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**REPORT OF THE INTERNATIONAL BOTTOM TRAWL SURVEY IN THE NORTH SEA,
SKAGERRAK AND KATTEGAT IN 1992: QUARTER 1**

by

The International Bottom Trawl Survey Working Group

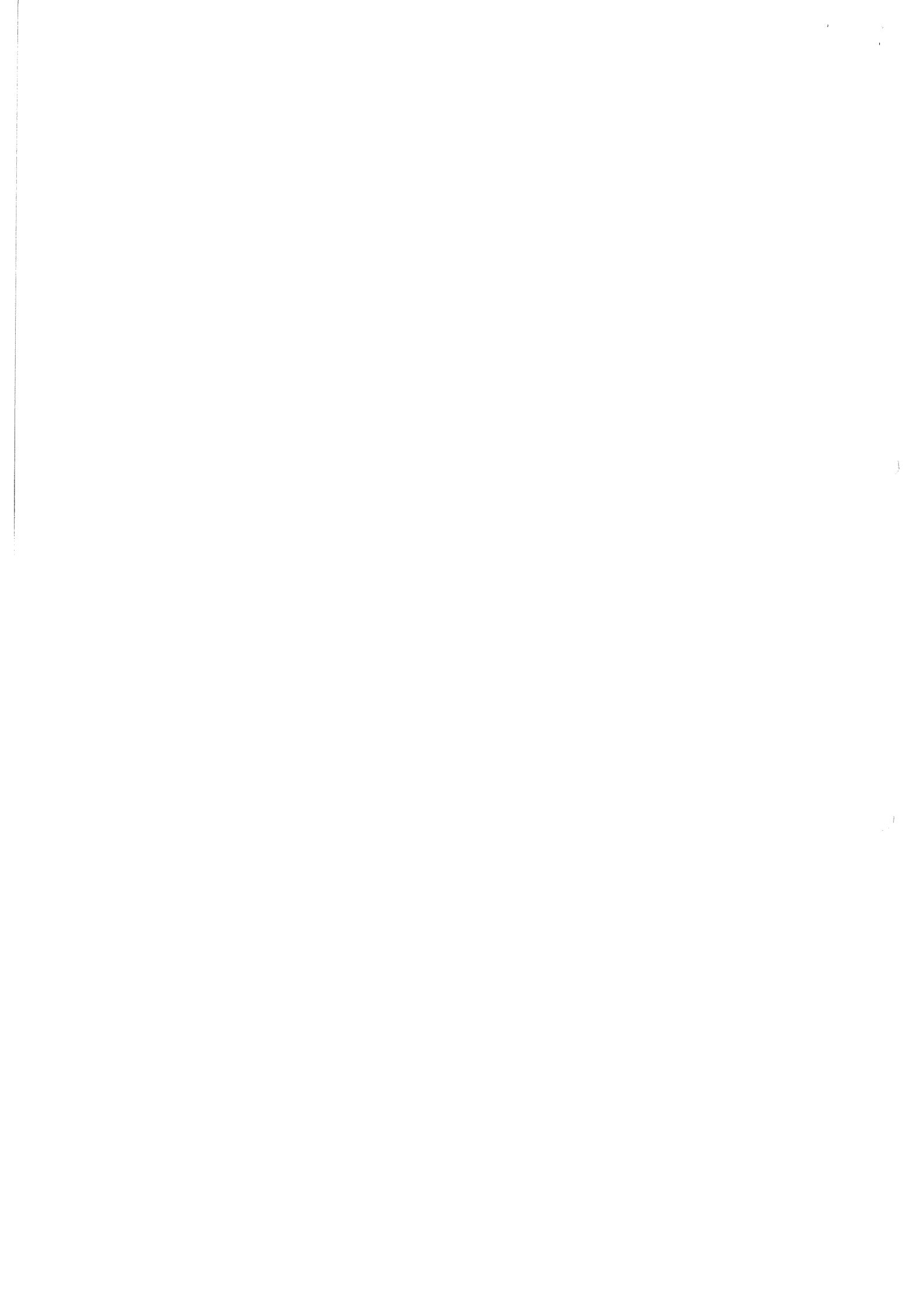
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CONTENTS

1	INTRODUCTION	1
2	SURVEY METHODS AND PARTICIPATION	1
3	DATA AVAILABLE	1
4	STANDARD OUTPUT FROM THE ICES IYFS DATA BASE	1
5	RESULTS GOV-TRAWL FOR 1992	1
	5.1 North Sea	1
	5.2 Skagerrak-Kattegat (Division IIIa)	3
6	RESULTS OF SAMPLING OF LARVAE IN 1992	4
7	HYDROGRAPHIC DATA	4
	7.1 Hydro-chemistry Survey	4
	7.2 UKDMA	4
8	REFERENCES	5
9	TABLES	6
10	FIGURES	13



1 INTRODUCTION

This report presents the final results for the International Bottom Trawl Survey in February/March 1992, formerly known as the International Young Fish Survey (IYFS).

In 1990 it was decided to combine the effort of the International Young Fish Survey with a number of national surveys such as the English and Scottish Groundfish Surveys into a quarterly coordinated bottom trawl survey, to be held for a period of 5 years (ICES C.Res.1990/4:3). These quarterly surveys started in 1991.

The data in this report comprise the bottom trawl catches of the seven standard species (herring, sprat, mackerel, cod, haddock, whiting and Norway pout), as well as the catches of herring and sprat larvae. Also summarized results of temperature and salinity sampling are presented.

2 SURVEY METHODS AND PARTICIPATION

For all matters on survey methodology, the reader is referred to the Manual of which a revision has been prepared this year (Addendum to ICES, Doc. C.M. 1992/H:3). Details on the participation in the 1992 survey are given below.

Country	Vessel	Period	Number of hauls	
			GOV	MIK/IKMT
Denmark	"Dana"	30.01/17.02	40	97
France	"Thalassa"	13.01/28.01	53	0
Germany, F.R.	"W. Herwig"	31.01/18.02	62	0
	"Solea"	08.02/15.02	31	0
Netherlands	"Tridens"	04.02.26.02	45	51
Norway	"G.O. Sars"	26.01/10.02	4965	65
Sweden	"Argos"	03.02/20.02	47	58
UK (Scotland)	"Scotia"	30.01/01.03	64	44

3 DATA AVAILABLE

In Table 3.1 is shown for which surveys data presently are available in the ICES IYFS Data Base.

At the time of the analysis of the 1992 survey presented in this report all final data were available in the data base.

4 STANDARD OUTPUT FROM THE ICES IYFS DATA BASE

For details on the standard analysis of the data the reader is referred to a description by Pedersen (1989). At request copies of this paper are available at the ICES Secretariat.

5 RESULTS GOV-TRAWL FOR 1992

5.1 North Sea

Preliminary indices based on certain size classes (herring <20 cm, sprat <10 cm, mackerel <20 cm, cod <25cm, haddock <20 cm, whiting <20 cm and Norway pout < 15 cm) and the indices used by the Assessment Working Groups are compared with the final indices in Table 5.1. The preliminary indices are, as in most years, very close to the final ones. Final indices of 1- and 2- group fish of the seven standard species are given in Table 5.2. Table 5.3 gives the mean age composition of the standard species within the relevant standard areas.

The number of hauls used in the analysis of the herring data and the hauls used for the other species are shown in Figure 5.1 and 5.2. The total number of hauls in the North Sea was 329 of which 270 were daylight hauls which were used for the analysis of the herring data. In Skagerrak and Kattegat a total of 46 daylight hauls was carried out which gives a grand total of 375 valid hauls. Per species there is a set of figures showing the distributions of the 1-, 2-, and 3+ group and the mean length of

1-group fish per rectangle. For each species a specific standard area is used to calculate the index of year class strength. This area is indicated in the figures. In case of 2-ringed herring it should be noted that the indices are based on all rectangles in the North Sea

HERRING

The indices for age groups 1 and 2 are given in Table 5.2 and the mean number per one hour trawling of 1-, 2- and 3+ ringers is shown in Figures 5.3 to 5.5. The mean length of the 1-ringers per rectangle is presented in Figure 5.6.

The abundance of 1-ringed herring was slightly below the average of the 10 preceding year classes. The age group was distributed in the usual areas in the southern and central North Sea.

Two-ringed herring were less abundant than in most previous years. The largest catches were taken in the central and southern North Sea. Few 2-ringed herring were caught in waters north of 57°N.

SPRAT

Sprat indices of 1- and 2-group are given in Table 5.2. The distributions of the same age groups and the 3+ group, as well as the mean length of 1-group per rectangle, are shown in Figures 5.7-5.10.

There was an increase in abundance of 1 year-old sprat compared to the two previous years. This age group was fairly abundant in the waters around the Dogger Bank. The index of 1,561 for year class 1991 is the second highest in the time series starting with year class 1971.

Two year-old sprat occurred in the same areas as the younger age group. The abundance of two-year-olds showed an increase compared to the previous year.

MACKEREL

Indices for mackerel are given in Table 5.2 and the distributions of 1-, 2- and 3+ group is shown in Figures 5.11-5.13. The mean length of the 1-group per rectangle is presented in Figure 5.14.

The index for age-1 mackerel of 16.0 has a very low precision, due to the extremely high variance on the individual hauls. It seems, however, that one-year-old mackerel are getting increasingly common in the North Sea during winter, especially in the northeastern part.

COD

Abundance indices are given in Table 5.2, the distributions of 1-, 2-, and 3+ group and the mean length of 1-group fish are given in Figures 5.15-5.18.

The 1991 year class of cod caught during the 1992 survey were widely distributed throughout the central North Sea. This pattern of one-year-old cod catches was similar to that found during the 1984, 1986 and 1989 surveys and along with these three years the 1992 survey has produced one of the four highest index values from the last 12 years. In terms of recent one-year-old indices it is approximately five times greater than for the 1990 year class, four times greater than that for the 1989 year class and equal to the 1988 year class. It is, however, still below the overall series average.

Catches of the 1990 year class as two-year-old fish were well dispersed throughout the survey area, as has been the usual recent pattern, but with no rectangle average number per hour, within the standard area, exceeding 29 fish. The index value, at 4.5, was well below the long term average but indicated a stronger year class than the one-year-old index value of the same year class had done. High catches of this year class, both at age one and at age two, were made in rectangles outside the standard area (see also Anon. 1991). This may suggest that both index values were an underestimate of the year class strength.

HADDOCK

Abundance indices are given in Table 5.2, the distributions of 1-, 2- and 3+ group and the mean length of 1-group fish are given in Figures 5.19-5.22.

The index value for one-year-old haddock was the second largest in the whole series and was one of only four to exceed 1,000 (1973, 1974 and 1983 year classes). It was almost two times greater than the value for the 1990 year class and over five times greater than that for either the 1989 or 1988 year class. The fish were well distributed throughout the northern and central parts of the standard area but, unusually, the higher average numbers per hour per rectangle were predominantly in the east and north of that area.

The two-year-old index value was slightly above the long term average and supported the strength of the 1990 year class as one-year-olds. The distribution of two-year-old fish was generally similar to that of the one-year-olds.

WHITING

Abundance indices are given in Table 5.2, the distributions of 1-, 2- and 3+ group and the mean length of 1-group fish are given in Figures 5.23-5.26.

The index value of 916 of the 1991 year class, almost twice the long term average, is the fourth highest recorded. With three of those high values having occurred in the last four years, this continues the trend in strong year classes of whiting. The higher numbers per hour per rectangle were, as usual, predominant in the central part of the standard area. Unusual, however, were the good catches made in the northern North Sea and this was the first survey in ten years to have produced a non-zero average number per hour in every North Sea rectangle that was fished.

The two-year-old fish followed the normal recent distribution pattern with the larger catches being made in the south-eastern, west-central and north-western parts of the standard area. The index value was almost twice the series average and supported the indication of a strong 1990 year class made by the 1991 one-year-old estimate.

NORWAY POUT

Abundance indices are given in Table 5.2, the distributions of 1-, 2- and 3+ group and the mean length of 1-group fish are given in Figures 5.27-5.30.

One-year-old Norway pout were well distributed throughout the central and northern parts of the standard area with several rectangles east of 0° having high average numbers per hour. These factors combined to produce the highest index value recorded during the 18 year series of Norway pout data. The abundance of the 1991 year class was more than twice that of the 1990 year class, almost four times that of the 1989- and two and a half times that of the 1988 year class.

The abundance of the two-year-olds was 24% above the long term average, compared with the abundance of the same year class as one-year-olds which was 10% below the long term average. The higher catches were made in the eastern and northern parts of the main body of the standard area.

5.2 Skagerrak-Kattegat (Division IIIa)

The number of hauls per rectangle for herring and gadoids is shown in Figure 5.1 and 5.2. In all 46 hauls were carried out and all standard rectangles were fished.

The final indices for 1- and 2-ringed herring and 1- and 2+ group sprat are given in Table 5.4. The herring indices are calculated as the mean catches in four depth strata, covering the depth range of 10 - 150 m, and weighted by the surface area of each stratum. Details of the analysis and separation of spring- and autumn spawners are given in the 1989 report (Anon., 1989).

Age/length keys for cod are available from the 1981 IYFS and onwards. The stocks of cod in Skagerrak and Kattegat are assessed separately and indices are given for each area. Final and preliminary indices for cod and preliminary indices for whiting and haddock are given in Table 5.5.

The distribution of herring, sprat and cod is included in the figures in Section 5.1.

HERRING

The indices are given in Table 5.4 and the distribution is shown in Figures 5.3-5.5. The mean length of 1-group is shown in Figure 5.6.

The mean index of 1-ringed herring was 5,057. This value is rather high considering the relatively low index for the North Sea. In previous years, the Skagerrak--Kattegat seemed to act as an "overflow area" for the North Sea. High indices in Skagerrak-Kattegat only occurred in years of abundant North Sea year classes. All 1-ringed herring in 1992 was classified as North Sea autumn spawners.

Two-ringed herring were less common than in previous years. Based on length and vertebral counts, about 40% of the 2-ringers was classified as spring spawners.

SPRAT

The index of 1- and 2+ group sprat is given in Table 5.4 and the distribution of 1-, 2- and 3+ group is shown in Figures 5.7-5.9. The mean length of 1-group sprat per rectangle is presented in Figure 5.10.

The index of 5,380 for 1 year-old sprat is the second highest in the time series starting in 1974. This suggests that sprat in Skagerrak-Kattegat is increasing again after several years of low abundance. The index for 2-year-olds, although higher than in the two previous years, is still below the long-term average.

COD

Preliminary and final indices are given in Table 5.5. The index value for the one-year-old cod in the Skagerrak, as the highest on record and three times greater than the long term average, indicates a strong 1991 year class. In the Kattegat, however, the indications are for one of only average strength.

The estimates from the 1991 survey of a very poor 1990 year class in both areas were further supported by the catch levels of two-year-old fish during the 1992 survey.

HADDOCK

Haddock of < 20 cm were abundant in the Skagerrak but less so in the Kattegat. The index value was the highest recorded in the 13 year series and, at four times greater than the long term average, indicated a strong 1991 year class.

WHITING

High catches of < 20 cm whiting were made throughout Division IIIa, providing the fourth highest index value of the 18 year series. This continues the previous six years trend in strong year classes of whiting.

6 RESULTS OF SAMPLING OF LARVAE IN 1992

The change of standard gear from the IKMT to the ring-framed fine meshed MIK was nearly complete this year. Only "Scotia" used the IKMT, and consequently the presentation of larval abundance is changed from this year onwards.

The catchability of the MIK at night is close to 100% (P. Munk, unpublished results), therefore the catches can be used to estimate absolute abundance:

$$\text{Density (no m}^{-2}\text{)} = (\text{no caught} / (\text{distance towed} * \text{net opening})) * \text{water depth}$$

The opening of the 2 m wide frame is 3.14 m², distance towed is measured by calibrated flowmeters in the centre of the frame.

The number of larvae within a statistical rectangle can then be approximated by multiplying the density with the approximate surface area of the rectangle (309 * 10⁷ m²). The total number of larvae (MIK-index) is then the total of all sampled statistical rectangles. The IKMT catches from this and previous years are converted to MIK catches. This is based on studies comparing the gears, information available from this year and from earlier studies.

HERRING

In all 315 hauls were made. High densities were found in most of the sampled area. A remarkable high abundance was observed in the northern and north-eastern areas (Figure 6.1). The abundance was much higher than in the previous two years (compare to Figures 6.2 and 6.3). The index value (Table 6.1) of 200.7 is of a size that equals the 'good' years in the mid-eighties.

SPRAT

Very few sprat larvae were caught and no interpretation of their distribution is made.

7 HYDROGRAPHIC DATA

7.1 Hydro-chemistry Survey

Seven ships contributed hydrographic data to the 1992 data set. The data set consists of 392 stations worked between 13 January and 26 February. Nutrient data were supplied for 142 of these stations, contributions being received from 3 ships. Past nutrient data collected during the IYFS provided an essential contribution to an investigation of North Sea nutrient trends for the purposes of the North Sea Task Force, and these new data will provide the basis of future similar studies.

Charts of the distribution of bottom temperature and salinity are given in Figures 7.1 and 7.2. An updated table giving the time series of temperature and salinity at 10 locations in the North Sea during IYFS surveys from 1972 to 1992 is provided as Table 7.1. The Figures and Table show that oceanographic conditions in the North Sea were very similar to those observed in every year since 1988. This reflects the continuing sequence of very mild winters with frequent westerly type weather. The clear presence of very high salinity water in parts of the Southern Bight in 1991 continued in 1992, but at somewhat lower salinity (>35.5 in 1991 and <35.35 in 1992). This appears to be a consequence of rather persistent, but unusual, oceanographic conditions in the English Channel.

7.2 UKDMA

Contour maps of all IYFS hydrographic and chemical data since 1970 have been incorporated into a digital computer-based atlas produced by the British Oceanographic Data Centre in Bidston, England. UKDMA (UK Digital Marine Atlas) incorporates many different types of data sets involving most marine disciplines, including fisheries, and is available for use on IBM compatible PCs at modest cost.

8 REFERENCES

Anon., 1989. Report of the International Young Fish Survey in the North Sea, Skagerrak and Kattegat in 1989. ICES Doc. C.M. 1989/H:54.

Anon., 1991. Report on the International Bottom Trawl Survey in the North Sea, Skagerrak and Kattegat in 1991: quarter 1. ICES Doc. C.M. 1991/H:5.

Anon., 1992. Manual for the International Bottom Trawl Survey. Addendum to ICES Doc. C.M. 1992/H:3.

Pedersen, L., 1989. International Young Fish Survey, computation of aggregated standard tables and charts. ICES Secretariat, section computer management.

Table 3.1 Data available in the ICES IYFS data base as at 1 August 1992

+ = Data available
 - = No data available
 x = No survey made or survey not valid

Country	1972	1973	1974	1975	1976	1977	1978	1979	1980
Denmark	+	+	+	+	+	+	+	+	x
France	x	x	x	x	+	x	x	+	+
Germany	-	-	-	-	-	-	-	-	-
Netherlands	+	+	+	+	+	+	+	+	+
Norway	-	-	-	-	-	-	-	-	-
Sweden	-	-	-	-	-	-	-	-	-
UK England	-	-	-	-	-	-	-	-	-
UK Scotland	x	x	+	+	+	+	+	+	+
USSR	x	x	+	+	+	+	x	+	x

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989
Denmark	x	+	+	+	+	+	+	+	+
France	x	+	+	+	+	+	+	+	+
Germany	-	-	+	+	+	+	+	+	+
Netherlands	+	+	+	+	+	+	+	+	+
Norway	-	-	+	+	+	+	+	+	+ ¹
Sweden	-	-	+	+	+	+	+	+	+
UK England	+	+	+	+	+	+	+	+	+
UK Scotland	+	+	+	+	+	+	+	+	+
USSR	+	+	x	x	x	x	x	x	x

Country	1990	1991	1992
Denmark	+	+	+
France	+	+	+
Germany	+	+	+
Netherlands	+	+	+
Norway	+	+	+
Sweden	+	+	+
UK England	+	x	x
UK Scotland	+	+	+
USSR	x	x	x

¹ No Smalk records for Herring.

Table 5.1

Preliminary 1990 IYFS indices for 1-group fish based on a split of the length distribution, indices used by assessment working groups and final indices for the North Sea.

	Preliminary	Working Group	Final
Herring	2,158	2,339	2,099
Sprat	1,639	1,639	1,561
Mackerel	16.7		16.0
Cod	14.3		13.0
Haddock	1,072		1,115
Whiting	766		916
Norway pout	4,964	4,964	5,121

Table 5.2 IYFS indices for 1- and 2-year old fish of various species. Indices in mean number per hour within the relevant standard area in the North Sea.

