

PRELIMINARY REPORT OF THE INTERNATIONAL 0-GROUP FISH SURVEY IN THE BARENTS SEA AND ADJACENT WATERS IN AUGUST-SEPTEMBER 2001

The 37th annual international 0-group fish survey was carried out during the period 10 August – 8 September 2001 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Vessel	Period	Research Institute
Norway	“G. O. Sars”	16.06 - 08.09	Institute of Marine Research, Bergen
Norway	“Johan Hjort”	20.08 - 08.09	Institute of Marine Research, Bergen
Russia	“AtlantNIRO”	10.08 - 03.09	The Polar Research Institute of Marine
Russia	“Fridtjof Nansen”	12.08 – 03.09	Fisheries and Oceanography, Murmansk

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” and “AtlantNIRO” 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 sea.

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 2001, used the type of midwater trawl recommended in 1980 (Anon. 1983). The standard procedure consisted of tows at 3 depths, each of 0.5 nautical miles, with the headline of the trawl located at 0, 20 and 40 m. Additional tows at 60 m, also of 0.5 nm length, were made when the 0-group fish layer was recorded deeper than 60 m on the echosounder. Trawling procedure was standardised in accordance with the recommendations made in 1980.

Most of the stations were taken 35 nautical miles apart. Hydrographical observations were made at each trawl station (Fig.1) and at several permanent hydrographical sections. Figs 2-5 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. Horizontal distributions of temperature and salinities are shown for 0, 50, 100, 200 m and bottom in Figs 6-15.

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 catches, measured in number of fish 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). Area based indices are given in Table 2. Another set of 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 indices were only calculated for the period 1985 to 2001 (Table 2) since Nakken and Raknes (1996) showed that previous results might not be comparable for methodological reasons. Length frequency distribution of the main species are given in Table 4.

HYDROGRAPHY

The following temperature anomalies were observed in the 2001 0-group survey; +0.2°C in the Norwegian and Coastal Murmansk currents, +0.4°C in the central branch of the North Cape current, +0.8°C in the Novaja Zemlja current and +1.3°C in the Kanin current. The temperature in the upper layers of the Murmansk current was close to the long term mean. These temperature observations were taken in the at the 0-200 m layer in the Bear Island – West, Kola and Cape Kanin sections (Table 1).

However, negative anomalies (-0.1°C) were observed at the 0-200 m layer in the North Cape – Bear Island section (North Cape current) with extreme values up to -1.3°C next to the coast (Coastal North Cape current) and -1.6°C at the undersurface layer (20-50 m, North Cape current) penetrating into the Barents Sea from the Norwegian Sea. Negative anomalies up to -1.6°C was observed in the Spitsbergen current at the 0-100 m layer in the Bear Island – West section. Reduced temperatures were also observed in the central and eastern parts of the Barents Sea with anomalies -2.3°C at the 30-50 m layer in the Kola section (Central Branch of North Cape current) and up to -2.1°C at the 25-40 m layer in the Kanin section (Novaya Zemlya current). Upper 20 m layer had positive anomalies along all sections. The waters of Bear Island current in the North Cape – Bear Island section had a significant positive anomaly (up to +3.8°C).

Water temperature differences between 2001 and 2000 were -0.2°C (Norwegian current), 0.0°C (North Cape current), -0.3°C (Coastal Murmansk current), -0.6°C (Murmansk current), $+0.3^{\circ}\text{C}$ (Central Branch of North Cape current), -0.1°C (Novaja Zemlja current) and -0.2°C (Kanin current) at the 0-200 m layer in the Bear Island – West, North Cape – Bear Island, Kola and Cape Kanin sections correspondingly.

The waters of upper 100 m layer were saltier than usual, except from the currents with positive temperature anomalies such as Spitsbergen, North Cape, coastal and central Branches of North Cape, Murmask, costal Murmansk and Novaja Zemlja currents, with negative salinity anomalies.

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

Herring (Fig.16)

In the central area of the Barents Sea 0-group herring were found in smaller areas compared to data from the previous 5 years, except for west of Spitsbergen, where increased distribution was found in a small patch. No dense concentrations were found. The abundance index 0.13 seems to indicate a continued decrease during the period 1998-2001, and was found to be clearly below the long-term mean (Table 3). The yearclass can be characterised as weak. The mean length of 0-group herring was 62.3 mm, this is close to what was observed in 2000 (Table 4).

Capelin (Fig.17)

Most of the 0-group capelin were found in the central part of the sea, from the coast to $76^{\circ}30'\text{N}$ and from Bear Island in west and to the coast of Novaja Zemlja. The area index was measured to 221 somewhat below the mean from 1985-2001. (Table 2). The yearclass can be characterised as medium. The abundance index is underestimated due to incomplete coverage of the distribution area towards the north. The length distribution and mean length were slightly higher than that measured last year (Table 4).

Cod (Fig. 18)

0-group cod were found in a smaller area compared to last years result. Scattered concentrations were observed from 80°N north west off Spitsbergen to 43°E . Eastwards, only small scattered patches were found. Both the logarithmic (0.23) and the abundance indices 212 is much lower than the long-term mean and close to what was observed in 1999 (Table 2+3). The implications of this is that the 2001 year-class is much less abundant than the average and can be characterised as weak. The mean length of the 0-group cod is 72.4 mm that is about 3 mm less than that found in 2000 (Table 4).

Haddock (Fig. 19)

Haddock is experiencing a continued period of high and stable recruitment. The total distribution area of 0-group haddock was slightly smaller than in previous years. The abundance index of 394 is the fourth largest observed. Only the indices for 1991, 1998 and 2000 were higher (Table 2). Just as last year, dense concentrations were found in a large area in the central part of the Barents Sea. The logarithmic index of 0.67 is also significantly above the long-term mean (Table 3). The length distribution and mean length of 0-group haddock are shown in Table 4. The mean length was 99.9 mm, almost 20 mm more than previous year.

Polar cod (Fig. 20)

As in previous years, two separate areas (components) of 0-group polar cod were found. To the west of Spitsbergen, dense concentrations were found in wider areas. The eastern component was reduced compared to observations from the previous 2 years. The abundance estimates for both polar cod components are underestimates due to incomplete coverage of the northern distribution areas. Nevertheless the abundance index of the eastern component seems to be lower than the long-term mean level and thus lower than in 2000 (Table 2). The mean length of polar cod is shorter than last year (Table 4).

Saithe (Fig. 21)

0-group saithe were found between Bear Island and 32° N in scattered densities. No abundance index is calculated, but based on the total distribution it seems that the part of the 2001 year-class in the Barents Sea might be somewhat lower than for 2000.

Redfish (Fig. 22)

During the last years the recruitment of redfish has continued to deteriorate. Over the whole observed area, only a small area of 0-group redfish was found to the west off Spitsbergen. The abundance index of the 2001 year-class is the lowest since 1965. (Table 2). The mean length of 0-group redfish was 32.9 mm, somewhat smaller than what was found last year (Table 4).

Greenland halibut (Fig. 23)

There is a slight increase in the abundance of 0-group Greenland halibut, which were found in two areas – to the south and to the west of Spitsbergen. The abundance index is significantly higher than the average and the highest since 1987 (Table 2). The mean length of 0-group Greenland halibut was 63.3 mm, close to what was found last year (Table 4).

Long rough dab (Fig. 24)

0-group long rough dab were registered as scattered concentrations. Larger patches of long rough dab were found to the west and south of Spitsbergen and in the central Barents Sea. A slight increase in distribution was found, and the abundance estimate of 0-group long rough dab (Table 2) was slightly higher than last year. The length of long rough dab observed this year was somewhat less than for 2000.

Sandeel (Fig. 25)

Small areas of 0-group sandeel were found in the south-eastern part of the Barents Sea with high density in one catch only. In the central part of the Barents Sea there were only two small catches. Total abundance and distribution seem to be much less than for last year. No abundance index is calculated for this species.

Catfish (Fig. 26)

The 0-group catfish had a similar north-west distribution as last year and were found in two scattered patches to the west and south of Spitsbergen. In the central Barents Sea there were only a few insignificant catches. No abundance index is calculated for this species.

Gonatus (Fig. 27)

0-group *Gonatus fabricii* had a similar distribution as in previous years. It was observed in the western parts of the investigated area, from the Norwegian coast to Spitsbergen. No abundance index is calculated for this species.

REFERENCES

- Anon.**, 1980. Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August/September 1978. *Annls biol., Copenh.*, 35:273-280.
- Anon.**, 1983. Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August/September 1980. *Annls biol., Copenh.*, 37:259-266.
- Fotland, Å., Mehl, S. and Sunnanå, K.** 1995. Methods of index calculation and presentation of fish abundance data using standard computer programs. Pp.207-214 in Hysten, A.(ed.): *Precision and relevance of prerecruit studies for fishery management related to fish stocks in the Barents Sea and adjacent waters. Proceedings of the sixth IMR-PINRO symposium. Bergen, 14-17 June 1994.* Institute of Marine Research, Bergen; Norway.
- Nakken, O. and A.Raknes** 1996. Corrections of indices of abundance of 0-group fish in the Barents Sea for varying capture efficiency. *ICES CM 1996/G:12*, Ref.M.
- Randa, K.** 1984. Abundance and distribution of 0-grouo Arcto-Norwegian cod and haddock 1965-1982. Pp. 189-209 in Godø, O.R. and Tilseth, H. (eds): reproduction and recruitment of Arctic cod. *Proceedings of the first Soviet-Norwegian symposium; Leningrad, 26-30 September 1983.* Institute of Marine Research, Bergen; Norway.
- Tereshchenko, V.V.** 1992. Some results from long-term oceanographic observations during 0-group surveys in the Barents Sea. *ICES CM 1992/C:18*.
- Toresen, R.** 1985. Recruitment indices of Norwegian spring-spawning herring for the period 1965-1984 based on the international 0-group fish surveys. *ICES CM 1985/H:54*.
- Ushakov, N.G. and Shamray E.A.** 1995. The effect of different factors upon the Barents Sea capelin year-classes. Pp. 75-84 in Hysten, A. (ed): *Precision and relevance of pre-recruit studies for fishery management related to fish stocks in the Barents Sea and adjacent waters. Proceedings of the sixth IMR-PINRO symposium. Bergen, 14-17 June 1994.* Institute of Marine Research, Bergen, Norway.

