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PROCEEDINGS OF THE INTERNATIONAL O-GROUP FISH SURVEY IN THE BARENTS SEA AND ADJACENT WATERS IN AUGUST-SEPTEMBER 1965-1997

Institute of Marine Research - IMR

Polar Research Institute of Marine Fisheries and Oceanography - PINRO

Joint IMR-PINRO report

PROCEEDINGS OF THE INTERNATIONAL 0-GROUP FISH SURVEY IN THE BARENTS SEA AND ADJACENT WATERS IN AUGUST-SEPTEMBER 1965-1997

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International Council for the
Exploration of the Sea

C.M. 1965
Herring Committee
Distant Northern Seas Committee
No. 161
Attn. Comparative Fishing Committee
Hydrographic Committee

Preliminary Report of the joint Soviet-Norwegian investigations in the Barents Sea and adjacent waters September 1965

1. Introduction

At the 1964 meeting of ICES the Herring Committee made the following recommendation (B5):

"The Committee recommends strongly that Norwegian and Soviet research vessels should undertake joint surveys of the distribution of the early stages of herring in the eastern Norwegian Sea and the Barents Sea".

The general program for this survey was discussed between Soviet and Norwegian scientists at the third meeting of the Atlanto-Scandian Herring Working Group in Moscow in May 1965, and it was agreed that the aims of this survey were to investigate the distribution and abundance, not only of group herring, but also of other commercial species of fish and to make hydrographic observations.

Final agreement on the detailed program was reached at a meeting in Murmansk on September 2 and 3 1965, and the survey was conducted from the 4 to the 17 September with two Soviet and two Norwegian research vessels. From the 17 to the 19 of September a meeting was held in Tromsø for the purpose of combining the observations made and to prepare a preliminary report.

The participating vessels and the scientific and technical staff were:

R/V "Akademik Knipovich":	Yu.K. Benko, A.G. Kisliakov, A.A. Gankov, M.I. Gusnova, V.M. Naumov, K.A. Semina
R/V "Jastreb":	I.V. Packhorukov, A.S. Seliverstov, A.I. Muchin, O.E. Schatoba, E.I. Zajtsev
R/V "Johan Hjort":	P.T. Hognestad, S. Olsen, B. Brynildsen O. Cruickshank, W. Løtvedt, T. Monstad, H.E. Olsen, V. Rasmussen
R/V "G.O. Sars":	O. Dragesund, L. Midttun, K. Gran, I. Hoff. O. Martinsen, B. Myrseth, J, Parker, G. Sangolt

2. Program and methods

It was agreed that the four vessels were to operate in two pairs, consisting of one Norwegian and one Soviet vessel, steaming more or less parallel courses 30-40 miles apart.

As will appear from Fig. 1 one pair of ships covered the eastern and northeastern areas, whereas the other pair investigated the central and western parts.

The technique and methods applied was the same as that of previous Norwegian

surveys (Dragesund and Olsen in press), i.e. a combination of echo sounding and fishing experiments with pelagic trawl. In order to make the observations of each ship directly comparable, all four ships ere equipped with the same type of echo sounder and the same type of trawl.

3. General outline of results

The time allotted for the meeting in Tromsø was of course not sufficient for a thorough analysis of the large material of data collected he report prepared is therefore preliminary in its scope, but nevertheless some fairly definite conclusions were reached.

3.1. Hydrography

The aim of doing hydrographic observations in connection with the investigations of the distribution and abundance of 0-group fish, is to get knowledge of the transporting system.

During this survey 143 hydrographic stations have been taken covering the whole area investigated (Fig. 1). Both temperature and salinity have been observed, giving a basic material for an analysis of the current a transport system. At this stage the salinity samples have not been work up and hence we can only discuss the temperature condition presented by a series of horizontal and vertical section charts in the Figs. 2, 3 and 4.

However, some information of the general factures in the current system can be drawn even from these charts, particularly those showing the temperature at the deeper layers (viz. 100 and 200 meters) (Fig. 3) Since the inflowing water of the Barents Sea and the West-Spitsbergen water are much warmer than the water originating from these areas, the inflow will cause tongue shaped out bends of the isotherms, as seen from the horizontal charts, for example outside the West-Spitsbergen, or along the banks near Novaya Zemlya.

The two vertical sections presented in Fig. 4 (North Cape –Bear Island and Bear Island-W) have been chosen because there already exists a large material from these sections, giving the opportunity to compare the present conditions with these of previous years. The average temperature at the section North Cape - Bear Island is about 1° below the normal and the anomaly along the Kola meridian is -0.4° which might indicate that the inflow to the Barents Sea also have been less than the normal. However, other factors may also contribute to such low anomalies.

3.2. Distribution and abundance of 0-group fish

Fig. 5 shows the total distribution of pelagic echo-recordings. In the central part of the Barents Sea and along the continental edge from the Norwegian coast to West-Spitsbergen most of these recordings are caused 0-group fishes, and to some extent also medusa and euphausiids. In the south western part of the area investigated the recordings also include large blue whiting and large herring, and in the north-eastern parts most the recordings were probably of large capelin and/or polar cod.

The distribution charts for the different species dealt with in the following paragraphs are based on the catch composition of the trawling experiments and on detailed analysis of the echo-recordings.

3.2.1. Herring

0-group herring were observed in two limited areas (Fig. 6) i.e. 1) between Bear Island and the Norwegian coast (72-73° N and 18-25° E), and along the edge of the continental shelf from NW of Bear Island to Isfjorden on West-Spitsbergen (75-78° N). Outside these small areas no group herring was identified. Special attention was also paid to investigating some of the traditional "småsild" fjords north of the Lofoten Islands (Eidsfjord, Ullsfjord, Lyngenfjord, Revsbotn and Varanger). In contrast to the conditions observed at the same time in previous years, when 0-group herring were present in these fjords or at their entrances, this survey indicated that there were only insignificant numbers of 0-group herring in the coastal areas.

It is thus evident that the abundance of 0-group herring in the area investigated is exceptionally low as compared with previous years.

3.2.2. Cod

0-group cod was caught in a small number at only one of the 86 trawl stations. Neither did the echo-recordings show any traces, which could be interpreted as caused by 0-group cod. In the same month in previous years cod fry have frequently been found pelagically distributed in the same areas, and in some years in large abundance. It is hardly likely that this year nearly all the young cod had already at the beginning of September descended to the bottom strata, and it is therefore justified to conclude that the 1965-year-class of cod is very small.

3.2.3. Haddock

Haddock were observed in two very limited areas (Fig. 7) i.e. 1) midways between Bear Island and the Norwegian coast, and 2) between Bear Island and West-Spitsbergen. It is safely concluded that also the 1965 year-class of haddock is poor.

3.2.4. Redfish

Redfish were found in abundance in the areas between the Norwegian coast and Bear Island (Fig. 8), between Bear Island and West-Spitsbergen along the continental slope, off West-Spitsbergen, and west of Andenes. The area of distribution extended to Skolpen Bank, but in the eastern part the abundance was low. It should be noticed that the size distribution varies between different regions, and in particular that the redfish in the southwestern most part were very small.

This distribution is very similar to that observed in 1964, and the total abundance in the area this year seems to be of the same order of magnitude. According to the Norwegian investigations conducted in the years before 1964 such a wide distribution of 0-group redfish has never been observed, nor has the abundance been nearly as large. This may indicate that there have been two strong year-classes in succession, but or cannot exclude that the high abundance may mainly be caused by a change in the total distribution pattern for the 0-group redfish.

3.2.5. Capelin

Capelin were found in two main areas (Fig. 9) l) from North Cape to 41° E south of 74° N, and 2) between Bear Island and West-Spitsbergen. In addition a small patch was found southeast of Bear Island.

Compared with previous observations in the Barents Sea it is evident that the young capelin this year have a westerly distribution, but there is not sufficient data from previous years to make any statement about year class strength.

3.2.6. Long rough dab

Long rough dab was found to have a very wide and continuous distribution extending from Novaya Zemlya in the east (72°-73° N) through central part of the Barents Sea and further northwest along the Spitsbergen continental edge. The areas of greatest density seemed to be in the central part between 72°30' to 74°30' N and 28° to 25° E, between Bear Island and the Norwegian coast, and in the area between Bear Island and Spitsbergen According to previous Norwegian investigations long rough dab has not been found in comparable abundance since 1960.

4. Concluding remarks

Perhaps the most striking result that has come to light from this survey is the very low abundance and restricted distribution area of the 0-group of the commercially important species, herring, cod and haddock. This may be caused by a very low survival rate for the 1965 broods of these species and/or a low inflow of Atlantic water into the Barents Sea, as indicated by the westerly distribution of capelin fry and the negative temperature anomaly in the North Cape - Bear Island section.

This emphasizes the need for more studies of the interrelationship between the transport of water masses and the distribution of fish 1arvae and fry.

The experience from this first four-ship survey confirms that a joint multi-ship investigation along similar lines as that of the present one may provide a reliable picture of the distribution and abundance of 0-group fish. However, it is necessary to improve the methods of identifying the echo recordings and for providing biological samples, i.e. by better pelagic trawls and trawling technique, direct under-water observation facilities, acoustic techniques etc.

It was therefore unanimously agreed by the participating Soviet and Norwegian scientists that these joint investigations shall be continued in the future, and possibly be extended both with regard to scope and volume of work.

The program for next year is to be discussed by correspondence and finally agreed at a meeting in Murmansk immediately prior to the start the 1966 survey.

Reference

Dragesund, O. and Olsen S. 1965. On the possibility of estimating year class strength by measuring echo-abundance of 0-group fish Fiskeridir. Skr. Havundersøk., 13 (8) (in press).

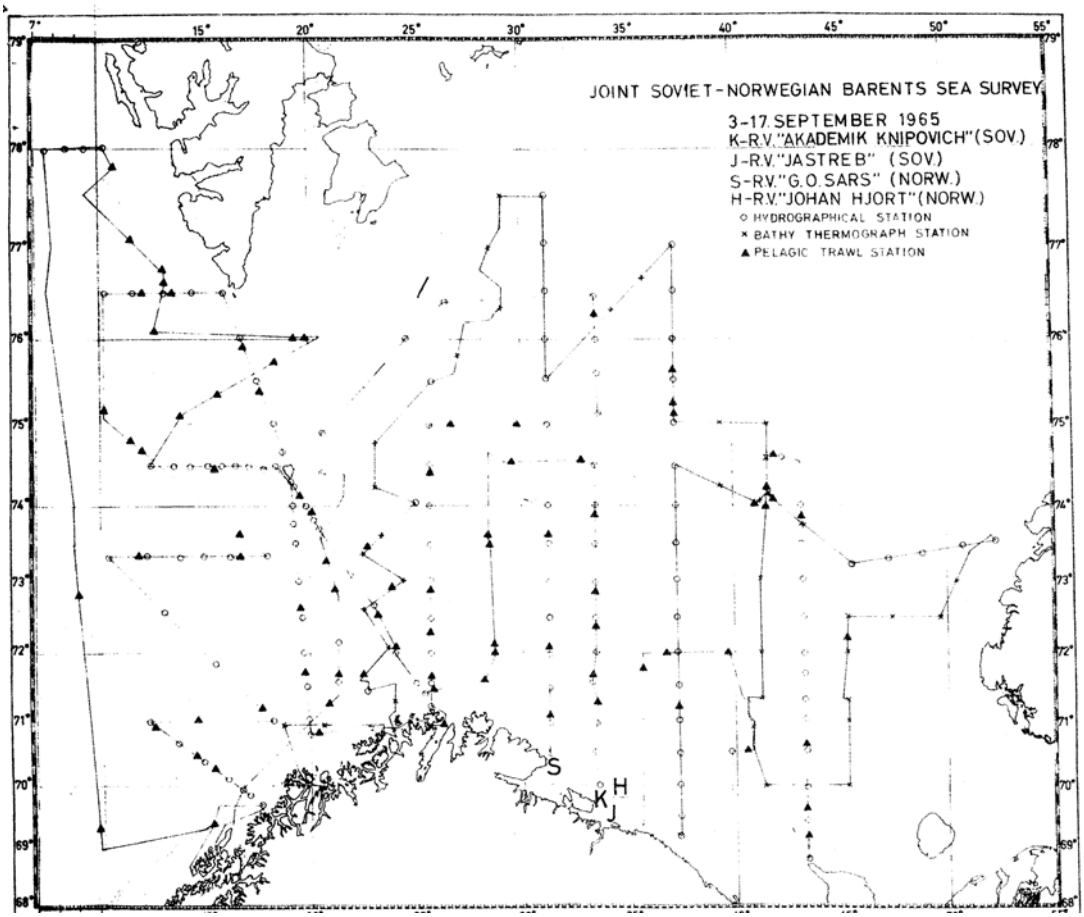

Fig. 1. Routes and stations

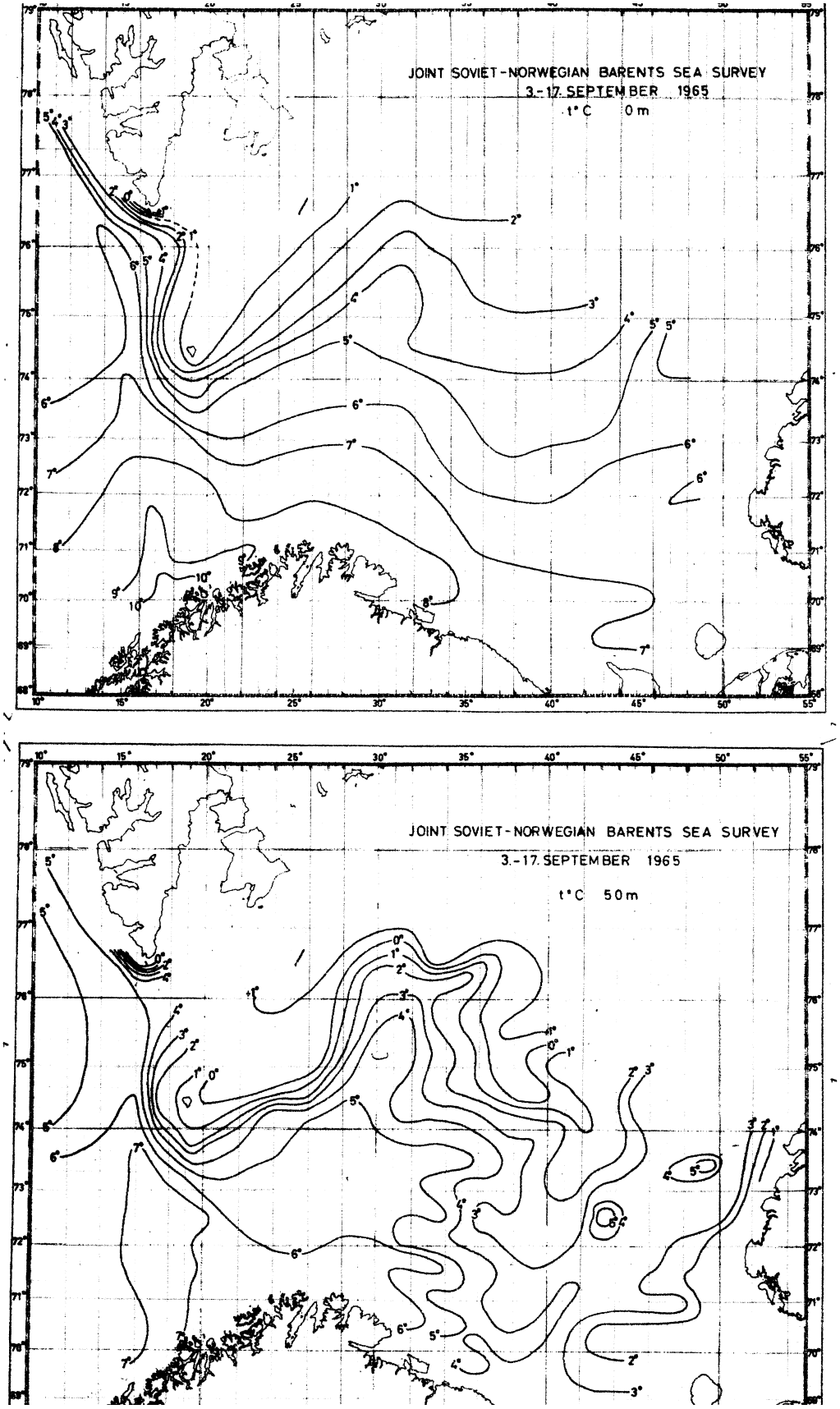

Fig. 2. Isotherms at 0 and 50 m

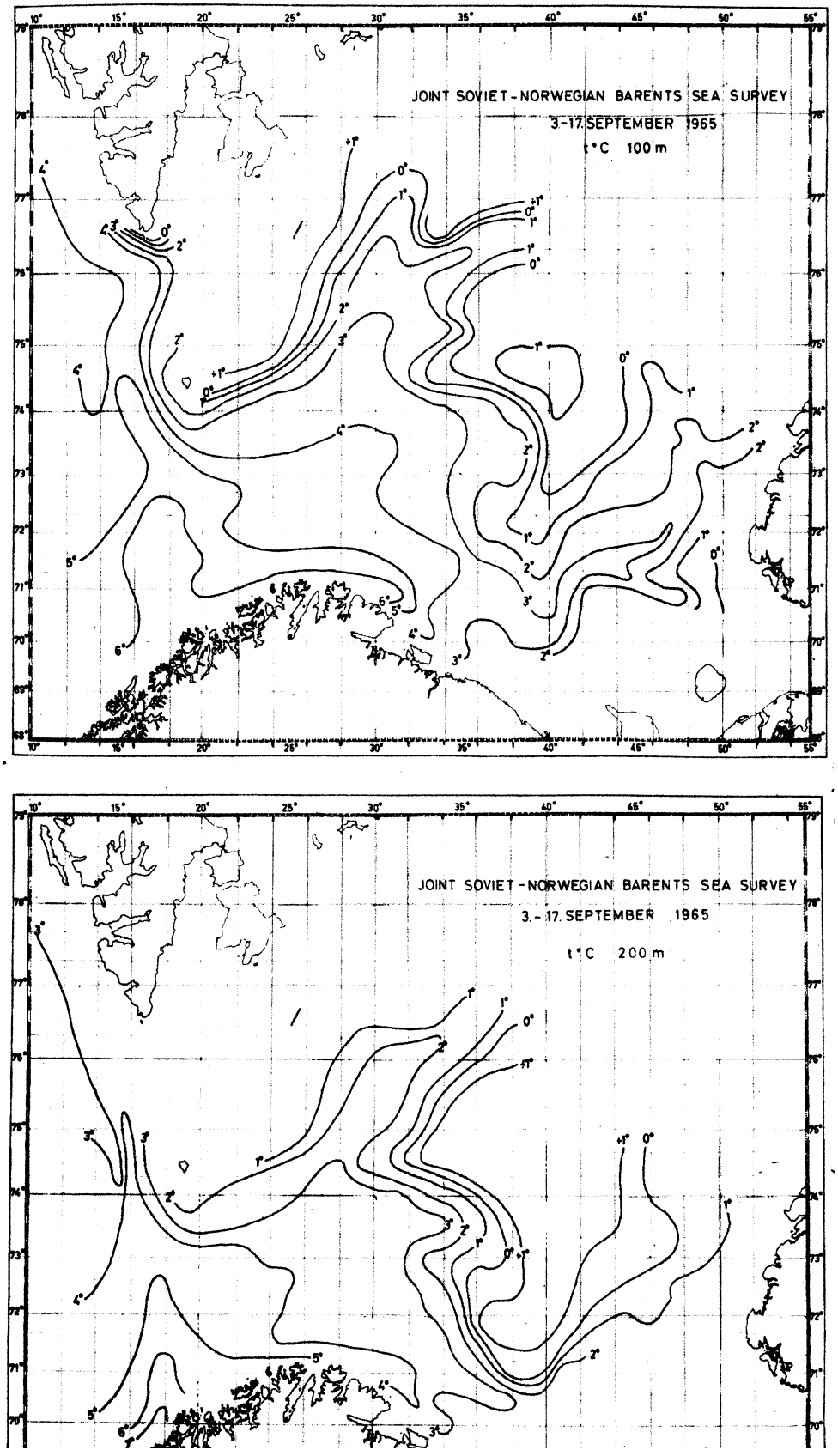

Fig. 3. Isotherms at 100 and 200 m

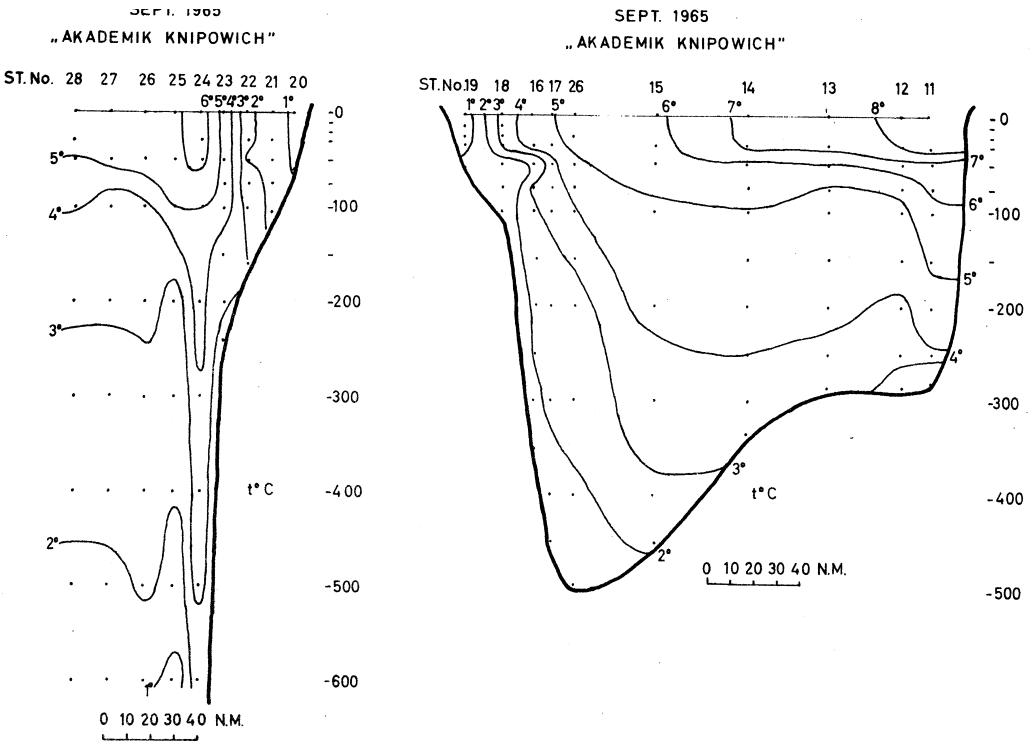

Fig. 4. Vertical temperature section North Cape-Bear Island and Bear Island-West

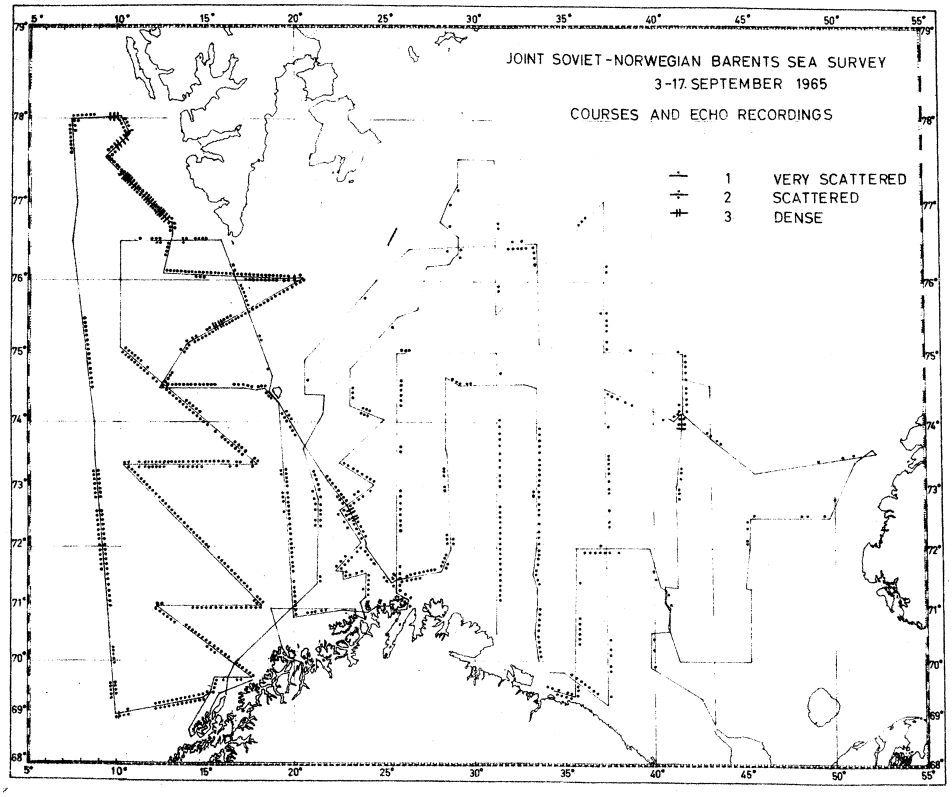

Fig. 5. Courses and echo recordings

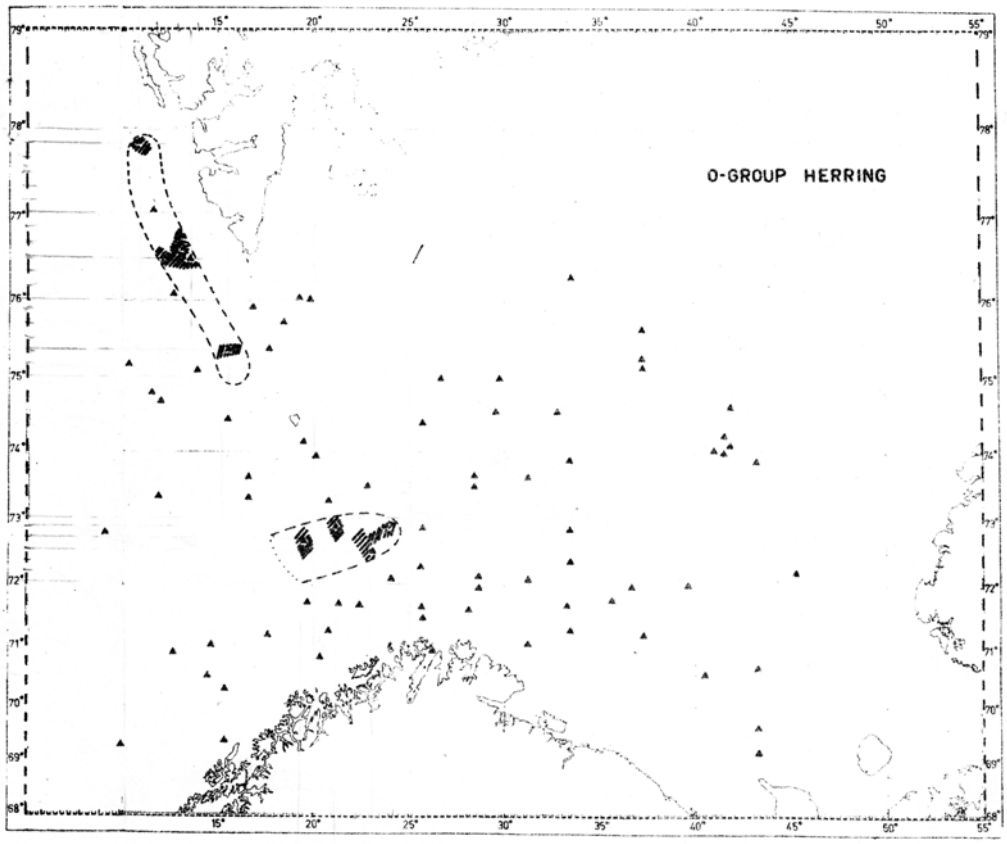

Fig. 6. Distribution of 0-group herring

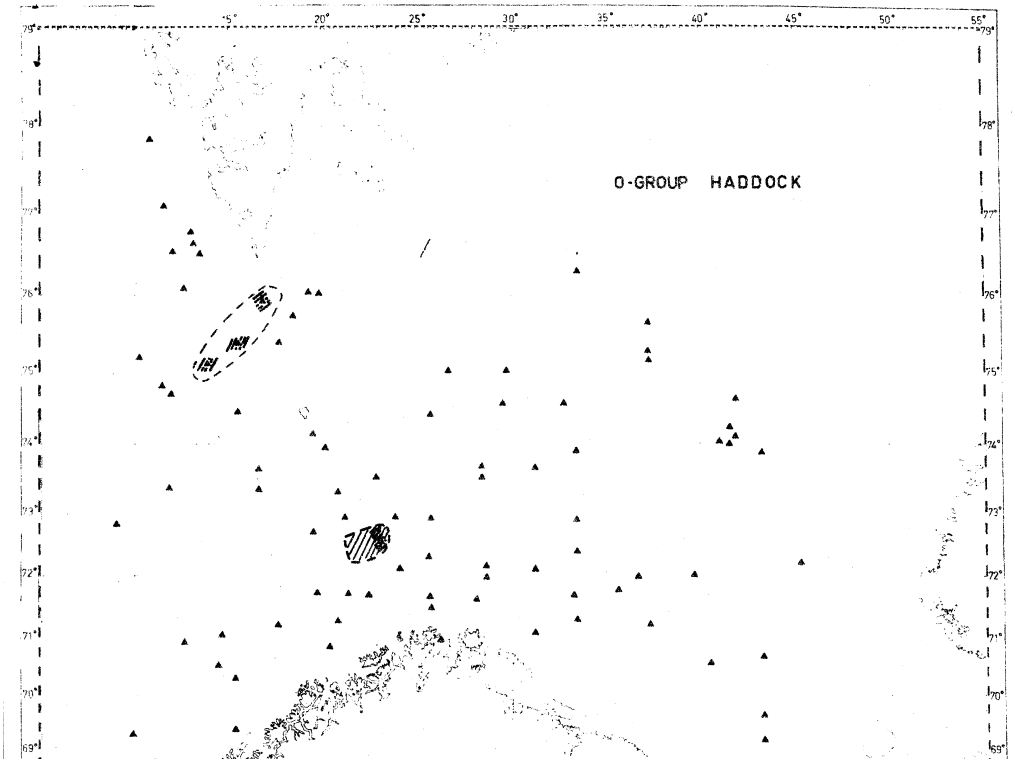

Fig. 7. Distribution of 0-group haddock

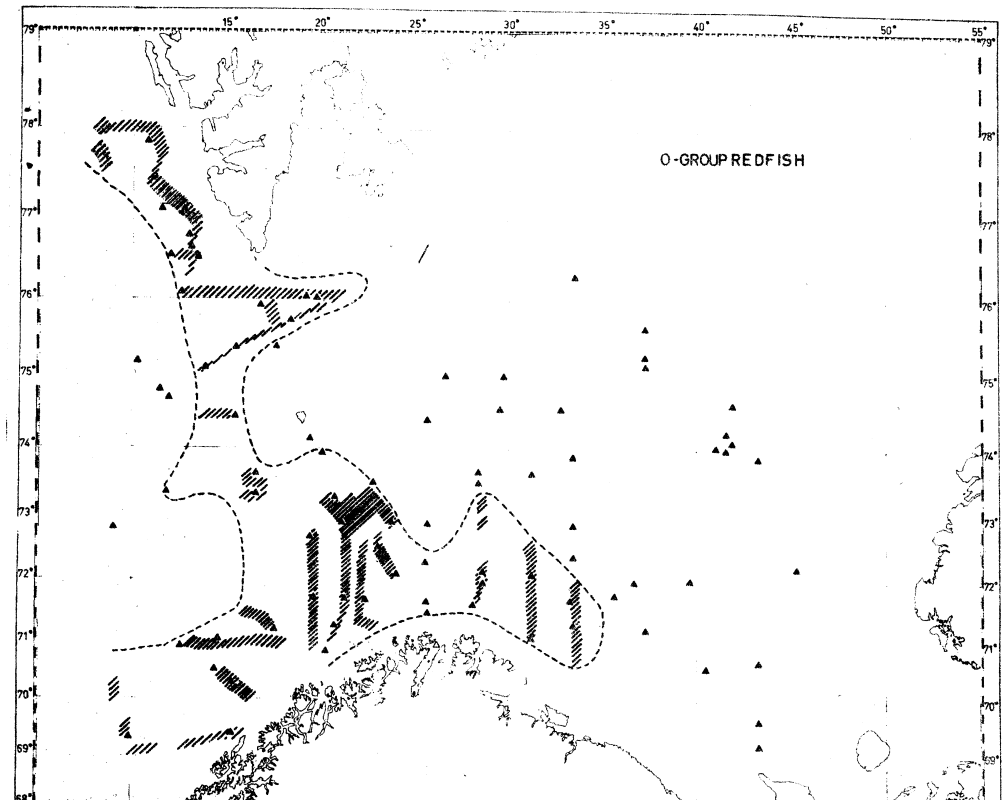

Fig. 8. Distribution of 0-group redfish

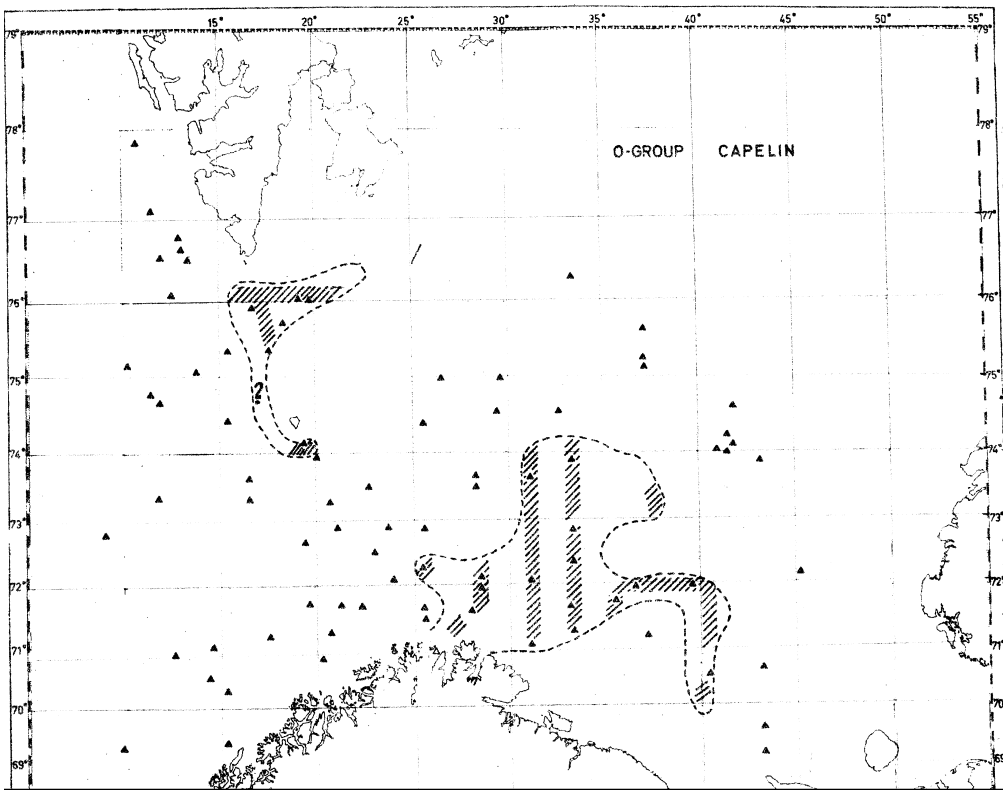

Fig. 9. Distribution of 0-group capelin

International Council for the
Exploration of the Sea

C.M. 1966/H:23
Herring Committee
Gadoid Committee
Attn. Comparative Flailing Committee
Hydrographic Committee

Preliminary Report of the joint international 0-group fish survey in the Barents Sea and adjacent waters August-September 1966

1. Introduction

Following the recommendation of the 1964 meeting of the ICES Herring Committee, Soviet and Norwegian research vessels undertook joint surveys of the distribution of the early stages of herring in the eastern Norwegian Sea and in the Barents Sea. The first joint survey was carried out in 1965 and from the results it was concluded that the method used could give a reliable estimate of the distribution of 0-group herring, and that the survey could usefully be extended to include 0-group stages of other important species, e.g. cod, haddock, redfish (Anon., 1965) In accordance with this enlarged scope of the survey the English research vessel was invited to participate in the survey reported here, which took place August 28th - September 10th 1966. The vessels taking part, and the scientists in charge of each vessel were:

USSR	R/V "Academik Knipovich"	Yu.K. Benko
	R/V "Fridtjof Nansen"	A.S. Selivorstov
Norway	R/V "Johan Hjort"	L. Midttun, P.T. Hognestad
	R/V "G.O. Sars"	O. Dragesund
England	R/V "Ernest Holt"	D.J. Garrod

The success of a survey of this kind depends upon close cooperation between scientist of different disciplines and a full list of those taking part is given in an appendix. The preliminary for program for the 1966 survey was discussed at a meeting in Bergen in June 1966 and final arrangements were concluded in Murmansk on August 25th - 27th. When the survey had been completed a third meeting was held in Tromsø, Norway September 11th - 14th to analyse the data collected.

2. Program and methods

The survey track of the five vessels is shown in Figure 1. This is similar to the 1965 grid, but the participation of the additional vessel made it possible to survey the whole area in more detail, and to extend it further west into the Norwegian Sea.

The basic technique employed was echo-sounding of the pelagic scattering layer with periodic midwater trawl hauls to identify the traces (Dragesund and Olsen 1965). So far as possible the apparatus used was standardized between vessels, but to ensure comparability of the results a preliminary internship calibration experiment was carried out before the survey commenced.

During the survey a continuous record of the pelagic scattering layer was collected with trawl stations being placed at appropriate intervals and depths determined by the characteristics of the trace, but not core than 40 miles apart in areas where a scattering layer was being recorded. In addition some control trawl hauls were carried out on the sea bed to determine the presence of 0-group fish that had already migrated out of the pelagic scattering layer.

Figure 1 also indicates the grid lines were worked as hydrographic sections in order to relate the distribution of organisms in the scattering layer to the principal hydrographic features of the region.

3. General outline of results

The time available at Tromsø at the end of the survey was not sufficient to carry out a comprehensive analysis of the data. In particular it was not possible to complete the interpretation of the hydrographic data in the absence of salinity determinations, and in the fish samples there are evidently some very interesting variations in the development of the 0-group stages between different areas. These aspects of the investigation will be reported at a later date and this preliminary report will only describe the distribution of temperature and of the 0-group fish with comments on their abundance.

3.1. Hydrography

On the hydrographic sections of the survey both temperature and salinity were recorded in order to determine the current and transport system has carried the 0-group fish from the spawning grounds up to their present localities. At present the salinity samples have net been analysed so it is only possible to discuss the temperature conditions which are presented as a series of horizontal and vertical sections in Figures 2, 3 and 4.

Even in the absence of the salinity measurements the general features of the current system are evident as tongue - shaped displacements of the isotherms, for example off West Spitsbergen and along the banks of Novaya Zemlya.

In the south western Barents Sea, up to approximately 37° E the temperature of 0-30 m layer was somewhat lower than average, and in the south eastern area it was considerably below the average for this time of year. Similarly the mean temperature of the 0-200 m layer of the North Cape - Bear Island section was 5.5 °C (0.5 °C below average) and in the Kola section across the Murman Current the anomaly of the 0-200 m layer amounted to – 1.3 °C (0-50 m layer -0,7 °C and 50-200 m layer -1.5 °C). Slightly above average surface water temperatures were only found in a very narrow band off the Murman Coast.

These predominantly negative anomalies suggested that either there has been an increased level of thermal loss from the sea surface during the winter of 1965/66, or the volume transport within the current system is below average. However, it is not possible to reach a definite conclusion until the salinity determinations have been analysed.

3.2. Distribution and abundance of 0-group fish

A chart of variations in the density of the total pelagic recordings is presented in Figure 5. It can be seen that the most dense traces were obtained between North Cape and Bear Island, at Spitsbergen, and in the eastern Barents Sea, but as in previous surveys many other organisms besides the 0-group fish have contributed to these traces. In general terms the 0-group fish were most abundant in the west and central area of the Barents Sea. Elsewhere

adult herring were present in the north-eastern Norwegian Sea (73°00' N-75°00' N and 05°00' E -15°00' E) and herring of the 1963 and 1964 year-classes were present off the East Finnmark coast southeastward to 40°00' E. Similarly adult blue whiting were found along the eastern boundary of the Norwegian Sea, and adult polar cod and capelin were widely distributed in the north-eastern Barents Sea from south east of Hope Island, east to Novaya Zemlya through the area whore the pelagic scattering layer was almost entirely absent. Concentrations of adult polar cod also extended into the south eastern Barents Sea.

These larger echo scatterers gave a readily identifiable trace could be excluded from the total survey trace in Figure 5. However, in addition, in the north-eastern Barents Sea, in a limited area near the Norwegian coast, and at Spitsbergen, the 0-group fish were heavily mixed with larger invertebrate organisms, particularly Euphausidae, Amphipodae and various medusa. Some allowance has been made for this in assessing the distribution and abundance of 0-grcup fish of different species illustrated in Figures 6-11.

These distribution charts are plotted from a consideration of the density of echo-traces attributed to the various species according to the trawl hauls. These catches were also used to confirm the general level of abundance which has been assessed on a scale 1 - 4 with isolines enclosing areas with reliably distinct levels of trace density It will be appreciated that these quantities are not precise, but close similarities between the catches of different vessels surveying the sane area confirm the general levels shown in the charts.

In addition to the 0-group fish of the species discussed below, 0-group fish of other less important species were also recorded. For example 0-group catfish were very widely, but sparsely distributed and 0-group Lumpenus, Cottidae and Myctophidae were occasionally reported and a very few 0-group Greenland halibut were recorded west of Spitsbergen.

3.2.1. Herring (Figure 6)

The 0-group herring were restricted to the Norwegian coastal belt with a slight extension northeastwards from North Cape. None were recorded north of 72°00' N or east of 34°00' E. It appears that the o-group herring had not penetrated into the fjords at the tine when the survey was carried out although they were present in the coastal waters. In 1965 the 0-group herring had a more offshore distribution.

A very few scattered individuals were recorded along the West Spitsbergen current, but they did not form any identifiable record "patch". This distribution contrasts with the results of the 1965 survey which recorded two patches of approximately equal abundance, one midway between North Cape and Bear Island, and a second north west of Bear Island to Spitsbergen.

At that tine the abundance of the 1965 year-class of herring was estimated to be very low compared to the more abundant, but still below average year-classes of 1963 and 1964. On this basis the present survey suggests that the 1966 year-class is also exceptionally low and this corresponds with the results of Norwegian and U.S.S.R. larval surveys carried out off the Norwegian Coast earlier this year.

3.2.2. Cod (Figure 7)

The distribution of 0-group cod was broadly similar to that of herring, but extended further to the north east, towards Central Bank. 3ven within this area they were very scarce indeed. Only 20 individuals were caught and in view of this scarcity only the trawl stations where cod were taken have been shown in the chart: no isolines can be drawn. No 0-group cod were found north of Bear Island and extensive bottom trawling in that area at varied depths, and elsewhere in the eastern Barents Sea, failed to locate any o-group fish on the sea-

bed. This confirms Baranenkova's opinion that 0-group cod are still present in the pelagic scattering layers at the time of the survey (Baranenkova, Drobysheva and Ponomarenko 1964). Therefore the 1966 year-class of cod oust be expected to be very poor indeed and this again confirms the results of larval surveys carried out earlier tills year.

3.2.3. Haddock (Figure 7)

0-group haddock were even less numerous than the cod, only 8 specimens being caught during the survey. For this reason the data have been illustrated in the same way as for the cod and included in Fig. 7. None were recorded as far north as Bear Island, but it is not possible to define their distribution accurately. However, it is clear that as for herring and cod the 1966 year-class must be extremely poor.

3.2.4. Saithe (Figure 7)

The 0-group saithe have not yet been found in the scattering layer forming characteristic traces. This was also the case during the present survey, although a few specimens were taken in the trawl catches. The 0-group saithe were found somewhat more westerly and northerly distributed than the cod and haddock (Figure 7).

3.2.5. Redfish (Figure 8)

0-group redfish were by far the most abundant pelagic echo scatterers in the western Barents Sea south of Boar Island between 15°00' E and 33°00' E. The western boundary of this distribution corresponded closely with the edge of the continental shelf and spread north and eastward along the main branches of the oceanic currents, reaching as far north as Prince Charles Foreland off West Spitsbergen and to the Central Bank and Skolpen Bank in the east. However, in the West Spitsbergen current, the distribution of 0-group redfish was very indistinct and only scattered individuals were present in trawl catches north of Bear Island. Within the main "patch" it was possible to distinguish a higher level of abundance which is indicated in the chart and which again reflects the orientation of the "path" along the path of the cost important water currents.

The main concentration of 0-group redfish corresponds very closely with the distribution recorded in the previous years, but its northerly extension to West Spitsbergen was very poorly represented compared to the results of the 1965 survey. On the other hand the complete survey suggests that in 1966 0-group redfish are significantly acre abundant than in 1964 and 1965 although these two year-classes were also considered to be above average strength. Consequently this holds a good prospect for the redfish fishery in future years.

3.2.6 Capelin (Figure 9)

0-group capelin were found over a very wide area, but once again in contrast to the 1965 survey they were poorly represented along the West Spitsbergen current with only a slight trace being recorded between Bear Island and the South Cape of Spitsbergen. The main patch was situated slightly further to the east than the concentration of 0-group redfish, with a western boundary at about 23°00' E and extending far to the north-east to the latitude of Hope Island and south-east to the edge of the survey area. It will be evident from the chart that the distribution of 0-group capelin tended to be discontinuous within this whole area, but it is possible to say that the main concentration lay between 71°00' N and 74°00' N. 0-group

capelin was not found close to the Muman and East Finnmark Coast although spawning is known to have taken place in the latter area during 1966. The distribution is centered further north and east than the o-group capelin recorded in 1965 and they are considered to more abundant this year.

3.2.7. Long rough dab (Figure 10)

The distribution of long rough dab overlapped that of 0-group capelin over a wide area, but it extended further to the northwest beyond Bear Island to Spitsbergen and it had a particularly marked northeast ward extension past Hope Island and beyond the limit of the survey. Long rough dab do not give such a well defined echo as other species so that it was not possible to form a reliable estimate of the varying abundance of fish within the whole area. However, the trawl catches indicate that there was an area of greater abundance in the southwestern half of the total distribution, between 72°00' N to 74°00' N, and 17°00' E to 35°00' E. This is very similar to the results of previous surveys.

3.2.8. Polar cod (Figure 11)

This year it has come desirable to consider the distribution of polar cod because for the first time 0-group fish of this species were found in significant quantities. Figure 11 shows the great difference between the distribution of polar cod and that of the other species. Two concentrations were found, one in the southeastern Barents Sea, from 40°00' E, east and northeast beyond the limit of the survey area. A second dense patch covered the banks west and south of Spitsbergen with a "tongue" extending as far south as Bear Island. Here again the northerly limit of the distribution could net be defined within the survey area.

4. Length compositions (Figure 12)

Figure 12 shows the length composition of 0-group redfish, capelin, long rough dab and polar cod, as taken from the total catches of each species by the U.S.S.R. and Norwegian research vessels. The numbers of 0-group herring, cod and haddock were not considered adequate to construct an accurate length composition. It is not possible at this stage of the investigation to comment on the comparison with the length composition recorded in 1965, or on the possible variations in length recorded in different parts of the area surveyed.

5. Discussion

There are a number of marked contrasts between the distributions recorded in 1966 and those of 1965. In particular the herring had a very much more coastal distribution than in 1965; although further east, both 0-group capelin and long rough dab were absent from the coastal waters off the Murman and East Finnmark coast. This second feature also occurred in 1965. Further north both 0-group long rough dab and capelin had a very much more pronounced north easterly extension of their distribution than in 1965 and both species and also 0-group redfish were relatively poorly represented northwest of Bear Island. In contrast polar cod were very much more numerous than in 1965 and had the extension southward from Spitsbergen and Bear Island which has not been recorded in previous surveys.

The analysis of the hydrographic data has not yet been carried far enough to relate these differences in the distribution of 0-group fish to any distinctive features of the distribution of the water masses. However, an attempt has been made to compare the

distribution of 0-group redfish and the isotherms in 50 m. Judging from Figure 13 it seems to be a fairly good correlation between the 4 °C isotherms and the border of the redfish distribution. This fact indicates that the transport of postlarval fish takes place along the path of the most important water currents and consequently it will be of great importance to relate differences in distribution of 0-group fish with any variations in the hydrographic condition.

Investigations carried out by U.S.S.R. earlier in the year have suggested that water transport to the Bear Island area has been weaker than usual (Kislyakov - verbal communication). It is also worth noting that the distribution of 0-group capelin lay further to the east than the distribution of 0-group redfish and this must be related to differences in either the time or area where spawning takes place.

6. Recommendations

1) The scientists participating in the survey consider that the results are of sufficient interest, that the work should be continued at least until such time as wider fluctuation in year-class strength of the important species have been observed, and until separate assessments of the strength of these same year-classes can be deduces from the commercial fisheries. It will then be possible to evaluate the accuracy of the method for determining year-class strength and will provide further information on the distribution of mortality of young fish during the first year of life.

2) The survey should be maintained in its present enlarged scope for the tine being, with a further extension of the area, southwest along the Norwegian coast, to be surveyed before or after the main work as carried out this year.

3) Every effort should be made to improve the techniques and apparatus employed in the survey, particularly with respect to refining the quantitative assessment of the traces, and to identifying the echo-scatterers by new methods in addition to the central midwater trawl hauls.

7. References

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Appendix

Scientific personnel

U.S.S.R.	R/V "Akademik Knipovich"	Yu.K. Benko, A.G. Kislyakov, A.A. Chernyshevich, I.P. Penina, E.S. Demidenko, N.G. Zherebtsova.
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	R/V "Johan Hjort"	L. Midttun, P. Hognestad, B. Brynildsen, O. Nakken, W. Løtvedt, H.E. Olsen, S. Agdestein, Sujatno Birowo.
England	R/V "Ernest Holt"	D.J. Garrod, R.R. Dickson, R.B. Mitson, J.E. Nicholls, B.K. Clarke.

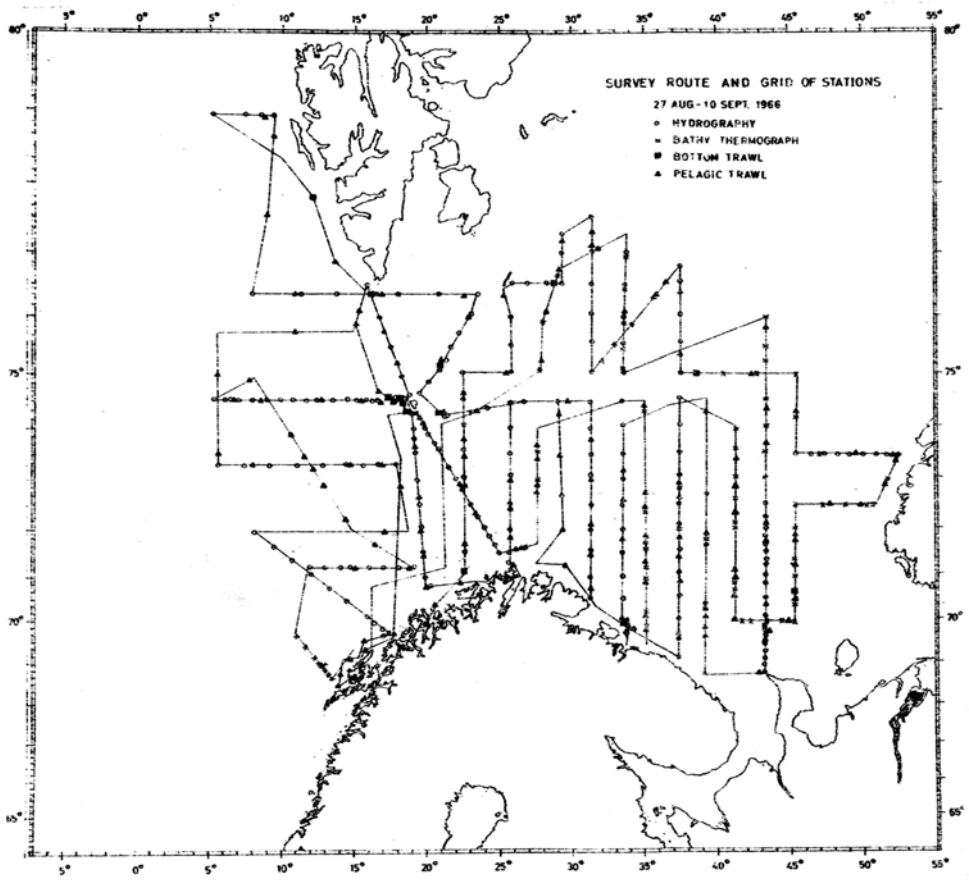


Fig. 1. Survey routes and grid of stations

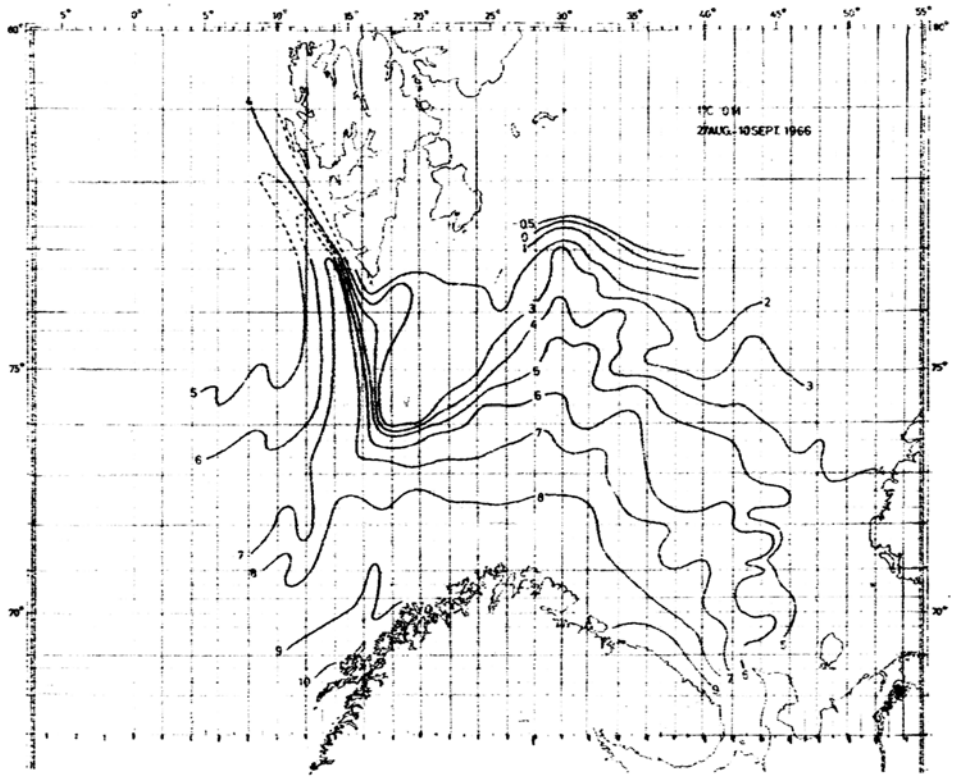


Fig. 2. Isotherms at 0 m

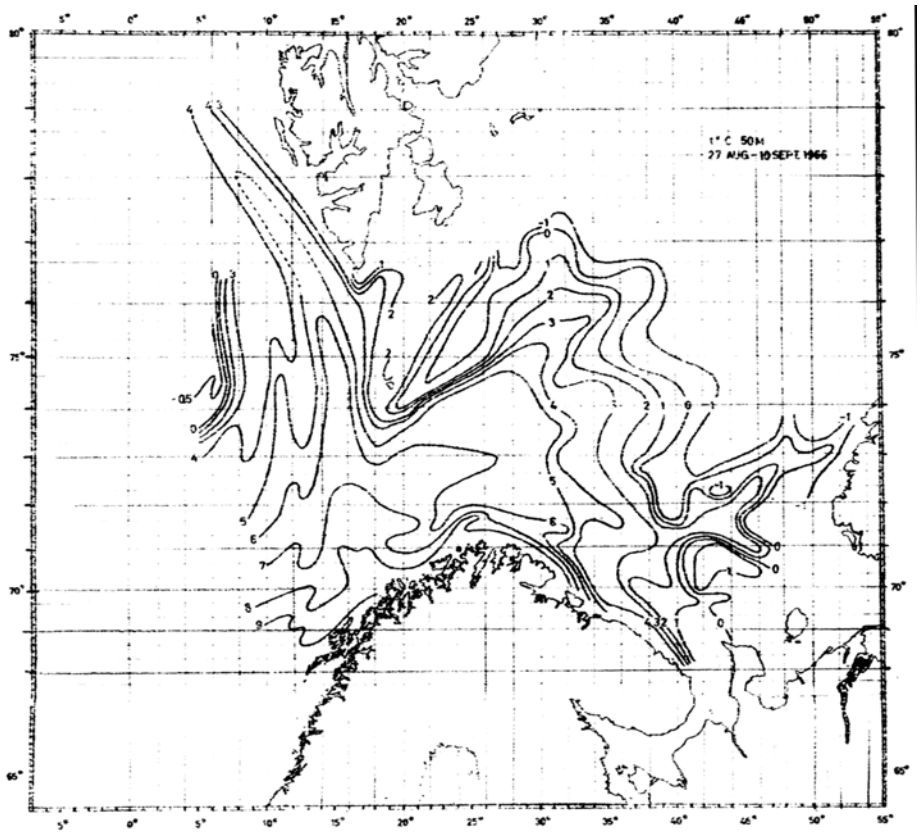


Fig. 2a. Isotherms at 50 m

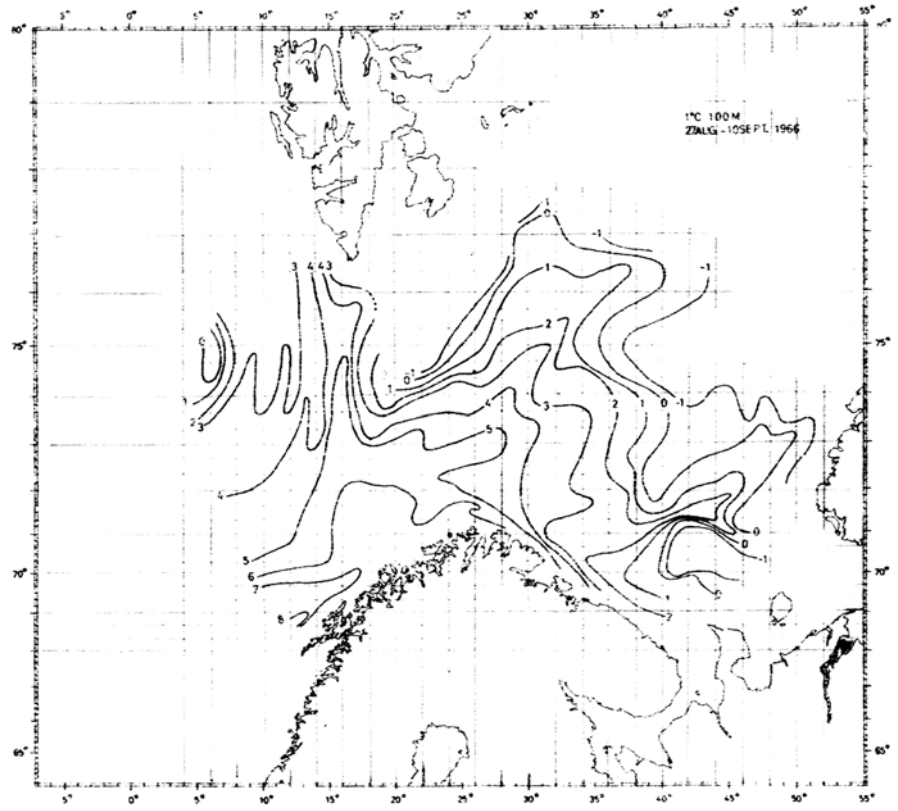


Fig. 3. Isotherms at 100 m

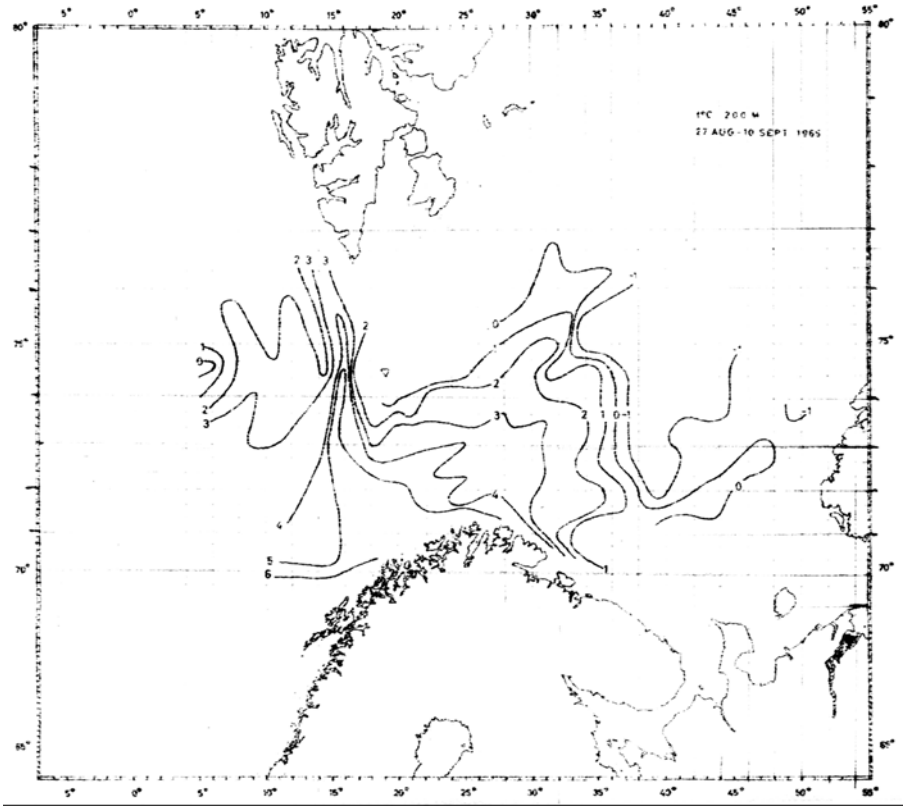
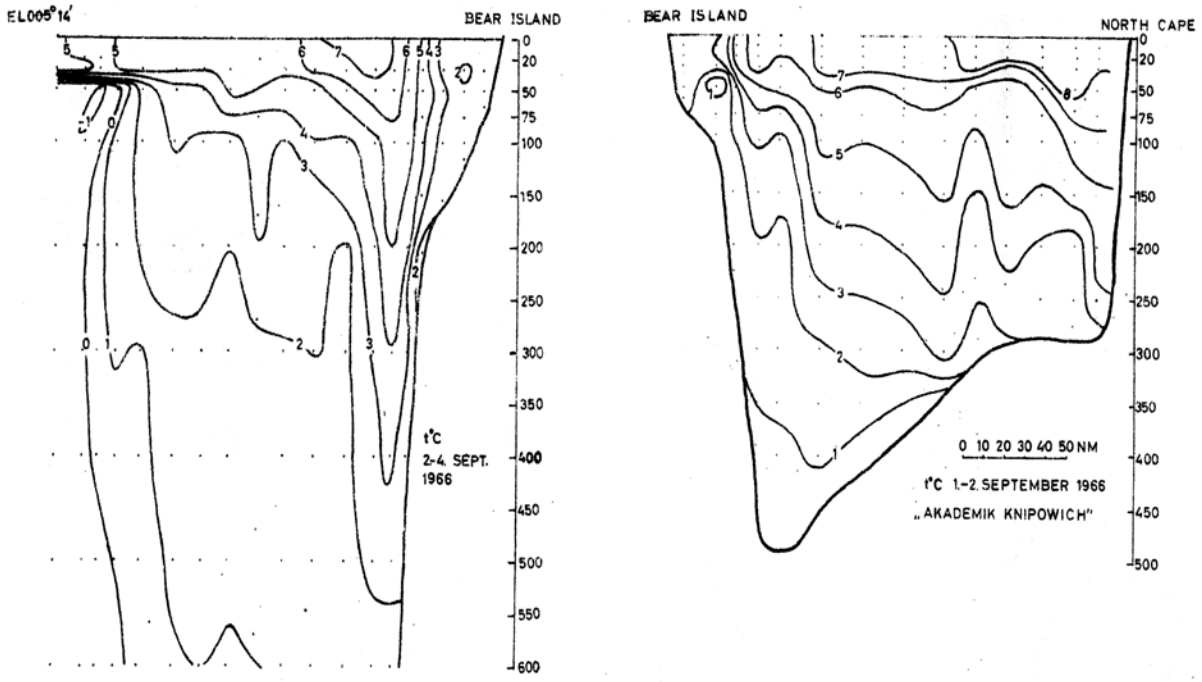


Fig. 3a. Isotherms at 200 m



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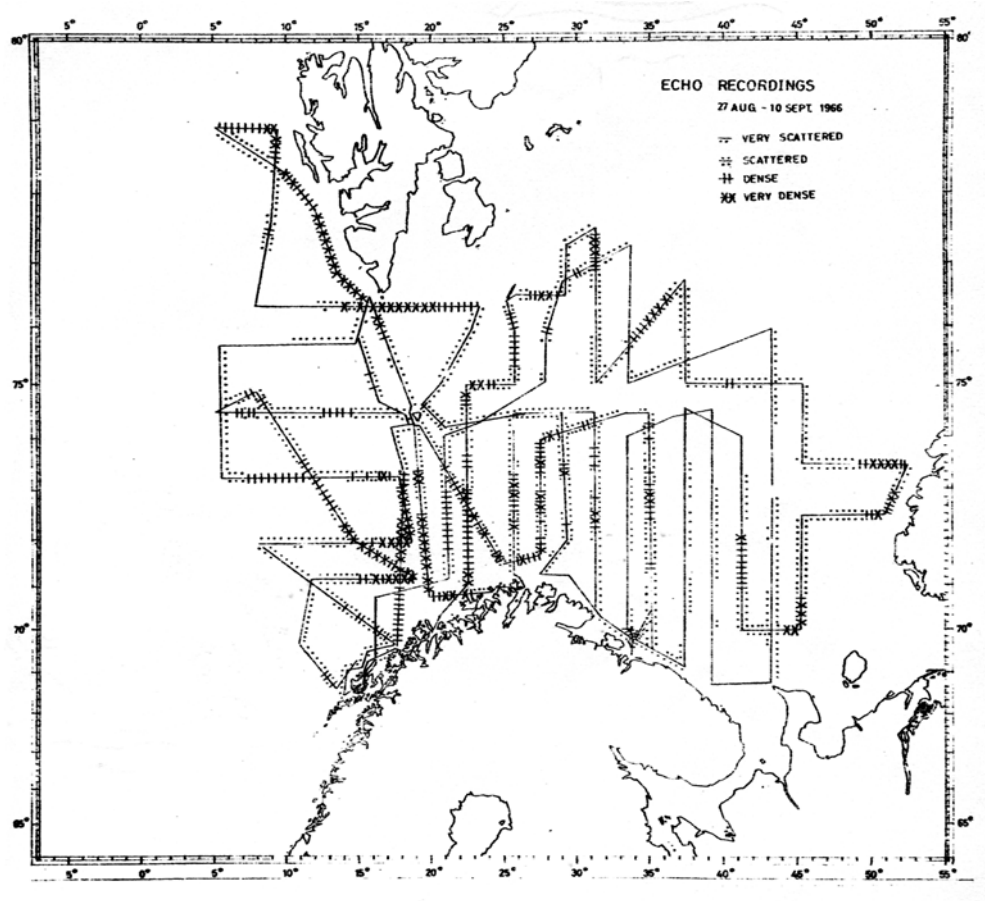

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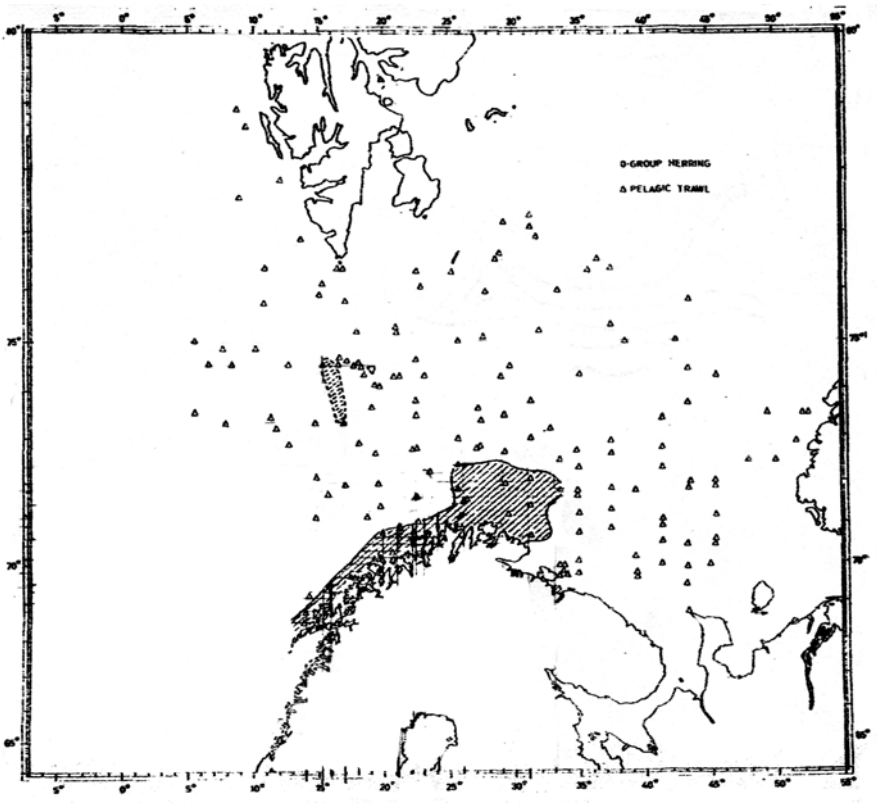


Fig. 6. Distribution of 0-group herring

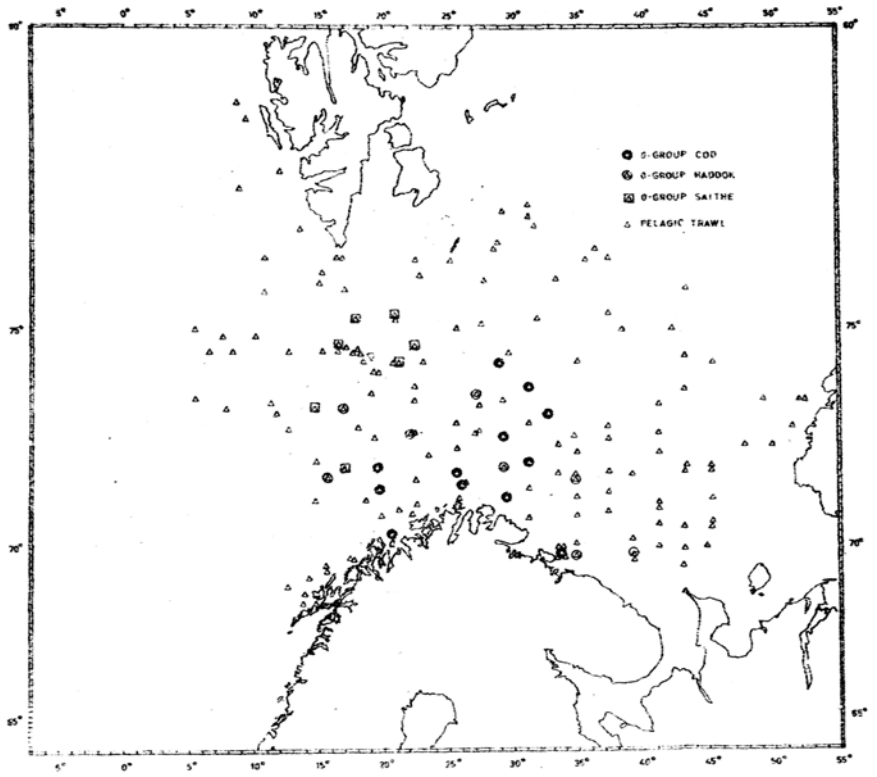


Fig. 7. Distribution of 0-group cod, haddock and saithe

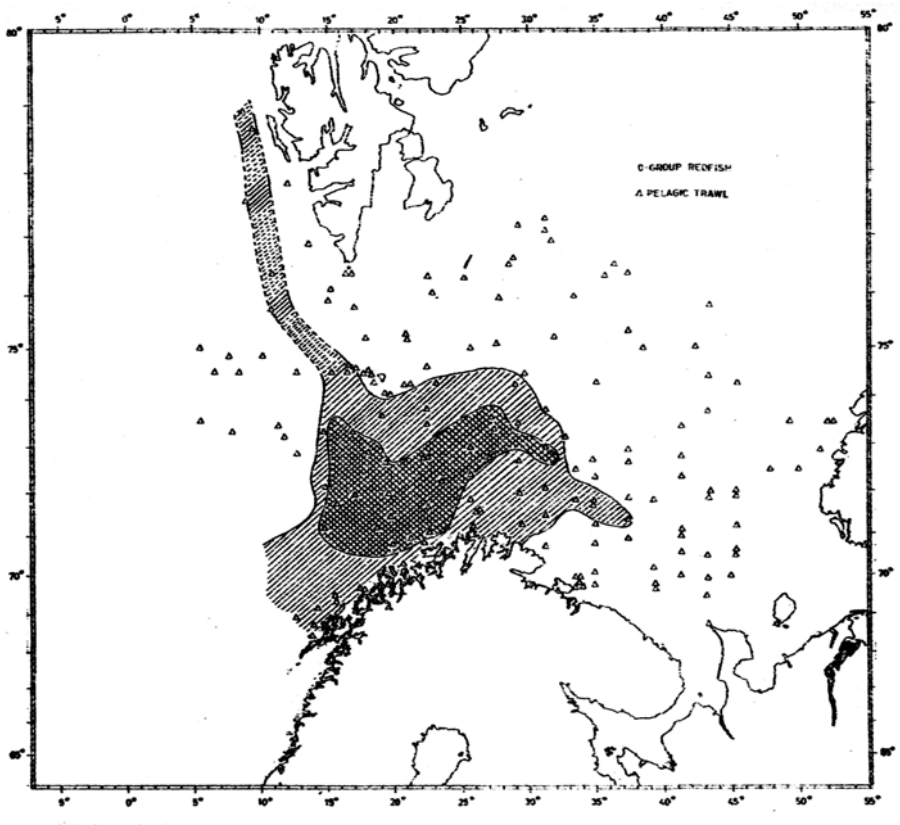


Fig. 8. Distribution of 0-group redfish. The double hatching indicates the highest abundance

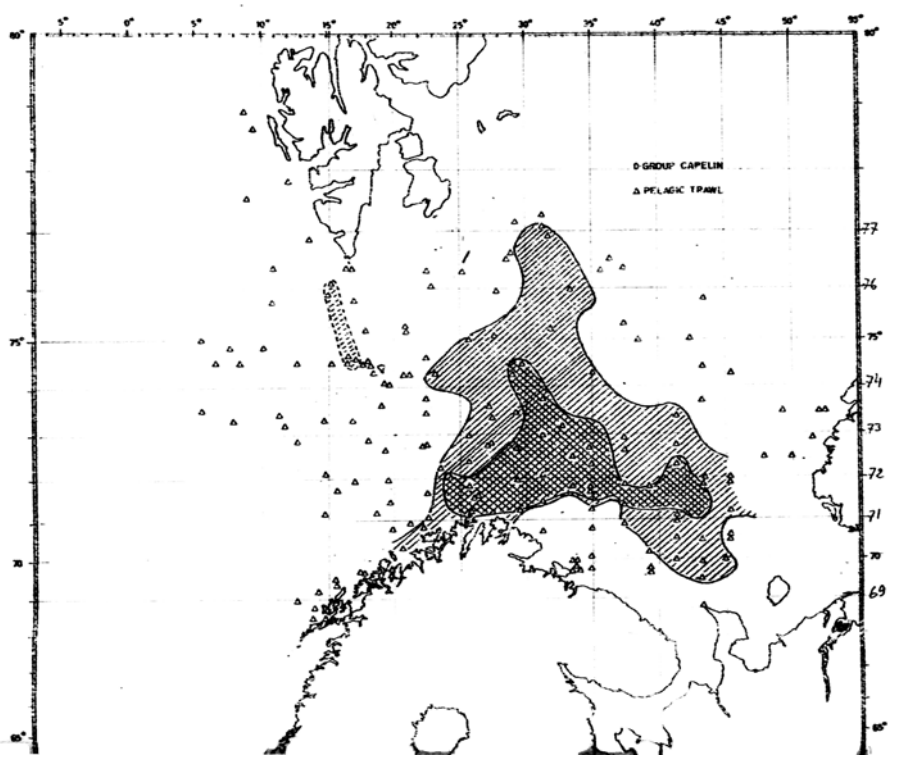


Fig. 9. Distribution of 0-group capelin. The double hatching indicates the highest abundance

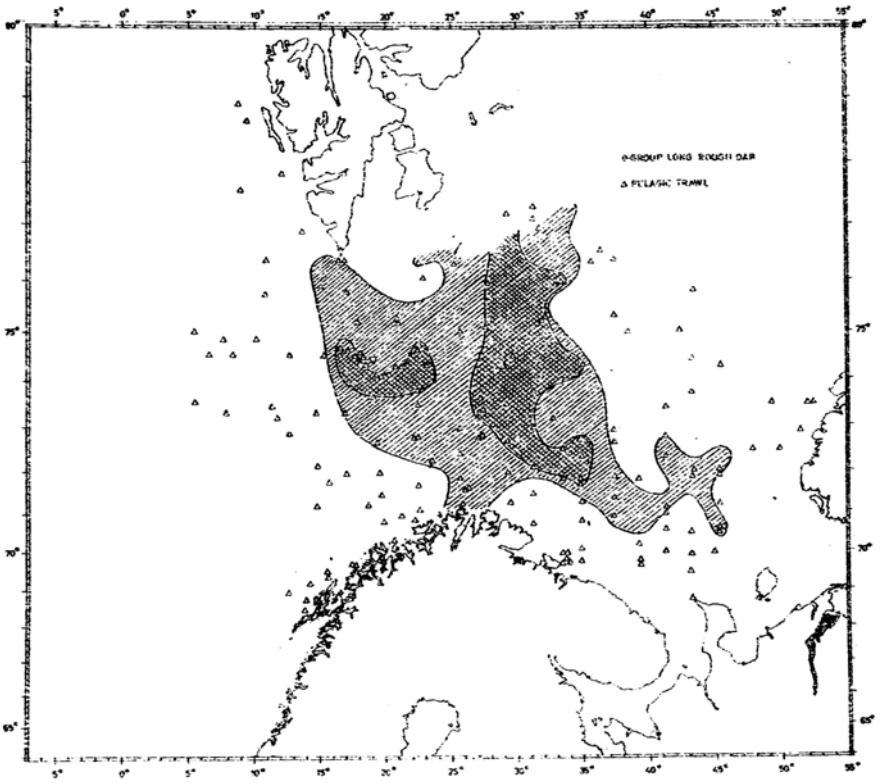


Fig 10. Distribution of 0-group long rough dab. The double hatching indicates the highest abundance

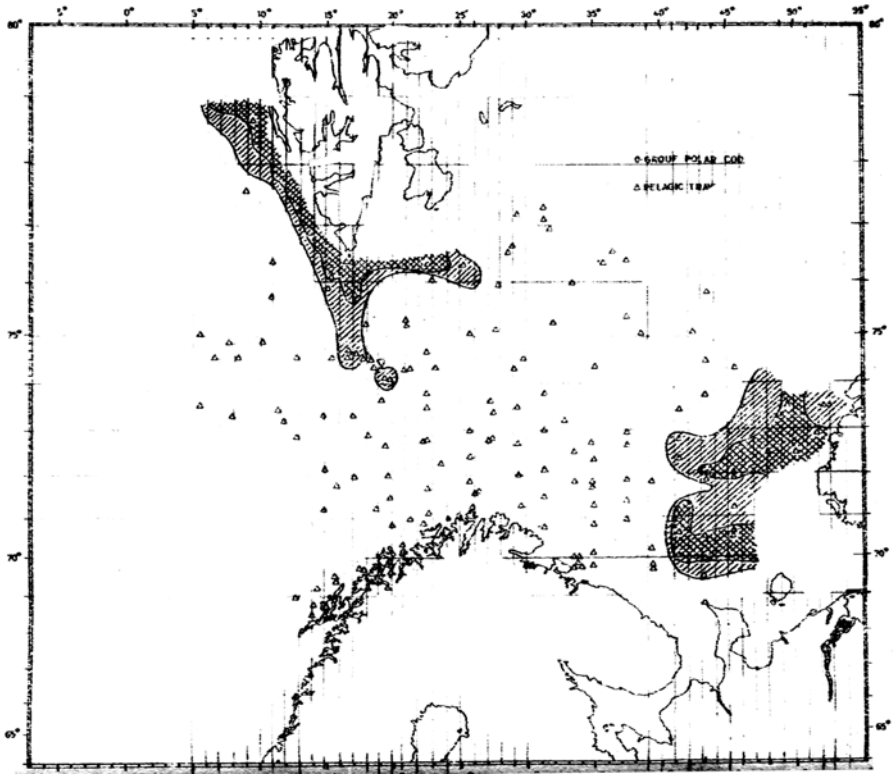


Fig. 11. Distribution of 0-group polar cod. The double hatching indicates the highest abundance

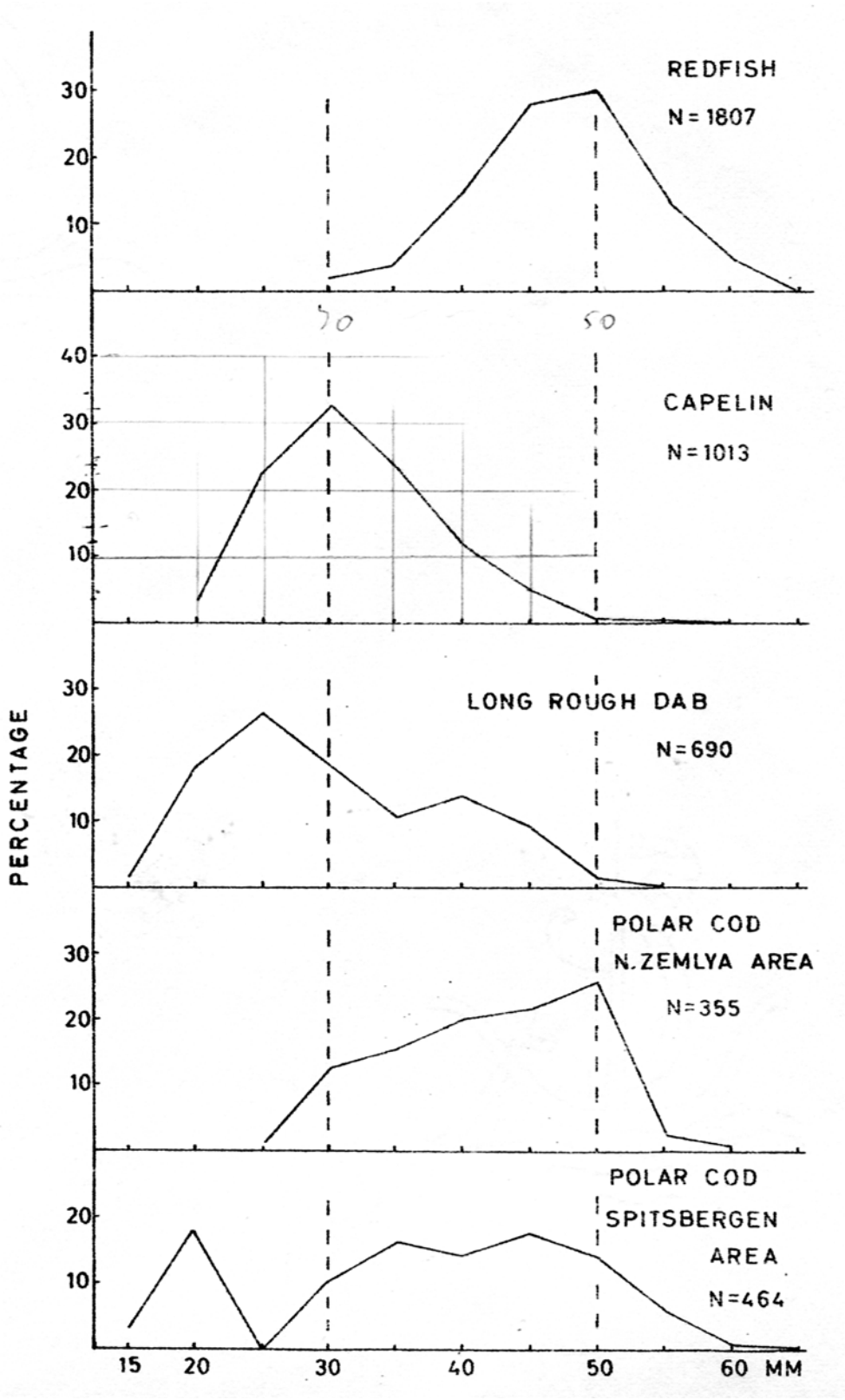


Fig. 12. Length composition

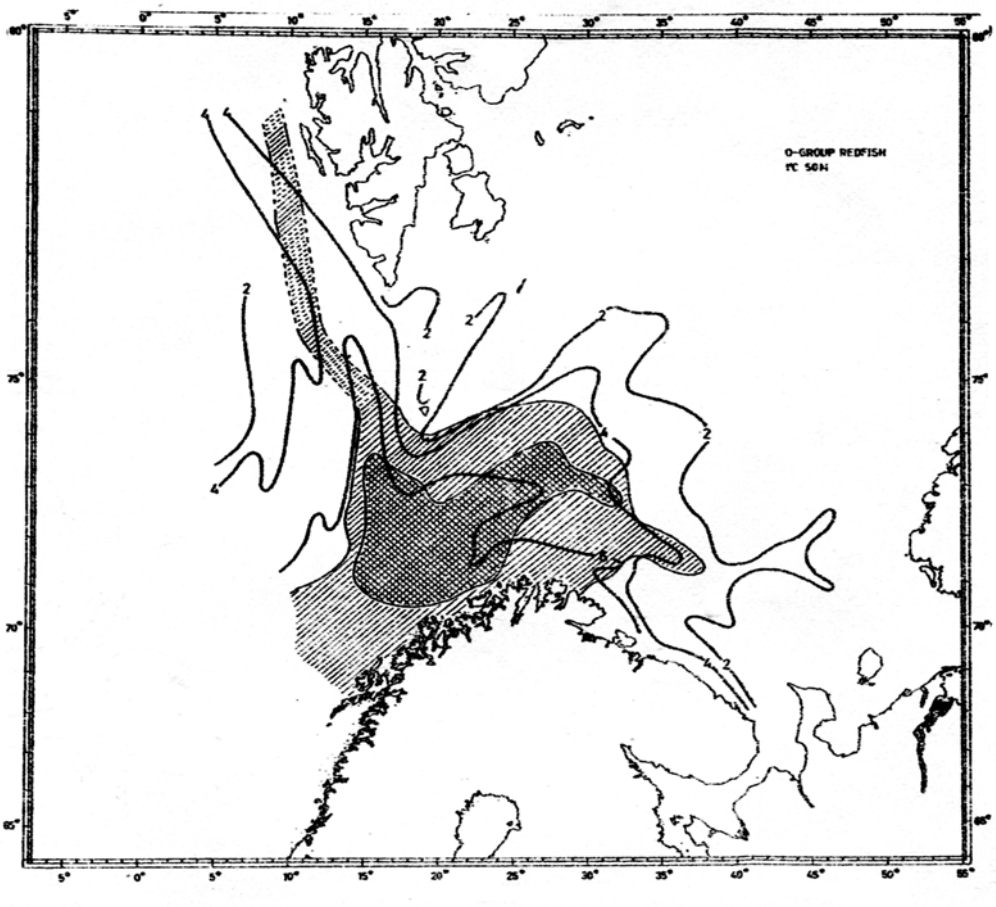


Fig. 13. Distribution of 0-group redfish compared with isotherms at 50 m

International Council for
the Exploration of the Sea

C. M. 1967/H:31
Pelagic Fish (Northern) Committee
Demersal Fish (Northern) Committee
Ref:
Gear and Behaviour Committee
Hydrographic Committee

Preliminary Report of the international 0-group flan survey in the Barents Sea and adjacent waters August-September 1967

1. Introduction

Representatives of the countries participating in the previous 0-group surveys (USSR, Norway and England), agreed that the results achieved in 1965 and in 1966 showed considerable promise for determine the abundance and distribution of 0-group fish of the different species of commercial importance. It was therefore concluded that a similar survey should be carried out in autumn 1967 with especial reference to the distribution of 0-group herring, capelin, cod, haddock and redfish, but including other species important to the ecological system of the area e. g. long rough dab and saithe.

The vessels taking part end the scientists in charge of each vessel were:

U.S.S.R.	R.V. "Akademik Khipovich"	Yu.K. Benko
	R.V. "Fridtjof Nansen"	A.S. Seliverstov
Norway	R.V. "Johan Hjort"	O. Dragesund, P.T. Hognestad
	R.V. "G.O. Sars"	L. Midttun, S. Olsen
England	R.V. "Ernest Holt"	D.J. Garrod

Following preliminary planning in Bergen in June 1967, and at Murmansk on 22—23 August, the survey was commenced on 24-th of August and continued through 9-th September, and was followed by a meeting in Tromsø 9 - 12 September in order to exchange data and analyse the results.

2. Methods

The techniques used were exactly the same as those used in the previous survey of 1966, namely the estimation of the density, distribution and identity of the pelagic scattering layer by echo-sounding, supported by direct sampling with a pelagic trawl. In order to improve the quantitative aspects of the survey experiments were also carried out with echo integration techniques and with high frequency echo-sounding (100 kHz) in order to give more precise details of the infrastructure of the scattering layer.

The survey grid, which can be seen in Fig. 1, follows closely the grid of 1966 with extended coverage to the north-west of West-Spitsbergen, as far as 80°00' N, and to the south-west off the Norwegian coast to 10°00' E and 67° N the latitude of Vestfjord.

3. Results

A comprehensive analysis of the data could not be carried out during the time available at Tromsø. In particular it was not possible to prepare a complete synopsis of the hydrographic situation, but nevertheless it is possible to identify the main features of the distribution of 0-group fish and to contrast it with the distribution observed in previous years.

3.1. Hydrography

The salinity samples have not yet been analysed and only the temperature condition in a series of horizontal and vertical sections are presented (Figs. 2, 3 and 4).

In the section Bear Island towards west the temperature of the surface layer was approximately 1.0 °C higher than in 1966 (Fig. 4). The temperature also appeared to be higher in the deeper layers and this may have been caused by increased transfer of heat within the branches of the Norwegian Current.

It is evident from observations made by U.S.S.R. that the large anomalies have been observed within the North Cape Current during the last years decreased in the spring and summer of 1967. Thus, the temperature of the 0-200 metre layer within the section North Cape - Bear Island increased during the period March to August with 0.7 °C compared to a normal increase of 0.4 °C. In the 0-200 m layer the absolute value of the temperature was 5.7 °C i.e. slightly below average, and in deeper layers (from 200 m to the bottom) the temperature was above the long-term average and about 1 °C higher than in 1966.

In the section crossing the Murman Current in the Kola meridian, and further east, the temperature in 1967 is almost at average level and considerably higher than last year (Table l).

Table 1. The temperature in various layers measured in the Kola section (70°30' N - 72°30' N).

Year/Layer	0-50 m	50-200 m	0-200 m
1967	7.5	4.05	4.9
1966	6.6	2.7	3.6
average	7.5	4.05	4.9

In the Goose Bank Current the 3 °C isotherm extended to the meridian. 45°00' E in 1967, whereas in 1966 it extended only to 35°00' E.

During the period of this survey the surface temperature in the western areas reached the long-tern average, at the Kola meridian it was 0.5 °C higher than average, and in the shallow waters of the south - eastern area it was considerably above average and 3.5 °C higher than in 1966.

Thus, in general the distribution of temperature observed in the Barents Sea in 1967 was near the long term average, in contrast to the low temperatures observed in 1966. This change which began in spring 1967 has been brought about by increased transfer of heat by the current system.

3.2. The distribution and abundance of 0-group fish

The variation in total density of the scattering layer is shown in Fig. 5. As in previous years this figure includes also traces from organisms other than the 0-group fish, especially from certain invertebrate species of Medusae, Euphausidae, Amphipodae, which contribute to

the uppermost scattering layers. The illustration also includes the contribution from fish of older age groups laying in mid water down to 250 m.

Intership calibration of results obtained from the same area has shown that the methods used give consistent agreement between vessels as to the location and density of the traces. Variations in echo abundance have bean expressed on a subjective scale of 0 to 4. The experiments with electronic integrators show that these subjective estimates are too coarse and rather inaccurate at high densities. Further experimental work on the influence of diurnal variation in the distribution of the scatters is also necessary before more precise quantitative measurements can be made.

The results show clearly that the main distribution of the scattering layer was almost entirely confined to the central part of the Barents Sea between the meridians 20°00' E and 45°00' E, with a subsidiary concentration further east along the coastal waters of Novaya Zemlya. In 1966 this principal scattering layer extended eastward from meridian 15°00' E. On the Svalbard shelf and off West Spitsbergen there was a marked contrast in the total abundance of scattering layer as compared with last year. The density was relatively low on the banks, but on the other hand there were significantly greater concentrations of the mid-water shoals off the edge of the continental shelf.

Apart from the principal 0-group species discussed below isolated specimens of Anarhichas, Agonus, Triglops and Leptagonus, were also recorded, and 0-group mackerel, Argentina and Myctophum occurred in the south-western area of the survey off Vestfjord. It was noticed that the Myctophum in particular were more numerous and more widely distributed than in previous years.

3.2.1. Herring (Fig. 6)

Throughout the entire survey 0-group herring were only located in small numbers in isolated patches in the south-western area and off North Cape. The abundance was probably lower than that of the 1966 year-class, which itself is regarded as being a very poor one.
Thus, in all three years during which the joint surveys have been carried out, the recruitment to the Norwegian spring spawning stock of herring appears to have been extremely low. It is, therefore, to be expected that the impact of these three very poor year-classes on the abundance of the exploited stock will in due time be seriously felt.

3.2.2. Cod (Fig. 7)

0-group cod with a length range 40-90 mm (Fig. 14) were distributed throughout the area north of Norway between the approximate limits of 25°00' E to 38°00' E with a narrow extension along the Murman coast. However, they were absent from a small area of coastal water off the eastern Finnmark coast. Even more important and unexpected, no 0-group cod were found on the Svalbard shelf, either to the south-east of Bear Island, or anywhere in the main part of the West Spitsbergen Current. In comparison with previous years it is clear that the 1967 year-class is rather weak though more numerous than those of 1965 and 1966. During the early years of the life history there is very little movement of cod between the Barents Sea and the Svalbard shelf, so the present distribution suggests that recruitment to the cod stock on the Svalbard shelf will be very poor indeed, and it is noticeable that this year the 0-group cod are almost entirely distributed within the Barents Sea itself.

3.2.3. Haddock (Fig. 8)

Haddock were observed within the general limits 20°00' E and 35°00' E with an extension towards south-east off the Murman coast. This distribution follows basically the sane pattern as in previous years, though they did not extend quite so far to the east as the 0-group cod. There were some variations in abundance within the main distribution of the haddock stock, with a higher concentration in the central part of the region. Overall these haddock were more considerably numerous than in 1965 and 1966, but it is not yet possible to assess how much better this year-class might be.

3.2.4. Saithe (Fig. 9)

Saithe were distributed over the Barents Sea more widely than cod and haddock, and in contrast to these two species a considerable number of saithe shoals was found and identified along the West Spitsbergen Current. Recently ingested 0-group saithe were found in stomach contents of cod at Bear Island, and positive identification of shoals extended to 78°00' N. However, similar traces were recorded northwards to the limit of the survey.

The experience of this year has also shown that already at this stage the saithe tend to form shoals with high target strength, indicating high numbers of individuals in spite of the relatively small size or volume of the shoals. This is confirmed by some incidental catches up to 200 tons in one shot by Norwegian purse seiners fishing for herring in the area at the brim of the survey.

Evidently the present sampling technique is quite inadequate for the fast-swimming, shoal-forming 0-group saithe. Nevertheless, it can be concluded that this year the abundance of saithe fry is exceptionally high with the main concentration in the area to the west and northwards from Bear Island. There is no previous observation of a comparable oceanic mass distribution of 0-group saithe, and no hypothesis can at this stage be advanced as to the chances of survival of these young fish. However, it is noticed that at the tine of the survey the condition of the saithe fry was good and their size (Fig, 14) rather large for their age. Consequently, unless a mass mortality occurs the indications are that the 1967 year-class of saithe will be very rich.

3.2.5. Redfish (Fig. 10)

The 0-group redfish were found to extend less far to the north than in 1966 with fewer identifiable traces in the West Spitsbergen Current. This more limited distribution is perhaps consistent with their reduced abundance compared with the two last years, and it may also be significant that the redfish caught in the trawl catches had a lower length range than in 1966, 20 - 50 mm in length (Fig. 14) compared to 30 - 60 on last year.

3.2.6. Capelin (Fig. 11)

The distribution of the young capelin was much the same as in previous years, being principally more to the eastward than the distribution of cod and haddock, with well defined extension and area of increased abundance along the main currents, reaching almost to Novaya Zemlya. One of the main features of the distribution of the 0-group capelin this year compared to that of 1966 is the close approach to the Murman coast. Last year the capelin distribution had a well-defined southern boundary. It will also be seen that in contrast to cod, isolated pitches of capelin were located in the West Spitsbergen Current, off the Storfjordrenna. The extent and overall density of the distribution suggest that though they

may not be quite so numerous as in 1966, nevertheless this is an indication of a good 1967 year-class of capelin.

3.2.7. Long rough dab (Fig. 12)

As in previous years the 0-group long rough dab were distributed further to the north-east than any of the other warn-water species. This concurs with the presumed area of the spawning relative to the spawning grounds of cod, haddock and redfish. Even so, comparison of the distribution of long rough dab with the isotherms at 50 metre indicates that the main area of distribution is confined by the cold water front of the north and eastern Barents Sea. Very few long rough dab were observed in the West Spitsbergen Current.

3.2.8. Polar Cod (Fig. 13)

This species were found distributed in exactly the same area of the eastern Barents Sea as in previous years, with a roughly comparable abundance. However, no concentration was to be found on the Svalbard shelf. This is a marked change from last year and must indicate that their total abundance is lower.

3.2.9. Adult and juvenile pelagic fish

It has already been noted that the survey detected mid-water shoals of age groups other than 0-group fish.

Maturing capelin were observed along the slope east of Bear Island to north-east of Hope Island with the densest concentrations on the Hope Island Bank. Some few adult capelin was also found further east on the Central Bank and near Novaya Zemlya.

I-group capelin wore observed over a wide area east of 42°00' E stretching from Cape Kanin to 74°00' N. Scattered observations of I-group capelin were also made on the Central Bank east of Bear Island.

Adult polar cod were observed over a wide area stretching from the shelf east of Bear Island to Hope Island, the Central Bank and the Novaya Zemlya, where the greatest concentrations were observed.

Shoals of fat herring (1963 and 1964 year-classes) were distributed at the entrances of Varangerfjord and Kola Bay, and at the time of the survey mature herring were concentrated in an area north-west of Bear Island between 74°30' N and 76°00' N and 07°00' E to 12°00' E.

Similar to the survey of last year, blue whiting were found over wide areas along the eastern boundary of the Norwegian Sea. In view of the size of the area where blue whiting were observed it can be concluded that the stock size of this species, which is presently unexploited, must be quite considerable.

4. Discussion

Although the broad distribution of the scattering layer was rather similar to that of 1966, we have found considerable changes in its structure. Firstly, redfish were less abundant this year, cod and haddock were present in larger numbers, but herring were again very scarce indeed. Throughout the Barents Sea the distribution of total echo traces of 0-group fish corresponded very well with the distribution of the isotherms recorded at the hydrographic sections. The extension of the capelin, cod, haddock and redfish along the main part of the Goose Bank is very clear. It is also clear that this year the 0-group fish have penetrated along

the east coast of Finnmark and the Murman coast in the Murman Current, leaving a relatively barren area on the East - Finnmark coast. The presence of concentration of 0-group fish in these coastal waters contrasts with the result of 1966 when the scattering layer was confined more to the Goose Bank Current with no significant traces along the coast.

To the north the weakness of the scattering layers on the Svalbard shelf and off West Spitsbergen ls a very significant change from 1966 and particularly from 1965. These changes are probably associated with the changes in hydrographic structure throughout the area and the return this year to near average temperature conditions. This might also be associated with the large quantities of saithe found in the West Spitsbergen Current. The contrast between this and the distribution of cod and haddock has already been referred to, and it seems possible that as in the other species the difference may in part be attributed to differences in the location of the time and area of the spawning with respect to the principal current system.

Recommendations

1. The results obtained during the three years surveys appear to be of sufficient interest to warrant a continuation of the work. The participating scientists, therefore, recommend that the joint survey should be repeated annually, at least until such time as separate assessments of the strength of some of the year-classes studied as 0-group fish by these surveys can be made from the catches of the commercial fisheries.

2. The survey should be maintained in its present scope and be carried out at the same time of the year. For 1968 a tentative starting date of August 24-th is suggested for the work at sea of all the vessels, but immediately prior to this date Soviet scientists will carry out a pre-survey as a guide for finalizing the program of the full survey to be discussed at a meeting in Murmansk. This program will be established at a meeting in Bergen in June 1968, during which the surveying technique is to be thoroughly reviewed.

3. Since the main short-coming of the present technique appears to be the difficulties encountered in identifying the echo-recordings, it is strongly recommended that high priority should be given to work on improving the identification and sampling methods. This work could follow two lines of approach, namely:

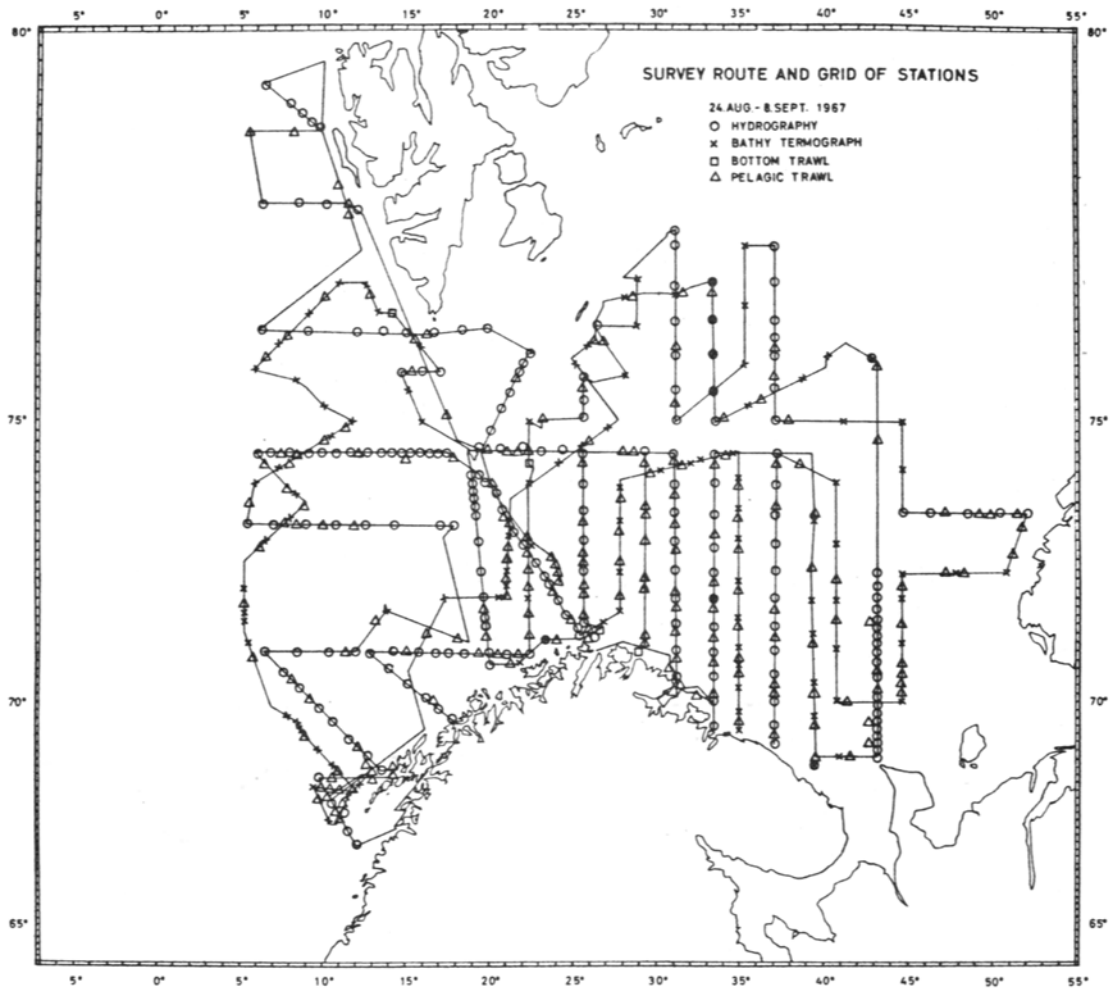
a) making the catch of fish fry more efficient and reliable by improving the design or type of the trawl used and simplifying the handling and control of the trawl. Serious consideration should also be given to the application of a suitable small purse seine;

b) refining and developing further methods of acoustic identification, for instance by applying echo-sounders with higher resolution, and by carrying out more detailed studies of target strength and trace pattern of the scatters.

4. The experience gained so far suggests that the subjective method of grading the intensity of echo-traces received is not adequate for proper quantitative assessments. Further efforts should therefore be made to develop and utilize precise methods for obtaining unbiased quantitative estimates of the echo-traces received. If possible, all vessels should during the 1968 - survey use integrators, and intership calibrations of the equipment should be carried out. It is also essential that theoretical and experimental work are conducted to establish the relationship between integrated signal voltage and the abundance of the scatters.

5. The participating scientists will endeavour to prepare each year at the end of the survey a progress report of their work for submission to the appropriate committees of ICES. It is recommended that a more comprehensive analysis and record of the data should be published at intervals of 3 to 5 years.

A suggestion for the scope and list of contents of the publication, comprising the data of the first four years (1965 - 1968), is to be prepared by the Norwegian participants within the end of 1967, to be circulated for comments by their colleagues within June 1968.



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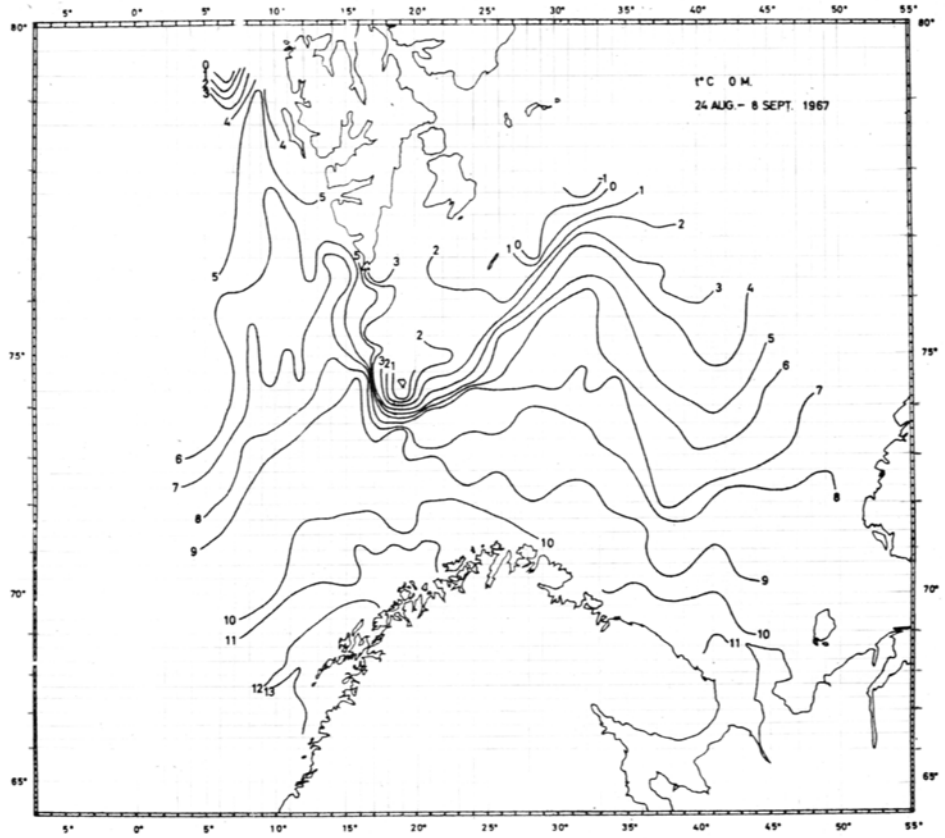

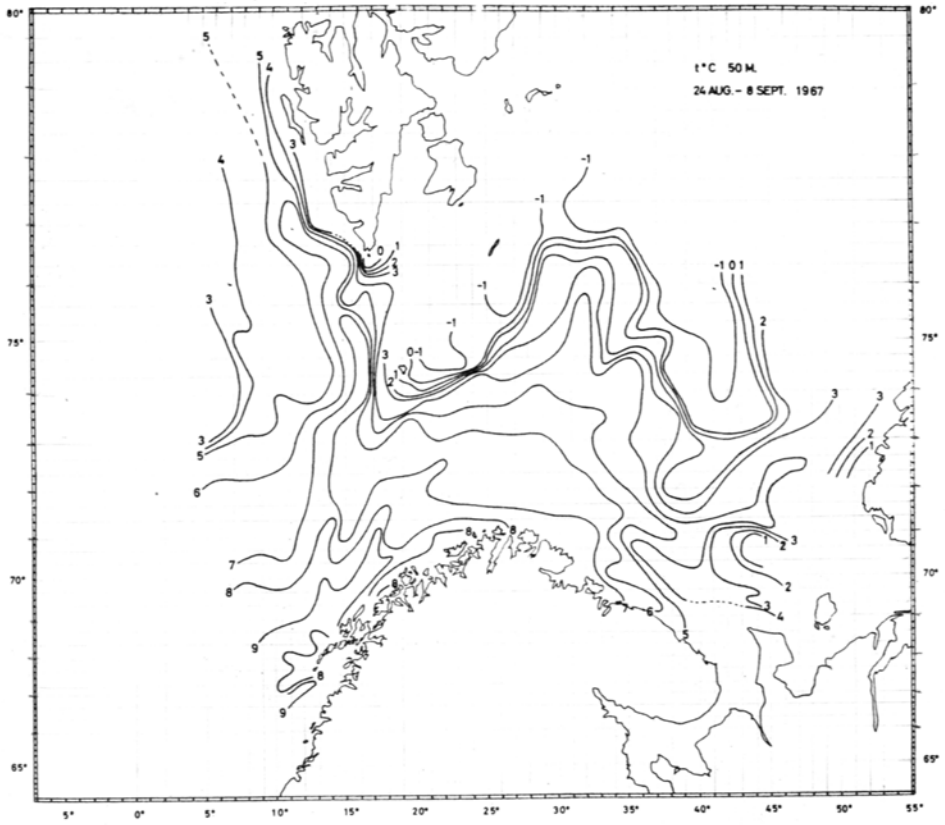

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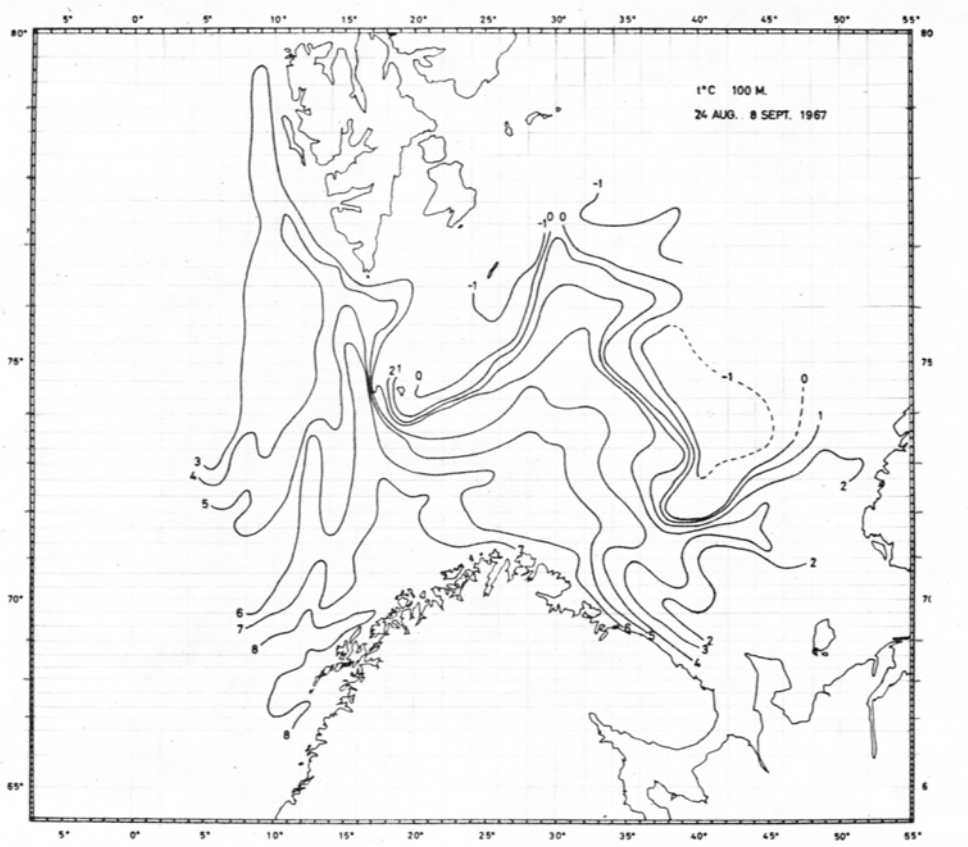


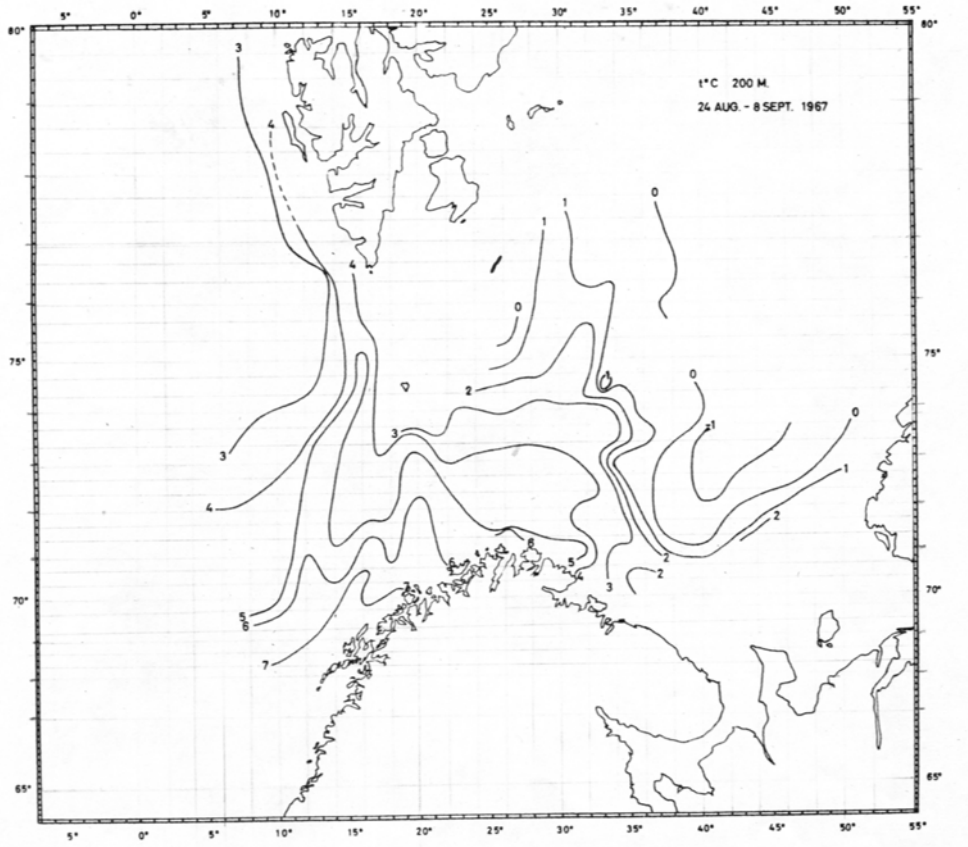
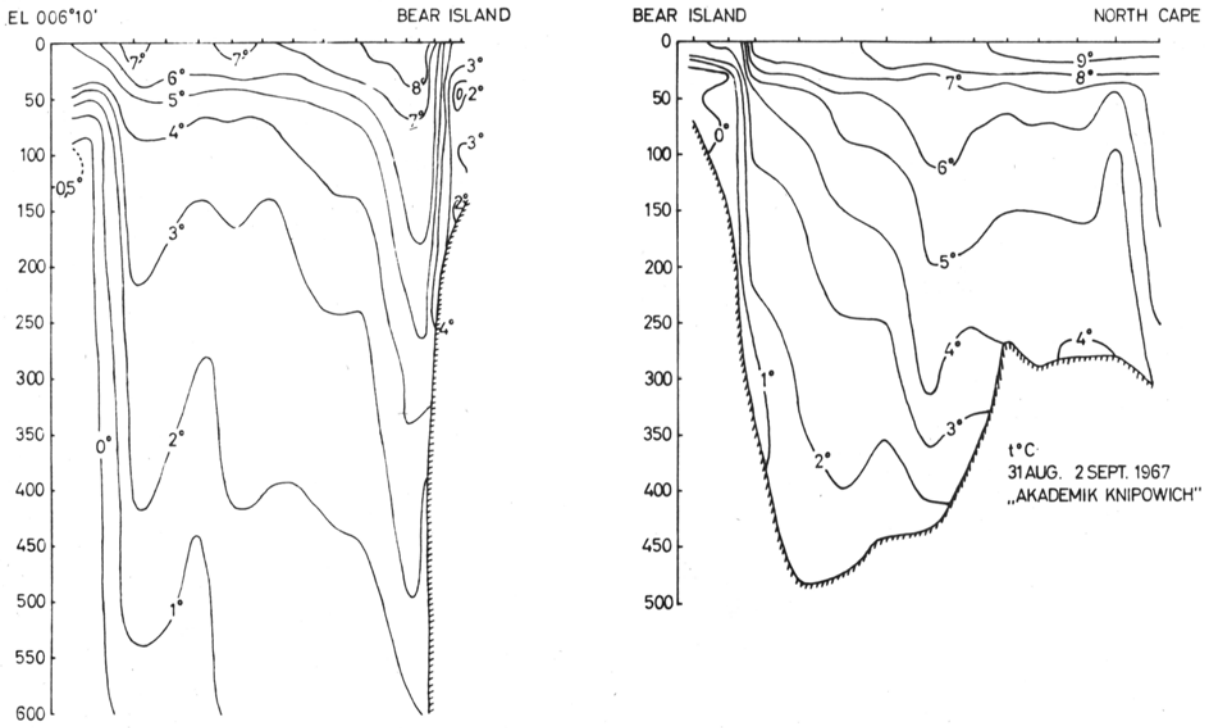


Fig. 3. Isotherms at 100 and 200 m



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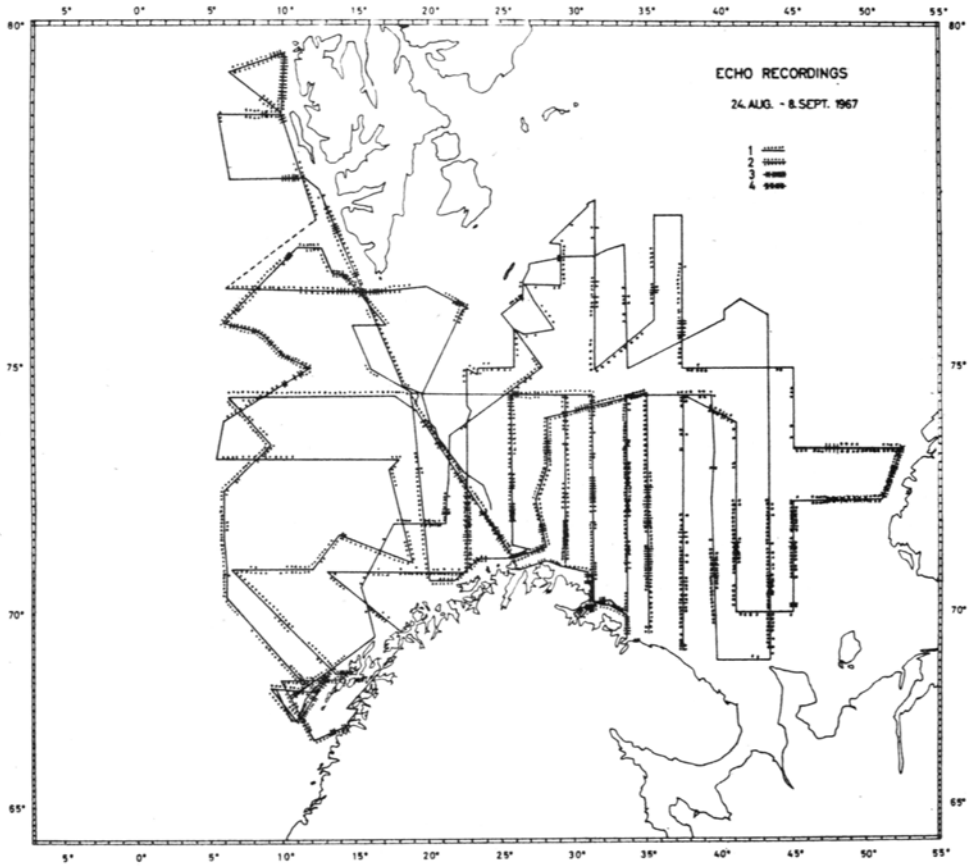

Fig. 5. Courses and total echo recordings

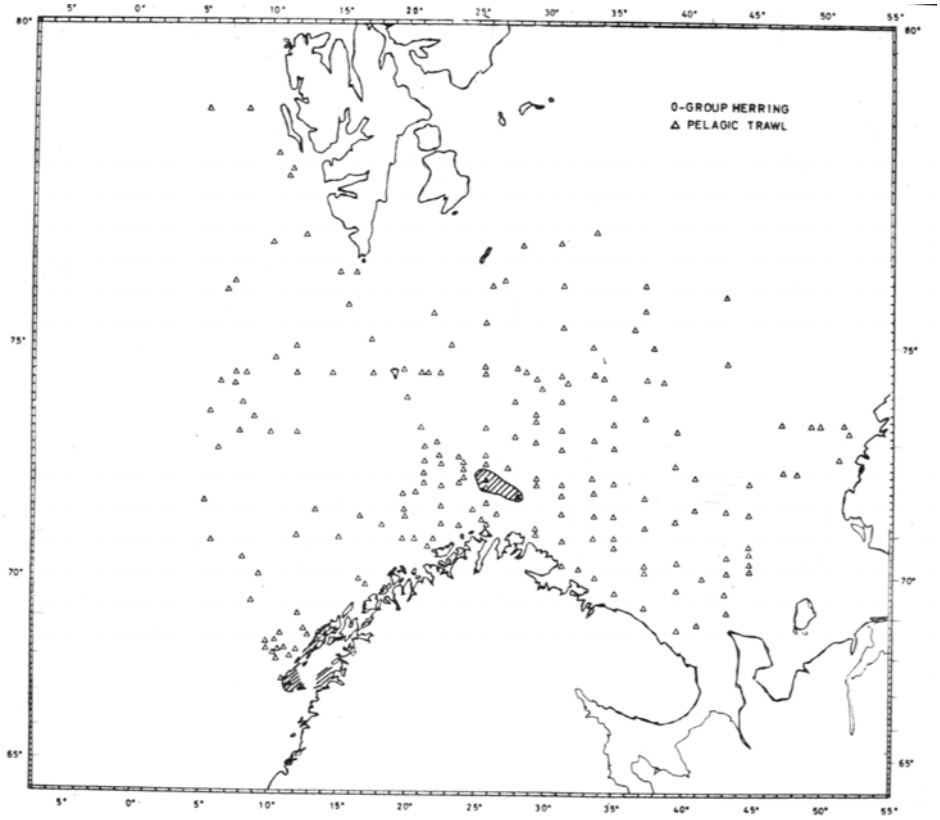

Fig. 6. Distribution of 0-group herring

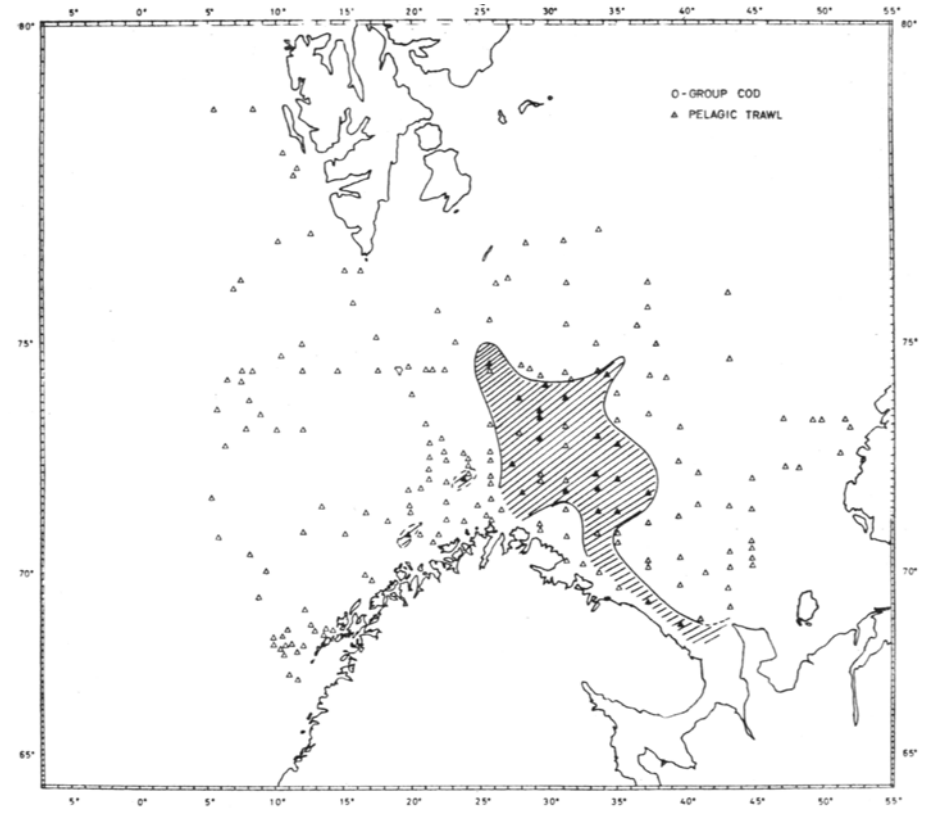

Fig. 7. Distribution of 0-group cod

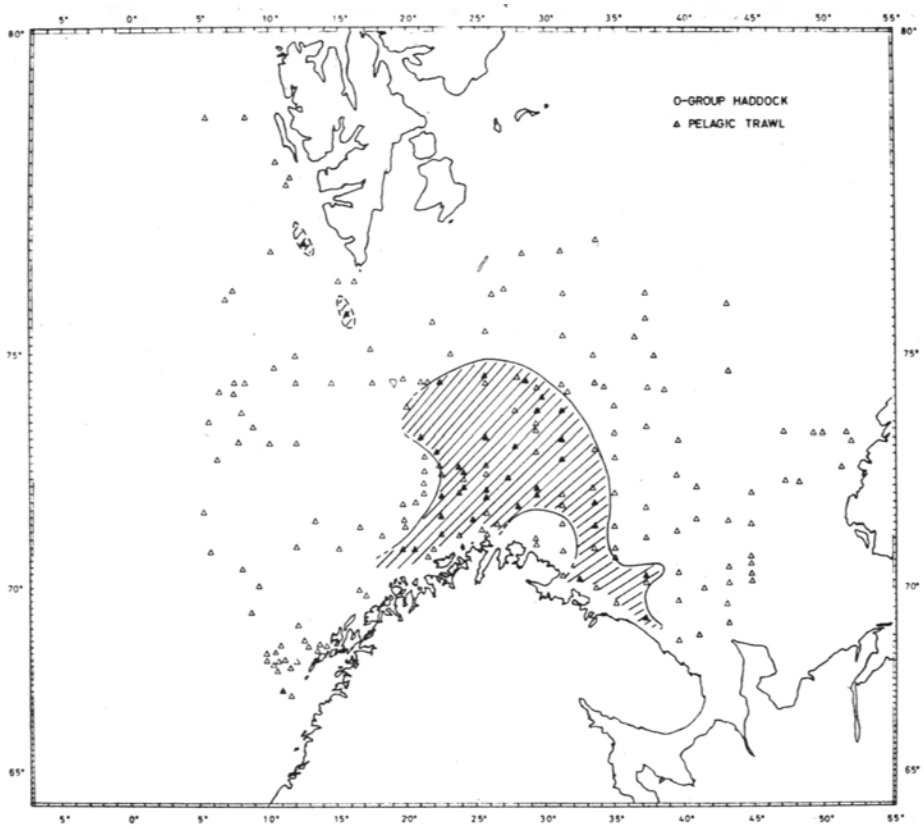

Fig. 8. Distribution of 0-group haddock

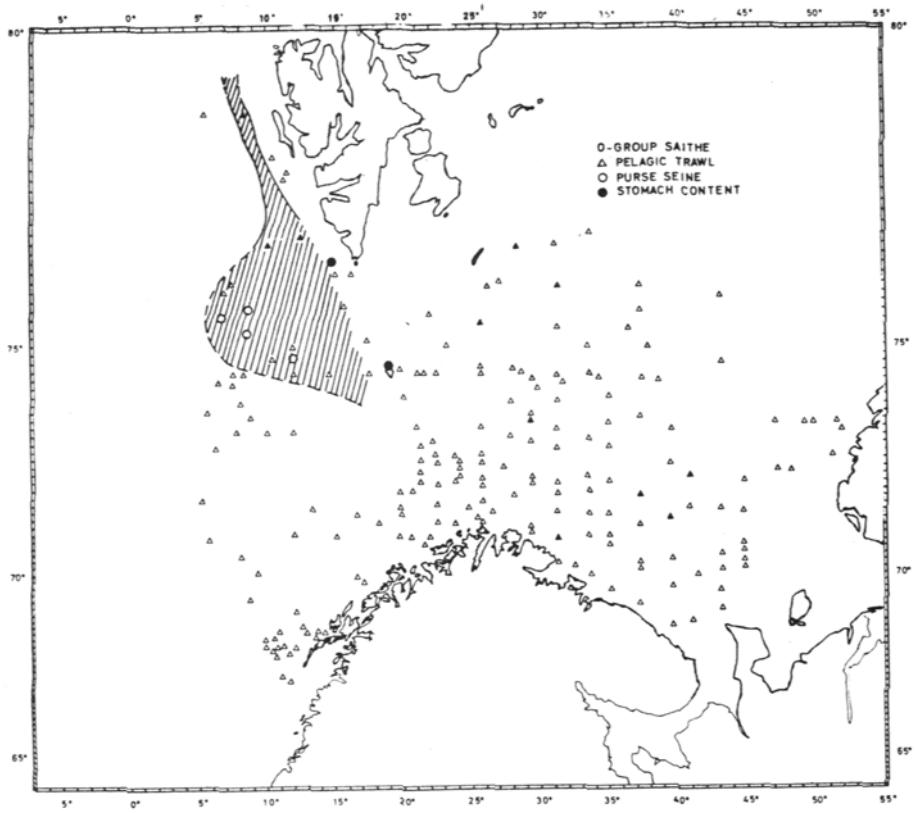

Fig. 9. Distribution of 0-group saithe

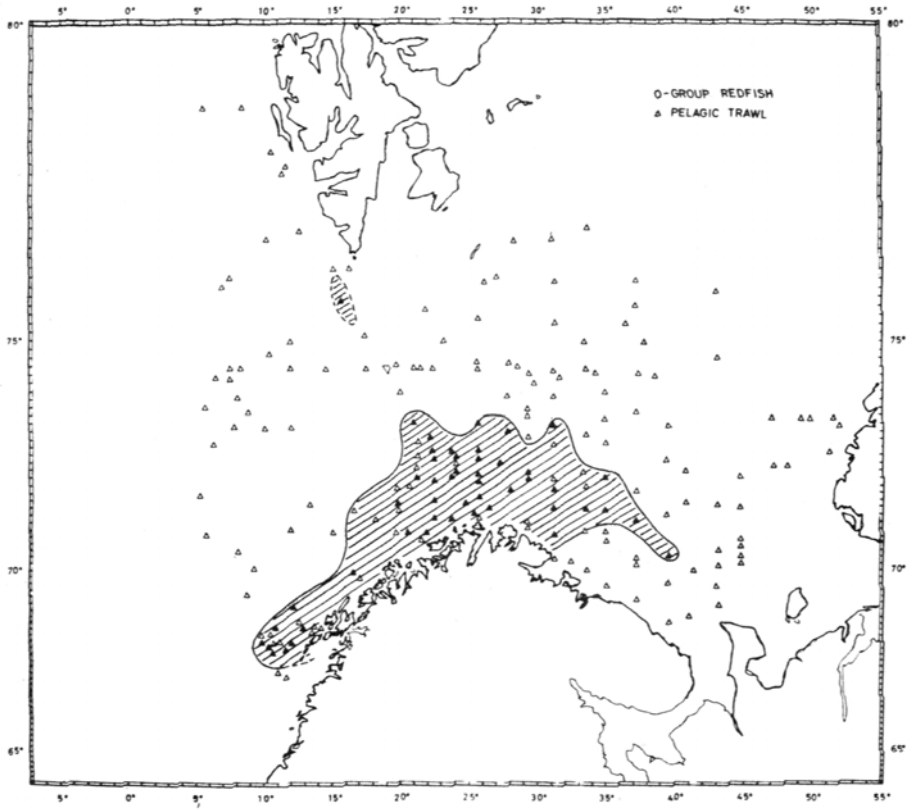

Fig. 10. Distribution of 0-group redfish

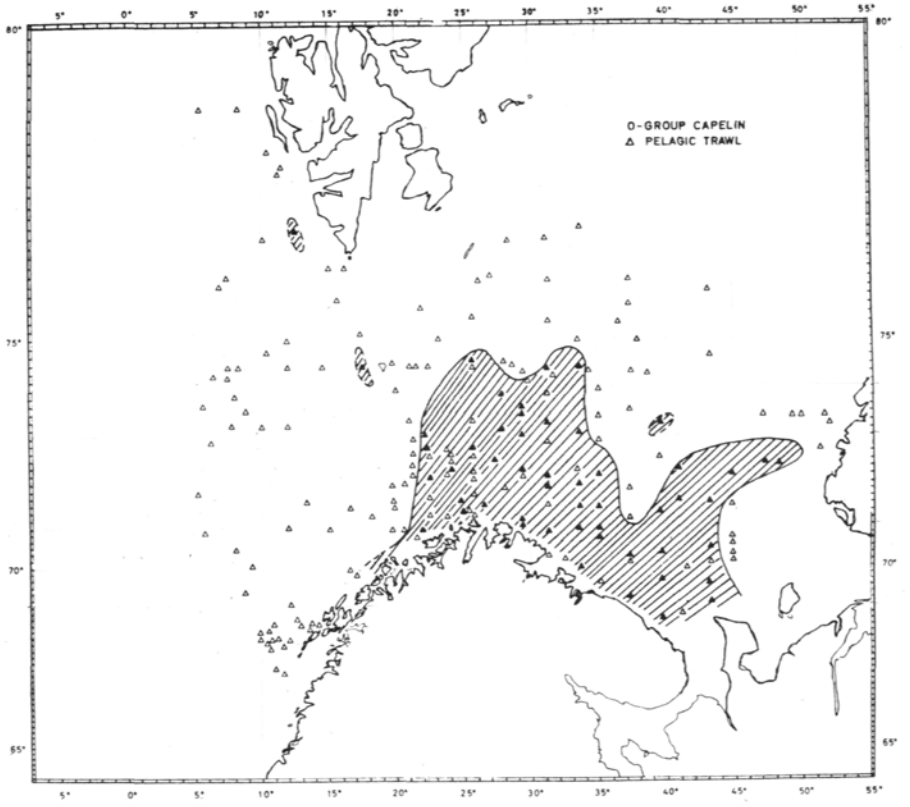

Fig. 11. Distribution of 0-group capelin

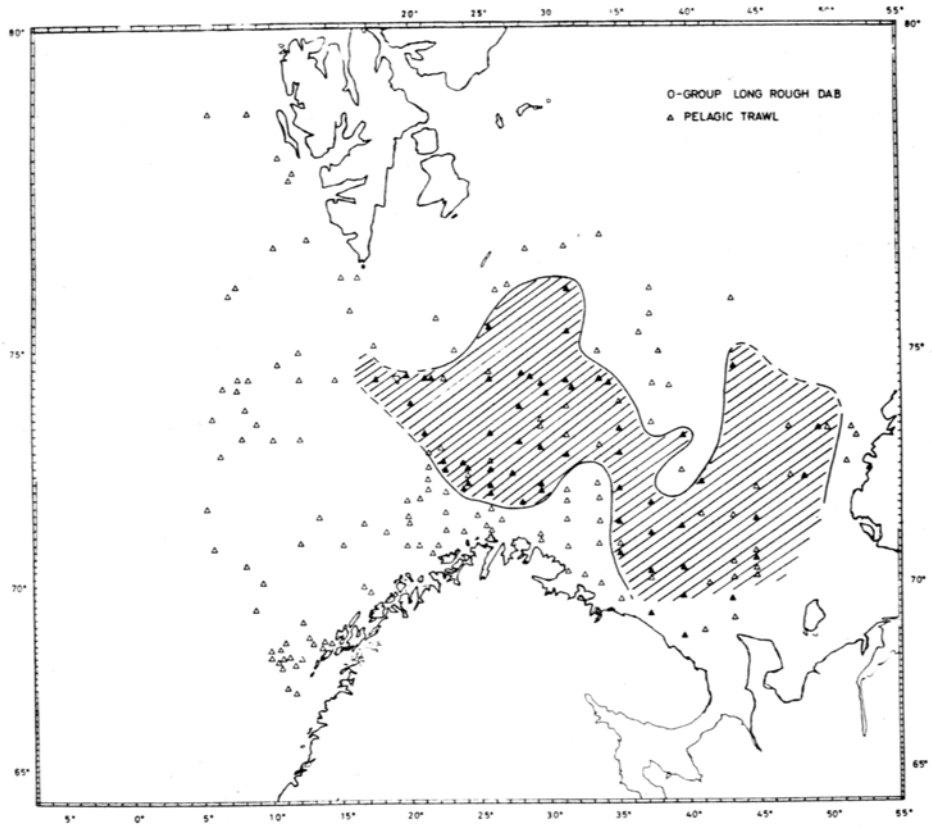

Fig. 12. Distribution of 0-group long rough dab

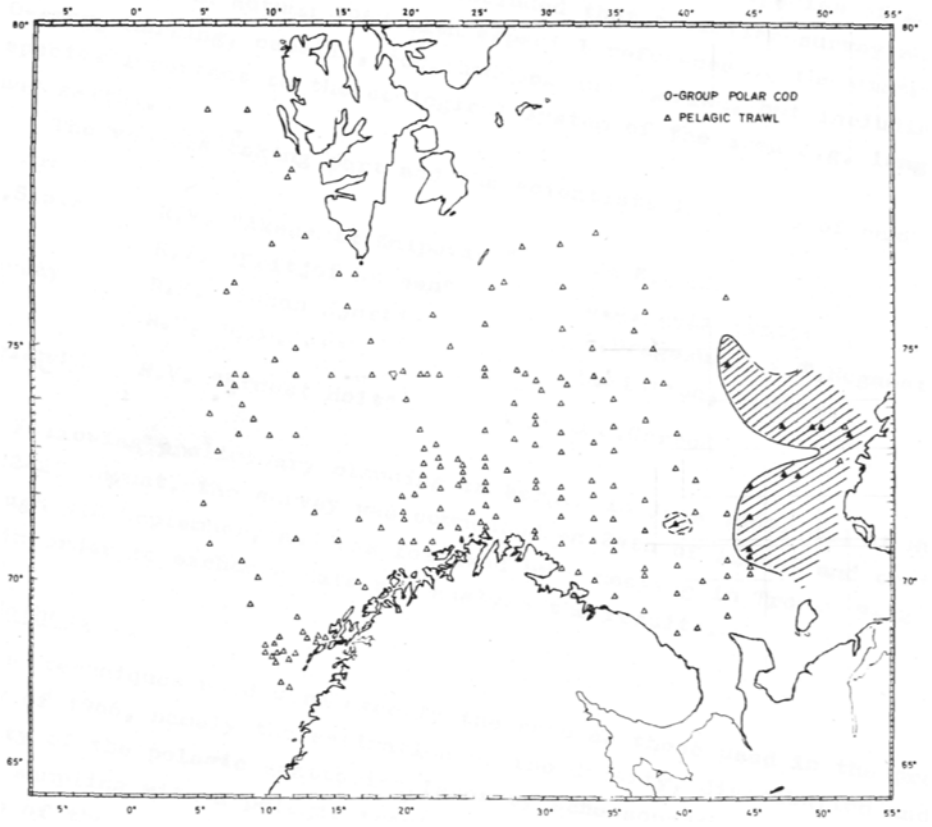

Fig. 13. Distribution of 0-group polar cod

JOINT

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REPORT

Preliminary Report of the 0-group fish survey in the Barents Sea and adjacent waters in August-September 1968

1. Introduction

This survey was the fourth of a series of surveys in the Barents Sea and adjacent waters to study the distribution and abundance of 0-group fish of the main commercial species: herring, capelin, cod, haddock, redfish, saithe, long rough dab and polar cod.

The vessels taking part and the scientists in charge of each vessel were as follows:

USSR	R/V "Akademik Knipovich,"	Yu. K. Benko
	R/V "Fridtjof Nansen"	A.S. Seliverstov
Norway	R/V "Johan Hjort"	O. Dragesund, T. Monstad
	R/V "G.O. Sars"	L. Midttun, P. Hognestad
England	R/V "Ernest Holt"	B. W. Jones

A preliminary planning meeting was held in Bergen on 27-28 June, then all the vessels met in Murmansk on 23-24 August for a final discussion of the program in the light of the results of a preliminary survey that had been made by "Akademik Knipovich" 6-15 August. The survey proper commenced on 25 August and ended on 9 September.

2. Methods

As in previous years the distribution and density of the pelagic scattering layer ware estimated from the echo-sounder paper record, and were identified by direct sampling by midwater trawl. As in 1967 some of the ships used integration techniques to obtain a more quantitative estimate of the scattering layer. High frequency echo-sounders (100-120 KHz) were also used to obtain better discrimination.

The area covered by the survey was much the same as in previous years. The ships' tracks and the distribution of hydrographic and trawl stations are shown in Fig. 1.

3. Results

3.1. Hydrography

The full hydrographic data are not yet analyzed but the charts have been prepared of the temperature distributions in depths of 4, 50, 100 and 200 meters (Figs. 2, 3, 4 and 5).

3.2. The distribution and abundance of 0-group fish

Fig. 6 shows the variation in total density of the scattering layer, which is composed of a variety of plankton organisms as well as 0-group fish. Echo density was determined by examination of the paper echo-sounder record and expressed in terms of the paper scale 0-4. In some areas scattering layers or shoals of fish older than 0-group were recorded. Results from the integrating equipment are not yet analysed.

The general distribution of 0-group fish. was closely related to the water temperature. The majority of species were distributed in the warmer water in the central part of the Barents

Sea and extending up along the west coast of Spitsbergen. Polar cod was recorded in the colder water in the eastern part of the survey area, but also west of Spitsbergen.

3.2.1. Herring

0-group herring were again very scarce this year being almost entirely absent over the whole area. They were even less abundant than last year. This is the fourth successive year in which very low abundance of herring has been recorded in the joint surveys.

3.2.2. Cod

0-group cod were distributed over an area in the southern central part of the Barents Sea with a small isolated patch west of Spitsbergen (Fig. 7). The length composition is shown. in Fig. 13 Once again the abundance of cod recorded was low which suggests that the 1968 year-class will be another weak one. As was the case last year there was again a virtual absence of cod on the Svalbard shelf.

3.2.3. Haddock and saithe

Both these species were found to be of very low abundance. The general distribution of haddock was similar to previous years (Fig. 8), but again the indications are that the 1968 year-class is a poor one.

Saithe also were found only rarely and no shoals which could be identified as saithe were located. The low abundance of saithe this year can be constructed with the widespread distribution and high of abundance of the previous year when a considerable number of dense shoals were identified.

3.2.4. Redfish

This year redfish were distributed over a more restricted area than in 1967, being limited to an area off the northern coast of Norway (Fig.9) with isolated patches to the west of Bear Island and West of Spitsbergen. This species was also lower in abundance than in previous years. The average size of redfish was also lower than in previous years (length range 15-45 mm).

3.2.5. Capelin

In contrast to most other fish species 0-group capelin were abundant and widely distributed over the Barents Sea (Fig.10) with a tongue extending almost to Novaya Zemlya coinciding with the eastward extension of the warmer water. Capelin were also found in an area over the west Spitsbergen shelf. The indications are that the 1968 year-class is a good one.

3.2.6. Long rough dab.

Long rough dab were distributed in small numbers over the most of the area (Fig. 11). This year their distribution extended up to the west coast of Spitsbergen. The general impression is that this species was much less abundant than in previous years.

3.2.7. Polar cod

This species was again found in the colder water at the eastern end of fhe Barents Sea (Fig.12) with a second area of distribution to the west of Spitsbergen. The general abundance of this species appeared to be similar to last year.

3.2.8. Greenland halibut

0-group Greenland halibut were recorded this year sometimes in quite large numbers on the west coast of Spitsbergen. This is the first year that Greenland halibut has been recorded in the joint surveys. The lenth distribution is shown in Fig. 13.

3.2.9. Other species

0-group of several other species ware recorded during the survey. Cottidae, Agonus and Liparis occurred frequently and other species included Anarhichas, Triglops, Myctophum.

3.2.10. Adult and juvenile pelagic fish

Adult blue whiting were, as last year, recorded over a wide area along the eastern boundary of the Norwegian Sea, from Spitsbergen to the Norwegian coast outside the shelf. The conclusion last year, that the stock size must be quite considerable, was confirmed this year.

Adult polar cod was observed with approximately the same abundance is the same area as last year, namely from east of Bear Island and Hope Island, over the northern part of the Central Bank to Novaya Zemlya.

Fat herring was not observed during the surveys this year. Mature herring were at the time of the surveys concentrated within the area from 72° N-75 °N and 6° E- 10° E.

Adult capelin were found to have a wider distribution than in previous years. The greatest concentrations were found in the area around Bear Island and Hope Island and up to the south western part of West-Spitsbergen. The concentrations consisted mainly of I-group fish, but older age-groups (mainly II-group) were also recorded. I-group capelin was also distributed in the central and south-eastern parts of the Barents Sea.

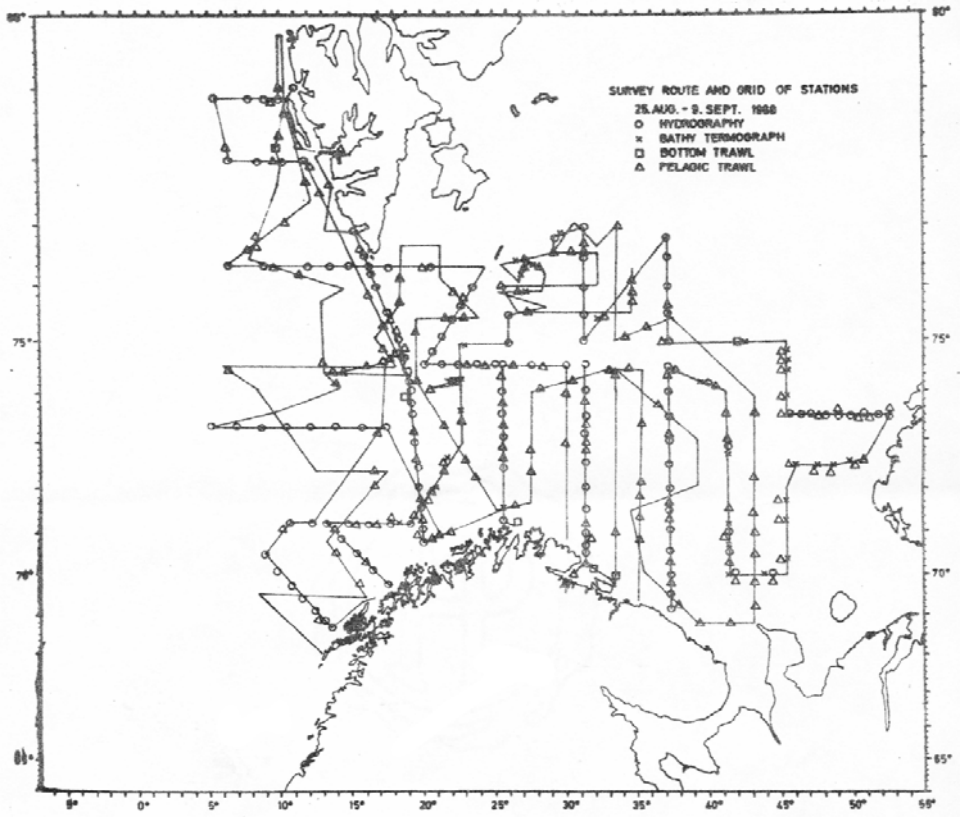

Fig. 1. Survey routes and grid of stations

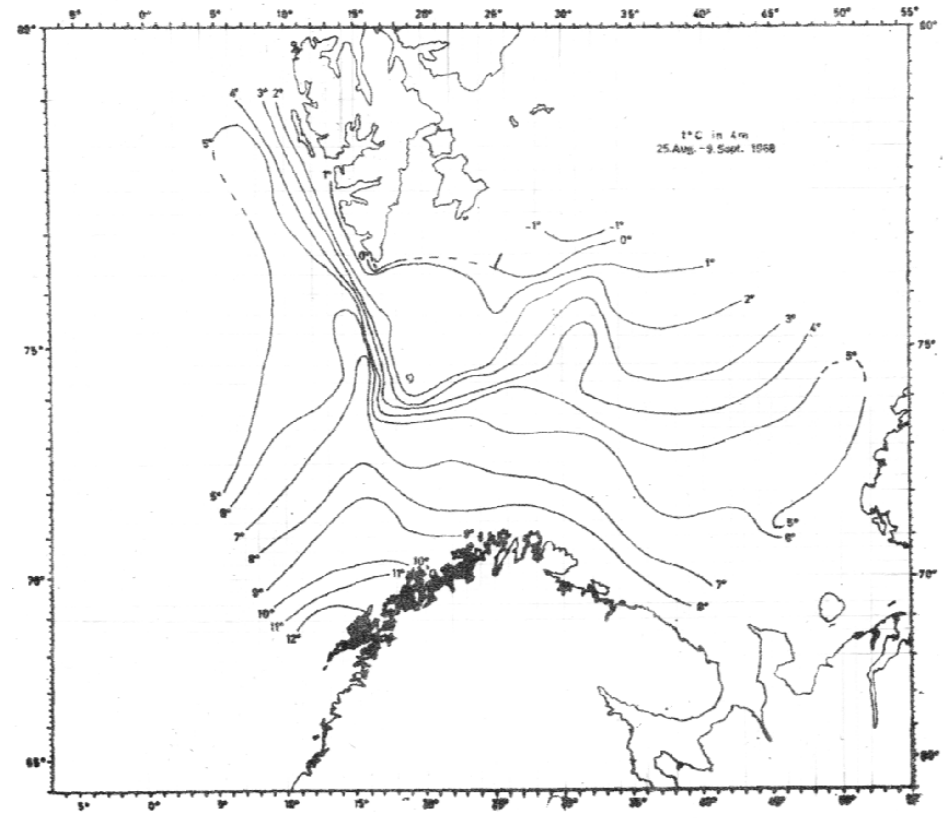

Fig. 2. Isotherms at 4 m

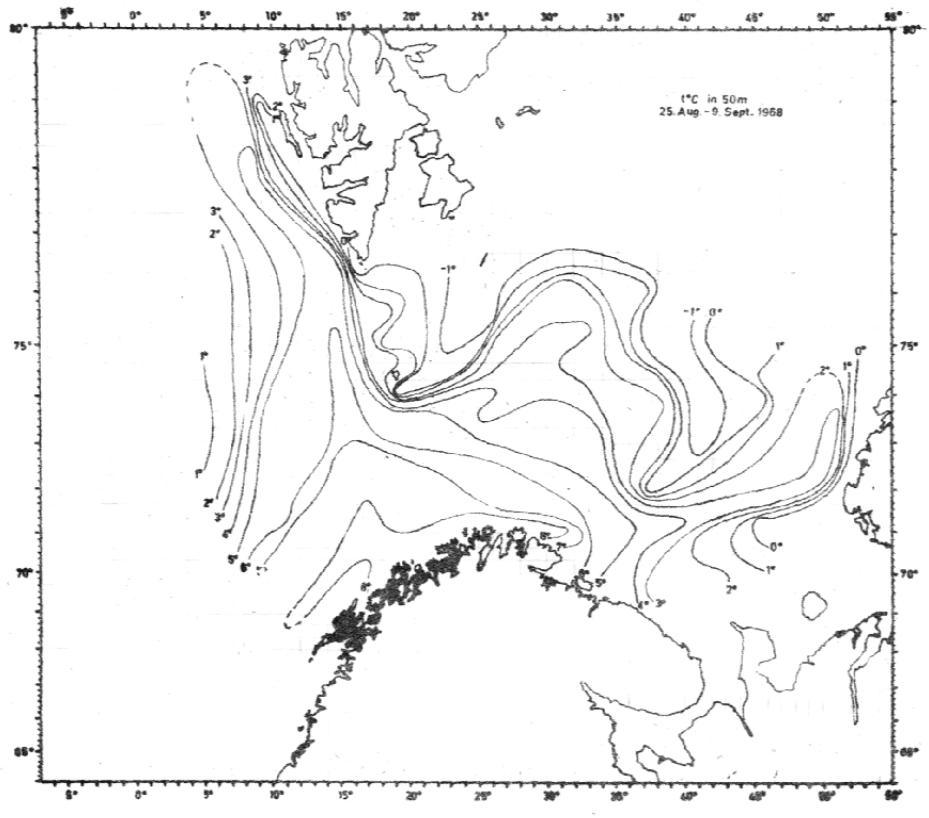

Fig. 3. Isotherms at 50 m

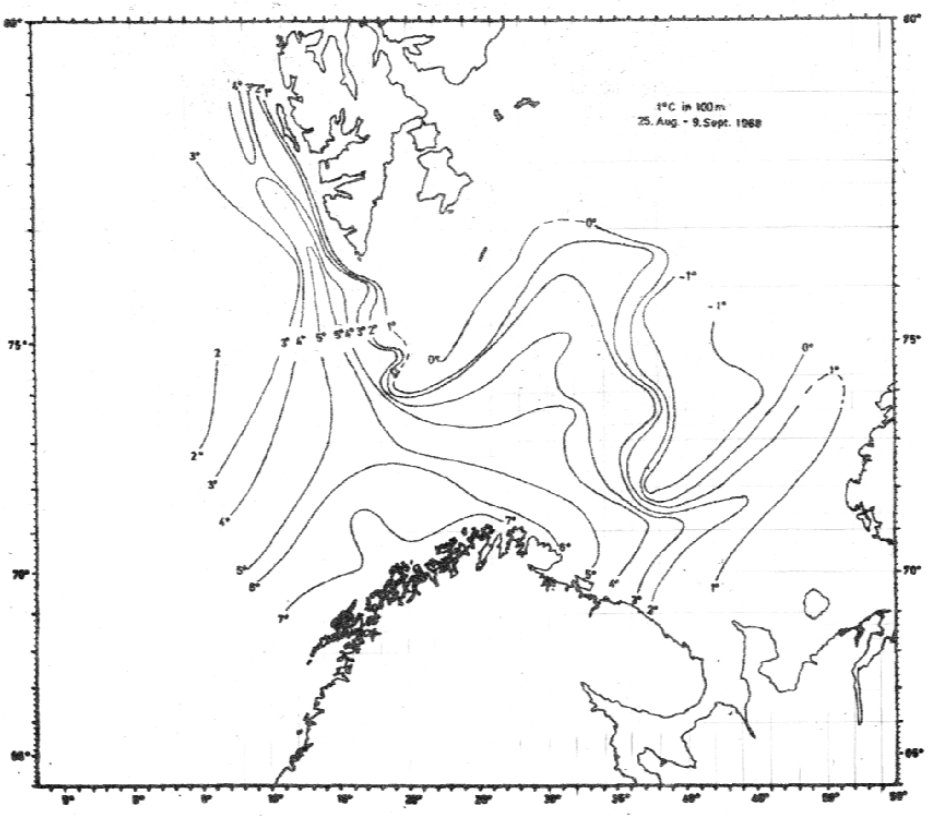

Fig. 4. Isotherms at 100 m

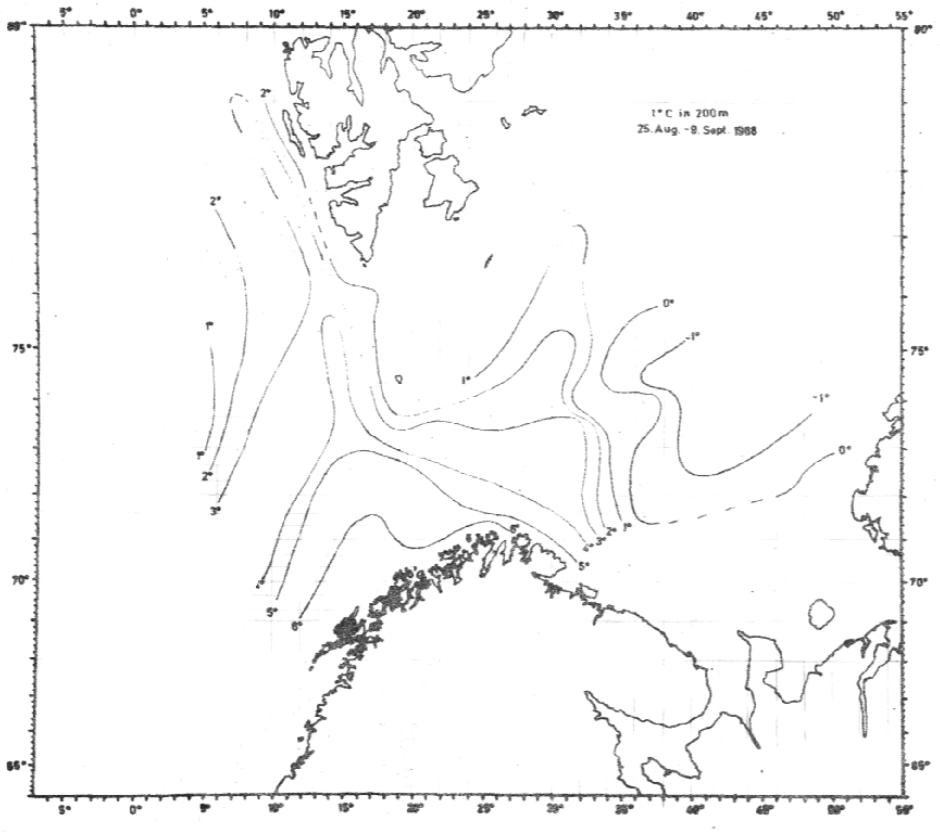

Fig. 5. Isotherms at 200 m

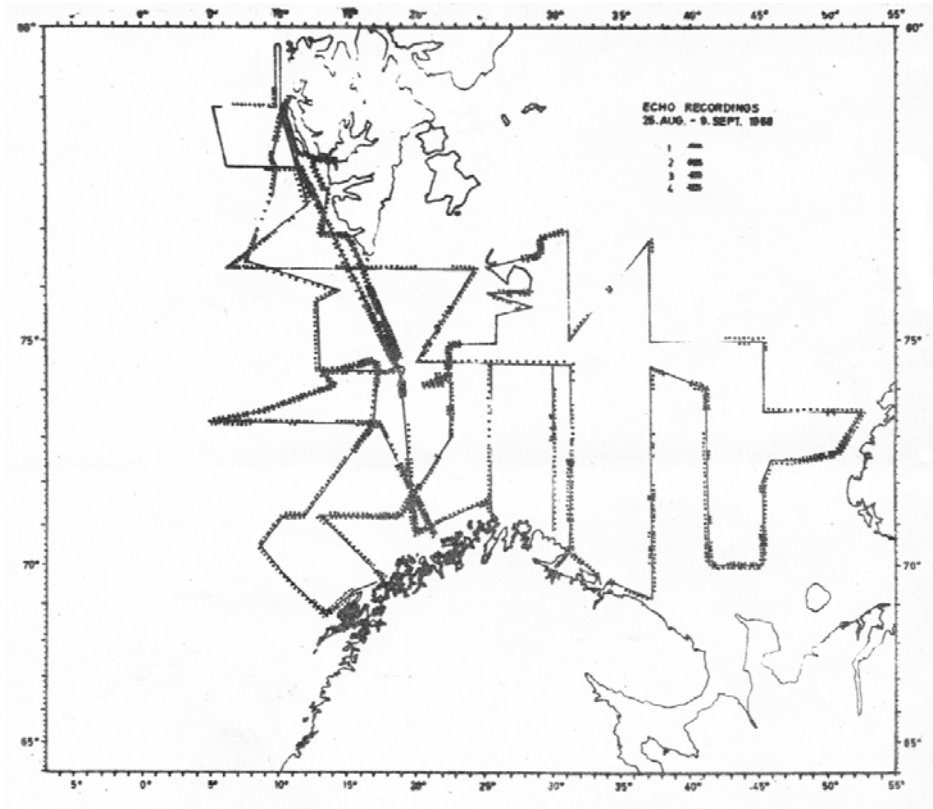

Fig. 6. Courses and echo recordings

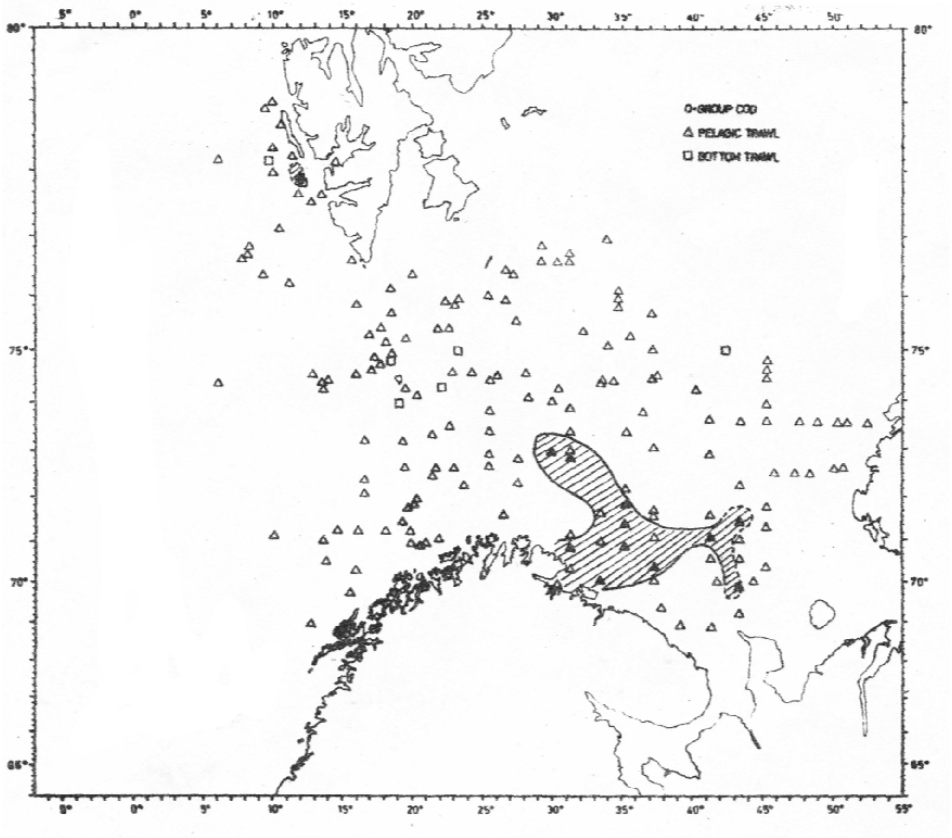

Fig. 7. Distribution of 0-group cod

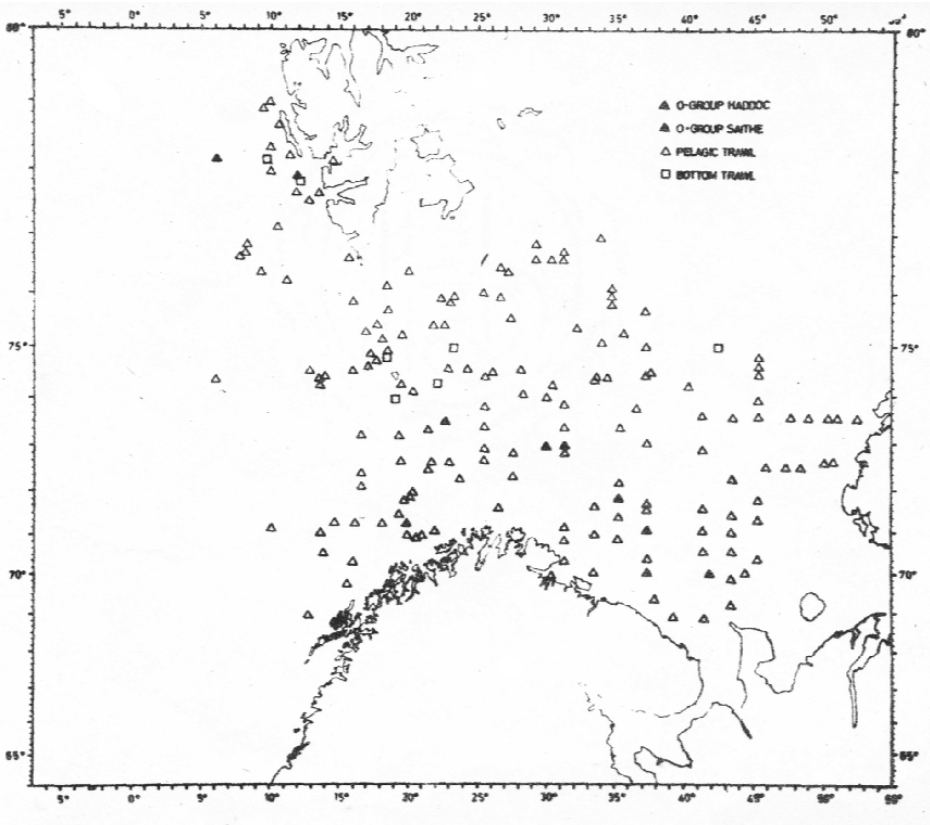

Fig. 8. Distribution of 0-group haddock and saithe

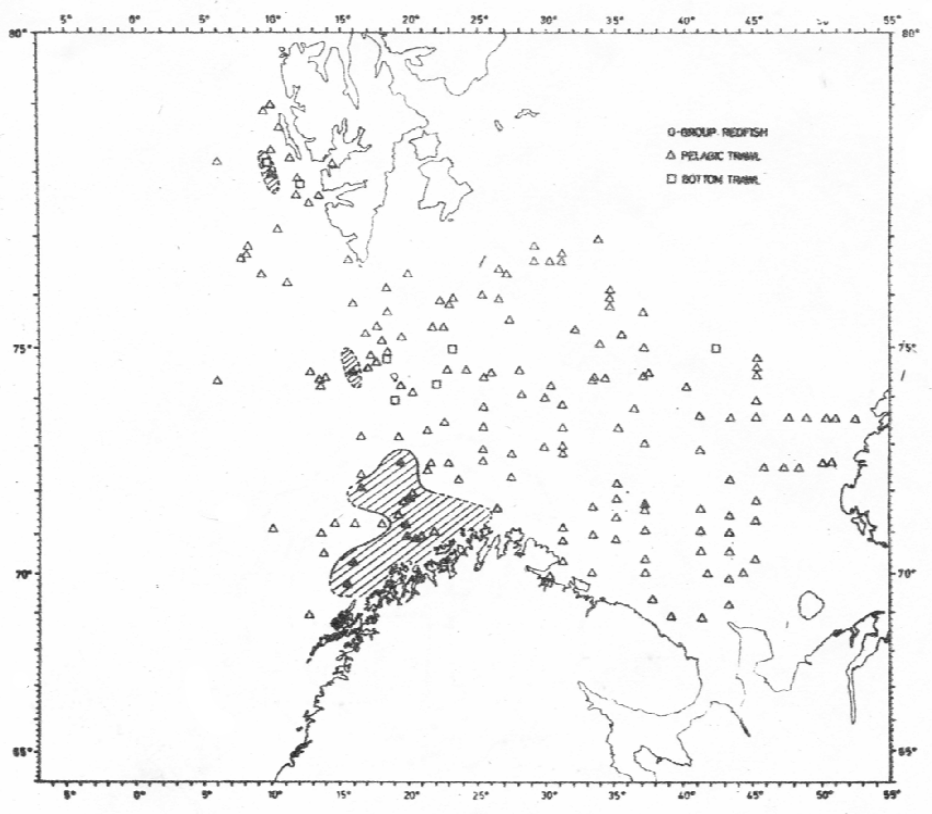

Fig. 9. Distribution of 0-group redfish

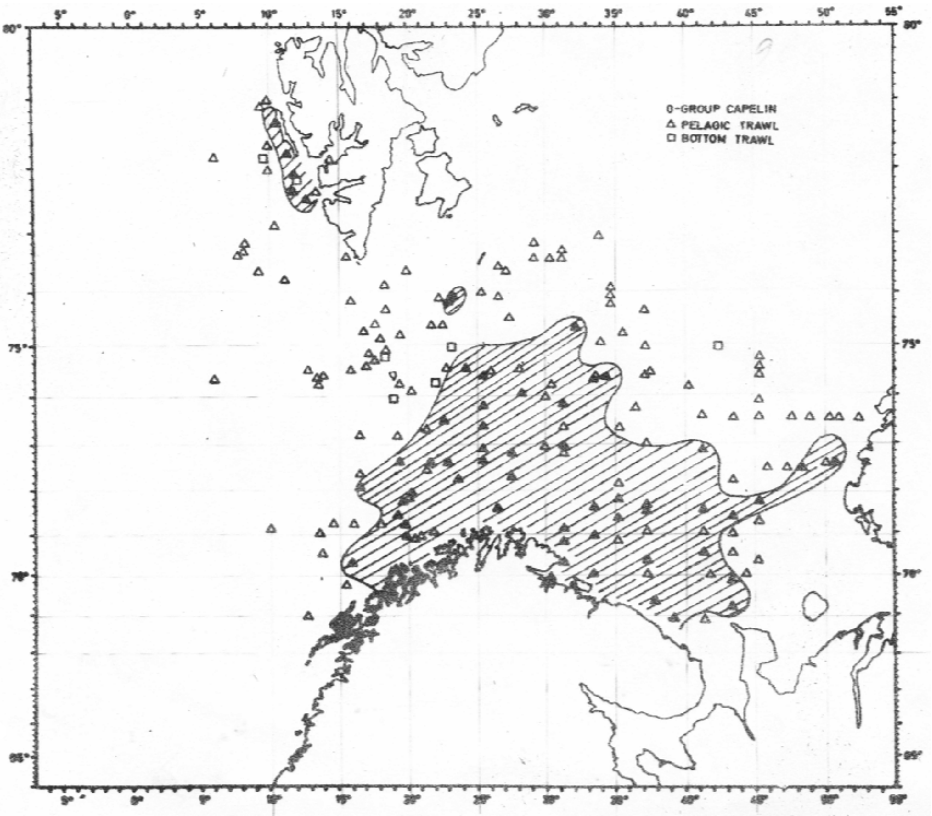

Fig. 10. Distribution of 0-group capelin

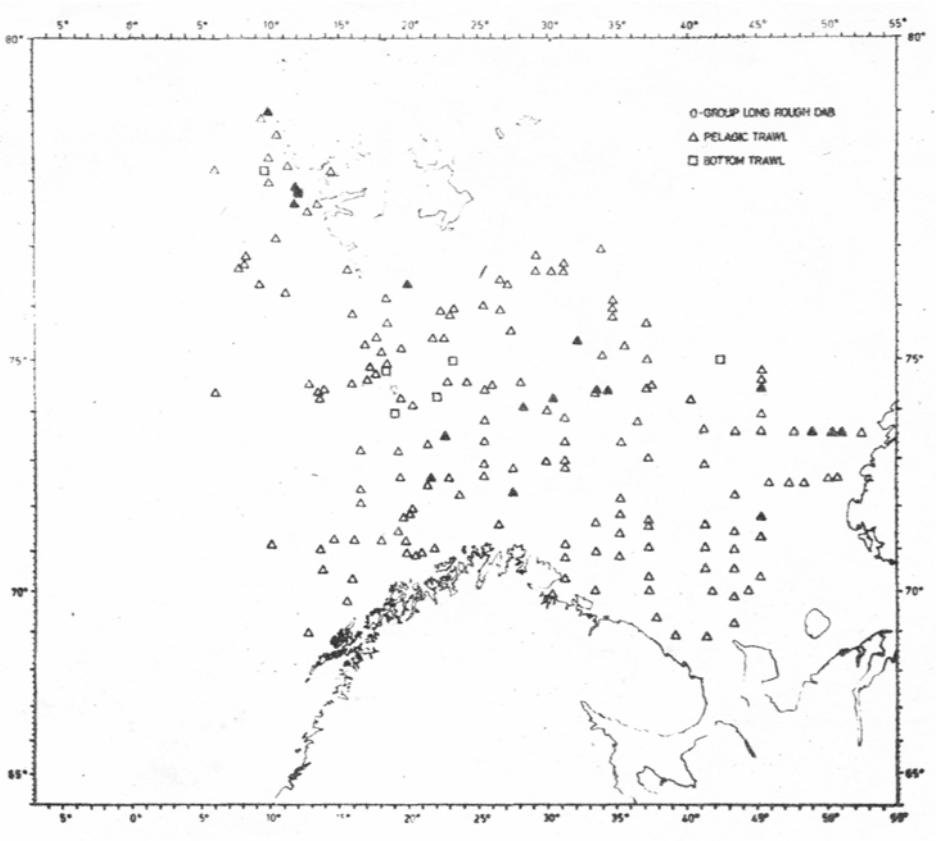

Fig. 11. Distribution of 0-group long rough dab

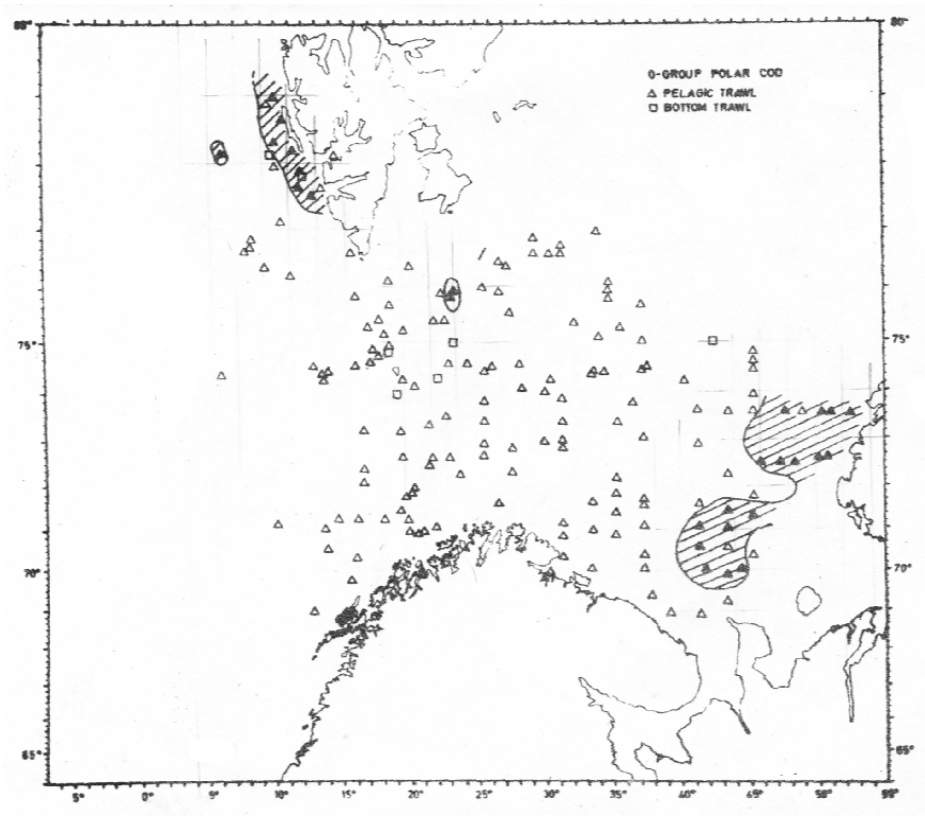

Fig. 12. Distribution of 0-group polar cod

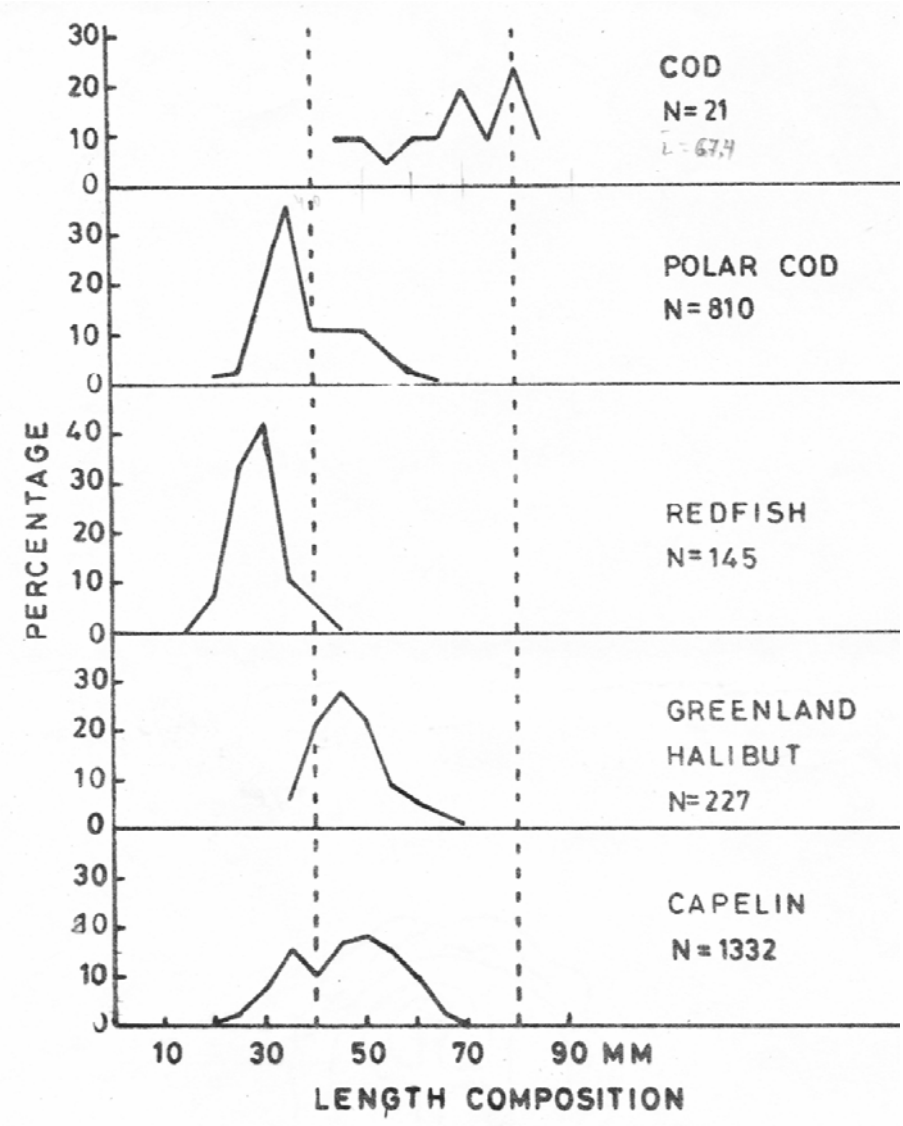

Fig. 13. Length composition

ICES C.M. 1969/F:34
Pelagic Fish (Northern) Commette

Report of the 0-group fish survey in the Barents Sea and adjacent waters in August-September 1969

1.Introduction

This was the fifth of a series of surveys in the Barents Sea and adjacent waters to study the abundance and geographical distribution of the 0-group fish of the main species of commercial importance: cod, haddock, herring, capelin, redfish, coalfish, polar cod and some others.

The five vessels taking part and the scientists in charge of each ship were as follows:

U.S.S.R.	R/V "Akademik Knipovich"	Yu.K. Benko
	R/V "Fridtjof Nansen"	A.S. Seliverstov
Norway	R/V "Johan Hjort"	L. Midttun, B. Myrseth
	R/V "G.O. Sars"	P.T. Hognestad, T. Monstad
England	R/V "Ernest Holt"	B.W. Jones

Preliminary plans for the survey were made at a meeting in Bergen in May 1969, and final arrangements for the coordination of the survey were made in Murmansk 22-24 August before the survey commenced. The survey took place between 24 August and 7 September, and was followed by a meeting in Tromsø 8-12 September where exchange of data and analysis of the results took place.

2. Methods

The survey method was much the same as in previous years. The distribution and density of the pelagic scattering layer were estimated from the echo-sounder paper record, and the organisms forming the scattering layer were identified from samples taken with small meshed pelagic trawls. The area surveyed is shown in Figure 1, where the ships' tracks and trawl and hydrographic stations are also indicated.

3. Results

3.1. Hydrography

The first half of 1069 was characterized by low temperature in the Barents Sea. In May for example, the anomaly of average temperature of the 0-200 meter layer in the section North Cape - Bear Island was - 0.8° and in the section along the Kola meridian it was -0.9°.

In July and August 1969 the average temperature of the section along North Cape - Bear Island was 0.5° above normal in the 0-50 m layer and about normal in the 0-200 m layer, indicating an intensification of heat transport by the North Cape Current during; the period of

investigation. In early September 1969 the temperature in the 0-200 m layer of this section was higher than in 1965-1968 (Table 1):

Table 1. Mean temperature in the section North Cape-Bear Island in the beginning of September 1965-1969 in 0-200 m layer.

Year	1965	1966	1967	1968	1969
T °C	5.1	5.5	5.6	5.4	6.0

In the eastern Barents Sea great negative anomalies of water temperature were observed during the summer. In July, August and early September the anomaly along the Kola meridian in 0-200 m layer was close to -1°. Comparing all the years 1965-1969, only in 1966 was the temperature in 0-200 m layer lower than in 1969 (Table 2).

Table 2. Mean temperature in section along Kola Meridian in 0-200 m layer in end of August 1965-1969.

Year	1965	1966	1967	1968	1969
T °C	4.45	3.6	4.9	4.4	4.0

In the beginning of September 1969 the eastern branch of the Norwegian Current in the section along 74°30' N was characterized by higher temperatures in the 0—50 m layer than in the previous years (1965—1968). Thus, the temperature this year was 1.6° higher than in 1968. In the central branch the temperature was 1.3° higher in the 0-50 m layer compared to 1968.

The temperature in 0-200 m of both the eastern and central branches were higher than in 1965, 1966 and 1968, but very similar to the temperatures observed in 1967.

We may therefore conclude that along with a high heat content of the water masses in the western Barents Sea and the northeastern Norwegian Sea, water masses in the eastern Barents Sea in the period of our investigations were characterized with low temperatures (Figs. 2-5).

3.2. The distribution and abundance of 0-group fish

The variation in total density of the scattering layer is shown in Figure 6. As in previous years (Dragesund, 1970) the figure also includes traces from organisms other than 0-group fish, especially from certain invertebrate species of Medusae, Euphauciacea and Amphipoda which contribute to the uppermost scattering layers. However, since the target strengths of those scatterers are not sufficiently known, their contribution to the total echo-abundance is also difficult to estimate. The illustration also includes the contribution from fish of older age groups when occurring in the mid water above 100 metres.

As in previous years the variation in echo-abundance has been expressed on a subjective scale from 0-4. In order to improve the quantitative estimates of the total echo-abundance, an echo-integrator technique has been applied (Dragesund and Olsen, 1965).

The results show that the main concentration of the scattering layer was confined to the central and western part of the Barents Sea between the meridians 18° E and 28° E. Subsidary concentrations were found in eastern areas, i.e. off the east Finmarken-Murman coast and near the Novaya Zemlya.

On the Svalbard shelf several dense concentrations were observed within limited areas.

In the westernmost part of the area surveyed the recordings are from adult blue whiting.

In contrast to previous years 0-group fish this year were very abundant in Spitsbergen waters. In addition to the 0-group fish species discussed below, other less important species were also recorded, such as catfish, Leptagonus, Agonus, Cottidae etc.

3.2.1. Herring

0-group herring were almost entirely absent in the investigated area except for a few specimens distributed in a restricted area off the coast of North Norway between Lofoten and Sørøy. No 0-group herring were observed in the fjords of North Norway (Fig. 7). This is the fifth successive year in which very low abundance of herring has been recorded in the joint surveys.

3.2.2. Cod

0-group cod were distributed over a wide area in the central Barents Sea extending from the Norwegian coast north to 76° N and from Bear Island east to 40° E. The distribution also extended northwestwards from Bear Island along the western coast of Spitsbergen as far north as the northern limit of the survey at the polar ice edge (Fig. 8). The area of distribution was much more extensive than that recorded in 1968, particularly in the extension this year over the Svalbard shelf. The abundance of cod this year was also much greater than in 1968 or, in fact, than in any of the previous international 0-group fish surveys, and the indications are that the 1969 year-class is the most abundant in the North-East Arctic since the very strong year classes of 1963 and 1964. However, the abundance of the 1969 year-class may not be as great as those year classes.

3.2.3. Haddock

As with the cod the 0-group haddock were distributed over a wide area in the central Barents Sea, with extensions northwestwards from Bear Island along the coast of Spitsbergen as far north as the northern limit of the survey and also eastwards along the Murman coast (Fig. 9). The abundance of 0-group haddock was much greater than in 1968 and the 1969 year-class is easily the most abundant recorded during the five year period covered by the joint surveys. One notable feature of the 0-group haddock this year was the large length range recorded (27-145 mm). The length composition of the trawl catches is shown in Figure 15.

3.2.4. Redfish

Compared with 1968 the 0-group redfish this year had a wider distribution. The redfish were observed between the meridians 13° E and 32° E and from the Norwegian coast to 75° N with a narrow tongue eastwards along the Murman coast to 39 ° (Fig. 10). Further redfish were distributed northwards from Bear Island and along the coast of Spitsbergen and may be beyond the limit of the investigated area ended at approximately 80° N. The highest abundance was found between the Norwegian coast and 74°20' N and between 15° E and 26° E. The total abundance was much higher than in 1968 and the 1969 year-class may be

considered as a very good one. The average size of redfish was greater than in 1958 (length range 15-60 mm).

3.2.5. Capelin

The young capelin this year was distributed in much the same manner as the two previous years, but the distribution pattern had a few characteristic features. An area stretching from North Cape to 74°30' N and between 25° E and 31° E was completely free of 0-group capelin. As in 1967 and 1968 the young capelin this year was recorded close to the Murman coast, but near Novaya Zemlya there was only a local patch. Capelin were found around Bear Island as well as along the West Spitsbergen current occupying a more extensive area than in the previous years and reaching 80° N. This year the highest concentrations of capelin were recorded to the east of North Cape. On the whole concentrations of 0-group capelin were a little less dense than in 1968 but occupied a greater area, so we may conclude that the 1969 year-class of capelin is as rich as that of 1968 (Fig. 11).

3.2.6. Long rough dab

0-group long rough dab were mainly distributed from Bear Island northwards along West Spitsbergen as far north as the limit of the investigated area. The species this year was low in abundance (Fig. 12). The length range was 20-45 mm.

3.2.7. Polar cod

As previously this species was found in the northeastern part of the Barents Sea, and this year 0-group polar cod were also distributed in a second area stretching from Hope Island and along West Spitsbergen up to the northern limit of the investigated area (Fig. 13). The strength of the 1969 year-class seemed to be very good, and the distribution was very similar to that observed in 1966.

3.2.8. Mackerel

This year 0-group mackerel (length range 55-100 mm) were observed in the investigated area for the first time as far north as 72°30' N. The species was distributed in an area off North Norway (Fig. 14).

3.2.9. Other species

0-group fish of several other species were observed during the survey. Most frequently occurred Cottidae, Liparis, Leptagonits and Agonus. Further a few Anarhichas and Ammodytes were observed, besides a few Greenland Halibut off West Spitsbergen. Only one coalfish was taken during this year’s survey.

4. Concluding remarks

Again a numerous year-class of redfish and capelin has been produced. This is the fifth successive years of rich year classes of capelin and the third of redfish since 1965.

Concerning cod and haddock the 1969 year-class is by far the most numerous since the joint surveys started in 1965. But the cod seems to be less abundant than the 1963 year-class which was observed at the 0-group stage by Dragesund and Olsen (1965).

Polar cod is obviously one of the best year-classes observed since 1965. On the other hand this year-class of herring was very poor, being the fifth successive year class with very low abundance.

Coalfish was almost absent this year and the long rough dab was concentrated in a much smaller area than in previous years, indicating a poor year-class.

A striking feature this year was the location of mackerel in significant numbers off the coast of Norway as far north as 72°30' N.

The distribution pattern of the 0-group fishes was this year characterized by high abundance in the Spitsbergen branch of the current system. Length frequencies of the different species are shown in Fig. 15.

References

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Dragesund, O. (Ed.). 1970. "International 0-group surveys in the Barents Sea 1965-1968". ICES Coop. Res. Rep. Ser. A. 18.

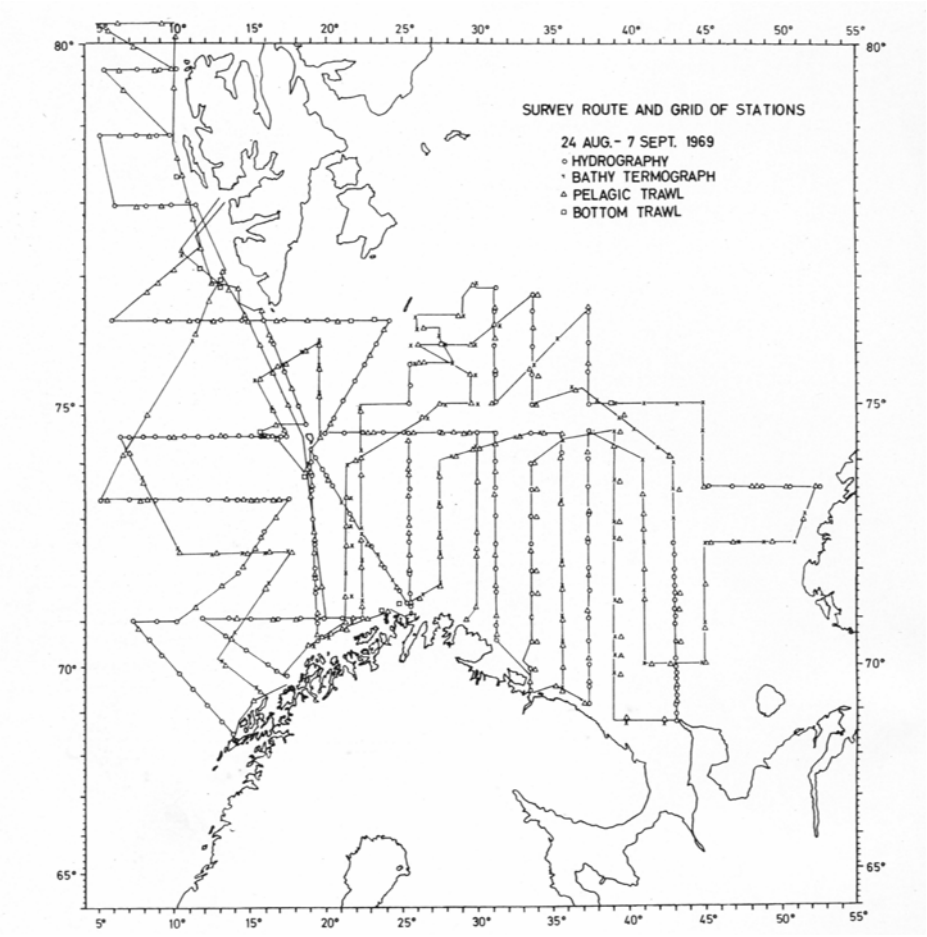

Fig. 1. Survey routes and grid of stations

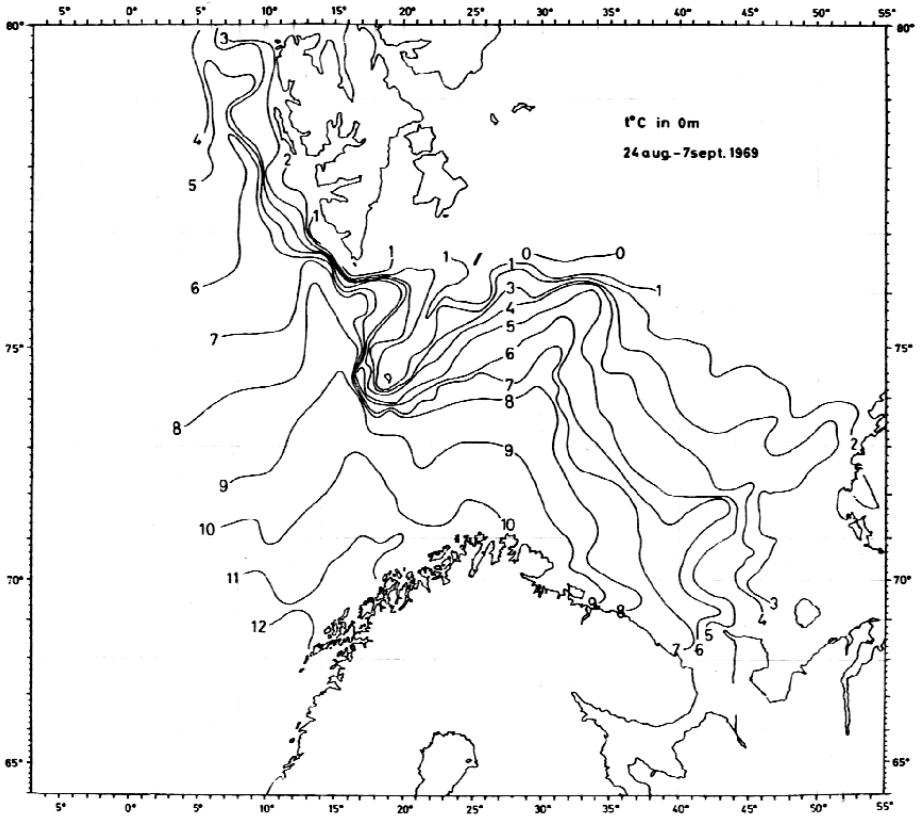

Fig. 2. Isotherms at 0 m

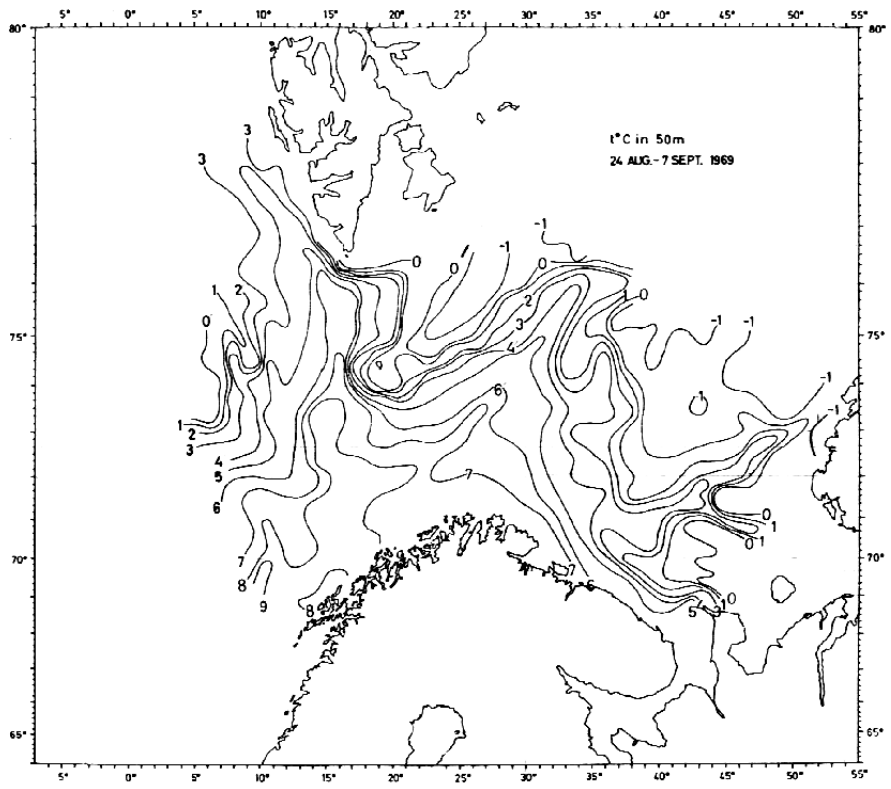

Fig. 3. Isotherms at 50 m

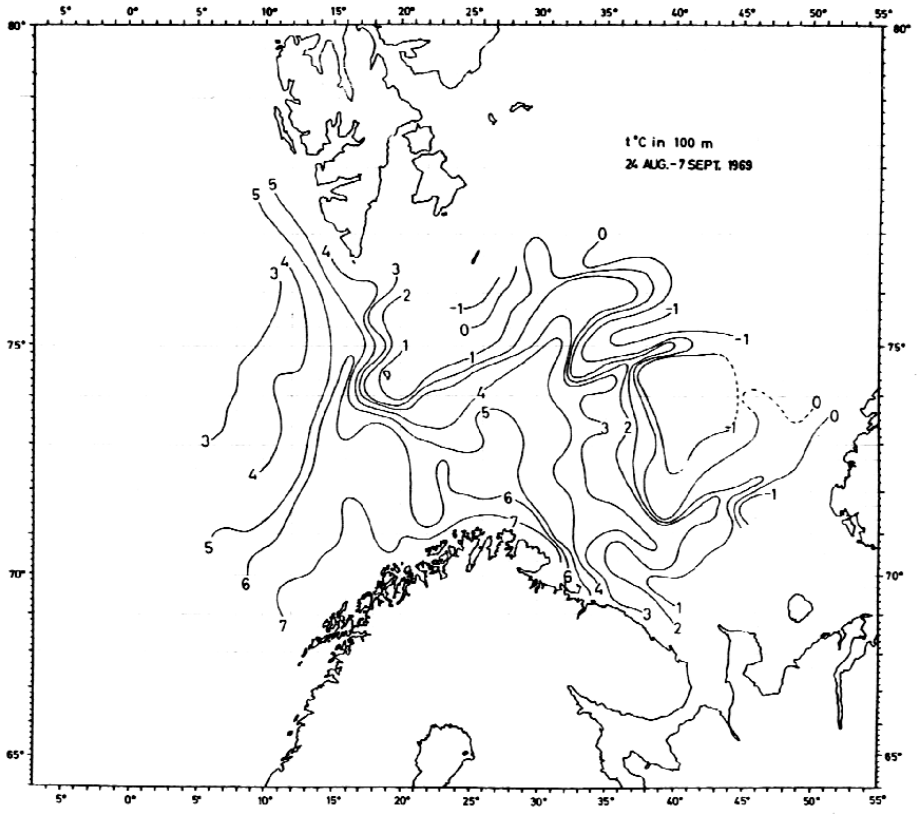

Fig. 4. Isotherms at 100 m

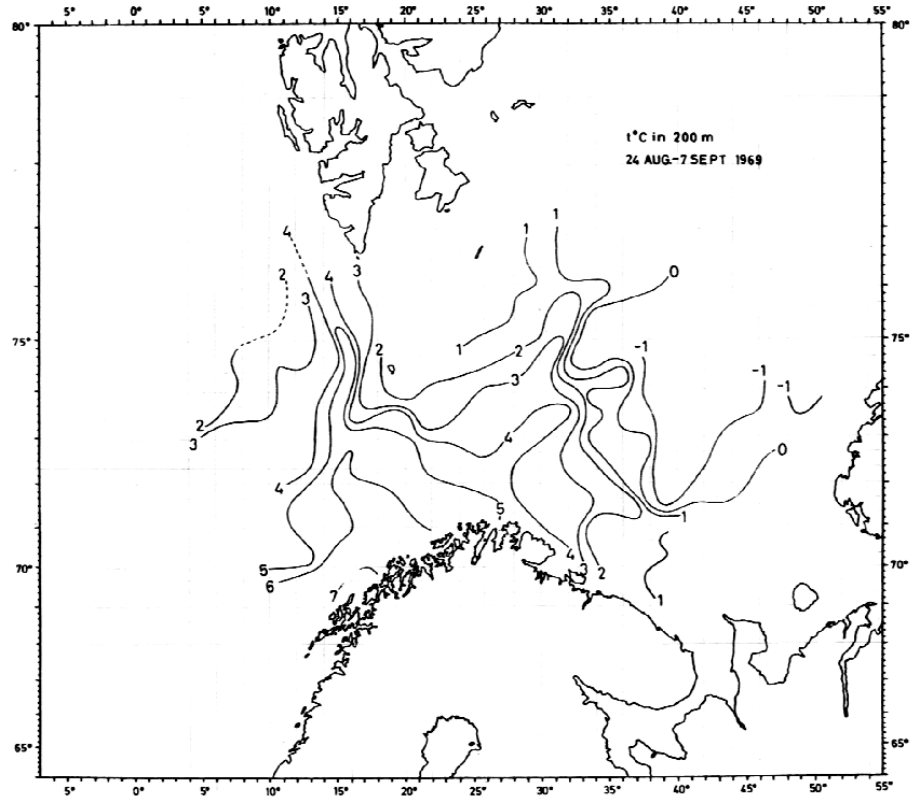

Fig. 5. Isotherms at 200 m

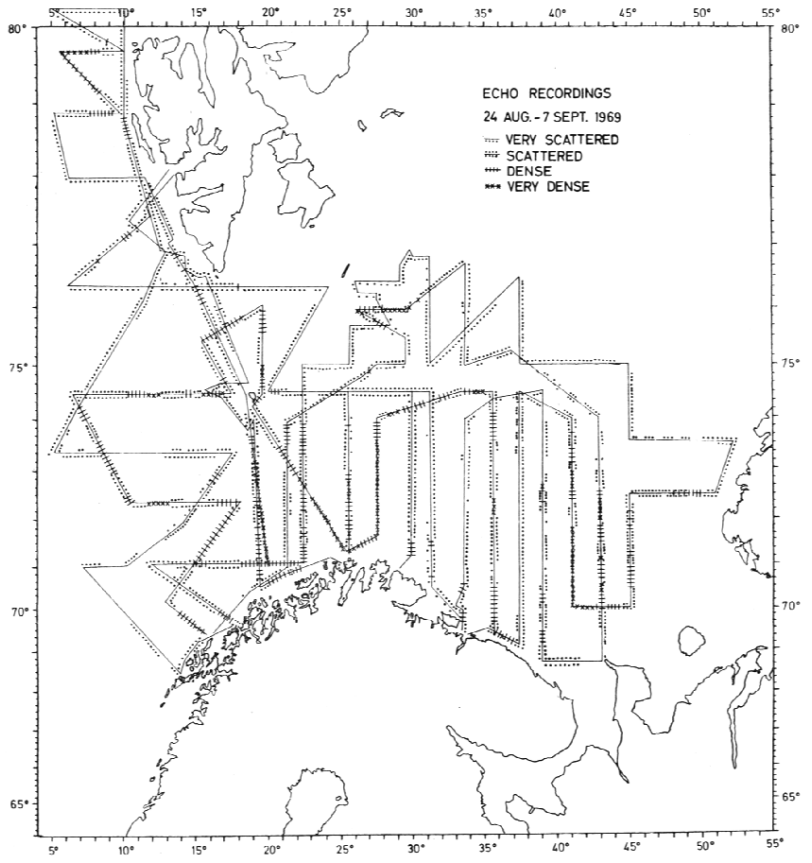

Fig. 6. Courses and echo recordings

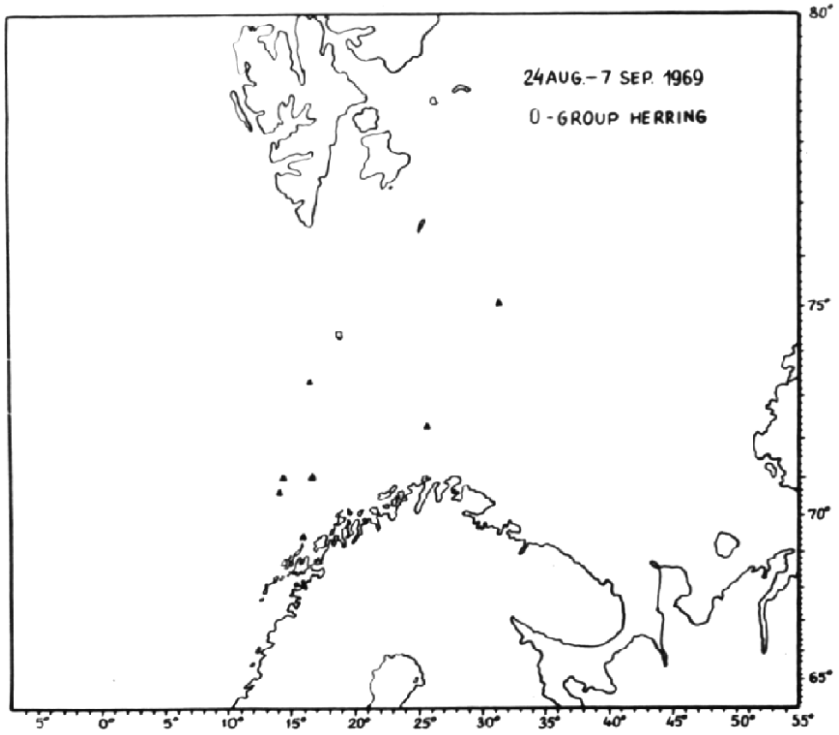

Fig. 7. Distribution of 0-group herring

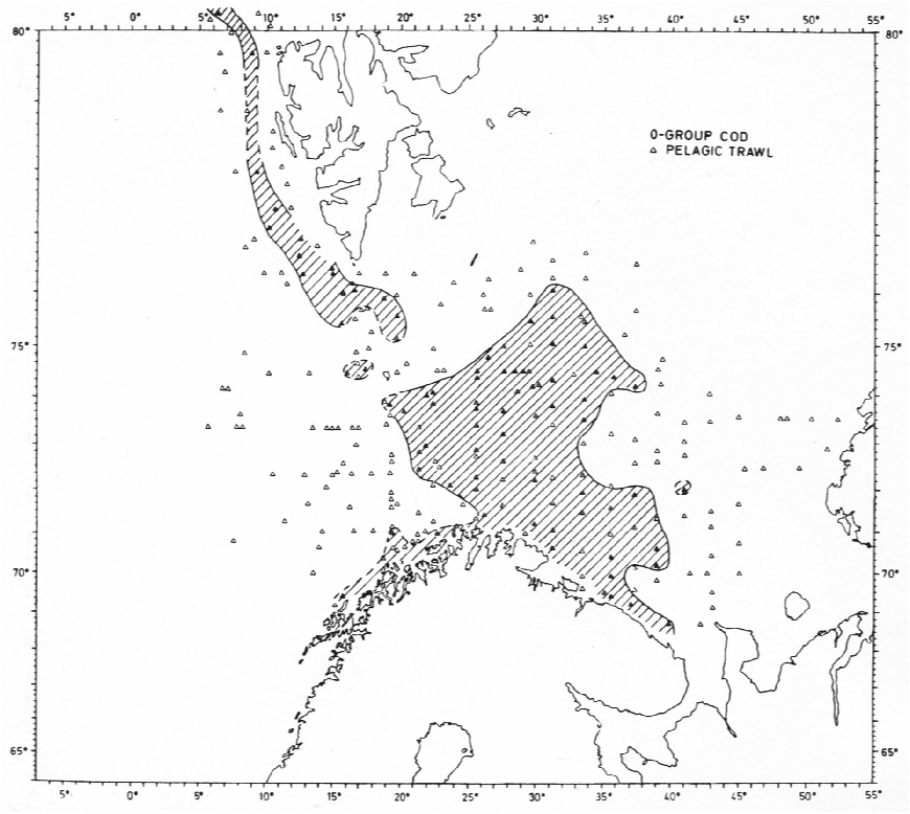

Fig. 8. Distribution of 0-group cod

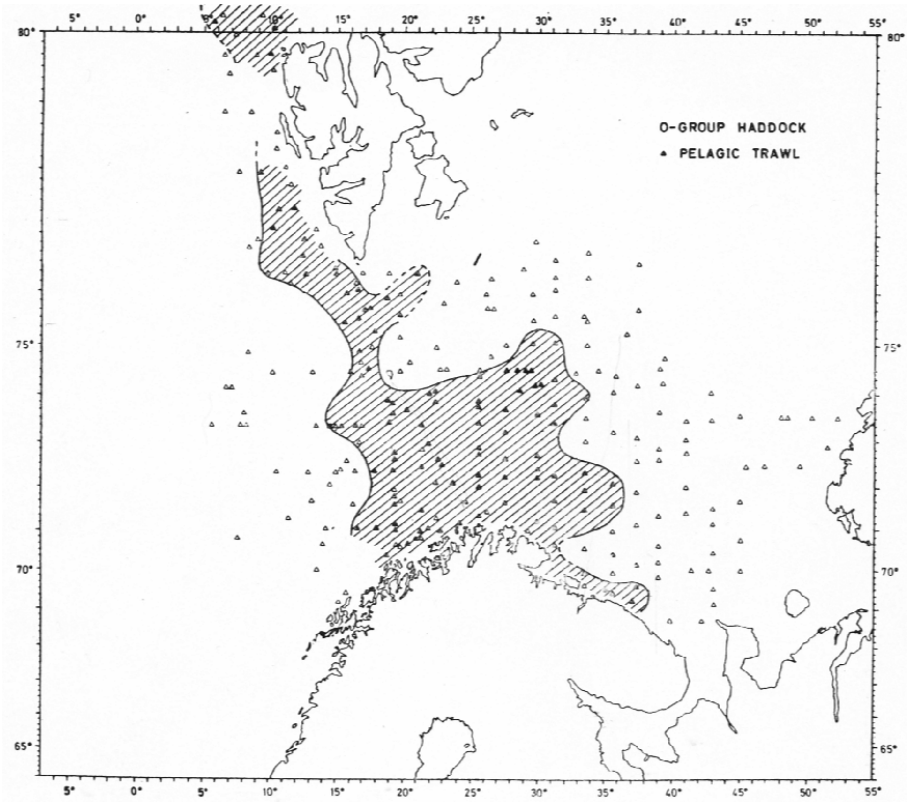

Fig. 9. Distribution of 0-group haddock

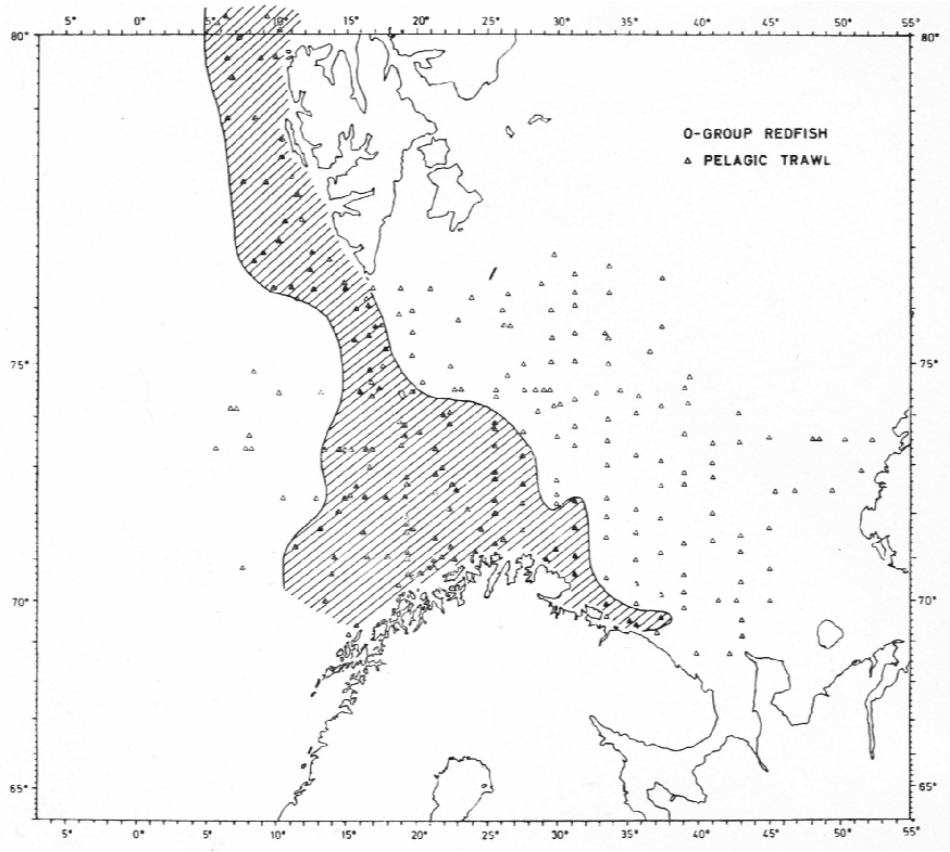

Fig. 10. Distribution of 0-group redfish

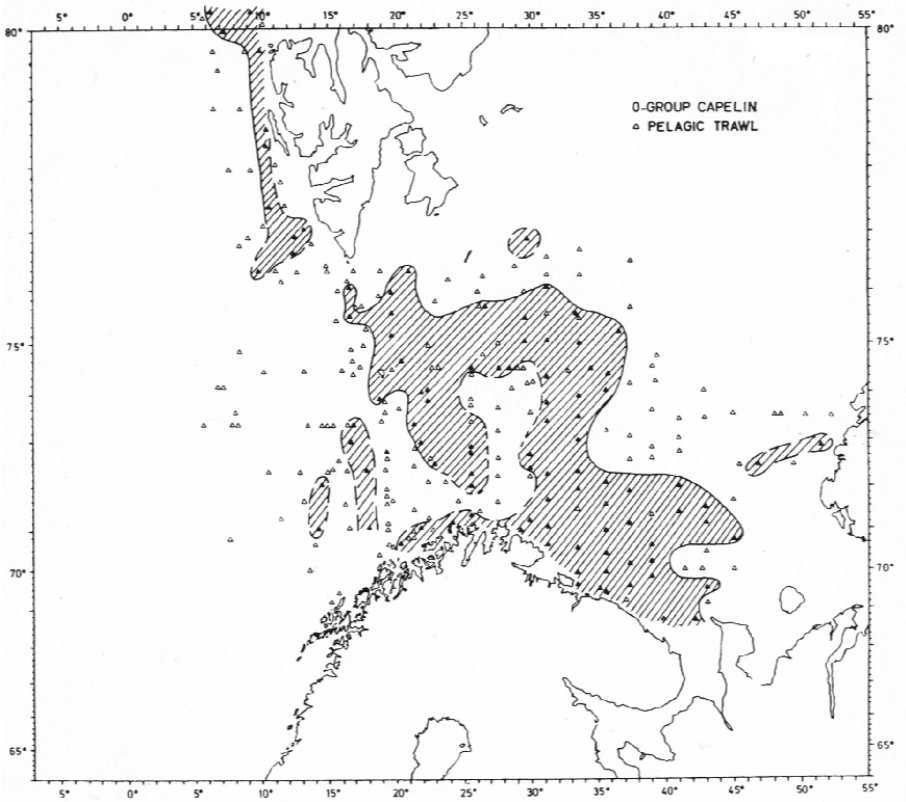

Fig. 11. Distribution of 0-group capelin

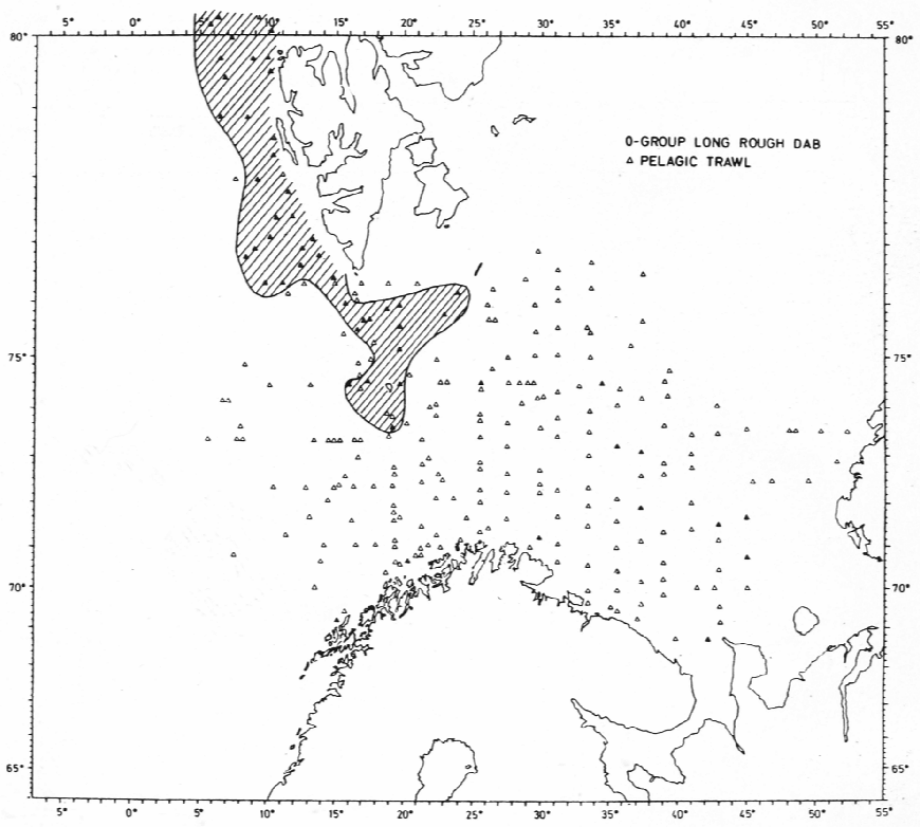

Fig. 12. Distribution of 0-group long rough dab

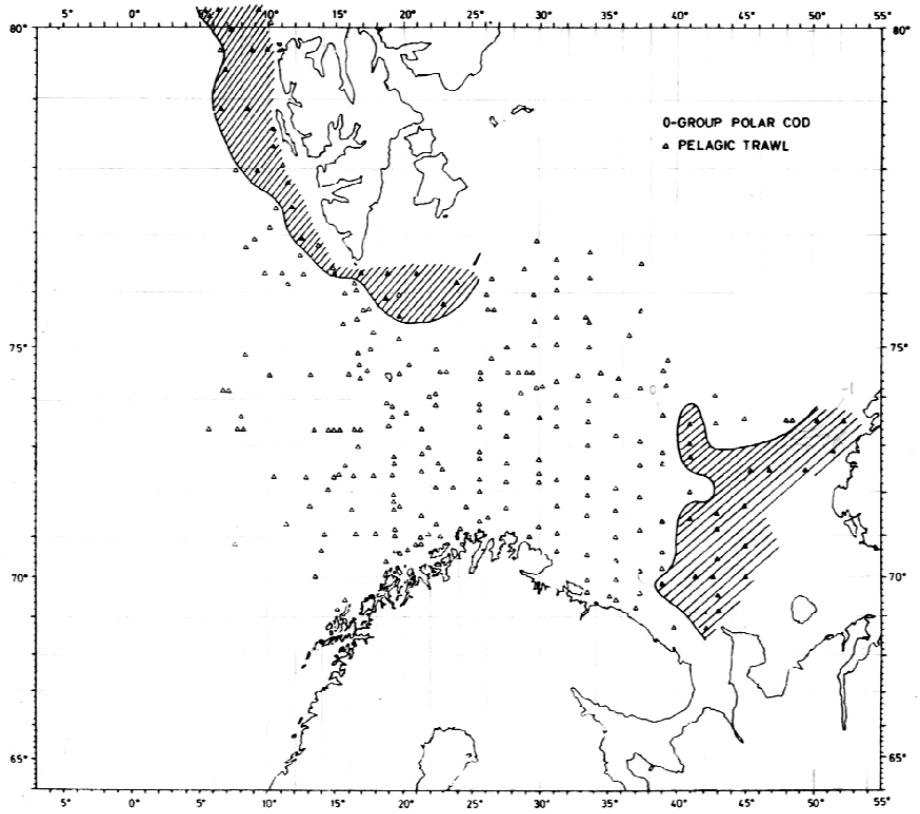

Fig. 13. Distribution of 0-group polar cod

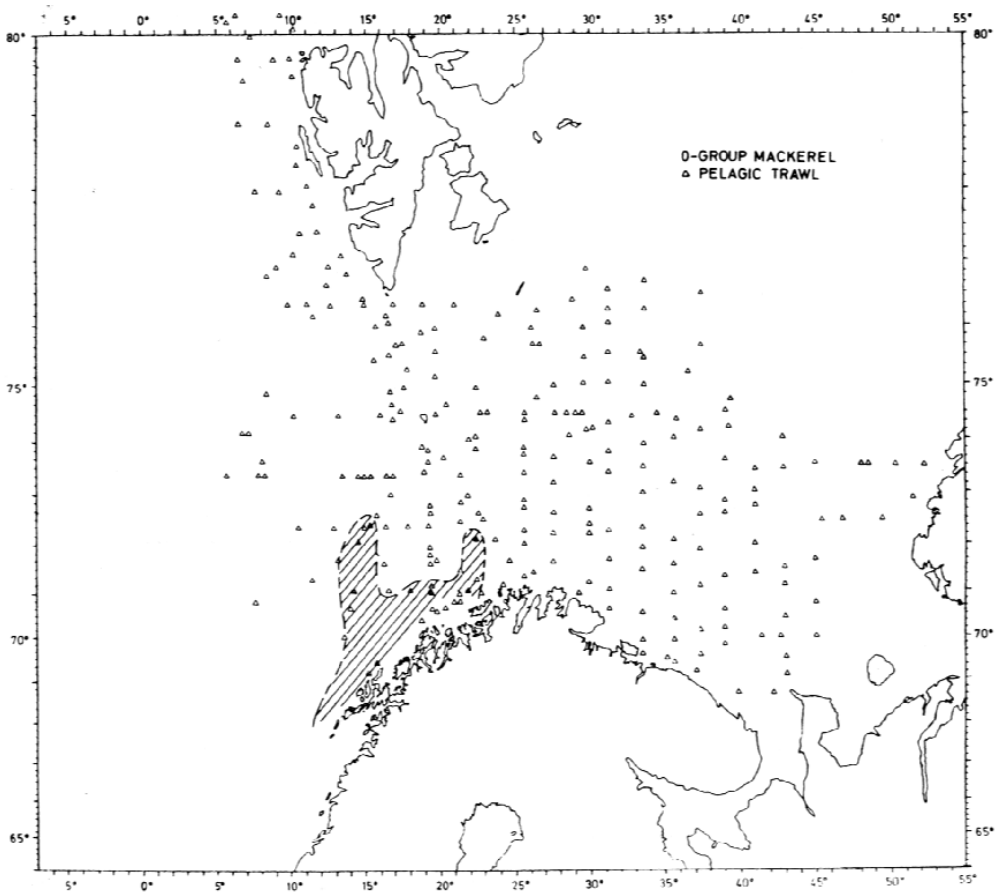

Fig. 14. Distribution of 0-group mackerel

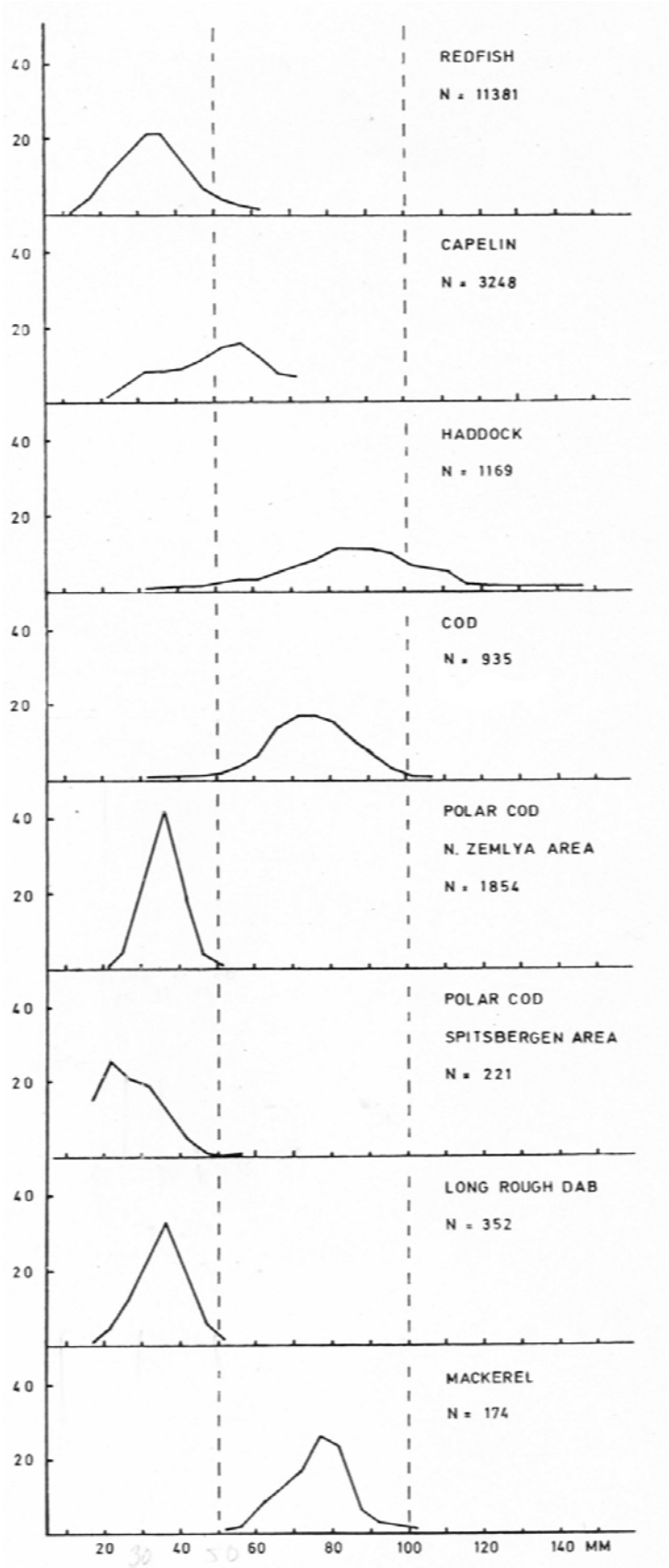

Fig. 15. Length composition

International Council for
the Exploration of the Sea

C.M. 1970/H: 34
Pelagic Fish (Northern) Committee
Ref:
Demersal Fish (Northern) Committee

Preliminary Report of joint Soviet-Norwegian 0-group fish survey in Barents Sea and adjacent waters in August-September 1970

Introduction

The present investigation was the sixth in the series of surveys in the Barents Sea and the Svalbard region to study the distribution and abundance of 0-group fishes.

