Fol. 41 D

Resource Management Committee

ICES CM 1998/D:10
Ref. G

Fiskeridirektoratet
Biblioteket

REPORT OF THE

INTERNATIONAL BOTTOM TRAWL SURVEY IN THE NORTH SEA, SKAGERRAK AND KATTEGAT IN 1993: QUARTER 2, 3 AND 4

by

The International Bottom Trawl Survey Working Group

This report is not to be quoted without prior consultation with the General Secretary. The document is a report of an expert group under the auspices of the International Council for the Exploration of the Sea and does not necessarily represent the views of the Council.

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

Palægade 2–4 DK–1261 Copenhagen K Denmark

3109/b 5013

TABLE OF CONTENTS

1 INTRODUCTION

This report presents the final results for the International Bottom Trawl Survey (IBTS) in the second, third and fourth quarter of 1993. 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. This report presents the results of the quarterly surveys in 1993. The results for the first quarter IBTS are also given in separate reports, but first quarter indices are given in this report as well to give a better overview of the changes within a whole year.

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*). 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 IBTS Manual (ICES, 1996b). Details on the participation in the 1993 surveys are given in Table 2.1

3 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. The weighting factors are given in Figure 3.1.

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 above mentioned rules for separation of autumn and spring spawners were intended for the first quarter IBTS data. In this report similar rules have been adopted as well for the second, third and fourth quarter data. The indices for 0-ringers in third and fourth quarter are calculated in a similar way as for the 1-ringers.

The IBTS Working Group decided at the meeting in November 1995 (ICES 1996a) 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) 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.

The standard gear for IBTS is the GOV trawl, but in the third quarter of 1993 an Aberdeen 40 ft trawl has been used by "Scotia". See Knijn *et al.* (1993) for specifications of the Aberdeen 40 ft trawl. In the calculation of indices it is assumed that all trawl types have the same size and fishing power.

4 RESULTS FOR 1993

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 4.1 and 4.2.

The number of otoliths sampled per target species, per roundfish area and quarter is given in Table 4.1.

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. 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. The distributions are given with dots of expanding size. Within one page, showing 2 or 4 quarterly distributions, the same scaling has been used. The catch in number per hour of the biggest dot is indicated. The surface area of each dot is relative to the average number per hour caught.

The mean age composition of the eight standard species within the relevant standard areas is given in Table 4.2.

Herring

Mean numbers of 0-, 1-, 2- and 3+ ringed herring are given per rectangle in Figures 4.3–4.6. Mean length per rectangle of 1-ringed herring are given in Figure 4.7. 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 1993 represent year class 1991.

Sprat

The distributions of 0-, 1-, 2- and 3+ groups, and the mean length of 1-group fish are given in Figures 4.8–4.12.

Mackerel

The distributions of 0-, 1-, 2- and 3+ groups, and the mean length of 1-group fish are given in Figures 4.13–4.17.

Cod

The distributions of 0-, 1-, 2-, and 3+ group, and the mean length of 1-group fish are given in Figures 4.18–4.22.

Haddock

The distributions of 0-, 1-, 2-, and 3+ group, and the mean length of 1-group fish are given in Figures 4.23–4.27.

Whiting

The distributions of 0-, 1-, 2-, and 3+ group, and the mean length of 1-group fish are given in Figures 4.28–4.32.

Saithe

The distributions of 2-, and 3+ group, and the mean length of 2-group fish are given in Figures 4.33–4.35.

Norway pout

The distributions of 0-, 1-, 2-, and 3+ group, and the mean length of 1-group fish are given in Figures 4.36–4.40.

5 HYDROGRAPHIC DATA

5.1 Hydro-Chemistry Survey

Details concerning the data collected during the three surveys are as follows:

Quarter 2: 183 stations from 26 April to 19 June from four ships ("Walter Herwig", "Isis", "Tridens" and "Argos")
Quarter 3: 313 stations from 9 August to 23 September from five ships ("Thalassa", "Isis", "Tridens", "Cirolana", and "Argos")
Quarter 4: 349 stations from 16 October to 20 November from five ships ("Dana", "G.O. Sars", "Isis", "Tridens", and "Cirolana")

Charts showing the distribution of bottom (<20m of bottom) temperature and salinity for each of the surveys are shown in Figures 5.1 to 5.6.

Digital (gif) copies of these charts may be retrieved or viewed from ftp://ftp.ices.dk/dist/ocean/iyfs/1993. The ftp directory also includes charts showing the location of the stations.

6 REFERENCES

Knijn J.R, Boon, T.W, Heessen, H.J.L and Hislop, J.R.G. 1993. Atlas of North Sea Fishes. ICES Cooperative Research Report. No. 194, 268 pp.

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

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 2.1 Participation and number of hauls in the IBTS for 1993.

Year 1993	Country	Vessel	Period	Number of Hauls ABD	GOV
Quarter 1	Sweden	Argos	8/2–25/2		46
	Denmark	Dana	5/2–18/2		43
	Netherlands	Isis	16/2–25/2		26
	Norway	Michael Sars	5/2–1/3		49
	UK Scotland	Scotia	4/2–24/2		52
	France	Thalassa	17/1–3/2		51
	Netherlands	Tridens	2/2–25/2		48
	Germany	Walter Herwig	23/1–11/2		65
Quarter 2	Sweden	Argos	26/4–12/5		48
	Netherlands	Isis	10/5–18/5		24
	Norway	Michael Sars	24/5–1/6		32
	UK Scotland	Scotia	29/4–17/5		74
	Netherlands	Tridens	3/5–18/5		44
	Germany	Walter Herwig	19/5–19/6		12
Quarter 3	Sweden	Argos	6/9–23/9		50
	UK England	Cirolana	9/8–4/9		77
	Netherlands	Isis	16/8–19/8		17
	UK Scotland	Scotia	6/8–25/8	89	
	France	Thalassa	13/9–30/9		69
	Netherlands	Tridens	16/8–3/9		48
Quarter 4	UK England	Cirolana	19/10–13/11		73
	Denmark	Dana	4/11–20/11		47
	Norway	G.O. Sars	17/10–10/11		79
	Netherlands	Isis	25/10–10/11		48
	Netherlands	Tridens	18/10–28/10		32

Gear used:

ABD Aberdeen 48 ft trawl

GOV Grand Overture Verticale trawl

Table 4.1 Number of otoliths sampled per species, roundfish area and quarter in 1993

Species	Roundfish area									
	1	2	3	4	5	6	7	8	9	Total
Quarter 1										
Herring	585	882	666	227	212	955	755	446	636	5,364
Sprat	-	85	135	158	113	471	320	21	159	1,462
Mackerel	113	-	-	-	-	-	-	-	-	113
Cod	1,048	470	286	310	39	334	248	278	439	3,452
Haddock	1,290	720	852	481	-	12	264	141	75	3,835
Whiting	1,017	634	713	629	561	1,371	175	208	204	5,512
Saithe	585	3	5	-	-	-	-	-	-	593
Norway pout	282	181	155	193	-	-	-	-	-	811
Quarter 2										
Herring	333	301	385	361	375	427	192	426	672	3,472
Sprat	-	89	168	187	162	230	100	138	171	1,245
Mackerel	27	17	49	82	119	218	-	-	-	512
Cod	607	382	199	320	15	152	178	649	406	2,90
Haddock	587	659	575	354	3	11	303	204	55	2,751
Whiting	453	469	491	369	167	430	210	183	177	2,949
Saithe	298	12	52	-	-	-	56	21	-	439
Norway pout	185	140	100	142	5	1	11	77	40	701
Quarter 3										
Herring	541	626	659	622	26	172	210	343	589	3,788
Sprat	17	157	147	179	148	237	24	33	160	1,102
Mackerel	221	300	163	88	96	233	97	-	-	1,198
Cod	737	469	126	632	57	389	175	277	215	3,077
Haddock	1,929	1,082	994	503	-	13	168	168	35	4,892
Whiting	1,283	805	752	333	114	288	175	148	153	4,051
Saithe	788	59	31	2	-	-	15	-	-	895
Norway pout	420	137	141	94	-	-	22	110	73	997
Quarter 4										
Herring	837	905	287	352	236	471	408	363	157	4,016
Sprat	-	292	132	360	191	317	102	-	142	1,536
Mackerel	214	122	128	27	13	304	22	-	-	83
Cod	597	277	48	100	36	364	177	120	52	1,771
Haddock	1,134	673	626	234	3	8	174	144	13	3,009
Whiting	876	576	521	369	193	923	125	126	127	3,836
Saithe	647	14	5	-	-	-	43	16	2	727
Norway pout	430	190	82	88	-	-	30	49	-	869

Table 4.2 Age composition of standard species in 1993 for the relevant standard areas.

		Age						
	Quarter	**0**	**1**	**2**	**3**	**4**	**5**	**6+**
Herring	1	.0	2,954.0	779.3	209.1	43.6	63.8	-
	2	.0	2,126.7	618.4	415.5	62.1	63.7	-
	3	3,799.2	1,136.9	324.8	175.2	92.0	195.8	-
	4	3,488.5	293.8	63.0	23.3	10.5	22.3	-
Sprat	1	.0	1,688.6	589.8	83.8	4.2	.1	-
	2	.0	7,815.4	5,196.1	504.6	19.5	.9	-
	3	6.8	2,575.1	2,728.4	559.3	23.5	.0	-
	4	2,528.0	9,476.2	2,918.0	81.3	.3	1.1	-
Mackerel	1	.0	1.0	.8	.9	.4	.2	.3
	2	.0	3.8	22.9	6.8	2.5	1.5	3.1
	3	5.3	91.3	67.6	25.7	18.9	10.1	18.1
	4	11.9	8.5	10.2	6.1	6.3	3.3	7.6
Cod	1	.0	13.1	19.5	2.0	.7	.6	.4
	2	2.1	8.4	13.6	1.9	.5	.3	.2
	3	17.0	10.0	8.0	.9	.2	.1	.1
	4	25.4	9.1	5.6	.8	.3	.1	.1
Haddock	1	.0	1,254.3	540.8	154.5	8.9	1.1	1.0
	2	.1	1,121.3	317.2	97.7	20.2	.9	.9
	3	571.9	604.3	141.5	37.7	2.4	.4	.3
	4	667.0	906.1	201.3	45.3	2.7	.5	.4
Whiting	1	.0	1,087.6	523.7	244.5	65.5	59.0	11.4
	2	7.2	742.5	244.2	147.0	35.1	21.4	6.7
	3	915.9	634.2	176.9	67.1	14.8	16.2	3.1
	4	1,014.1	755.5	324.1	110.3	42.0	14.2	7.6
Saithe	1	.0	.1	2.0	.5	1.3	2.5	1.8
	2	.0	.1	1.3	1.2	1.5	1.8	.8
	3	.0	.9	1.8	8.5	2.9	1.2	.4
	4	.0	.2	1.6	7.3	1.9	.6	.4
Norway pout	1	.0	2,681.4	2,644.1	258.5	6.0	7.0	.1
	2	.0	2,075.2	1,252.5	193.8	.2	.0	.0
	3	4,103.9	1,831.5	608.5	52.6	3.3	.0	.0
	4	4,775.1	1,767.0	579.9	47.5	2.7	.0	.0

