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INTERNATIONAL COUNCIL FOR THE
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REPORT ON THE ICES YOUNG HERRING SURVEY IN THE NORTH SEA IN 1978.

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1. Introduction.

The ICES Young Herring Survey is an international programme for obtaining yearly estimates of the abundance of I-group herring in the North Sea and Skagerak. These estimates are used by the ICES Herring Assessment Working Group in advising next year's TAC's for herring in the North Sea.

The abundance of I-group herring is estimated by means of a bottom trawling survey which covers most of the North Sea, Skagerak and Kattegat. The surveys were first made in 1960 and 1961. After a break of 3 years they were resumed in 1965 and from then onward they have been continued without interruption. At present, 7 countries cooperate in this programme.

In recent years, the surveys have also been used to estimate the abundance of O-group herring, which are sampled by means of an Isaacs-Kidd midwater trawl (IKMT).

Results from the surveys have been reported annually to the ICES Council Meeting. In addition to these reports, the ICES Working Group on North Sea Young Herring Surveys has produced several meeting documents in which the survey methods and results have been evaluated (most recent report: ICES 1978).

Data on the abundance of other species and hydrography, obtained from the survey, are presented to the ICES Council Meeting in separate reports.

2. Material and Methods.

2.1. Participation in the 1978 survey.

The following countries took part in the survey:

<u>Country</u>	<u>Ship</u>	
Denmark	J.C. Svabo	14 Feb - 1 Mar
France	Thalassa	1 - 26 Feb
Germany (Fed. Rep.)	Solea	1 - 21 Mar
Norway	Johan Hjort	8 - 28 Feb
Netherlands	Tridens	30 Jan - 2 Mar
Sweden	Argos	6 - 24 Feb
United Kingdom	Cirolana	28 Feb - 20 Mar
United Kingdom	Explorer	2 - 21 Feb
United Kingdom	Clupea	26 Jan - 9 Feb

2.2. Methods used in the trawling survey.

The sampling of juvenile herring was concentrated in the standard area of 57 statistical rectangles, defined in the latest report of the Working Group (ICES 1978). A stratified sampling pattern was used, in which most of the sampling effort was directed towards rectangles which had yielded the highest catches of juvenile herring in the past. Hauls in the herring standard area were only made during daytime. Standard duration of the hauls was 30 minutes.

Three vessels employed the GOV-trawl which has now been adopted as standard gear for the Young Herring Survey (ICES 1978). These vessels were "Thalassa", "Tridens" and "Cirolana". The other ships used a variety of different bottom trawls, most of which had also been used during previous surveys. It was assumed that the average fishing power of all participating vessels had remained at the same level as in previous years.

2.3. Methods used in the IKMT survey.

Sampling of herring larvae by means of an IKMT was carried out by the research vessels Johan Hjort, Tridens, Argos, Cirolana and Explorer. Each vessel made two night-hauls in rectangles which were sampled by bottom trawl during daytime. The IKMT used was of the Swedish design, recommended by the ICES larval surveys working group (ICES 1977). Hauls were made according to a standard procedure described in the above report.

3. Results.

3.1. Results of the trawling survey.

A total of 218 valid herring hauls (i.e. hauls during daylight and without gear damage) were made in the herring standard area, and another 133 valid hauls were made in the remaining rectangles. Mean catches per rectangle of I-group herring (yearclass 1976 autumn spawners) are shown in figure 1. The overall abundance of year-class 1976 was quite low, at a level only slightly below that of the two previous year-classes. The highest catches were made as usual in the southern and eastern part of the North Sea. In addition, some large catches of I-group herring were made in the Moray Firth, probably consisting of juvenile herring that originated from the west of Scotland. The exceptionally high catches in the Kattegat probably consisted mainly of local O-group spring spawners, which cannot be distinguished from I-group autumn spawners.

The mean abundance of I-group herring for the standard area (calculated as the mean of all the rectangle means) was 575 herring/hour. Table 1 shows that this value is slightly above the figure for the two previous surveys, but still only 40 % of the average for the surveys in the years 1970-75. Catches of II-group herring (year-class 1975) were extremely low throughout the North Sea, confirming the low estimate of this year-class obtained from the previous survey (figure 3).