The vessels and the scientists taking part were:

USSR	R/V "Akademik Knipovich"	V.V. Penin, M.L. Zaferman.
	R/V "Fridtjof Nansen"	A.S. Seliverstov, R.N. Sarynina, S.M. Kovalyov
Norway	R/V "Johan Hjort"	A. Hylen, O. Smestad, R. Sætre, B. Myrseth, G. Nilsen
	R/V "G.O. Sars"	L. Midttun, O. Dragesund, P.T. Hognestad, J. Blindheim, O. Nakken, N.Radhakrishnan, T. Benjaminsen

Preliminary plan for the survey was made at a meeting in Bergen in May 1970, and the final arrangements for the coordination was made in Murmansk 26-27 August before the survey commenced. The survey was carried out between 27 August and 11 September and was followed by a meeting in Tromsø 11-13 September where exchange of data and analysis of the material took place.

Material and methods

The distribution and density of the pelagic scattering layers were estimated from the echo sounder paper records and the organisms forming the scattering layers were identified from samples taken with small meshed pelagic trawls (Dragesund, Midttun and Olsen 1970).

R/V "G.O.Sars" had a Simrad Net Sonde and the other three research vessels had depth recorders attached to the trawls. On board the R/V "G.O.Sars" and "Johan Hjort" Simrad Echo Integrators (QM) worked in conjunction respectively with 38 and 50 kHz Simrad Scientific Sounder in order to estimate more quantitatively the total echo abundance. The results of these investigations will be presented later. The area surveyed is shown in Fig. 1, where also the ships' tracks, trawl and hydrographic stations are indicated.

Results

Hydrography

A preliminary analysis of data on water temperature in the Barents Sea observed during the survey (Figs. 2-7) made it possible to compare some hydrographica1 features to those of the previous years (Dickson, Midttun and Mukhin 1970).

The mean temperature of the 0-200 m layer observed in the Spitsbergen Current west of Bear Island (Fig. 6) was the highest since our surveys started in 1965.

The mean temperature of the 0-200 m layer in the North Cape Current observed in the section North Cape to Bear Island (Fig. 7) was also the highest since before 1965 (Table 1).

Table 1. Mean temperature in the 0-200 m layer in the North Cape Current

Year	1965	1966	1967	1968	1969	1970
T °C	5.0	5.5	5.6	5.4	6.0	6.5

The mean temperature of the 0-200 m layer in the Murmansk Current (along the 33°30' E meridian) was also characterized by high values. (4.70) (Table 2).

Table 2. Mean temperature of the 0-200 m layer in the Murmansk Current (along the 33°30' E meridian)

Year	1965	1966	1967	1968	1969	1970
T °C	4.4	3.6	4.9	4.4	4.0	4.7

The mean temperature recorded from surface to bottom in the section to the north of Cape Kanin (along 43°15' E) reached the long-term mean value (4.0°). Only the upper layers of water in the Kanin-Kolguev and Novaya Zemlya Currents were found to be warmer than the normal. For instance, the temperature of the surface layer in the Novaya Zemlya Current was 8,8°, whereas during the previous years it ranged from 5.7° to 6.8°.

Thus, it is obvious that during August-September 1970 the western part of the Barents Sea was relatively warmer than the eastern part, and that intensive heat advection had taken place in the Spitsbergen Current and in the northern branch of the North Cape Current.

The distribution and abundance of 0-group fish

The variation in total density of the scattering layers is shown in Fig. 8. As in previous years the recordings include the contribution from fish of older age groups occurring in the layer down to 100 meters. The density figures probably also to some extend include traces from organisms other than fishes, e.g. certain invertebrates species of Medusae, Euphausiacea and Amphipoda which contribute to the uppermost scattering layers. Although, attempts were made to distinguish such recordings from those of 0-group fishes by in situ target strength measurements their contribution to the total echo abundance is difficult to estimate since target strength of these scatters are yet to be determined.

As in previous years the variation in echo abundance has been expressed on a subjective scale from 0-4 (Dragesund, Midttun and Olsen 1970) The results showed that the concentration of scatters was mainly confined to the central and western part of the Barents

Sea between the meridians 18° and 28°E. Concentrations were also recorded near the Novaya Zemlya and off the Spitsbergen coast.

In addition to the 0-group fish species discussed below, a few other species were occasionally recorded such as Agonus, Cottidae, Leptagonus, Liparis, Lumpenus etc.

Herring

0-group herring were not recorded during the entire survey and this is the sixth successive year of very low abundance of 0-group herring.

Cod

The 0-group cod were distributed over a wide area in the central Barents Sea, extending from the Norwegian coast north to 77° N and from Bear Island along the western coast of Spitsbergen as far north as 79° N (Fig. 9). The area of distribution was more extensive and the concentrations were considerably denser than in any of the previous years since 1963. Therefore the indication is that the 1970 year-class of cod is very abundant.

Haddock

Similar to cod, the 0-group haddock were also distributed over a wide area in the central Barents Sea, with extensions northwards along the coast of Spitsbergen as far as the northern limit of the survey (Fig. 10). However, the abundance of 0-group haddock was probably lower than that of 1969 but second in strength for the years covered by the joint surveys (1965-1970).

Redfish

The 0-group redfish this year were distributed within a smaller area than in 1959. The redfish concentrations were observed in the western part of the Barents Sea with extension northwards along the Spitsbergen coast and may even be distributed beyond the limit of the investigated area, i.e. approximately 80° N. The density was found to be rather high (Fig. 11). The total echo abundance may indicate a fairly strong year-class, though probably less abundant than that of 1969.

Capelin

In contrast to the four previous years the distribution of 0-group capelin was found to be limited to smaller areas along the Finnmark and Murman coast and in the eastern part of the Barents Sea (Fig. 12). The concentrations were rather low indicating a weak 1970 year-class.

Long rough dab

The 0-group long rough dab were mainly distributed within an area from Bear Island northwards along the coast of Spitsbergen. Similar to 1969 this species again showed low values in abundance (Fig. 13).

Polar cod

The concentrations of this species were found in two separated areas, namely in the eastern part of the Barents Sea and in an area extending from Hope Island to the water west of Spitsbergen as far as the northern limit of the investigation (Fig. 14). The distribution was more or less similar to that of 1969 and the year-class seemed to be abundant.

Other species

0-group fishes of several other species were observed during the survey. The Greenland halibut (Fig. 15), Anarhichas and Ammodytes were frequently netted. Only a few saithe were taken during the survey (Fig.15).

Concluding remarks

Again a numerous year-class of redfish has been produced, being the fourth successive rich year-class since 1965. In contrast to the four previous years the abundance of capelin was low, indicating that a decrease in the adult capelin stock will occur during 1972-1973.

Concerning cod and haddock the 1970 year-class seems to be abundant. The 0-group cod may be of the same magnitude as that of 1963 and considerably more abundant than the 1969 year-class (Hylen and Dragesund 1970). The 0-group haddock seems to be somewhat less abundant than this year together with the rich year-classes of 1966 and 1969 (Anon. 1969, Benko et al.1970) indicate that the stock is on a relatively high level. Length frequencies of the different species are shown in Fig.16.

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Anon. 1969. Preliminary report of the 0-group fish survey in the Barents Sea and adjacent waters in August-September 1969. Coun. Meet. int. Coun. Explor. Sea. 1969 (F 34): 1-5, 15 figs. (Mimeo.)

Benko, Y.K., Dragesund, O., Hognestad, P.T., Jones, B.W., Monstad, T., Nizovtsev, G,P., Olsen. S., and Seliverstov, A.S. 1970. Distribution and abundance of 0-group fish in the Barents Sea in August-September 1955-1968. Coop. res. rep. Int. Coun. Explor. Sea .Ser. A 18: 35-47.

Dickson, R.R., Midttun, L. and Mukhin, A.I. 1970. The hydrographic conditions in the Barents Sea in August-September 1965-1968. Coop. res. rep. Int. Coun. Explor. Sea. Ser.A 18: 3-15.

Dragesund, O., Midttun, L. and Olsen. S. 1970. Methods for estimating distribution and abundance of 0-group fish. Coop. res. rep Int. Coun. Explor. Sea. Ser. A 18: 25-37.

Hylen, A. and Dragesund, O. 1970. Recruitment of young Arcto-Norwegian cod and haddock in relations to parent stock size. Stock and recruitment. Int. Coun. Explor. Sea. Symp., Aarhus. 1970 (19): 1-13, 21 figs. (Mimeo.).

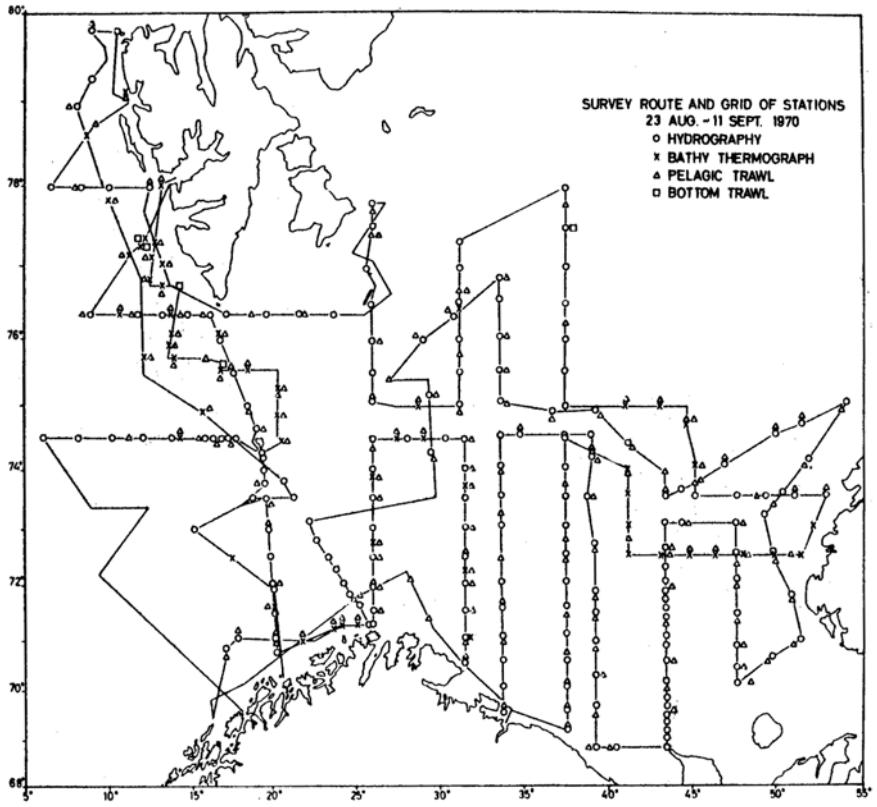

Fig. 1. Survey routes and grid of stations

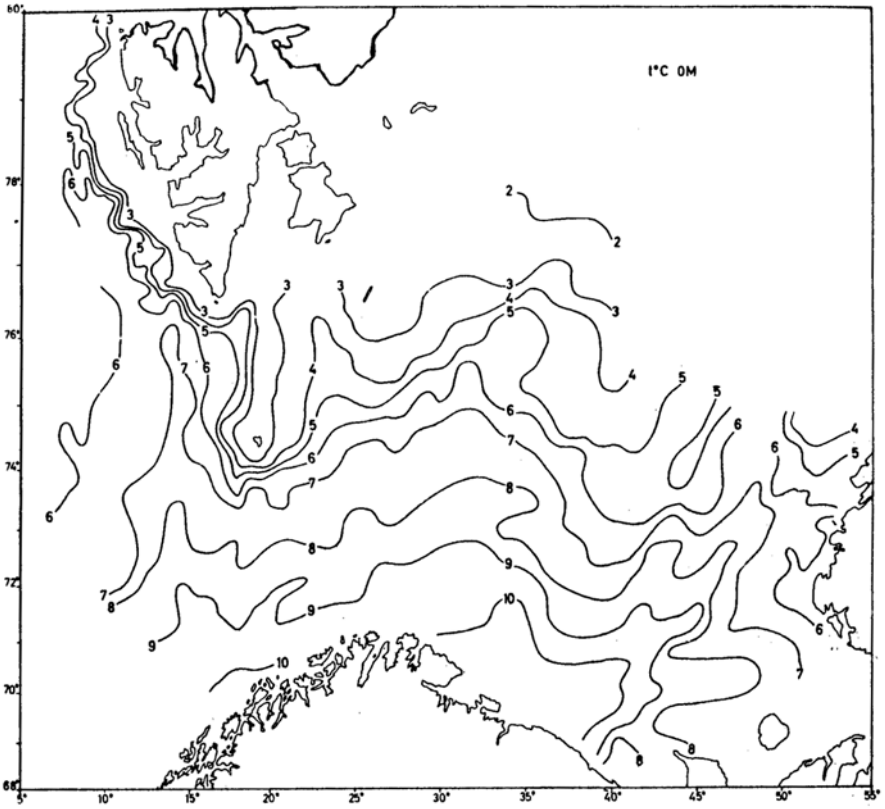

Fig. 2. Isotherms at 0 m

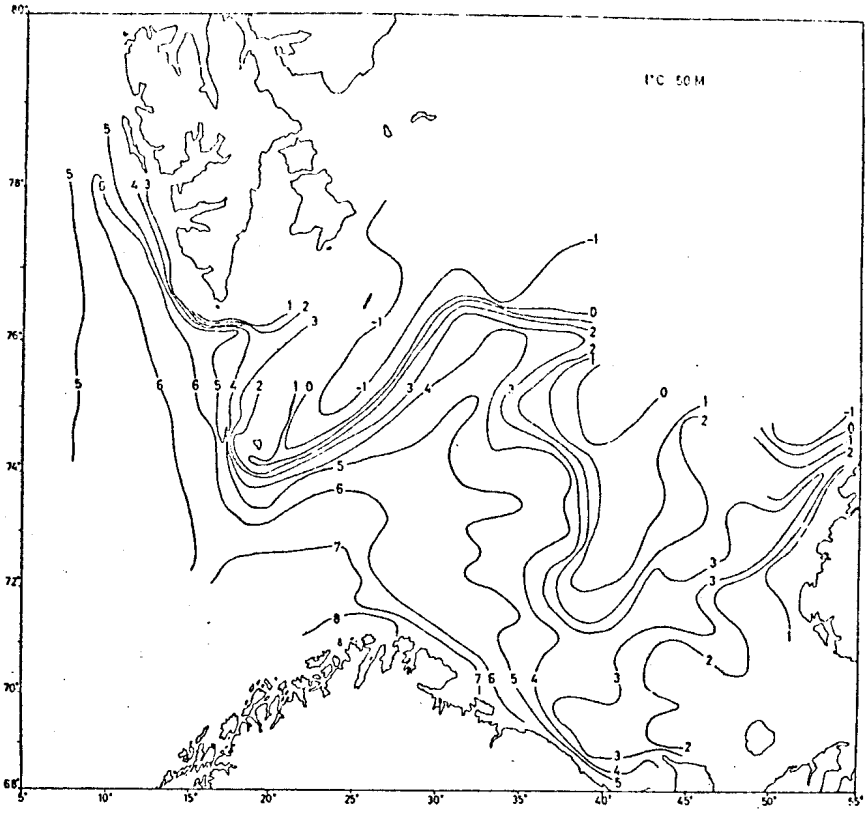

Fig. 3. Isotherms at 50 m

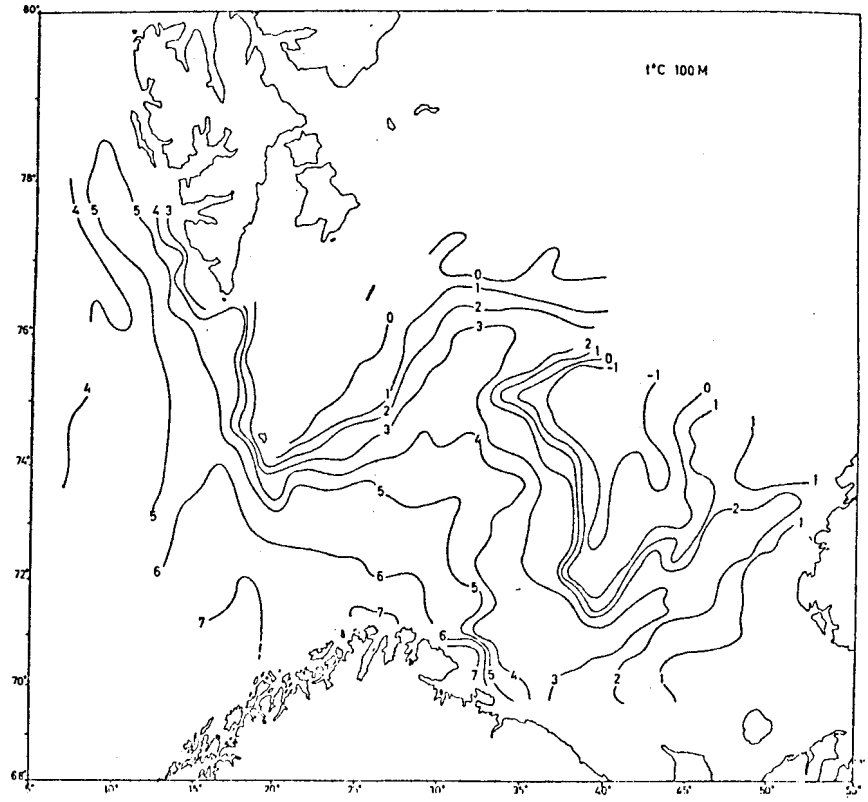

Fig. 4. Isotherms at 100 m

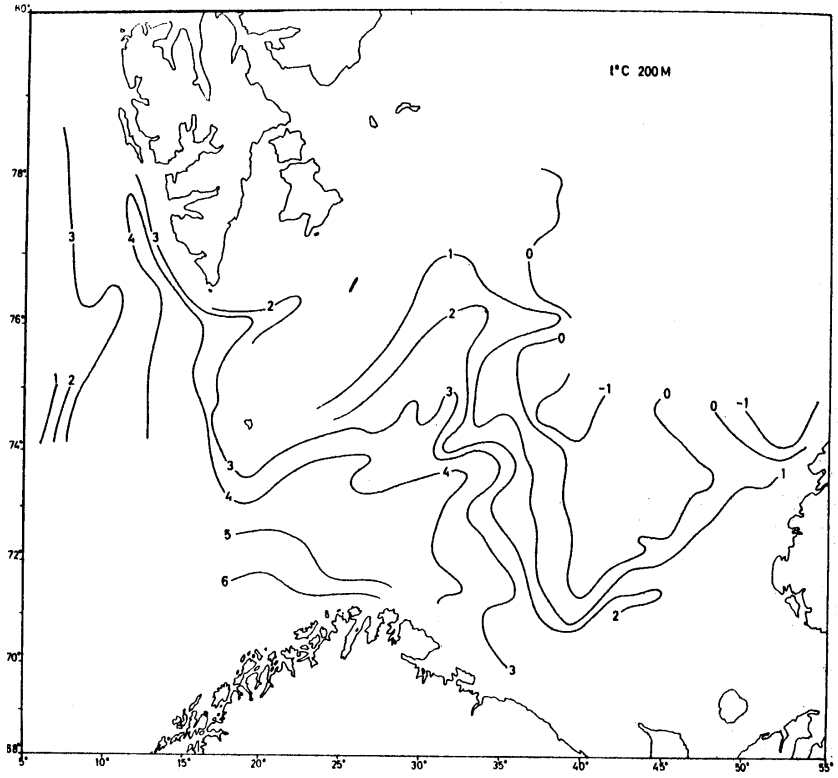

Fig. 5. Isotherms at 200 m

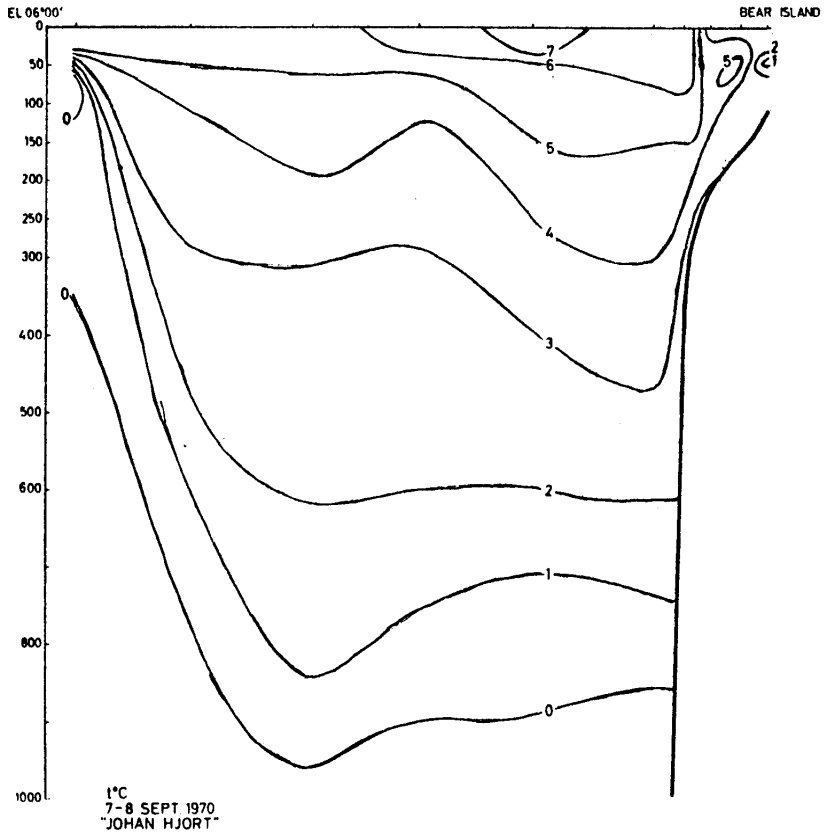

Fig. 6. Temperature section Bear Island-West

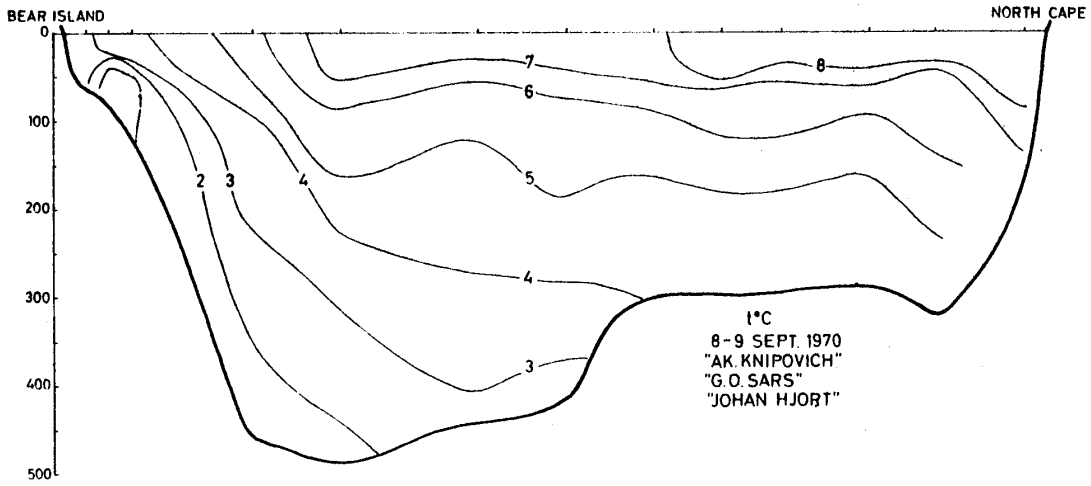

Fig. 7. Temperature section Bear Island-North Cape

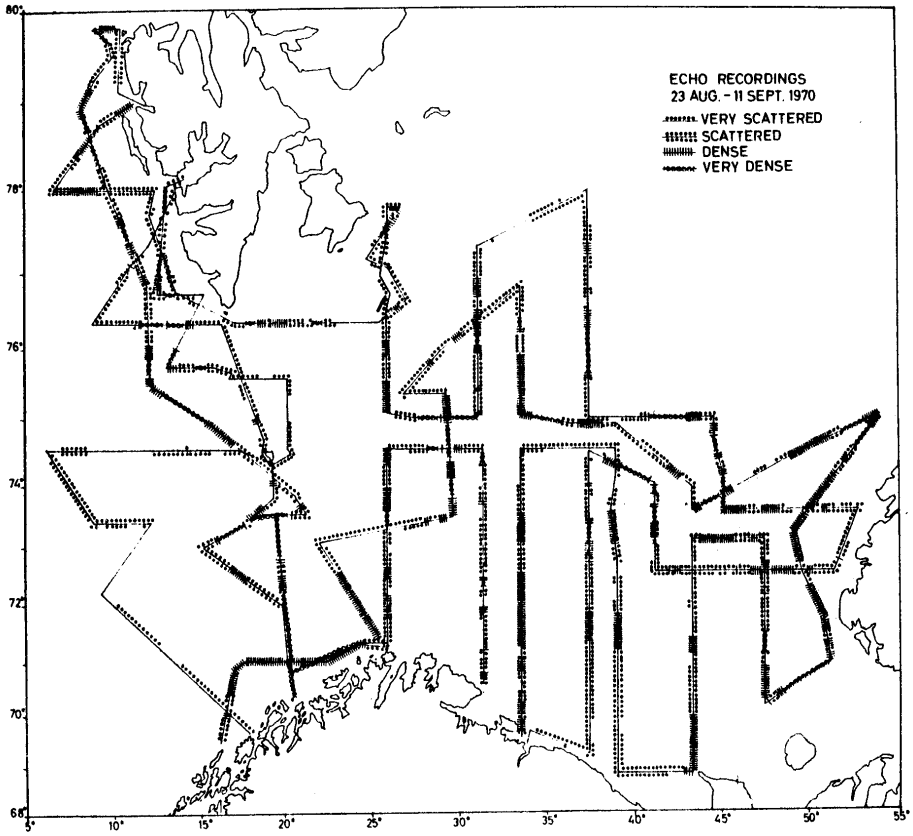

Fig. 8. Courses and echo recordings

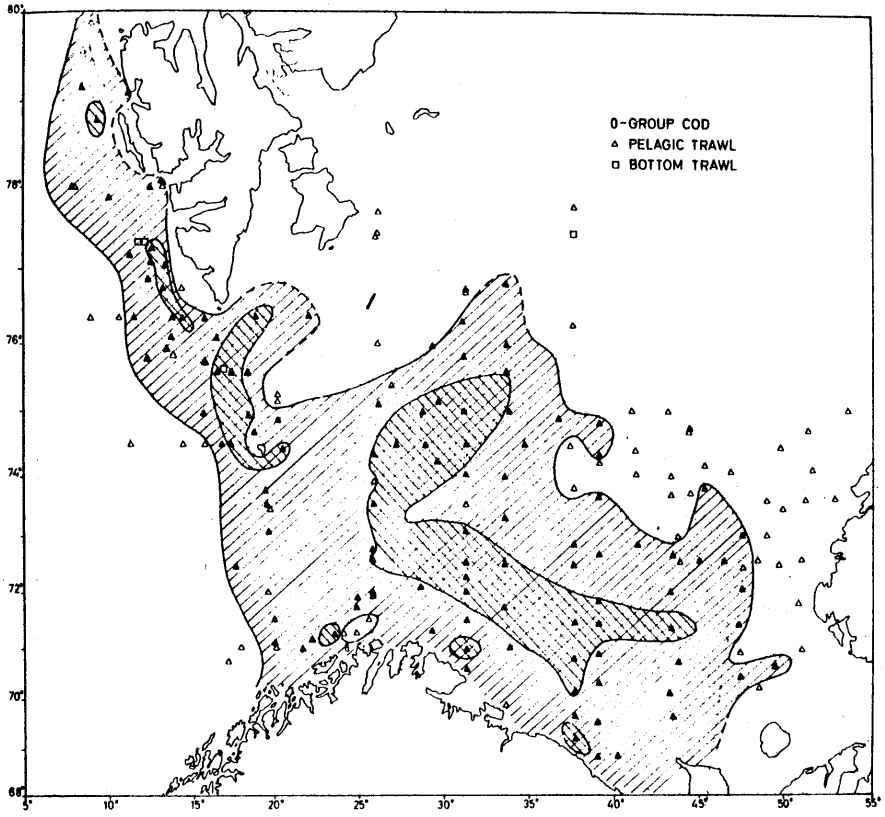

Fig. 9. Distribution of 0-group cod

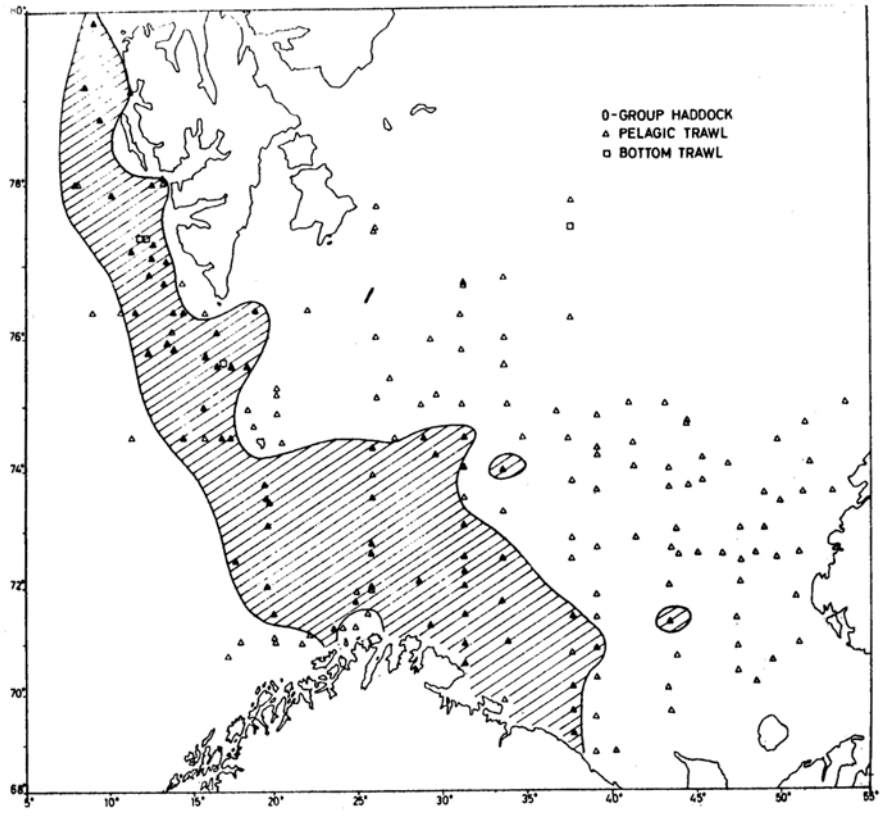

Fig. 10. Distribution of 0-group haddock

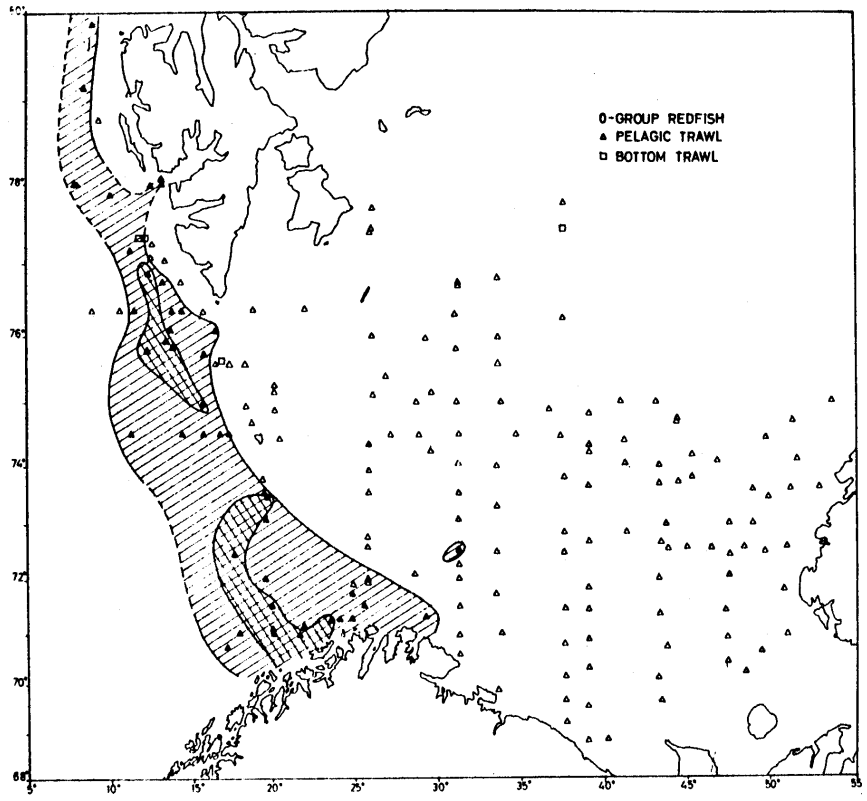

Fig. 11. Distribution of 0-group redfish

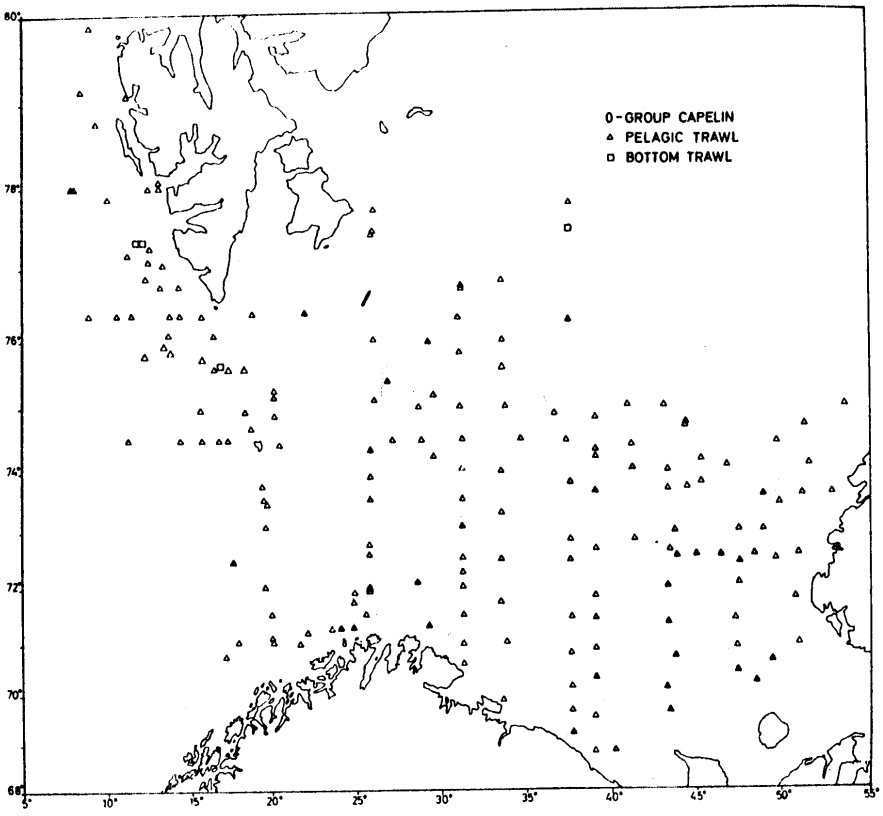

Fig. 12. Distribution of 0-group capelin

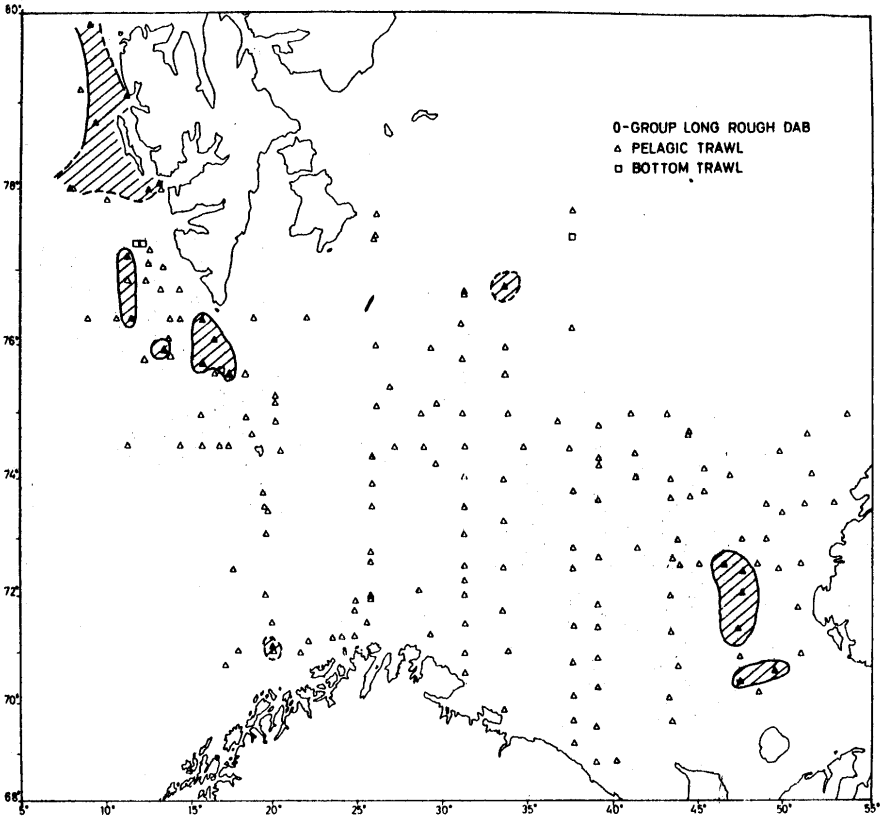

Fig. 13. Distribution of 0-group long rough dab

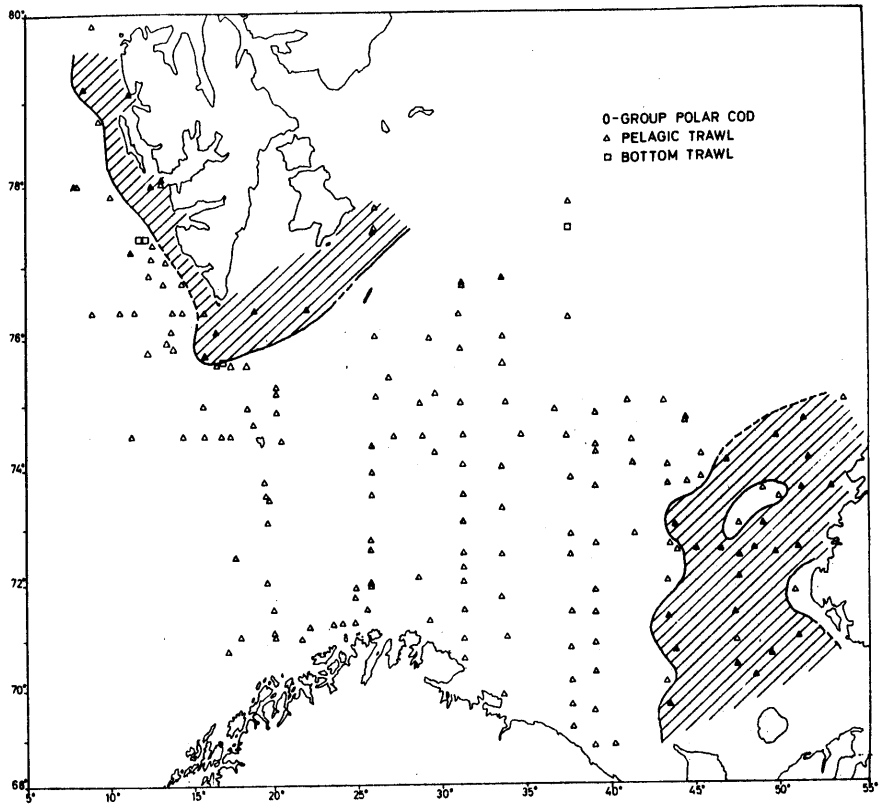

Fig. 14. Distribution of 0-group polar cod

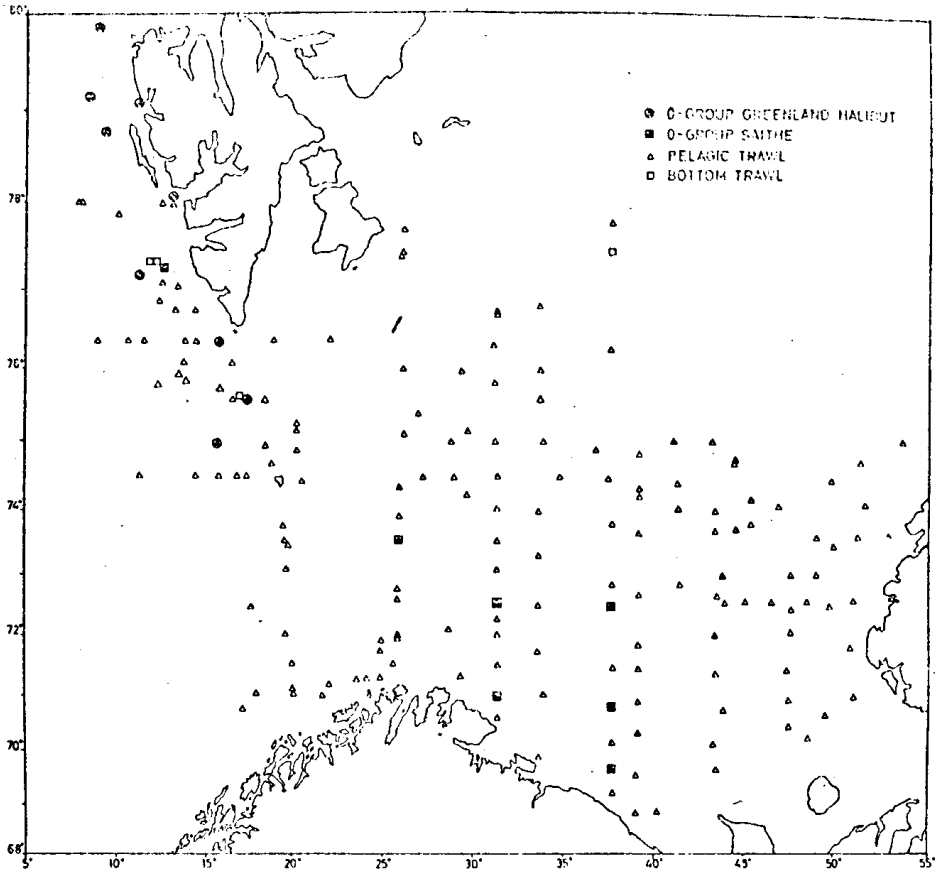

Fig. 15. Distribution of 0-group Greenland halibut and saithe

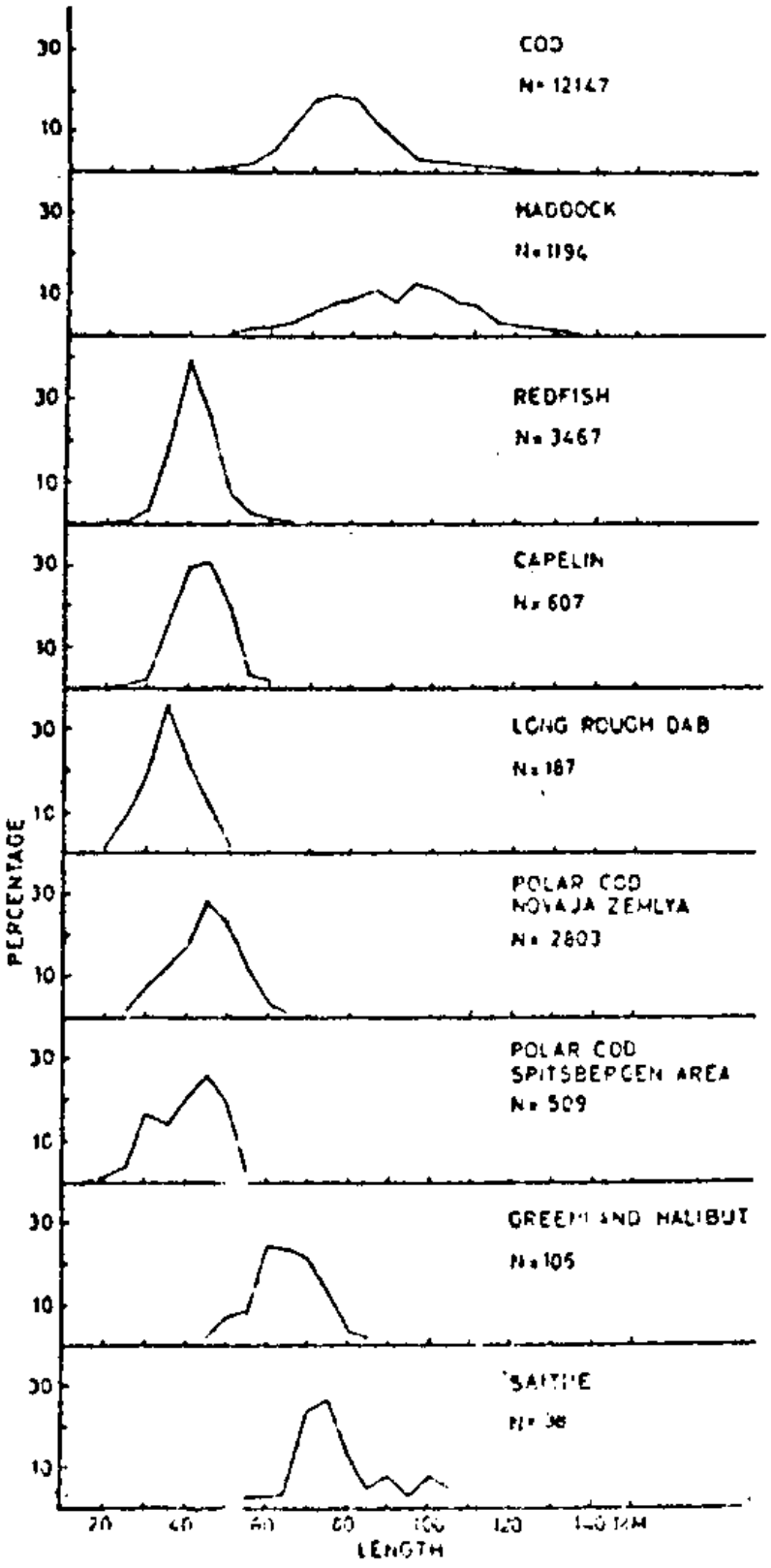

Fig. 16. Length frequencies

International Council for
the Exploration, of the Sea

C.M. 1971/H:32
Pelagic Fish (Northern) Committee
Ref:
Demersal Fish (Northem) Committee
Hydrography Committee

Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August-September 1971

Introduction

This was the seventh in a series of international surveys to study the abundance and distribution of 0-group fish in the Barents Sea and the Svalbard region.

The following vessels and scientists took part in the survey:

USSR	R/V "Akademik Knipovich"	A.S. Seliverstov, V.V. Penin
	R/V "Fridtjof Nansen"	V.N. Schleinik, V.D. Tester, A.I. Lysota
Norway	R/V "G.O. Sars"	O. Dragesund, P.T. Hognestad, O.M. Nakken
	R/V "Johan Hjort"	A. Hylen, O.M. Gmedstad, R. Sætre
England	R/V "Cirolana"	B.W. Jones, J.H. Nichols, J.G. Pope, C. Doddington

Preliminary plans for the survey were made at a meeting in Bergen in May 1971, and final arrangements for coordination were made in Tromsø and Murmansk immediately before the commencement of the survey. The main part of the survey was carried out between 25 August and 9 September, but "Akademik Knipovich" commenced on 20 August. The survey was followed by a meeting in Tromsø during 10-13 September arranged for the exchange and analysis of data.

Material and methods

As in previous years the distribution and density of the pelagic scattering layers were estimated from the echo sounder paper records, and the organisms forming the scattering layers were identified by sampling with small meshed pelagic trawls. Various depth metering devices on the trawls were used for the accurate control of the depth of trawling. Echo integrators were used in conjunction with the echo sounders on board R/V "G.O. Sars", R/V "Johan Hjort", R/V "Cirolana" and R/V "Fridtjof Nansen".

It was thought that the different trawls used on the various ships probably had different fishing characteristics and it was recommended that for the future surveys a standard net should be selected and used by all ships in order to make quantitative comparisons of the catches more reliable.

Fig.1 shows the area surveyed and the ships' tracks together with the trawl and hydrographic stations worked.

Results

Hydrography

Hydrographic observations were conducted on the standard sections: along the Kola meridian (33°30' E), along the 43°15' E (north of the Cape Kanin), between Kolguyev Island and south-west part of Novaya Zemlya, between North Cape and Bear Island and west of Bear Island (74°30' N) and also on other hydrographic sections and at trawl stations, as shown in Fig. 1.

A preliminary analysis of data made it possible to conclude the following (Figs. 2-8). In early September the temperature of the 0-200 in layer in the eastern branch of the Spitsbergen Current in the section west of Bear Island was only 0.1° higher than the normal. Compared to the temperature in 1970, it was 0.4° lower. The temperature of the 0-200 m layer in the middle branch of the Spitsbergen Current in this section was found to be close to the normal, but it was 0.7° lower than that of 1970 observed at the same period. The degree of the surface warming in these waters was similar to the long-term mean, but a little lower than in 1970.

In early September 1971 the temperature of the 0-200 m layer in the North Cape Current in the section North Cape-Bear Island was found to be the highest during all the 0— group fish surveys; it was 0,6° higher than the normal and 0,2° higher than that of 1970.

At the end of August 1971 the temperature of the 0-200 m layer in the northern branch of the North Cape Current in the section eastward of Bear Island was found to be close to the normal, but was 0.4° less than in 1970. At 33°30' E and north of 76°00' N the water temperature of this current was 0.3° below the normal and 0.7° below that of early September 1970.

In late August 1971 the temperature of the 0-200 m layer in the Murmansk Current in the section along the 33°30' E was 0.1° below the normal, but 0.5° below that of 1970 observed in the same period. Surface temperature in this current was found to be 1.9° below that of 1970, which was characterized by considerable warming up.

At the end of August 1971 in the section north of Cape Kanin the temperature of the whole water column in the Murmansk Current was found to be close to the normal and its value in previous years, whereas the surface temperature was 0.7° below the normal and 2.6° below that of 1970.

The temperature from the surface to the bottom in the warm Kanin-Kolguyev Current was also close to the normal and its value observed in 1970; but in the surface layers it was found to be 1° below the normal and 2° below that of 1970.

Distribution and abundance of 0-group fish

The variation in the total density of the scattering layers is shown in Fig. 9. The echo recordings include, as well as 0-group fish, contributions from fish of older age-groups, notably capelin, polar cod and blue whiting, and also include any echos which may come from invertebrate organisms. The total echo abundance has been expressed on a subjective scale from 0-4.

In addition to the species listed below a few other species were also recorded in the catches as catfish, lumpsucker, Agonus, Leptagonus, Cottidae, Liparis, lumpenus and Triglops. No saithe were recorded this year.

Percentage length compositions of the main species caught are given in Fig. 10.

Herring

No 0-group herring were recorded this year and this is the seventh year in succession of very low abundance of the species.

Cod

0-group cod were distributed over a wide area in the central Barents Sea from Norwegian coast to 77° N, with an extension from Bear Island along the western coast of Spitsbergen to 80° N (Fig. 11). The area of distribution was somewhat less extensive than in 1970. Although the abundance was lower than was recorded in 1970 when cod were very abundant the 1971 year class can be described as being of above average abundance and more numerous than were recorded for the year classes 1965-1969.

Haddock

The distribution of 0-group haddock was similar to that of cod being distributed over a wide area in the central Barents Sea with an extension northwards along the west coast of Spitsbergen (Fig. 12). The abundance of haddock was about average for the years covered by the International surveys, the 1971 year class being less abundant than the 1969 and 1970 year classes, but more abundant than the poor year classes of 1965-1968.

Redfish

The 0-group redfish had a more westerly distribution than cod and haddock and the area covered was very similar to that observed in 1970, covering the western part of the Barents Sea and extending northwards along the west coast of Spitsbergen to 81° N (Fig. 13). The 1971 year-class appeared to be less abundant than the year classes of 1970 and 1969.

Capelin

The abundance of 0-group capelin this year was not so great as was observed in the years 1966-1969, but was more abundant than in 1970 which was relatively poor year. It should be noted however, that the 1970 year-class seems to be somewhat stronger than indicated by the last years 0-group fish survey, probably due to a contribution from summer spawned capelin. The area of distribution (Fig. 14) was more widespread than in 1970 and more similar to that observed in earlier year.

Long rough dab

0-group long rough dab were distributed in an area around Bear Island and west of Spitsbergen and also in the eastern Barents Sea (Fig. 15). The abundance was greater than in the previous two years, but possibly not as abundant as in 1965-1967.

Polar cod

There were two areas of distribution of 0-group Polar cod, one in the eastern Barents Sea and the other in an area extending from Hope Island to Bear Island and west of Spitsbergen (Fig. 16). The 1971 year-class appears to be of average abundance.

Greenland halibut

0-group Greenland halibut were recorded from eight trawl hauls. The numbers caught were small, but the average size or the fish vas larger than in previous years.

Distribution of adult fish

During the survey fairly abundant concentrations of adult Polar cod and capelin were observed in the northeast Barents Sea. Adult blue waiting were widely distributed over the western part of the survey area and extended eastward to the region between South Cape Bear Island- Fugløy.

Additional observations

During the course of the survey there were indications that the small trawl used by "Cirolana" was not catching representative catches of the larger 0-group fish, particulary cod and haddock. Earlier this year this net had proved to be very satisfactory for gadoid fish, but during this survey it was suspected that the gadoids, having reached a larger size, were able to escape capture to some degree. This suspicion was confirmed with comparative hauls with an Engels trawl.

During a period of 24 hours fishing by R/V "Cirolana" and R/V "Johan Hjort" in the same position considerable haul to haul variation was observed in species composition and the quantities of fish caught. Some evidence was obtained that for redfish the larger fish have a deeper distribution than the smaller ones.

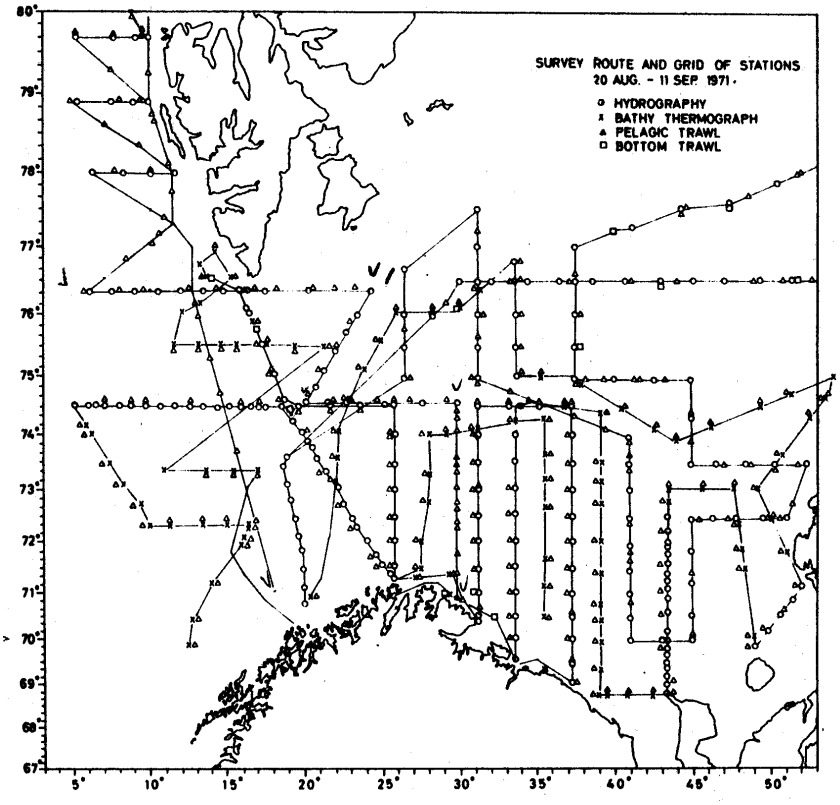

Fig. 1. Survey routes and grid of stations

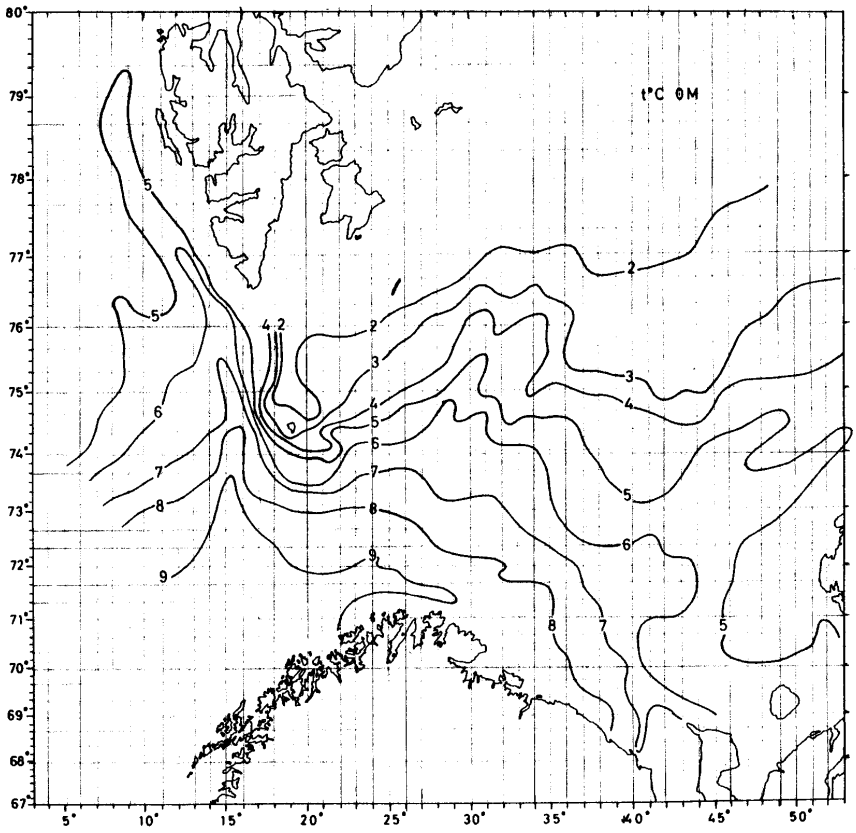

Fig. 2. Isotherms at 0 m

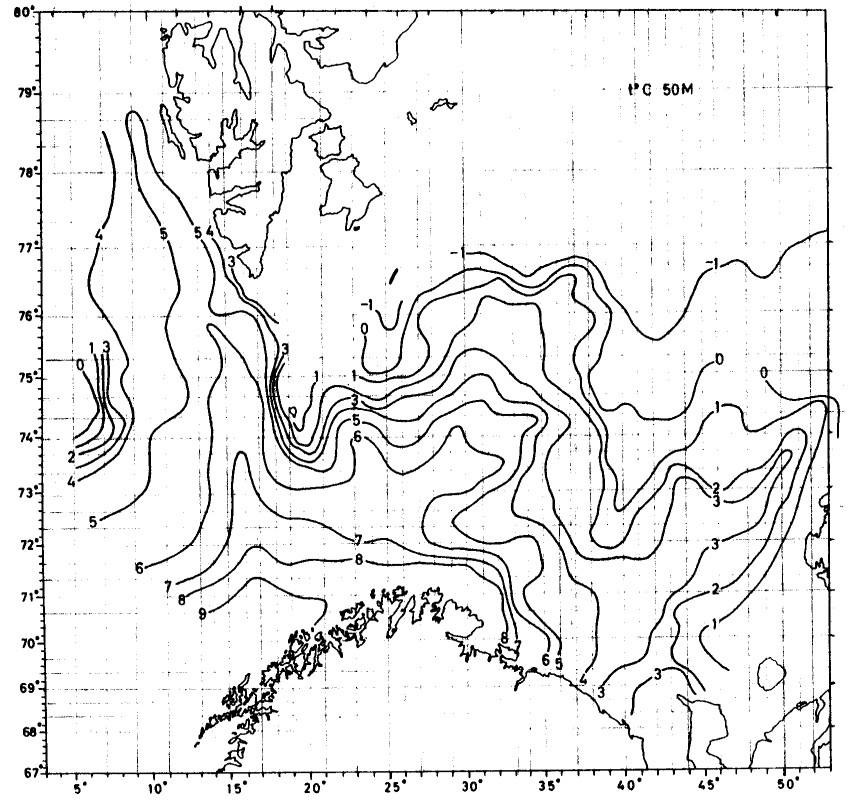

Fig. 3. Isotherms at 50 m

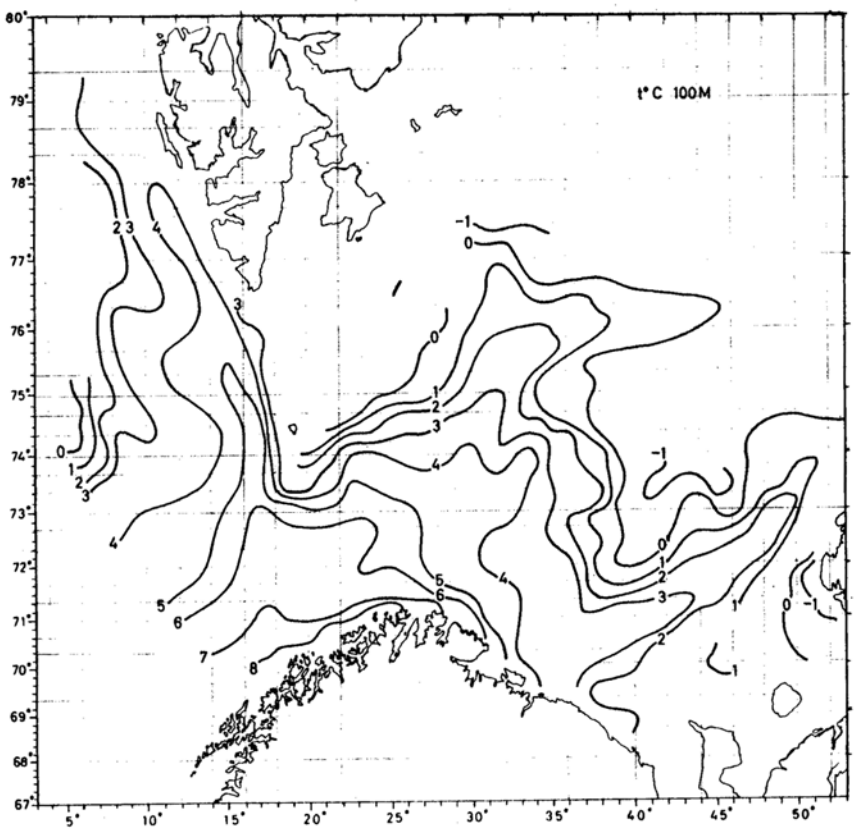

Fig. 4. Isotherms at 100 m

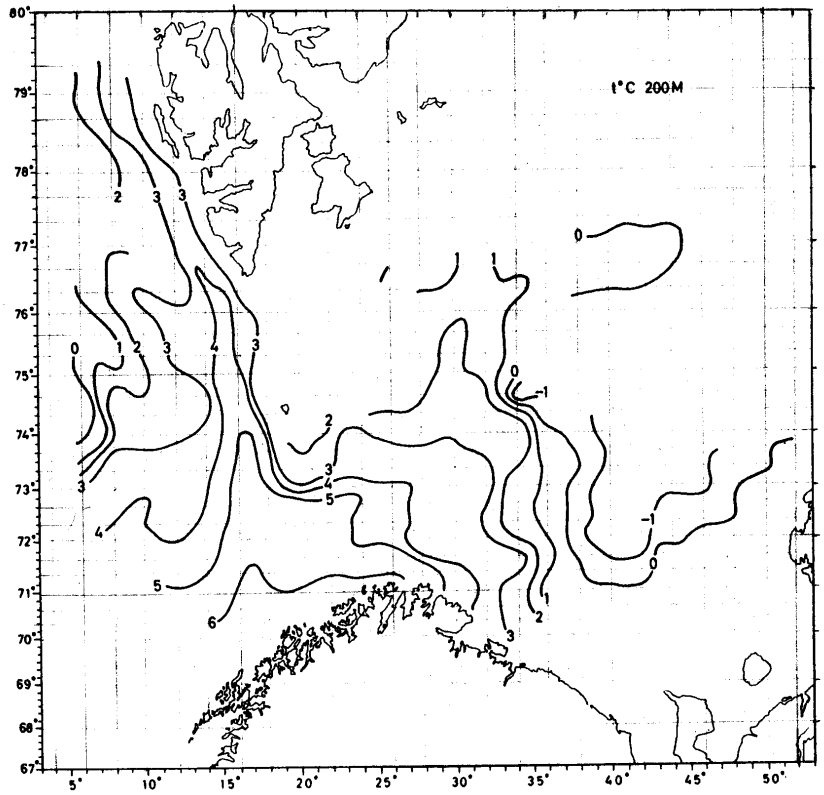

Fig. 5. Isotherms at 200 m

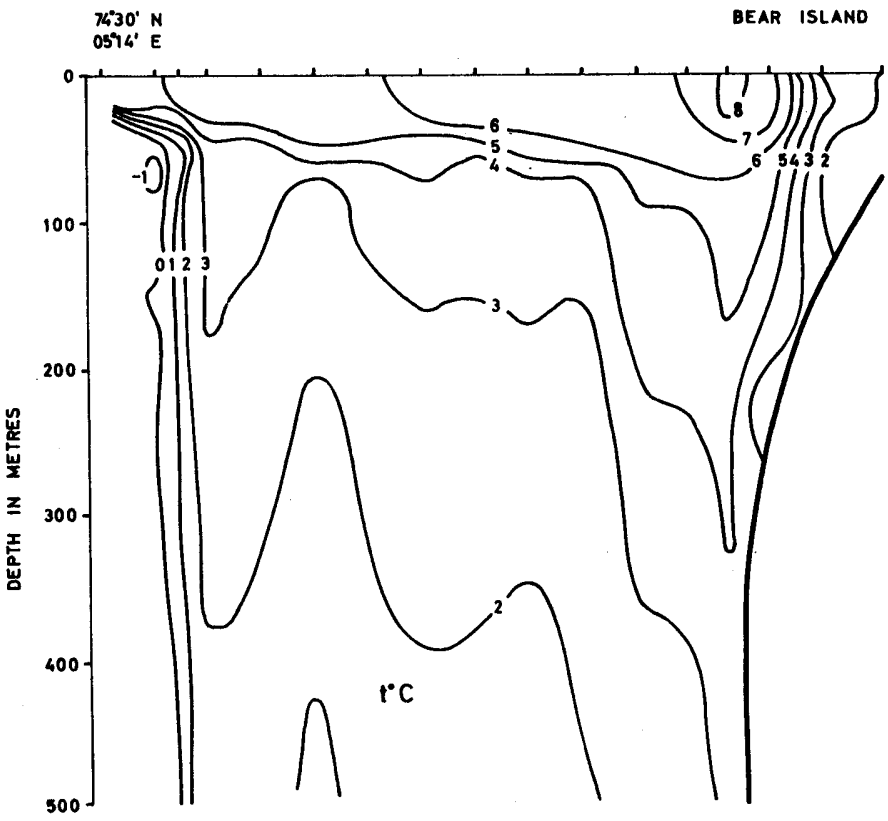

Fig. 6. Temperature section Bear Island – West. 3-9 September 1971

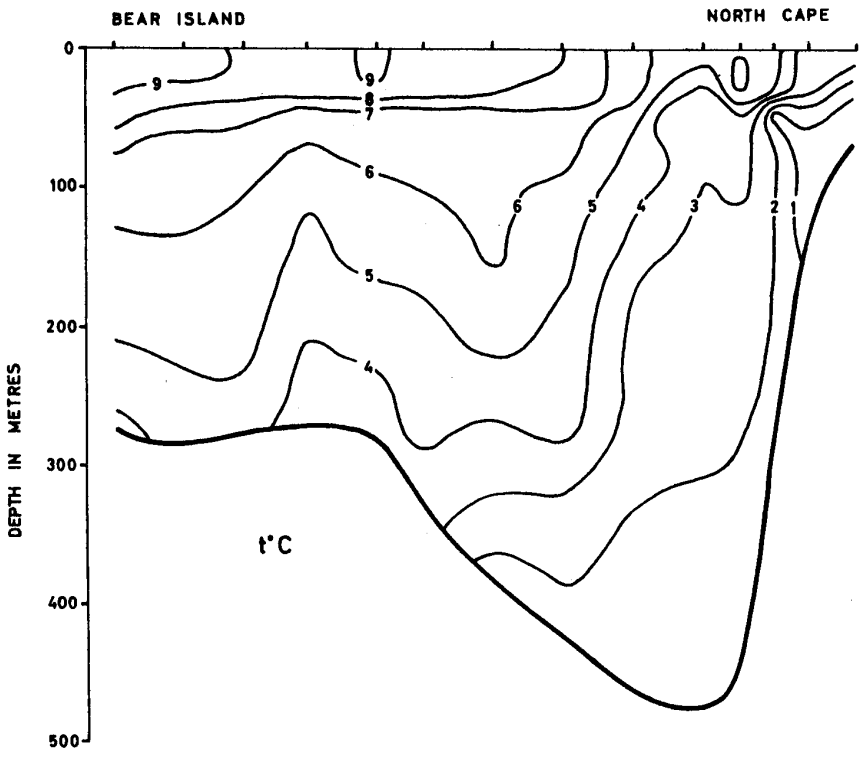

Fig. 7. Temperature section Bear Island – North Cape. 1-9 September 1971

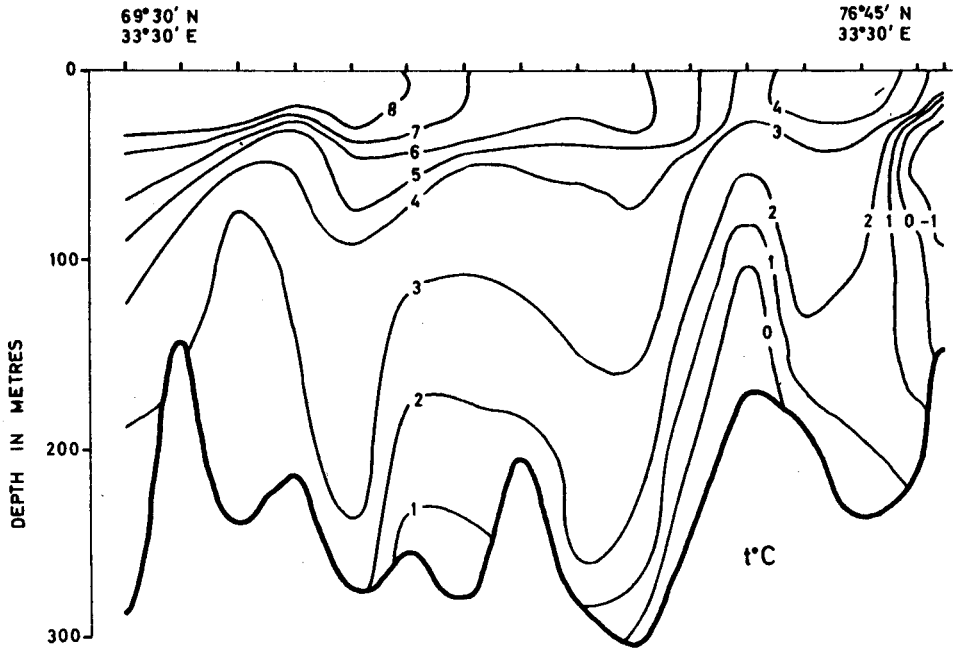

Fig. 8. Temperature in the section along the Kola meridian, 33°30'. 20 August-6 September 1971

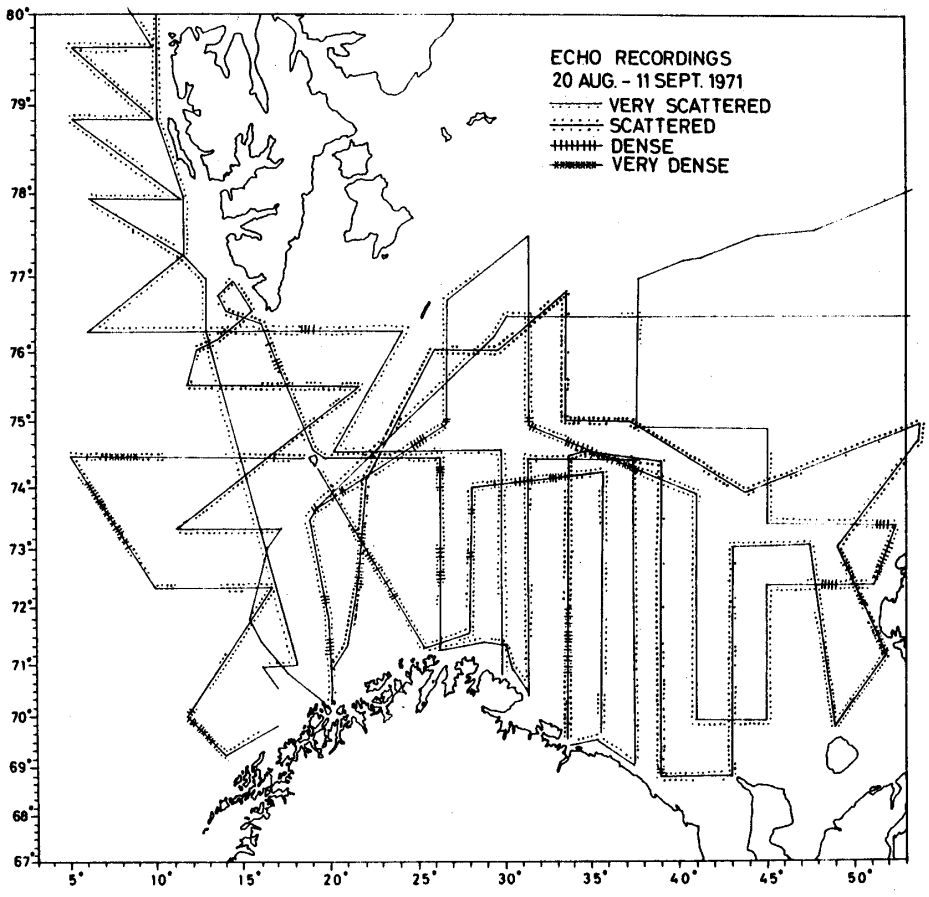

Fig. 9. Courses and echo recordings

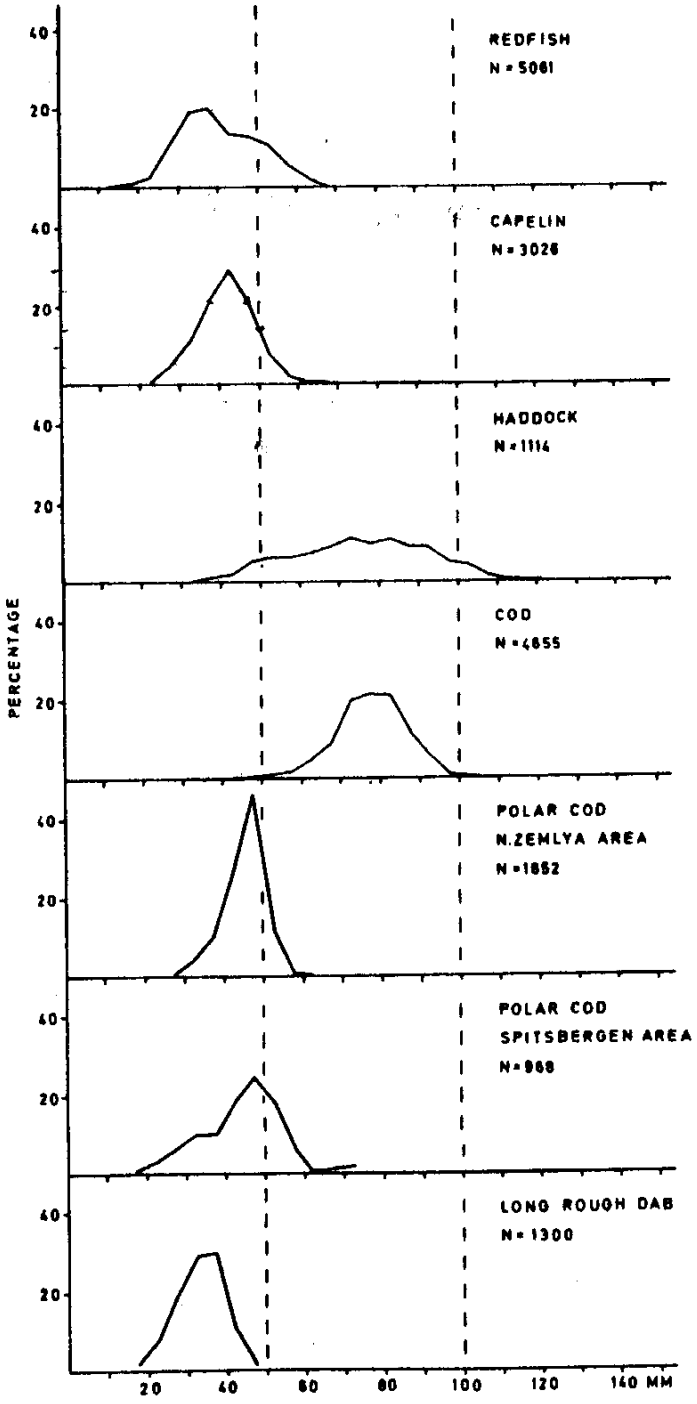

Fig. 10. Length distribution of 0-group fish

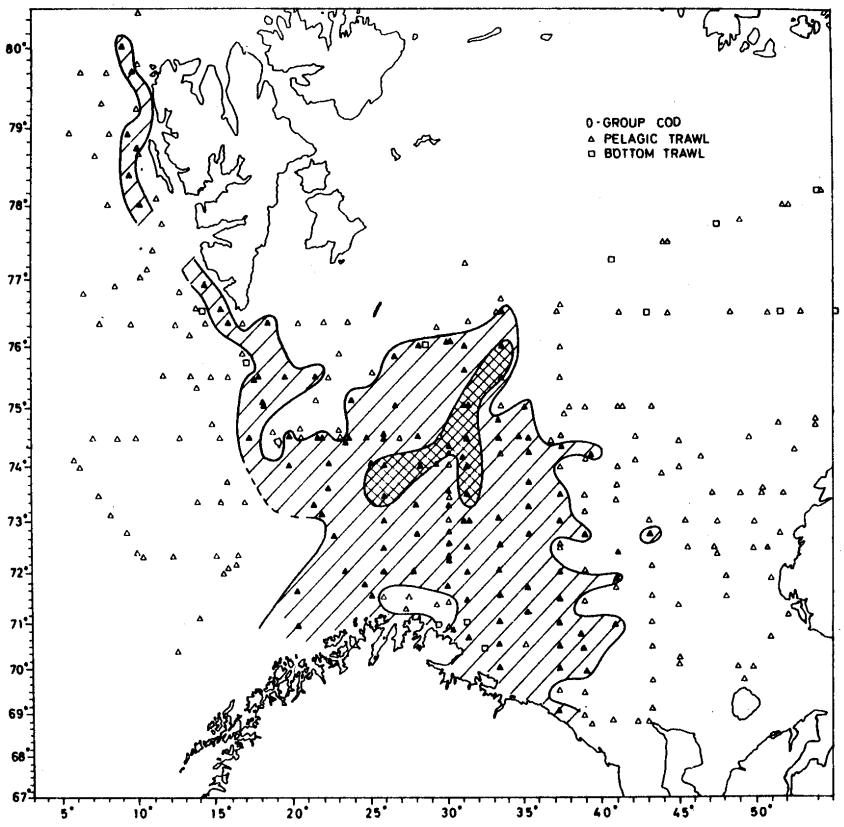

Fig. 11. Distribution of 0-group cod

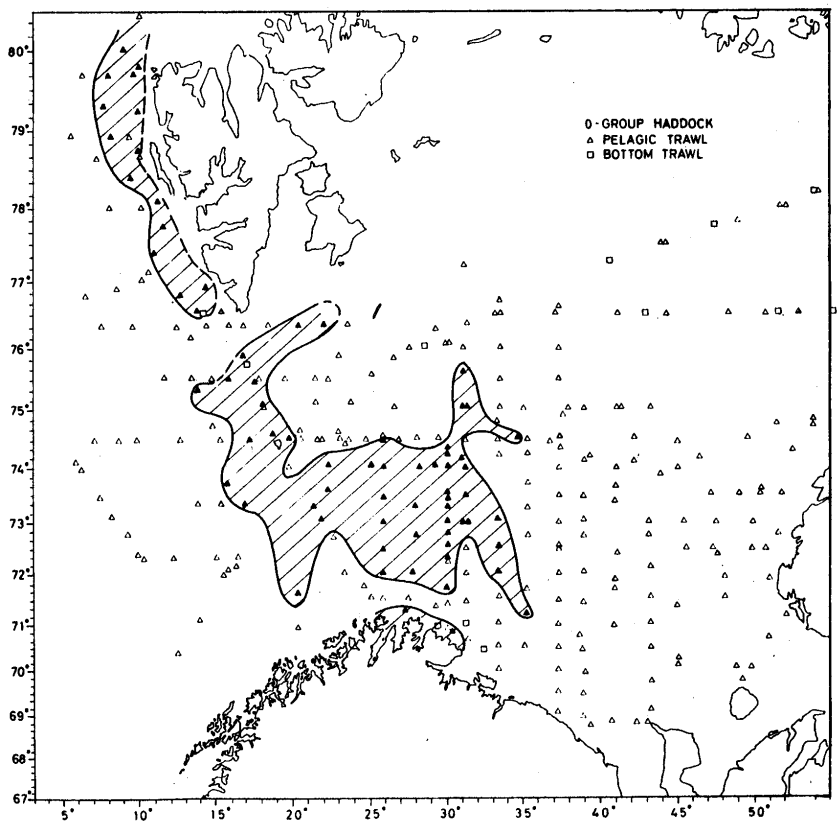

Fig. 12. Distribution of 0-group haddock

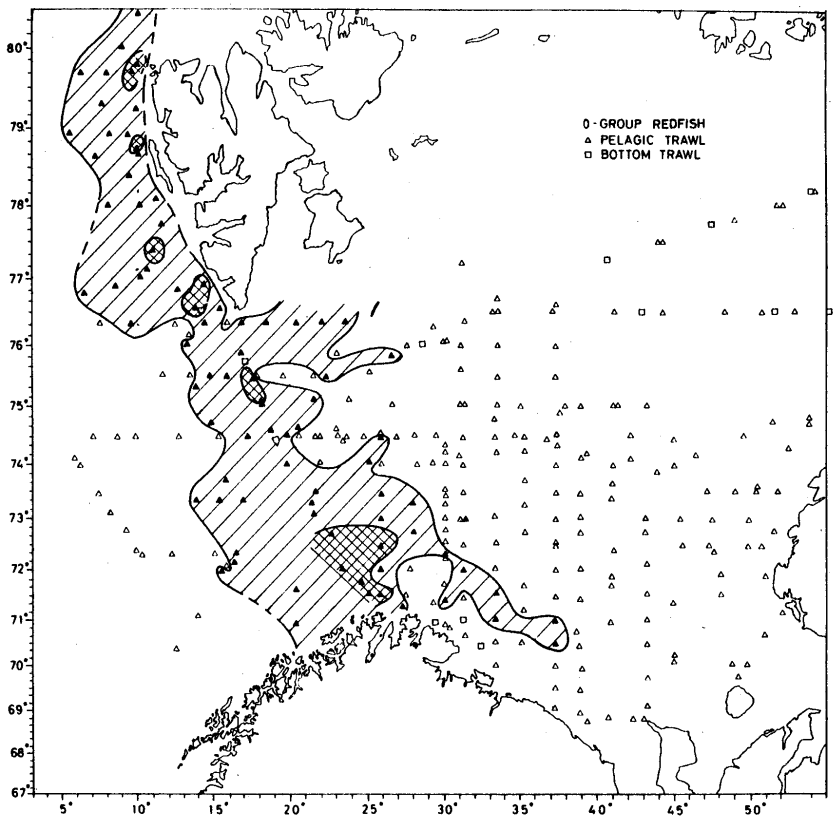

Fig. 13. Distribution of 0-group redfish

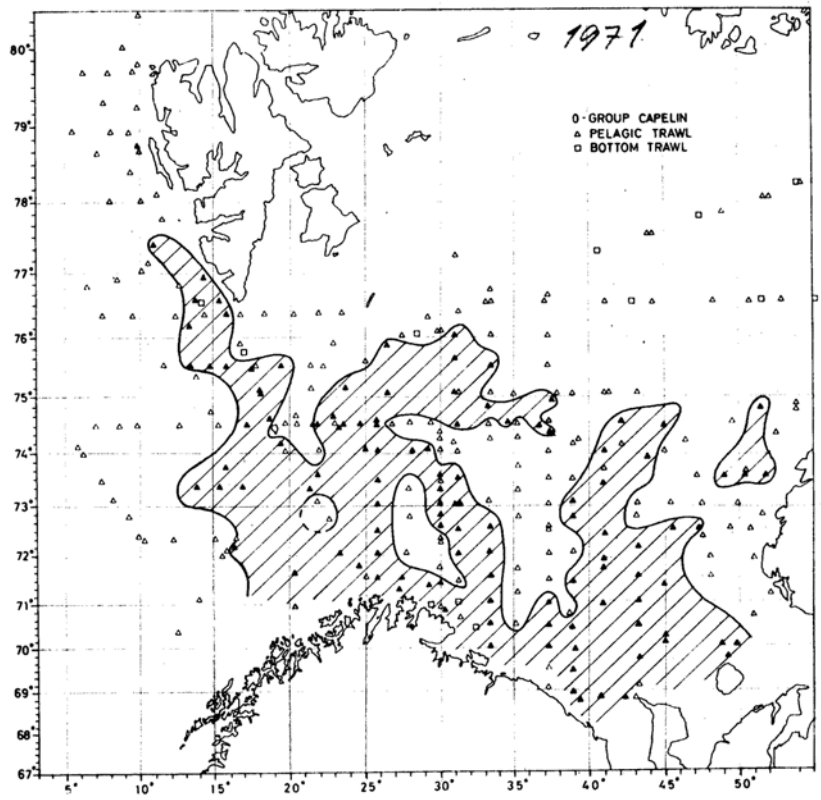

Fig. 14. Distribution of 0-group capelin

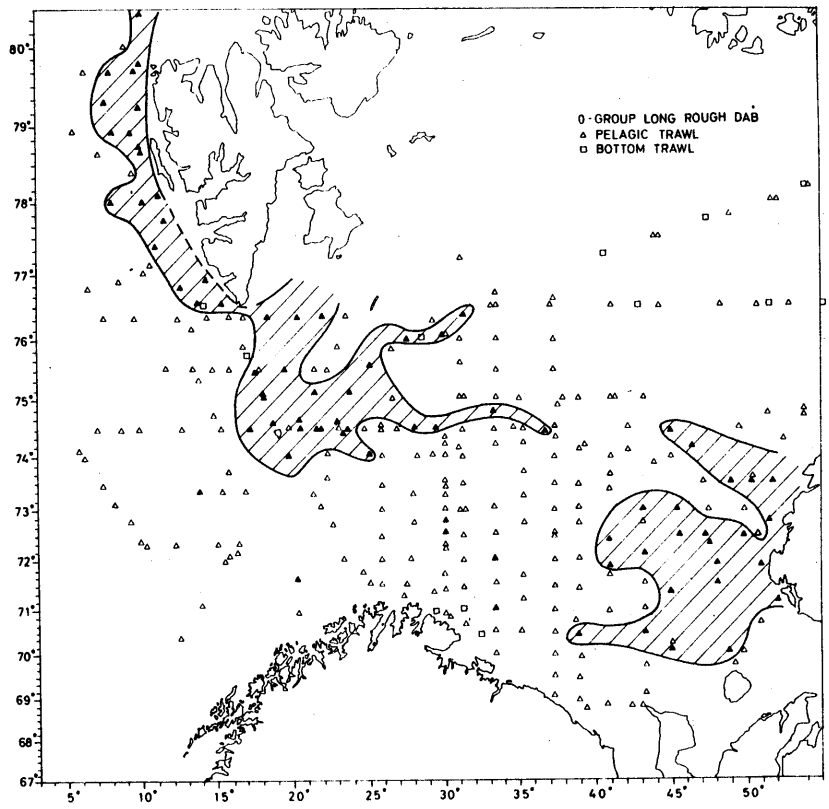

Fig. 15. Distribution of 0-group long rough dab

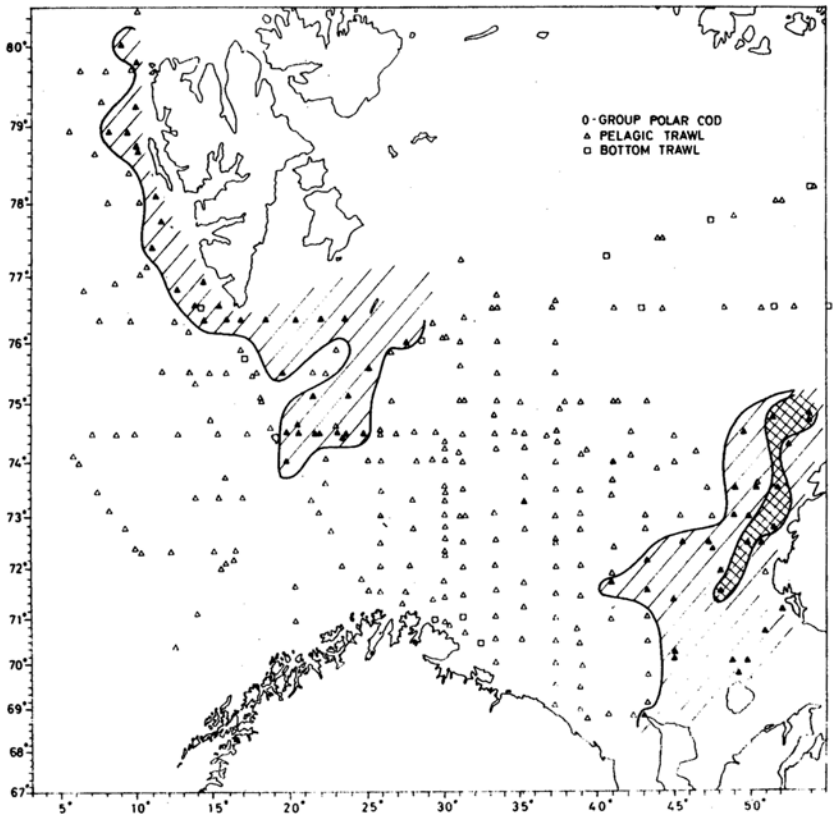

Fig. 16. Distribution of 0-group polar cod

Preliminary Report of the International 0-group fish survey in the Barents Sea and adjacent waters in August-September 1972

Introduction

This was the eighth in a series of international surveys to study the abundance of 0-group fish in the Barents Sea and the Svalbard Region.

The following vessels and scientists took part in the survey:

USSR	R/V "Akademik Knipovich"	V.N. Schleinik
	R/V "Fridtjof Nansen"	V.N. Kusnetsov
	R/V "Poisk"	A.S. Seliverstov, V.K. Nethaev
Norway	"Johan Hjort"	T. Monstad, R. Sætre, O. Smestad
	"G.O.Sars"	L. Midttun, P. Hognestad, O. Nakken

Dragesund and Sarynina took part in preparation of the report.

Preliminary plans for the survey were made at a meeting in Bergen in May 1972, and final arrangements for coordination were made in Kirkenes and Murmansk immediately before the commencement of the survey. The main part of the survey was carried out between 27 August and 11 September but "Akademik Knipovich" commenced somewhat earlier. The survey was followed by a meeting in open sea on the 13 September. Materials were exchanged and a brief report worked out based on a rather superficial analysis of data. The final version of this report was agreed upon in a meeting in Moscow in November 1972.

Material and methods

The distribution and density of the pelagic scattering layers were estimated from echo sounder paper records but also to some extent from echo integrator measurements. The organisms forming the scattering layers were identified by sampling with small meshed pelagic trawls. Various depth metering devices on the trawl were used for the accurate control of the depth of the trawling. Since different trawl types were used by the different vessels, a direct quantitative comparison between catches could not be made.

Fig. 1 shows the area surveyed and the ship's tracks together with trawl and hydrographic stations worked.

Results

Hydrography

Hydrographic observations were carried out along the same standard sections as in previous years.

A preliminary analysis of the data made it possible to conclude as follows (Fig. 2-6, 6a) (horizontal temperature distribution is shown for 0,50,100 and 200 m depth in Bear Island-North Cape, Bear Iceland-West and Kola sections).

Section's data are based on the material of Russian investigations. Maps and pictures made by Norwegian scientists.

Distribution and abundance of 0-group fish

The distribution and density of the scattering layers are shown in Figs. 7 and 8. The echo records do not include other age group fish but there might be some contribution from invertebrate organisms. The echo abundance is as usual expressed on a subjective scale from 0-4 (Fig. 7). However, this year is also prepared a distribution chart based on echo integrator deflections (Fig. 8). Integrator deflection is proportional to fish density.

In the following we shall give short comments on the abundance of the different species observed. Length distribution based on all catches of the most important species are shown in Fig. 9.

Herring

No 0-group herring were recorded this year.

Cod

0-group cod were distributed over a rather wide area both in central and eastern parts of the Barents Sea and also along the western and north-western Spitsbergen shelf (Fig. 10). The total area of distribution was hardly covered this year, since the cod had an unusual far easterly and northerly location within the circulation system. The abundance is considered to be of the same magnitude as in 1971, this means somewhat above average.

Haddock

The haddock were found in the western Barents Sea and along the west coast of Spitsbergen (Fig. 11). This year the abundance was estimated to be low compared with the years 1969-1971.

Redfish

The distribution of redfish was found to be similar to that in 1965 and 1971, located in the western Barents Sea and northwards along the western Svalbard shelf (Fig. 12). The 1972 year-class was considered to be somewhat stronger than those of 1965 and 1971 but weaker than the rich 1969 year-class.

Capelin

The 0-group capelin were distributed over the total Barents Sea south of latitude 77° N and within a smaller area west of Spitsbergen (Fig. 13). The exact northern limit of distribution was not fully described by this years field coverage. The density varied much and the highest concentrations were found west of Novaya Zemlya and near the Bear and Hope Islands. The abundance of young capelin (0 and 1 groups) can be considered as being high. Part of the recorded capelin originated from the spawning of 1971. This is indicated by the length distribution of Fig. 9. The 1971 year-class can be stated to be rich probably comparable with those of 1967 and 1969.

Long rough dab

The 0-group long rough dab were found within three separated areas as seen from Fig. 14. The abundance this year was appearently low.

Polar cod

According to observations from R/V "Akademik Knipovich" the polar cod was found to be abundant in the Novaya Zemlya area, but in the other parts of the area covered, the abundance was low (Fig. 15). However as a conclusion the 1972 year-class is considered to be strong, probably at the same order as that of 1969. It should also be noted that the distribution in the southern area of sea was somewhat more south-easterly than in previous years.

Other species

Fig.16 indicate observations of three other species viz. Greenland halibut, Mackerel and Saithe. These species were found in only small quantities. Smaller quantities of Cottides, Squids and Lumpenus were also observed, the abundance of Cottides is probably somewhat higher this year compared to 1971.

Adult fish

The observations of adult fish during the 0-group survey were not been reported in this paper, but will be dealt with in national reports.

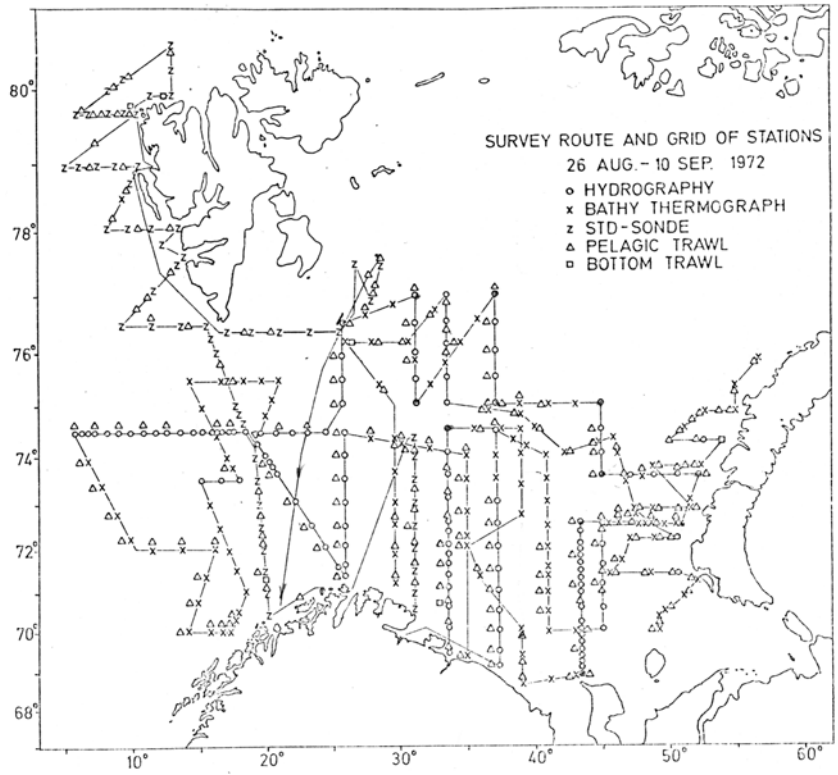

Fig. 1. Survey routes and grid of stations

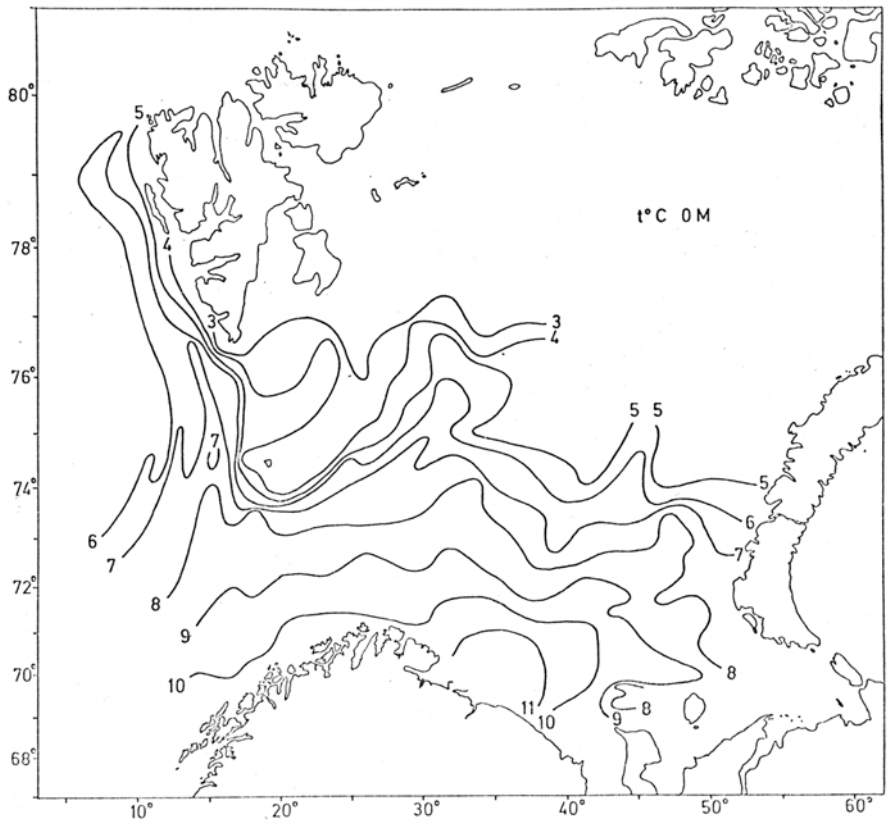

Fig. 2. Isotherms at 0 m

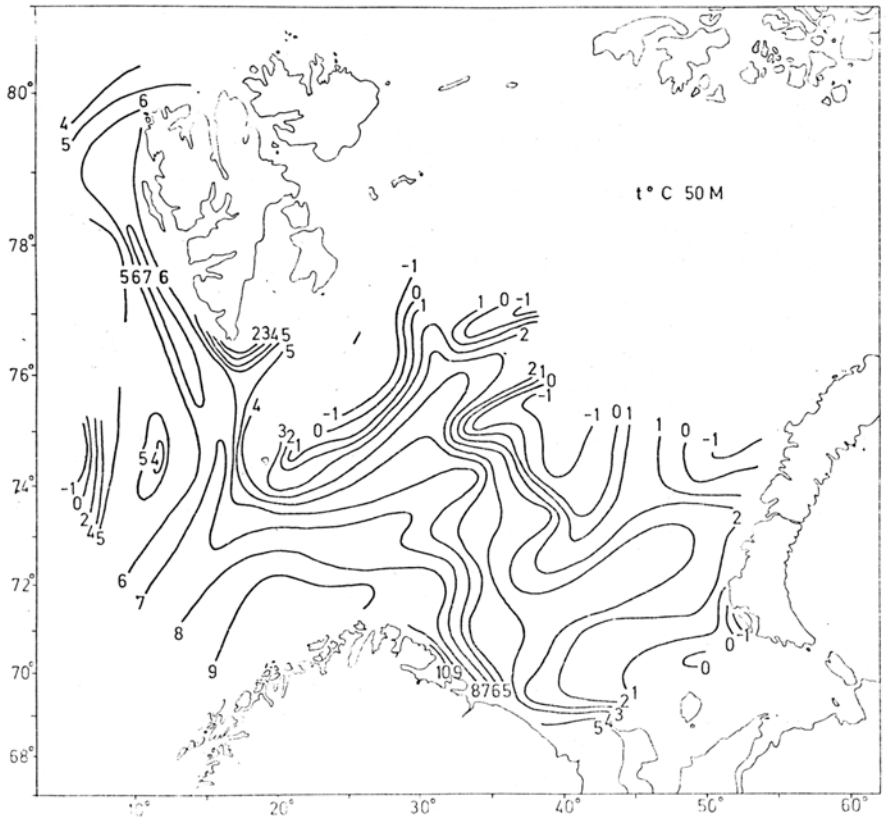

Fig. 3. Isotherms at 50 m

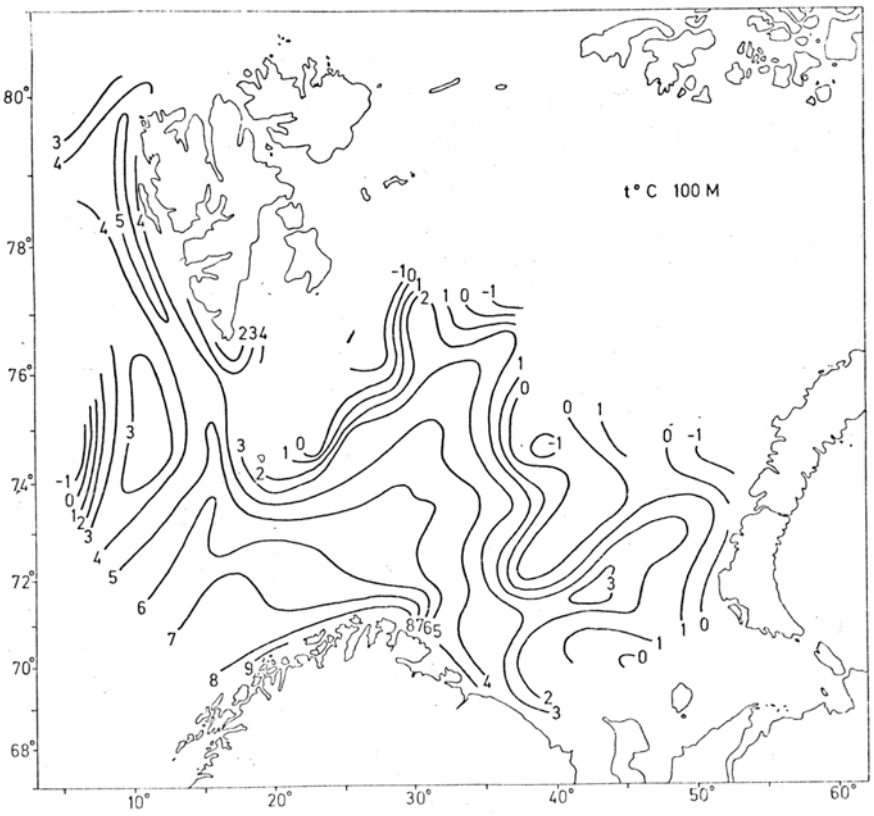

Fig. 4. Isotherms at 100 m

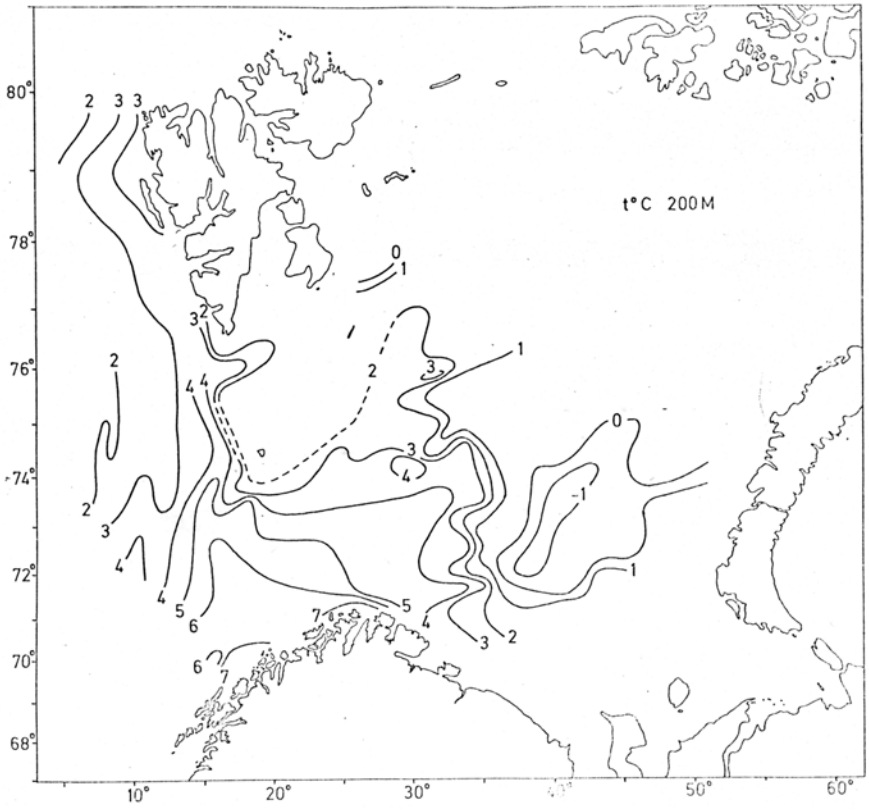

Fig. 5. Isotherms at 200 m

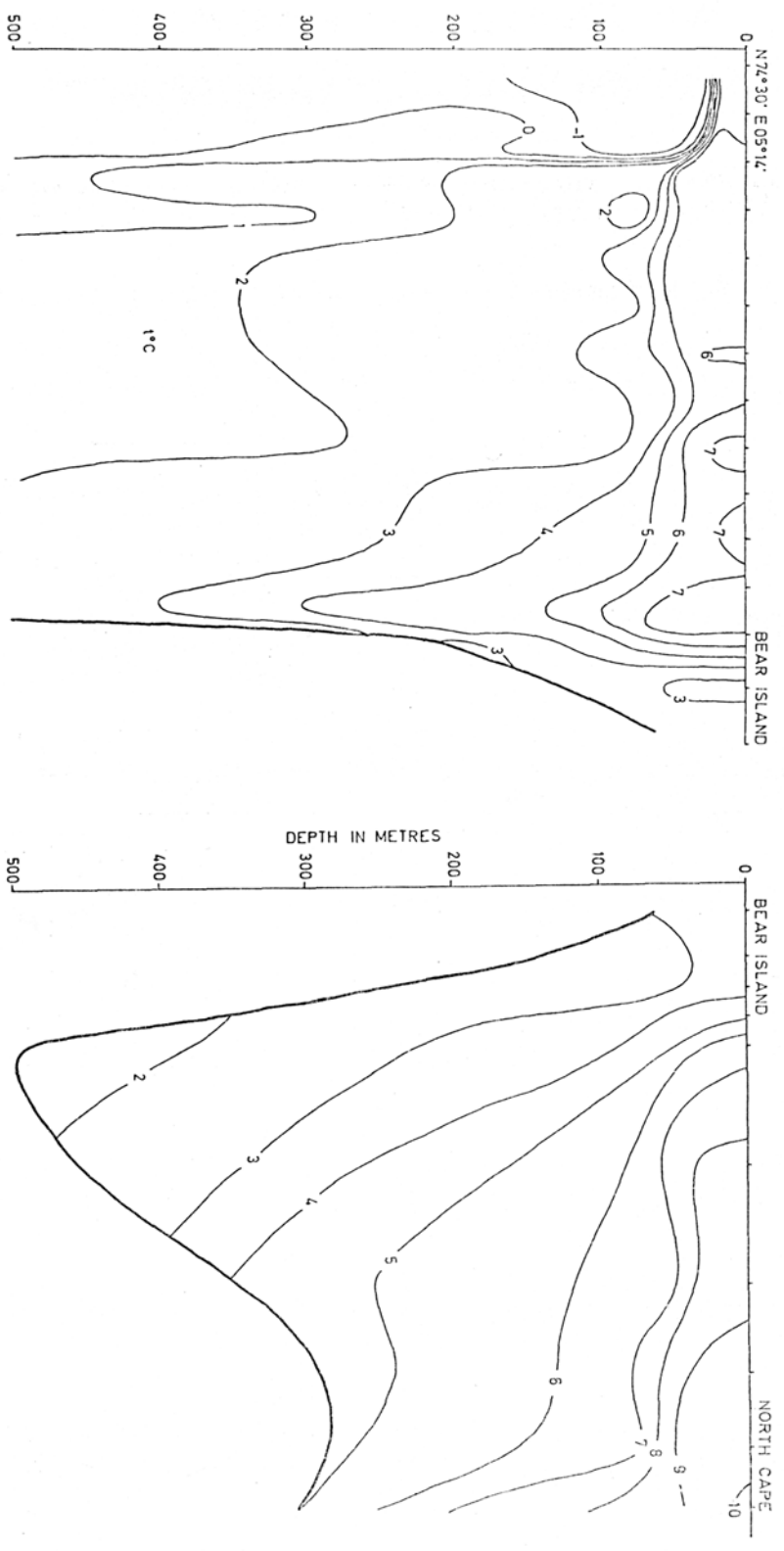

Figure 6. Temperature section Bear Island-west and Bear Island-North Cape.

Fig. 6. Temperature section Bear Island-West and Bear Island-North Cape

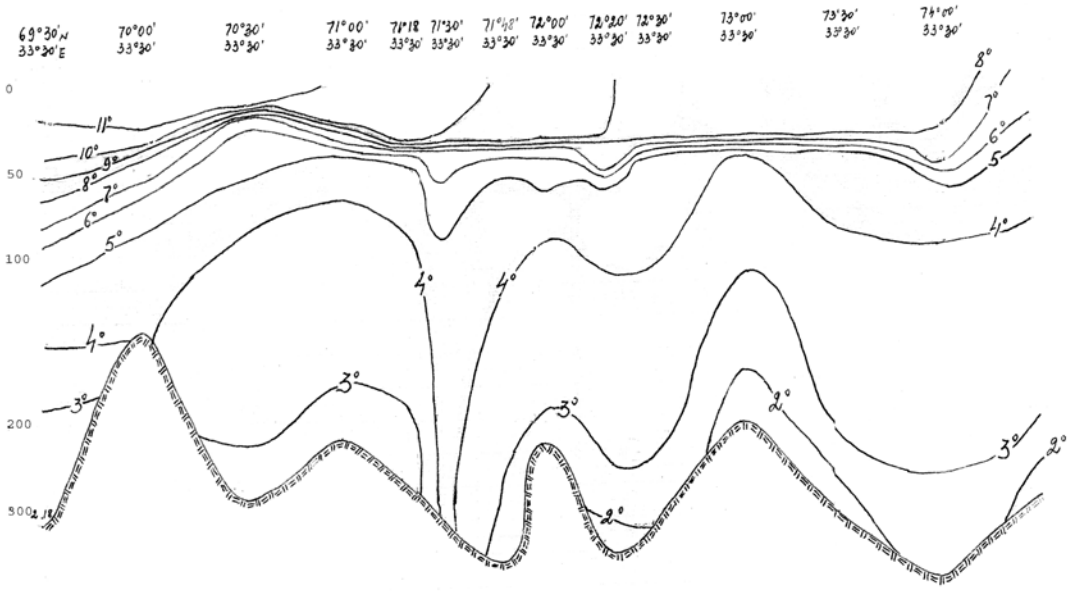

Fig. 6a. Temperature section along the Kola meridian

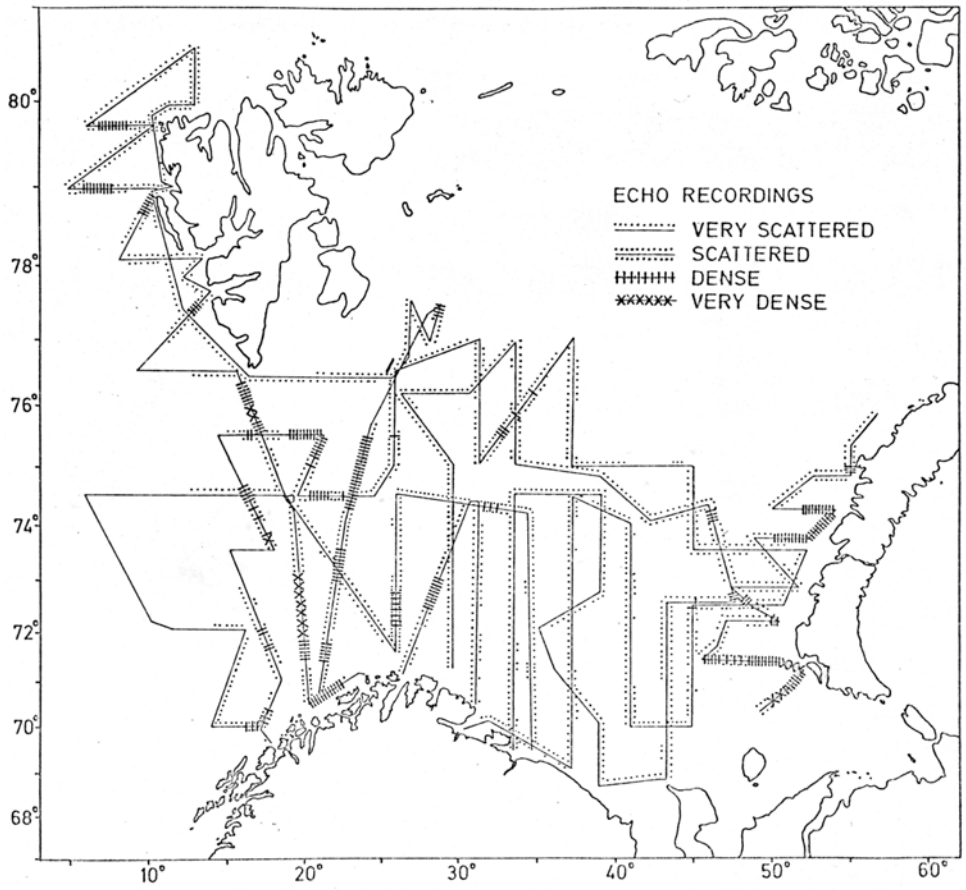

Fig. 7. Courses and echo recordings

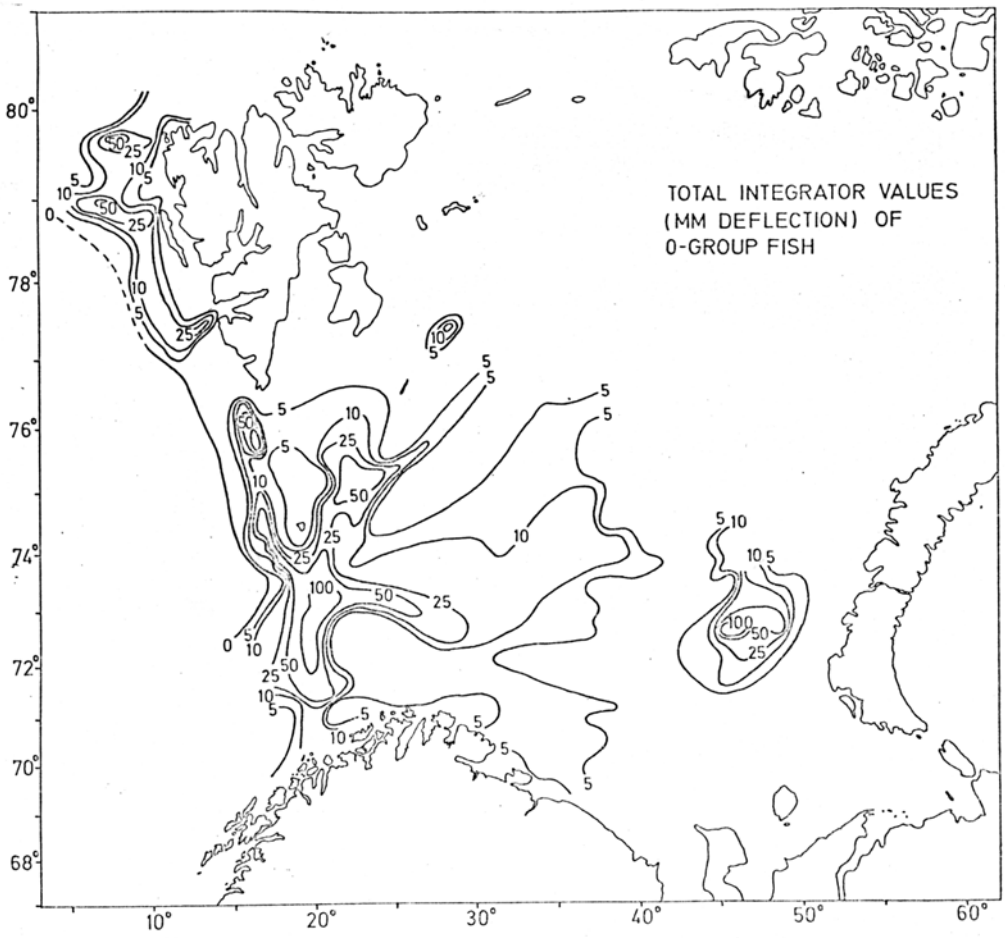

Fig. 8. Total integrator values (mm deflection) of 0-group fish

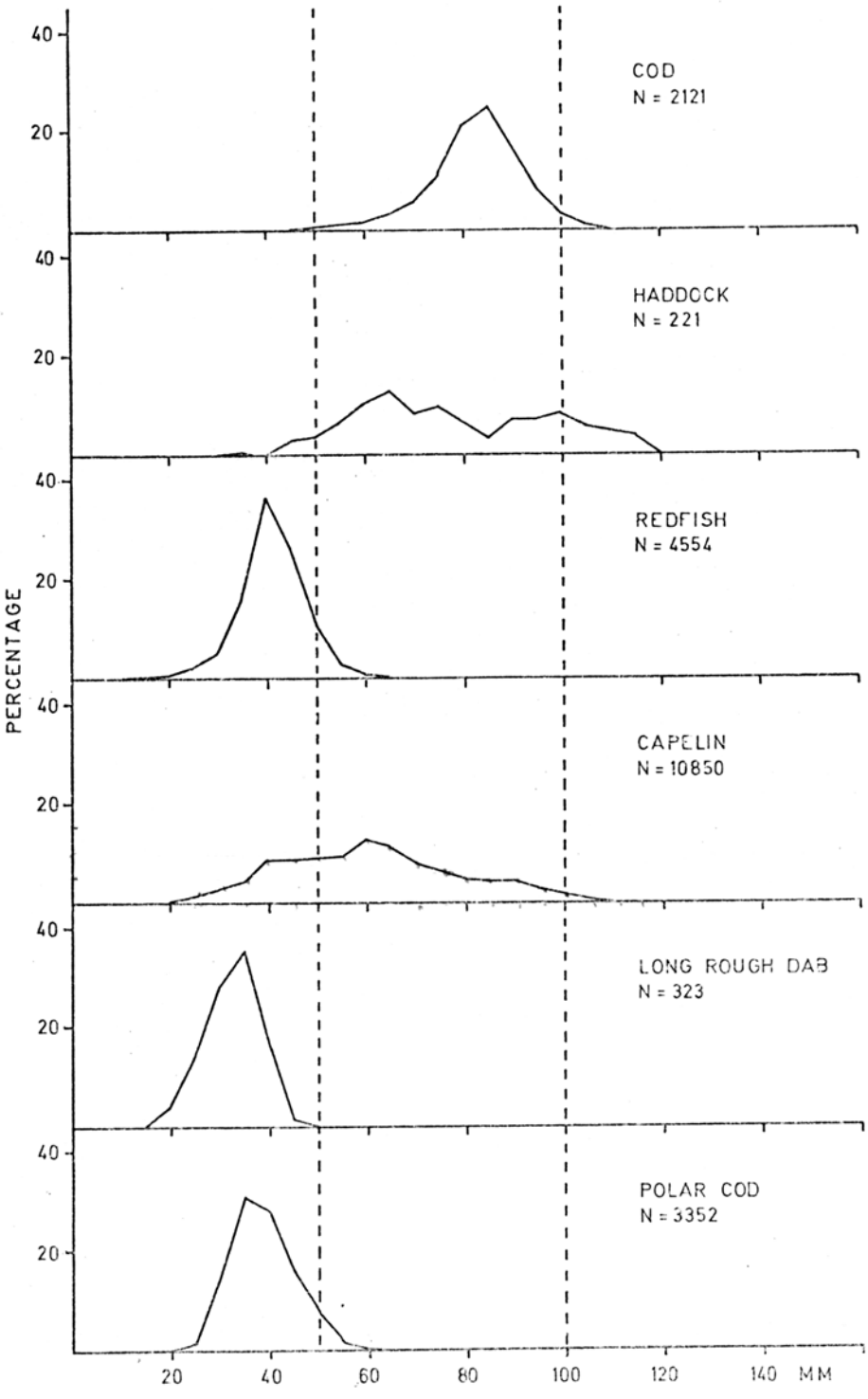

Fig. 9. Length distribution of 0-group fish

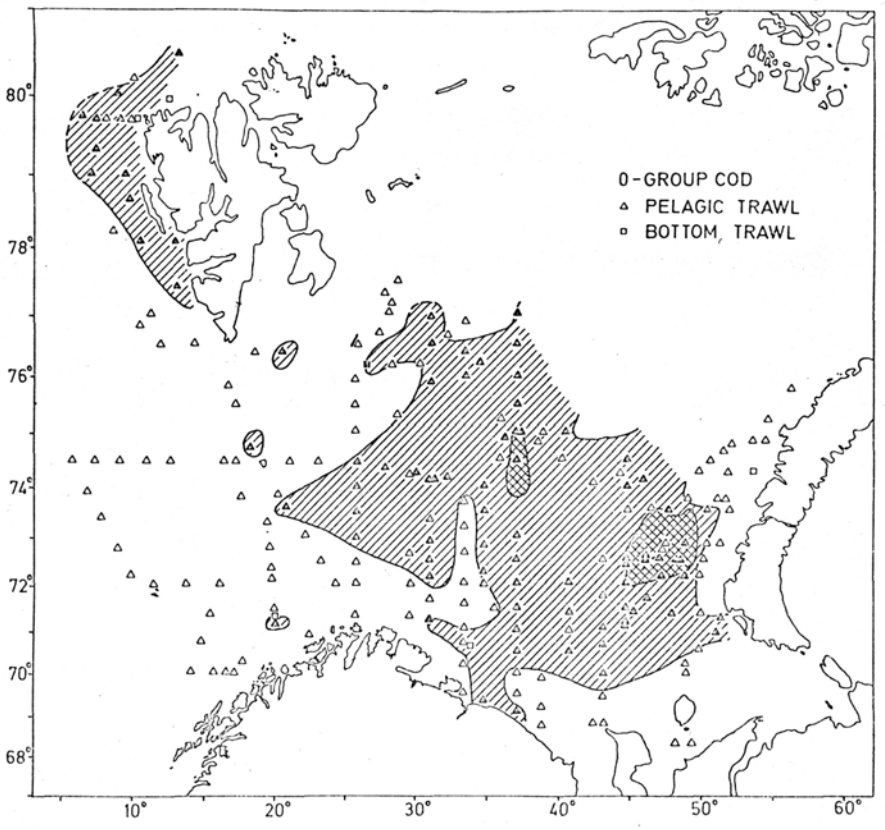

Fig. 10. Distribution of 0-group cod

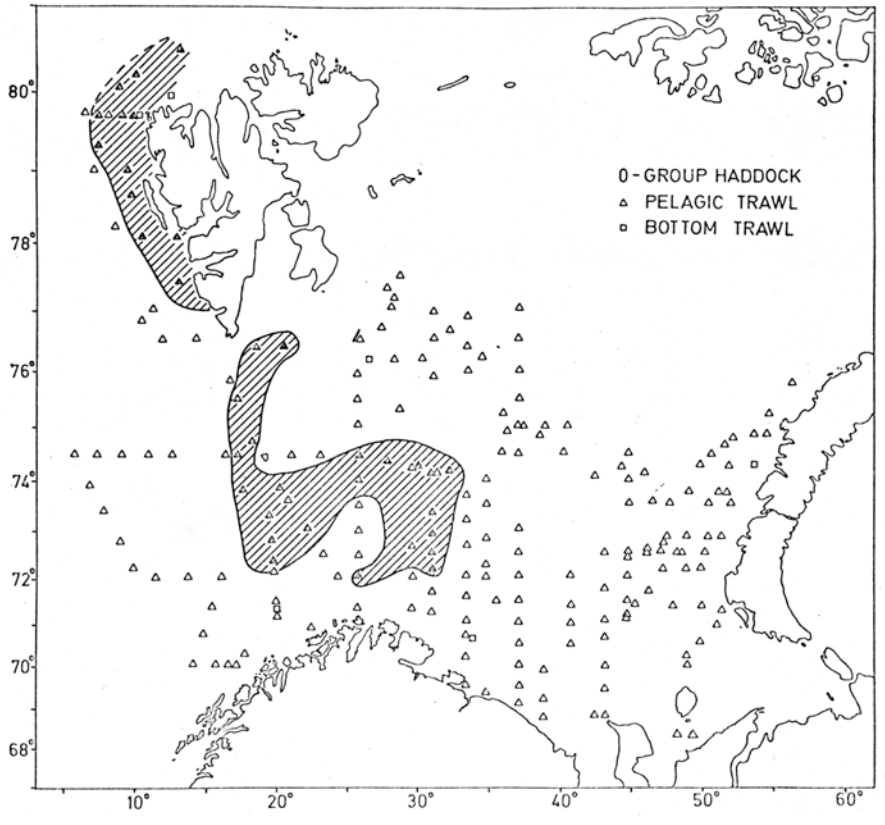

Fig. 11. Distribution of 0-group haddock

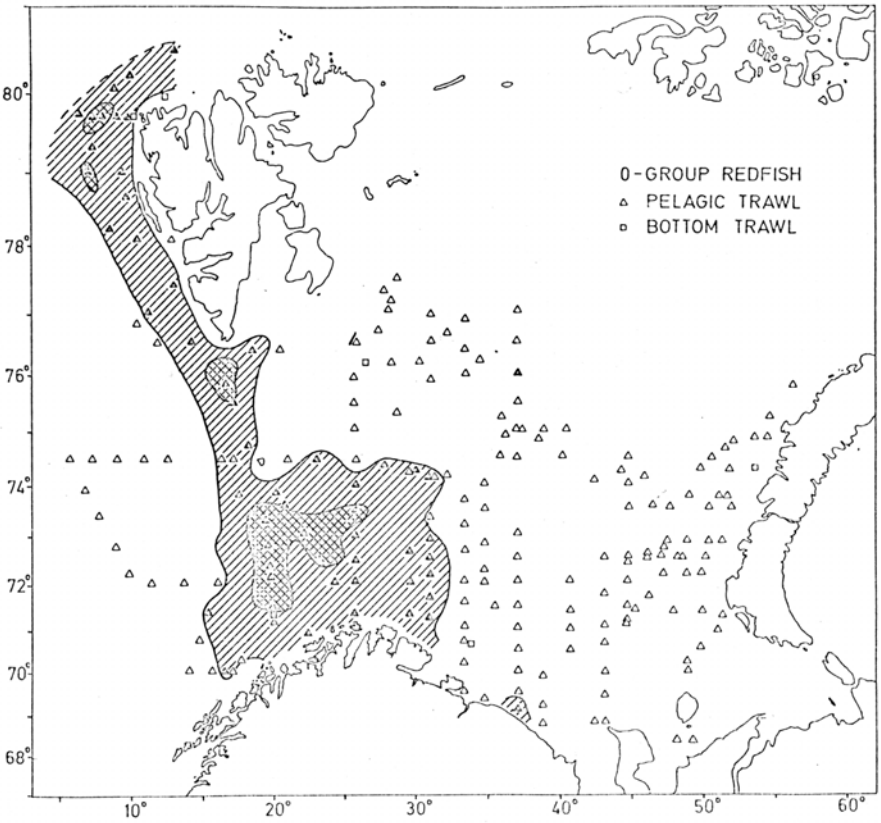

Fig. 12. Distribution of 0-group redfish

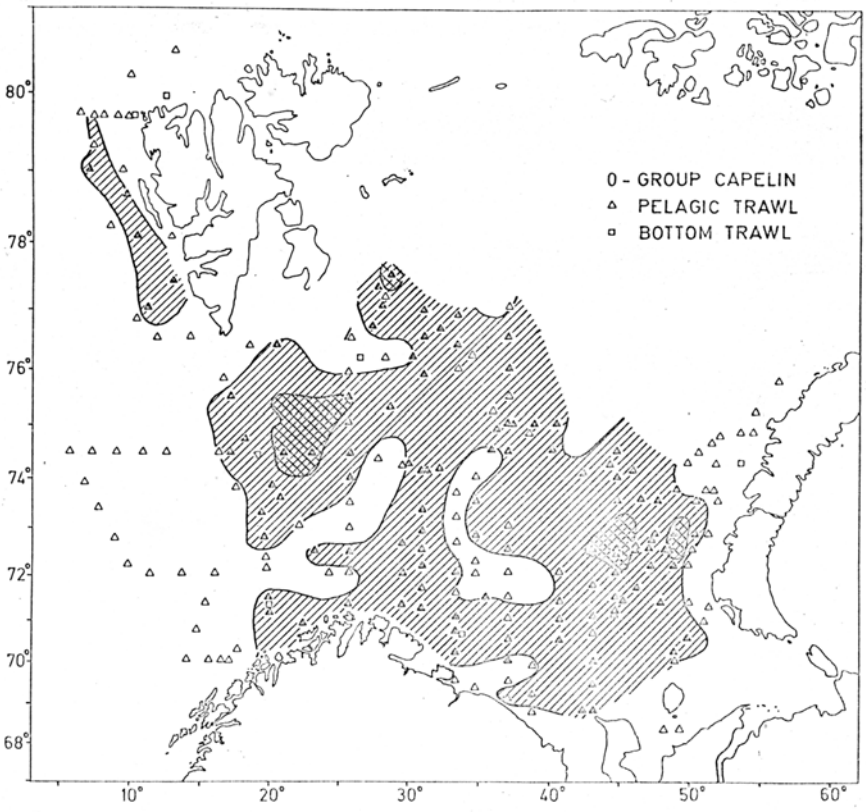

Fig. 13. Distribution of 0-group capelin

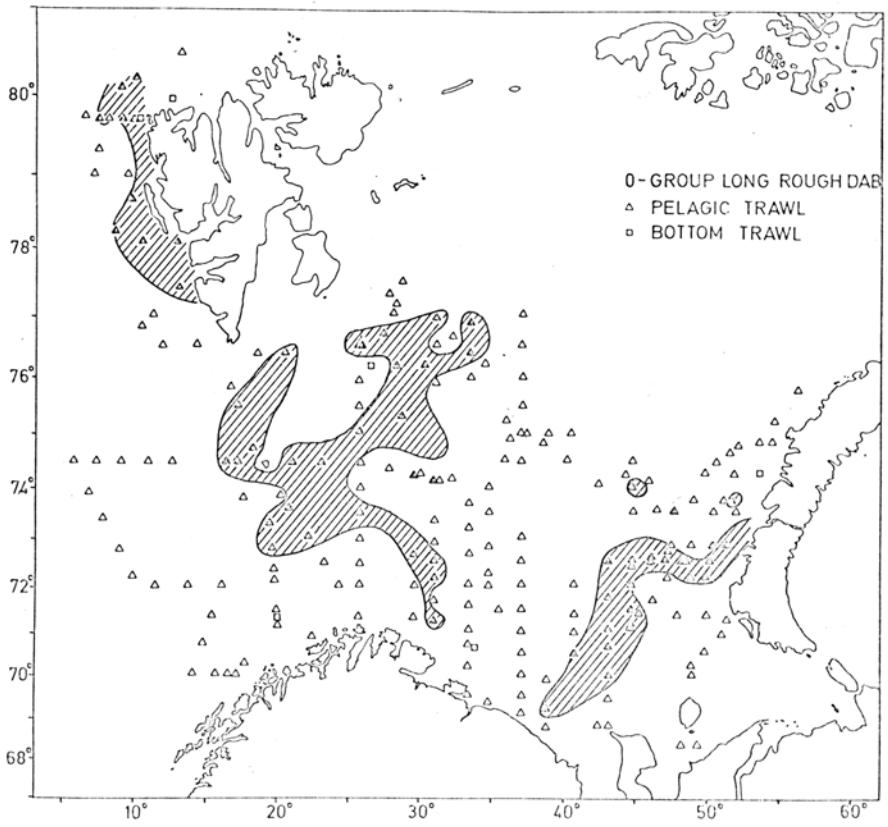

Fig. 14. Distribution of 0-group long rough dab

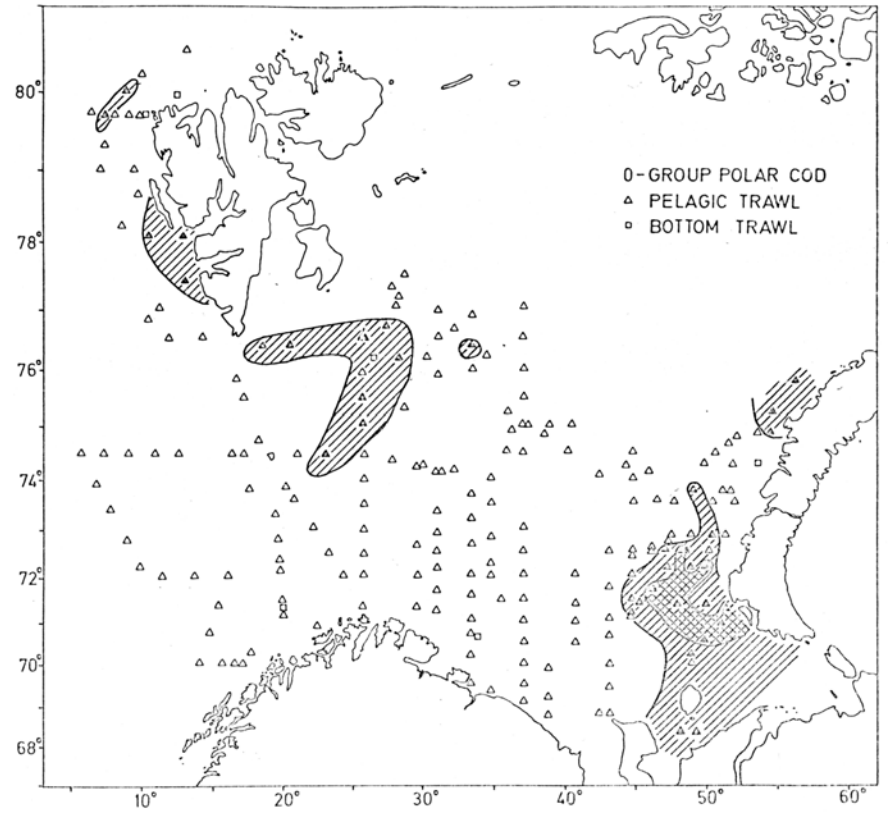

Fig. 15. Distribution of 0-group polar cod

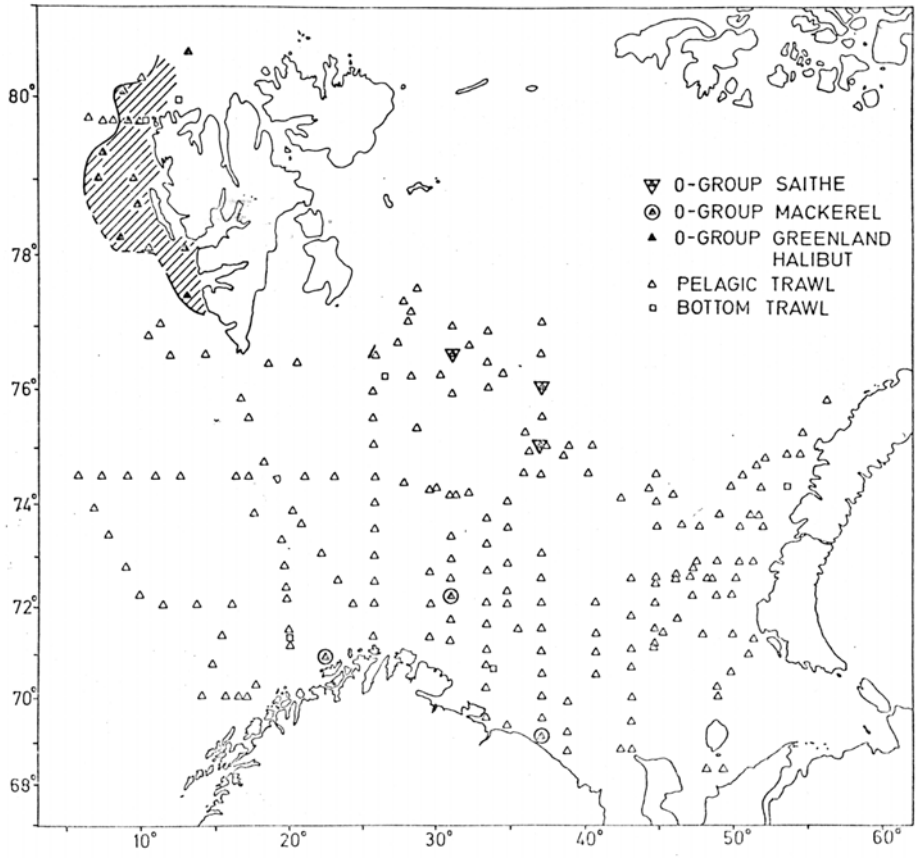

Fig. 16. Distribution of 0-group saithe, mackerel and Greenland halibut

Internal Council for
the Exploration of the Sea

C.M. 1973/H25
Pelagic Fish (Northern) Committee
Ref: Hydrography and Demersal
Fish (N) Committees. 27 pp.

Preliminary Report of the International 0-group fish survey in Barents Sea and adjacent waters in August-September 1973

Introduction

This was the ninth in a series of international surveys to study the abundance of 0-group fish in the Barents Sea and the Svalbard region.

The following vessels and scientists took part in the survey:

USSR	R/V "Fridtjof Nansen"	V.N. Kusnetsov, V.V. Rossov, N.G. Ushakov.
	R/V "Poisk"	V.N. Shleinik, Z.M. Berdichevski
Norway	"Johan Hjort"	O. Nakken, O. Smedstad, I. Hoff
	"G.O. Sars"	L. Midttun, O. Dragesund, G. Vestnes
U.K.	"Cirulana"	R.W. Blacker, K. Brander, W. Huggins M. Vine

Preliminary plans for the survey were made at a meeting in Bergen in May 1973, and final arrangements for coordination were made in Kirkenes and Murmansk immediately before the commencement of the survey. The main part of the survey was carried out between 28 August and 11 September but "Cirolana" commenced and finished a little earlier. The survey was followed by a meeting in Hammerfest 12-14 September. Material was exchanged and a report worked out.

Materials and methods

The distribution and density of the pelagic scattering layers was estimated from echo sounder paper records but also to some extent from echo integrator measurements. The organisms forming the scattering layers were identified by sampling with small meshed pelagic trawls. Various depth metering devices on the trawl were used for the accurate control of the trawling depth.

An attempt was made to compare the fishing power of the trawls used by "Poisk", "Fridtjof Nansen", "Johan Hjort" and "G.O. Sars". Two parallel tows were made on the same recording of 0-group redfish. The results are too few to give a reliable comparison, but they indicate that comparability increases with increasing size of the trawl gape.

No comparison could be made with the "Cirolana's" gear, but most of the houls were made with a Norwegian trawl similar to that used on the "Johan Hjort" and "G.O. Sars".

Fig. 1 show the area surveyed and the ship's tracks together with trawl and hydrographic stations worked.

Results

Hydrography

Hydrographic observations were made along the same standard sections as in previous years. Preliminary analyses of the data are given in Figs. 3-9.
Comparison of the hydrographic conditions in the Barents Sea in 1973 with those of previous years shows that temperatures were similar to the very warm conditions of 1972 (Tables 1 and 2).

Table 1. Mean water temperature in the Murman Current, the Kola section at the end of August in the years 1965-1973

Year/ Layer	1965	1966	1967	1960	1969	1970	1971	1972	1973
0-50 m	6.7	6.7	7.5	6.4	6.7	7.8	7.1	8.7	7.7
50-200 m	3.8	2.6	4.1	3.7	3.1	3.6	3.2	4.0	4.5
0-200 m	4.6	3.6	4.9	4.4	4.0	4.7	4.2	5.2	5.2

Table 2. Mean water temperature in the North Cape Current, the North Cape-Bear Island section at the beginning of September in the years 1965-1973

Year/Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973
0-200 m	5.1	5.5	5.6	5.4	6.0	6.1	5.7	6.3	6.2

The surface temperature in the southern part of the Barents Sea was about 1 °C colder than in 1972, but at 50 m depth conditions were much warmer and the limit of water colder than 0 °C was nearly 100 n. miles further north along longitude 40°00' E than in 1972.

The temperature of the 50-200 m layer of the Murman Current was the highest recorded in the period 1965-1975. This shows very intensive advection of warm water in the Murman Current in 1973, in contrast to the situation in 1972 when the warm conditions were attributable to high solar radiation.

In the Bear Island-Hope Island area the influence of the Cold Bear Island current was weak, and the sub-zero temperatures typical of the 50-100 m layer were not found in 1973.

The West Spitsbergen current was also very warm in 1973 compared with conditions in 1971 and 1972 (Table 3).

Table 3. Mean water temperature in the Spitsbergen Current west of Bear Island at the beginning of September in the years 1971-1973

Year/Layer	1971	1972	1973
0-200 m	4.5	4.6	5.4

Distribution and abundance of 0-group fish

In previous years a map has been given showing: the total echo density based on a subjective evaluation of the echo sounder paper records. Improvement in echo-sounding techniques has now introduced more accurate assessments by the use of echo integrators

which can measure relative fish density parameters and even absolute density, provided some calibration constants are known.

Last year total echo abundance from echo integrator deflection values was given.

This year's data based on data from the "G.O. Sars" and "Johan Hjort" with additional information from "Poisk". Both "Poisk" and "Cirolana" have integrators, but in order to compare the results with those from "G.O. Sars" and "Johan Hjort" calibration trials must be made between the ships. This was not possible with "Cirolana", but some comparable values were obtained from "G.O. Sars", "Johan Hjort" and "Poisk". More information is needed before all the data can be combined.

It is recommended that next year's survey program should allow time for these essential calibration runs.

The "G.O. Sars" carried out some initial trials to relate integrator values to absolute abundance for some species. These values need confirmation from additional experiments.

The distribution of the 0-group fish of various species is shown by the shaded areas in Figs. 11-19.

The estimates of the relative abundance in the following comments have been based mainly on the trawl catches, but the echo abundance indices as used by Haug and Nakken (1973) have also been taken into account.

Herring (Fig. 11)

For the first time since 1966 0-group herring were recorded in more than a few scattered hauls. The main area of distribution was similar to that found in 1966, but none found west of 19°00' E.

Cod (Fig. 12)

As in 1972 0-group cod were distributed over a wide area of the Barents Sea from 17°00'-18°00' E to Novaya Zemlja and south of 76°50' N latitude. The highest concentrations were found in the east and south-east Barents Sea. 0-group cod were virtually absent west of Spitsbergen and only small numbers were caught in Storfjordrenna. The indications are that the 1973 year-class is a strong one.

Haddock (Fig. 13)

The distribution of haddock extended further south and east in the southern Barents Sea than in 1972, but off West Spitsbergen its range was less extensive. The abundance was estimated to be similar to that of the 1972 year-class which was below the average of the 1969-1971 year-classes.

Redfish (Fig. 14)

Like the cod and haddock the distribution of 0-group redfish extended further south and east into the Barents Sea than in 1972. Redfish were much less abundant than usual west of Spitsbergen. The 1973 year-class was considered to be strong.

Capelin (Fig.15 and 16)

0-group capelin was sparsely distributed except in the eastern Barents Sea. None were caught off West Spitsbergen. 1-group capelin was widely distributed over the north and east Barents Sea, but few were caught west of Spitsbergen. Catches of 1-group capelin seem to confirm last year's estimate that the 1972 year-class was a strong one. The abundance of the 1973 year-class appears to be low compared with the 1971 and 1972 year-classes.

Long rough dab (Fig. 17)

The distribution of 0-group long rough dab is broadly similar to that found in 1972, except that few were caught in the Hope Island area, and its abundance is about the same as the 1972 year-class.

Polar cod (Fig. 18)

Polar cod were found in areas west, south and east of Spitsbergen and also off Novaya Zemlya as in 1972. Assessment of the abundance of 0-group polar cod must await data from the "Akademik Knipovich".

Creenland halibut (Fig. 19)

0-group Greenland halibut were found in small numbers north west of Spitsbergen.

Other species (Fig 19)

Small numbers of mackerel, saithe, catfish and 0-group blue whiting were caught during the survey, and 0-group Leptagonus, Lumpenus and Liparis were widely distributed. 0-group sandeel were abundant and widely distributed in the south-east Barents Sea.

Adult fish

Adult blue whiting were caught over deep water of the Norwegian Sea, everywhere from 79°29' N southwards. Small numbers of Lumpsucker (Cyc1opterus lumpus) were also caught. Off north-west Spitsbergen cod of the 1970 year-class occurred pelagically along the edge of the shelf.

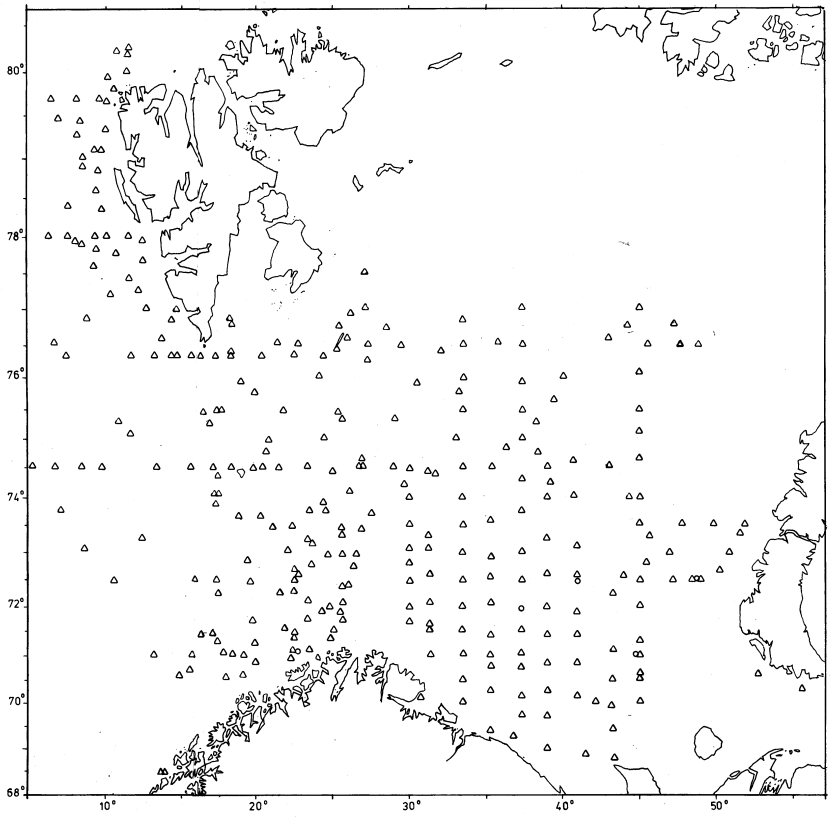

Fig. 1. Survey routes and grid of stations

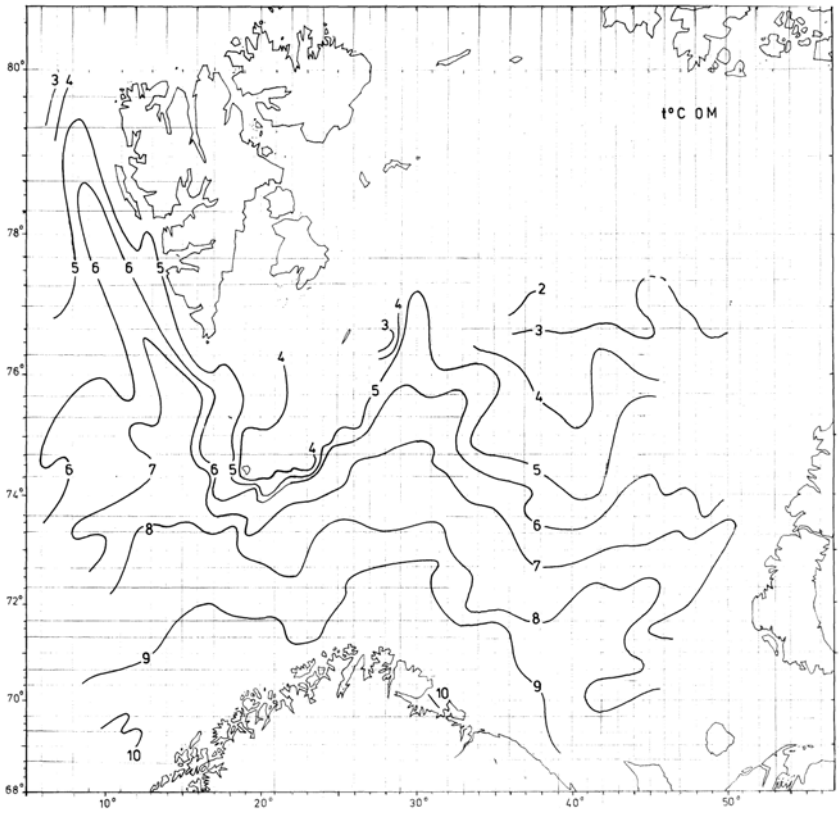

Fig. 3. Isotherms at 0 m

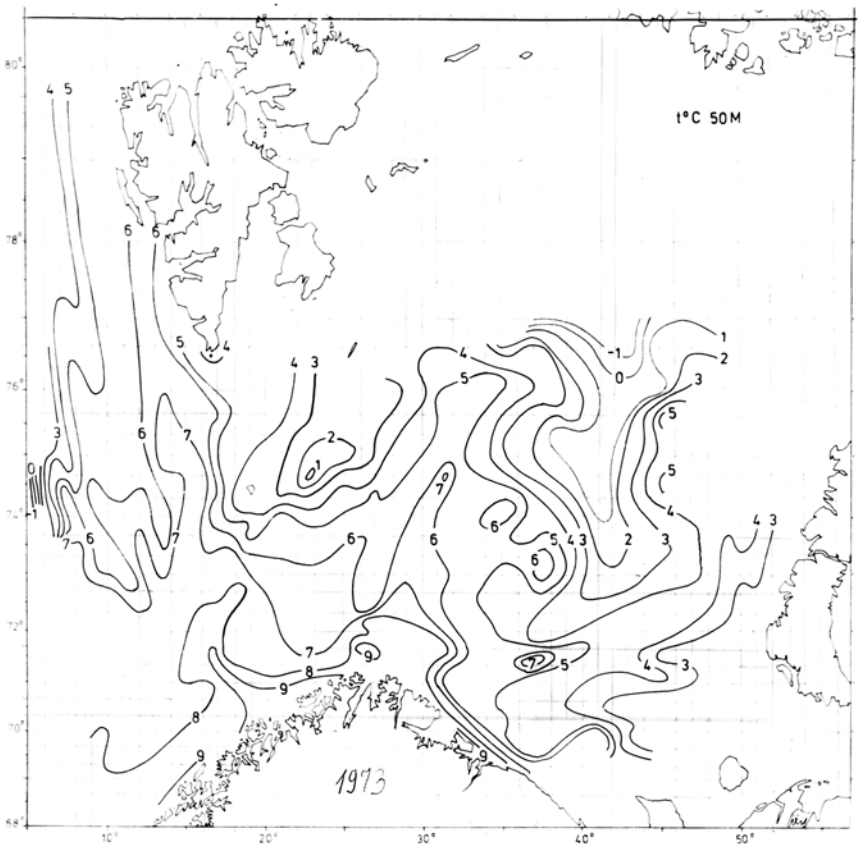

Fig. 4. Isotherms at 50 m

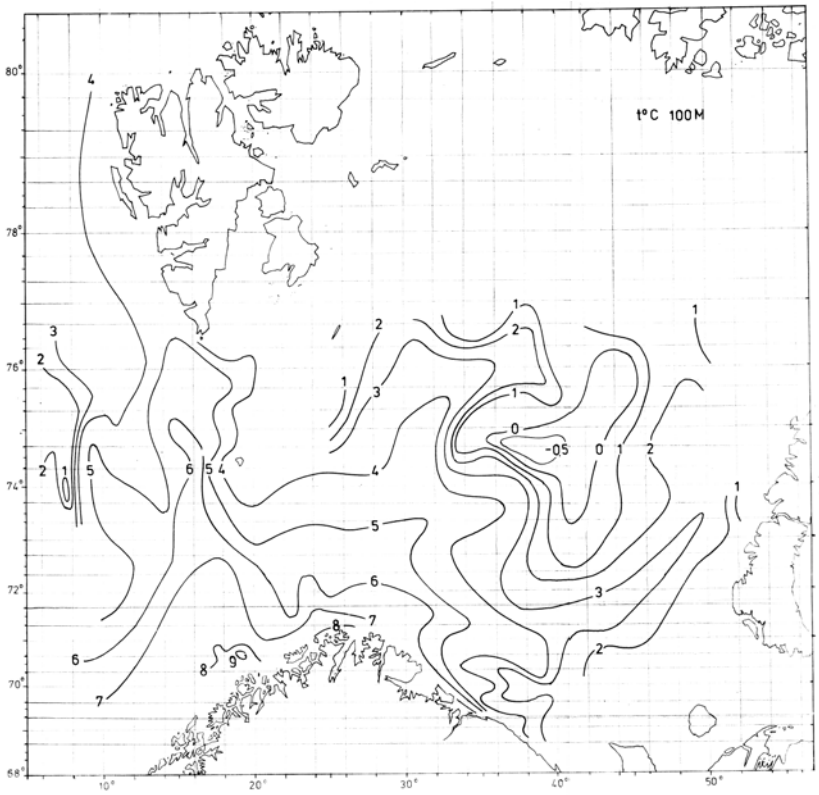

Fig. 5. Isotherms at 100 m

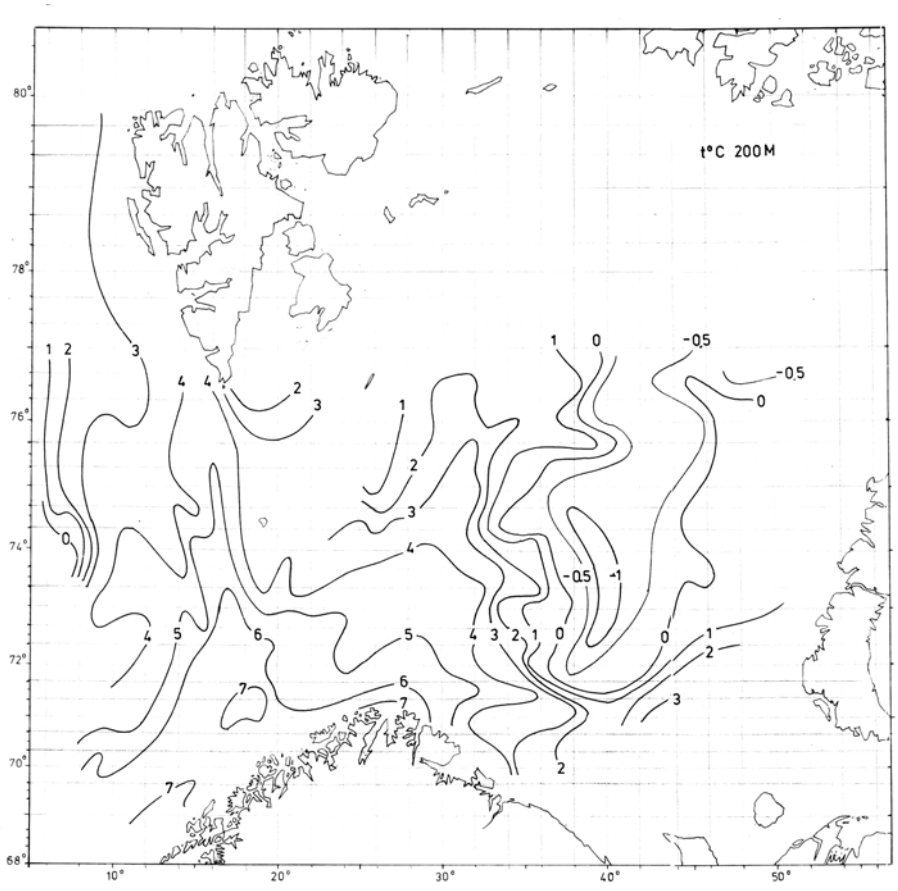

Fig. 6. Isotherms at 200 m

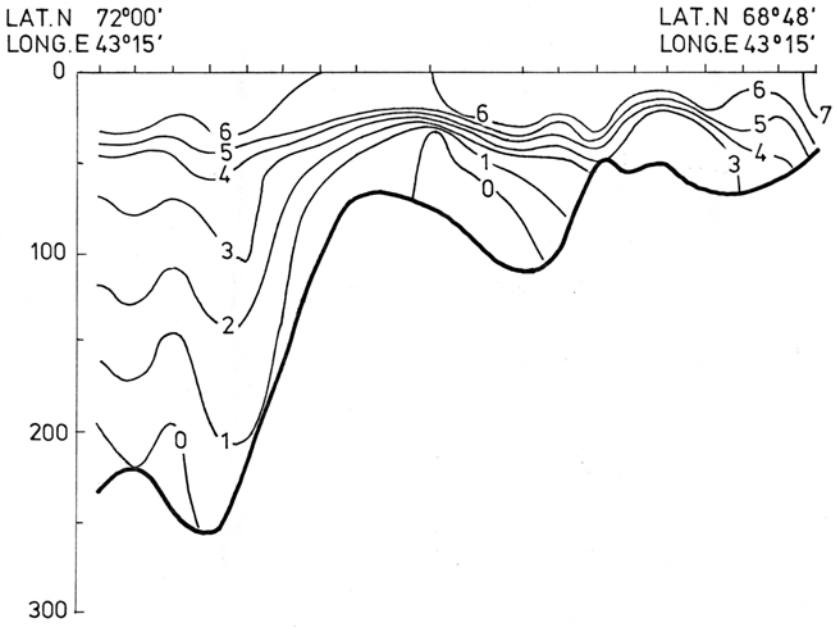

Fig. 7. Temperature section along the Cape Kanin meridian

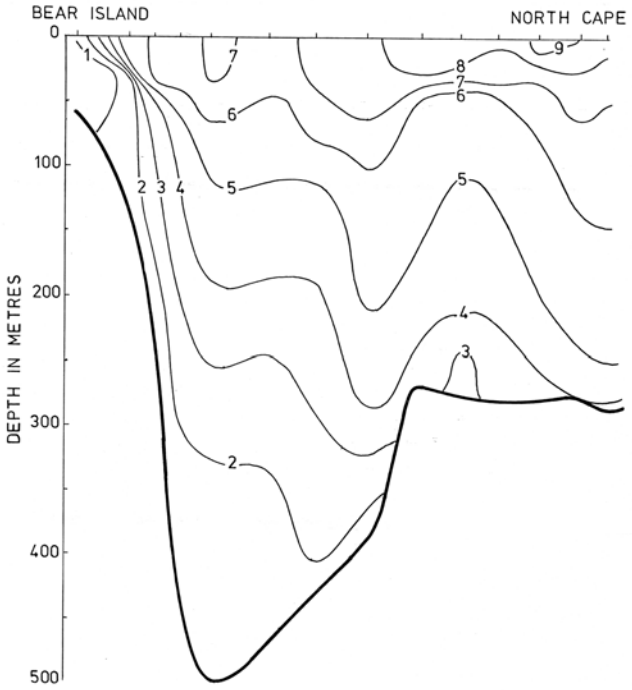

Fig. 8. Temperature section Bear Island-North Cape

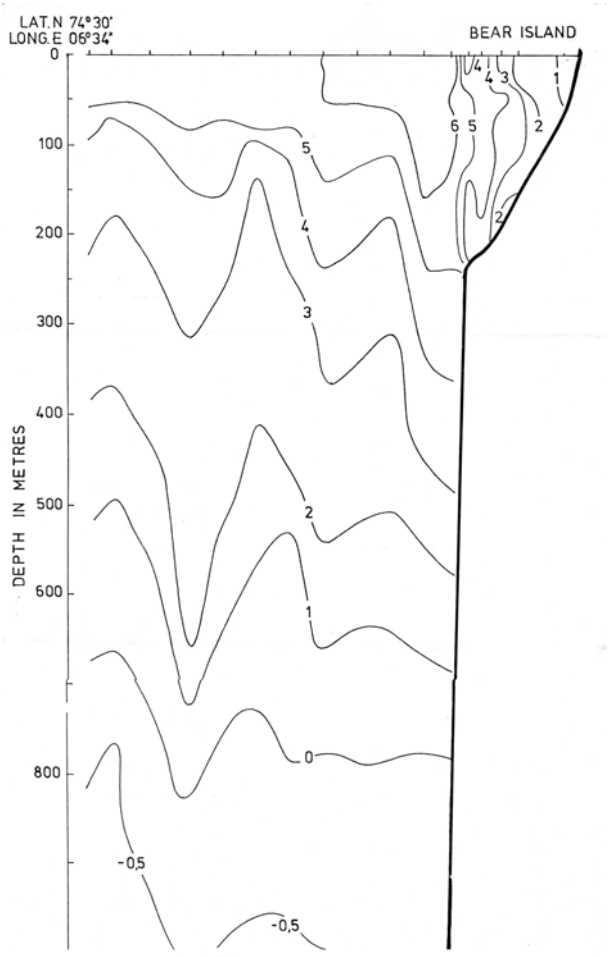

Fig. 9. Temperature section Bear Island-West

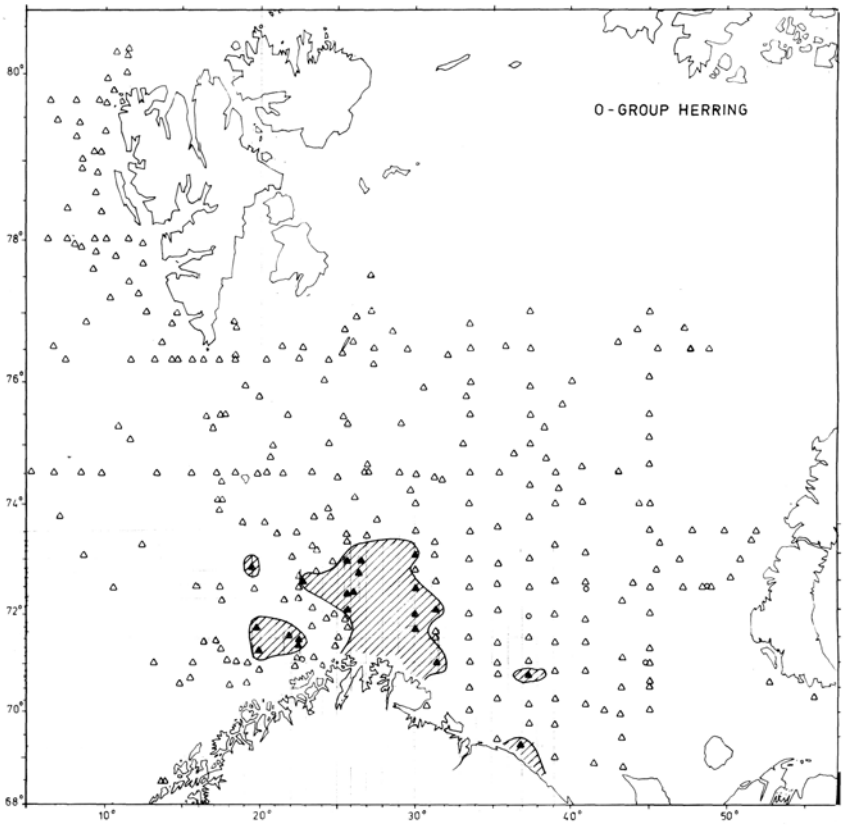

Fig. 11. Distribution of 0-group herring

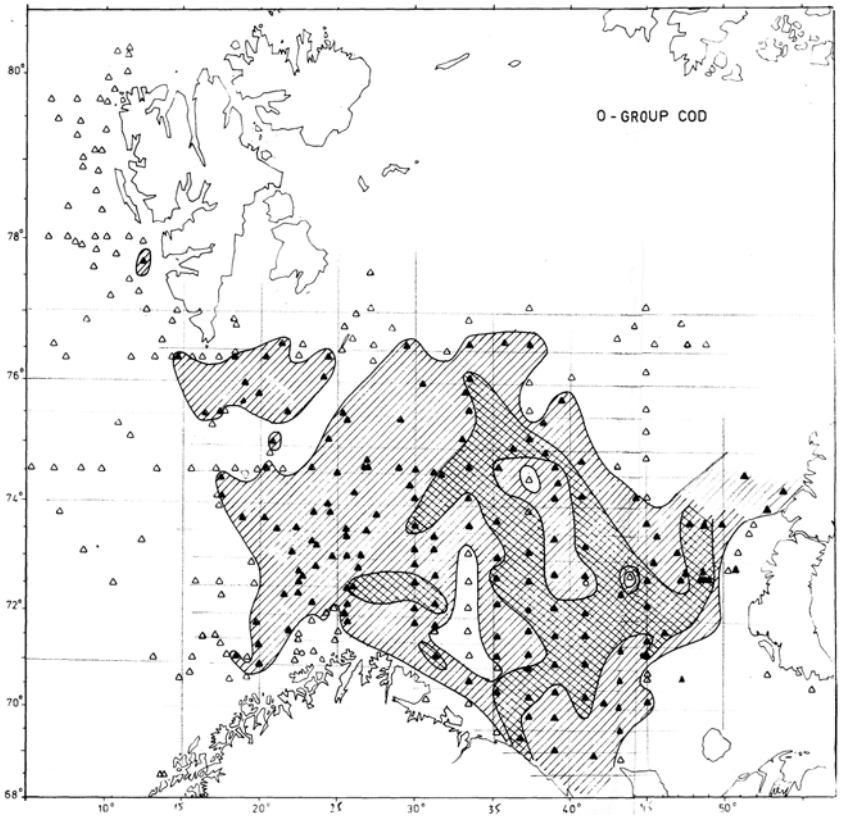

Fig. 12. Distribution of 0-group cod

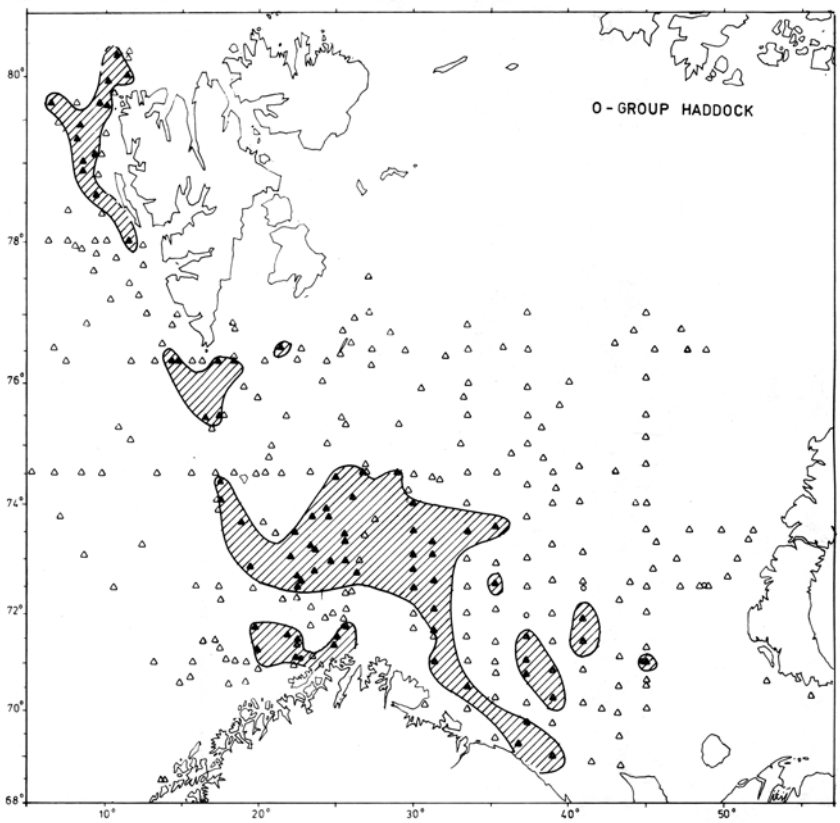

Fig. 13. Distribution of 0-group haddock

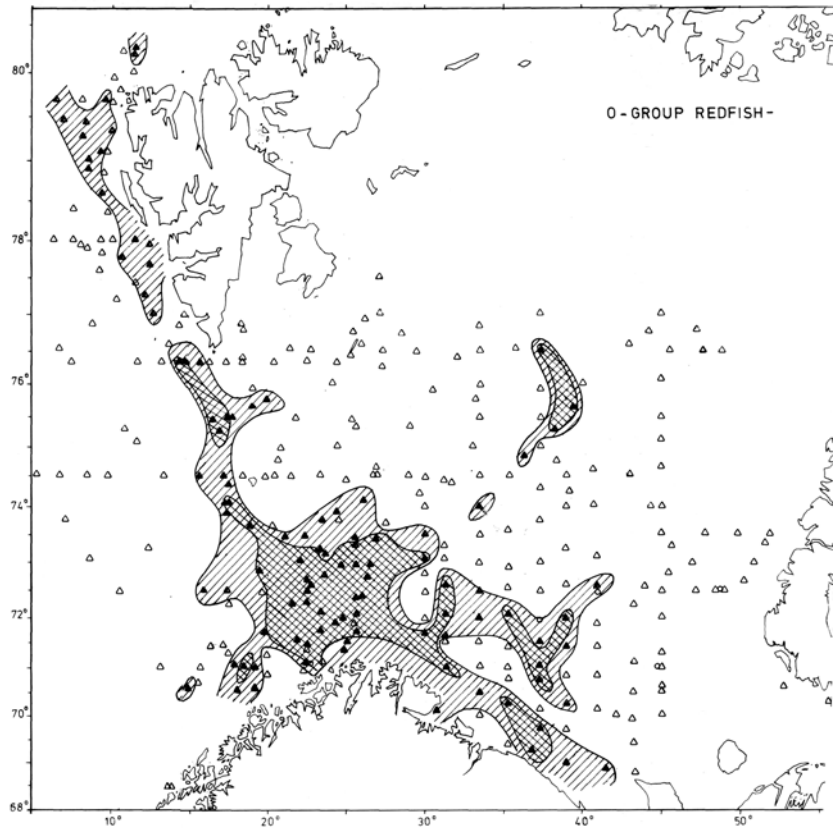

Fig. 14. Distribution of 0-group redfish

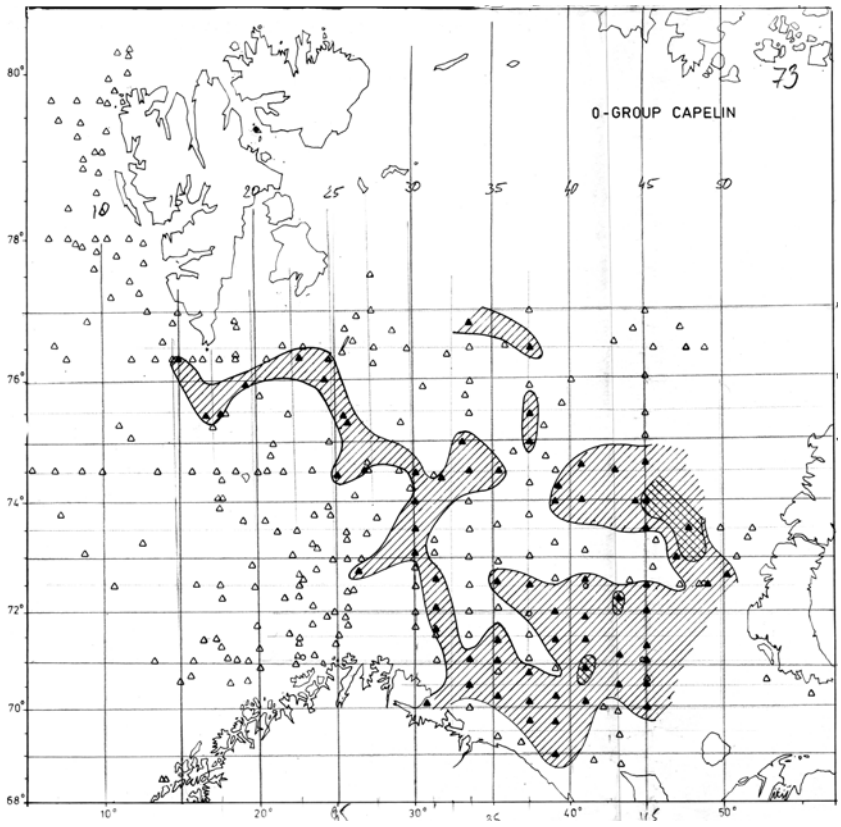

Fig. 15. Distribution of 0-group capelin

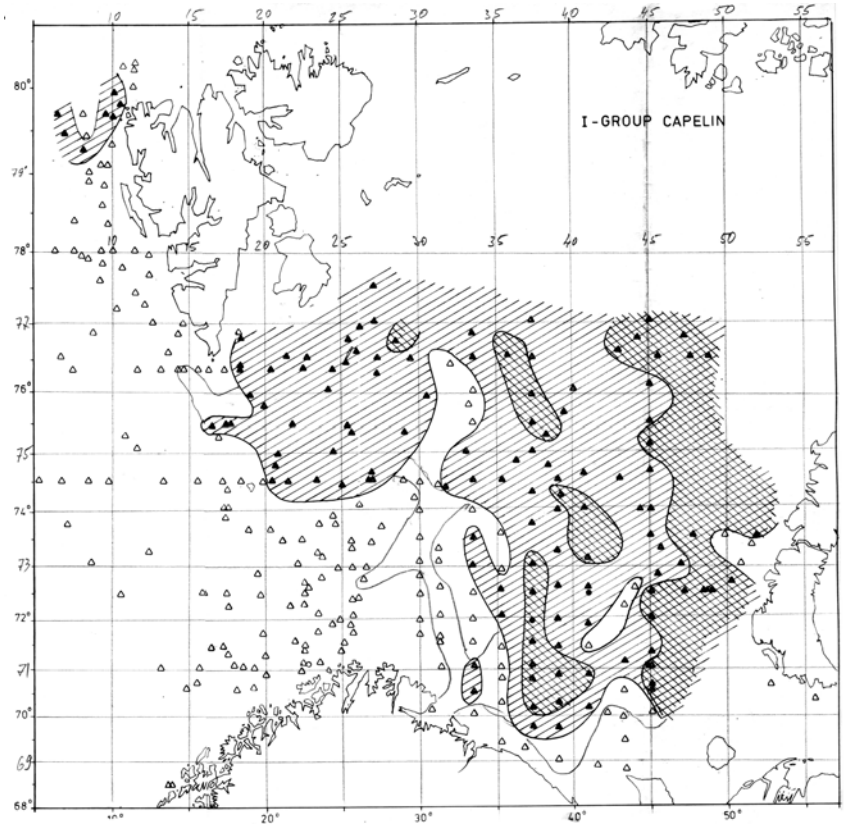

Fig. 16. Distribution of 1-group capelin

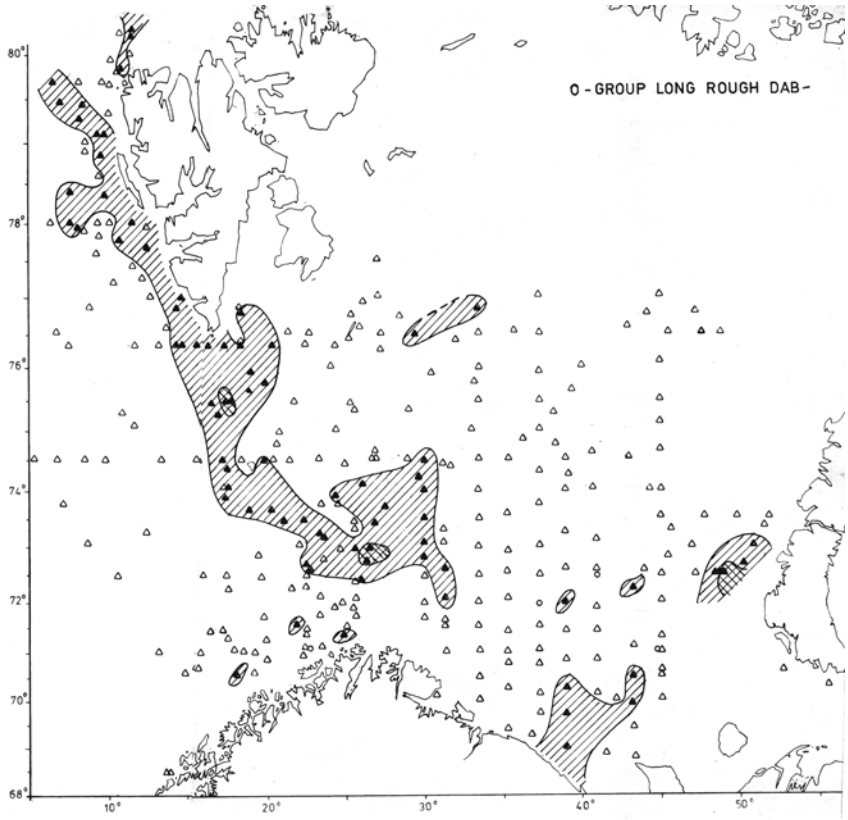

Fig. 17. Distribution of 0-group long rough dab

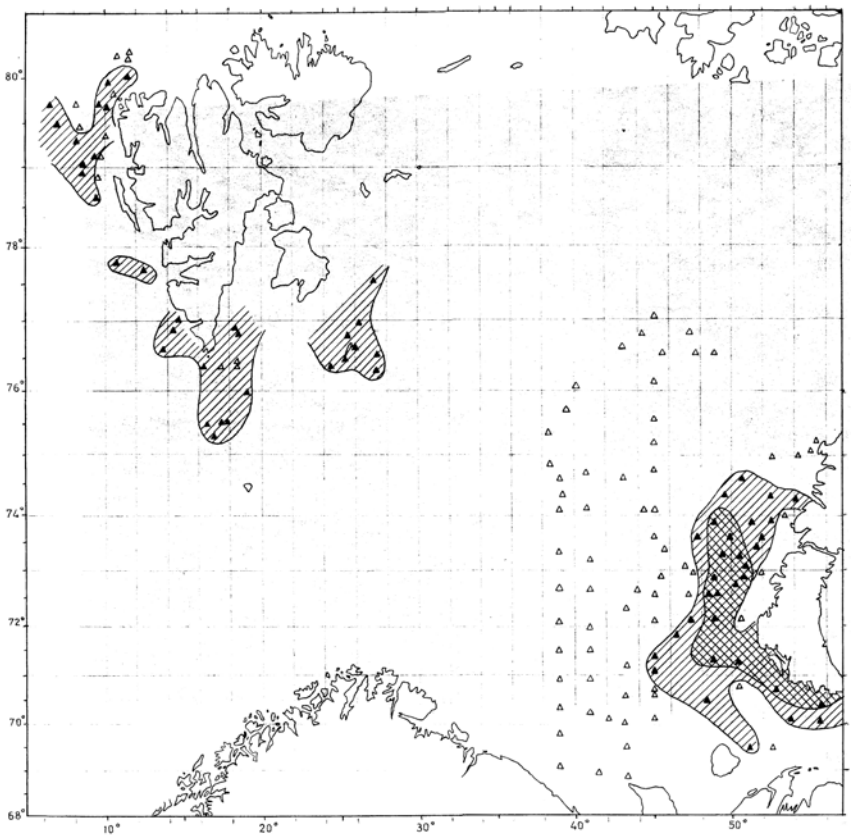

Fig. 18. Distribution of 0-group polar cod

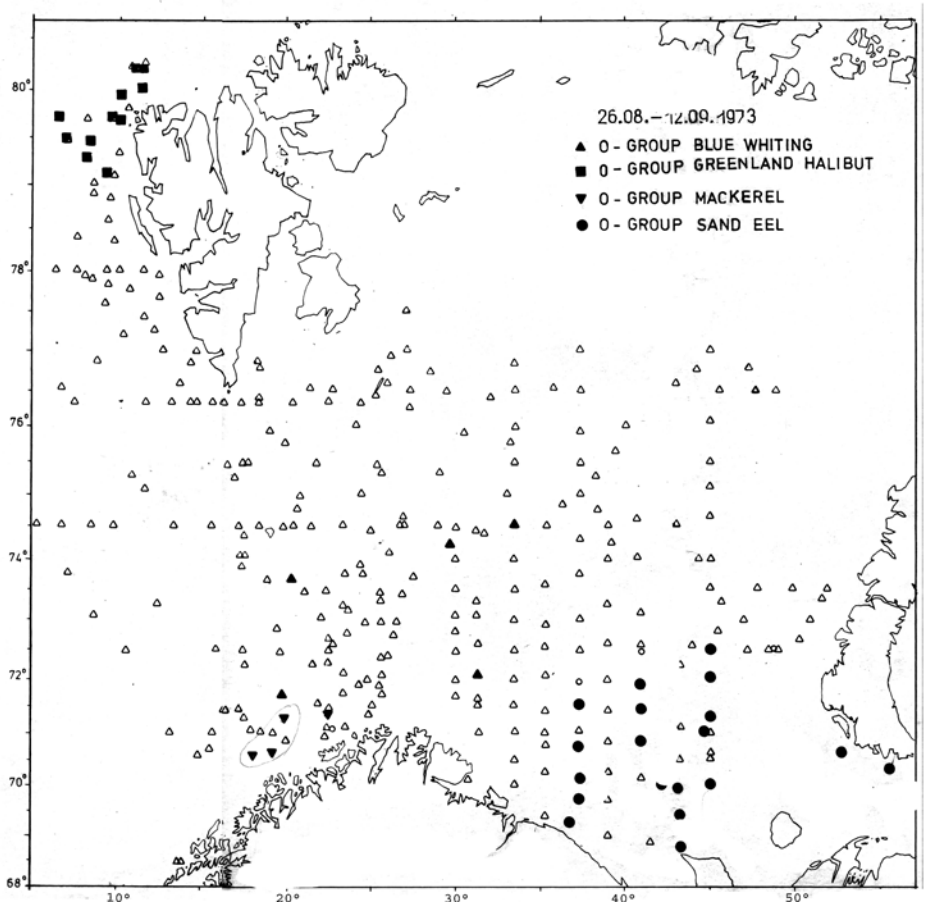

Fig. 19. Distribution of 0-group blue whiting, Greenland halibut, mackerel and sandeel

ICES C.M. 1974/H: 33
Pelagic Fish Northern Committee

Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August-September 1974

Introduction

This was the tenth international survey to study the abundance and distribution of 0-group fish in the Barents Sea and Svalbard region. The following vessels and scientists participated in the survey:

USSR	"Akademik Knipovich"	N.G. Ushakov, A.Y. Lysota
	"Poisk"	V.V. Rossov, A.S. Galkin, Z.M. Berdichevski
Norway	"G.O. Sars"	Lars Middtun, Olav Dragesund
	"Havdrøn"	Odd Nakken, Odd Smedstad, Arvid Beltestad
UK	"Cirolana"	B.W. Jones, J.G. Pope, A.J. Burridge

A meeting was held in Murmansk between the scientists of "Poisk" and "G.O. Sars" to make final arrangements for the coordination of the survey. "Cirolana" commenced surveying on 28 August with the other vessels joining shortly after. The main aim of "Havdrøn" was to undertake special observations on the behaviour of 0-group fish. The survey was completed on 11 September, and was followed by a meeting of scientists in Tromsø to analyse the data and to prepare the report.

Material and methods

The distribution and density of the pelagic scattering layers was estimated from echo-sounder paper records, from echo integrator measurements, and by fishing with small meshed pelagic trawls. Various depth meter devices were used for the accurate control the depth of trawling.

Figs 1 and 2 show the area worked and the ships' tracks together with the trawl and hydrographic stations worked.

Results

Hydrography

Hydrographic observations were made along the same standard sections as in previous years. Preliminary analyses of the data are given in Figs. 3-8. Mean water temperature in three hydrographic sections across the main water currents are given in Tables 1-3 for each of the ten years - if the surveys, together with the ten-year average temperature.

Table 1. Mean water temperature in the Murman Current, along the Kola section at the end of August in the years 1965-1974

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1965-1974
0-50 m	6.7	6.7	7.5	6.4	6.7	7.8	7.1	8.7	7.7	8.1	7.3
50-200 m	3.8	2.6	4.1	3.7	3.1	3.6	3.2	4.0	4.5	3.9	3.7
0-200 m	4.6	3.6	4.9	4.4	4.0	4.7	4.2	5.2	5.2	4.9	4.6

Table 2. Mean water temperature in the North Cape Current along the North Cape-Bear Island section in early September in the years 1965-1974

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1965-1974
0-200 m	5.1	5.5	5.6	5.4	6.0	6.1	5.7	6.3	6.2	6.1	5.8

Table 3. Mean water temperature in the West Spitsbergen current along the Bear Island -West section in early September in the years 1971-74

Layer 0-200 m.	1971	1972	1973	1974	1971-1974
	4.5	4.6	5.4	6.1	5.2

The temperature in the 0-200 m layer in the Murman current was close to the long-term average, but in the 0-50 m layer it was 0.8 °C above the average. The temperature along the North Cape-Bear Island section was also slightly above the long-term average. The high temperature in the West Spitsbergen current indicated a strong inflow of warm water. The ice edge north of Spitsbergen was further to the north than in previous years.

Distribution of 0-group fish

Distribution of the 0-group fish of various species are shown by the shaded areas in Figs. 9-16. The estimates of the relative abundance in the following comments have been based mainly on trawl catch data and echo abundance indices calculated by the method of Haug and Nakken (1973).

Herring (Fig. 16)

Only 5 specimens of herring were taken during the entire survey indicating that the 1974 year-class is of very low abundance.

Cod (Fig 9)

Cod were distributed over a fairly wide area but at a low density. The abundance was well below average and the 1974 year-class must be described as poor. It was noted that the cod this year were smaller than in previous years (Fig. 17).

Haddock (Fig. 10)

The distribution of haddock covered a wide area and was typical for this species. The abundance was well above average indicating a rich year-class. There was a higher proportion of larger fish in the catches compared with 1973.

Redfish (Fig. 11)

Redfish this year had a normal distribution which was similar to that of 1973. The area of distribution extended well to the north on the west side of Spitsbergen. The density of redfish was much greater than in previous years indicating a very abundant year-class.

Capelin (Figs. 12, 13)

The area of distribution of 0-group capelin was smaller than in some of the earlier years with very few west of 25° E. None were recorded west of Spitsbergen and this is consistent with the distribution of spawning, which this year was east of North Cape. The apparent density in the main concentrations was very high. Experimental work carried out aboard "Havdrøn" showed capelin to be distributed close to the surface except for a few hours at night when they descended to a lower level. This means that a significant proportion of the capelin are undetected by echo sounders because they are above the level of the transducers. Awareness of the distribution pattern has resulted in sampling of this species becoming more efficient over the years and producing an apparent increase in abundance. Nevertheless it is considered that the abundance recorded in this years survey is indicative of a rich year-class. 1-group capelin had a distribution similar to that recorded last year.

The abundance of 1-group capelin was similar to or slightly lower than the high level recorded last year. The preliminary assessment of 1-group fish this year suggests that the 1973 year-class is more abundant than last years 0-group survey indicated but a more detailed survey will be undertaken immediately after the 0-group survey.

The size of 0-group fish is similar to 1973 but the 1-group fish are larger.

Long rough dab (Fig. 14)

The distribution of this species was similar to that of 1973 being mainly in the central area and westwards with an extension west of Spitsbergen. This year-class appears to be a strong one.

Polar Cod (Fig. 15)

Polar cod were distributed to the west and south of Spitsbergen and in the eastern Barents Sea. In the latter area the density of fish was high indicating a very rich year-class. As usual the Polar cod in the eastern Barents Sea were larger than those in the Spitsbergen area.

Greenland halibut (Fig. 16)

0-group Greenland Halibut were found in average numbers west and south of Spitsbergen.

Mackerel (Fig. 16)

Mackerel were recorded in greater abundance than in previous years and their distribution extended further to the east. The length composition (Fig. 17) shows two modes, the larger fish being caught in the south-western part of the area.

Other species

Small numbers of catfish and a single specimen of saithe were caught during the survey. 0-group Leptagonus, Liparis and Cottus were widely distributed in the colder water. 0-group sandeels were abundant in the south-eastern Barents Sea.

Adult fish

Adult blue whiting were recorded over the deep water of the Norwegian Sea south of 77° N. The distribution also extended eastwards to the longitude of Vardø and to the north of Central Bank. Blue whiting have not been recorded this far east in previous years. Small numbers of lumpsucker (Cyclopterus lumpus), 3-spined stickleback and Maurolicus were also caught.

Recommendations

In order to improve the accuracy of the 0-group surveys it is recommended that studies in the behaviour of the 0-group fish should be continued in the future.

Reference

Haug, A. and Nakken, O. 1973. Echo abundance indices of 0-group fish in the Barents Sea. 1965-1972. ICES/FAO/ICNAF-Symposium on Acoustic Methods in Fisheries Research, Bergen, June 1973. 1-13, 4 tab., 2 Fig. (Mimeo)

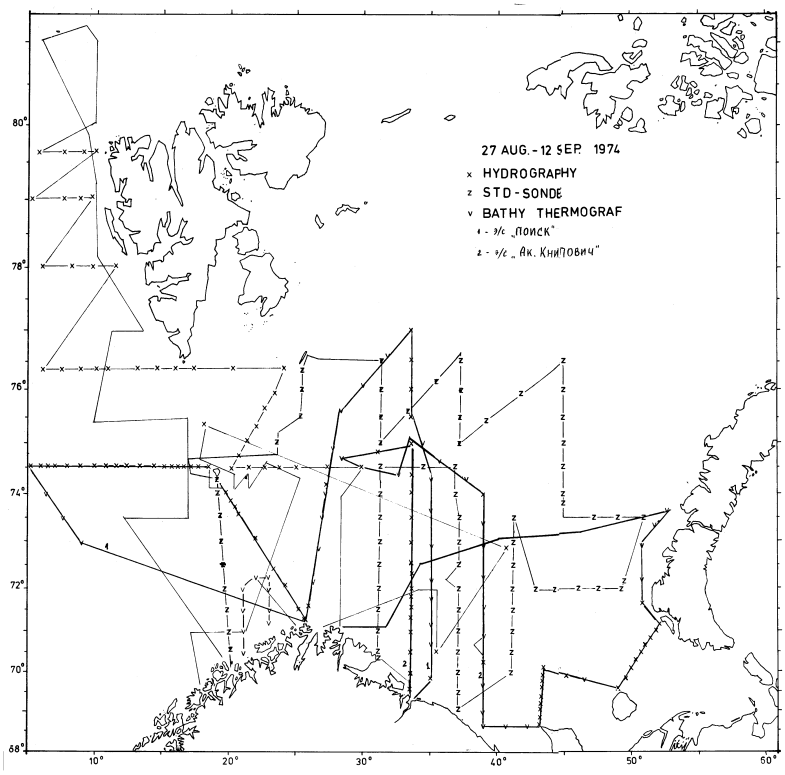

Fig. 1. Survey routes and grid of stations

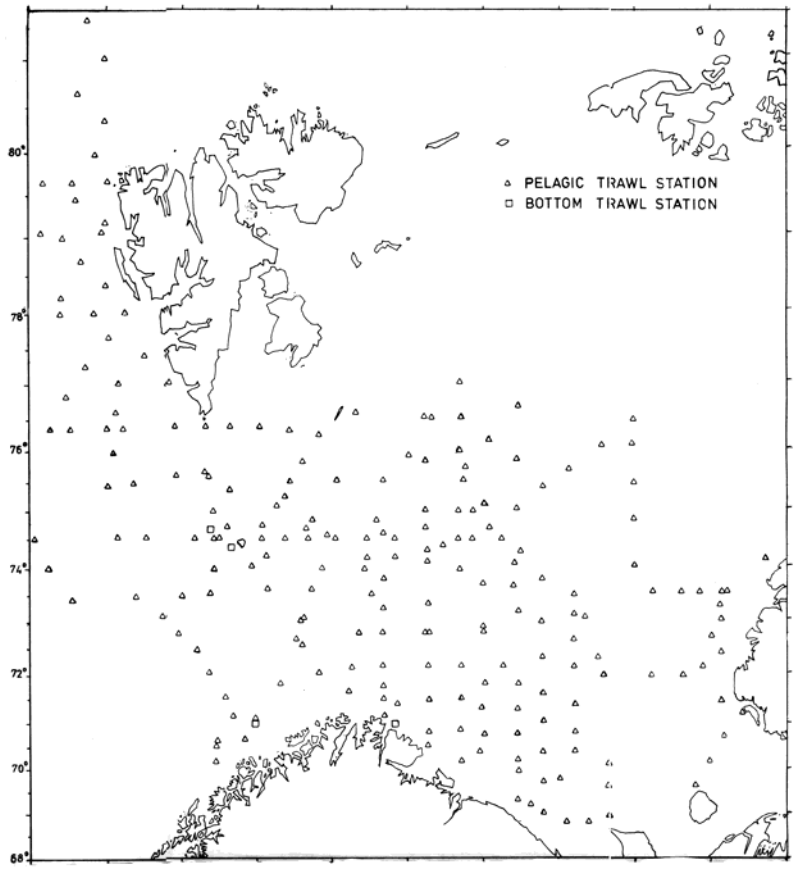

Fig. 2. Trawl stations

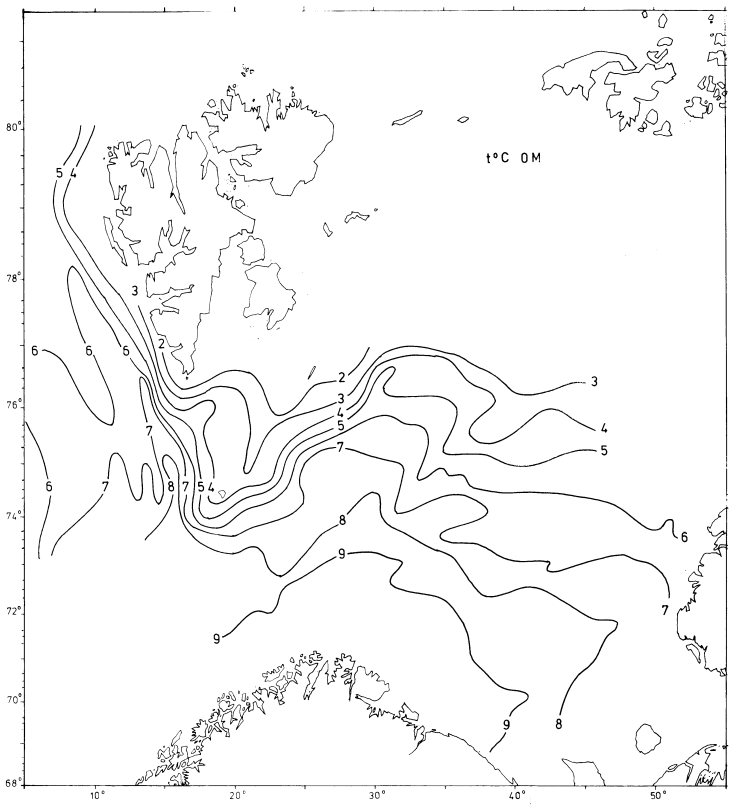

Fig. 3. Isotherms at 0 m

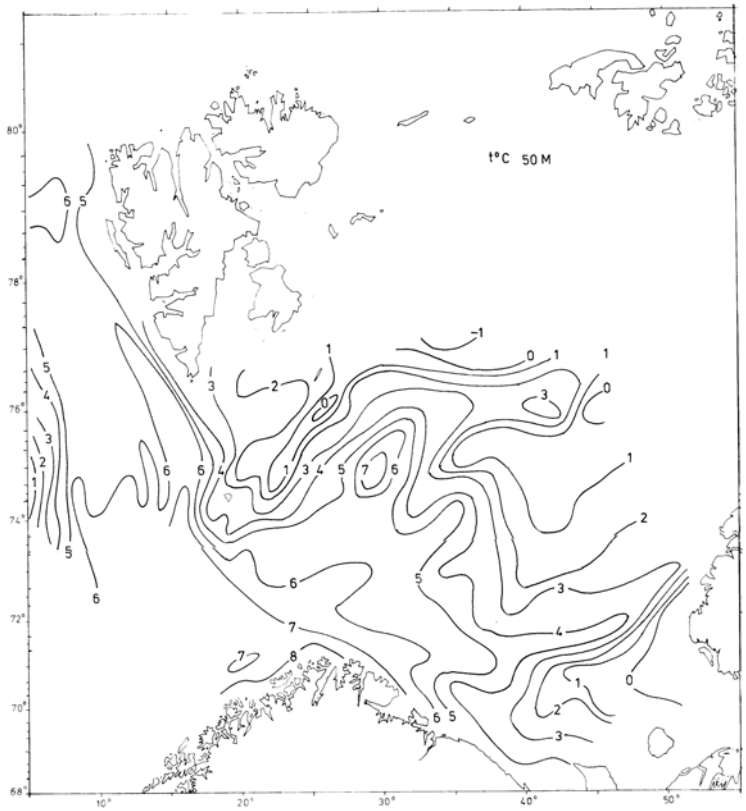

Fig. 4. Isotherms at 50 m

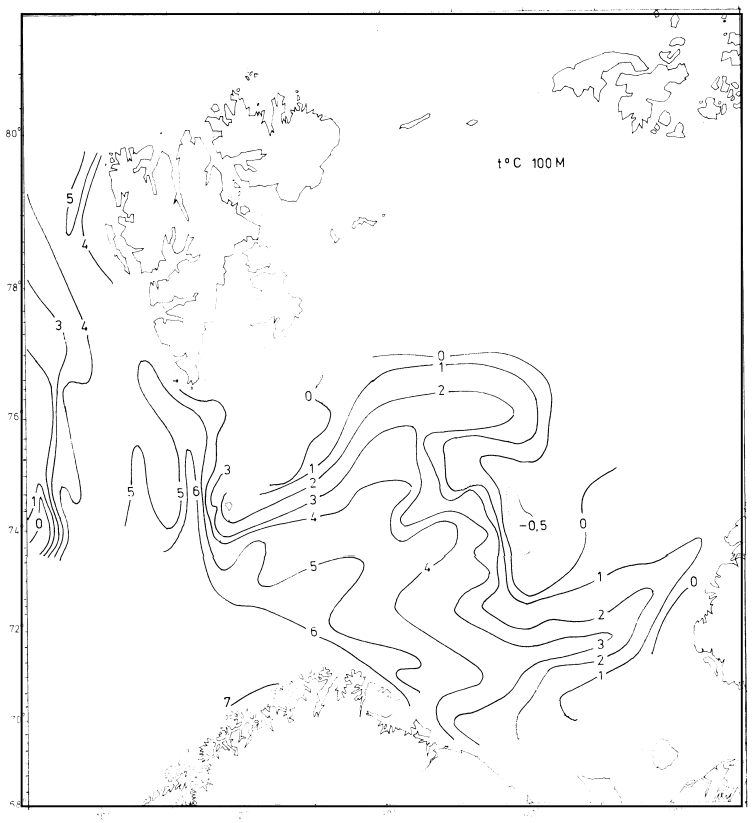

Fig. 5. Isotherms at 100 m

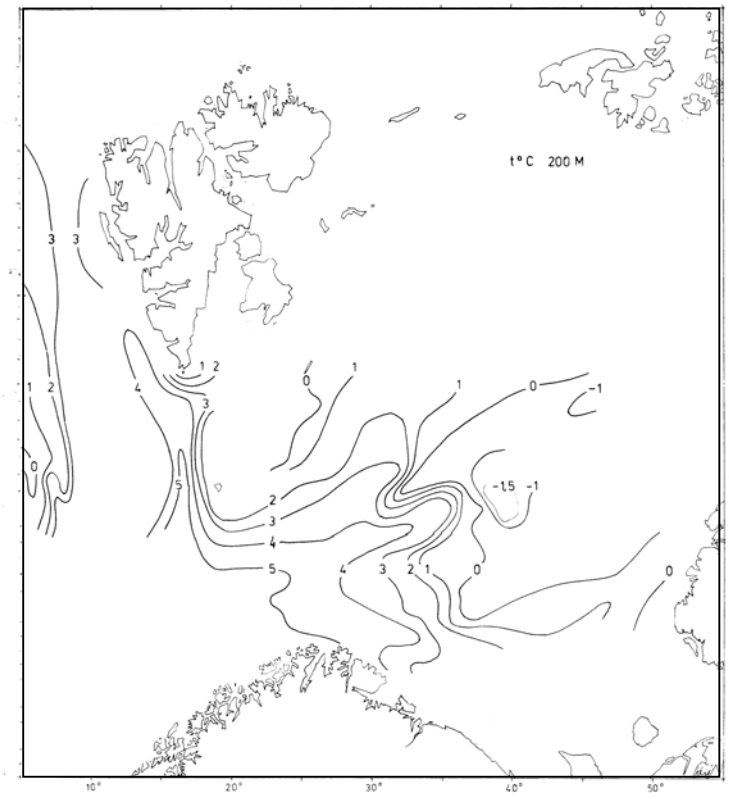

Fig. 6. Isotherms at 200 m

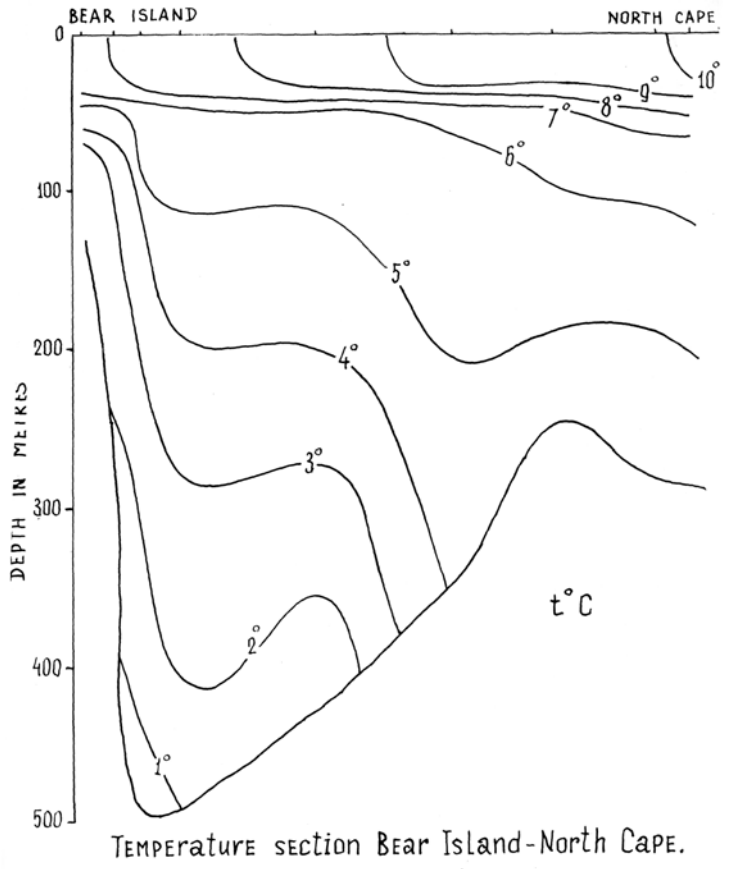

Fig. 7. Temperature section Bear Island – North Cape

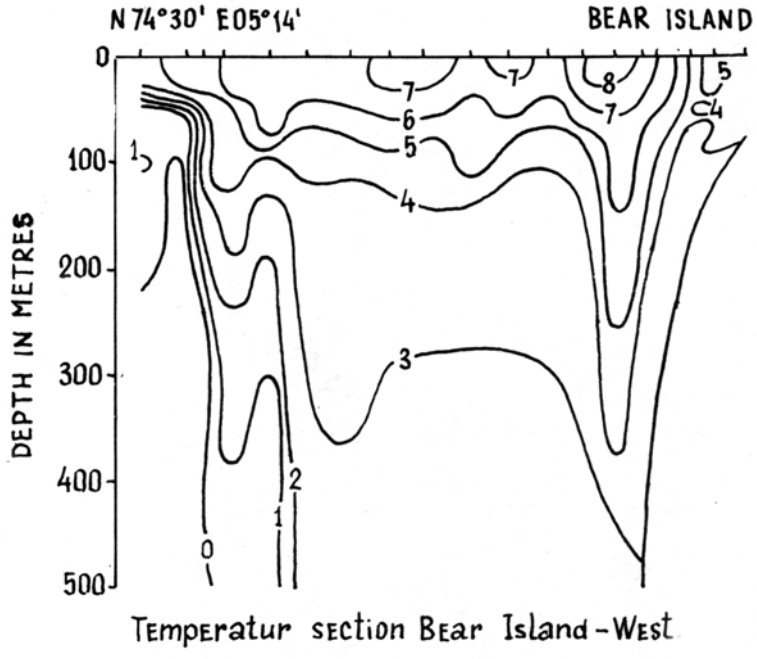

Fig. 8. Temperature section Bear Island-West

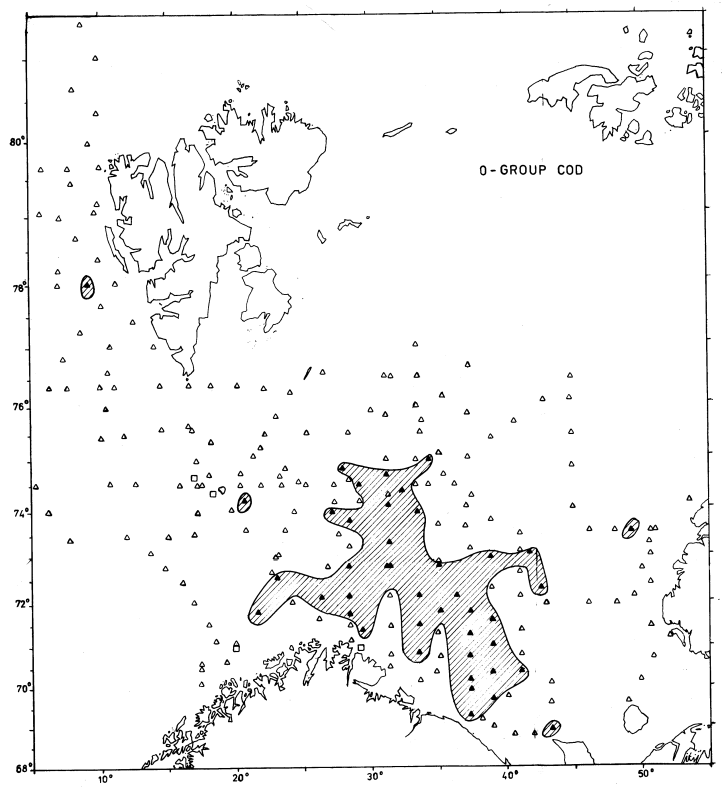

Fig. 9. Distribution of 0-group cod

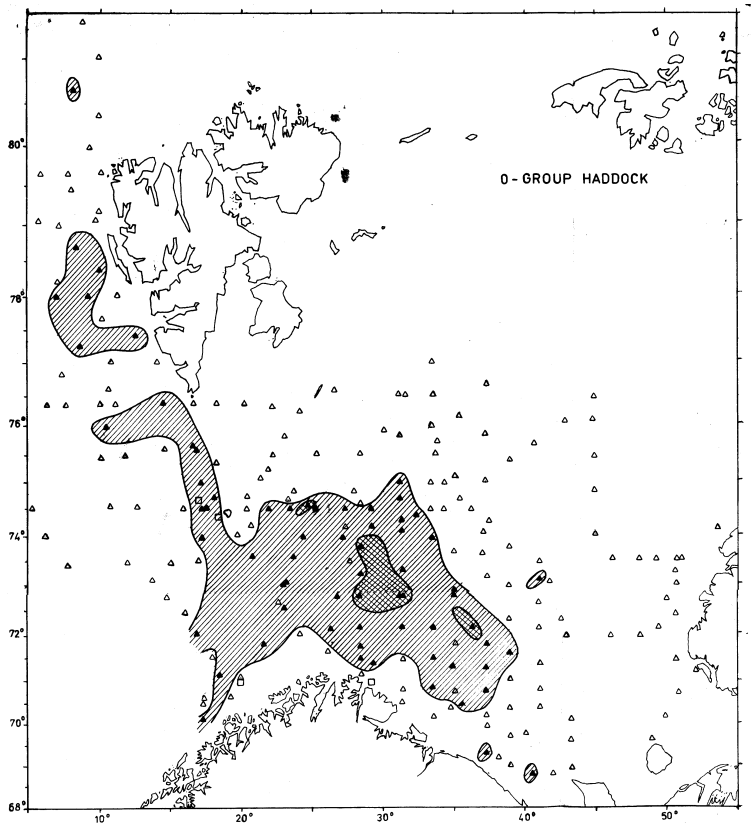

Fig. 10. Distribution of 0-group haddock

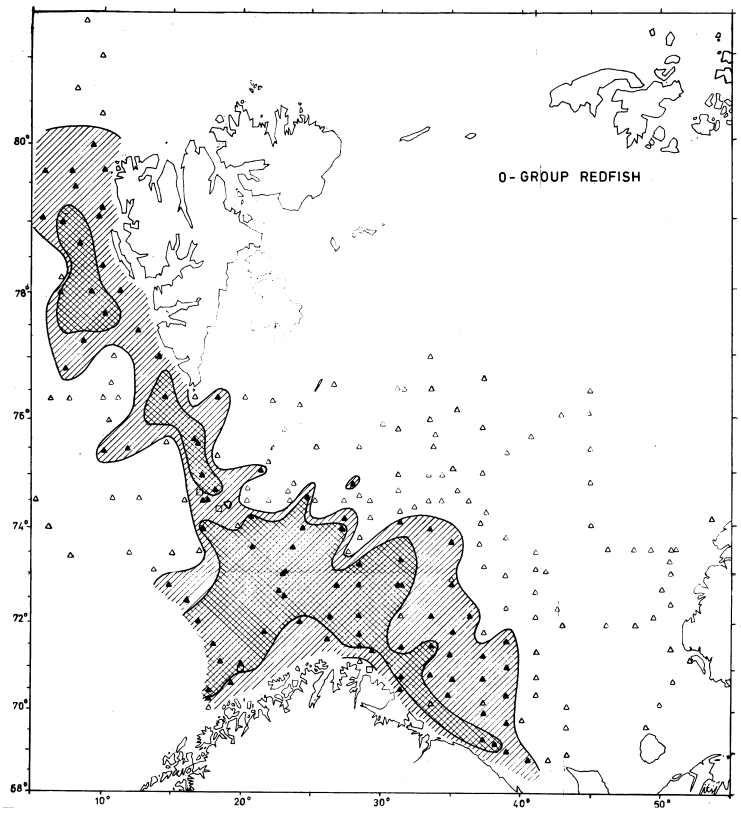

Fig. 11. Distribution of 0-group redfish

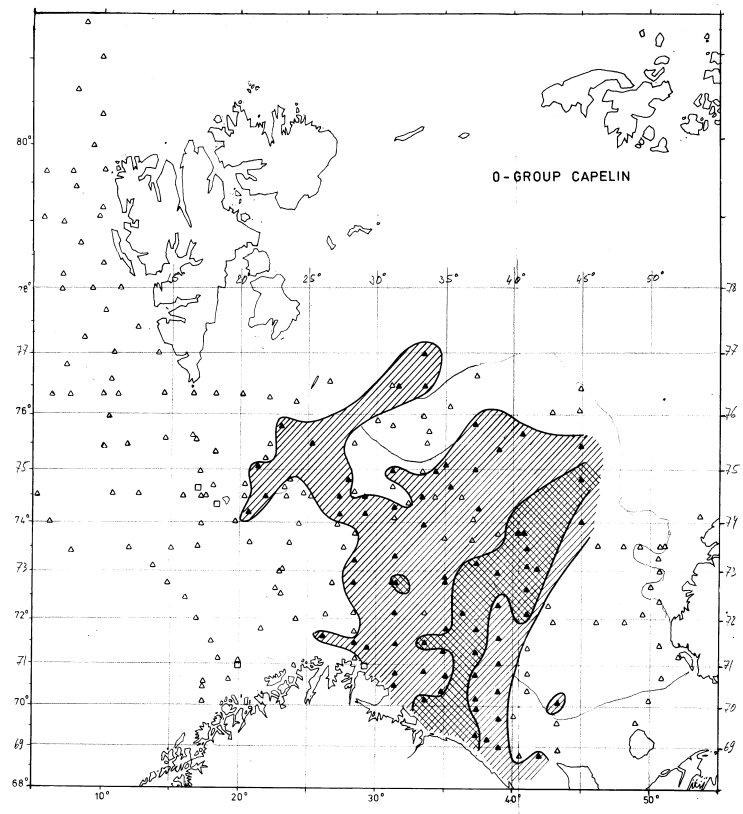

Fig. 12. Distribution of 0-group capelin

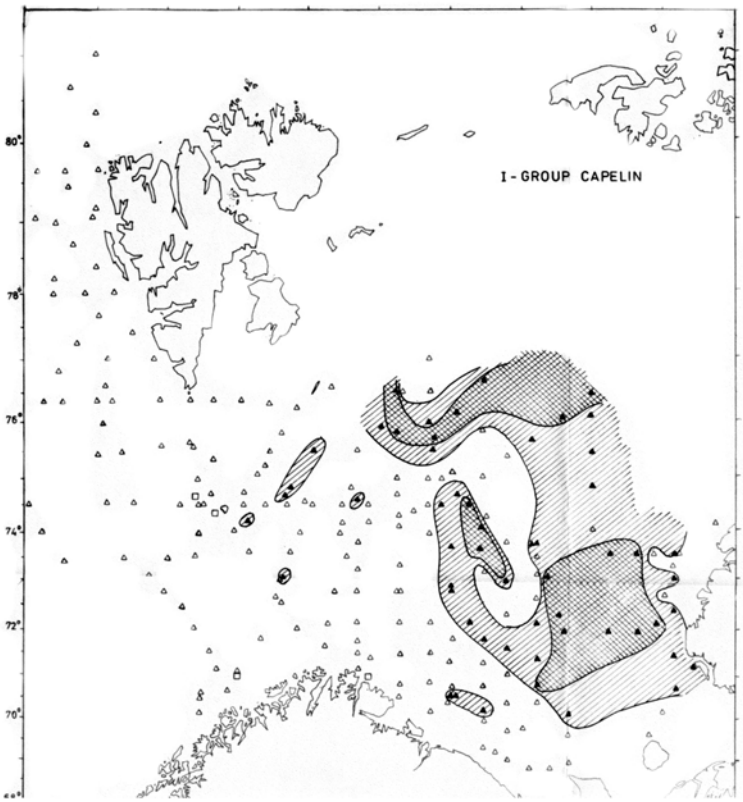

Fig. 13. Distribution of 1-group capelin

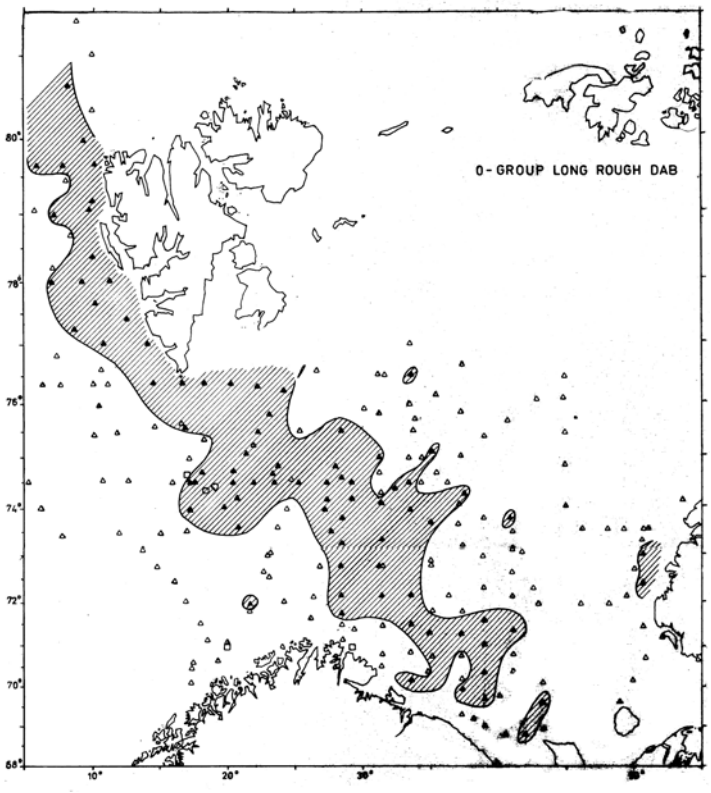

Fig. 14. Distribution of 0-group long rough dab

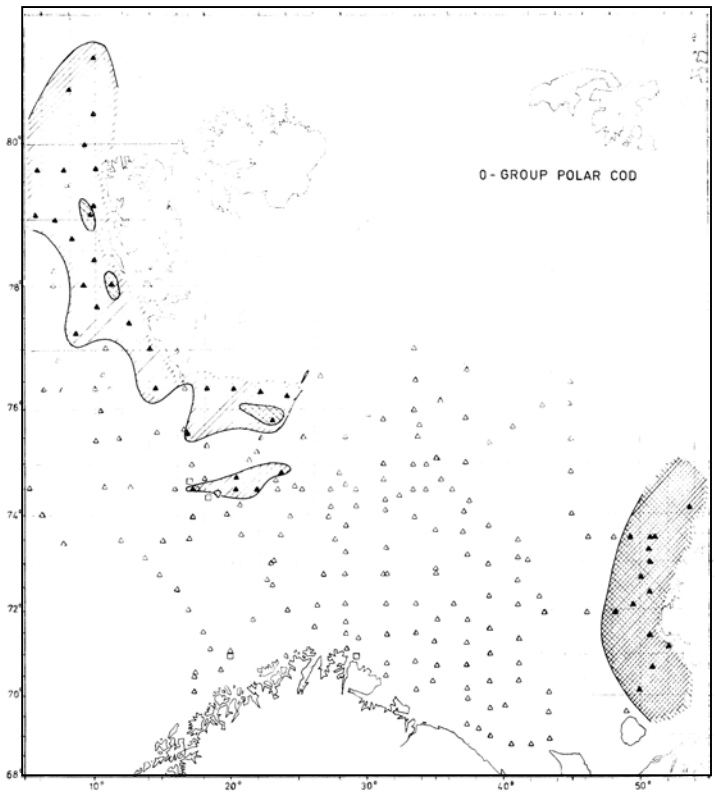

Fig. 15. Distribution of 0-group polar cod

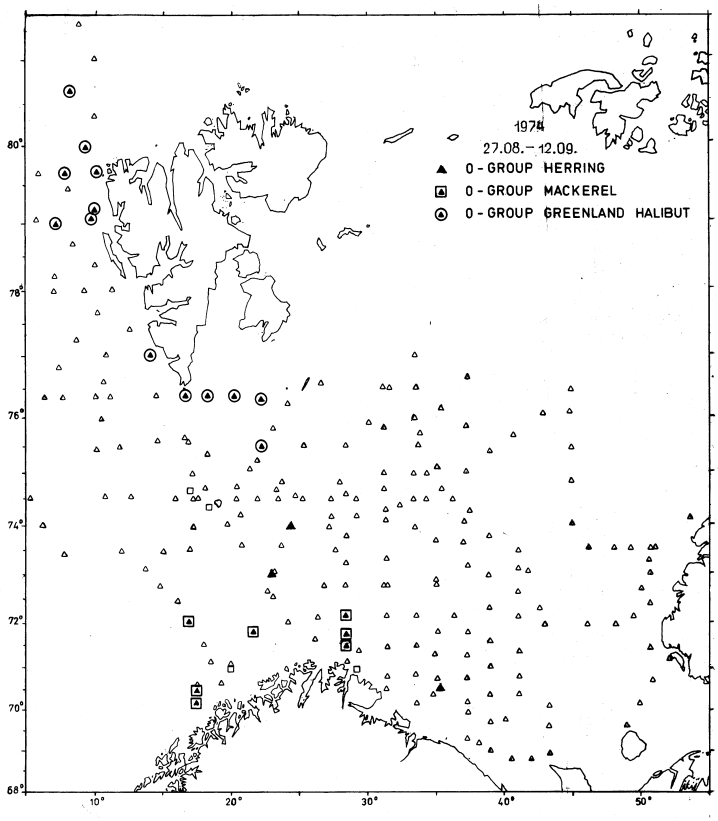

Fig. 16. Distribution of 0-group herring, mackerel and Greenland halibut

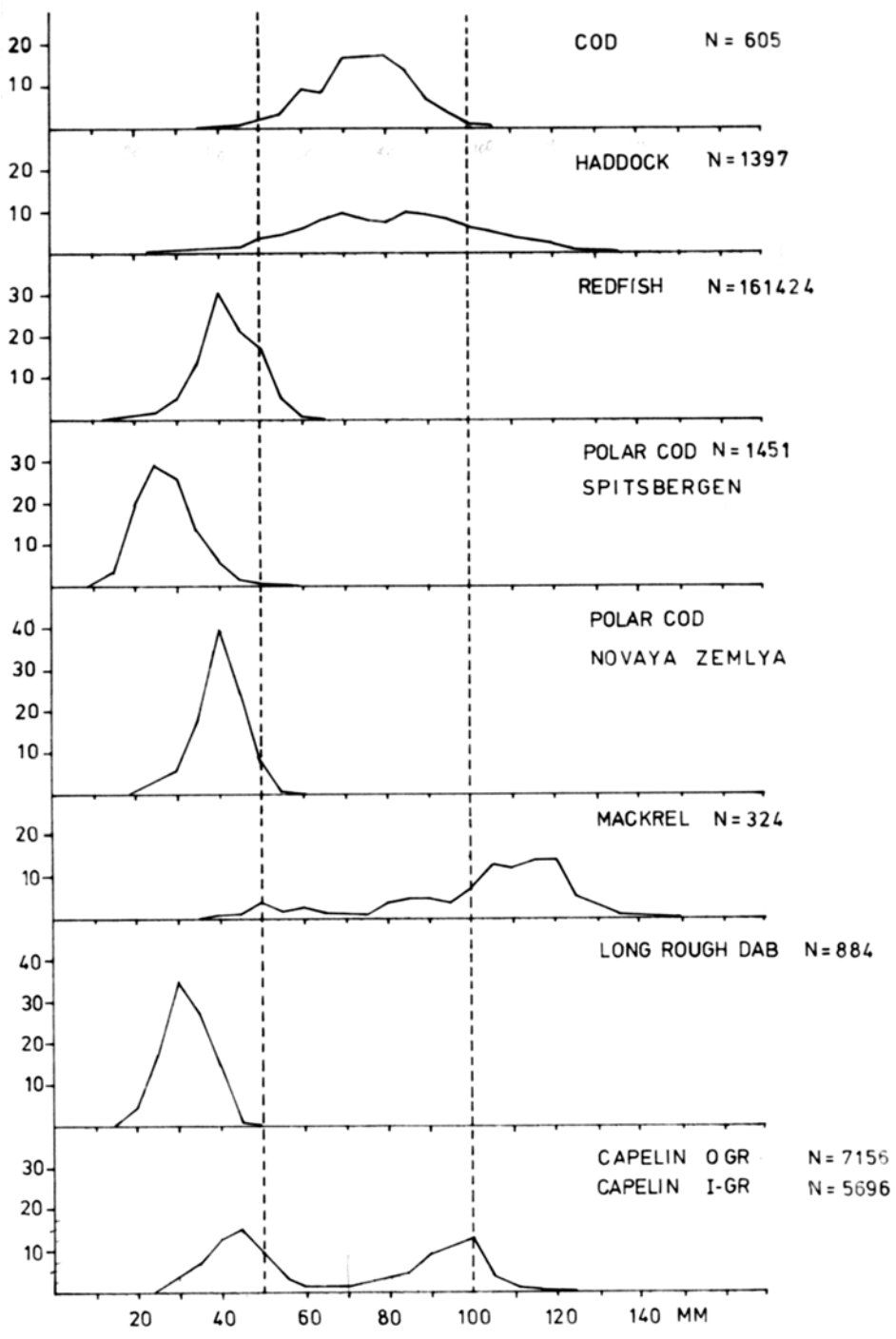

Fig. 17. Length distribution of 0-group fish

International Council for
the Exploration of the Sea

CM B75/H48
Pelagic Fish (Northern)Committee
Ref: Hydrographic and Demersal
Fish (N) Committees

Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August-September 1975

Introduction

The following vessels and scientists participated in the eleventh international survey to study the abundance and distribution of 0-group fish in the Barents Sea and Svalbard region:

USSR	"Fridtjof Nansen"	V.N. Kusnetsov, J.F. Shevtsov
	"Poisk"	V.V. Rossov, A.S. Galkin, E.A. Jakovlenkov
Norway	"Johan Hjort"	J. Hamre, V. Ausen
	"G.O. Sars"	L. Midttun, A. Beltestad
U.K.	"Cirolana"	B.W. Jones, H.R. Stewardson, M.R. Vince

A meeting was held in Murmansk between the scientists of PINRO and "G.O. Sars" to make final arrangement for the coordination of the survey. The period of the survey was from 25 August to 7 September, and a meeting of scientists was held in Hammerfest on 8-9 September to analyse the data and to prepare the report.

