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THE RESULTS OF THE INTERNATIONAL 0-GROUP GADOID  
SURVEY IN THE NORTH SEA, 1978

by

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INTRODUCTION

The survey was carried out in the period 11 June - 11 July by 4 vessels, CORELLA (England), EXPLORER (Scotland), JOHAN HJORT (Norway) and TRIDENS (Netherlands). The gears used, the design of the experiment and the method of fishing were all as described for the 1976 survey by Daan et al. (1976).

RESULTS

Area fished

The statistical squares fished by each vessel are shown in Figures 1 and 2. Because all the ships were not available during the same period and because the JOHAN HJORT had to carry out a mackerel egg and larval survey at the same time as the 0-group gadoid survey, the time interval between sampling each statistical square varied from a minimum of 1 day to a maximum of 19 days. Two statistical squares (49E9 and 45E8) were fished three times and one square (42E7) only once.

For this reason, the average numbers per haul, mean length, standard deviation and range for all species by groups of 4 statistical rectangles were calculated by one week periods (Tables 1-4).

### Distribution

The numbers of 0-group gadoids caught in each statistical square are shown in Figures 3-7.

Cod were found in three main areas, off the Danish coast, to the southeast of the Shetlands and in the Moray Firth/Orkney region. The area of highest abundance was off the Danish coast. Cod were scarce along the English coast.

Haddock were present in moderate numbers east and south-east of the Shetlands and off the Danish coast. These are the two areas in which the abundance of haddock has been highest in past surveys. However, in 1978 haddock were unusually abundant to the west of Fair Isle and around the Orkneys, the catch rates in these areas being as high as those in the area east of the Shetlands. Comparison of the catches made in the Orkney area during the first and second times of sampling shows that the distribution of the fish changed. This suggests that there may have been an influx of 0-group haddock to the North Sea, possibly from a spawning area to the west.

Whiting were found mainly to the west of Fair Isle and the Orkneys and off the Danish coast. Over the rest of the survey area catches were small, with the exception of a single large catch (636 fish) in rectangle 50F3 (Fig. 5).

Norway pout were restricted to the area between the Shetlands and the Norwegian Deeps, except for a single large catch (2280 fish) made in 47E5 (Fig. 6).

Saithe were scarce, as is usual, and were distributed mainly along the eastern part of the northern North Sea (Fig. 7).

### Prediction of year-class size

Examination of the catch-rates for the 3 standard areas (Danish Coast, English coast and Northern area, (see Fig. 1) showed that there were statistically significant differences between the first and second times of fishing for all species and areas, except haddock in the Danish Coast area (Table 5). However, to get an average value to use as an index of year-class abundance, results from both surveys were combined, using the standard areas for each species shown in Fig. 3-5 for cod, haddock and whiting respectively. The results are given in Table 6.

Compared with previous years, when the main distribution of haddock was east of the Shetlands, 1978 haddock were also around the Orkneys (Fig. 4). As this region of high density includes rectangles which have not been used in previous years in calculating the index of haddock abundance, it was decided that a mean based on the whole of the Northern area would provide a better index of abundance for year to year comparison of year-class size. Data for previous years (1974-77) were re-calculated on this basis (Table 7). The mean abundances for Norway pout, which have not previously been given for 1974-77, were also calculated on this basis.

The mean abundances of cod, haddock, whiting and Norway pout by standard areas are shown in Table 8 together with the indices of abundance of cod, haddock and whiting from the International Young Herring Survey (Anon, 1978a) and the estimates of year-class size from virtual population analysis (Anon. 1978b).

Since the 1978 North Sea Roundfish Working Group entered an estimated recruitment figure from the IYHS for the 1976 year-class in the VPA, the data series of independent VPA estimates for comparison has not been extended from last year. Because the number of data sets is limited, regression analyses were not done. The data in Table 8 indicate that the 1978 year-classes of cod, haddock and whiting are below average. The distribution of cod and haddock off the British east coast indicates that, in this area, their abundance may be very low.

### Planning of future surveys

The group agreed that the dates for the 1979 survey should be similar to those of 1977-78. However, in view of the atypical distribution of 0-group haddock in 1978, it was considered that it would be very desirable to extend the area of the survey to include statistical squares in the north Minch and to the north of the Outer Hebrides and also to increase the number of squares sampled off the Danish coast. However, it would be necessary to increase the number of ships in the survey to do this because the area sampled now is as large as is possible with the 4 ships currently committed to this survey.

### By-catch data

The catches of herring, sprat and sandeel are given in Tables 9-11. These and by-catch data for other species will be fully reported in Annales Biologiques.

### REFERENCES

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- DAAN, N., HISLOP, J.R.G., HOLDEN, M.J., PARNELL, W.G., KNUDSEN, H. and LAHN-JOHANNESSEN, J. 1976. The results of the international 0-group gadoid survey in the North Sea, 1976. Coun. Meet. int. Coun. Explor. Sea, 1976. (F: 12): 1-4. 4 tab., 9 fig. [Mimeo.]





Table 3. Catch rates, mean length (cm), standard deviations and ranges of lengths by species and blocks of four statistical rectangles, 27 June - 3 July 1978.

