

**DATA ON THE 1983 YEAR CLASS OF NORWEGIAN SPRING SPAWNING HERRING FROM  
THE PERIOD JUNE 1985-AUGUST 1986**

by

Ingolf Røttingen

Institute of Marine Research  
P.O. Box 1870, N-5011 Nordnes  
Bergen, Norway

ABSTRACT

This paper considers the distribution, growth and migration of the 1983 year class of Norwegian spring spawning herring. There are, at present, two geographical components of this year class, one component with a nursery area in Norwegian coastal waters, and one in the Barents Sea. There are different growth rates between and within these components.

INTRODUCTION

Prior reports to the ICES Statutory Meeting by the present author (Røttingen 1984 and 1985a) have given data on distribution, growth and measured acoustic abundance for the 1983 year class of Norwegian spring spawning herring for the period April 1983 to May 1985. The aim of the present paper is to update this information to August 1986.

METHODS

The main part of the data on distribution of the 1983 year class of herring have been collected during acoustic research vessel surveys in the Barents sea and on the Norwegian coast. The Norwegian research vessels are equipped with a 38 kHz echo sounder and digital echo integrator. To identify the recordings and to collect the biological samples, a "Fotø"-herring trawl (64 meshes with a meshsize of 3200 mm in the opening) has been applied in open sea areas. In the coastal areas, a smaller commercial capelin trawl (Harstad trawl, 1600 meshes with a meshsize of 100mm in the opening) has been used. In addition, since 1985 an increasing amount of biological data on the 1983 year class have become available from the commercial fishery and from the tagging programme on Norwegian spring spawning herring.

## DISTRIBUTION AND MIGRATION

Fig. 1 shows a map which includes the geographical names which are mentioned in the text.

### *Barents Sea and Norwegian Sea*

September 1985: Fig. 3 shows the distribution of the 1983 year class in this area in September 1985 (Gjøsæter og Hamre 1985). The distribution in May 1985 (Hamre og Dommasnes 1985) is included for comparison (Fig. 2). It can be seen that during the summer season of 1985, there was not any major change in the distribution area in the Barents sea. During daytime the herring were mostly distributed in dense schools near the surface. But there were also recorded schools of herring down to 100-150 m depth. During nighttime the schools were dissolved and the herring was recorded in scattering layers. Some 0-group herring and juvenile cod and haddock were recorded together with the II-group herring.

November 1985: Fig. 4 shows the distribution of the 1983 year class in November 1985. (Røttingen 1985b) Only the area west of 41° E was surveyed during this cruise with R/V "G O Sars". In the area between 30° E and 35° E there is a substantial difference in geographical distribution between September and November 1985, i.e. a time interval of 2 months. The herring in the eastern part of the distribution area were mostly located as a scattering layer in the upper 50m of the water masses.

January 1986: Fig. 5 shows the distribution of III-group herring in January 1986 (Gjøsæter og Hamre 1986). This is the most eastern distribution of the 1983 year class that has been observed since June 1984. The westward migration that was observed in spring 1985 was followed by an eastward migration in autumn 1985, and consequently the wintering areas in 1985 and 1986 were approximately the same. From about 38° E and eastward, the herring was recorded as a "carpet" near the bottom. At some locations, i.e. at approximately 72° N, 46° E, more dense concentrations appeared as "columns" raising up to 50 m from the sea bed. West of 38° E, some very large schools of herring were detected, particularly in the area north and east of the Skolpen Bank.

May 1986: Fig. 6 gives the distribution in May 1986. (Gjøsæter og Toresen 1986) There was now an extended east-west distribution in a "belt" of approximately 40-50 nautical miles width. The herring was mostly recorded as a scattering layer in 150-200m depth. The density of the herring is much lower than recorded during previous surveys.

July-August 1986: In this period there have been several observations of herring of the 1983 year class from both research and fishing vessels. The location of these observations are plotted in Fig. 7. The herring was recorded both as schools seen on the sea surface, and as scattering layers down to 200 meters depth. The length distributions of the herring has been reported to 23-27 cm.

### Norwegian coastal areas

In November 1984 there were recorded considerable amounts of I-group herring in the fjords of Northern Norway, especially north of 69°N. (Røttingen, 1985a). There were also recorded some II-group herring in these areas in November 1985, but by this time most of the herring of the 1983 year class had migrated from this area.

South of Lofoten (68°N) no herring of the 1983 year class were found in the fjord areas in November 1985, all herring of this year class had migrated from the fjords. During a tagging survey in April 1986, schools consisting of only 1983 year class of herring were recorded in the outer coastal areas. Fig. 8 gives the distribution of the 1983 year class as 0-group and as 3 years old in the coastal areas between 66°N and 67°N.

### ABUNDANCE

Abundance estimates of herring of the 1983 year class have been obtained by applying the capelin "conversion constant" to convert integrator values to number of herring. The following target strength-length relationship has been applied (Dommasnes and Røttingen 1985):

$$TS = 19.1 \log L - 74.0$$

L = Length of herring.

The abundance estimates for herring of the 1983 year class in the Barents Sea are given in the table below:

Time	Number of herring (Nx10 <sup>-9</sup> )	Weight (thousand tonnes)
September 1985	23.3	1495
January 1986	16.1	814
May 1986	5.9	235

The conditions for acoustic abundance estimation of herring in the Barents Sea have usually not been very good. The main problem in September 1985 was small dense schools near the surface (Gjøsæter og Hamre 1985), and in January 1986 the herring was recorded on the sea bed. (Gjøsæter og Hamre 1986). In May 1986, however, the herring was recorded as a scattering layer in 150-200m depth, and this, together with good weather conditions, should give good conditions for acoustic abundance estimation. The reason for the unexpected low estimate in May 1986 is not known, but one or more of the following factors may contribute:

1) Emmigration from the area.  
Herring of the 1983 year class have now been observed in the eastern part of the Norwegian sea (Fig.7), but it is at present not known to what degree this herring "originates" from the Barents Sea.