Material and methods

The distribution and density of the pelagic scattering layers was estimated from echo-sounder paper records, from echo integrator measurements, and by fishing with small meshed pelagic trawls. Depth metering devices were used for the accurate control of the depth of trawling. All vessels used the modified capelin trawl with an opening of 18 x 15 m except for "Fridtjof Nansen", which used a smaller trawl with an opening of 6 x 10 m.
Figs. 1 and 2 show the survey tracks of the ships and the trawl and hydrographic stations worked.

Results

Hydrography (Figs. 3-9)

Comparing the temperature distribution in the 0 m layer for this year and previous years, and from Table 1 it is possible to conclude that a weak insolation warming of the western Barents Sea waters (in the 0-50 m layer) had occurred.

But because of fairly high temperature in the 50-200 m layer due to increased heat transport, the mean water temperature in the 0-200 m layer along the Kola section was above the normal. On the section North Cape - Bear Island it was close to the norm (Table 2), although a little colder near surface in the southern part.

This year an increased heat transport into the south-western Barents Sea is particularly apparent in the 100 m layer similar to that of 1973, but differs from that of 1974 by the more eastern position of the 5° and 6° isotherms. It is supposed that the eastern distributions of main 0-group cod concentrations was due to a considerably greater than average inflow of the Norwegian Current water into the Barents Sea. Compared to 1973/74 lower temperatures were registered in the 0-50 m layer not only in the south-western Barents Sea but also in the area between Hope Island and Bear Island and in the north-easternmost part of the area. But in 1975 temperatures as low as in 1974 in the 200 m layer in the north-eastern Barents Sea were not observed.

Low water temperatures near the surface, relatively high ones in the deeper layers caused only a weak development of thermocline in the western Barents Sea. Temperatures above the long-term average were recorded in the whole 0-200 m layer on the section west of Bear Island.

Distribution and abundance of 0-group fish

The distribution of 0-group fish of the main species are shown by the shaded areas in Figs. 10-16. Estimates of abundance were calculated by the method of Haug and Nakken (1973) and these are given in Table 4 where they can be compared with estimates prepared from earlier surveys. Some qualifying remarks on the validity of these abundance indices are made in the comments on some of the species given below. Length frequency distributions of the main species are shown in Fig.17.

Herring

Only two specimens were taken during the entire survey indicating once again recovery of the herring stock in the Barents Sea.

Cod (Fig. 10)

0-group cod were distributed over a wide area in the central Barents Sea with the area of greatest density near the coast between 30° E and 40° E. Only one specimen was taken in the waters west of Spitsbergen. The calculated abundance index indicates the 1975 year-class to be a strong one, although less abundant than the very strong year-classes of 1970 and 1973.

Haddock (Fig. 11)

The distribution was very similar to that of cod. Very few were caught in the Svalbard area and the area of greatest abundance was in an area off the Finmark-Murman coast. The abundance index for haddock is the highest on record and the 1975 year-class is considered to be abundant.

Redfish (Fig. 12)

The redfish distribution was similar to that in previous years. The areas of high density were not as extensive as in 1974. The 1975 year-class is a strong one, but less abundant than the very strong 1974 year-class.

Capelin (Fig. 13)

Capelin was distributed in the eastern Barents Sea but not as far north as usual. Only small numbers were recorded north of 74° N. None were taken in the Svalbard area. This year there was an extensive summer pawning in Varanger Fjord in June and newly hatched larvae was observed in late June. The smaller size of the larvae in the southern part of the area is associated with this late spawning.

With our better knowledge of the vertical distribution of 0-group capelin (Beltestad, Nakken and Smedstad 1975, in press), sampling has been more efficient in 1974 and 1975. Consequently any comparison of abundance indices for these years with earlier years is likely to be misleading. During day time the larvae are up at the surface and concentrated in a very narrow depth range. At night they become much more dispersed in a much wider depth range. Accordingly the numbers caught in surface hauls during daylight will be much greater than those during the night. Also large numbers of capelin larvae are caught in the meshes of the trawls. These problems make it difficult to assess the abundance but it appears similar to 1974.

Long rough dab (Fig. 14)

This species was distributed over a wide area, but at a low density. The overall abundance appears to be about, or slightly above average.

Polar cod (Fig. 15)

Very few polar cod were caught this year in the eastern Barents Sea although survey coverage on the coast Novaya Zemlya was less extensive than in previous years. The 1975 year-class in this area is considered to be of low abundance. In the Svalbard area catches indicated an abundance rather higher than usual.

Greenland halibut (Fig. 16)

This species was recorded in the Svalbard area with a similar distribution to earlier years.

Mackerel

No mackerel were recorded this year.

Other species

Small numbers of catfish and saithe were caught during the survey 0-group Leptagonus, Liparis and Cottus were widely distributed in the colder water. 0-group sandeels were abundant in the south-eastern Barents Sea.

Reference

Beltestad, A.K., Nakken, O. and Smedstad, O.M. 1975. Investigations on diel vertical migration of 0-group fish in the Barents Sea. Fiskdir. Skr. Ser. Havunders. 17: 000-000, (In press)

Haug, A. and Nakken, O. 1973. Echo abundance indices of 0-group fish in the Barents Sea 1965-1972. ICES/FAO/ICNAF Symposium on Acoustic Methods in Fisheries Research Bergen, June 1973. 1-13, 4 tab., 27 figs. Mimeo.

Table 1. Mean water temperature in the Murmansk current, the Kola section (between 70°30' N and 72°30' N) at the end of August (°C)

Year/Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Aver. 1965-1975
0-50 m	6.7	6.7	7.5	6,4	6,7	7.8	7.1	8.7	7.7	8.1	7.0	7.3
50-200 m	3.8	2.6	4.1	3.7	3.1	3.6	3.2	4.0	4.5	3.9	4.6	3.8
0-200 m	4.6	3.6	4.9	4.4	4.0	4.7	4.2	5.2	5.2	4.9	5.2	4.7

Table 2. Mean water temperature in the North Cape current, the North Cape to Bear Island section (between 71°33' N, 25°02' E and 73°35' N, 20°46' E) at the beginning of September (°C)

Year/Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	Aver. 1965-1975
0-200 m	5.1	5.5	5.6	5.4	6.0	6.1	5.7	6.3	6.2	6.1	5.7	5.8

Table 3. Mean water temperature in the West Spitsbergen current along the West Bear Island section (between 06°34' E and 05°55' E) in early September

Year/ Layer	1966	1967	l968	1969	1970	1971	1972	1973	1974	1975	Aver. 1965-1975
0-200 m	3.3	4.2	3.6	4.2	No data	4.2	3.9	5.0	4.6	4.9	4.2

Table 4. Estimates of year-class strength, P (poor), A (average) and S (strong), and the corresponding abundance indices, T, E1 is the estimate from annual reports, E2 is the estimate based on the average indices at the bottom of the table

Species	Cod			Capelin			Haddock			Redfish			Polar cod			Lrd		
Year	E1	T	E2	E1	T	E2	E1	T	E2	E1	T	E2	E1	T	E2	E1	T	E2
1965	P	6	P	A	37	P	P	7	P	S	159	A	P	0	P	S	66	A
1966	P	< 1	P	S	119	A	P	<1	P	S	256	S	S	129	A	S	97	S
1967	P	34	P	S	89	A	A	42	A	?	44	P	A	165	A	S	75	A
1968	P	25	P	S	99	A	P	8	P	?	21	P	A	60	P	P	17	P
1969	?	93	A	S	109	A	?	82	S	S	295	S	S	208	S	P	26	P
1970	S	606	S	P	51	P	?	115	S	S	247	S	S	197	S	P	12	P
1971	A-S	157	S	S	151	S	A	73	S	?	172	A	A	181	S	?	81	S
1972	A-S	140	A	S	275	S	?	46	A	A	177	A	?	140	A	P	65	A
1975		687	S		125	A		54	P		385	S		26	P		67	P
1974		51	A		359	S		147	S		468	VS*		227	S		83	S
1975		343	S		320	S		188	VS		315	S		75	P		113	S
Aver. 1		133			116			47			169			135			55	
Aver. 2		75			105			43			173			145			55	
Average Index		75-150			75-150			30-60			100-225			75-175			40-80	

* VS-very strong.

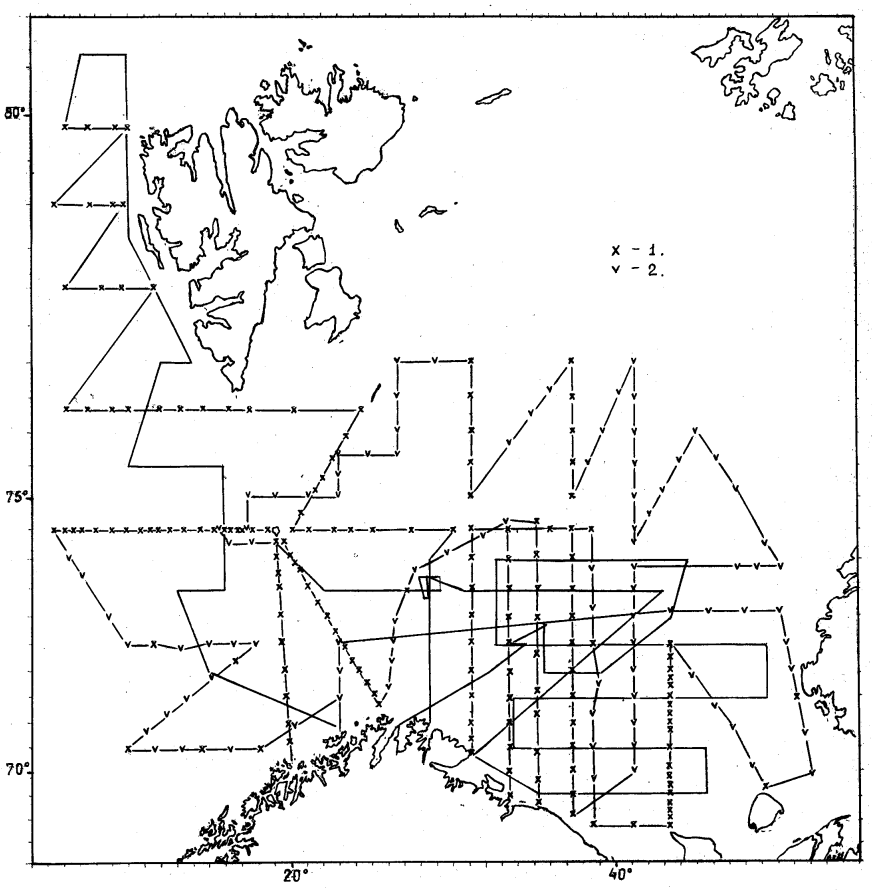

Fig. 1. Survey routes and grid of stations

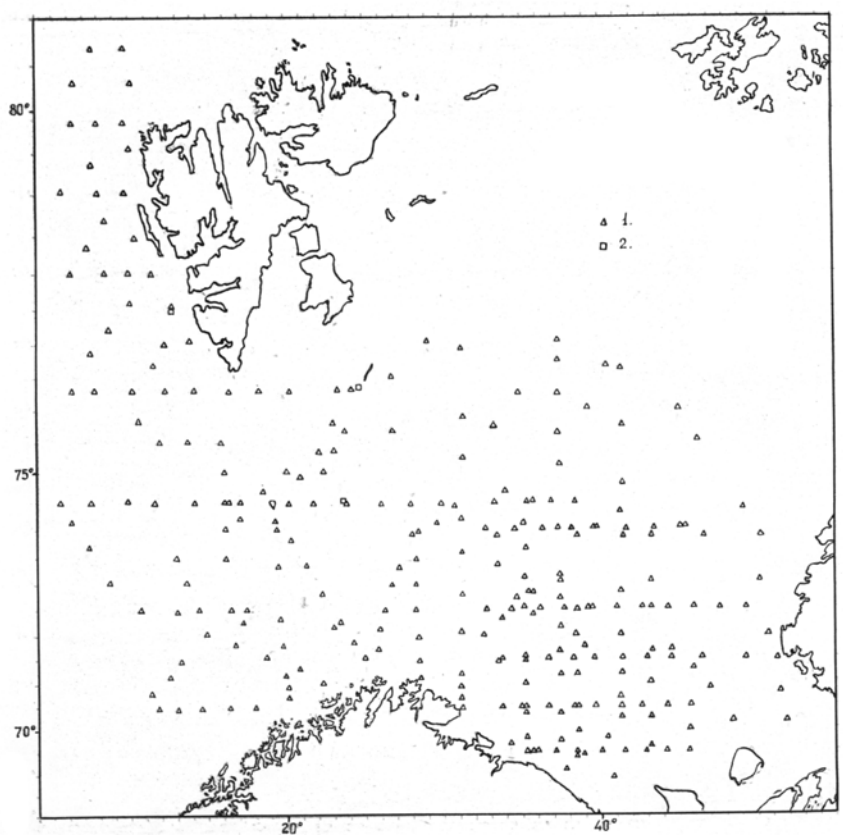

Fig. 2. Trawl stations

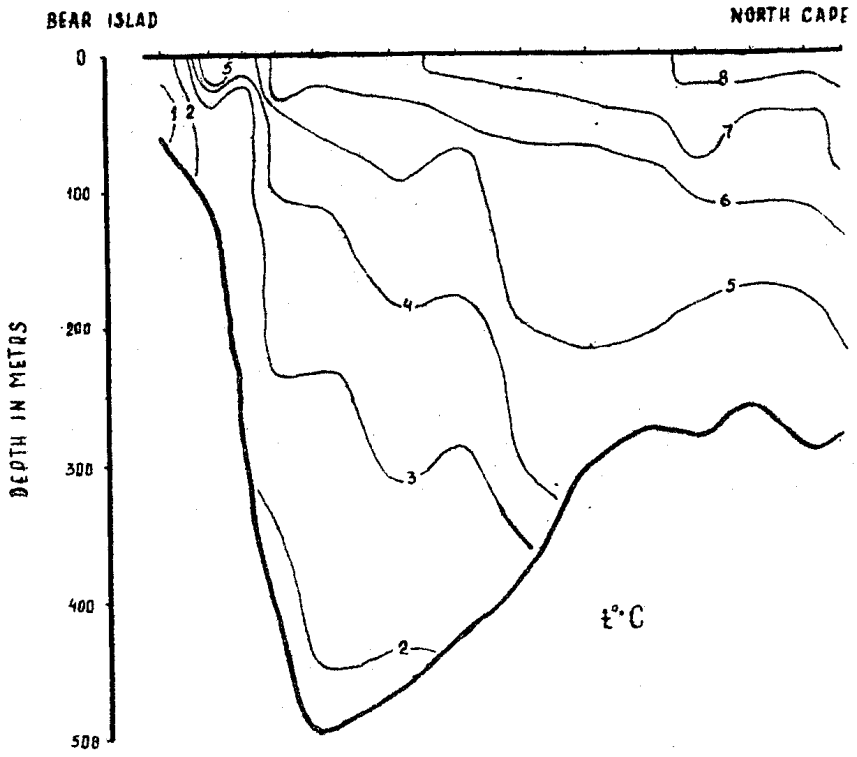

Fig. 3. Temperature section Bear Island-North Cape

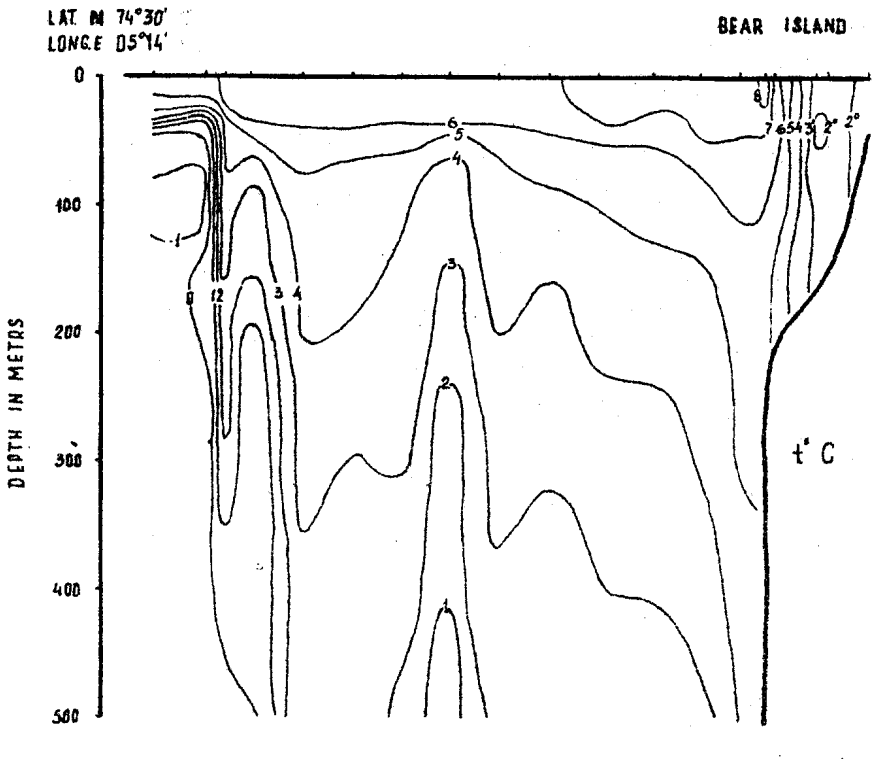

Fig. 4. Temperature section Bear Island-West

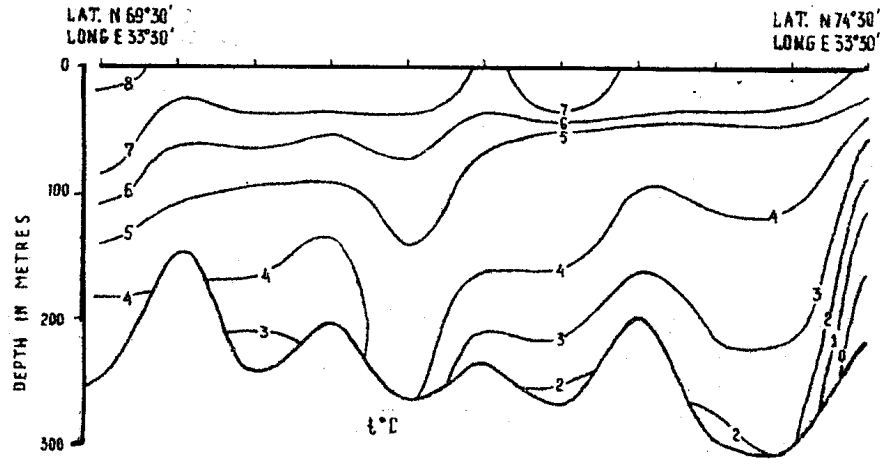

Fig. 5. Temperature section along the Kola meridian

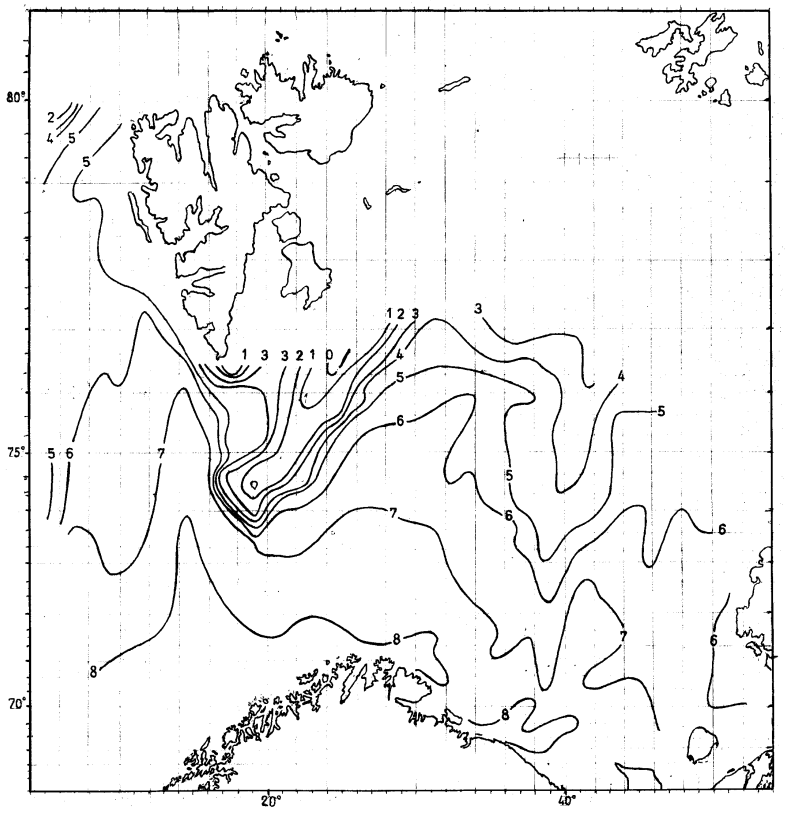

Fig. 6. Isotherms at 0 m

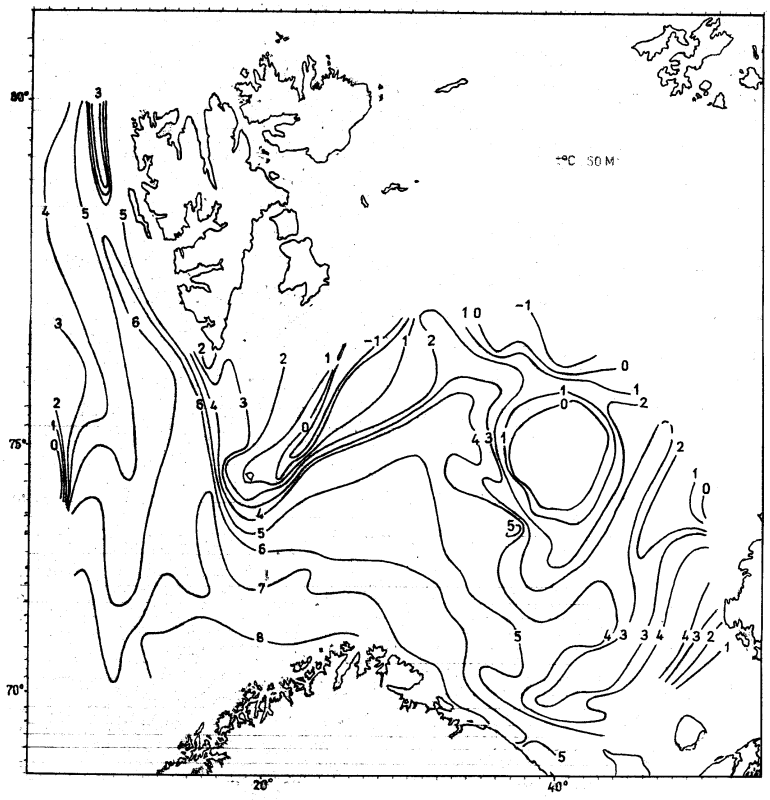

Fig. 7. Isotherms at 50 m

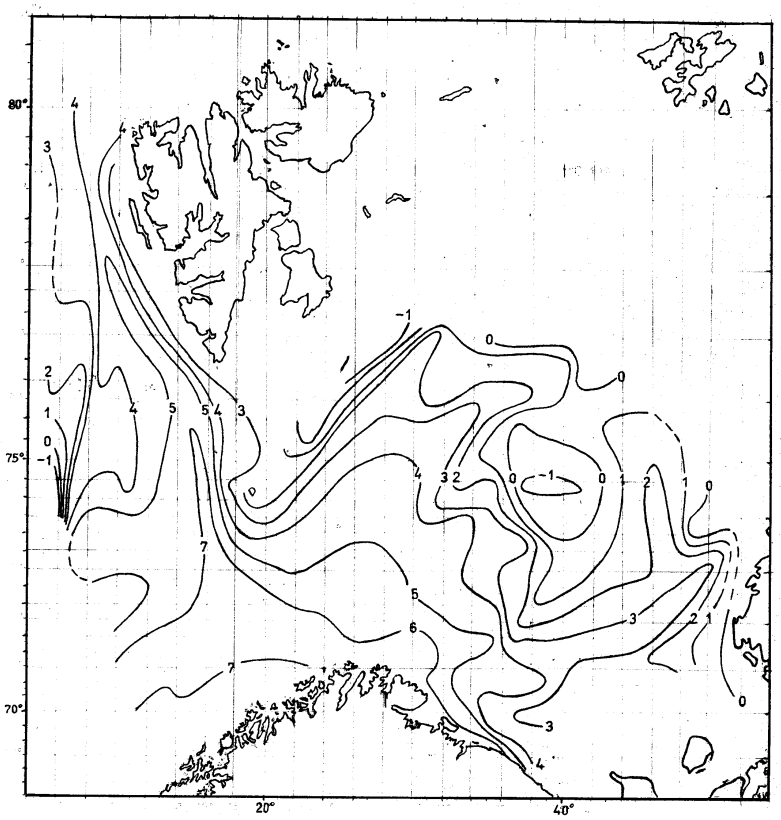

Fig. 8. Isotherms at 100 m

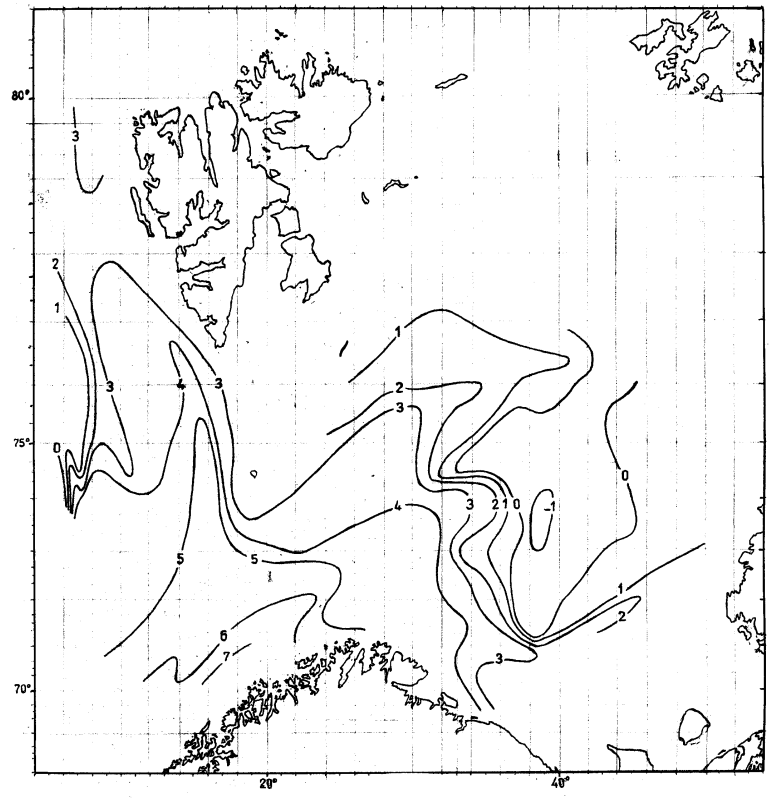

Fig. 9. Isotherms at 200 m

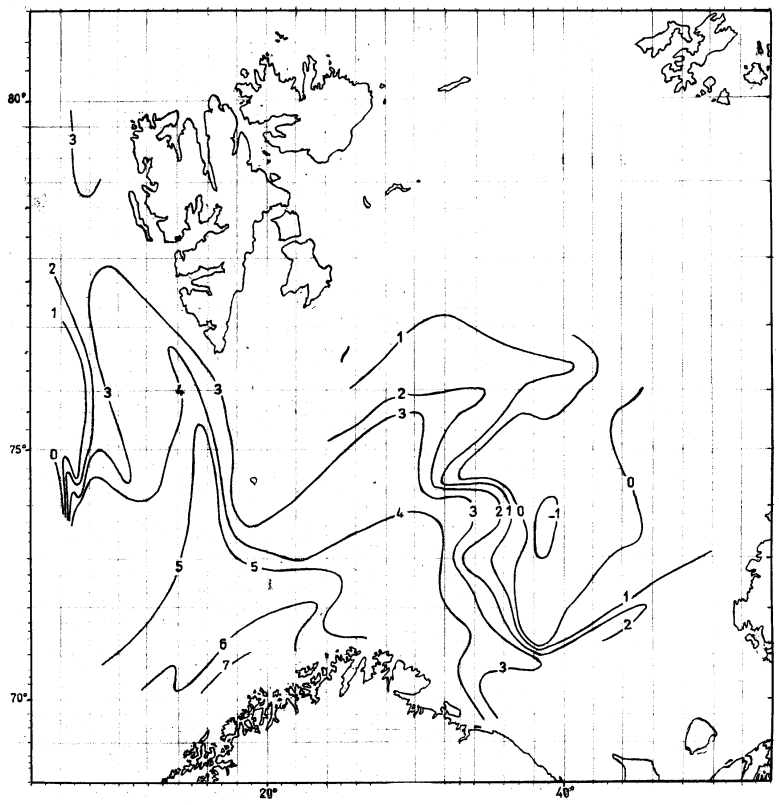

Fig. 10. Distribution of 0-group cod

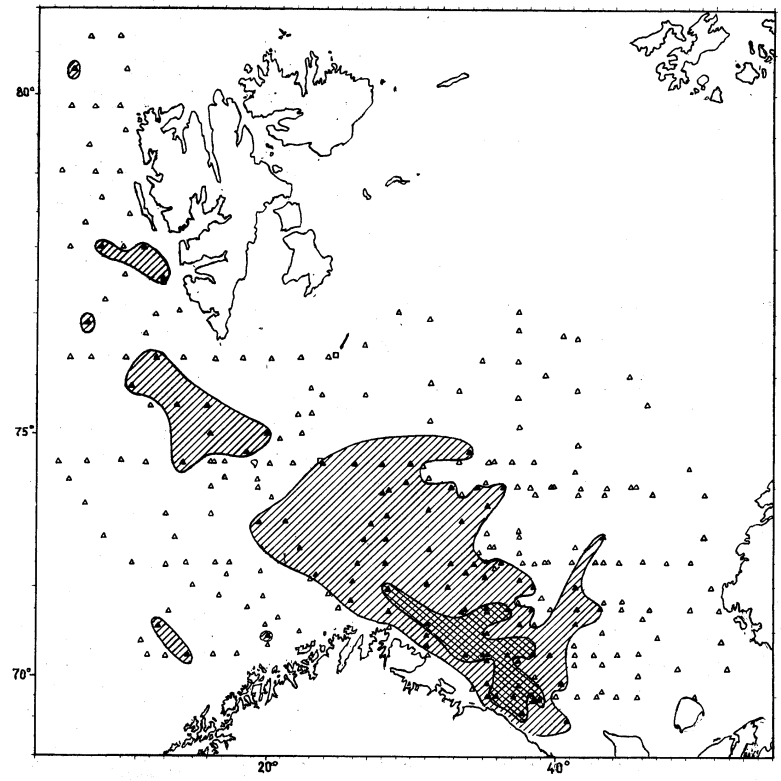

Fig. 11. Distribution of 0-group haddock

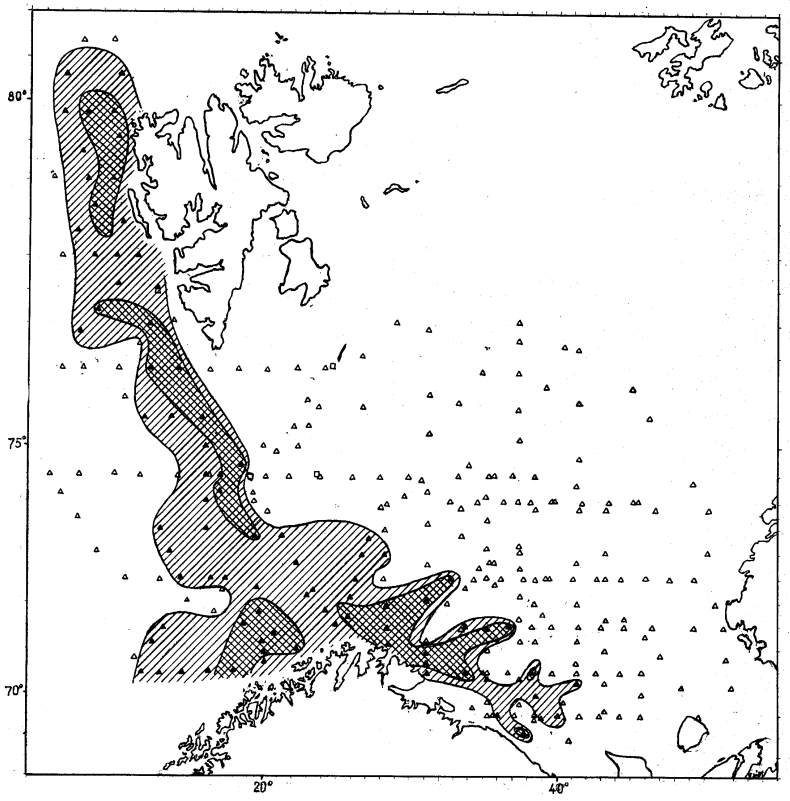

Fig. 12. Distribution of 0-group redfish

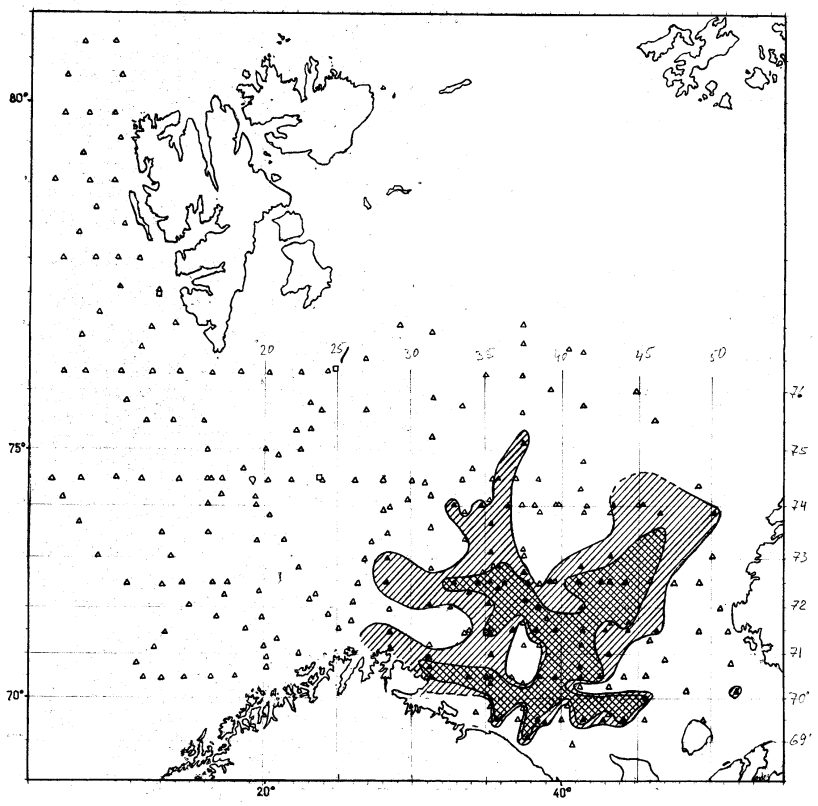

Fig. 13. Distribution of 0-group capelin

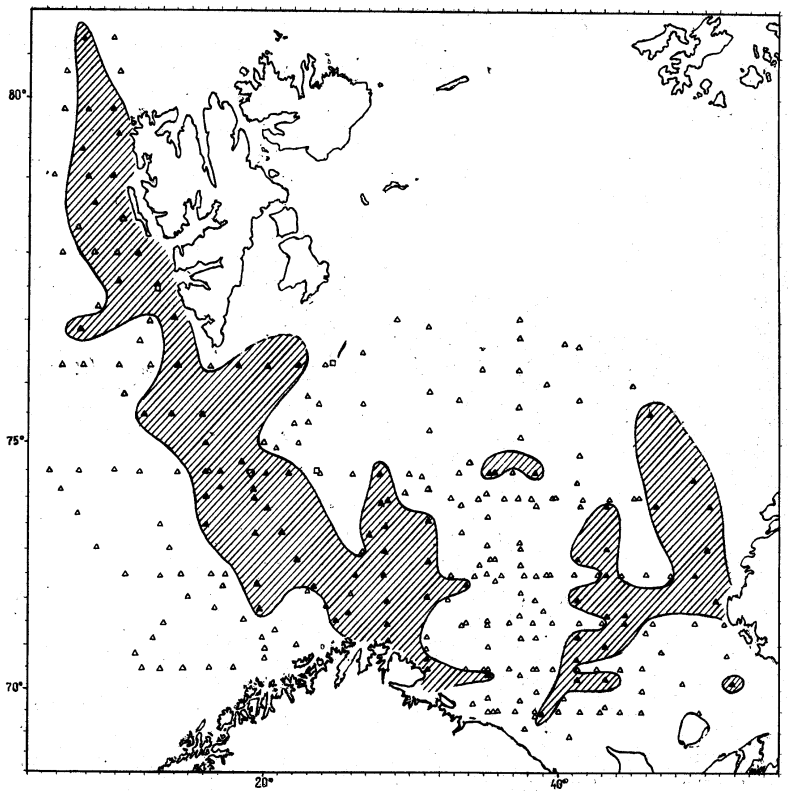

Fig. 14. Distribution of 0-group long rough dab

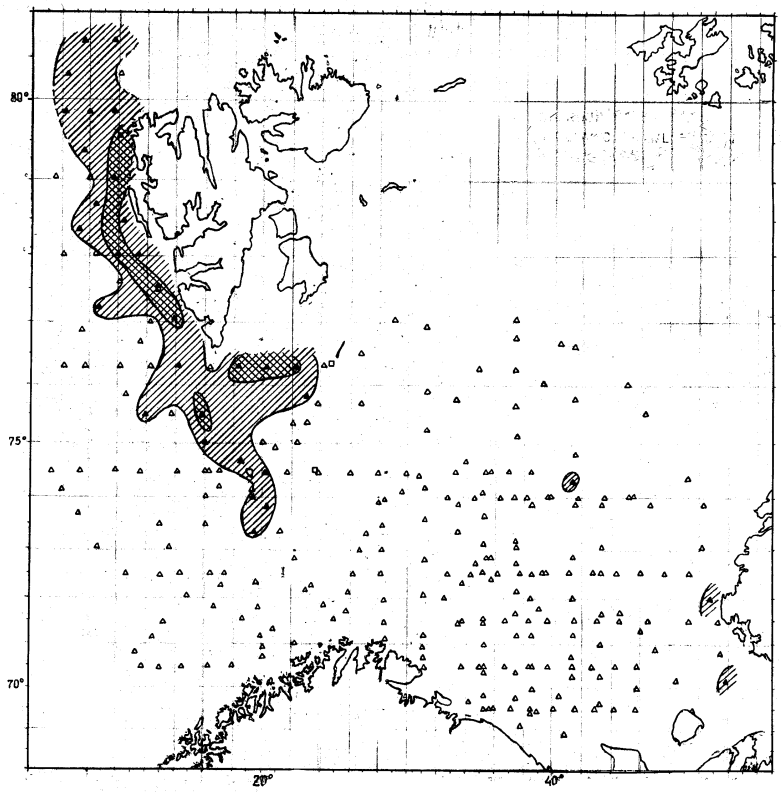

Fig. 15. Distribution of 0-group polar cod

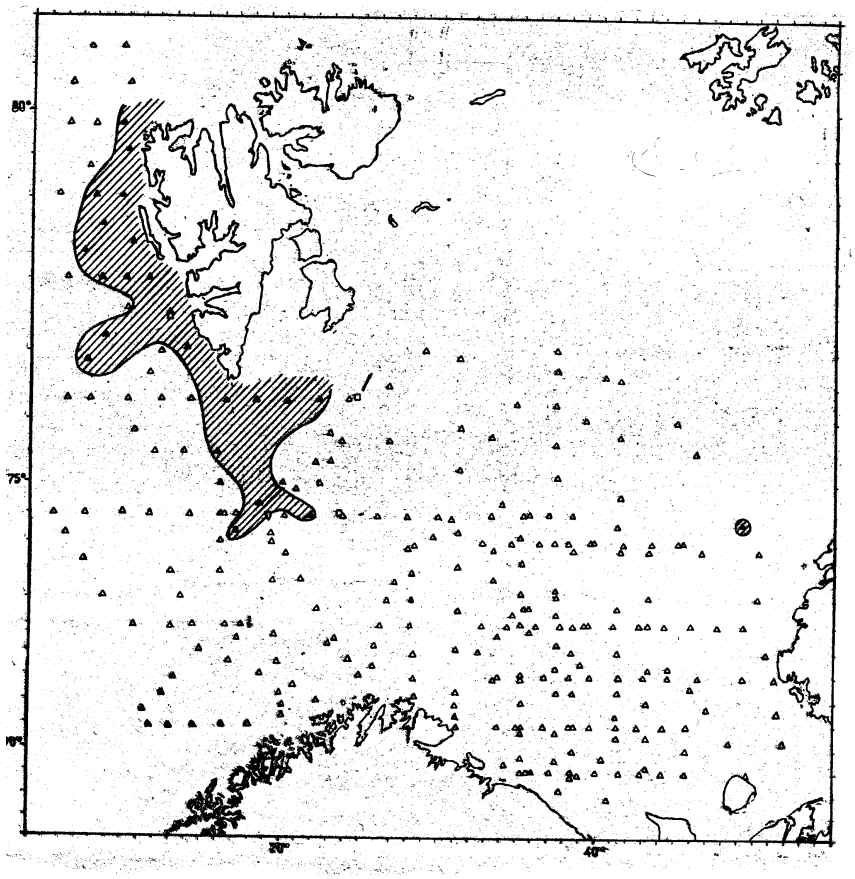

Fig. 16. Distribution of Greenland halibut

International Council for
the Exploration of the Sea

CM 1976/H:43
Pelagic Fish (Northern) Committee
Ref: Demersal Fish (Northern) and
Hydrographic Committees

Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August-September 1976

Introduction

The following vessels and scientists participated in the twelfth international survey to study the abundance and distribution of 0-group fish in the Barents Sea and the Svalbard region:

USSR	"Odissey"	V.N. Shleinik, .A. Ermolichev, M. L. Zaferman, V.Z. Salmov, A.S. Galkin
	"Fridtjof Nansen"	I. Borkin
Norway	"Johan Hjort"	O. M. Smedstad, A. Romslo
	"G. O. Sars"	L. Midttun, A. Hylen, J. Hamre, H. P. Knudsen H. Kismul
U.K.	"Cirolana"	B. W. Jones, M.R. Vince, R.N. Tucker, K. Medler

A meeting was held in Murmansk between scientists of The Polar Research Institute of Marine Fisheries and Oceanography (PINRO) and the Institute of Marine Research, Bergen to make final arrangement for the coordination of the survey. The period of the survey was from 25 August to 7 September, and a meeting of scientists from the participating research vessels was held in Hammerfest on 8-9 September to analyse the data and to prepare the report.

Material and methods

The distribution and density of the pelagic scattering layers was estimated from echo-sounder paper records, from echo integrator measurements, and by fishing with small meshed midwater trawls.

Depth metering devices were used for the accurate control of the depth of trawling. All vessels used the modified capelin trawl with an opening of (18 x 15) m^2 except for "Fridtjof Nansen", which used a smaller trawl with an opening of (6 x 10) m^2.

R.V "Fridtjof Nansen" continued the survey in the eastern Barents Sea, and 12 additional trawl stations were worked. These data could not be worked into the Figures 10 - 18 in time to get the preliminary report mimeographed. However, the additional information would only effect the abundance estimate of the 1976 year class of Polar cod.

Fig. 1 shows the survey tracks of the ships and the hydrographic stations worked. Positions of trawl stations are indicated on the species distribution charts (Figs. 10-17).

Results

Hydrography (Figs 2-9)

Hydrographic observations were made along the same standard sections as in previous years. Preliminary analyses of the data are given in Figs. 2-9. Mean water temperatures in the hydrographic sections across the main water currents are given in Tables 1-4.

The temperature conditions in the Barents Sea in 1976 seem to be close to the long term average, although the upper 50 meters are somewhat warmer than the normal.

The temperature in the West Spitsbergen Current is found to be above average.

Distribution and abundance of 0-group fish

The distribution of 0-group fish of the main species are shown by the shaded areas in Figs. 10-17. Estimates of abundance were calculated by the method of Haug and Nakken (1973) and these are given in Table 5 where they can be compared with estimates prepared from earlier surveys, early reported to ICES. Length frequency distributions of the main species are shown in Fig. 18.

Herring (Fig. 10)

A small patch of 0-group herring was recorded extending in a narrow band along the northern coast of Norway. This is possibly the same patch that had been located by a Norwegian research vessel at the end of July in an area north-west of Lofoten.

Cod (Fig. 11)

The distribution of 0-group cod was very similar to that recorded in 1974. No cod were recorded in the Svalbard area, and the main area of distribution in the central Barents Sea was small in extent and of low density. The density index of 43 indicates a year class of low abundance and similar in size to the 1974 year class (Index 51).

Haddock (Fig. 12)

As for cod the haddock distribution was similar to that recorded in 1974. The main distribution area north of Norway was rather more to the west than in 1975. Haddock were also recorded in the vicinity of Bear Island and west of Spitsbergen. The 1976 year-class is an abundant one, but not as large as the very abundant year classes of 1974 and 1975.

Redfish (Fig. 13)

The redfish distribution was very similar to last year, but in the Svalbard area the density was lower than in 1975. The overall index of abundance indicates a very abundant year class comparable with that of 1974.

Capelin (Fig. 14)

The 1976 year-class of capelin is similar to last year with respect to both the area of distribution and abundance. As mentioned in last year's report improved sampling techniques for capelin have probably resulted in higher indices of abundance in recent years.

Long rough dab (Fig. 15)

As in previous years this species was distributed over a wide area, but at a low density. The abundance index indicates that the 1976 year-class is of above average abundance.

Polar cod (Fig. 16)

In the Svalbard area the distribution was similar to that observed in 1975 and the above average abundance in that area was also similar to last year.

In the eastern Barents Sea, however, few Polar cod were caught. R/V "Fridtjof Nansen" which continued the work after the survey was finished caught 0-group Polar cod on three trawl stations along Novaya Zemlja (between 73°54' and 74°29' N and 53°44' and 54°36' E). The area of distribution is thus a little bigger than shown in Fig. 16 and the additional information give and increased index for 0-group Polar cod by about 3 units (Table 4). Even with these information the abundance of the 1976 year-class is considered to be low in this area.

Greenland halibut (Fig. 17)

This species was recorded in the Svalbard area with a similar distribution to previous years.

Mackerel

Small numbers of mackerel were taken off the coast of northern Norway.

Other species

Small numbers of catfish and saithe were caught during the survey. 0-group Leptagonus, Liparis, Lumpenus and Cottus were widely distributed in the colder water. 0-group sandeels were again abundant in the south-eastern Barents Sea.

Reference

Haug, A. and Nakken, O. 1973. Echo abundance indices of 0-group fish in the Barents Sea 1965 - 1972. ICES/FAO/ICNAF Symposium on Acoustic Methods in Fisheries Research Bergen, June 1973. 1 - 13, 4 tab., 27 figs. [Mimeo.]

Table 1. Mean water temperature in the Murmansk current, the Kola section (between 70°30' N and 72 30' N) at the end of August (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1965-1976
0-50 m	6.7	6.7	7.5	6.4	6.7	7.8	7.1	8.7	7.7	8.1	7.0	8. 1	7.4
50-200 m	3.8	2.6	4.1	3.7	3.1	3.6	3.2	4.0	4. 5	3.9	4.6	4. 1	3.8
0-200 m	4.6	3.6	4.9	4.4	4.0	4.7	4.2	5.2	5.2	4.9	5.2	5. 1	4.7

Table 2. Mean water temperature in the North Cape current, the North Cape to Bear Island section (between 71°33' N, 25°02' E and 73°35' N, 20°46' E) at the beginning of September (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1965-1976
0-200 m	5.1	5.5	5.6	5.4	6.0	6.1	5.7	6.3	6.2	6.1	5.7	5.7	5.8

Table 3. Mean water temperature in the West Spitsbergen current along the West Bear Island section (between 06°34' E and 15°55' E) in early September (T °C)

Year/ Layer	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1966-1976
0-200 m	3.3	4.2	3.6	4.2	No data	4.2	3.9	5.0	4.6	4.9	5.0	4.3

Table 4. Mean water temperature between 0 m and bottom in the section Cape Kanin-North in early September (T °C)

Year/ Section	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1965-1976
68°45'N 70°05'N	4.8	2.0	6.1	4.7	2.6	4.0	4.0	5. 1	5.7	4.5	4.7	4.8	4.4
71°00'N 72°00'N	4.2	2.5	3.7	3.1	2.3	3.3	3.2	4. 1	4.5	3.9	No data	4.4	3.9

Table 5. Abundance indices

Species/ Year	Cod	Capelin	Haddock	Redfish	Polar cod	Long rough dab
1965	6	37	7	159	0	66
1966	< 1	119	< 1	236	129	97
1967	34	89	42	44	165	73
1968	25	99	8	21	60	17
1969	93	109	82	295	208	26
1970	606	51	115	247	197	12
1971	157	151	73	172	181	81
1972	140	275	46	177	140	65
1973	684	125	54	385	(26)	67
1974	51	359	147	468	227	83
1975	343	320	170	315	75	113
1976	43	281	112	447	131	96

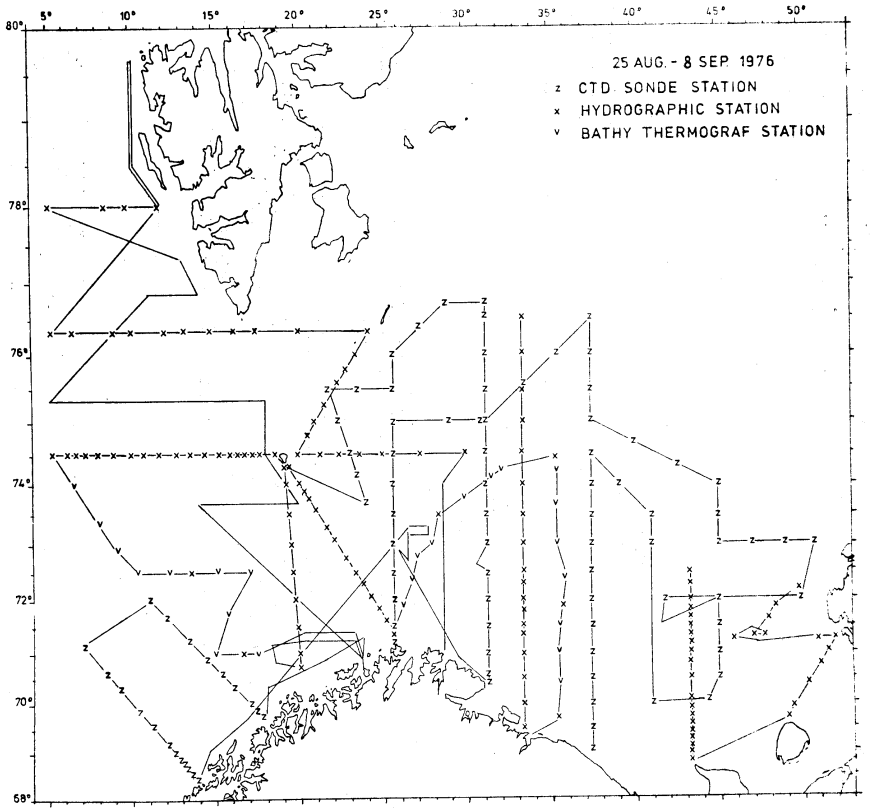

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

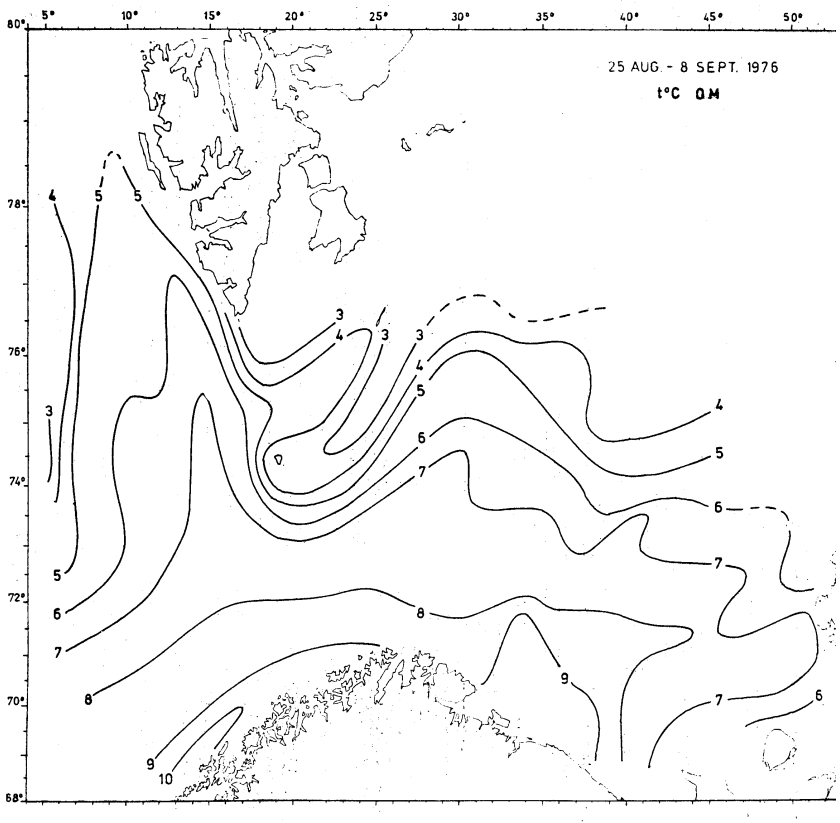

Fig. 2. Isotherms at 0 m

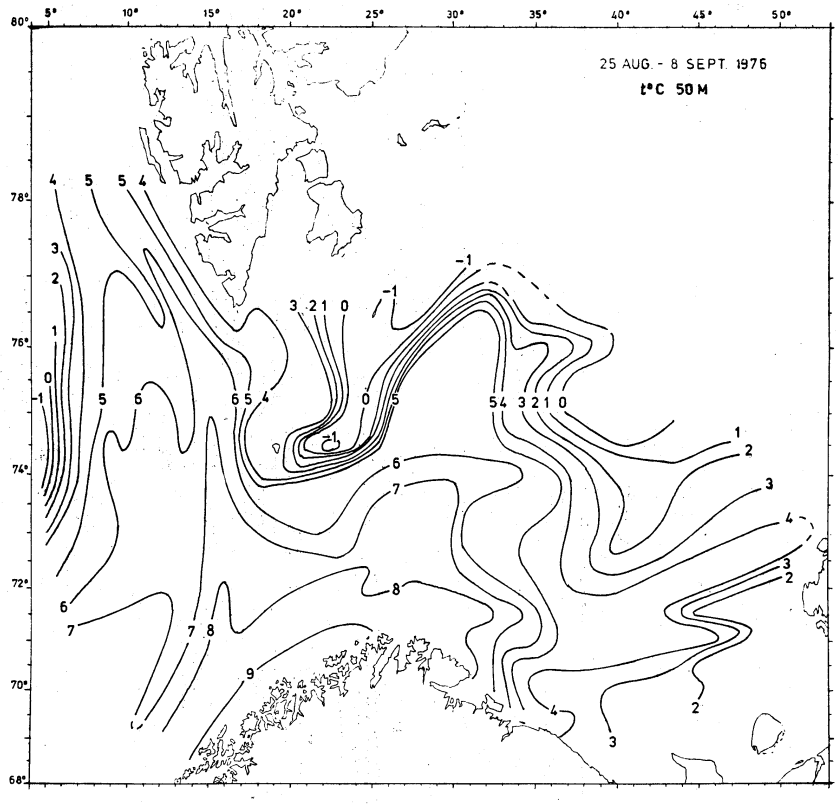

Fig. 3. Isotherms at 50 m

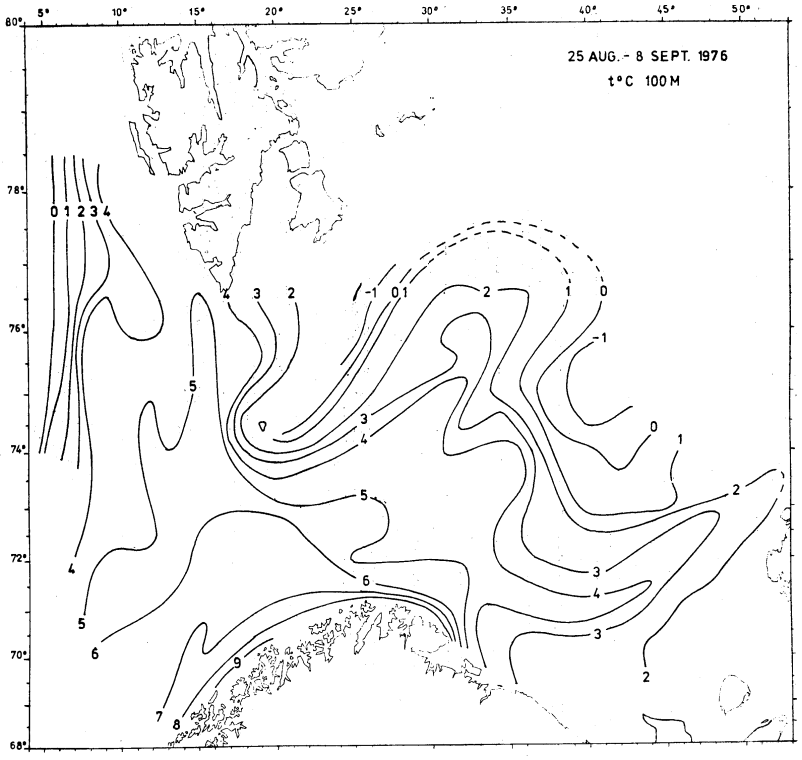

Fig. 4. Isotherms at 100 m

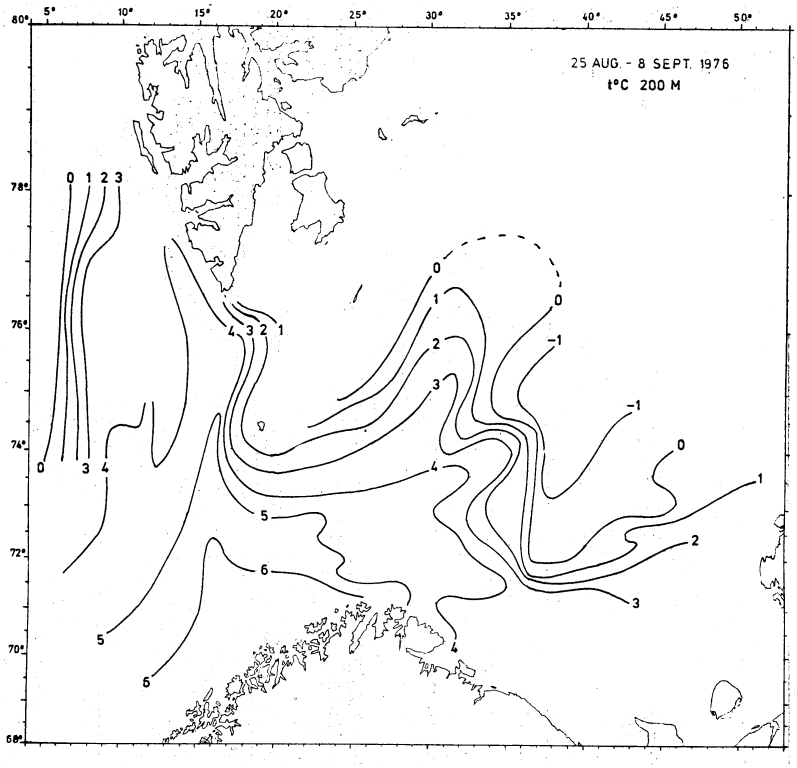

Fig. 5. Isotherms at 200 m

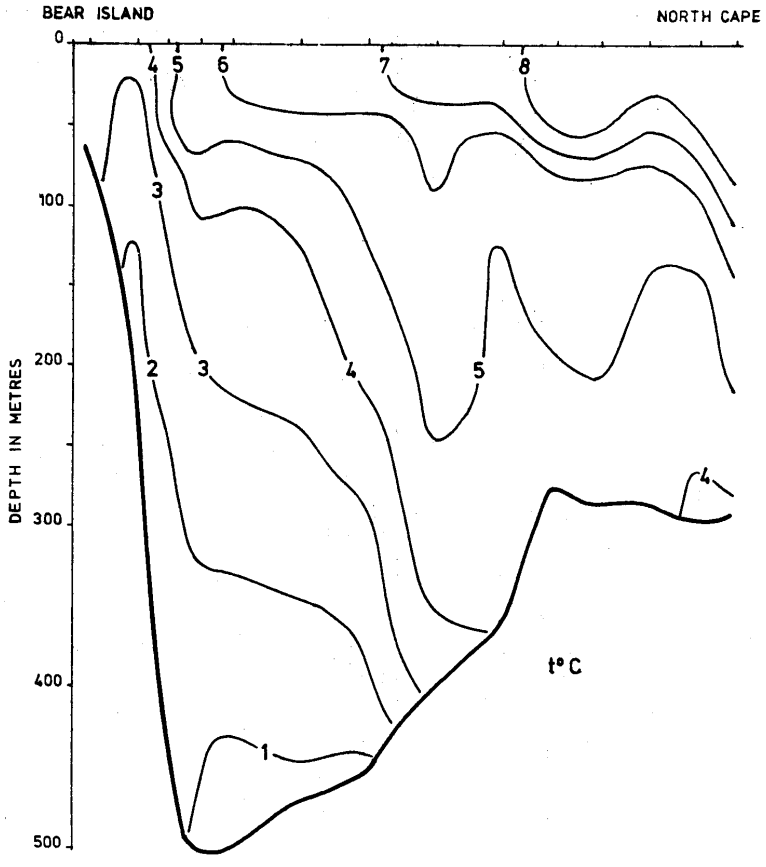

Fig. 6. Temperature section Bear Island-North Cape

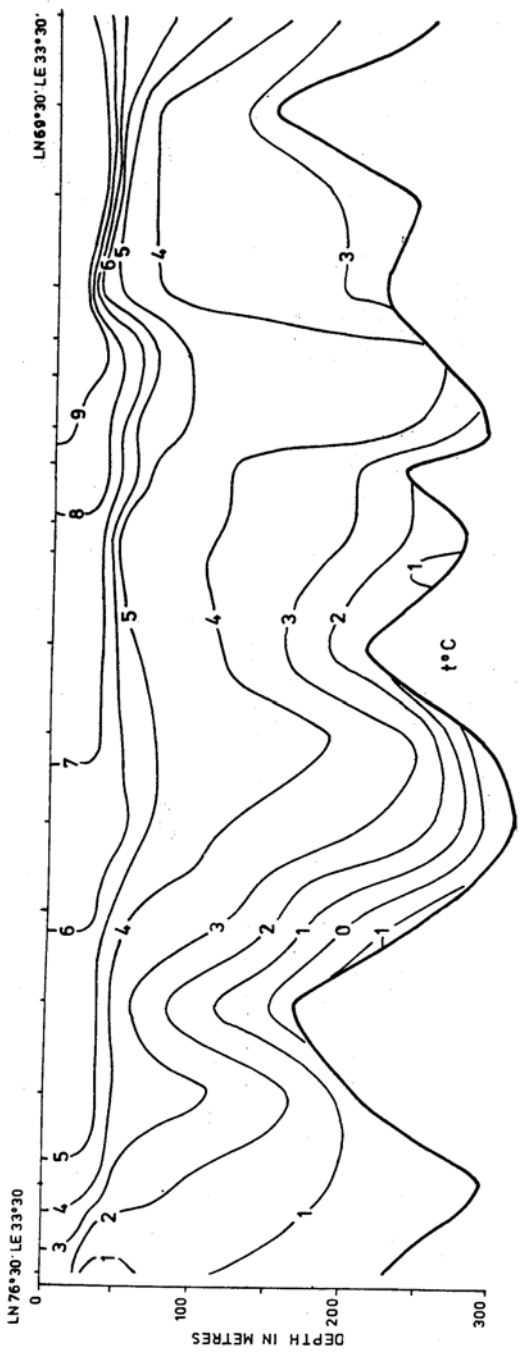

Fig. 7. Temperature section along the Kola meridian

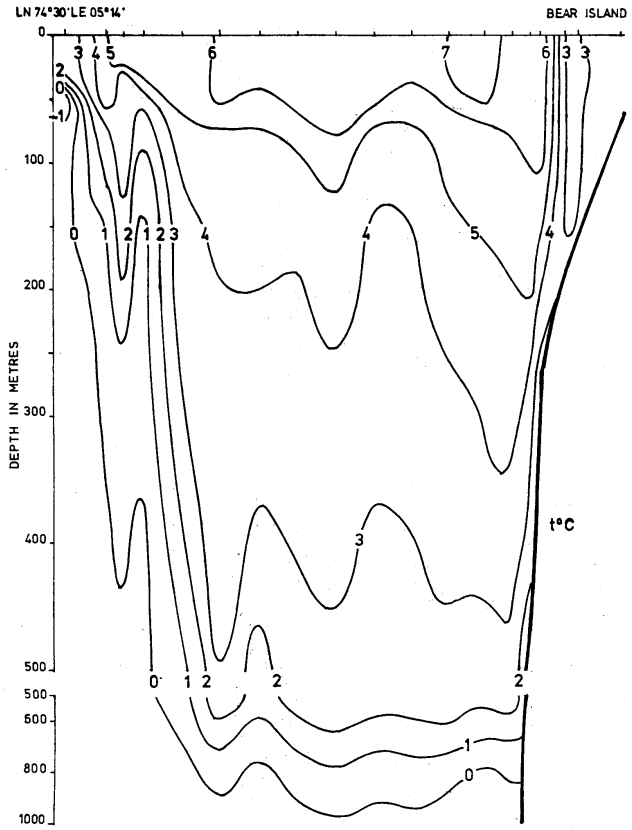

Fig. 8. Temperature section Bear Island-West

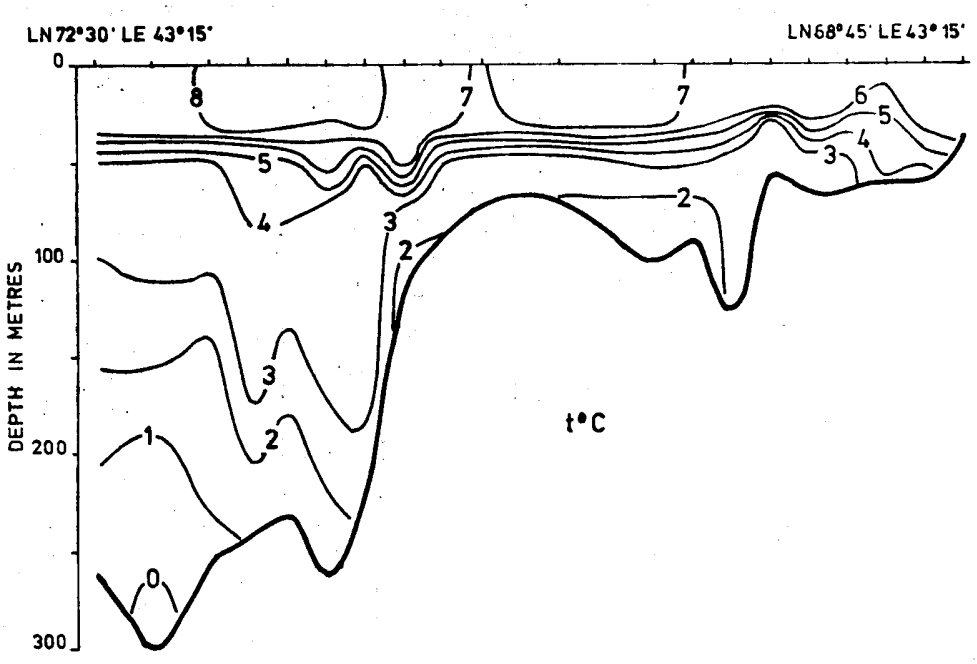

Fig. 9. Temperature section along the Cape Kanin meridian

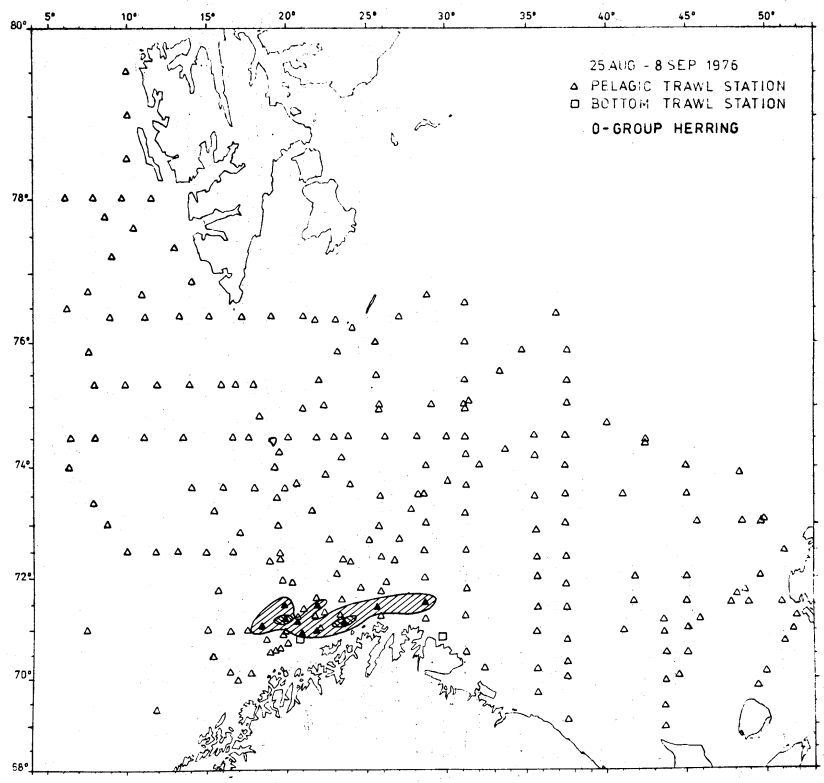

Fig. 10. Distribution of 0-group herring

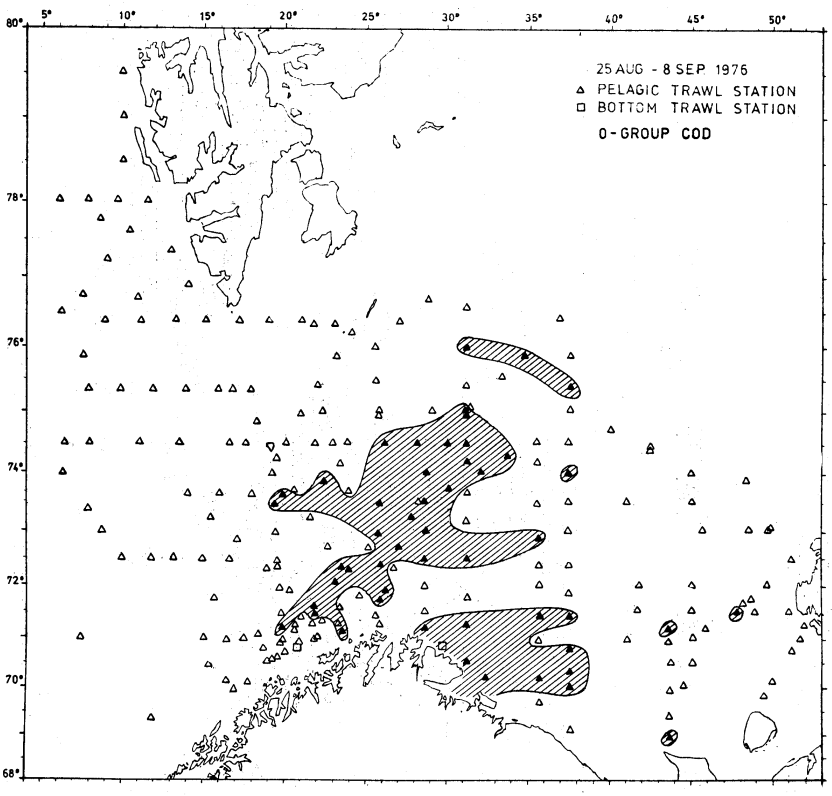

Fig. 11. Distribution of 0-group cod

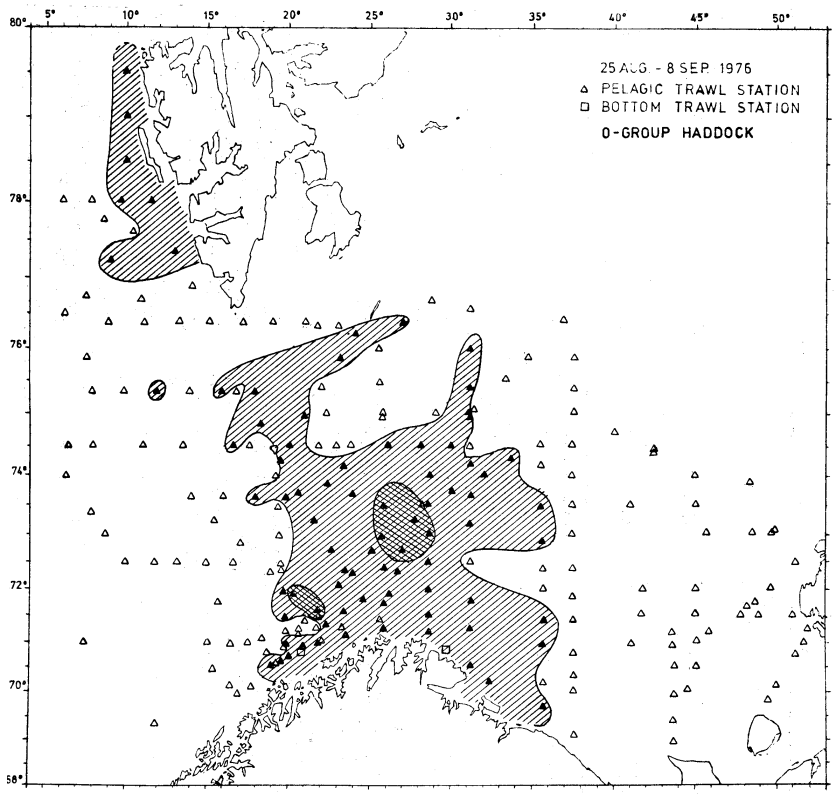

Fig. 12. Distribution of 0-group haddock

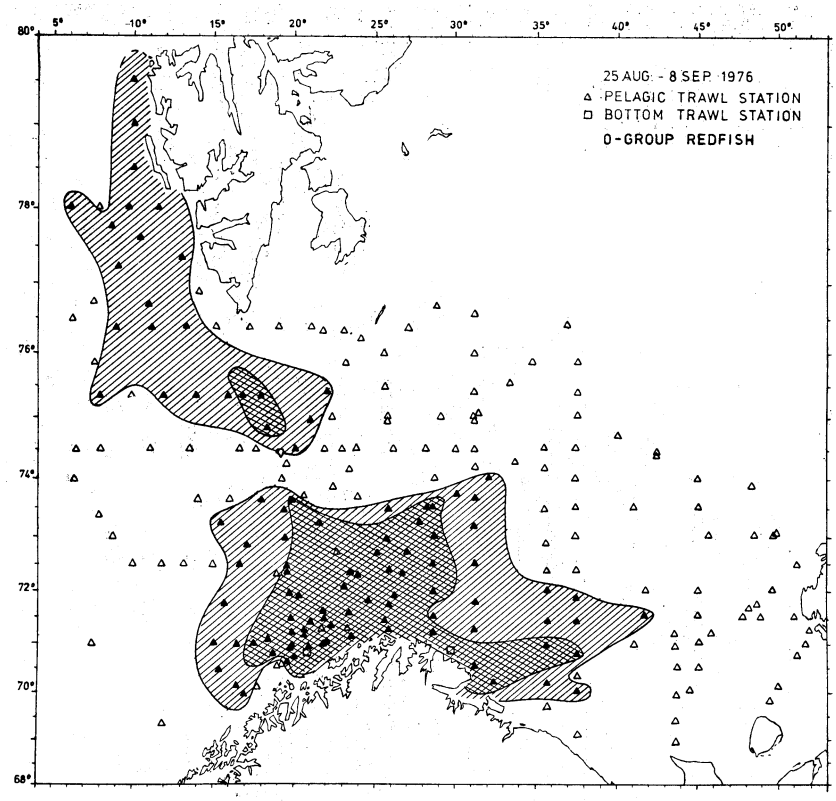

Fig. 13. Distribution of 0-group redfish

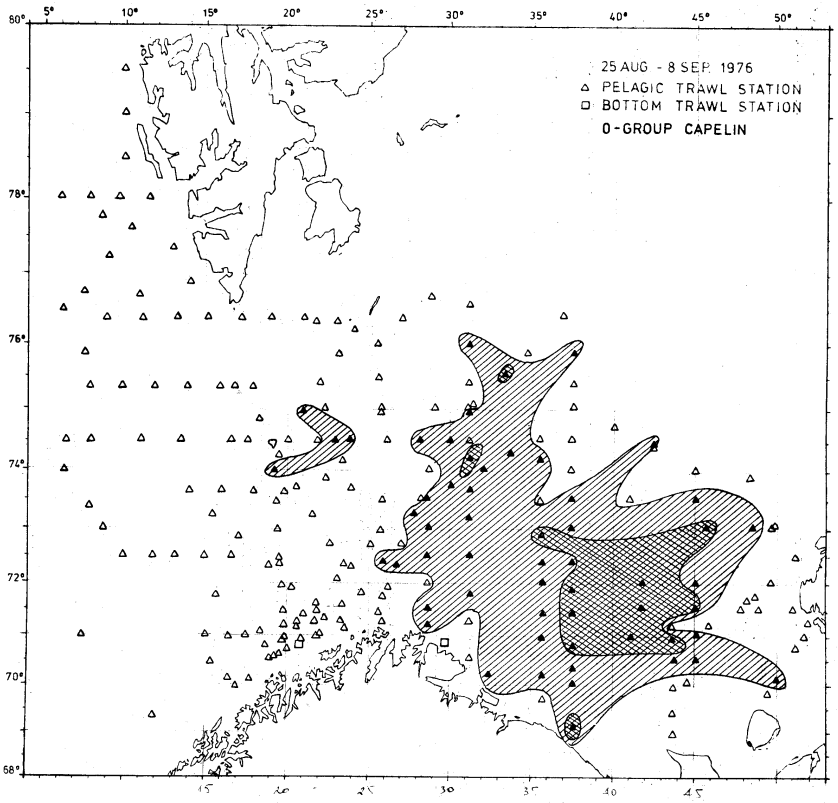

Fig. 14. Distribution of 0-group capelin

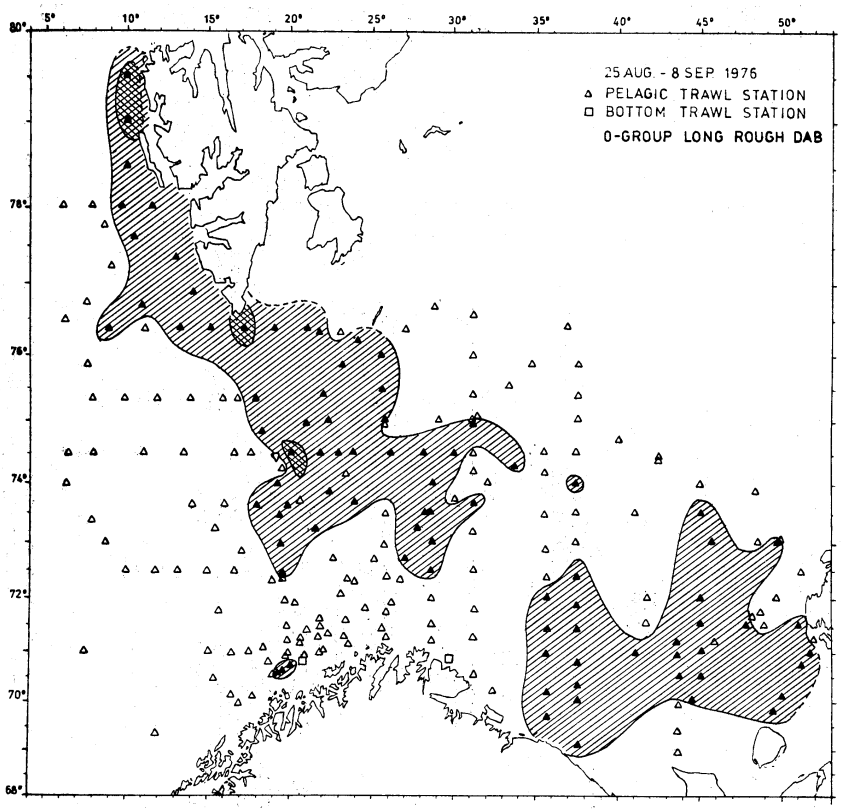

Fig. 15. Distribution of 0-group long rough dab

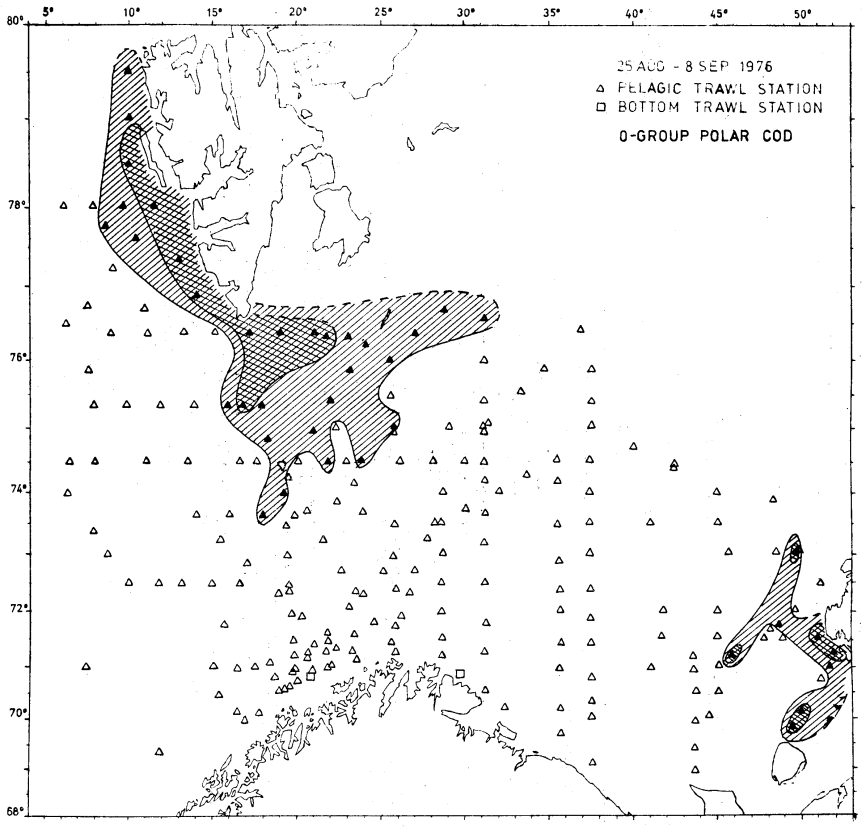

Fig. 16. Distribution of 0-group polar cod

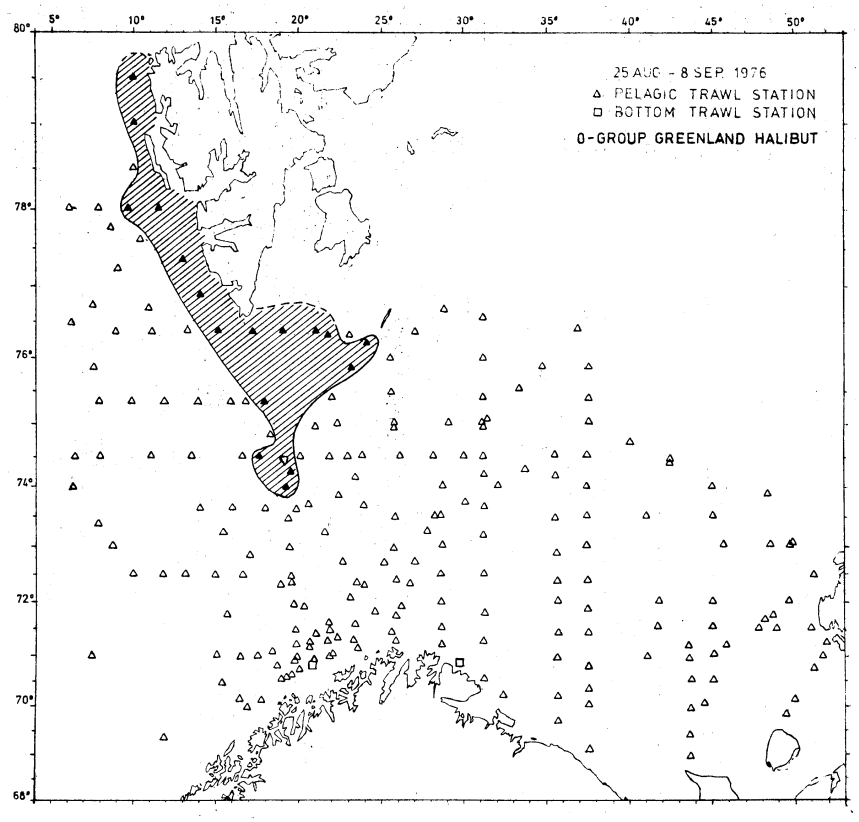

Fig. 17. Distribution of 0-group Greenland halibut

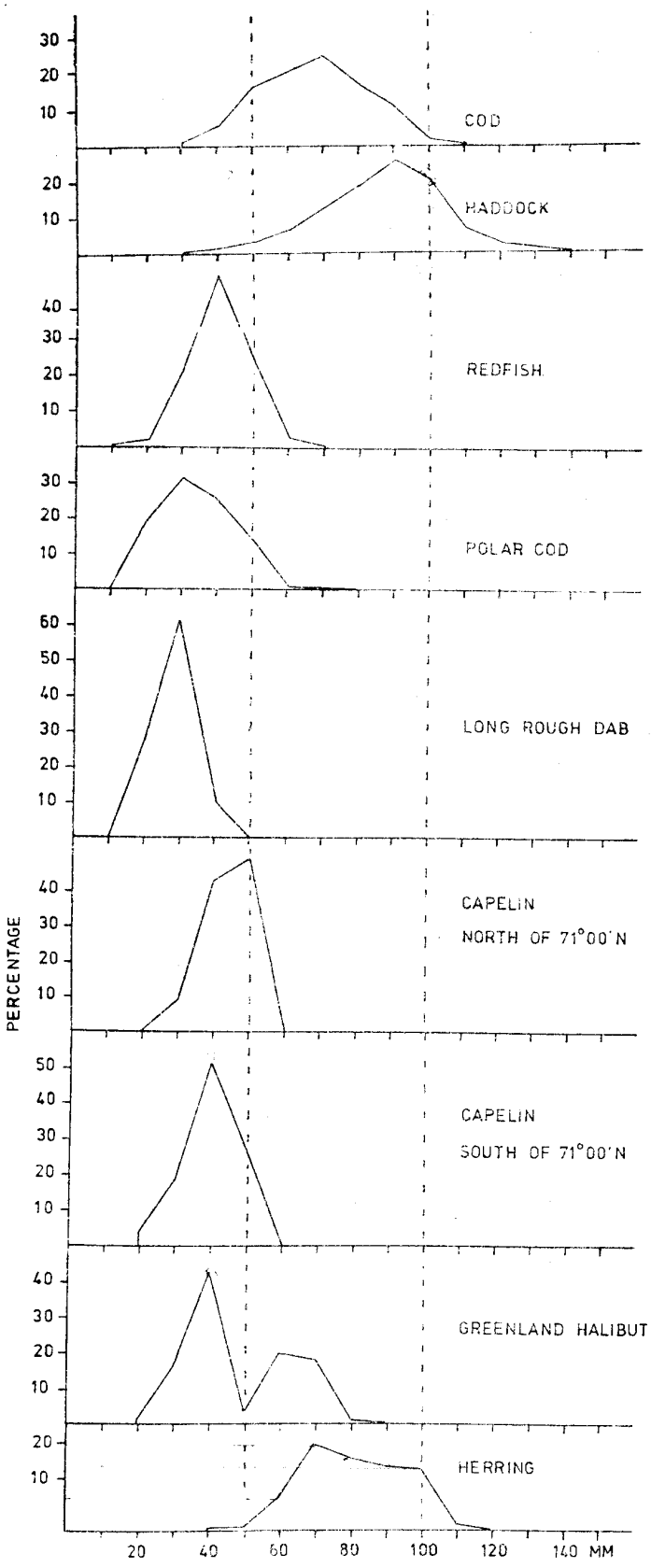

Fig. 18. Length distribution of 0-group fish

International Council for
the Exploration of the Sea

CM 1977/H:45
Pelagic Fish (Northern) Committee
Ref: Demersal Fish (Northern) and
Hydrographic Committees

Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August-September 1977

Introduction

The following research vessels participated in the thirteenth international 0-group fish survey in the Barents Sea and the Svalbard region:

State	Name of vessel	Survey period	Research Institute
Norway	"G.O. Sars"	22 Aug. - 11 Sept.	Institute of Marine Research, Bergen
Norway	"Johan Hjort"	20 Aug. -11 Sept.	" "
USSR	"Odissey"	31 Aug.- 11 Sept.	The Polar Reseach Institute of Marine Fisheries and Oceanography, Murmansk
USSR	"Fridtjof Nansen"	26 Aug. - 11 Sept.	" "
USSR	"Poisk"	25 Aug. - 11 Sept.	" "

The scientists and technician who took part on the different vessels are given in the Appendix.

The aim of the survey has each year been to study the distribution and the abundance of 0-group fish in the area. Preliminary plan for the 1977 survey was discussed by correspondence. Final arrangements for the coordination of the survey were discussed in Murmansk on the 22 August between scientists from the two Institutes responsible for the investigation. The survey program was covered in the period 20 August - 11 September. A meeting of scientists from the two participating countries was held in Hammerfest on 12 - 13 September to analyse the data and to prepare a report.

Material and methods

The geographical distribution and density of the 0-group fish were estimated by fishing with small meshed midwater trawls in the pelagic scattering layer, mainly between 0-50 m. However, echo sounder paper records and echo integrator measurements were also used as guide in these estimations.

A trawl haul was made about every 30 nautical miles sailed. Trawling distance was mainly 1 n. mile, and the trawling speed was about 3 knots. In layer with no 0-group fish recordings the hauls were made in the surface by using floats on the headline of the trawl and 50 m wire. On localities with some 0-group fish recordings in the 0-35 m layer the trawl -with floats was towed for 0. 5 n. mile in the surface and 0. 5 n. mile at 25 m by using 25 m more wire. By trawling deeper than 35 m the trawl had to be used without floats, and depth

metering devices were used for accurate control of the depth of trawling. All vessels used the modified capelin trawl with an opening of (18-15) m except for "Fridtjof Nansen" and "Poisk", who used a smaller trawl with an opening of (6-10) m.

The described trawling procedure has involved a higher trawling frequency in the surface during the 1977 survey than in previous surveys. Such improved sampling techniques results probably in higher index of abundance for 0-group capelin (Beltestad et. al. 1975).
Fig. 1 show the survey tracks of the ships and the hydrographic stations worked. Positions of trawl stations are indicated on the species distribution charts (Fig. 9-16).

Results

Hydrography (Figs. 2-8)

As in previous years hydrographic observations were carried out along the survey tracks. The temperature conditions are shown in Figs. 2-5. At three main sections (Figs. 6-8) the mean temperature have been compared with the average temperature from the period 1965-1977. The results are listed in Tables 1-3. Some few comments are given:

a) The Kola Section:

The mean temperature in all layers are somewhat lower than normal. The anomalies are -0.6°, -0.3° and -0.3° for the layers 0-50 m, 50-200 m and 0-200 m respectively.

b) The North Cape - Bear Island Section:

The mean temperature in the 0-200 m layer is 4.9° or 0.8° lower than the 1965-1977 average. This is the lowest mean temperature observed for the period 1965-1977.

c) The Bear Island - West Section:

The mean temperature is 0.3° below the average for the period 1966-1977.

Generally, the temperature conditions in the Barents Sea and West Spitsbergen waters are low in 1977. This should indicate low water transport of the main current systems, particularly low inflow to the
Barents Sea.

Distribution and abundance of 0-group fish

The distribution of 0-group fish of the main species are shown by the shaded areas in Figs. 9-16. Estimates of abundance which were calculated by the method of Haug and Nakken (1977), are given in Table 4 where they can be compared with estimates prepared from earlier surveys, yearly reported to ICES. Length frequency distribution of the main species are shown in Fig. 17.

Herring (Fig. 9)

A small patch of 0-group herring was observed along the coast of Northern Norway, extending from Senja Island to the North Cape area. The distribution area was slightly larger than last year, but the density was lower. The herring were small in size and the metamorphosis had not started.

Capelin (Fig. 10)

0-group capelin was distributed in several patches in the central and eastern part of the Barents Sea. The abundance was lower than the three previous years. The capelin were small in size and mainly distributed in the very surface layer.

Cod (Fig. 11)

The 0-group cod was mainly distributed in the central part of the Barents Sea. However, in contrast to the three proceeding years cod were also observed in the Bear Island - Spitsbergen area up to 80° N. The index of abundance indicates that the 1977 year-class is of above average strength (Table 4). This year the cod were smaller in size compared to 1976.

Haddock (Fig. 12)

The distribution of haddock was similar to that observed in 1976. However, the abundance was higher in the Bear Island – Spitsbergen area. The 1977 year-class is an abundant one, but not as abundant as the 1975 and 1974 year-classes. The size of the 0-group haddock was smaller this year than in 1976, and the specimens caught in the northwestern part of the survey area was smaller than the specimens in the central part.

Polar cod (Fig. 13)

Polar cod was as in earlier years distributed in two separate areas. The distribution in the Spitsbergen area was similar to that of 1976, and the abundance index indicates that the year class was above average.

The area of distribution along the coast of Novaya Zemlja was larger than last year, but the density was very low. The abundance index for this component indicates that the 1977 year-class is of low abundance. The size distributions are approximately the same as that of 1976.

Redfish (Fig. 14)

The 0-group redfish had a more western distribution than previous years, but the area of dense concentrations was similar to that of 1976. The index of abundance indicates that the 1977 year-class is a very rich year class comparable to that of 1974 and 1976. The 0-group redfish were slightly smaller in size compared to 1976, especially in the western part of the survey area.

Greenland halibut (Fig. 15)

As in previous years, Greenland halibut were only recorded in the West Spitsbergen area. The abundance was lower than the three previous years.

Long rough dab (Fig. 16)

This species was distributed over a wide area, but at low density like previous years. The abundance index indicates that the 1977 year-class is of average abundance. The size of the fish was approximately similar to 1976.

Other species

Small numbers of 0-group mackerel, saithe, catfish and blue whiting were caught on a few trawl stations during the survey. 0-group Leptagonus, Liparis, Lumpenus and Acanthocottus were widely distributed in the colder water. 0-group sandeels were as in previous years abundant in the south-eastern Barents Sea.

References

Beltestad, A.K., Nakken, O. and Smedstad, O.M. 1975. Investigations on diel vertical migration of 0-group fish in the Barents Sea. Fiskdir. Skr. Ser. Havunders., 16: 229-244.

Haug, A. and Nakken, O. 1977. Echo abundance indices of 0-group fish in the Barents Sea 1965-1972. Rapp. P. -v. Reun. Cons. int. Explor. Mer, 170: 259-264.

Table1. Mean water temperature in the Murmansk current, the Kola section (between 70°30' N and 72°30' N) at the end of August (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1965-1977
0-50 m	6.7	6.7	7.5	6.4	6.7	7.8	7.1	8.7	7.7	8.1	7.0	8.1	6.9	7.3
50-200 m	3.8	2.6	4.0	3.7	3.1	3.6	3.2	4.0	4.5	3.9	4.6	4.0	3.4	3.7
0-200 m	4.6	3.6	4.9	4.4	4.0	4.7	4.2	5.2	5.5	4.9	5.2	5.0	4.3	4.6

Table 2. Mean water temperature in the North Cape current, the North Cape to Bear Island section (between 71°33' N, 25°02' E and 73°35' N, 20°46' E) at the beginning of September (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1965-1977
0-200 m	5.1	5. 5	5.6	5.4	6.0	6.1	5.7	6.3	5.9	6.1	5.7	5.7	4.9	5.7

Table 3. Mean water temperature in the West Spitsbergen current along the West Bear Island section (between 06°34' E and 15°55' E) in early September (T °C)

Year/ Layer	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1966-1977
0-200 m	3.3	4.2	3.6	4.2	No data	4.2	3.9	5.0	4.6	4.9	5.0	4.0	4.3

Table 4. Abundance indices

Species/ Year	Cod	Capelin	Haddock	Redfish	Polar cod			Long rough dab	Greenland halibut
					West		East		
1965	6	37	7	159		0		66	
1966	<1	119	< 1	236		129		97	
1967	34	89	42	44		165		73	
1968	25	99	8	21		60		17	
1969	93	109	82	295		208		26	
1970	606	51	115	247		197		12	< 1
1971	157	151	73	172		181		81	< 1
1972	140	275	46	177		140		65	8.0
1973	684	125	54	385		(26)		67	3.2
1974	51	359	147	468		227		83	13.4
1975	343	320	170	315		75		113	21.1
1976	43	281	112	447		131		96	15.6
1977	173	194	116	472	157		70	72	9.0

Appendix

Survey period	Research vessel	Research Institute	Participants
22 August- 11 September	"G.O.Sars"	Institute of Marine Research, Bergen.	O. Annaniassen, O. Alvheim, S. Brattås, J. Dalen, K. Hansen, A. Hylen, H.Kismul,H. P. Knudsen, E. Lifjell, L. Midttun, O.M. Smedstad.
20 August- 11 September	"Johan Hjort"	Institute of Marine Research,Bergen.	I. Hoff, K.A. Larsen, S. Lygren, J. Monstad, T. Monstad, O. Martinsen,A. Pedersen, I. Røttingen, B. Skarsten, Ø. Torgersen.
31 August- 11 September	"Odissey"	Polar Research Institute of Marine Fisheries and Oceanography (PINRO), Murmansk.	V.N. Kuznetsov, A.S. Galkin, S.D. Melnikov, O.F. Pavlov, V.S. Mamylov, E.A. Sorokin, V.V. Vidosov, V.N. Ryazantsev, H.I. Kovtsov, G.V. Popkov, Mrs. A.V. Il'ina, Miss L.N. Popova, A.M. Gavrikov.
26 August- 11 September	"Fridtjof Nansen"	PINRO, Murmansk.	I.V. Borkin, Yu.F. Shevtsov, S.V. Rochitelev, N.P. Chebotok.
25 August- 11 September	"Poisk"	PINRO, Murmansk.	E.N. Gavrilov, N.A. Isaev, T.P. Yarovoy.

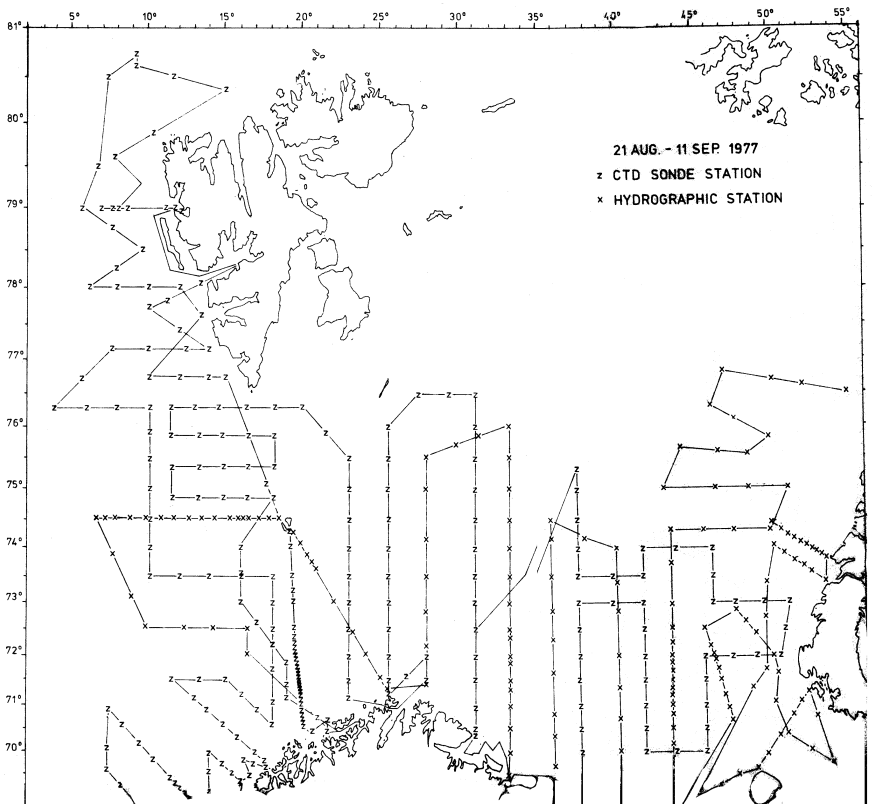

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

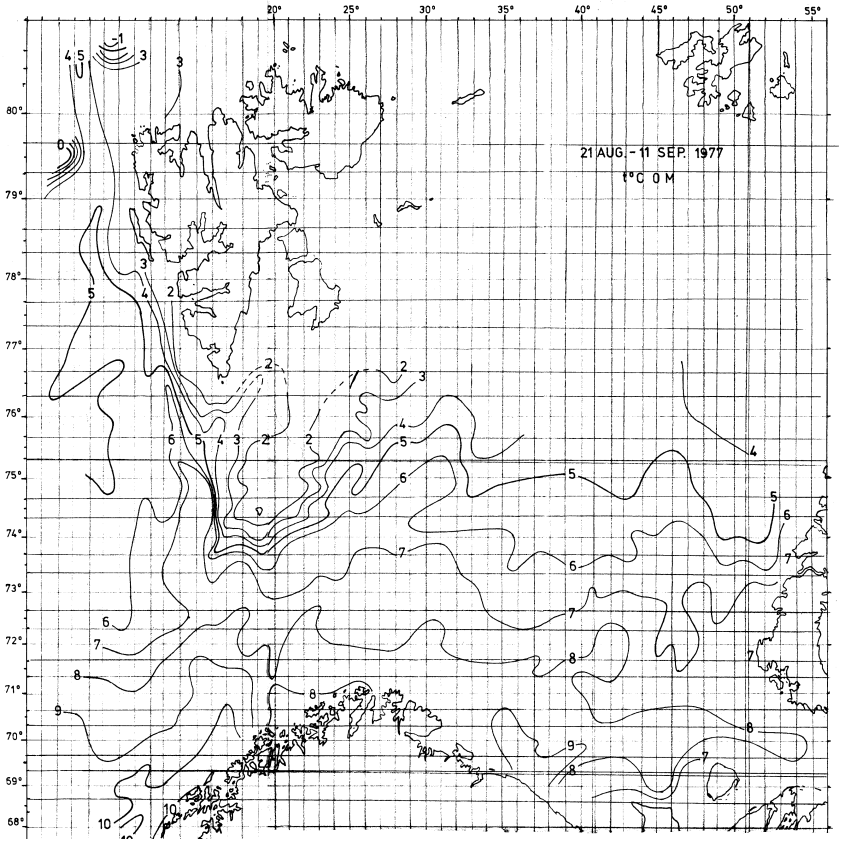

Fig. 2. Isotherms at 0 m

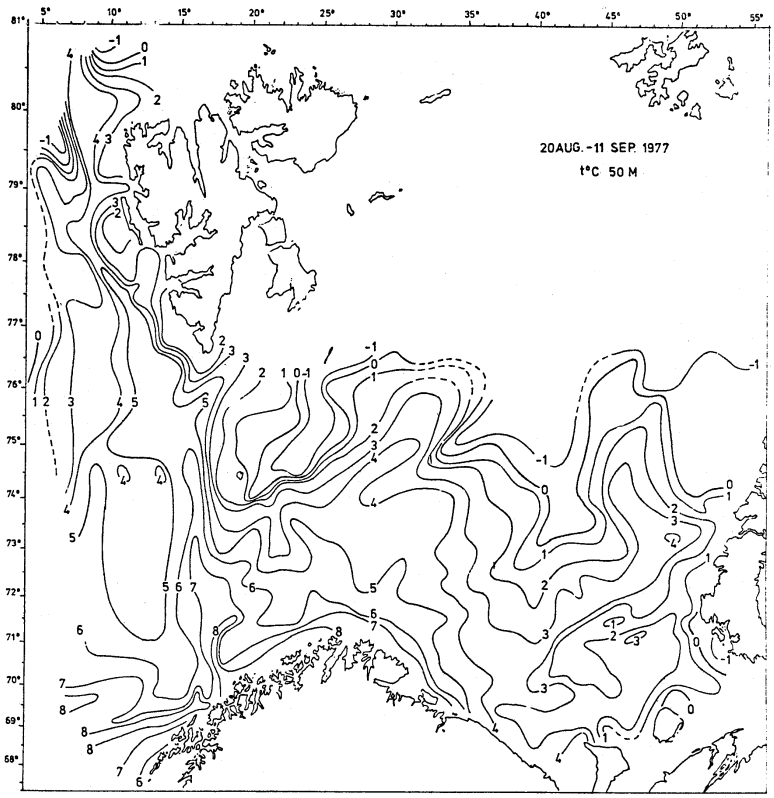

Fig. 3. Isotherms at 50 m

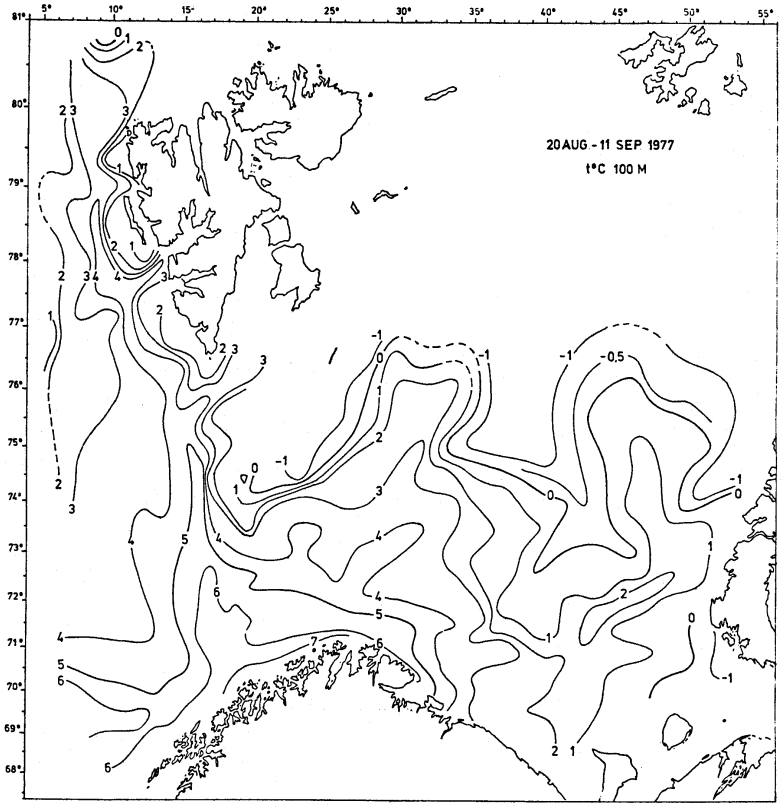

Fig. 4. Isotherms at 100 m

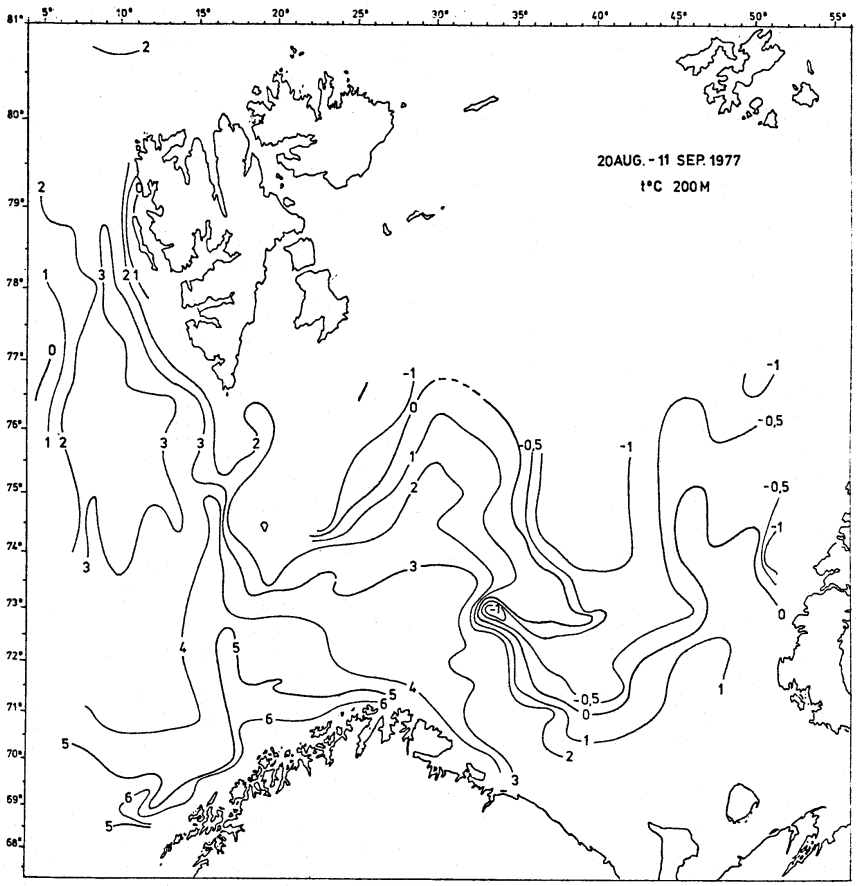

Fig. 5. Isotherms at 200 m

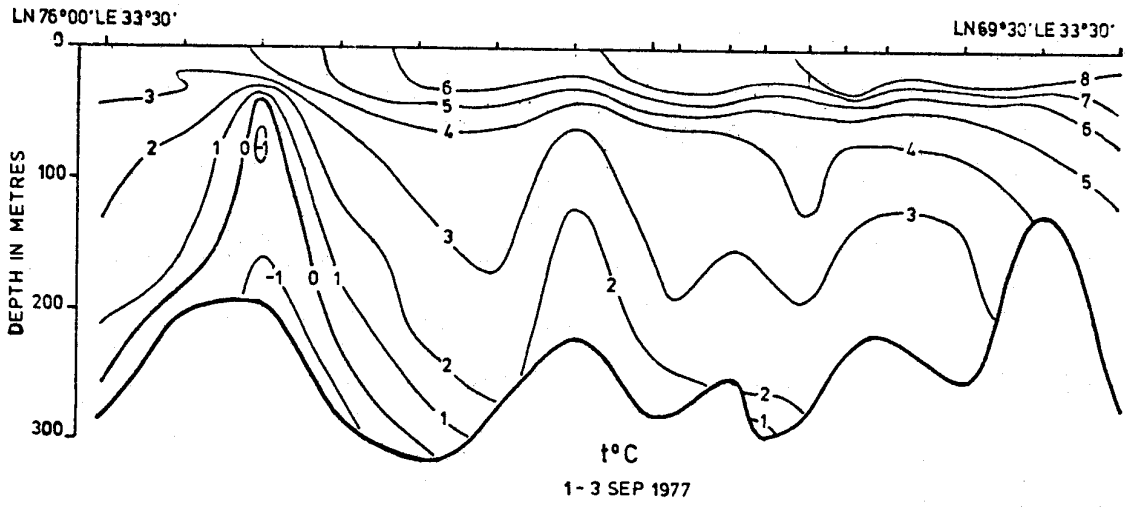

Fig. 6. Temperature section along the Kola meridian

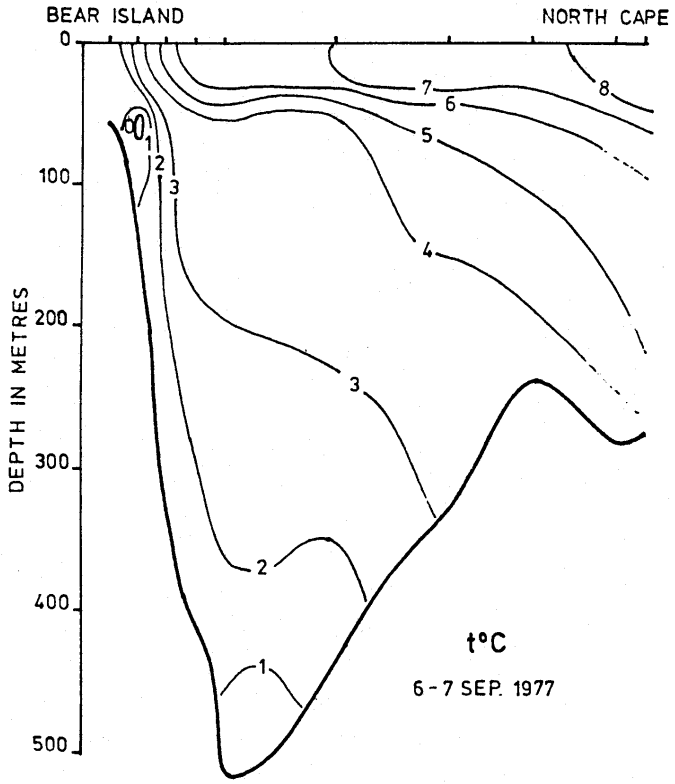

Fig. 7. Temperature section Bear Island-North Cape

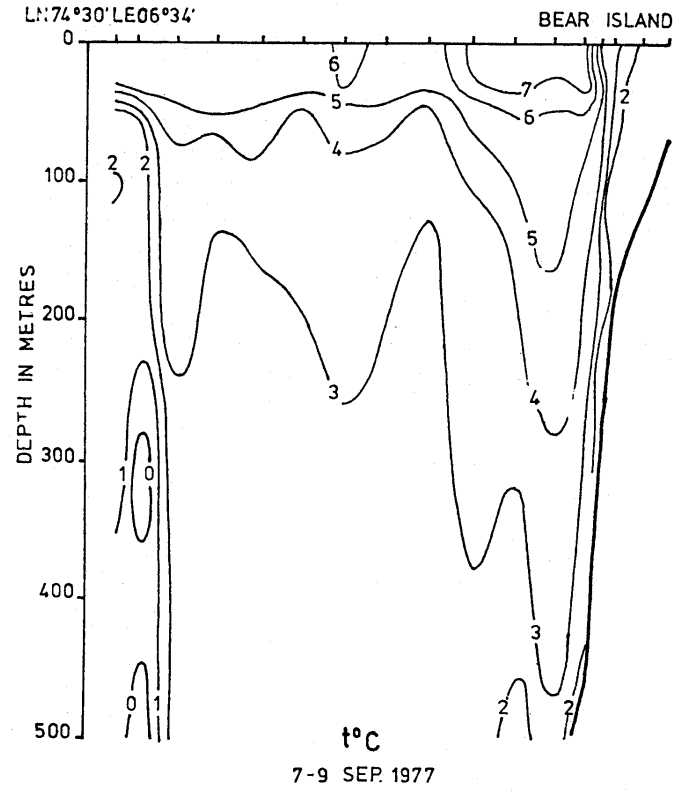

Fig. 8. Temperature section Bear Island-West

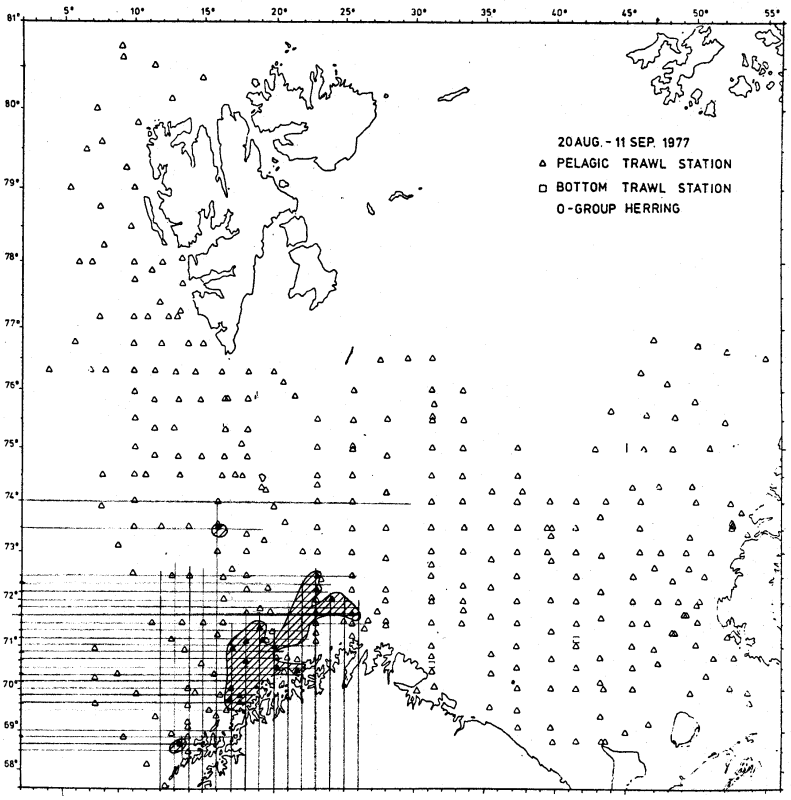

Fig. 9. Distribution of 0-group herring

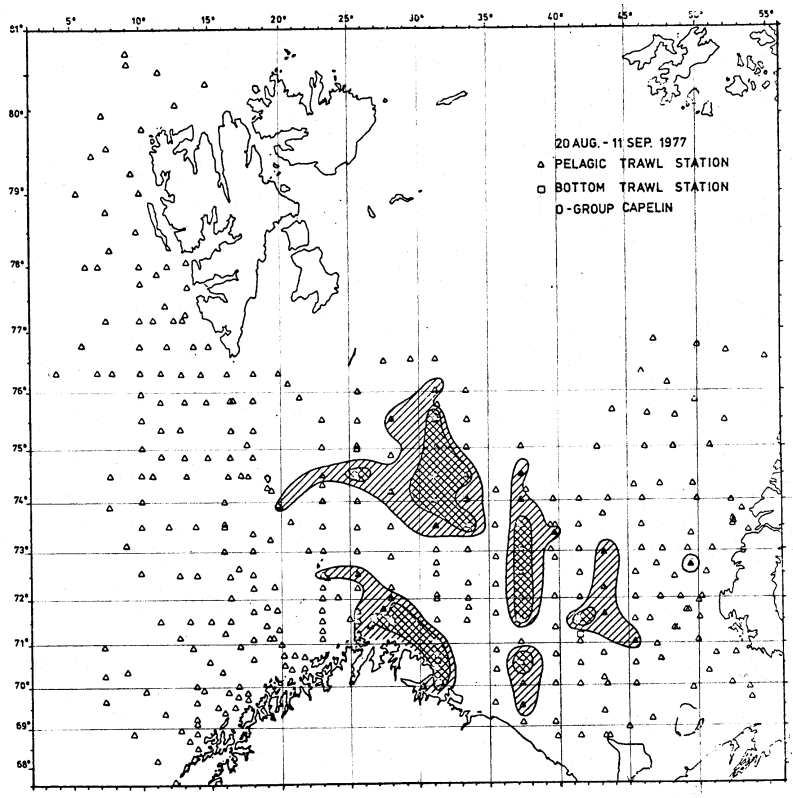

Fig. 10. Distribution of 0-group capelin

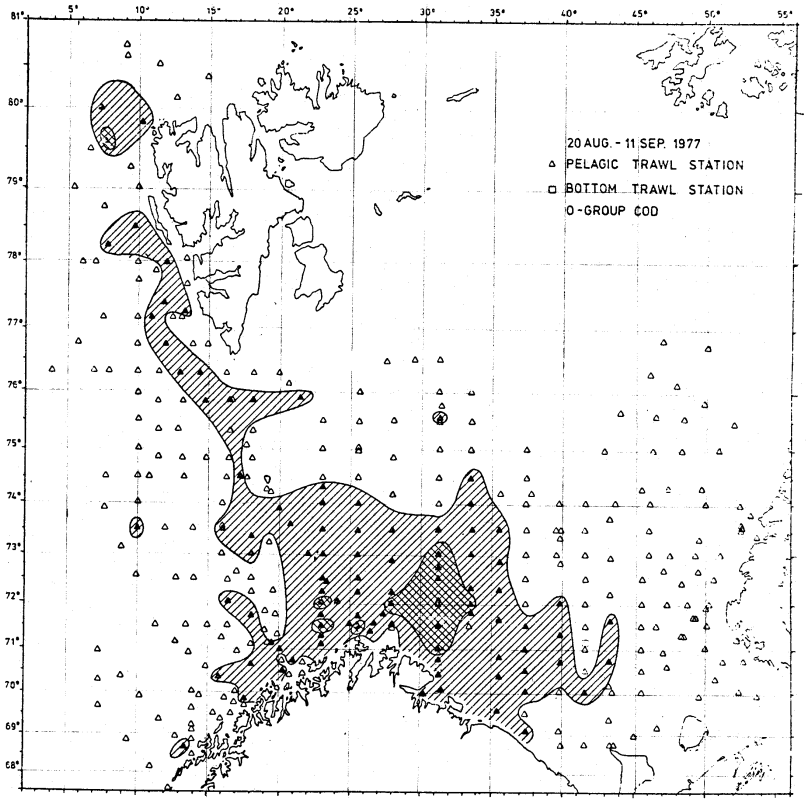

Fig. 11. Distribution of 0-group cod

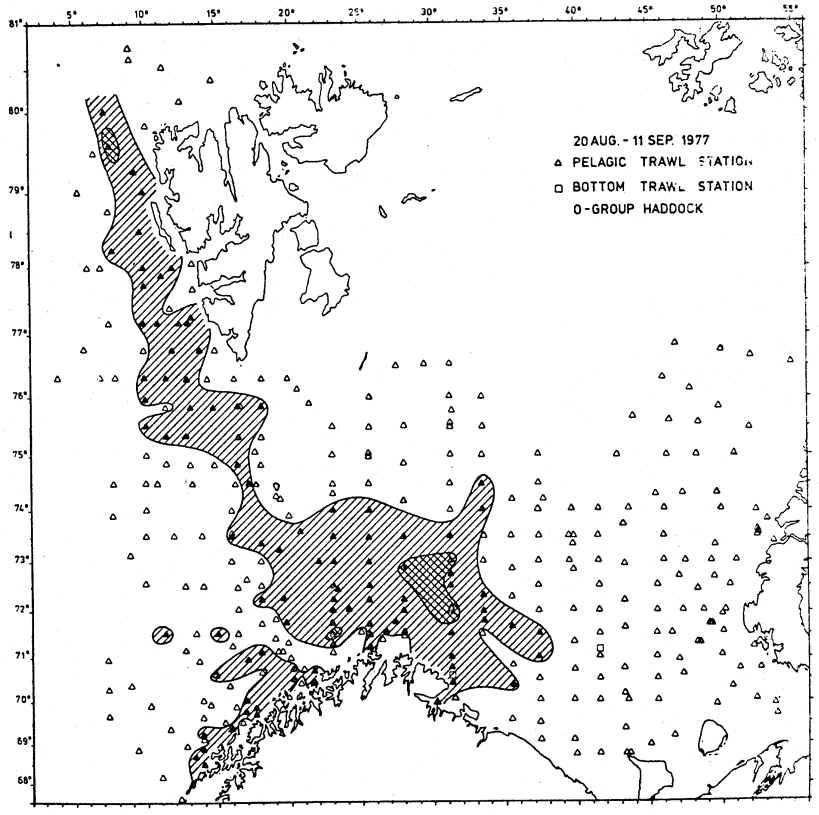

Fig. 12. Distribution of 0-group haddock

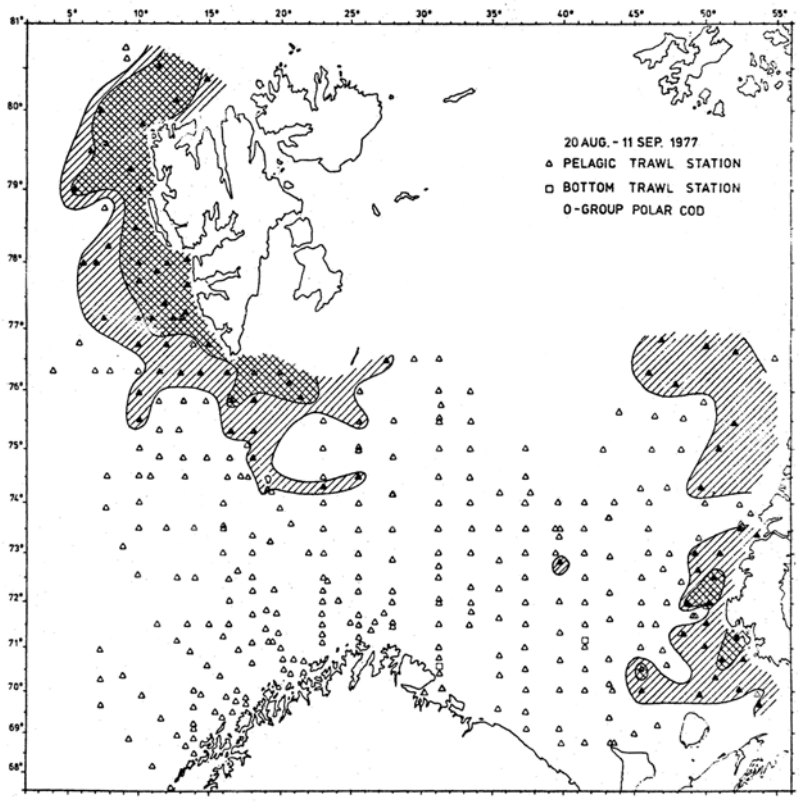

Fig. 13. Distribution of 0-group polar cod

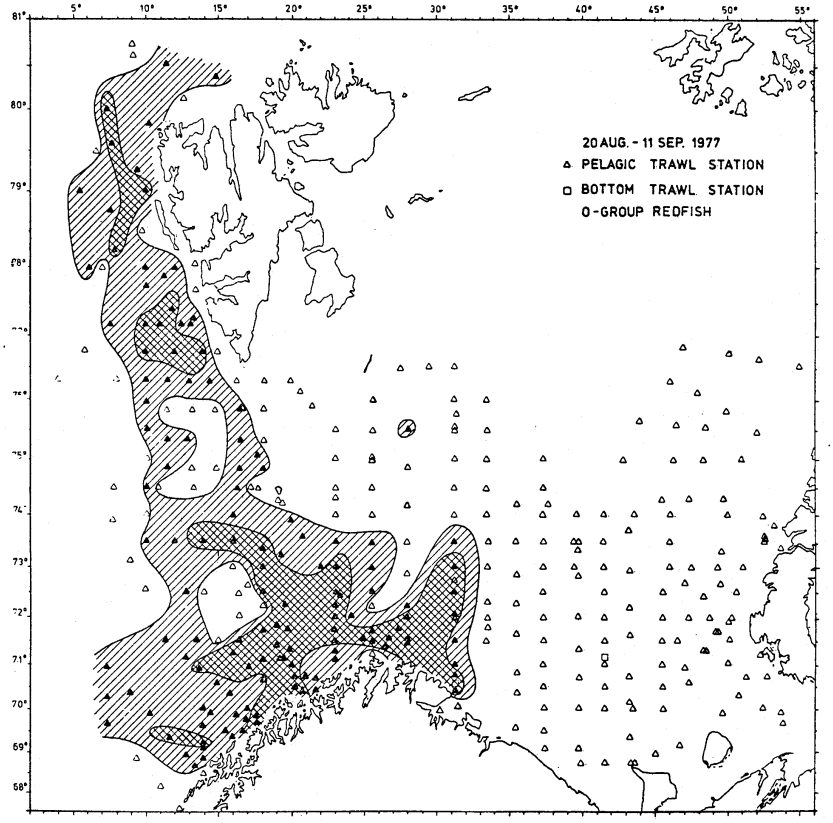

Fig. 14. Distribution of 0-group redfish

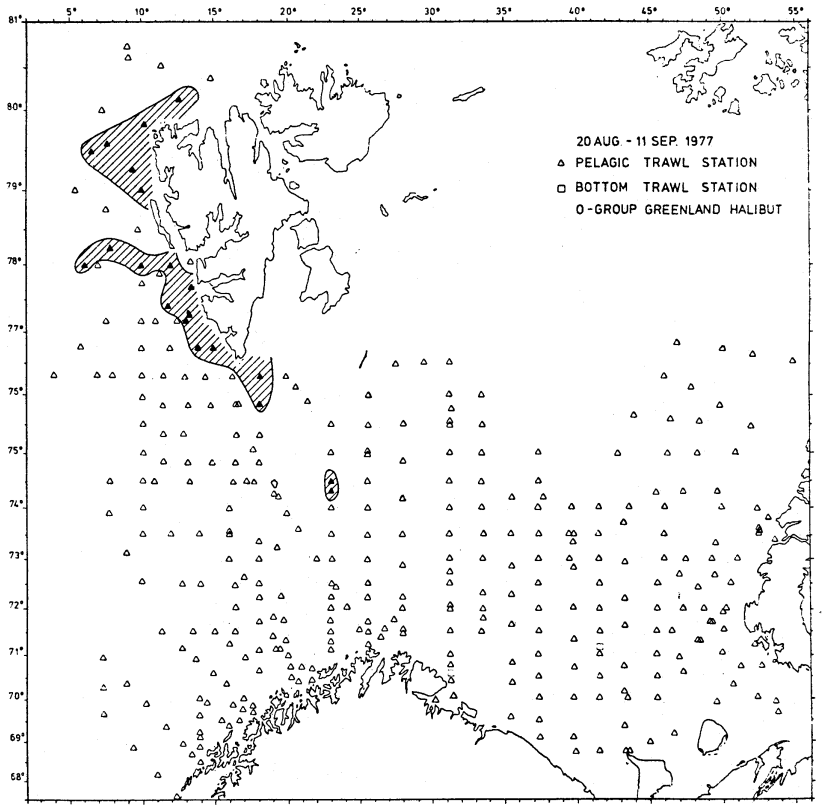

Fig. 15. Distribution of 0-group Greenland halibut

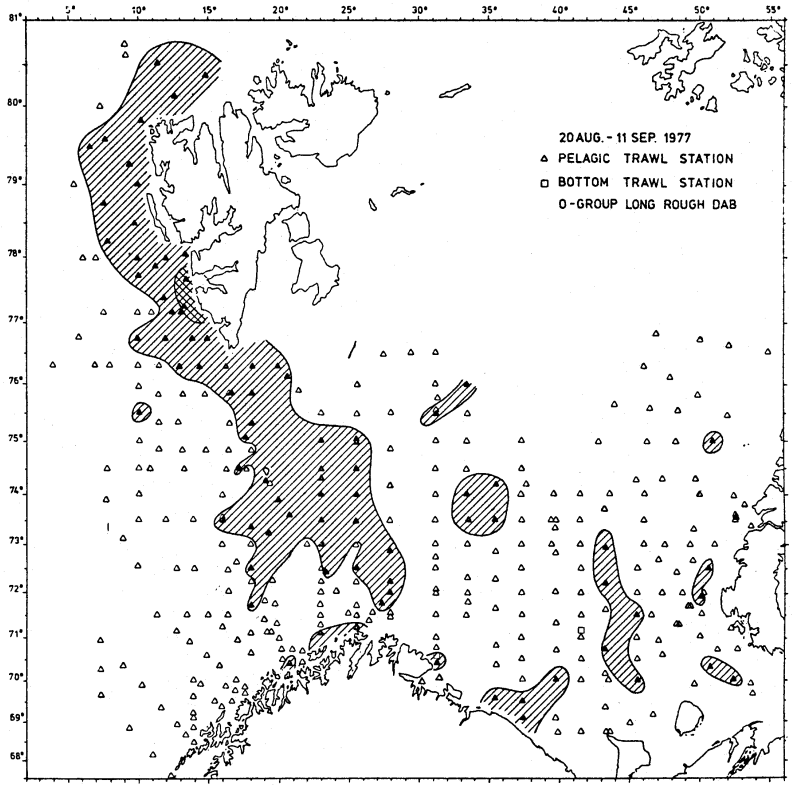

Fig. 16. Distribution of 0-group long rough dab

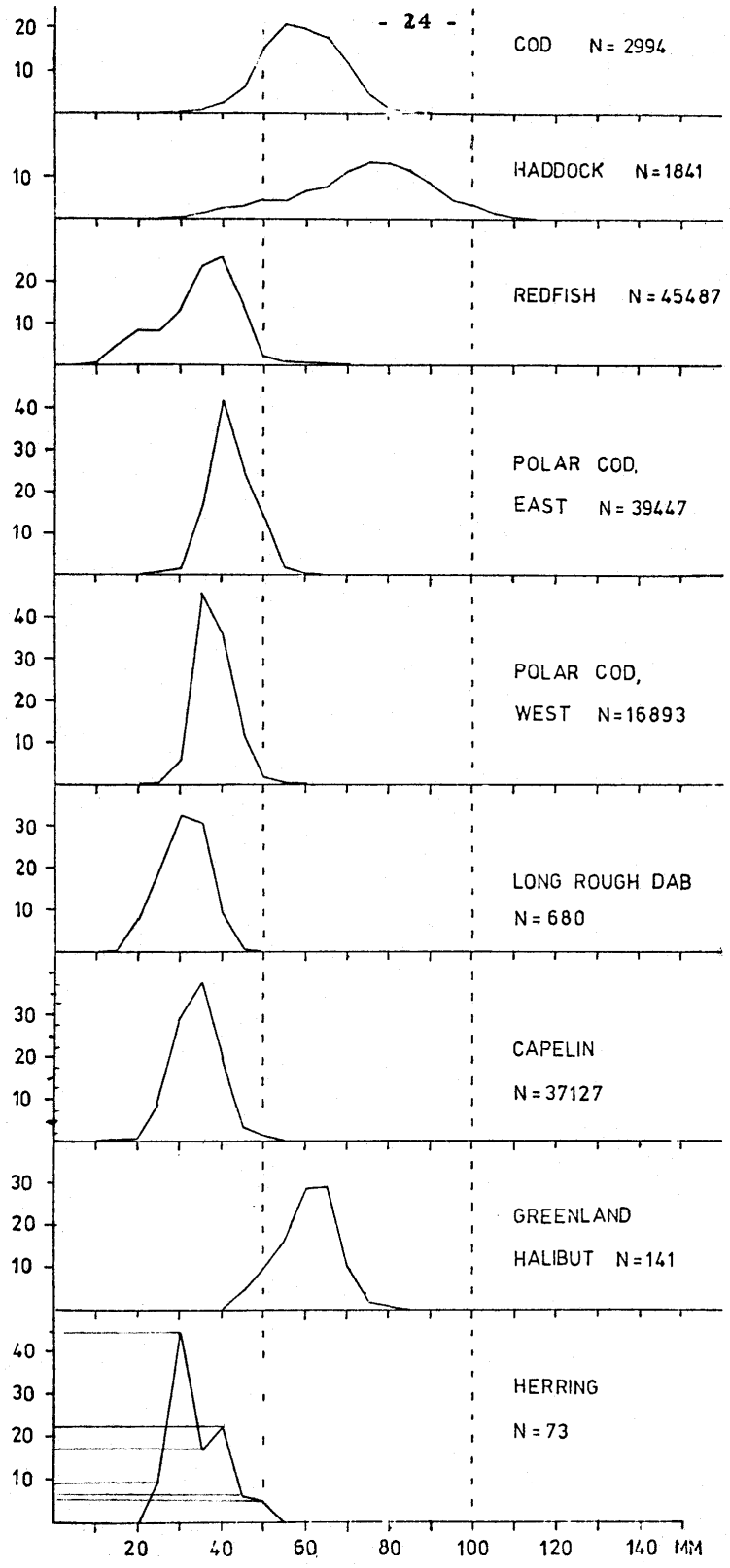

Fig. 17. Length distribution of 0-group fish

ICES C.M. 1978/H:33, 24 pp.

Report of the International 0-gruup fish survey in the Barents Sea and adjacent waters in August-September 1978

Introduction

The aim of this airway has been to study geographical distribution and the abundance of 0-group fish in the area. Some of the hydrographical observation made during the survey are used to give the temperature distribution at certain depths. The temperature conditions in some hydrographical sections give some indications of change, from year to year in the main current systems in the area.

Participation and arrangements

A preliminary plan for the 1979 survey was discussed by correspondence. Coordination and final arrangements were discussed on the 24 August in Murmansk between scientist from the Polar Institute of Marine Fisheries and Oceanography, Murrmansk and the Institute of Marine Research, Bergen. The survey program was covered in the period 20 August-10 September. The following research vessels participated in the fourteenth international 0-group fish survey in the Barents Sea and the Svalbard Region:

State	Name of vessel	Survey period	Research Institute
Norway	"G.O. Sars"	25 August-10 September	Institute of Marine Research, Bergen
Norway	"Johan Hjort"	20 August-10 September	-
USSR	"Poisk"	25 August-10 September	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
USSR	"Fridtjof Nansen"	25 August-8 September	-

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

Data collected during the survey were analysed during a meeting in Hammerfest on the 11-13 September between scientists from the two participating countries. Some preliminary findings were given in this report.

Material and methods

The geographical distribution and the density of the 0-group fish mere estimated by fishing with small meshed midwater trawls in the scattering layer, mainly between 0-50 m. The trawls used by the different vessels and the trailing procedure were the same as described in the 1977 report of this survey (Annls. Biol. 1977).

Survey tracks and hydrographical stations worked are given in Fig. 1. Trawl stations with and without catch are indicated on the species distribution charts (Figs. 10-18).

Results

Hydrography (Figs. 2-9)

Hydrographic observations were carried out along the survey tracks, and several standard sections for observations of the main currents in the Barents Sea were working.

The horizontal distribution of the temperature are shown in Figs. 2-5, and the temperature conditions in four of the standard sections are shown in Figs. 6-9. Mean temperatures of different layers in these sections are given in Table 1-4.

Analysis of the 1978 data shows that all of the main current in the Barents Sea have negative anomalies of the mean temperature in the 0 - 200 m layer. This indicate that there is in general a lesser heat transportation in the Norwegian current compared to previous years.

In 1978 as in 1977, the mean temperature of the North Cape current in 0-200 m is lower than average and has an anomaly of -0.6°.

The anomalies increase towards east. In the Murmansk current it is -1.0° and it reaches the maximum in the Cape Kanin section with values of -1.7° and -1.9°.

In the North Cape Current the mean temperature of the 0-50 m layer is 0.4 above the average, while in the Kola section the anomaly in the same layer is -0.7°.

The mean temperature of the 0-200 m layer is close to the average in the Spitsbergen Current.

Distribution and abundance of 0-group fish

Distribution of 0-group fish of the main species in the survey area are shown by shaded areas in Figs. 9-17. Areas with double shading indicate higher abundance. The criteria used to discriminate between scattered and dense concentrations in the distribution charts is for cod, haddock, redfish and Greenland halibut 85 0-group fish caught per haul, and for capelin and polar cod 1050 and 110 respectively (Haug and Nakken 1977). Abundance estimates are represented by the area of distribution. However, the areas with high densities are weighted by 10. The abundance indices are given in Table 5 for the year classes 1965 - 1978. Length distributions of the main species are given in Table 6.

Herring (Fig. 10)

0-group herring was distributed over a larger area than in previous years. The catches per haul have also increased, indicating a slight increased of the year class strength.

Mackerel (Fig. 11)

Mackerel was recorded occasionally in the 0-group survey. This year the mackerel was found over a relative wide area from Lofoten to North Cape.

Capelin (Fig. 12)

0-group capelin was distributed in the central part of the Barents Sea. The distribution area was small and the estimated abundance index is the lowest recorded in the period 1966 - 1978. There is, however, a rather low correlation between the 0-group indices and acoustic estimates of strength of the same year classes as tow year olds.

Cod (Fig. 13)

As in 1977, the 0-group cod was distributed in the central Barents Sea and along the Bear Island/West Spitsbergen shelf. No dense concentrations were observed in the central Barents Sea, and the eastern contour of the distribution was further west than in 1977. Three smaller dense concentration were observed along West-Spitsbergen and the observations indicate a higher abundance in this area than in the most recent years. The abundance index indicates that the 1978 year-class is somewhat less than average year class strength.

Haddock (Fig. 14)

The 0-group haddock was not observed as far east in the Barents Sea and as far north of West-Spitsbergen as in 1977, but beyond that Ins distribution of 1977 and 1978 mere similar. The abundance index indicates that the 1978 year-class is below average year-class strength. It might be only half of the 1977 year-class, which was an abundant one.

Polar cod (Fig. 15)

As in previous years, 0-group polar cod was separated in two components, in the Spitsbergen and the Novaya Zemlya area. These areas were similar to those in 1977, but the present observation shows a wider area of dense concentration west of Novaya Zemlya. Neither the 1977 or 1978 survey covered the whole area of distribution of the two components, Estimated abundance indices mere therefore too low. However, compared with the 1977 data the 1978 observation indicates a somewhat lower abundance in the Spitsbergen component and a higher abundance of the Novaya Zemlya component.

Redfish (Fig. 16)

0-group redfish man not observed as far north of West-Spitsbergen as last year. However, the area of dense concentrations were similar to that of 1977. The abundance index indicates that the 1978 year-class is a rich year class comparable to that of 1974, 1976 and 1977.

Greenland halibut (Fig. 17)

Greenland halibut were as in previous years only observed in the West-Spitsbergen area. Compared with 1977, the 0-group was distributed further to the west. The abundance was the highest estimated for the period 1970-1978.

Long rough dab (Fig. 18)

0-group long rough dab was separated in two components. The Bear Island/Spitsbergen component had a similar distribution as in 1977, while the Barents Sea component was distributed over a wider area in the more central part of the Barents Sea. The abundance index indicates that the 1978 year-class is above average abundance.

Table 1. Mean water temperature in the Murmansk current, the Kola section (between 70°30' N and 72°30' N) at the end of August (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1965-1978
0-50 m	6.7	6.7	7.5	6.4	6.7	7.8	7.1	8,7	7.7	8.1	7.0	8.1	6.9	6.6	7.3
50-200 m	3.8	2.6	4.0	3.7	3.1	3.6	3.2	4.0	4.5	3. .9	4.6	4.0	3.4	2.5	3.6
0-200 m	4.6	3.6	4.9	4.4	4.0	4.7	4.2	5.2	5.5	4.9	5.2	5.0	4.3	3.6	4.6

Table 2. Mean water temperature in the Cape Kanin - North section (between 68°45' N and 72°00' N) from surface to bottom at the beginning of September (T °C)

Year	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1965-1978
68°45'N-70°05'N	4.8	2.0	6.1	4.7	2.6	4.0	4.0	5.1	5.7	4.6	5.6	4.9	4.1	2.4	4.3
71°00'N-72°00'N	4.2	2.5	3.6	3.1	2.3	3.3	3.2	4.1	4.5	-	4.3	4.6	3.3	1.7	3.4

Table 3. Mean water temperature in the North Cape current, the North Cape to Bear Island section (between 71°33' N, 25°02' E and 73°35' N, 20°46' E) at the beginning of September (T°C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1965-1978
0-200 m	5.1	5.5	5.6	5.4	6.0	6.1	5.7	6.3	5.9	6.1	5.7	5.7	4.8	5.0	5.6

Table 4. Mean water temperature in the West Spitsbergen current along the West Bear Island section (between 06°34' E and 15°55' E) in early September (T °C)

Year/ Layer	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1966-1978
0-200 m	3.3	4.2	3.6	4.2	-	4.2	3.9	5.0	4.6	4.9	5.0	4.0	4.1	4.2

Table 5. Abundance indices

Species/ Year	Cod	Capelin	Haddock	Redfish	Polar cod			Long rough dab	Greenland halibut
					West		East		
1965	6	37	7	159		0		66	
1966	1	119	< 1	236	28	129	101	97	
1967	34	89	42	44	0	165	165	73	
1968	25	99	8	21	34	60	26	17	
1969	93	109	82	295	17	208	191	26	
1970	606	51	115	247	29	197	168	12	< 1
1971	157	151	73	172	31	181	150	81	< 1
1972	140	275	46	177	16	140	124	65	8.0
1973	684	125	54	385		(26)		67	3.2
1974	51	359	147	468		227		83	13.4
1975	343	320	170	315		75		113	21.1
1976	43	281	112	447		131		96	15.6
1977	173	194	116	472	157		70	72	9.0
1978	106	40	61	460	167		144	76	35.4

Table 6. Length distribution of 0-group fish in percent

Length, mm	Herring	Capelin	Polar cod		Greenland halibut	Lrd	Haddock	Cod	Redfish	Saithe
			East	West						
5-9										
10-14									0.1	
15-19						0.2			2.4	
20-24		0.8		1.7		3.1			7.1	
25-29		4.2		6.0		11.9			8.2	
30-34		10.7	28.6	52.0		27.5	0.1	0.2	14.5	
35-39	0.1	17.1	71.4	35.4	0.7	27.2	1.0	0.9	21.7	0.3
40-44	0.3	21.1		4.3	2.2	23.5	2.4	3.3	21.9	0.1
45-49	2.3	22.8		0.4	10.4	6.1	4.4	6.7	17.5	0.3
50-54	14.5	16.6			10.9	0.4	6.2	9.6	5.5	0.8
55-59	30.4	5.2		0.1	30.0		7.9	12.0	1.0	1.1
60-64	41.0	1.3			17.0		9.6	17.8		0.1
65-69	11.3	0.2			14.1		10.0	15.7		
70-74	0.1				8.5		11.4	15.8		0.1
75-79					5.2		9.7	9.2		0.1
80-84					1.1		8.8	6.5		0.2
85-89	0.1				0.4		9.8	1.8		0.1
90-94							7.5	0.6		0.9
95-99							4.7			0.1
100-104							3.7			2.6
105-109							1.5			10.6
110-114							0.7			16.5
115-119							0.3			22.1
120-124							0.1			19.1
125-129										12.0
130-134										9.9
135-139										3.2
N	1774	515072	7	8994	270	4264	2888	2738	3999385	1166
Mean	6.0	4.4	3.6	3.4	6.0	3.6	7.4	6.5	3.8	11.7

Appendix

Survey period	Research vessel	Research Institute	Participants
25 August- 10 September	"G.O. Sars"	Institute of Marine Research, Bergen.	O. Annaniassen, T. Antonsen, J. Hamre, K. Hansen, V. Helgason, A. Hylen, H. Kismul, E. Lifjell, O. Martinsen, A. I. Prøven, A. Romslo, E. Sælen, A. Thomassen
20 August- 10 September	"Johan Hjort"	Institute of Marine Research, Bergen.	J. Blindheim, L. Kolbeinshavn, S. Lygren, T. Monstad, Ø. Tangen, J. E. Nygaard, Ø. Torgersen, A. Asenjo
25 August- 10 September	"Poisk"	Polar Research Institute of Marine Fisheries and Oceanography, Murmansk.	A.S. Galkin, Z.M. Berdichevski, I.I. Balabanov, V.J. Korelski, V.I. Zubou, A.P. Tereschenko, A.V. Averchenko, T.M. Sergeeva, A.U. Il'ina.
25 August- 8 September	"Fridtjof Nansen"	Polar Research Institute ofMarine Fisheries and Oceanography, Murmansk.	S.V. Rochitelev, V.F. Terzlev.

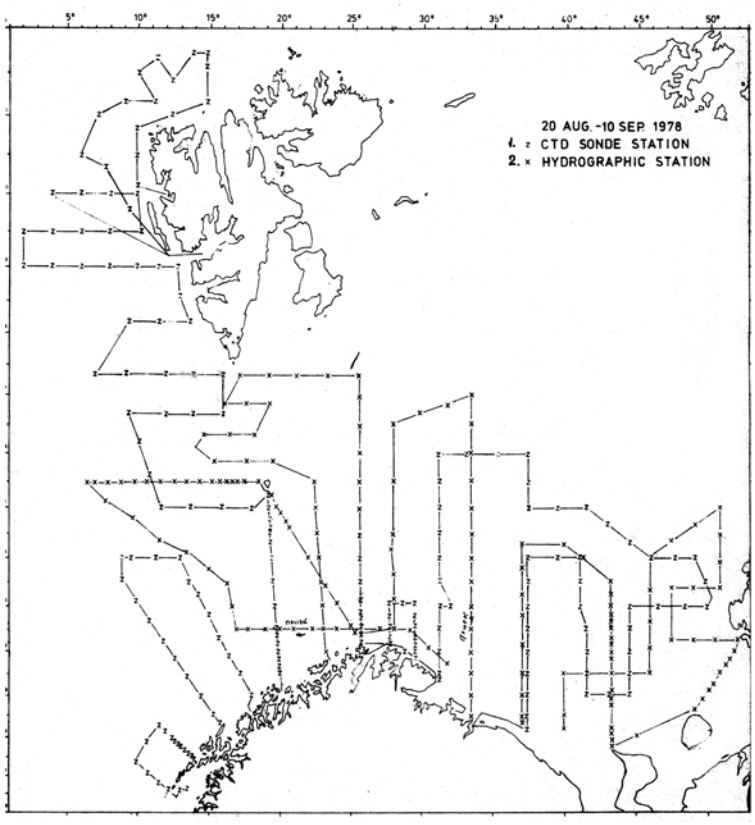

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

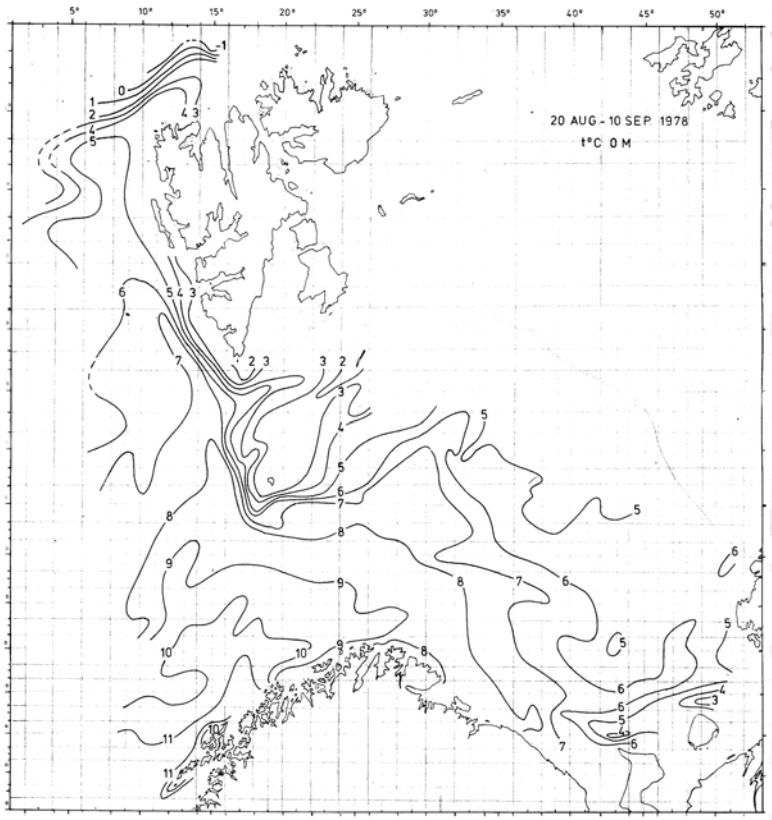

Fig. 2. Isotherms at 0 m

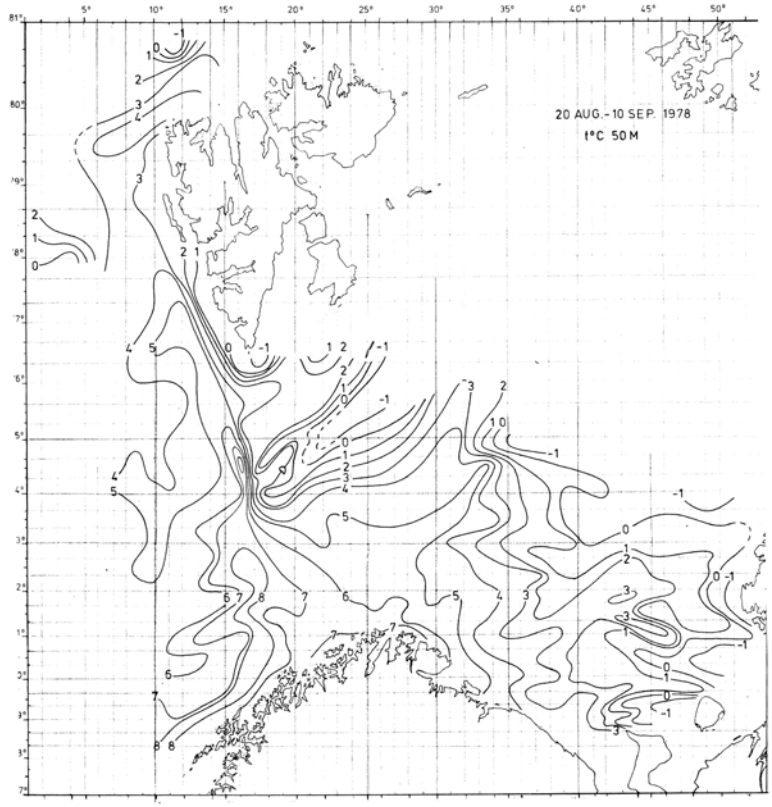

Fig. 3. Isotherms at 50 m

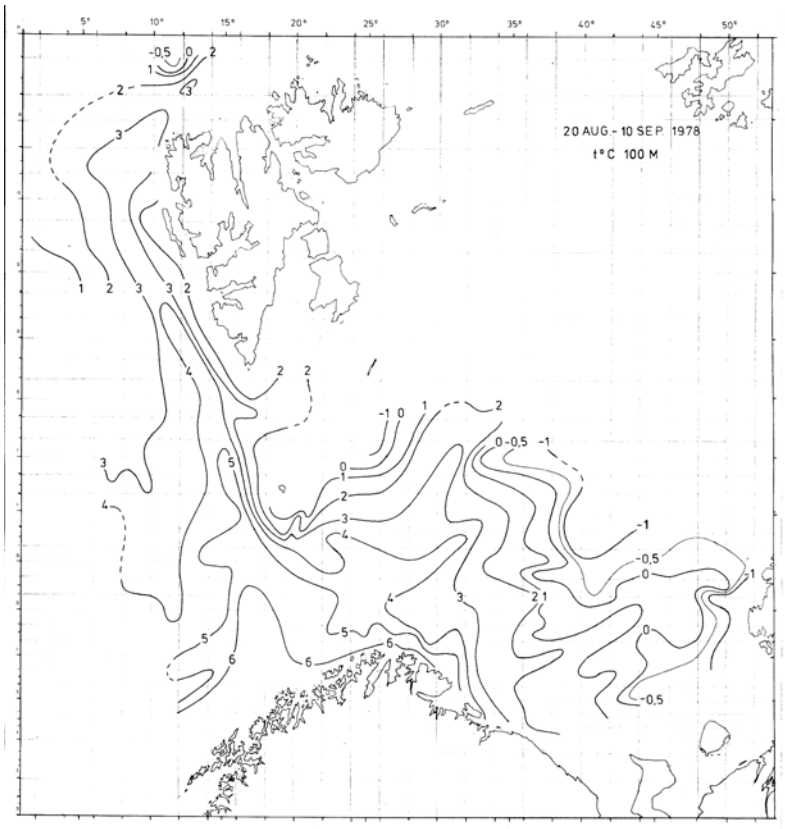

Fig. 4. Isotherms at 100 m

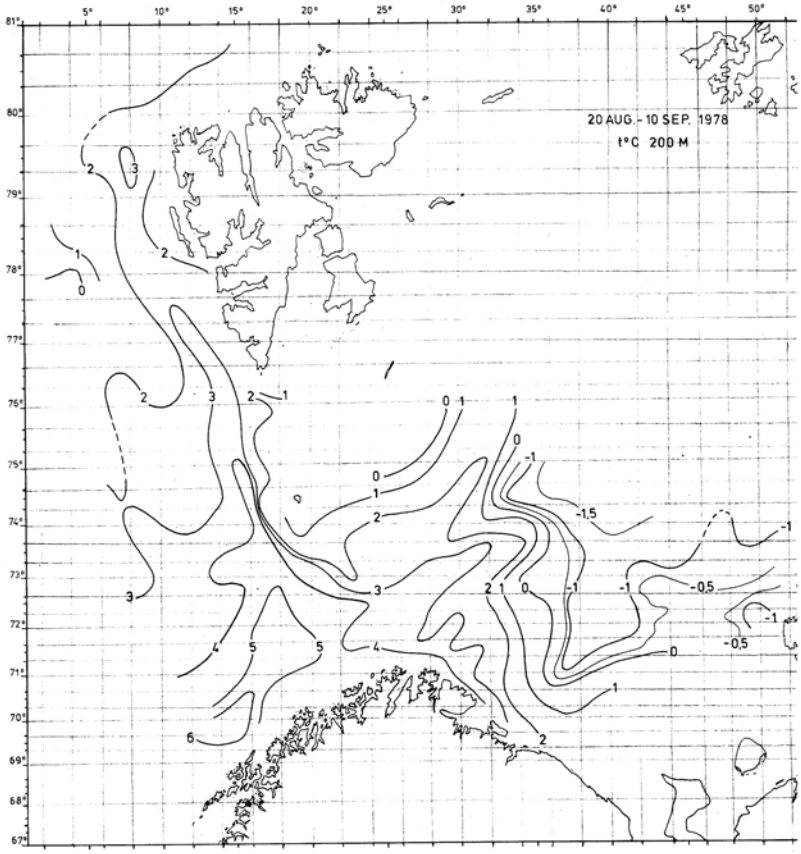

Fig. 5. Isotherms at 200 m

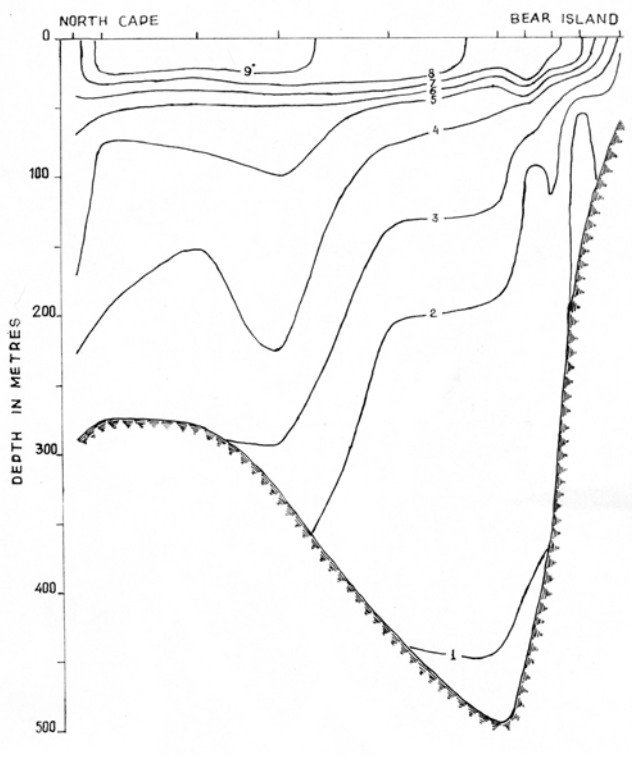

Fig. 6. Temperature section Bear Island-North Cape

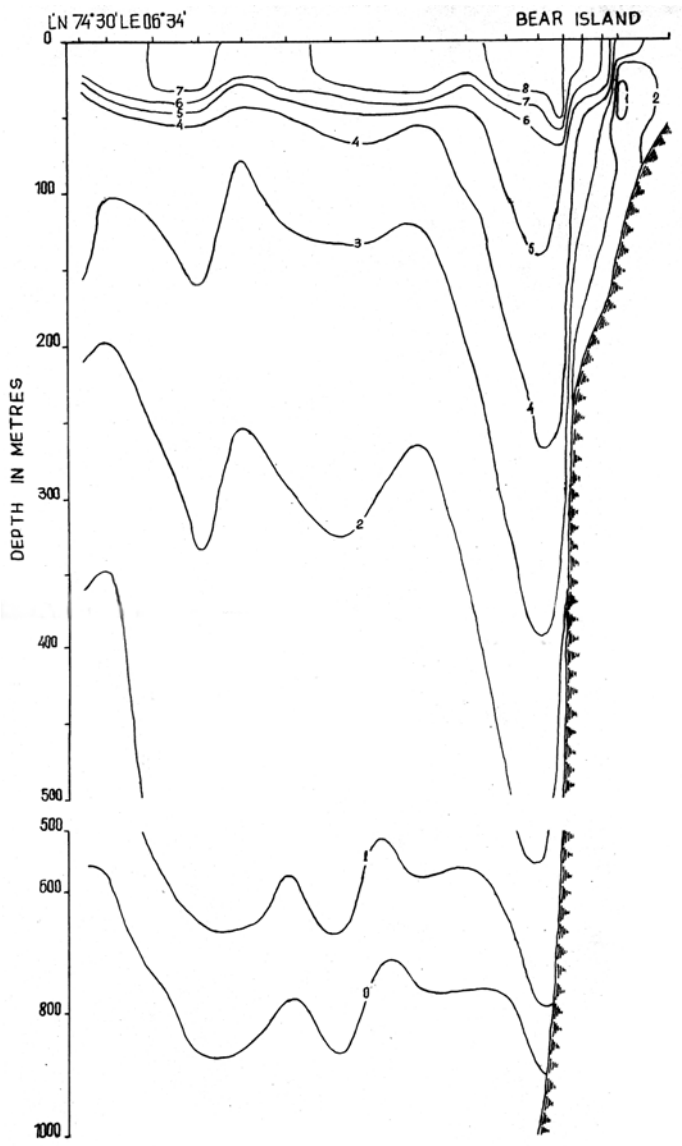

Fig. 7. Temperature section Bear Island-West

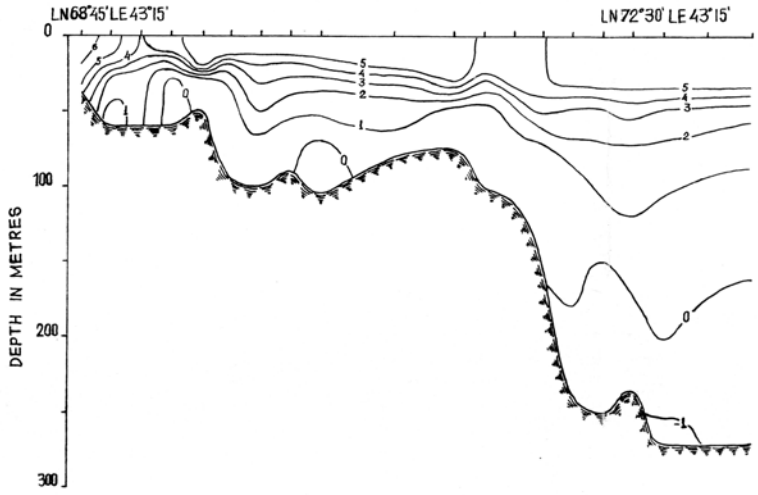

Fig. 8. Temperature section along the Kola meridian

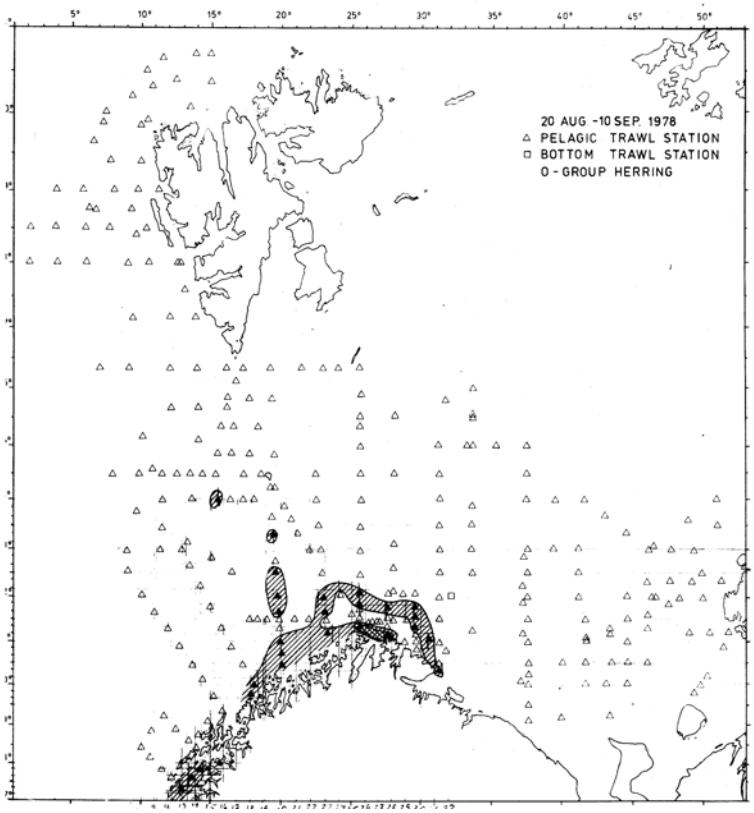

Fig. 9. Temperature section Cape Kanin-North

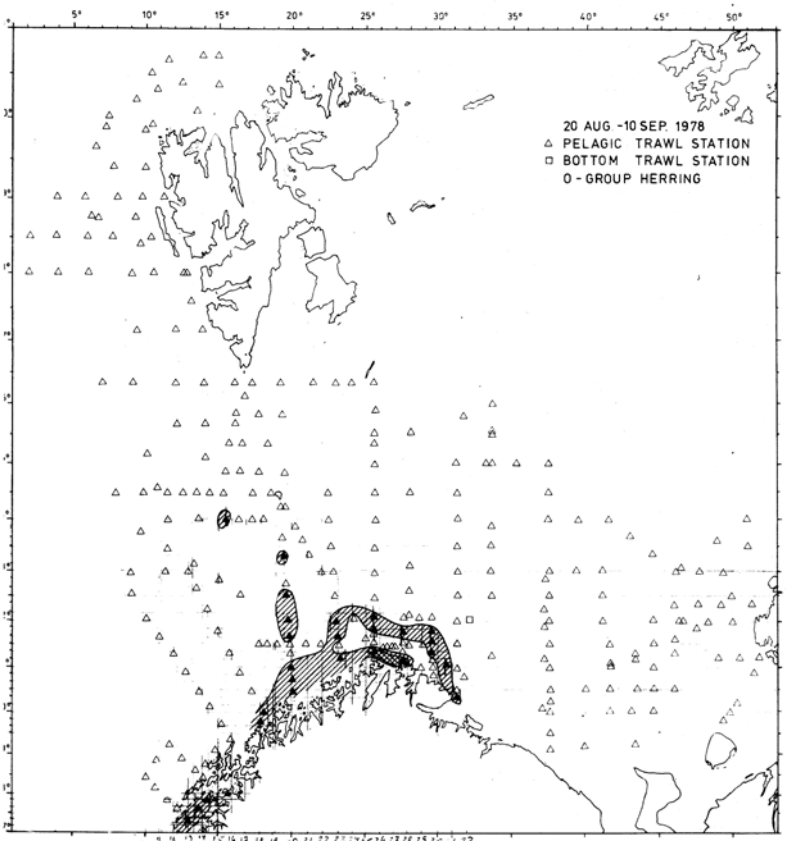

Fig. 10. Distribution of 0-group herring

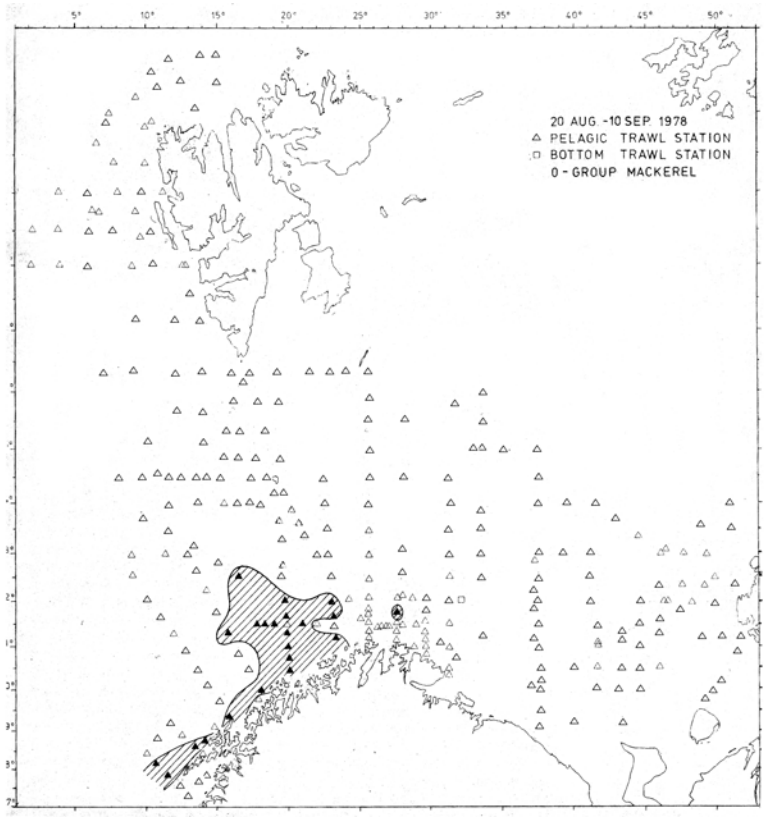

Fig. 11. Distribution of 0-group mackerel

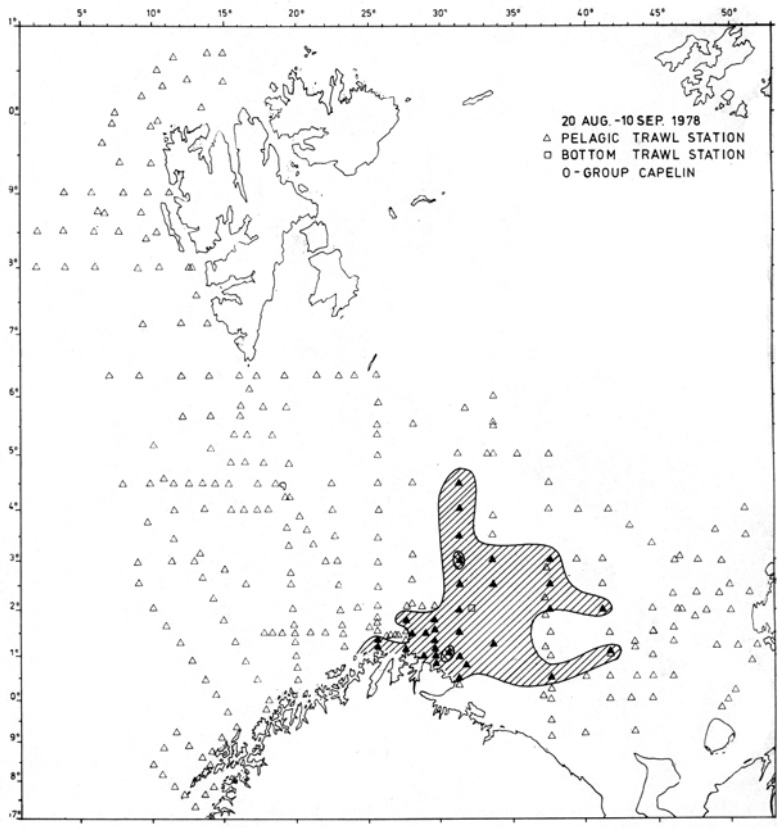

Fig. 12. Distribution of 0-group capelin

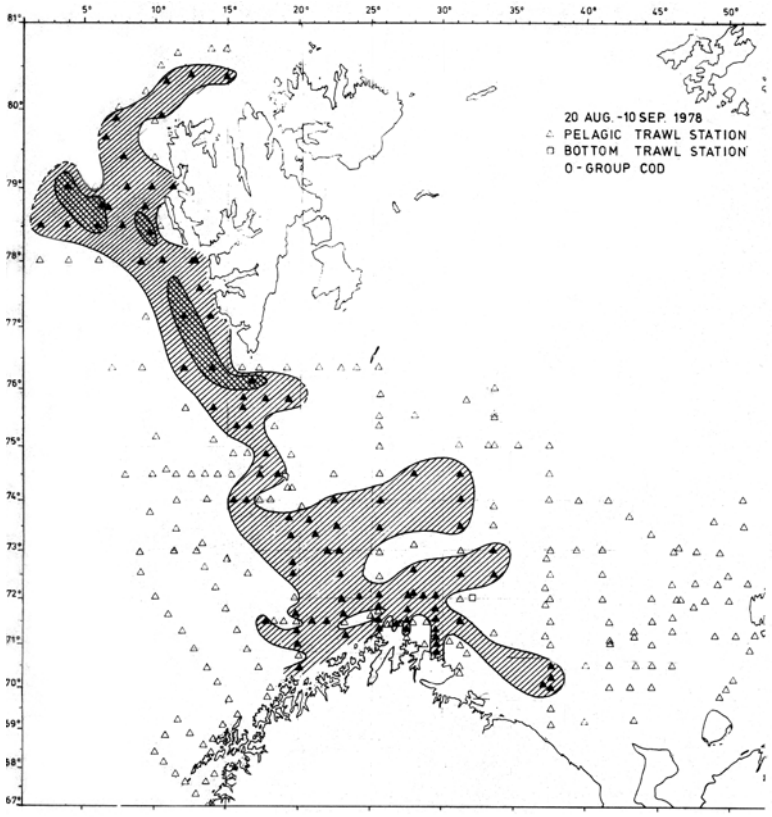

Fig. 13. Distribution of 0-group cod

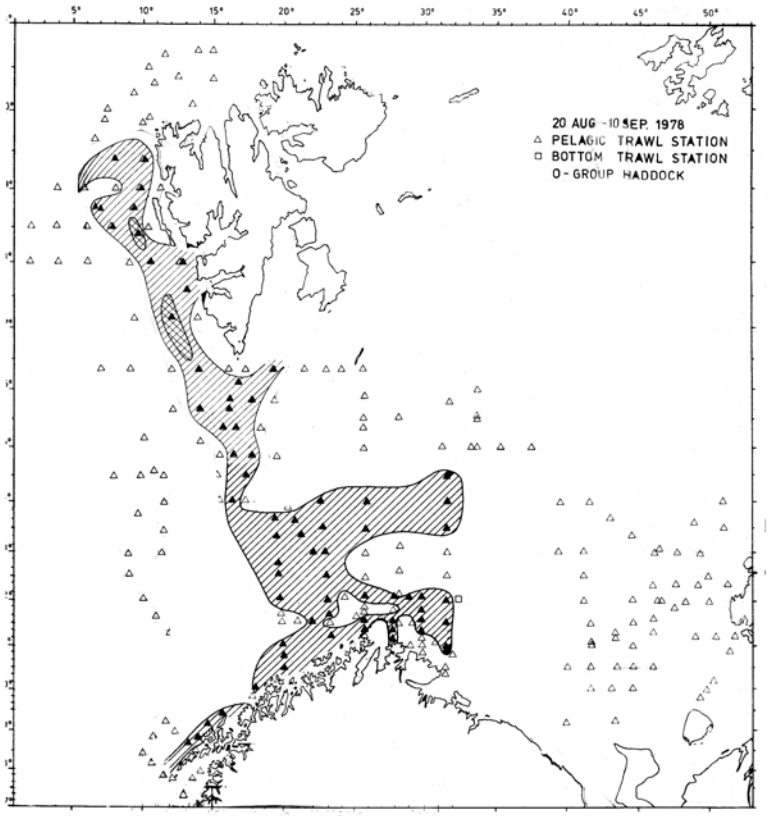

Fig. 14. Distribution of 0-group haddock

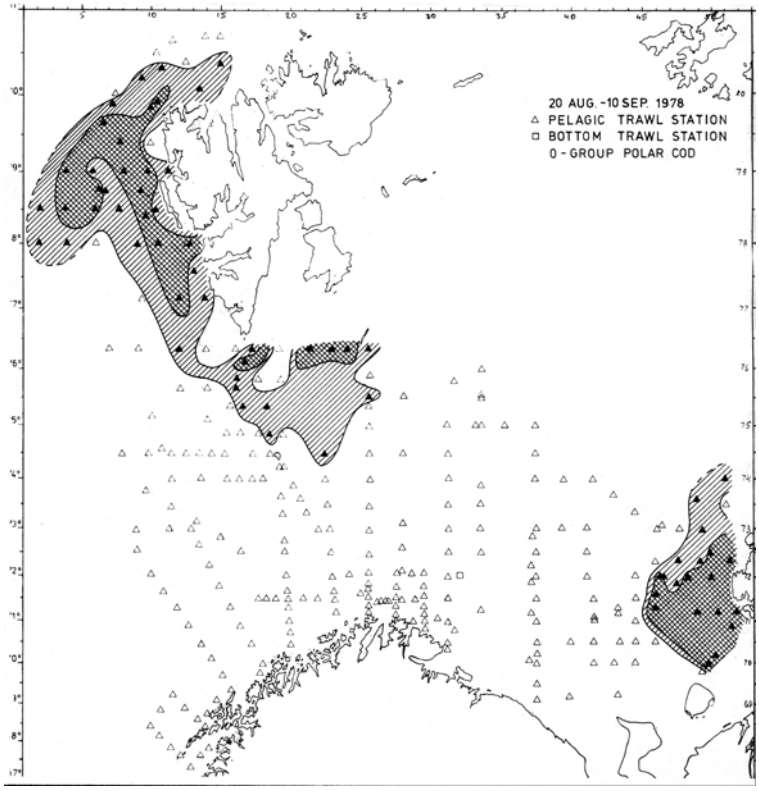

Fig. 15. Distribution of 0-group polar cod

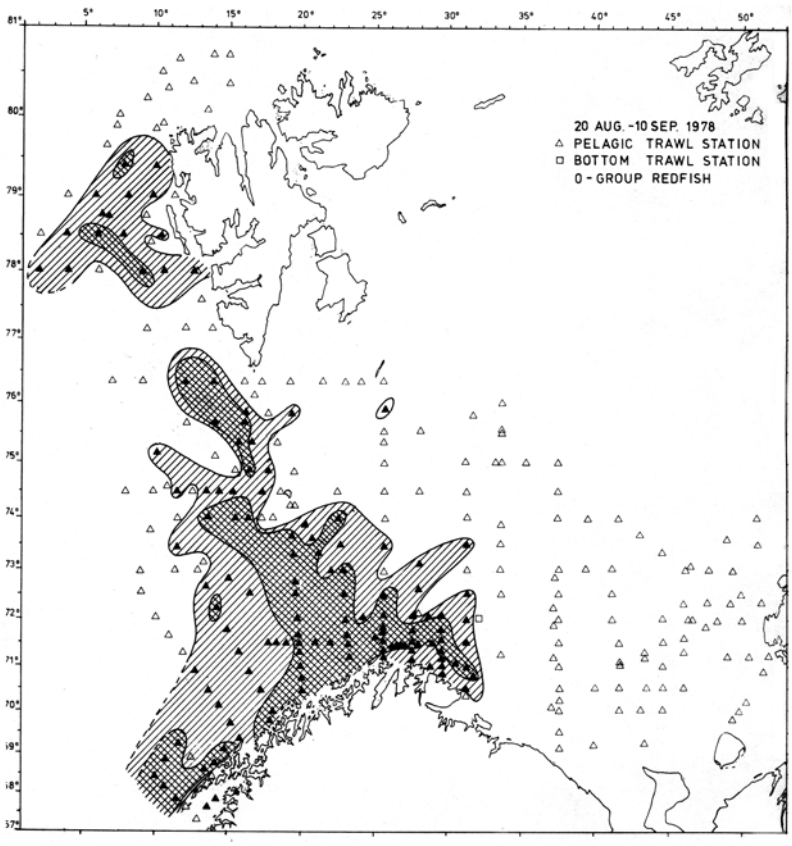

Fig. 16. Distribution of 0-group redfish

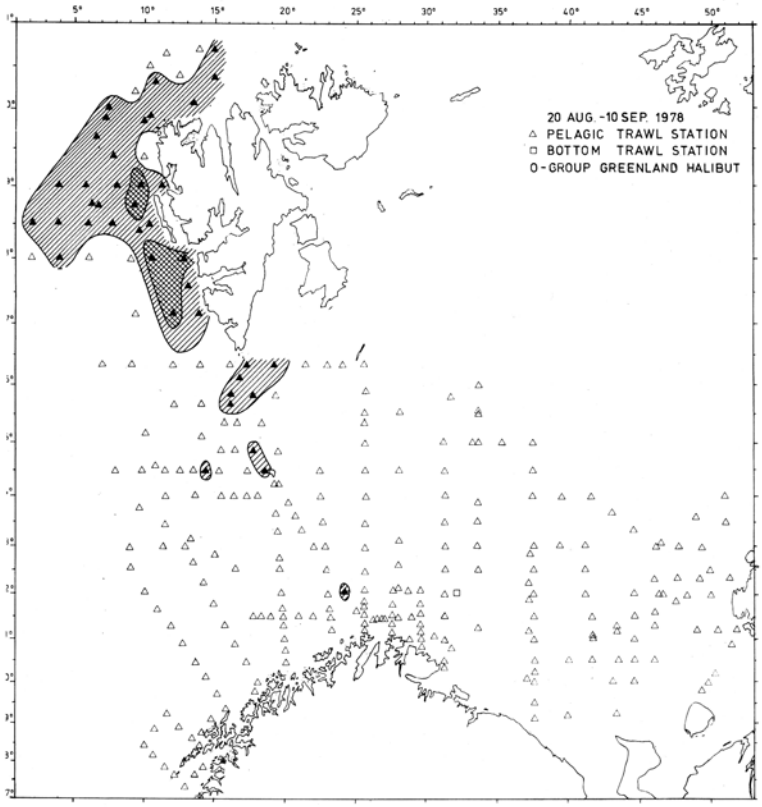

Fig. 17. Distribution of 0-group Greenland halibut

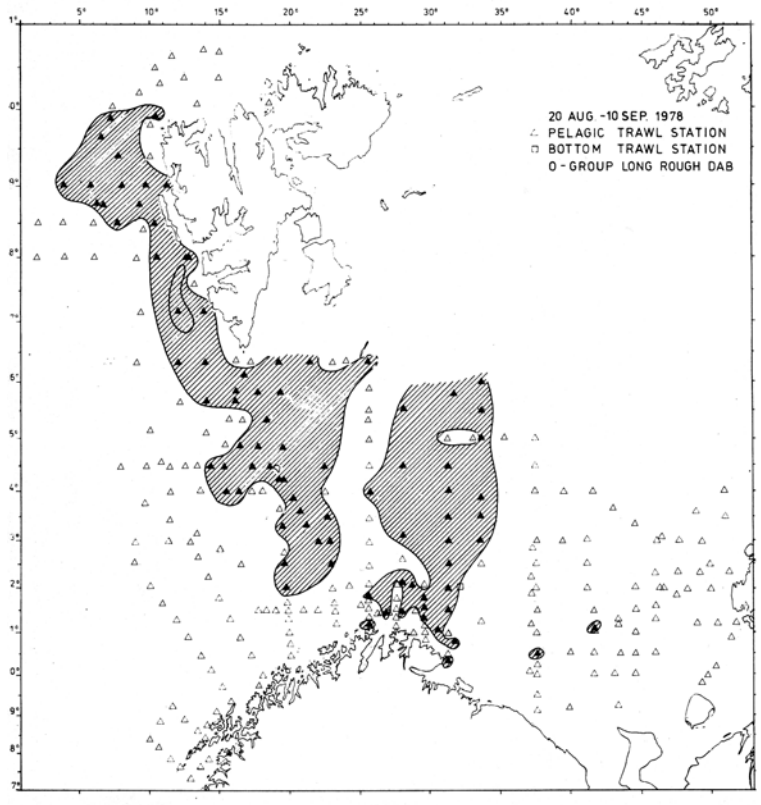

Fig. 18. Distribution of 0-group long rough dab

International Council for
the Exploration of the Sea

CM 1979/H:65
Pelagic Fish Committee
Ref: Demersal Fish and
Hydrographic Committees

Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August-September 1979

The fifteenth annual International 0-group fish survey was made during the period 19 August-14 September 1979 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey time	Research Institute
Norway	"Johan Hjort"	26 August-14 September	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	19 August-14 September	" "
USSR	"Poisk"	29 August-14 September	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
USSR	"Akhill"	1 September-3 September	" "

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

The survey data was analysed the 15-16 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 condition in the area.

Material and methods

Most of the trawl hauls are made at the depth of the heaviest trace of 0-group fish recorded on the echosounder, mainly between 0-50 m. Trawling procedure has been the same as in 1977 and 1978 (Ann. biol. 1978).

R/V "G.O. Sars" and R/V "Johan Hjort" are operating the midwater trawl from the stern, while R/V "Poisk" does it from the side of the vessel. The midwater trawl used by the Norwegian vessels has a 16 fathom horizontal and vertical opening, while the measures of the trawl used by the USSR vessel are 8-11 m and 4 m respectively. Norwegian vessels are able to trawl near the surface by using 4 bigger floats on the headline. Such floats are not used by the USSR vessel, and she is, therefore, not able to trawl in the near surface layer. All these factors give a low catch performance of the USSR vessel, especially for redfish and capelin. The catch rates of this vessel have, therefore, only been used as a guideline in the drawing of distribution charts for 0-group fish.

Survey tracks and hydrographical stations are given in Fig. 1. Trawl stations with and without catch are given on the distribution charts in Figs. 10-17, as filled and open symbols respectively.

Results

Hydrography (Figs. 2-9 and Tables 1-4)

Hydrographic observations were made along all survey tracks, mainly at each 30 nautical mile. Horizontal temperature distributions are shown for 0, 50 100 and 200 m depth (Figs. 2-5). Temperature condition is given in Figs. 6-9 for four standard hydrographic sections and the average temperature in these sections are given in Tables 1-4. Some general comments are given:

1) Kola section

The cooling of the 0-50 m, 50-200 m and 0-200 m layers observed from 1976 to 1978 was nearly reversed in 1979. However, the average temperature is still below the average for the period 1965-1979, with an anomalies of -0.7° for all three layers.

2) Cape Kanin - North section

A further decrease of average temperature in the 0 to bottom layer was observed from 1978 to 1979 in the southern part of the section (2.4 °C to 2.0 °C). In the northern part, the average temperature increased from 1.7 °C to 1.8 °C. For both parts of the section the temperature condition was at the lowest level recorded for the period, with anomalies of -2.2 and -1.5° respectively.

3) North Cape - Bear Island section

The average temperature in the 0-200 m layer increased from 5.0 °C in 1978 to 5.3 °C in 1979. However, the anomalies is still -0.3 °.

4) Bear Island - West section

The average temperature in the 0-200 m layer increased from 4.1 °C in 1978 to 4.4 °C in 1979, compared with the average 4.3 °C for the period 1966-1979.

In general, the temperatures in the Barents Sea were low in 1979. This should indicate a low water transport by the main current in this area. The average temperature condition west of Bear Island indicates a more normal transport by the Spitsbergen current.

Distribution and abundance of 0-group fish

Geographical distribution of 0-group fish are shown by shaded areas in Figs. 10-18. Double shading indicates dense concentrations. Criteria used to discriminate between scattered and dense concentrations are the same as used in earlier reports (Ann. biol. 1978).

Abundance indices estimated as the area of distribution, areas of high densities weighted by 10, are given in Table 5.

Herring (Fig. 10)

0-group herring was distributed over an area slightly larger than in 1978, but the overall density was lower. In addition to the observations along the coast of northern Norway, smaller areas or patches were located in the area west of Spitsbergen and in the Barents Sea. The offshore patches of herring in the Barents Sea were observed in areas with dense concentration of 0-group capelin. This might have created by difficulties in selecting 0-group herring from the catches, completely dominated by 0-group capelin.

Capelin (Fig. 11)

The 0-group capelin was mostly confined to the near surface layer and almost all capelin caught were found entangled in the trawl meshes. It was distributed over a much

wider area than in the recent 3 years, and dense concentrations covered the main part of the area. This create the highest abundance index recorded for the period 1965-1979. However, in spite of the rather low correlation between 0-group indices and acoustic abundance estimate of the year class as two year old, the high abundance index indicate that the 1979 year-class is good.

Cod (Fig. 12)

0-group cod was not observed as far north west of Spitsbergen as in 1978, but the 1979 year-class was recorded further to the east than last year. More than 85 0-group cod, the number discriminating between scattered and dense concentrations, was only caught on 2 trawl stations. The estimated abundance index indicates that the 1979 year class is below average, the same classification as given for the 1978 year-class.

Haddock (Fig. 13)

0-group haddock was not observed west of Spitsbergen as in 1978. The distribution in other parts of the area was similar to that in 1978. No dense concentrations were recorded, and the abundance index indicates that the 1979 year-class is below average strength, similar to the preceding year-class.

Saithe (Fig. 14)

In most years, only few 0-group saithe have been recorded outside the Norwegian coastal waters. However, in 1979 a patch was observed in the area west of Spitsbergen, a situation similar to that in 1967. No abundance index of any significance can be estimated on the basis of the survey data.

Polar cod (Fig. 15)

The distribution of 0-group polar cod was more or less similar to those of the preceding two years, with the Spitsbergen and the Novaya Zemlja components. Because of limited research vessel time, the area of distribution was not adequately covered, either in 1978 or in 1979. The estimated abundance indices are therefore too low for both components. However, even so the high abundance index of the 1979 year-class in the eastern component indicate a good year-class.

Redfish (Fig. 16)

The area of distribution was similar to that in 1978. However, a bigger area of dense concentration was observed. This involve a high abundance index, the highest recorded, which indicates another rich year class, the seventh in succession.

Greenland halibut (Fig. 17)

The distribution of 0-group Greenland halibut was similar to those of the two previous year classes, located mainly in the Spitsbergen area. The abundance index for the 1979 year-class indicates that it is above average strength.

Long rough dab (Fig. 18)

Unlike the previous two years, 0-group long rough dab was nearly absent in the area west of Spitsbergen. It extended further to the east in the Barents Sea than in 1978. The abundance index indicates a year-class of average strength.

Table 1. Mean water temperature in the Murmansk current, the Kola section (between 70°30' N and 72°30' N) at the end of August (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1965-1979
0-50 m	6.7	6.7	7.5	6.4	6.7	7.8	7.1	8.7	7.7	8.1	7.0	8.1	6.9	6.6	6.5	7.2
50-200 m	3.8	2.6	4.0	3.7	3.1	3.6	3.2	4.0	4.5	3.9	4.6	4.0	3.4	2.5	2.9	3.6
0-200 m	4.6	3.6	4.9	4.4	4.0	4.7	4.2	5.2	5.5	4.9	5.2	5.0	4.3	3.6	3.8	4.5

Table 2. Mean water temperature in the Cape Kanin-North section (between 68°45' N and 72°00' N from surface to bottom at the beginning of September (T °C)

Year	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1965-1979
68°45'N 70°05'N	4.8	2.0	6.1	4.7	2.6	4.0	4.0	5.1	5.7	4.6	5.6	4.9	4.1	2.4	2.0	4.2
71°00'N 72°00'N	4.2	2.5	3.6	3.1	2.3	3.3	3.2	4.1	4.5	-	4.3	4.6	3.3	1.7	1.8	3.3

Table 3. Mean water temperature in the North Cape current, the North Cape to Bear Island section (between 71°33' N, 25°02' E and 73°35' N, 20°46' E) at the beginning of September (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1965-1979
0-200 m	5.1	5.5	5.6	5.4	6.0	6.1	5.7	6.3	5.9	6.1	5.7	5.7	4.8	5.0	5.3	5.6

Table 4. Mean water temperature in the West Spitsbergen current along the West Bear Island section (between 06°34' E and 15°55' E) in early September (T °C)

Year/ Layer	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1966-1979
0-200 m	3.3	4.2	3.6	4.2	-	4.2	3.9	5.0	4.6	4.9	5.0	4.0	4.1	4.4	4.3

Table 5. Abundance indices

Species Year	Cod	Haddock	Polarcod			Redfish	Greenland halibut	Long rough dab
			West		East			
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	8.0	65
1973	684	54		(26)		385	3.2	67
1974	51	147		227		468	13.4	83
1975	343	170		75		315	21.1	113
1976	43	112		131		447	15.6	96
1977	173	116	157		70	472	9.0	72
1978	106	61	107		144	460	35.4	76
1979	94	69	23		302	980	22.5	69

Appendix

Survey period	Research vessel	Research Institute	Participants
19 August- 14 September	"G.O. Sars"	Institute of Marine Research, Bergen.	A. Asenjo, E. Anziani, O. Alvhetm, H. Abrahamsen, J. Blindheim, A. Dommasnes, I. Forberg, H. Gundersen, J. Hamre, K. Hansen, K. Hestenes, A. Hylen, E. Molvær, A. Nødtvedt, A. Pedersen, A. Romslo, J. Røttingen, I. Svellingen.
26 August- 14 September	"Johan Hjort"	Institute of Marine Research, Bergen.	V.N. Bande, V. Frivoll, I. Hoff, E. Lifjell, S. Lygren, O. Martinsen, T. Monstad, Ø. Torgersen.
29 August- 14 September	"Poisk"	Polar Research Institute of Marine Fisheries and Oceanography, Murmansk.	N.G. Ushakov, V.S. Mamylov, N.P. Chebotok, B.N. Nenko, A.V. Averchenko, V.N. Zaitsev.
1 September- 3 September	"Akhill"	Polar Research Institute of Marine Fisheries and Oceanography, Murmansk.	

