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REPORT ON THE INTERNATIONAL BOTTOM TRAWL SURVEY IN THE NORTH SEA, SKAGERRAK AND KATTEGAT IN 1995: QUARTER 1

by

The International Bottom Trawl Survey Working Group

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1 INTRODUCTION

This report presents the final results for the International Bottom Trawl Survey (IBTS) in the first quarter of 1995. The survey was formerly called 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. These quarterly surveys started in 1991. The results for quarters 2-4 will be published elsewhere.

The data in this report comprise the bottom trawl catches of the seven standard species (herring *Clupea harengus*, sprat *Sprattus sprattus*, mackerel *Scomber scombrus*, cod *Gadus morhua*, haddock *Melanogrammus aeglefinus*, whiting *Merlangius merlangus* and Norway pout *Trisopterus esmarki*), as well as the catches of herring 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 1995 survey are given below. Except for four rectangles around Shetland the whole survey area has been covered as planned.

Country	Vessel	Period	Number of hauls GOV	MIK/IKMT
Denmark	"Dana"	29/1-14/2	44	93
France	"Thalassa"	4-20/2	50	-
Germany, F.R.	"W. Herwig III"	25/1-20/2	68	-
Netherlands	"Tridens"	6-24/2	35	45
Norway	"Michael Sars"	7/1-11/2	59	32
Sweden	"Argos"	30/1-16/2	49	47
UK Scotland	"Scotia"	7-28/2	46	61

3 DATA AVAILABLE

Table 3.1 shows for which years data are presently available in the ICES IBTS Database for the quarter 1 surveys.

At the time of the analysis of the 1995 data presented in this report all final data were available in the database.

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 REVISION OF THE AUTUMN SPAWNER HERRING INDEX

In 1994 the Herring Assessment Working Group for the Area South of 62°N has adopted a new index for 1-ringer abundance of North Sea autumn spawners. The new index is based on daytime catches in all statistical rectangles sampled during the quarter 1 survey, both in the North Sea and in the Skagerrak/Kattegat. In the calculation of this index, catches made in rectangles shallower than 10m, or deeper than 200m (250m in Skagerrak), have been given less weight. The weighting factors are given in Figure 5.1.

It is implicitly assumed that all 1-ringer herring in the North Sea, Skagerrak, and Kattegat are autumn spawners. Unsampled rectangles are allocated the mean catch rate estimated within "roundfish areas" and the index is expressed as the

mean catch rate (number per hour) for the entire survey area. The indices for 2+-ringers have been revised in the same way, with the exception that the catches in Skagerrak and Kattegat are assumed to be 0. This implicitely assumes that all 2+-ringers in Skagerrak and Kattegat are local or Baltic spring spawners. The use of "zero" catches instead of "missing" catches of 2+-ringers in this area is convenient because it brings the indices of all age groups on a similar scale so that for instance mortalities can be calculated directly from the indices.

6 RESULTS GOV-TRAWL FOR 1995

6.1 North Sea

Preliminary indices based on certain size classes are compared with the final indices in Table 6.1. With the exception of sprat, the preliminary indices are very close to the final ones. Final indices of 1- and 2- group fish of the seven standard species are given in Table 6.2. Table 6.3 gives the mean age composition of the standard species within the relevant standard areas.

In the analysis only day-light hauls are used for herring, whereas for the other species all valid hauls are used. The number of hauls used for herring and for the other species is shown in Figure 6.1 and 6.2.

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. In the analysis of the herring data daylight hauls from the whole survey area have been included, for the other species a specific standard area is used to calculate the index of year class strength. This area is indicated in the figures.

HERRING

Indices for 1- and 2-ringed herring are presented in Table 6.2 and mean numbers per rectangle are given in Figures 6.3 to 6.5. It should be noted that the term "age group" in herring refers to number of winter rings and not to years. All juvenile herring in the North Sea are assumed to be autumn spawners, and this means that for instance age group 1 herring in February 1995 represent year class 1993.

The index for the 1993 year class is about as low as those for year classes 1988-1990.

SPRAT

Sprat indices of 1- and 2-group are given in Table 6.2. 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 Herring Assessment Working Group has also for sprat adopted a new index series (Anonymous, 1993) in which only hauls between 10 and 150 m depth are included. The standard area has remained the same: Division IVb only. The index for the 1994 year class is about one third of that for the 1992 year class.

MACKEREL

Indices for mackerel are given in Table 6.2. This year only a few mackerel otoliths (8!) have been collected. This is not enough to allow the calculation of indices by age. Therefore, only the distribution of the total numbers caught is shown in Figure 6.11.

COD

Abundance indices are given in Table 6.2, the distributions of 1-, 2-, and 3+ group, and the mean length of 1-group fish are given in Figures 6.12–6.15. For the last four years the 1-group index is about the same.

HADDOCK

Abundance indices are given in Table 6.2, the distributions of 1-, 2-, and 3+ group, and the mean length of 1-group fish are given in Figures 6.16–6.19.

After a very poor 1993 year class, the index of this year's survey indicates a strong 1994 year class. The index is the highest one since 1975.

WHITING

Abundance indices are given in Table 6.2, the distributions of 1-, 2- and 3+ group and the mean length of 1-group fish are given in Figures 6.20–6.23.

The whiting 1-group index is about the same as last year.

NORWAY POUT

Abundance indices are given in Table 6.2, the distributions of 1-, 2- and 3+ group and the mean length of 1-group fish are given in Figures 6.24–6.27.

As for haddock, the 1-group index of the 1994 year class is the highest index since 1975. The strong 1994 year class is preceeded by a rather poor 1993 year class.

6.2 Skagerrak-Kattegat (Division IIIa)

The number of hauls per rectangle for herring and gadoids is shown in Figure 6.1 and 6.2.

The final indices for 1- and 2-group herring and 1- and 2+ group sprat are given in Table 6.4. 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.

Age/length keys for cod are available from the 1981 IBTS 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 6.5.

The distribution of herring, sprat and cod is included in the figures in Section 6.1.

HERRING

The indices are given in Table 6.4 and the distribution shown in Figures 6.3-6.5. The mean length of 1-ringers is shown in Figure 6.6.

SPRAT

The standard index for sprat in Division IIIa is not available this year. The way of calculating the index has been revised by the Herring Assessment Working Group for the Area South of 62^0 N (Anonymous 1995).

COD

Preliminary and final indices are given in Table 6.5. The 1-group index for the 1994 year class in the Skagerrak is about the same as during the preceeding last three years, indicating the fourth good year class in a row. The 1-group index for the Kattegat is the highest index in the time series since 1980.

HADDOCK

The preliminary index value for haddock <20cm (1994 year class) indicates a moderate to good year class.

WHITING

The preliminary index value for whiting of <20cm (1994 year class) indicates a moderate year class.

7 RESULTS OF SAMPLING OF LARVAE IN 1995

Sampling of fish larvae during IBTS is carried out by use of a small-meshed ring net (MIK) of an opening of 3.14 m^2 . Catches are used for estimation of larvae density and abundance, assuming an 100% efficiency of the MIK in catching larvae at night (P.Munk unpubl. results).

Larvae density is estimated from:

Density (no. m^{-2}) = (no. caught / [distance towed (m) * netopening (m^2)] * water depth (m).

The number of larvae within a given statistical rectangle is estimated by multiplying the density found by the approximate surface area of a rectangle (309 * 10^7 m^2). 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 278 hauls were made. A number of rectangles were left unsampled in the northernmost part of the investigation area.

The abundance of herring larvae during this year's survey was relatively high in specific areas of the North Sea (Figure 7.1). The major concentrations of larvae were found in the central/eastern areas. Larvae mean lengths were in the order of 25 mm. The overall index, estimated to be 126.9 * 10^9, is relatively low, but indicate an increase from last years size of recruitment (Table 7.1 and Figure 7.2).

SPRAT

Sprat juveniles were caught in the south-eastern part of the investigation area. Catches were limited and no interpretation of the total abundance is carried out.

8 HYDROGRAPHIC DATA

8.1 Hydro-chemistry Survey

Seven ships contributed hydrographic data to the 1995 dataset. These consist of 352 stations worked between 6 January and 28 February. Nutrient data were supplied for 73 stations, contributions being received from two ships. Data quality appeared excellent, and, as a result, no stations were rejected by the data centre. Some data sets were submitted only just in time for inclusion in this report.

Charts of the distribution of bottom temperature and salinity are given in Figs 8.1 and 8.2. An updated table giving the time series of temperature and salinity at 10 locations in the North Sea during IYFS/IBTS (1) surveys from 1970 to 1995 is provided as Table 8.1. The Figures and Table show that the mild temperatures that had prevailed since 1988 but which had given way to somewhat cooler conditions last year, returned once again this year. This was undoubtedly due to the continued mild winter weather over the North Sea resulting from persistent south and westerly airflows. The distribution of salinity was markedly similar to those apparent in 1994 and absolute levels were barely indistguishable from the 1994 levels.

Particularly exceptional temperature levels were present to the east of the Strait of Dover. According to Table 8.1, the value at location 10 had been exceeded only once since 1970. Similarly, salinity leveles immediately west of Denmark (location 8) were also extremely low. Similar low levels had previously been encountered in 1976 and 1987, and was undoubtedly due to the exceptionally wet weather during January and February.

9 REFERENCES

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

Anonymous. 1995. Report of the Herring Assessment Working Group for the Area South of 62°N. ICES Doc. C.M. 1995/Assess:13.

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 IBTS data base as at July 1995
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	-	-	+	+	+	+	+	+	+[1]
Sweden	-	-	+	+	+	+	+	+	+
UK England	+	+	+	+	+	+	+	+	+
UK Scotland	+	+	+	+	+	+	+	+	+
USSR	+	+	x	x	x	x	x	x	x

Country	1990	1991	1992	1993	1994	1995
Denmark	+	+	+	+	+	+
France	+	+	+	+	+	+
Germany	+	+	+	+	+	+
Netherlands	+	+	+	+	+	+
Norway	+	+	+	+	+	+
Sweden	+	+	+	+	+	+
UK England	+	x	x	x	x	x
UK Scotland	+	+	+	+	+	+
USSR	x	x	x	x	x	x

[1]No Smalk records for Herring.

Table 6.1 Preliminary indices for 1-group fish based on a split of the length distribution, and final indices for the North Sea from the first quarter IBTS in 1995. For herring the "old" standard area is used.

	Preliminary	Final
Herring	1,883	2,021
Sprat	2,903	1,138
Mackerel	0.3	-
Cod	10.6	9.7
Haddock	1,323	1,375
Whiting	584	679
Norway pout	5,726	5,941

Table 6.2 IBTS 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 1-ring	HERRING 2-ring	SPRAT age 1	SPRAT age 2	MACKEREL age 1	MACKEREL age 2	COD age 1	COD age 2	HADDOCK age1	HADDOCK age 2	WHITING age 1	WHITING age 2	NORWAY POUT age 1	NORWAY POUT age 2
1969	-	-	-	-	-	-	-	25.9	-	32	-	31	-	-
1970	-	-	-	-	-	-	98.3	34.5	855	299	274	190	-	-
1971	-	-	90	-	-	-	4.1	10.6	740	971	332	763	-	-
1972	-	-	123	-	-	-	38.0	9.5	187	110	1,156	496	-	-
1973	-	-	481	-	-	0.1	14.7	6.2	1,092	385	322	153	-	2,412
1974	-	-	-	-	16.5	0.2	40.3	19.9	1,168	670	893	535	4,242	385
1975	-	-	1,186	-	0.4	+	7.9	3.2	177	84	679	219	4,599	334
1976	-	-	136	-	1.4	+	36.7	29.3	162	108	418	293	4,813	1,215
1977	172*	-	1,474	-	2.3	+	12.9	9.3	385	240	513	183	1,913	240
1978	312*	-	248	-	0.2	+	9.9	14.8	480	402	457	391	2,690	611
1979	431*	-	1,402	1,380	+	+	16.9	25.5	896	675	692	485	4,081	557
1980	772*	109	941	502	0.1	0.1	2.9	6.7	268	252	227	232	1,375	403
1981	1,260	161	296	754	0.1	5.2	9.2	16.6	526	400	161	126	4,315	663
1982	1,443	716	210	387	1.9	0.4	3.9	8.0	307	219	128	179	2,331	802
1983	2,083	661	382	298	0.1	0.0	15.2	17.6	1,057	828	436	359	3,925	1,423
1984	2,542	838	660	103	0.7	2.1	0.9	3.6	229	244	341	261	2,109	384
1985	3,684	4103	71	74	0.5	+	17.0	28.8	579	326	456	544	2,043	469
1986	4,530	775	803	1,437	8.9	0.1	8.8	6.1	885	688	669	862	3,023	760
1987	2,313	580	148	442	1.2	1.8	3.6	6.3	92	97	394	542	127	260
1988	1,016	794	4,246	557	1.1	1.2	13.1	15.2	210	114	1,465	887	2,079	773
1989	1,159	377	177	116	35.0	0.2	3.4	4.1	219	131	509	675	1,320	677
1990	1,162	762	1,121	340	6.9	0.4	2.4	4.5	679	371	1,014	748	2,497	902
1991	2,943	1094	1,561	422	16.0	0.8	13.0	19.9	1,115	543	916	524	5,121	2,644
1992	1,667	1285	1,755	1,368	1.0	+0.1	12.7	4.4	1,242	504	1,087	637	2,681	375
1993	1,186		4,003	2,716	2.2		14.8	22.1	229	205	721	457	1,868	785
1994			1,138		+		9.7		1,375		679		5,941	

* Revised according to new procedures by the Herring Assessment Working Group for the Area South of 62°N (1995/Assess:13), but not based on retrival from database.

Table 6.3 Age composition of the standard species in 1995 for the relevant standard areas in the North Sea. For herring the new standard area is used.

Age group	1	2	3	4	5	6+
Herring	1,186.2	1,284.9	152.3	46.2	9.3[1]	-
Sprat	1,138.1	2,715.8	131,5	3.2	1.1[1]	-
Mackerel	-	-	-	-	-	-
Cod	9.7	22.1	2.8	1.1	0.3	0.3
Haddock	1,375.2	205.3	180.6	25.0	5.4	0.8
Whiting	678.8	456.9	244.5	59.3	12.1	5.7
Norway pout	5,940.5	784.9	76.5	8.6	0.0	0.0

[1]Plus-group.

Table 6.4 IBTS 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 (n.a. = not available).

Year	Herring						Sprat		
	Total		Spring-spawners		Autumn-spawners				
	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	5,818**	861	7,034
1985	7,994	2,473	- *	1,867	- *	606	2,404	2,426	5,388
1986	21,489	2,738	- *	1,562	- *	1,176	670	1,934	4,545
1987	11,733	3,671	- *	2,921	- *	949	2,234	2,219	8,048
1988	67,753	10,095	- *	7,834	- *	2,161	950	5,527	10,634
1989	17,451	4,976	- *	0	- *	4,976	435	1,012	3,310
1990	3,544	3,876	0	3,192	3,544	684	510	243	944
1991	3,588	3,749	- *	480	- *	3,269	659	468	1,945
1992	5,057	1,934	0	771	5,057	1,163	5,897	634	7,122
1993	26,738	3,165	0	203	26,738	2,962	1,593	4,237	7,186
1994	8,777	2,333	0	0	8,777	2,333	1,494	586	3,361
1995	7,114	535	0	0	7,114	535	n.a.	n.a.	n.a.

* Separation not valid
** From 1984 onwards only hauls taken in depths between 10 and 150m are included in the estimates

Table 6.5 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		Whiting 1-group	Haddock 1-group
	Prel.	Final	Prel.	Final	Skagerrak	Kattegat	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	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	7	13	1359	405
1993	77	82	22	19			525	180
1994	111	97	390	300			1105	233

Table 7.1 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 is found by multiplying density by surface area and summing up.

