

**REPORT OF THE  
INTERNATIONAL BOTTOM TRAWL SURVEY IN THE  
NORTH SEA, SKAGERRAK AND KATTEGAT  
IN 1998: QUARTER 1**

**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 1998. 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 1996/H:1a) early analyses of the data indicated the potential usefulness of quarterly surveys and it was decided to encourage their continuation.

The results for 1998, quarter 2-4 will be published in a separate ICES Report.

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 summarised 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 1996/H:1b). Details on the participation in the 1998 survey are given below. The whole survey area has been covered as planned.

Country	Vessel	Period	Number of Hauls	
			GOV	MIK
Denmark	Dana	28/1-15/2	51	99
France	Thalassa (new)	28/1-19/2	83	55
Germany, F.R.	W. Herwig III	6/1-10/2	79	-
Netherlands	Tridens	26/1-25/2	55	56
Norway	Michael Sars	24/1-08/2	43	62
Sweden	Argos	26/1-12/2	45	57
UK Scotland	Scotia	20/1-09/2	60	103
Total			416	432

## 3 DATA AVAILABLE

In Table 3.1 it 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 1998 data presented in this report all final data, except German saithe age/length 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.

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 (ICES 1993/Assess:15).

It is implicitly assumed that all 1-ringer herring in the North Sea, Skagerrak, and Kattegat are autumn spawners. Unsourced 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:1a) 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.

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.

For the index of the remaining species (cod, haddock, whiting, Norway pout and mackerel), the catch at age per hour is averaged for all hauls within a rectangle, and the survey index is calculated by taking the average of all rectangles within a species-specific standard area. Rectangles where no haul was made, are excluded from the calculation.

## **5 RESULTS GOV-TRAWL FOR 1998**

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 5.1.

The number of otoliths sampled per target species and roundfish area is given in Table 5.1.

Per species a set of figures gives the distributions of the 0-, 1-, 2-, and 3+ group and the mean length of 1-group fish per rectangle. The specific standard area used to calculate the index of year class strength is indicated in the figures.

### **5.1 North Sea**

Preliminary indices based on certain size classes are compared with the final indices in Table 5.2. The preliminary indices are very close to the final ones except for cod and Norway pout. Final indices of 1- and 2-group fish of the eighth standard species are given in Table 5.3. Table 5.4 gives the mean age composition of the standard species within the relevant standard areas.

#### **Herring**

Indices for 1- and 2-ringed herring are presented in Table 5.3 and mean numbers per rectangle are given in Figures 5.2-5.5. 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 1998 represent year class 1996.

The index for the 1996 year class is of average size.

#### **Sprat**

Sprat indices of 1- and 2-group are given in Table 5.3. 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 5.6-5.9.

The index value for the 1997 year class is twice as big as the 1996 year class and 80% higher than the series average.

### **Mackerel**

Indices for mackerel are given in Table 5.3, the distributions of 1-, 2- and 3+ groups, and the mean length of 1-group fish are given in Figures 5.10-5.13.

The index value of 1-group is back again at a normal level compared to the very high 1996 year class. This year, the 1-group was caught in the central North Sea, a contrast to 1997 where the index was due to the high abundance in the northern and north-western part of the survey area.

### **Cod**

Abundance indices are given in Table 5.3, the distributions of 1-, 2-, and 3+ group, and the mean length of 1-group fish are given in Figures 5.14-5.17.

The index value for one-year-old cod is very low. The Kattegat area, which is not included in the cod standard area, has a relative high abundance of the 1997 year class.

### **Haddock**

Abundance indices are given in Table 5.3, the distributions of 1-, 2-, and 3+ group, and the mean length of 1-group fish are given in Figures 5.18-5.21.

The index value at 374 is 65% of the long-term average.

### **Whiting**

Abundance indices are given in Table 5.3, the distributions of 1-, 2-, and 3+ group, and the mean length of 1-group fish are given in Figures 5.22-5.25.

The decreasing trend in whiting abundance since 1992 seems to have stopped and the 1997 year class is of long-term average size.

### **Saithe**

Abundance indices are given in Table 5.3, the distributions of 1-, 2-, and 3+ group, and the mean length of 1-group fish are given in Figures 5.26-5.29.

As usual only very few 1- and 2-group saithe were found in the North Sea in 1998.

### **Norway Pout**

Abundance indices are given in Table 5.3, the distributions of 1-, 2-, and 3+ group, and the mean length of 1-group fish are given in Figures 5.30-5.33.

After the record high 1996 year class of Norway pout, the 1997 year class index is one third of the long time average. The 1996 year class produced a record high index of 2-group fish.

## **5.2 Skagerrak-Kattegat (Division IIIa)**

The number of hauls per rectangle for herring and gadoids is shown in Figures 5.1.

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.

The stocks of cod in Skagerrak and Kattegat are assessed separately and indices are given for each area.

Updates of the indices for the 1996-1998 surveys are not available. Previous years final and preliminary indices for herring and gadoids are given in Table 5.5-5.6.

## 6 RESULTS OF THE SAMPLING FOR HERRING AND SPRAT LARVAE IN 1998

### Results of the sampling for herring and sprat larvae in 1998.

During the IBTS fish larvae are sampled by towing a small meshed ring net (MIK) in oblique hauls. The catches are used in an estimation of fish larval density and abundance, assuming a 100% efficiency of the gear in catching the larvae at night.

Larval density is estimated from:

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

The number of larvae within a given statistical rectangle is estimated by multiplying the density found by the surface area of a rectangle (approx.  $309 * 10^7 \text{ m}^2$ ). 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 the IKMT, used in the first period of the series, and the MIK is estimated. This is used to convert earlier catches to total numbers (MIK indices).

### Herring larvae

In total 432 hauls were made. This number represents a significant increase from the preceding years, and the 1998 coverage of the sampling area was very good.

The herring larvae showed the same westerly distribution of major concentrations as observed during the last three years (Figure 6.1), however compared to preceding years the total abundance estimate showed a marked decrease. The estimated index value of  $53.1 * 10^9$  (Table 6.1, Figure 6.2) is the lowest in 7 years.

### 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 of indices will be carried out.

## 7 HYDROGRAPHIC DATA

### 7.1 Hydro-chemistry Survey

Seven ships contributed hydrographic data to the 1998 dataset. These consist of 534 stations worked between 16 January and 25 February. Nutrient data were supplied for 167 stations, contributions being received from four ships. Data quality was again good. In the case of the "Michael Sars" dataset, which was submitted in December 1998, approximately 60 CTD stations were supplied in addition to those worked along with trawl stations. These data are included in this analysis.

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 1970 to 1998 is provided as Table 7.1. The Figures and Table show that temperatures throughout most of the North Sea were well above average over the entire area, and at location 2, temperatures were higher than hitherto reported (See Figure 7.3). Salinity levels were close to their maximum values throughout much of the North Sea. Levels were particularly high east of the English Channel where a significant intrusion of Atlantic water was evident.



Additionally charts from the 1998 IBTS-1 survey have been published in the ICES website on [www.ices.dk/ocean/project/datasets/iyfs.htm](http://www.ices.dk/ocean/project/datasets/iyfs.htm). These additional charts include ones for station positions, phosphate, silicate, nitrate and nitrite.

## 8 REFERENCES

- ICES 1993/Assess:15. Report of the Herring Assessment Working Group for the Area South of 62°N. ICES Doc. CM 1993/Assess:15.
- ICES 1995/Assess:13. Report of the Herring Assessment Working Group for the Area South of 62°N. ICES Doc. CM 1995/Assess:13.
- ICES 1996/H:1a. Report of the International Bottom Trawl Survey Working Group. ICES Doc. CM 1996/H:1.
- ICES 1996/H:1b. 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 at August 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	1998
Denmark	✓	✓	✓	✓	✓	✓	✓	✓	✓
France	✓	✓	✓	✓	✓	✓	✓	✓	✓
Germany	✓	✓	✓	✓	✓	✓	✓	✓	✓
Netherlands	✓	✓	✓	✓	✓	✓	✓	✓	✓
Norway	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sweden	✓	✓	✓	✓	✓	✓	✓	✓	✓
UK England	✓	x	x	x	x	x	x	x	x
UK Scotland	✓	✓	✓	✓	✓	✓	✓	✓	✓
USSR	x	x	x	x	x	x	x	x	x

**Table 5.1** Number of otoliths sampled per species and roundfish area, 1998, quarter 1.

Species	ICES Round fish area									
	1	2	3	4	5	6	7	8	9	ALL
Herring	504	880	914	325	86	738	534	588	667	5,236
Sprat	29	237	337	137	106	382	185	61	202	1,676
Mackerel	164	277	31	-	-	-	3	-	-	475
Cod	957	634	233	351	235	718	218	399	460	4,205
Haddock	1,024	933	1,065	515	-	8	298	-	-	3,843
Whiting	712	767	864	285	277	498	149	256	227	4,035
Saithe	205	1	-	1	-	-	-	-	-	207
Norway pout	197	151	218	126	-	1	-	117	62	872

**Table 5.2** 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 1998.

	Preliminary	Final
Herring	2,286	2,067.1
Sprat	2,152	1,694.6
Mackerel	26	27.7
Cod	9.2	2.7
Haddock	356	373.6
Whiting	503	556.1
Saithe	-	0.1
Norway pout	3,529	1,006.3

**Table 5.3** 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	743	233	409	10.4	3.6	3.5	6.9	267	366	502	342	-	0	923	1,474
1996	2,067		854	1,711	718.8	7.8	40.0	26.4	860	423	288	162	0	0	9,752	5,343
1997			1,695		27.7		2.7		374		556		0.1		1,006	

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

**Table 5.4** Age composition of the standard species in 1998 for the relevant standard areas in the North Sea.

Age group	1	2	3	4	5	6+
Herring	2,067.1	743.4	89.6	20.4	19.3 <sup>1</sup>	-
Sprat	1,694.6	1,710.6	280.4	11.9	2.3 <sup>1</sup>	-
Mackerel	27.7	7.8	0.4	0.2	0.2	0.1
Cod	2.7	26.4	2.0	0.9	0.5	0.4
Haddock	373.6	423.3	105.5	113.7	8.7	5.4
Whiting	556.1	161.5	124.6	54.4	15.7	9.4
Saithe	0.1	0.0	0.4	3.2	1.8	2.3
Norway pout	1,006.3	5,343.3	300.1	73.8	0.1	0.0

<sup>1</sup>Plus-group.

**Table 5.5** 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-group	2+group	Total
	1-ring	2-ring	1-ring	2-ring	1-ring	2-ring			
1974							1,325		
1975							5,339		
1976							2,069		
1977							5,713	984	6,697
1978							5,119	2,117	7,236
1979							3,338	1,482	4,820
1980	2,311	387	1,607	307	704	80	4,960	3,592	8,558
1981	3,246	1,393	966	1,318	2,250	75	2,809	3,068	5,877
1982	2,560	549	1,408	445	1,152	104	1,577	4,695	6,272
1983	5,419	1,063	1,522	946	3,897	117	1,173	1,685	2,858
1984	6,035	1,947	2,793	1,419	3,242	528	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.
1998	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 5.6** 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	Haddock 1-group
	Prel.	Final	Prel.	Final			Prel.	Prel.
1974							499	
1975							236	
1976							99	
1977							392	
1978							561	
1979	79		386		93	171	722	40
1980	18	15	42	26	31	63	968	4
1981	36	36	126	104	30	258	690	48
1982	32	28	113	96	19	143	262	34
1983	24	23	49	39	52	106	500	72
1984	18	14	18	9	10	72	940	161
1985	82	78	229	213	113	372	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.	n.a.	n.a.
1997	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1998	n.a.	n.a.	n.a.	n.a.			n.a.	n.a.

**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 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 <sup>2</sup> x 10 <sup>9</sup>	83	34	86	102	37	93	31	31	N 10 <sup>9</sup>
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
1997	0.042	0.021	0.338	0.064	0.178	0.035	0.023	0.083	53.1



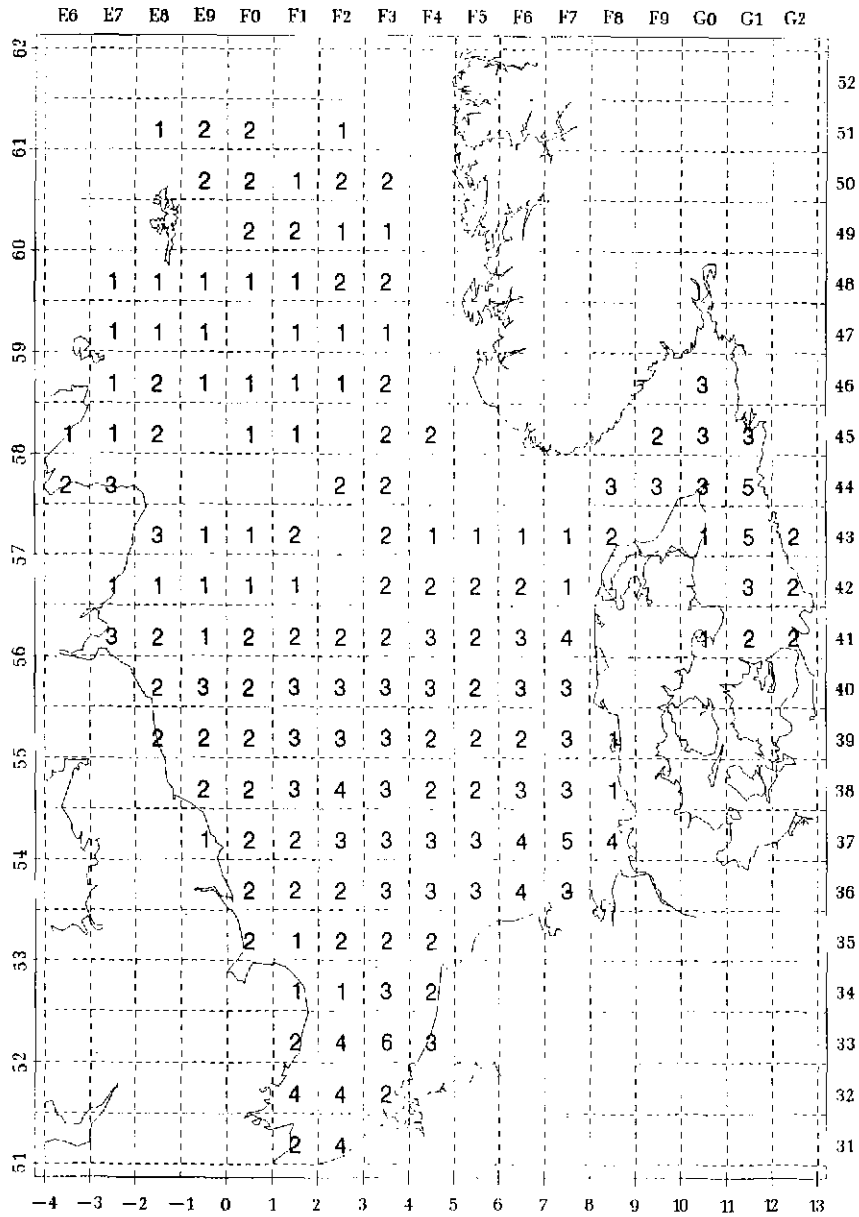
Table 7.1 Time series data of bottom temperature and salinity during IYFS/IBTS(1) 1970-1998

Location	1		2		3		4		5		6		7		8		9		10	
Position	60° 0'N		57° 30'N		57° 30'N		57° 30'N		55° 0'N		55° 0'N		55° 0'N		55° 0'N		54° 0'N		52° 30'N	
	2°E		0°E		2°E		4°E		0°E		2°E		4°E		8°E		3°E		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
1998	8.2	35.29	8.5	35.14	7.8	35.16	7.0	35.00	7.5	34.79	6.3	34.84	6.1	34.62	3.5	31.78	6.3	34.56	7.2	35.25

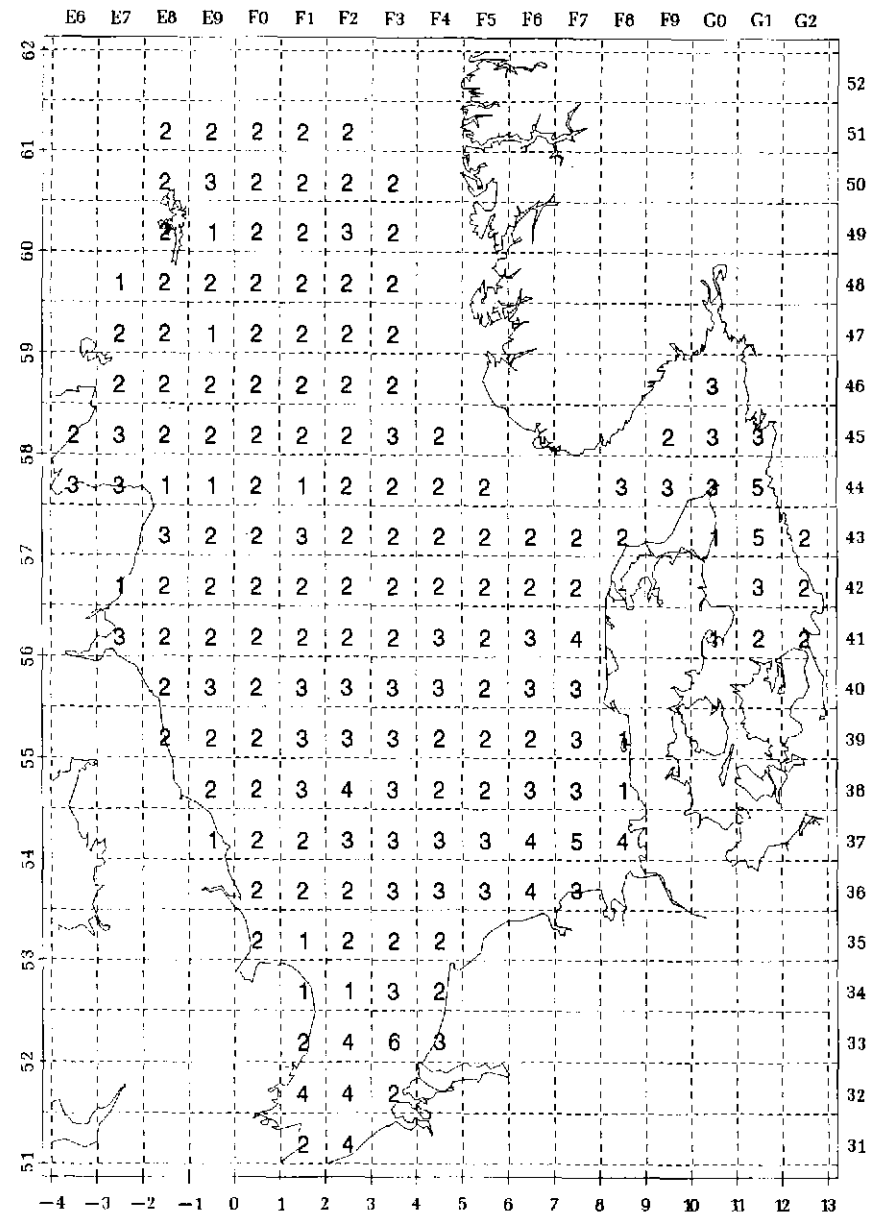
Figure 5.1

Number of valid day- and nighttime hauls.