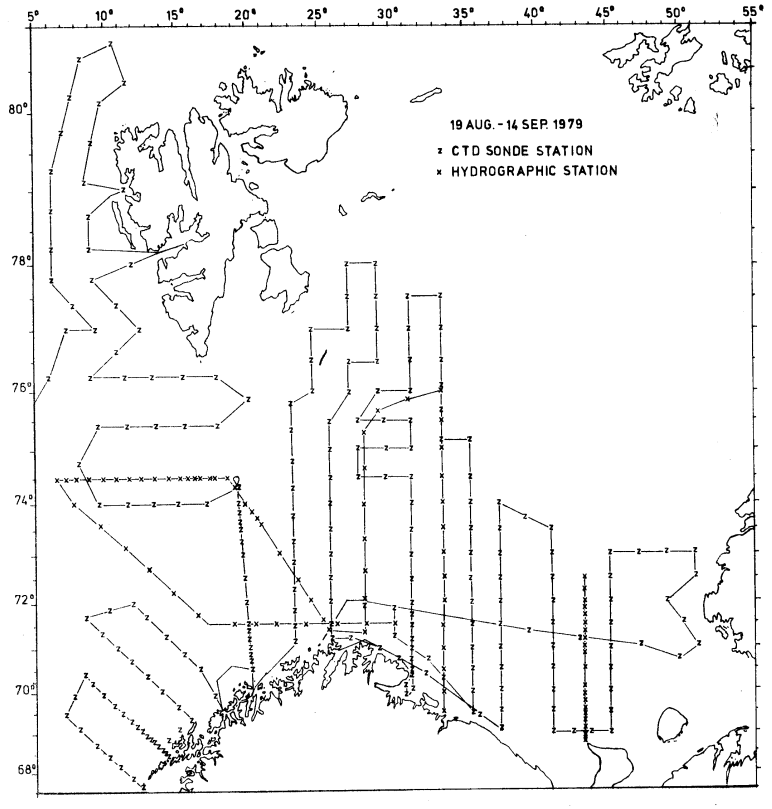

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

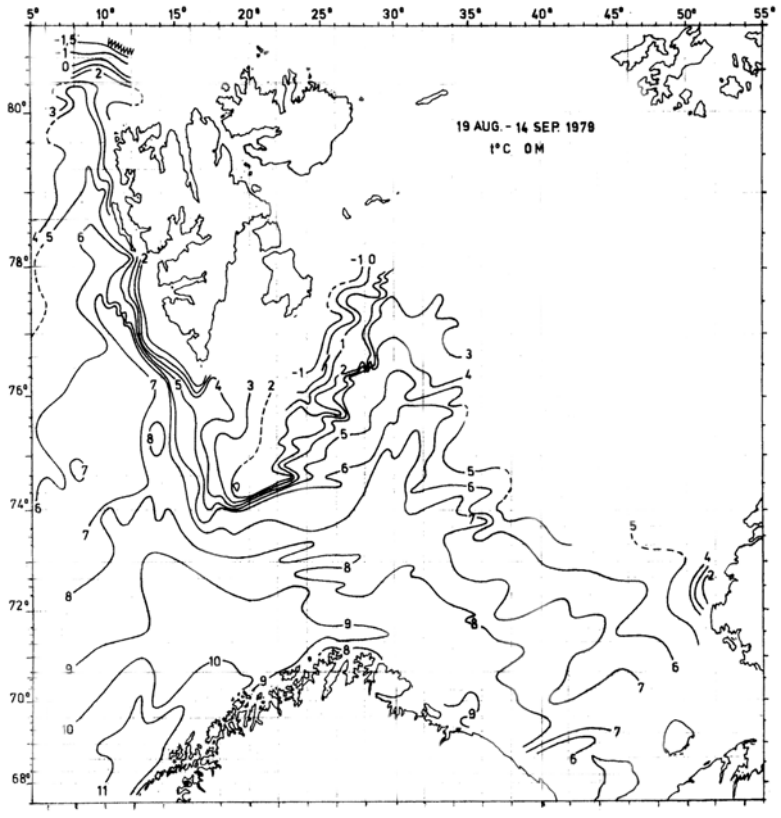

Fig. 2. Isotherms at 0 m

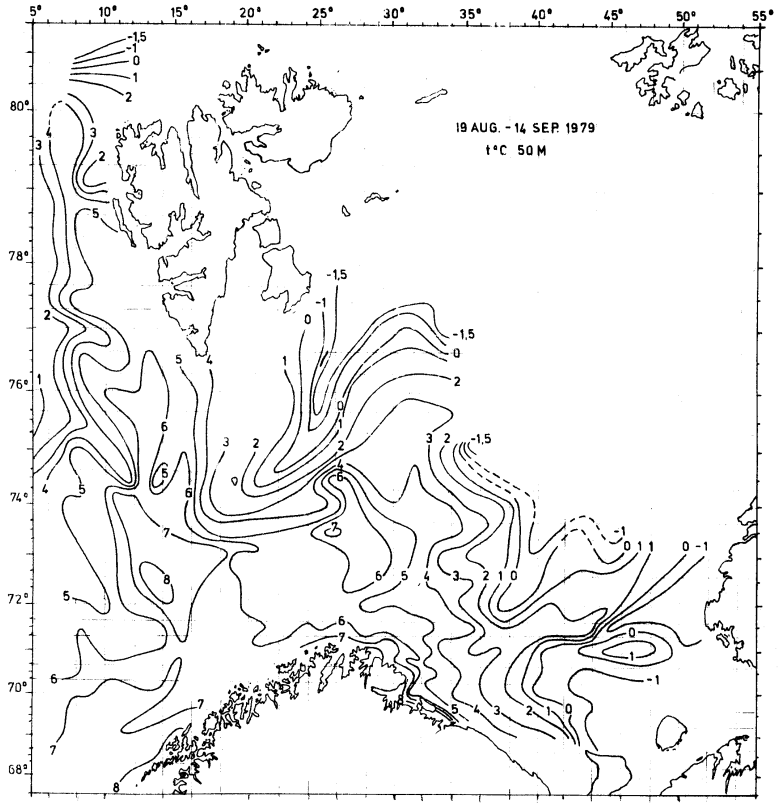

Fig. 3. Isotherms at 50 m

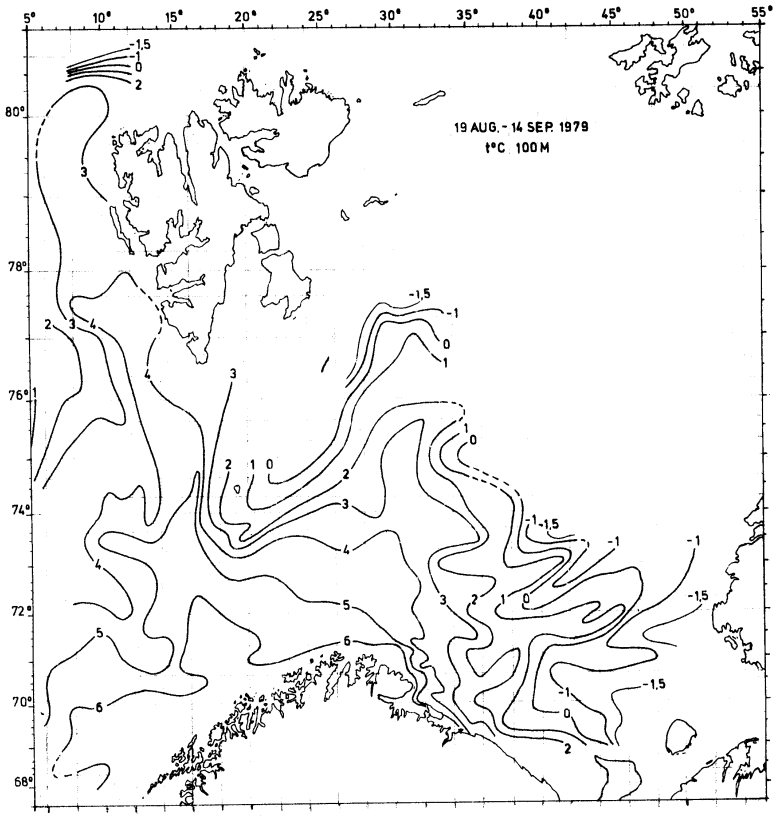

Fig. 4. Isotherms at 100 m

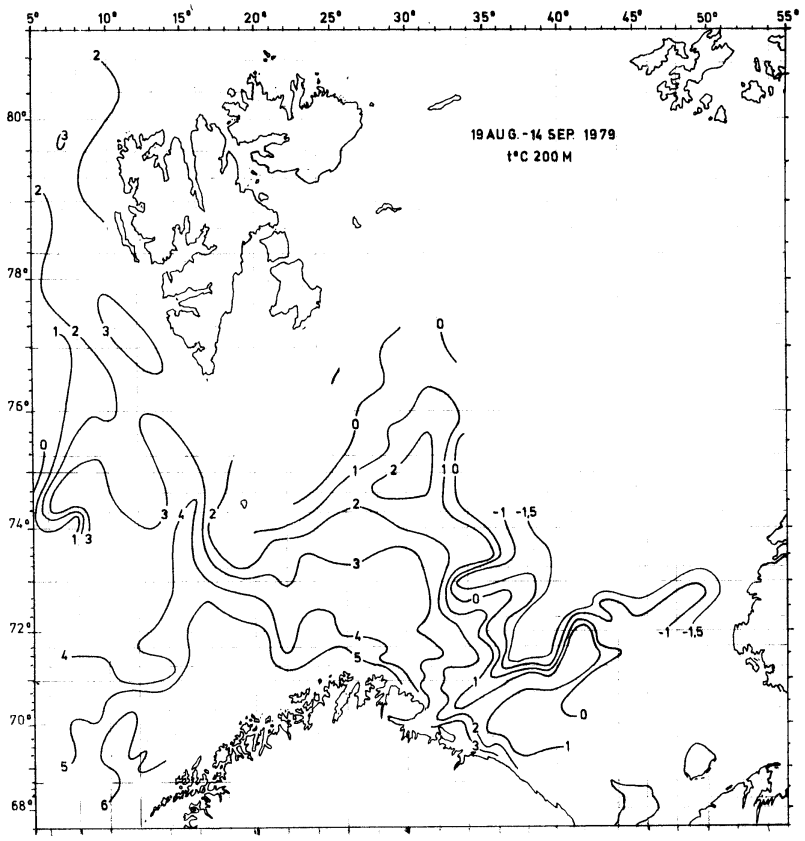

Fig. 5. Isotherms at 200 m

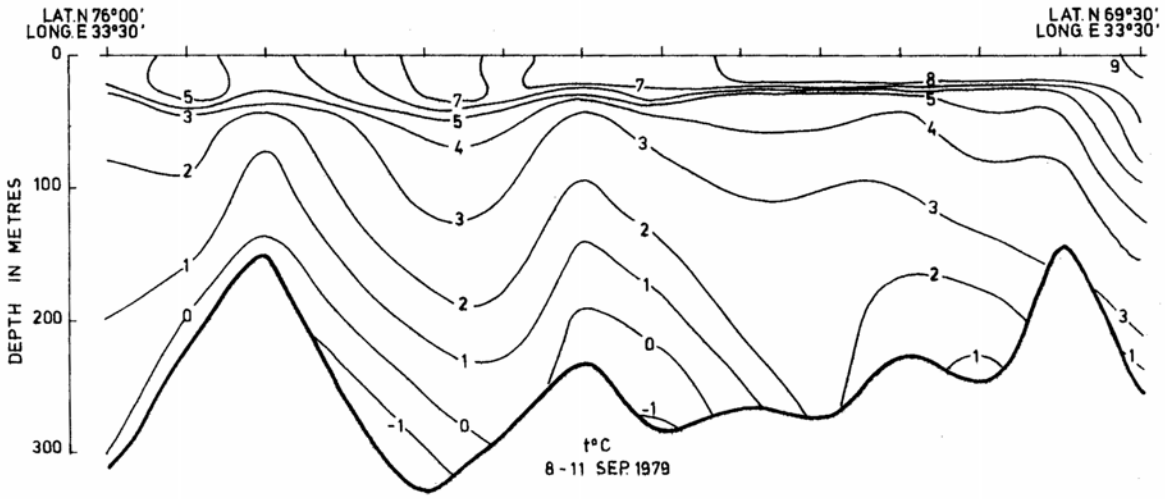

Fig. 6. Temperature section along the Kola meridian

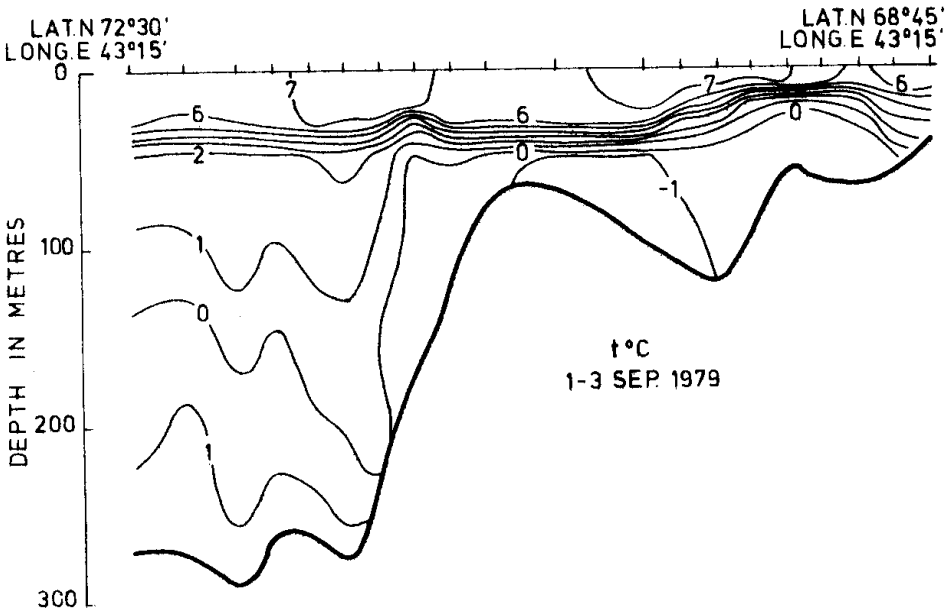

Fig. 7. Temperature section Cape Kanin-North

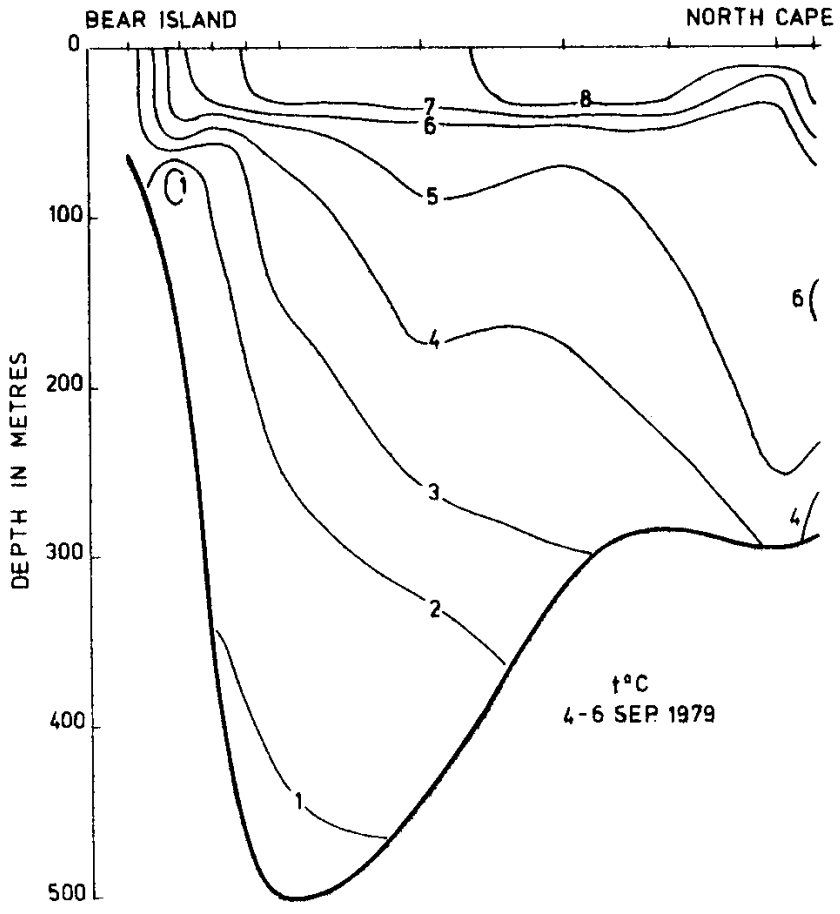

Fig. 8. Temperature section Bear Island-North Cape

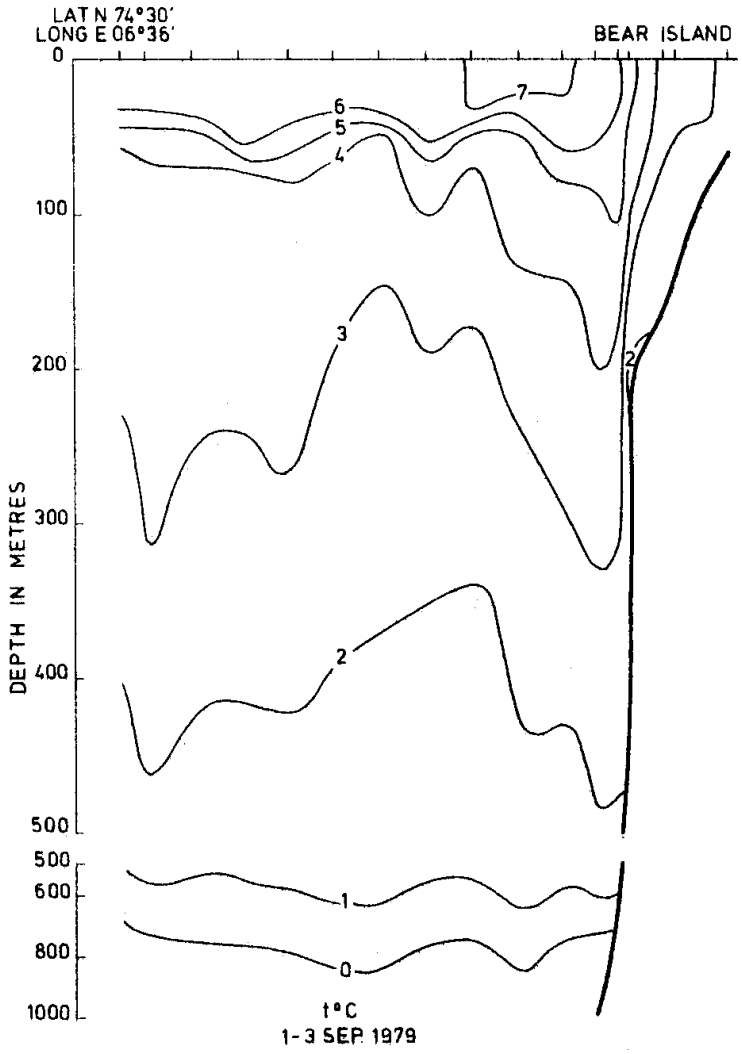

Fig. 9. Temperature section Bear Island-West

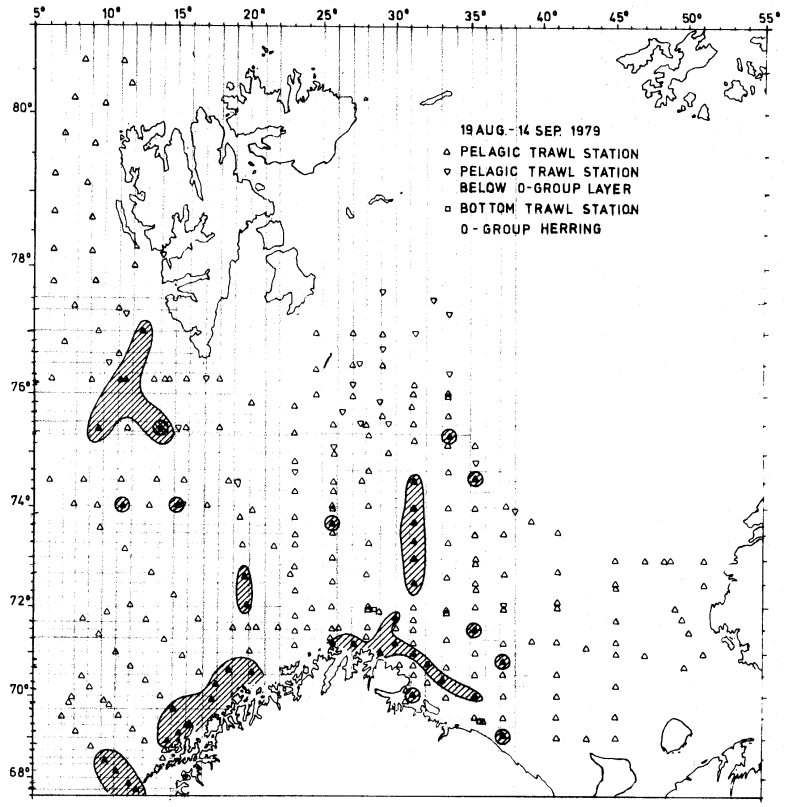

Fig. 10. Distribution of 0-group herring

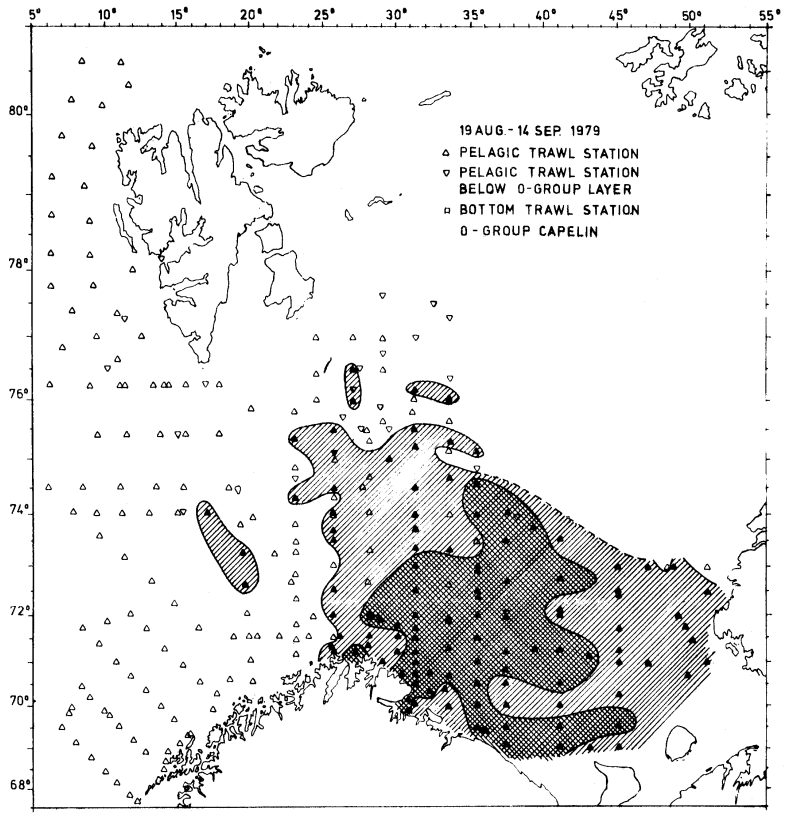

Fig. 11. Distribution of 0-group capelin

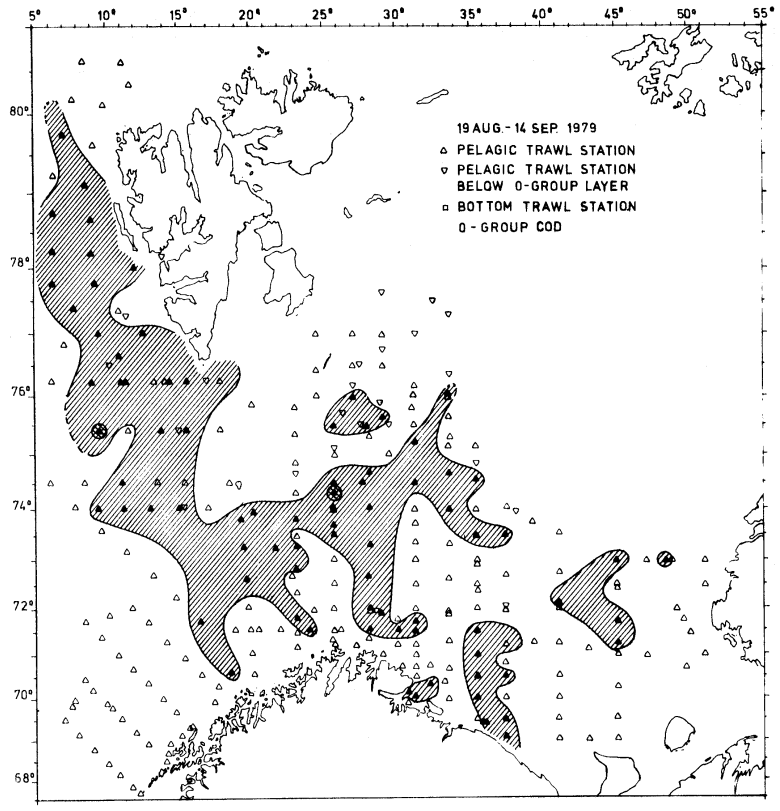

Fig. 12. Distribution of 0-group cod

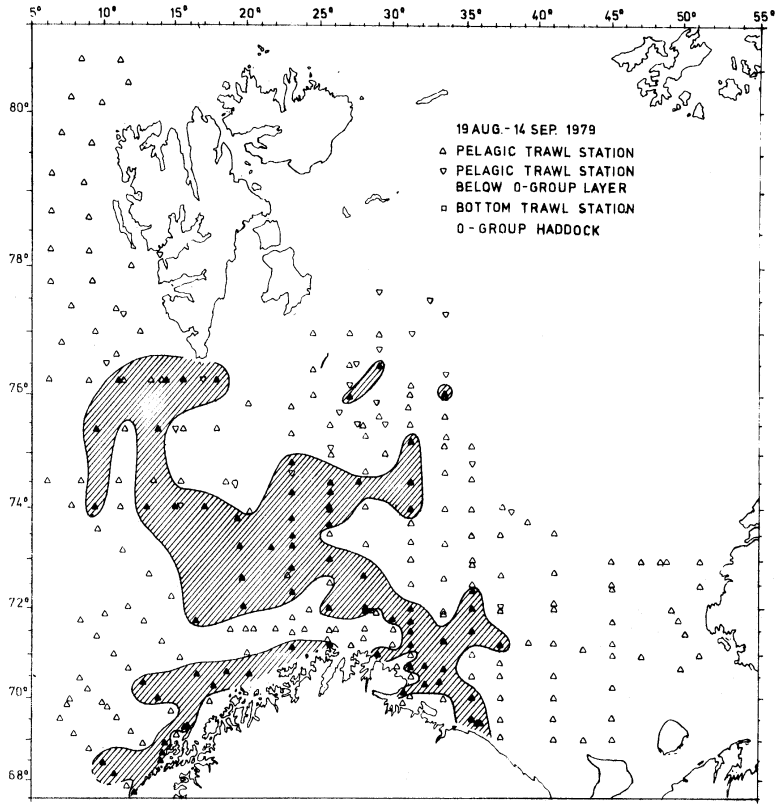

Fig. 13. Distribution of 0-group haddock

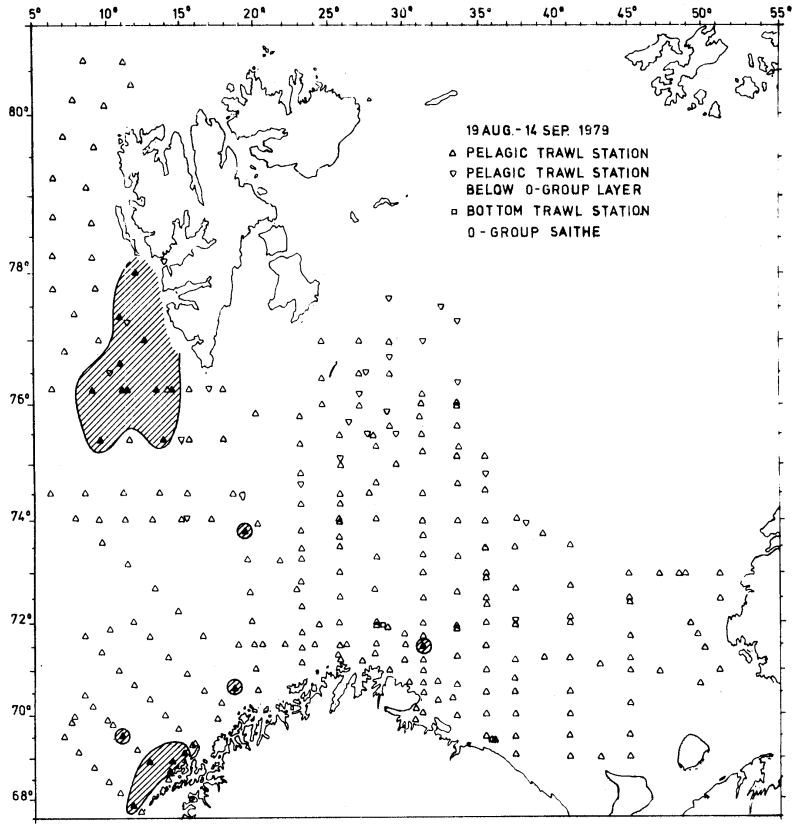

Fig. 14. Distribution of 0-group saithe

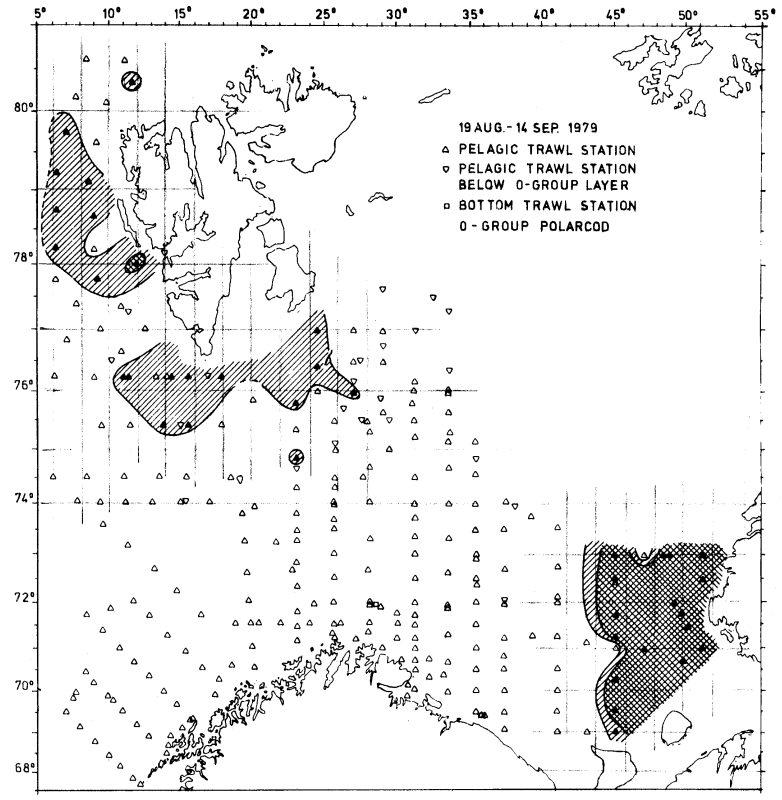

Fig. 15. Distribution of 0-group polar cod

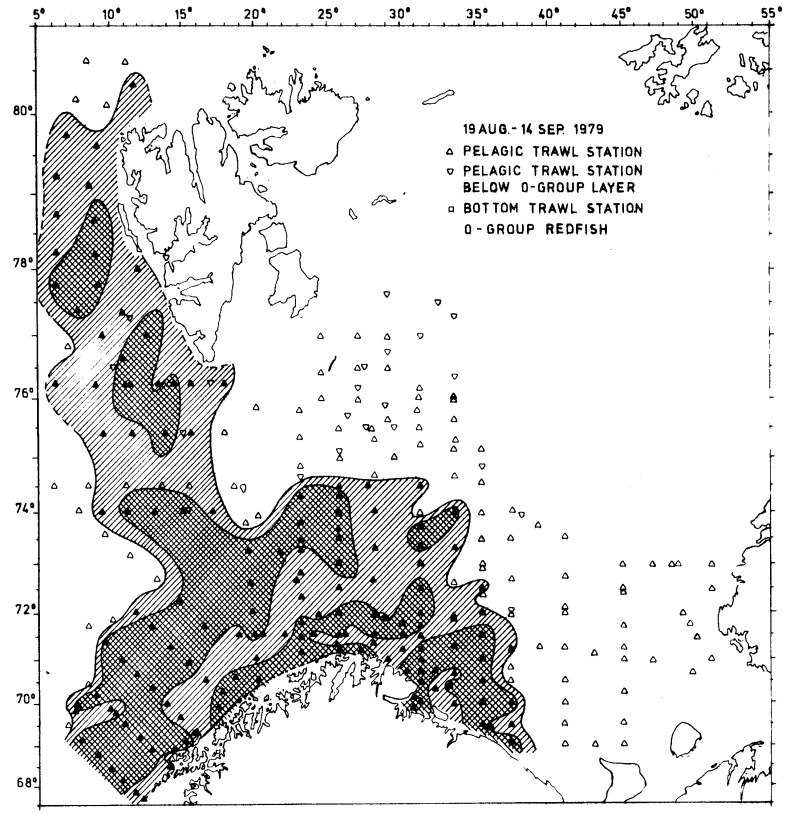

Fig. 16. Distribution of 0-group redfish

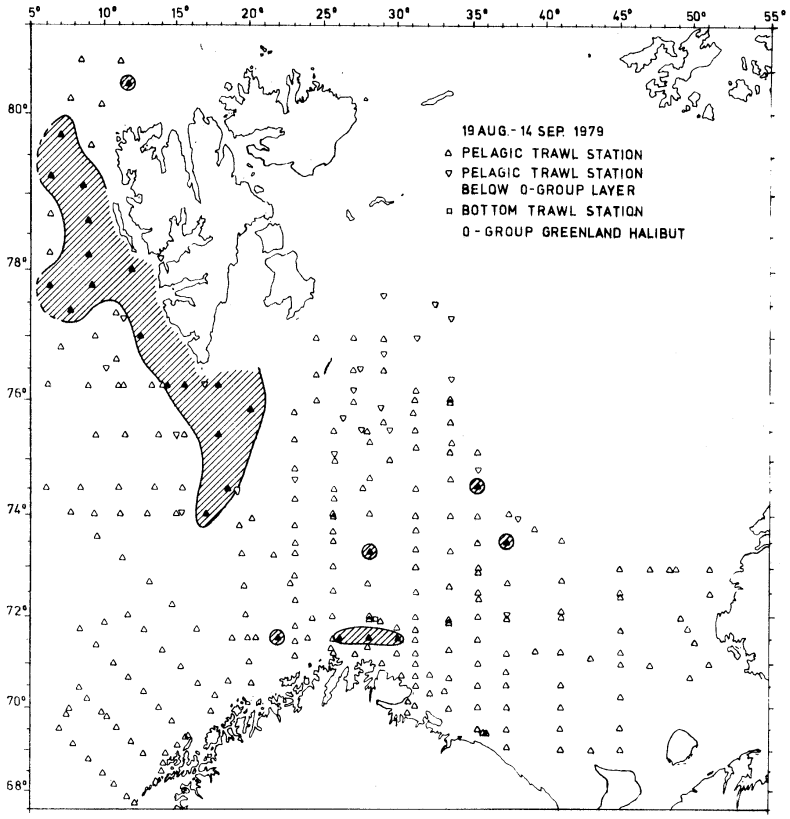

Fig. 17. Distribution of 0-group Greenland halibut

International Council for
the Exploration of the Sea

CM 1980/G:53
Pelagic Fish Committee
Ref: Demersal Fish and
Hydrographic Committees

Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August-September 1980

The sixteenth annual International 0-group fish survey was made during the period 16 August-8 September 1980 in the Barents Sea and adjacent maters. The following research vessels participated in the survey:

State	Name of vessel	Survey time	Research Institute
Norway	"Johan Hjort"	16 Auqust-7 September	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	16 August-7 September	" "
Norway	"Michael Sars"	16 August-8 September	" "
USSR	"Poisk"	22 August-7 September	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
USSR	"Akhill"	2 September-4 September	" "

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

The survey data was analysed the 8-9 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 condition in the area.

Material and methods

The geographical distributions of the 0-group Fish have in earlier surveys been estimated by fishing with a small meshed midwater trawl at the depth of the heaviest traces of 0-group fish on the echo-sounder, mainly between 0-50 m. In layers with no recordings hauls were made in the surface and with some recordings both in the surface and at 25 m depth, 0.5 n. mile in each depth. A higher standardized trawling procedure should be preferable. However, the trawling technics has made this difficult.

For fishing in the near surface layer floats were used on the headline of the trawl. By trawling deeper than 20 m a depth metering device had to be used for accurate control of the depth of trawling. Some trawling experiments in the beginning of the survey have shown that it is possible to control the trawling depth with both floats and metering device on the trawl. This make it possible to cover the mater column from 0-80 m in one haul. The Norwegian vessels, which use a trawl with a 20 m vertical opening cover this mater column by trawling with the headline in 0, 20, 40 and 60 m respectively.

A careful examination of all echo recordings have shown that 0-group fish is rear below 40-50 m. It should therefore only be necessary to trawl in 0, 20 and 40 m when the trawl has a 20 m opening.

After the 28 August this trawling procedure was followed by the Norwegian vessels on most of their trawl stations, and the trawling distance was 0,5 n. mile in 0, 20 and 40 m respectively. A trawl haul was made about every 30 nautical mile sailed. The USSR vessel, which used a trawl with a 6 m vertical and 10 m horizontal opening operated the trawl according to the old procedure.

The participants in the Hammerfest meeting discussed the need for a standardization of trawl gears and trawling procedure. They agreed to recommend that:

1) all vessels participating in the 0-group survey should use the same type of midwater trawl as the Norwegian vessels and it should be rigged in the same way;

2) the trawl should at each trawl station be working 0.5 n. mile in 0, 20 and 40 m, if necessary also in 60 m.

Trawl stations with and without catch are given on the distribution charts in Fig. 10-18, as filled and open symbols respectively. The density grading is based on catch in number per 1.0 nautical mile trawling.

Results

Hydrography (Figs. 2-9, Tables 1-4)

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). In Figs. 6-9 are given the temperature conditions at four standard sections, and the mean temperature of these sections are given in Tables 1-4. Some general comments are given below:

1) Kola section

During the last two years the mean temperature in this section has been low, but the I980 values are now close to the average for 1965-1980 in all three layers.

2) Cape Kanin - North section

The mean temperature in this section was in 1980 higher than in the previous years 1978 and 1979, but it is still below the average value for 1965-1980. The anomalies are -0.3 °C in the northern part and -0.8 °C in the southern part of the section.

3) North Cape - Bear Island section

The mean temperature in the section has gradually increased since 1977, the coldest year of the period 1965-1980. The 1980 value is 0.1 °C above the average 1965-1980.

4) Bear Island-West section

The mean temperature of the 0-200 m layer was this year 0.6 °C above the average value for the period 1965-1980. The 1980 therefore regarded as a rather warmer year and similar to the conditions found during 1973 and 1976-1977.

In general, the 1980 temperatures of the western Barents Sea are about normal, whereas the eastern part of the sea still is somewhat colder than the average 1965-1980. The temperature conditions west of the Bear Island indicate rather strong transport in the Spitsbergen current.

Distribution and abundance of 0-group fish

Geographical distribution of 0-group fish are shown by shaded areas in Figs. 10-18. Double shading indicates dense concentrations. Criteria used to discriminate between scattered and dense concentrations are the same as earlier reports (Ann. boil. 1978).

Abundance indices estimated as the area of distribution, areas of high densities weighted by 10, are given in Table 5. Lenght frequencies distributions of the main species are given in Fig. 19.

Capelin (Fig. 10)

The distribution of 0-group capelin in 1980 is similar to that found in 1979. The highest concentrations were found off the Finnmark and the Murman coast.

Contrary to the other species described in the present report, 0-group capelin is mostly found entangled in the meshes in the middle part of the trawl. This makes it difficult to sample 0-group capelin unbiased from year to year particularly because of variable weather conditions. Therefore it is regarded that an abundance index for capelin has little value. However, Table 5 gives the impression that the 1960 year-class is an abundant one.

Haddock (Fig. 11)

0-qroup haddock in 1980 has a westerly distribution, and is similar to that found in 1978. No high concentrations were found. The abundance index is only about half of the average abundance index in the previous 10 years.

Polar cod (Fig. 12)

The distribution of 0-group polar cod was similar to those found in the preceding three years, with a Spitsbergen and a Novaya Zemlya component. As in last years the area of distribution was not adequately covered because of limited research vessel time.

The estimated abundance indices are therefore too low for both components. The indices for the covered areas indicate that the 0-group polar cod is more abundant off Spitsbergen, but less abundant in the eastern part compared to 1979.

Greenland halibut (Fig. 13)

As in previous years 0-group Greenland halibut was mostly found off Bear Island and Spitsbergen. The abundance index for the 1980 year-class is close to the average abundance index from 1970 to 1979.

Herring (Fig. 14)

0-group herring was found in few numbers and only on 14 trawl stations, mainly off the East Finnmark coast. The abundance of the 0-group herring in the Barents Sea and adjacent areas is still low.

Cod (Fig. 15)

0-group cod was found in two main areas off the coast of Finnmark and west of Spitsbergen. It is the fourth year in succession a westerly distribution of 0-group cod has been observed.

The area of distribution was found to be rather small, and no dense concentrations were observed. The estimated abundance index of the 1980 year-class is about half of that for 1979, and is only 21 % of the average 0-group index for the previous 10 years.

Saithe (Fig. 16)

Only a few numbers of 0-group saithe were caught. As in previous years no abundance index of any significance can be estimated on the basis of the survey data.

Redfish (Fig. 17)

0-group redfish were found within a large area from Lofoten to the Murman coast, and continuously between Norway and the northern part of Spitsbergen. The abundance index of the 1980 year-class is the second highest recorded for redfish since 1965, only exceeded by the 1979.

Long rough dab (Fig. 18)

As in the last years, except for 1979, 0-group long rough dab was common in the trawl catches in the area west of Spitsbergen. Compared with 1979 it was also found further to the east in the Barents Sea. The abundance index is above the average in the previous 10 years.

Table 1. Mean water temperature in the Murmansk current, the Kola section (between 70°30' N and 69°30' N) at the end of August (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1965-1980
0-50 m	6.7	6.7	7.5	6.4	6.7	7.8	7.1	8.7	7.7	8.1	7.0	8.1	6.9	6.6	6.5	7.4	7.2
50-200m	3.8	2.6	4.0	3.7	3.1	3.6	3.2	4.0	4.5	3.9	4.6	4.0	3.4	2.5	2.9	3.5	3.6
0-200 m	4.6	3.6	4.9	4.4	4.0	4.7	4.2	5.2	5.5	4.9	5.2	5.0	4.3	3.6	3.8	4.5	4.5

Table 2. Mean water temperature in the Cape Kanin-North section (between 68°45' N and 72°00' N) from surface to bottom at the beginning of September (T °C)

Year	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1965-1980
68°45'N 70°05'N	4.8	2.0	6.1	4.7	2.6	4.0	4.0	5.1	5.7	4.6	5.6	4.9	4.1	2.4	2.0	3.3	4.1
71°00'N 72°00'N	4.2	2.5	3.6	3.1	2.5	3.3	3.2	4.1	4.5	-	4.5	4.6	3.3	1.7	1.8	3.0	3.3

Table 3. Mean water temperature in the North Cape current, the North Cape to Bear Island section (between 71°33' N, 25°02' E and 73°35' N, 20°46' E) at the end of August and at the beginning of September (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1965-1980
0-200 m	5.1	5.5	5.6	5.4	6.0	6.1	5.7	6.3	5.9	6.1	5.7	5.7	4.8	5.0	5.3	5.7	5.6

Table 4. Mean water temperature in the West Spitsbergen current along the Bear Island West section (between 06°34' E and 15°55' E) in early September (T °C)

Year/ Layer	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1966-1980
0-200m	3.3	4.2	3.6	4.2	-	4.2	3.9	5.0	4.6	4.9	5.0	4.0	4.1	4.4	4.9	4.3

Table 5. Abundance indices

Species	Cod		Haddock	Polar cod			Redfish		Greenland	Long rough
Year		ln		West		East		ln	Halibut	dab
1965	6	1.79	7		0		159	5.07		66
1966	1	0.41	< 1		129		236	5.46		97
1967	34	3.53	42		165		44	3.78		73
1968	25	3.22	8		60		21	3.04		17
1969	93	4.53	82		208		295	5.69		26
1970	606	6.41	115		197		247	5.51	< 1	12
1971	157	5.06	73		181		172	5.15	< 1	81
1972	140	4.94	46		140		177	5.18	8.0	65
1973	684	6.53	54		(26)		385	5.95	3.2	67
1974	51	3.93	147		227		468	6.15	13.4	83
1975	343	5.84	170		75		315	5.75	21.1	113
1976	43	3.76	112		131		447	6.1	15.6	96
1977	173	5.15	116	157		70	472	6.16	9.0	72
1978	106	4.66	61	107		144	460	6.13	35.4	76
1979	94	4.54	69	23		302	980	6.89	22.5	69
1980	49	3.89	54	79		247	651	6.48	12.0	108
	cp. 163						cp. 346			

Appendix

Survey period	Research vessel	Research institute	Participants
22 August- 7 September	"Poisk"	Polar Research Institute of Marine Fisheries and Oceano- graphy, Murmansk	A.U. Averchenko, U.D. Boitsov, O.J. Gavrilina, A.U. Iljina, U.N. Kochedykov, L.N. Korol', V.S. Mamylov, U.N. Nenko, N.G. Ushakov, U.P. Vorontsov.
2 September- 4 September	"Akhill"	"	
16 August- 8 September	"Michael Sars"	Institute of Marine Research, Bergen	S. Brattås, R. Johannessen, J.Monstad, T. Monstad, J.H. Nilsen, T.H. Sangold, S. Torheim.
16 August- 8 Septeinber	"G.G. Sars"	"	G. Farstad, K. Gjertsen, K. Hansen, A. Hylen, H. Kismul, E. Lifjell, L. Midttun, E. Molvær, K. Randa, I. Svellingen, Ø. Tangen.
16 August- 8 September	"Johan Hjort"	"	C. Aranda, J. Blindheim, K.A. Larsen, O. Martinsen, C.J. Rørvik, J. Rørvik, J. Sortland, A. Thomassen, Ø. Torgersen

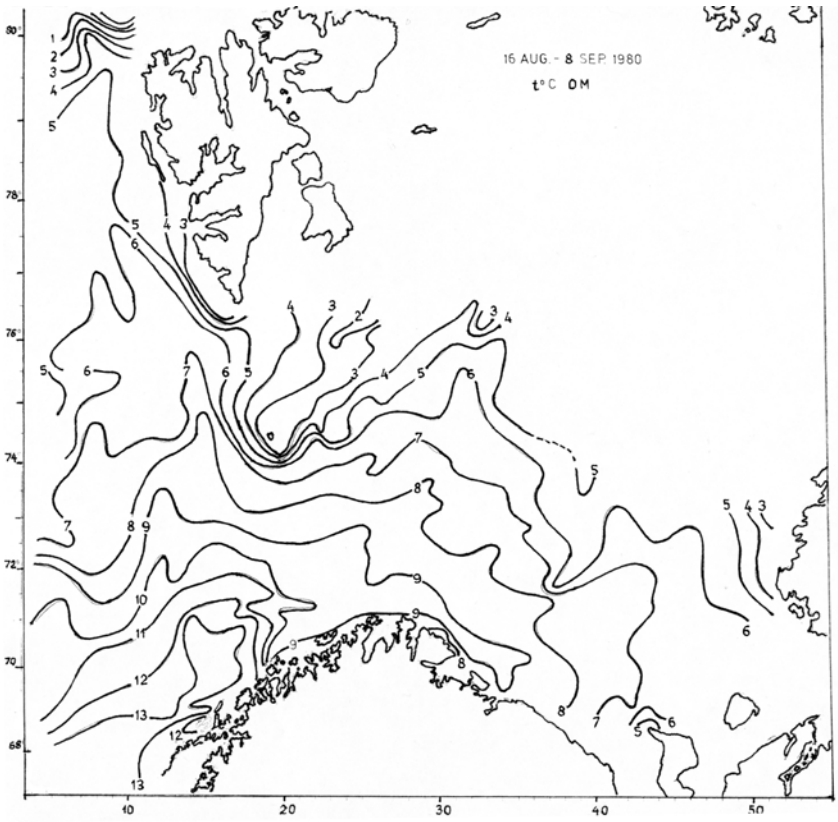

Fig. 2. Isotherms at 0 m

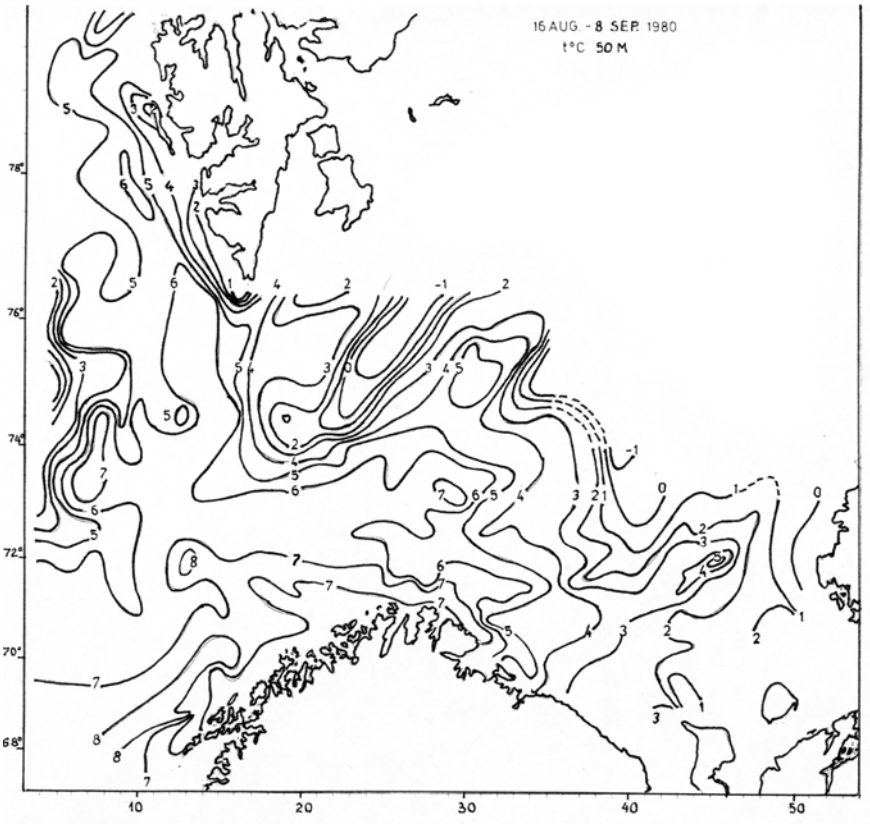

Fig. 3. Isotherms at 50 m

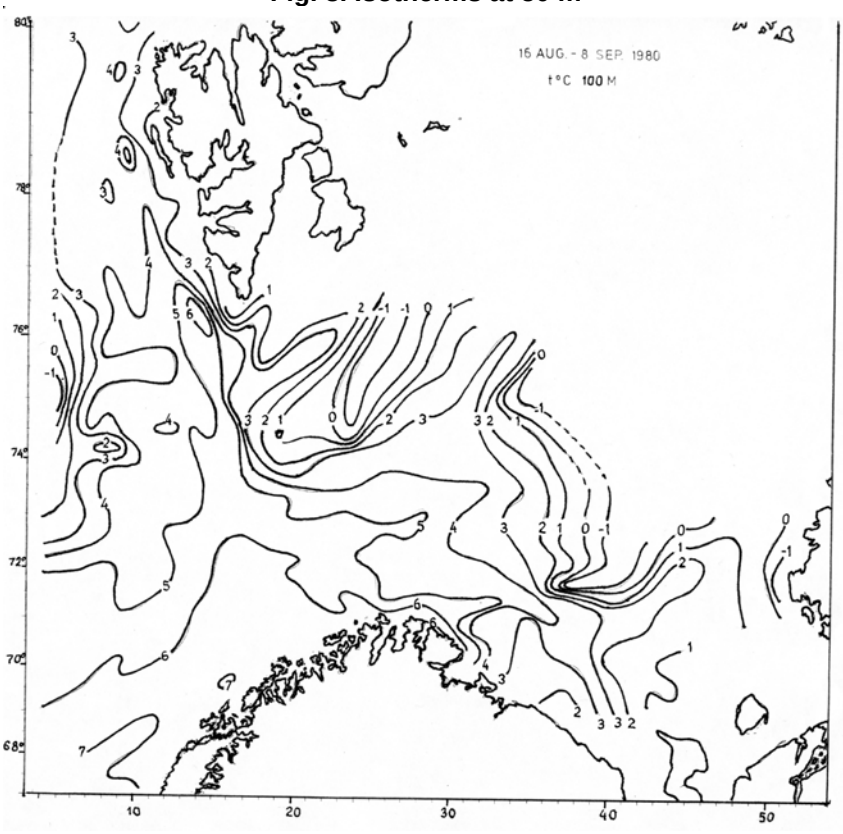

Fig. 4. Isotherms at 100 m

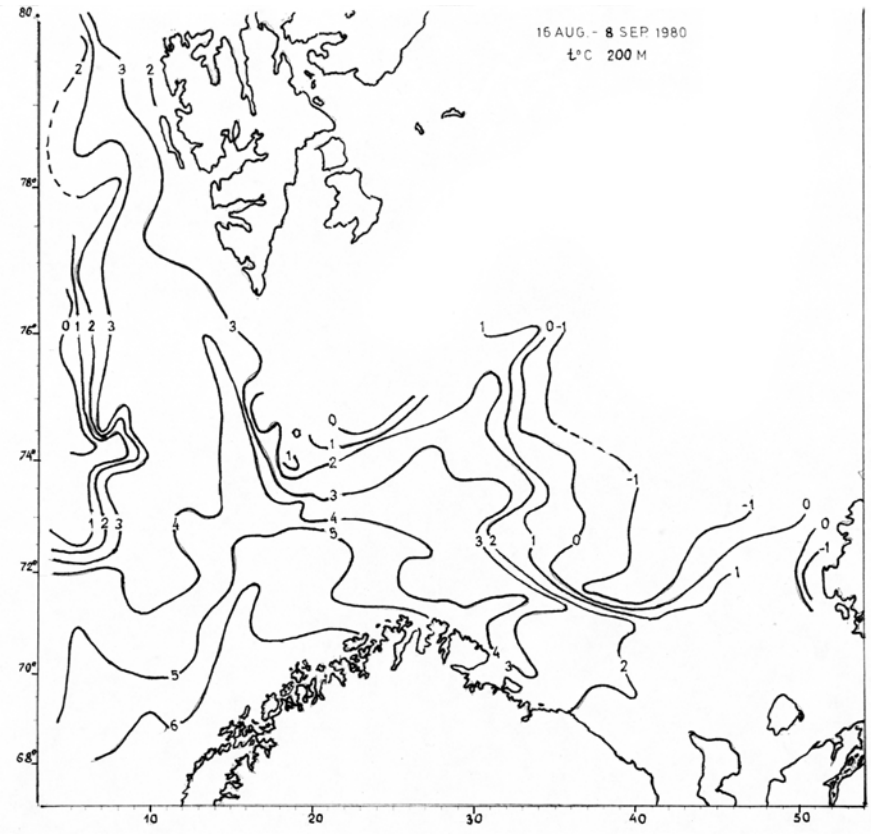

Fig. 5. Isotherms at 200 m

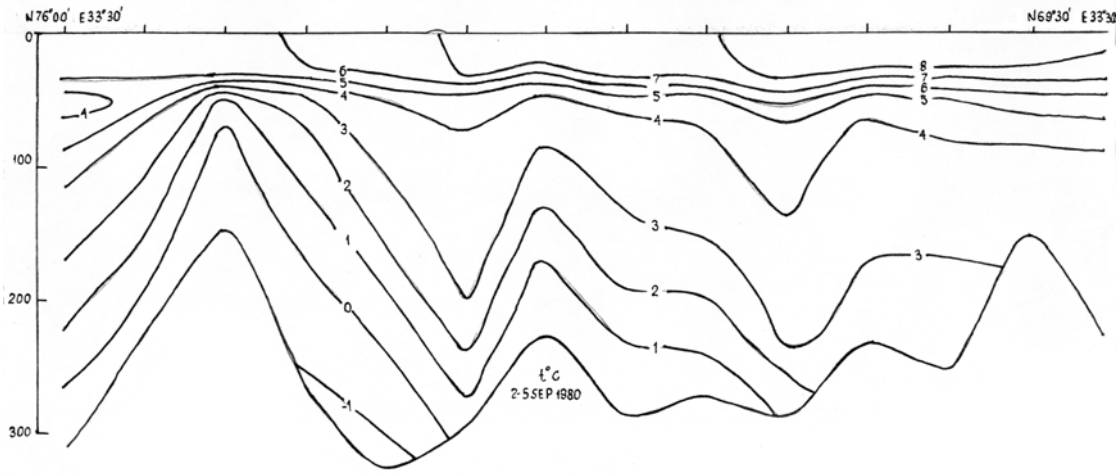

Fig. 6. Temperature section along the Kola meridian

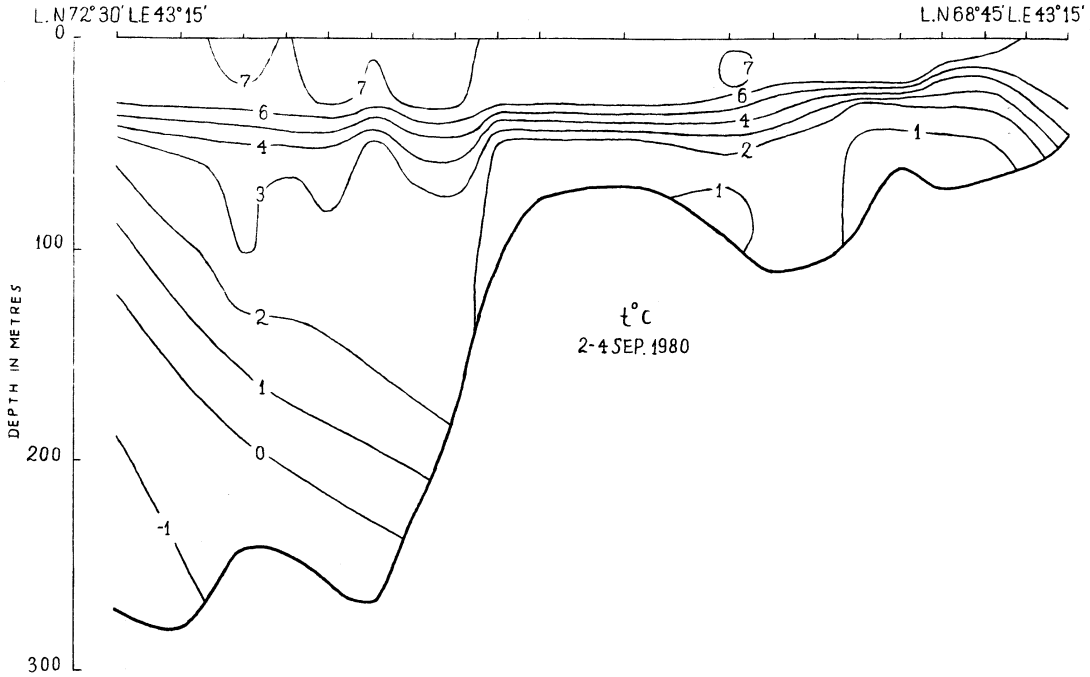

Fig. 7. Temperature section Cape Kanin-North

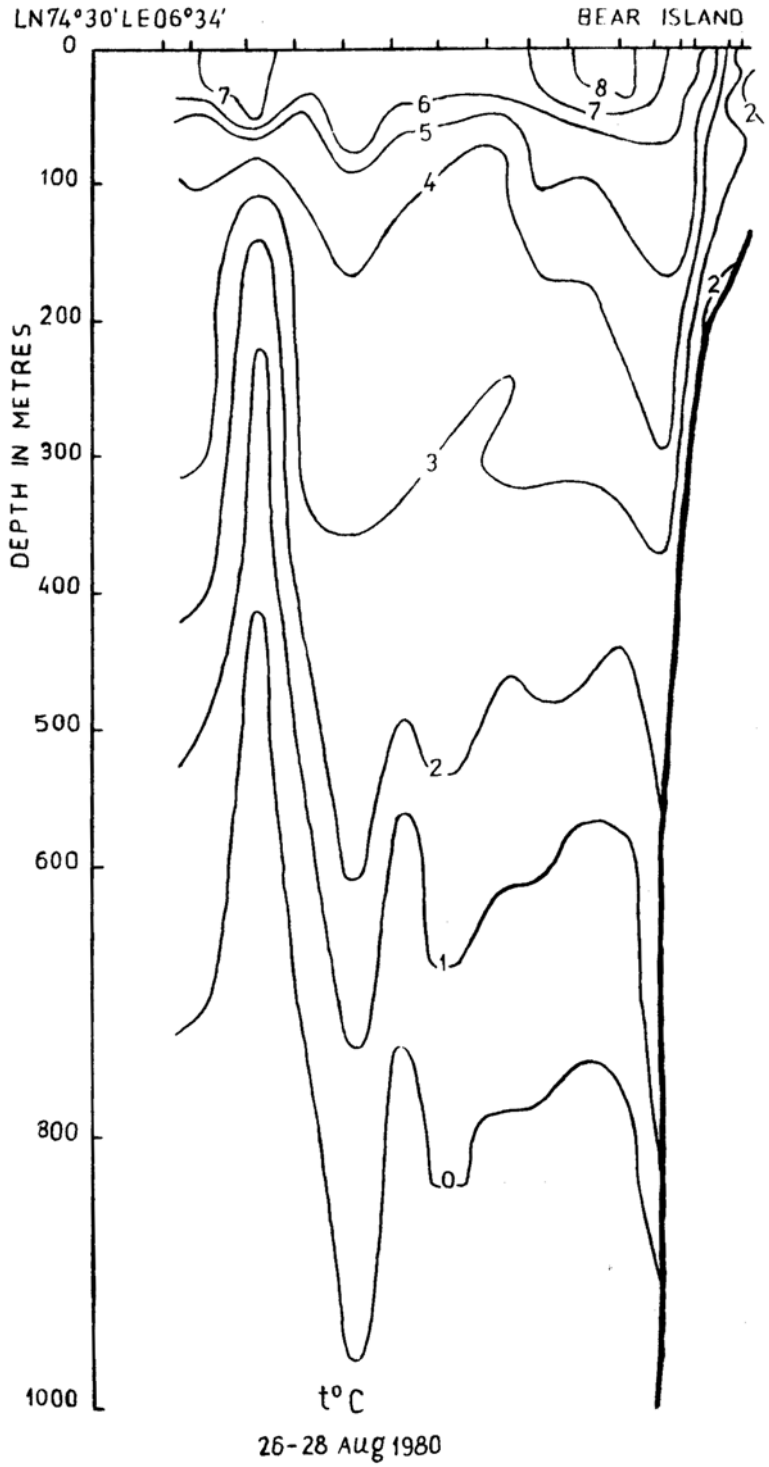

Fig. 8. Temperature section Bear Island-West

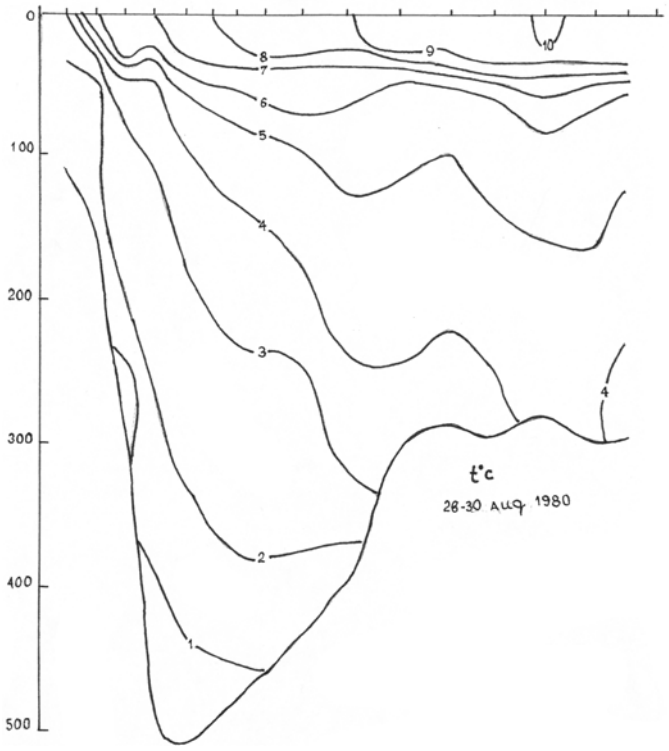

Fig. 9. Temperature section Cape Kanin-North

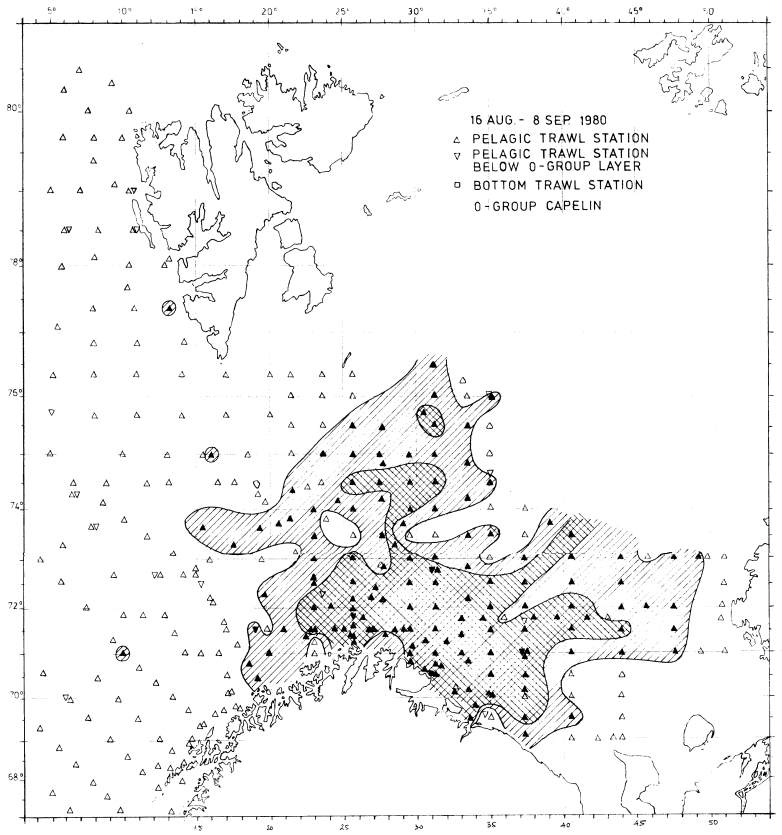

Fig. 10. Distribution of 0-group capelin

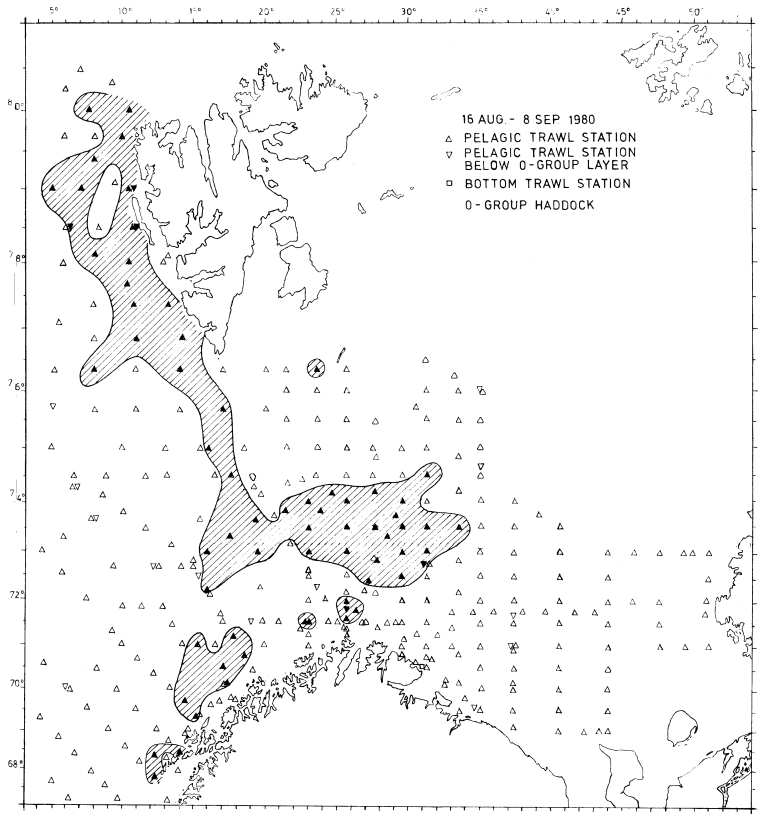

Fig. 11. Distribution of 0-group haddock

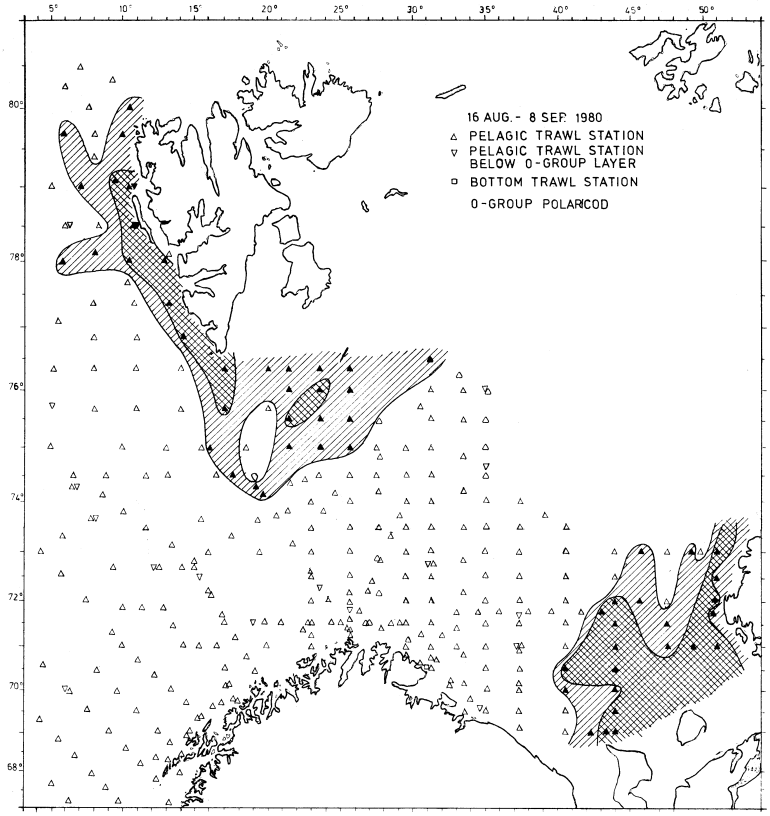

Fig. 12. Distribution of 0-group polar cod

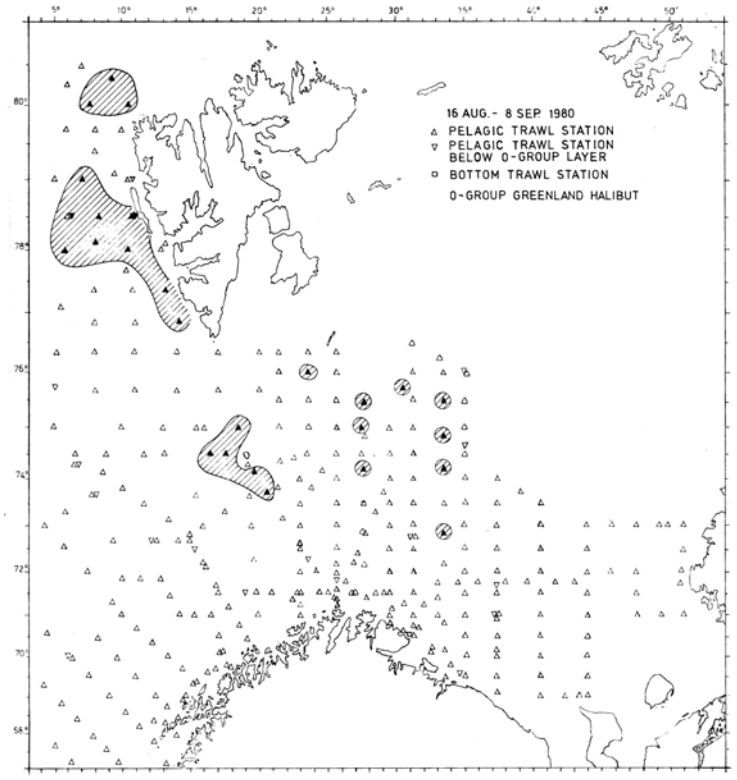

Fig. 13. Distribution of 0-group Greenland halibut

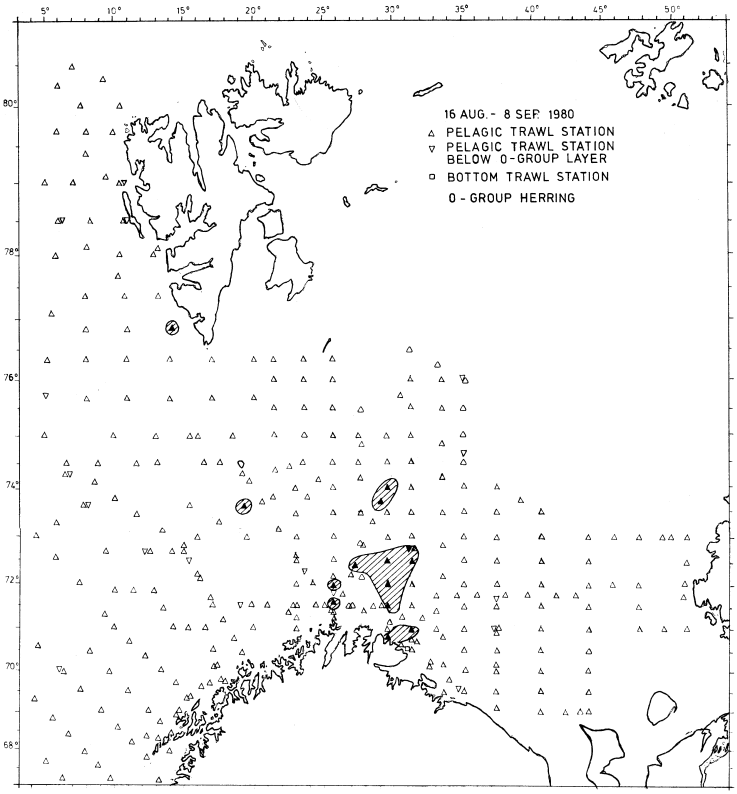

Fig. 14. Distribution of 0-group herring

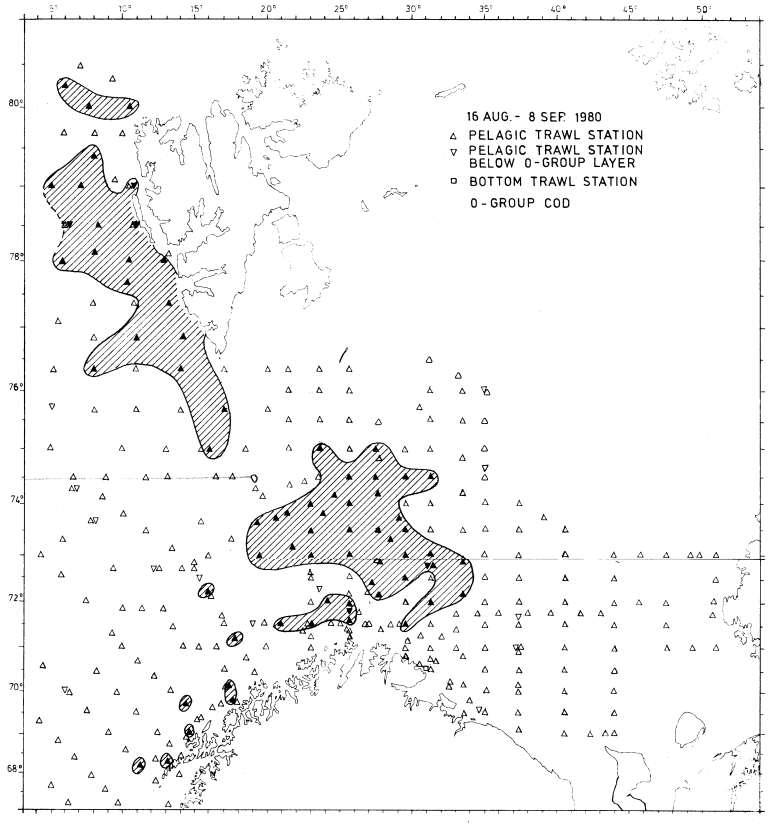

Fig. 15. Distribution of 0-group cod

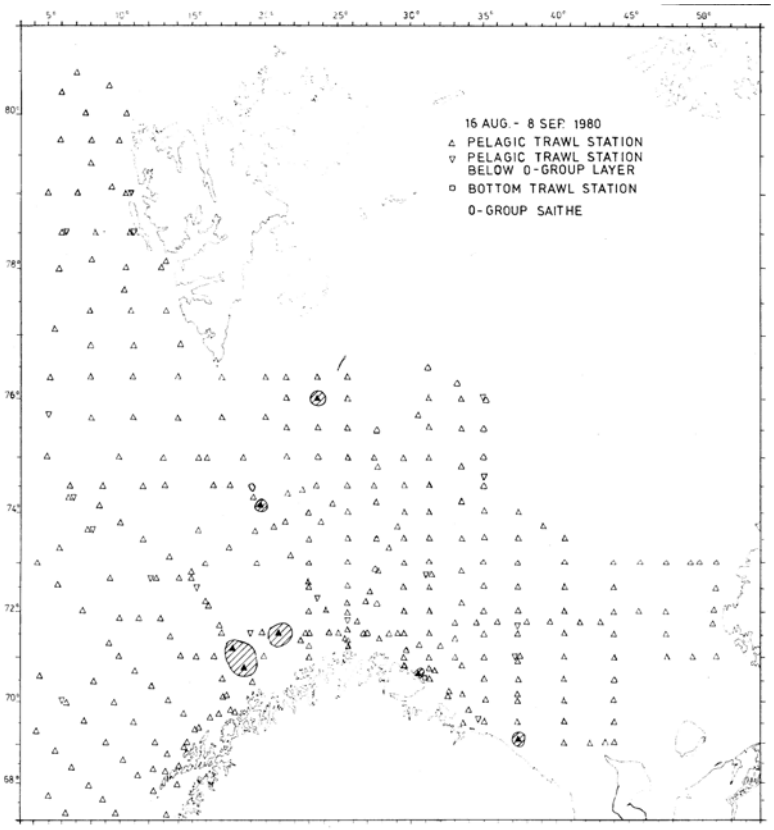

Fig. 16. Distribution of 0-group saithe

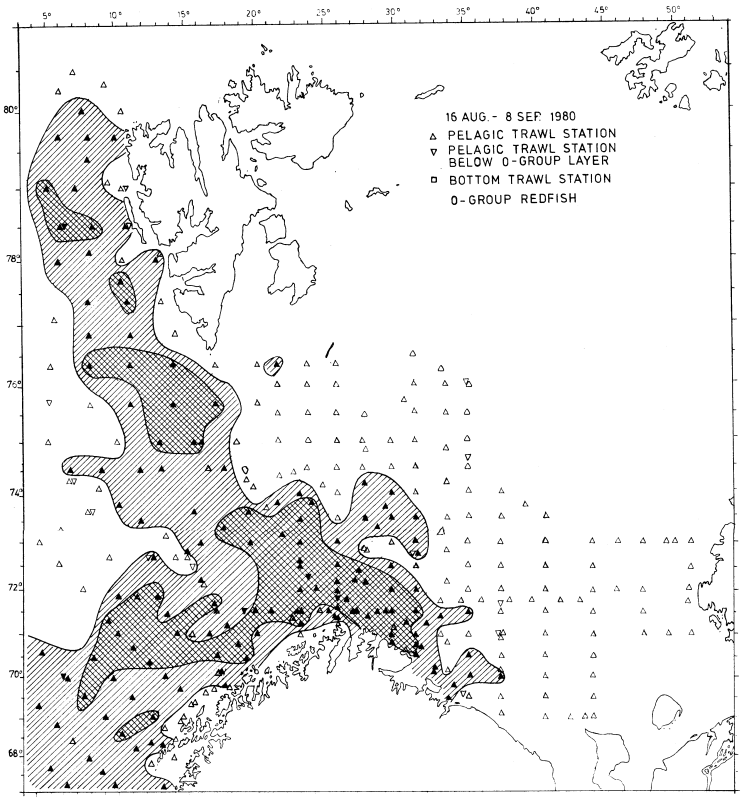

Fig. 17. Distribution of 0-group redfish

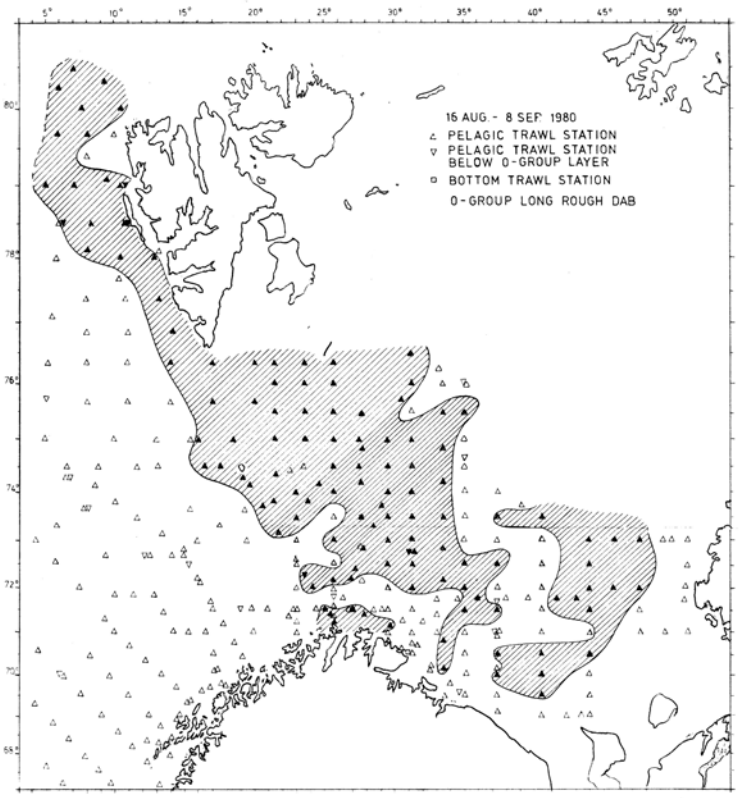

Fig. 18. Distribution of 0-group long rough dab

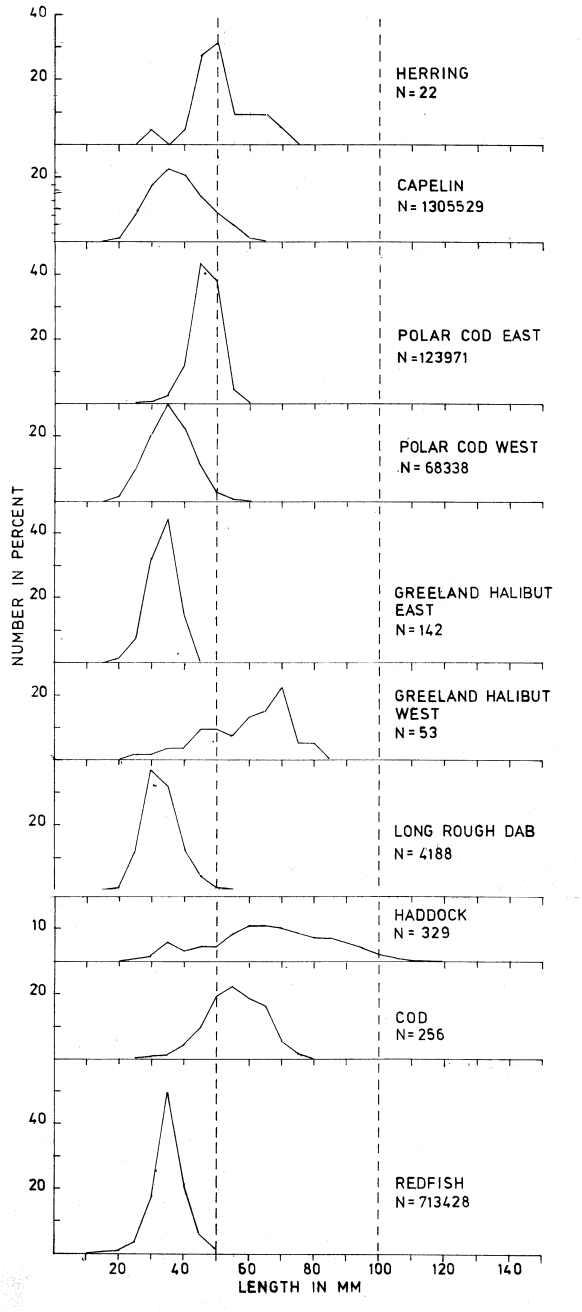

Fig. 19. Length distribution of 0-group fish

International Council for
the Exploration of the Sea

CM 1981/G:78
Demersal Fish Committee
Ref: Pelagic Fish and
Hydrographic committees

Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August-September 1981

The seventeenth annual International 0-group fish survey was made during the period 12 August-6 September 1981 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey time	Research Institute
Norway	"Johan Hjort"	21 August-5 September	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	14 August-4 September	" "
Norway	"Michael Sars"	12 August-4 September	" "
USSR	"Persey-III"	22 August-6 September	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
USSR	"Akhill"	23 August-1 September	" "

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

The survey data were analysed 5-7 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 meshed midwater trawl. The vessels participating in the survey in 1981 used the type of midwater trawl recommended by the meeting held after the survey in 1980 (Anon. 1980b). The trawling procedure was standardized in accordance with the recommendation made at the same meeting. At about every 30 nautical miles sailed the trawl was towed 0.5 nautical mile at each depth; the headline of the trawl at 0,20 and 40 m. If traces on the echo-sounder deeper than 60 m were recognized as 0-group fish the trawl was also towed at 60 m.

Survey tracks and hydrographical stations are given in Fig. 1. Trawl stations with and without catch are given on the distribution charts in Figs. 10-17, as filled and open symbols respectively. The density grading is based on catch in number per 1.0 nautical mile trawling.

Hydrography

Hydrographic observations were made along all the survey tracks, normally after each 30 nautical miles sailed. Horizontal temperature distribution is shown for 0,50,100 and 200 m depth (Figs. 2-5). Figs. 6-9 show the temperature conditions at four standard sections, and the mean temperature of these sections are given in Tables 1-4. Some general comments are given below:

1) Kola Meridian

Mean water temperatures on this section were the following: 0-50 m: 6.6 °C, 50-200 m: 2.7 °C, 0-200 m: 3.7 °C. Those temperatures were below the long-term mean by -0.6, -0.8, -0.8 respectively, i.e. after 1980 some cooling was again observed.

2) Kanin Meridian

In 1981, the mean water temperature on this section was below that of 1980 and considerably less than the long-term mean, particularly in the southern part of the section. Temperature values for southern and northern parts of the section were: 2,7 and 2.5 °C, anomalies were: -1.3 and -0.7 °C respectively.

3) North Cape - Bear Island section

Mean water temperature on this section was 5.3 °C, which is 0.3 ° below the long-term mean for the 1965-1981 period of observations.

4) Section west of Bear Island

In 1981, water temperature on this section in the 0-200 m layer was 4.4 °C, which is close to the long-term mean of 4.3 °C.

In 1981 temperature conditions in the Barents Sea were colder than those of the mean level for 1965-1981, particularly in the east. To the west, the anomalies decreased, and on the section west of Bear Island mean temperature was at the level of the long-term mean.

Distribution and abundance of 0-group fish

Geographical distributions of 0-group fish are shown by shaded areas in Figs. 10-17. Double shading indicates dense concentrations. The criteria for discrimination between scattered and dense concentrations are the same as used in earlier reports (Anon. 1978).

Abundance indices estimated as the area of distribution with areas of high densities weighted by 10, are given in Table 5. Length frequency distributions of the main species are given in Table 6.

Two new sets of abundance indices have been estimated for 0-group cod (Randa 1981). They are both based on stratified mean catch in numbers for a standard trawl haul of one nautical mile. The stratification system was based on 17 geographical areas. Basis for the establishment of these strata was that some trawl stations could be allocated to each strata every year. In addition, attention was paid to the temperature conditions and the water transport in the different currents in the surveyed area.

Herring (Fig. 10)

0-group herring were found only on six stations in the Bear Island - Spitsbergen area. In contrast to the most recent years no herring were captured off the Finnmark coast. Although one single haul off Spitsbergen gave a catch of 10 per nautical mile, the abundance of 0-group herring in the surveyed area seems to be low.

Capelin (Fig. 11)

The distribution of 0-group capelin in 1981 is distinguished from the distributions in the most recent years by being extended considerably more towards west and northwest,

whereas the distribution to the east is less extensive. The main area of dense concentrations was found off the Finnmark coast and the distribution of 0-group capelin in 1981 clearly reflects a westerly distribution of the spawning.

0-group capelin is mostly found entranted in the meshes in the middle part of the trawl. It is difficult to sample 0-group capelin unbiased because a varying proportion is washed out of the meshes depending on the weather conditions. In the past, abundance indices for 0-group capelin have not been very reliable. However, the extensive area of distribution in 1981 indicates that the 1981 year-class of capelin is abundant.

Cod (Fig. 12)

The main distribution of 0-group cod is separated into two areas west of Spitsbergen and one area north of Finnmark with an extension southeastward to the Kola peninsula. The distribution to the southeast is clearly more pronounced than in the most recent years. The total area of distribution is relatively small, the concentrations were generally low and the resulting index is less than half of the long-term average.

The data were normalized by applying a logarithmic transformation to the catch in numbers of 0-group cod per nautical mile and confidence limits for the two sets of abundance indices were estimated (Table 7). The sets of indices are on a logarithmic scale and transformed back to numbers of 0-group cod per standard trawl haul. The indices together with their confidence limits are shown in Table 7. Details of the calculations are given in Randa (1981). The basic theory behind the calculations is provided by Pennington and Grosslein (1978), Aitchinson and Brown (1957) and Jones (1956).

The correlation coefficient between the area based abundance indices for 0-group cod of the year classes 1965-1975 and the VPA estimates for the same year-classes as 3 year old (Anon 1980b) is 0.70. The corresponding correlation coefficient between logarithmic indices and the VPA estimates is 0,88, and between retransformed indices and VPA estimates 0,83. The new sets of abundance indices for the 1981 year-class of cod are low, and they indicate a year-class strength below all year-classes since 1968.

Haddock (Fig. 13)

Two main areas of distribution of 0-group haddock were found, one area north of Finnmark and another extending from west of Bear Island northward up to Spitsbergen and along part of its west coast. The distribution is more to the west than in most earlier years. The area is small, the concentrations were low and the index indicates that the 1981 year-class of haddock is very poor, possibly the least abundant year-class after 1967.

Polar cod (Fig. 14)

There are three main areas of distribution of polar cod. The largest area is in the Bear Island - Spitsbergen region and is assumed to represent the western component of the stock. This is also where the largest concentrations were found, in an area from east of Bear Island to southeastern Spitsbergen. The main area for the eastern component of the stock was found along the coast of Novaya Zemlya north of 73° N. Polar cod were also found in a smaller area north of the Kola peninsula and these were assumed to belong to the eastern component of the stock. The indices indicate that the 1981 year-class of the western component is very rich, possibly the most abundant year class recorded in the 0-group surveys, whereas in the eastern part the year class seems to be below average. However, the latter estimate may not be very reliable since the distribution in the east extends beyond the surveyed area.

Redfish (Fig. 15)

The distribution of 0-group redfish is similar to those of the most recent years, but the area of highest concentrations is more to the southwest. The index indicates that the 1981 year-class is nearly as rich as the 1979 year-class, which has the highest index recorded in these surveys.

Greenland halibut (Fig. 16)

The distribution of Greenland halibut was as usual confined chiefly to the Bear Island-West Spitsbergen area. The index is the highest recorded in the 0-group surveys.

Long rough dab (Fig. 17)

The distribution of 0-group long rough dab in 1981 is similar to the one in 1980, but does not extend so far to the east. The index of abundance indicates that the 1981 year-class is above average.

Table 1. Mean water temperature in the Murmansk current, the Kola section (between 70°30' N and 69°30' N) at the end of August (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1965-1981
0-50 m	6.7	6.7	7.5	6.4	6.7	7.8	7.1	8.7	7.7	8.1	7.0	8.1	6.9	6.6	6.5	7.4	6.6	7.2
50-200 m	3.8	2.6	4.0	3.7	3.1	3.6	3.2	4.0	4.5	3.9	4.6	4.0	3.4	2.5	2.9	3.5	2.7	3.5
0-200 m	4.6	3.6	4.9	4.4	4.0	4.7	4.2	5.2	5.5	4.9	5.2	5.0	4.3	3.6	3.8	4.5	3.7	4.5

Table 2. Mean water temperature in the Cape Kanin-North section (between 68°45' N and 72°00' N) from surface to bottom at the beginning of September (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1965-1981
68°45'N 70°05'N	4.8	2.0	6.1	4.7	2.6	4.0	4.0	5.1	5.7	4.6	5.6	4.9	4.1	2.4	2.0	3.3	2.7	4.0
71°00'N 72°00'N	4.2	2.5	3.6	3.1	2.3	3.3	3.2	4.1	4.5	-	4.3	4.6	3.3	1.7	1.8	3.0	2.5	3.3

Table 3. Mean water temperature in the North Cape current, the North Cape to Bear Island section (between 71°33' N, 25°02' E and 73°35' N, 20°46' E) at the end of August and at the beginning of September (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1965-1981
0-200 m	5.1	5.5	5.6	5.4	6.0	6.1	5.7	6.3	5.9	6.1	5.7	5.7	4.8	5.0	5.3	5.7	5.3	5.6

Table 4. Mean water temperature in the West Spitsbergen current along the Bear Island West section (between 06°34' E and 15°55' E) at the end of August and at the beginning of September (T °C)

Year/ Layer	1966	1967	196&	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1965-1981
0-200 m	3.3	4.2	3.6	4.2	-	4.2	3.9	5.0	4.6	4.9	5.0	4.0	4.1	4.4	4.9	4.4	4.3

Table 5. Abundance indices

Species	Cod	Haddock	Polar cod			Redfish	Greenland	Long
Year			West		East		halibut	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	8.0	65
1973	684	54		(26)		385	3.2	67
1974	51	147		227		468	13.4	83
1975	343	170		75		315	21.1	113
1976	43	112		131		447	15.6	96
1977	173	116	157		70	472	9.0	72
1978	106	61	107		144	460	35.4	76
1979	94	69	23		302	980	22.5	69
1980	49	54	79		247	651	12.0	108
1981	65	30	149		73	861	38.0	95

Table 6. Length distribution of 0-group fish (%)

Length, mm	Herring	Capelin	Polar cod		Greenland halibut	Long rough dab	Haddock	Cod	Redfish
			East	West					
5-9									0.0
10-14						0.0			1.1
15-19		0.3		0.0		2.0			1.9
20-24		4.9	0.2	3.6		14.6			1.9
25-29		12.8	0.7	16.7		36.7			2.7
30-34		16.0	17.5	33.4		31.9	1.18	2.2	2.6
35-39		13.2	51.1	37.6	0.2	10.0	2.35	1.8	12.1
40-44		16.7	26.9	8.2	1.1	3.5	5.88	5.4	38.5
45-49	23.5	22.6	3.5	0.4	3.0	1.2	4.71	6.5	29.4
50-54		10.9	0.2	0.1	6.2	0.1	5.9	15.2	9.6
55-59	17.7	2.7		0.0	12.1	0.0	11.8	14.8	0.2
60-64	58.8	0.1			19.9		5.9	14.4	
65-69	11.8	0.0			25.6		28.2	18.8	
70-74					24.3		5.9	14.4	
75-79					6.6		10.6	5.4	
80-84					0.9		8.2	1.1	
85-89							5.9		
90-94							3.5		
N	19	658174	2176	43207	437	4052	85	277	982905
Mean length, mm	59.1	39.9	38.2	34.1	65.4	29.9	66.3	60.5	42.5

Table 7. Abundance indices with 90 % confidence limits for 0-group cod

Year-class	Logarithmic indices		Retransformed indices	
	Index	Confidence limits	Index	Confidence limits
1965	0.01	x)	0.10	x)
1966	0.03	0.02-0.05	0.14	0.14-0.15
1967	0.06	0.03-0.11	0.34	0.30-0.37
1968	0.02	0.01-0.05	0.24	0.22-0.26
1969	0.31	0.22-0.43	2.51	2.20-2.87
1970	2.54	2.07-3.01	369.19	268.89-506.91
1971	0.83	0.61-1.08	28.13	9.15-47.11
1972	0.62	0.42-0.86	6.47	5.10-8.19
1973	1.33	1.04-1.66	170.69	126.90-229.60
1974	0.35	0.22-0.51	6.50	4.81-8.12
1975	0.97	0.71-1.27	157.87	114.13-218.39
1976	0.15	0.07-0.26	1.26	1.01-1.56
1977	0.51	0.37-0.69	12.81	4.53-21.08
1978	0.28	0.18-0.39	3.72	3.15-4.39
1979	0.44	0.30-0.61	3.36	2.71-4.17
1980	0.17	0.11-0.24	0.98	0.88-1.09
1981	0.11	0.06-0.19	0.71	0.61-0.82

x) 0-group cod caught only in one haul.

Appendix

Survey period	Research vessel	Research Institute	Participants
22 August- 6 September	"Persey III"	Polar Research Institute of Marine Fisheries and Oceanography, Murmansk	I.V. Borkin, N.P. Chebotok, A.S. Galkin, A.Sh. Gubaidullin, A.V. Ilyina, V.A. Khiyupin, S.A. Larkina, S.D. Melnikov, L.N. Korol, V.V. Podolsky, N.V. Vanyukhina, V.I. Zubov.
23 August- 1 September	"Akhill"		A.I. Lysota, V.I. Ashikhmin
12 August- 4 September	"Michael Sars"	Institute of Marine Research, Bergen	M. Abrahamsen, S. Andreassen, J. Blindheim, A. Dommasnes, B. Hofstad, A.L. Halvorsen T. Mørk, Ø. Skåthun, Ø. Tangen, J. Vartdal.
14 August- 4 September	"G.O. Sars"	"	O. Alvheim, B. Brynildsen, I. Byrkjedal, K. Hansen, K. Hestenes, A. Hylen, O.S. Kjesbu, W. Løtvedt, L. Midttun, E. Molvær, G. Molvik, T. Monstad, R. Pedersen, O.I. Poulsen, A. Randa, A. Roald, S. Sveinbjørnsson.
21 August- 5 September	"Johan Hjort"	"	G. Farstad, T. Jakobsen, H. Larsen, O. Martinsen, J.P. Maude, Ø. Torgersen.

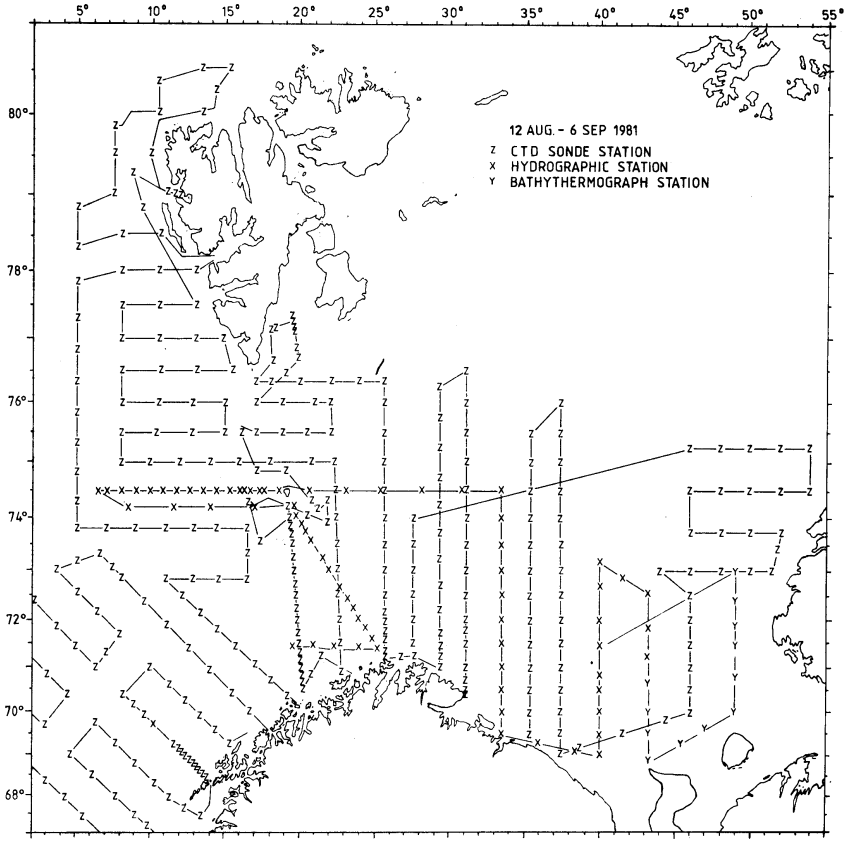

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

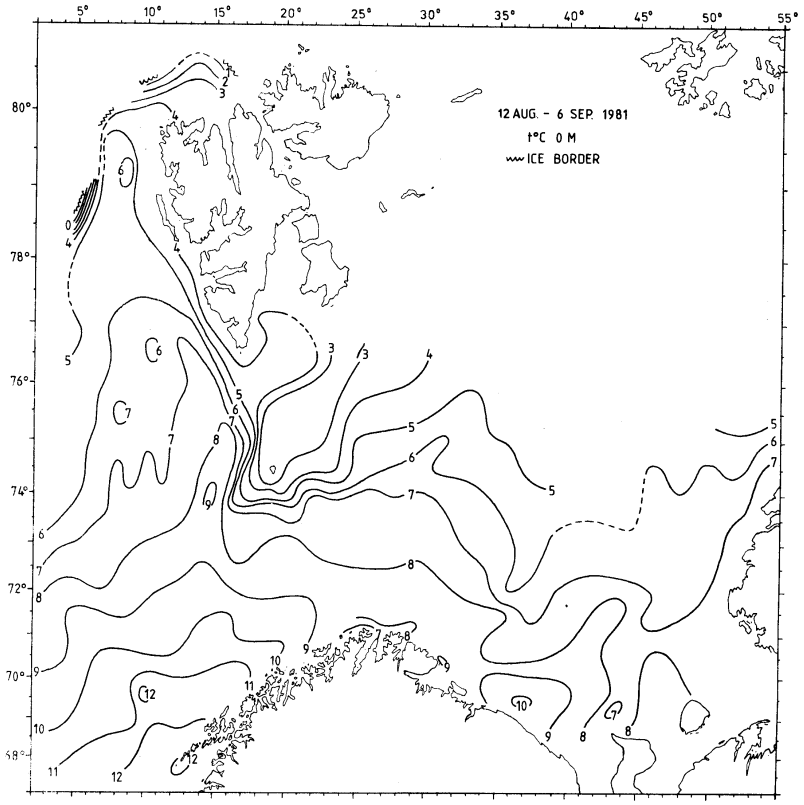

Fig. 2. Isotherms at 0 m

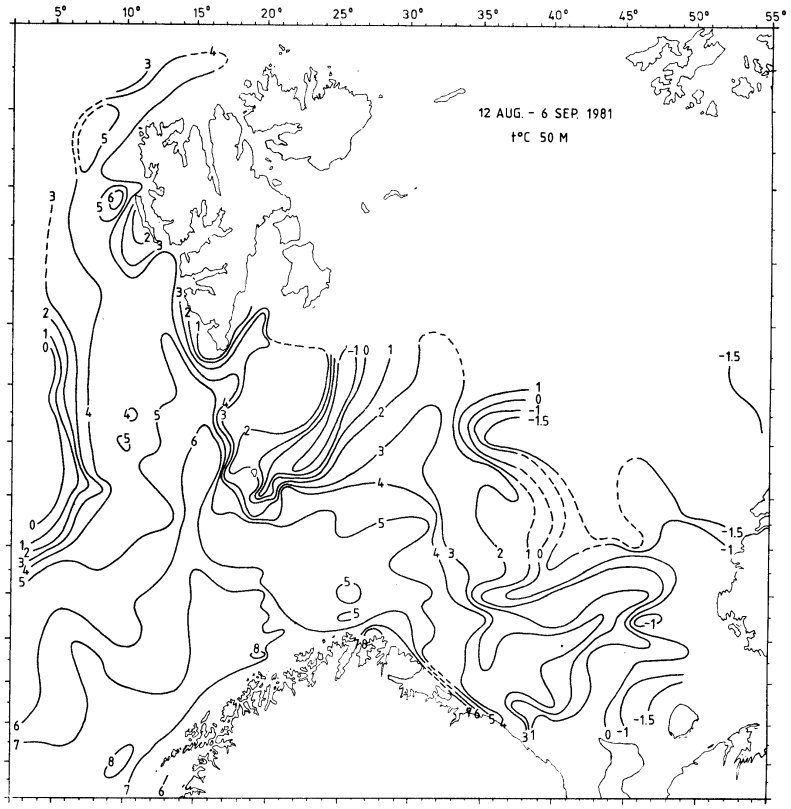

Fig. 3. Isotherms at 50 m

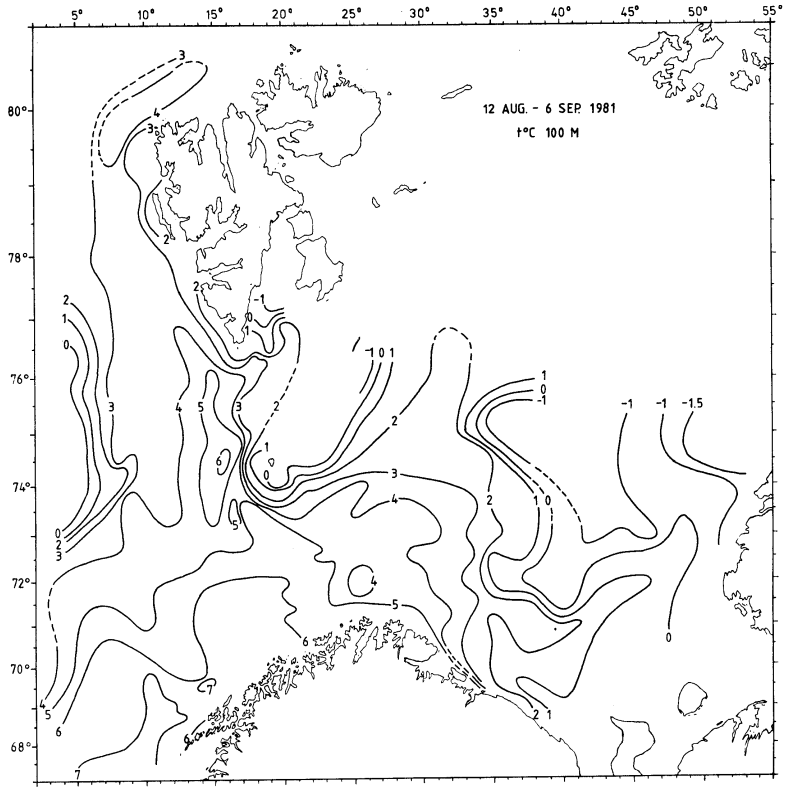

Fig. 4. Isotherms at 100 m

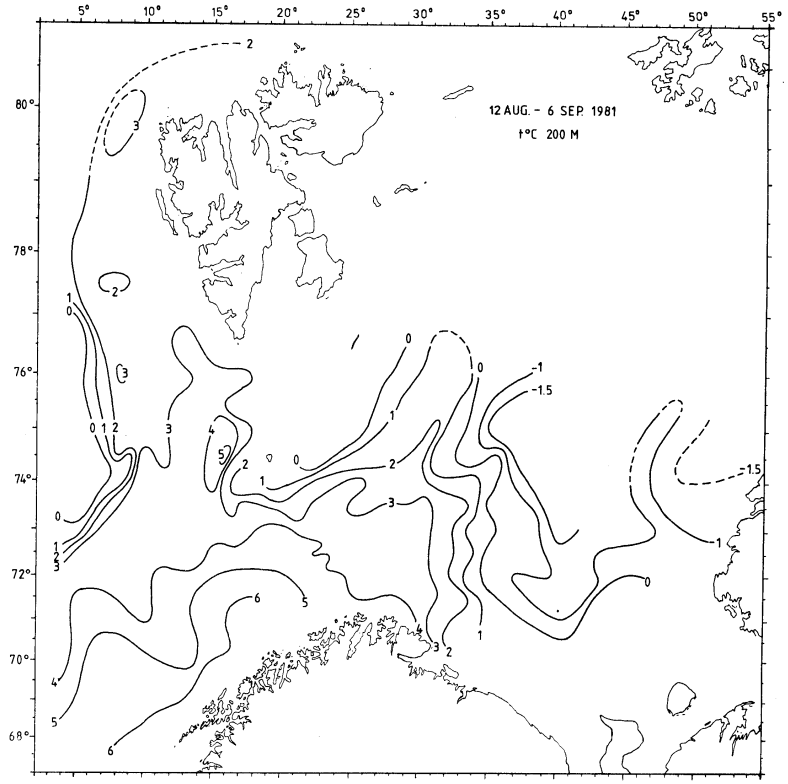

Fig. 5. Isotherms at 200 m

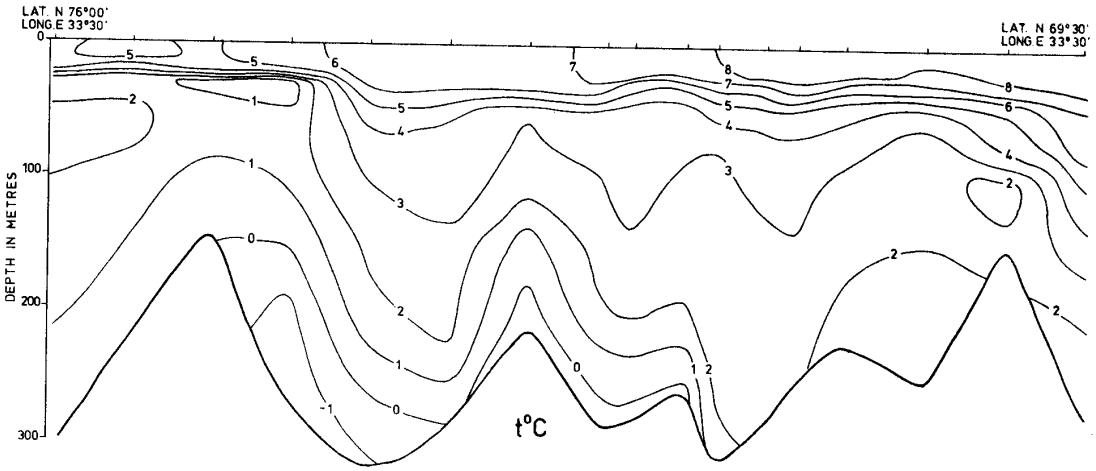

Fig. 6. Temperature section along the Kola meridian

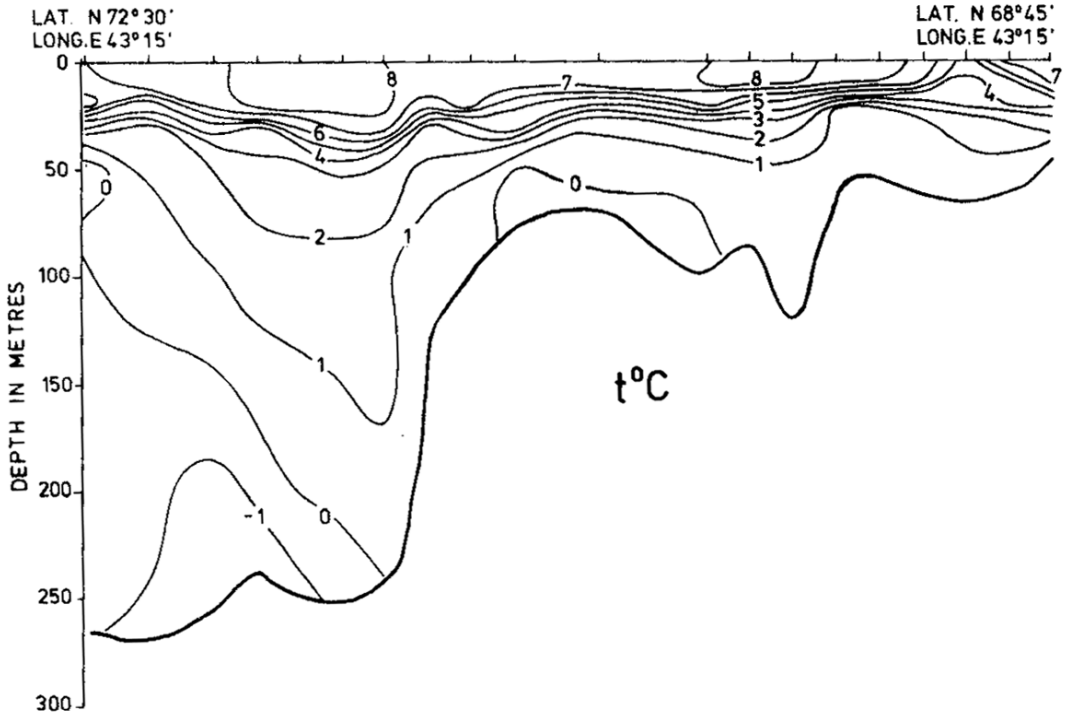

Fig. 7. Temperature section Cape Kanin-North

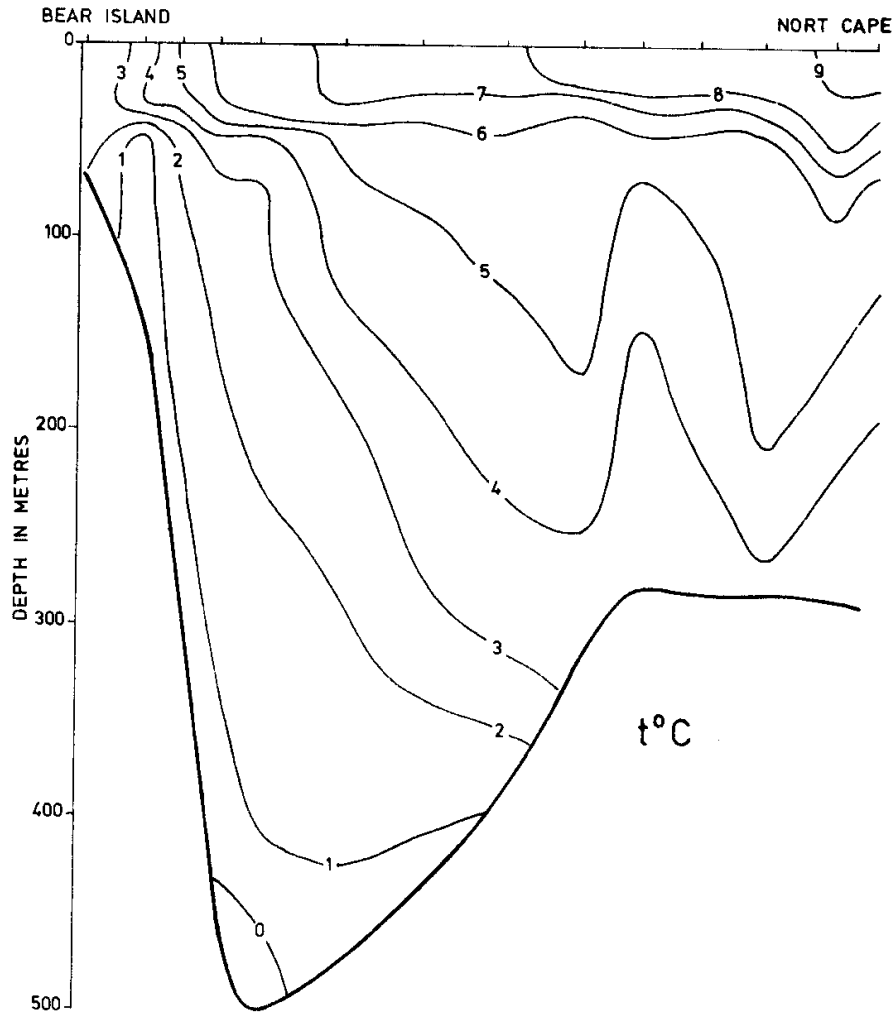

Fig. 8. Temperature section Bear Island-North Cape

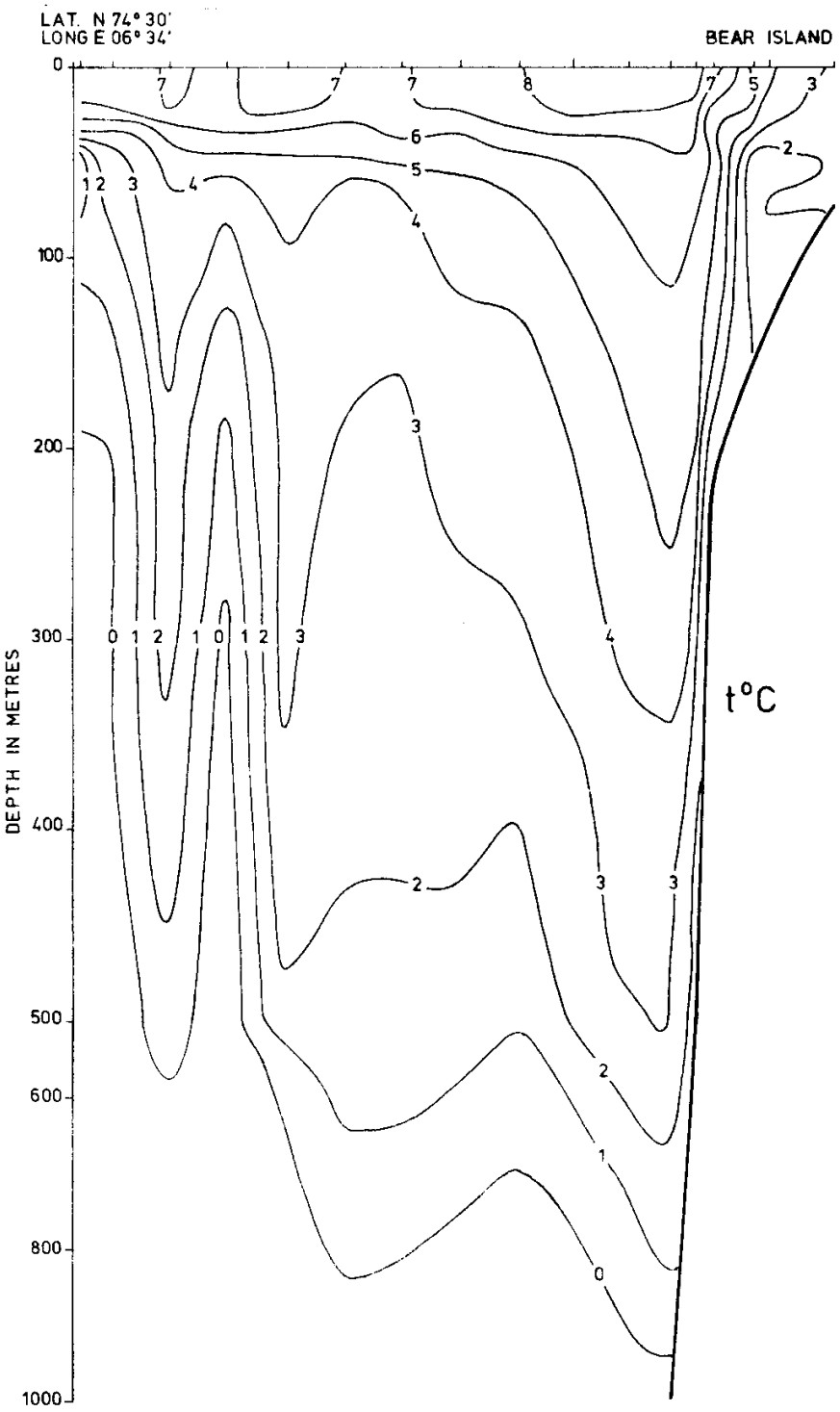

Fig. 9. Temperature section Bear Island-West

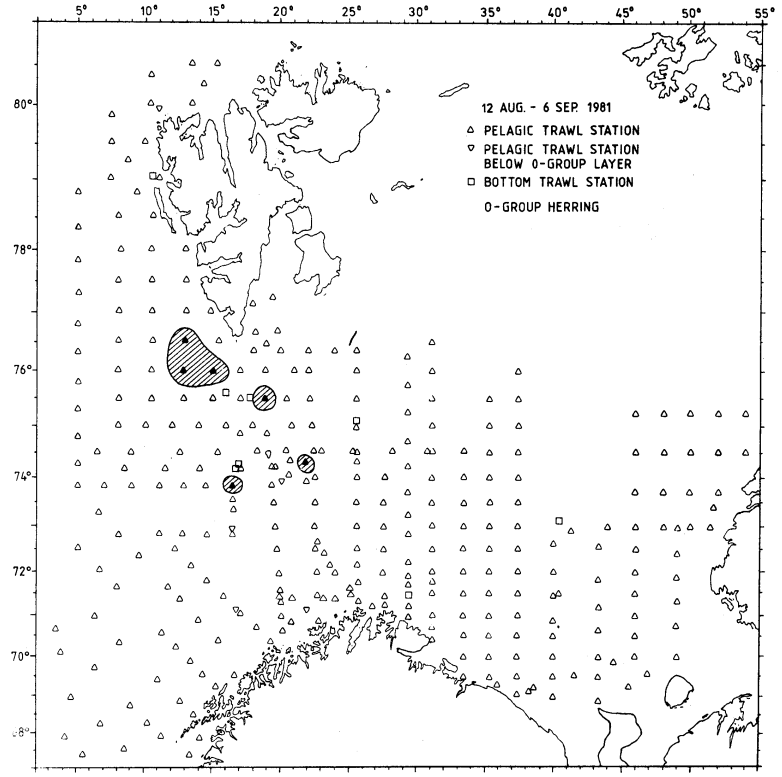

Fig. 10. Distribution of 0-group herring

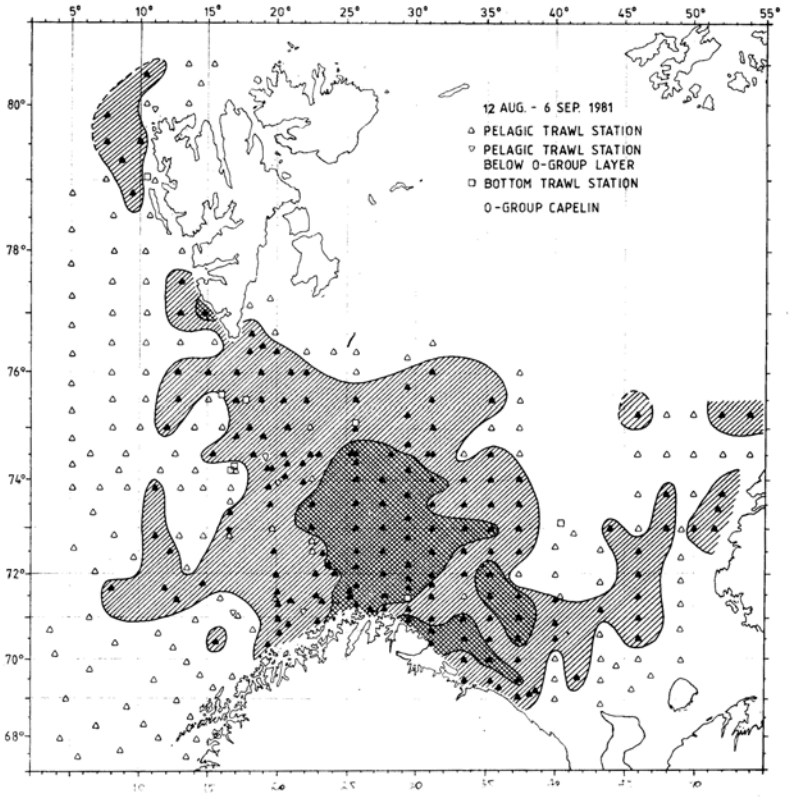

Fig. 11. Distribution of 0-group capelin

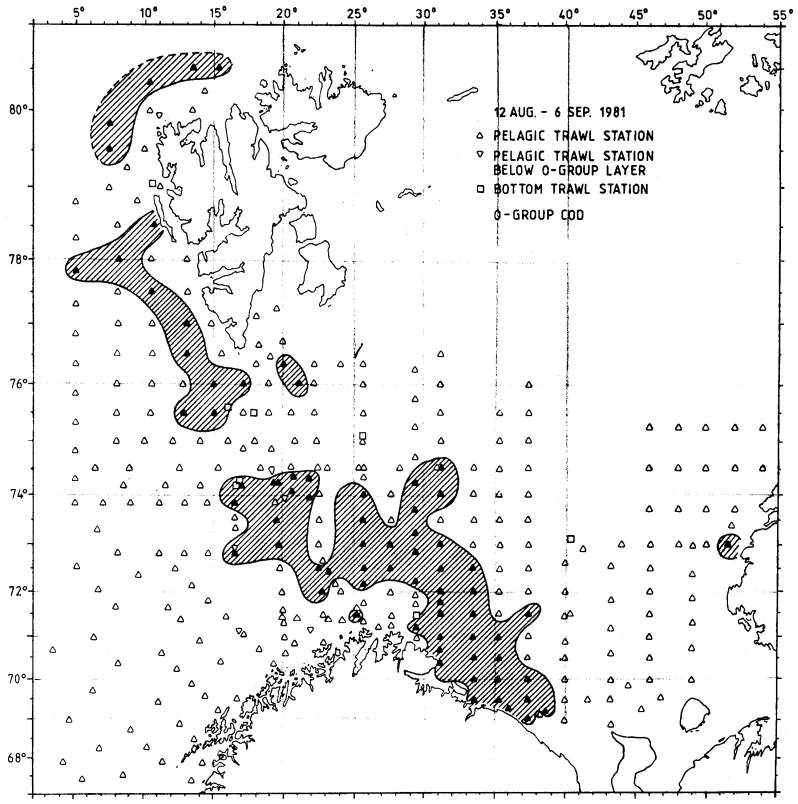

Fig. 12. Distribution of 0-group cod

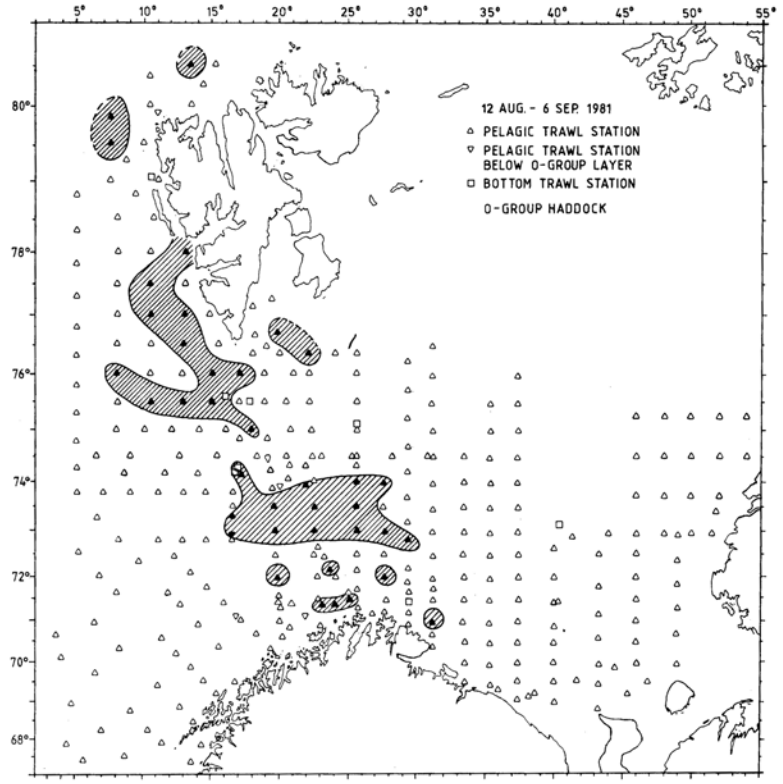

Fig. 13. Distribution of 0-group haddock

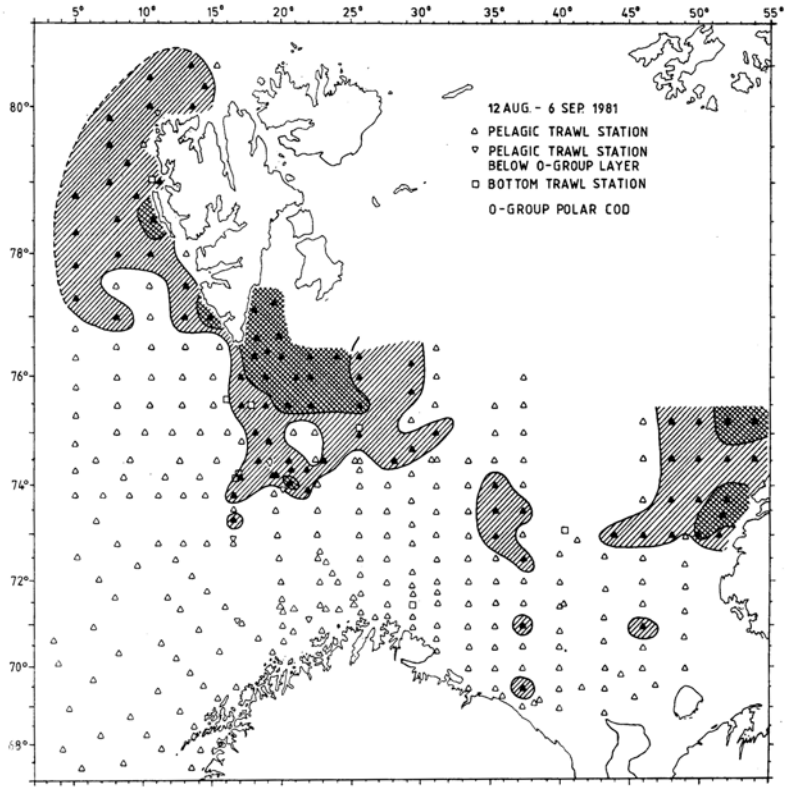

Fig. 14. Distribution of 0-group polar cod

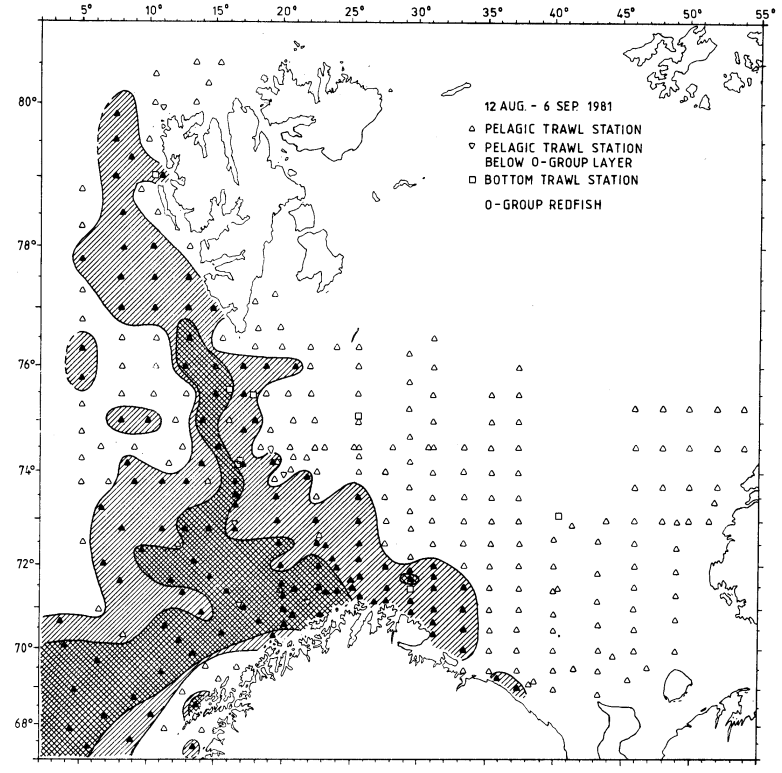

Fig. 15. Distribution of 0-group redfish

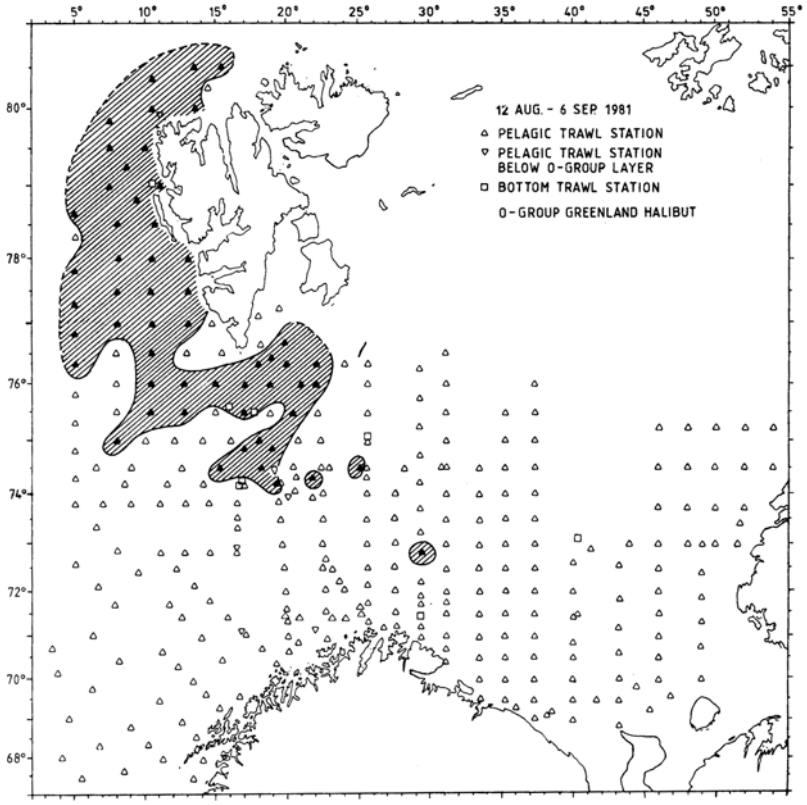

Fig. 16. Distribution of 0-group Greenland halibut

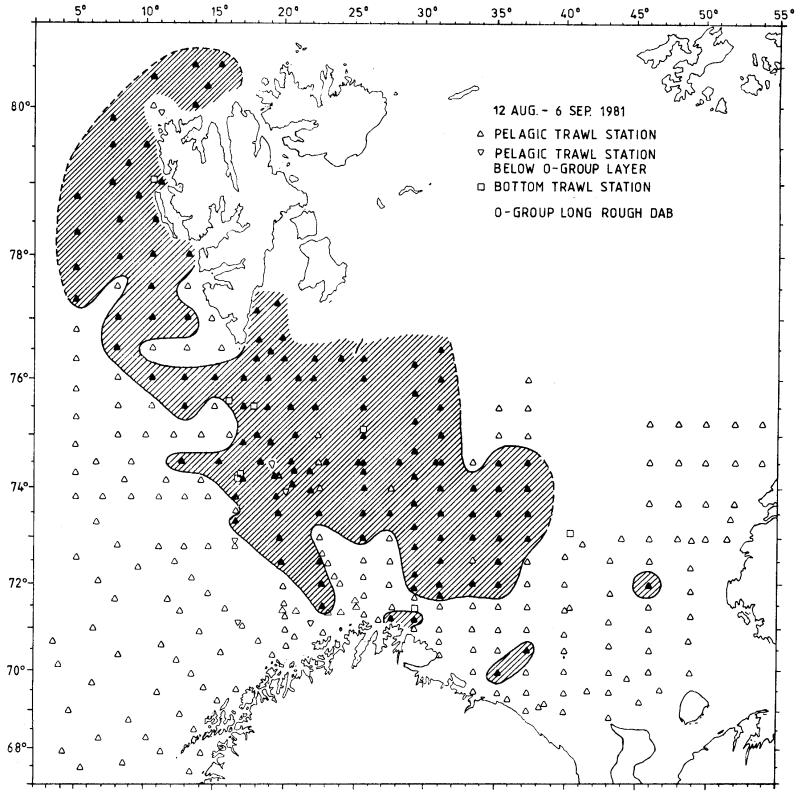

Fig. 17. Distribution of 0-group long rough dab

International Council for
the Exploration of the Sea

CM 1982/G: 44
Demersal Fish Committee
Ref: Pelagic Fish and
Hydrographic Committee

Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August-September 1982

The eighteenth annual International 0-group fish survey was made during the period 17 August-5 September 1982 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey time	Research Institute
Norway	"Johan Hjort"	17 August-5 September	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	21 August-5 September	"
Norway	"Michael Sars"	21 August- September	"
USSR	"Persey III"	31 August-5 September	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
USSR	"Poisk"	23 August-5 September	"
USSR	"Protsion"	28-30 August–7-8 September	"

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

Survey data were analysed 6-7 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.

Due to several consecutive days with bad weather in the last part of the survey an area west and southwest of Bear Island in particular, was only partly recorded. In order to reduce this gap R/V "Michael Sars" took trawl stations on her way to a ground fish survey off Spitsbergen after the meeting in Hammerfest. The result from these trawl stations have been incorporated in this report.

Material and methods

The geographical distribution of 0-group fish were estimated by fishing with a small meshed midwater trawl. The vessels participating in the survey in 1982 used the type of midwater trawl recommended by the meeting held after the survey in 1980 (Anon. 1980). The trawling procedure was standardized in accordance with the recommendation made at the same meeting. At about every 30 nautical miles sailed the trawl was towed 0.5 nautical mile at each depth; the headline of the trawl at 0, 20 and 40 m.

Survey tracks and hydrographical stations are given in Fig. 1. Trawl stations with and without catch are given on the distribution charts in Figs. 10-18, as filled with open symbols respectively. The density grading is based on catch in number per 1.0 nautical mile trawling.

Hydrography

Hydrological observations were carried out along all routes and as a role every 30 miles. The horizontal distribution of water temperature is given at 0, 50, 100 and 200 m depth. Temperature conditions data for 4 standart sections are shown in tables 1-4. The results of these observations are given below.

1) Kola section

In comparison with 1981 the water temperature has increased for all layers. The average water temperature at the 50-200 m and 0-200 m layers has exceeded the long-term mean, and at the 0-50 m layer the temperature was close to the long-term mean. Temperature anomaly at the 0-50 m layer was -0,1 °C, at the 50-200 m layer - +0,4 °C, at the 0-200 m layer - +0,3 °C.

2) Kanin section

In the southern part of the section the water temperature has increased from 2,7 °C up to 4,5 °C in comparison with 1981. In the northern part of the section rise of water temperature was insignificant (from 2,5 °C up to 2,8 °C). The anomaly of water temperature in the southern part of the section was +0,4 °C, in the northern part - -0,4 °C.

3) Norht Cape –Bear Island section

The average water temperature at the 0-200 m layer has insreased from 5,3 °C in 1981 up to 5,8 °C in 1982. The anomaly was +0,2 °C.

4) Bear Island – West section (on 74°30' N)

The water temperature at the 0-200 m layer has increased on 0,5 °C in comparison with the last year (from 4,4 °C up to 4,9 °C) and has exceeded the long-term mean on 0,5 °C.

Thus, temperature conditions in the Barents sea during the 0-group survey in 1982 were the same as long-term mean and have exceeded it only on 0,1-0,4 °C in the west of the sea. In the east part of the sea in this period weak negative anomalies were kept. It point to increase of advection of heat by currents in comparison with the last year; with usual solar radiating warming up of surfaces layers.

Distribution and abundance of 0-group fish

Geographical distributions of 0-group fish are shown by shaded areas in Figs. 10-l8. Double shading indicates dense concentrations. The criteria for discriminations are the same as used in earlier reports (Anon. 1978). Abundance indices, estimated as the area of distribution with areas of high densities weighted by 10, are given in Table 5. Length frequency distributions of the main species are given in Table 7.

Two new sets of abundance indices have been estimated for 0-group cod as described by Randa (1982). They are both based on standard trawl haul of one nautical mile. The stratification system was based on 17 geographical areas. Basis for the establishment of these strata was that at least two trawl stations could be allocated to each strata every year. In addition attention was paid to the temperature conditions and the water transport in the different currents in the surveyed area.

Cod (Fig. 10)

The main distribution of 0-group cod is normally separated into two areas west of Spitsbergen and on area north of Finnmark with an extension southeastward to the Kola

peninsula. Although not clearly separated at the time when the survey was conducted, the same general pattern prevails.

The usual 0-group index as given in previous years is given in Table 5. The normalized indices introduced last year (Anon. 1981) and described by Randa (1982) are given in Table. 6.

The 1982 year-class seems to be about the same size as the 1977 year-class. That is larger than the last four year-classes (1978-1981), but well below the rich 1975 year-class that now dominants the fishery.

Haddock (Fig.11)

The distribution extended into more eastern waters than in 1981 when the distribution was more western than usual. The 0-group index indicates that the 1982 year-class is longer than the 1980 and the 1981 year-classes, or about the size of the 1978 and 1979 year-classes.

Herring (Fig. 12)

0-group herring were found on a larger number of stations than in the previous years. In addition to some isolated patches in the western part of the Barents Sea, 0-group herring were found over a relatively large area in the central and eastern part of the Barents Sea. The herring were usually found in areas with dense concentrations of 0-group capelin and/or 0-group redfish, and this created some difficulties in sorting out herring from the catches. It should be emphasized that the overall density of 0-group herring is still very low.

Capelin (Fig. 13)

As in 1981 the distribution of 0-group capelin was more westerly than in 1980 and previous years, reflecting a westerly distribution of the spawning. The area of distribution and overall density is also very similar to 1981, and indicates that the 1982 year-class may be abundant as well.

Polar cod (Fig. 14)

0-group polar cod was much less abundant than in the previous years, and the areas of distribution seemed to be smaller both for the eastern and the western components. It is however quite possible that the 0-group polar cod is distributed partly outside the investigated area.

Redfish (Fig. 15)

The distribution and abundance of 0-group redfish was similar to 1981, indicating a rich year-class.

Saithe (Fig. 16)

Saithe were found occasionally in most parts of the area surveyed, and except for one trawl haul off West Spitsbergen only in small numbers. Since the area surveyed only cover a smaller part of the area were 0-group saithe occur regularly the 0-group index has not been calculated.

Greenland halibut (Fig. 17)

The distribution of Greenland halibut was as usual confined chiefly to the Bear Island-West Spitsbergen area. The index is close to the average of 17.8 in the previous 10 years.

Long rough dab (Fig. 18)

The distribution of 0-group long rough dab in 1982 is similar to the one in 1981. The index of abundance is the highest on record.

Table 1. Mean water temperature in the Murmansk current, the Kola section (between 70°30' N and 72°30' N) at the end of August and the beginning of September 1982 (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1965-1982
0-50 m	6.7	6.7	7.5	6.4	6.7	7.8	7.1	8.7	7.7	8.1	7.0	8.1	6.9	6.6	6.5	7.4	6.6	7.1	7.3
50-200 m	3.8	2.6	4.0	3.7	3.1	3.6	3.2	4.0	4.5	3.9	4.6	4.0	3.4	2.5	2.9	3.5	2.7	4.0	3.6
0-200 m	4.6	3.6	4.9	4.4	4.0	4.7	4.2	5.2	5.5	4.9	5.2	5.0	4.3	3.6	3.8	4.5	3.7	4.8	4.5

Table 2. Mean water temperature in the Cape Kanin - North section (between 68°45' N and 72°00' N) at the surface at the end of August and at the beginning of September 1982 (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1965-1982
68°45'N 70°05'N	4.8	2.0	6.1	4.7	2.6	4.0	4.0	5.1	5.7	4.6	5.6	4.9	4.1	2.4	2.0	3.3	2.7	4.5	4.1
71°00'N	4.2	2.5	3.6	3.1	2.3	3.3	3.2	4.1	4.5	-	4.3	4.6	3.3	1.7	1.8	3.0	2.5	2.8	3.2

Table 3. Mean water temperature in the North Cape current, the North Cape to Bear Island section (between 71°33' N, 25°02' E and 73°35' N, 20°46' E) at the end of August and at the beginning of September 1982 (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1965-1982
0-200 m	5.1	5.5	5.6	5.4	6.0	6.1	5.7	6.3	5.9	6.1	5.7	5.7	4.8	5.0	5.3	5.7	5.3	5.6	5.6

Table 4. Mean water temperature in the West Spitsbergen current along the Bear Island West section (between 06°34' E and 15°55' E) at the end of August and at the beginning of September 1982 (T °C)

Year/ Layer	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1965-1982
0-200 m	-	3.3	4.2	3.6	4.2	-	4.2	3.9	5.0	4.6	4.9	5.0	4.0	4.1	4.4	4.9	4.4	4.9	4.4

Table 5. Abundance indices

Species / Year	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab
			West		East			
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	8.0	65
1973	684	54		(26)		385	3.2	67
1974	51	147		227		468	13.4	83
1975	343	170		75		315	21.1	113
1976	43	112		131		447	15.6	96
1977	173	116	157		70	472	9.0	72
1978	106	61	107		144	460	35.4	76
1979	94	69	23		302	980	22.5	69
1980	49	54	79		247	651	12.0	108
1981	65	30	149		73	861	38.0	95
1982	107	73	14		50	494	16.0	140

Table 6. Abundance indices with 90 % confidence limits for 0-group cod

Year-class	Logarithmic indices		Retransformed indices	
	Index	Confidence Iimits	lndex	Confidence Iimits
1965	0.01	x)	0.10	x)
1966	0.03	0.02-0.05	0.14	0.14-0.15
1967	0.06	0.03-0.11	0.34	0.30-0.37
1968	0.02	0.01-0.05	0.24	0.22-0.26
1969	0.31	0.22-0.43	2.51	2.20-2.87
1970	2.54	2.07-3.01	369.19	268.89-506.91
1971	0.83	0.61-1.08	28.13	9.15-47.11
1972	0.62	0.42-0.86	6.47	5.10-8.19
1973	1.33	1.04-1.66	170.69	126.90-229.60
1974	0.35	0.22-0.51	6.50	4.81-8.12
1975	0.97	0.71-1.27	157.87	114.13-218.39
1976	0.15	0.07-0.26	1.26	1.01-1.56
1977	0.51	0.37-0.69	12.81	4.53-21.08
1978	0.28	0.18-0.39	3.72	3.15-4.39
1979	0.44	0.30-0.61	3.36	2.71-4.17
1980	0.17	0.11-0.2	0.98	0.88-1.09
1981	0.11	0.06-0.19	0.71	0.61-0.82
1982	0.77	0.57-0.98	7.2	5.9-8.9

x) 0-group cod caught only in one haul.

Table 7. Length distribution of 0-group fish (%)

Length, mm	Herring	Capelin	Polar cod	Cod	Haddock	Redfish	Greenland halibut	Lrd	Saithe
10-14						0.1			
15-19			0.3	0.1		2.4		0.2	
20-24		0.9	5.0	1.3		7.1		2.7	
25-29		4.2	20.4	5.4		8.2		10.2	
30-34		10.7	24.8	6.6	0.1	14.5		25.3	
35-39	0.1	17.0	23.1	6.5	0.9	21.7	0.7	30.4	0.3
40-44	0.4	21.0	15.5	6.3	2.2	21.9	2.2	24.8	0.1
45-49	2.4	22.9	8.0	6.7	4.1	17.6	10.3	6.1	0.3
50-54	14.8	16.6	2.8	7.6	5.8	5.5	10.3	0.3	0.8
55-59	30.2	5.2		8.8	7.3	1.0	29.8		1.1
60-64	40.7	1.3		13.6	9.2		16.9		0.1
65-69	11.2	0.2		12.3	9.4		14.3		
70-74	0.1			12.0	11.2		8.8		0.1
75-79				6.8	9.8		5.2		0.1
80-84				4.4	9.5		1.1		0.2
85-89	0.1			1.2	9.9		0.4		0.1
90-94			0.1	0.4	8.3				0.9
95-99					5.4				0.1
100-104					4.0				2.6
105-109					1.7				10.6
110-114					0.8				16.5
115-119					0.3				22.1
120-124					0.1				14.1
125-129									12.0
130-134									9.9
135-139									3.2
N	1788	516805	1105	4212	3139	400809	272	5005	1166
Mean length, mm	57	41	32	54	72	36	58	34	117

Appendix

Survey period	Research vessel	Research Institute	Participants
August-6 September	"Poisk"	Polar Research Institute Marine Fisheries and Oceanography, Murmansk	N.G. Ushakov, V.K. Ozhigin, A. Sennikov and others
August-6 September	"Persey III"	"	
August-5 September	"G.O. Sars"	Institute of Marine Research, Bergen	K. Hansen, A. Hylen, H. Ludvigsen, H. Kismul, E.Molvær, A. Nødtvedt, A. Roald, K. Randa
August-September	"Michael Sars"	"	H. Abrahamsen, O. Alvheim, A. Donunasnes, K. Gjertsen, M. Myhr, J.E. Nygård
17 August-5 September	"Johan Hjort"	"	S. Andreassen, J. Blindheim, P. Bratland, K. Gjertsen, I. Hoff, E. Klæt, K. Lauvås, J.E. Klæt, S. Lygren, C.J. Rørvik, J.Rørvik, A.M. Skorpen

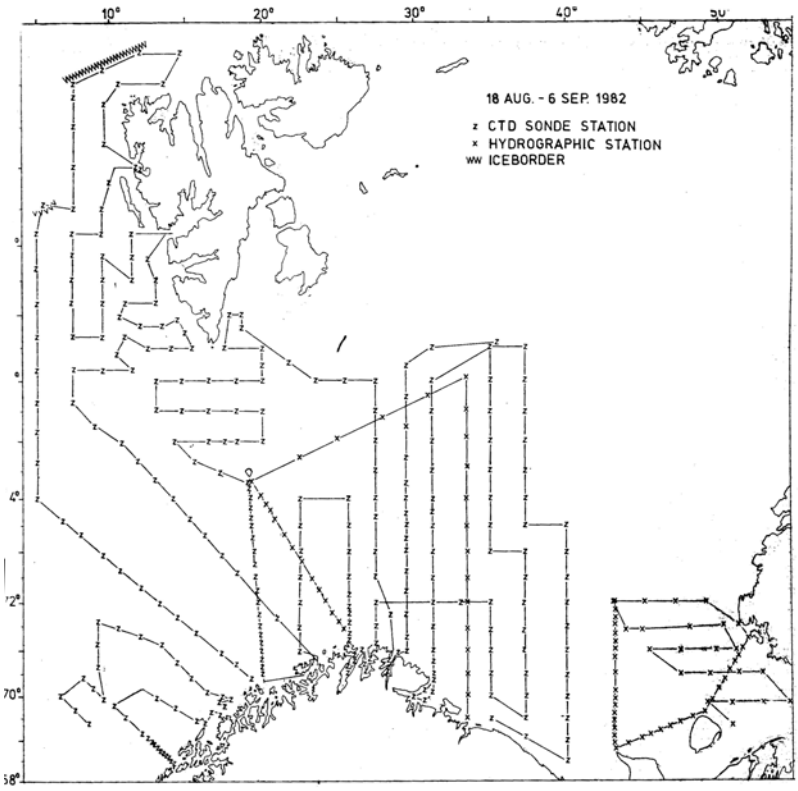

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

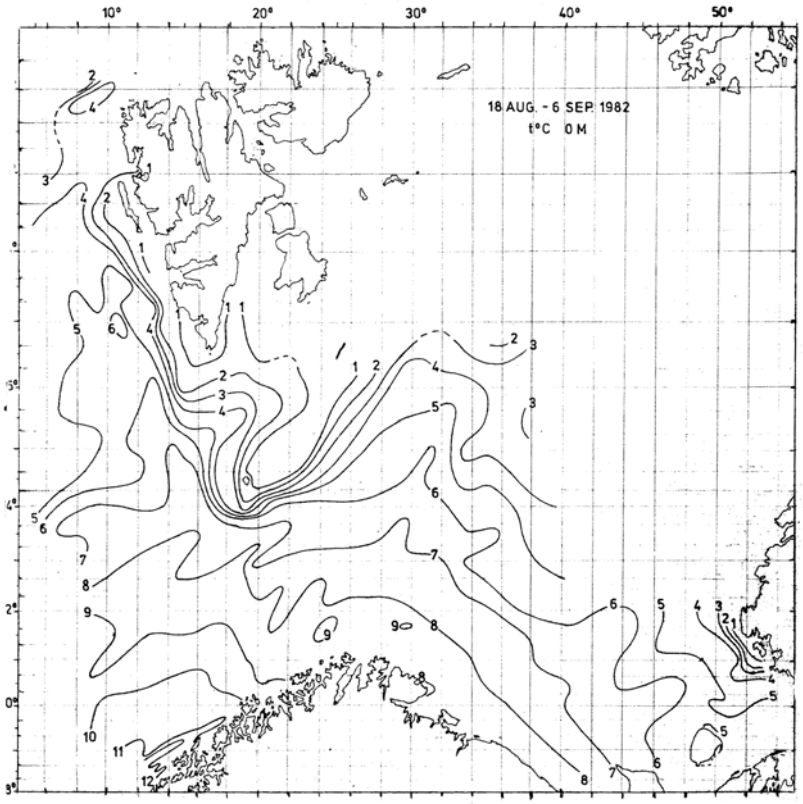

Fig. 2. Isotherms at 0 m

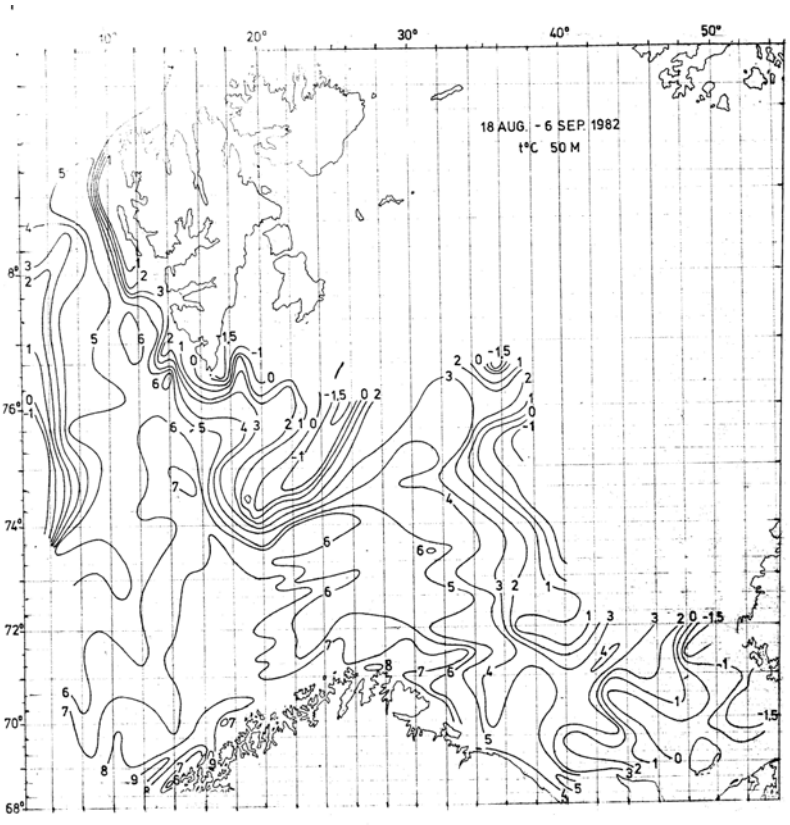

Fig. 3. Isotherms at 50 m

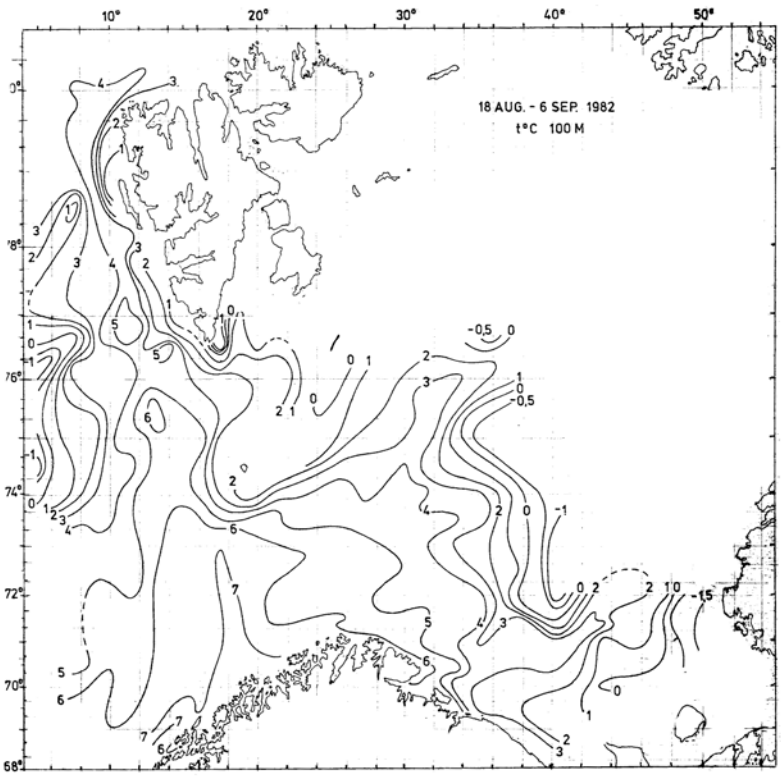

Fig. 4. Isotherms at 100 m

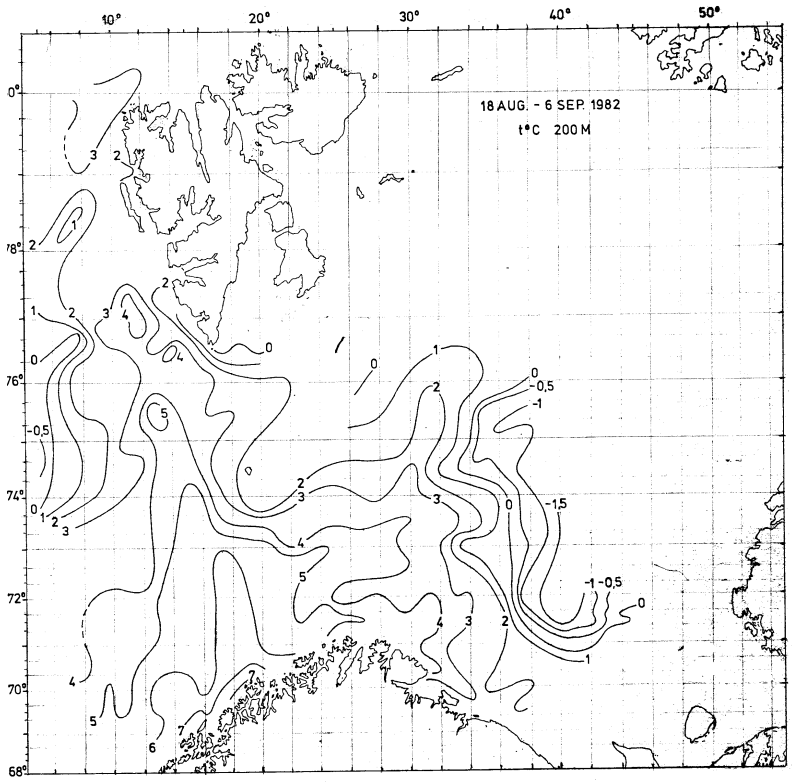

Fig. 5. Isotherms at 200 m

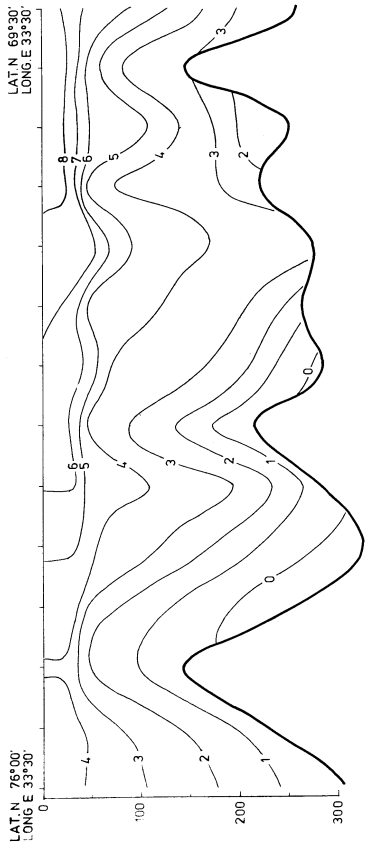

Fig. 6. Temperature section along the Kola meridian

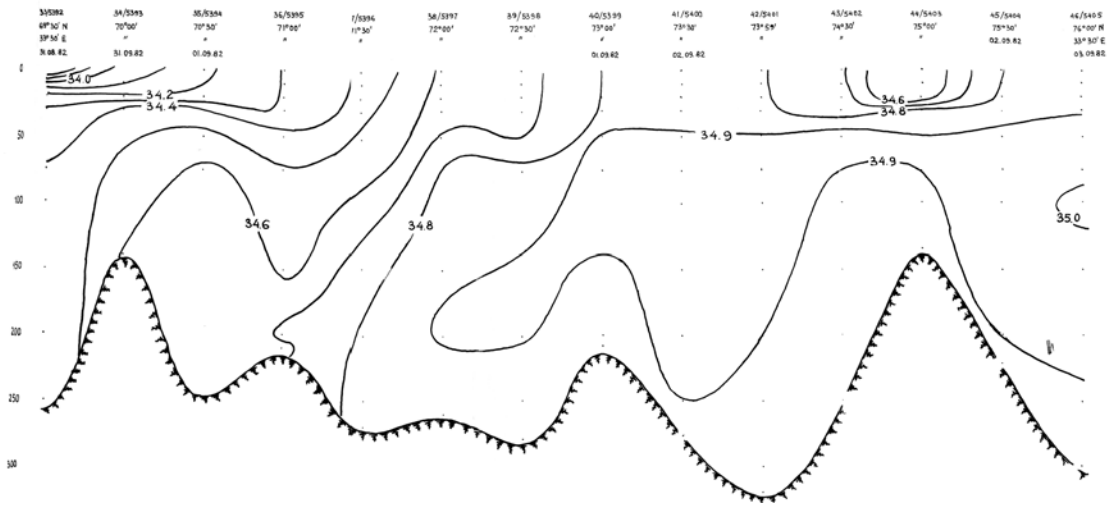

Fig. 7. Salinity section along the Kola meridian

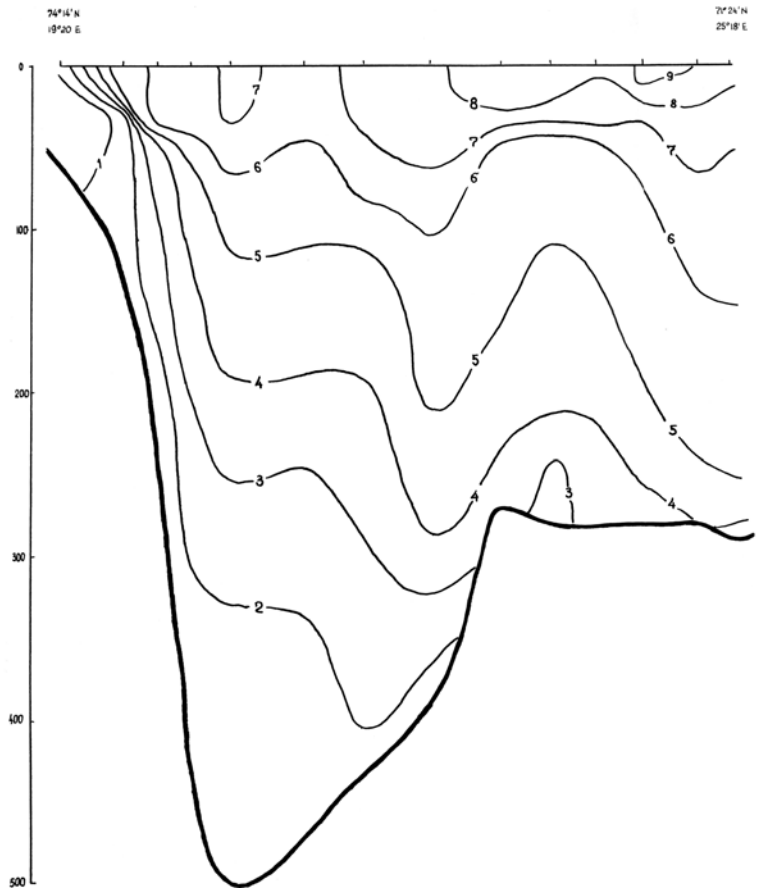

Fig. 8. Temperature section Bear Island-North Cape

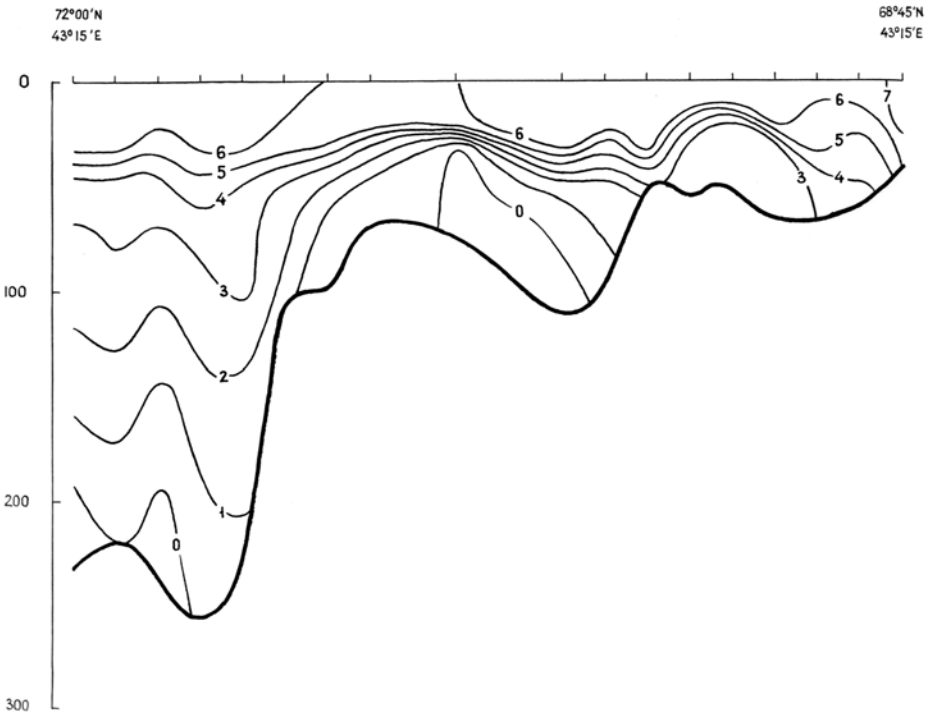

Fig. 9. Temperature section Cape Kanin-North

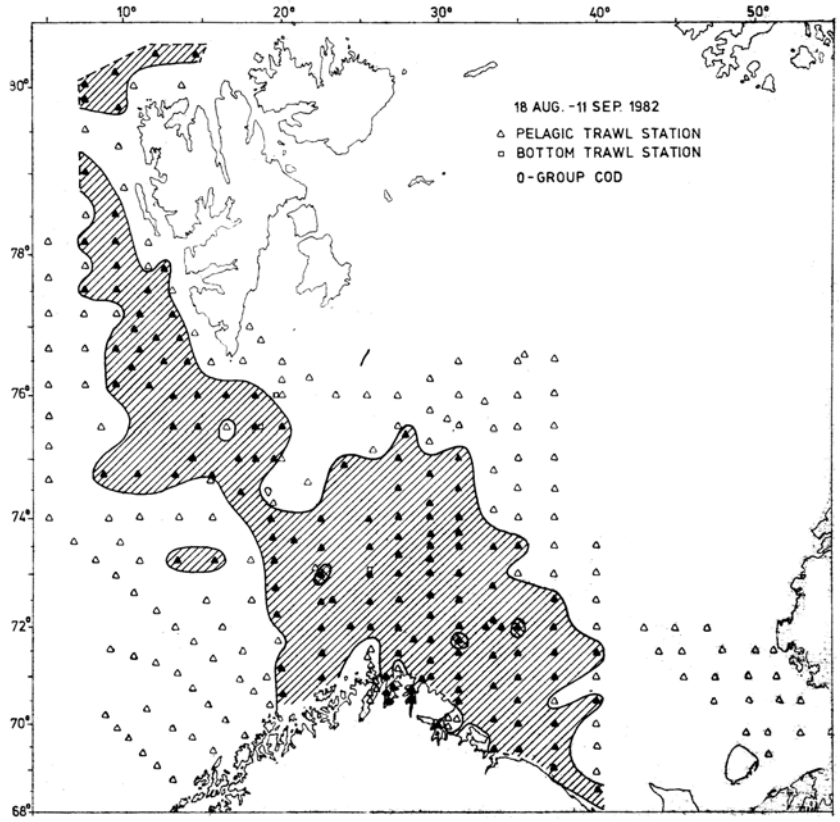

Fig. 10. Distribution of 0-group cod

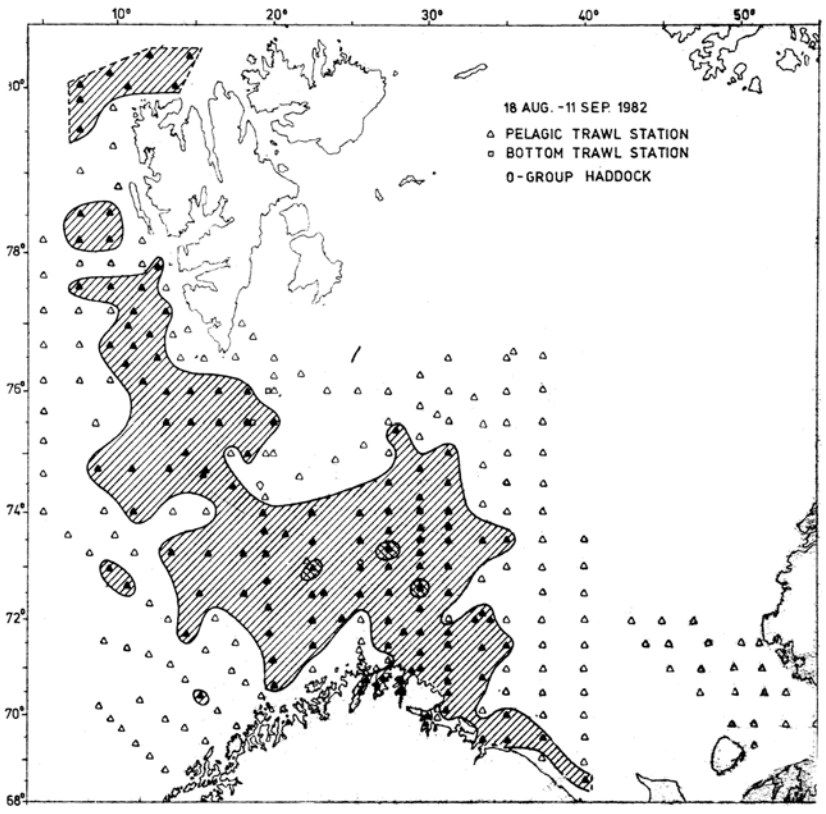

Fig. 11. Distribution of 0-group haddock

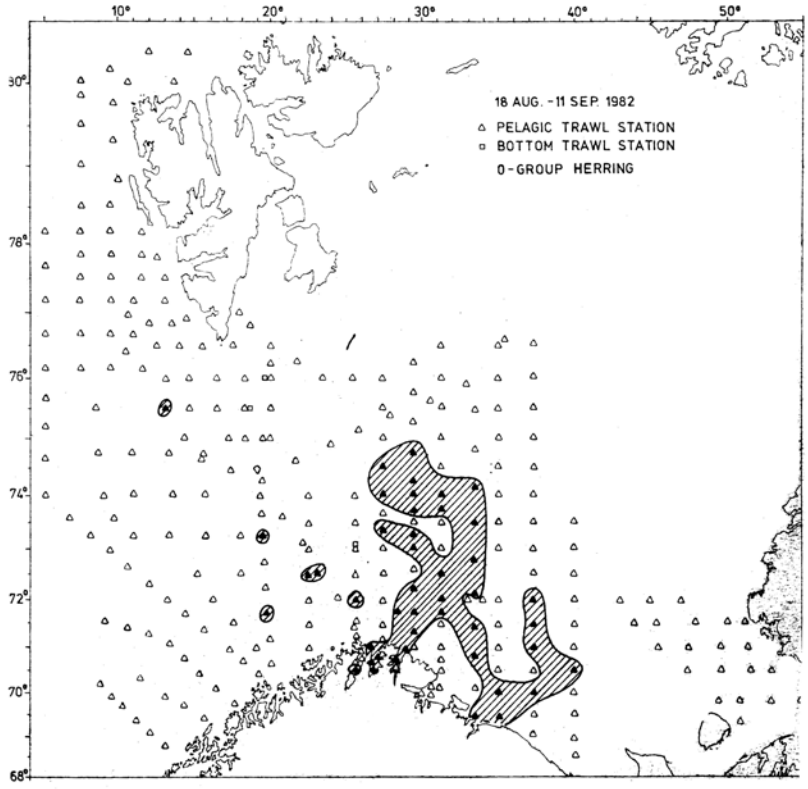

Fig. 12. Distribution of 0-group herring

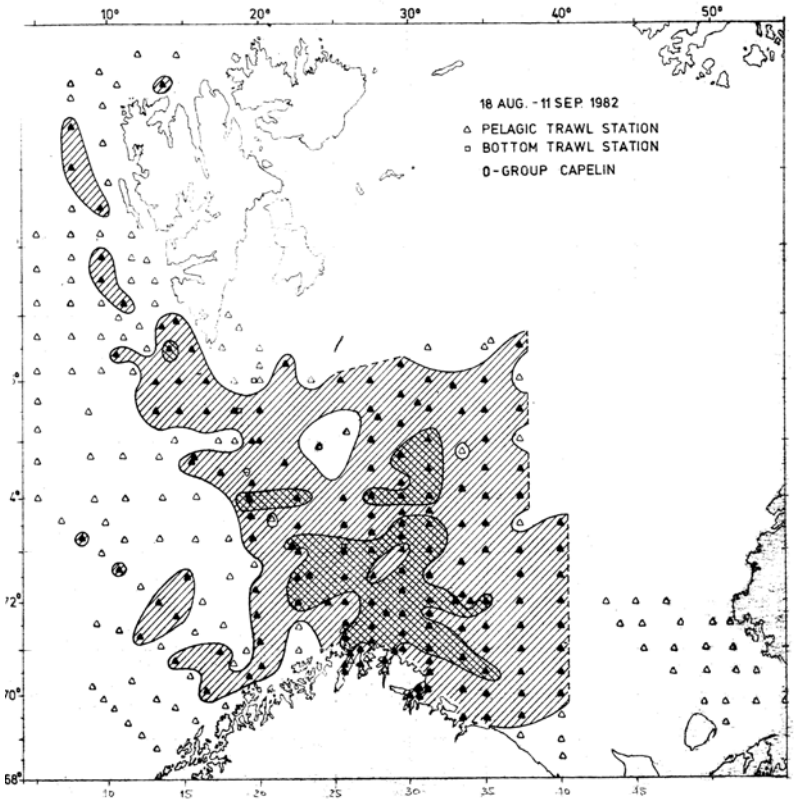

Fig. 13. Distribution of 0-group capelin

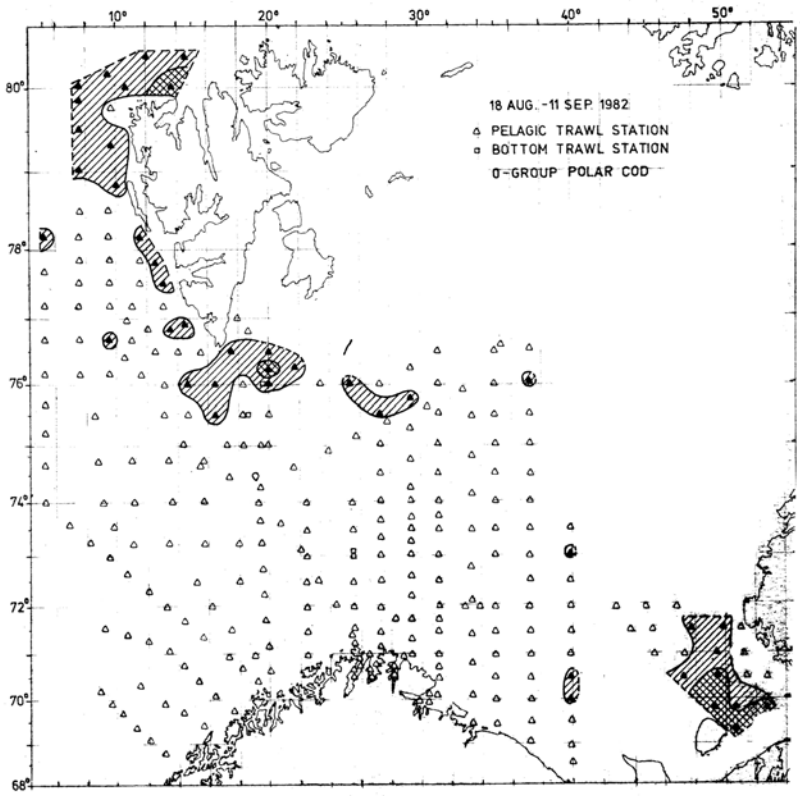

Fig. 14. Distribution of 0-group polar cod

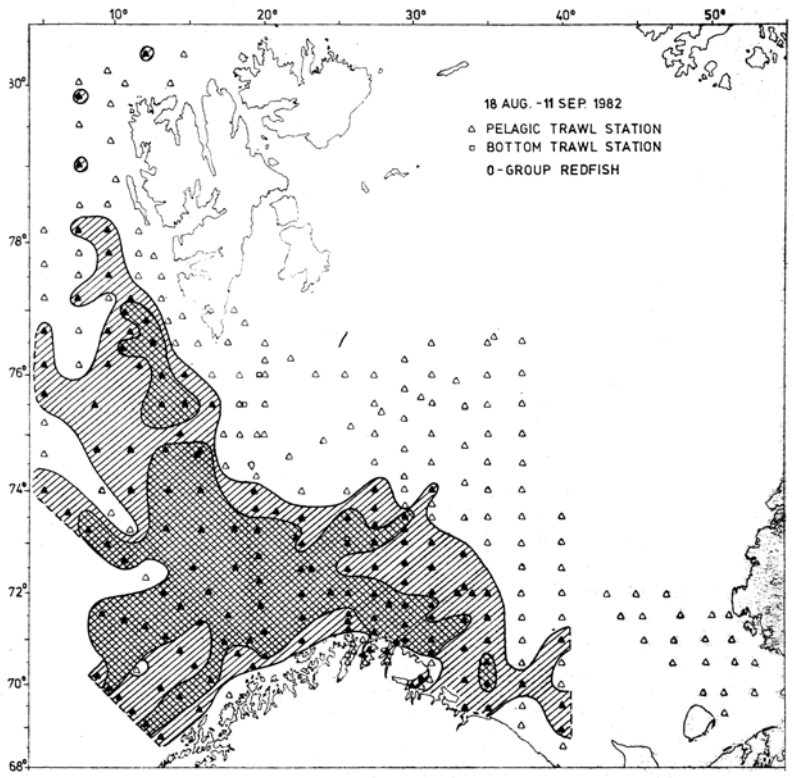

Fig. 15. Distribution of 0-group redfish

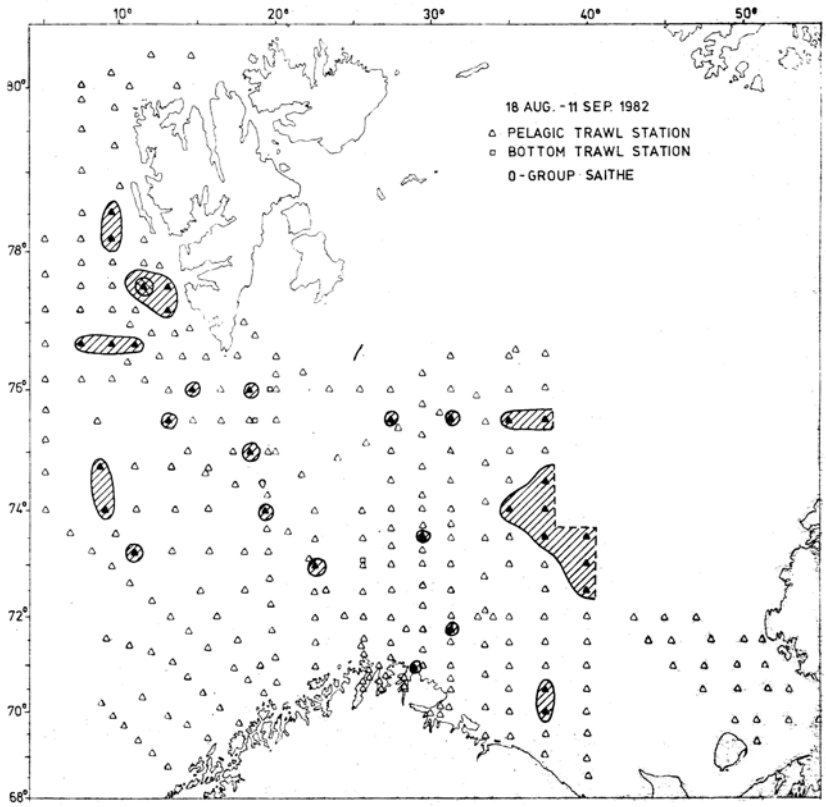

Fig. 16. Distribution of 0-group saithe

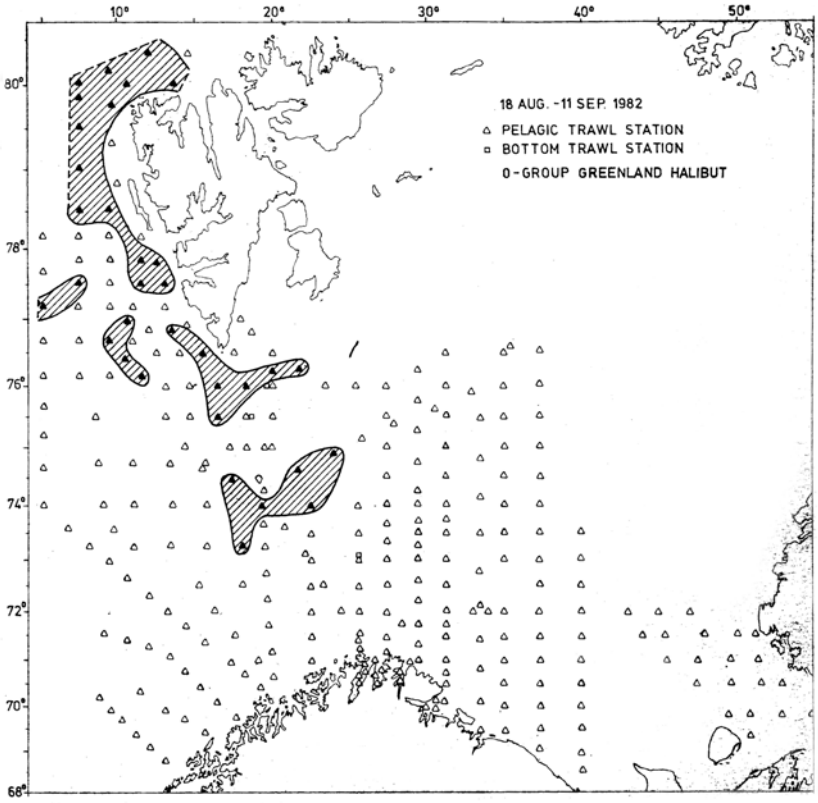

Fig. 17. Distribution of 0-group Greenland halibut

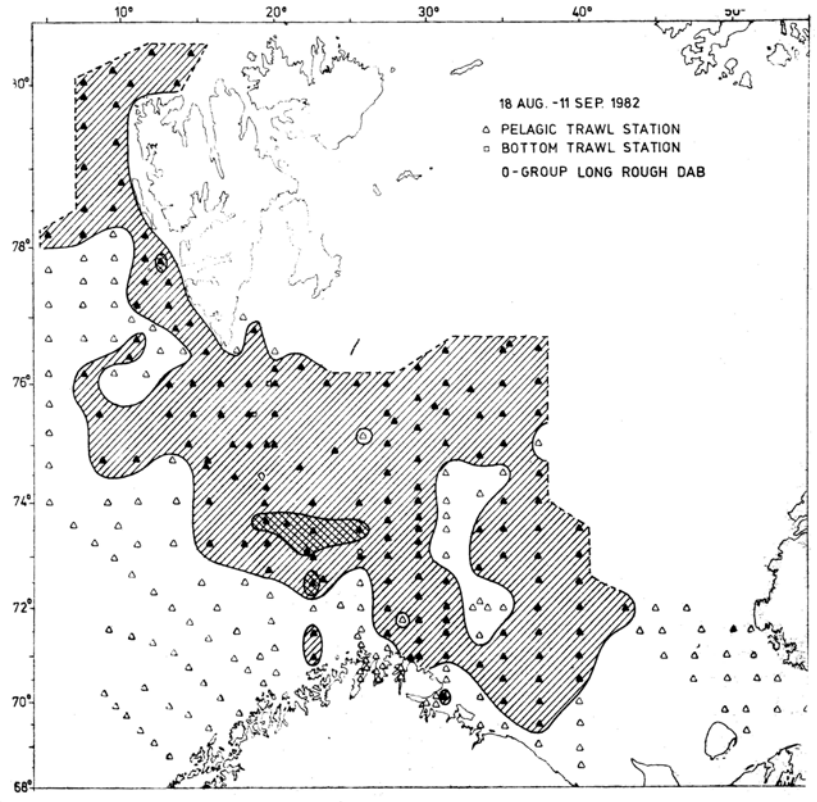

Fig. 18. Distribution of 0-group long rough dab

International Council for
the Exploration of the Sea

CM 1983/G:35
Demersal Fish Committee
Ref: Pelagic Fish and
Hydrographic Committee

Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August-September 1983

The nineteenth annual International 0-group fish survey was made during the period 21 August-8 September 1983 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey time	Research Institute
Norway	"Eldjarn"	21 August-8 September	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	21 August-5 September	"
Norway	"Michael Sars"	21 August-5 September	"
USSR	"Persey III"	22 August-5 September	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
USSR	"Poisk"	24 August-3 September	"
USSR	"Alaid"	20 August-26 August	"

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

Survey data were analyzed 5-6 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. Due to lack of time in the last part of the survey an area west and southwest of Bear Island in particular, was only partly covered. In order to reduce this gap R/V "Eldjarn" took trawl stations in the period 7 September-8 September on her way to a ground fish survey off Spitsbergen after the meeting in Hammerfest. The results from these trawl stations have been incorporated in this report.

Material and methods

The geographical distribution of 0-group fish were estimated by fishing with a small meshed midwater trawl. The vessels participating in the survey in 1983 (except "Poisk") used the type of midwater trawl recommended by the meeting held after the survey in 1980 (Anon., 1980). The trawling procedure was standardized in accordance with the recommendation made at the same meeting. At about every 30 nautical miles sailed the trawl was towed 0.5 nautical mile at each depth; the headline of the trawl at 0, 20 and 40 m.

Survey tracks and hydrographical stations are given in Fig. 1. Trawl stations with and without catch are given on the distribution charts in Figs 10-19, as filled and open symbols respectively. The density grading is based on catch in number per 1.0 nautical mile trawling.

Hydrography

Hydrographical observation was made along all the survey tracks normally after each 30 nautical miles sailed. Horizontal temperature distribution is shown for 0, 50, 100 and 200 m depth (Figs 2-5). Figs 6-9 show the temperature conditions at the four standard sections, and the mean temperature of these sections are given in Tables 1-4. Some general comments are given below:

1) Kola section

Compared with 1982 the temperature was almost 1 °C higher. In the layers 0-200 and 50-200 m the temperature was higher than the average long-term level. It's absolute values turned out to be the highest during the whole period of investigations. In the layer 0-50 m the temperature conditions reached the level of warm years (1974, 1976). The anomalies at this section were 0.8 °C for the layer 0-50 m, 1.0 °C for 0-200 m and 1.2 °C for 50-200 m.

2) Cape Kanin section

In the northern part of the section the temperature was 1.4 °C higher compared with 1982. Compared with the average long-term value the anomaly in this part of the section was 0.7 °C; in the southern part it was 1.0 °C.

3) North Cape - Bear Island section

The mean temperature in the 0-200 m has increased from 5.8° in 1982 to 6.3° in 1983. The anomaly was 0.7 °C.

4) Bear Island-West section

In the 0-200 m layer the temperature has increased by 0.2°C compared with the previous year, which is higher than the average long-term level for the period 1965-1982 by 0.7 °C.

Thus, in late August - early September 1983 the water temperature was higher than the previous year and above the average long-term value both in the eastern and western part of the survey area. The temperature conditions approached the level of warm years.

Distribution and abundance of 0-group fish

Geographical distributions of 0-group fish are shown by shaded areas in Figs. 10-18. Double shading indicates dense concentrations. The criteria for discriminations are the same as used in earlier reports (Anon., 1978). Abundance indices, estimated as the area of distribution with areas of high densities weighted by 10, are given in Table 5. Length frequency distributions of the main species are given in Table 7.

A new sets of abundance indices have been calculated for 0-group cod and haddock (Table 6) as described by Randa (1983). They are based on the number caught during a standard trawl haul of one nautical mile.

Herring (Fig. 10)

0-group herring was found on a far larger number of stations and the numbers of specimens at each station were also far greater than it has been observed since the international 0-group surveys started in 1965. The double shading indicates more than 1000 specimen per haul of 1 n. mile. 0-group herring were found in large areas of central and western parts of the Barents Sea and the most dense concentrations were found at the south-western limit of the survey area.

The extension of the distribution towards south-west, along the Norwegian coast is thus not covered in this survey but reports from Norwegian fishermen indicates that the 0-group herring is also distributed south of the Lofoten islands. It is therefore concluded that the overall density of 0-group herring is very high this year compared to all years after 1965.

Capelin (Fig. 11)

The area of distribution and the overall density is similar to that in 1982, and indicate that the 1983 year-class may be as abundant as the 1982 year-class. The density of capelin this year is somewhat higher in the north-western part of the survey area (off Spitsbergen) than in previous years.

Cod (Fig. 12)

The 0-group cod was distributed in two separated areas as in 1982, north of the Finnmark and Murman coast and west of Spitsbergen. Two different indices of year-class strength are given in Table 5 and 6. Both indices indicate that the 1983 year-class is a rich year-class, even more abundant than the 1975 year-class, which has dominated the fishery in the recent years.

Haddock (Fig. 13)

The distribution extended into more northeastern waters than in 1982. The two indices of year-class strength indicate that the 1983 year-class is stronger than the 1975 year-class, which has dominated the fishery in the late seventies and early eighties. The 1983 year-class was stronger in the 0-group survey than the 1982 year-class. However, a ground fish survey in winter 1983 indicates that the 1982 year-class is stronger than recorded in the 0-group survey.

Polar cod (Fig. 14)

0-group polar cod was as usually found in two separated areas. Areas of high concentrations were found mostly in the Spitsbergen area, and the abundance index indicated that the western component is the most abundant. The index for the eastern component indicated it to be less abundant than last year. The total index indicated the 1983 year-class is somewhat more abundant than the 1982 year-class. It is, however, quite possible that 0-group polar cod is distributed outside the investigated area in high numbers.

Redfish (Fig. 15)

The distribution of 0-group redfish is similar to the one found last year, indicating that the 1983 year-class is another strong one.

Greenland halibut (Fig. 16)

0-group Greenland halibut was as usually found in the Bear Island - West Spitsbergen area. The abundance index for the 1983 year-class is similar to the one for the 1982 year-class and close to the long time average.

Long rough dab (Fig. 17)

0-group long rough dab was found further to the north than in 1982. The calculated index is lower than the very high 1982 index and close to the 1981 figure.

Saithe (Fig. 18)

0-group saithe was found in an exceptionally large area in the central Barents Sea. The shaded area in Fig. 18 represents more than 85 specimens per haul of 1.0 nautical mile. 0-group saithe has not been observed in such high numbers during the 0-group survey since 1967. No index of abundance has been calculated because 0-group saithe is not found every year in the survey area.

Blue whiting (Fig. 19)

0-group blue whiting was recorded south of 75° N and between 20° E and 35° E. This is the first year 0-group blue whiting has been recorded during the 0-group survey in the Barents Sea. As for saithe no index of abundance has been calculated.

References

Anon., 1978. Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August-September 1978. Coun. Meet. int. Coun. Explor. Sea, 1978 (H: 33); 1-24. [Mimeo.]

Anon., 1980. Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August-September 1980. Coun. Meet. int. Coun. Explor. Sea, 1978 (G: 53): 1-25. [Mimeo.]

Randa, K., 1983. Abundance and distribution of 0-group Arcto-Norwegian cod and haddock 1965-1982. Contribution to the PINRO/IMR-symposium in Leningrad, September 1983. 1-26. [Mimeo.]

Table 1. Mean water temperature in the Murmansk Current, the Kola section (between 70°30' N and 69°30' N)at the end of August and the beginning of September 1983 (T °C)

Year/ Layer	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1965-1983
0-50 m	6.7	7.5	6.4	6.7	7.8	7.1	8.7	7.7	8.1	7.0	8.1	6.9	6.6	6.5	7.4	6.6	7.1	8.1	7.3
50-200 m	2.6	4.0	3.7	3.1	3.6	3.2	4.0	4.5	3.9	4.6	4.0	3.4	2.5	2.9	3.5	2.7	4.0	4.8	3.6
0-200 m	3.6	4.9	4.4	4.0	4.7	4.2	5.2	5.5	4.9	5.2	5.0	4.3	3.6	3.8	4.5	3.7	4.8	5.6	4.6

Table 2. Mean water temperature in the Cape Kanin - North section (between 68°45' N and 72°00' N) from surface to bottom at the end of August and at the beginning of September 1983 (T °C)

Year/ Layer	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1965-1983
68°45'N 70°05'N	2.0	6.1	4.7	2.6	4.0	4.0	5.1	5.7	4.6	5.6	4.9	4.1	2.4	2.0	3.3	2.7	4.5	5.1	4.1
71°00'N 72°00'N	2.5	3.6	3.1	2.3	3.3	3.2	4.1	4.5	-	4.3	4.6	3.3	1.7	1.8	3.0	2.5	2.8	4.2	3.5

Table 3. Mean water temperature in the North Cape current, the North Cape to Bear Island section (between 71°33' N, 25°02' E and 73°35' N, 20°46' E) at the end of August and at the beginning of September 1983 (T °C)

Year/ Layer	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1965-1983
0-200 m	5.5	5.6	5.4	6.0	6.1	5.7	6.3	5.9	6.1	5.7	5.7	4.8	5.0	5.3	5.7	5.3	5.6	6.3	5.6

Table 4. Mean water temperature in the West Spitsbergen current along the Bear Island West section (between 06°34' E and 15°55' E) at the end of August and at the beginning of September 1983 (T °C)

Year/ Layer	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1965-1983
0-200 m	3.3	4.2	3.6	4.2	-	4.2	3.9	5.0	4.6	4.9	5.0	4.0	4.1	4.4	4.9	4.4	4.9	5.1	4.4

Table 5. Abundance indices

Species Year	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab	Capelin
			West		East				
1965	6	7		0		159		66	37
1966	1	1		129		236		97	119
1967	34	42		165		44		73	89
1968	25	8		60		21		17	99
1969	93	82		208		295		26	109
1970	606	115		197		247	1	12	51
1971	157	73		181		172	1	81	151
1972	140	46		140		177	8.0	65	275
1973	684	54		(26)		385	3.2	67	125
1974	51	147		227		468	13.4	83	359
1975	343	170		75		315	21.1	113	320
1976	43	112		131		447	15.6	96	281
1977	173	116	157		70	472	9.0	72	194
1978	106	61	107		144	460	35.4	76	40
1979	94	69	23		302	980	22.5	69	660
1980	49	54	79		247	651	12.0	108	592
1981	65	30	149		73	861	38.0	95	570
1982	114	90	14		50	694	17.0	150	393
1983	386	184	48		39	851	15.8	80	589

Table 6. Estimated indices with 90 % confidence limits of year class abundance for 0-group cod and haddock in the total area

Year-class	Cod			Haddock		
	Logarithmic index	Confidence limits (95%)		Logarithmic index	Confidence limits (95%)	
1965	+			0.01	0.00	0.04
1966	0.02	0.01	0.04	0.01	0.00	0.03
1967	0.04	0.02	0.08	0.08	0.03	0.13
1968	0.02	0.01	0.04	0.00	0.00	0.02
1969	0.25	0.17	0.34	0.29	0.20	0.41
1970	2.51	2.02	3.05	0.64	0.42	0.91
1971	0.77	0.57	1.01	0.26	0.18	0.36
1972	0.52	0.35	0.72	0.16	0.09	0.27
1973	1.48	1.18	1.82	0.26	0.15	0.40
1974	0.29	0.18	0.42	0.51	0.39	0.68
1975	0.90	0.66	1.17	0.60	0.40	0.85
1976	0.13	0.06	0.22	0.38	0.24	0.51
1977	0.49	0.36	0.65	0.33	0.21	0.48
1978	0.22	0.14	0.32	0.12	0.07	0.19
1979	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	0.10	0.06	0.18	0.03	0.00	0.05
1982	0.59	0.43	0.77	0.38	0.30	0.52
1983	1.69	1.34	2.08	0.62	0.48	0.77

Table 7. Length distribution of 0-group fish (%)

Length, mm	Herring	Capelin	Polar cod	Greenland halibut	Lrd	Haddock	Cod	Redfish	Saithe	Blue whiting
10-14								+		
15-19								0.2		
20-24		+	2.3		1.4			1.9		
25-29		0.1	19.2		4.1		+	6.1		0.1
30-34	+	0.6	31.9	0.4	13.0		+	11.4		1.0
35-39	+	6.0	20.8		22.1	0.1	0.2	15.2		2.6
40-44	+	16.7	16.7	2.8	34.9	0.8	0.8	21.1		5.4
45-49	0.1	18.4	5.3	7.9	19.5	1.5	1.7	22.7		4.9
50-54	0.4	21.8	3.3	7.9	1.9	3.0	2.8	14.4		7.9
55-59	0.9	20.9	0.3	4.7	+	3.1	3.5	5.8		8.3
60-64	3.2	10.6	0.1	18.5	+	5.1	6.0	0.9		16.2
65-69	9.0	4.6	+	18.9		5.8	7.4	+		15.9
70-74	17.3	0.4	+	29.9		6.3	13.6	+		13.4
75-79	13.2	+	+	4.3		7.3	18.9	+		11.0
80-84	13.6			3.5		8.9	16.8	+	0.4	7.9
85-89	12.9		+	1.2		8.5	12.7	+	1.0	4.1
90-94	13.4					10.3	7.9		3.1	1.7
95-99	8.9					8.5	3.7		2.3	0.4
100-104	5.8					8.6	2.6		7.3	0.1
105-109	1.0					6.2	0.7		9.0	
110-114	0.3					6.9	0.3		11.2	
115-119	0.1					4.6	0.1		19.2	
120-124						2.1	+		19.8	
125-129						0.1	+		16.4	
130-134						+	+		19.9	
135-139						+	+		17.3	
140-144						+	+		10.6	
145-149									4.4	
150-154									2.0	
155-159									0.3	
160-164									0.1	
N	96533	380747	56499	254	1191	6109	16550	430684	1373	761
Mean length, mm	82.6	51.7	35.6	65.2	39.3	88.7	78.0	42.9	124.8	65.6

Appendix

Survey period	Research vessel	Research Institute	Participants
24 August- 3 September	"Poisk"	Polar Research Institute of Marine Fisheries and Oceanography, Murmansk	I.V. Borkin, E.N. Loparev. V.N. Nen'ko
22 August- 5 September	"Persey III"	"	S.V. Belikov, N.V. Bryzgalova, E.S. Demidenko, P.V. Fedorov, V.A. Khljupin, L.N. Korol, V.I. Shapovalov, Ju.F. Shevtso, M.V. Shkatova, E.S. Shishkin, N.G. Ushakov, N.V. Vanjukhina, A.D. Voloshin
24 August- 3 September	"Alaid"	"	N.P. Chebotok, A.Ph. Pshenichnov
21 August- 5 September	"G.O. Sars"	Institute of Marine Research, Bergen	B. Brynildsen, A. Hylen, H. Kismul, L. Pettersen, J. Røttingen, A.M. Skorpen, I. Svellingen, B. Tveranger, E. Øvretvedt
21 August- 5 September	"Michael Sars"	"	I.M. Beck, K. Gjertsen, B. Kvinge, E. Molvær, H. Myran, R. Thoresen
21 August- 8 September	"Eldjarn"	"	O.R. Godø, B. Hoffstad, F. Lie, H. Ludvigsen, J.E. Klæt, M. Møgster, H. Mørner, K. Randa, A. Romslo, A.K. Solheim, Ø. Torgersen, S. Torheim

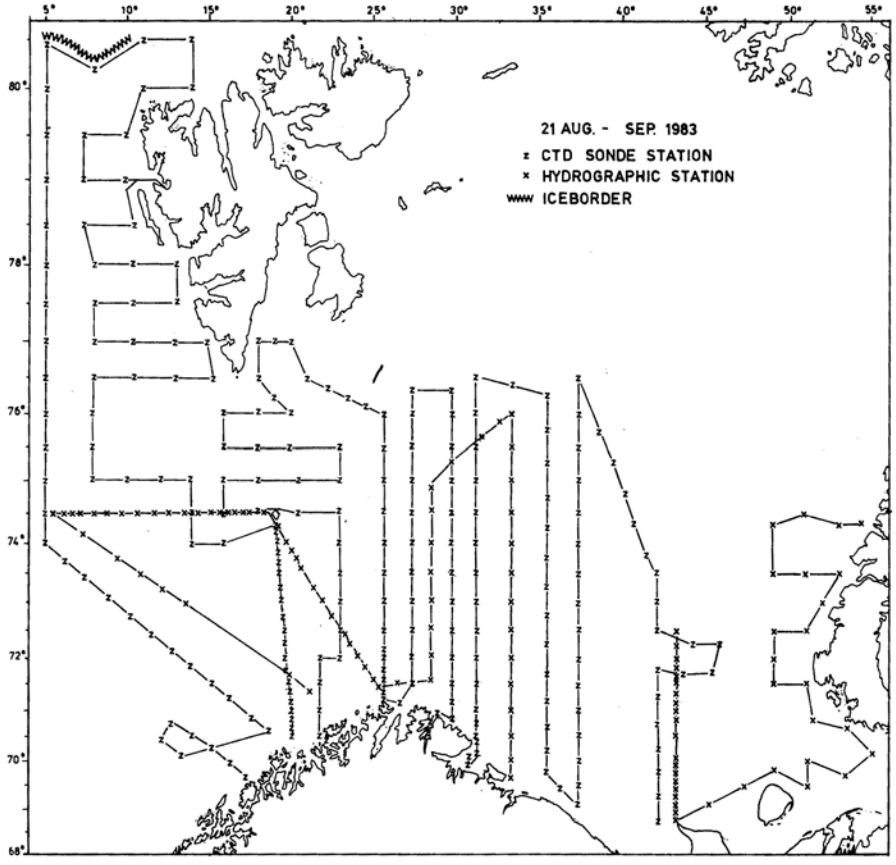

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

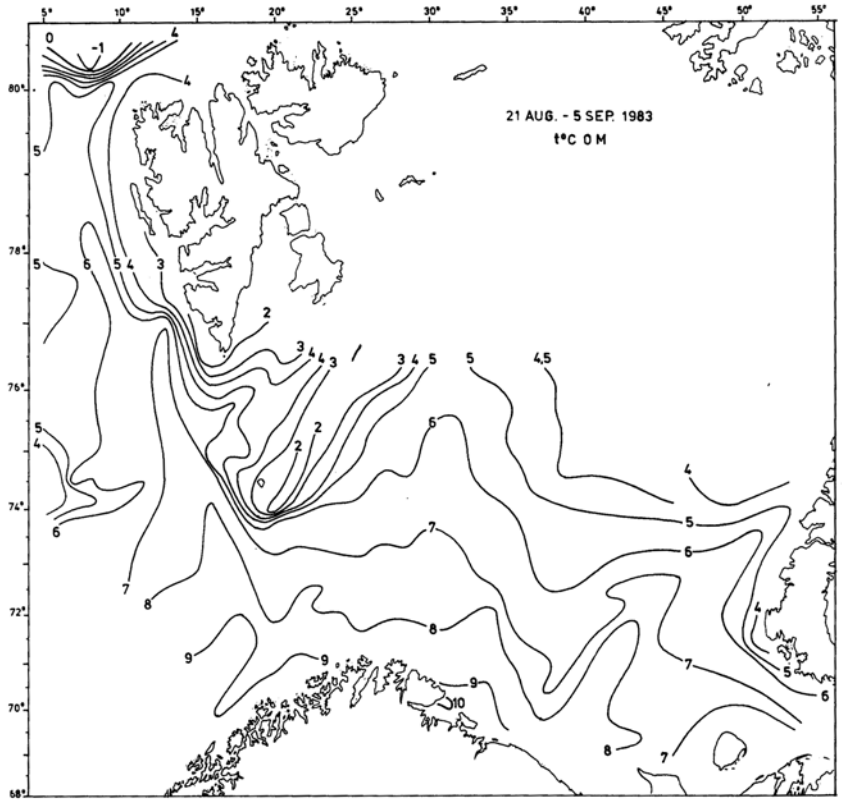

Fig. 2. Isotherms at 0 m

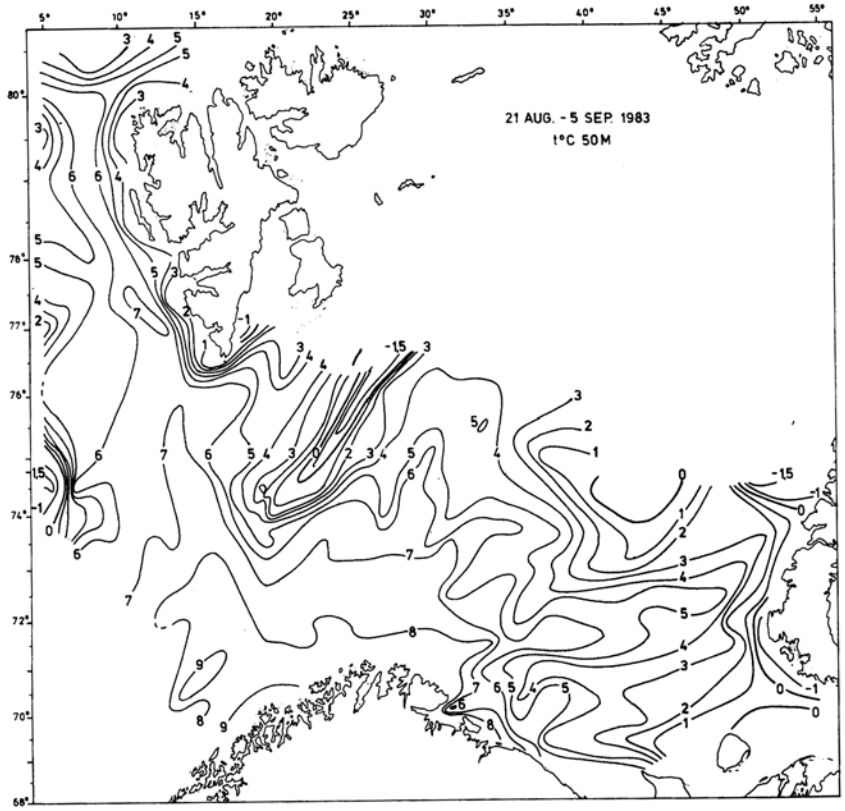

Fig. 3. Isotherms at 50 m

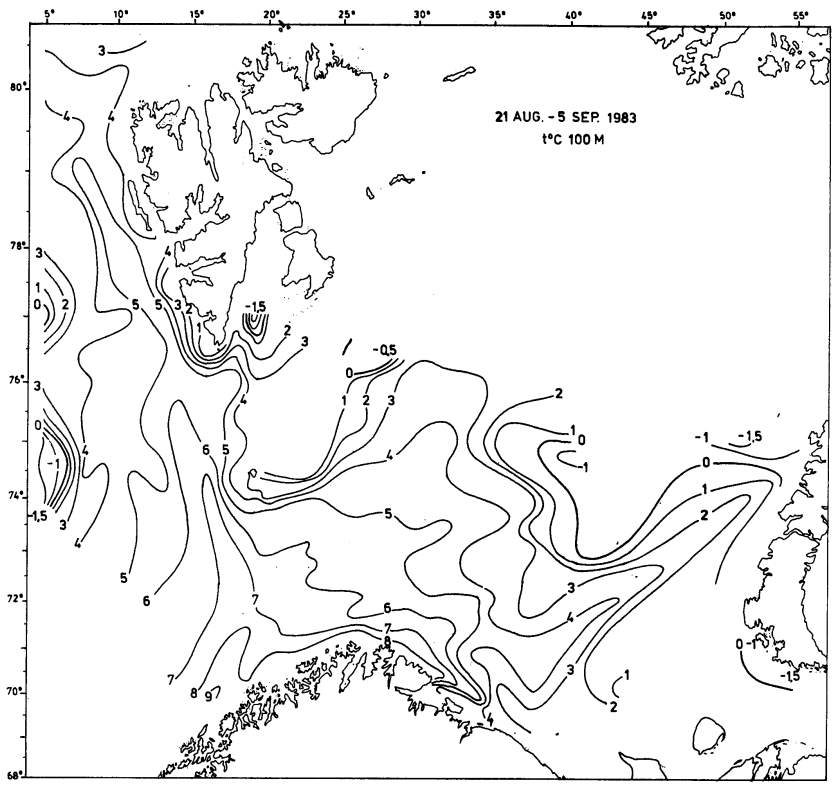

Fig. 4. Isotherms at 100 m

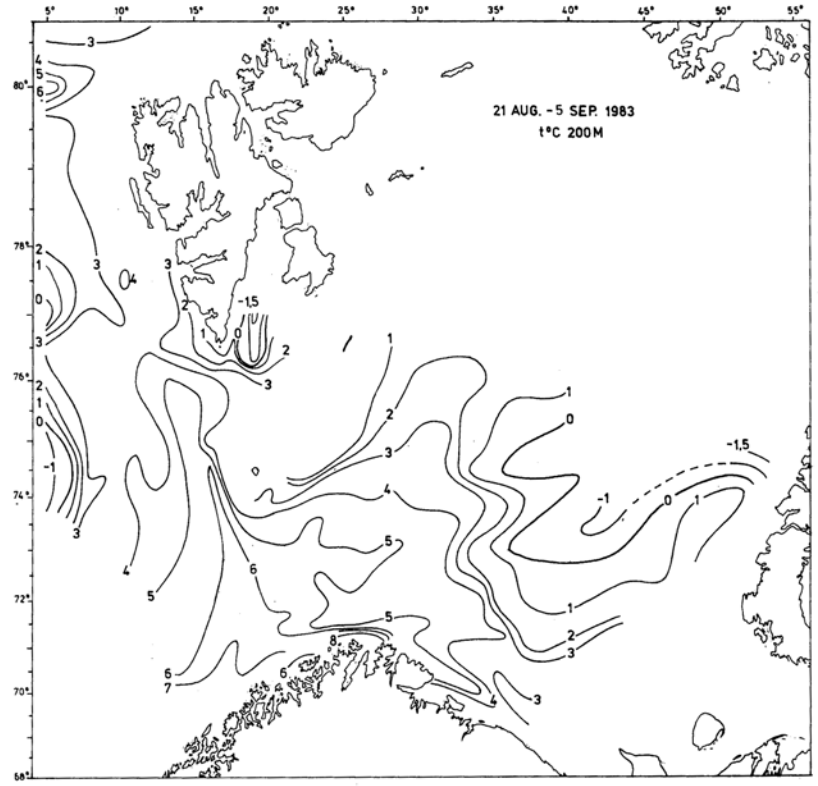

Fig. 5. Isotherms at 200 m

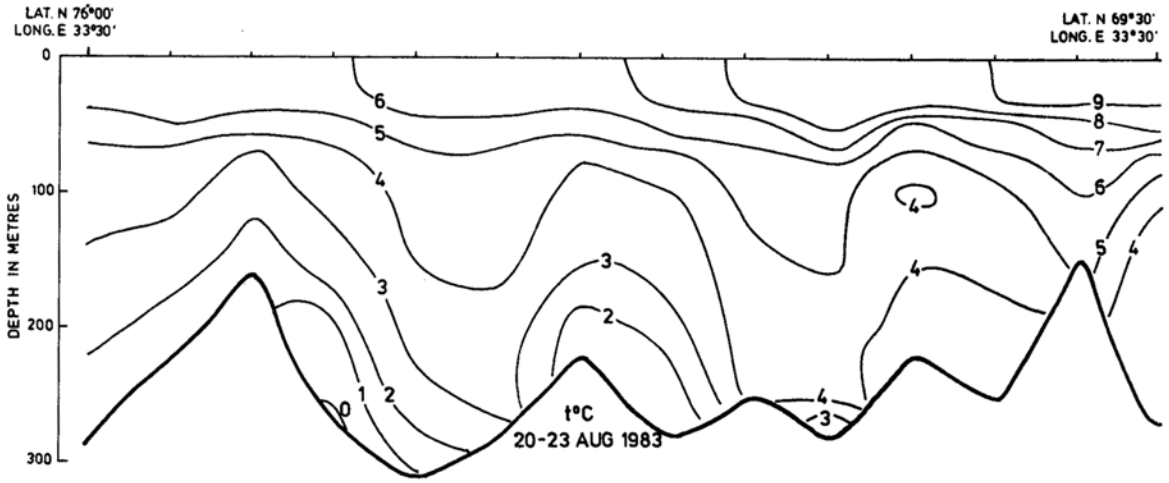

Fig. 6. Temperature section along the Kola meridian

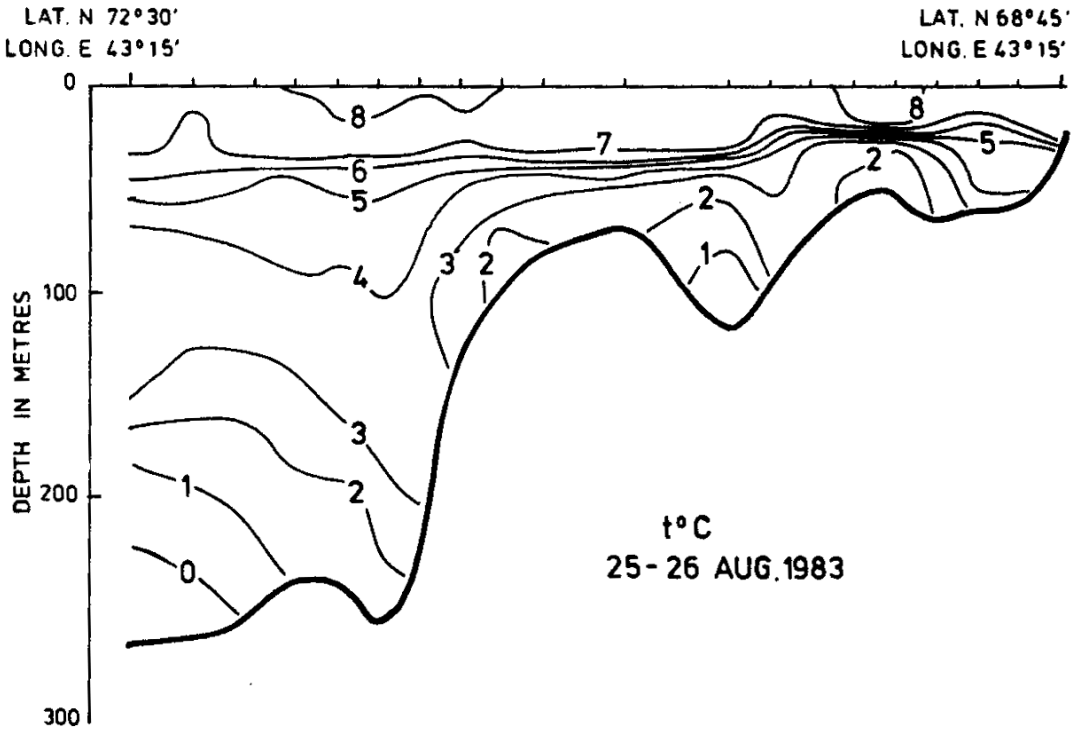

Fig. 7. Temperature section Cape Kanin-North

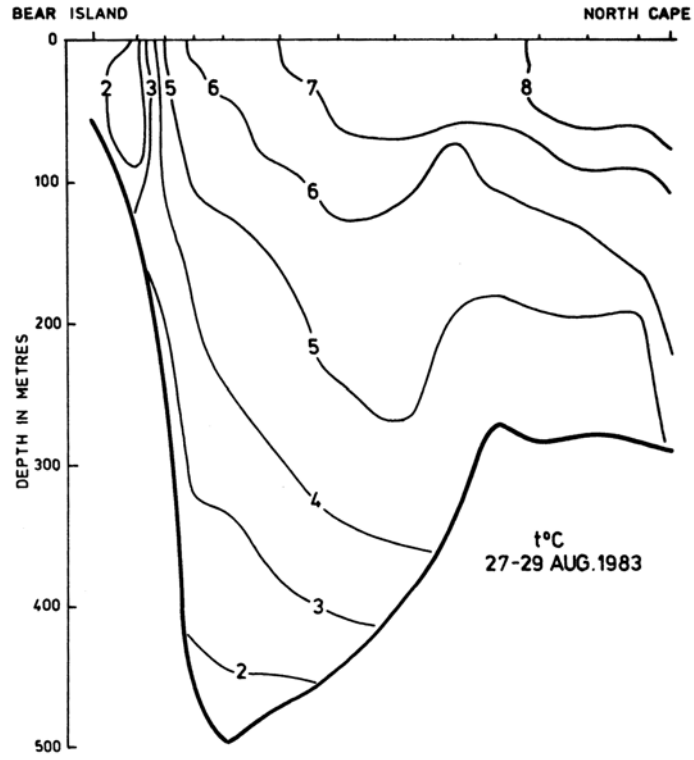

Fig. 8. Temperature section Bear Island-North Cape

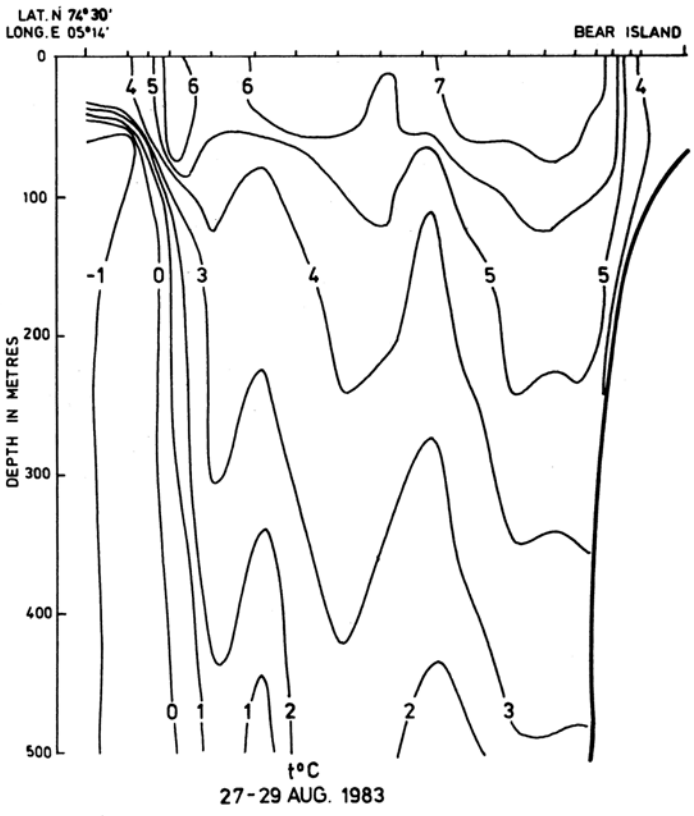

Fig. 9. Temperature section Bear Island-West

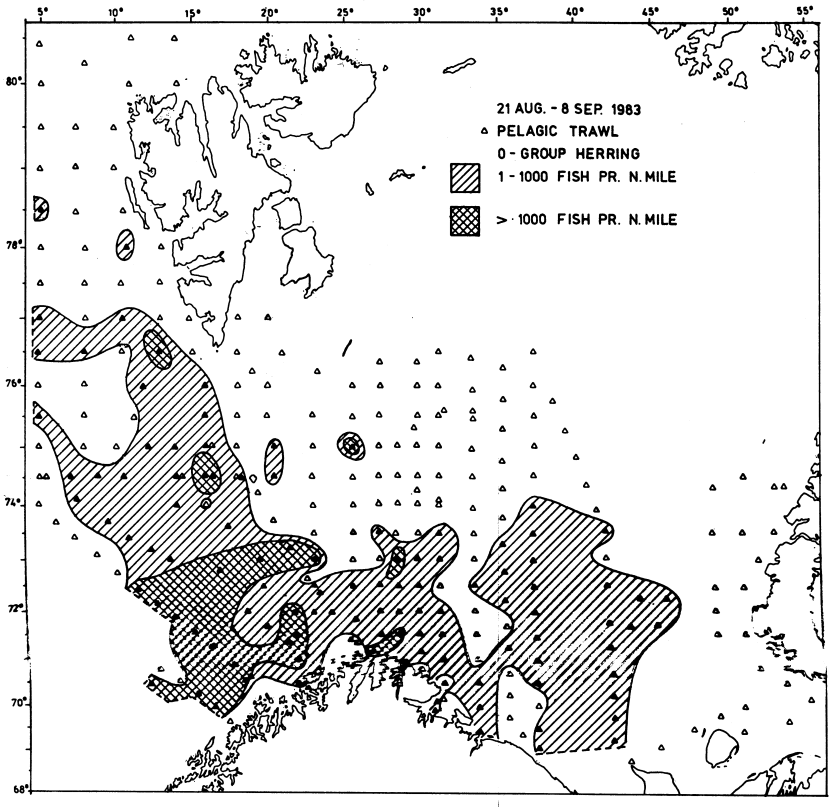

Fig. 10. Distribution of 0-group herring

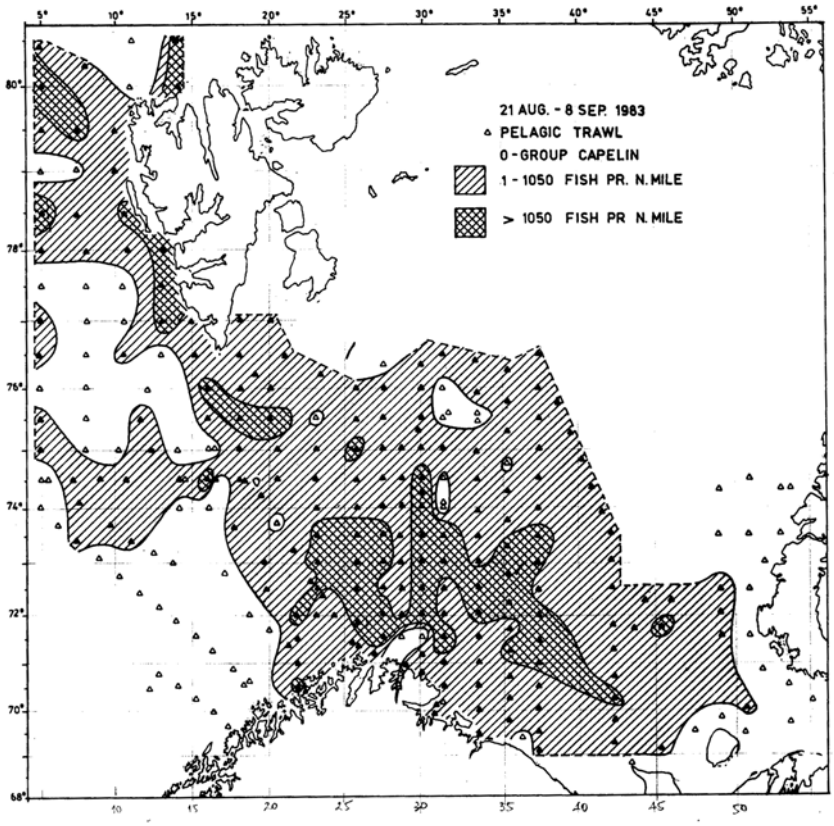

Fig. 11. Distribution of 0-group capelin

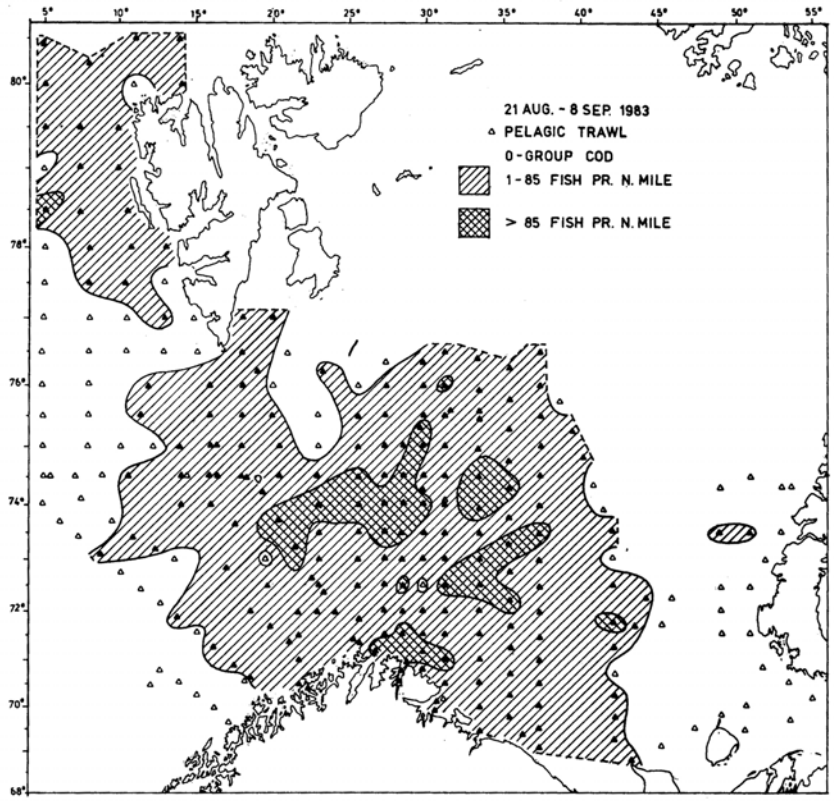

Fig. 12. Distribution of 0-group cod

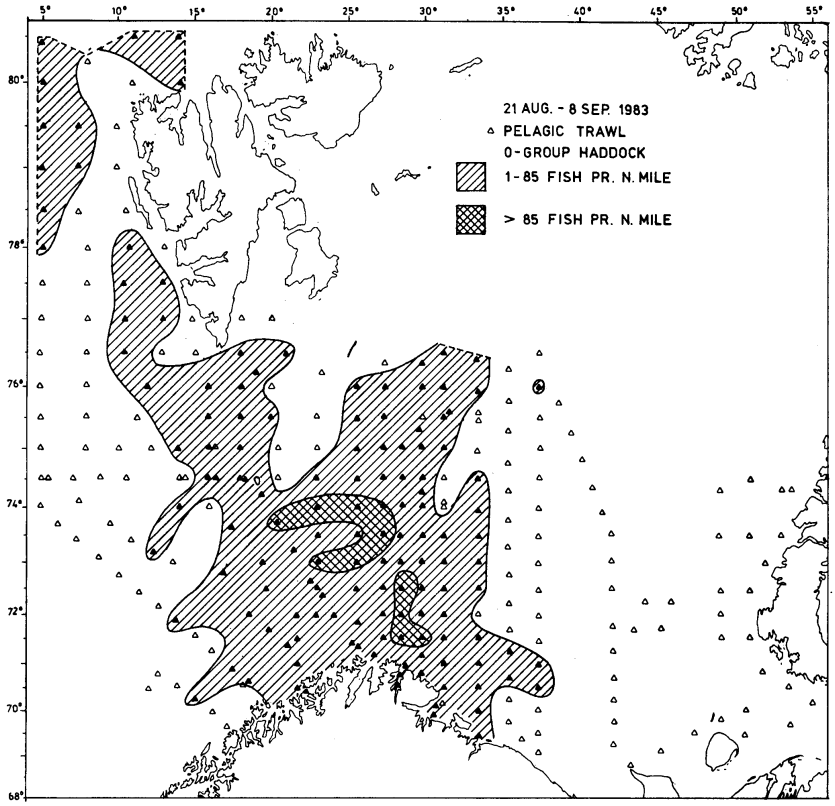

Fig. 13. Distribution of 0-group haddock

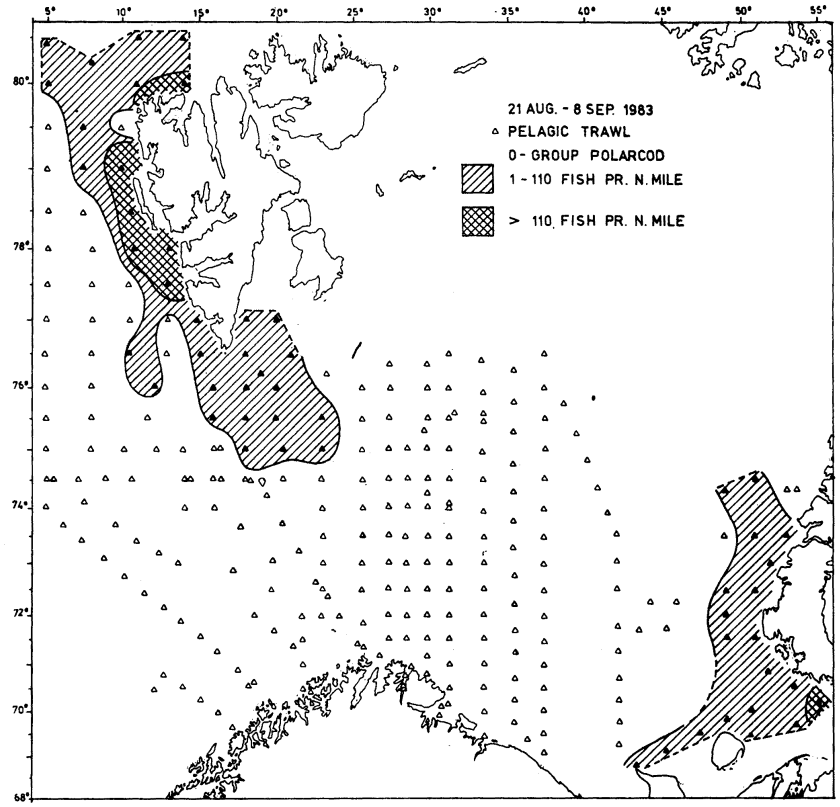

Fig. 14. Distribution of 0-group polar cod

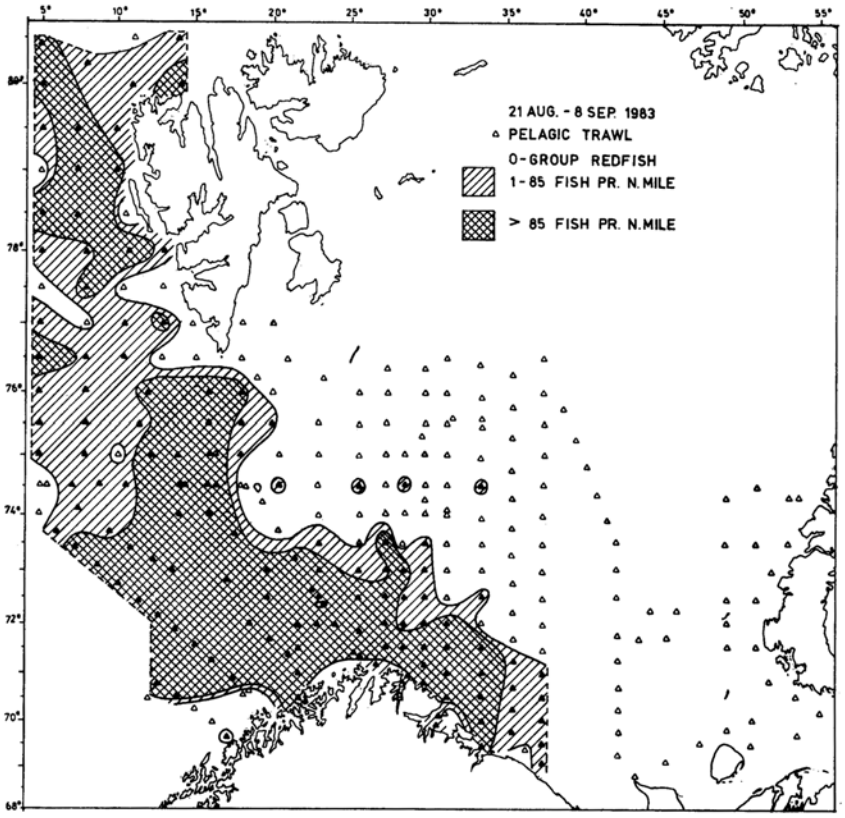

Fig. 15. Distribution of 0-group redfish

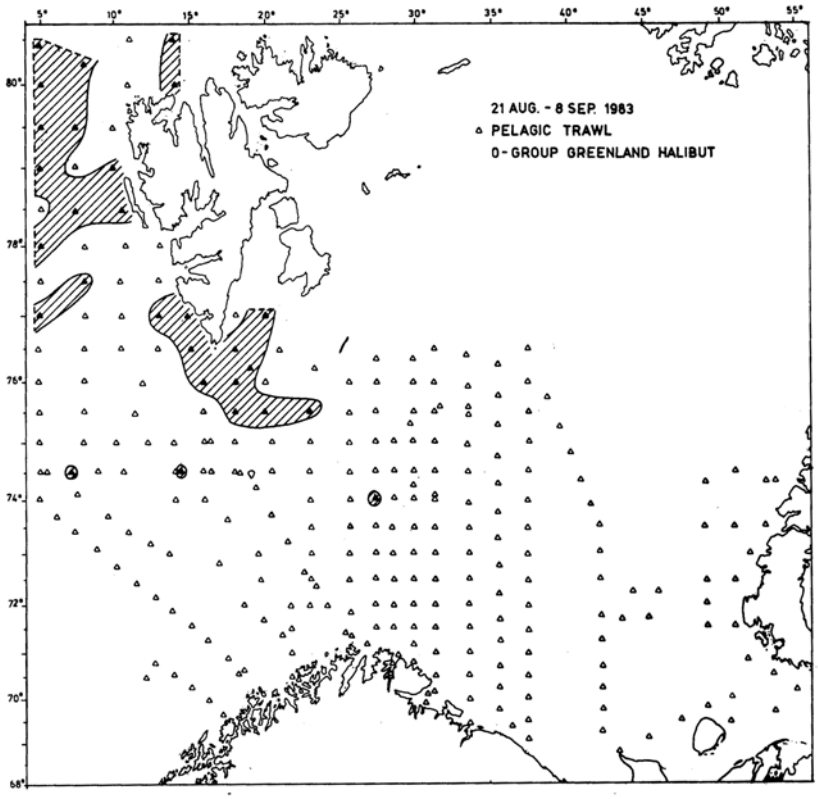

Fig. 16. Distribution of 0-group Greenland halibut

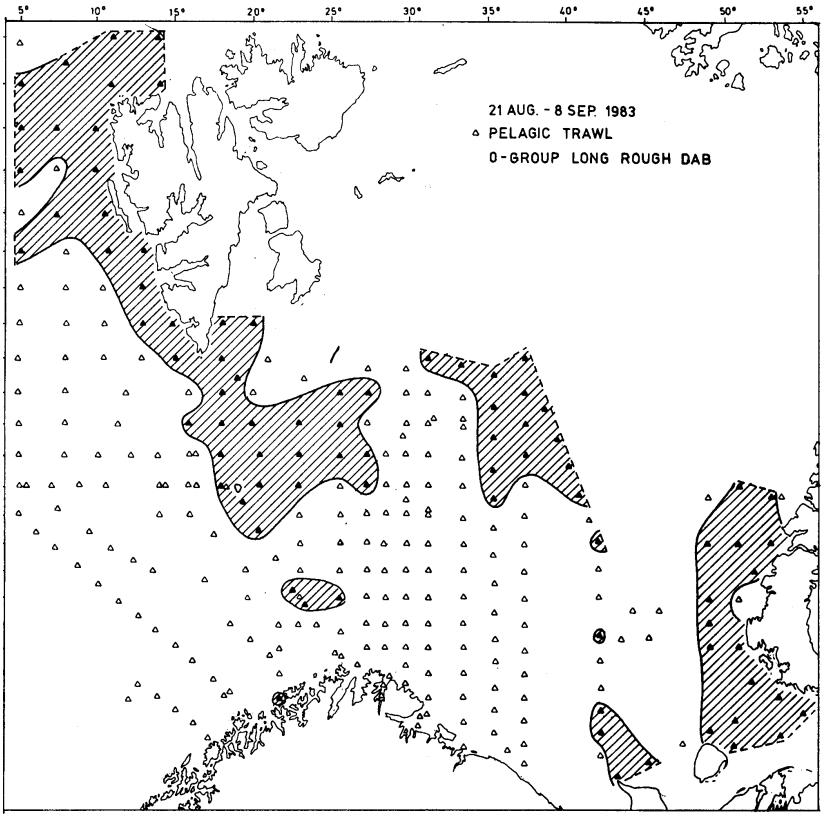

Fig. 17. Distribution of 0-group long rough dab

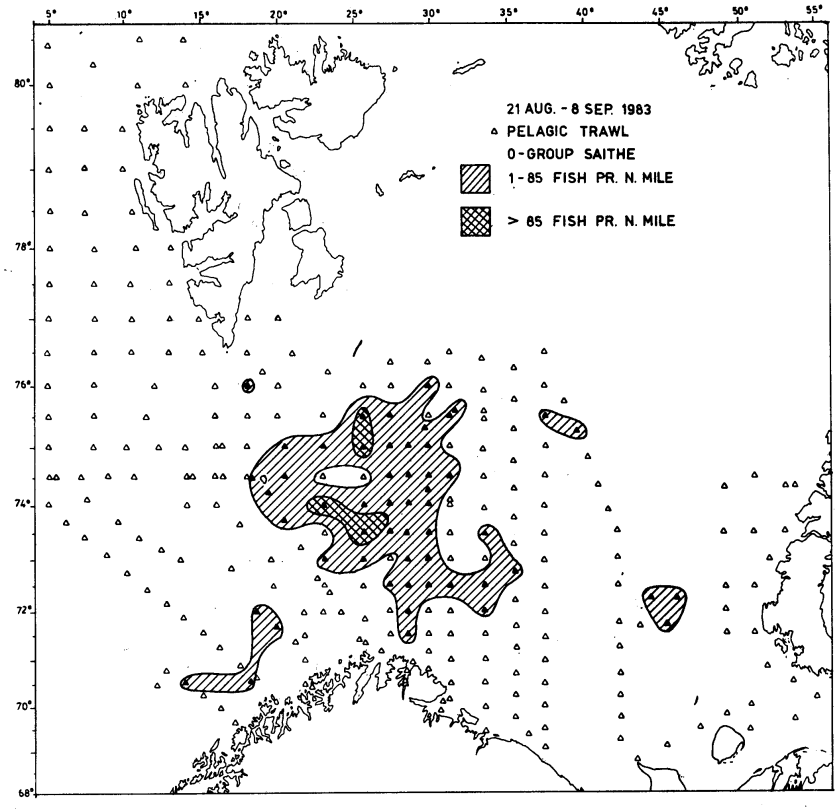

Fig. 18. Distribution of 0-group saithe

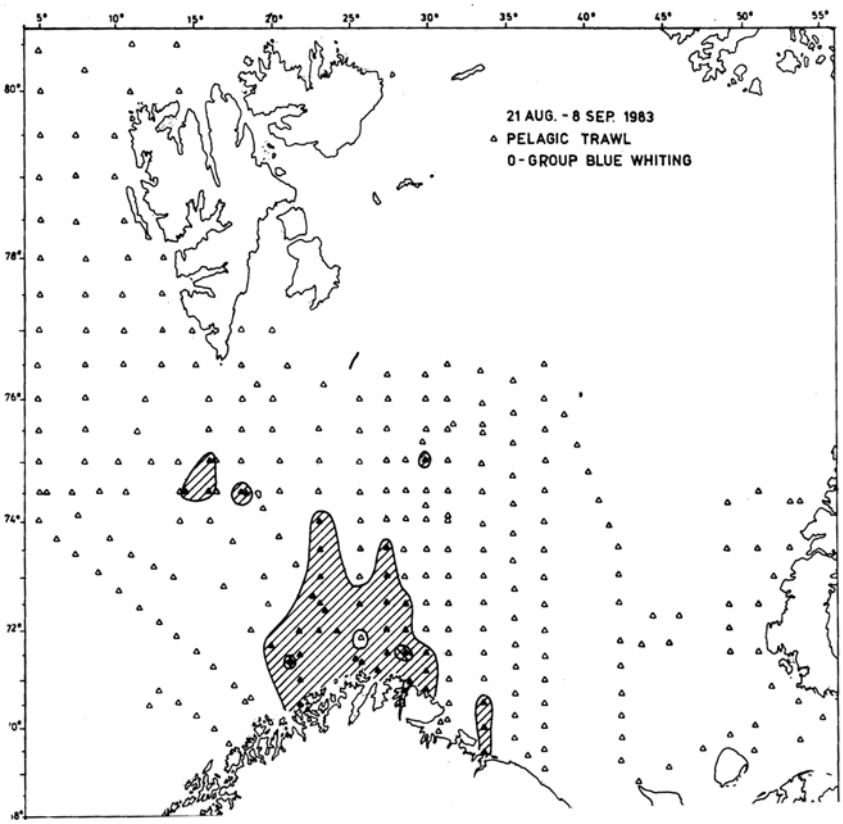

Fig. 19. Distribution of 0-group blue whiting

International Council for
the Exploration of the Sea

C.M. 1984/H.-36
Pelagic Fish Committe
Ref. Demersal Fish Committe

Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1984

The twentieth annual International 0-group fish survey was made during the period 13 August-5 September 1984 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey period	Research Institute
Norway	"Eldjarn"	12 August-5 September	Institute of Marine, Research, Bergen
Norway	"G.O. Sars"	19 August-3 September	"
Norway	"Hakon Mosby"	19 Augus -5 September	"
USSR	"Persey III"	20 August-30 August	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
USSR	"Poisk"	26 August-29 August	"
USSR	"Alaid"	20 August-27 August	"
USSR	"Kokshaisk"	27 August-2 September	"

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 3 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 meshed midwater trawl. The vessels participating in the survey in 1984 (except "Poisk") 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 the recommendation made at the same meeting. At about every 30 nautical miles sailed the trawl was towed 0,5 nautical mile at each depth; the headline of the trawl at 0, 20, 40 and at 60 m when 0-group fish layer was recorded deeper than 60 m.

