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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)

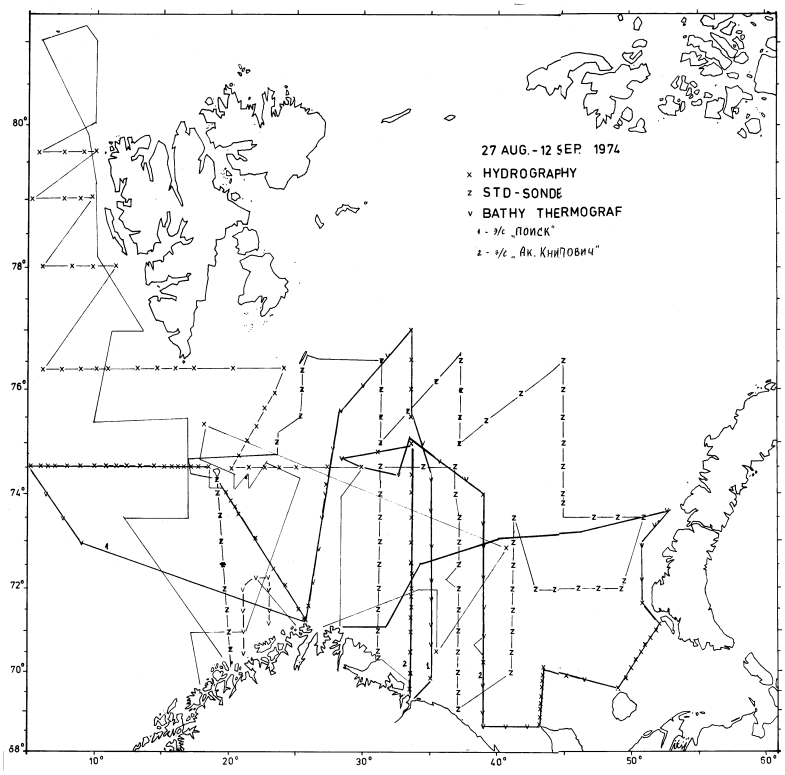


**Fig. 1. Survey routes and grid of stations**

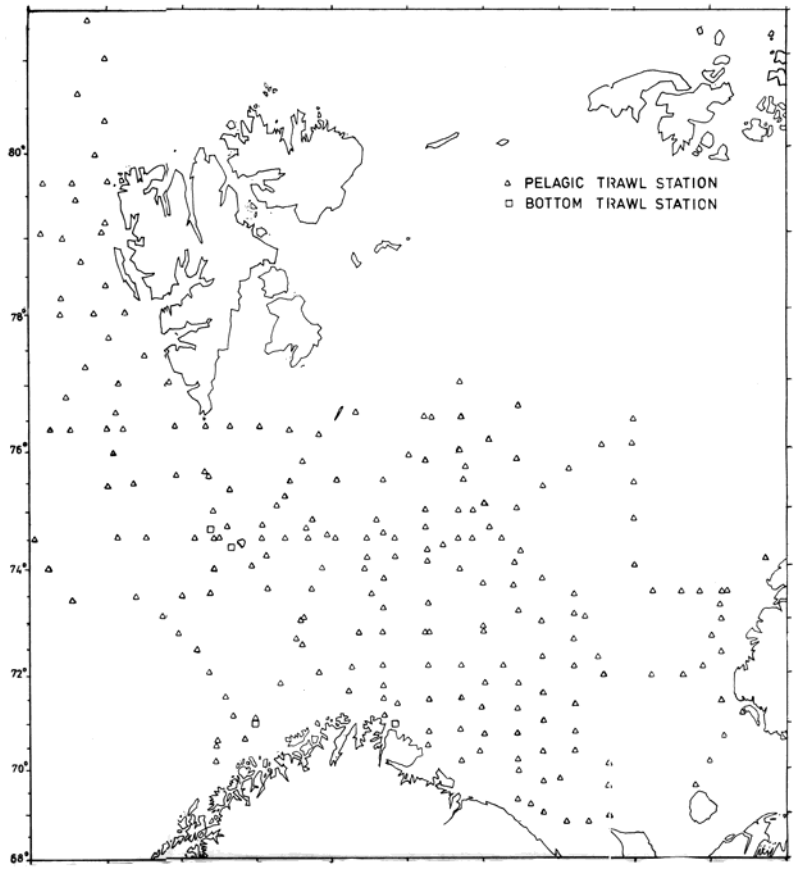


**Fig. 2. Trawl stations**

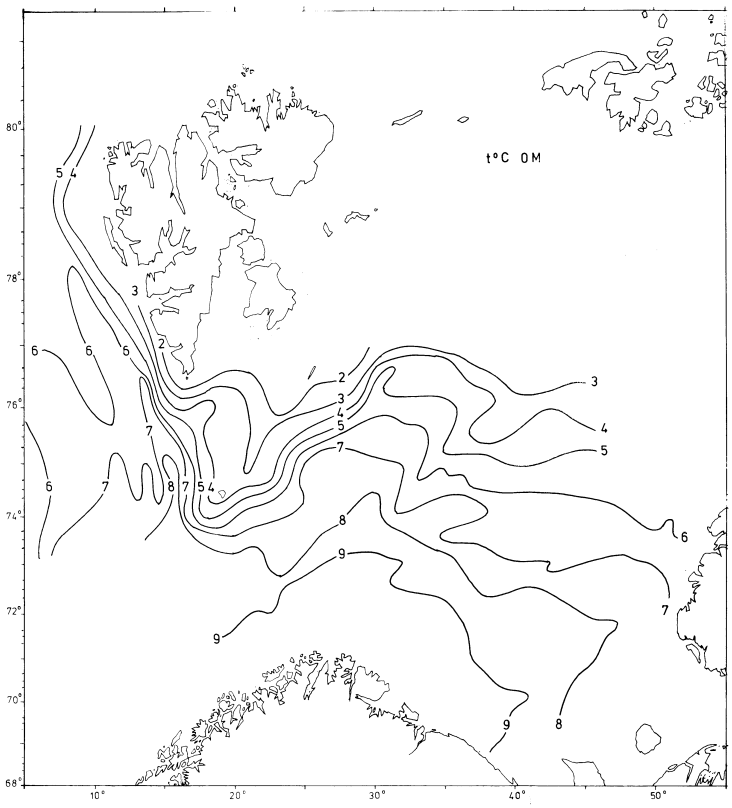


**Fig. 3. Isotherms at 0 m**

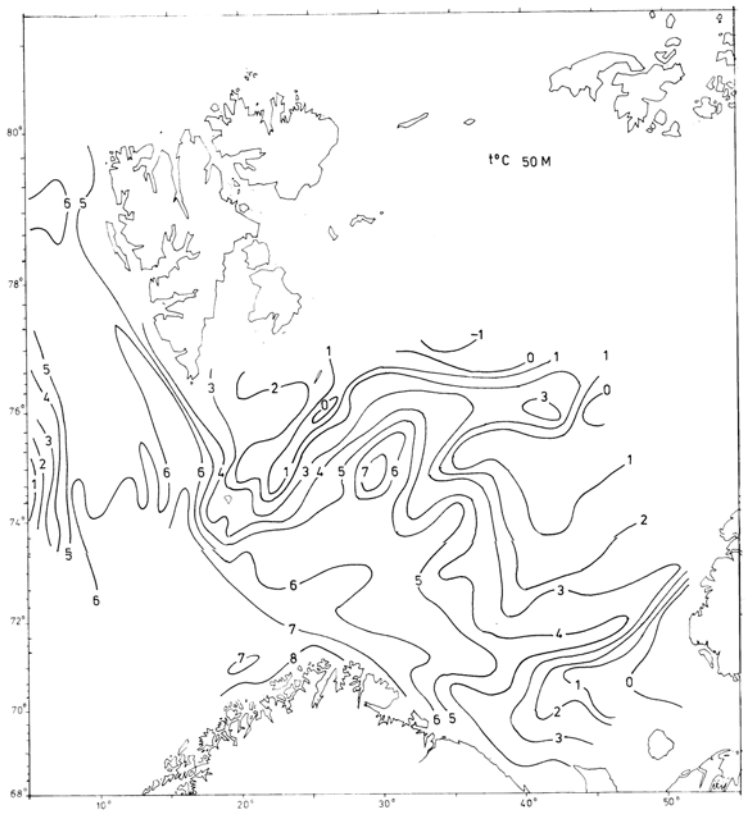


**Fig. 4. Isotherms at 50 m**

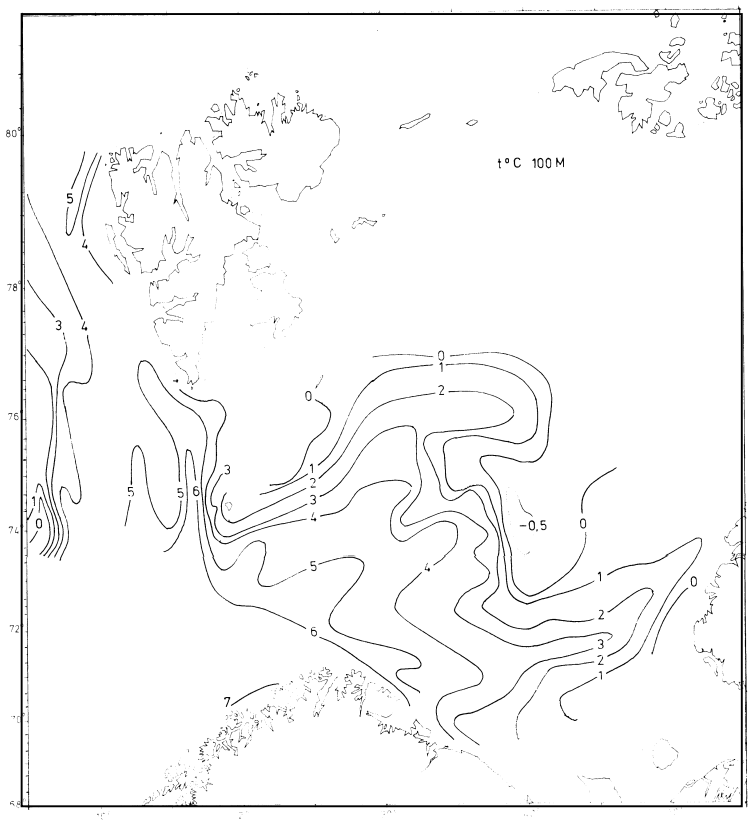


**Fig. 5. Isotherms at 100 m**

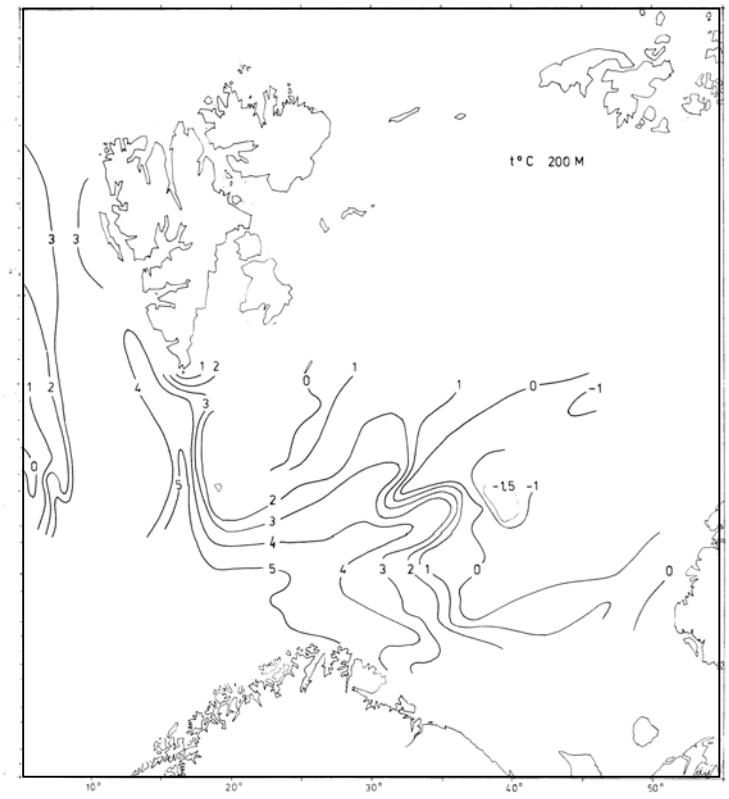


**Fig. 6. Isotherms at 200 m**

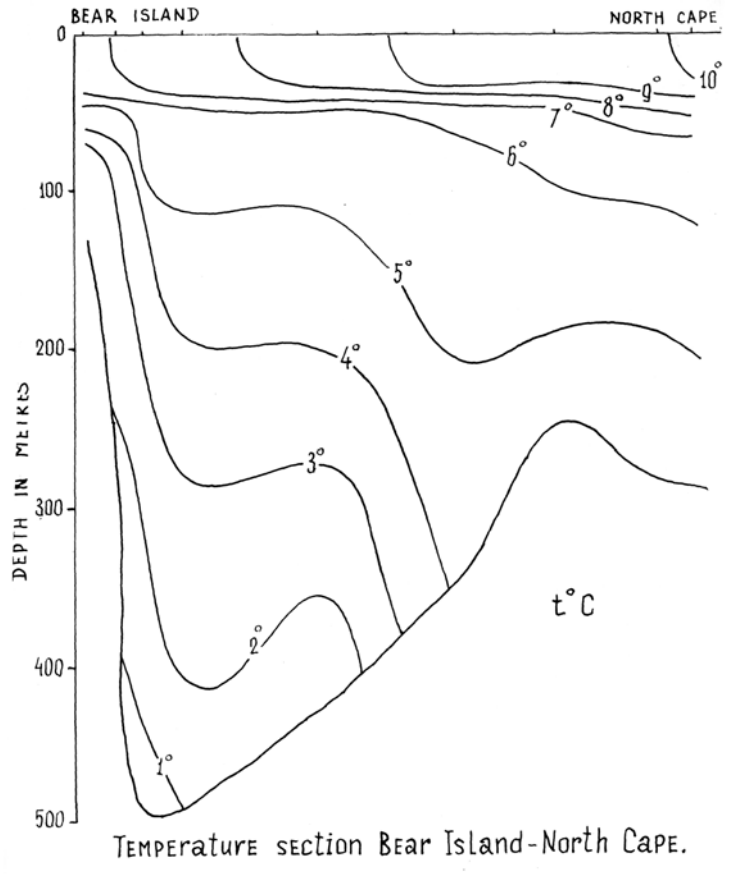


**Fig. 7. Temperature section Bear Island – North Cape**

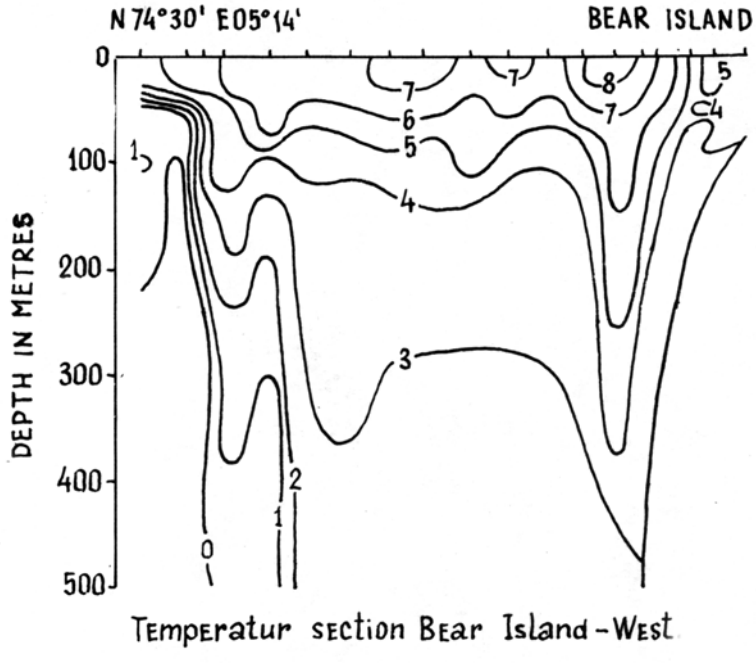


**Fig. 8. Temperature section Bear Island-West**

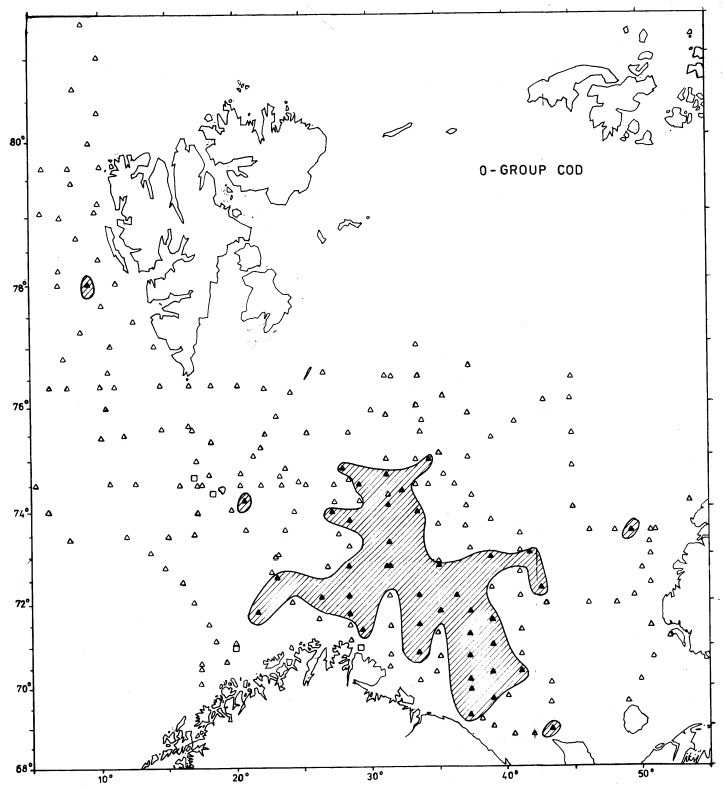


**Fig. 9. Distribution of 0-group cod**

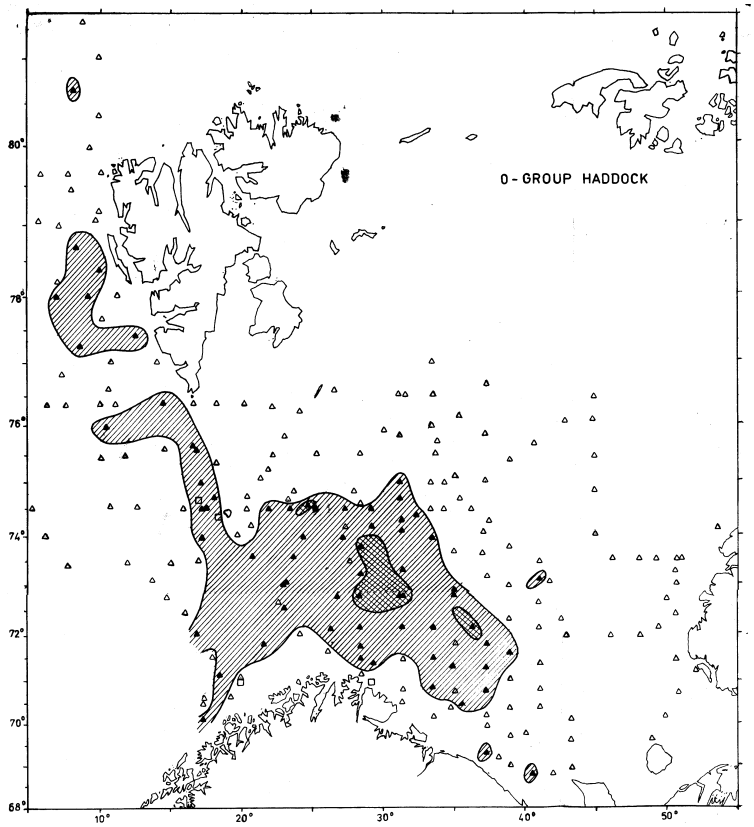


**Fig. 10. Distribution of 0-group haddock**

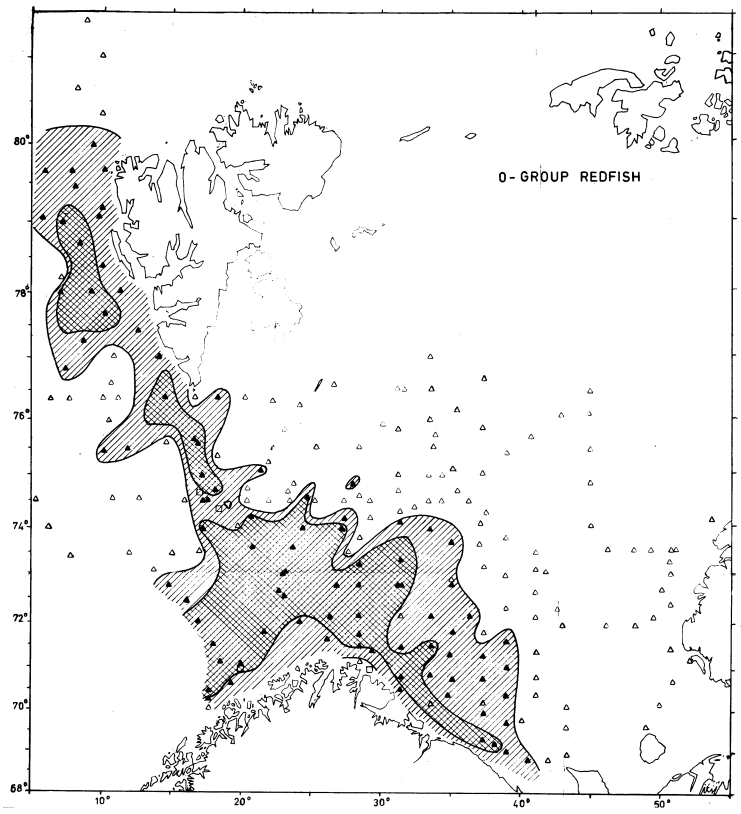


**Fig. 11. Distribution of 0-group redfish**

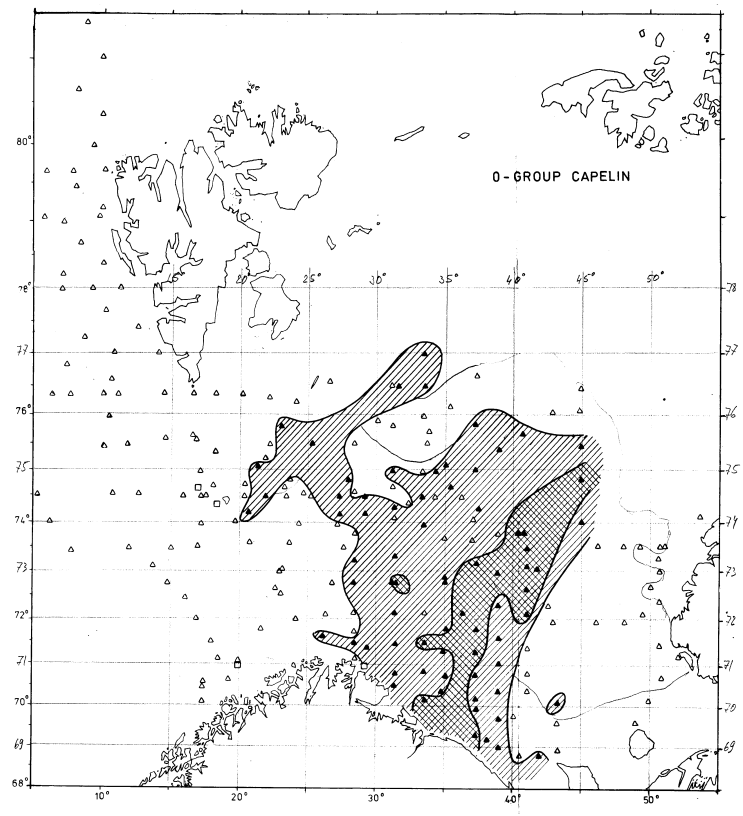


**Fig. 12. Distribution of 0-group capelin**

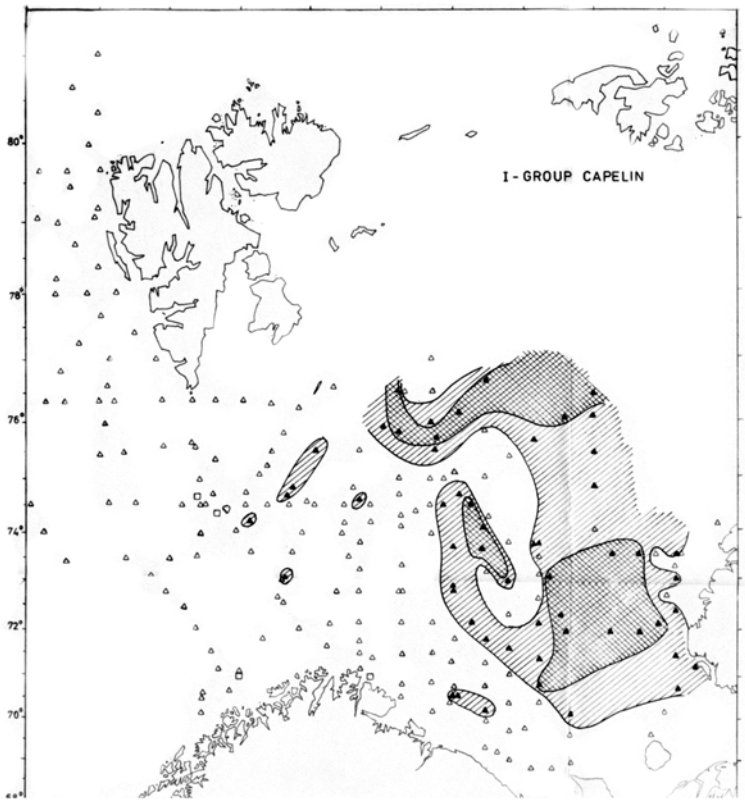


**Fig. 13. Distribution of 1-group capelin**

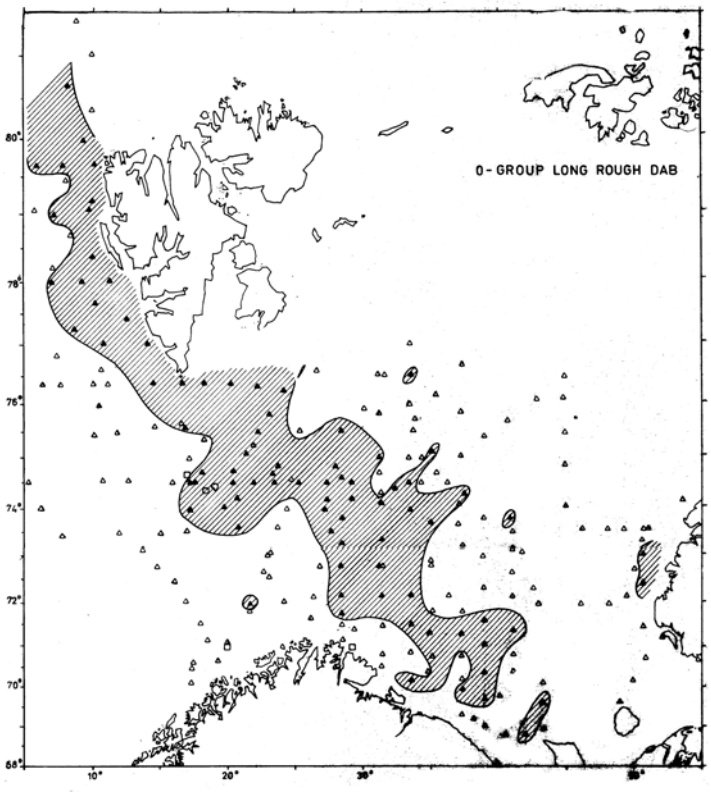


**Fig. 14. Distribution of 0-group long rough dab**

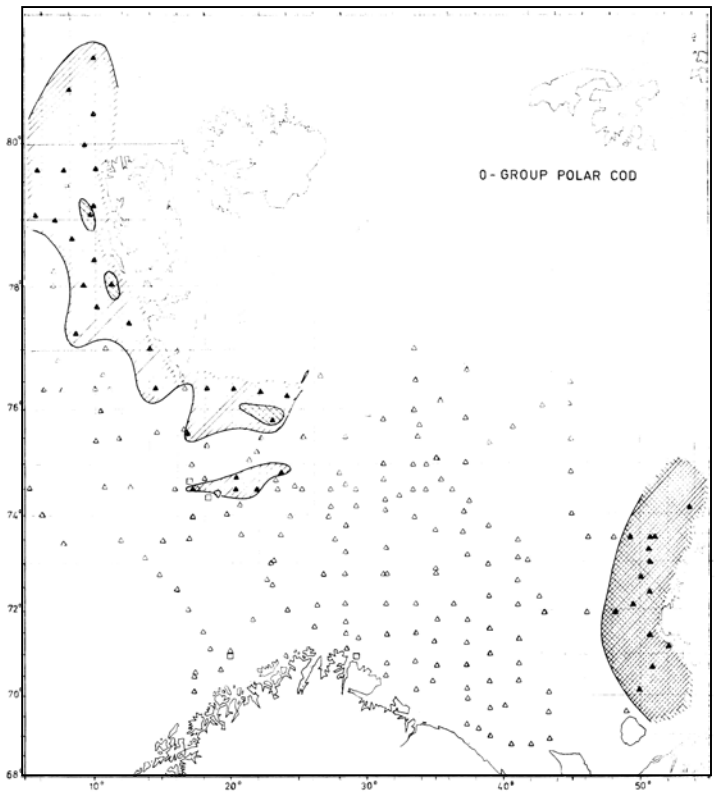


**Fig. 15. Distribution of 0-group polar cod**

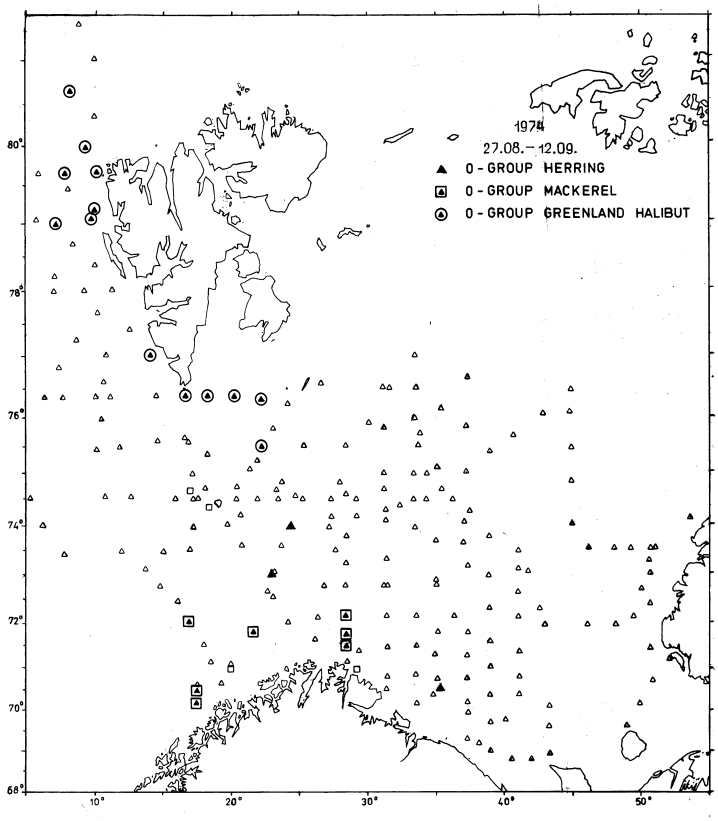


**Fig. 16. Distribution of 0-group herring, mackerel and Greenland halibut**

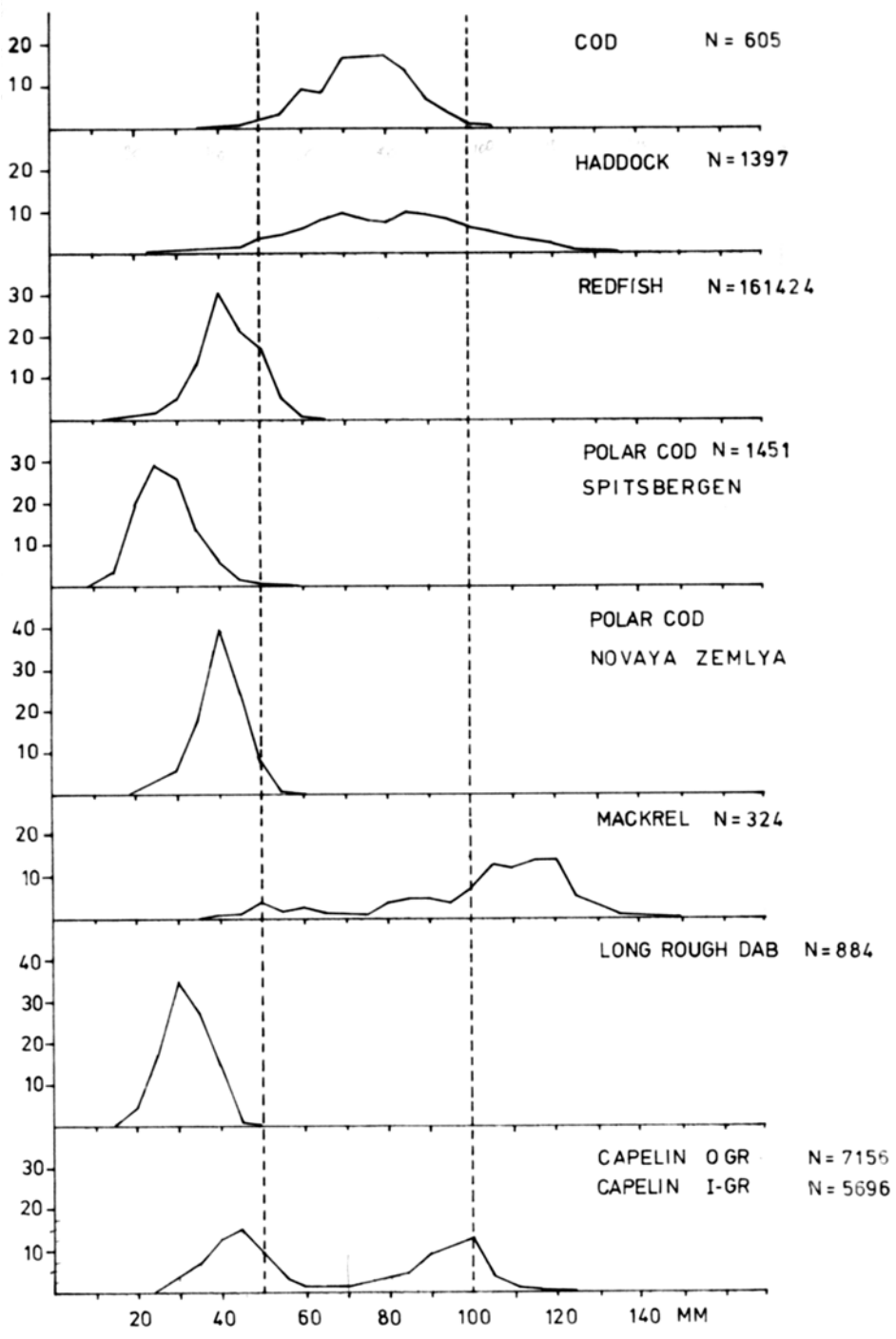


**Fig. 17. Length distribution of 0-group fish**

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.