3.2. Results of the IKMT-survey.

The coverage of the North Sea by IKMT hauls was improved again in 1978. Except for a gap in the sampling area between 57°N and 58°N, the North Sea was almost completely covered up till 61°N.

Fig. 4 presents the mean number of larvae caught per haul in each statistical rectangle. Relatively high catches were made in the central North Sea along the English coast between 53°N and 56°N, and also over a large area in the northern North Sea. The density of larvae in the eastern North Sea and Skagerak was low, although the numbers per tow were slightly above those from last years. Unfortunately, no sampling was carried out in the Moray Firth where high numbers of larvae had been caught in 1977.

Comparing the results from 1978 to those of 1977, the abundance of O-group herring has increased slightly in most areas that have been fished in both years.

A remarkable feature of the O-group herring is their extremely wide distribution. Relatively high catches were made as far north as the Shetland Islands.

A great advantage in sampling O-group herring is their very even distribution. Because of the low variance between individual hauls within a square, a sampling frequency of 2 hauls per rectangle seems to be sufficient to obtain a good estimate of O-group abundance.

4. Discussion.

4.1. Confidence limits of the I-group estimate.

In calculating the mean abundance of I-group herring for the whole standard area, the average is taken of all individual rectangle means. This procedure, although providing the most accurate estimate of the mean abundance, does not allow us to calculate the variance and confidence limits of this mean. The reason for this is that several rectangles contain only one or two hauls, and it is impossible to calculate a variance for the mean of each rectangle.

In order to calculate a variance and confidence limits, the hauls have to be grouped into larger units, e.g. the 3 strata used for optimum allocation of sampling effort (ICES 1978). For each stratum, the mean and variance are calculated. Next, the stratified mean and its variance are calculated for the whole standard area.

stratum	1	2	3
number of rectangles	37	15	5
number of hauls	77	88	53
stratum mean	275	1 160	869
stratum variance	1 098 680	8 849 402	2 743 301
variance stratum mean	14 269	100 561	51 760
stratified mean for whole area		560	
variance stratified mean		13 375	
standard error		116	
90 % confidence limits		560 ± 191	

The stratified mean for the whole area, calculated according to the above procedure (560) is slightly different from the mean that is obtained by averaging all rectangle means (575). Still, the 90 % confidence limits calculated above will give an indication of the precision that can be ascribed to both estimates of the mean abundance.

4.2. Prediction of year-class strength.

The relationship between YHS mean abundance of I-group herring and the corresponding estimate from Virtual Population Analysis is according to the latest analysis (ICES 1978) given by the equation.

$$y = 0.0031 x - 0.21$$

where y is the VPA stock estimate of I-ringers in billions, and x is the mean catch of I-group herring per hour for the standard area of 57 rectangles.

Using this formula, the size of year-class 1976 in February 1978 is estimated at 1.57 billion.

5. Acknowledgements.

Special thanks are due to Dr. J. Hislop and his colleagues of the Marine Laboratory in Aberdeen, for analysing the raw data from the survey on their computer.

6. References.

- ICES 1978. Report of the Working Group on North Sea Young Herring Surveys, 1977. ICES Coop. Res. Rep. No. 81.
- ICES 1977. Report of the Working Group on North Sea Herring Larval Surveys. ICES Coop. Res. Rep. No. 68.

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TABLE I - YHS abundance indices in No/hour for the standard area of 57 squares, and VPA estimates of year-class strength.