### Number of daytime hauls. 1998 quarter 1



### Number of hauls. 1998 quarter 1



# Herring, number per hour

## Age group 1, 1998 quarter 1

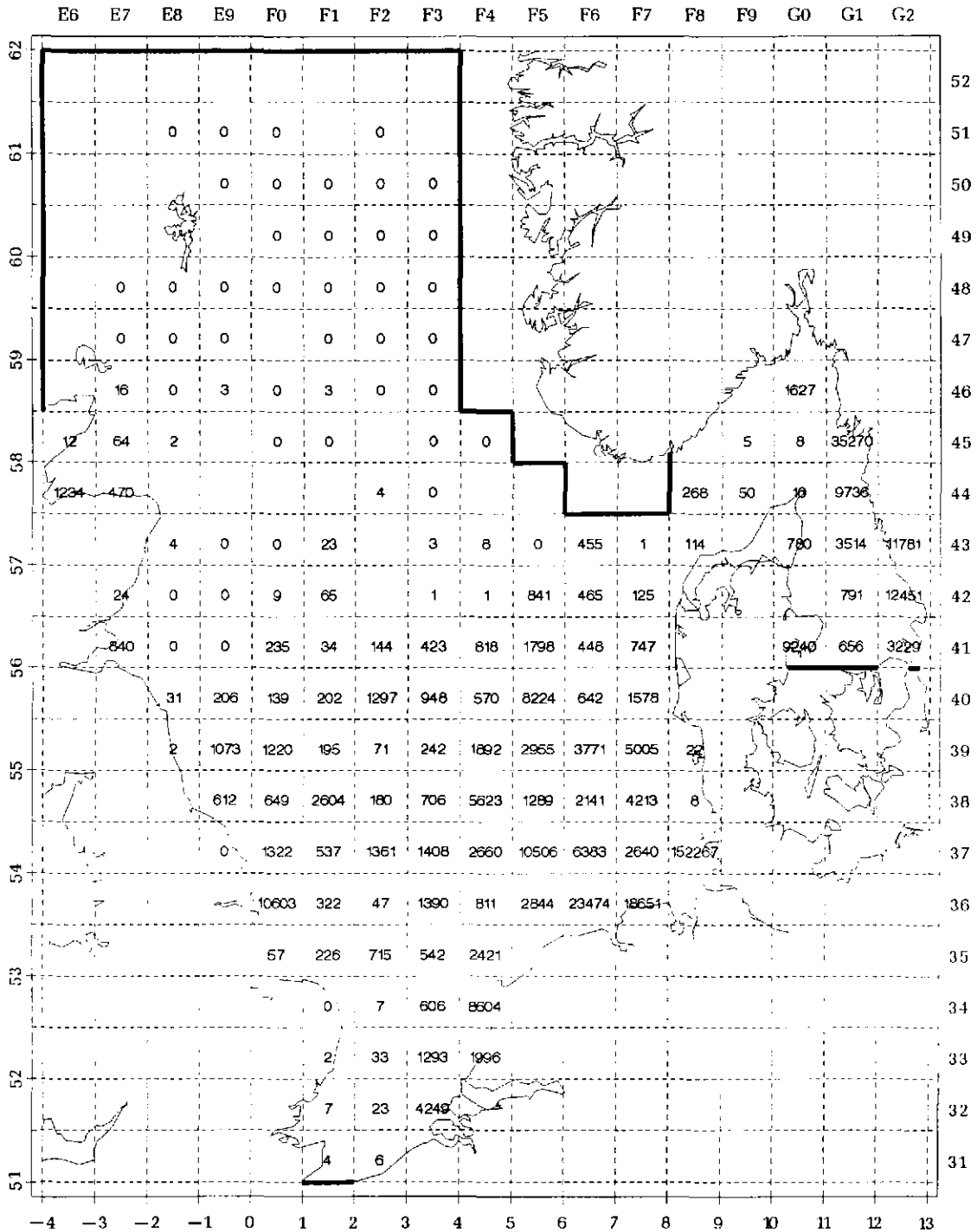


Figure 5.2 Herring: number per hour, 1-ringers.

# Herring, number per hour

## Age group 2, 1998 quarter 1

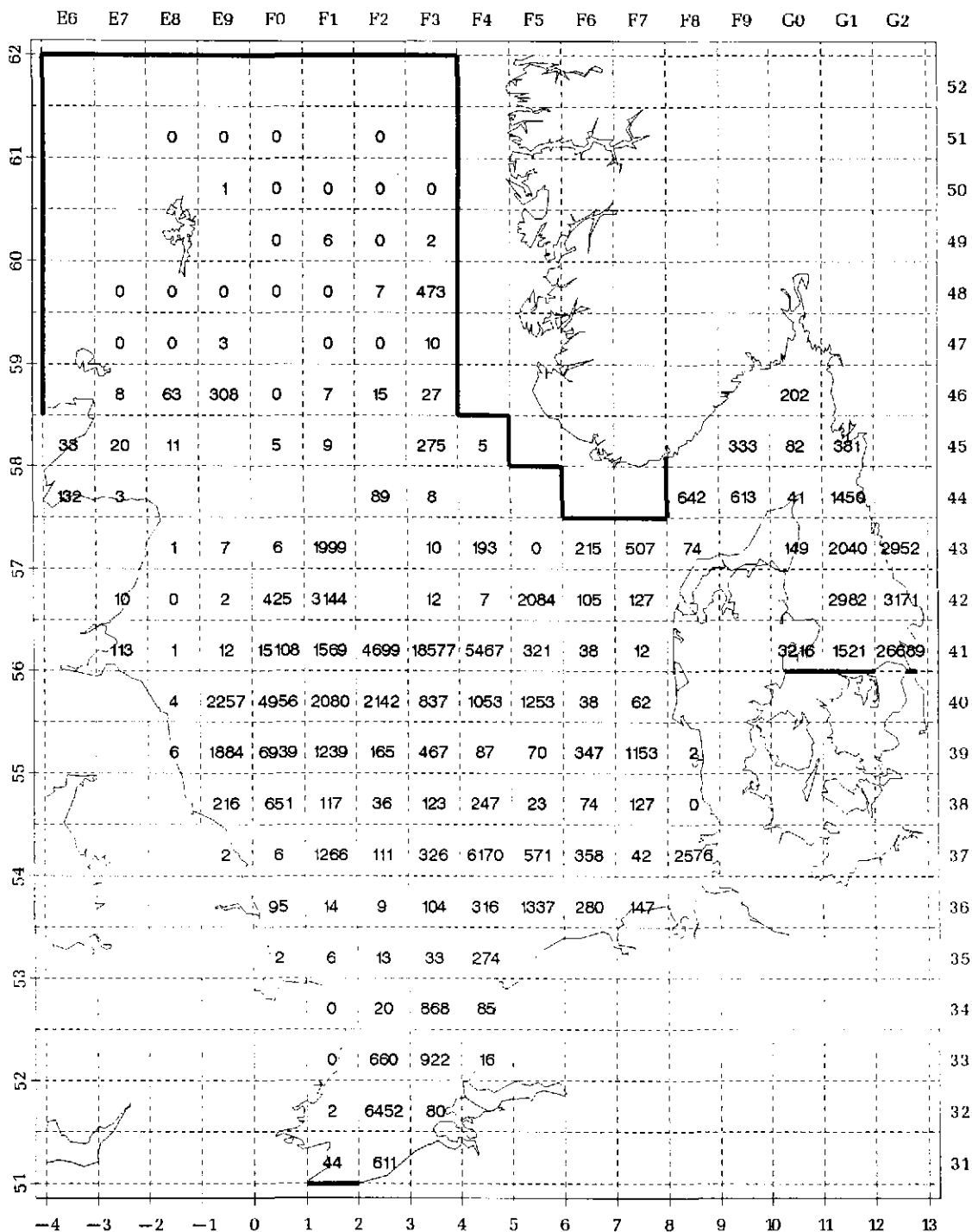


Figure 5.3 Herring: number per hour, 2-ringers.

# Herring, number per hour

## Age group 3+ , 1998 quarter 1

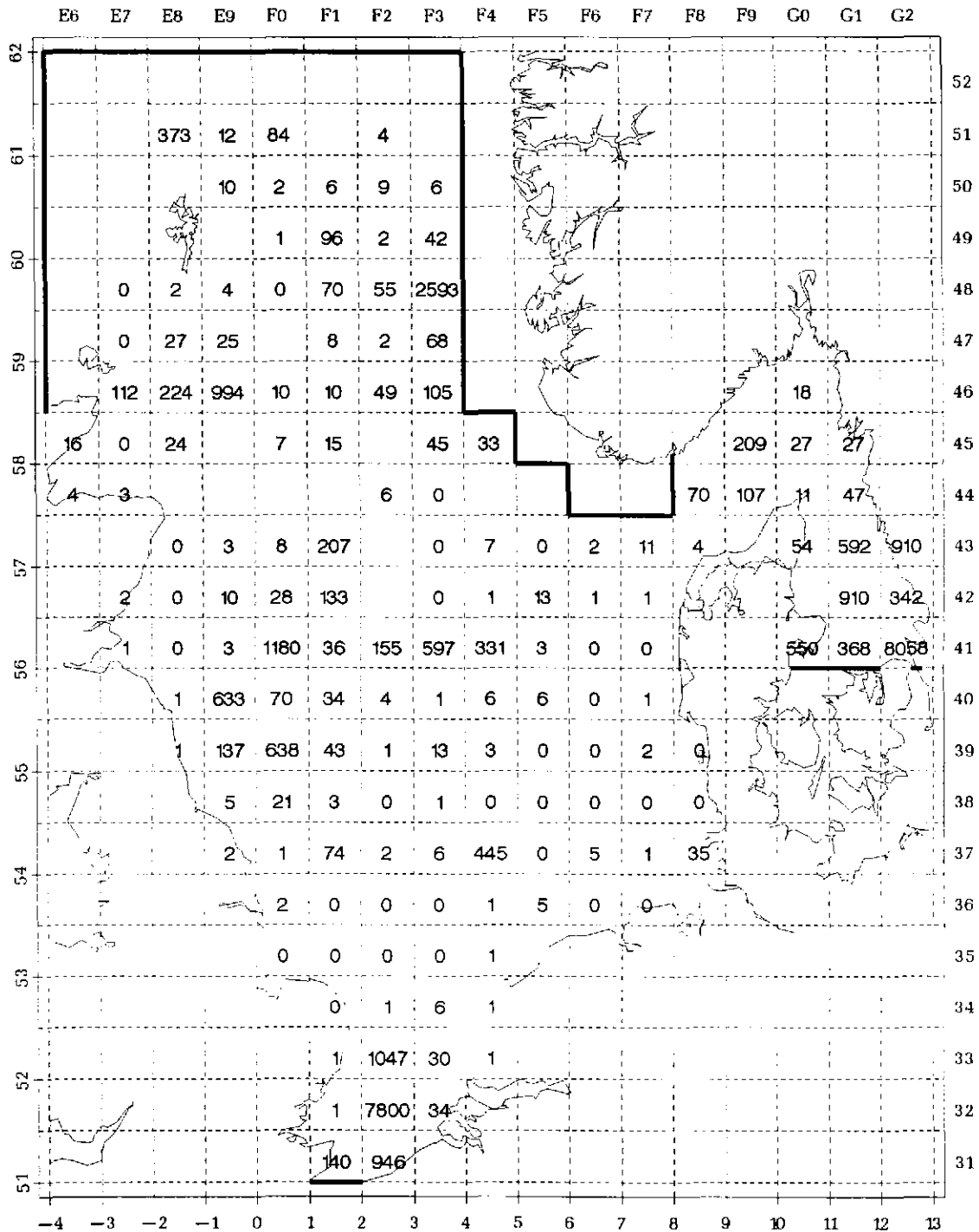


Figure 5.4 Herring: number per hour, 3+ringers.

# Herring, mean length

## Age group 1, 1998 quarter 1

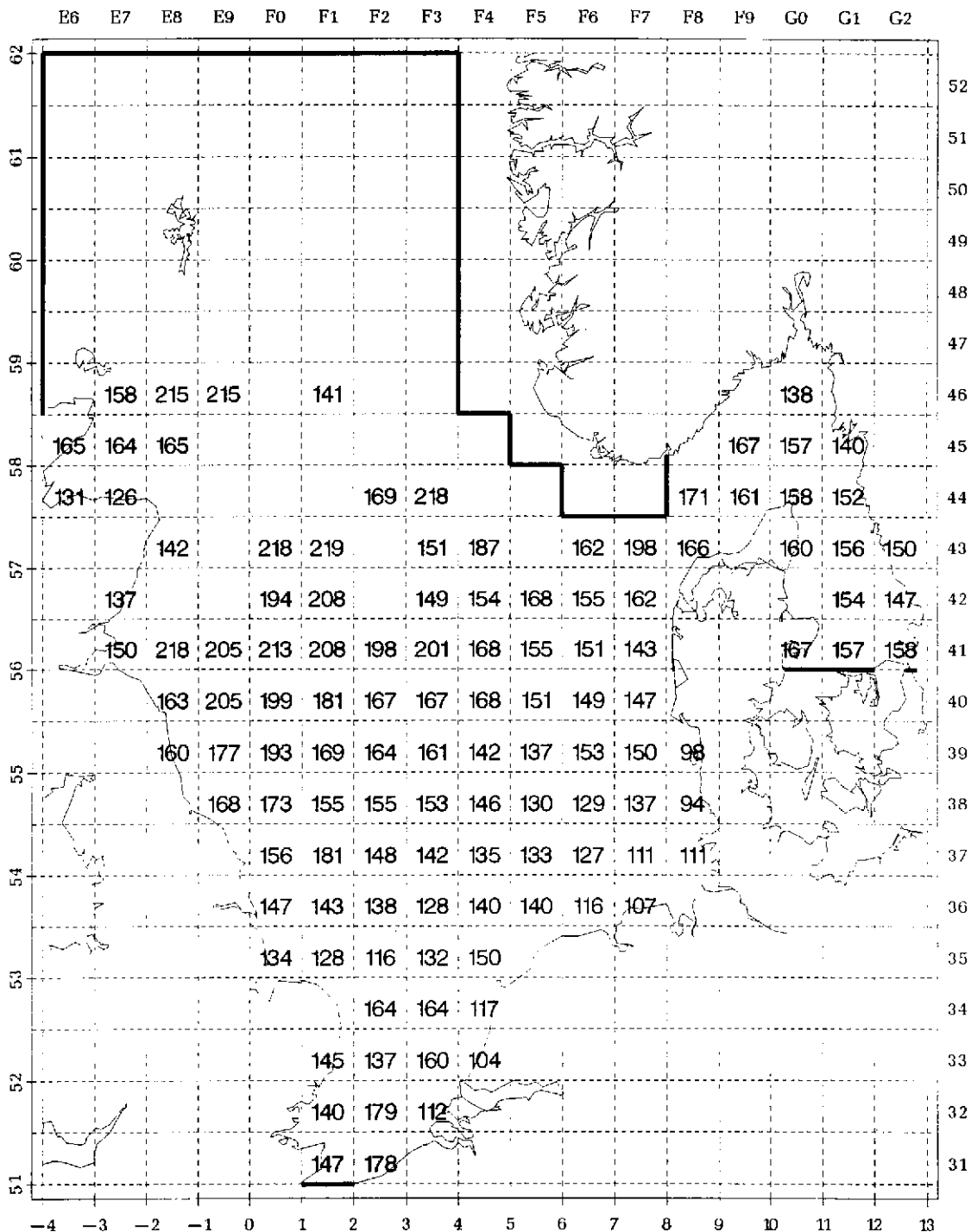


Figure 5.5 Herring: mean length (mm), 1-ringers.

# Sprat, number per hour

## Age group 1, 1998 quarter 1

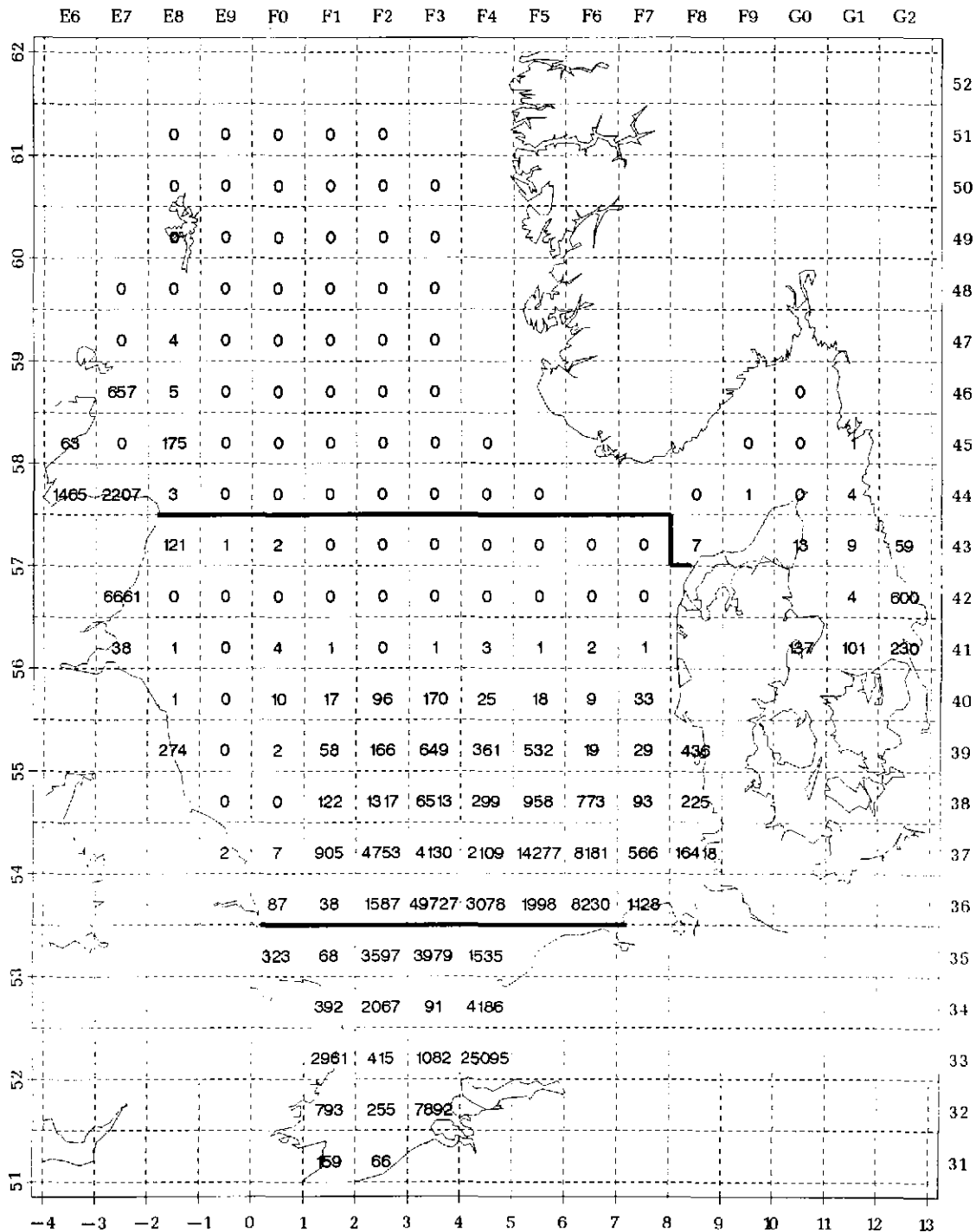


Figure 5.6 Sprat: number per hour, age-group 1.