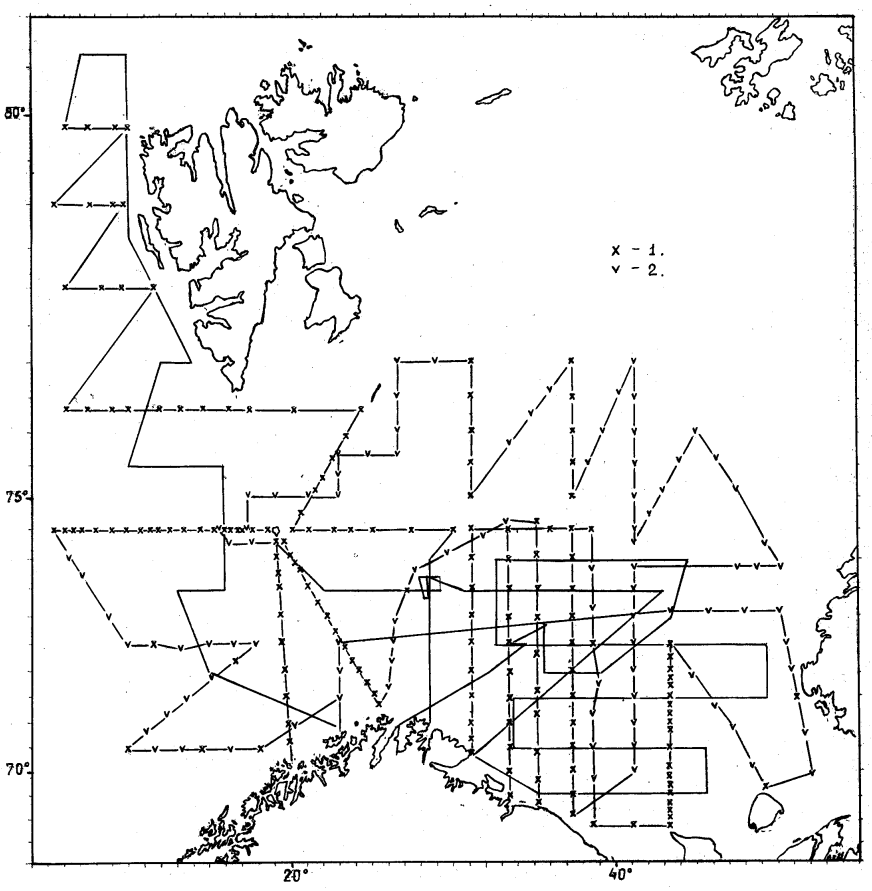


**Fig. 1. Survey routes and grid of stations**

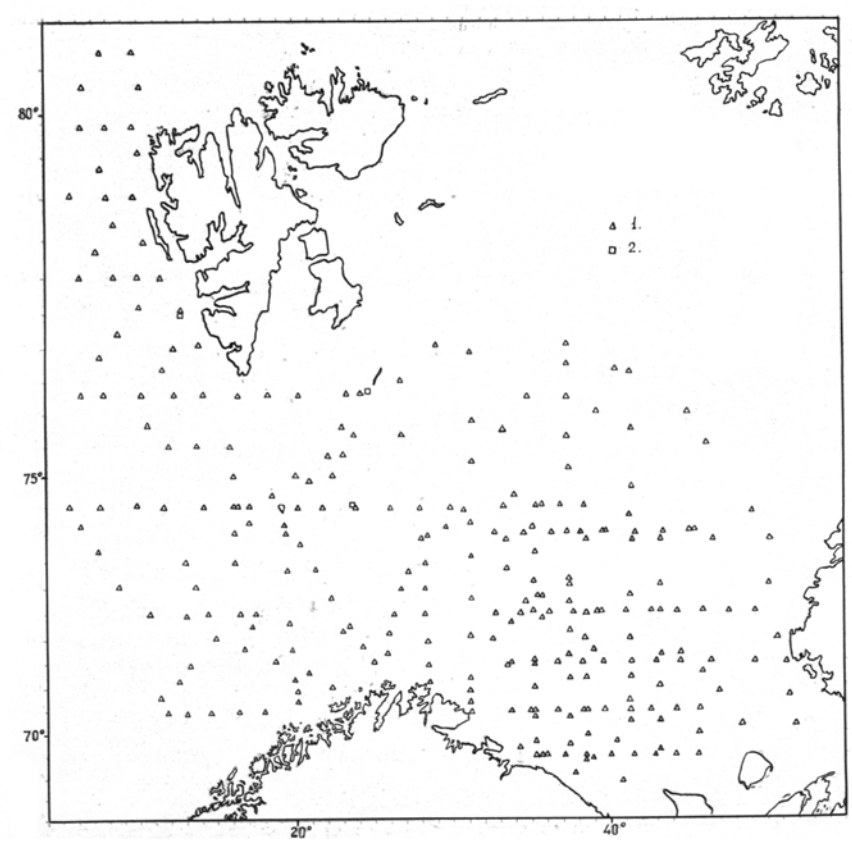


**Fig. 2. Trawl stations**

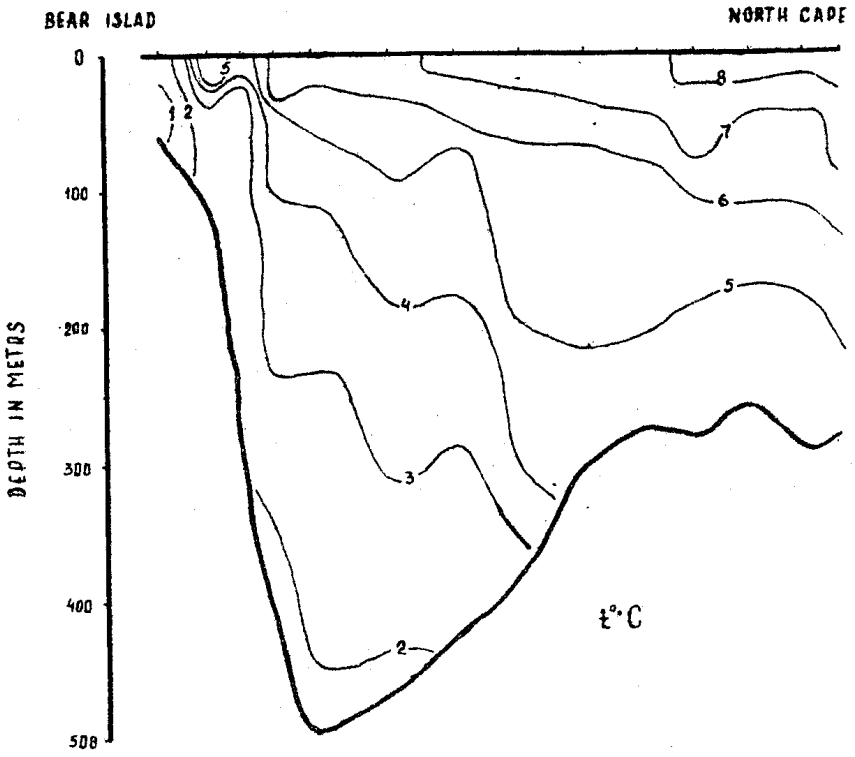


**Fig. 3. Temperature section Bear Island-North Cape**

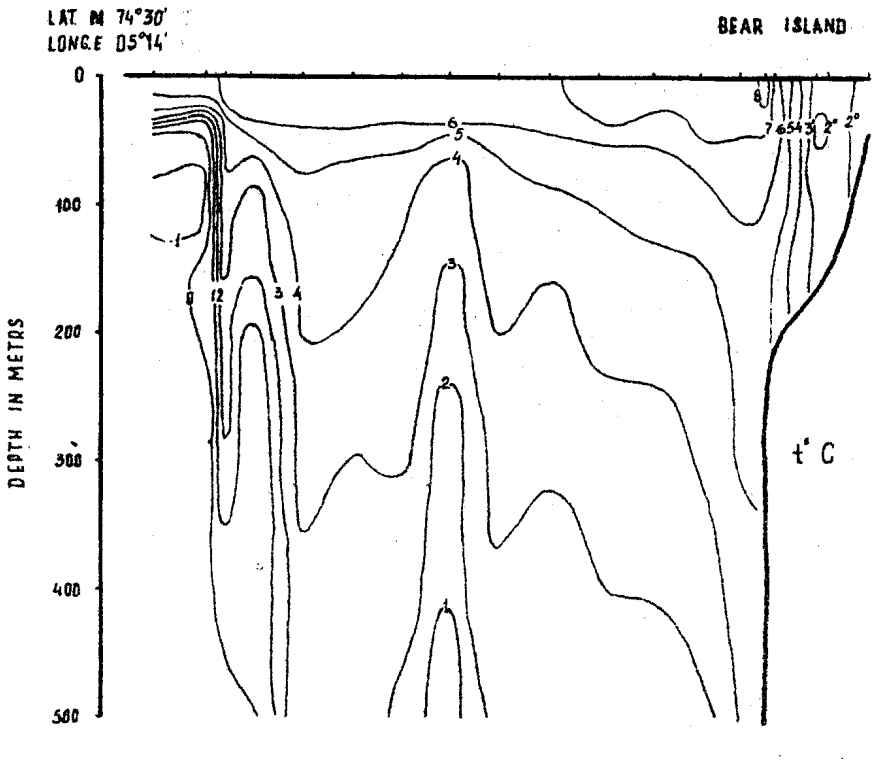


**Fig. 4. Temperature section Bear Island-West**

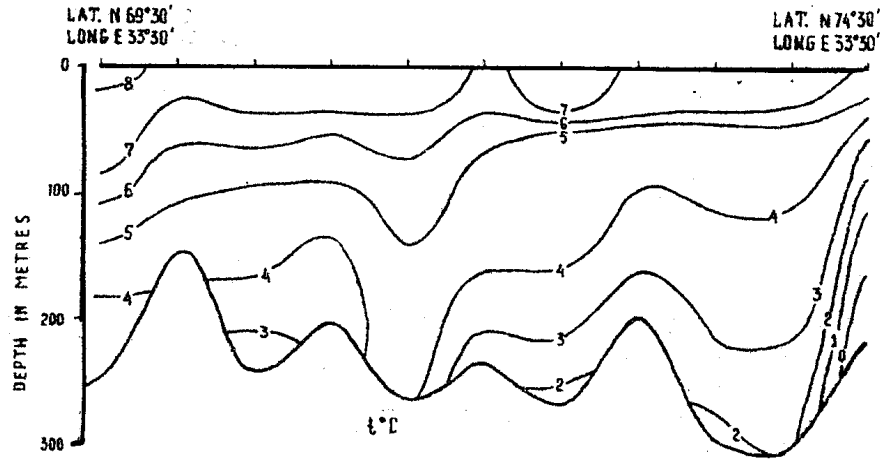


**Fig. 5. Temperature section along the Kola meridian**

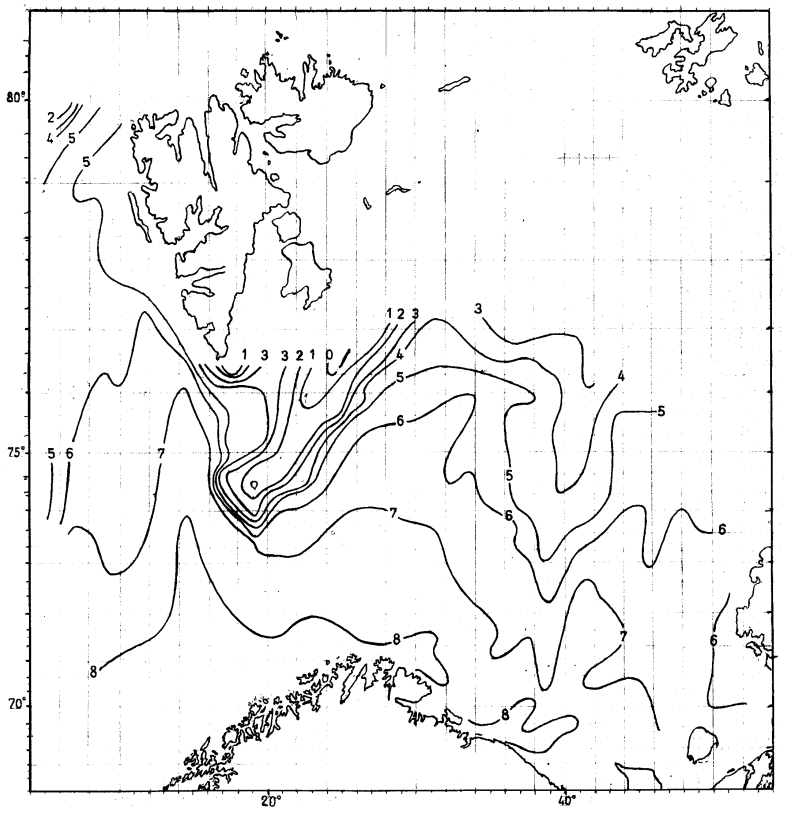


**Fig. 6. Isotherms at 0 m**

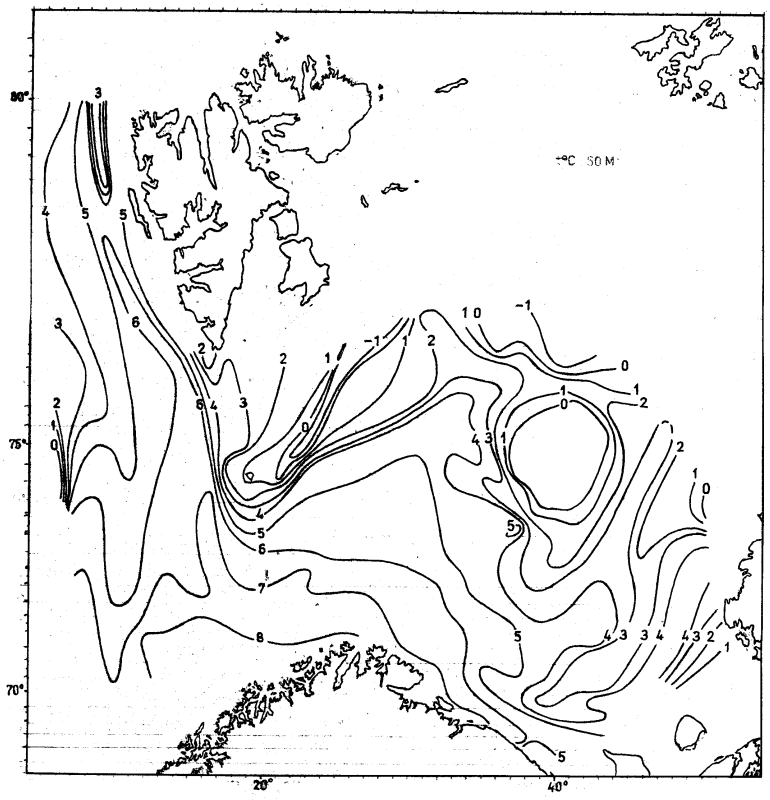


**Fig. 7. Isotherms at 50 m**

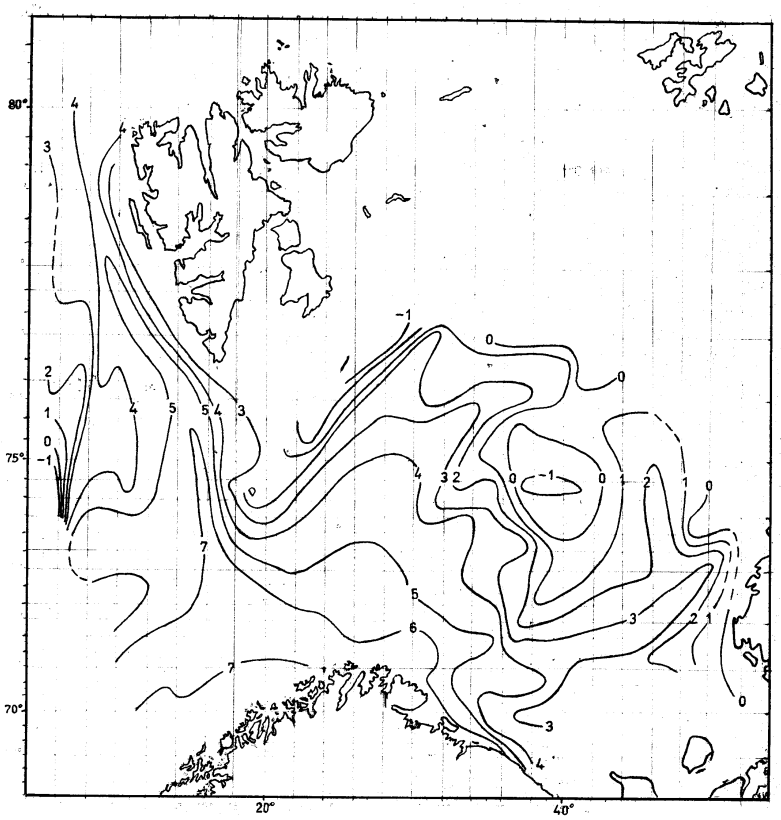


**Fig. 8. Isotherms at 100 m**

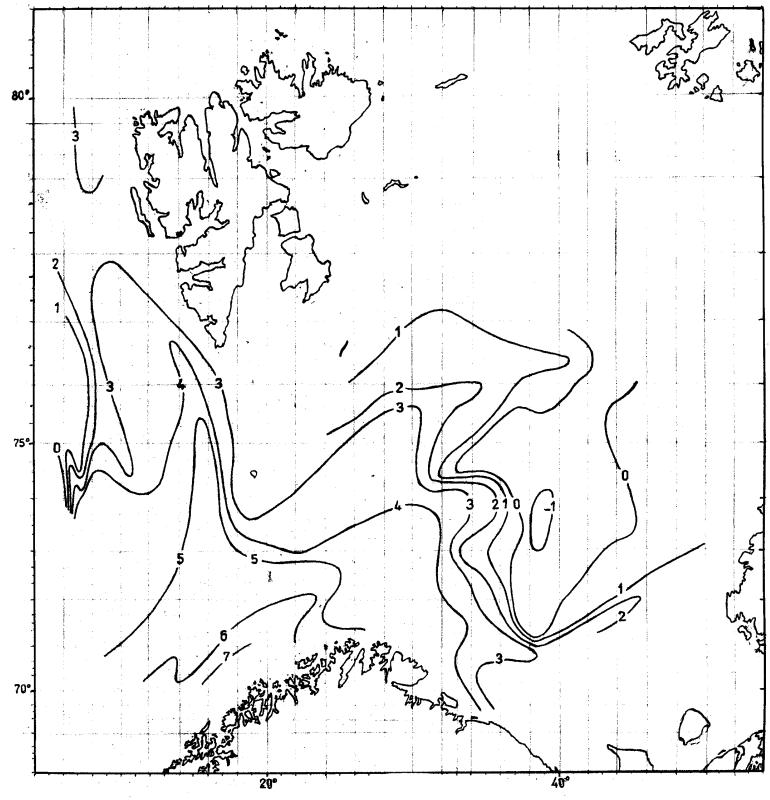


**Fig. 9. Isotherms at 200 m**

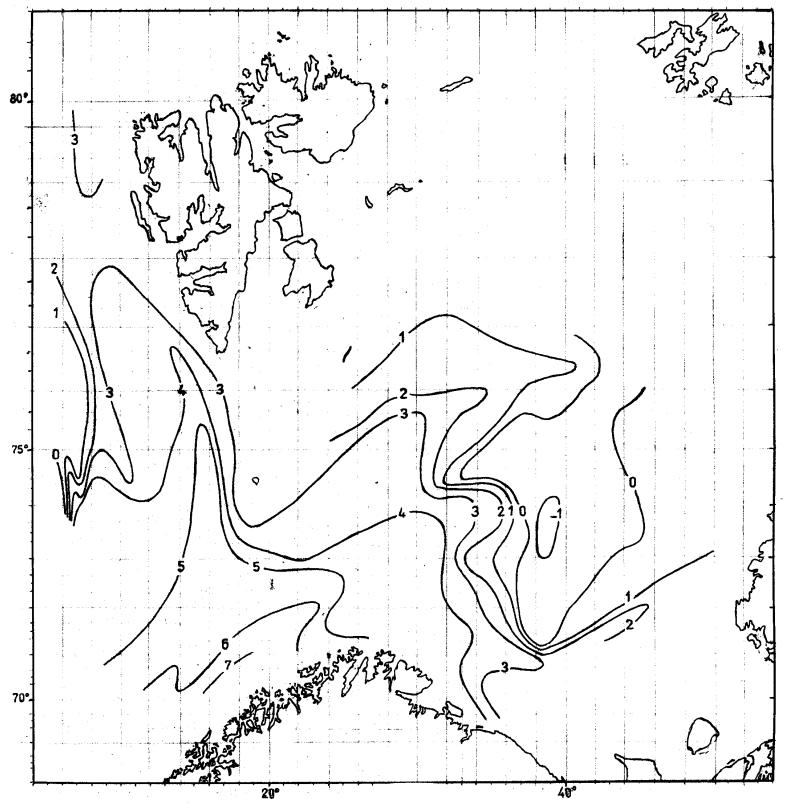


**Fig. 10. Distribution of 0-group cod**

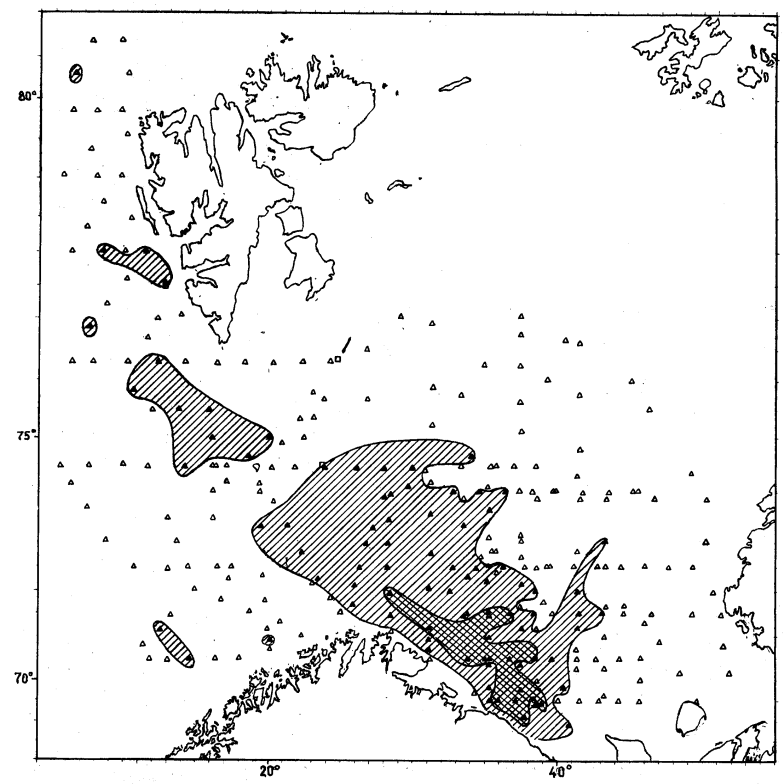


**Fig. 11. Distribution of 0-group haddock**

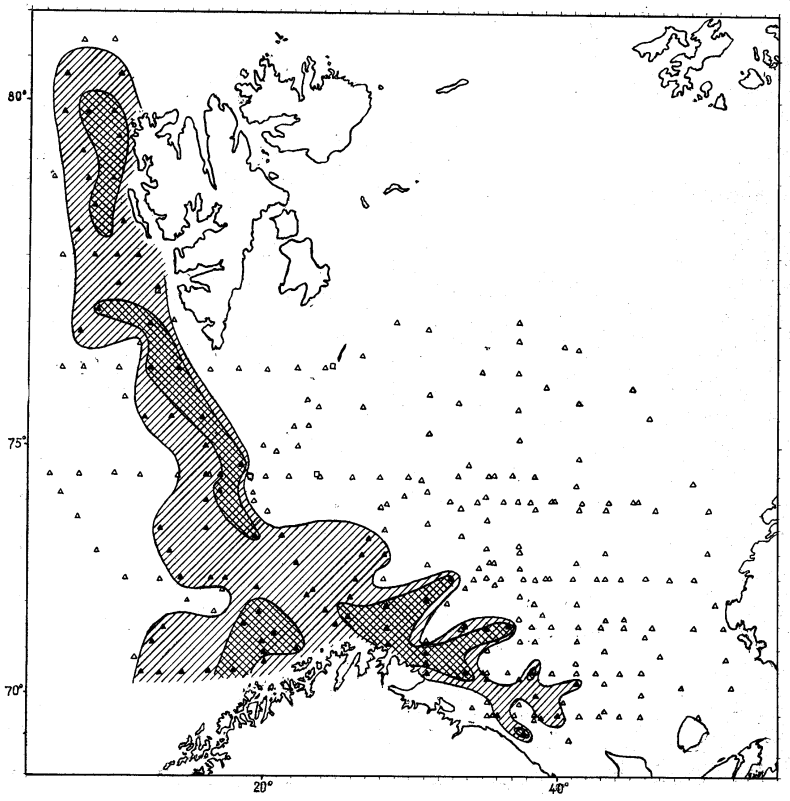


**Fig. 12. Distribution of 0-group redfish**

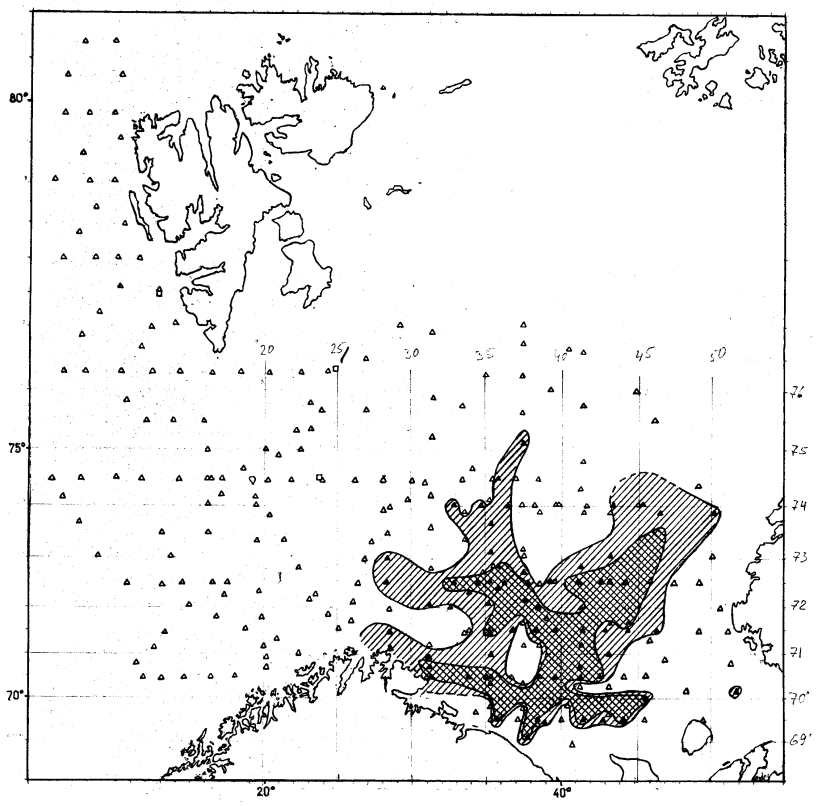


**Fig. 13. Distribution of 0-group capelin**

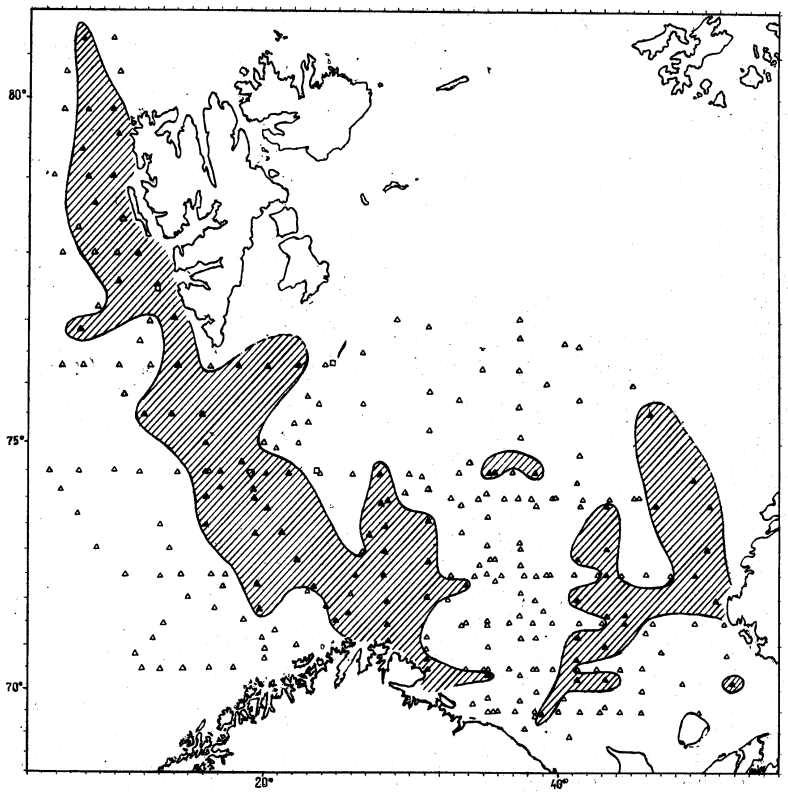


