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IRISH MACKEREL EGG SURVEY in Divisions VIa and VIIb, 1986

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ABSTRACT

This paper describes the results for a mackerel egg survey which was financed by the Irish fishing industry and which was carried out west of Ireland and Scotland in May and June 1986. The purpose of the survey was to investigate the quantities of mackerel which spawn in some of the areas not covered by the major international egg surveys. The results indicated that quantities of mackerel were spawning in the area surveyed and the total spawning biomass amounted to between 5% - 8% of the total western spawning stock.

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1. Introduction

Landings of mackerel by Irish vessels have increased dramatically in recent years and from 1982-1985 have averaged about 100000 tonnes per annum. The total catch has however been restricted because of the quota imposed on the fleet by the EEC. The international Total Allowable Catch (TAC), from which the Irish quota is allocated, is dependent on the size of the total stock. The estimate of the total stock size comes from the assessment made by the Mackerel Working Group of the International Council for the Exploration of the Sea (ICES).

The estimate of the total stock size is based on a comprehensive sampling programme of the catches made by the various countries taking part in the fishery, together with a series of international egg surveys carried out during the main spawning period. However the ICES Mackerel Working Group which makes the assessment of the total stock each year have consistently drawn attention to a large number of shortcomings and defects in the data which are made available to them for making the necessary calculation. Unfortunately, although some considerable doubts surround the estimates of total stock sizes, there is no better information available on which to base management policies. It is also true that in recent years the location and distribution of the fisheries and the stocks have changes rapidly (Anon, 1985 and 1986). At the same time the egg surveys which play a very major part in the assessments, have only been carried out every three years. Thus, for the Western Stock, there have been only four fishery-independent surveys - those carried out in 1977, 1980, 1983 and 1986. The area over which these surveys were carried out was based on the information then available about

the spawning of mackerel - and the main spawning areas were considered to be southwest of Ireland and across the Celtic Sea. For a number of reasons - (financial cutbacks, lack of research vessel availability and the declining importance of the mackerel fishery to various countries) the surveys have been confined to the same areas in each year and have not been extended to other areas. It has been necessary, in order to make valid comparisons, to cover the same areas each survey. This means, however, that if a change occurs in the spawning area of the mackerel then an important part of the spawning population may be excluded by the surveys.

The ICES Mackerel Working Group of 1985 and 1986 have studied the changes that have taken place in the distribution of the fisheries in recent years. Walsh (1986) has suggested that the changes in the fisheries may be associated with changes in the strength of the North Atlantic drift at the shelf edge. During the period of change in the distribution of the fisheries the North Atlantic drift may have been weak, resulting in more of the shelf edge water coming into the North Sea than in normal times, when the drift was stronger and carried more water into the Norwegian Sea. The 1985 Mackerel Egg Production Workshop (Anon 1985b) considered that, because of the changes in the distribution of the stocks, spawning north of 54degN may be significant. It was agreed therefore to extend all the 1986 surveys up to 55degN and as far north as 56degN for the May/June surveys. The ICES Mackerel Working Group (Anon 1986) also noted that the 1986 surveys would be reduced compared with those of 1980 and 1983 and it expressed concern that the recent change in the distribution of the Western stock may mean that increased spawning may occur to the North West of Ireland and West of Scotland i.e. ICES divisions VIa and VIIb. This would mean that the total egg production may be underestimated. The Working Group considered that a survey in this area during the main spawning season (May/June) would provide valuable information about the distribution and size of the spawning stock.

In 1986, the Donegal mackerel management committee were concerned about the difficulties faced by the ICES Working Group and the possibility that the curtailment of the 1986 egg surveys might lead to an innacurate estimate of the spawning stock size. The Committee therefore decided that it would act on the suggestion of the Working Group and carry out an egg survey north west of Ireland and west of Scotland. The two main aims of the survey would be to

(i) establish whether mackerel spawn in the area;
(ii) estimate the size of the spawning stock in the area.

It was decided that the survey would be carried out in as far as possible, along the lines recommended by the Mackerel Egg Production Workshop (1985) and that the results would be submitted to the Mackerel Egg Production Workshop organized by ICES for November 1986.