Table 1. Mean water temperature¹ in main parts of standard sections in the Barents Sea and adjacent waters in August-September 1965-2001.

Year	Section ² and layer (depth in meters)						
	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
2000	7.6	4.5	5.3	5.8	4.1	5.7	5.1
2001	6.9	4.0	4.7	5.6	4.0	5.7	4.9
1965-2001	7.4	3.8	4.7	4.3	3.3	5.8	4.7

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

Table 2. Abundance indices of 0-group fish in the Barents Sea and adjacent waters in 1965-01
 *)Assessment for 1965-1978 in Anon (1980) and for 1979-1993 in Ushakov and Shamray 1995.
 **) Indices for 1965-1985 adjusted according to Nakken and Raknes 1996.

Year	Capelin*	Cod**	Haddock**	Polar cod W	Polar cod E	Redfish	Greenland halibut	Long rough dab
1965	37	11	13	0		159		66
1966	119	2	2	129		236		97
1967	89	62	76	165		44		73
1968	99	45	14	60		21		17
1969	109	211	186	208		295		26
1970	51	1097	208	197		247	1	12
1971	151	356	166	181		172	1	81
1972	275	225	74	140		177	8	65
1973	125	1101	87	26		385	3	67
1974	359	82	237	227		468	13	93
1975	320	453	224	75		315	21	113
1976	281	57	148	131		447	16	96
1977	194	279	187	157	70	472	9	72
1978	40	192	110	107	144	460	35	76
1979	660	129	95	23	302	980	22	69
1980	502	61	68	79	247	651	12	108
1981	570	65	30	149	93	861	38	95
1982	393	136	107	14	50	694	17	150
1983	589	459	219	48	39	851	16	80
1984	320	559	293	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
2000	303	870	417	76	387	195	28	81
2001	221	212	394	148	146	11	32	86
1985-2001	294	644	247	110	273	351	18	116
1965-2001	278	447	182			396	17	95

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 1966-2001.

Year	Herring			Cod			Haddock		
	Index	Confidence limits		Index	Confidence limits		Index	Confidence limits	
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	0.05	0.03	0.08	1.48	1.18	1.82	0.26	0.15	0.40
1974	0.01	0.01	0.01	0.29	0.18	0.42	0.51	0.39	0.68
1975	0.00	-	-	0.90	0.66	1.17	0.60	0.40	0.85
1976	0.00	-	-	0.13	0.06	0.22	0.38	0.24	0.51
1977	0.01	0.00	0.03	0.49	0.36	0.65	0.33	0.21	0.48
1978	0.02	0.01	0.05	0.22	0.14	0.32	0.12	0.07	0.19
1979	0.09	0.01	0.20	0.40	0.25	0.59	0.20	0.12	0.28
1980	-	-	-	0.13	0.08	0.18	0.15	0.10	0.20
1981	0.00	-	-	0.10	0.06	0.18	0.03	0.00	0.05
1982	0.00	-	-	0.59	0.61	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	0.49	0.76	0.38	0.30	0.48	0.14	0.10	0.20
1990	0.31	0.16	0.50	1.23	1.04	1.34	0.61	0.48	0.75
1991	1.19	0.90	1.52	2.30	1.97	2.37	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	0.59	0.21	0.11	0.34	0.25	0.11	0.44
2000	0.30	0.17	0.46	1.49	1.21	1.78	0.64	0.46	0.84
2001	0.13	0.04	0.25	0.23	0.12	0.36	0.67	0.52	0.84
Mean 1985- 2001	0.43			1.41			0.47		

Table 4. Length distribution of 0-group fish in percent in the Barents Sea and adjacent waters in August - September 2001.

Length (mm)	Herring	Capelin	Cod	Haddock	Polar cod	Redfish	Sandeel	Greenland halibut	Long rough dab
10- 14									
15- 19									2.45
20- 24	0.02	0.28			2.86	9.09			6.10
25- 29		3.13			12.19	18.18			27.40
30- 34	0.22	5.63		0.01	23.20	18.18	21.00	0.38	26.96
35- 39	0.45	23.16	0.15	0.11	33.87	54.55	30.50	1.24	27.42
40- 44	2.87	35.47	0.52	0.37	16.87		27.67	0.76	9.11
45- 49	3.62	17.89	3.26	0.77	5.44		13.79	11.09	0.56
50- 54	4.79	3.66	6.26	1.18	5.58		4.63	6.16	
55- 59	29.08	0.76	16.21	1.39	1.93		0.25	6.81	
60- 64	32.19	0.76	12.66	1.52	0.76		1.39	10.06	
65- 69	13.96	1.41	8.90	2.14	0.12		0.57	50.93	
70- 74	4.75	2.69	6.35	2.61				9.33	
75- 79	2.78	2.84	10.19	3.55				3.23	
80- 84	1.40	1.64	12.22	4.78			0.16		
85- 89	1.36	0.66	11.35	8.34					
90- 94	1.57		5.32	8.82			0.04		
95- 99	0.67		4.06	12.36					
100-104	0.13		2.03	11.52					
105-109	0.02		0.43	10.95					
110-114	0.02			8.43					
115-119				6.18					
120-124			0.02	5.90					
125-129	0.02		0.06	3.87					
130-134	0.02			4.50					
135-139	0.02			0.39					
140-144	0.02			0.32					
No. measured	1520	3990	1271	3828	1566	12	133	224	388
Total catch	4635	29569	4023	8605	95828	22	2443	264	451
Mean length, mm	62.3	44.9	72.4	99.9	36.9	32.9	40.6	63.2	32.5

Research vessel	Participants
“AtlantNIRO”	A. Bendik, O. Dolgaja, T. Gavrilik, S. Ivanov, V. Kapralov, V. Mamylov, T. Prokhorova, D. Prozorkevich (cruise leader), S. Ratushny, M. Rybakov, T. Sergeeva
“F. Nansen”	A. Astakhov, I. Dolgolenko (cruise leader), J. Garbut, V. Guzenko, V. Kapralov, S. Kharlin, S. Rusyaev, V. Sergeev, I. Shevelev, O. Vavilova
“G. O. Sars”	P. Fossum (cruise leader), H. Gill, A. Hassel, T. Haugland, K. Helle, J. Horne, Ø. Leikvin, A. Sæther, J. Træland, N.Ushakov
“J. Hjort”	J.R. Andersen, M. Dahl, K. Gjertsen, H. Græsdal (cruise leader), R. Ingvaldsen, E. Sælen Meland, M. Mjanger, H. Sagen, H.J. Skaug

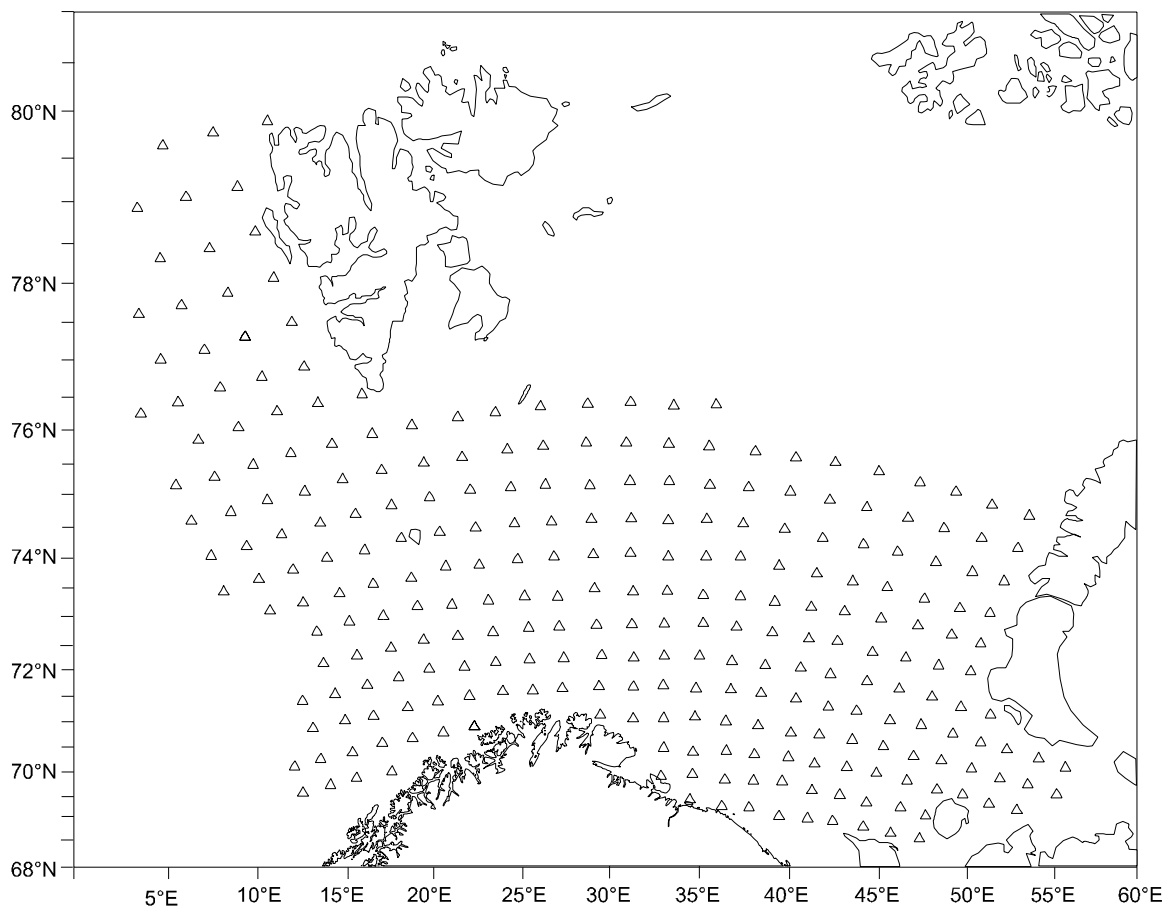


Fig.1. Trawl stations taken at the 0-group survey in 2001.

