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INVESTIGATIONS ON THE 1983 YEAR CLASS OF NORWEGIAN SPRING-
SPAWNING HERRING

by

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SUMMARY

The 1983 year class of Norwegian spring-spawning herring is very strong as 0-group compared to any year class since the collapse of the stock in the late 1960s. This paper gives a summary of the Norwegian investigations on this year class in the period April 1983 - June 1984. Distribution charts, length distributions and relative and absolute abundance estimates are given.

INTRODUCTION

The Norwegian spring-spawning herring had a stock collapse in the late 1960s. (Dragesund et.al 1980). Since then the stock has been in a rebuilding period. The year class during the rebuilding period have all been poor compared with the average year class strength of this stock prior to the collapse.

In order to get information as early as possible on year class strength, there has each year in the rebuilding period been

carried out larvae and 0-group surveys. The results from these surveys in 1983 showed that there had been recorded more larvae and 0-group herring compared with any year since the collapse. The aim of this paper is to give summary of the Norwegian investigations on the 1983 year class of the Norwegian spring-spawning herring in the period April 1983 to June 1984.

METHODS AND RESULTS

The results from the surveys are mainly given in intern. cruise reports of the Institute of Marine Research, Bergen. Many are multi-purpose cruises, a summary of the results of the "herring part" of the surveys are given below in chronological order.

April 1983: Herring larvae were recorded on a survey 5-22 April 1983, using a Gulf III plankton recorder. Fig. 1A gives number of larvae on each Gulf-station on 6 April (to few observations to draw isolines). Fig. 1B gives number of herring larvae/m² surface in the period 14-21 April 1983. The main concentrations of larvae were recorded between 62° - 64°N, which has traditionally been the most stable spawning grounds.

Summary:	Time period	Number of larvae caught	Larvae >12 mm
	14-21 April 1983	5200	390

June-July 1983: Postlarvae off Northern Norway were recorded on a survey in the period 20 June - 16 July 1983. The sampling was done with a pelagic trawl. The opening of the trawl was 10 x 10 fathoms and with a small meshed codend. The trawl was towed in 15 minutes with the head line in 40m and 20m depth respectively. Finally the trawl was towed with the headline in the surface in 30 minutes. Fig. 2 shows the distribution of the herring postlarvae. The main concentrations were found off Tromsøflaket (approximately 71°N, 19°E). The western limit of the distribution is not recorded. The length distribution of the herring postlarvae are given in

Table 1. The mean length of the larvae was 5 mm greater in 1983 compared with the corresponding cruise in 1982, although the cruise in 1983 was carried out approximately two weeks earlier than in 1982.

August-September 1983: A considerable number of O-group herring were recorded during the international O-group surveys in the Barents Sea (Anon. 1983). Fig. 3 gives the geographical distribution of O-group herring in the Barents Sea in August-September 1983. Double shading indicates dense concentrations.

The sampling gear used in these investigations is a midwater trawl with opening 16 x 16 fathoms and with a small meshed codend. The trawl is towed at 0.5 m at each depth, the headline of the trawl at 0, 20 and 40 m.

The figure shows that the O-group herring is recorded over a large area. The southwestern limit of the distribution is not recorded. Length distribution of the O-group is given in Table 1. The abundance index is given each year on each O-group. The largest abundance index for herring since the stock collapse was in 1979, when the calculated abundance index was 8. In the 1983 the index was 431. Both the geographical distribution and abundance index in 1983 indicate a much larger O-group herring stock in the Barents Sea in 1983 than in any other year since the stock collapse.

October 1983: During the period 3-19 October 1983 a survey was carried out in order to investigate if the occurrence of O-group herring on the coastal banks in the area $62^{\circ}\text{N} - 71^{\circ}\text{N}$, areas that were not surveyed during the international O-group surveys in September-October.

No O-group herring were recorded except on one station close to the coast. However, herring larvae from 20 to 40 mm length were recorded. Fig. 4 shows where these larvae were recorded. With a

growth rate of 0.3 mm per day and a length at hatching of 8 mm, these larvae must have been hatched from the middle of July to the middle of August. The sampling gear was the same midwater trawl which was applied during the international O-group surveys in August-September. No quantitative measurements of these larvae could be made from the trawl catches.

November-December 1983: In this period two surveys were carried out, one in the coastal areas of Norway north of 62°N, and one in the Barents Sea.

Since the collapse of the stock in the late 1960s, the main part of the O-group has in autumn been distributed in the fjord areas, very little has been recorded in the open sea. Therefore, the data from which the first prognosis on year class strength have been based, have been collected during a survey in coastal areas. This survey has been carried out in November-December every year since 1975, and the methodology is described in a Working Group report (Anon. 1977). All the main fjord areas on the Norwegian coast north of 62°N are surveyed at the same time each year, and the cruise tracks almost identical. Fig. 5 gives a typical echo recording of O-group herring in a fjord area.

