

***DISTRIBUTION AND MIGRATION OF THE 1983 YEAR CLASS OF NORWEGIAN SPRING
SPAWNING HERRING IN THE PERIOD JULY 1987-AUGUST 1988***

by

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ABSTRACT

From a wide distribution on the Norwegian coastal banks between 65° N and 69° N in June-July 1987 the herring of this year class accumulated in an area west of the Lofoten Island in August 1987, and migrated into the Vestfjord in September 1987. The main part of this herring wintered in the inner and eastern part of the Vestfjord area, where the herring occurred in very large schools. The spawning migration to the traditional spawning areas off Møre occurred in February 1988. This year class now completely dominates the spawning stock of the Norwegian spring spawning herring. The migration pattern of the herring in the period July 1987 to July 1988 seems to be comparable to the period July 1986 to July 1987. This particular migration pattern is seen in relation to earlier migration patterns for the Norwegian spring spawning herring.

INTRODUCTION

The greater part of the 1983 year class were recruit spawners in spring 1988. At present, about 95% of the spawning stock of Norwegian spring spawning herring belongs to this year class.

By far the greater part of the 1983 year class had its nursery area in the Barents Sea (Røttingen 1984 and 1985). This herring migrated from the Barents Sea in May-June 1986 (Røttingen 1986), and the distribution and migration routes up to July 1987 have been described in Røttingen (1987). The aim of the present paper is to update the information on distribution and migration of this component in the period July 1987 to August 1988.

A minor part of the 1983 year class had their nursery area in the fjord and coastal areas of western (north of 64°N) and northern Norway. Some of these herring aggregated in wintering areas separate from the wintering areas of the main component, but a mixing seems to have taken place on the spawning grounds.

METHODS

The main part of the data on distribution of the 1983 year class have been collected during acoustic research vessel surveys in the Norwegian Sea and on the Norwegian coastal banks and coast. The Norwegian research vessels are equipped with a 38 kHz echo sounder and a digital echo integrator. Some of the cruises have been carried out as scouting cruises. On these cruises the herring has been located by sonar, and an echo integrator has usually not been operated during this category of investigations. To identify the recordings and to collect the biological samples, a "Fotø"-herring trawl (64 meshes with a meshsize of 3200 mm at 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 100 mm in the opening) has been used. In addition, biological data on the 1983 year class is available from samples from the commercial fishery and from the tagging programme on Norwegian spring spawning herring.

DISTRIBUTION

JUNE-JULY 1987: The main summer feeding areas in 1987 for the 1983 year class are given in Figs 1 and 2. The herring occurred in small schools near the surface feeding on *Calanus*. The herring did not appear to make any extensive vertical migrations during this time period.

Figures indicating the summer distribution in 1987 were also given in Røttingen 1987. However, results from the working up of later biological samples have shown that the herring located in the southern part of the distribution area given in Røttingen 1987 did not belong to the Norwegian spring spawning herring.

AUGUST 1987: Medio August 1987 the 1983 year class concentrated in the area west of the Lofoten (Fig 3). The behaviour of the herring had, compared with June-July, changed, and the herring now concentrated in a rather dense scattering layer in about 10-20 m depth during most of the day (Fig 4). This was typically "fat herring", with a lot of fat in the intestine area. The gonads were poorly developed.

SEPTEMBER 1987: In September the main concentrations of herring had migrated into the Vestfjord area (Fig 5). By this time the herring began to make extensive vertical migrations. During daytime the herring was recorded in schools at 250 to 300 m depth, raising towards the surface and dispersing during night. The gonads were considerably more developed than in August.

NOVEMBER 1987/JANUARY 1988: In October the herring migrated further into the Vestfjord, and by November the herring were located in the tributary fjords of the Vestfjord (Fig 6). Here the herring occurred in enormous schools, often extending over several nautical miles. The herring undertook vertical migrations (Fig 7). The gonads were further developed, and the amount of fat in the intestine area had clearly decreased compared with August/ September. In this area the herring wintered until the end of January. In winter 1986/87 the 1983 year class wintered in the outer and middle parts of the Vestfjord. (Røttingen 1987).

FEBRUARY 1988: According to fisheries data, the main part of the 1983 year class began to appear on the spawning fields in mid-February. Fig 8 gives the area where spawning herring was recorded in the period 22.2-19.3 1988. The main spawning grounds were from Statt to Kristiansund, and some spawning were also recorded north to Vikna. There were very few records of full herring in the Lofoten-Vesterålen area. The spawning grounds are essentially the same as in the period 1974-1986. In 1988, approximately 95% of the spawning stock consisted of 1983 year class herring. During daytime on the spawning fields the herring were distributed hard down to the bottom and were very difficult to observe on the echo recorder. It was only in a few restricted areas where schools could be seen near the bottom. However, during nighttime the herring rose and dispersed in the upper 100 meters of the water masses. Fig 9 shows a typical night recording on the spawning fields in February 1988. The main spawning commenced at the end of February in the southernmost part of the distribution area. In the Vikna area (Fig 8) the main part of the herring had not spawned by 15 March. Spawning on the "old" spawning fields south of Statt was not resumed in 1988.

APRIL 1988: The feeding migration in 1988 seems to have followed the same pattern as in 1987. The spent herring have moved in a northern direction from the spawning fields and the geographical distribution at the end of April 1988 is outlined in Fig 10. The distribution area is located off the Norwegian coast mainly between 64° N and 68° N and extending approximately 150 nautical miles westwards.

MAY 1988: The geographical distribution in May 1988 is shown in Fig 11. Compared with the end of April 1988 the herring has migrated further to the north and is dispersed over a wider area. The main concentration of herring in May 1988 is somewhat further to the north compared with the distribution in May 1987 (Røttingen 1987).

JULY 1988: The research vessel "G O Sars" steamed westwards from the coast and along the 68° parallel in the period 24.7-26.7 1988. No herring were recorded west of 12° E on this course line. Compared with the situation in May, when the herring was distributed west to 7° E, the herring had now migrated eastward and concentrated west of the Lofoten Islands. Fishing vessels, taking part in a whale scouting programme, reported echo recordings only east of 11° E in these areas. Thus the eastward shift in distribution, compared with May, was

confirmed.

