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SPAWNING AND STOCK SIZE OF NORTH SEA MACKEREL IN 1981

by

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ABSTRACT

Four surveys were carried out in the North Sea during the summer 1981 to estimate the mackerel egg production. This year the mackerel spawned from late May until last week of July, and the estimated egg production indicates that spawning stock size is reduced by about 30% since 1980.

INTRODUCTION

Since 1968 egg surveys have been carried out in the mackerel spawning area in the North Sea. In the first years only the northern part of the area was covered, but in later years the surveyed area has been extended southwards. The surveys were carried out to delineate the spawning area and to see if trends in spawning stock size, estimated from VPA and tagging data (Anon 1981) were reflected in the egg data (eggindices) (Iversen 1977, 1981). In 1980 and 1981 the spawning area was covered several times during the spawning season to estimate total egg production.

MATERIAL AND METHODS

In 1981 the mackerel spawning area in the North Sea was covered four times in the period 10 June - 27 July. Only the central part of the spawning area was covered in the last survey. As in 1980 a 20 cm Bongo net (mesh size 500 μ) worked stepwise in 20, 15, 10, 5 m and just below the sea surface. The sampling procedure is described in Iversen (1981). The survey grid and stations sampled during the four surveys are shown in Fig. 1, 2 and 3. The numbers of mackerel eggs less than 2 days old (Danielssen and Iversen 1977) per square metre were estimated for all the sampled stations. The values were smoothed (Iversen 1977, 1981) and plotted in charts, and isolines were drawn by eye (Fig. 4, 5 and 6). To estimate the egg biomass for each survey, the area between two neighbour isolines was integrated and multiplied by the intermediate value of the two isolines.

Daily plankton samples were collected at two fixed positions 57°04'N, 02°26'E (Cod) and 56°34'N, 03°08'E (Ekofisk) to establish spawning intensity curves. Two hauls per day per position were carried out with a small Juday net (diameter 36 cm) between mid May and late August.

SPAWNING AREA

The egg distribution for the three first surveys are shown in Fig. 4, 5 and 6. The egg amount observed in the fourth survey was negligible. Therefore the spawning in the central part of the North Sea seems to be finished towards the end of July. The main spawning area was situated south of 58°N and east of 3° - 4°E. This is further to the east than in previous years (Iversen 1981). In 1980 the spawning area moved westwards during the season. A similar movement was not observed in 1981. The area between 57°30'N, 55°30'N and between 3°30'E, 5°30'E was consistent as spawning area throughout the season because mackerel eggs were observed here during the three first surveys. In the area outside this rectangle eggs were just observed in one or two of the surveys. The size of the spawning area during the first survey in 1981 was about 20% less than in 1981.

EGG INDEX

In the years previous to 1980 the spawning area was covered once per season. To get comparable egg indices for the different years the most important spawning area (central North Sea) was always covered within the two last weeks of June.

The egg index is defined as estimated number of mackerel eggs less than 2 days old (eggs without visible embryos) in the area north of 56°N or 55°N based on a single survey. This index is the sum of products between the area and actual value of the respective isoline.

The egg index this year was based on the first survey and was about 60% lower than that of last year, which indicates a rather drastic reduction in spawning stock size.

TOTAL EGG PRODUCTION

The spawning intensity curves as obtained from samples collected at Cod and Ekofisk in 1981 and 1980 are shown in Fig. 7. These two locations are in the border of the spawning area, therefore relatively few eggs were sampled.

The spawning intensity is expressed on a weekly basis as percentages of the total amount of sampled eggs without visible embryos. Because the spawning intensities represent the border of the spawning area, they are probably not representative for the total spawning area.

According to the actual temperature in the sea surface layer the eggs without visible embryos are maximum 1.8 - 2.2 days old (Danielssen and Iversen, 1977). The surface temperature varied between 9.5° and 16.4°C depending on area and time. By dividing the total number of eggs without visible embryos by their age the daily egg production was estimated within the period of each survey (Fig. 8). As shown in Fig. 8 the first part of the spawning period was not surveyed. The data from Cod and Ekofisk during this period indicate that spawning started about 25 May.

If this is chosen as first day of spawning the spawning period this year was 65 days which is similar to 1980.

By integrating the area below the curve in Fig. 8 the egg production in the North Sea was estimated to 40×10^{12} eggs.