Block	Date	Ships	Cod					Haddock					Whiting					Saithe					Norway Pout					
			N	N/hr	$\bar{L}$	Sd	Range	N	N/hr	$\bar{L}$	Sd	Range	N	N/hr	$\bar{L}$	Sd	Range	N	N/hr	$\bar{L}$	Sd	Range	N	N/hr	$\bar{L}$	Sd	Range	
50-49	F2, F3	24/6	E	160	40	4.38	0.76	2.5-5.9	1122	280	4.23	1.31	1.0-10.4	716	179	2.89	0.62	1.5-4.9	6	1	4.42	0.68	3.5-4.9	347	87	2.83	0.70	1.0-5.9
48-47	F2, F3	28/6	E	36	9	4.96	0.80	3.5-5.9	98	24	5.58	1.29	3.0-7.9	13	3	4.52	0.53	3.5-5.4	2	<1	6.25	1.41	5.0-6.9	303	76	4.58	0.70	3.0-6.4
46-45	F2-3	29/6	E	117	29	5.19	0.72	3.5-6.4	61	15	5.75	0.96	3.0-6.9	3	<1	4.75	-	4.5-4.9	0					5016	1254	4.56	0.60	3.0-5.9
42-41	F4-5	1/7	E	24	6	3.06	1.40	1.0-5.9	20	5	4.85	1.28	2.5-6.9	742	185	3.89	0.96	1.0-5.9	0					0				
42-41	F6-7	2/7	E	159	40	3.50	0.42	2.0-3.9	36	9	5.04	1.48	3.0-8.4	597	149	4.71	1.19	1.0-7.9	0					0				
42-41	F0-1	27/6	T	0					0				0										0					
40-39	F0-1	27/6	T	0					0				0										0					
DANISH COAST				183	23	3.44	0.65	1.0-5.9	56	7	4.97	1.40	2.5-8.4	1339	167	4.25	1.14	1.0-7.9	0					0				
ENGLISH COAST				0					0				0										0					
SCOTTISH COAST				0					0				0										0					
NORWEGIAN DEEPS				313	26	4.75	0.84	2.5-6.4	1220	153	4.34	1.36	1.0-7.9	732	61	2.93	0.66	1.5-5.4	8	1	4.87	1.16	3.5-6.9	5666	472	4.45	0.74	1.0-6.4

Table 4. Catch rates, mean lengths (cm), standard deviations and ranges of lengths by species and blocks of four statistical rectangles, 5-11 July 1978.

Block	Date	Ships	Cod					Haddock					Whiting					Saithe					Norway Pout					
			N	N/hr	$\bar{L}$	Sd	Range	N	N/hr	$\bar{L}$	Sd	Range	N	N/hr	$\bar{L}$	Sd	Range	N	N/hr	$\bar{L}$	Sd	Range	N	N/hr	$\bar{L}$	Sd	Range	
48-47	E6-7	8, 9, 10	E	15	4	4.08	0.45	3.0-4.9	2031	508	5.62	0.92	3.5-9.9	790	198	4.35	0.99	2.0-9.4	0					8	2	2.26	0.18	2.0-2.9
48-47	E4-5	9	E	9	9	4.47	0.71	3.0-5.9	133	133	6.01	1.27	3.5-9.9	269	269	4.61	0.94	2.0-8.9	0					2280	2280	5.56	0.80	1.5-7.4
46-45	E8-9	11	E	15	15	4.55	0.39	3.0-5.4	241	241	6.33	0.98	4.0-8.9	49	49	3.63	0.73	2.0-5.9	0					121	121	4.26	1.41	2.0-7.9
46-45	E6-7	7, 8, 9	E	18	5	3.89	1.04	2.5-7.4	209	52	4.59	0.66	3.0-6.9	136	34	4.53	1.04	2.0-10.4	0					1	<1	2.75	-	2.5-2.9
46-45	E4-5	9	E	0					16	16	5.63	0.50	4.5-6.4	70	70	5.01	0.91	2.0-7.9	0					0				
44-43	E8-9	5, 11	E	10	5	4.50	0.59	3.5-5.4	44	22	5.24	0.96	3.0-7.9	16	8	4.16	0.71	2.5-5.9	0					0				
44-43	E6-7	7	E	3	2	4.42	0.29	4.0-4.9	23	12	4.99	1.02	3.0-7.4	28	14	4.59	1.08	2.5-7.4	0					0				
SCOTTISH COAST				70	5	4.26	0.72	2.5-5.9	2697	180	5.61	1.00	3.0-9.9	1358	91	4.43	1.00	2.0-10.4	0					2412	161	5.48	0.89	1.5-7.9

Table 5. Geometric means and 95% confidence limits for all species for the first and second times of sampling and for the whole survey.

	Danish Coast		British East Coast		Northern area	
	Mean	95%	Mean	95%	Mean	95%
1 <sup>st</sup> time	No.of obs.= 8		No.of obs.= 18		No.of obs.= 57	
Cod	98.4	28.7-237.5	0.7	0.5-0.9	3.6	2.6-4.8
Haddock	15.3	3.6-65.9	0.1	0.09-0.11	39.0	24.0-63.3
Whiting	0.6	0.4-1.1	0.1	0.09-0.11	3.5	2.5-4.9
Norway pout	0.0		0.0		2620	1089-6303
Saithe	0.0		0.0		1.3	1.0-1.6
2 <sup>nd</sup> time	No.of obs.= 8		No.of obs.= 17		No.of obs.= 59	
Cod	21.9	6.2-77.2	2.2	1.3-3.9	9.1	6.3-13.1
Haddock	7.3	2.5-21.0	0.43	0.33-0.56	168.0	98.6-286.5
Whiting	549.9	68.2-4435.6	0.53	0.37-0.75	23.2	14.0-38.3
Norway pout	0.0		0.0		191.1	810-4505
Saithe	0.0		0.0		0.2	
Whole survey	No.of obs.= 16		No.of obs.= 35		No.of obs.= 116	
Cod	62.4	26.1-149.4	2.1	1.4-3.2	6.0	4.7-7.7
Haddock	10.6	4.8-23.3	0.25	0.22-0.29	85.3	59.0-123.
Whiting	112.7	29.4-431.5	0.29	0.24-0.35	10.2	7.5-13.9
Norway pout	0.0		0.0		2239	1215-4125
Saithe	0.0		0.0		0.7	0.6-0.8



Table 6. Geometric means and 95% confidence limits for cod, haddock and whiting by standard areas (see text) for first and second time of sampling and for whole survey. n = number of observations.

