C.M. 1977/ F:13
Demersal Fish (Northern) Ctte.

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THE RESULTS OF 0-GROUP HADDOCK AND WHITING INVESTIGATIONS IN THE NORTH SEA, 1973-1976

Abstract

The results of the O-group gadoid trawling surveys in the North Sea in 1973-1976 are analysed, and the distribution and size of the young haddock and whiting by area described. The regions of the highest occurrence of the species are shown. The necessity to extend the standard survey area is scientifically proved. It is suggested that the recommended increase of the station number does not facilitate the extension of confidence limits in the average catch assessment.

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LES RÉSULTATS DES CAMPAGNES DE CHALUTAGE DES GADIDÉS DE O-GROUPE DANS LA MER DU NORD. 1973-1976

Exposé

Sont analisés les résultats des campagnes de chalutage des Gadidés de O-groupe dans la mer du Nord en 1973-1976 et sont décrites la dèstribution et la grandeur d'églefin et de merlan jeunes dans des différentes régions de la mer. Les régions de la plus haute occurence des éspèces ont été montrées. La nécessité d'extention des limites de la région standarlisé de prospections est prouvée. On a montré, que l'augmentation récommendé de nombre des stations ne facìlite pas de l'extention des limites confidentielles d'estimation de la capture moyenne.

1. Introduction

Pelagic surveys of 0-group gadoids have been carried out by the AtlantNIRO since 1973. This was necessiated by the need to obtain the data on behaviour, distribution and growth of gadoids during the early months of their life and to reveal the possibilities of their quantitative calculation in order to determine the year class strength.

2. Methods

In pelagic surveys, as well as in trawling surveys of the adult gadoids and international North Sea young herring surveys 2-panel trawl has been used. Headline length is 27 m, vertical opening at the towing speed of 2.5 knots is 7-8 m. The trawl is lined with the gauze having 196 orifices per square cm. The perimeter of the trawl opening is 18 m. One hauling of 1 hour duration was made in the centre of a statistical square during the light hours of the day.

In 1973 and 1974 the haulings were made at three horizons within the upper 30 m layer, 20 minutes each, accordingly at the upper, intermediate and lower levels. Since 1975 the surface and pre-bottom layers and that under the thermocline have been fished. In case of absence of the latter the middle part of the water column was surveyed.

The 1973 survey was the experimental one and was conducted only in the north-west part of the sea (fig. 1). Later the attempts were made to cover larger area.

3. Results

3.1 Distribution

The data on the catch size are shown in Figs. 1-8. In the first half of July 1973 haddock was fished mainly pelagically in the north North Sea, while whiting - in the southern part of the north-central area. In July-August 1974 the abundance of whiting was the lowest in the central part of the sea and the highest along the Scotland coast, where almost all haddock catch was also taken. The fact that during the 1974 survey the haddock catch was extremely small indicated that in July-August the fishing in the upper 30 m layer was not effective. In the course of the total fishing made in June-July 1975 almost all haddock was caught in the north part of the sea, and the largest stable catches of whiting were yielded from the squares adjacent to Scagerrak and Scotland, and also from the north-west part of the sea and from the Dogger Bank. Similar distribution was recorded in July-August 1976.

3.2 Statistical treatment of the data

The availability of the four-year series of the data obtained in June, July and August allows to seak reguliarities in the distribution of the young fish. The areas of stable occurrence of the fish (Fig. 11), for which the annual values of the average catch have been calculated, are contoured based on the data on the average catch for the given years as shown in Figs. 9-10. Such values were also calculated for the area (Fig. 12) which had been selected by Daan et al. as a standard one for similar surveys (CM 1975/F:33). Since in the above case the geometrical averaging suggested by R.Jones (1954) was applied our data were also subjected to logarithmic transformation in

order to obtain comparable results, though the catch groupings by division not always agree well with a corresponding distribution pattern. The agreement might be closer if several haulings had been made per statistical square, which would reduce the number of zero and too large catches. The results of the data treatment are presented in Table 1.

The results of fish measurement always agree well with the normal distribution and may be characterized by the arithmetical means given in Table 2 together with the estimates of the least and largest lengths. The averaging was made separately for the traditionally selected North Sea areas which are contoured by a broken line in fig. 12. In addition, two regions divided by the 50-m isobath have been selected in the central area for whiting. This isobath coincided with the zone of the lowest occurrence of the whiting fry.

3.3 Discussion

The analysis of all data on the catch of 0-group haddock and whiting within the area contoured in fig. 12 confirms the idea that the bulk of the fry is concentrated in this area. However, the southward extension of the survey borders may be useful for determination of the direct correlation between the abundance of the fish within and beyond the given area. It is especially true for whiting, the proportion of which in 1974-1976 was accordingly 71%, 51% and 31% of the total catch taken during the surveys. The extension of the investigation area borders as shown by a broken line in fig. 11 not only does not widen the confidence limits of the average catch values as

the abundance index, but even somewhat reduces these limits (Table 1). The diffusion of the average value is not changed considerably when the data on the catch of the whiting fry are grouped separately by the northern and southern parts of the area of their stable occurrance. The annual distribution of O-group whiting which is an indirect evidence of the availability of two isolated populations in the south and in the north is in favour of such division.

It is hardly possible to select the area suitable for estimation of the abundance values both for haddock and whiting O-groups. According to Table 2, the sizes of the fish caught during later surveys are larger. Slightly increased growth rate of whiting in the southern part of the sea in 1976 as compared with that in the previous year, presents the exception and cannot be attributed to the lack of the data, for the number of specimens measured has been large enough. The irregular growth rate of whiting may be a typical case for the area. The idea of irregular growth rate of O-group whiting as a typical phenomenon for the area is confirmed by the annual high dispersion values of size distribution illustrating the difference between the extended size series in the north.

The survey year 1976 is characterized by increased dispersion of lengths of both species without marked increase of the length range. Although the available data are not enough to analyse the reasons of this phenomenon, we may, however, to appraise its possible influence on the results of the surveys. The extended size series may be characterized by the average value which is

acceptible enough, however, they may also contain a large number of sizable fishes notable for higher ability to avoid the gear. Therefore, the first half of August, when 0-group haddock may attain over 16 cm in length should be considered the last term for the surveys. Simultaneously, a certain amount of very small fish, in particular, of whiting ranging from 0 to 1 cm body length and available in the catches yielded by the beginning of August necessiates the conduction of the survey during this period as well.

3.4 Conclusions.

Despite the difference between the hatching dates and growth rates, and differing variability of these factors in haddock and whiting, the abundance of 0-group fish of both species may be estimated simultaneously. The data grouping by species should be made for each region. In July-August the young whiting from the middle and southern parts of the sea is characterized by a wider size range including the specimens below 1 cm. Therefore, a more extended series of surveys can be recommended for these areas compared to the northern part for better record of generations.