2. The 1986 Survey

The survey was timed to coincide with what was believed to be the main spawning period for the area - i.e. mid May to early June. It is not necessary therefore to describe in detail the methods used during the survey except to say that they are described in the report of the 1985 workshop (Anon 1985b).

The survey was carried out using an 86ft. chartered commercial fishing vessel "Emer Marie" (Skipper P. Conneely from Killybegs. Plankton samples were obtained from 72 stations (Fig 1.), each station being at about the centre of standard 0.5deg x 0.5deg rectangles. In general the major sampling took place between the 100 metre and 200 metre line. However bad weather at the beginning of the survey prevented sampling at some of the outer stations in the southern part of the proposed area. The sampler was shot to the bottom in waters less than 200 metres, while in deeper water it was shot to slightly less than 200 metres. Surface temperatures were taken at all stations, and in addition, at 20 metres below surface at a number of stations covering the entire area.

3. Results

Prior to 1986, there have been no directed mackerel egg surveys in this area so that no estimates of spawning stock size using this method are available. Walsh (1976), however, was able to use a series of plankton samples obtained during a blue whiting survey carried out in 1967 to give some indication of the timing and distribution of mackerel spawning in the area. He concluded that, based on surveys carried out between mid April and May, mackerel eggs were distributed over a wide area extending as far west as 17degW and as far north as 60degN. The main areas of egg concentrations were found along the 100 fathom contour near the Porcupine Bank, northwest of Ireland and off North Rona. It is interesting to note the westerly distribution of eggs during the survey - eggs being found around Rockall Bank and even southwest of the Bank itself. Another interesting fact is that the eggs were found hatched before what would be considered as the main spawning period.

The 1986 survey indicates that spawning takes place over a large part of the area surveyed but that spawning tends to be heaviest along the 100 fathom line (Fig 2). The densest concentrations of eggs were found in rectangle D.5 which is situated off the northwest Donegal coast. Mackerel appear to spawn even further west than the 100 fathom line and it is possible that high egg concentrations may be found in these areas. Again mackerel eggs were also found along the most northerly row of stations (i.e. row M) so that further spawning may also occur north of this line.

4. Analysis of results

Mackerel eggs and larvae were removed from all samples obtained during the survey, and were counted and staged according to the classification scheme recommended by the ICES Mackerel Egg Production Workshop. The identification and staging procedures were checked and agreed by the Plankton Section of the Fisheries Laboratory, Lowestoft.

Having been counted, the number of eggs produced each day per square metre of water (i.e. eggs produced m-2 d-1) was calculated for each station, using the temperature of the water and the amount of water filtered at each station. Finally the total production of eggs for the area was calculated.

The Irish survey was carried out in May and early June. However it is known that mackerel spawn over a long period extending from March to July and it is therefore necessary to make some assumptions in calculating the total production of eggs over the entire spawning period. It was therefore assumed that spawning takes place as in the southern areas - i.e. with a peak in late May and June. Using this procedure the total egg production for Div. VIa was calculated as 4.26 x 10 (Fig. 3). This production estimate was then converted into the number of mature females required to produce that number of eggs by using fecundity length relationship. The length distribution of spawning mackerel was obtained from samples taken by Irish commercial vessels fishing in the southern part of Div VIa in late May and early June. The number of mature females was converted into the total number of mature adults by using the sex ration 1:1 as observed in the spawning area in the southern zone. The total number of mature fish in the area was thus calculated to be about 322 million fish (Fig 4). Finally this number was converted into biomass (i.e. weight) by using any of a number of possible procedures. The total biomass calculated ranged from 85,000 - 100,000 tonnes.

This whole procedure is based on a number of assumptions which are open to scientific debate and which have far reaching effects on the overall conclusion. It must be pointed out that there are still considerable doubts surrounding the fecundity estimates, the sex ratio and the egg mortality levels - all of which will effect the overall conclusions to varying degrees.

5. Discussion of results

The results of the survey indicate that at least 85,000 - 100,000 tonnes of mackerel spawned in Div VIa during the Spring and Summer of 1986. This amount represents a small but important quantity of mackerel which would not have been included in the major international surveys carried out in Divisions VII and VIII. The 1986 ICES Mackerel Egg Working Group considered that the spawning in Div VI represented 5%-8% of the biomass spawning in the southern areas.