AUGUST 1988: The main part of the herring was now located in the outer part of the Vestfjord (Fig 12). However, some herring are distributed west of the Lofoten Islands where the main concentrations were located in August 1987. The herring was recorded as a more or less continuous layer at the bottom (approximately depth 200-250 m) and to about 30-40m above bottom. But from midnight to approximately 4 a.m., the herring rose and formed a scattering layer in the upper 50 meters of the water masses.

MIGRATION

In the period autumn 1983 to spring 1986 the main part of the 1983 year class was distributed within the Barents Sea. A general picture of the seasonal changes in the geographical distribution of the 1983 year class in that area are given in Røttingen 1986.

This component of the 1983 year class migrated from the Barents Sea and into the eastern part of the Norwegian Sea as 3 year old immature herring in May-June 1986. (Røttingen op.cit.) The following movements of that component for the period August 1986 to August 1988 are outlined as follows. In the beginning of August the herring seems to accumulate in an area west of the Lofoten Islands and in the outer part of the Vestfjord. Medio August to beginning of September the migration into the Vestfjord starts. The wintering areas were however somewhat different in 1986/87 and 1987/88. In 1986/87 the herring wintered in the middle and outer part of Vestfjord, but in the latter winter the herring wintered closer to the shore and in tributary fjords of the Vestfjord. The spawning migration started at the end of January. The 1983 year class spawned on the traditional spawning grounds off Møre. After spawning the herring undertakes a northward feeding migration. During summer the herring is dispersed in small scattered schools, and the herring feeds in an area which extends from approximately 64° N to 69° N and extends to 200 miles from the Norwegian coast, an area of approximately 40 thousand square nautical miles. These seasonal changes and migrations are summarized in Fig 13D.

DISCUSSION

The 1983 year class is by far the strongest year class since the collapse of this stock at the end of the 1960'ies. Are the nursery areas and migration routes of this strong yearclass in the stock rebuilding fase comparable to the situation before the stock collapse?

Figs 13A-C shows the migration routes for adult Norwegian spring spawning herring from 1950 to the stock collapse at the end of the 1960'ies. From the begining of the 1970'ies to 1986 the adult herring stock was distributed in the Norwegian coastal areas. The situation for the period August 1986 to August 1988 is shown in Fig 13D.

Note should be taken that in the years 1963-1966 a sepearate stock unit of the Norwegian spring spawning herring occured of northern Norway (Fig 13C). This herring consisted mostly of the strong 1959 year class, and also some herring of the 1960 and 1961 year classes. This stock unit had a spawning, feeding and wintering area separated from the rest of the stock of Norwegian spring spawning herring (Devold 1968). However, in autumn of 1966 this separate stock component migrated all the way from the Bear Island feeding grounds to the

wintering grounds off East Island and mixed with the main component of the stock that had traditionally wintered in that area.

The geographical distribution areas for this stock unit as juveniles is given in Dragesund 1970. These yearclasses, as juveniles, had a more western distribution in the Barents Sea than the 1983 year class. (Røttingen 1986). However, as can be seen from Figs 13B,C and D seasonal distribution and migration of these year classes as 3 to 5 year old fish have been very different, the main difference being that the 1983 year class, until now, has not migrated out to the "old" feeding grounds in the North Iceland-Jan Mayen area. The feeding areas of the 1983 year class has been from the coastal areas and extending approximately 200 nautical miles out in the Norwegian Sea.

At present it cannot, of course, be said with any certainty if the 1983 year class will in the future keep to the same migration routes as it has done in the period summer 1986 to summer 1988. It should be kept in mind that the northern component of the 1959 year class made an abrupt change in the migration pattern in autumn 1966 as 7 year old fish. (Devold 1968). The individual growth of the 1983 year class in 1986 and 1987 has been normal, i.e. the food supply on the present summer feeding grounds seems to be adequate for the 1983 year class. The spawning stock of the Norwegian spring spawning herring is not expected to increase in the next 3-4 years if the present exploitation (TAC 120 thousand tonnes) is maintained. This is due to an expected poor recruitment to the spawning stock in the period 1989-1992 from the year classes 1984 to 1987 (Anon 1988). It should therefore not be any change in the availability of food for the 1983 year class if the zooplankton production remains unchanged in the feeding area off the Norwegian coast in this period. Consequently, if search for food is the driving force in the feeding migration, it may probably not be "necessary" for the 1983 year class to change the present feeding migration in order to find a sufficient food supply.

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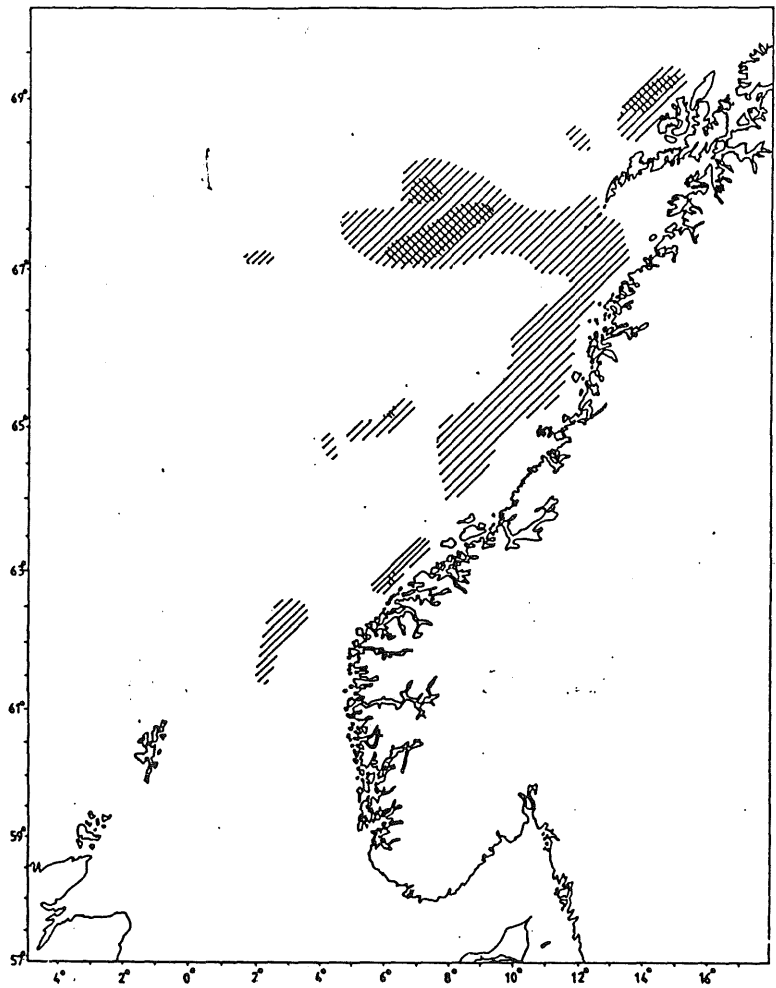


Fig 1 Distribution of the 1983 year class in June 1987 (Modified from Monstad 1987).

