Resource Management Committee

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REPORT OF THE

INTERNATIONAL BOTTOM TRAWL SURVEY IN THE NORTH SEA, SKAGERRAK AND KATTEGAT IN 1997: QUARTER 1

by

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International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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1 INTRODUCTION

This report presents the final results for the International Bottom Trawl Survey (IBTS) in the first quarter of 1997. 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. During a meeting of this Working Group in November 1995 (ICES 1996a) early analyses of the data indicated the potential usefulness of quarterly surveys and it was decided to encourage their continuation.

The results for quarters 2–4 will be published elsewhere.

The data in this report comprise the bottom trawl catches of the 8 standard species (herring *Clupea harengus*, sprat *Sprattus sprattus*, mackerel *Scomber scombrus*, cod *Gadus morhua*, haddock *Melanogrammus aeglefinus*, whiting *Merlangius merlangus*, saithe *Pollachius virens* 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 (ICES, 1996b). Details on the participation in the 1997 survey are given below. The whole survey area has been covered as planned.

Country	Vessel	Period	Number of Hauls	
			GOV	MIK
Denmark	"Dana"	1–19/2	48	94
France	"Thalassa"	4–24/2	65	20
Germany, F.R.	"W. Herwig III"	18/1–07/2	70	-
Netherlands	"Tridens"	3/2–27/2	51	20
Norway	"Michael Sars"	23/1–15/2	40	53
Sweden	"Argos"	27/1–13/2	46	40
UK Scotland	"Scotia"	31/1–18/2	45	62
Total			365	289

3 DATA AVAILABLE

In Table 3.1 is shown for which years data are presently available in the ICES IBTS data base for the quarter 1 surveys.

At the time of the analysis of the 1997 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 10 m, or deeper than 200 m (250 m 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 implicitly assumed 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.

The IBTS Working Group decided at the meeting in November 1995 (ICES 1996/H:1) that saithe should be added to the list of standard species. The indices of saithe for each age group are calculated in a similar way as for 1-ringer herring (see above) with the exception that also night-time hauls are used for saithe.

6 RESULTS GOV-TRAWL FOR 1997

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 herring and sprat, the preliminary indices are very close to the final ones. Final indices of 1- and 2-group fish of the eighth 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 Figures 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 a specific standard area for each species 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 6.6. 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 1997 represent year class 1995.

The index for the 1995 year class is the largest value since 1986, a value more than twice the series average.

Sprat

Sprat indices of 1- and 2-group are given in Table 6.2. The distribution of the same age groups and the 3+ group, as well as the mean length of 1-group per rectangle, are shown in Figures 6.7–6.10.

The Herring Assessment Working Group has also for sprat adopted a new index series (ICES 1993/Assess:15) in which only hauls between 10 and 150 m depth are included. The standard area has remained the same: Division IVb only.

The index value for the 1996 year class, at a little below the series average and only 20% of the record 1988 year class, is still three times higher than that for the preceding year class.

Mackerel

Indices for mackerel are given in Table 6.2, the distributions of 1-, 2- and 3+ groups, and the mean length of 1-group fish are given in Figures 6.11–6.14.

The index value of 1-group is very high, more than 20 times the second highest, due to the high abundance in the northern and north-western part of the survey area.

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 6.15–6.18.

The index value for one-year-old cod (1996 year class) is the third highest recorded and more than twice the long-term average.

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 6.19–6.22.

The index value at 860 is 25% above the long-term average and more than three times that of the weak 1995 year class.

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 6.23–6.26.

The decreasing trend in whiting abundance continued in 1997 and the index value is the lowest produced since 1982.

Saithe

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 6.27–6.30.

As usual only very few 1- and 2-group saithe were found in the North Sea in 1997.

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 6.31–6.34.

High catch rates of the 1996 year class of Norway pout in the northern North Sea in particular produced the largest index value for one-year-olds in the whole 23 year series, a value more than three times the series average and ten times that for the 1995 year class.

6.2 Skagerrak-Kattegat (Division IIIa)

The number of hauls per rectangle for herring and gadoids is shown in Figures 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.

Updates of the indices for the 1997 survey are not available.

7 RESULTS OF THE SAMPLING FOR HERRING AND SPRAT LARVAE IN 1997

During the IBTS fish larvae were sampled by a small meshed ring net (MIK). This gear was towed in oblique hauls during night. The catches were used for estimation of larval densities and total abundance, in the estimation a 100% efficiency of the gear for catching clupeid larvae at night was assumed.

Larval density is estimated from:

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

The number of larvae within a given rectangle is estimated by multiplying the estimated density of larvae by the surface area of the rectangle. The total abundance of larvae in the North Sea (the MIK index) is the sum of estimates from all statistical rectangles.

Herring

In total 289 hauls were carried out. This sampling intensity gave a reasonable coverage of the sampling area.

In February 1997 the herring larvae were distributed with major concentrations off the Scottish coast (Figure 7.1). The distribution pattern resembles last year's westerly distribution of the larvae. However, in 1997 the distribution extended further to the south than observed in 1996. The total abundance is estimated to 148.1*109 which is an increase compared to last years (Table 7.1, Figure 7.2).

Sprat larvae

Sprat larvae were sampled in small quantities in the central/southern sections of the sampling area. Because of the limited numbers, no calculation was carried out.

8 HYDROGRAPHIC DATA

8.1 Hydro-chemistry Survey

Six ships contributed hydrographic data to the 1997 data set. These consist of 415 stations worked between 18 January and 27 February. Nutrient data were supplied for 70 stations, contributions being received from only two ships. Data quality was good, and as a result, no stations were rejected by the data centre. Many of the data sets were submitted very late preventing the early completion of this report.

Charts of the distribution of bottom temperature and salinity are given in Figures 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 1997 is provided as Table 8.1. The Figures and Table show that temperatures throughout most of the North Sea were some 1°C warmer than average in the Northern North Sea, but were up to 2°C colder than average in the south (but much warmer than in 1996). Salinity was very close to the long-term mean throughout the North Sea.

During the 28 years of this time series, there are no significant trends in salinity and temperature in most areas of the North Sea. However, in the northern North Sea, where inter-annual variability is least, there is some evidence of a rising trend of some 0.1 in salinity and 0.8°C in temperature over this period. Figure 8.3 illustrates the salinity time series, along with the time series of the index of the North Atlantic (atmospheric) Oscillation (NAO) during the same period.

9 REFERENCES

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

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

ICES 1996a. Report of the International Bottom Trawl Survey Working Group. ICES Doc. CM 1996/H:1.

ICES 1996b. Manual for the International Bottom Trawl Surveys. Rev. V. Addendum to ICES CM 1996/H:1.

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 February 1998.

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	-	-	✓	✓	✓	✓	✓	✓	✓
Sweden	-	-	✓	✓	✓	✓	✓	✓	✓
UK England	✓	✓	✓	✓	✓	✓	✓	✓	✓
UK Scotland	✓	✓	✓	✓	✓	✓	✓	✓	✓
USSR	✓	✓	x	x	x	x	x	x	x

Country	1990	1991	1992	1993	1994	1995	1996	1997
Denmark	✓	✓	✓	✓	✓	✓	✓	✓
France	✓	✓	✓	✓	✓	✓	✓	✓
Germany	✓	✓	✓	✓	✓	✓	✓	✓
Netherlands	✓	✓	✓	✓	✓	✓	✓	✓
Norway	✓	✓	✓	✓	✓	✓	✓	✓
Sweden	✓	✓	✓	✓	✓	✓	✓	✓
UK England	✓	x	x	x	x	x	x	x
UK Scotland	✓	✓	✓	✓	✓	✓	✓	✓
USSR	x	x	x	x	x	x	x	x

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 1997. For herring the "old" standard area is used.

	Preliminary	Final
Herring	4,318	4,068.8
Sprat	1172	853.7
Mackerel	725.6	718.8
Cod	40.5	40.0
Haddock	862	860.2
Whiting	295	287.7
Saithe	-	0
Norway pout	10,409	9,751.6

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		SPRAT		MACKEREL		COD		HADDOCK		WHITING		SAITHE		NORWAY POUT	
	1-ring	2-ring	age 1	age 2	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	-	-	-	-	-	-	-	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	4,103	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	1,094	1,561	422	16.0	0.8	13.0	19.9	1,115	543	916	524	-	-	5,121	2,644
1992	1,667	1,285	1,755	1,368	1.0	0.1	12.7	4.4	1,242	504	1,087	637	-	-	2,681	375
1993	1,186	194	4,003	2,716	2.2	+	14.8	22.1	229	205	721	457	-	-	1,868	785
1994	1,735	437	1,138	558	+	0.7	9.7	8.0	1,375	813	679	486	-	1.1	5,941	2,631
1995	4,069		233	409	10.4	3.6	3.5	6.9	267	366	502	342	0	0	923	1,474
1996			854		718.8		40.0		860		288		0		9,752	

* 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 retrieval from database.

Table 6.3 Age composition of the standard species in 1997 for the relevant standard areas in the North Sea.

Age group	1	2	3	4	5	6+
Herring	4,068.8	436.6	180.6	34	14.4[1]	-
Sprat	853.7	409.1	50.7	4.6	0.0[1]	-
Mackerel	718.8	3.6	0.4	1.4	0.4	0.6
Cod	40.0	6.9	2.3	1.1	0.4	0.4
Haddock	860.2	366.4	470.6	24.8	15.1	3.4
Whiting	287.7	342.2	162.5	60.4	18.0	9.2
Saithe	0.0	0.0	0.0	1.5	2.4	0.5
Norway pout	9,751.6	1,474.1	669.9	2.9	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	2,006	1,726	3,802
1996	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	255	5,099	5,312
1997	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a	n.a.	n.a.

* Separation not valid.

** From 1984 onwards only hauls taken in depths between 10 and 150 m 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	47	114	525	180
1994	111	97	390	300	35	272	1105	233
1995	37	36	172	52	n.a.	n.a.	883	490
1996	n.a.	n.a.	n.a.	n.a.			n.a.	n.a.

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	1.500	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
1995	0.260	0.086	0.699	0.092	0.266	0.018	0.001	0.020	106.2
1996	0.003	0.004	0.935	0.135	0.436	0.379	0.039	0.032	148.1

Table 8.1 **Time series data of bottom temperature and salinity during IYFS/IBTS(1) 1970-1997**

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	Sal	t°C	Sal	t°C	Sal	t°C	Sal	t°C	Sal	t°C	Sal	t°C	Sal	t°C	Sal	t°C	Sal	t°C	Sal
1970	5.5	35.08	5.8	34.95	5.3	35.00	4.7	34.92	5.9	34.75	4.5	34.82	4.0	34.72	0.5	33.00	4.0	34.72	4.0	34.62
1971	7.1	35.15	7.0	35.05	6.9	35.15	6.0	35.10	7.0	34.82	6.2	34.88	5.5	34.80	3.5	33.00	5.9	34.55	7.0	34.95
1972	5.8	35.22	6.9	35.08	5.9	35.20	4.5	34.78	6.5	34.91	4.8	34.86	5.2	34.80	2.5	33.80	5.2	34.70	6.9	35.10
1973			7.4	35.02	7.2	35.20	6.7	35.10	7.0	35.05	6.1	35.00	6.0	34.86	5.0	33.00	6.4	34.80	6.5	35.05
1974	6.9	35.28	6.5	35.11	6.5	35.08	6.3	35.04	6.5	34.90	6.0	34.90	5.6	34.90	4.7	33.00	6.1	34.78	8.0	35.20
1975	7.3	35.20	6.6	35.05	6.6	35.15	6.4	35.13	6.6	34.95	6.4	34.90	6.1	34.85	5.2	33.50	5.9	34.62	6.9	34.62
1976	6.7	35.20	6.5	35.00	6.5	35.15	5.6	35.12	6.1	34.81	4.9	34.95	4.9	34.85	2.2	31.00	5.1	34.78	5.1	34.80
1977	6.0	35.18	6.2	35.02	5.1	35.00	4.8	34.92	6.0	34.98	4.9	34.85	5.0	34.80	3.1	33.60	5.6	34.78	7.1	35.22
1978	6.4	34.88	6.6	35.00	6.0	34.90	4.7	34.88	5.6	34.78	4.9	34.88	4.2	34.80	2.2	32.50	4.6	34.68	5.5	34.90
1979	6.4	35.15	6.0	34.80	4.1	34.88	4.0	34.98	4.5	34.64	2.8	34.62	2.8	34.62	-1.5	32.00	3.0	34.62	4.2	34.95
1980	5.9	35.12	6.6	35.00	5.5	35.00	4.5	34.70	6.1	34.60	3.8	34.65	4.5	34.50	3.1	33.50	5.1	34.70	6.1	35.11
1981	6.9	35.22	6.6	34.90	6.2	35.05	5.8	35.15	6.5	34.80	5.8	34.82	5.1	34.82	3.4	32.50				
1982	6.6	35.28	6.1	35.02	5.9	35.05	5.5	35.10	5.5	34.72	4.8	34.82	4.5	34.62	2.8	32.50	4.7	34.30	6.0	34.65
1983	6.9	35.22	6.5	35.00	6.4	35.10	6.2	35.15	5.6	34.62	6.1	34.95	5.2	34.90	3.0	33.00	5.2	34.80	6.4	34.70
1984	6.3	35.18	6.4	35.10	6.4	35.10	5.2	35.12	5.9	34.80	5.0	34.84	4.9	34.90	3.5	33.00	4.9	34.65	7.4	34.95
1985	6.9	35.17	6.8	35.10	6.5	35.18	5.9	35.05	6.5	34.70	4.7	34.91	5.0	34.90	1.0	32.50	4.0	34.70	6.0	34.80
1986	6.6	35.25	5.8	35.05	5.4	35.08	5.2	35.05	5.2	34.65	3.9	34.72	3.6	34.60	0.0	32.50	4.0	34.60	4.0	34.65
1987	6.5	35.28	6.1	34.90	5.9	35.08	4.9	35.00	5.0	34.75	4.2	34.80	4.3	34.60	0.8	30.00	4.9	34.60	4.8	34.90
1988	7.6	35.18	7.6	34.95	7.4	35.03	7.0	34.96	7.1	34.70	6.6	34.80	6.5	34.50	5.9	33.50	6.9	34.60	7.7	34.90
1989	8.5	35.29	8.0	34.85	7.8	34.89	7.6	35.05	7.5	34.76	7.1	34.81	6.8	34.80	6.0	34.10	6.5	34.68	7.5	34.62
1990	8.5	35.29	7.6	35.00	7.6	35.12	7.6	35.15	7.5	34.70	7.5	34.85	7.5	34.80	6.5	34.10	7.4	34.70	7.4	34.60
1991	7.9	35.30	6.7	35.10	7.1	35.22	6.1	34.97	6.6	34.65	5.8	34.85	5.5	34.80	3.0	34.00	5.8	34.60	6.1	35.30
1992	8.1	35.29	7.6	35.10	7.1	35.16	7.1	35.19	7.4	34.80	6.6	34.80	6.5	34.80	6.6	32.00	4.5	34.80	6.0	35.20
1993	7.4	35.31	6.5	34.92	6.4	35.18	6.5	35.30	6.5	35.05	6.2	35.00	5.4	34.95	4.3	33.50	5.6	34.80	6.0	35.00
1994	6.2	35.20	6.5	35.05	5.5	34.93	4.3	34.80	6.3	34.90	5.4	34.90	5.2	34.80	4.0	32.00	5.5	34.70	7.0	35.00
1995	7.5	35.23	7.0	34.92	7.1	35.00	6.7	35.09	6.7	34.71	6.0	34.87	5.6	34.81	4.0	30.03	6.0	34.65	7.9	34.51
1996	7.1	35.24	6.5	34.91	5.0	34.94	4.7	34.87	6.0	34.59	4.6	34.71	3.0	34.44	-0.2	32.12	3.4	34.71	3.8	34.83
1997	7.6	35.21	7.3	34.92	6.2	34.92	6.4	35.09	6.5	34.72	5.8	34.80	4.9	34.72	2.9	32.93	5.2	34.67	5.2	34.96

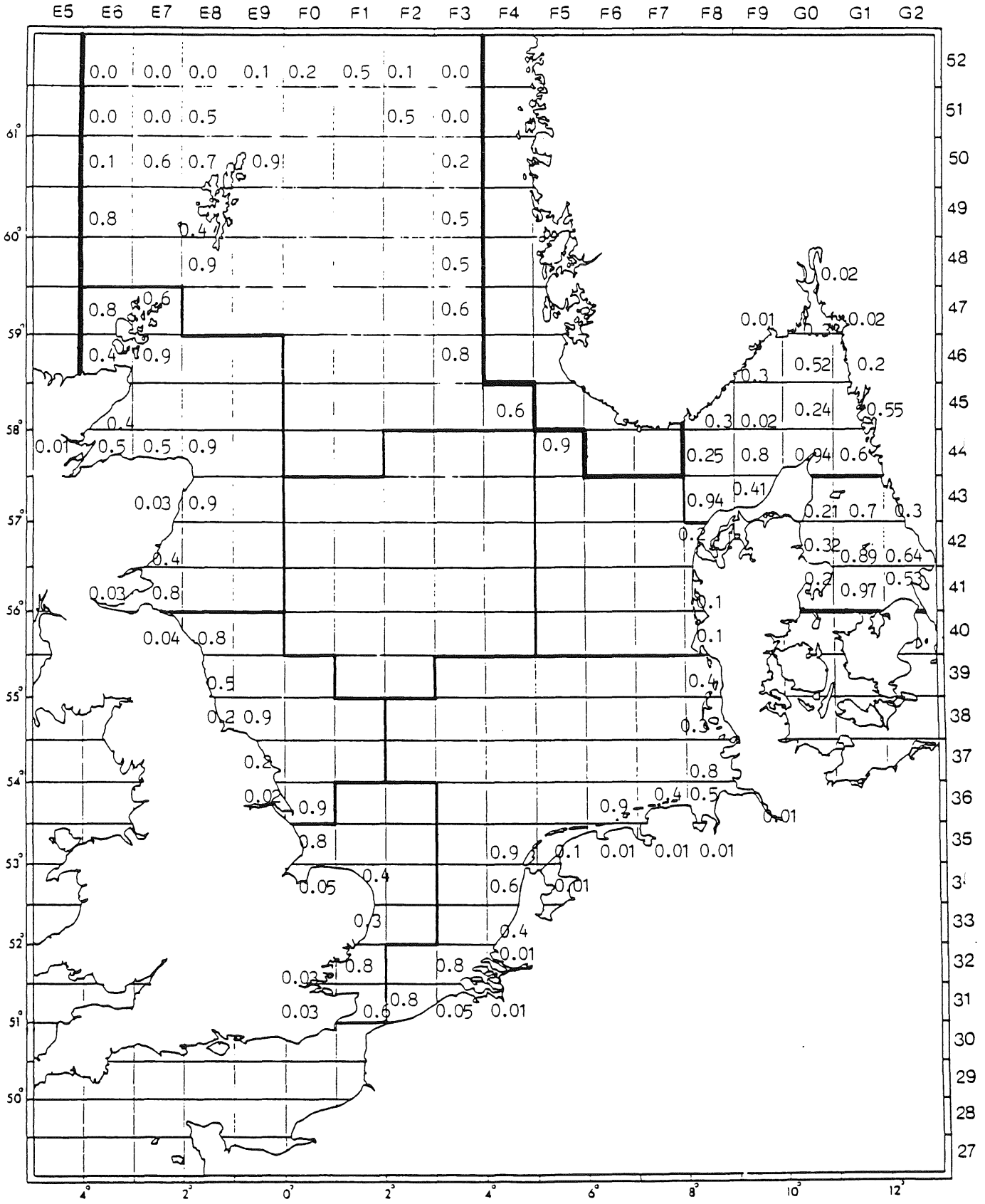

Figure 5.1 Weighting factors used in the revised IBTS herring index. Numbers denote the relative weight of a given rectangle. Only weighting factors less than 1 are shown.

