

**PRELIMINARY REPORT  
OF  
THE INTERNATIONAL 0-GROUP FISH SURVEY IN THE  
BARENTS SEA AND ADJACENT WATERS IN  
AUGUST - SEPTEMBER 1996**

The thirty second annual International 0-group fish survey was made during the period 16 August - 10 September 1996 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

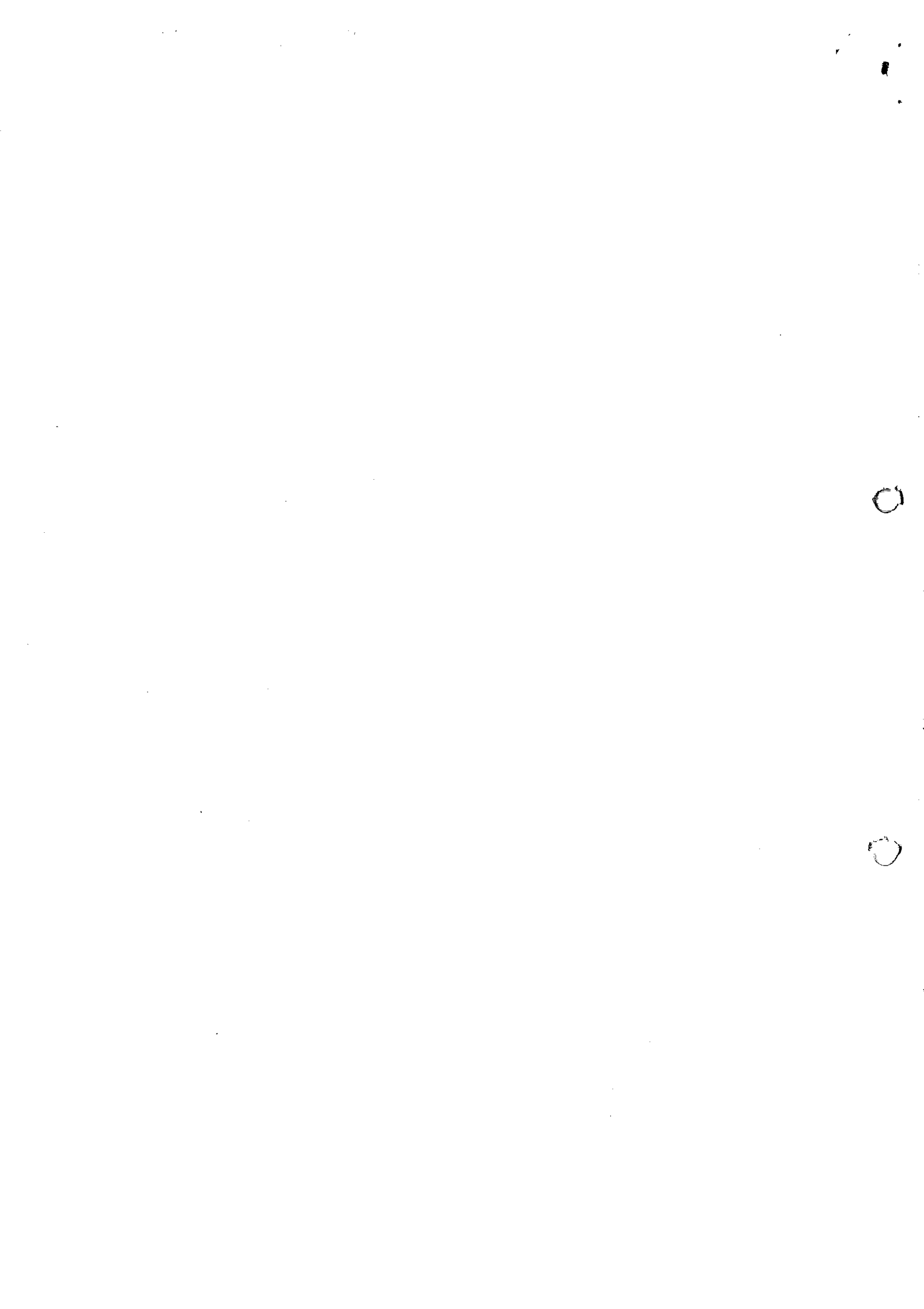
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<b>State</b>	<b>Name of vessel</b>	<b>Period</b>	<b>Research Institute</b>
Norway	«Michael Sars»	22.08 - 10.09	Institute of Marine Research, Bergen
Norway	«Johan Hjort»	24.08 - 10.09	
Norway	«G. O. Sars»	17.08 - 10.09	
Russia	«Atlantida»	15.08 - 10.09	The Polar Research Inst.of Marine Fisheries and Oceanography, Murmansk
Russia	«Persey III»	24.08 - 10.09	

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

Preliminary analysis of the survey data were made on board "G.O.Sars" during the survey, and the final report was finished by 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 mesh midwater trawl. All vessels which participated in the survey in 1996, used the type of midwater trawl recommended in 1980 (Anon. 1983). The standard procedure consisted of tows 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 60 and 80m for 0.5 nautical mile were made when 0-group fish layer was recorded deeper than 60m or 80m on the echosounder. Trawling procedure was standardized in accordance with the recommendation made in 1980.

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

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

Trawl stations with and without catch are indicated on the distribution charts in Figs. 16 - 27, as filled and open symbols respectively. The density grading is based on catch as number per 1.0 nautical mile trawling.

## HYDROGRAPHY

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

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

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

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

Geographical distribution of 0-group fish are shown as shaded areas in Figs. 16 - 26, and of *Gonatus fabricii* in Fig. 27. Double shading indicates dense concentrations. The criteria for discriminating between dense and scattered concentrations are the same as used in earlier reports (Anon. 1980). Abundance indices, estimated as the area of distribution with areas of high densities weighed by 10, are given in Table 2. All area based abundance indices were estimated by using standard computer programs (Fotland *et al.* 1995). Another set of abundance indices are given for 0-group herring, cod and haddock (Table 3), calculated according to Randa (1984). These are based on the number caught during a standard trawl haul of one nautical mile. Length frequency distributions of the main species are given in Table 4.

### Herring (Fig. 16)

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

### Capelin (Fig. 17)

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

### Cod (Fig. 18)

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

### Haddock (Fig. 18)

0-group haddock was distributed in an area west of Bear Island and eastwards in the Barents Sea as far east as 43°E. Only five small patches of high abundance were observed within the area of scattered concentrations. The abundance indices indicate that the 1996-year-class is below the average strength of the 1988 - 1995-year-classes. A Norwegian survey in July-

August observed high abundance of 0-group in the area southwest of the present survey area. However, the trawling strategy differed from that used in the 0-group survey, and the observations are not included in the present analysis. The effect might be that the year-class strength measured in the present survey is somewhat underestimated.

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

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

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

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

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

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

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

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

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

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

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

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

#### **Catfish (Fig. 26)**

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

**Gonatus (Fig. 27)**

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

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Table 1. Mean water temperature<sup>1</sup> in main parts of standard sections in the Barents Sea and adjacent waters in August-September 1965 - 1996.

Year	Section <sup>2</sup> and layer (deep in meter)						
	1	2	3	4	5	6	7
	0-50	50-200	0-200	0-bot.	0-bot.	0-200	0-200
1965	6.7	3.9	4.6	4.6	3.7	5.1	-
1966	6.7	2.6	3.6	1.9	2.2	5.5	3.6
1967	7.5	4.0	4.9	6.1	3.4	5.6	4.2
1968	6.4	3.7	4.4	4.7	2.8	5.4	4.0
1969	6.7	3.1	4.0	2.6	2.0	6.0	4.2
1970	7.8	3.7	4.7	4.0	3.3	6.1	-
1971	7.1	3.2	4.2	4.0	3.2	5.7	4.2
1972	8.7	4.0	5.2	5.1	4.1	6.3	3.9
1973	7.7	4.5	5.3	5.7	4.2	5.9	5.0
1974	8.1	3.9	4.9	4.6	3.5	6.1	4.9
1975	7.0	4.6	5.2	5.6	3.6	5.7	4.9
1976	8.1	4.0	5.0	4.9	4.4	5.6	4.8
1977	6.9	3.4	4.3	4.1	2.9	4.9	4.0
1978	6.6	2.5	3.6	2.4	1.7	5.0	4.1
1979	6.5	2.9	3.8	2.0	1.4	5.3	4.4
1980	7.4	3.5	4.5	3.3	3.0	5.7	4.9
1981	6.6	2.7	3.7	2.7	2.2	5.3	4.4
1982	7.1	4.0	4.8	4.5	2.8	5.8	4.9
1983	8.1	4.8	5.6	5.1	4.2	6.3	5.1
1984	7.7	4.1	5.0	4.5	3.6	5.9	5.0
1985	7.1	3.5	4.4	3.4	3.4	5.3	4.6
1986	7.5	3.5	4.5	3.9	3.2	5.8	4.4
1987	6.2	3.3	4.0	2.7	2.5	5.2	3.9
1988	7.0	3.7	4.5	3.8	2.9	5.5	4.2
1989	8.6	4.8	5.8	6.5	4.3	6.9	4.9
1990	8.1	4.4	5.3	5.0	3.9	6.3	5.7
1991	7.7	4.5	5.3	4.8	4.2	6.0	5.4
1992	7.5	4.6	5.3	5.0	4.0	6.1	5.0
1993	7.5	4.0	4.9	4.4	3.4	5.8	5.4
1994	7.7	3.9	4.8	4.6	3.4	6.4	5.3
1995	7.6	4.9	5.6	5.9	4.3	6.1	5.2
1996	7.6	3.7	4.7	5.2	2.9	5.8	4.7
Average 1965- 1996	7.3	3.8	4.7	4.3	3.3	5.8	4.6

<sup>1)</sup> Earlier presented temperatures 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).

Table 2. Abundance indices of 0-group fish in the Barents Sea and adjacent waters in 1965 - 1996.

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	-	220	15	66
1996	291	1142	196	59	484	19	5	10

<sup>1)</sup> 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 1965-1995.

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	0.38	0.30	0.48	0.14	0.10	0.20
1990	0.31	0.16	0.50	1.23	1.04	1.34	0.61	0.48	0.75
1991	1.19	0.90	1.52	2.30	1.97	2365	1.17	0.98	1.37
1992	1.06	0.69	1.50	2.94	2.53	3.39	0.87	0.71	1.06
1993	0.75	0.45	1.14	2.09	1.70	2.51	0.64	0.48	0.82
1994	0.28	0.17	0.42	2.27	1.83	2.76	0.64	0.49	0.81
1995	0.16	0.07	0.29	2.40	1.97	2.88	0.25	0.13	0.41
1996	0.65	0.47	0.85	2.87	2.53	3.24	0.39	0.25	0.56

<sup>1)</sup> Assessment for 1965-1984 made by Toresen (1985).

Table 4. Length distribution of 0-group fish in percent in the Barents Sea and adjacent waters in August - September 1996.

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

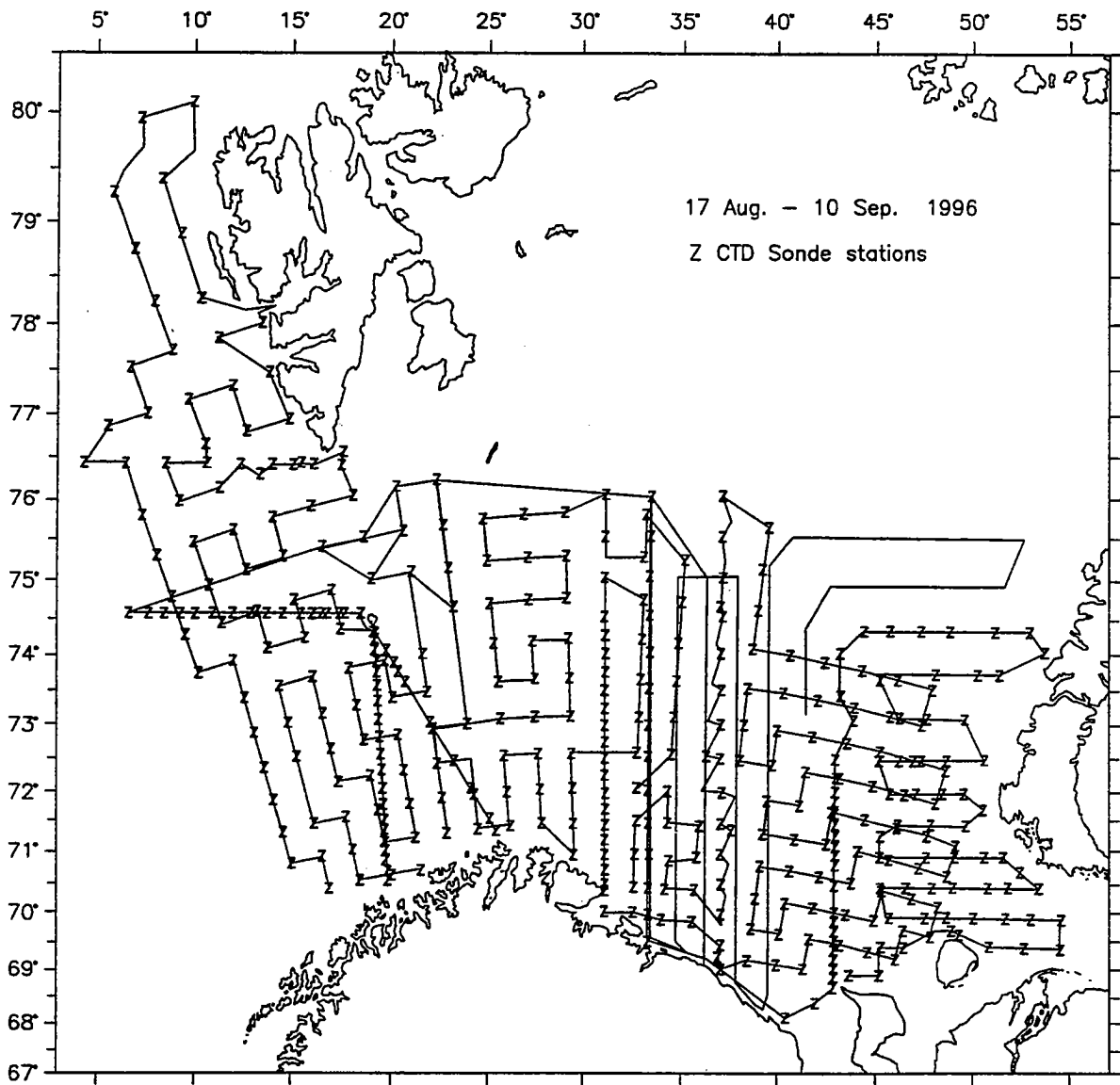


Fig. 1. Survey tracks and hydrographic stations.