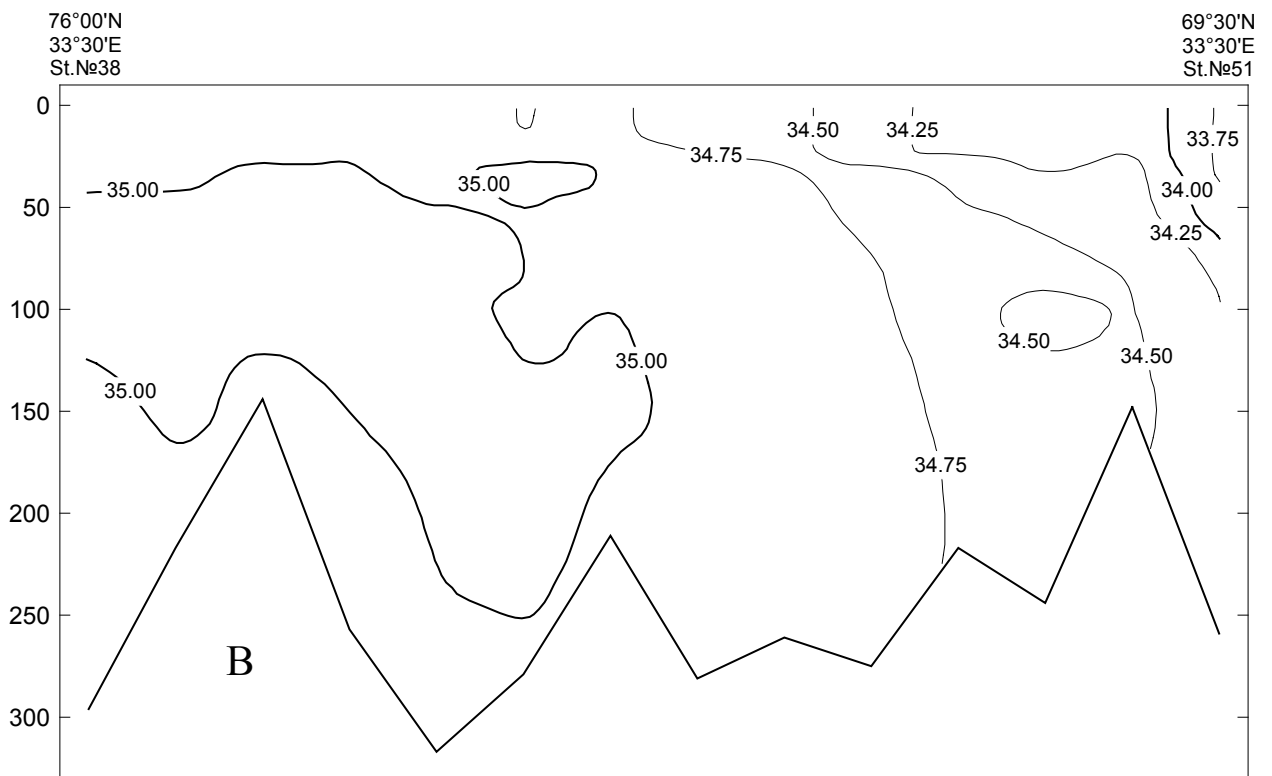
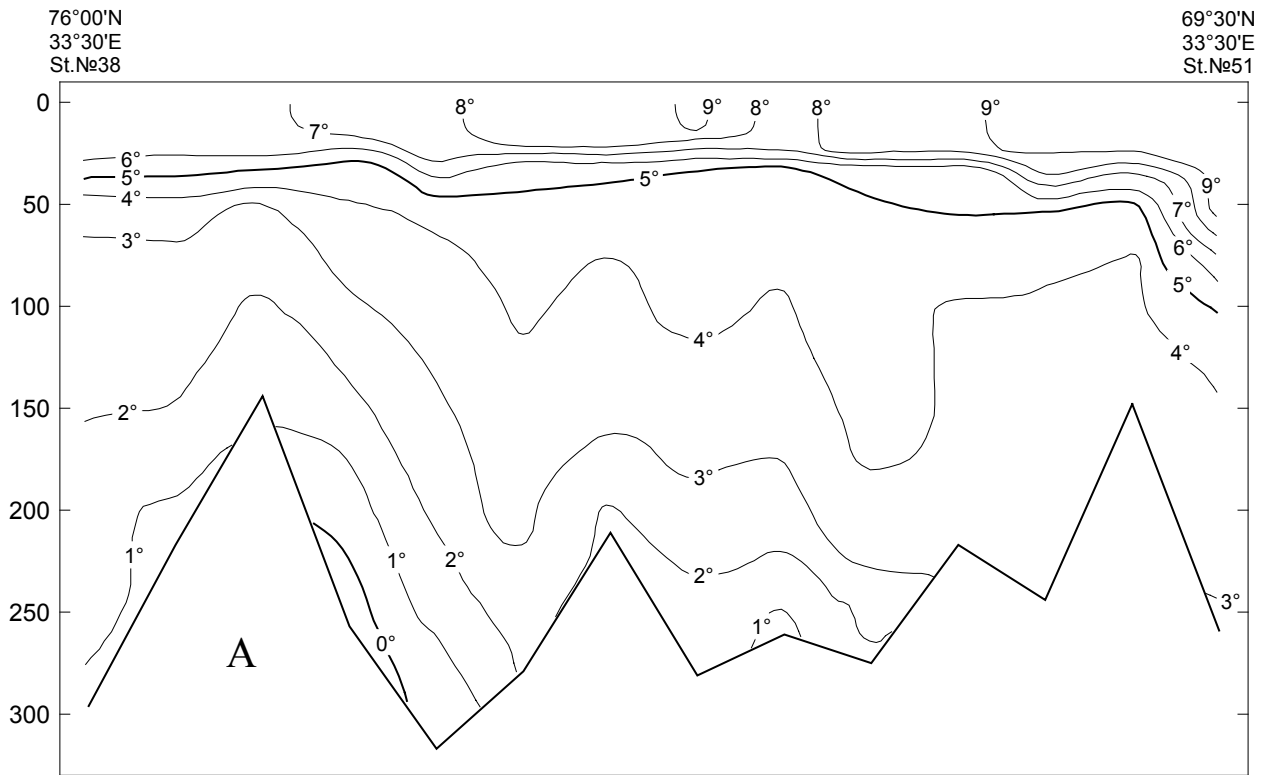