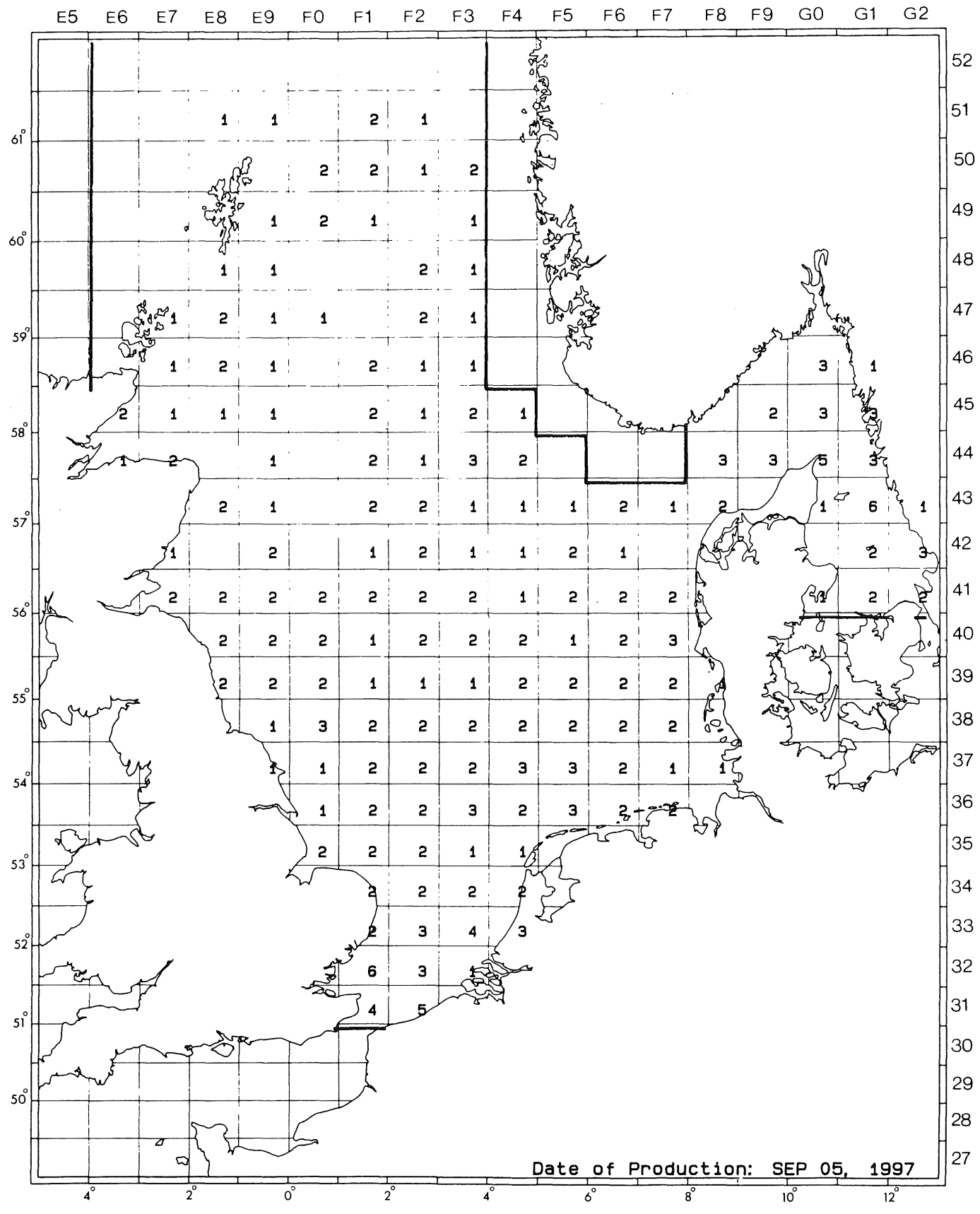

Figure 6.1 Number of hauls used in the analysis of herring 1997 data.

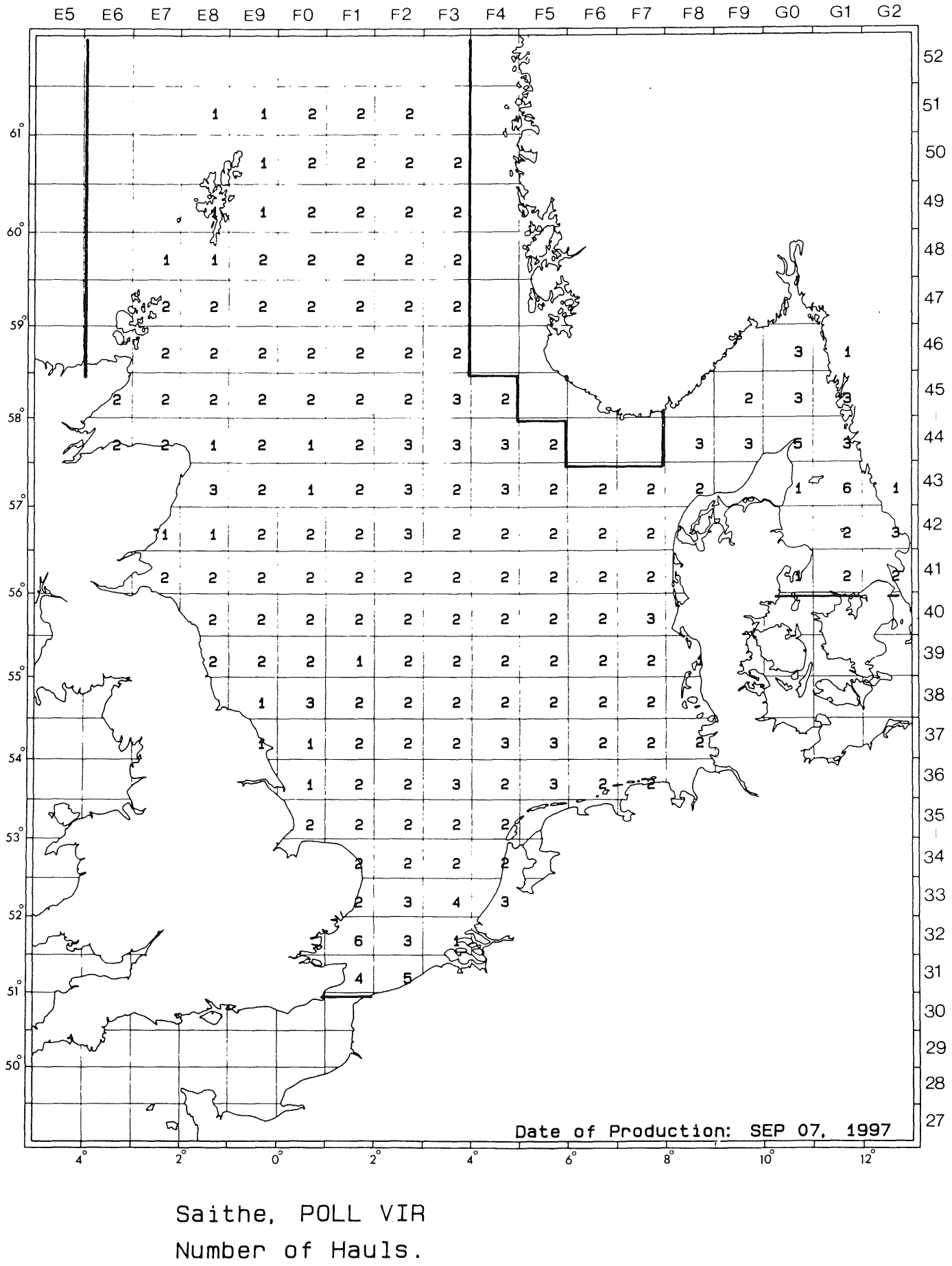

Figure 6.2 Number of hauls used in the analysis of 1997 data on sprat, mackerel, cod, haddock, saithe, whiting and Norway Pout.

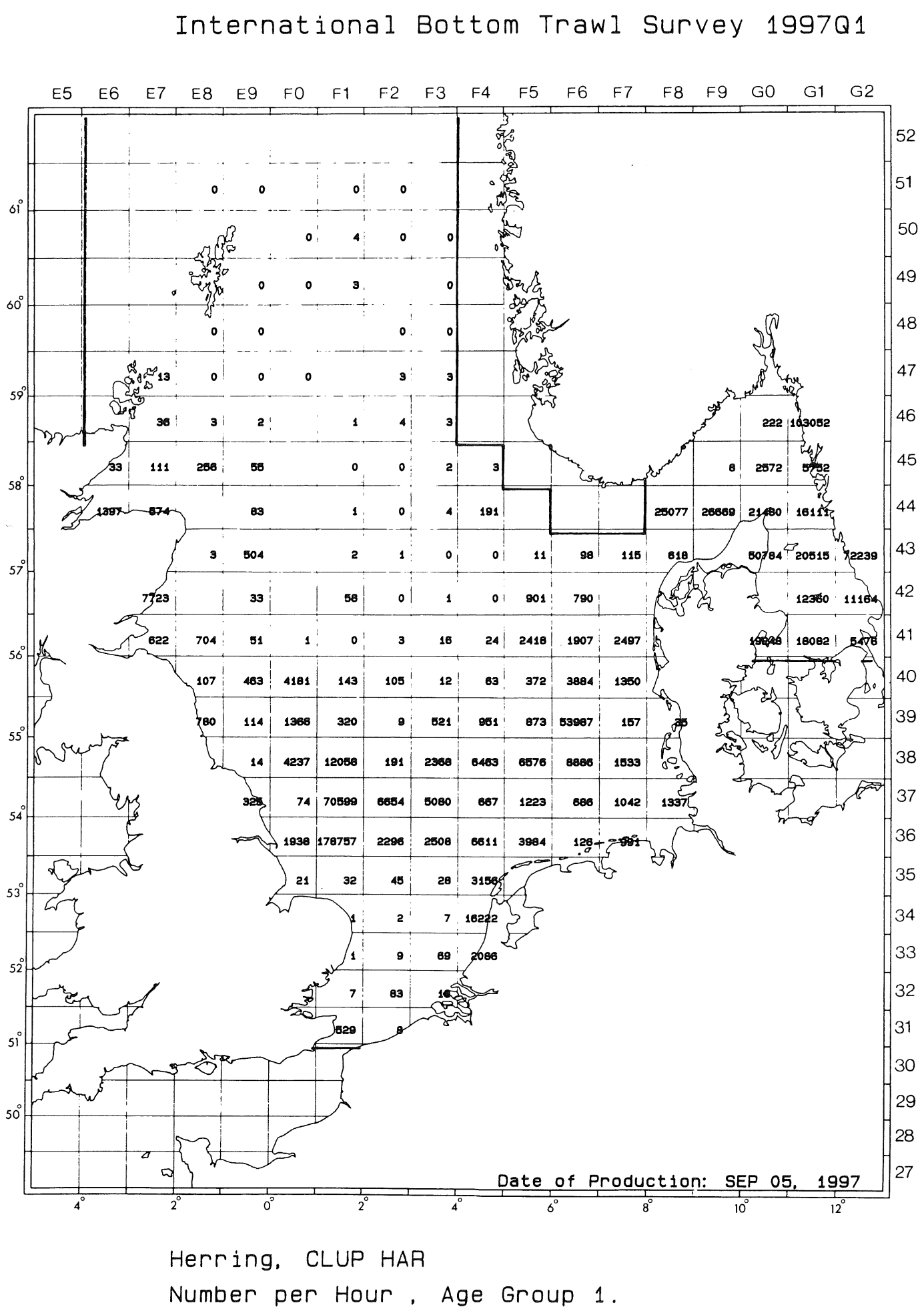

Figure 6.3 Herring: number per hour, 1-ringers.

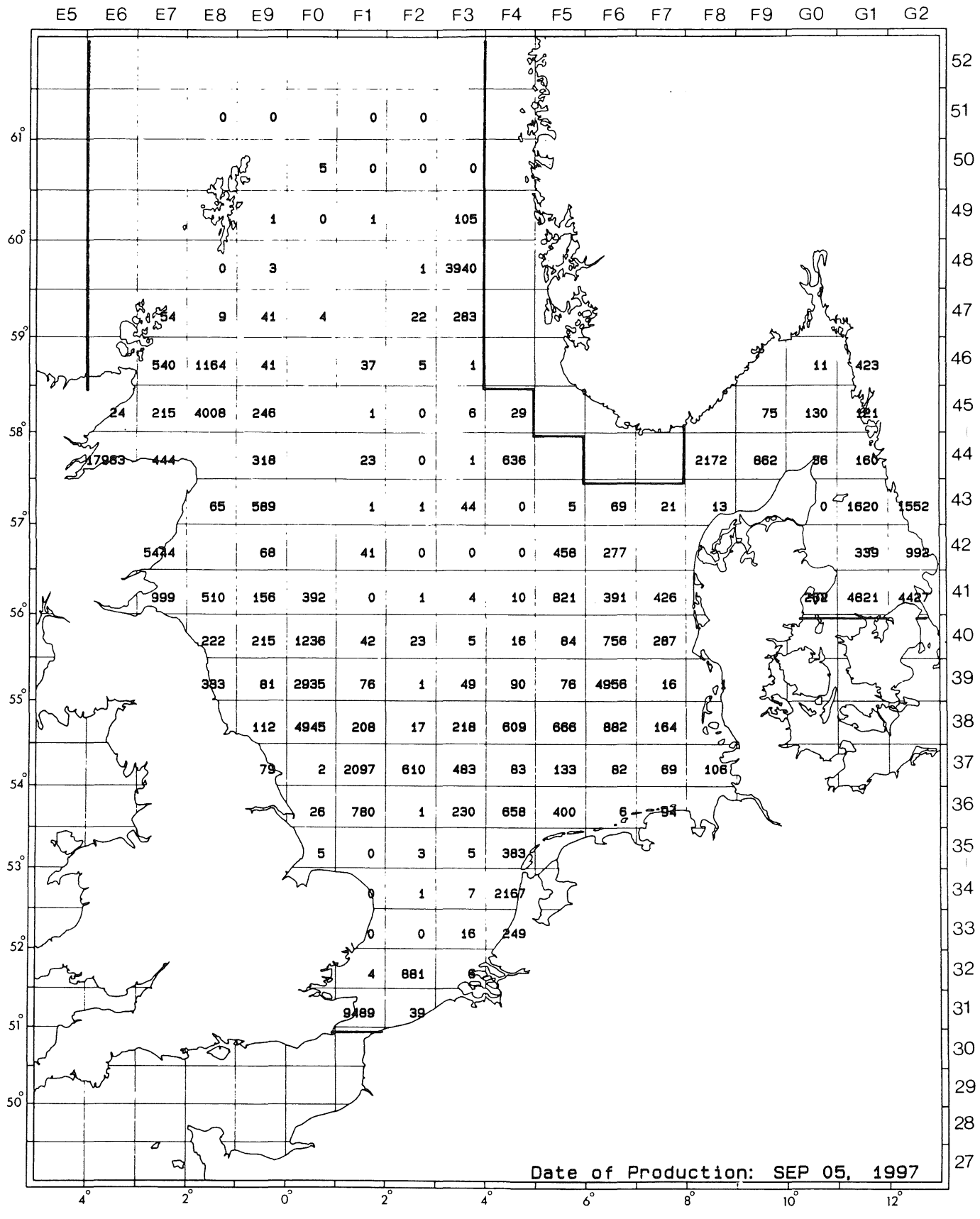

Figure 6.4 Herring: number per hour, 2-ringers.

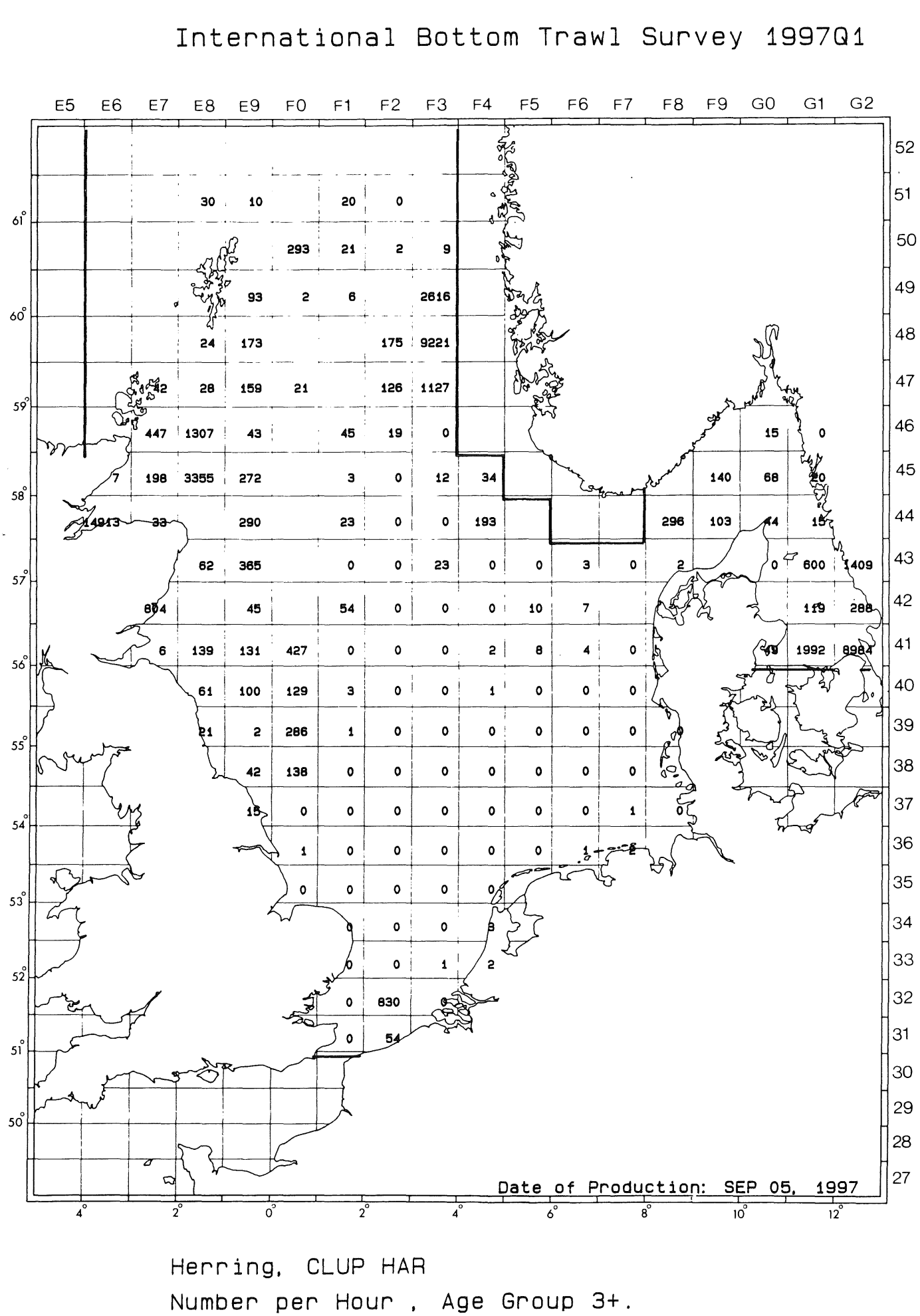

Figure 6.5 Herring: number per hour, 3+ ringers.

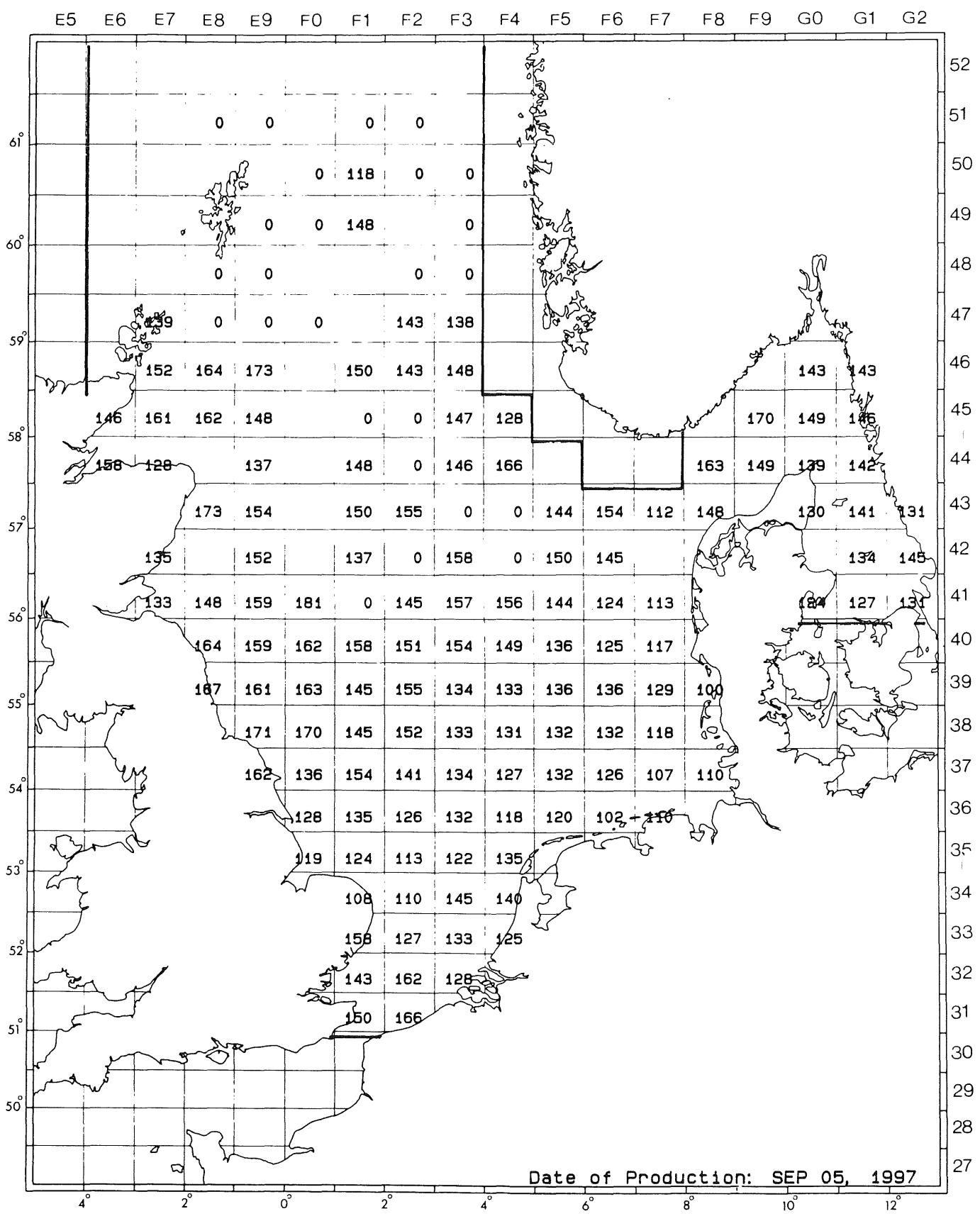

Figure 6.6 Herring: mean length, age 1.