DISCUSSION

The spawning intensities obtained at Cod and Ekofisk differ from the egg production curve obtained from the surveys. According to Cod and Ekofisk the main spawning period was in the weeks 25 and 26, which is about two weeks later than indicated by the surveys. The main reason for this is probably that Cod and Ekofisk are located in the border of the spawning area, besides the spawning intensities from the locations are based on rather few eggs sampled. Therefore the intensities obtained here are probably not representative for the spawning activity in the total spawning area.

The egg index in 1981 was about 60% lower than in 1980. This indicate a further decline in spawning stock since last year. The egg indices the last years have demonstrated a similar decline in spawning stock size as resulted from VPA and tagging experiments (Iversen 1981, Anon. 1981).

The total egg-production in the North Sea in 1981 was estimated to be about 30% lower than in 1980. In 1981 the peak of egg production was less than the year before. However, the peak production seemed to last for a longer period in 1981. This explains why the egg index was more drastically reduced from 1980 to 1981 than the total egg production. The shape of the spawning curve the first weeks of spawning is uncertain due to lack of data. The shape of the production curve in this period will influence the egg production estimate. However, the daily egg sampling from Cod and Ekofisk demonstrate a rather low spawning activity during the first weeks of spawning. Therefore, the suggested shape of the curve in this period (Fig. 8) probably overestimate rather than underestimate the egg production.

There are no new fecundity data of North Sea mackerel than those published by (Borges, Iversen and Dahl, 1980). This data differed from fecundity data of the Western mackerel stock (Lockwood et.al. 1981). The fecundity data published in these papers and by Morse (1978) which gives data of the American mackerel, were applied to the estimated egg-production in 1980 (Iversen, 1981) and gave very varying spawning stock estimates. Therefore no such estimate is given here. However, the spawning investigations in 1980 and 1981 demonstrate a reduction in spawning stock size of about 30%.

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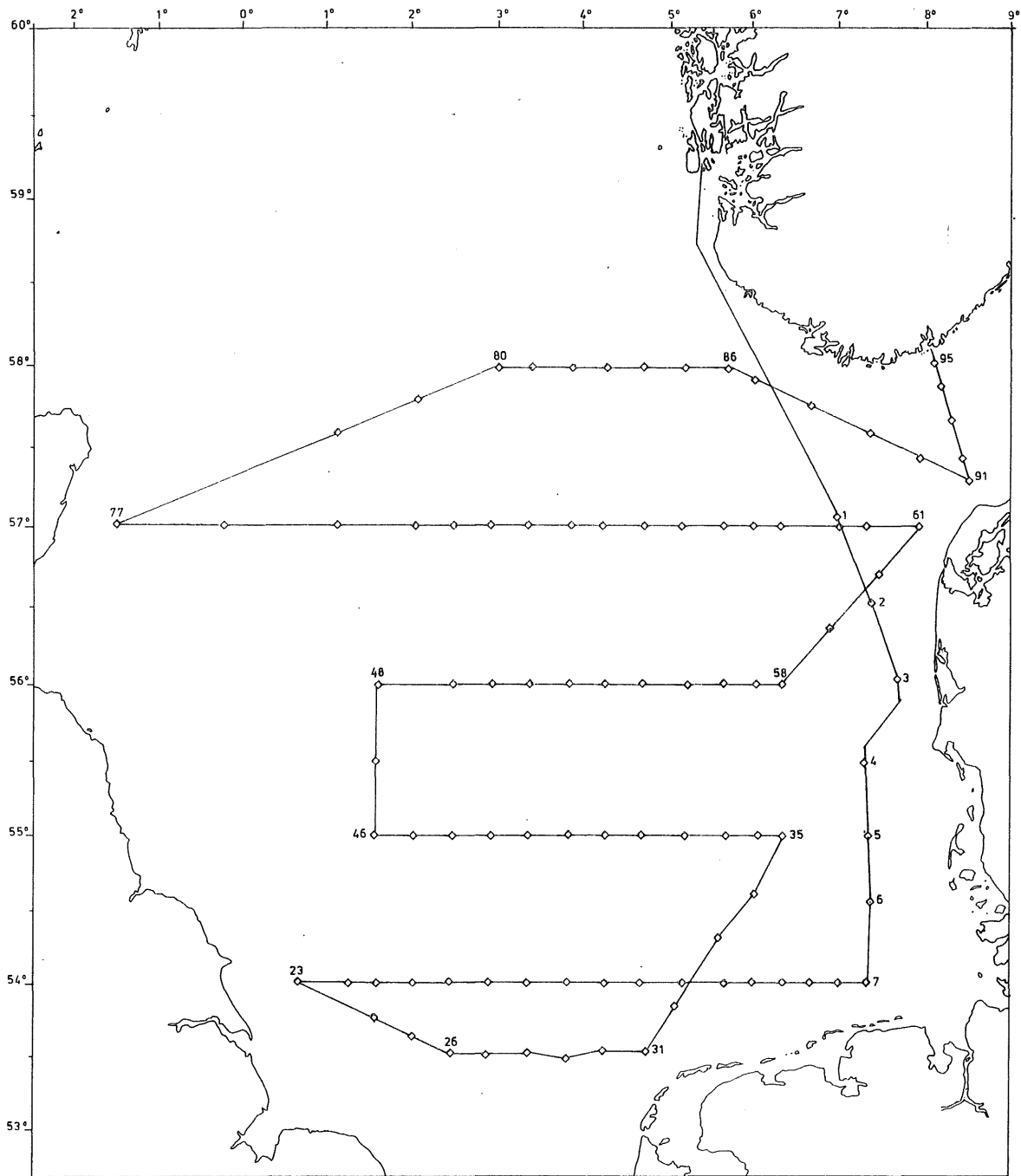