**Fig. 14. Distribution of 0-group long rough dab**

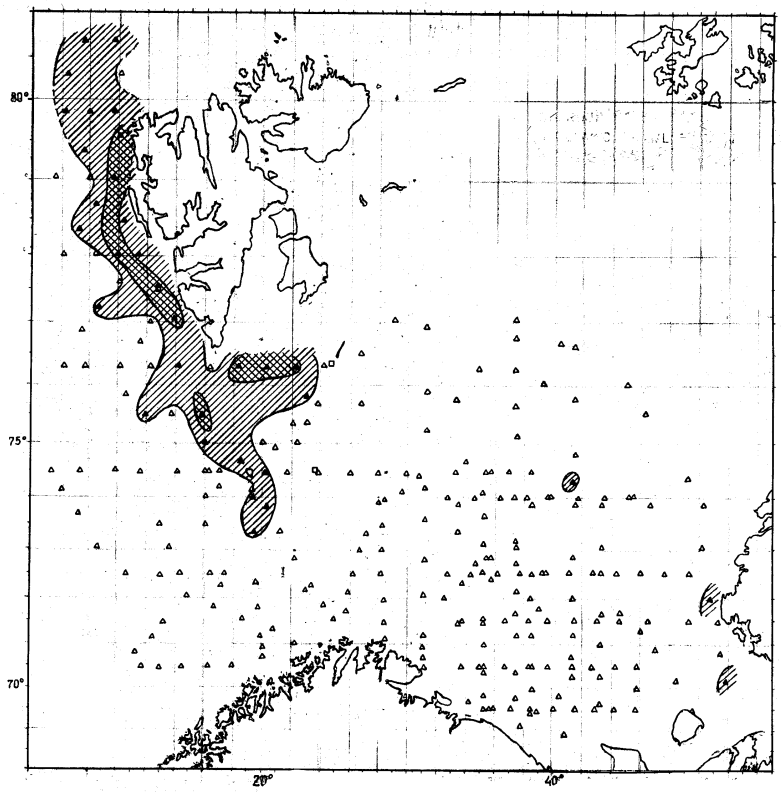


**Fig. 15. Distribution of 0-group polar cod**

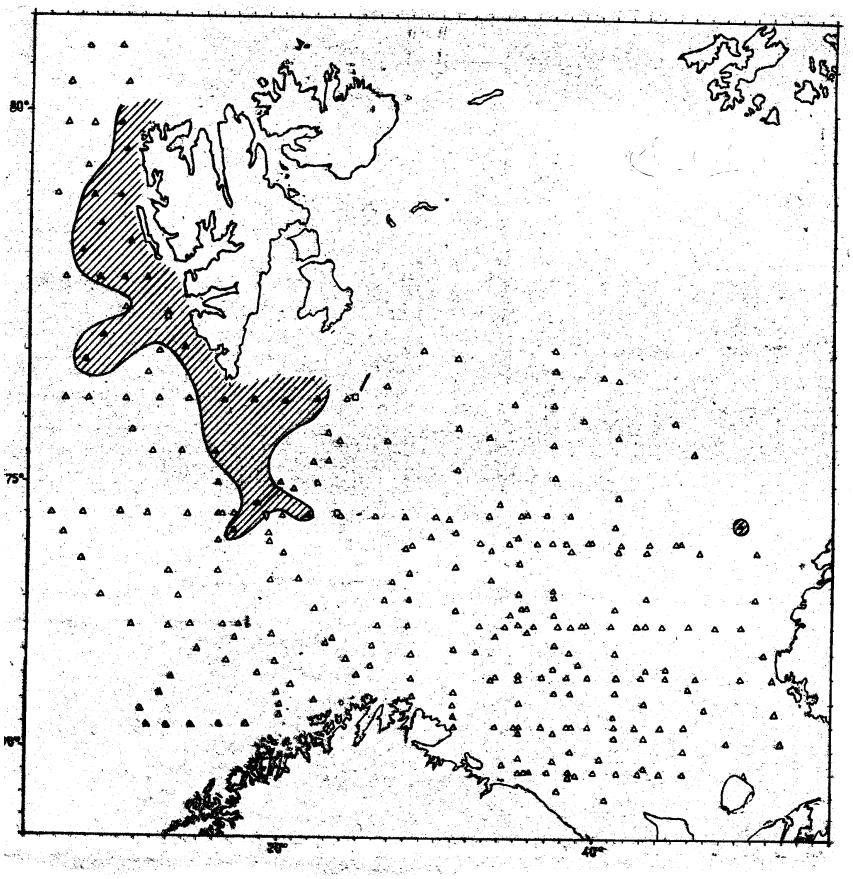


**Fig. 16. Distribution of Greenland halibut**

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 |

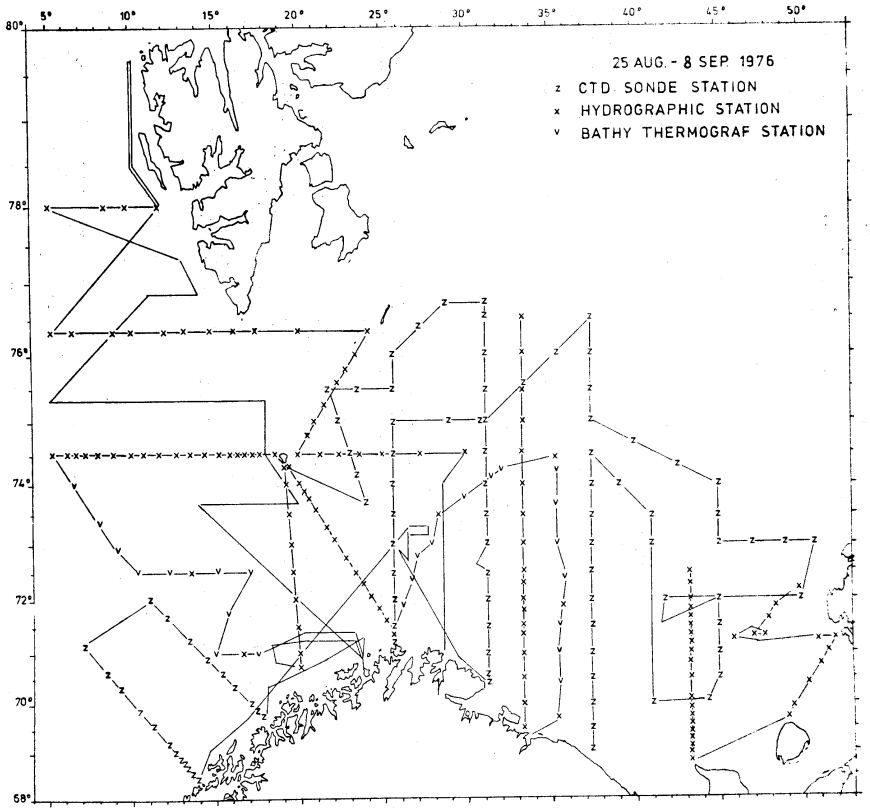


**Fig. 1. Survey tracks of the ships and the grid of hydrographic stations**

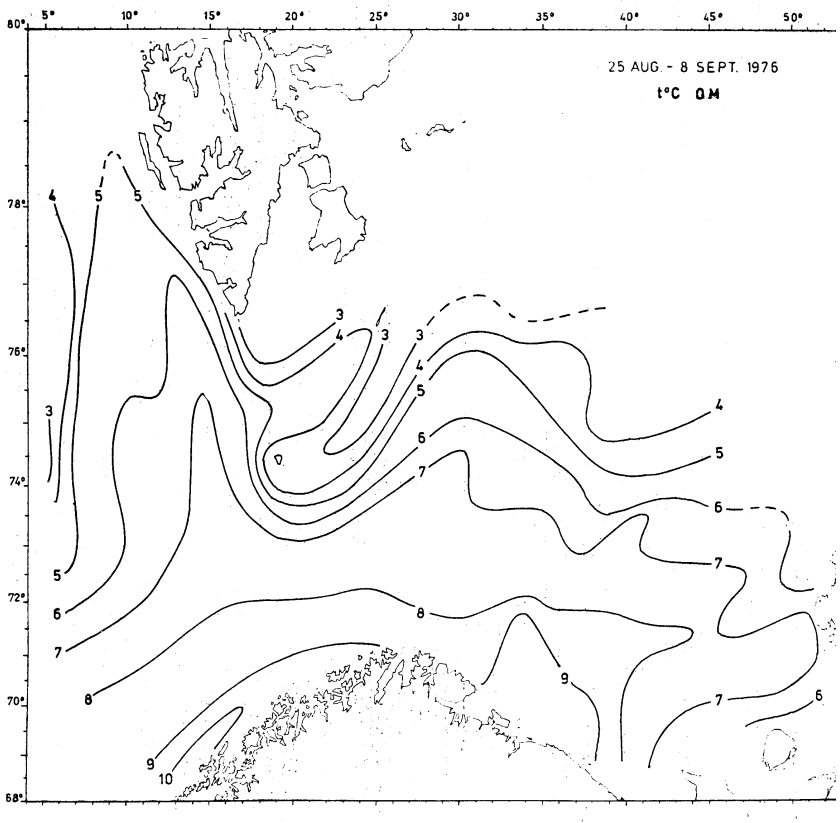


**Fig. 2. Isotherms at 0 m**

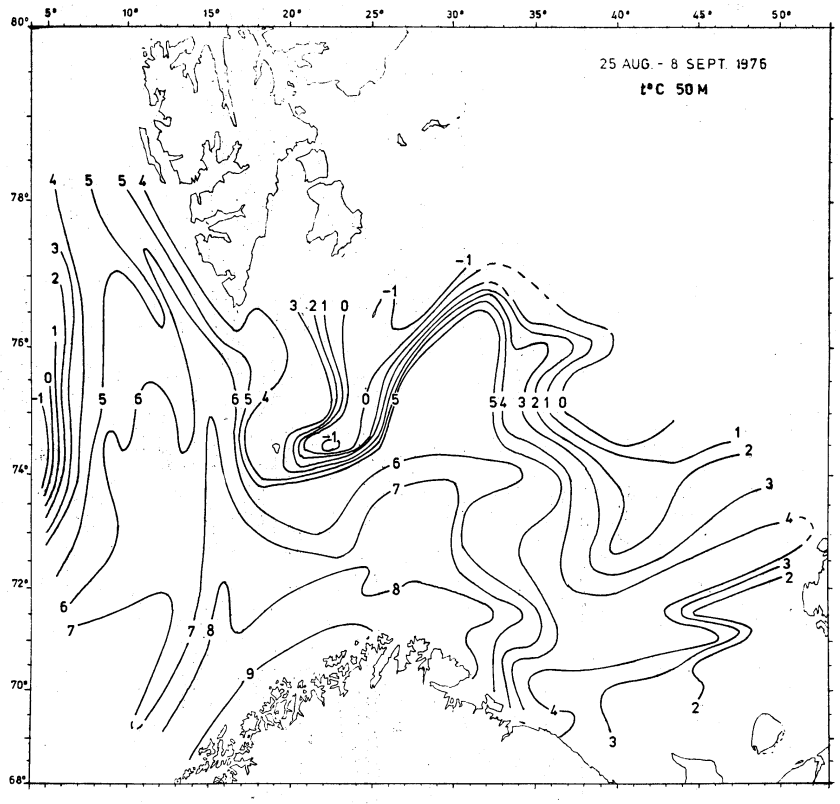


**Fig. 3. Isotherms at 50 m**

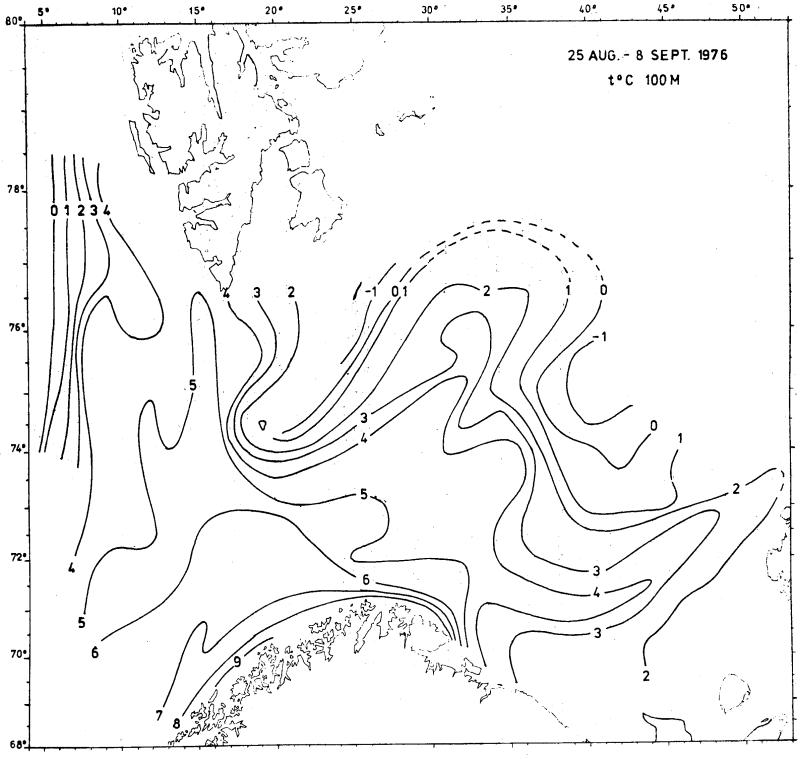


**Fig. 4. Isotherms at 100 m**

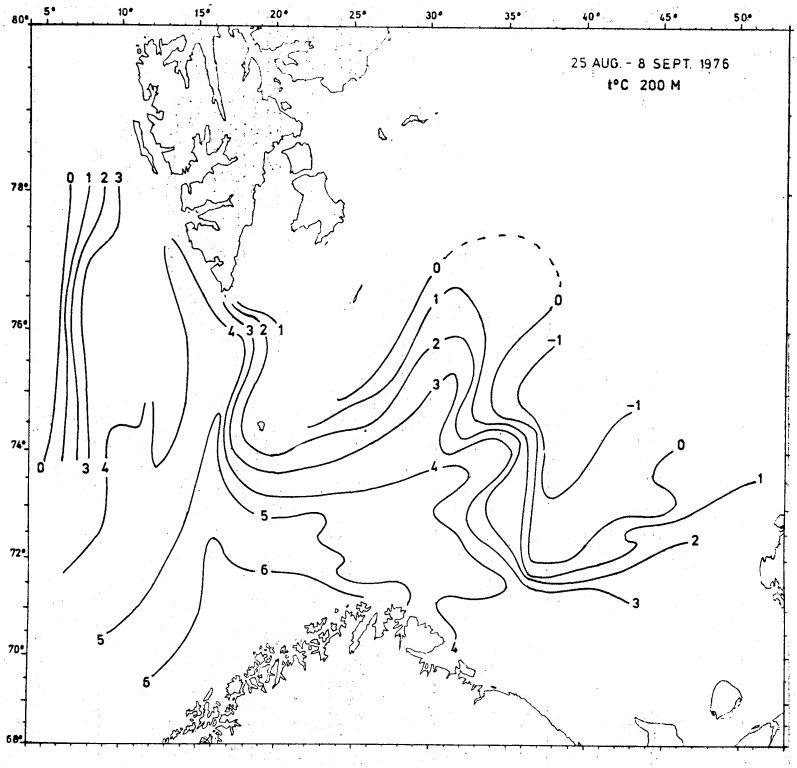


**Fig. 5. Isotherms at 200 m**

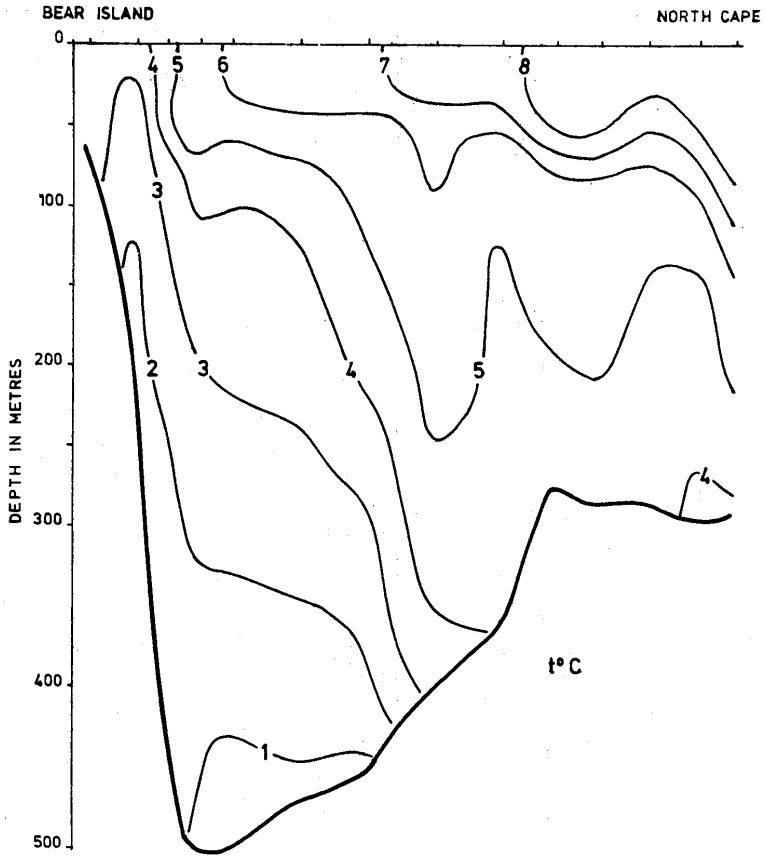


**Fig. 6. Temperature section Bear Island-North Cape**

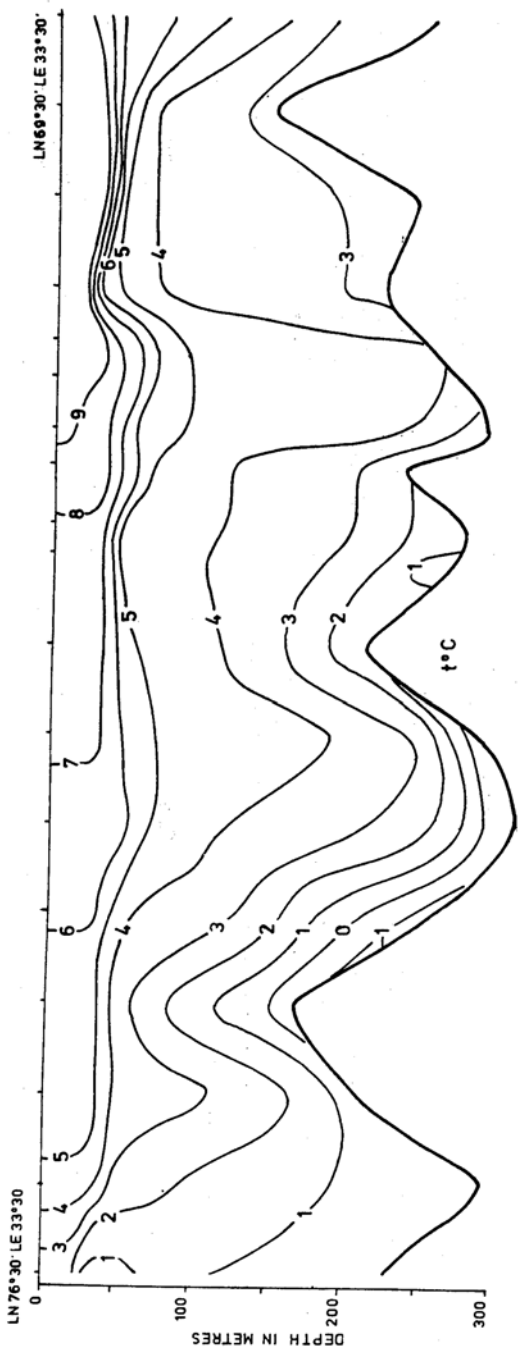


**Fig. 7. Temperature section along the Kola meridian**

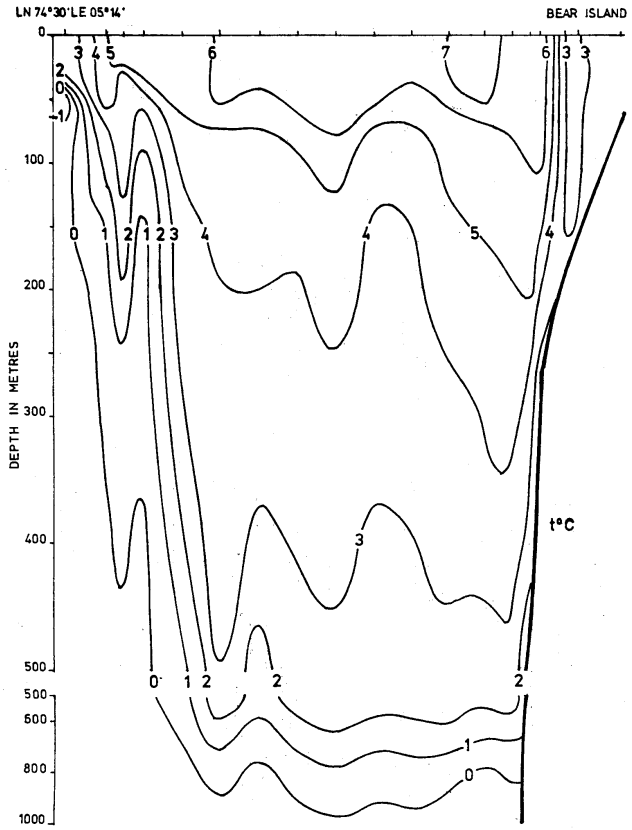


**Fig. 8. Temperature section Bear Island-West**

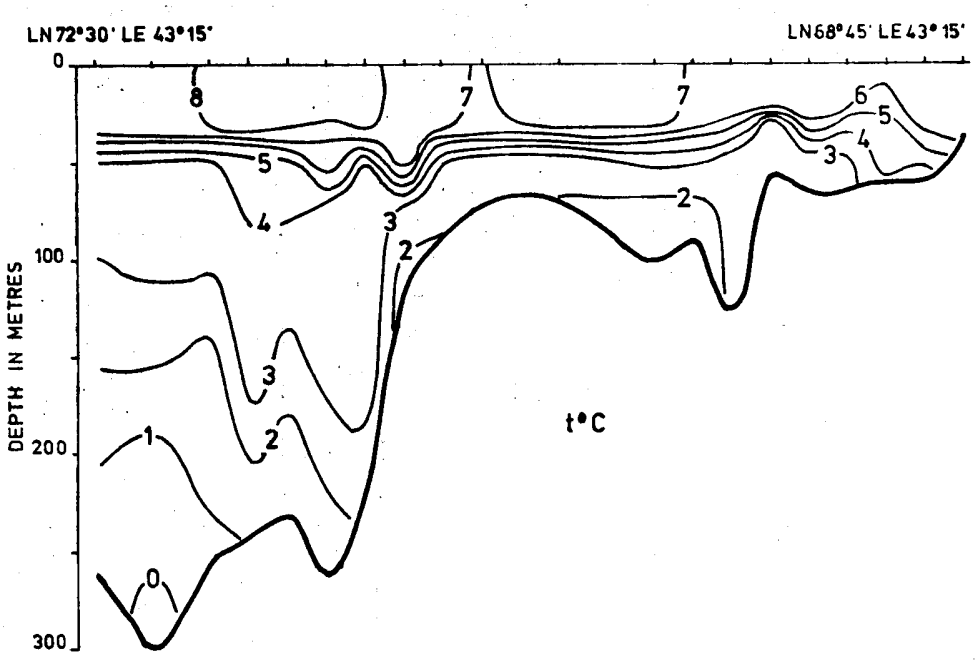


**Fig. 9. Temperature section along the Cape Kanin meridian**

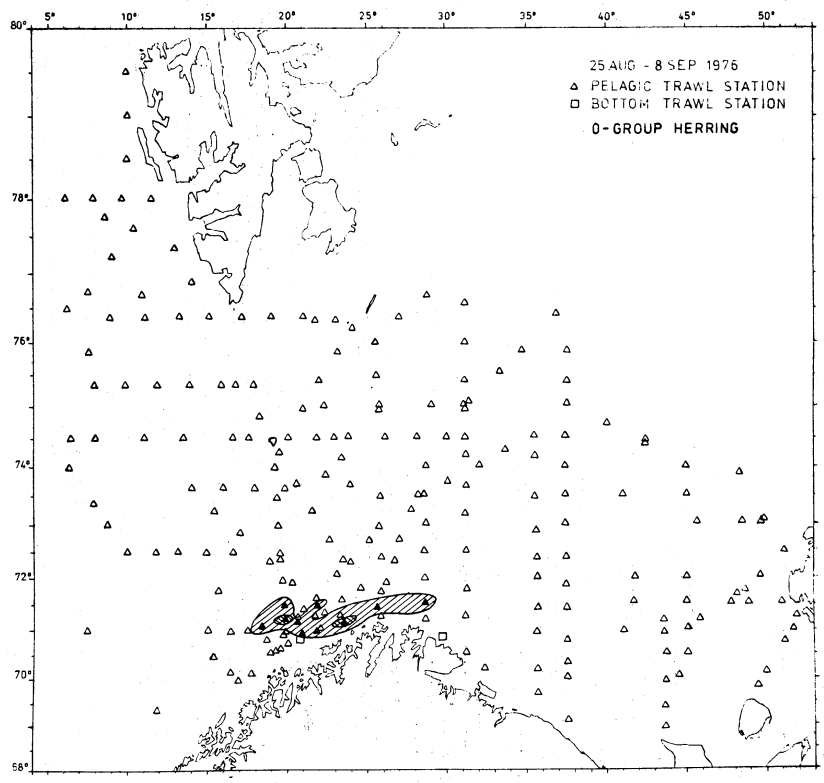


**Fig. 10. Distribution of 0-group herring**

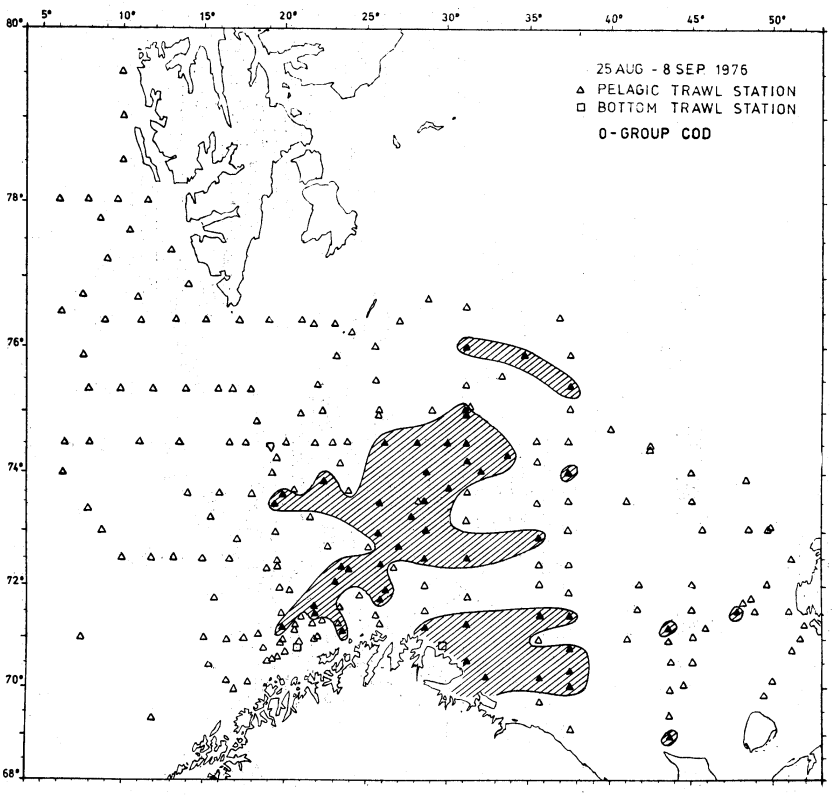