	1 <sup>st</sup> time of sampling			2 <sup>nd</sup> time of sampling			Whole survey		
	n	Mean	95%	n	Mean	95%	n	Mean	95%
Cod	20	41.5	16.9-102.1	20	40.6	20.0-82.1	40	43.3	24.9-75.5
Haddock	19	53.1	21.6-130.7	20	495.4	178.3-1376.6	39	230.9	114.5-465.5
Whiting	38	0.8	0.6-1.0	39	53.7	27.5-104.8	77	12.8	8.6-19.1

Table 7. Geometric means and 95% confidence limits for haddock and Norway pout for the northern area for 1974-1977. n = number of observations.

Year	Haddock			Norway pout	
	n	Mean	95%	Mean	95%
1974	55	828.0	423.4-1619.1	2599	1112-6073
1975	50	65.4	35.0-122.2	1269	542-2969
1976	104	154.5	98.6-241.9	19845	9724-40498
1977	97	33.4	23.4-47.9	209	124-352

Table 8. Indices of year-class abundance for cod, haddock and whiting from the 0-group surveys (a = standard area, b = northern North Sea area) and from the IYHS and virtual population analysis and for Norway pout from the 0-group survey only : figures in parentheses are based on non-standard survey results.

Year	Cod			Haddock			Whiting			Norway pout 0-gp	
	0-gp (a)	IYHS	VPA	0-gp (a)	(b)	IYHS	VPA	0-gp	IYHS		VPA
1969	-	60	367	248	-	35	109		71	777	
1970	-	89	450	34	-	1545	899		225	849	
1971	-	3	82	4068	-	957	1325		356	1782	
1972	(26)	32	158	93	-	230	259	(138)	1161	2337	
1973	(8)	11	138	301	-	1314	1298	(40)	325	1631	
1974	157	55	228	2173	828	1370	2541	276	943	2392	2599
1975	17	6	121	622	65	212	552	70	832	965	1269
1976	188	44		579	155	189		16	436		19845
1977	35	12		143	32	458		4	474		209
1978	43			231	85			13			2239

Table 9. Herring by-catch

NORTH SEA INTERNATIONAL O-GROUP GADOID SURVEY

COUNTRY ENGLAND VESSEL CORELLA YEAR 1978 SPECIES HERRING

ICES RECTANGLE SURVEY NUMBER	37E9	38E8	41F0	41G7	44G7	46G6	47G6	47E5	46E5	40E9	40E9	37E8	38F0	38E8	37E9	
DATE	13.6	14.6	15.6	16.6	19.6	19.6	21.6	22.6	22.6	24.6	24.6	24.6	25.6	25.6	26.6	
HAUL	2	6	10	14	26	27	31	34	35	40	41	42	46	46	48	
LENGTH IN 0.5 cm GROUPS	0.5															
	1.0															
	1.5															
	2.0															
	2.5															
	3.0															
	3.5															
	4.0															
	4.5	2			5											
	5.0	6				1	156									
	5.5						312									
	6.0	2			70		1151					6				1
	6.5				160		507					36				
	7.0				265							31				
	7.5	5		1	50						1	12				
	8.0				5							6				
	8.5															
9.0																
9.5																
10.0																
10.5																
11.0																
11.5																
12.0																
12.5																
13.0																
13.5																
14.0																
14.5																
15.0	5	16					2					10	13	256	14	
NUMBER PER HOUR	22	16	1	535	1	2126	2	1	1	1		10	13	256	17	
MEAN LENGTH																
STANDARD DEVIATION																
STANDARD ERROR																
COMMENTS																

NORTH SEA INTERNATIONAL O-GROUP GADOID SURVEY

COUNTRY SCOTLAND VESSEL EXPLORER YEAR 1978 SPECIES HERRING\*

ICES RECTANGLE SURVEY NUMBER	43F3	41F5	43E8	44E6	44E7	45E7	46E7	47E7	43E9	
DATE	30.6	1.7	5.7	7.7	7.7	8.7	8.7	8.7	11.7	
HAUL	145	150	155	159	160	161	162	163	171	
LENGTH IN 0.5 cm GROUPS	0.5									
	1.0									
	1.5									
	2.0									
	2.5									
	3.0									
	3.5									
	4.0									
	4.5									
	5.0		1							
	5.5		6		22					
	6.0		9		289					
	6.5		5		1924					
	7.0		1	4	1954	1				
	7.5		1	6	456	2		1		
	8.0			2	65				1	
	8.5	1								
9.0										
9.5										
10.0										
10.5										
11.0										
11.5										
12.0					1					
12.5					3					
13.0										
13.5					1					
14.0					3					
14.5										
15.0					1	60				
NUMBER PER HOUR	1	23	12	4060	12	60	1	1	1	
MEAN LENGTH										
STANDARD DEVIATION										
STANDARD ERROR										
COMMENTS		* All unidentified clupeoids (< 5.0cm) have been recorded as sprats								

Table 9! (contd.)

NORTH SEA INTERNATIONAL 0-GROUP GADOID SURVEY

COUNTRY NORWAY VESSEL JOHAN HJORT YEAR 1978 SPECIES HERRING

ICES RECTANGLE	50F2	50F3	49F3	48F0	48E9	47F2	46F2													
SURVEY NUMBER																				
DATE	11.6	15.6	15.6	16.6	17.6	19.6	21.6													
HAUL	1	8	9	13	17	26	27													
0.5																				
1.0																				
1.5																				
2.0																				
2.5																				
3.0	1		1	1	1															
3.5			4																	
4.0			7		1		2													
4.5			3			20														
5.0																				
5.5																				
6.0																				
6.5																				
7.0																				
7.5																				
8.0																				
8.5																				
9.0																				
9.5																				
10.0																				
10.5																				
11.0																				
11.5																				
12.0																				
12.5																				
13.0																				
13.5																				
14.0																				
14.5																				
15.0																				
NUMBER PER HOUR	1	1	15	1	2	20	2													
MEAN LENGTH																				
STANDARD DEVIATION																				
STANDARD ERROR																				
COMMENTS																				