The estimation of the young had
catches taken during

N - number of squares investigated
$\bar{X}$ - arithmetical mean
$\bar{y}$ - arithmetical mean of the values $y = \ln (X + I)$

Area	Year	N	$\bar{X}$	$\bar{y}$
Bordered by a solid line in the Fig.1.2.	I974	49	30.I	2.4473
	I975	55	46.I	I.9270
	I976	66	5.0	0.88I6
mean	I974-I976	68	20.5	2.03II
Bordered by a broken line in the upper part of Fig. 11	I974	78	24.9	2.2592
	I975	8I	60.I	2.5I83
	I976	8I	I2.8	I.2848
mean	I974-I976	82	3I.3	2.80I3
Bordered by a broken line in the upper part of Fig. 11	I974	36	34.5	2.6993
	I975	39	49.8	I.7857
	I976	39	3.7	0.7690
mean	I974-I976	40	26.4	2.4877
Bordered by a broken line in the lower part of Fig. 11	I974	42	I6.6	I.8862
	I975	42	69.7	3.2007
	I976	42	2I.2	I.7664
mean	I974-I976	42	35.9	3.I054
Bordered by a solid line in Fig. 12	I974	4I	6.0	0.8448
	I975	52	22.5	I.30I3
	I976	57	5.4	0.6094
mean	I974-I976	58	I0.0	I.2747
Bordered by a solid line in Fig. 11	I974	45	3.4	0.7756
	I975	45	25.8	I.4033
	I976	45	7.9	0.97II
mean	I974-I976	45	I3.7	I.8I60

Table 1

dock and whiting occurrence in the
0-group surveys

M geometrical mean - $\exp\bar{y} + (0.4994 S_y^2 (N-1)/N) - 1$

Diffusion factor - a ratio of confidence limits to M

M	S_y^2	$S_{\bar{y}}$	95% confidence limit	Diffusion factor
Whiting				
47.8	2.9487	0.2453	78.21-29.22	I.02
45.9	3.9200	0.2670	78.11-26.79	I.12
3.9	I.4742	0.1494	5.38- 2.95	0.61
21.0	2.1588	0.1781	29.99-14.73	0.72
34.1	2.6373	0.1839	49.16-23.72	0.74
96.0	4.1705	0.2265	150.73-61.10	0.93
9.8	2.2374	0.1662	13.77- 7.10	0.67
33.1	I.4764	0.1342	43.04-25.46	0.53
59.0	2.8757	0.2826	104.54-33.31	I.20
42.4	4.0812	0.3235	81.48-22.07	I.40
3.1	I.3213	0.1841	4.5 - 2.14	0.76
25.4	I.6207	0.2013	37.98-16.98	0.82
18.1	2.1850	0.2281	28.72-11.42	0.95
125.6	3.3653	0.2831	222.22-70.35	I.21
20.3	2.6555	0.2514	33.77-12.33	I.05
38.7	I.1830	0.1678	54.22-27.69	0.68
dock				
3.6	I.4006	0.1848	5.23- 2.48	0.76
14.2	2.9012	0.2362	22.84- 8.81	0.96
2.2	I.1635	0.1487	3.00- I.80	0.53
7.5	I.7827	0.1753	10.76- 5.34	0.71
2.7	I.0997	0.1563	3.72- I.98	0.64
18.3	3.1973	0.2665	31.27-10.74	I.11
4.6	I.5452	0.1853	6.71- 3.17	0.76
12.2	I.5667	0.1866	17.77- 8.38	0.76

Table 2

Mean length (I), dispersion (S^2) and length range of O-group haddock and whiting during the surveys. 1-74-1976

Area	Date	n	I (cm)	length range	S^2
		Haddock			
North	29.7- I.8.I974	49	9.0	5.5-I2.0	2.2
	9-25.6.I975	679	3.4	I.5- 7.5	0.6
	7-I2.8.I976	259	II.I	6.0-I6.0	3.8
North-Central	28.7- 5.8.I974	205	8.8	3.0-I2.0	2.I
	8.6-I5.7.I975	44	5.2	2.0- 7.0	I.2
	2- 6.8.I976	7I	8.I	5.5-II.5	2.5
Central	I9-2I.7.I975	42	6.7	4.0-9.0	I.3
	I8.7- I.8.I976	24	7.9	5.0-9.5	I.9
		Whiting			
North	29.7- I.8.I974	477	9.I	6.0-II.0	0.7
	9-23.6.I975	337	2.3	I.0- 3.5	0.3
North-Central	28.7- 5.8.I974	656	8.8	3.0-I2.0	I.6
	8.6-I5.7.I975	28I	2.7	I.0- 5.0	0.6
	3- 6.8.I976	II9	6.4	2.0-I0.0	4.3
East-Central	I7 -20.8.I974	74	5.5	2.0- 8.0	0.9
	20 -26.7.I975	I230	3.9	I.0-I0.5	2.9
	I8 -28.7.I976	436	5.6	2.0-I0.5	2.7
West-Central	6-I5.8.I974	392	8.I	3.0-I2.0	2.6
	I7-26.7.I975	803	3.I	I.0- 8.0	I.7
	26-28.7.I976	6I	5.7	3.0- 8.5	3.I
South-Central	I5-2I.8.I974	356	6.4	2.0-II.5	4.5
	2I.7- I.8.I975	590	4.0	I.0- 8.5	2.7
	I7 -26.7.I976	457	6.9	2.5-II.0	3.4

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Fig. 4. The number of 0-group whiting specimens per standard hauling in July-August 1974.

Fig. 5. The number of 0-group whiting specimens per standard hauling in June-July 1975.

Fig. 6. The number of 0-group whiting specimens per standard hauling in June-July 1975.

Fig. 7. The number of 0-group haddock specimens per standard hauling in July-August 1976.

Fig. 8. The number of 0-group whiting specimens per standard hauling in July-August 1976.

Fig. 9. Mean number of 0-group haddock specimens per standard hauling in 1973-1976 (upper figure) and the number of haulings (lower figure).

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Fig. 11. The areas of stable occurrence of 0-group haddock (solid line) and whiting (broken line). The region where no young fish was available and which was not covered by the averaging procedure is shaded.

Fig. 12. A supposed standard survey area according to Daan et al. (1975) - solid line; the borders of the traditional survey areas in the North Sea - broken line.

