

**This report not to be quoted without prior reference to the Council\***

International Council for the  
Exploration of the Sea

C.M.1993/H:49  
Ref. C + G

**REPORT ON THE INTERNATIONAL BOTTOM TRAWL SURVEY IN THE NORTH SEA,  
SKAGERRAK AND KATTEGAT IN 1993: QUARTER 1**

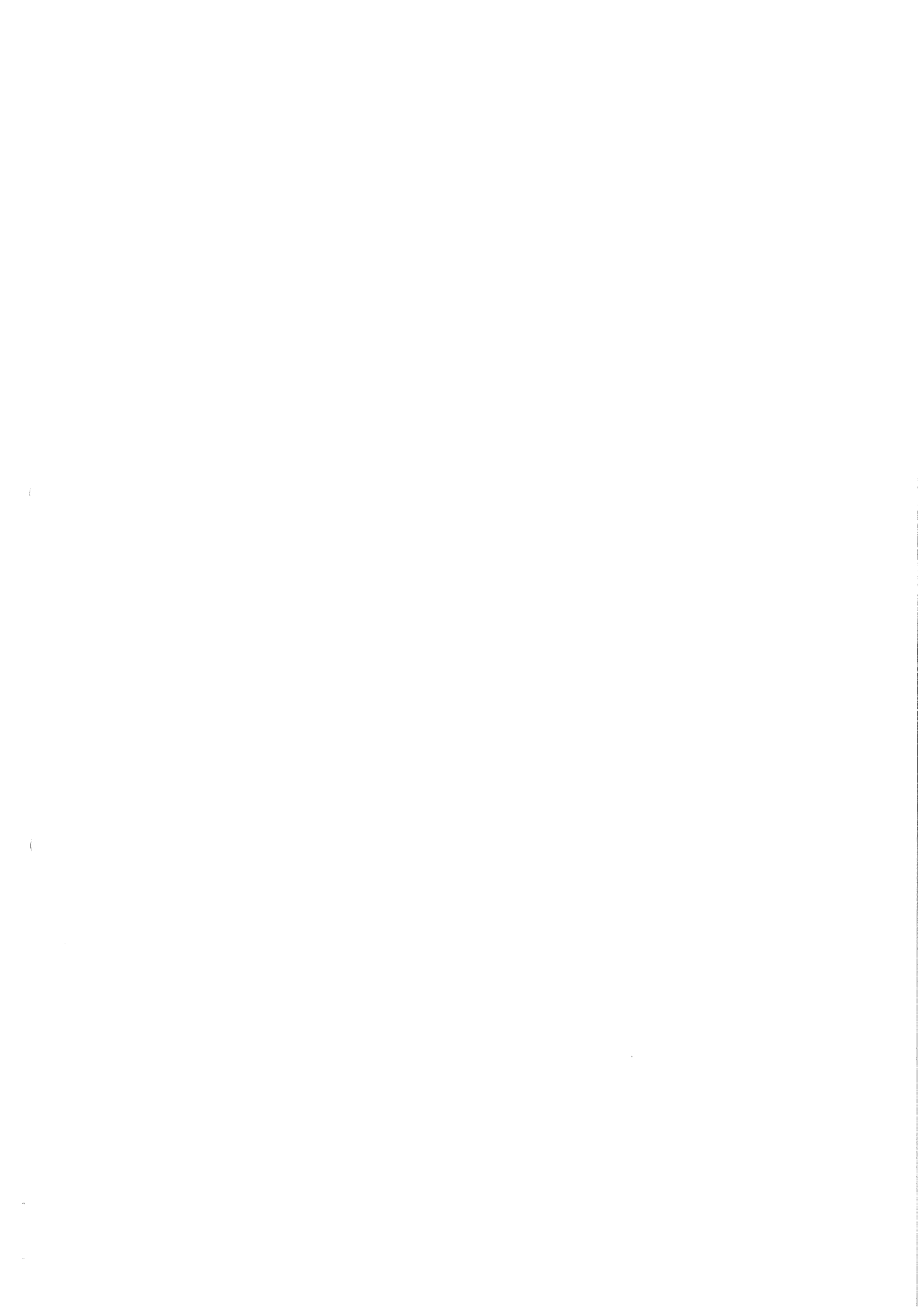
by

The International Bottom Trawl Survey Working Group

This document is a report of a Working Group of the International Council for the Exploration of the Sea and does not necessarily represent the views of the Council. Therefore, it should not be quoted without consultation with the General Secretary.

---

\*General Secretary  
ICES  
Palægade 2-4  
DK-1261 Copenhagen K  
DENMARK



## CONTENTS

1	INTRODUCTION . . . . .	1
2	SURVEY METHODS AND PARTICIPATION . . . . .	1
3	DATA AVAILABLE . . . . .	1
4	STANDARD OUTPUT FROM THE ICES IBTS 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 1993 . . . . .	4
7	HYDROGRAPHIC DATA . . . . .	4
	7.1 Hydro-chemistry Survey . . . . .	4
8	REFERENCES . . . . .	4
	Tables 3.1 - 7.2 . . . . .	6
	Figures 5.1 - 7.2 . . . . .	14



## 1 INTRODUCTION

This report presents the final results for the International Bottom Trawl Survey in February/March 1993. The survey was formerly named 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 (Addendum to ICES Doc. C.M. 1992/H:3). Details on the participation in the 1993 survey are given below. The effort of one of the participating countries was limited due to the oil spill at Shetland early February.

Country	Vessel	Period	Number of hauls	
			GOV	MIK/IKMT
Denmark	"Dana"	5-2/18-2	43	94
France	"Thalassa"	17-1/31-1	51	0
Germany	"W. Herwig"	23-1/11-2	65	0
Netherlands	"Tridens"	2-2/25-2	48	} 41
	"Isis"	16-2/25-2	26	
Norway	"Michael Sars"	5-2/1-3	48	86
Sweden	"Argos"	8-2/25-2	46	51
UK Scotland	"Scotia"	4-2/24-2	50	56

## 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 1993 survey presented in this report all final data were available in the data base except for Danish age-length keys for herring and sprat.

## 4 STANDARD OUTPUT FROM THE ICES IBTS 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 < 20cm, sprat < 10cm, mackerel < 20cm, cod <

25cm, haddock < 20cm, whiting < 20cm and Norway pout < 15cm) 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 was 374 of which 313 were daylight hauls which were used for the analysis of the herring data.

Per species a set of figures gives 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

Indices for 1- and 2-ringed herring are presented in Table 5.2 and mean numbers per rectangle are given in Figures 5.3 to 5.5. It should be noted that the term "age group" in herring refers to number of winter rings and not to years. The herring in the sampling area are mainly autumn spawners. This means that age group 1 in February 1993 represents year class 1991.

The abundance of 1-ringed herring in the North Sea was much lower than in Skagerrak and Kattegat. This presented a problem to the Herring Assessment Working Group for the Area South of 62°N when they had to predict the strength of this year class. If the index for the standard area in the North Sea was used as the best estimator, the year class was predicted to be below average. However, if the strength of the year class was estimated on the basis of the mean abundance for the whole survey area, including Division IIIa, the year class was expected to be quite strong. The Herring Assessment Working Group for the Area South of 62°N used the latter index for their stock predictions (Anon. 1993).

The distribution of 2-ringed herring was very irregular, as usual. The survey average was driven largely by one exceptional haul off the Moray Firth. It is generally accepted that the index for 2-ringed herring is an imprecise estimator of year class size.

## 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.

The increasing trend in sprat abundance continued in 1993. Both the 1- and 2-group index were higher than in the previous three years. The 1-group sprat occurred in high numbers over a large part of the south-eastern central North Sea. The high survey index, therefore, is probably a realistic estimator of year-class strength. The 2-group sprat also occurred in relatively high numbers in the survey area. The distribution of this age group also extended into the southern and western central North Sea.

## 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.

Both 1- and 2-group mackerel were found mainly at the northern periphery of the survey area. There is as yet no large scale overwintering of juvenile mackerel in the

North Sea, and consequently the first quarter IBTS does not provide good estimates of year-class strength for this stock.

## 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 distribution of the 1992 year class of cod caught during the 1993 survey was generally confined to a band stretching from the English northeast coast to the Skagerrak. The index value is only slightly less than that for the 1-group caught during the 1992 survey and is the sixth highest in the last 15 years. However, this value resulted from high catches made in a small number of rectangles and it is still well below the series average.

The 1991 year class as two-year-old fish was dispersed throughout the survey area with the bigger catches coming from the central and northern North Sea, and remarkably low catches in the German Bight. Three rectangles produced more than 100 fish per hour and another 13 more than 50 per hour. This combined to produce the third highest index value from the last fifteen years and one somewhat above the series average. This increases the year-class strength as indicated by the one-year-old index value of the 1992 survey. Above average catches of this year class, both at age one and at age two, were made in rectangles outside the standard area (see also Anon., 1992).

## 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.

High catch rates of the 1992 year class of haddock over most of the standard area produced the largest index value for one-year-olds in the whole 23 year series, a value more than twice the series average. Two of the strongest year classes in the IYFS series have appeared in consecutive years (1991 and 1992 year classes), following three of the weakest ones (1987, 1988 and 1989 year classes) and one of moderate strength (1990 year class).

Good catches of two-year-old haddock (1991 year class) were also well distributed throughout the standard area, zero catches only appearing around the southern edge. The index value, although quite high at one and a half times the series average, does not fully support the indicated strength of the 1991 year class when sampled as one-year-olds (twice the series average). As with cod, some large catches were made outside the standard area.

## 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 1088 for one-year-old whiting (1992 year class) is the third highest recorded and almost twice the long term average. Four of the five highest values have occurred during the last five years, continuing the trend in strong year classes. The higher catch rates were encountered in the western part of the North Sea, with three coastal rectangles producing in excess of 10,000 per hour and two further ones (one of which was outside the standard area) producing only slightly less.

Catches of two-year-old fish (1991 year class) were generally very low in the southern and eastern-central North Sea, a marked deviation from the distribution pattern of the previous ten years. The higher catches were made in the western parts of the central and northern North Sea. The index value at 524 is the lowest for seven years and at only 25% above the long term average now suggests a weaker 1991 year class than the level indicated by the one-year-old estimate during the 1992 survey.

## 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 (1992 year class) were distributed throughout the standard area with notable catches in the vicinity of rectangle 43F1 and along the western edge of the Norwegian Deep. The index value, at a little below the series average and only half that for the record 1991 year class, was still higher than those for the four preceding year classes (1987-90).

The 1991 year class which produced a record index value as one-year-olds has also produced a record index value as two-year-olds, more than three and a half times the series average. The distribution followed the normal pattern of higher catches being made in the vicinity of Shetland and Orkney. Some of those catches this year were substantial. The previous highest index value of two-year-old Norway pout (1973 year class) was followed by three of the highest index values of one-year-olds (1974-76 year classes).

### 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.

The final indices for 1- and 2-group 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 index of 1-ringed herring was 26,738. This value is high considering the relatively low index for the North Sea. All 1-ringed herring in 1993 was classified as North Sea autumn spawners.

Based on length and vertebral counts, about 6% 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.

## COD

Preliminary and final indices are given in Table 5.5. Good catches of one-year-old cod in the Skagerrak have produced a record index value. At almost three times the series average this should indicate a very strong year class. However, the indication of an equally strong 1991 year class as one-year-olds (Anon., 1992) was not supported by the catches of two-year-old fish in this area. The index value produced being only half that of the long term average.

The 1992 year class of cod was less abundant in the Kattegat, the index value, at half of the series average, indicating a rather weak brood. The index value for two-year-olds, at one third the long term average, indicates a weak 1991 year class. As in the Skagerrak, this is much reduced from the one-year-old estimate of this year class.

## HADDOCK

The index value for haddock <20cm was the highest recorded in the fourteen year series, more than four times greater than the average. This value was, however, derived from very high catches in the western part of the Skagerrak. Small haddock were rather scarce elsewhere in Division IIIa.

## WHITING

Whiting of <20cm were well distributed throughout Division IIIa and produced an index value of 1359, 30% above the series average. The seven highest index values have appeared in the last eight years.

## 6 RESULTS OF SAMPLING OF LARVAE IN 1993

This year all participants used the MIK as sampling gear. Thus, catches are now directly converted to densities of larvae, assuming a 100% efficiency of the MIK in catching larvae at night (P. Munk, unpubl. results).

Abundance of larvae below a certain surface area is estimated according to:

Density (no m<sup>-2</sup>) = (no caught / [distance towed (m) \* netopening m<sup>2</sup>]) \* water depth (m).

The opening of the 2m ring is 3.14 m<sup>2</sup>, distance towed is measured by a calibrated flowmeter in centre of the frame.

The number of larvae within a statistical rectangle is approximated by multiplying the density found by the approximate surface area of a rectangle (309 \* 10<sup>7</sup> m<sup>2</sup>). The total number of larvae in the sampled area (the MIK-index) is the sum of estimates for all statistical rectangles.

Based on a series of comparative hauls a conversion factor between catchability of the IKMT, used in earlier years, and the MIK is estimated. This is used to convert earlier years catches to total numbers.

## HERRING

In all, 318 hauls were made. This years distribution differed markedly from observations made in previous years (Fig 6.1). Usually the major concentrations were found in eastern parts of the North Sea, contrary to this the 1992 year class was predominantly distributed in the western North Sea. The larvae in the western North Sea are usually smaller than elsewhere. This is also the case this year, and consequently the overall mean size of larvae is smaller than usual.

The index value is relatively high (Table 6.1). It is slightly lower than the value of the 1991 year class, but of a magnitude equal to the abundances in the mid-eighties.

Contrary to the MIK-index estimates used by the Herring Assessment Working Group in 1993, the present final indices were calculated after the Scottish data became available. The two estimates, however, differ only slightly.

## 7 HYDROGRAPHIC DATA

### 7.1 Hydro-chemistry Survey

Eight ships contributed hydrographic data to the 1993 data set. The data set consists of 370 stations worked between 17 January and 25 February. Because of data quality problems (errors approaching 0.5 in salinity), 97 stations were rejected with the permission of originators (see C.M. 1993/C5). Nutrient data were supplied for 120 of these stations, contributions being received from 4 ships. Past nutrient data collected during the IYFS provided an essential contribution to the investigation of North Sea nutrient trends, and these new data will provide the basis of future similar studies.

Charts of the distribution of bottom temperature and salinity are given in Figs 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/IBTS(1) surveys from 1972 to 1993 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, especially so far as temperature is concerned. This reflects the continuing sequence of very mild winters with frequent westerly type weather. However, the distribution of salinity showed some marked changes in comparison to recent years. The presence of very high salinity water in parts of the Southern Bight in 1991 and 1992 declined somewhat, although there were still some small areas with salinity approaching 35.5. The most marked changes occurred however in the central, and eastern part of the North Sea, arising from an unusually large penetration of high salinity water from the North. In the neighbourhood of 57°30'N; 4°E salinity levels were far higher than observed since the start of this series of observations. A similar penetration not appear to have occurred since 1973. In contrast, salinity levels in the western North Sea, especially off the Scottish coast, were lower than typically occurs.

## 8 REFERENCES

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



Anon. 1992. Report of the International Bottom Trawl Survey in the North Sea, Skagerrak and Kattegat in 1992: Quarter 1. ICES Doc. C.M.1992/H:20.

Anon. 1993. Report of the Herring Assessment Working Group for the Area South of 62°N. ICES Doc. C.M.1993/Assess:15.

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

Table 3.1 Data available in the ICES IBTS data base as at 23 August 1993.  
First Quarter.

+ = Data available  
- = No data available  
x = No survey made

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	-	-	+	+	+	+	+	+	+ <sup>1</sup>
Sweden	-	-	+	+	+	+	+	+	+
UK England	+	+	+	+	+	+	+	+	+
UK Scotland	+	+	+	+	+	+	+	+	+
USSR	+	+	x	x	x	x	x	x	x

Country	1990	1991	1992	1993
Denmark	+	+	+	+
France	+	+	+	+
Germany	+	+	+	+
Netherlands	+	+	+	+
Norway	+	+	+	+
Sweden	+	+	+	+
UK England	+	x	x	x
UK Scotland	+	+	+	+
USSR	x	x	x	x

<sup>1</sup>No Smalk records for Herring.