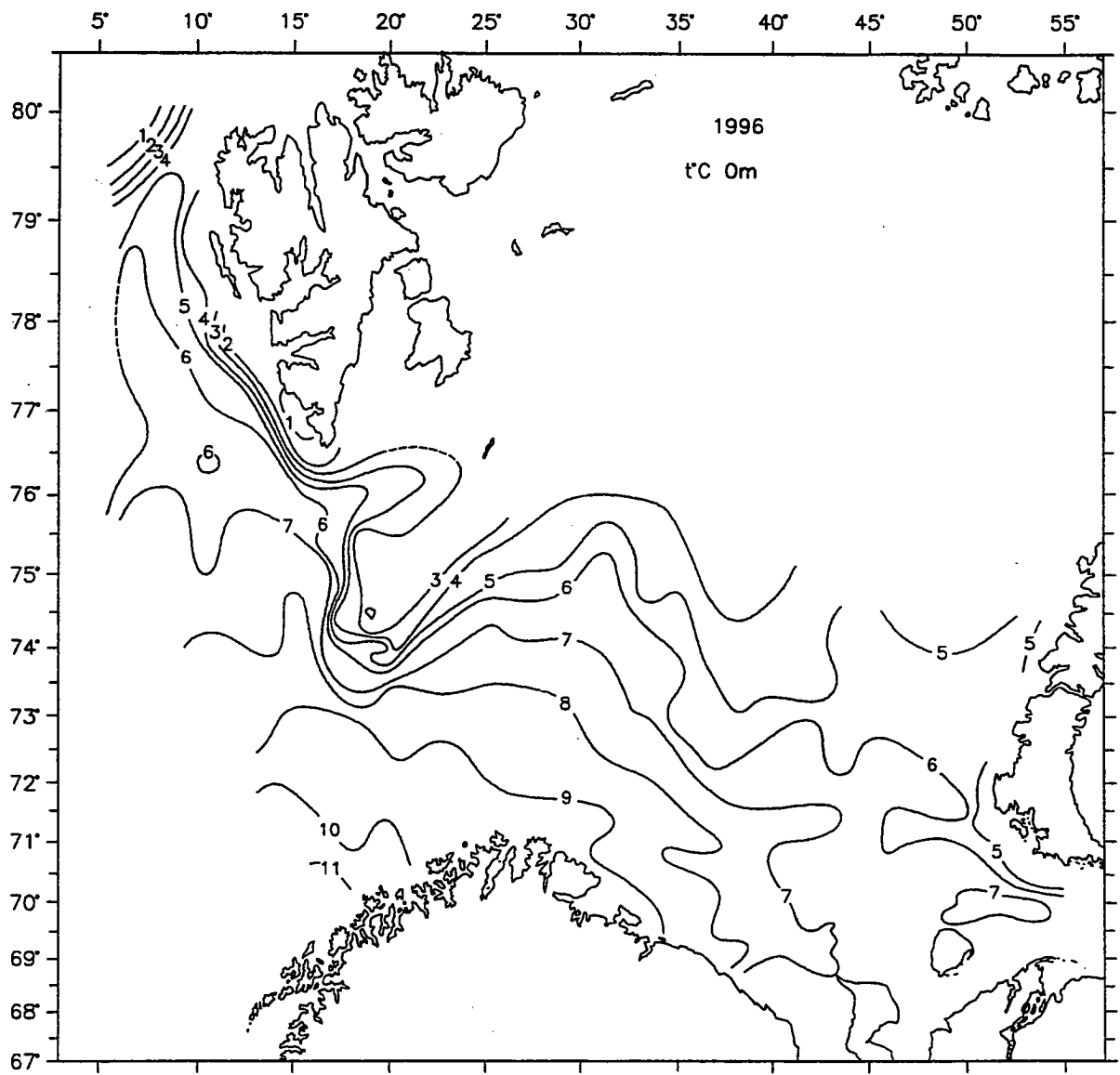


Fig. 2. Isotherms at 0m.

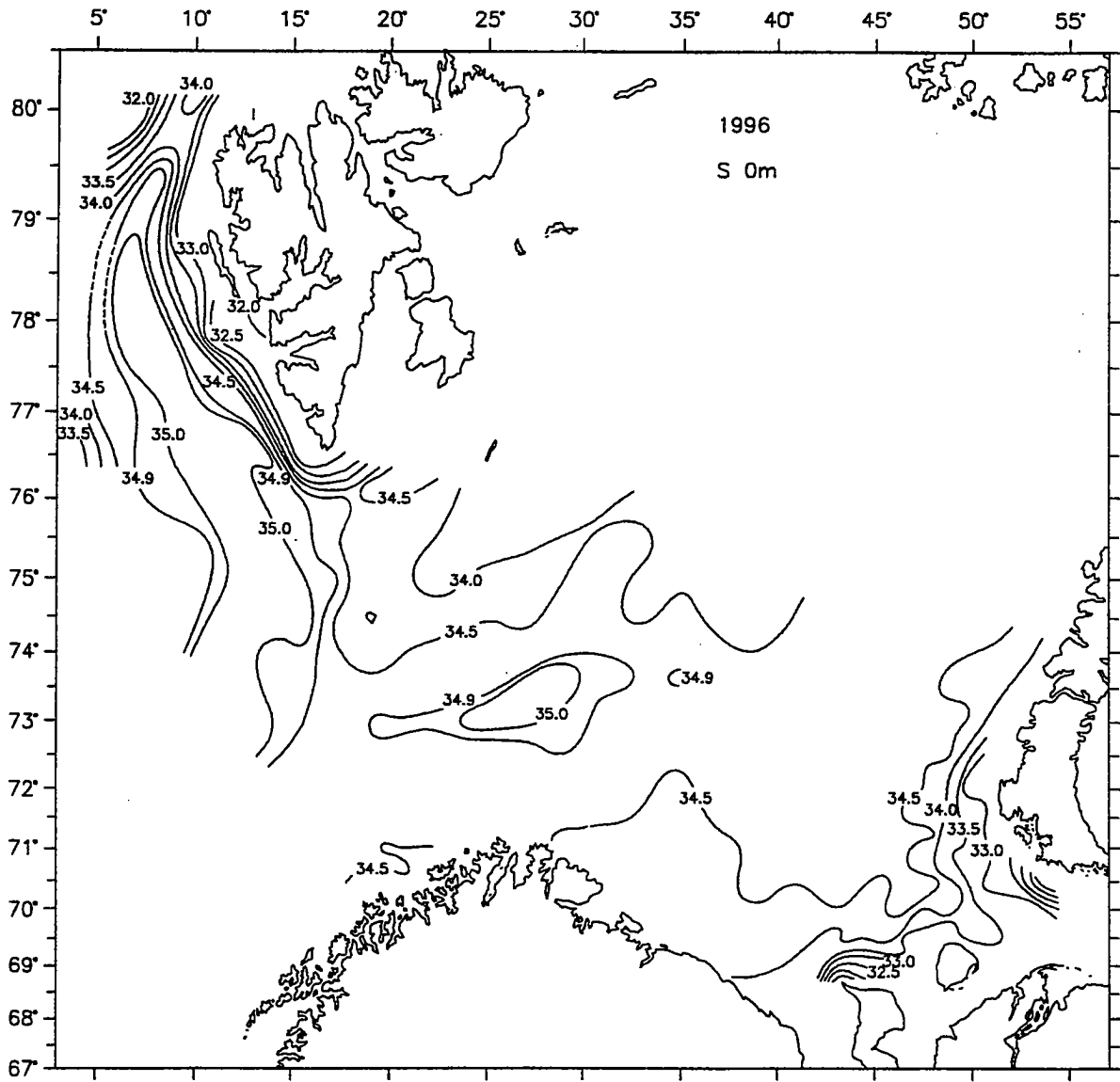


Fig. 3. Isohalines at 0m.

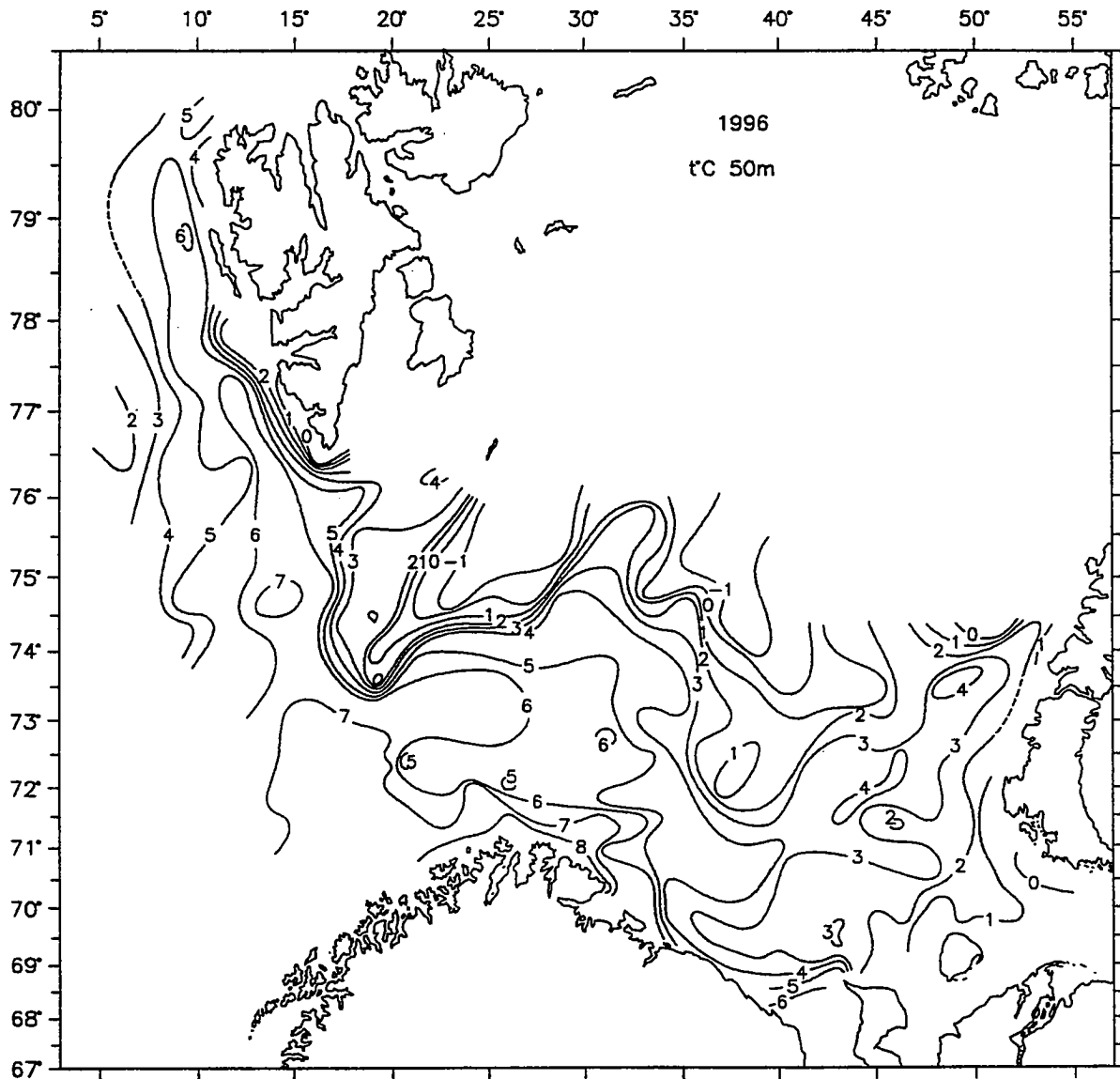


Fig. 4. Isotherms at 50m.

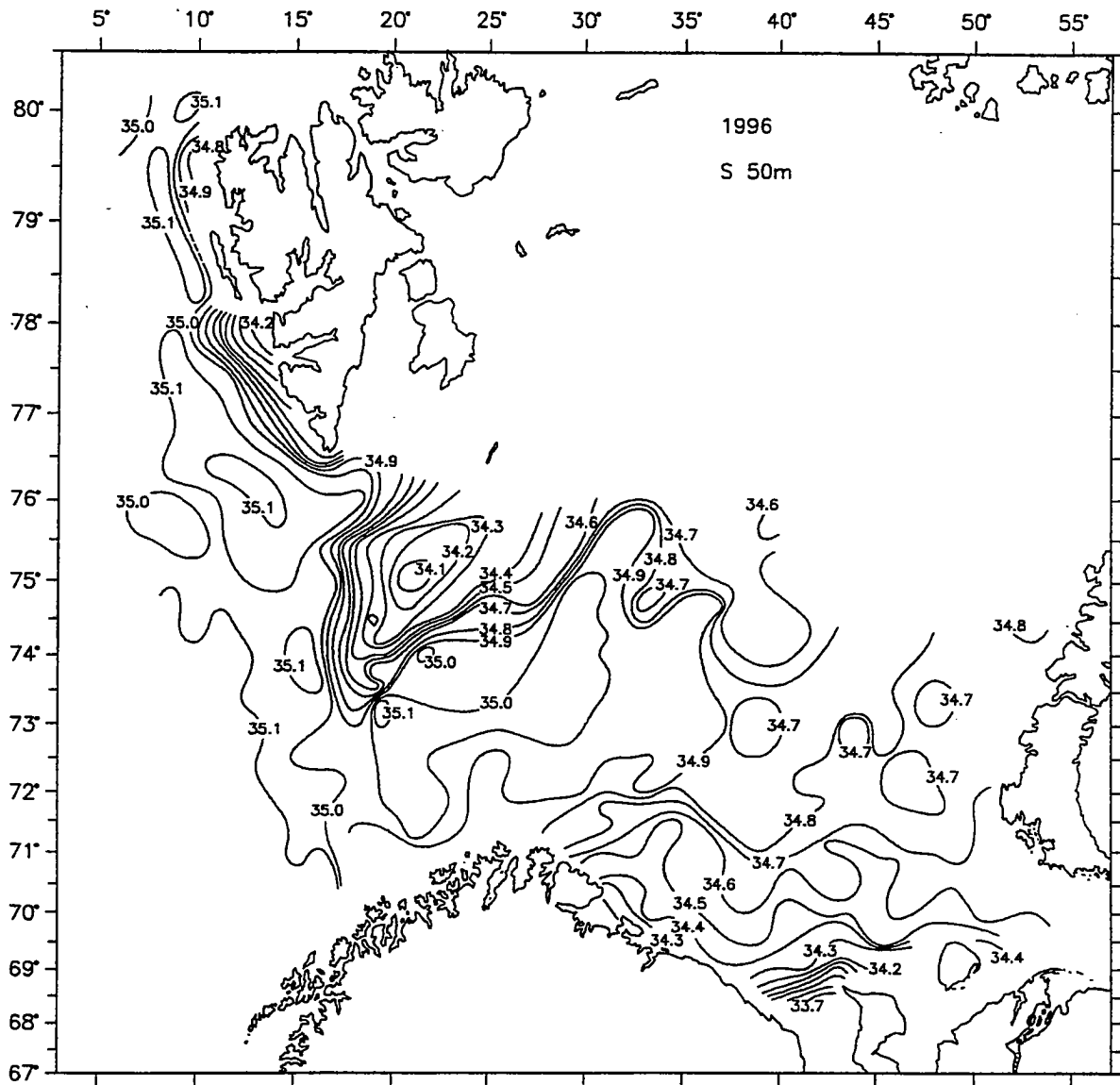


Fig. 5. Isohalines at 50m.