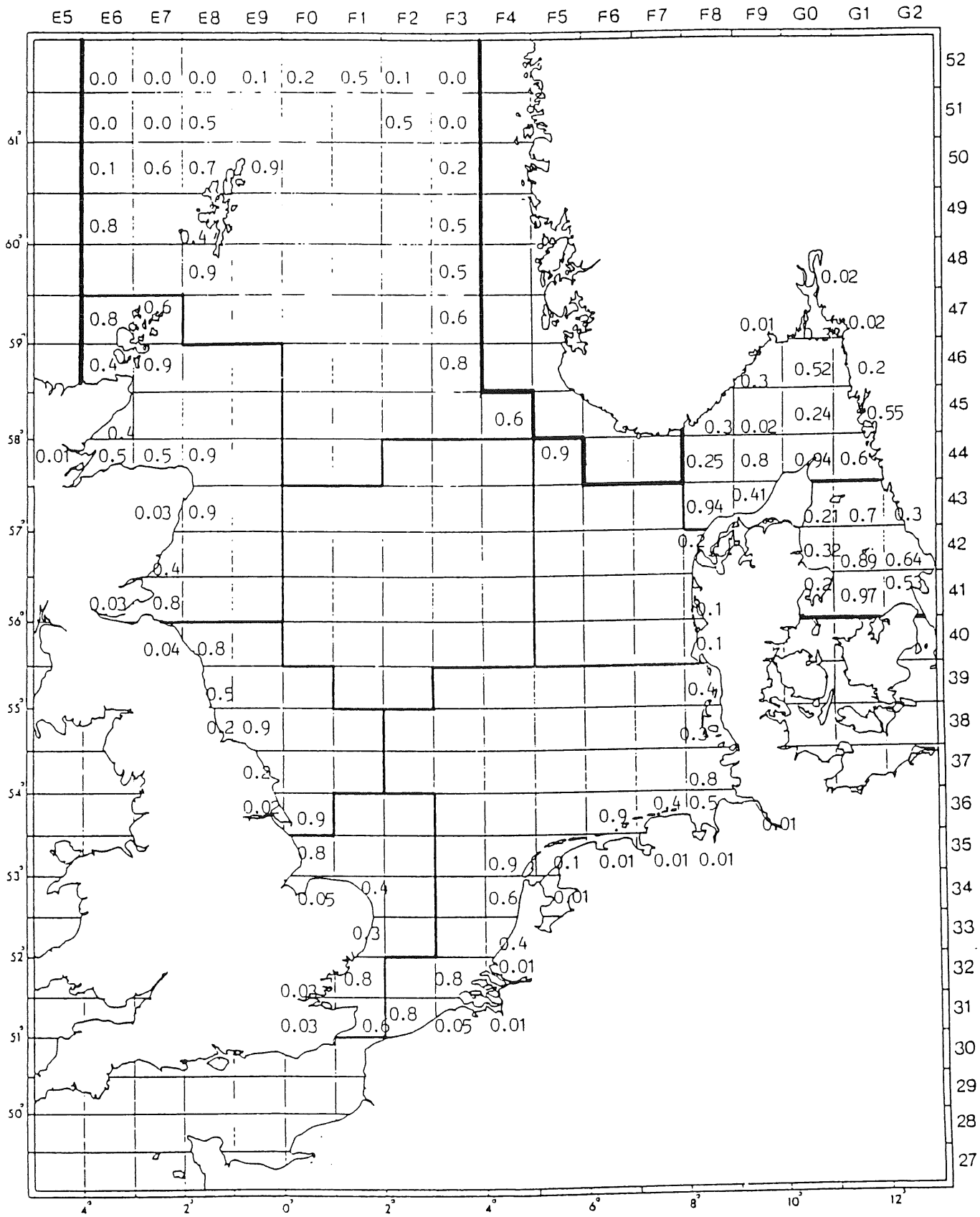

Figure 3.1 Weighting factors used in the calculation of the indices for herring and saithe. Numbers denote the relative weight of a given rectangle. Only weighting factors less than 1 are shown, other rectangles are given a weight of 1.

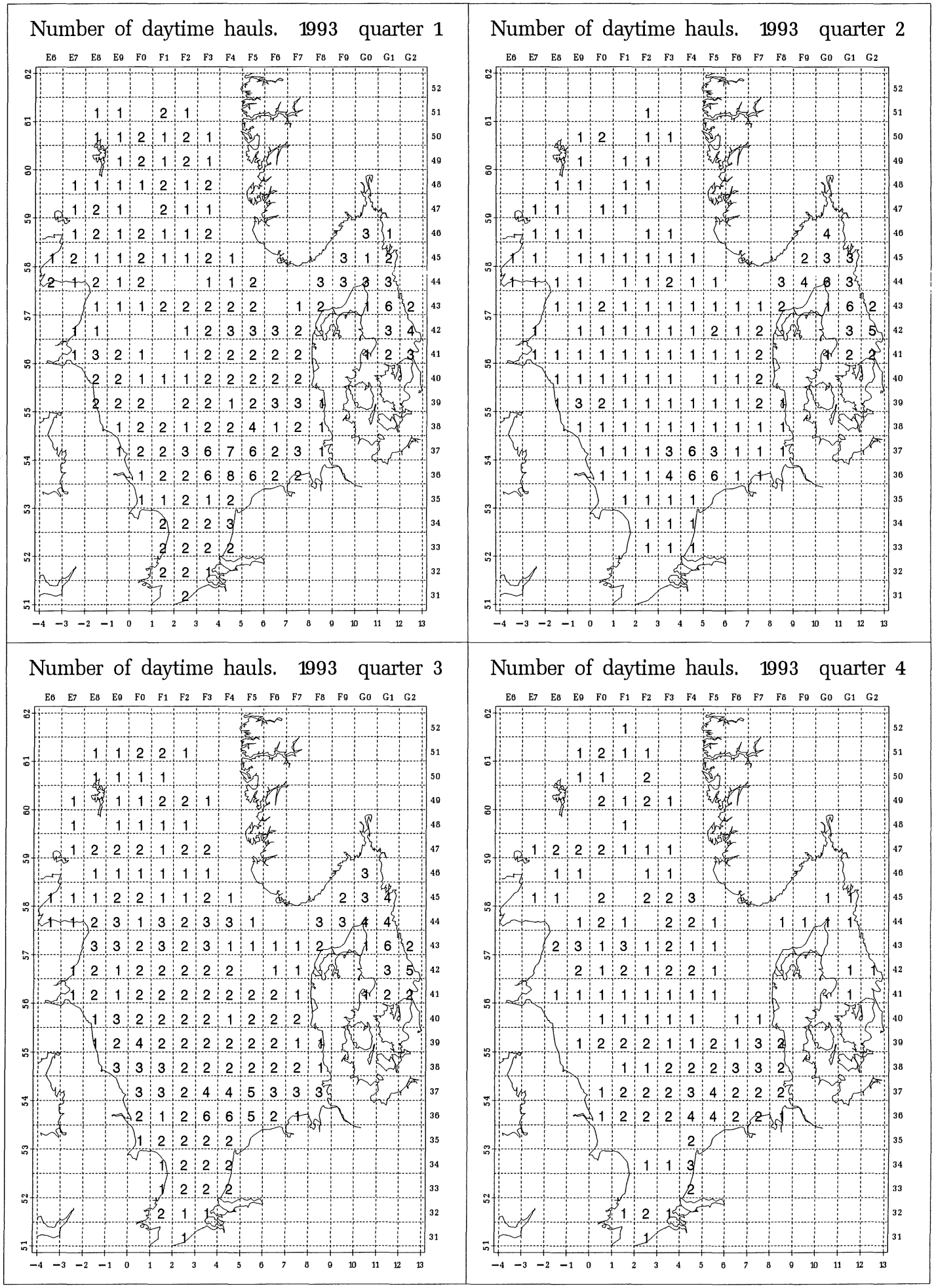

Figure 4.1 Number of valid daytime hauls.