Fig.1 Station grid first survey 1981

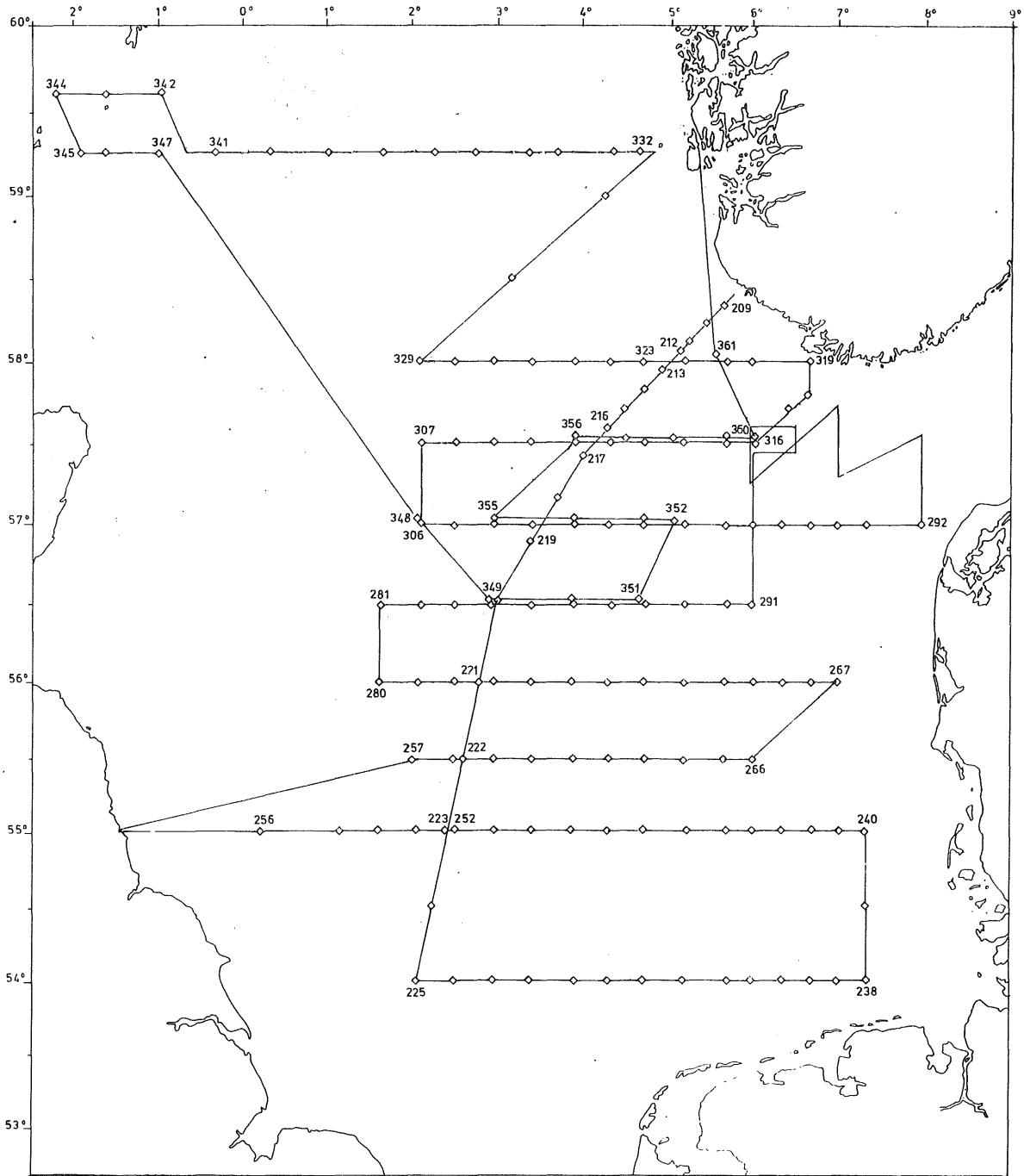


Fig.3 Station grid third (st.no.209-347)
and fourth (st.no.348-361) survey 1981