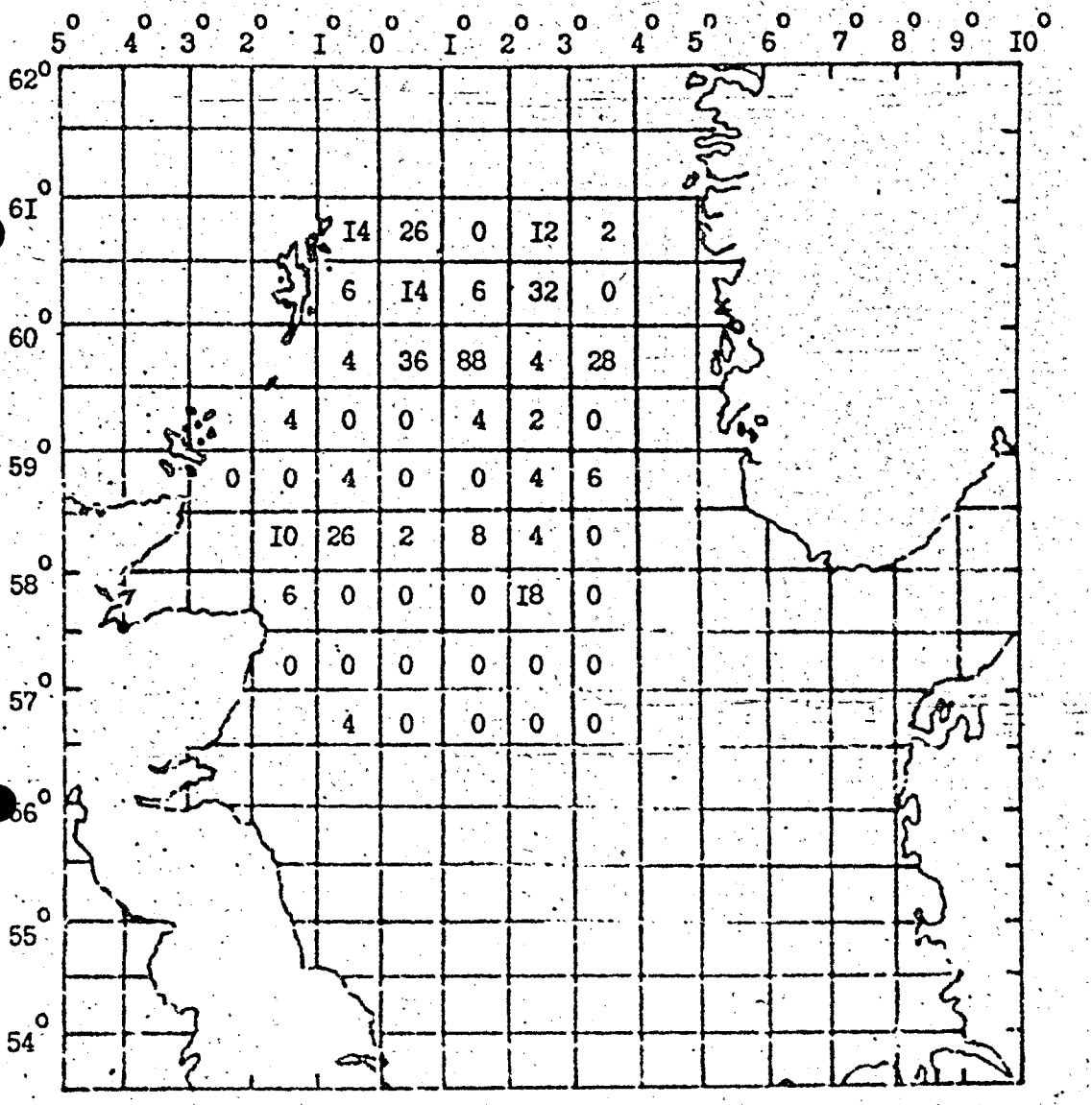
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Fig. 1