2) Underestimate due to threshold problems in the integration system. Copper sphere calibration in spring and summer 1986 show stability of the integration system of R/V "Eldjarn", but an intercalibration with R/V "G O Sars" 30.7-1986 indicates a higher threshold in the integration system of R/V "Eldjarn".

### 3) Increased total mortality.

No directed fishery on the 1983 year class in the Barents Sea has been conducted by Norway in the period June 1985-August 1986. The bycatch of this herring in other Norwegian fisheries has been negligible. However, a catch of approximately 24 thousand tonnes of herring has been reported by USSR in the Barents Sea in winter 1986.

### GROWTH

Fig. 9 gives mean weight and mean length of the 1983 year class in September-October in 1983, 1984 and 1985 in different areas of the Norwegian coast, and in the open sea in ICES areas IIa (west of  $32^{\circ}$  E) and I (east of  $32^{\circ}$  E). The figure shows that there is a decrease in growth from south to north on the Norwegian coast. The greater part of this year class has been distributed in ICES area I, the area with the smallest growth. The difference in growth in this year class was not apparent as 0-group.

Fig. 10 gives the mean condition factor  $C=W/L^3$  for some of the areas given in Fig 9. This figure shows that, as II-group, the herring in the Barents Sea (ICES area IIa and I) has a higher condition factor than herring on the Norwegian coast. Further, the condition factor increases with age for all areas.

### MATURATION

In winter of 1986 herring of the 1983 year class for the first time appeared on the spawning grounds off Møre (approximately  $63^{\circ}$  N). About 7 % of the herring in the spawning areas were of this year class. However, less than 10% of the 1983 year class which appeared on the spawning grounds seemed to be recruit spawners, the rest were immature fish.

### DISCUSSION

Only a small proportion (less than 1 %) of the 1983 year class spawned as 3 year olds in 1986. In 1987, however, this proportion will increase substantially. Almost all the herring of this year class which in spring 1986 were recorded south of Lofoten ( $68^{\circ}$  N) will appear on the spawning grounds as recruit spawners in 1987. But the main part of the 1983 year class (i.e. the Barents Sea component), will not reach maturity in 1987.

The herring which, a 0-group, was distributed in the fjord areas south of  $68^{\circ}$  N, have migrated to the outer coastal areas (Fig.8). In the southern part of the distribution area they are mixed with the adult herring population, further north the mixing is not complete and the 1983 year class still form separate schools. The herring which as 0-group was distributed in the fjords north of  $68^{\circ}$  N -  $69^{\circ}$  N has also left the inner fjord areas.

The herring which was distributed over wide areas in the Barents Sea as 0-group (Anon. 1983) has since then formed a more restricted distribution area, and carried out certain migrations. These migrations are shown schematically in Fig. 11. The figure shows that in winter/spring of both 1985 and 1986 there has been a migration in a westward direction. In autumn 1985 the herring migrated eastwards, while in autumn 1984 there was a slight northwards migration. More

detailed information on the distribution in 1983-1985 is given in Røttingen (1984 and 1985a).

Dragesund (1970) has given an account of the migration of juvenile herring of the year classes 1959-1965. He states: "The 1963 and 1964 year classes were mainly recorded off eastern Finnmark. Migrations over short distances were observed back and forth between the eastern part of the Finnmark coast and the Murman coast, and in contrast to the 1959-1961 year classes those of 1963 and 1964 did not concentrate in any detectable shoals off western Finnmark or off Troms during the second to fourth years of life. Their migration from the nursery areas off eastern Finnmark was at least delayed one year compared with the migrations of the 1959-1961 year classes".

In general, the 1983 year class has until now, had a more easterly distribution than the rich 1959 year class. However, in August 1986, schools of 3 year old herring have been detected 100-150 nautical miles west of Troms. (Fig.7). Although most of the 1959 year class were distributed off Troms and Finnmark as 3 year olds (Dragesund, op.cit.), herring of this year class appeared as far west as the fishing grounds off Northern Iceland in September 1962. (Jacobsson, 1978).

The 3 year old herring in the Barents Sea in May 1986 had a mean length of approximately 20 cm, while the schooling herring off Troms 2 months later had a length distribution of 24-27 cm. At present the "origin" of the herring off Troms is not known, but according to the length distributions (Fig. 9), it is possible that this is herring which had nursery areas in the fjords of Troms.

For the 1983 year class, important biological parameters such as growth and age at first maturity seem to be area correlated (Fig. 9), the herring growing much faster in the southern part of the distribution area. However, the condition factor does not seem to vary significantly with area, (Fig. 10) indicating that the food supply is not the growth restricting factor in the northern areas.