Table 5.1 Preliminary 1993 IYFS indices for 1-group fish based on a split of the length distribution, and final indices for the North Sea

	Preliminary	Final
Herring	2,267	1,995
Sprat	1,725	1,692
Mackerel	0.8	1.0
Cod	15.8	12.7
Haddock	1,147	1,242
Whiting	972	1,087
Norway pout	3,078	2,681

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*	age 1	age 2	age 1	age 2	age 1	age 2	age1	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	-	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	877	1,121	340	6.9	0.4	2.4	4.5	679	371	1,014	748	2,497	902
1991	1,995	-	1,561	588	16.0	0.8	13.0	19.9	1,115	543	916	524	5,121	2,644
1992	-	-	1,692	-	1.0	-	12.7	-	1,242	-	1,087	-	2,681	-

\* Total North Sea

Table 5.3 Age composition of the standard species in 1993 within the relevant standard area in the North Sea

Age group	1	2	3	4	5	6+
Herring	1 995.0	570.3	225.0	15.1	30.7 <sup>1</sup>	-
Sprat	1 692.3	587.6	82.1	4.3	0.1 <sup>1</sup>	-
Mackerel	1.0	0.8	0.9	0.4	0.2	0.3
Cod	12.7	19.9	2.0	0.7	0.6	0.4
Haddock	1 242.8	543.6	154.5	8.9	1.1	1.0
Whiting	1 087.6	524.2	244.8	65.6	59.1	11.5
Norway pout	2 681.4	2 644.1	258.5	6.0	7.0	0.1

<sup>1</sup>Plus-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	Total		Herring		Autumn-spawners		Sprat		
	1-ring	2-ring	1-ring	2-ring	1-ring	2-ring	1-group	2+group	Total
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	- *	1,867	- *	606	2,077	2,067	4,744
1986	21,489	2,738	- *	1,562	- *	1,176	684	4,834	5,518
1987	11,733	3,671	- *	2,921	- *	949	1,830	16,543	18,373
1988	67,753	10,095	- *	7,834	- *	2,161	945	8,238	9,183
1989	17,451	4,976	- *	0	- *	4,976	442	2,891	3,333
1990	3,544	3,876	0	3,192	3,544	684	503	471	974
1991	3,588	3,749	- *	480	- *	3,269	693	1,245	1,938
1992	5,057	1,934	0	771	5,057	1,163	5,380	1,698	7,078
1993	26,738	3,165	0	203	26,738	2,962	1,693	5,451	7,144

\* Separation 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 < 20cm.

Year Class	Cod 1-group Skagerrak		Cod 1-group Kattegat		Cod 2-group Skagerrak Kattegat		Whiting 1-group Prel.	Haddock 1-group Prel.
	Prel.	Final	Prel.	Final				
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	1379	57
1986	15	5	48	11	18	28	2178	251
1987	81	77	76	68	24	48	2978	125
1988	62	56	6	3	8	16	478	20
1989	25	31	131	153	25	112	2255	8
1990	42	9	39	19	5	20	1636	74
1991	119	96	64	64	16	38	1796	288
1992	171	110	40	31			1359	405

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 Text).

Area	North west	North east	Central west	Central east	South west	South east	Division IIIa	Southern Bight	O-ringers abundance
Area m <sup>2</sup> x 10 <sup>9</sup>	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
1992	0.164	0.039	0.652	0.438	0.734	0.268	0.345	0.285	187.5 *

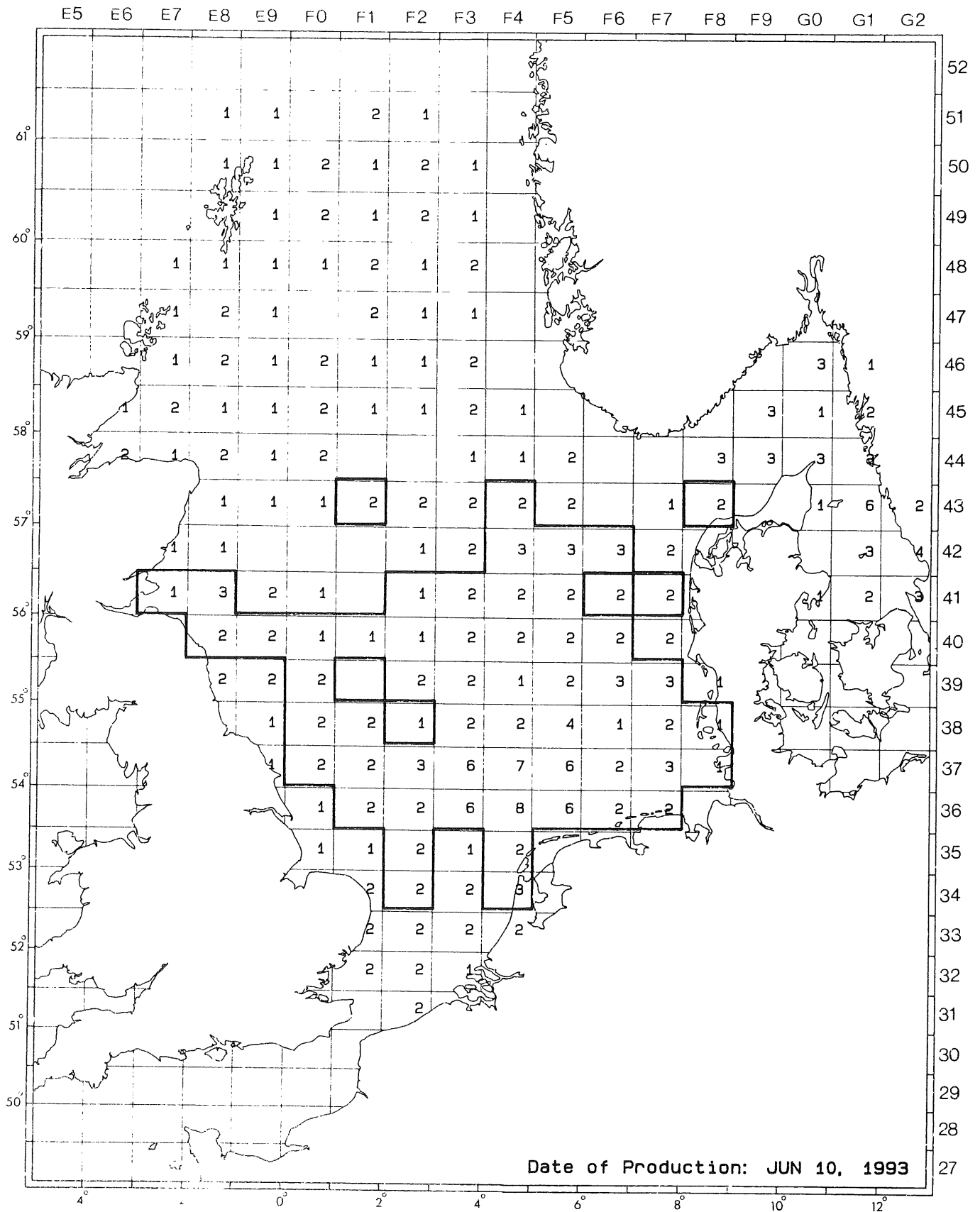
\* revised since the Herring Assessment W.G. meeting 1993



TABLE 7.1 Time series data of bottom temperature and salinity during IYFS/IBTS(1) 1972-1993

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
1993	7.4	5.31	6.5	4.92	6.4	5.18	6.5	5.30	6.5	5.05	6.2	5.00	5.4	4.95	4.3	3.50	5.6	4.80	6.0	5.00

# International Young Fish Survey 1993



Herring, CLUP HAR  
Number of Hauls.

Figure 5.1 Number of hauls used in the analysis of herring data 1993.

# International Young Fish Survey 1993

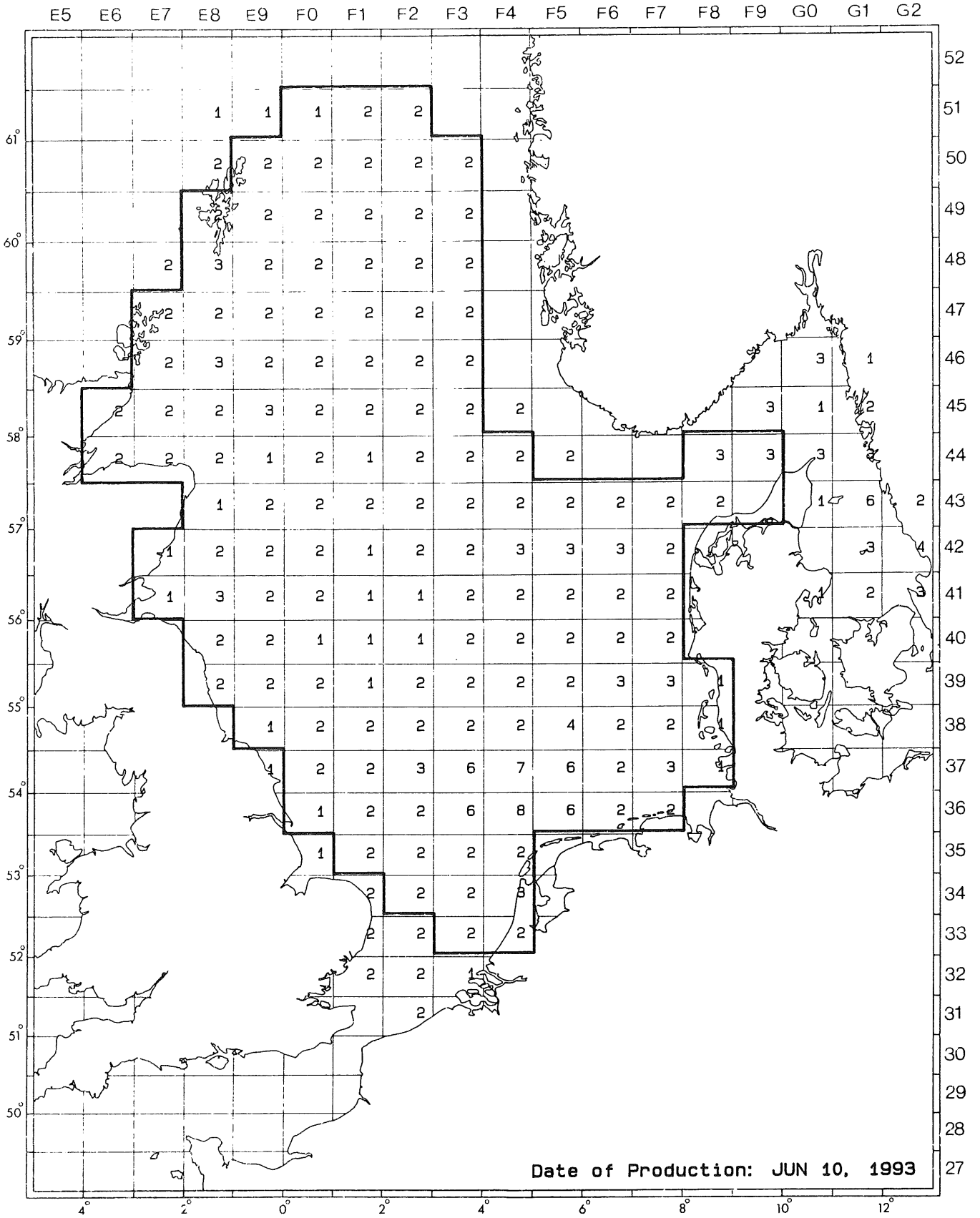
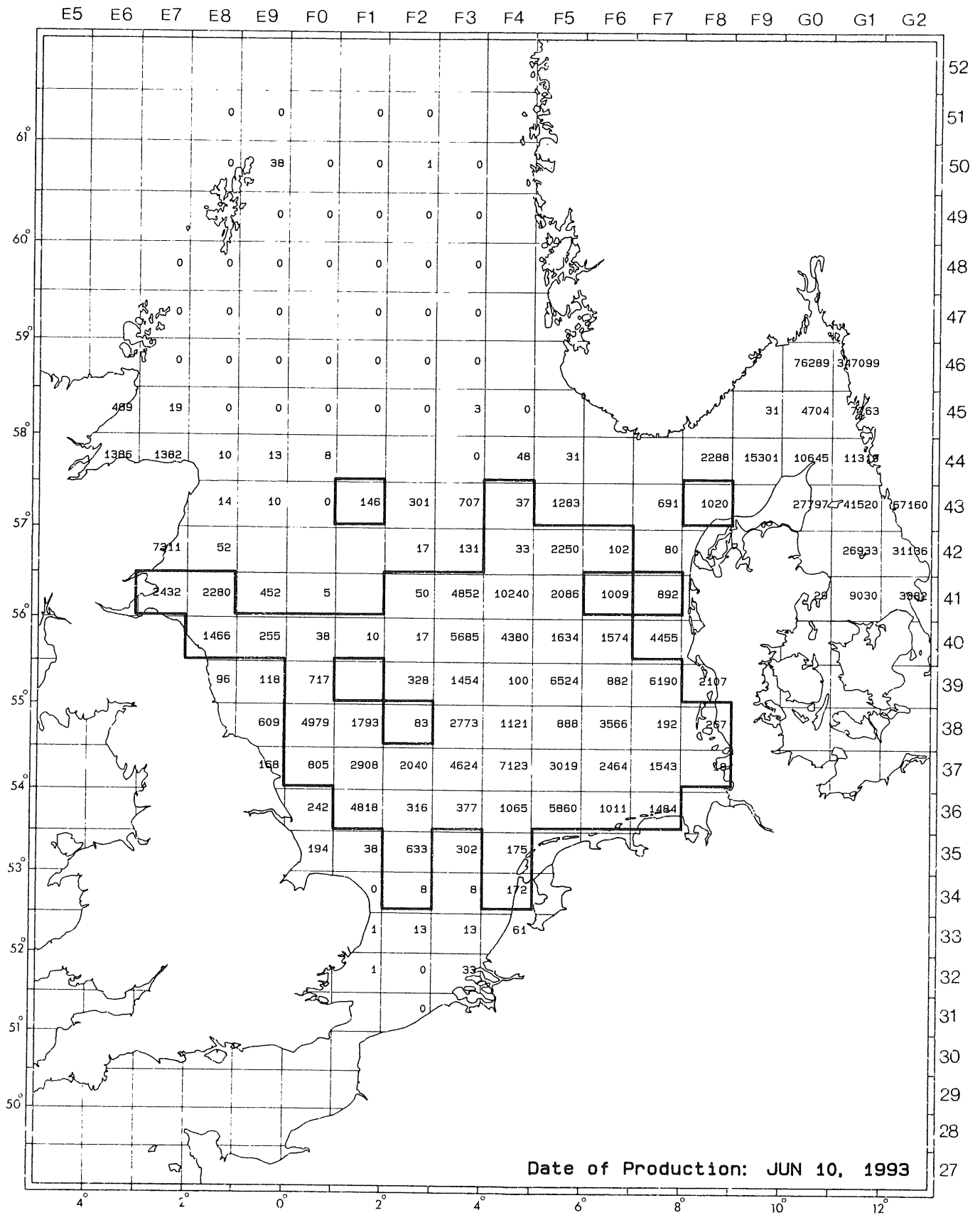


Figure 5.2 Number of hauls used in the analysis of data on sprat, mackerel, cod, haddock, whiting and Norway pout 1993.