# Sprat, number per hour

## Age group 2, 1998 quarter 1

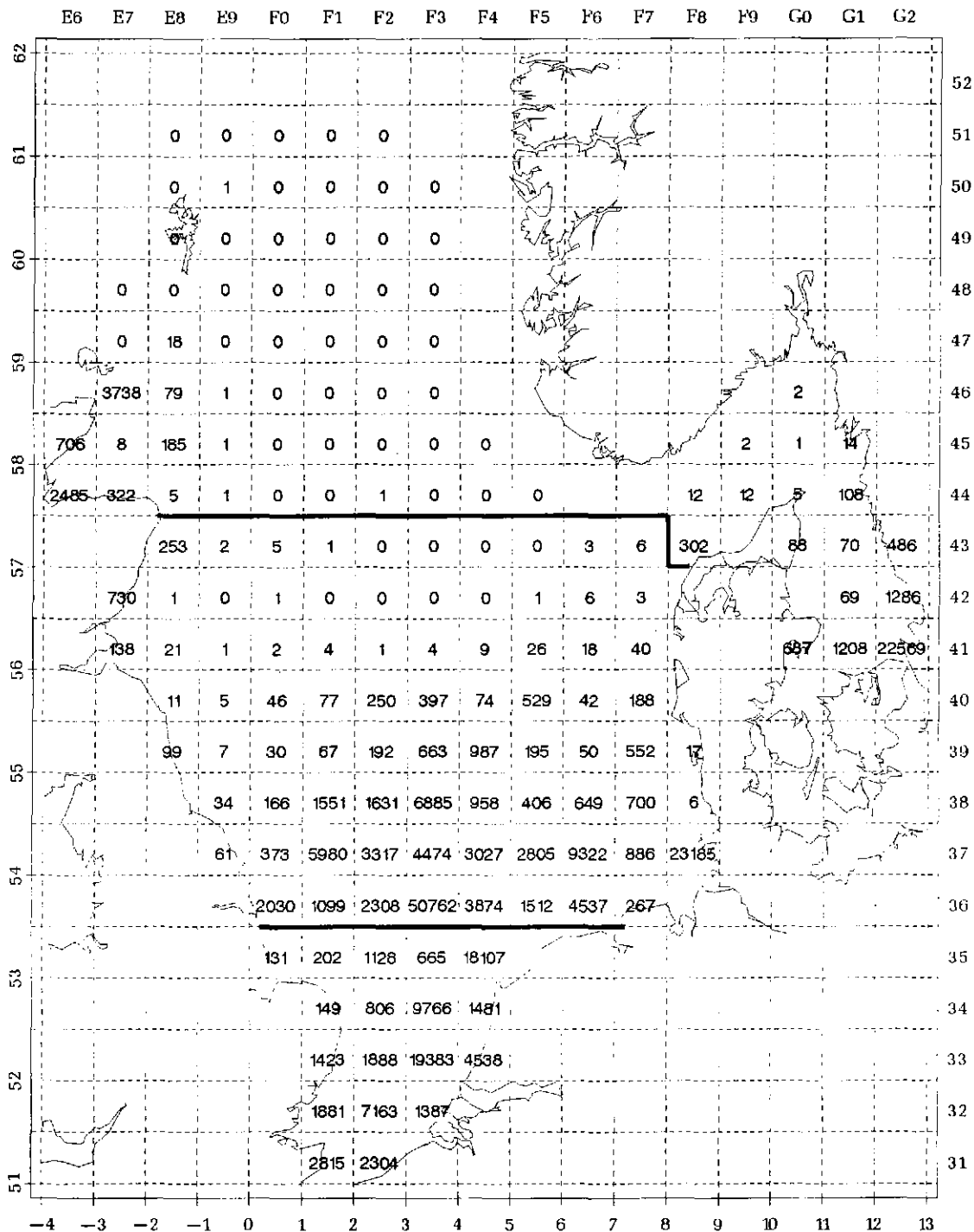


Figure 5.7 Sprat: number per hour, age-group 2.



# Sprat, number per hour Age group 3+, 1998 quarter 1

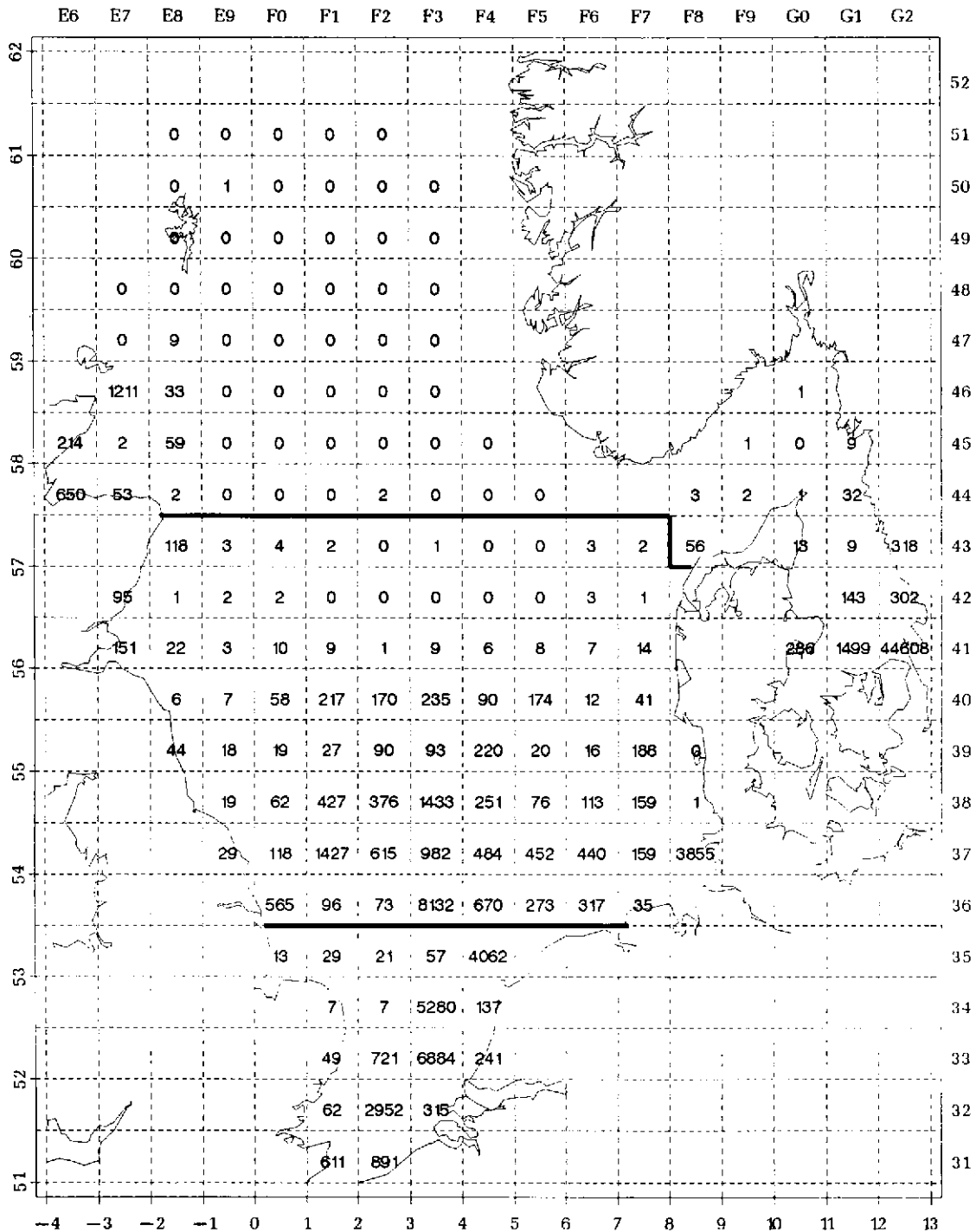


Figure 5.8 Sprat: number per hour, age-group 3+.

# Sprat, mean length

## Age group 1, 1998 quarter 1

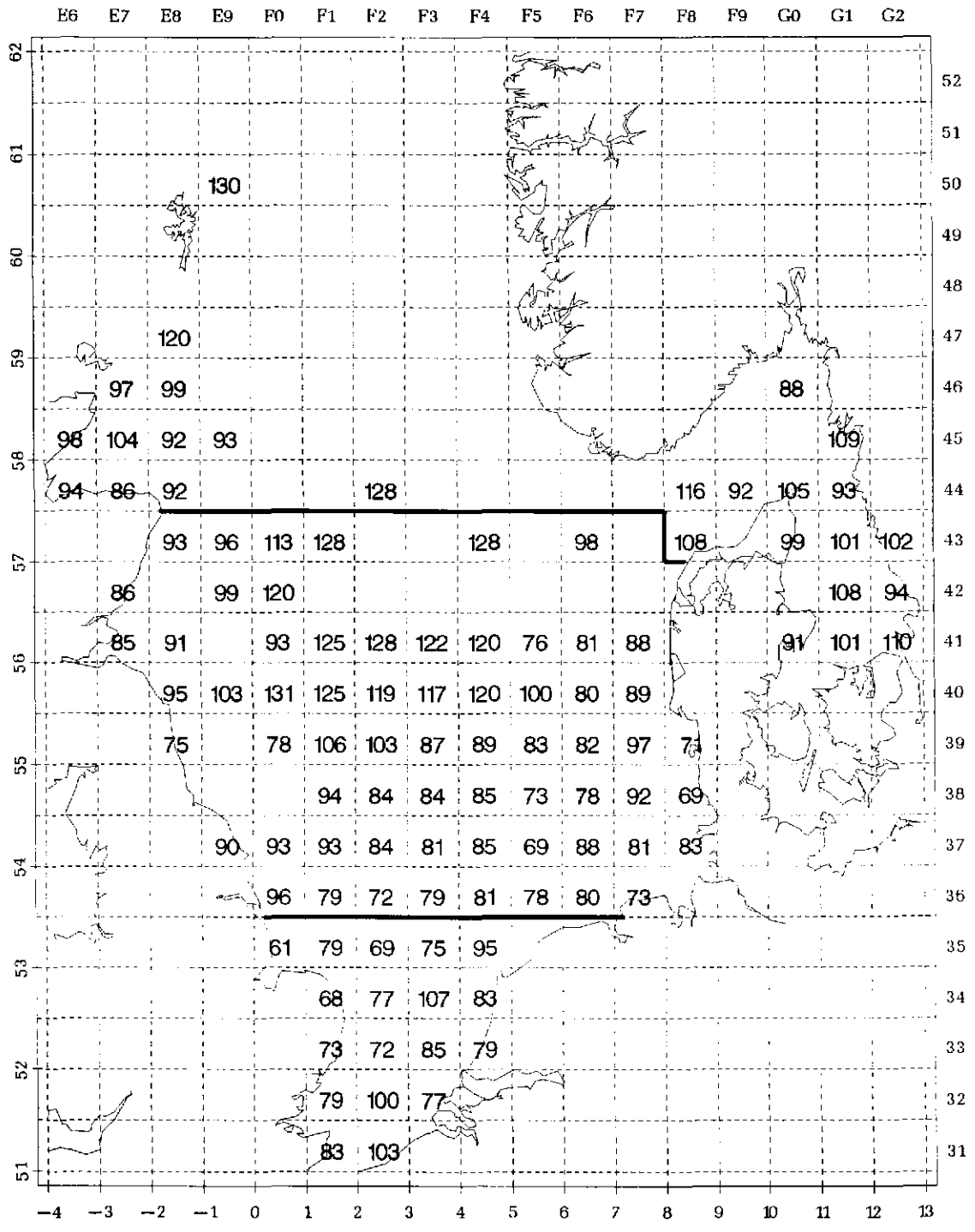


Figure 5.9 Sprat: mean length (mm), age-group 1.

# Mackerel, number per hour

## Age group 1, 1998 quarter 1

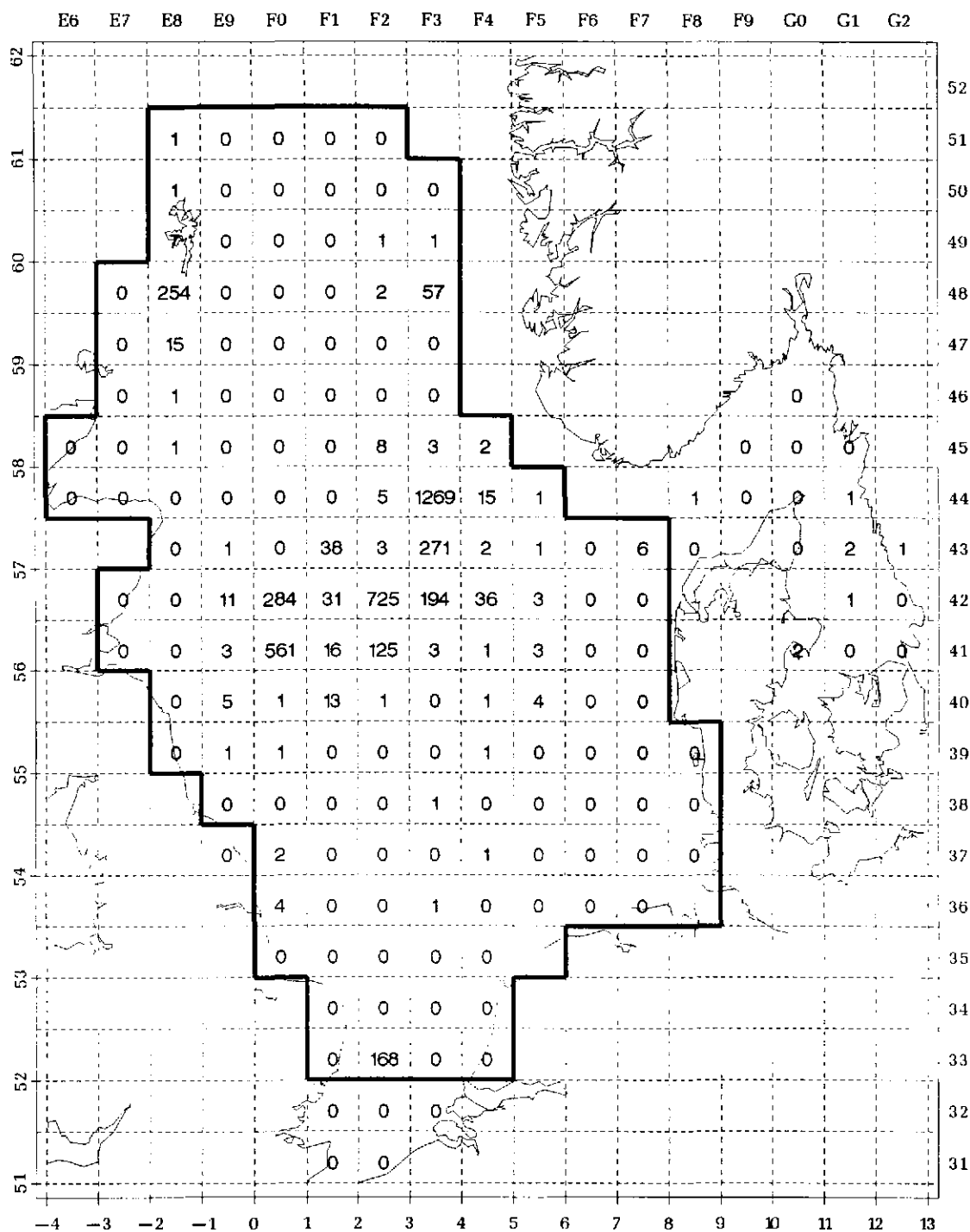


Figure 5.10 Mackerel: number per hour, age-group 1.

# Mackerel, number per hour

## Age group 2, 1998 quarter 1

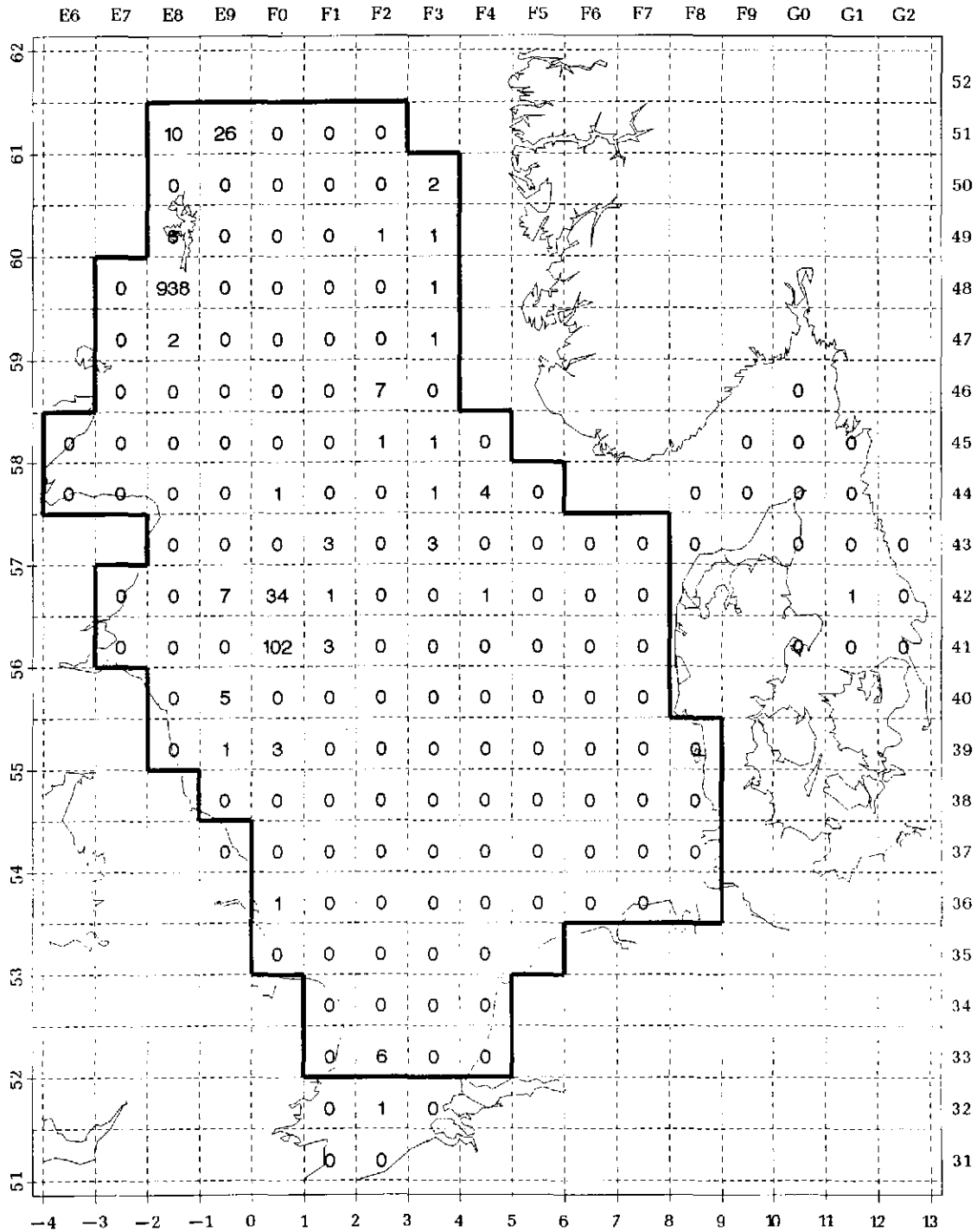


Figure 5.11 Mackerel: number per hour, age-group 2.

# Mackerel, number per hour

Age group 3+, 1998 quarter 1

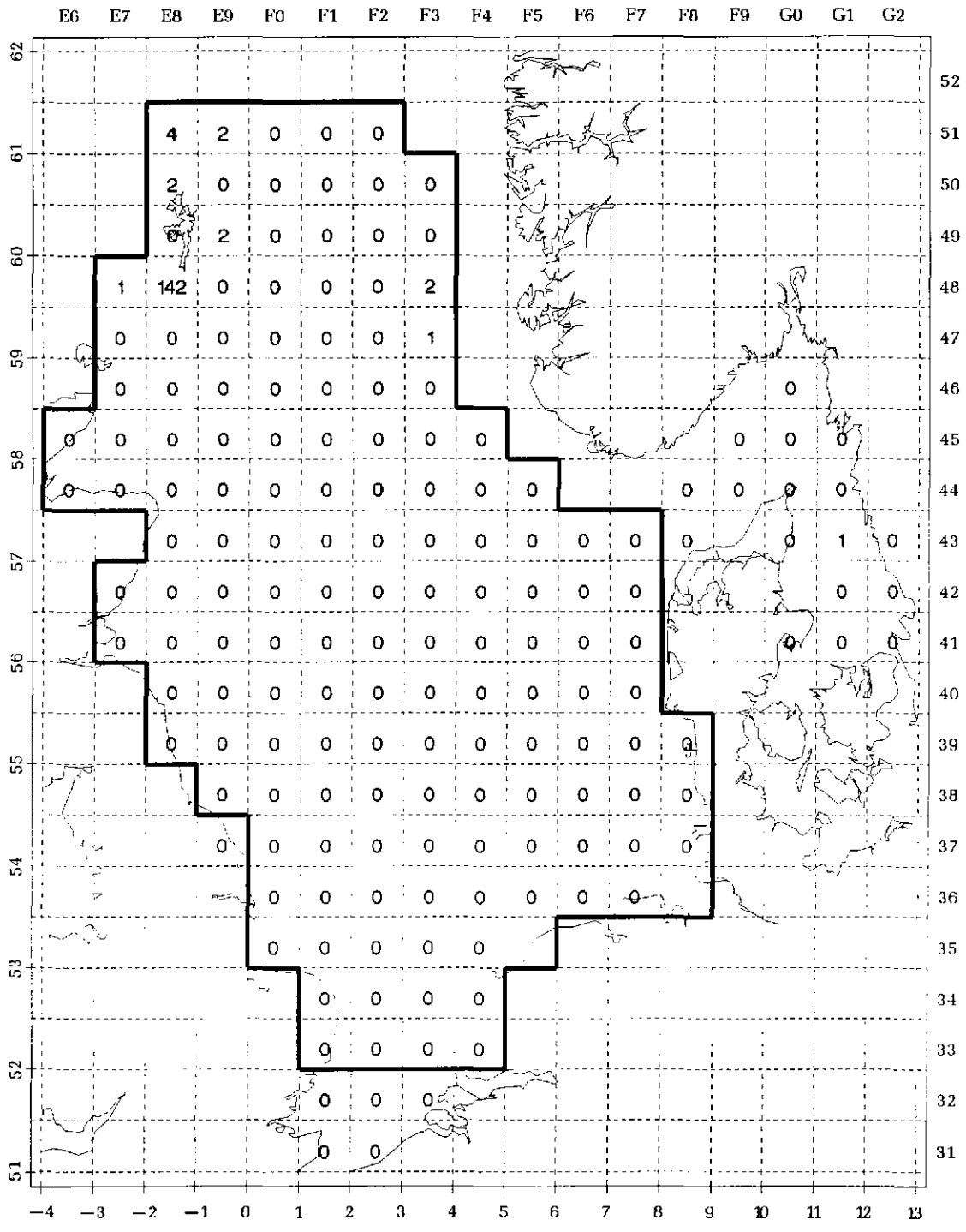


Figure 5.12 Mackerel: number per hour, age-group 3+.