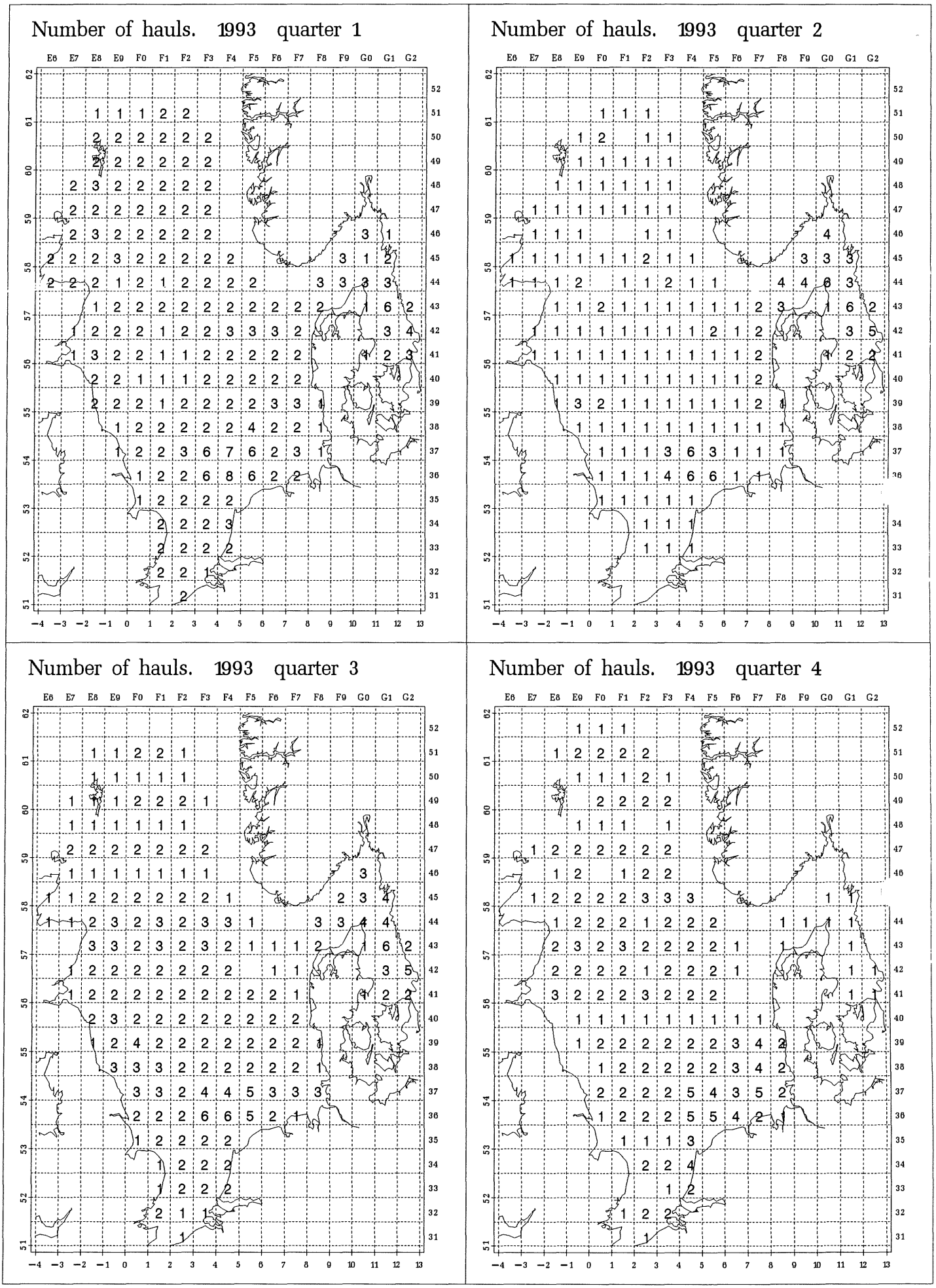

Figure 4.2 Number of valid day- and nighttime hauls.

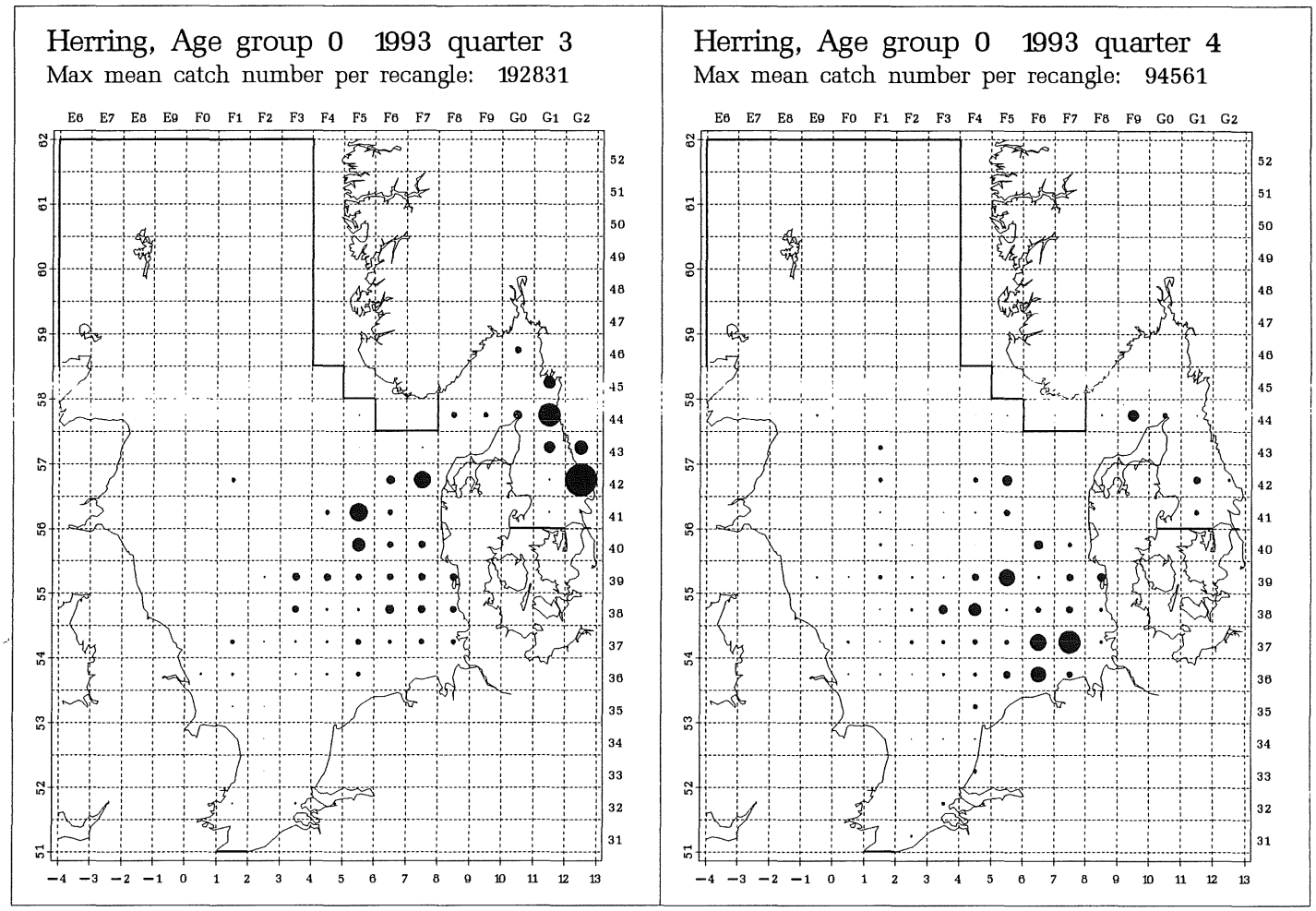

Figure 4.3 Herring: number per hour, 0-ringers.

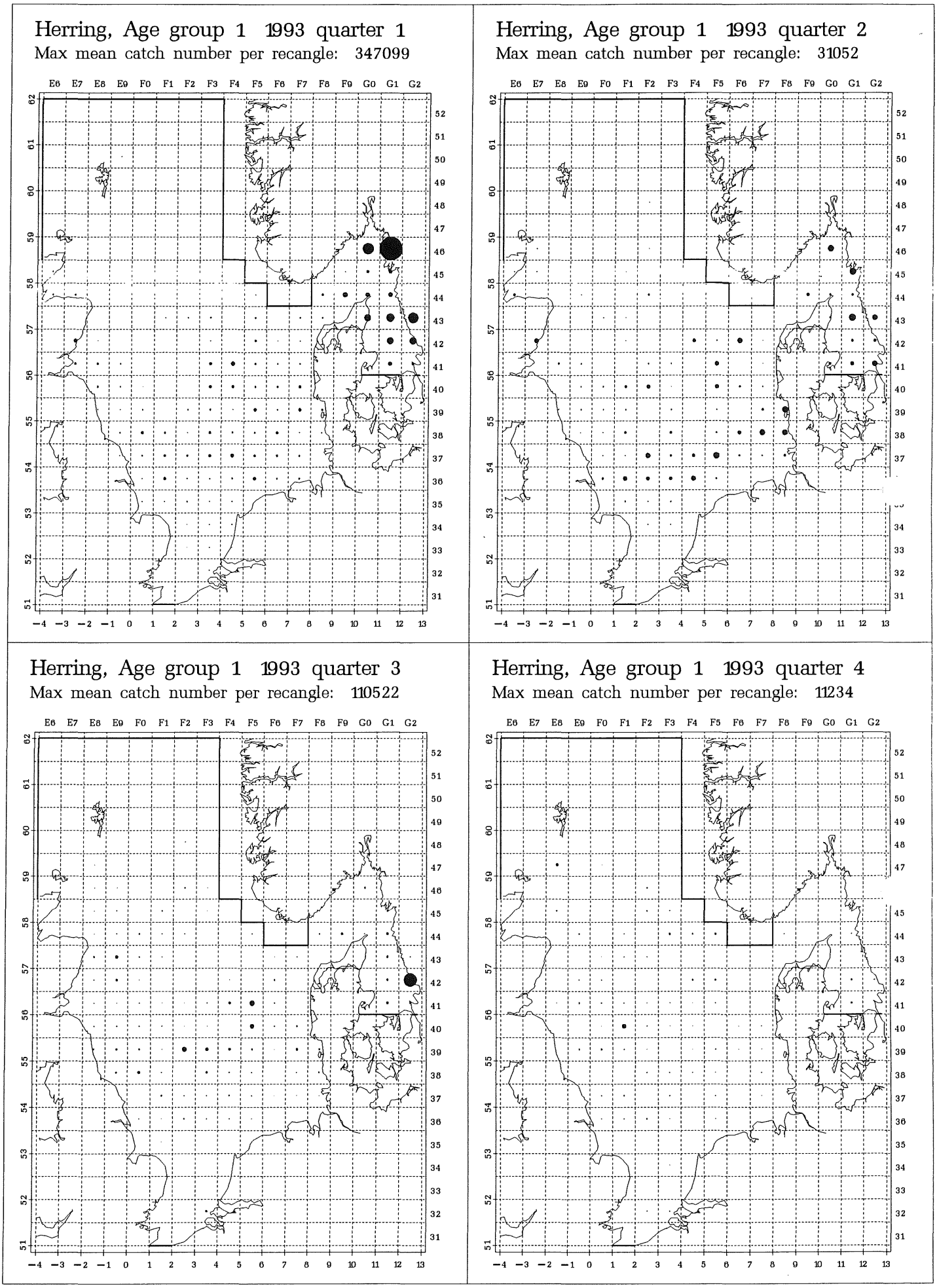

Figure 4.4 Herring: number per hour, 1-ringers.