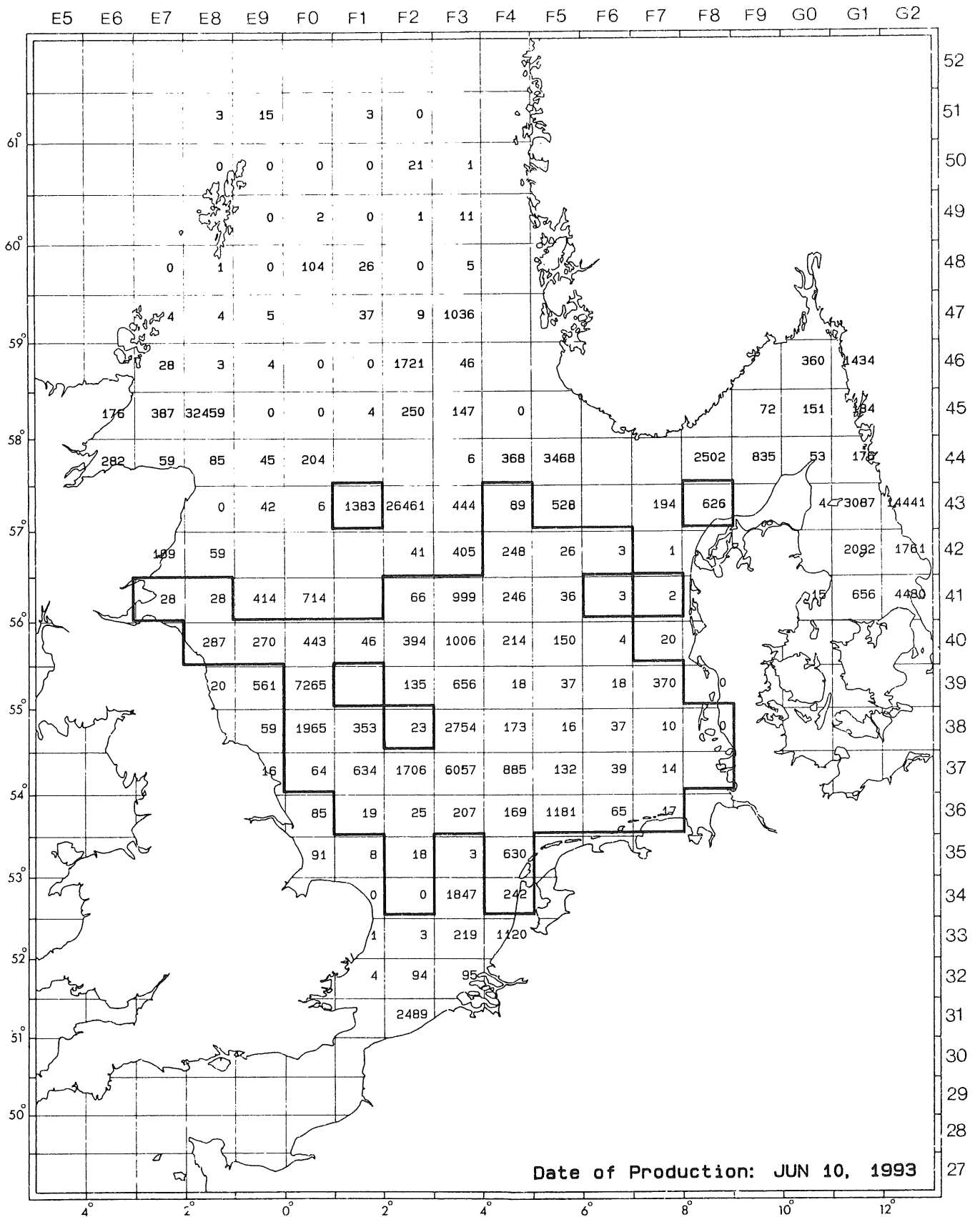
# International Young Fish Survey 1993



Herring, CLUP HAR  
 Number per Hour , Age Group 1.

Figure 5.3 Herring: number per hour, age group 1.

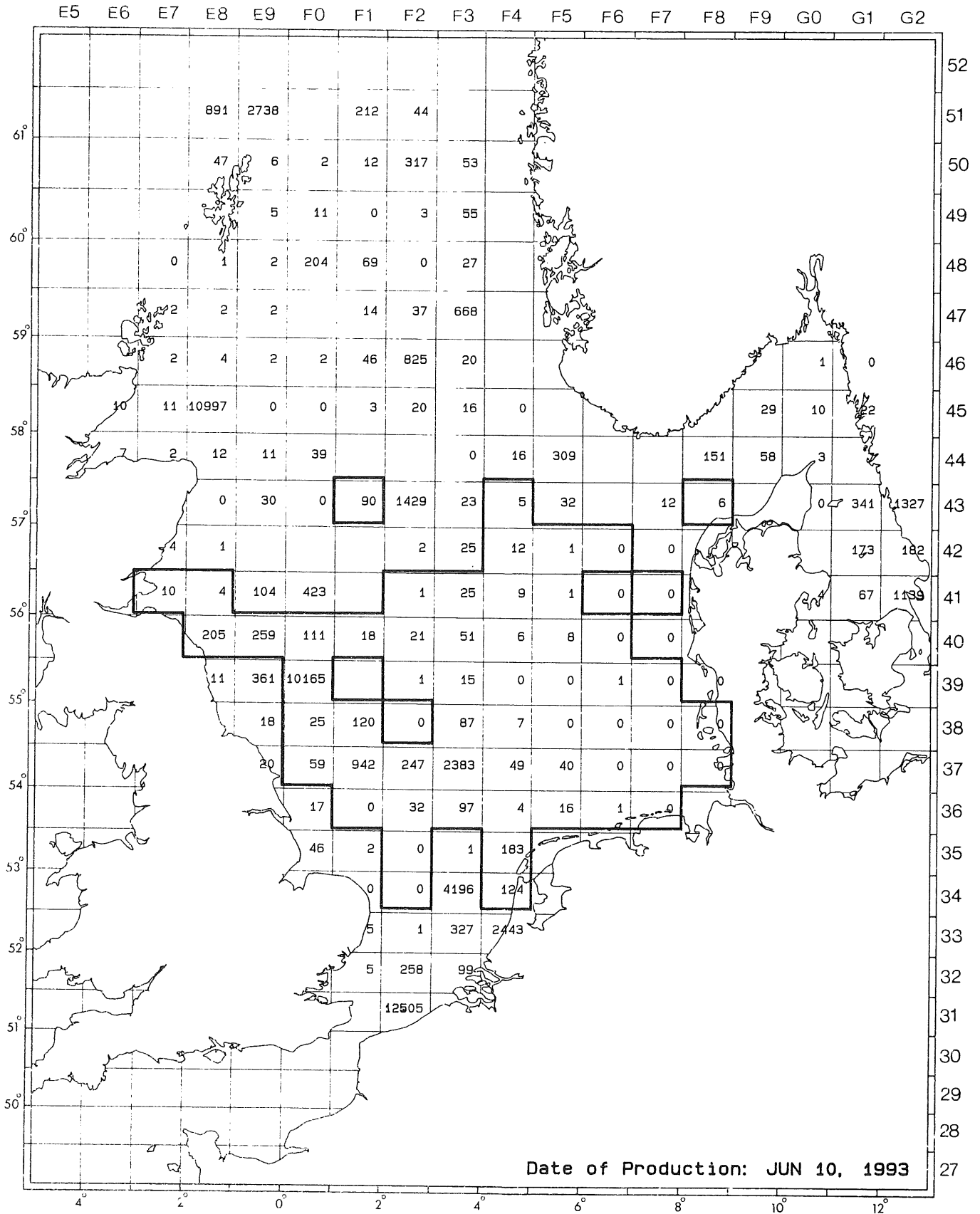
# International Young Fish Survey 1993



Herring, CLUP HAR  
 Number per Hour , Age Group 2.

Figure 5.4 Herring: number per hour, age group 2.

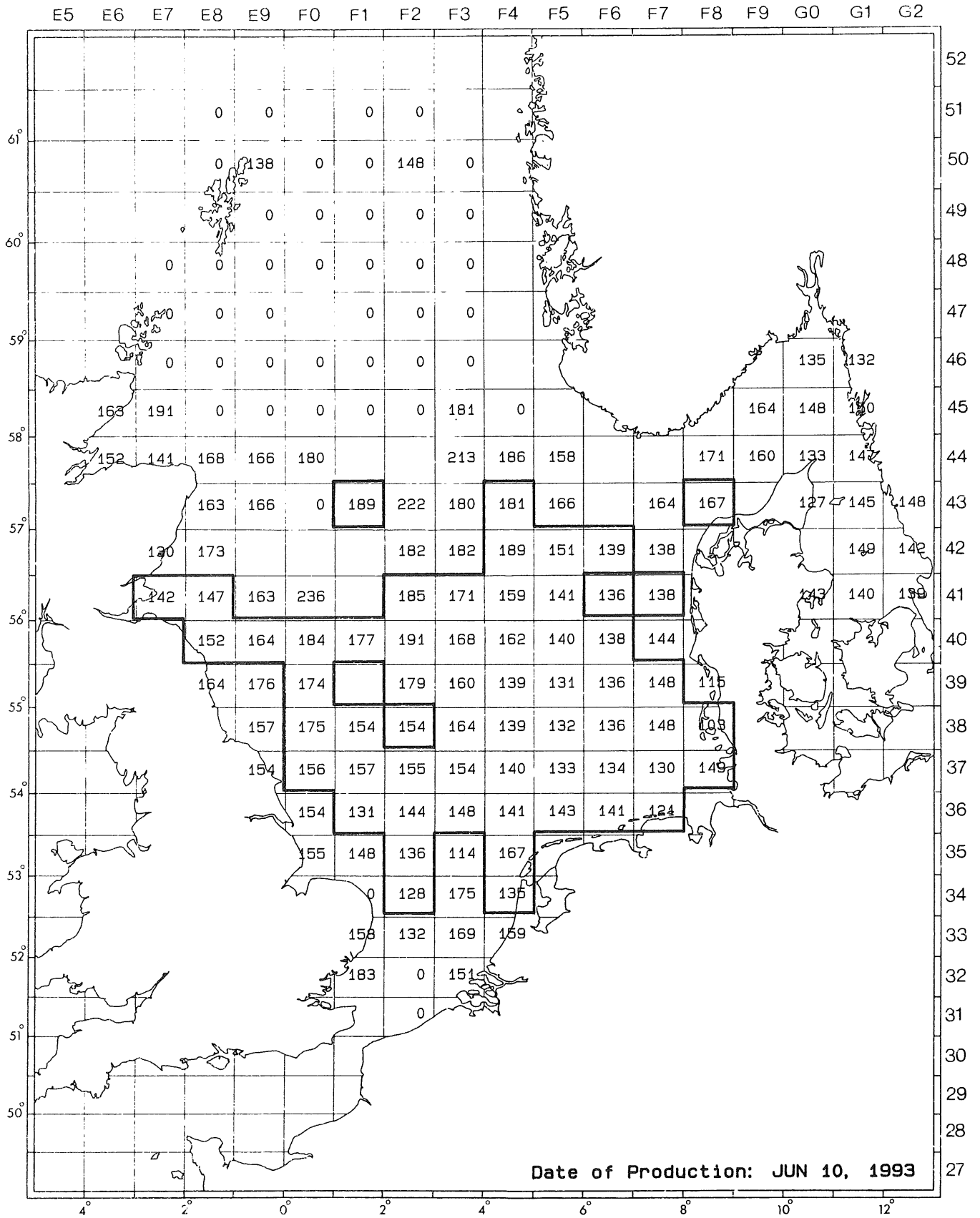
# International Young Fish Survey 1993



Herring, CLUP HAR  
 Number per Hour , Age Group 3+.

Figure 5.5 Herring: number per hour, age group 3+.

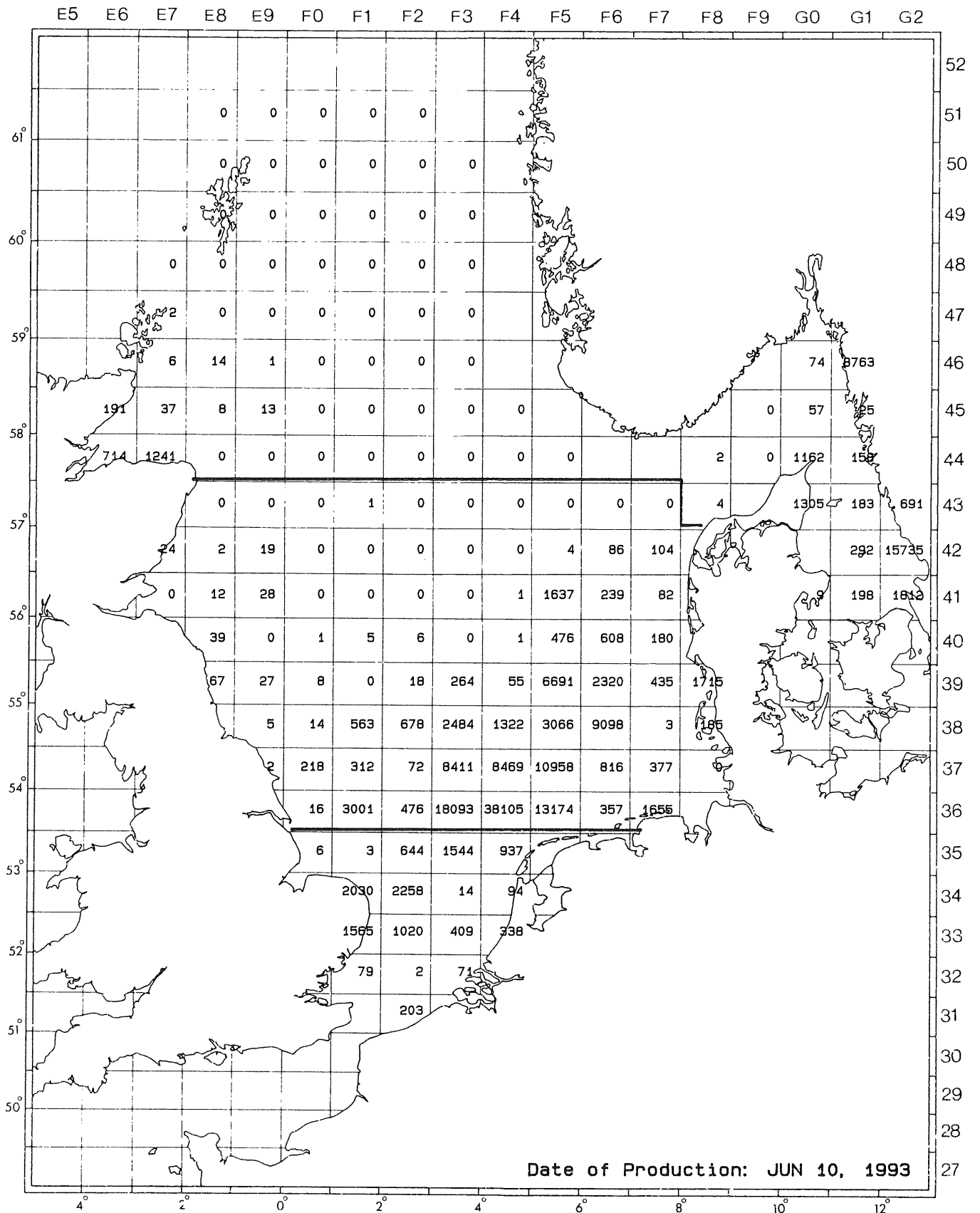
# International Young Fish Survey 1993



Herring, CLUP HAR  
Mean Length, Age Group 1.

Figure 5.6 Herring: mean length, age group 1.

