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PRELIMINARY REPORT OF THE INTERNATIONAL 0-GROUP FISH SURVEY IN THE
BARENTS SEA AND ADJACENT WATERS IN AUGUST-SEPTEMBER 1986

The twenty-second annual International 0-group fish survey was made during the period 11 August - 4 September 1986 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey period	Research Institution
Norway	"Eldjarn"	20 August-4 September	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	11 August-4 September	"
Norway	"Håkon Mosby"	20 August-3 September	"
USSR	"Kokshaysk"	21 August-1 September	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
USSR	"Vilnius"	20 August-2 September	"

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

Preliminary analyses of the survey data were made 4-5 September in Hammerfest. Observations concerning the geographical distribution of 0-group fish and their abundance are given in this report together with a brief description of the temperature conditions in the area.

MATERIAL AND METHODS

The geographical distribution of 0-group fish were estimated by fishing with a small mesh midwater trawl. The vessels participated in the survey in 1986 used the type of midwater trawl recommended by the meeting held after the survey in 1980 (ANON. 1983). The trawling procedure was standardized in accordance with recommendation made at the same meeting. At about every 30 nautical miles sailed the trawl was towed in several depths in one haul. The standard procedure consisted of towings of 0.5 nautical mile in each of 3 depths with the headline of the trawl located at 0, 20 and 40 m. An additional tow at 60 m for 0.5 nautical mile was made when 0-group fish layer was recorded deeper than 60 m on the echosounder.

Survey tracks and hydrographic stations are given in Fig. 1. Trawl stations with and without catch are given on the distribution charts in Fig. 8-16, as filled and open symbols respectively. The density grading is based on catch in number per 1.0 nautical mile trawled.

HYDROGRAPHY

Hydrographic observations were made along all the survey tracks normally after each 30 nautical miles sailed. Horizontal temperature distributions are shown for 0, 50, 100 and 200 m depth (Figs. 2-5). Figs. 6-9 show the temperature conditions at the Kola, Cape Kanin, North Cape - Bear Island and Bear Island- West sections. The mean temperature of these sections are given in Table 1. The 1986 data have been included in the calculations of the long-term means for these sections.

The analyses of the data has indicated a higher heat content of water masses in the survey area caused by an increased influx of water of Atlantic origin. Comparison of isotherm distributions with those of the previous year confirms this conclusion. Thus, at the 100 m depth the 6 °C isotherm has been observed at 74°30'N, whereas the temperature recorded here the year before was below 6 °C. At the surface the 9 °C isotherm reaches as far as the Kola meridian while in the previous year it was observed only east to the North Cape. The average temperatures compared to the long-term mean for 1965 - 1986 by section are as follows:

Kola section

The water temperature in the 0 - 50 m layer was 0.9 °C above that in the preceding year and 0.3 °C higher than the long term mean. This may be caused by solar radiation as well as the increased inflow of Atlantic water. The temperatures in the 50 - 200 and 0 - 200 m layers were close to that observed in the previous year and somewhat lower average one.

Cape Kanin - North

In comparison to 1985, there was an increase observed in the temperature of the 0 m - bottom layer in the southern part of the section while in the northern part the temperature in this layer was close to average and similar to the preceding year.

North Cape - Bear Island section

The temperature in the 0 - 200 m layer was 0.6 °C higher than in 1985 and 0.2 °C above the long-term mean.

Bear Island - West section (along 74°30')

In the 0 - 200 m layer the temperature was near average but lower than in the previous year. It is noteworthy that the warm water inflow is distributed more to the east with higher temperatures than last year. At the same time an increase in Arctic water influx from the north was observed which contributed to the formation of the clearly pronounced frontal zone. The general heat content was therefore lower than in the previous year.

DISTRIBUTION AND ABUNDANCE OF 0-GROUP FISH

Geographical distributions of 0-group fish are shown as shaded areas in Figs. 10 - 19. Double shading indicates dense concentrations. The criteria for discriminations are the same as used in earlier reports (ANON. 1980). Abundance indices, estimated as the area of distribution with areas of high densities weighted by 10, are given in Table 2. Another set of abundance indices is given for 0-group herring, cod and haddock (Table 3) as described by 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. 10)

The overall density and the area of distribution of herring is far smaller this year than it has been for the last three years. Only a few individuals are caught in the area covered by the five vessels. The estimated logarithmic index this year is zero indicating a weak year class comparable to the strength of the year classes in the early seventies and early eighties.

Capelin (Fig. 11)

Although the results from the Barents Sea 0-group survey have not given a reliable index of year class strength of capelin, it is evident that the 1986 year class is very weak. This year, the western limit of the area of distribution was to the east of 30°E and the density is much lower than it has been for any of the year classes in the period 1980-1985.

Cod (Fig. 12)

The 0-group cod is found most abundant in the eastern part of the investigated area. The highest densities are found further to the southeast than previous years, probably indicating a strong drift along the coastal currents. The indices given in Table 2 and 3 points to a strong year class in line with those of 1983 and 1984. The results indicates

the presence of four strong year classes following each other and this is very unusual.

Haddock (Fig. 13)

Haddock were only found in the central and southern part of the area. The distribution here is very much the same as last year. The indices given in Table 2 and 3 points to a year class of the same strength as 1982 and 1985 year classes, which are somewhat above average.

Polar cod (Fig. 14)

This year, polar cod was found as a continuous distribution from the east to the west in the northern part of the investigated area. The most dense concentrations were found in the eastern part of the survey area. Although the total area of distribution was not covered, the abundance index is the highest one for the eastern area since 1977. In the area to the west of 25°E, the high density also here indicate this year class to be a strong one.

Redfish (Fig. 15)

The redfish is found much further east than usual and the western border is further to the east than last year. The highest abundance is found north of Troms. The index in Table 2 is high and in line with previous years.

Greenland halibut (Fig. 16)

The distribution resembles the distribution found in recent years, except patches of Greenland halibut are also found all over the eastern area. The highest densities are found west of Spitsbergen. The index in Table 2 is the highest recorded.

Long rough dab (Fig. 17)

Long rough dab is extremely abundant this year and is found in high concentrations throughout the central and eastern area. The index given in Table 2 is 10 times that of the preceding three years, which was close to average and five times the highest recorded previously.

Blue whiting (Fig. 18)

This map is included only to show the distribution and no indices are given.

Sandeel (Fig. 19)

Sandeel was found in high concentrations to the south-east. This is the same area as cod and capelin were found in high concentrations. Data from the survey also indicated that there were high concentrations of zooplankton in this area. No index is calculated for sandeel.

Squid

Squid were widely distributed throughout the western part of the survey area, but very little squid occurred east of the Kola section. The abundance of squid was also at a higher level than observed in previous surveys.

REFERENCES

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- Randa, K. 1984. Abundance and distribution of 0-group Arcto-Norwegian cod and haddock 1965-1982. *Proceedings of the Soviet-Norwegian symposium on Reproduction and recruitment of Arctic cod. Leningrad 26-30 Sept. 1983*: 192-212.
- Toresen, R. 1985. Recruitment/indices of Norwegian spring-spawning herring for the period 1965-1984 based on the international 0-group fish surveys. *Coun. Meet.int. Coun. Explor. Sea, 1985 (H:54)*: 1-9 [*Mimeo.*]

Table 1. Mean water temperature during the International 0-group fish survey in the Barents Sea and adjacent waters in late August - early September 1986

- 2-4 - Murmansk Current: Kola section (70°30'N - 72°30'N)
 5 - Cape Kanin section (68°45'N - 70°05'N)
 6 - Cape Kanin section (71°00'N - 72°00'N)
 7 - North Cape Current: North Cape- Bear Island section (71°33'N;
 25°02'E - 73°35'N; 20°46'E)
 8 - West Spitsbergen Current: Bear Island - West section (06°34'E
 - 15°55'E)

Layer/ Year	0-50m	50-200m	0-200m	0- bottom	0- bottom	0-200m	0-200m
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
1965	6.7	3.8	4.6	4.8	4.2	5.1	-
1966	6.7	2.6	3.6	2.0	2.5	5.5	3.3
1967	7.5	4.0	4.9	6.1	3.6	5.6	4.2
1968	6.4	3.7	4.4	4.7	3.1	5.4	3.6
1969	6.9	3.1	4.0	2.6	2.3	6.0	4.2
1970	7.8	3.6	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	5.5	5.7	4.5	5.9	5.0
1974	8.1	3.9	4.9	4.6	-	6.1	4.6
1975	7.0	4.6	5.2	5.6	4.3	5.7	4.9
1976	8.1	4.0	5.0	4.9	4.6	5.7	5.0
1977	6.9	3.4	4.3	4.1	3.3	4.8	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	1.8	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	2.5	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	5.4	4.1	5.9	5.0
1985	6.6	3.5	4.3	3.3	3.2	5.2	4.6
1986	7.5	3.4	4.4	3.9	3.2	5.8	4.4
Average 1965- 1986	7.2	3.6	4.6	4.1	3.3	5.6	4.4

Table 2. Abundance indices.

Species Year	Cod	Haddock	West	Polar cod	East	Redfish	Greenland halibut	Long rough dab
1965	6	7		0		159		66
1966	1	1		129		236		97
1967	34	42		165		44		73
1968	25	8		60		21		17
1969	93	82		208		295		26
1970	606	115		197		247	1	12
1971	157	73		181		172	1	81
1972	140	46		140		177	8	65
1973	684	54		(26)		385	3	67
1974	51	147		227		468	13	83
1975	343	170		75		315	21	113
1976	43	112		131		447	16	96
1977	173	116	157		70	472	9	72
1978	106	61	107		144	460	35	76
1979	94	69	23		302	980	23	69
1980	49	54	79		247	651	12	108
1981	65	30	149		73	861	38	95
1982	114	90	14		50	694	17	150
1983	386	184	48		39	851	16	80
1984	486	255	115		16	732	40	70
1985	742	156	60		334	795	36	86
1986	434	160	111		366	702	55	755

Table 3. Estimated indices with 90% confidence limits of year class abundance for 0-group cod and haddock in the total area.