Area	North west	North east	Central west	Central east	South west	South east	Division IIIa	Southern Bight	O-ringers abundance
Area $m^2 \times 10^9$	83	34	86	102	37	93	31	31	N 10^9
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	0.168	0.039	0.672	0.444	0.734	0.268	0.345	0.285	190.1
1993	0.358	0.212	0.260	0.187	0.120	0.119	0.223	0.028	101.7
1994	0.148	0.024	0.417	0.381	0.332	0.148	0.252	0.169	126.9

Table 8.1 Time series data of bottom temperature and salinity during IYFS/IBTS(1) 1970-1995

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
1970	5.5	5.08	5.8	4.95	5.3	5.00	4.7	4.92	5.9	4.75	4.5	4.82	4.0	4.72	0.5	3.00	4.0	4.72	4.0	4.62
1971	7.1	5.15	7.0	5.05	6.9	5.15	6.0	5.10	7.0	4.82	6.2	4.88	5.5	4.80	3.5	3.00	5.9	4.55	7.0	4.95
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
1994	6.2	5.20	6.5	5.05	5.5	4.93	4.3	4.80	6.3	4.90	5.4	4.90	5.2	4.80	4.0	2.00	5.5	4.70	7.0	5.00
1995	7.5	5.23	7.0	4.92	7.1	5.00	6.7	5.09	6.7	4.71	6.0	4.87	5.6	4.81	4.0	0.03	6.0	4.65	7.9	4.51

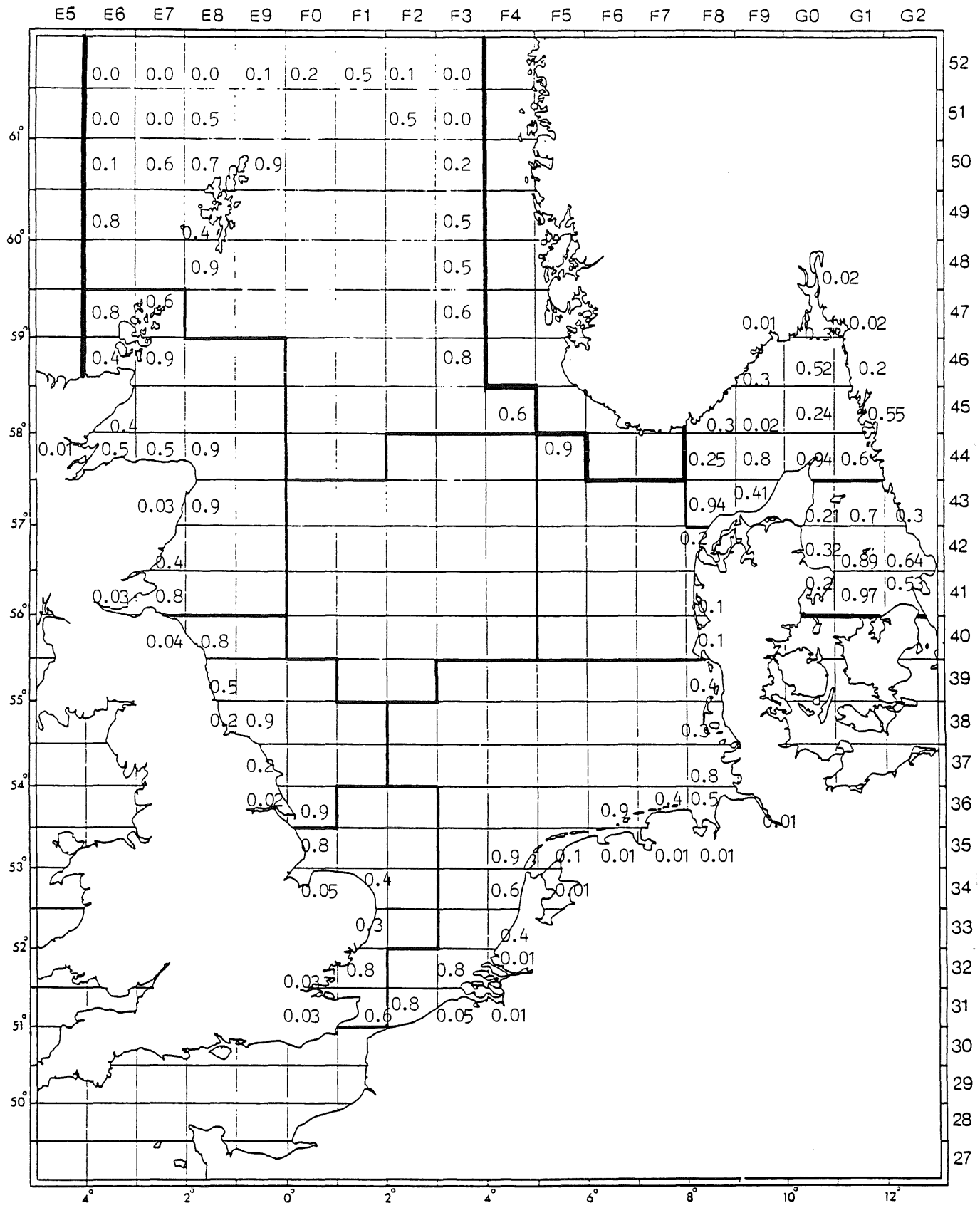

Figure 5.1 Weighting factors used in the revised IBTS herring index. Numbers denote the relative weight of a given rectangle. Only weighting factors less than 1 are shown.

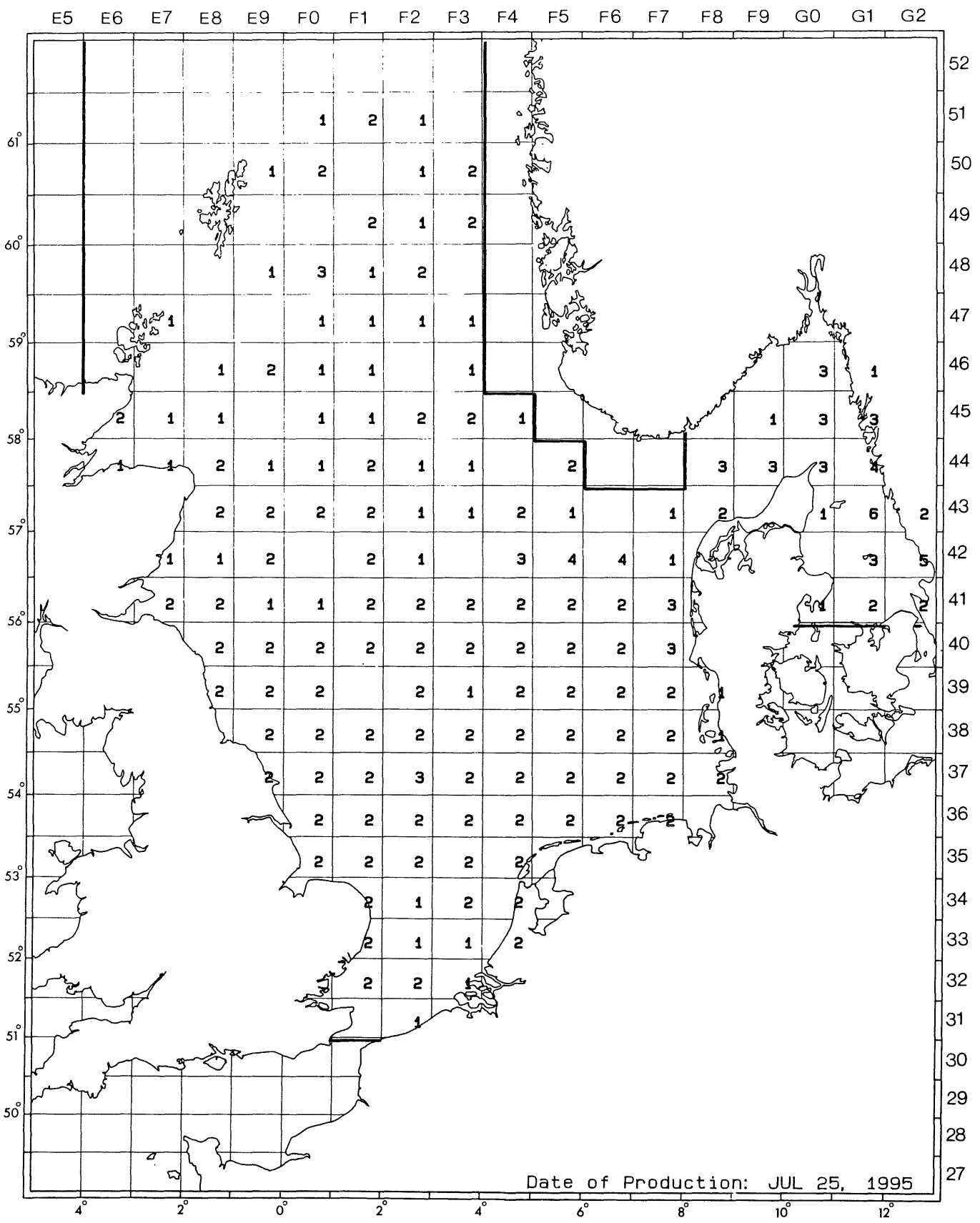

Figure 6.1 Number of hauls used in the analysis of herring 1995 data.

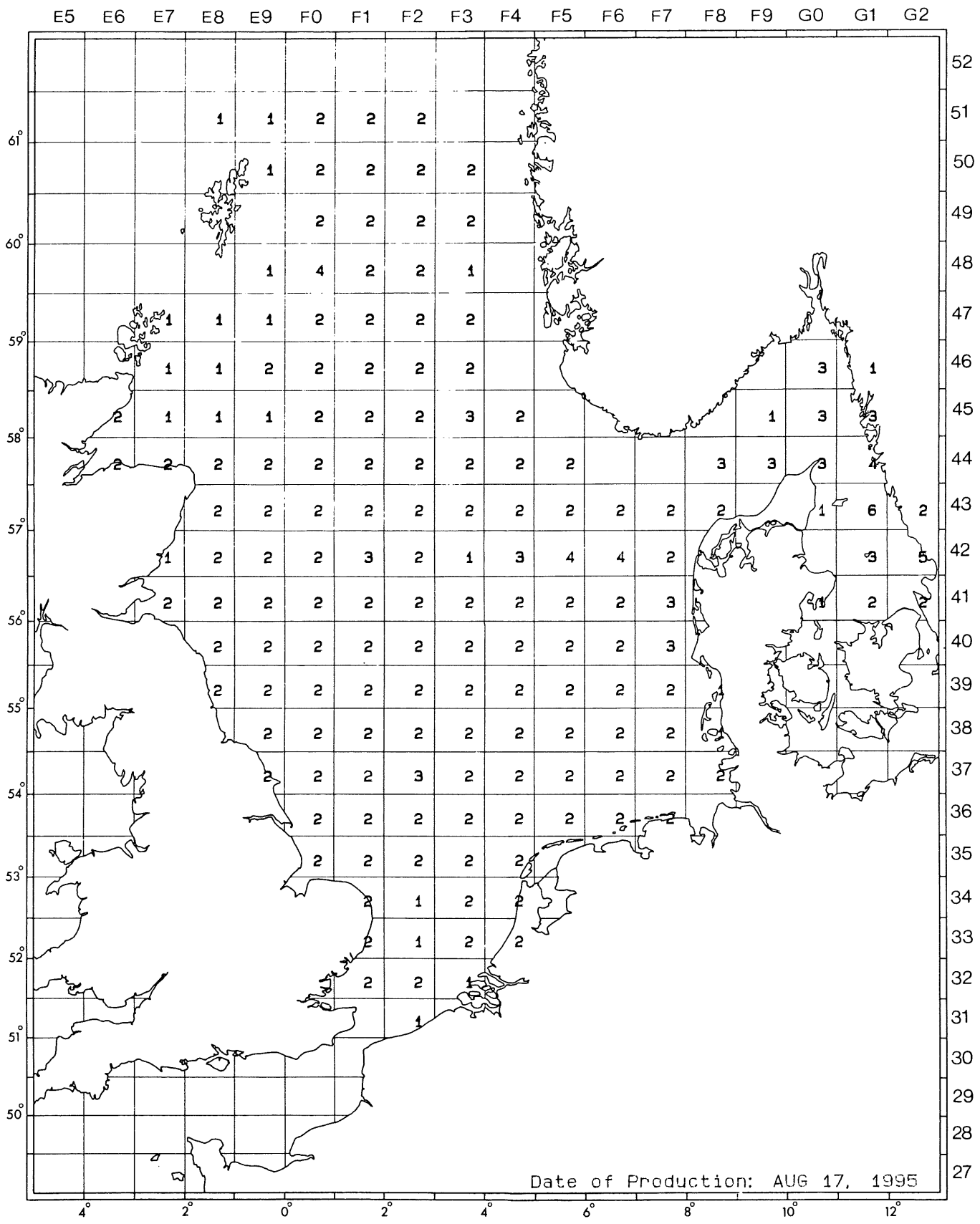

Figure 6.2 Number of hauls used in the analysis of 1995 data on sprat, mackerel, cod, haddock, whiting and Norway pout.

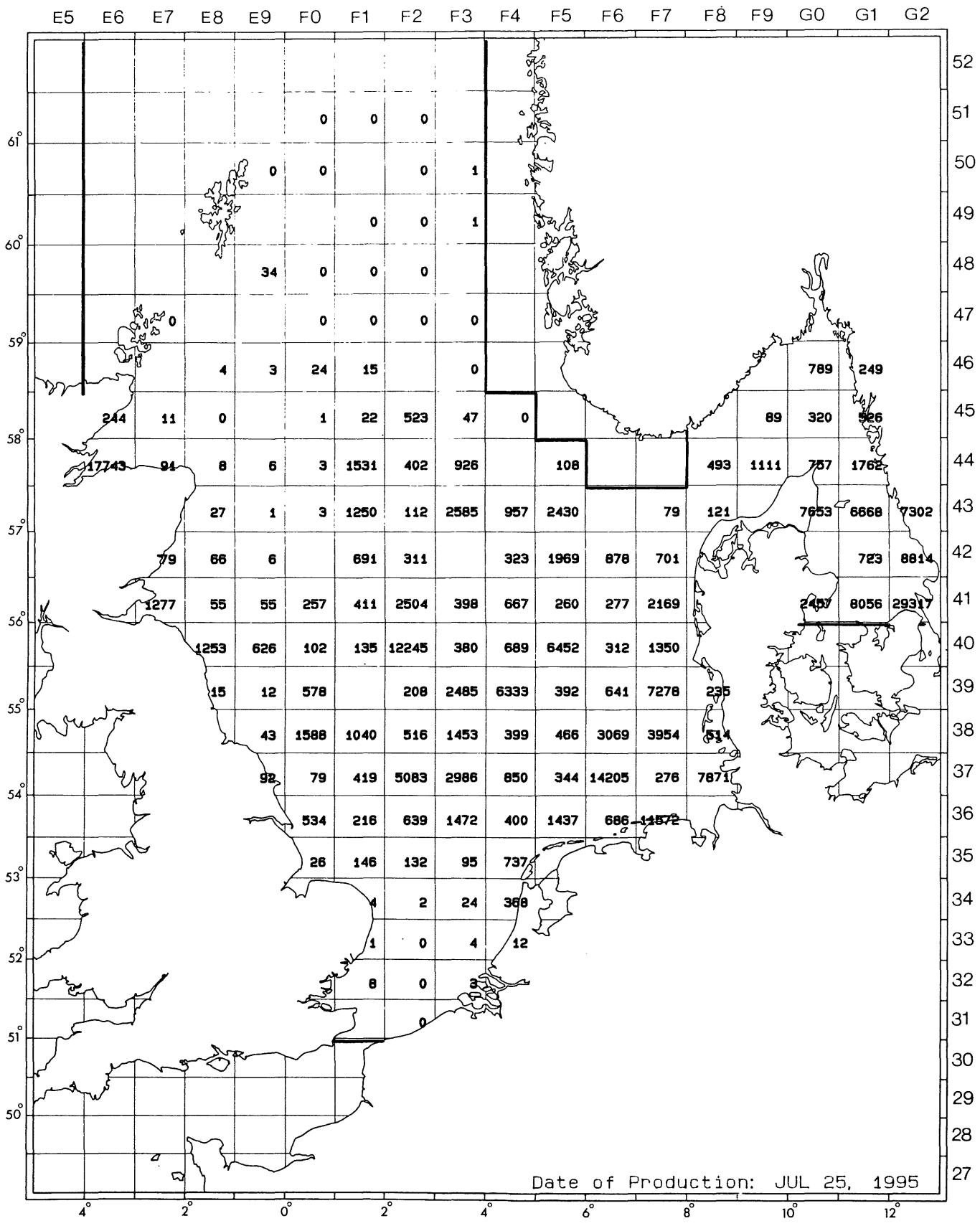

Figure 6.3 Herring: number per hour, 1-ringers.

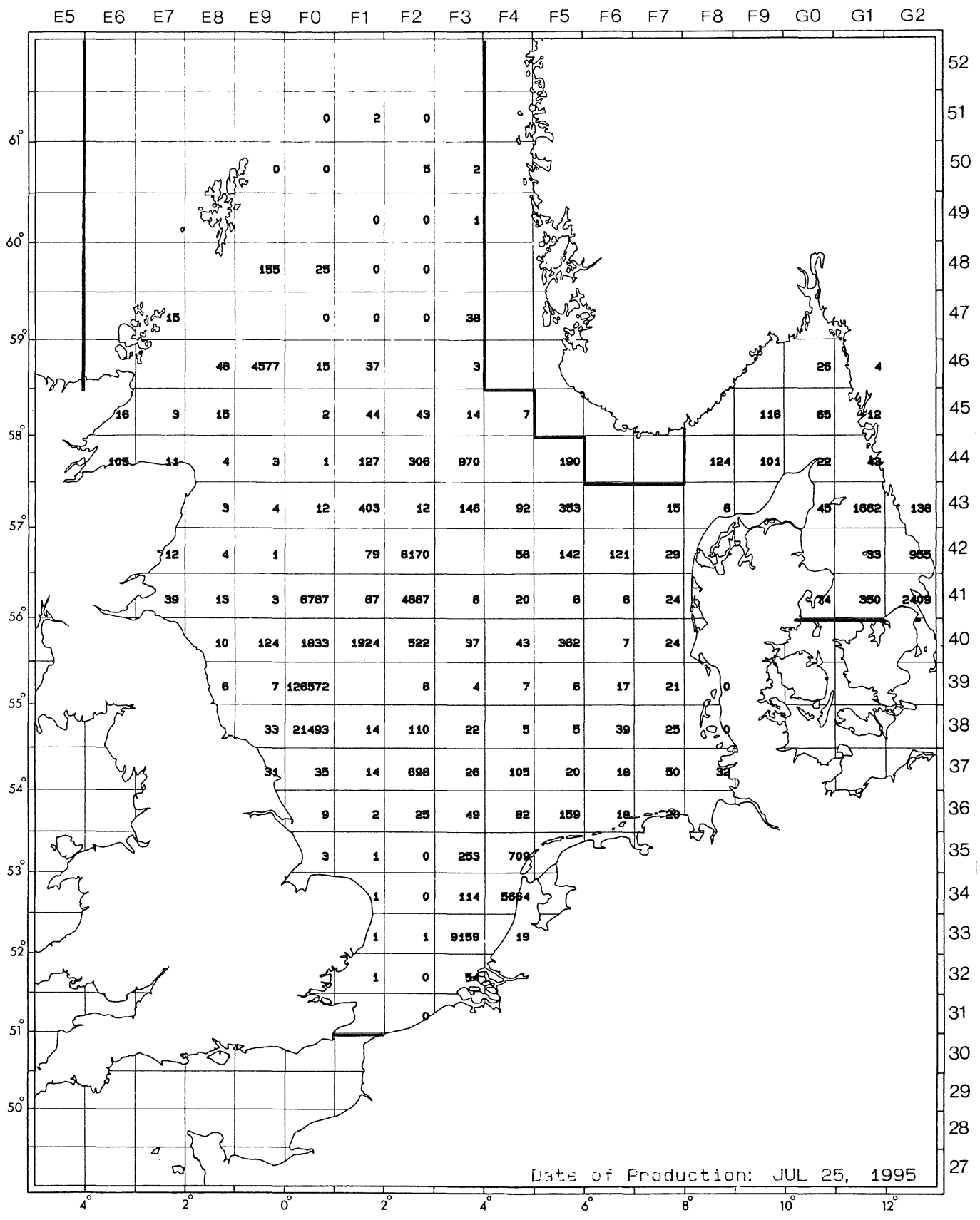

Figure 6.4 Herring: number per hour, 2-ringers.