Fig. 2. Temperature (A) and salinity (B) in the Kola Section

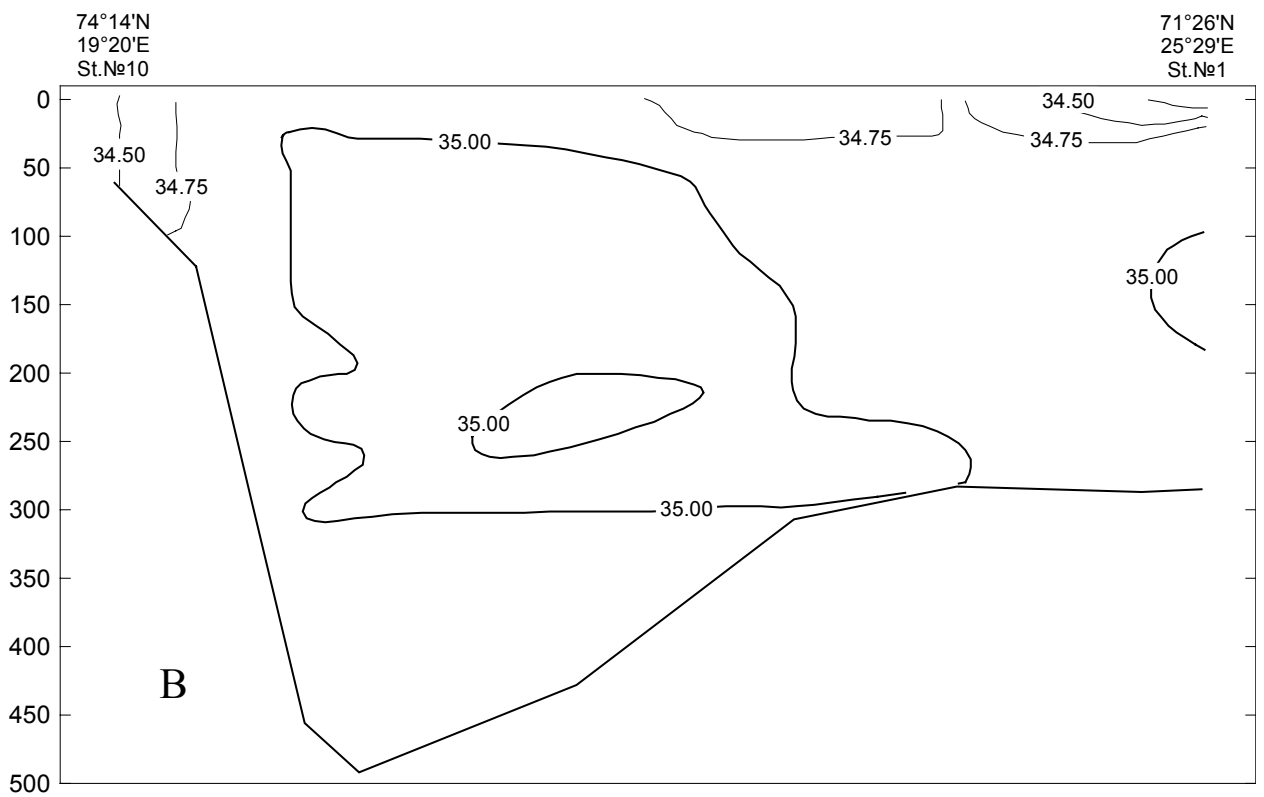
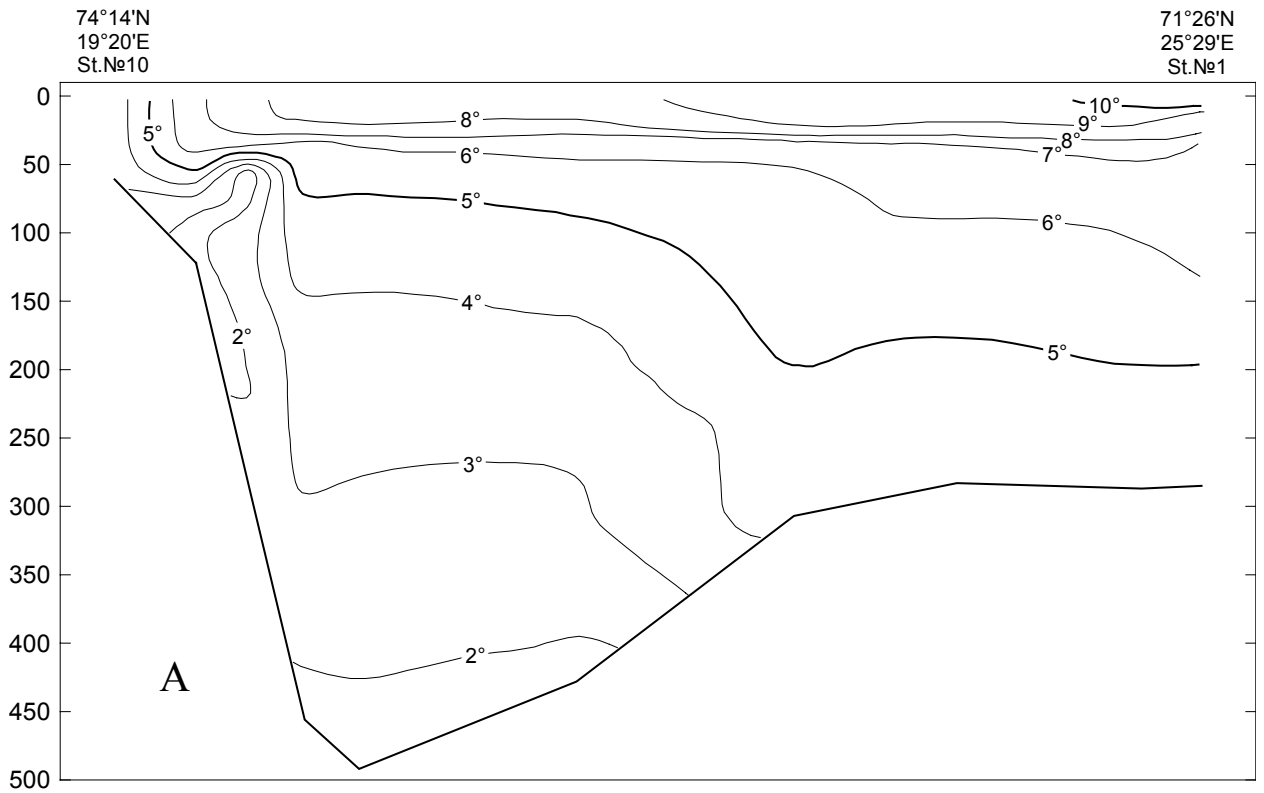


Fig. 3 . Temperature (A) and salinity (B) in the North Cape - Bear Island Section

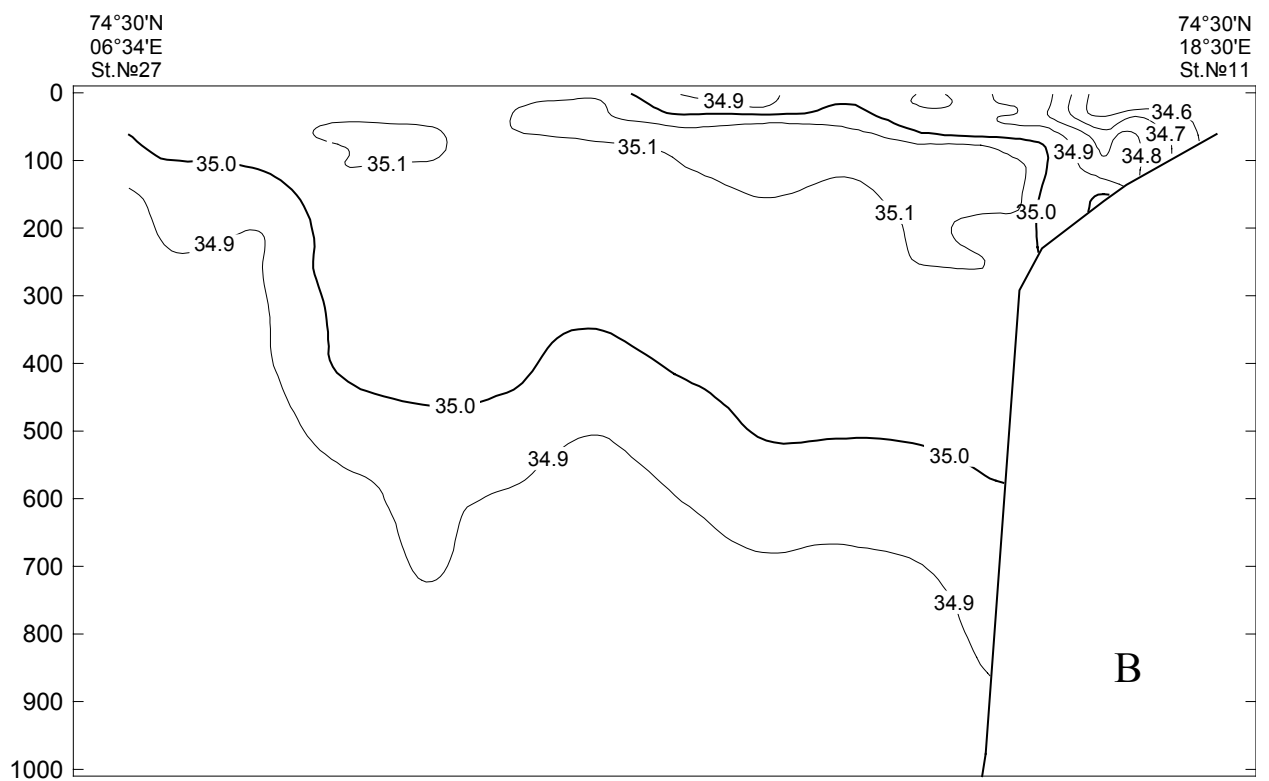
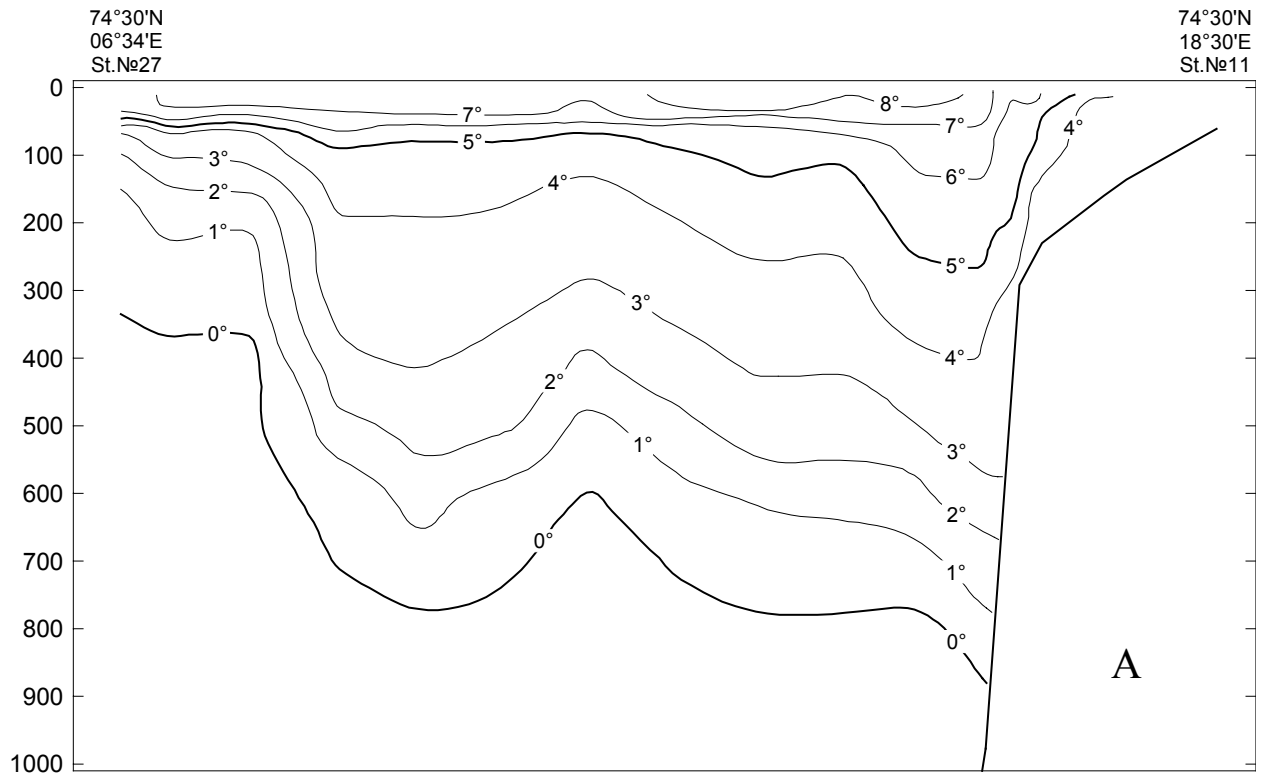


