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THE DISTRIBUTION AND ABUNDANCE OF SCYPHOMEDUSAE
IN THE NORTH SEA DURING THE SUMMER OF 1976

by

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Abstract

A preliminary report is given on the scyphomedusae collected by five vessels during the international O-group gadoid survey in the North Sea in June 1976. As in previous years the main species were Cyanea capillata, C. lamarckii and Aurelia aurita. The 1976 survey was carried out as two consecutive surveys of the same area. Changes in abundance of the medusae are demonstrated between surveys. The distribution of the three species extended along the English and Scottish east coasts to the Scottish north coast and east of the Orkney and Shetland islands. The scyphomedusae also occurred in the area surveyed north west of Denmark.

The size frequency distributions for five sub-areas are tabulated for Cyanea spp. Equations relating umbrellar disc weight to disc diameter are given for C. capillata and C. lamarckii. The extent of the opportunity for commensal association between both Cyanea spp and the four main gadoid species is indicated. The data suggest that the opportunities for commensal association were greatest for whiting, less for cod and haddock and poor for Norway pout.

Introduction

This preliminary report deals with the results of studies on the scyphomedusae during the O-group gadoid survey of 1976 (Daan, et. al., 1976). These results follow on from those of similar surveys in previous years (Hay and Adams, 1975 and Hay, Adams and Hislop, 1976). The data from the 1977 survey have not yet been evaluated.

Methods

During the period 13-30 June 1976 five vessels carried out a survey designed to sample each statistical rectangle in the area outlined in Figure 1. Each rectangle was to be sampled twice by different vessels with as great a time interval between samples as possible. All vessels used the Dutch version of the International Young Gadoid Pelagic Trawl (Anon 1973) except "Explorer" which used the Scottish version. Hauls were of one hour's duration at ships speed of 1.5-2.5 knots. Each haul was stratified as described by Daan, et. al., 1975 except that in 1976 where bottom depth exceeded 150 m then this depth was taken as bottom and the midwater hauls made at 75 m or the midwater thermocline depth where this existed. All scyphomedusae caught were identified, counted and measured across their umbrellar disc except for specimens of Aurelia aurita (L.) which were generally too badly damaged in the trawl for measurement.

Results and Discussion

The area surveyed is shown in Figures 1 and 2. The hauls shown in Figure 1 are referred to as survey one, and those in Figure 2 as survey two. The survey was carried out as planned except that the statistical rectangles 48E7, 47E7 and 46F2 were only sampled once, and that most samples from 41F4-7 and 42F4-7 were taken within 4 days. In 1976 less of the southern and central North Sea was covered than in 1975.

Distribution and abundance of scyphomedusae

The distribution and abundance of the three main species, Aurelia aurita (L.), Cyanea capillata (L.) and Cyanea lamarckii Péron and Lesuer are charted in Figures 3-8 for both surveys separately.

Comparison between years

As in previous years Aurelia aurita was the most abundant scyphomedusan off the Scottish east coast, particularly in the Moray Firth. As in 1975 however, it was less numerous than the Cyanea spp. in the areas east of Orkney and Shetland and north west of Denmark. Cyanea capillata was generally as abundant as in 1975; in the Moray Firth it was more abundant than in 1975 but north of 58°30'N this species was less abundant with a wider, more southerly distribution than in 1975. Large numbers of C. capillata were found north west of Denmark. Cyanea lamarckii, which was more abundant in 1976 than in 1975, was more numerous than C. capillata along the east coast of Britain. As with C. capillata a fairly large population of C. lamarckii was found north west of the Danish coast.

Comparison between surveys

All three scyphomedusae species showed increased abundance between survey one and survey two in the areas off the east coast of the mainland of Britain. In the area off the Danish coast however, although both Cyanea spp increased numerically, Aurelia aurita numbers declined. North of 58°30'N and off the Scottish north coast numbers of C. lamarckii caught in the second survey were considerably lower than in the first survey. Abundance of C. capillata and A. aurita remained similar between surveys in the area north of 58°30'N except off the Scottish north coast where numbers of C. capillata declined sharply. The distribution of C. capillata also spread further east between surveys in the area above 58°30'N.

Percentage size frequency distribution of Cyanea spp.

These distributions are shown in Table 1 for numbers of each Cyanea species and in Table 2 for umbrellar disc wet weights of each Cyanea species. The survey area has been divided into sub-areas similar to those of 1975, as follows:

Area 1	58°30'N to 61°30'N	and 3°W to 4°E
Area 1a	"	to 60°00'N and 5°W to 3°W
Area 2	54°00'N to 58°30'N	and 4°W to 0°
Area 3	"	to " and 0° to 3°E
Area 4	"	to " and east of 3°E

As can be seen from the distributions charted in Figures 3-8

Area 1 contains the populations east of Orkney and Shetland.
Area 1a " " " off the Scottish north coast.

Précis

On donne un rapport préliminaire sur les scyphomedusae collectées par cinq navires durant l'étude internationale portant sur les gadoïdes du groupe O en mer du Nord en juin 1976. Au cours des années précédentes, les principales espèces étaient les Cyanea capillata, C. lamarckii et Aurelia aurita. L'étude de 1976 s'est déroulée en prenant la forme de deux études consécutives du même secteur. Celle-ci démontre les changements quant à l'abondance des méduses entre les deux études. La distribution des trois espèces s'étendait le long des côtes Est de l'Angleterre et de l'Ecosse jusqu'à la côte Nord de l'Ecosse et jusqu'à l'Est des Orcades et des Shetland. Les scyphomedusae existaient également dans le secteur étudié au Nord-Ouest du Danemark.