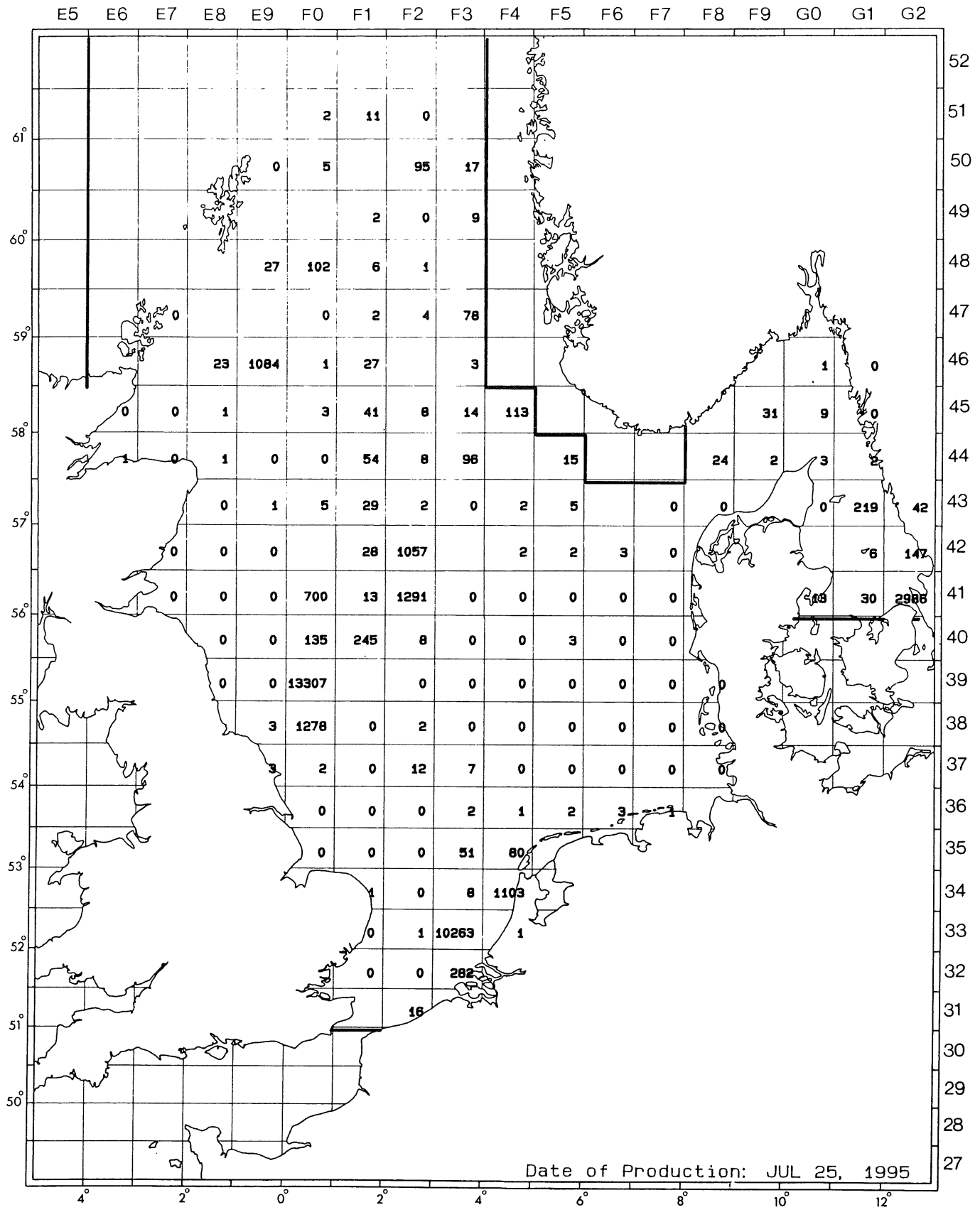

Figure 6.5 Herring: number per hour, 3+ ringers.

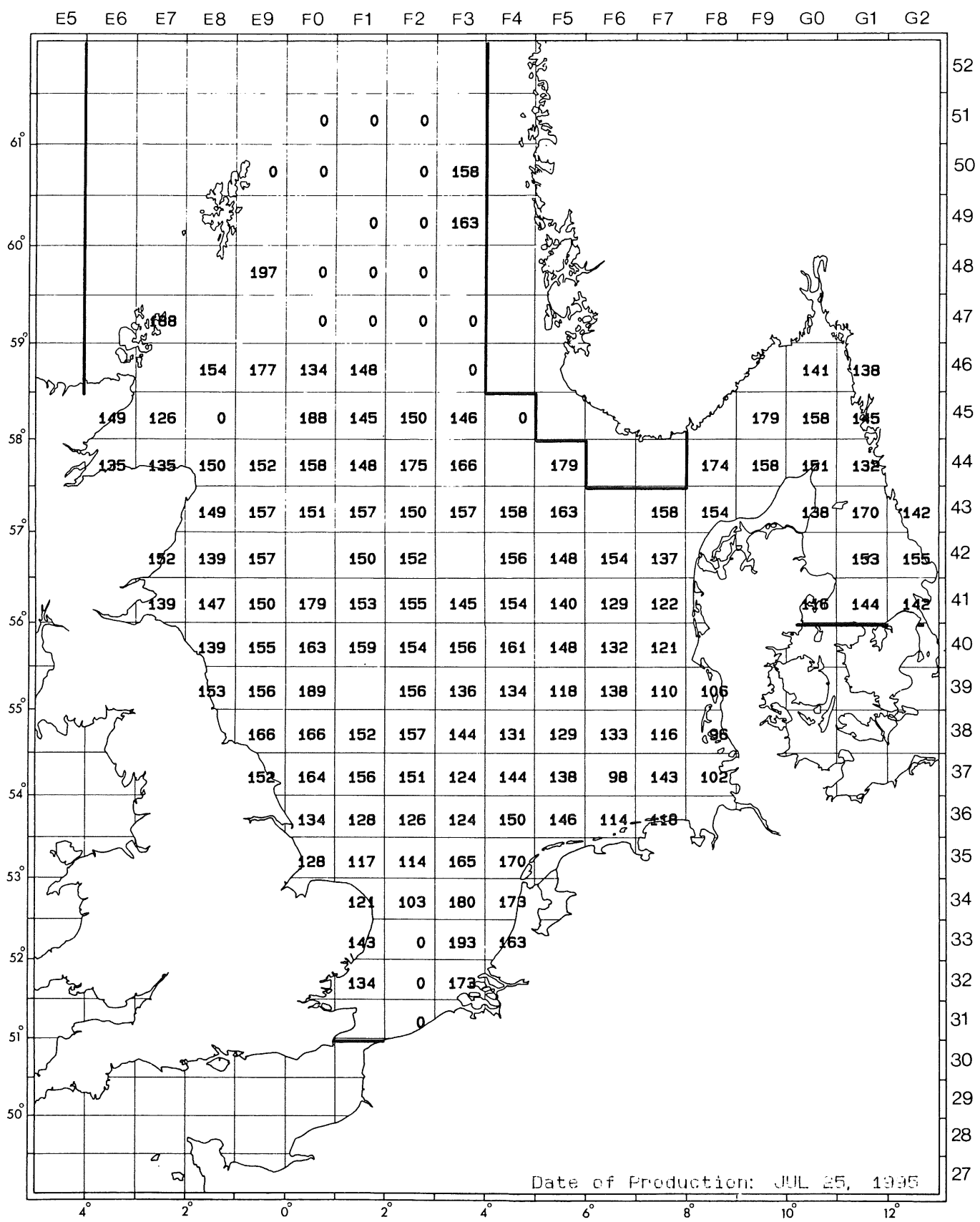

Figure 6.6 Herring: mean length, 1-ringers.

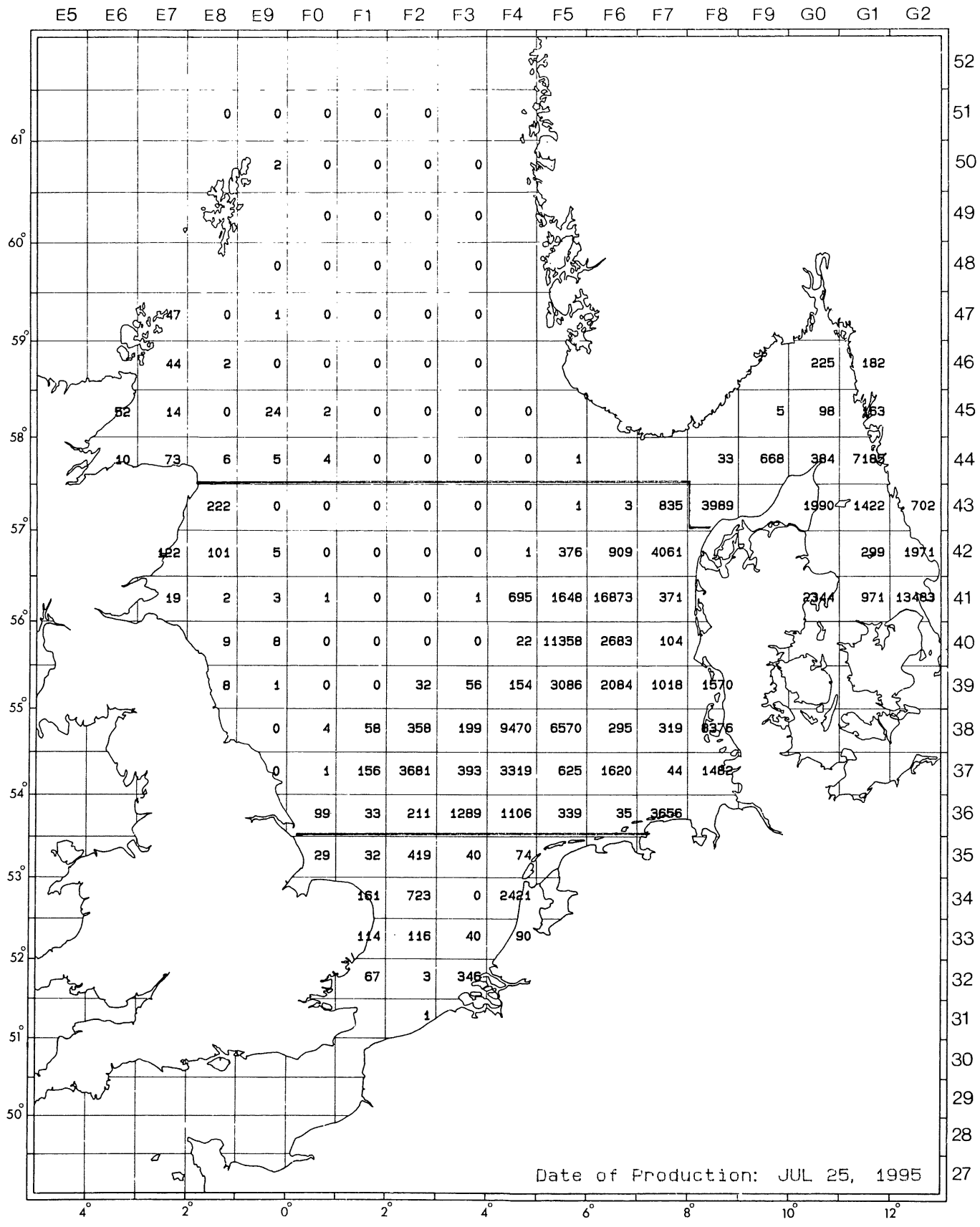

Figure 6.7 Sprat: number per hour, age group 1.

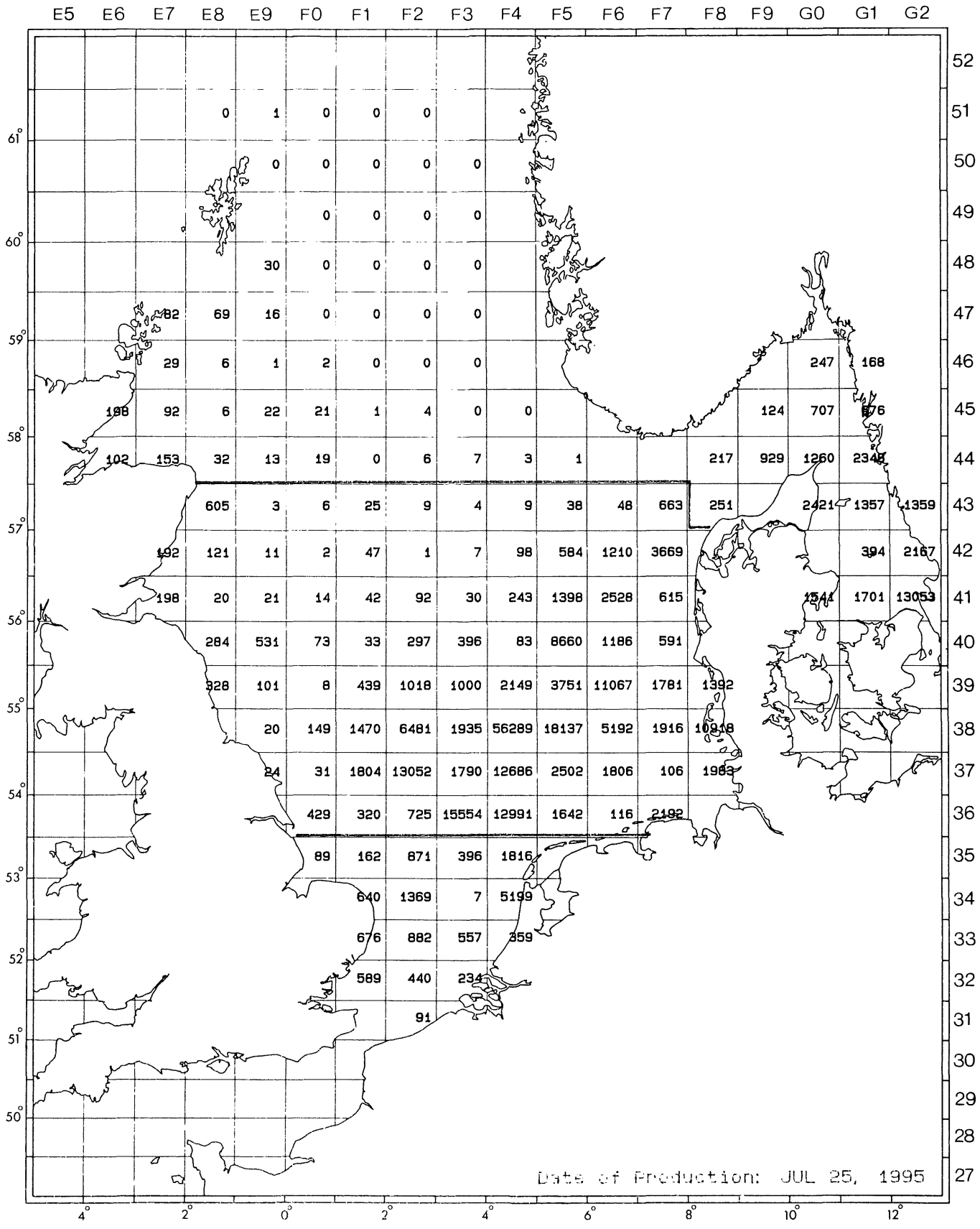

Figure 6.8 Sprat: number per hour, age group 2.