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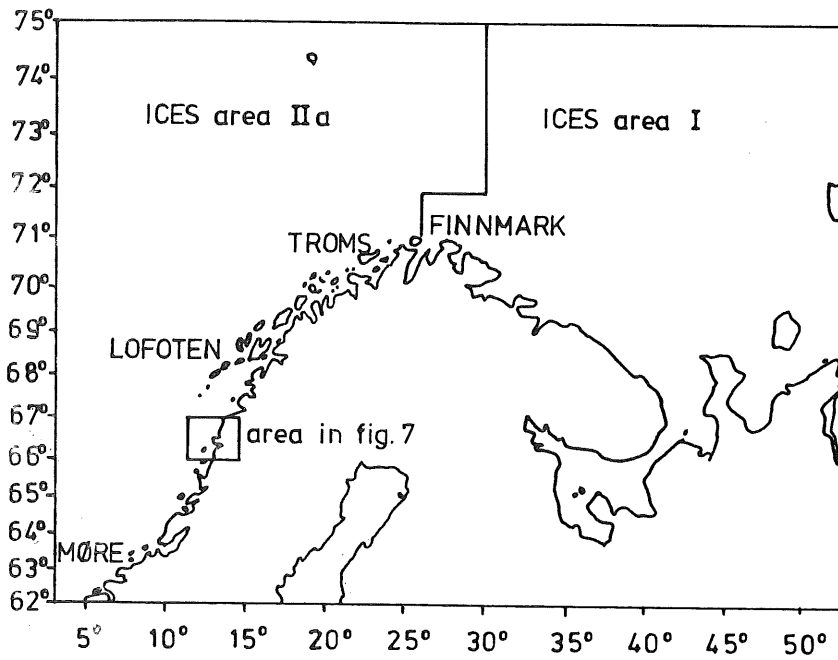


Fig.1 Names of areas mentioned in the text.

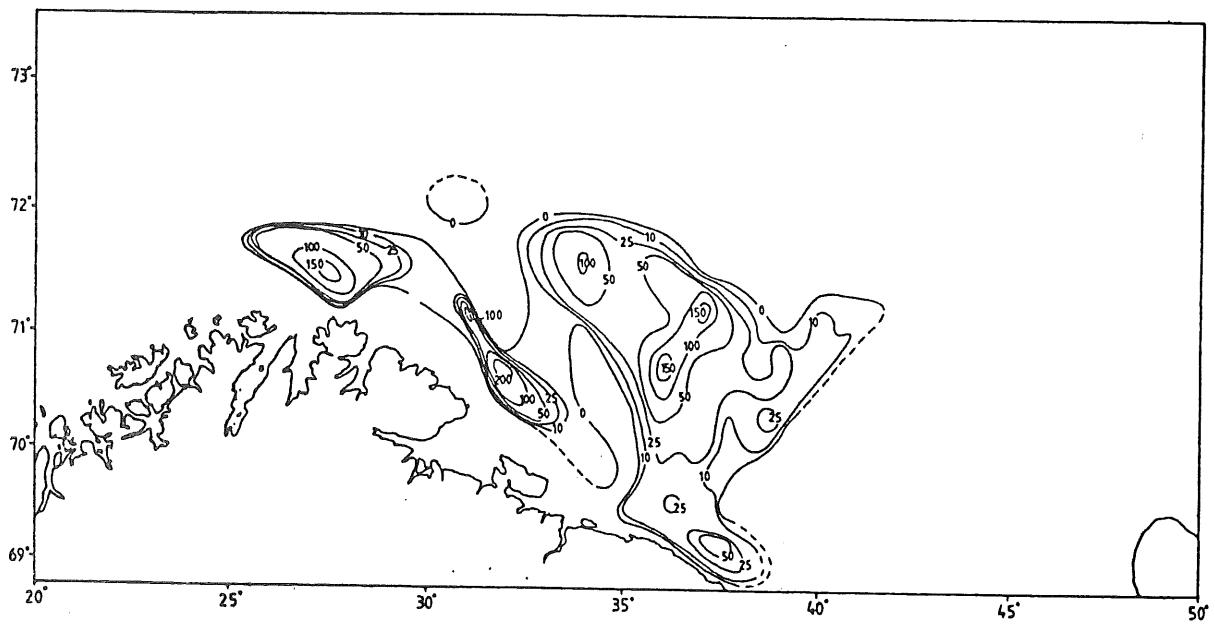


Fig.2 Distribution of the 1983 year class in the Barents Sea in May 1985. (Tonnes per square nautical mile).