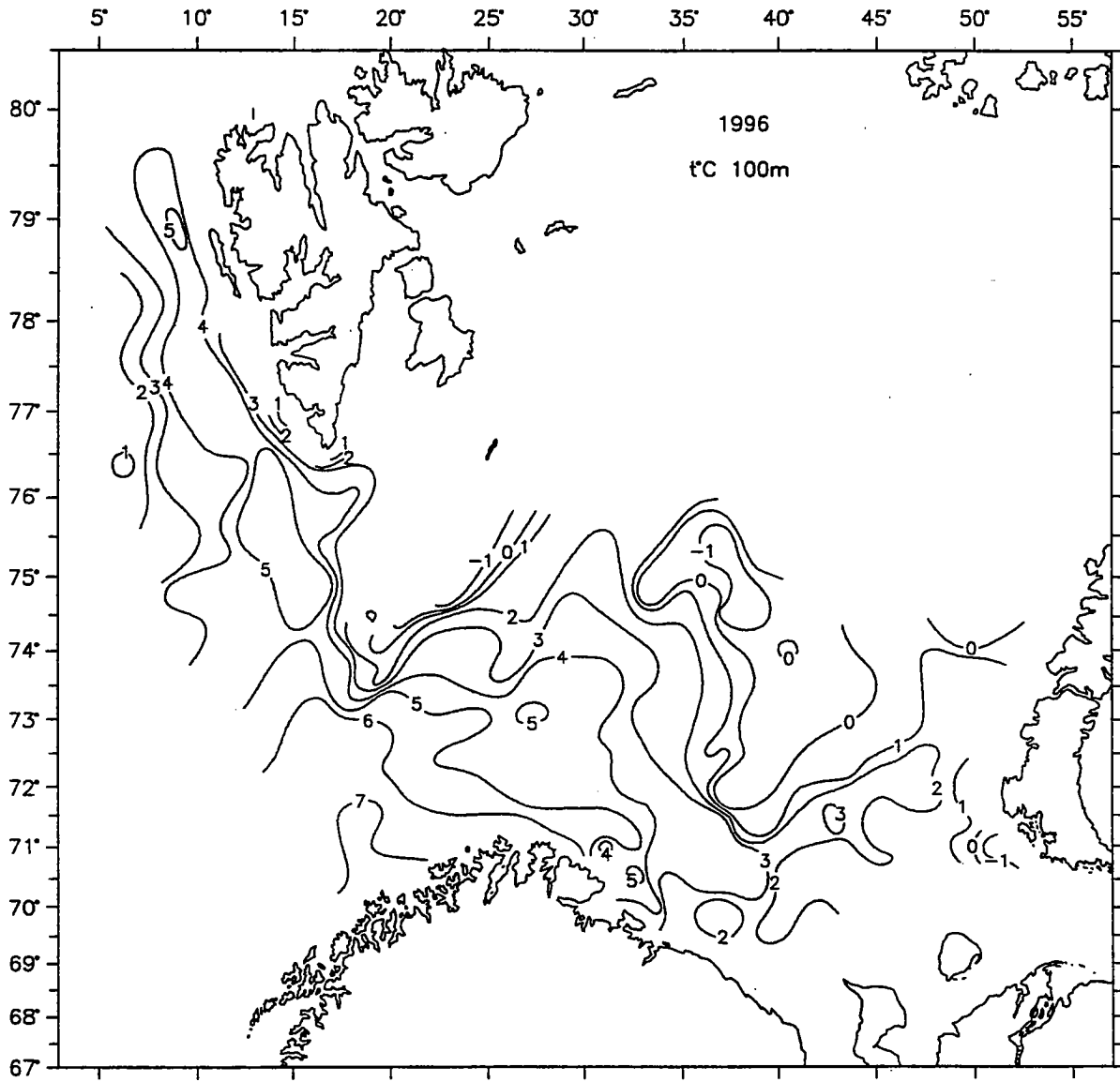


Fig. 6. Isotherms at 100m.



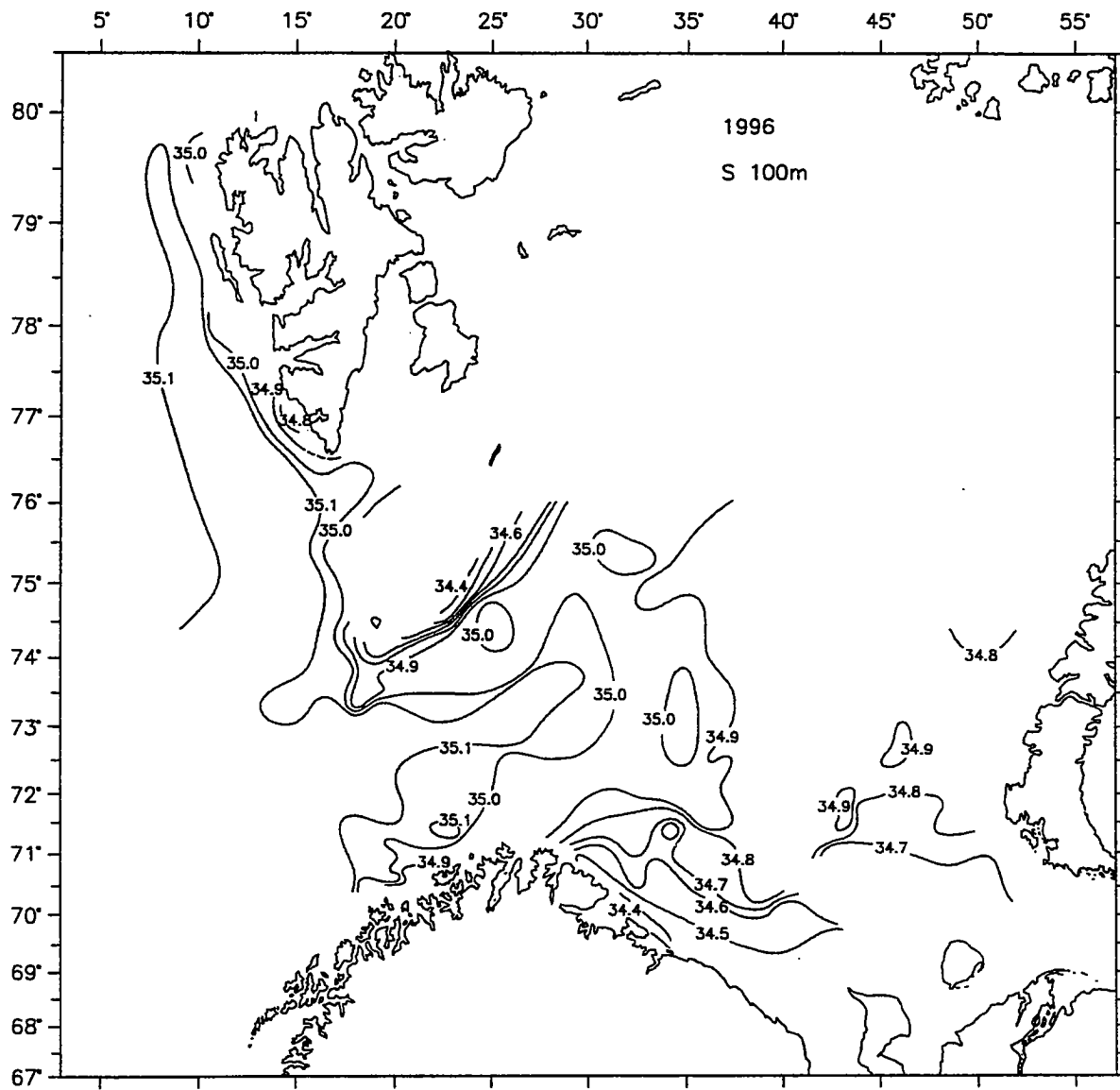


Fig. 7. Isohalines at 100m.

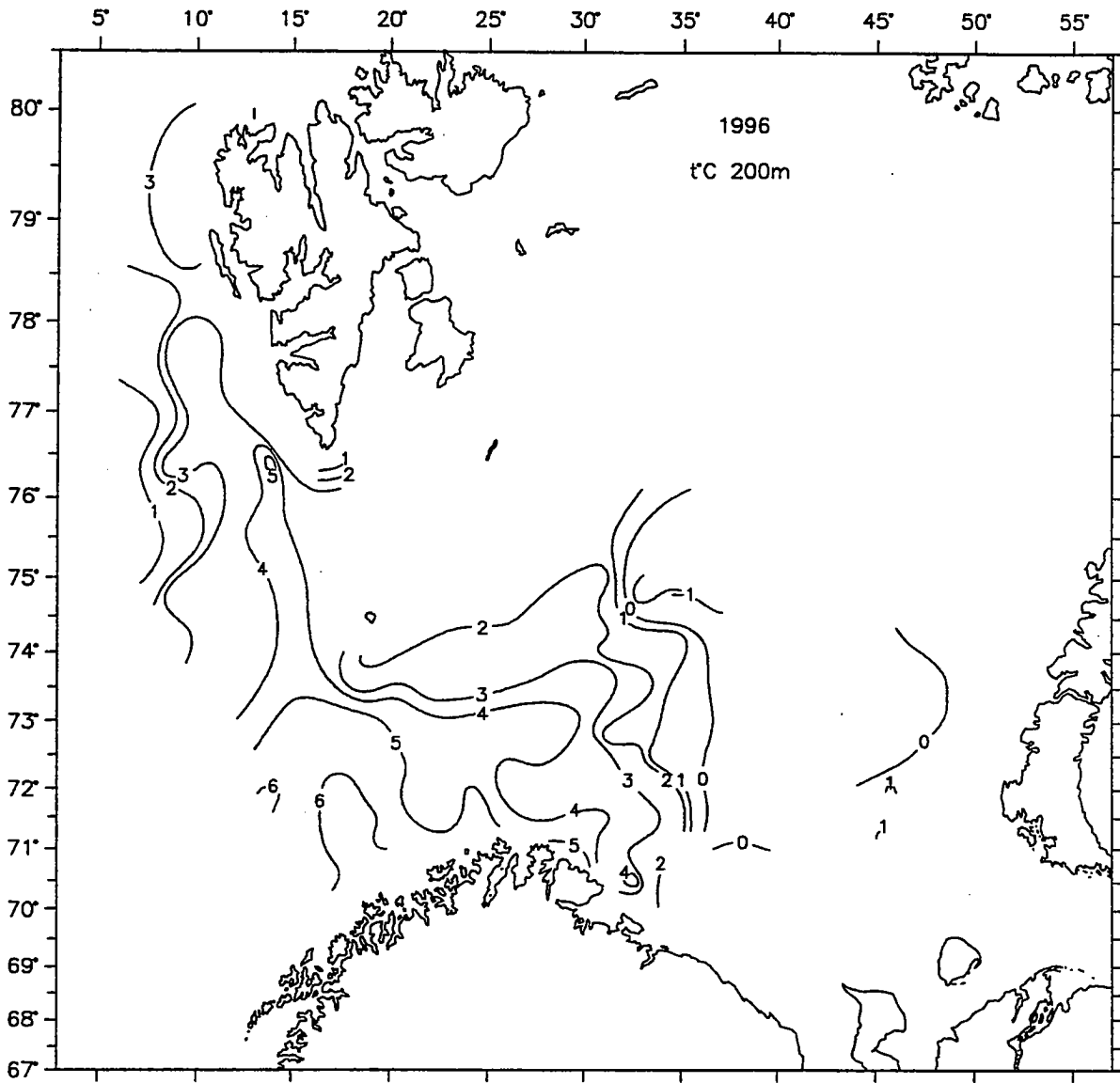


Fig. 8. Isotherms at 200m.