Year class	Herring		Sprat		Mackerel		Cod		Haddock		Whiting		Norway Pout	
	1-ring	2-ring ¹	age 1	age 2	age 1	age 2	age 1	age 2	age 1	age 2	age 1	age 2	age 1	age 2
1969	2,647	-	-	-	-	-	-	25.9	-	32	-	31	-	-
1970	1,629	-	-	-	-	-	98.3	34.5	855	299	274	190	-	-
1971	827	-	90	-	-	-	4.1	10.6	740	971	332	763	-	-
1972	1,195	-	123	-	-	-	38.0	9.5	187	110	1,156	496	-	-
1973	1,592	-	481	-	-	0.1	14.7	6.2	1,092	385	322	153	-	2,412
1974	452	-	-	-	16.5	0.2	40.3	19.9	1,168	670	893	535	4,242	385
1975	342	0	1,186	-	0.4	+	7.9	3.2	177	84	679	219	4,599	334
1976	575	-	136	-	1.4	+	36.7	29.3	162	108	418	293	4,813	1,215
1977	139	-	1,474	-	2.3	+	12.9	9.3	385	240	513	183	1,913	240
1978	535	-	248	-	0.2	+	9.9	14.8	480	402	457	391	2,690	611
1979	551	-	1,402	-	+	+	16.9	25.5	896	675	692	485	4,081	557
1980	1,293	106	886	-	0.1	0.1	2.9	6.7	268	252	227	232	1,375	403
1981	1,797	149	183	461	0.1	5.2	9.2	16.6	526	400	161	126	4,315	663
1982	2,663	712	512	335	1.9	0.4	3.9	8.0	307	219	128	179	2,331	802
1983	3,416	648	347	295	0.1	0.0	15.2	17.6	1,057	828	436	359	3,925	1,423
1984	3,667	853	659	101	0.7	2.1	0.9	3.6	229	244	341	261	2,109	384
1985	5,717	3,857	72	71	0.5	+	17.0	28.8	579	326	456	544	2,043	469
1986	4,192	816	807	1,433	8.9	0.1	8.8	6.1	885	688	669	862	3,023	760
1987	3,468	470	145	442	1.2	1.8	3.6	6.3	92	97	394	542	127	260
1988	2,146	913	4,246	557	1.1	1.2	13.1	15.2	210	114	1,465	887	2,079	773
1989	2,433	505	177	116	35.0	0.2	3.4	4.1	219	131	509	675	1,320	677
1990	2,099		1,121	340	6.9	0.4	2.4	4.5	679	371	1,014	748	2,497	902
1991			1,561		16.0		13.0		1,115		916		5,121	

¹Total North Sea.

Table 5.3 Age composition of the standard species in 1992 within the relevant standard area in the North Sea.

Age group	1	2	3	4	5	6+
Herring	2098.7	663.1	229.4	28.0	53.6 ¹	-
Sprat	1560.5	340.2	37.8	5.5	0.4 ¹	-
Mackerel	16.0	0.4	2.2	1.1	0.0	0.0
Cod	13.0	4.5	1.2	1.0	0.3	0.5
Haddock	1115.0	370.7	18.8	2.9	0.5	2.0
Whiting	915.9	748.1	260.5	168.9	16.0	14.3
Norway pout	5120.7	902.3	33.4	4.7	0.0	0.2

¹Plus-group.

Table 5.4 IYFS indices for herring and sprat in Skagerrak-Kattegat. The herring indices are weighted by the area of four depth strata and the sprat indices are the mean by hour within the total area.

Year	Herring						Sprat		
	Total		Spring-spawners		Autumn-spawners		1-group	2+ group	Total
	1-ring	2-ring	1-ring	2-ring	1-ring	2-ring			
1974							1,325		
1975							5,339		
1976							2,069		
1977							5,713	984	6,697
1978							5,119	2,117	7,236
1979							3,338	1,482	4,820
1980	2,311	387	1,607	307	704	80	4,960	3,592	8,558
1981	3,246	1,393	966	1,318	2,250	75	2,809	3,068	5,877
1982	2,560	549	1,408	445	1,152	104	1,577	4,695	6,272
1983	5,419	1,063	1,522	946	3,897	117	1,173	1,685	2,858
1984	6,035	1,947	2,793	1,419	3,242	528	4,141	2,216	6,357
1985	7,994	2,473	- ¹	1,867	- ¹	606	2,077	2,067	4,744
1986	21,489	2,738	- ¹	1,562	- ¹	1,176	684	4,834	5,518
1987	11,733	3,671	- ¹	2,921	- ¹	949	1,830	16,543	18,373
1988	67,753	10,095	- ¹	7,834	- ¹	2,161	945	8,238	9,183
1989	17,451	4,976	- ¹	0	- ¹	4,976	442	2,891	3,333
1990	3,544	3,876	0	3,192	3,544	684	503	471	974
1991	3,588	3,794	- ¹	480	- ¹	3,269	693	1,245	1,938
1992	5,057	1,934	0	771	5,057	1,163	5,380	1,698	7,078

¹Separation not valid.

Table 5.5 Indices of 1- and 2-group cod and 1-group whiting and haddock in Skagerrak-Kattegat. The preliminary indices are the mean number per hour for cod <25 cm, whiting and haddock <20 cm.

Year Class	Cod 1-group		Cod 1-group		Cod 2-group		Whiting	Haddock
	Skagerrak		Kattegat		Skagerrak	Kattegat	1-group	1-group
	Prel.	Final	Prel.	Final			Prel.	Prel.
1974							499	
1975							236	
1976							99	
1977							392	
1978							561	
1979	79		386		93	171	722	40
1980	18	15	42	26	31	63	968	4
1981	36	36	126	104	30	258	690	48
1982	32	28	113	96	19	143	262	34
1983	24	23	49	39	52	106	500	72
1984	18	14	18	9	10	72	940	161
1985	82	78	229	213	113	372	1,379	57
1986	15	5	48	11	18	28	2,178	251
1987	81	77	76	68	24	48	2,978	125
1988	62	56	6	3	8	16	478	20
1989	25	31	131	153	25	112	2,255	8
1990	42	9	39	19	5	20	1,636	74
1991	119	96	64	64			1,796	288

Table 6.1 Density and abundance of herring larvae caught in February during the IBTS. Values for year classes by areas are density estimates in number per square metre. Total abundance (MIK-index) is found by multiplying density by surface area and adding up (see also text).

Area	North west	North east	Central west	Central east	South west	South east	Division IIIa	Southern Bight	O-ringers abundance
Area m ² x 10 ⁹	83	34	86	102	37	93	31	31	N in billion
Year Class									
1976	0.054	0.014	0.122	0.005	0.008	0.002	0.002	0.016	17.1
1977	0.024	0.024	0.050	0.015	0.056	0.013	0.006	0.034	13.1
1978	0.176	0.031	0.061	0.020	0.010	0.005	0.074	0.000	52.1
1979	0.061	0.195	0.262	0.408	0.226	0.143	0.099	0.053	101.1
1980	0.052	0.001	0.145	0.115	0.089	0.339	0.248	0.187	76.7
1981	0.197	0.000	0.289	0.199	0.215	0.645	0.109	0.036	133.9
1982	0.025	0.011	0.068	0.248	0.290	0.309	0.470	0.140	91.8
1983	0.019	0.007	0.114	0.268	0.271	0.473	0.339	0.377	115.0
1984	0.083	0.019	0.303	0.259	0.996	0.718	0.277	0.298	181.3
1985	0.116	0.057	0.421	0.344	0.464	0.777	0.085	0.084	177.4
1986	0.317	0.029	0.730	0.557	0.830	0.933	0.048	0.244	270.9
1987	0.078	0.031	0.417	0.314	0.159	0.618	0.483	0.495	168.9
1988	0.036	0.020	0.095	0.096	0.151	0.411	0.181	0.016	71.4
1989	0.083	0.030	0.040	0.094	0.013	0.035	0.041	0.000	25.9
1990	0.075	0.053	0.202	0.158	0.121	0.198	0.086	0.196	69.9
1991	0.255	0.390	0.431	0.539	0.500	0.369	0.298	0.395	200.7

Location	1		2		3		4		5		6		7		8		9		10	
Position	60° 0'N 2°E		57° 30'N 0°E		57° 30'N 2°E		57° 30'N 4°E		55° 0'N 0°E		55° 0'N 2°E		55° 0'N 4°E		55° 0'N 8°E		54° 0'N 3°E		52° 30'N 3°E	
Year	t°C	S-30	t°C	S-30	t°C	S-30	t°C	S-30	t°C	S-30	t°C	S-30	t°C	S-30	t°C	S-30	t°C	S-30	t°C	S-30
1972	5.8	5.22	6.9	5.08	5.9	5.20	4.5	4.78	6.5	4.91	4.8	4.86	5.2	4.80	2.5	3.80	5.2	4.70	6.9	5.10
1973			7.4	5.02	7.2	5.20	6.7	5.10	7.0	5.05	6.1	5.00	6.0	4.86	5.0	3.00	6.4	4.80	6.5	5.05
1974	6.9	5.28	6.5	5.11	6.5	5.08	6.3	5.04	6.5	4.90	6.0	4.90	5.6	4.90	4.7	3.00	6.1	4.78	8.0	5.20
1975	7.3	5.20	6.6	5.05	6.6	5.15	6.4	5.13	6.6	4.95	6.4	4.90	6.1	4.85	5.2	3.50	5.9	4.62	6.9	4.62
1976	6.7	5.20	6.5	5.00	6.5	5.15	5.6	5.12	6.1	4.81	4.9	4.95	4.9	4.85	2.2	1.00	5.1	4.78	5.1	4.80
1977	6.0	5.18	6.2	5.02	5.1	5.00	4.8	4.92	6.0	4.98	4.9	4.85	5.0	4.80	3.1	3.60	5.6	4.78	7.1	5.22
1978	6.4	4.88	6.6	5.00	6.0	4.90	4.7	4.88	5.6	4.78	4.9	4.88	4.2	4.80	2.2	2.50	4.6	4.68	5.5	4.90
1979	6.4	5.15	6.0	4.80	4.1	4.88	4.0	4.98	4.5	4.64	2.8	4.62	2.8	4.62	-1.5	2.00	3.0	4.62	4.2	4.95
1980	5.9	5.12	6.6	5.00	5.5	5.00	4.5	4.70	6.1	4.60	3.8	4.65	4.5	4.50	3.1	3.50	5.1	4.70	6.1	5.11
1981	6.9	5.22	6.6	4.90	6.2	5.05	5.8	5.15	6.5	4.80	5.8	4.82	5.1	4.82	3.4	2.50				
1982	6.6	5.28	6.1	5.02	5.9	5.05	5.5	5.10	5.5	4.72	4.8	4.82	4.5	4.62	2.8	2.50	4.7	4.30	6.0	4.65
1983	6.9	5.22	6.5	5.00	6.4	5.10	6.2	5.15	5.6	4.62	6.1	4.95	5.2	4.90	3.0	3.00	5.2	4.80	6.4	4.70
1984	6.3	5.18	6.4	5.10	6.4	5.10	5.2	5.12	5.9	4.80	5.0	4.84	4.9	4.90	3.5	3.00	4.9	4.65	7.4	4.95
1985	6.9	5.17	6.8	5.10	6.5	5.18	5.9	5.05	6.5	4.70	4.7	4.91	5.0	4.90	1.0	2.50	4.0	4.70	6.0	4.80
1986	6.6	5.25	5.8	5.05	5.4	5.08	5.2	5.05	5.2	4.65	3.9	4.72	3.6	4.60	0.0	2.50	4.0	4.60	4.0	4.65
1987	6.5	5.28	6.1	4.90	5.9	5.08	4.9	5.00	5.0	4.75	4.2	4.80	4.3	4.60	0.8	0.00	4.9	4.60	4.8	4.90
1988	7.6	5.18	7.6	4.95	7.4	5.03	7.0	4.96	7.1	4.70	6.6	4.80	6.5	4.50	5.9	3.50	6.9	4.60	7.7	4.90
1989	8.5	5.29	8.0	4.85	7.8	4.89	7.6	5.05	7.5	4.76	7.1	4.81	6.8	4.80	6.0	4.10	6.5	4.68	7.5	4.62
1990	8.5	5.29	7.6	5.00	7.6	5.12	7.6	5.15	7.5	4.70	7.5	4.85	7.5	4.80	6.5	4.10	7.4	4.70	7.4	4.60
1991	7.9	5.30	6.7	5.10	7.1	5.22	6.1	4.97	6.6	4.65	5.8	4.85	5.5	4.80	3.0	4.00	5.8	4.60	6.1	5.30
1992	8.1	5.29	7.6	5.10	7.1	5.16	7.1	5.19	7.4	4.80	6.6	4.80	6.5	4.80	6.6	2.00	4.5	4.80	6.0	5.20

TABLE 7.1 Time series data of bottom temperature and salinity during IYFS 1972-1992

International Young Fish Survey 1992

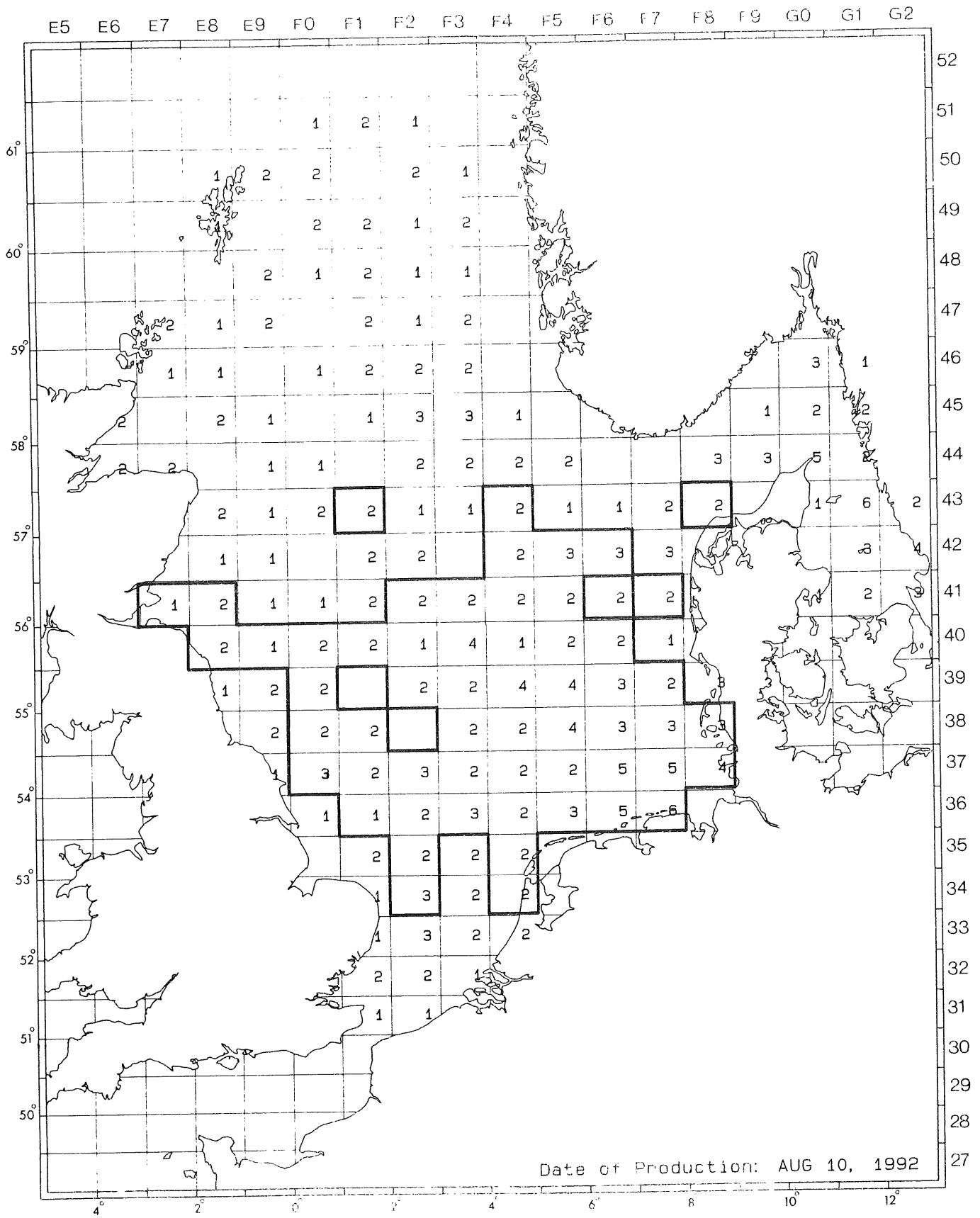


Figure 5.1 Number of hauls used in the analysis of herring data 1992.

International Young Fish Survey 1992

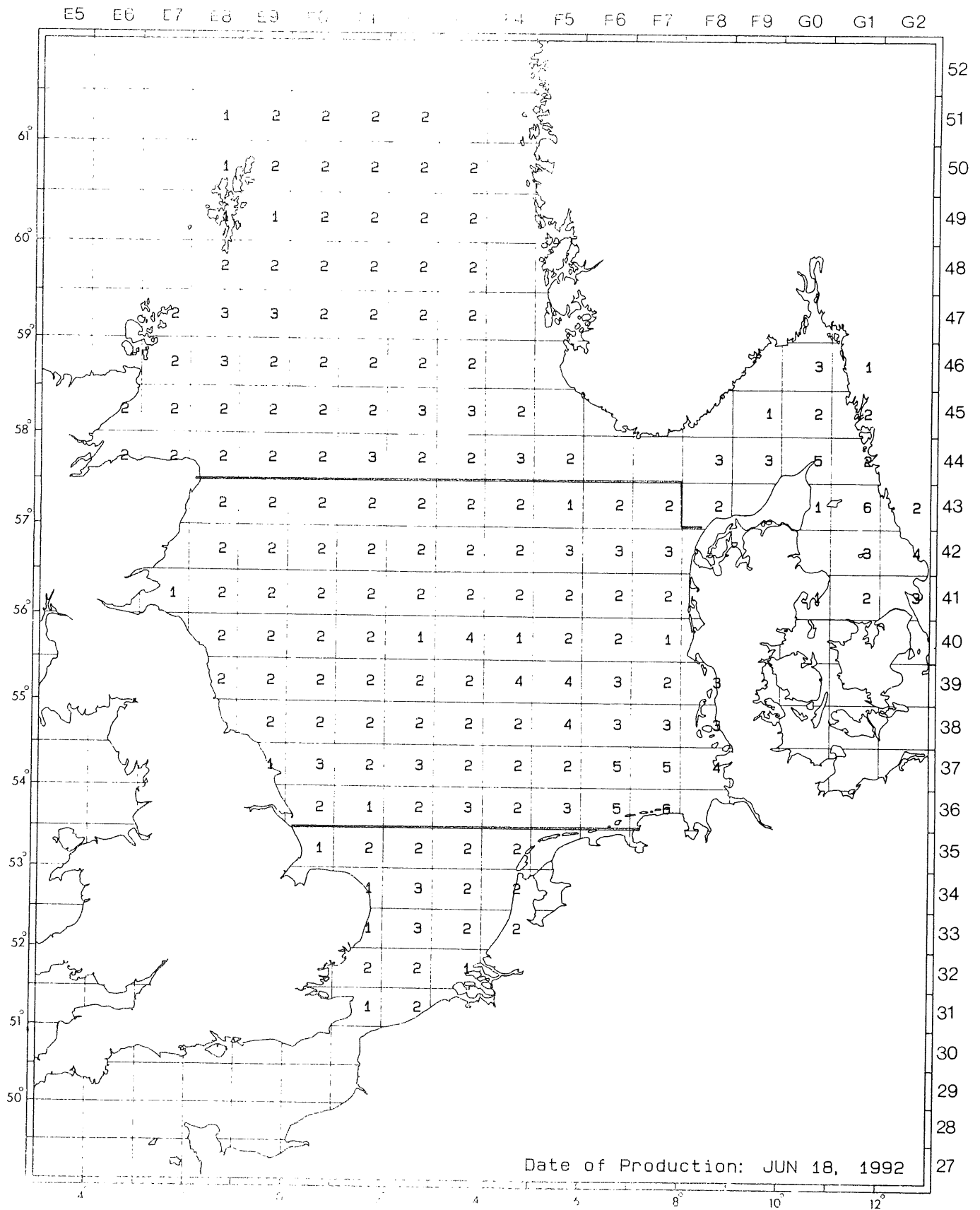


Figure 5.2 Number of hauls used in the analysis of data on sprat, mackerel, cod, haddock, whiting and Norway pout 1992.