NORTH SEA INTERNATIONAL 0-GROUP GADOID SURVEY

COUNTRY NETHERLANDS VESSEL TRIDENS YEAR 1970 SPECIES HERRING

ICES RECTANGLE	41F7	42F6	42F4	43F2	44F1	47E9	46E0	46F0	45F0	45E9	41E7	39F0								
SURVEY NUMBER																				
DATE	13/6	14/6	14/6	15/6	15/6	16/6	19/6	21/6	22/6	22/6	26/6	27/6								
HAUL	2	4	8	10	14	15	13	25	34	35	38	46								
0.5																				
1.0																				
1.5																				
2.0																				
2.5																				
3.0											1									
3.5																				
4.0									33	10										
4.5			1					81	3											
5.0																				
5.5																				
6.0											2									
6.5											11									
7.0											12									
7.5											8									
8.0											5									
8.5																				
9.0																				
9.5																				
10.0																				
10.5																				
11.0																				
11.5																				
12.0																				
12.5																				
13.0																				
13.5	3																			
14.0	1																			
14.5	3																			
15.0	37						6													
NUMBER PER HOUR	44	1	1	1	1	1	6	1	114	15	38	1								
MEAN LENGTH																				
STANDARD DEVIATION																				
STANDARD ERROR																				
COMMENTS																				

IDENTIFICATION OF HERRING AND SPRAT UNCERTAIN



Table 10. (contd.)

NORTH SEA INTERNATIONAL O-GROUP GADOID SURVEY

COUNTRY	SCOTLAND																			
VESSEL	EXPLORER																			
YEAR	1978																			
SPECIES	SPRAT *																			
ICES RECTANGLE SURVEY NUMBER	48F3	46F3	45F3	45F2	44F2	43F2	42F4	41F5	42E6	41F6	43E8	45E6	44E6	44E7	45C7	46E7	47E7	47E6	47E5	48E7
DATE	28.6	29.6	29.6	29.6	30.6	30.6	1.7	1.7	2.7	2.7	5.7	7.7	7.7	7.7	8.7	8.7	8.7	9.7	9.7	10.7
HAUL	136	140	141	142	143	146	148	150	151	152	155	158	159	160	161	162	163	164	167	169
LENGTH IN 0.5 cm GROUPS	0.5																			
	1.0																			
	1.5																			
	2.0																			
	2.5																			
	3.0	1																		
	3.5		1		1															
	4.0		1		1															
	4.5		6		1	1														
	5.0						3													
	5.5																			
	6.0								1											
	6.5								3											
	7.0								2											
	7.5																			
	8.0																			
	8.5																			
	9.0																			
	9.5																			
	10.0																			
10.5																				
11.0																				
11.5																				
12.0																				
12.5																				
13.0																				
13.5																				
14.0																				
14.5																				
≥ 15.0																				
NUMBER PER HOUR	1	14	1	3	1	3	1	6	1	5	905	227	396	12	2008	1	8	40	2040	1
MEAN LENGTH																				
STANDARD DEVIATION																				
STANDARD ERROR																				
COMMENTS	* Includes some unidentified clupeoids (< 5.0 cm)																			

NORTH SEA INTERNATIONAL O-GROUP GADOID SURVEY

COUNTRY	SCOTLAND																			
VESSEL	EXPLORER																			
YEAR	1978																			
SPECIES	SPRAT *																			
ICES RECTANGLE SURVEY NUMBER	48E8	43E9										48E8	47E9							
DATE	11.7	11.7										16.6	17.6							
HAUL	170	171										14	18							
LENGTH IN 0.5 cm GROUPS	0.5																			
	1.0																			
	1.5																			
	2.0	40																		
	2.5	72																		
	3.0	40																		
	3.5	26	4											2						
	4.0	24	7																	
	4.5	5	1																	
	5.0																			
	5.5																			
	6.0																			
	6.5																			
	7.0																			
	7.5																			
	8.0	1																		
	8.5	7																		
	9.0	15												10						
	9.5	6																		
	10.0	4																		
10.5																				
11.0																				
11.5																				
12.0																				
12.5																				
13.0																				
13.5																				
14.0	1																			
14.5																				
15.0																				
NUMBER PER HOUR	241	13										10	2							
MEAN LENGTH																				
STANDARD DEVIATION																				
STANDARD ERROR																				
COMMENTS	* Includes some unidentified clupeoids (< 5.0 cm) <span style="float: right;">RIV JOHAN HJORT</span>																			