Survey tracks and hydrographical stations are given in Fig. 1 Trawl stations with and without catch are given on the distribution charts in Figs. 10-19 as filled and open symbols respectively. The density grading is based on catch in number per 1.0 nautical mile trawling.

Hydrography

Hydrographical observations were made along all the survey tracks normally after each 30 nautical miles sailed. Horizontal temperature distribution is shown for 0, 50, 100 and 200 m depth (Figs. 2-5). Figs. 6-9 show the temperature conditions at four standard sections, and the mean temperature of these sections are given in Table 1. Some general comments are given below:

1) Kola section

In 1983 the temperature in the layers 0-50, 50-200 and 0-200 m turned out to be the highest during the whole period of the 0-group survey. The mean temperatures in 1984 are 0.1, 0.7 and 0.6 °C lower than in the respective layers in 1983. However, they are all above the average for the period 1965-1984.

2) Cape Kanin - North section

An insignificant rise of water temperature was observed in the southern part of the section, as compared to 1983, and the temperature exceeded the long-term mean by 1,2 °C. The temperature in the northern part of the section kept close to the 1983 level and exceeded the normal by 0,9 °C.

3) North Cape - Bear Island section

In 1984 the mean temperature in the 0-200 m layer exceeded the long-term mean by 0.2 °C. Compared with 1983, it decreased by 0,4 °C.

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

The water temperatures in the West Spitsbergen Current remained close to the 1983 level and exceeded the normal by 0,6 °C.

Thus, in late August - early September 1984 the water temperature was lower than the previous year, but above the average long-term value both in the eastern and western part of the survey area.

Distribution and abundance of 0-group fish

Geographical distributions of 0-group fish are shown by shaded areas in Figs. 10-18. 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. A new set of abundance indices have been calculated for 0-group 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 distribution of 0-group herring was restricted in 1984 to the western part of the Barents Sea, and the overall density was lower in 1984 than in 1983. However, with the exception of 1983, the density and distribution area of 0-group herring in 1984 is the largest since the present investigations started in 1965.

Capelin (Fig. 11)

The area of distribution and the overall density is similar to that in 1983 which indicate that the 1984 year-class may be as abundant as both the 1982 and 1983 year-classes. However according to the great variation in numbers of 0-group capelin in the catches, caused

by weather conditions, it must be stressed that an index of year-class strength of capelin is not as reliable as for other species.

Cod (Fig. 12)

The 0-group cod was distributed north of Finnmark and Murman coast and west of Spitsbergen. Both indices for year-class strength (Table 3 and 4) indicate that the 1984 year-class is a rich year-class, even more abundant than the 1975 year-class, which has dominated the fishery in the recent years. It is only exceeded in abundance at the 0-group stage by the outstanding 1970 and 1973 year-classes. The logarithmic index is only exceeded by the 1970 and 1983 year -classes.

Haddock (Fig. 13)

The distribution was similar to that in 1983. Both indices of year class strength indicate that the 1984 year-class is stronger than the 1975 year-class, which has dominated the fishery in the late seventies and early eighties. It is even stronger than the 1983 year-class, which was the most abundant year class recorded in the 0-group survey.

Polar cod (Fig. 14)

As in previous years, 0-group polar cod was found in two separated areas, off Spitsbergen and in the south-eastern part of the Barents Sea. The most dense concentrations were found off Spitsbergen. Sparse concentrations were recorded in the eastern part of the survey area. It is, however quite possible that 0-group polar cod is distributed outside the investigated area.

Redfish (Fig. 15)

The distribution of 0-group redfish is similar to the one found last year. The overall density indicate that the 1984 year-class is another strong one, but somewhat less abundant than the 1983 year-class.

Greenland halibut (Fig. 16)

0-group Greenland halibut was as usually found in the Bear Island - West Spitsbergen area. The abundance index for the 1984 year-class is higher than for the 1983 and 1982 year-classes and above the long term average.

Long rough dab (Fig. 17)

0-group long rough dab was found in many patches all over the survey area. The abundance index for 1984 is lower than the very high 1982 index and close to the average for the period 1965-1984.

Saithe (Fig. 18)

0-group saithe was found in many patches in the survey area. The double shaded area in Fig. 18 represents more than 85 specimen per haul of 1.0 nautical mile. 0-group saithe has only been observed in such high numbers during the 0-group surveys in 1967 and 1983, and no abundance index has been calculated.

Blue whiting (Fig. 19)

0-group blue whiting was recorded in the same area as in 1983, -south of 75° N and between 20° E and 35° E. No index of abundance has been calculated.

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.

Randa, K., 1984. Abundance and distribution of 0-group Arcto-Norwegian cod and haddock 1965-1982. In The Proceedings of the Soviet-Norwegian on Reproduction and recruitment of Melic cod. Leningrad 26-30 Sept. 1983: 192-212.

Table 1. Mean water temperature during the International 0-group fish survey in the Barents Sea and adjacent waters in late August - early September 1984
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	0-50 m	50-200 m	0-200 m	0-bottom	0-bottom	0-200 m	0-200 m
1	2	3	4	5	6	7	8
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
Average 1965-1984	7.3	3.6	4.6	4.2	3.3	5.7	4.4

Table 2. Abundance indices

Species / Year	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab
			West		East			
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	8.0	65
1973	684	54		(26)		385	3.2	67
1974	51	147		227		468	13.4	83
1975	343	170		75		315	21.1	113
1976	43	112		131		447	15.6	96
1977	173	116	157		70	472	9.0	72
1978	106	61	107		144	460	35.4	76
1979	94	69	23		302	980	22.5	69
1980	49	54	79		247	651	12.0	108
1981	65	30	149		73	861	38.0	95
1982	114	90	14		50	694	17.0,	150
1983	386	184	48		39	851	15.8	80
1984	486	255	115		16	732	40.4	70

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

Year-class	Cod			Haddock		
	Logarithmic index	Confidence limits (95%)		Logarithmic index	Confidence limits (95%)	
1965	+			0.01	0.00	0.04
1966	0.02	0.01	0.04	0.01	0.00	0.03
1967	0.04	0.02	0.08	0.08	0.03	0.13
1968	0.02	0.01	0.04	0.00	0.00	0.02
1969	0.25	0.17	0.34	0.29	0.20	0.41
1970	2.51	2.02	3.05	0.64	0.42	0.91
1971	0.77	0.57	1.01	0.26	0.18	0.36
1972	0.52	0.35	0.72	0.16	0.09	0.27
1973	1.48	1.18	1.82	0.26	0.15	0.40
1974	0.29	0.18	0.42	0.51	0.39	0.68
1975	0.90	0.66	1.17	0.60	0.40	0.85
1976	0.13	0.06	0.22	0.38	0.24	0.51
1977	0.49	0.36	0.65	0.33	0.21	0.48
1978	0.22	0.14	0.32	0.12	0.07	0.19
1979	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	0.10	0.06	0.18	0.03	0.00	0.05
1982	0.59	0.43	0.77	0.38	0.30	0.52
1983	1.69	1.34	2.08	0.62	0.48	0.77
1984	1.55	1.18	1.98	0.78	0.60	0.99

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

Length, mm	Herring	Capelin	Cod	Haddock	Polar cod		Redfish	Greenland halibut	Lrd	Saithe	Blue whiting
					West	East					
10-14					+		0.3				
15-19				+	0.3		9.2				
20-24		+		+	0.7		21.9		0.3		
25-29		0.3			10.1		18.2		2.8		
30-34	+	3.4	+	+	28.8		12.1	1.8	21.3	+	5.3
35-39	+	7.7	0.1	0.1	21.2		11.0	2.5	32.7		3.2
40-44	+	12.1	0.3	0.5	19.3	12.2	10.5	7.9	28.7	+	9.5
45-49	0.3	16.9	0.8	1.1	12.1	41.0	10.8	6.5	12.2	+	11.6
50-54	0.6	18.7	2.4	2.4	5.4	36.6	4.3	10.1	1.4	+	10.5
55-59	1.4	18.0	4.7	4.6	1.7	8.5	1.2	7.9	0.3	+	23.2
60-64	3.1	17.0	8.5	6.9	0.3	1.3	0.3	10.1	+		9.5
65-69	5.1	5.2	13.6	8.4	+		+	13.7	0.3		8.4
70-74	7.3	0.7	18.1	9.0	0.1		+	14.1			11.6
75-79	15.5	+	21.9	7.6	+			14.4			1.1
80-84	20.5	+	16.0	9.7				7.2		+	
85-89	17.4	+	7.4	8.4	+	0.3		2.9			
90-94	15.9		4.1	9.1				1.0		+	
95-99	10.2		2.0	8.2						0.2	4.2
100-104	1.8		0.1	9.9	+					0.4	
105-109	0.8			6.1	+					1.4	2.1
110-114	0.1			4.1						2.0	
115-119		+	+	2.4						3.8	
120-124				1.1						7.8	
125-129				0.3						11.2	
130-134				+						14.4	
135-139				+	+					14.3	
140-144				+	+					19.1	
145-149										10.1	
150-154										8.5	
155-159										3.8	
160-164										1.9	
165-169										0.9	
170-174										+	
N	23876	337172	30719	8317	30537	317	317204	277	352	10423	95
Mean length, mm	83,6	52.1	74.6	84.8	38.3	49.9	32.5	64.3	39.1	137.2	58.4

Appendix

Survey period	Research vessel	Research Institute	Participants
20 august- 30 august	"Persey III"	Polar Research Institute of Marine Fisheries and Oceanography, Murmansk	A.S. Galkin, V.K. Ozhigin, L.N. Korol, A.E. Dorchenkov, I.N. Konforkin, A.A. Mukhin, V.V. Vlasov, N.V. Miss Vanukhina, I.V. Novikov, A.A. Gavrukhov
27 august- 2 September	"Kokshalsk"	"	V.N. Kaikov, V. Kaponirov, E.P. Loparev, L.D. Panasenko, S.S. Drobysheva, D.N.Klochkov, A.L. Lovchikov
26 august- 29 august	"Poisk"	"	A.I. Kurbatov, M.D. Kleopin, K. Lysunets, I.I. Prokopovich
20 august- 27 august	"Alaid"	"	B.P. Shein
19 august- 3 September	"G.O. Sars"	Institute of Marine Research, Bergen	B. Brynildsen, A. Hylen, H. Ludvlgsen, E. Nilsen, B. Reppe, A. Raknes, I. Svellingen, Ø. Tanken, E. Øvretvedt.
13 august- 5 September	"Eldjarn"	"	I. M. Beck, B. Hoffstad, B. Kvinge, K. Lauvås, L. Løvheim, T. Monstad, A. Romslo, E. Sælen, R. Toresen, A. Valantine
19 august- 5 September	"Håkon Mosby"	"	G. Hylen, I. Mørk, R. Pedersen, D. Rossebø, A.M. Skorpen, K. Sunnanå

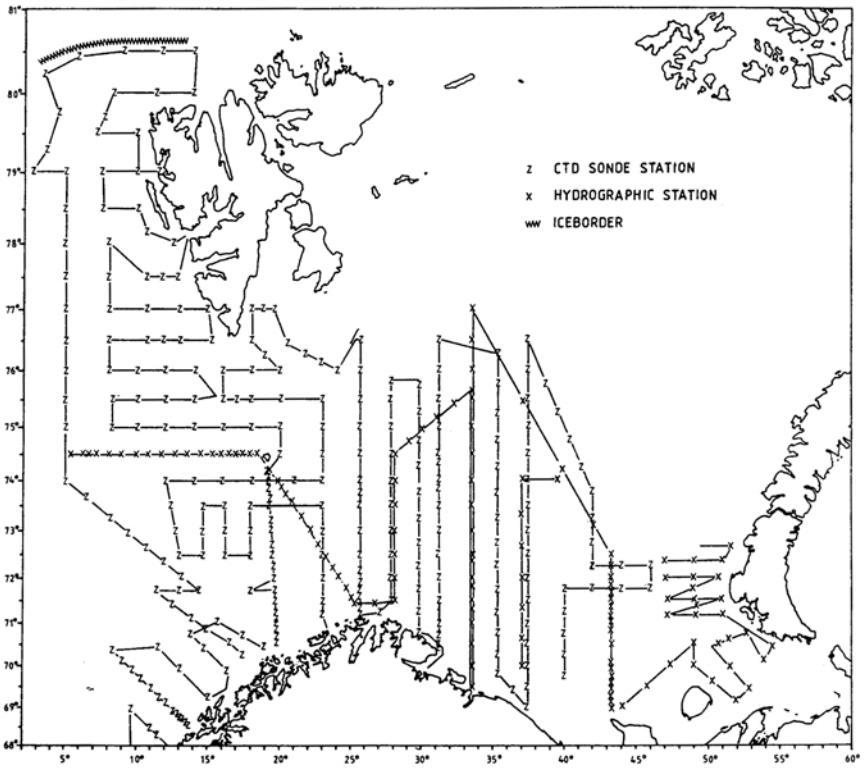

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

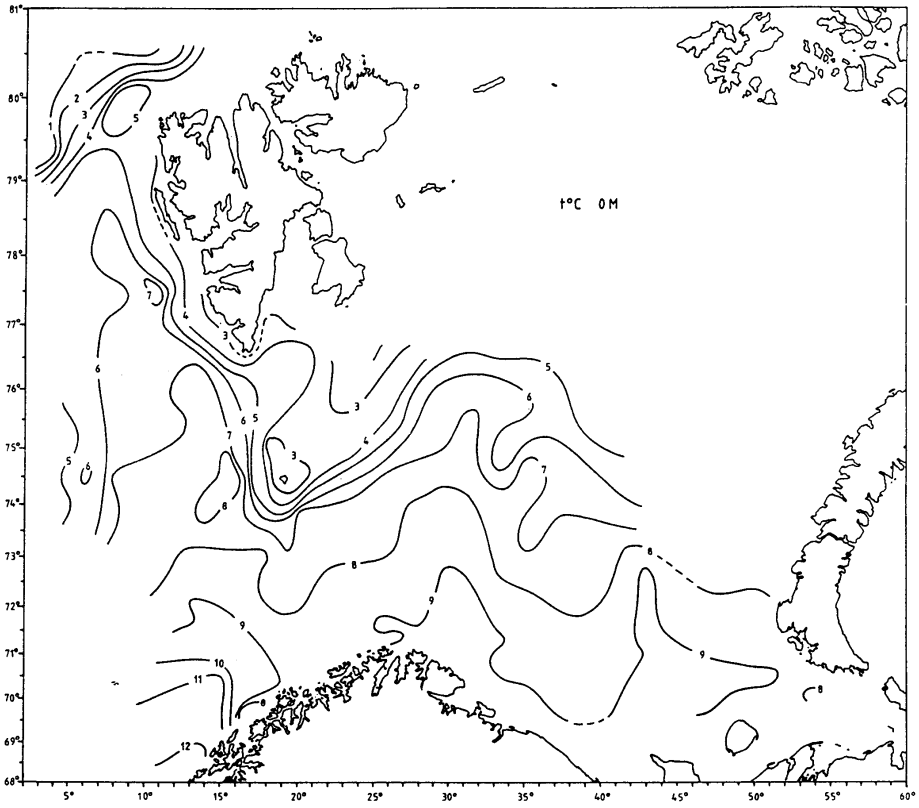

Fig. 2. Isotherms at 0 m

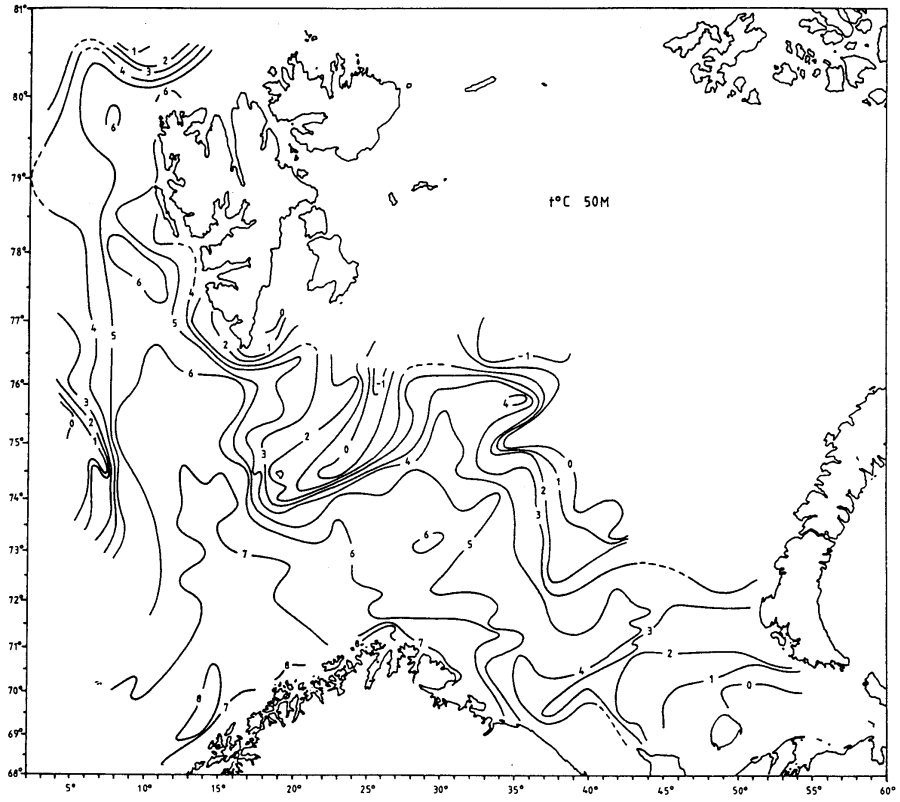

Fig. 3. Isotherms at 50 m

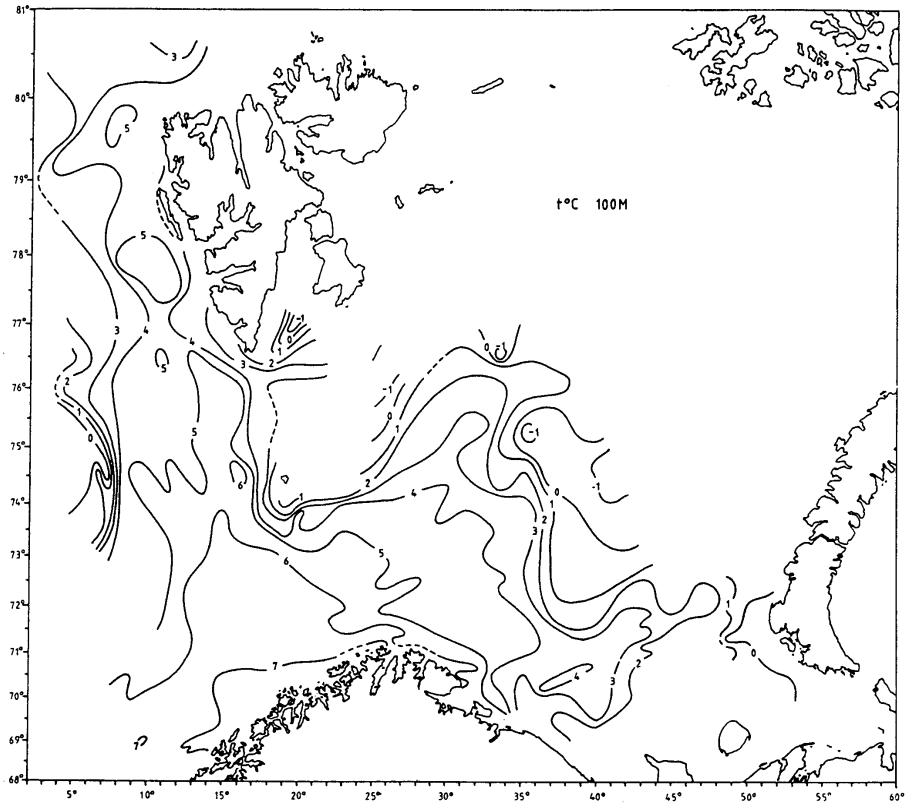

Fig. 4. Isotherms at 100 m

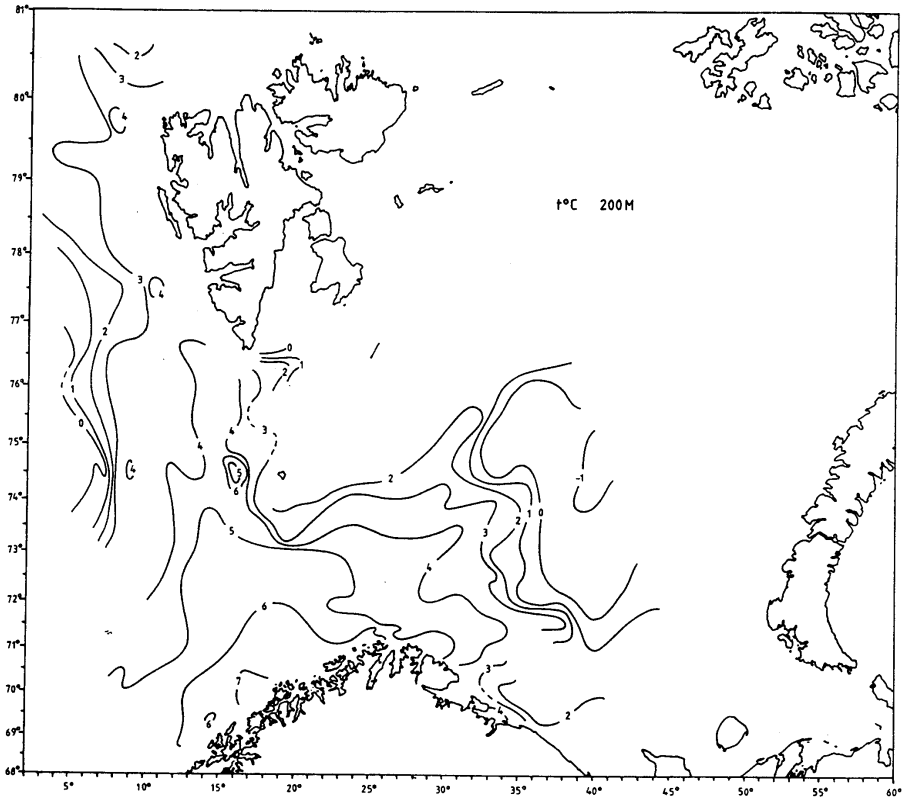

Fig. 5. Isotherms at 200 m

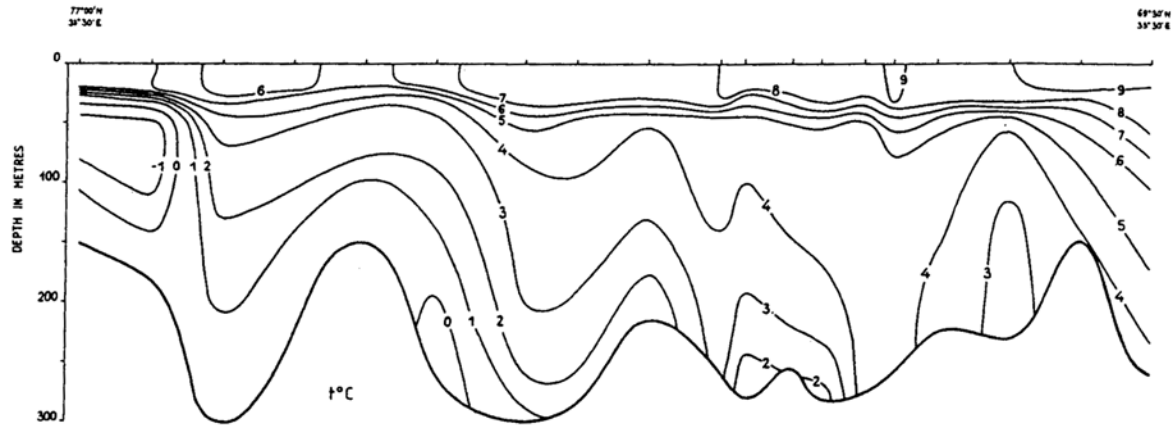

Fig. 6. Temperature section along the Kola meridian

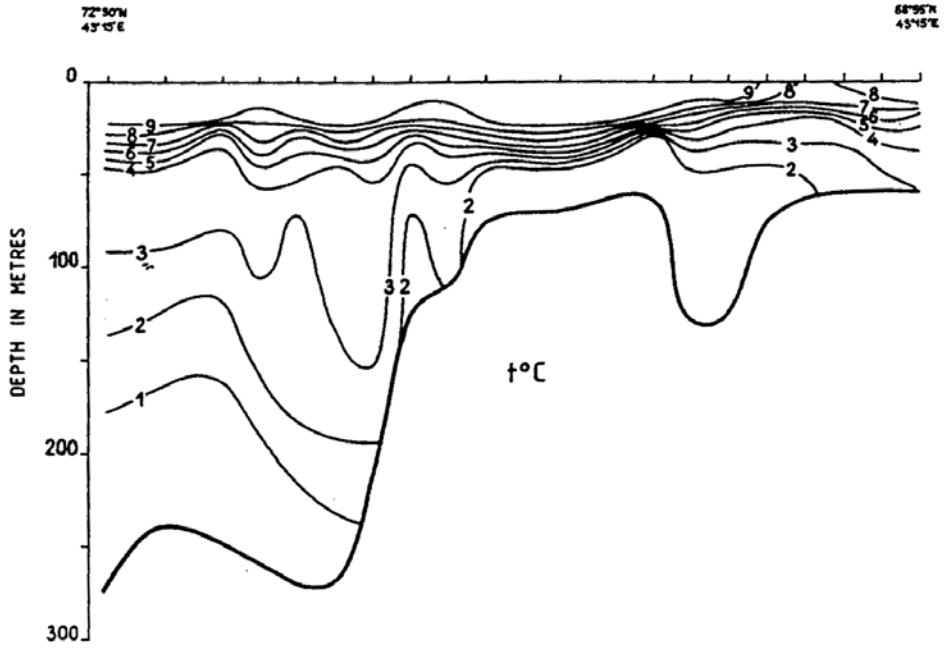

Fig. 7. Temperature section Cape Kanin-North

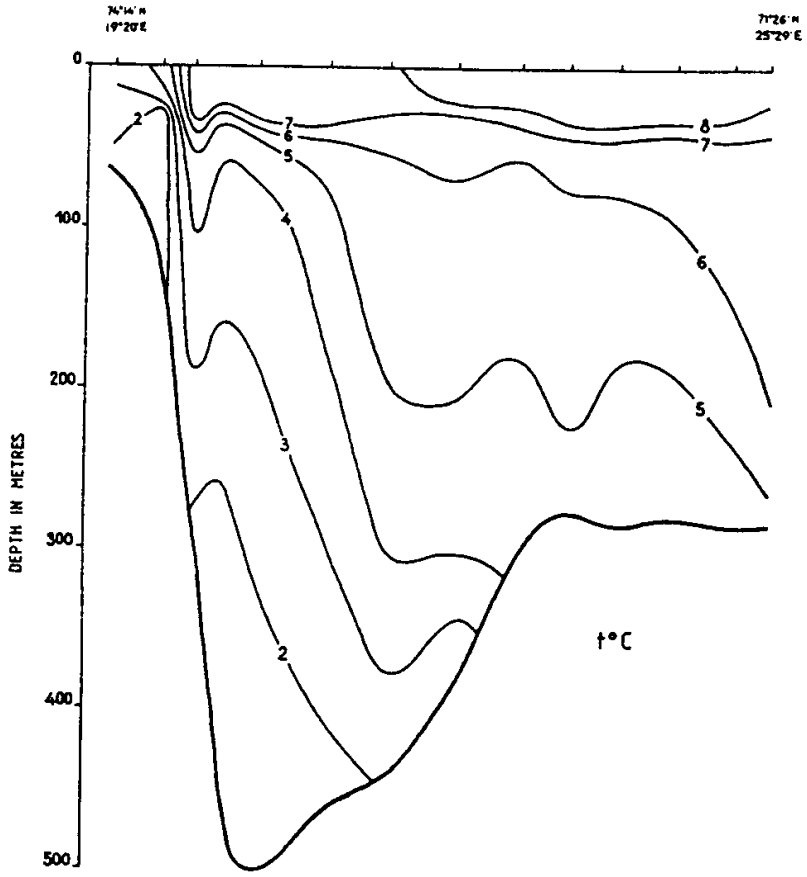

Fig. 8. Temperature section Bear Island-North Cape

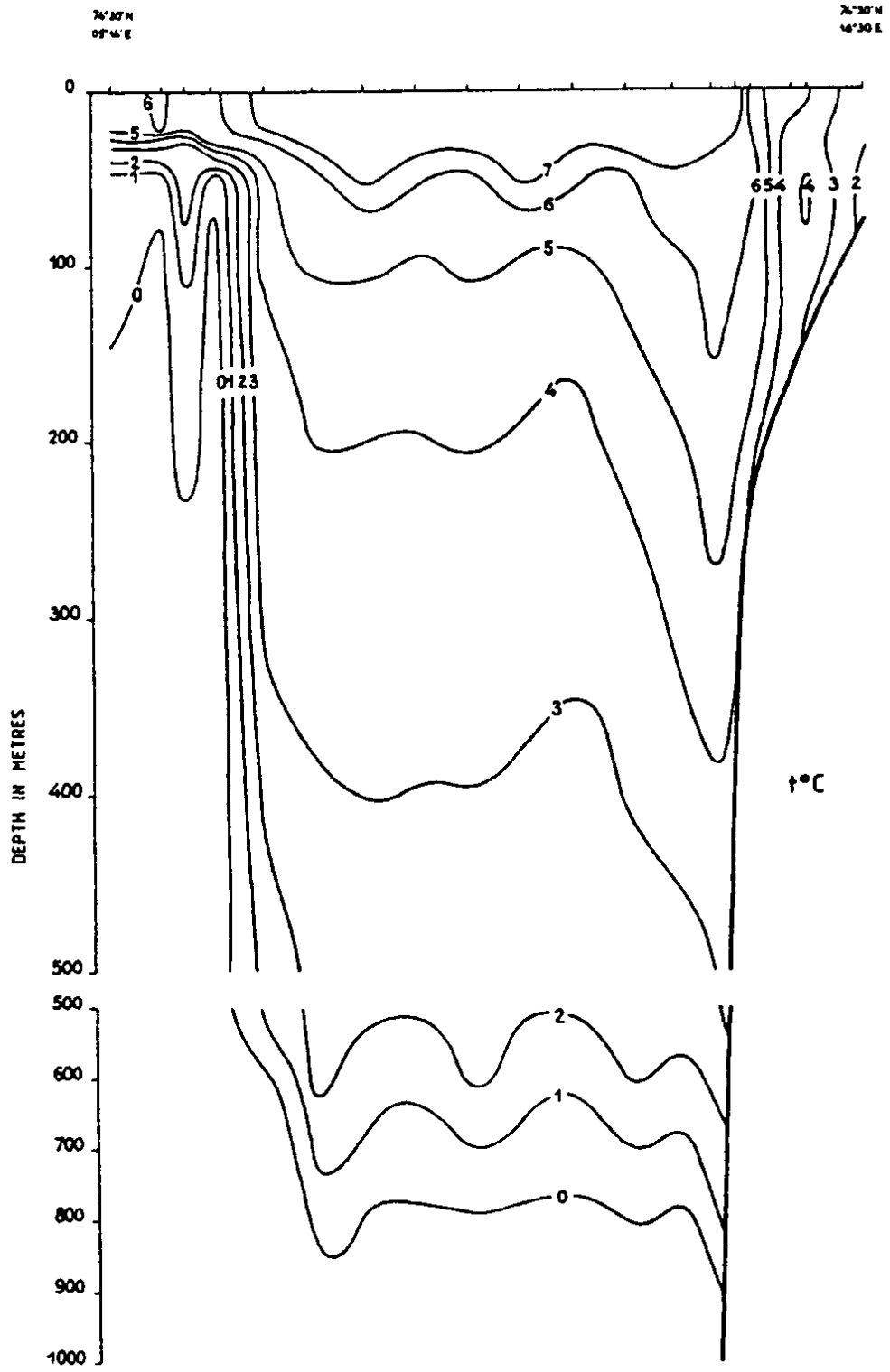

Fig. 9. Temperature section Bear Island-West

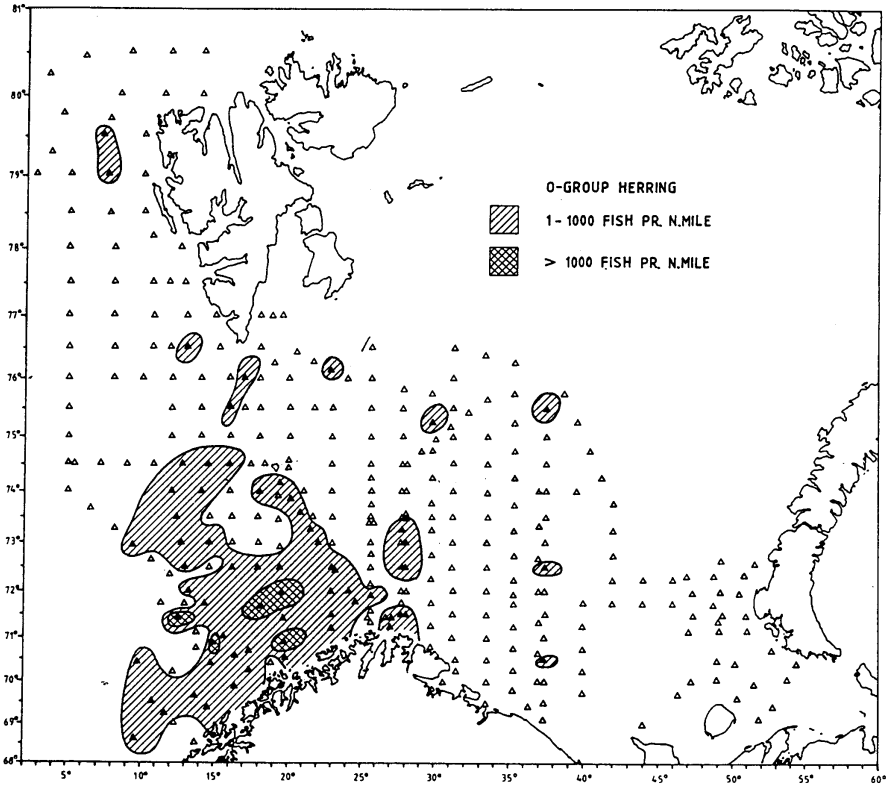

Fig. 10. Distribution of 0-group herring

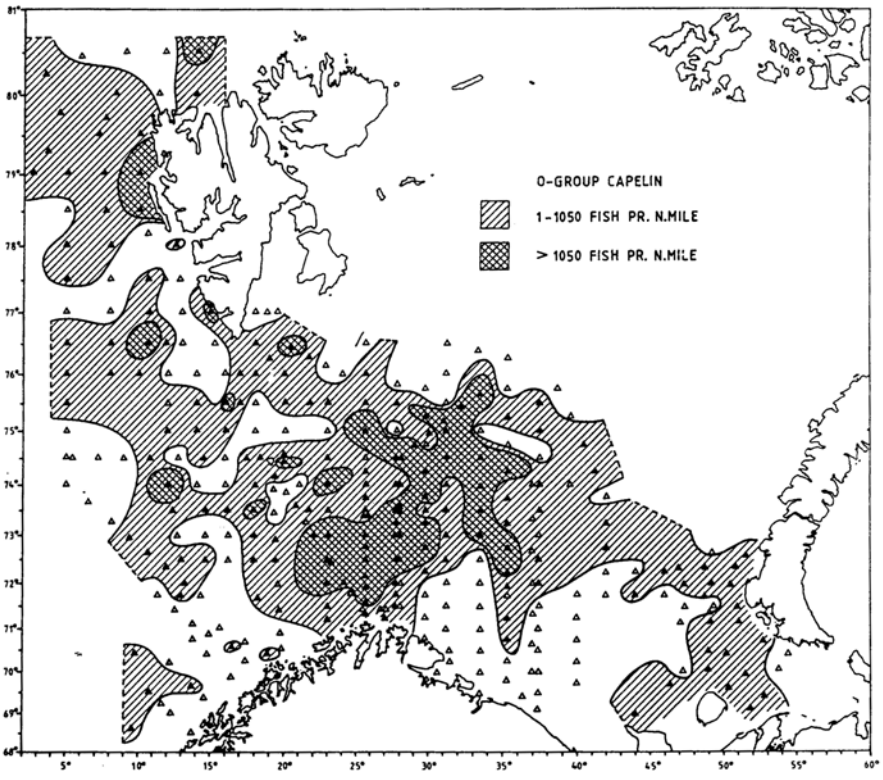

Fig. 11. Distribution of 0-group capelin

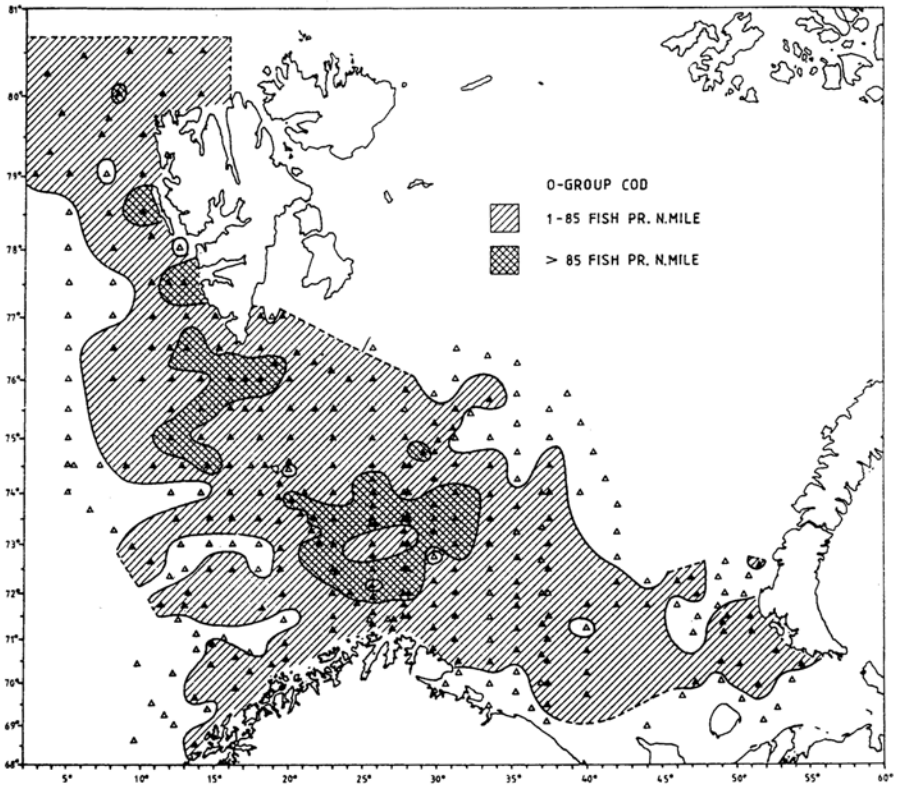

Fig. 12. Distribution of 0-group cod

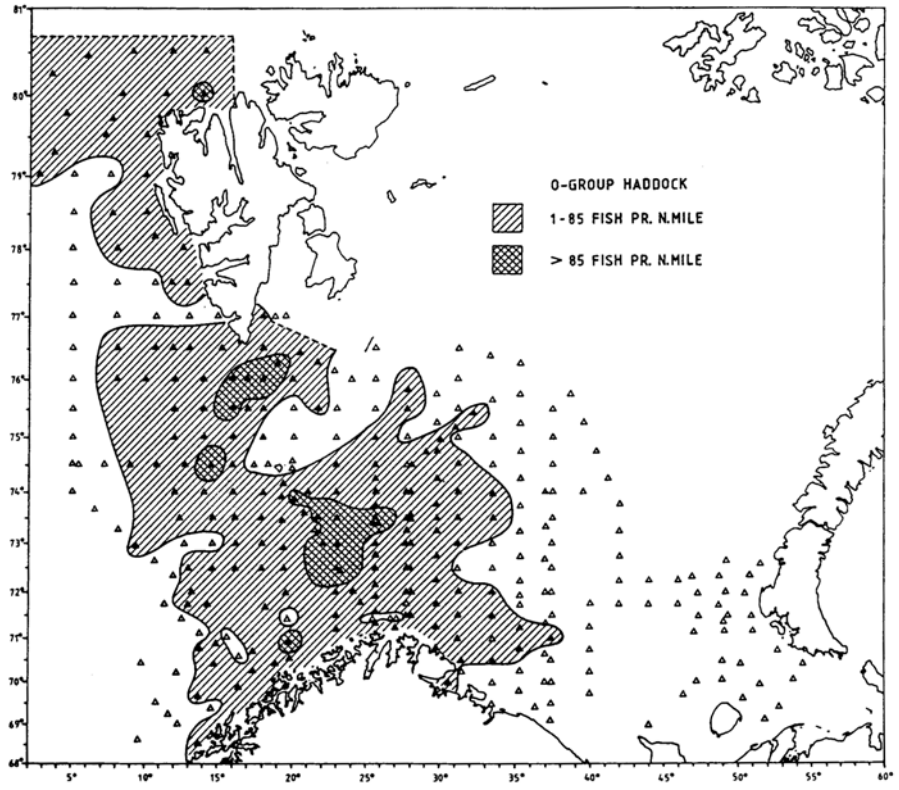

Fig. 13. Distribution of 0-group haddock

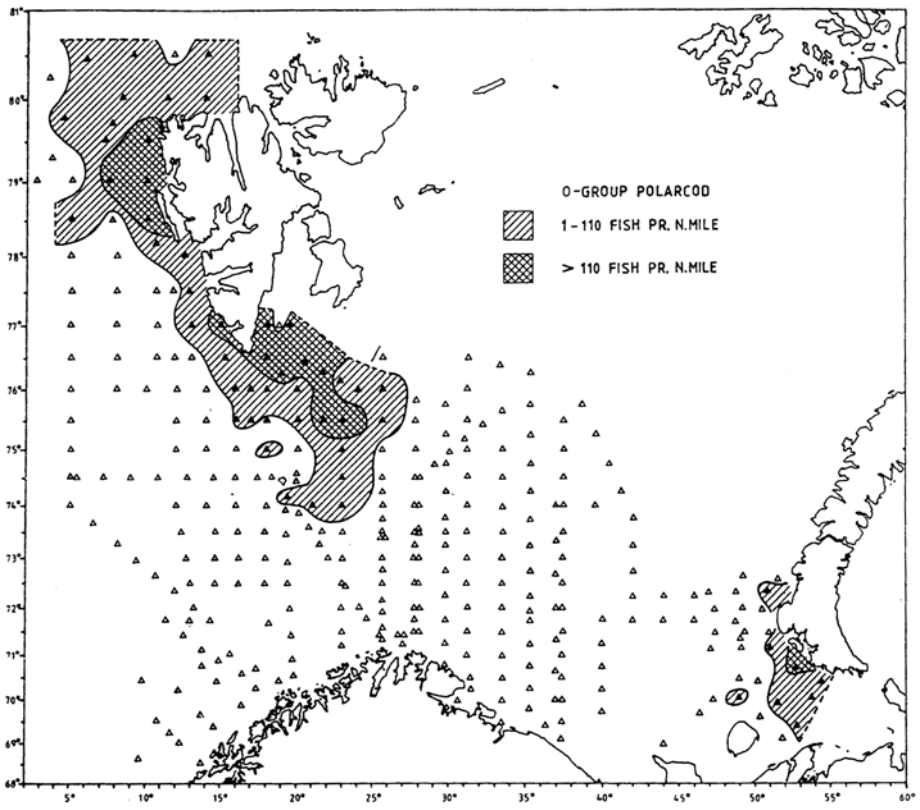

Fig. 14. Distribution of 0-group polar cod

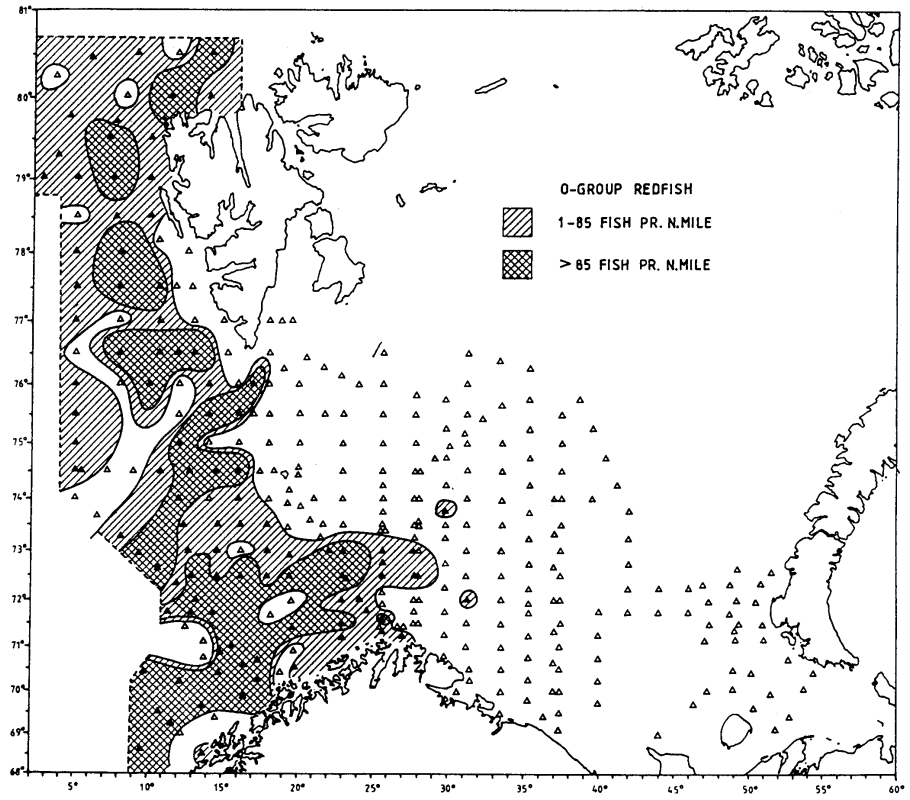

Fig. 15. Distribution of 0-group redfish

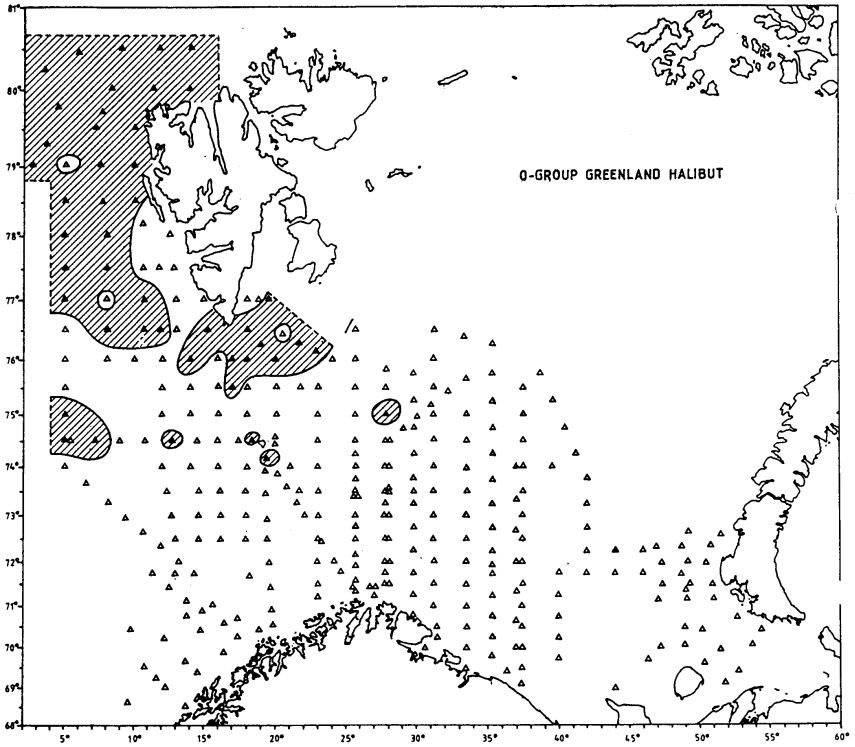

Fig. 16. Distribution of 0-group Greenland halibut

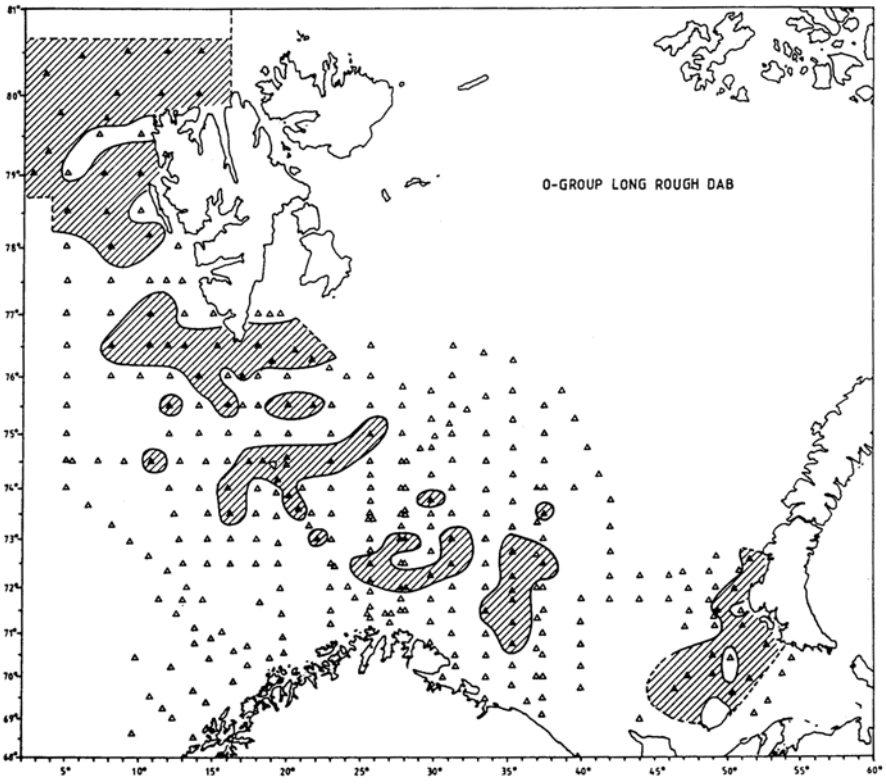

Fig. 17. Distribution of 0-group long rough dab

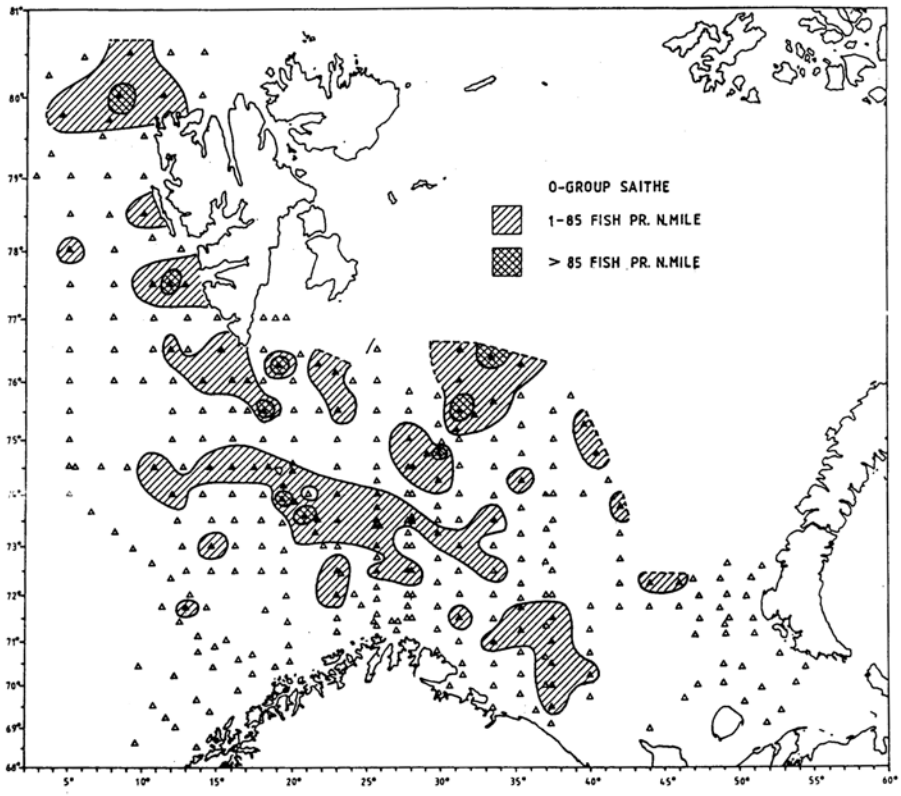

Fig. 18. Distribution of 0-group saithe

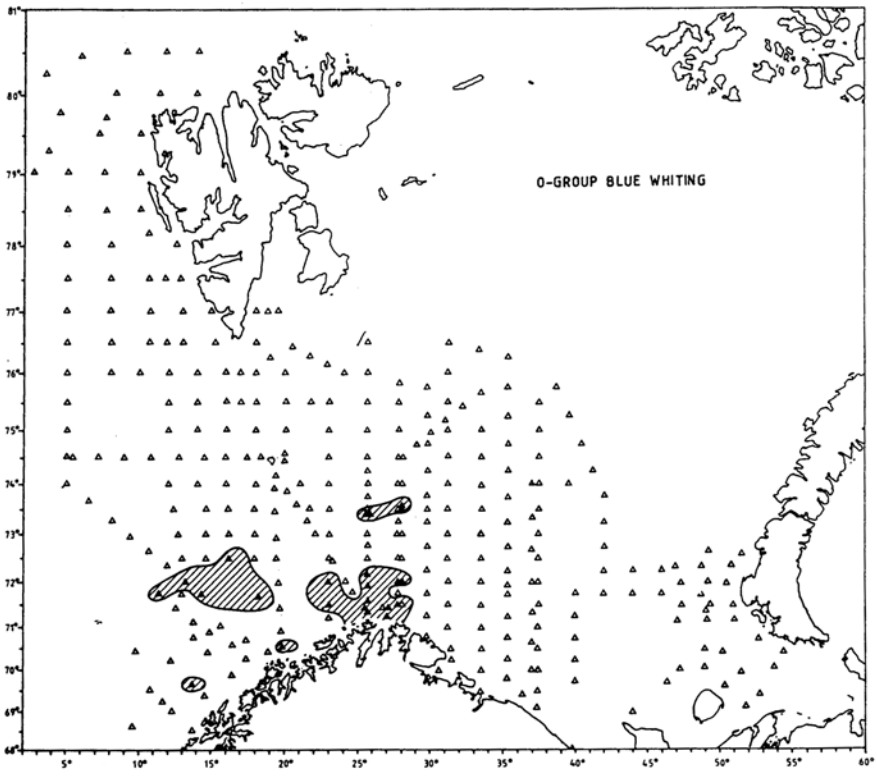

Fig. 19. Distribution of 0-group blue whiting

International Council for
the Exploration of the Sea

C.M. 1985/G:7
Demersal Fish Committe
Ref. Pelagic Fish committe

Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1985

The twentifirst annual International 0-group fish survey was made during the period 17 August-4 September 1985 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey period	Research Institute
Norway	"Eldjarn"	19 August-4 September	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	19 August-3 September	"
Norway	"Häkon Mosby"	20 August-2 September	"
Norway	"Michael Sars"	17 August-19 August	"
USSR	"Kokshaysk"	23 August-2 September	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
USSR	"Vilnyus"	25 August-1 September	"

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 4-6 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.

Materials and methods

The geographical distribution of 0-group fish were estimated by fishing with a small meshed midwater trawl. The vessels participating in the survey in 1985 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 the recommendation made at the same meeting. At about every 30 nautical miles sailed the trawl was towed 0,5 nautical mile at each depth; the headline of the trawl was at 0, 20 and 40 m and additionally at 60 m when 0-group fish layer was recorded deeper than 60 m on the echo-sounder.

Survey tracks and hydrographical stations are given in Fig. 1. Trawl stations with and without catch are given on the distribution charts in Figs. 8-16, as filled and open symbols respectively. The density grading is based on catch in number per 1,0 nautical mile trawling.

Hydrography

Hydrographical observations were made along all the survey tracks normally after each 30 nautical miles sailed. Horizontal temperature distribution is shown for 0, 50, 100 and 200 m depth (Figs. 2-5). Figs. 6-7 show the temperature conditions at the Kola and Bear Island - West sections, and the mean temperature of these sections are given in Table 1 together with those at the Cape Kanin and North Cape - Bear Island sections.

In general there has been a trend at cooling trend in the Atlantic inflow since 1983. This is demonstrated by the temperature distribution at 50, 100 and 200 m depth, with the clearest deviation at the 50 m level. Hence, in 1983 the temperatures at this level were above 7 °C in the southwestern Barents Sea, south of 73 °C, while in 1985 the temperature in the same area were mainly below 6 °C. Similarly, temperatures above 6 °C were in 1985 not observed north of the latitude of Sörkapp while there were temperatures between 6 ° and 7 °C along the whole West Spitsbergen coast in 1983. This trend is also reflected in the mean temperatures of the sections (Table 1). The conditions in the various sections compared to the long-term mean for the period 1965-1985 were:

1) Kola section

Water temperature decreased in all the layers compared to those of the previous year. The temperature in the 50-200 and 0-200 m was close to the normal, but below the long-term mean in the 0-50 m layer.

2) Cape Kanin - North section

Compared to 1984 the temperature in the layer 0 m to bottom decreased by 0,9 °C in the northern part of the section, and it was close to the long-term level. In the southern part a decrease of 2,1 °C from 1984 was observed and the temperature was reduced to 0,8 °C below the long-term level.

3) North Cape - Bear Island section

Water temperature in the 0-200 m layer decreased by 0,7 °C from 1984 to 1985 and it was somewhat below the long-term mean.

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

Water temperature in the 0-200 m layer decreased by 0,4 °C compared to that of 1984 and exceeded the long-term mean by 0,2 °C.

Distribution and abundance of 0-group fish

Geographical distributions of 0-group fish are shown by shaded areas in Figs. 8-16. 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.

Norwegian spring spawning herring (Fig. 8)

The distribution of herring is in 1985, as in 1984, restricted to the areas west of 28 °E. The overall density is comparable to 1984. Both year-classes are smaller than the 1983, but much higher than the average for the period 1965-1982.

Capelin (Fig. 9)

The area of distribution and the overall density is considerably smaller than the average for the years 1980-1984. This indicates a weak 1985 year-class of Barents Sea capelin, although it must be stressed that the results from the Barents Sea 0-group survey have not given such a reliable index of year class strength of capelin as for other species.

Cod (Fig. 10)

The 0-group cod had a wide distribution with a high abundance north of Finnmark and Murman coast and west of Spitsbergen. Two different abundance indices are given in Table 2 and 3. The indices are among the highest ever recorded and point for a very strong year-class. This indicate a series of strong year-classes occuring in 1983, 1984 and 1985.

Haddock (Fig. 11)

The 0-group haddock was distributed in two separate areas, north of Finnmark and west of Spitsbergen. The indices given in Table 2 and 3 indicate a somewhat above and close to average strength of the year-class, but smaller than the 1983 and 1984 year-classes.

Polar cod (Fig. 12)

The distribution of 0-group polar cod was almost the same in the western area as in 1984, but the abundance index was less than in 1984 and also somewhat below the long term average 1977-84. The eastern area of distribution including the area of dense concentrations was larger in 1985 compared with 1984. The abundance index was the greatest ever recorded and more than seven times greater than the average for 1981-84. A couple of extra stations in the north-eastern part of the investigated area this year may have minor influences on the comparison with previous years. As in previous years the eastern component of the 0-group polar cod was distributed north of the investigated area.

Redfish (Fig. 13)

The distribution of 0-group redfish is similar to those found in previous years with the highest densities west of Spitsbergen. The abundance index points to another good year-class somewhat stronger than the 1984 year-class but less than the 1983 year-class.

Greenland Halibut (Fig. 14)

The Greenland Halibut was distributed from Bear Island to the area north-west of Spitsbergen, and the highest densities was observed west of Spitsbergen. The 1985 year-class is indicated as the third best and well above the average for the last 5 years.

Long rough dab (Fig. 15)

Long rough dab was found in highest densities in the Bear Island area but patches were recorded in the whole survey area. The abundance index is at the same level as in 1983 and 1984 and very close to the average.

Saithe (Fig. 16)

It seems characteristic for the 0-group saithe to concentrate in patches in the survey area. Compared with 1984 a small number was caught and more than 1 specimen per haul of 1.0 nautical mile was only recorded on three trawl stations. No abundance index has been calculated.

Blue whiting

0-group blue whiting was recorded only on four stations within a small area south of 70°50' N and between 15° E and 19° E. The catches and the area of distribution was smaller than in 1983 and 1984. No abundance index has been calculated.

Mackerel

0-group mackerel was recorded on four stations with some concentrations in the area around 18° E and between 70°30' N and 71° N. No index of abundance has been calculated.

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 1985

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	0-50 m	50-200 m	0-200 m	0-bottom	0-bottom	0-200 m	0-200 m
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
Average 1965-1985	7.2	3.6	4.2	4.1	3.3	5.6	4.4

Table 2. Abundance indices

Species / Year	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab
			West		East			
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	8.0	65
1973	684	54		(26)		385	3.2	67
1974	51	147		227		468	13.4	83
1975	343	170		75		315	21.1	113
1976	43	112		131		447	15.6	96
1977	173	116	157		70	472	9.0	72
1978	106	61	107		144	460	35.4	76
1979	94	69	23		302	980	22.5	69
1980	49	54	79		247	651	12.0	108
1981	65	30	149		73	861	38.0	95
1982	114	90	14		50	694	17.0	150
1983	386	184	48		39	851	15.8	80
1984	486	255	115		16	732	40.4	70
1985	742	156	60		334	795	36.0	86

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				+			0.01		
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

[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	Saithe
					East	West				
10-14										
15-19							+			
20-24							+		1.7	
25-29		+	+		2.3	1.0	0.2		16.6	
30-34		0.2	+	0.1	21.2	4.3	8.0		29.0	
35-39		1.7	+	0.1	49.9	8.6	35.5		34.5	
40-44	+	5.5	0.2	0.3	18.0	30.6	28.0	0.3	14.1	
45-49	0.1	17.8	0.8	1.2	7.0	31.9	17.6	2.3	0.7	
50-54	0.4	39.9	1.8	2.4	1.3	19.3	7.1	12.9	0.1	
55-59	0.1	29.3	4.8	2.4	0.2	4.0	2.7	11.7	0.1	3.2
60-64	0.3	4.9	9.4	4.0	0.1	0.3	0.8	25.5	2.1	
65-69	1.6	0.2	17.1	5.0	+	+	0.1	24.4	1.1	1.6
70-74	4.1	0.2	21.9	7.9			+	14.6		11.1
75-79	9.5	0.1	20.9	10.8			+	2.3		1.6
80-84	13.8	+	13.9	11.1				6.0		3.2
85-89	20.6	0.1	6.1	12.6						3.2
90-94	23.0	0.1	2.2	13.8						1.6
95-99	9.1	+	0.8	10.4						4.7
100-104	10.8	+	0.1	.8.9						6.3
105-109	3.6	+		4.8						3.2
110-114	3.0	+		2.9						14.3
115-119	+			0.7						1.6
120-124				0.3						28.5
125-129				0.2						11.1
130-134				+						3.2
135-139				0.1						1.6
140-144				+						
Total numbers	170360	121288	71030	3524	5401	73698	1838899	349	1501	63
Mean length mm	89.7	52.9	73.4	85.6	38.1	45.7	42.0	64.5	35.8	107. 1

Appendix

Survey period	Research vessel	Research Institute	Participants
23 August- 2 September	"Kokshaysk"	Polar Research Institute of Marine Fisheries and Oceanography, Murmansk	N.A. Isaev, V.I. Zubov, N.G. Ushakov, S.D. Melnikov, V.I. Shapovalov, V.L. Kaponirov, N.V, Antropov, A.V. Mukhin, Yu.G. Ignatyev
25 August- 2 September	"Vilnyus"	"	A.I. Krysov, I.V, Borkin, A.V. Bezdenezhnykh, O.V. Solovyova, S.N. Ashikhmin, A.E. Dorchenkov, S.Yu. Annenkov, S.G. Isapu
19 August- 3 September	"G.O. Sars"	Institute of Marine Research, Bergen	H. Bjørke, A. Hylen, H.P. Knudsen, E. Moksness, J. Monkan, A. Raknes, A.M. Skorpen
19 August- 4 September	"Eldjarn"	"	J. Blindheim, M. Haukås, A. Nødtvedt, R. Pedersen, I. Røttingen, Ø. Torgersen
20 August- 2 September	"Hakon Mosby"	"	I. Hoff, H. Ludvigsen, K. Nedreaas, K. Nythun, K. Sunnanå, E. Sæthre
17 August- 19 August	"Michael Sars"	"	S. Kolbeinson, B. Kvinge, T. Monstad, J.H. Nilsen, Ø. Tangen

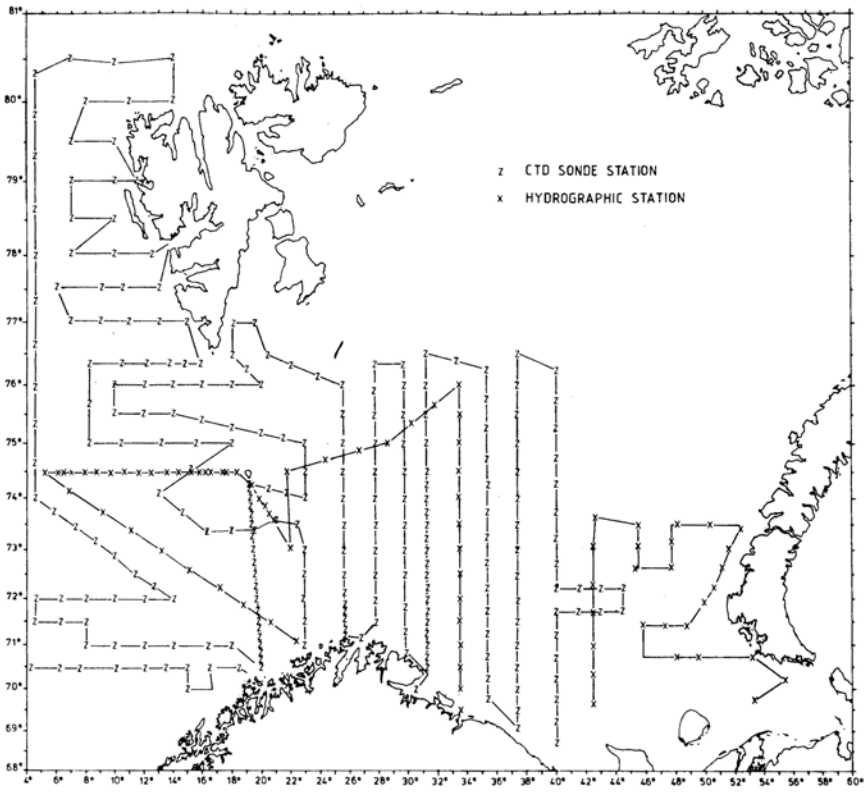

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

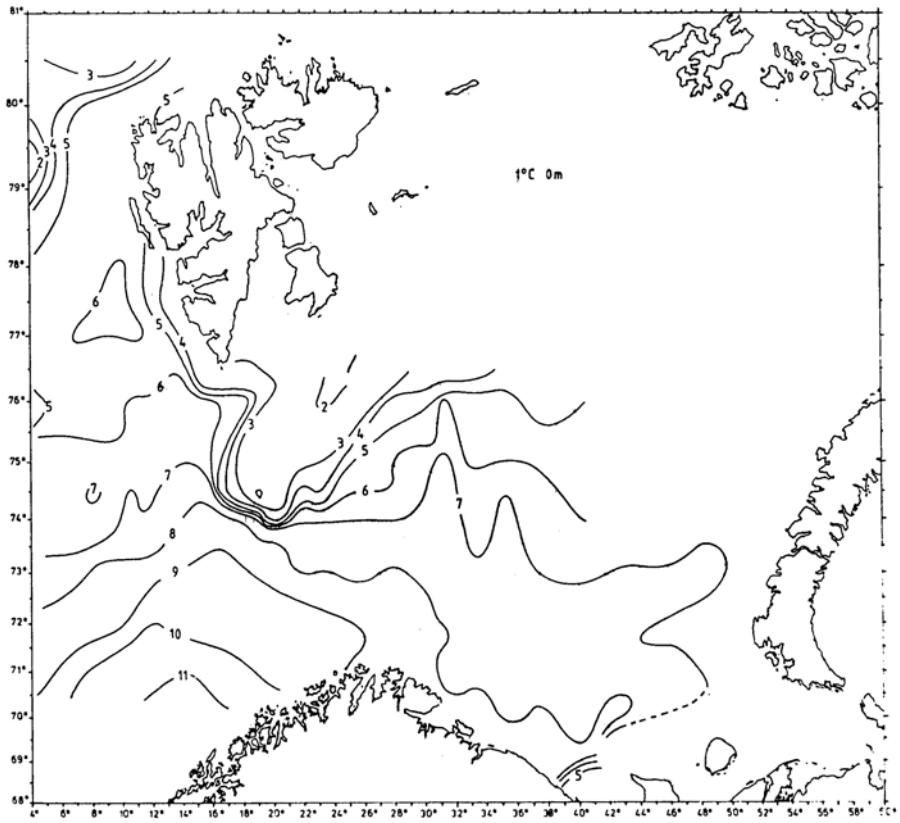

Fig. 2. Isotherms at 0 m

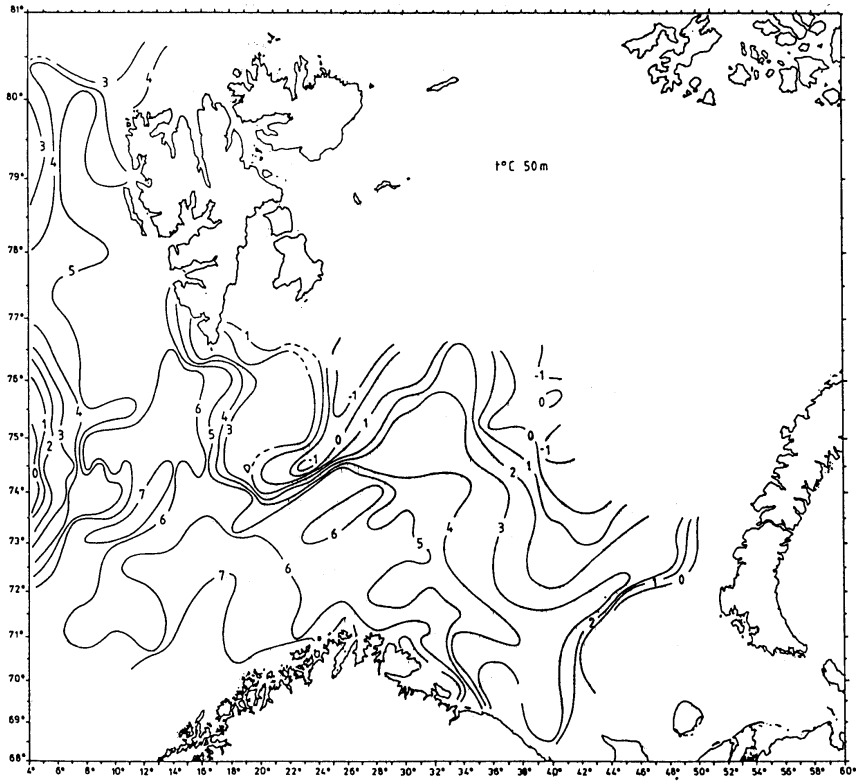

Fig. 3. Isotherms at 50 m

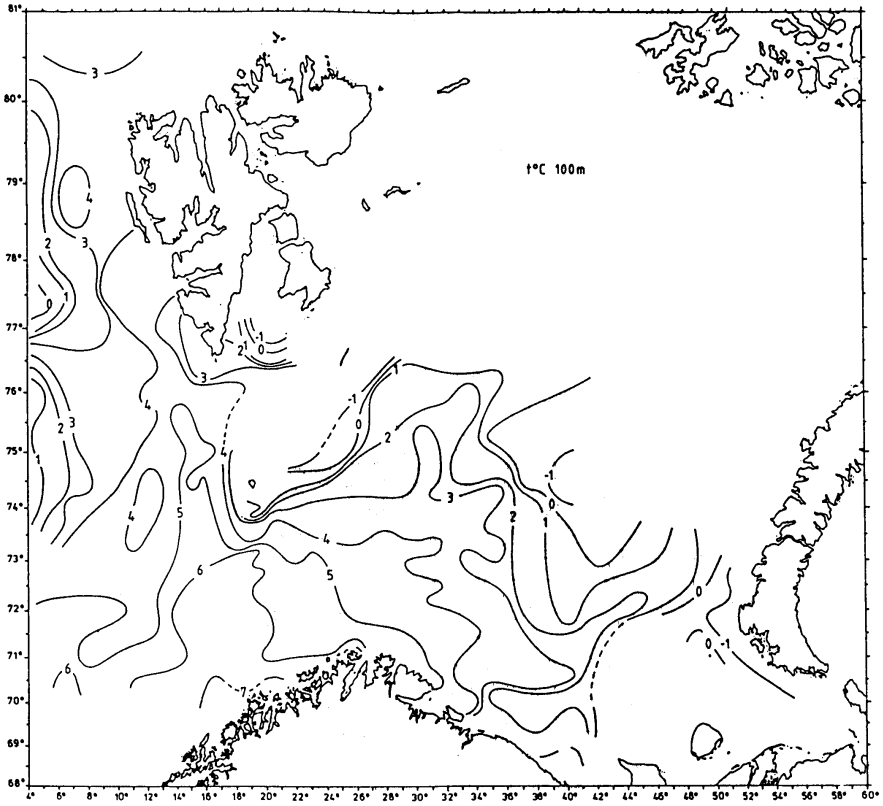

Fig. 4. Isotherms at 100 m

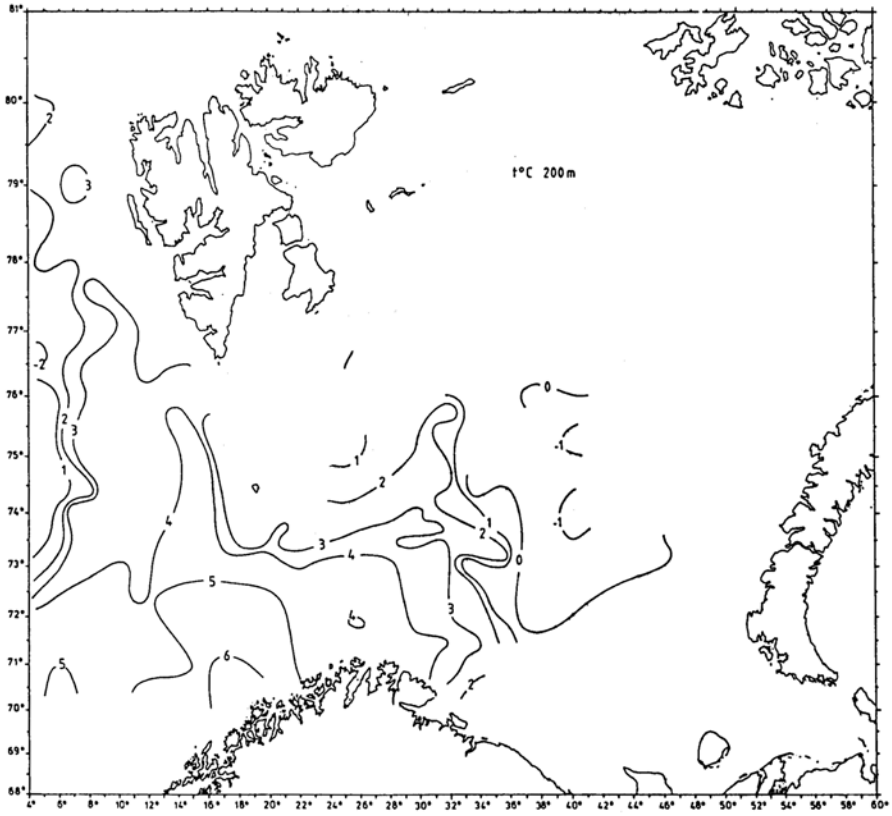

Fig. 5. Isotherms at 200 m

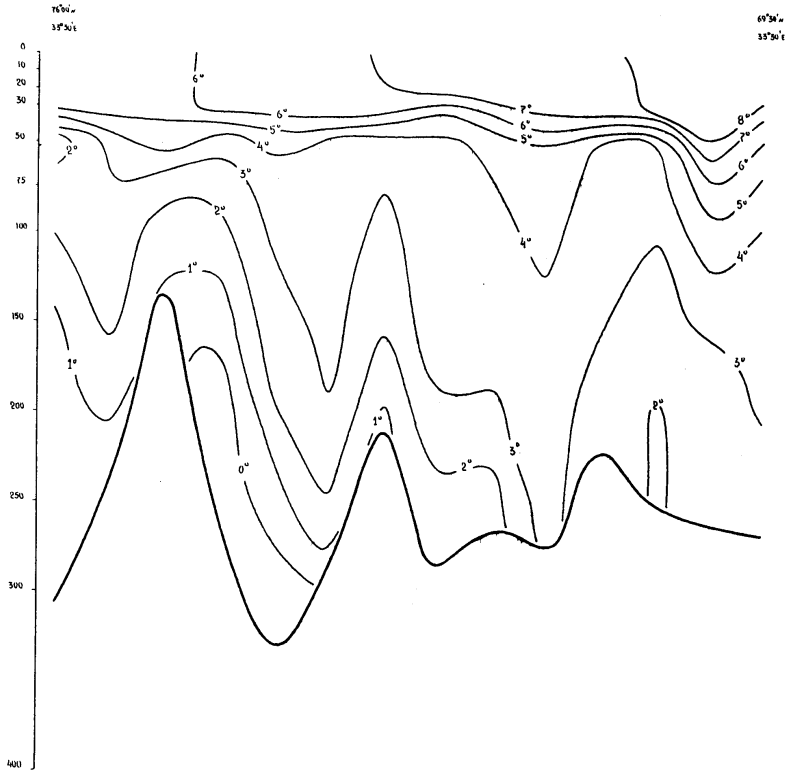

Fig. 6. Temperature section along the Kola meridian

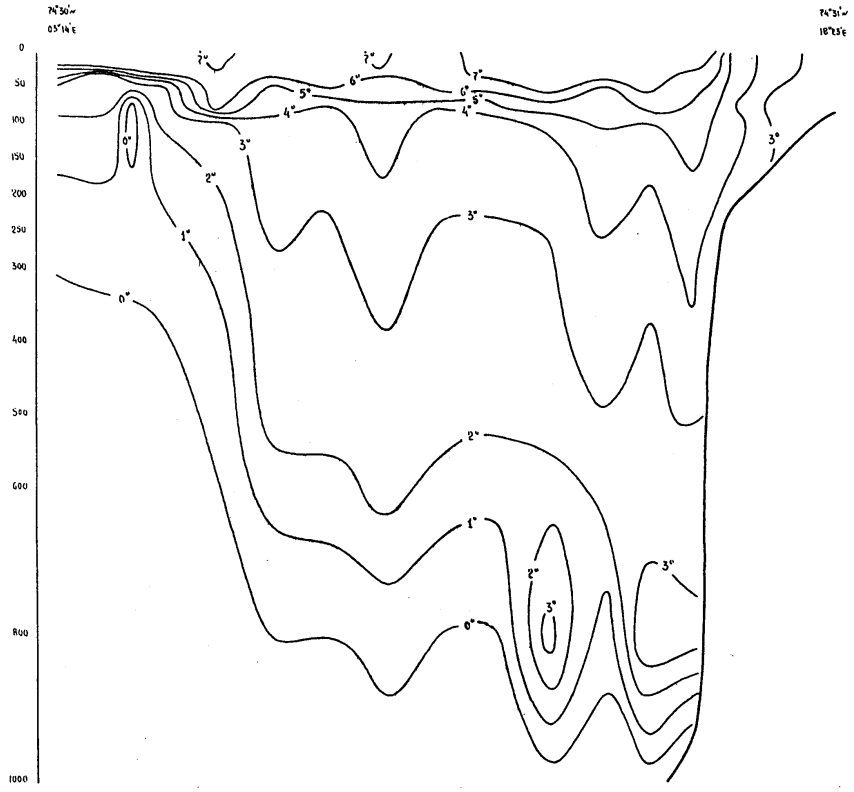

Fig. 7. Temperature section Bear Island-West

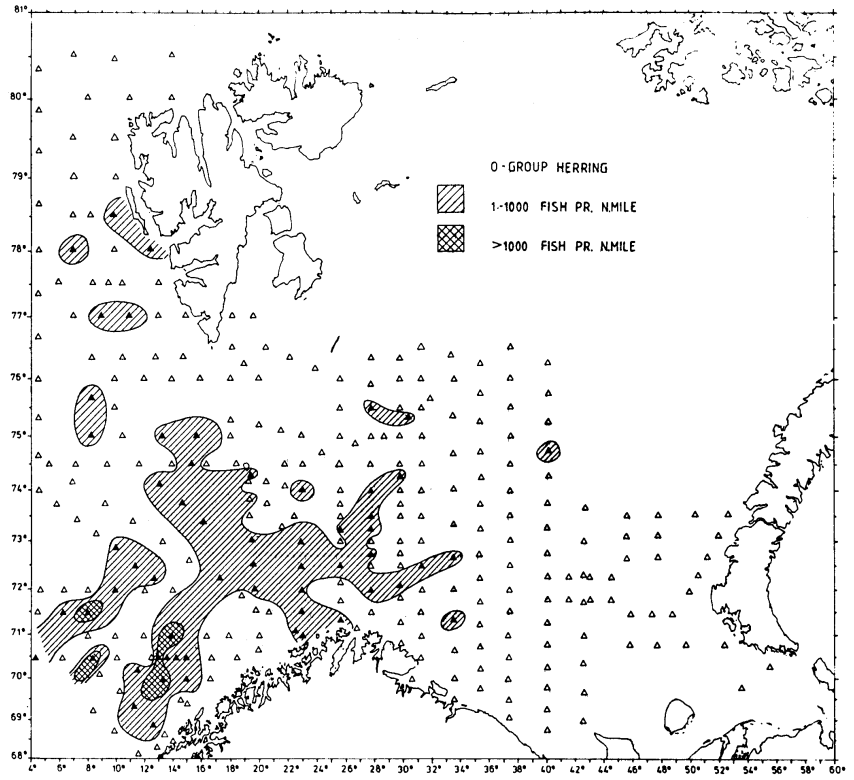

Fig. 8. Distribution of 0-group herring

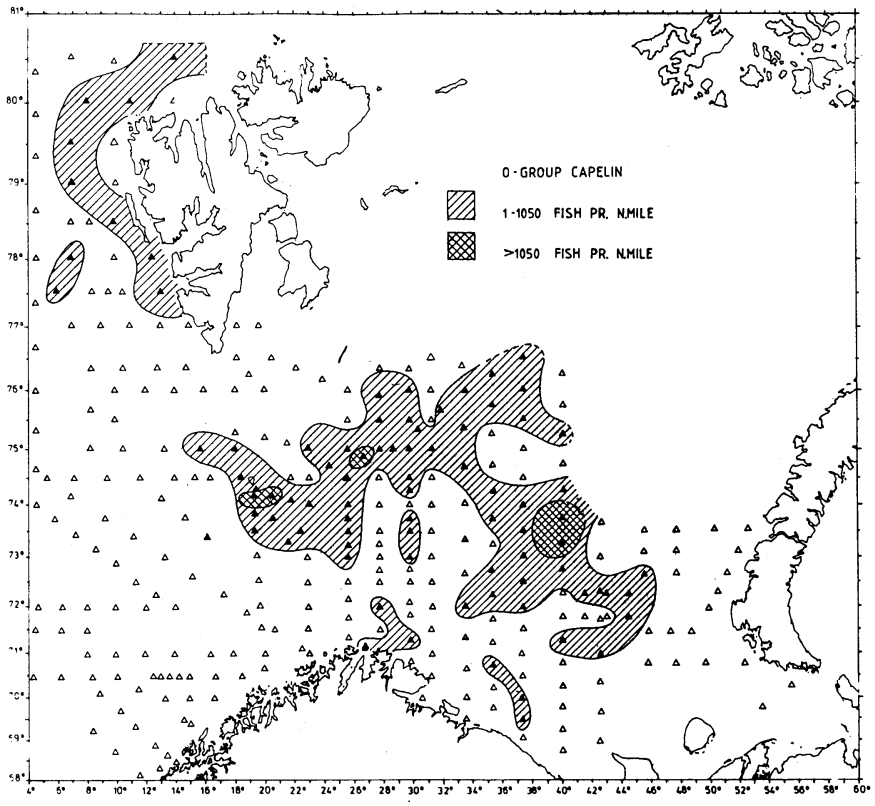

Fig. 9. Distribution of 0-group capelin

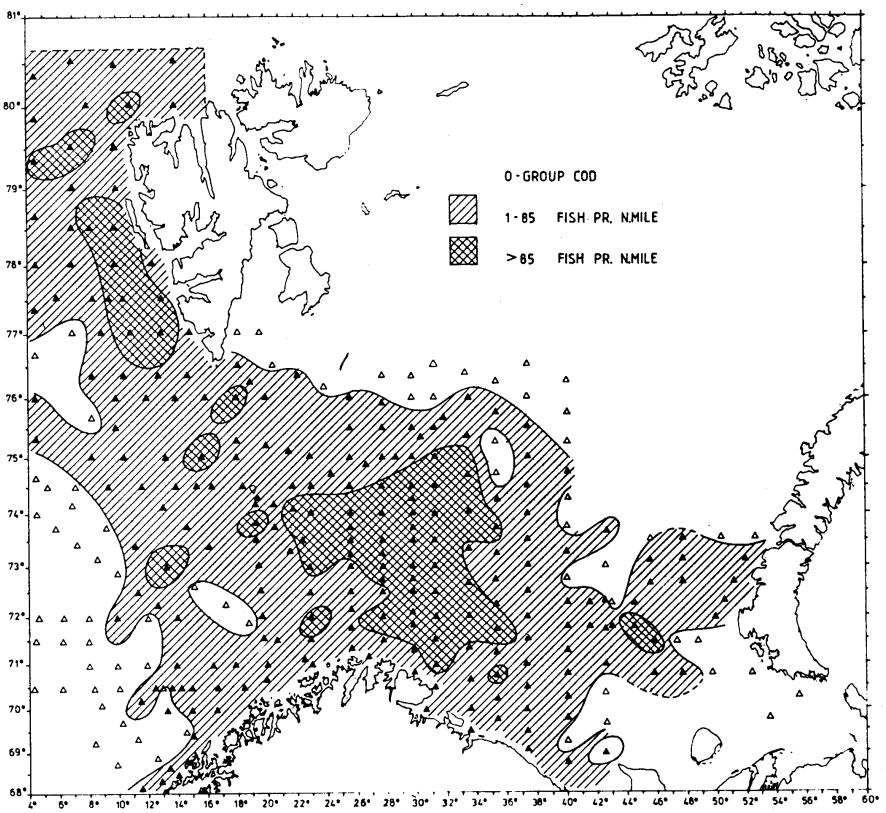

Fig. 10. Distribution of 0-group cod

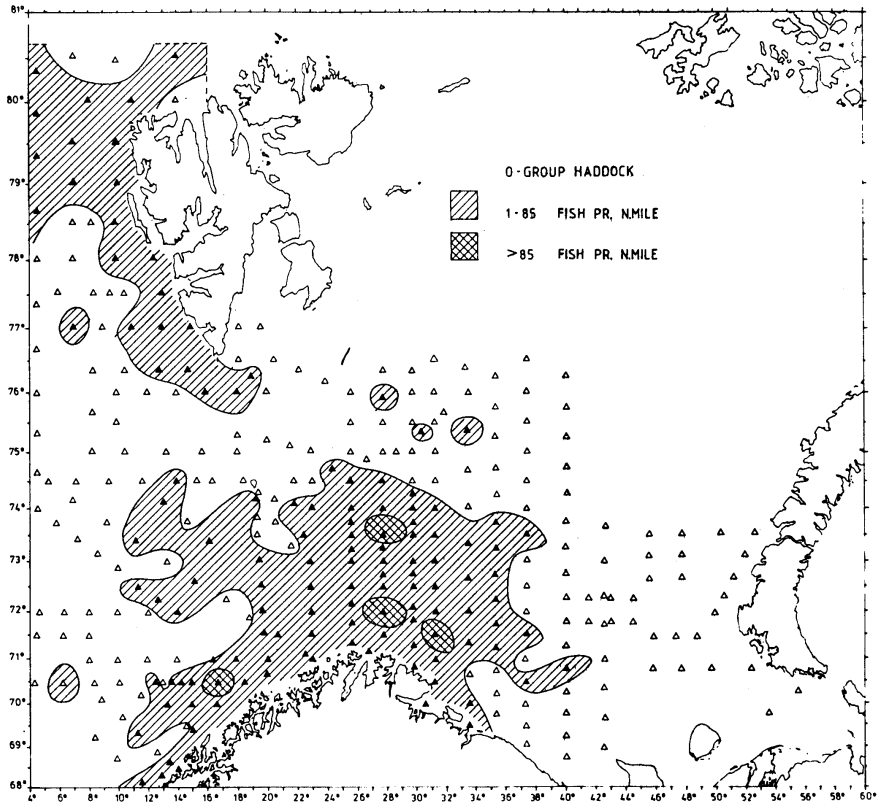

Fig. 11. Distribution of 0-group haddock

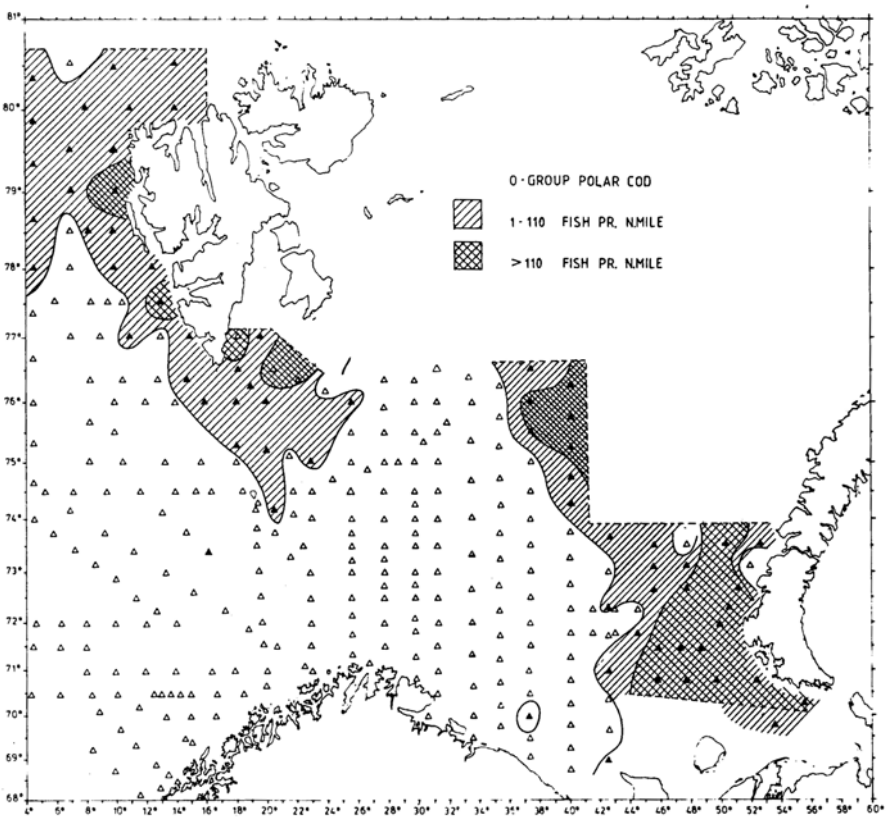

Fig. 12. Distribution of 0-group polar cod

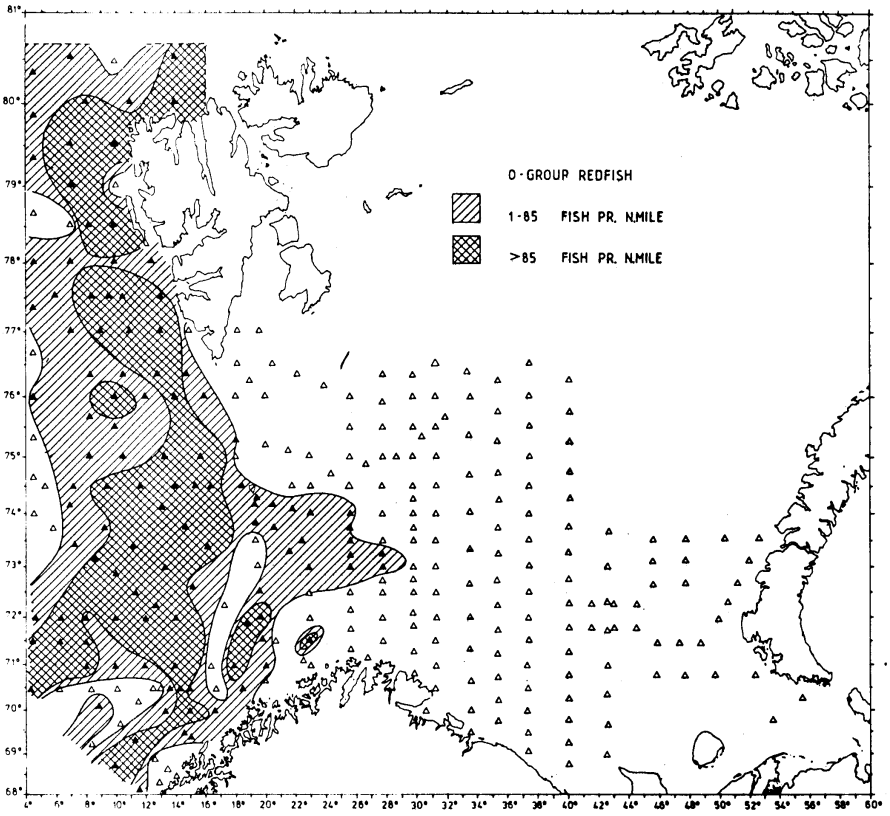

Fig. 13. Distribution of 0-group redfish

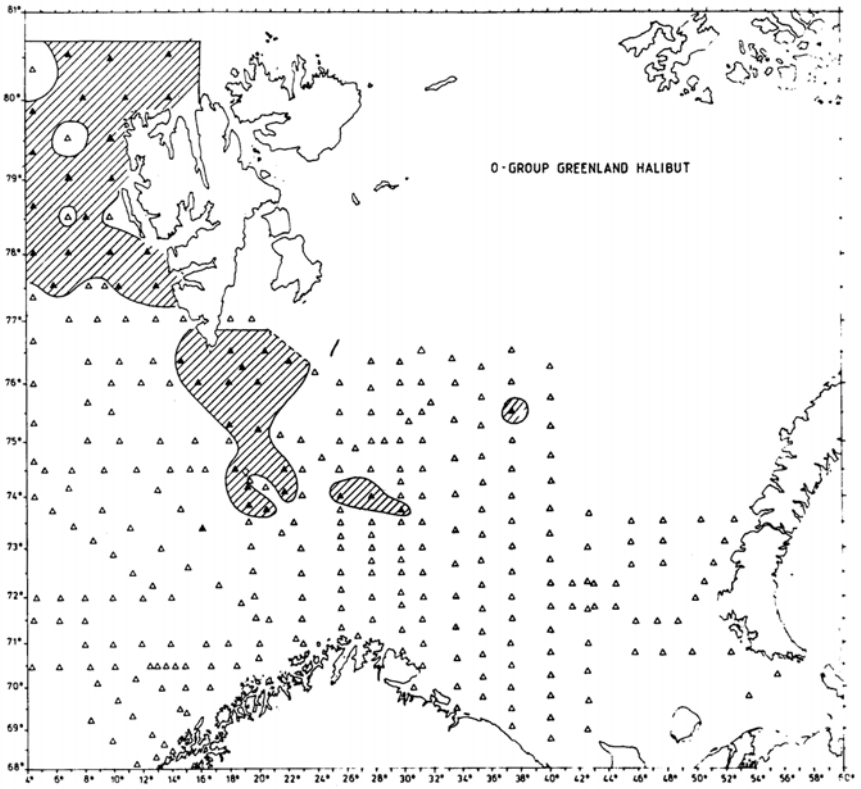

Fig. 14. Distribution of 0-group Greenland halibut

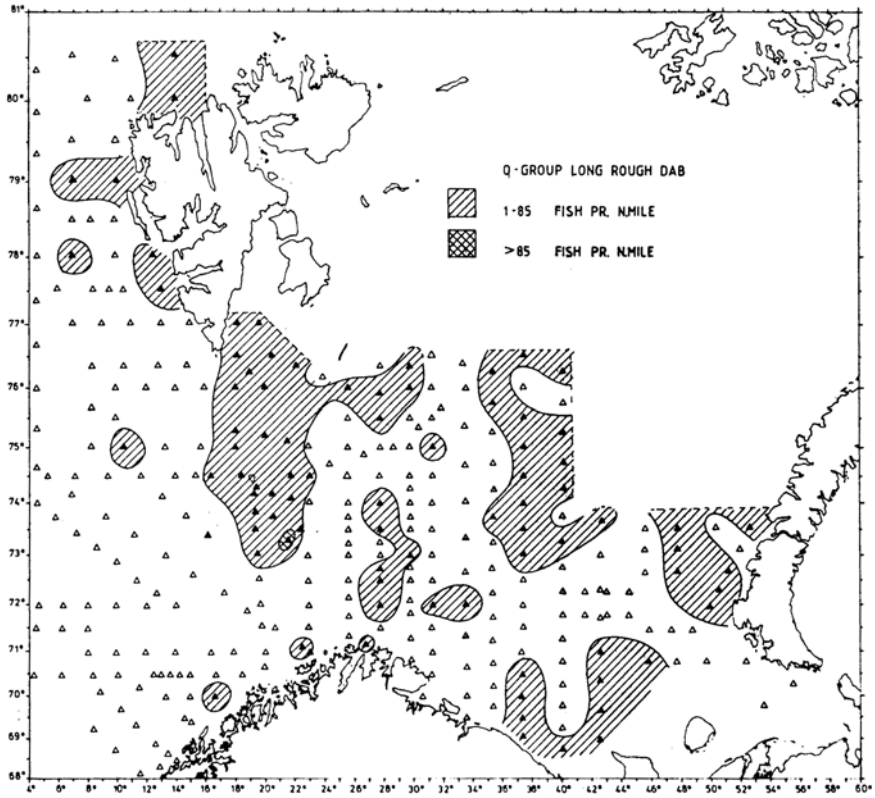

Fig. 15. Distribution of 0-group long rough dab

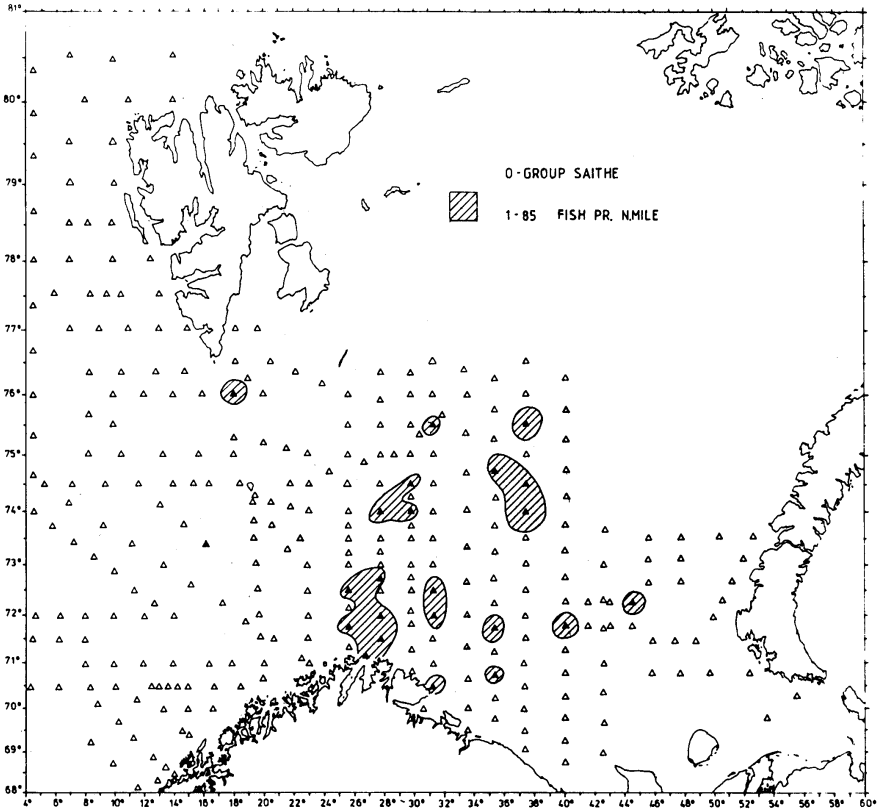

Fig. 16. Distribution of 0-group saithe

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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	"Hakon 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 miles was made when 0-group fish layer was recorded deeper than 60 m on the echo-sounder.

Survey tracks and hydrographic stations are given in Fig. 1. Trawl stations with and without catch are given on the distribution charts in Figs. 10-19, 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 is 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 had 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 б °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:

1) Kola section

The water temperature in the 0 - 50 m layer was 0.9 °C above that in the proceeding 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.

2) 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 proceeding year.

3) North Cape - Bear Island section

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

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

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 are 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 indicate 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 indicates 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 Tromsø. The index in Table 2 is high and in line with previous years.

Greenland halibut (Fig. 16)

The distribution resembles the distribution found in resent 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 proceeding 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

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.

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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	0-50 m	50-200 m	0-200 m	0-bottom	0-bottom	0-200 m	0-200 m
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	Polar cod			Redfish	Greenland halibut	Long rough dab
			West		East			
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				+			0.01		
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	Polarcod		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		+	25.4	3.7	0.1	2.2	
30-34	2.4	22.9	0.3	0.1	1.1	19.5	6.3		10.8	
35-39	2.4	38.0	1.1	0.6	25.7	9.4	23.0	0.7	18.6	
40-44		8.5	3.6	1.2	50.3	11.7	41.1	0.6	12.1	1.3
45-49	9.8	1.9	6.8	2.3	18.4	12.2	15.6	2.4	4.1	8.9
50-54	19.5	0.4	13.7	7.1	4.5	2.9	1.9	8.6	0.3	19.3
55-59	24.4	+	18.5	7.4	+	+	0.3	22.7	+	15.8
60-64	19.5	0.2	21.4	10.0		0.1	0.1	18.4		12.7
65-69	17.1	2.4	15.3	11.0		+		19.9		13.6
70-74		3.9	11.4	13.1		+		17.7		13.3
75-79		5.3	5.0	14.4		+		4.8		7.1
80-84		5.6	2.0	10.0		+		4.1		5.7
85-89		6.0	0.7	9.2		+		0.1		0.6
90-94		1.1	0.1	6.0		+				0.5
95-99		0.5		5.0		+				0.2
100-104		0.1		1.2		+				0.3
105-109				0.8						0.4
110-114				0.3						
115-119				+						
120-124				0.1						0.1
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.

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. Konovalov, S.V. Ratushniy, 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. Hylen, H. Ludivigsen, E. Moksness, T. Monstad, T. Mørk, A. Raknes, E. Sælen, A. Totland, M. Wallevik. V. Wespestad.
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. Toresen.

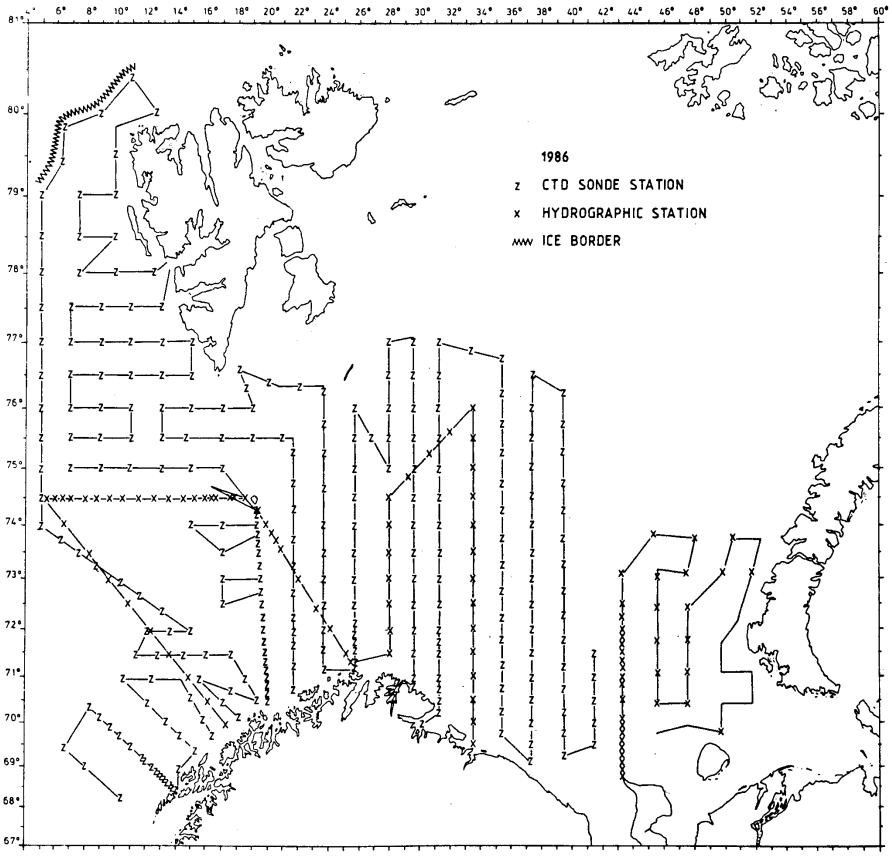

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

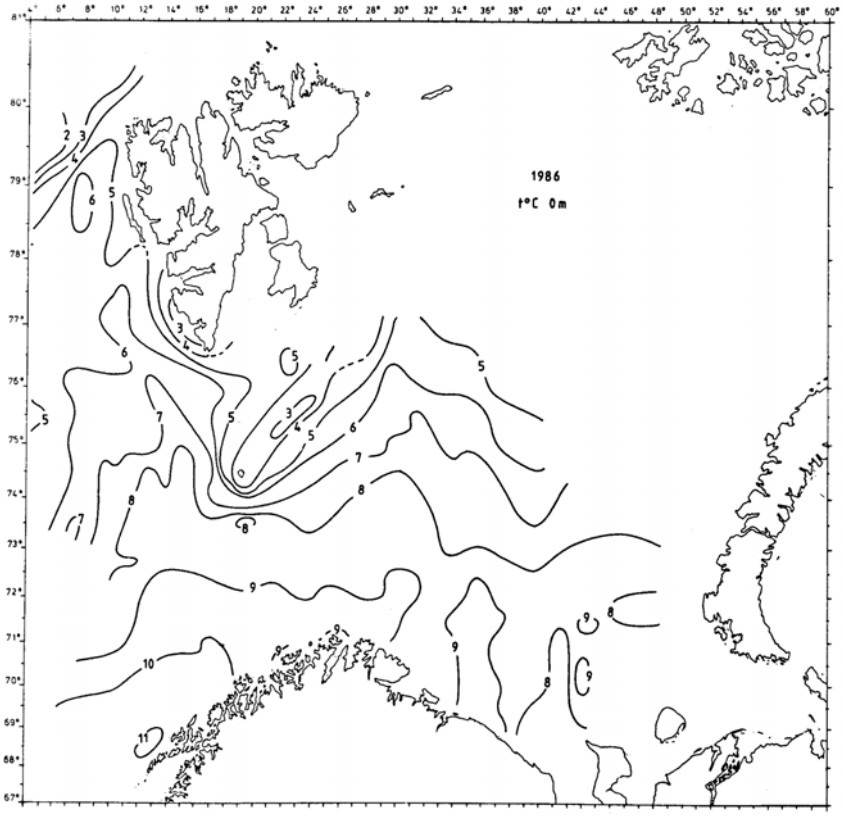

Fig. 2. Isotherms at 0 m

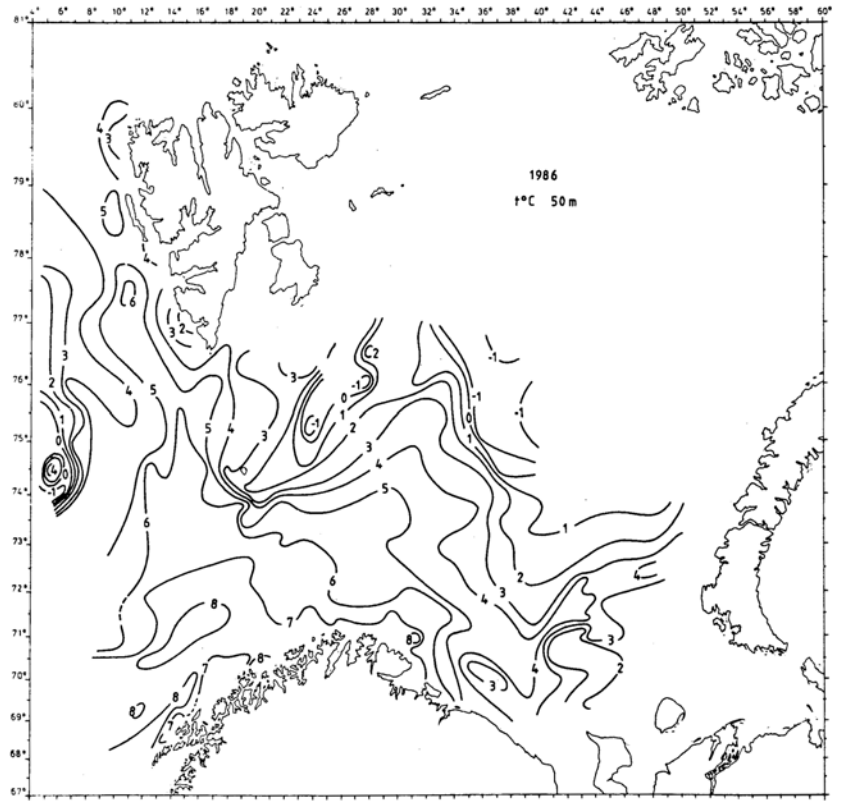

Fig. 3. Isotherms at 50 m

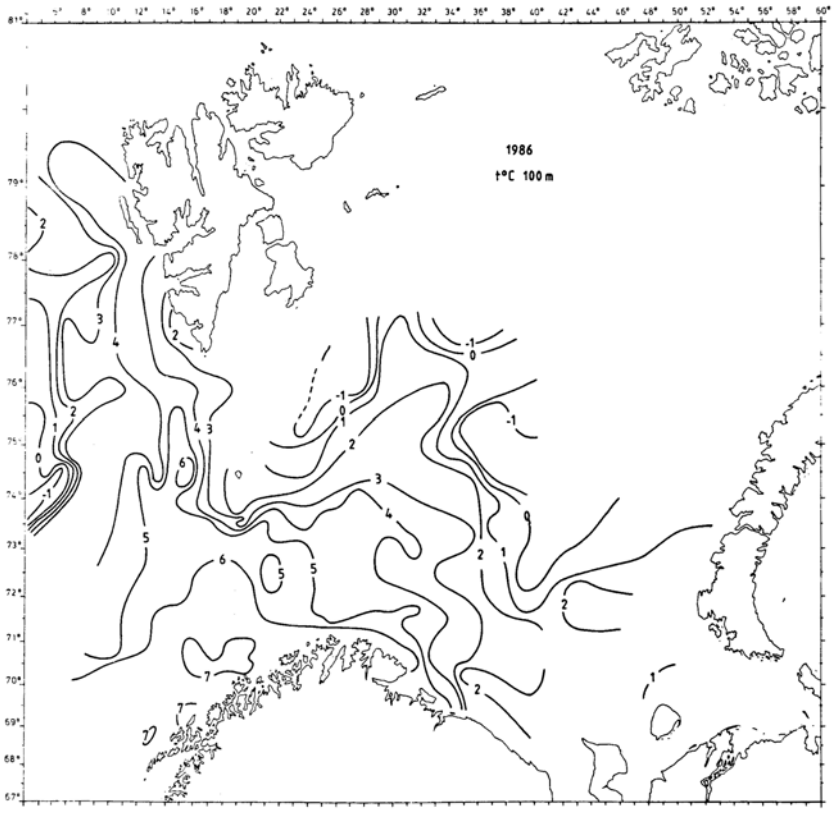

Fig. 4. Isotherms at 100 m

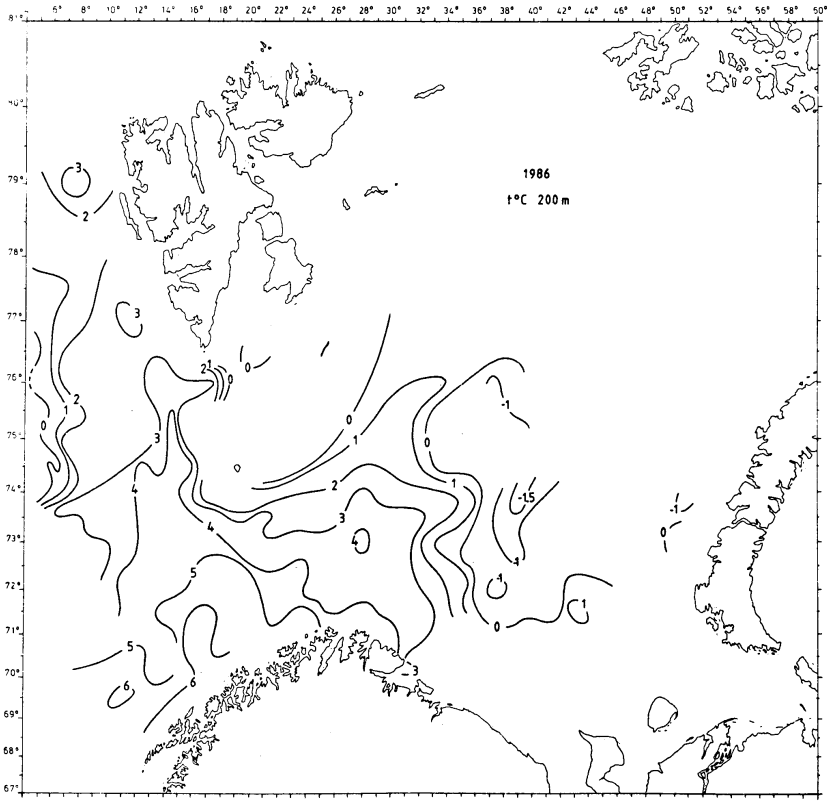

Fig. 5. Isotherms at 200 m

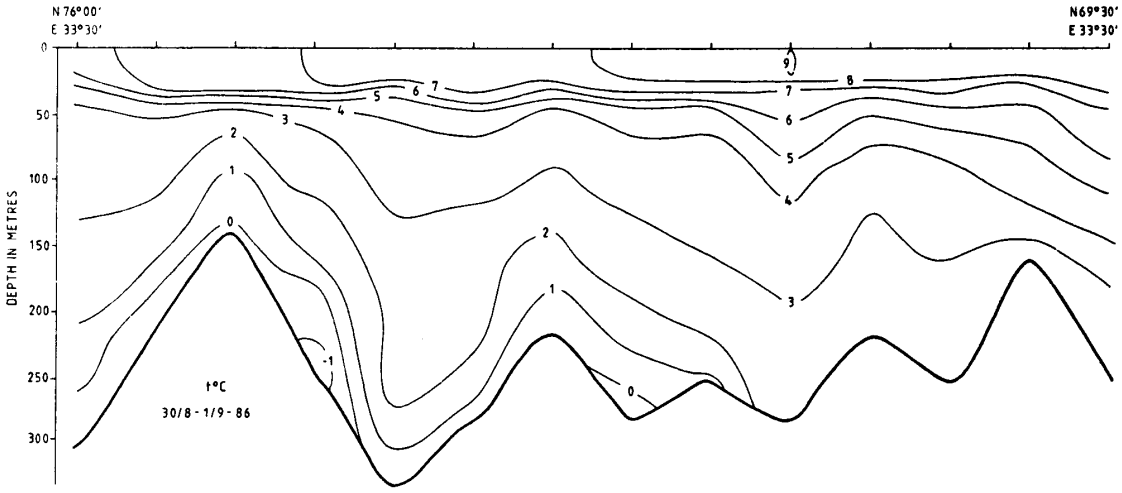

Fig. 6. Temperature section along the Kola meridian

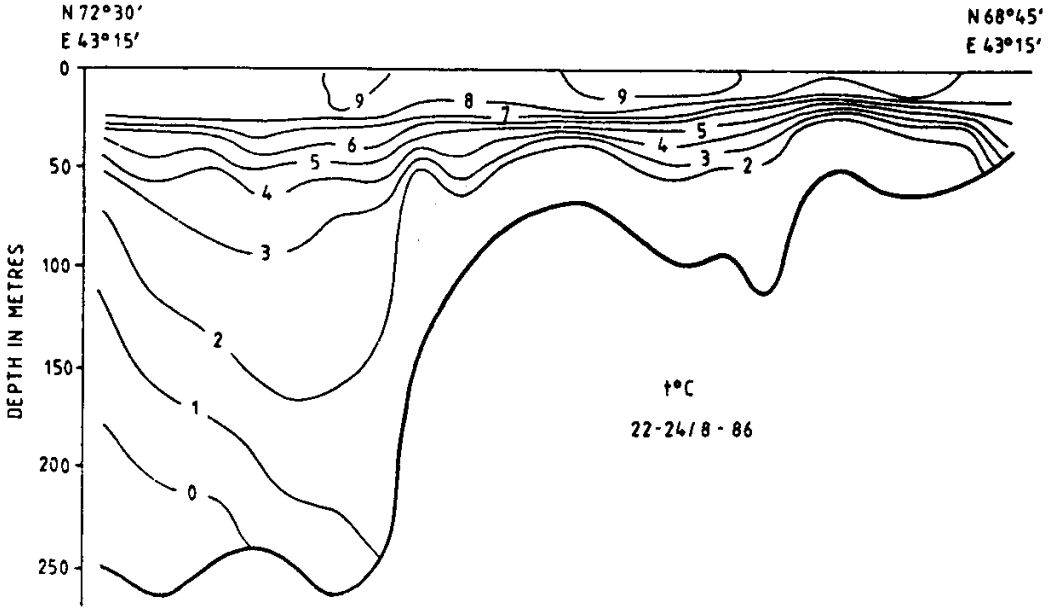

Fig. 7. Temperature section Cape Kanin-North

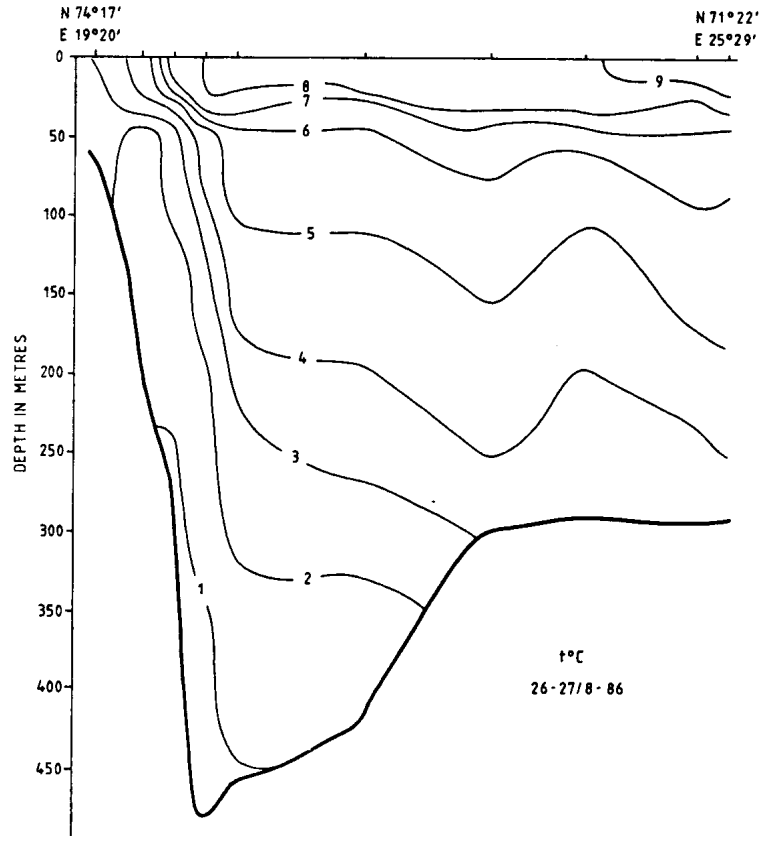

Fig. 8. Temperature section Bear Island-North Cape

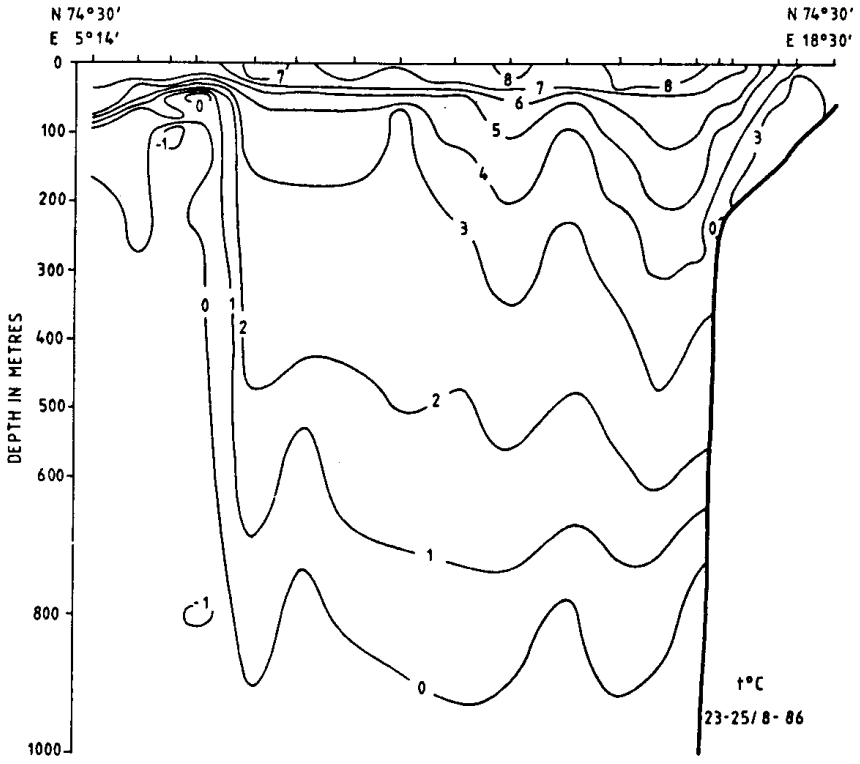

Fig. 9. Temperature section Bear Island-West

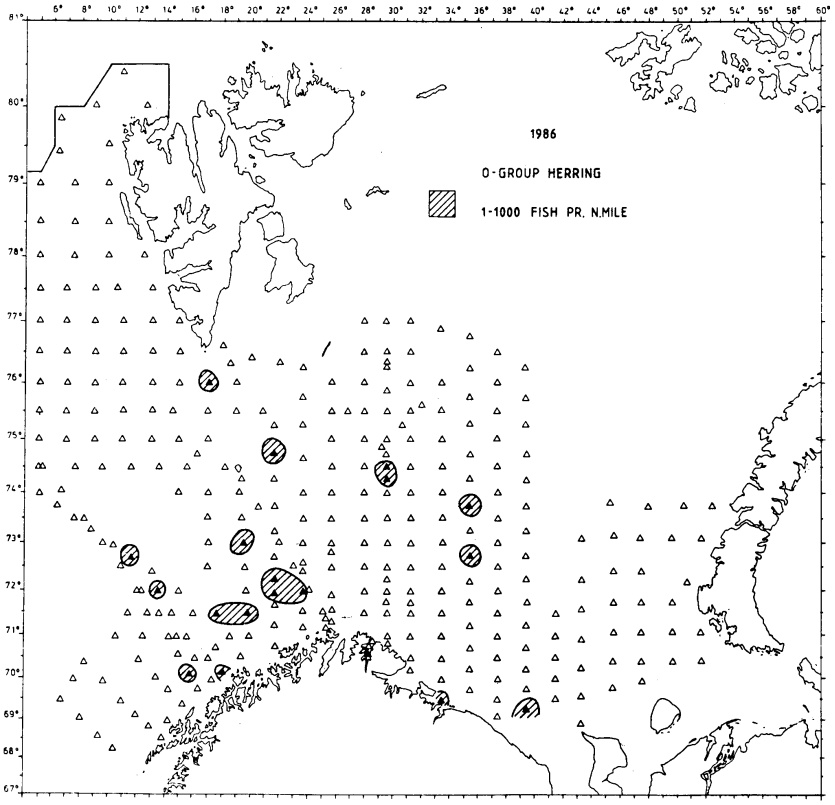

Fig. 10. Distribution of 0-group herring

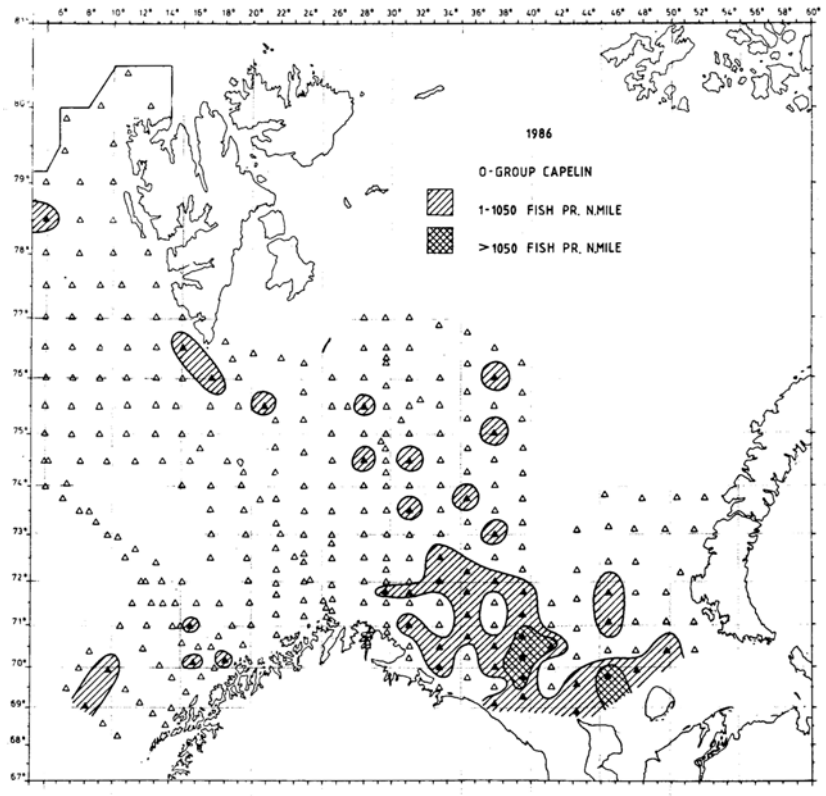

Fig. 11. Distribution of 0-group capelin

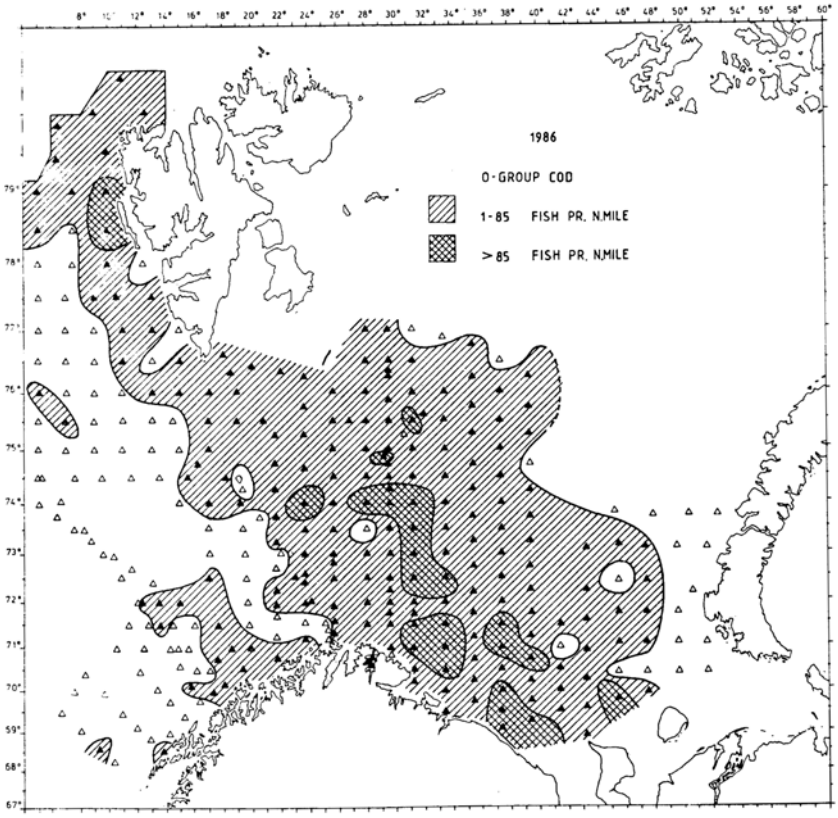

Fig. 12. Distribution of 0-group cod

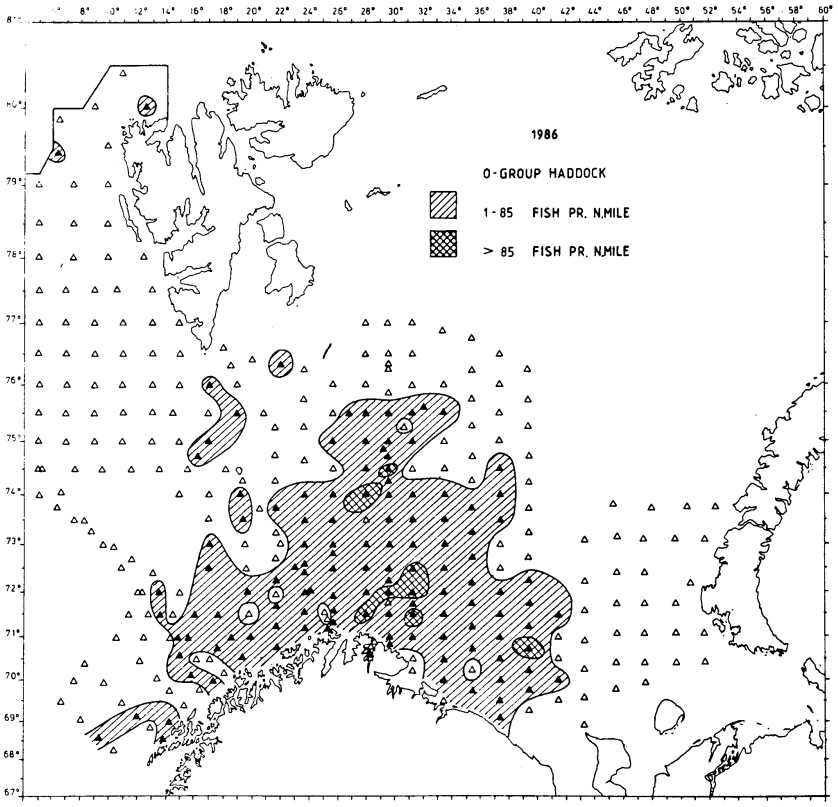

Fig. 13. Distribution of 0-group haddock

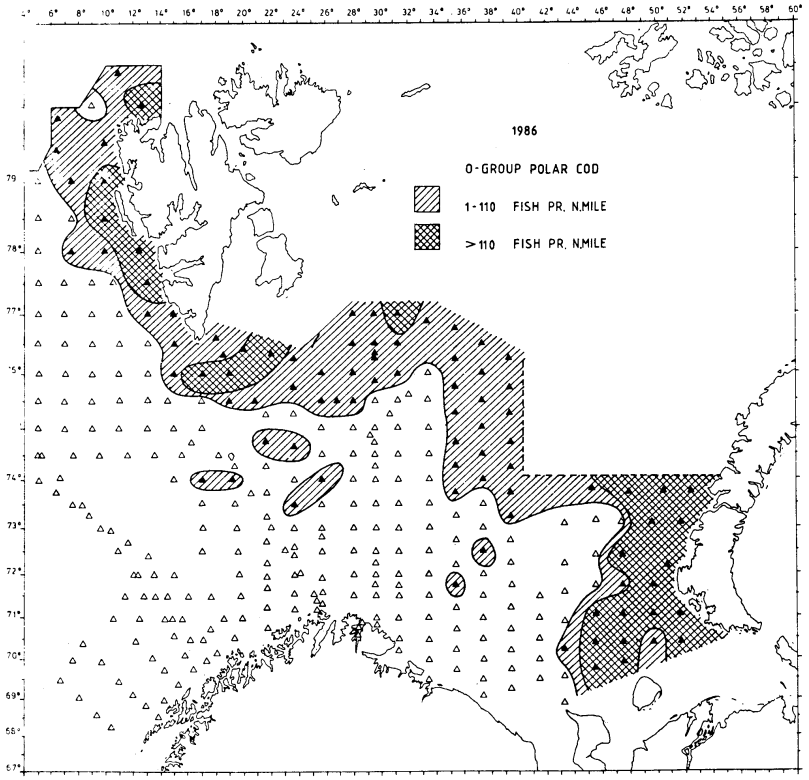

Fig. 14. Distribution of 0-group polar cod

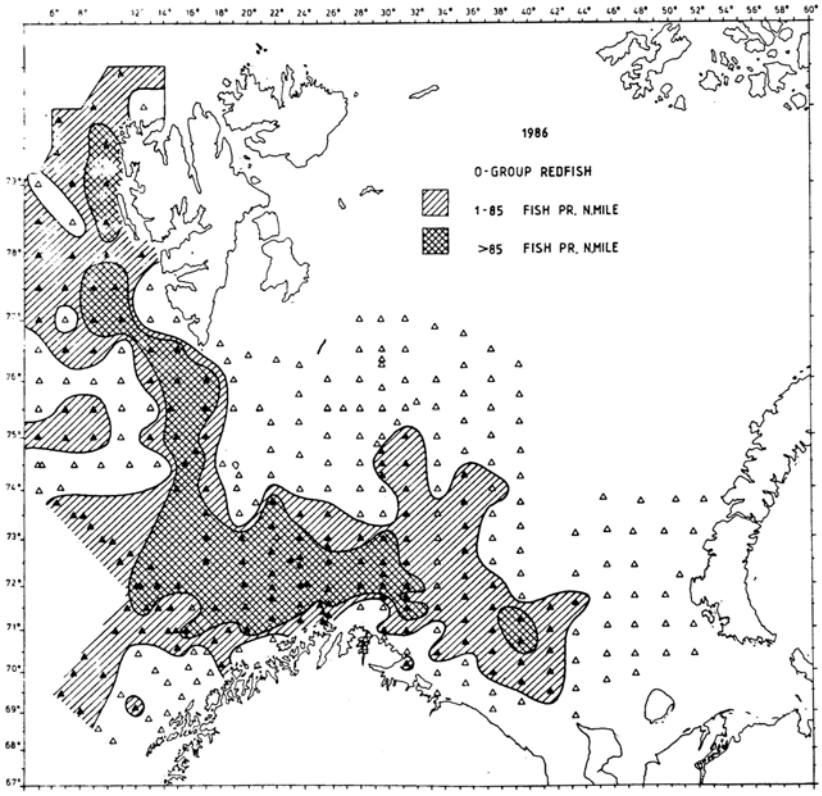

Fig. 15. Distribution of 0-group redfish

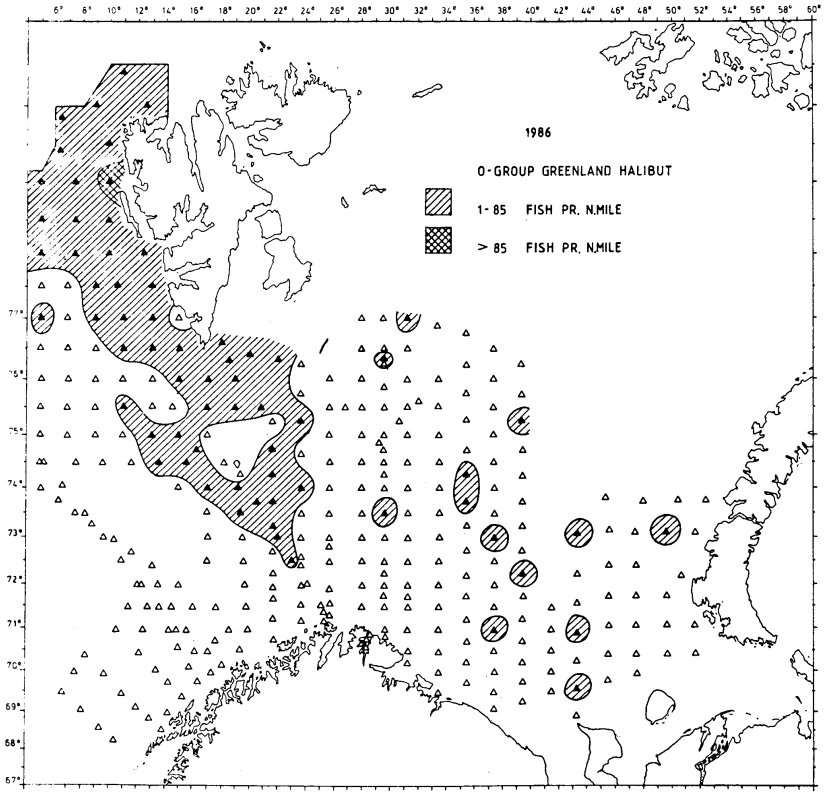

Fig. 16. Distribution of 0-group Greenland halibut

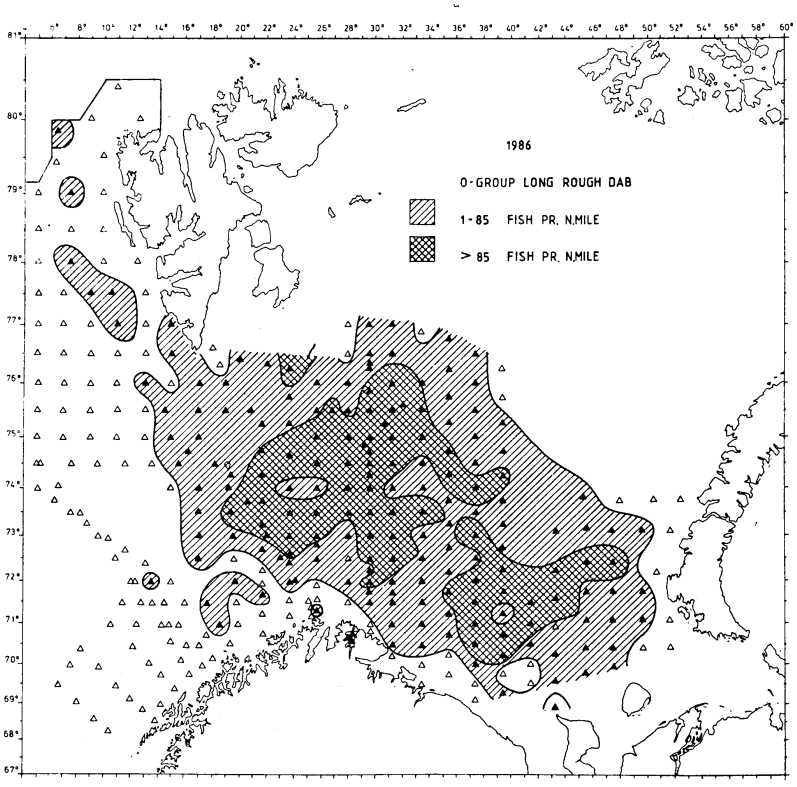

Fig. 17. Distribution of 0-group long rough dab

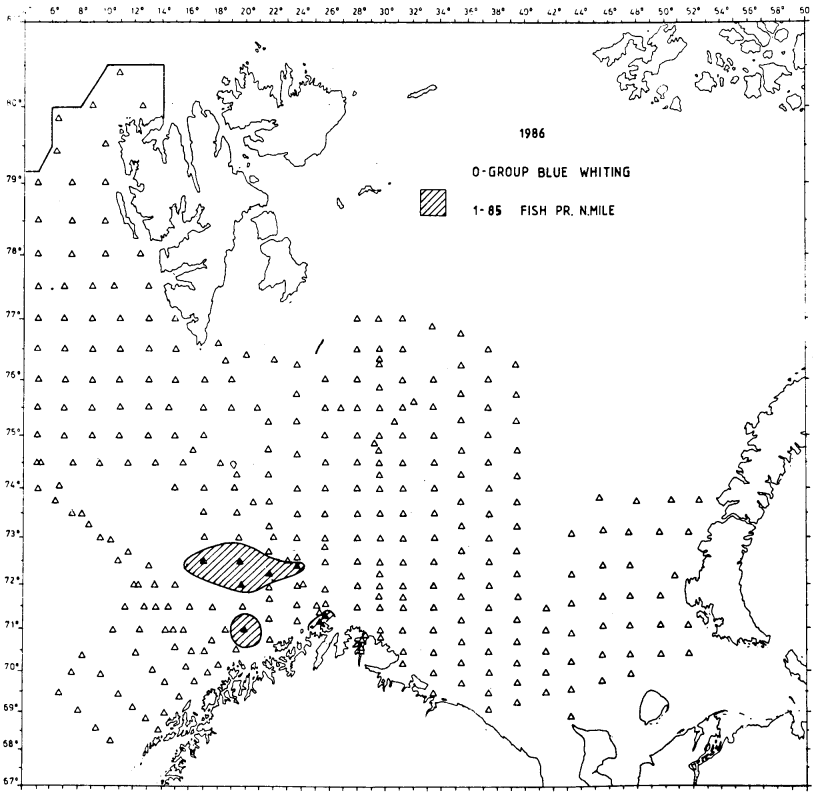

Fig. 18. Distribution of 0-group blue whiting

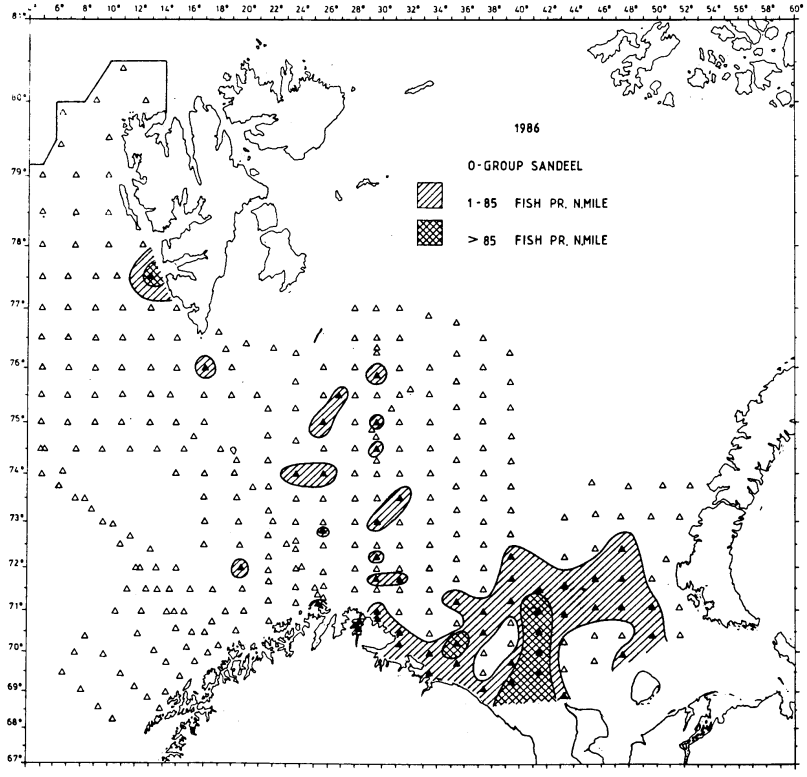

Fig. 19. Distribution of 0-group sandeel

International Council for
the Exploration of the Sea

C.M.1987/G: 38
Demersal Fish Committee
Ref. Pelagic Fish Committee

Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1987

The twenty-third annual International 0-group fish survey was made during the period 17 August-3 September 1987 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"	17 August-3 September	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	17 August-3 September	"
Norway	"Håkon Mosby"	20 August-3 September	"
USSR	"Artemida"	18 August-28 August	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
USSR	"Vilnyus"	20 August-1 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 3-4 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 miles 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 miles was made when 0-group fish layer was recorded deeper than 60 m on the echo-sounder.

Survey tracks and hydrographic stations are given in Fig. 1. Trawl stations with and without catch are given on the distribution charts in Figs. 14 - 21, 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 with 30-40 nautical miles between stations.

Horizontal temperature and salinity distribution are shown for 0, 50, 100 and 200 m depth (Figs. 2-9). Figs. 10-13 shows the temperature and salinity conditions in the Kola, Cape Kanin-Bear Island and Bear Island - West sections. The mean temperature for parts of these sections is given in Table 1.

In 1987 the temperature decreased in all layers of the Barents Sea compared to 1986, most in the surface layer. This is clearly demonstrated with values from the Kola section (Table 1). The temperature decrease is therefore mainly due to less warming of the surface layer from the atmosphere, but the temperature of the inflowing current are also somewhat lower than last year. The most considerable negative anomalies compared to the long-term mean were found in the middle and eastern parts of the sea.

Distribution and abundance of 0-group fish.

Geographical distributions of 0-group fish are shown as shaded areas in Figs. 14-21. 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. 14)

The overall density and the area of distribution of herring is about the same as last year, but far smaller than it has been for the 1983-1985 year-classes. Only a few individuals are caught in the area covered by the five vessels. The estimated logarithmic index for 1987 is zero, indicating a weak year class compared to the strength of the year-classes in the early seventies and early eighties.

Capelin (Fig. 15)

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 1987 year-class is very weak. This year, as last year, the western distribution was to the east of 30° E. No dense concentrations were observed and the density is much lower than it has been for any of the year-classes in the period 1980-1985.

Cod (Fig. 16)

The 0-group cod is this year found further to the west (west of 36° E) and not as far north in the Barents Sea as last year. No dense concentrations are observed and the catch per nautical mile is lower than last year. The indices (Tables 2 and 3) indicate a poor year-class. The logarithmic index indicates the strength to be of the same level as the poor 1980-1981 year-classes, corresponding to about 1/10 of the average strength of the 1983-1986 year-classes, classified as strong ones.

Haddock (Fig. 17)

As last year, haddock is only found in the central and western part of the area. The eastern and northern borders are further to the west and not as far north as observed in 1986. No dense concentrations are observed and the indices (Table 2 and 3) indicate about a poor

year-class, following a series of good year classes in 1982-1986. The logarithmic index indicates that the 1987 year-class is about 1/4 of the 1986 year-class.

Polar cod (Fig. 18)

Last year, polar cod was found as a continuous distribution from the east to the west in the northern part of the survey area. Even that year the total area of distribution was not covered. However, this year, the polar cod is found in two separate components, a western and an eastern. Dense concentrations is only found in the eastern area, and the abundance index for the 1987 year-class in this component is close to 2/5 of those for the 1985-1986 year-classes, which were indicated to be strong ones in the survey area. In the area to the west of 25° E, the density is estimated to be about 1/7 of the 1986 year-class.

Redfish (Fig. 19)

The distribution of redfish resembles that of last year, although the eastern border is further to the west in 1987. The highest abundance is found in the western part of the central survey area. The index (Table 2) is high, although the index is somewhat less than for the previous year classes. The 1987 year-class is indicated to be rich.

Greenland halibut (Fig. 20)

The distribution is similar to the distribution observed in 1986. The abundance index (Table 2) is at the same level as observed for the 1984-1986 year-classes, indicating a good year-class.

Long rough dab (Fig. 21)

Long rough dab is widely distributed as last year, although the eastern boarder is somewhat further to the west. Some dense concentrations are found in the central part of the survey area. The abundance index (Table 2) is about 1/4 of the 1986 year-class, indicating an average year-class.

Blue whiting

No 0-group blue whiting is found this year.

Sandeel

Few catches of 0-group sandeel is recorded in the southeastern part of the survey area. No high concentrations are observed and no abundance index is calculated.

Squid

Squid is widely distributed in the western part of the survey area, and few is caught east of 25° E. In 1987, the abundance of squid is at a much higher level than observed in previous years.

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.

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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 1987.

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	0-50 m	50-200 m	0-200 m	0-bottom	0-bottom	0-200 m	0-200 m
1	2	3	4	5	6	7	8
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
1987	6.2	3.3	3.9	2.6	2.5	5.2	3.9
Average 1965-1987	7.2	3.6	4.5	4.1	3.3	5.6	4.4

Table 2. Abundance indices

Species Year	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab
			West		East			
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	486486	255	115		16	732	40	70
1985	742	156	60		334	795	36	86
1986	434	160	111		366	702	55	755
1987	102	72	17		153	631	41	174

Table 3. Estimated indices with 90 % confidence limits of year class abundance for 0-group herring, 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				+				0.01	
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
1987	0.00	0.00	0.03	0.17	0.01	0.40	0.10	0.00	0.25

[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	L.R.D.	Sandeel
					East	West				
10-14							2.2			
15-19		+					9.3			
20-24		0.7				3.5	17.2		1.3	
25-29		11.2	0.1	0.1	0.6	9.2	18.7		11.0	
30-34		11.6	1.0	1.7	16.5	30.6	27.0	0.4	32.5	
35-39	9.1	19.8	1.6	3.3	37.5	29.6	16.0	0.9	35.0	
40-44	36.4	9.0	10.1	7.7	31.1	21.6	8.1	3.1	17.5	0.1
45-49	27.3	10.0	15.3	11.6	10.9	5.1	1.4	4.4	2.7	5.0
50-54	18.2	9.2	19.2	10.3	3.5	0.2	0.1	11.0	+	12.5
55-59	9.1	9.1	21.1	13.6			+	14.5		52.0
60-64		8.1	20.2	16.6				25.6		22.4
65-69		6.4	8.6	8.4				15.4	+	2.9
70-74		3.5	2.0	6.5		0.2		16.3		0.2
75-79		1.2	0.8	2.2				7.9		2.9
80-84		0.1		0.9				0.4		1.6
85-89				1.8						0.3
90-94				0.7						
95-99				0.6						
100-104				0.6						
105-109				0.3						
110-114				0.1						
115-119										
120-124										
125-129										
130-134										
135-139										
140-144										
Total numbers	11	4164	891	775	22558	487	118761	227	4784	858
Mean length, mm	46.6	46.1	55.2	58.5	39.8	36.2	29.9	62.7	35.7	58.9

+) Less than 0.1

Appendix

Survey period	Research vessel	Research Institute	Participants
18 August-28 August	"Artemida"	Polar Research Institute of Marine Fisheries and Oceanography, Murmansk	A.S. Galkin, S.D. Melnikov, V.I. Shapovalo, Yu.A. Perepechaev, A.G. Korneev, V.A. Tararoshchenko, V.V. Kryukov, V.I. Zubov, M.D. Kleopin, S.V. Lisovets, I.S. Shafran, V.M. Ulanov.
20 August-1 September	"Vilnyus"	"	S.A. Baranov, I.V. Borkin, V.V. llyin, V.M. Kapralov, O.P. Garbut, A.E. StepurinK.A. Trostin, Yu.E. Zhak.
17 August-3 September	"G.O. Sars"	Institute of MarineResearch, Bergen	A. Hylen, K.H. Hansen, A. Raknes, A.M. Skorpen, I.M. Beck, Ø. Tangen, R. Johannessen.
20 August-3 September	"Håkon Mosby"	"	K. Sunnanå, H. Senneset, V. AnthonypillaiE. Skoglund, I. Hoff.
17 August-3 September	"Eldjarn"	"	O. Nakken, A. Romslo, T. Mørk, T.I. Hallar, J.H. Nilsen, K. Hansen.

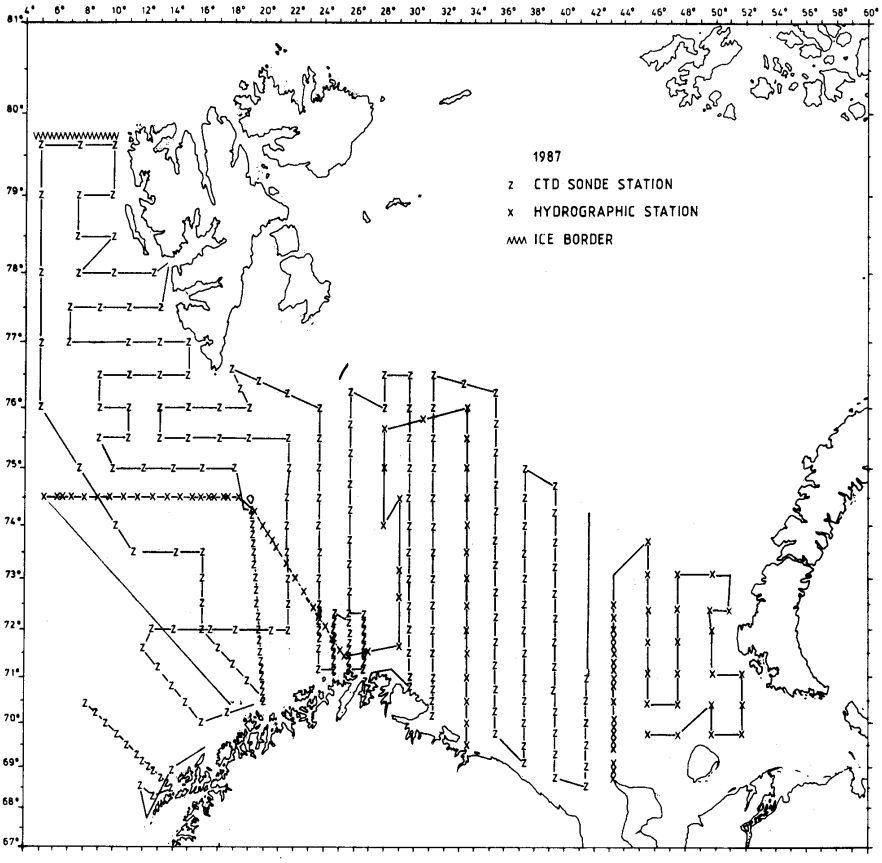

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

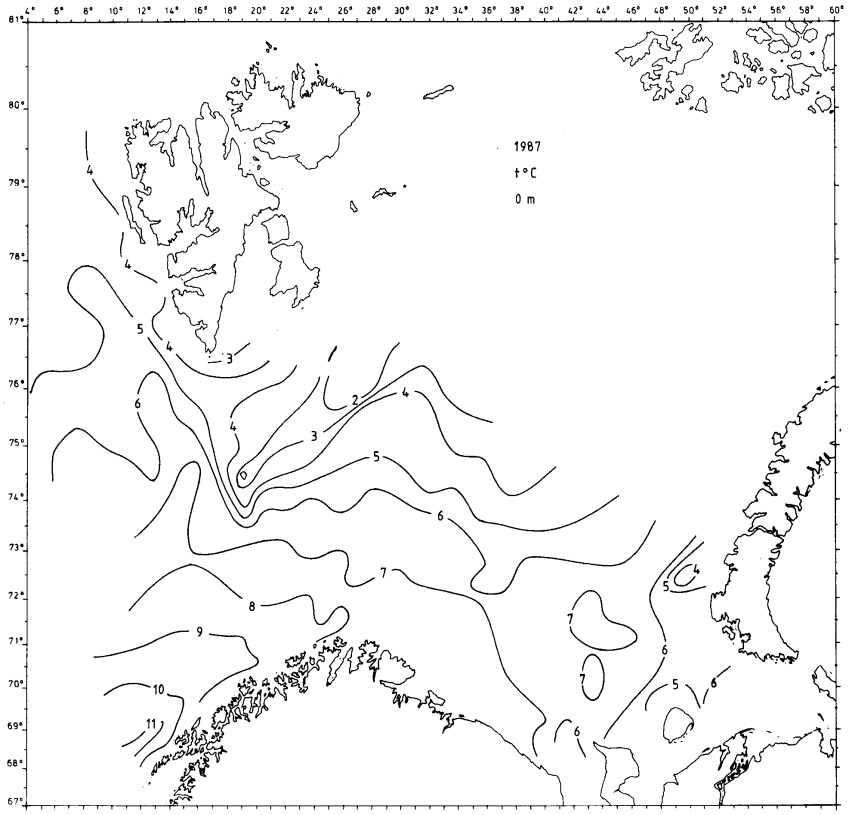

Fig. 2. Isotherms at 0 m

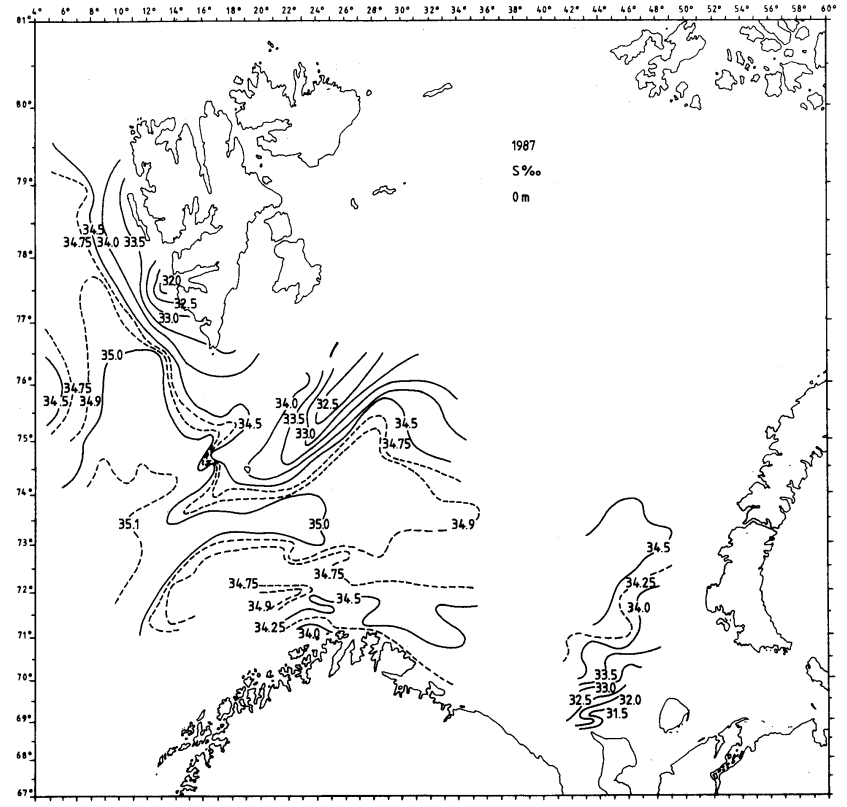

Fig. 3. Isohalines at 0 m

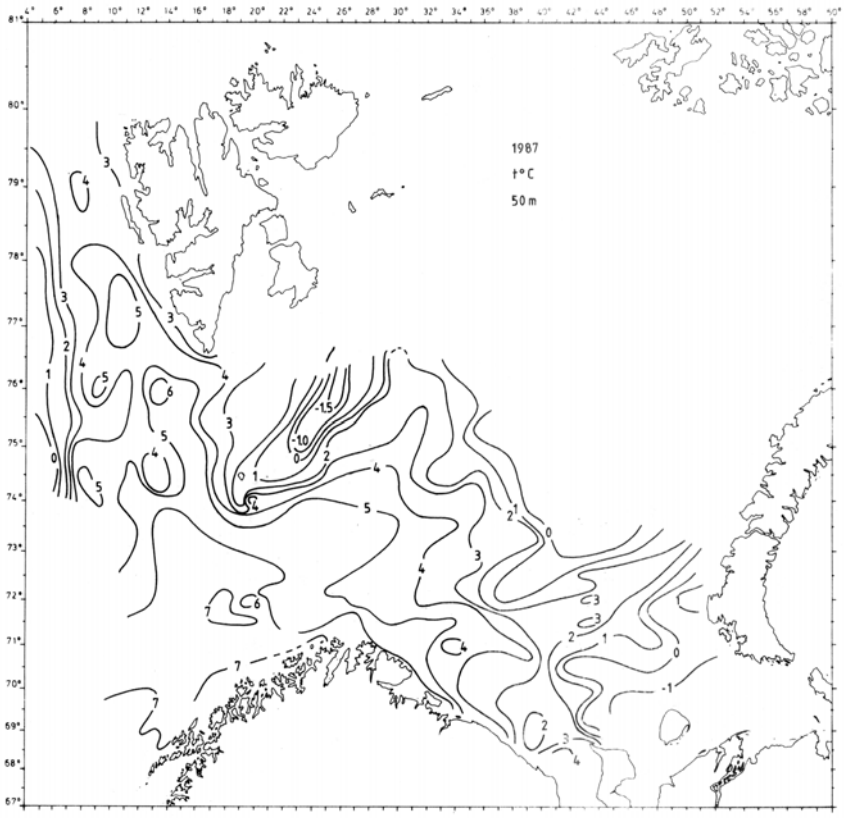

Fig. 4. Isotherms at 50 m

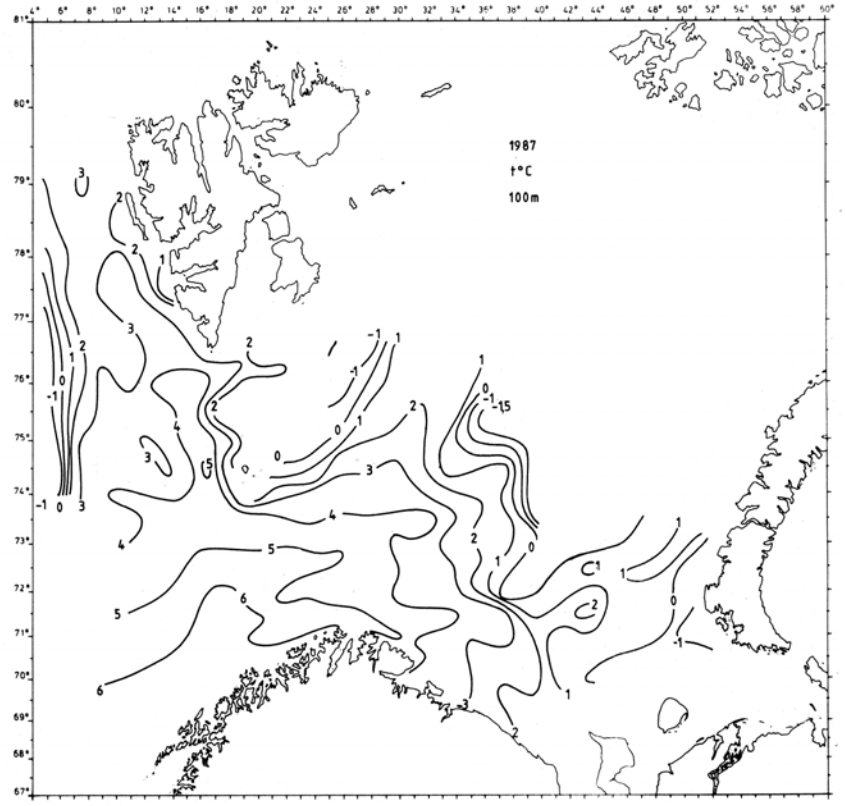

Fig. 5. Isohalines at 50 m

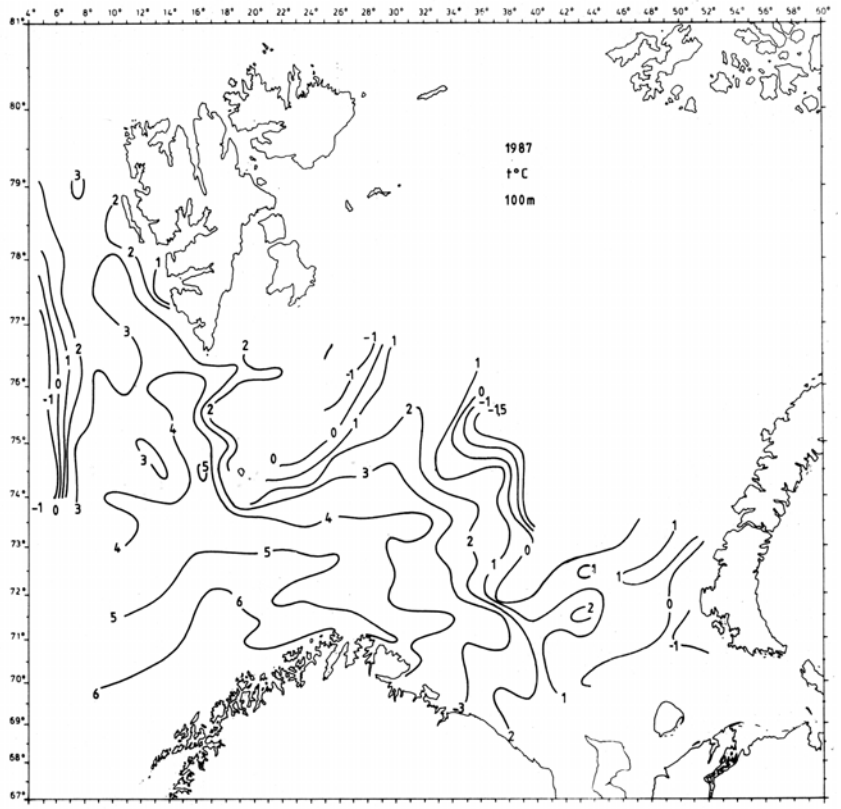

Fig. 6. Isotherms at 100 m

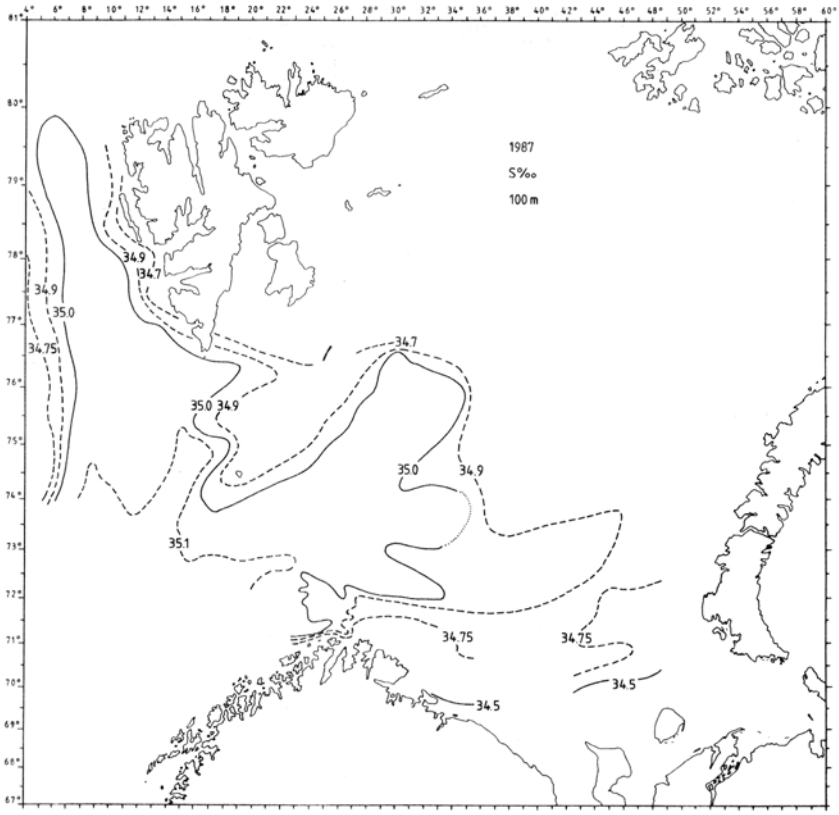

Fig. 7. Isohalines at 100 m

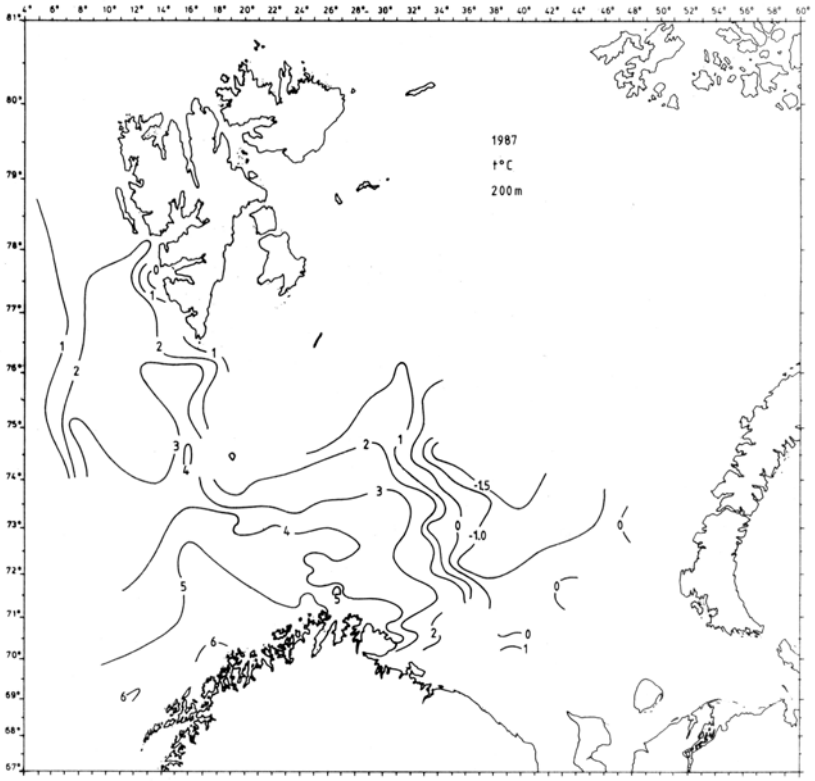

Fig. 8. Isotherms at 200 m

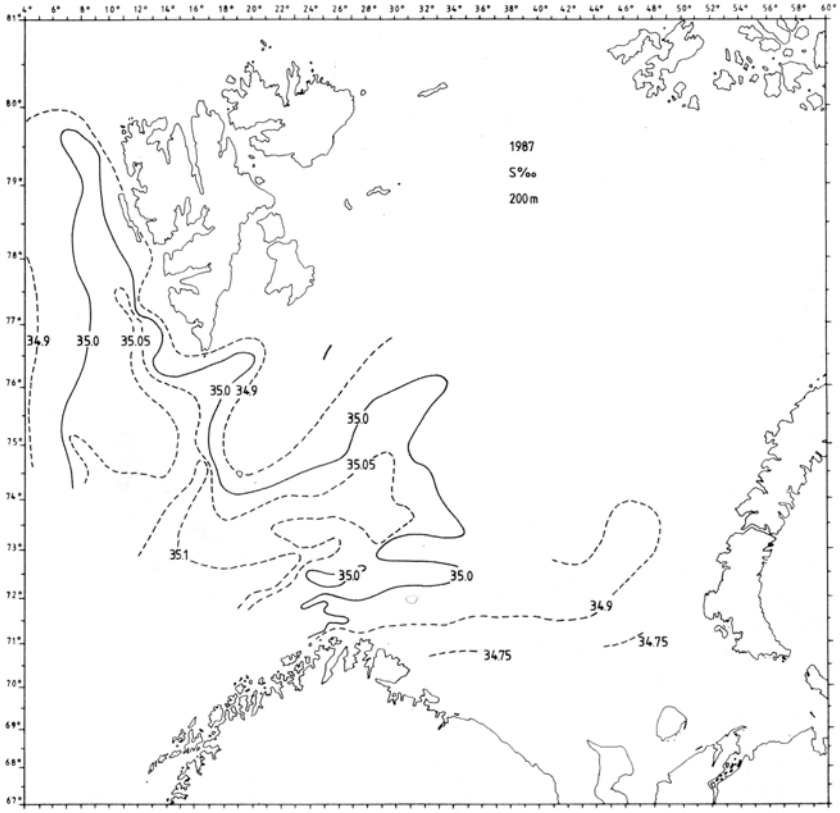

Fig. 9. Isohalines at 200 m

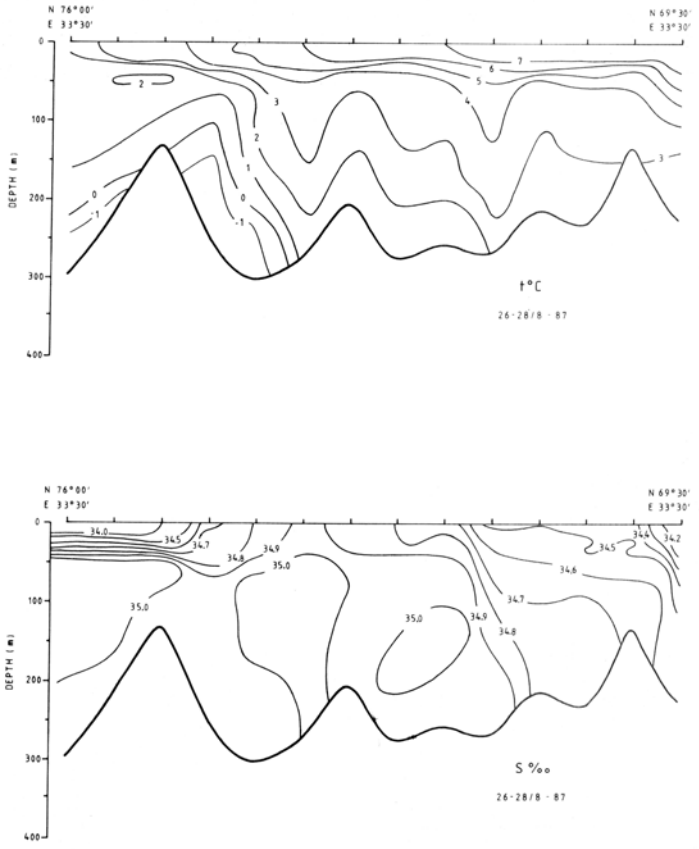

Fig. 10. Hydrographic section along the Kola meridian. Temperature and salinity

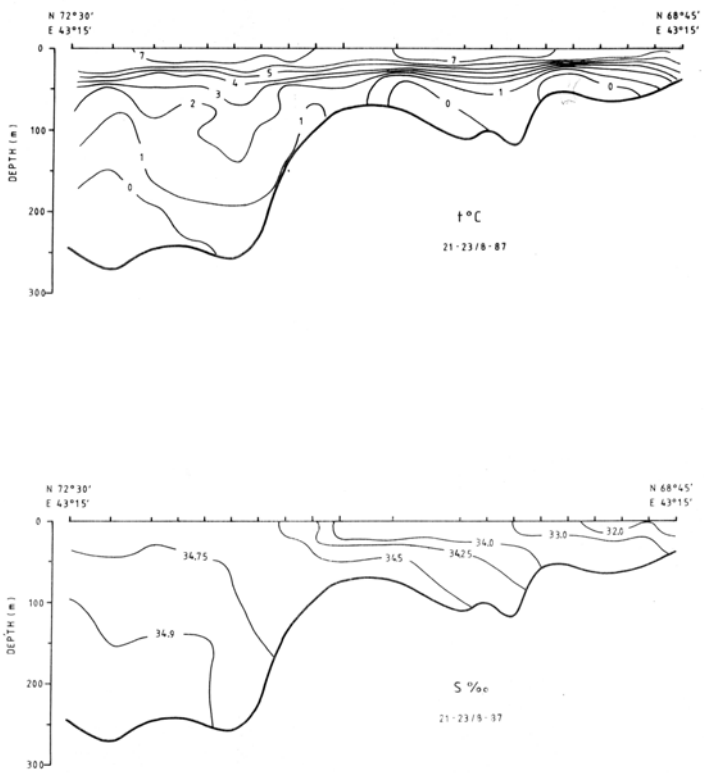

Fig. 11. Hydrographic section Cape Kanin-North. Temperature and salinity

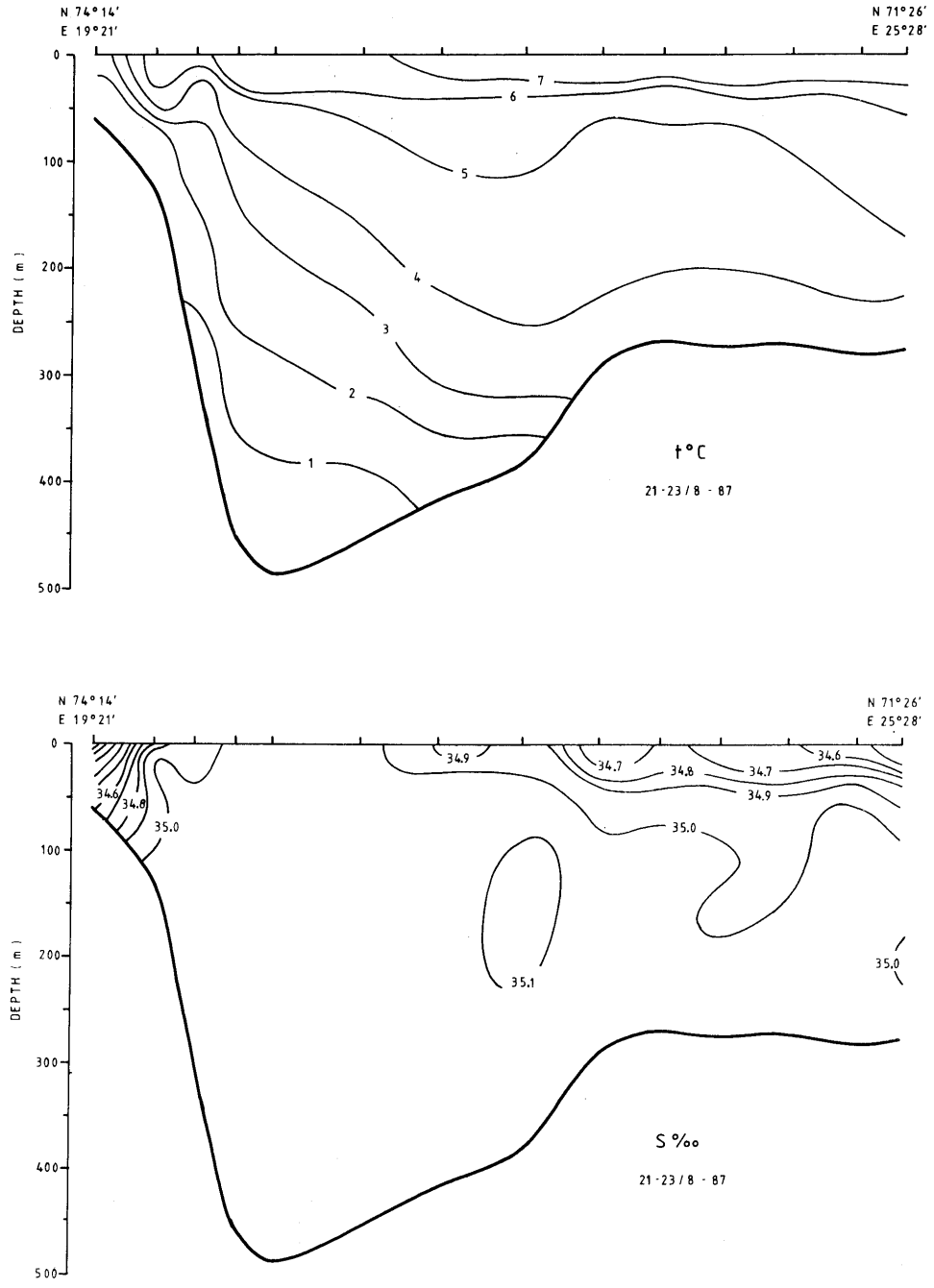

Fig. 12. Hydrographic section Bear Island-North Cape. Temperature and salinity

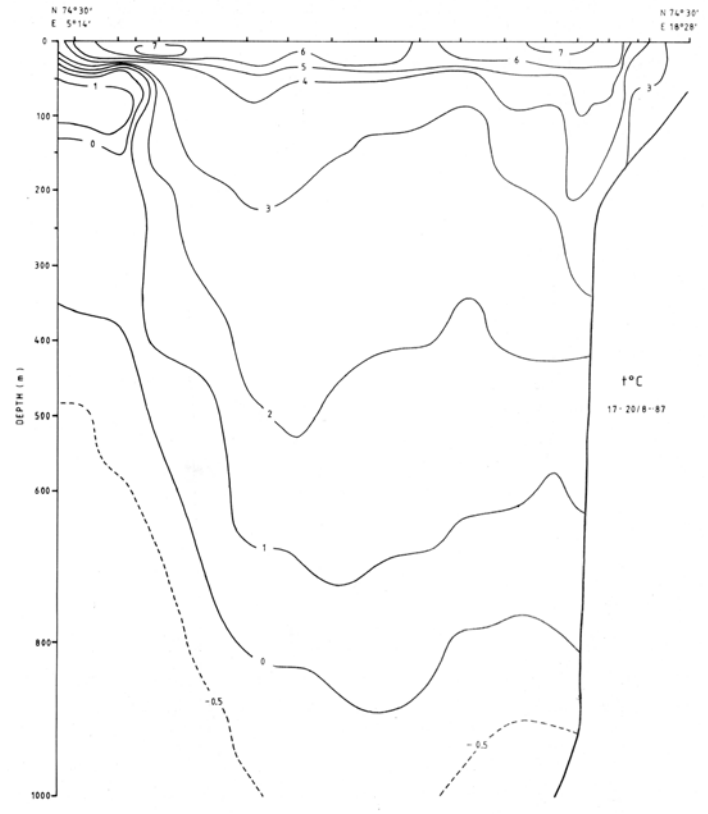

Fig. 13 a. Hydrographic section Bear Island-West. Temperature

Fig. 13 b. Hydrographic section Bear Island-West. Salinity

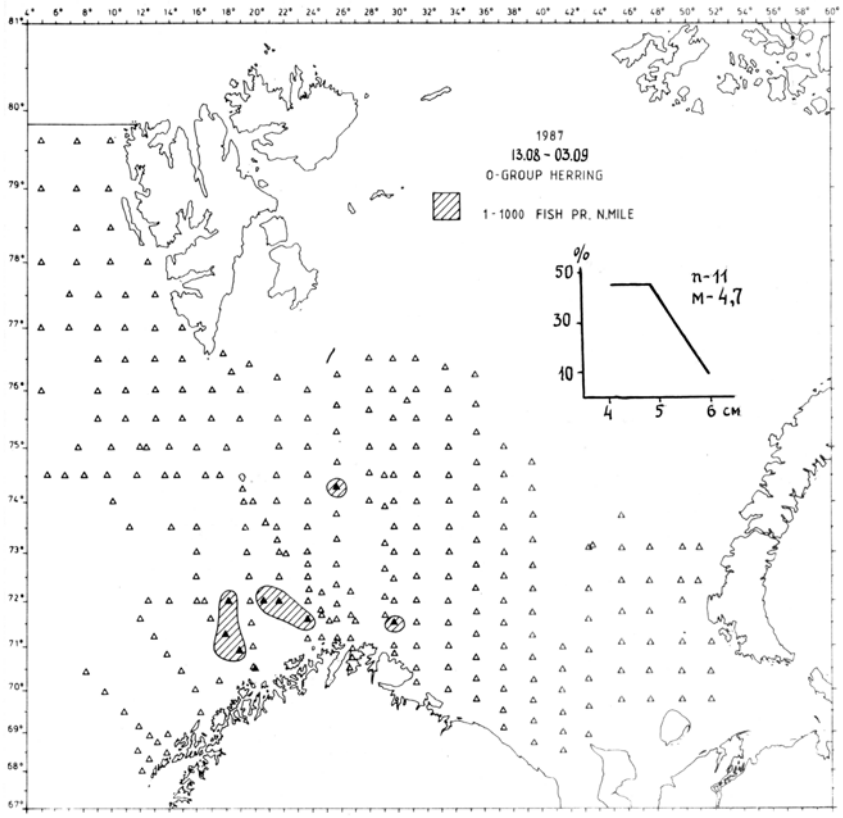

Fig. 14. Distribution of 0-group herring

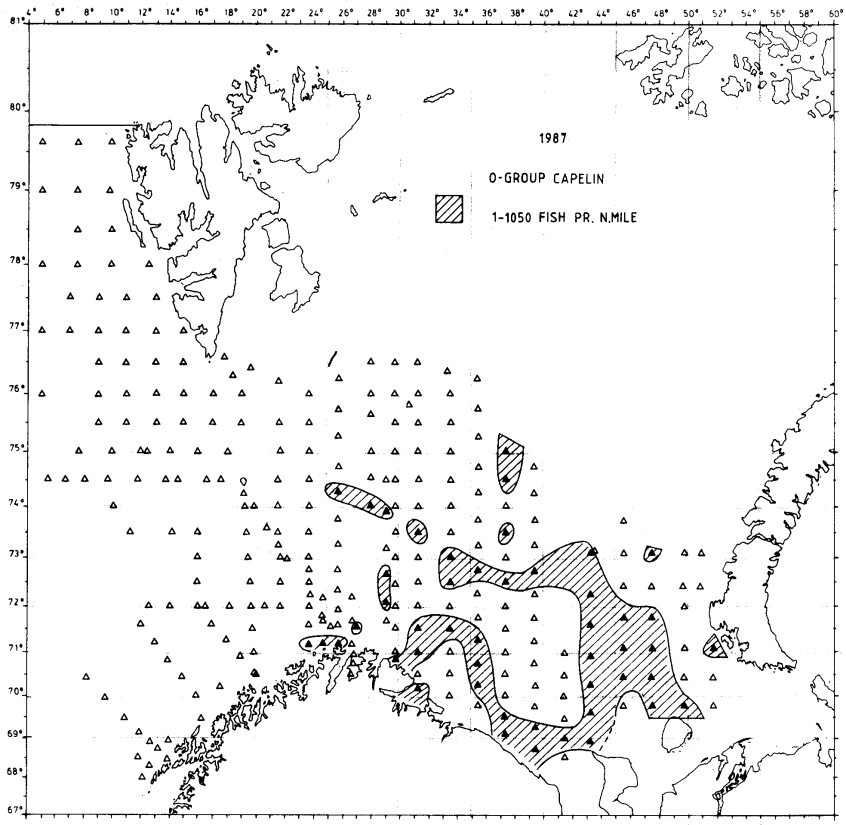

Fig. 15. Distribution of 0-group capelin

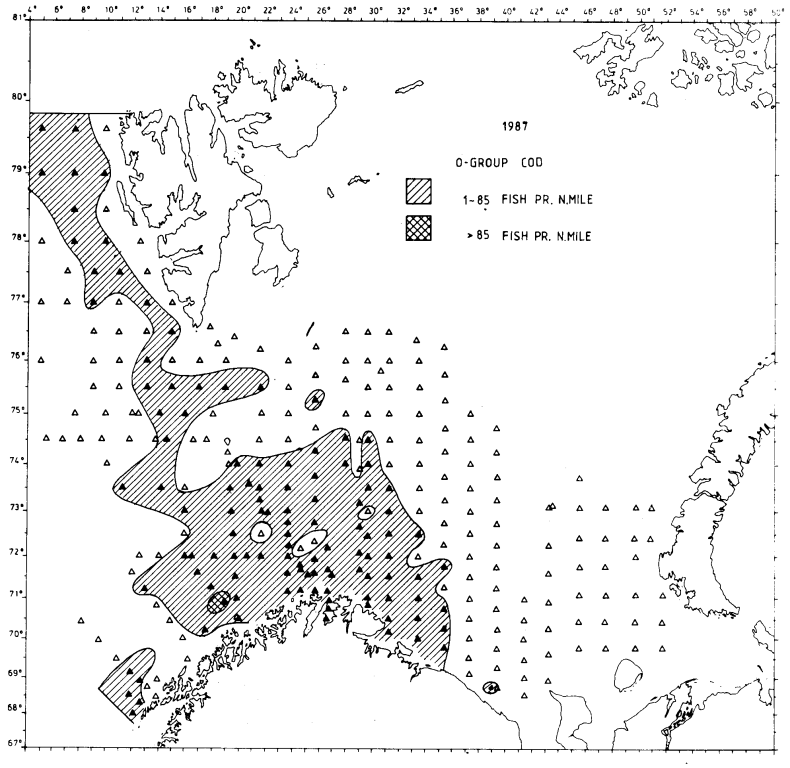

Fig. 16. Distribution of 0-group cod

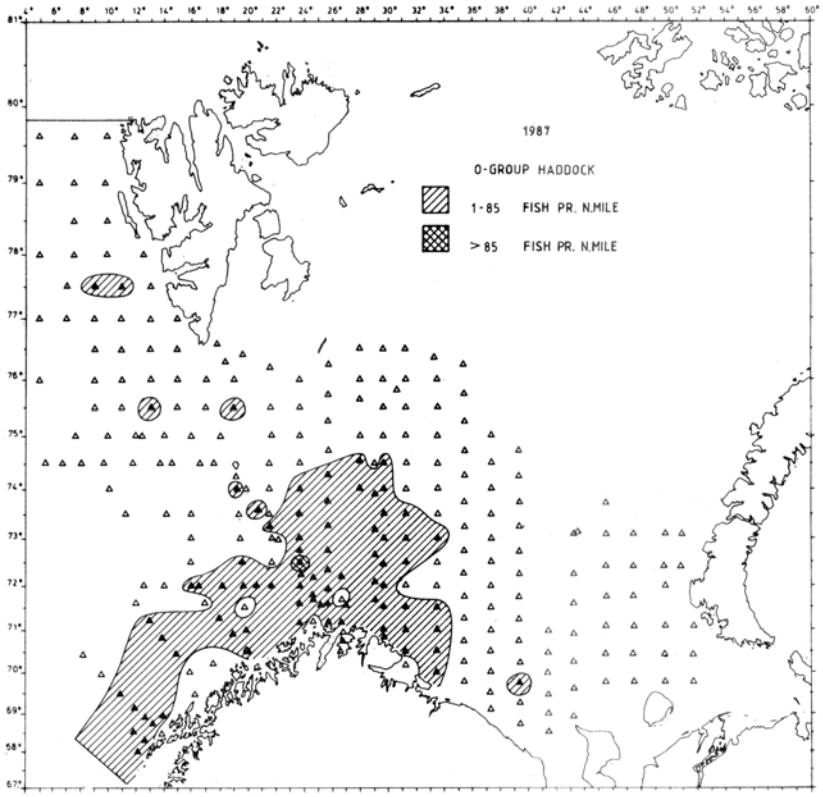

Fig. 17. Distribution of 0-group haddock

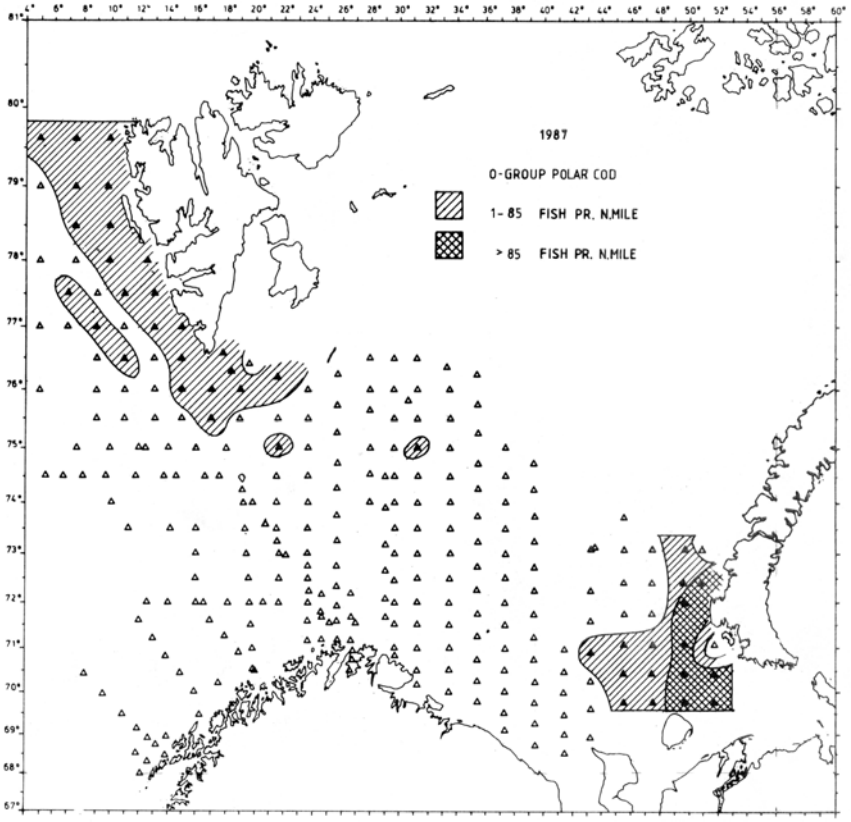

Fig. 18. Distribution of 0-group polar cod

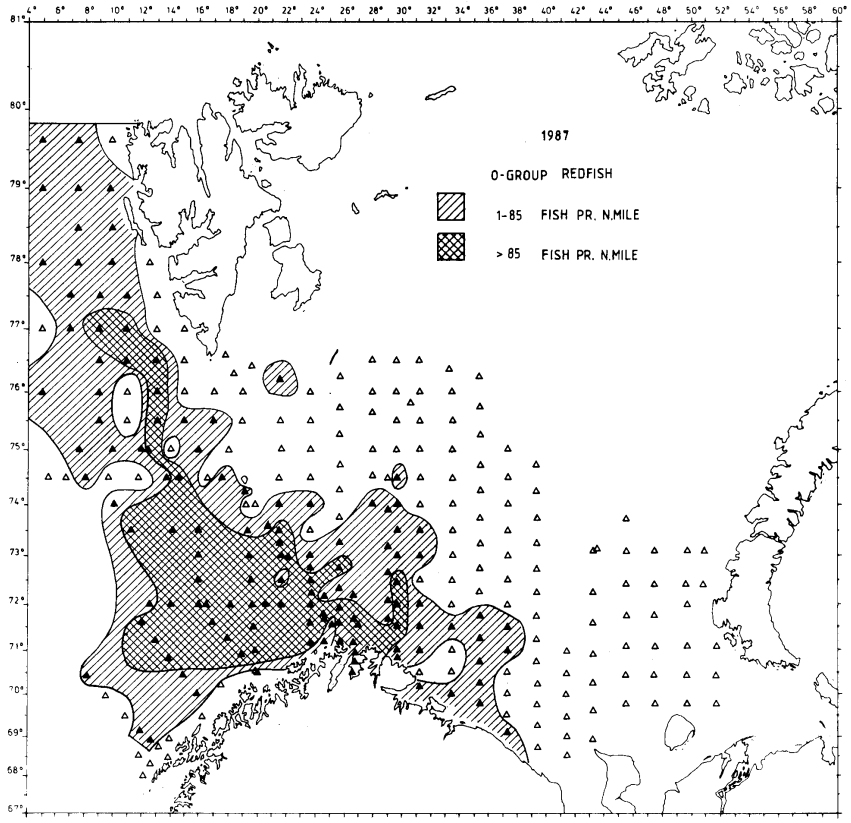

Fig. 19. Distribution of 0-group redfish

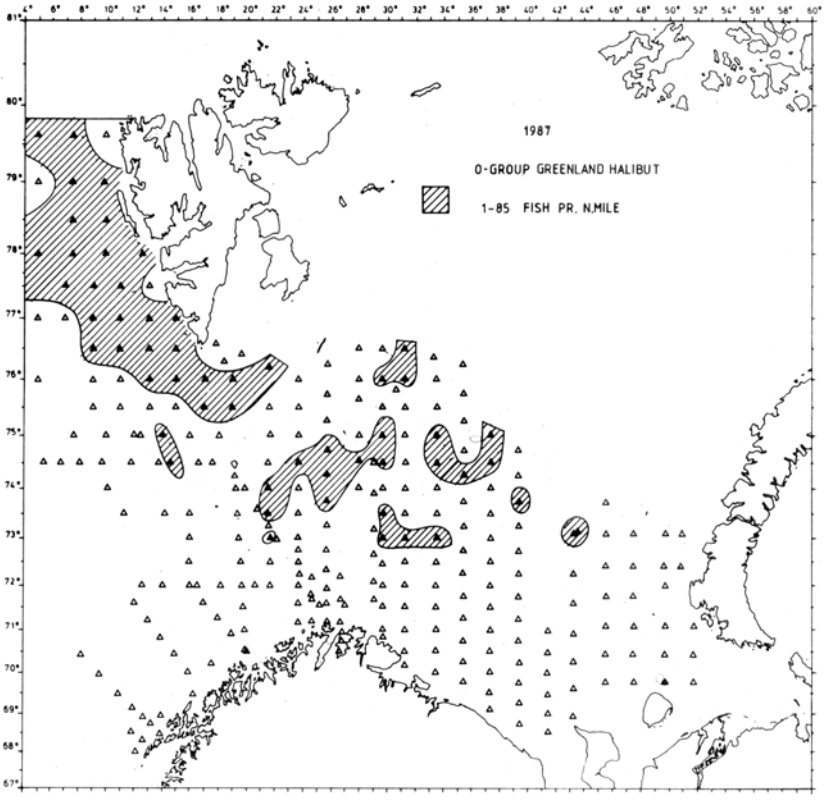

Fig. 20. Distribution of 0-group Greenland halibut

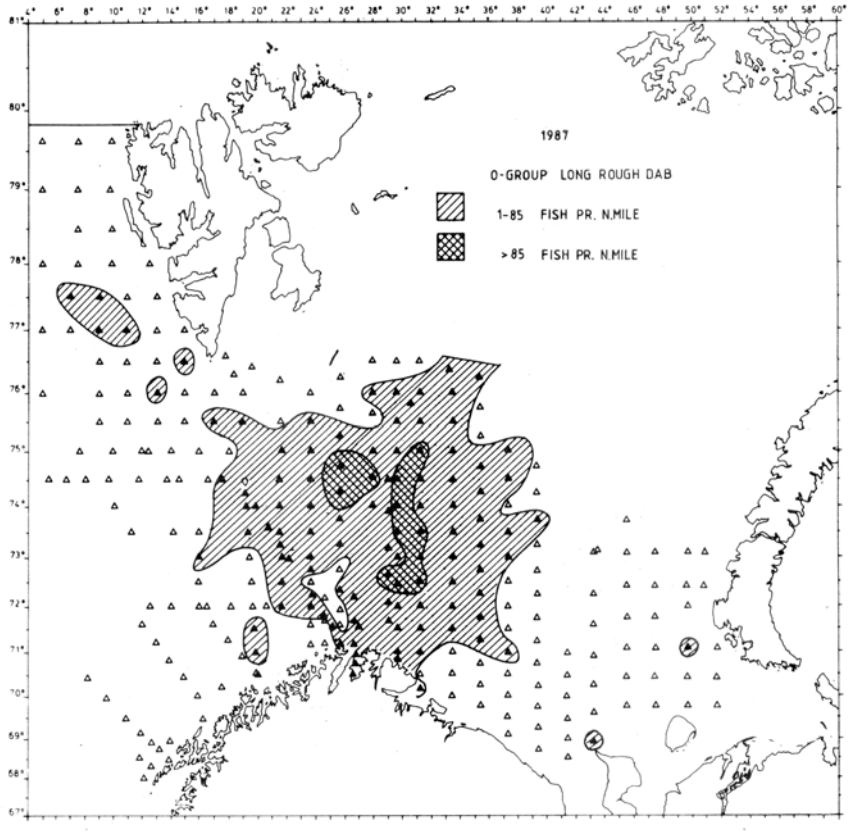

Fig. 21. Distribution of 0-group long rough dab

International Council for
the Exploration of the Sea

C.M. 1988/G:45
Demersal Fish Committee
Ref. Pelagic Fish Committe

Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1988

The twenty-fourth annual International 0-group fish survey was made during the period 20 August-7 September 1988 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey period	Research Institute
Norway	"Eldjarn"	22 August-6 September	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	22 August-7 September	"
Norway	"Håkon Mosby"	20 August-3 September	"
USSR	"Artemida"	21 August-2 September	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
USSR	"Professor Marty"	26 August-4 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 7-8 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 hydrographical conditions in the area.

Material and methods

The geographical distribution of 0-group fish was estimated by fishing with a small mesh midwater trawl. The vessels participated in the survey in 1988 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 30-40 nautical miles sailed the trawl was towed in several depths in one haul. The standard procedure consisted of towings of 0.5 nautical miles 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 miles was made when 0-group fish layer was recorded deeper than 60 m on the echo-sounder.

Survey tracks and hydrographical stations are given in Fig. 1. Trawl stations with and without catch are given on the distribution charts in Figs. 14-26, as filled and open symbols respectively. The density grading is based on catch in number per 1.0 nautical mile trawling.

Hydrography

Hydrographic observations were made along all the survey tracks with 30-40 nautical miles between stations.

Horizontal temperature and salinity distribution are shown for 0, 50, 100 and 200 m depth (Figs. 2-9). Figs. 10-13 show the temperature and salinity conditions in the Kola, Cape Kanin, Bear Island - North Cape and Bear Island - West sections. The mean temperature for parts of these sections are listed in Table 1.

Due to favorable weather and increased advection into the Barents Sea, the total heat content compared to 1987 has increased and all temperatures are close to 1965-1988 norms (Table 1). The increased advection, especially of less saline water associated with the Norwegian Coastal Current, has led to a distinct decrease in salinity mainly of the upper 0-50 (100) meters. The horizontal temperature distribution at 50 m (Fig. 3) indicates a strong outflow around Bear Island.

Distribution and abundance of 0-group fish and Gonatus fabricii

Geographical distributions of 0-group fish are shown as shaded areas in Figs. 14-25, and of Gonatus fabricii in Fig. 26. 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. 14)

The estimated logarithmic index for herring in 1988 is 0.30. This is about the 1984-level, far below the 1983 year-class strength. The area of distribution is different from the years 1983 and 1984 in that the 0-group herring in 1988 also were distributed outside Spitsbergen. 0-group herring in the fjords will in addition contribute to the total index.

Capelin (Fig. 15)

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 1988 year-class is stronger than last year. A couple of dense concentrations were observed, and the area of distribution is also larger than the last two years. This year the main area of distribution was east of 26° E. The length distributions showed that 0-group capelin east of 40° E were considerably larger than further west.

Mackerel (Fig. 16)

Some 0-group mackerel were caught in the south-western part of the survey area. No abundance index has been calculated.