Year-class	Herring 1)		Cod		Haddock	
	Logarithmic index	Confidence limits	Logarithmic index	Confidence limits	Logarithmic 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	0.57 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	0.43 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

1) Assessments for 1965-1984 made by Toresen (1985).

Table 4. Length distribution of 0-group fish in percent.

Length (mm)	Herring	Capelin	Cod	Haddock	Polar cod		Redfish	Greenland halibut	Long rough dab	Sandeel
					East	West				
10-14							0.3			
15-19							2.5			
20-24	2.4	0.2	+	0.1		18.7	5.2		+	
25-29	2.4	3.0	0.1	0.1	+	25.4	3.7	0.1	2.2	
30-34	2.4	22.9	0.3	0.6	1.1	19.5	6.3	0.7	10.8	
35-39	2.4	38.0	1.1	1.2	25.7	9.4	23.0	0.6	18.6	
40-44		8.5	3.6	2.3	50.3	11.7	41.1	2.4	12.1	1.3
45-49	9.8	1.9	6.8	7.1	18.4	12.2	15.6	8.6	4.1	8.9
50-54	19.5	0.4	13.7	7.4	4.5	2.9	1.9	22.7	0.3	19.3
55-59	24.4	+	18.5	10.0	+	+	0.3	18.4	+	15.8
60-64	19.5	0.2	21.4	11.0		0.1	0.1	19.9		12.7
65-69	17.1	2.4	15.3	13.1	+	+		17.7		13.6
70-74		3.9	11.4	14.4	+	+		4.8		13.3
75-79		5.3	5.0	10.0	+	+		4.1		7.1
80-84		5.6	2.0	9.2	+	+		0.1		5.7
85-89		6.0	0.7	6.0	+	+				0.6
90-94		1.1	0.1	5.0	+	+				0.5
95-99		0.5		1.2	+	+				0.2
100-104		0.1		0.8	+	+				0.3
105-109				0.3						0.4
110-114				+						
115-119				0.1						0.1
120-124				+						
125-129				+						
130-134				+						
135-139										
140-144										
Total numbers	41	56479	11339	3229	40842	14983	545971	713	39472	41856
Mean length (mm)	55.6	47.4	61.3	73.6	33.5	42.5	39.4	64.1	35.5	63.2

+) Less than 0.1

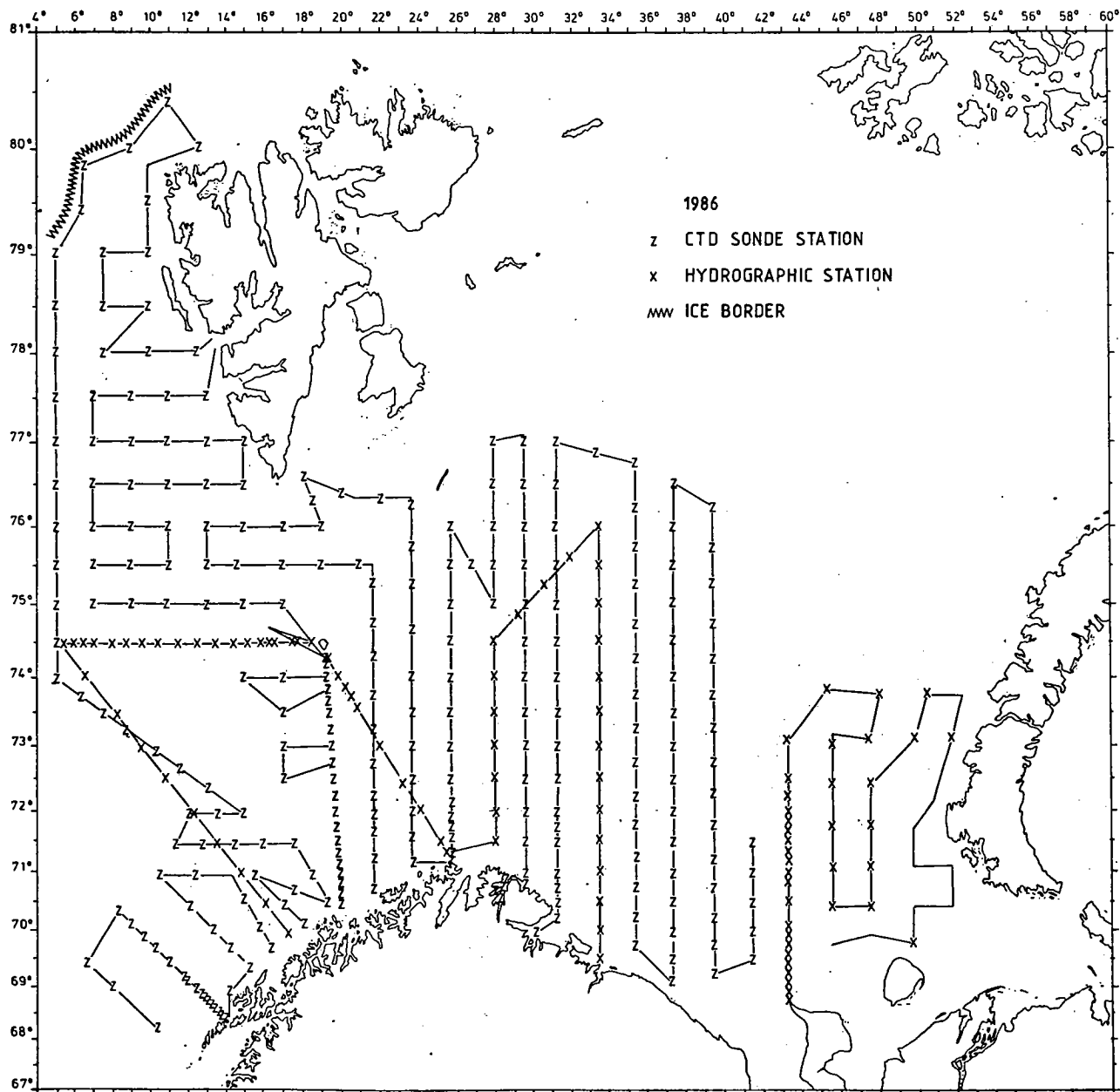


Figure 1. Survey tracks of the ships and the grid of hydrographic stations

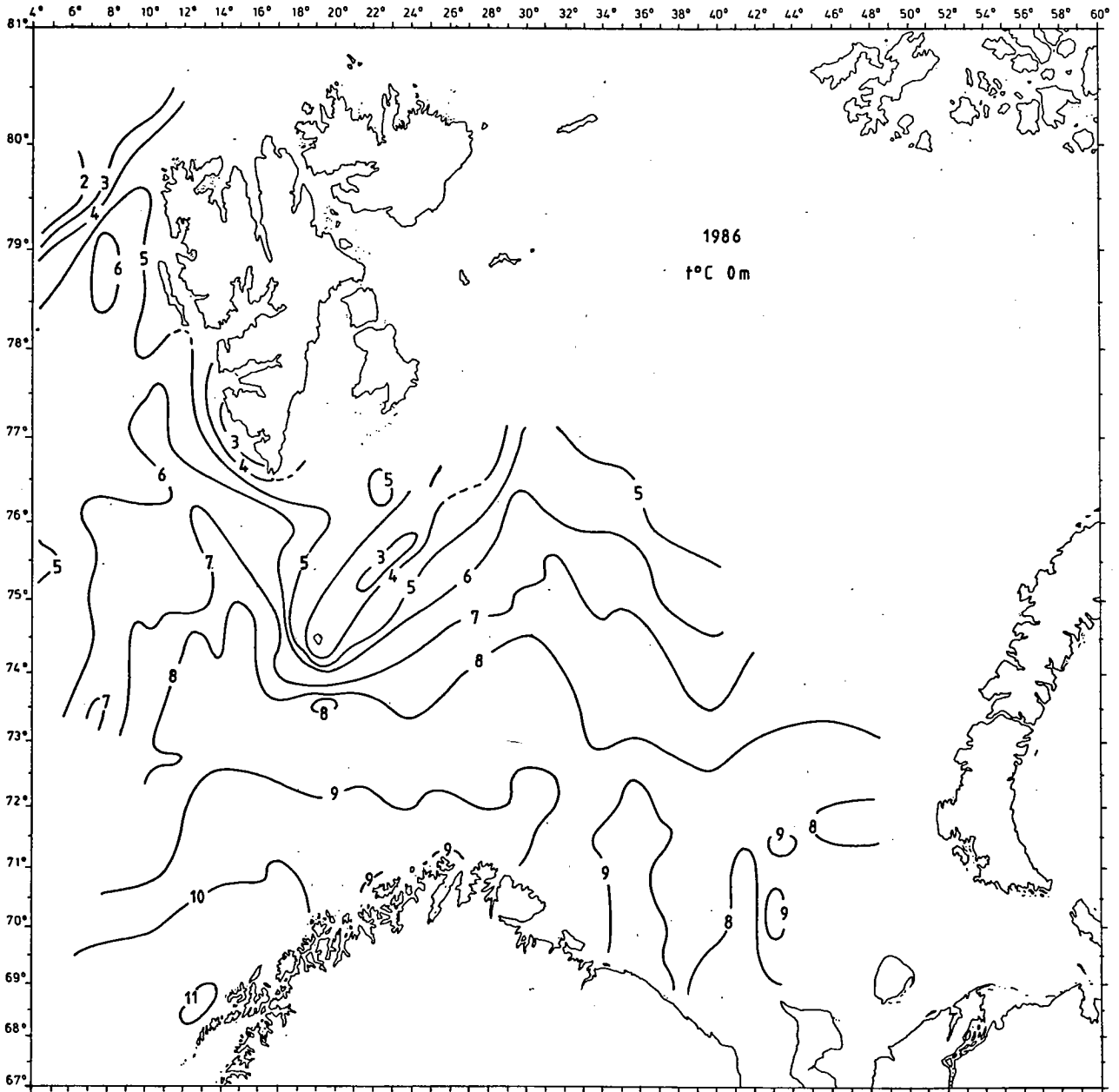


Figure 2. Isotherms at 0 m.