International Young Fish Survey 1992

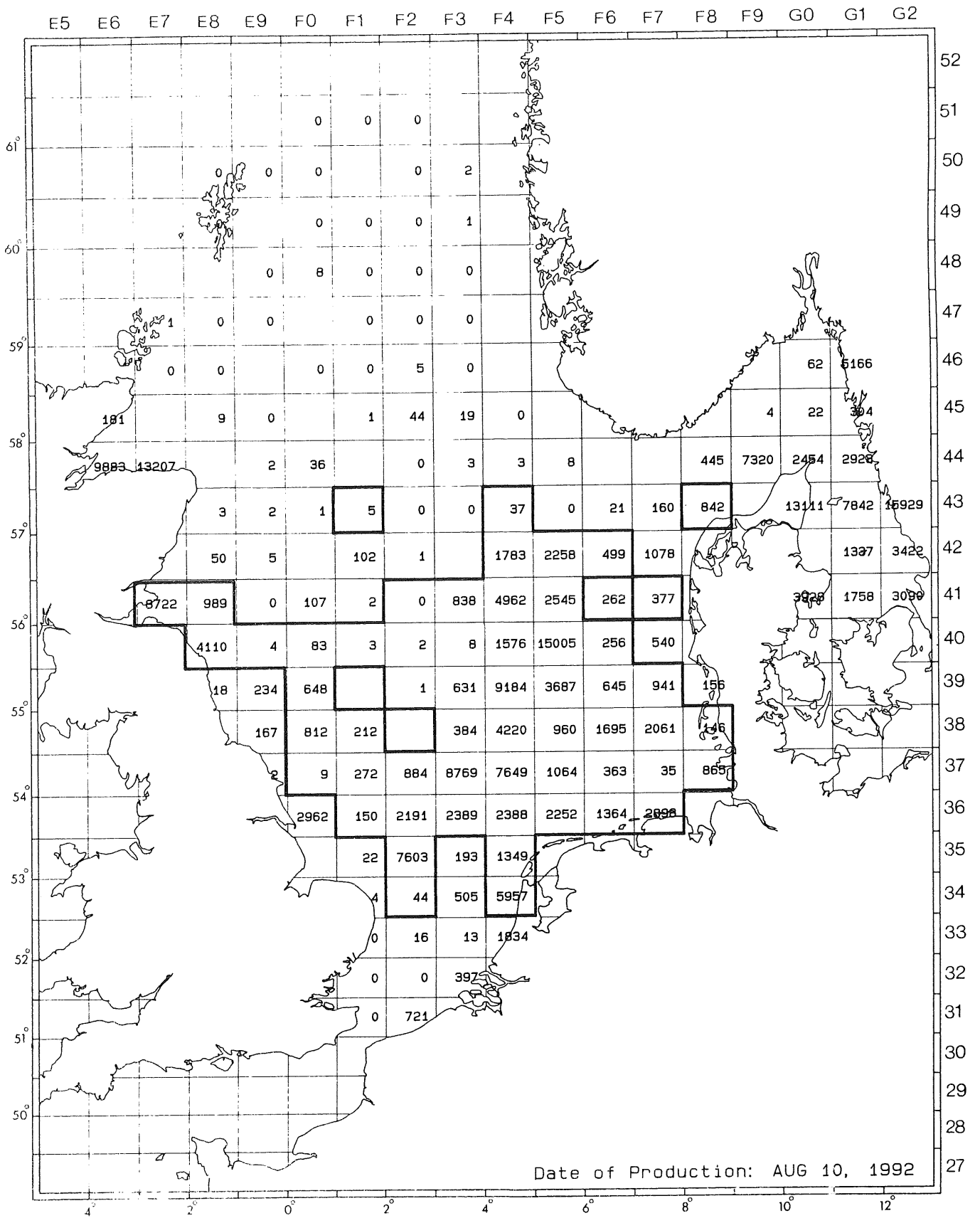


Figure 5.3 Herring: number per hour, 1-ringers.

International Young Fish Survey 1992

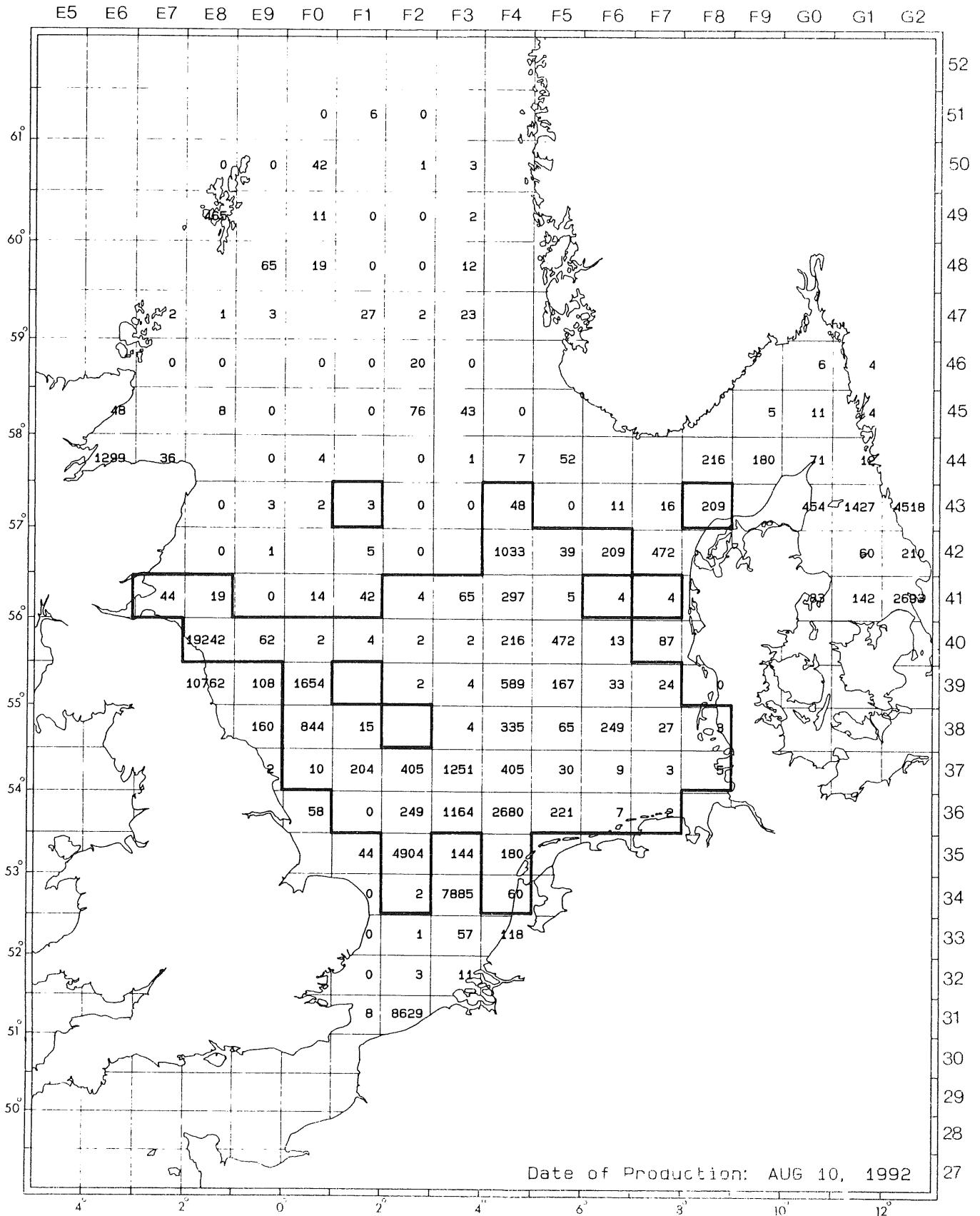


Figure 5.4 Herring: number per hour, 2-ringers.

International Young Fish Survey 1992

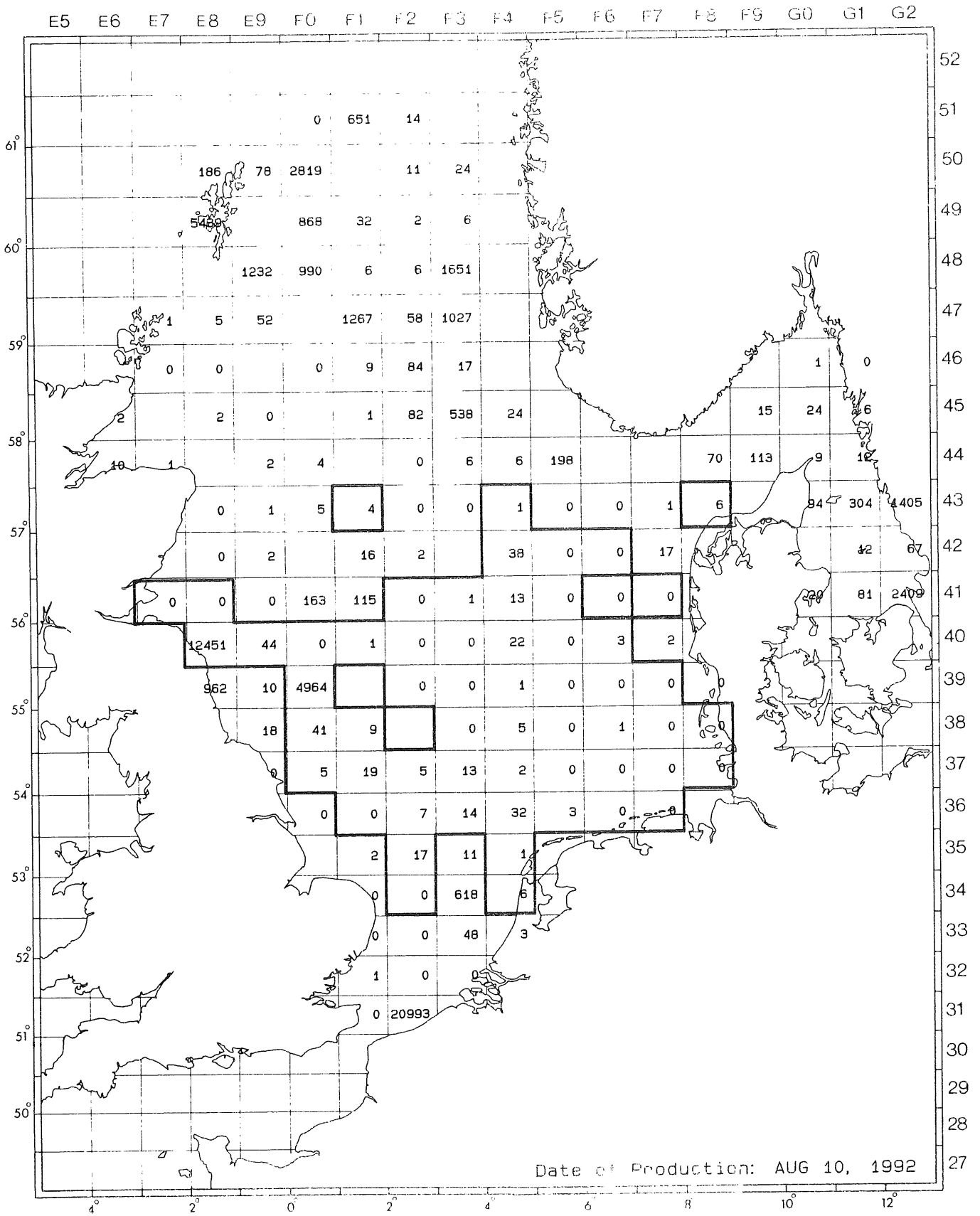


Figure 5.5 Herring: number per hour, 3+ringers.

International Young Fish Survey 1992

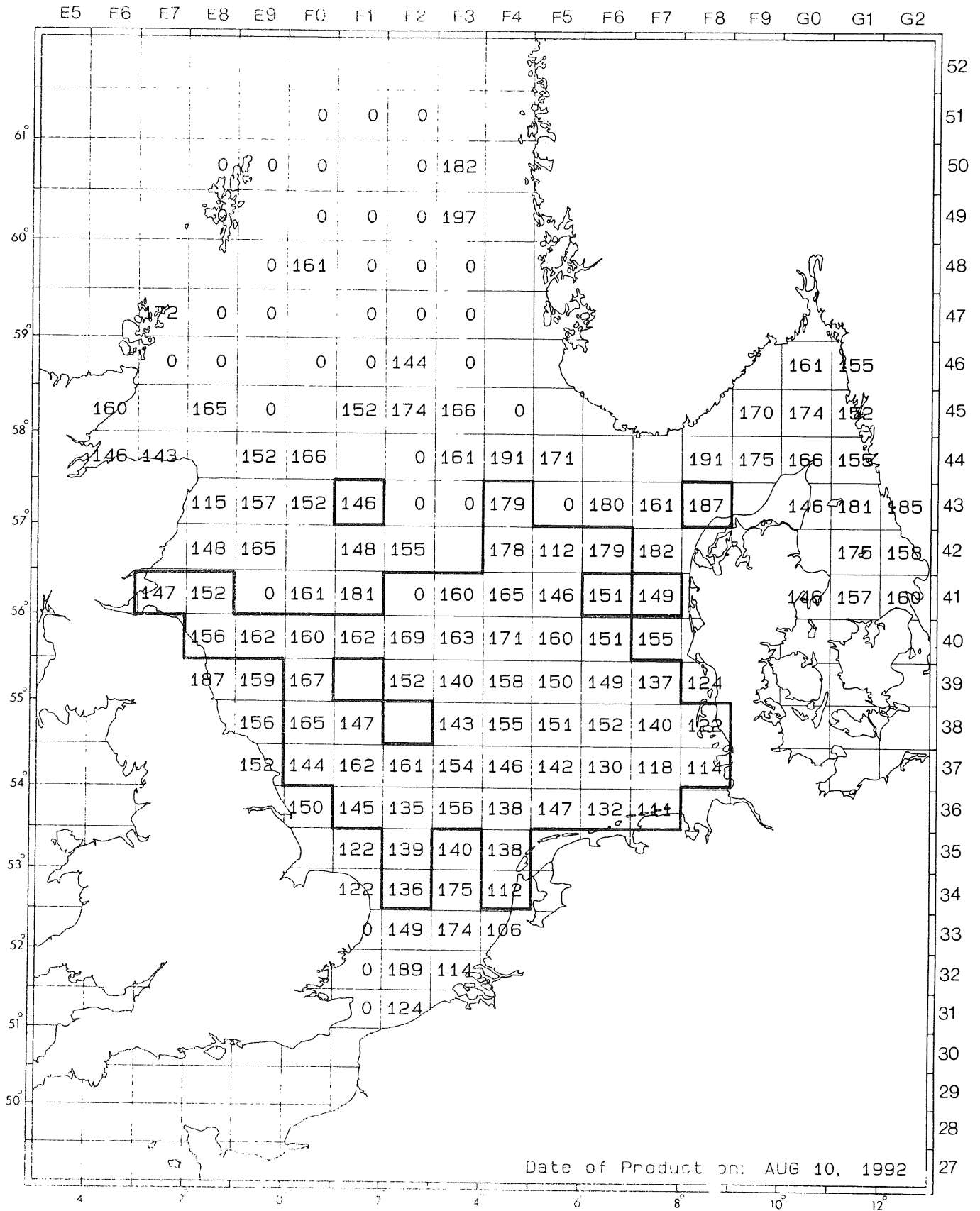


Figure 5.6 Herring: mean length, 1-ringers.

International Young Fish Survey 1992

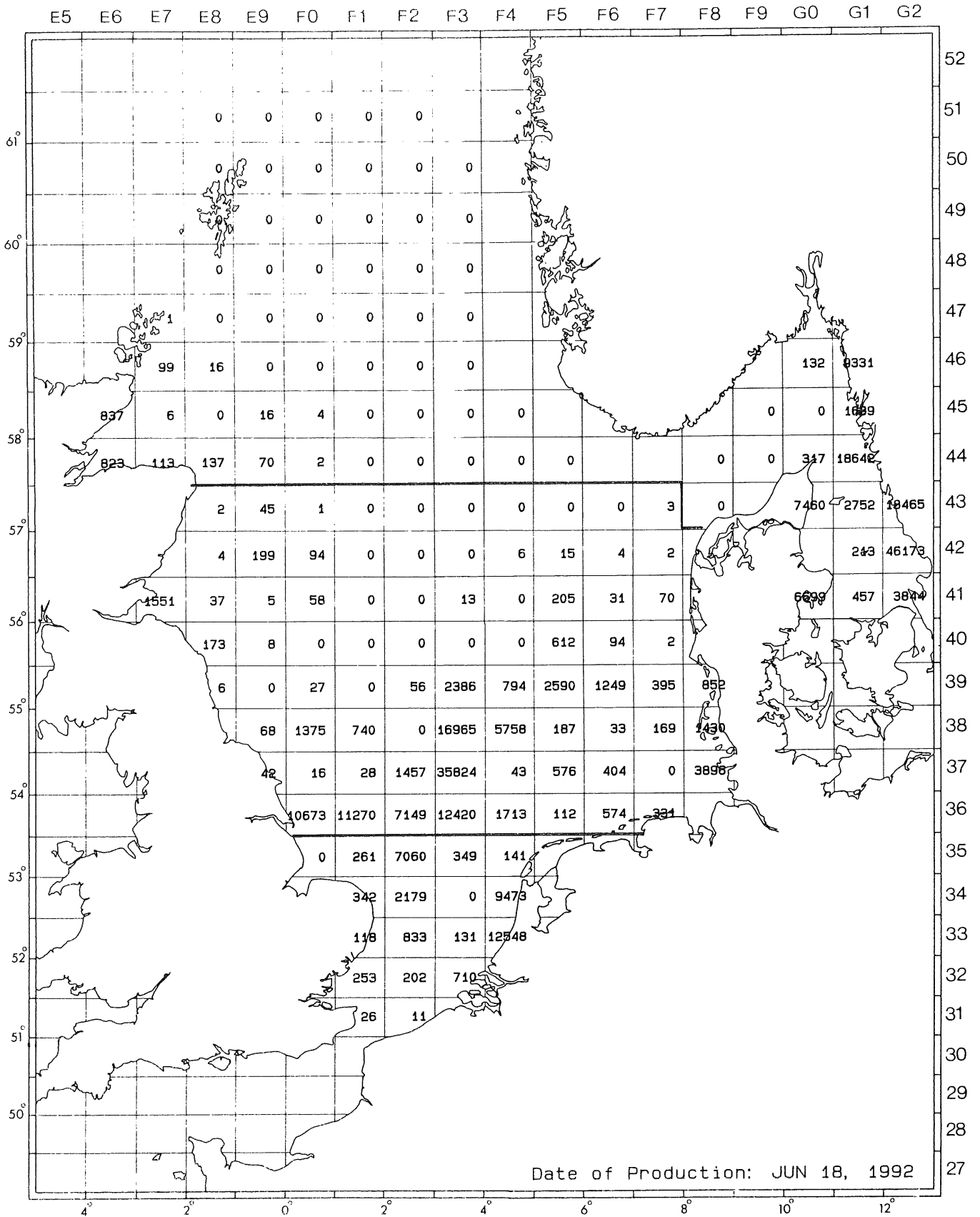


Figure 5.7 Sprat: number per hour, age group 1.

International Young Fish Survey 1992

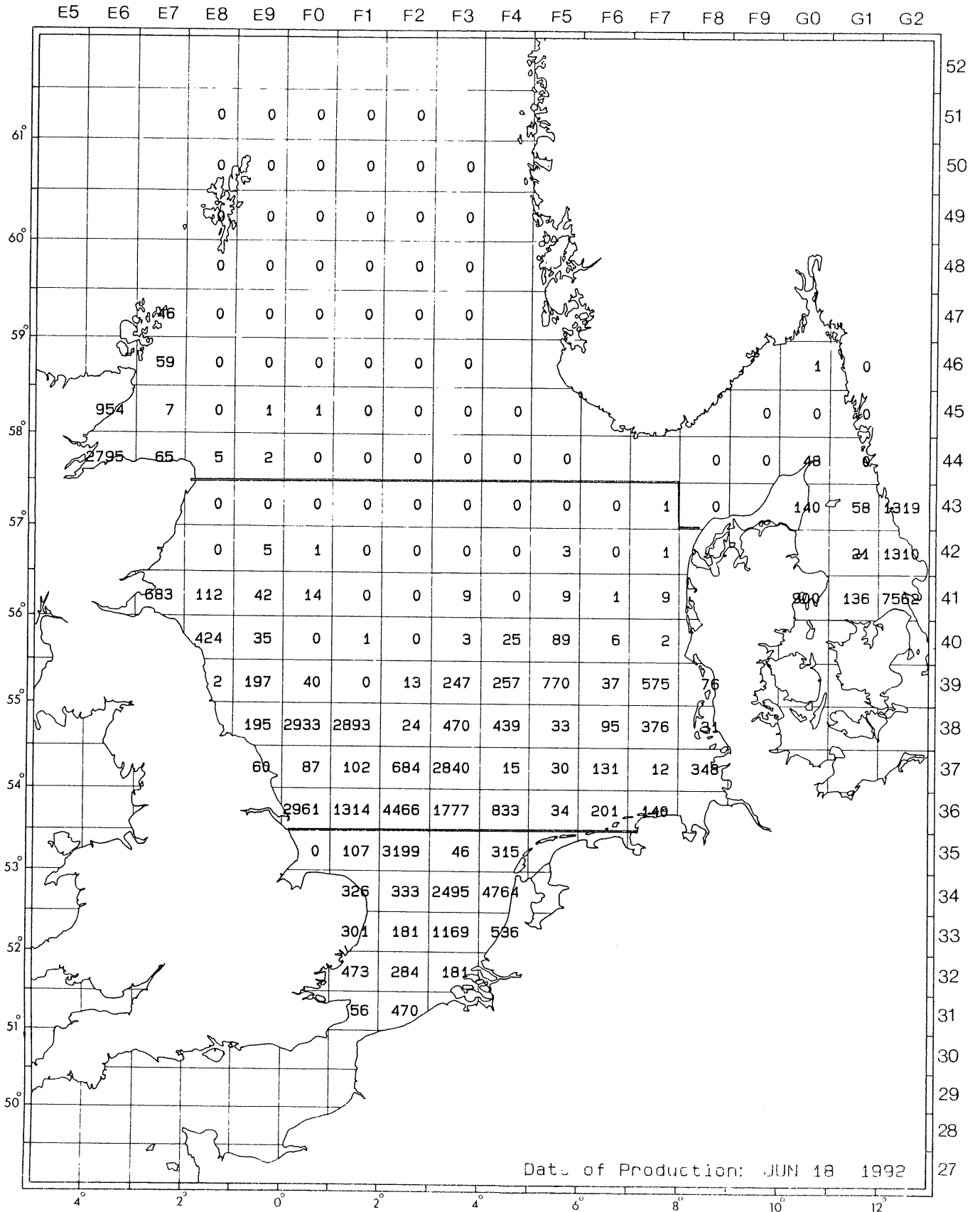


Figure 5.8 Sprat: number per hour, age group 2.