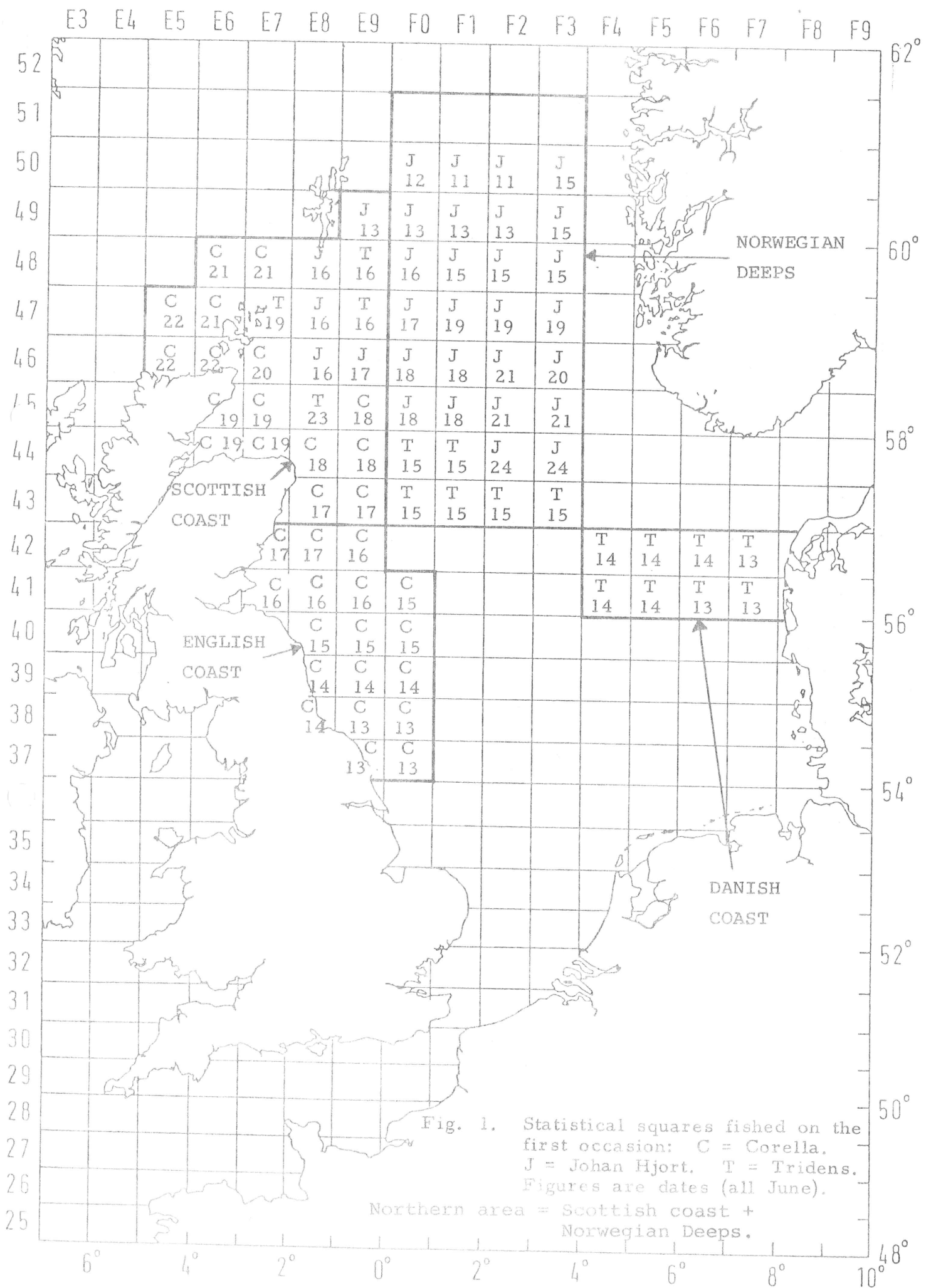


Fig. 1. Statistical squares fished on the first occasion: C = Corella, J = Johan Hjort, T = Tridens. Figures are dates (all June).

Northern area = Scottish coast + Norwegian Deeps.