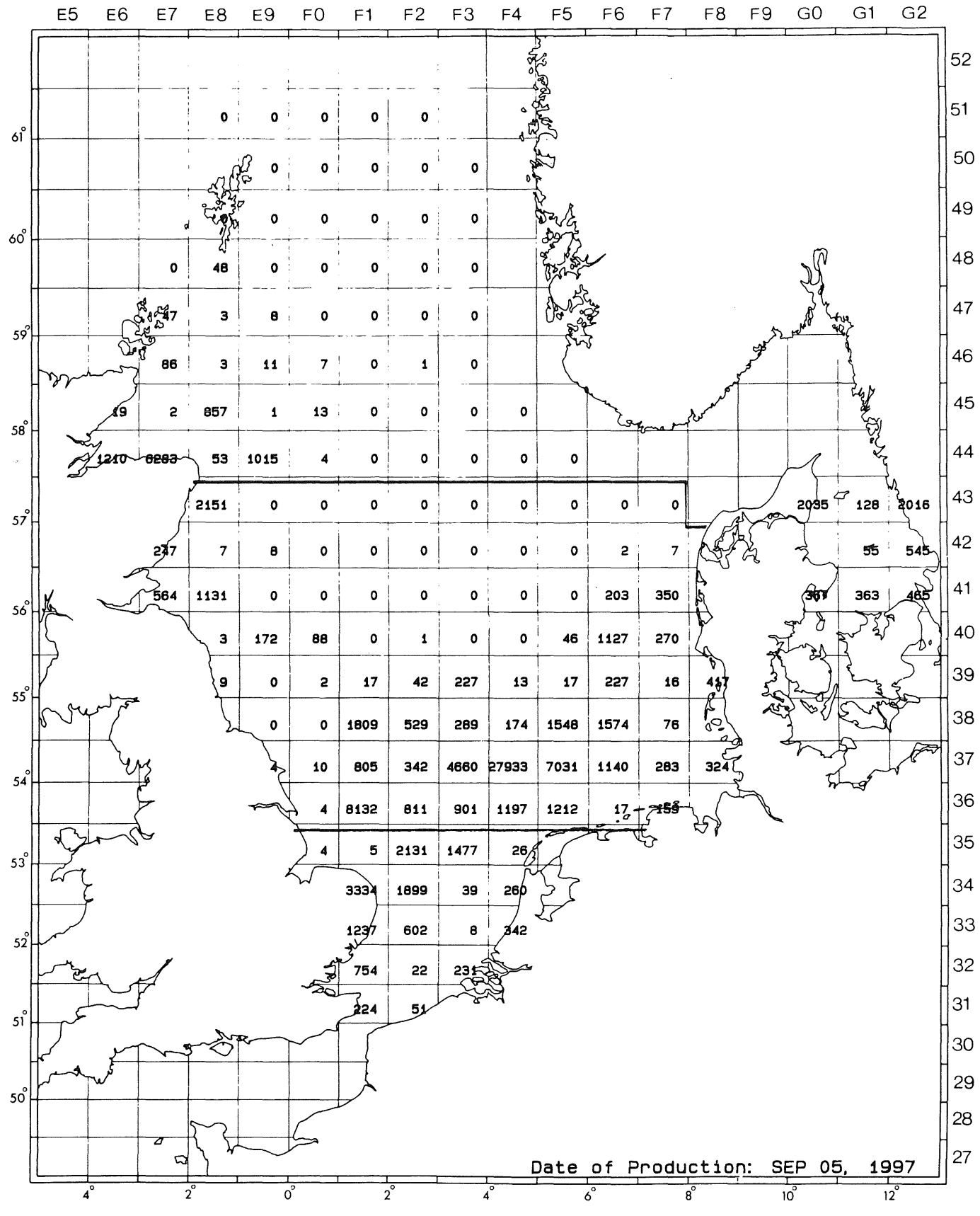

Figure 6.7 Sprat: number per hour, age group 1.

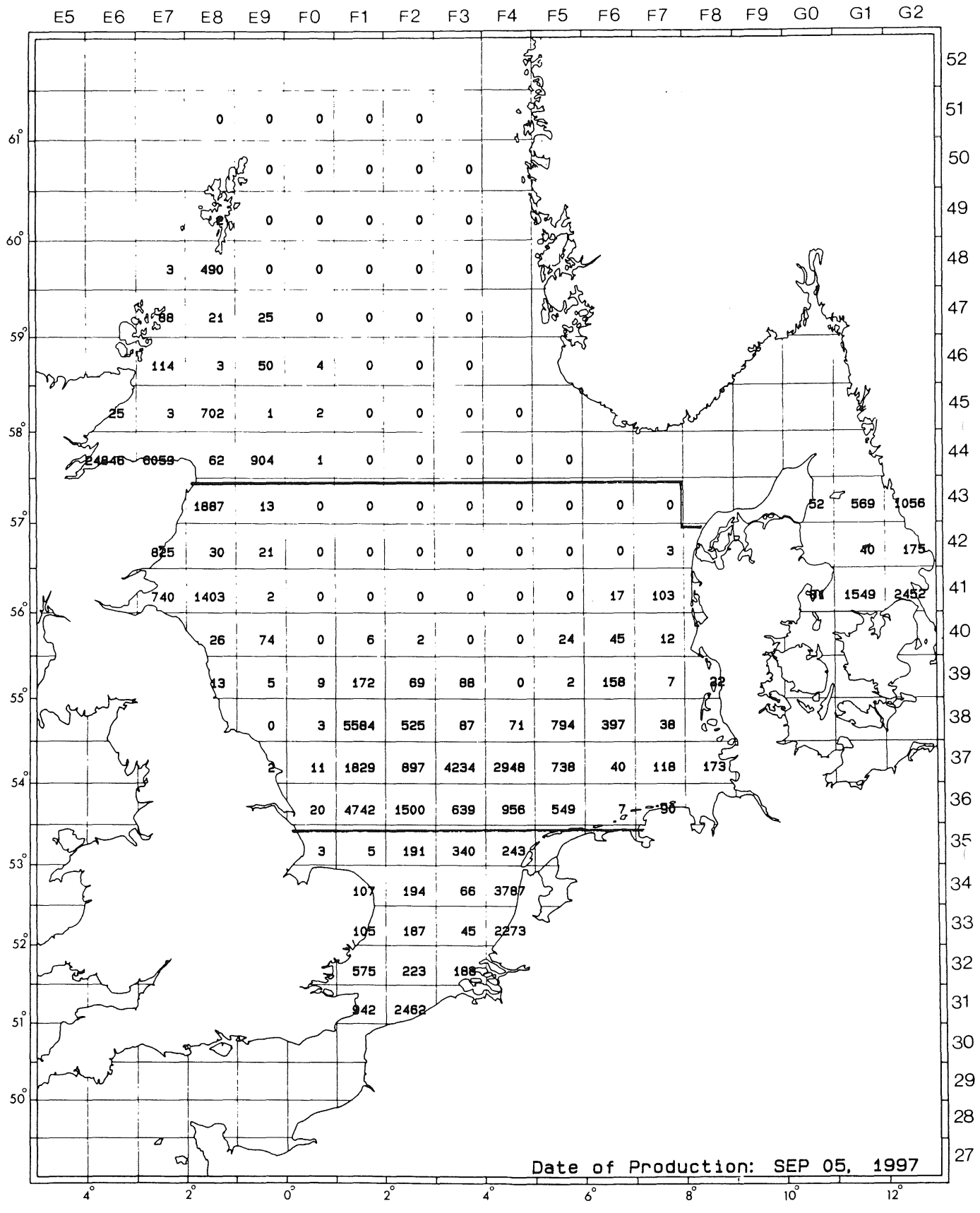

Figure 6.8 Sprat: number per hour, age group 2.

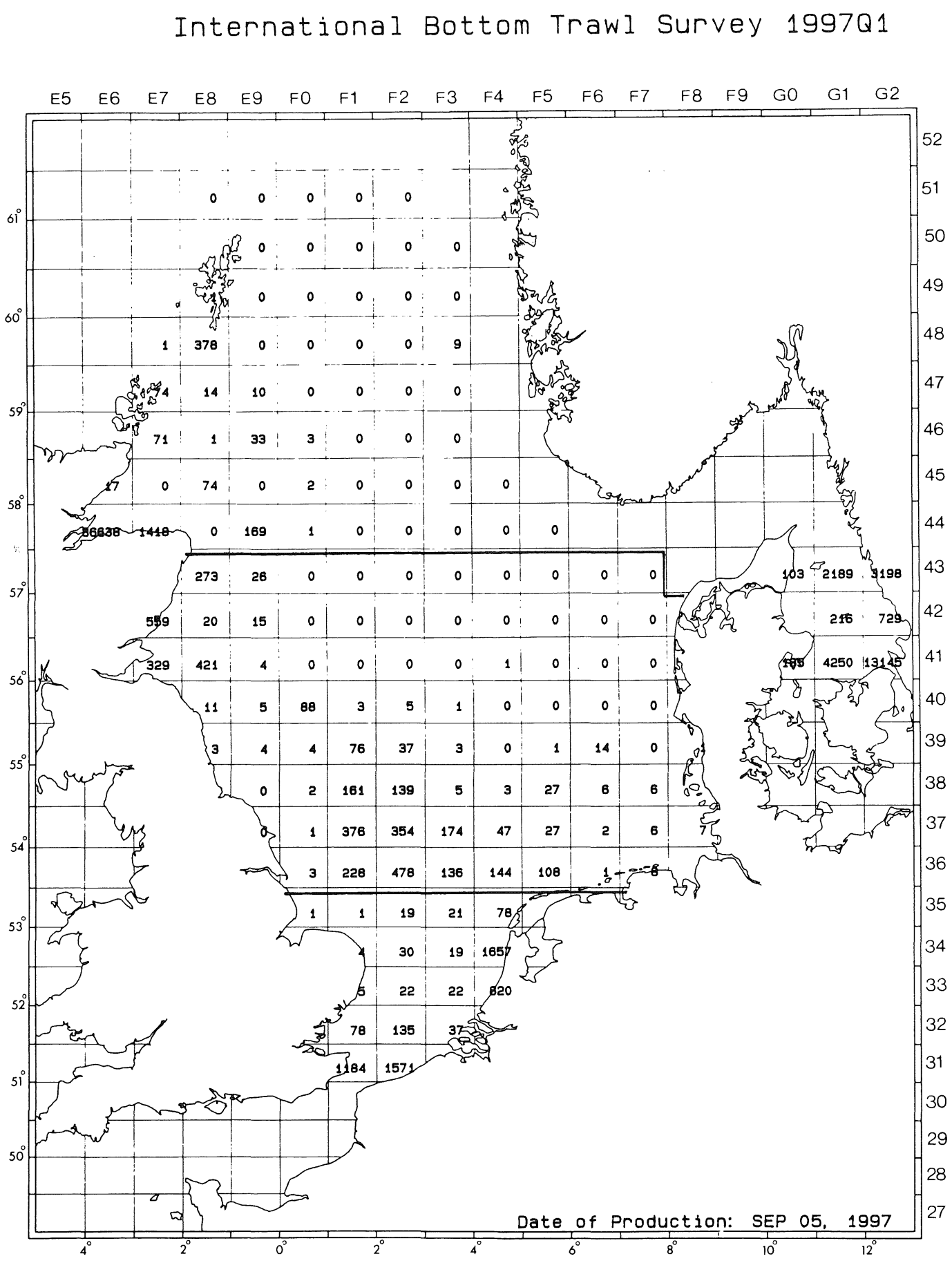

Figure 6.9 Sprat: number per hour, age group 3+.

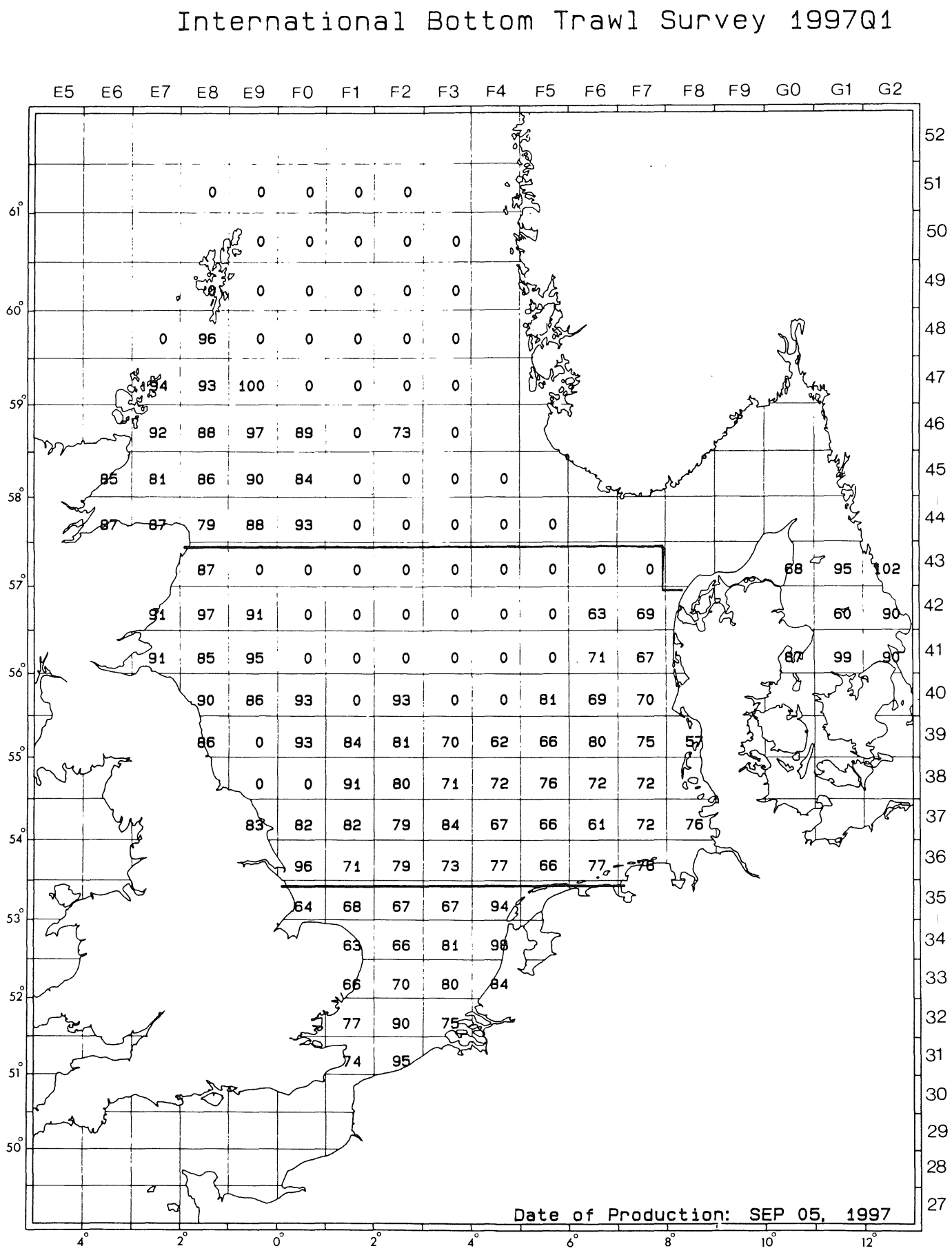

Figure 6.10 Sprat: mean length, age group 1.

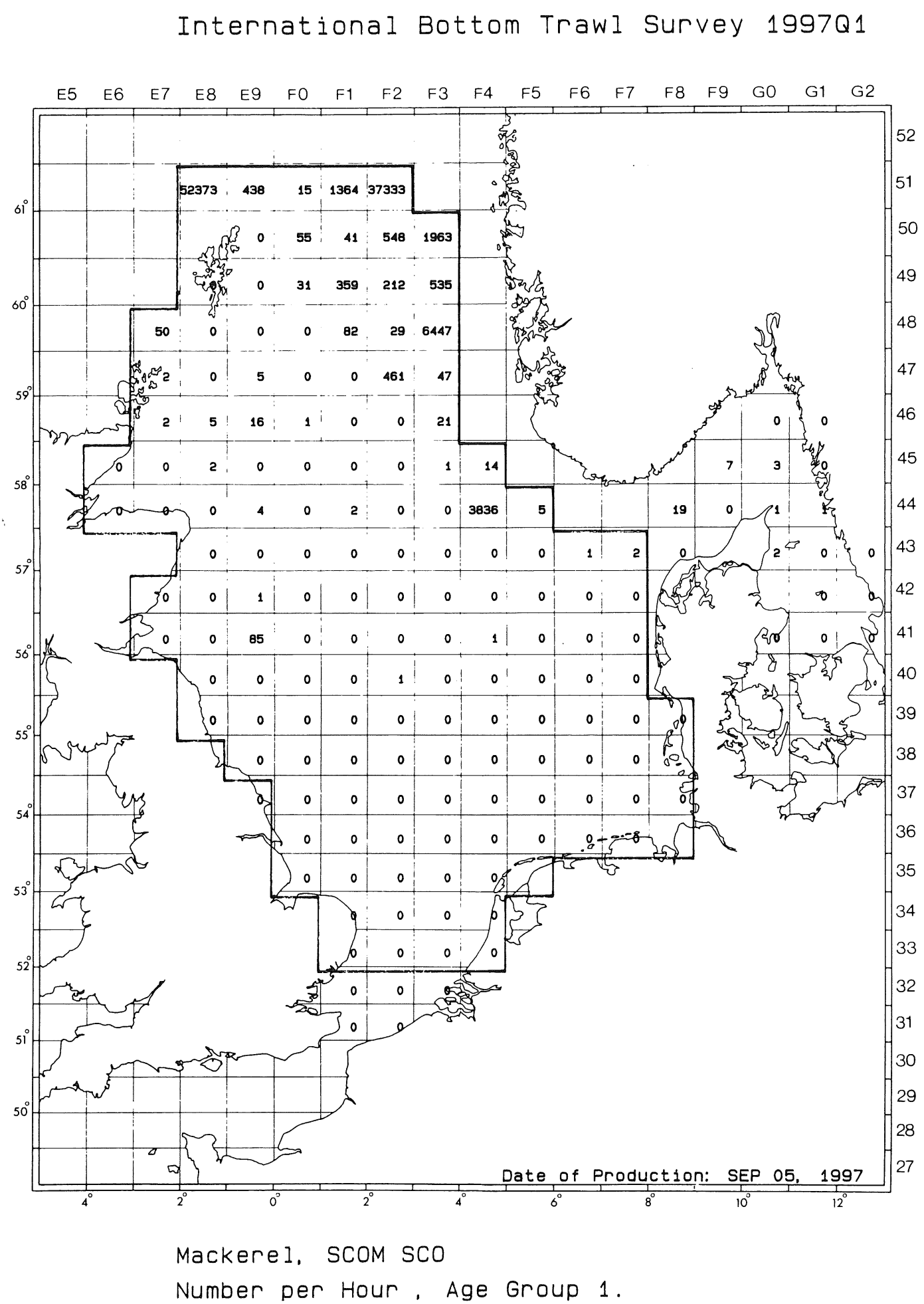

Figure 6.11 Mackerel: number per hour, age 1.