**Fig. 11. Distribution of 0-group cod**

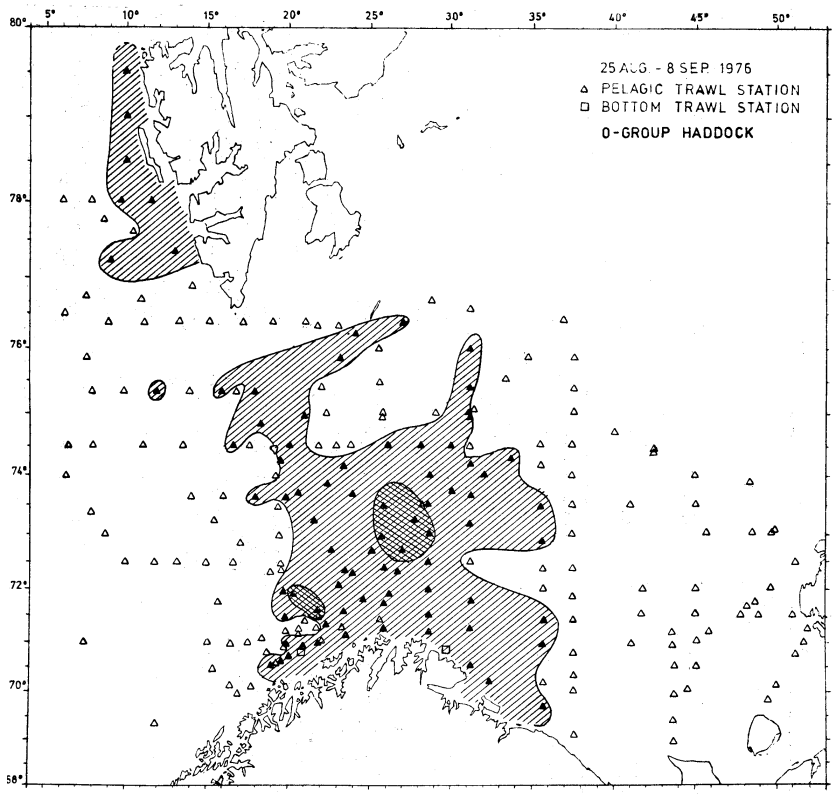


**Fig. 12. Distribution of 0-group haddock**

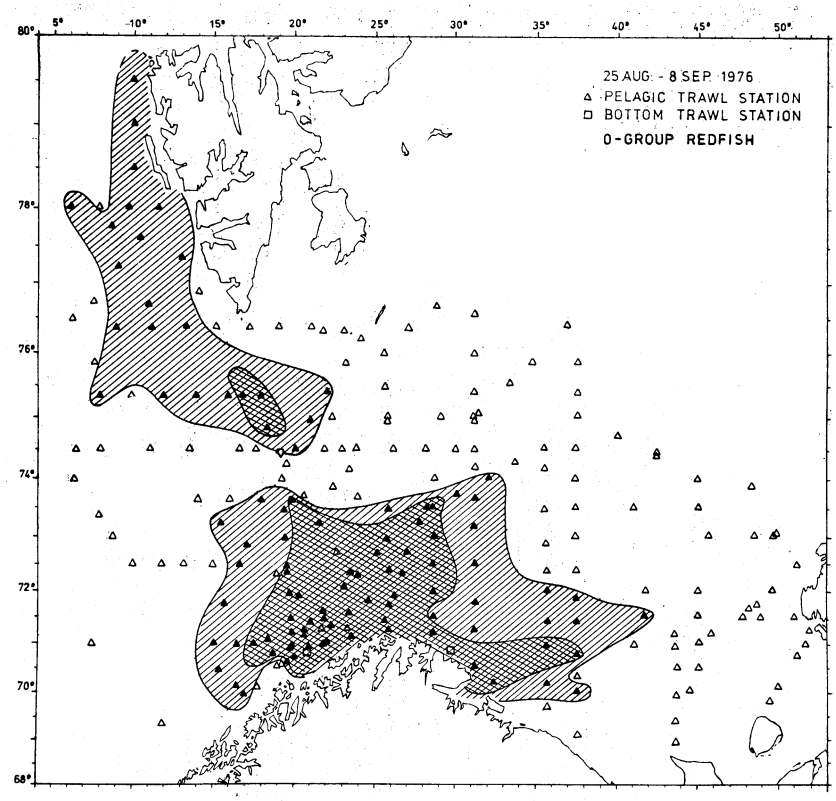


**Fig. 13. Distribution of 0-group redfish**

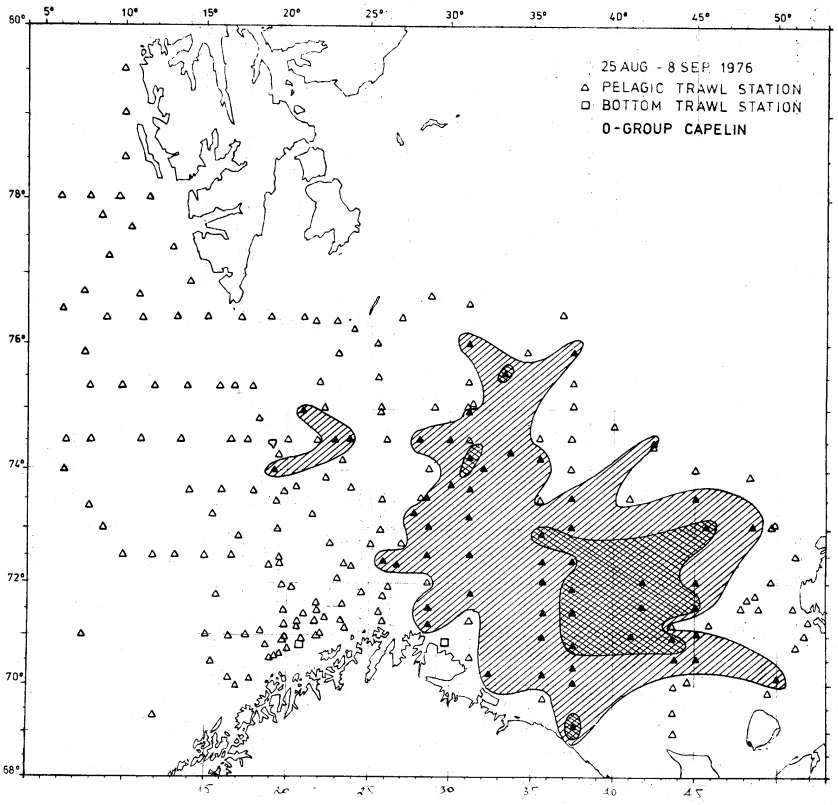


**Fig. 14. Distribution of 0-group capelin**

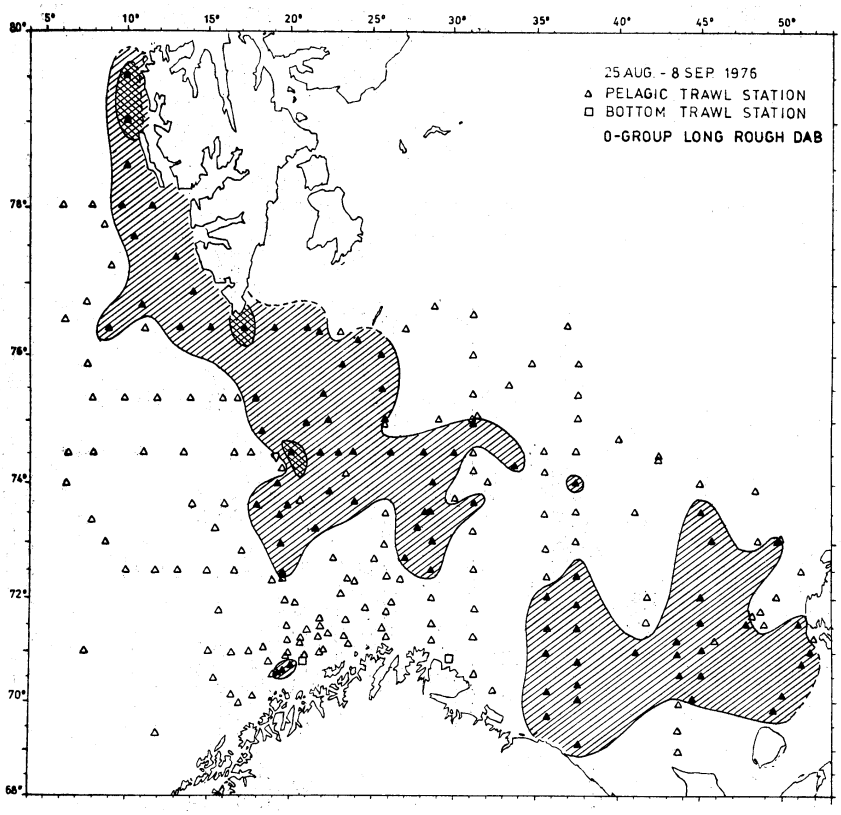


**Fig. 15. Distribution of 0-group long rough dab**

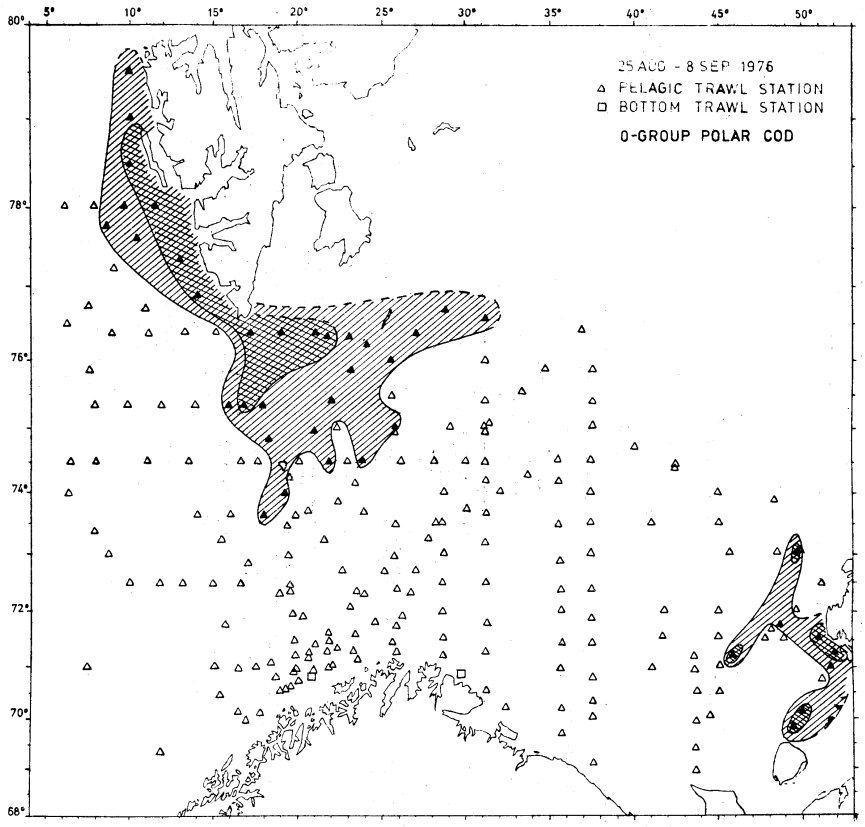


**Fig. 16. Distribution of 0-group polar cod**

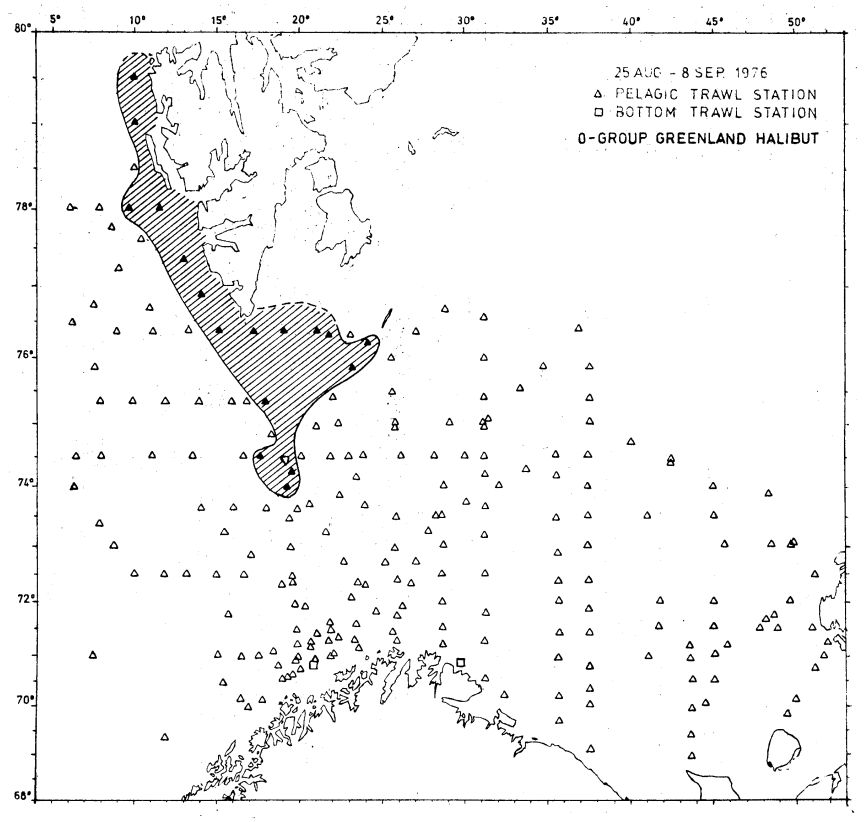


**Fig. 17. Distribution of 0-group Greenland halibut**

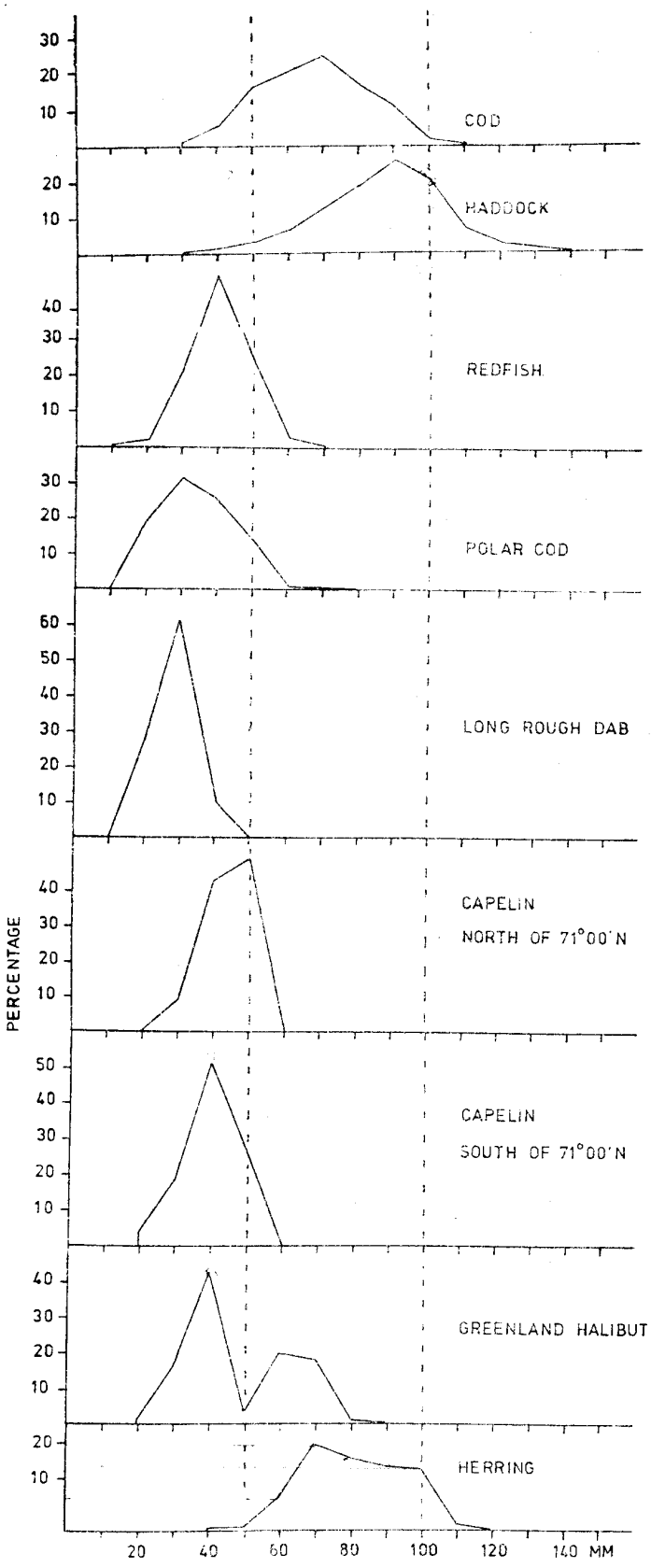


**Fig. 18. Length distribution of 0-group fish**

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-<br>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-<br>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-<br>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-<br>11 September | "Fridtjof Nansen" | PINRO, Murmansk. | I.V. Borkin, Yu.F. Shevtsov, S.V. Rochitelev, N.P. Chebotok. |
| 25 August-<br>11 September | "Poisk" | PINRO, Murmansk. | E.N. Gavrilov, N.A. Isaev, T.P. Yarovoy. |