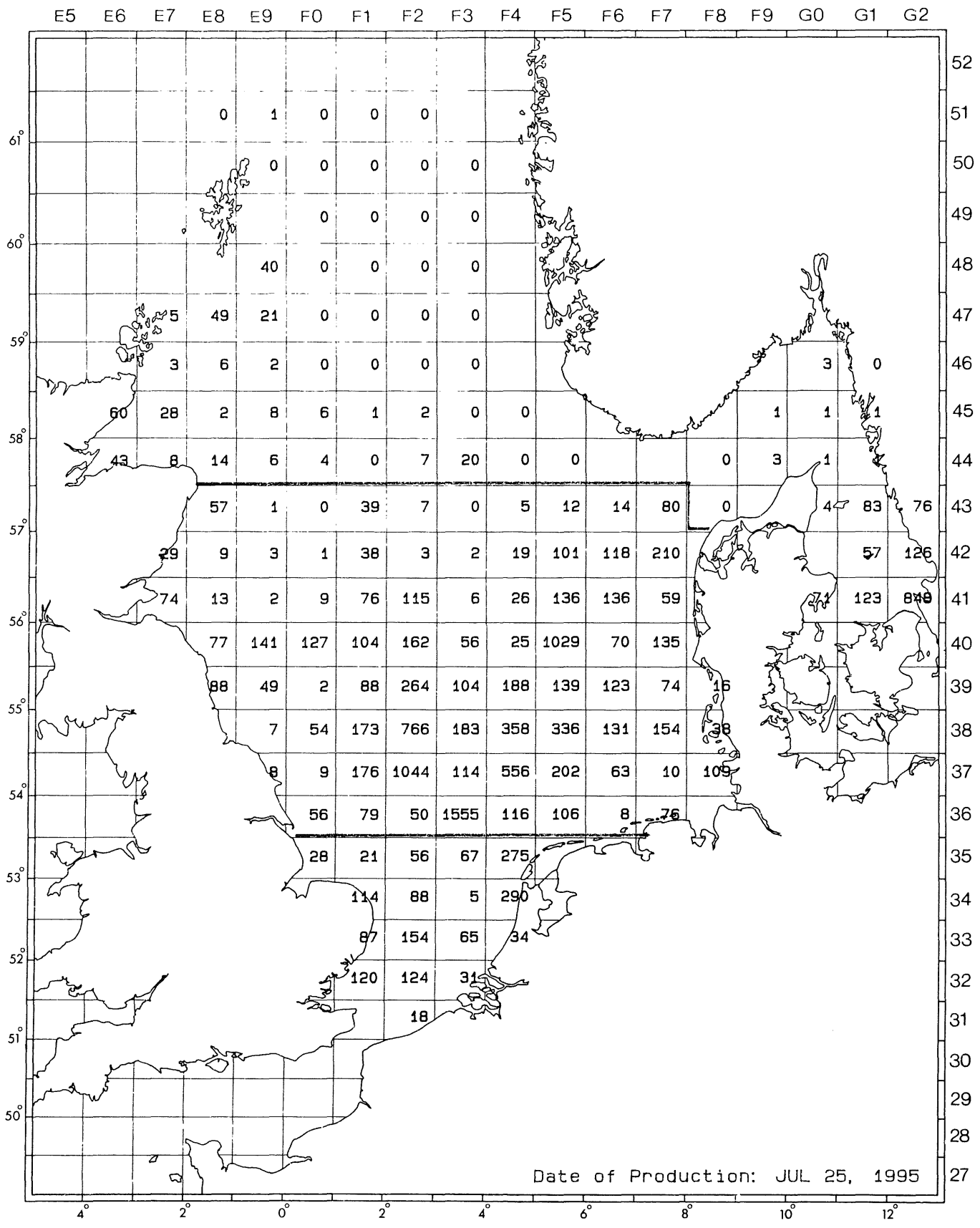

Figure 6.9 Sprat: number per hour, age group 3+.

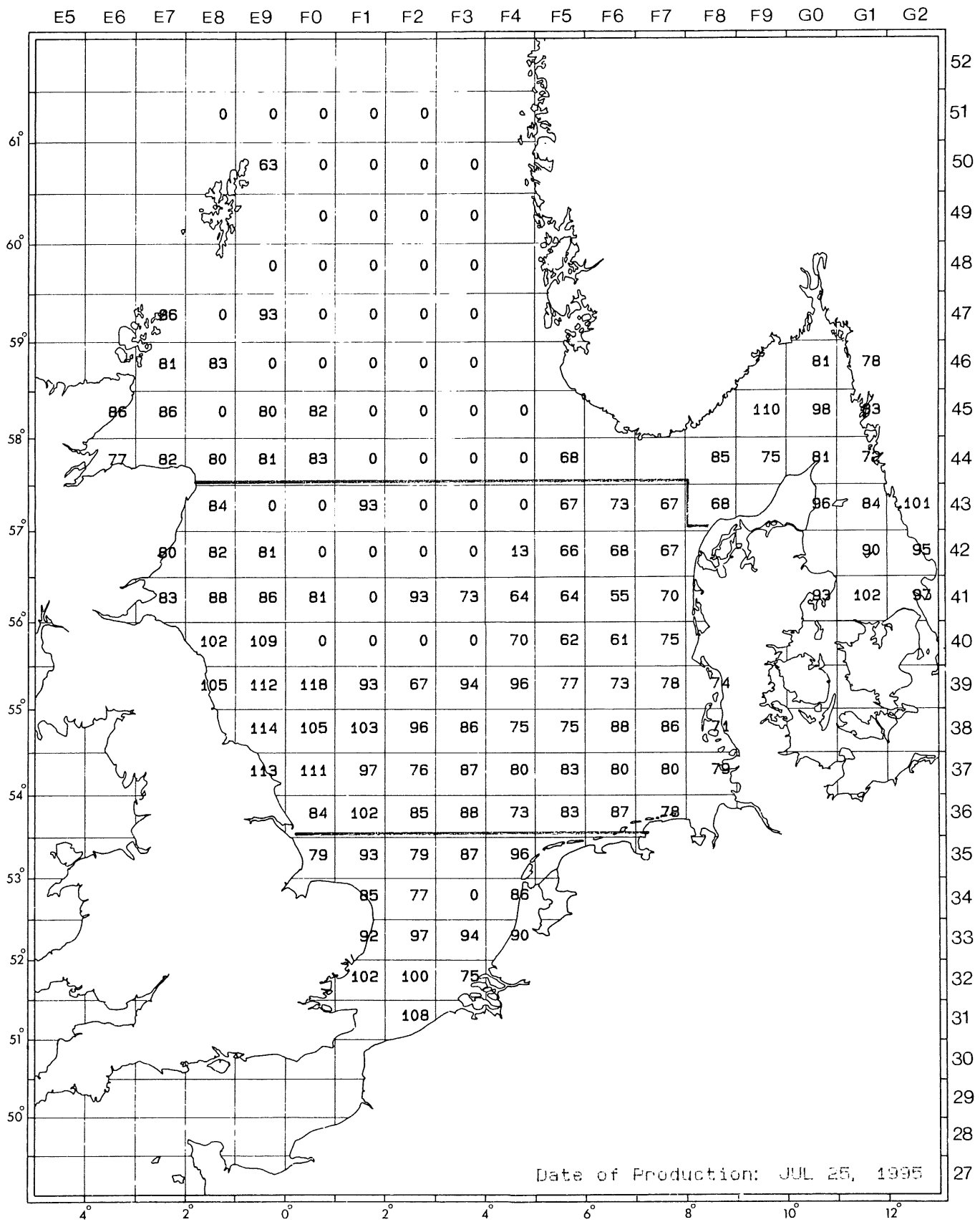

Figure 6.10 Sprat: mean length, age group 1.

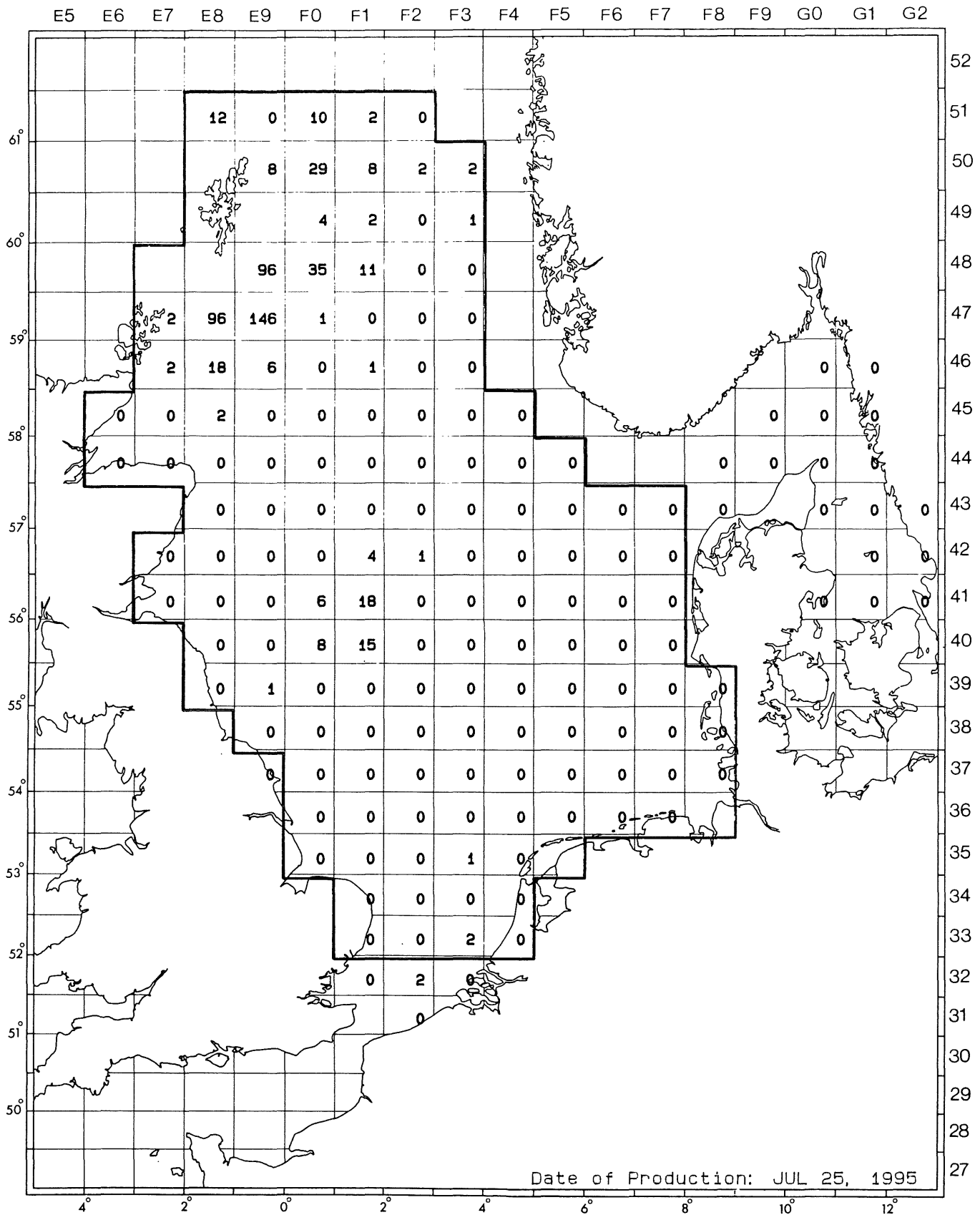

Figure 6.11 Mackerel: number per hour, total catch.

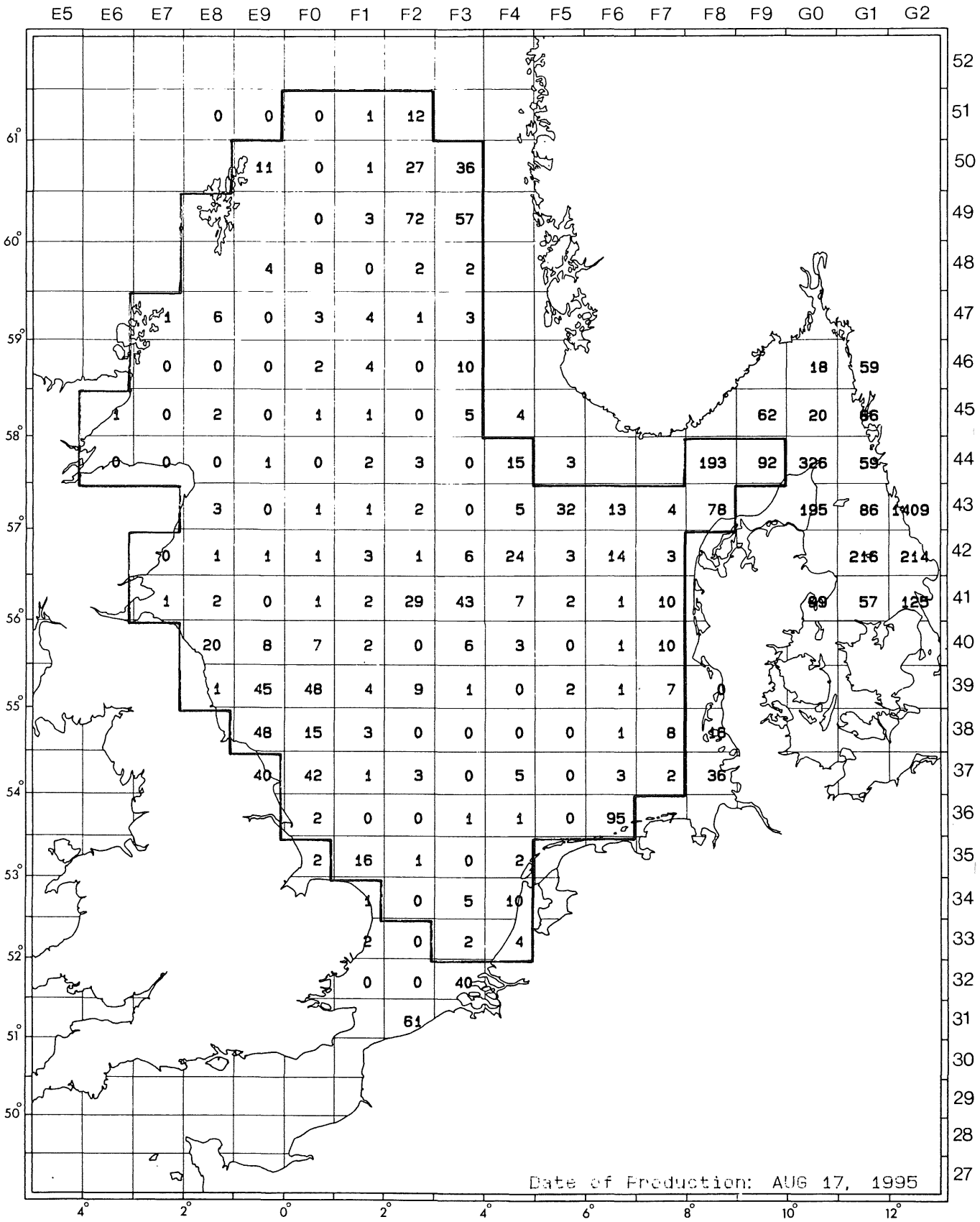

Figure 6.12 Cod: number per hour, age group 1.

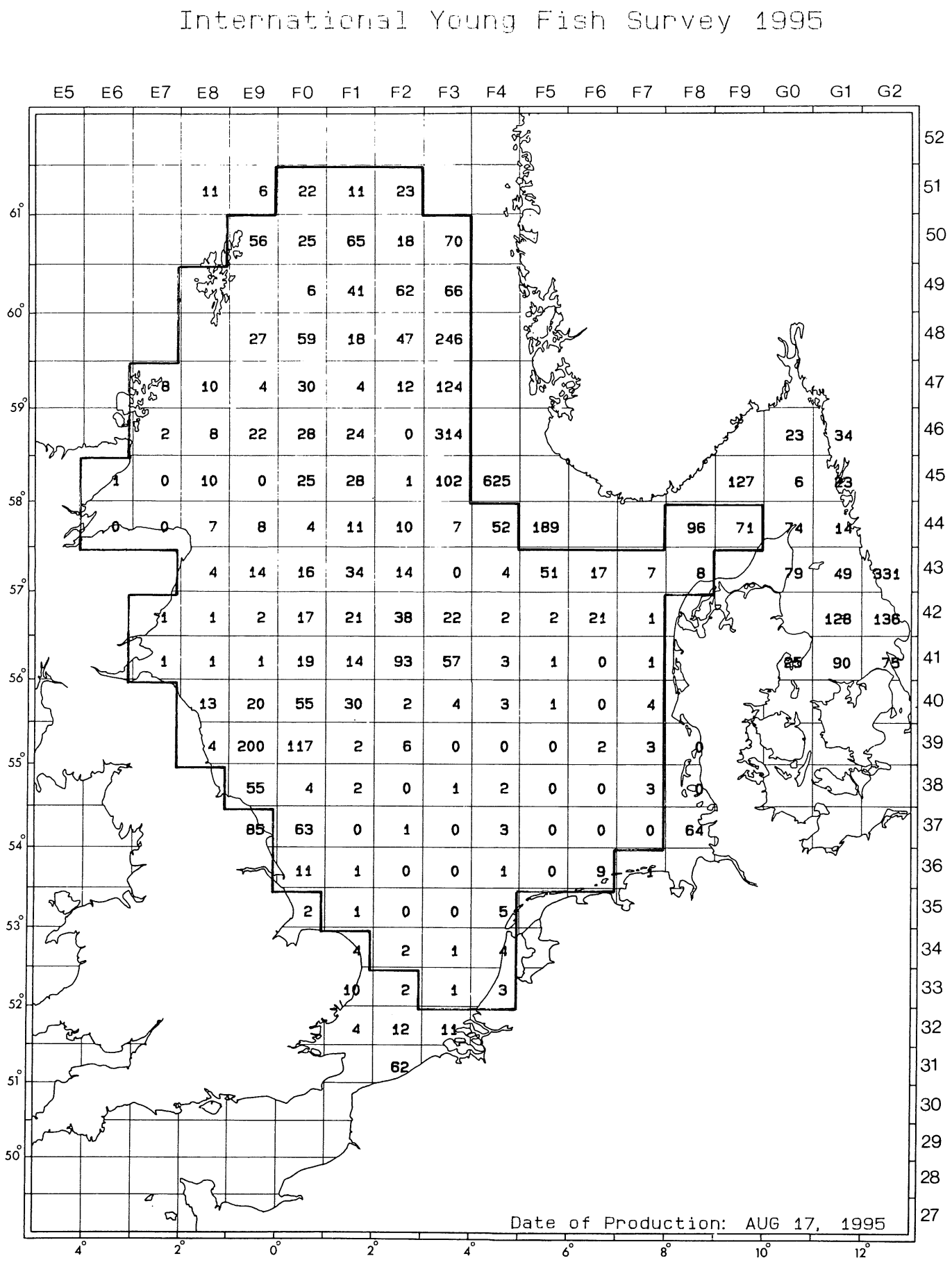

Figure 6.13 Cod: number per hour, age group 2.