Although this appears to be small in comparison with the total spawning population of about 1.8 million tonnes it must be remembered that the amounts indicated by the Irish survey are a minimum estimate because of the restricted area covered and because of the preliminary nature of the survey. The Mackerel Egg Production Workshop therefore considered that it would be advisable that the areas covered by future international surveys should be extended to include this previously unestimated spawning area.

The results of the mackerel egg survey conducted by the MFV Emer Marie have therefore been used to

(1) Demonstrate that mackerel spawn over a large area northwest of Ireland and Scotland.

(2) Calculate a spawning biomass of at least 85,000 - 100,000 tonnes in the area surveyed.

(3) Provide additional information which has resulted in an extension of the area which will be surveyed in future international surveys.

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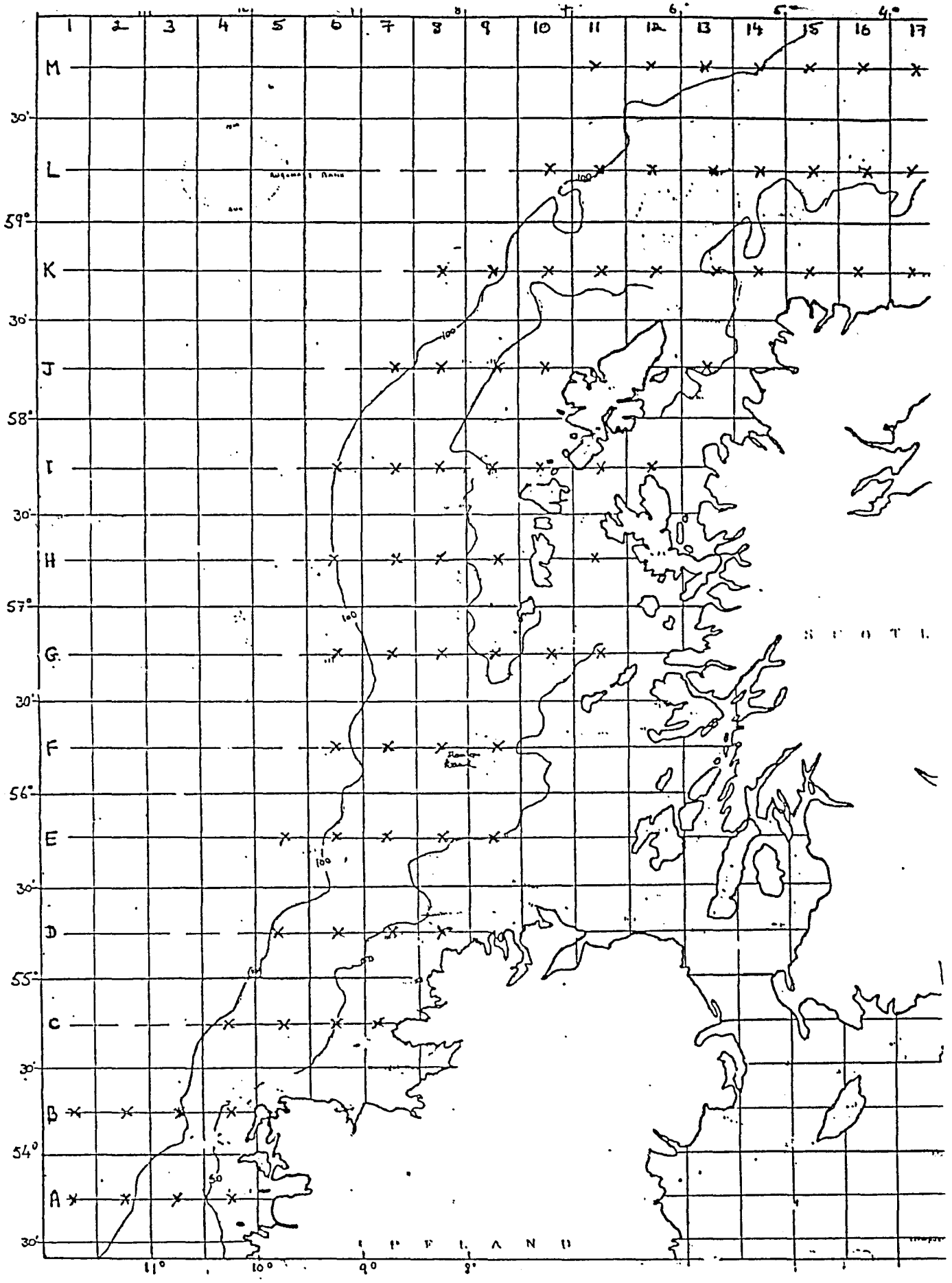