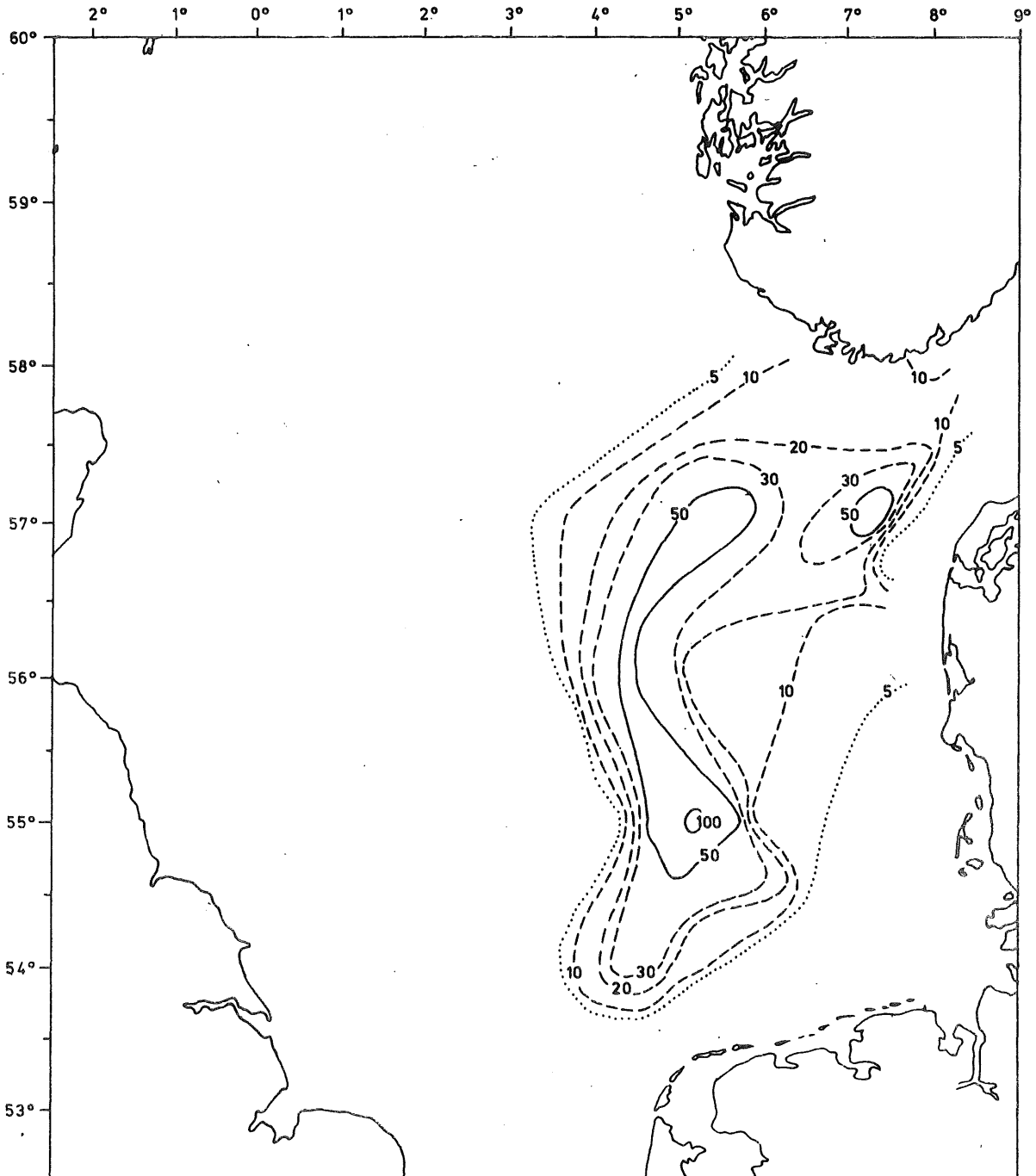


Fig.4 The distribution of mackerel eggs without visible embryo during first survey in 1981 (eggs per m²)