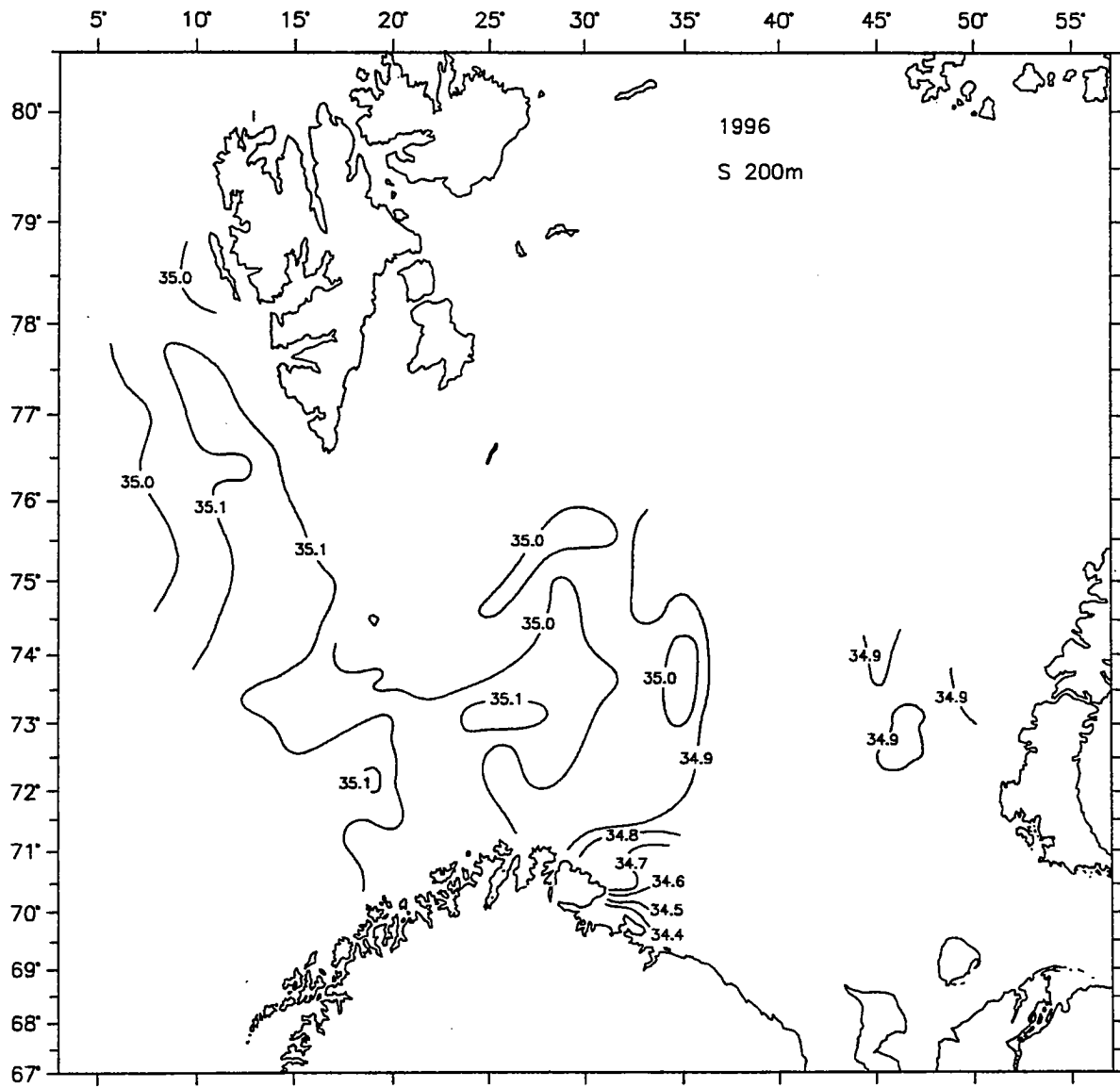


Fig. 9. Isohalines at 200m.

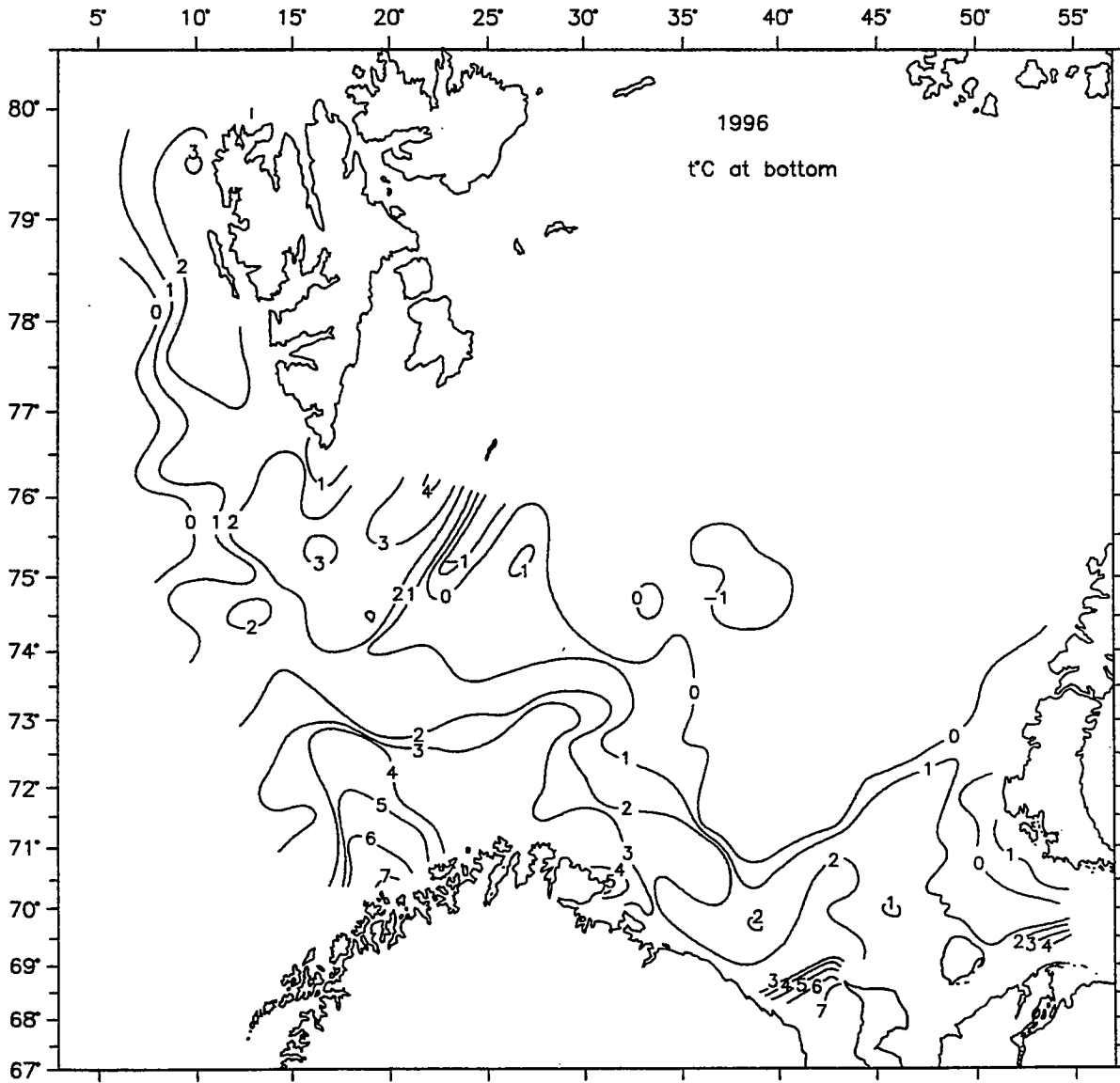


Fig. 10. Isotherms at the bottom.

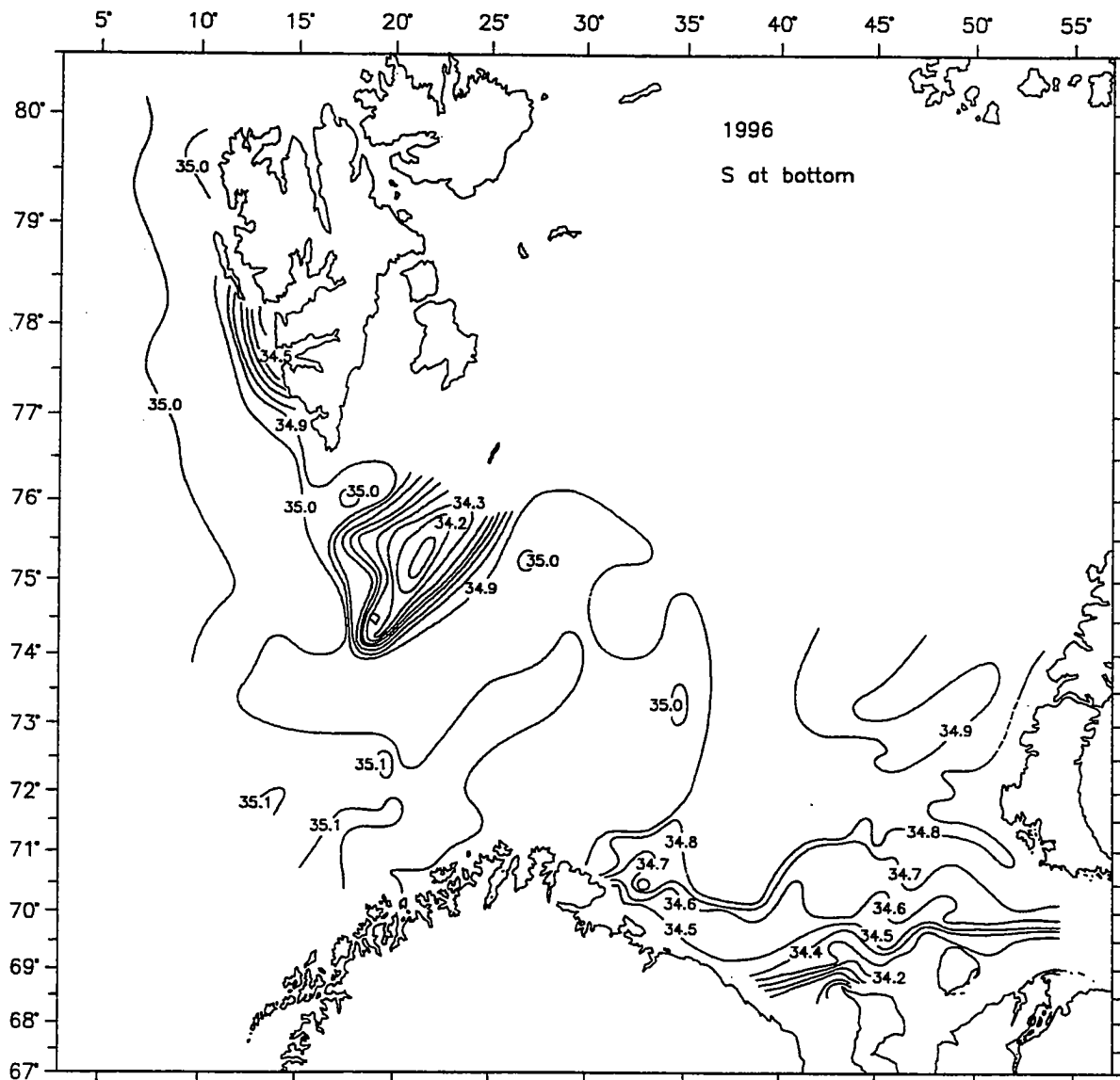


Fig. 11. Isohalines at the bottom.

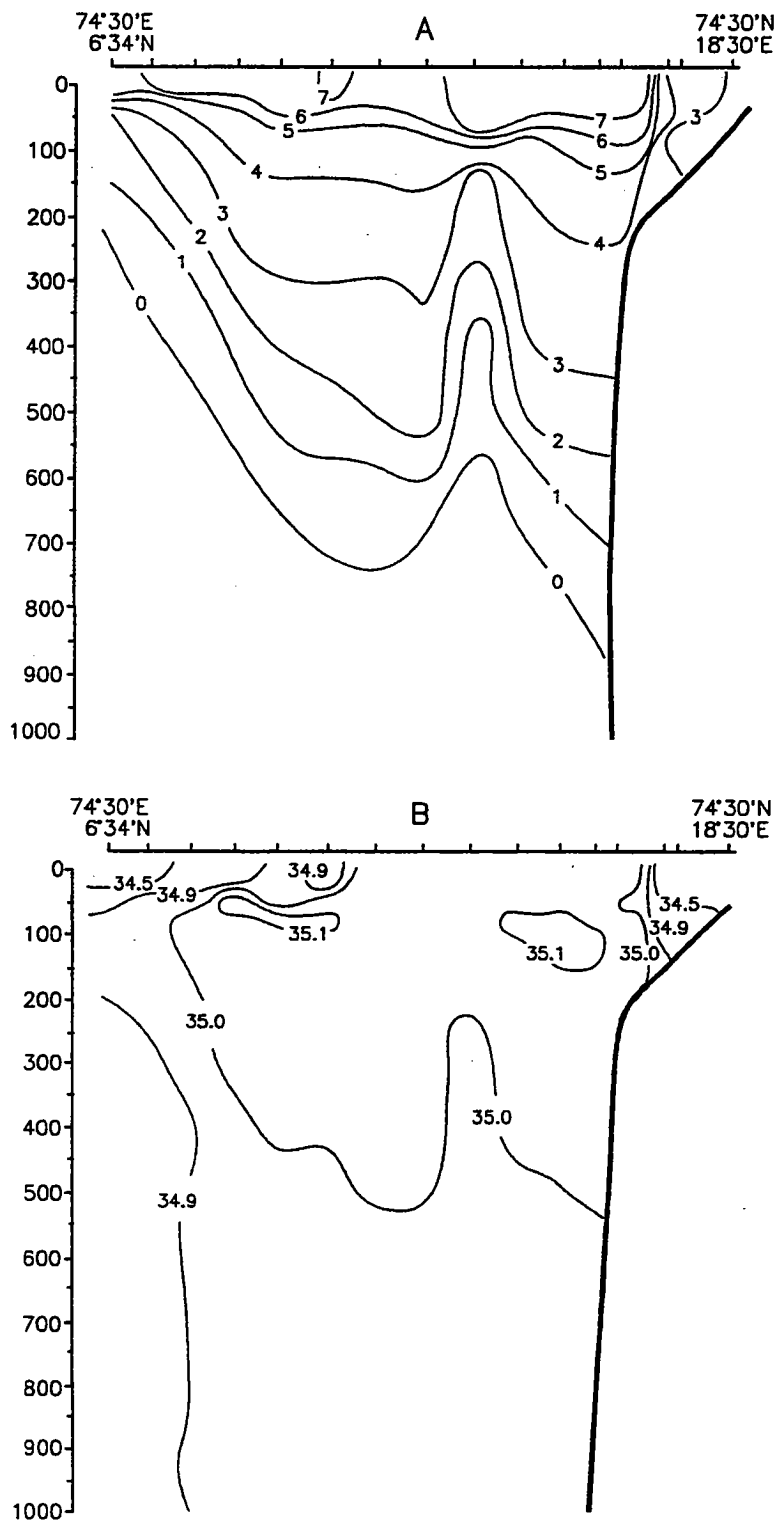


Fig. 12. Hydrographic section  
Bear Island - West  
Temperature (A) and salinity (B).