# International Young Fish Survey 1993

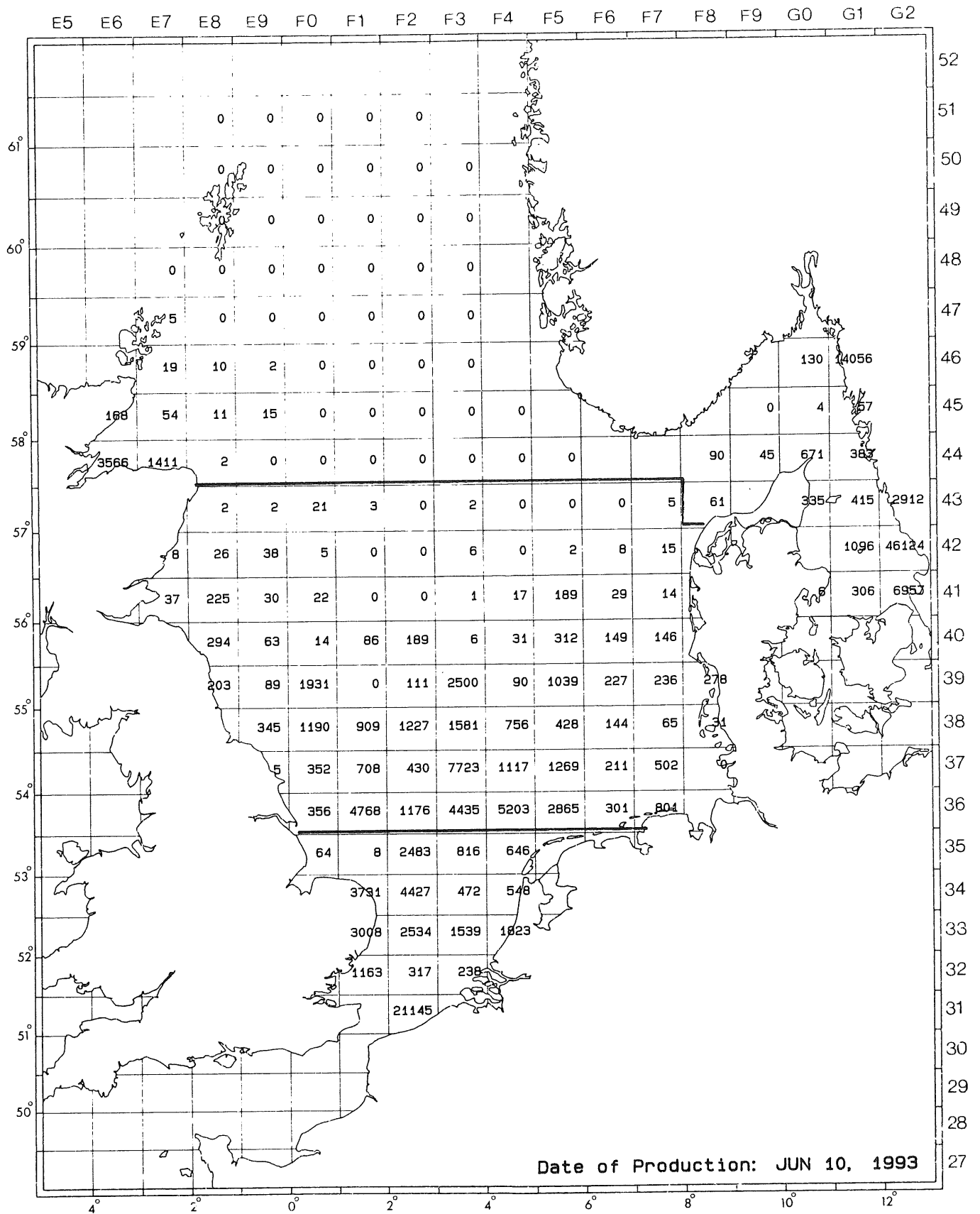


Sprat, SPRA SPR  
 Number per Hour , Age Group 1.

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



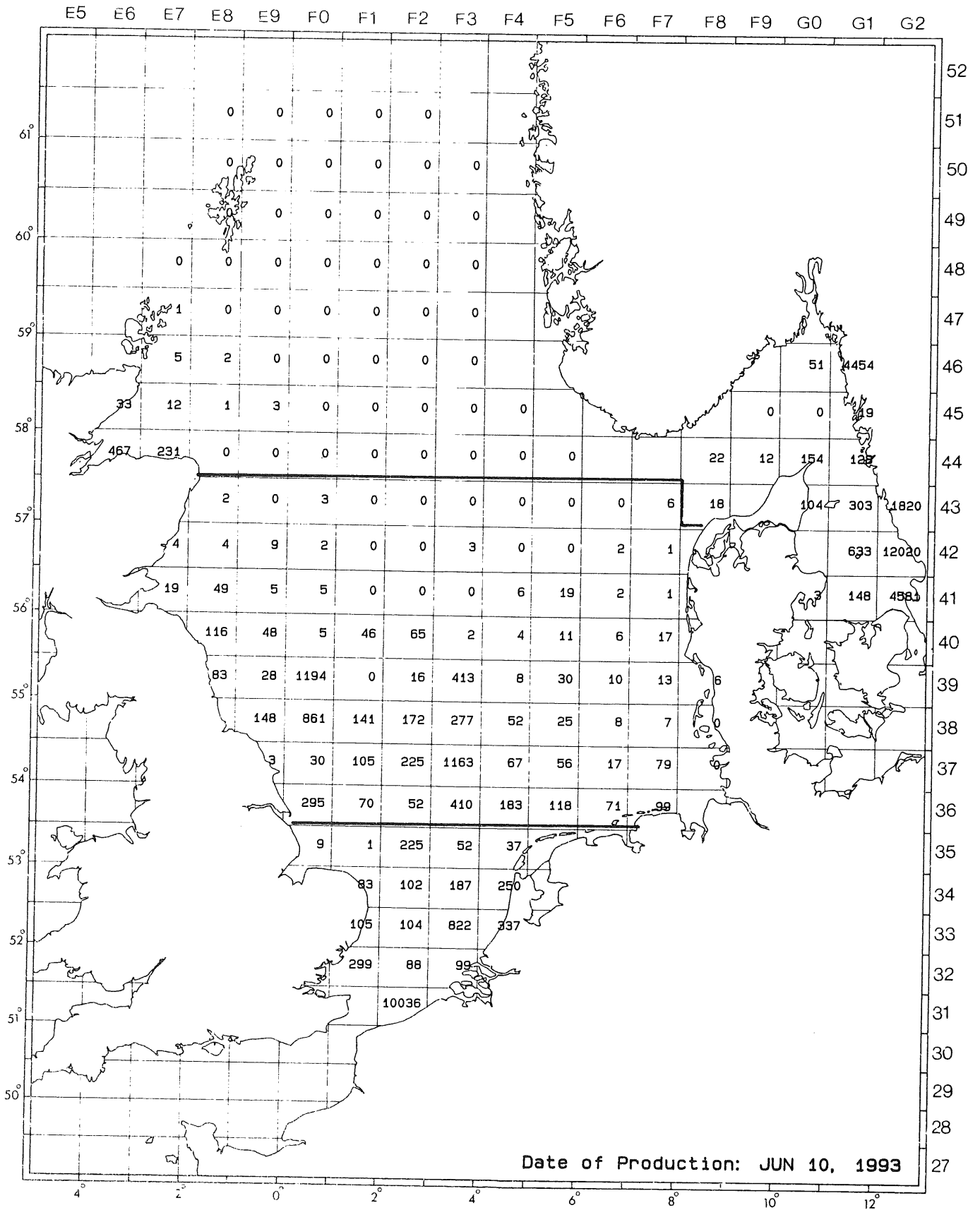
# International Young Fish Survey 1993



Sprat, SPRA SPR  
 Number per Hour , Age Group 2.

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

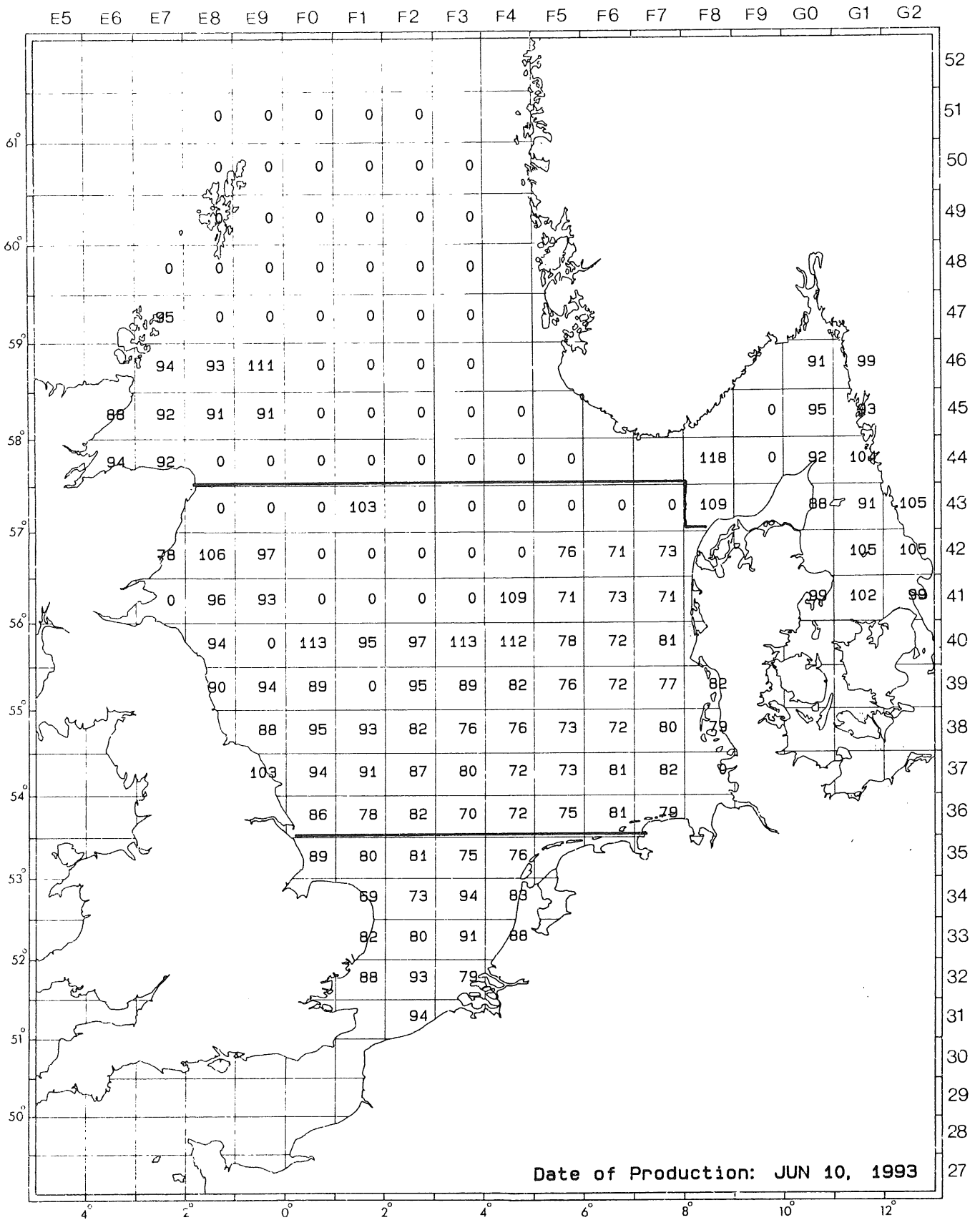
# International Young Fish Survey 1993



Sprat, SPRA SPR  
 Number per Hour , Age Group 3+.

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

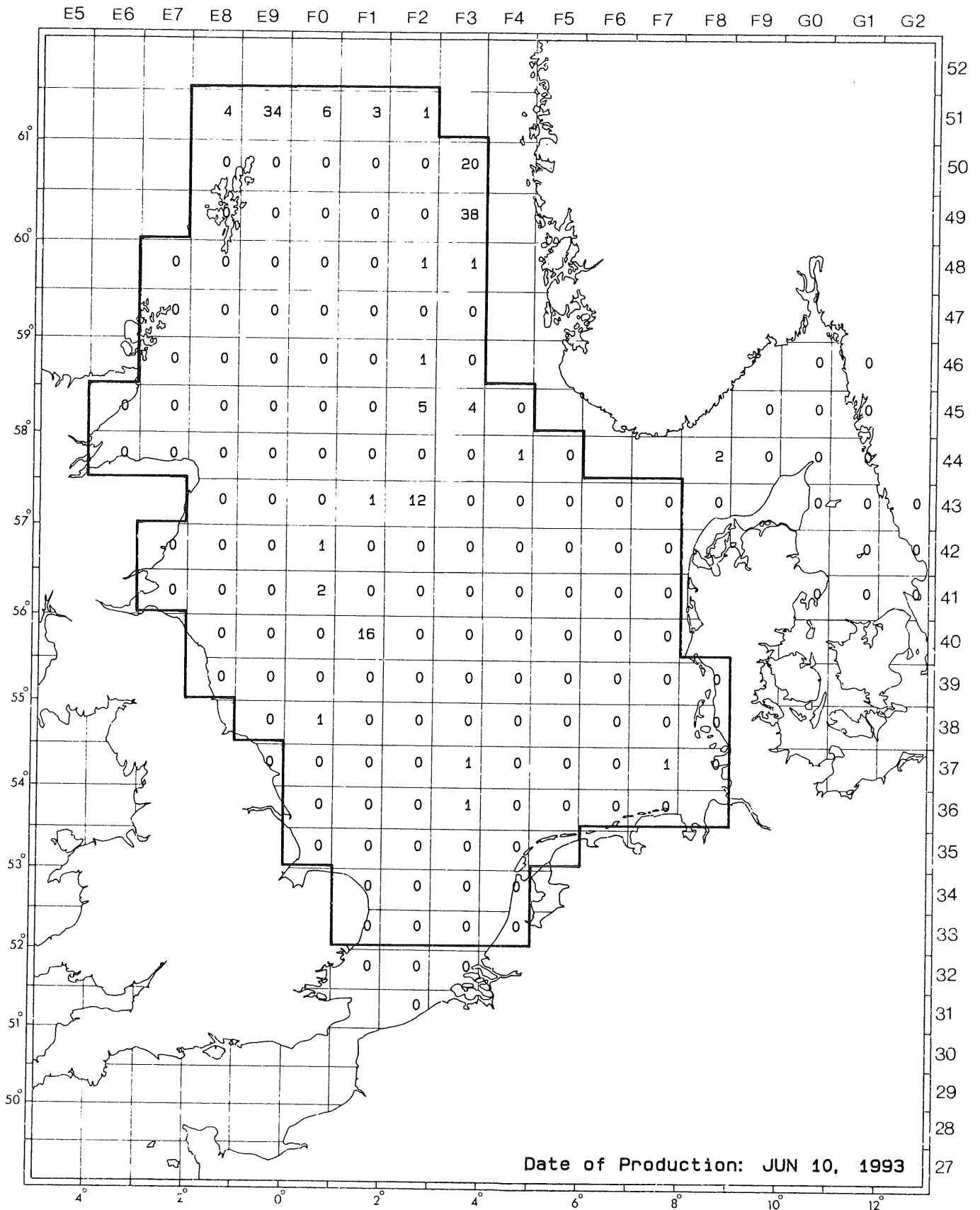
# International Young Fish Survey 1993



Sprat, SPRA SPR  
 Mean Length, Age Group 1.

Figure 5.10 Sprat: mean length, age group 1.