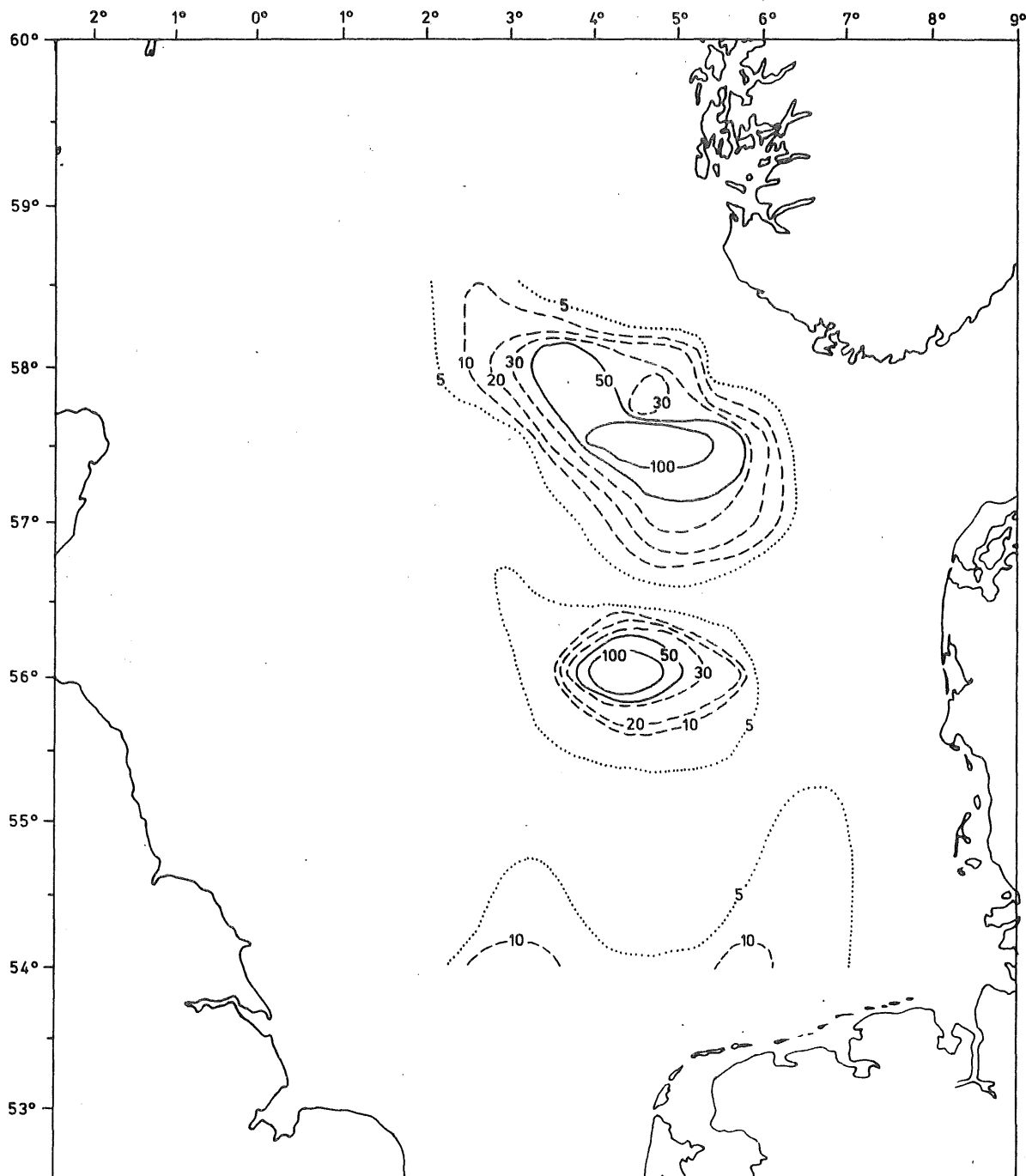


Fig.5 The distribution of mackerel eggs without visible embryo during second survey in 1981 (eggs per m^2)