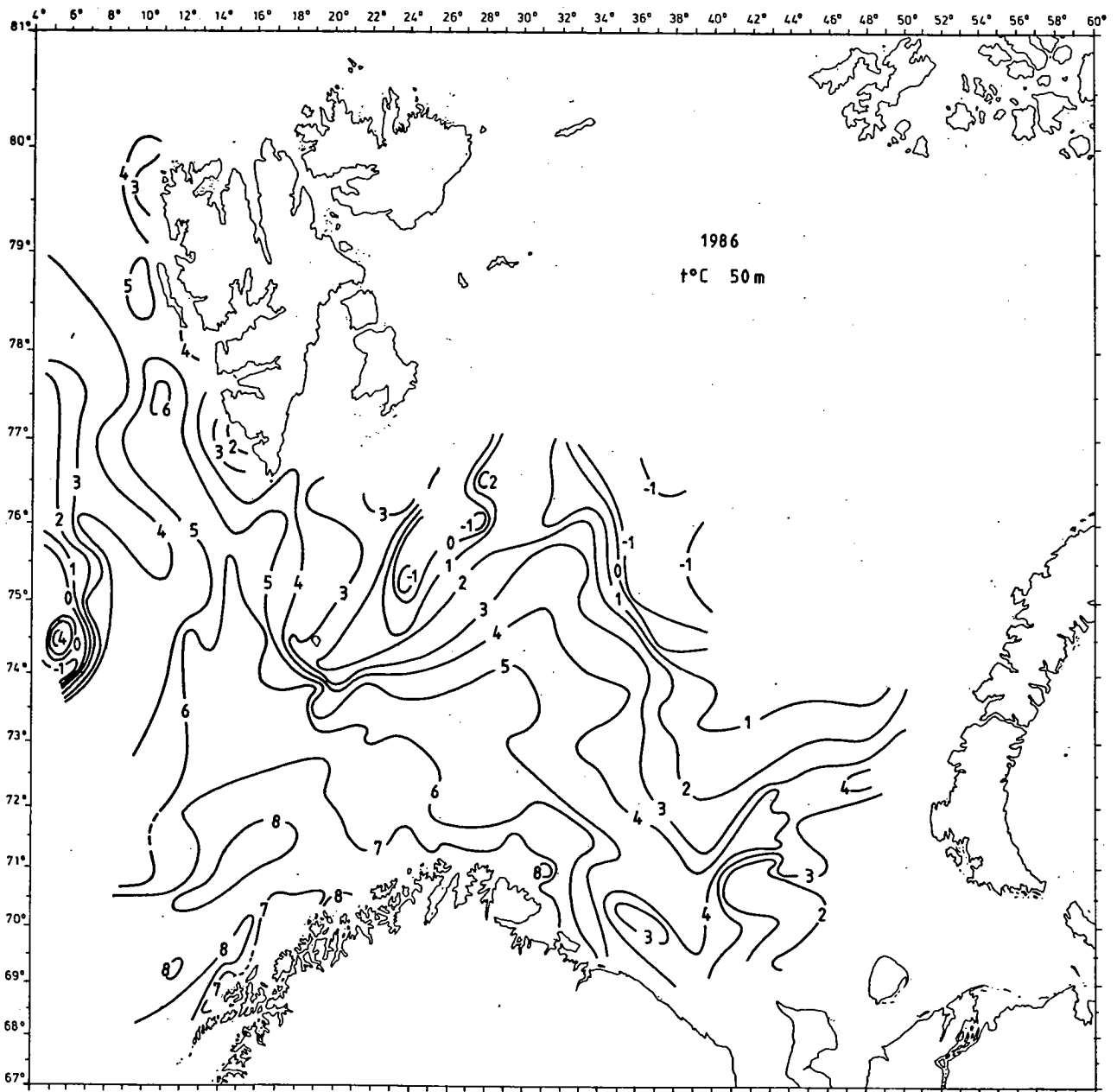


Figure 3. Isotherms at 50 m.

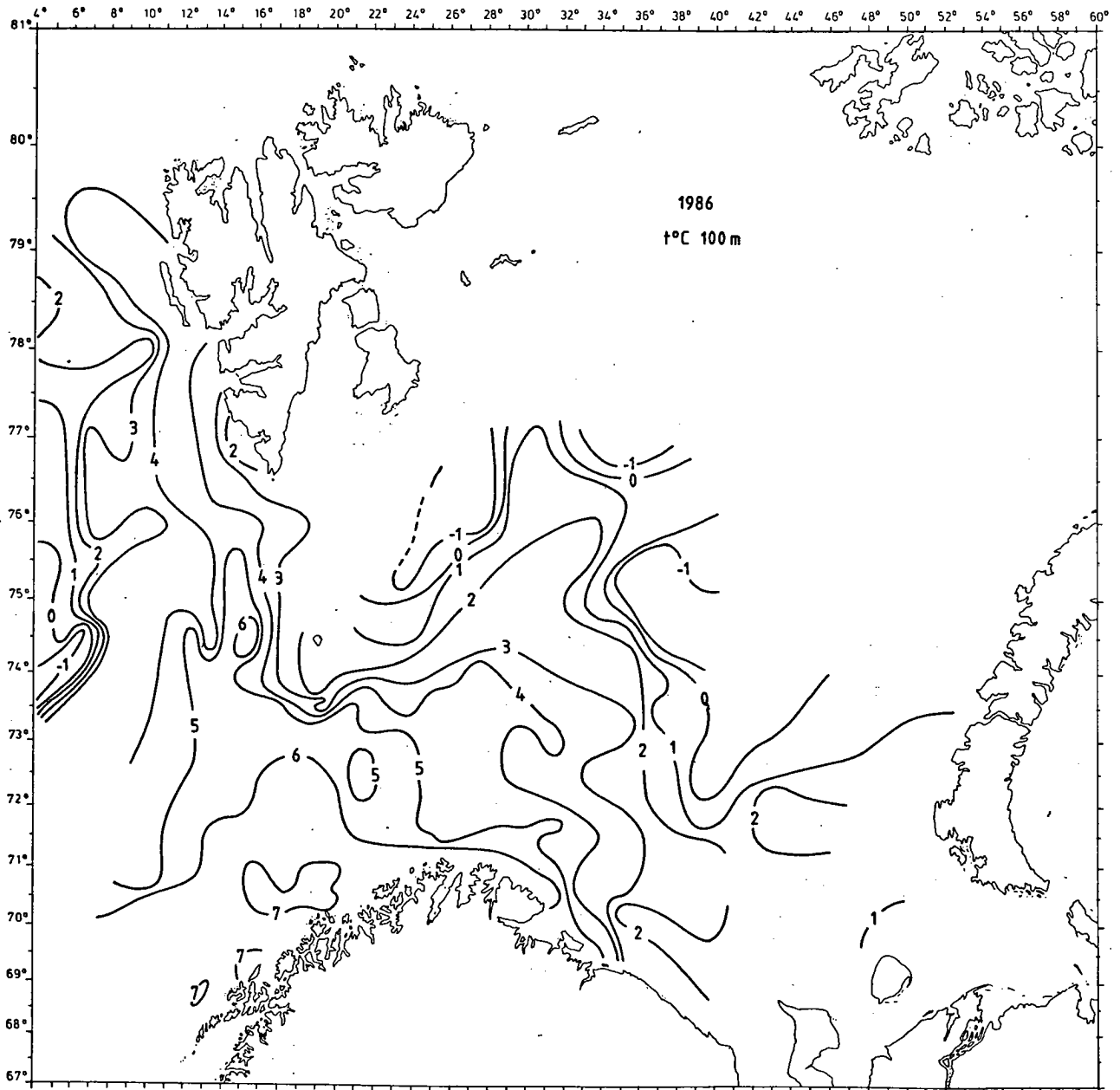


Figure 4. Isotherms at 100 m.