FIG 1. AREA COVERED BY IRISH SURVEY

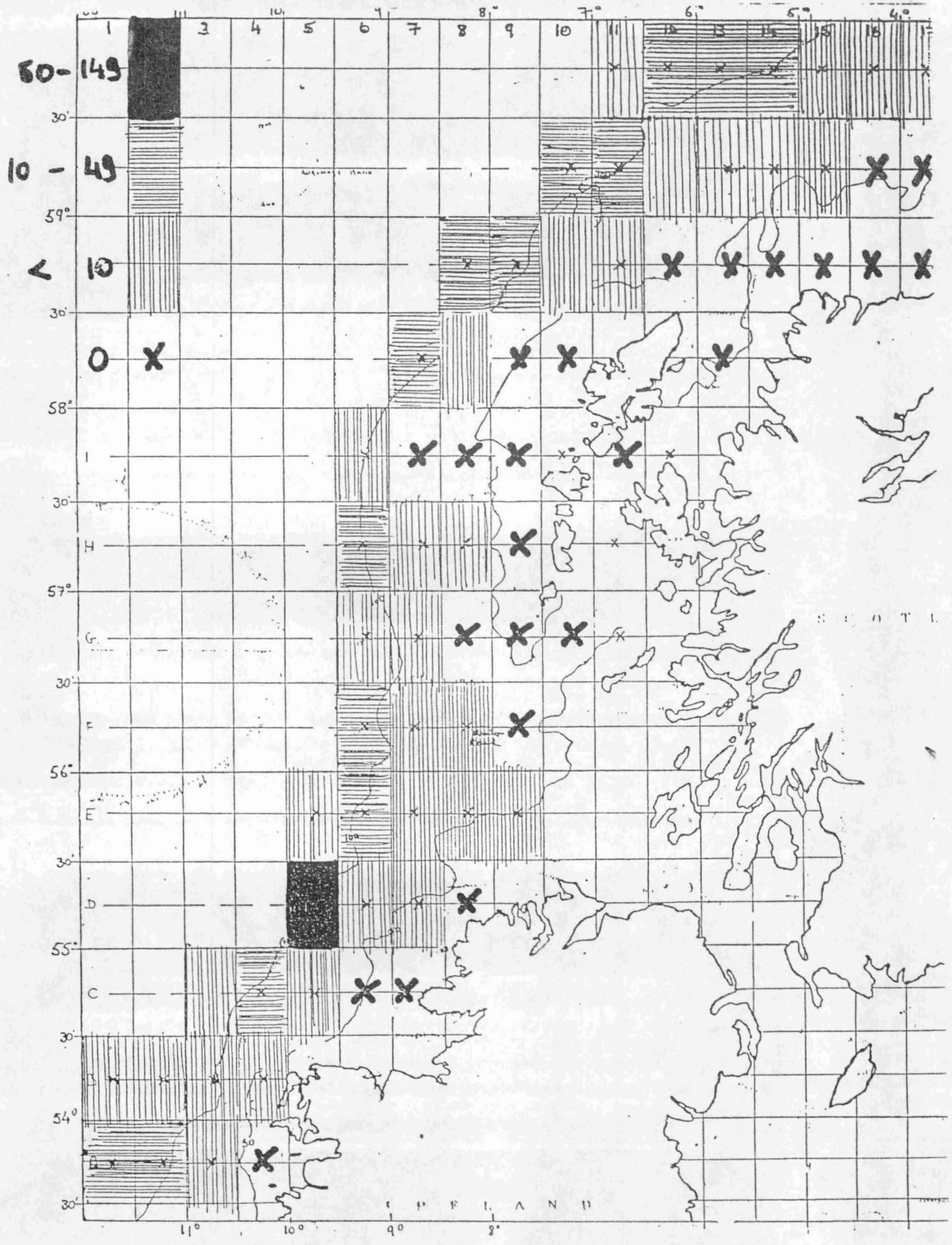

FIG. 2. STAGE