Survey year	year-class	No/hour	VPA-estimate as I-group
1970	1968	822	5.79×10^9
1971	1969	2647	8.82
1972	1970	1629	1.75
1973	1971	827	4.39
1974	1972	1195	0.69
1975	1973	1529	
1976	1974	452	
1977	1975	342	
1978	1976	575	

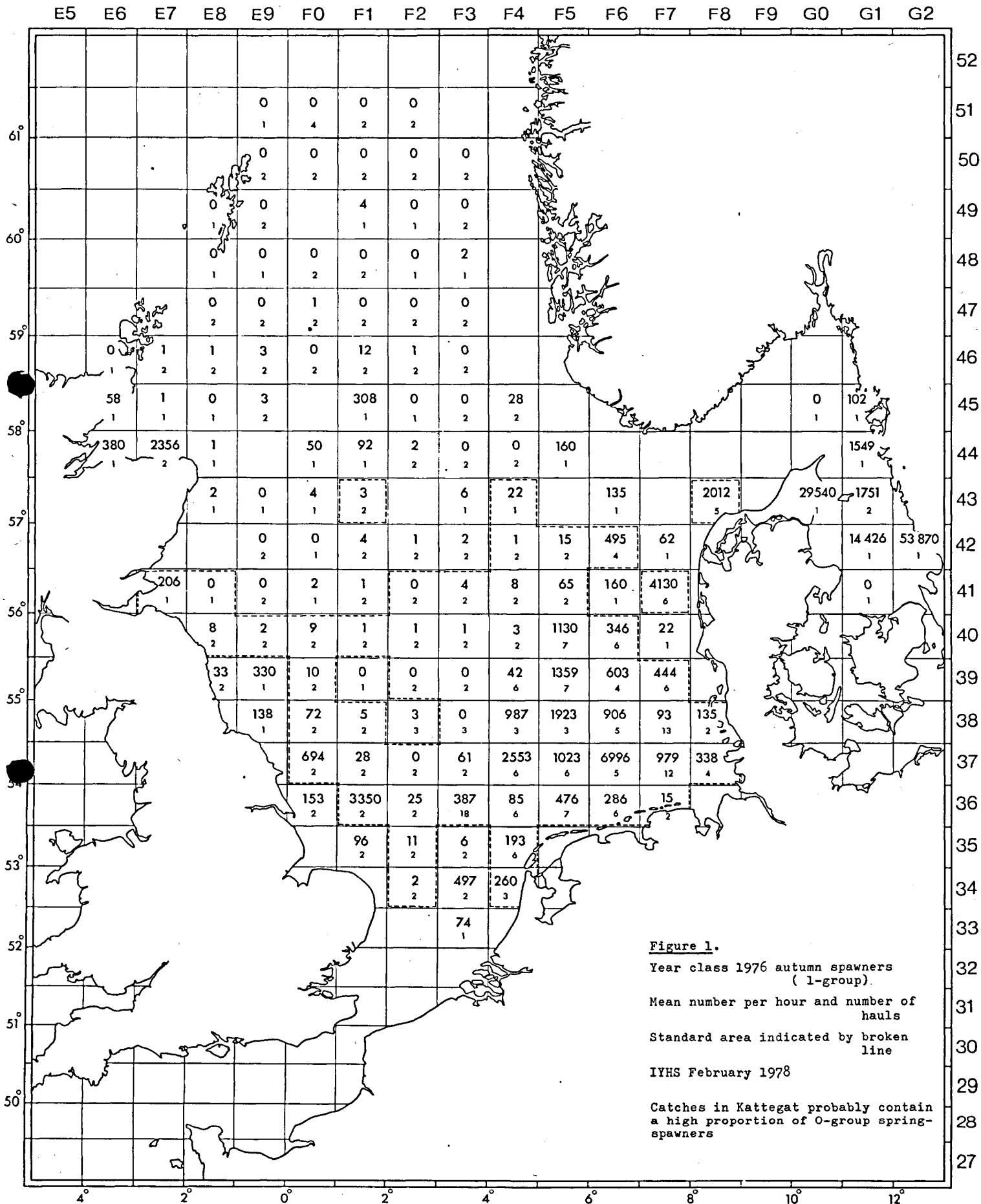


Figure 1.
 Year class 1976 autumn spawners
 (1-group).
 Mean number per hour and number of hauls
 Standard area indicated by broken line
 IYHS February 1978
 Catches in Kattegat probably contain
 a high proportion of 0-group spring-spawners