Cod (Fig. 17)

The area of distribution is very much the same as in 1987, although more patchy outside Spitsbergen. There were a few more areas with dense concentrations this year than last year. The abundance index (Table 2) indicate that the 1988 year-class is stronger than the 1987 year-class but considerably lower than the year-classes 1983-1986, possibly not far from the 1972 or 1982 year-class. The logarithmic index (Table 3) show a similar pattern although at a level somewhat lower than the 1972 and 1982 year-class. The mean length of the 0-group cod is higher this year than last year.

Haddock (Fig. 18)

The area of distribution is much the same as last year. The abundance index (Table 2) is about or slightly above the 1987 index, but below the 1982-1986 year-classes. The logarithmic index (Table 3) is sligthly above the 1987 year-class, at the 1979-1980 level, but far below the 1982-1986 year-classes. The mean length of the 0-group haddock had also increased.

Saithe (Fig. 19)

Only scattered catches of 0-group saithe were taken. No abundance index has been calculated.

Polar cod (Fig. 20)

The abundance index for the western component of polar cod is higher than last year, mainly because of a wider distribution. The abundance index for the eastern component is lower than last year, but above the poor year-classes 1981-1984. 0-group polar cod at or east of 40° E are this year included in the eastern group.

Blue whiting (Fig. 21)

Only some scattered catches of blue whiting were taken. No abundance index has been calculated.

Sandeel (Fig. 22)

The distribution of sandeel is mainly within the southeastern area. Bigger catches than last year were recorded, but no abundance index has been made.

Redfjsh (Fig. 23)

The area of distribution is this year enlarged towards the east, with dense concentrations as far east as 38–40° E. The 0-group redfish dominated most of the catches in the western and central part of the survey area. The calculated abundance index, indicating a strong year-class, is the second highest since 1965.

Greenland halibut (Fig. 24)

The area of distribution is much smaller than in 1987, and only a few specimens were caught on the positive stations. The abundance index shows an alarming low value indicating a poor year-class.

Long rough dab (Fig. 25)

The area of distribution is smaller than the previous years, and without dense concentrations. The abundance index indicate a poor year-class.

Gonatus fabricii (Fig. 26)

Gonatus is widely distributed in the western part of the survey area. In 1988 Gonatus were caught as far east as 34° E. The abundance of Gonatus in 1988 is at a higher level than in 1987, which again was at a much higher level than observed in previous years. The length interval was 12-95 mm.

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.

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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 1987

2-4 - Murmansk Current: Kola section (70°30' N – 72°30' N)
5 - Cape Kanin section (68°45' – 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	0-50 m	50-200 m	0-200 m	0-bottom	0-bottom	0-200 m	0-200 m
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
1987	6.2	3.3	3.9	2.6	2.5	5.2	3.9
1988	7.1	3.7	4.5	3.9	2.9	5.5	4.2
Average 1965-1988	7.2	3.6	4.5	4.1	3.3	5.6	4.4

Table 2. Abundance indices

Species Year	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab
			West		East			
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	2	69
1980	49	54	79		247	651	12	108
1981	65	30	149		73	861	3	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
1987	102	72	17		155	631	41	174
1988	133	86	144		120	949	8	72

Table 3. Estimated indices with 90 % confidence limits of year class abundance for 0-group herring, 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				+			0.01		
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
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

[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 alibut	Long rough dab	Sandeel
					East	West				
10-14							0.1			
15-19							1.0		0.1	
20-24		0.1		0.1		+	2.8		0.7	
25-29		0.6		0.3		14.4	4.4		10.6	
30-34		1.7	0.3	0.2		46.4	10.9		30.6	1.5
35-39	+	8.9	0.9	0.9	1.0	26.0	30.6	1.9	32.3	7.5
40-44	+	15.9	3.3	1.7	13.3	9.6	26.2	1.9	22.7	14.1
45-49	0.1	13.7	6.2	3.6	23.2	2.9	13.5	7.6	2.2	17.4
50-54	1.3	22.5	9.3	5.5	42.2	0.5	7.1	15.1	0.3	21.7
55-59	6.3	23.2	10.8	6.2	17.0	0.1	3.0	18.9		22.9
60-64	20.9	3.4	12.7	9.1	3.3		0.5	18.9		6.8
65-69	27.9	1.9	14.0	9.0		+	+	18.9	0.1	4.0
70-74	22.3	2.5	12.1	10.5		+	+	13.2		2.4
75-79	14.1	1.4	12.9	9.2			+	3.8		0.2
80-84	6.3	1.6	8.5	8.5		+	+		0.1	0.1
85-89	0.6	1.2	5.4	6.5						0.1
90-94	0.1	1.0	2.5	5.2		+				0.3
95-99	+	0.1	0.9	5.4		+				0.7
100-104		+	+	4.2						0.3
105-109		+	0.1	2.9		+				0.2
110-114		+	+	5.4						+
115-119		+		1.8						
120-124		+	0.1	1.4		+				
125-129		+	+	1.0					0.1	
130-134				1.0						
135-139				0.1						
140-144		+		0.1						
Total numbers	39789	104960	2249	1741	1586	27738	603434	53	963	19587
Mean length, mm	66.7	50.0	64.8	76.6	48.5	32.1	37.8	58.4	33.8	50.0

Appendix

Survey period	Research vessel	Research Institute	Participants
26 August- 4 September	"Professor Marti"	Polar Research Institute of Marine Fisheries and Oceanography, Murmansk	N.G. Ushakov, S.D. Melnikov, V.I. Zubov, S.V. Ratushny, Yu.A. Perepechaev, A.G. Korneev, V.M. Kapralov, S.V. Lisovets, V.V. Doronin, S.M. Gotovtsev, A.P. Pronin.
21 August- 2 September	"Artemida"	"	V.S Bakanev, I.V. Borkin, V.I. Shapovalov, L.L. Pavlyuchenko, A.P. Pedchenko, I.D. Altynov, V.V. Konovalov, L.G. Kuzmin, A.I. Shatilov, I.A. Adarov, V.M. Ulanov, V.I. Lvov, N.V. Mokeeova, A. Badigin, S.Yu. Dudnikov, A.P. Shavgzhdis, M.I. Prikotov, S.N. Pryakhin.
22 August- 7 September	"G.O. Sars"	Institute of Marine Research, Bergen	A. Hylen, K. Nedreaas, E. Svendsen, S. Lygren, J.H. Nilsen, A. Raknes, K. Hansen, M. Dahl.
20 August- 3 September	"Hakon Meshy"	"	K. Hansen, K. Andreassen, I Sværen, Ø. Tangen, M. Johannessen, I. Hoff.
22 August- 6 September	"Eldjarn"	"	K. Sunnanå, B.K. Berntsen, H. Kismul, L. Løvheim, Ø. Nævdal, I. Svellingen, R. Pedersen.

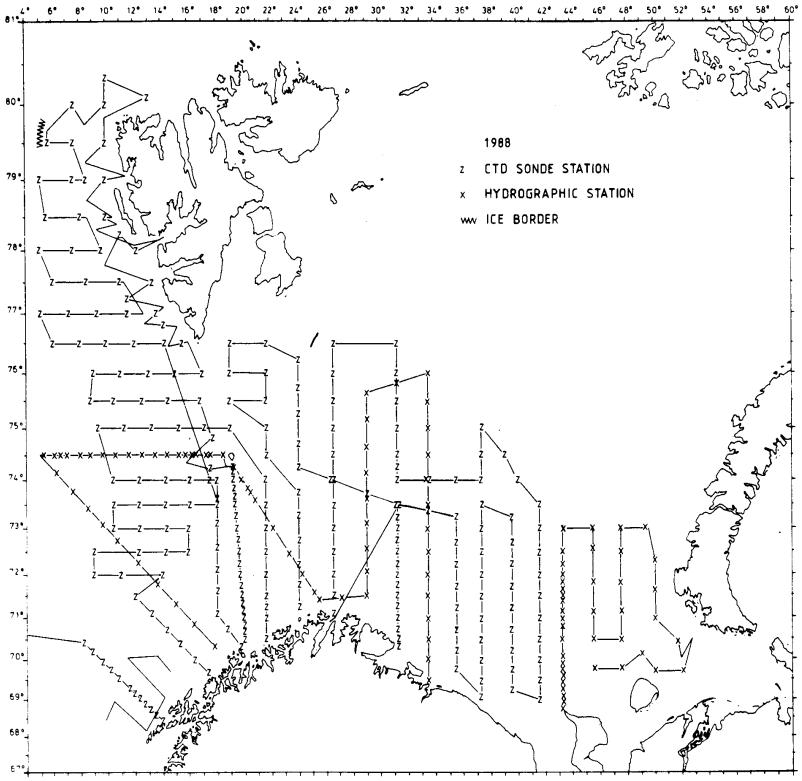

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

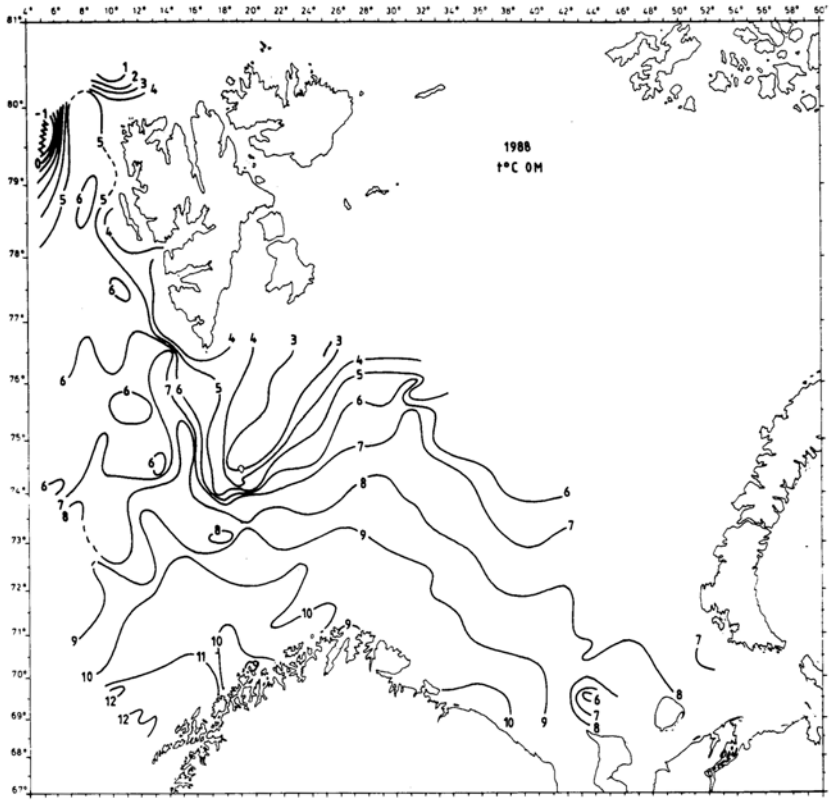

Fig. 2. Isotherms at 0 m

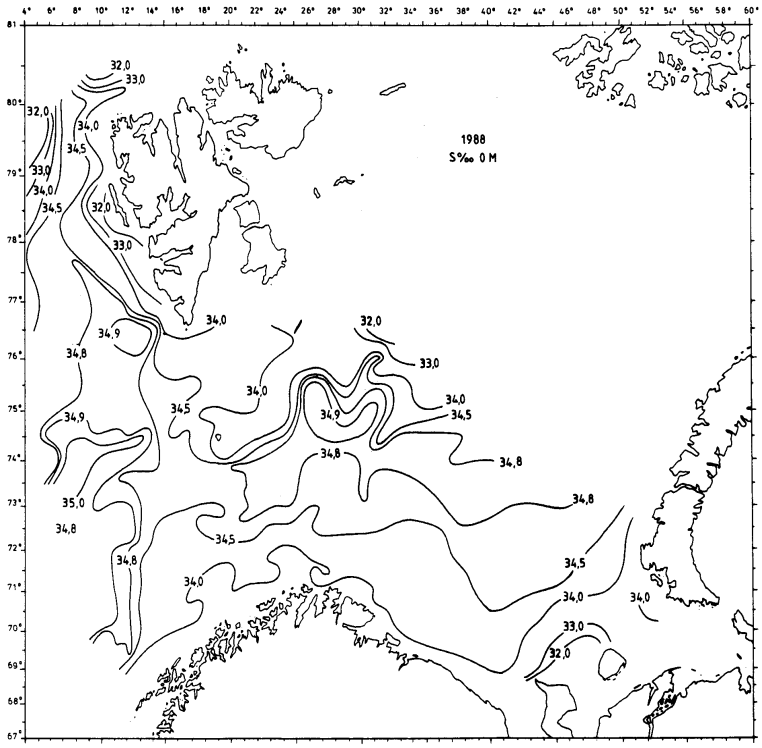

Fig. 3. Isohalines at 0 m

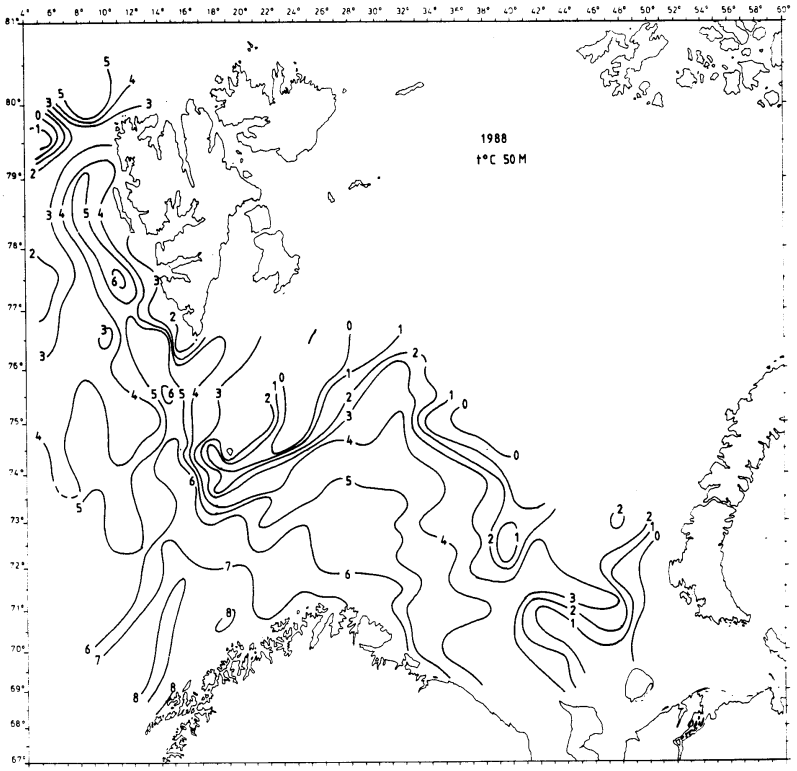

Fig. 4. Isotherms at 50 m

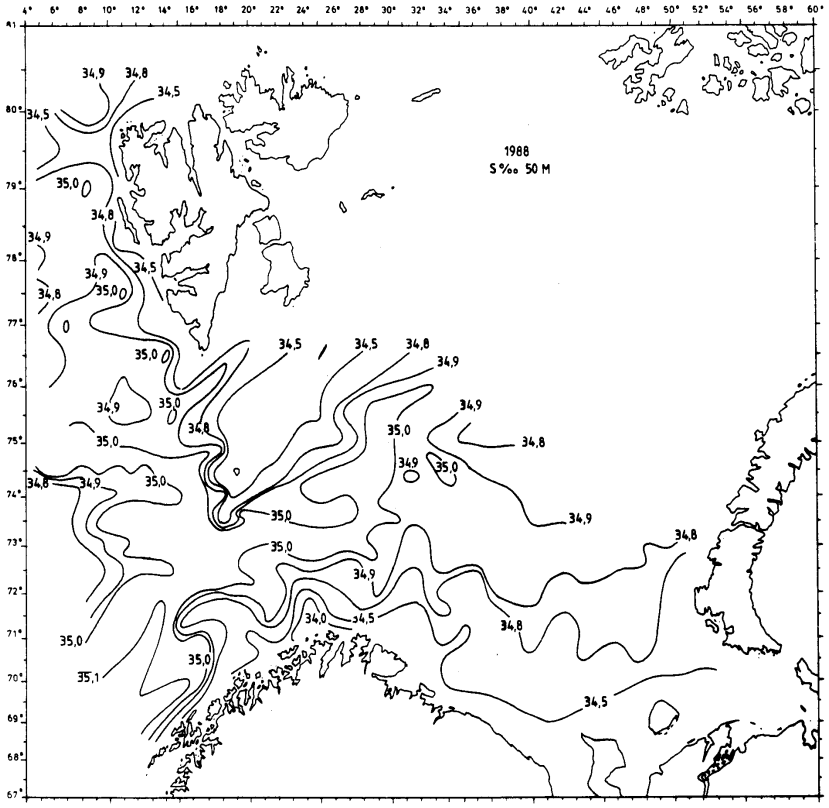

Fig. 5. Isohalines at 50 m

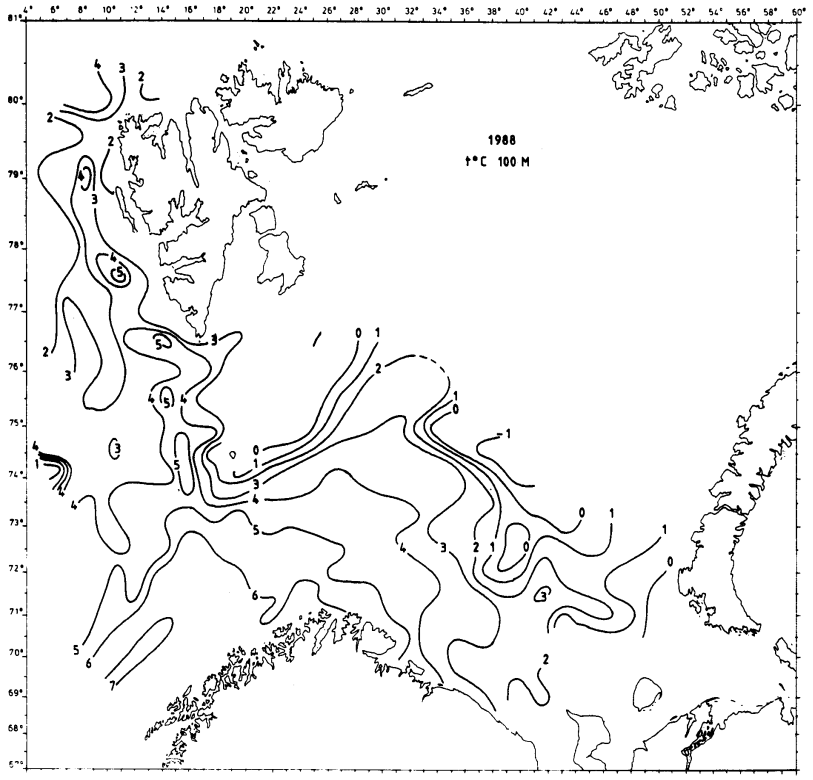

Fig. 6. Isotherms at 100 m

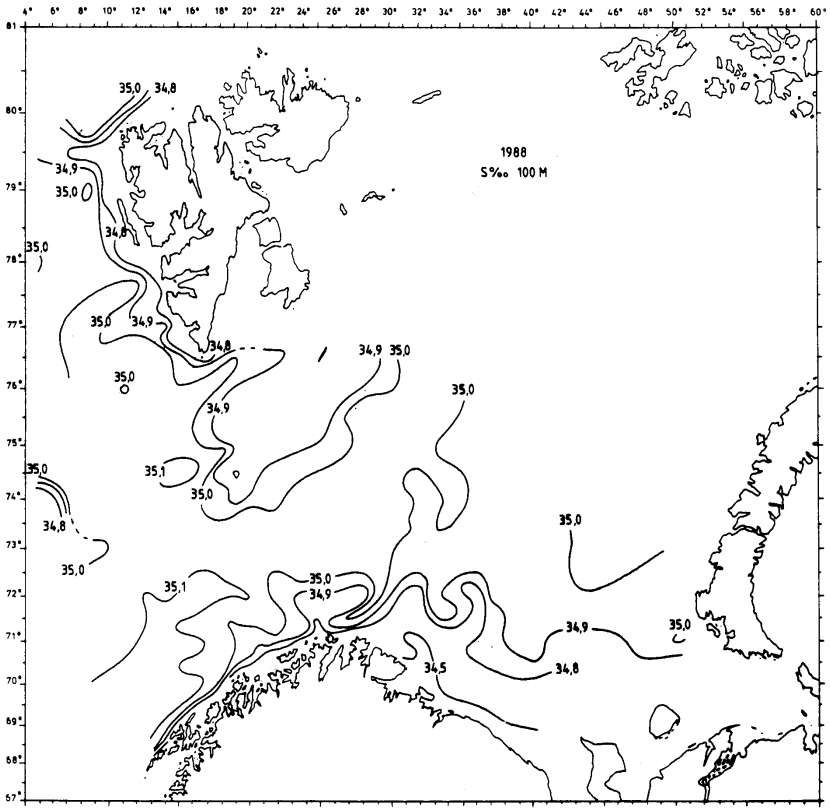

Fig. 7. Isohalines at 100 m

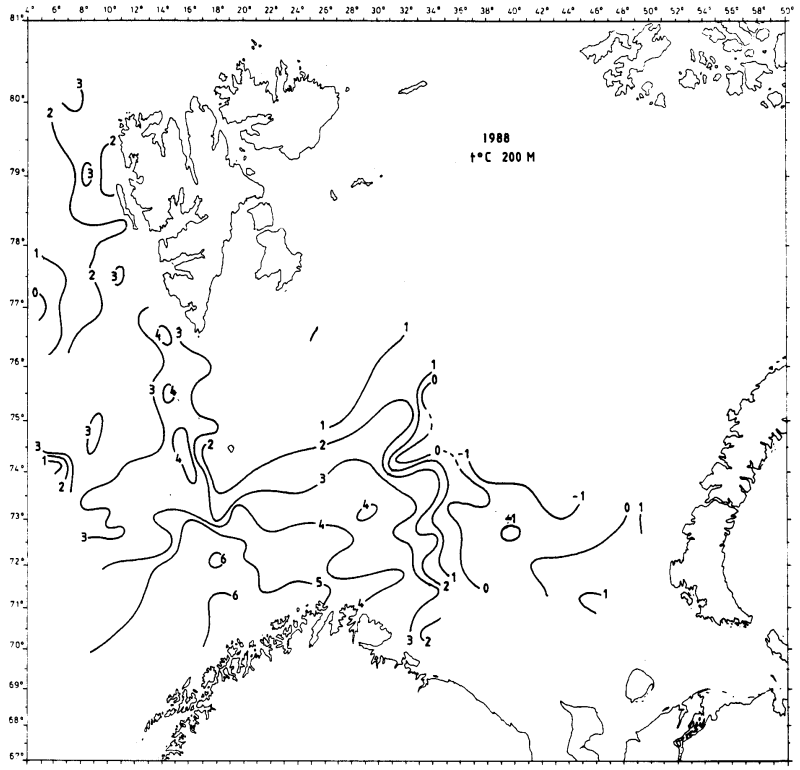

Fig. 8. Isotherms at 200 m

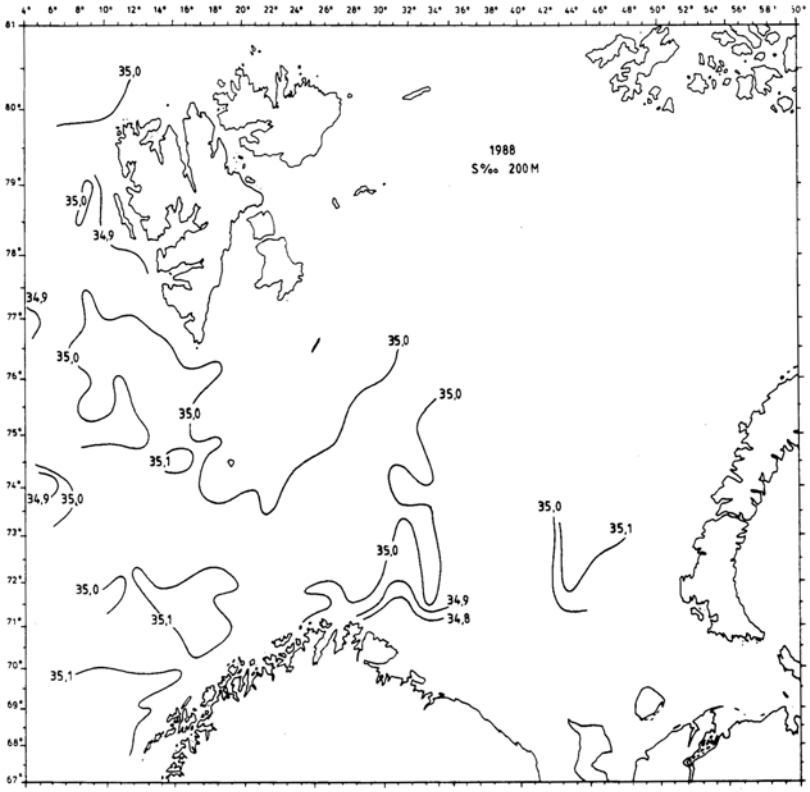

Fig. 9. Isohalines at 200 m

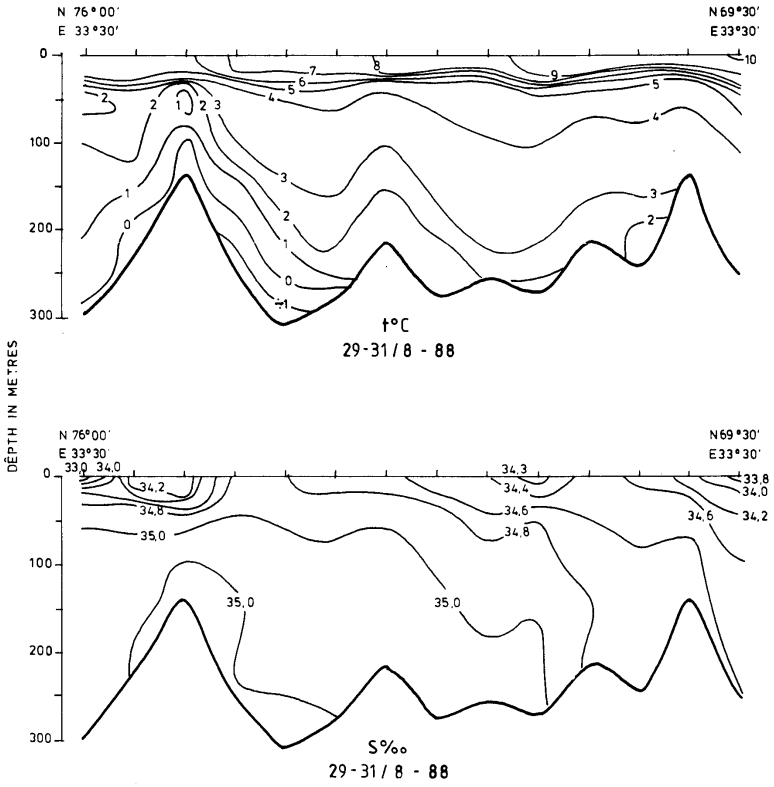

Fig. 10. Hydrographic section along the Kola meridian. Temperature and salinity

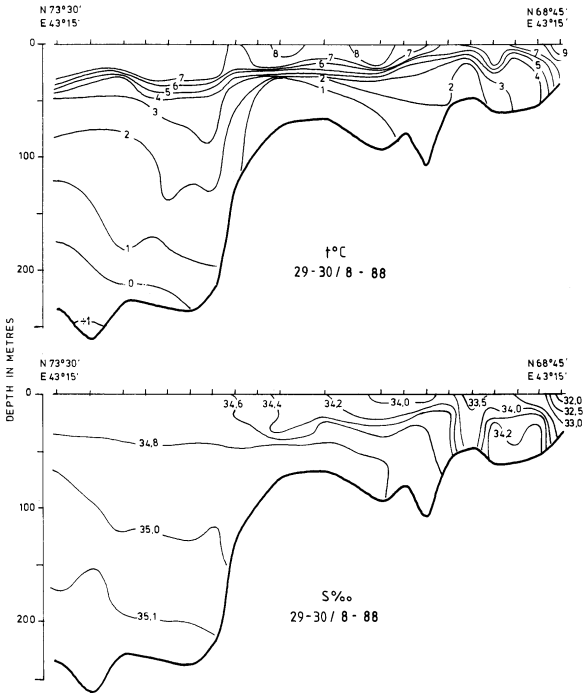

Fig. 11. Hydrographic section Cape Kanin-North. Temperature and salinity

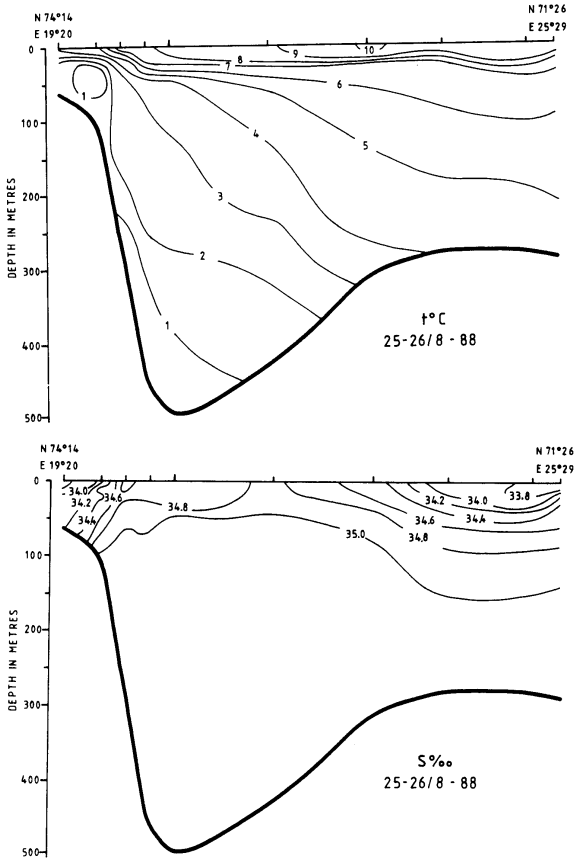

Fig. 12. Hydrographic section Bear Island-North Cape. Temperature and salinity

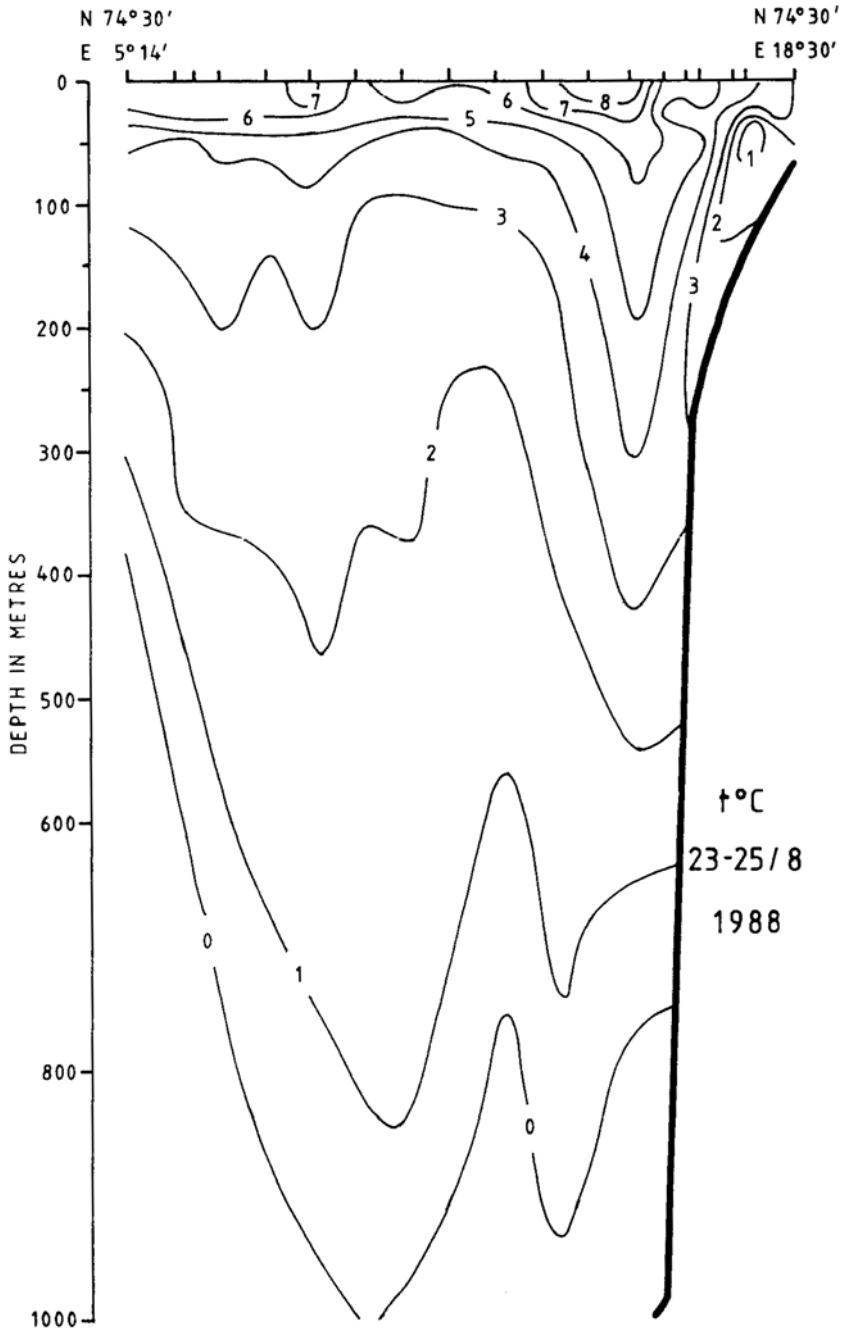

Fig. 13 a. Hydrographic section Bear Island-West. Temperature

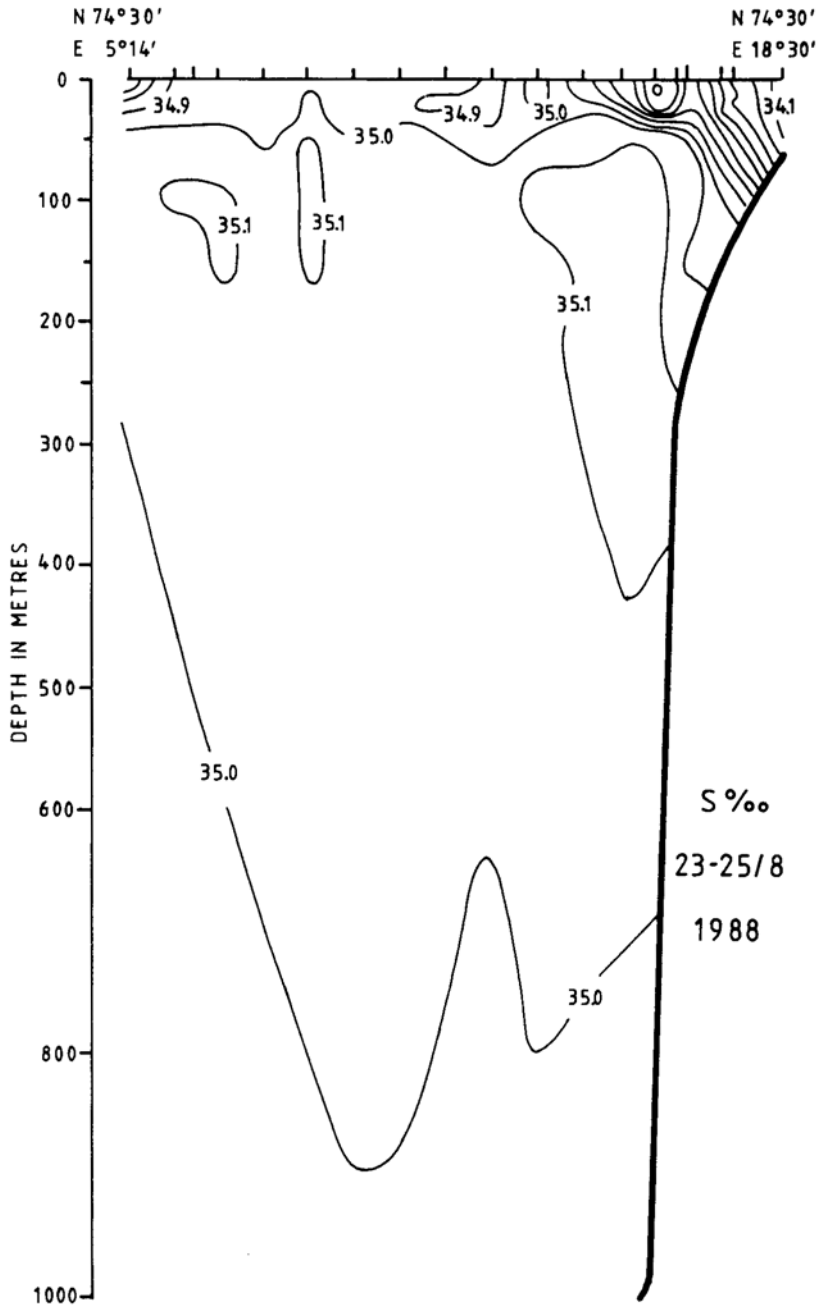

Fig. 13 b. Hydrographic section Bear Island-West. Salinity

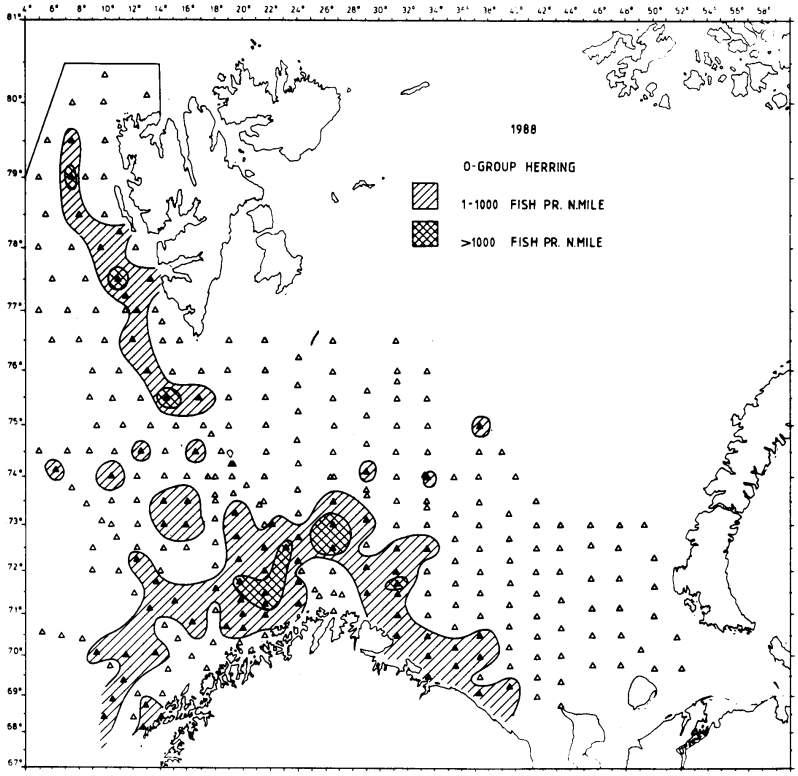

Fig. 14. Distribution of 0-group herring

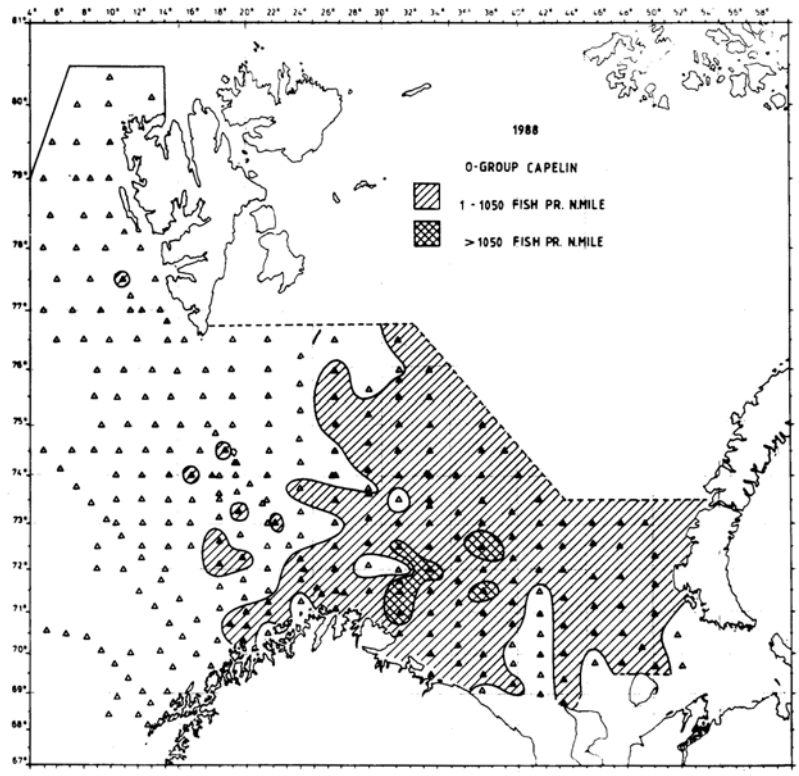

Fig. 15. Distribution of 0-group capelin

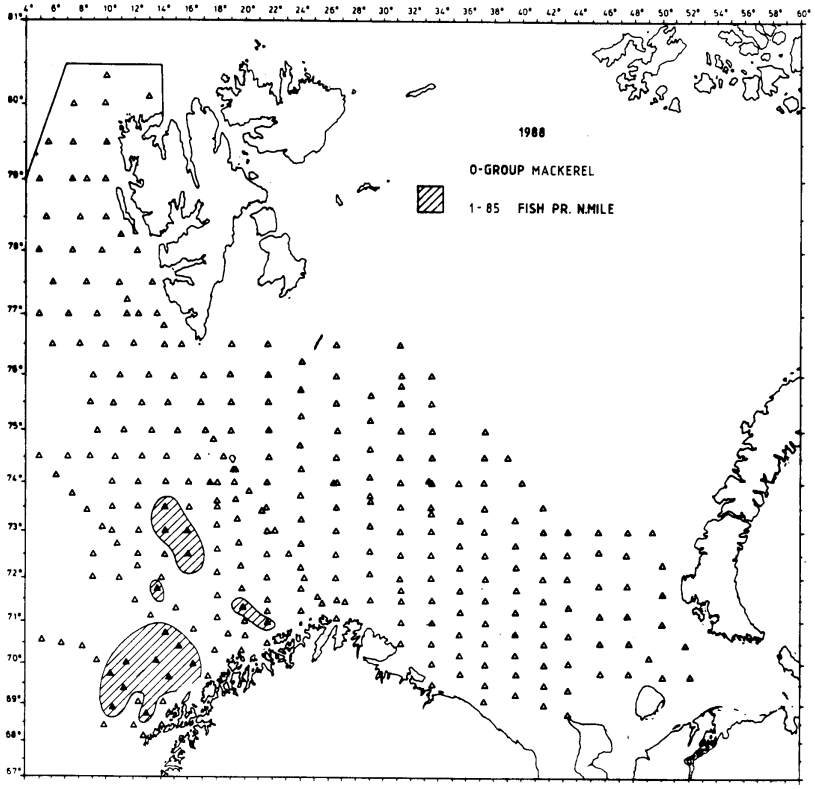

Fig. 16. Distribution of 0-group mackerel

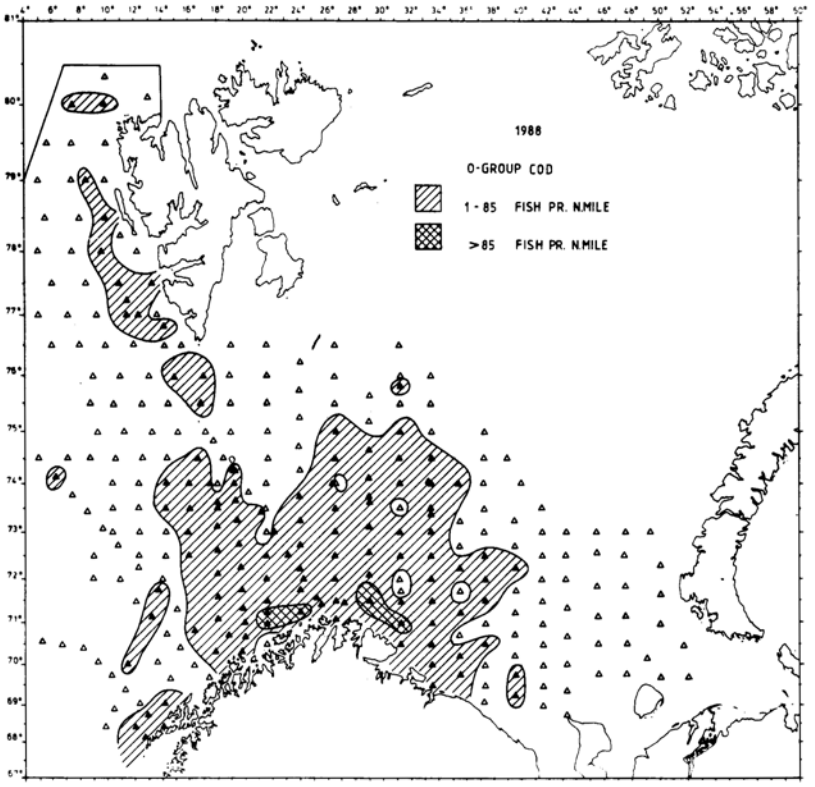

Fig. 17. Distribution of 0-group cod

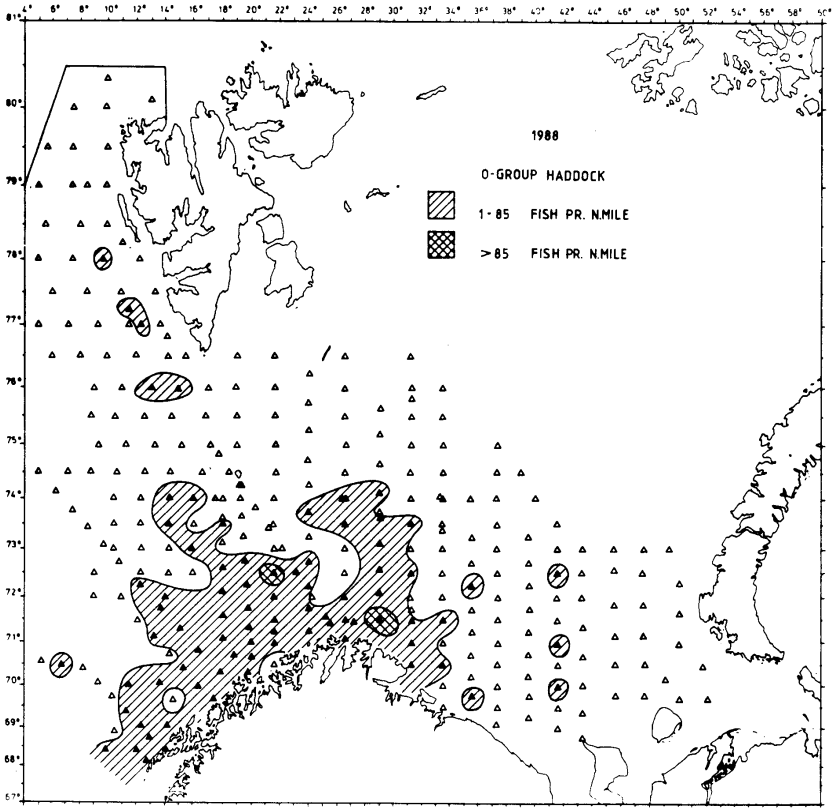

Fig. 18. Distribution of 0-group haddock

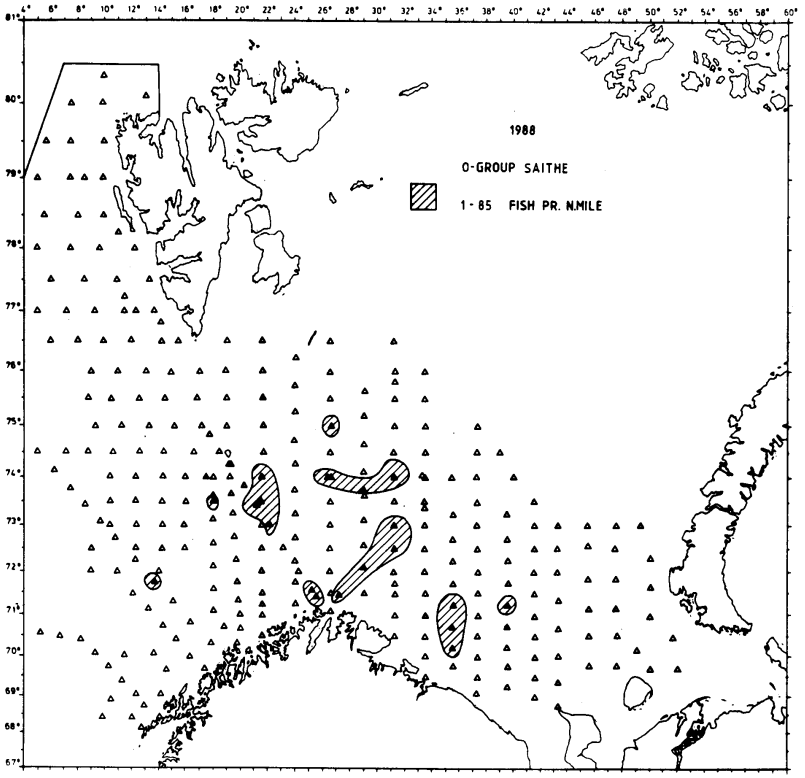

Fig. 19. Distribution of 0-group saithe

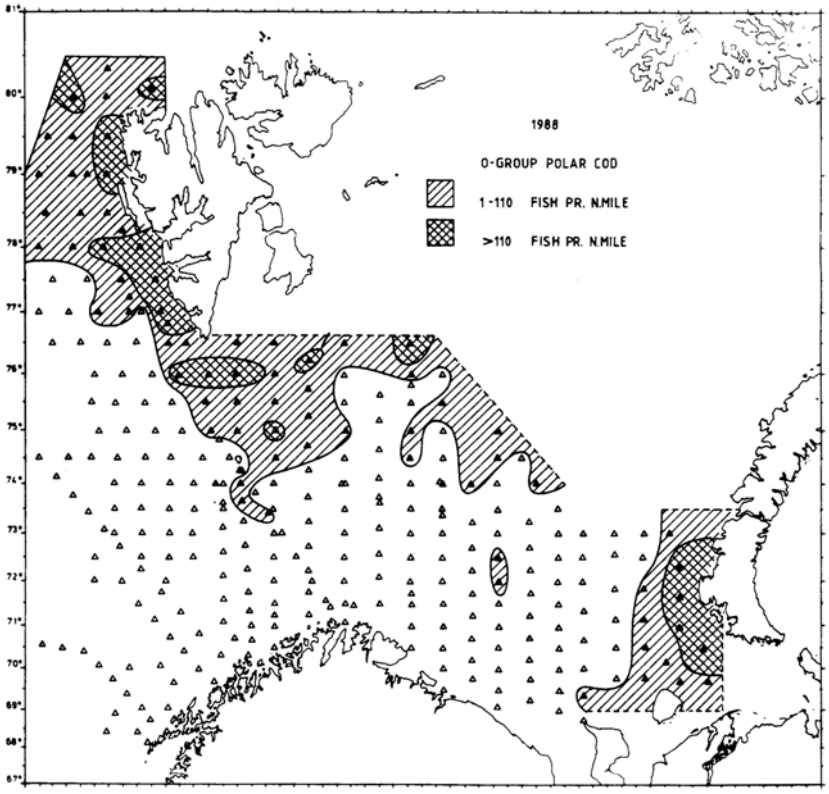

Fig. 20. Distribution of 0-group polar cod

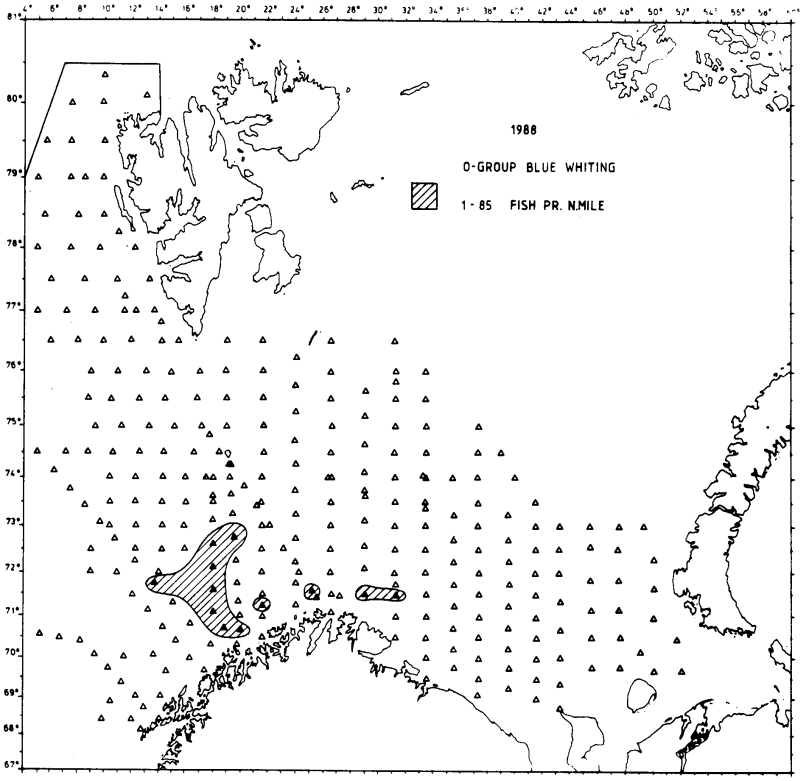

Fig. 21. Distribution of 0-group blue whiting

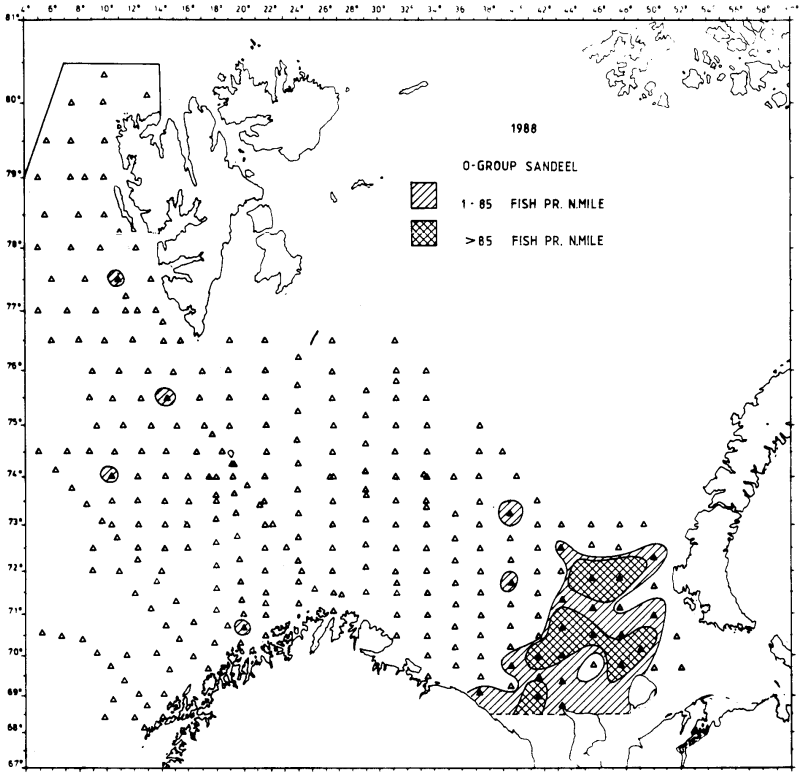

Fig. 22. Distribution of 0-group sandeel

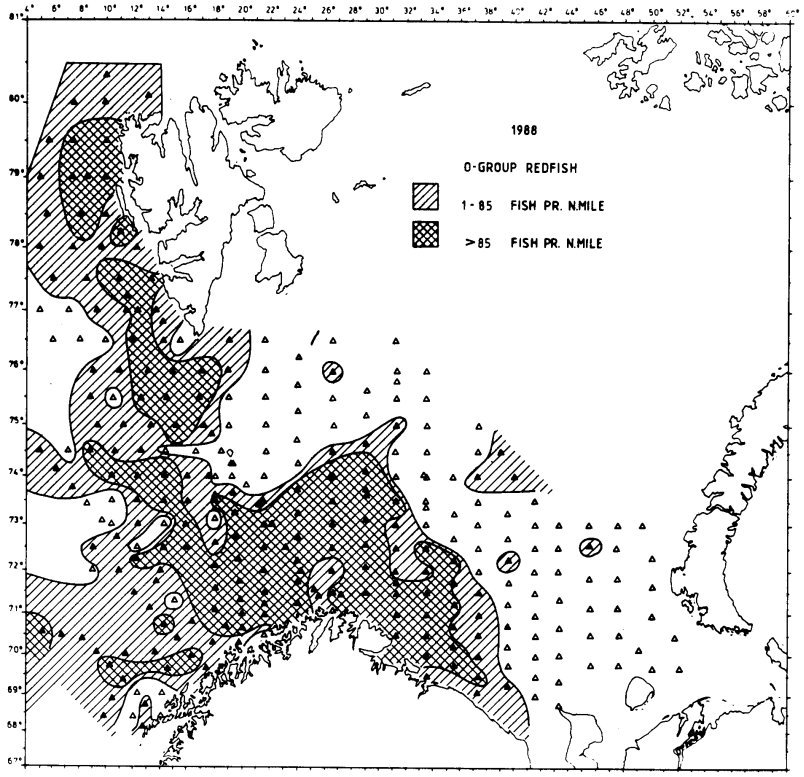

Fig. 23. Distribution of 0-group redfish

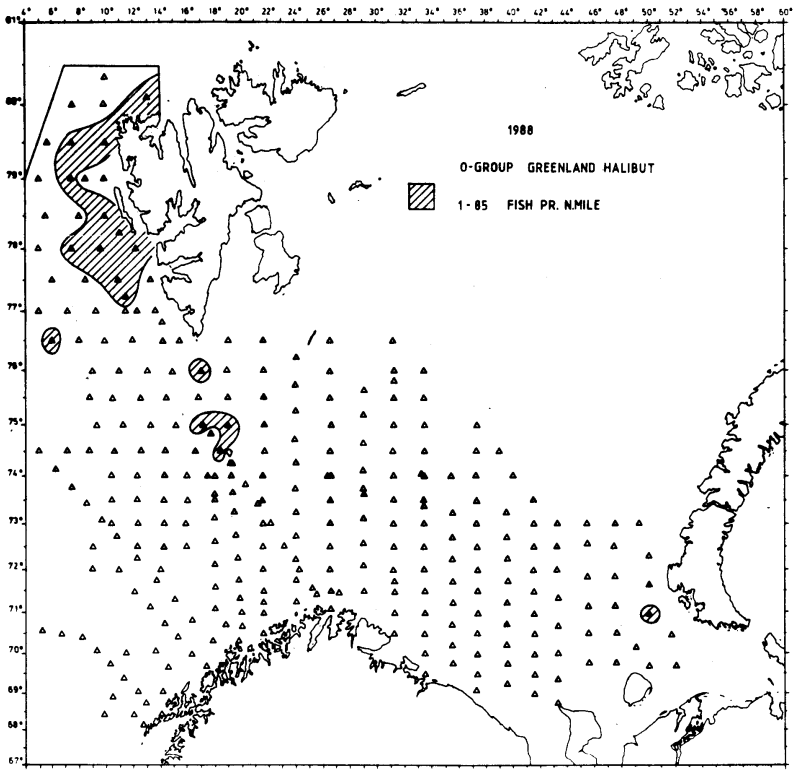

Fig. 24. Distribution of 0-group Greenland halibut

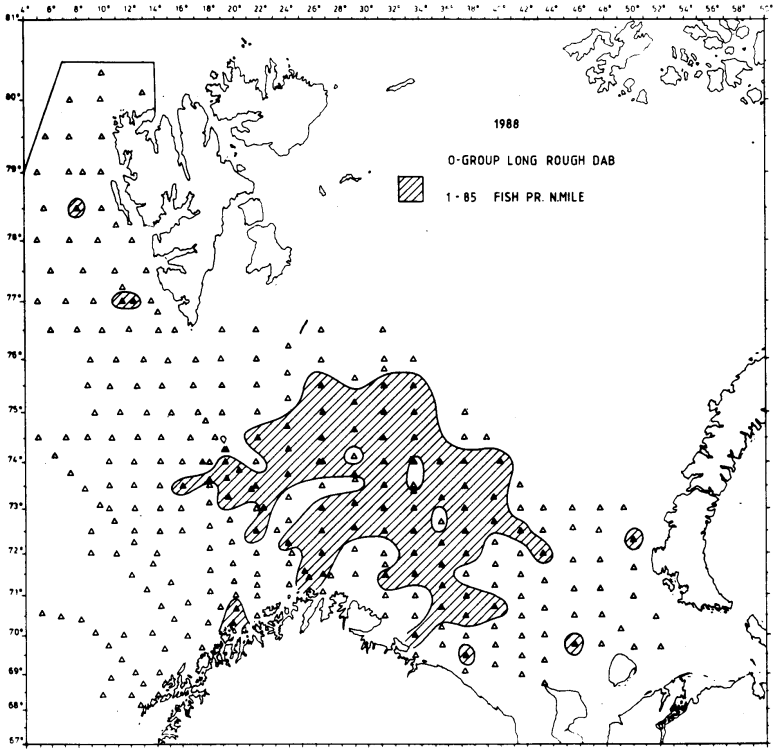

Fig. 25. Distribution of 0-group long rough dab

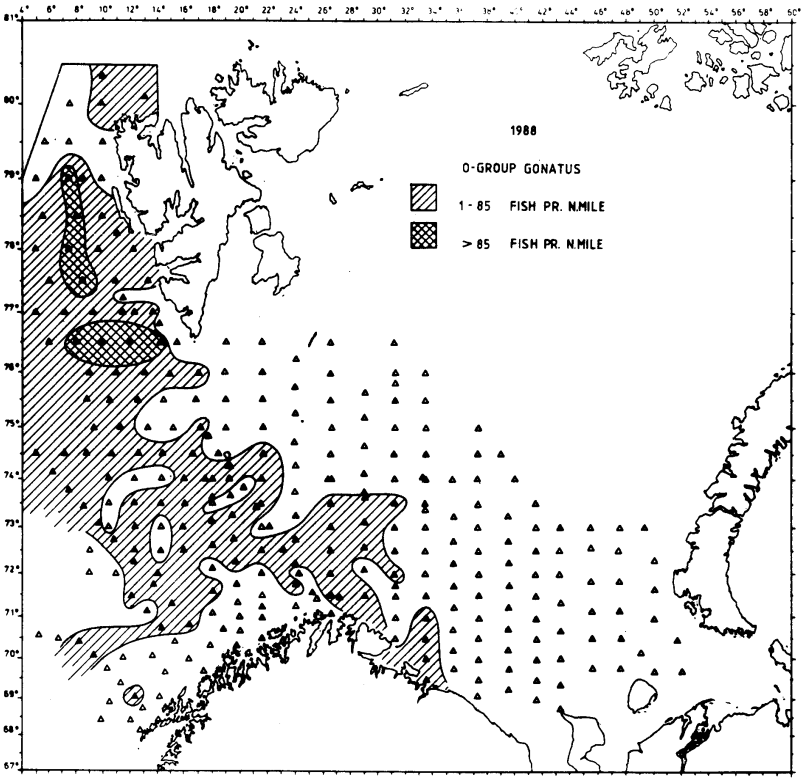

Fig. 26. Distribution of 0-group Gonatus fabricii

Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1989

The twenty-fifth annual International 0-group fish survey was made during the period 21 August-11 September 1989 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey period	Research Institute
Norway	"Eldjarn"	22 August-11 September	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	21 August-11 September	"
Norway	"Michael Sars"	22 August-11 September	"
USSR	"Professor Marty"	20 August-8 September	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
USSR	"PINRO"	20 August-9 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 11-12 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 hydrographical 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 1989 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 30-40 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 miles was made when 0-group fish layer was recorded deeper than 60 m on the echo-sounder.

Survey tracks and hydrographical stations are given in Fig. 1. Trawl stations with and without catch are given on the distribution charts in Figs. 16-28, as filled and open symbols respectively. The density grading is based on catch in number per 1.0 nautical mile trawling.

Hydrography

Hydrographic observations were made along all the survey tracks with 30-40 nautical miles between stations.

Horizontal temperature and salinity distribution are shown for 0, 50, 100 and 200 m depth (Figs. 2-11). Figs. 12-15 show the temperature and salinity conditions in the Kola, Cape Kanin, Bear Island-North Cape and Bear Island-West sections. The mean temperature for parts of these sections is listed in Table 1.

Hydrographic observations were made along all the survey tracks with 30-40 nautical miles between stations.

Temperature and salinity conditions in the Kola, Cape Kanin, Bear Island and Bear Island - North Cape sections are shown in graphic form. The mean temperatures have been calculated for fixed parts of these sections in different layers (see Table 1).

Mean water temperatures in the Barents Sea and adjacent waters in late August-early September 1989 have increased compared to 1988 in all layers and are considerably above 1965-1989 normal. On the Kola section mean temperature in layers 0-50, 0-200 m reached the maximum for the whole period of observations (since 1965). Together with this, a decrease in salinity was observed in layer 0-500 m west of Bear Island. A similar decrease was observed on Kola and Cape Kanin sections in all layers.

Distribution and anbudance of 0-group fish and Gonatus fabricii

Geographical distributions of 0-group fish are shown as shaded areas in Fig. 16-27, and of Gonatus fabricii in Fig. 28. 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 weighed by 10, are given in Table 2. Another set of abundance indices are given for 0-group herring, cod and haddock (Table 3) as decribed 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. 16)

0-group herring was caught on a far larger number of stations than has been observed during these surveys since 1983. However, the number of specimens caught in each station was low leading to a logarithmic index of 0.59. This value is slightly higher than for the 1984 and 1985 year-classes, but is considerable lower than the index of the 1983 year-class, estimated to 1.77.

Capelin (Fig. 17)

The area of distribution and the overall density is similar to what was recorded in 1983 and 1984, indicating that the 1989 year-class may be as abundant as the year-classes in the mid-eighties. However, according to the great variation in numbers of 0-group capelin in the catches, it must be stressed that an index of the year-class strength of capelin is not as reliable as for other species.

Mackerel (Fig. 18)

Some 0-group mackerel were caught in the south-western part of the survey area. No abundance index has been calculated.

Cod (Fig. 19)

The distribution of cod this year follow the same pattern as last year in the western and central part of the area. In the eastern part there is a separate distribution of cod close to Novaya Zemlya, and the main distribution also extend more to the south-east. The largest concentrations are found in this extension, but the indices calculated this year are only just above the indices of 1988. The logarithmic index is almost the same as in 1988 but the distribution index is about the average of the 1983 index and those found in 1987 and 1988.

Haddock (Fig 20)

The distribution of haddock is somewhat different this year than last. Haddock is found to be distributed more to the north-east and there is practically no haddock in the south-western waters. The indices show the same picture as for cod, the logarithmic index being almost equal to that of 1988 and the distribution index slightly above that of 1987 and 1988.

Saithe (Fig 21)

Only a few catches of single fishes of saithe were obtained and these are given in the map. No index have been calculated.

Polar cod (Fig. 22)

As observed earlier, 0-group polar cod was observed in two separated areas, off Spitsbergen and in the south-eastern part of the Barents Sea. However, the concentrations this year was very spare indicating the 1989 year-class to be a weak one.

Blue whiting (Fig. 23)

Only a few catches o-f blue whiting were obtained and these are shown in the map. No index have been calculated.

Sandeel (Fig 24)

The catches of sandeel were smaller this year than in 1968. Also the distribution area is smaller than last year. No index have been calculated.

Redfish (Fig 25)

The area of dense distribution of redfish is considerable smaller this year than last. In 1966 the redfish-distribution was extending far to the east with high concentrations and the redfish was dominant in the trawl catches in most of this area. This year redfish did not dominate the catches and the main concentrations are found in the currents going north along the western side of Spitsbergen and in the current going east along the Norwegian coast. The distribution index is about the level of 1966 indicating a somewhat above average year-class.

Greenland halibut (Fig 26)

Very few Greenland halibut were caught and the index is very low indicating a very weak year-class.

Long rough dab (Fig 27)

Also this year the index of long rough dab is very, indicating a weak year-class. The distribution is somewhat more to the north-west than in 1966.

Gonatus fabricii (Fig. 28)

Also this year concentrations of Gonatus fabricii with relative high abundance are found in the western area. The distribution do not reach as far to the south-east as last year.

References

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. Exolor. 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 1987

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	0-50 m	50-200 m	0-200 m	0-bottom	0-bottom	0-200 m	0-200 m
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
1987	6.2	3.3	3.9	2.6	2.5	5.2	3.9
1988	7.1	3.7	4.5	3.9	2.9	5.5	4.2
1989	8.6	4.8	5.8	6.5	3.4	6.9	4.9
Average 1965-1989	7.3	3.7	4.6	4.2	3.3	5.7	4.4

Table 2. Abundance indices

Species Year	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab
			West		East			
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	2	69
1980	49	54	79		247	651	12	108
1981	65	30	149		73	861	3	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
1987	102	72	17		155	631	41	174
1988	133	86	144		120	949	8	72
1989	202	112		247		698	5	92

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

Year-class	Herring [1)]			Cod			Haddock		
	Logarithmic index	Confidence limits		Logarithmic index	Confidencelimits		Logarithmic index	Confidence limits	
1965				+			0.01		
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
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	0.39	0.66	0.38	0.30	0.48	0.14	0.10	0.20

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

Appendix

Survey period	Research vessel	Research Institute	Participants
20 August- 8 September	"Professor Marli"	Polar Research Institute of Marine Fisheries and Oceanography, Murmansk	I.V Borkin, B. Filoffov, I. Dolgolenko, Y. Perepechaev, A. Shvagzhdis, V. Ulanov, A. Pedchenko, A. Cheremovsky, K. Drevetnyak, V. Khvastov, A. Shatilov.
20 August- 9 September	"Pinro"		V. Komlichenko, A. Kusmichov, E. Shamraj, A. Doronin, A. Badiqin, A. Dorchenkov, S. Lisovetq, S. Gotovtsev.
21 August- 11 September	"G.O. Sars"	Institute of Marine Research, Bergen	I.M. Beck, O.J. Gullaksen, H. Hammer, H. Loeng, L. Midthun, R. Pedersen, S.Rosseland, H. Sagen, R. Toresen,
22 August- 11 September	"Michael Sars"		B. Hofstad, B. Kvinge, A. M. Skorpen, S. Sundby. K. Sunnana, P. Agotnes.
22 August- 11 September	"Eldjarn"		I. Byrkjedal, T.I. Halland, K.A. Hansen, K. Hansen, A. Hylen, K. Lauvas, L. L0vheim, M. Mogster.

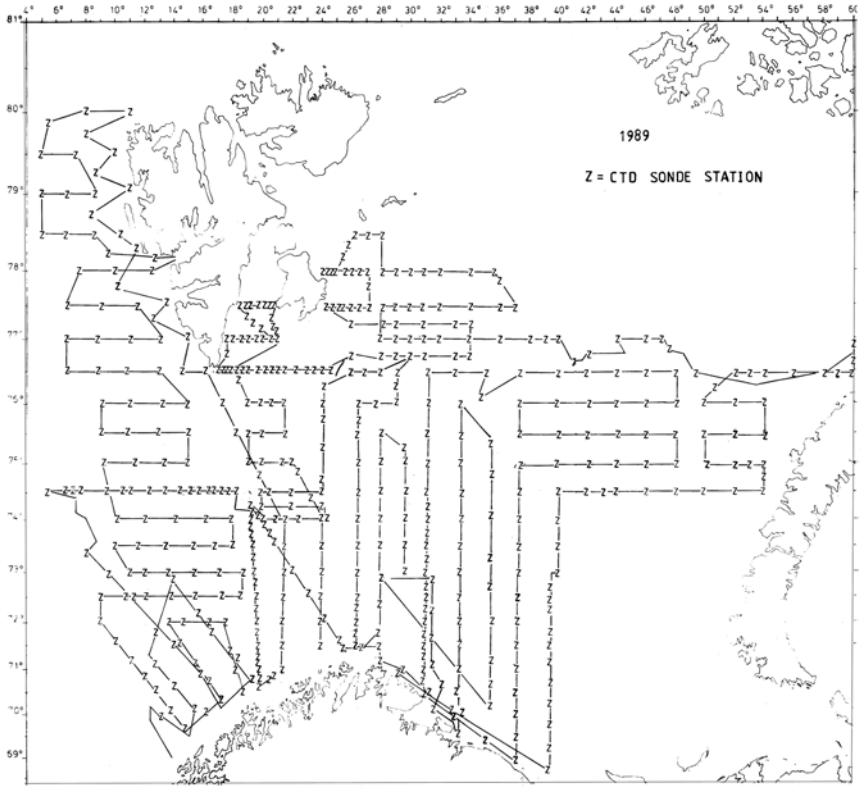

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

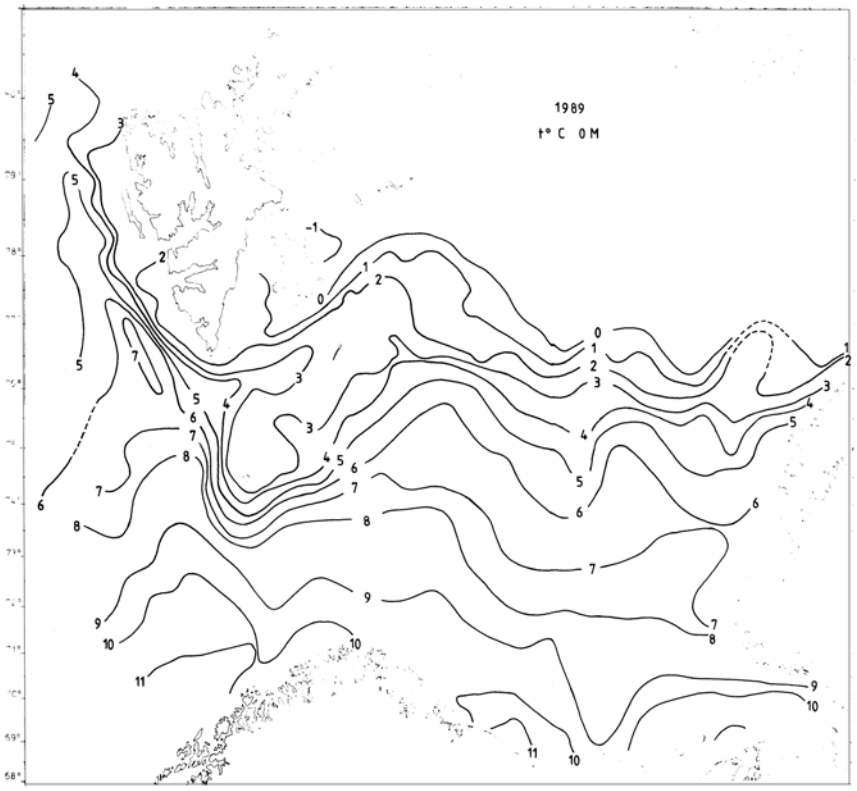

Fig. 2. Isotherms at 0 m

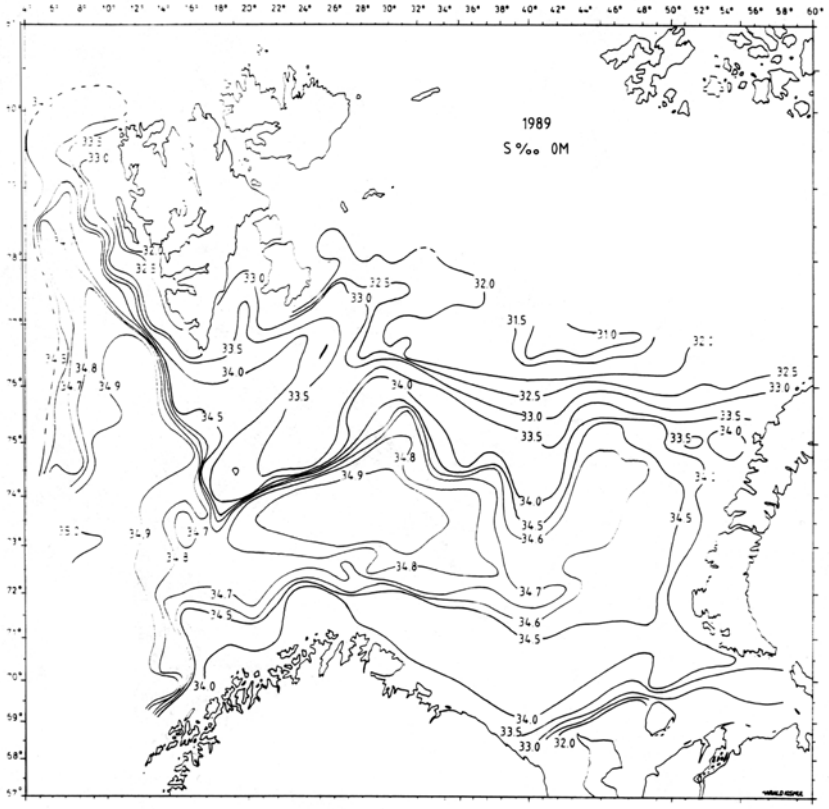

Fig. 3. Isohalines at 0 m

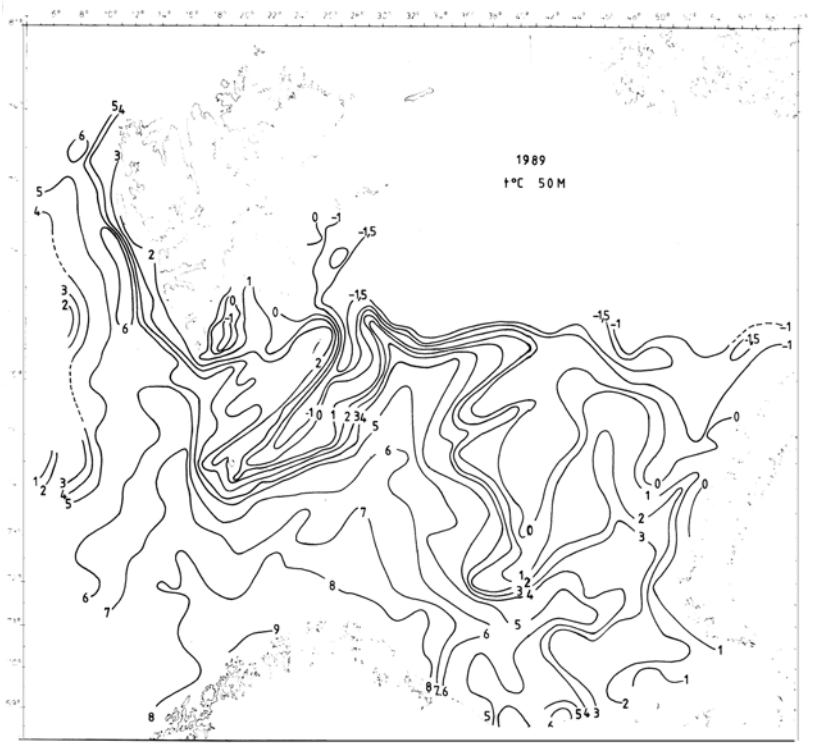

Fig. 4. Isotherms at 50 m

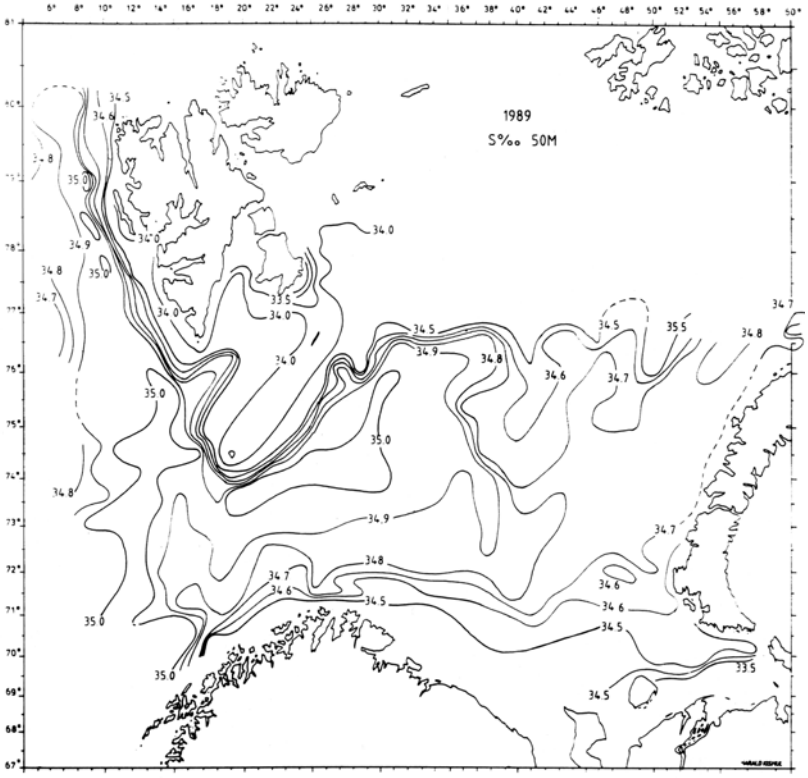

Fig. 5. Isohalines at 50 m

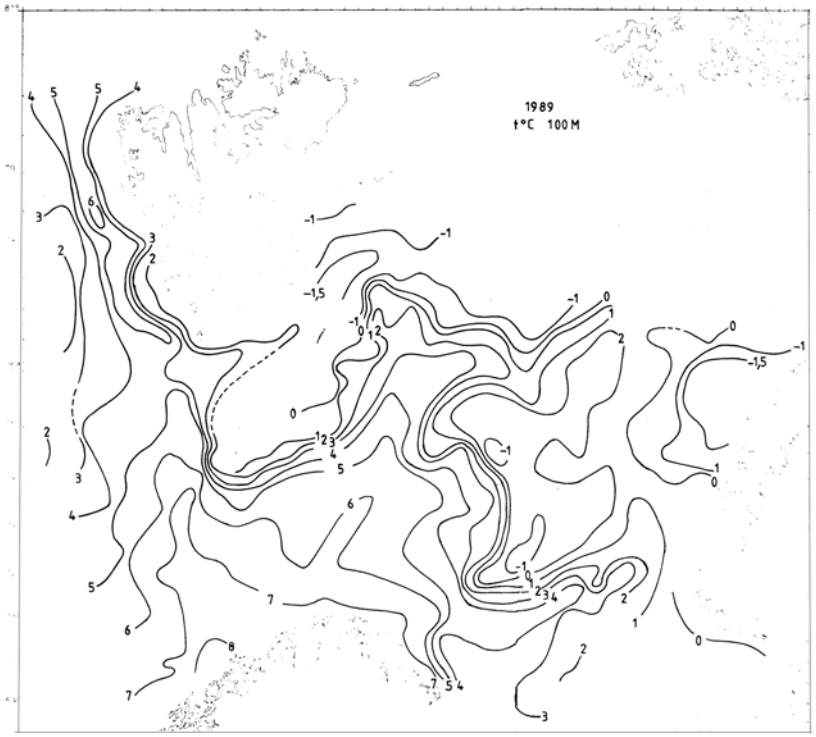

Fig. 6. Isotherms at 100 m

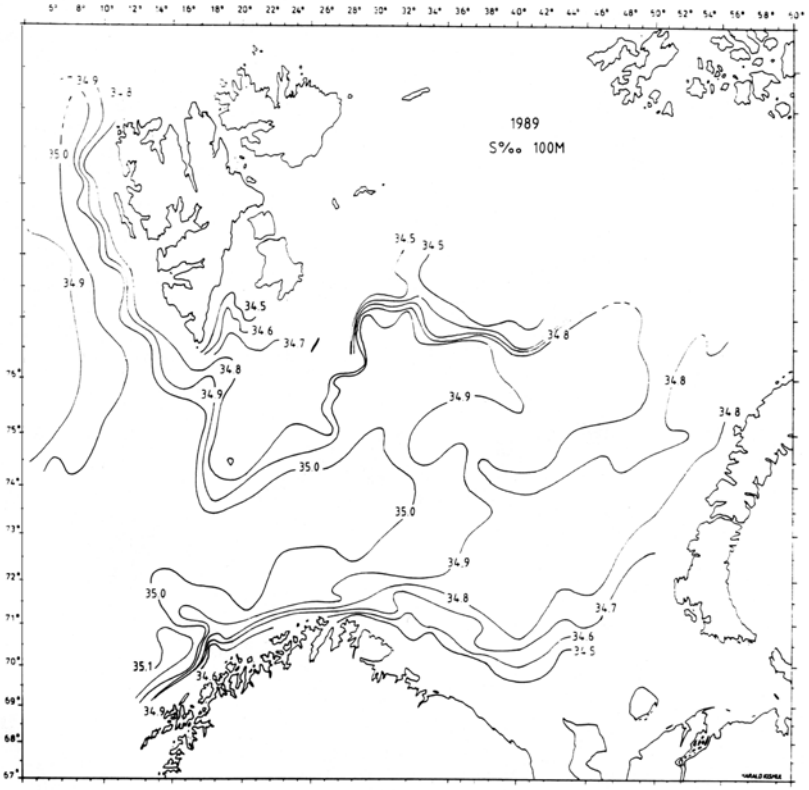

Fig. 7. Isohalines at 100 m

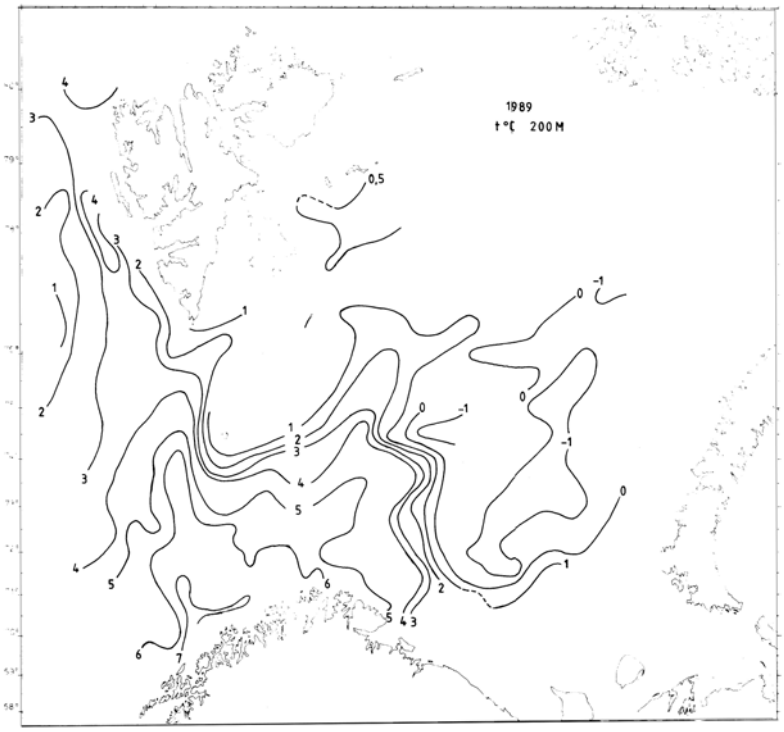

Fig. 8. Isotherms at 200 m

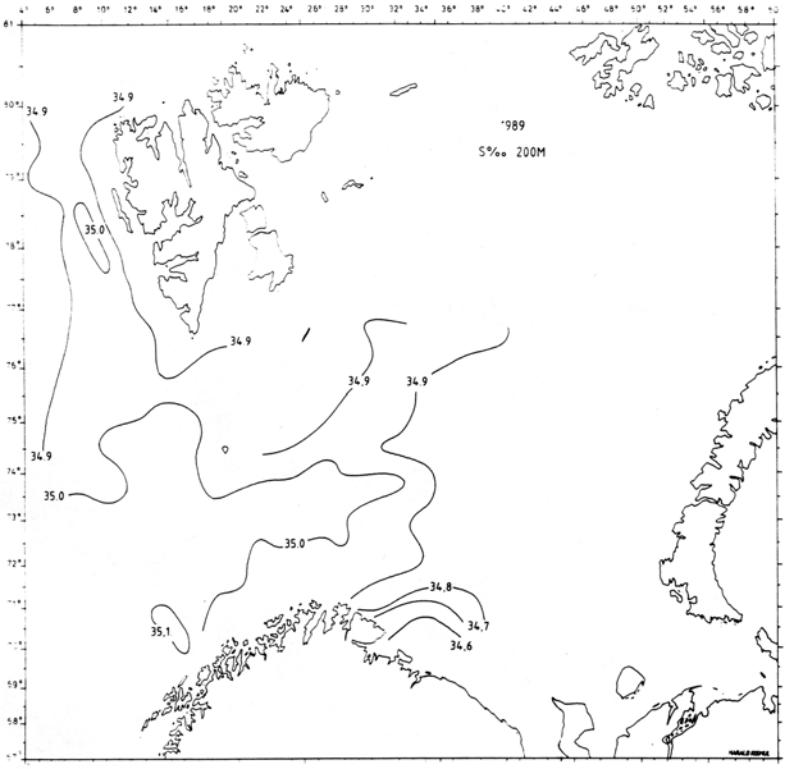

Fig. 9. Isohalines at 200 m

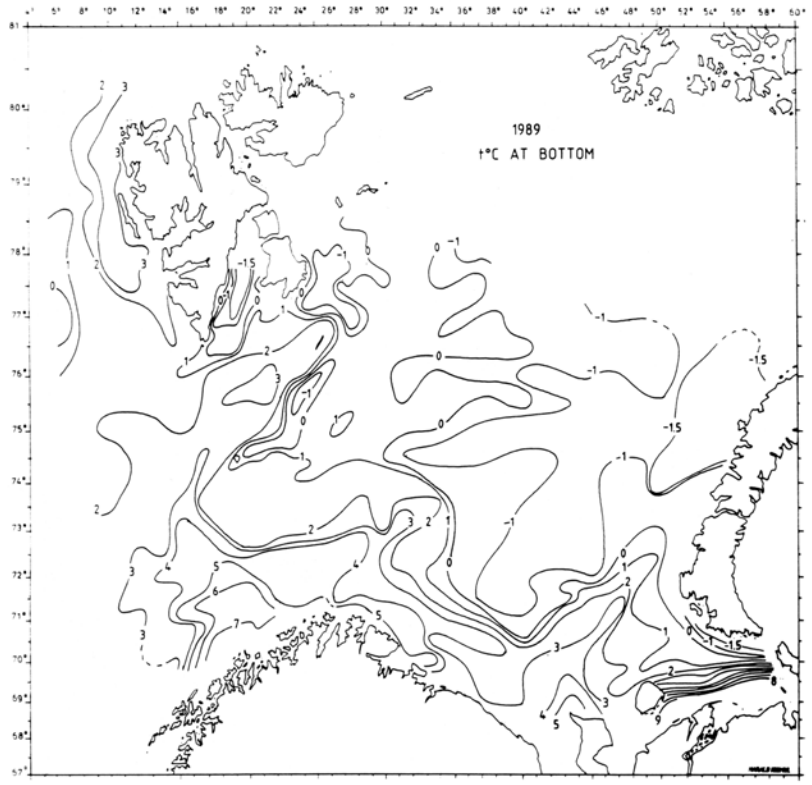

Fig. 10. Isotherms at bottom

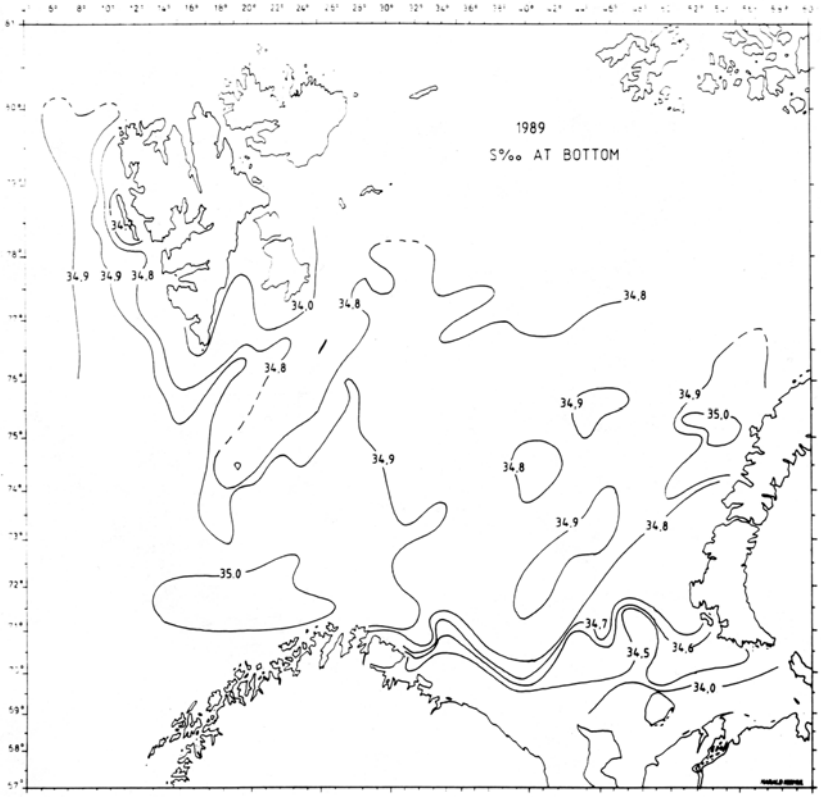

Fig. 11. Isohalines at bottom

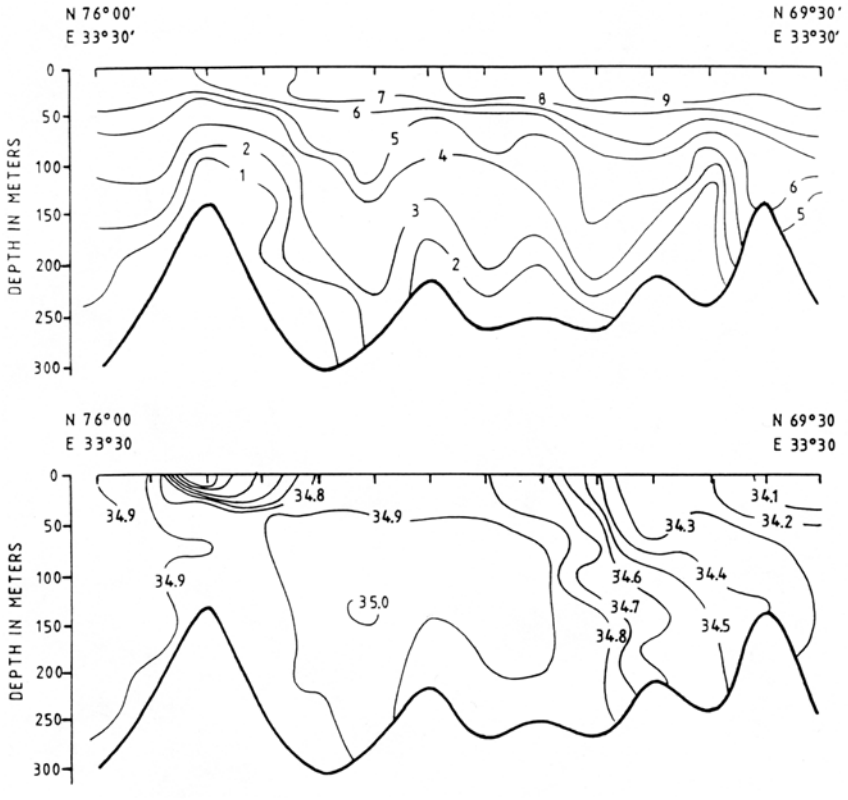

Fig. 12. Hydrographic section along the Kola meridian. Temperature and salinity

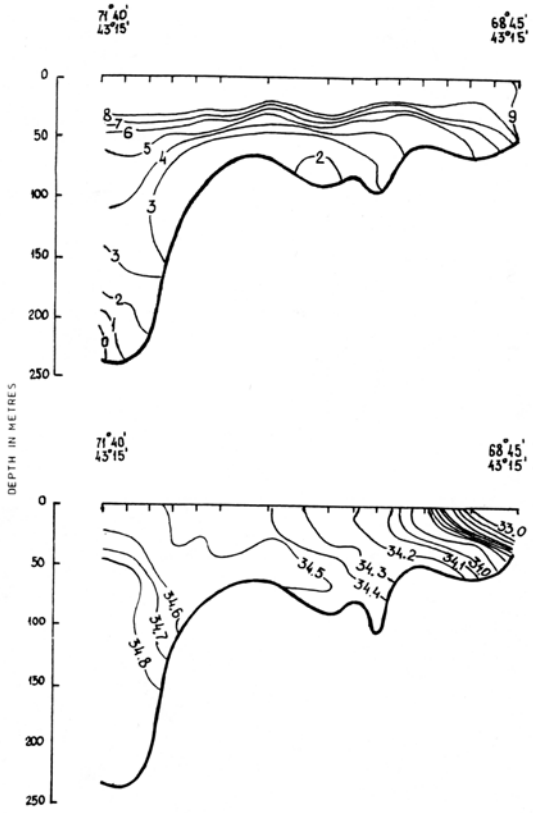

Fig. 13. Hydrographic section Cape Kanin-North. Temperature and salinity

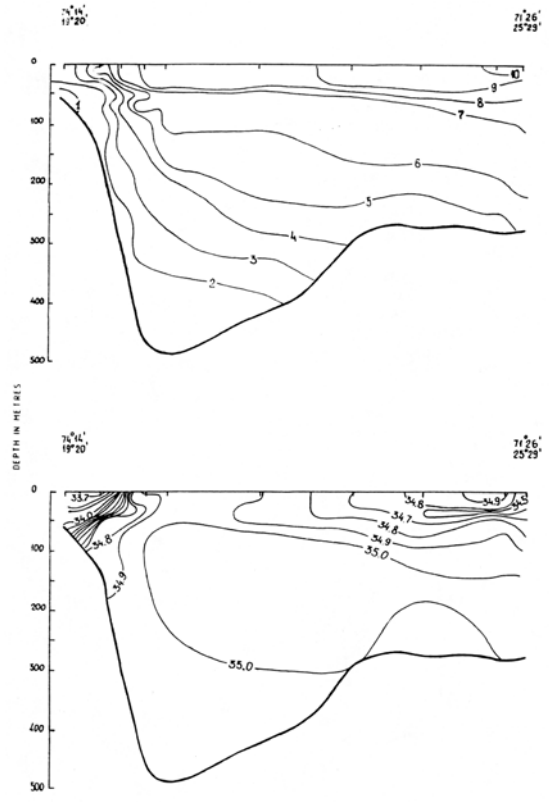

Fig. 14. Hydrographic section Bear Island-North Cape. Temperature and salinity

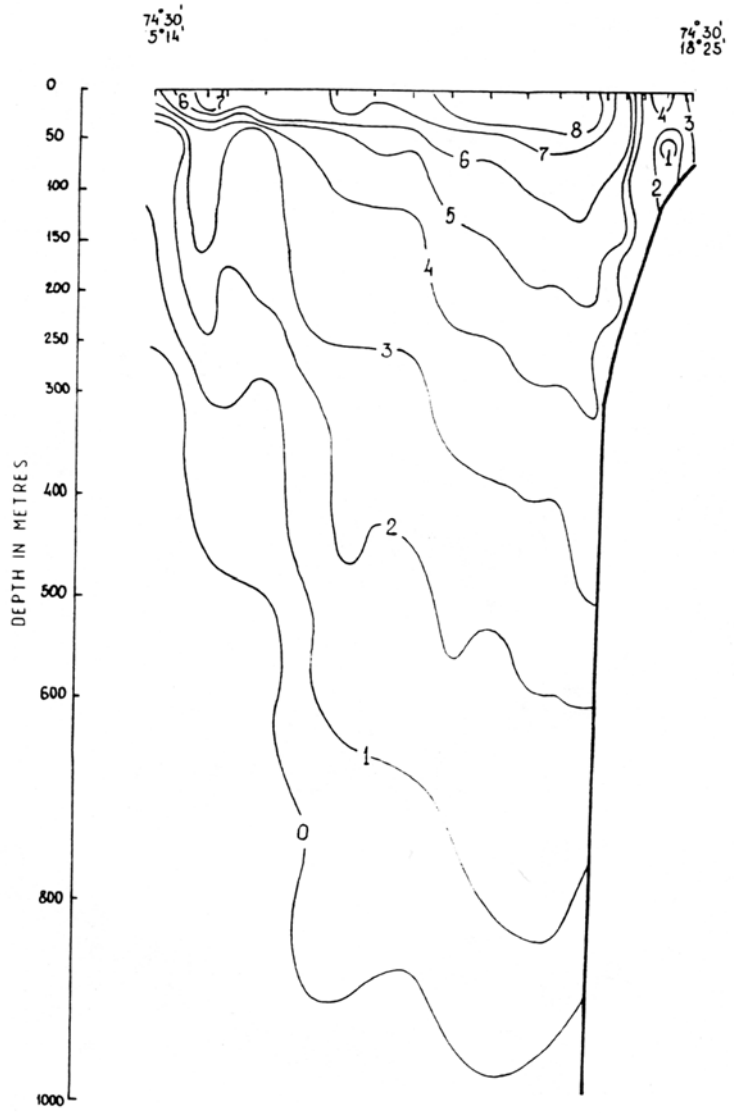

Fig. 15a. Hydrographic section Bear Island-West. Temperature

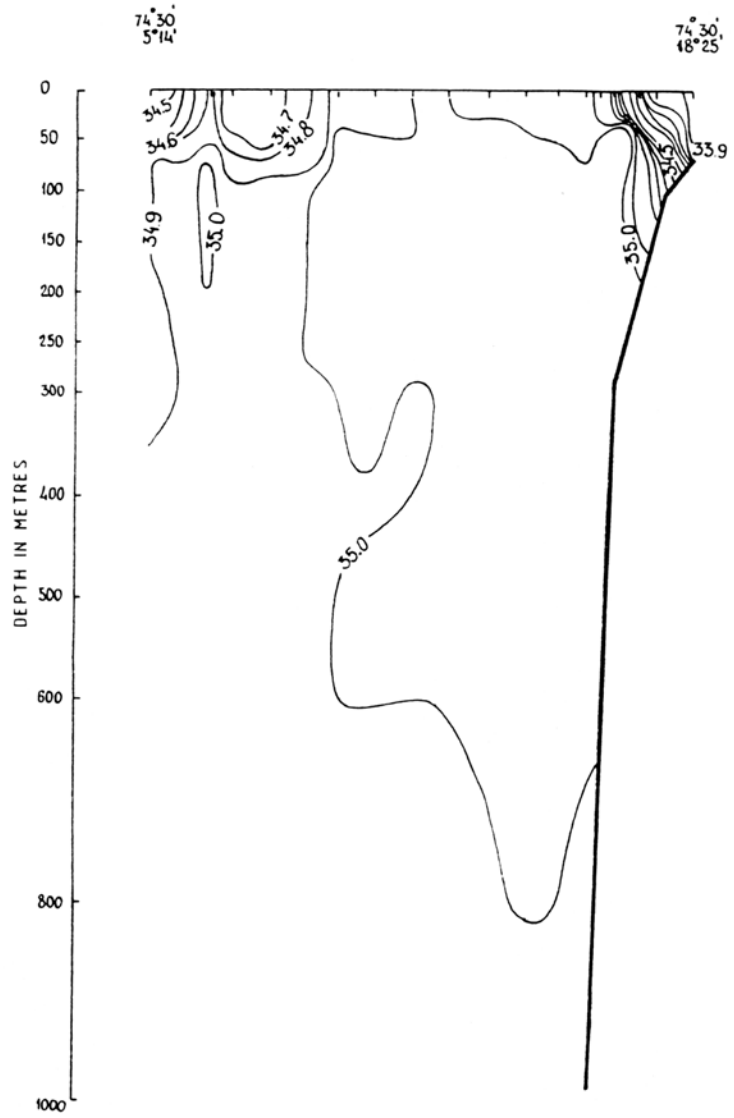

Fig. 15b. Hydrographic section Bear Island-West. Salinity

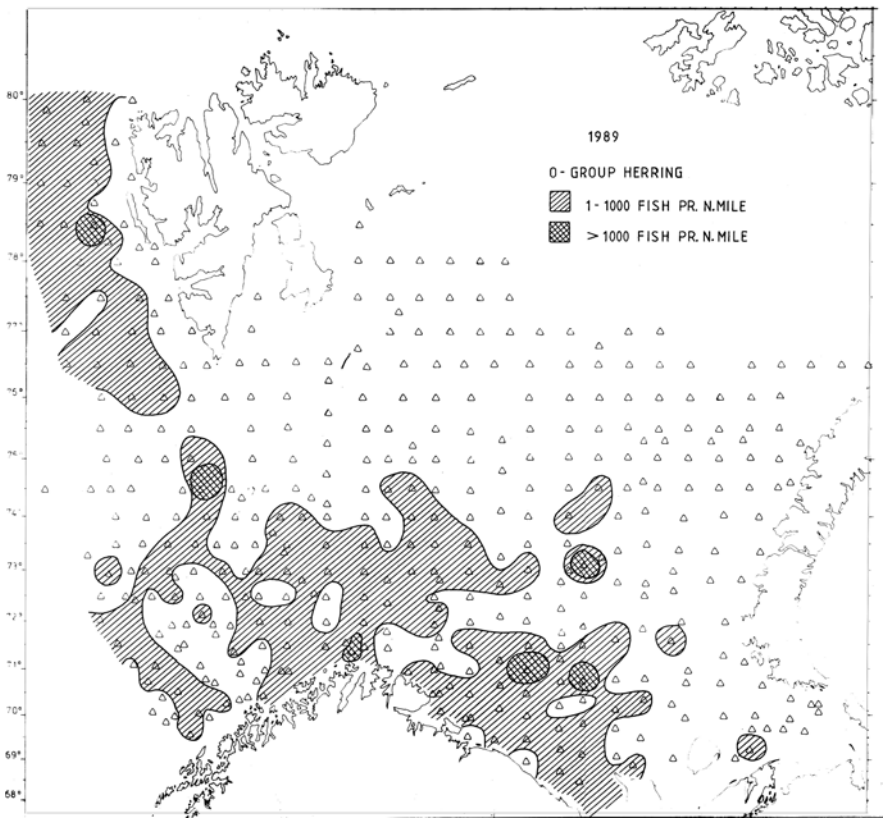

Fig. 16. Distribution of 0-group herring

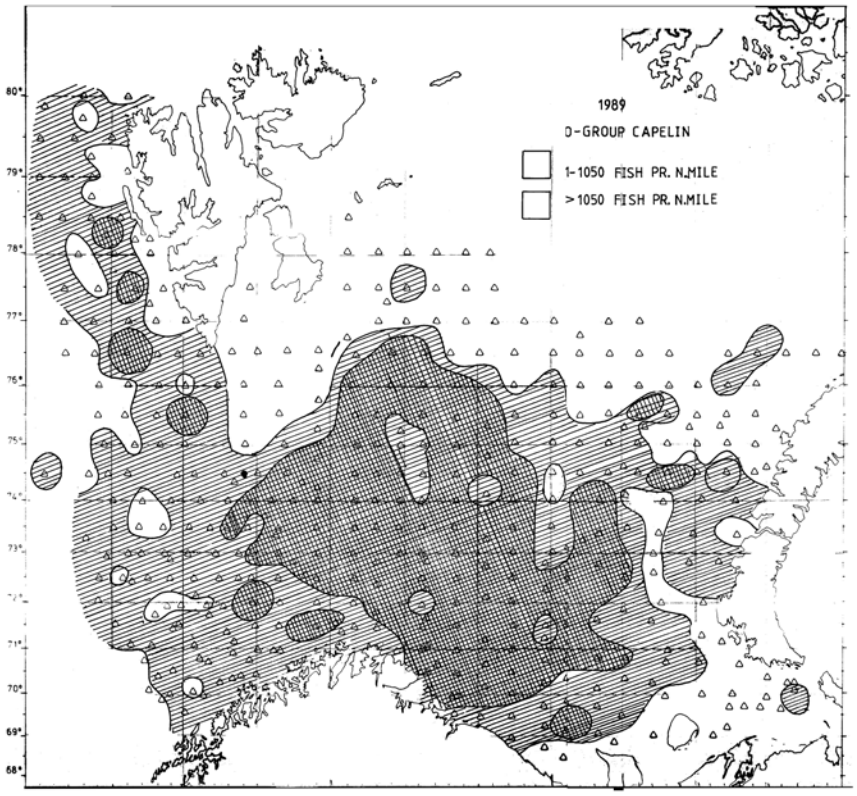

Fig. 17. Distribution of 0-group capelin

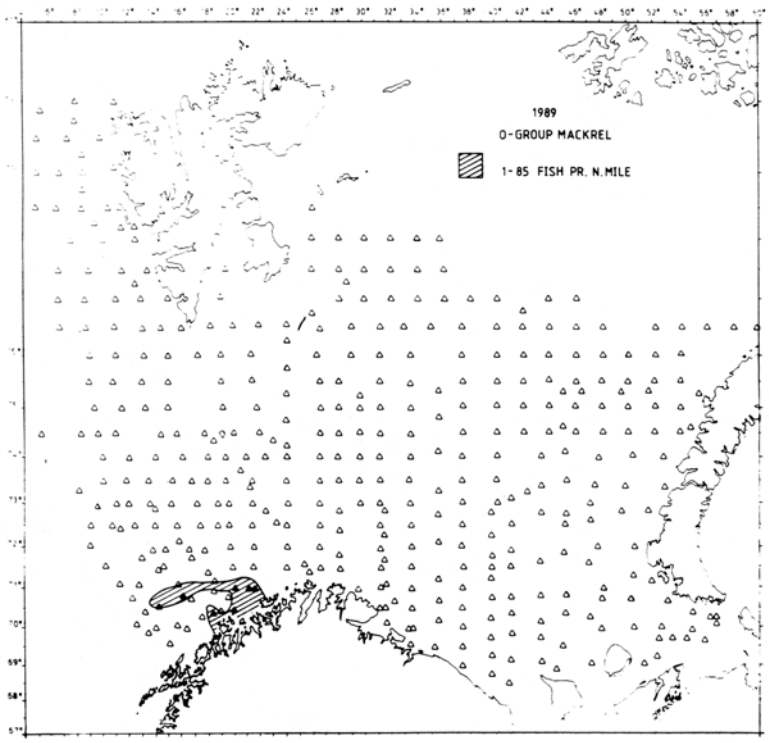

Fig. 18. Distribution of 0-group mackerel

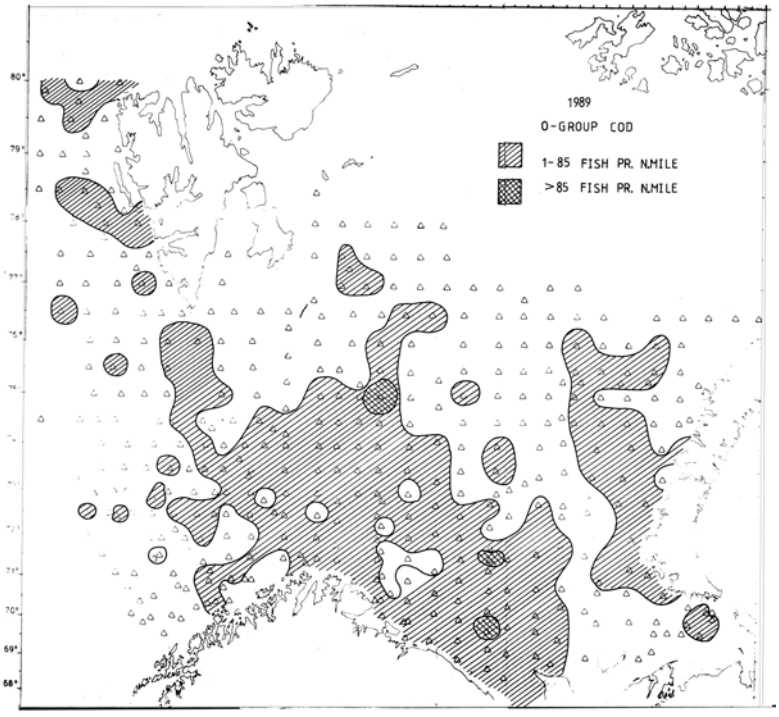

Fig. 19. Distribution of 0-group cod

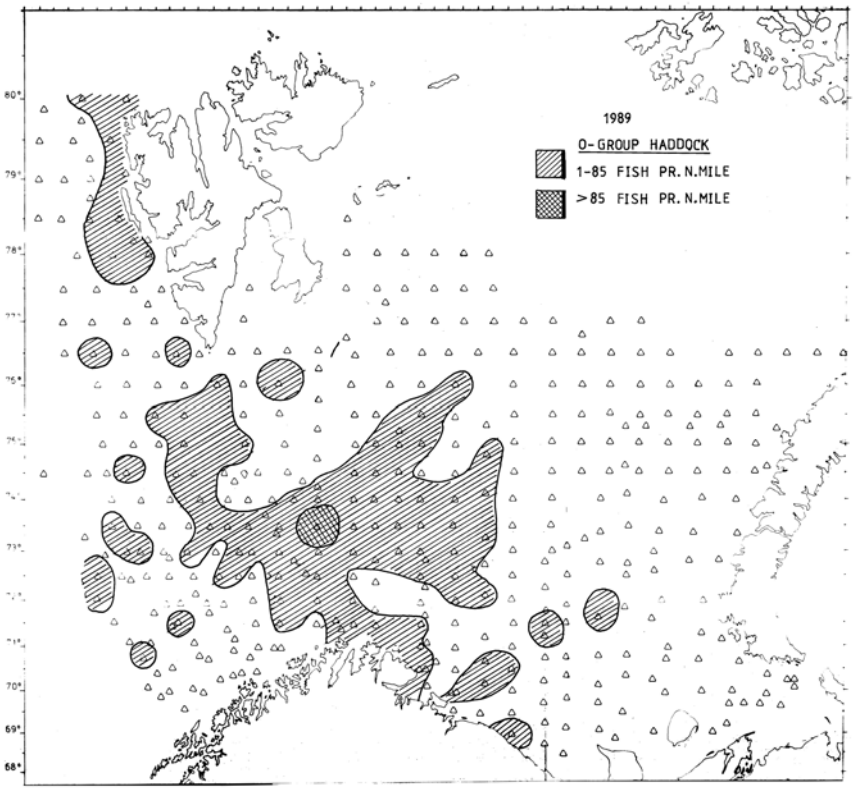

Fig. 20. Distribution of 0-group haddock

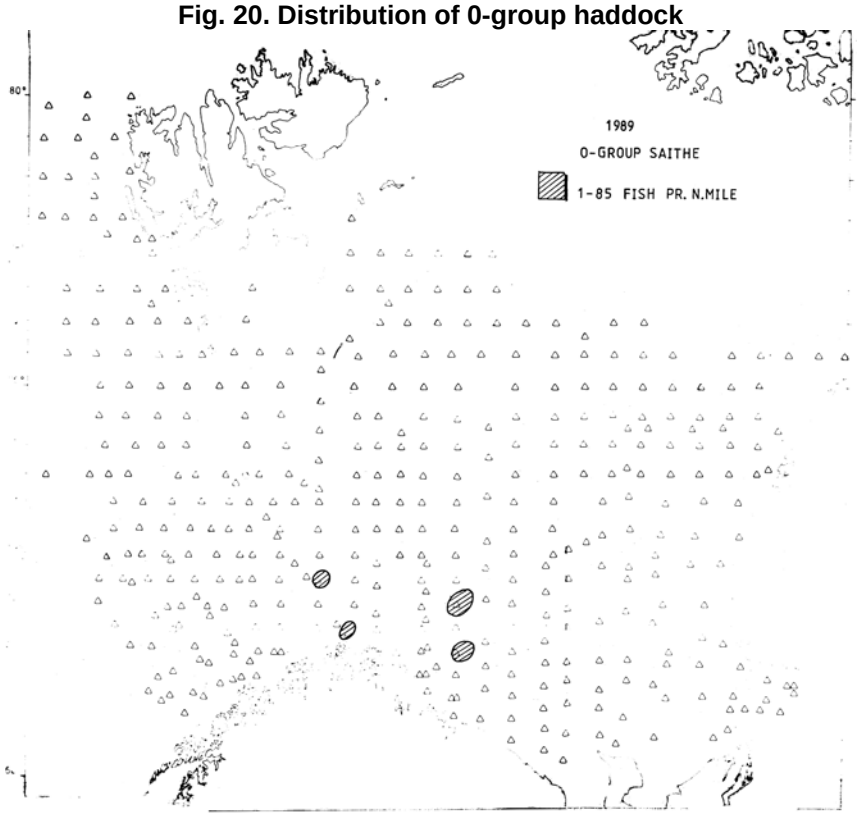

Fig. 21. Distribution of 0-group saithe

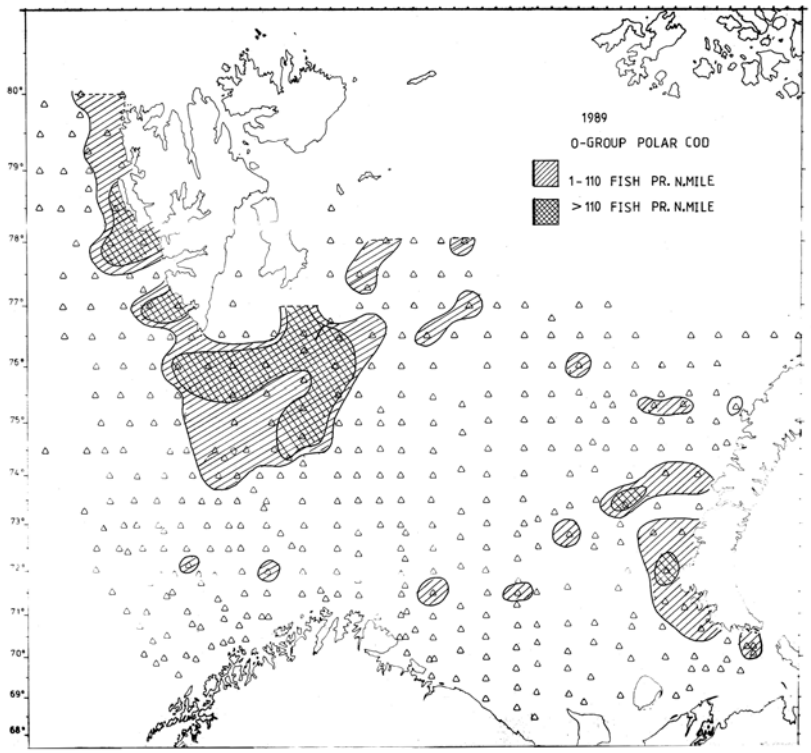

Fig. 22. Distribution of 0-group polar cod

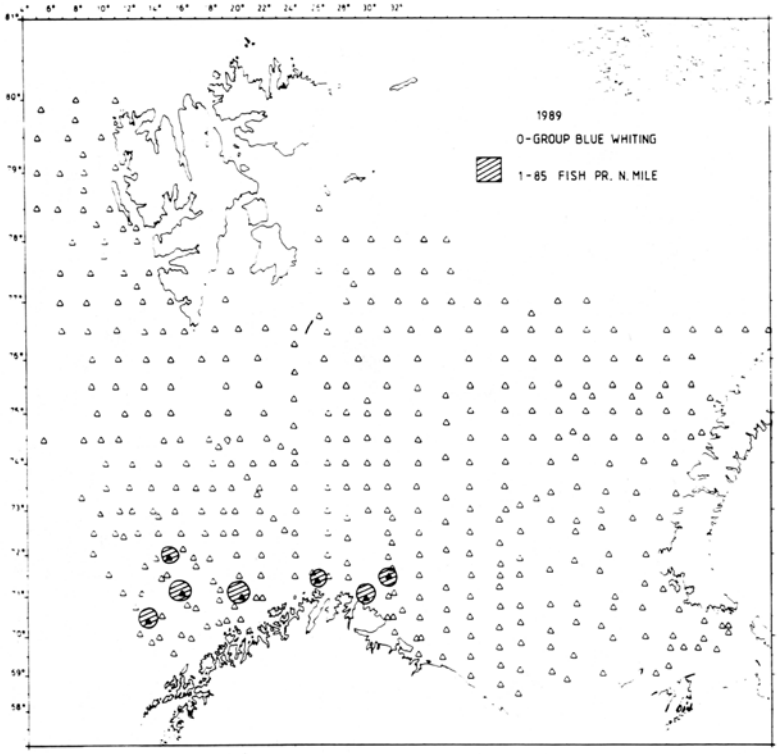

Fig. 23. Distribution of 0-group blue whiting

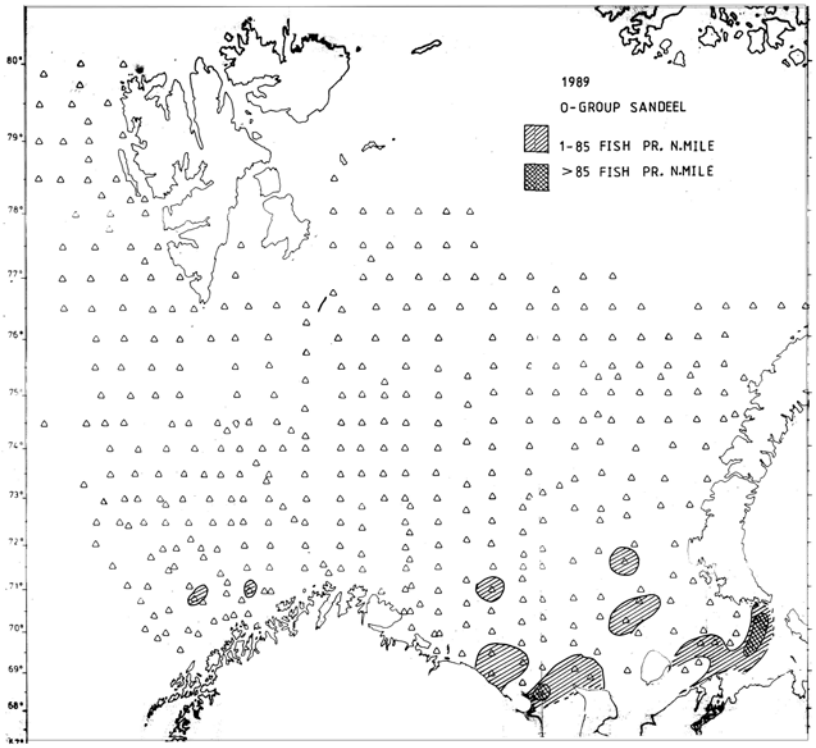

Fig. 24. Distribution of 0-group sandeel

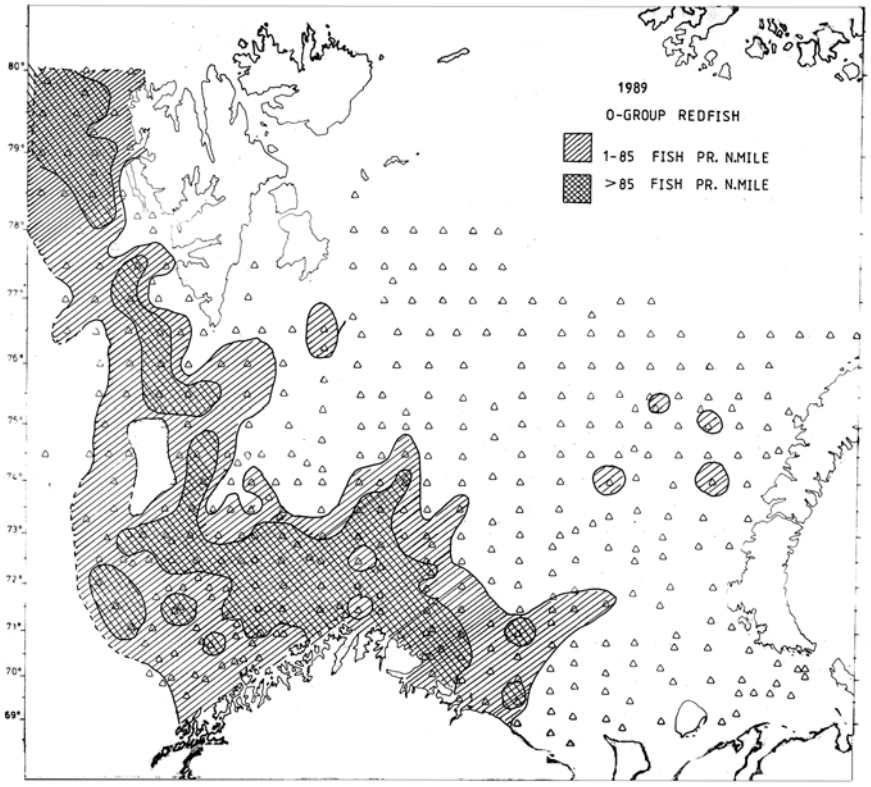

Fig. 25. Distribution of 0-group redfish

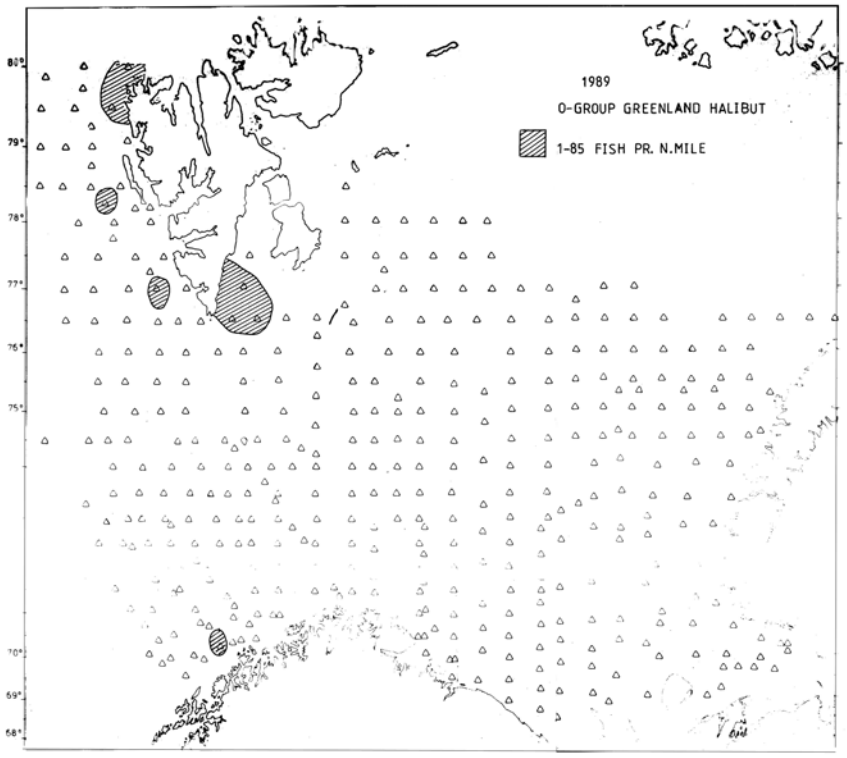

Fig. 26. Distribution of 0-group Greenland halibut

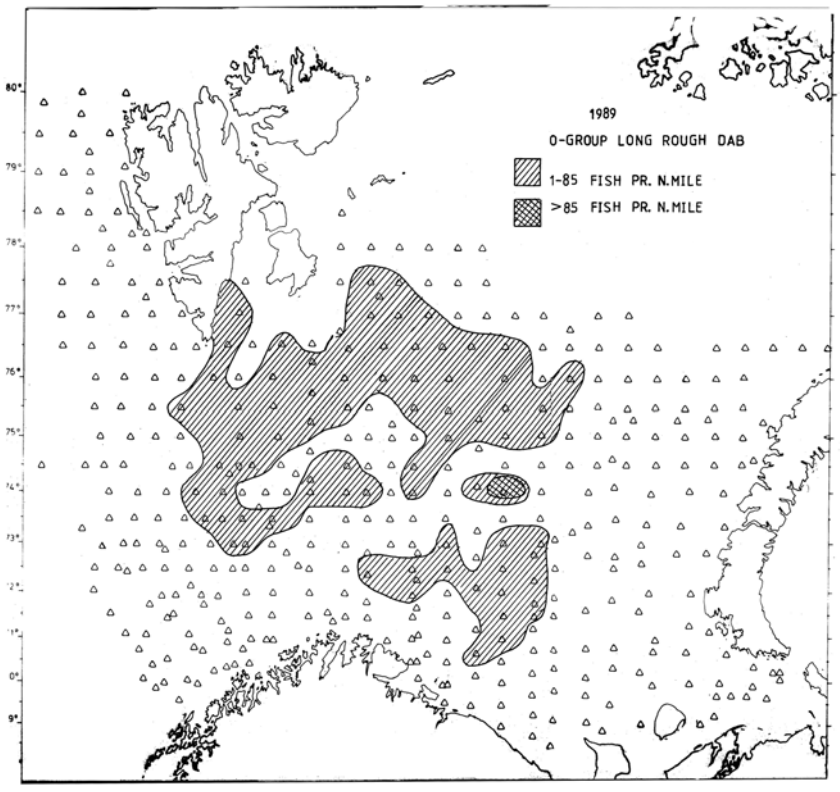

Fig. 27. Distribution of 0-group long rough dab

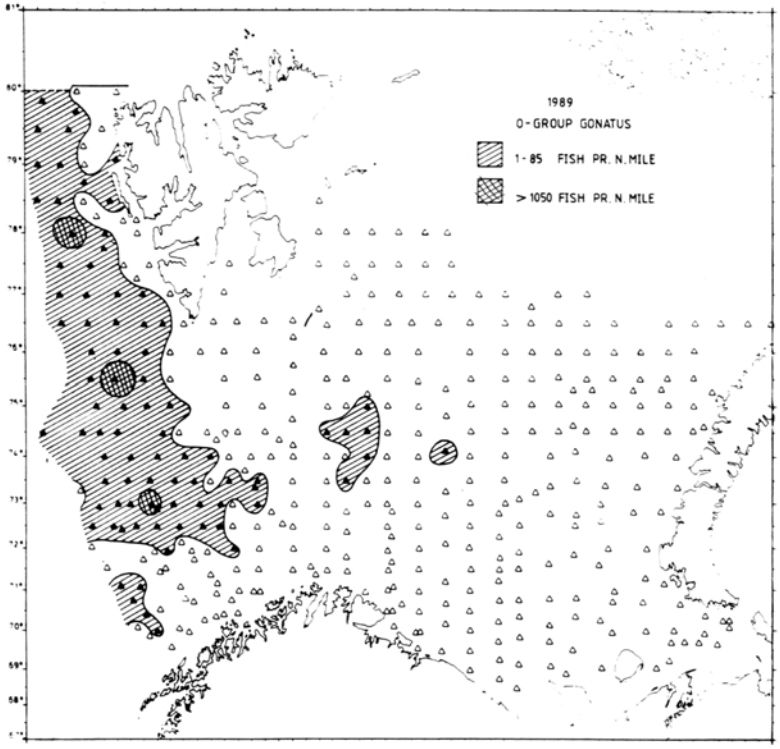

Fig. 28. Distribution of 0-group Gonatus fabricii

International Council for
the Exploration of the Sea

C.M. 1990/G:46
Demersal Fish Committee
Ref.H. Pelagic Fish Committee

Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1990

The twenty-sixth annual International 0-group fish survey was made during the period 16 August-5 September 1990 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey period	Research Institute
Norway	"Eldjarn"	21 August-5 September	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	21 August-5 September	"
Norway	"Michael Sars"	16 August-5 September	"
USSR	"Professor Marty"	16 August-4 September	The Polar Research Institute of Marine 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 6-7 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 hydrographical 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 which participated in the survey in 1990, 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 the recommendation made at the same meeting. At about every 30-40 nautical miles sailed the trawl was towed in several depths in one haul. The standard procedure consisted of towings of 0.5 nautical miles 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 miles was made when 0-group fish layer was recorded deeper than 60 m on the echo-sounder.

Survey tracks and hydrographical stations are given in Fig. 1. Trawl stations with and without catch are given on the distribution charts in Figs. 14-25, as filled and open symbols respectively. The density grading is based on catch in number per 1.0 nautical mile trawling.

Hydrography

Observations were made along all the survey tracks with 5 to 40 nautical miles between stations. Horizontal distribution of temperatures and salinities is shown for 0, 50, 100, 200 m and bottom (Figs. 2-9). Figs. 10-13 show the temperature and salinity conditions along the

Kola, Cape Kanin, Bear Island - North Cape and Bear Island - West sections. The mean temperatures in the main parts of these sections are presented in Table 1.

The mean temperatures in the Barents Sea and adjacent waters as found during the survey, were higher than the long-term means (1965-1990) by 0.6-1.2 °C. This was the case for all sections. However, compared to 1989 the temperature anomalies were less pronounced. Table 1 shows mean temperatures in different layers by section. The features of temperature pattern in the 0-20 m layer over the whole sea should be emphasized. First of all they are associated with the favourable conditions of the spring-summer heating and the absence of considerable wind stirring. This resulted in development of a thermohaloclyne with higher vertical gradients than in previous years. The position of frontal zone of warm Atlantic waters and cold waters of the Barents Sea corresponded to the previous year.

Distribution and abundance of 0-group fish and Gonatus fabricii

Geographical distributions of 0-group fish are shown as shaded areas in Figs. 14-24, and of Gonatus fabricii in Fig. 25. 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 weighed by 10, are given in Table 2. Another set of abundance indices are 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. 14)

The distribution of 0-group herring in the central part of the area, was to a great extend similar to the distribution pattern in 1989. In the southwestern and northwestern part, however, it occurred more rarely. Although some trawl hauls had high numbers of 0-group herring, most of the stations had low numbers, and hence the logarithmic index for 1990 became only 0.31. This is at the same level as in 1988, but lower than in 1989, and considerably lower than the index in 1983, which was 1.77.

Observations made during the survey indicated that the 0-group herring had already started the schooling behaviour, and this may, reduce the reliability of the calculated abundance index.

Capelin (Fig. 15)

The area of distribution is more limited than in 1989. In the western and northwestern part of the survey area there are practically no capelin observed. The area of dense concentrations is considerably smaller than in 1989, being located in the central part of the Barents Sea. According to great variation in numbers of 0-group capelin in the catches, an abundance index is less reliable compared with other species. Anyhow, the abundance of 0-group capelin is considered to be considerably lower than in 1989 but higher than the average for the 1985-1988 year-classes.

Cod (Fig. 16)

The distribution of cod follows the 1989 pattern in the central and western part of the survey area. However, a larger area of dense concentration is observed in the central part of the distribution area. The patch of 0-group cod close to Novaya Zemlya in 1989 was missing

this year. The logarithmic abundance index is below those found for the 1983-1986 year-classes (Table 3) while the distribution index is at the 1984 and 1986 level (Table 2), but above that for 1983. At this stage the year-class is estimated to be a strong one.

Haddock (Fig. 17)

Haddock is distributed more to the southwest than in 1989, and the distribution is disrupted in the southern part of the Spitsbergen area. The area with high concentrations are larger than in the previous year, and both abundance indices are at the same level as the 1984, but above that for the 1983, indicating a strong year-class at this stage.

Saithe (Fig. 18)

Saithe is distributed in two limited areas in the central part of the survey area. Outside these areas, 1-2 specimens were recorded in a few hauls.

Polar cod (Fig. 19)

The 0-group polar cod is also this year separated in two components, off Spitsbergen and in the southeastern part of the Barents Sea. In the Spitsbergen area the distribution is very much the same as in 1989, but less abundant. In the northern part of the area east of Spitsbergen, there is a rather large area of scattered concentration.

Off Novaya Zemlya the distribution area is small, with mainly scattered concentration.

The abundance index for the Spitsbergen component (i.q. west of 40° E) is calculated to 144, which is lower than in 1989, but at the same level as in 1988, close to the average. In southeast, the abundance index is estimated to 47, close to the 1989 level, which is low.

Blue whiting (Fig. 20)

The blue whiting was located in a limited area from the coast of Finnmark to the central part of the Barents Sea. Only low numbers were caught per haul, but more frequently than in the previous year.

Sandeel (Fig. 21)

The 0-group sandeel was located in the southeastern part of the Barents sea. The area of distribution was significantly larger than in 1989, and the density by far above.

Redfish (Fig. 22)

As observed in 1989, the main concentrations are found off West-Spitsbergen and in the current going east along the Norwegian coast. In general, the distribution pattern is similar to that in the previous years. The abundance index is at the 1987 and 1989 level, indicating a year-class of about average strength.

Greenland halibut (Fig. 23)

Few Greenland halibut were caught in the western part of the survey area. The abundance index is very low, indicating a poor year-class, even less than the 1989 year-class.

Long rough dab (Fig. 24)

The distribution is somewhat more to the west than in 1989 and separated in several patches. Also this year the abundance index is low, indicating a poor year-class.

Gonatus fabricii (Fig. 25)

As in previous year, Gonatus fabricii is distributed in the western part of the survey area. In general, the number caught per trawlhaul is less than in 1989, indicating a reduced abundance.

References

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Table 1. Mean water temperature during the International 0-group fish survey in the Barents Sea and adjacent waters in late August - early September 1990

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	0-50 m	50-200 m	0-200 m	0 - bottom	0 - bottom	0-200 m	0-200 m
1	2	3	4	5	6	7	8
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
1987	6.2	3.3	3.9	2.6	2.5	5.2	3.9
1988	7.1	3.7	4.5	3.9	2.9	5.5	4.2
1989	8.6	4.8	5.8	6.5	3.4	6.9	4.9
1990	8.1	4.4	5.3	5.0	4.2	6.3	5.7
Average 1965-1990	7.3	3.7	4.6	4.2	3.3	5.7	4.5

Table 2. Abundance indices

Species Year	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab
			West		East			
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	2	69
1980	49	54	79		247	651	12	108
1981	65	30	149		73	861	3	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
1987	102	72	17		155	631	41	174
1988	133	86	144		120	949	8	72
1989	202	112	206		41	698	5	92
1990	465	227	144		48	670	2	35

Table 3. Estimated indices with 90 % confidence limits of year class abundance for 0-group herring, 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				+			0.01		
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	- -		2.15	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
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

[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	L.R.D.	Sandeel
					East	West				
10-14							+			
15-19							0.1			
20-24		+	+			+	0.8		0.6	
25-29	+	0.1	+		1.0	6.3	1.8		10.8	
30-34	+	2.7	+	+	23.4	21.3	4.8		24.8	
35-39	+	8.7	0.1	+	9.2	29.8	19.7	50.0	38.6	
40-44		19.6	0.1	0.2	5.1	27.7	27.7		17.8	0.1
45-49		23.8	0.3	0.4	15.0	11.0	21.7		7.1	1.1
50-54	+	22.1	0.7	0.4	41.4	3.8	15.0		0.3	4.5
55-59	0.1	15.8	1.9	1.1	4.7	0.1	6.5			4.8
60-64	0.2	5.9	4.6	2.6	0.2	+	1.4			6.9
65-69	1.4	1.1	7.4	3.5	+	+	0.5			10.0
70-74	3.7	0.2	10.6	5.4		+	+			22.4
75-79	5.1	+	12.6	7.4			+	50.0		25.4
80-84	5.0		14.3	8.1						19.5
85-89	18.2		15.4	9.1			+			4.5
90-94	36.4		12.8	8.0			+			0.7
95-99	20.7		9.3	6.9			+			0.1
100-104	5.7		5.7	6.2						
105-109	2.0		2.7	7.7						+
110-114	1.1		0.9	7.6						
115-119	0.2		0.4	7.1						
120-124	0.1		0.1	6.7						
125-129	0.1		+	4.9						+
130-134			0.1	3.1						
135-139			+	1.8						
140-144			+	1.1						
145-149				0.7						
150-159				+						
Total numbers	32184	207740	37891	6923	1682	187185	617224	5	371	8227
Mean length, cm	8.9	4.9	8.4	9.9	4.5	3.9	4.5	6.0	3.7	7.4

Appendix

Survey period	Research vessel	Research Institute	Participants
16 August- 4 September	"Professor Marti"	Polar Research Institute of Marine Fisheries and Oceanography, Murmansk	I. Altynov, A. Dorchenkov, V. Kapralov, V. Komlichenko, A. Kuzmichev, L. Kuzmin, Yu. Lepesevich, N. Makeeva, V. Ryazantsev, M. Shevelev, V. Tretyak, A. Vlakhno
20 August- 4 September	"Pinro"	"	S. Boranov, A. Cheremovsky, I Dolgolenko, V. Doronin, A. Gordov, V. Khvastov, Yu. Perepechaev, N. Plokhikh, E. Shamrai, N. Ushakov, V. Zhuravlev
21 August- 5 September	"G.O. Sars"	Institute of Marine Research, Bergen	O.J. Gullaksen, K. Hansen, K.A. Hansen, T. Haugland, A.Hylen, H. Kismul, M. Mögster, T. Wickström.
16 August- 5 September	"Michael Sars"	"	J. Alvsväg, B. Hoffstad, K. Lauväs, T. Mörk, K. Nedreaas, Ø. Navdal, J. E. Nygärd.
20 August- 5 September	"Eldjan"	"	T.I. Halland, J.C. Hoist, E. Molvær, T. Monstad, A. Romslo, E. Skoglund, Ø. Tangen

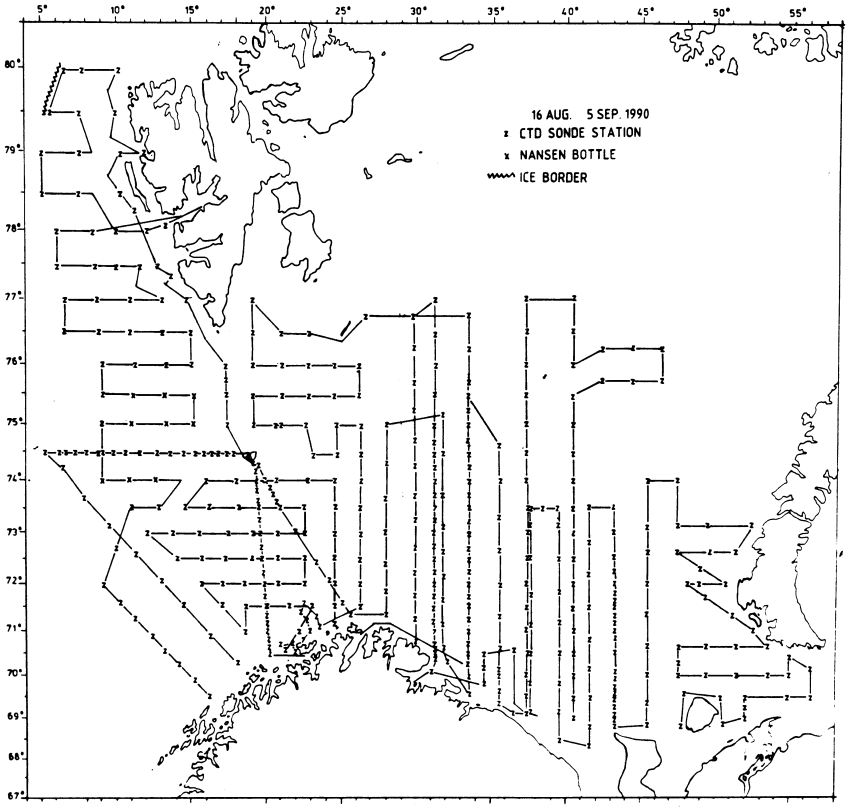

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

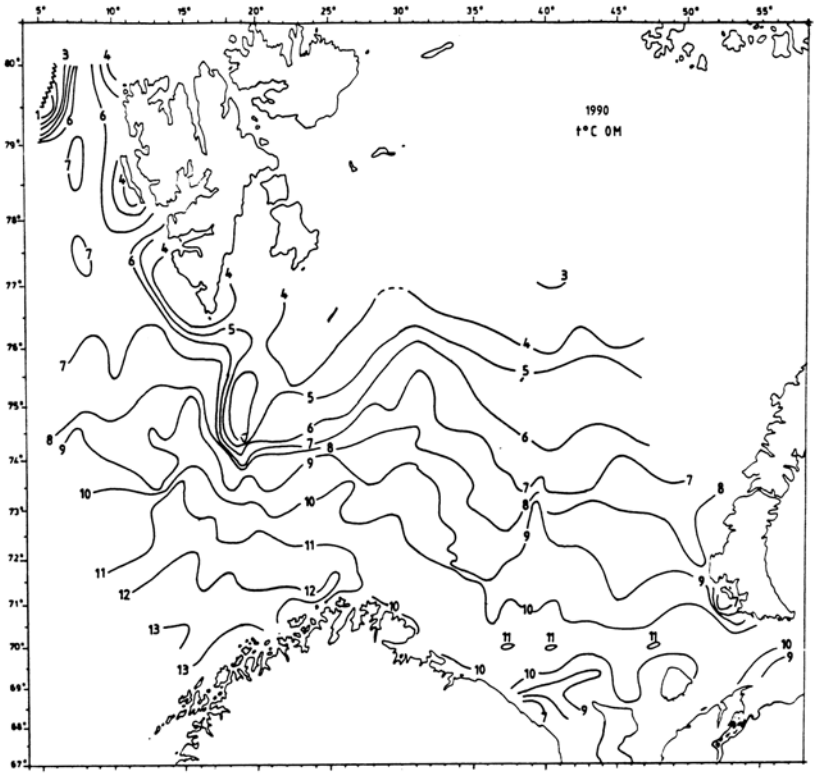

Fig. 2. Isotherms at 0 m

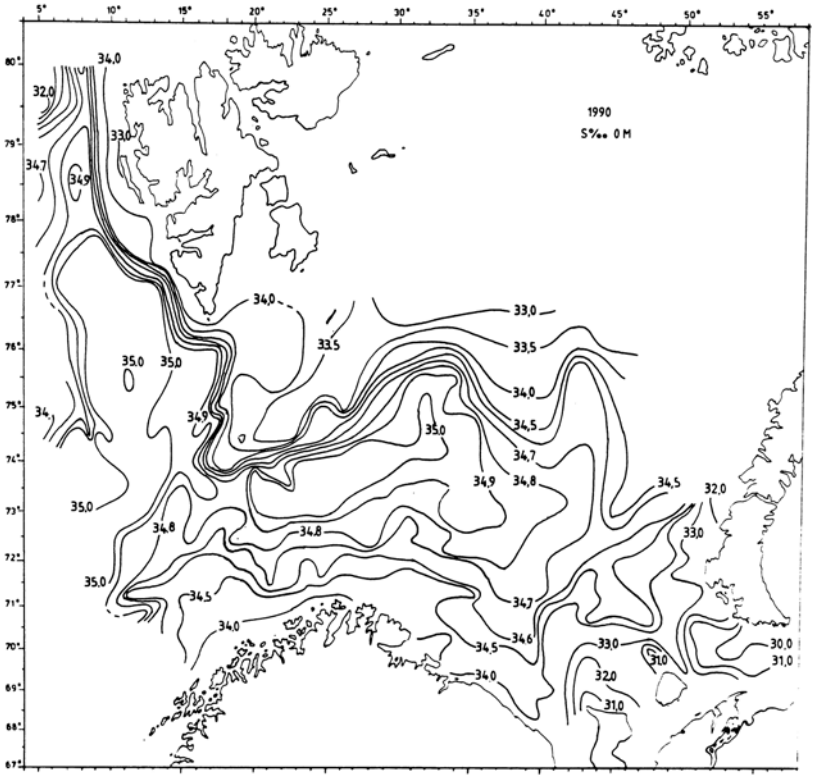

Fig. 3. Isohalines at 0 m

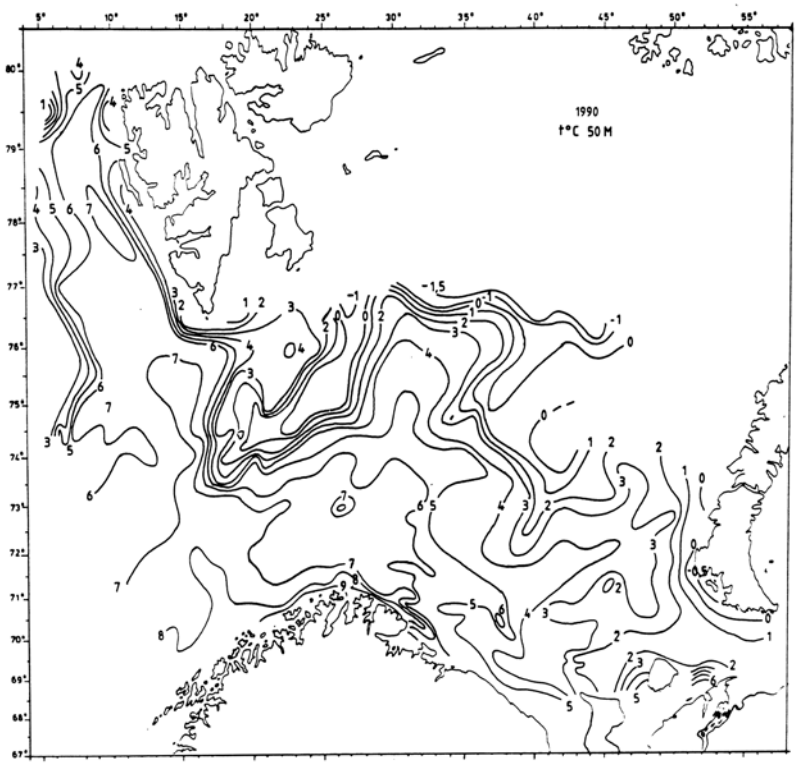

Fig. 4. Isotherms at 50 m

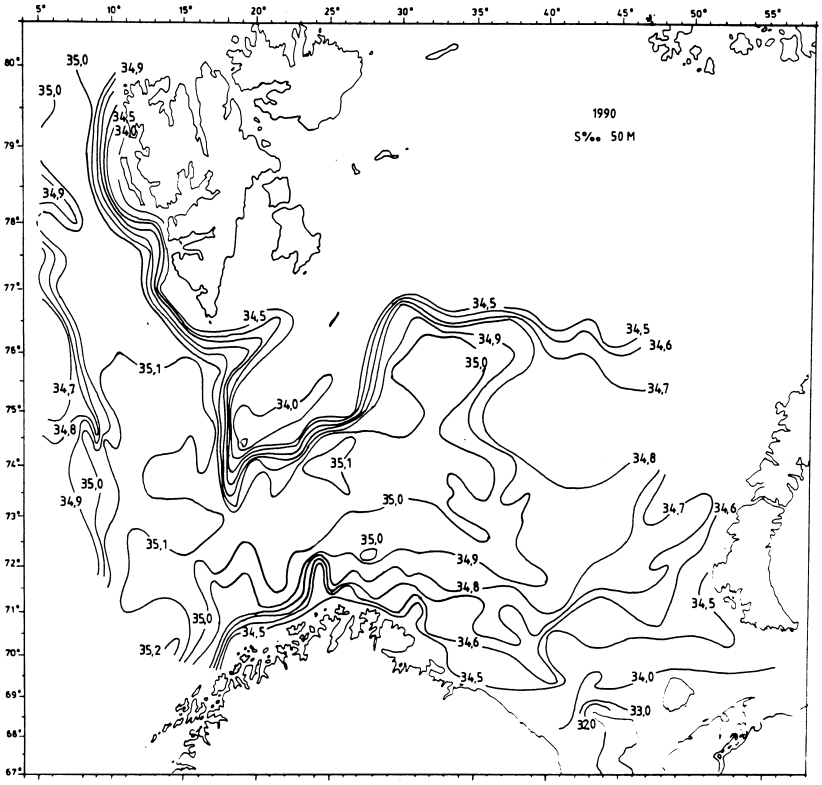

Fig. 5. Isohalines at 50 m

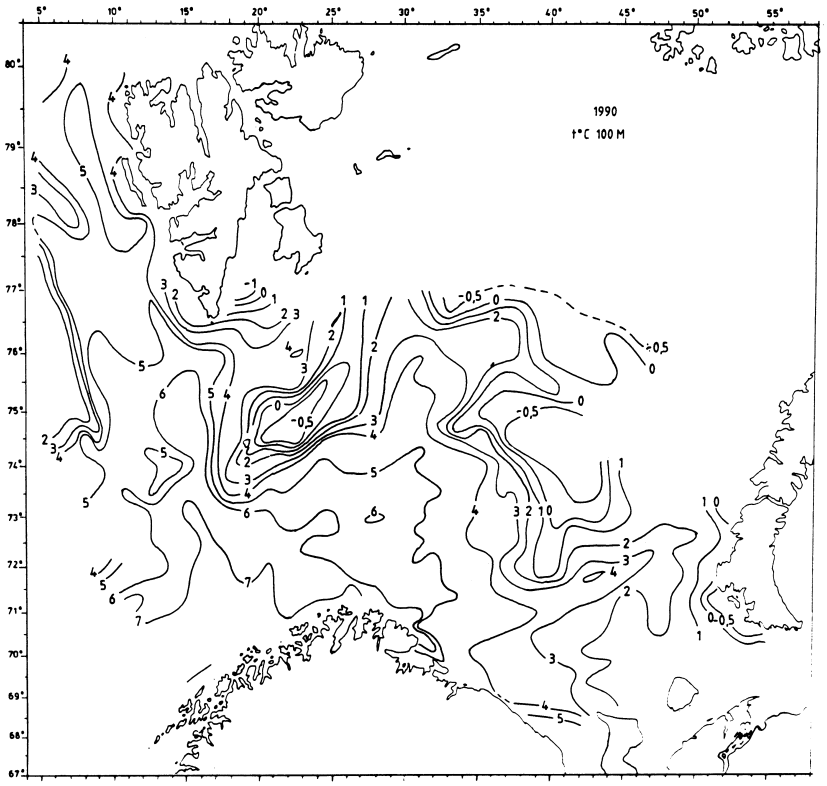

Fig. 6. Isotherms at 100 m

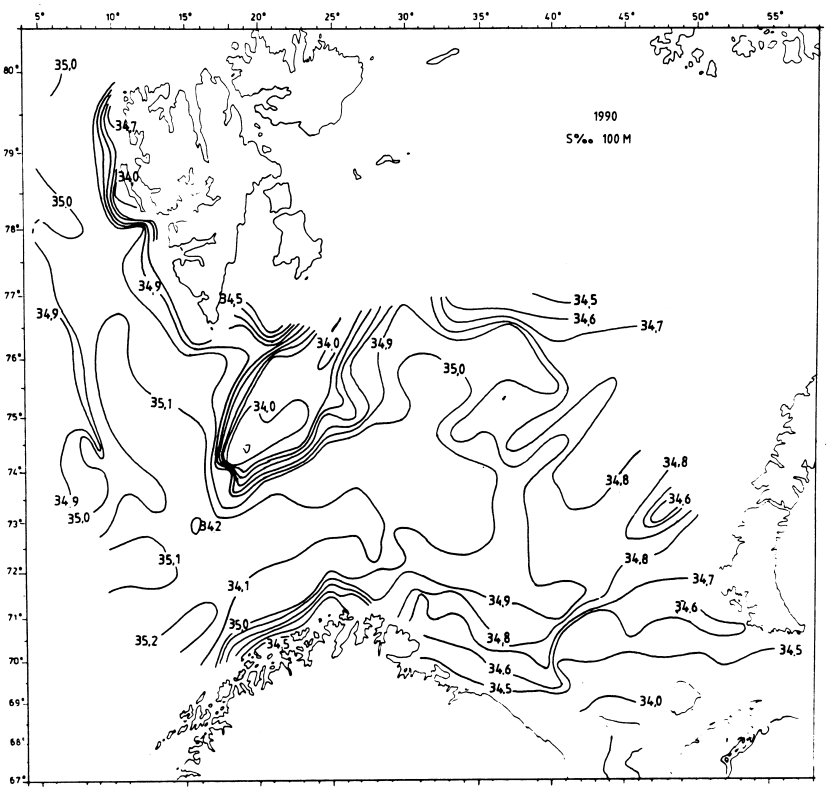

Fig. 7. Isohalines at 100 m

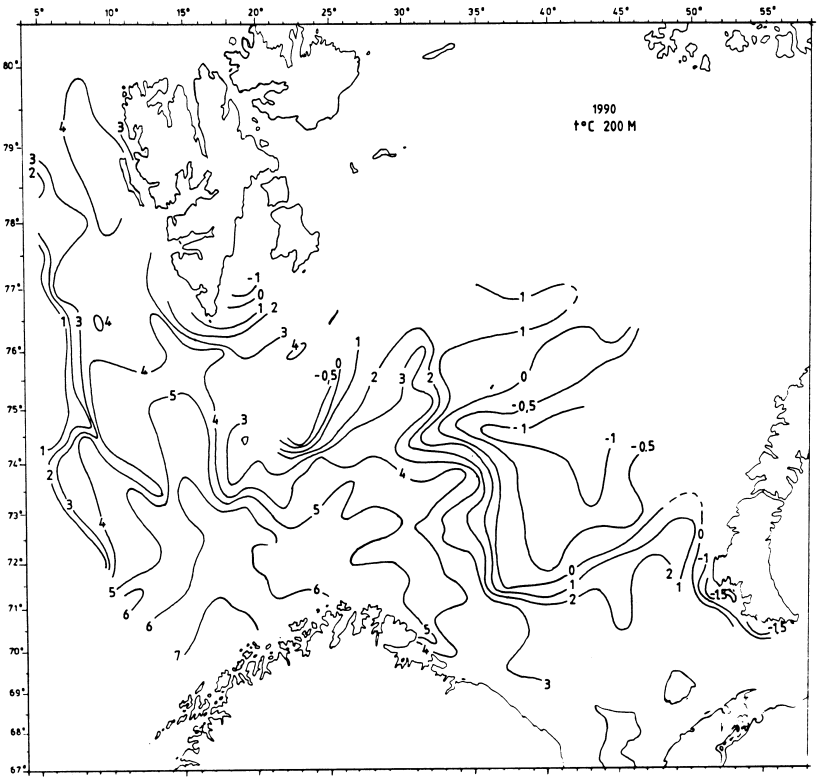

Fig. 8. Isotherms at 200 m

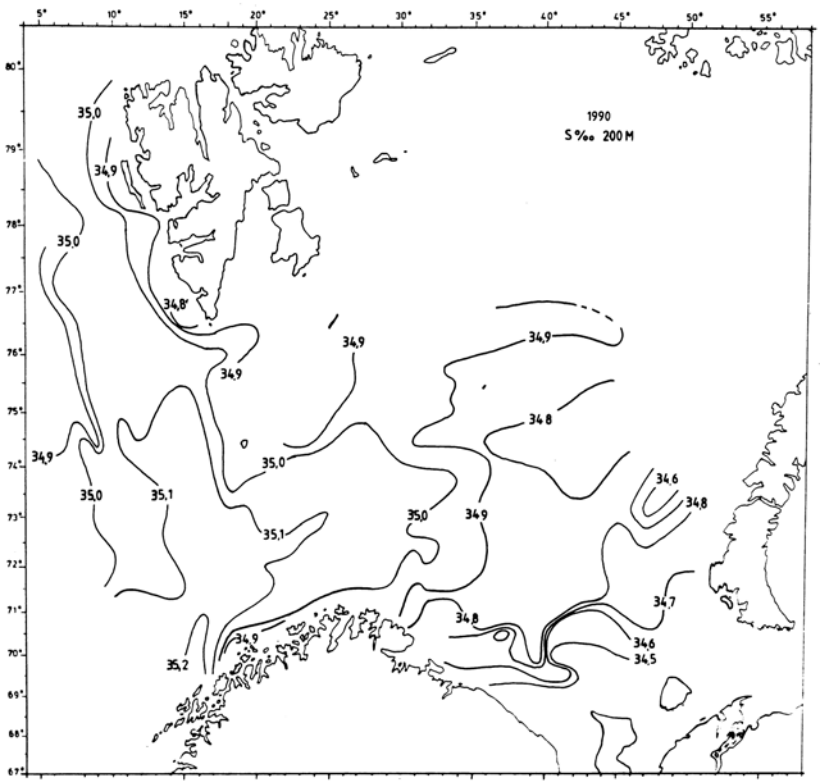

Fig. 9. Isohalines at 200 m

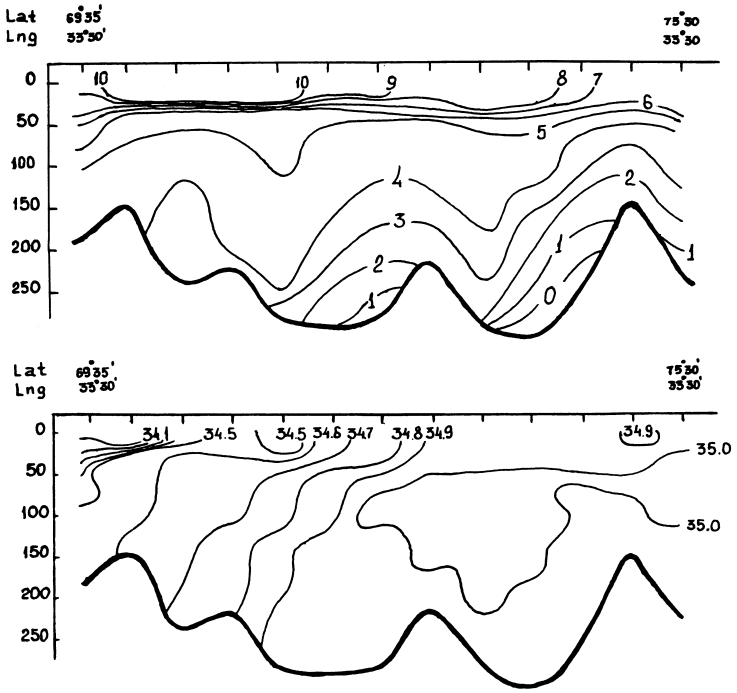

Fig. 10. Hydrographic section along the Kola meridian. Temperature and salinity

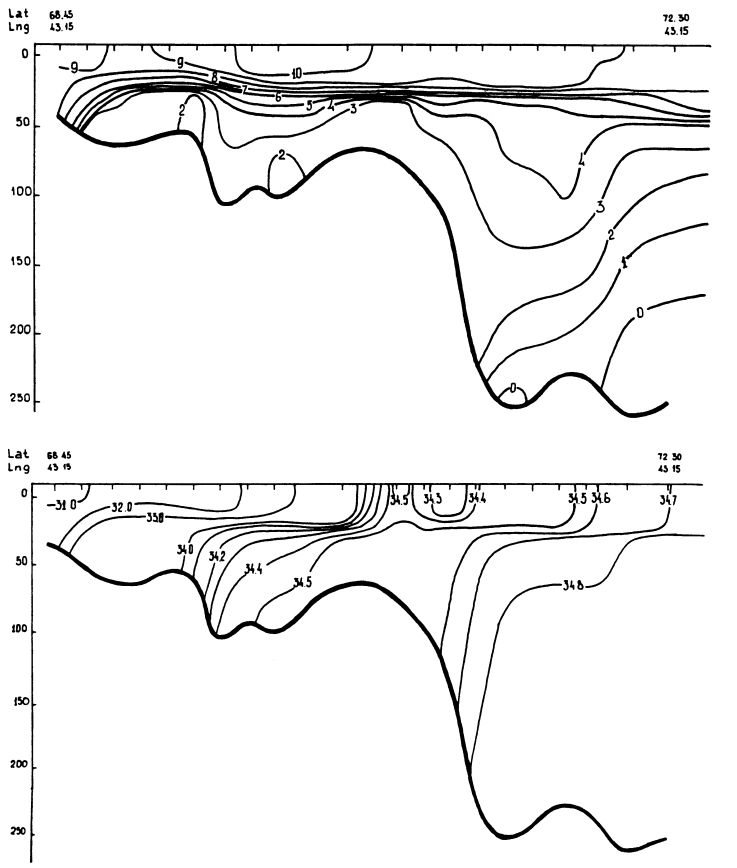

Fig. 11. Hydrographic section Cape Kanin-North. Temperature and salinity

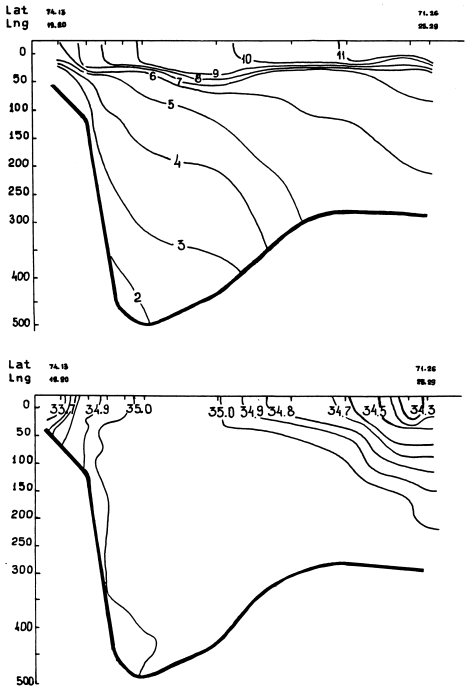

Fig. 12. Hydrographic section Bear Island-North Cape. Temperature and salinity

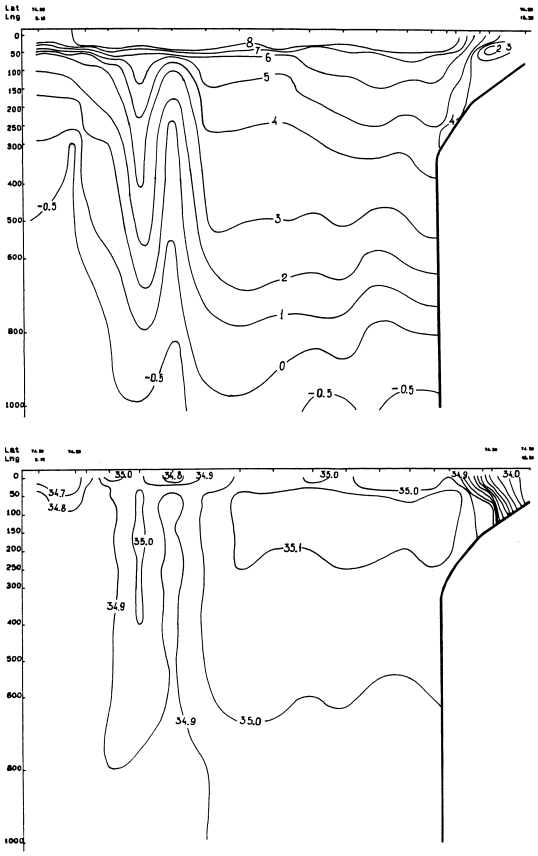

Fig. 13. Hydrographic section Bear Island – West. Temperature and salinity

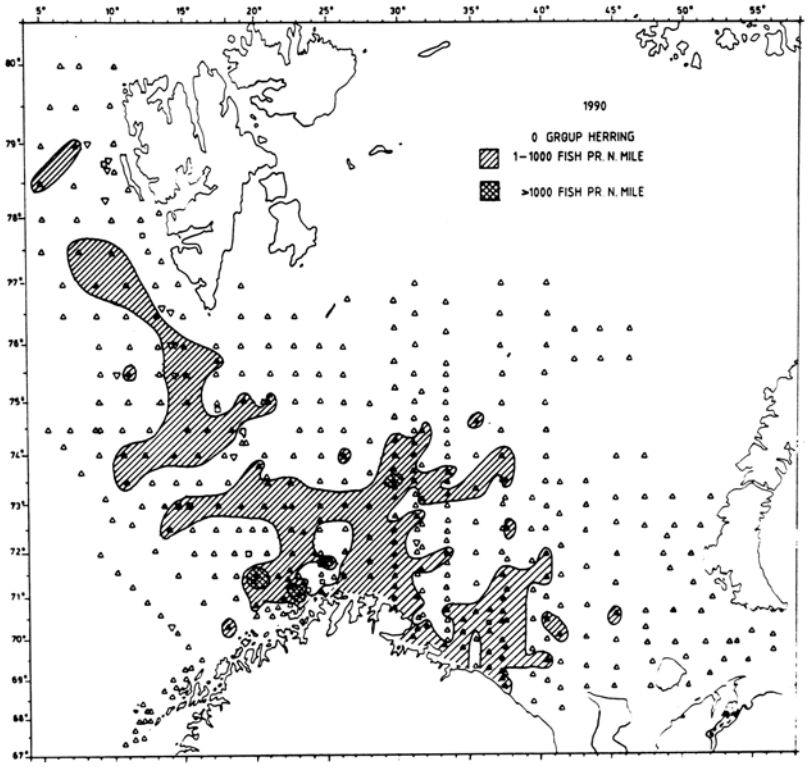

Fig. 14. Distribution of 0-group herring

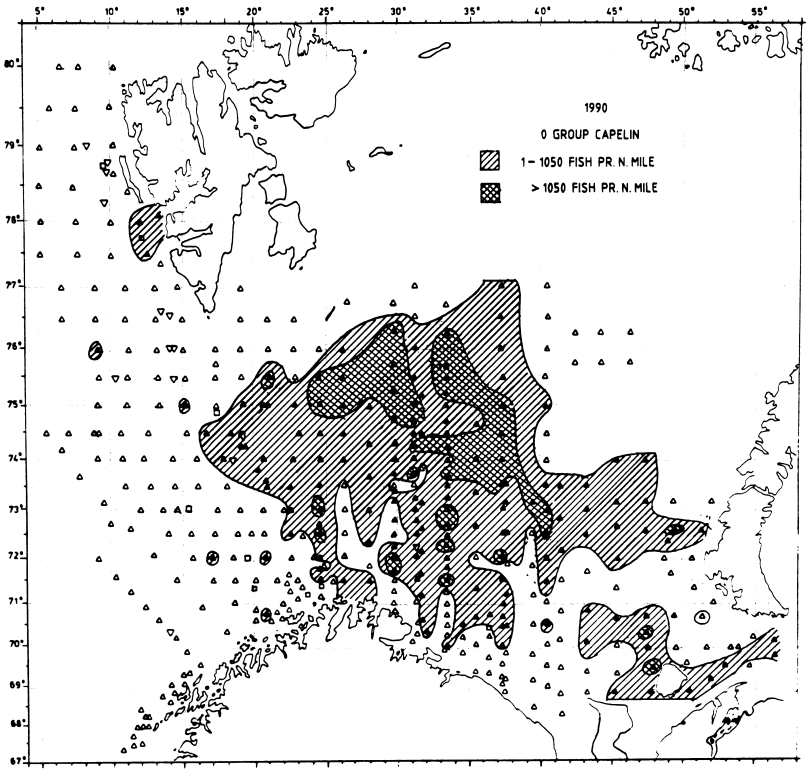

Fig. 15. Distribution of 0-group capelin

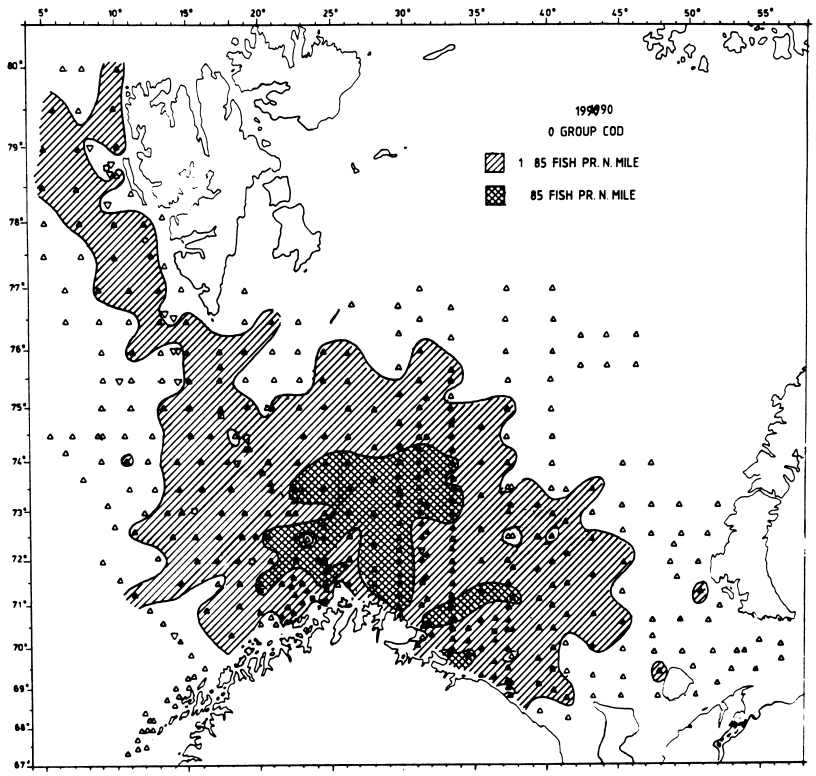

Fig. 16. Distribution of 0-group cod

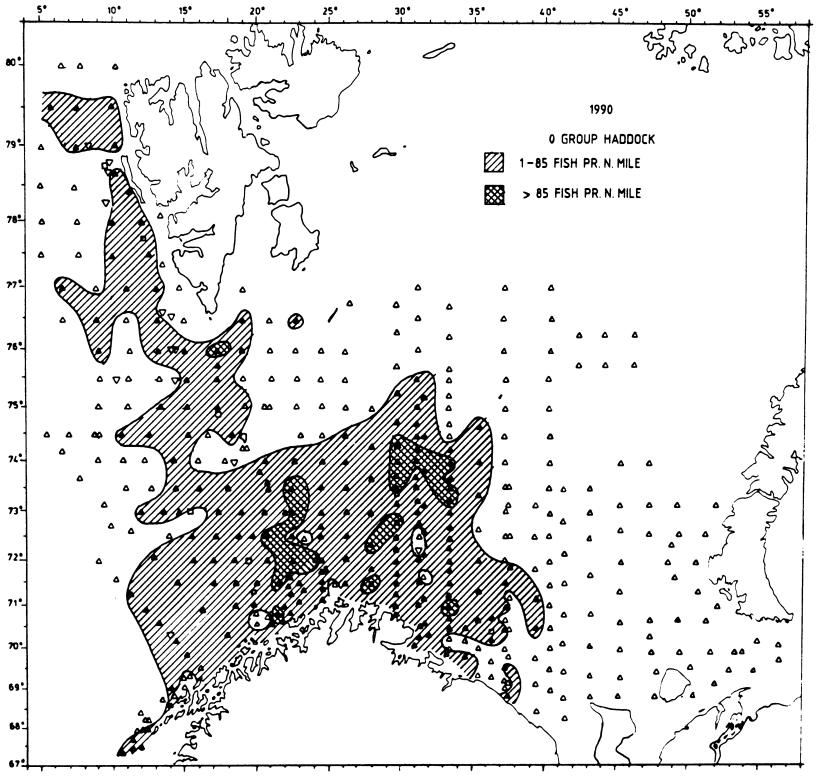

Fig. 17. Distribution of 0-group haddock

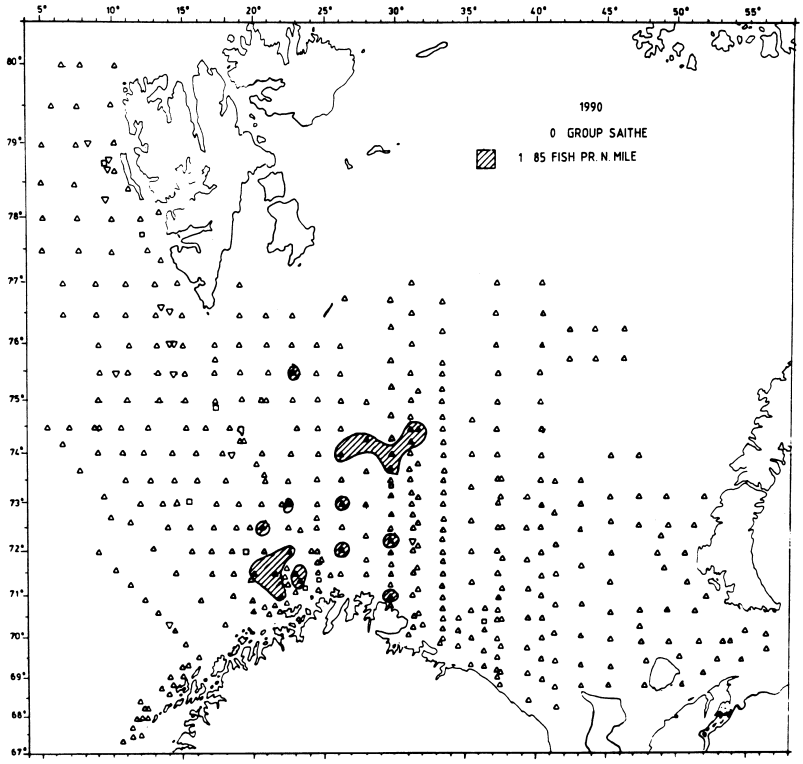

Fig. 18. Distribution of 0-group saithe

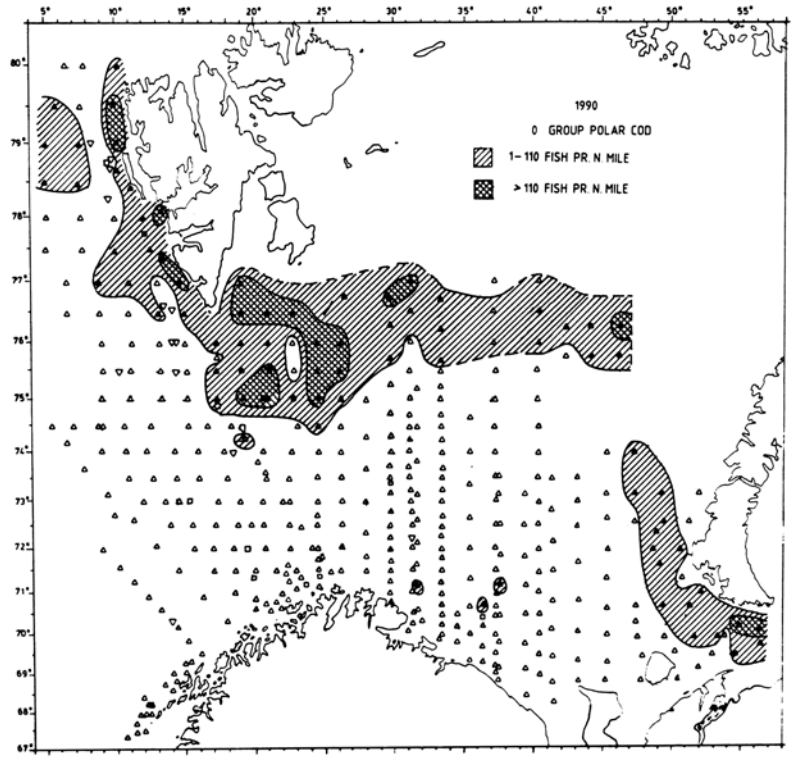

Fig. 19. Distribution of 0-group polar cod

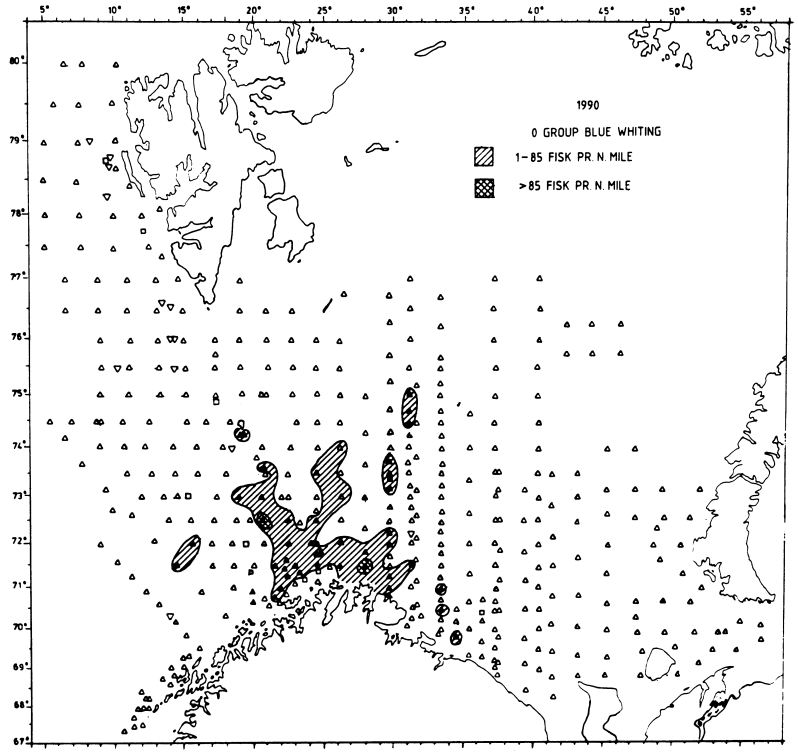

Fig. 20. Distribution of 0-group blue whiting

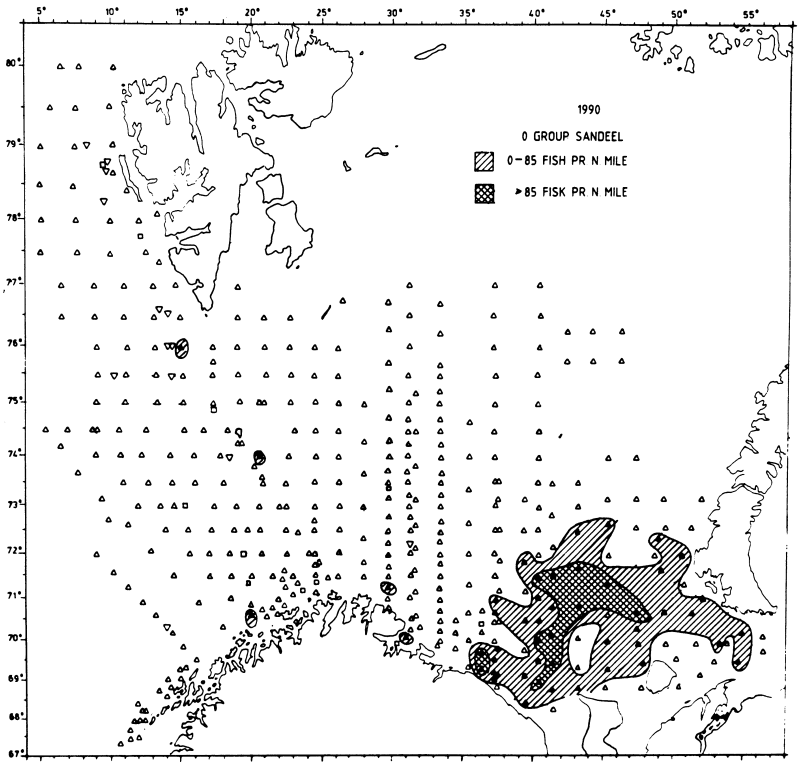

Fig. 21. Distribution of 0-group sandeel

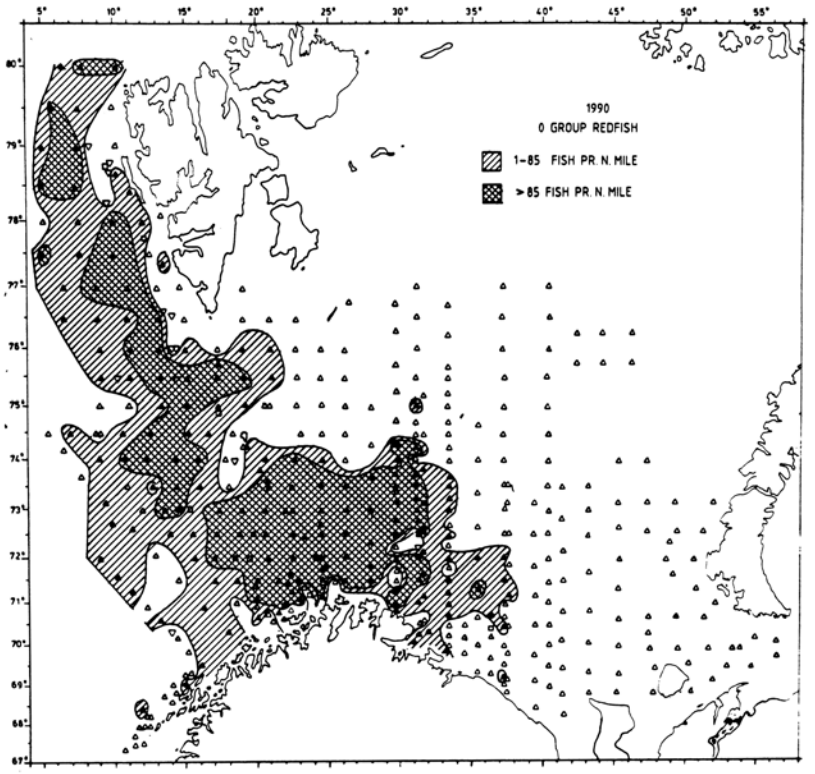

Fig. 22. Distribution of 0-group redfish

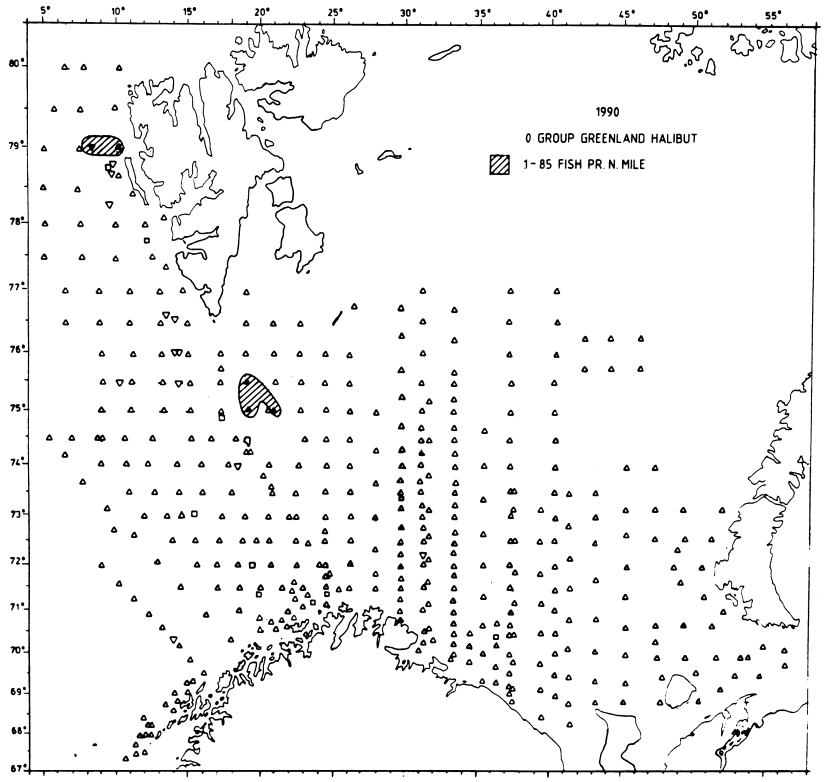

Fig. 23. Distribution of 0-group Greenland halibut

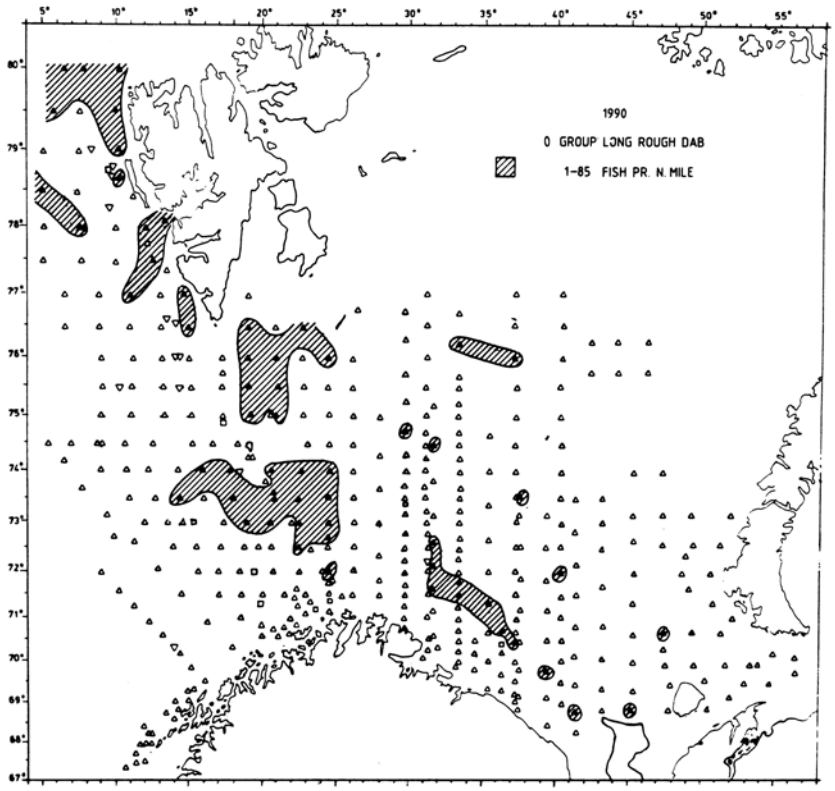

Fig. 24. Distribution of 0-group long rough dab

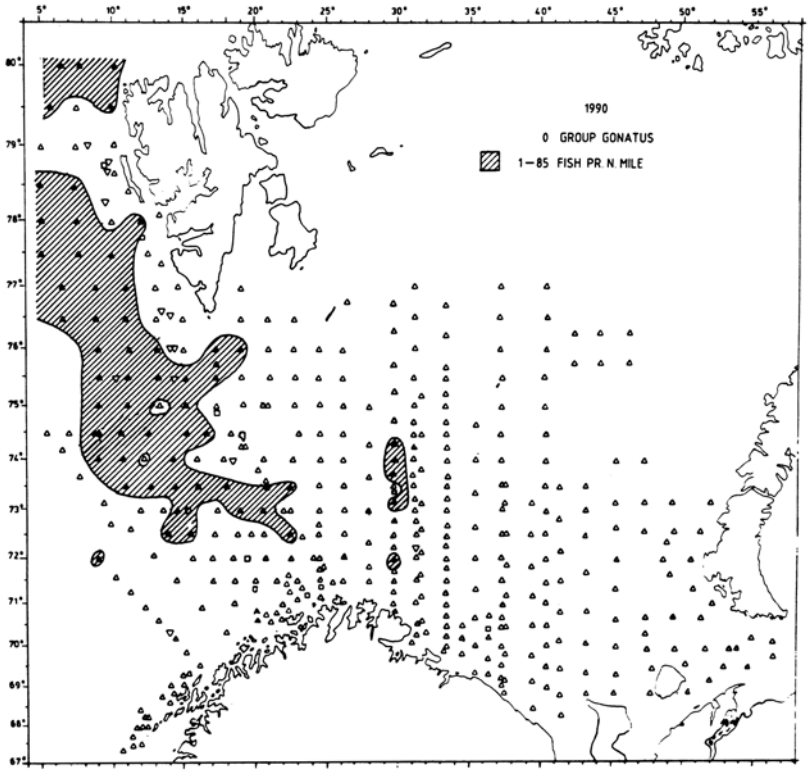

Fig. 25. Distribution of 0-group Gonatus fabricii

International Council for
the Exploration of the Sea

C.M. 1991/G:50 Ref. H
Demersal Fish Committee

Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1991

The twenty-seventh annual International 0-group fish survey was made during the period 15 August-9 September 1991 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey period	Research Institute
Norway	"Johan Hjort"	8 August-9 September	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	19 August-9 September	"
Norway	"Michael Sars"	15 August-9 September	"
USSR	"Professor Marty"	15 August-6 September	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
USSR	"Fridtjof Nansen"	18 August-6 September	"

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 10 - 11 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 hydrographical 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 which participated in the survey in 1991, 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 the 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 miles 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 on the echo-sounder deeper than 60 m.

Survey tracks and hydrographical stations are given in Fig. l. Trawl stations with and without catch are given on the distribution charts in Figs. 14-23, as filled and open symbols respectively. The density grading is based on catch in number per 1.0 nautical mile trawling.

Hydrography

Observations were made along all the survey tracks with 5 to 40 nautical miles between stations. Horizontal distribution of temperatures and salinities is shown for 0, 50, 100 and 200 m (Figs. 2-9). Figs.10-13 show the temperature conditions along the Kola, Cape Kanin, Bear Island-North Cape and Bear Island - West sections and Fig.11 the salinity conditions along the Cape Kanin section. The mean temperatures in the main parts of these sections are presented in Table 1.

Mean water temperatures in 0-200 m along all standard sections covered during the survey, were above the long-term average (1965-1991) by 0.3-0.9 °C. Compared to 1990 a minor increase in temperature was recorded in 50-200 m on the Kola section. In the Western Spitsbergen and the North Cape Currents (0-200 m) as well as in the Murmansk Current (0-50 m), mean water temperature was 0.3 to 0.5 °C colder than last year. The thermal conditons of the Barents Sea and adjacent waters showed a cooling in the upper homogenious layer. In 1991 the 10 °C isotherm in 0 m was recorded only as far as North Cape, while in 1990 it reached southern Novaya Zemlya. Distribution of water temperatures in the layer from the seasonal thermocline down to bottom in the survey area was close to that observed last year. The seasonal thermocline was weak over nearly the whole Barents Sea, which seems to be associated with cooling in the upper homogeneous layer. The frontal zone position corresponds to the long-term mean.

Distribution and abundance of 0-group fish and Gonatus fabricii

Geographical distributions of 0-group fish are shown as shaded areas in Figs. 14-23, and of Gonatus fabricii in Fig.24. 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 weighed by 10, are given in Table 2. Another set of abundance indices are 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. 14)

In general, the distribution of herring was similar to that of 1989. However, in the south-western part more dense concentrations were recorded. Herring occurred mainly in the western Barents Sea along the edge of the shelf between the Norwegian coast and up to 80° off Western Spitsbergen. In southern areas, herring was found from the coast up to 75° N and eastwards as far as 43° E. The logarithmic abundance index is estimated to be 1.19, which is considerable higher than the 1990 index (0.31) and slightly below the 1983 index (1.77). The estimated index indicates that the 1991 year-class is relatively strong.

Capelin (Fig. 15)

The distribution area was much smaller than in 1989 and 1990. Capelin occurred mostly in the eastern and central areas and partly west of Spitsbergen. Dense concentrations were seen as separate patches, but the overall catch in numbers were smaller than in recent years. The 1991 year- class may therefore be estimated as poor or below average.

Cod (Fig. 16)

Cod was distributed over a large area, extending from Norway and Murman coast to 80° N off Western Spitsbergen and to 76°30' N in central parts. In the east it was recorded north to 73°30' N and west of 46° E. Compared to the last 5 years, dense concentrations were recorded over much larger areas in the central and western parts of the survey area. The abundance index for the 1991 year-class is at the same level as the 1985 and above the 1983--. At this stage the 1991 year-class has been classified as a very strong one.

Haddock (Fig. 17)

Haddock was mainly distributed in western areas from the Norwegian coast to 80° N of Western Spitsbergen. The eastern limit in the Barents Sea was at about 37° E. Dense concentrations were found in most of the western areas and the area with high concentrations was by far larger than in all preceding years. The abundance index is the highest observed since the 0-group investigations started in 1965 and the 1991 year-class may be classified as rich.

Saithe

Like in previous years only single fish occurred in a few hauls, mainly in the central part of the Barents Sea.

Polar cod (Fig. 18)

Like previous years, polar cod was distributed in two separated areas – in the south-east along Novaya Zemlya, and in the north-west off Eastern Spitsbergen. In the north-western area, the 1991 year-class was estimated to be weaker than those of the three proceeding years, but close to that of 1985. The 0-group index for this area indicate a rather poor year-class.

In the south-east the area of dense and scattered concentrations were larger than in the three proceeding years, but smaller than in 1985. The abundance index indicates that the 1991 year-class in this component may be considered as a strong one.

Blue Whiting

Only a few specimens of blue whiting were caught this year.

Redfish (Fig. 19)

The main concentrations of redfish occurred along the western edge of the shelf. The distribution pattern showed several separate patches. However, the area of scattered and dense concentrations were much smaller than in previous years. The abundance index is the lowest since 1972 and the 1991 year-class may be considered as poor.

Green1and halibut (Fig. 20)

Single fish occurred in hauls west and east of Spitsbergen. The abundance index indicates that the 1991 year-class is very poor.

Long rough dab (Fig. 21)

This species occurred in patches almost over the whole area. Only few fish were found in the catches. The abundance index is the lowest recorded, and the year-class is considered to be poor.

Sandeel (Fig. 22)

Like in previous years sandeel was distributed in the south-eastern part of the survey area, but the concentrations in 1991 were less than in previous years.

Gonatus (Fig. 23)

Only a few squids occurred in hauls in the western areas. The distribution area was smaller than in the three proceeding years.