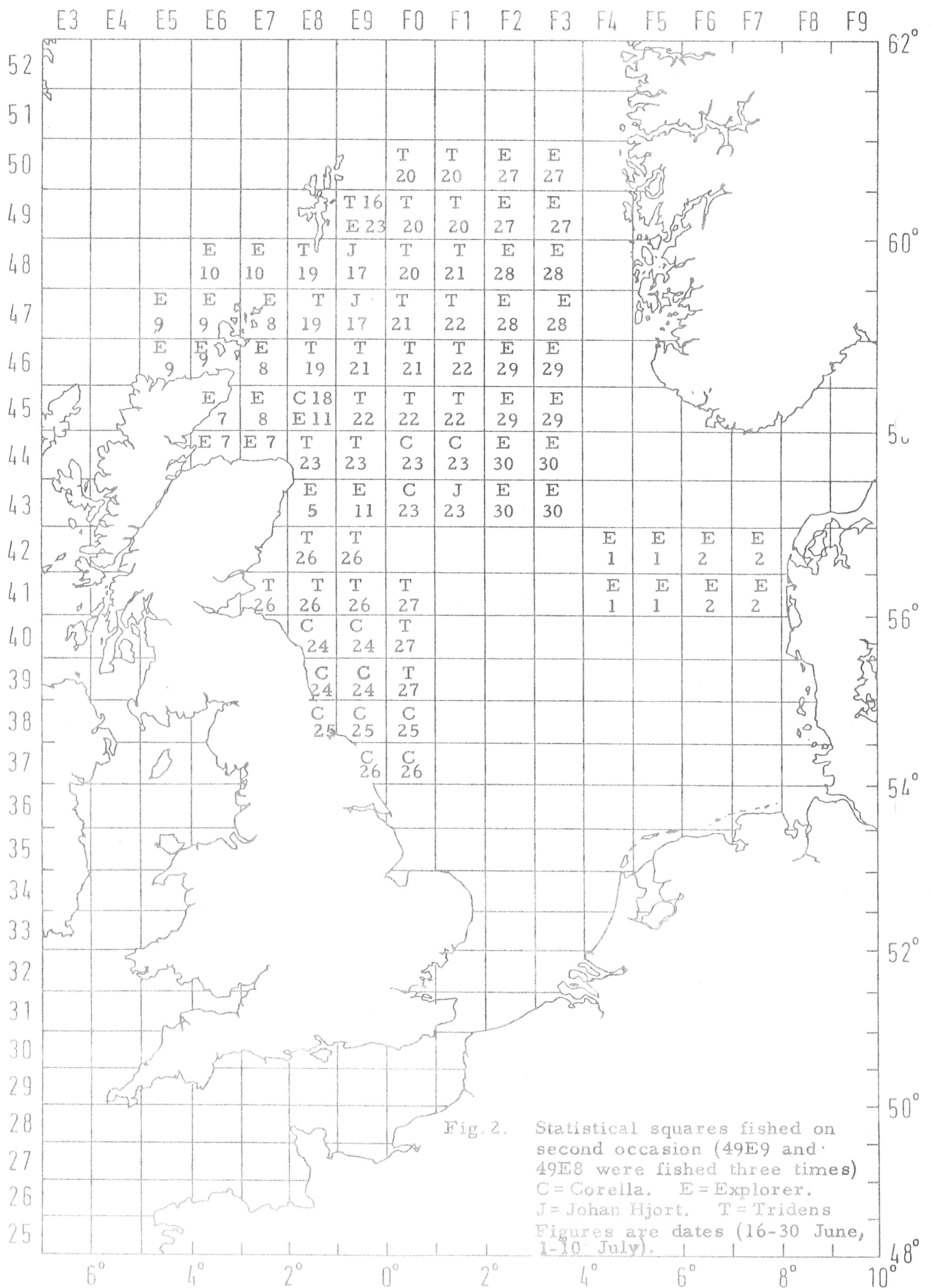


Fig. 2. Statistical squares fished on second occasion (49E9 and 49E8 were fished three times) C = Corella. E = Explorer. J = Johan Hjort. T = Tridens. Figures are dates (16-30 June, 1-10 July).

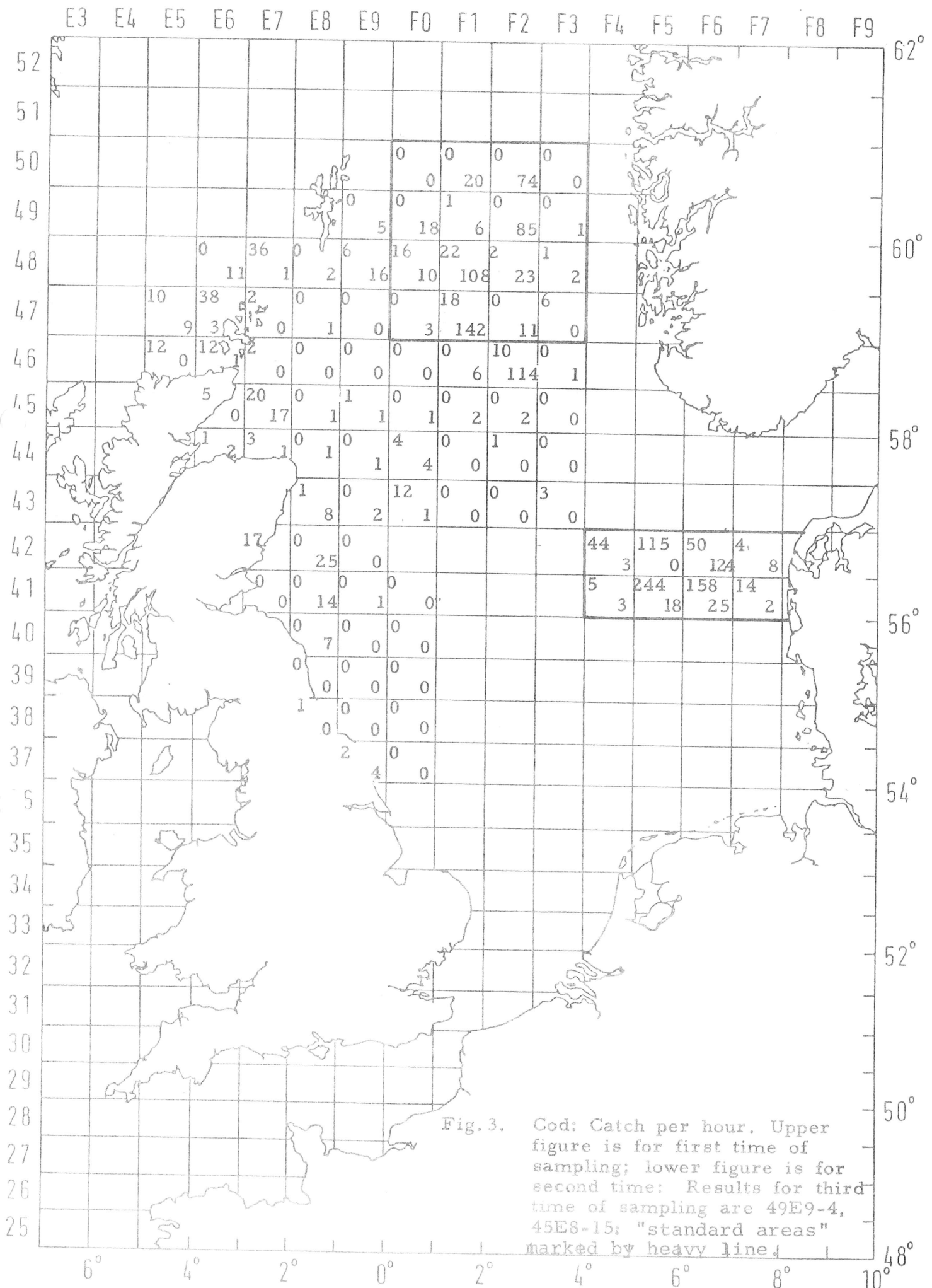
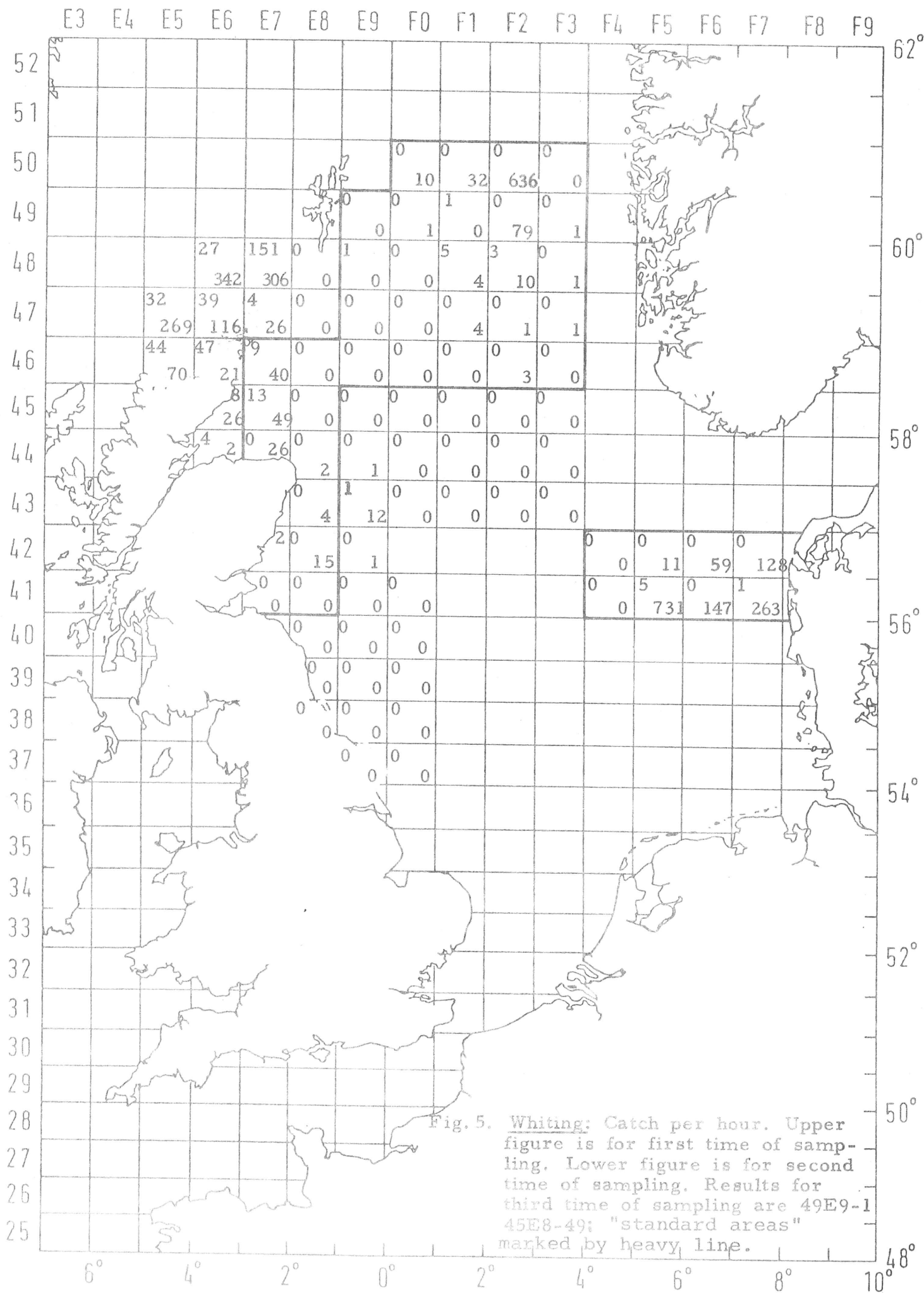