Les distributions de fréquence dimensionnelle pour les cinq sous-secteurs sont données sous forme de tableau pour la Cyanea spp. Des équations donnant le rapport existant entre le poids du disque d'ombrelle et le diamètre de disque sont données pour la C. capillata et la C. lamarckii. L'étendue de la possibilité de commensalisme entre à la fois la Cyanea spp et les quatre principales espèces gadoïdes est indiquée. Les données suggèrent que les possibilités de commensalisme étaient supérieures pour le merlan, moindres pour la morue et l'églefin et médiocres pour le tacaud norvégien.

Area 2 contains the populations down the British east coast.
Area 4 " " " off the Danish coast.

Area 3 corresponds to no particular population centre for Cyanea capillata, but may represent for Cyanea lamarckii, either an extension of the English east coast population or a separate population in the Dogger Bank area.

Umbrellar wet weights were obtained as in previous years (Hay and Adams 1975) from regressions of \log_{10} umbrellar disc weight on \log_{10} umbrellar disc diameter. The results for 1976, which compare reasonably well with those of previous years, are shown below:

$$\underline{C. capillata}: \log_{10} w = -1.042 + 2.6166 \log_{10} d$$

$$\underline{C. lamarckii}: \log_{10} w = -1.004 + 2.5600 \log_{10} d$$

Umbrellar wet weights represent the weight of the jelly disc only, with the tentacle/gonad/mouth mass removed. For C. capillata the umbrellar wet weight represents approximately 40% of the wet weight of the entire organism and for C. lamarckii umbrellar weight represents approximately 50%. These percentages were derived from examination of entire specimens collected in fine mesh nets by divers.

The numbers of medusae over 20cm caught in 1976 were low with modal sizes for both species in all five areas being in the ranges 1-4 cm or 5-9 cm disc diameter. In all areas the average size and the range of diameters of medusae caught increased between survey one and survey two for both species. In area 1 the modal sizes for both species lay in the range 1-4 cm during both surveys. In areas 1a and 2 the modal sizes of both species lay between 5 and 9 cm for both surveys. In area 3, C. lamarckii had a modal size between 1 and 4 cm for survey one which shifted to between 5 and 9 cm for survey two. This shift of modal size from 1-4 cm to 5-9 cm occurred in area 4 for C. capillata but not for C. lamarckii which had a modal size in the range 5-9 cm for both surveys.

Table 2 presents, for each survey, the total umbrellar wet weight caught in the five areas and the distribution of these weights over 5 cm size categories.

The opportunity for commensal association between 0-group gadoids and the scyphomedusae

The commensal associations have been known for many years (Dahl 1961, Mansueti 1963, Russell 1970) but the importance of any effects they may have on survival of juvenile gadoids in the North Sea can, as yet, only be assumed. As indicated in previous years (Hay and Adams 1975, Hay, Adams and Hislop 1976) the evidence of the extent of these associations can only be derived circumstantially from the data presented here. However, Table 3 duplicates our attempt of 1975 to quantify the availability of Cyanea spp. in statistical rectangles where 0-group whiting, haddock, cod and Norway pout were present or "abundant". The number of fish caught per haul chosen to define the lower limit of "abundance" for each species, was chosen subjectively, but with regard to the arithmetic mean numbers of each fish species in those squares where each was present. Unlike 1975 when all three species of jellyfish were used to prepare the table, only numbers of Cyanea spp. were used in 1976.

As in 1975 Norway pout, not normally considered commensal with Cyanea spp., was for both surveys the species with least opportunity for association with the jellyfish. Whiting had the greatest opportunity whereas the opportunity for cod and haddock lay between these extremes, the latter two species having less opportunity for association than they did in 1975. Opportunity for association increased between survey one and survey two for whiting, remained about the same for haddock and increased slightly for cod. The opportunity for Norway pout decreased between surveys.

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Table 1

Percentage Size Frequency Distribution by Number for Cyanea capillata (C.c.) and Cyanea lamarckii (C.l.)

Area	Species	Survey No	Number Measured	Diameter of Umbrellar Disc (cm)								
				1-4cm	5-9cm	10-14cm	15-19cm	20-24cm	25-29cm	30-34cm	35-39cm	40-44cm
Area 1	C.c.	1	182	58.8	33.0	6.6	1.6					
		2	191	40.8	34.0	16.8	3.7	2.6	1.6	0.5		
	C.l.	1	377	73.7	23.1	3.2						
		2	117	53.8	41.0	4.3	0.9					
Area 1a	C.c.	1	325	25.5	68.0	5.2	1.2					
		2	37	16.2	35.1	29.7	5.4	13.5				
	C.l.	1	48	8.3	43.8	27.1	18.7	2.1				
		2										
Area 2	C.c.	1	90	25.6	35.6	27.8	5.6	4.4			1.1	
		2	200	4.5	39.0	26.0	12.0	8.5	4.5	3.5	0.5	1.5
	C.l.	1	269	39.0	52.0	9.0						
		2	469	15.1	60.9	15.8	5.7	1.7	0.6	0.1	0.1	
Area 3	C.c.	1										
		2	1	100								
	C.l.	1	87	85.1	14.9							
		2	347	16.7	57.3	24.8	1.2					
Area 4	C.c.	1	194	63.4	24.2	8.8	2.6	0.5	0.5			
		2	451	32.7	41.1	19.8	5.7	0.5	0.1	0.1		
	C.l.	1	238	19.7	64.3	16.0						
		2	425	11.5	62.4	23.3	2.8					

Note: For explanation of areas see text.

Table 2

Percentage Size Frequency Distribution by Weight for Cyanea capillata (C.c.) and Cyanea lamarekii (C.l.)