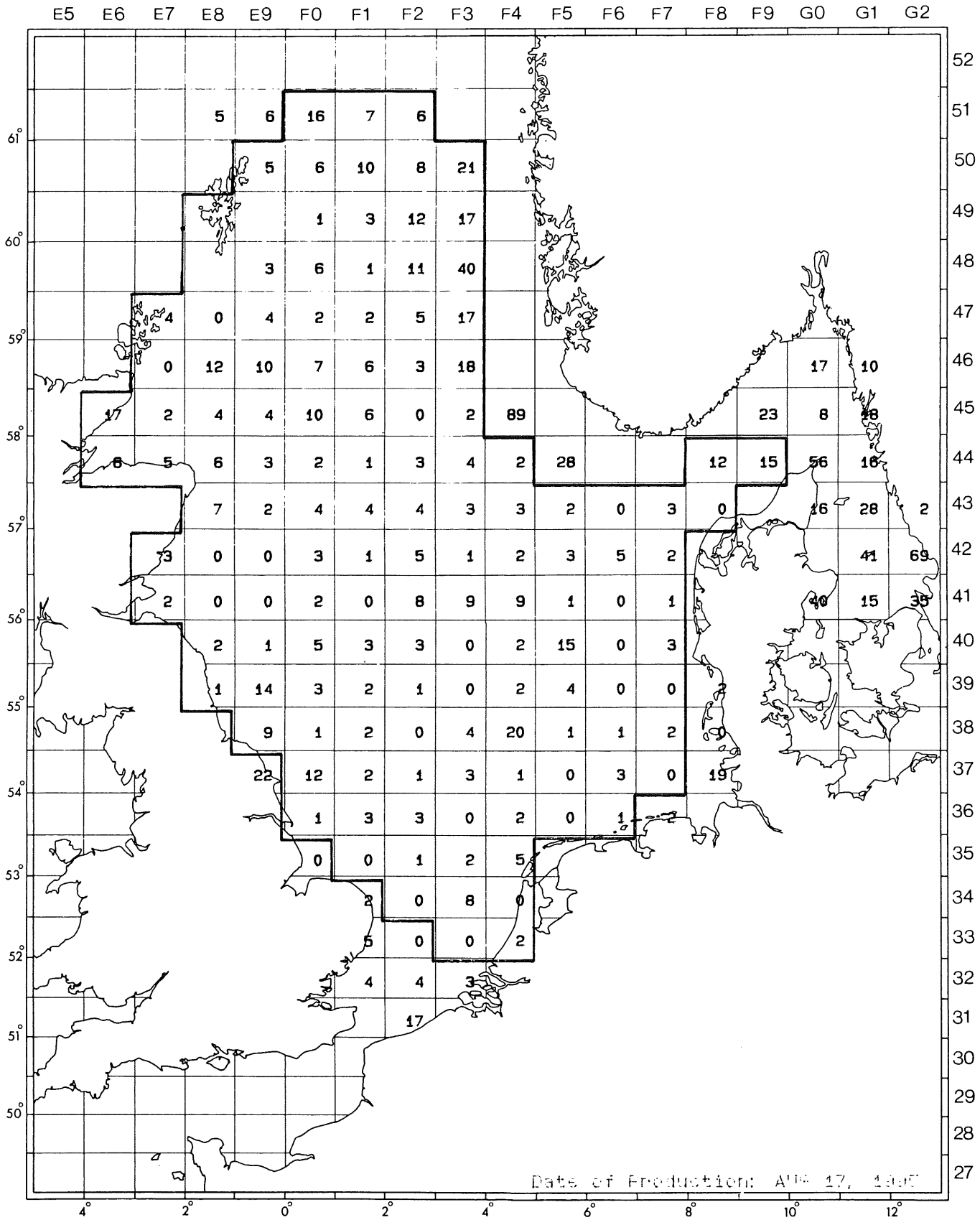

Figure 6.14 Cod: number per hour, age group 3+.

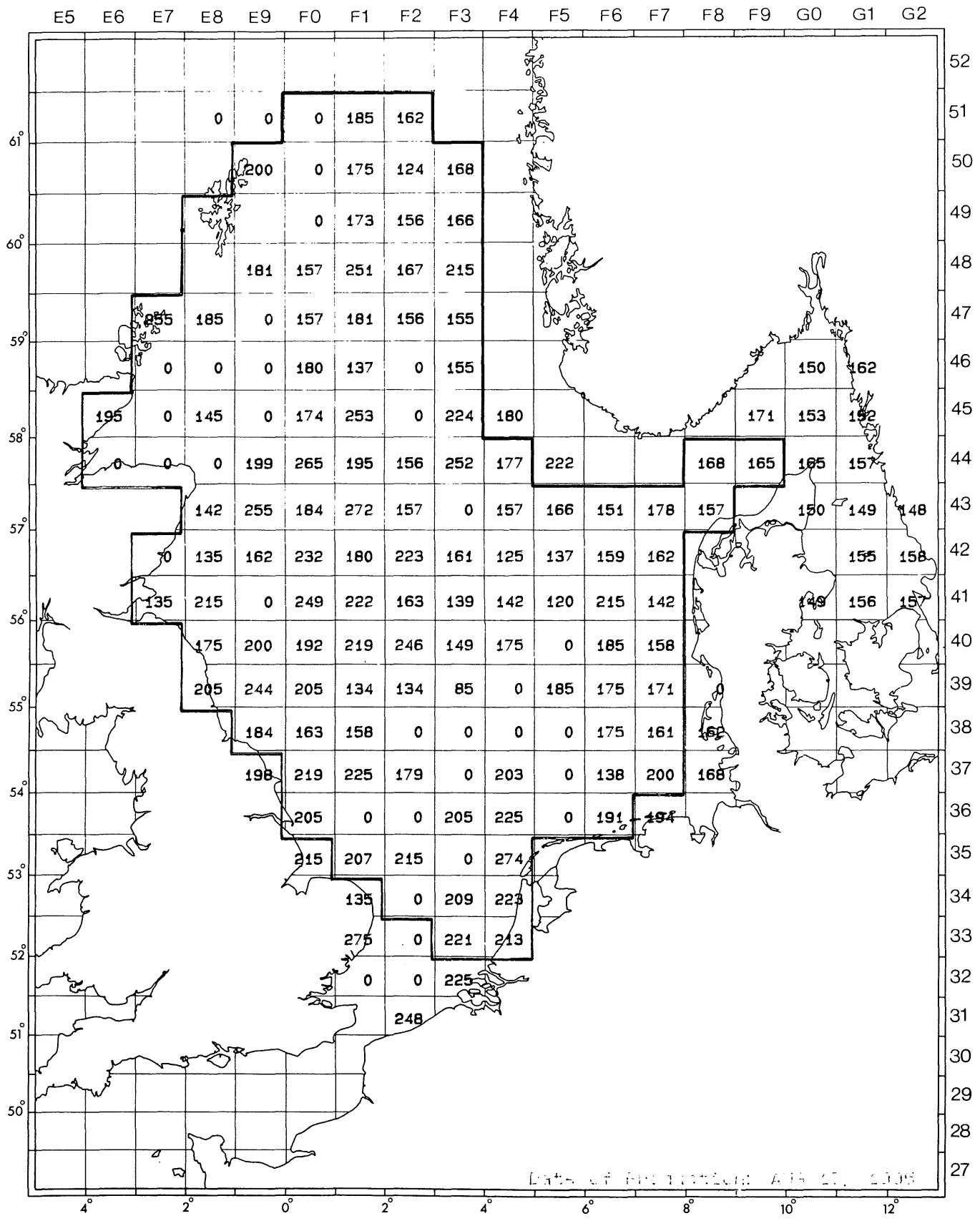

Figure 6.15 Cod: mean length, age group 1.

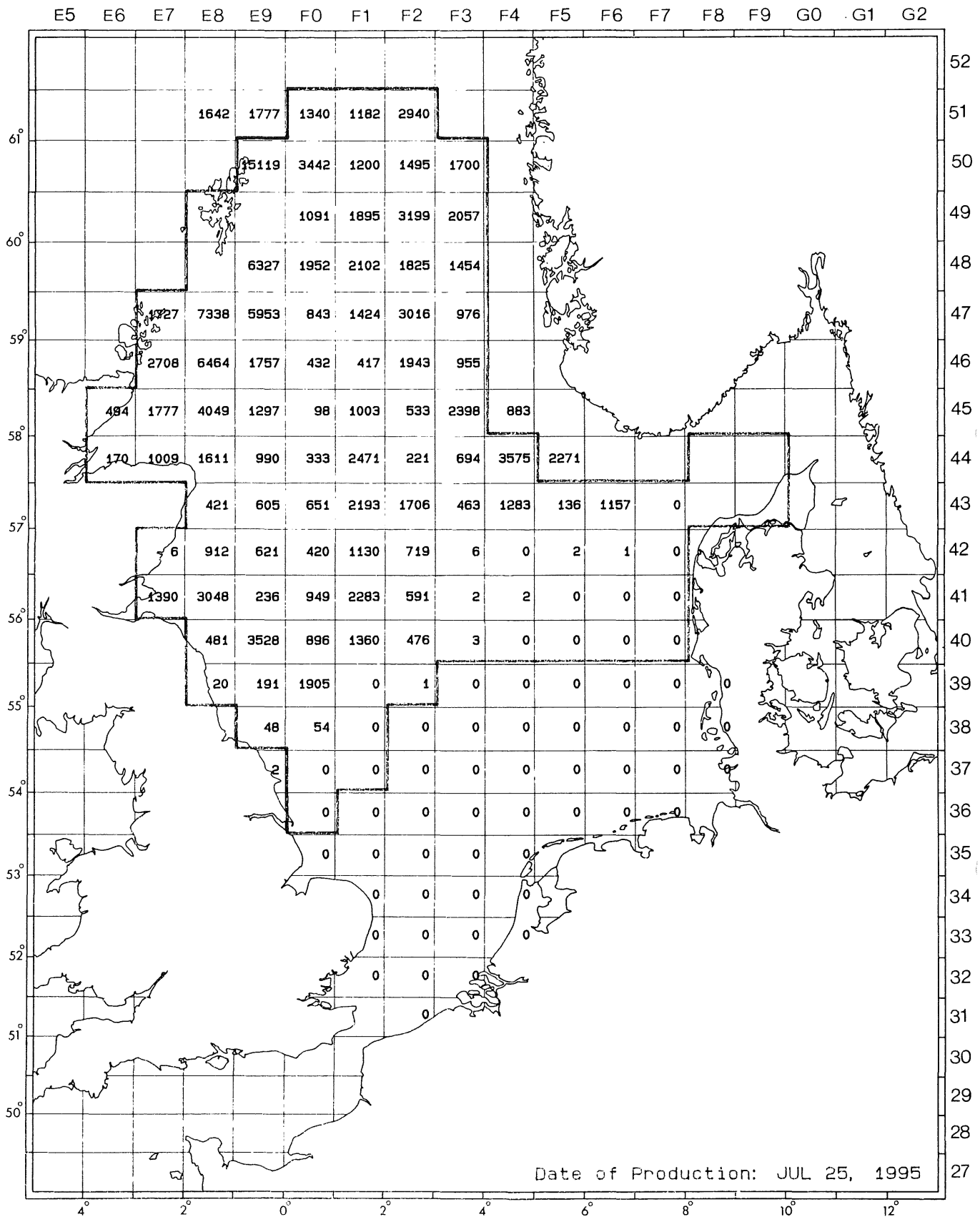

Figure 6.16 Haddock: number per hour, age group 1.

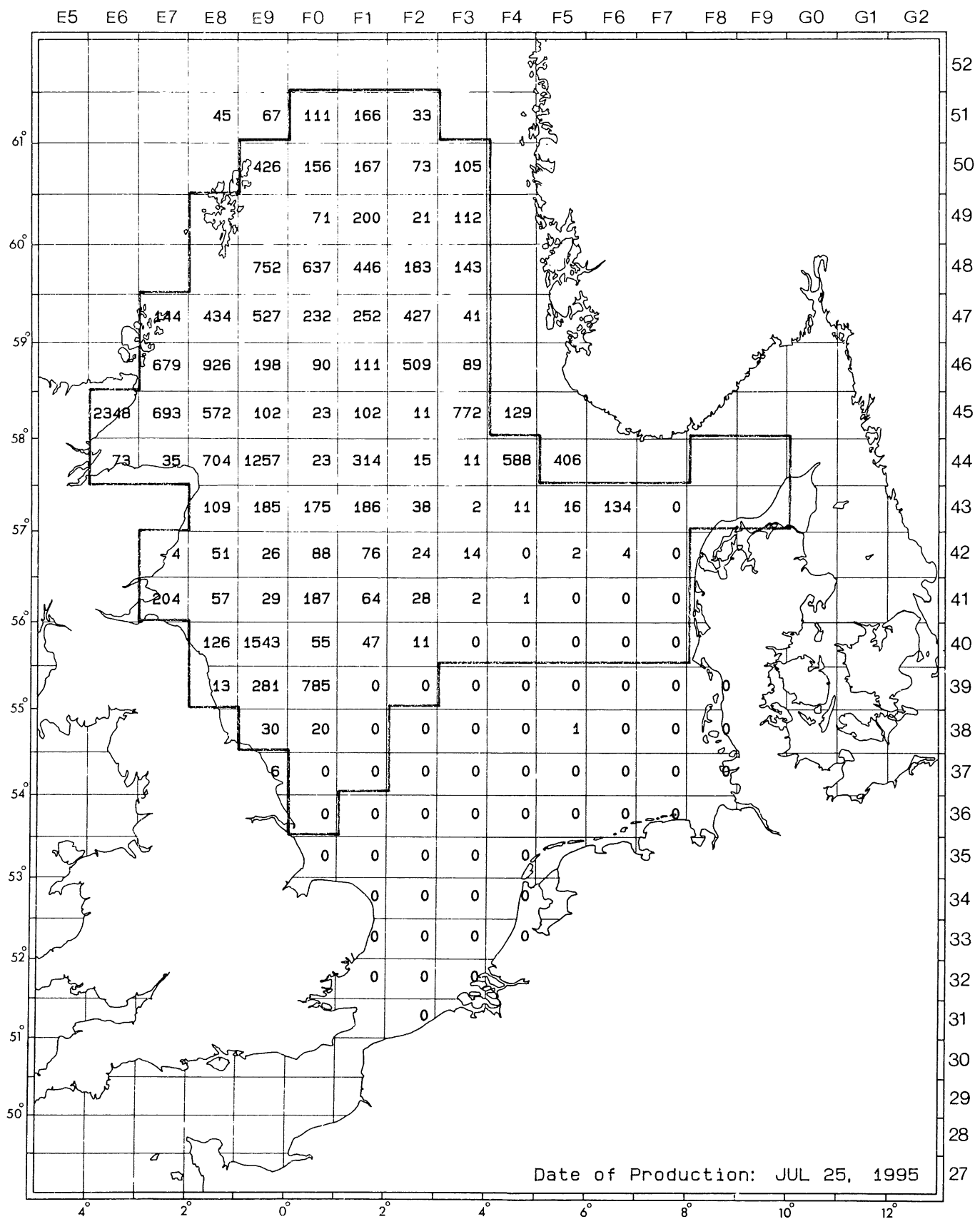

Figure 6.17 Haddock: number per hour, age group 2.