Fig. 3. Cod: Catch per hour. Upper figure is for first time of sampling; lower figure is for second time: Results for third time of sampling are 49E9-4, 45E8-15; "standard areas" marked by heavy line.





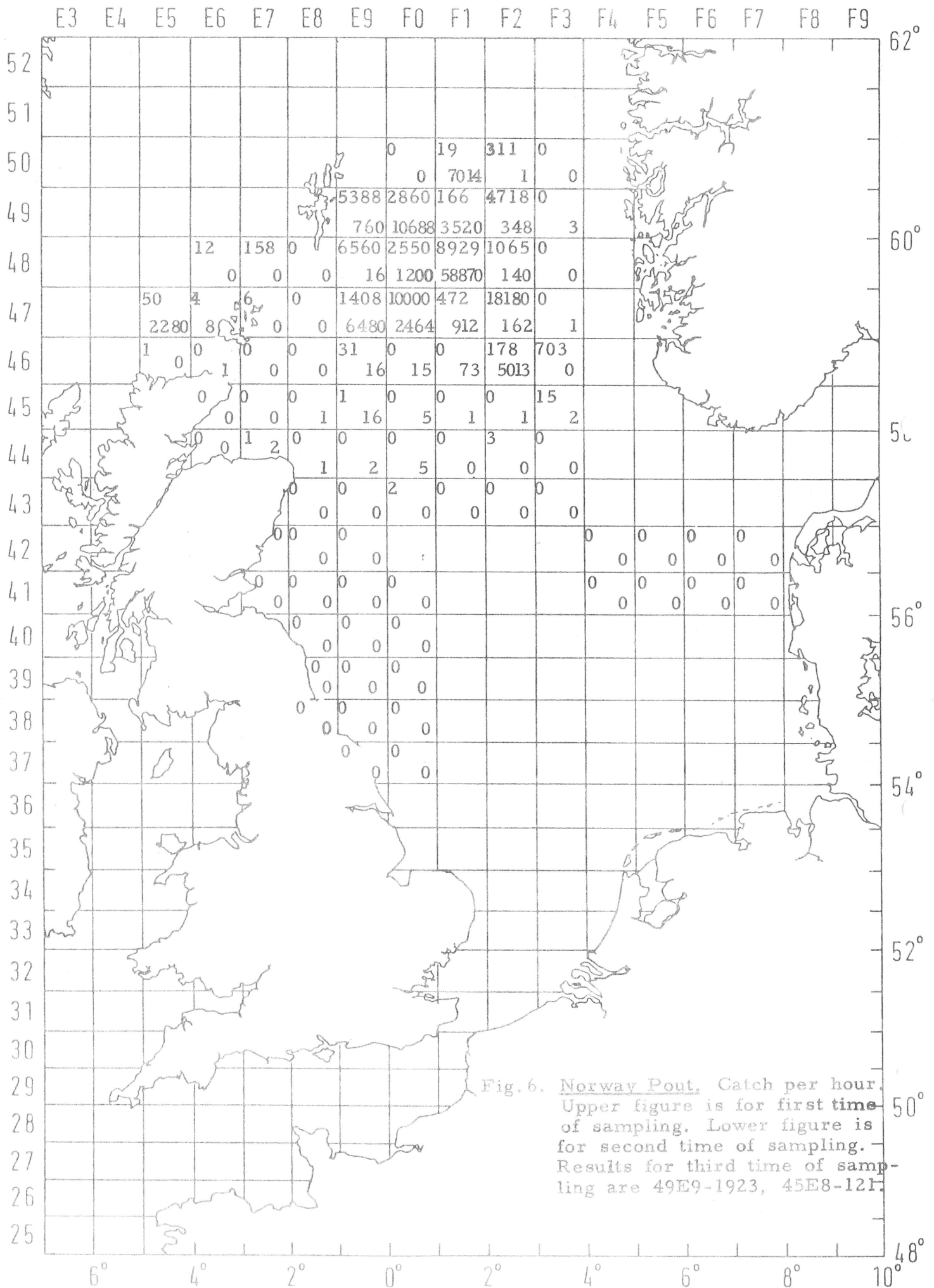


Fig. 6. Norway Pout. Catch per hour. Upper figure is for first time of sampling. Lower figure is for second time of sampling. Results for third time of sampling are 49E9-1923, 45E8-121.



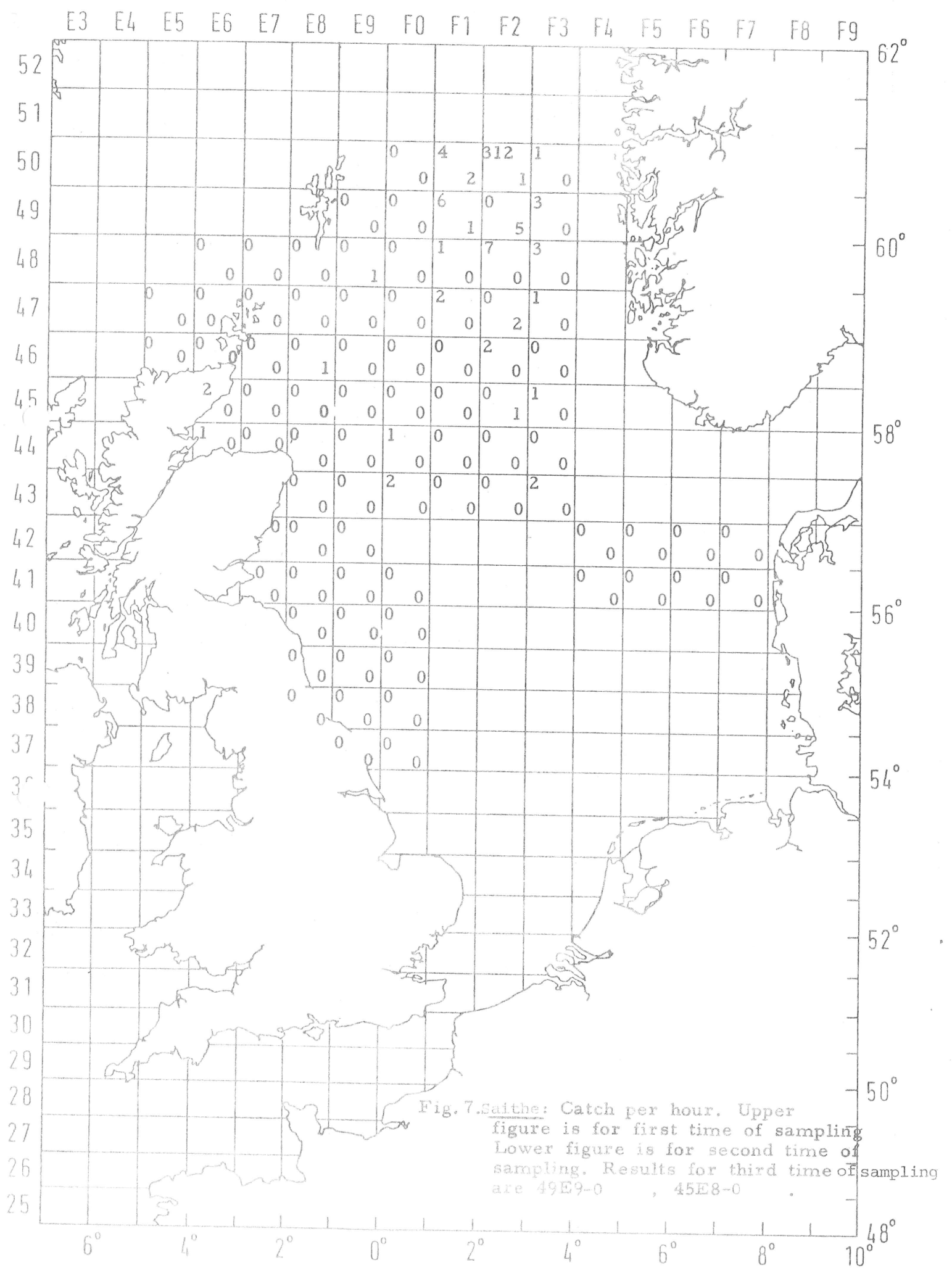


Fig. 7. Saithe: Catch per hour. Upper figure is for first time of sampling. Lower figure is for second time of sampling. Results for third time of sampling are 49E9-0, 45E8-0.

a) Area

b) 2 vessels J.H and G.O. save.

c) Period 10 pasty - 10, adqusb

d) App 200 haulst. at bottom and pil.