Fig. 4 . Temperature (A) and salinity (B) in the Bear Island - West Section

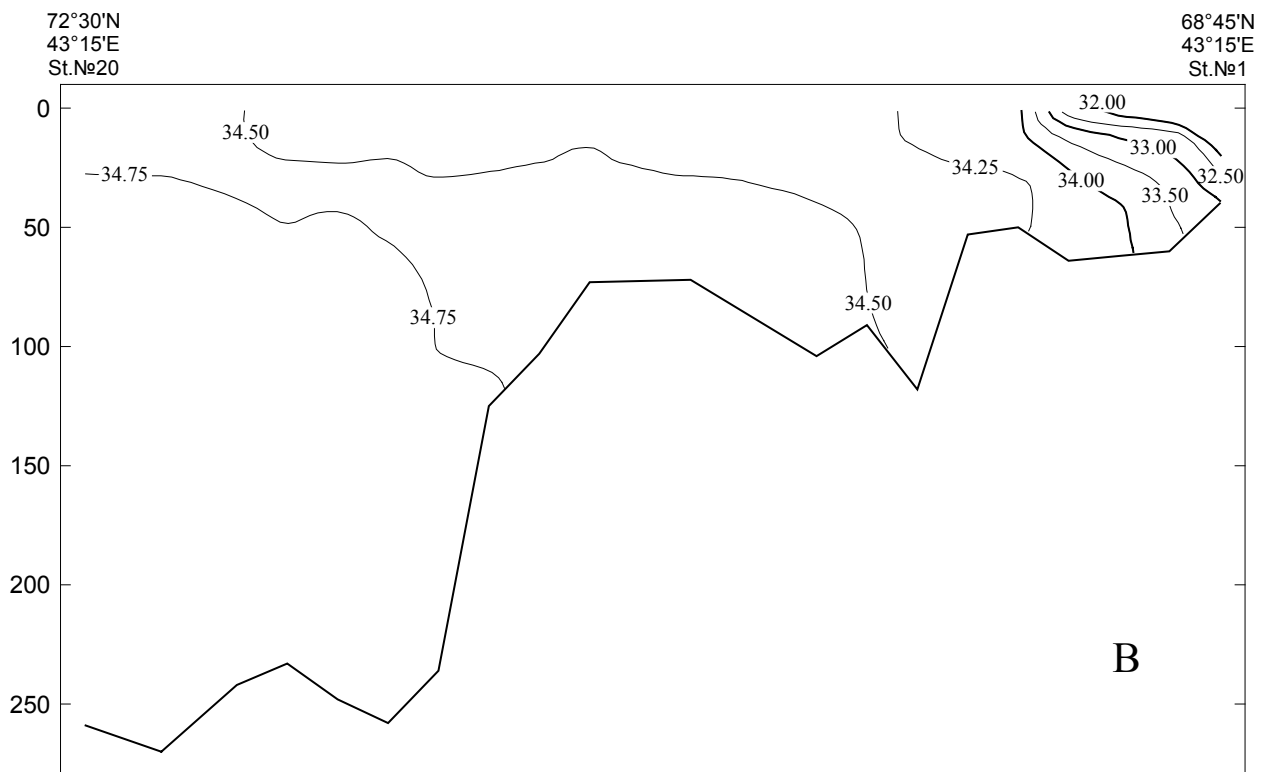
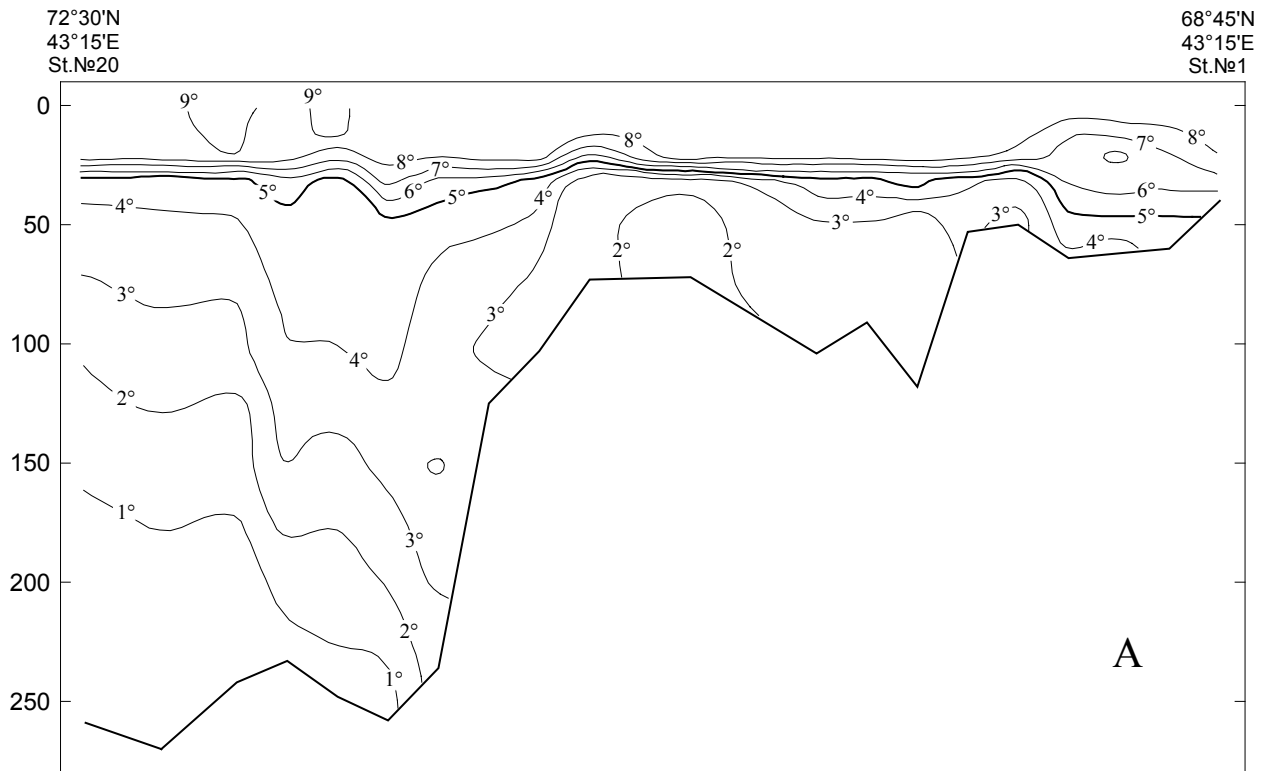


Fig. 5 . Temperature (A) and salinity (B) in the Kanin Section

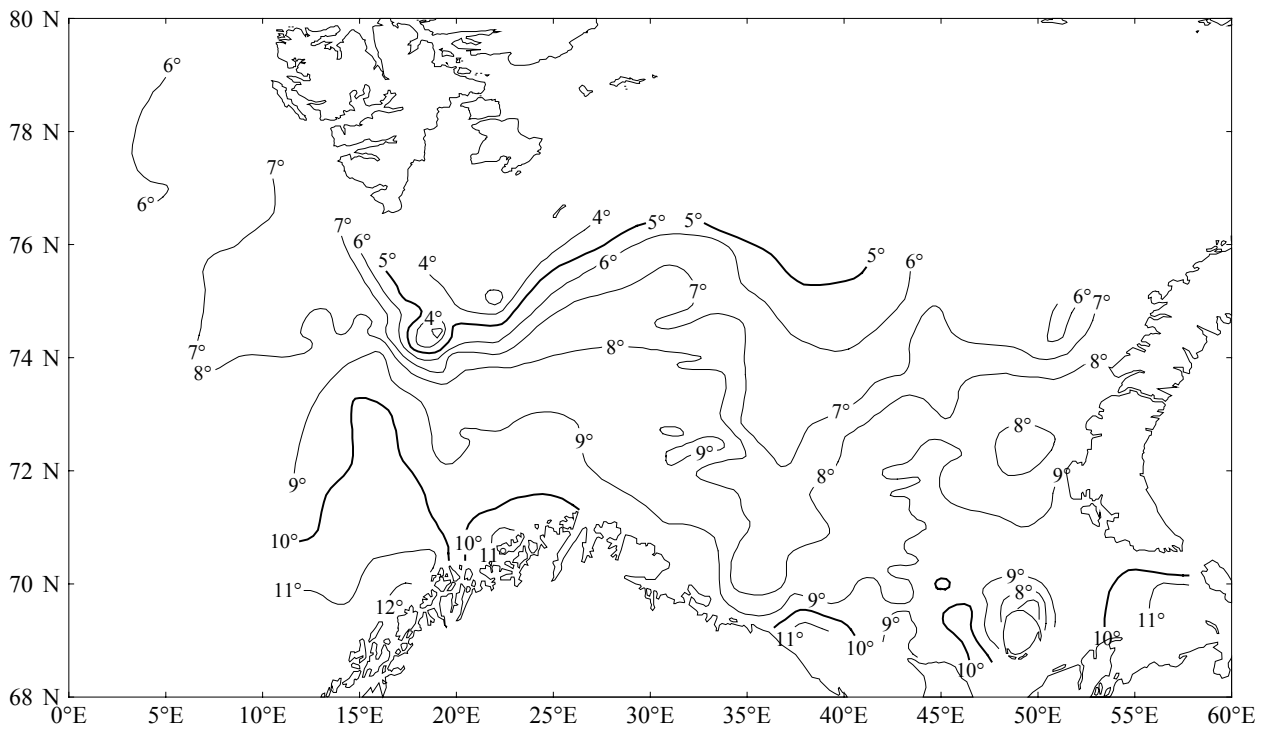


Fig. 6 . Distribution of surface temperature (°C)