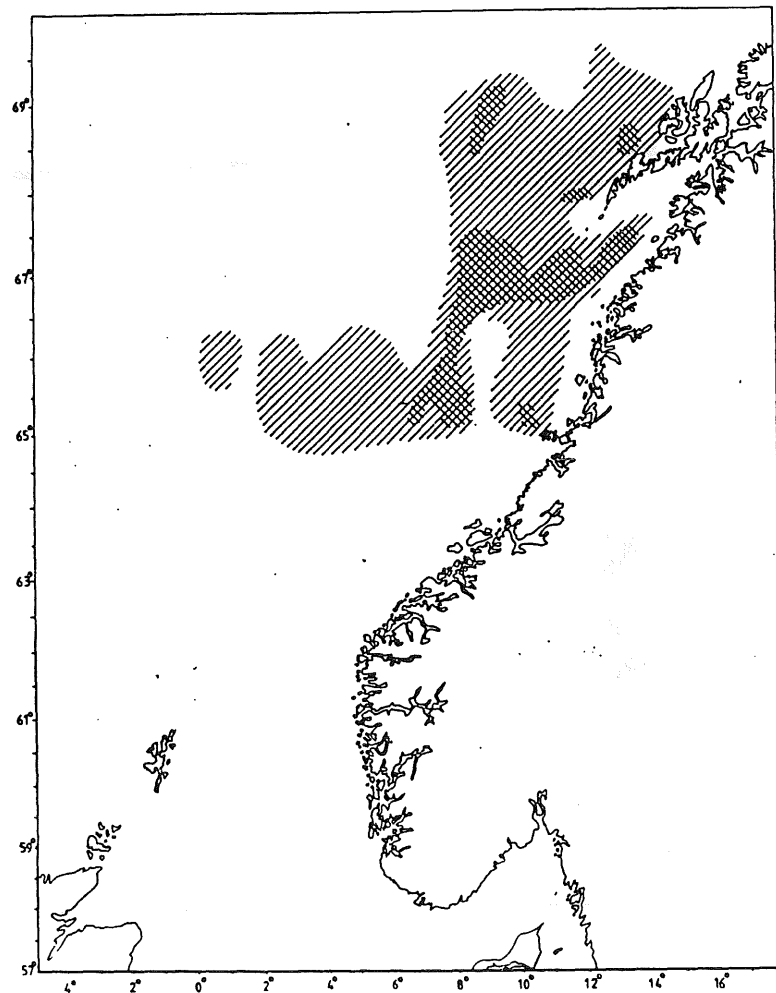


Fig 2 Distribution of the 1983 year class in July 1987 (Modified from Monstad 1987).

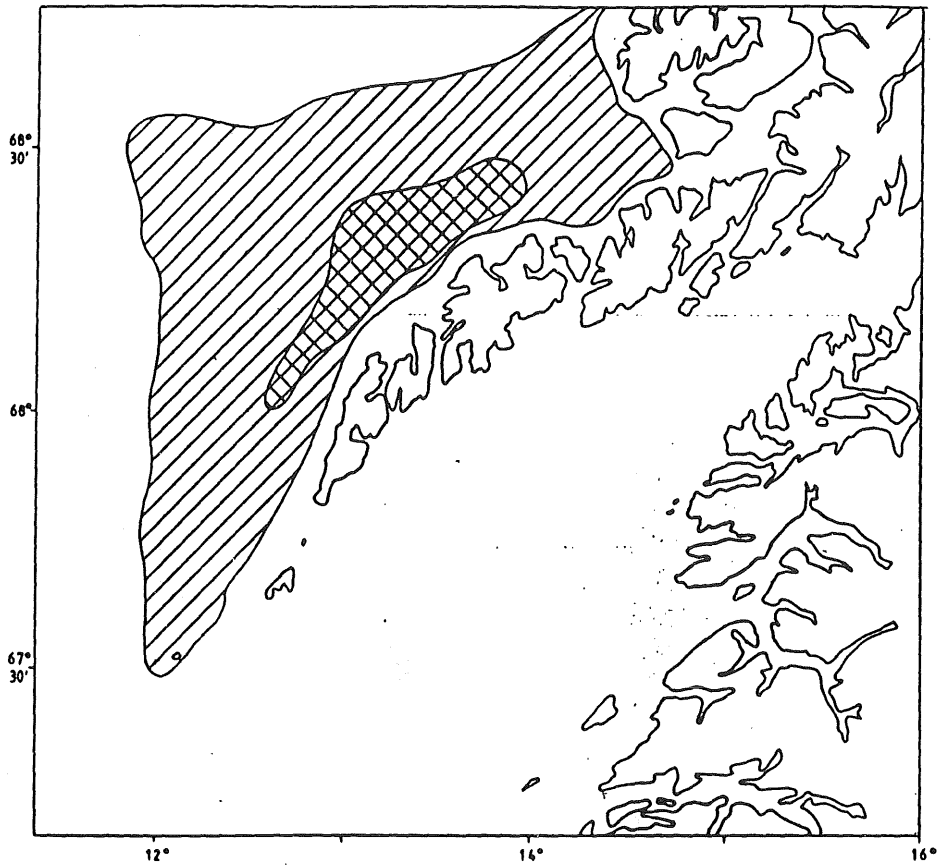


Fig 3 Distribution of the 1983 year class in August 1987 (Modified from Blindheim and Dommasnes 1987).