International Young Fish Survey 1992

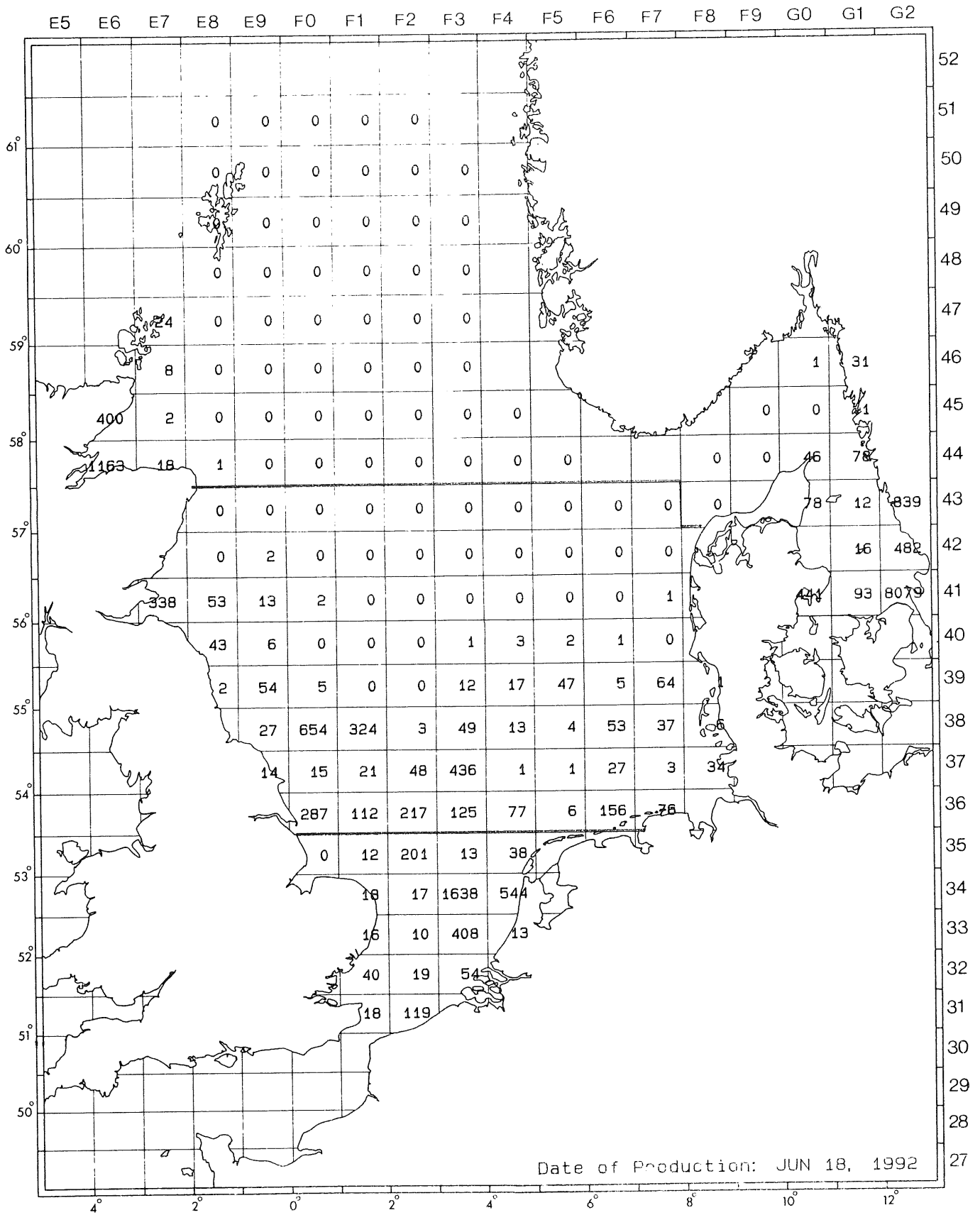


Figure 5.9 Sprat: number per hour, age group 3+.

International Young Fish Survey 1992

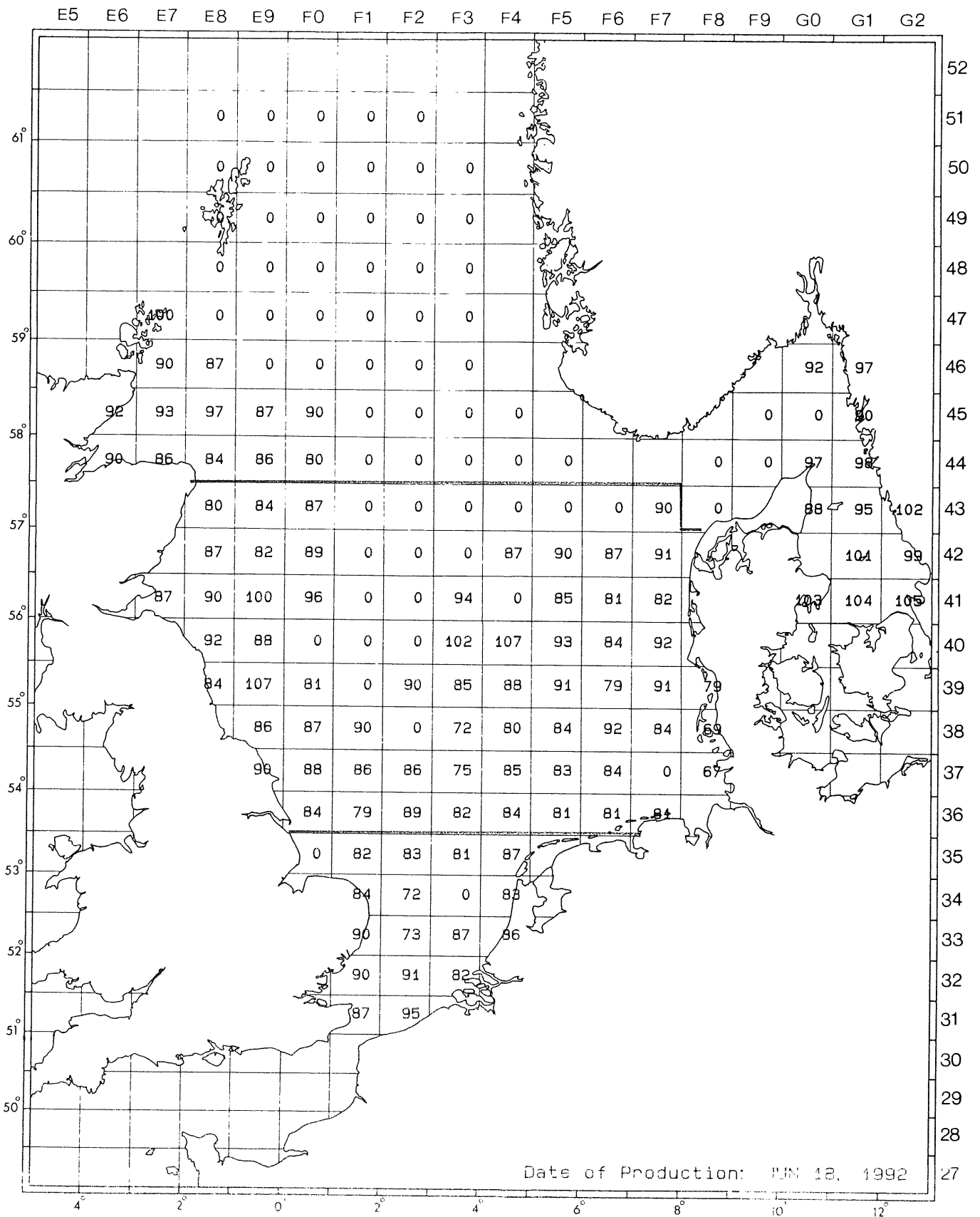


Figure 5.10 Sprat: mean length, age group 1.

International Young Fish Survey 1992

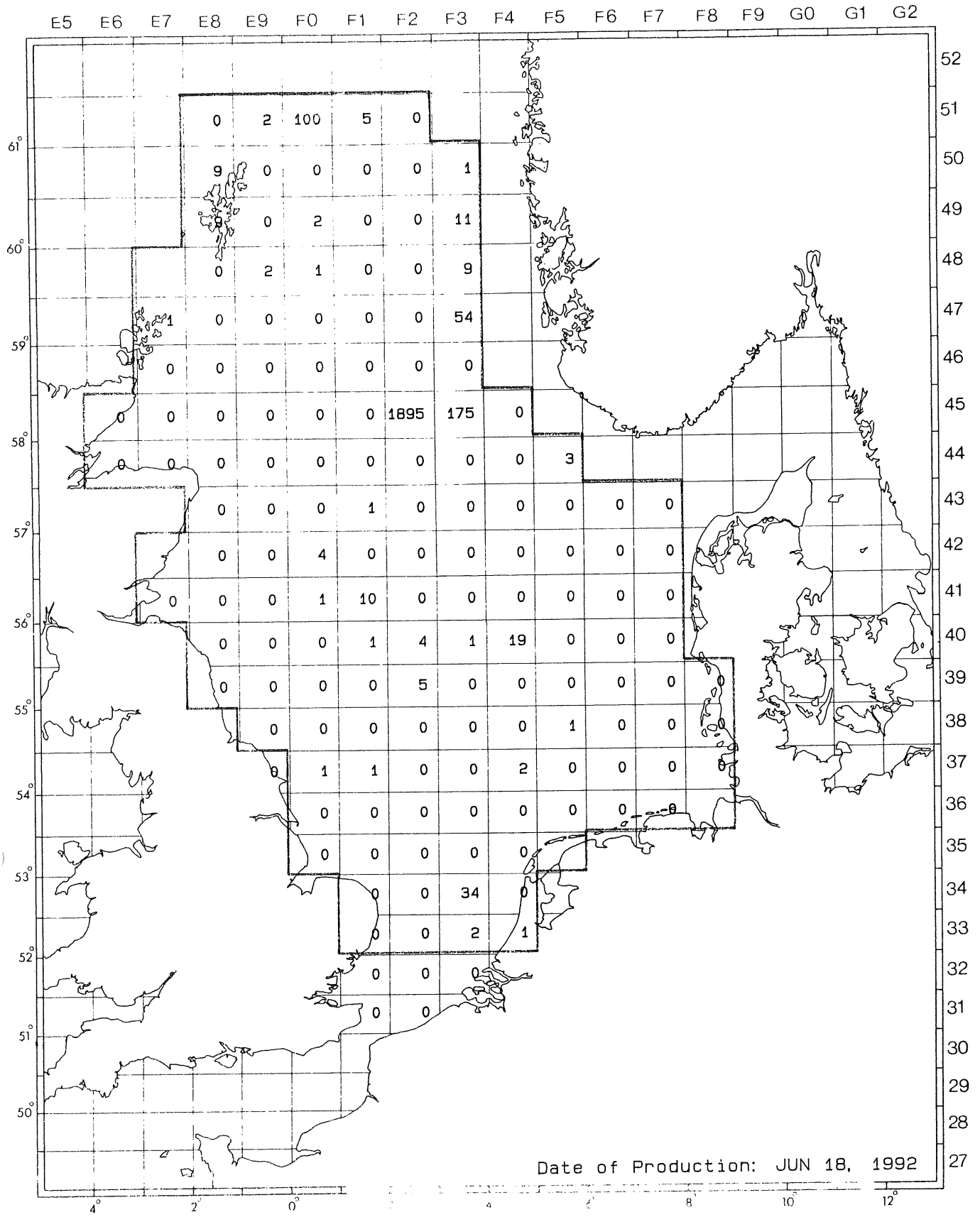


Figure 5.11 Mackerel: number per hour, age group 1.

International Young Fish Survey 1992

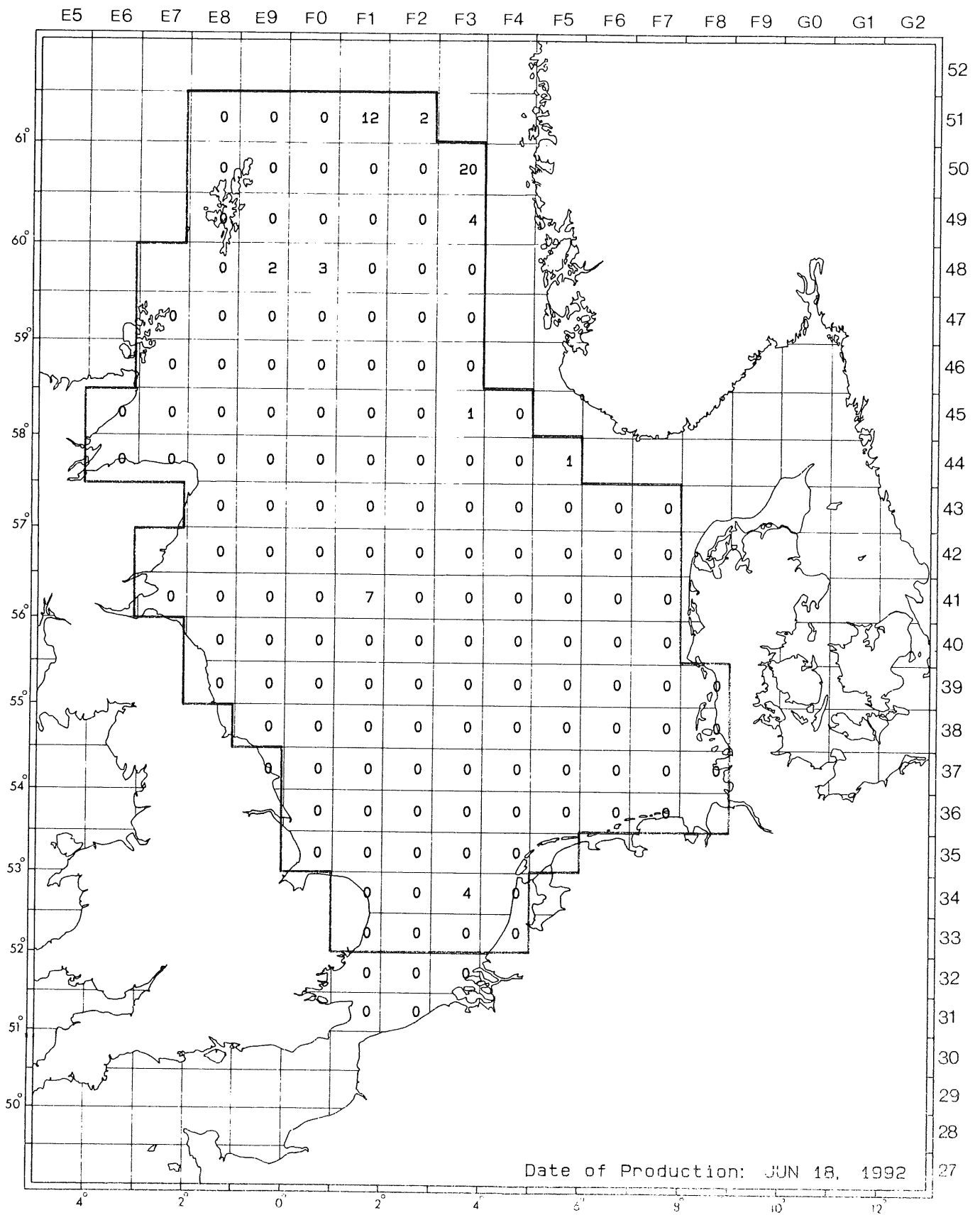


Figure 5.12 Mackerel: number per hour, age group 2.

International Young Fish Survey 1992

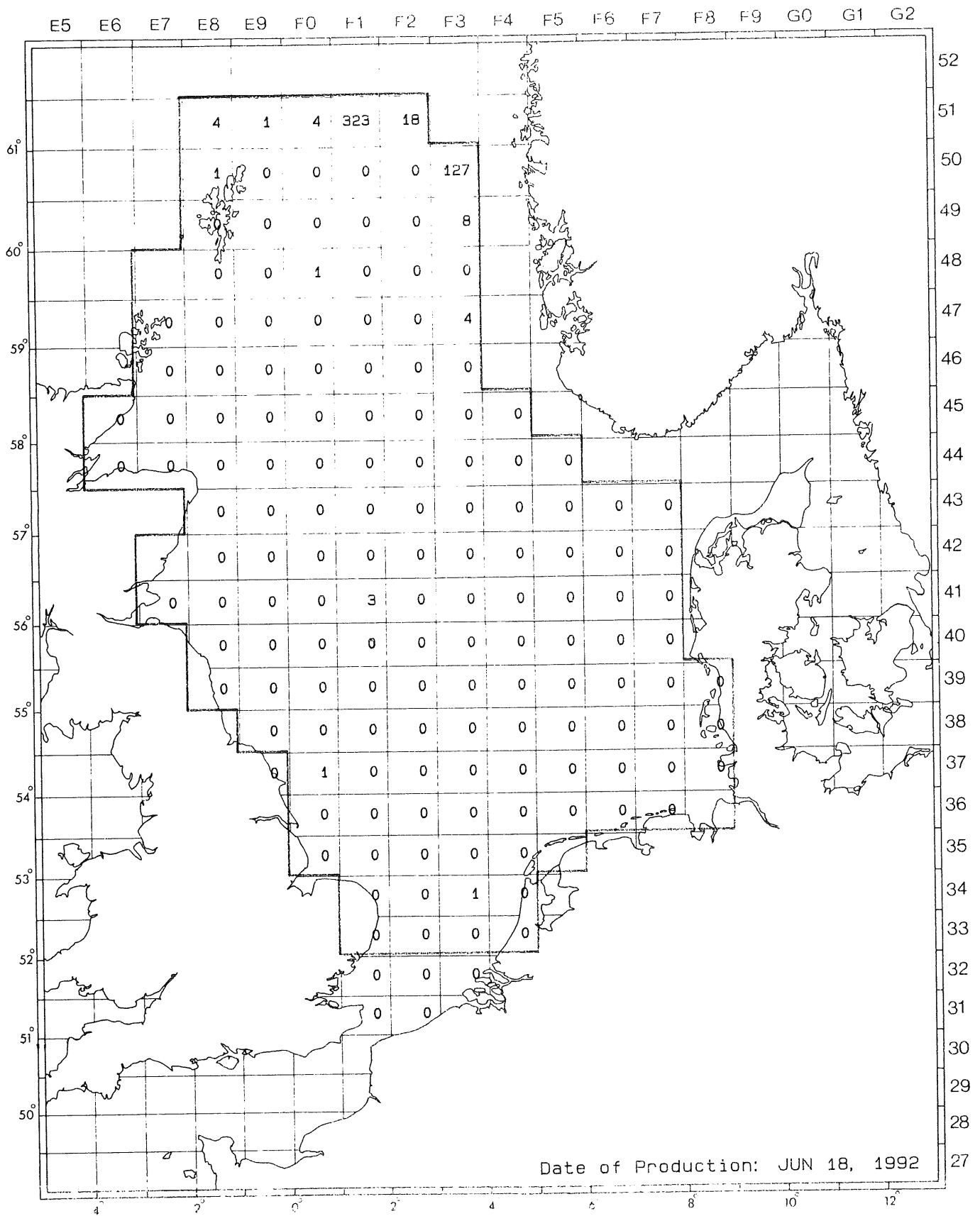


Figure 5.13 Mackerel: number per hour, age group 3+.

