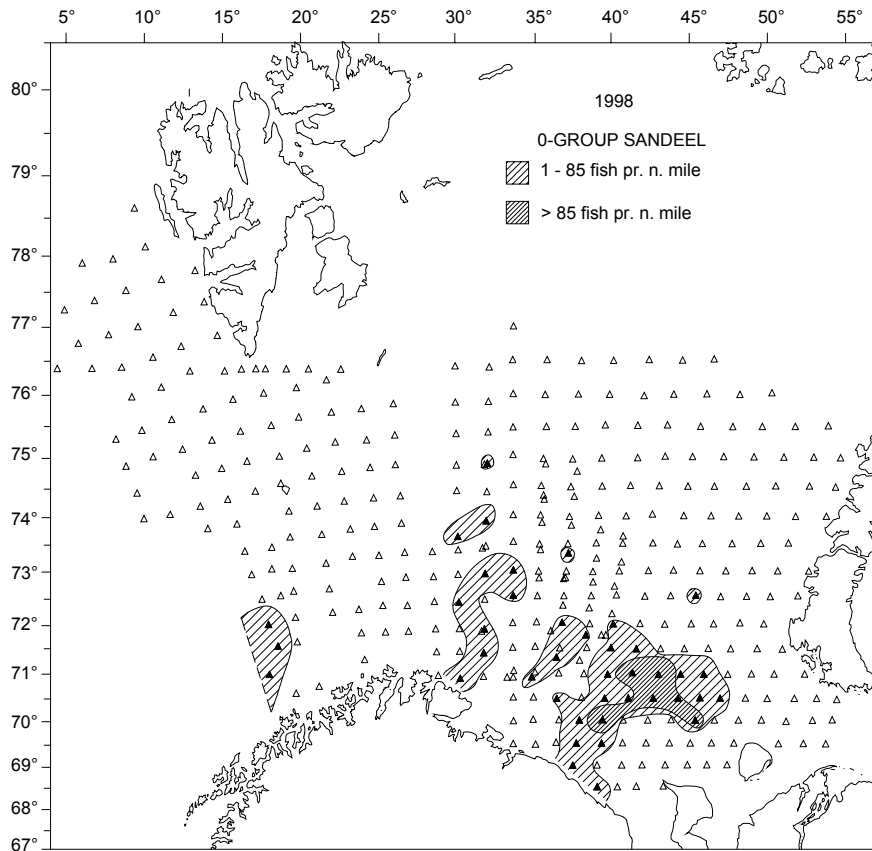


Fig. 25. Distribution of 0-group sandeel

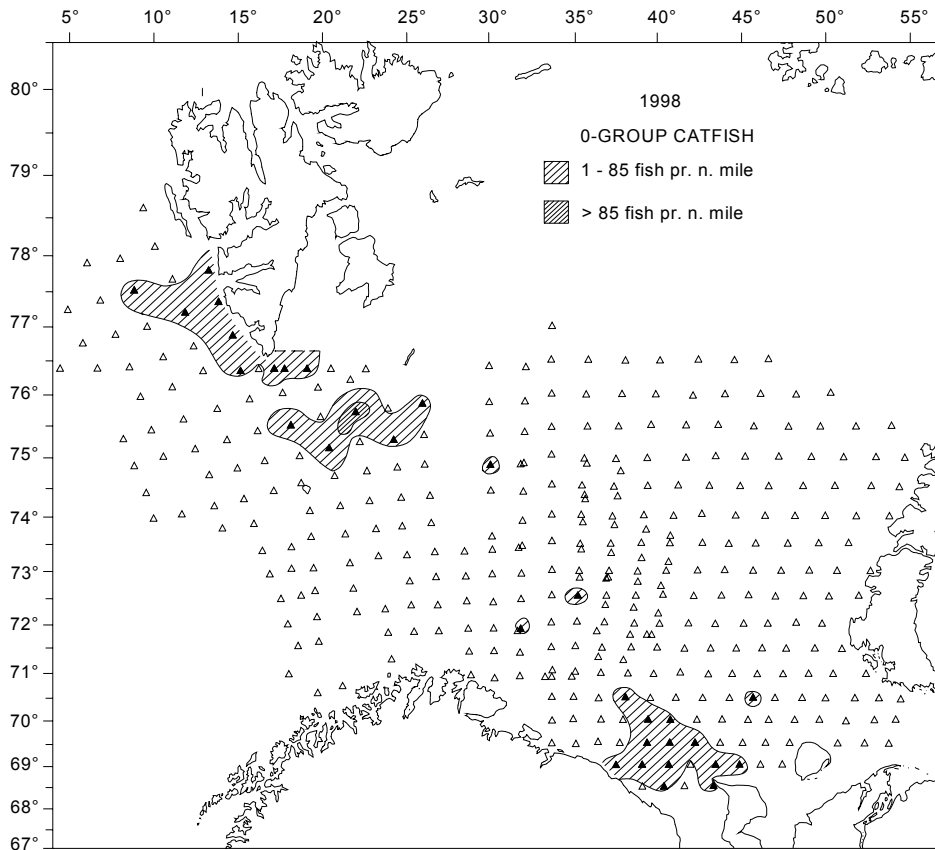


Fig. 26. Distribution of 0-group catfish

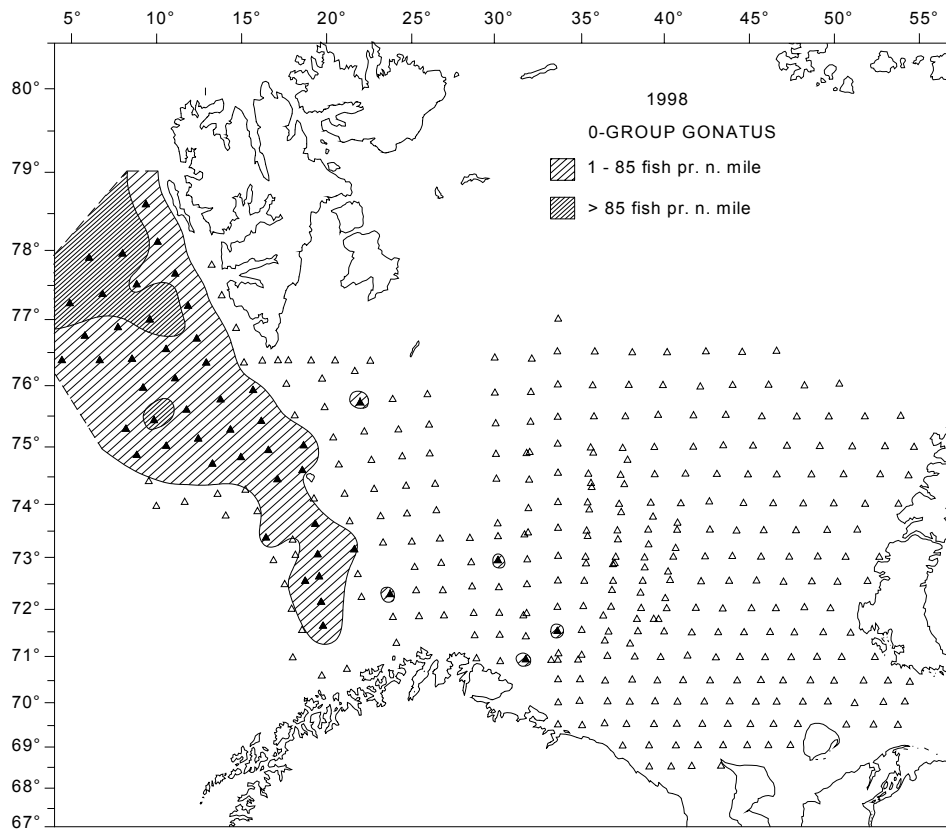


Fig. 27. Distribution of *Gonatus fabricii*

## APPENDIX

<b>Research vessel</b>	<b>Participants</b>
<b>"G. O. Sars"</b>	P. Fossum (cruise leader), H. Græsdal, Å. Løvaas Pedersen, J. de Lange, R. Sundt, R. Pettersen, T. Haugland, R. Johannesen
<b>"Johan Hjort"</b>	H. Loeng (cruise leader), R. Invaldsen, H. Sagen, Ø. Østensen, S. Storeid, A. Haugsdal, B. Endresen, A. Romslo, N. Ushakov, E. Holm, K. Gjertsen, J. Jakobsen
<b>"Michael Sars"</b>	K. Westrheim (cruise leader), H. Gill, B. Hoffstad, R. Johannessen, J. Pedersen, A. Salthaug, G. Tveit
<b>"Atlantida"</b>	T. Gavrilik, I. Dolgolenko (cruise leader), V. Mamylov, A. Pedchenko, A. Pronin, V. Hlivnoi, V. Shalaginov, V. Shnar, T. Yusupov
<b>"Fr. Nansen "</b>	A. Astahov, P. Borodin, N. Vovchuk, Zelinsky, V. Ignashkin, V. Kapralov, S. Ostrovsky, D. Prozorkevitch (cruise leader), F. Shevchenko

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