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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 August-September 1991

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	0-50 m	50-200 m	0-200 m	0-bottom	0-bottom	0-200 m	0-200 m
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
1987	6.2	3.3	3.9	2.6	2.5	5.2	3.9
1988	7.1	3.7	4.5	3.9	2.9	5.5	4.2
1989	8.6	4.8	5.8	6.5	3.4	6.9	4.9
1990	8.1	4.4	5.3	5.0	4.2	6.3	5.7
1991	7.6	4.6	5.3	5.0	4.2	6.0	5.2
Average 1965-1991	7.3	3.7	4.6	4.2	3.3	5.7	4.5

Table 2. Abundance indices

Species Year	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab
			West		East			
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	2	69
1980	49	54	79		247	651	12	108
1981	65	30	149		73	861	3	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
1987	102	72	17		155	631	41	174
1988	133	86	144		120	949	8	72
1989	202	112	206		41	698	5	92
1990	465	227	144		48	670	2	35
1991	766	472	90		239	200	1	28

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

Year - class	Herring [1)]			Cod			Haddock		
	Logarithmic index	Confidence limits		Logarithmic index	Confidence limits		Logarithmic index	Confidence limits	
1965				+				0.01	
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	-	-	2.15	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
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	2.65	1.17	0.98	1.37

[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	L.R.D.	Sandeel
					East	West				
10-14							+			
15-19							+		0.2	
20-24					0.2	+	0.4		0.3	
25-29		+	+		4.9	+	5.5		0.9	2.0
30-34		0.2	+	0.1	24.1	1.0	33.8		9.2	1.1
35-39		3.1	0.1	0.1	41.1	7.5	31.6		29.9	20.2
40-44	+	12.7	0.3	0.4	26.5	31.2	19.2		34.2	39.1
45-49	+	31.3	1.4	0.9	3.1	54.8	7.9		22.6	19.9
50-54	+	22.1	3.8	2.0	0.1	4.6	1.6		2.8	2.4
55-59	0.9	19.9	5.6	3.5		0.9	0.1	16.7		3.0
60-64	8.7	5.2	7.4	5.8		+		16.7		6.6
65-69	13.6	2.4	9.3	8.7				16.7		3.3
70-74	19.5	1.6	11.6	9.2						0.9
75-79	15.7	1.0	9.3	9.9				50.0		0.9
80-84	14.0	0.3	11.4	13.4						0.1
85-89	8.8	0.1	10.8	11.5						0.1
90-94	6.7	+	12.0	10.3						
95-99	4.3		8.6	6.5						0.3
100-104	3.5		5.3	6.5						
105-109	3.4		2.1	4.1						
110-114	0.9		0.7	3.1						
115-119	0.1		0.2	1.5						
120-124	+		+	1.3						
125-129	+			0.6						
130-134				0.4						
135-139				0.1						
140-144				+						
Total numbers	366708	315736	63209	29497	3050	240430	22793246		579	1084
Mean length, cm	7.9	5.2	8.0	8.4	3.7	4.5	3.7	7.0	4.1	4.6

Appendix

Survey period	Research vessel	Research Institute	Participants
15 August- 6 September	"Professor Marti"	Polar Research Institute of Marine Fisheries and Oceanography, Murmansk	A. Cheremovsky, I. Dolgolenko, A. Gordov, V. Khastov, A. Krysov, Yu. Lepecevich, V. Ozhiguin, B. Shein, V. Tretyiak, D. Tyan, V. Zhuravlev
18 August- 6 September	"Fridtjof Nansen"	"	Yu.Ablyassov, V. Chizhikov, V. Formichev, S. Kuzetsov, V. Makhonin, A. Mukhin, E. Shamrai, A. Shatilov, A. Tarasov, S. Ustinov
19 August- 9 September	"G.O. Sars"	Institute of Marine Research, Bergen	P. de Barros, T. Haugland, G. Iversen, M. Møgster, T. Mørk, B. Røttingen, R. Toresen
15 August- 9 September	"Michael Sars"	"	E. Holm, R. Johannessen, B. Kvinge, S. Mehl, G. Nyhammer, A.M. Skorpen, R. Sundt, B.V. Svendsen
8 August- 9 September	"Johan Hjort"	"	H. Bjø rke, H. Græsdal, A. Hylen, L. Kalvenes, H. Kismul, K. Lauvås, L. Løvheim, L. Solbakken, Ø Torgersen, A. Totland

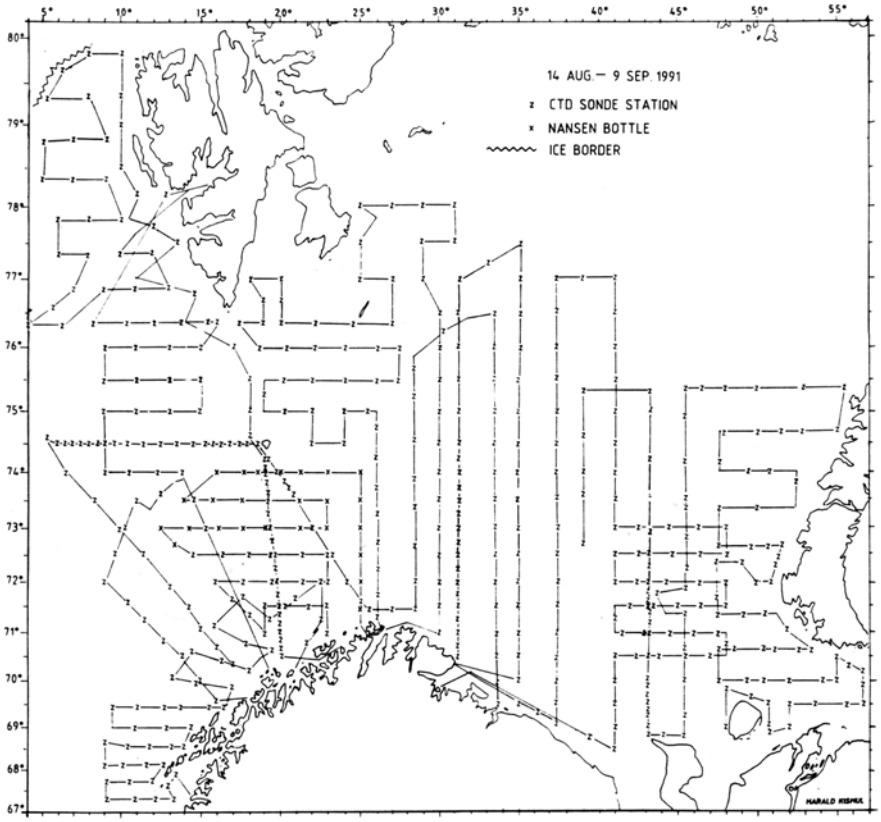

Fig. 1. Survey tracks of the ships and the grid of hydrographic stations

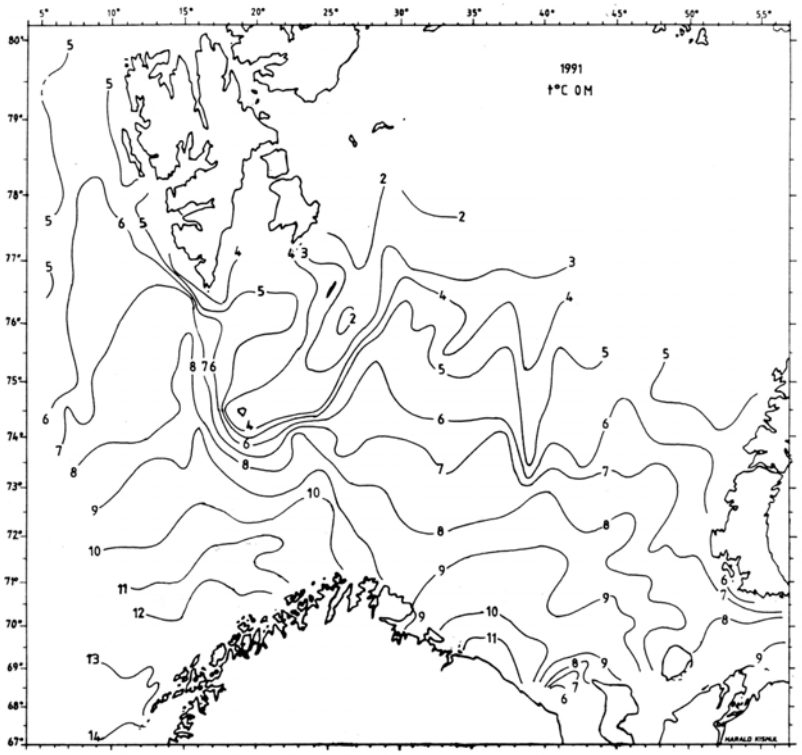

Fig. 2. Isotherms at 0 m

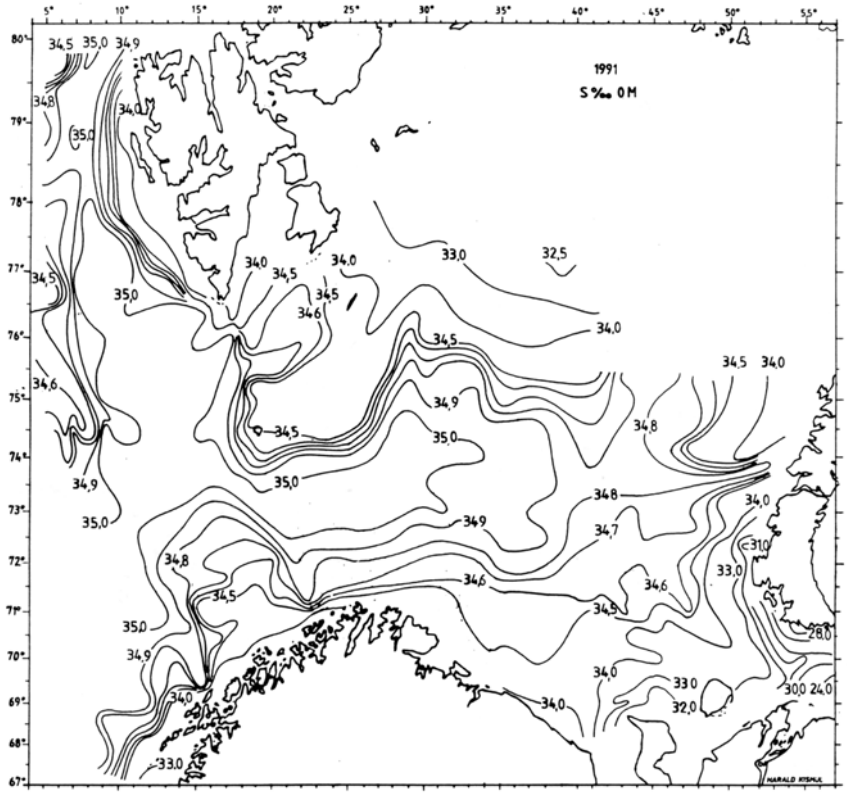

Fig. 3. Isohalines at 0 m

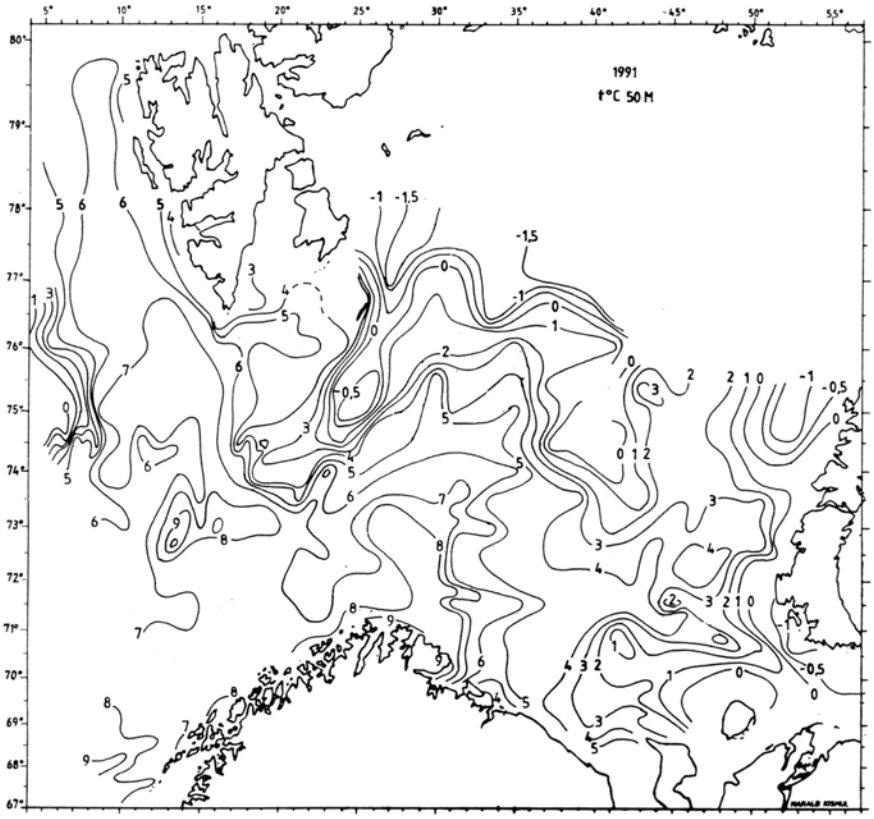

Fig. 4. Isotherms at 50 m

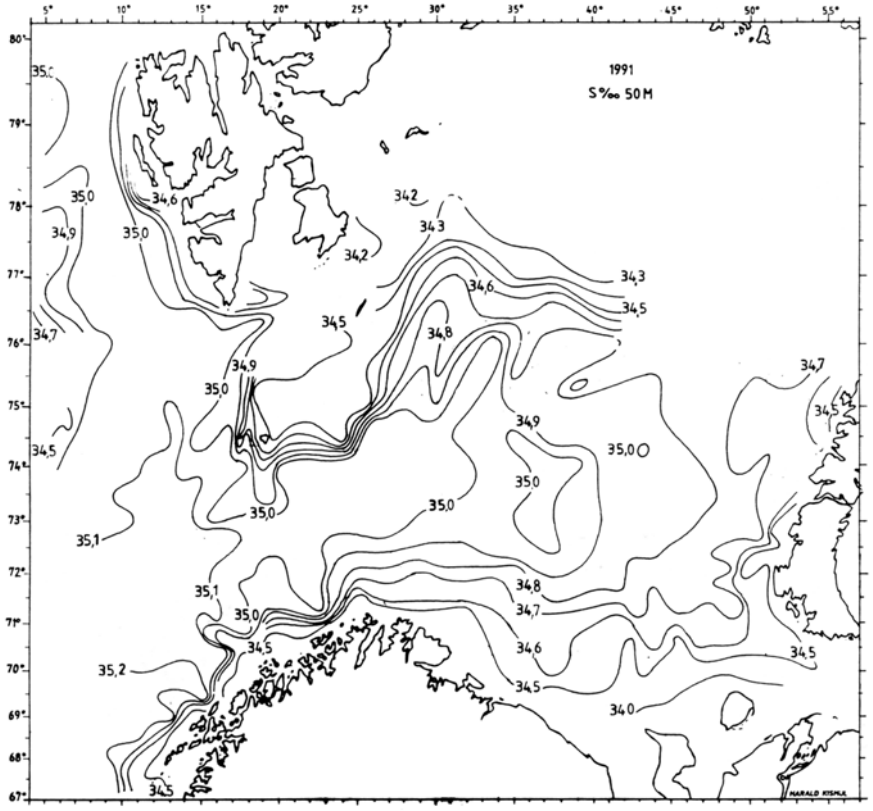

Fig. 5. Isohalines at 50 m

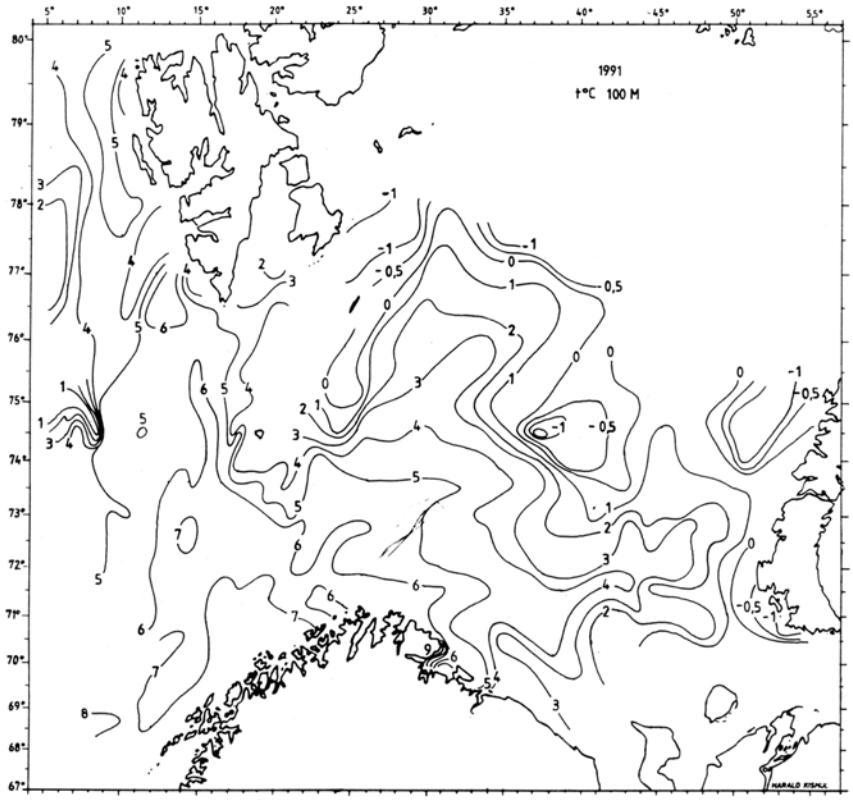

Fig. 6. Isotherms at 100 m

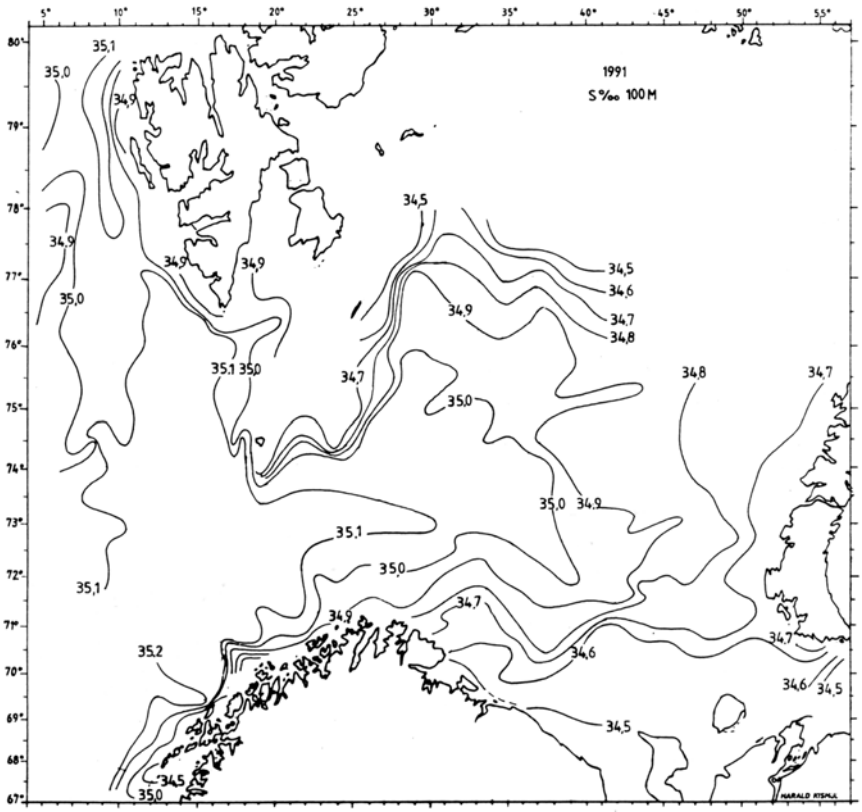

Fig. 7. Isohalines at 100 m

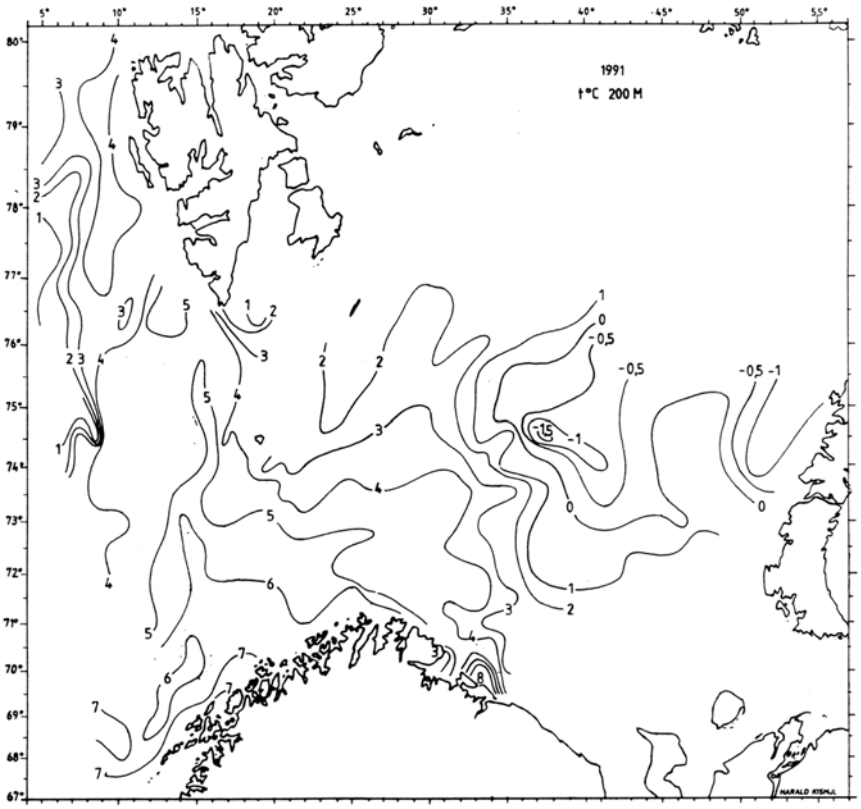

Fig. 8. Isotherms at 200 m

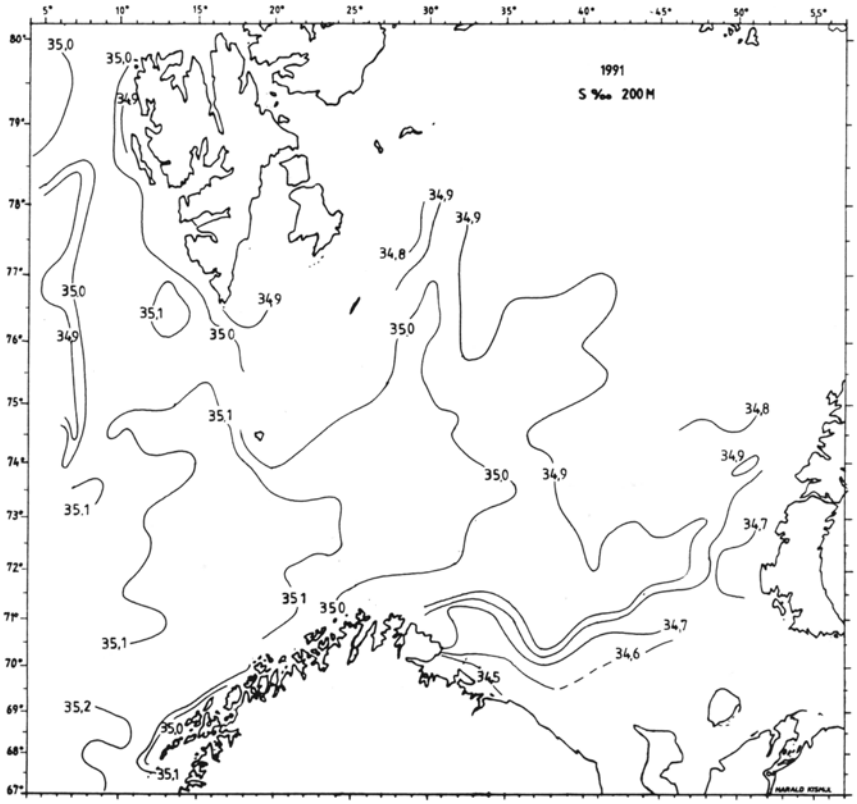

Fig. 9. Isohalines at 200 m

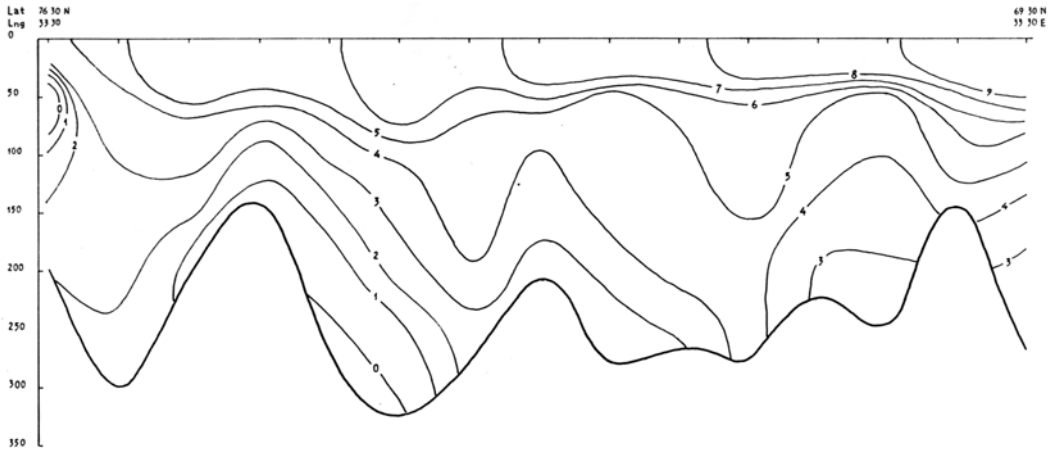

Fig. 10. Hydrographic section along the Kola meridian. Temperature

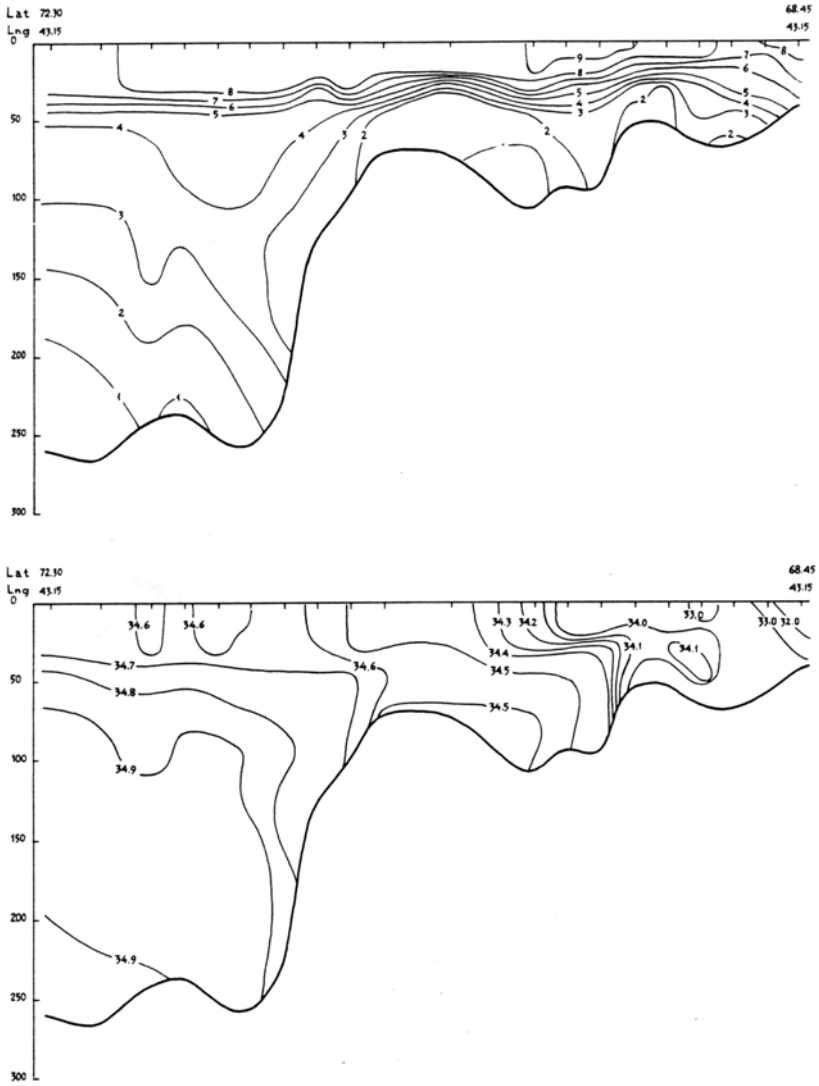

Fig. 11. Hydrographic section Cape Kanin-North. Temperature and salinity

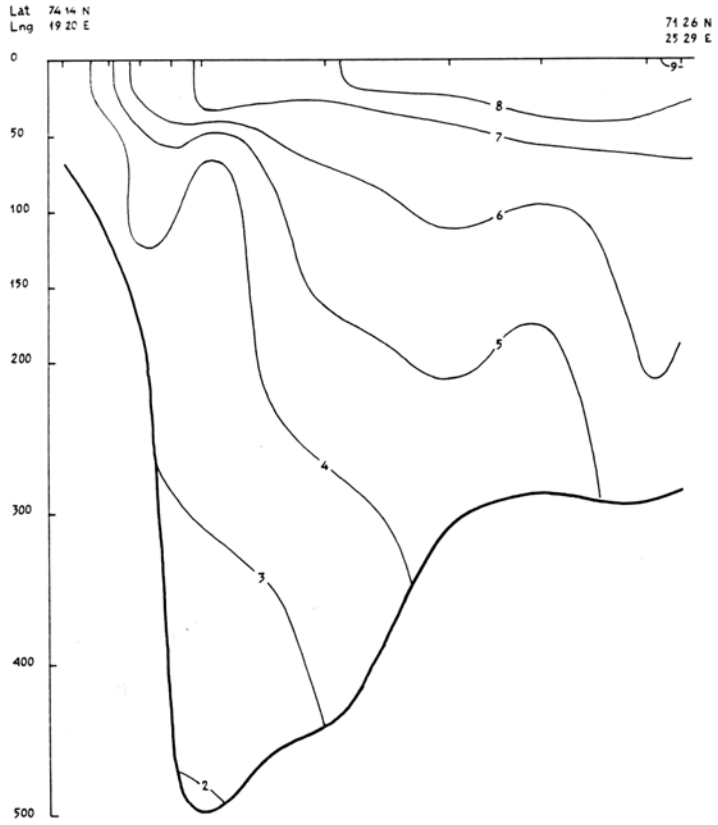

Fig. 12. Hydrographic section Bear Island-North Cape. Temperature

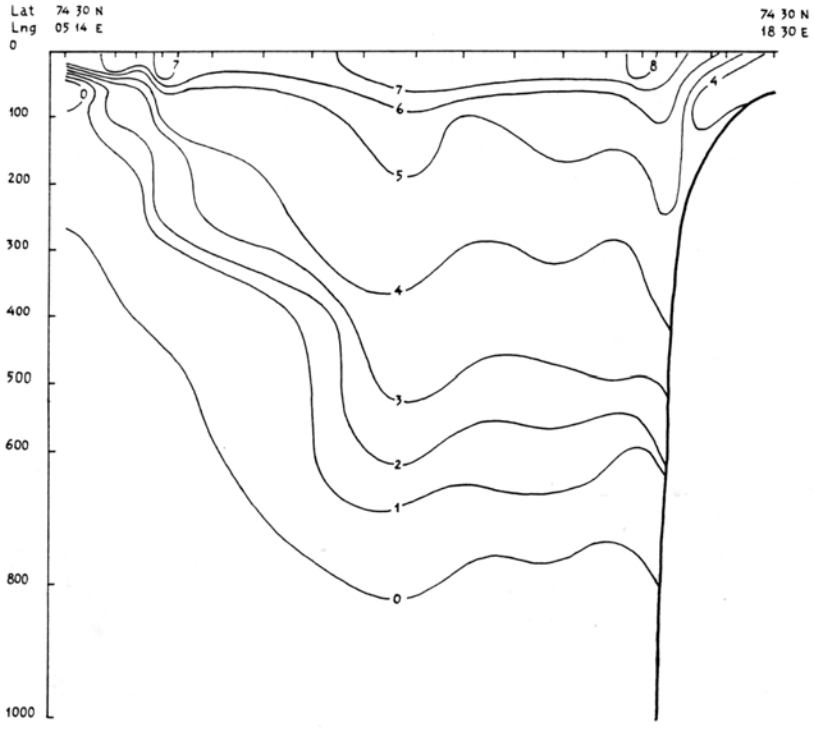

Fig. 13. Hydrographic section Bear Island-West. Temperature

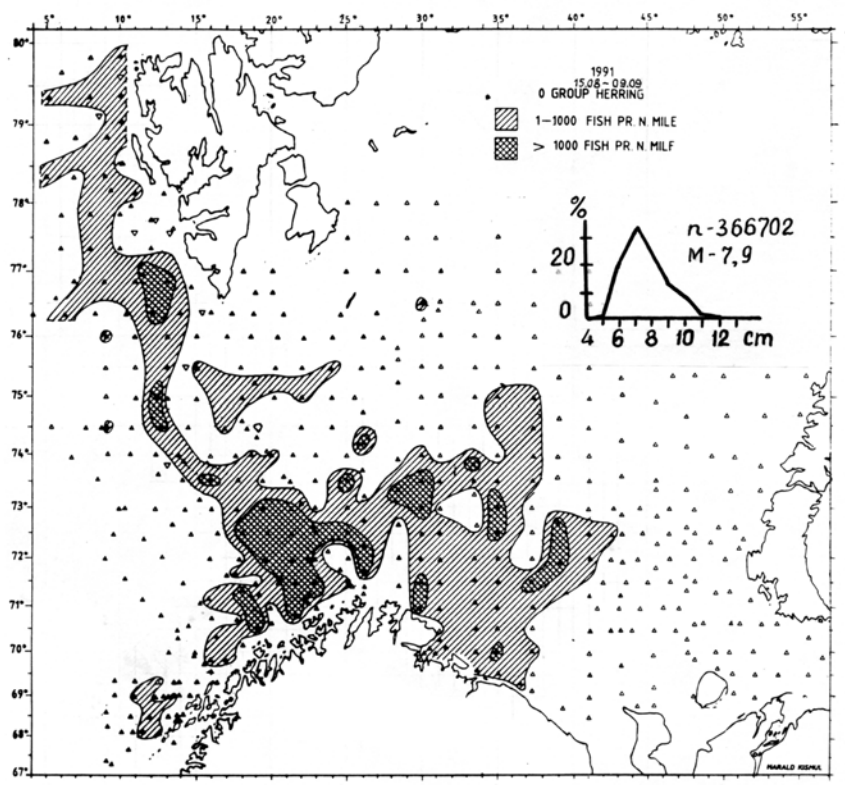

Fig. 14. Distribution of 0-group herring

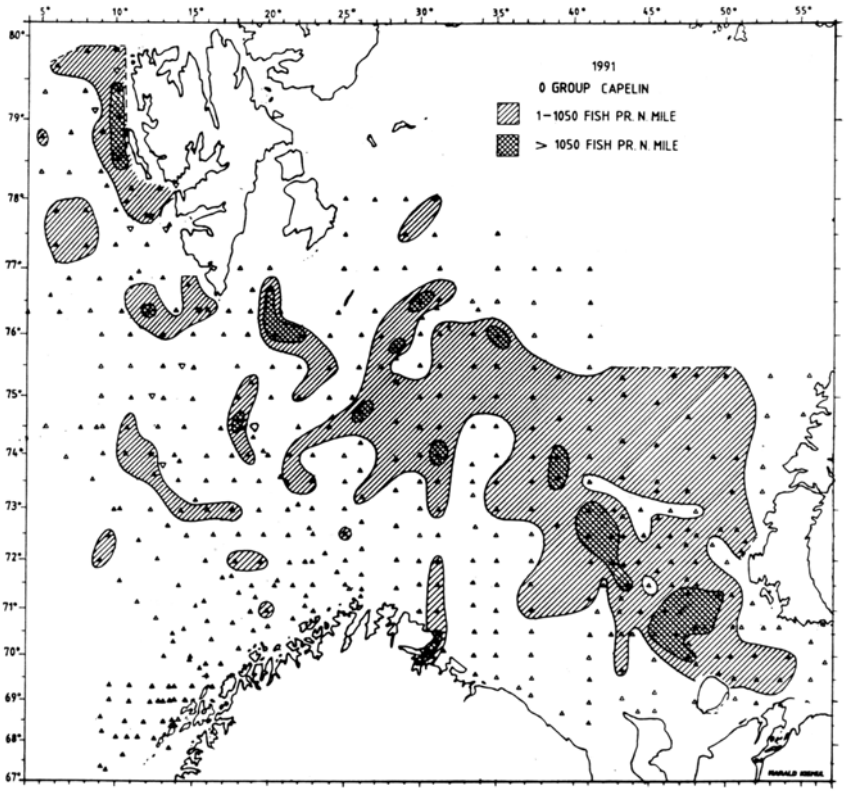

Fig. 15. Distribution of 0-group capelin

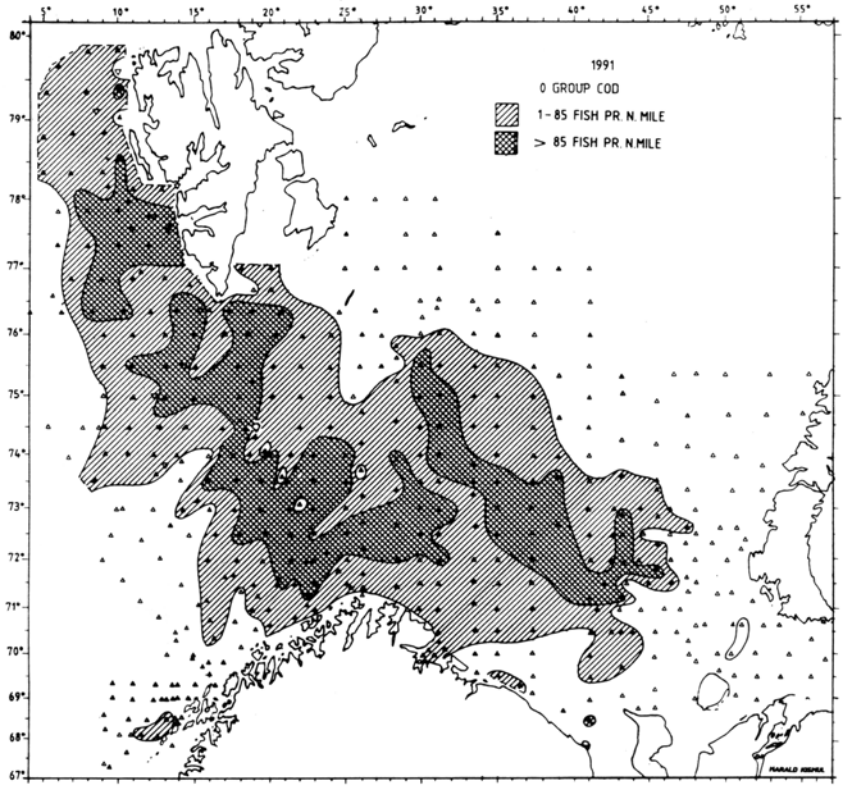

Fig. 16. Distribution of 0-group cod

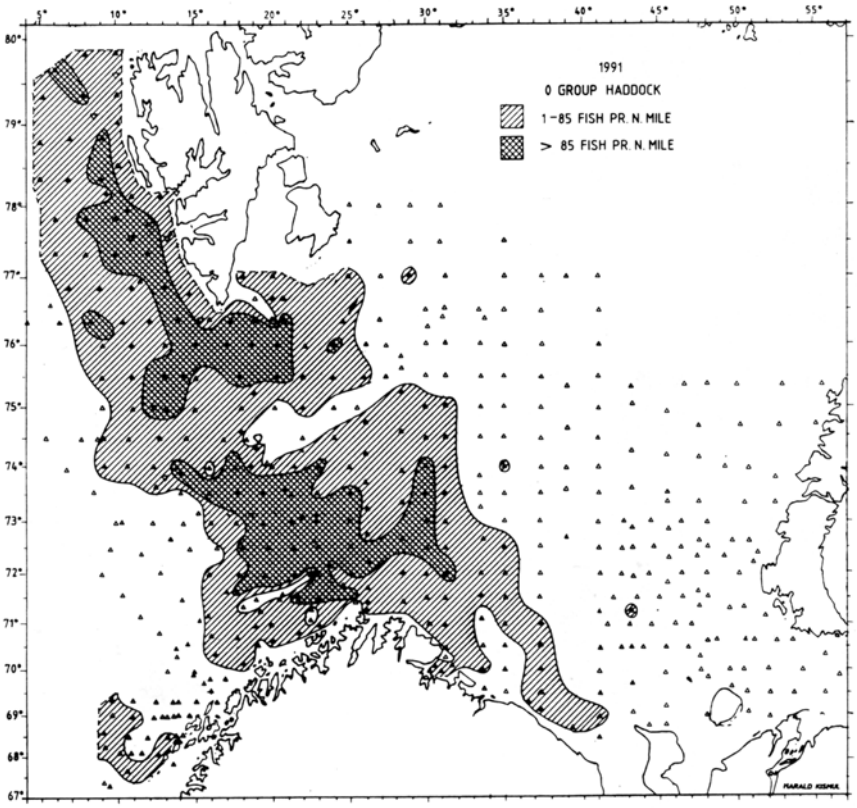

Fig. 17. Distribution of 0-group haddock

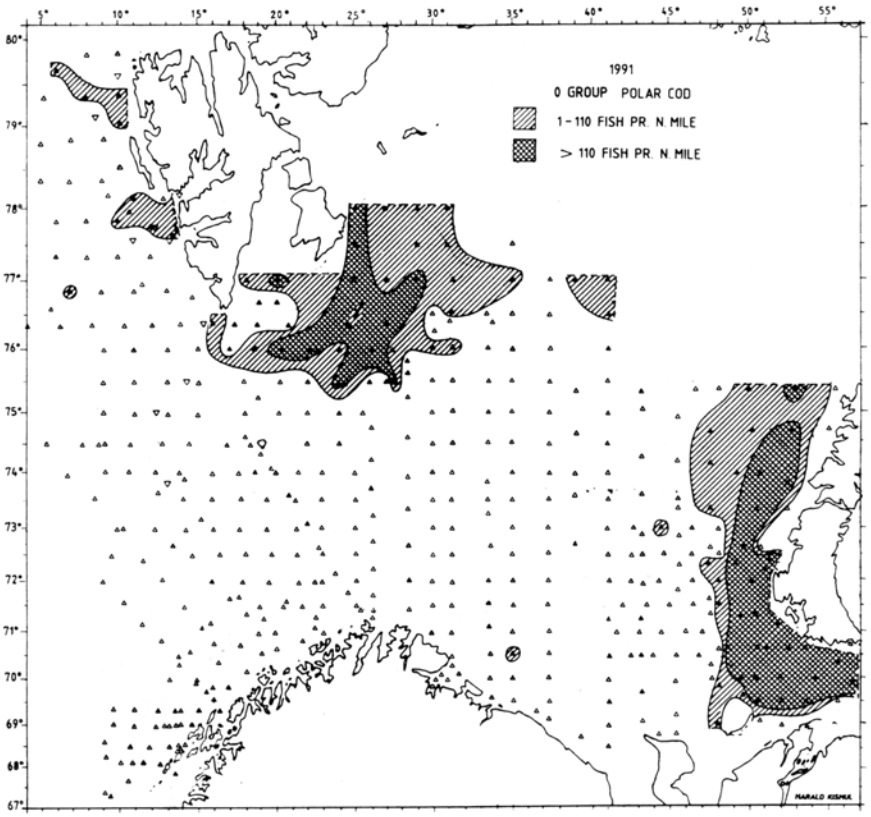

Fig. 18. Distribution of 0-group polar cod

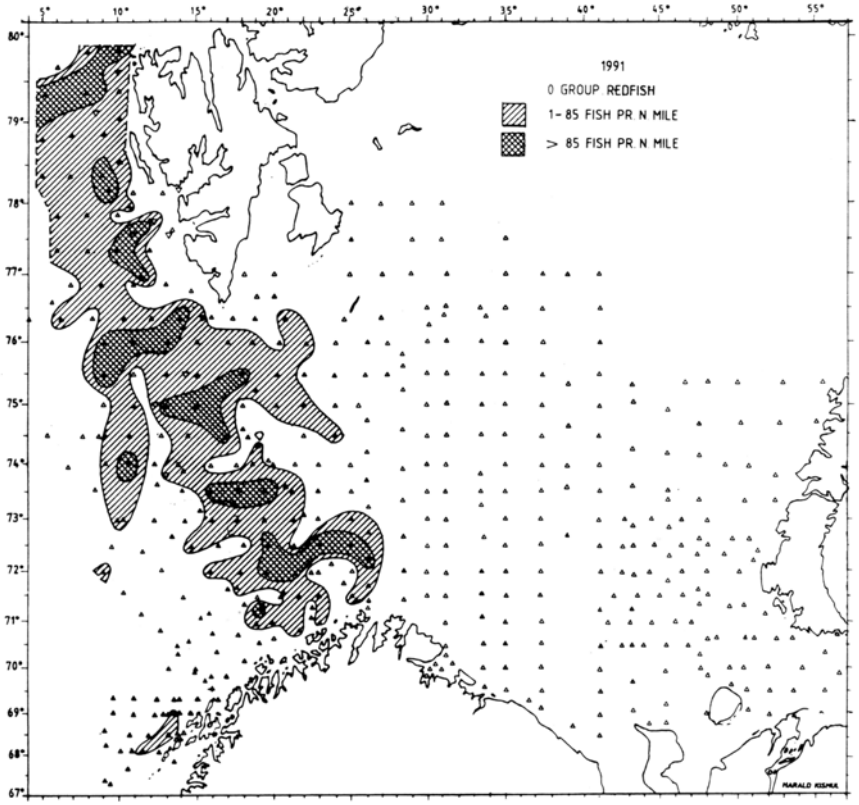

Fig. 19. Distribution of 0-group redfish

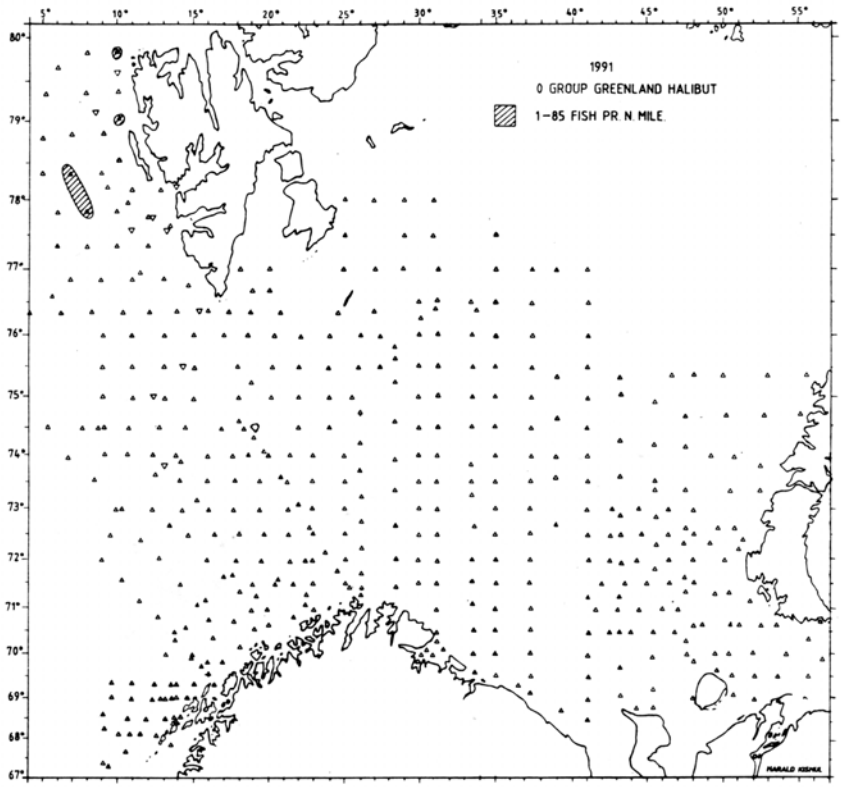

Fig. 20. Distribution of 0-group Greenland halibut

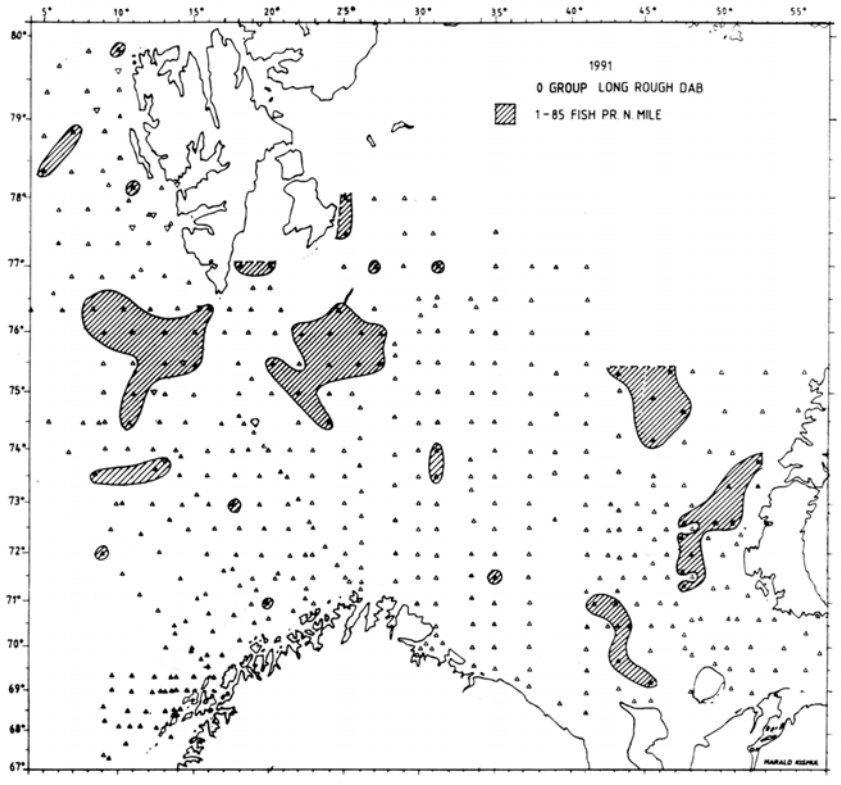

Fig. 21. Distribution of 0-group long rough dab

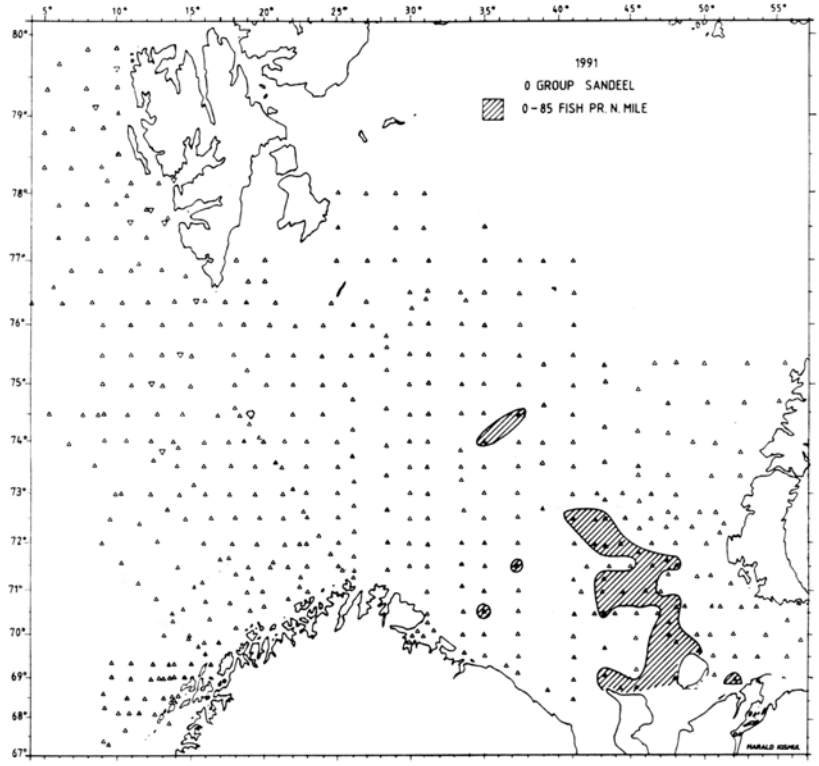

Fig. 22. Distribution of 0-group sandeel

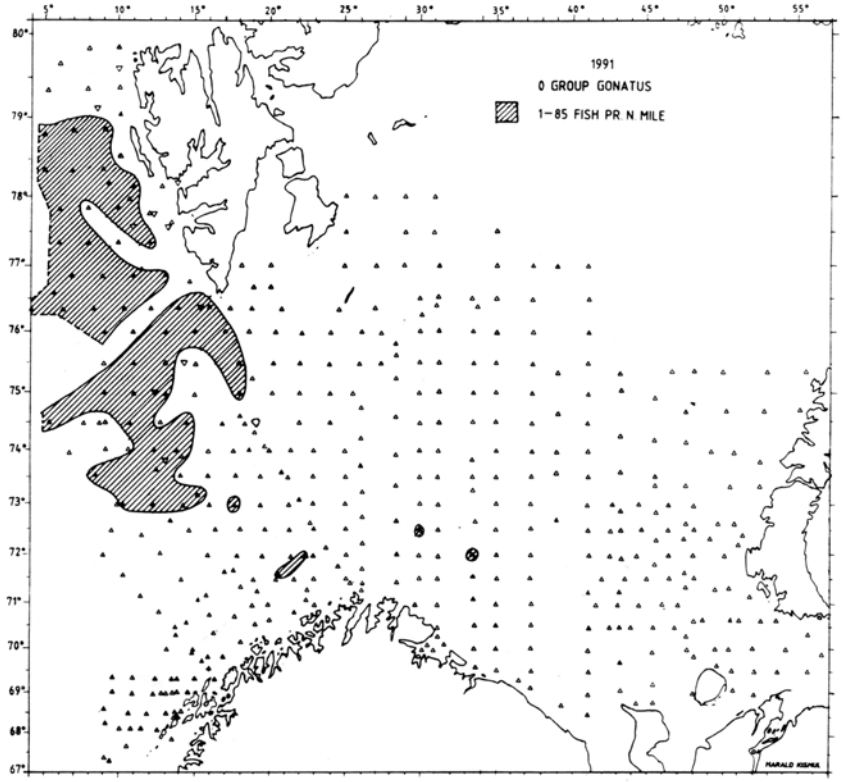

Fig. 23. Distribution of 0-group Gonatus fabricii

International Council for
the Exploration of the Sea

C.M. 1992/G: 82 Ref. H
Demersal Fish Committee

Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1992

The twenty-eight annual International 0-group fish survey was made during the period 12 August-8 September 1992 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey period	Research Institute
Norway	"Johan Hjort"	17.08 - 03.09	Institute of Marine Research Bergen
Norway	"G.O. Sars"	18.08 - 07.09	"
Norway	"Michael Sars"	13.08 - 07.09	"
Russia	"Professor Marty"	17.08 - 28.08	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
Russia	"Fridtjof Nansen"	24.08 - 05.09	"
Russia	"Akhill"	13.08 - 15.08	"

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

Preliminary analysis of the survey data were planned to take place during a meeting 8-9 September in Hammerfest. Since none of the Russian vessels were able to call at Hammerfest data were analysed at IMR, Bergen and PINRO, Murmansk and the results exchanged by correspondence (telefax and telemail).

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 distribution of 0-group fish were estimated with a small mesh midwater trawl. The vessels, which participated in the survey in 1992, 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 the 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 miles in each of 3 depths with the headline of the trawl located at 0, 20 and 40m. An additional tow at 60 and 80m for 0.5 nautical mile was made when 0-group fish layer was recorded on the echo-sounder deeper than 60m.

Survey tracks and hydrographical stations are given in Fig. 1. Trawl stations with and without catch are indicated on the distribution charts in Figs. 14-23, as filled and open symbols respectively. The density grading is based on catch in number per 1.0 nautical mile trawling.

Hydrography

Observations were made along all the survey tracks with 5 to 40 nautical miles between stations. Horizontal distribution of temperatures and salinities is shown for 0, 50, 100 and 200 m (Figs. 2-9). Figs. 10-13 show the temperature and salinity conditions along the Kola, Bear Island - North Cape, Bear Island - West and Cape Kanin sections. The mean temperatures in the main parts of these sections are presented in Table 1.

It appears that mean sea temperatures from 0 to 200 m were high and well above (0.4 °C to 0.7 °C) the long term average in all parts of the surveyed area, and 1992 is the fourth "warm year" in succession. The positive anomalies were mainly caused by large contents of heat in intermediate and deep layers and thus associated with water masses of Atlantic origin flowing into the Barents Sea from west. Surface layer temperatures (0-50 m) in the central and southeastern parts of the area were significantly lower in 1992 than in 1991 and just slightly above the long-term average.

Distribution and abundance of 0-group fish and Gonatus fabricii

Geographical distribution of 0-group fish is shown as shaded areas in Figs. 14-22, and of Gonatus fabricii in Fig. 23. 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. 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.14)

The distribution of herring was similar to that of 1991 in the Barents Sea, but with fewer observations along West-Spitsbergen. The main concentrations were found in the Western Barents Sea along the edge of the shelf between the Norwegian coast and up to South Cape (76° N), and eastwards as far as 50° E. The logarithmic abundance index is estimated at 1.06, which is only slightly below the 1991 index (1.19) and indicates that the 1992 year-class is relatively strong.

Capelin (Fig.15)

There were very few observations of 0-group capelin and dense concentrations were observed at one station only in the southeastern part of the Barents Sea. The overall catch in numbers is among the lowest ever recorded since the 0-group investigations started in 1965 and the 1992 year-class seems to be very poor.

Cod (Fig.16)

0-group cod had one of the widest distributions ever observed, similar to that of 1991, extending from Norway and Murman coast to at least 80°30' N off West-Spitsbergen (into the drift ice) and to 77° N in central parts. In the east it was recorded north to 73° N and east to Novaya Zemlya (52° E). The abundance indices for the 1992 year-class are the highest in the

time-series and well above both the 1983, 1985 and 1991 year-classes. At this stage the 1992 year-class must be classified as a very strong one.

Haddock (Fig.17)

Haddock was, as in 1991, mainly distributed in western areas from the Norwegian coast to 80° N off West-Spitsbergen. The eastern limit in the Barents Sea was at about 42° E. Dense concentrations were found in a smaller area than in 1991, mainly north of Cape North to 74° N. The abundance indices is the second highest ever observed, and the 1992 year-class may be classified as rich.

Saithe (Fig.18)

Unlike in previous years, 0-group saithe occurred in many hauls in most of the survey area. This may indicate good saithe recruitement in 1992.

Polar cod (Fig.19)

0-group polar cod is distributed in two separate areas, with one component west and southeast of Spitsbergen and one component in east along the western coast of Novaya Zemlya. During the 0- group survey the total area of distribution is not completely covered.

In the north-western area, the distribution was wider than in 1991, mainly off West-Spitsbergen, and the index about twice that of 1991. The 1992 year-class of polar cod in this area seems to be at least of average abundance.

In the southeastern area along Novaya Zemlya the distribution was similar to that of 1991, but the area with dense concentrations was smaller and the index only half of that in 1991. The 1992 year-class in this component of the polar cod stock may therefore be considered to be of average strength or slightly below average.

Redfish (Fig.20)

The main distribution of redfish was along the western edge of the shelf, from 73° N to 80°30' N off West-Spitsbergen. The area both scattered and dense concentrations were smaller than in 1991 and the index 25 % lower, the lowest since 1968. The 1992 year-class of redfish may therefore be considered as poor.

Greenland halibut (Fig.21)

Only single fish occurred in hauls west and east of Spitsbergen and, as in the previous four years, the abundance index indicates that the year-class is very poor.

Long rough dab (Fig.22)

This species occurred mainly southeast of Spitsbergen. The abundance index is the lowest recorded since 1970 and the 1992 year-class is considered to be poor

Blue whiting, sandeel and catfish.

Only a few specimens of these species were caught this year.

Gonatus (Fig.23)

Specimens of 0-group Gonatus fabricii were found over a larger area than in 1991. The distribution is westerly, from the Norwegian coast at 28° E and west into the Norwegian Ocean and north to about 80° N off Western Spitsbergen.

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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.

Table 1. Mean water temperature1 in main parts of standard sections in the Barents Sea and adjacent waters in august-September 1965-1992

[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)

Year	Section[2] 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
Average 1965-1992	7.3	3.7	4.6	4.1	3.2	5.7	4.5

Table 2. Abundance indices of 0-group fish in the Barents Sea and adjacent waters in 1965-1992

Year	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab
			West		East			
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	22	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
1987	102	72	17		155	631	41	174
1988	133	86	144		120	949	8	72
1989	202	112	206		41	698	5	92
1990	465	227	144		48	670	2	35
1991	766	472	90		239	200	1	28
1992	1159	313	195		118	150	3	32

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 1965-1992

Year	Herring[1)]			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	-	-	2.15	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
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	2.65	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

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

Table 4. Length distribution of 0-group fish[1] in percent in the Barents Sea and adjacent waters in August-September 1992

Length, mm	Herring	Capelin	Cod	Haddock	Polar cod		Redfish	Greenland halibut	Long rough dab	Sandeel
					East	West				
15-19						0.1				
20-24						0.8	+		0.6	
25-29				+		6.3	0.3		1.7	
30-34					6.3	16.2	0.9		14.9	
35-39		33.3			6.3	31.5	12.2	7.3	40.5	2.3
40-44		45.5	+	+	22.6	32.0	53.1	7.3	39.3	29.3
45-49	+	9.1	0.1		25.0	8.8	30.1	12.5	3.1	36.1
50-54	+	3.0	0.7	0.1	31.3	3.7	3.1			27.1
55-59	0.1	3.0	2.0	0.4	7.8	0.6	0.3			4.5
60-64	0.7		5.1	1.0	0.9	0.2				
65-69	2.4		8.1	2.0		0.1		2.1		
70-74	6.1	3.0	11.3	5.2				35.4		
75-79	12.0		16.8	8.0						
80-84	14.5		20.4	12.1				17.7		
85-89	14.8		18.0	13.0				17.7		
90-94	13.7	3.0	9.8	11.5						
95-99	12.5		4.4	10.6						
100-104	10.7		2.0	9.8						0.8
105-109	6.7		0.8	10.1						
110-114	3.7		0.1	5.8						
115-119	2.0		0.2	4.4						
120-124	0.2			2.5						
125-129	0.1			1.7						
130-134				1.1						
135-139	+			0.6						
140-144	+			0.1						
Total numbers	162-002	33	179-354	3795	116	68-621	80-474	8	169	132
Mean length	90.0	44.0	80.2	94.3	46.8	38.7	43.1	68.5	38.3	47.5

[1)] Based on Norwegian observations only.

Appendix

Research vessel	Participants
"Professor Marty"	N. Bolshakova, S. Boychuk, V. Chizhikov, I. Dolgoleko, A. Gordov, T. Jusupov, L. Kuzmin, S. Ratushny, V. Ryazantsev, N. Ushakov
"Fridtjof Nansen"	S. Baturin, S. Boranov, A. Dorchenkov, V. Kapralov, O. Leontovich, S. Ostrovsky, A. Pedchenko, T. Shamray, Y. Shamray
"Akhill"	A.L. Karsakov, A.G. Nikiforov, V.K. Ozhigin, V.A. Tataurov, V.P. Vorontsov, N.S. Vovchuc
"Johan Hjort"	I.M. Beck, M. Dahl, H. Grædal, S. Lygren, S. Mehl, E. Meland, E. Ona, L. Solbakken, I.Svellingen
"G.O. Sars"	J. Erices, H. Hammer, A. Hylen, R. Johannessen, L.Kalvenes, H. Larsen, K. Lauvås, M. Møgster, O. Nakken, A. Raknes, S. Wilhelmsen, V.Serebryakov
"Michael Sars"	O. Gullaksen, T.I. Halland, K. Hansen, G. Iversen, K. Korsbrekke, B. Kvinge, M. Mjanger, Ø.Nævdal

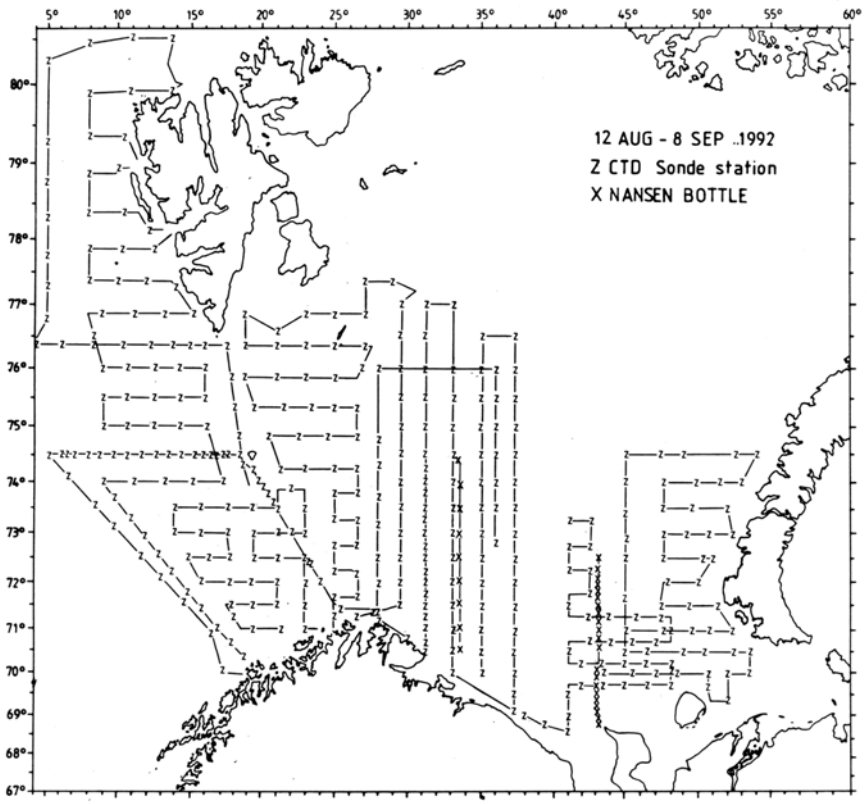

Fig. 1. Survey tracks and hydrographic stations

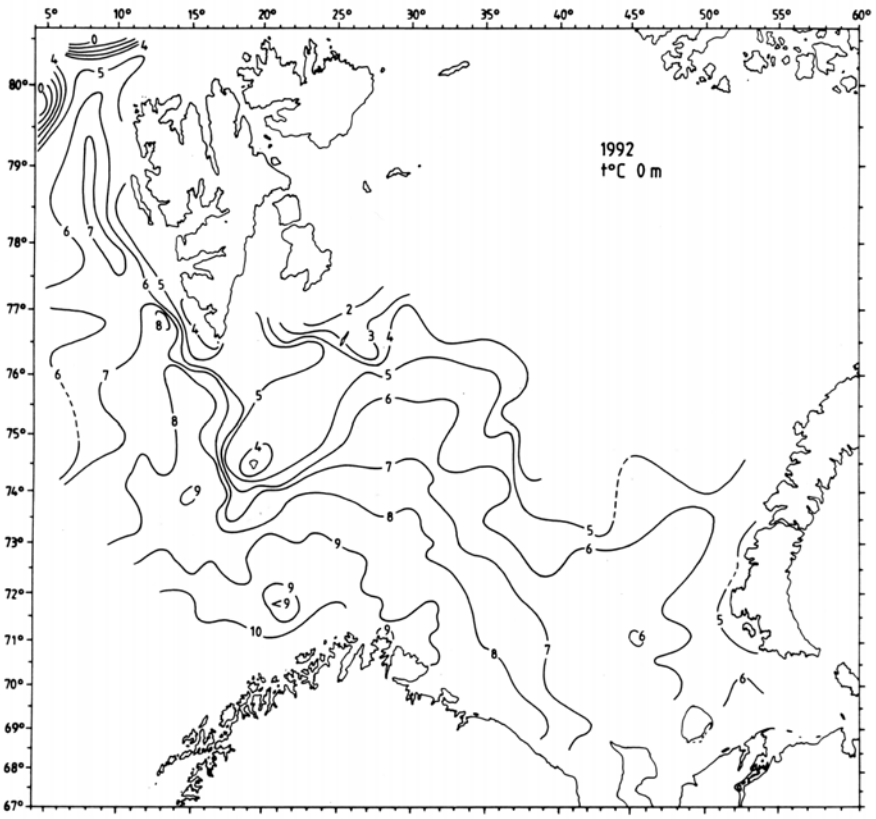

Fig. 2. Isotherms at 0 m

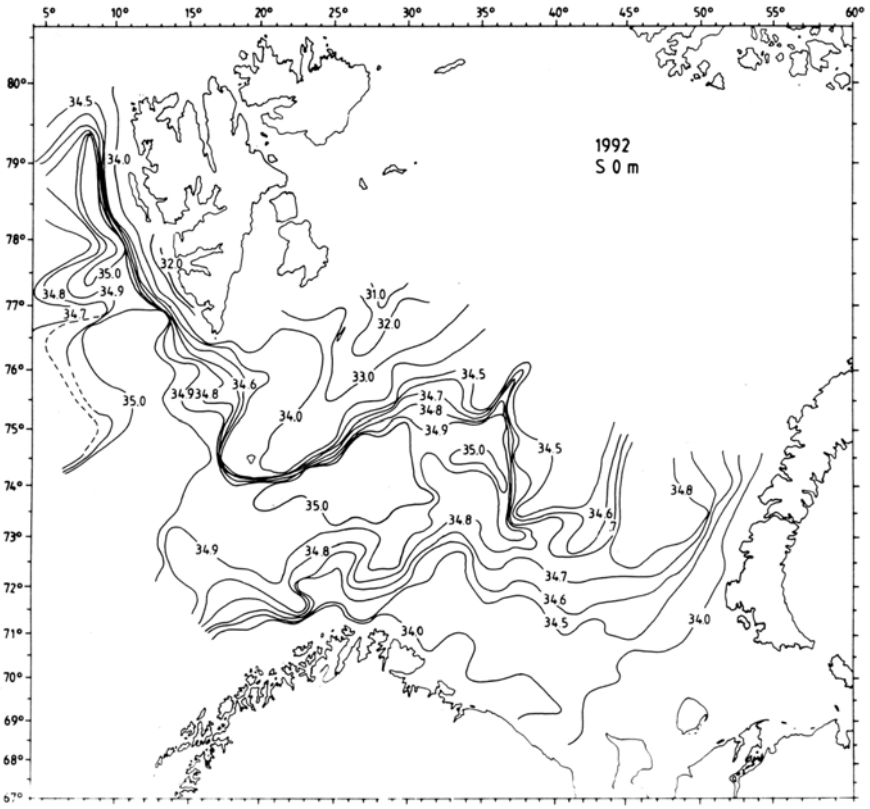

Fig. 3. Isohalines at 0 m

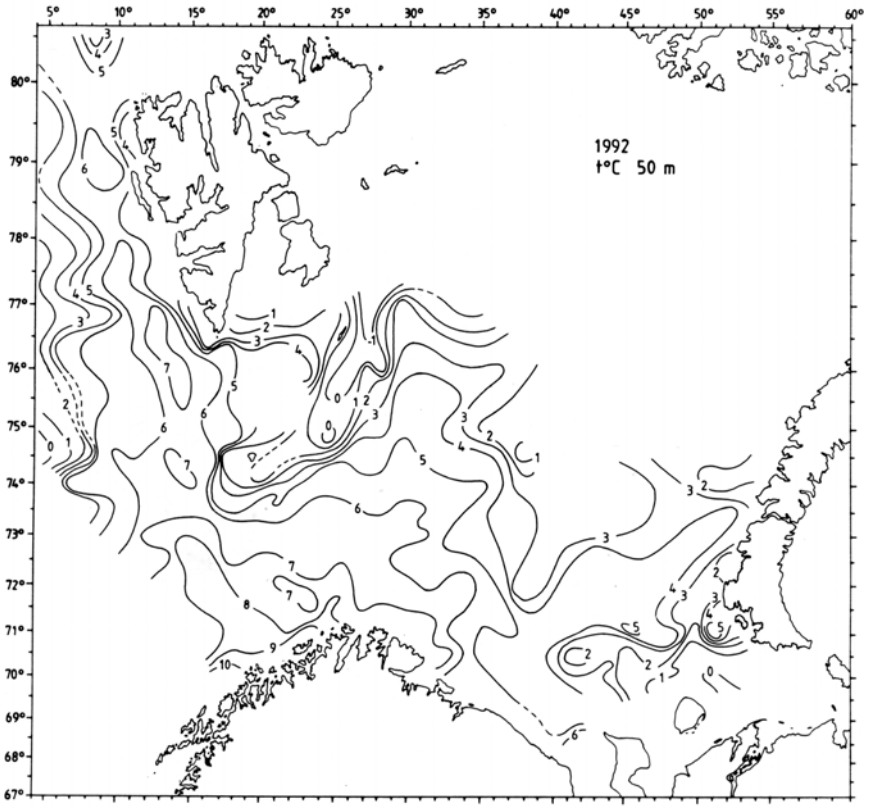

Fig. 4. Isotherms at 50 m

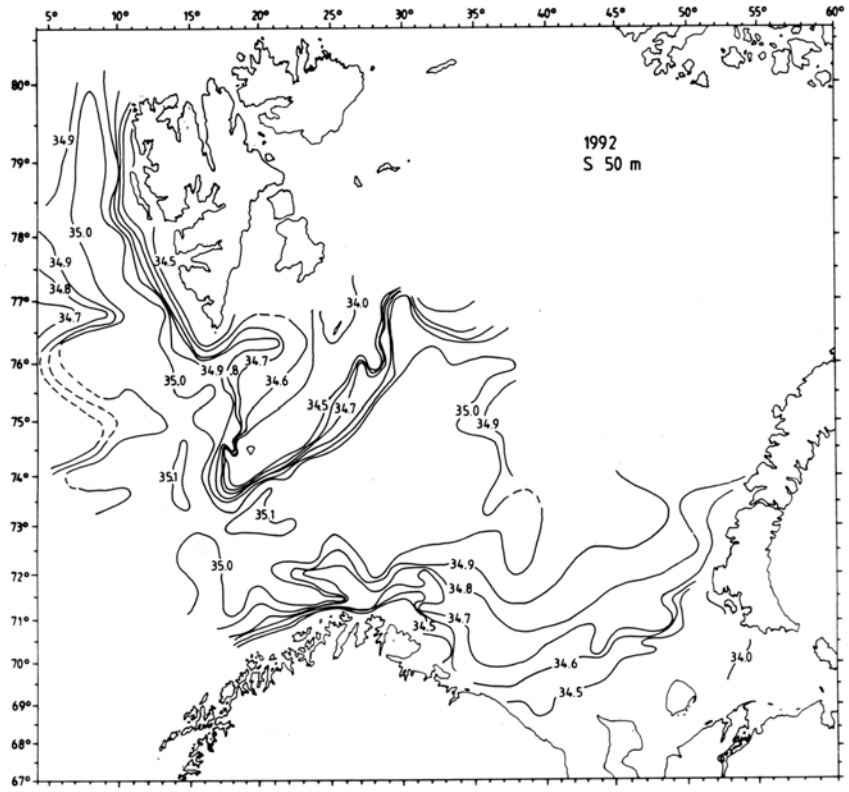

Fig. 5. Isohalines at 50 m

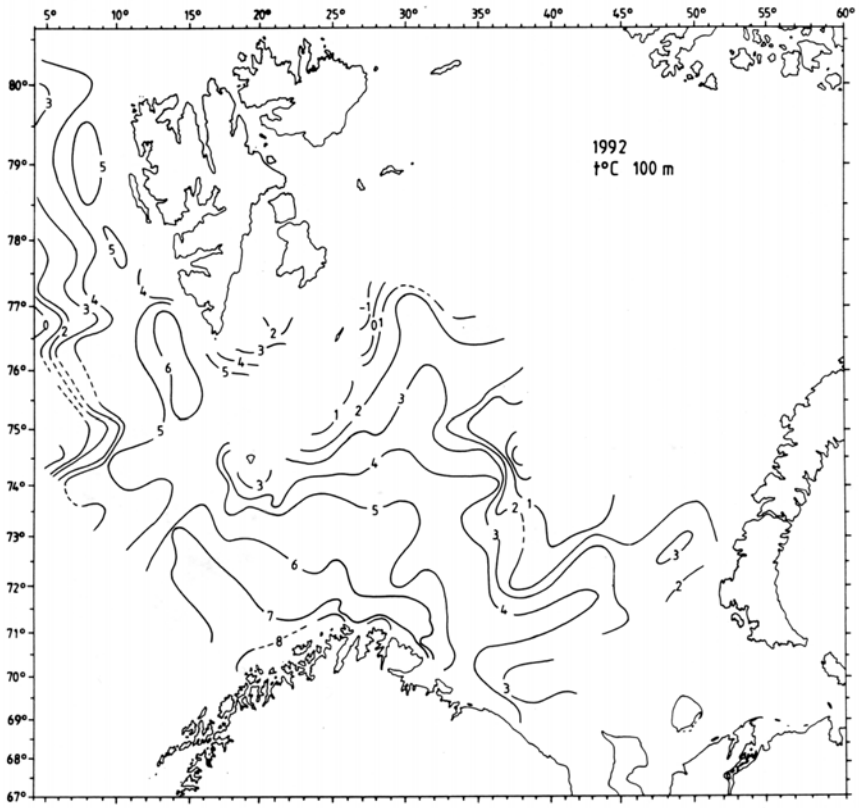

Fig. 6. Isotherms at 100 m

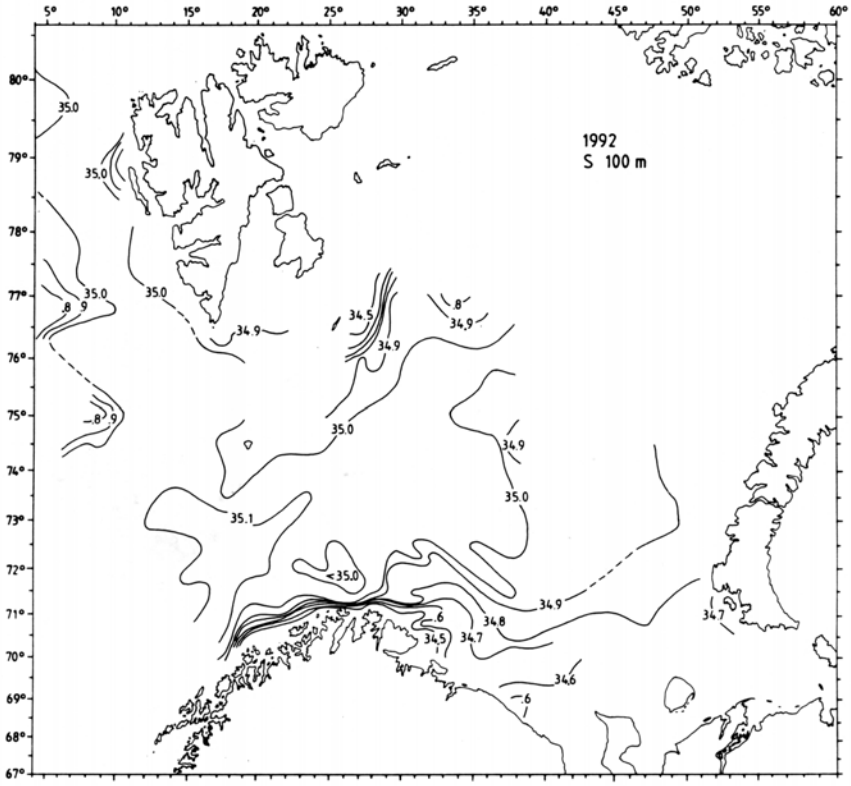

Fig. 7. Isohalines at 100 m

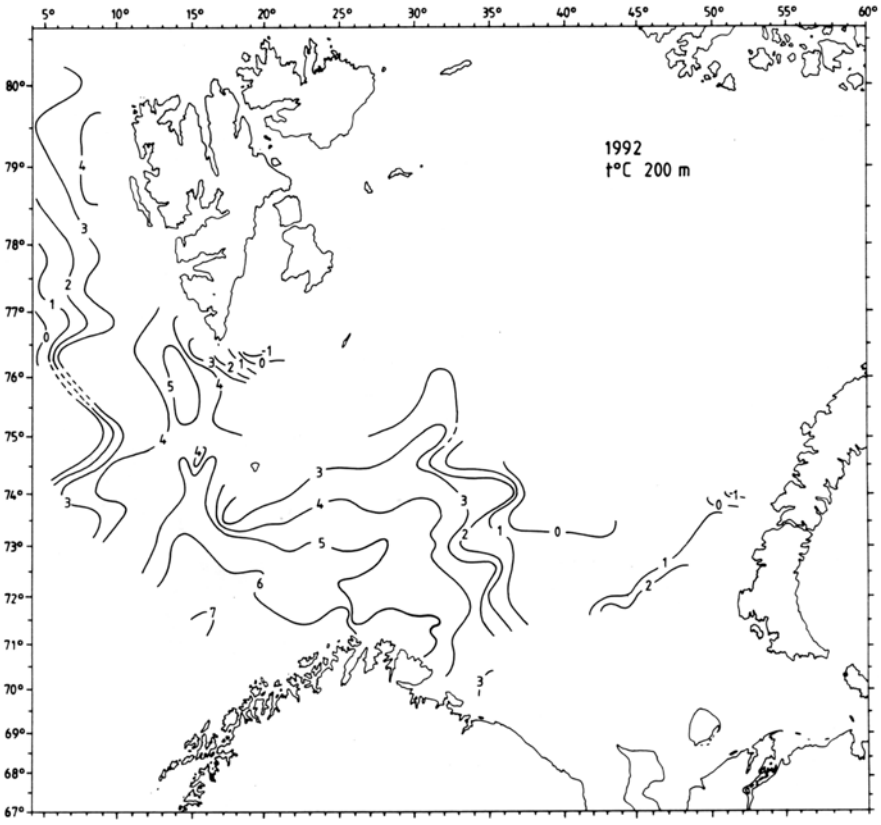

Fig. 8. Isotherms at 200 m

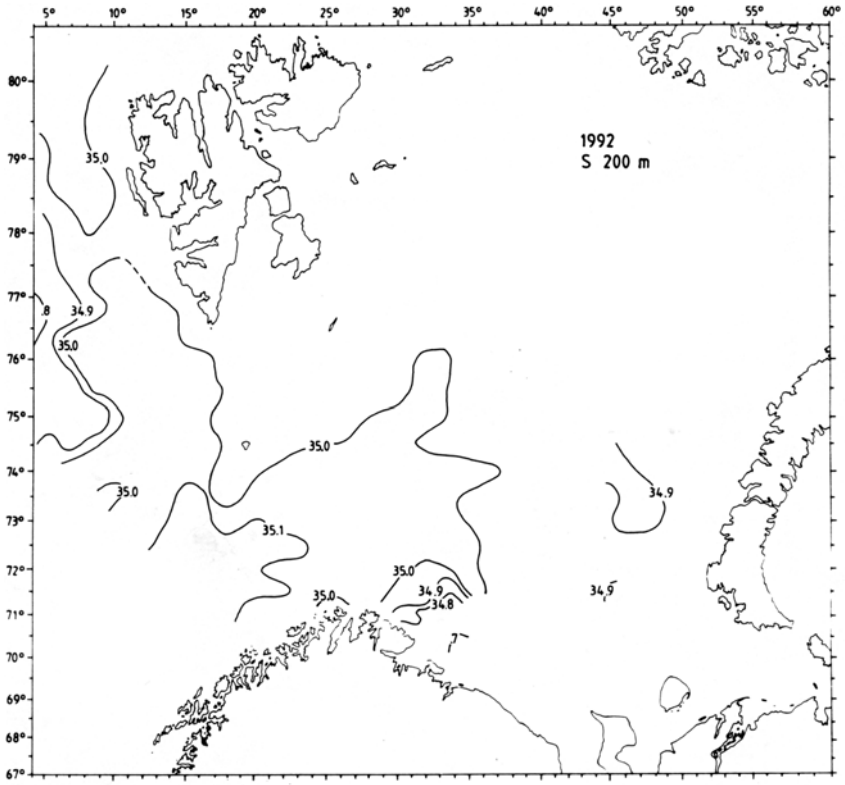

Fig. 9. Isohalines at 200 m

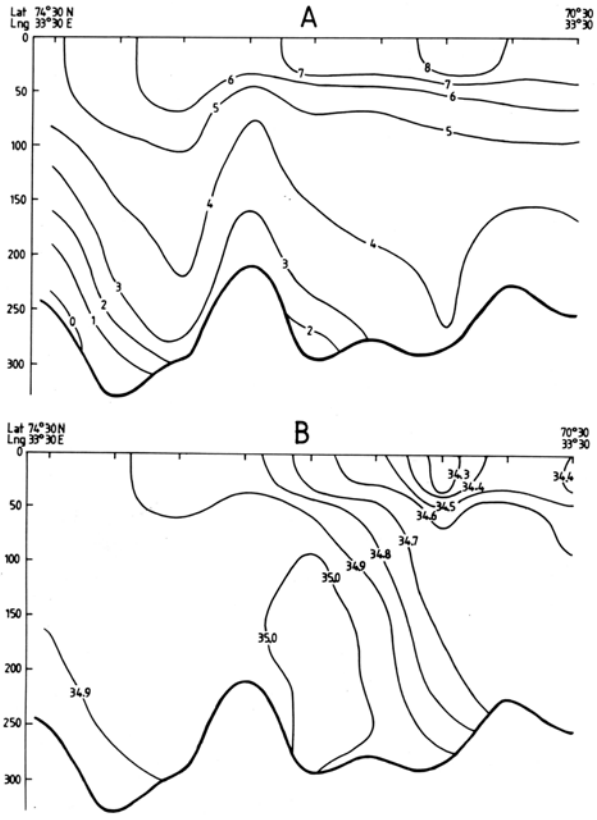

Fig. 10. Hydrographic section along the Kola meridian. Temperature (A) and salinity (B)

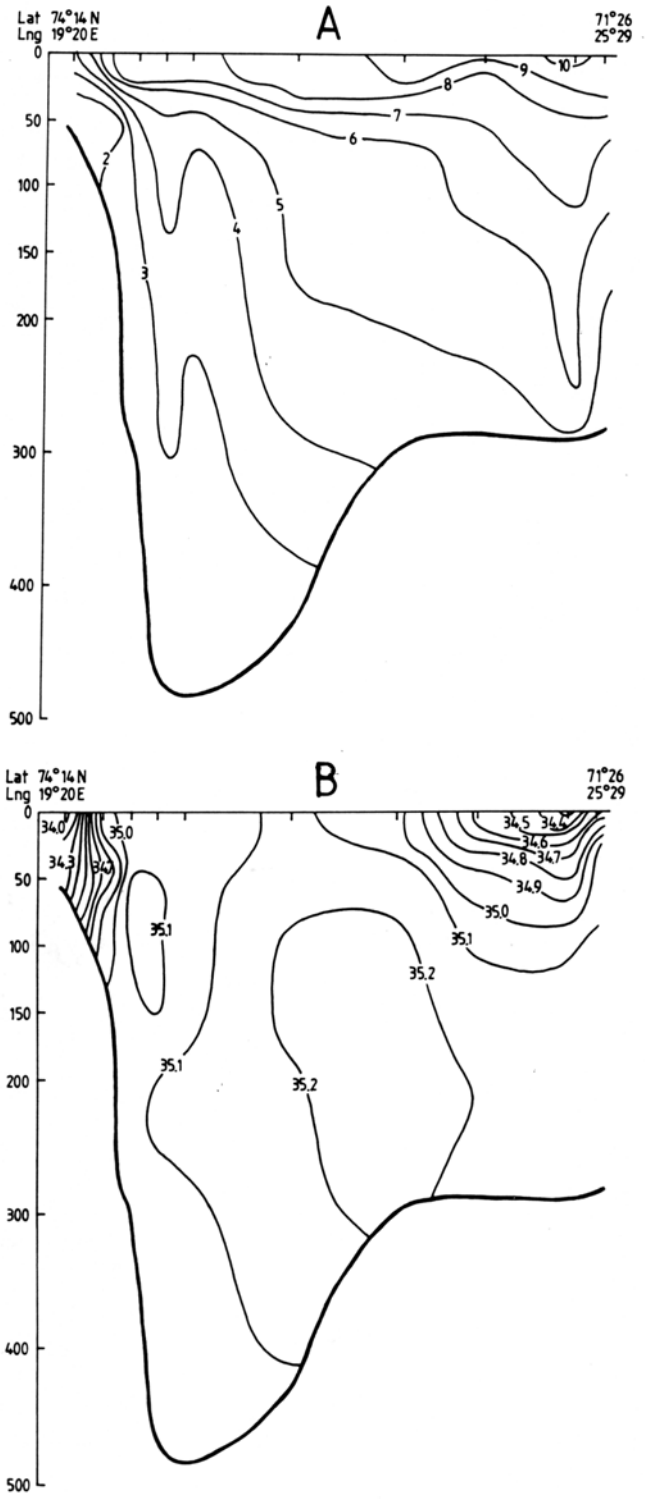

Fig. 11. Hydrographic section North Cape-Bear Island. Temperature (A) and salinity (B)

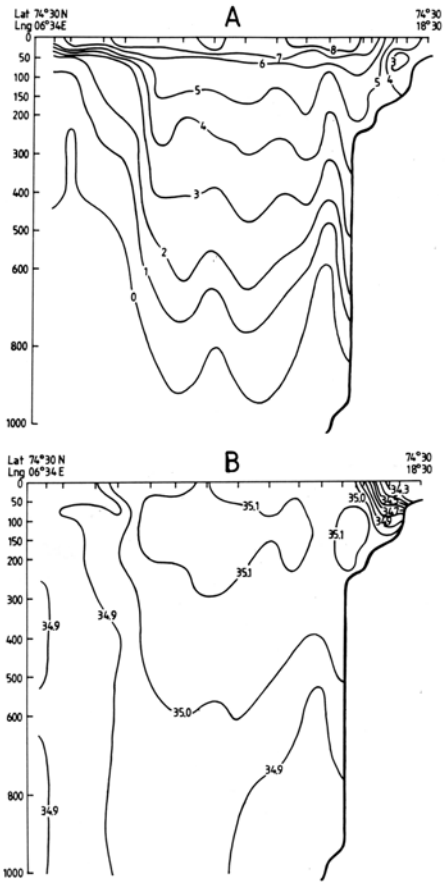

Fig. 12. Hydrographic section Bear Island-West. Temperature (A) and salinity (B)

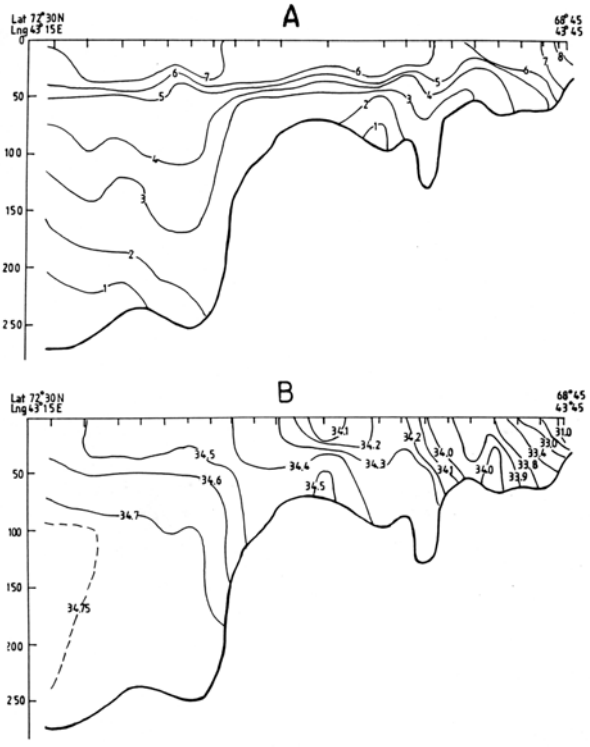

Fig. 13. Hydrographic section Cape Kanin-North. Temperature (A) and salinity (B)

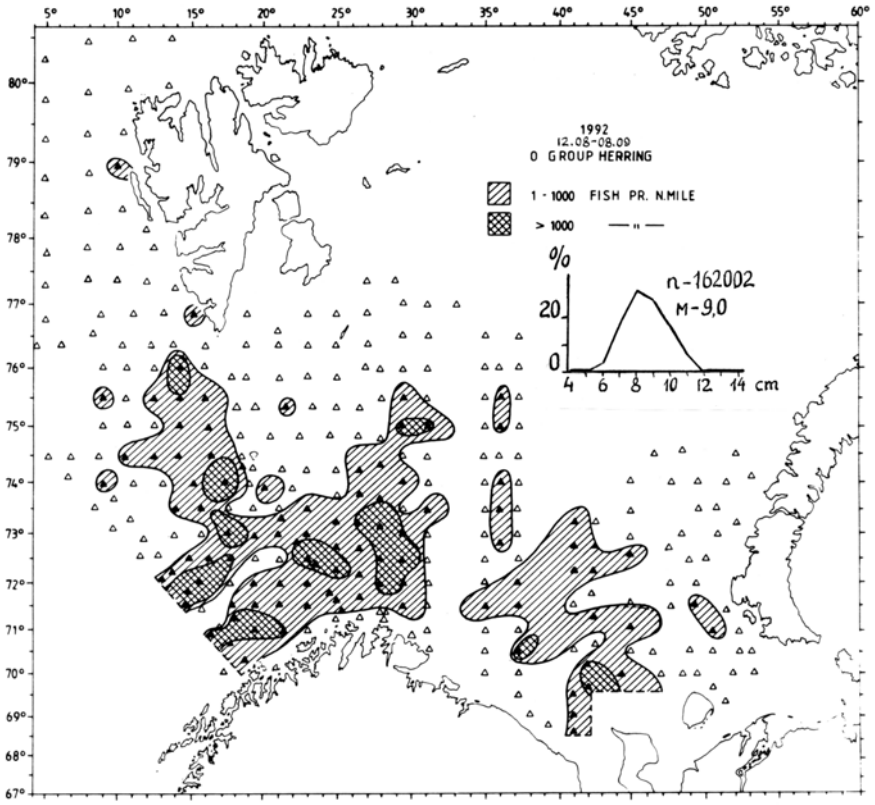

Fig. 14. Distribution of 0-group herring

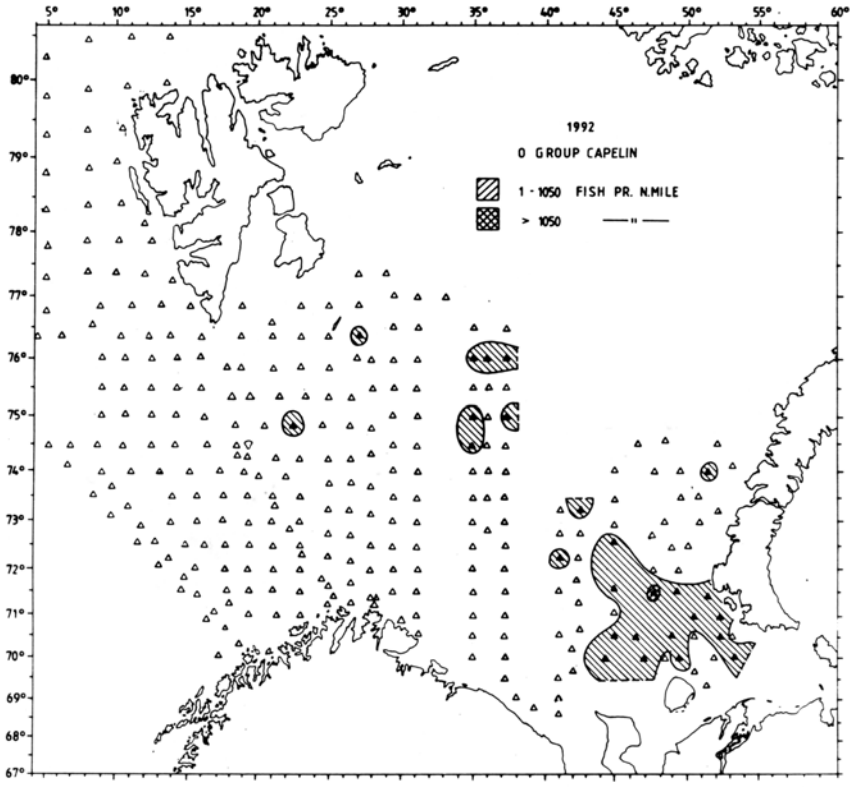

Fig. 15. Distribution of 0-group capelin

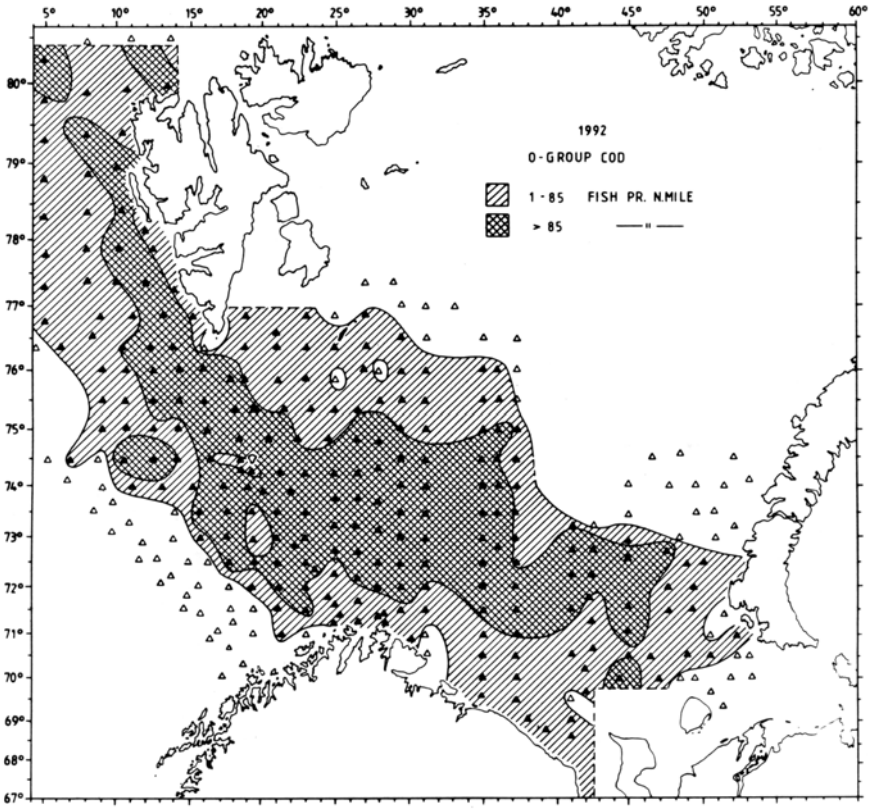

Fig. 16. Distribution of 0-group cod

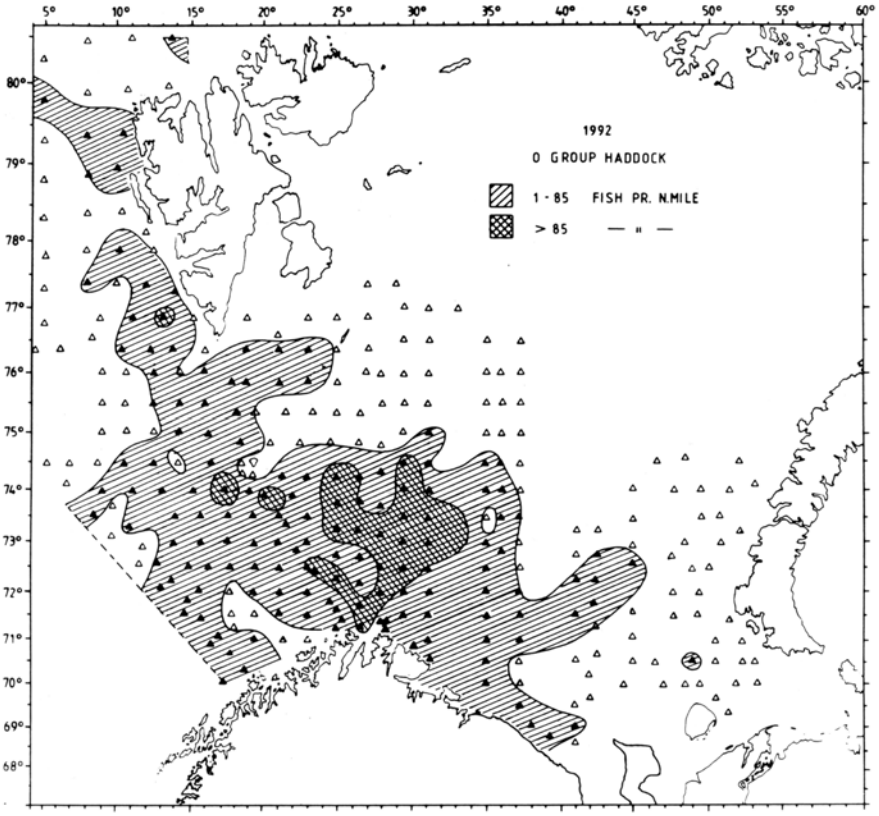

Fig. 17. Distribution of 0-group haddock

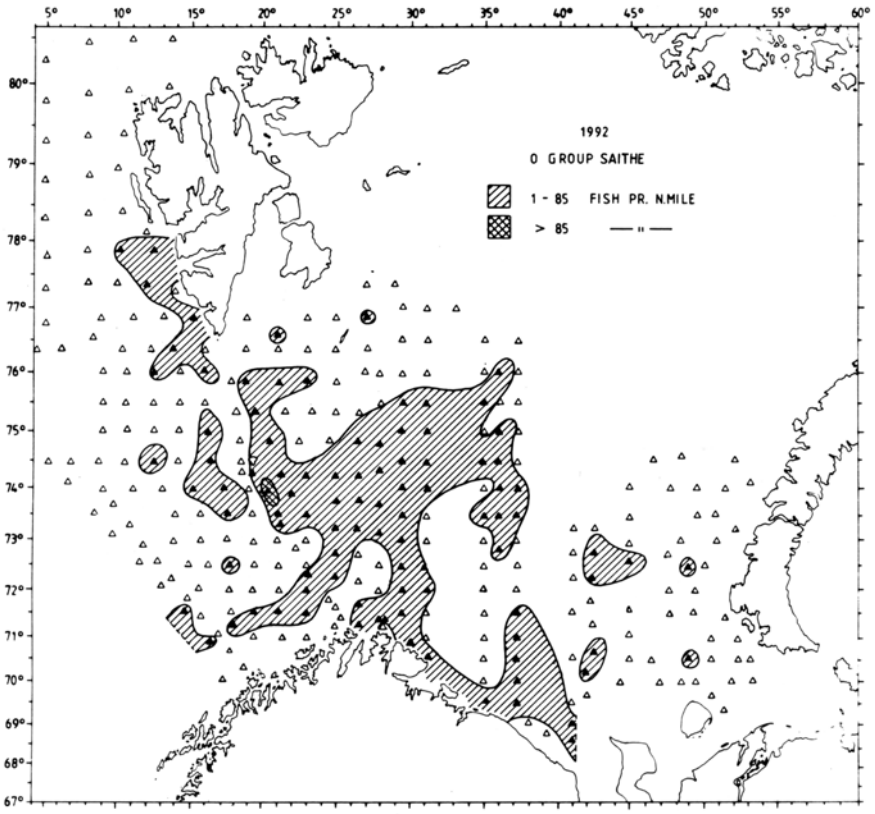

Fig. 18. Distribution of 0-group saithe

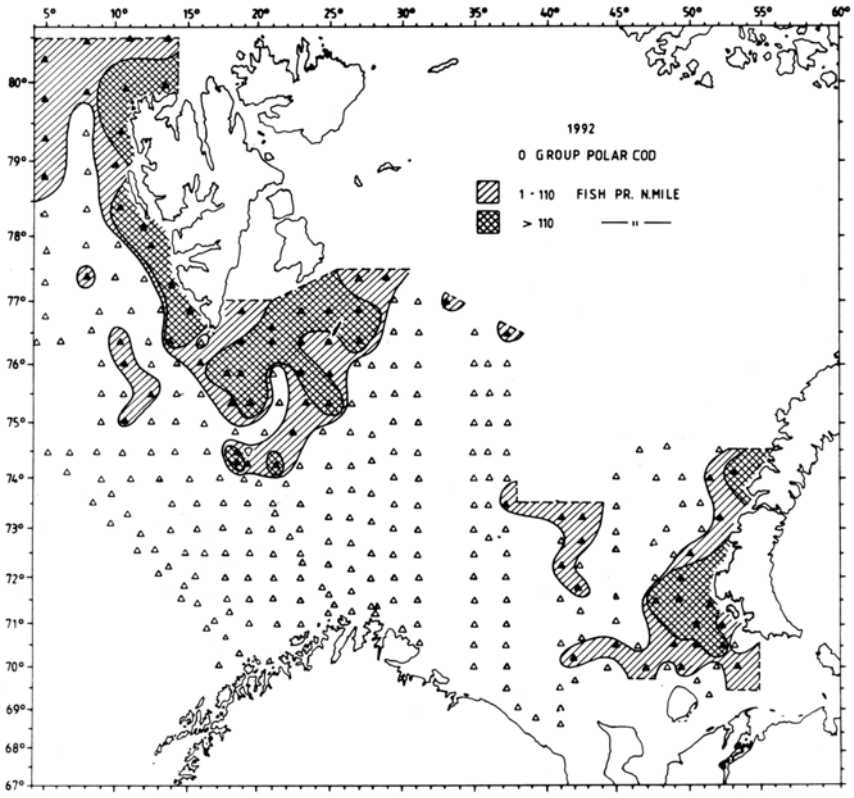

Fig. 19. Distribution of 0-group polar cod

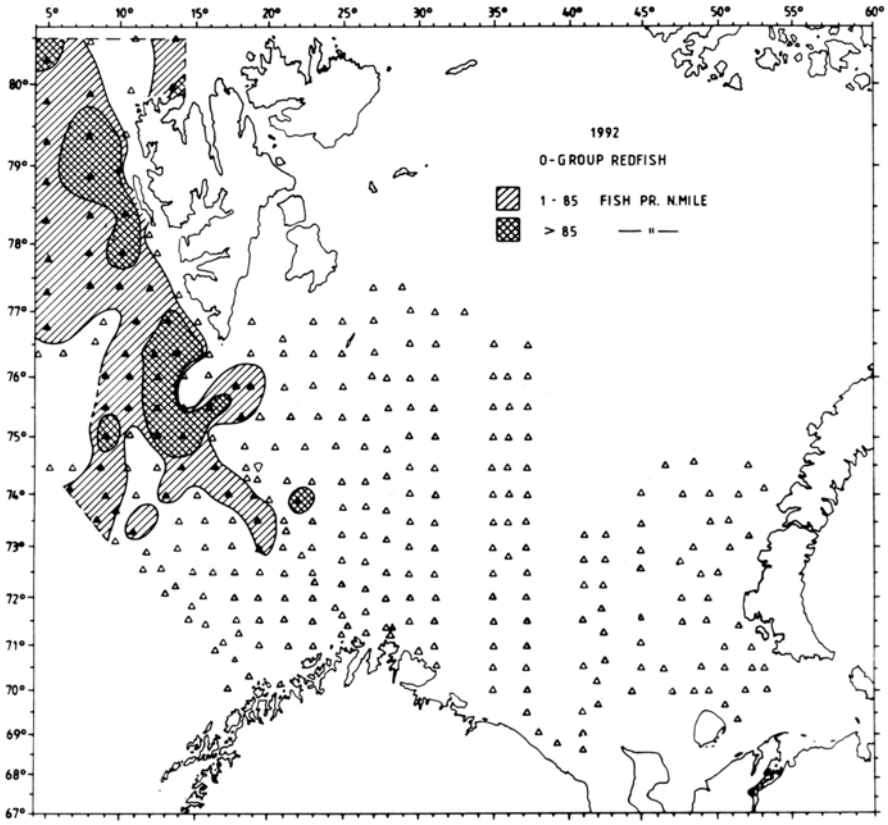

Fig. 20. Distribution of 0-group redfish

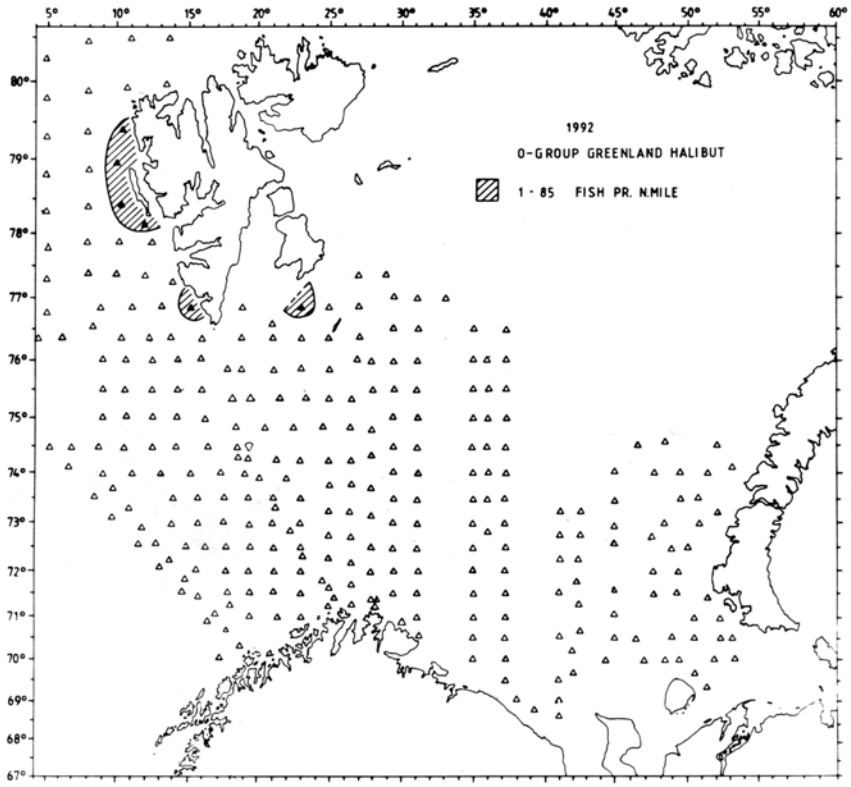

Fig. 21. Distribution of 0-group Greenland halibut

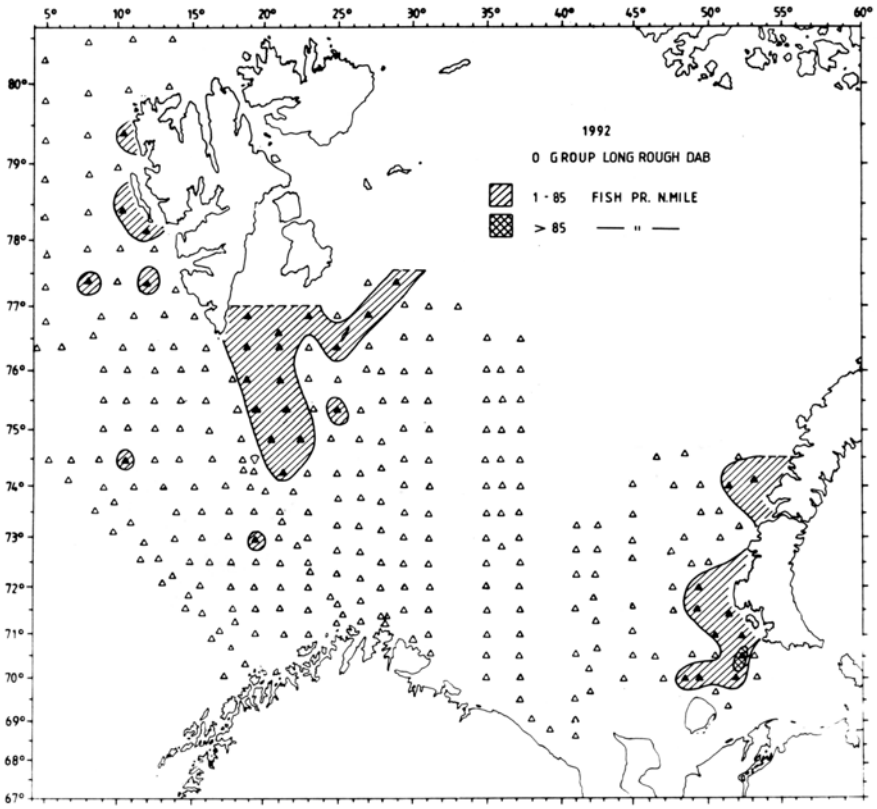

Fig. 22. Distribution of 0-group long rough dab

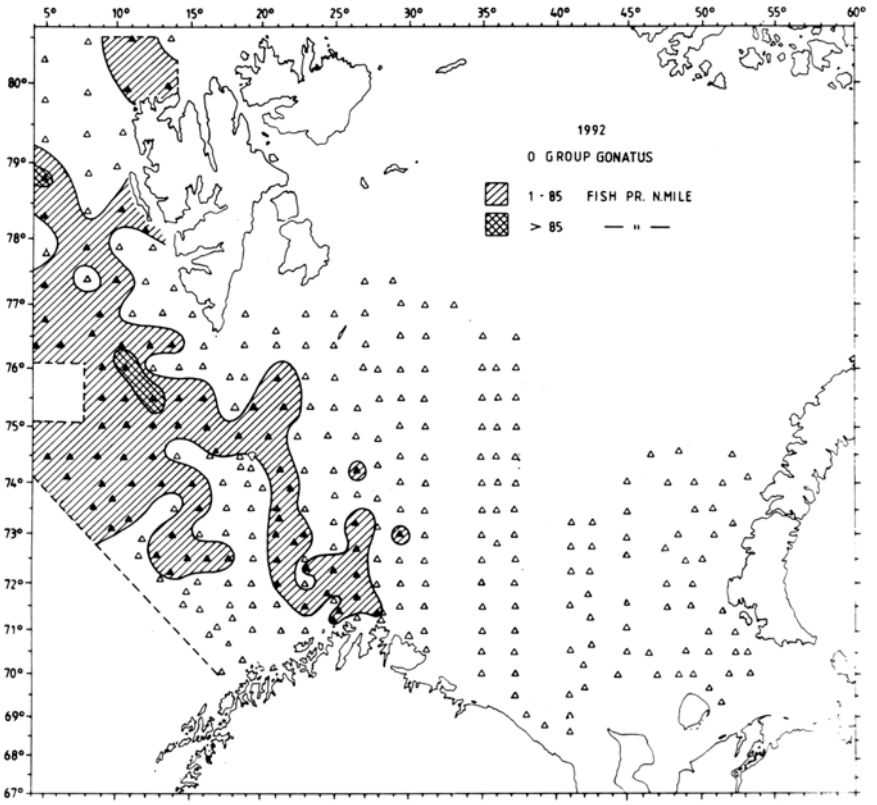

Fig. 23. Distribution of 0-group Gonatus fabricii

International Council for the Exploration of the Sea

C.M. 1994/G: 3
Ref.H Demersal Fish Committee

Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1993

The twenty-ninth annual International 0-group fish survey was made during the period 16 August-8 September 1993 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey period	Research Institute
Norway	"Johan Hjort"	16.08 – 08.09	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	17.08 – 07.09	"
Russia	"Professor Marty"	22.08 – 08.09	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
Russia	"Pinro"	23.08-06.09	"

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 5-7 October in Murmansk. 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 distribution of 0-group fish was estimated with a small mesh midwater trawl. The vessels, which participated in the survey in 1993, 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 the 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 miles in each of 3 depths with the headline of the trawl located at 0, 20 and 40 m. An additional tow at 60 and 80m for 0.5 nautical mile was made when 0-group fish layer was recorded on the echo-sounder deeper than 60m.

A procedure starting with the trawl in the deepest layer would probably be preferable. The trawl would then be "fishing" more efficient troughout the whole trawl haul and maintain the correct geometry. It is recommended that this in further investigated.

Survey tracks and hydrographical stations are given in Fig. 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 in number per 1.0 nautical mile trawling.

Hydrography

Observations were made along all the survey tracks with 5 to 40 nautical miles between stations. Horizontal distributions of temperatures and salinities are shown for 0, 50, 100, 200 m and bottom (Figs. 2-11). Figs. 12-15 show the temperature and salinity conditions along the Bear Island - West, Bear Island - North Cape, Kola and Cape Kanin sections. The mean temperatures in the main parts of these sections are presented in Table 1.

According to temperature conditions, 1993 is the fifth "warm year" in succession. However this year the mean sea temperatures from 0-200 m in the Barents Sea were only 0.1-0.2 °C above the long term average (1965-1993). Compared to 1992 a significant fall in temperature (0.3-0.6 °C) was observed. The reduced positive anomalies in the hydrographical standard sections are mainly due to lower heat content in the layer below the seasonal thermoclyne. The temperature in 50-100 m layer along the Kola section was the same as observed in 1992. Upper mixed layer temperature was significantly (0.5-1.5 °C) higher than previous year. This is associated with the favourable conditions of the summer heating. In the West Spitsbergen Current (0-200 m) temperature was 0.8 °C above long-term average and 0.4 °C higher than in 1992. Upper mixed layer temperature in this area was also 1.0-1.5 °C higher than previous year. Observed thermal conditions were caused by decrease of Atlantic inflow into the Barents Sea and increase into the area west of Bear Island and West of Spitsbergen.

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. Another set of abundance indices are 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.

The main distribution of 0-group fish were more westerly orientated in 1993 than in previous years.

Herring (Fig. 16)

Scattered concentrations with small dense patches were observed more westerly than last year and approached 80° N west of Spitsbergen. The main concentrations were found in the central part of the Barents Sea, and herring was distributed eastwards to 38° E. The logarithmic abundance index is estimated at 0.75, which is somewhat below the 1991 and 1992 indices, but still the fourth highest in the time-series. This indicates that the 1993 year-class is relatively strong.

Capelin (Fig. 17)

As in last year 0-group capelin was distributed mainly near Novaya Zemlya and in small quantities, and it seems to be the second very poor year-class in succession. The length distribution indicates that this 0-group comes from summer spawners.

Cod (Fig. 18)

Along west off Spitsbergen dense concentrations were recorded in a wider area than previous year. The largest area with dense concentrations was found in the central part of the Barents Sea, from about 20-40° E and north to 76° N. In the southeastern part of the Barents Sea mainly scattered concentrations were observed. 0-group cod was absent in the south-east off the Murman coast until Kolguev island. The logarithmic abundance index for the 1993 year-class (2.09) is the fifth highest in the time-series, above that of 1983, and the year-class must be classified as strong.

Haddock (Fig. 19)

To the west of Spitsbergen 0-group haddock was distributed in a smaller area than last year. In the western and central part of the Barents Sea the distribution was similar to that of 1992, but with few observations east of 35° E. The logarithmic index was estimated at 0.64, which is the third highest since 1965, indicating another good year-class of haddock.

Saithe (Fig. 20)

In the central part of the investigated area saithe was less abundant than in 1992, while to the west of Spitsbergen the species was observed over a larger area and in higher quantities. In most years there are relatively few observations of 0-group saithe in the Barents Sea and therefore no index is calculated.

Polar cod (Fig. 21)

0-group polar cod is distributed in two separate areas, with one component - west and southeast of Spitsbergen and a second component in east along the western coast of Novaya Zemlya. During the 0-group survey the total area of distribution is not completely covered.

In the north-western area, the distribution was similar to previous year. The index was just a little lower than in 1992 and the 1993 year-class of polar cod in this area seems to be of average abundance.

Dense concentrations of the eastern component were distributed over a wider area than in 1992. During the following pelagic fish survey in September it was found that this component covered a much wider area towards northeast, but since this area normally is not investigated during the 0-group survey, it was not included in the calculations of the abundance index. Still the index increased by 32 % and the 1993 year-class in the eastern area may be considered to be at least of average strength.

Redfish (Fig. 22)

Similar to 1992, 0-group redfish was only distributed in the western areas, along the western edge of the shelf and off West- Spitsbergen. The area with dense concentrations was larger this year, and the index slightly higher (8 %), but still the year-class must be considered to be poor, as in the two previous years.

Greenland halibut (Fig. 23)

Only scattered concentrations were recorded in limited patches mainly to the west of Spitsbergen. The index increased with a factor of more than 3 compared to previous year, but the year-class is still poor (the sixth in succession).

Long rough dab (Fig. 24)

The 0-group was mainly distributed in the central part of the Barents Sea over a wider area than previous year and with some scattered patches in the eastern and southeastern areas. No dense aggregations were observed. The index increased by over 40 %, but still the year-class is considered to be another poor one.

Sandeel (Fig. 25)

Sandeel was mainly observed nearby Novaya Zemlya as in 1987, but further to the north.

Catfish (Fig. 26) and blue whiting.

Only a few specimens of catfish and blue whiting were caught.

Gonatus (Fig. 27)

0-group Gonatus fabricii was found in the western part of the investigated area, but in smaller quantities than in 1992.

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Tereshchenko, V.V. 1992. Some results from long-term oceanographic observations during 0-group surveys in the Barents Sea. ICES CM 1992/C:18.

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Table 1. Mean water temperature[1] in main parts of standard sections in the Barents Sea and adjacent waters in august-September 1965-1993

[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)

Year	Section[2] 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
Average 1965-1993	7.3	3.8	4.7	4.2	3.2	5.7	4.6

Table 2. Abundance indices of 0-group fish in the Barents Sea and adjacent waters in 1965-1993

Year	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab
			West		East			
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	22	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
1987	102	72	17		155	631	41	174
1988	133	86	144		120	949	8	72
1989	202	112	206		41	698	5	92
1990	465	227	144		48	670	2	35
1991	766	472	90		239	200	1	28
1992	1159	313	195		118	150	3	32
1993	910	240	171		156	162	11	55

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 1965-1993

Year	Herring[1]			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	0.57	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
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	2.65	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	1.7.0	2.51	0.64	0.48	0.82

[1)] 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 1993

Length, mm	Herring	Capelin	Cod	Haddock	Polar cod		Redfish	Greenland halibut	L.R.D.	Sandeel
					East	West				
15-19									1.1	
20-24		0.1			1.9	0.2	5.3		-	
25-29		0.4			3.7	4.9	24.4	4.3	5.7	0.8
30-34		3.3	+		10.8	29.6	45.4	-	44.3	12.3
35-39		10.0	0.1	0.1	13.3	40.5	21.0	8.7	38.6	19.9
40-44	0.1	18.8	0.2	0.1	12.6	22.0	3.8	-	10.2	17.3
45-49	0.6	21.4	0.5	0.2	18.6	2.7	0.1	8.7		9.1
50-54	3.8	14.2	1.3	0.3	22.6	0.1	+	30.4		9.2
55-59	3.8	3.0	2.0	0.4	9.7	+		30.4		10.8
60-64	8.0	5.0	3.1	0.5	6.4	+		13.0		10.0
65-69	12.1	3 .3	5.9	0.8	0.3			4.3		3.5
70-74	16.7	5.8	10.7	1.1	-					3.2
75-79	25.5	4.6	15.5	2.1	+					2.3
80-84	16.8	5.0	20.2	2.9						1.4
85-89	8.8	2.3	17.1	6.3						0.1
90-94	3.0	1.9	13.5	15.1						
95-99	0.5	0.9	6.9	14.2						
100-104	0.1		2.3	15.8						
105-109	0.1		0.6	14.0						
110-114			+	13.4						
115-119			+	6.2						
120-124			+	2.3						
125-129			+	1.8						
130-134				1.2						
135-139	+			0.6						
140-144				0.5						
Total numbers	327-193	702	134-724	5810	278-129	48-55	34-18	23	176	7431
Mean length	74.6	54.1	81.8	101.5	45.8	36.4	31.7	53.2	35.0	48.4

Appendix

Research vessel	Participants
"Professor Marty"	S. Boychuk, V. Donetskov, Yu. Garbut, A. Gordov, S. Ratushny, E. Shamray, V. Tretyak
"Pinro"	N. Chebotok, P. Duzin, E. Gusev, S. Hardin, A. Krysov, F. Minyazov, G. Polyakin
"Johan Hjort"	B. Bergfløt, I. Fjellstad, M. Fonn, A. Fotland, H. Græsdal, H. Larsen, K. Lauvås, S. Mehl, M. Mjanger, A. Næss, A. Romslo, L. Solbakken, R. Toresen, B. Kvinge
"G.O. Sars"	M. Dahl, E. Holm, A. Hylen, S. Iversen, L. Kalvenes, J. de Lange, M. Møgster, Ø. Nævdal, V. Ozhigin (PINRO), R. Pettersen, A. Raknes, N. Ushakov (PINRO), E. Øvretveit

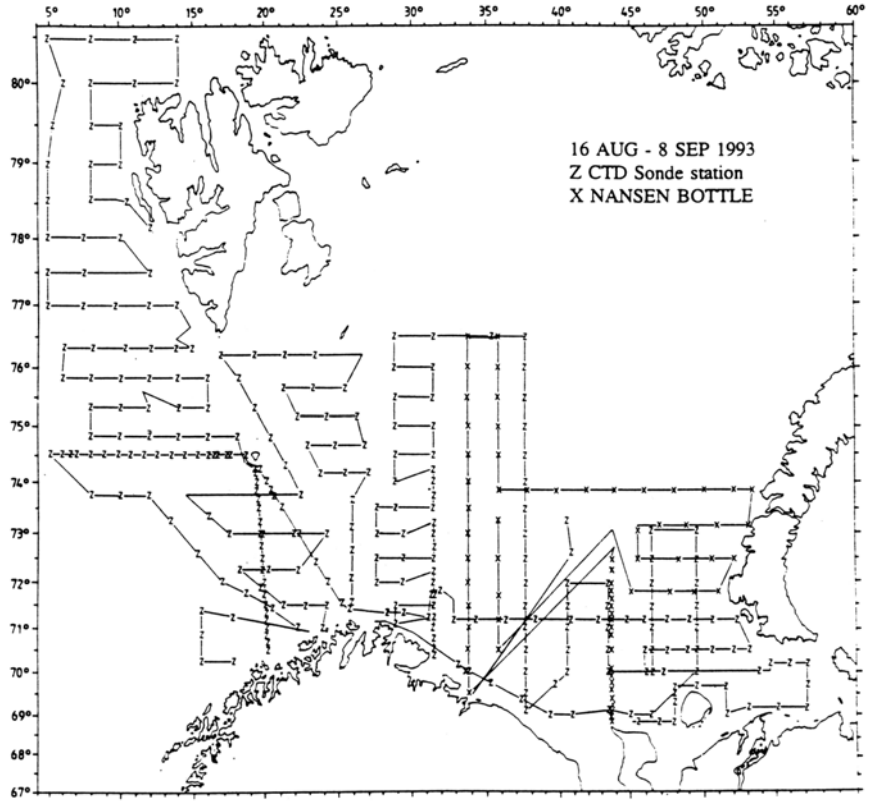

Fig. 1. Survey tracks and hydrographic stations

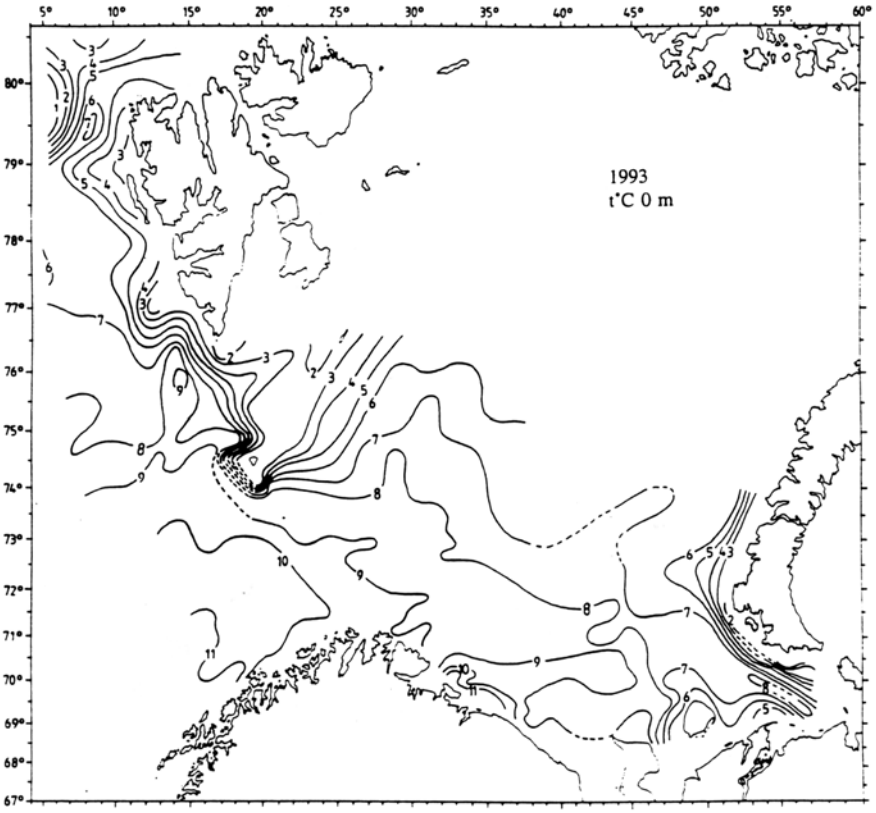

Fig. 2. Isotherms at 0 m

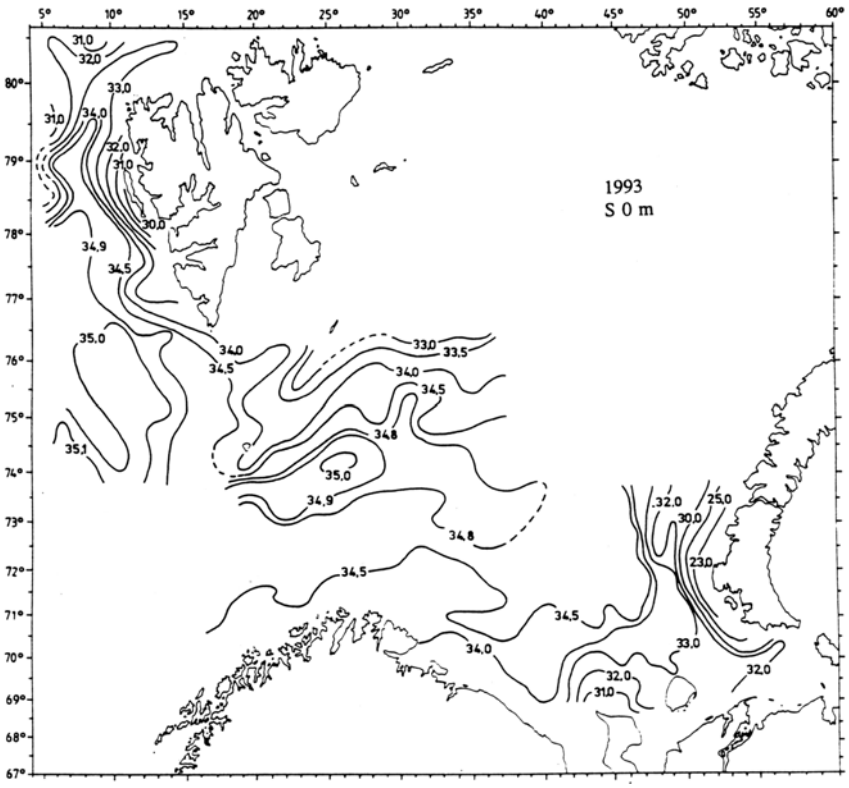

Fig. 3. Isohalines at 0 m

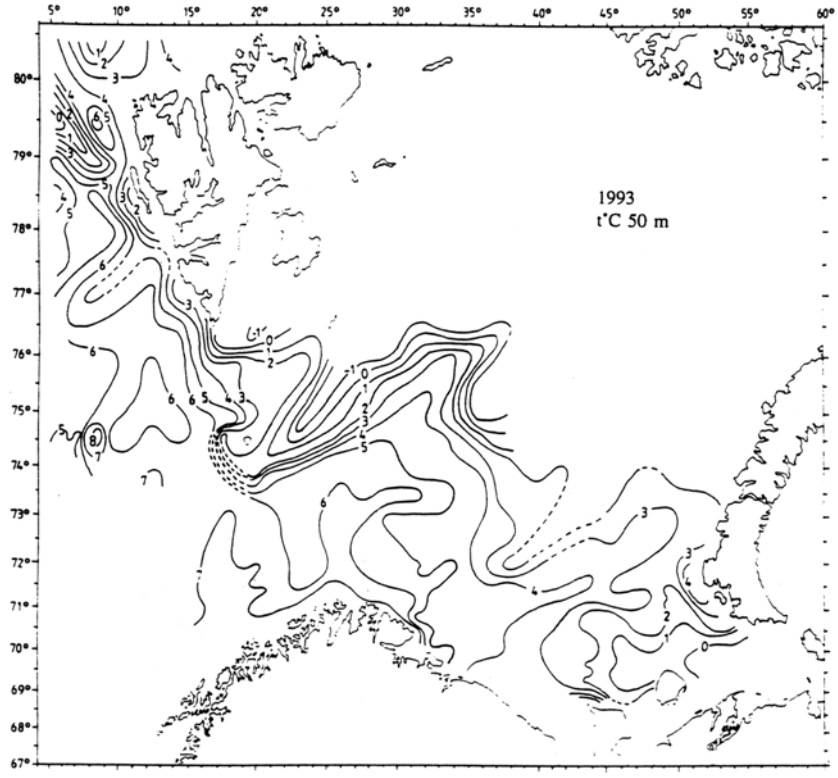

Fig. 4. Isotherms at 50 m

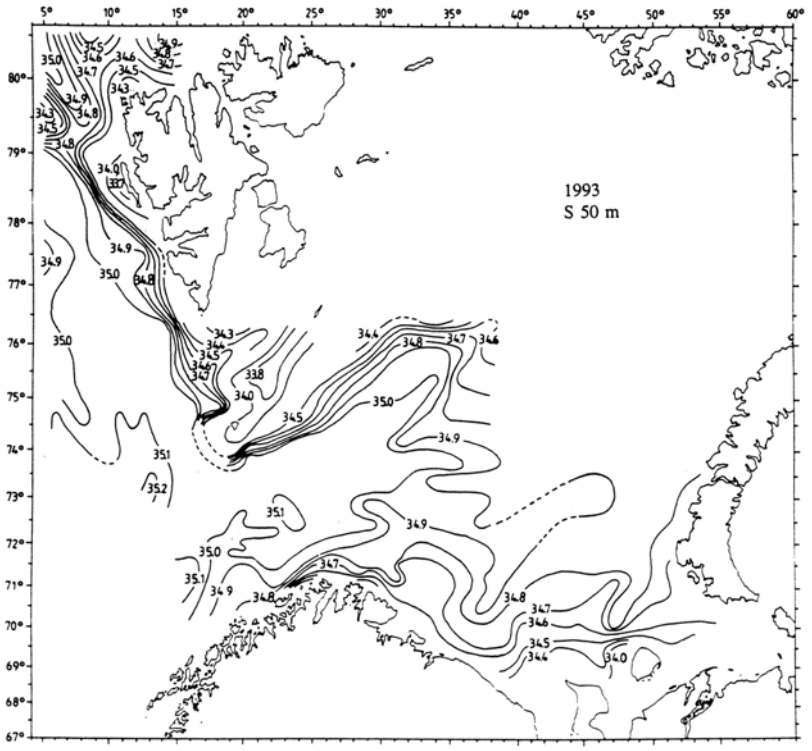

Fig. 5. Isohalines at 50 m

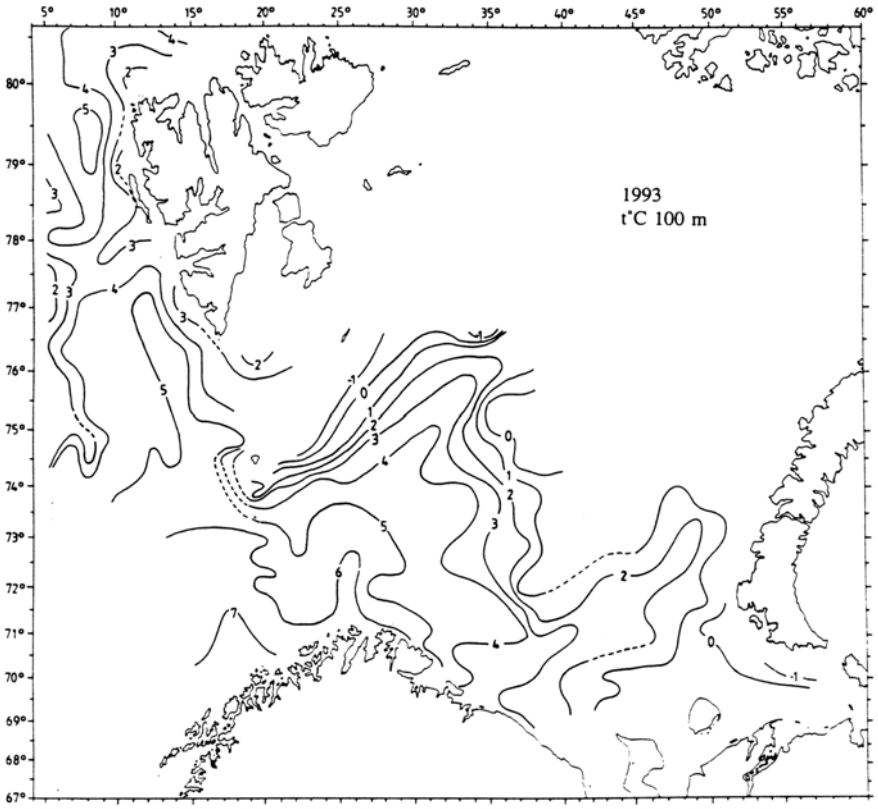

Fig. 6. Isotherms at 100 m

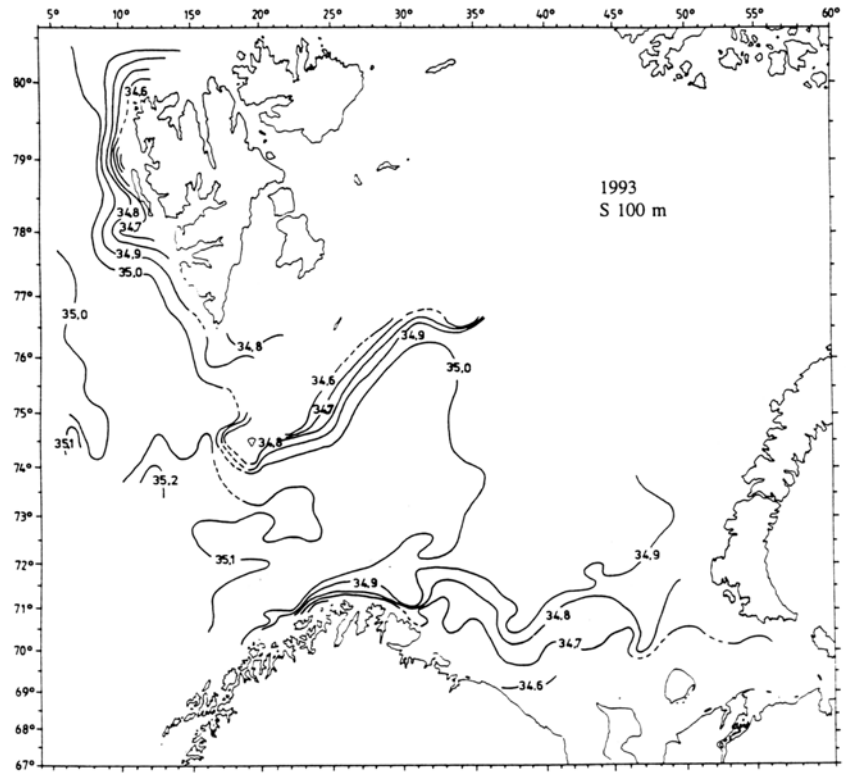

Fig. 7. Isohalines at 100 m

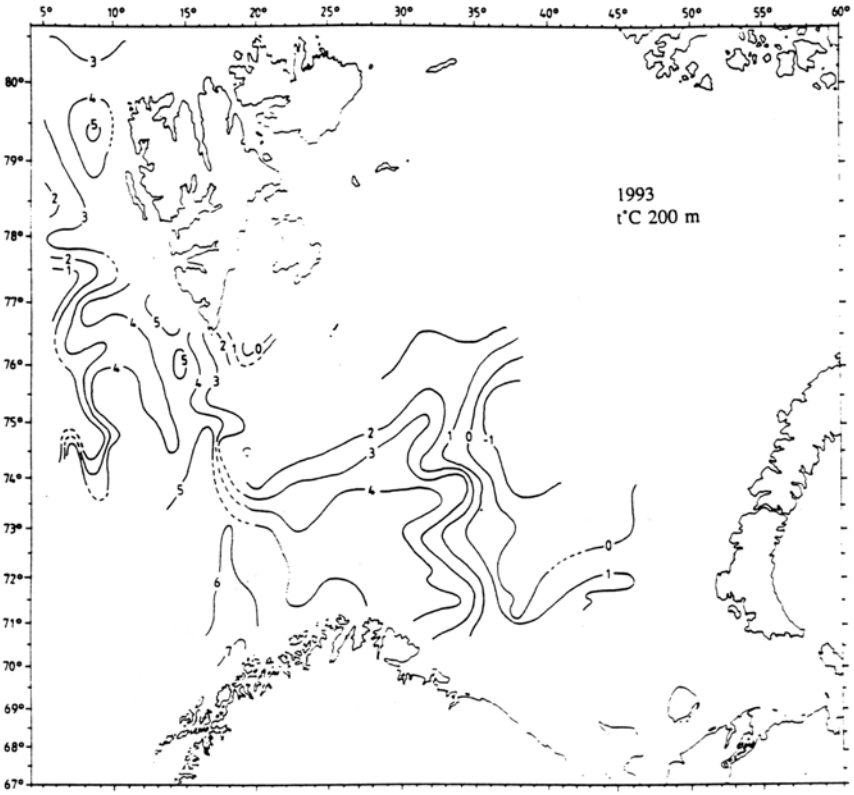

Fig. 8. Isotherms 200 m.

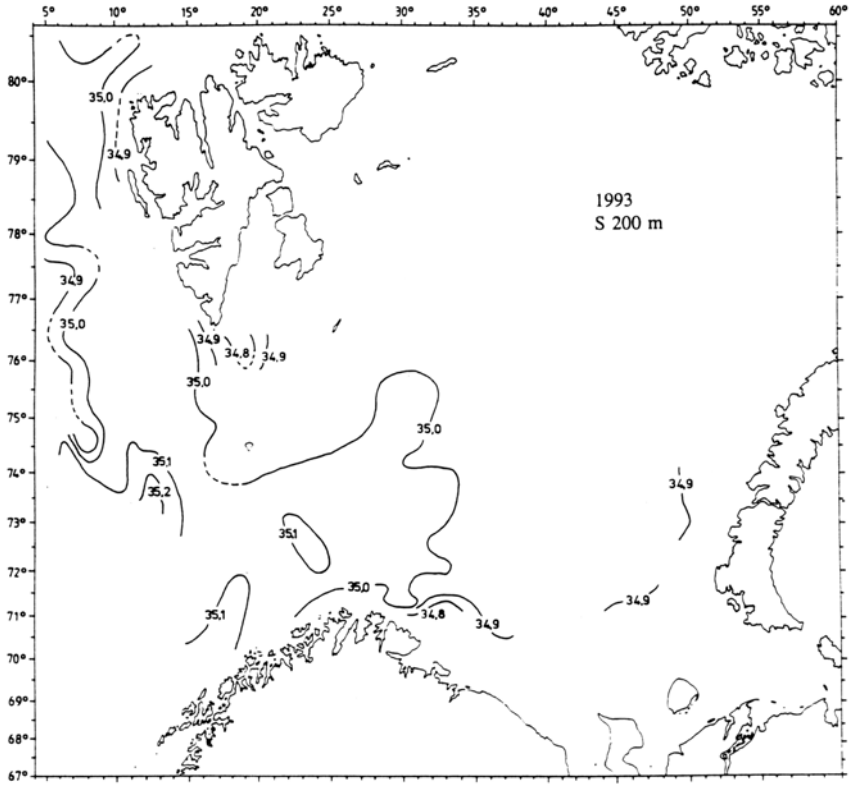

Fig. 9. Isohalines at 200 m

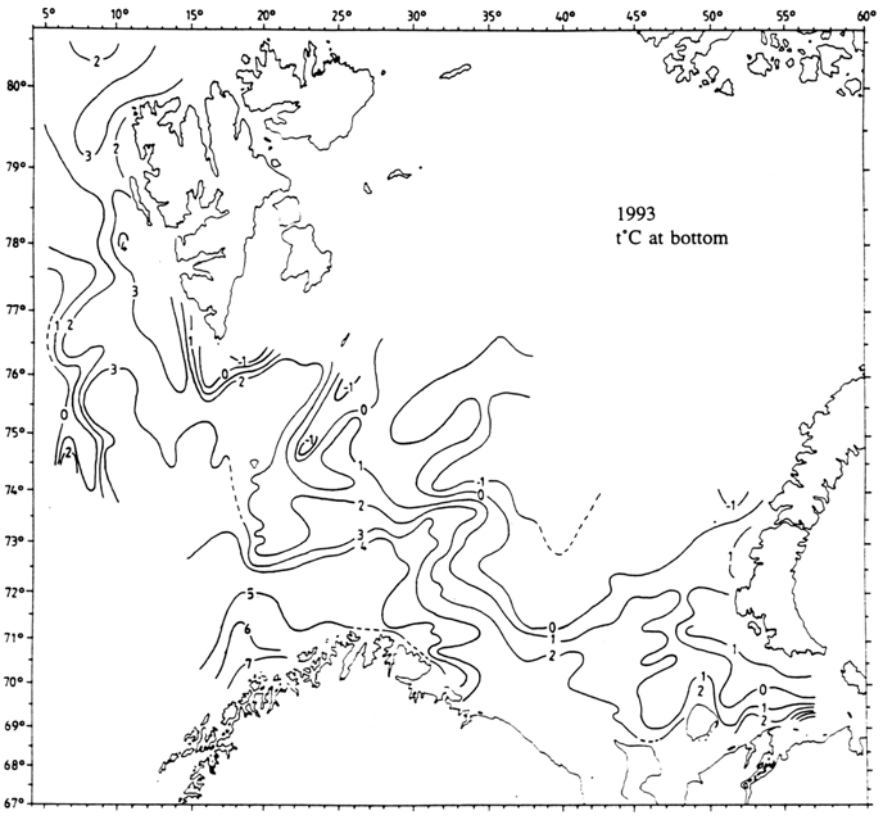

Fig. 10. Isotherms at the bottom

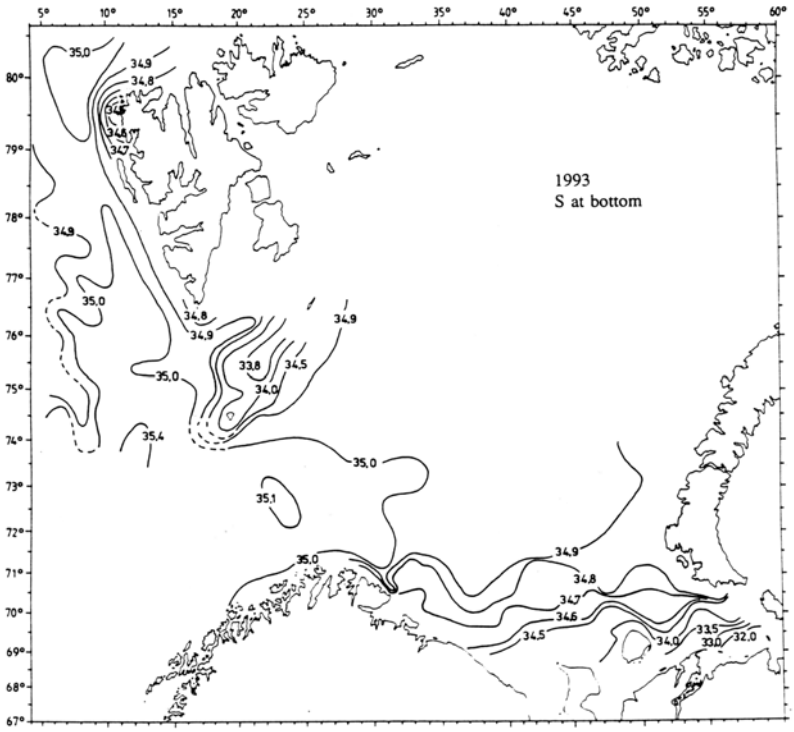

Fig. 11. Isohalines at the bottom

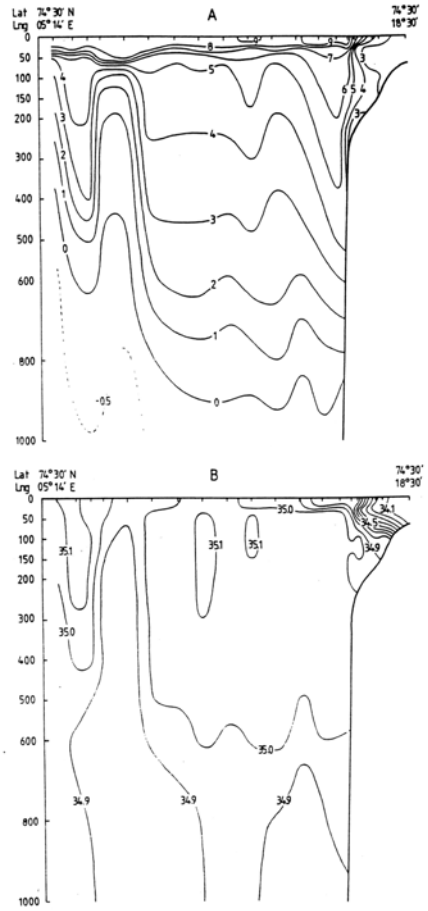

Fig. 12. Hydrographic section Bear Island-West. Temperature (A) and salinity (B)

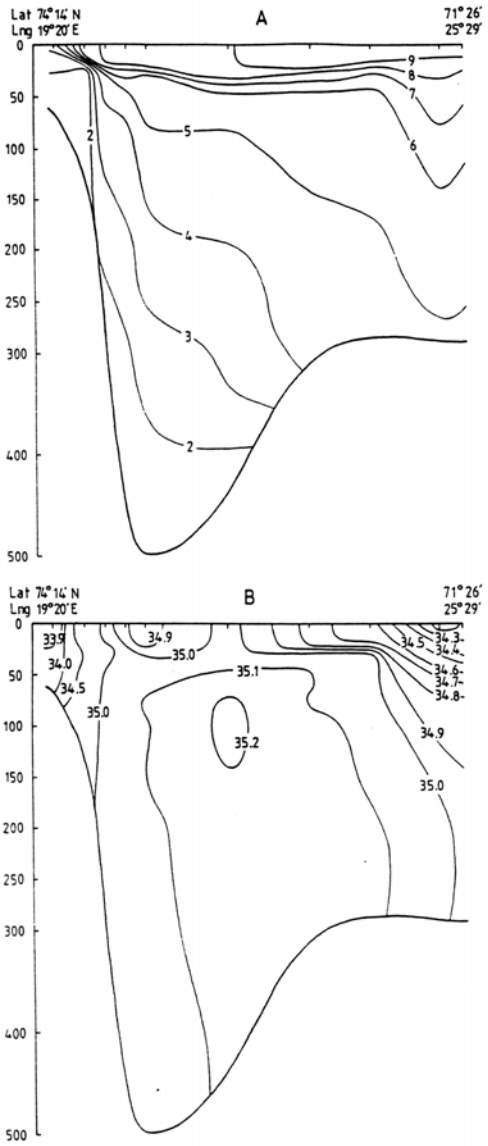

Fig. 13. Hydrographic section North Cape-Bear Island. Temperature (A) and salinity (B)

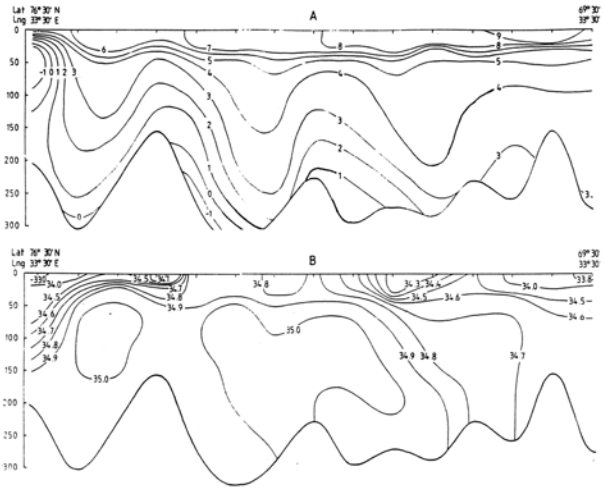

Fig. 14. Hydrographic section along the Kola meridian. Temperature (A) and salinity (B)

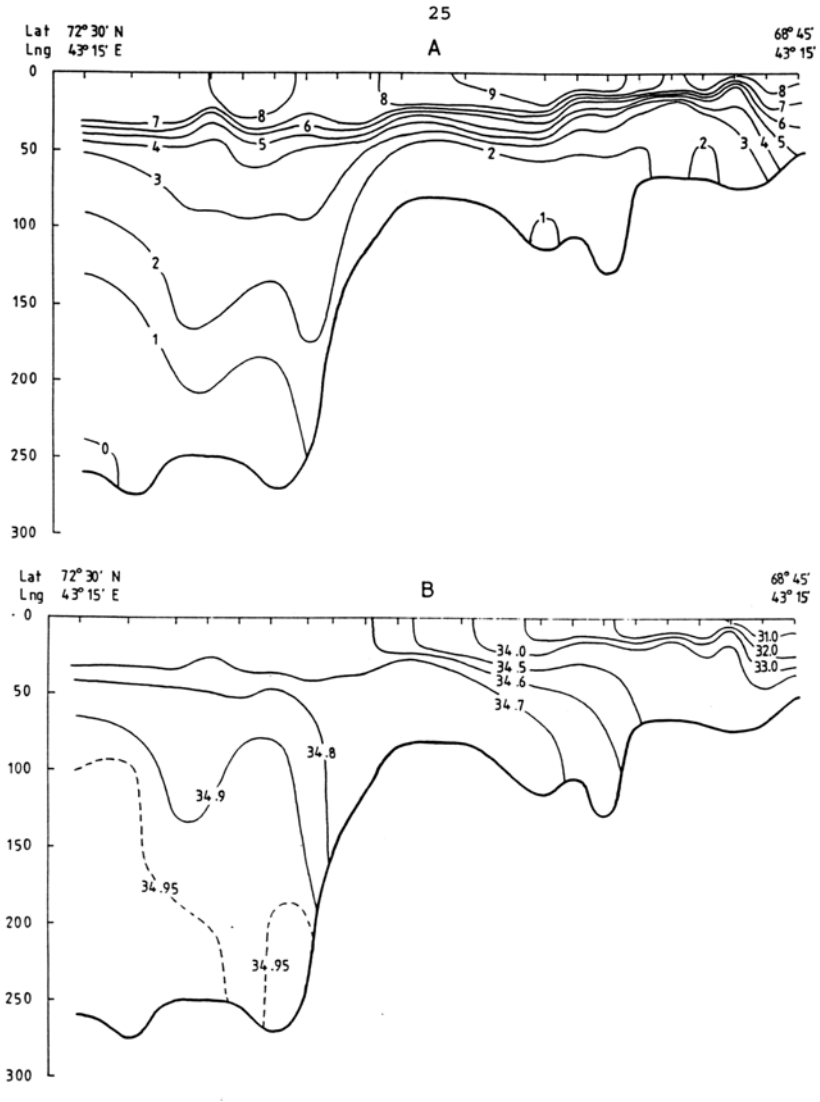

Fig. 15. Hydrographic section Cape Kanin-North. Temperature (A) and salinity (B)

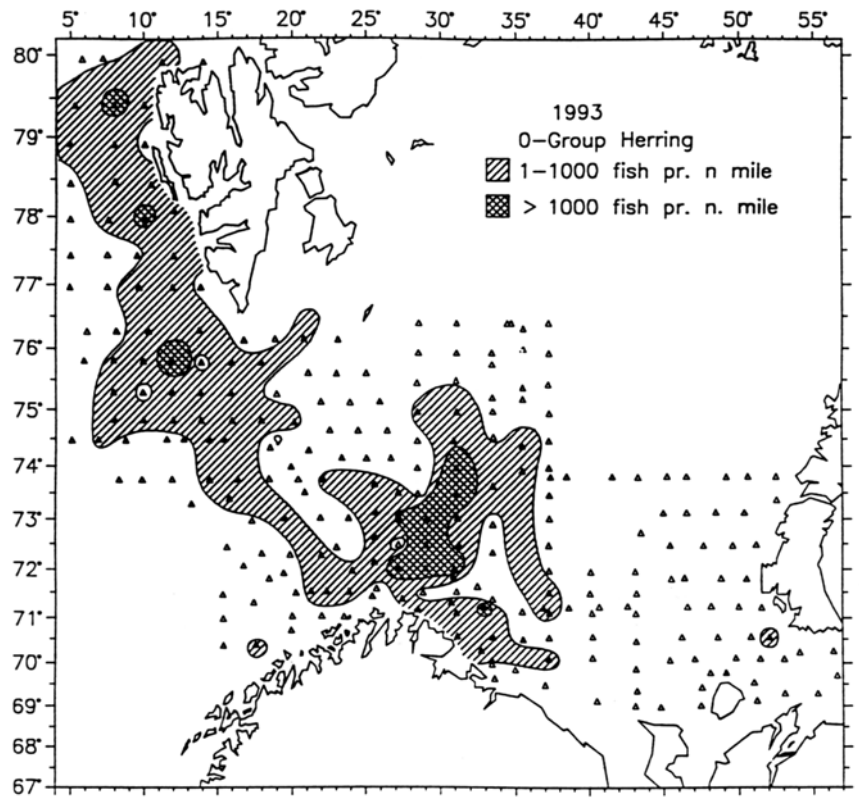

Fig. 16. Distribution of 0-group herring

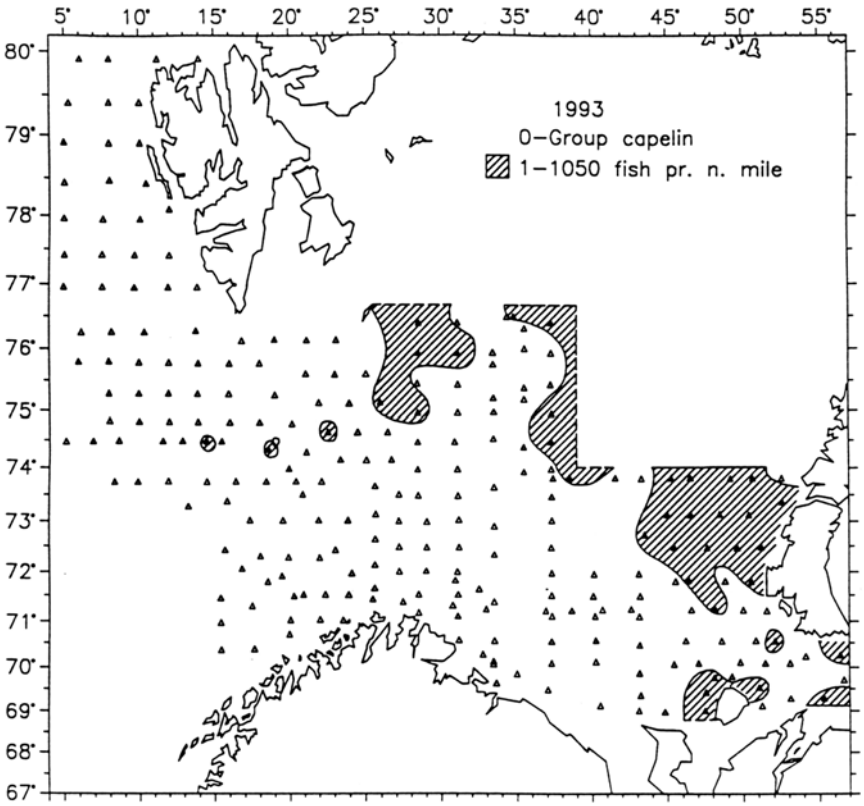

Fig. 17. Distribution of 0-group capelin

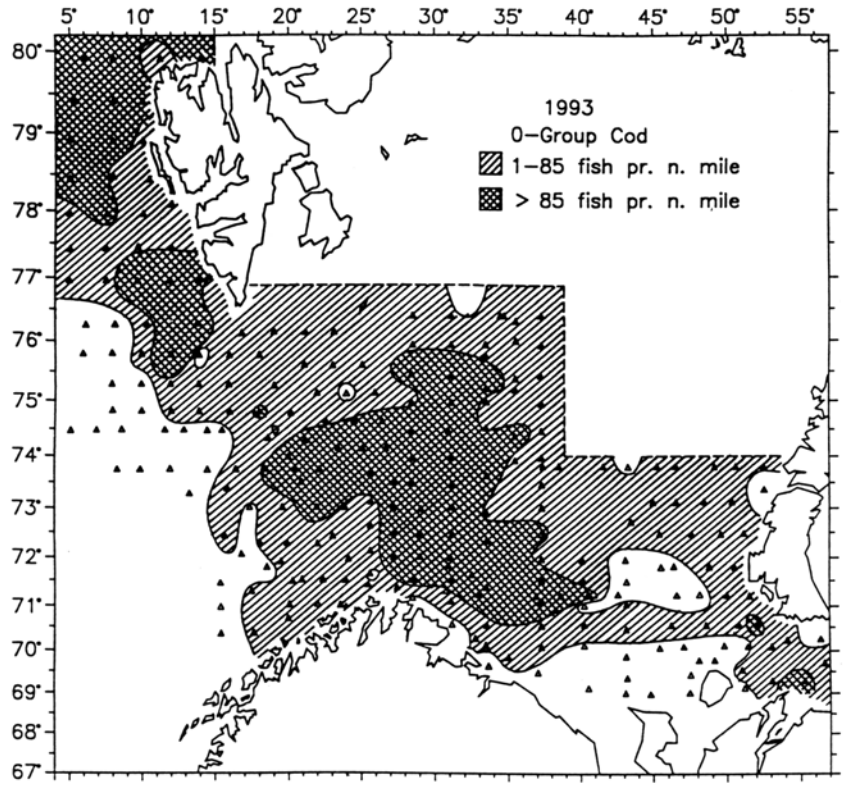

Fig. 18. Distribution of 0-group cod

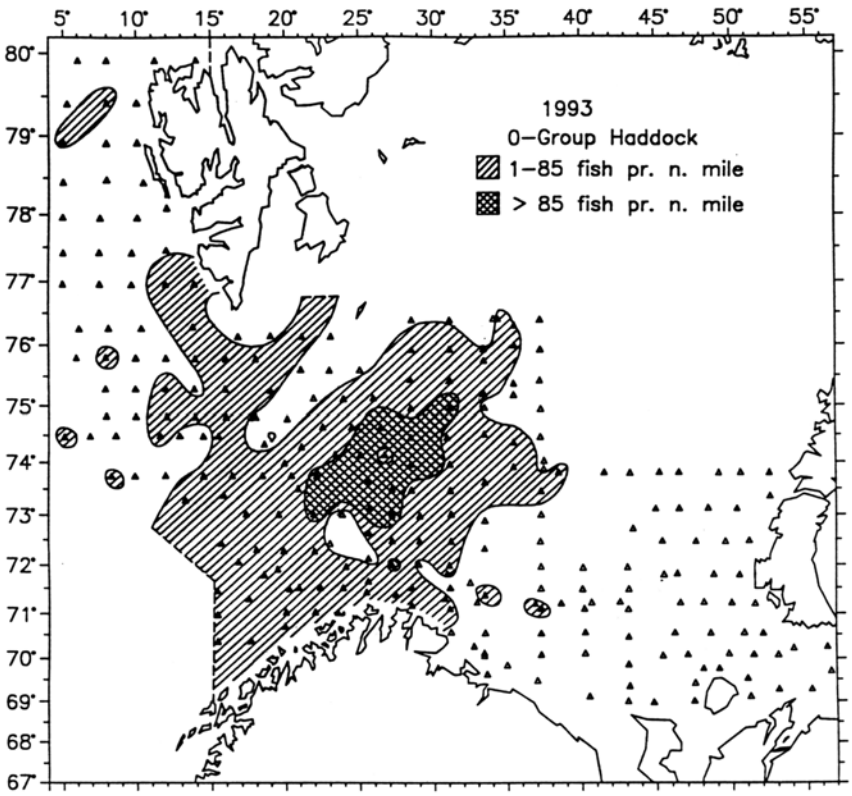

Fig. 19. Distribution of 0-group haddock

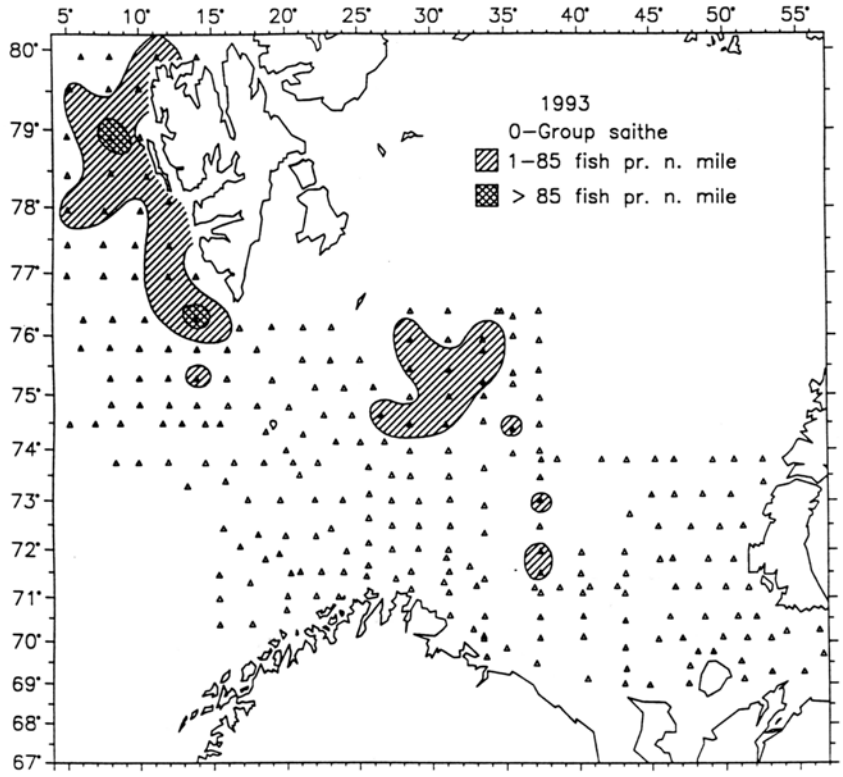

Fig. 20. Distribution of 0-group saithe

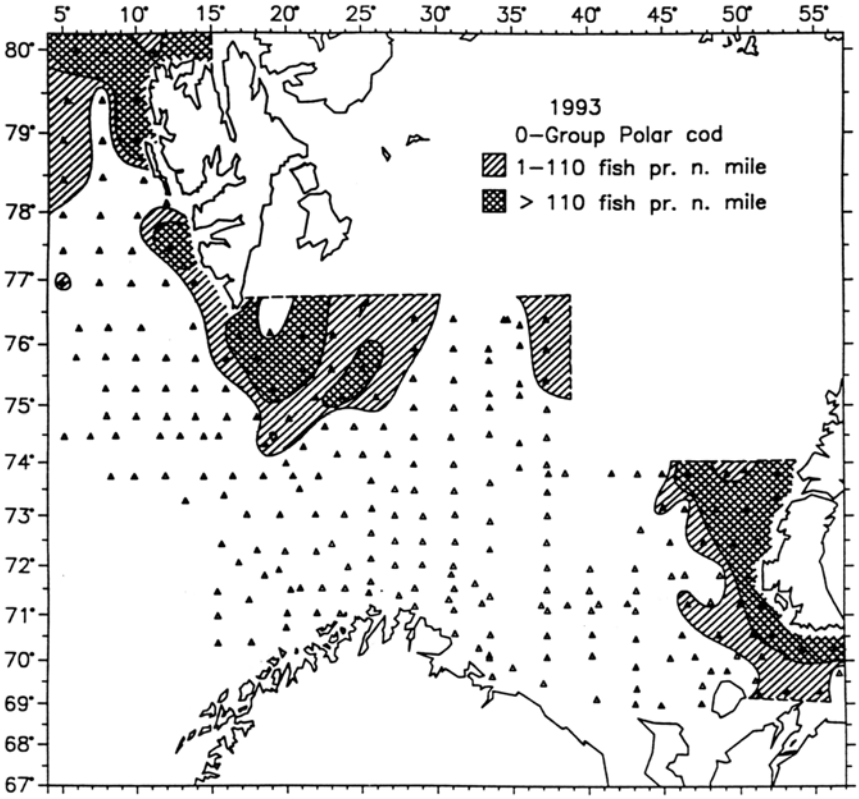

Fig. 21. Distribution of 0-group polar cod

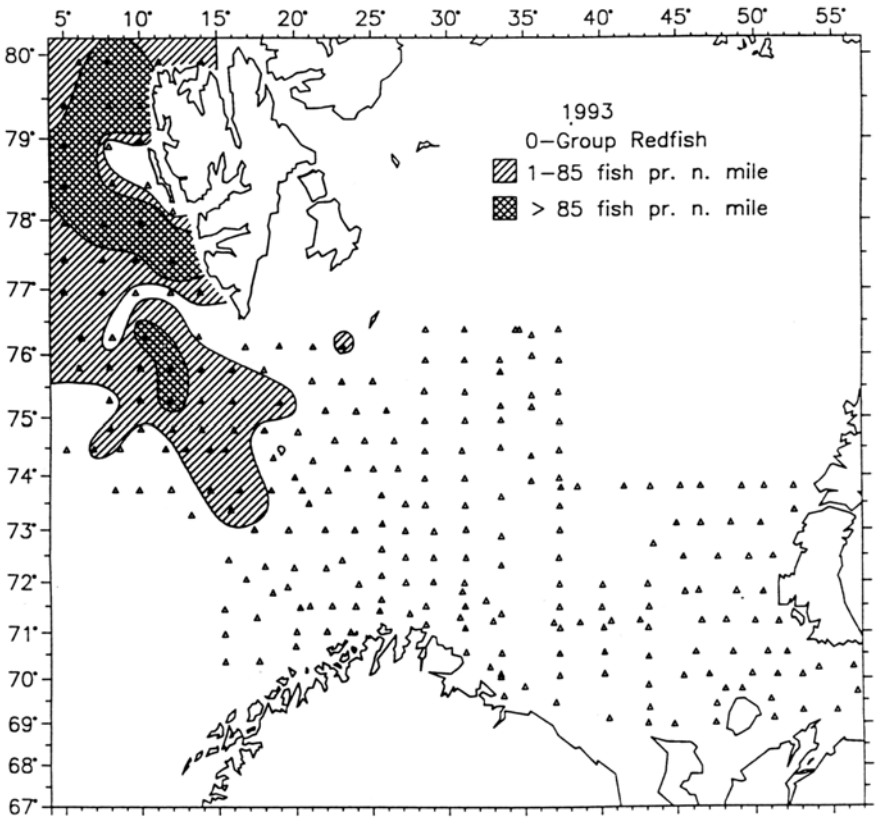

Fig. 22. Distribution of 0-group redfish

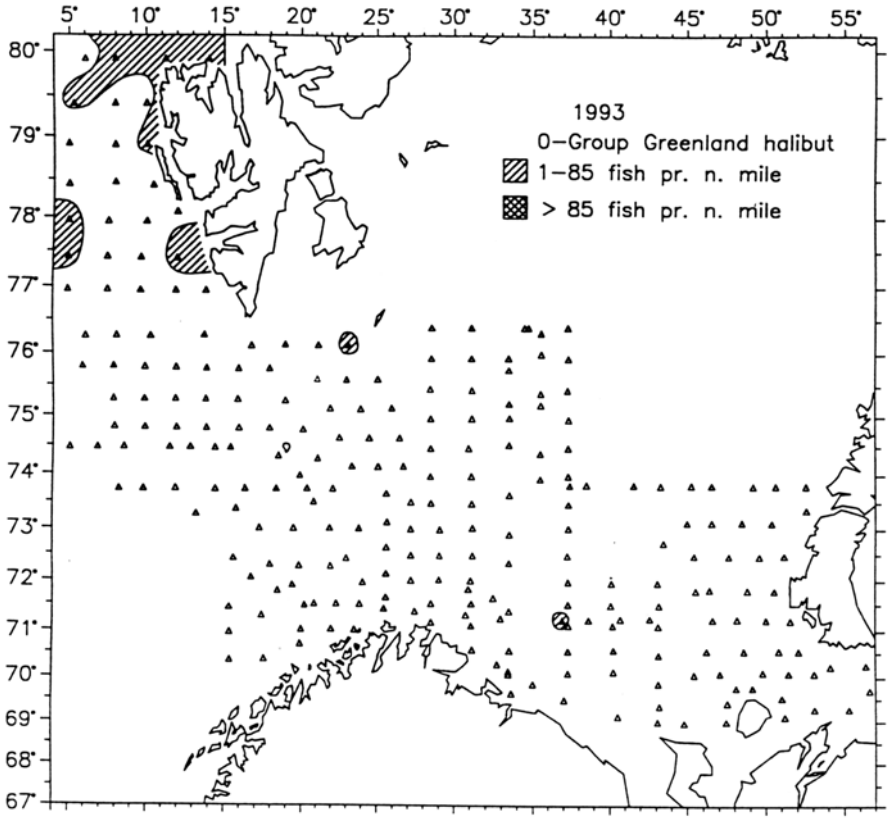

Fig. 23. Distribution of 0-group Greenland halibut

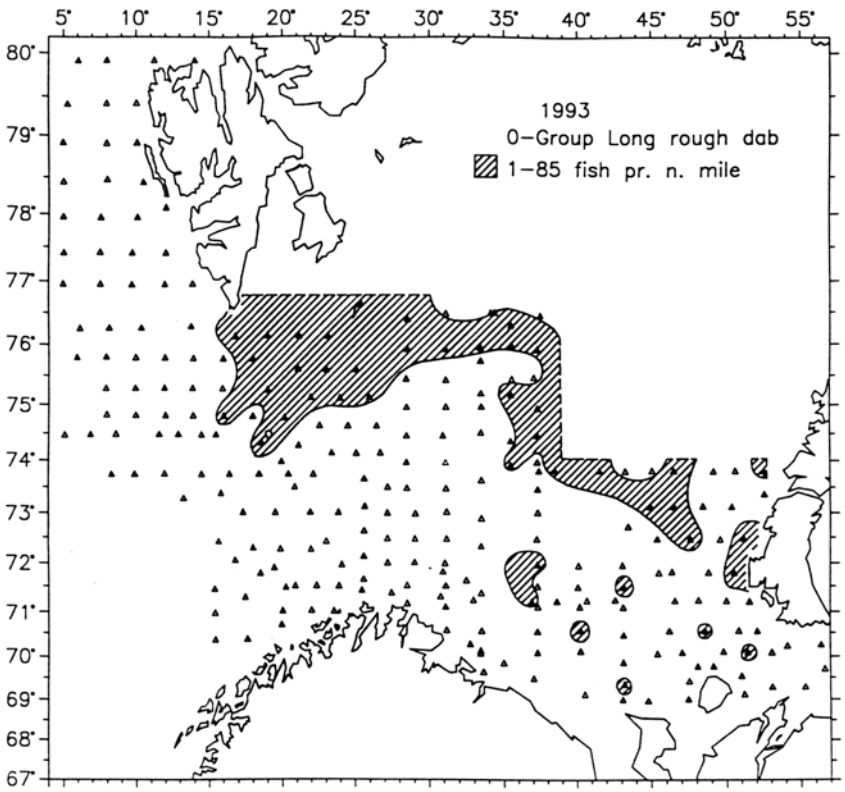

Fig. 24. Distribution of 0-group long rough dab

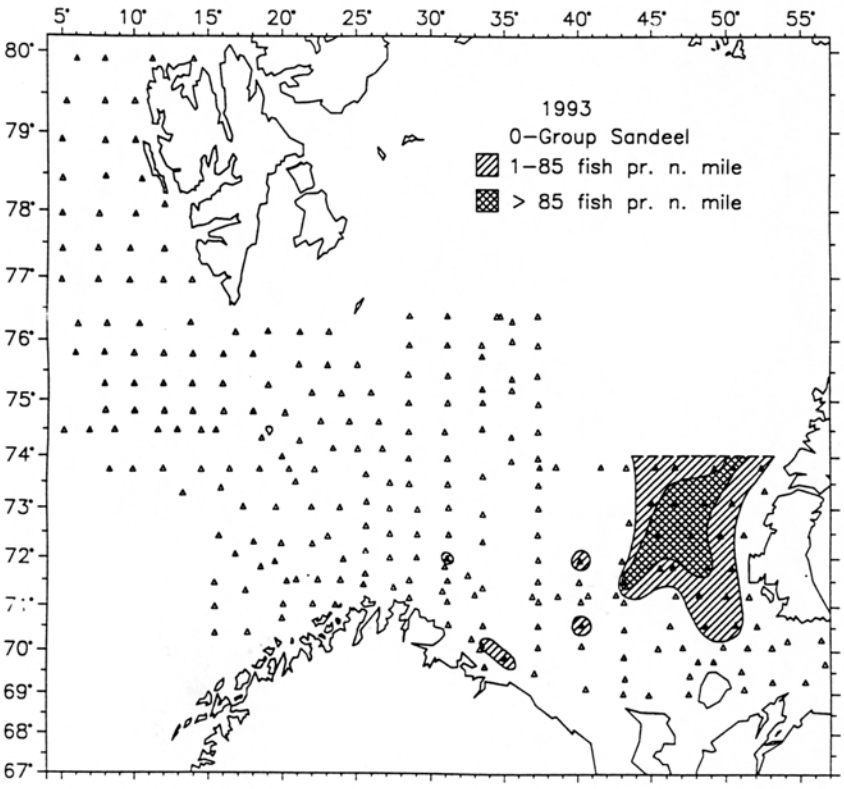

Fig. 25. Distribution of 0-group sandeel

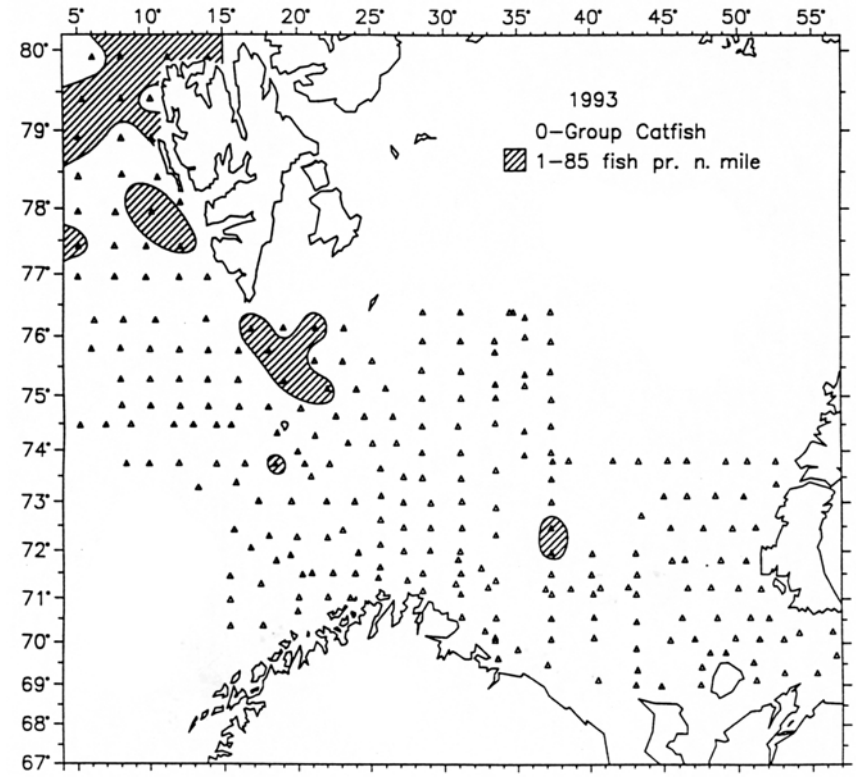

Fig. 26. Distribution of 0-group catfish

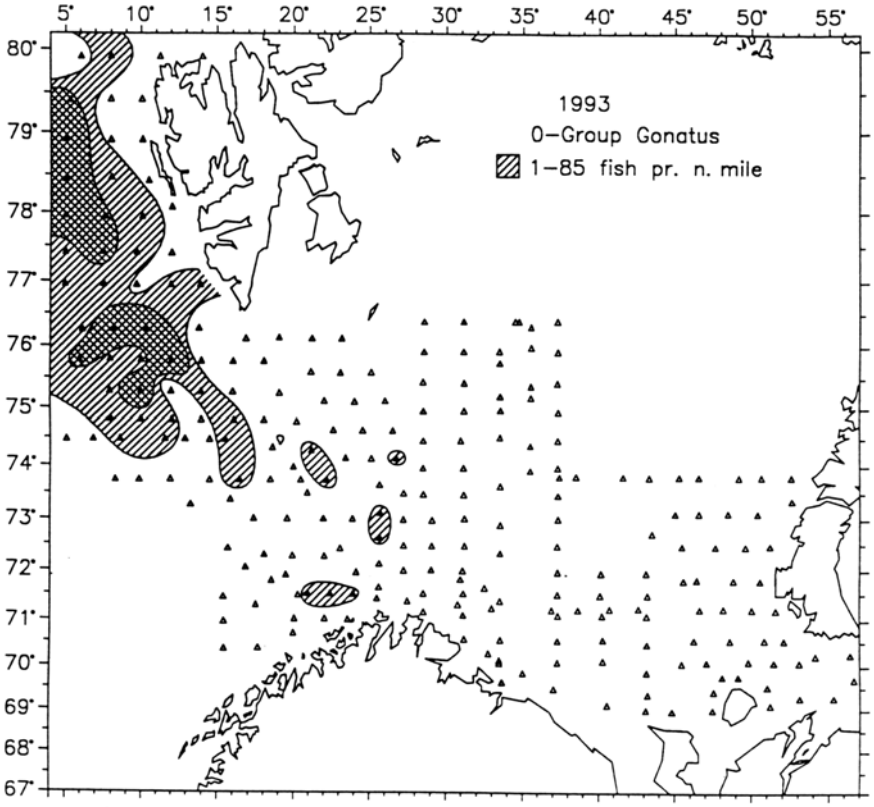

Fig. 27. Distribution of 0-group Gonatus fabricii

International Council for
the Exploration of the Sea

C.M. 1995/G: Ref. H
Demersal Fish Committee

Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1994

The thirties annual International 0-group fish survey was made during the period 17 August-8 September 1994 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey period	Research Institute
Norway	"Johan Hjort"	17.08 - 06.09	Institute of Marine Research, Bergen
Norway	"G.O. Sars"	20.08 - 07.09	"
Russia	"Professor Marty"	02.09 - 08.09	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
Russia	"Atlantida"	24.08 - 08.09	"
Russia	"Fridtjof Nansen"	27.08 - 08.09	"

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

Preliminary analysis of the survey data was made 4-6 October 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 hydrographical conditions in the area.

Hydrography

Observations were made along all the survey trace with 5 to 40 nautical miles between stations. Horizontal distributions of temperatures and salinities are shown for 0, 50, 100, 200 m and bottom (Figs. 2-11). Figs. 12-15 show the temperature and salinity conditions along the Bear Iceland-West, Bear Iceland-North Cape, Kola and Cape Kanin sections. The mean temperatures in the main parts of these sections are presented in Table 1.

According to temperature conditions, 1994 is "warm year" in succession, was observed since 1989. This year the mean sea temperatures from 0-200 m in the Barents Sea were 0.1-0.6 °C above the long term average (1965-1994). Compared to 1993 the temperature differences varied from minus 0.1 till 0.6 °C. The maximum increase water temperature was recorded on Bear Iceland - North Cape (0-200 m) and Kola (0-50 m) sections. On the East of Barents Sea (Cape Kanin section) water temperutures were 0.2-0.4 °C above long term average and was the same as observed in 1993. In the West Spitsbergen Current (0-200 m) temperature was 0.7 °C above long-term average. However the Atlantic water distribution area was narrow then last year and was associate with decrease on 0.5-1.0 °C upper mixed layer temperature to north 75°00' N. The temperature conditions 1994 were determine by decrease of Atlantic inflow into the area West Spitsbergen and increase into central part of Barents Sea south-eastward Bear Island.

Table 1. Mean water temperature[1] in main parts of standard sections in the Barents Sea and adjacent waters in August-September 1965-1994

Year	Section[2] 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
Average 1965-1994	7.3	3.8	4.7	4.2	3.2	5.7	4.6

[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)

Table 2. Abundance indices of 0-group fish in the Barents Sea and adjacent waters in 1965-1994

Year	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab	Capelin
			West		East				
1965	6	7		0		159		66	37
1966	1	1		129		236		97	119
1967	34	42		165		44		73	89
1968	25	8		60		21		17	99
1969	93	82		208		295		26	109
1970	606	115		197		247	1	12	51
1971	157	73		181		172	1	81	151
1972	140	46		140		177	8	65	275
1973	684	54		(26)		385	3	67	125
1974	51	147		227		468	13	83	359
1975	343	170		75		315	21	113	320
1976	43	112		131		447	16	96	281
1977	173	116	157		70	472	9	72	194
1978	106	61	107		144	460	35	76	40
1979	94	69	23		302	980	22	69	660
1980	49	54	79		247	651	12	108	502
1981	65	30	149		73	861	38	95	570
1982	114	90	14		50	694	17	150	393
1983	386	184	48		39	851	16	80	589
1984	486	255	115		16	732	40	70	320
1985	742	156	60		334	795	36	86	110
1986	434	160	111		366	702	55	755	125
1987	102	72	17		155	631	41	174	55
1988	133	86	144		120	949	8	72	187
1989	202	112	206		41	698	5	92	1300
1990	465	227	144		48	670	2	35	324
1991	766	472	90		239	200	1	28	241
1992	1159	313	195		118	150	3	32	26
1993	910	240	171		156	162	11	55	43
1994	899	282	50		448	414	20	272	58

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 1965-1994

Year	Herring[1]			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	0.57	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
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	2.65	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

*) Assessed at 07.09.1994

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

Appendix

Research vessel	Participants
"G.O. Sars"	V. Anthonypillai, H. Hammer, J. Hamre, A. Hylen, L. Kalvenes, H. Larsen, E. Molvær, A. Raknes, K. Strømsnes, A. Slatte»N. Ushakov (PINRO)
"Michael Sars"	B.K. Berntsen, T.I. Halland, K. Korsbrekke, T. Mørk,J.E. Nygaard.
"Johan Hjort"	J. de Lange, P. Fossum, H. Græsdal, S.A. Iversen, E. Meland, O. Nakken, Ø. Nævdal, R. Pedeen, A. Romslo, U. Schauer(Tyskl.)
"Professor Marty"	V. Chixhikov, M. Ermolchev, A. Nlkiforov, D. Prozorkevich, S. Ratushnyy, E. Shamray, E. Tereshchenko, A. Vakulenko, N. Vovchuk
"Fridtjof Nansen"	A. Badigin, S. Boichuk, S. Gotovtsev, T. Sergeeva, V. Tataurov, S. Ustinov, T. Yusupov
"Atlantida"	I. Dolgolenko, T. Gavrilik, V Ignashkin, V. Mamylov,A. Pedchenko, A. Sagaydachny, V. Tretjak, V. Zhuk

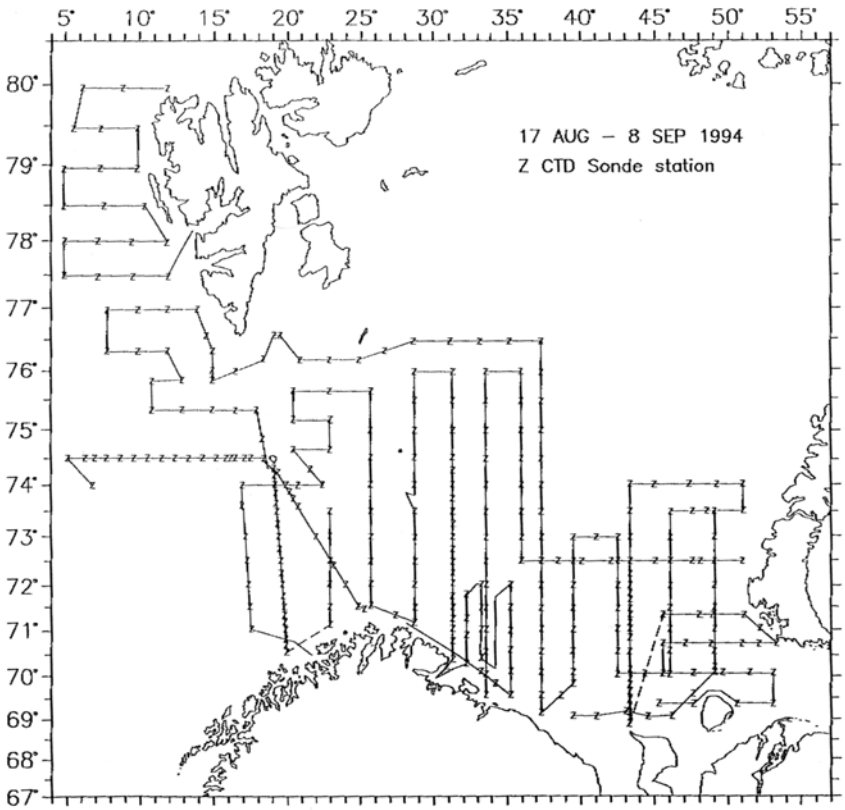

Fig. 1. Survey tracks and hydrographic stations

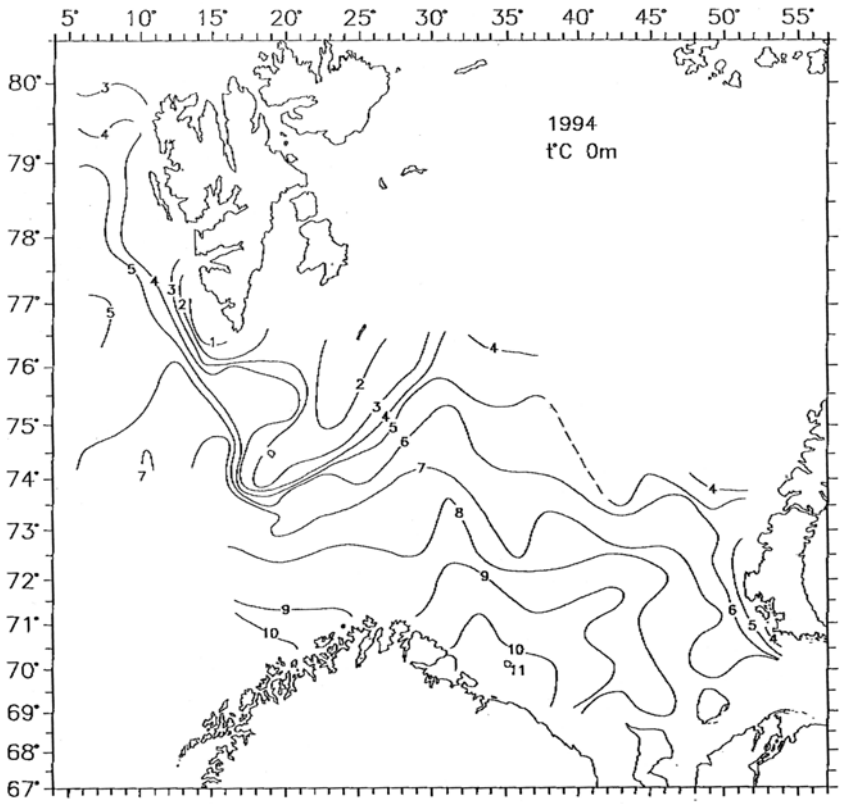

Fig. 2. Isotherms at 0 m

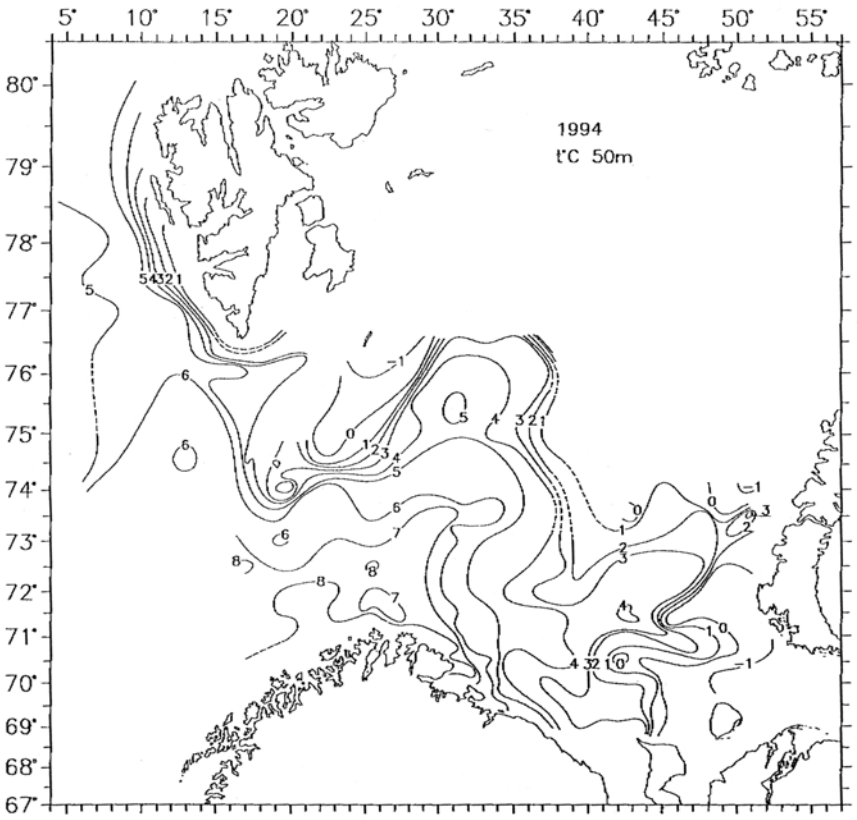

Fig. 3. Isotherms at 50 m

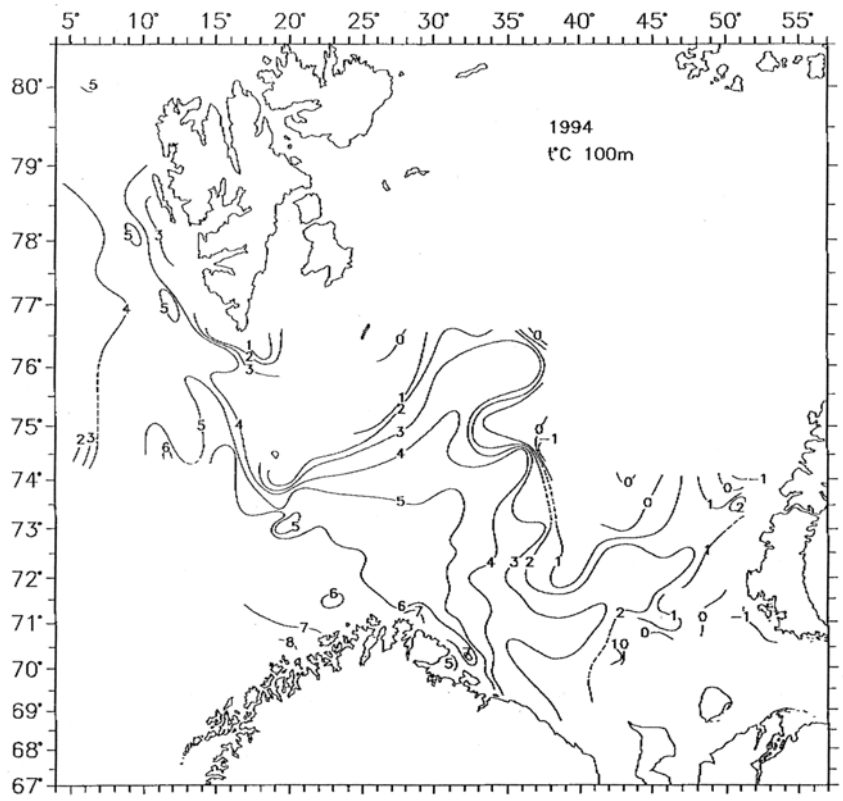

Fig. 4. Isotherms at 100 m

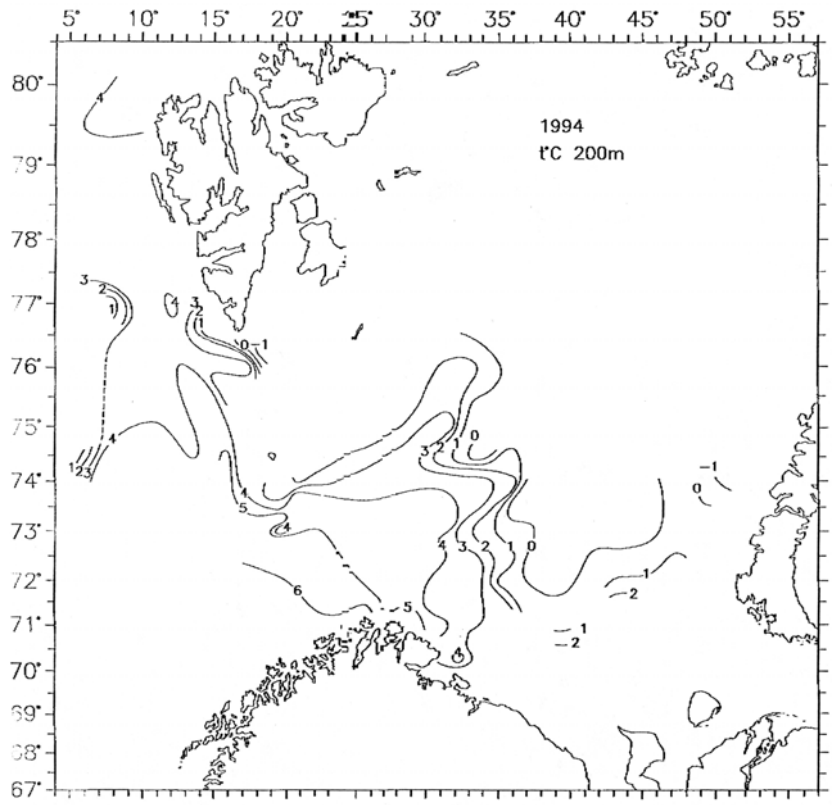

Fig. 5. Isotherms 200 m

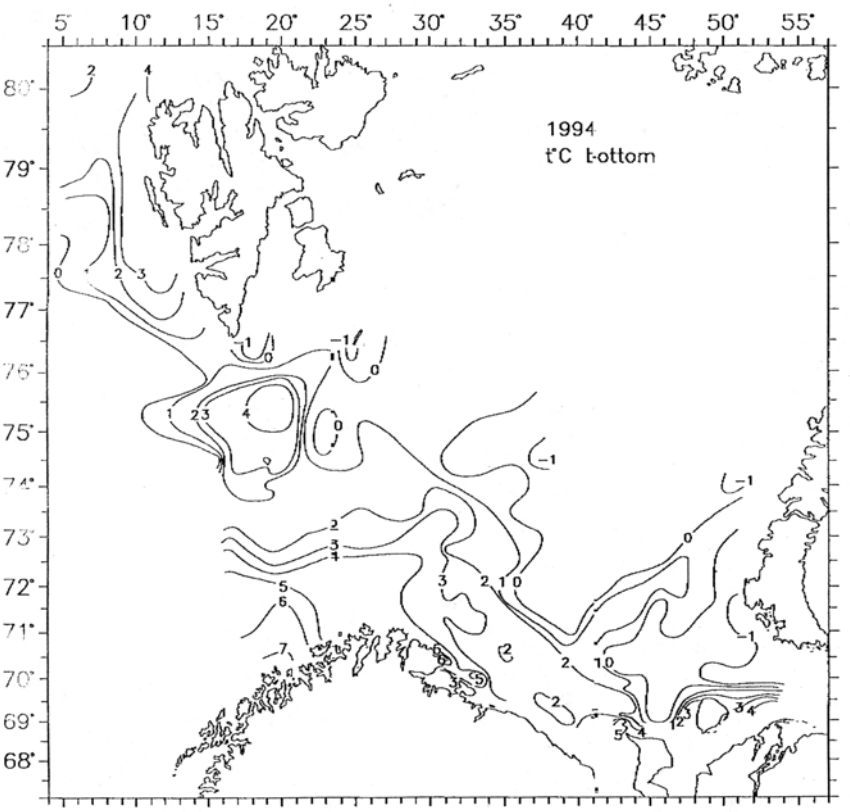

Fig. 6. Isotherms at the bottom

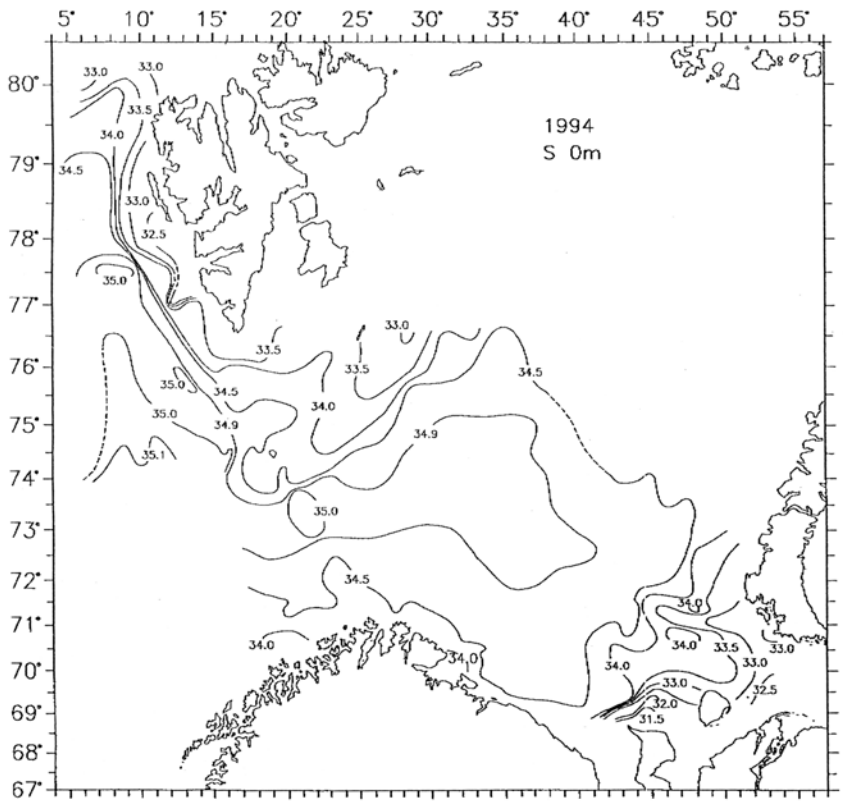

Fig. 7. Isohalines at 0 m

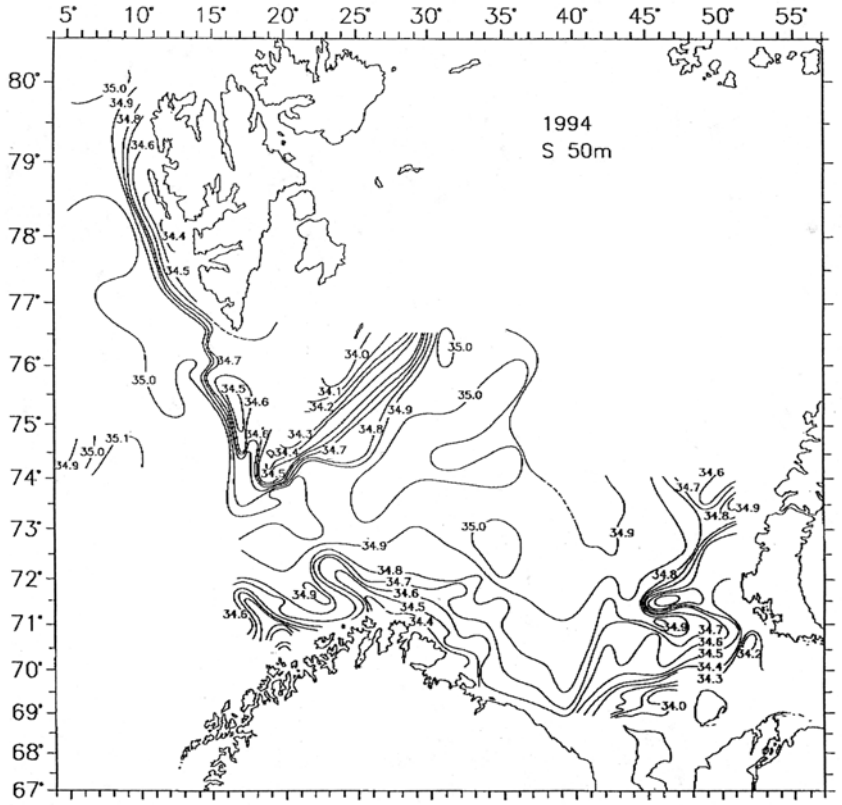

Fig. 8. Isohalines at 50 m

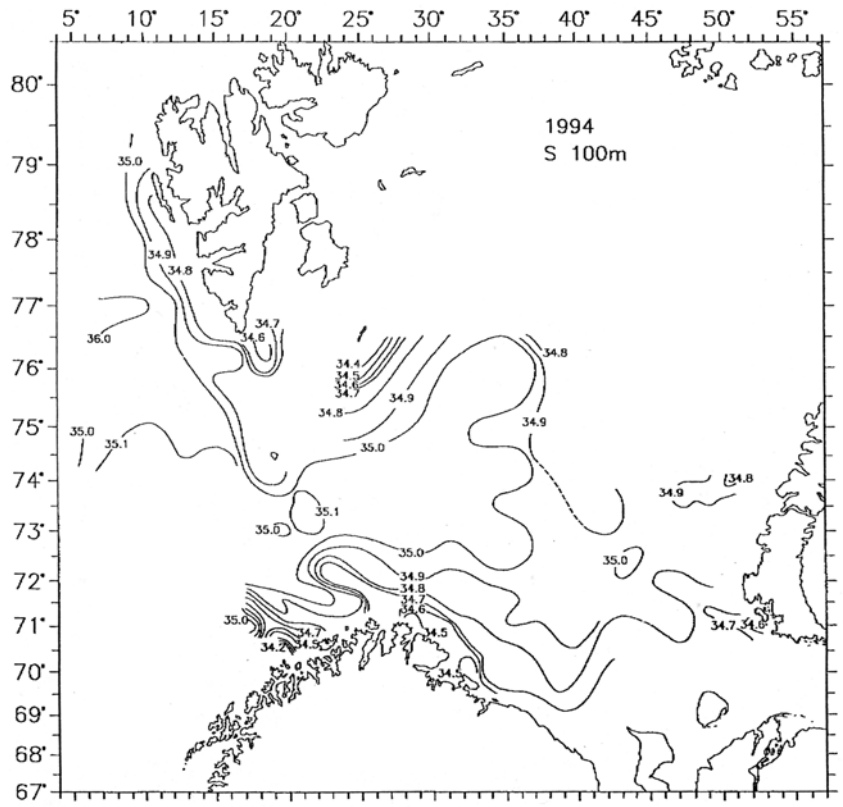

Fig. 9. Isohalines at 100 m

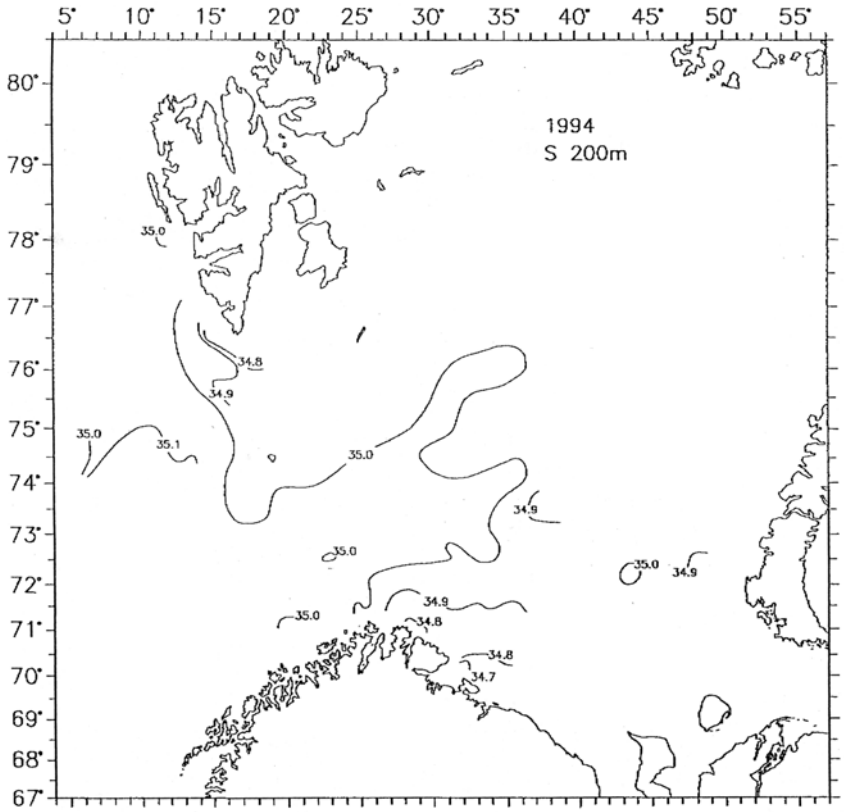

Fig. 10. Isohalines at 200 m

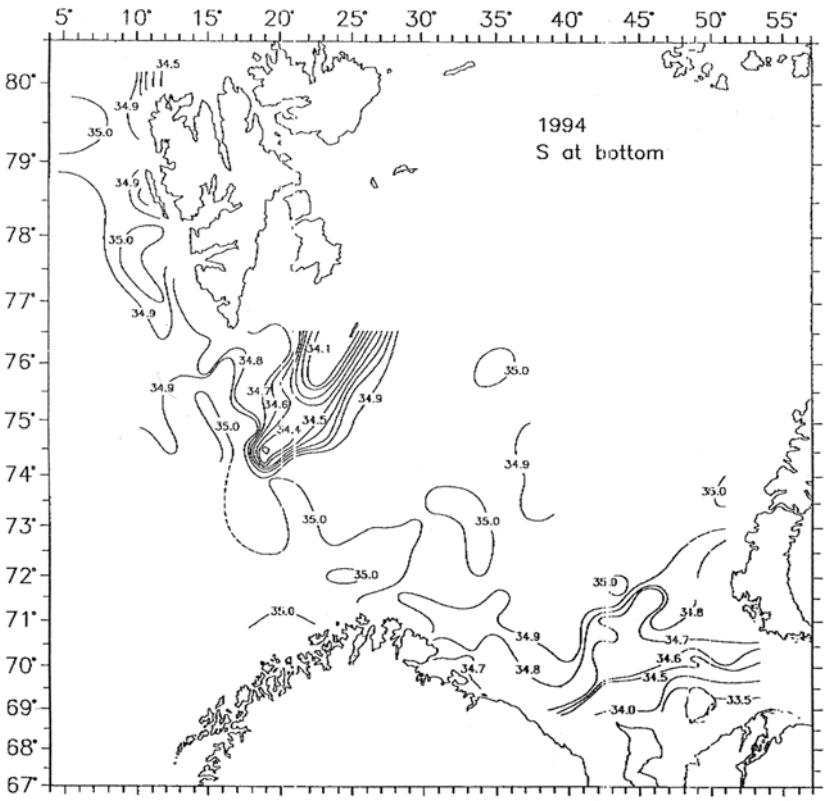

Fig. 11. Isohalines at the bottom

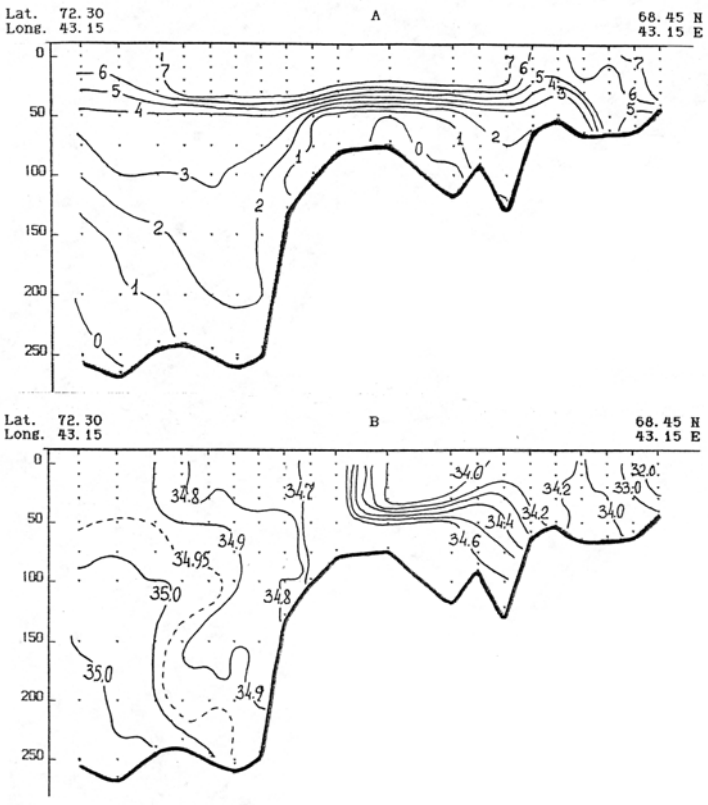

Fig. 12. Hydrographic section Cape Kanin-North. Temperature (A) and salinity (B)

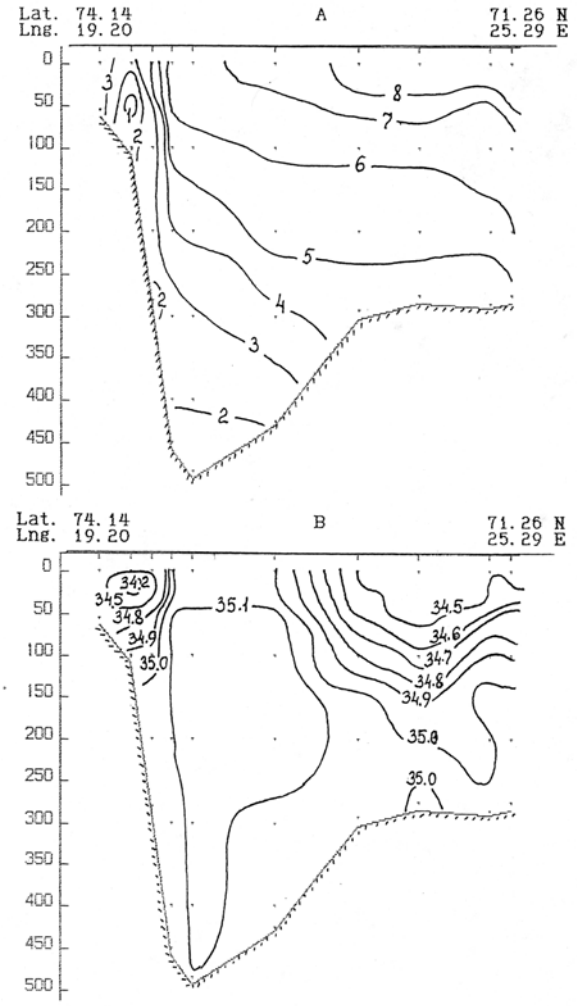

Fig. 13. Hydrographic section North Cape-Bear Island. Temperature (A) and salinity (B)

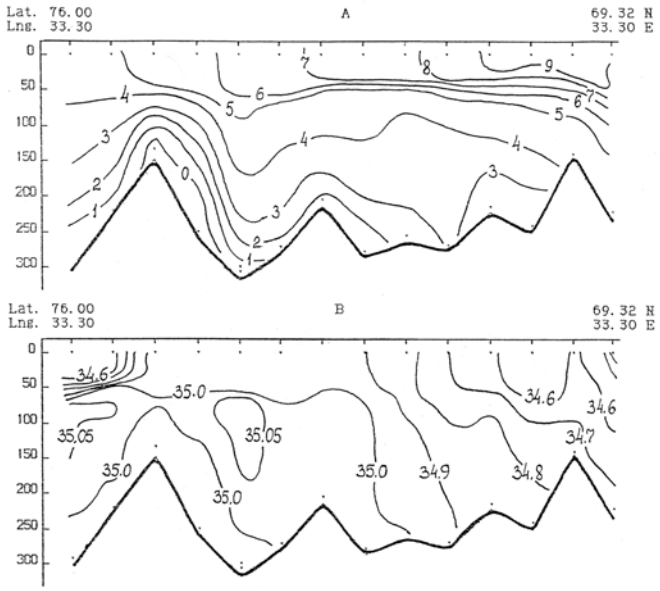

Fig. 14. Hydrographic section along the Kola meridian. Temperature (A) and salinity (B)

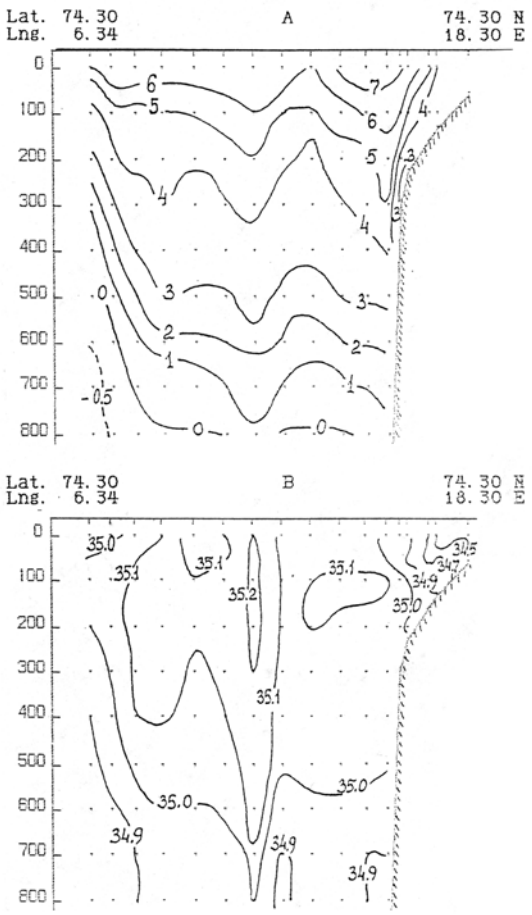

Fig. 15. Hydrographic section Bear Island-West. Temperature (A) and salinity (B)

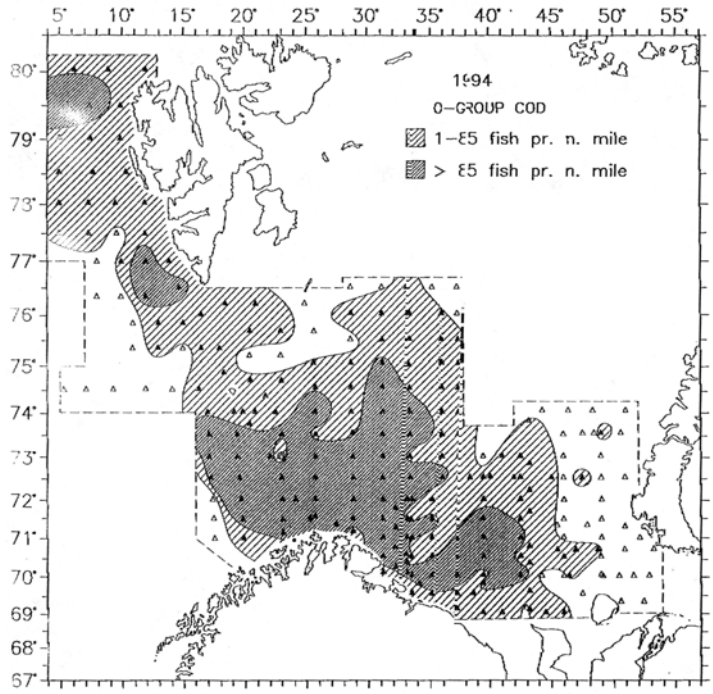

Fig. 16. Distribution of 0-group cod

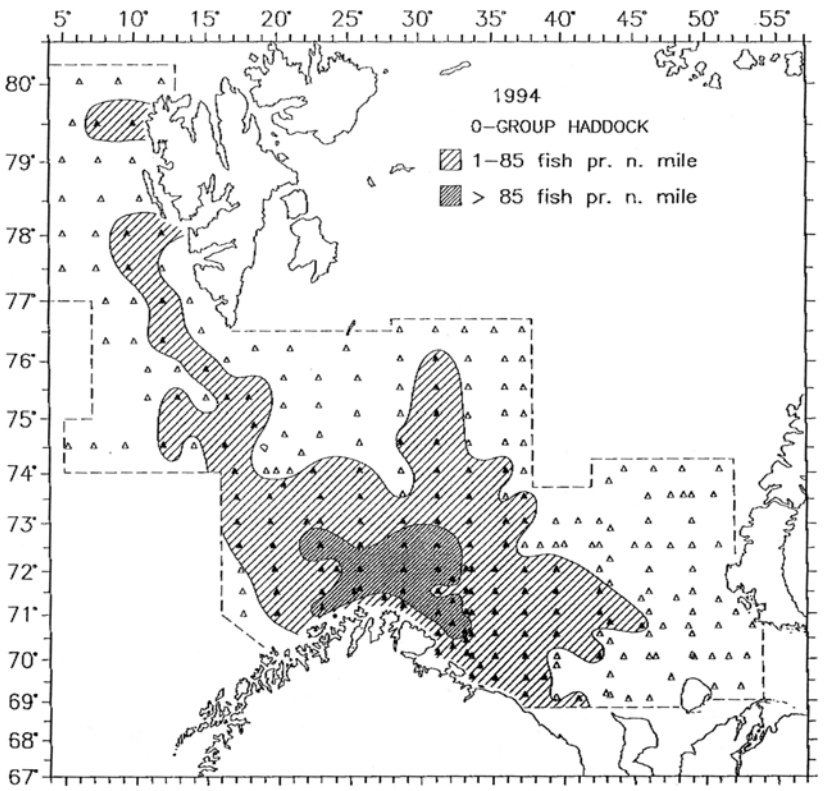

Fig. 17. Distribution of 0-group haddock

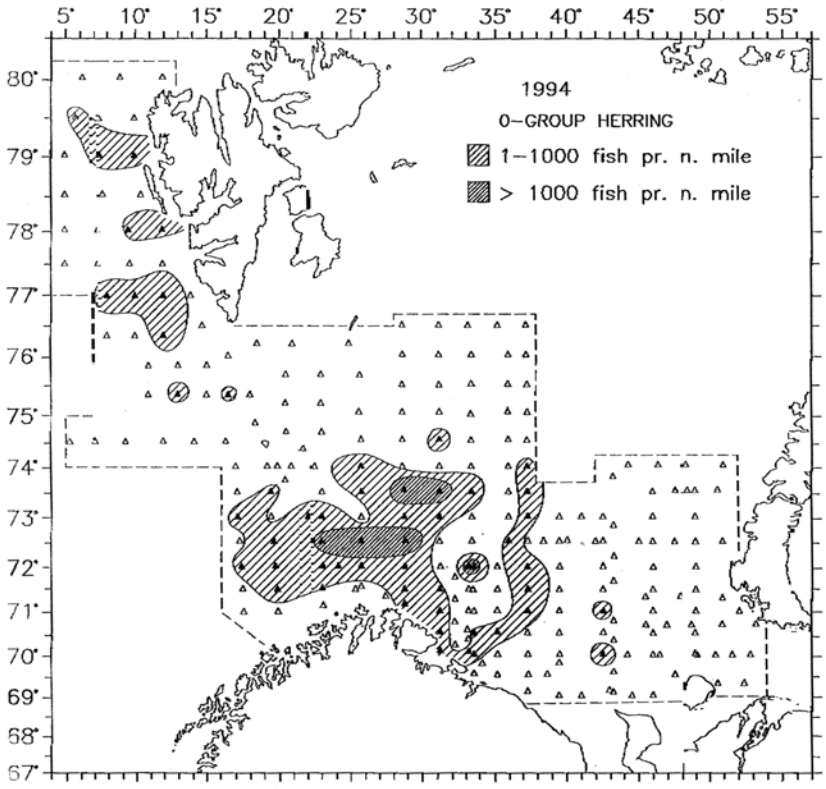

Fig. 18. Distribution of 0-group herring

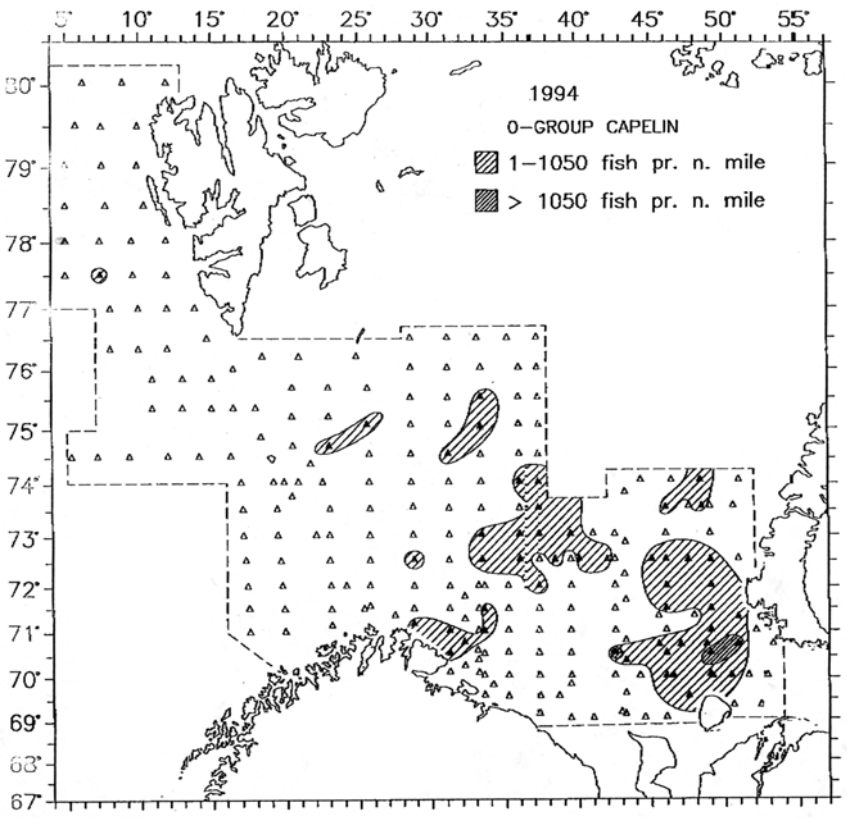

Fig. 19. Distribution of 0-group capelin

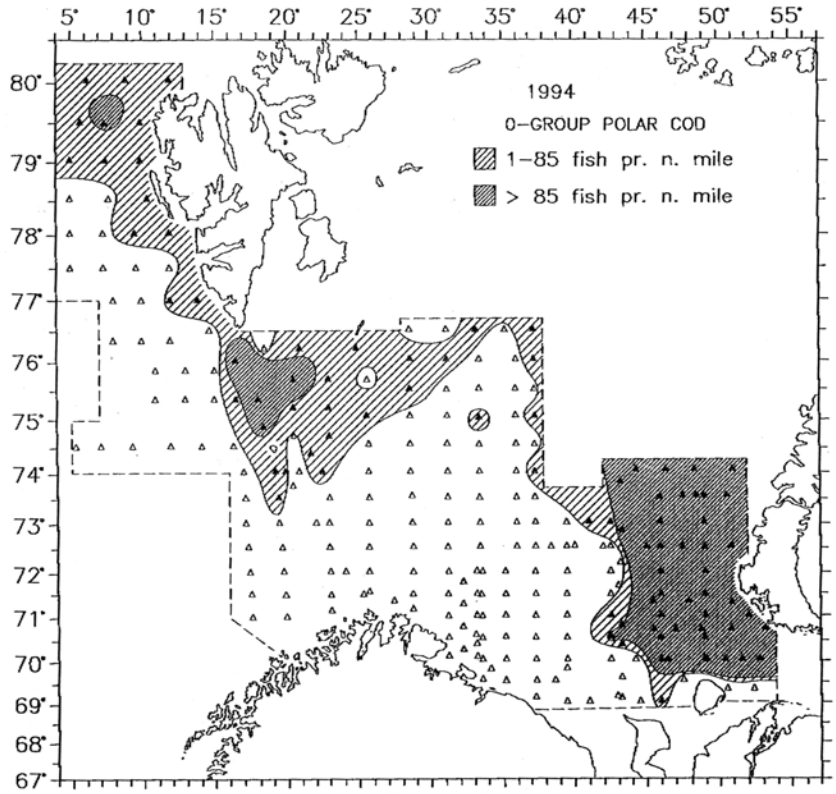

Fig. 20. Distribution of 0-group polar cod

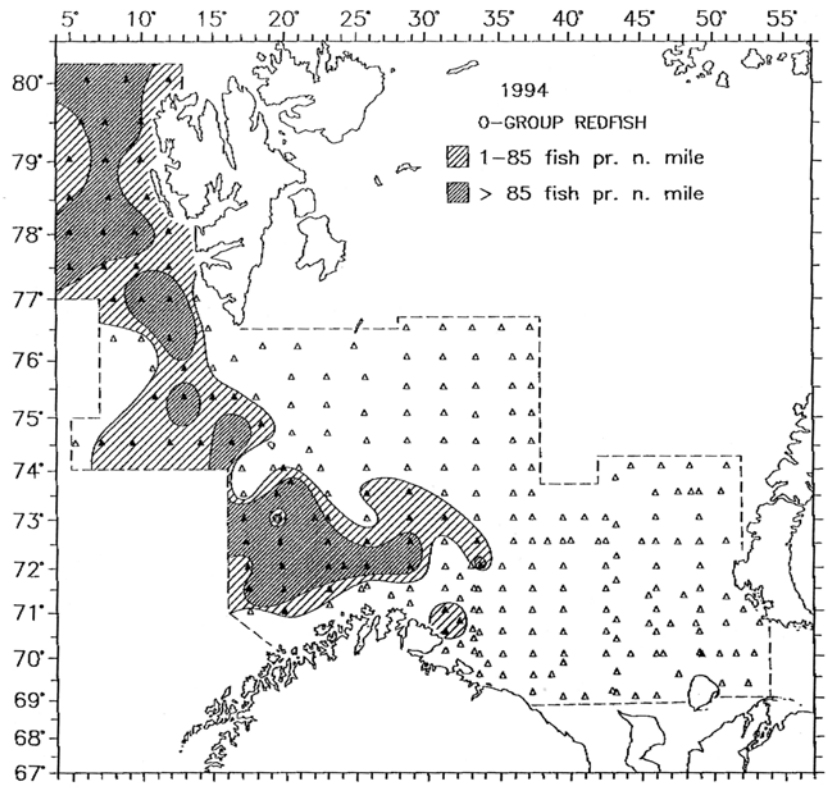

Fig. 21. Distribution of 0-group redfish

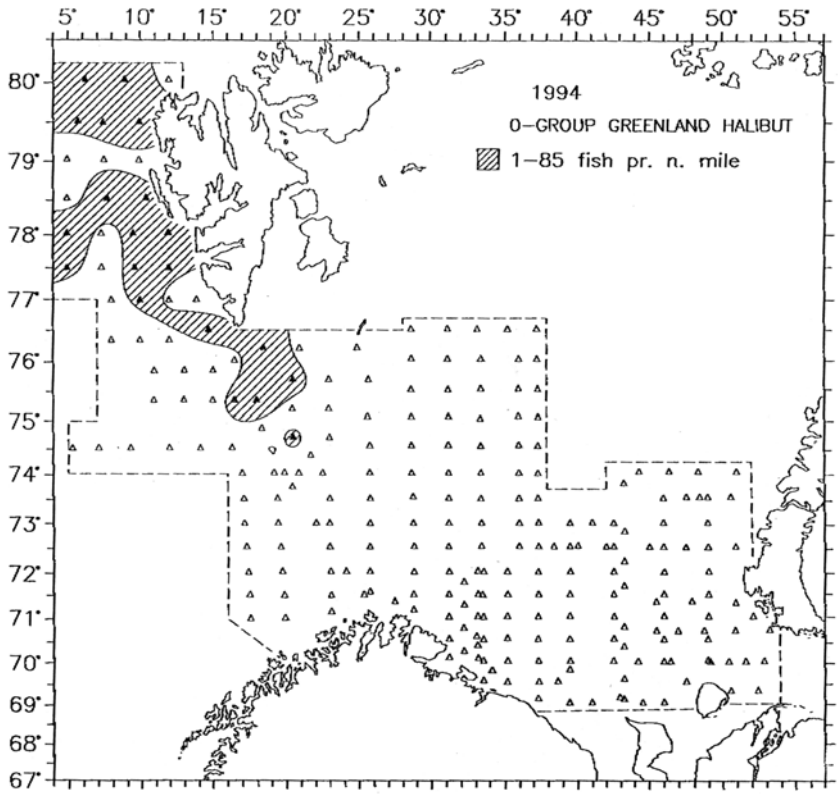

Fig. 22. Distribution of 0-group Greenland halibut

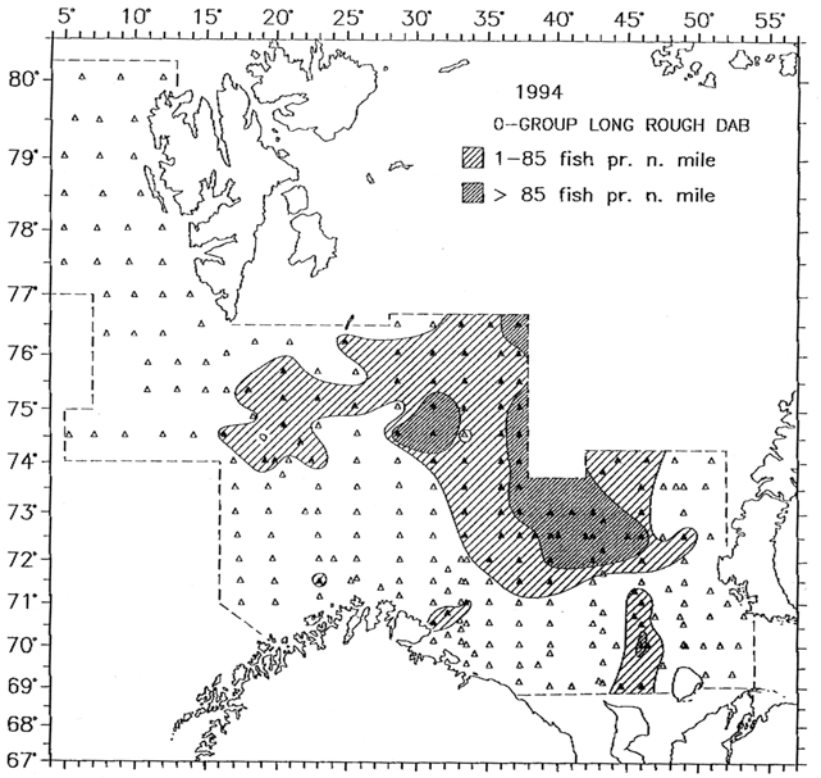

Fig. 23. Distribution of 0-group long rough dab

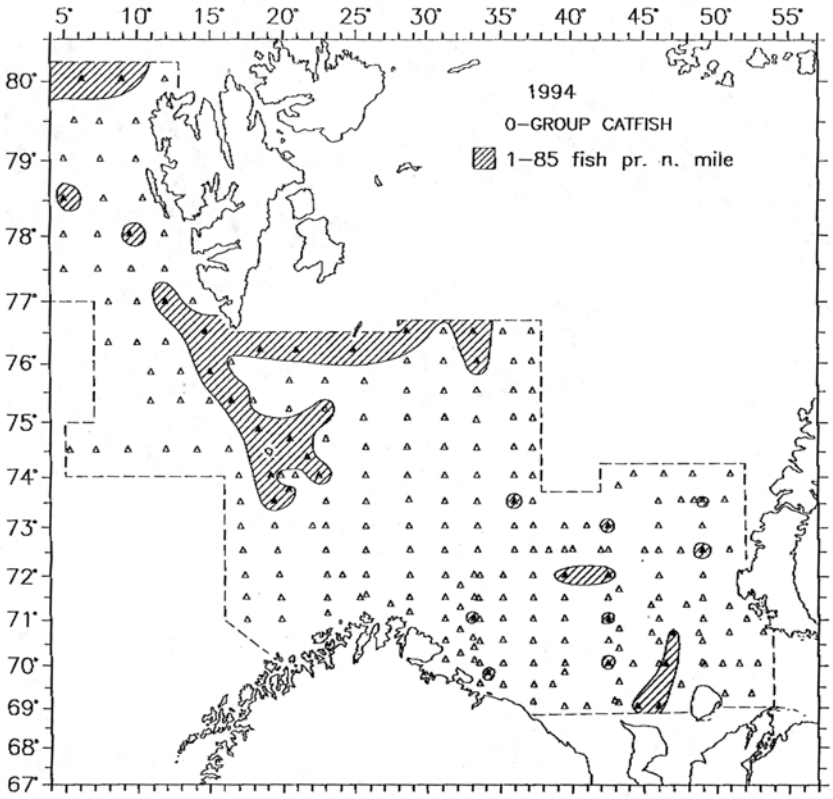

Fig. 24. Distribution of 0-group catfish

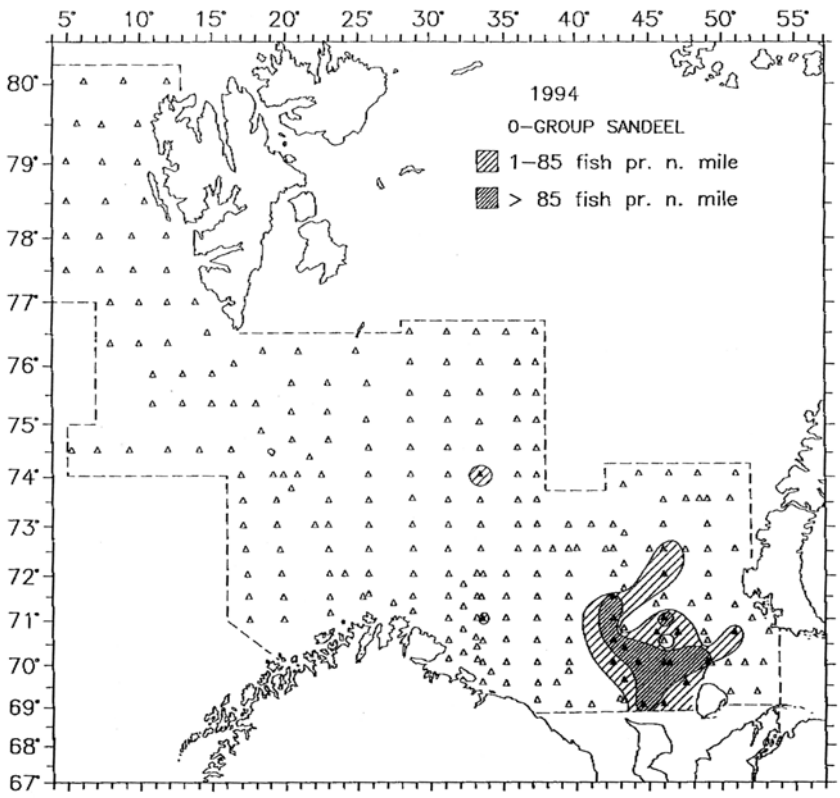

Fig. 25. Distribution of 0-group sandeel

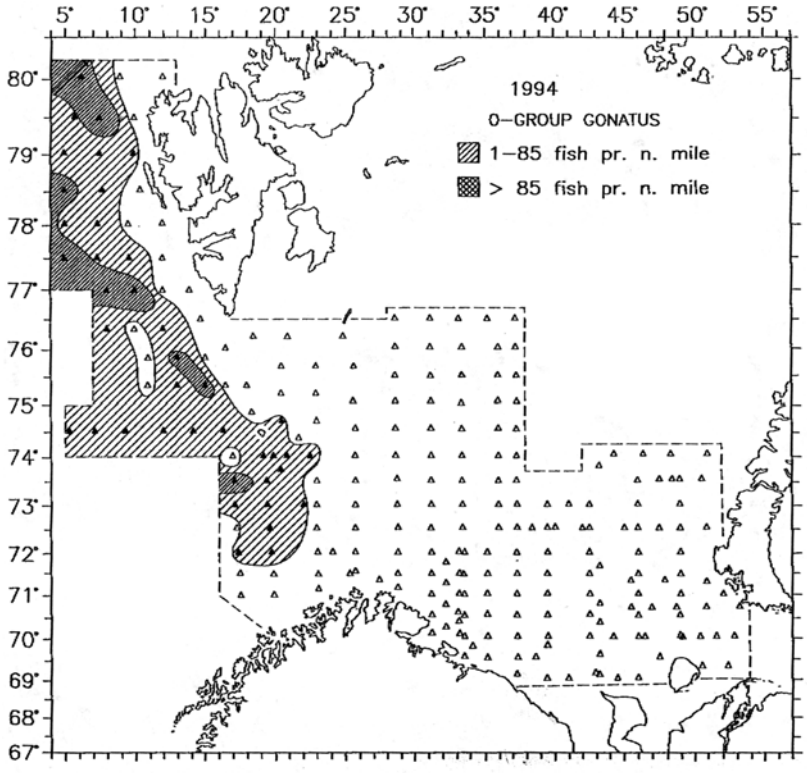

Fig. 26. Distribution of 0-group Gonatus fabricii

International Council for
the Exploration of the Sea

C.M. 1996/ G: xx Ref. H
Demersal Fish Committee

Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1995

The thirty first annual International 0-group fish survey was made during the period 16 August-11 September 1995 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey period	Research Institute
Norway	"Michael Sars"	22.08 - 09.09	Institute of Marine Research, Bergen
Norway	"Johan Hjort"	25.08 - 10.09	"
Norway	"G.O. Sars"	16.08 - 10.09	"
Russia	"Professor Marty"	05.09 - 11.09	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
Russia	"Fridtjof Nansen"	26.08 - 11.09	"

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 distribution of 0-group fish was estimated with a small mesh midwater trawl. Four of the five vessels, which participated in the survey in 1995, used the type of midwater trawl recommended in 1980 (Anon., 1983). The standard procedure consisted of towings of 0.5 nautical miles in each of 3 depths with the headline of the trawl located at 0. 20 and 40 m. Additional tows at 60 and 80 m for 0.5 nautical mile was made when 0-group fish layer was recorded on the echo-sounder deeper than 60 m and 80 m. Trawling procedure was standardized in accordance with the recommendation made in 1980. However, the Russian research vessel "Professor Marty" used a trawl with 30m vertical opening and unknown wingspread. Two steps were trawled to cover the usual 3 step trawling, 0.5 nautical miles in each depth.