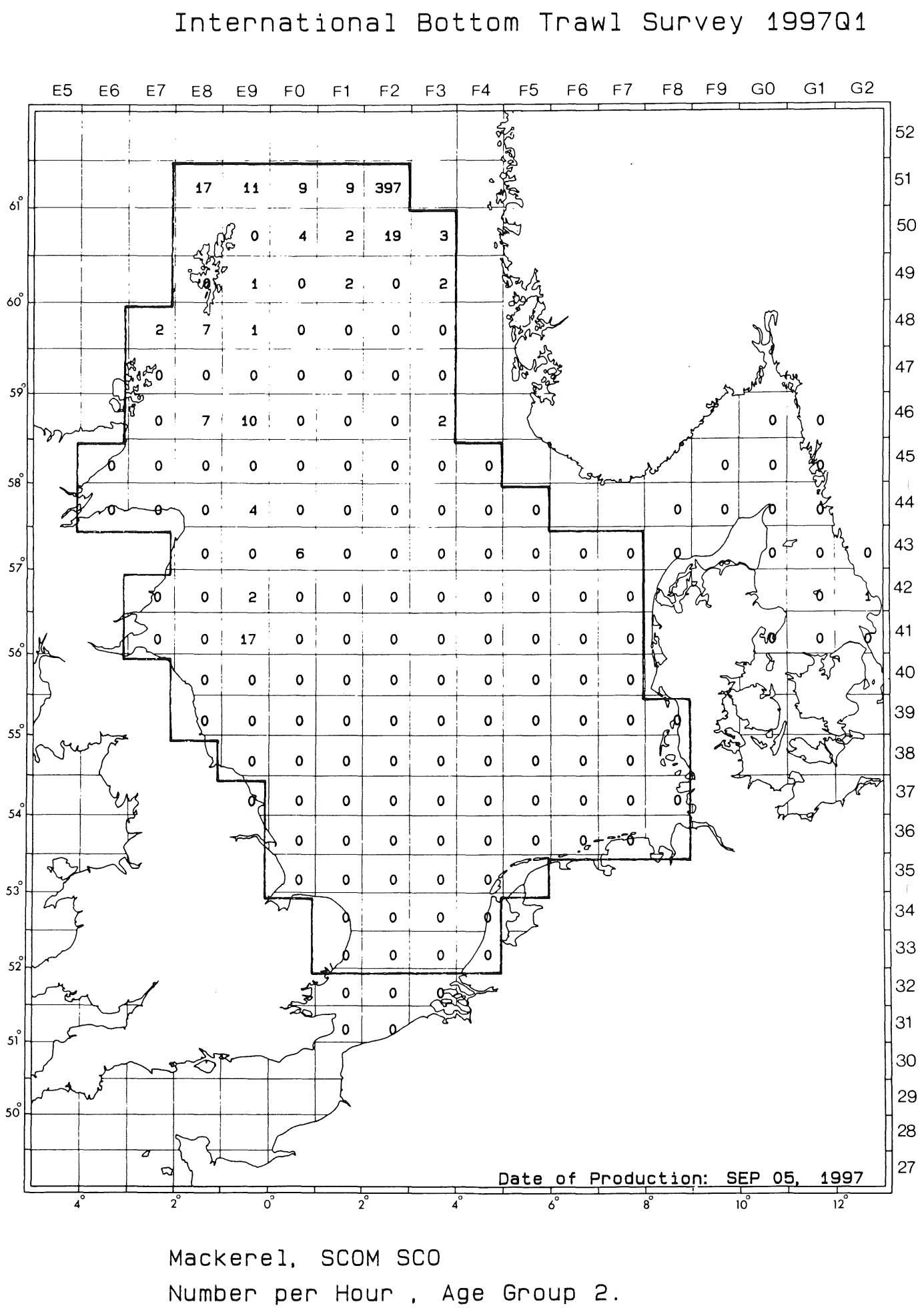

Figure 6.12 Mackerel: number per hour, age 2.

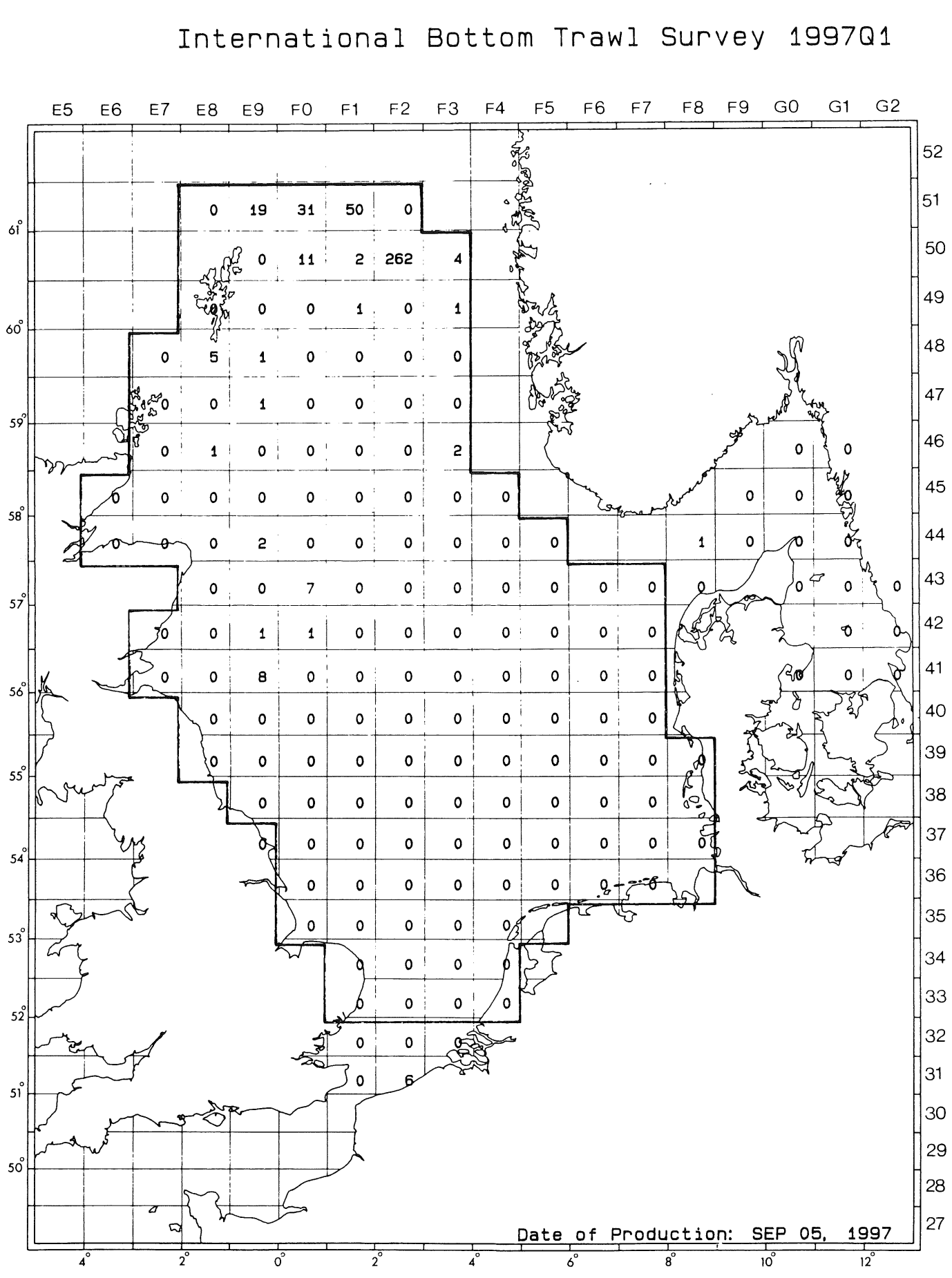

Figure 6.13 Mackerel: number per hour, age 3+.

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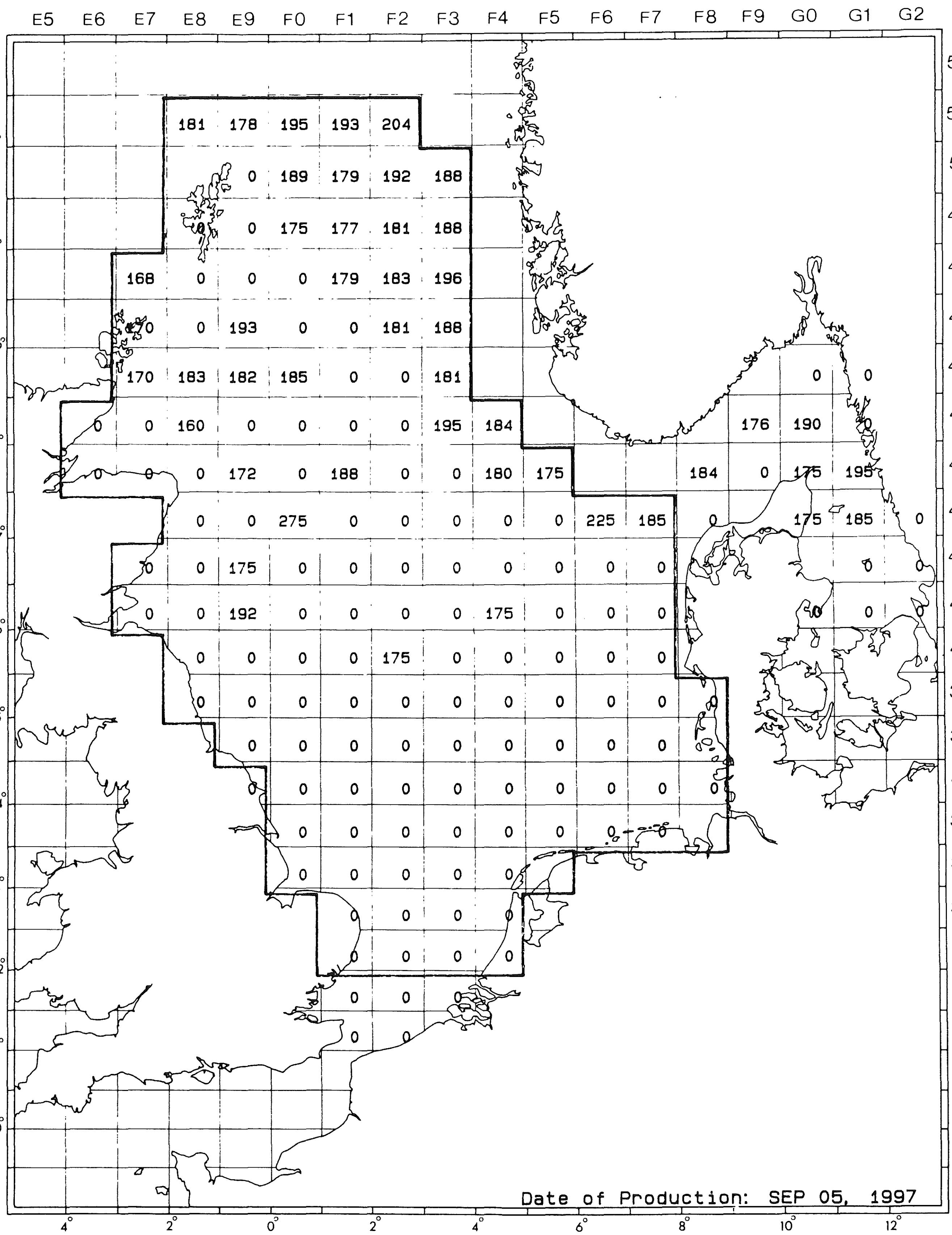

Mackerel, SCOM SCO

Mean Length, Age Group 1.

Figure 6.14 Mackerel: mean length, age 1.

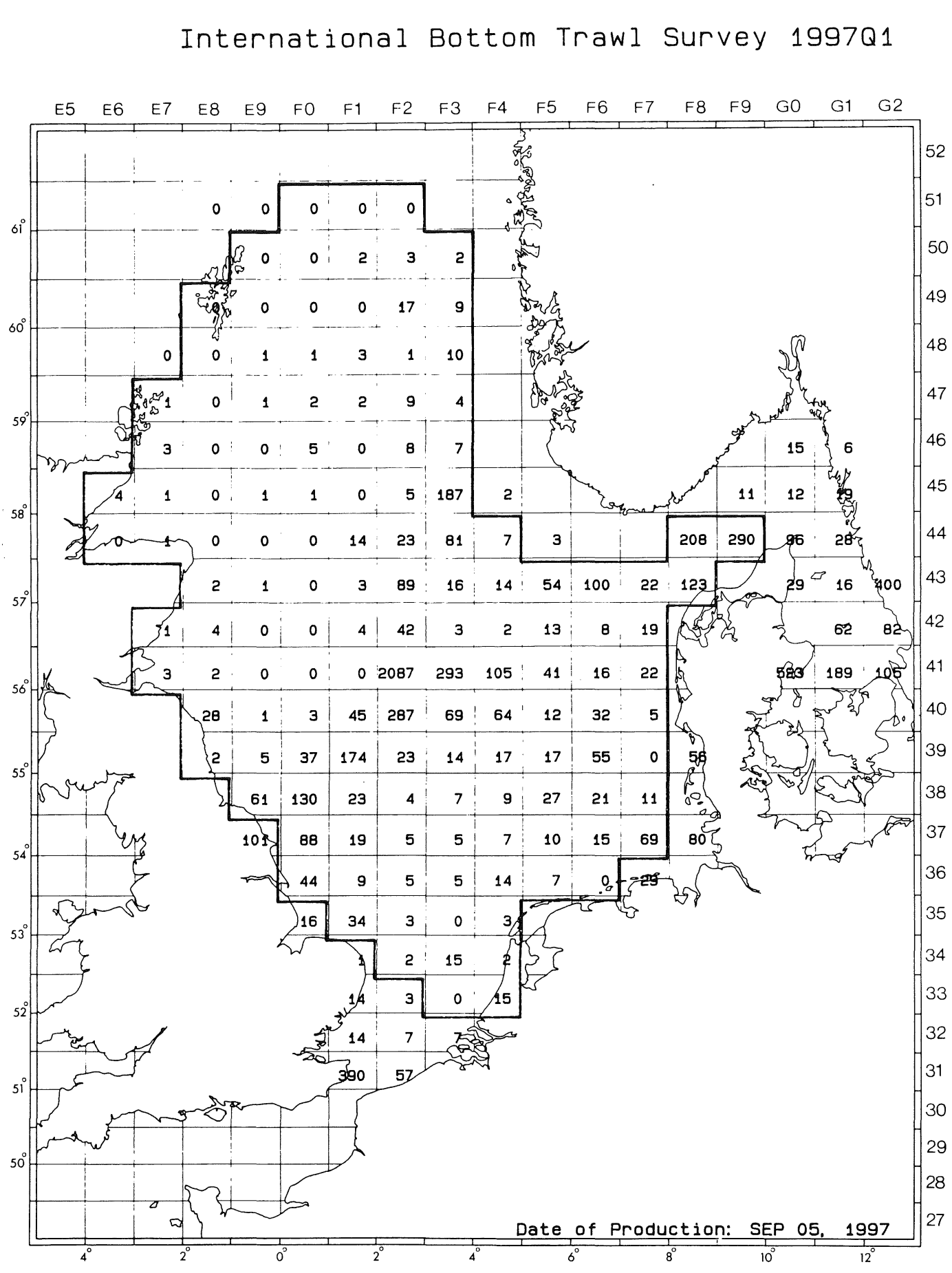

Figure 6.15 Cod, number per hour, age group 1.

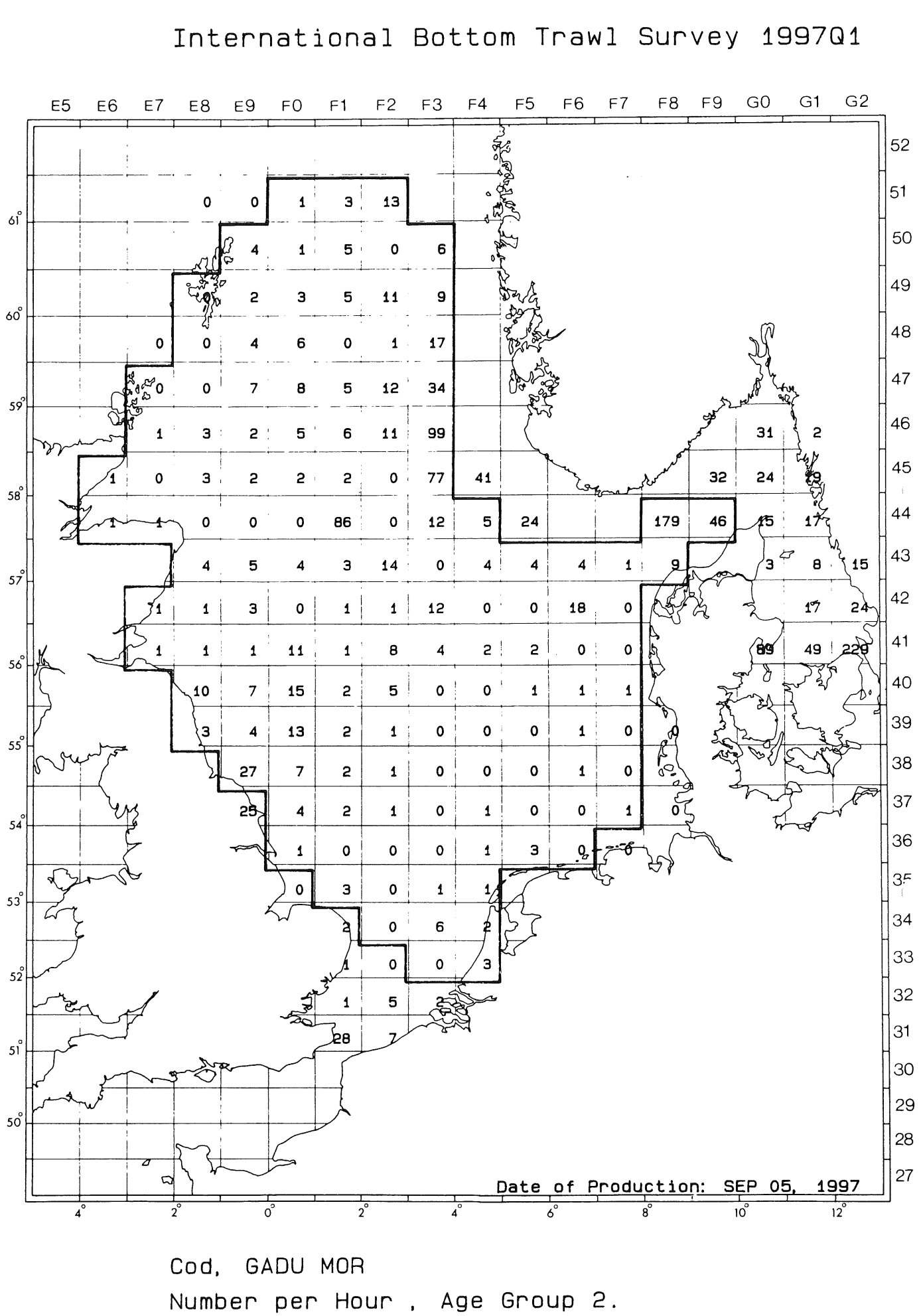

Figure 6.16 Cod: number per hour, age group 2.

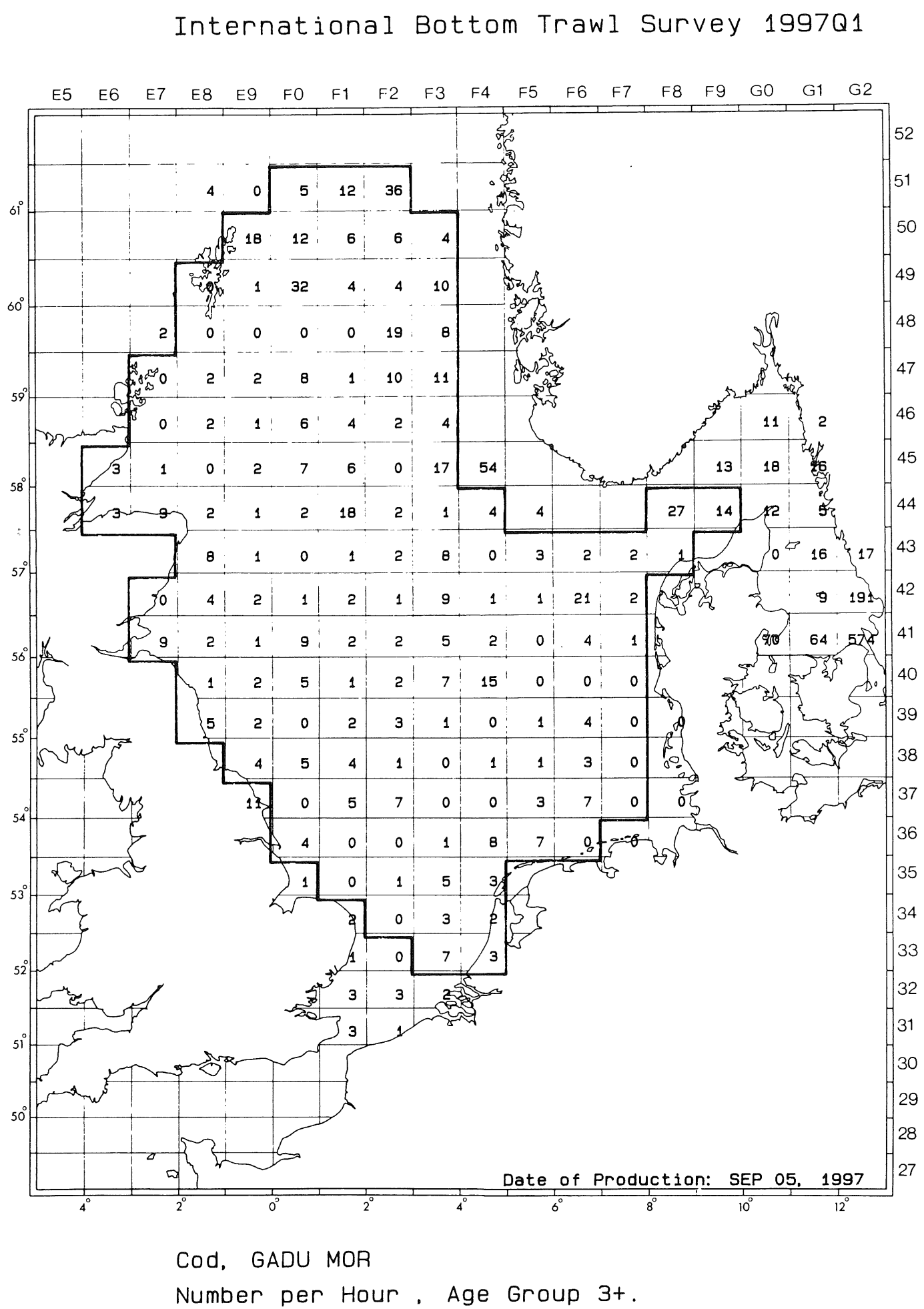

Figure 6.17 Cod: number per hour, age group 3+.