International Young Fish Survey 1992

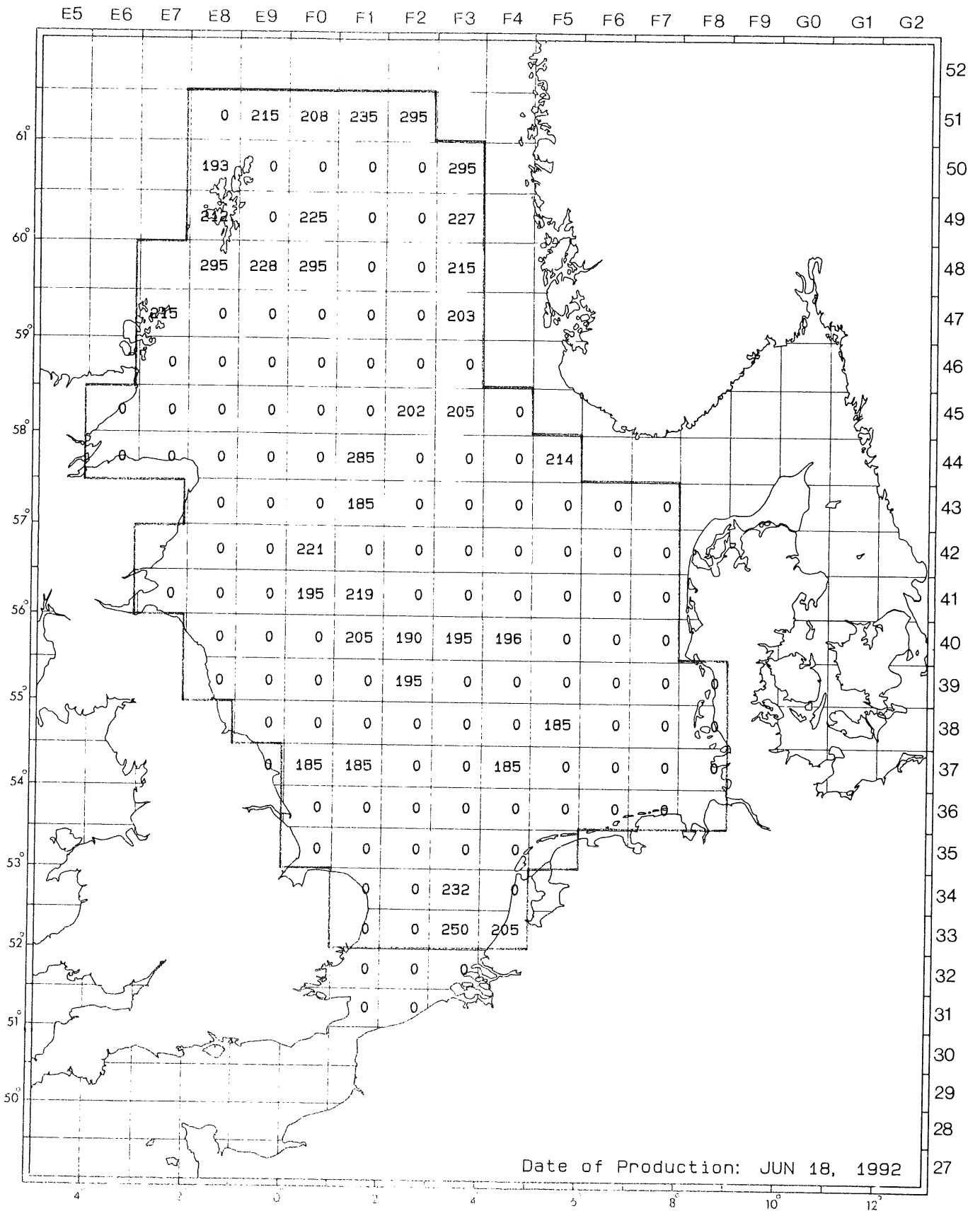


Figure 5.14 Mackerel: mean length, a_c group 1.

International Young Fish Survey 1992

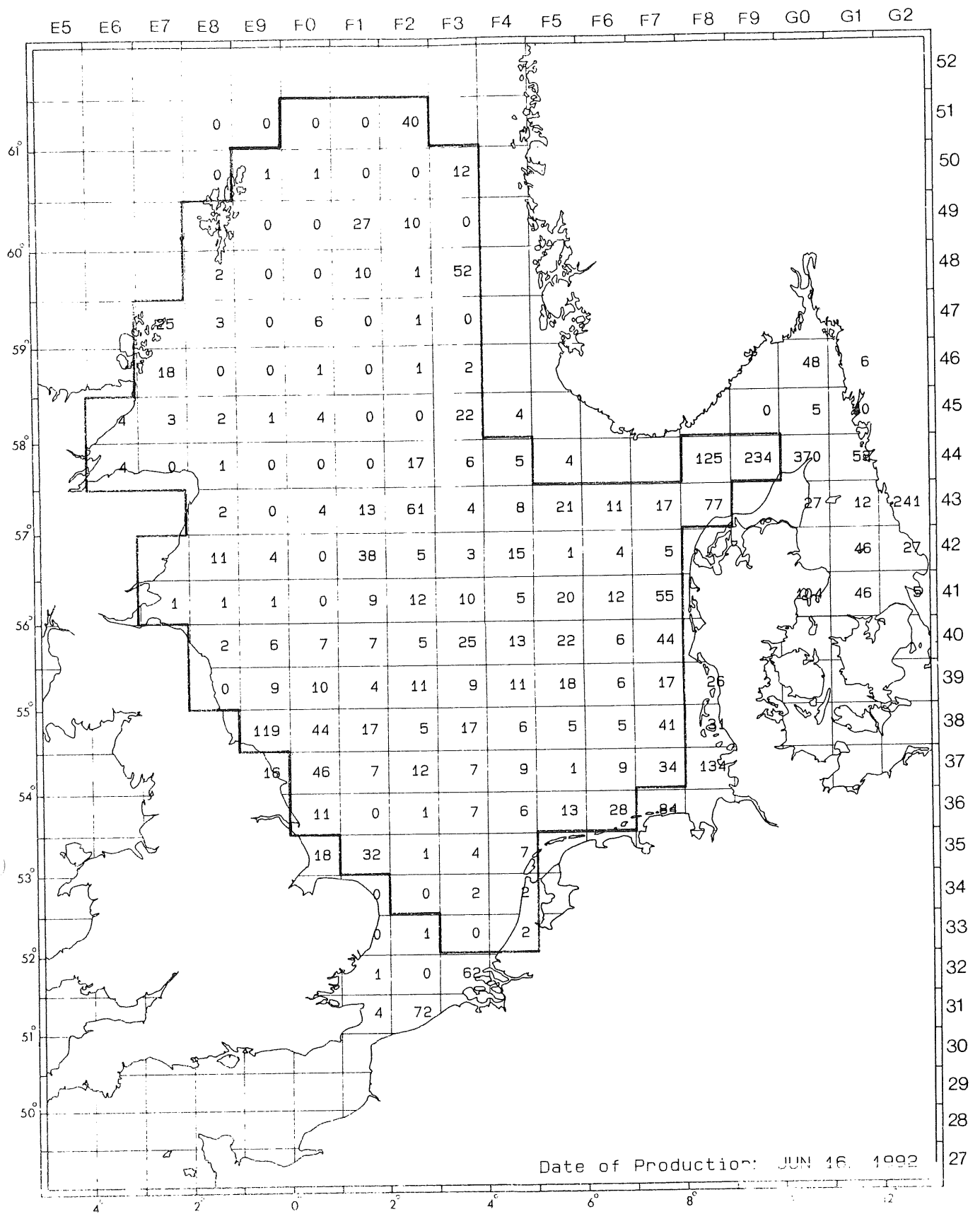


Figure 5.15 Cod: number per hour, age group 1.

International Young Fish Survey 1992

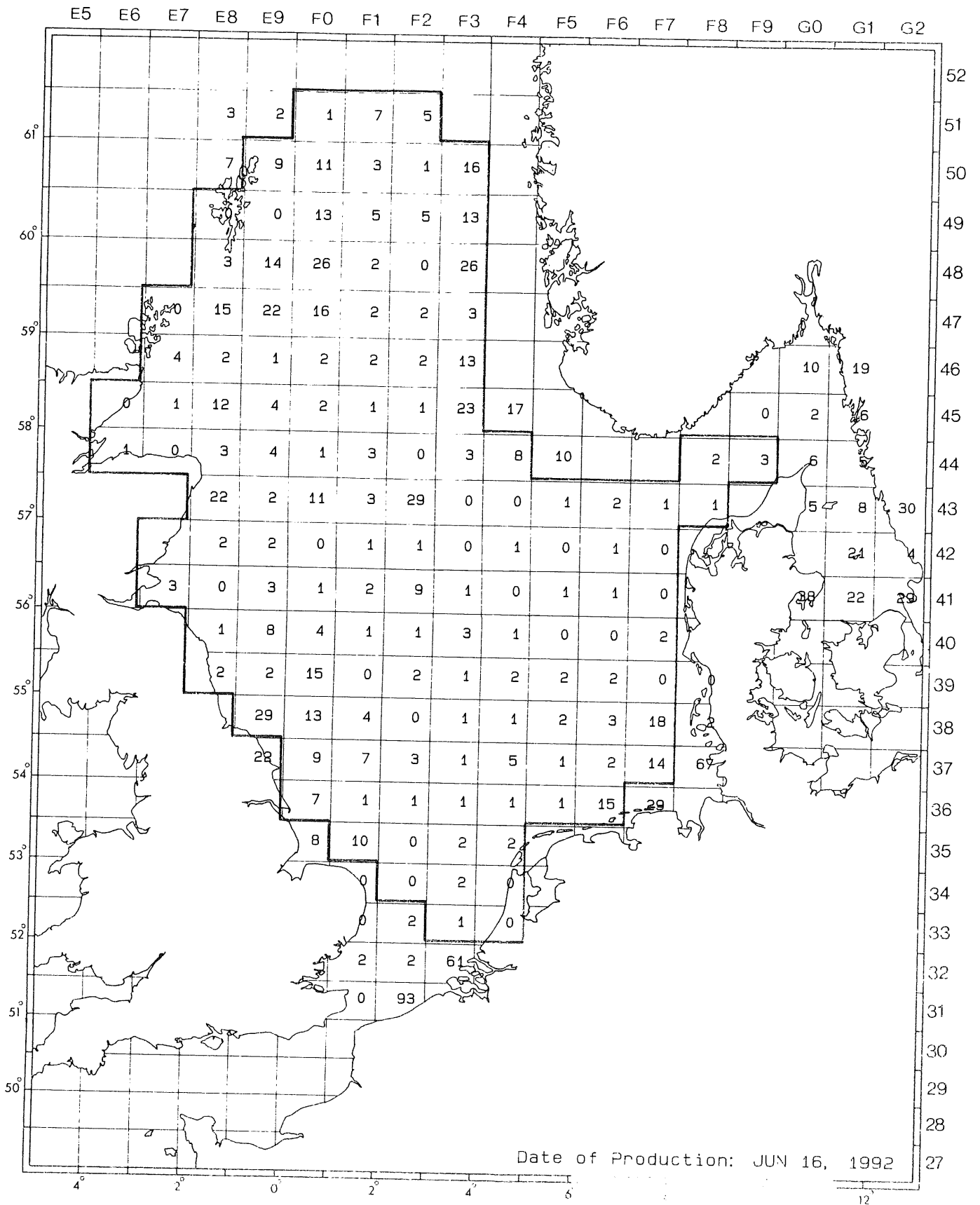


Figure 5.16 Cod: number per hour, age group 2.

International Young Fish Survey 1992

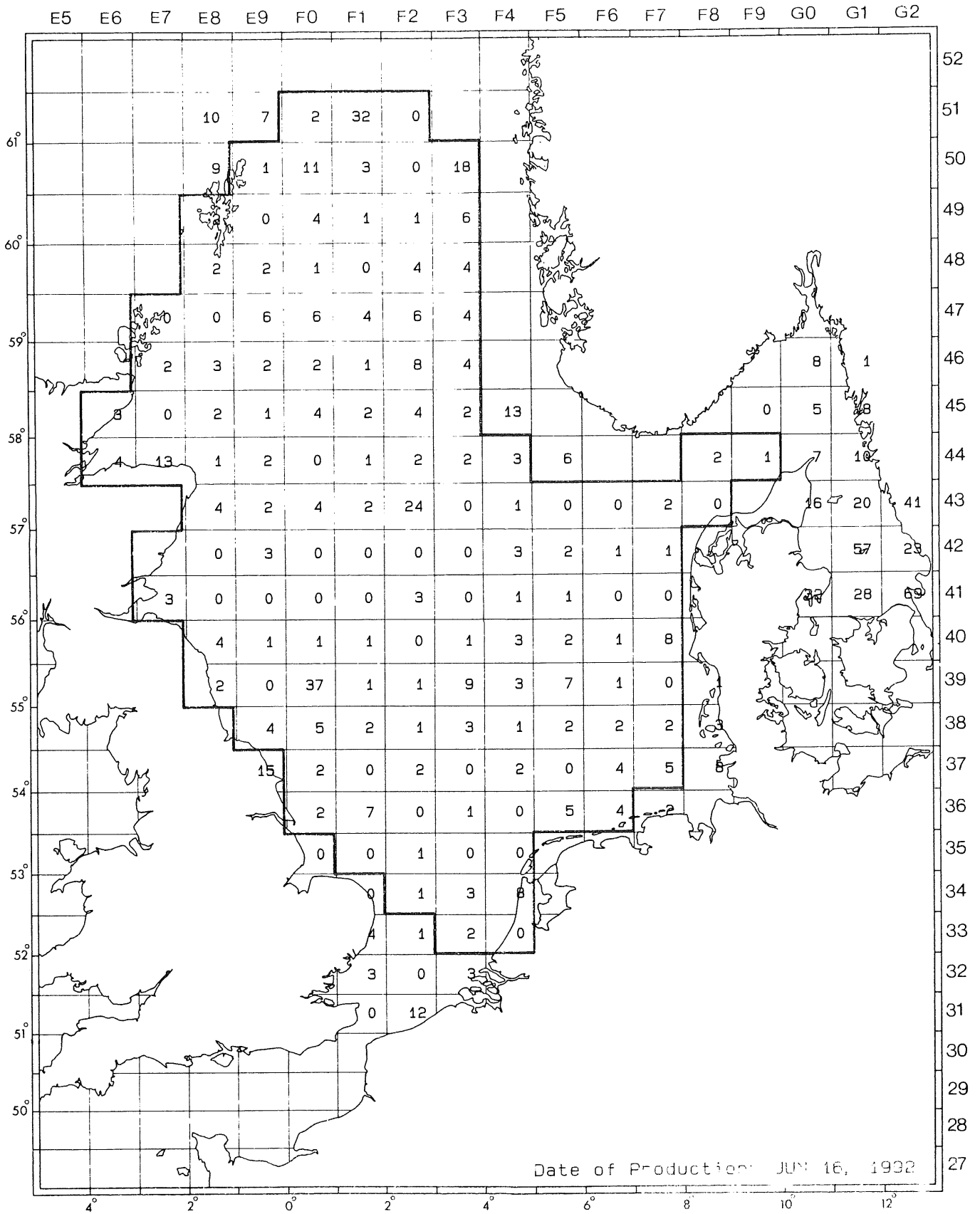


Figure 5.17 Cod: number per hour, age group 3+.

International Young Fish Survey 1992

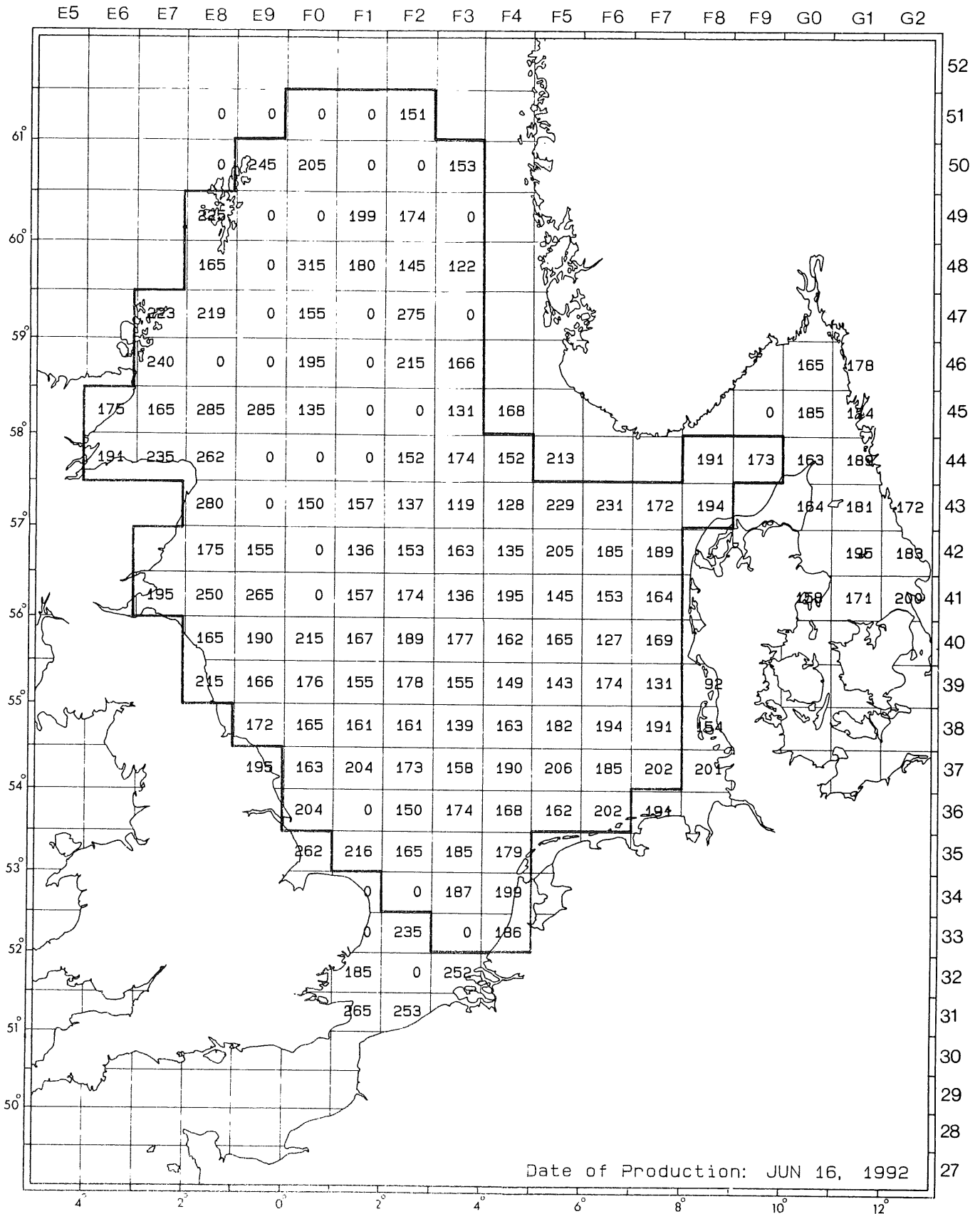


Figure 5.18 Cod: mean length, age group 1.

International Young Fish Survey 1992

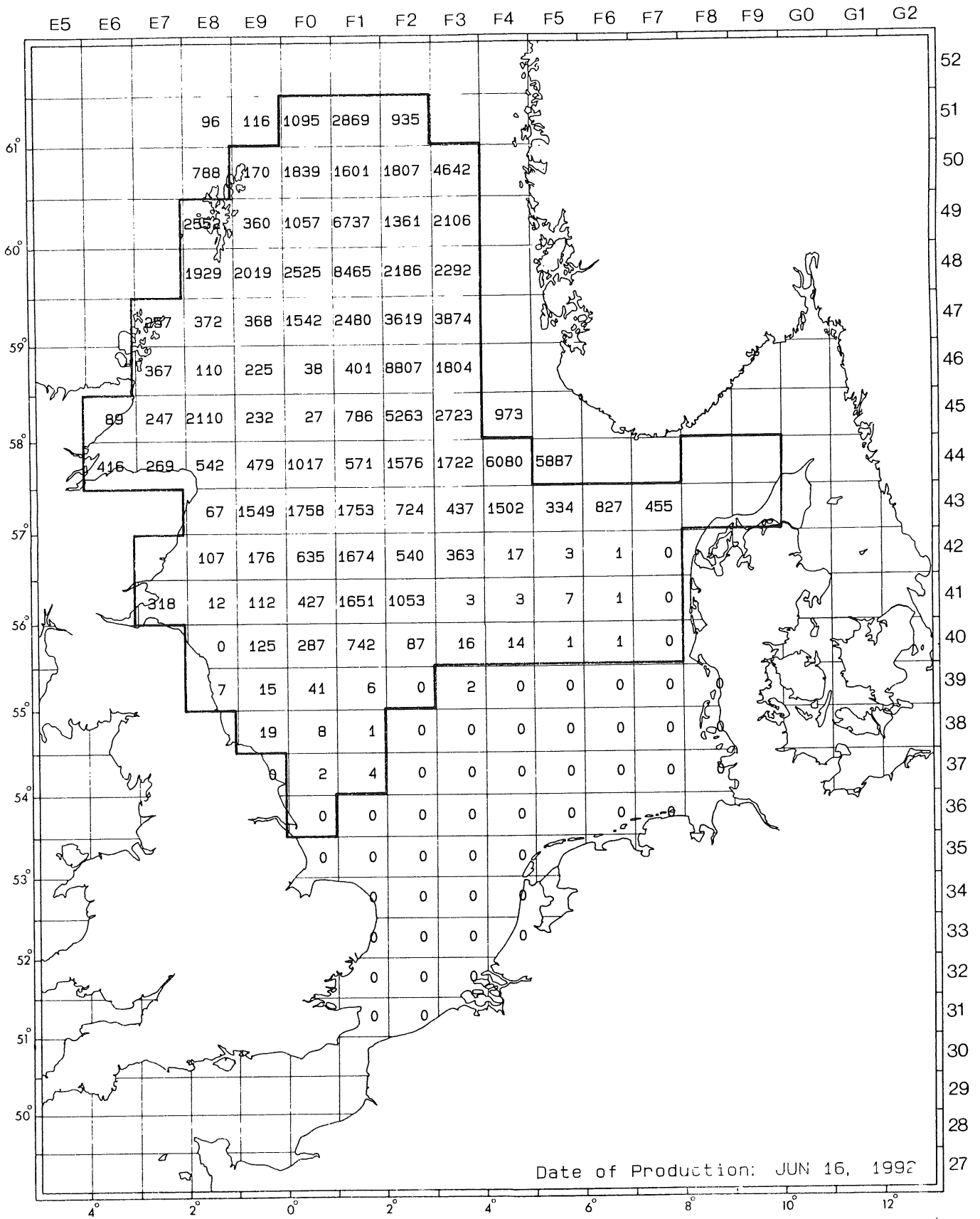


Figure 5.19 Haddock: number per hour, age group 1.