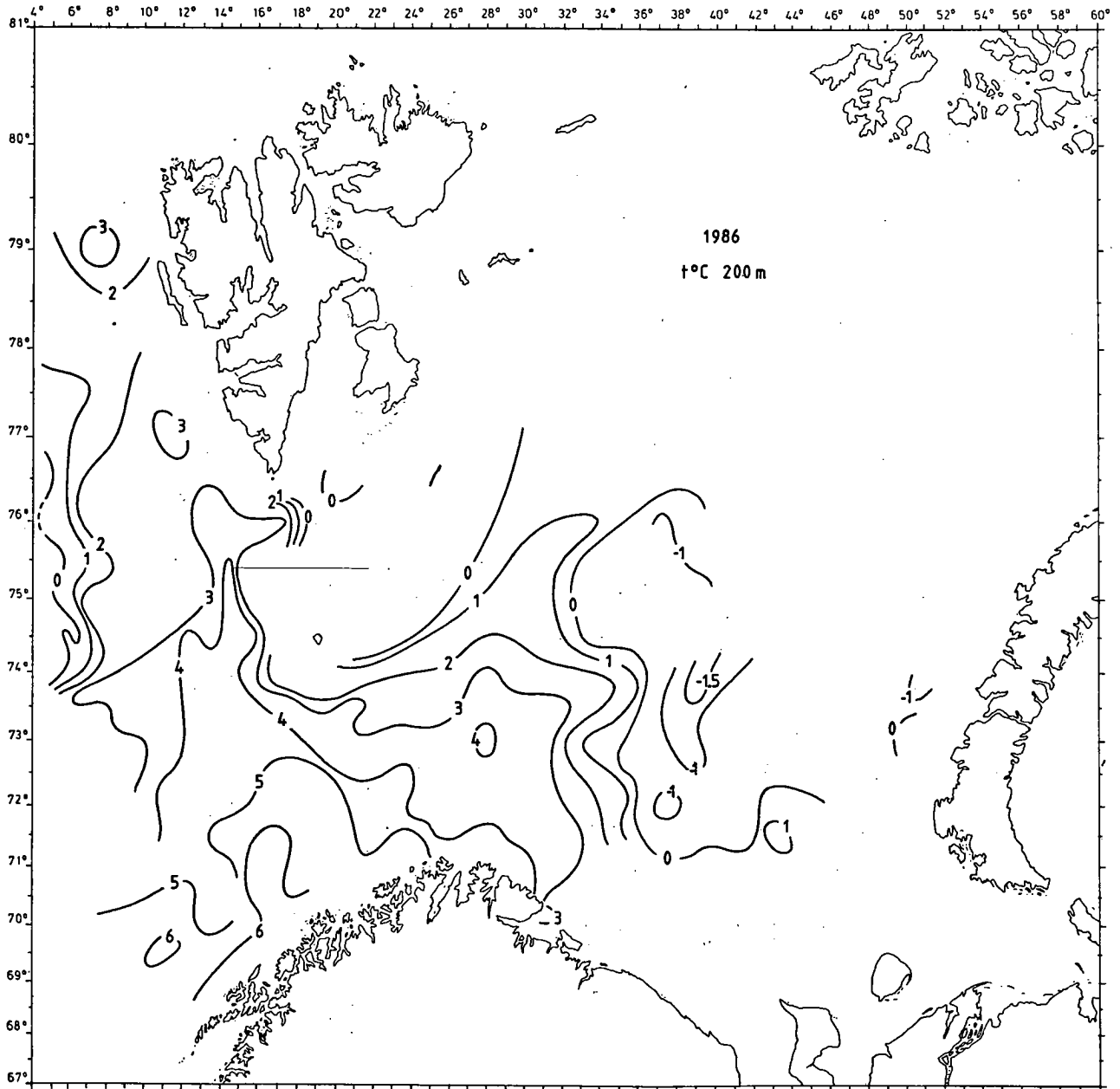


Figure 5. Isotherms at 200 m.

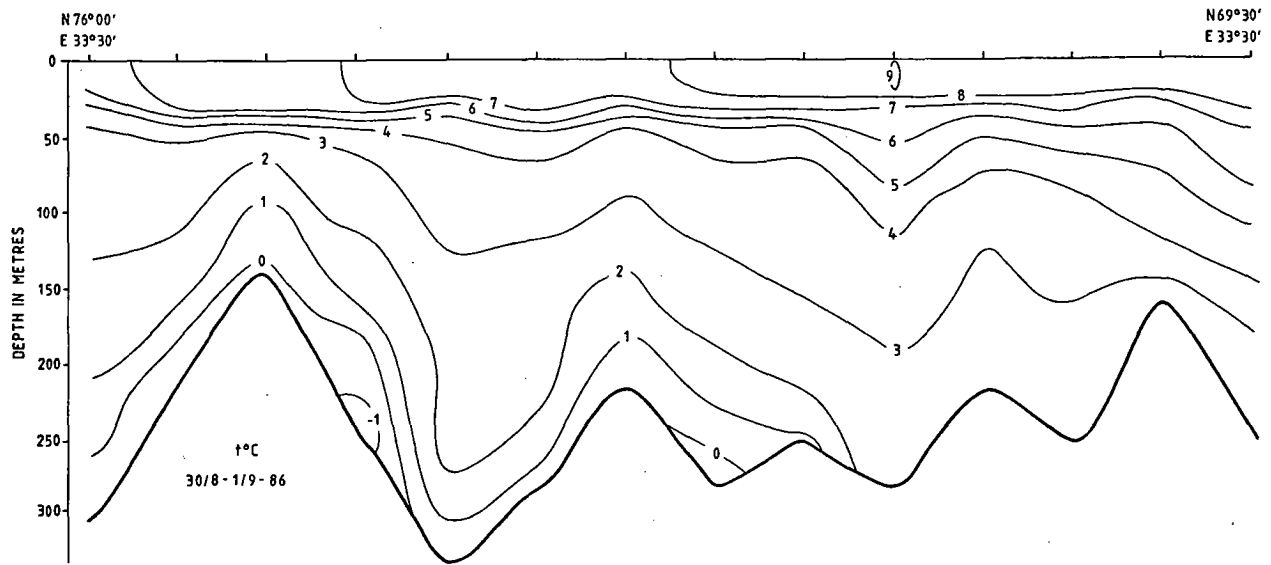


Figure 6. Temperature section along the Kola meridian.

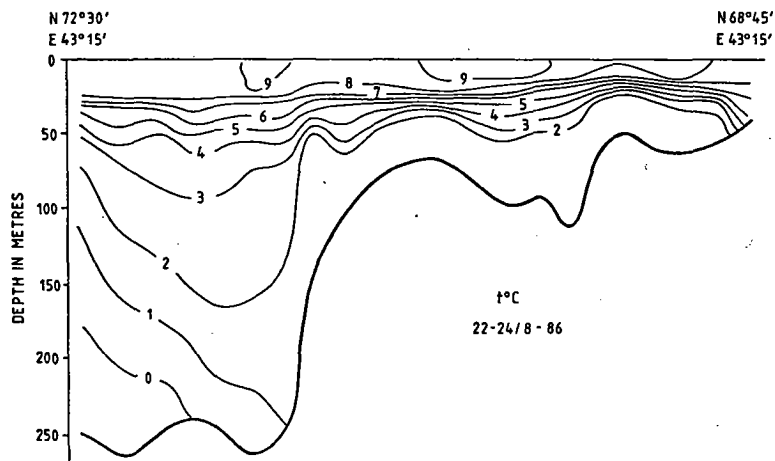


Figure 7. Temperature section Cape Kanin - North.

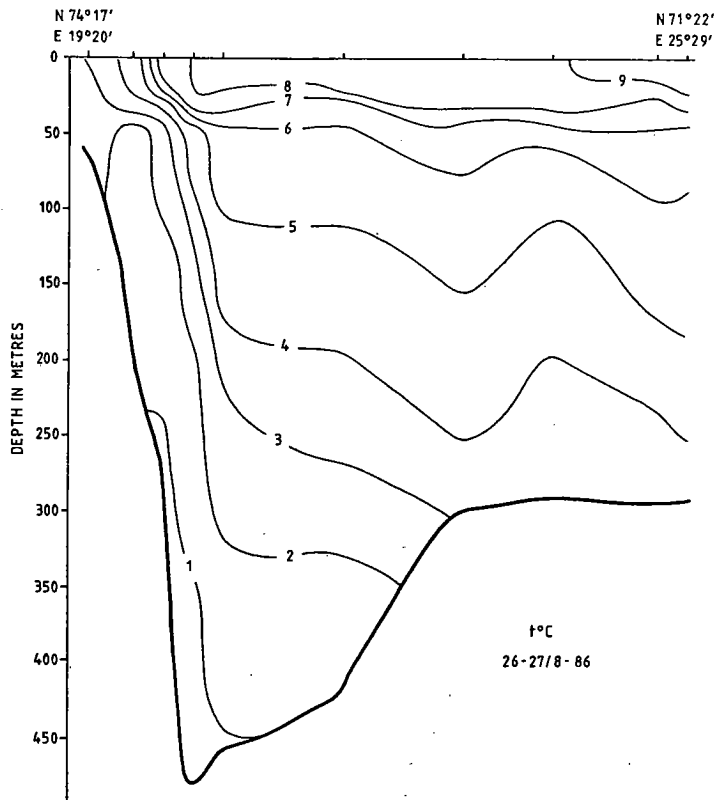


Figure 8. Temperature section Bear Island - North Cape.