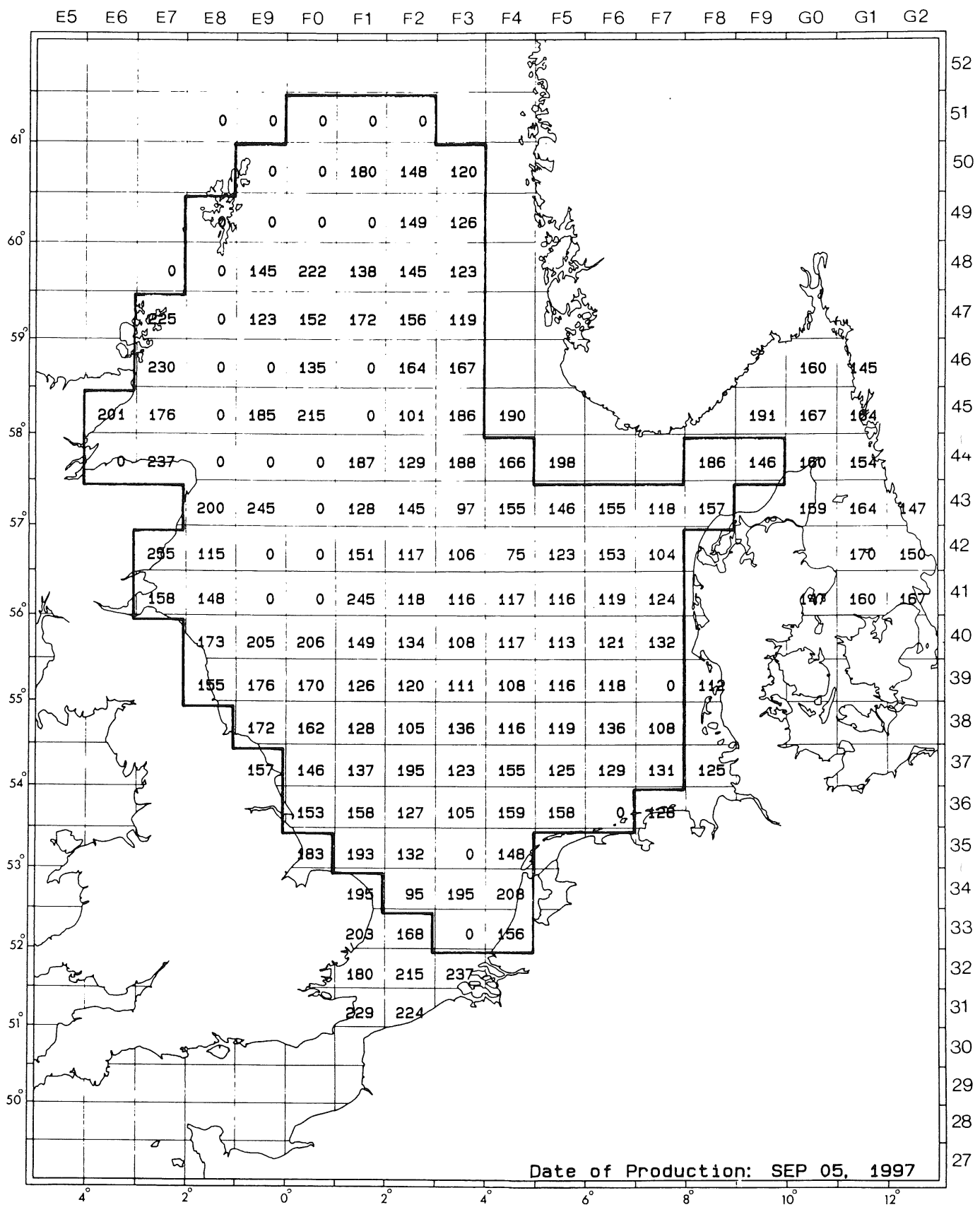

Figure 6.18 Cod, mean length, age group 1.

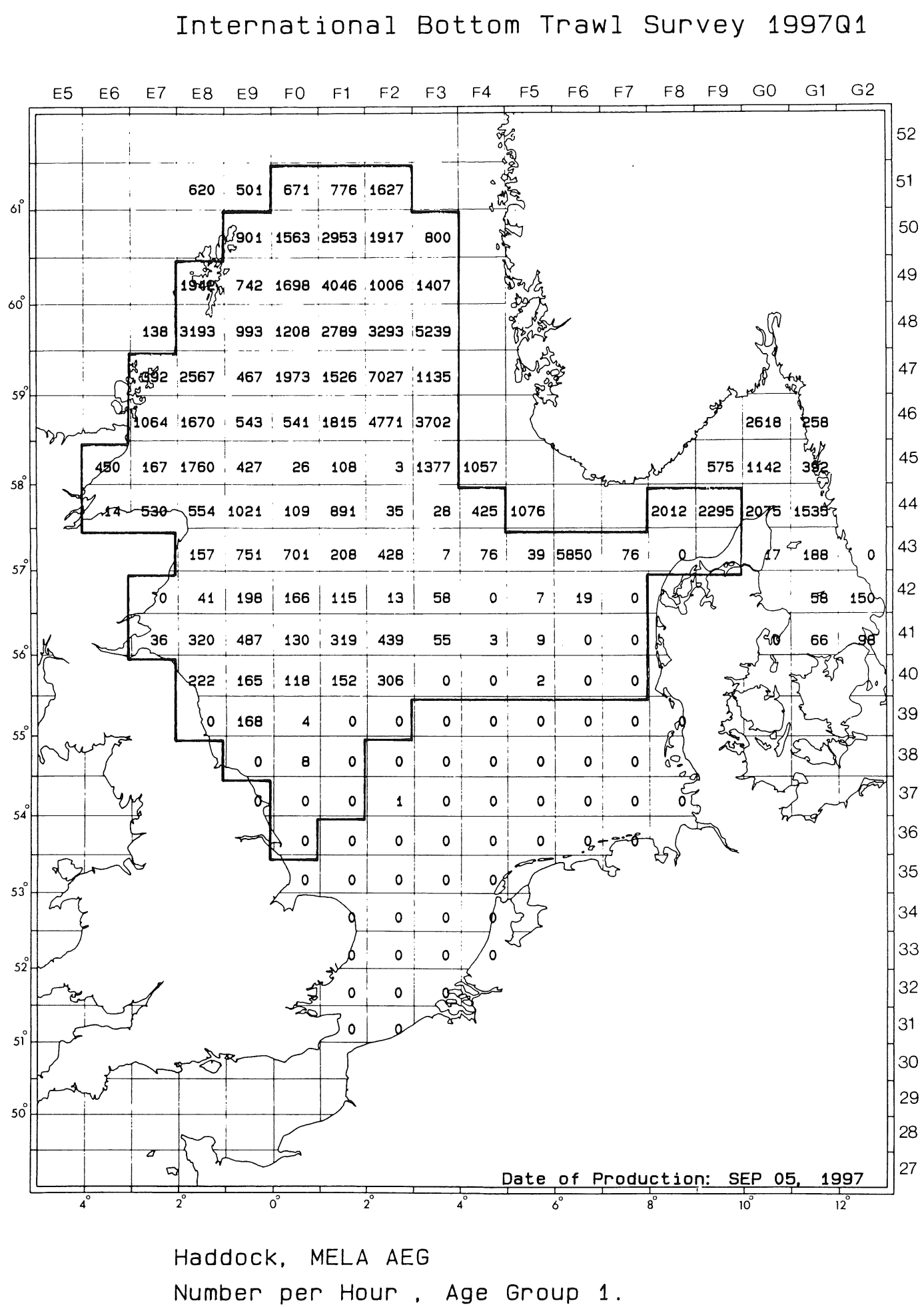

Figure 6.19 Haddock, number per hour, age group 1.

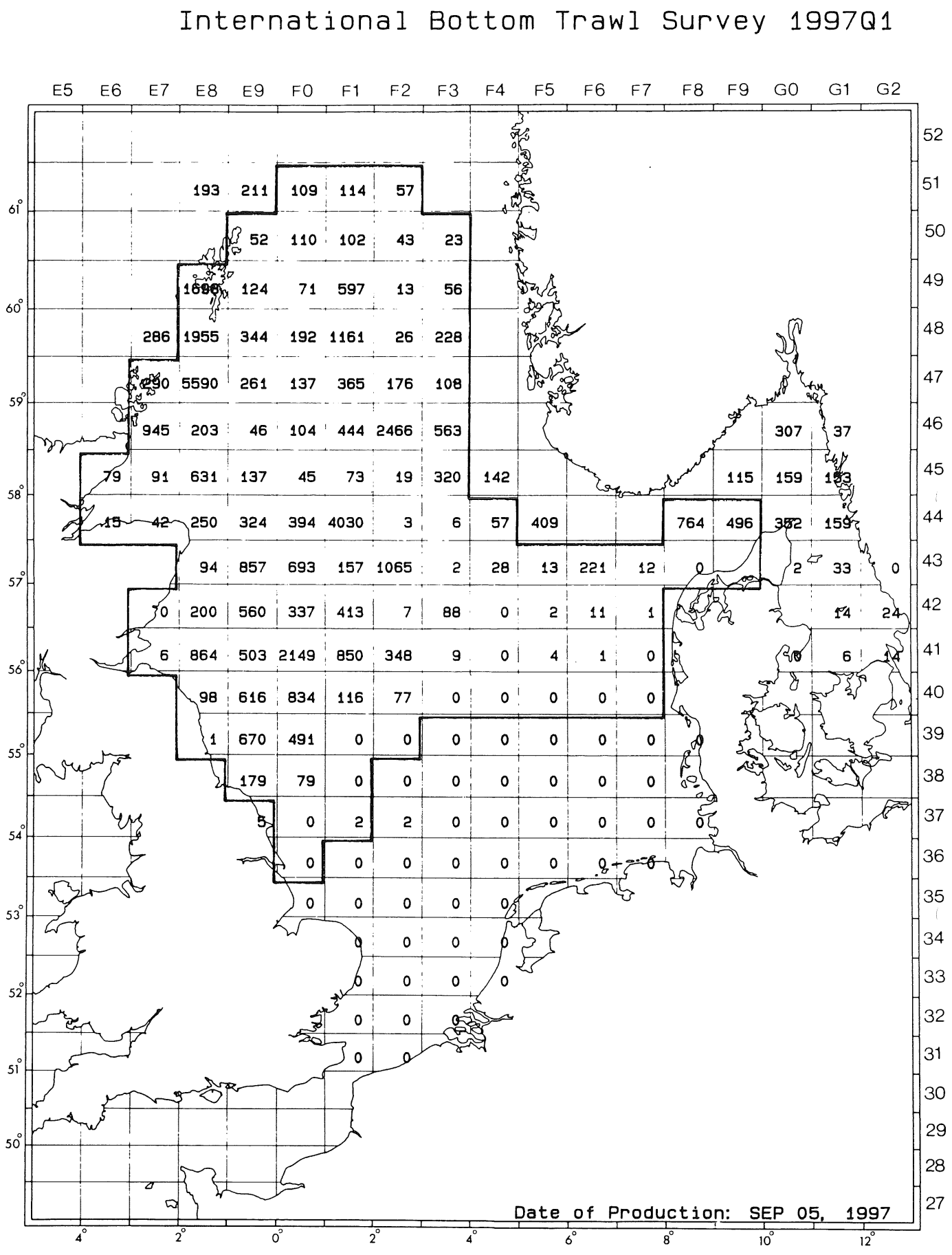

Figure 6.20 Haddock, number per hour, age group 2.

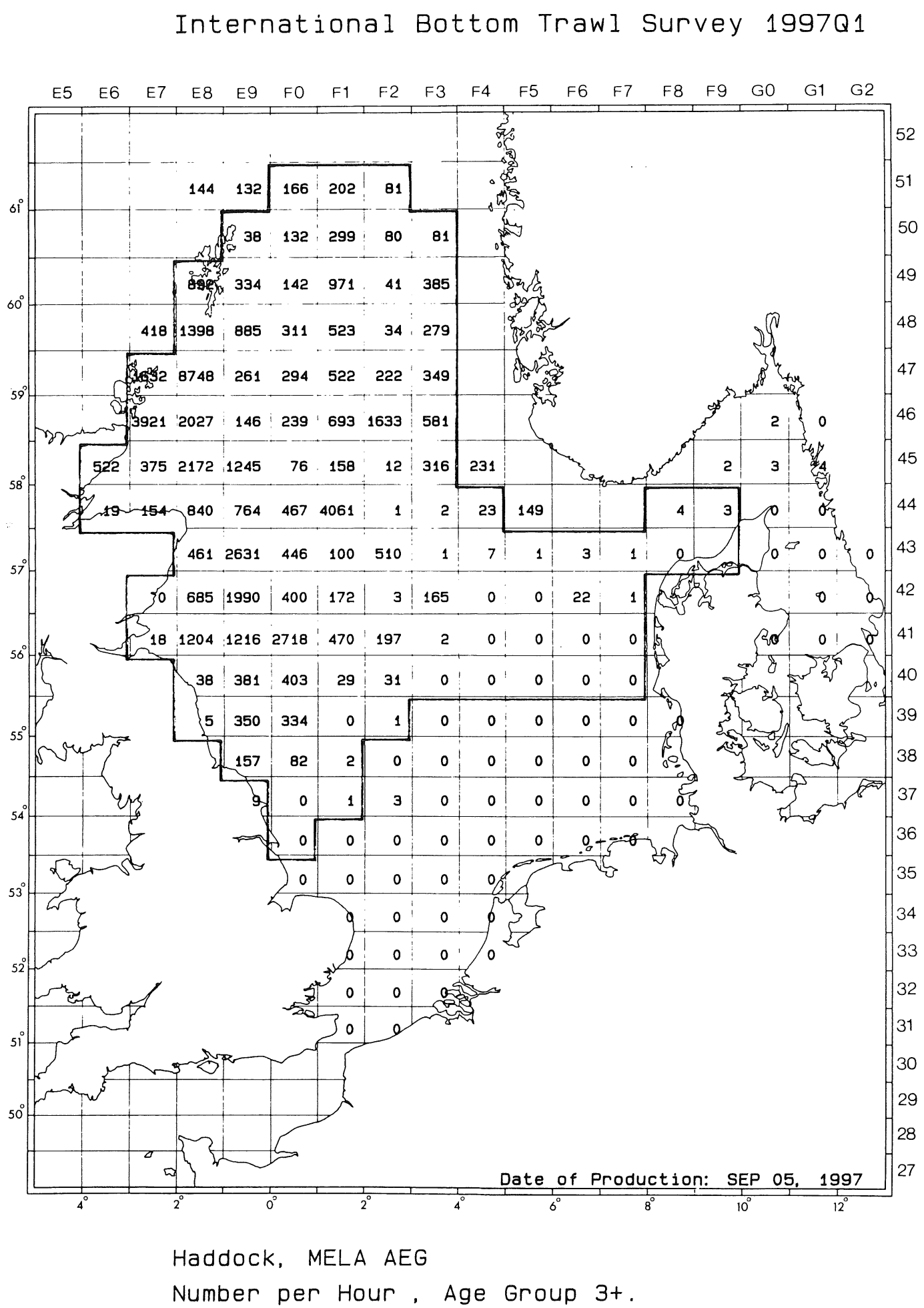

Figure 6.21 Haddock, number per hour, age group 3+.

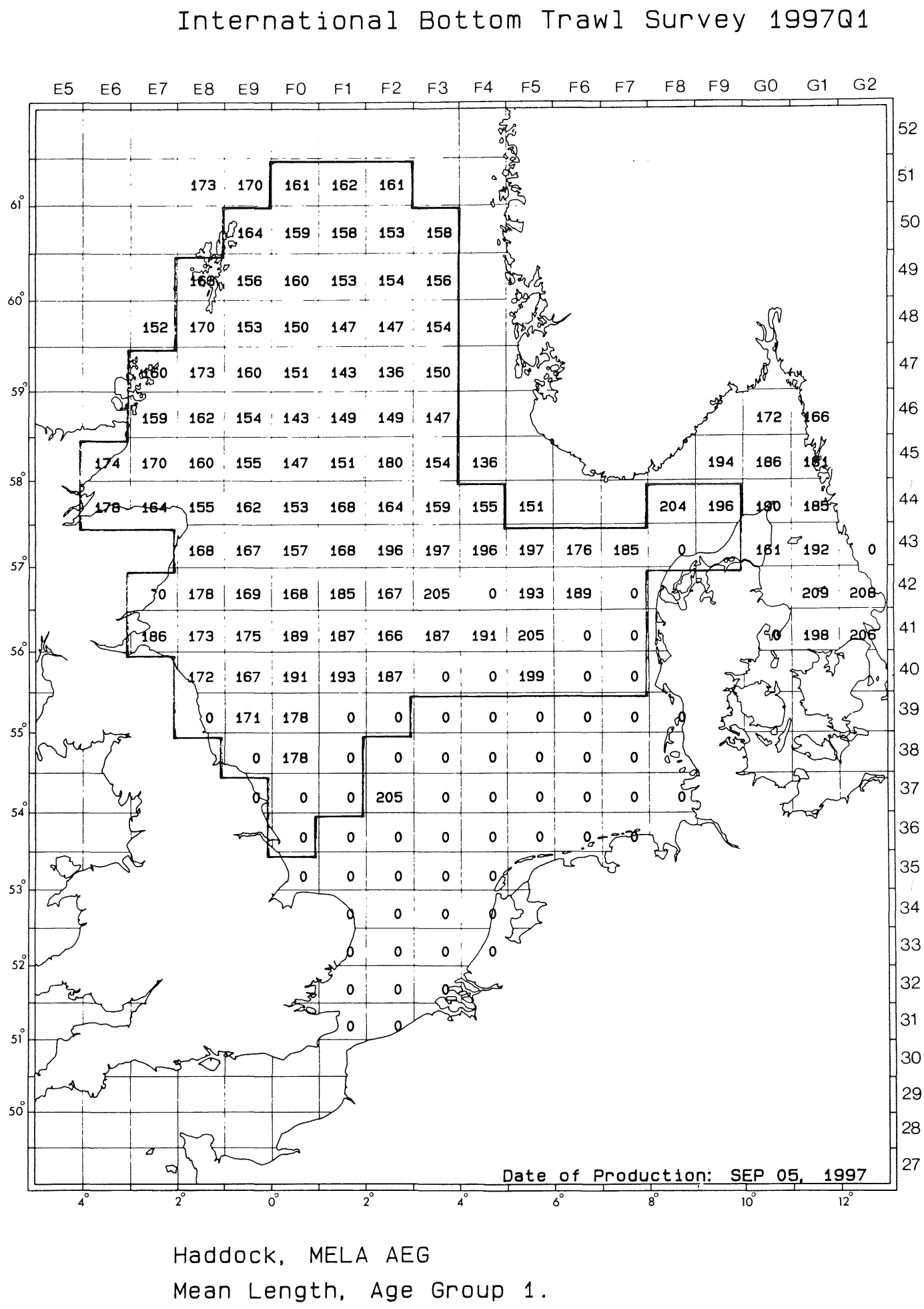

Figure 6.22 Haddock, mean length, age group 1.