West of 20° E most of the stations were taken by R/V "G.O. Sars" and R/V "Johan Hjort" at a distance of 30 nautical miles. This was a too ambitious program, and the distance between stations was increased to 35 nautical miles east of 20° E for the Norwegian research vessels. This design differed from earlier surveys in which the stations were taken at about each 30 nautical miles sailed.

Hydrographical observations were made along all the survey tracks with 5 to 40 nautical miles between stations (Fig. 1). Horizontal distributions of temperatures and salinities

are shown for 0, 50, 100, 200 m and bottom (Figs. 2-11). Figs. 12-19 show the temperature and salinity conditions along the hydrographical sections: Bear Island - West, Bear Island – North Cape, Kola and Cape Kanin. 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. 20-31, as filled and open symbols respectively. The density grading is based on catch as number per 1.0 nautical mile trawling.

Hydrography

According to temperature condition, 1995 is the seventh "warm year" in succession since 1989. The mean water temperatures at 0-200 m in the Barents Sea in 1995 were 0.2-1.0 °C above the long-term average (1965-1995). Compared to 1994, the anomalies of water temperatures ranged from 0.4 below to 1.2 °C above. From 1994 to 1995 the highest increase in water temperatures was recorded in the Kola meridian (50-200 m) and Cape Kanin – North sections, where the anomalies of water temperature constituted 1.1 and 1.6 °C respectively. On the North Cape - Bear Island section (0-200 m) the anomaly of water temperature decreased with 0.3 °C. In the west Spitsbergen current (0-200 m) the temperature was 0.6 °C above the long-term average, but 0.1 °C lower then last year. The overall decrease in water temperatures in the upper layers in the west and south areas of the Barents Sea were determined by low insolation compared to last year. The vertical gradients of water temperatures in the standard sections were scattered and lower then last year. The bottom layer of the coastal current has increased the inflow of Atlantic water at least eastward to the Cape Kanin - North section, where the anomaly of water temperature was 3.0 °C above the long-term average (0 °C). It was an effect of extra high level of atmospheric activity with powerful and prolonged air transport from west and south-west during the previous spring. The observed temperature conditions in the Barents Sea seem to be close to those observed in 1983 and 1991.

Distribution and abundance of 0-group fish and Gonatus fabricii

Geographical distribution of 0-group fish are shown as shaded areas in Figs. 20-30, and of Gonatus fabricii in Fig. 31. 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. 20)

The present survey did not cover the 0-group distribution in the northwestern corner of the survey area. Two main concentrations were observed west of northern Spitsbergen and from south of Bear Island and eastwards to about 43° E. Only scattered concentrations were observed, indicating a poor to below average 1995 year-class strength.

Capelin (Fig. 21)

As in 1993 and 1994, 0-group capelin had a patchy distribution in the eastern Barents Sea, mainly with scattered concentrations. However, the survey did not cover the eastern and northeastern part of the distribution. The area based 0-group abundance index indicates that the 1995 year-class is the fourth consecutive poor year-class.

Cod (Fig. 22)

The 0-group cod was distributed along Spitsbergen to the Norwegian coast and eastwards, close to Novaya Zemlya. However, the survey did not cover the total distribution of 0-group cod in the northwestern and eastern part of the distribution area. During the survey, 0-group cod was observed a little deeper than in most of the previous years, and four and even five trawling steps had to be made on some stations. Even so, 0-group cod was recorded on the echo-sounder deeper than 100 m. Both factors have caused an underestimation of the abundance index. The area based abundance and the logarithmic abundance indices are classifying the 1995 year-class as very strong and the fifth strong year-class in succession.

Haddock (Fig. 23)

The present survey covered to a great extent the distribution area along Spitsbergen and in the western and central Barents Sea. Only two small patches of dense concentrations were observed inside the area of scattered concentrations. The indices indicate that the strength of the 1995 year-class is about average.

Polar cod (Fig. 24)

A continuous distribution was only recorded along the west coast of Spitsbergen. The total area of distribution was not covered, which would affect the abundances indices of both the western and the eastern component. Compared to 1994, the abundance index was much less in the area north of Bear Island, and the year-class strength in the western component was recorded as the poorest in the period 1977-1995. No indication of the year-class abundance of the eastern component can be given, caused by the lack of area coverage.

Saithe (Fig. 25)

A continuous area of distribution, with low abundance, was observed in the central Barents Sea and in the western part of the survey area northwards to about 78° N. Single hauls with one or two specimens were observed in the more eastern part of the Barents Sea. 0-group saithe is at this time of the year to a great extent living inside the Norwegian coastal waters, and the observations in open sea give no indication of the year-class strength.

Redfish (Fig. 26)

The observed distribution of redfish is an almost complete coverage of the 0-group. In general, the distribution pattern was similar to those after 1990. Dense concentrations were only recorded in five small patches within the distribution area from north of Spitsbergen to the area between Bear Island and the Norway coast. The abundance index indicates a year-class strength far below the average, but about the average of the poor 1991-1995 year-classes.

Greenland halibut (Fig. 27)

A continuous distribution of 0-group Greenland halibut was observed along Spitsbergen, only with low abundance. In addition, three small patches of low abundance were observed in the northeastern Barents Sea. The abundance index of the 1995 year-class is close to the abundance level of the 1993-1994 year-classes and a little higher than the five proceeding ones. However, the 1995 year-class is recorded as poor.

Long rough dab (Fig. 28)

0-group long rough dab was mainly observed in the eastern part of the Barents Sea, only with low abundance. However, the total area of distribution was not covered in the eastern Barents Sea. Only two positive hauls were made close to the southern part of Spitsbergen. The abundance index indicate a poor 1995 year-class.

Sandeel (Fig. 29)

As in 1994, the 0-group sandeel was mainly observed in the southeastern Barents Sea. However, the distribution area was not covered in the east.

Catfish (Fig. 30)

0-group catfish was distributed in a narrow area north of Bear Island and along Spitsbergen to at least 80° N. Two small patches were recorded in the central Barents Sea, and only a small number were caught in each haul.

Gonatus (Fig. 31)

As in earlier years, 0-group Gonatus fabricii was distributed in the western part of the survey area. However, the area of distribution was not completely covered to the west. The level of survey catches were at a lower level than in the 1994 survey.

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prerecruit studies for fishery management related to fish stocks in the Barents Sea and adjacent waters. Proceedings of the sixth PINRO - IMP symposium. Bergen, 14-17 June 1994. Institute of Marine research, Bergen. Norway.

Table 1. Mean water temperature[1] in main parts of standard sections in the Barents Sea and adjacent waters in August-September 1965-1995

Year	Section[2] 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	4.7	6.1	5.2
Average 1965-1995	7.3	3.8	4.7	4.3	3.3	5.8	5.2

[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)

Table 2. Abundance indices of 0-group fish in the Barents Sea and adjacent waters in 1965-1995

Year	Capelin[1]	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab
				West		East			
1965	37	6	7		0		159		66
1966	119	1	1		129		236		97
1967	89	34	42		165		44		73
1968	99	25	8		60		21		17
1969	109	93	82		208		295		26
1970	51	606	115		197		247	1	12
1971	151	157	73		181		172	1	81
1972	275	140	46		140		177	8	65
1973	125	684	54		(26)		385	3	67
1974	359	51	147		227		468	13	83
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		73	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

[1)] 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[1]			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	0.57	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
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	2.65	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	0.16	0.40

[1)] 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 1995

Length, mm	Herring	Capelin	Cod	Haddock	Polar cod West	Redfish	Greenland halibut	Long rough dab	Sandeel
10-14						+			
15-19						0.2			
20-24						0.9			
25-29		0.1			1.0	2.2		0.5	
30-34	+	0.9			10.3	12.5		14.8	
35-39	0.6	2.5		+	39.2	21.7		45.5	1.3
40-44	0.7	16.0	+	0.5	27.5	24.2	3.5	31.3	8.2
45-49	2.7	45.7	+	0.4	8.3	24.8	0.9	7.6	22.5
50-54	5.1	32.3	+	0.4	1.5	10.7	11.6	0.1	33.7
55-59	15.5	2.2	0.1	0.6	1.0	2.4	10.1		9.1
60-64	24.4	0.2	0.3	0.3	2.0	0.4	22.8		4.2
65-69	33.7	0.2	1.1	1.7	3.4		33.0		4.0
70-74	15.0		3.3	1.3	2.5		4.7		7.5
75-79	2.2		8.1	2.8	2.9		11.3	0.1	5.6
80-84	0.1		16.8	3.9	0.5		0.9		3.0
85-89			20.6	5.3				0.1	1.0
90-94			20.2	11.2			0.9		0.1
95-99			15.7	14.6					
100-104			9.2	14.7					
105-109			3.6	12.0					
110-114			0.7	10.2					
115-119			0.3	9.9					
120-124			+	4.8					
125-129				4.5					
130-134				1.0					
135-139				+					
140-144									
No. measured	1563	843	11025	1090	159	2420	44	541	818
Total numbers	6763	7307	393-497	2563	204	66128	106	1108	19968
Mean length	63.5	45.3	89.4	101.5	42.4	41.8	63.8	38.6	55.5

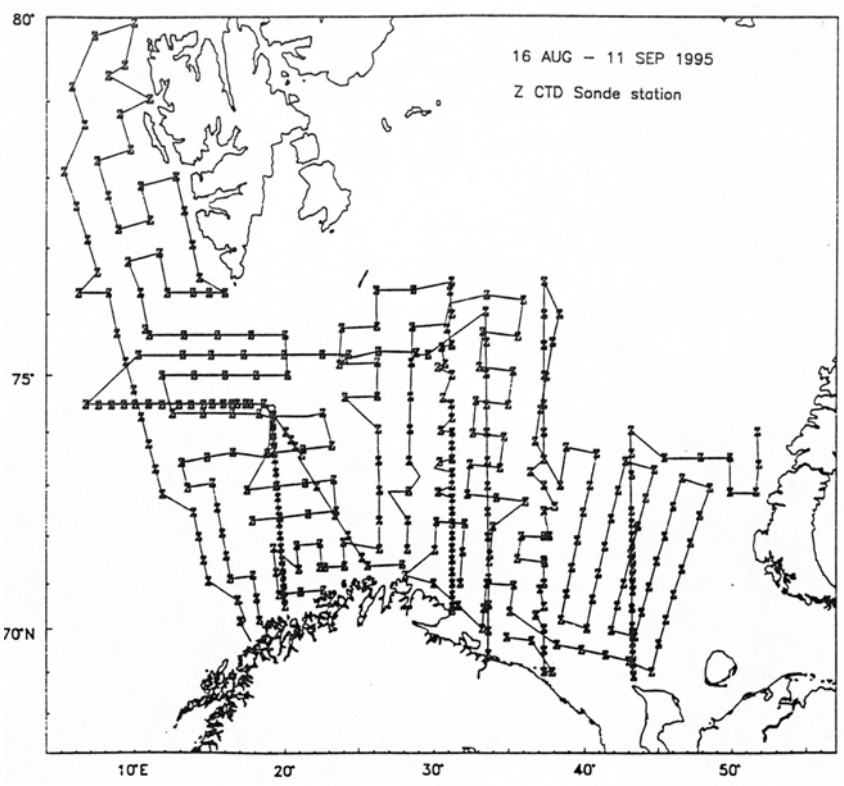

Fig. 1. Survey tracks and hydrographic stations

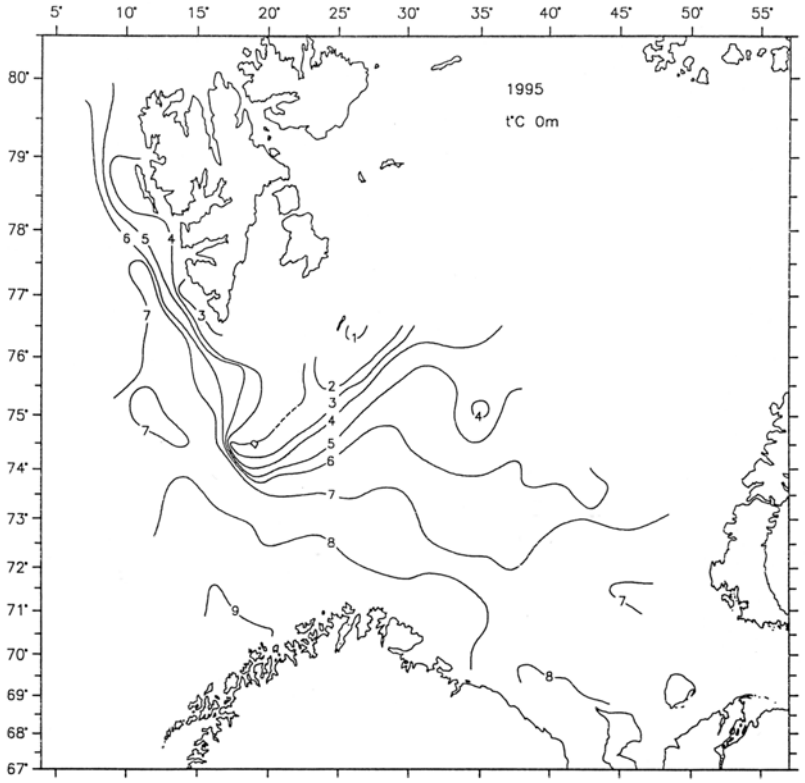

Fig. 2. Isotherms at 0 m

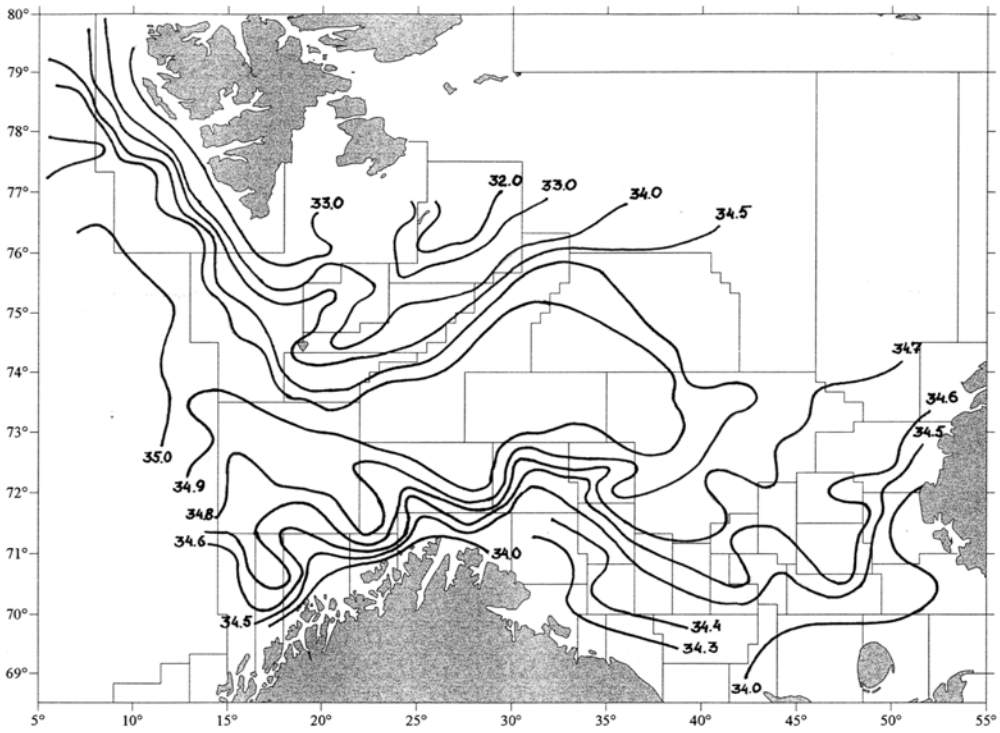

Fig. 3. Isohalines at 0 m

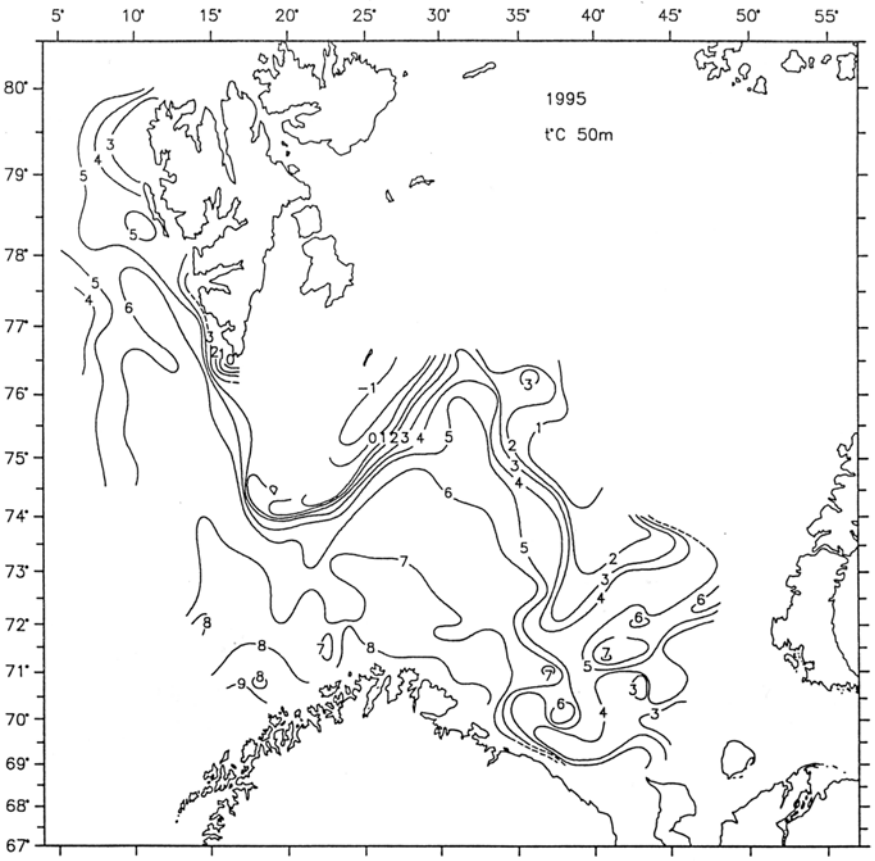

Fig. 4. Isotherms at 50 m

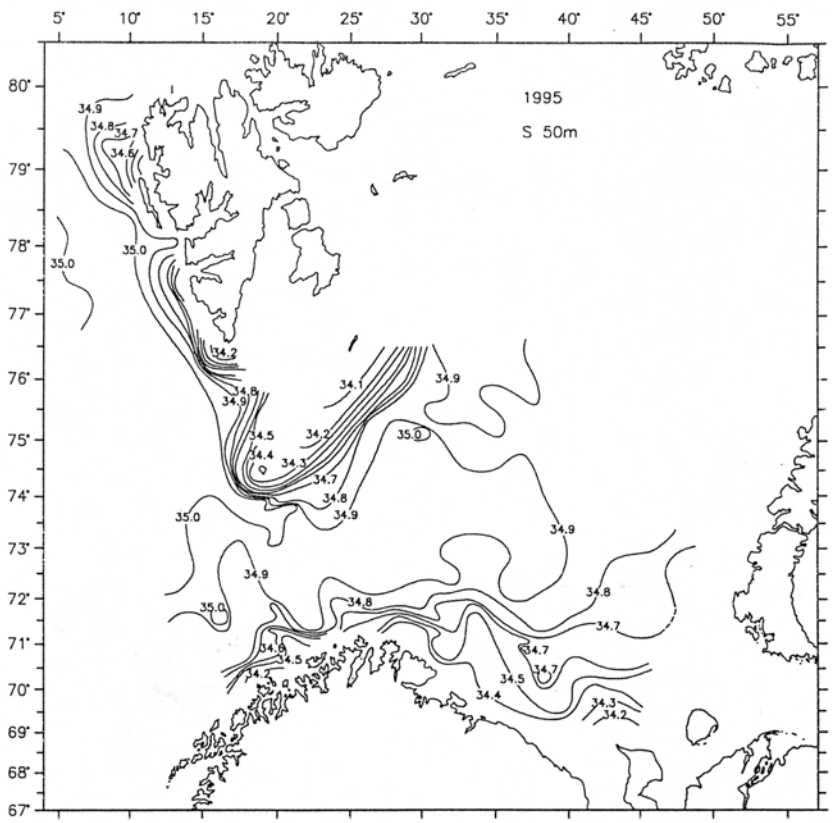

Fig. 5. Isohalines at 50 m

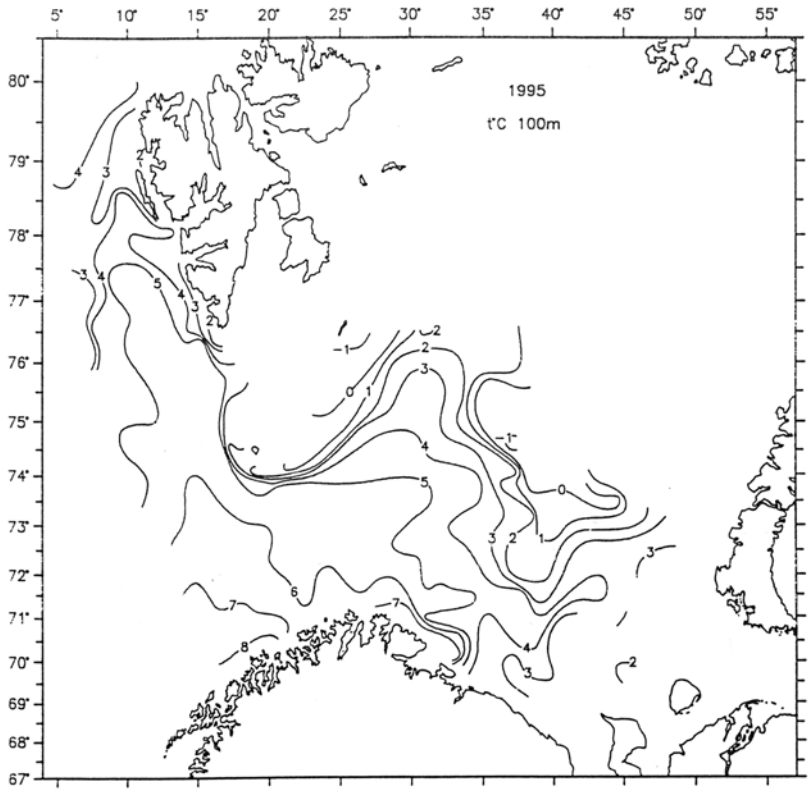

Fig. 6. Isotherms at 100 m

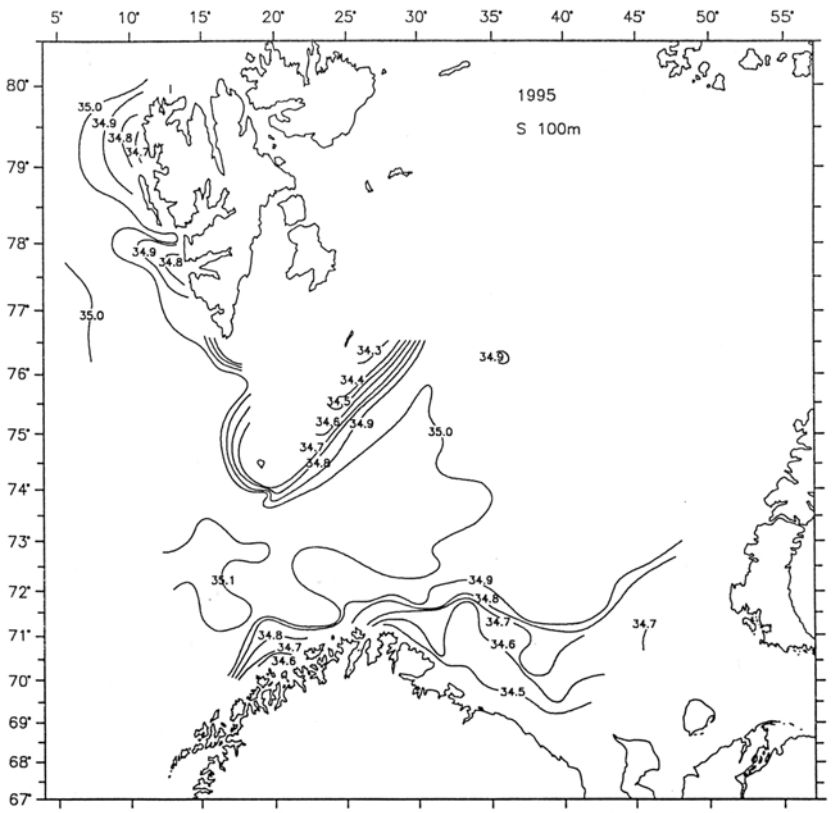

Fig. 7. Isohalines at 100 m

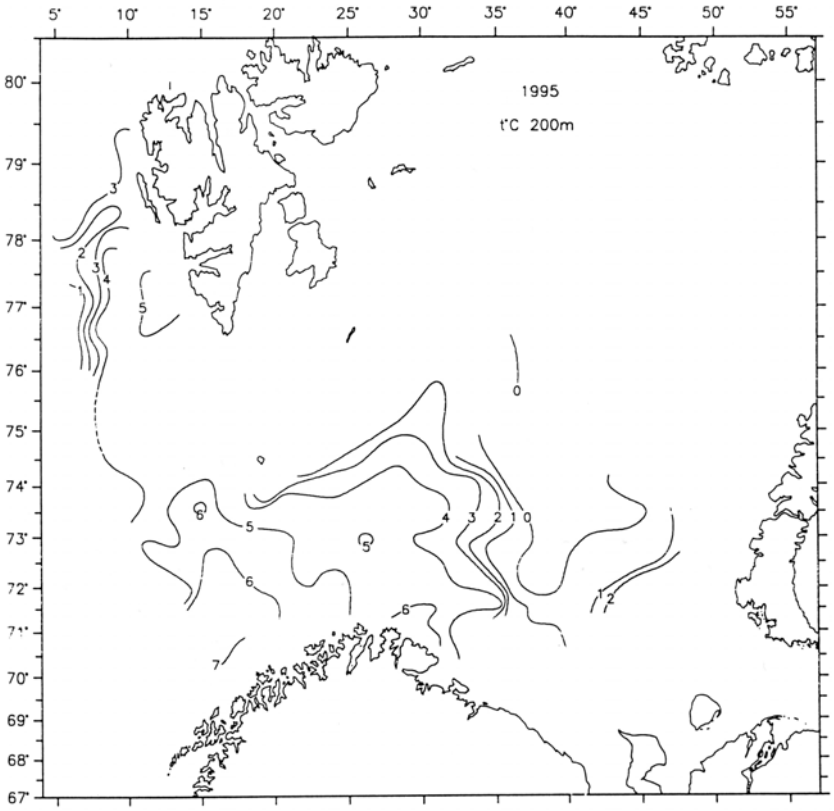

Fig. 8. Isotherms 200 m

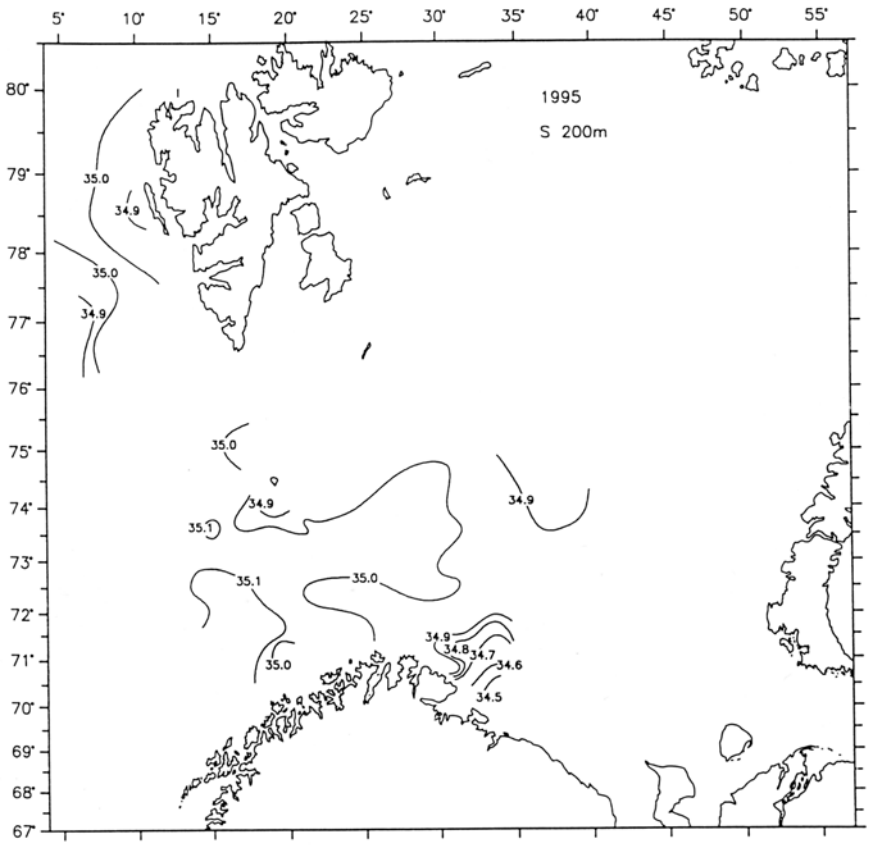

Fig. 9. Isohalines at 200 m

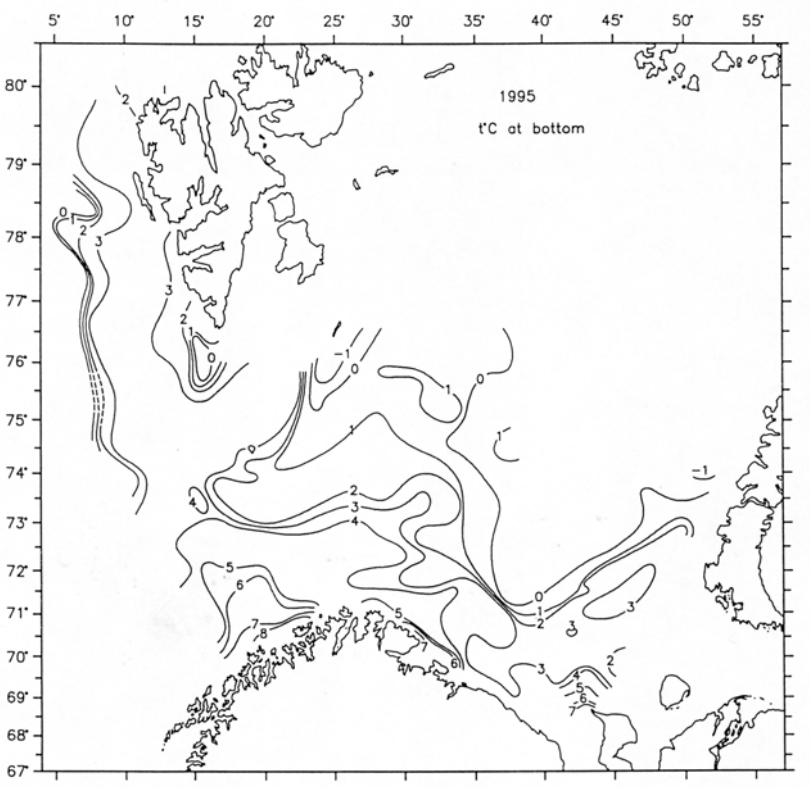

Fig. 10. Isotherms at the bottom

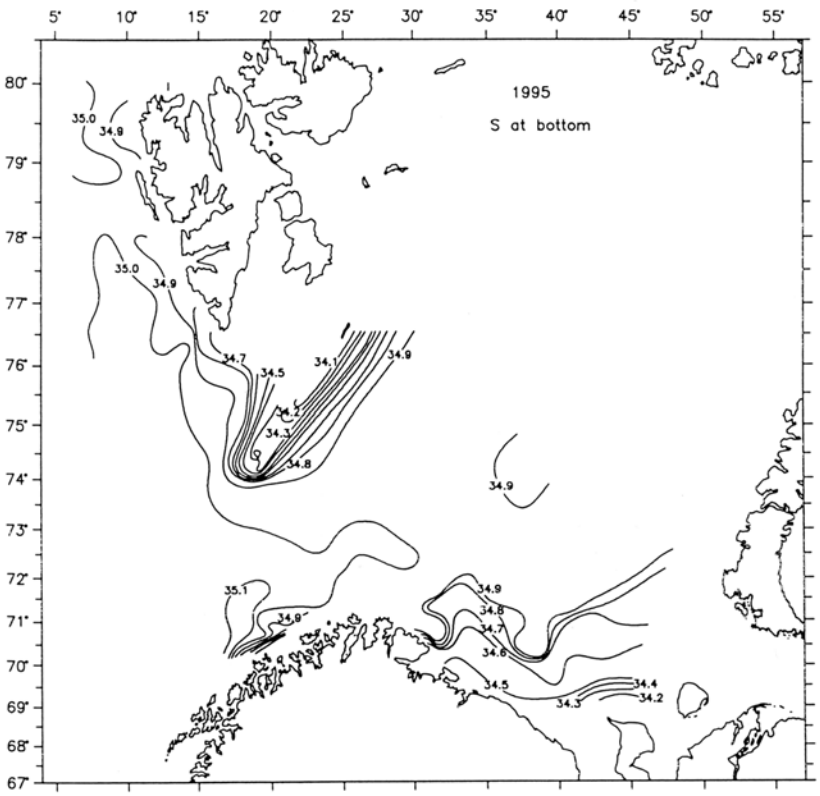

Fig. 11. Isohalines at the bottom

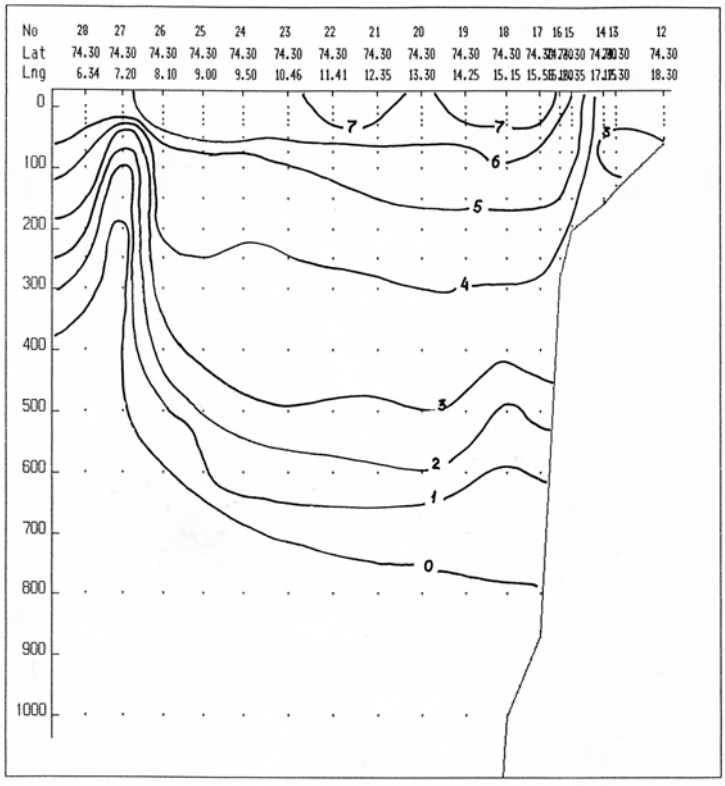

Fig. 12. Hydrographic section Bear Island-West. Temperature

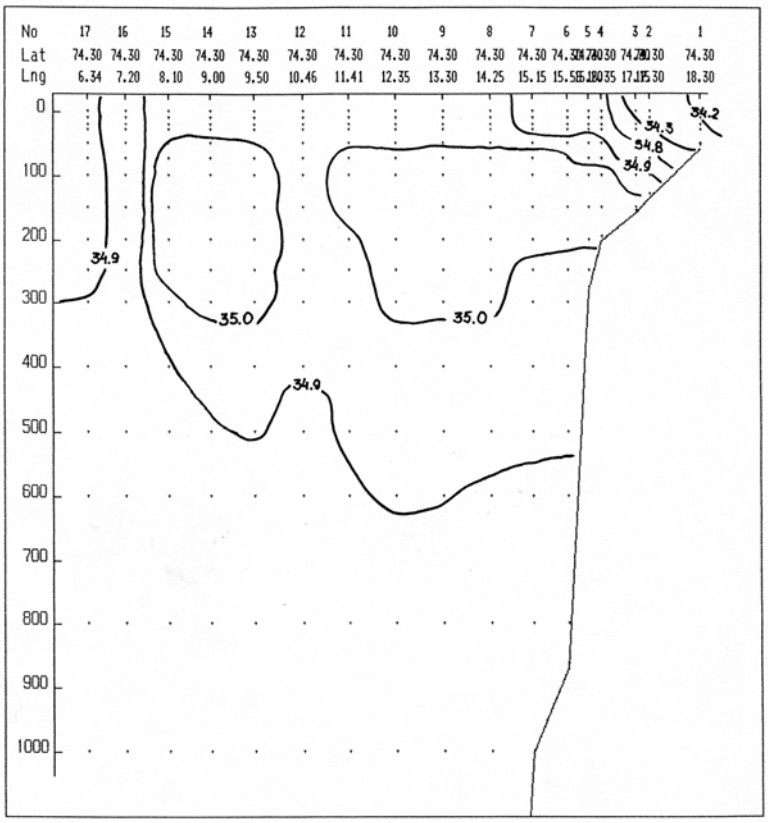

Fig. 13. Hydrographic section Bear Island-West. Salinity

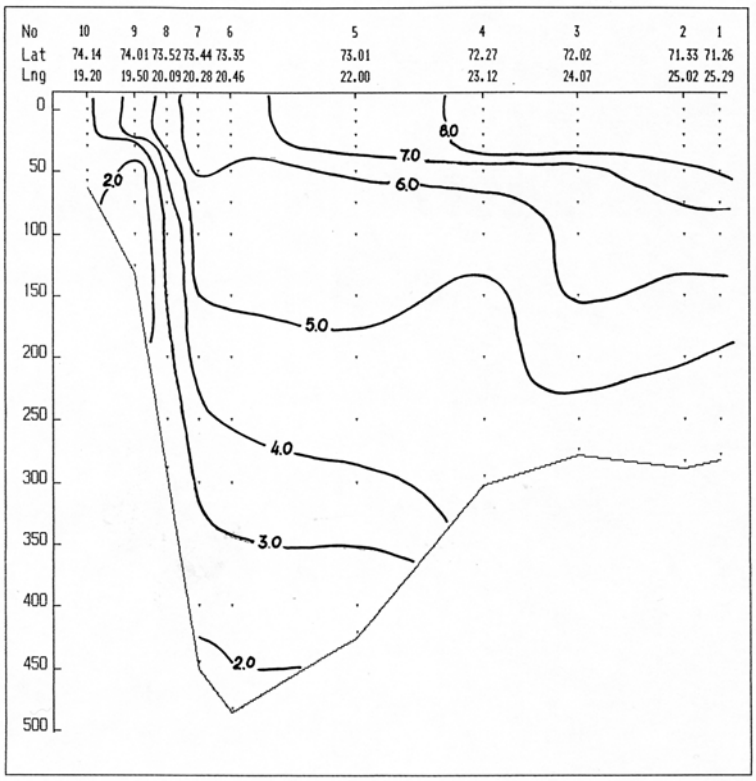

Fig. 14. Hydrographic section North Cape-Bear Island. Temperature

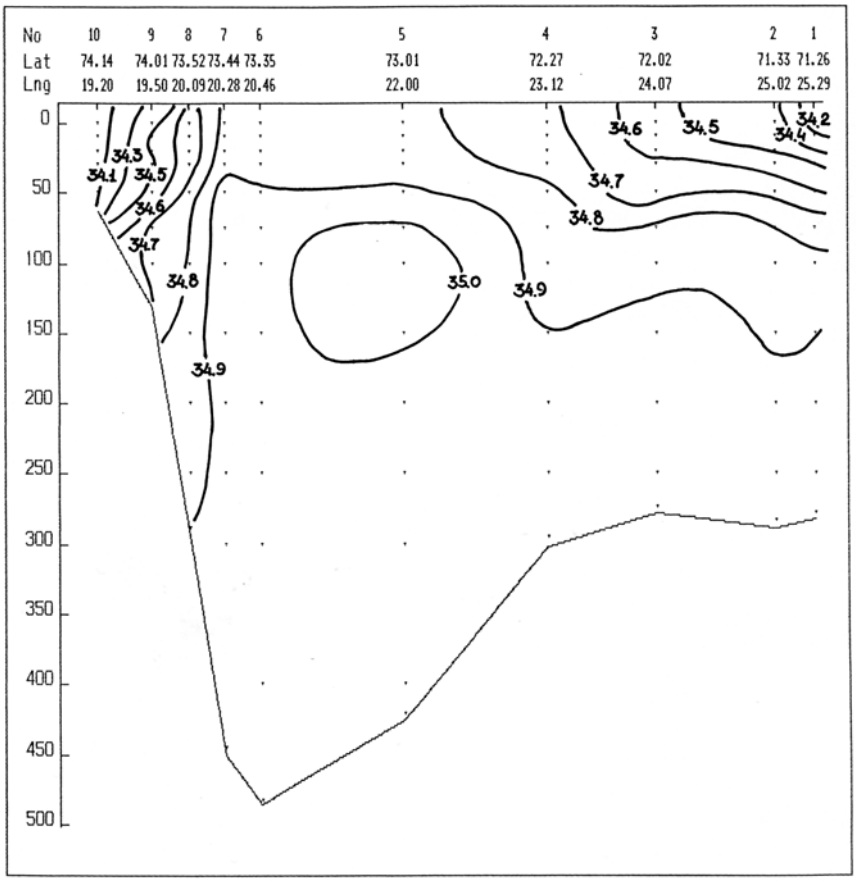

Fig. 15. Hydrographic section North Cape-Bear Island. Salinity

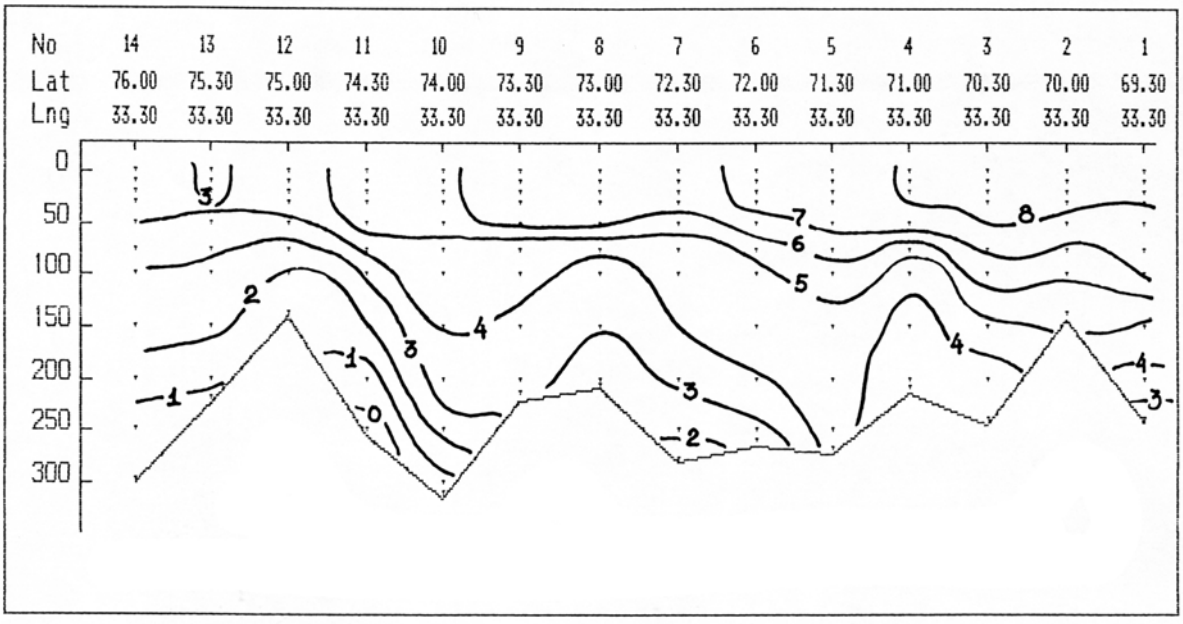

Fig. 16. Hydrographic section along the Kola meridian. Temperature

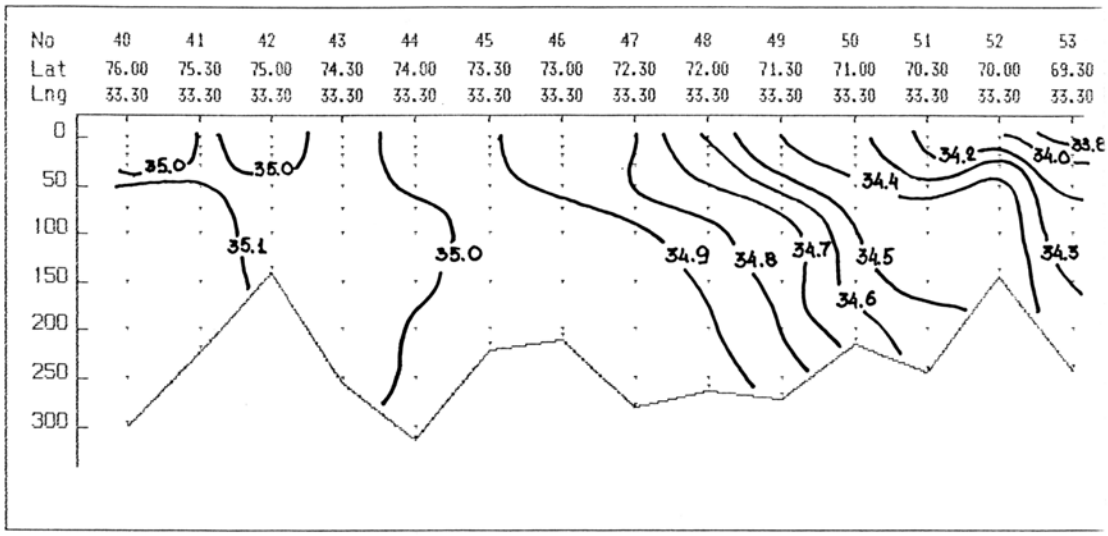

Fig. 17. Hydrographic section along the Kola meridian. Salinity

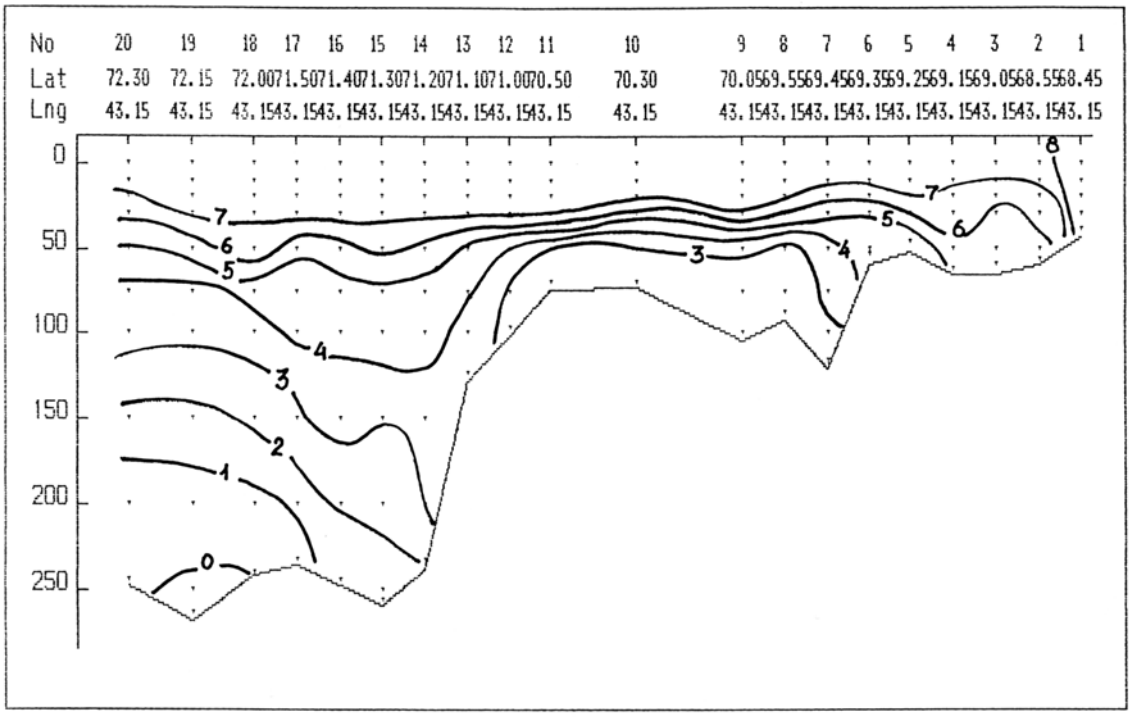

Fig. 18. Hydrographic section Cape Kanin-North. Temperature

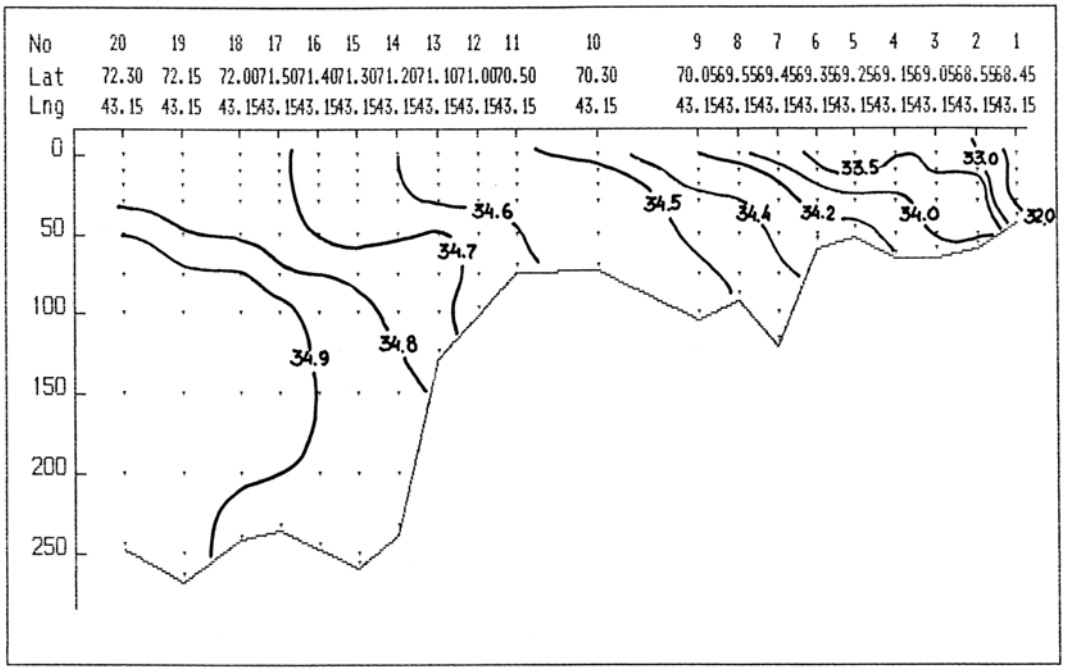

Fig. 19. Hydrographic section Cape Kanin – North. Salinity

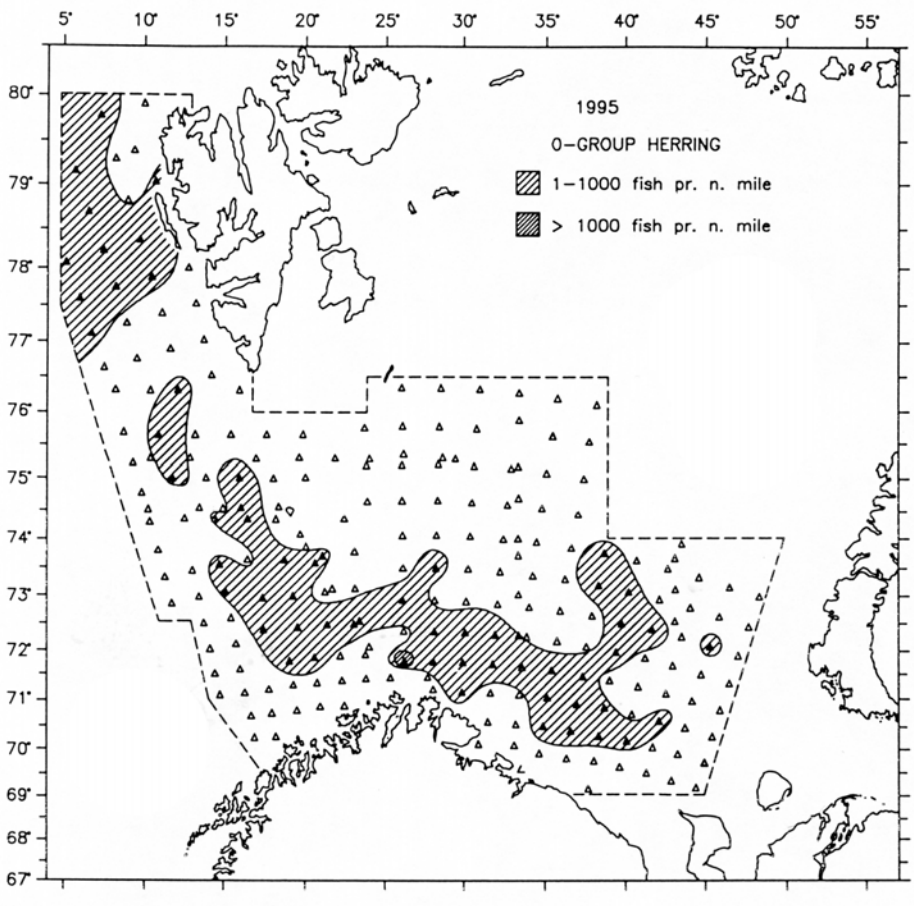

Fig. 20. Distribution of 0-group herring

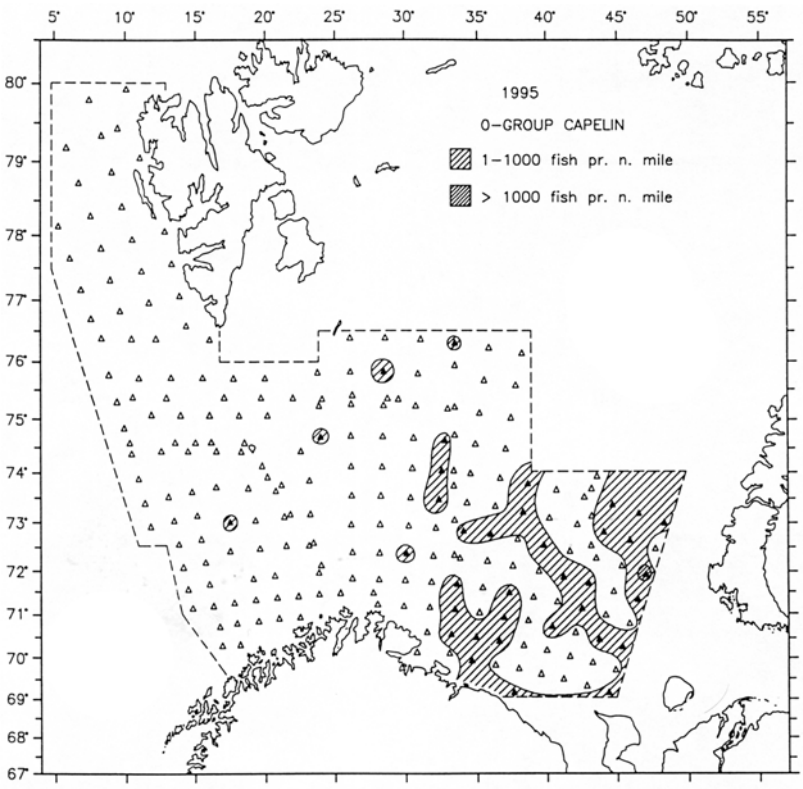

Fig. 21. Distribution of 0-group capelin

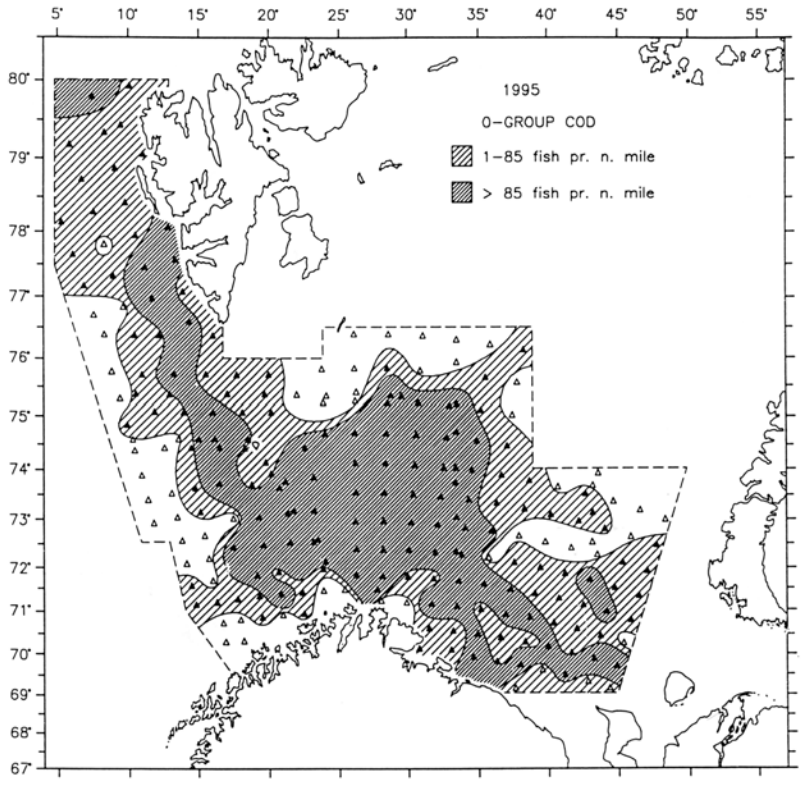

Fig. 22. Distribution of 0-group cod

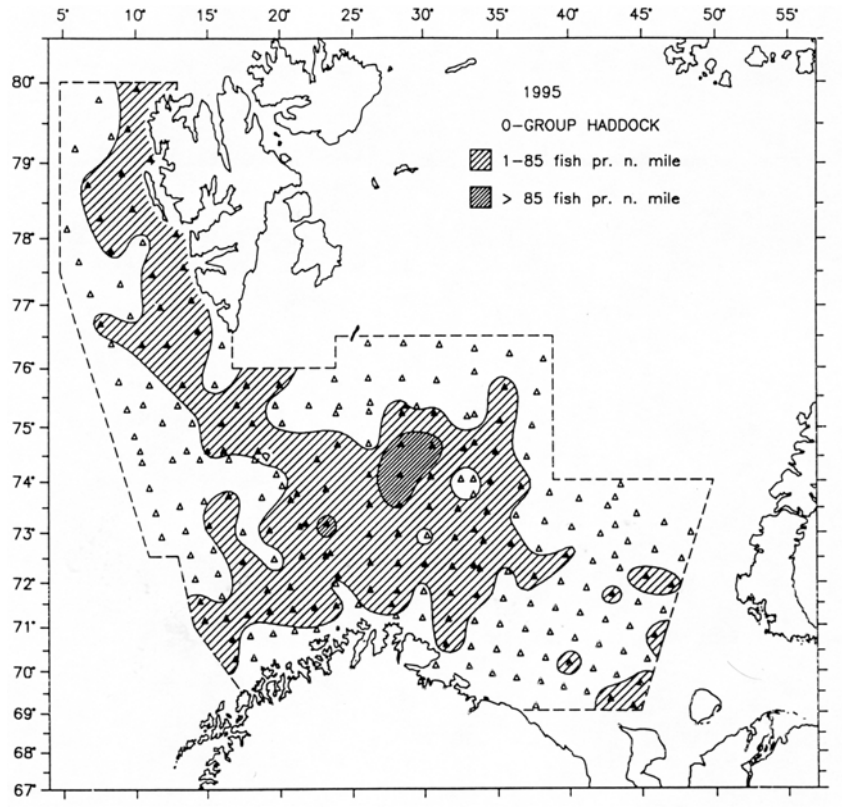

Fig. 23. Distribution of 0-group haddock

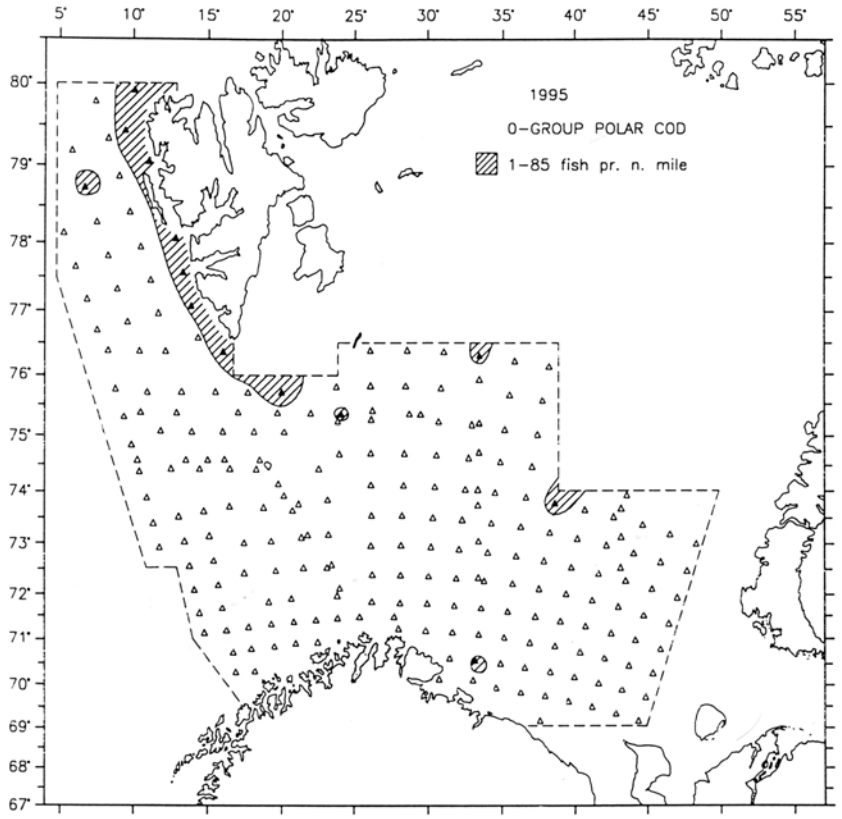

Fig. 24. Distribution of 0-group polar cod

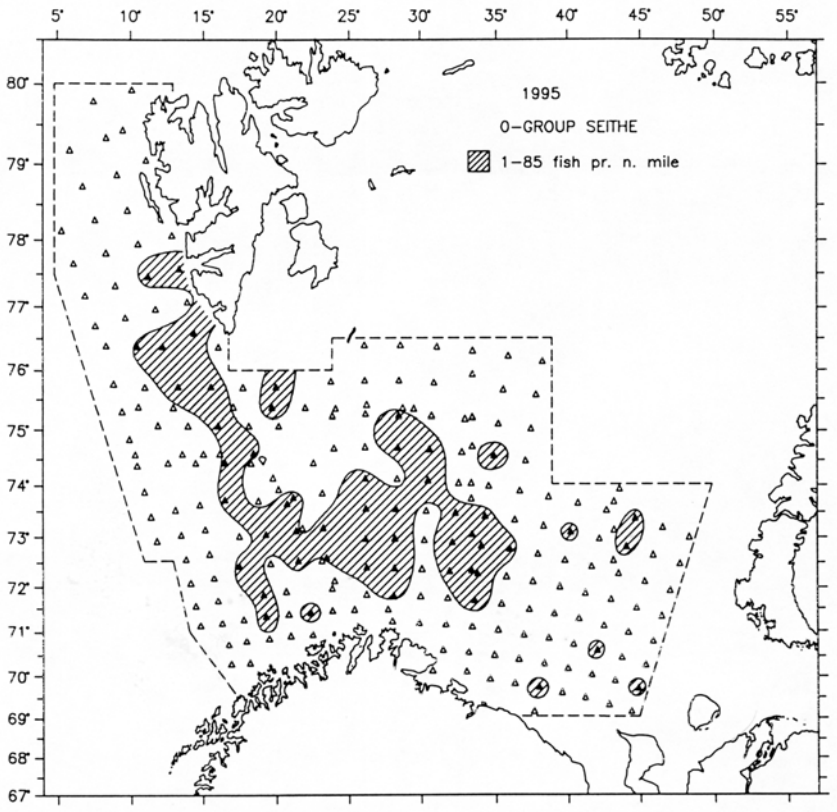

Fig. 25. Distribution of 0-group saithe

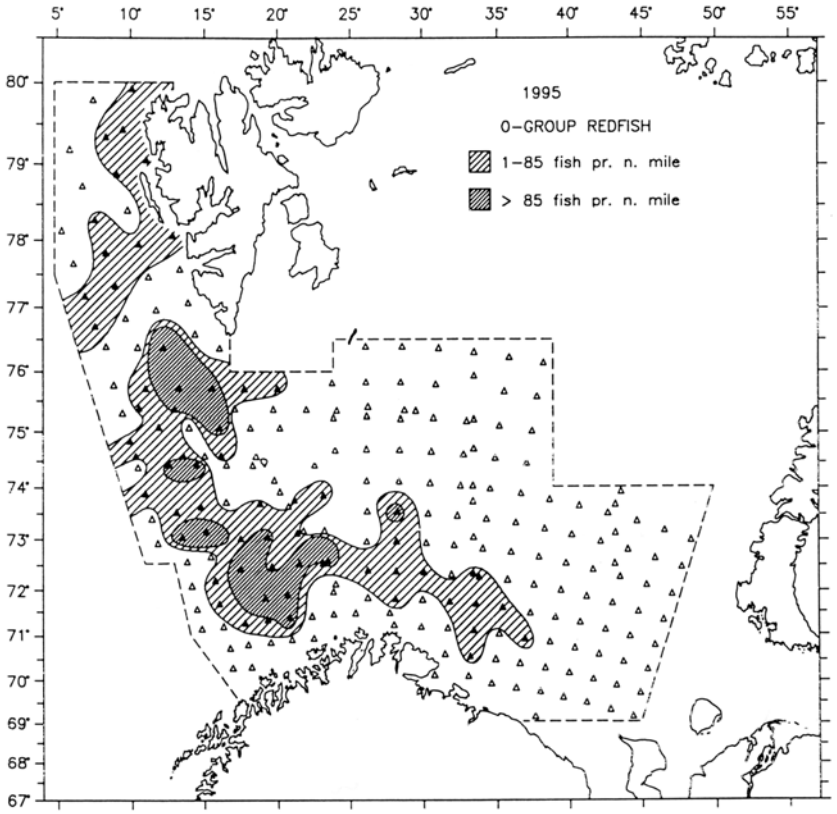

Fig. 26. Distribution of 0-group redfish

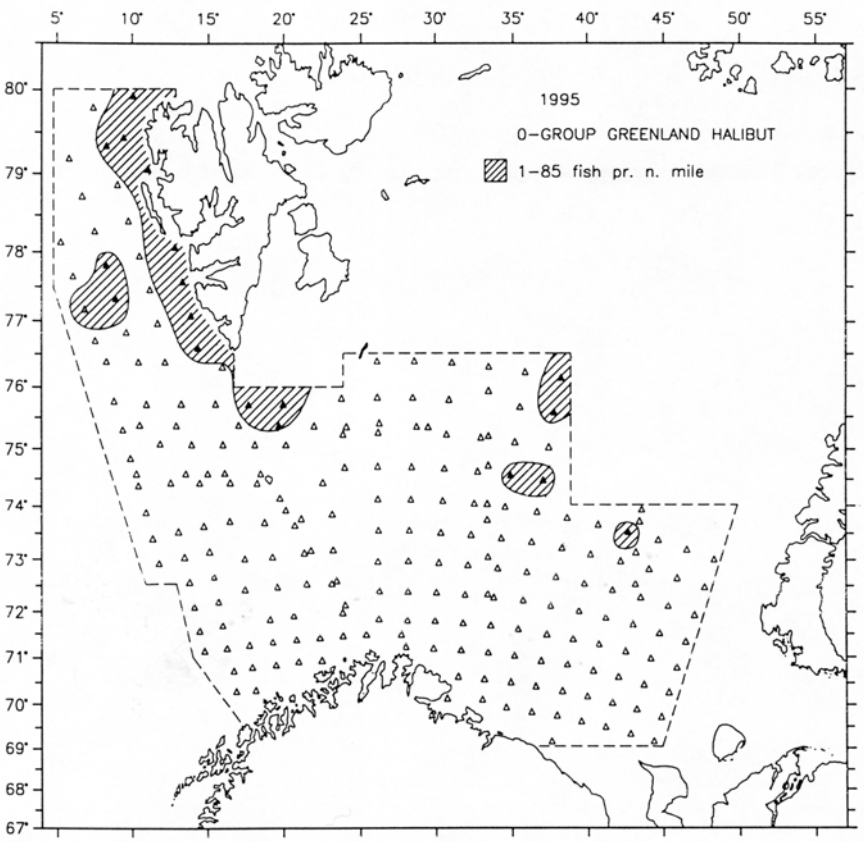

Fig. 27. Distribution of 0-group Greenland halibut

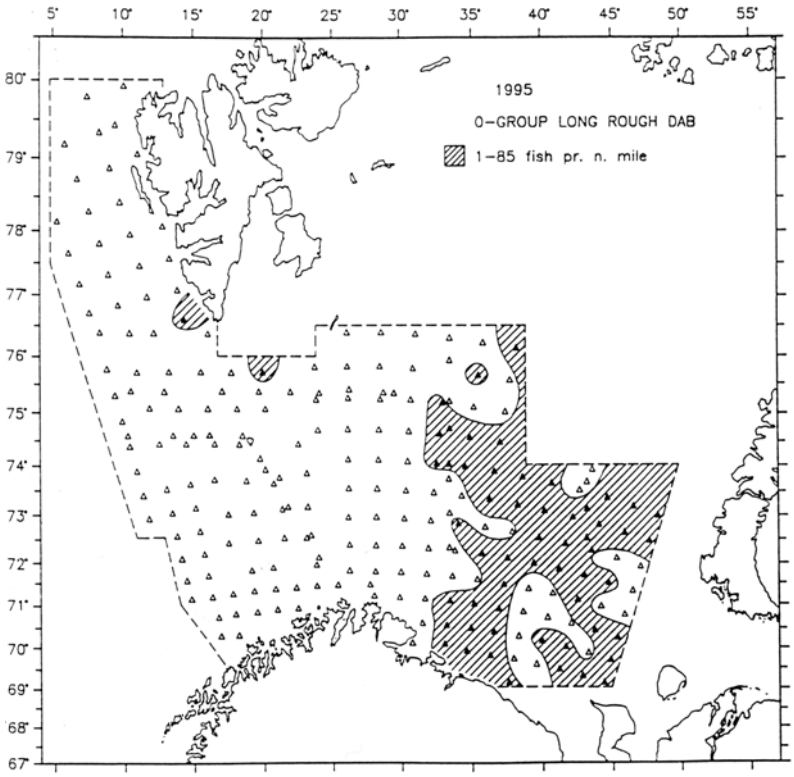

Fig. 28. Distribution of 0-group long rough dab

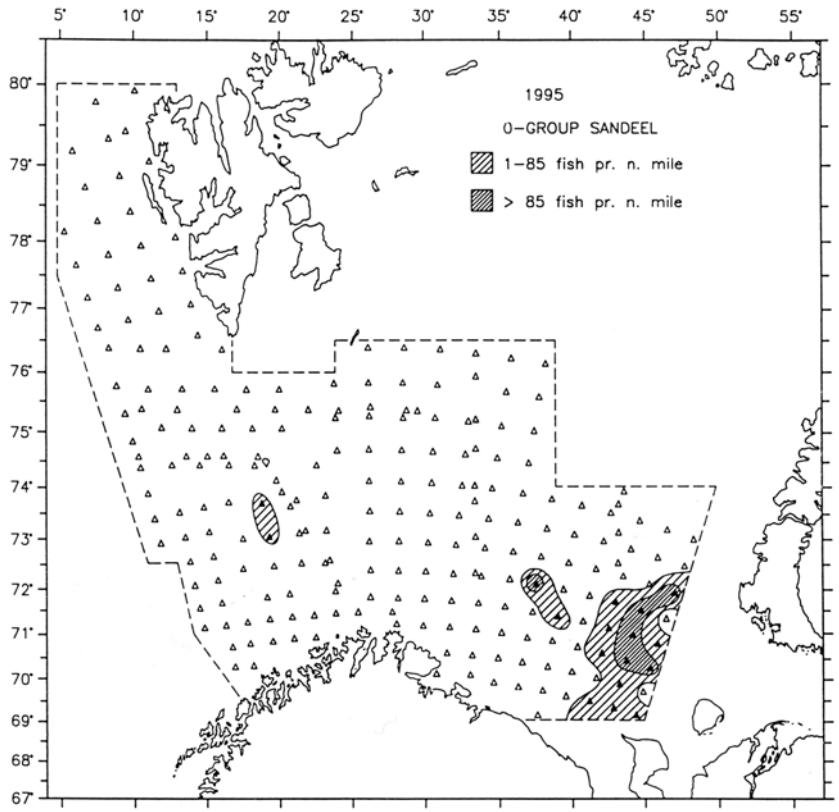

Fig. 29. Distribution of 0-group sandeel

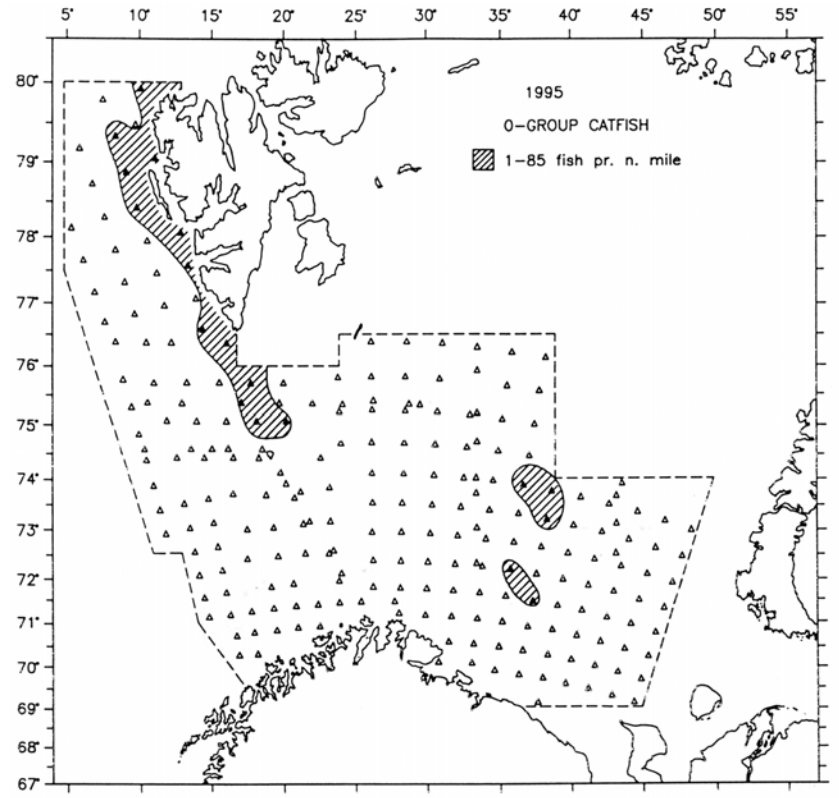

Fig. 30. Distribution of 0-group catfish

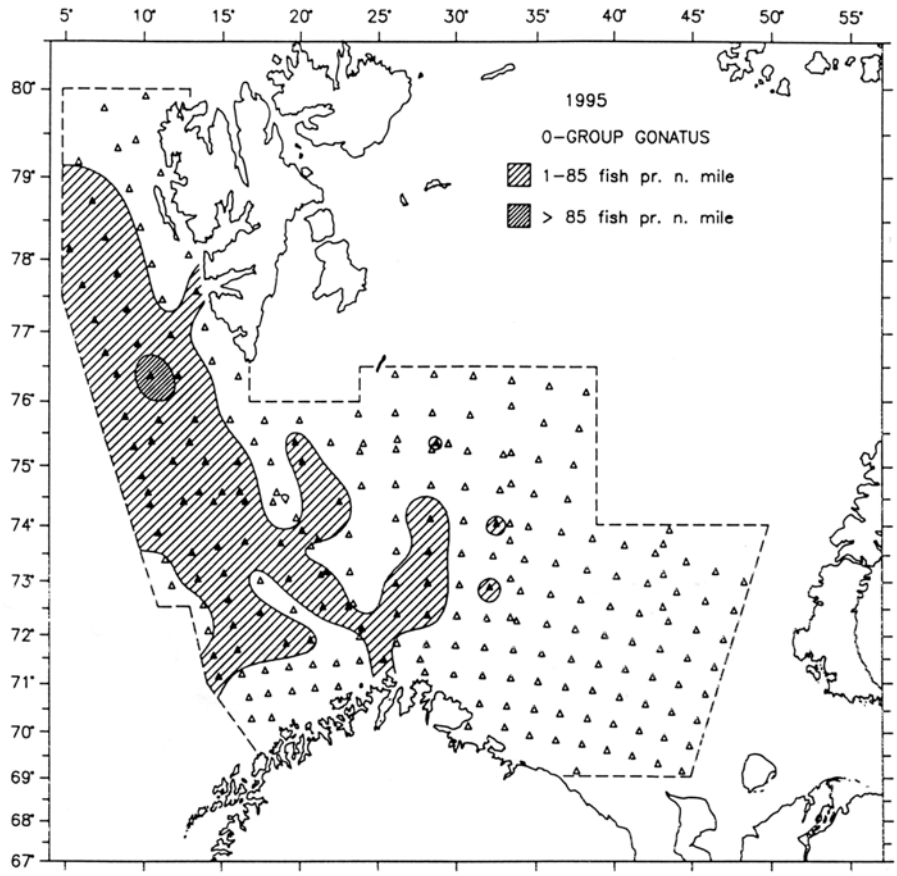

Fig. 31. Distribution of 0-group Gonatus fabricii

International Council for
the Exploration of the Sea

C.M. 1996/G: 31 Ref. H
Demersal Fish Committee

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:

State	Name of vessel	Survey period	Research Institute
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 Institute of Marine Fisheries and Oceanography, Murmansk
Russia	"Persey III"	24.08 - 10.09	"

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 correspondance. 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 towings of 0.5 nautical mile in each of 3 depths with the headline of the trawl located at 0, 20 and 40 m.

Additional steps at 60 and 80 m for 0.5 nautical miles were made when 0-group fish layer was recorded deeper than 60m or 80m on the echo-sounder. Trawling procedure was standardized in accordance with the recommendation made in 1980.

Most of the stations worked by the Norwegians 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, 200 m 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 0-200 m 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 it 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 150 m 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. 19)

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 Novaya 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[1] in main parts of standard sections in the Barents Sea and adjacent waters in August-September 1965-1996.

Year	Section[2] 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

[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).

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

Year	Capelin[1]	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab
				West		East			
1965	37	6	7		0		159		66
1966	119	1	1		129		236		97
1967	89	34	42		165		44		73
1968	99	25	8		60		21		17
1969	109	93	82		208		295		26
1970	51	606	115		197		247	1	12
1971	151	157	73		181		172	1	81
1972	275	140	46		140		177	8	65
1973	125	684	54		(26)		385	3	67
1974	359	51	147		227		468	13	93
1975	320	343	170		75		315	21	113
1976	281	43	112		131		447	16	96
1977	194	173	116	157		70	472	9	72
1978	40	106	61	107		144	460	35	76
1979	660	94	69	23		302	980	22	69
1980	502	49	54	79		247	651	12	108
1981	570	65	30	149		93	861	38	95
1982	393	114	90	14		50	694	17	150
1983	589	386	184	48		39	851	16	80
1984	320	486	255	115		16	732	40	70
1985	110	742	156	60		334	795	36	86
1986	125	434	160	111		366	702	55	755
1987	55	102	72	17		155	631	41	174
1988	187	133	86	144		120	949	8	72
1989	1300	202	112	206		41	698	5	92
1990	324	465	227	144		48	670	2	35
1991	241	766	472	90		239	200	1	28
1992	26	1159	313	195		118	150	3	32
1993	43	910	240	171		156	162	11	55
1994	58	899	282	50		448	414	20	272
1995	43	1069	148	6		-	220	15	66
1996	291	1142	196	59		484	19	5	10

[1)]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 1965-1996

Year	Herring[1]			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

[1)] 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	Capelin	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	62.5	50.1	76.9	102.1	37.4	41.4	55.6	35.8	43.1

Appendix

Research vessel	Participants
"G. O. Sars"	J. Erices, I. Fjellstad, R. Johannessen, A. Hylen (toktleder), L. Kalvenes, J. de Lange, H. Mjanger (fra 31/8), A. Raknes, N.G. Ushakov (Russia)
"Johan Hjort"	K. Bolstad, K. Gjertsen, H. Græssdal, E. Sælen Meland, M. Møgster, Ø. Torgersen, O.J. Østvedt (toktieder)
"Michael Sars"	H. Bjørke, T.I. Halland (toktieder), 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

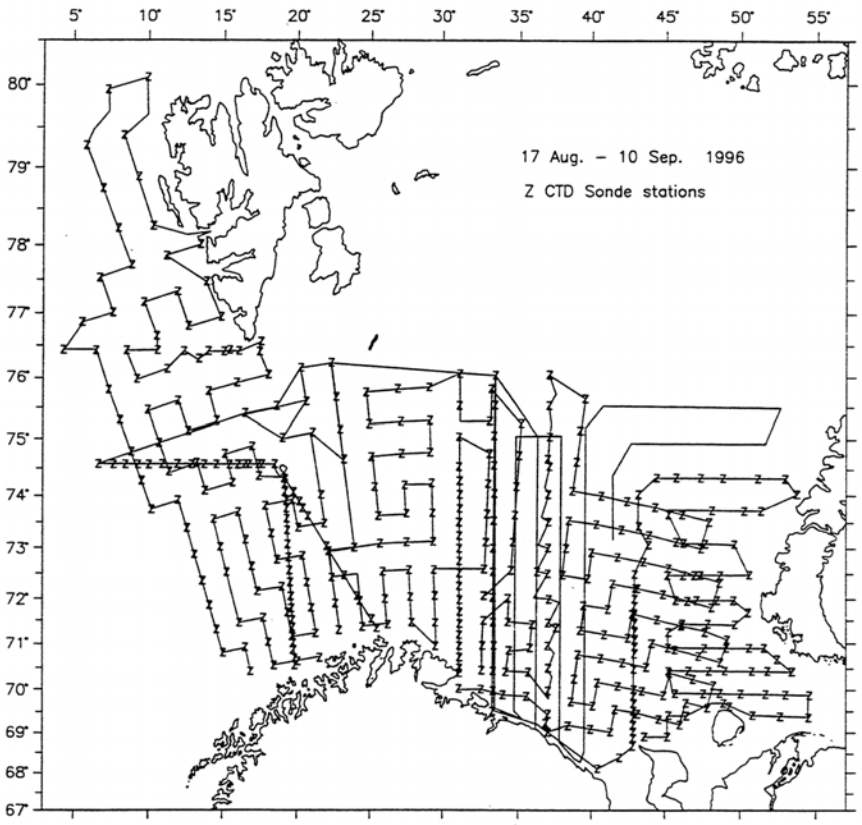

Fig. 1. Survey tracks and hydrographic stations

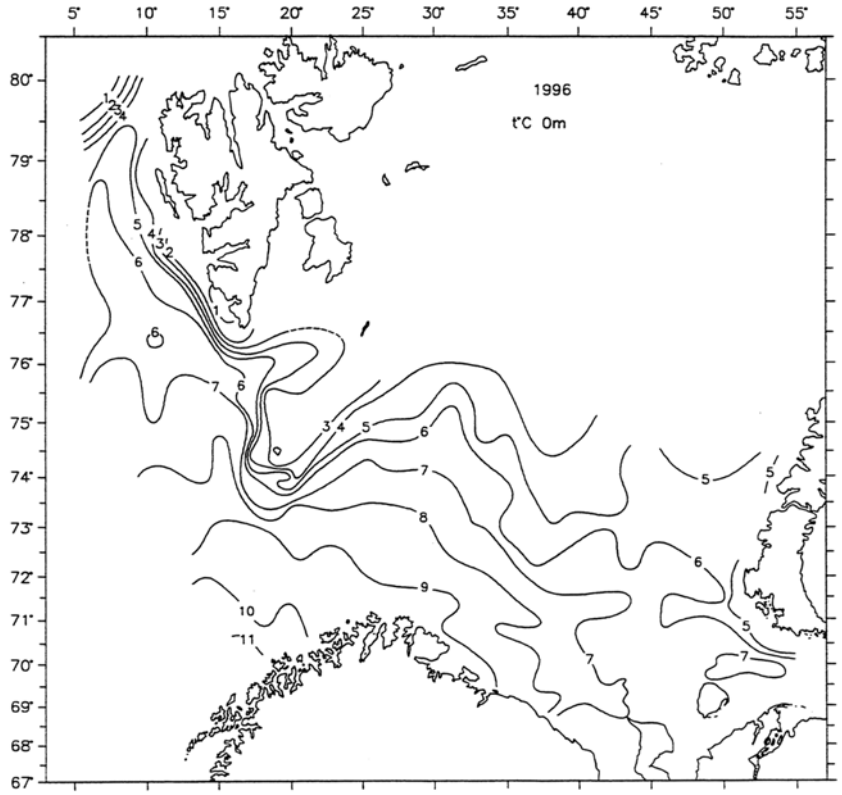

Fig. 2. Isotherms at 0 m

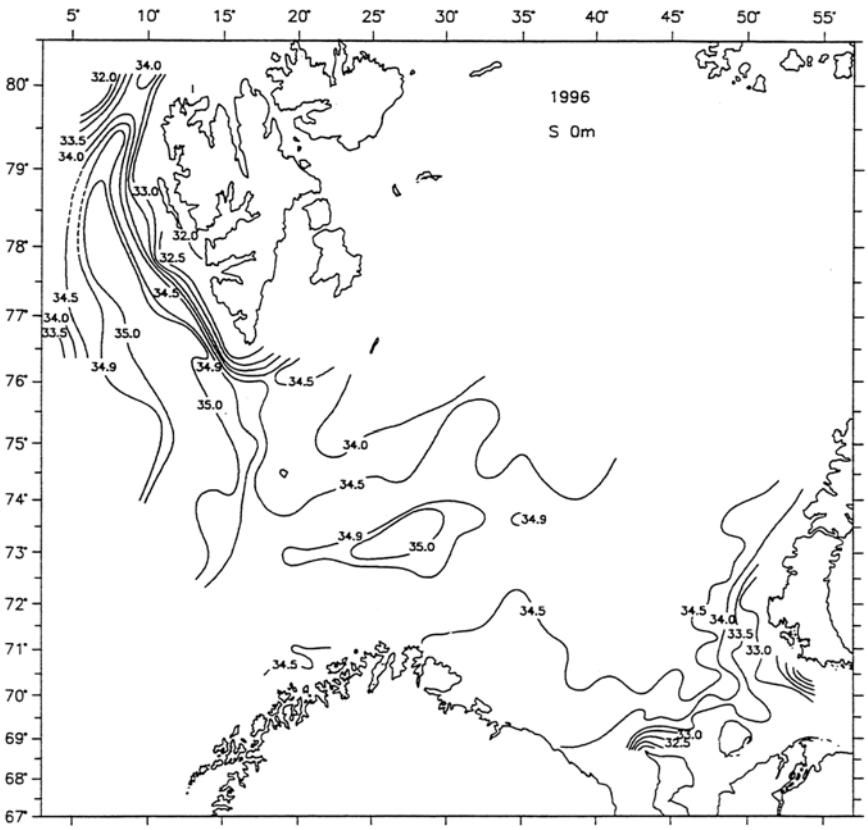

Fig. 3. Isohalines at 0 m

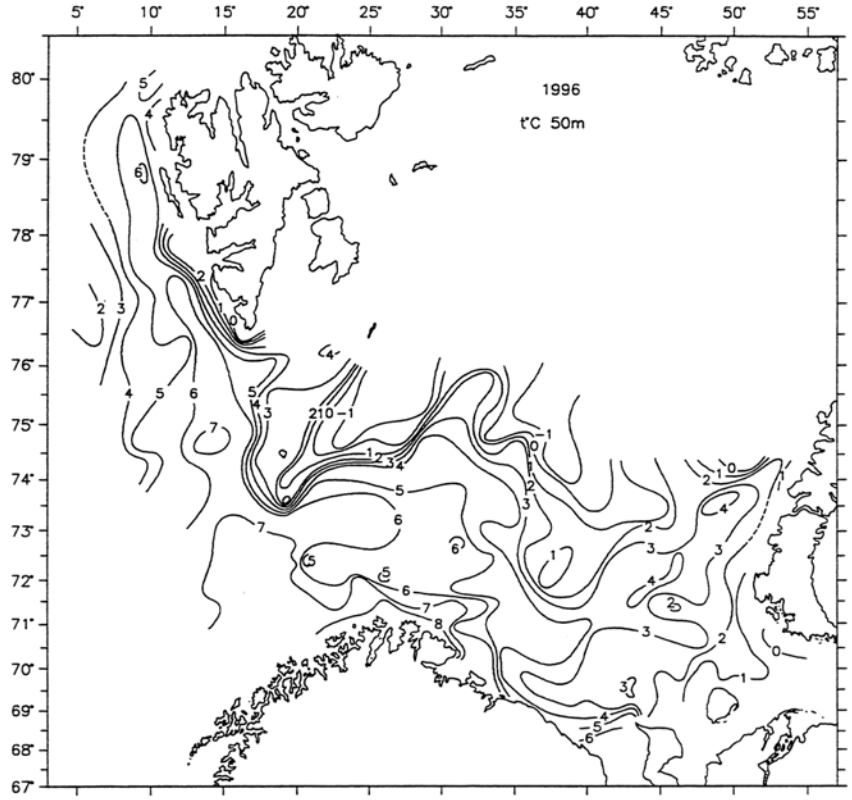

Fig. 4. Isotherms at 50 m

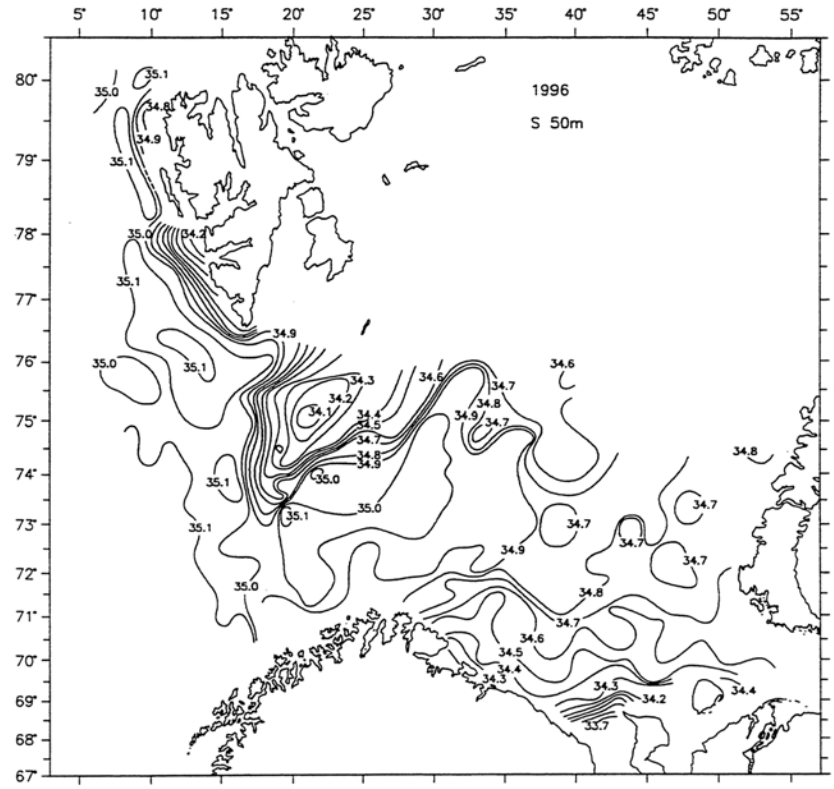

Fig. 5. Isohalines at 50 m

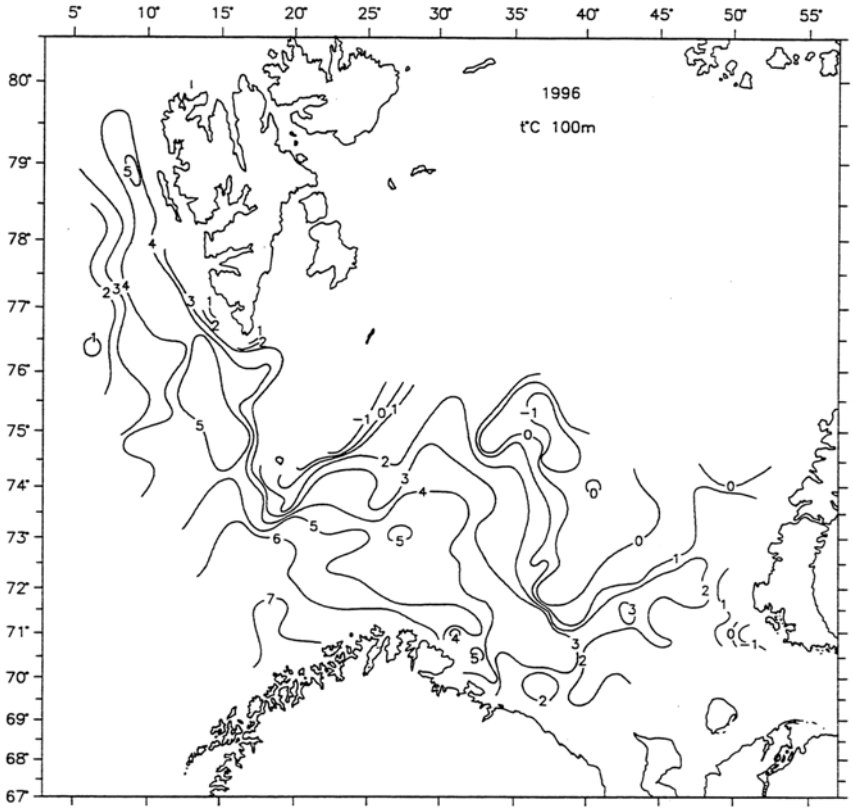

Fig. 6. Isotherms at 100 m

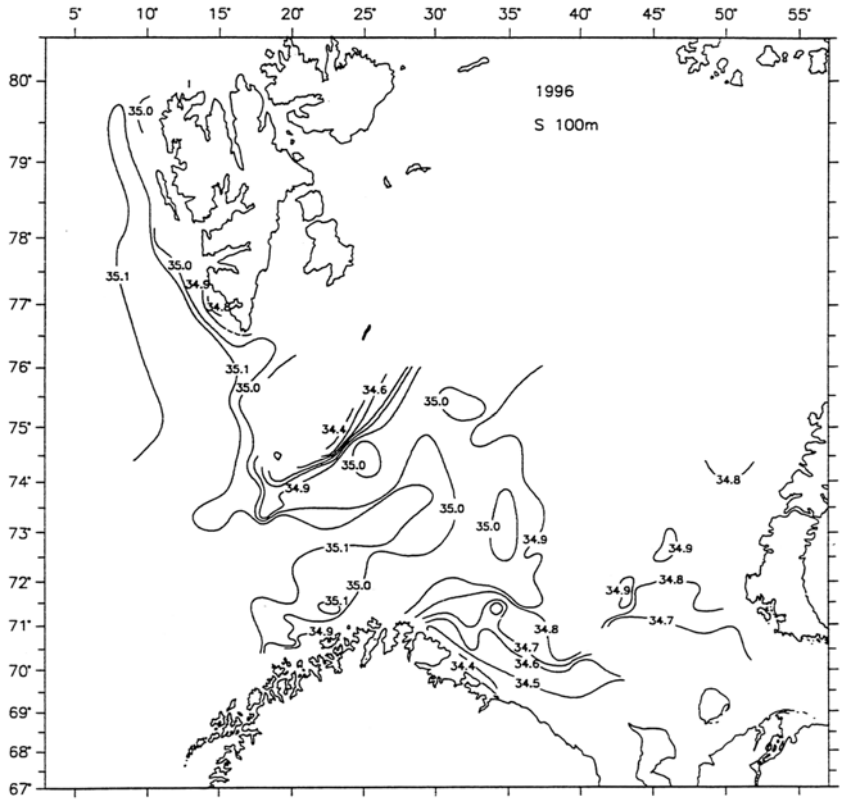

Fig. 7. Isohalines at 100 m

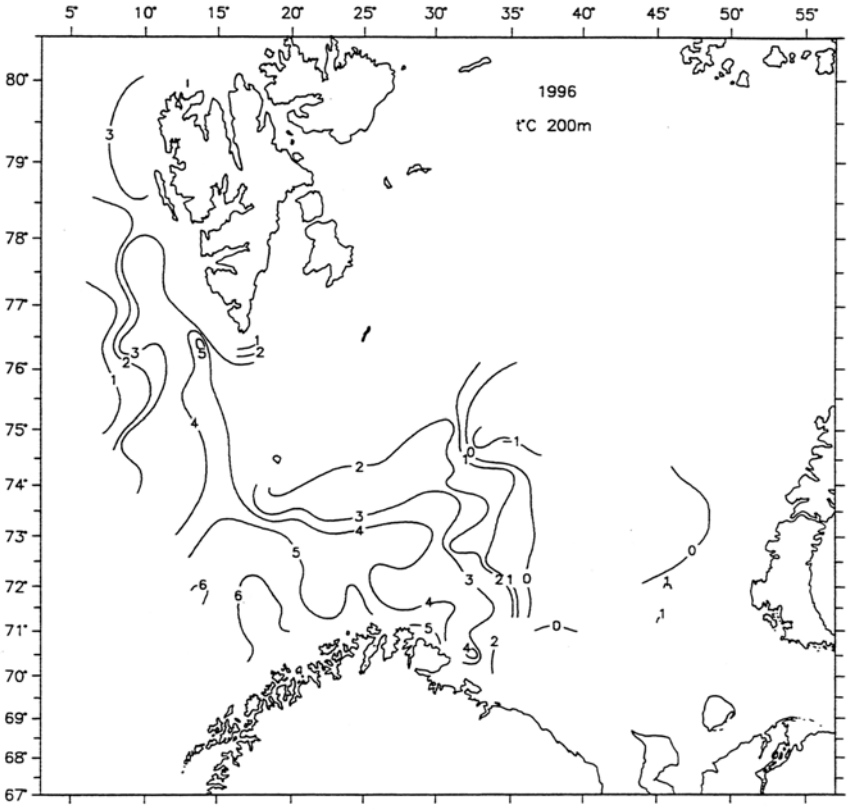

Fig. 8. Isotherms 200 m

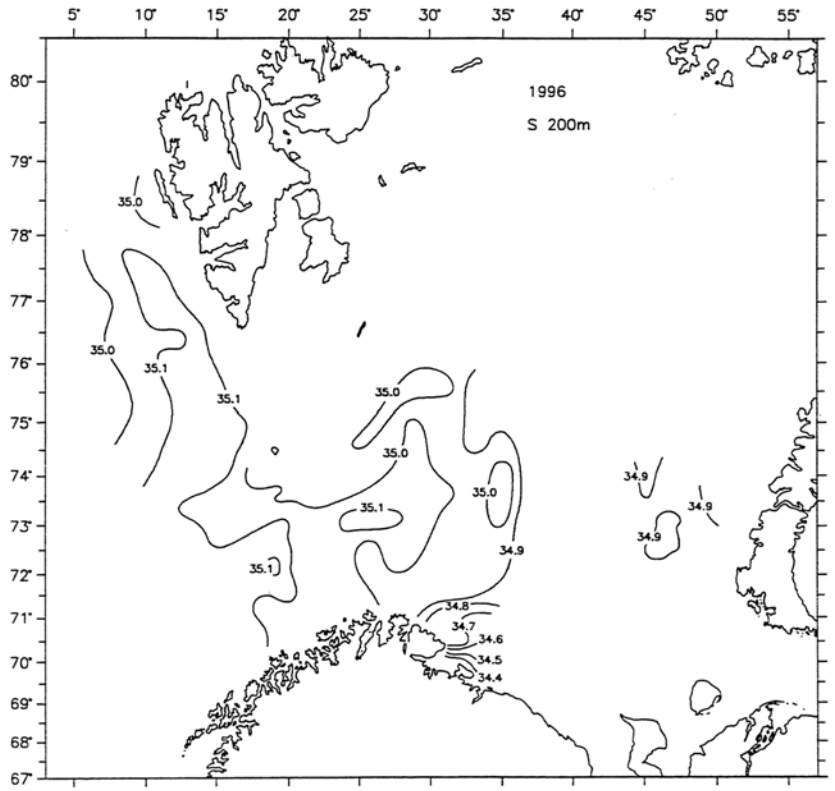

Fig. 9. Isohalines at 200 m

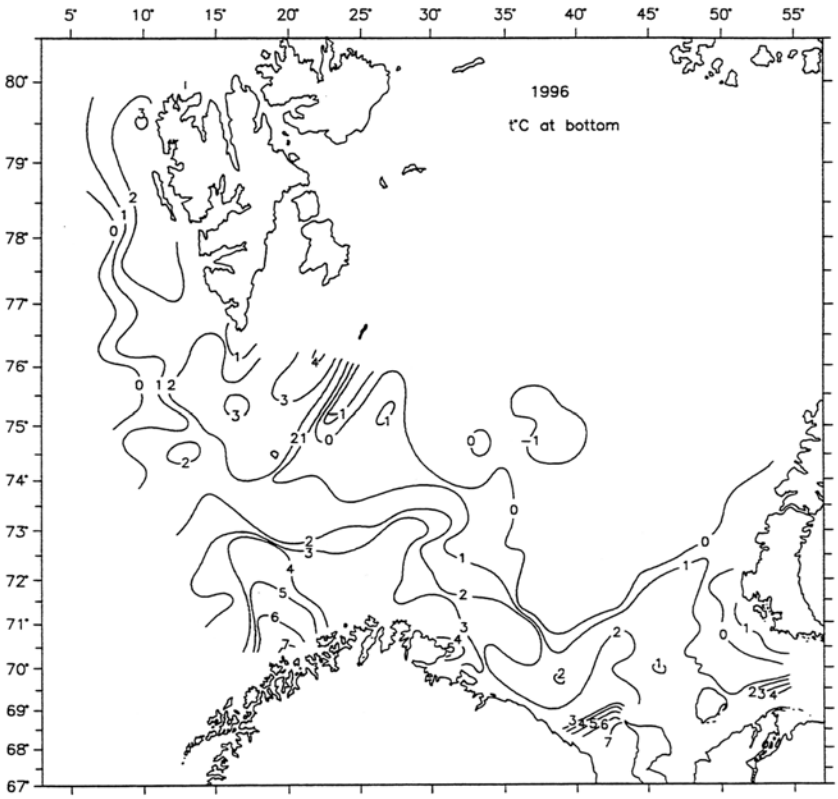

Fig. 10. Isotherms at the bottom

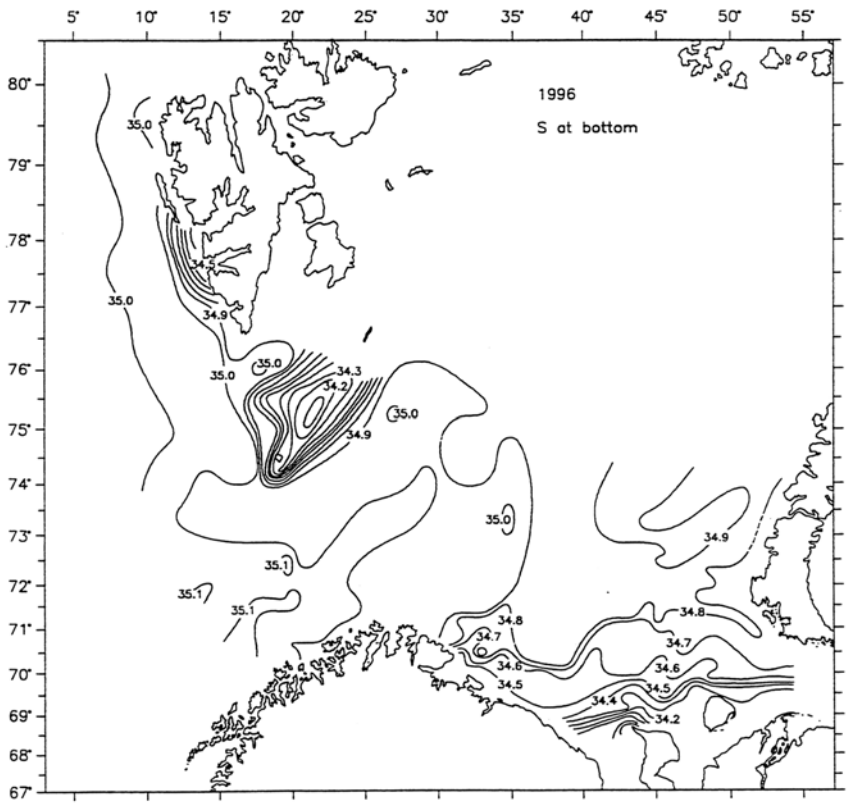

Fig. 11. Isohalines at the bottom

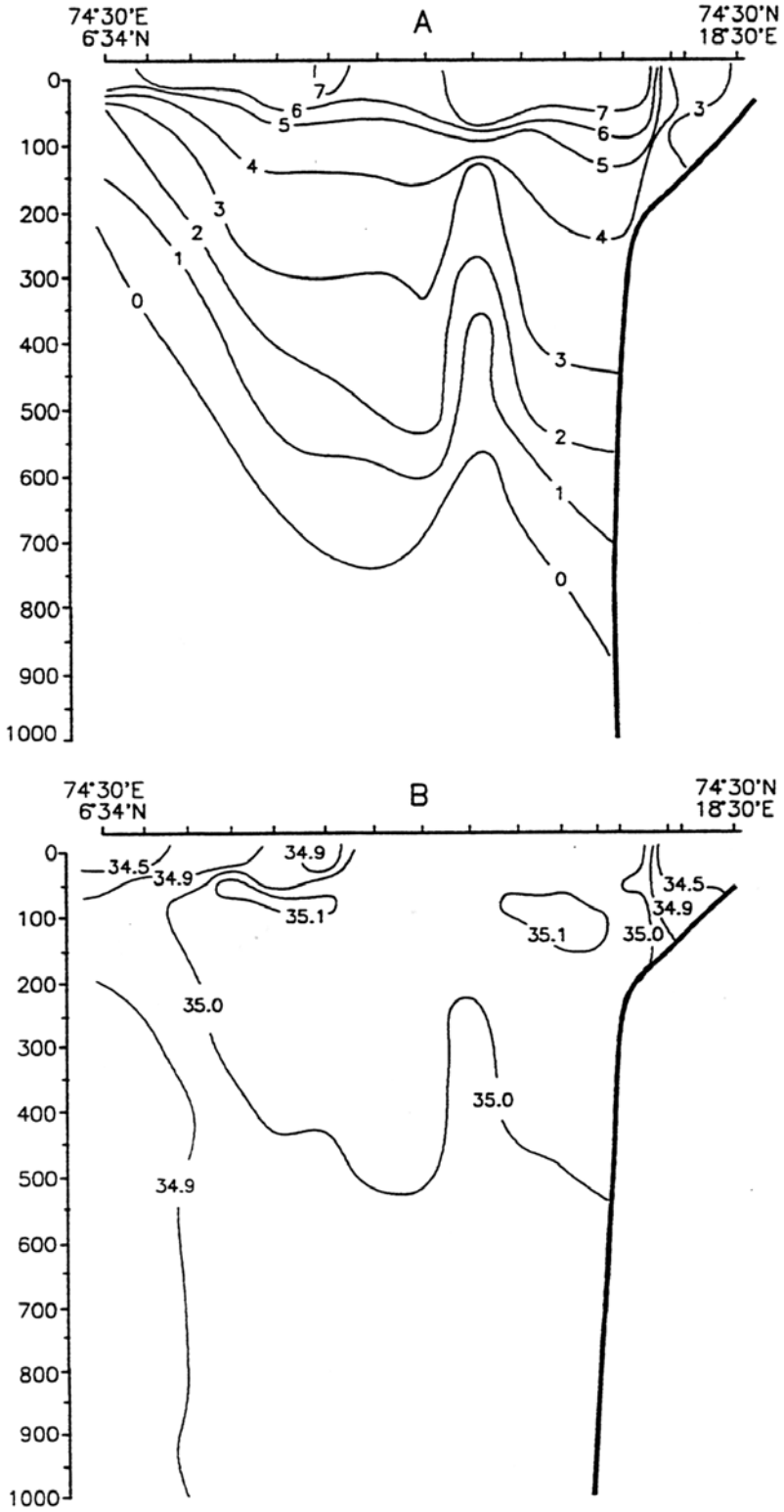

Fig. 12. Hydrographic section Bear Island-West. Temperature (A) and salinity (B)

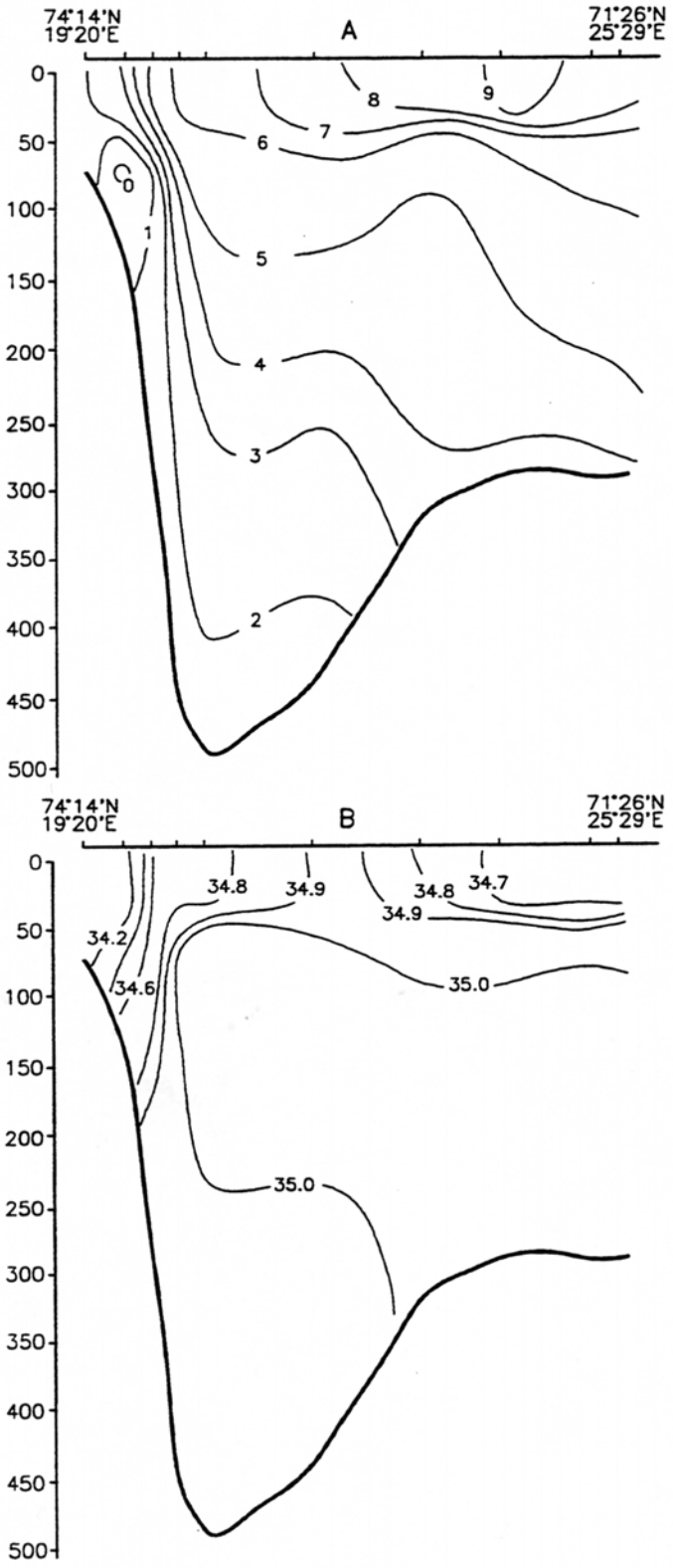

Fig. 13. Hydrographic section North Cape-Bear Island. Temperature (A) and salinity (B)

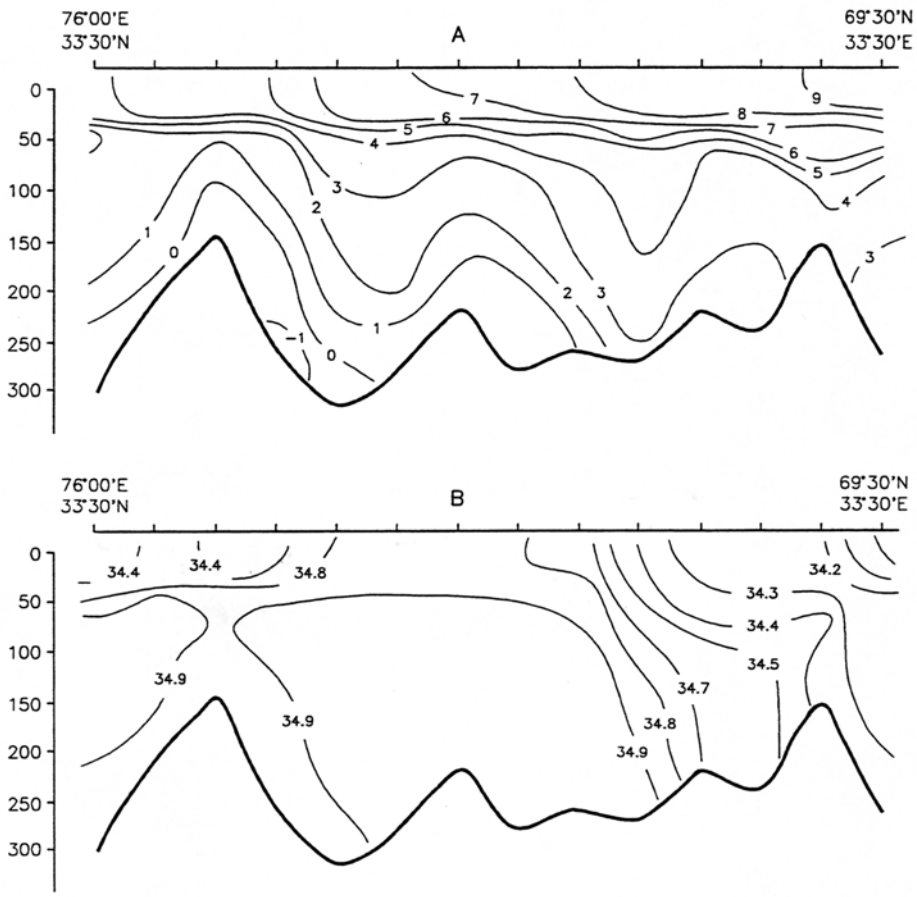

Fig. 14. Hydrographic section along the Kola meridian. Temperature (A) and salinity (B)

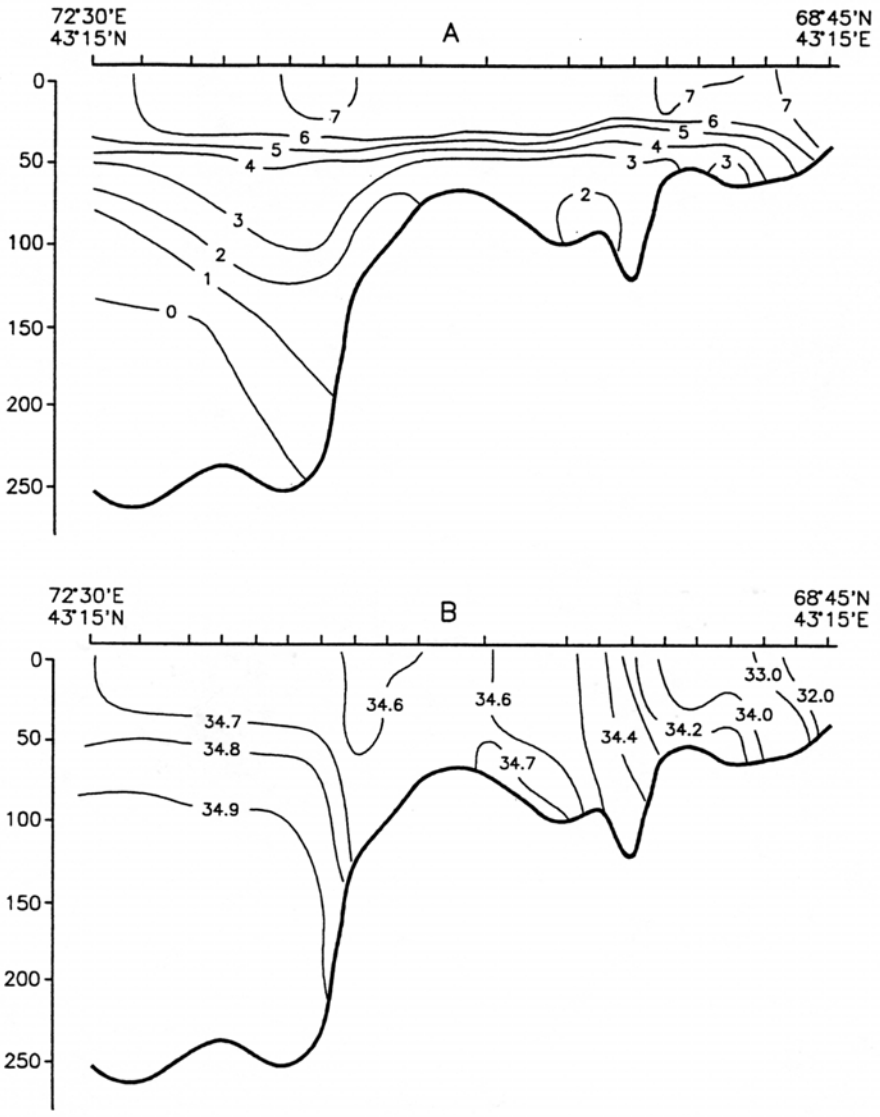

Fig. 15. Hydrographic section Cape Kanin-North. Temperature (A) and salinity (B)

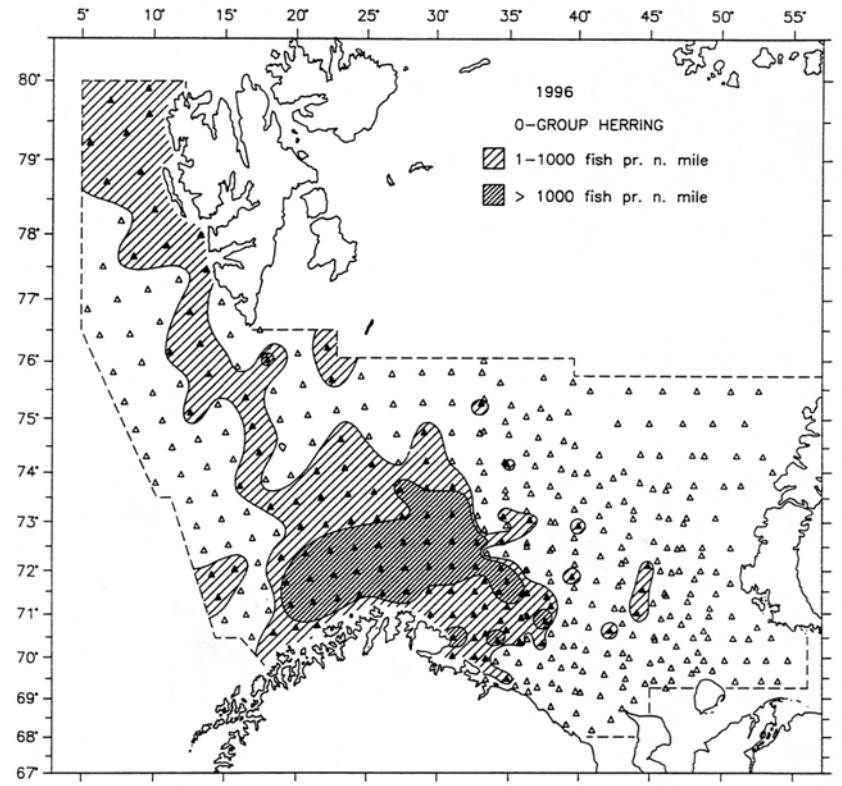

Fig. 16. Distribution of 0-group herring

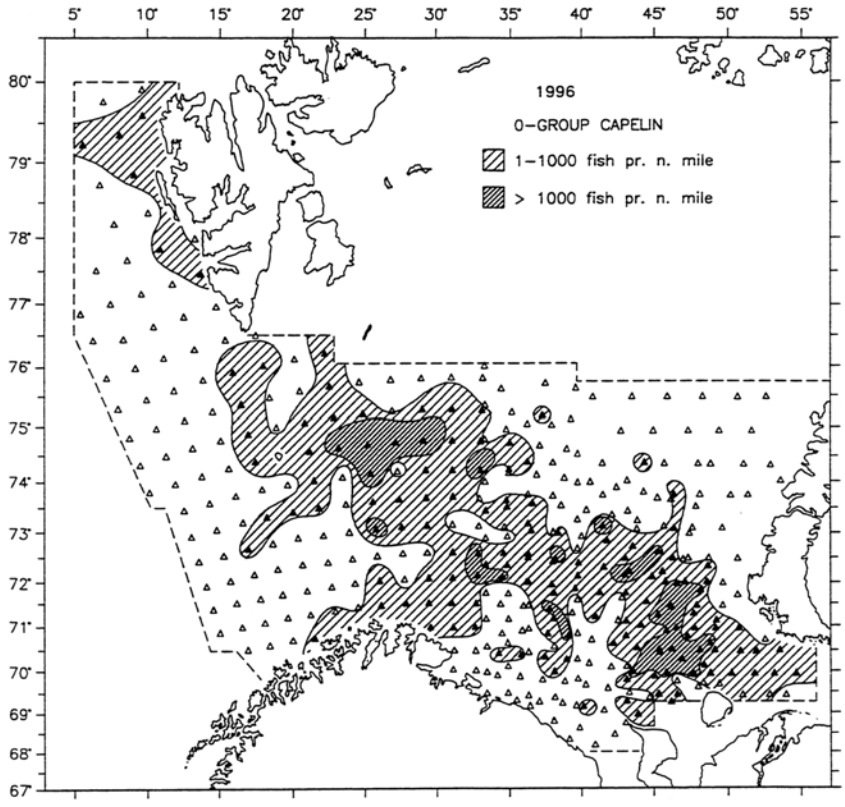

Fig. 17. Distribution of 0-group capelin

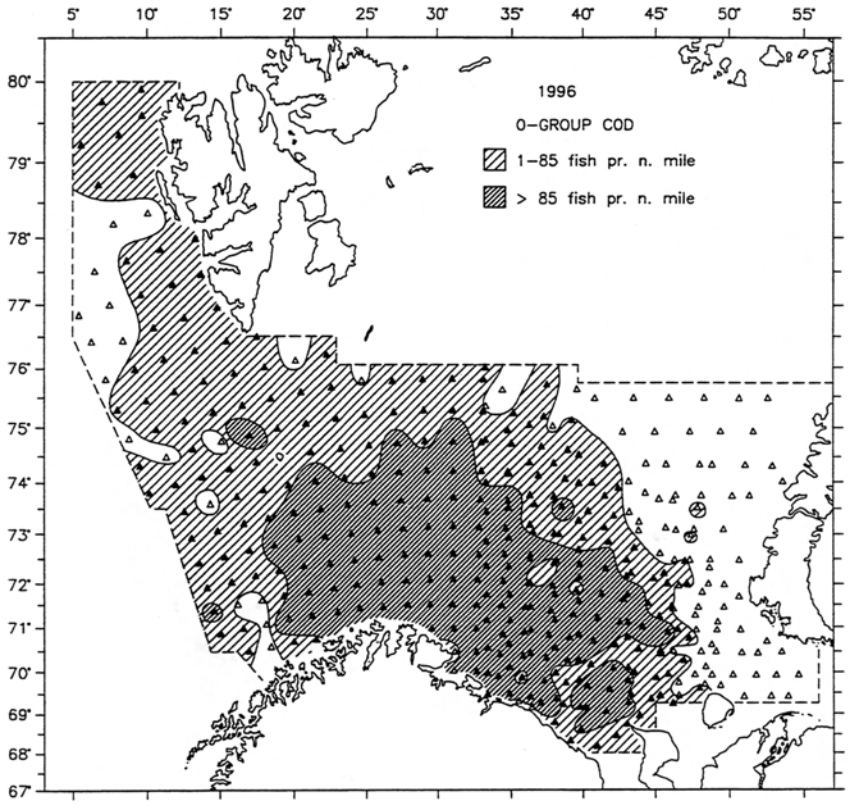

Fig. 18. Distribution of 0-group cod

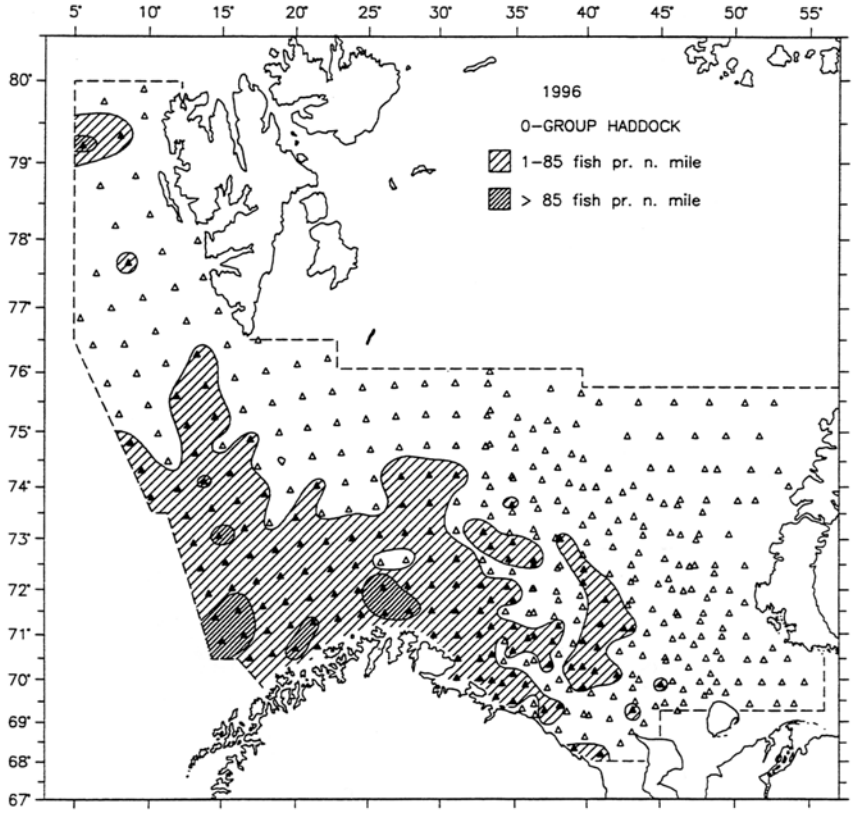

Fig. 19. Distribution of 0-group haddock

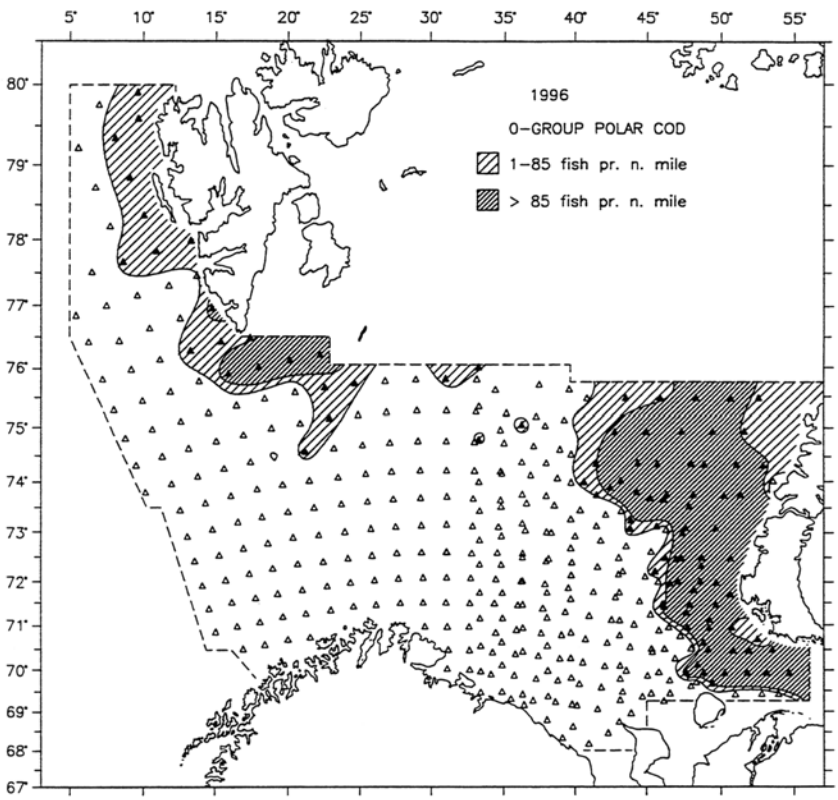

Fig. 20. Distribution of 0-group polar cod

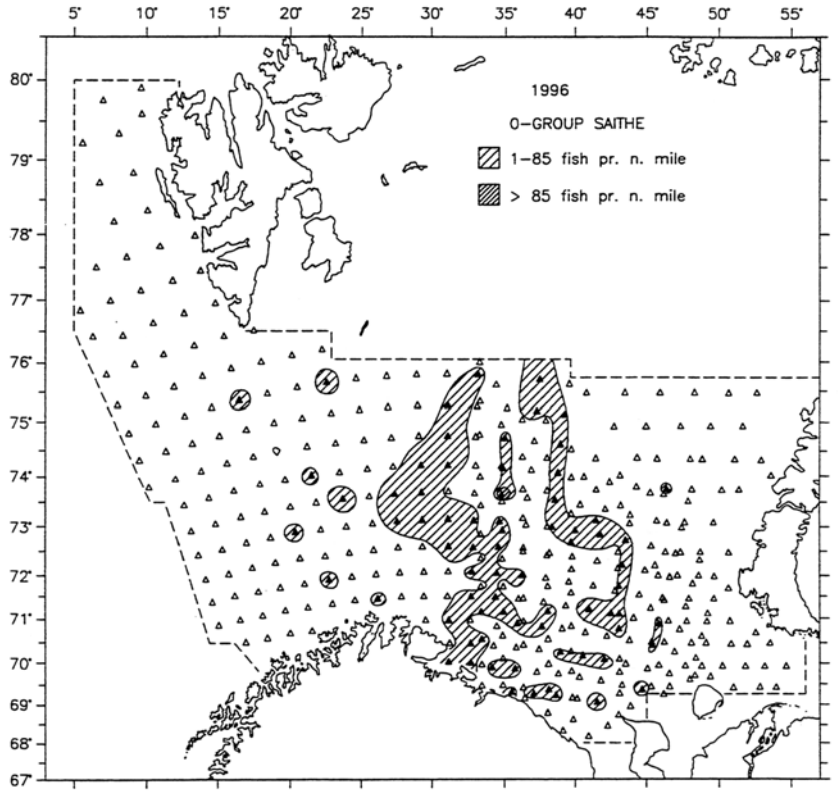

Fig. 21. Distribution of 0-group saithe

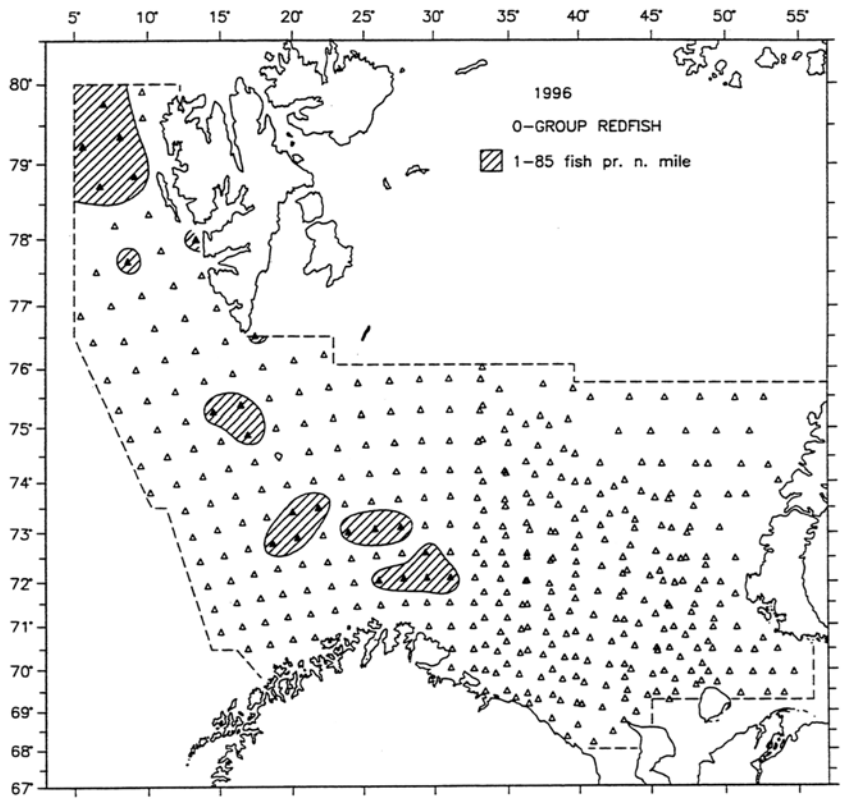

Fig. 22. Distribution of 0-group redfish

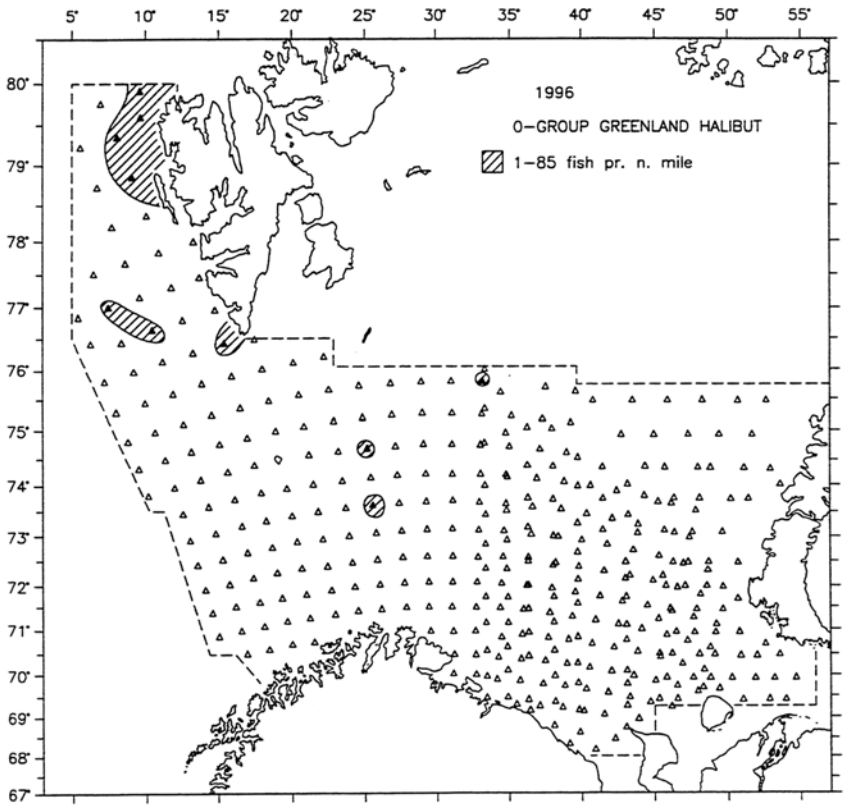

Fig. 23. Distribution of 0-group Greenland halibut

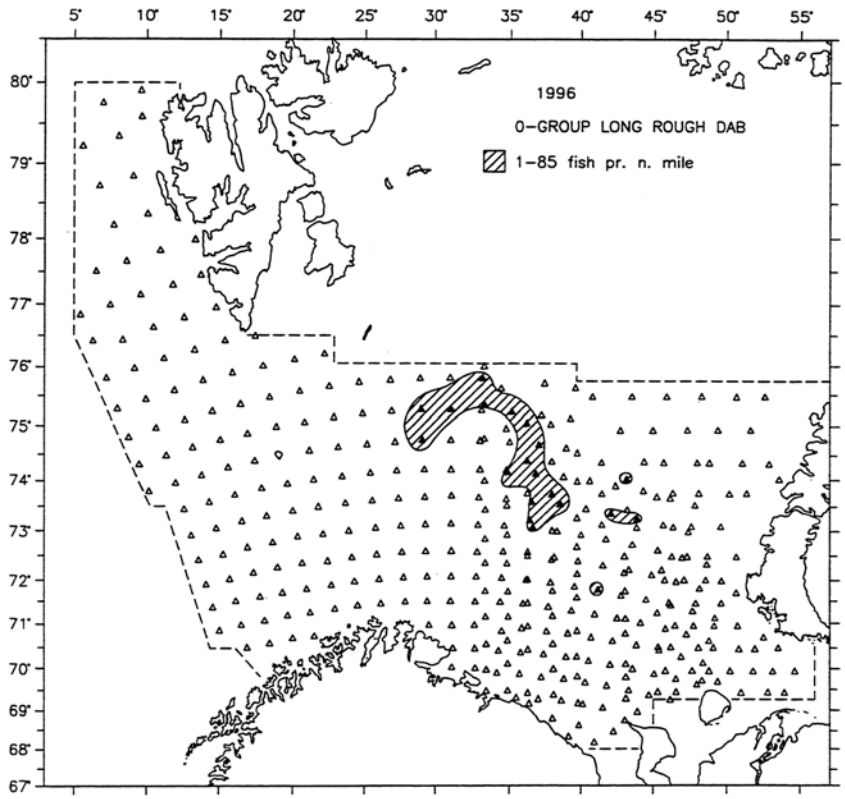

Fig. 24. Distribution of 0-group long rough dab

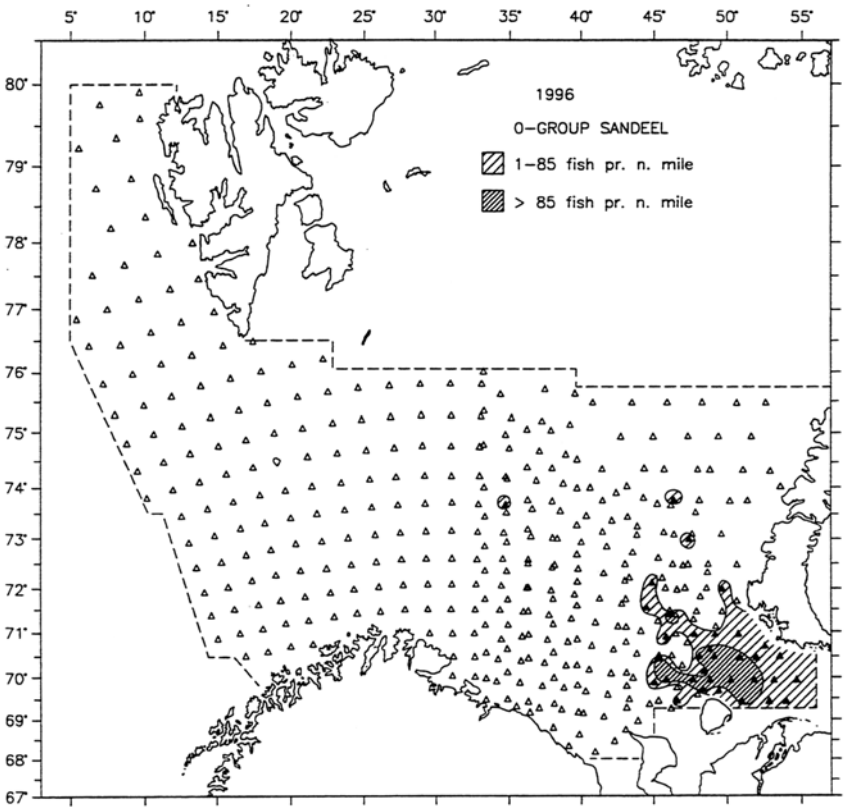

Fig. 25. Distribution of 0-group sandeel

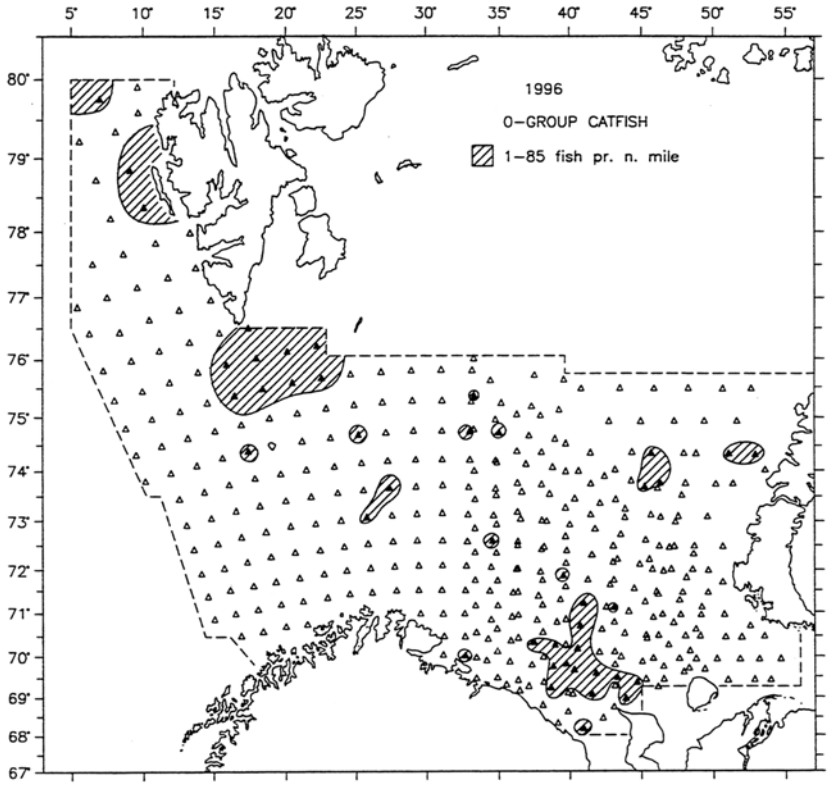

Fig. 26. Distribution of 0-group catfish

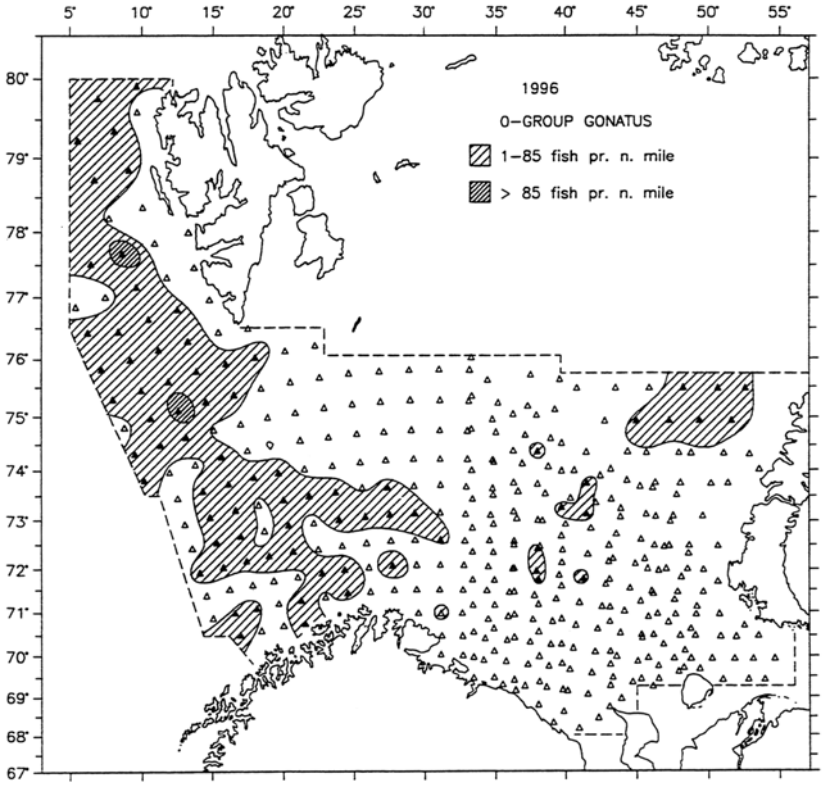

Fig. 27. Distribution of 0-group Gonatus fabricii

International Council for the Exploration of the Sea

C.M. 1998/G: Ref. H
Demersal Fish Committee

Preliminary report of the international 0-group fish survey in the Barents Sea and adjacent waters in August-September 1997

The thirty third annual International 0-group fish survey was made during the period 15 August-08 September 1997 in the Barents Sea and adjacent waters. The following research vessels participated in the survey:

State	Name of vessel	Survey period	Research Institute
Norway	"Johan Hjort"	20.08-08.09	Institute of Marine Research, Bergen.
Norway	"G.O. Sars"	19.08-08.09	"
Russia	"Atlantida"	21.08-06.09	The Polar Research Institute of Marine Fisheries and Oceanography, Murmansk
Russia	"Persey III"	15.08-06.09	"

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

Preliminary analysis of the survey data were made on board "Johan Hjort" and "Atlantida" during the survey, and the report was finished by correspondance. 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 meshed midwater trawl. All vessels which participated in the survey in 1997, used the type of midwater trawl recommended in 1980 (Anon., 1983). The standard towing procedure consisted of hauls of 0.5 nautical mile in each of 3 depths with the headline of the trawl located at 0. 20 and 40 m. Additional steps at 0.5 nautical miles at 60 and 80 m were made when 0-group fish layers were recorded deeper than 60m or 80m on the echo-sounder. The trawling procedure was standardized in accordance with the recommendation made in 1980.

Hydrographic 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, 200 m and bottom (Figs. 2-11). Figs. 12-15 show temperature and salinity distribution along the hydrographical sections: Bear Island - West, Bear Island – North Cape, Kola and Cape Kanin-North. Mean temperatures in standard 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 in number per 1.0 nautical mile trawling.

Hydrography

The temperatures in the upper layer (0-50 m) were close to the long-term average (1965-1997). In the deeper layers temperatures had continued to decrease since last years observations and were now well below the long term average in all areas; 0.5 °C below in the Bear Island – West section and in the northern part of the Cape Kanin section and 0.2-0.4 °C below average in the central and southern areas (Table 1). 1997 is the first year since 1988 that negative anomalies in temperature were recorded in the deeper layers over the entire area of investigation, and it is probably a combined effect of more severe winter cooling within the Barents Sea and reduced inflow of heat from the Norwegian Sea in recent years. In the southern and eastern parts the vertical gradients in temperature were larger in 1997 than in 1996, indicating that the solar radiation during spring and summer to some extent had compensated the heat loss in the upper layers.

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 multiplied by 10. are given in Table 2. All area-based abundance indices were estimated by 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. For comparisons mean values of abundance indices were calculated for the period 1985 - 1997. Indices obtained prior to 1985 should be corrected for capture efficiency of the trawls used. before mean values for the whole time series are made (Nakken and Raknes 1996). Length frequency distributions of the main species are given in Table 4.

Herring (Fig. 16)

0-group herring was observed in scattered concentrations along West-Spitsbergen and over wide areas in the Barents Sea from 18° E in the coastal areas. Areas of high abundance were more westerly and of slightly less extent than observed in 1996 resulting in a lower abundance index than last year and close to the 1985-1997 mean value (Table 3). The distribution map indicate that smaller amounts of herring in the Bear Island - Spitsbergen region might have been distributed outside the area of coverage. The mean length was similar to that found in 1996 and the smaller fish were observed at the eastern and northern boundaries of the distribution area.

Capelin (Fig. 17)

0-group capelin was observed all over the investigated area except in near shore waters and in the most southwestern parts. Dense concentrations appeared between 20° and 39°E in the central part of the Barents Sea and small patches of high abundance were observed up to 54° E in the southeastern parts. The abundance index of the 1997 year-class was the highest since 1989 and approximately 2 times the average value for the period 1985-1997 (Table 2).

The mean length was about 45 mm and substantially less than last year (50 mm) indicating that large amounts of the 0-group originated from the summer spawning in 1997.

Cod (Fig. 18)

The distribution of cod was similar to last year but the areas of dense concentrations were slightly more westerly. As in most recent years dense concentrations were absent in the Spitsbergen area. The abundance index (Table 2 and 3) indicate a year class strength of the same level as in the past 5-6 years and at about the average of 1985-1997.

The mean length in 1997 (72 mm) is below the 1996-value (77 mm).

Haddock (Fig. 19)

0-group haddock was observed in scattered concentrations eastward to 35° E with a narrow belt somewhat farther east along the Murman coast. Dense concentrations but very limited in extent occurred in the south and southwestern part. Compared with 1996 the distribution of scattered concentrations along West-Spitsbergen were wider in 1997. The abundance index was below the 1996 value and well below the average of 1985-1997. Mean lengths increased from 80 mm in the western part of the area to more than 90 mm at the east and north-eastern borders. The overall mean length of 0-group haddock, 89 mm, was substantially less than in 1996 (102 mm).

Polar cod (Fig. 20)

As usual 0-group polar cod were found in two separated areas. In the Spitsbergen area the distribution extended farther offshore than in 1996 resulting in a slightly higher abundance index in 1997 than in 1996. The southern part of the eastern component was wider than in 1996 but farther north, between 72° and 75° N the distribution area was more narrow than last year, resulting in an abundance index at the same level. It should however be noted that the indicies in both areas are underestimates due to incomplete coverage of the distribution areas. The mean length was 37 mm, which is the same as in 1996.

Saithe(Fig.21)

0-group saithe was observed in slightly higher densities and over a somewhat wider area than in 1996. Altogether 469 specimens were caught with a mean length of 72 mm.

Redfish (Fig. 22)

Compared with last year there was an increase of distribution area and abundance index. However, the abundance index for 1997 amounts to about 10 percent of the average 1985-1997 average value (Table 2), indicating that also this year class is very week. The mean length (41 mm) was equal to that in 1996 (40 mm).

Greenland halibut (Fig. 23)

0-group Greenland halibut was recorded in 5 hauls to the southeast and east of Bear Island and in most hauls off northwestern Spitsbergen. Catches were low, mainly 1-3 specimens per nautical mile towed. The index of abundance is somewhat higher than in 1996 and near the average for the period 1985-1997. However, it should be noted that this average is for a period with extremely low abundance indices in most years as compared with the levels experienced during 1978-1987 (Table 2).

The mean length (62 mm) was slightly higher than in 1996 (56 mm).

Long rough dab (Fig. 24)

The 0-group was observed over a larger area than in 1996 and the index of abundance is higher than last year, but considerably below the average for 1985-1997. Mean length was 31 mm and lower than last year (36 mm).

Sandeel (Fig. 25)

In addition to the usual area in southeast, 0-group sandeel was also recorded in the central and southwestern areas. Mean length in western and central areas were 87-88 mm while the fish in the southeastern area had a mean length of 43 mm.

Catfish (Fig. 26)

0-group catfish (not identified to species) was found in small numbers in isolated patches within the entire area of investigation. Total catch was 189 specimens and the mean length was about 45 mm.

Gonatus fabricii (Fig. 27)

As in most previous years Gonatus fabricii ranging 15-80 mm in length was caught in the western parts of the area. No observations were made in the eastern region where scattered concentrations of the species was found last year.

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Table 1. Mean water temperature[1] in main parts of standard sections in the Barents Sea and adjacent waters in August-September 1965-1997

Year	Section[2] 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
1997	7.3	3.4	4.4	4.2	2.8	5.6	4.1
Average 1965-1997	7.4	3.8	4.7	4.3	3.3	5.8	4.6

[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)

Table 2. Abundance indices of 0-group fish in the Barents Sea and adjacent waters in 1965-1997

Year	Capelin[1]	Cod	Haddock	Polar cod			Redfish	Greenland halibut	Long rough dab
				West		East			
1965	37	6	7		0		159		66
1966	119	1	1		129		236		97
1967	89	34	42		165		44		73
1968	99	25	8		60		21		17
1969	109	93	82		208		295		26
1970	51	606	115		197		247	1	12
1971	151	157	73		181		172	1	81
1972	275	140	46		140		177	8	65
1973	125	684	54		(26)		385	3	67
1974	359	51	147		227		468	13	93
1975	320	343	170		75		315	21	113
1976	281	43	112		131		447	16	96
1977	194	173	116	157		70	472	9	72
1978	40	106	61	107		144	460	35	76
1979	660	94	69	23		302	980	22	69
1980	502	49	54	79		247	651	12	108
1981	570	65	30	149		93	861	38	95
1982	393	114	90	14		50	694	17	150
1983	589	386	184	48		39	851	16	80
1984	320	486	255	115		16	732	40	70
1985	110	742	156	60		334	795	36	86
1986	125	434	160	111		366	702	55	755
1987	55	102	72	17		155	631	41	174
1988	187	133	86	144		120	949	8	72
1989	1300	202	112	206		41	698	5	92
1990	324	465	227	144		48	670	2	35
1991	241	766	472	90		239	200	1	28
1992	26	1159	313	195		118	150	3	32
1993	43	910	240	171		156	162	11	55
1994	58	899	282	50		448	414	20	272
1995	43	1069	148	6		-	220	15	66
1996	291	1142	196	59		484	19	5	10
1997	522	1077	150	129		453.	50	13	42
Mean 1985-1997	256	700	201	106		247	436	17	132

[1)] 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 1965-1997

Year	Herring[1]			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	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
Mean 1985-1997	0.46			1.72			0.46		

[1)] 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 1997

Length, mm	Herring	Capelin	Cod	Haddock	Polarcod	Redfish	Greenland halibut	Long rough dab	Sandeel
10-14						0.1			
15-19						0.9			
20-24					0.3	3.4		11.1	
25-29		0.4			3.8	7.1		30.3	
30-34		6.5			36.1	8.2		33.3	4.7
35-39	0.6	20.5		+	33.1	20.8	2.6	20.7	30.4
40-44	4.7	24.7	+	0.2	23.0	33.4	2.6	3.8	21.9
45-49	3.0	32.7	0.3	0.5	3.4	23.4	5.3	0.8	24.4
50-54	5.1	8.7	1.3	1.3	0.2	2.5	13.2		9.0
55-59	16.8	1.8	4.5	1.4	+	0.3	21.1		2.6
60-64	29.2	0.8	12.2	3.2		0.3	15.8		0.3
65-69	20.5	0.9	21.9	5.0		0.3	21.1		0.5
70-74	12.4	1.1	25.1	7.0		0	7.9		0.1
75-79	5.1	0.9	18.9	9.4		0.3	0		0.5
80-84	2.5	0.8	9.0	12.1			10.5		1.0
85-89	0.1	0.2	4.4	15.3					1,5
90-94			1.5	11.9					1.4
95-99			0.6	10.5					0.8
100-104			0.2	7.8					0.5
105-109			0.1	5.1					0.1
110-114			+	4.3					+
115-119				2.9					
120-124				0.8					
125-129				0.9					
130-134				0.4					
135-139				+					
140-144									
No. measured	4862	6164	10026	2648	3173	230	32	459	263
Total numbers	356030	369805	424460	4603	142892	1152	38	637	4956
Mean length	63.2	45.0	72.2	88.5	36.8	40.7	62.2	31.4	45.9

Appendix

Research vessel	Participants
"G.O. Sars"	H. Græsdal, H. Hammer, B. Hoffstad, J. Home (from 29/8), R. Ingvaldsen (until 29/8), R. Johannessen, J. de Lange, H. Loeng (until 29/8), K. Michalsen (cruiseleader), H. Sagen (until 29/8)
"Johan Hjort"	K. Gjertsen (until 30/8), A. Haugsdal, E. Holm, Å. Husebø (from 30/8), R. Korneliussen, E. Molvær, O. Nakken (cruiseleader), L. Solbakken (from 30/8), Ø. Torgersen
"Atlantida"	A. Bendick, S. Harlin, V. Hlivnoy, V. Iljin, V. Kiselev, D. Prozorkevitch, S. Ustinov, T. Yusupov, G. Zuikov
"Persey III"	I. Dolgolenko, V. Kapralov, V. Shevchenko, N. Vovchuck, V. Zshuck

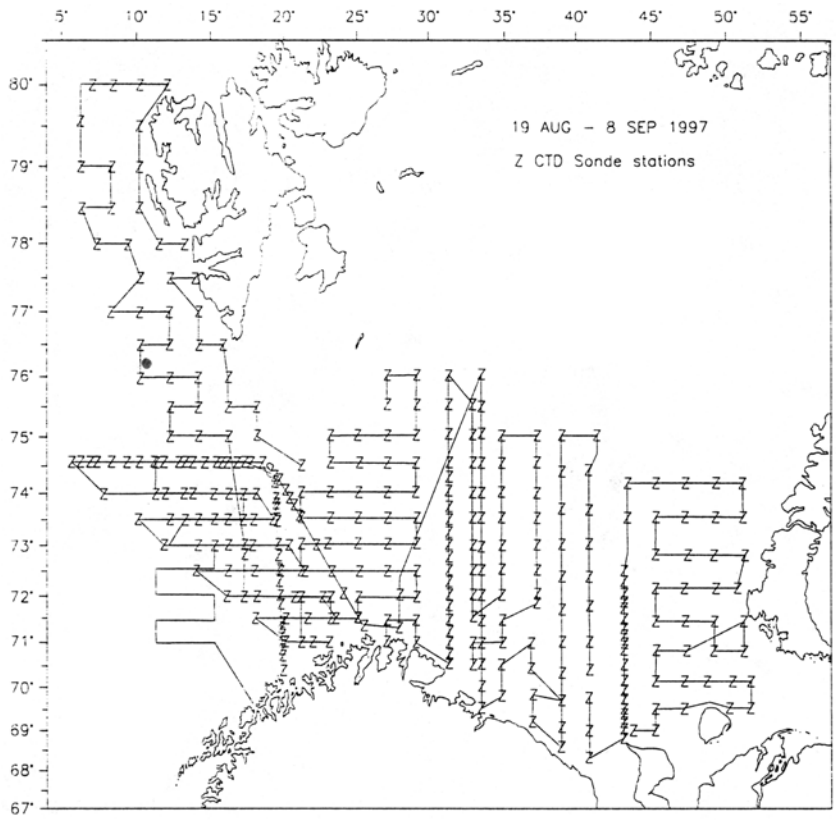

Fig. 1. Survey tracks and hydrographic stations

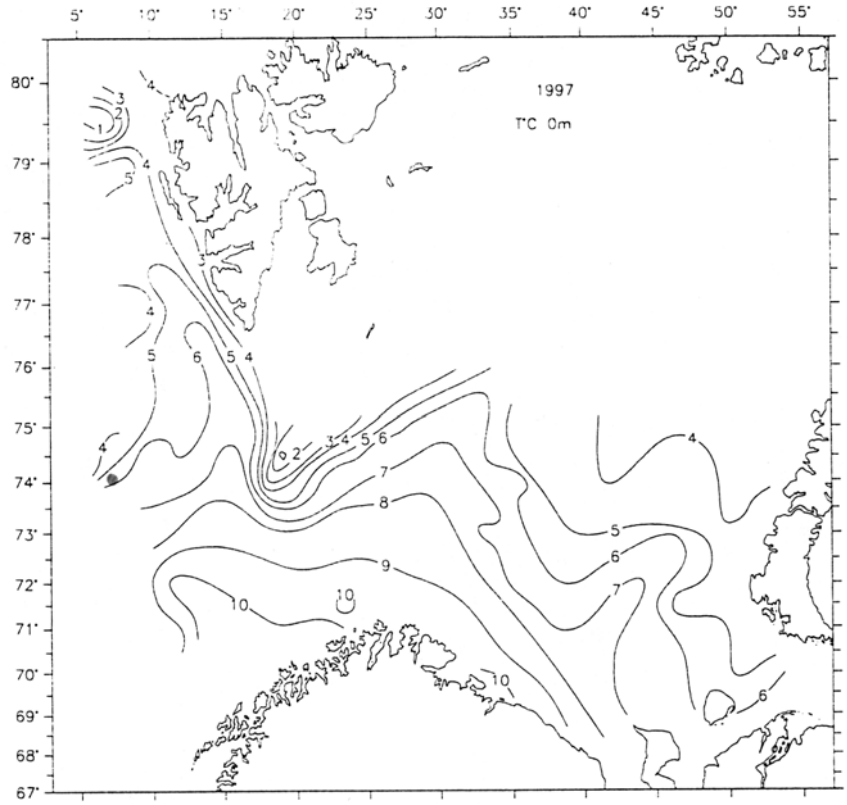

Fig. 2. Isotherms at 0 m

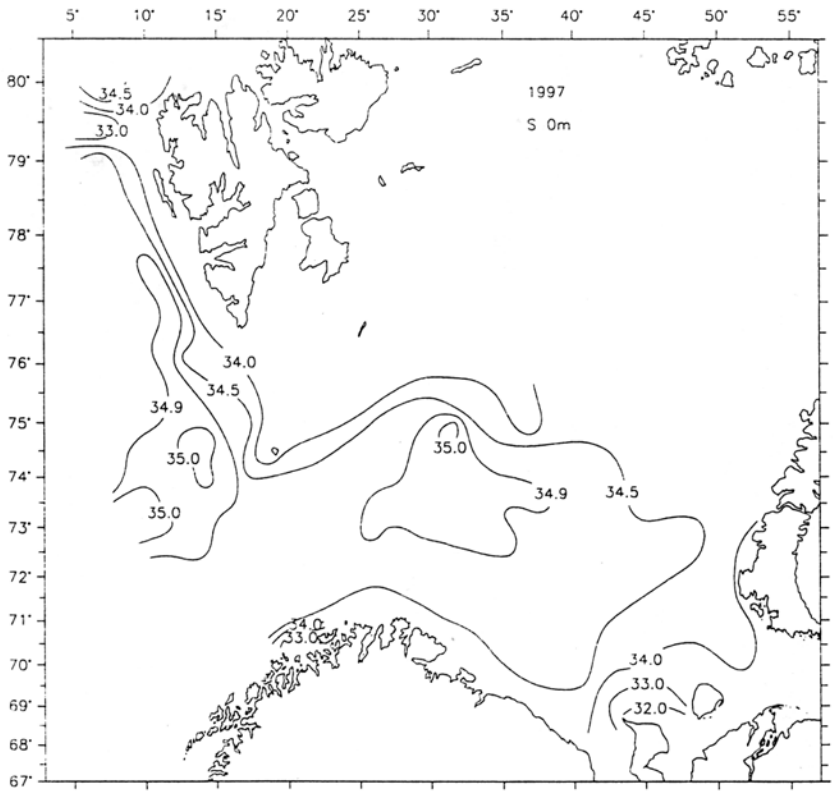

Fig. 3. Isohalines at 0 m

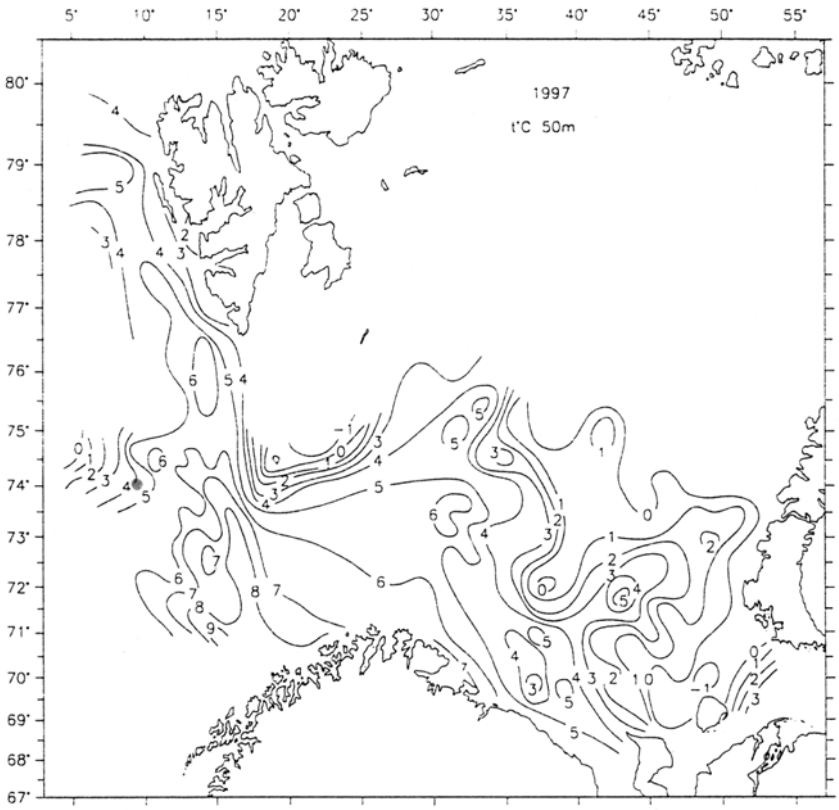

Fig. 4. Isotherms at 50 m

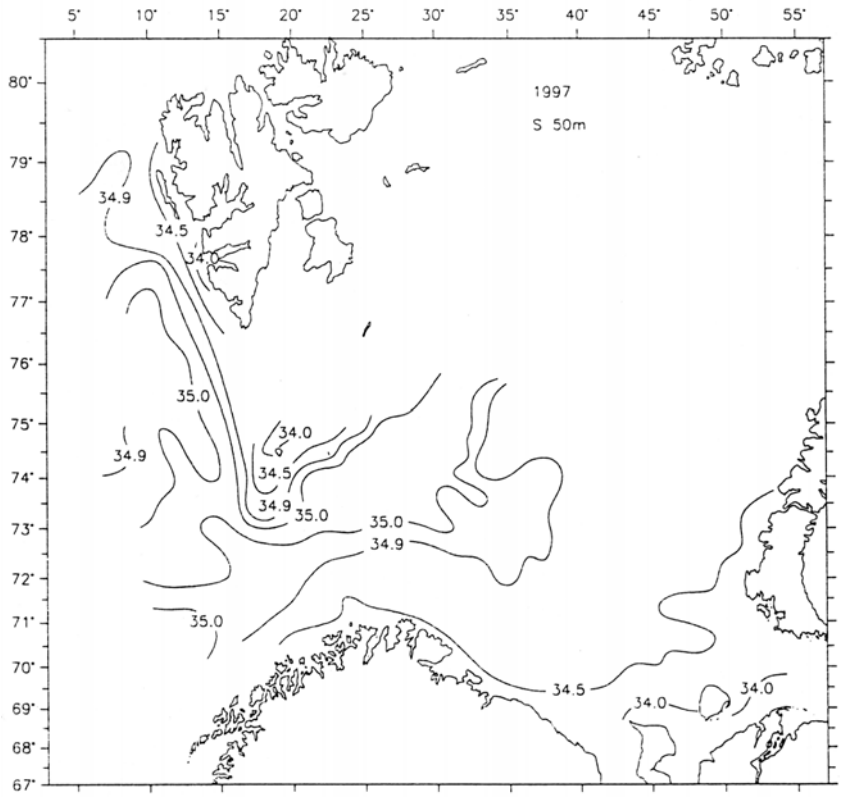

Fig. 5. Isohalines at 50 m

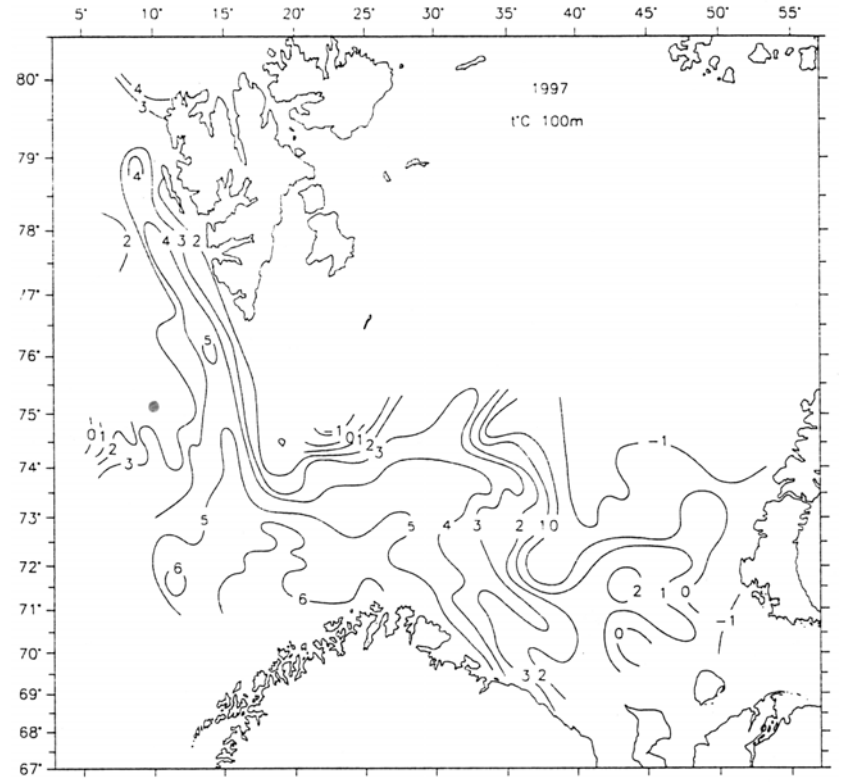

Fig. 6. Isotherms at 100 m

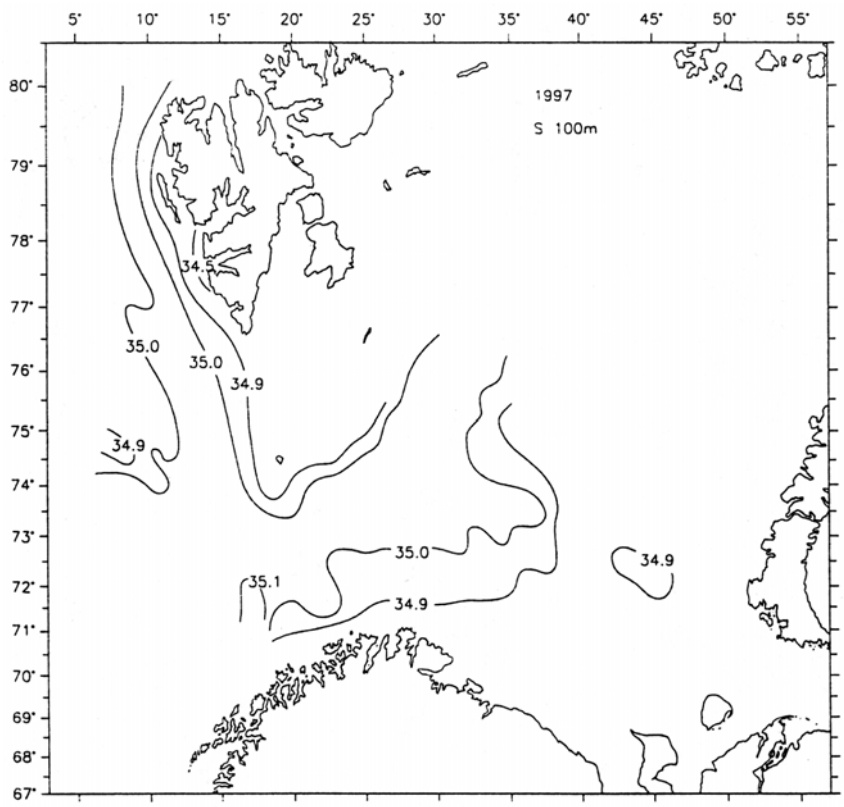

Fig. 7. Isohalines at 100 m

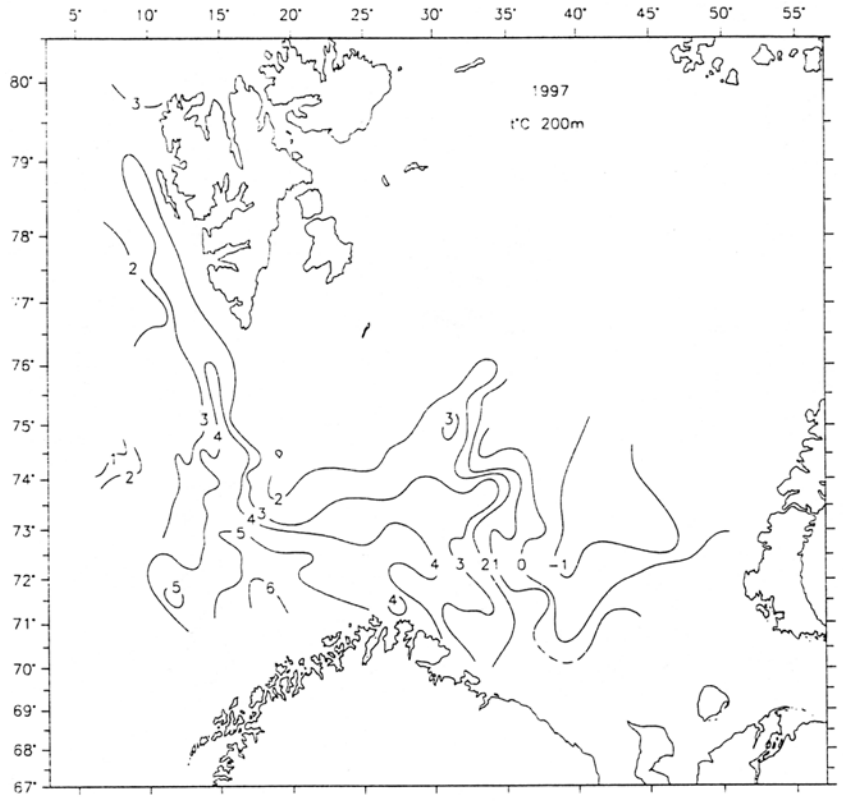

Fig. 8. Isotherms 200 m

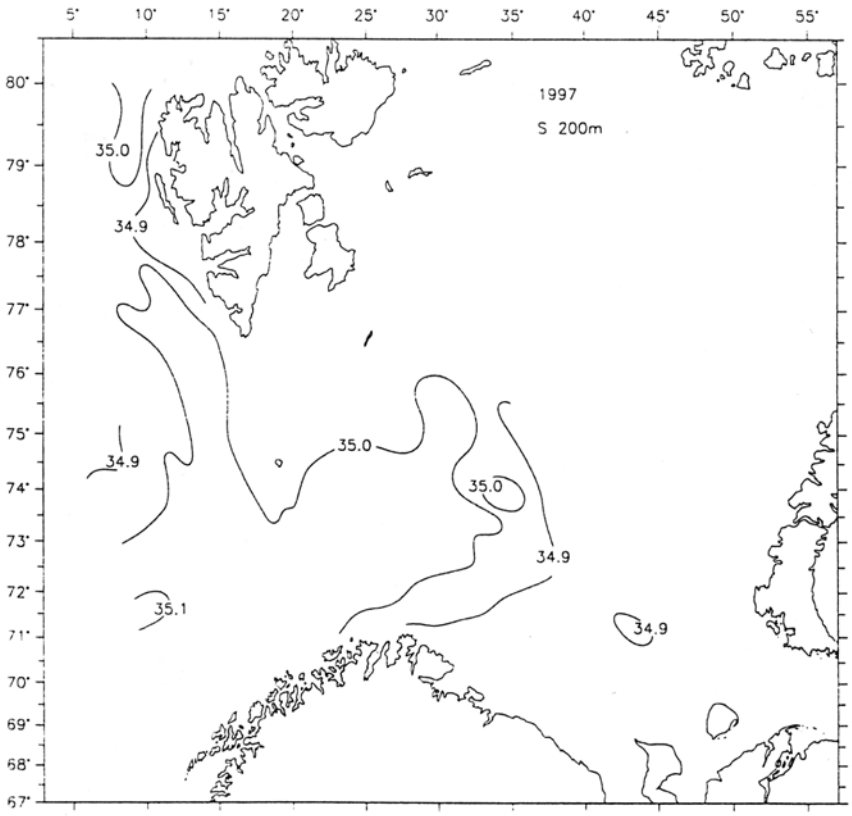

Fig. 9. Isohalines at 200 m

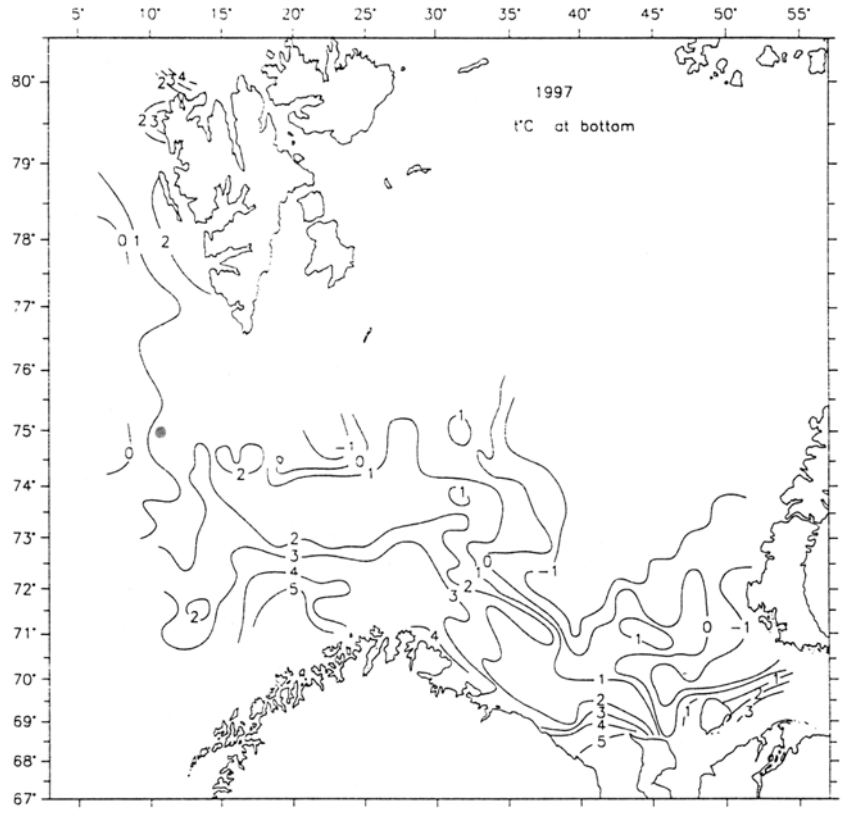

Fig. 10. Isotherms at the bottom

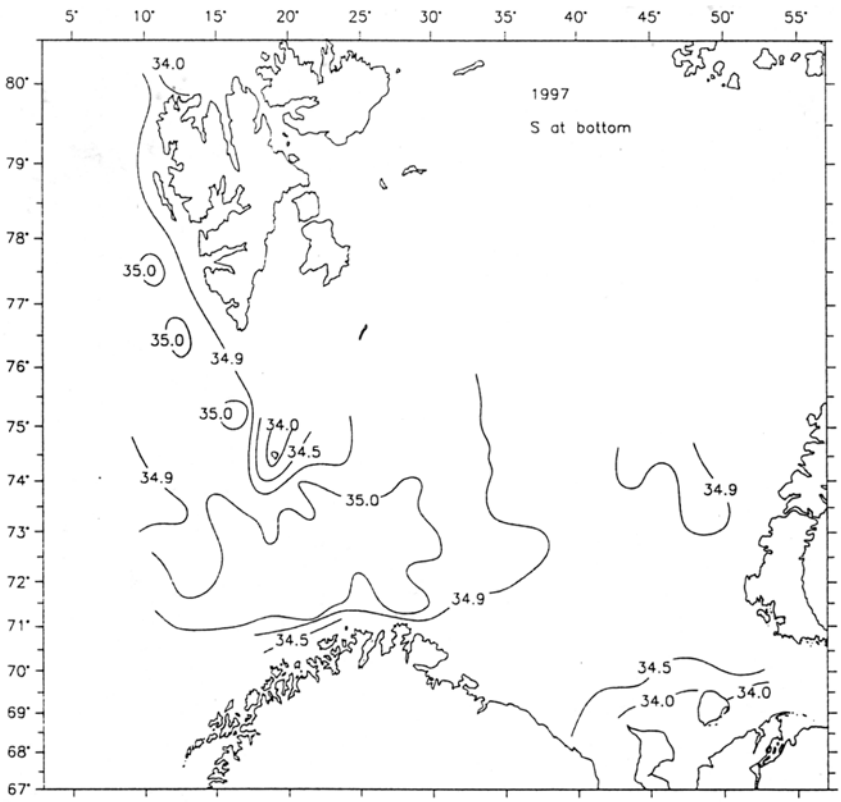

Fig. 11. Isohalines at the bottom

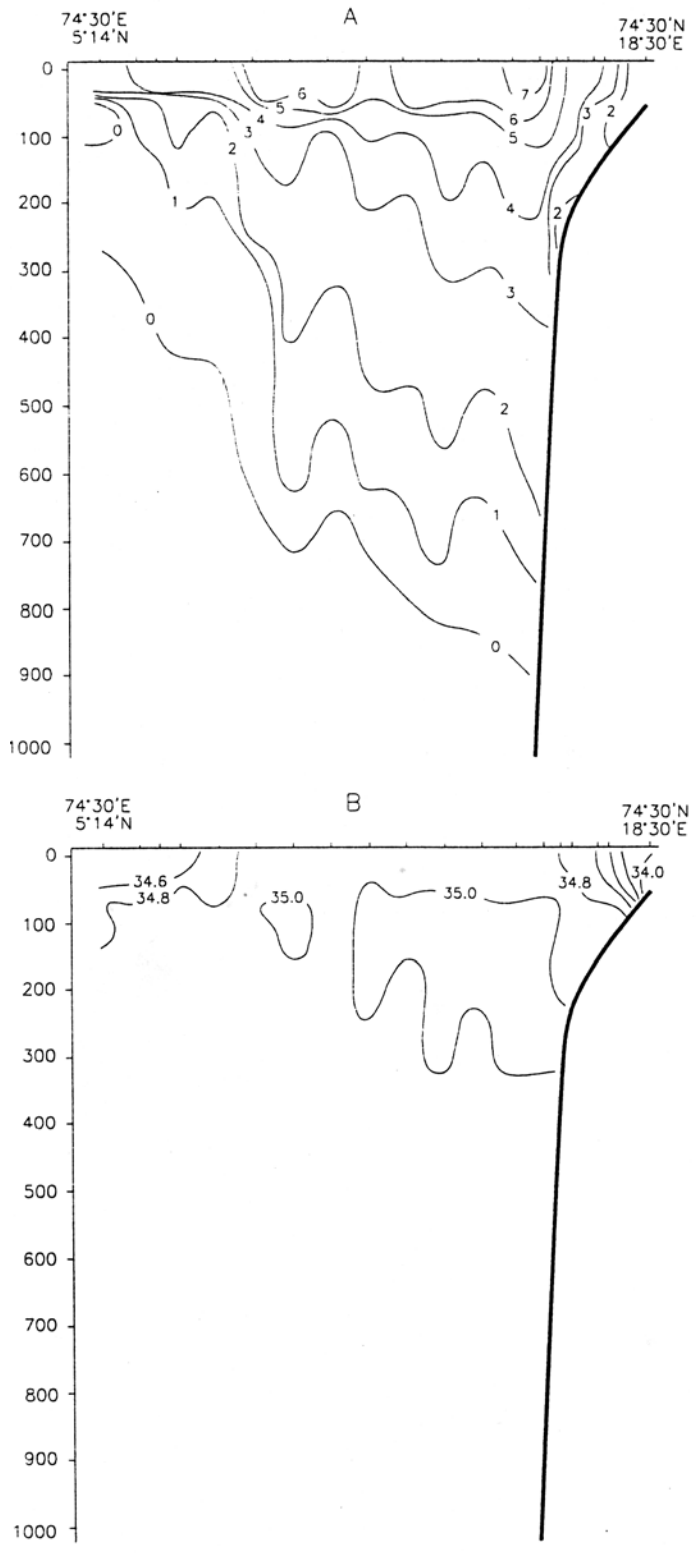

Fig. 12. Hydrographic section Bear Island-West. Temperature (A) and salinity (B)

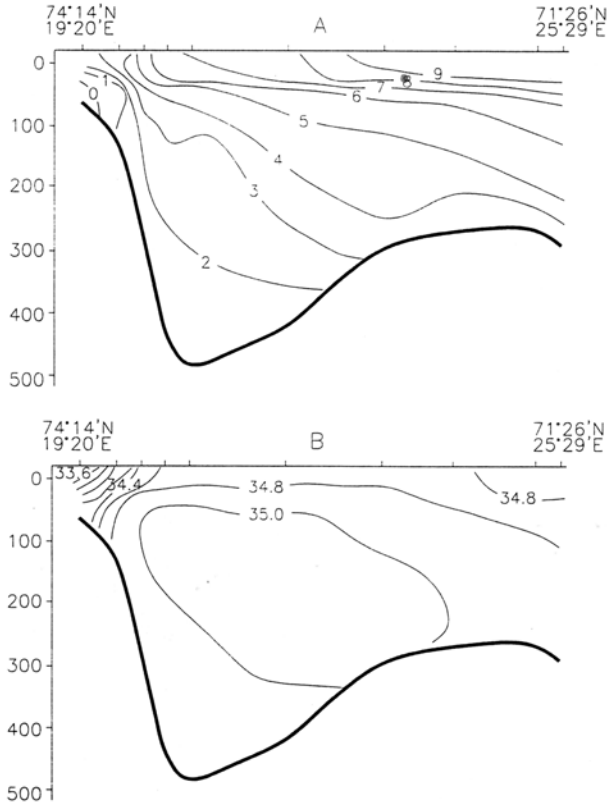

Fig. 13. Hydrographic section North Cape-Bear Island. Temperature (A) and salinity (B)

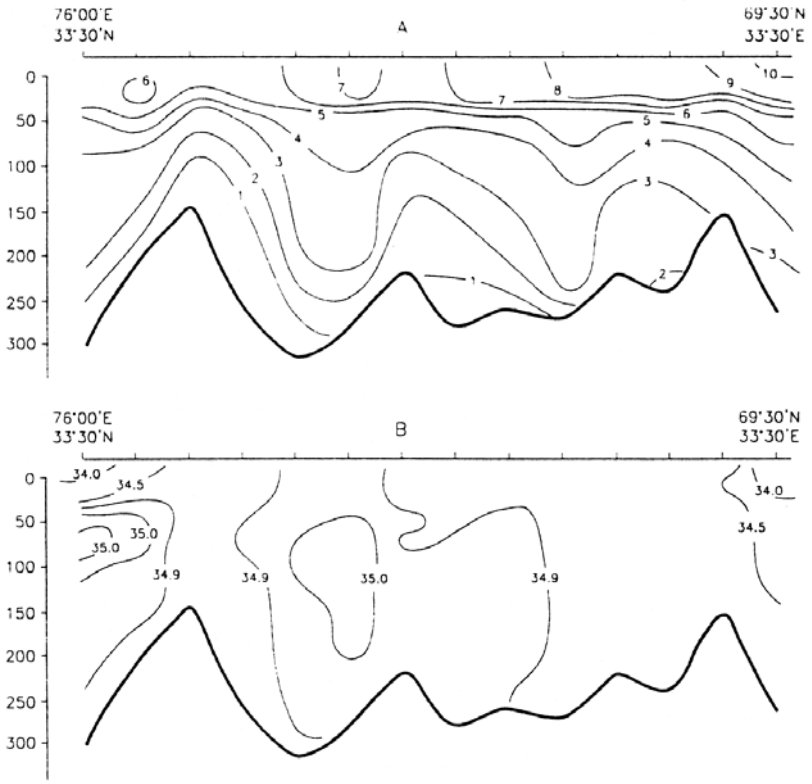

Fig. 14. Hydrographic section along the Kola meridian. Temperature (A) and salinity (B)

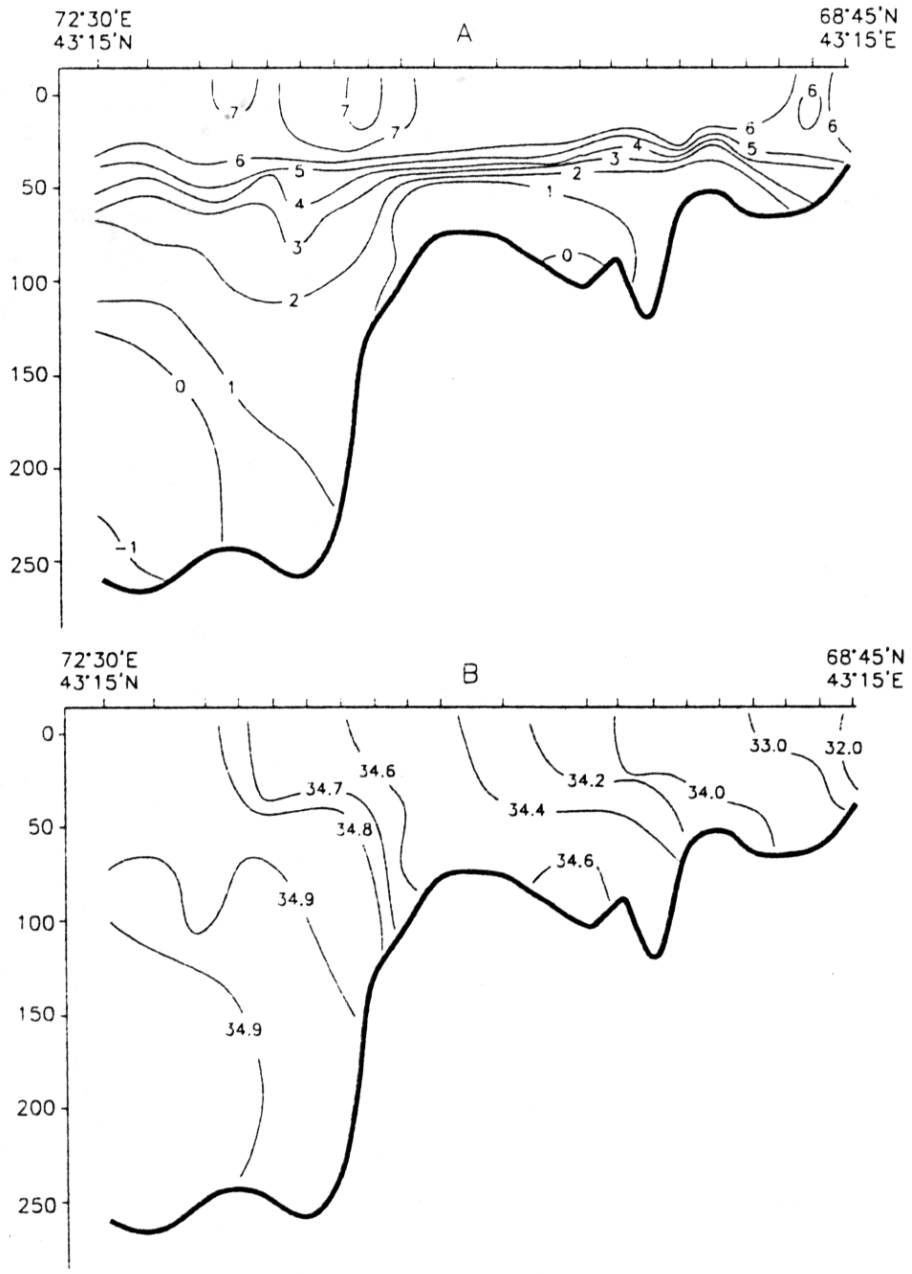

Fig. 15. Hydrographic section Cape Kanin-North. Temperature (A) and salinity (B)

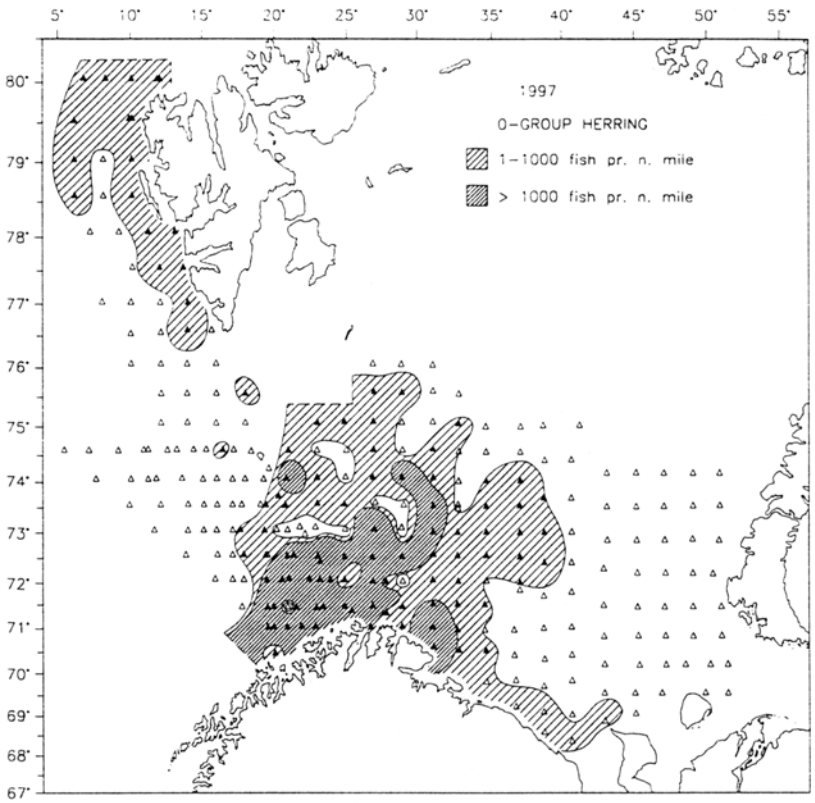

Fig. 16. Distribution of 0-group herring

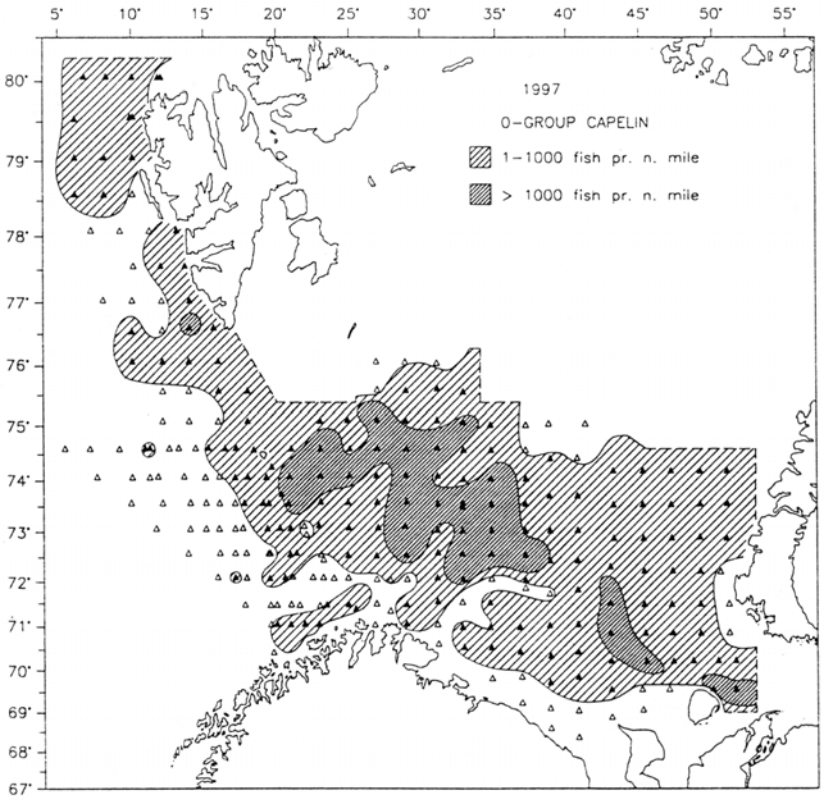

Fig. 17. Distribution of 0-group capelin

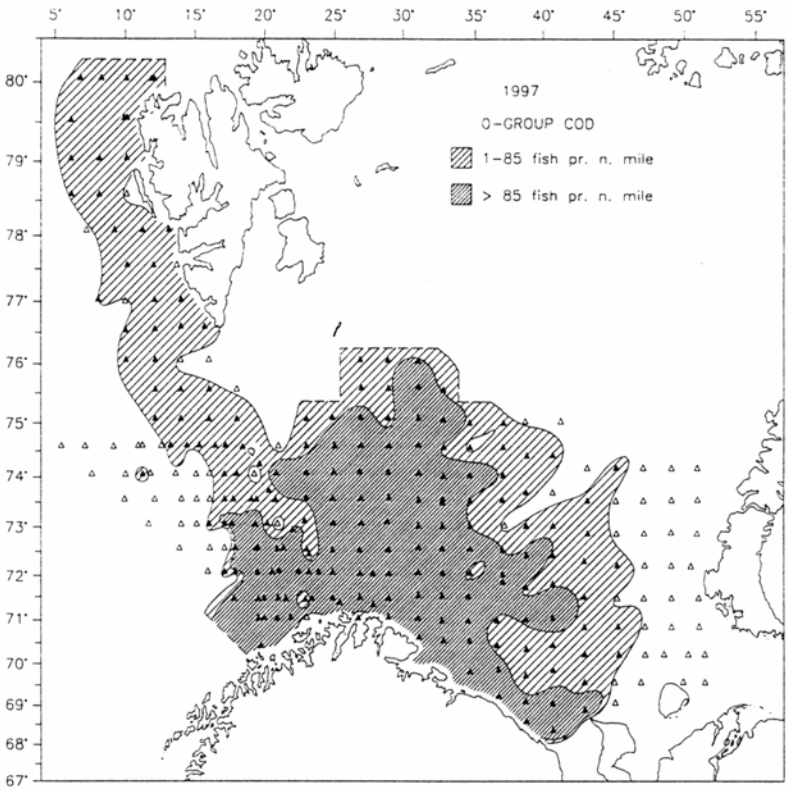

Fig. 18. Distribution of 0-group cod

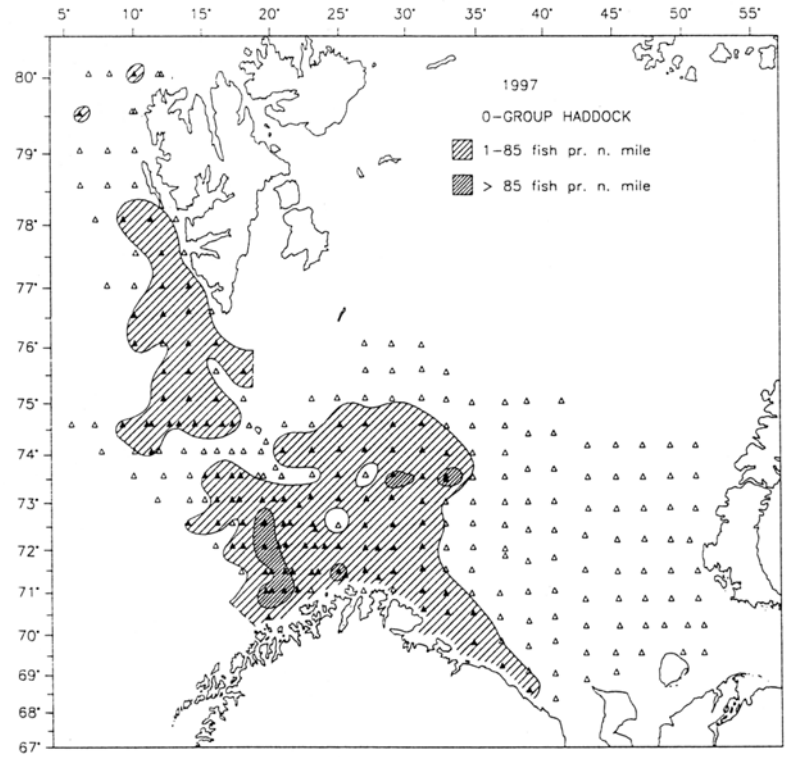

Fig. 19. Distribution of 0-group haddock

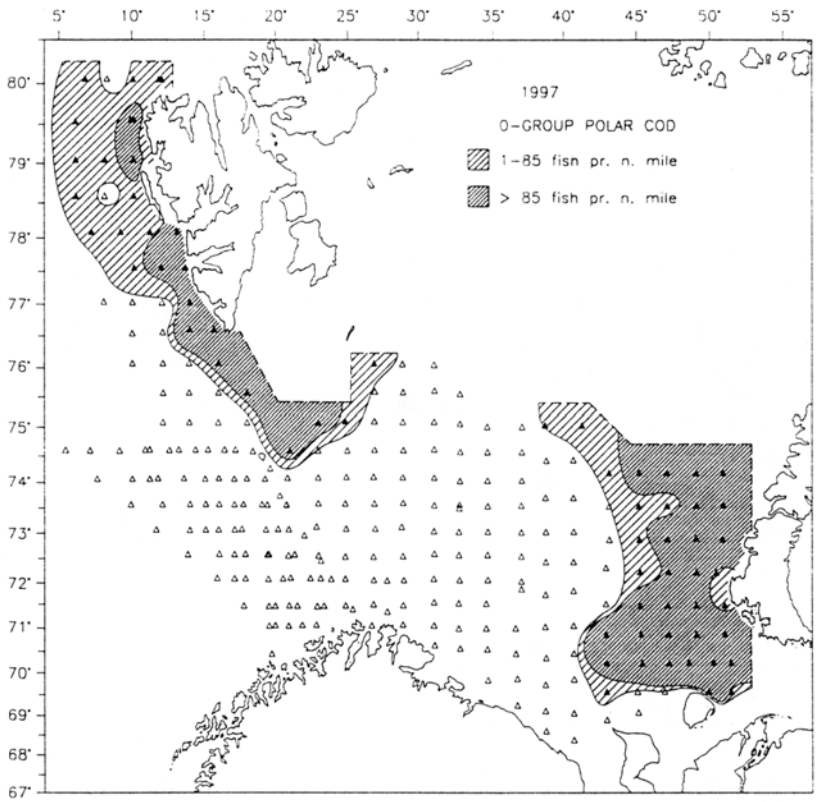

Fig. 20. Distribution of 0-group polar cod

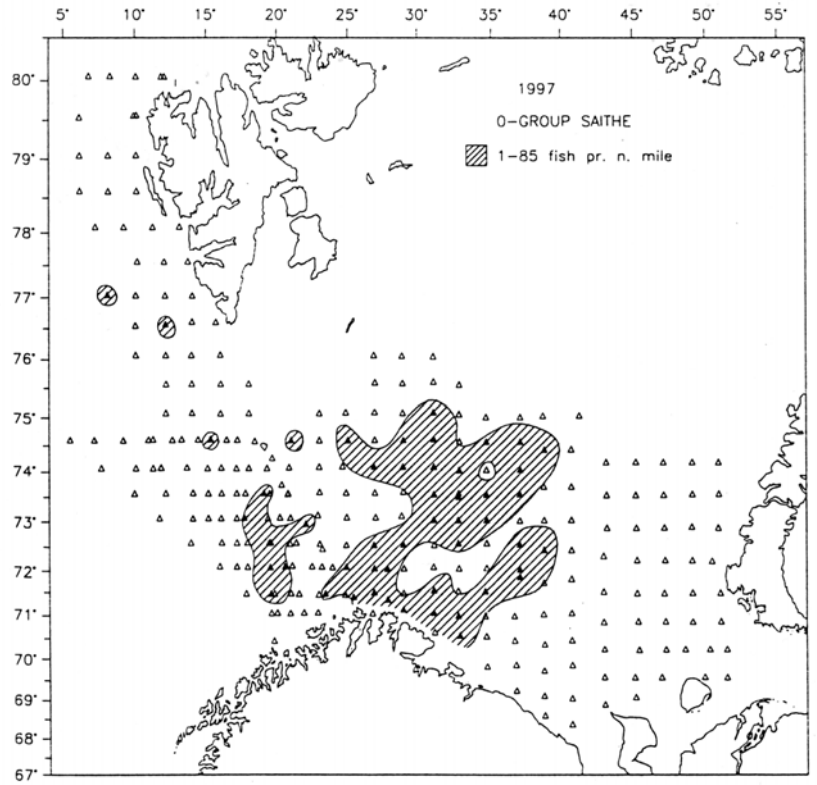

Fig. 21. Distribution of 0-group saithe

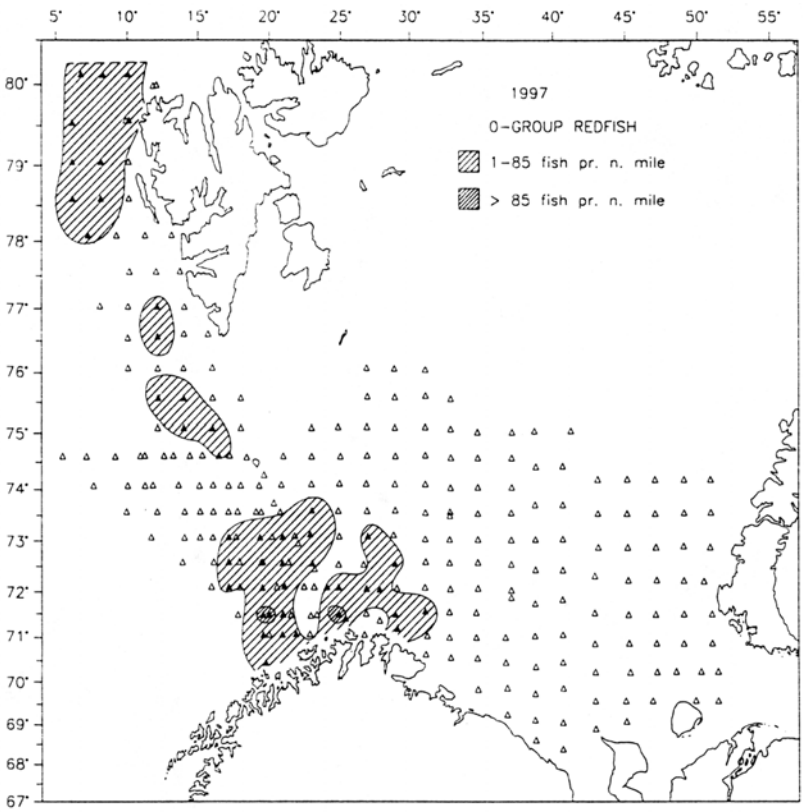

Fig. 22. Distribution of 0-group redfish

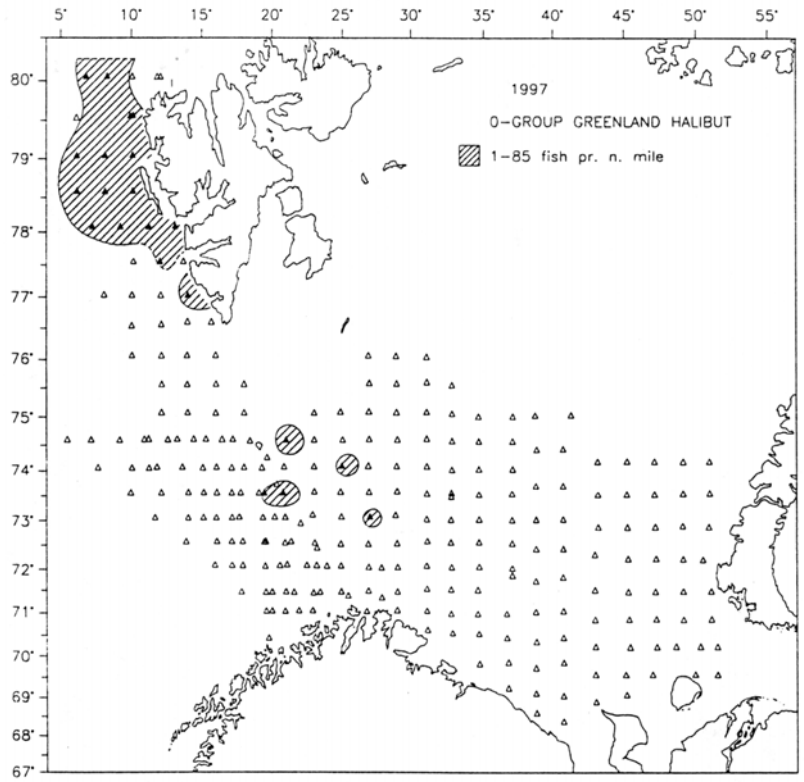

Fig. 23. Distribution of 0-group Greenland halibut

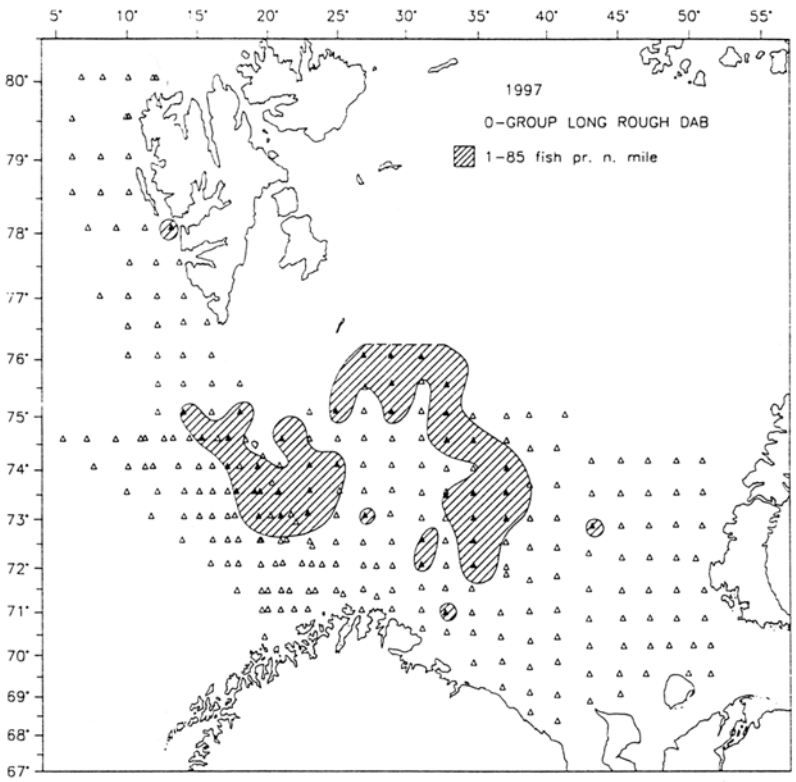

Fig. 24. Distribution of 0-group long rough dab

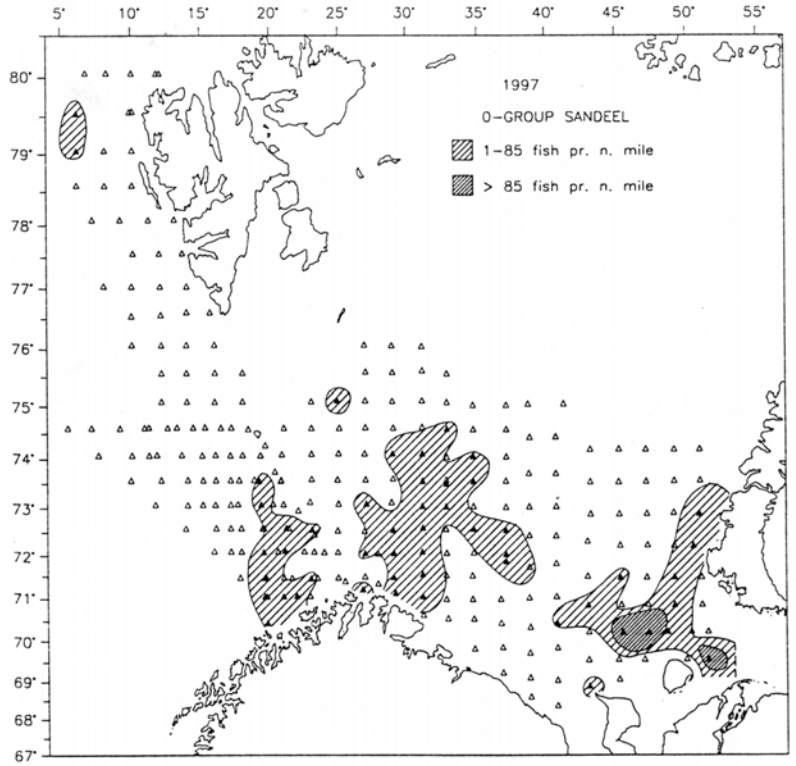

Fig. 25. Distribution of 0-group sandeel

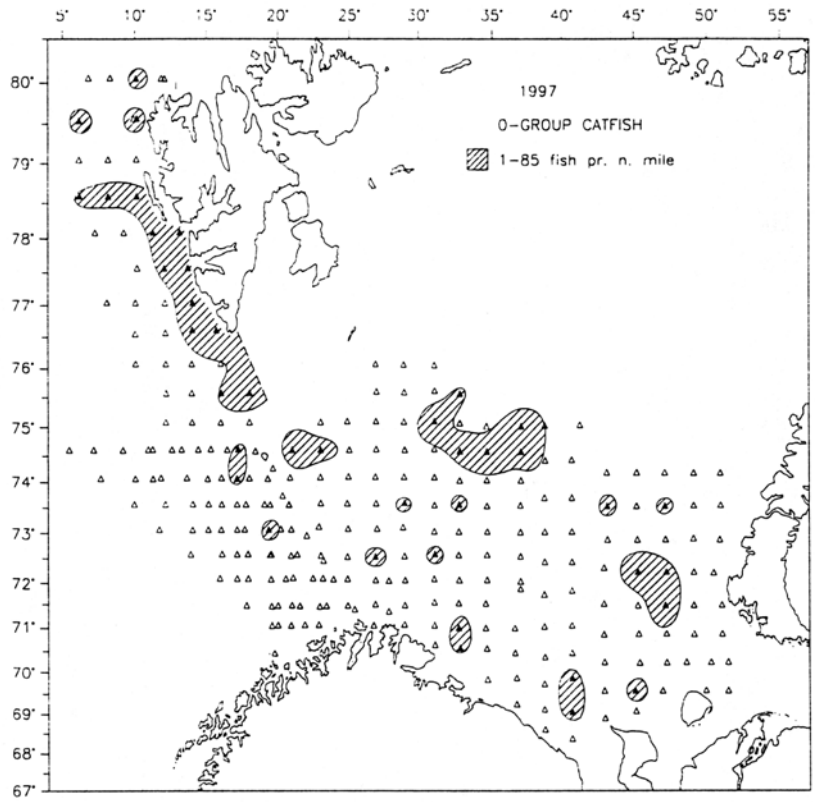

Fig. 26. Distribution of 0-group catfish

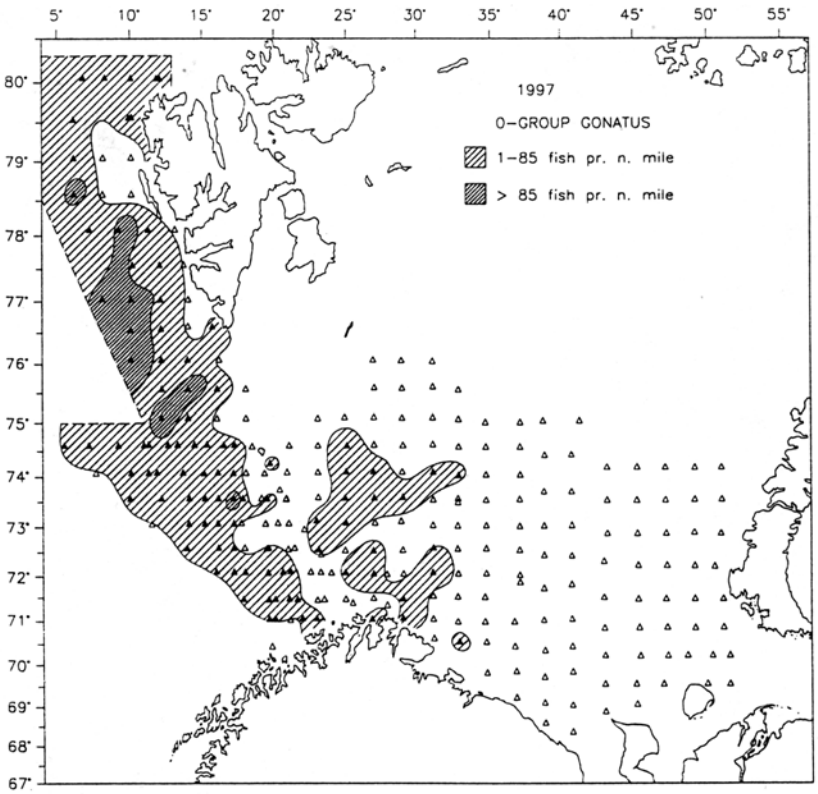

Fig. 27. Distribution of 0-group Gonatus fabricii