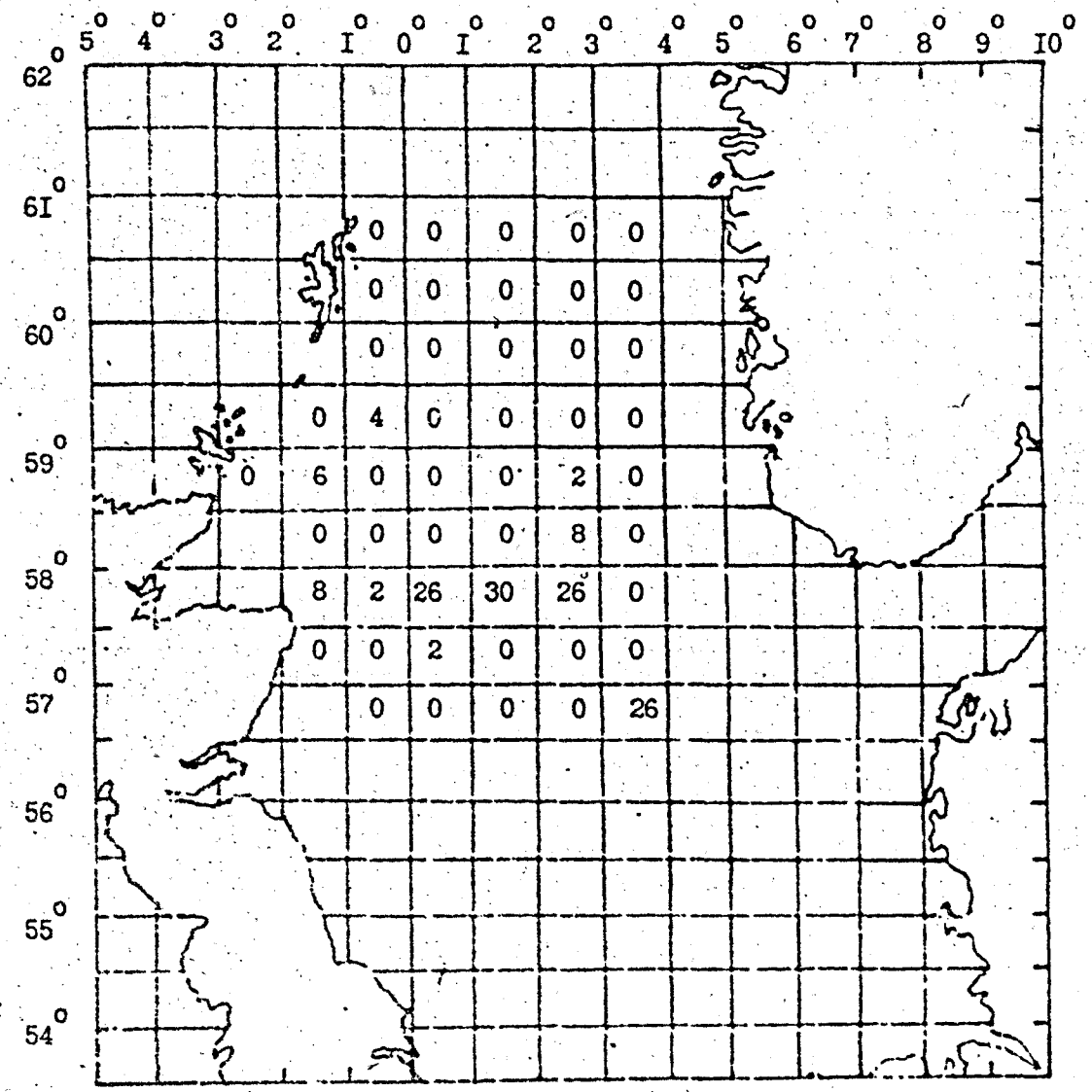
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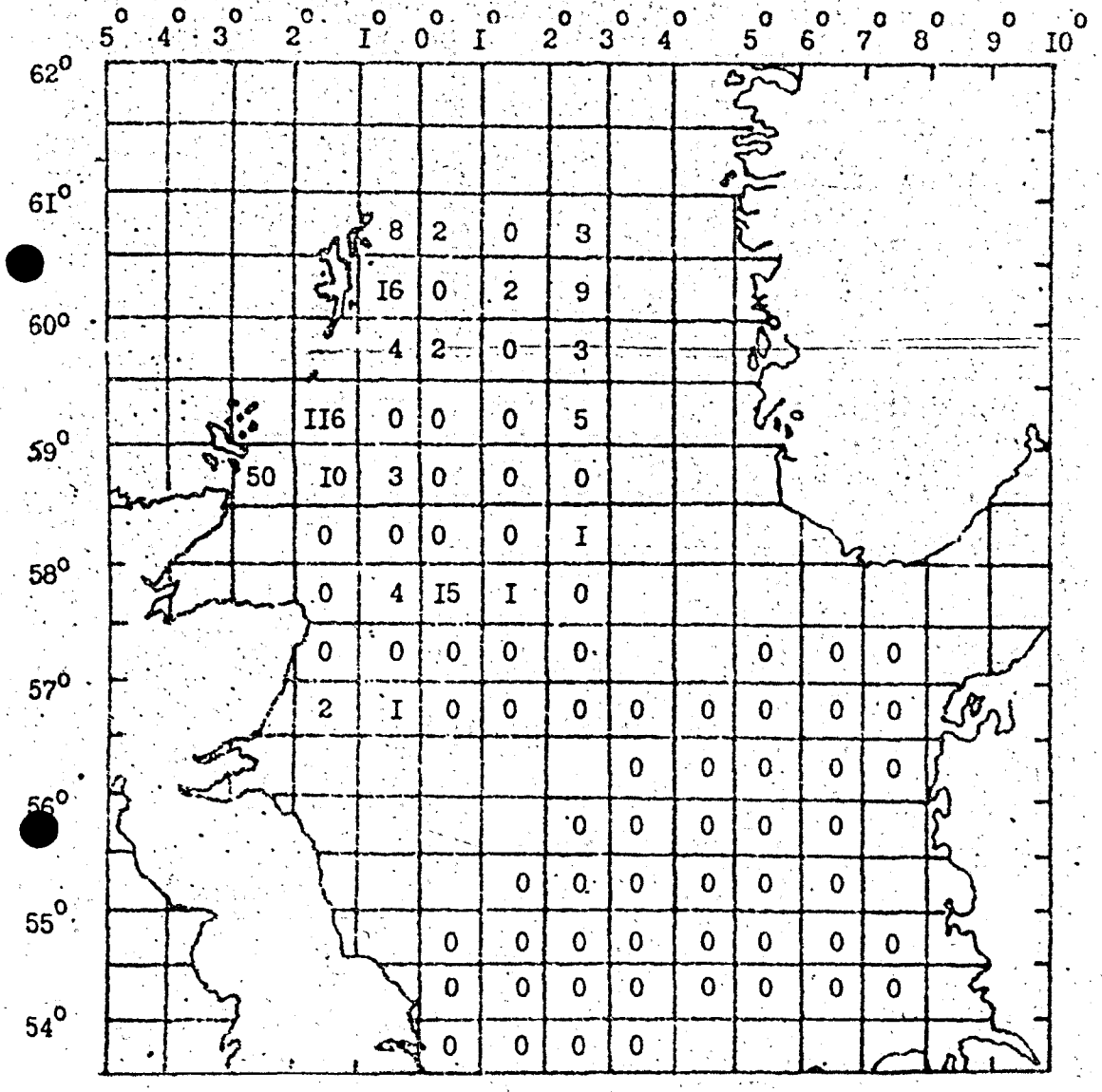
Fig. 2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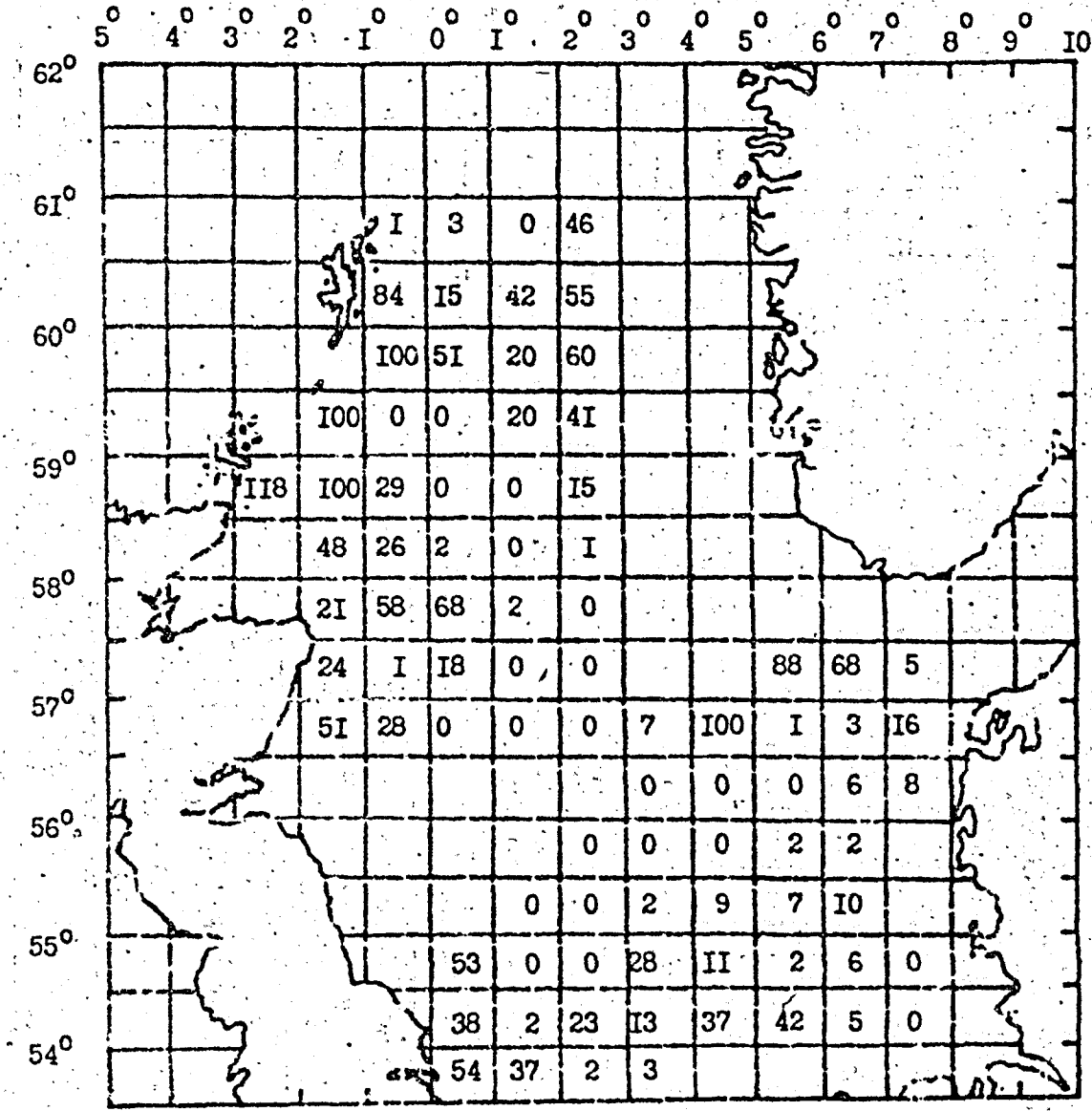