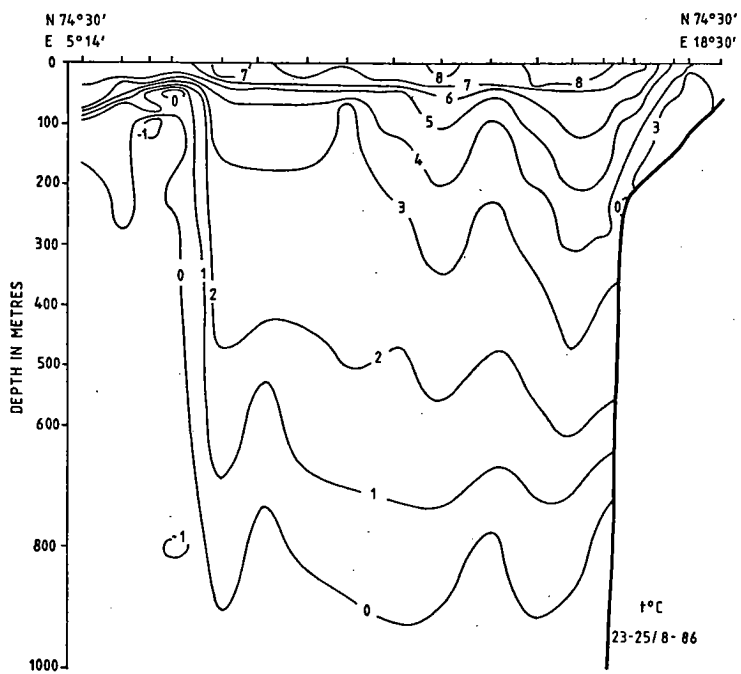


Figure 9. Temperature section Bear Island - West

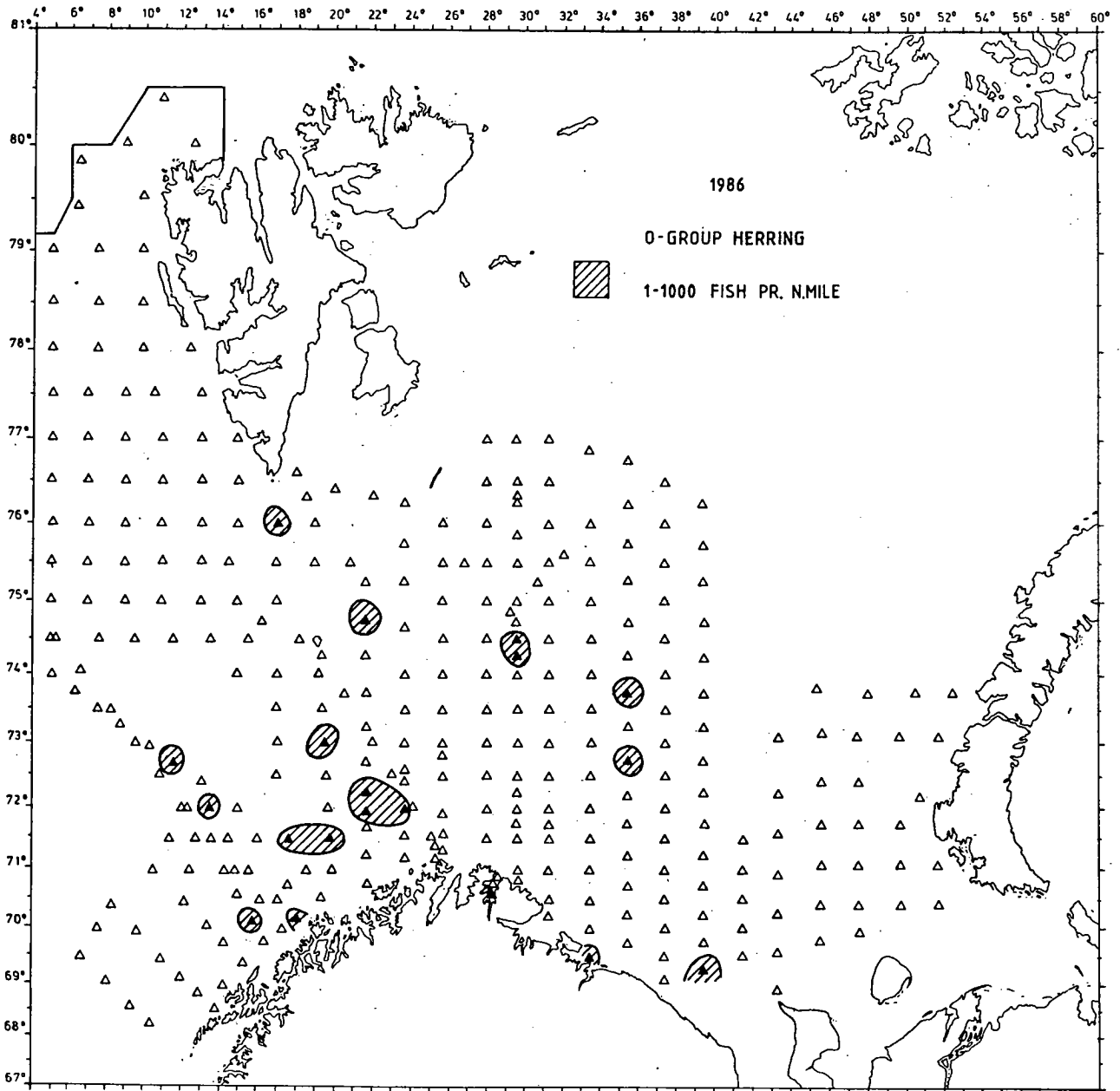


Figure 10. Distribution of 0-group herring.

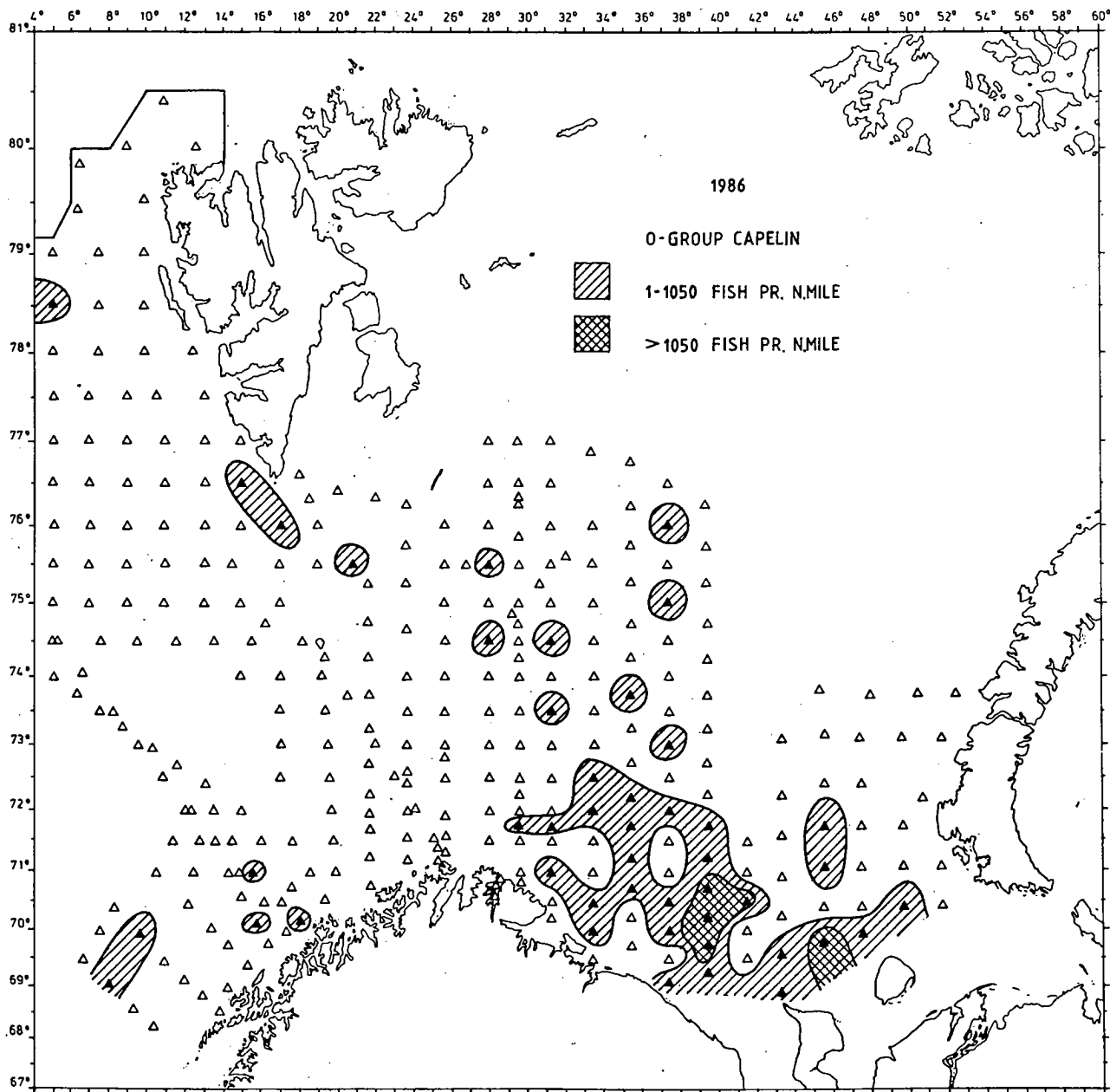


Figure 11. Distribution of 0-group capelin.