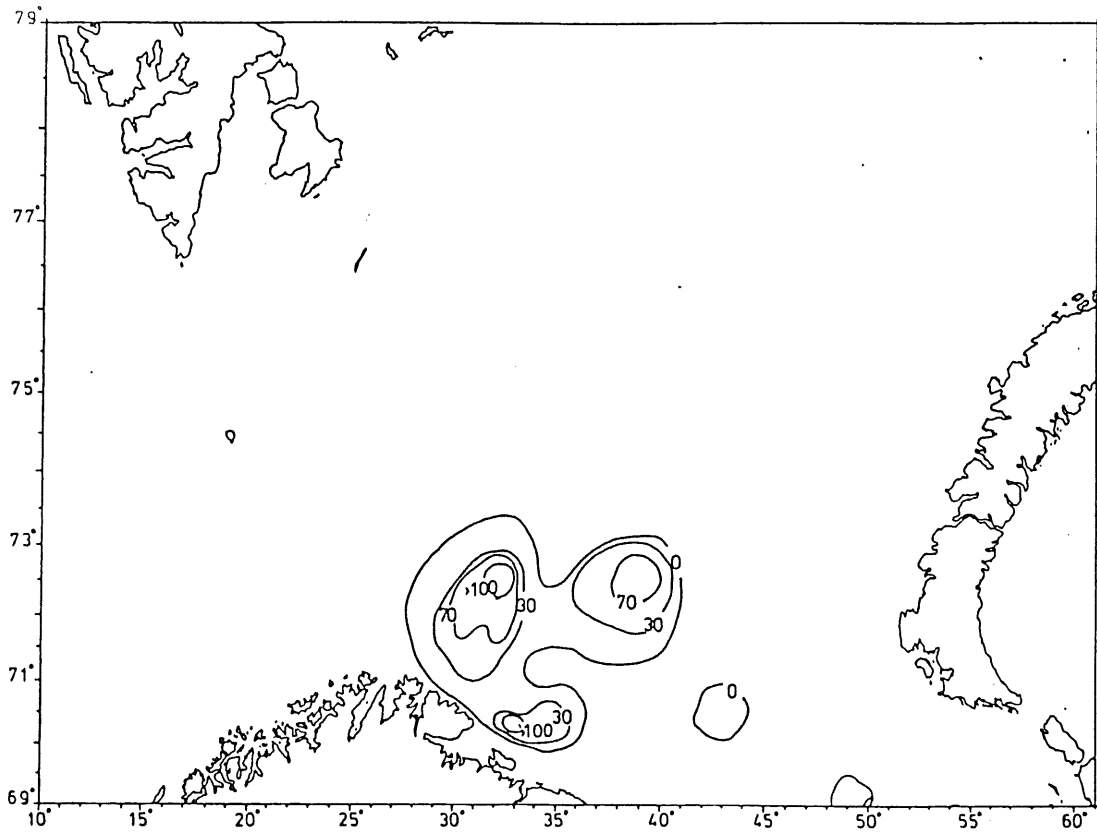


Fig.3 Distribution of the 1983 year class in the Barents Sea in Sept 1985. (Tonnes per square nautical mile).

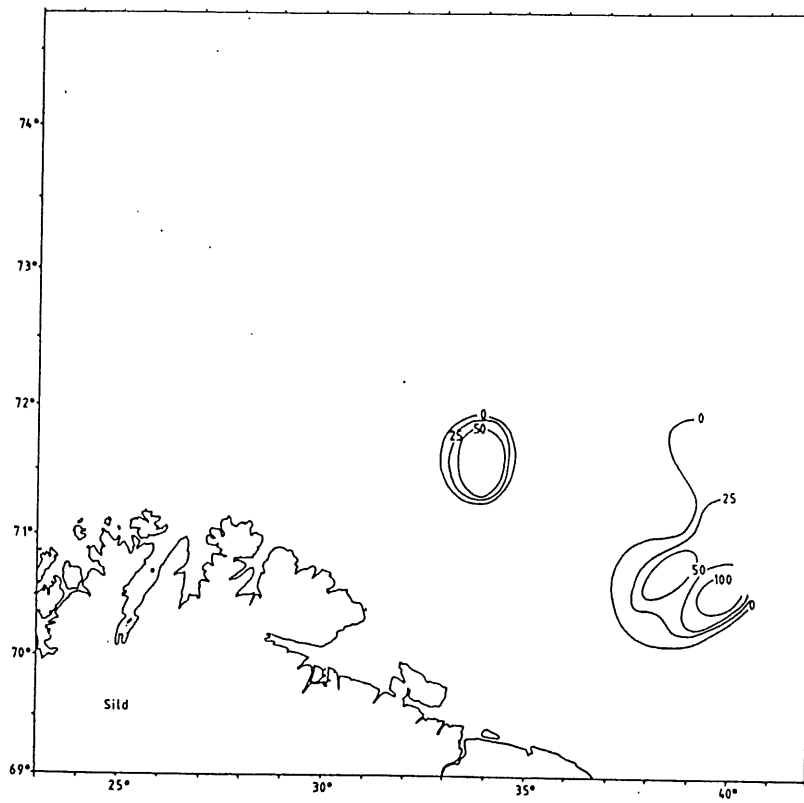


Fig.4 Distribution of the 1983 year class in the Barents Sea in Nov 1985 (Tonnes per square nautical mile).