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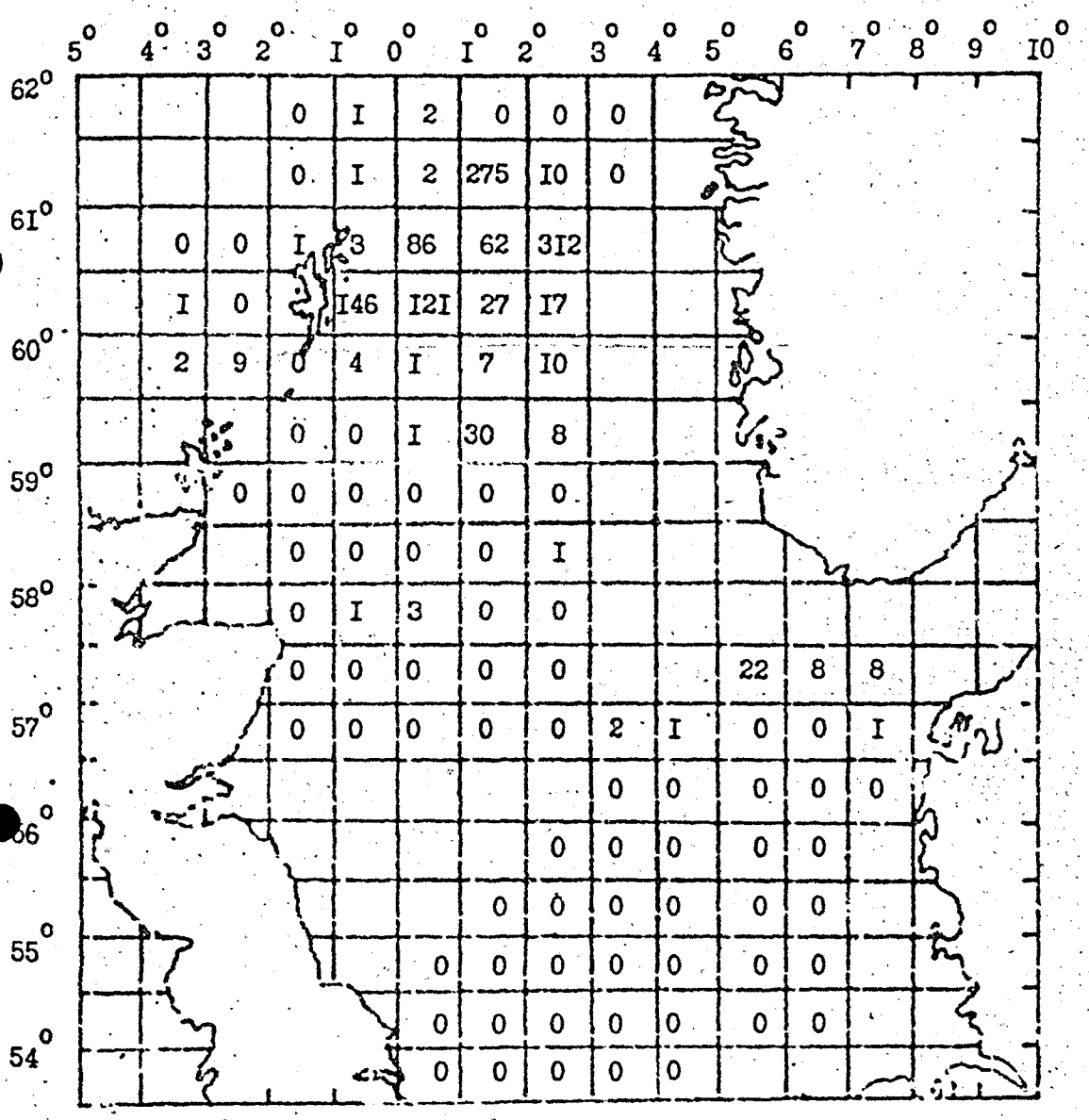
Fig. 4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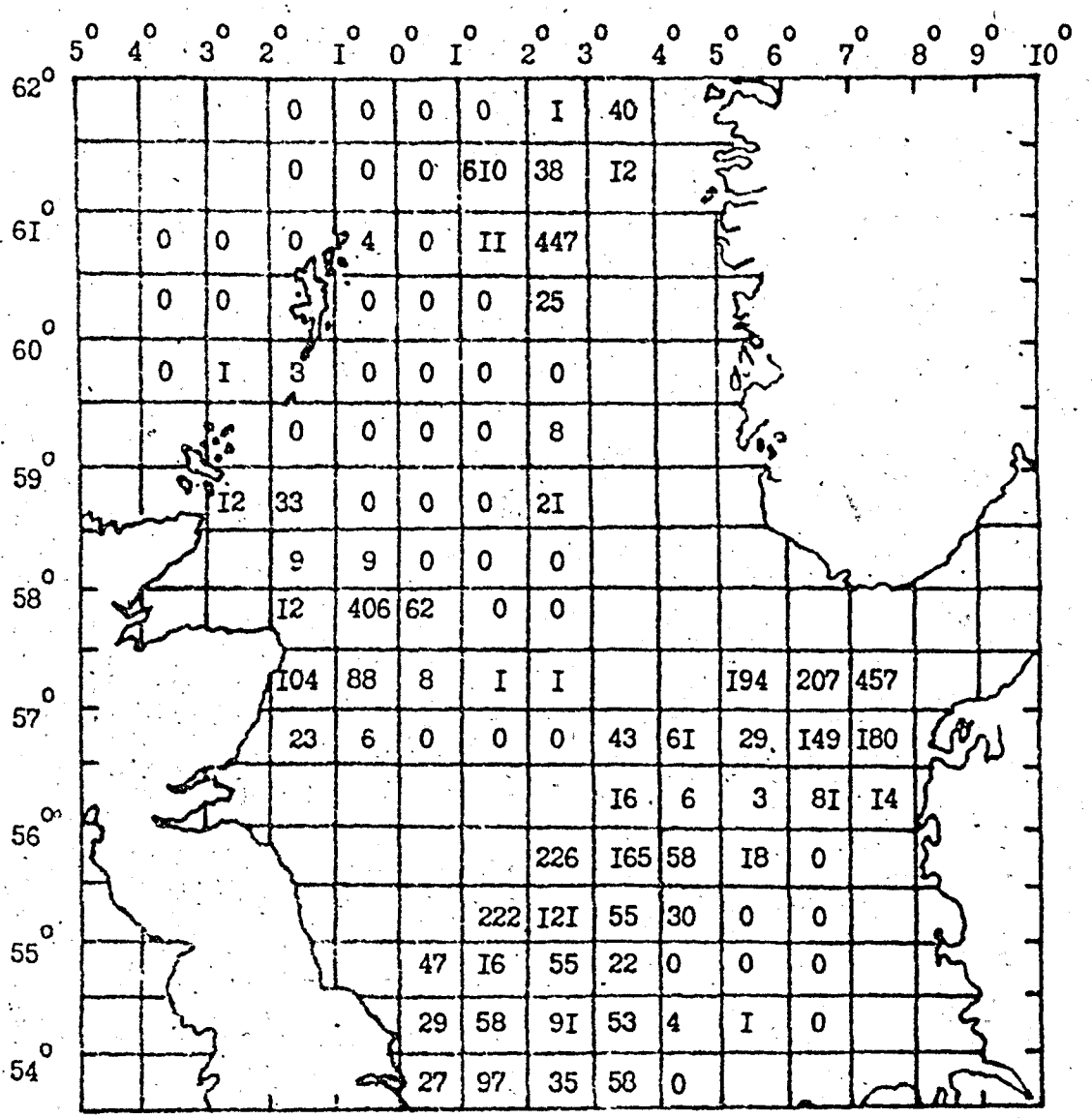
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Fig. 6