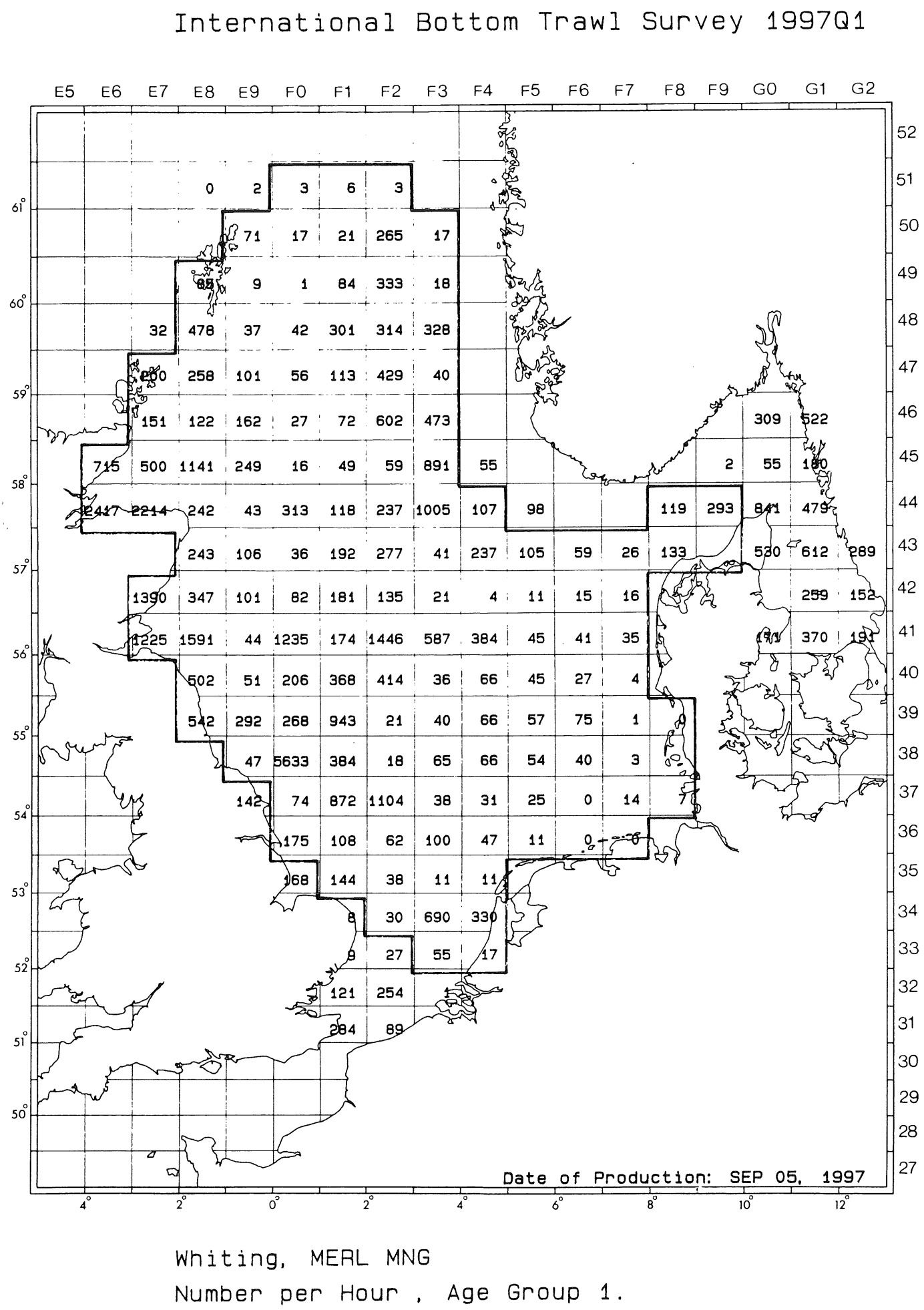

Figure 6.23 Whiting: number per hour, age group 1.

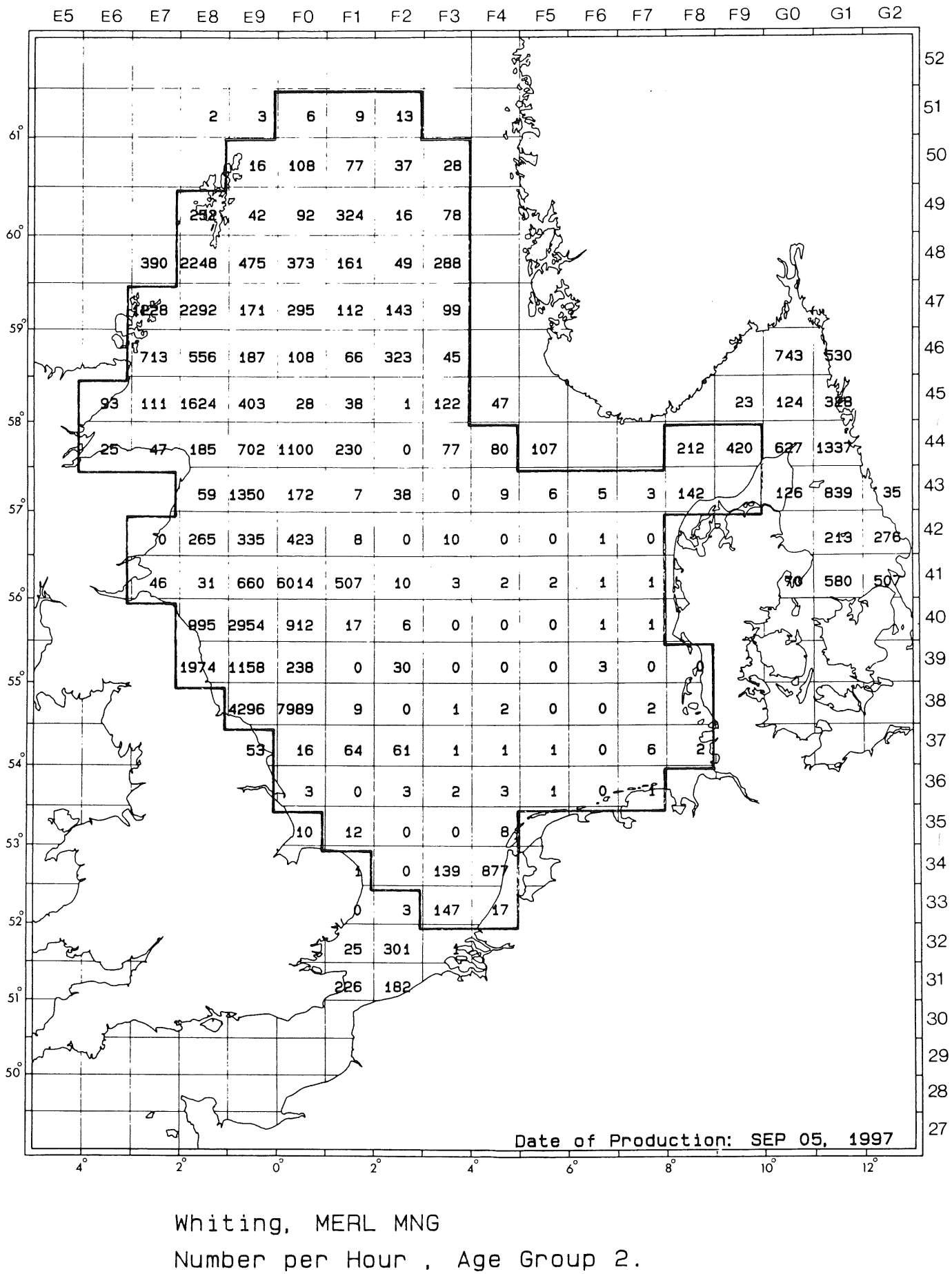

Figure 6.24 Whiting: number per hour, age group 2.

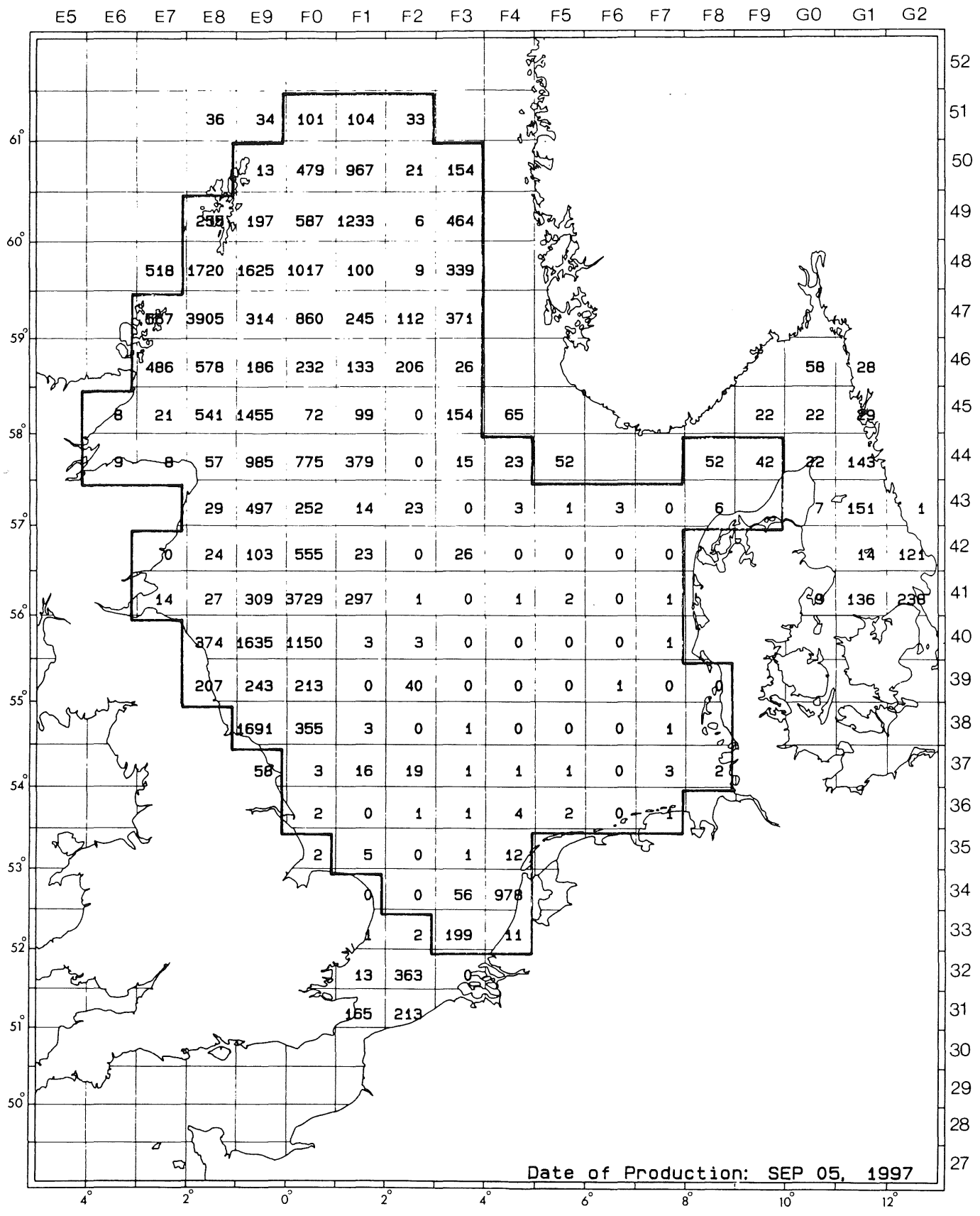

Figure 6.25 Whiting: number per hour, age group 3+.

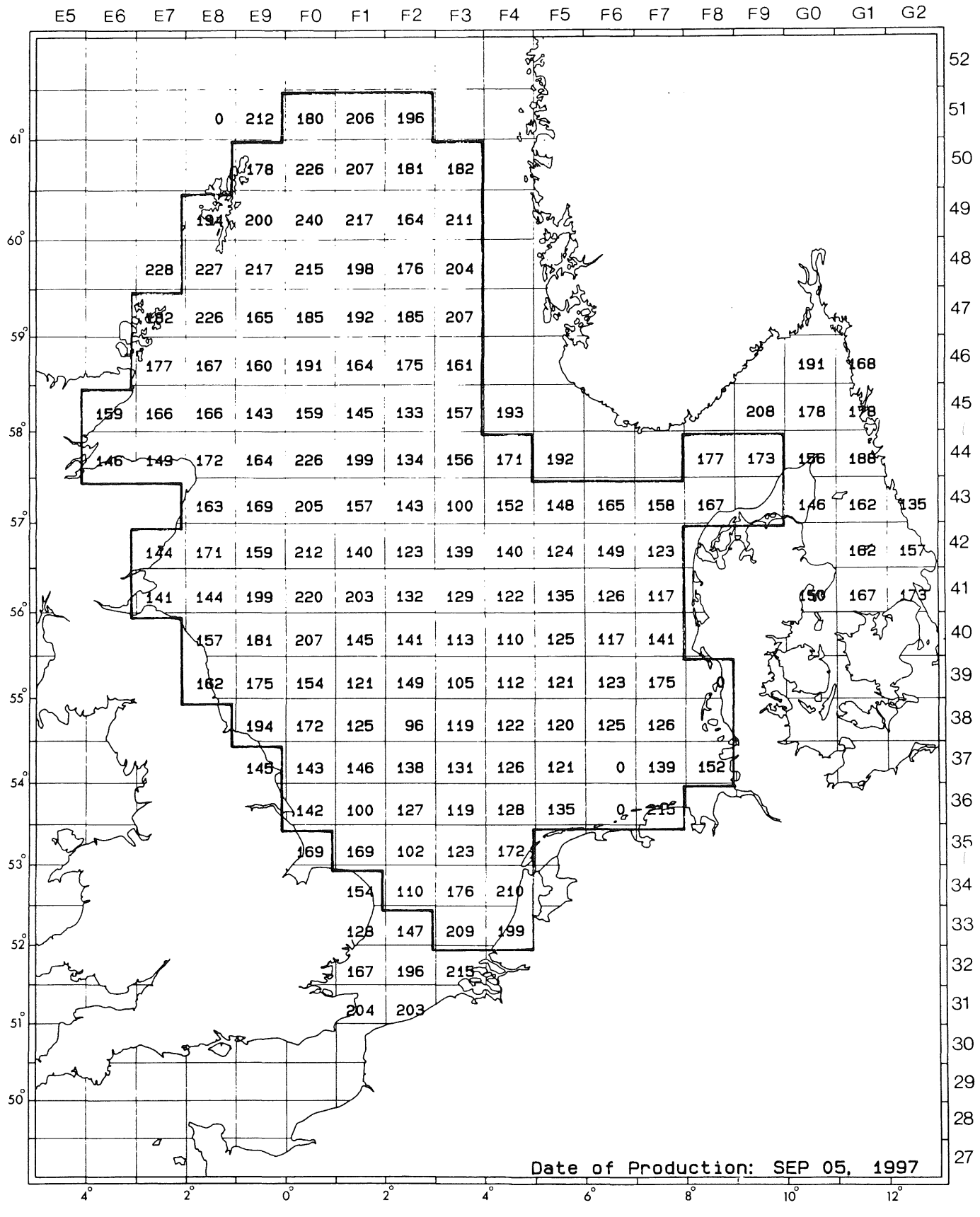

Figure 6.26 Whiting: mean length, age group 1.

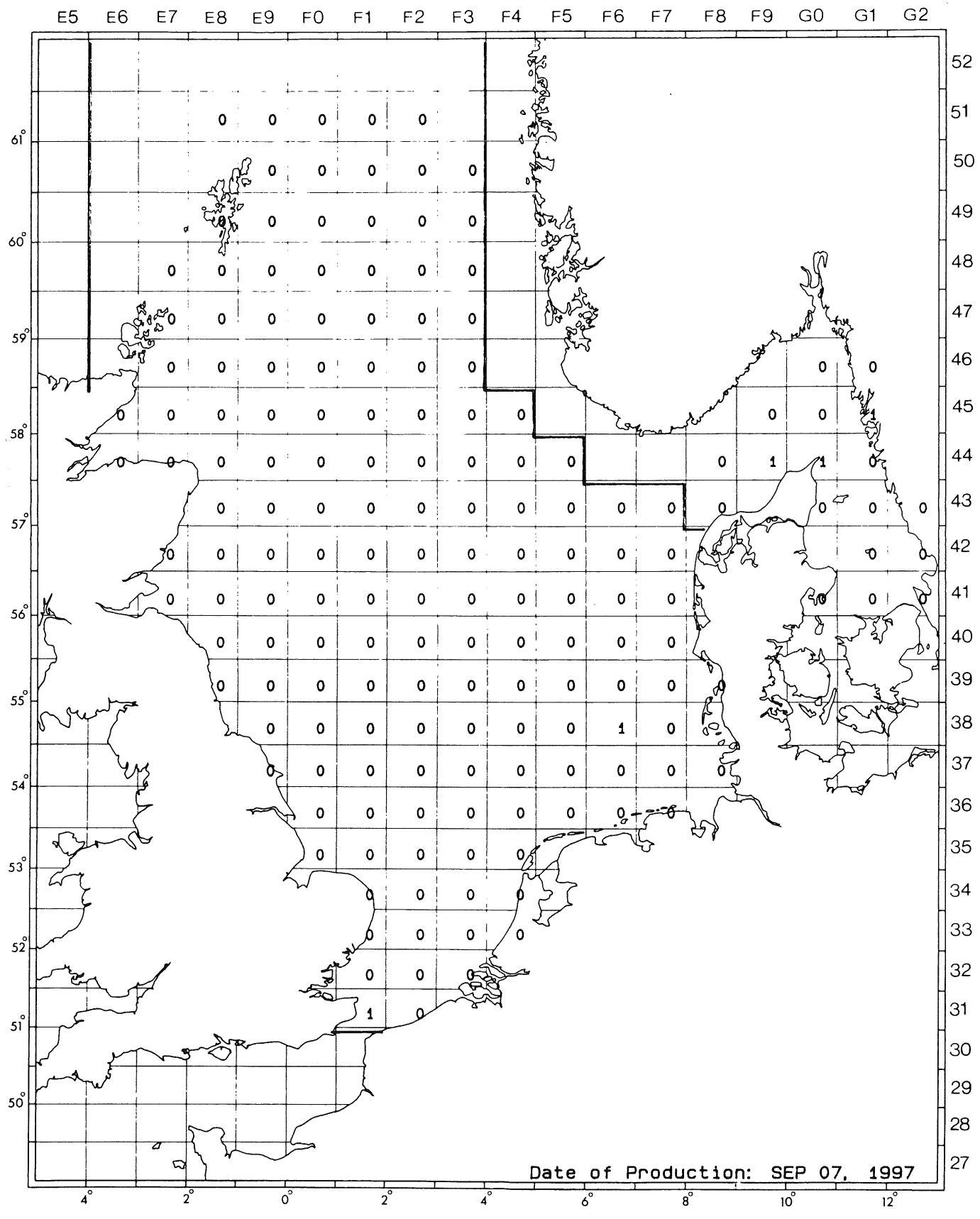

Figure 6.27 Saithe: number per hour, age group 1.

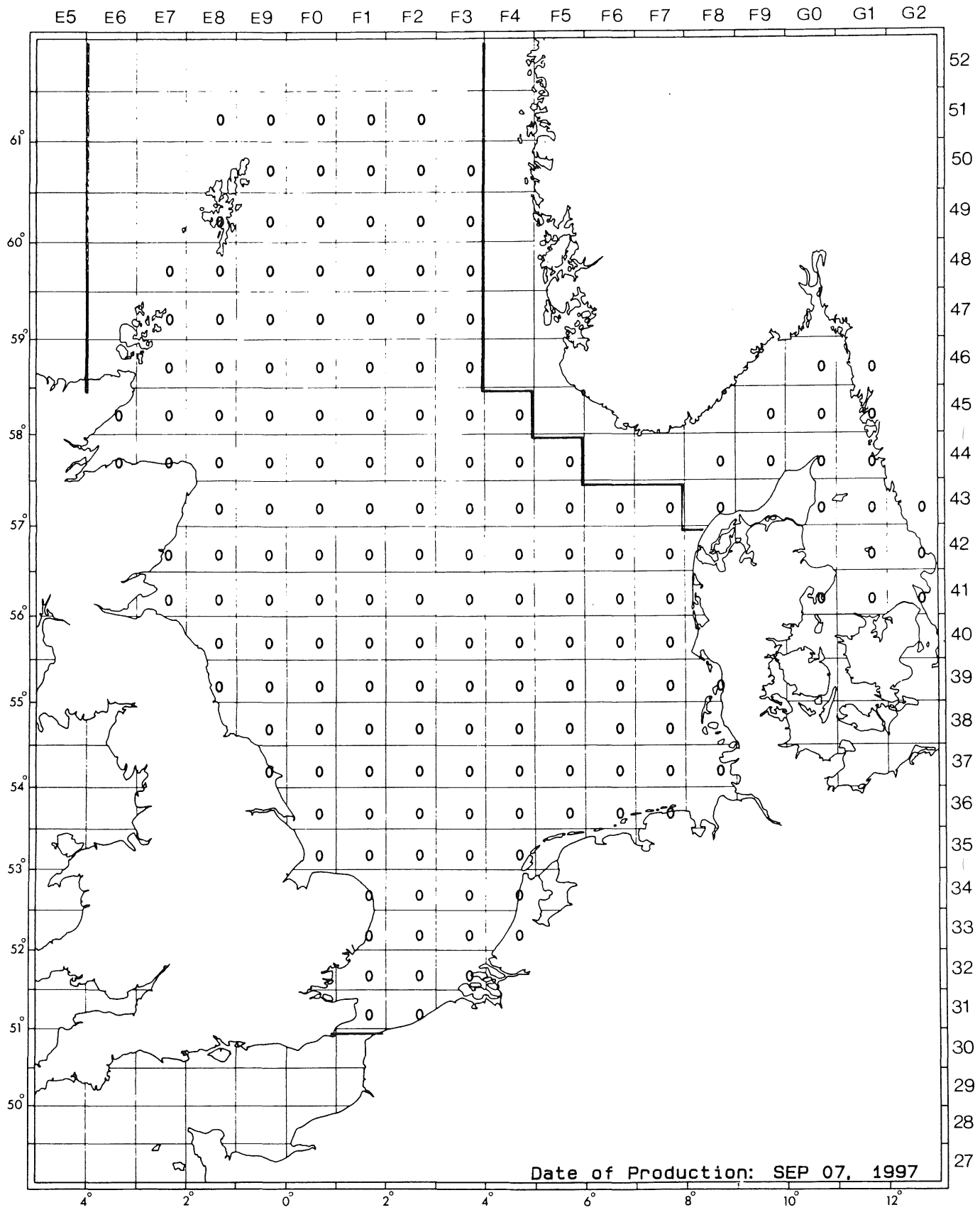

Figure 6.28 Saithe: number per hour, age group 2.