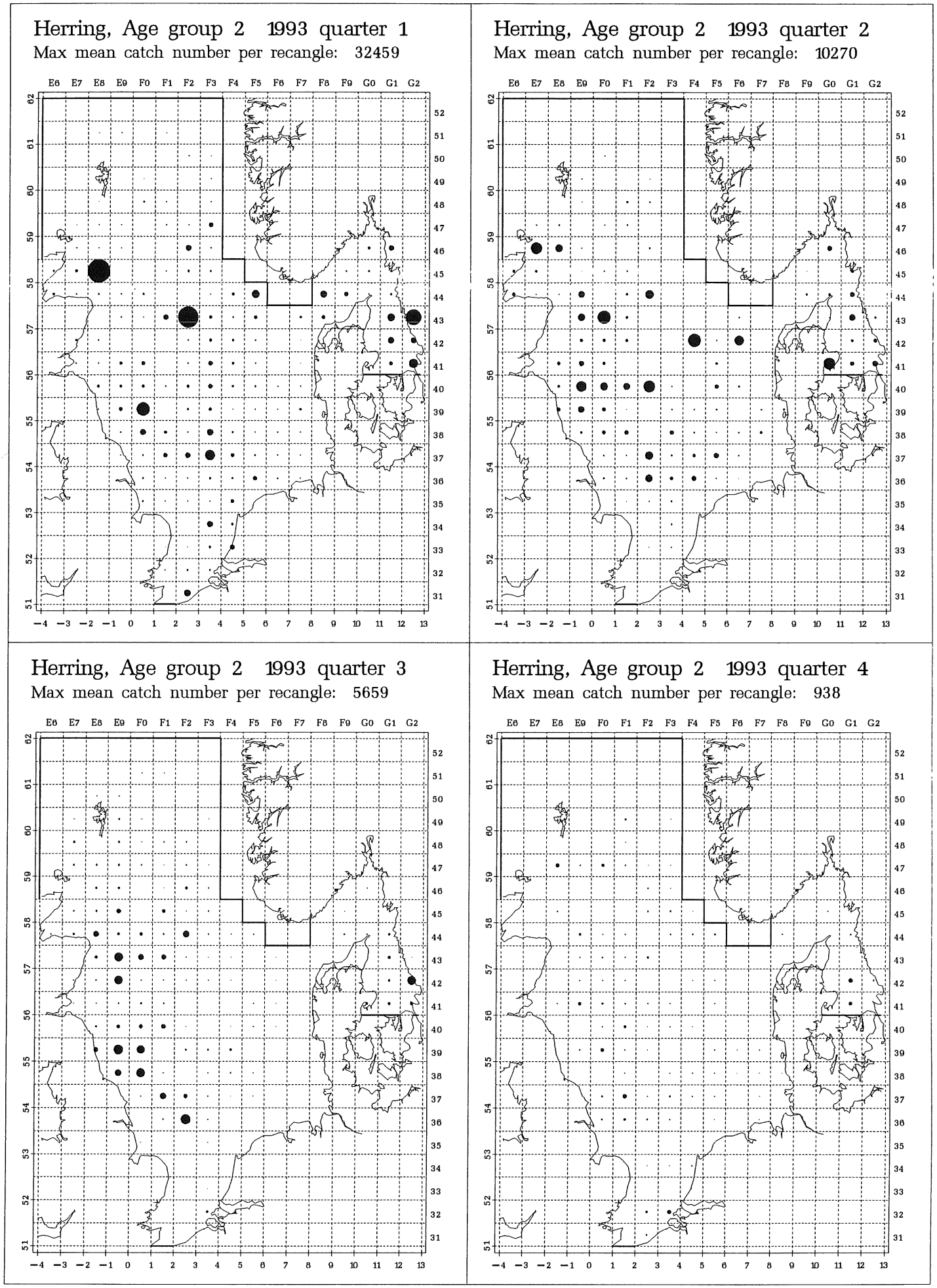

Figure 4.5 Herring: number per hour, 2-ringers.

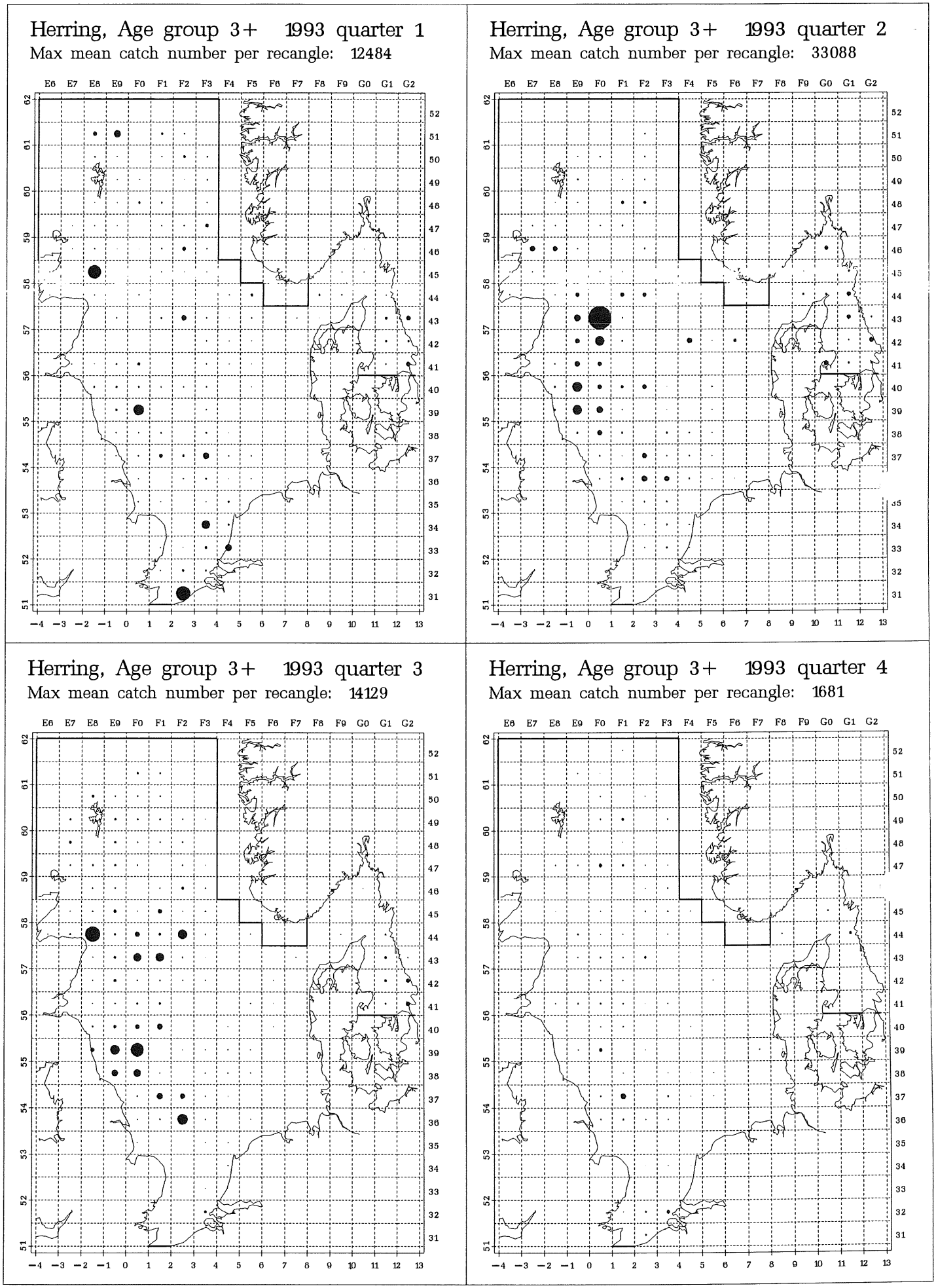

Figure 4.6 Herring: number per hour, 3+ringers.

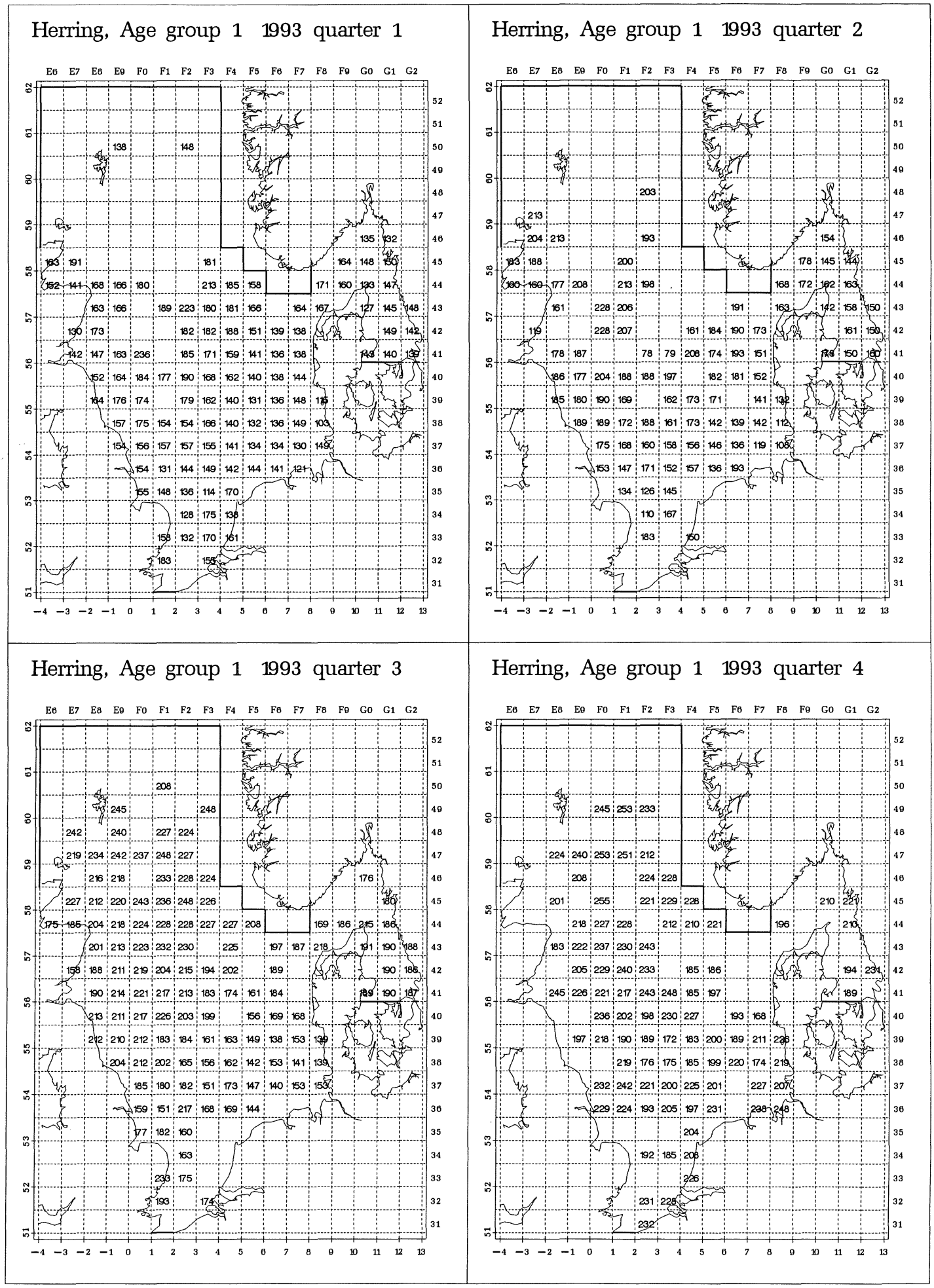

Figure 4.7 Herring: mean length (mm), 1-ringers.