E5 E6 E7 E8 E9 F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 G0 G1 G2

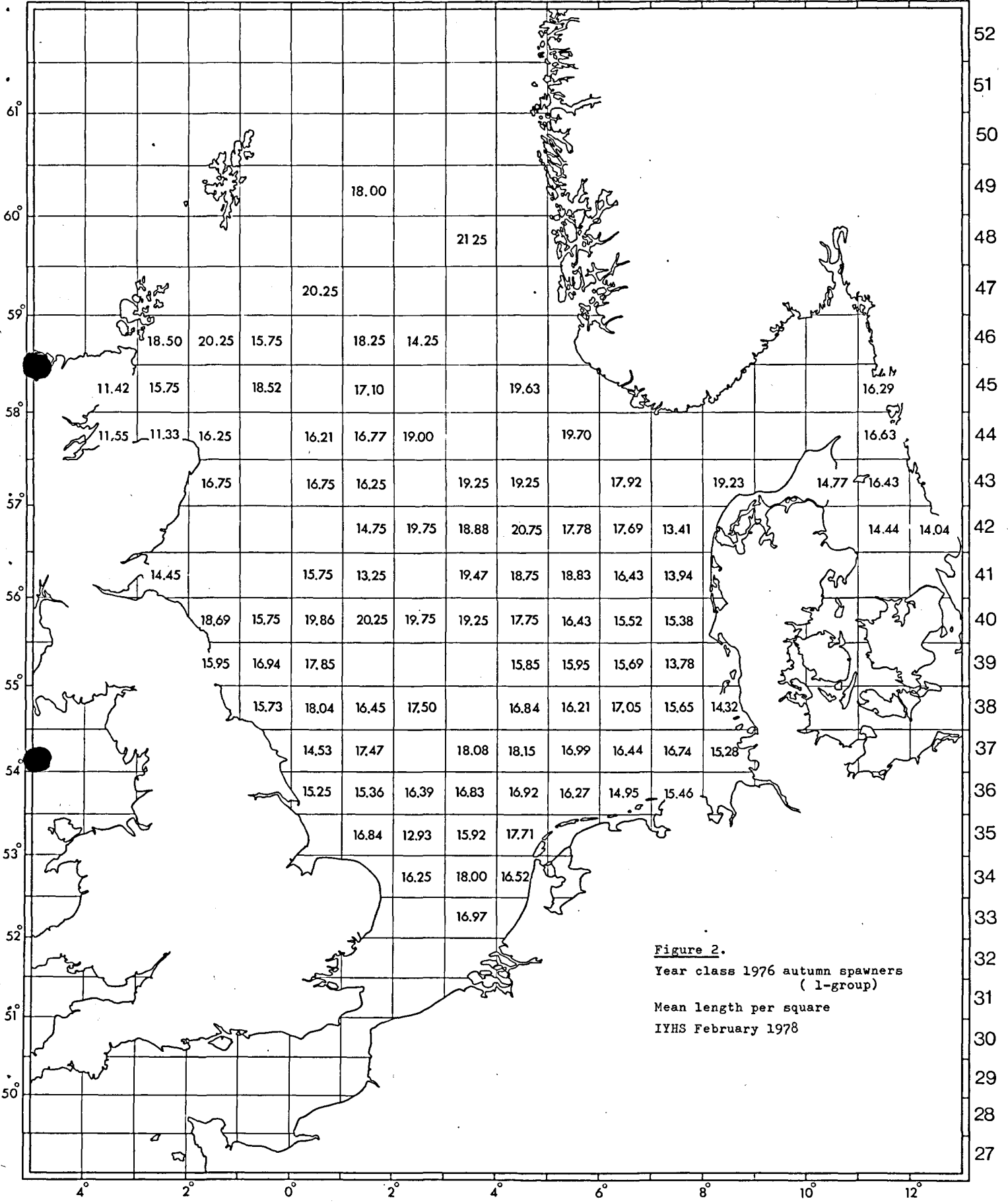


Figure 2.
 Year class 1976 autumn spawners
 (1-group)
 Mean length per square
 IYHS February 1978