# Mackerel, mean length

Age group 1, 1998 quarter 1

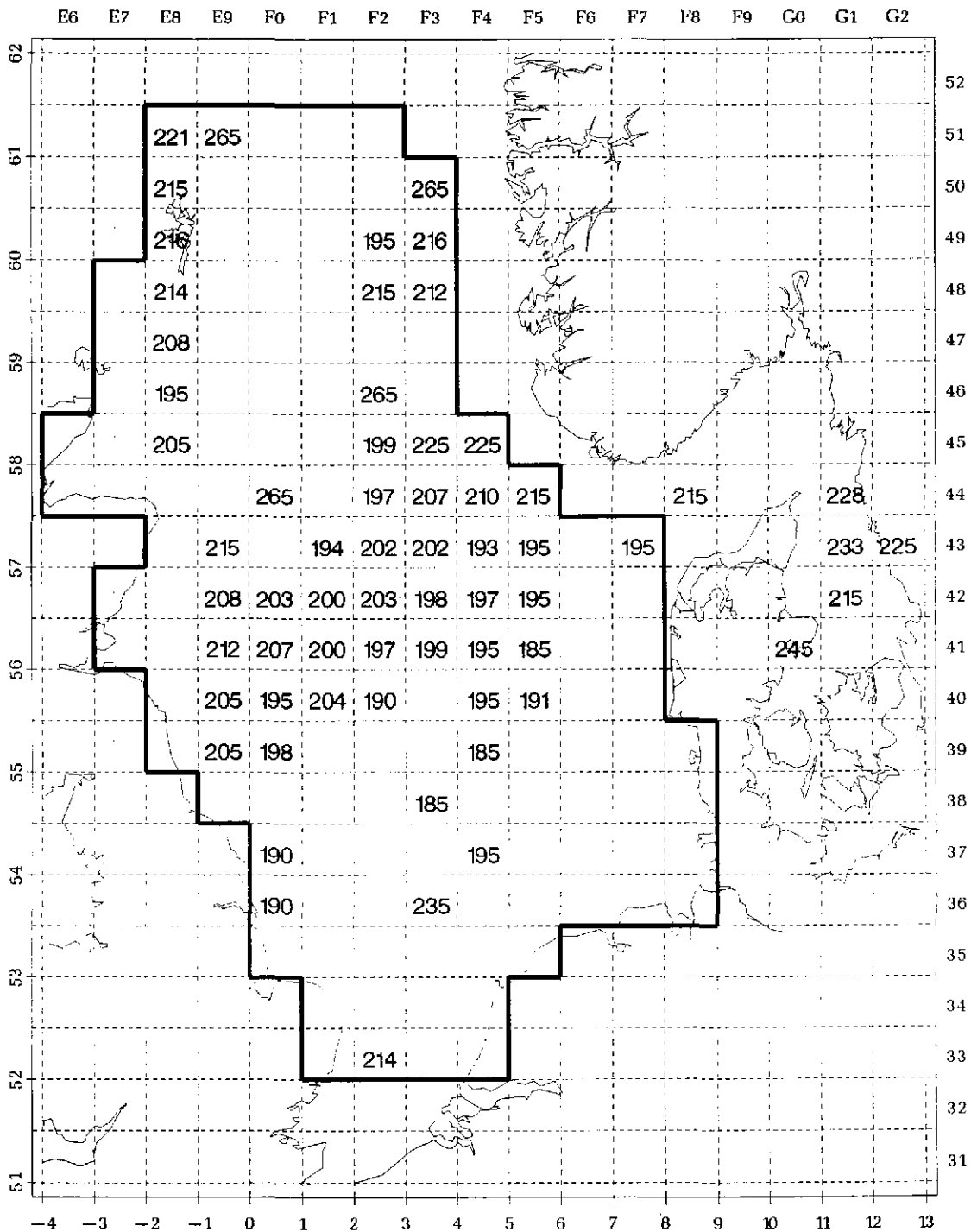


Figure 5.13 Mackerel: mean length (mm), age-group 1.

# Cod, number per hour

## Age group 1, 1998 quarter 1

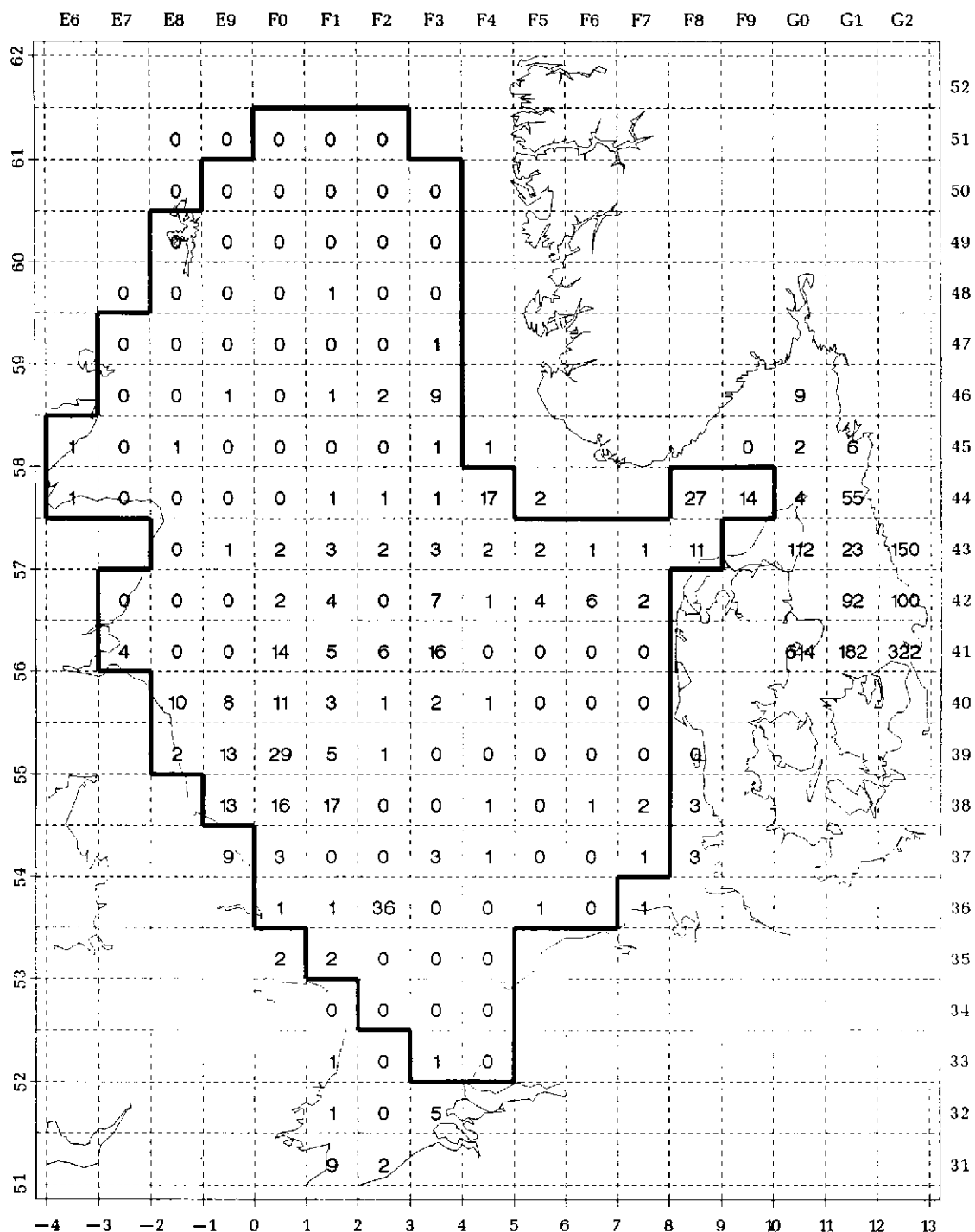


Figure 5.14 Cod: number per hour, age-group 1.

# Cod, number per hour

## Age group 2, 1998 quarter 1

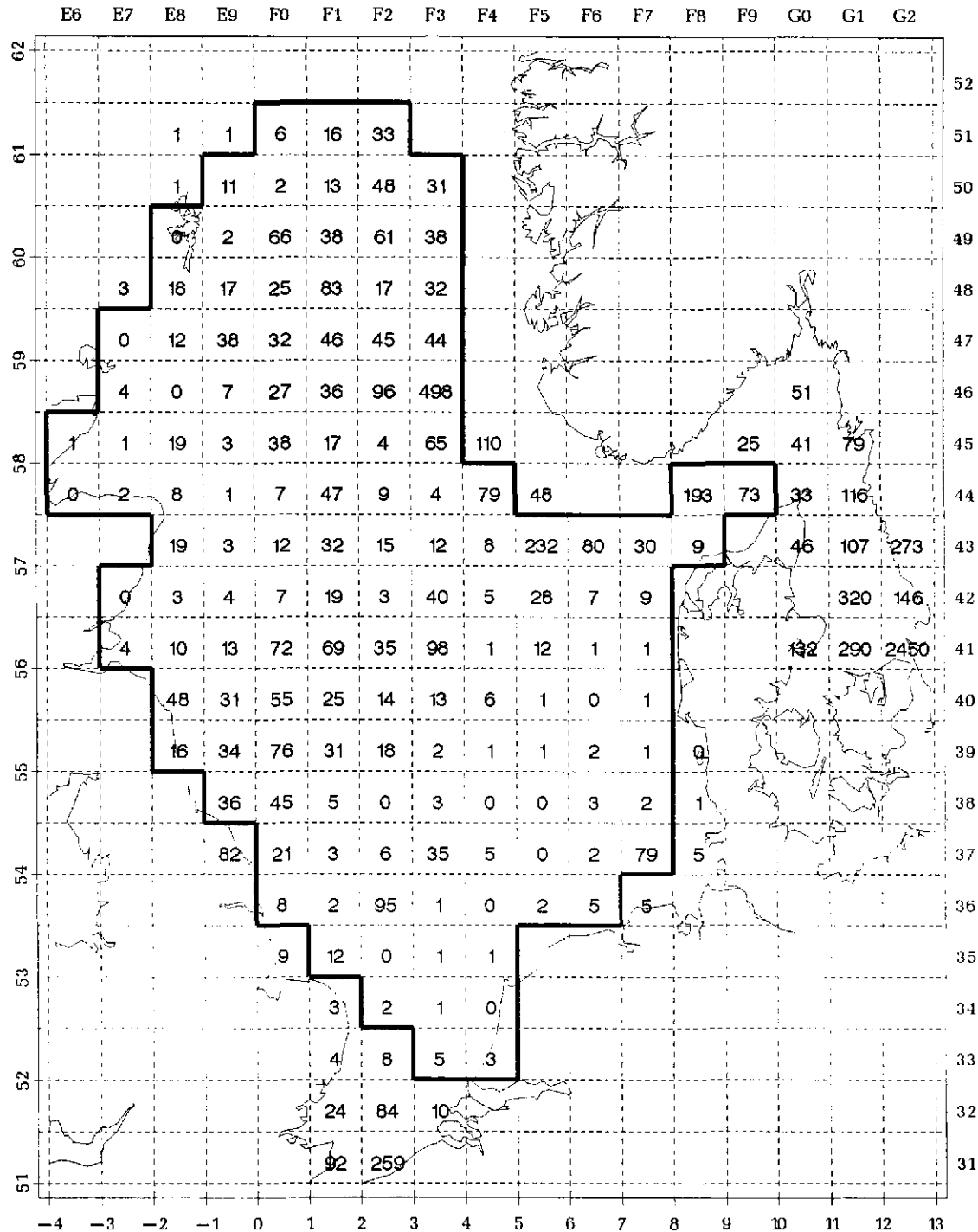


Figure 5.15 Cod: number per hour, age-group 2.



# Cod, number per hour Age group 3+, 1998 quarter 1

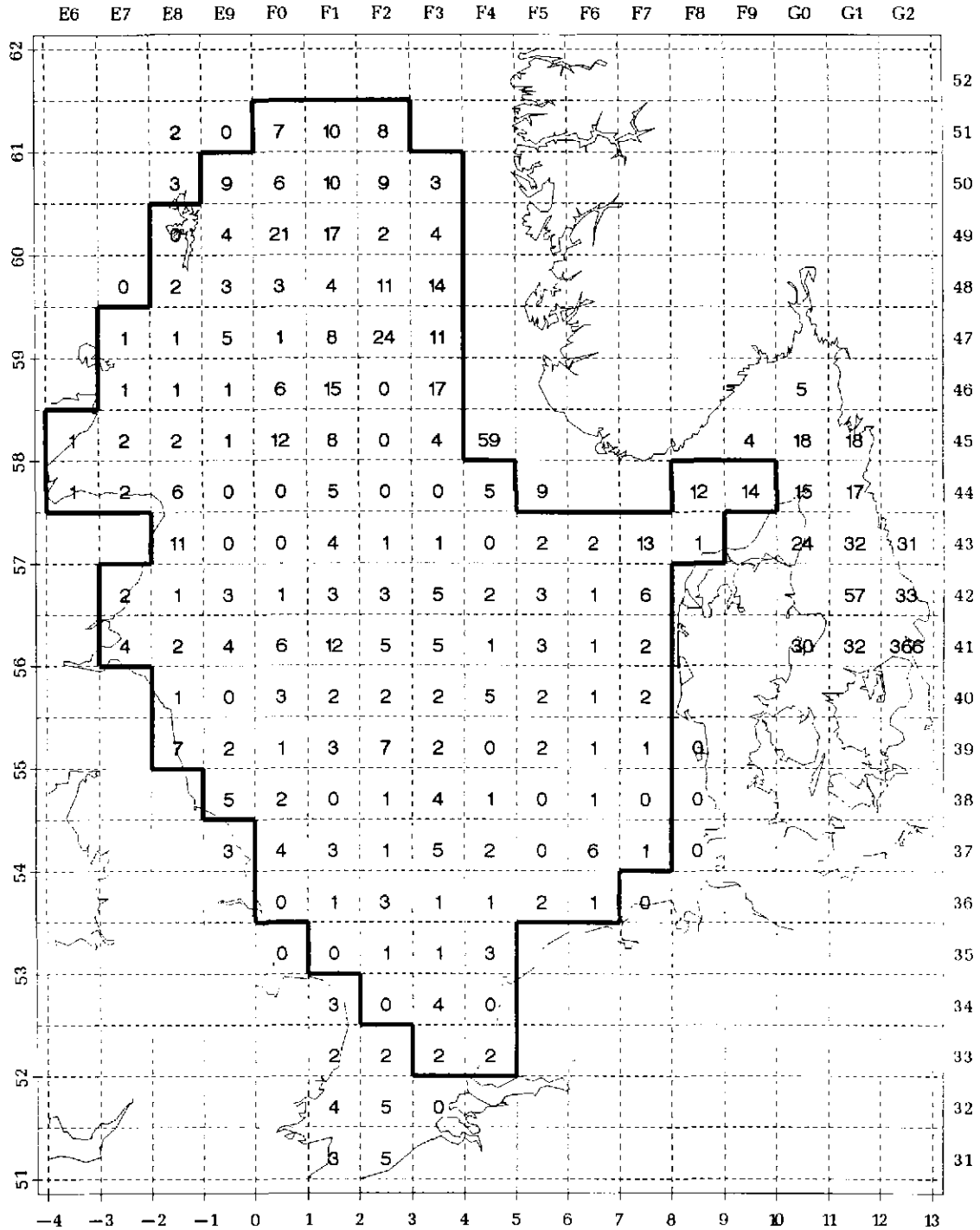


Figure 5.16 Cod: number per hour, age-group 3+.

# Cod, mean length

Age group 1, 1998 quarter 1

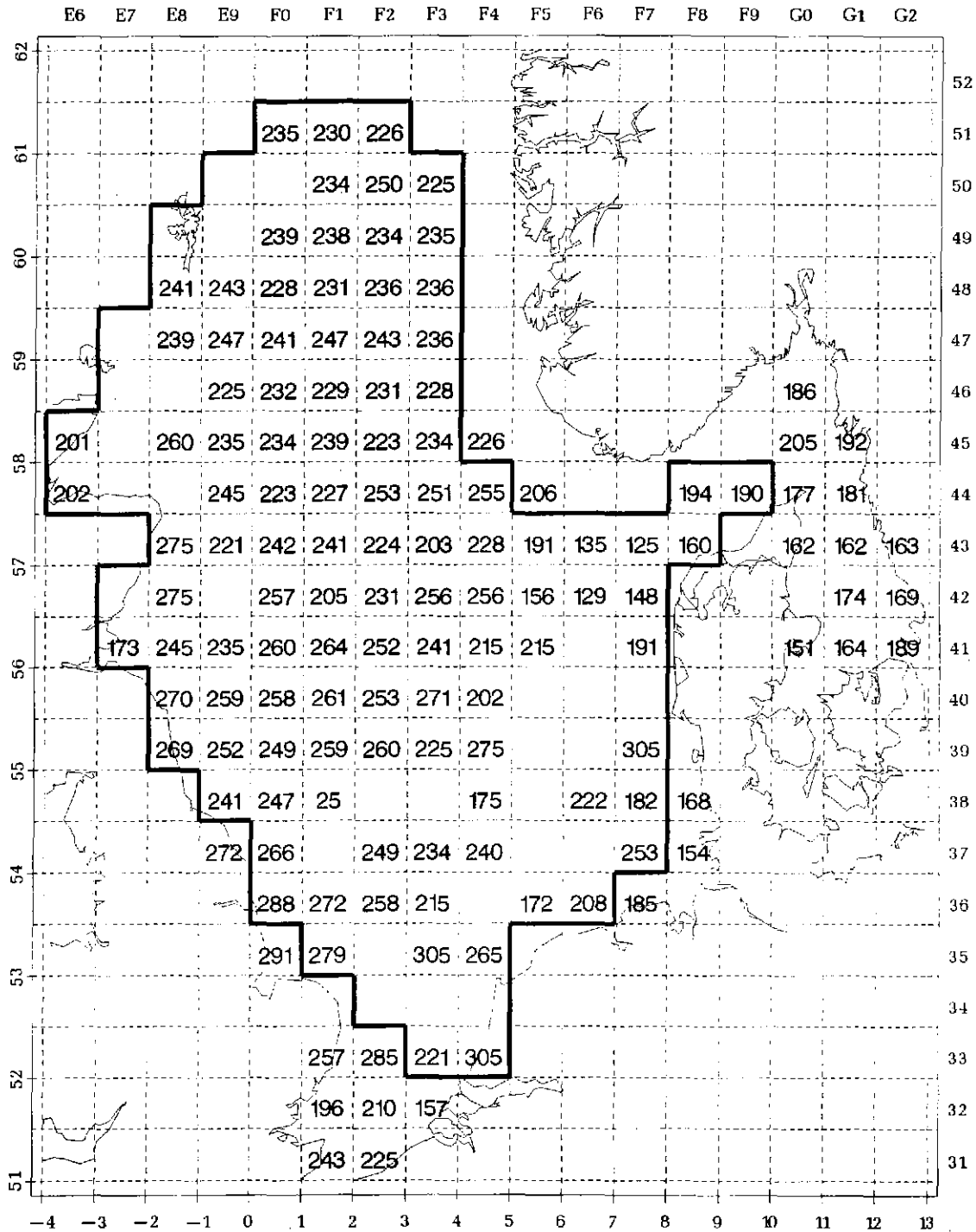


Figure 5.17 Cod: mean length (mm), age-group 1.