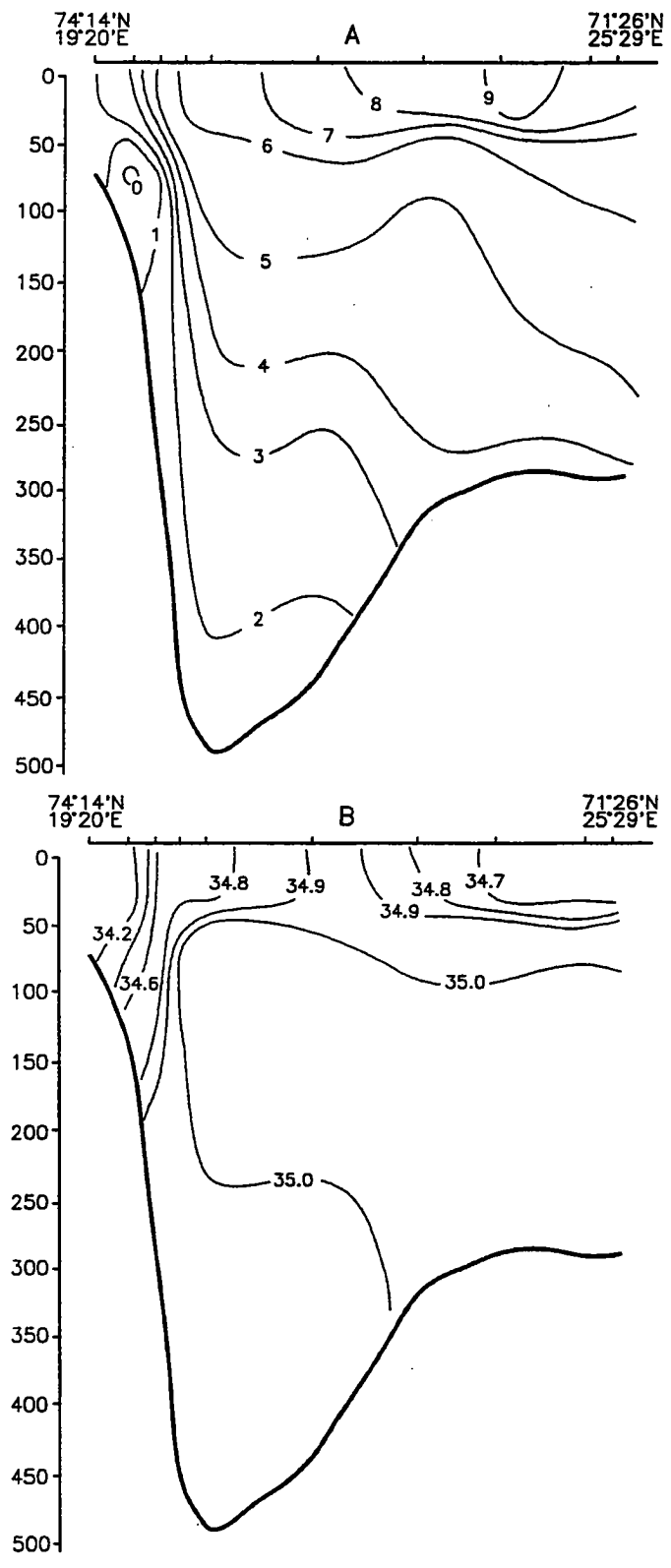


Fig. 13. Hydrographic section  
North Cape - Bear Island  
Temperature (A) and salinity (B).

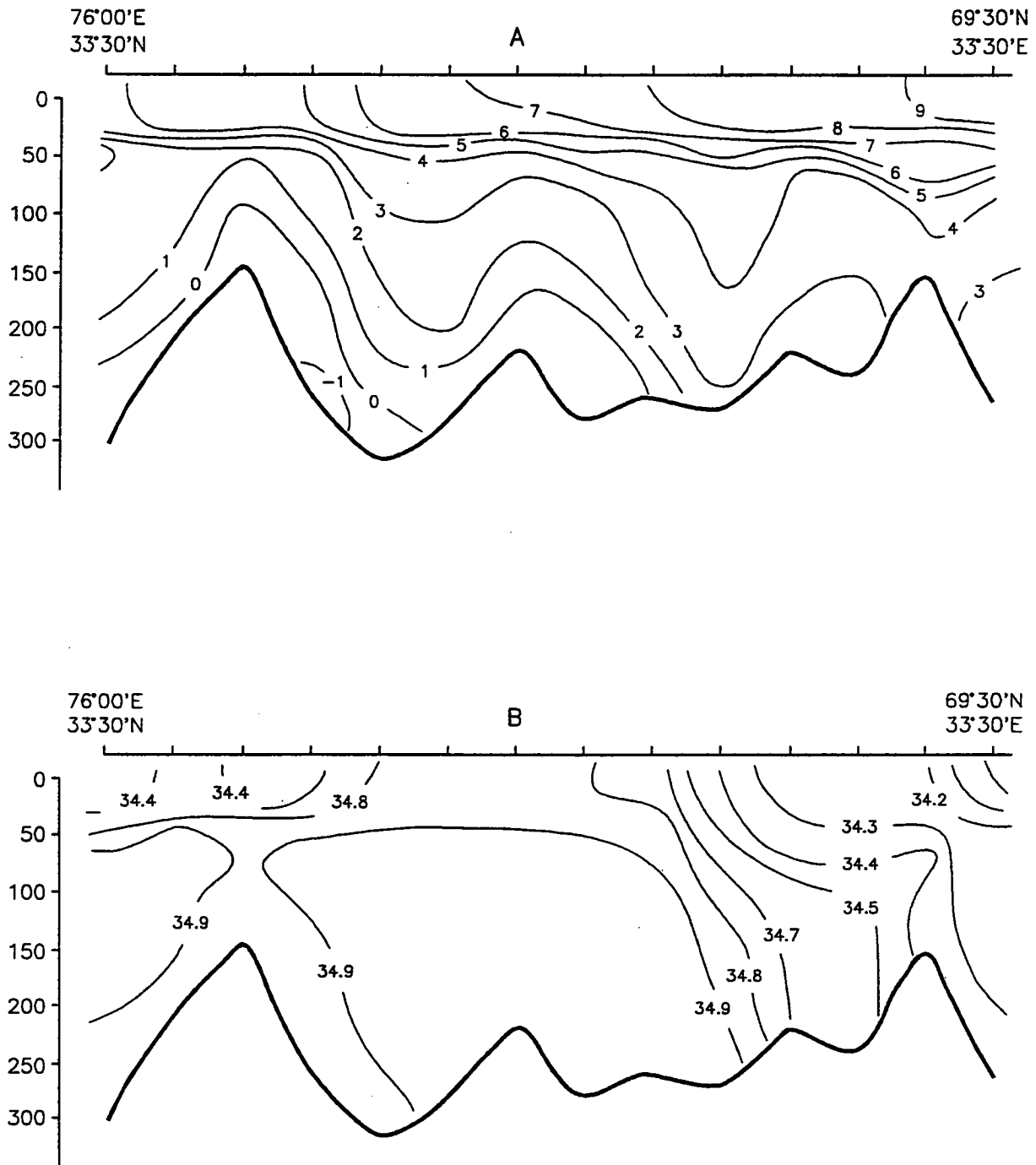


Fig. 14. Hydrographic section along the Kola meridian  
Temperature (A) and salinity (B).



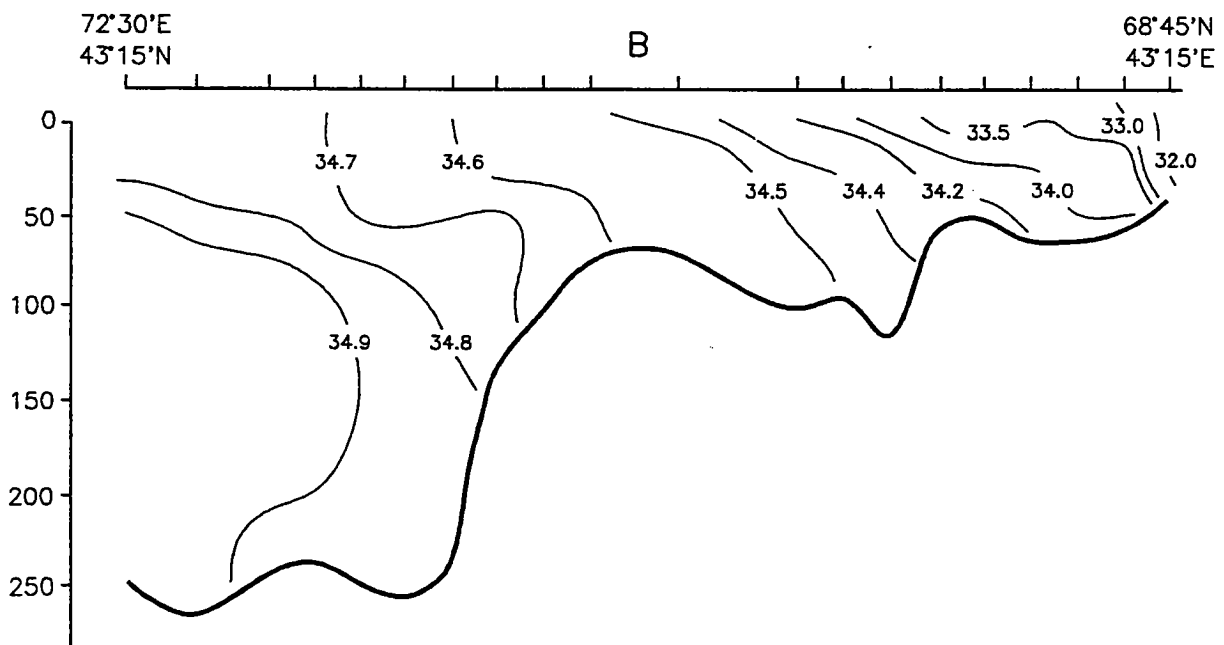
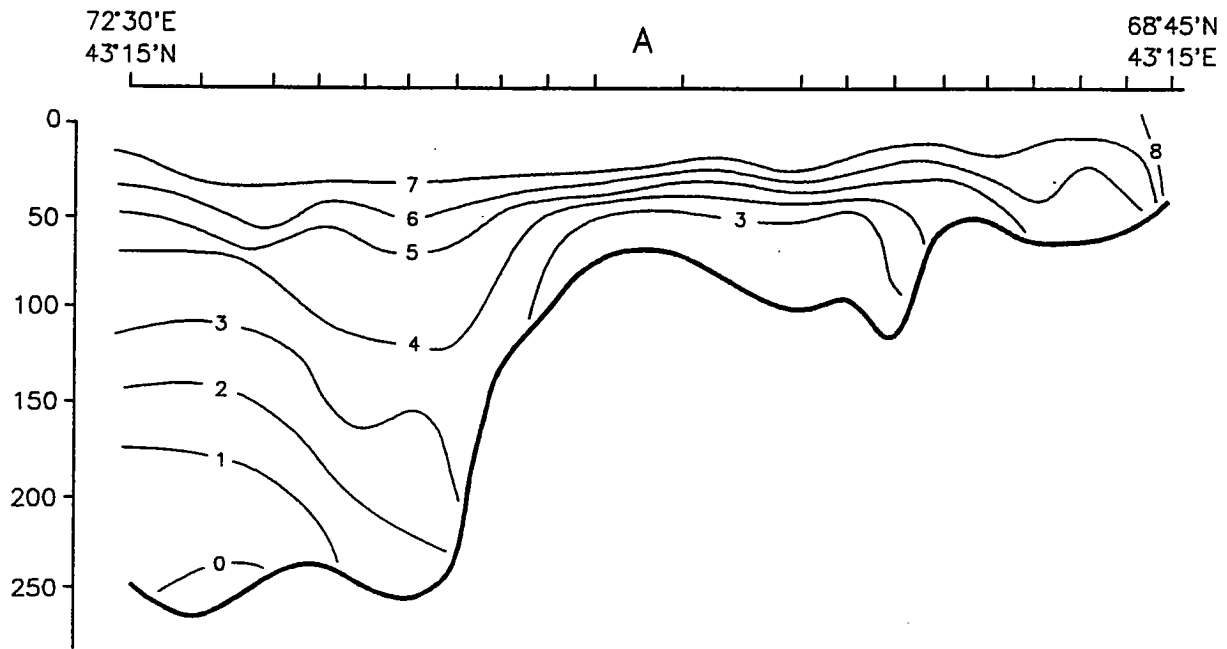


Fig. 15. Hydrographic section Cape Kanin - North  
Temperature (A) and salinity (B).

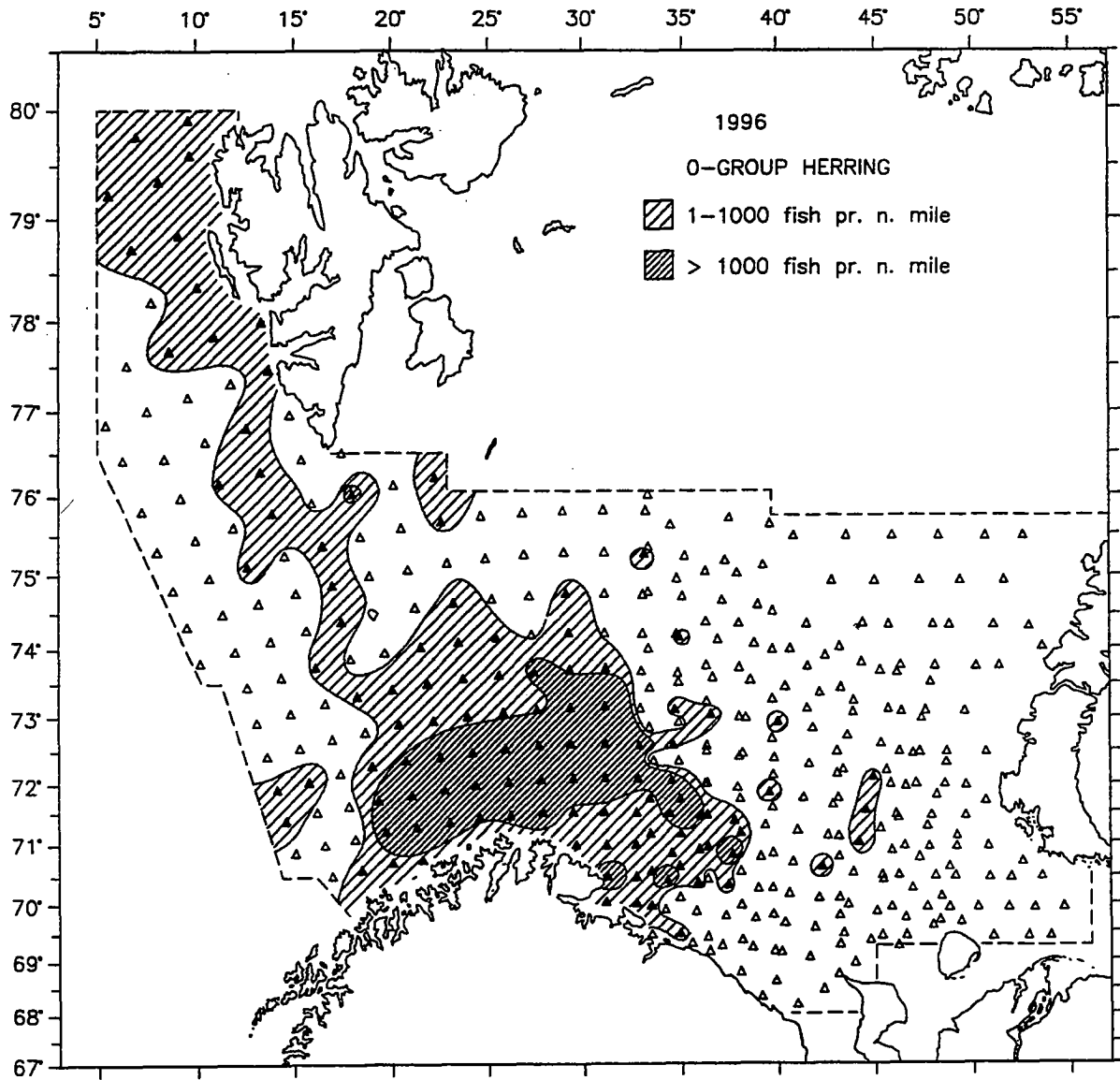


Fig. 16. Distribution of 0-group herring.