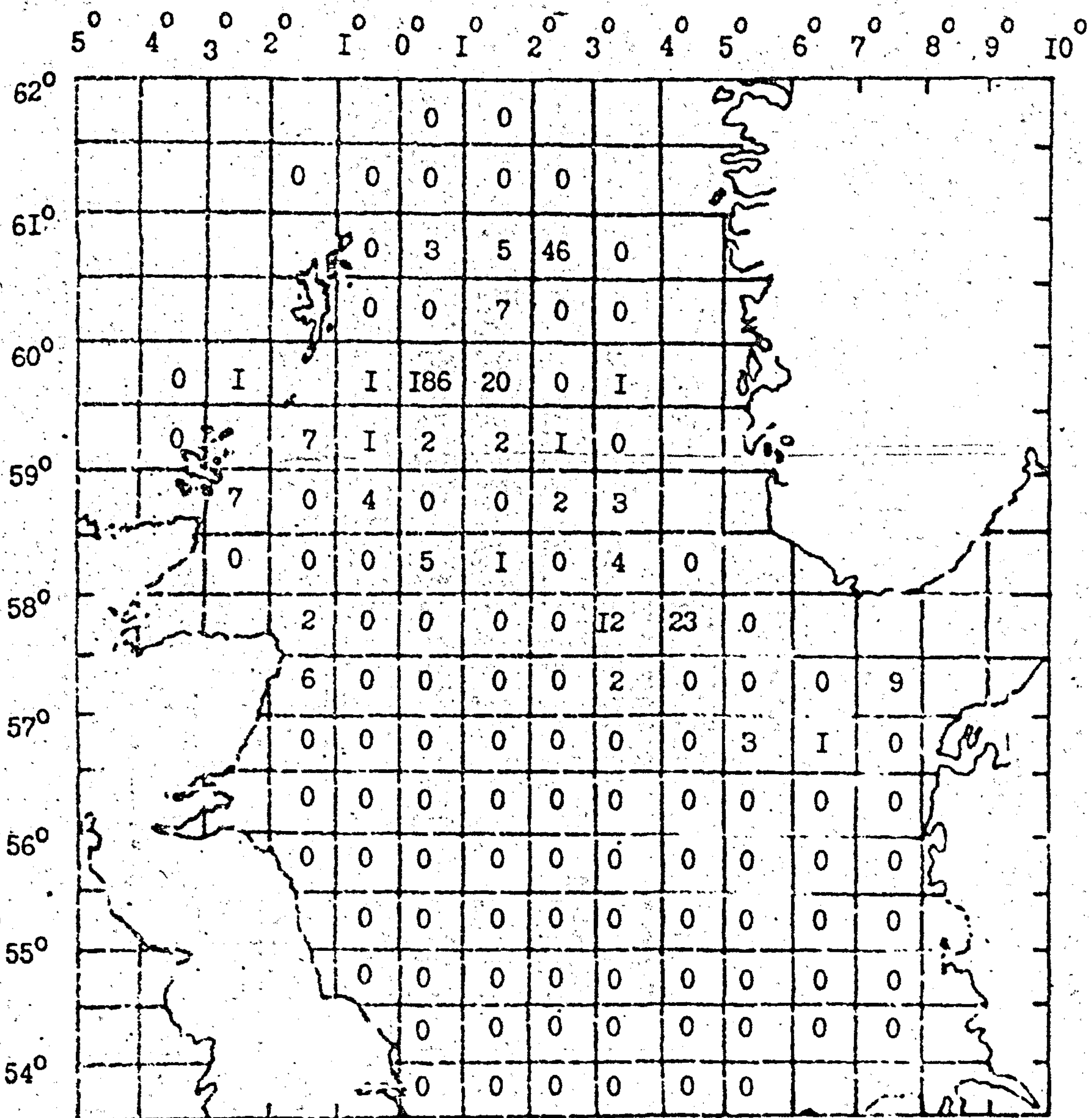
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Fig. 7