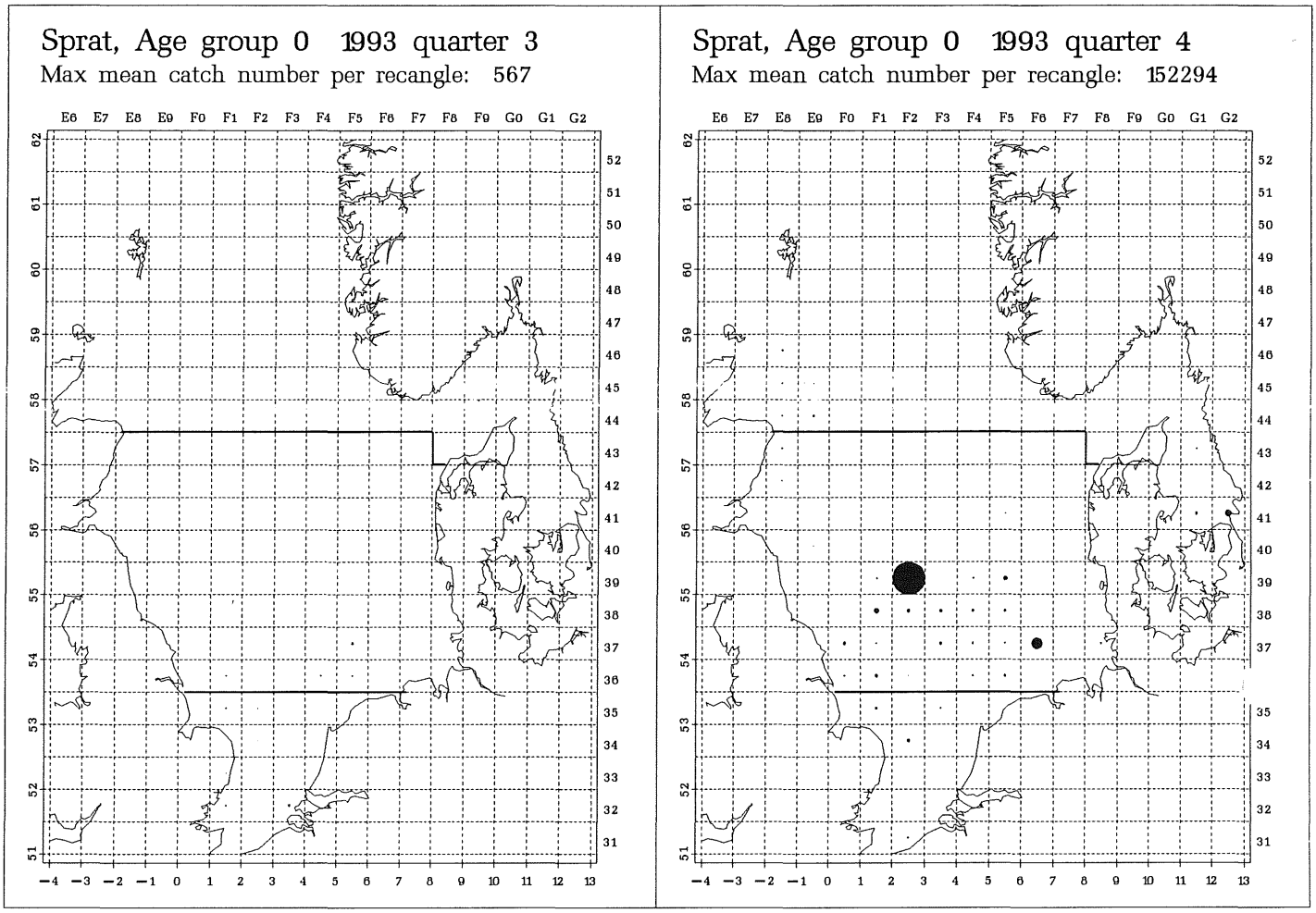

Figure 4.8 Sprat: number per hour, age-group 0.

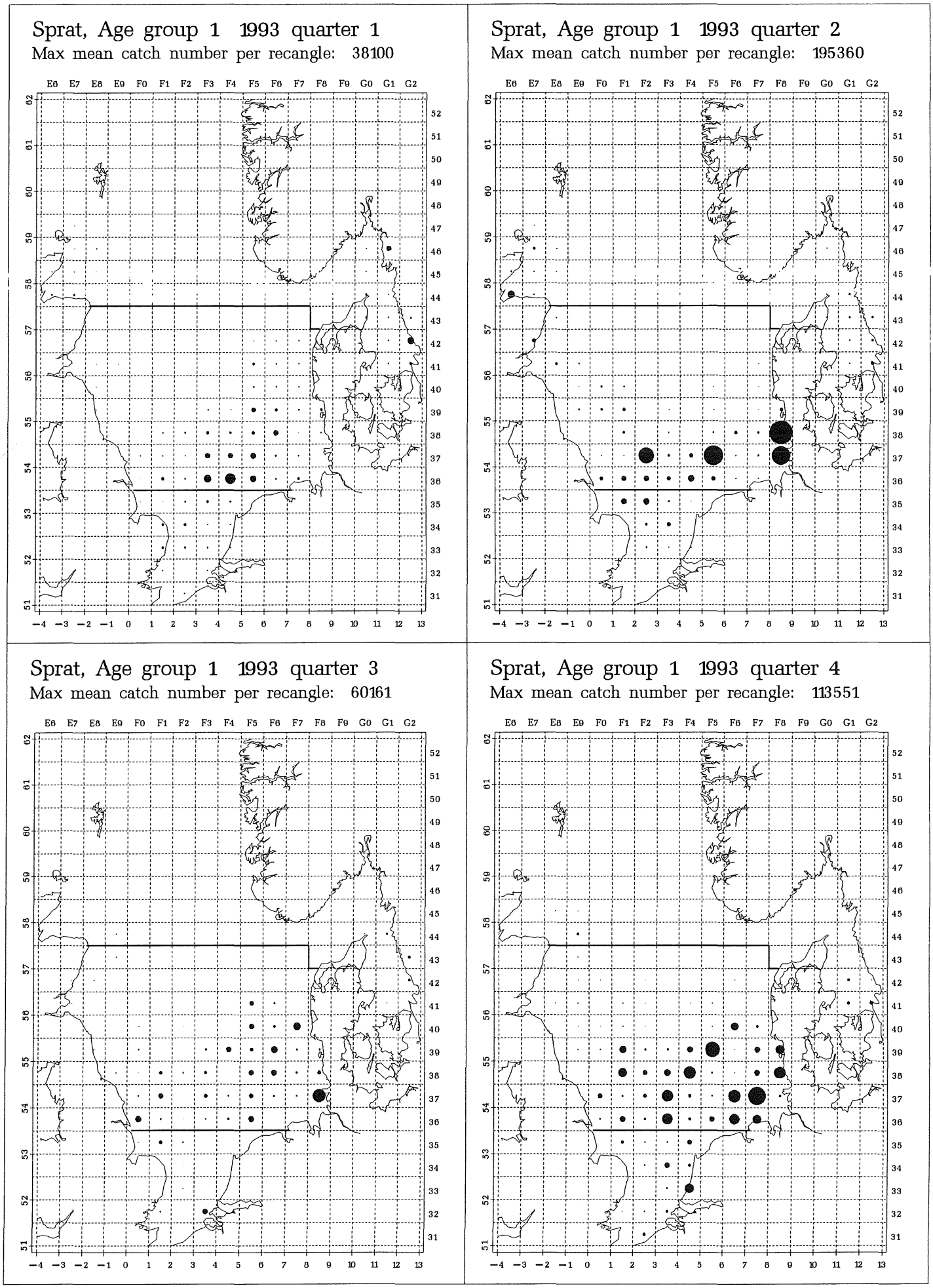

Figure 4.9 Sprat: number per hour, age-group 1.

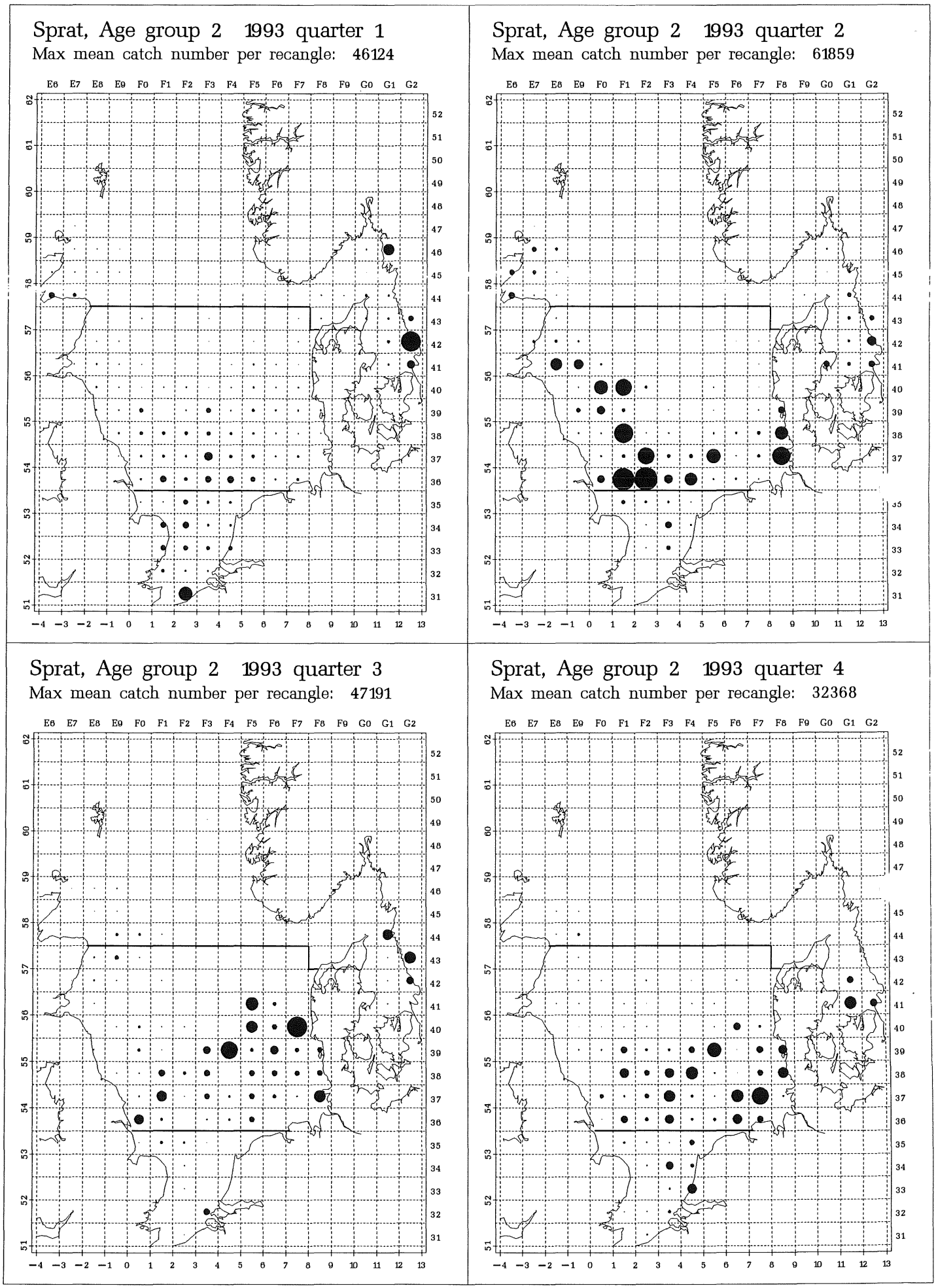

Figure 4.10 Sprat: number per hour, age-group 2.