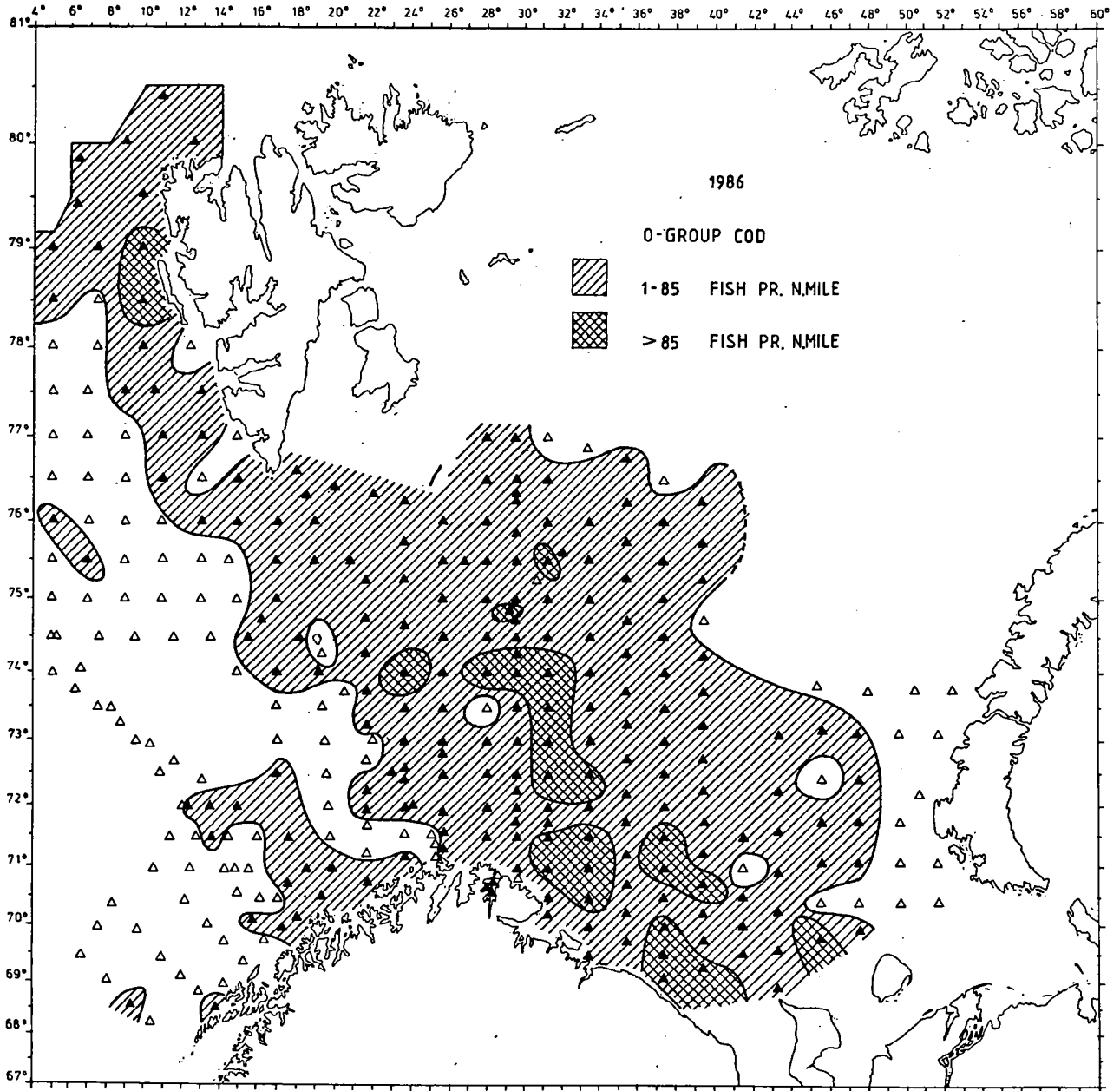


Figure 12. Distribution of 0-group cod

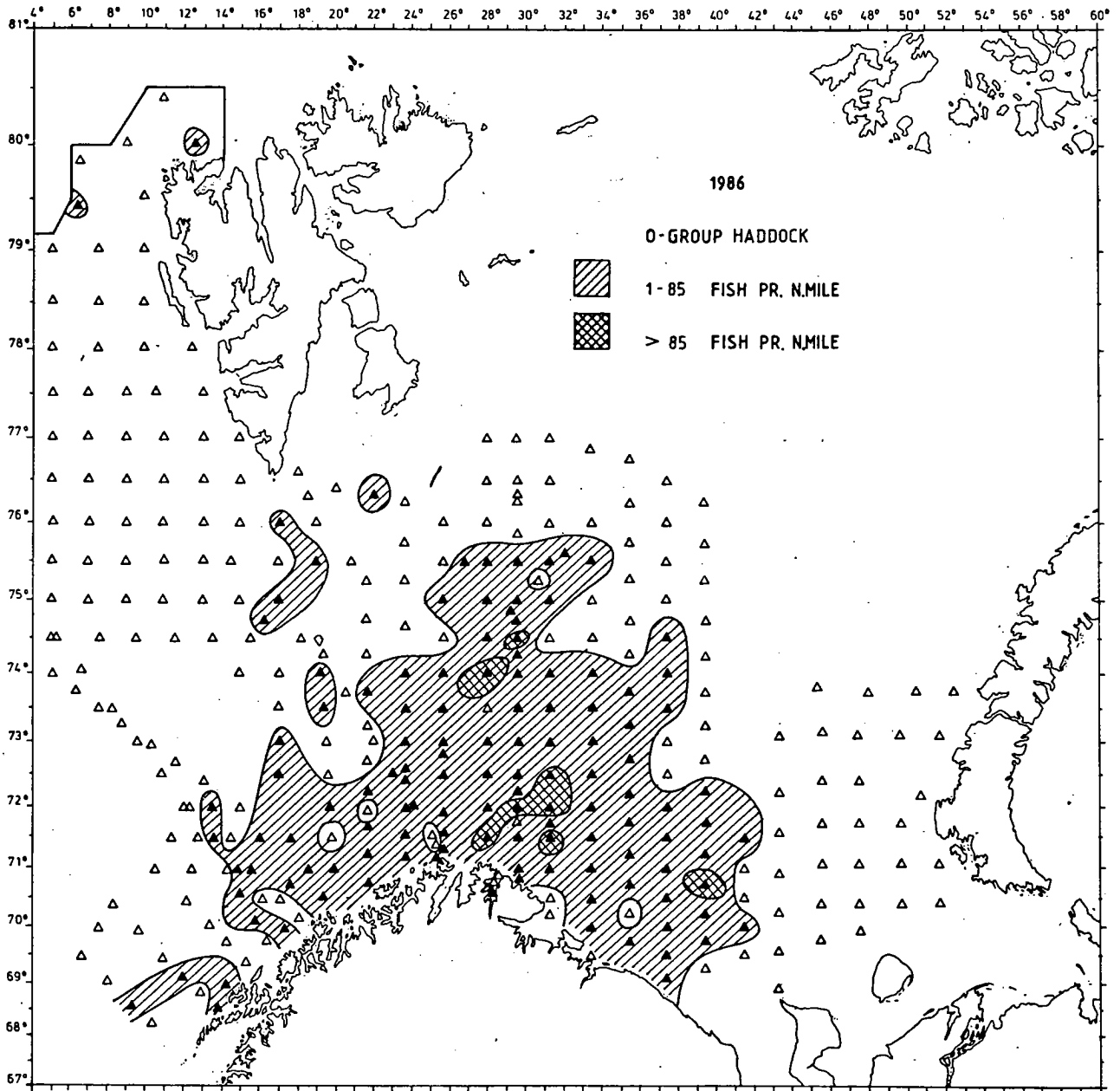


Figure 13. Distribution of 0-group haddock.