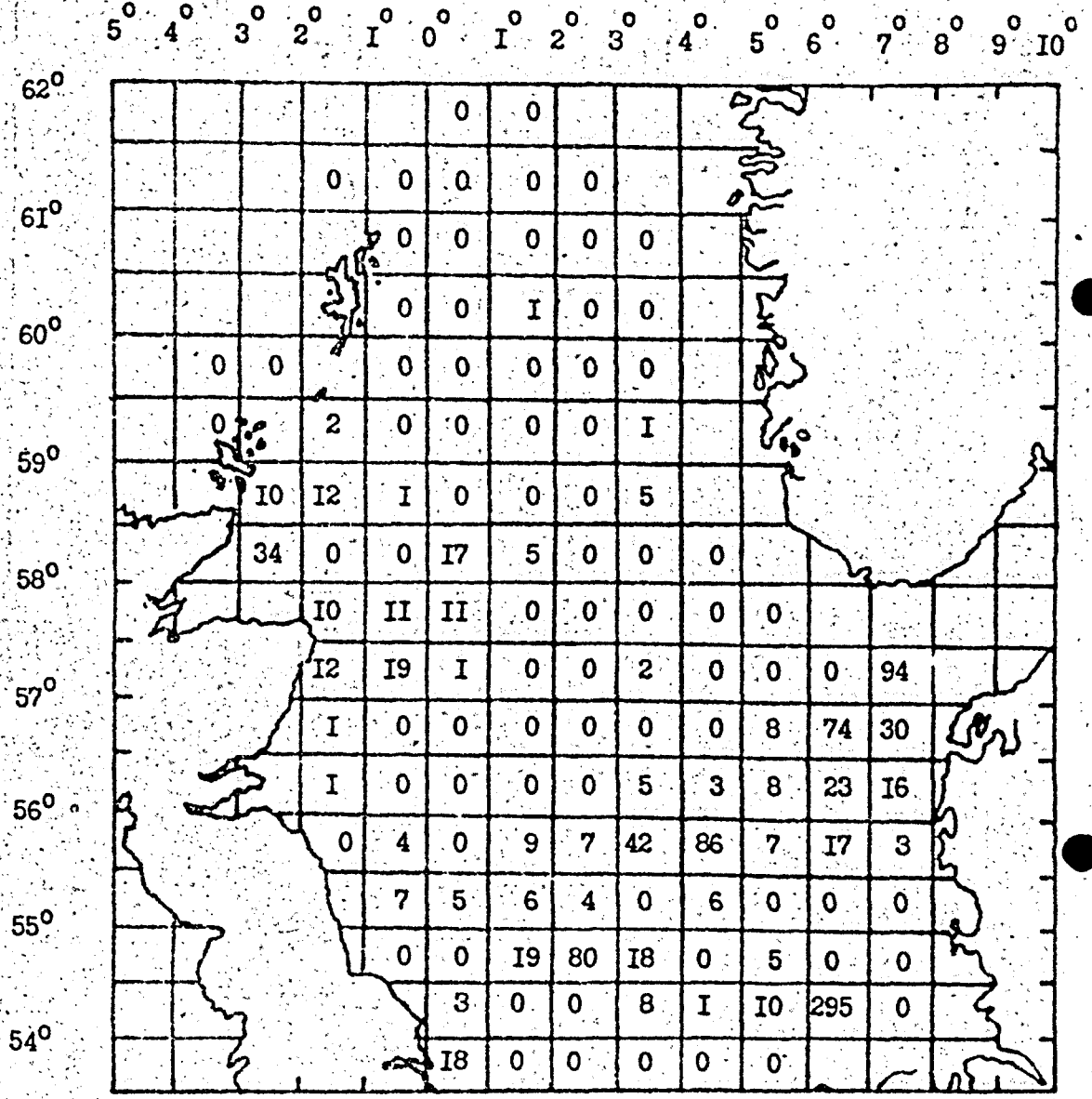
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Fig. 8