I EGGS. NOS. PROD. M^{-2} DAY^{-1}

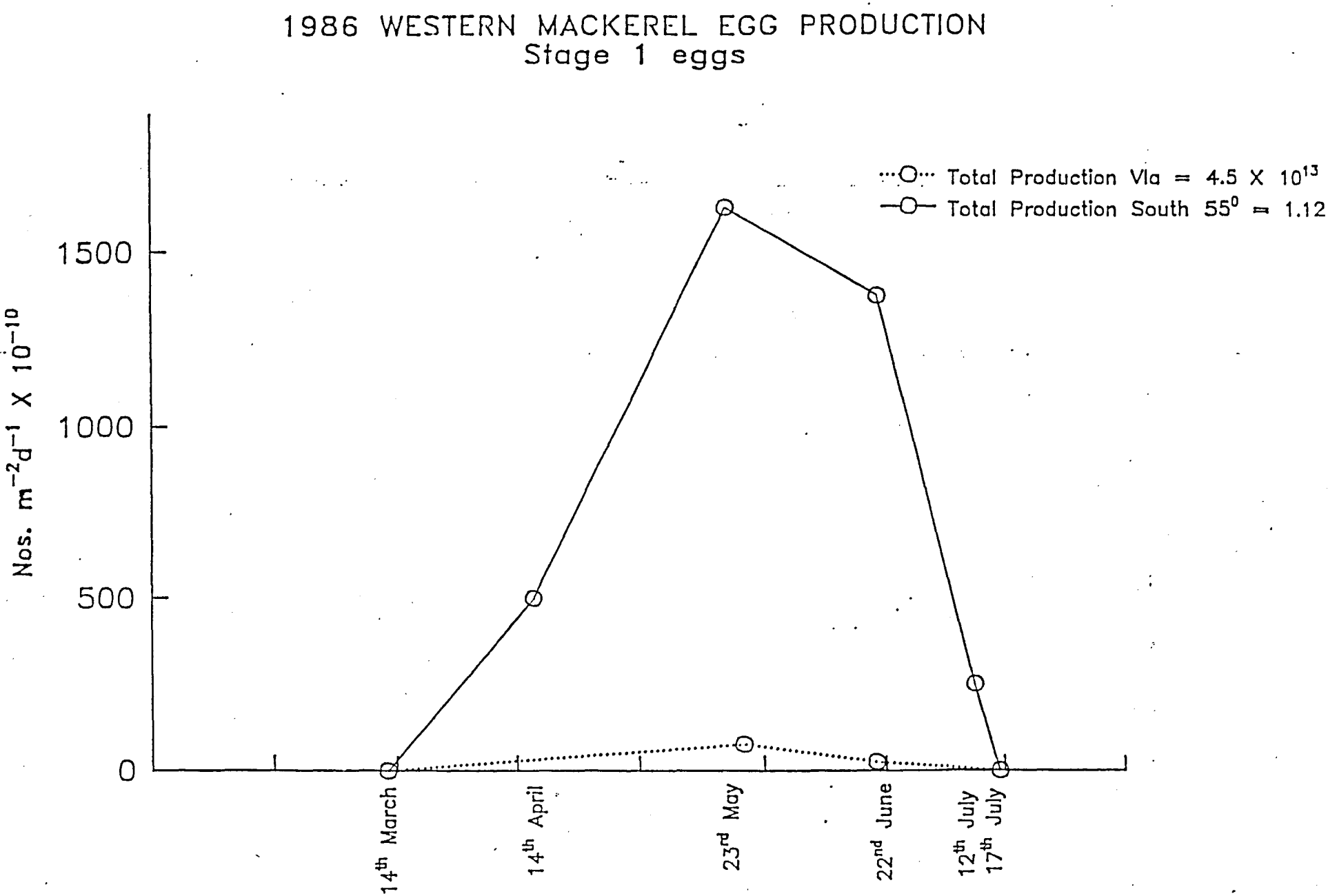

Fig 3. Seasonal