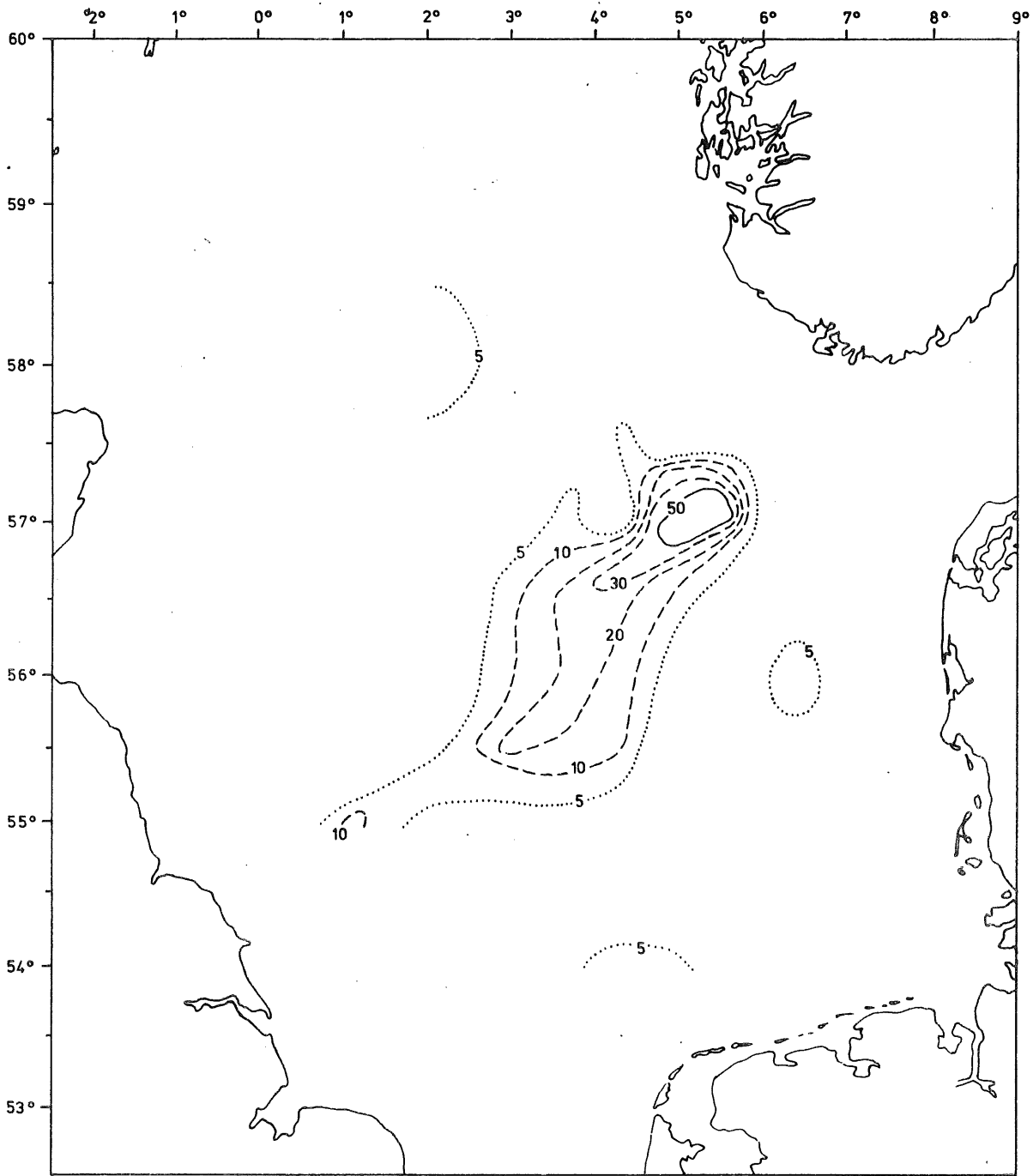


Fig.6 The distribution of mackerel eggs without visible embryo during third survey in 1981 (eggs per m^2)