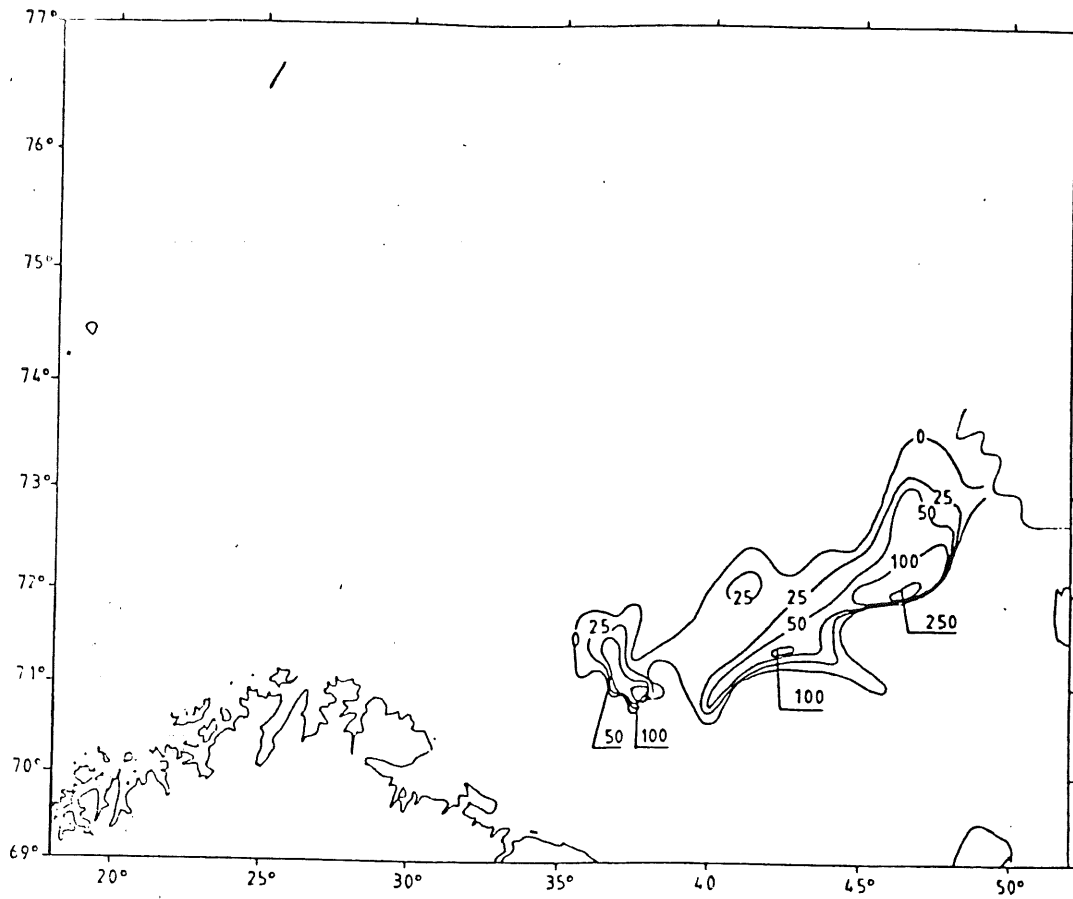


Fig.5 Distribution of the 1983 year class in the Barents Sea in Jan 1986 (Tonnes per square nautical mile).

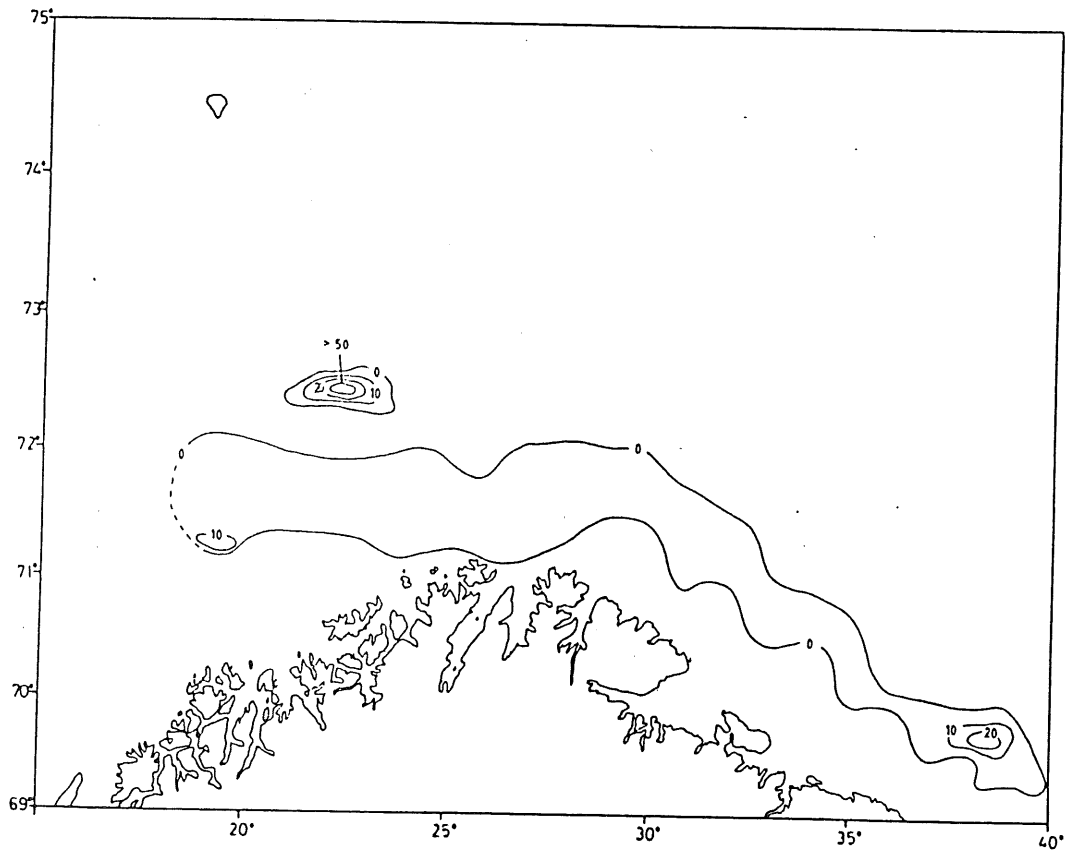


Fig.6 Distribution of the 1983 year class in the Barents Sea in May 1986 (Tonnes per square nautical mile).