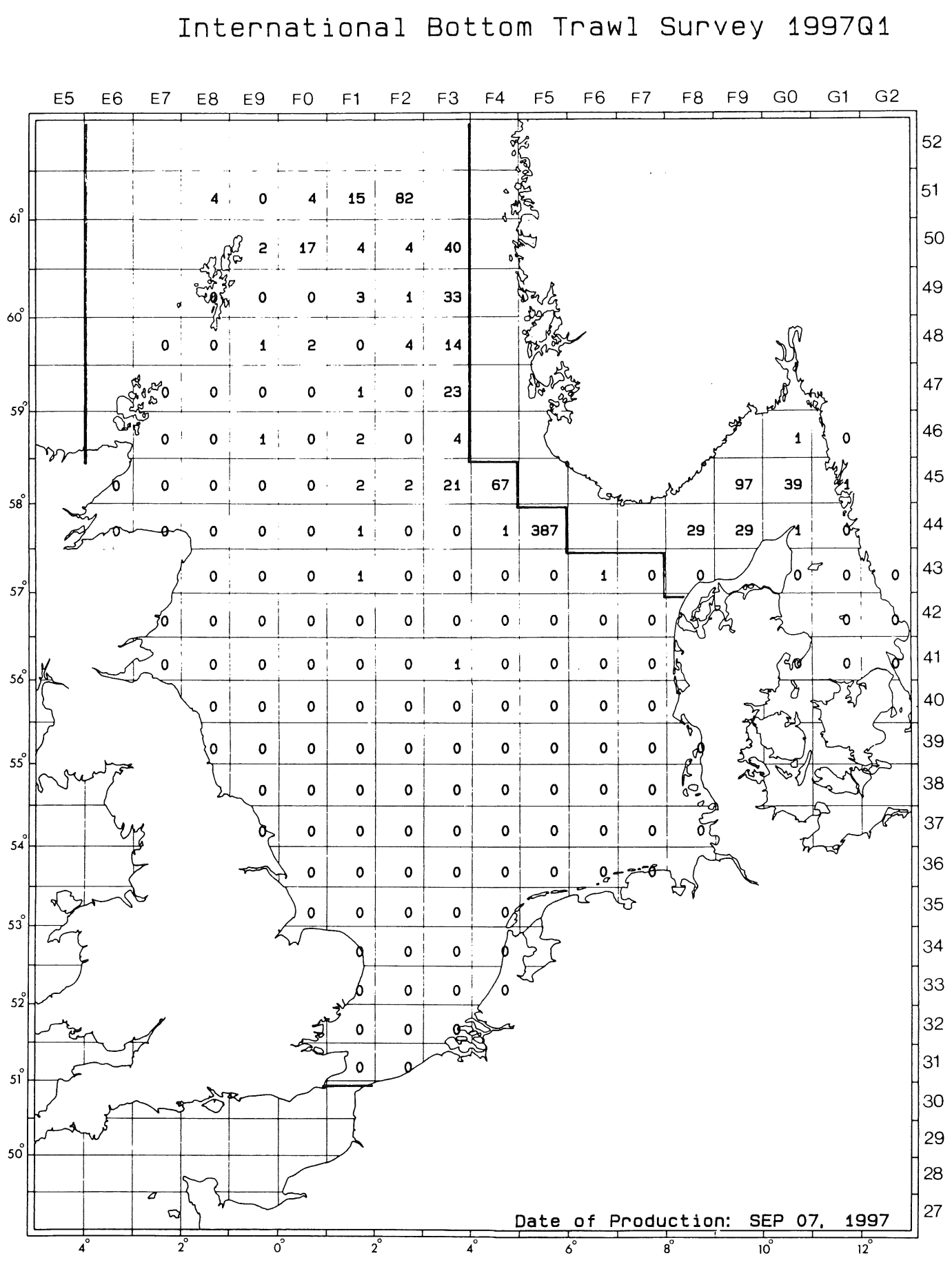

Figure 6.29 Saithe: number per hour, age group 3+.

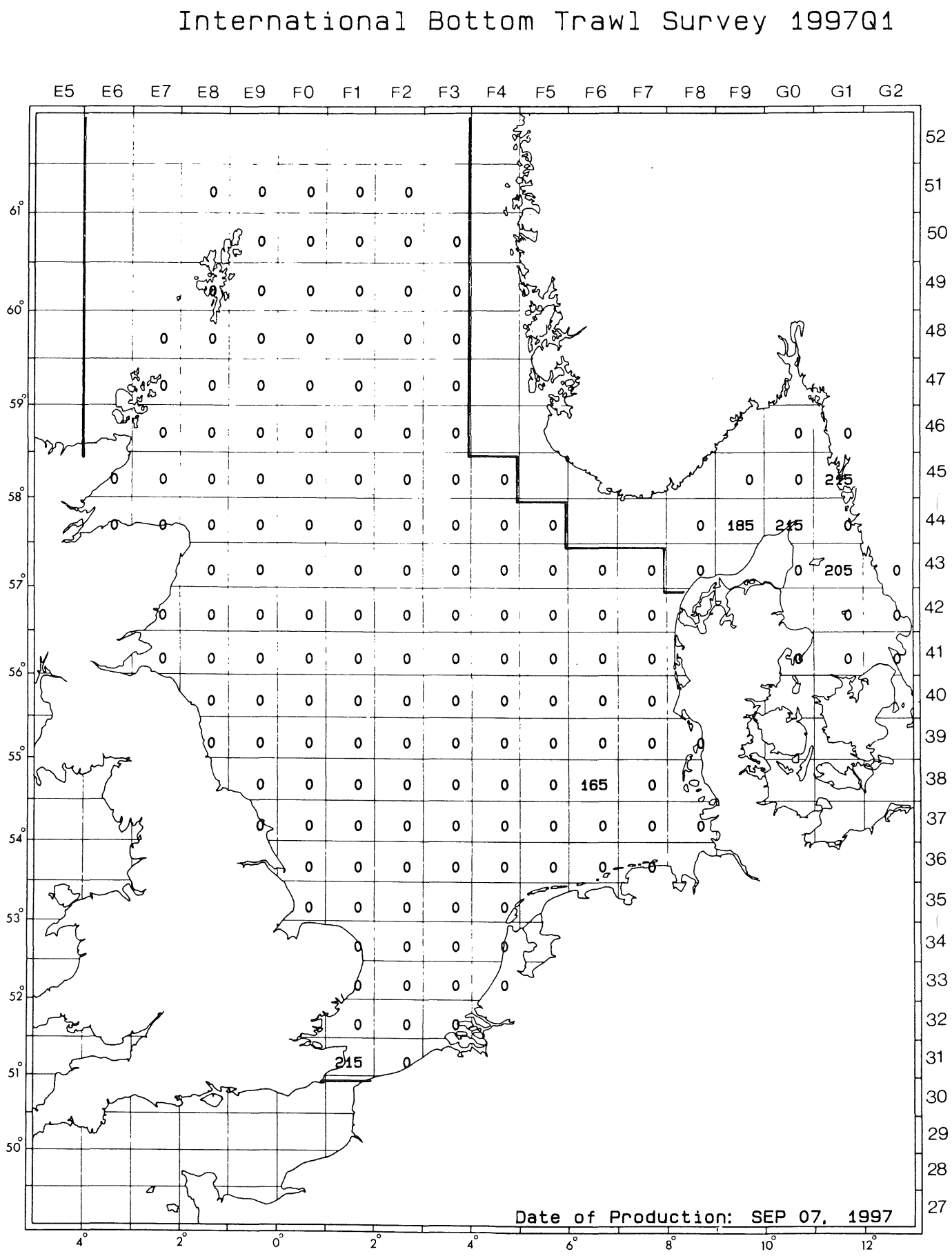

Figure 6.30 Saithe: mean length, age group 1.

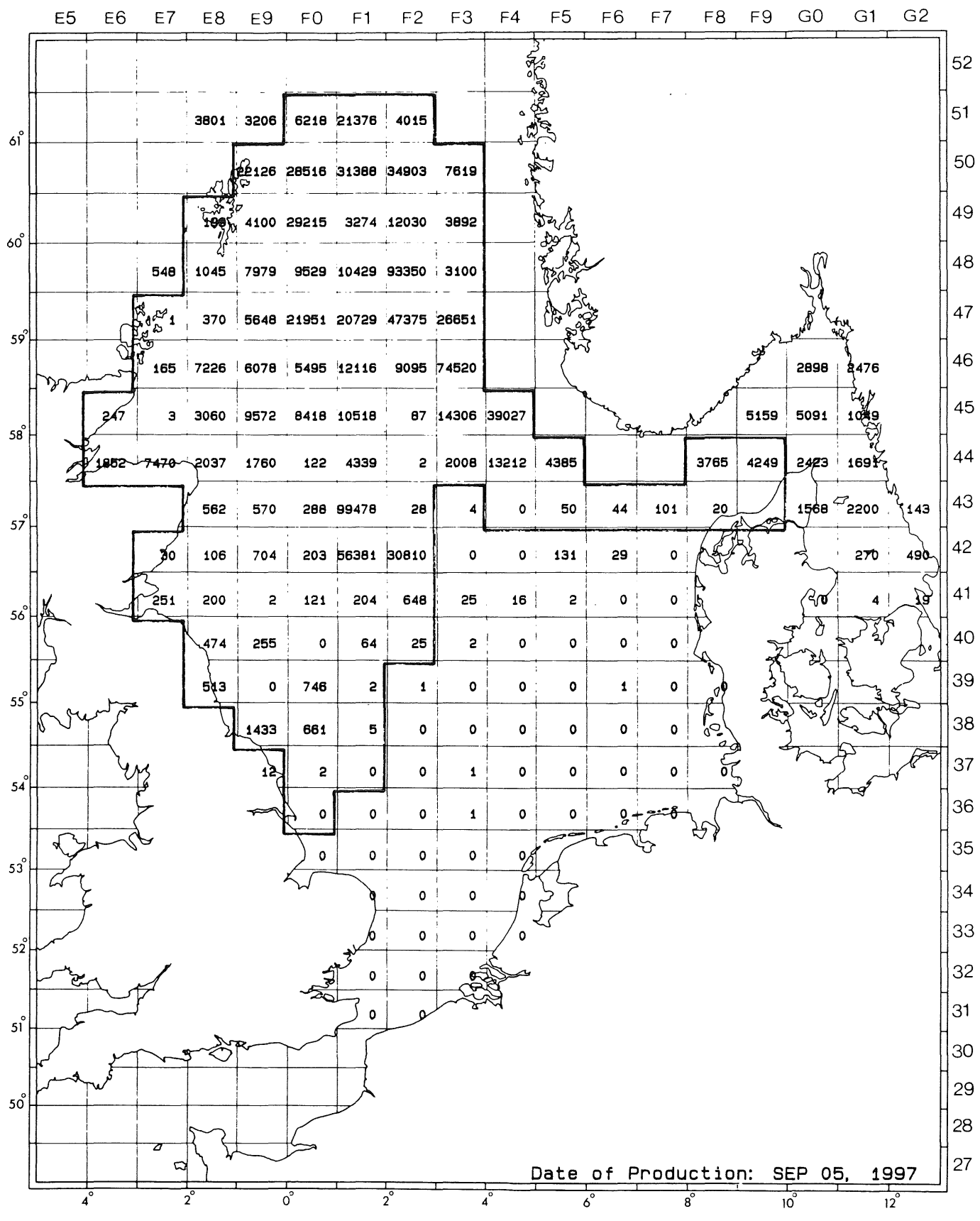

Figure 6.31 Norway pout: number per hour, age group 1.

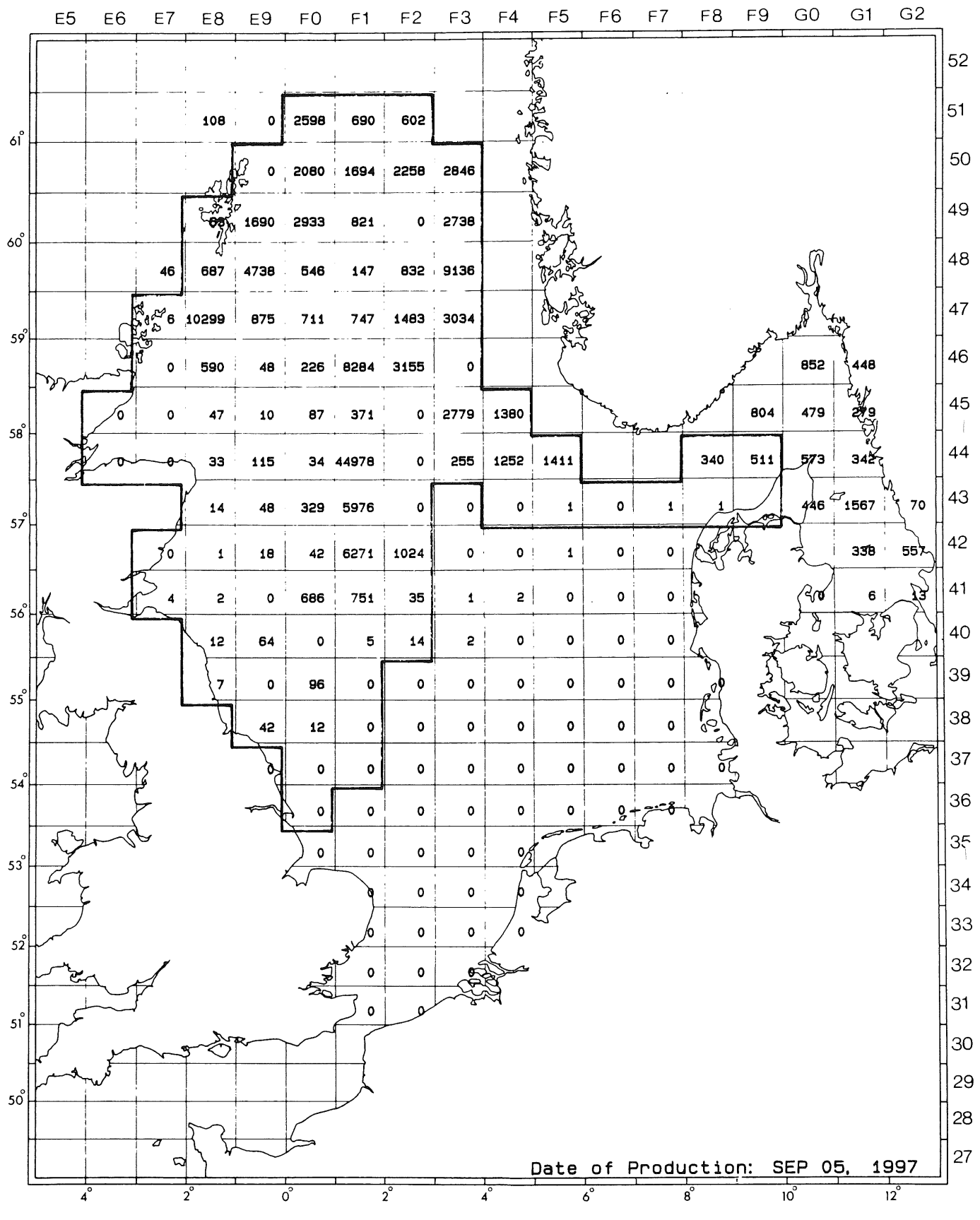

Figure 6.32 Norway pout: number per hour, age group 2.

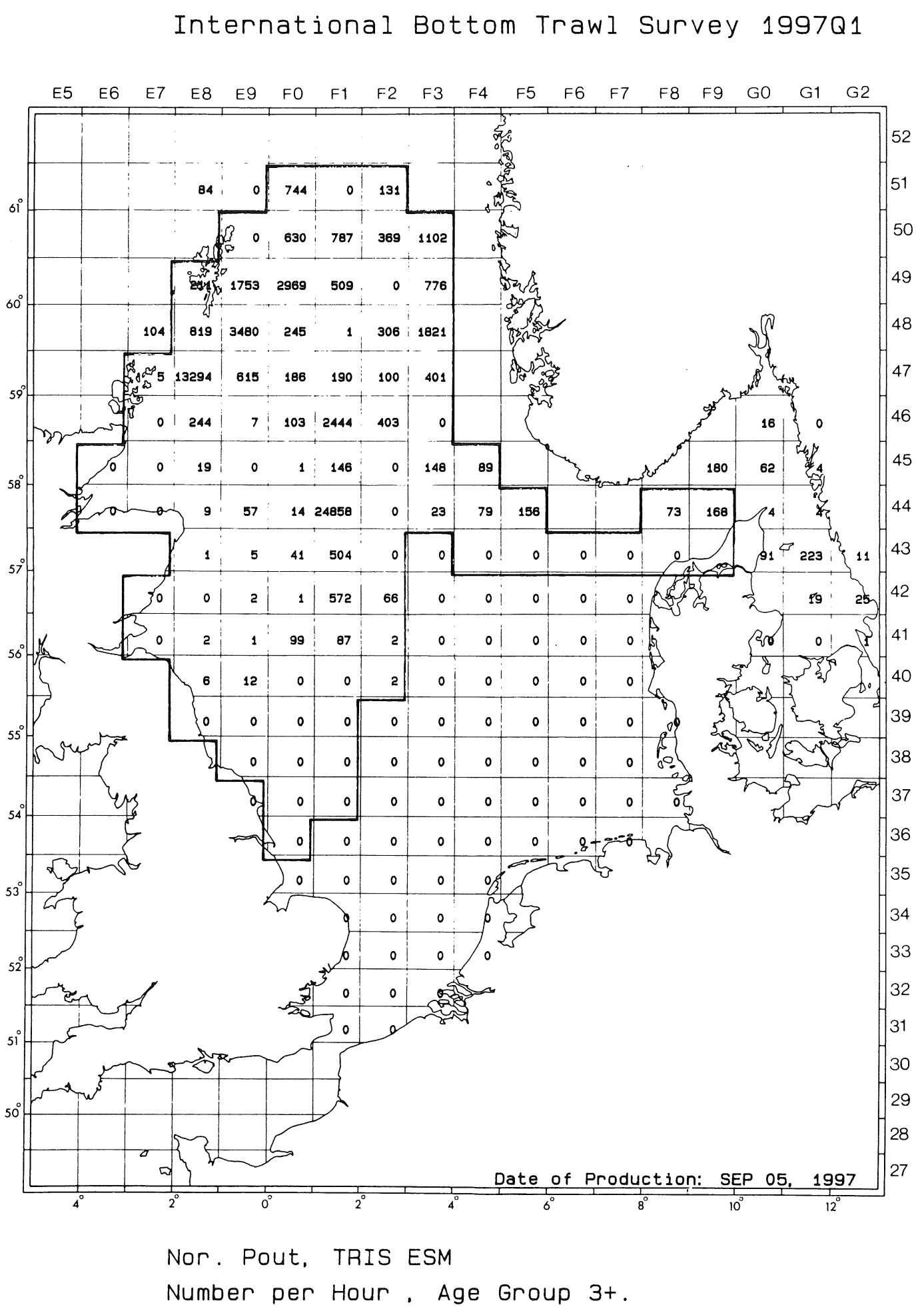

Figure 6.33 Norway pout: number per hour, age group 3+.

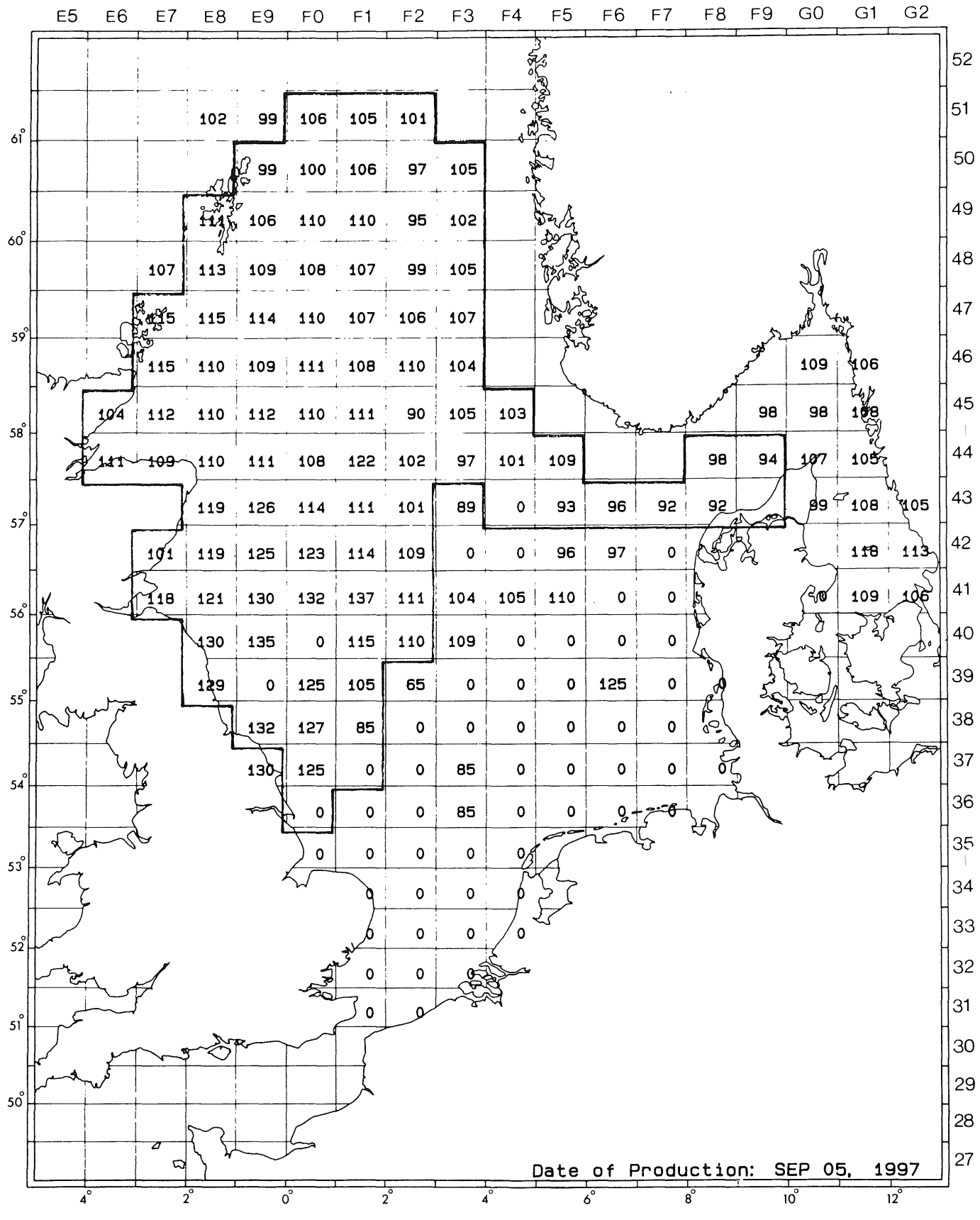

Figure 6.34 Norway pout: mean length, age group 1.