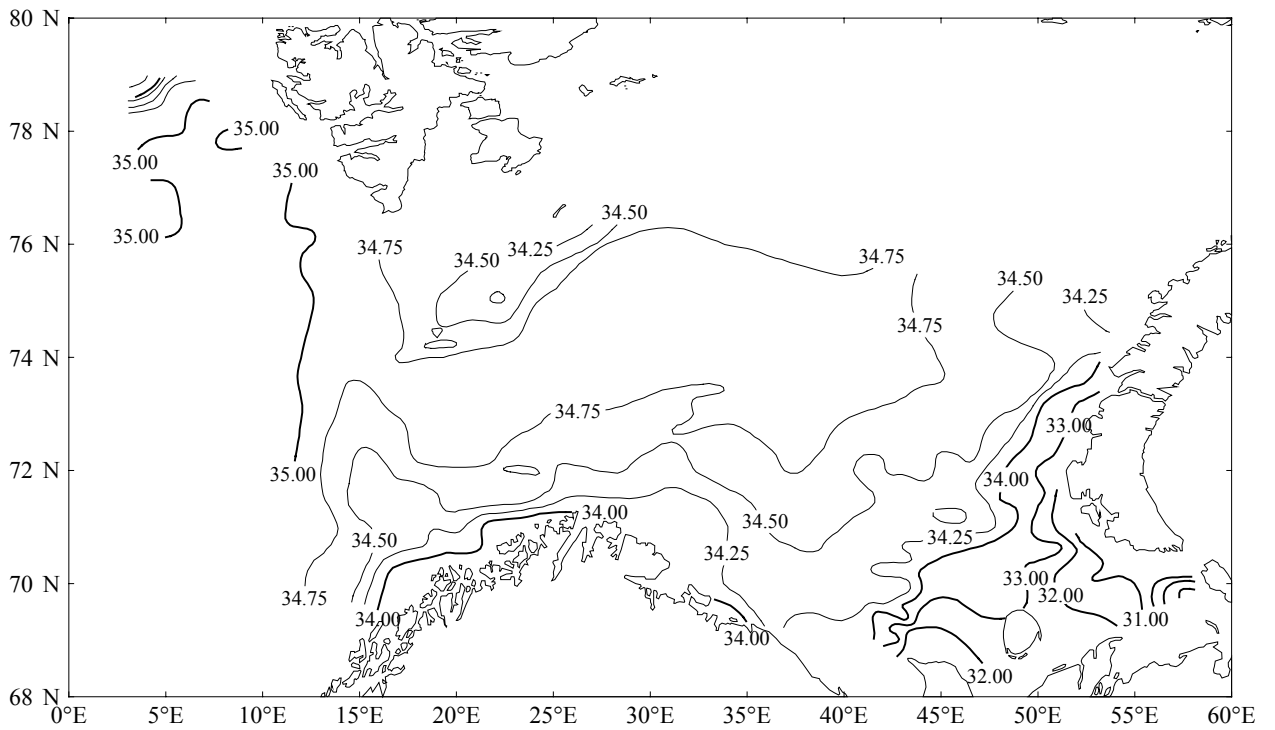


Fig. 7 . Distribution of surface salinity

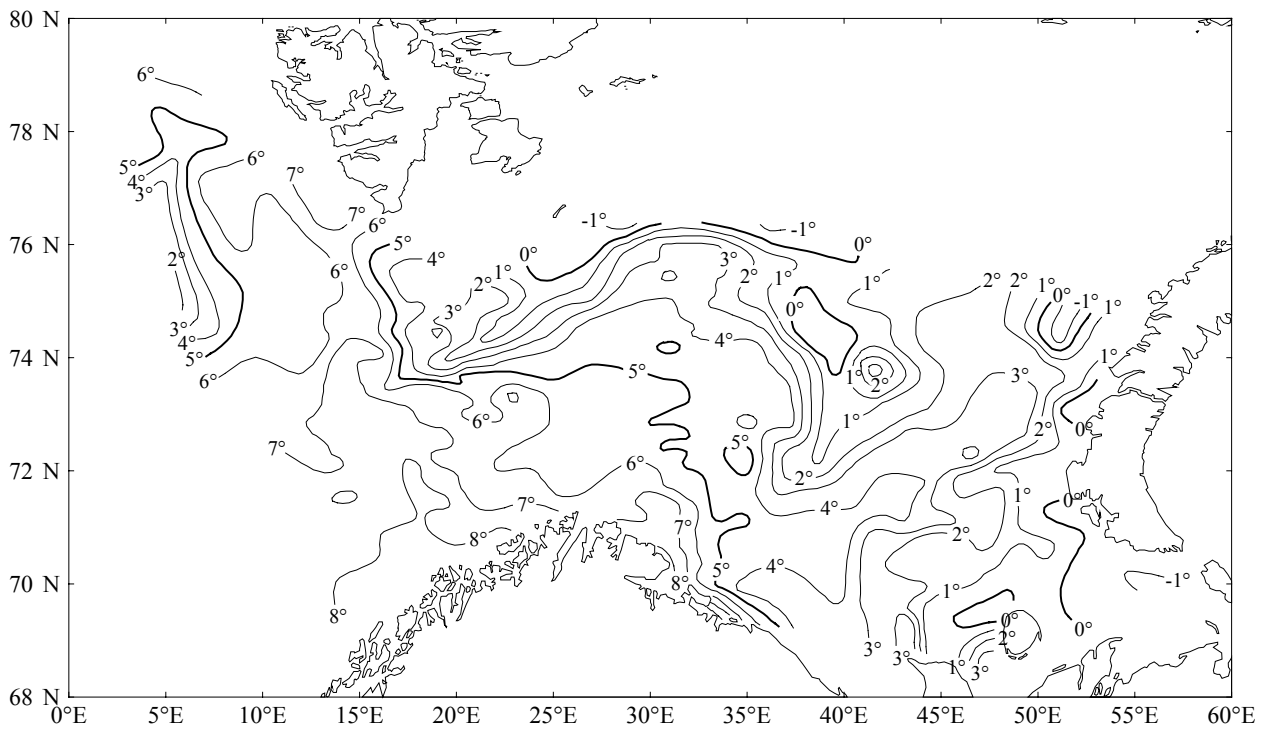


Fig. 8 . Distribution of temperature (°C) at the 50 m depth

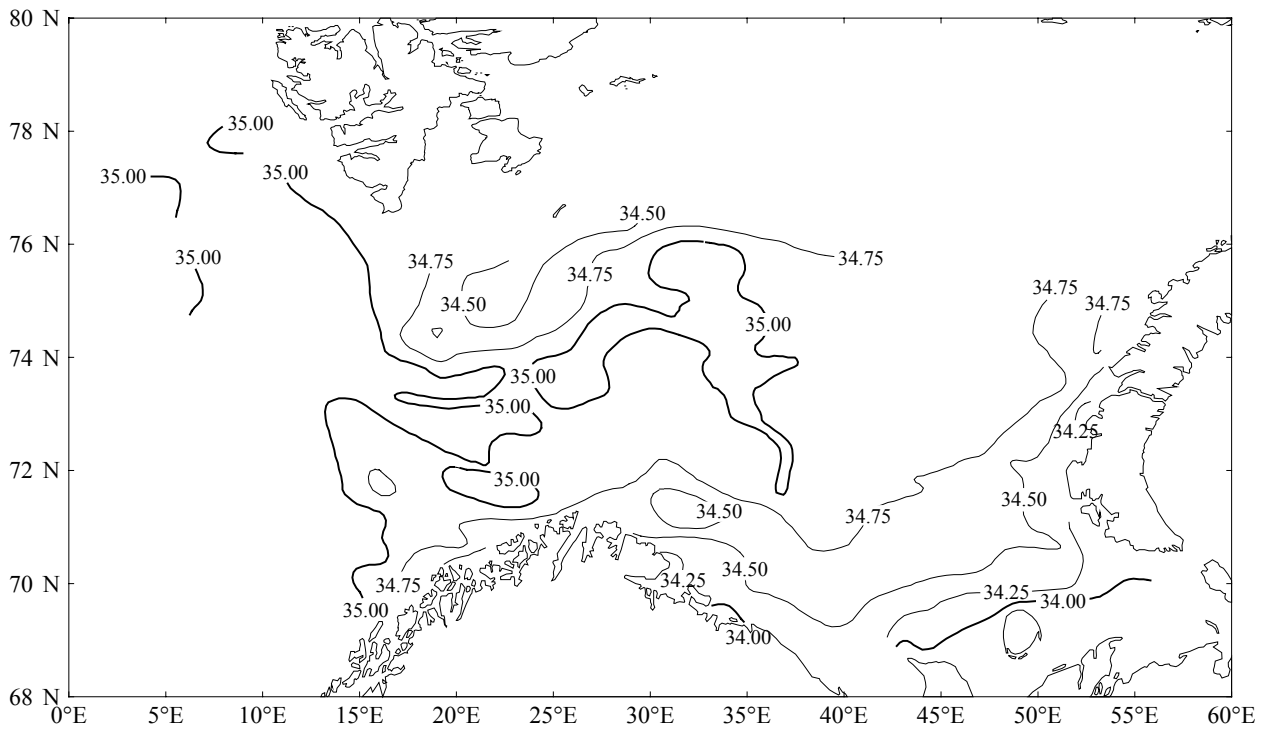


Fig. 9 . Distribution of salinity at the 50 m depth

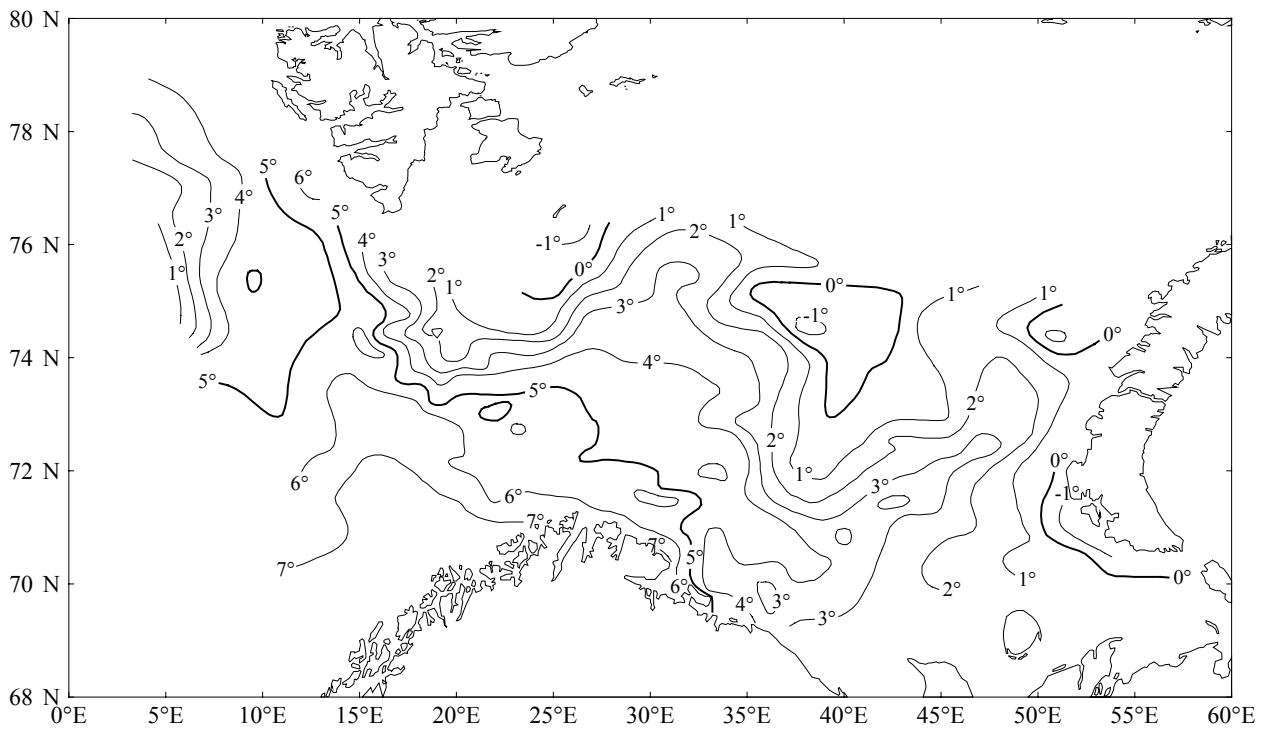