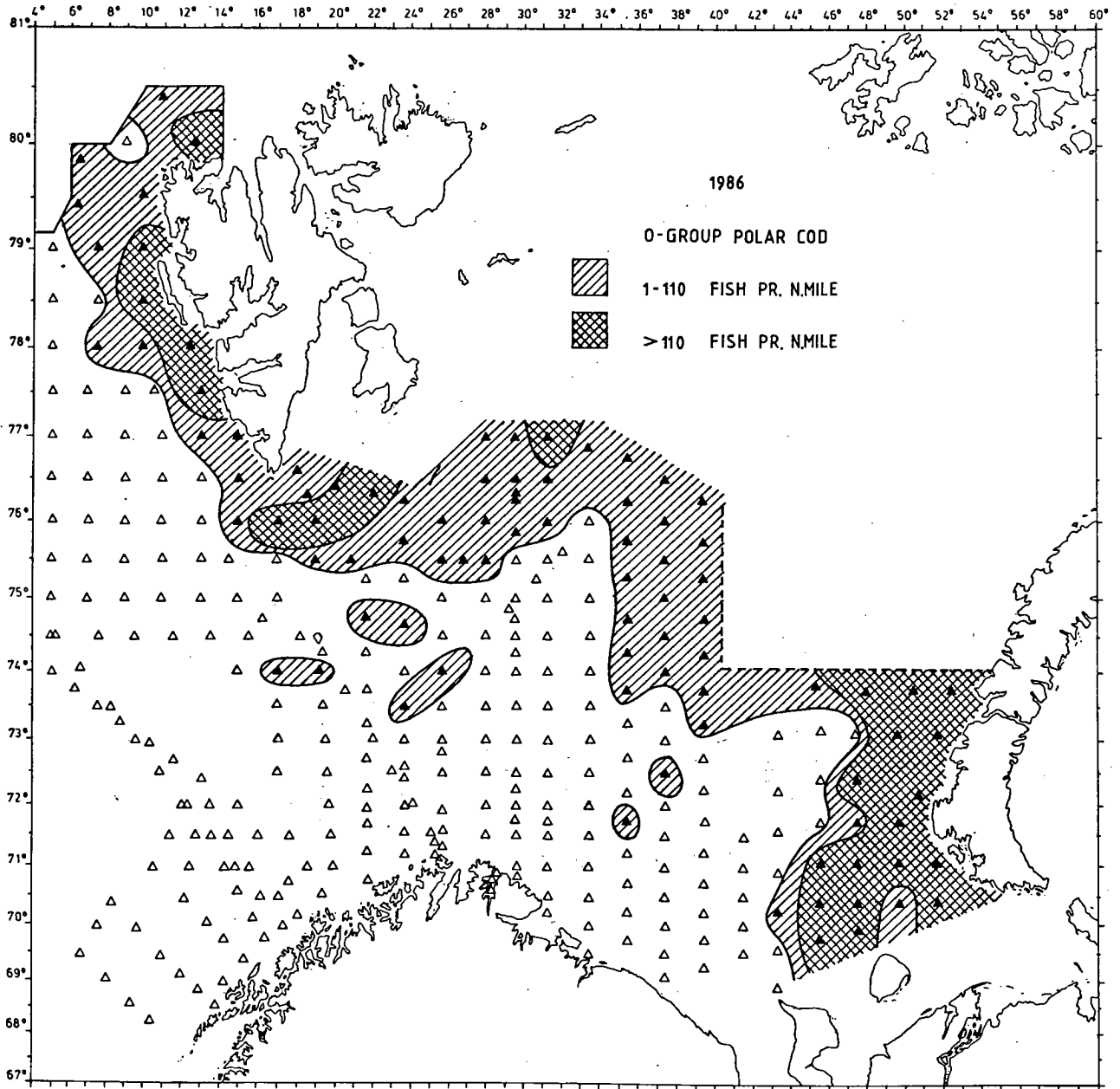


Figure 14. Distribution of 0-group polar cod

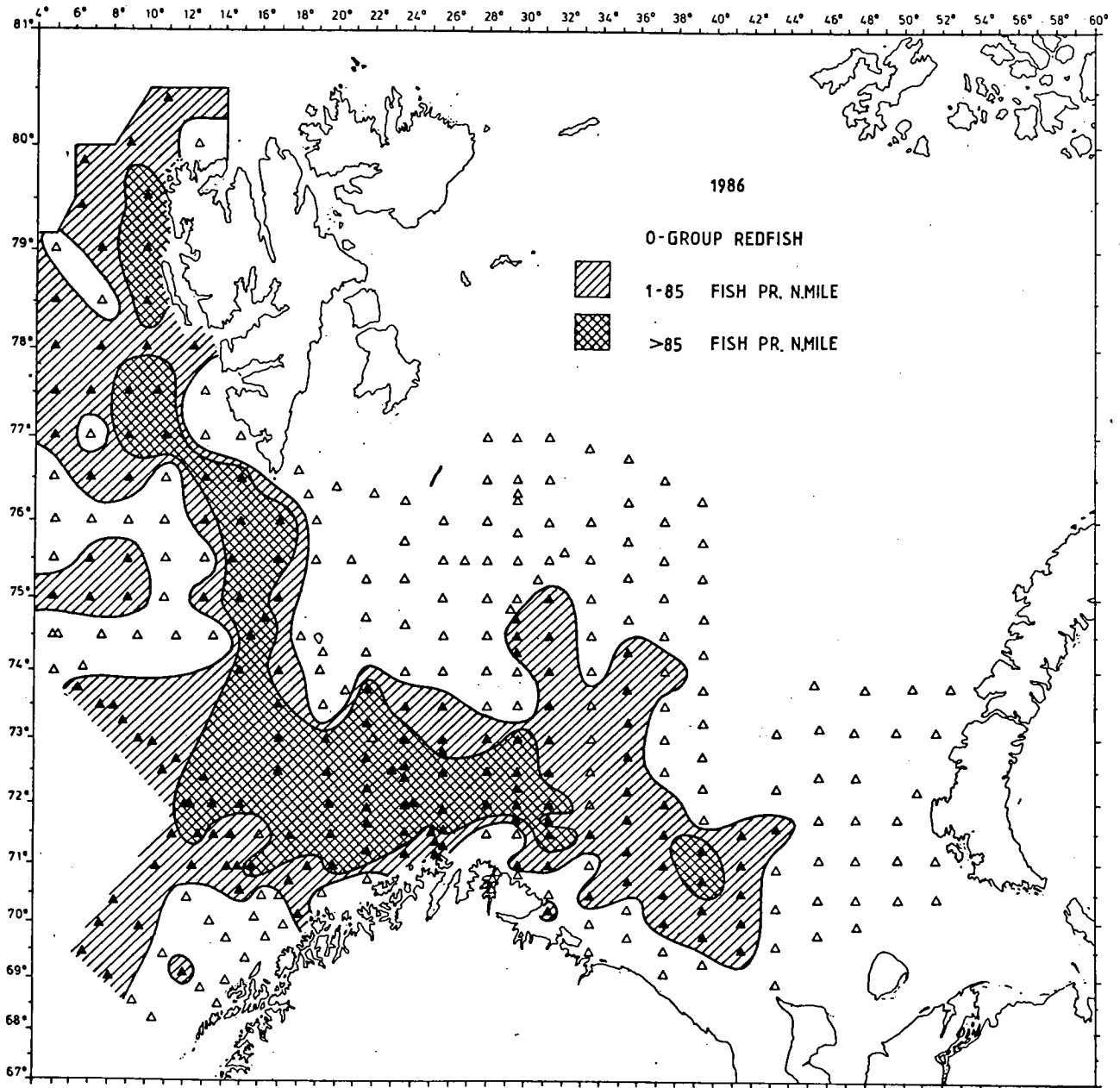


Figure 15. Distribution of 0-group redfish.

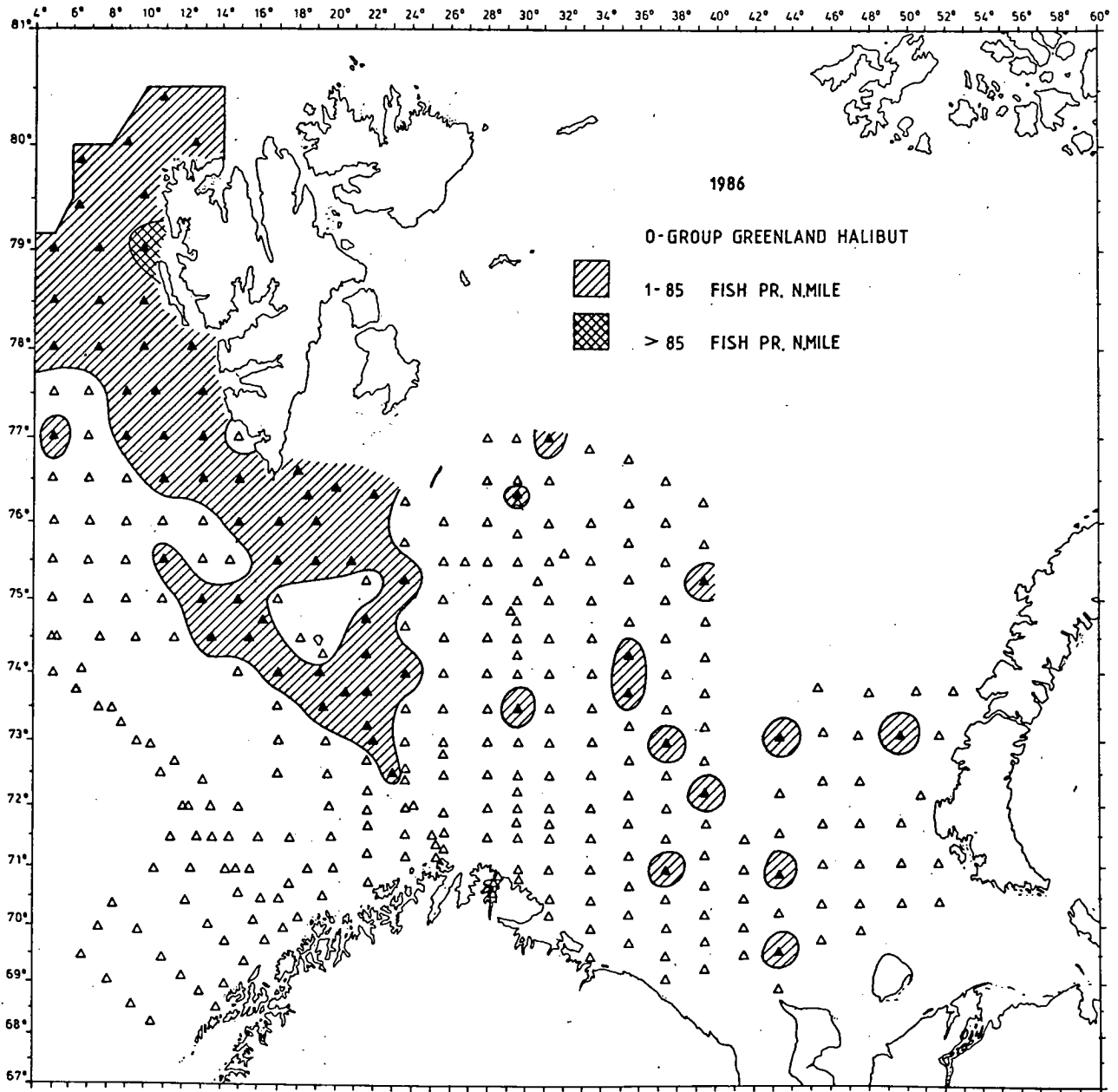


Figure 16. Distribution of 0-group Greenland halibut.

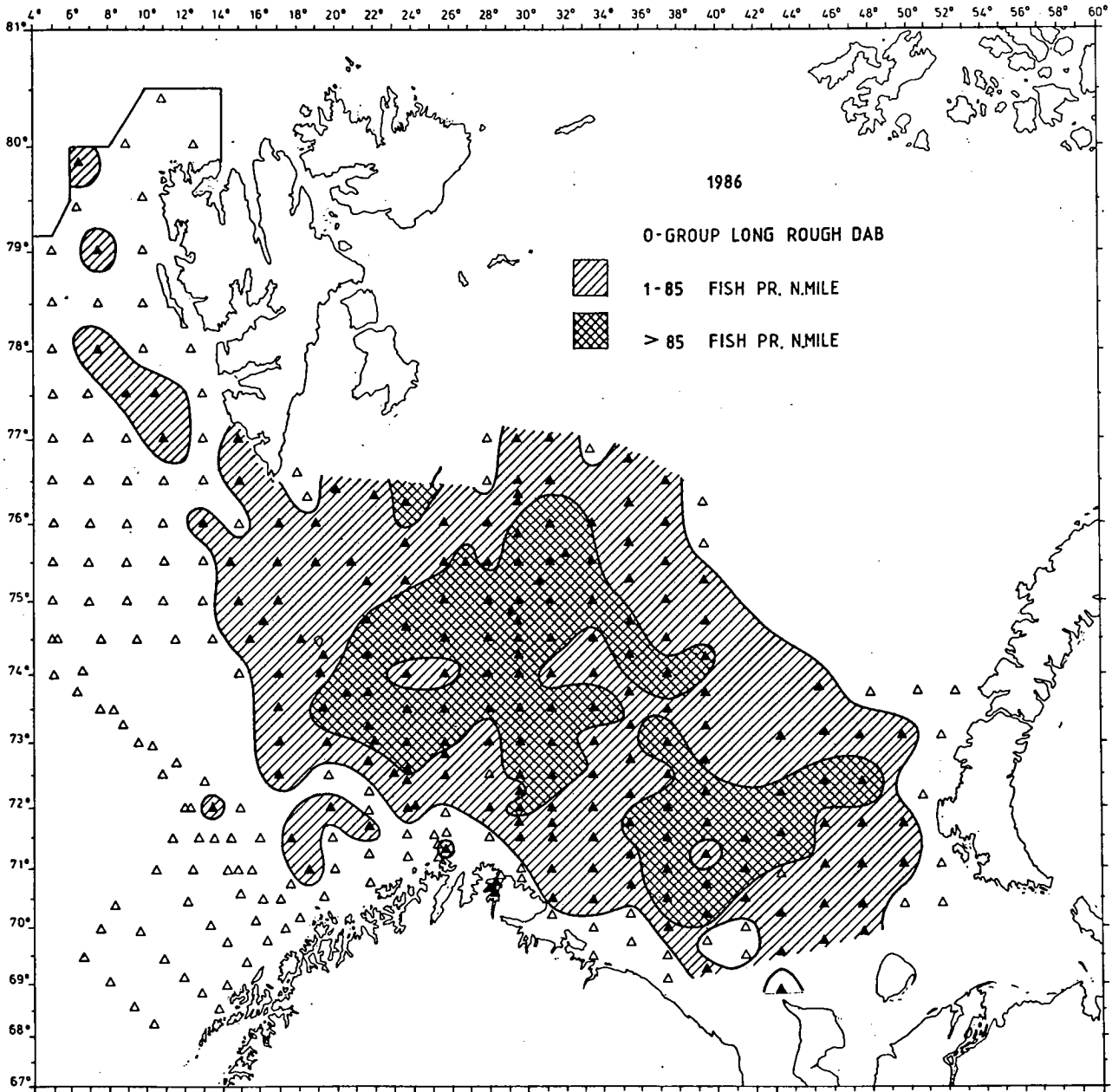


Figure 17. Distribution of 0-group long rough dab.