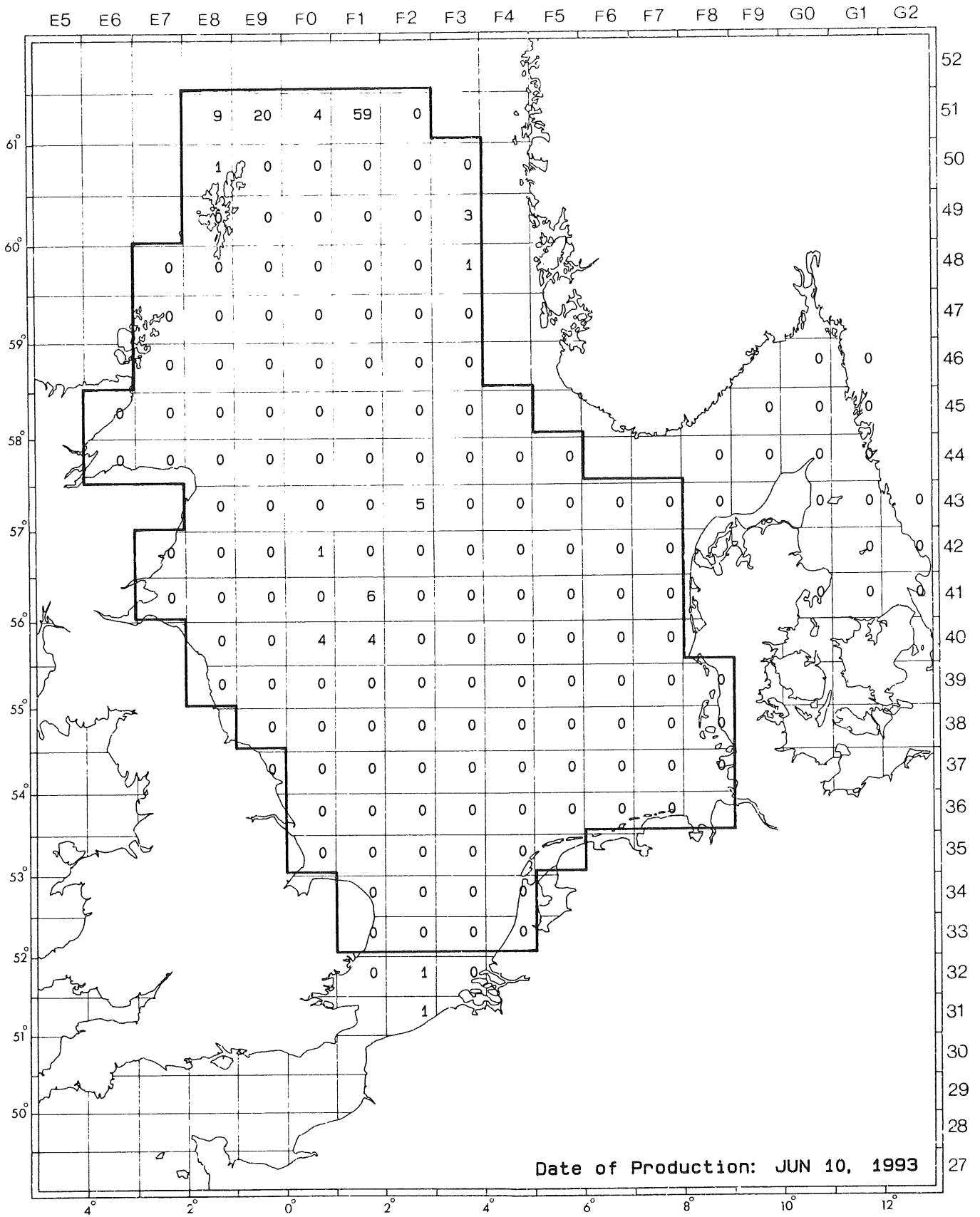
# International Young Fish Survey 1993



Mackerel, SCOM SCO  
 Number per Hour , Age Group 1.

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

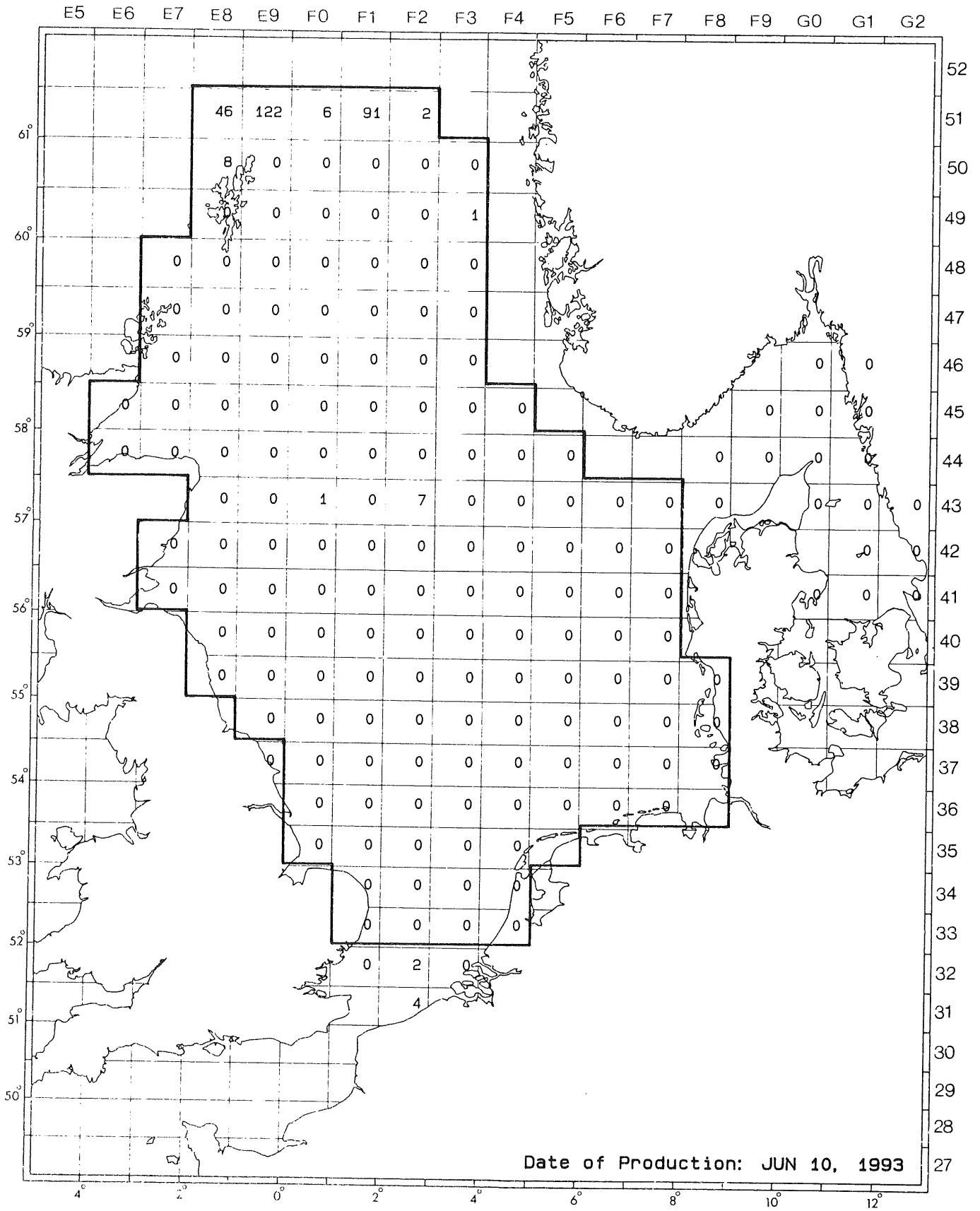
# International Young Fish Survey 1993



Mackerel, SCOM SCO  
 Number per Hour , Age Group 2.

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

# International Young Fish Survey 1993

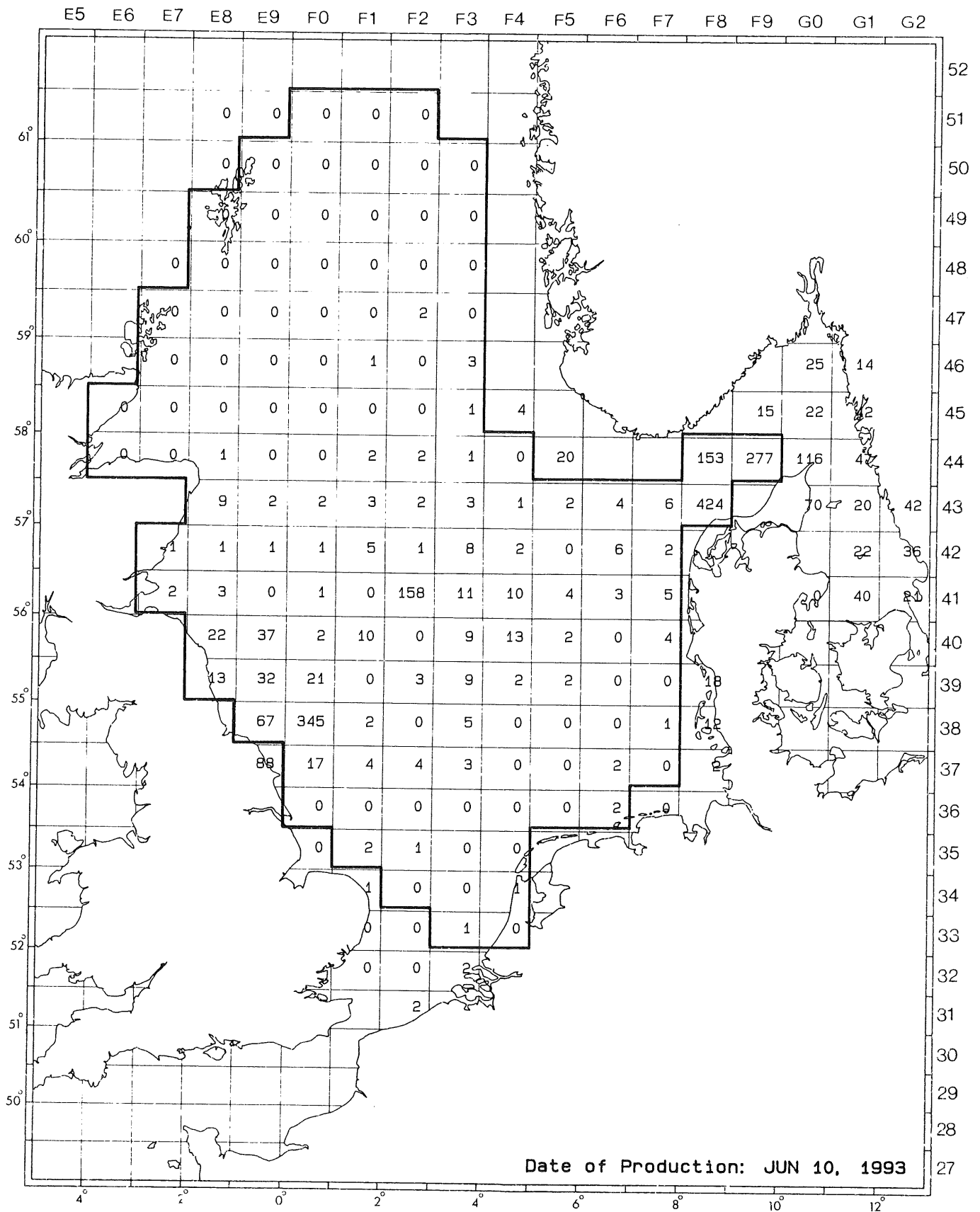


Mackerel, SCOM SCO  
 Number per Hour , Age Group 3+.

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



# International Young Fish Survey 1993

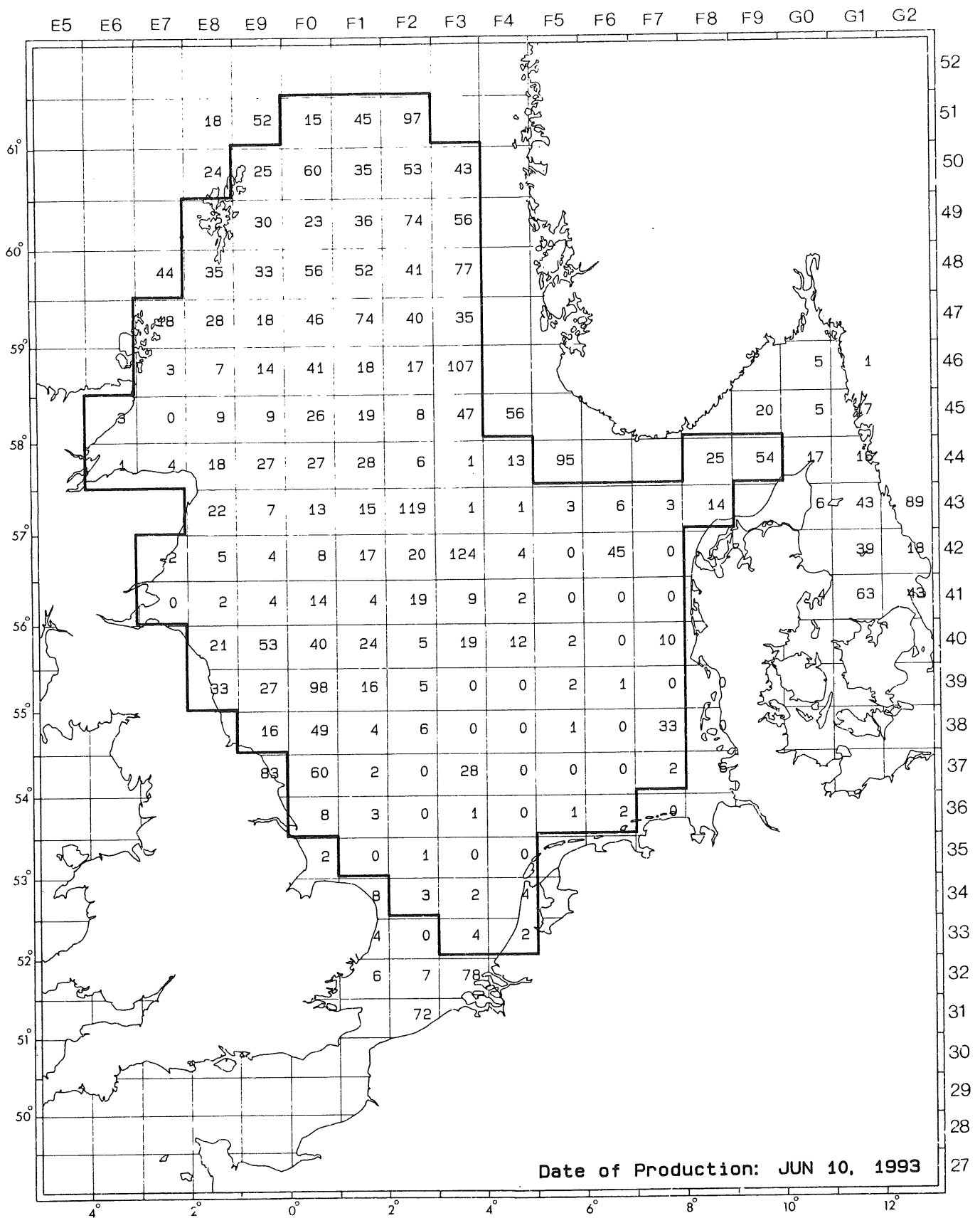


Cod, GADU MOR  
 Number per Hour , Age Group 1.

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



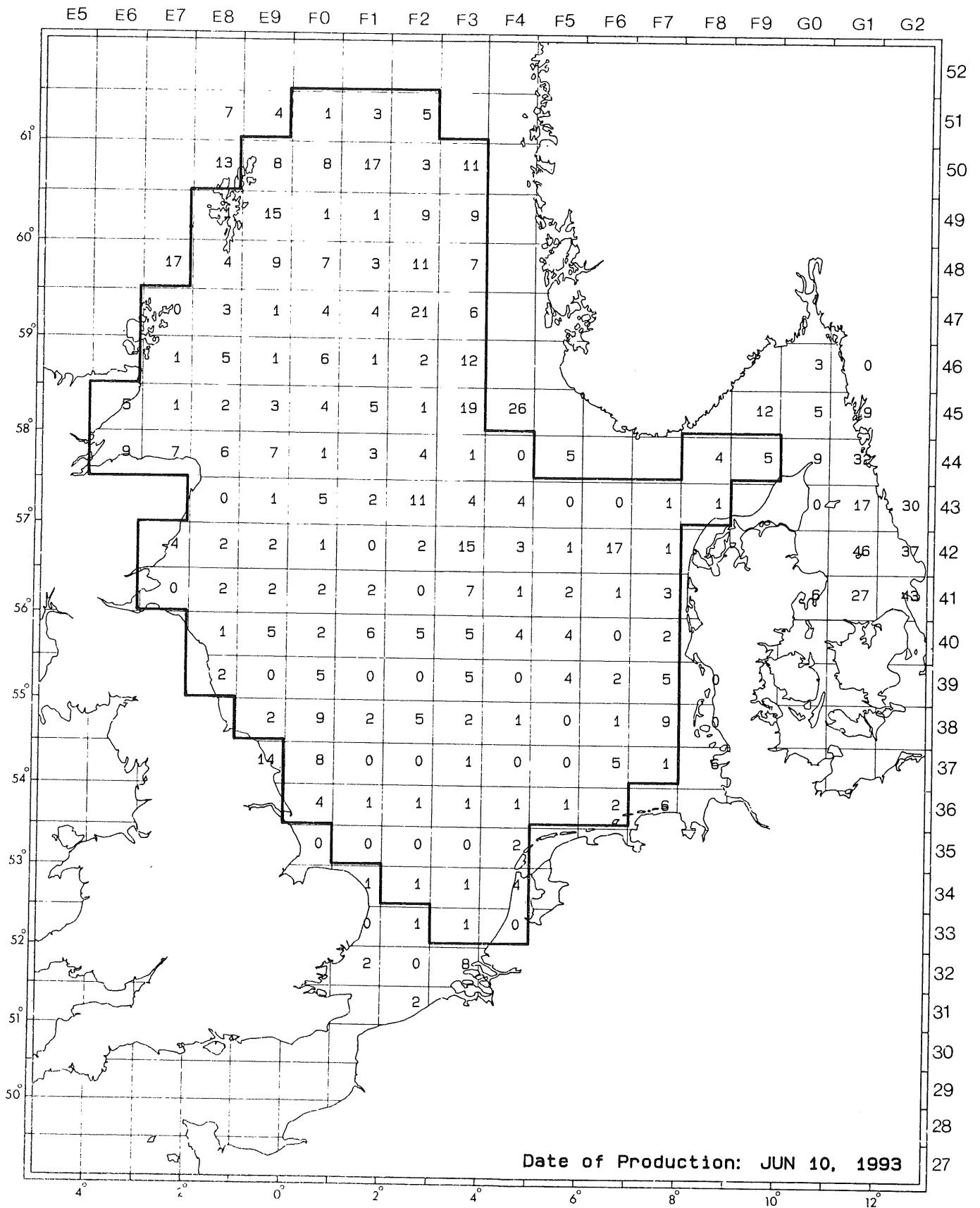
# International Young Fish Survey 1993



Cod, GADU MOR  
Number per Hour , Age Group 2.