The aim of the cruise in the Barents Sea which was carried out in the period 3-16 November was to survey parts of the western and south-eastern Barents Sea. The area was chosen on the basis of earlier distribution charts of O-group herring, i.e. from 1959 and 1960 (Figs. 10-11). The year classes of 1959 and 1960 were strong year classes (Dragesund et.al 1970).

During the international O-group surveys in August-September the different species of O-group are mixed, and it is very difficult to split the integration outputs into components belonging to each of the different O-group species. Thus it will be difficult to make an absolute abundance estimate of O-group herring at that

time of the year. In November the different species are more separated. Although some mixing with O-group redfish occurred in the Barents Sea in November, it was possible to make an abundance estimate. However, the estimate almost certainly an underestimate because bad weather and technical difficulties only the southeastern part of the Barents Sea was surveyed (Fig. 6). The abundance estimate of O-group herring in the southeastern part of the Barents Sea and in Norwegian coastal waters was made on the basis of the capelin conversion constant:

$$\begin{aligned} TS &= 19.1 \log L - 74.5 \text{ dB} \\ L &= \text{length of the O-group herring} \end{aligned}$$

The following result was obtained:

Area	Number ($N \times 10^{-9}$)
Coastal areas	14
Barents Sea (south east)	36
Total	50

In November the mean length of the O-group on the Norwegian fjord areas was 9.4 cm and in the Barents Sea 9.5 cm.

January 1984: Herring of the 1983 year class (now I-group) were also recorded during the investigations on the spawning migration of capelin. Fig. 7 gives the trawl stations where the I-group was recorded. Although the data from the by-catches in the Norwegian capelin fishery are not completely worked up, there seems to have been only limited by-catches of I-group herring in that fishery.

May-June 1984: A major part of the Barents Sea was surveyed under good weather conditions in this period. I-group herring was recorded over a wide area (Toresen 1984), and Fig. 8 gives the geographical distribution of the I-group herring. The distribution

lines east of 32°E are dotted. These observations were made during a survey for capelin larvae, and there was time only for few trawl stations. However, there is additional material from a cruise with R/V "Eldjarn" which is not yet worked up. This material may give additional observations of I-group herring in the area $20^{\circ}\text{E} - 32^{\circ}\text{E}$. Fig. 9 gives a typical recording of I-group herring in the Barents Sea. The length distribution varied from 12 cm in the western part of the distribution area to 8 cm in the eastern part. An acoustic abundance estimate gave a total of approximately 40×10^9 I-group herring.

COMMENT

For comparison Fig. 10 and Fig. 11 are included and give the distribution of O-group herring in 1959 and 1960 (Dragesund 1970). As mentioned earlier this was strong year classes. The survey effort was not as extensive as in later years. Fig. 12 gives the distribution charts for the years 1966, 1973, 1979 and 1983.

On the basis of the information available in October 1983 the Working Group on Atlanto-Scandian herring and capelin concluded that "The 1983 year class was very strong as O-group compared to any year class since the collapse of the stock in the late 1960s, and that it could well turn out to be in the same order of magnitude as the year classes which were produced in the period 1961-66" (Anon. 1984).

The investigations which have been carried out since the Working Group took place have confirmed the assumption that the 1983 year class is strong, and that there will be a large increase in the spawning stock in 1987-1988 when this year class recruits to the spawning stock.

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Table 1. Length distributions

Length mm	Time	
	20/6-16/7	21/8-8/9
20-24	0.4	
25-29	13.7	
30-34	37.1	+
35-39	26.0	+
40-44	12.4	+
45-49	6.9	0.1
50-54	3.0	0.4
55-59	0.5	0.9
60-64		3.2
65-69		9.0
70-74		17.3
75-79		13.2
80-84		13.6
85-89		12.9
90-94		13.4
95-99		8.9
100-104		5.8
105-109		1.0
110-114		0.3
115-119		0.1
Number	1220	96533
Mean length	35.6	82.6