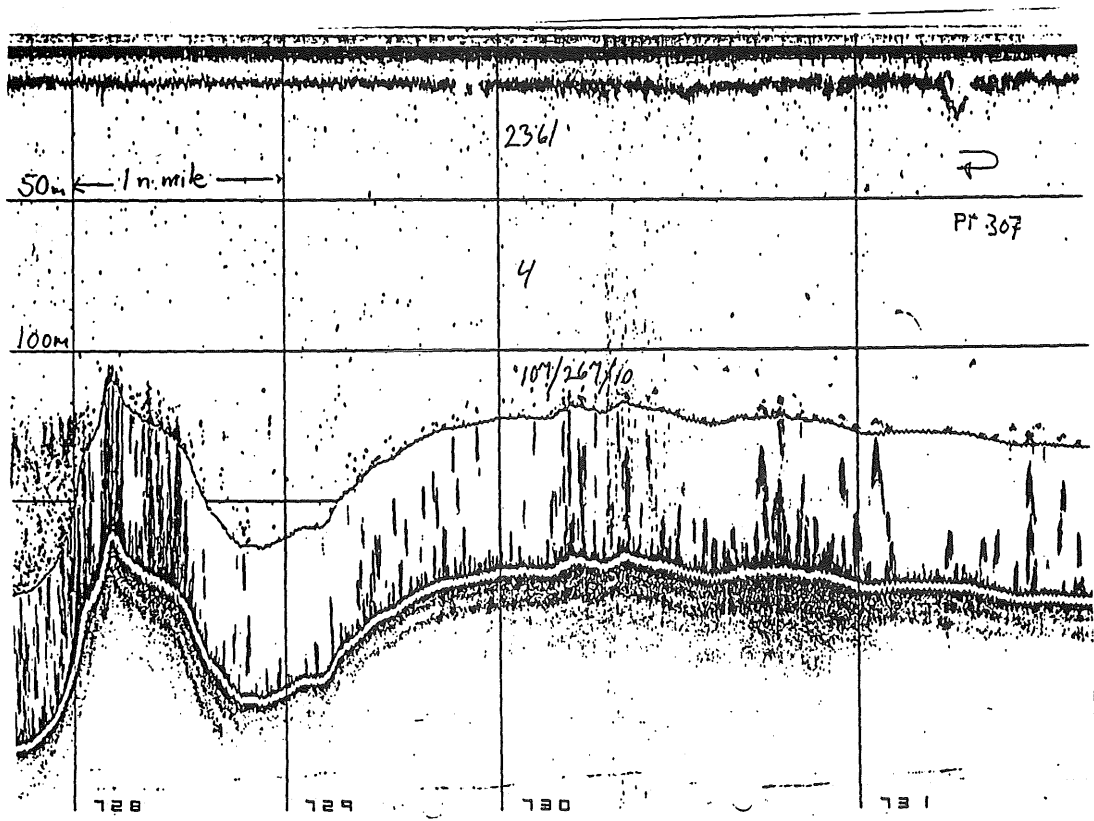


Fig 4 Echo recordings of the 1983 year class in August 1987 (Blindheim and Dommasnes 1987).

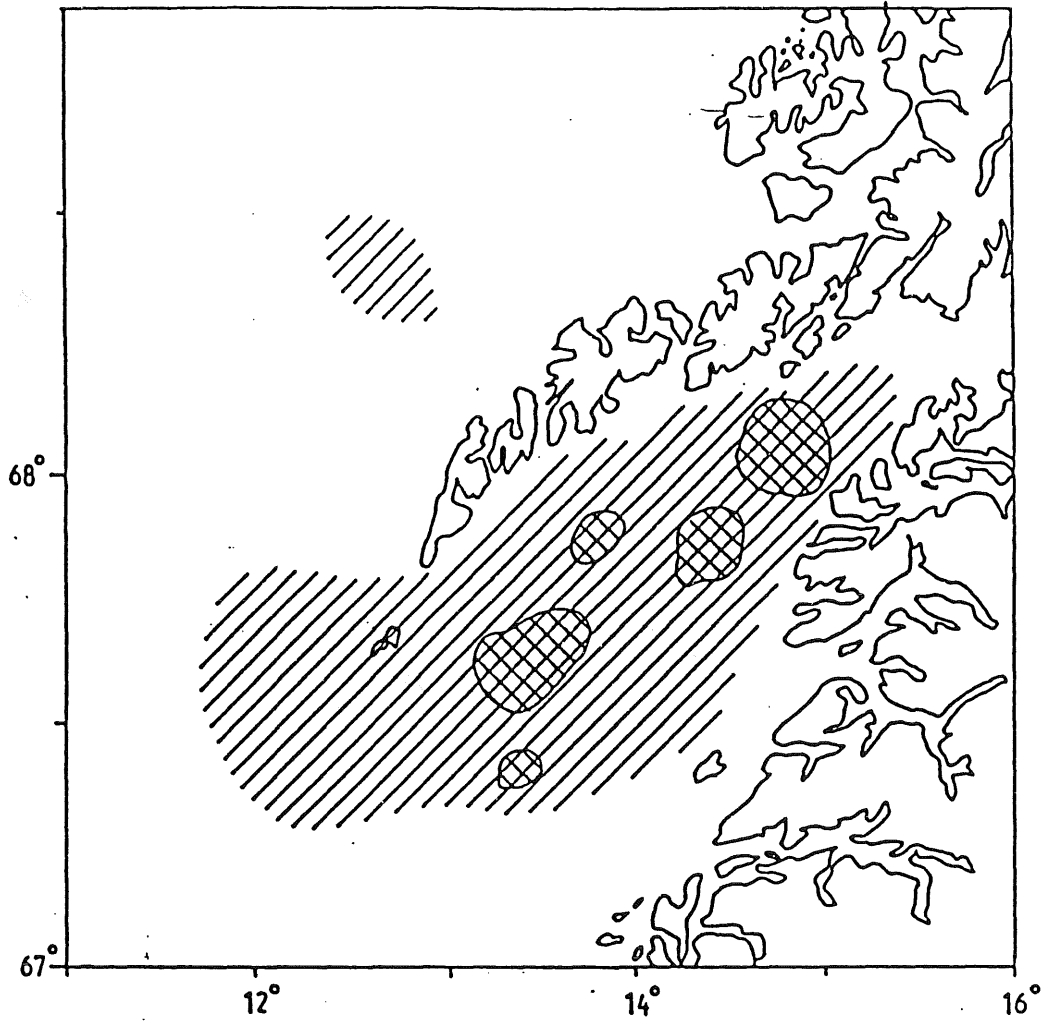


Fig 5 Distribution of the 1983 year class in September 1987 (Anon 1987).