Area	Species	Survey No	Total weight of specimens measured	Diameter of Umbrellar disc (cm)								
				1-4cm	5-9cm	10-14cm	15-19cm	20-24cm	25-29cm	30-34cm	35-39cm	40-44cm
Area 1	C.c.	1	1 776 g	13.3	30.3	35.7	20.7					
		2	7 329 g	1.9	13.0	23.6	12.7	19.3	18.8	10.7		
	C.l.	1	1 875 g	27.0	40.5	32.4						
		2	962 g	12.4	47.8	23.0	16.8					
Area 1a	C.c.	1	4 423 g	5.6	61.4	17.5	15.5					
		2	2 568 g	0.5	10.1	23.2	11.0	55.1				
	C.l.	1	2 339 g	0.5	16.8	29.3	44.4	9.0				
		2										
Area 2	C.c.	1	3 999 g	1.1	10.2	32.9	18.0	21.2		16.6		
		2	28 852 g	0.1	4.0	10.6	14.1	18.9	15.0	18.3	4.0	15.0
	C.l.	1	3 573 g	7.1	51.4	41.5						
		2	84 846 g	1.1	25.5	25.1	22.8	12.8	8.2	2.3	2.2	
Area 3	C.c.	1										
		2	2 g	100								
	C.l.	1	218 g	56.5	43.5							
		2	8 083 g	1.9	37.8	55.2	5.0					
Area 4	C.c.	1	3 065 g	5.4	20.0	30.9	21.2	7.5	14.9			
		2	39 870 g	2.4	20.8	40.6	28.3	4.7	1.5	1.7		
	C.l.	1	4 169 g	3.1	50.9	46.0						
		2	10 370 g	1.5	37.8	47.1	13.6					

Note: For explanation of areas see text.

Table 3

Survey Number	Species present or " \bar{x} " "abundant"	Number of hauls	Of the statistical squares in which each gadoid species was (a) present (b) "abundant" the percentage which had:-			
			No Cyanea sp.	1-9 Cyanea spp per haul	10-29 Cyanea spp per haul	30+ Cyanea spp per haul
1	Whiting present (75) >50	22 5	9.1 0	36.4 0	18.2 60	36.4 40
	Haddock present (82) >100	39 11	25.6 45.5	41.0 18.2	7.7 18.2	25.6 18.2
	Cod present (62) >50	45 11	24.4 54.5	26.7 9.1	15.6 18.2	33.3 18.2
	Norway pout (5 670) >1000	24 12	45.8 66.7	25.0 8.3	12.5 8.3	16.7 16.7
2	Whiting present (38) >50	35 11	22.9 9.1	22.9 9.1	14.3 18.2	40.0 63.6
	Haddock present (163) >100	46 17	32.6 47.1	21.7 29.4	13.1 5.8	32.6 17.7
	Cod present (83) >50	36 23	30.6 43.5	22.2 13.0	19.4 8.7	27.8 34.8
	Norway pout (11 663) >1000	24 13	33.3 53.8	37.5 30.8	16.7 15.4	12.5 0

* \bar{x} = the arithmetic mean number of each fish species caught, in those squares where each was found.

Note:- The 1975 paper included Aurelia aurita in calculating percentages of squares in each abundance category of jellyfish.