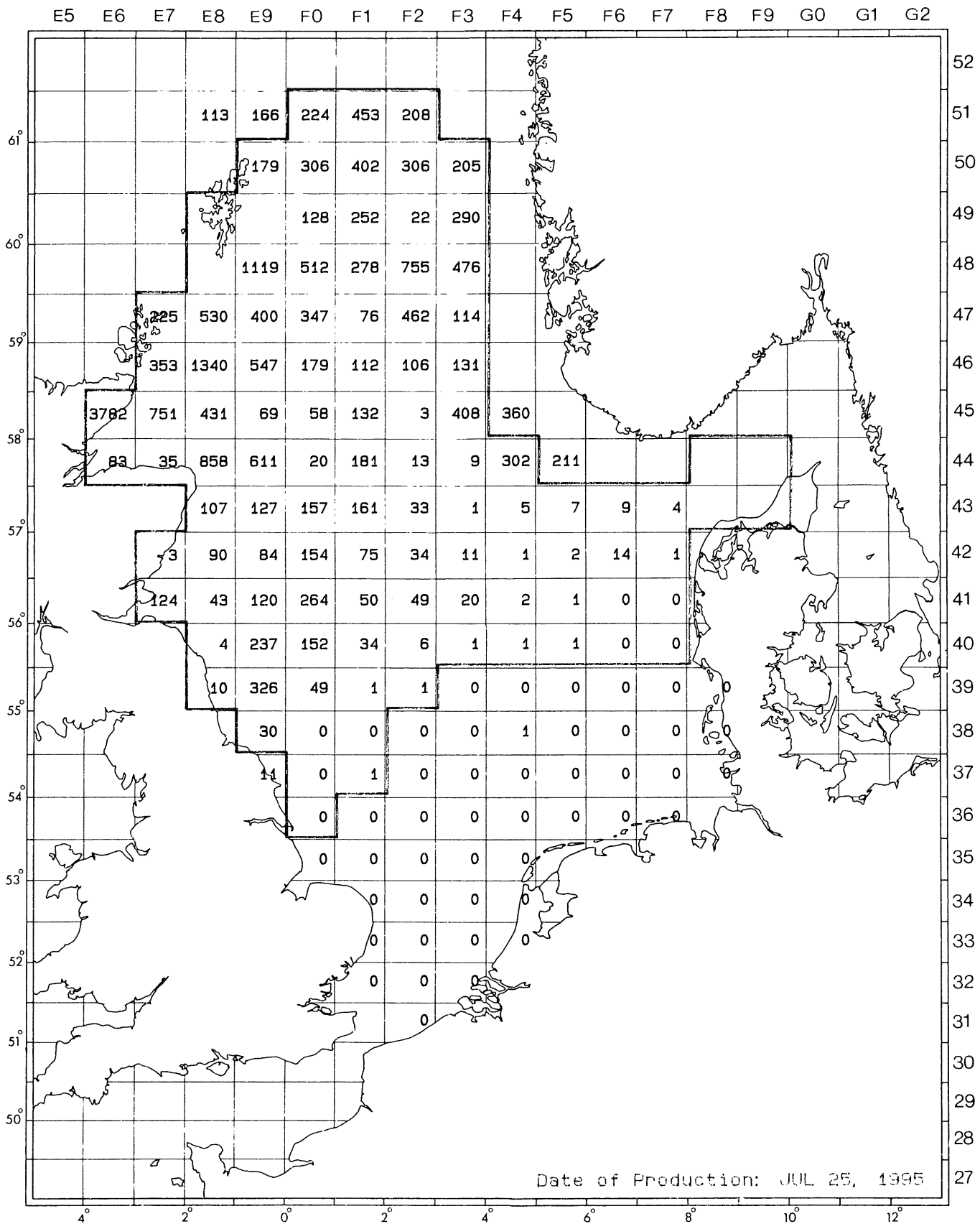

Figure 6.18 Haddock: number per hour, age group 3+.

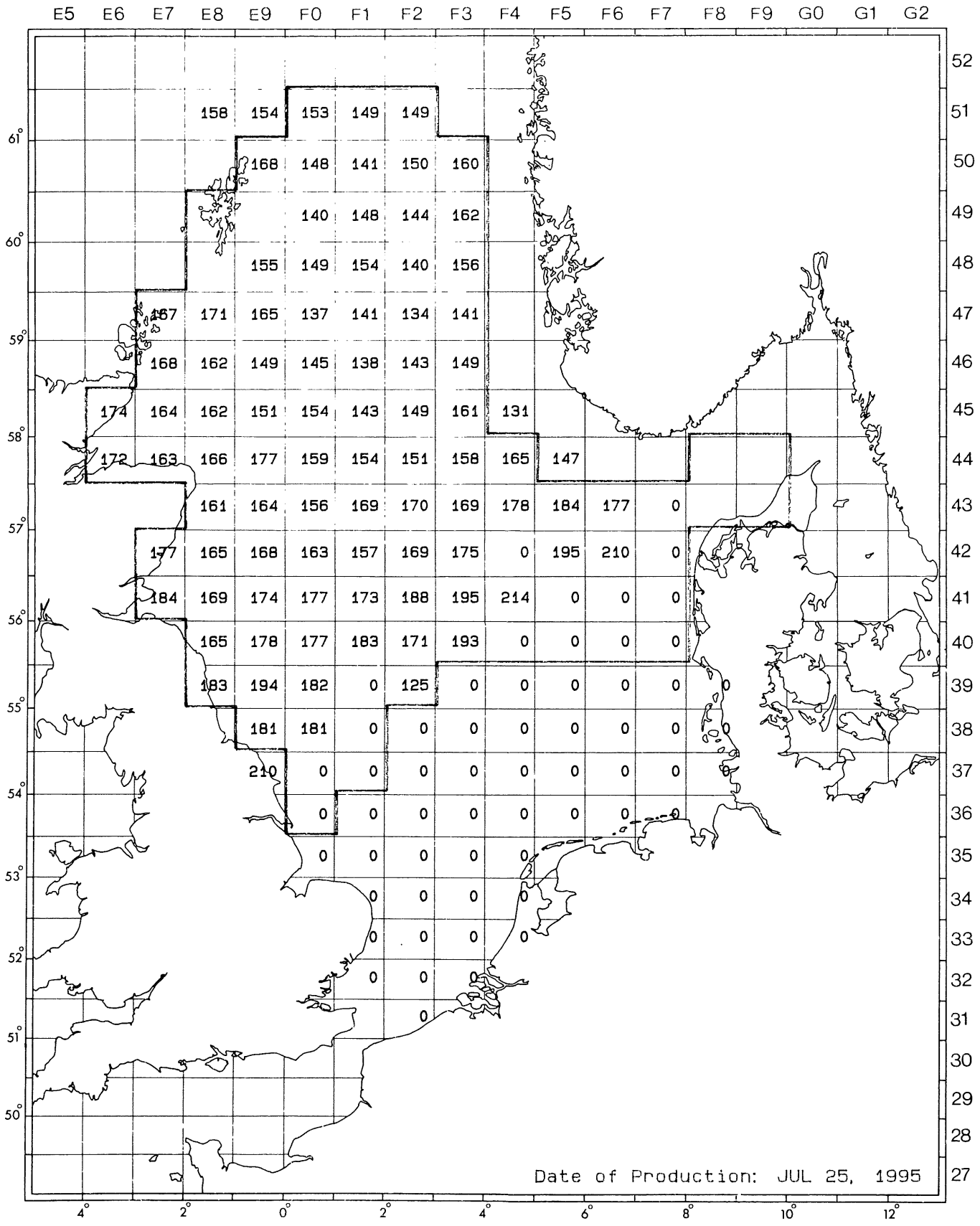

Figure 6.19 Haddock: mean length, age group 1.

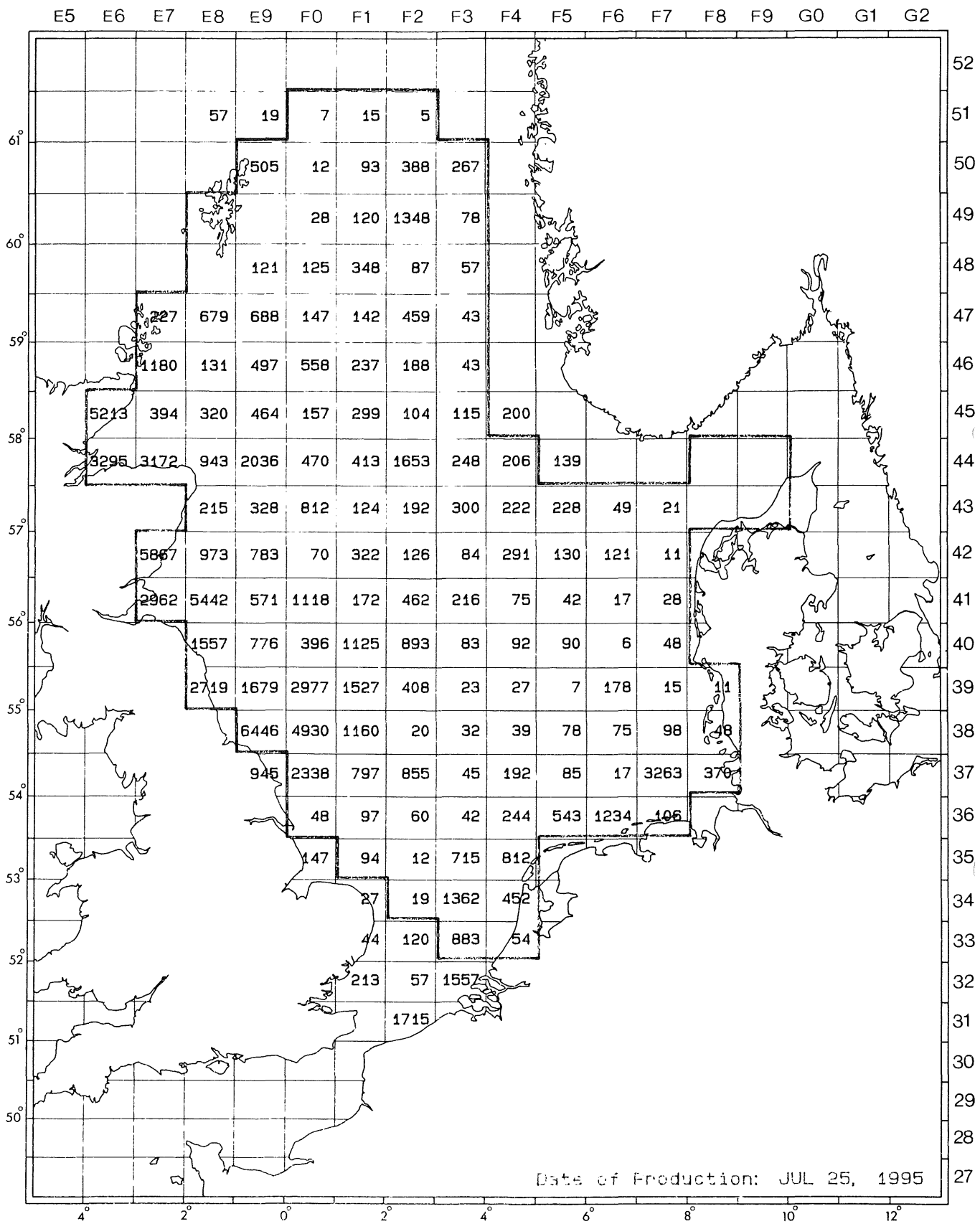

Figure 6.20 Whiting: number per hour, age group 1.

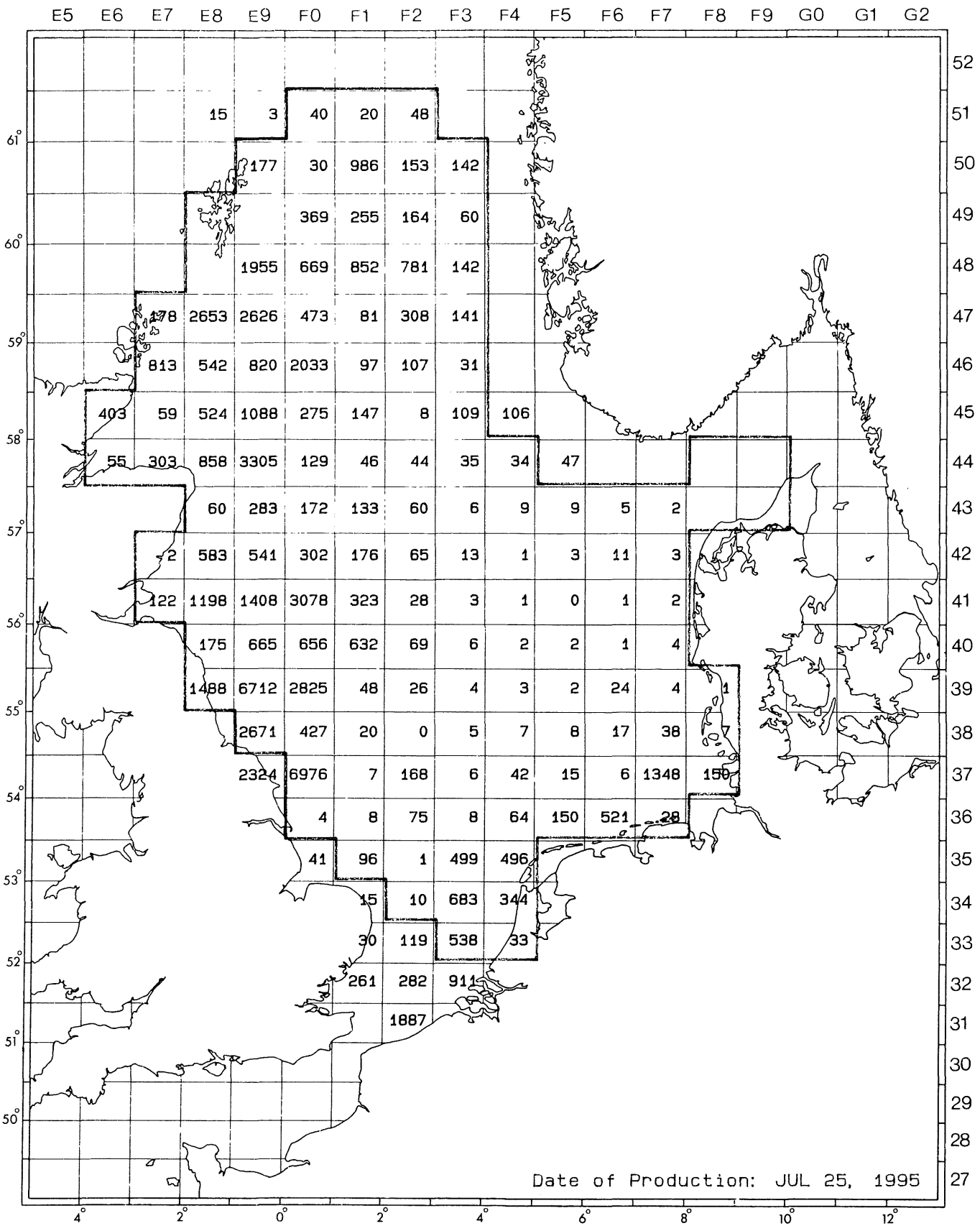

Figure 6.21 Whiting: number per hour, age group 2.

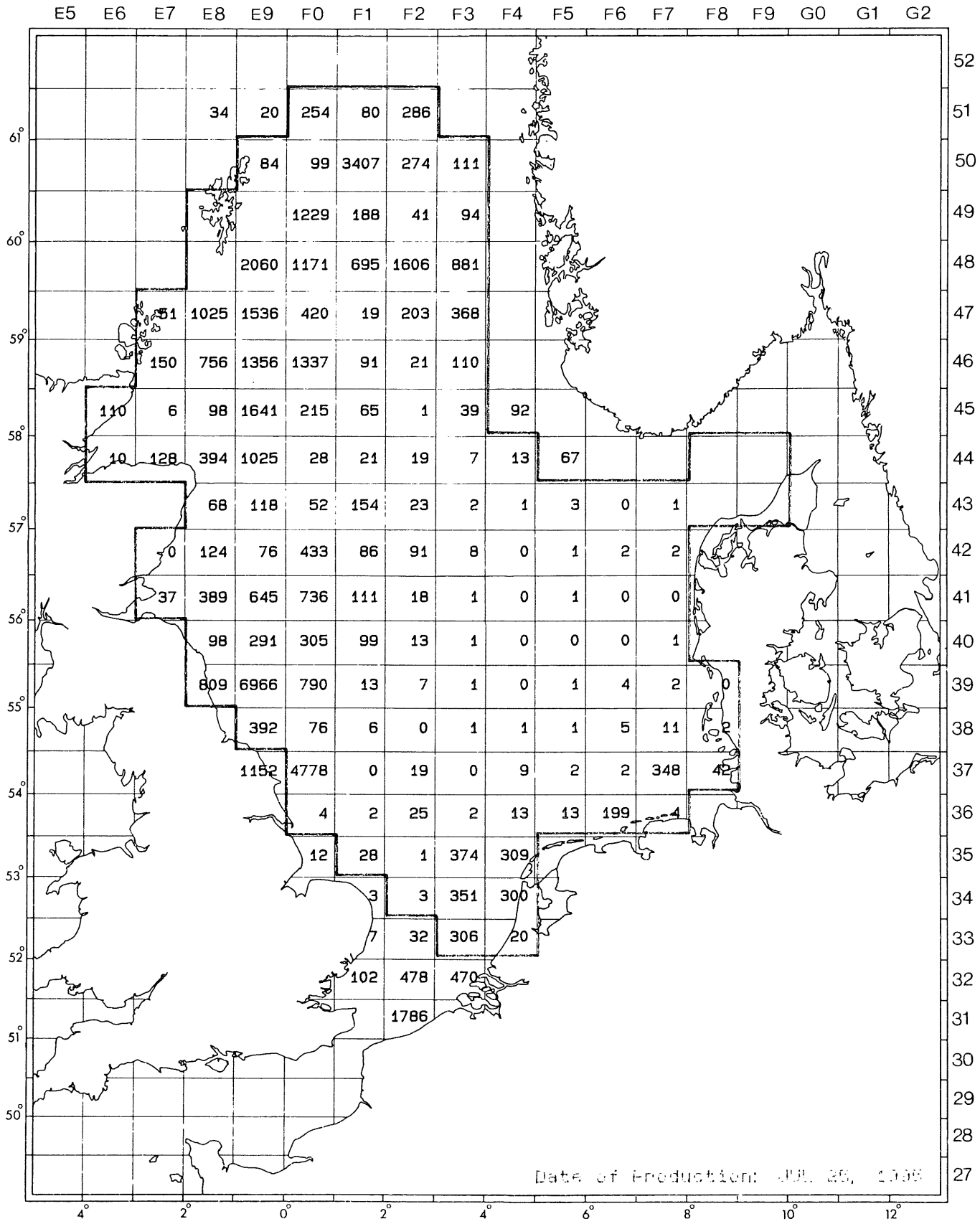

Figure 6.22 Whiting: number per hour, age group 3+.