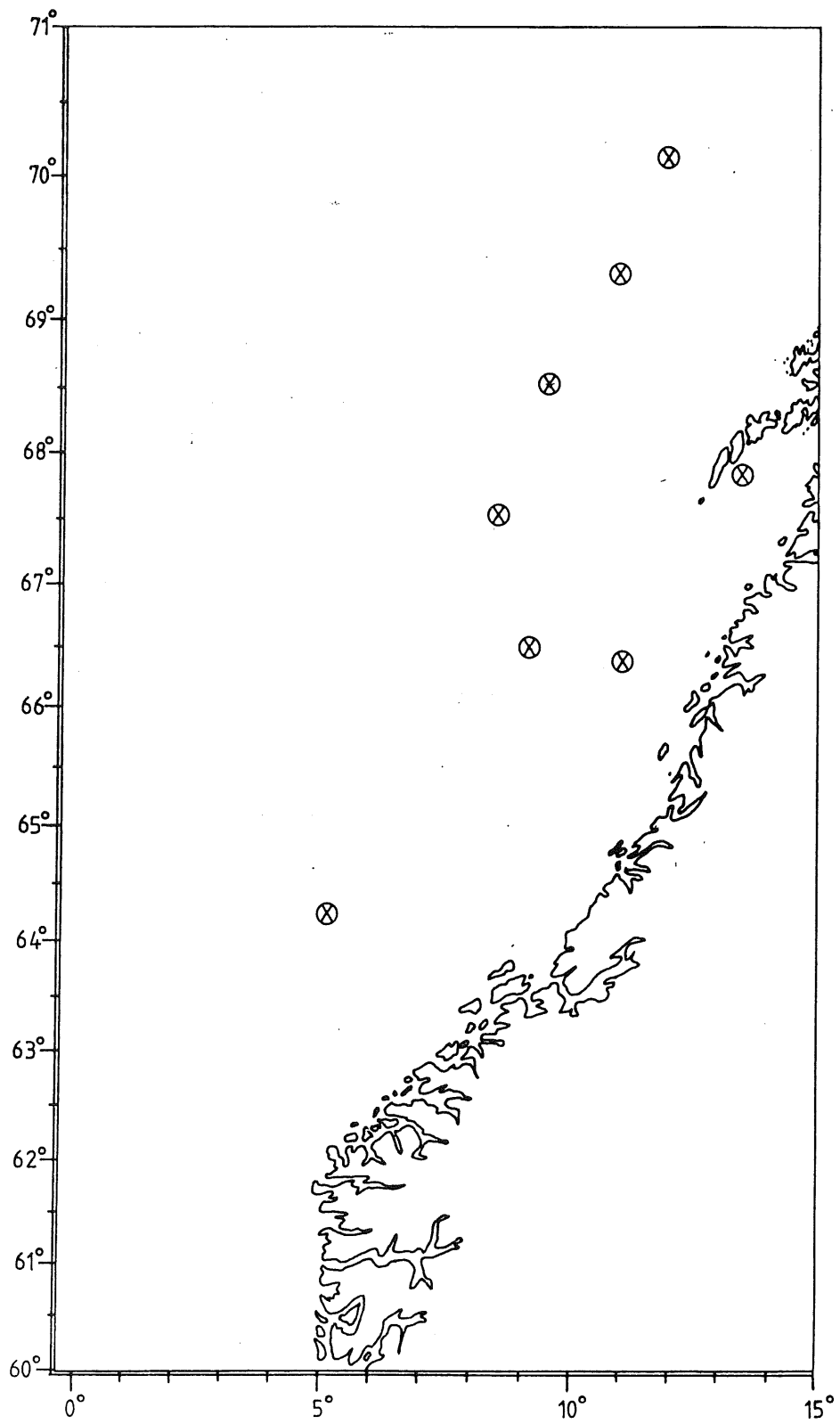


Fig.7 Observations of the 1983 year class in July-August 1986.