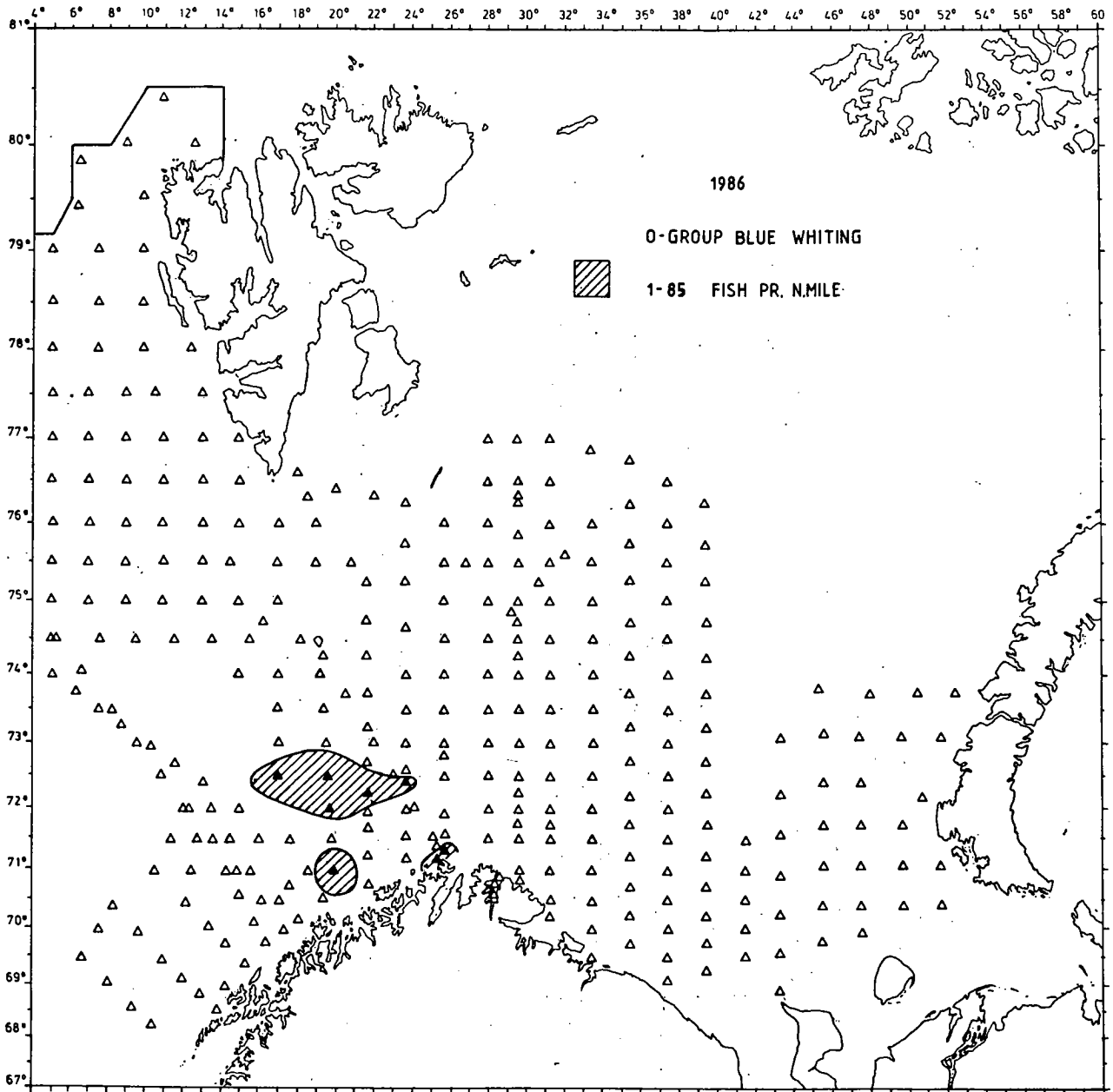


Figure 18. Distribution of 0-group blue whiting

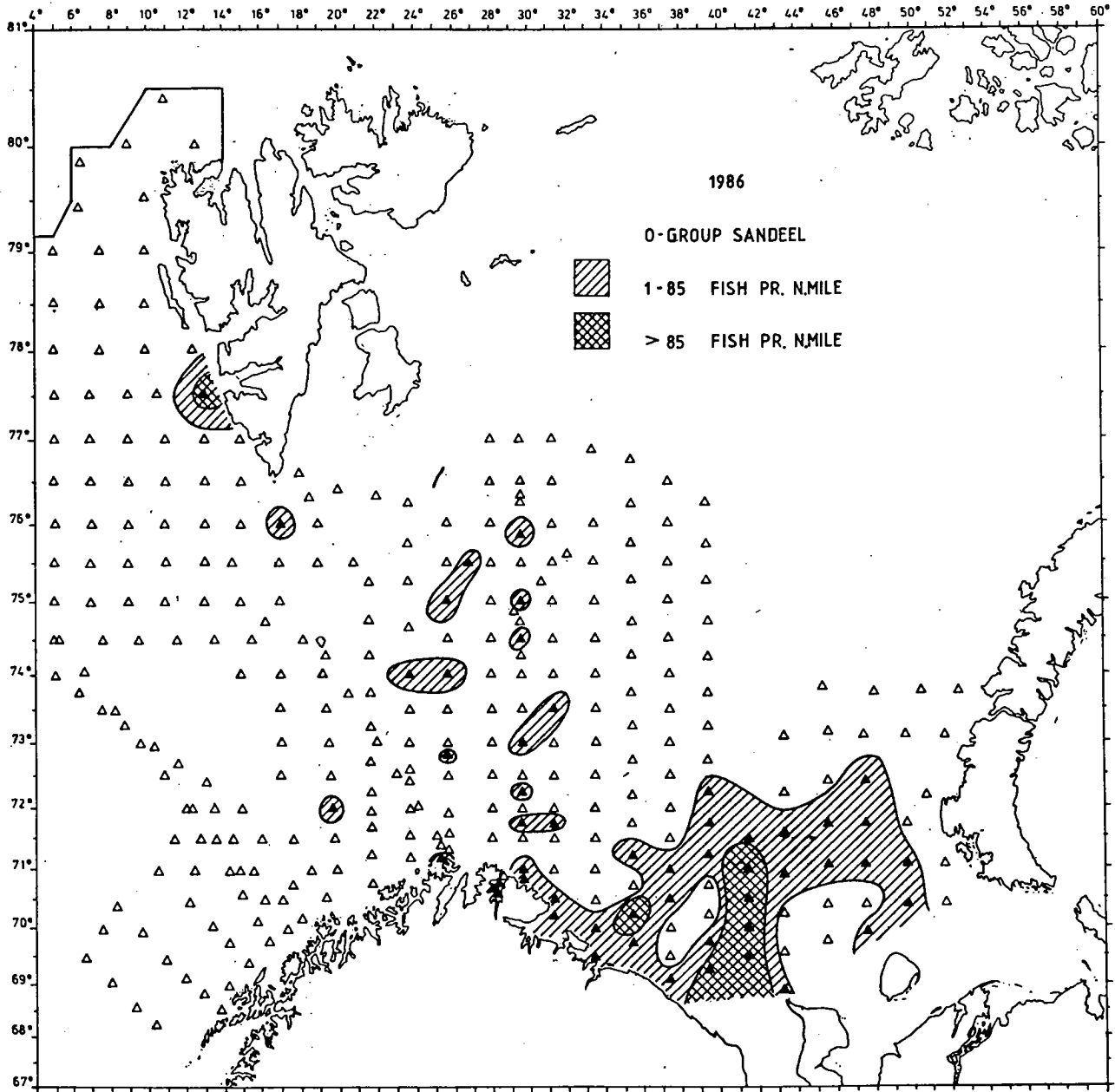


Figure 19. Distribution of 0-group sandeel

Appendix

Survey period	Research vessel	Research Institute	Participants
21 August - 1 September	"Kokshaysk"	Polar Research Institute of Marine Fisheries and Oceanography, Murmansk	S.V. Ashikhmin, A.V. Bezdenezhnykh, I.V. Borkin, M.F. Efremov, S.M. Gotovtsev, A.A. Konovatov, S.V. Ratushnyi, V.P. Shurupov
20 August - 2 September	"Vilnius"	"	N.V. Vanjukhina, V.I. Zubov, A.L. Lovchikov, V.S. Mamylov, L.L. Pavljuchenko, A.I. Semochkin, S.B. Ustinov, N.G. Ushakov, B.S. Shabalin
11 August - 4 September	"G.O.Sars"	Institute of Marine Research, Bergen	H. Abrahamsen, L. Austgulen, P. Bangstad, I.M. Beck, M. Dahl, O. Gullaksen, K.H. Hansen, A. Høyen, H. Ludvigsen, E. Moksness, T. Monstad, T. Mørk, A. Raknes, E. Sælen, A. Totland, M. Wallevik, V. Weststad.
20 August - 3 September	"Håkon Mosby"	"	B. Haugland, I. Hoff, M. Johannessen, E. Nilsen, K. Sunnanå.
20 August - 4 September	"Eldjarn"	"	K. Hansen, B. Hoffstad, R. Pettersen, A. Romslo, R. Tøresen.