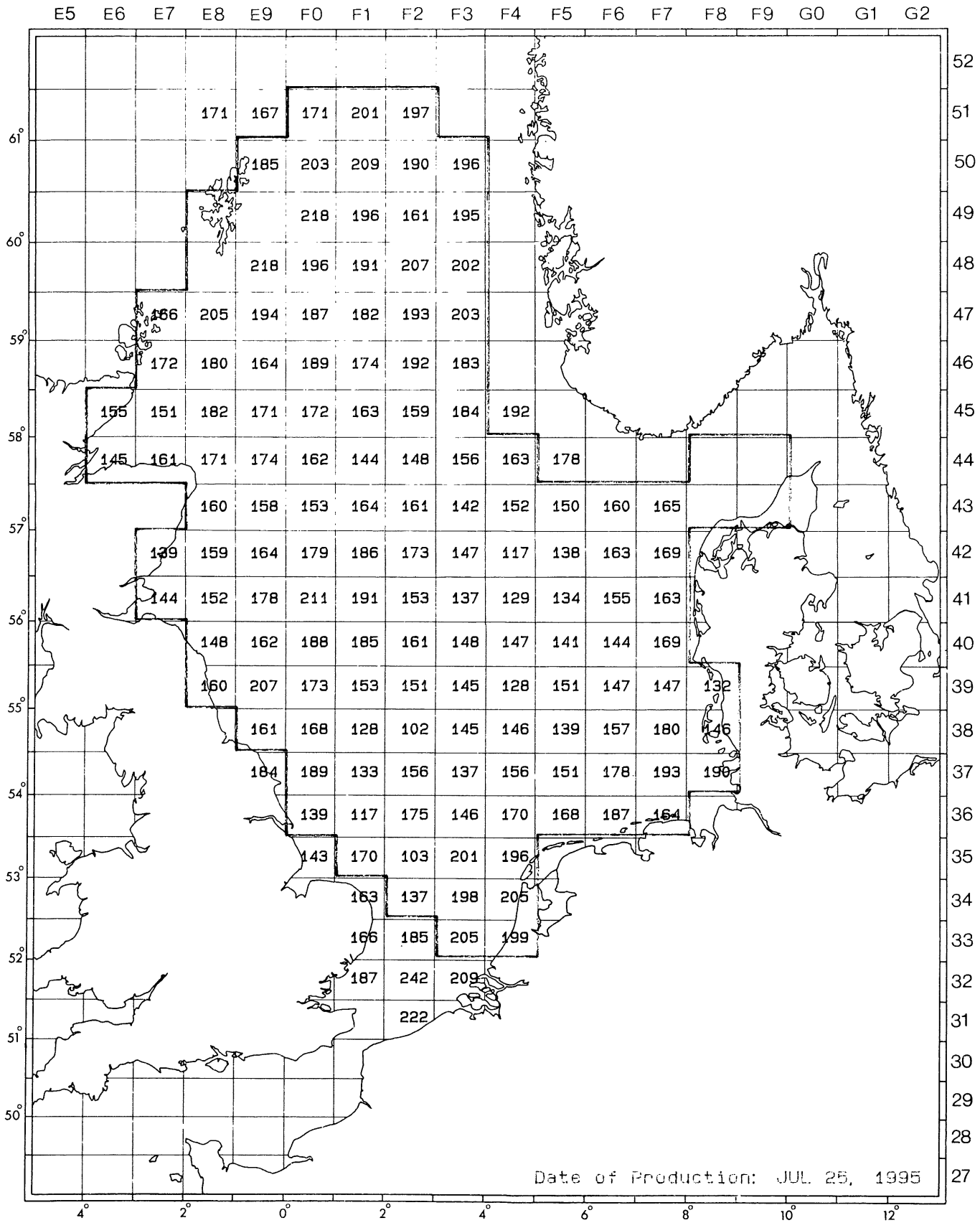

Figure 6.23 Whiting: mean length, age group 1.

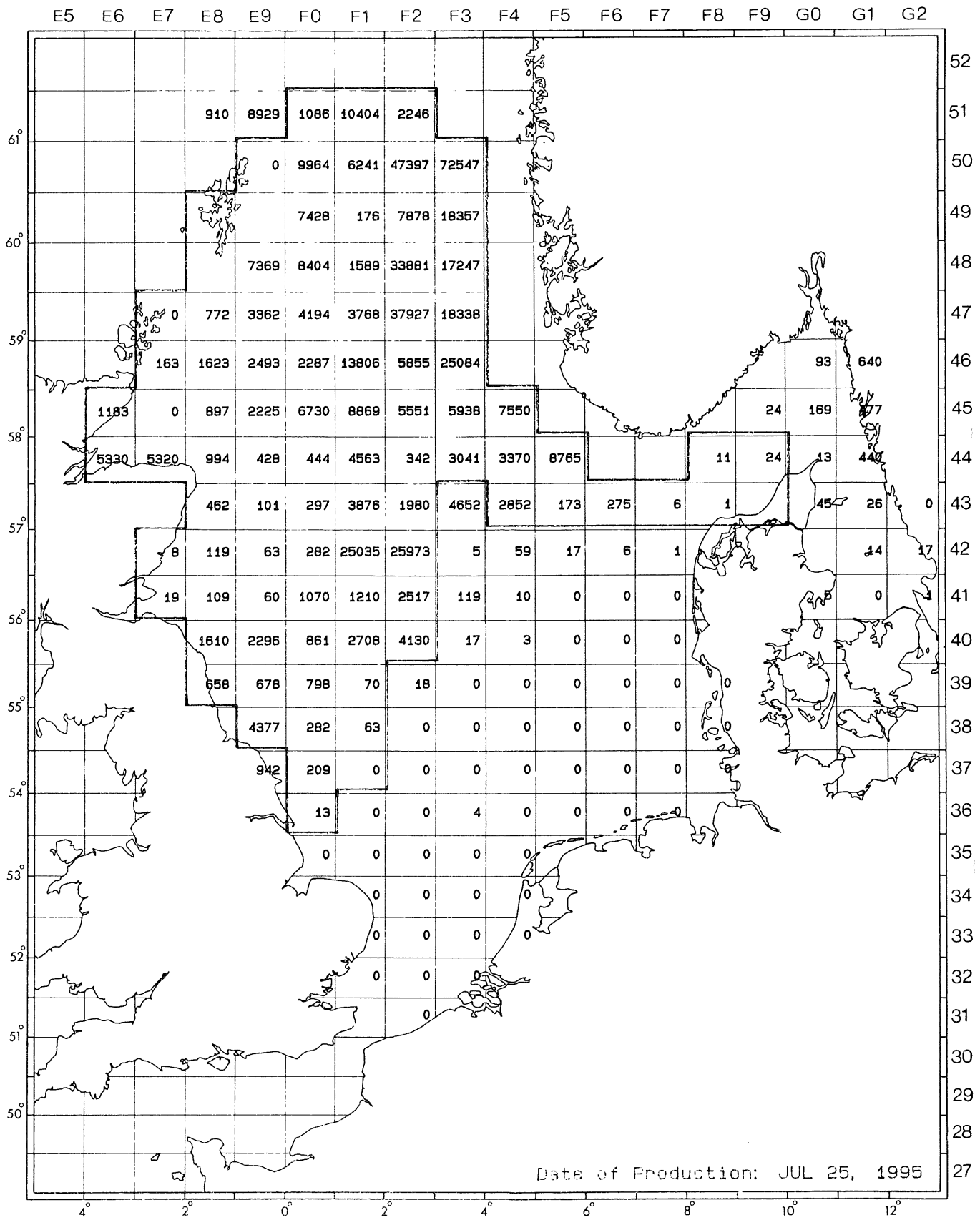

Figure 6.24 Norway pout: number per hour, age group 1.

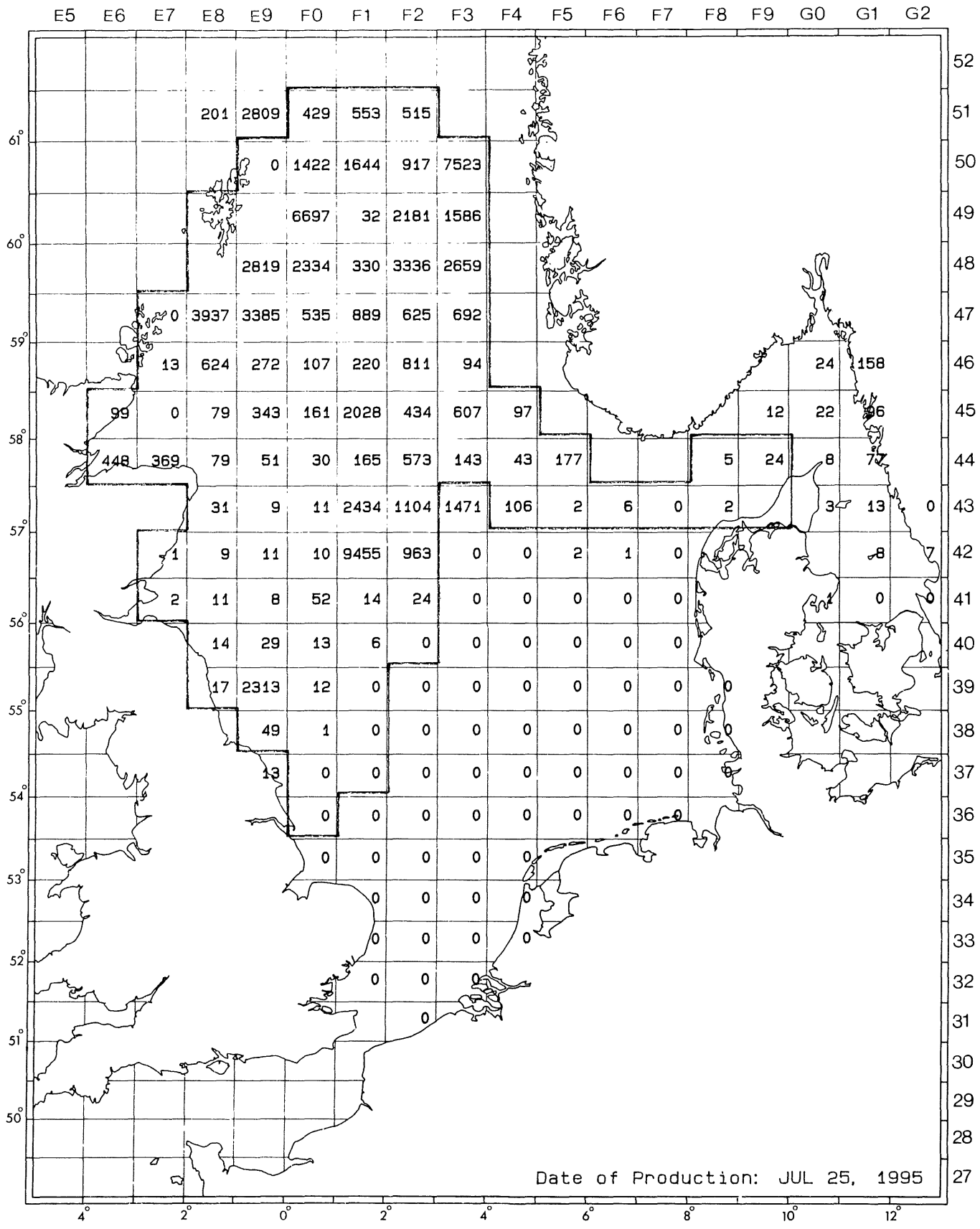

Figure 6.25 Norway pout: number per hour, age group 2.

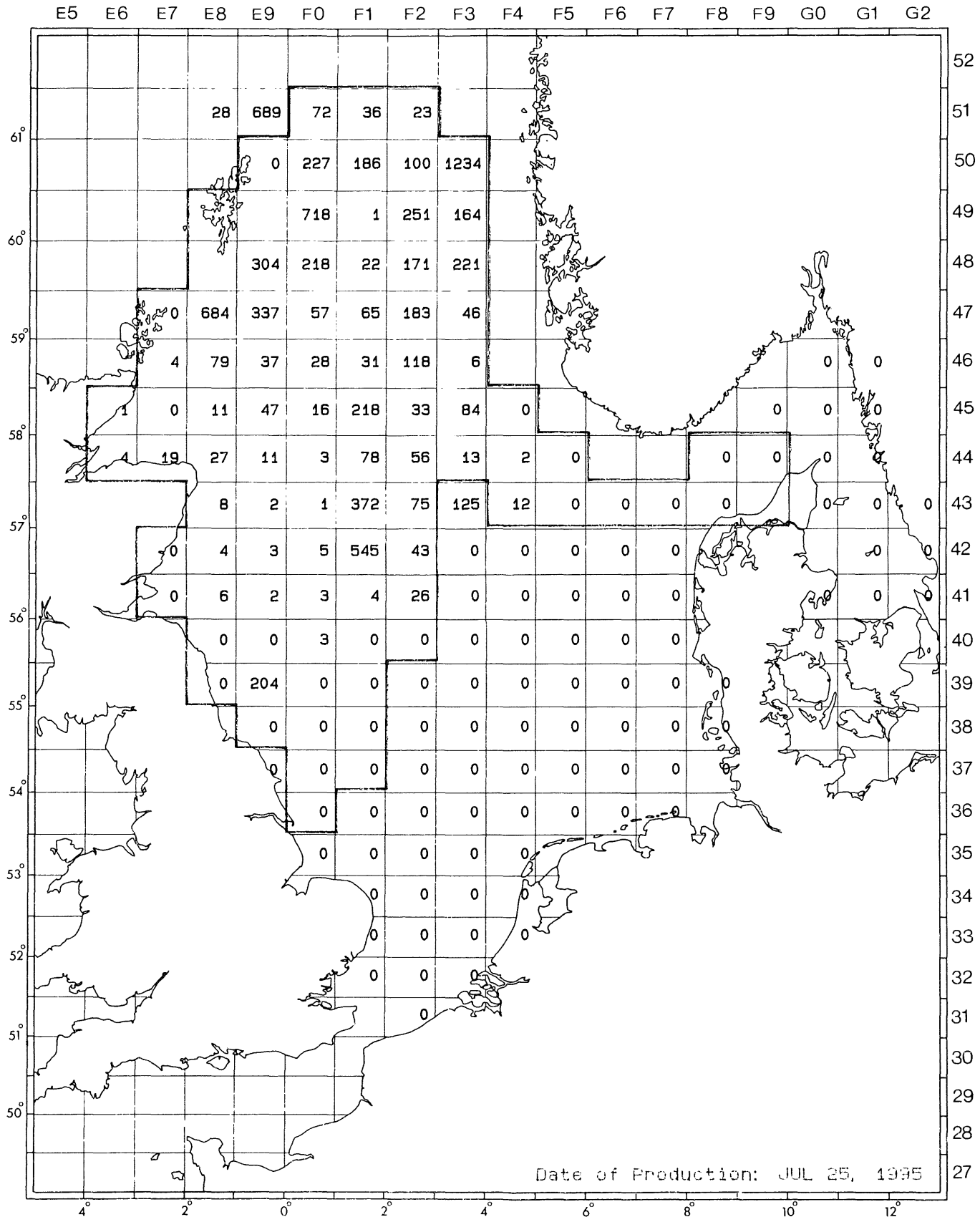

Figure 6.26 Norway pout: number per hour, age group 3+.

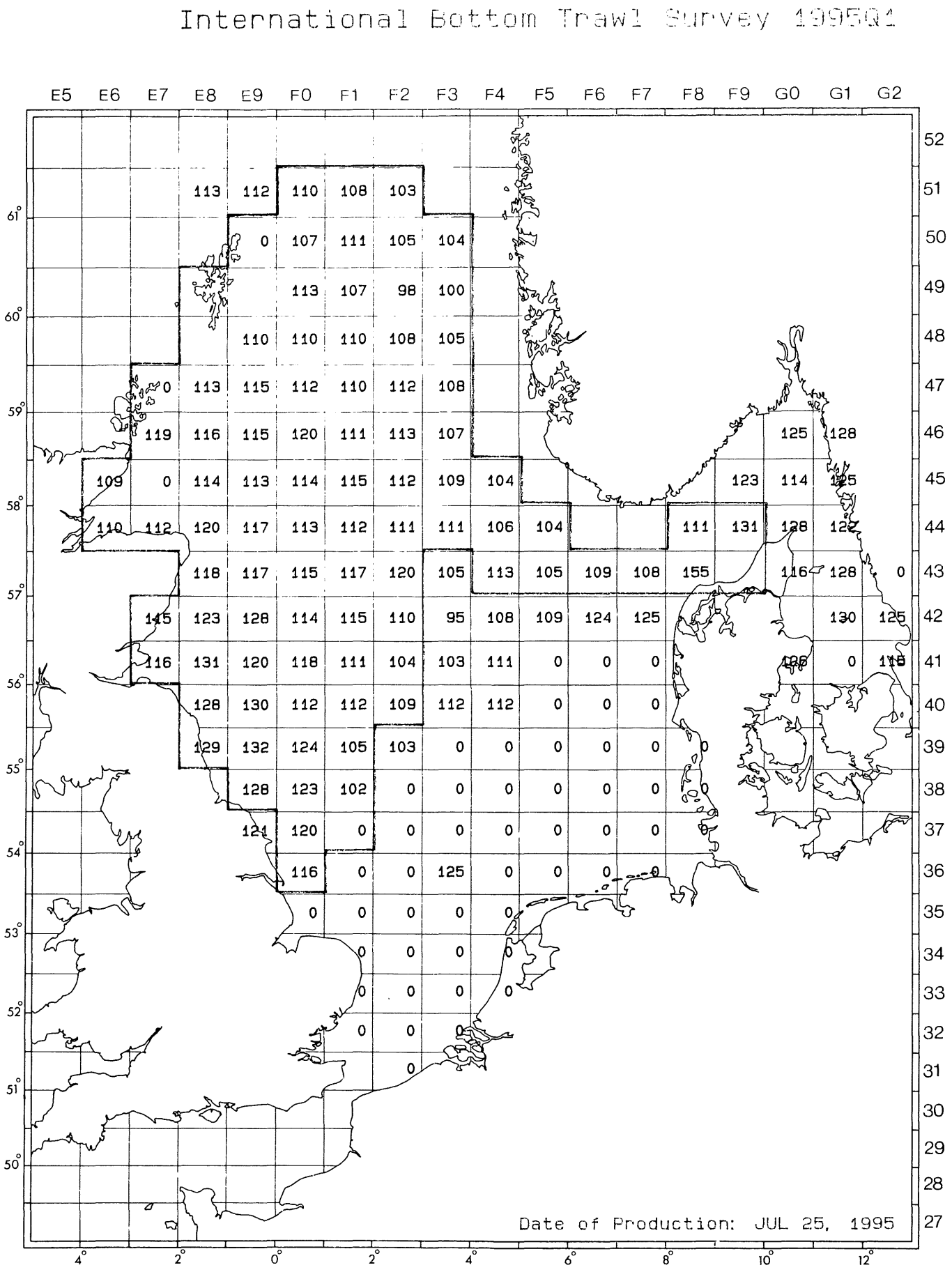

Figure 6.27 Norway pout: mean length, age group 1.