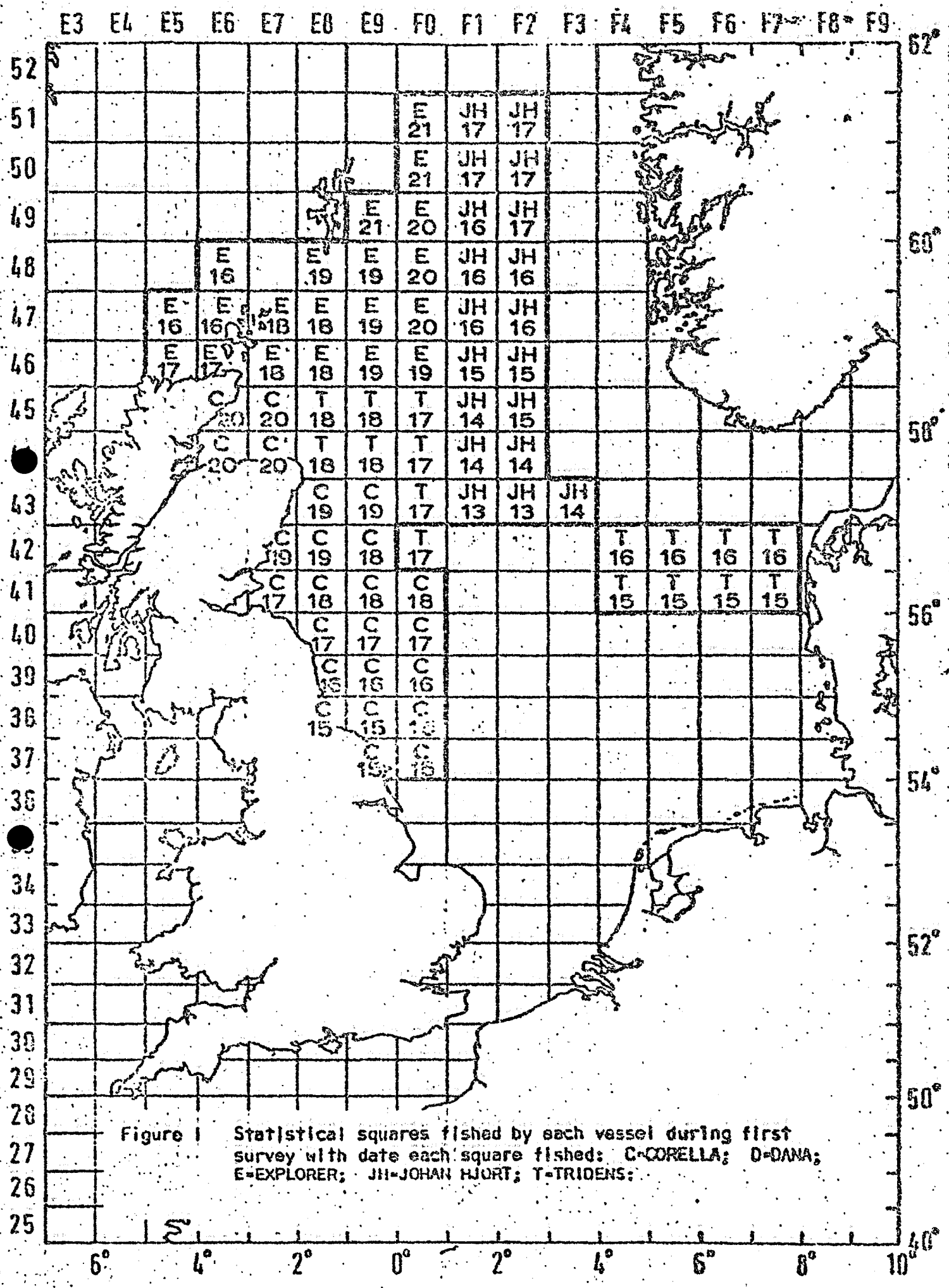


Figure 1 Statistical squares fished by each vessel during first survey with date each square fished: C-CORELLA; D-DANA; E-EXPLORER; JH-JOHAN HJORT; T-TRIDENS.

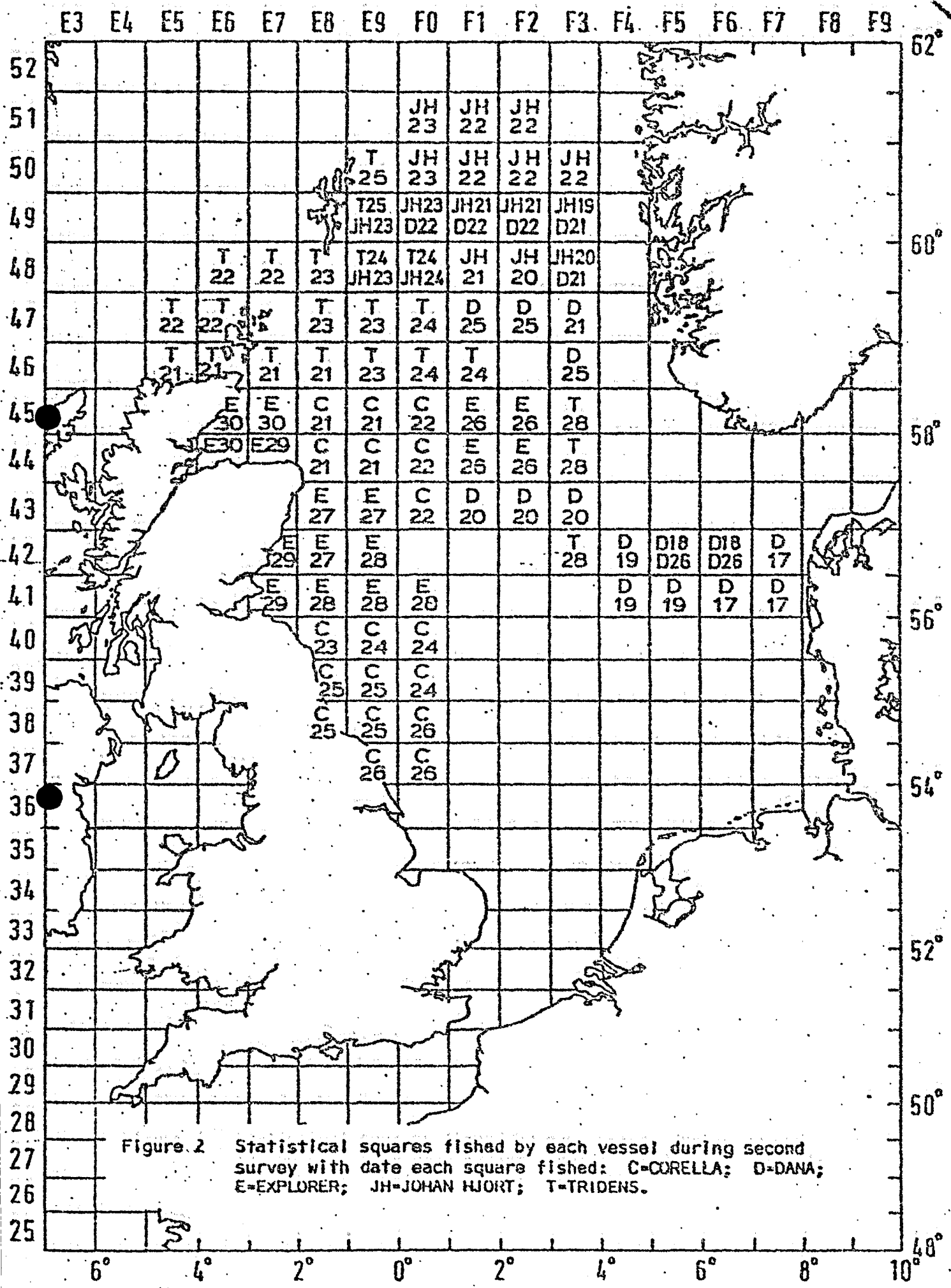


Figure 2 Statistical squares fished by each vessel during second survey with date each square fished: C-CORELLA; D-DANA; E-EXPLORER; JH-JOHAN HJORT; T-TRIDENS.