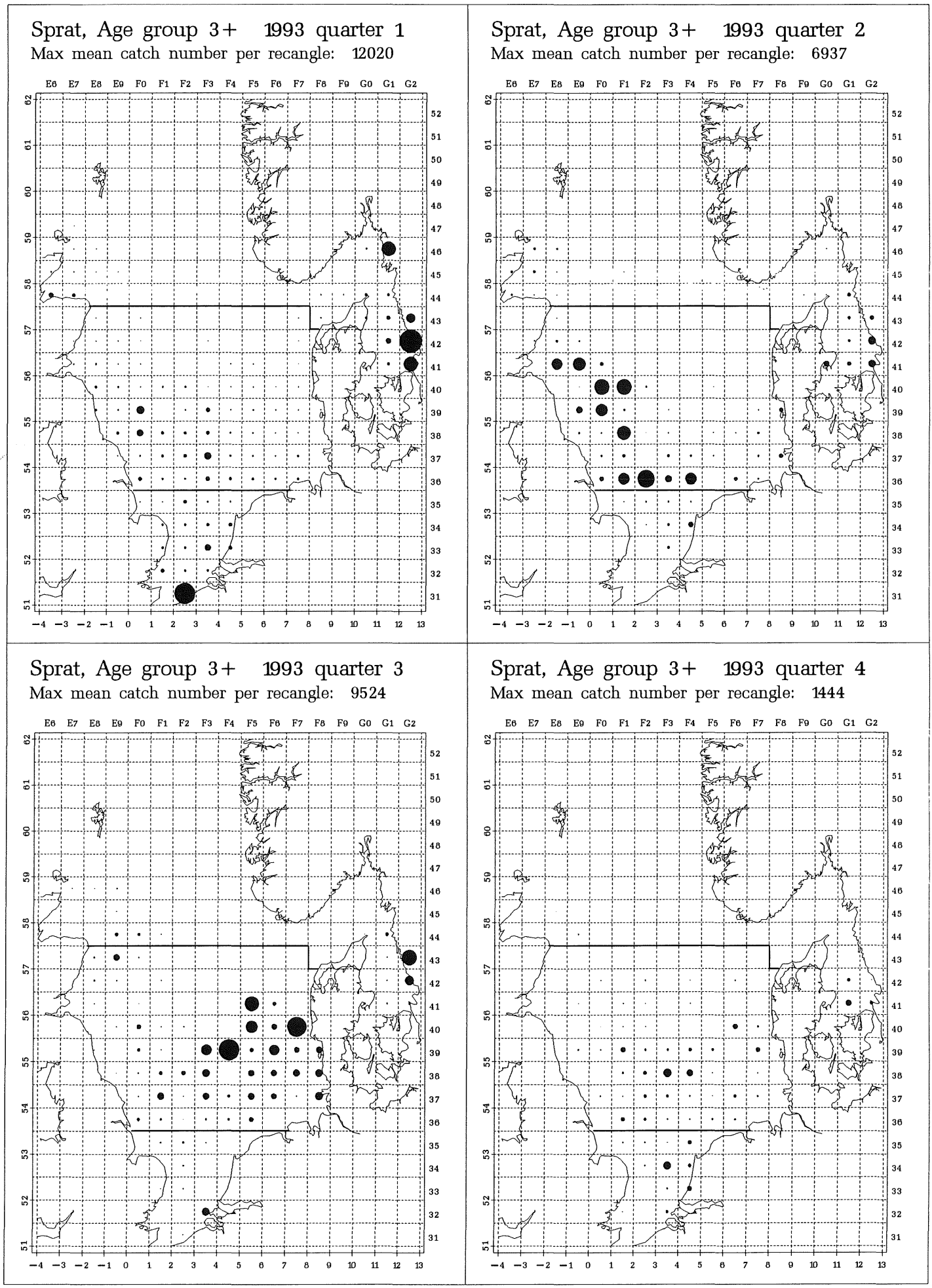

Figure 4.11 Sprat: number per hour, age-group 3+.

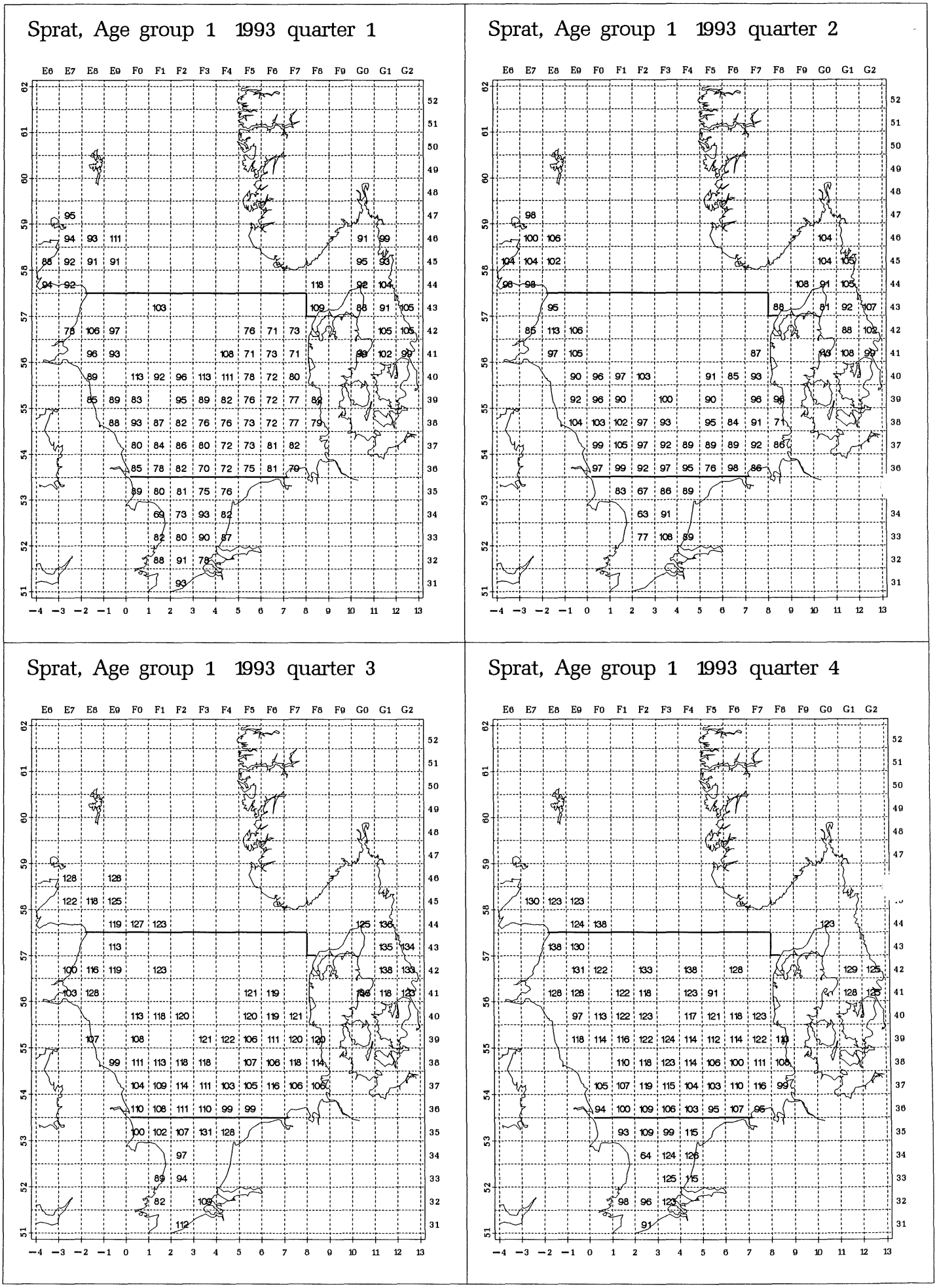

Figure 4.12 Sprat: mean length (mm), age-group 1.