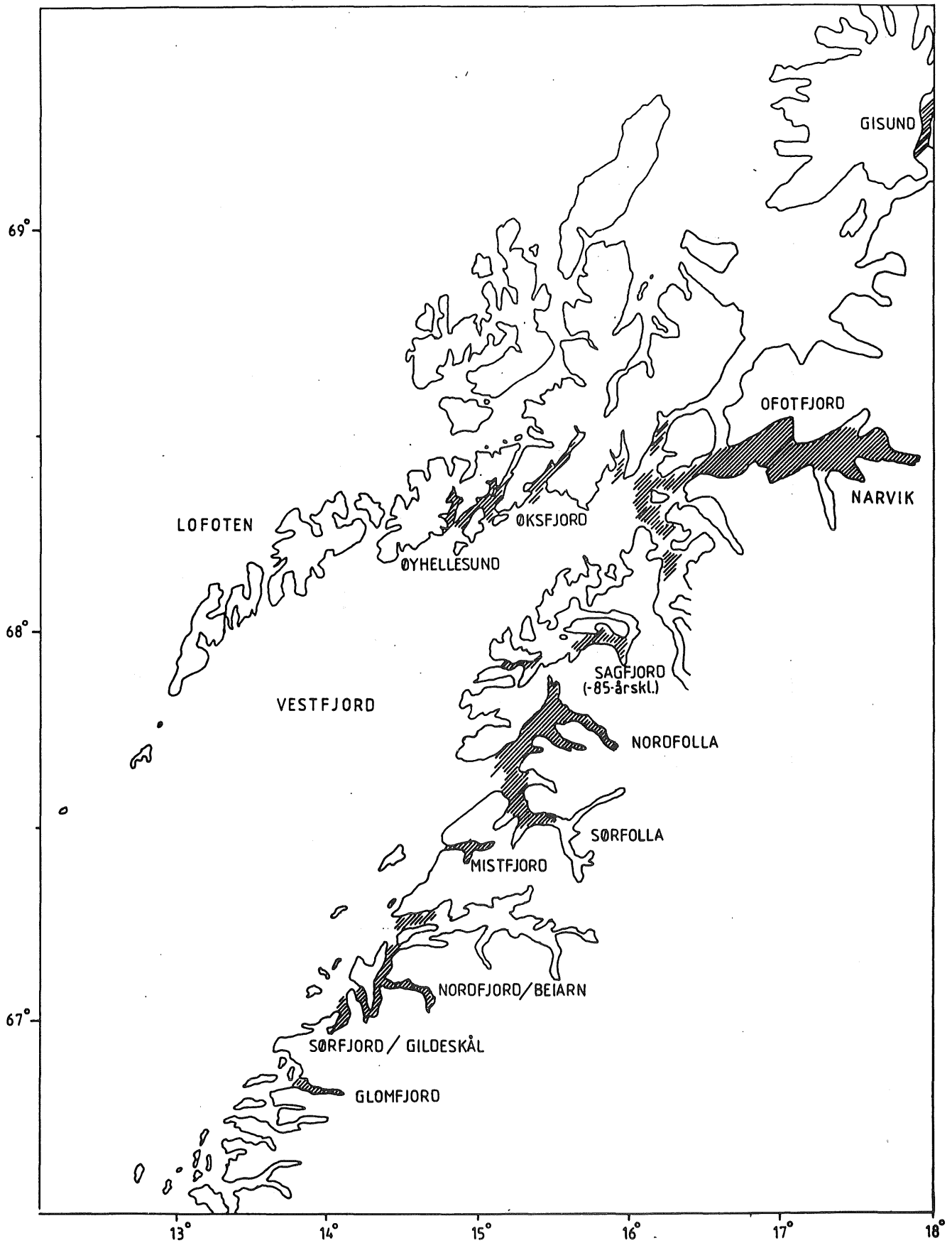


Fig 6 Distribution of the 1983 year class in November 1987.

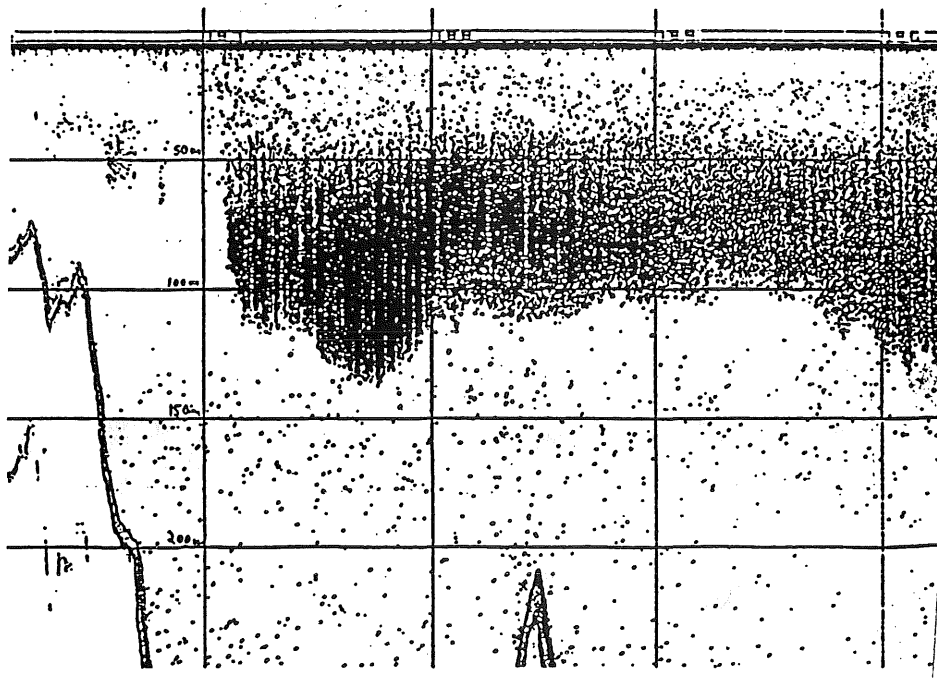
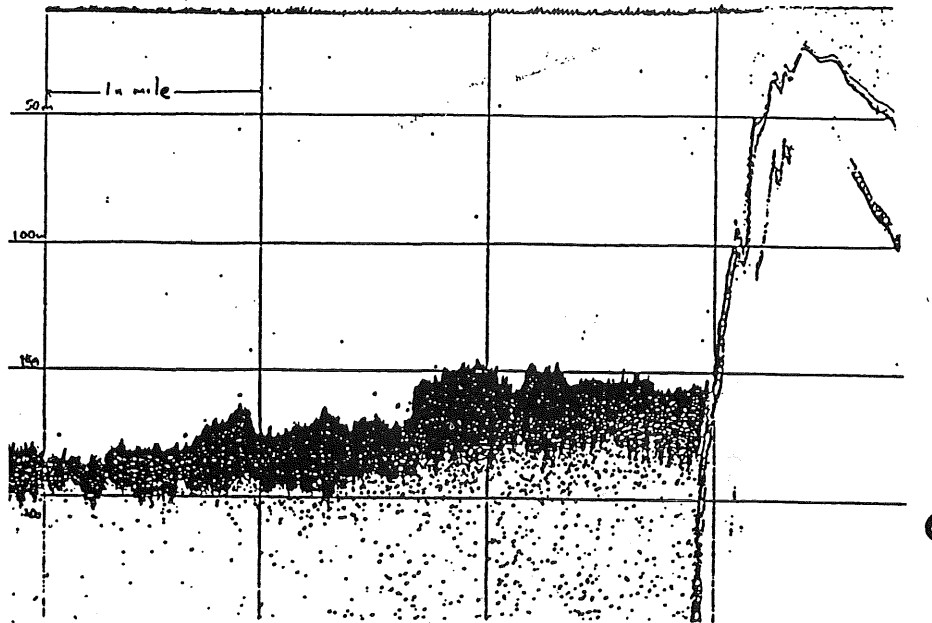