Egg Production

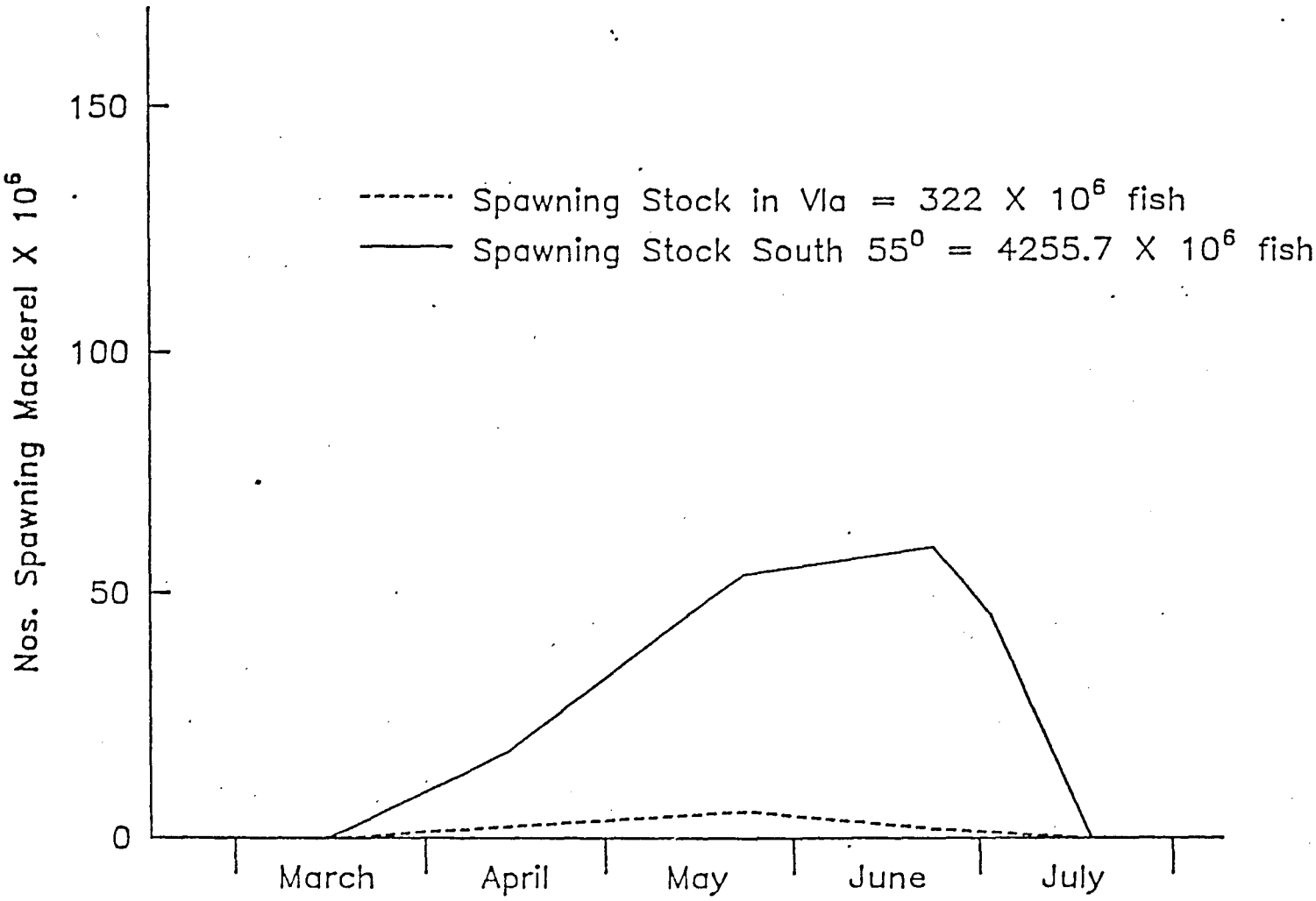

FIG. 4. SPAWNING STOCK IN NUMBERS.