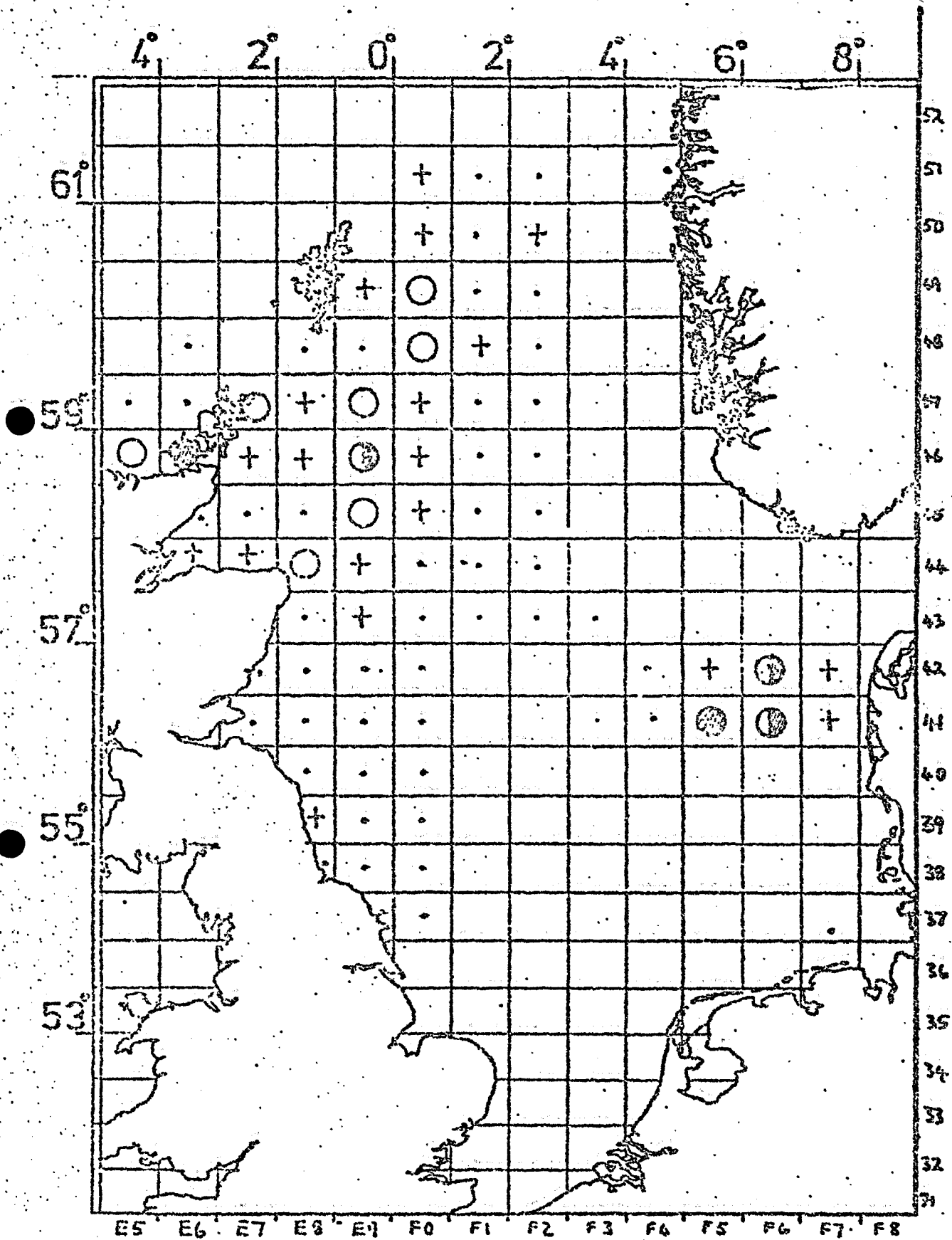


Figure 3 Distribution and abundance of *Cyanea capillata*, Survey 1.

Legend . Nil per haul; + < 10 per haul; ○ 10-29 per haul;

● 30-39 per haul; ◐ 100-299 per haul; ⊕ 300 per haul.