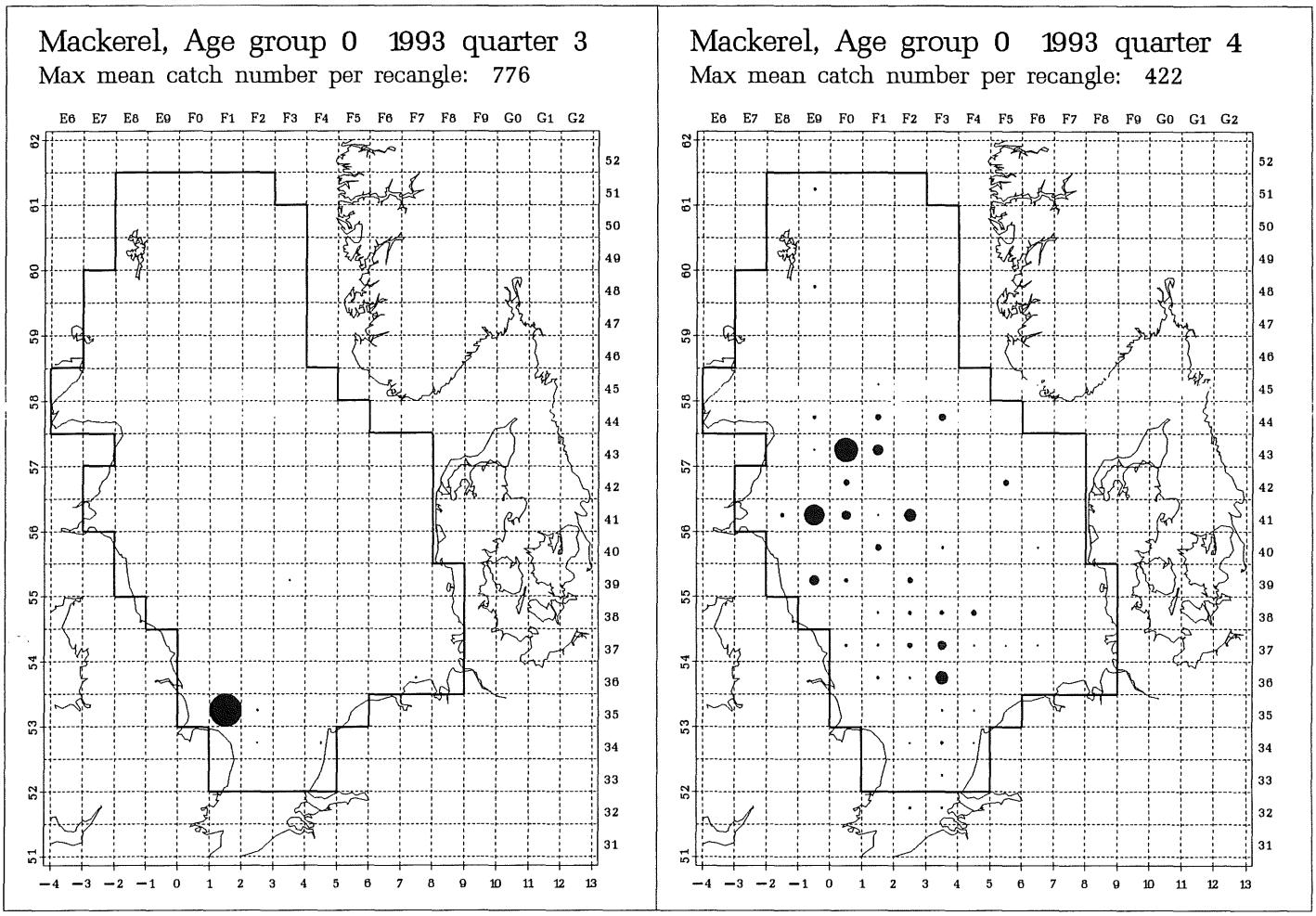

Figure 4.13 Mackerel: number per hour, age-group 0.

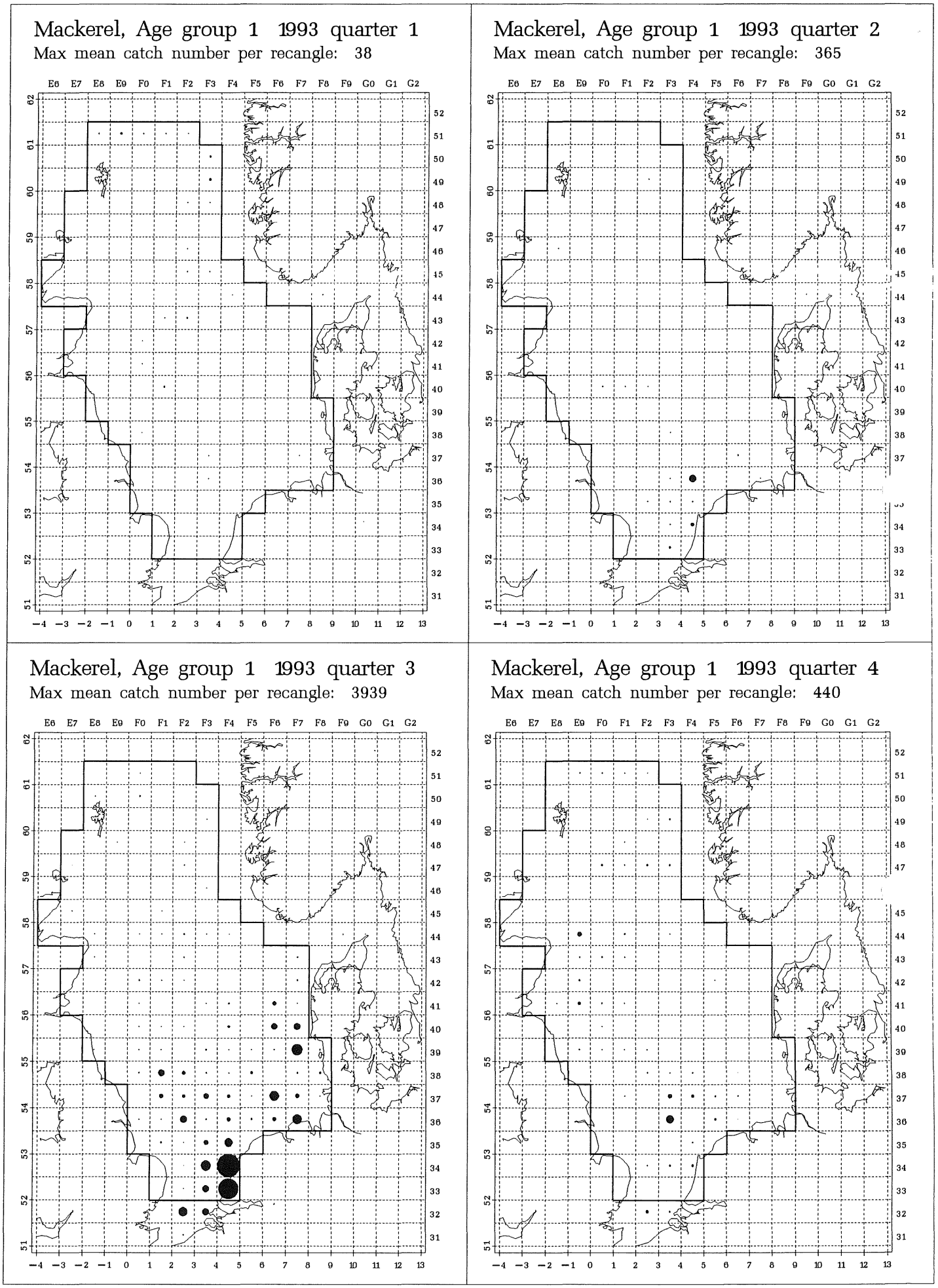

Figure 4.14 Mackerel: number per hour, age-group 1.

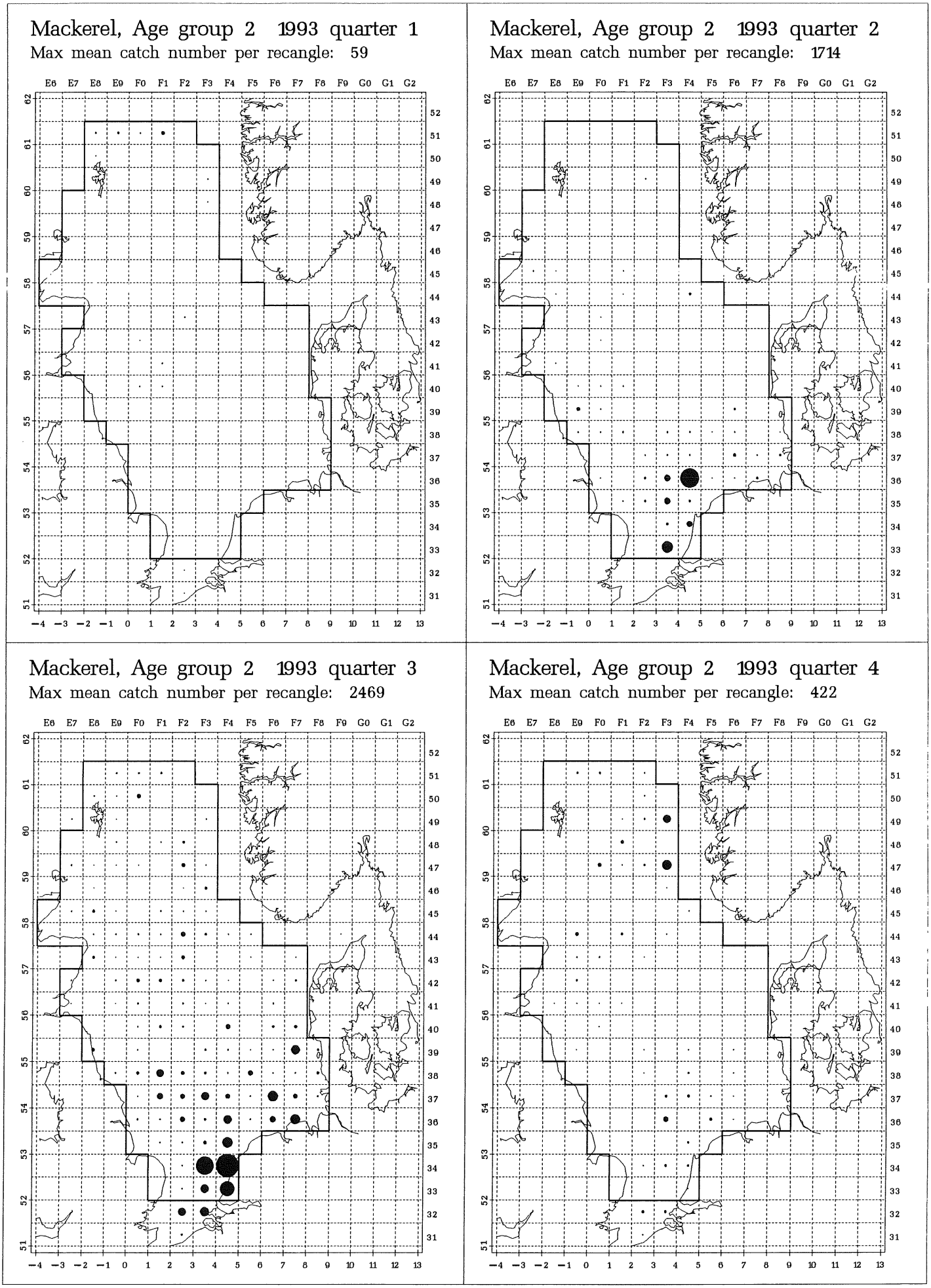

Figure 4.15 Mackerel: number per hour, age-group 2.