Fig 7 Echo recordings during daytime (upper) and nighttime (lower) of the 1983 year class from the approximately same location in the Ofoten fjord in November 1987.

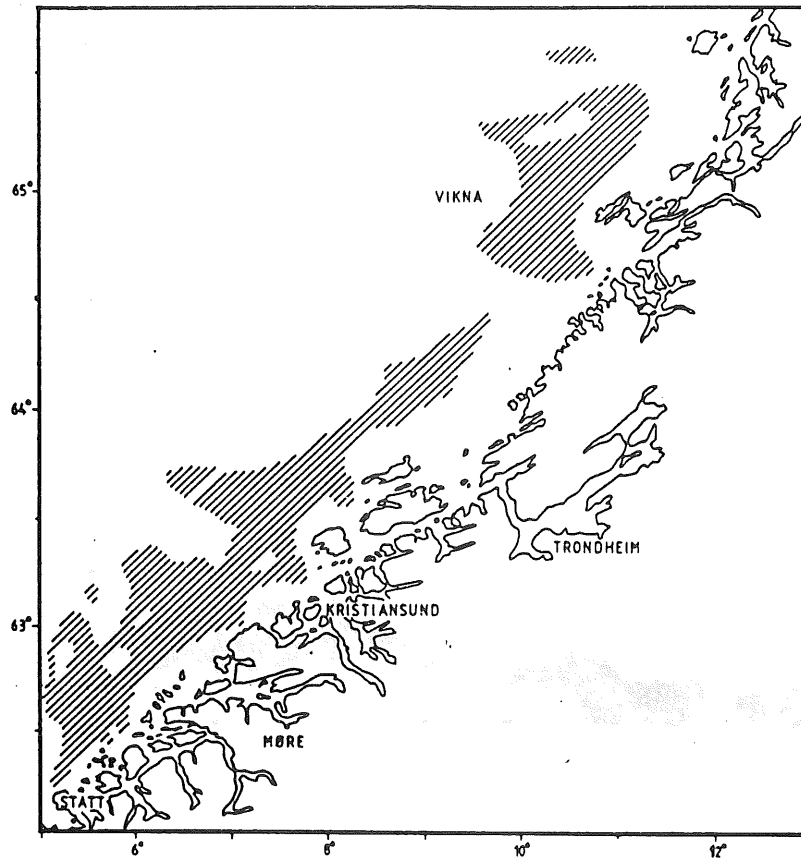


Fig 8 Distribution of spawning herring in the period 22.2-19.3 1988

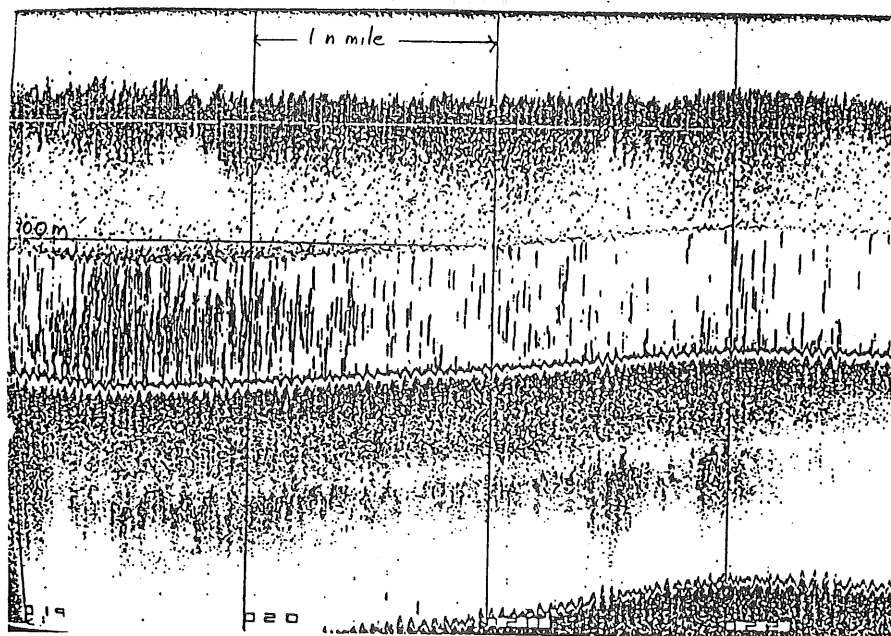


Fig 9 Nighttime echo recording of spawning herring. Møre, February 1988.

Fig 10 Distribution of the 1983 year class class in April 1988 (Gjørøster 1988).