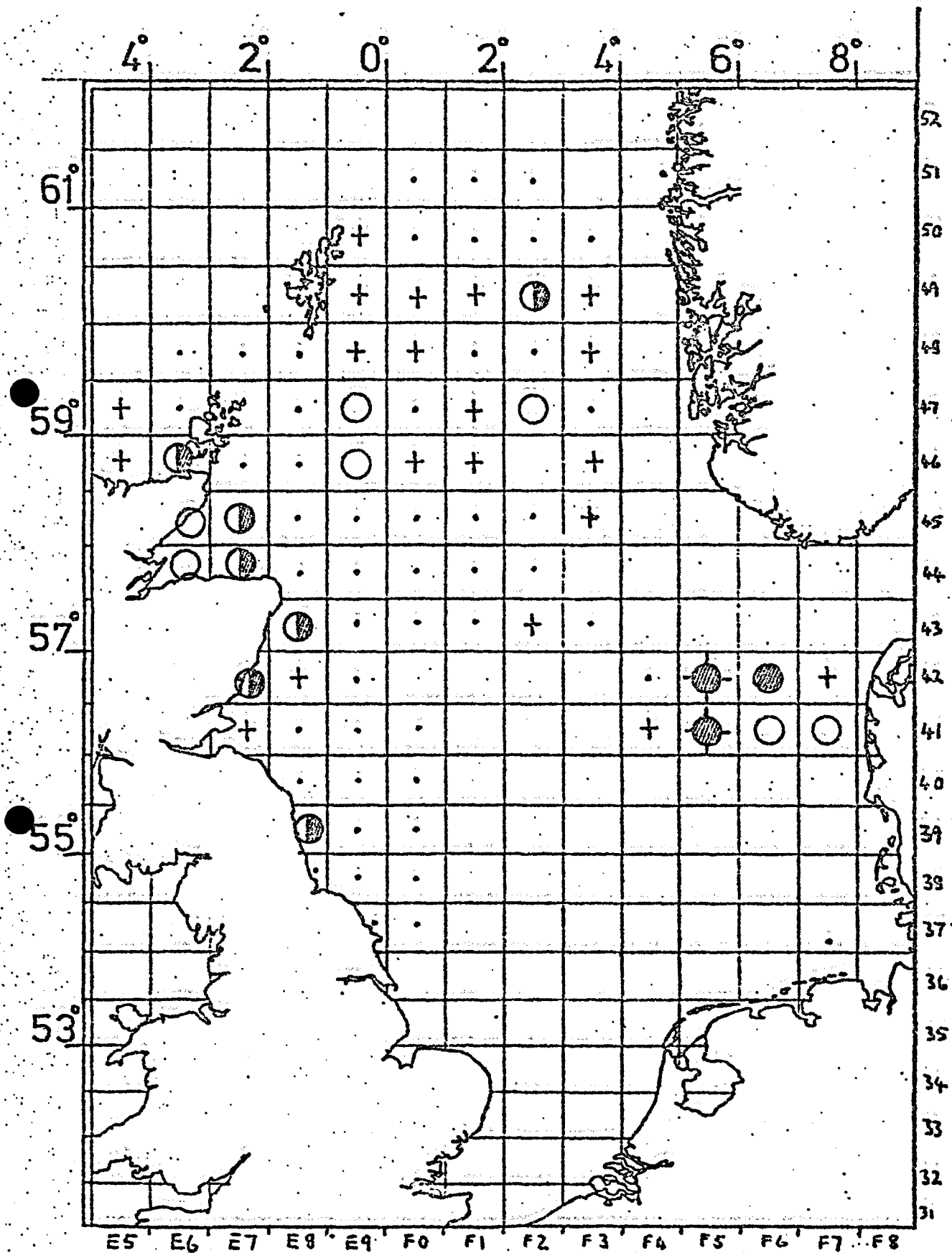


Figure 4 Distribution and abundance of *Cyanea capillata*, Survey 2.
 Legend as in Figure 3. :

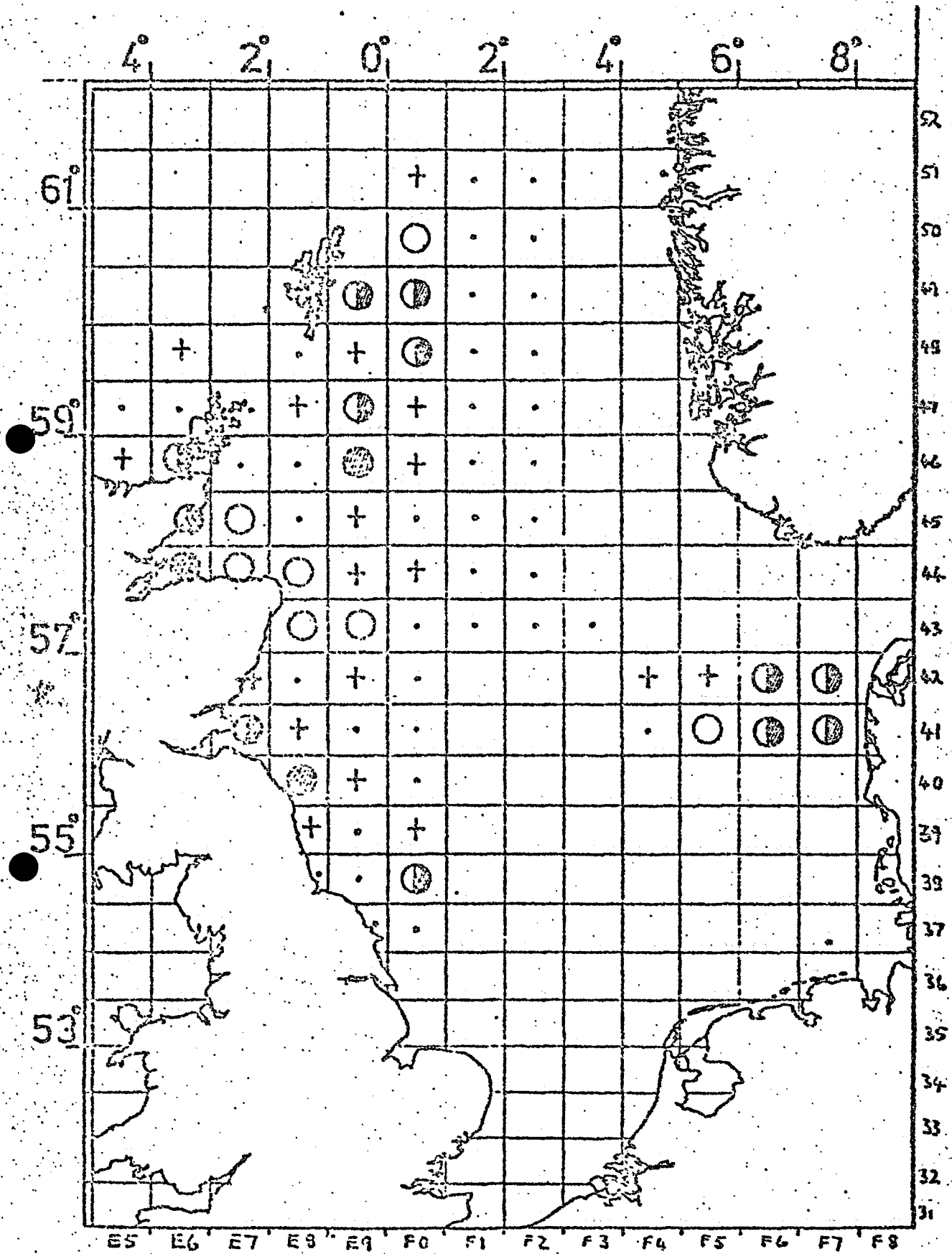


Figure 5 Distribution and abundance of *Cyanea lamarckii*, Survey 1.
 Legend as in Figure 3.