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

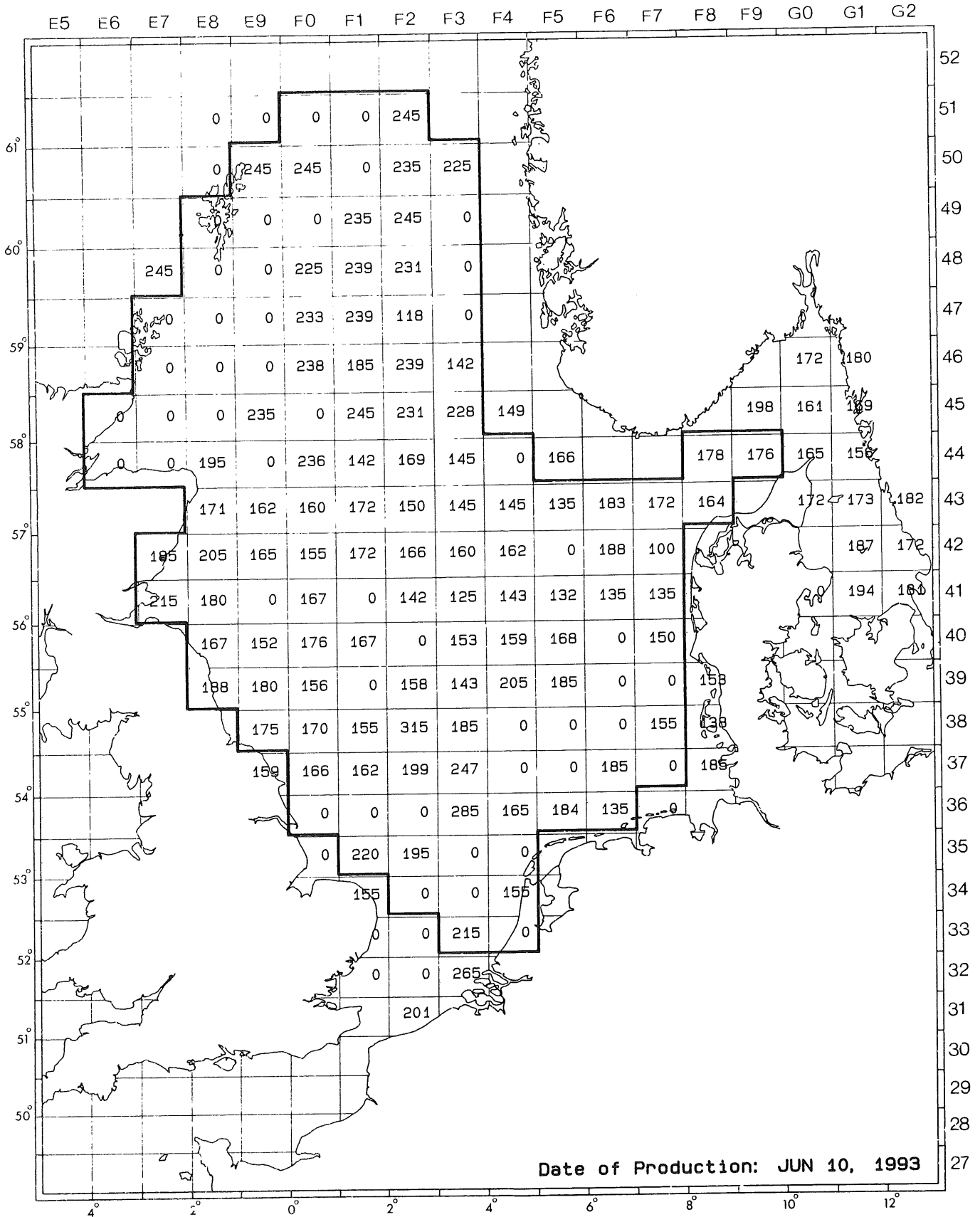
# International Young Fish Survey 1993



Cod, GADU MOR  
 Number per Hour , Age Group 3+.

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

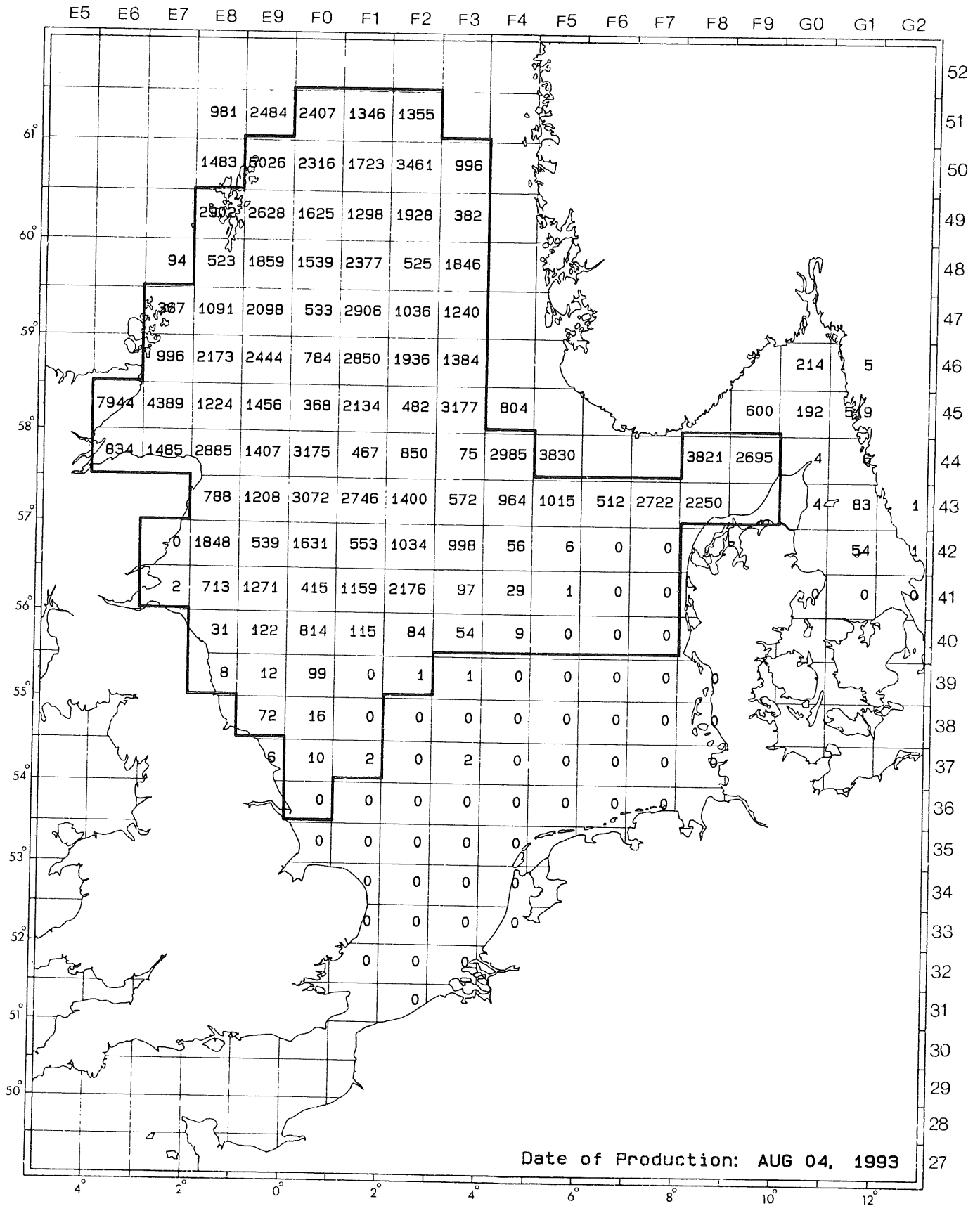
# International Young Fish Survey 1993



Cod, GADU MOR  
Mean Length, Age Group 1.

Figure 5.18 Cod: mean length, age group 1.

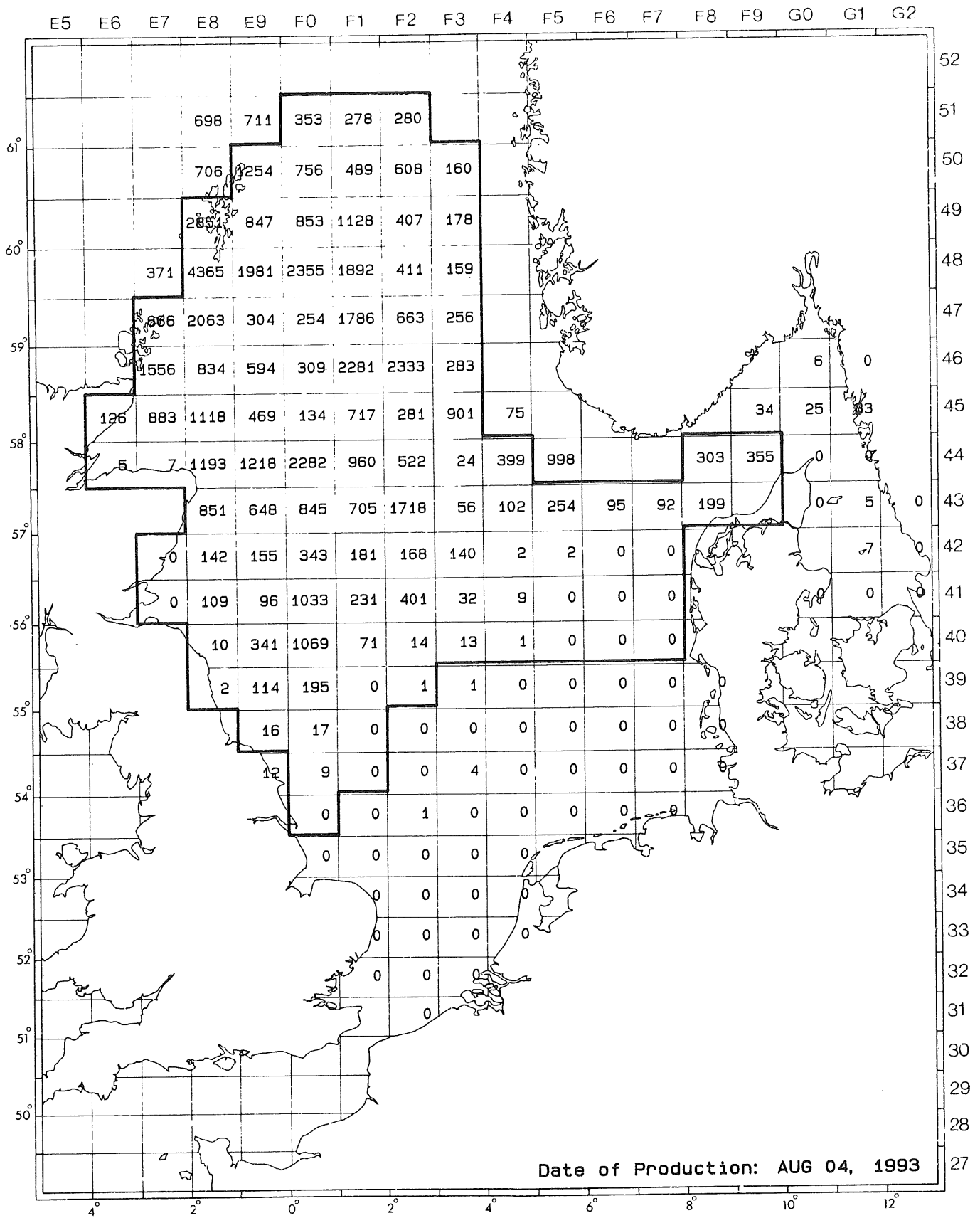
# International Young Fish Survey 1993



Haddock, MELA AEG  
 Number per Hour , Age Group 1.

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

# International Young Fish Survey 1993

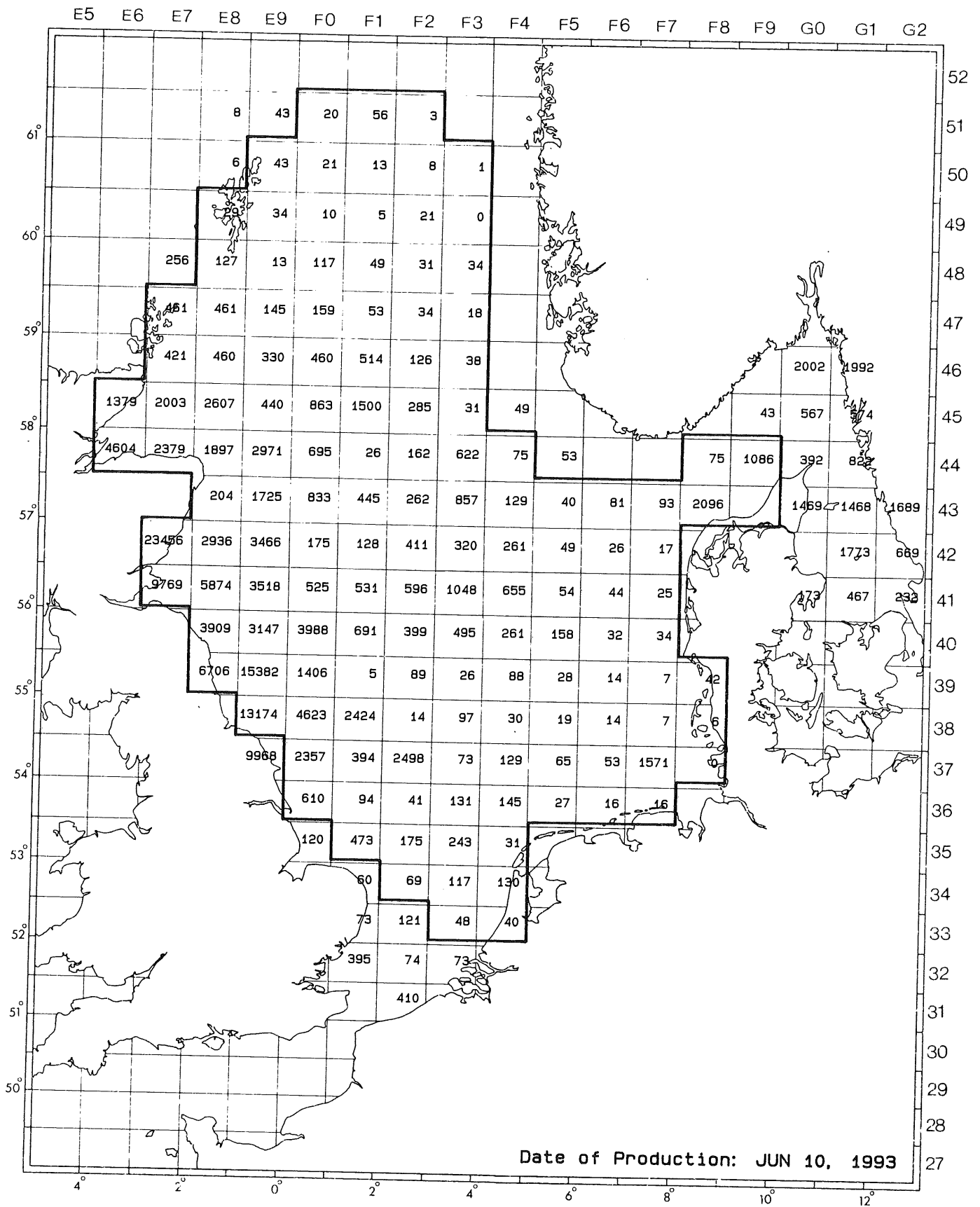


Haddock, MELA AEG  
 Number per Hour , Age Group 2.