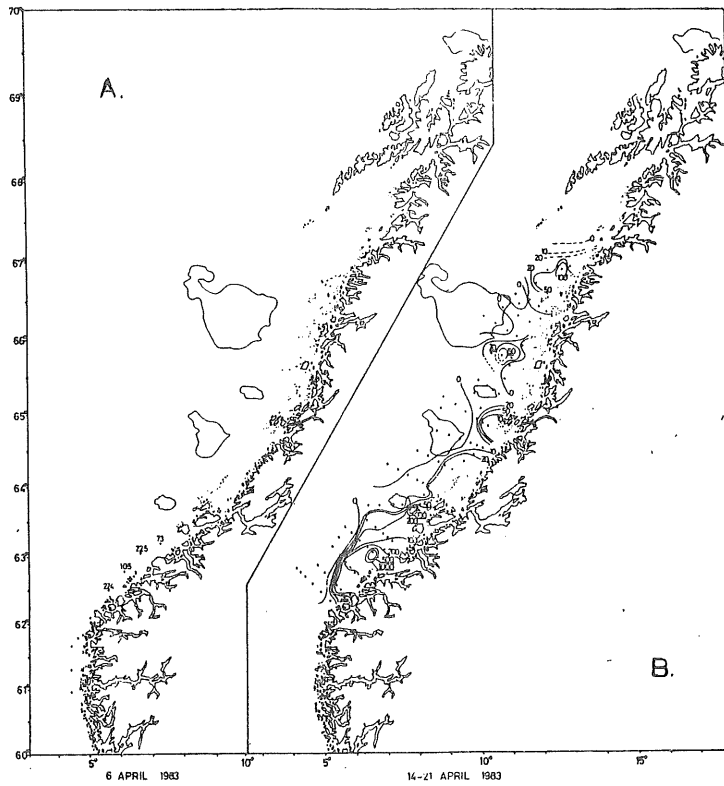


Fig. 1. A: Number of herring larvae on Gulf III-stations on 6 April 1983. B: Number of herring larvae per m² surface 14-21 April 1983.

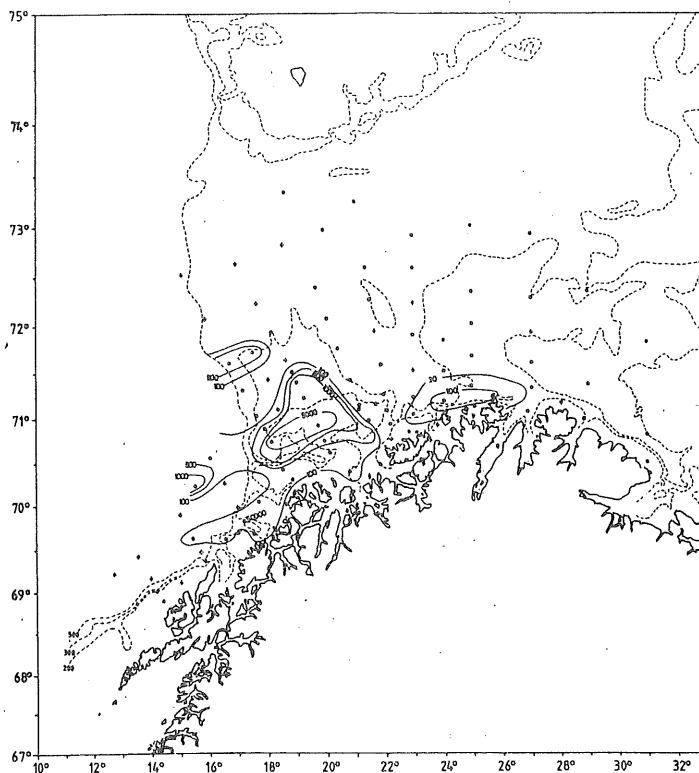


Fig. 2. Distribution of herring postlarvae 20 June - 16 July 1983.