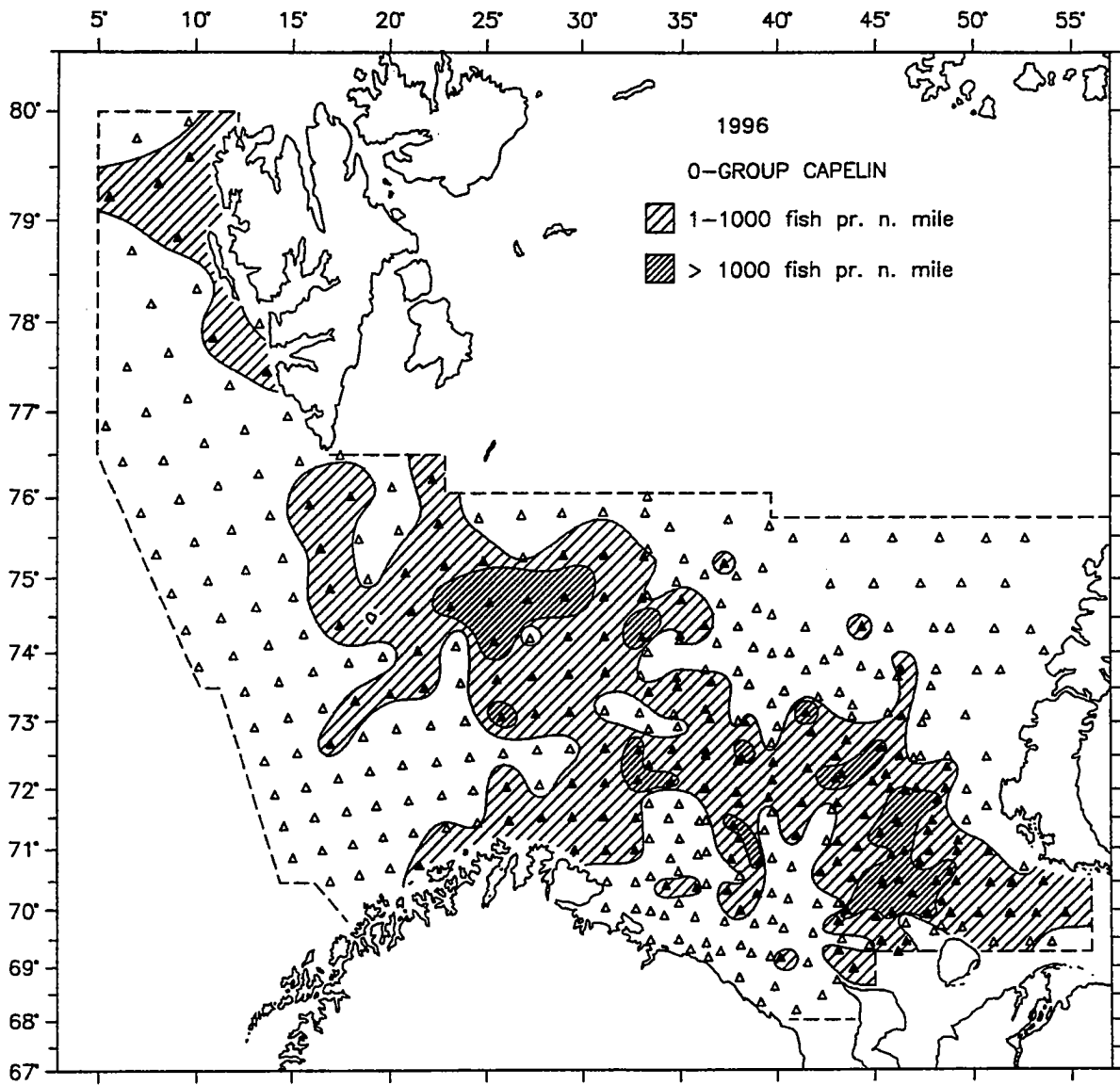


Fig. 17. Distribution of 0-group capelin.

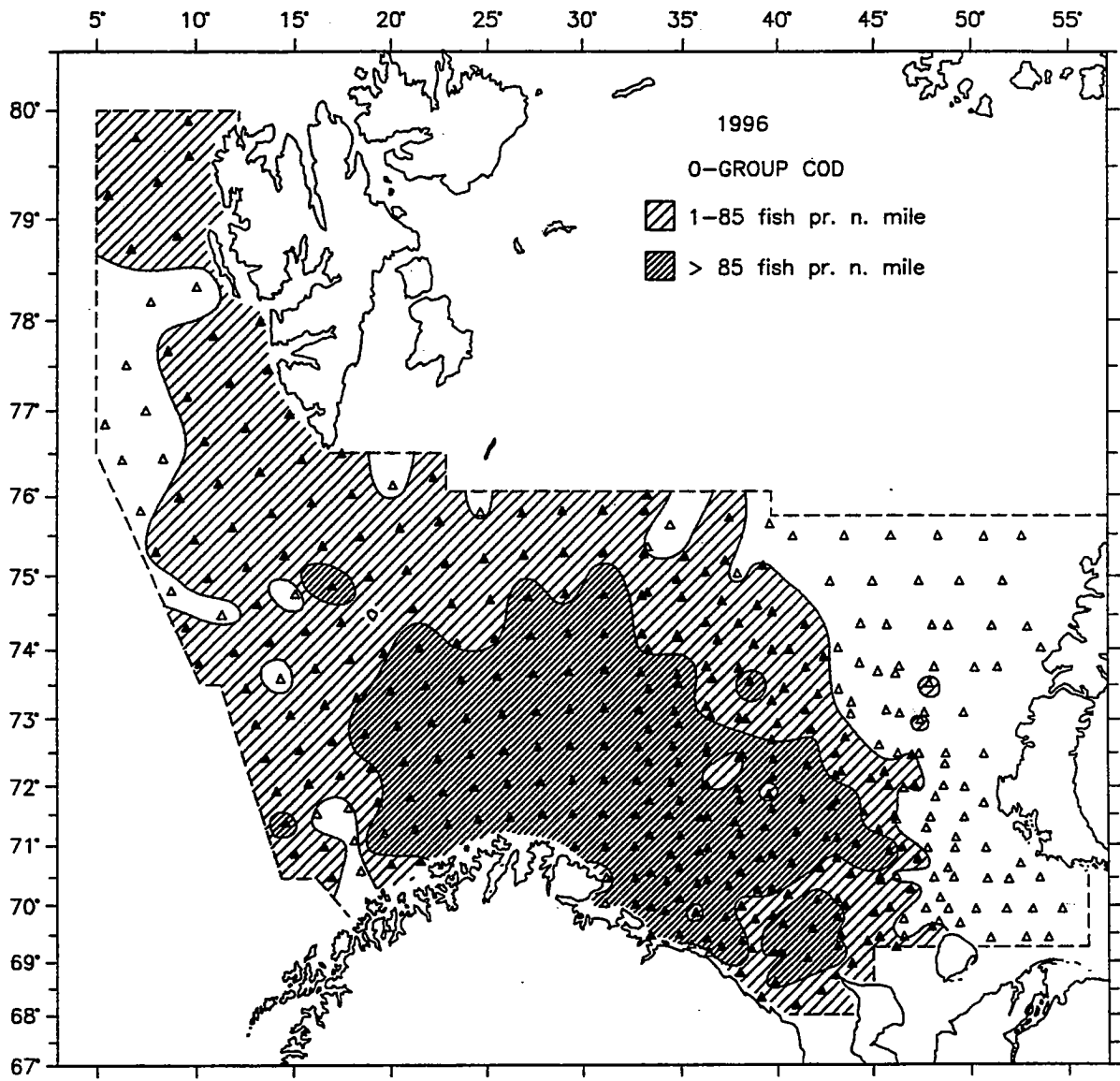


Fig. 18. Distribution of 0-group cod.

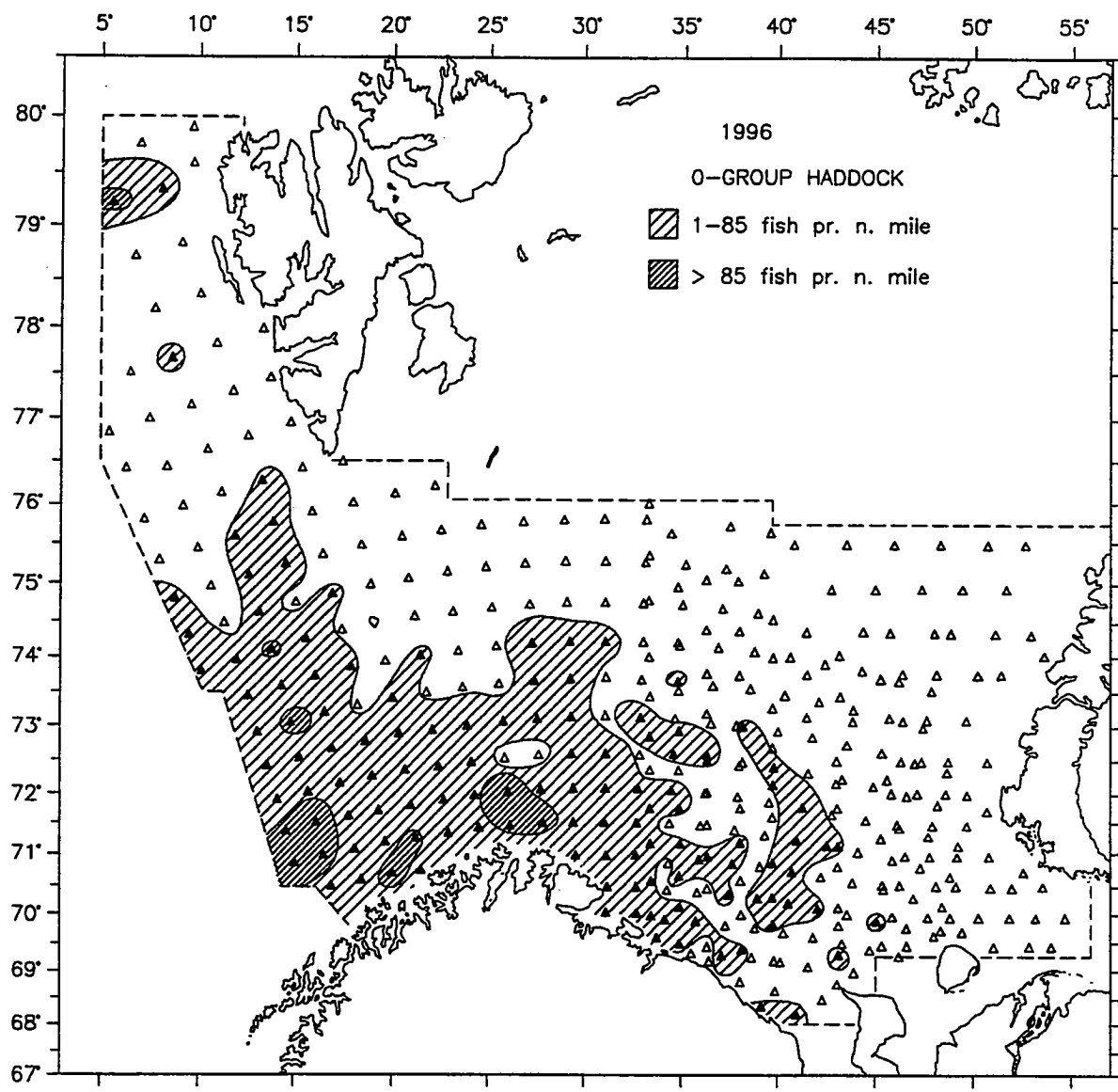


Fig. 19. Distribution of 0-group haddock.

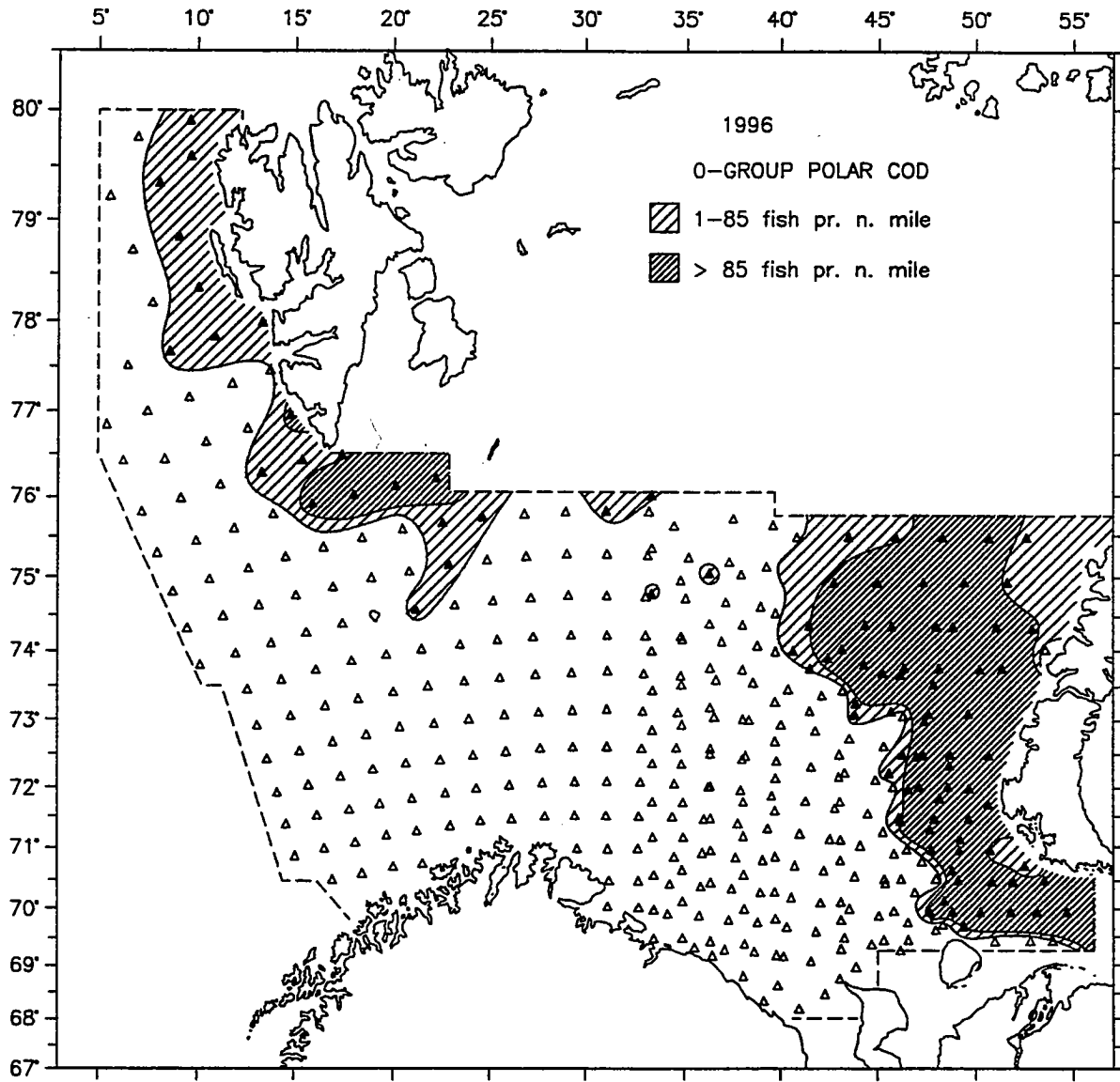


Fig. 20. Distribution of 0-group polar cod.