# Haddock, number per hour

## Age group 1, 1998 quarter 1

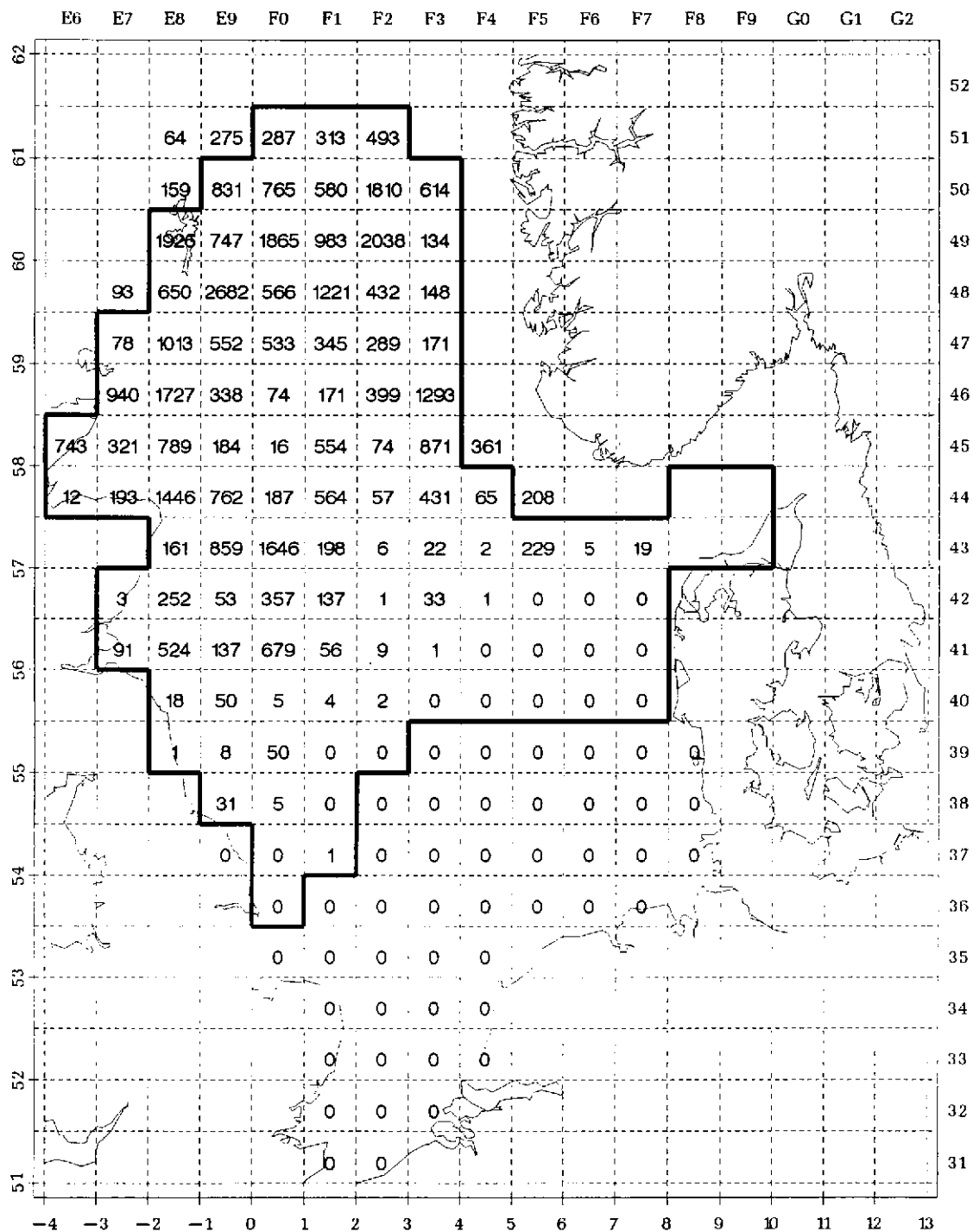


Figure 5.18 Haddock: number per hour, age-group 1.

# Haddock, number per hour

## Age group 2, 1998 quarter 1

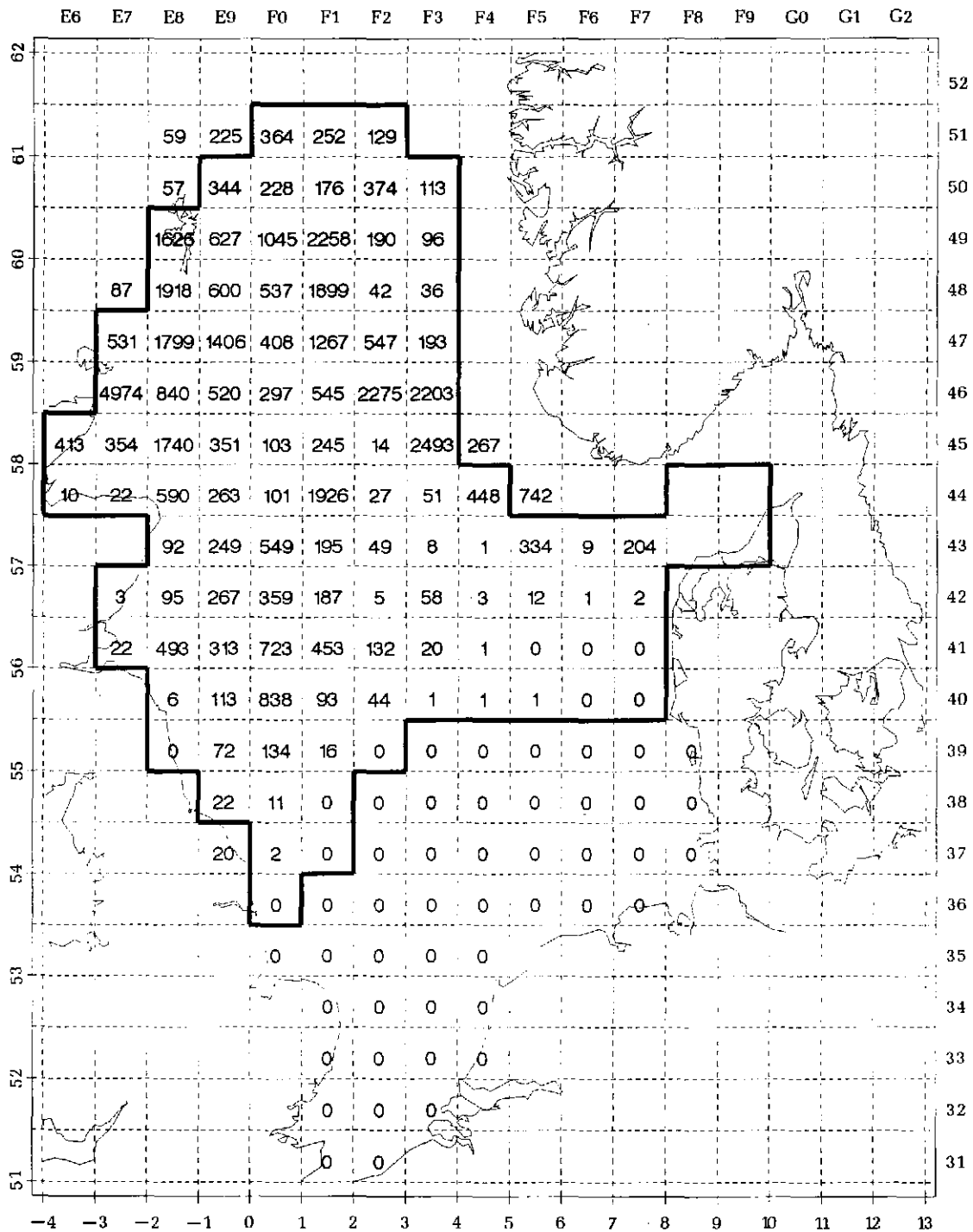


Figure 5.19 Haddock: number per hour, age-group 2.

# Haddock, number per hour

## Age group 3+, 1998 quarter 1

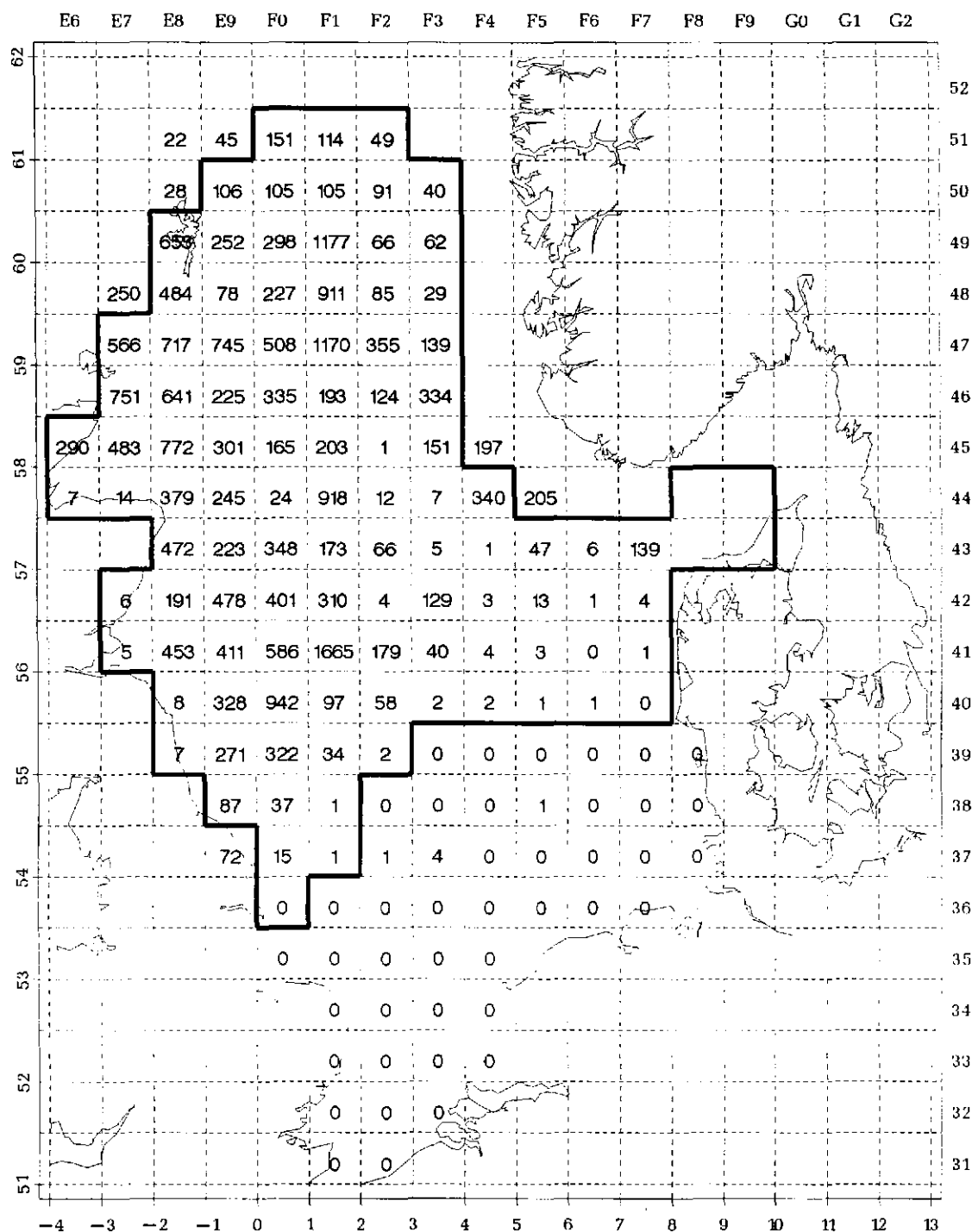


Figure 5.20 Haddock: number per hour, age-group 3+.

# Haddock, mean length

## Age group 1, 1998 quarter 1

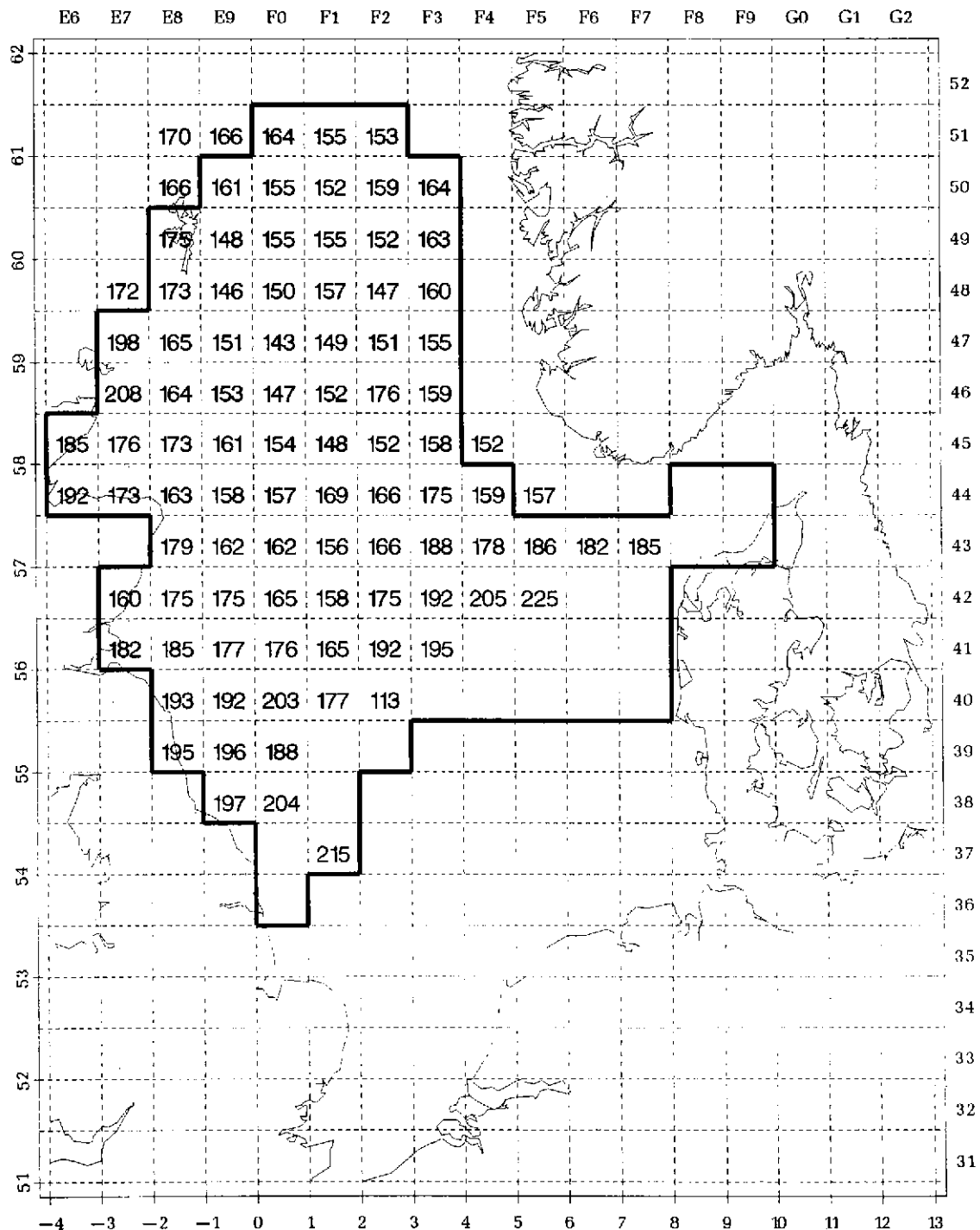


Figure 5.21 Haddock: mean length (mm), age-group 1.

# Whiting, number per hour

## Age group 1, 1998 quarter 1

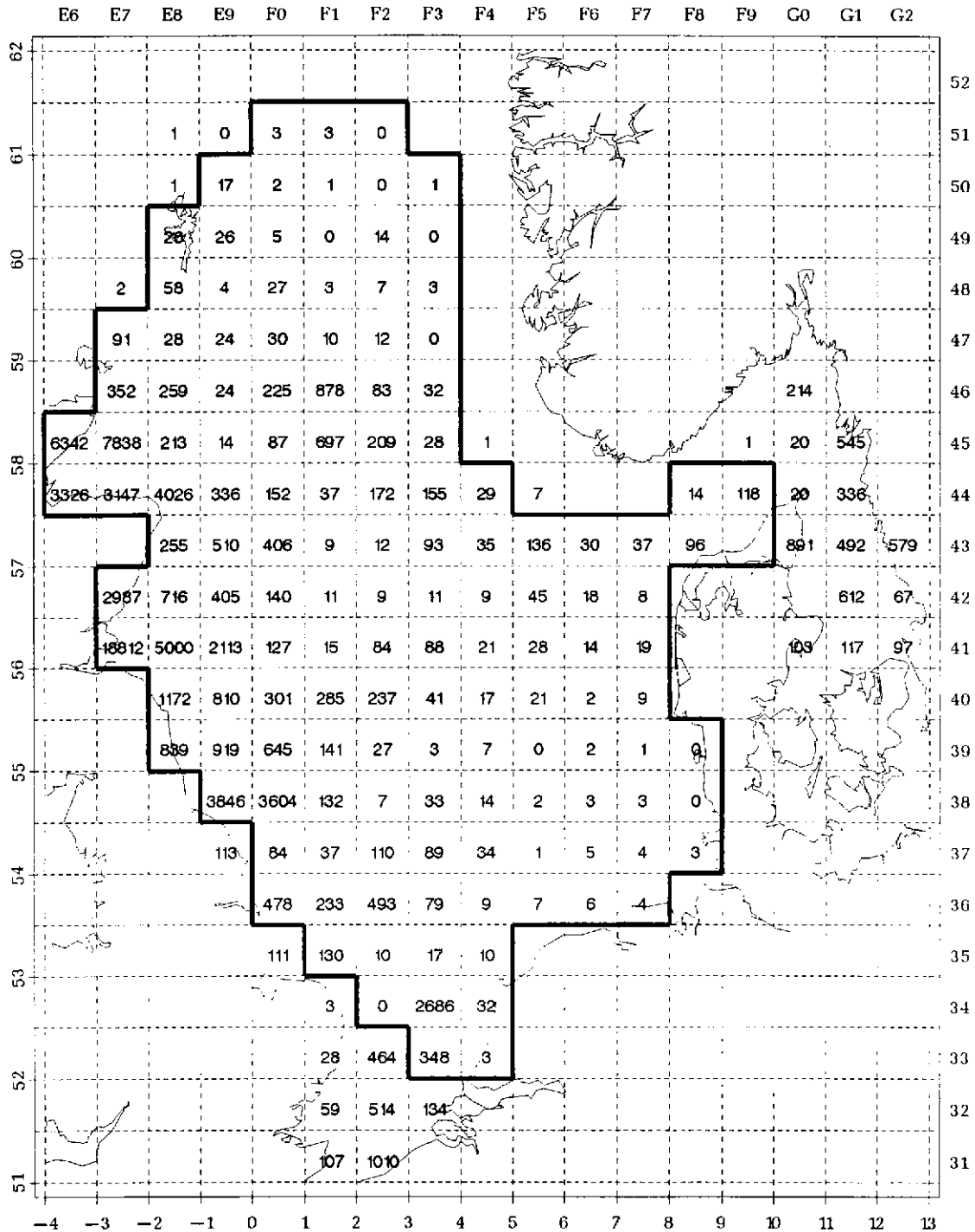


Figure 5.22 Whiting: number per hour, age-group 1.