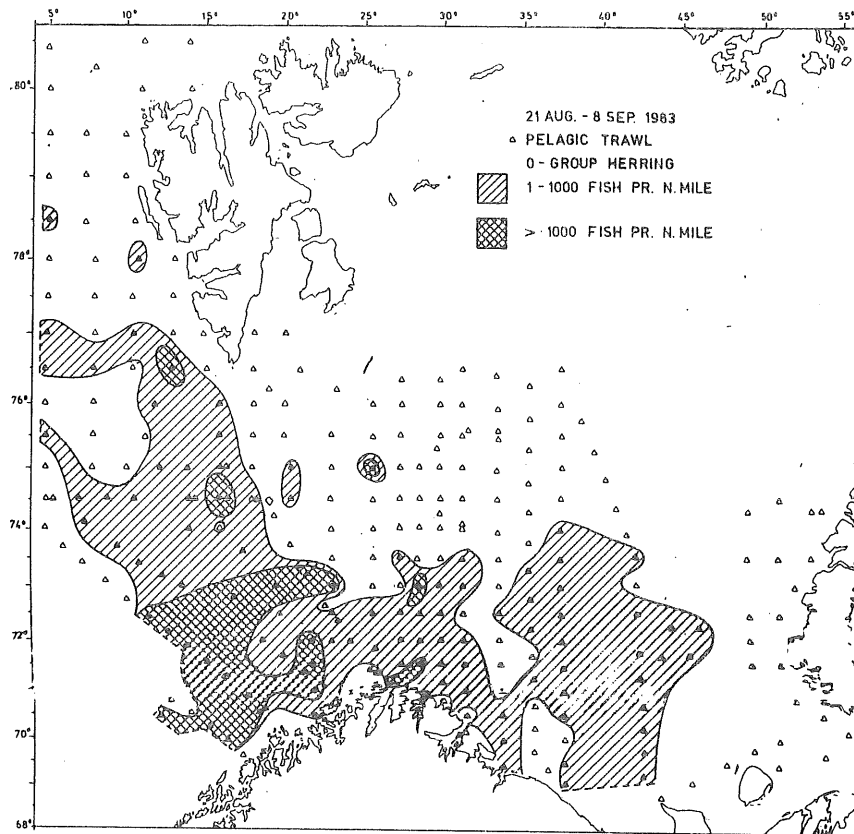


Fig. 3. Distribution of O-group herring, international O-group survey.

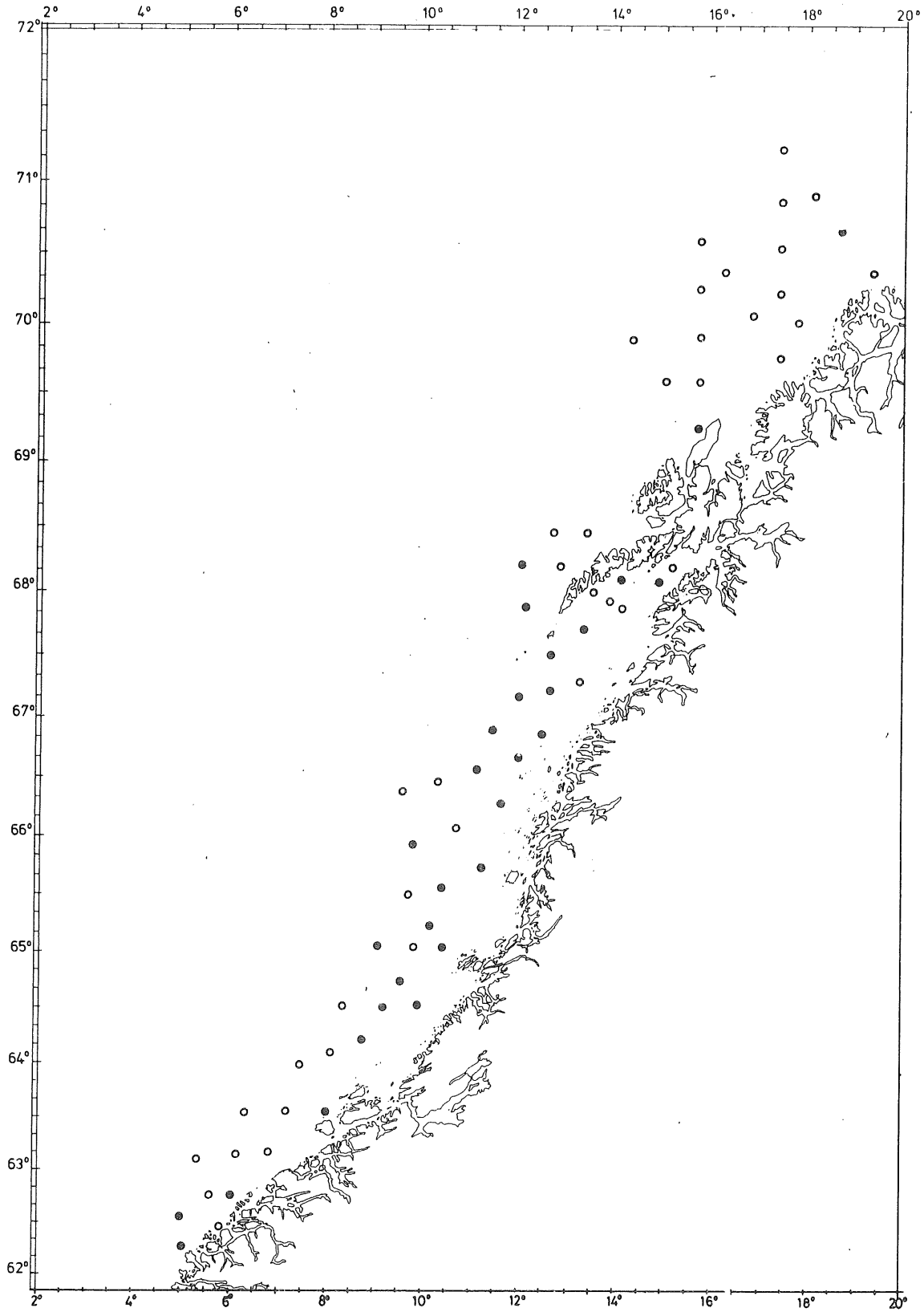


Fig. 4. Trawl stations 3/10-19/10 1983. Filled circles indicate catch of herring larvae.