Fig. 10 . Distribution of temperature ($^{\circ}\text{C}$) at the 100 m depth

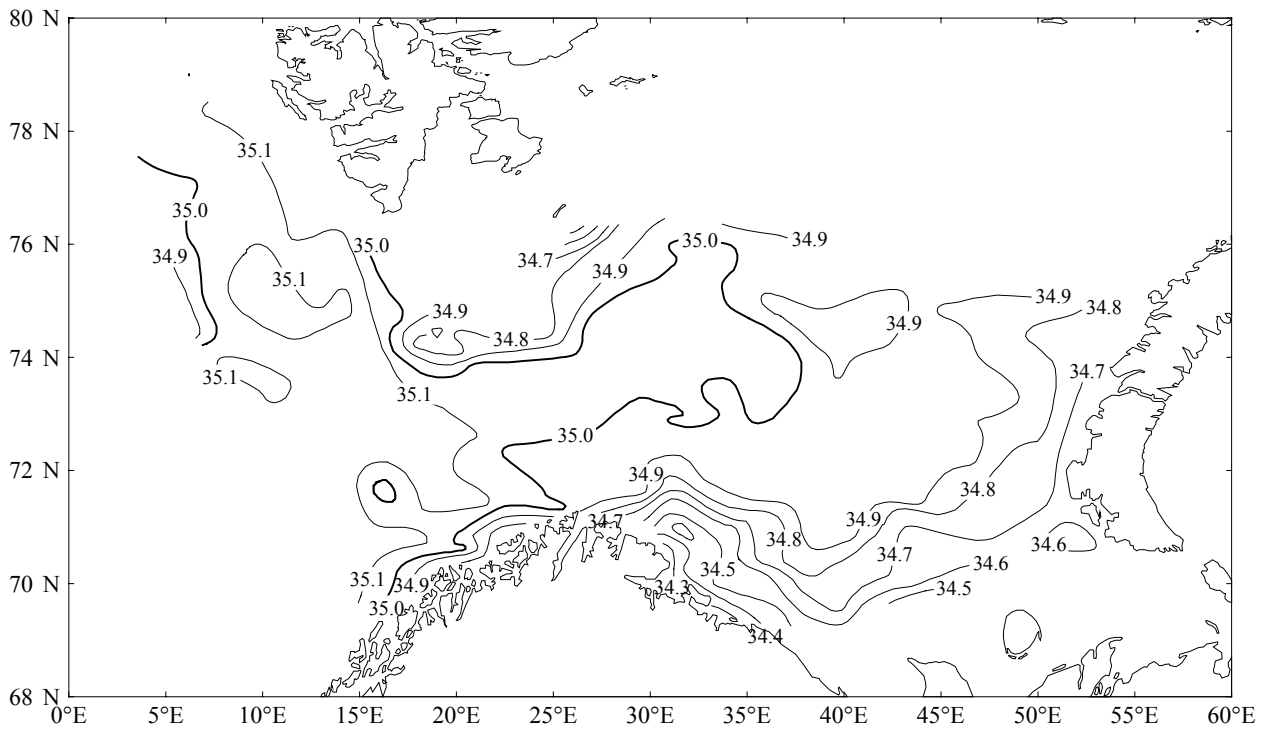


Fig. 11 . Distribution of salinity at the 100 m depth

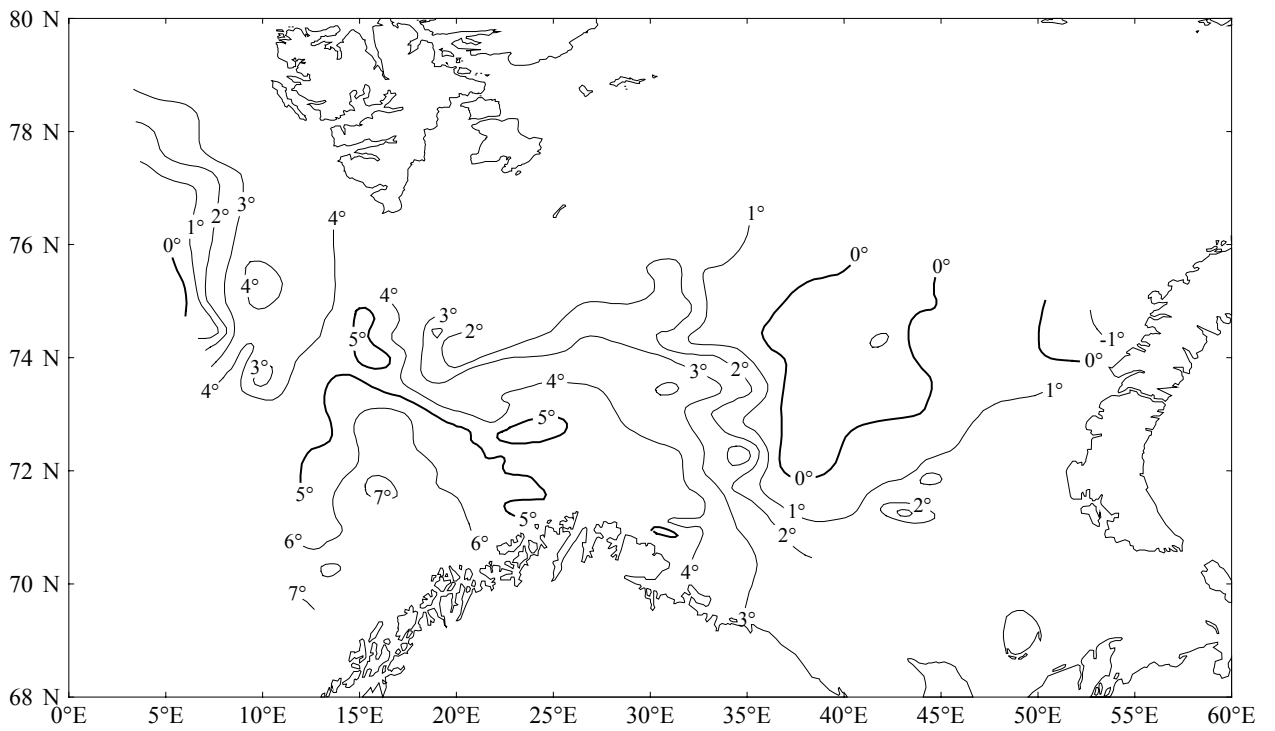


Fig. 12 . Distribution of temperature ($^{\circ}\text{C}$) at the 200 m depth

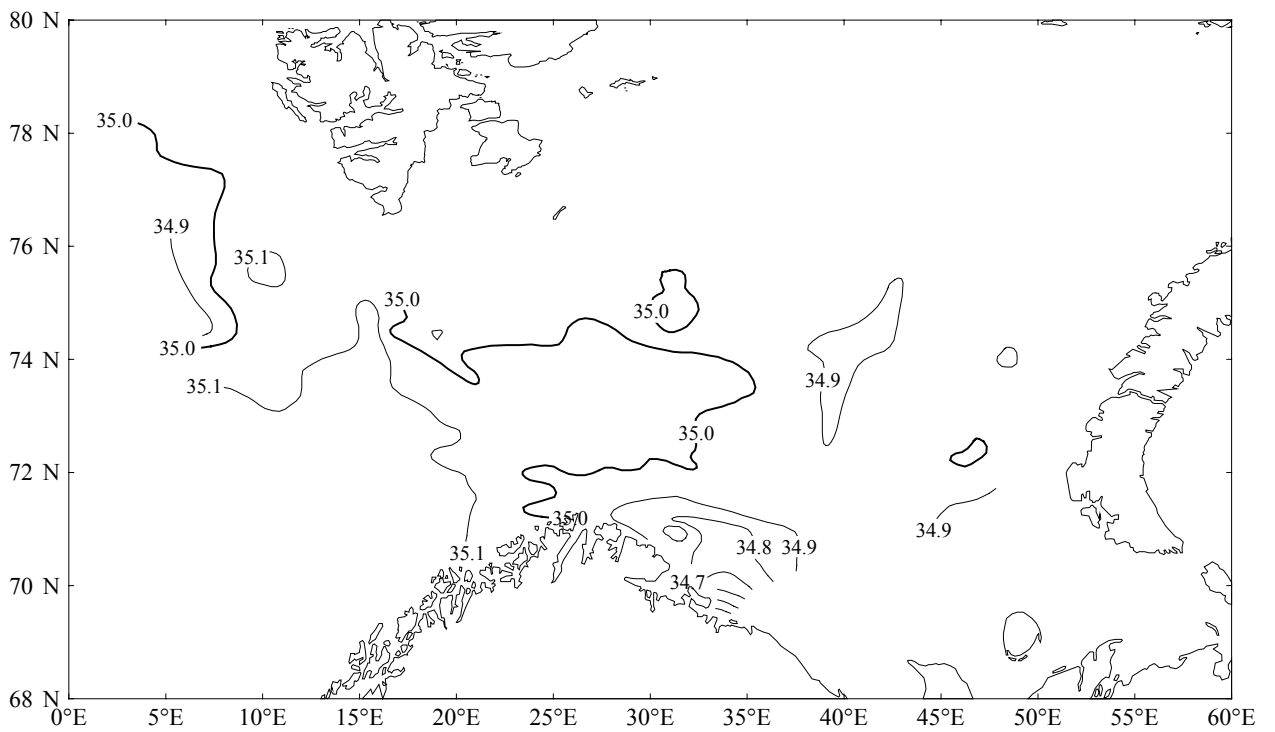