International Young Fish Survey 1992

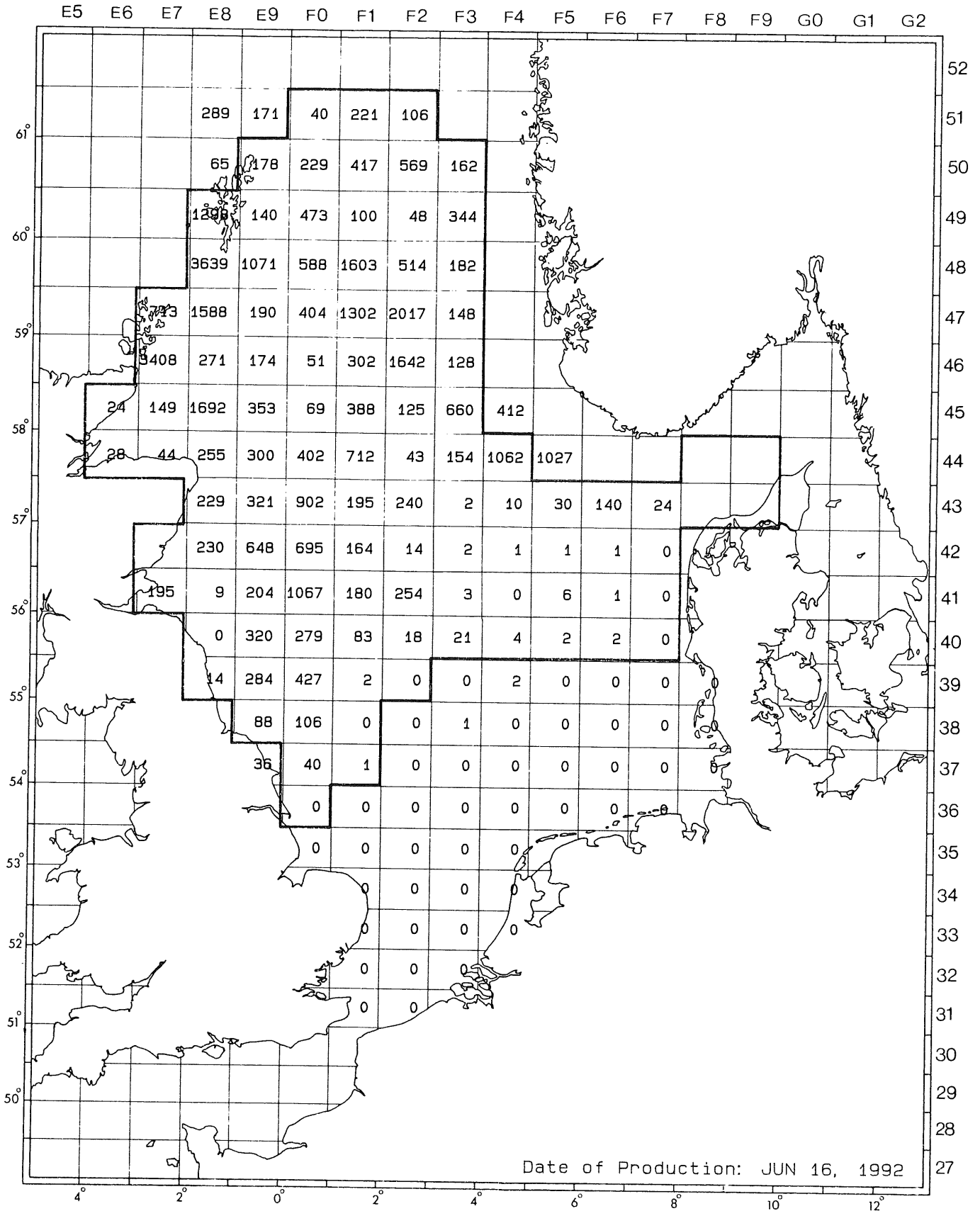


Figure 5.20 Haddock: number per hour, age group 2.

International Young Fish Survey 1992

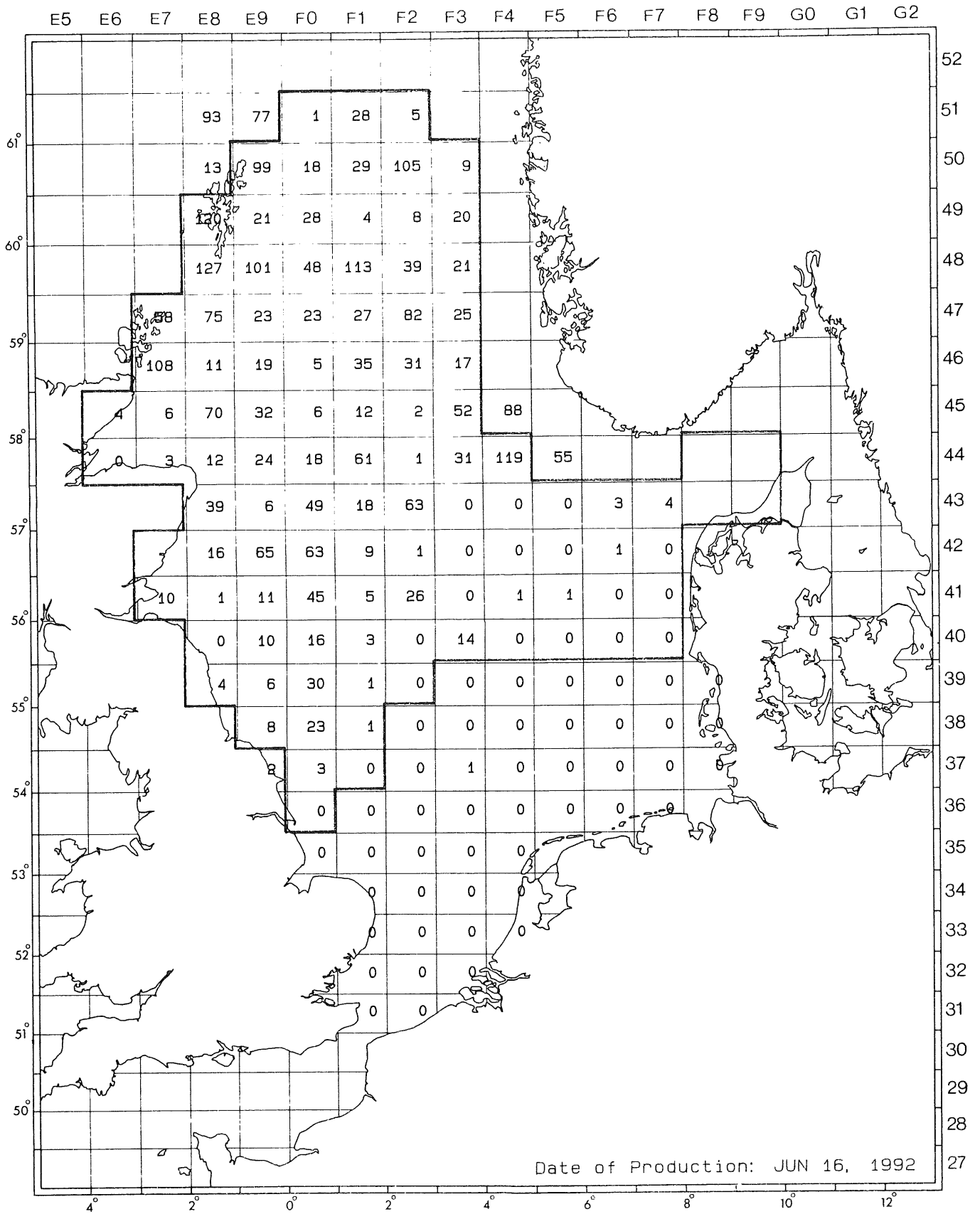


Figure 5.21 Haddock: number per hour, age group 3+.

International Young Fish Survey 1992

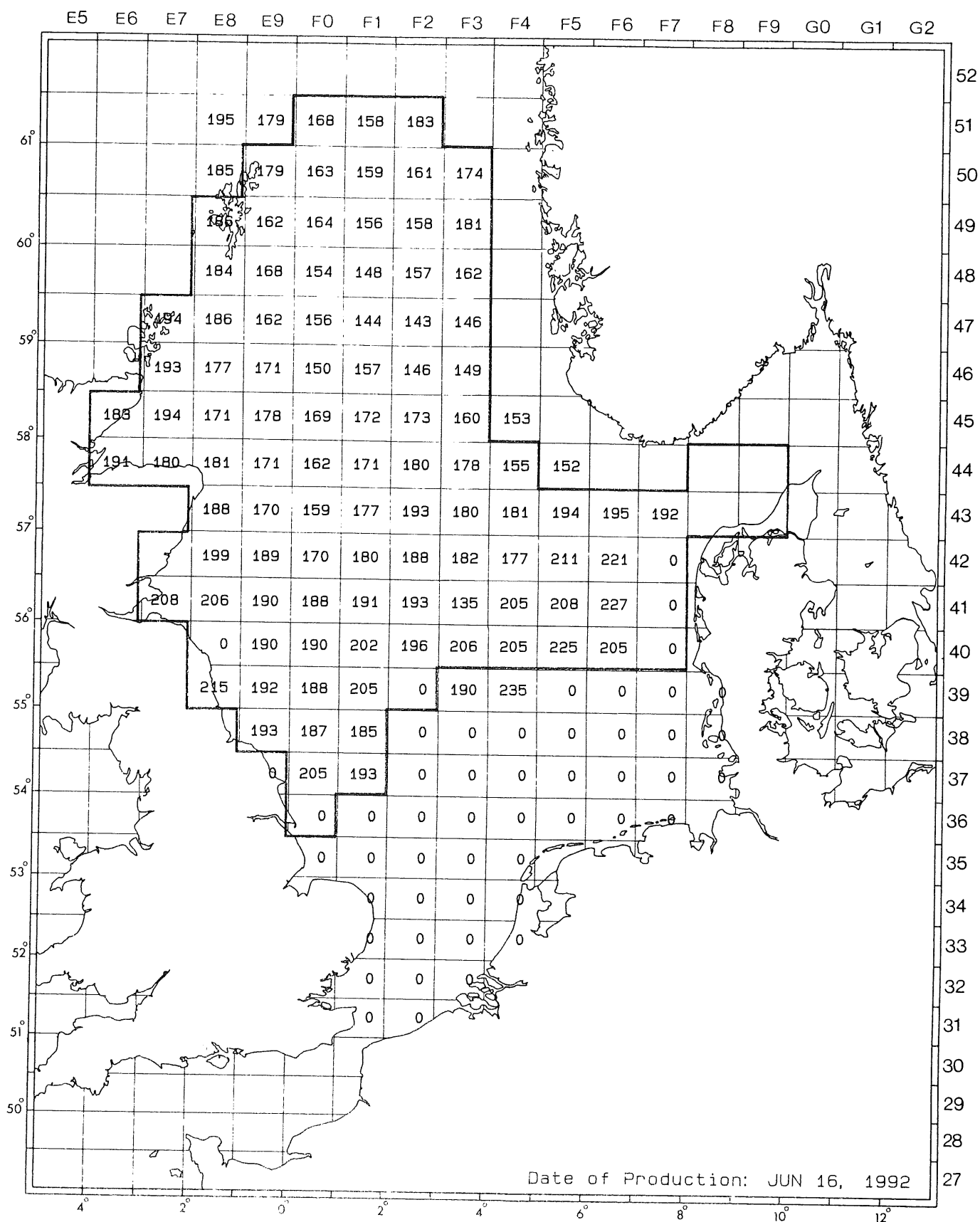


Figure 5.22 Haddock: mean length, age group 1.

International Young Fish Survey 1992

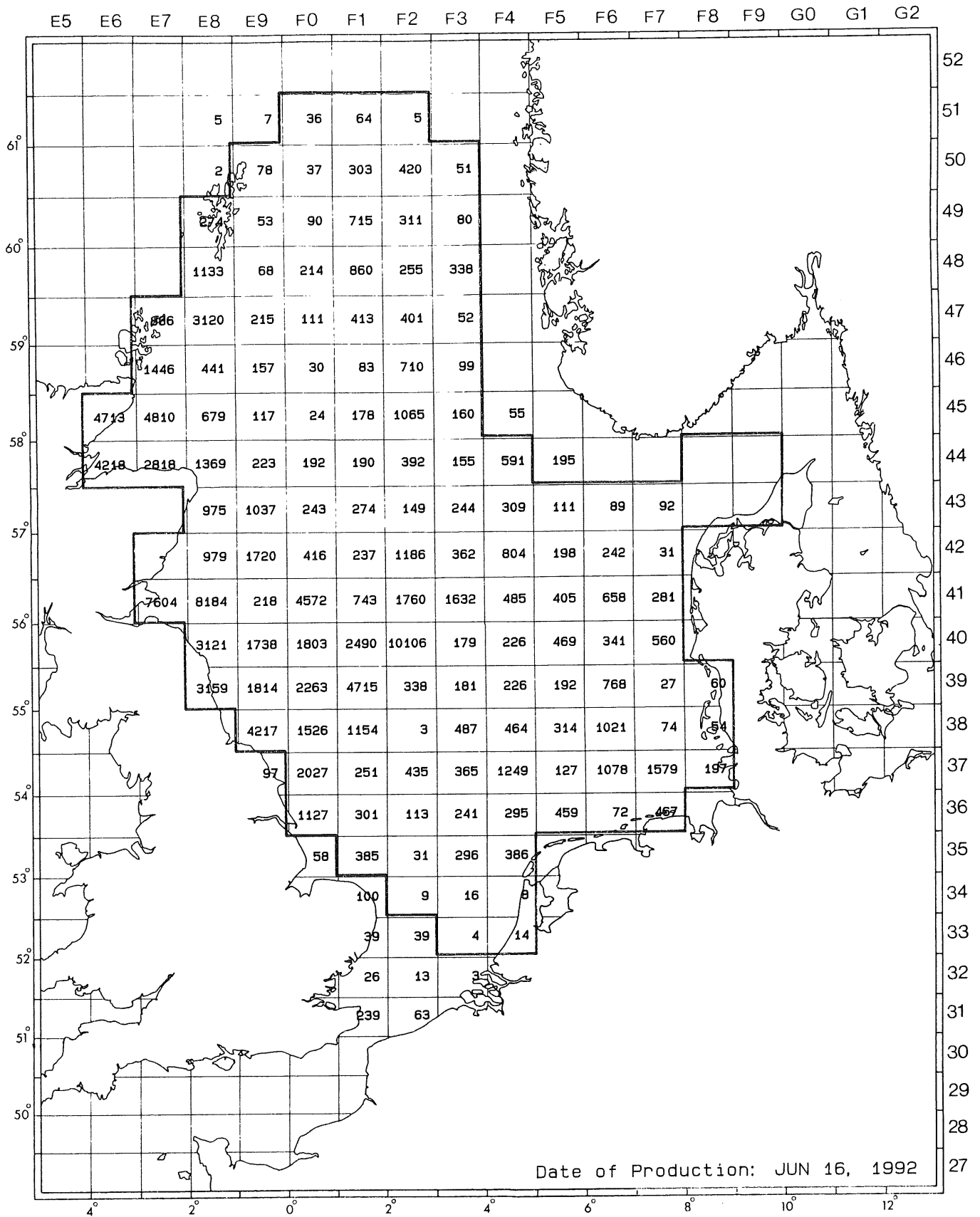


Figure 5.23 Whiting: number per hour, age group 1.

International Young Fish Survey 1992

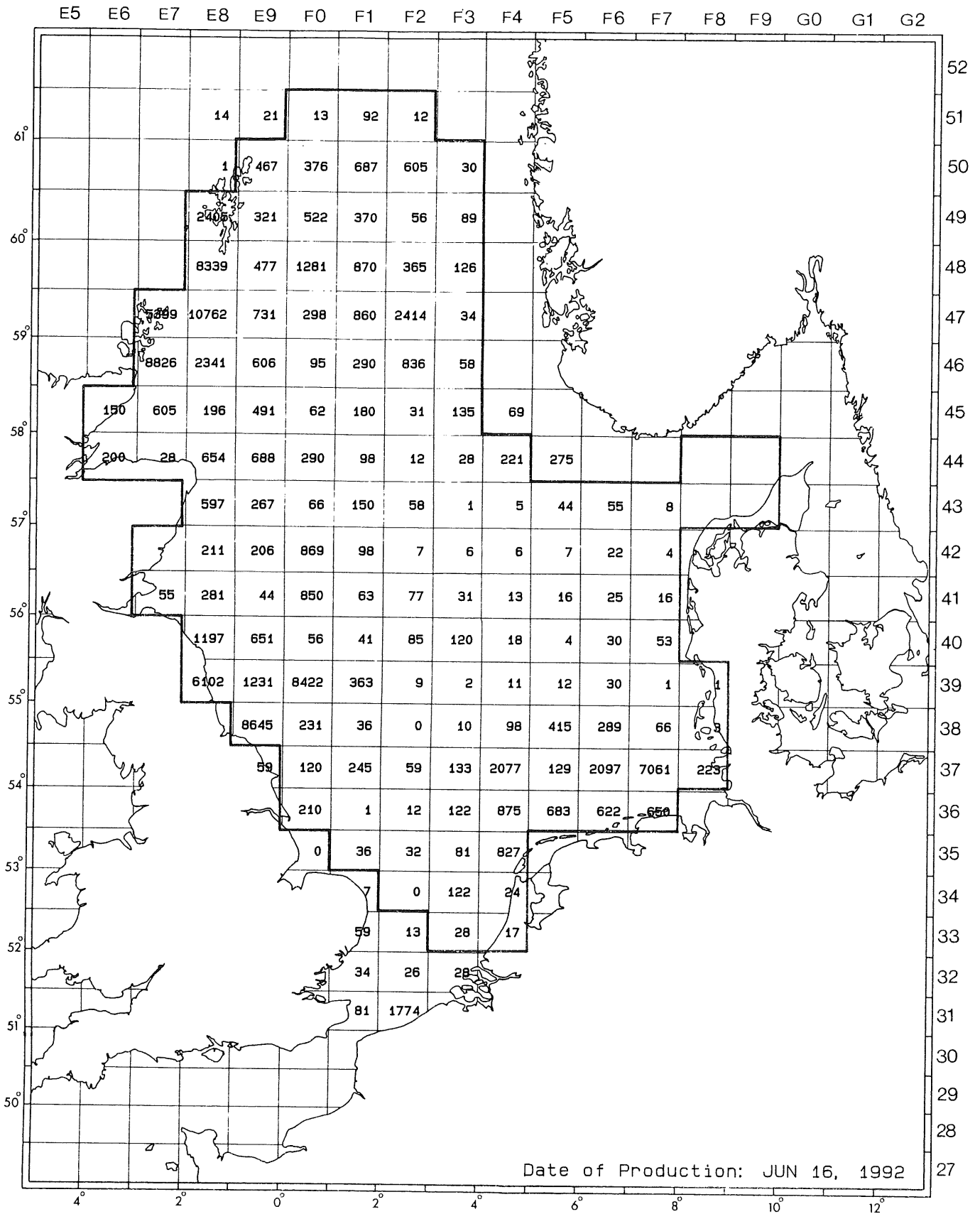


Figure 5.24 Whiting: number per hour, age group 2.