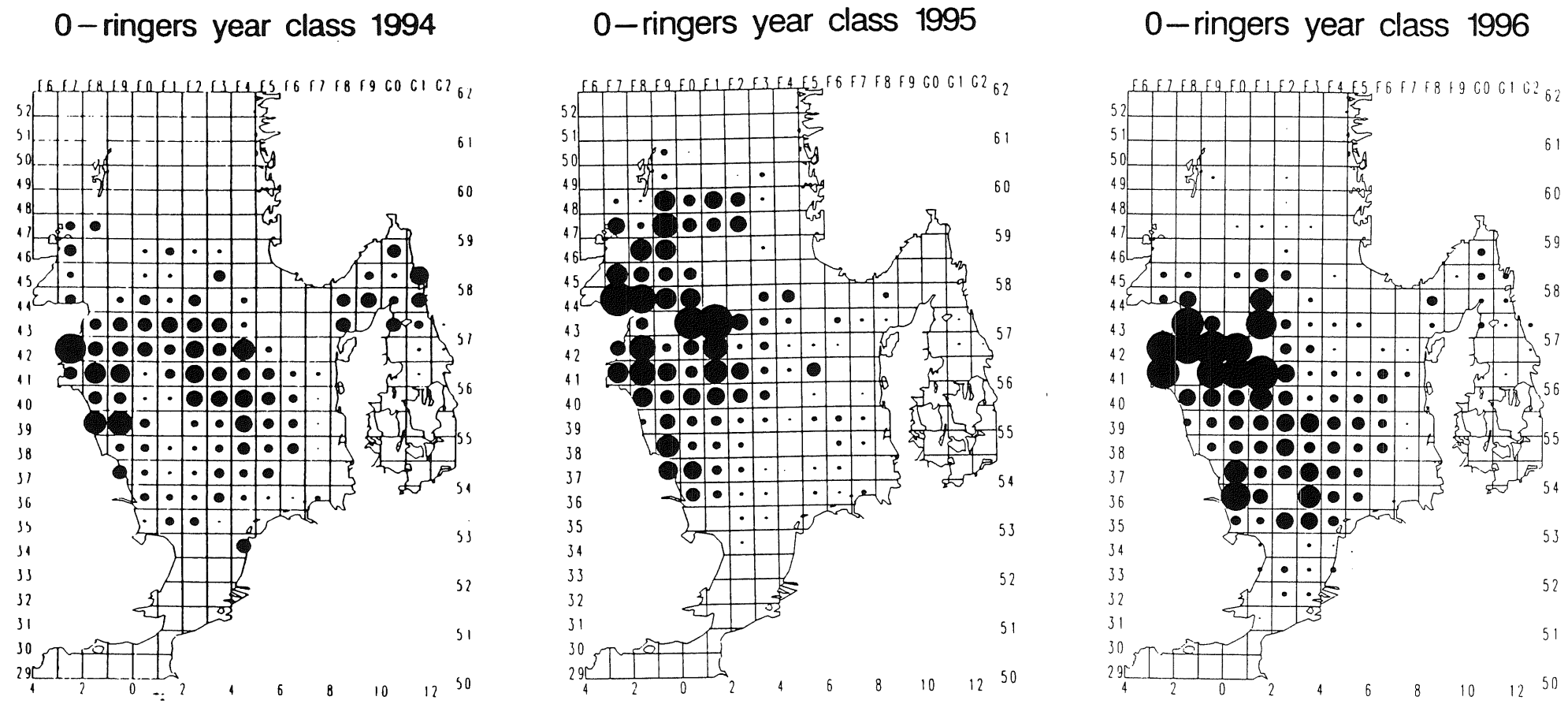

Figure 7.1 Distribution of 0-ringer herring, year classes 1994–1996. Abundance estimates of 0-ringers within each statistical rectangle based on MIK catches during IBTS in February. Areas of filled circles illustrate densities in no m^{-2}, the area of a circle extending to the border of a rectangle represents 1.5 m^{-2}.

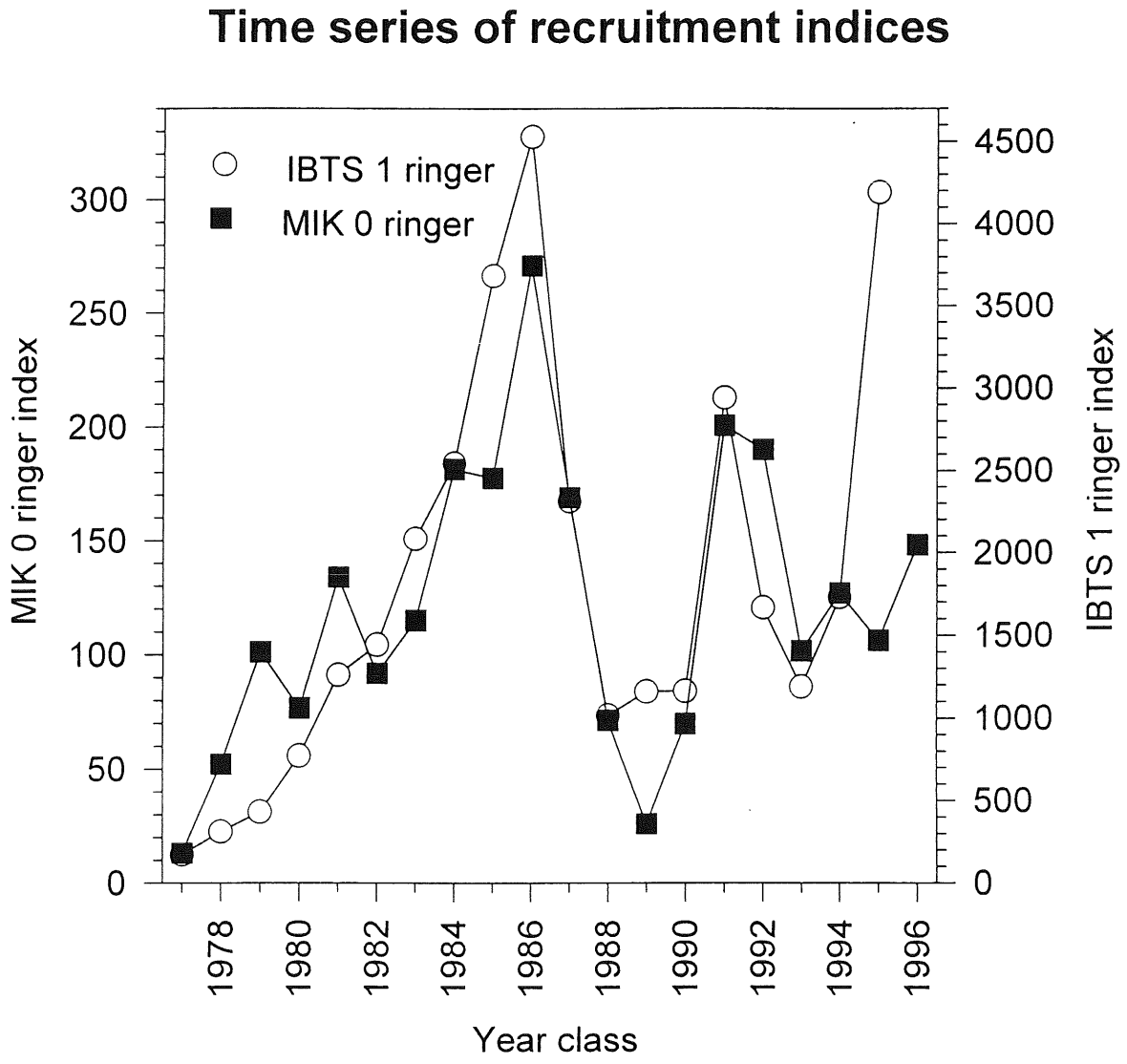

Figure 7.2 Trend in MIK 0-ringer and IBTS 1-ringer indices for the year classes 1977–1996.

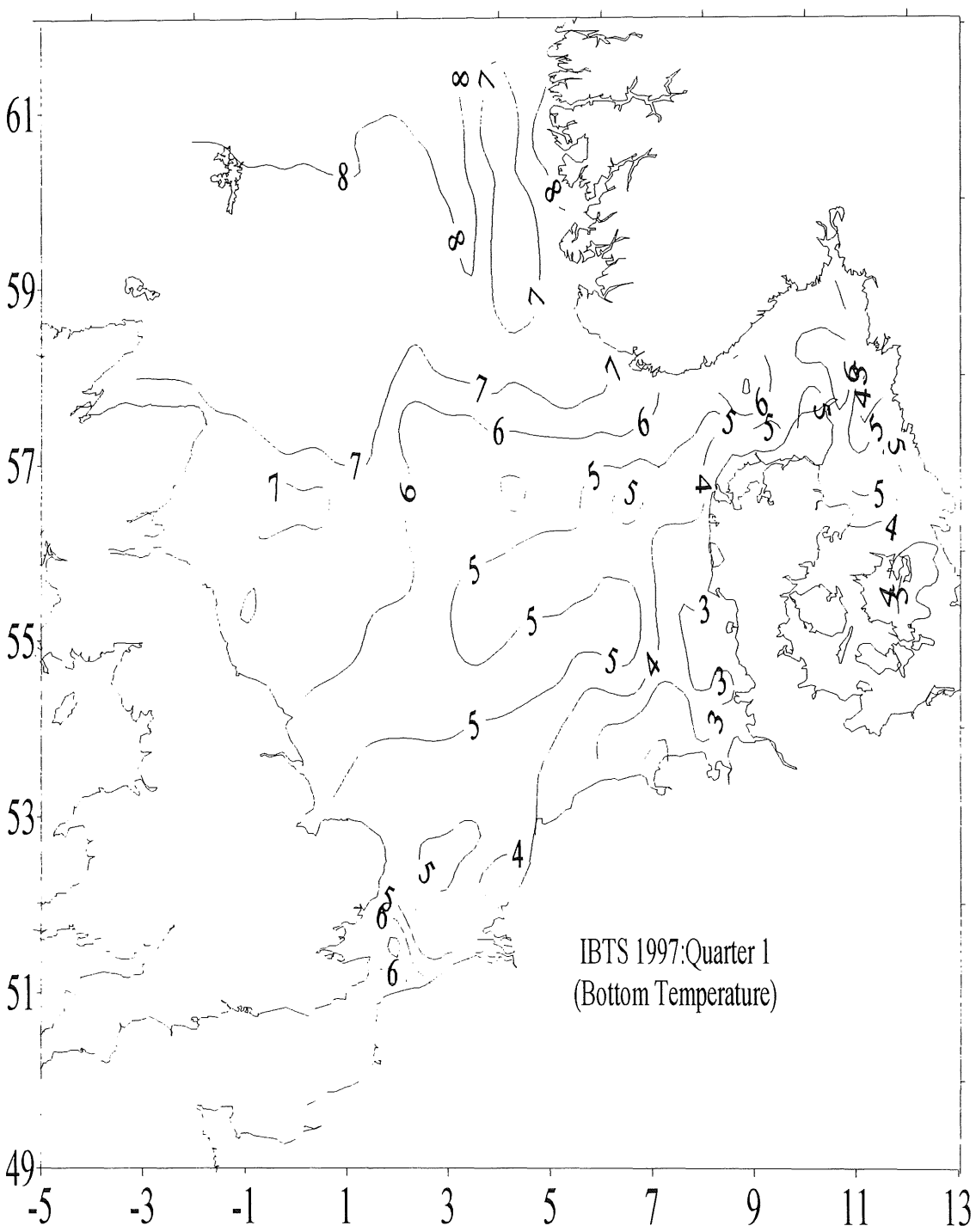
61
59
57
55
53
51
49
-5
-3
-1
1
3
5
7
9
11
13
IBTS 1997:Quarter 1
(Bottom Temperature)

Figure 8.1

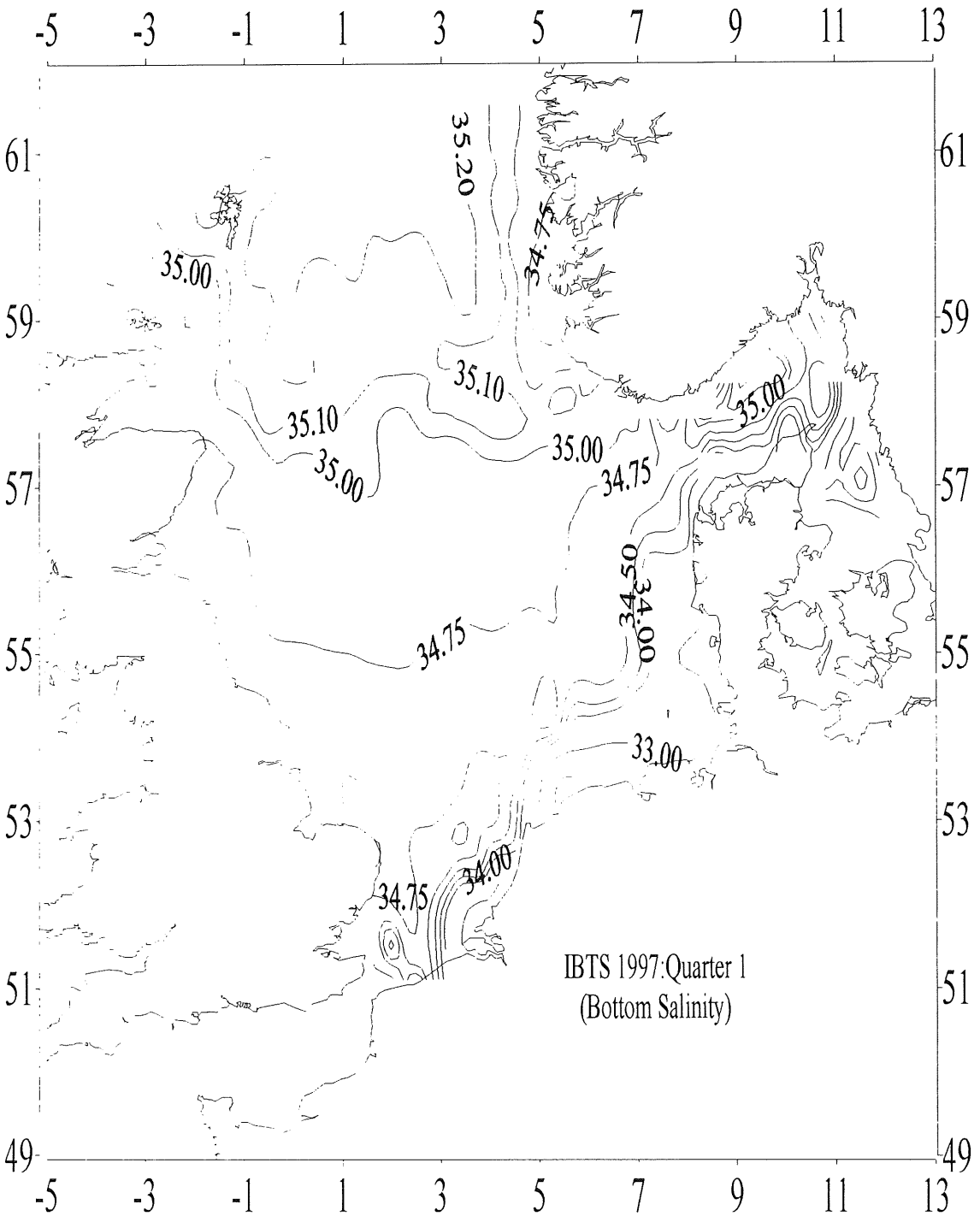
-5
-3
-1
1
3
5
7
9
11
13
61
59
57
55
53
51
49
35.20
34.75
35.00
35.10
35.10
35.00
35.00
34.75
35.00
34.50
34.00
34.75
33.00
34.00
34.75
IBTS 1997:Quarter 1
(Bottom Salinity)

Figure 8.2

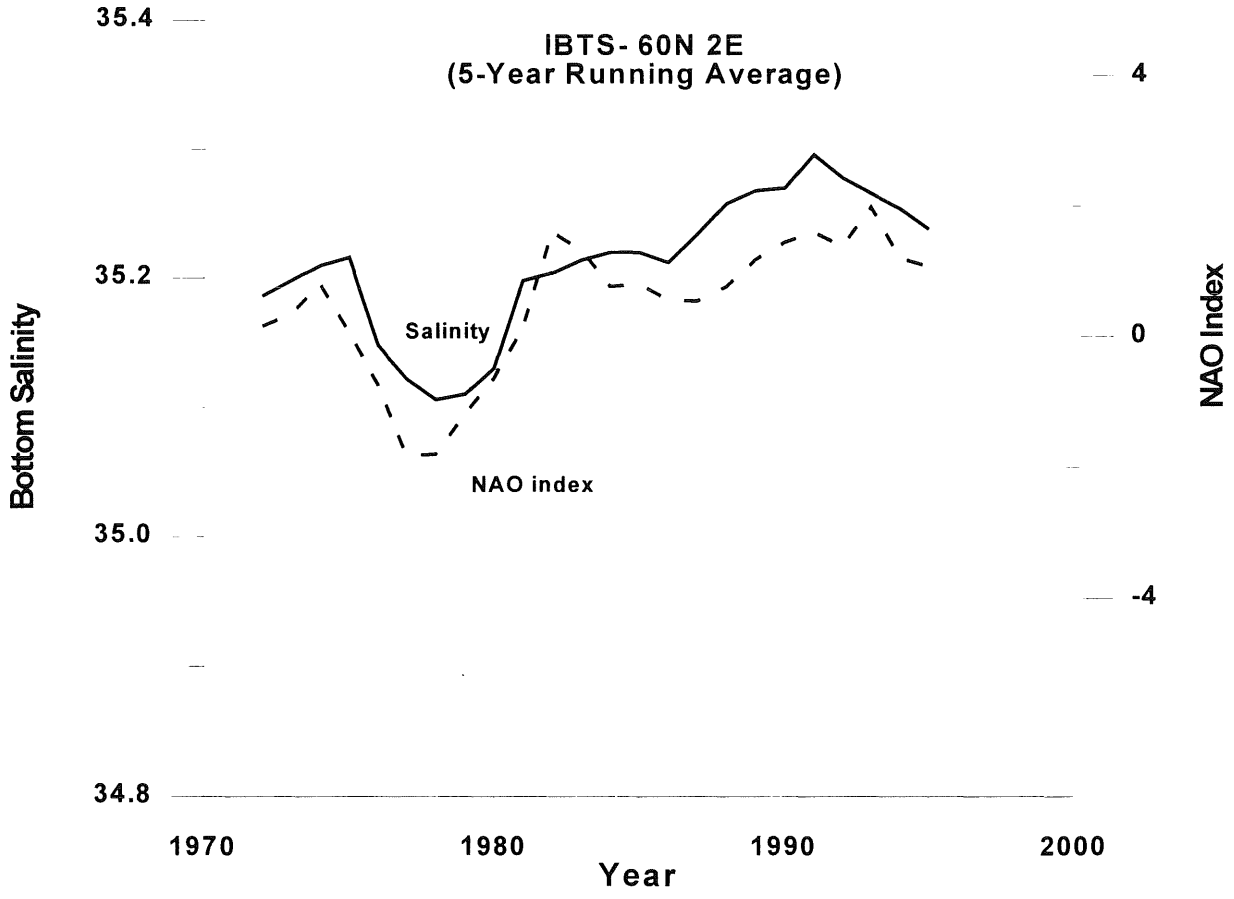
IBTS- 60N 2E
(5-Year Running Average)
35.4
35.2
35.0
34.8
Bottom Salinity
4
0
-4
NAO Index
Salinity
NAO index
1970
1980
1990
2000
Year

Figure 8.3