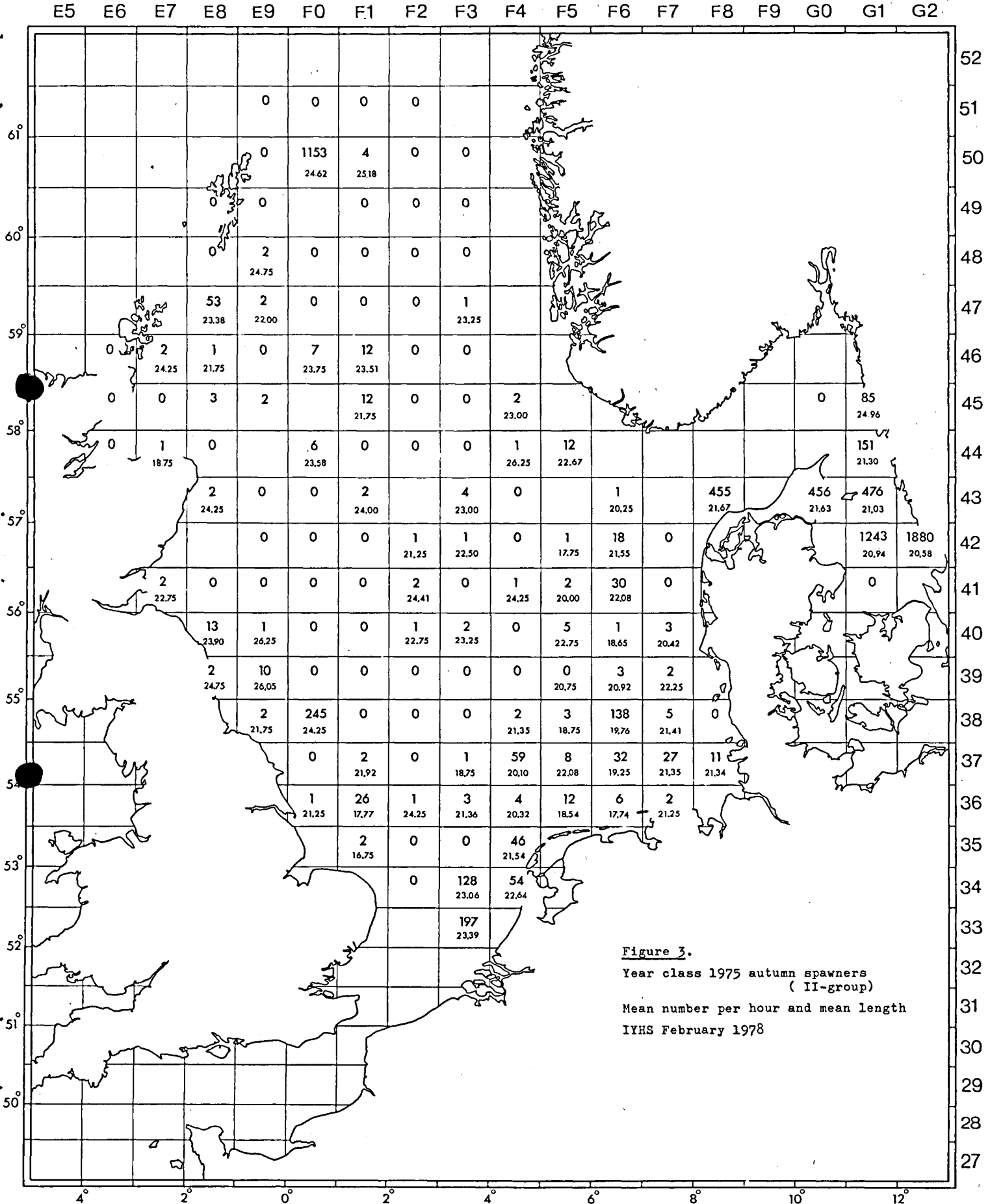


Figure 3.
 Year class 1975 autumn spawners
 (II-group)
 Mean number per hour and mean length
 IYHS February 1978