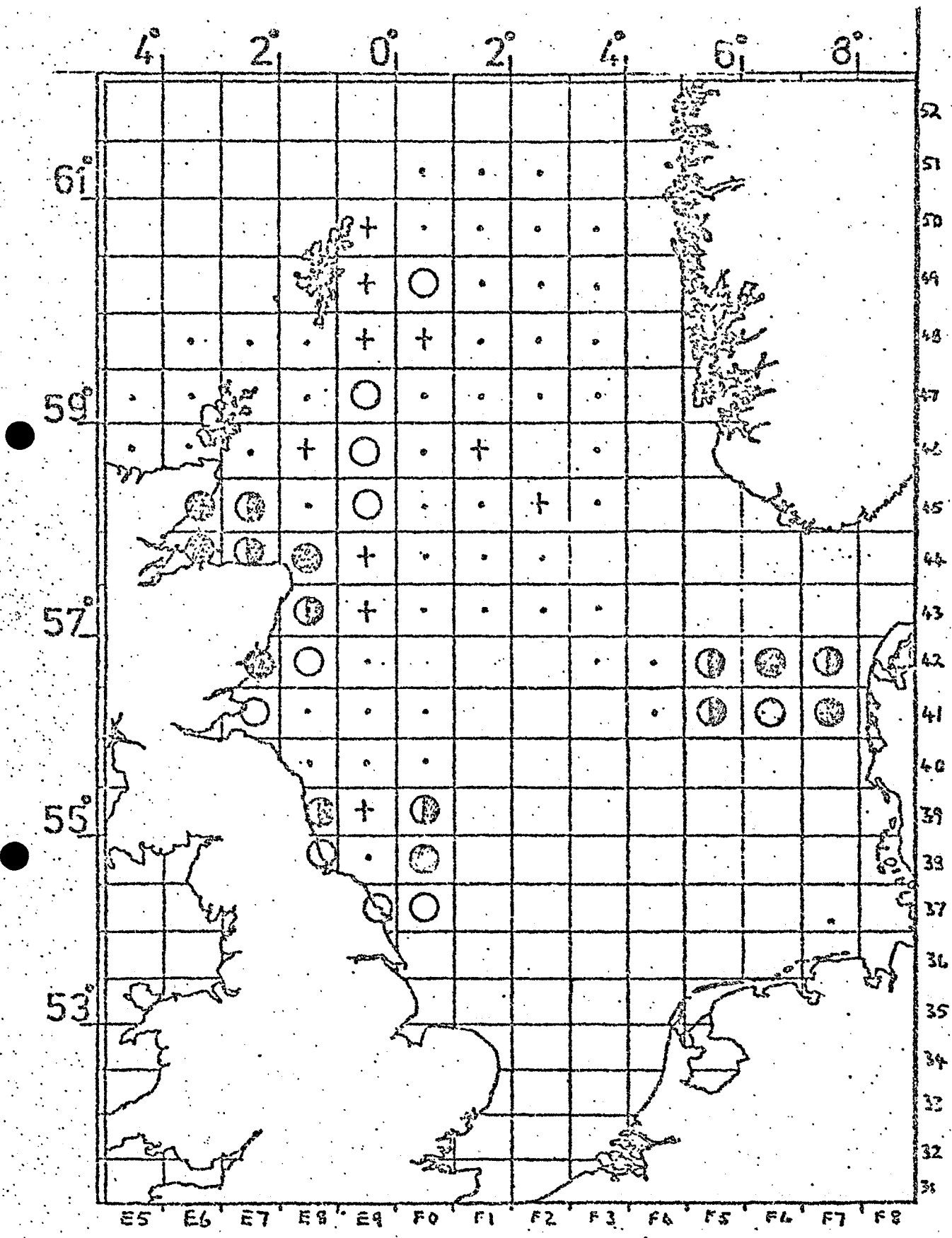


Figure 6 Distribution and abundance of *Cyanea lamarckii*, Survey 2.
 Legend as in Figure 3.