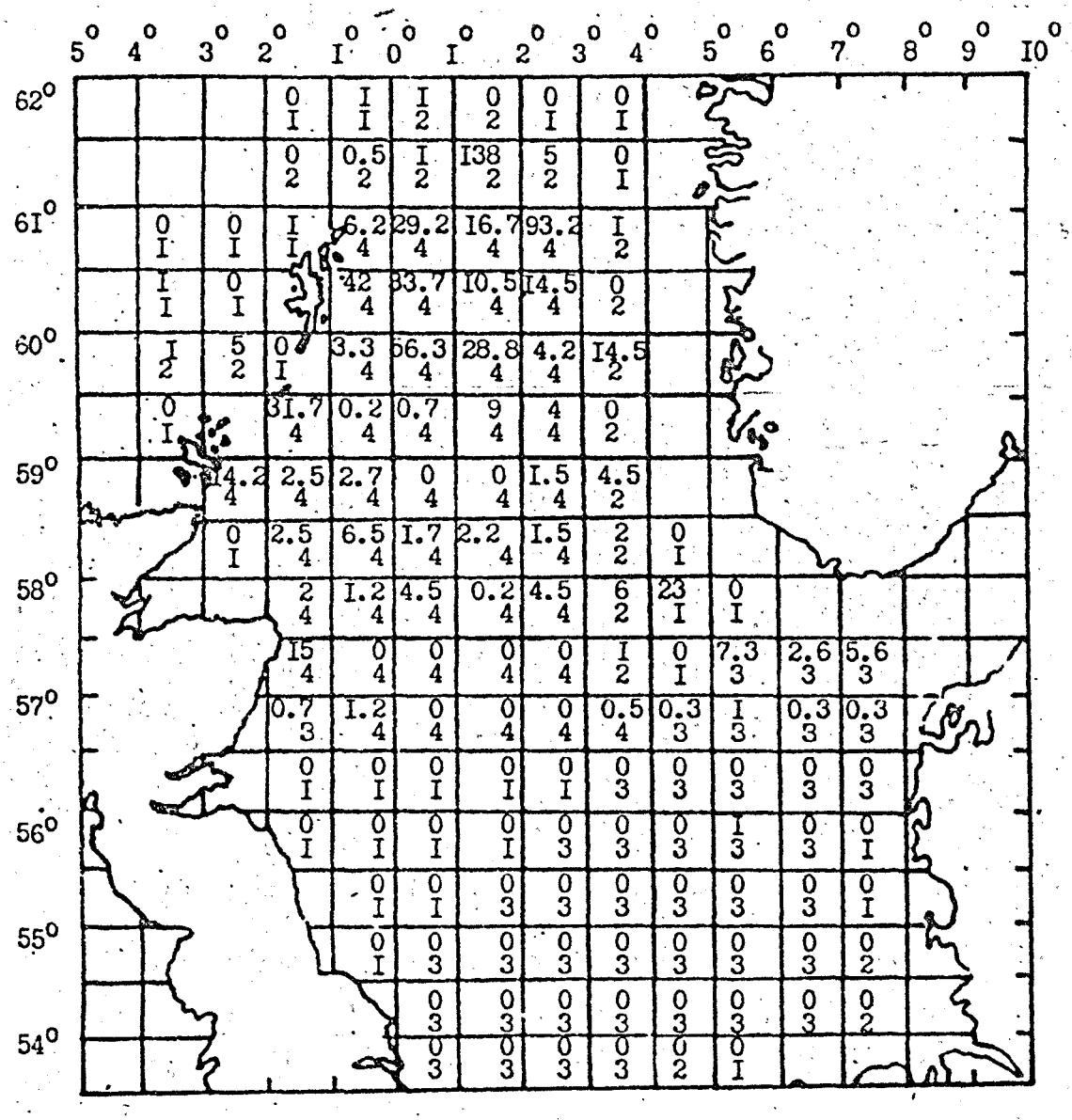

Fig 9

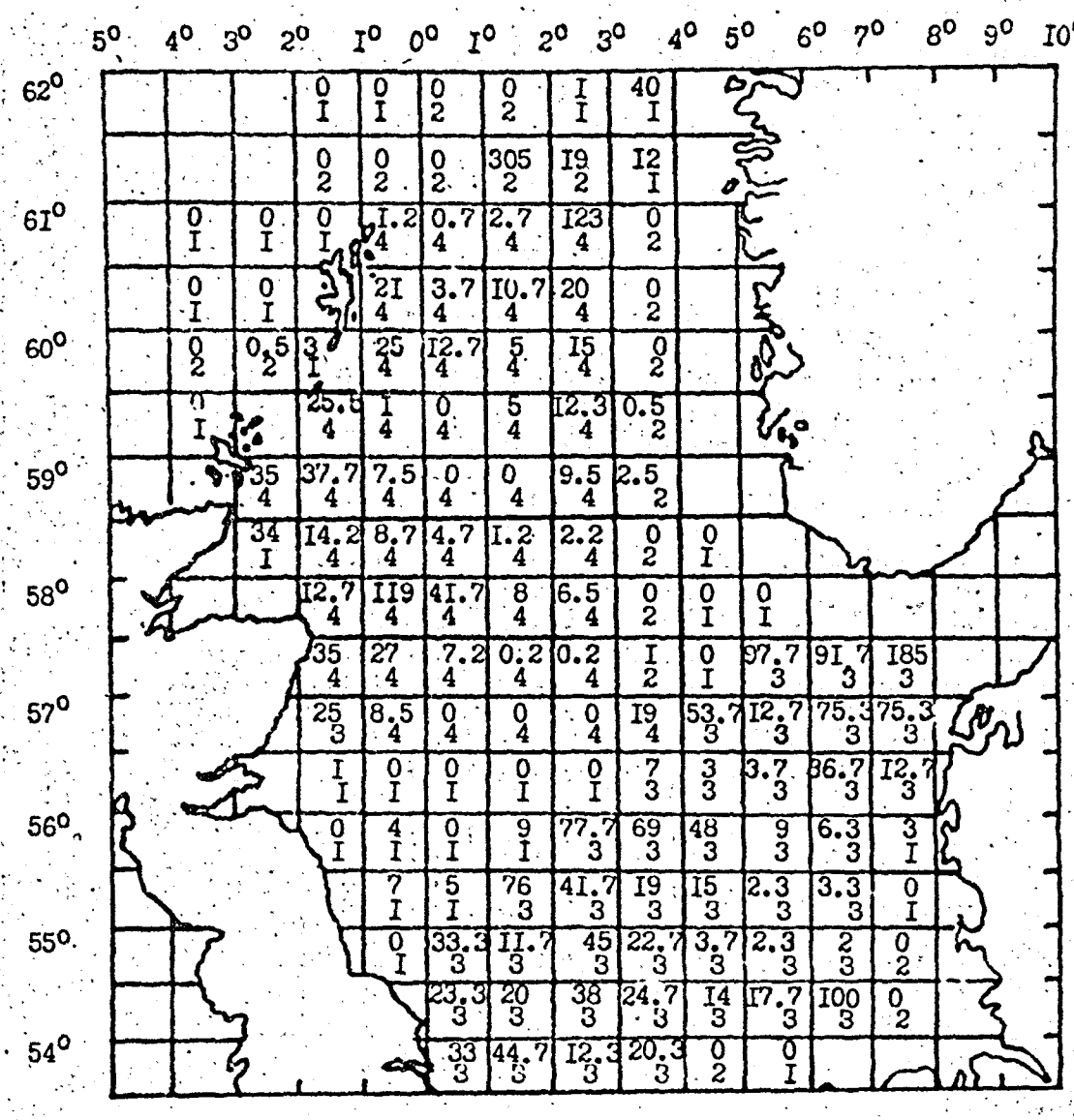

Fig. 10

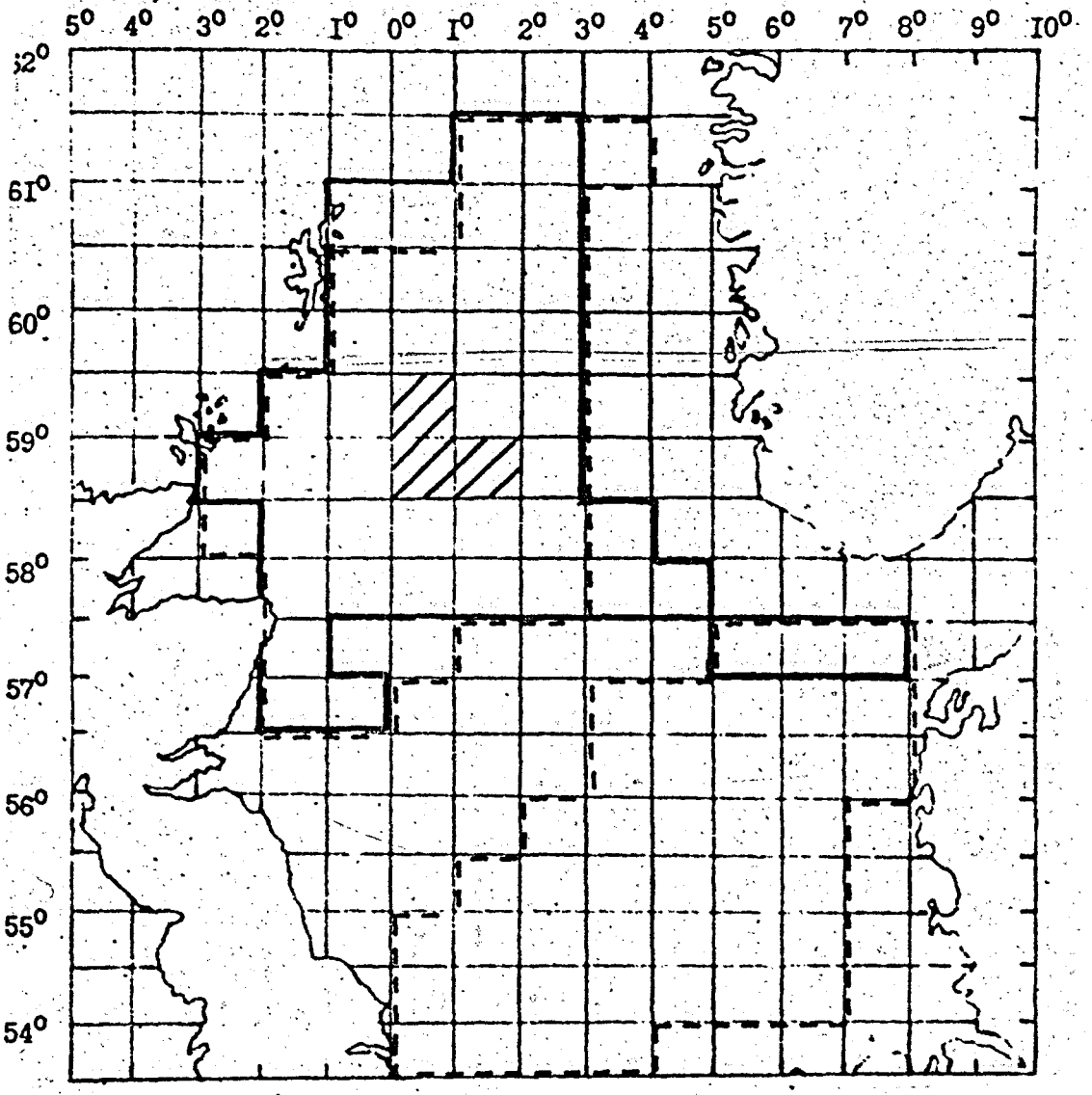

Fig. 11

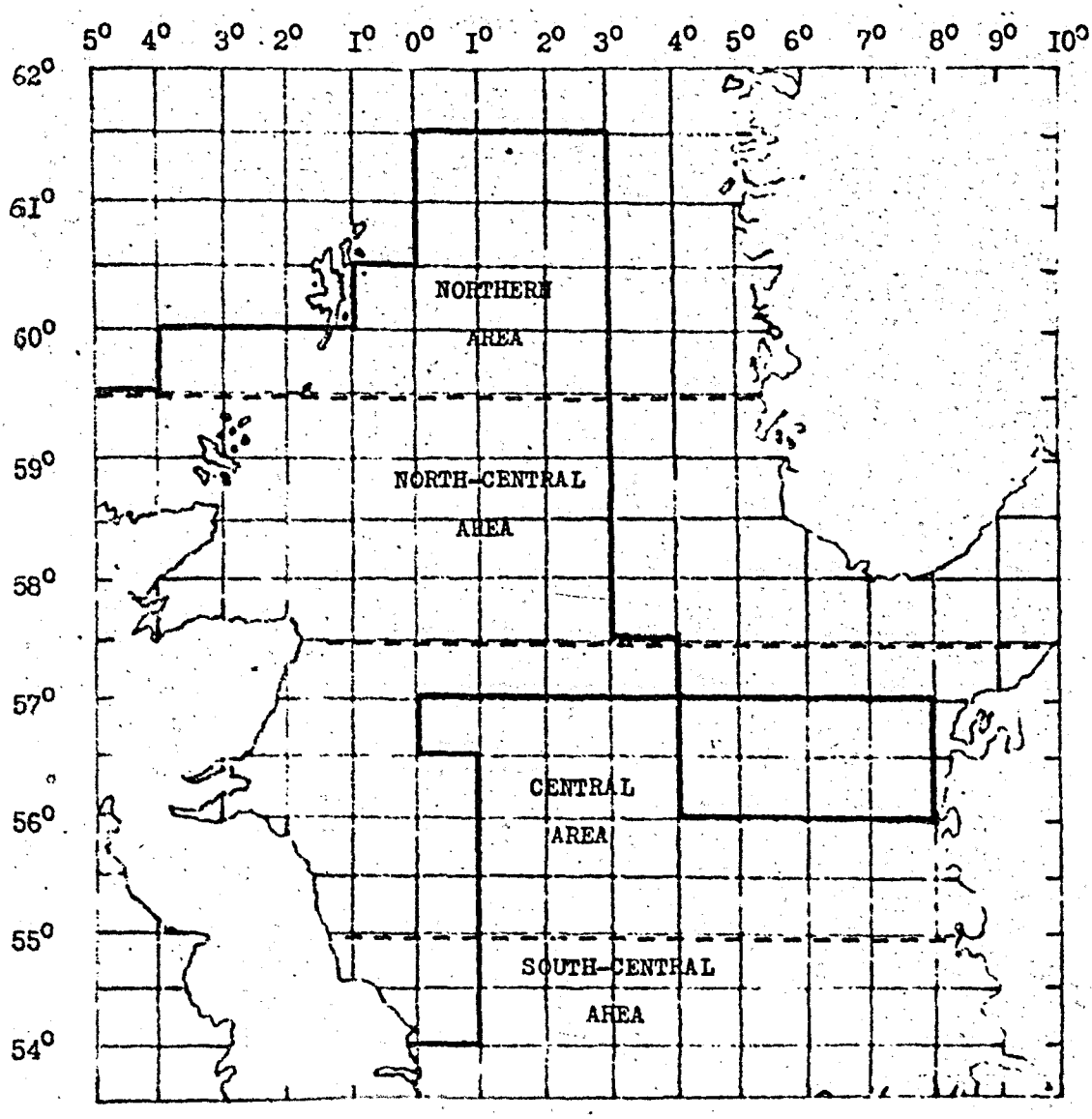
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Fig. 12

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