# Whiting, number per hour

## Age group 2, 1998 quarter 1

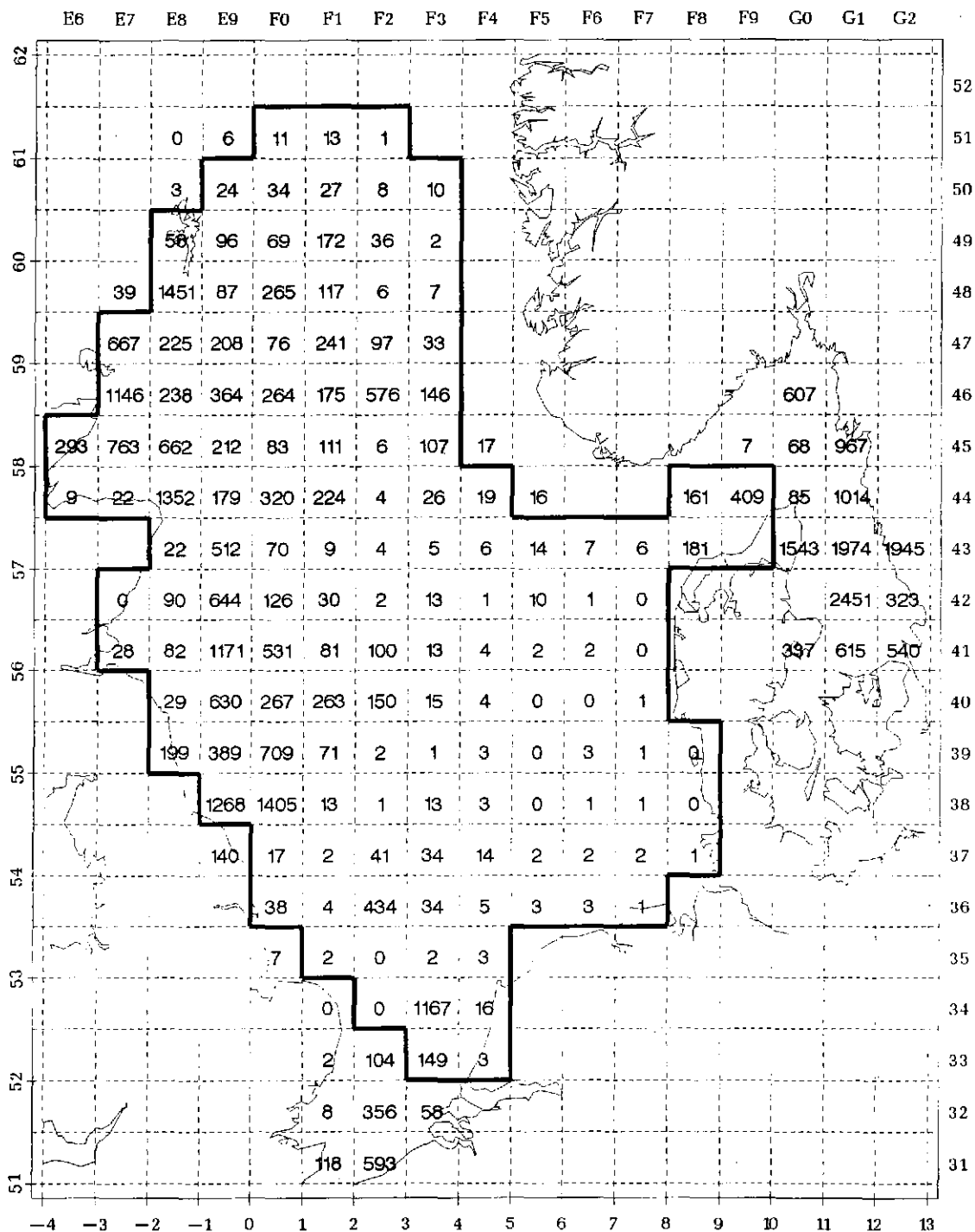


Figure 5.23 Whiting: number per hour, age-group 2.



# Whiting, number per hour

## Age group 3+, 1998 quarter 1

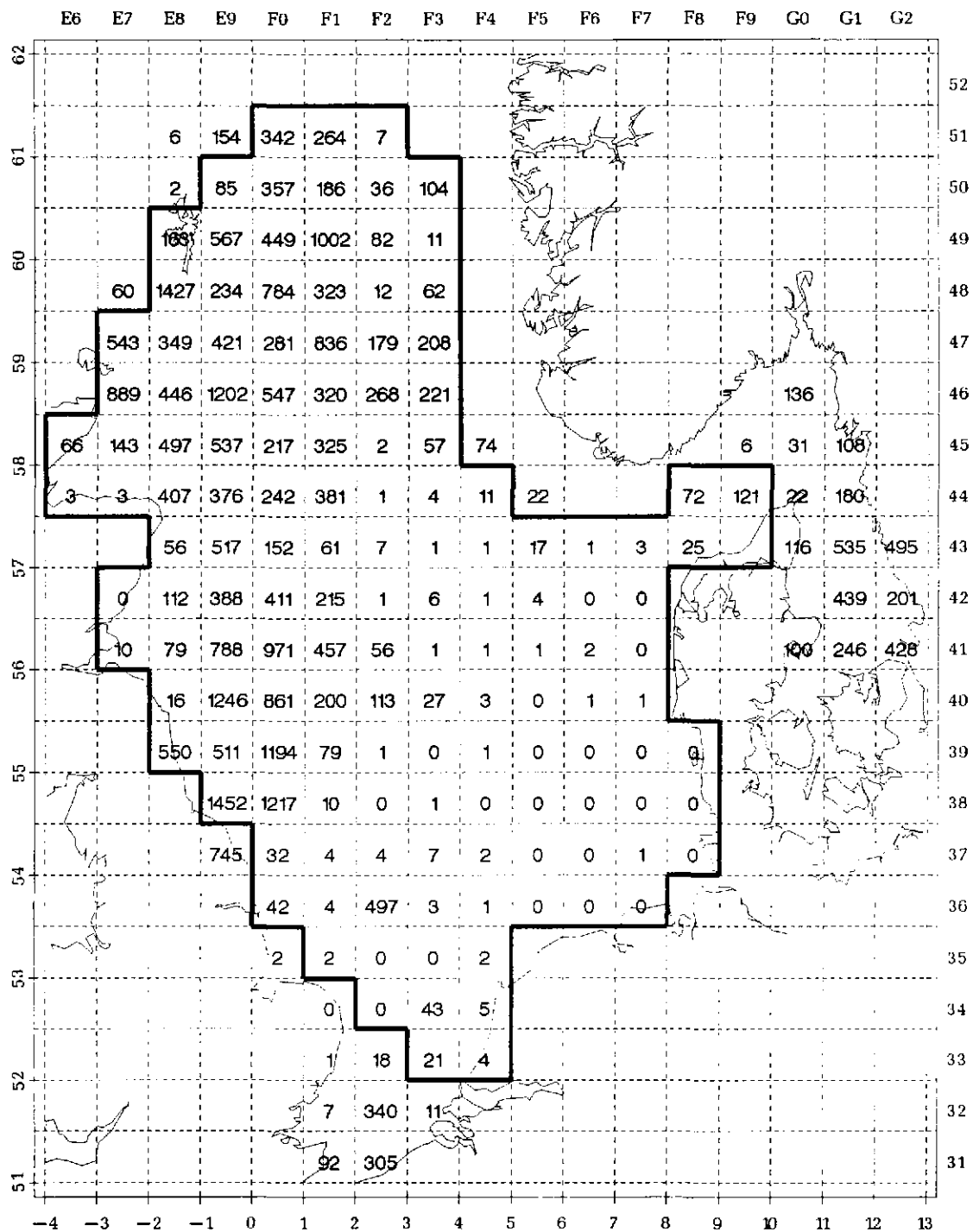


Figure 5.24 Whiting: number per hour, age-group 3+.

# Whiting, mean length

## Age group 1, 1998 quarter 1

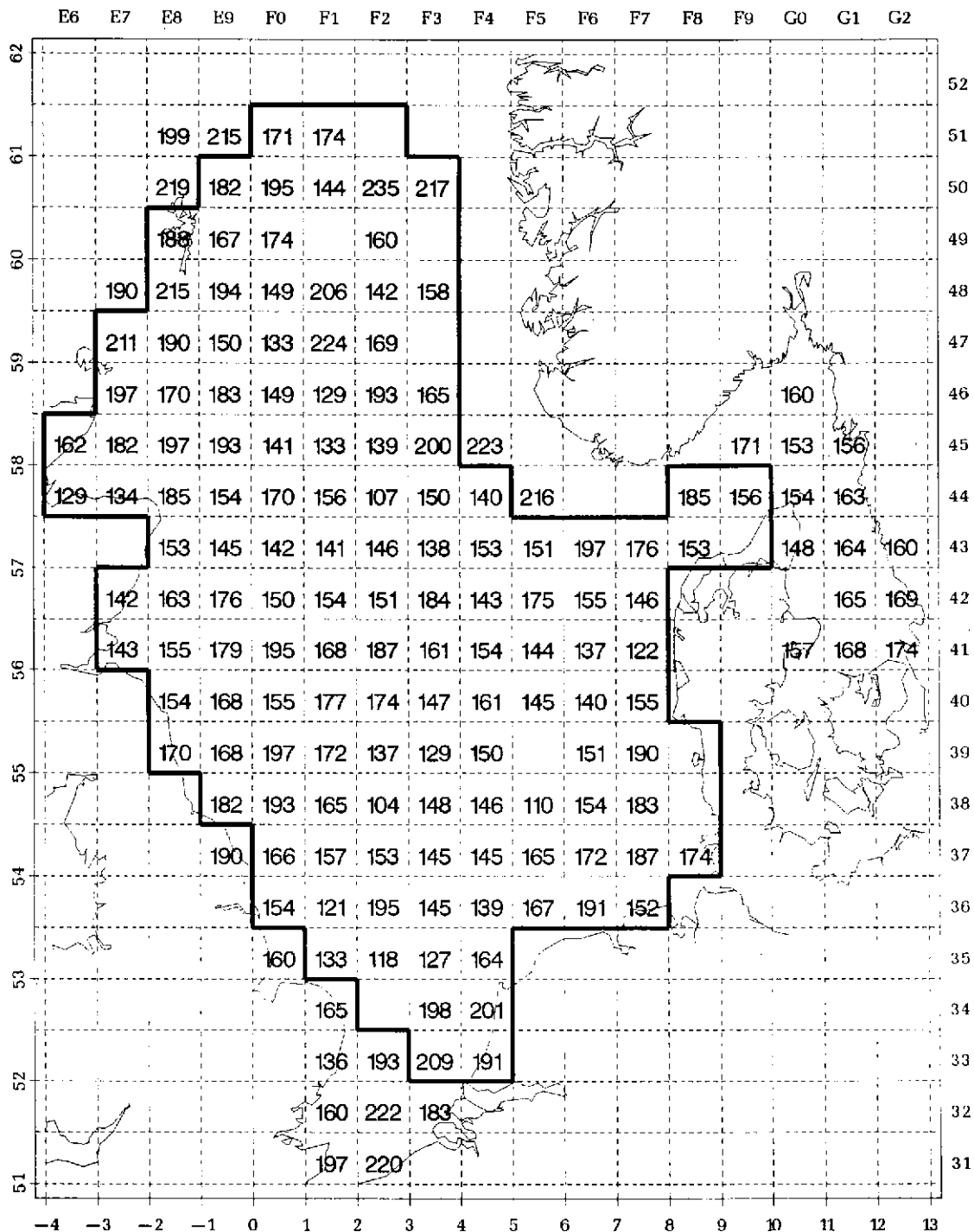


Figure 5.25 Whiting: mean length (mm), age-group 1.

# Saithe, number per hour

Age group 1, 1998 quarter 1

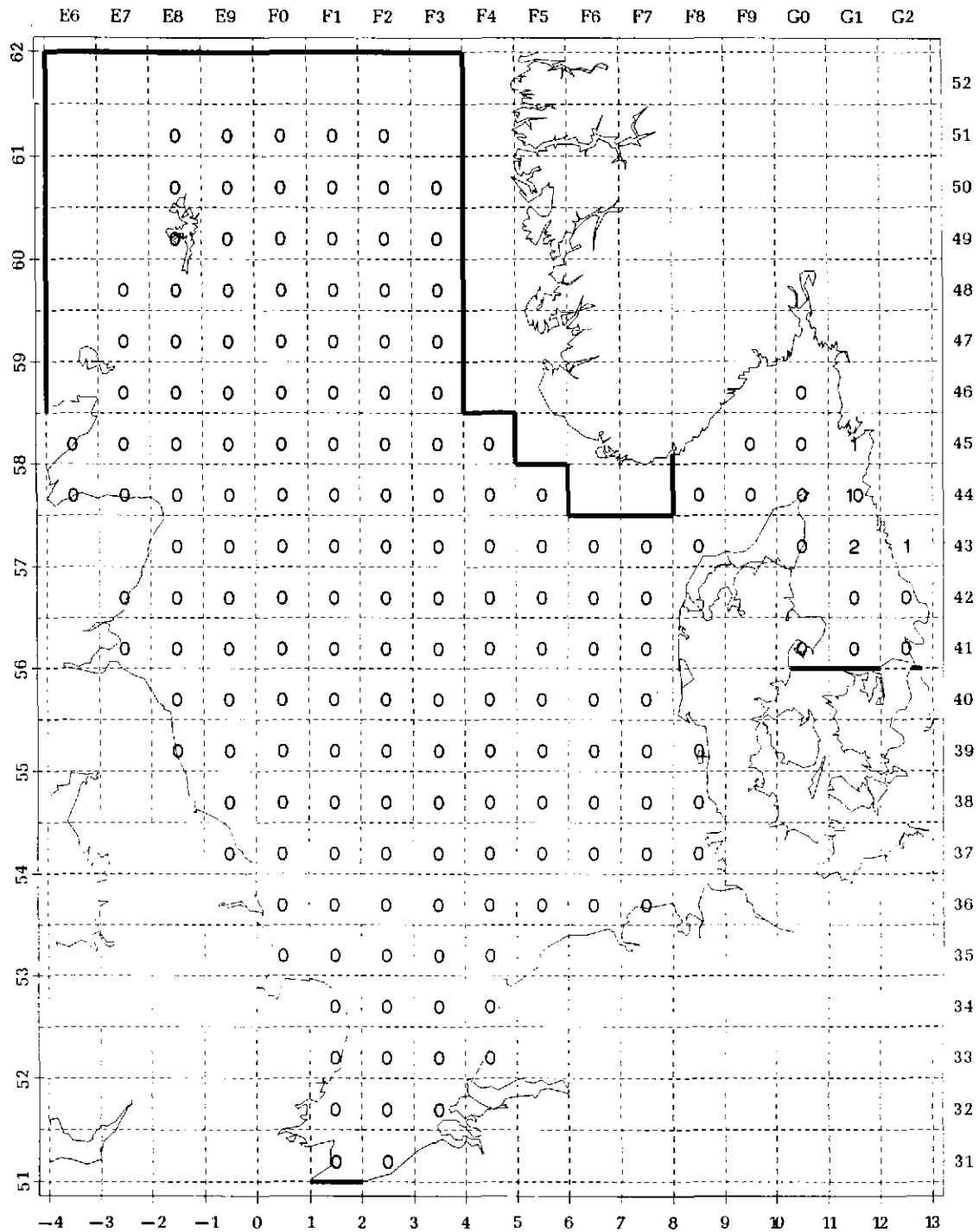


Figure 5.26 Saithe: number per hour, age-group 1.

# Saithe, number per hour

## Age group 2, 1998 quarter 1

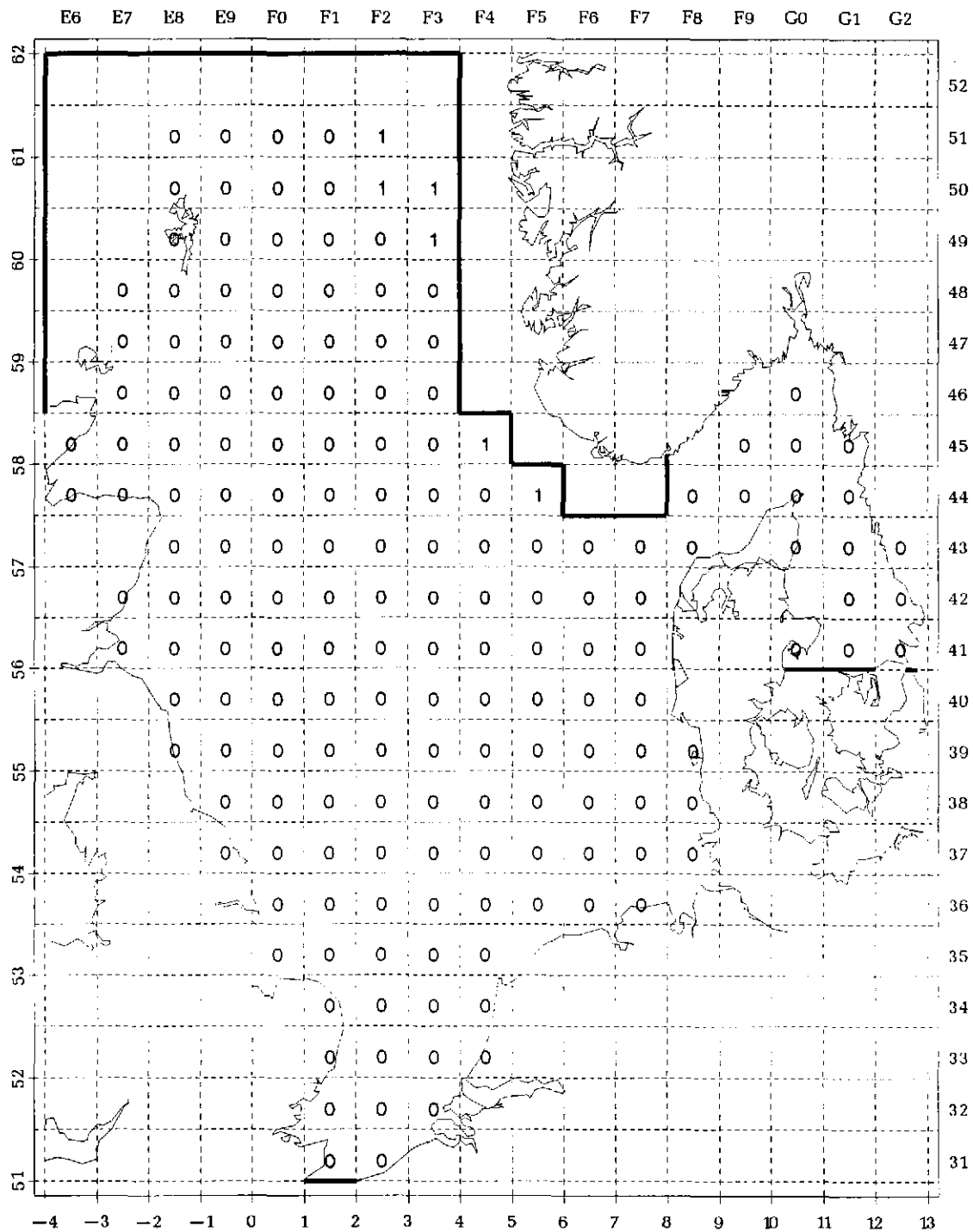


Figure 5.27 Saithe: number per hour, age-group 2.