Fig. 13 . Distribution of salinity at the 200 m depth

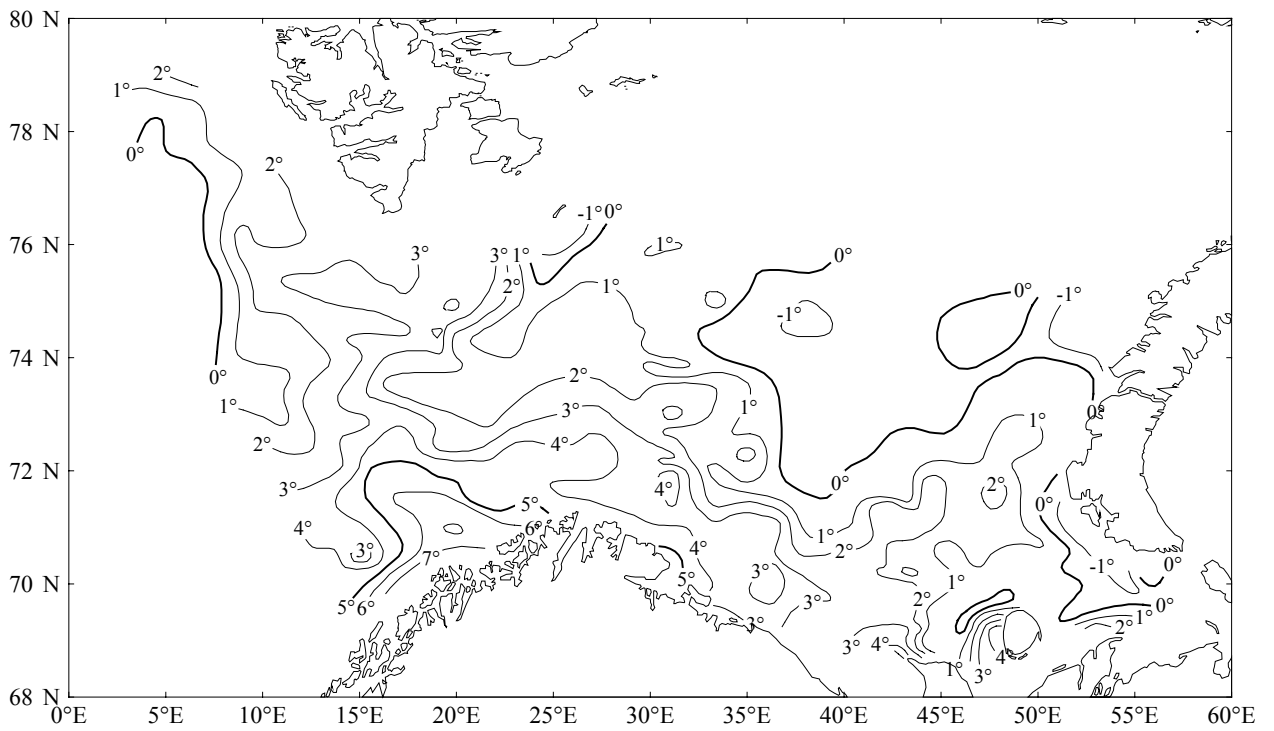


Fig. 14 . Distribution of bottom temperature (°C)

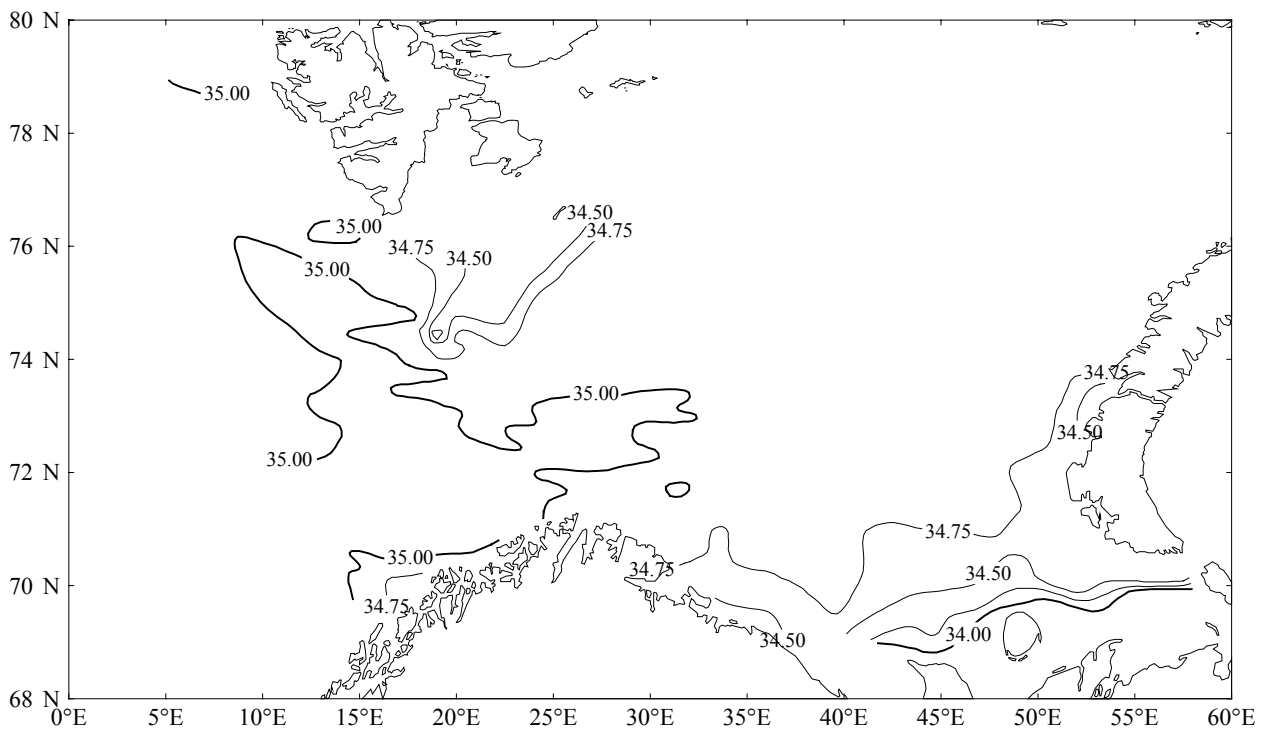


Fig. 15 . Distribution of bottom salinity

Fig 16-27 Distribution of 0-group of several fish species in the Barents Sea in 2001