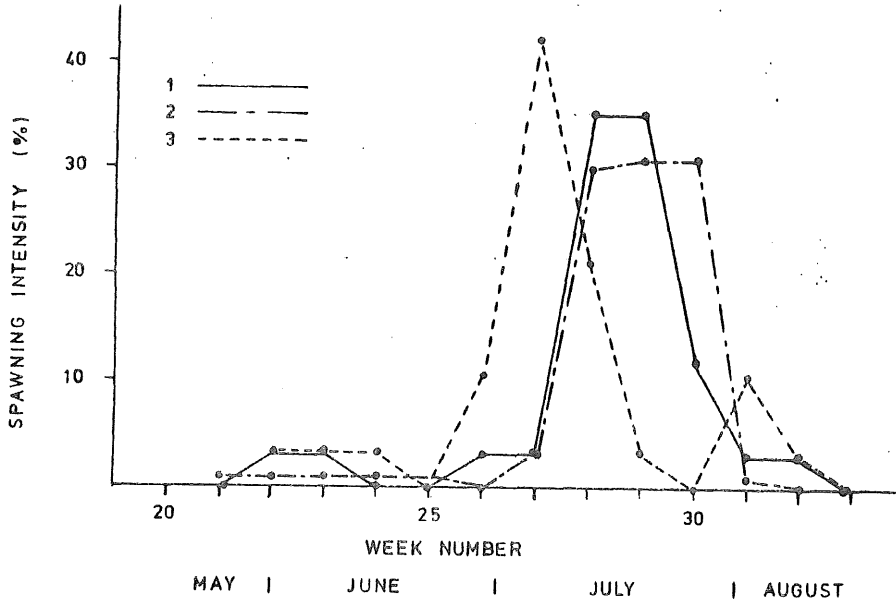


Fig.7 Spawning intensities of North Sea mackerel in 1980 and 1981 based on data from:

- 1. Cod 1981
- 2. Ekofisk 1981
- 3. Cod 1980

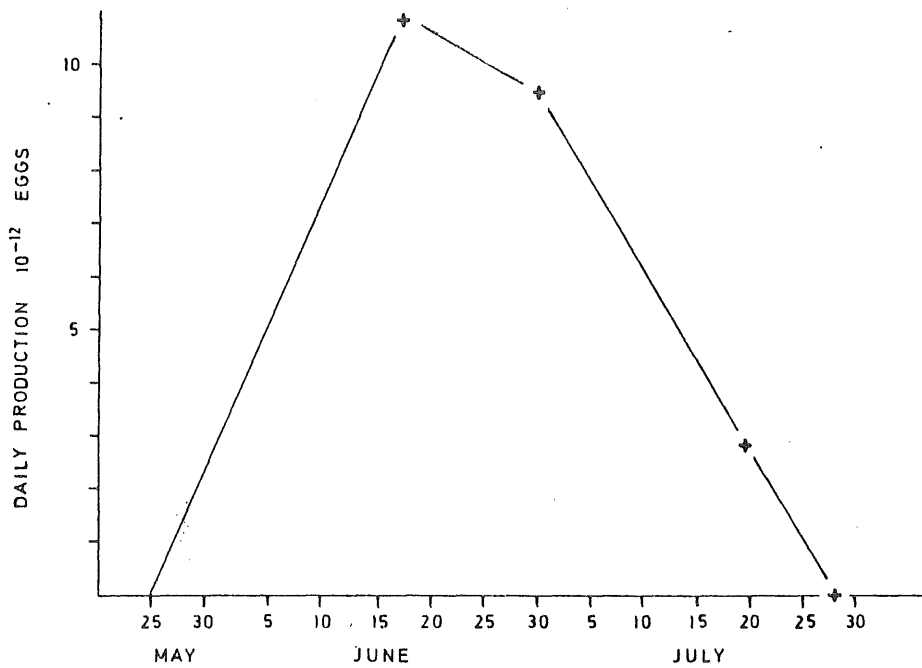


Fig.8 The egg production curve based on the four surveys (+) in 1981