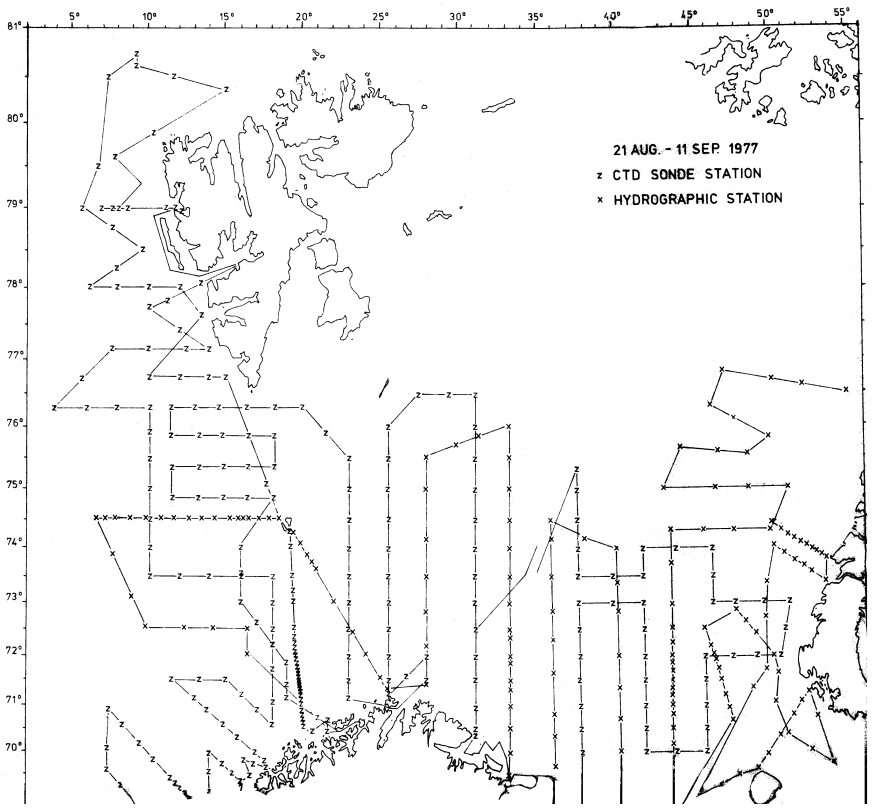


**Fig. 1. Survey tracks of the ships and the grid of hydrographic stations**

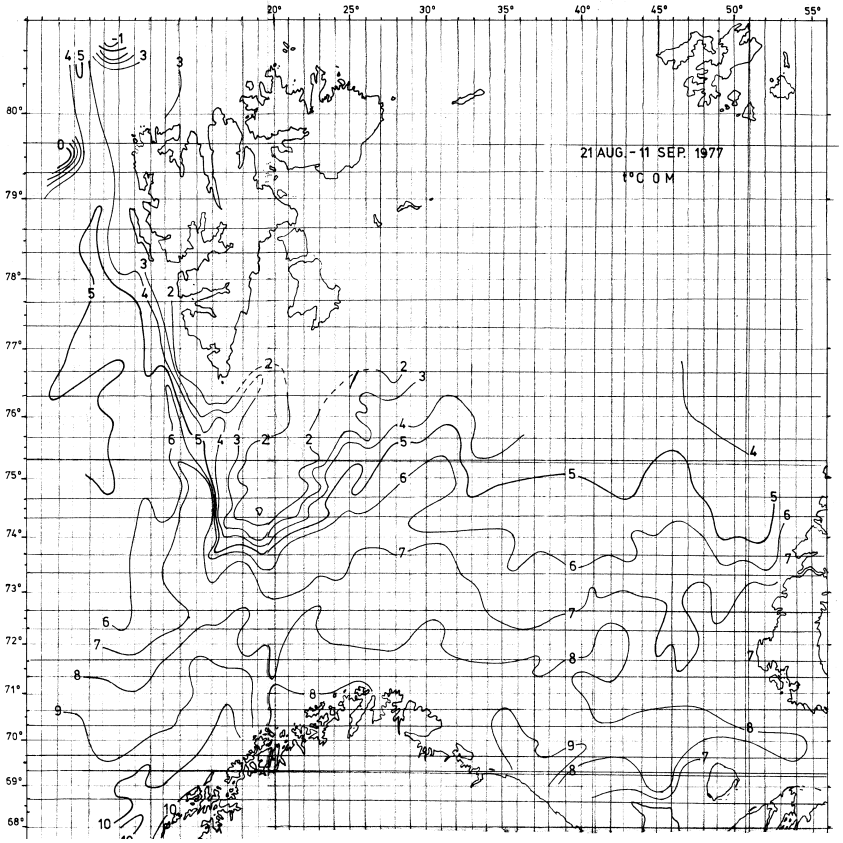


**Fig. 2. Isotherms at 0 m**

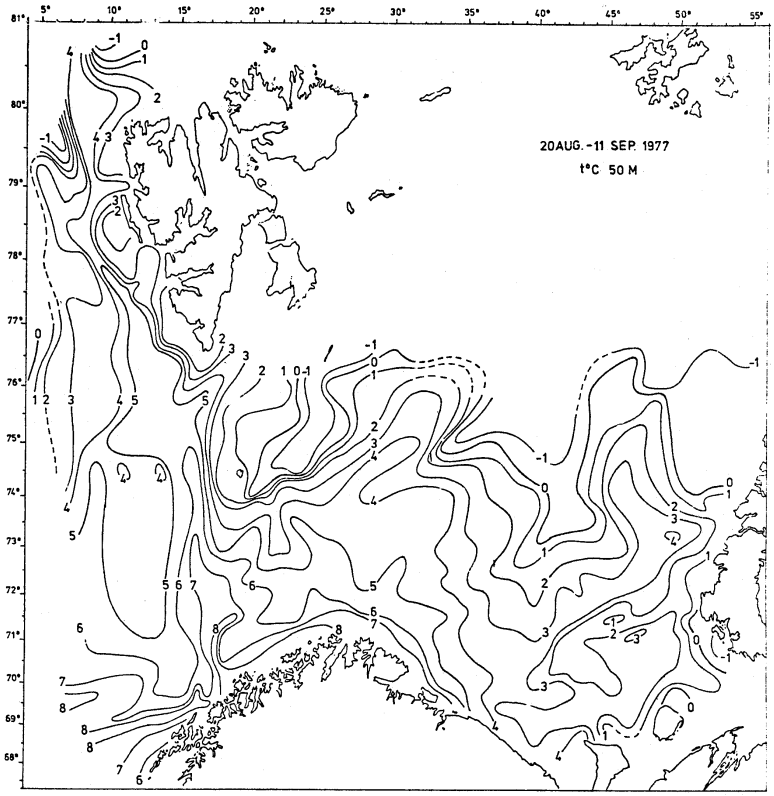


**Fig. 3. Isotherms at 50 m**

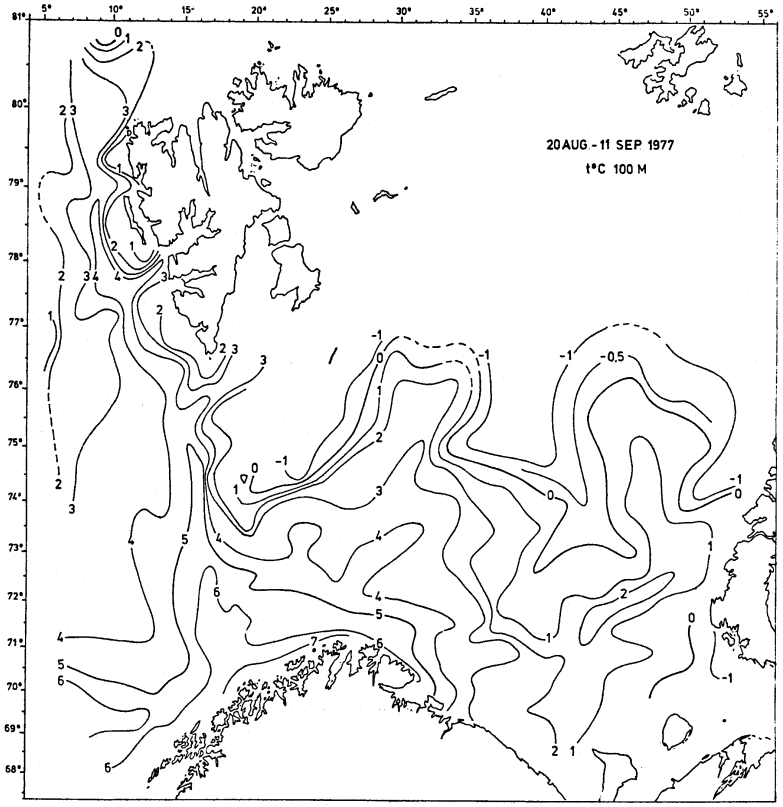


**Fig. 4. Isotherms at 100 m**

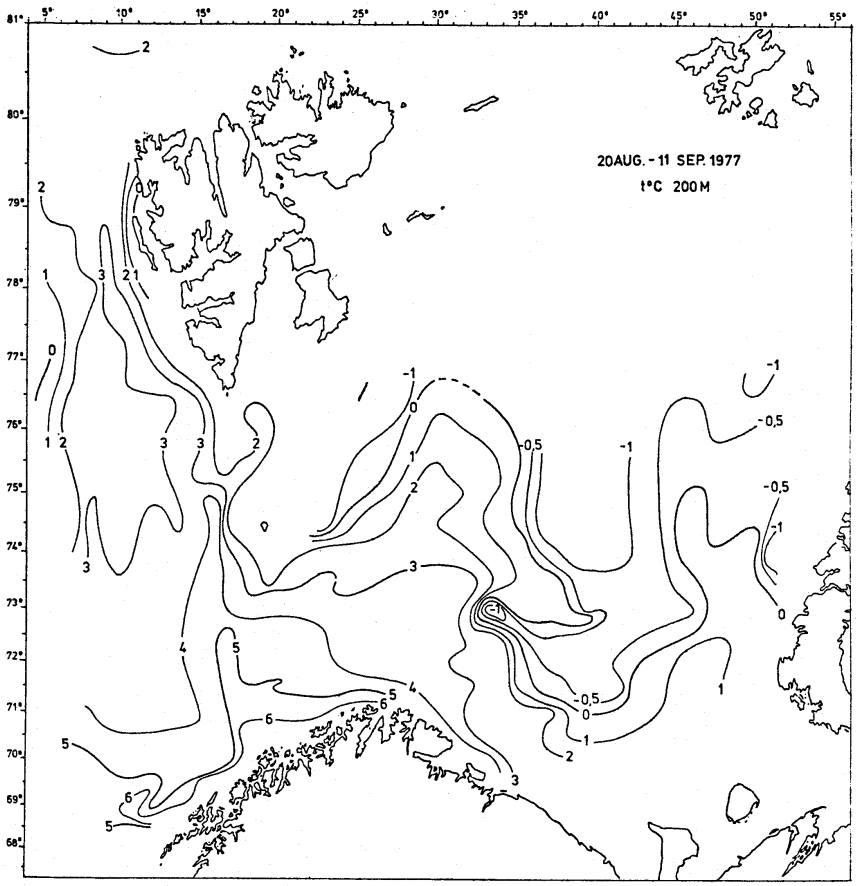


**Fig. 5. Isotherms at 200 m**

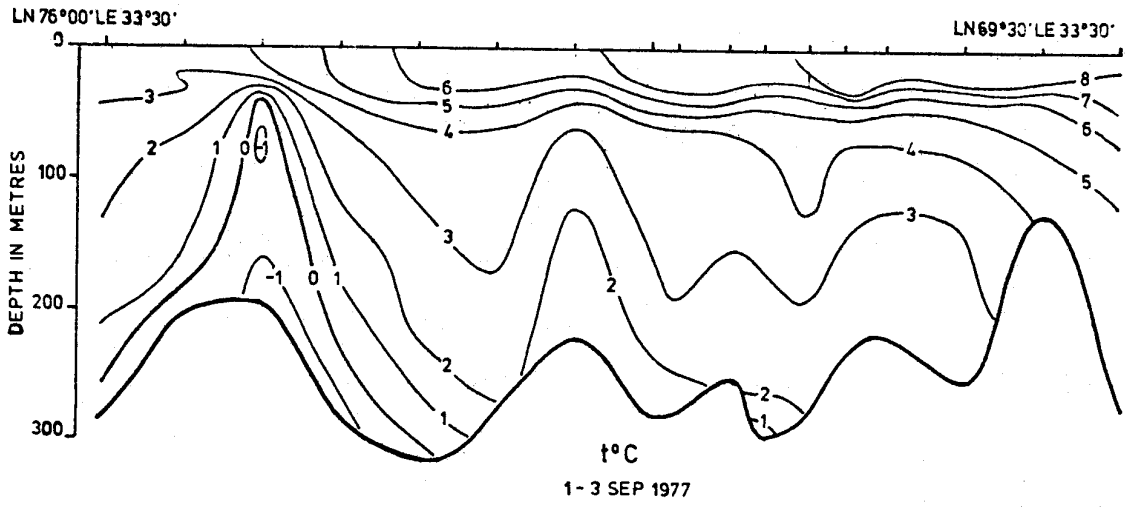


**Fig. 6. Temperature section along the Kola meridian**

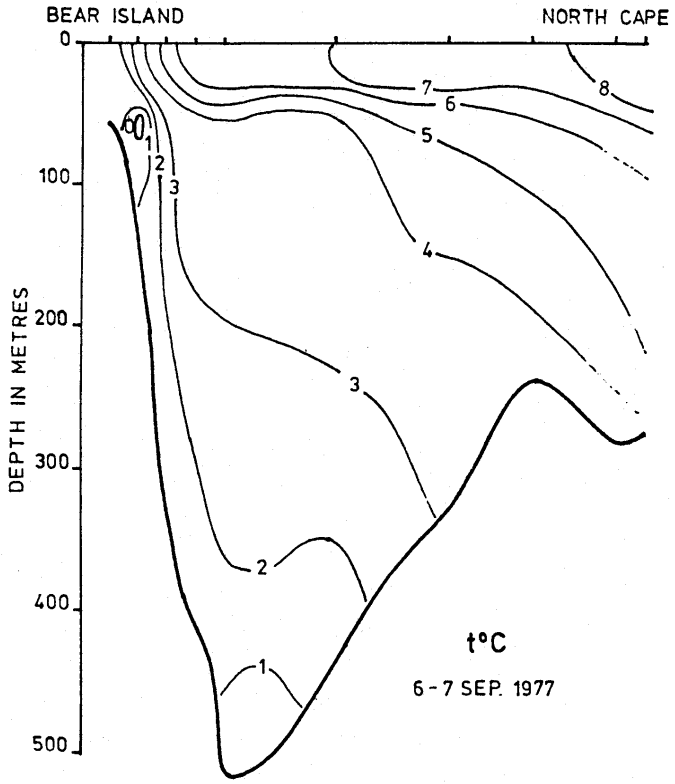


**Fig. 7. Temperature section Bear Island-North Cape**

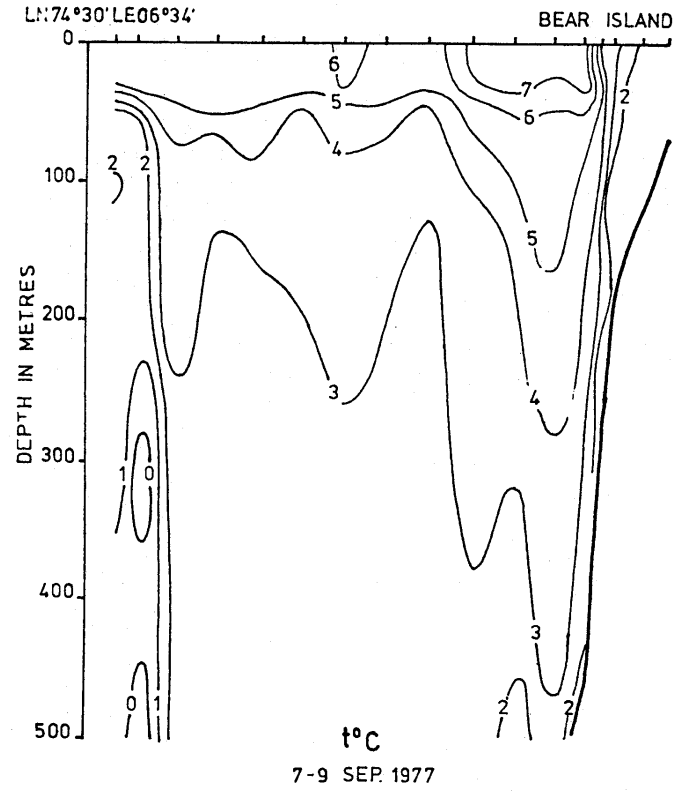


**Fig. 8. Temperature section Bear Island-West**

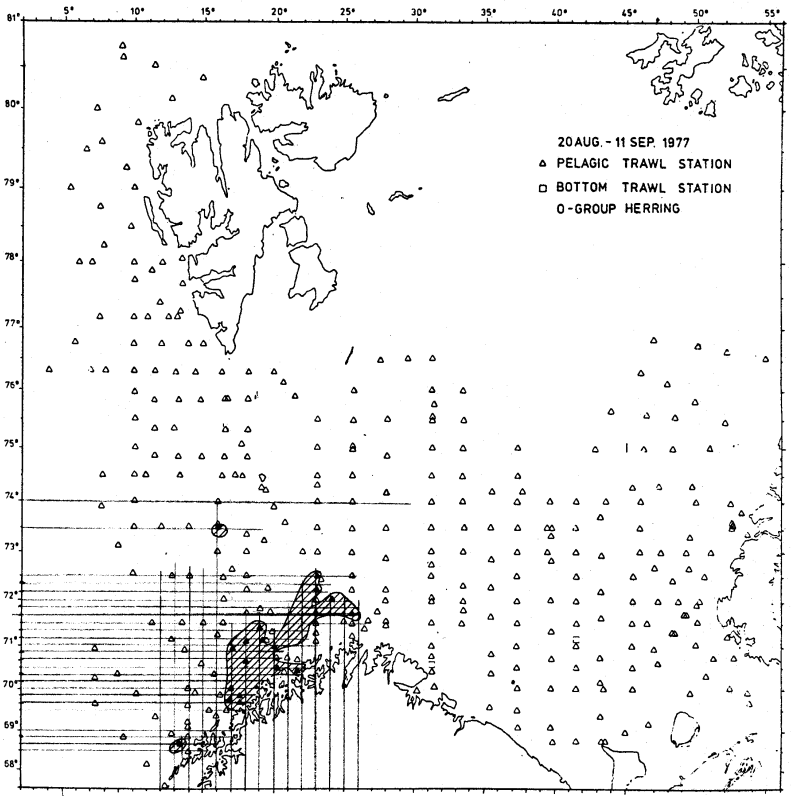


**Fig. 9. Distribution of 0-group herring**

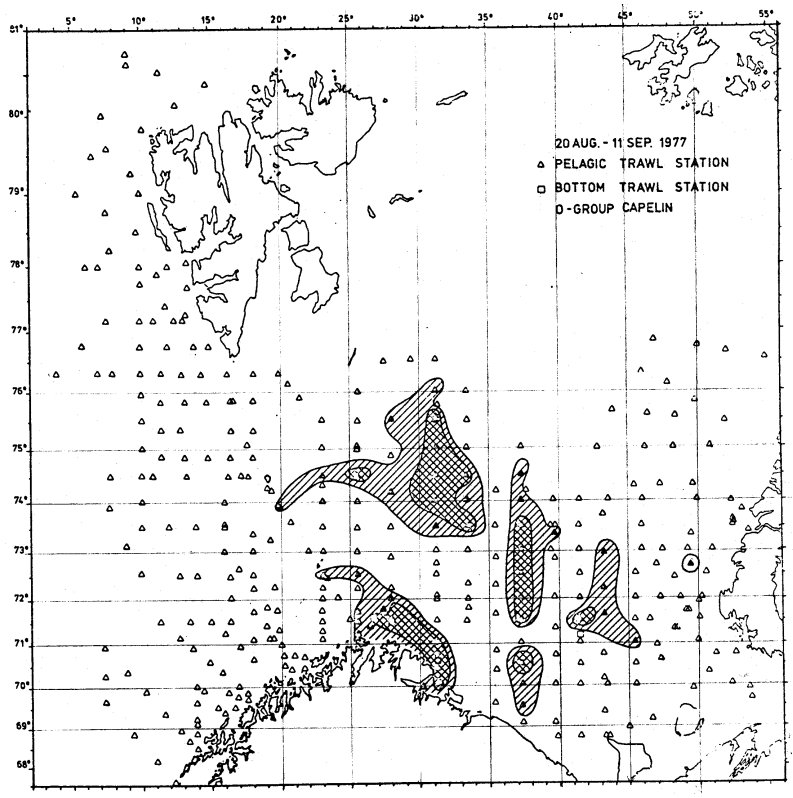


**Fig. 10. Distribution of 0-group capelin**

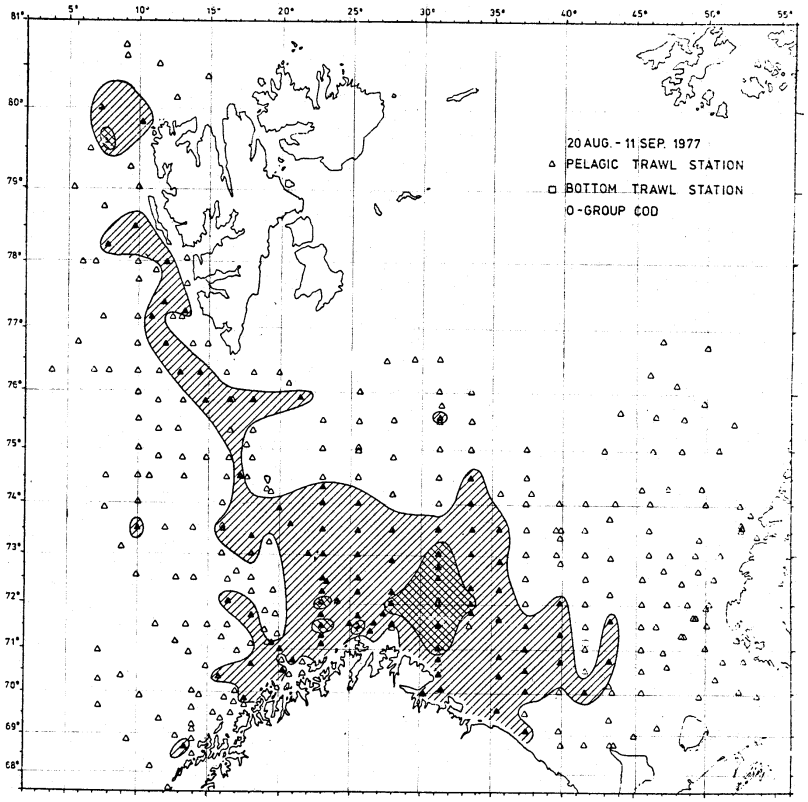