# Saithe, number per hour

## Age group 3+ , 1998 quarter 1

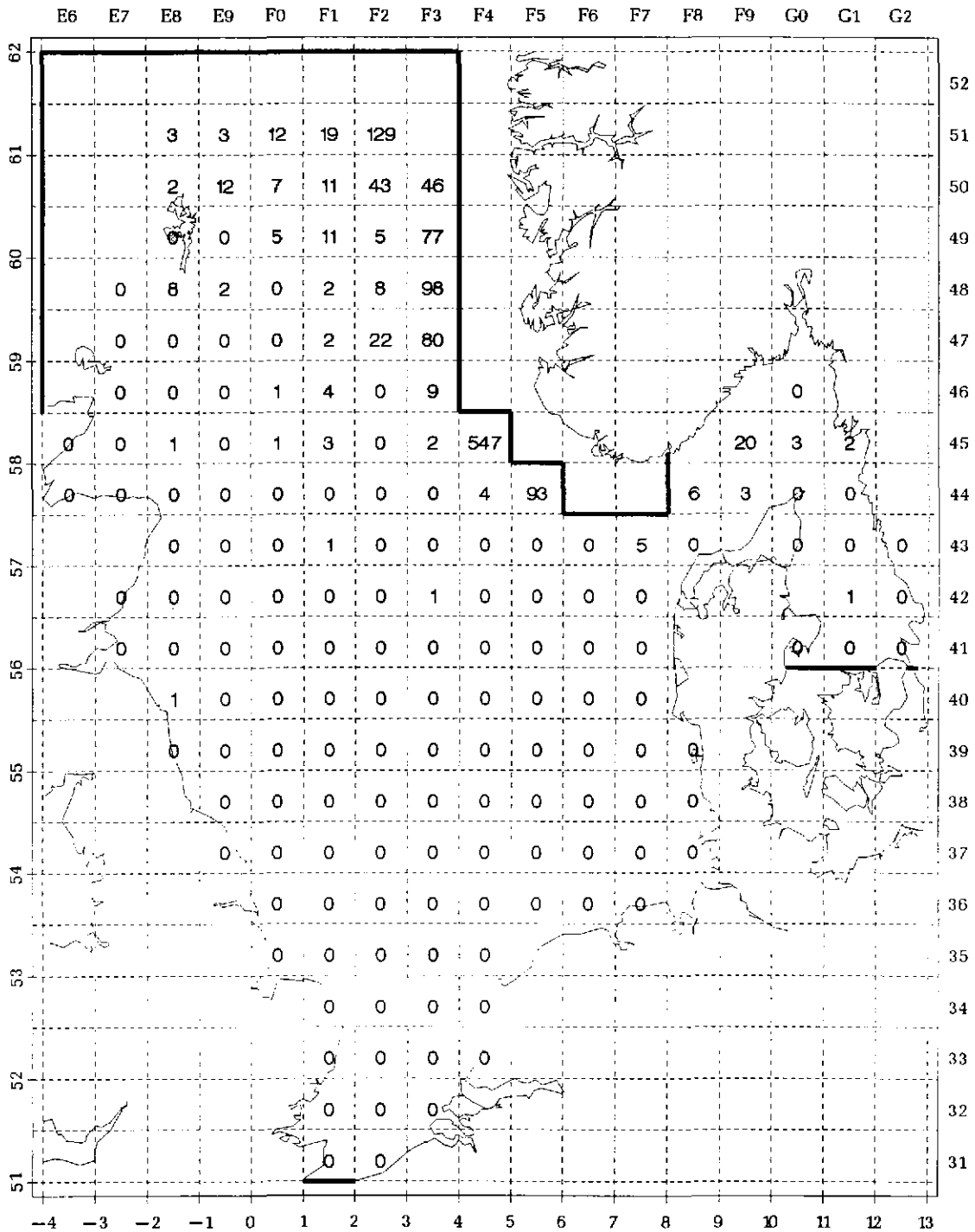


Figure 5.28 Saithe: number per hour, age-group 3+.

# Saithe, mean length

## Age group 1, 1998 quarter 1

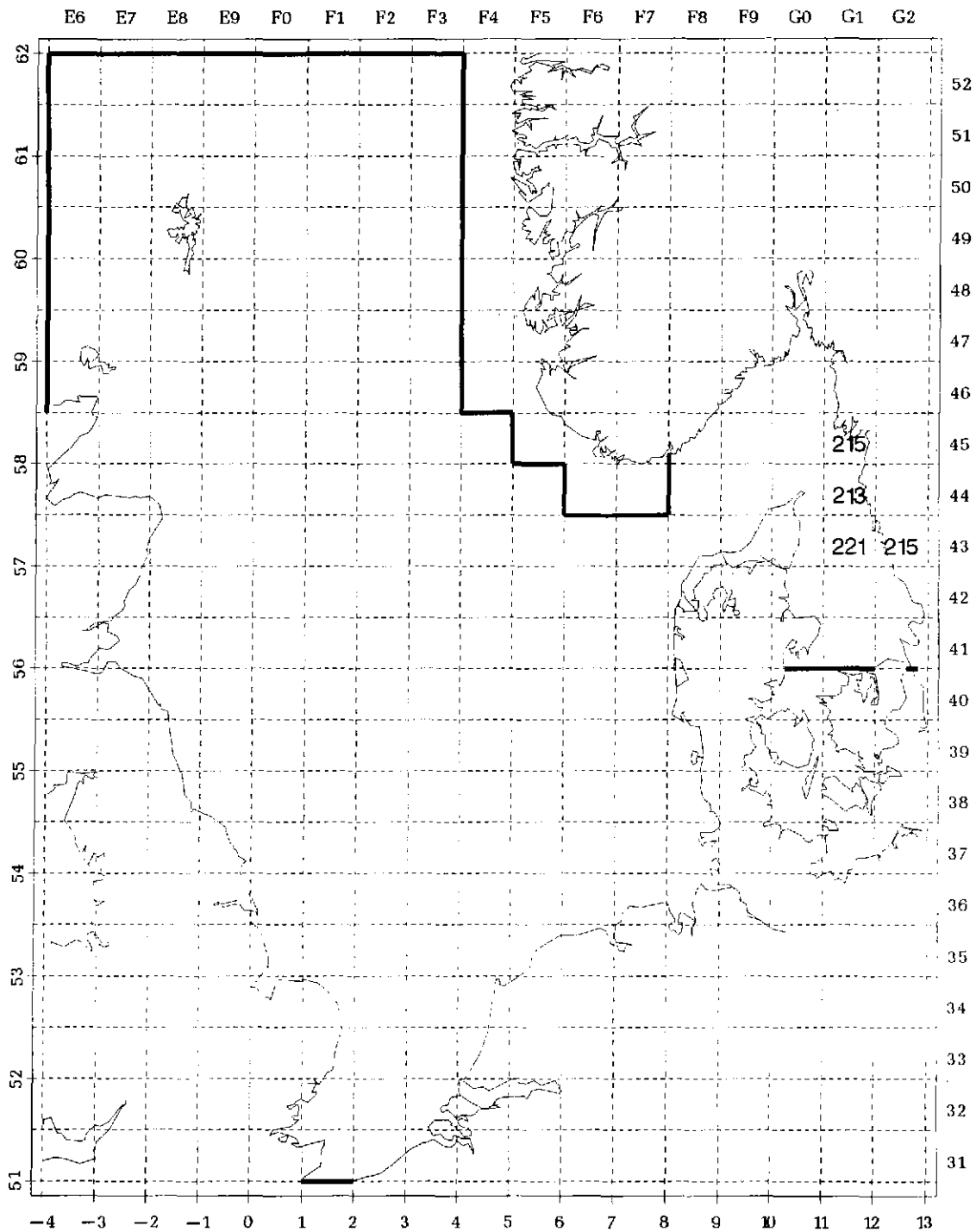


Figure 5.29 Saithe: mean length (mm), age-group 1.

# Norway pout, number per hour

## Age group 1, 1998 quarter 1

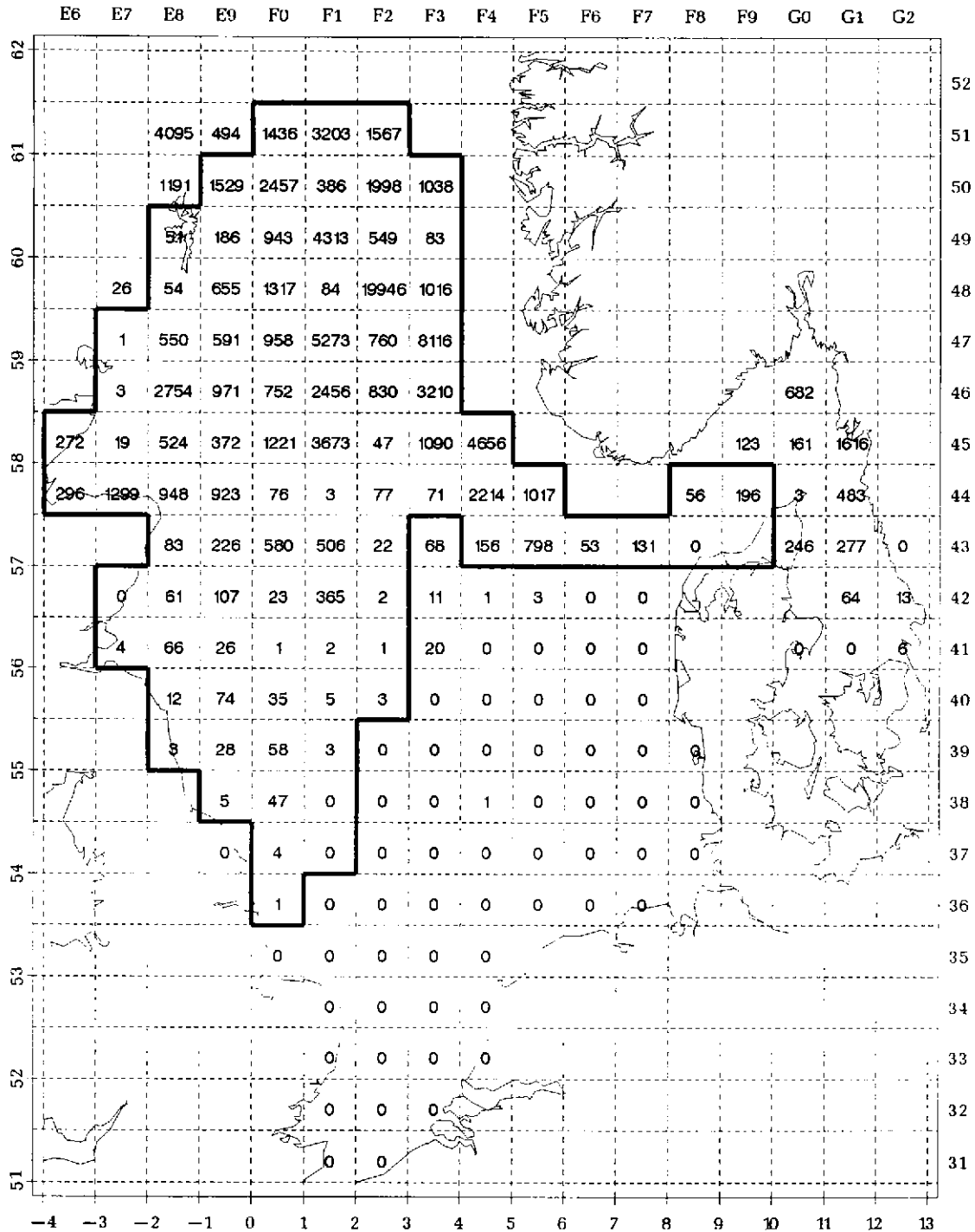


Figure 5.30 Norway pout: number per hour, age-group 1.

# Norway pout, number per hour

Age group 2, 1998 quarter 1

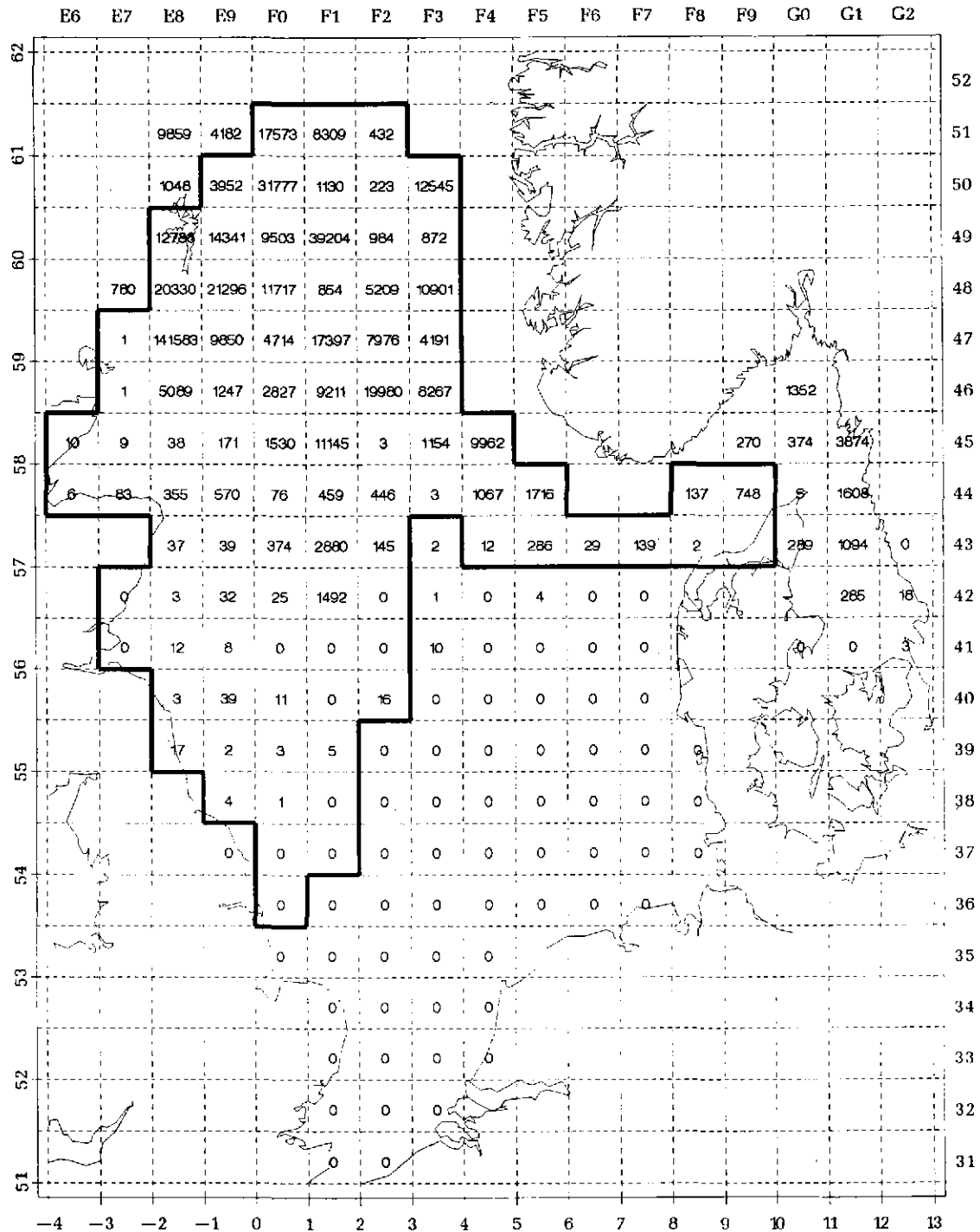


Figure 5.31 Norway pout: number per hour, age-group 2.



# Norway pout, number per hour

## Age group 3+, 1998 quarter 1

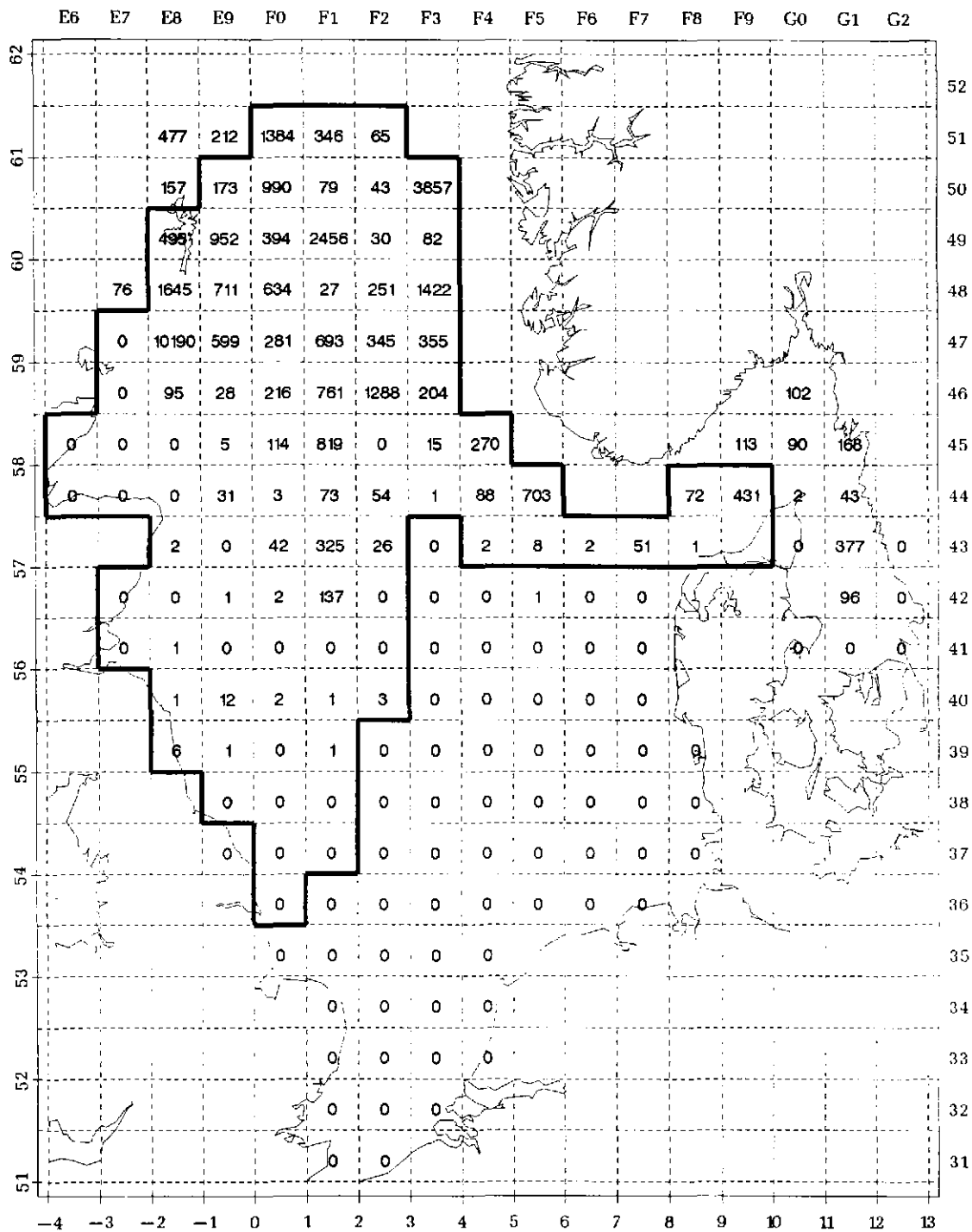


Figure 5.32 Norway pout: number per hour, age-group 3+.