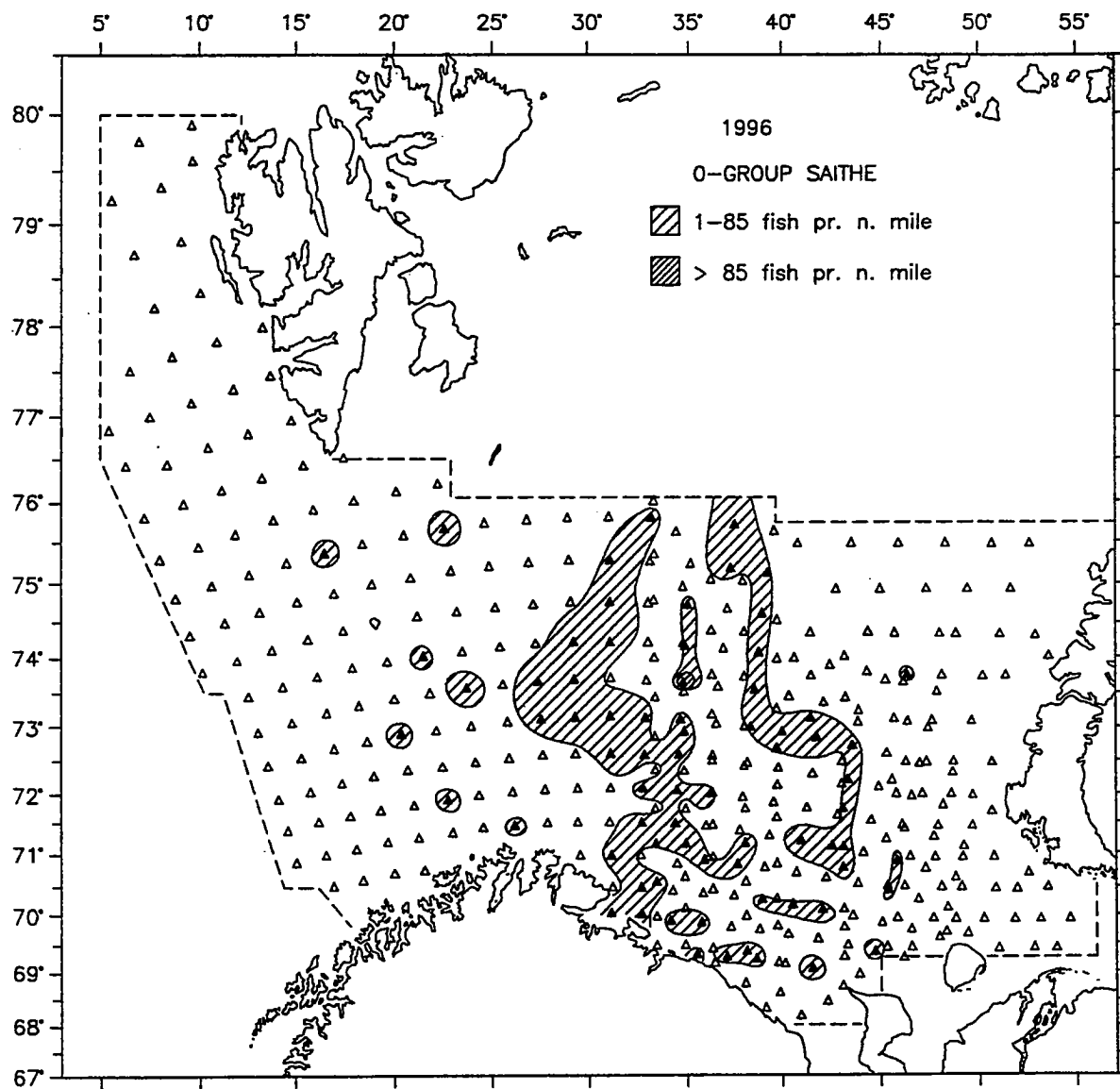


Fig. 21. Distribution of 0-group saithe.

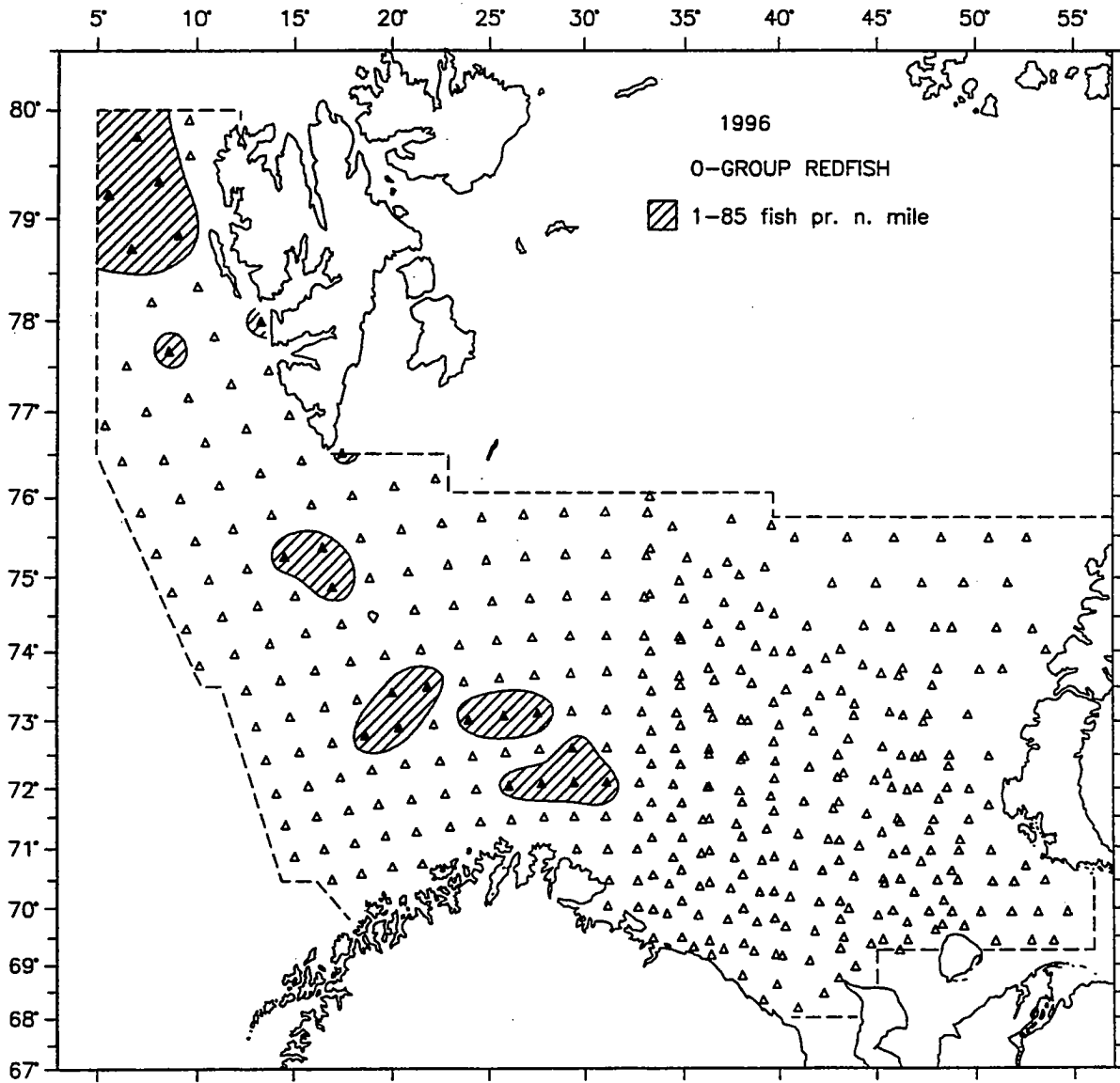


Fig. 22. Distribution of 0-group redfish.



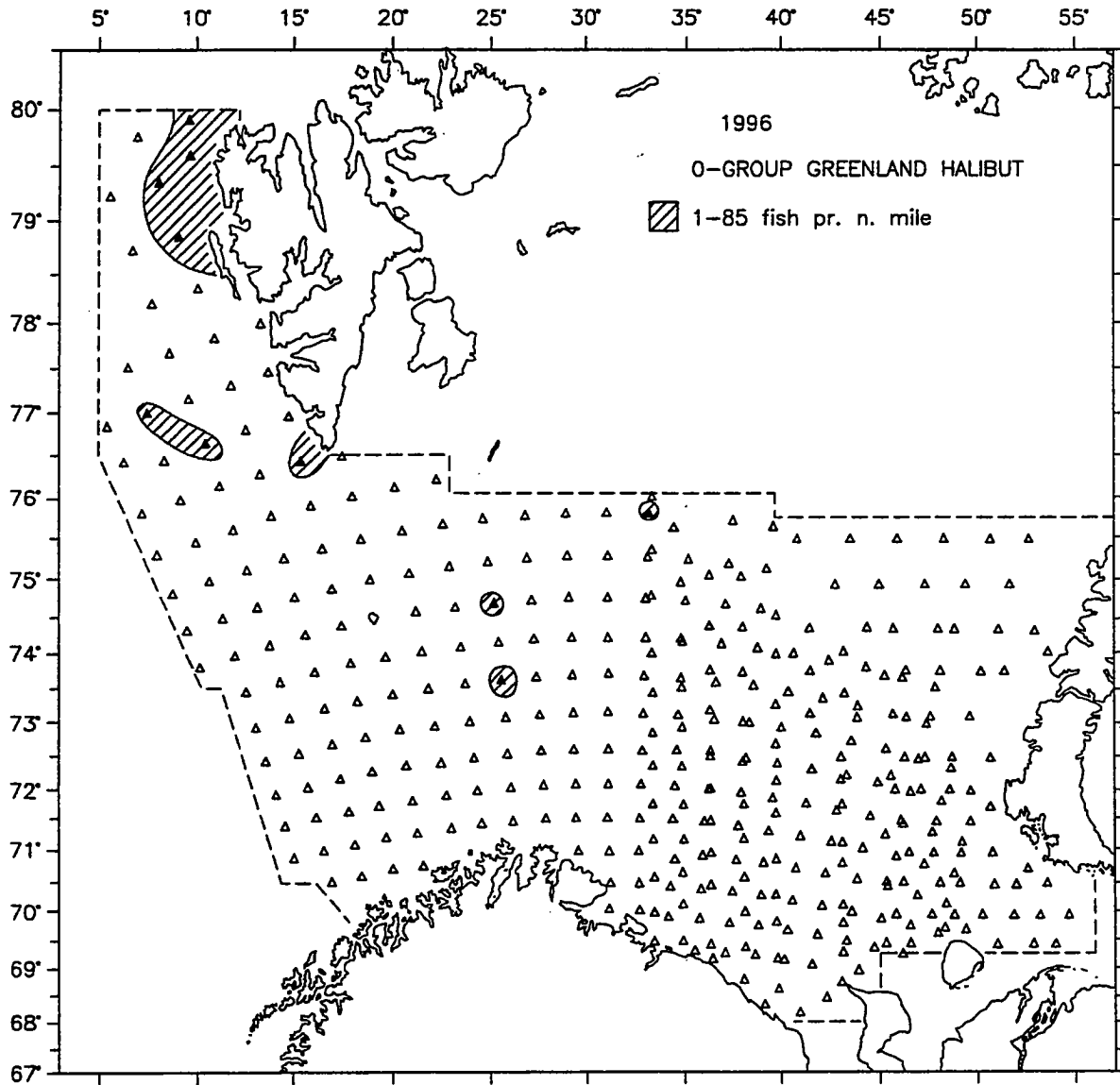


Fig. 23. Distribution of 0-group Greenland halibut.