**Fig. 11. Distribution of 0-group cod**

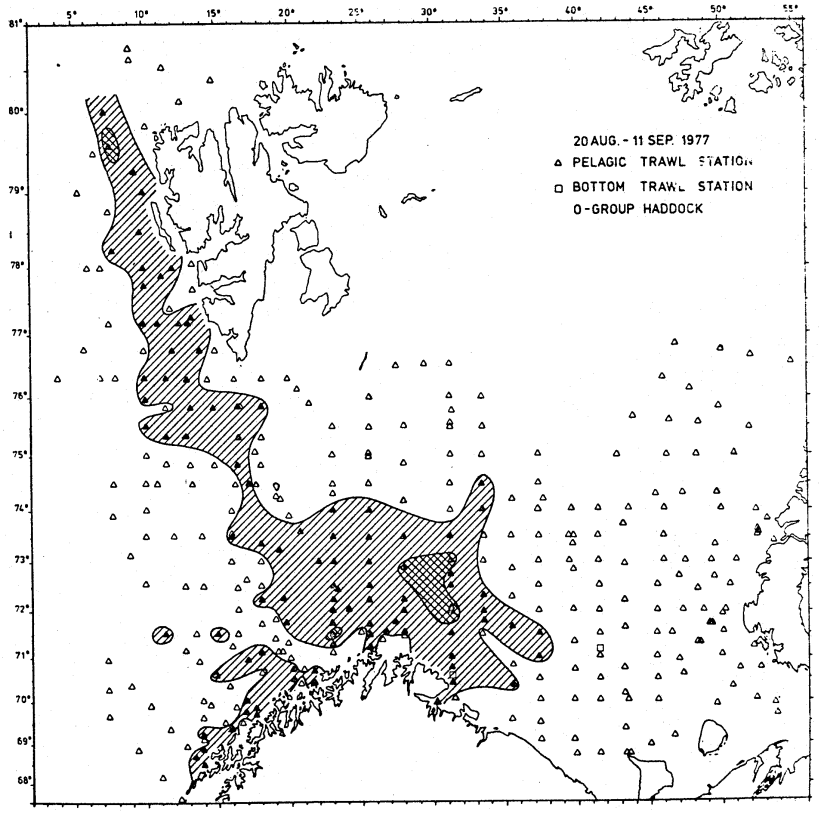


**Fig. 12. Distribution of 0-group haddock**

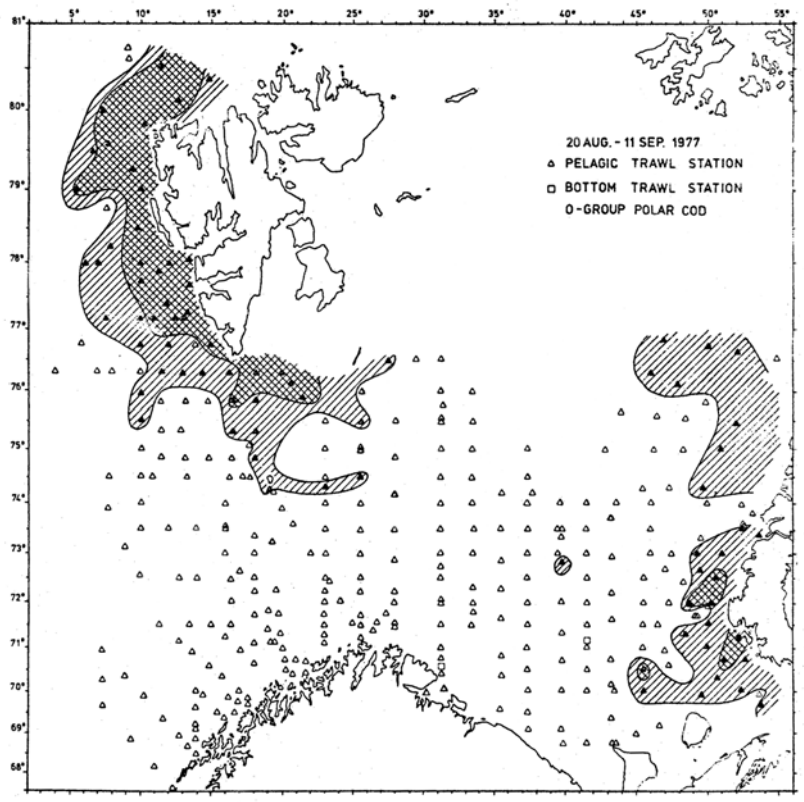


**Fig. 13. Distribution of 0-group polar cod**

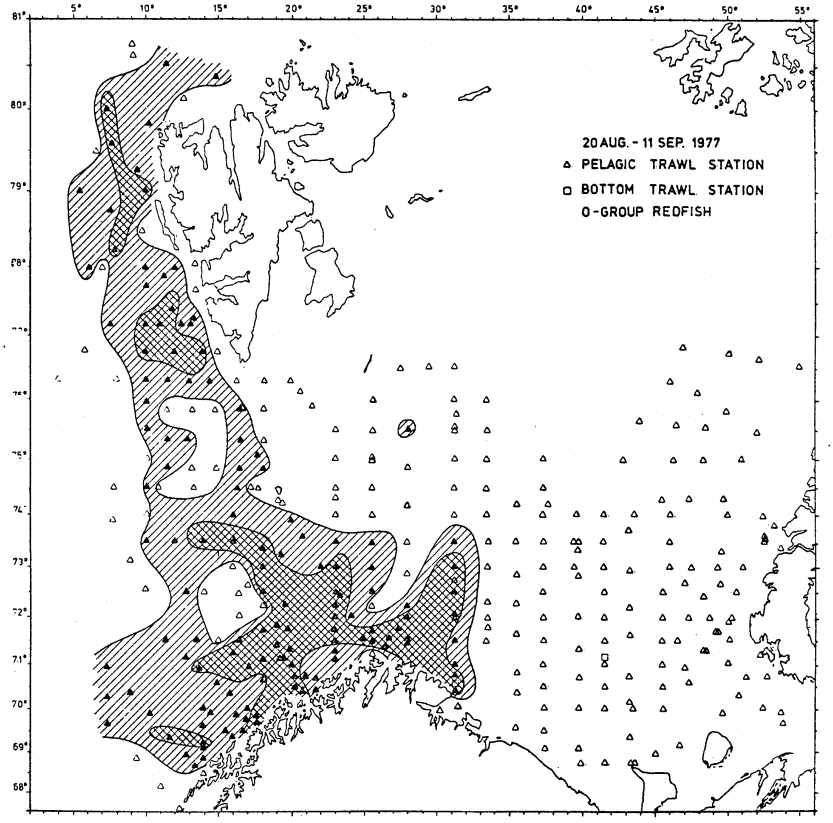


**Fig. 14. Distribution of 0-group redfish**

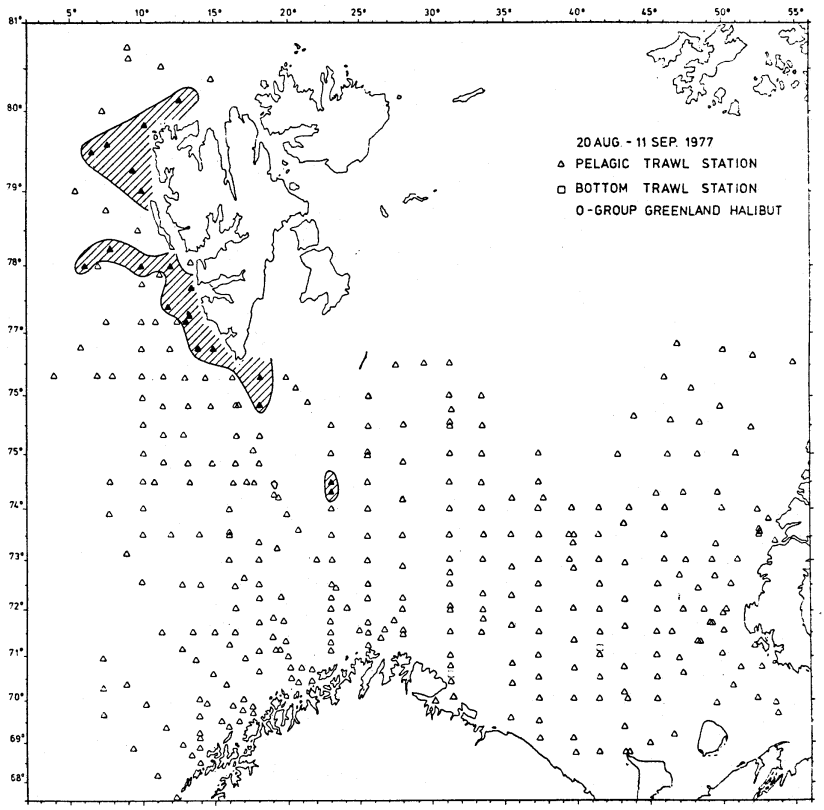


**Fig. 15. Distribution of 0-group Greenland halibut**

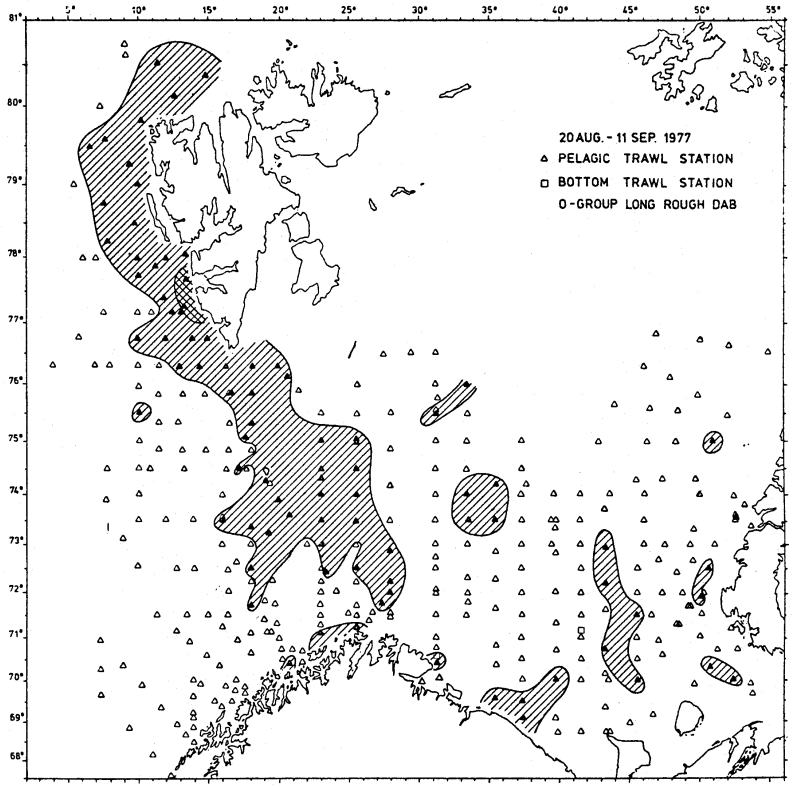


**Fig. 16. Distribution of 0-group long rough dab**

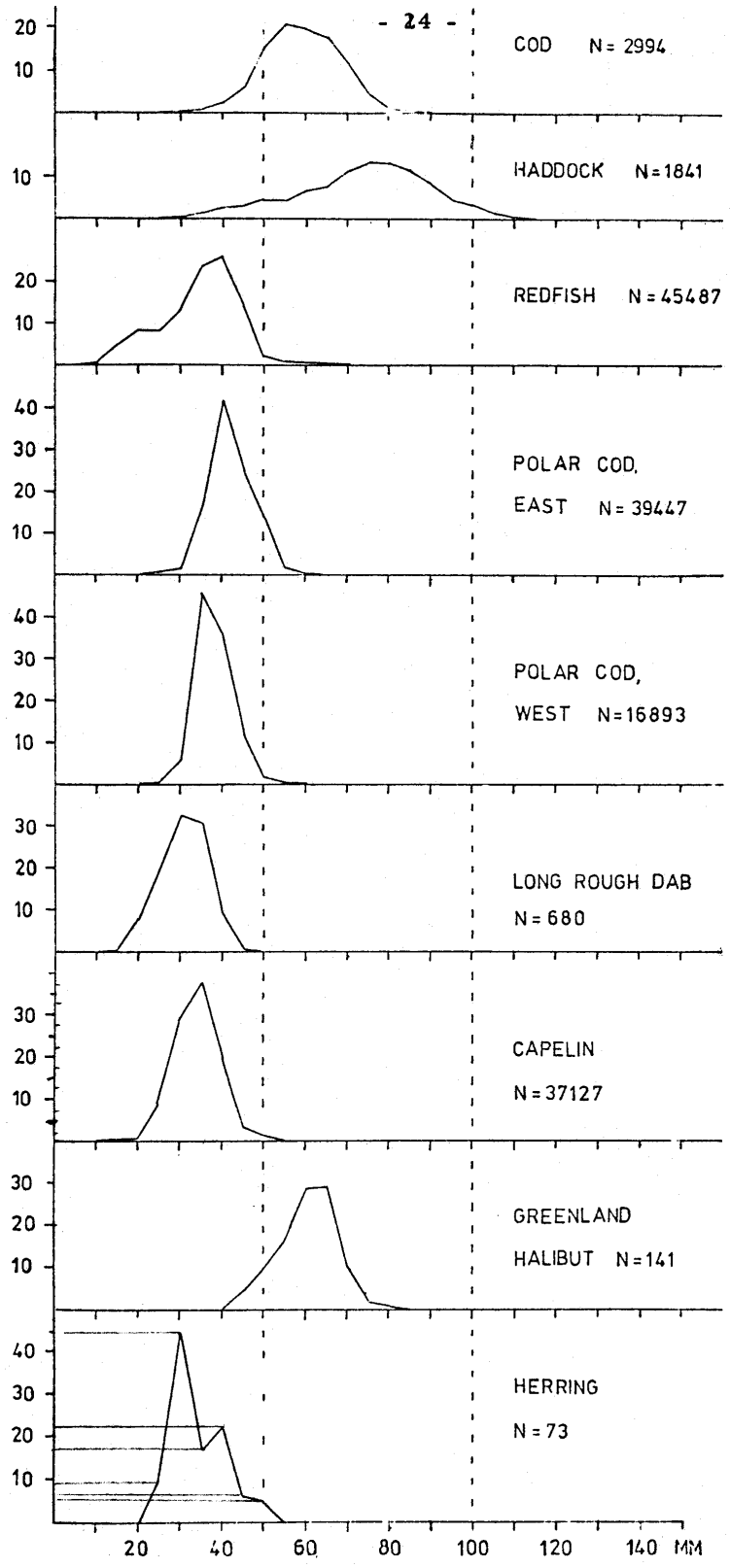


**Fig. 17. Length distribution of 0-group fish**

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-<br>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-<br>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-<br>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-<br>8 September | "Fridtjof Nansen" | Polar Research Institute ofMarine Fisheries and Oceanography, Murmansk. | S.V. Rochitelev, V.F. Terzlev. |