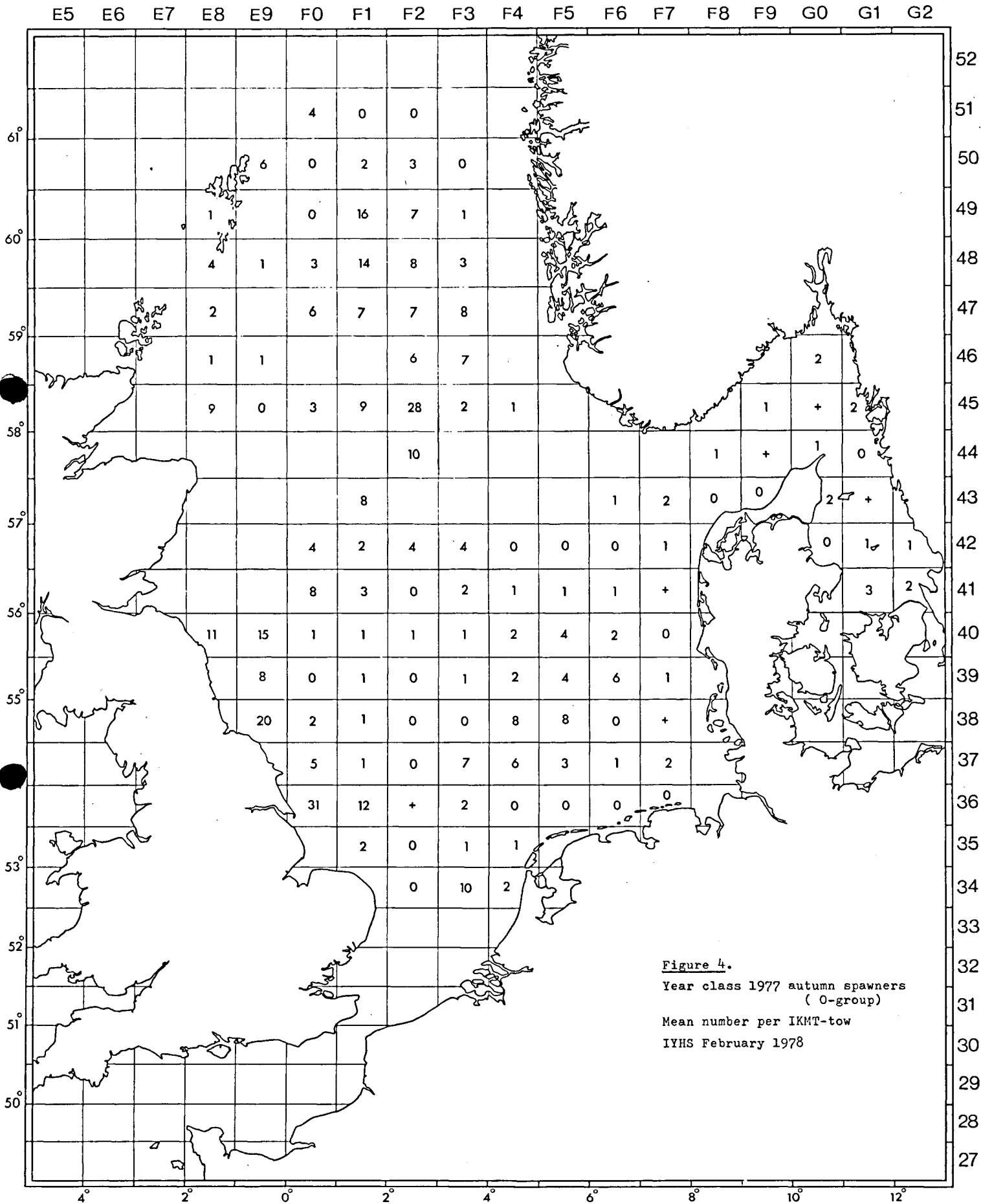


Figure 4.
 Year class 1977 autumn spawners
 (O-group)
 Mean number per IKMT-tow
 IYHS February 1978