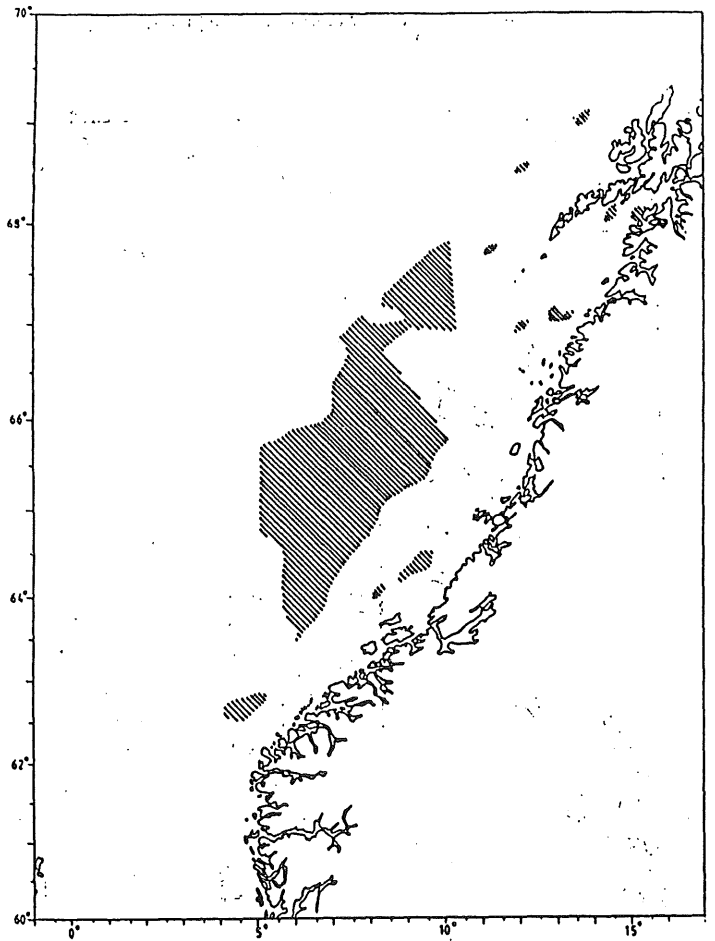
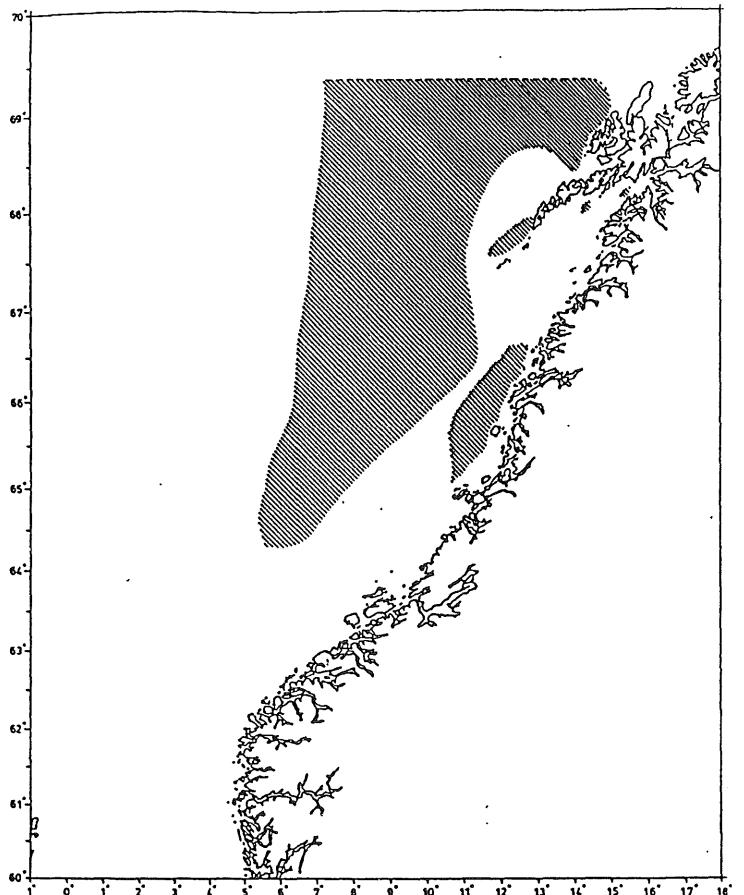


Fig 11 Distribution of the 1983 year class in May 1988 (Anon 1988a).