# Norway pout, mean length

## Age group 1, 1998 quarter 1

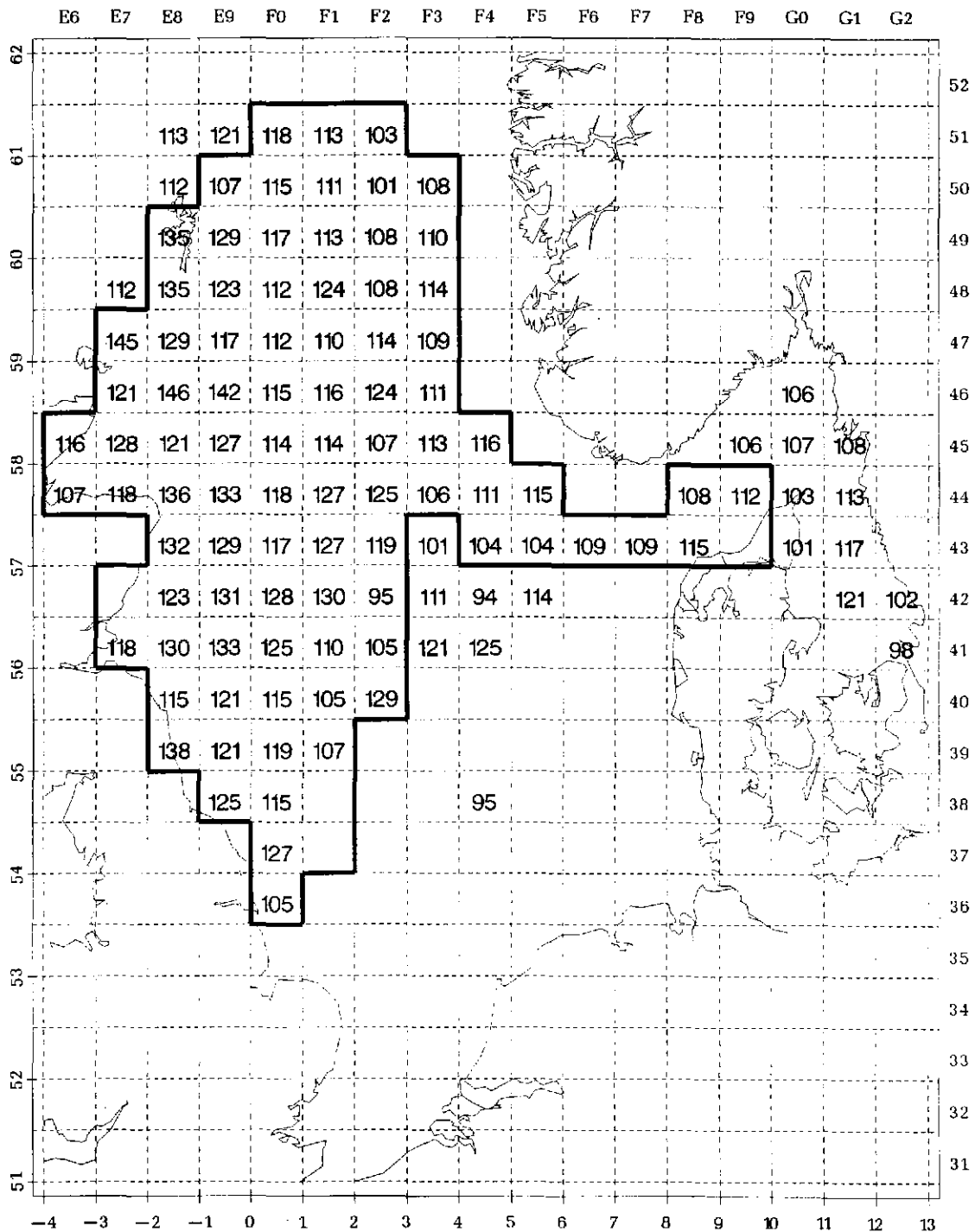
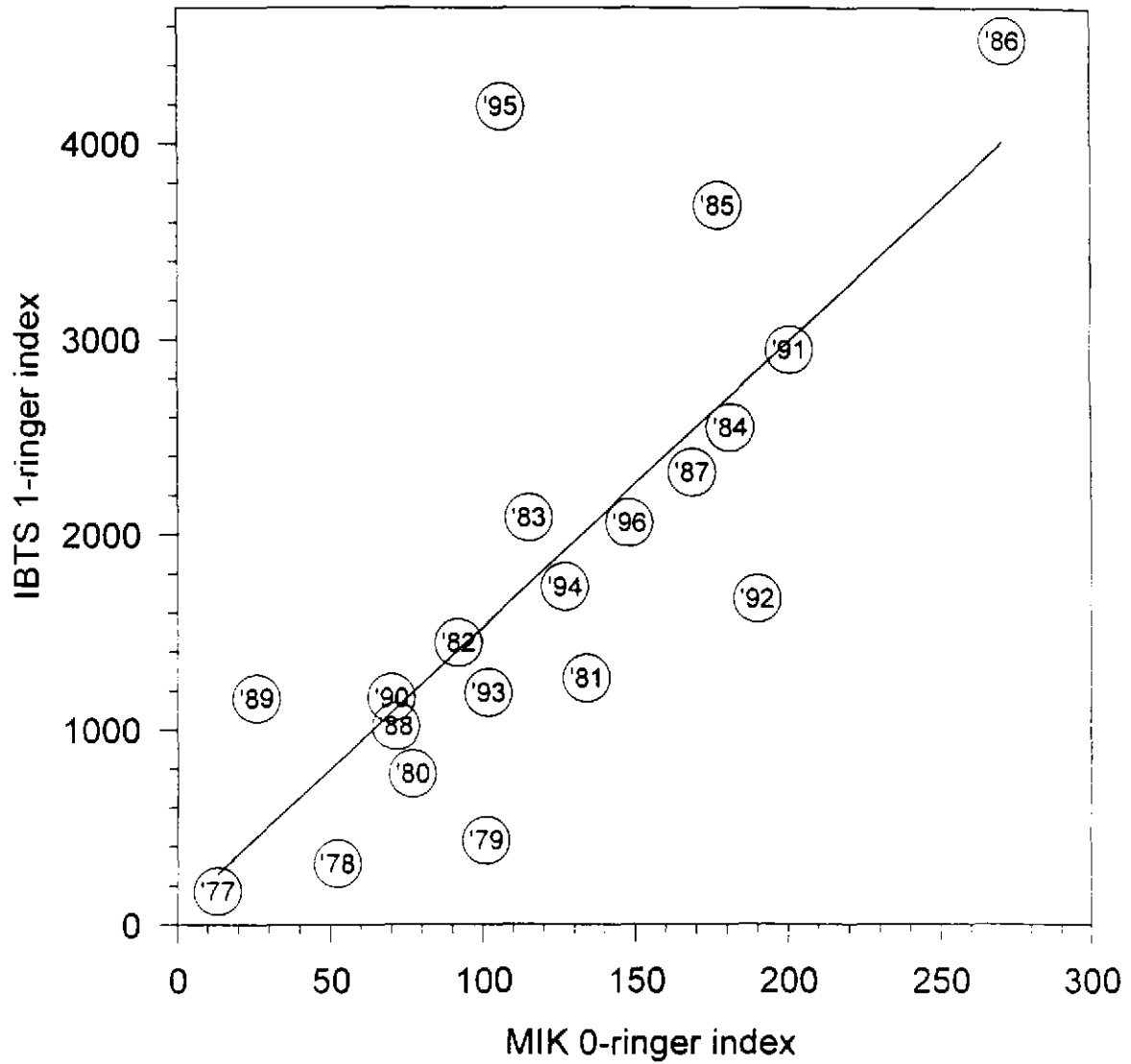


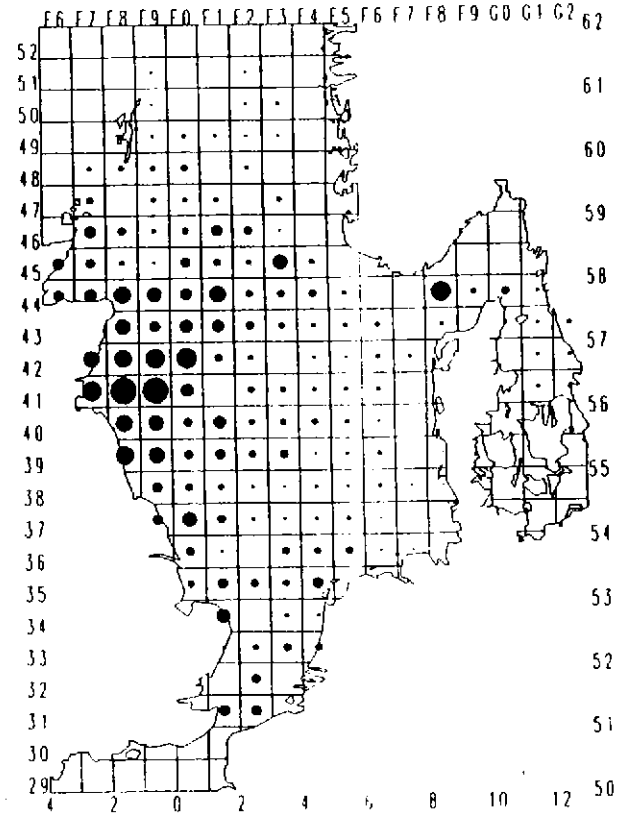
Figure 5.33 Norway pout: mean length (mm), age-group 1.

## Relationship between recruitment indices

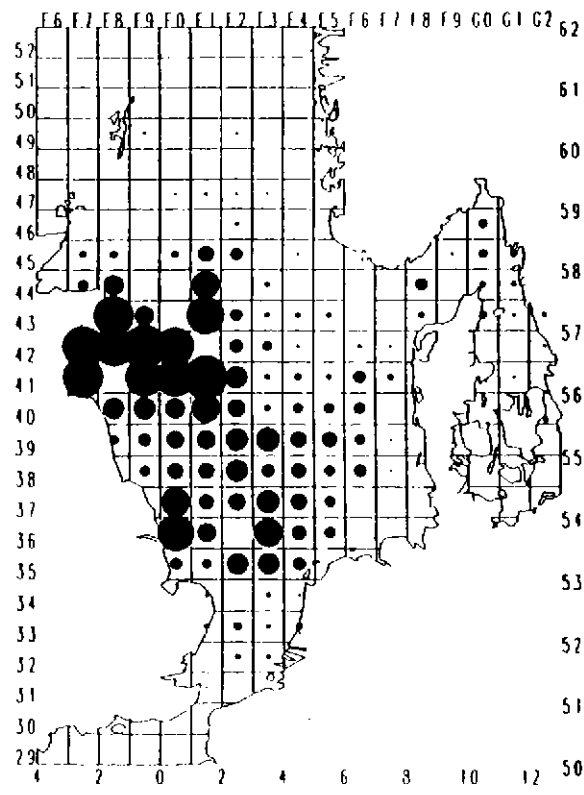


**Figure 6.1** Regression between the MIK 0-ringer index and the IBTS 1-ringer indices for year classes 1977 to 1996. Numbers in symbol indicate year class.

0-ringers year class 1997



0-ringers year class 1996



0-ringers year class 1995

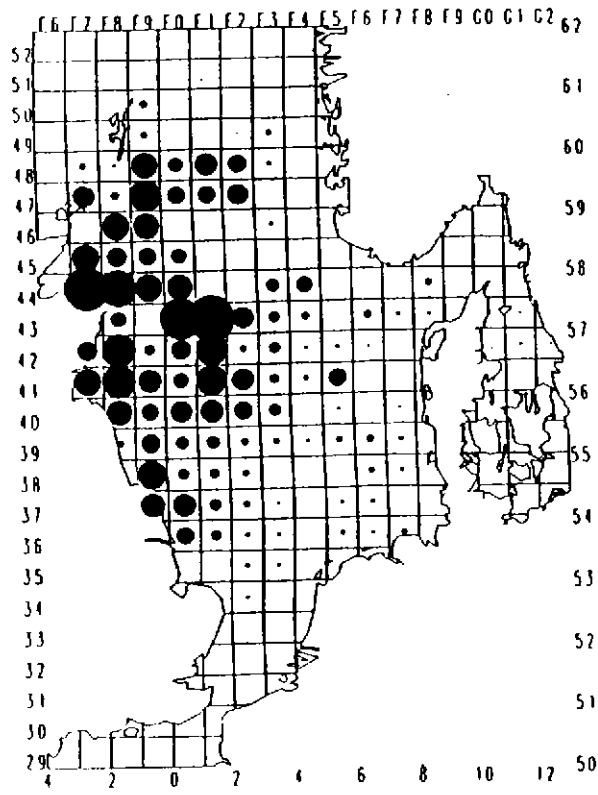


Figure 6.2 Distribution of 0-ringer herring, year classes 1993-1995. Abundance estimate of 0-ringers within each statistical rectangle based on MIK catches during IBTS in February. Area of filled circles illustrate densities in  $\text{no m}^{-2}$ , the area of a circle extending to the border of a rectangle represents  $1.5 \text{ m}^{-2}$ .

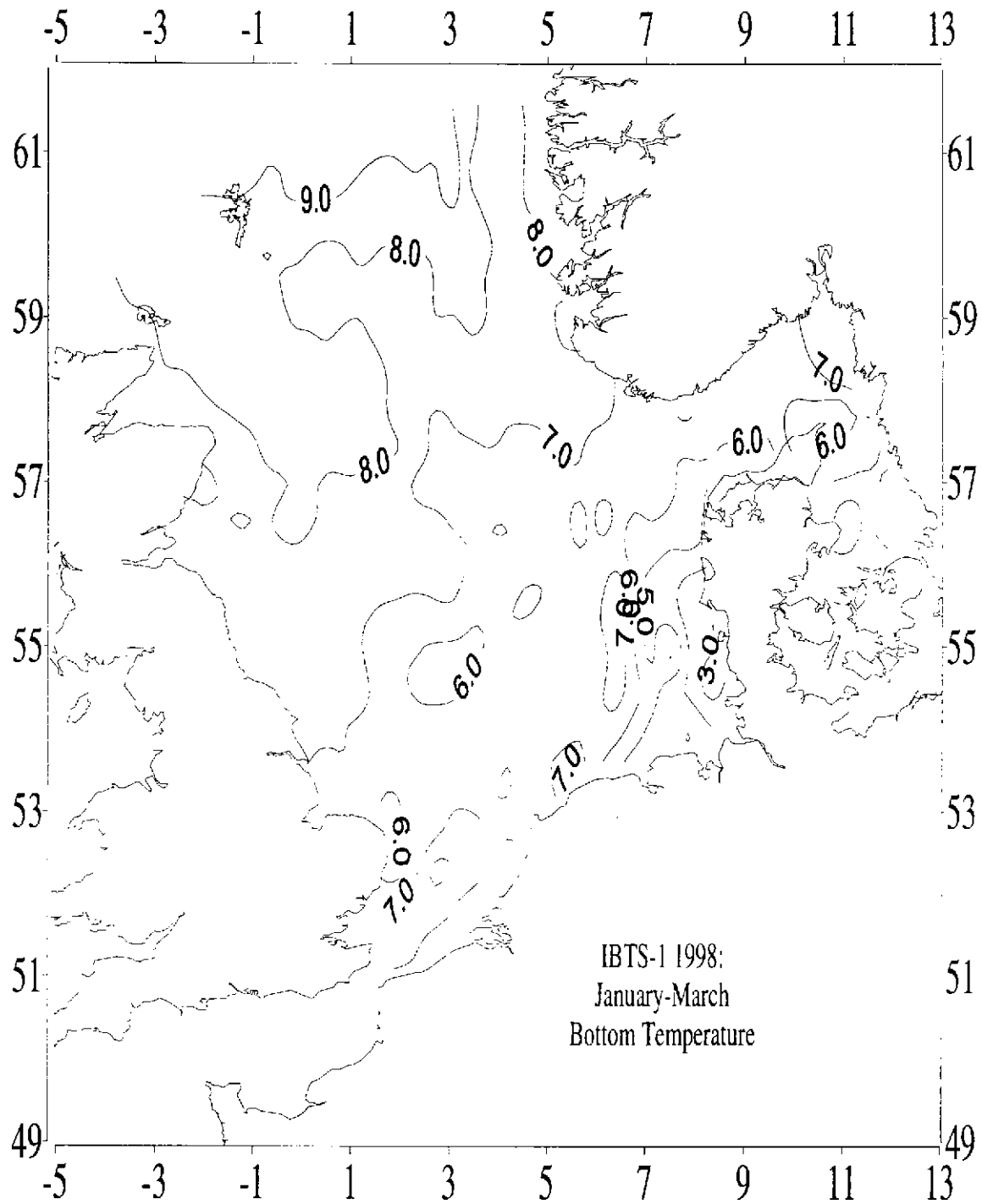


Figure 7.1

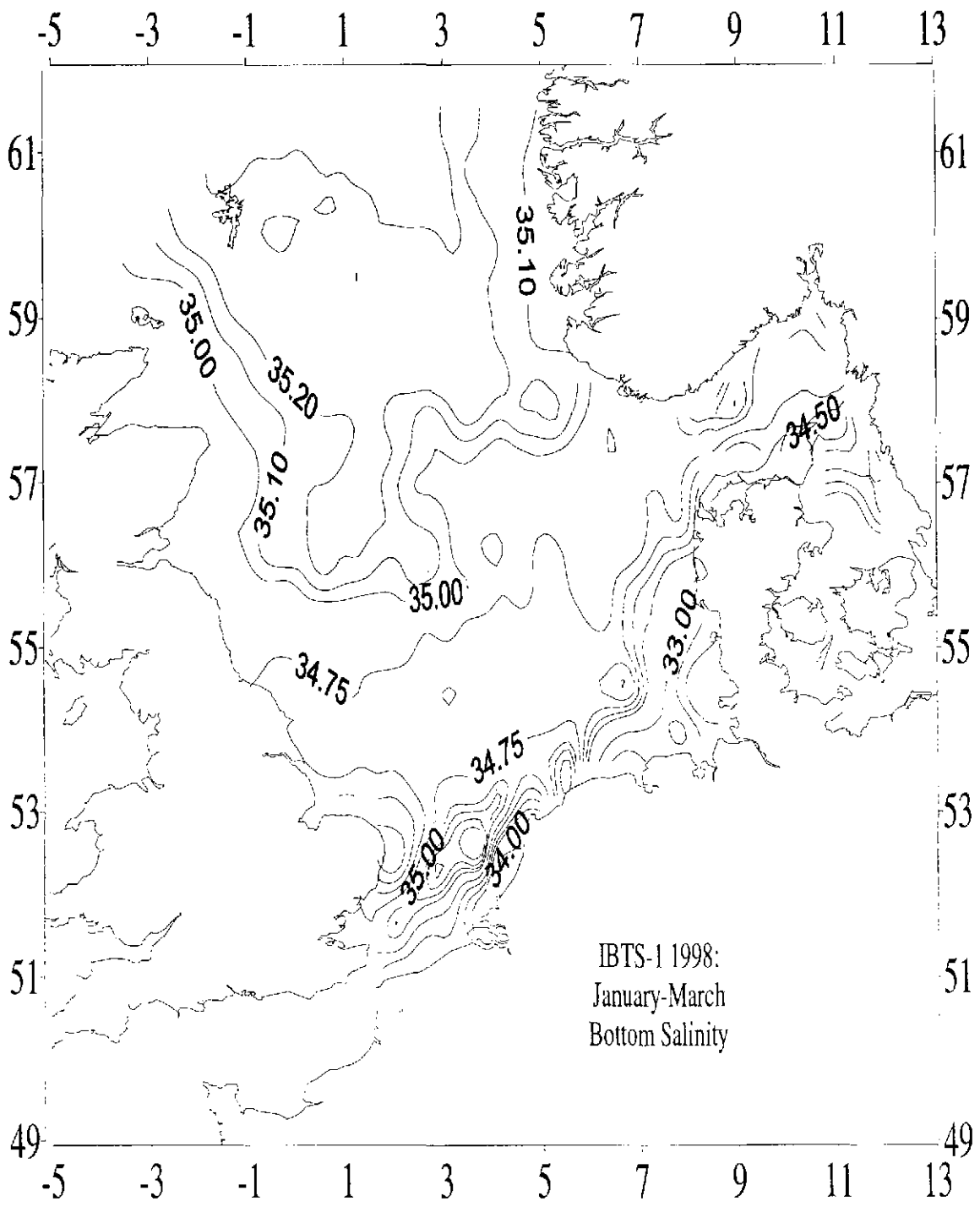


Figure 7.2

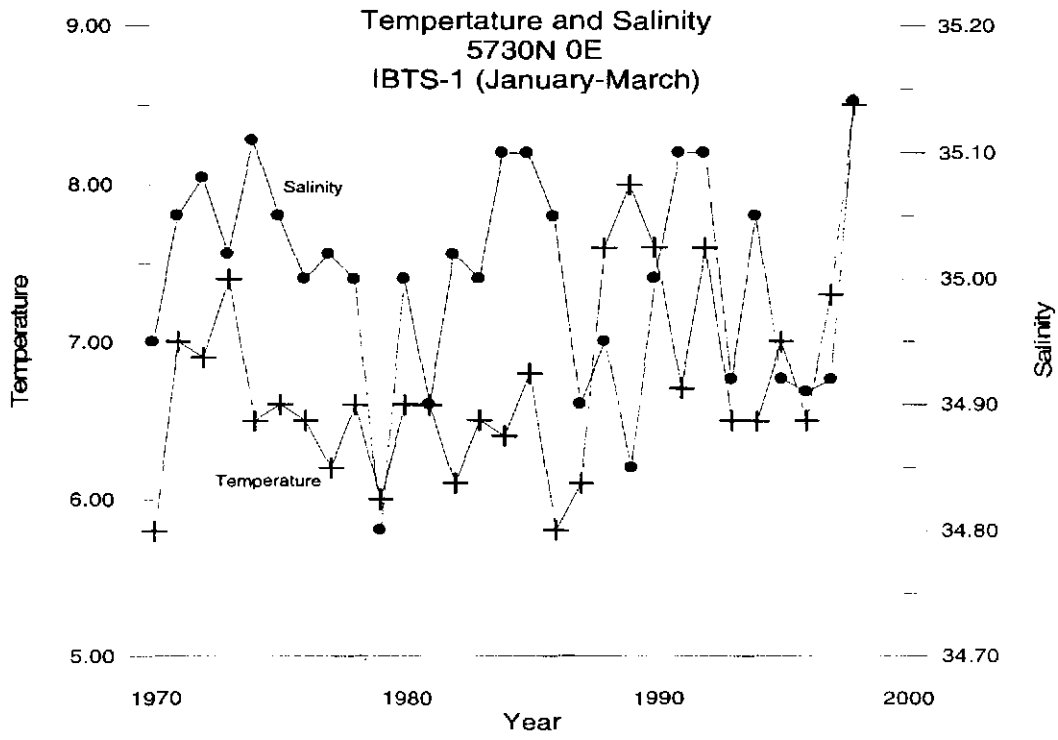


Figure 7.3