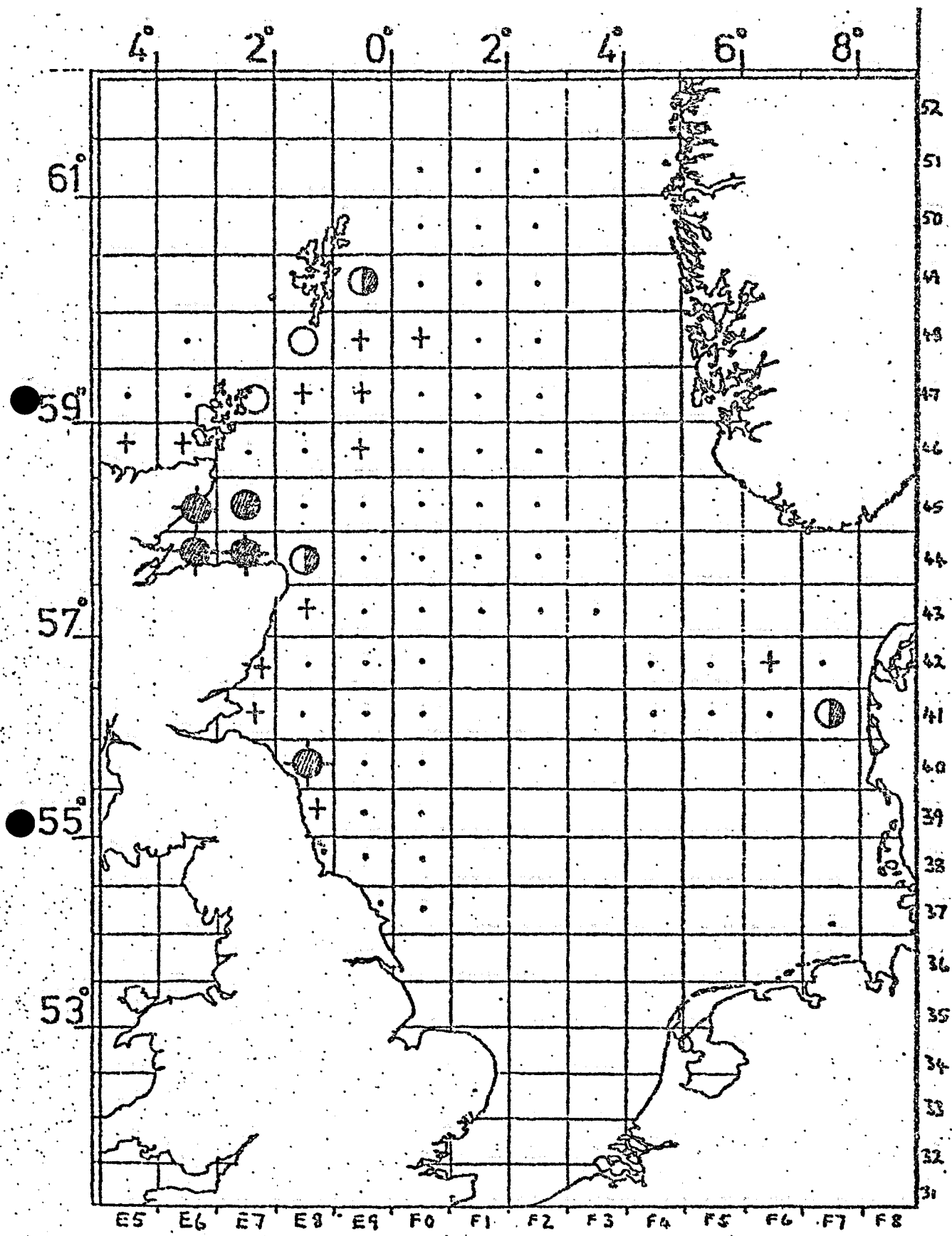


Figure 7. Distribution and abundance of *Aurelia aurita*, Survey 1.
 Legend as in Figure 3.

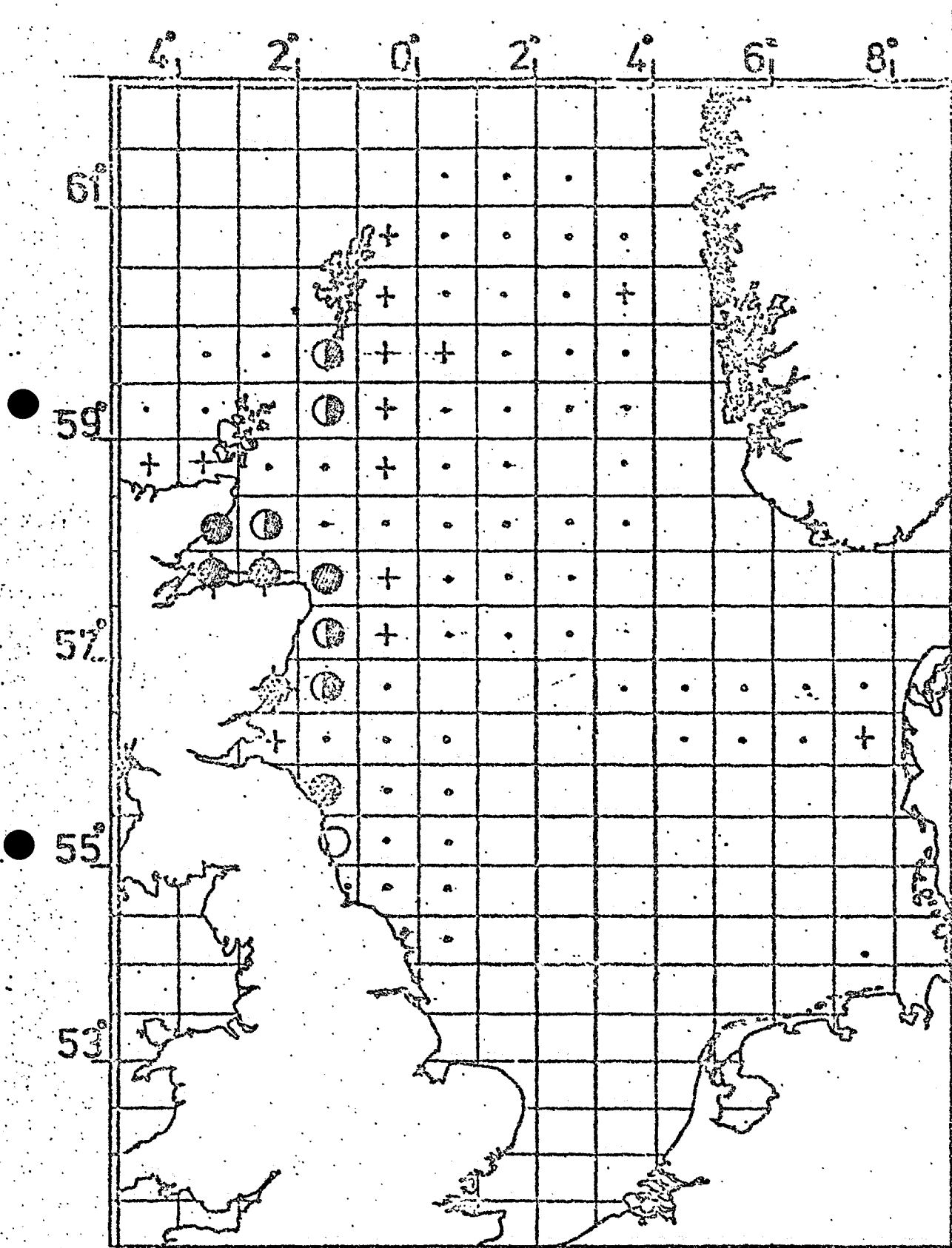


Figure 8 Distribution and abundance of *Aurelia aurita*, Survey 2.
 Legend as in Figure 3.