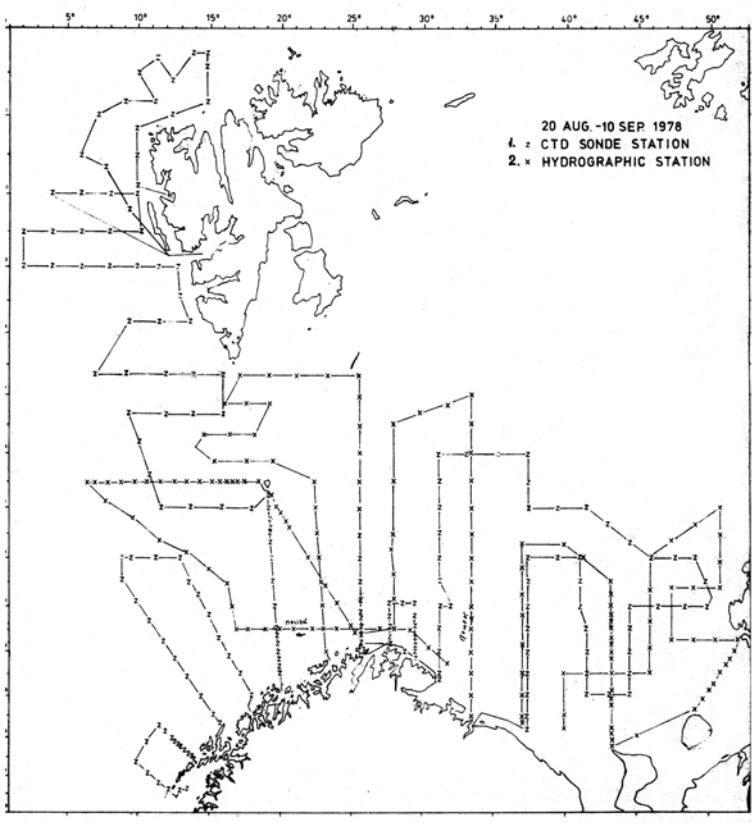


**Fig. 1. Survey tracks of the ships and the grid of hydrographic stations**

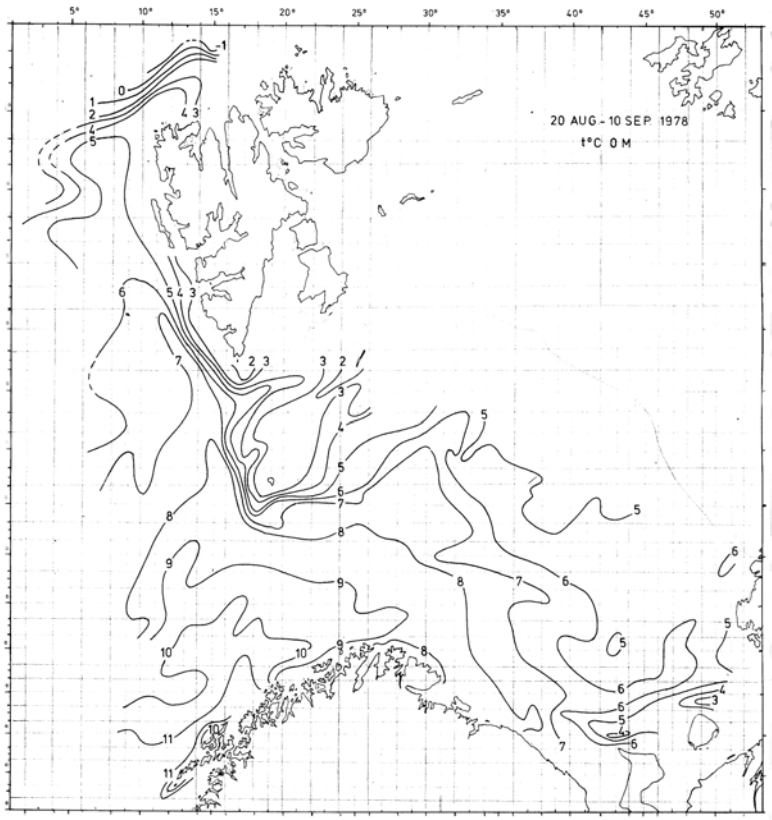


**Fig. 2. Isotherms at 0 m**

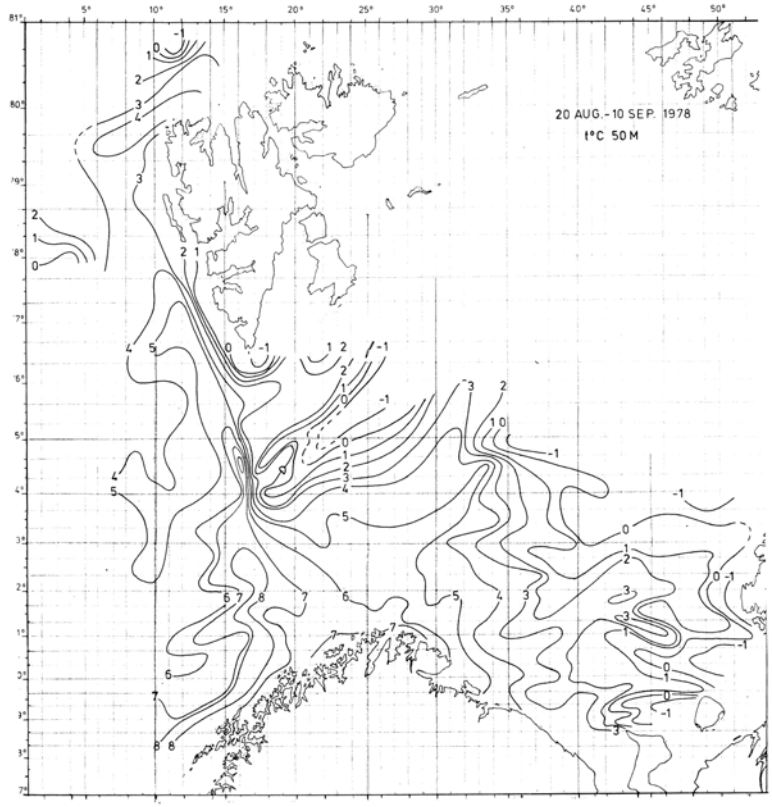


**Fig. 3. Isotherms at 50 m**

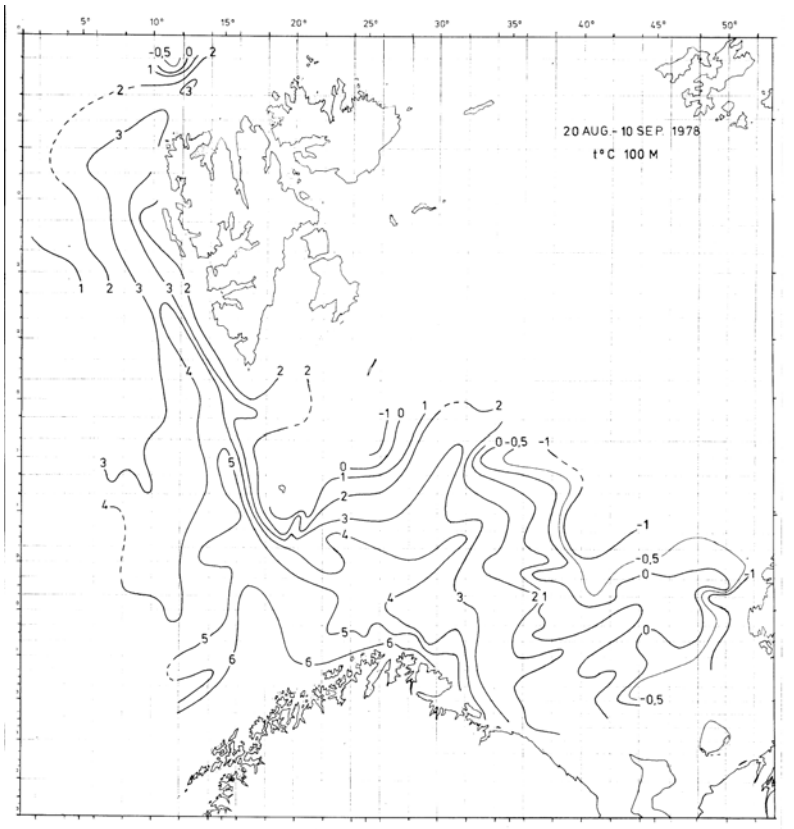


**Fig. 4. Isotherms at 100 m**

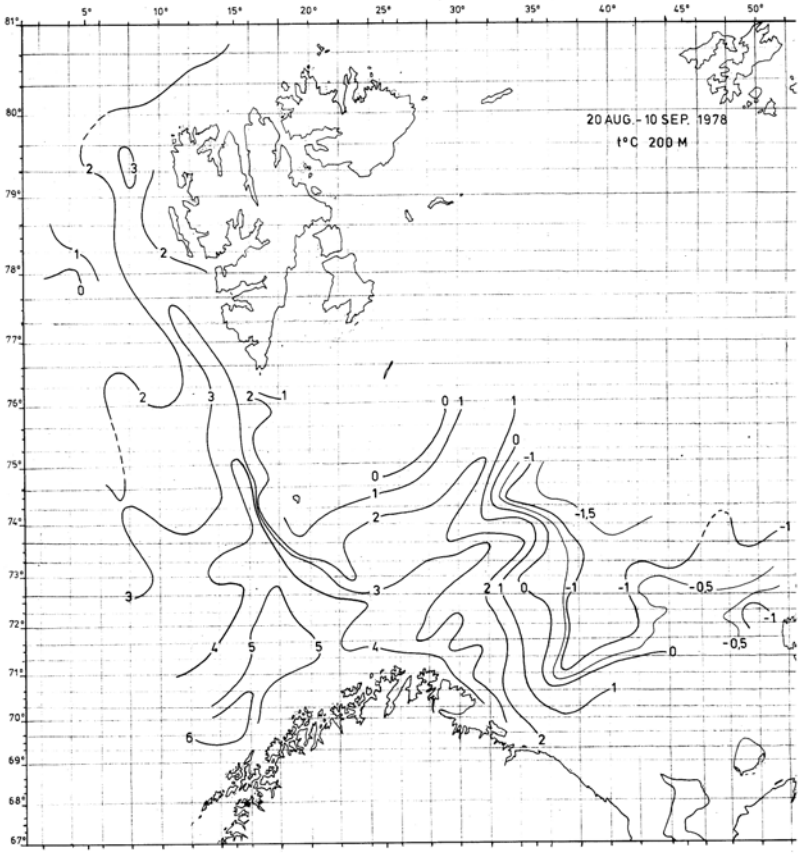


**Fig. 5. Isotherms at 200 m**

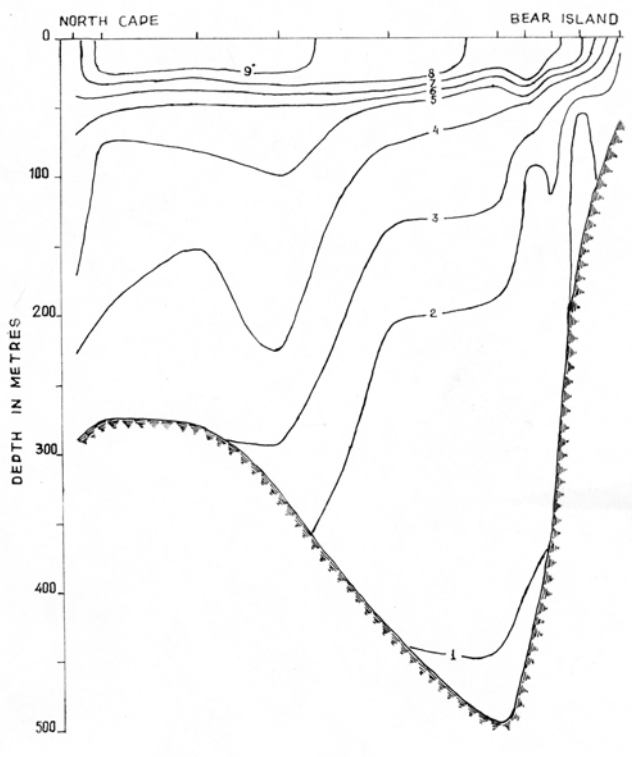


**Fig. 6. Temperature section Bear Island-North Cape**

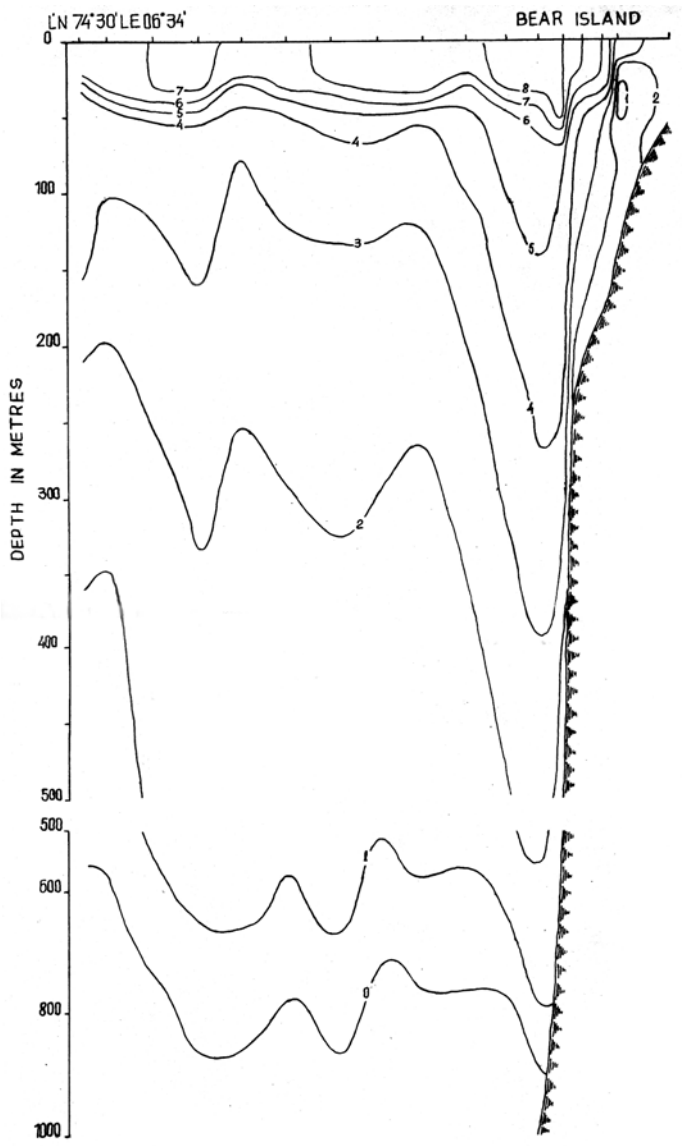


**Fig. 7. Temperature section Bear Island-West**

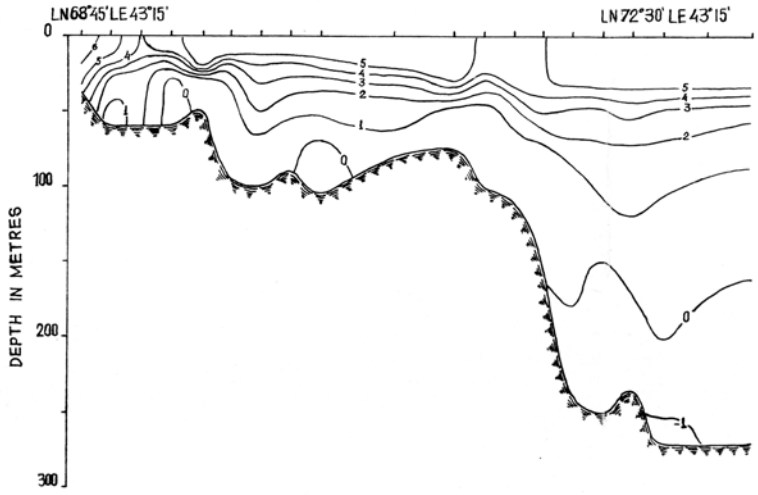


**Fig. 8. Temperature section along the Kola meridian**

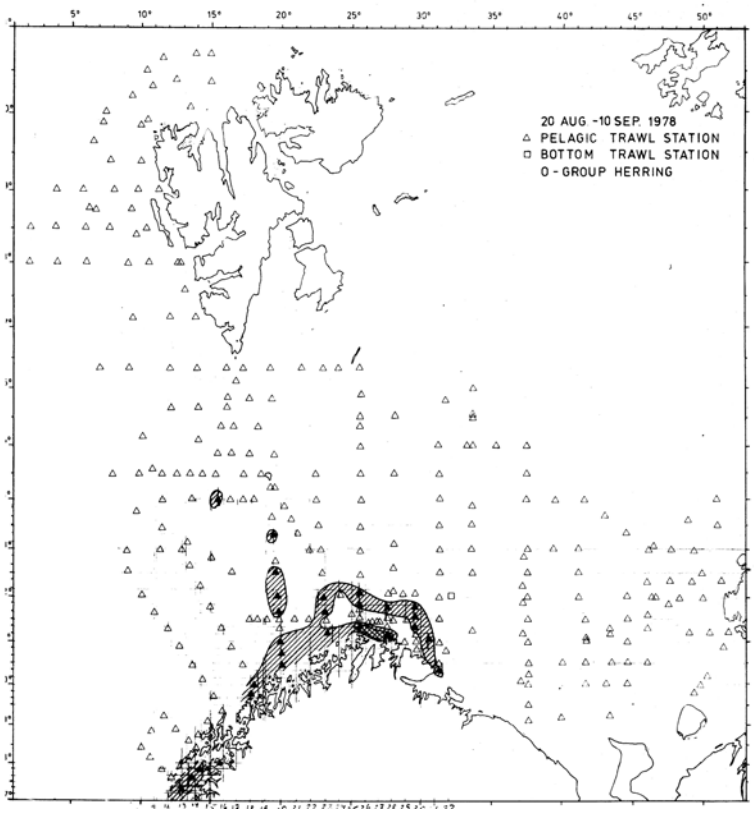


**Fig. 9. Temperature section Cape Kanin-North**

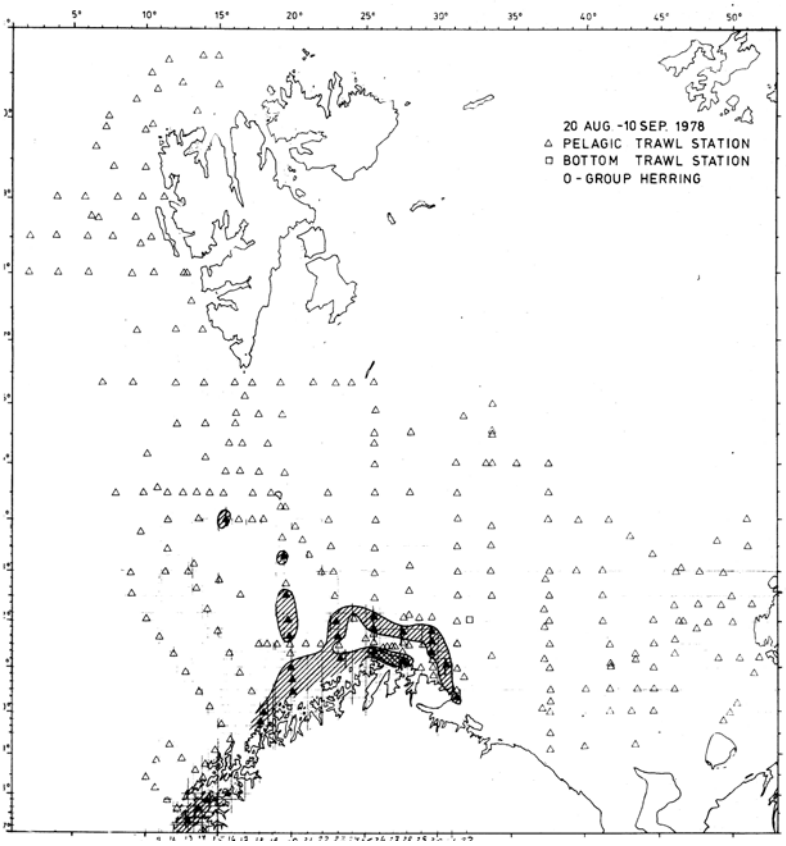