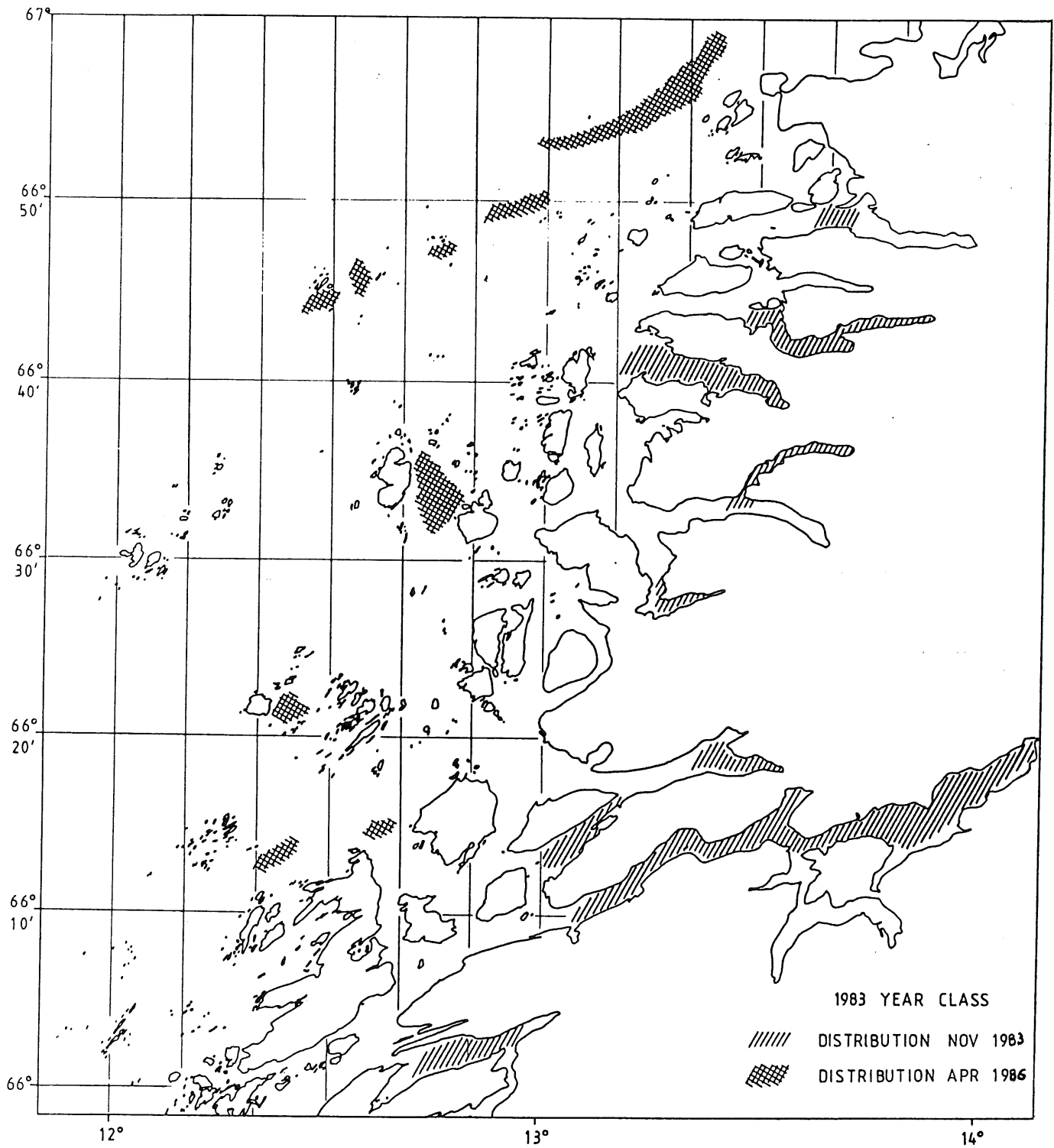


Fig.8 Distribution of the 1983 year class in 1983 and 1986 between 66° N and 67° N on the Norwegian coast.

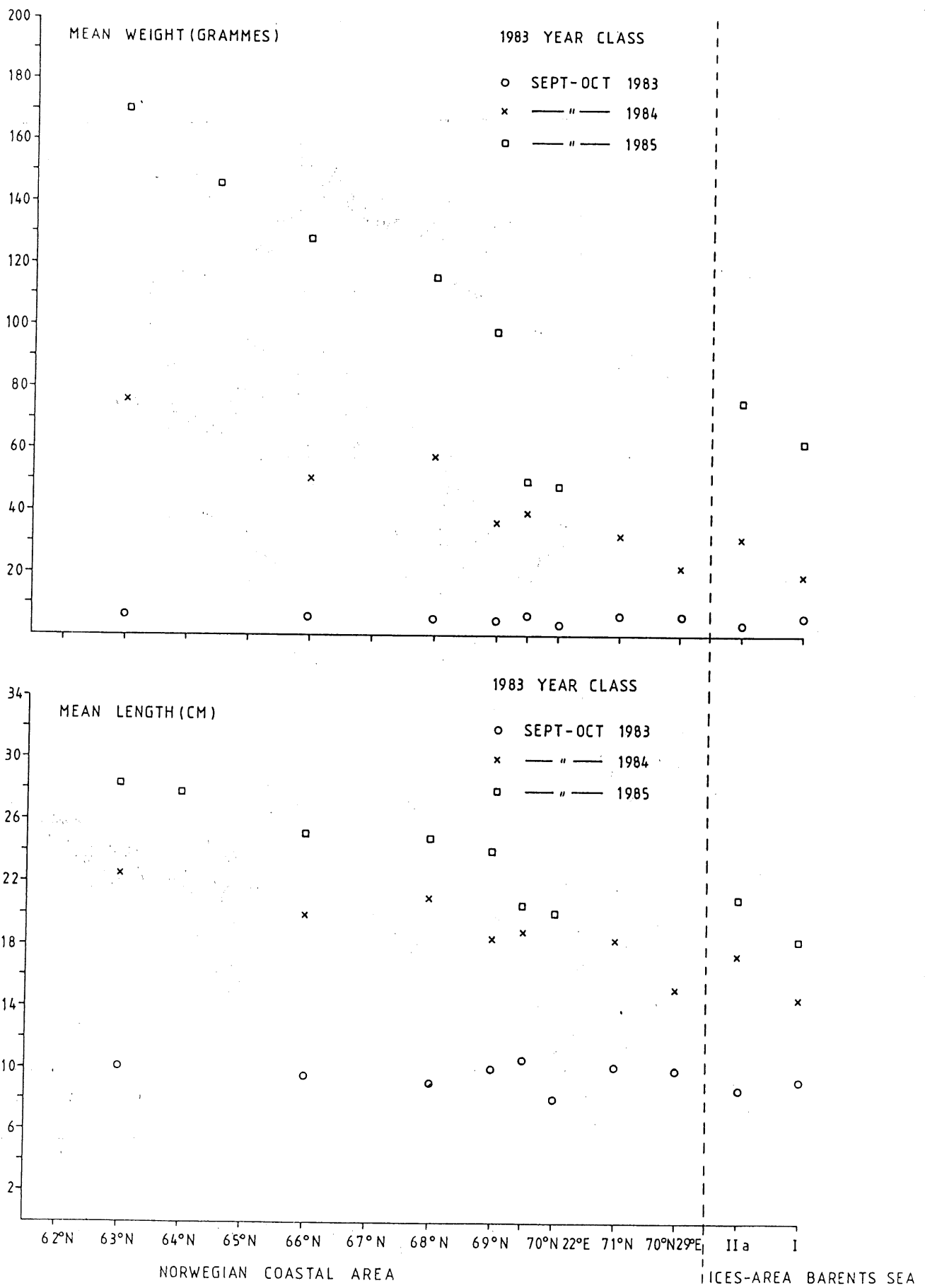


Fig.9 Weight and length data for the 1983 year class for different areas.