# International Young Fish Survey 1993

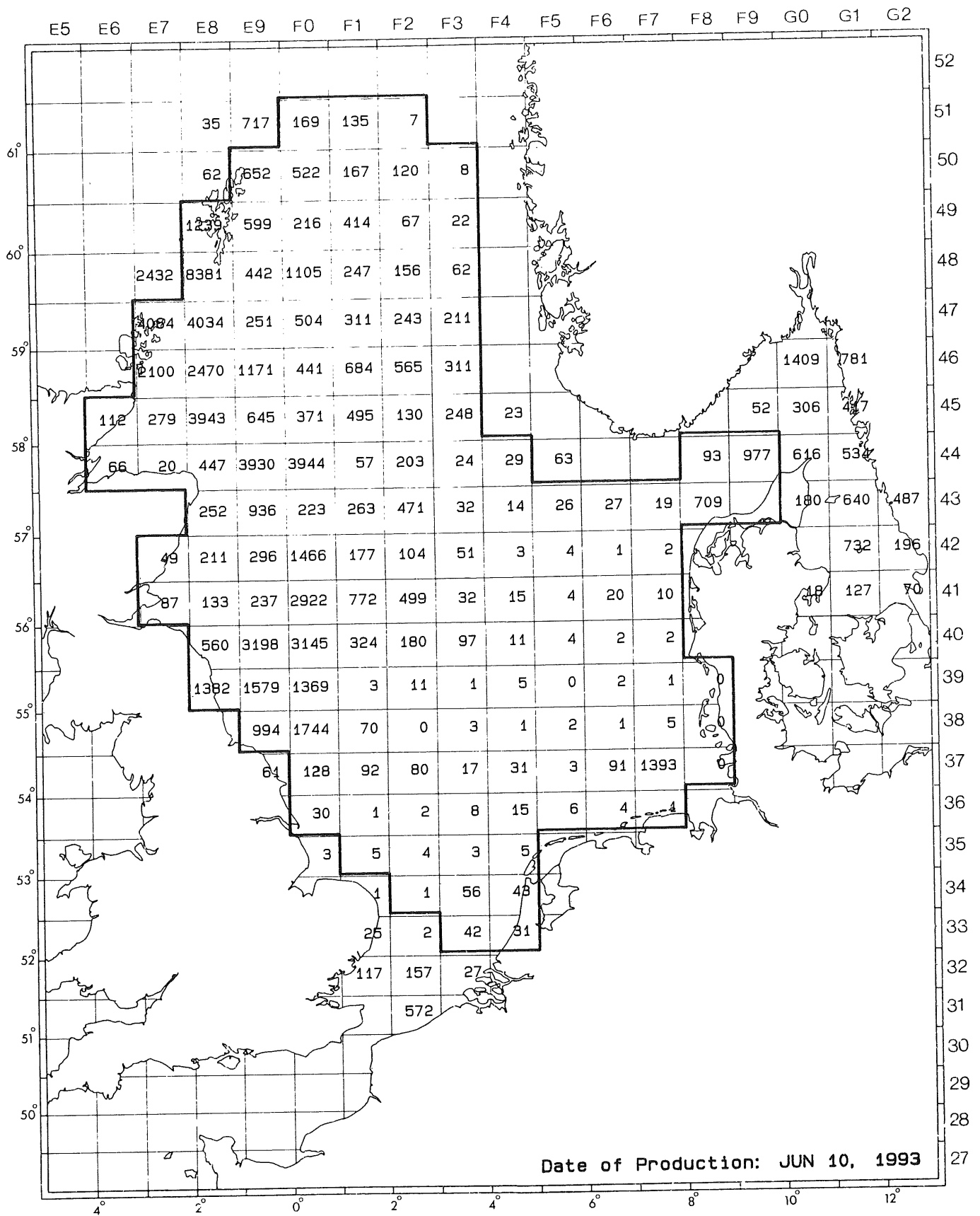


Whiting, MERL MNG  
 Number per Hour , Age Group 1.

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



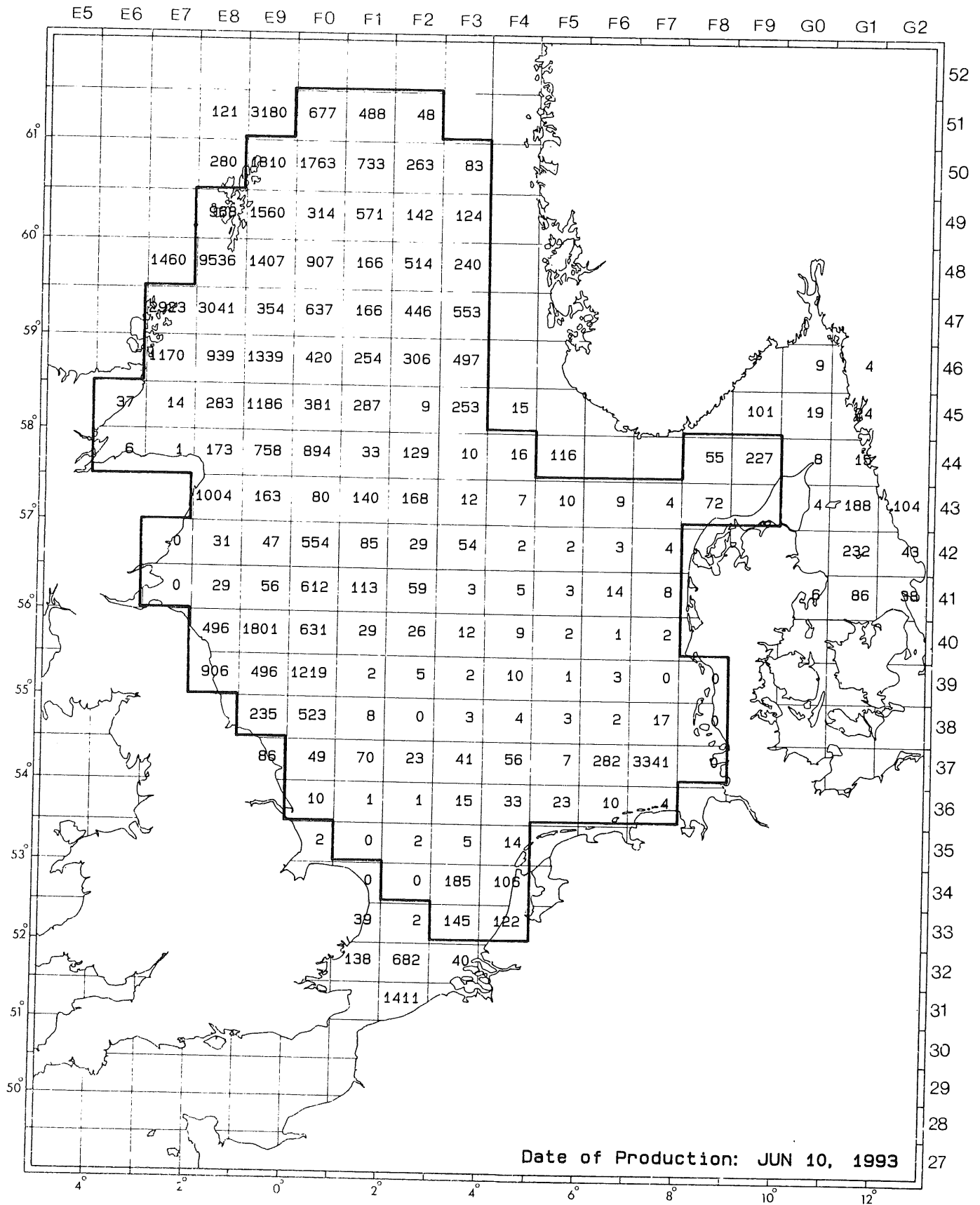
# International Young Fish Survey 1993



Whiting, MERL MNG  
 Number per Hour , Age Group 2.

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

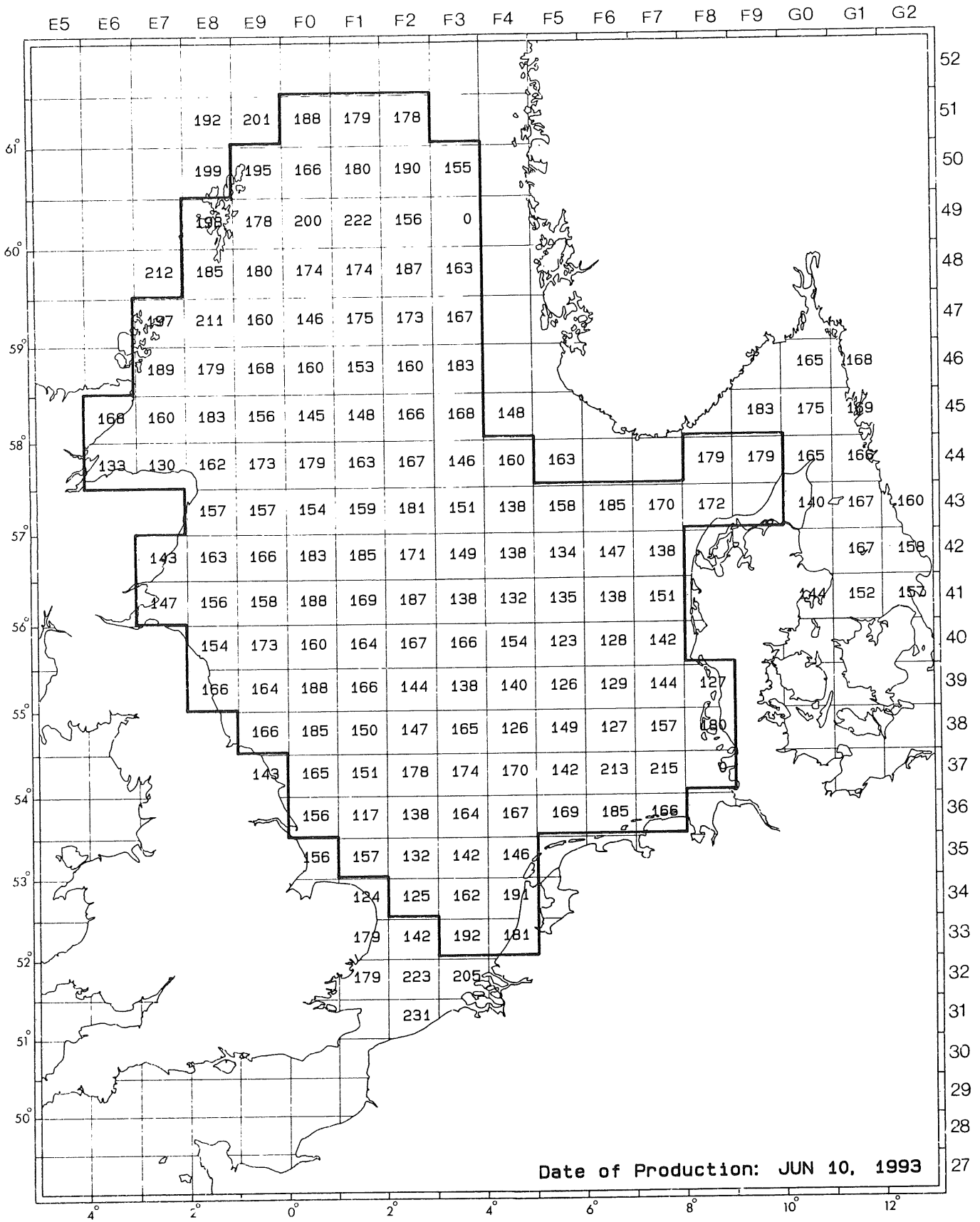
# International Young Fish Survey 1993



Whiting, MERL MNG  
 Number per Hour , Age Group 3+.

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

# International Young Fish Survey 1993

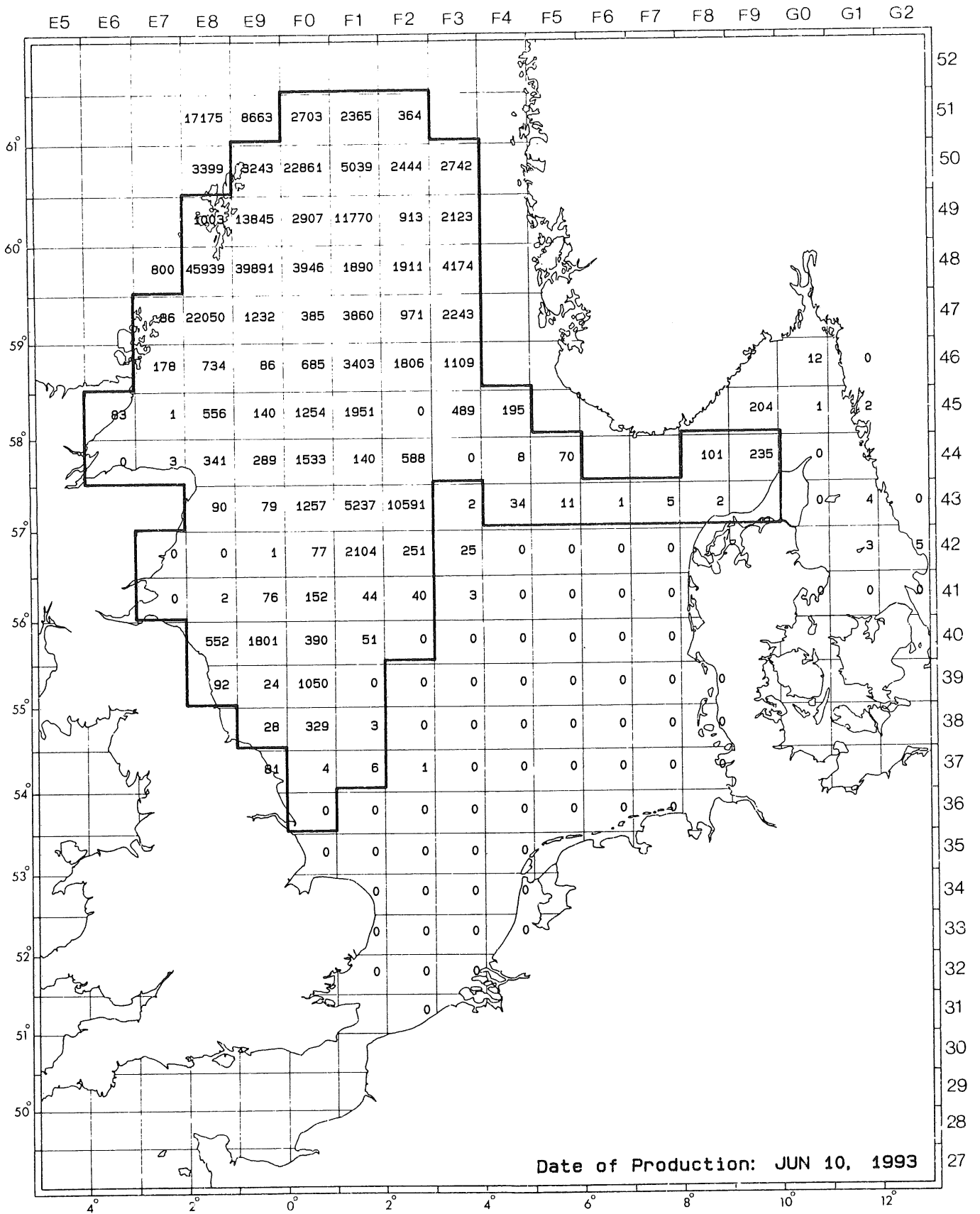


Whiting, MERL MNG  
 Mean Length, Age Group 1.