International Young Fish Survey 1992

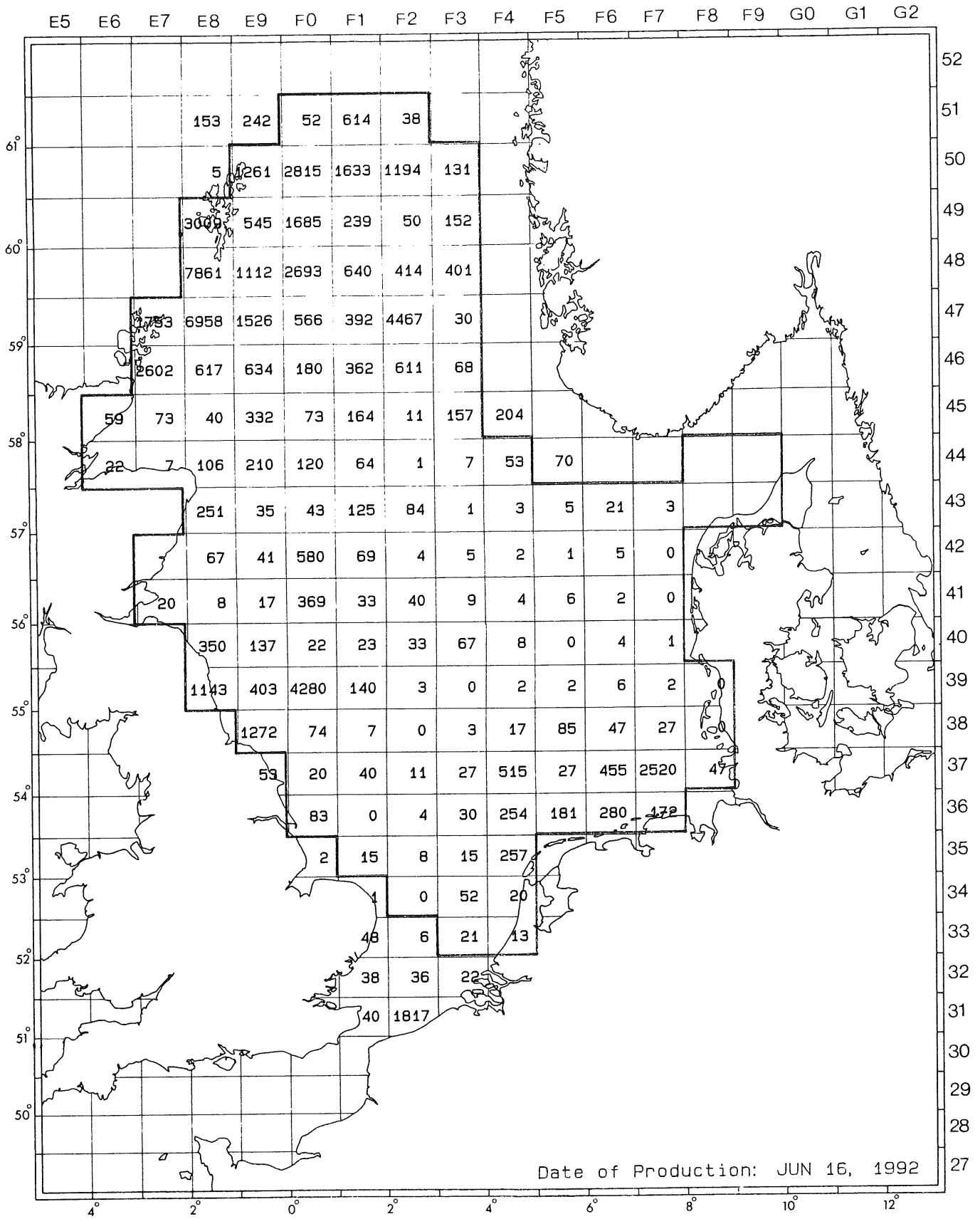


Figure 5.25 Whiting: number per hour, age group 3+.

International Young Fish Survey 1992

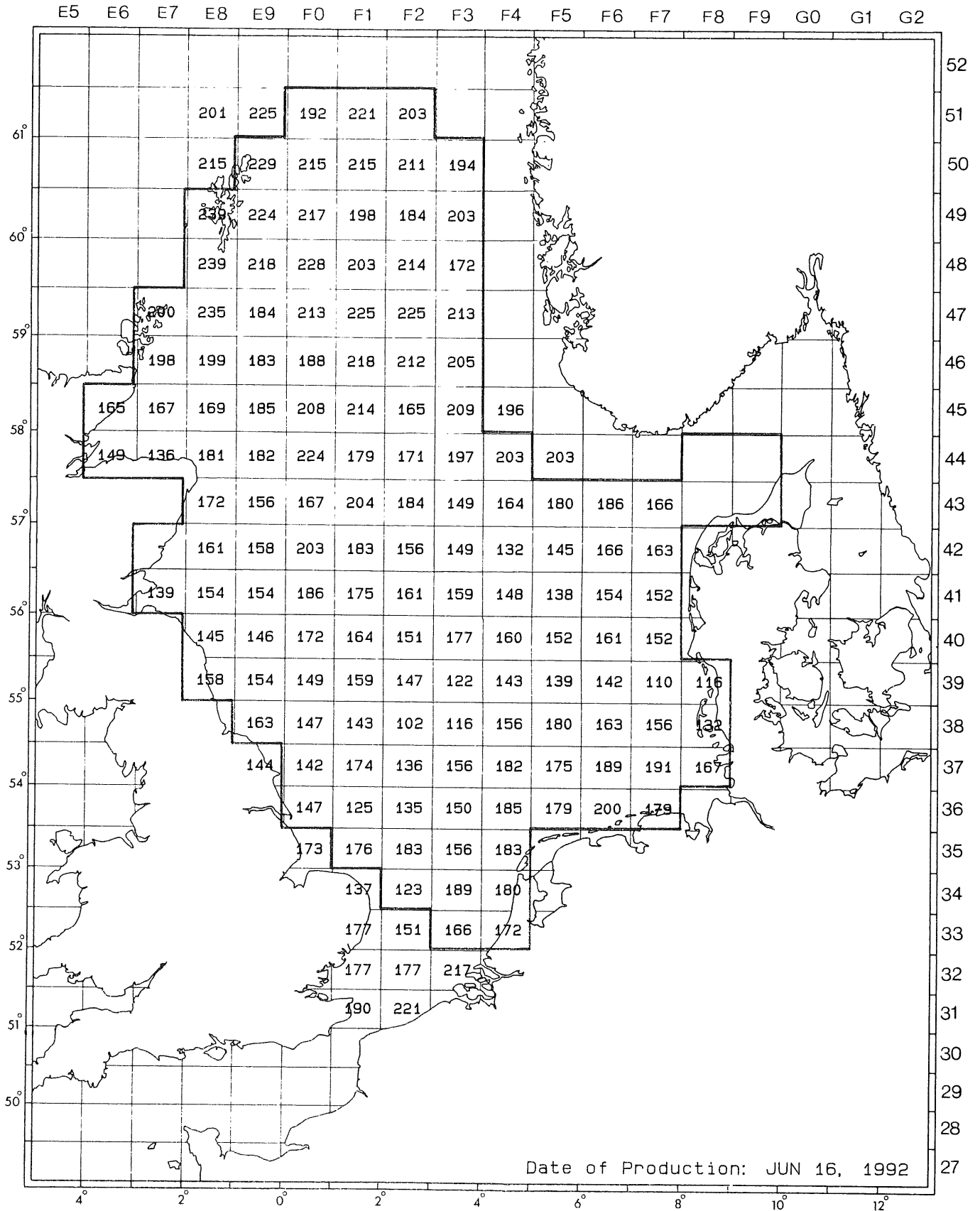


Figure 5.26 Whiting: mean length, age group 1.

International Young Fish Survey 1992

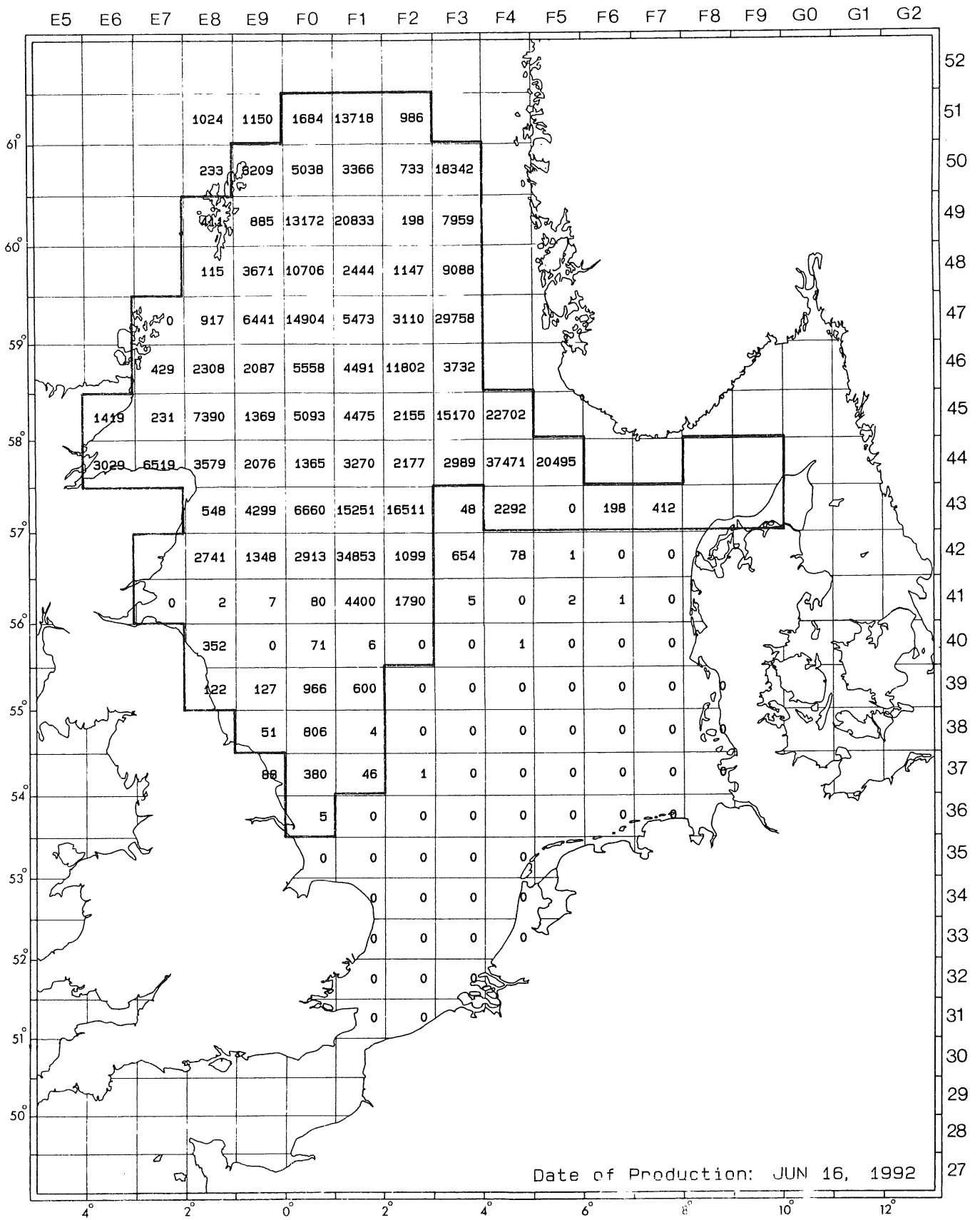


Figure 5.27 Norway pout: number per hour, age group 1.

International Young Fish Survey 1992

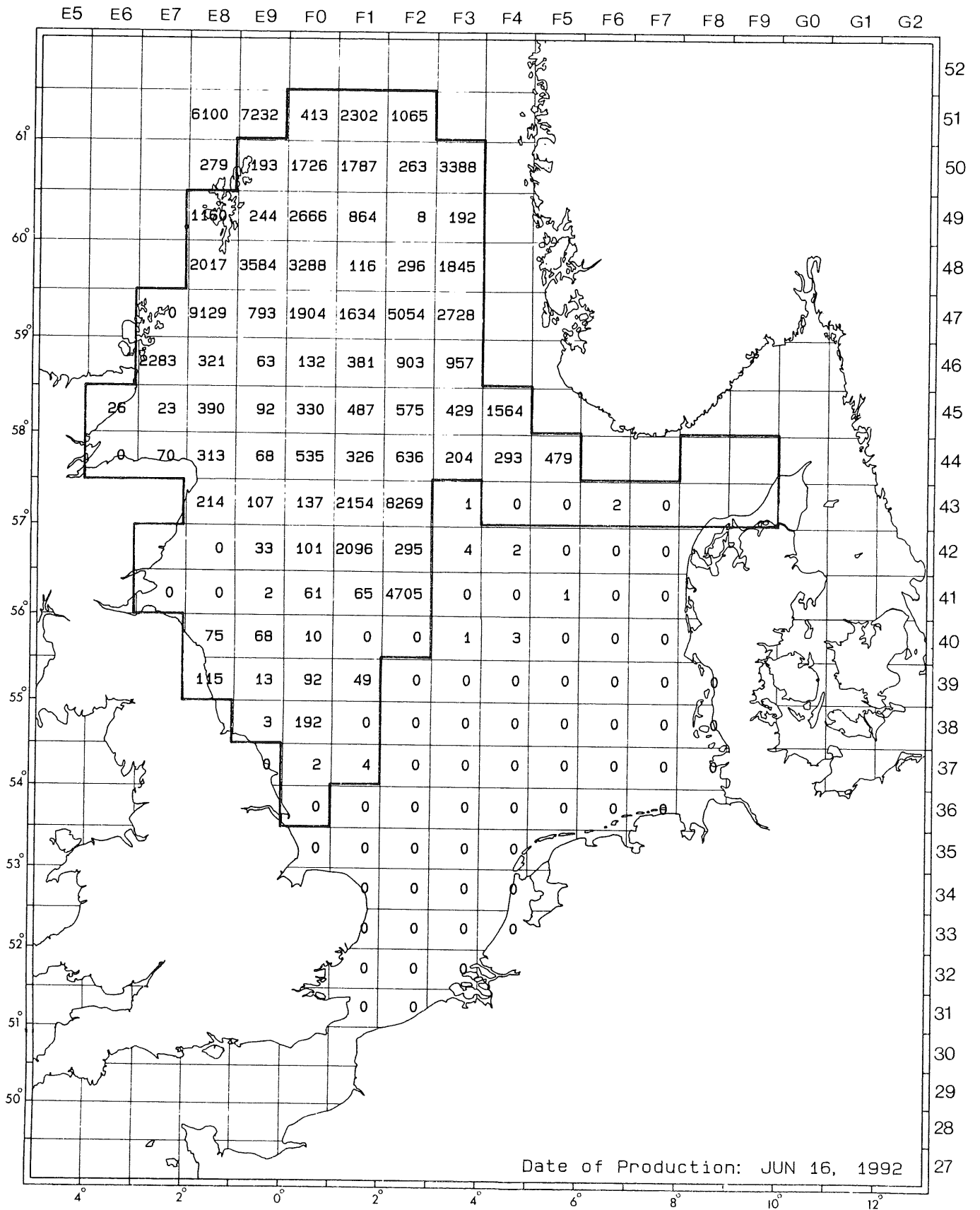


Figure 5.28 Norway pout: number per hour, age group 2.

International Young Fish Survey 1992

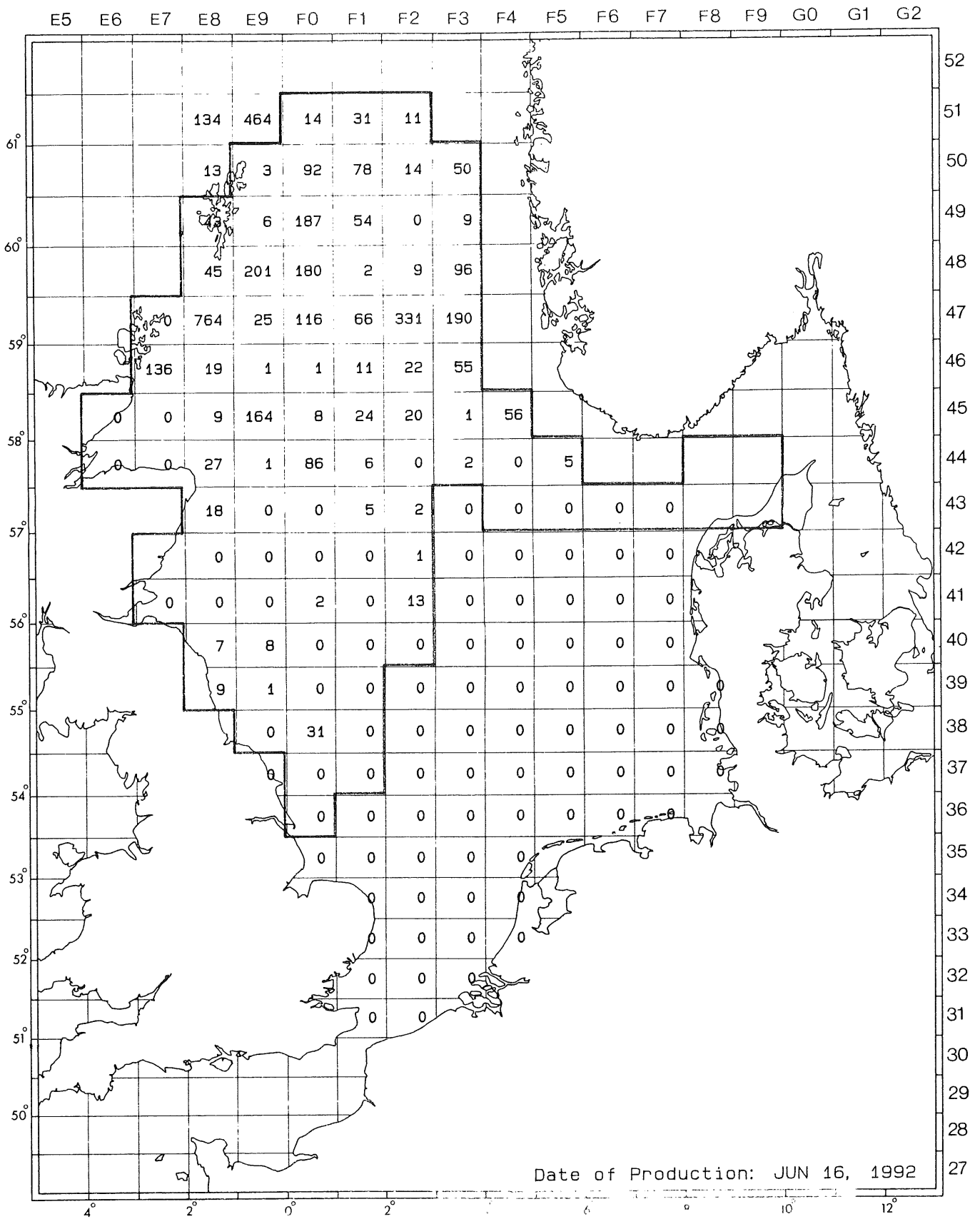


Figure 5.29 Norway pout: number per hour, age group 3+.

International Young Fish Survey 1992

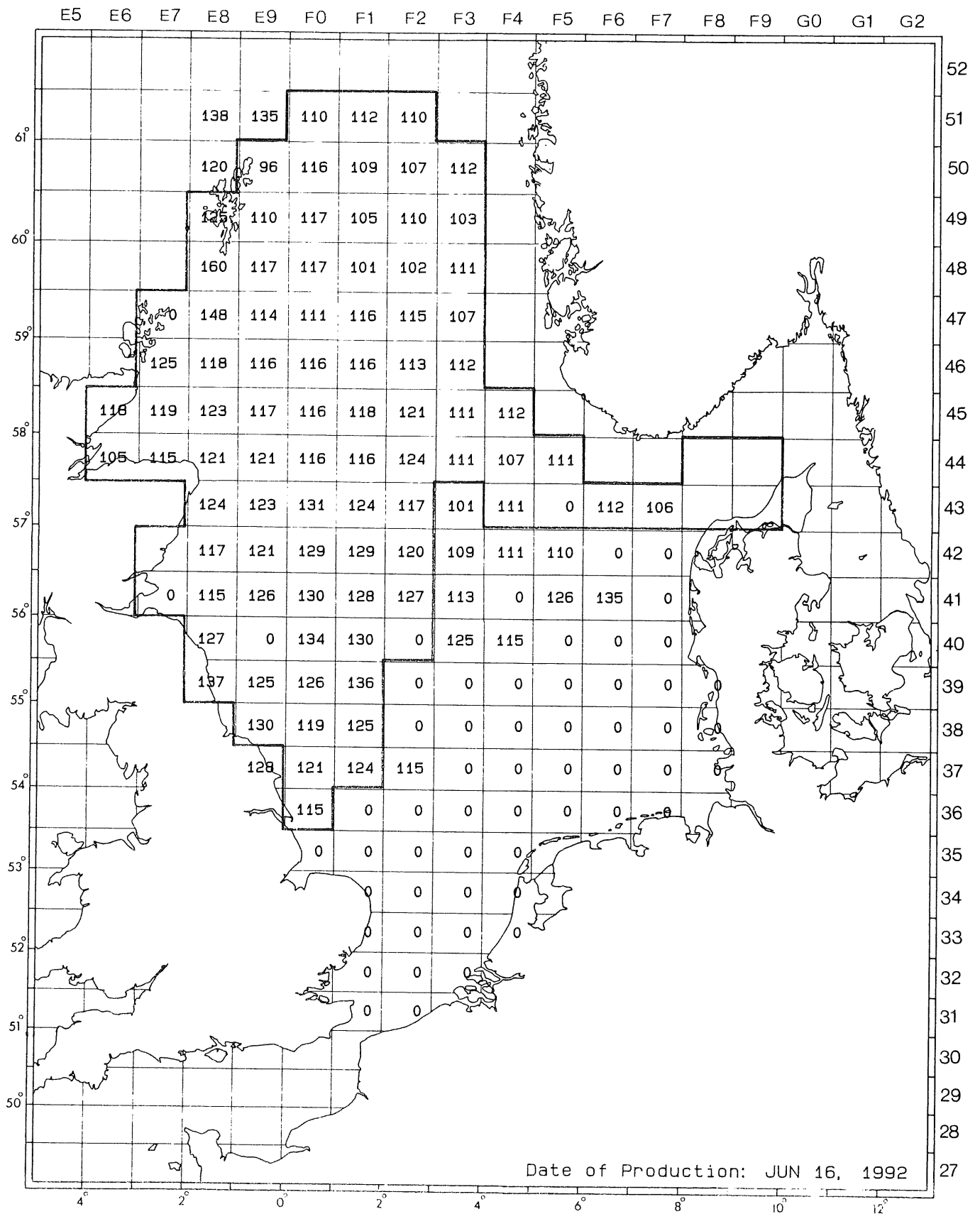


Figure 5.30 Norway pout: mean length, age group 1.