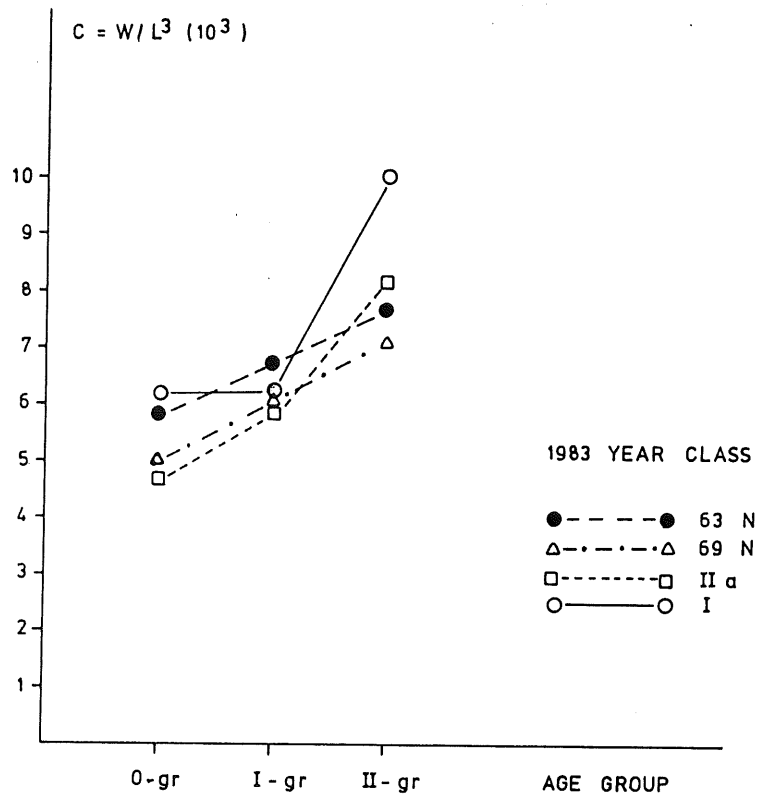


Fig.10 Condition factor for the 1983 year class for different areas.

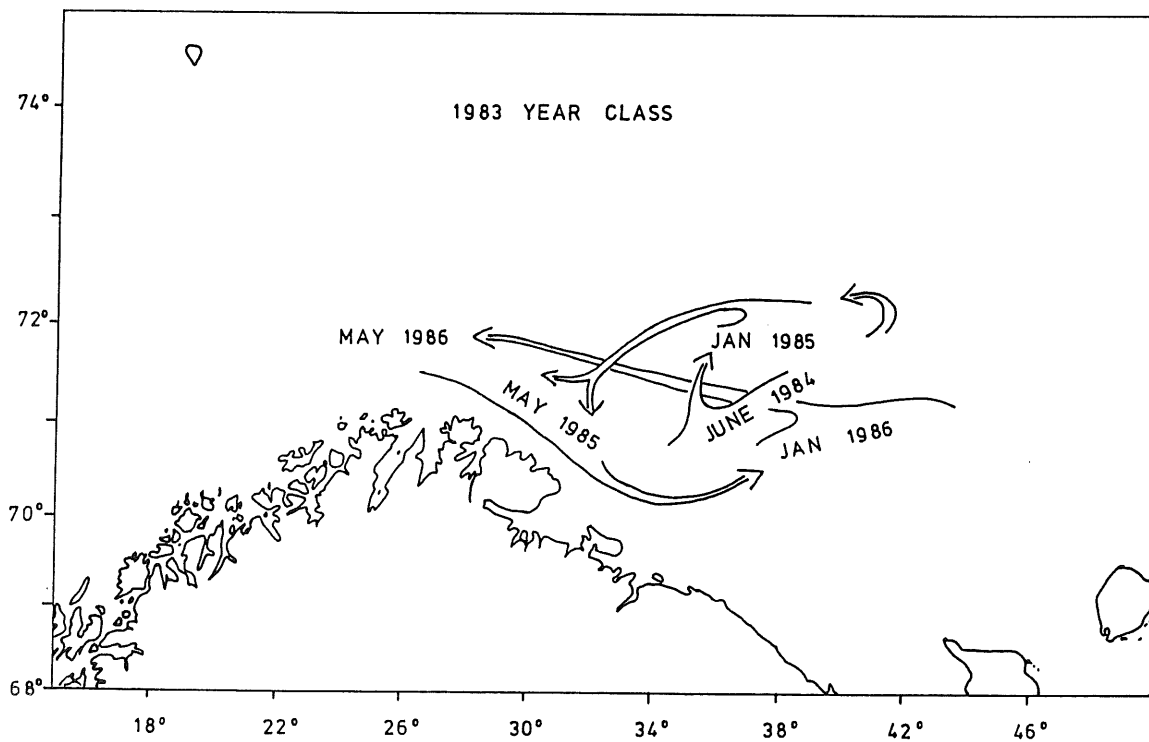


Fig.11 Migration routes (schematic) for the 1983 year class in the Barents Sea.