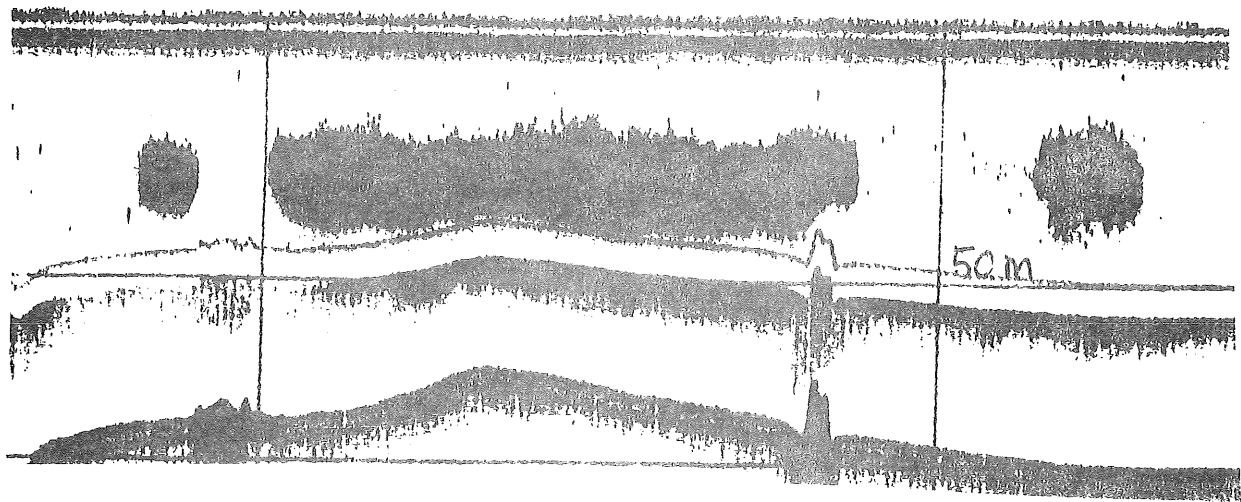


Fig. 5. Echogram of O-group herring. Altafjord 21/11-1983.

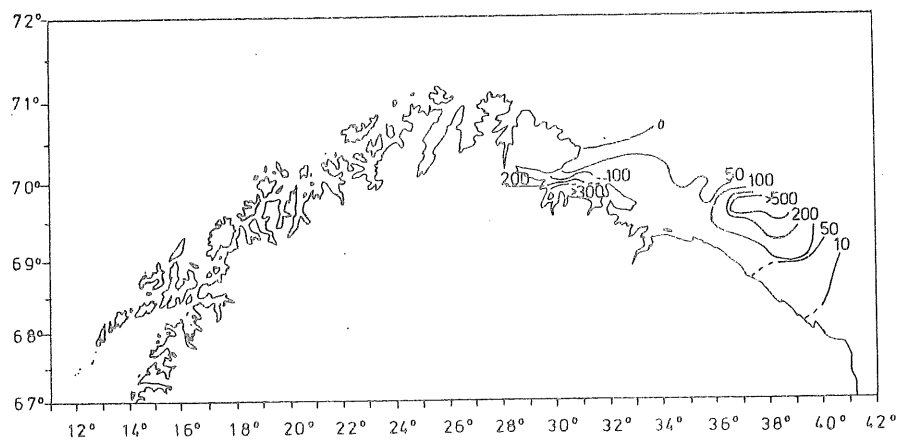


Fig. 6. Distribution of O-group herring recorded during survey 3/11-16/11 1983. Integrator output presented as total integrated scattering cross section per squared nautical mile multiplied by 10.