0-ringers year class 1991

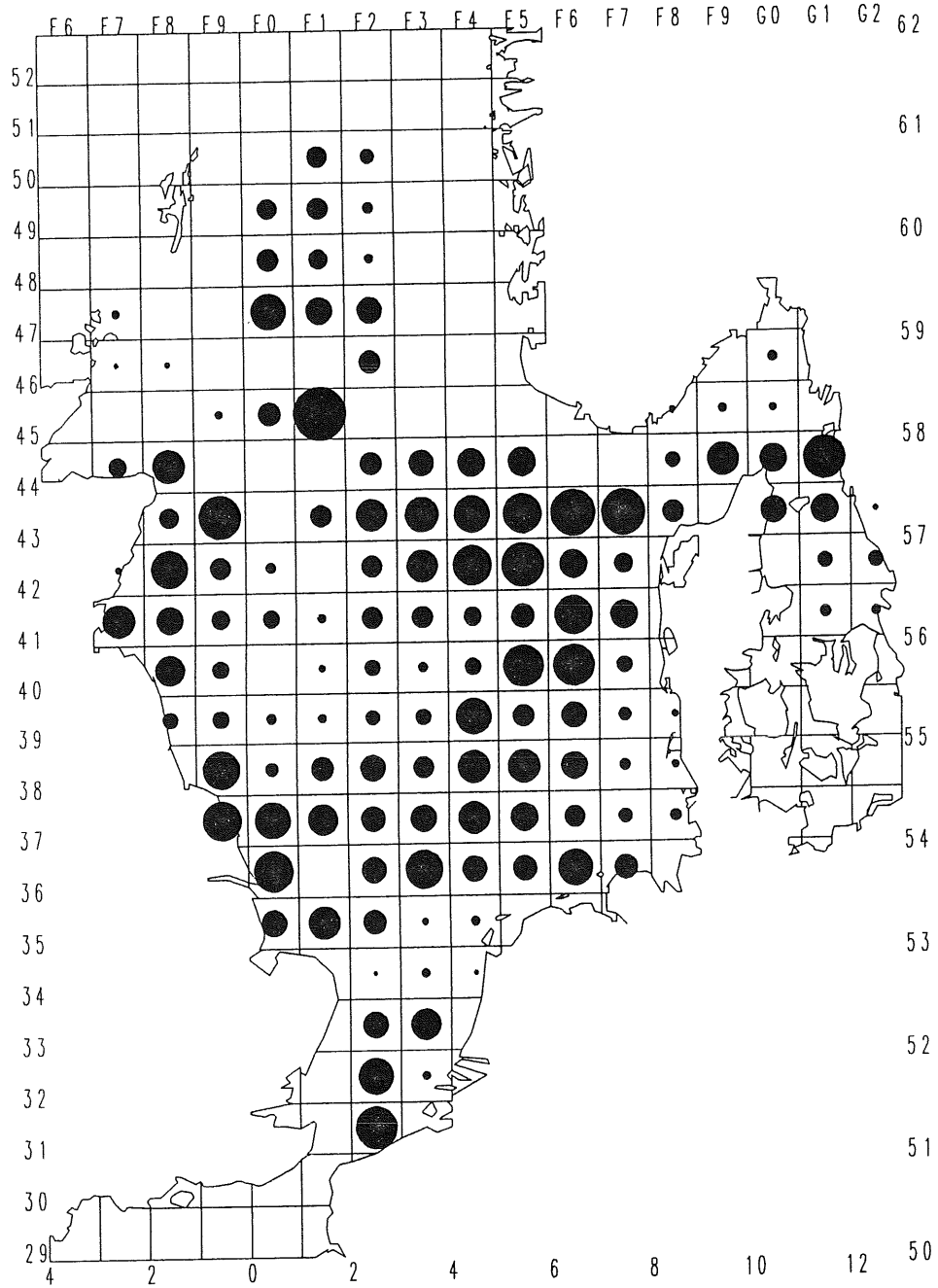


Figure 6.1

Herring larvae: mean abundance per statistical rectangle. Surface of black dots represents densities in no m⁻², the surface of the circles that extend to the borders of a statistical rectangle represents 1.8 larvae m⁻². Year class 1991 sampled in February 1992.

0-ringers year class 1989

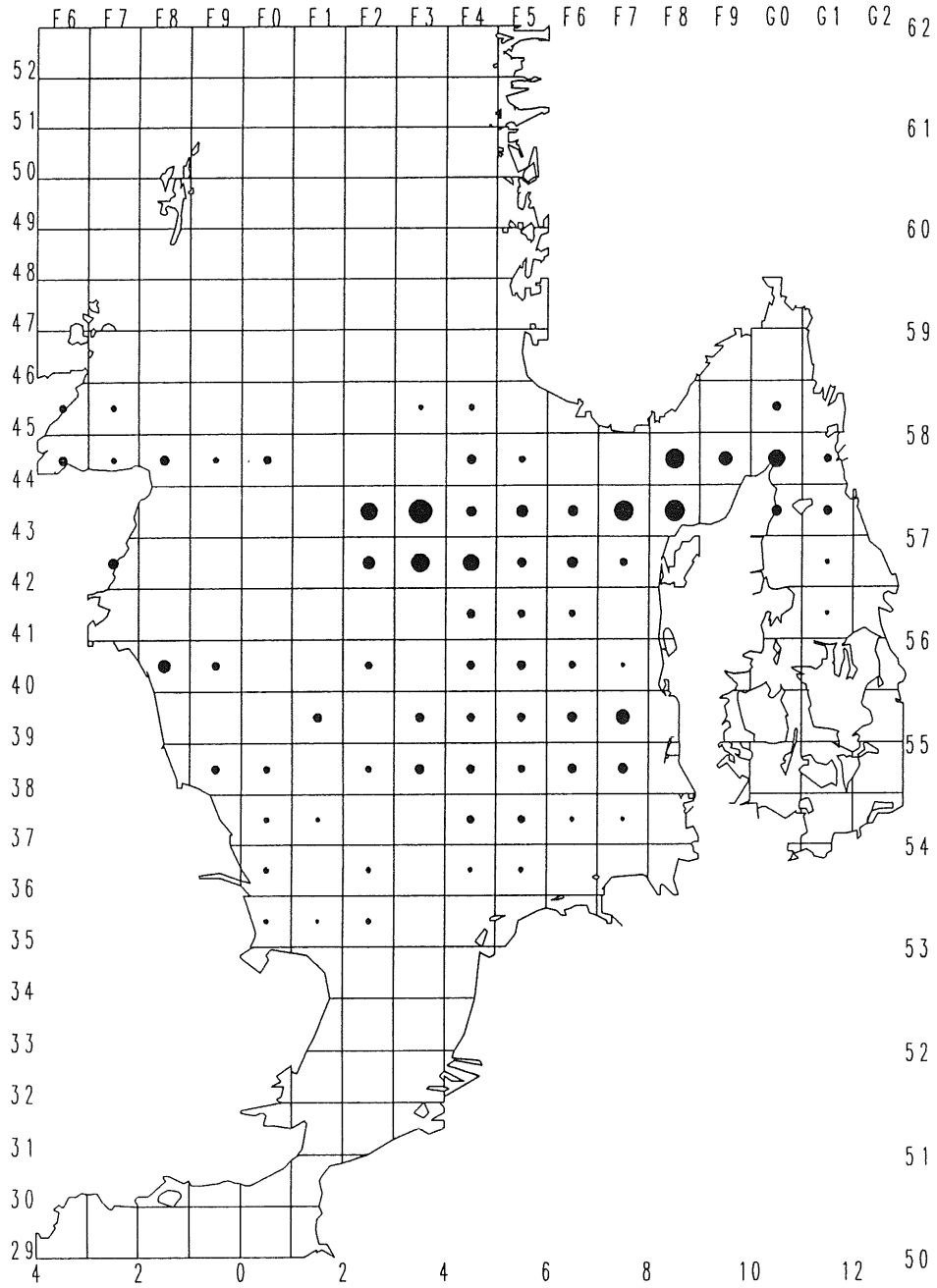


Figure 6.2

Herring larvae: mean abundance per statistical rectangle. Surface of black dots represents densities in no m^{-2} , the surface of the circles that extend to the borders of a statistical rectangle represents 1.8 larvae m^{-2} . Year class 1989 sampled in February 1990.

0-ringers year class 1990

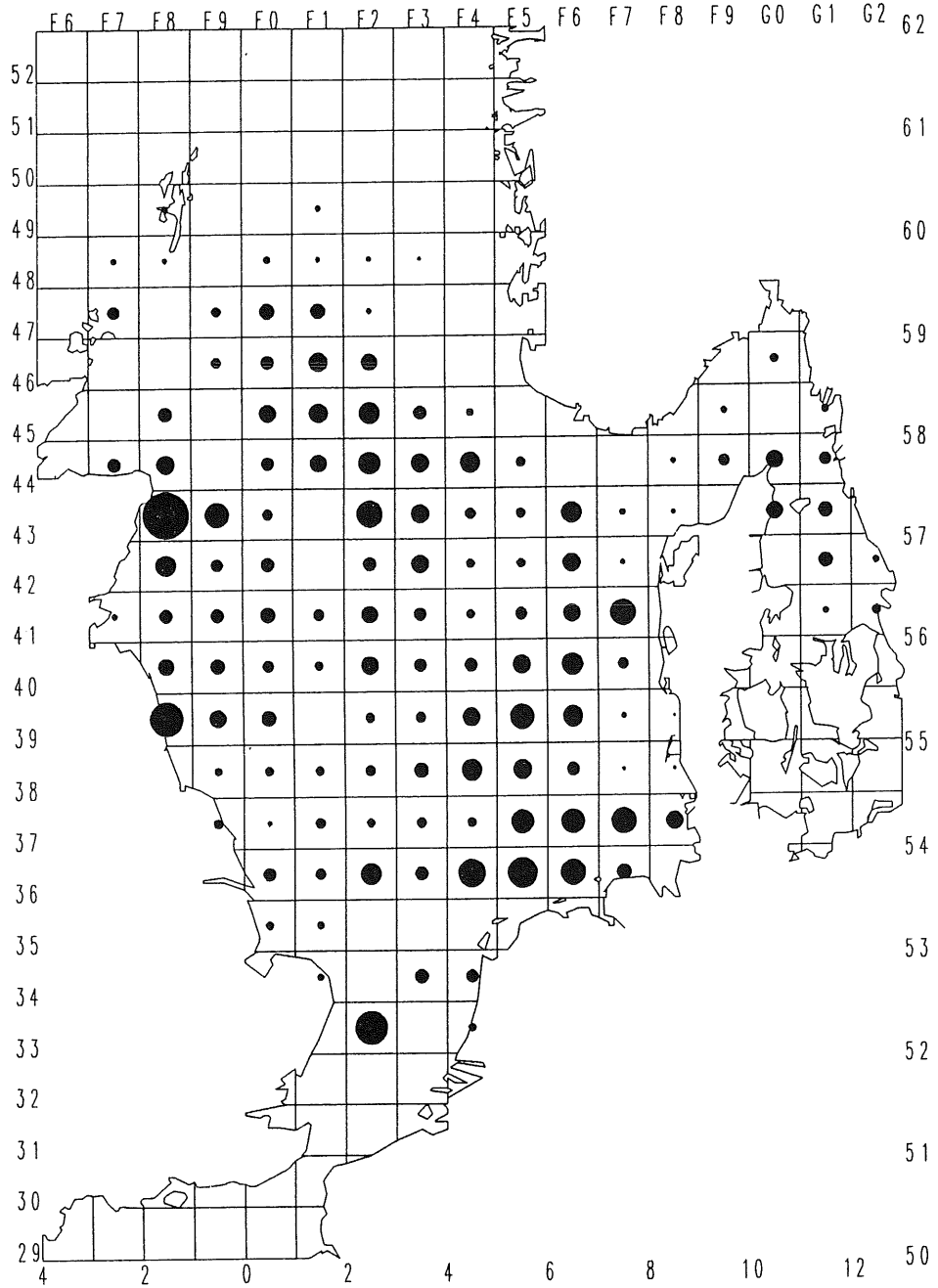


Figure 6.3 Herring larvae: mean abundance per statistical rectangle. Surface of black dots represents densities in no m⁻², the surface of the circles that extend to the borders of a statistical rectangle represents 1.8 larvae m⁻². Year class 1990 sampled in February 1991.

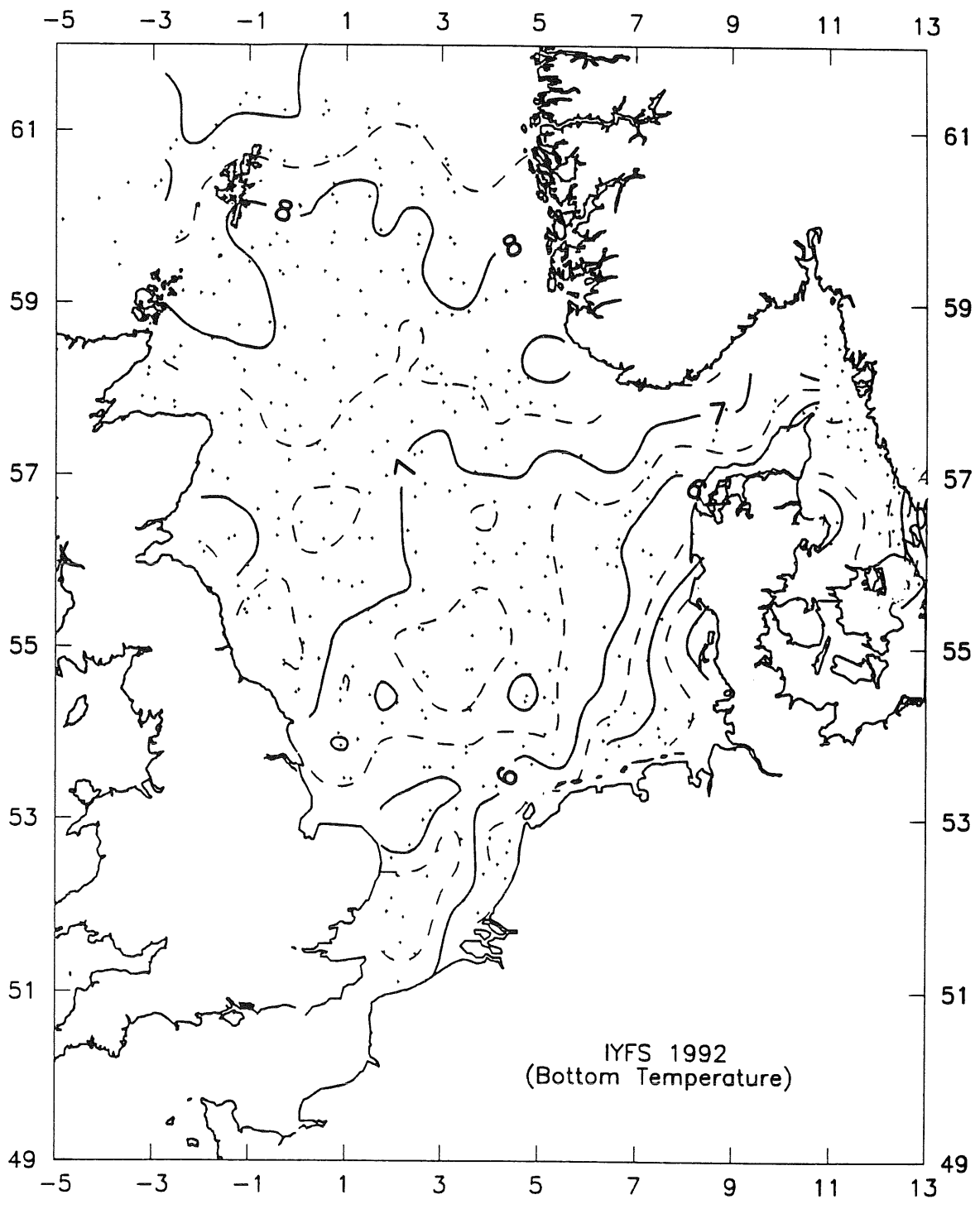


Figure 7.1

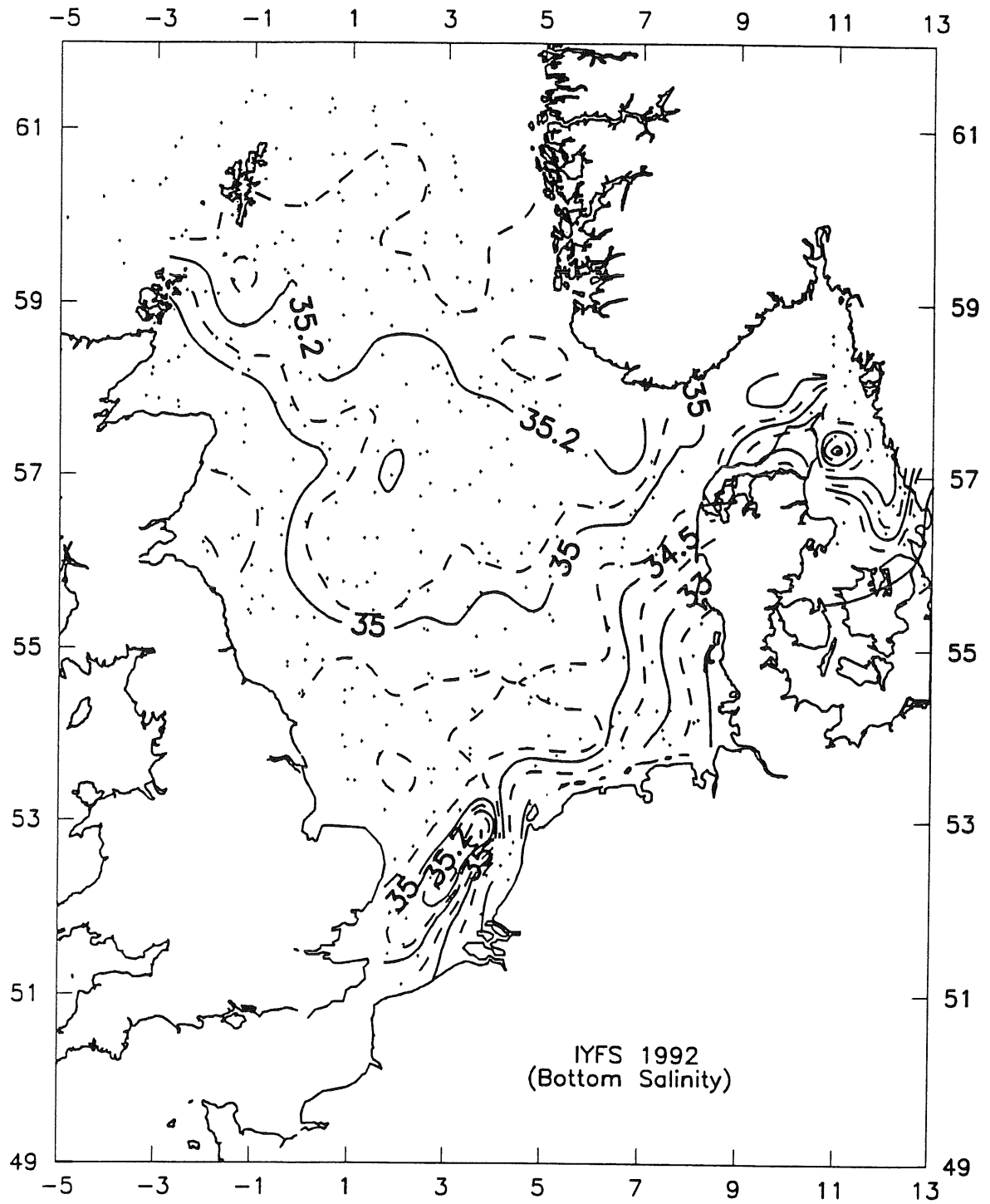


Figure 7.2