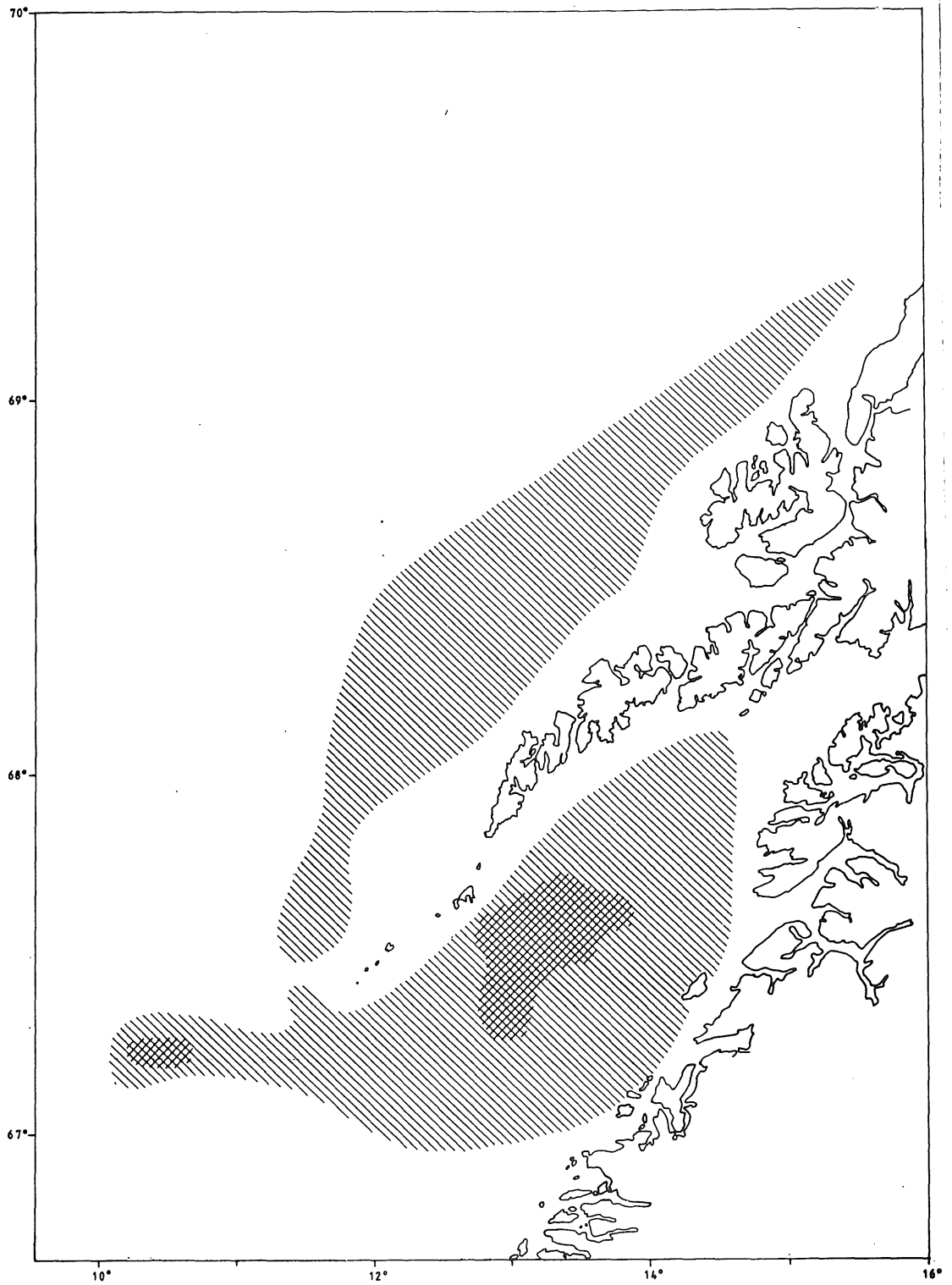


Fig 12 Distribution of the 1983 year class in August 1988.
(A. Dommasnes and T. Monstad, personal communication).

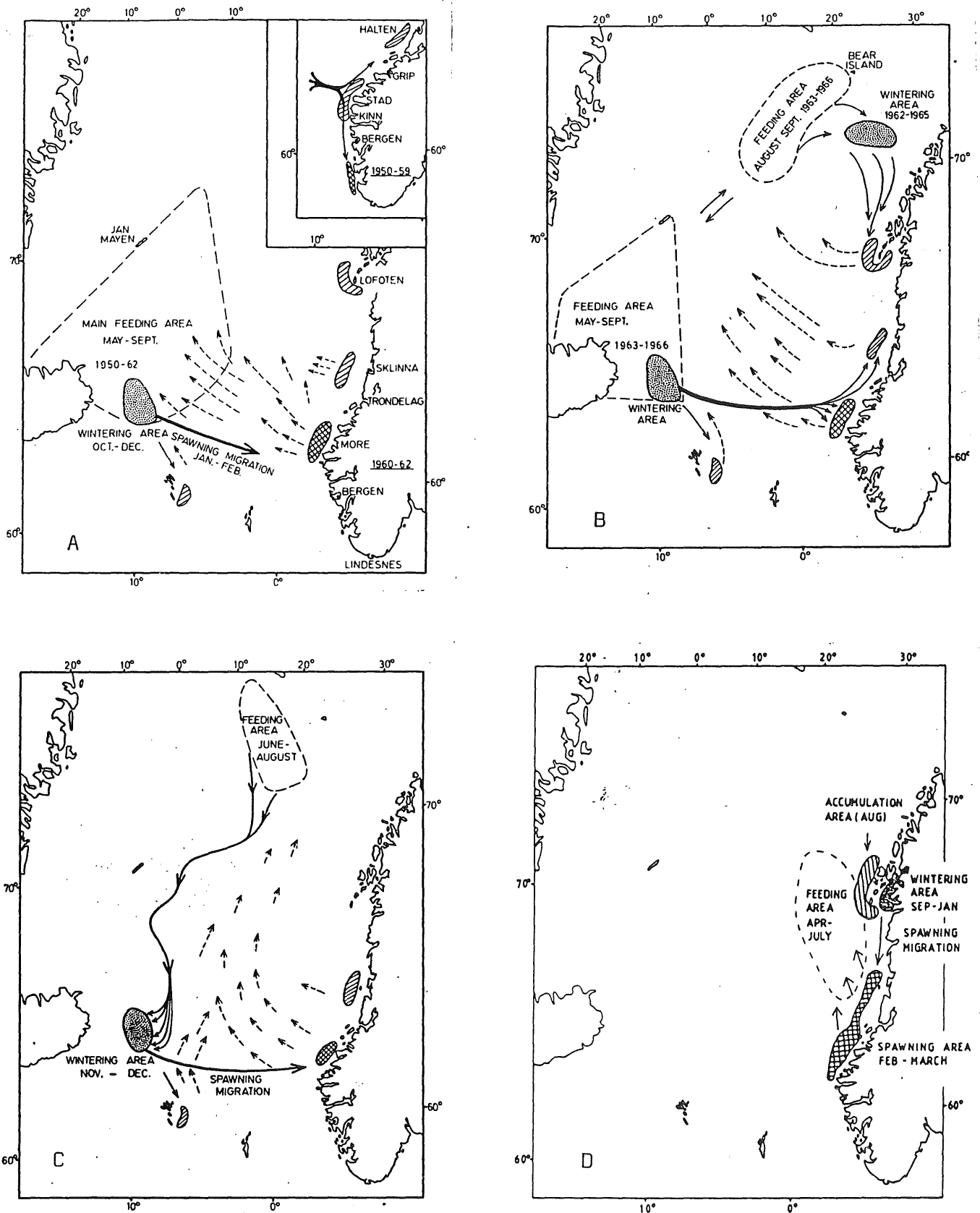


Fig 13 Migration routes of Norwegian spring spawning herring,

A. 1950-1962

B. 1963-1966

C. 1967-1968

D. August 1986-August 1988

(A, B and C from Dragesund et al 1980).