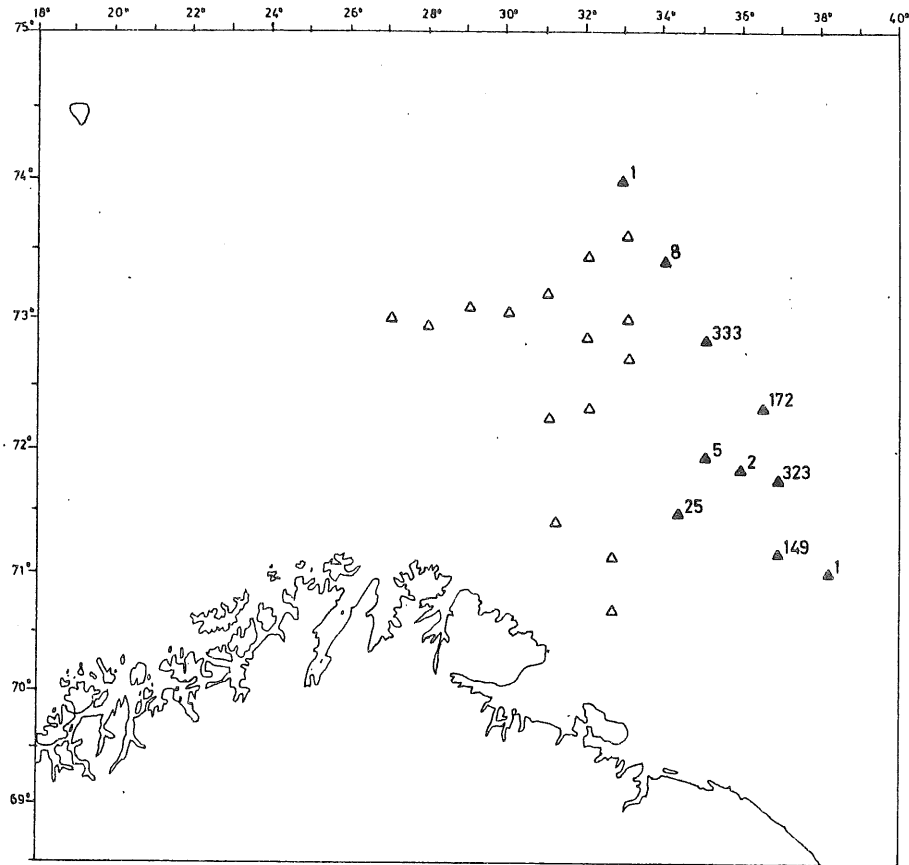


Fig. 7. Number of I-group herring per trawled nautical mile. 8.1-26.1 1984.

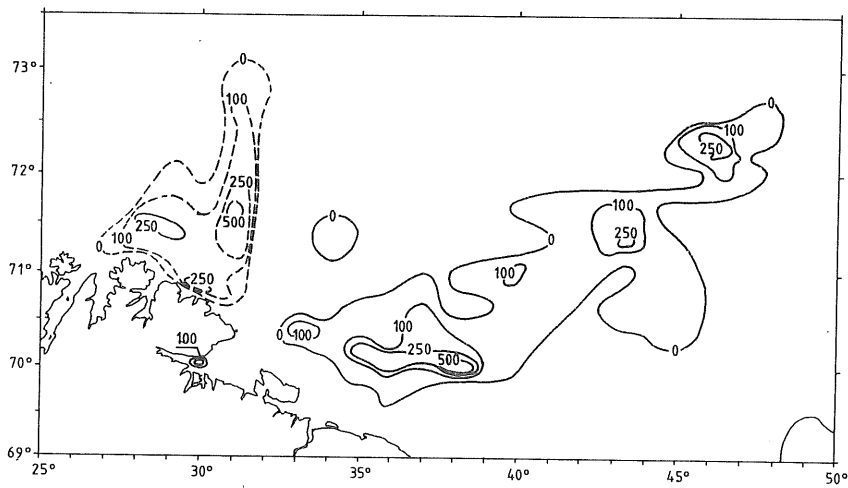


Fig. 8. Distribution of I-group herring recorded during survey 19/5-8/6 1984. Integrator output as in Fig. 6.