**Fig. 10. Distribution of 0-group herring**

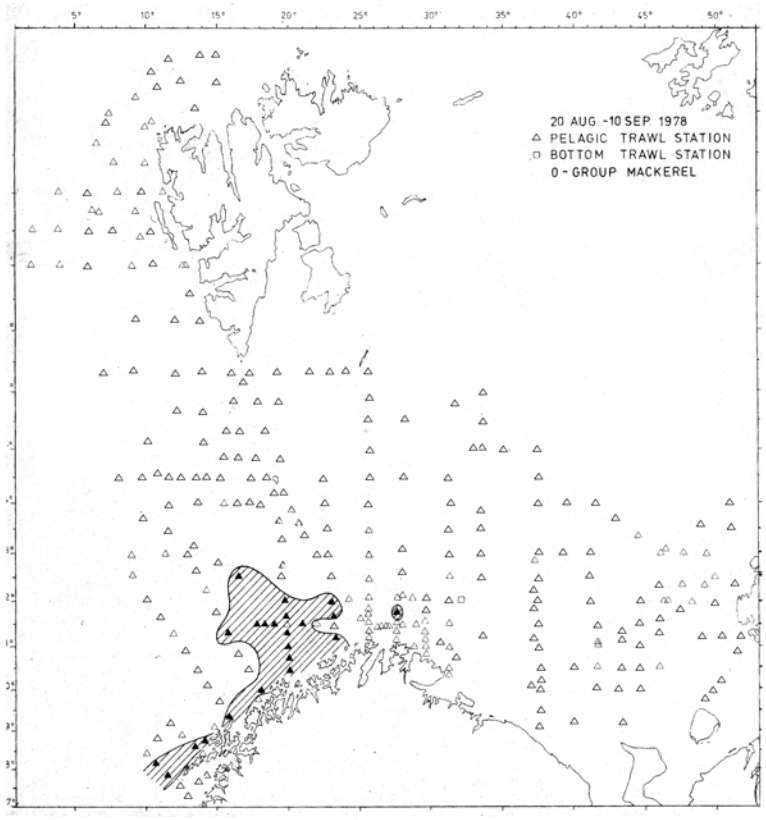


**Fig. 11. Distribution of 0-group mackerel**

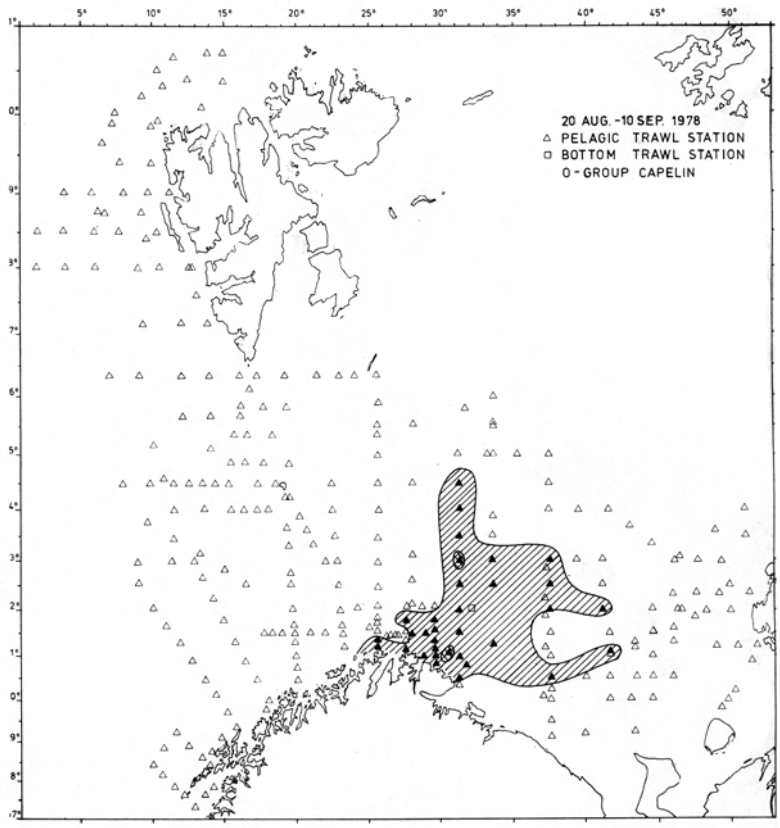


**Fig. 12. Distribution of 0-group capelin**

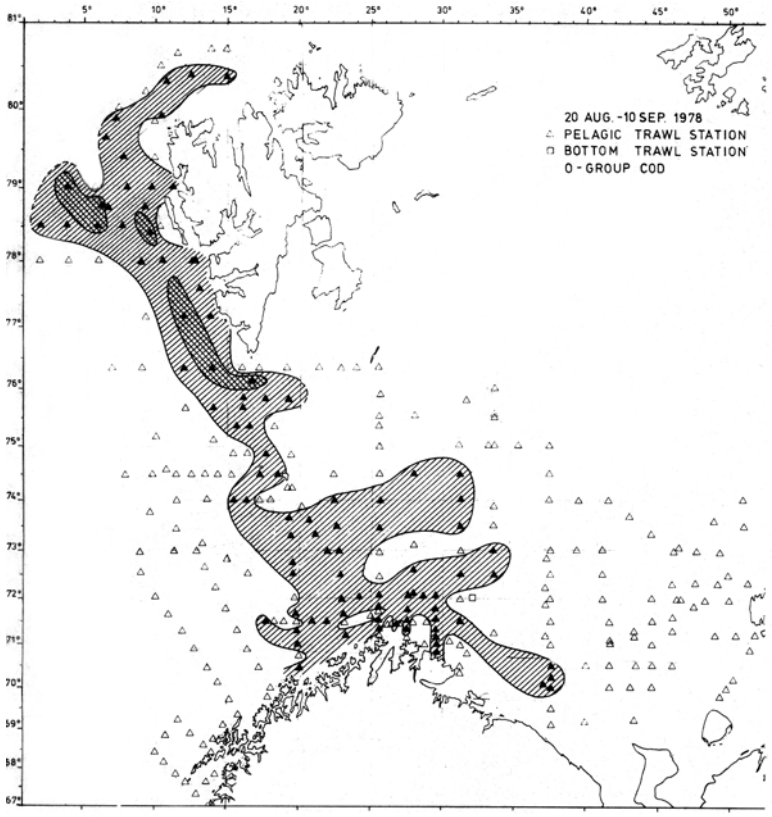


**Fig. 13. Distribution of 0-group cod**

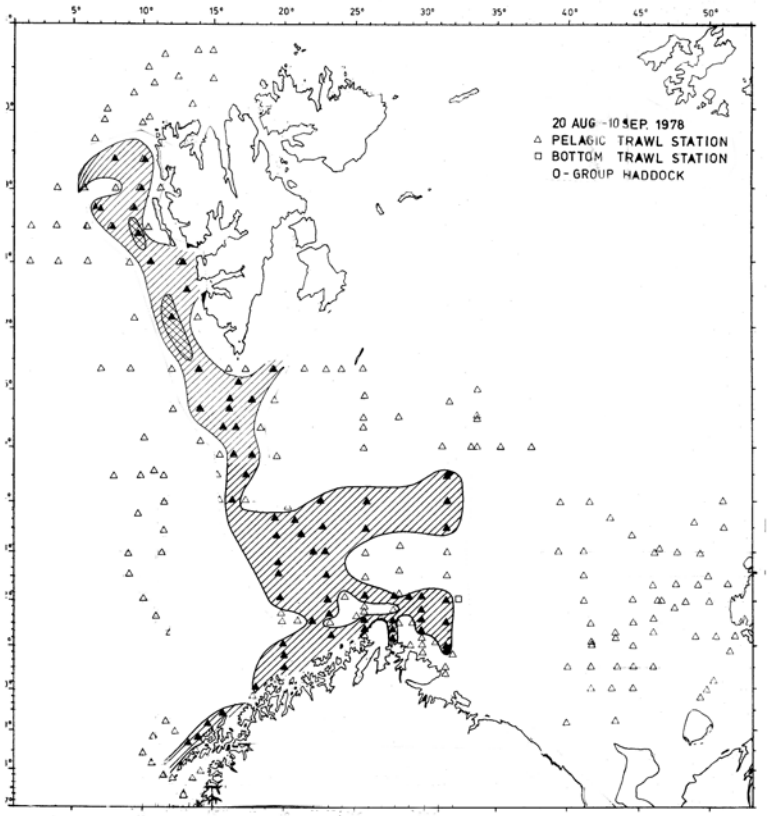


**Fig. 14. Distribution of 0-group haddock**

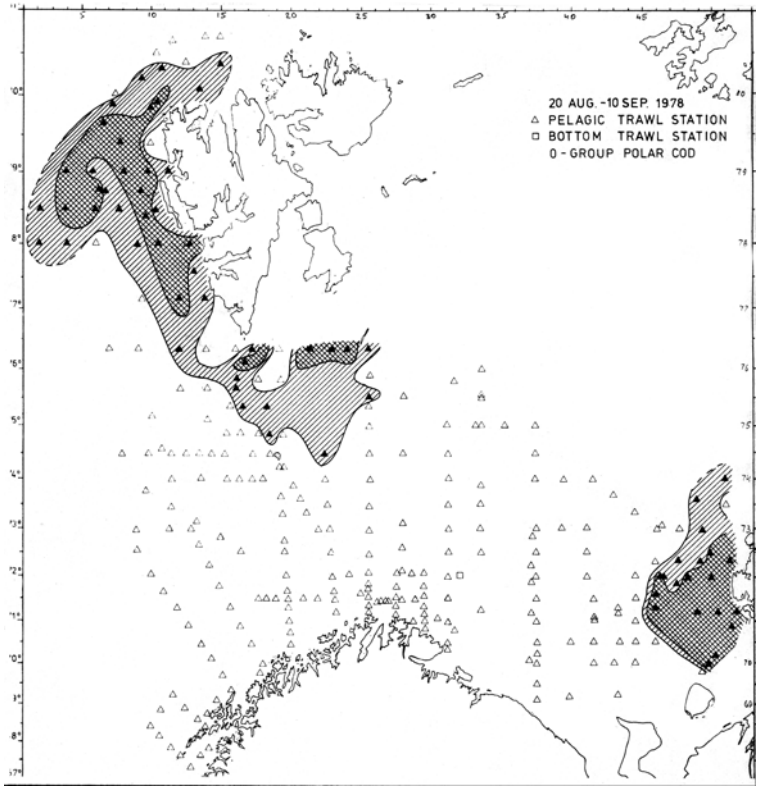


**Fig. 15. Distribution of 0-group polar cod**

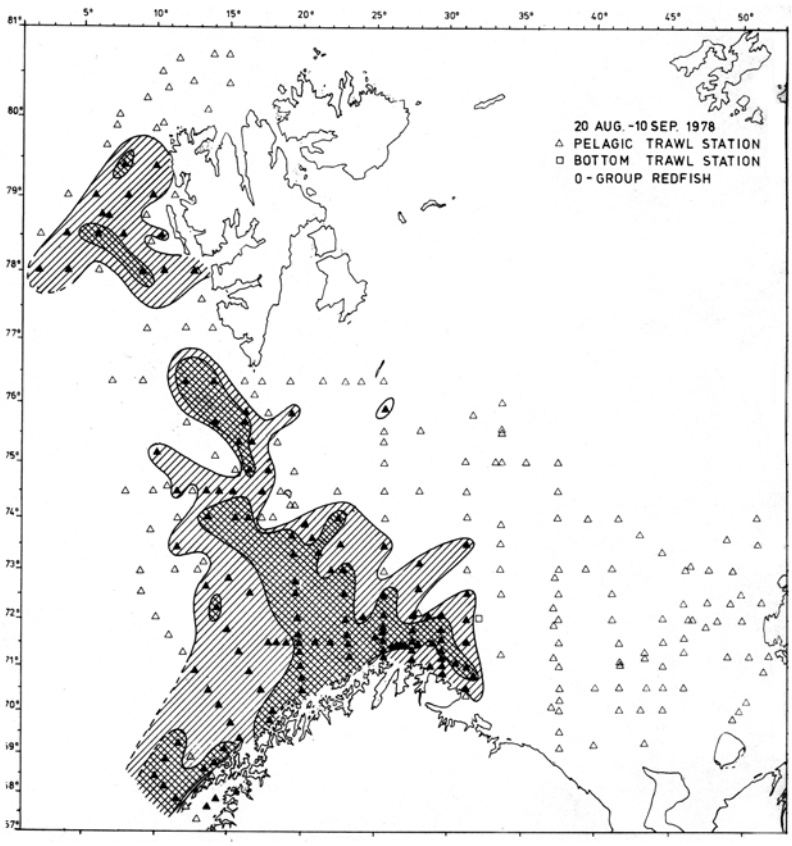


**Fig. 16. Distribution of 0-group redfish**

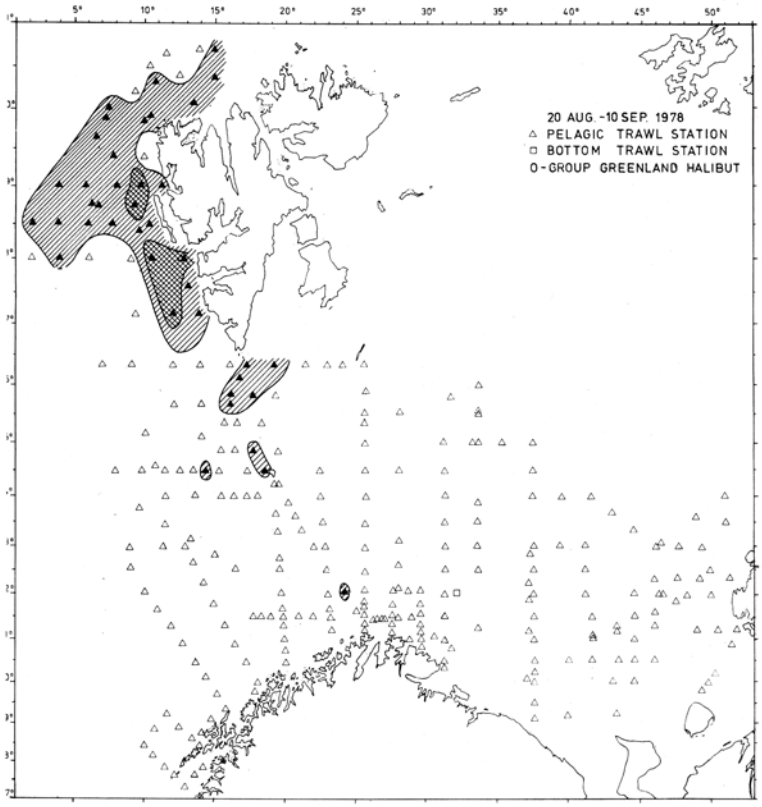


**Fig. 17. Distribution of 0-group Greenland halibut**

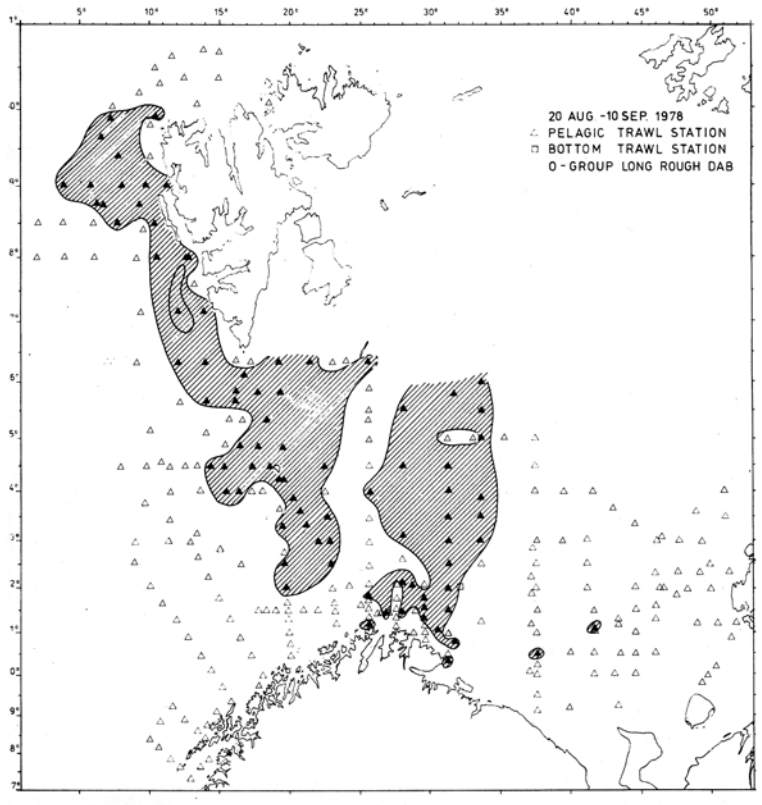


**Fig. 18. Distribution of 0-group long rough dab**