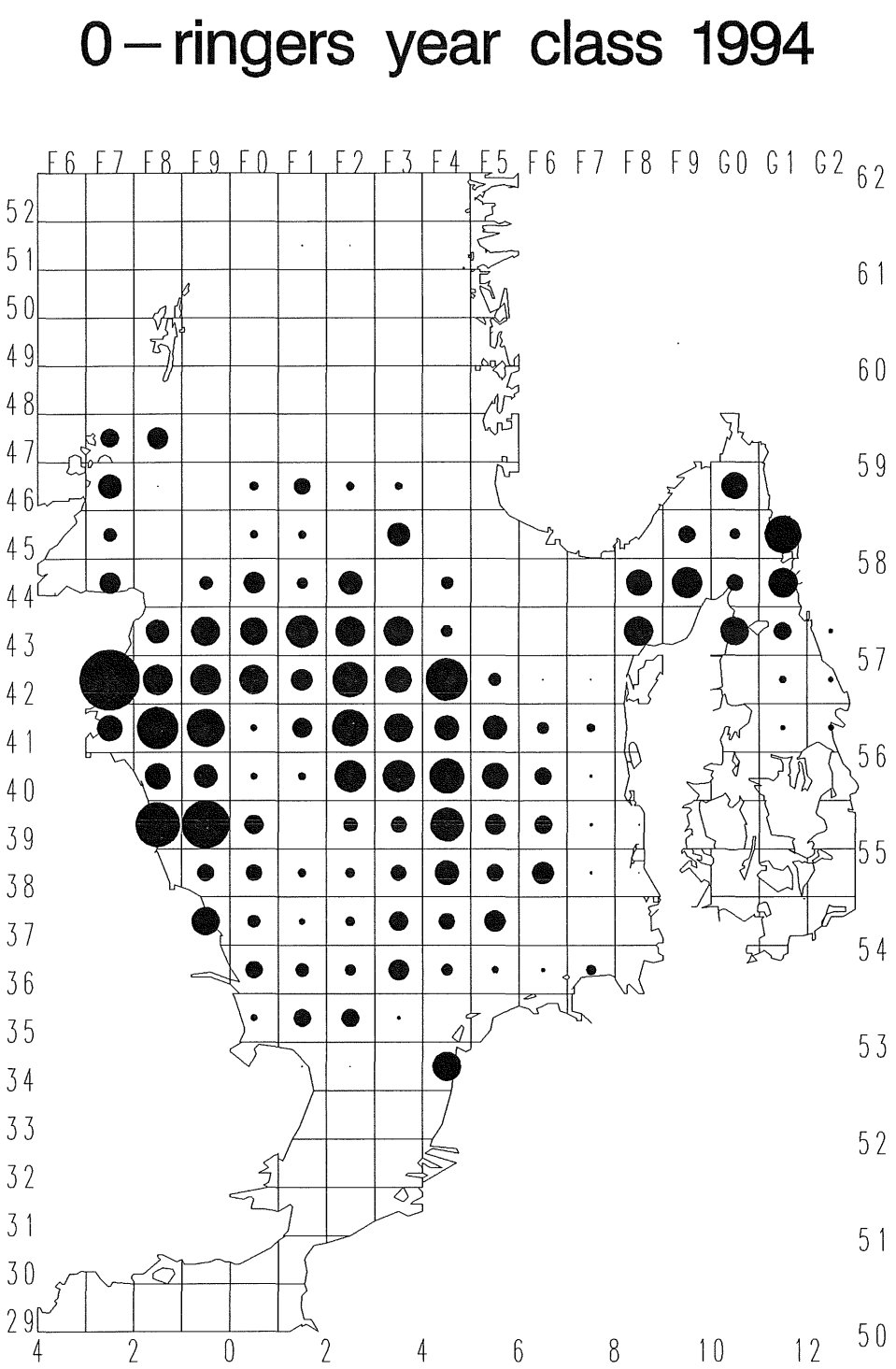

Figure 7.1 Distribution of herring larvae (0-ringers) based on MIK catches during the IBTS in February 1995. The surface area of the filled circles represents the density in no. m^{-2}; the surface area of a circle that extent to the borders of a statistical rectangle represents 1.8 larvae m^{-2}.

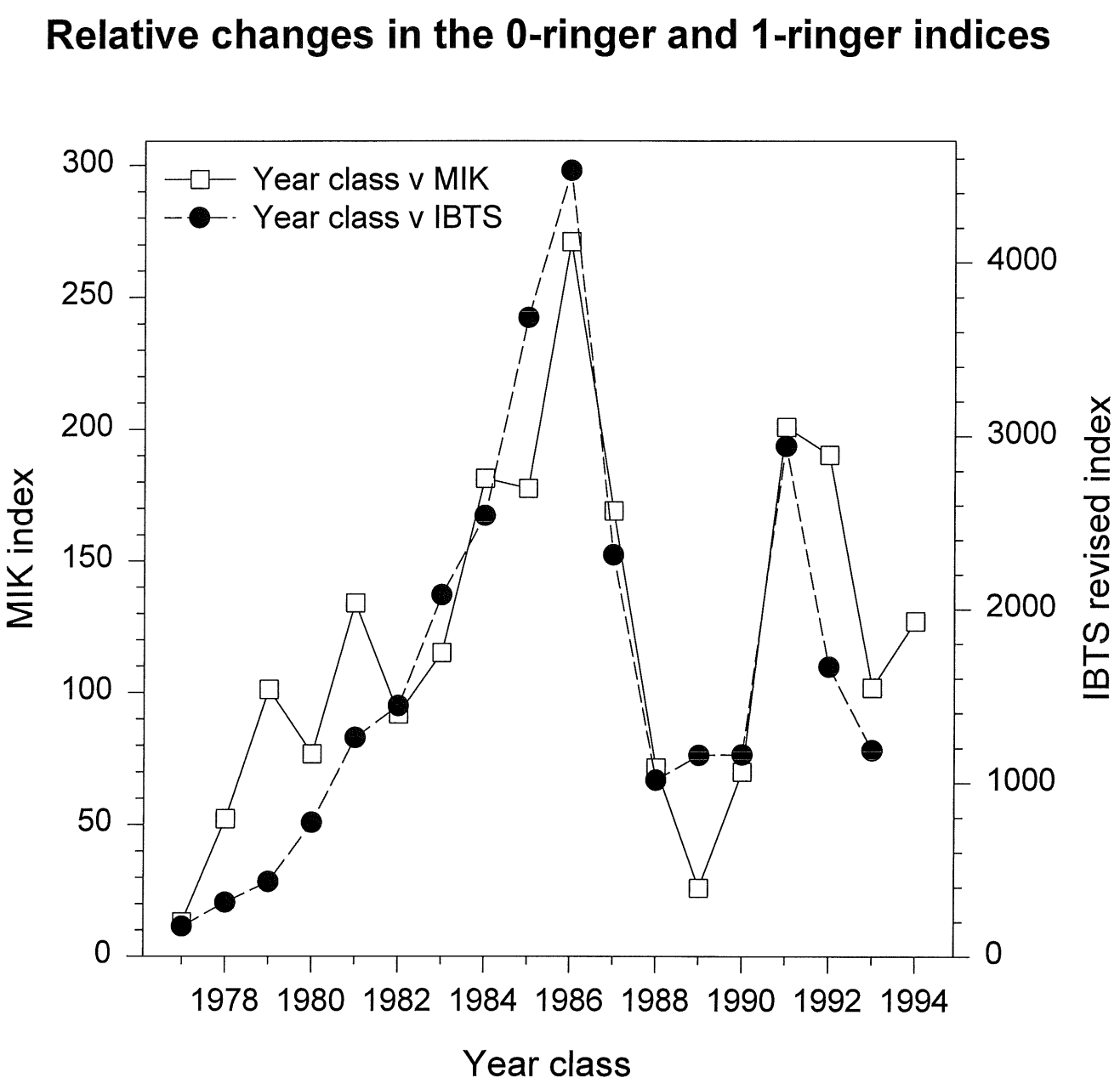

Figure 7.2 Trends in MIK 0-ringer and the new (called "revised" on the y-axis) IBTS 1-ringer indices for the survey years 1978-1995.

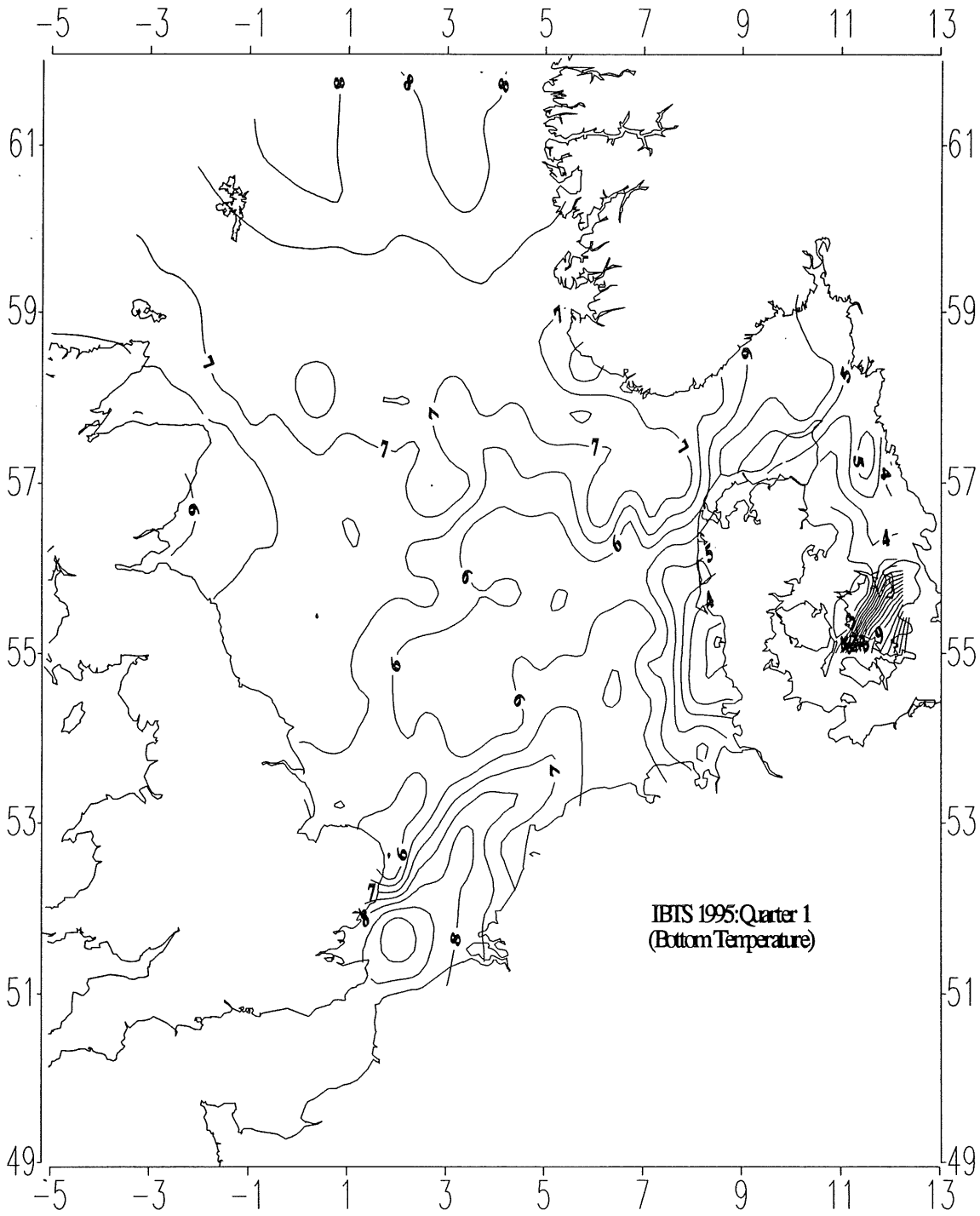
-5
-3
-1
1
3
5
7
9
11
13
61
59
57
55
53
51
49
IBTS 1995:Quarter 1
(Bottom Temperature)

Figure 8.1

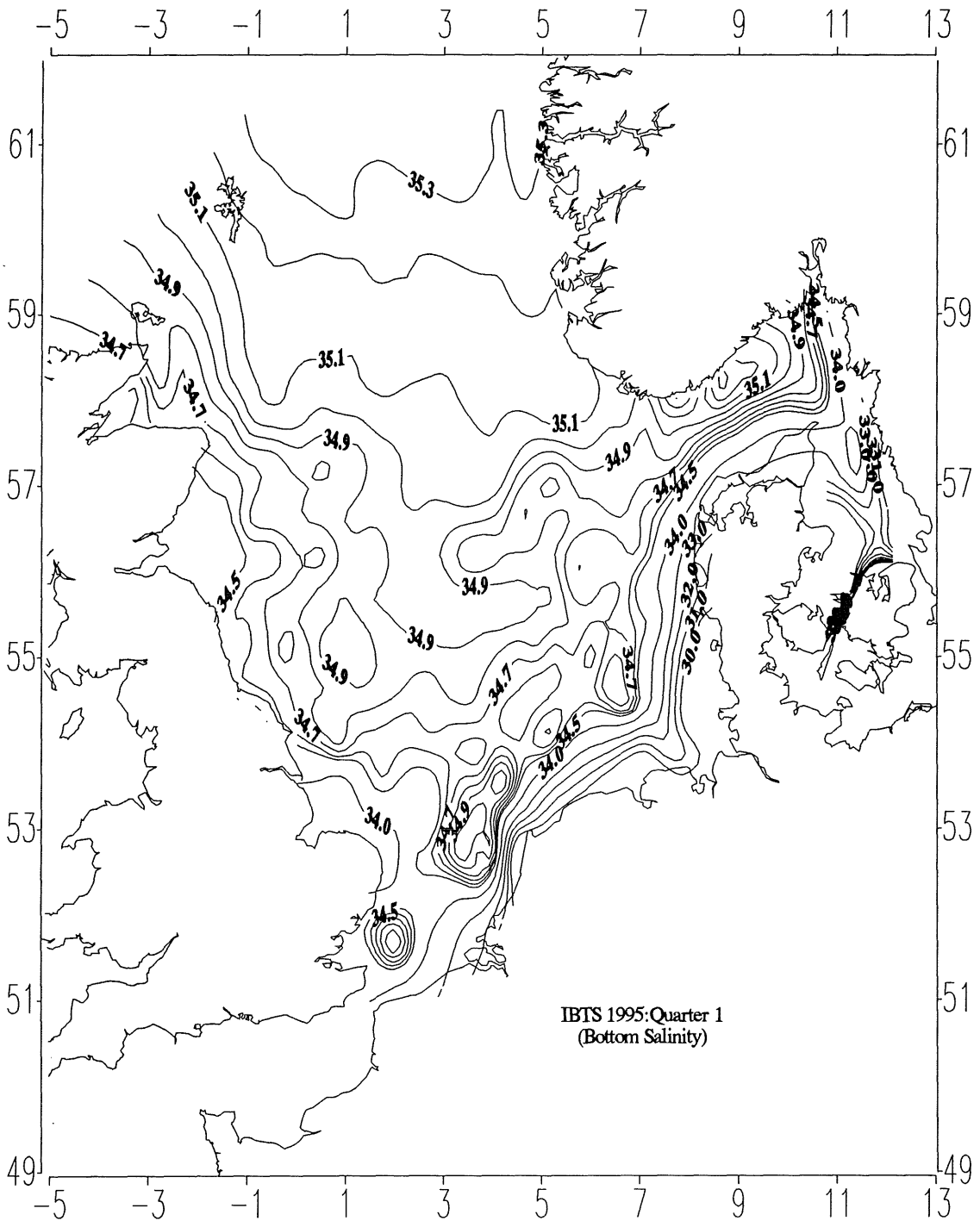
-5
-3
-1
1
3
5
7
9
11
13
61
59
57
55
53
51
49
35.3
35.1
34.9
34.7
34.5
34.0
33.0
32.0
30.0
IBTS 1995:Quarter 1
(Bottom Salinity)

Figure 8.2