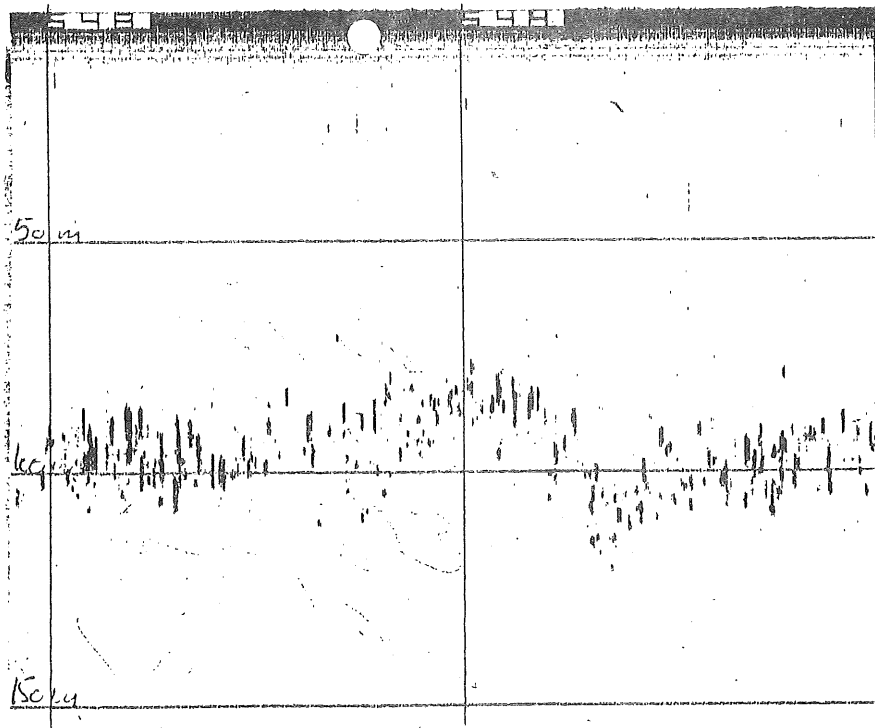


Fig. 9. Echogram of I-group herring. Goosebank (approx. 72°N , 47°E) 27/5-1984.

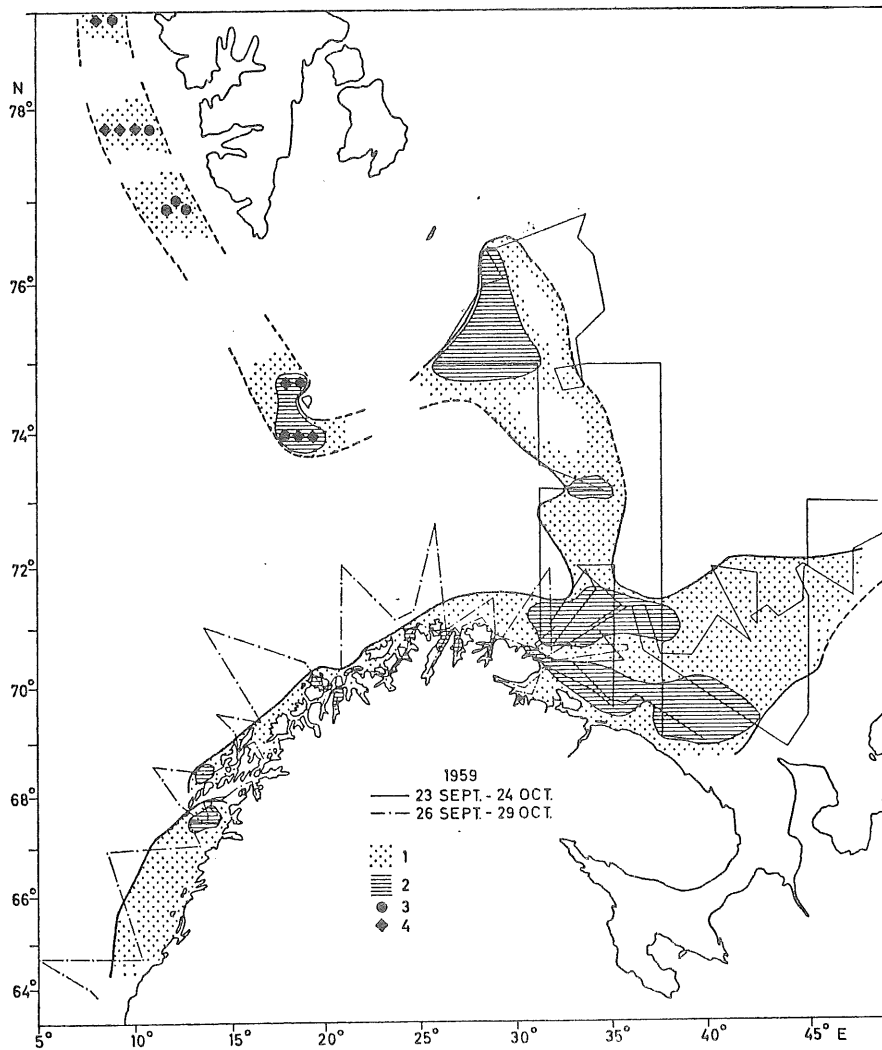


Fig. 10. Distribution of O-group herring autumn 1959.