Figure 5.26 Whiting: mean length, age group 1.



# International Young Fish Survey 1993



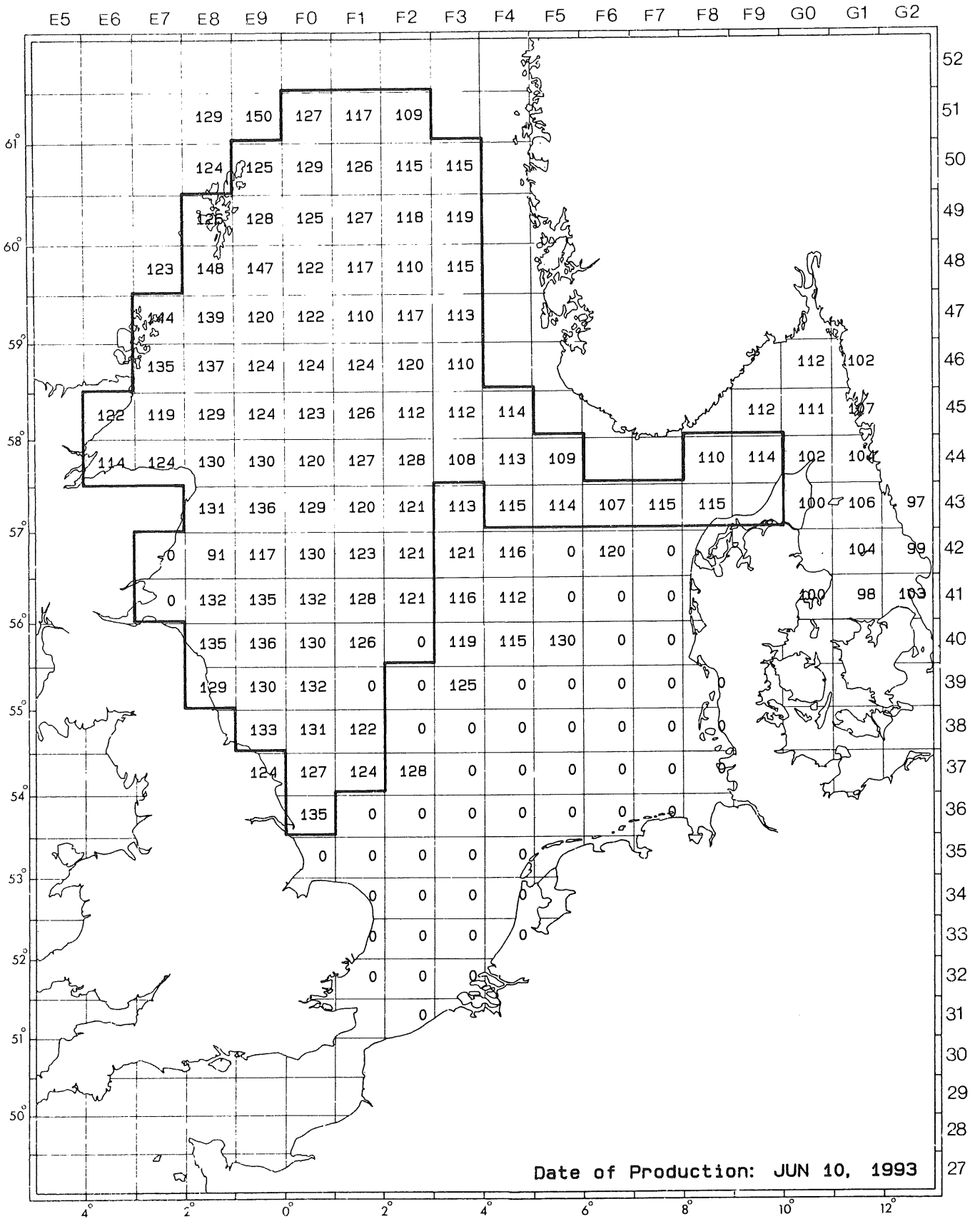
Date of Production: JUN 10, 1993

Nor. Pout, TRIS ESM  
 Number per Hour , Age Group 2.

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



# International Young Fish Survey 1993

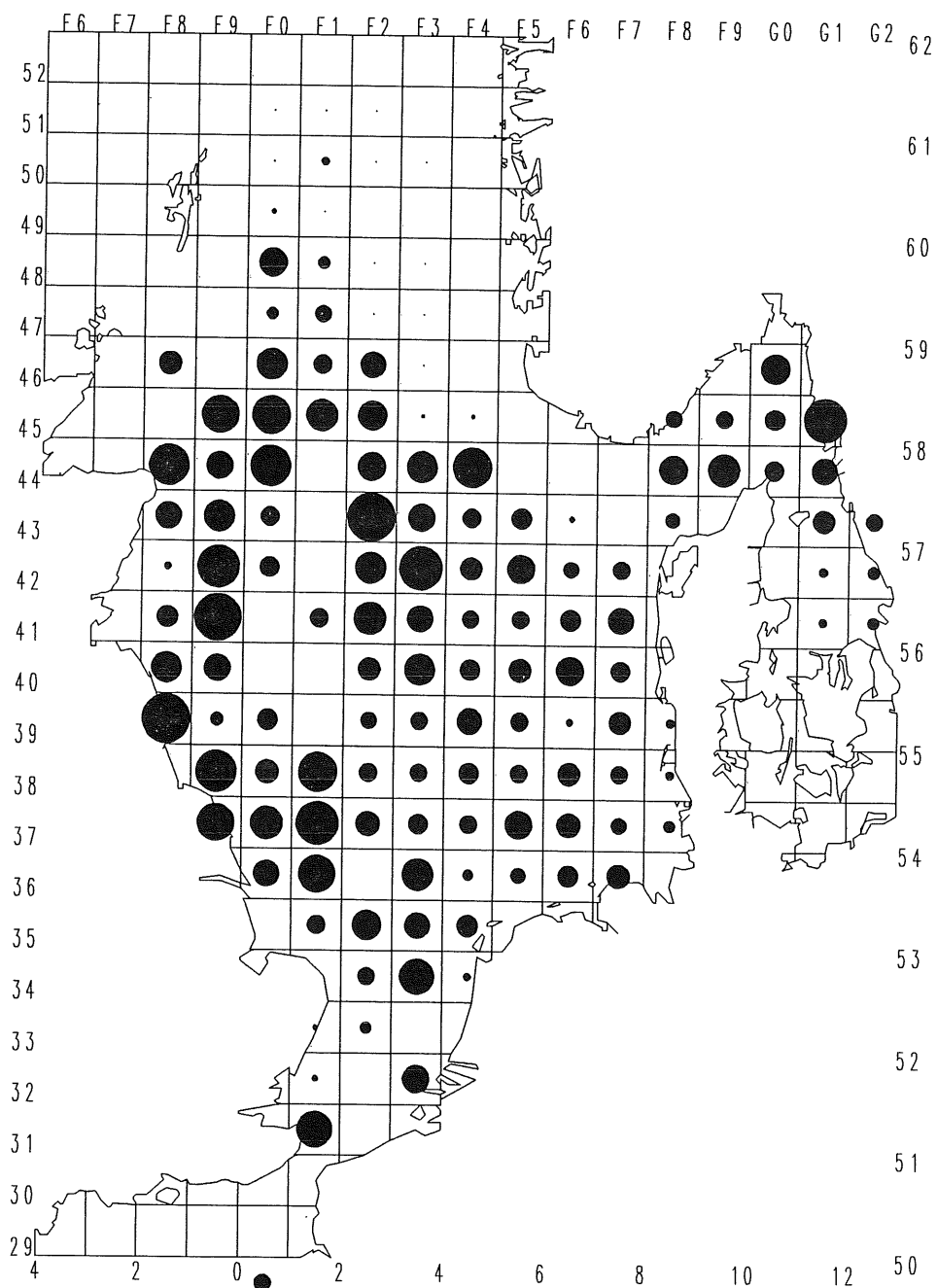


Nor. Pout, TRIS ESM  
 Mean Length, Age Group 1.

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

Figure 6.1 Herring larvae: mean abundance per statistical rectangle. Surface of black dots represents densities in no m<sup>-2</sup>, the surface of the circles that extend to the borders of a statistical rectangle represents 1.8 larvae m<sup>-2</sup>. Year class 1992 sampled in February 1993.

### 0-ringers year class 1992





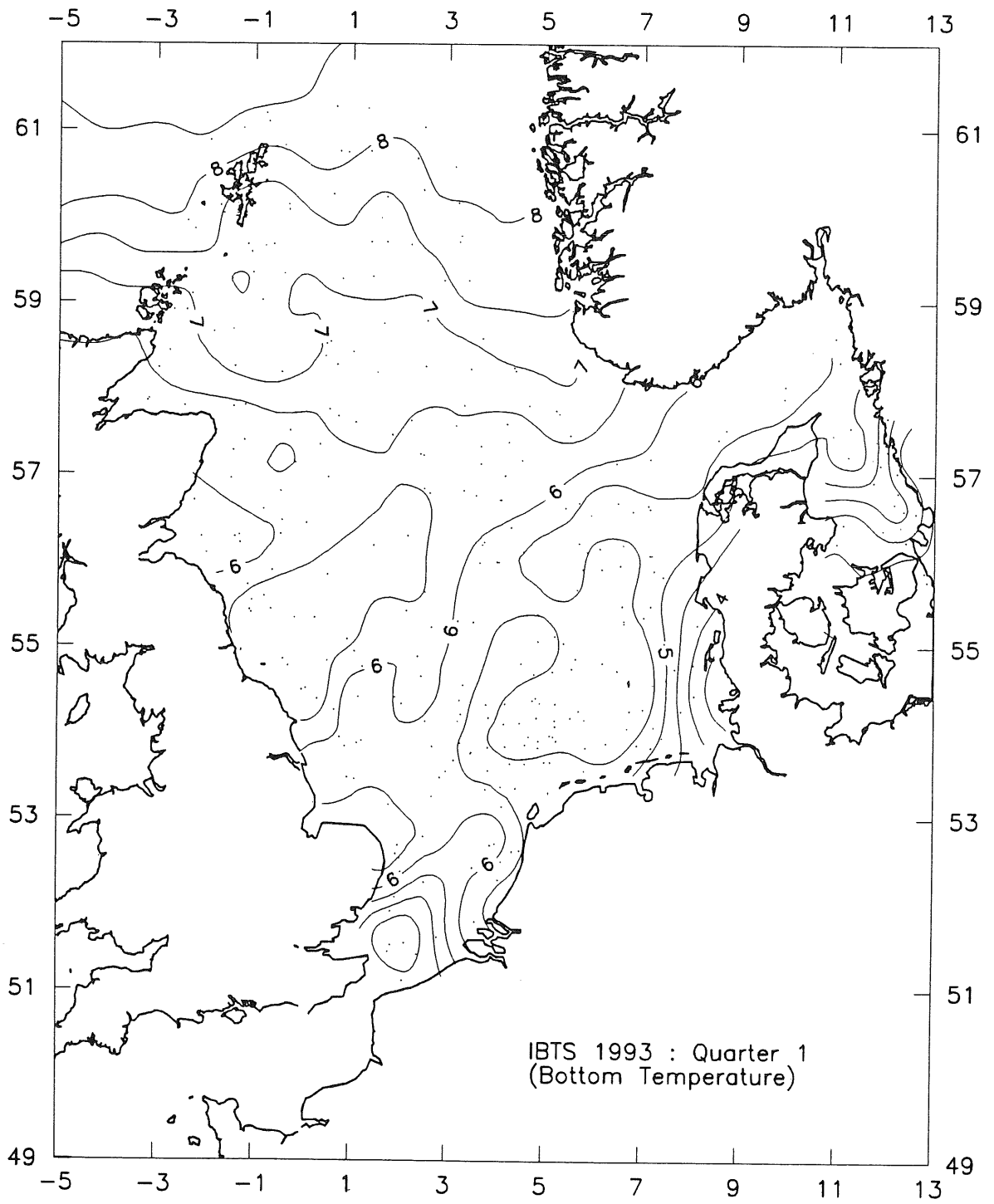


Figure 7.1

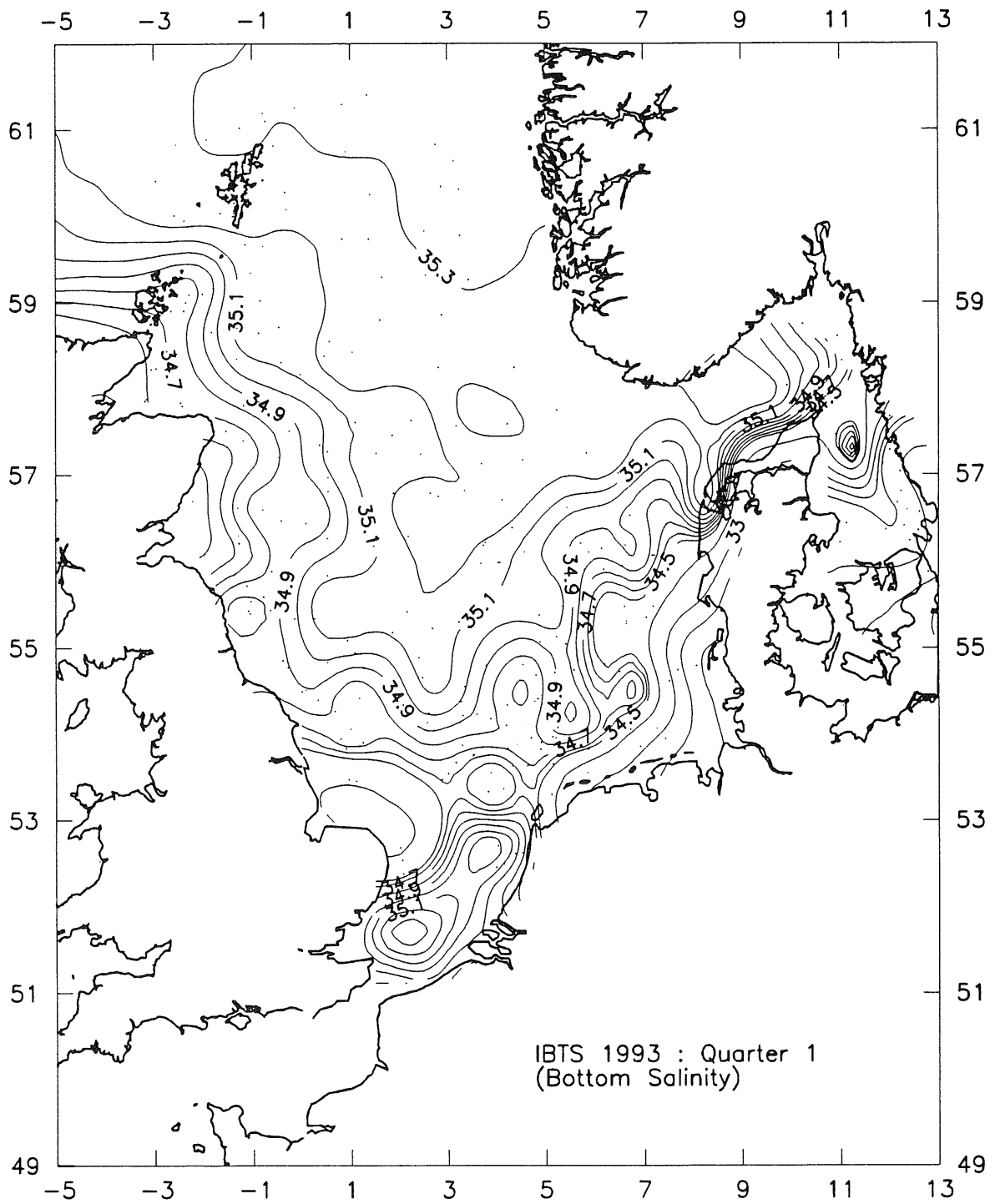


Figure 7.2