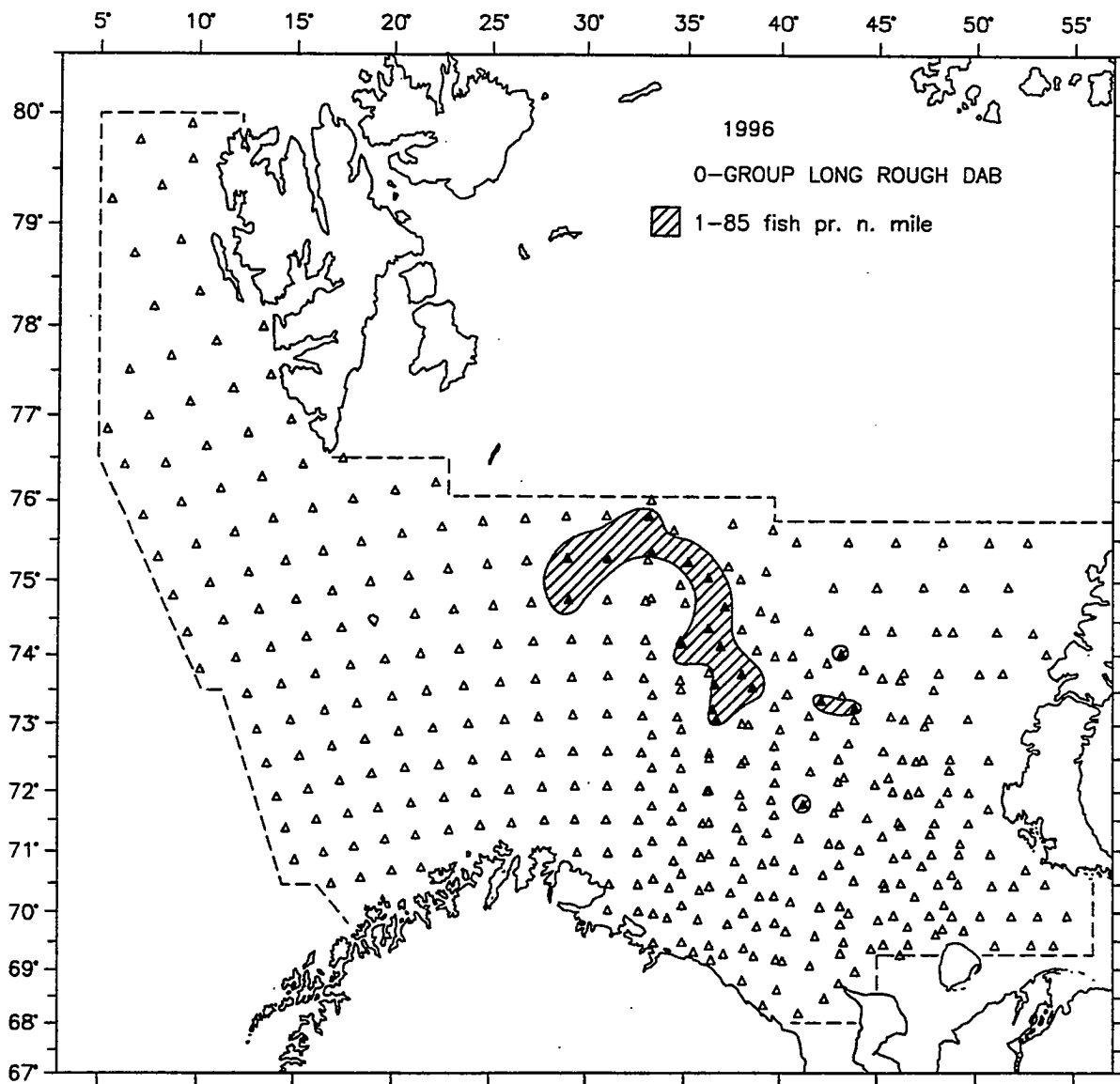


Fig. 24. Distribution of 0-group long rough dab.

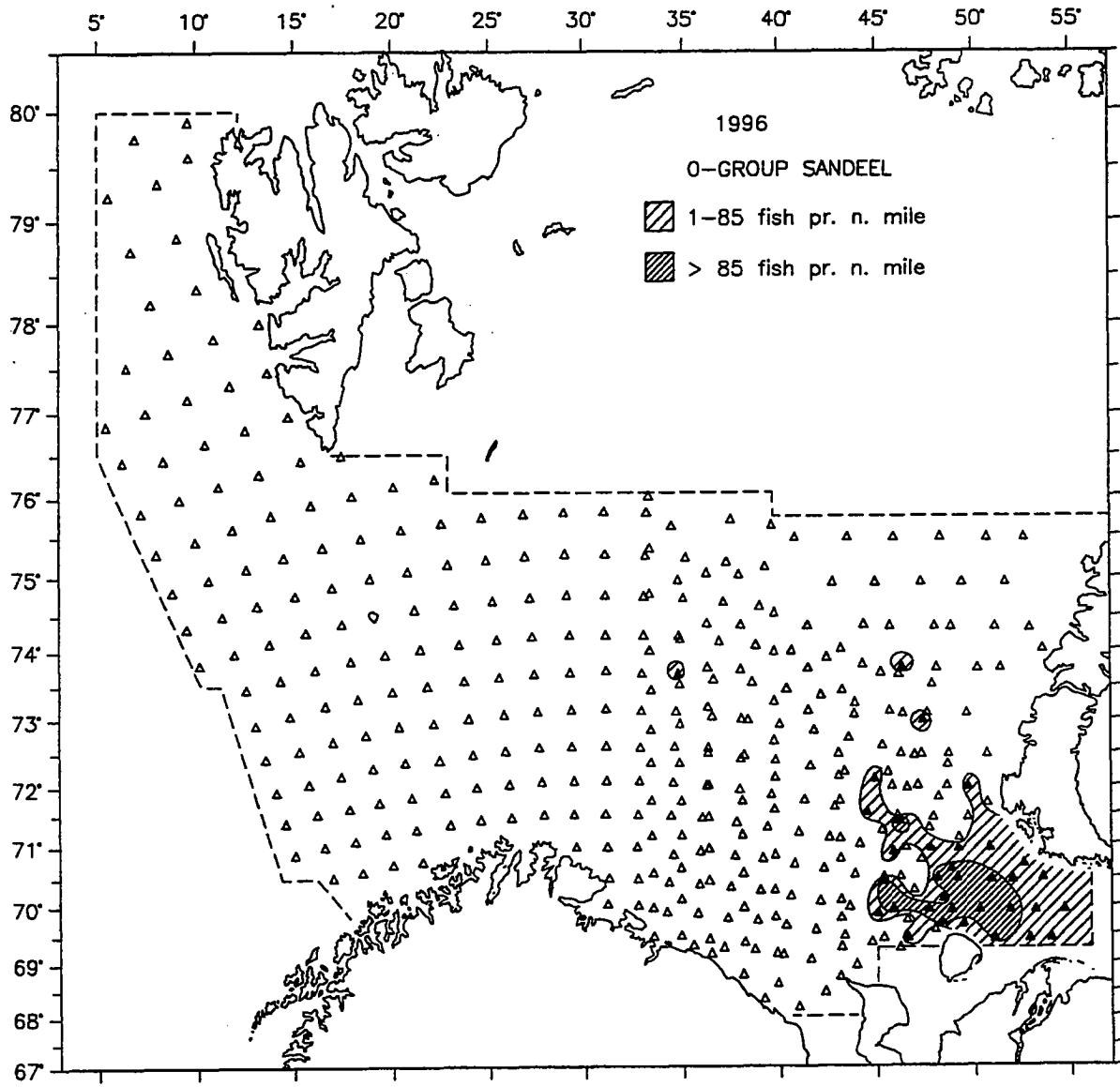


Fig. 25. Distribution of 0-group sandeel.

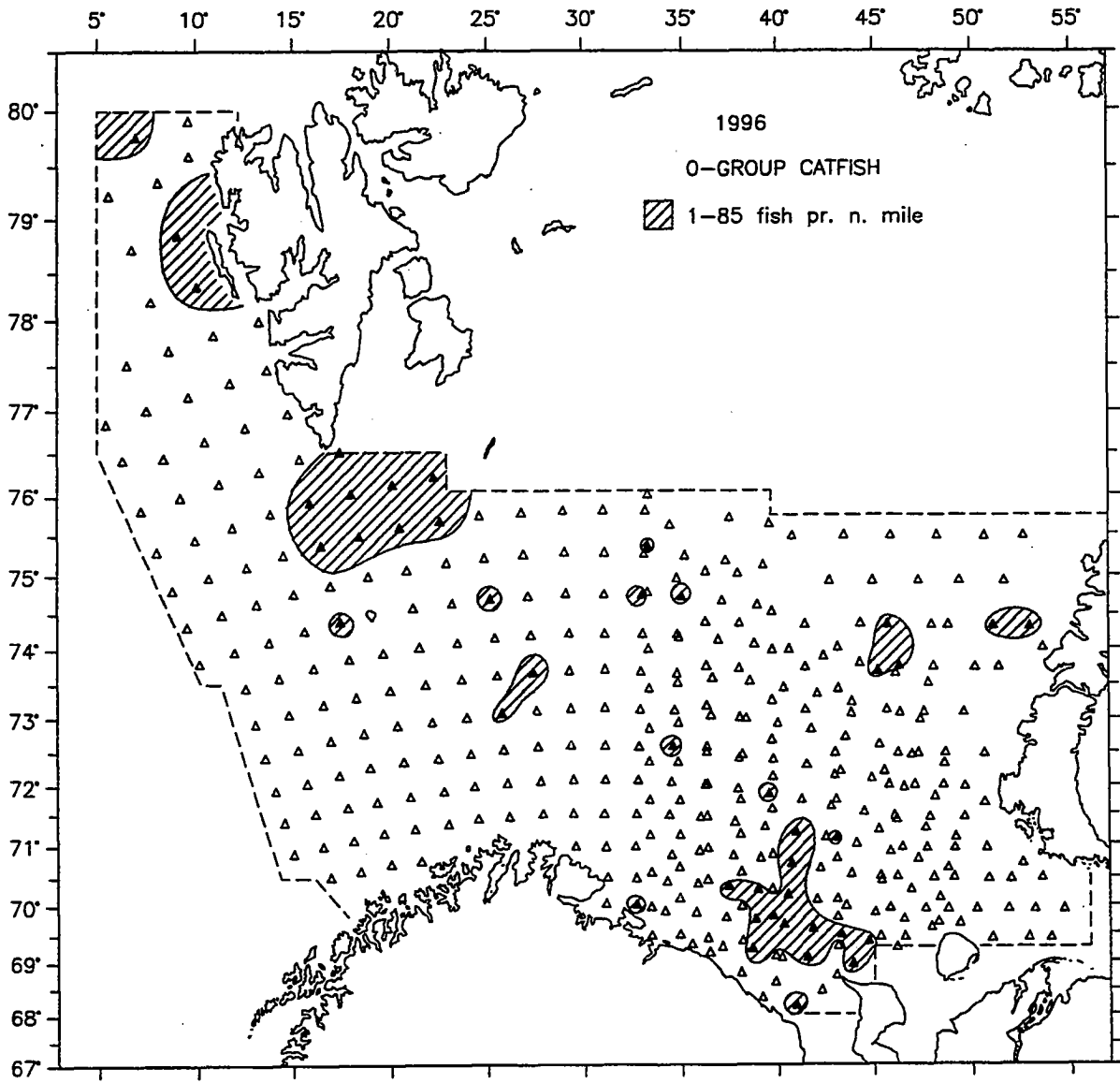


Fig. 26. Distribution of 0-group catfish.

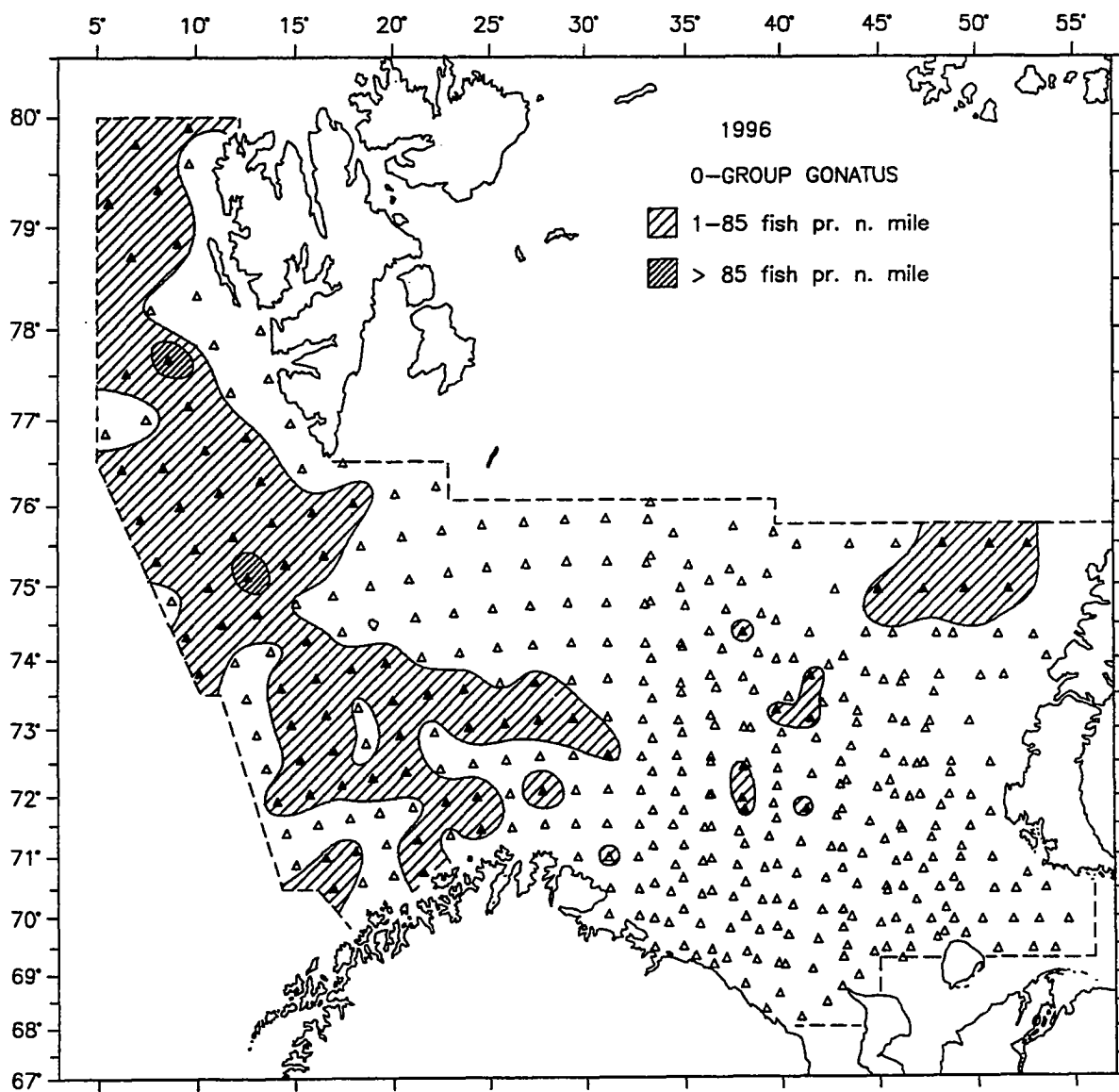


Fig. 27. Distribution of 0-group *Gonatus fabricii*.

## APPENDIX

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