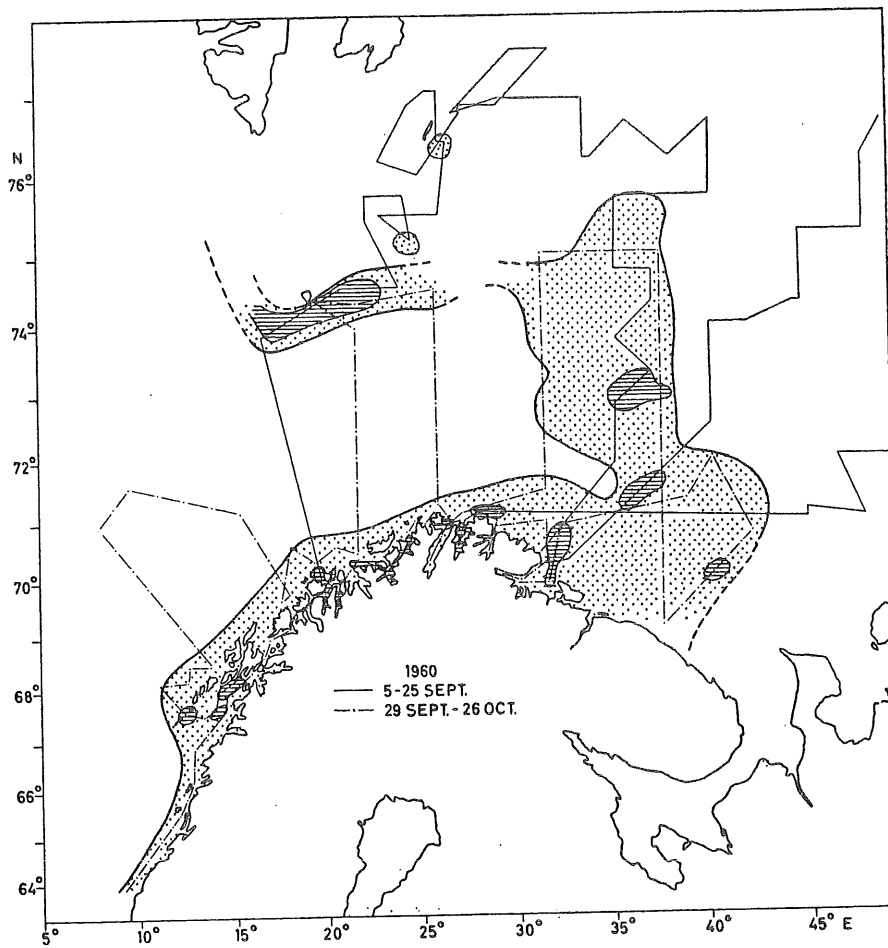


Fig. 11. Distribution of O-group herring autumn 1960.

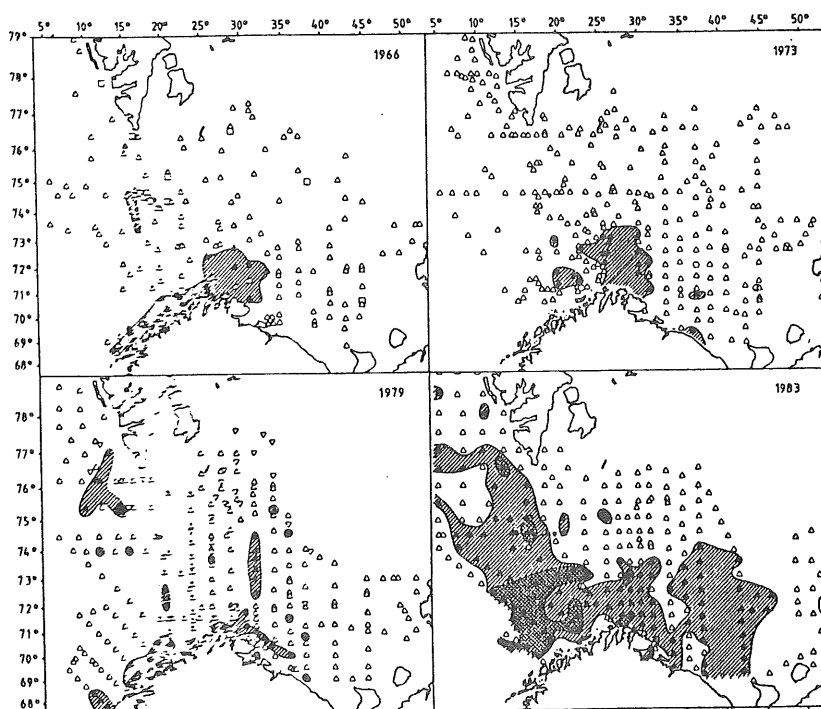


Fig. 12. Distribution of O-group herring in Barents Sea in 1966, 1973, 1979 and 1983.