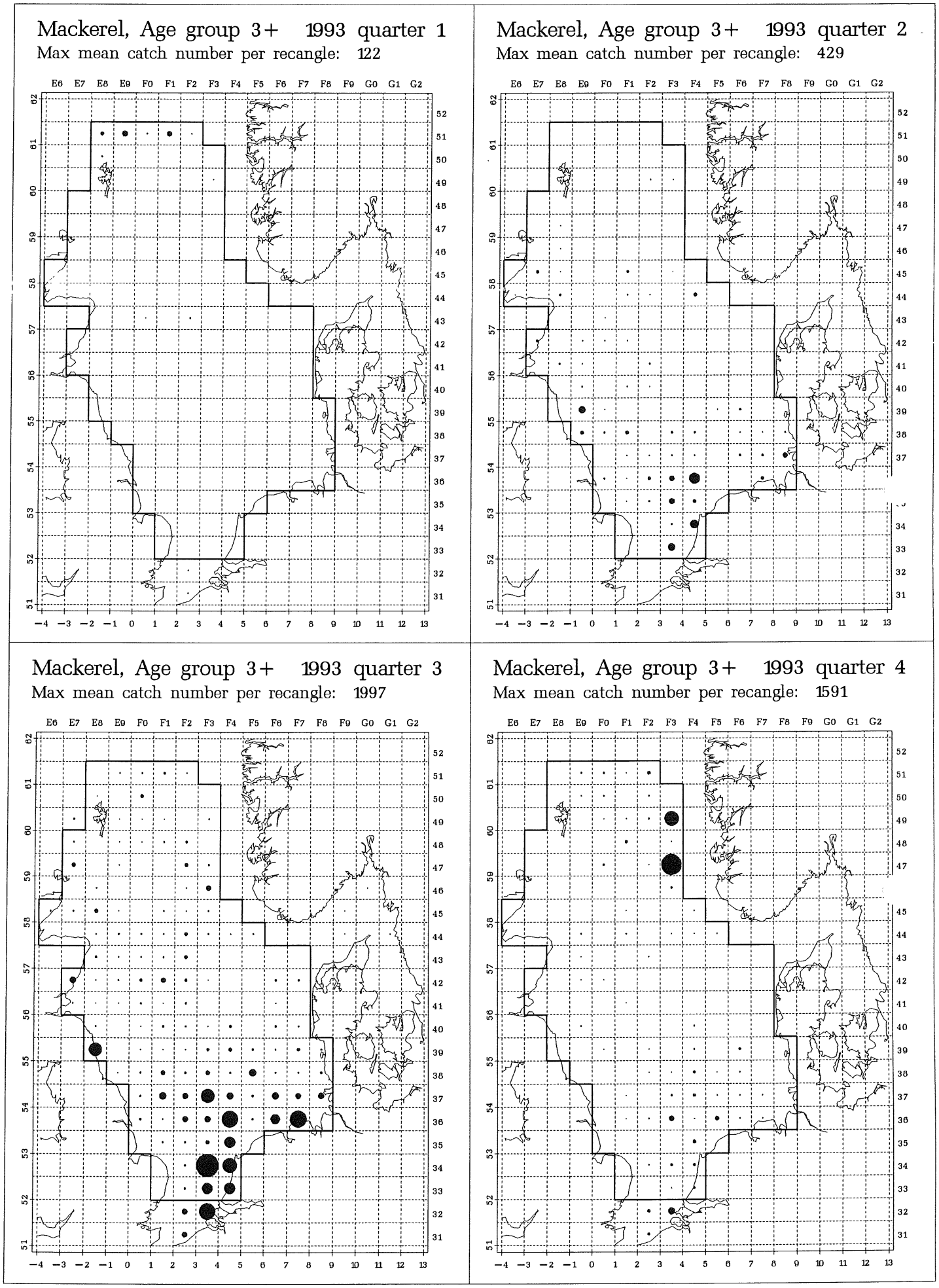

Figure 4.16 Mackerel: number per hour, age-group 3+.

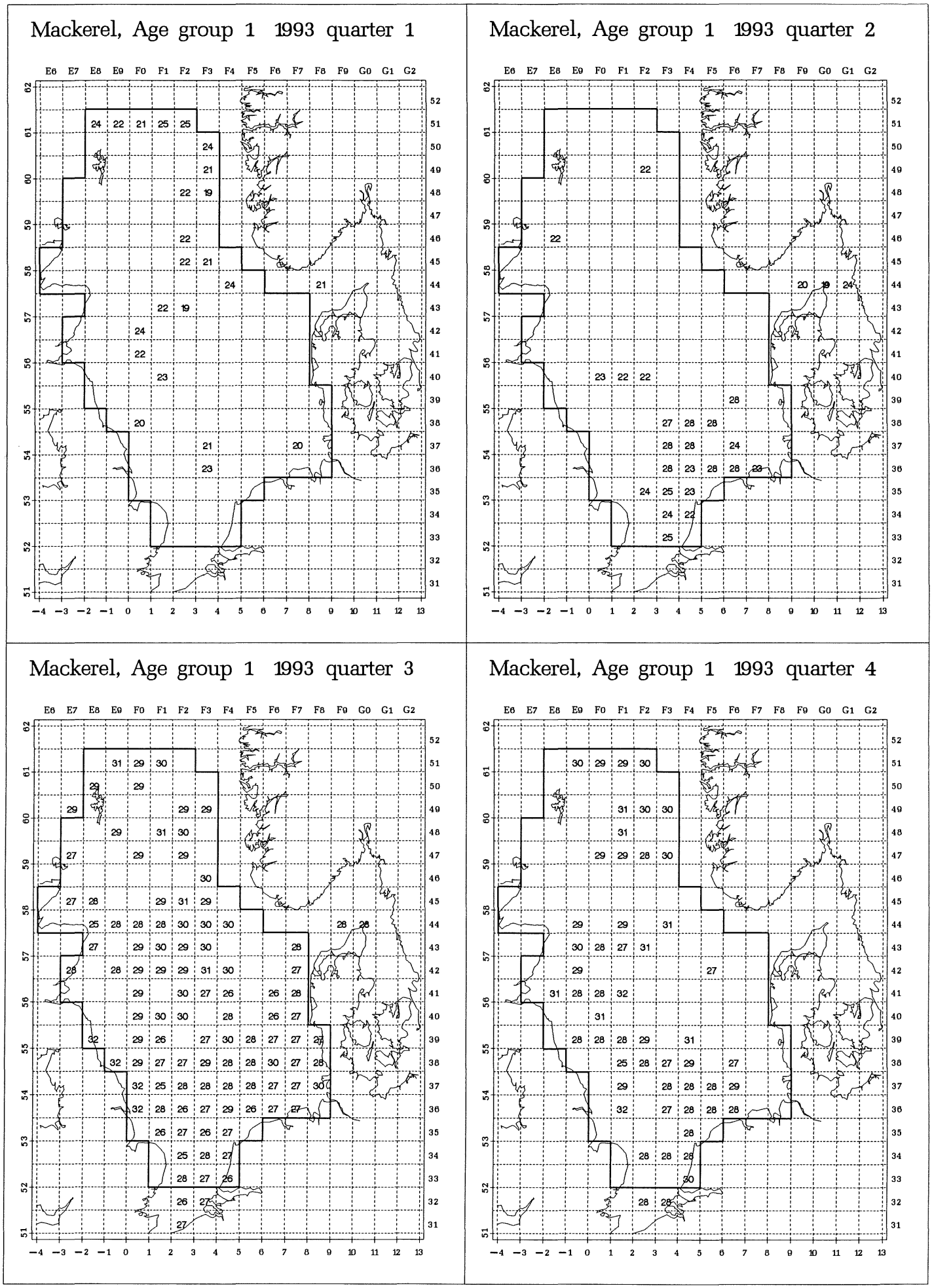

Figure 4.17 Mackerel: mean length (cm below), age-group 1.

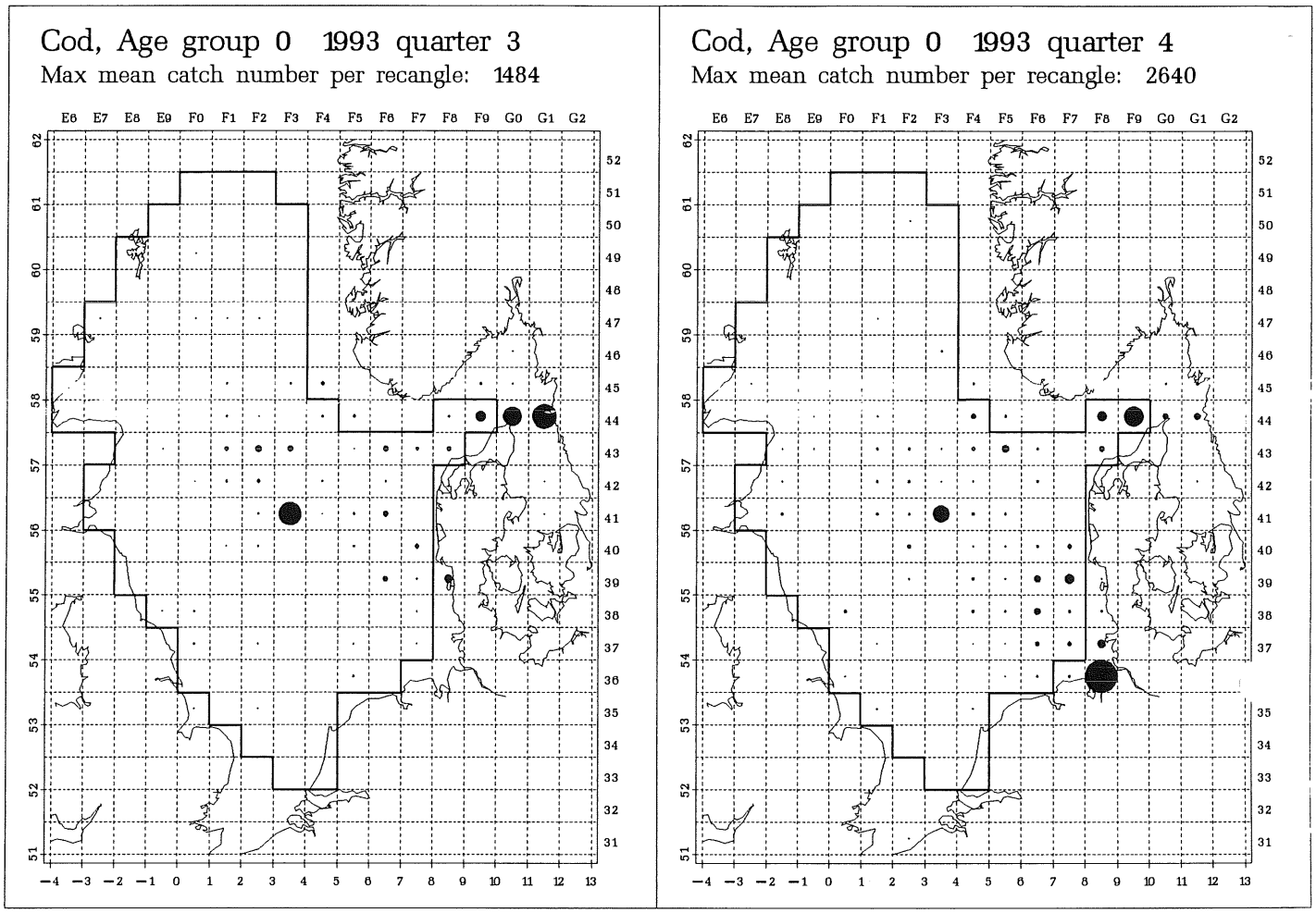

Figure 4.18 Cod: number per hour, age-group 0.

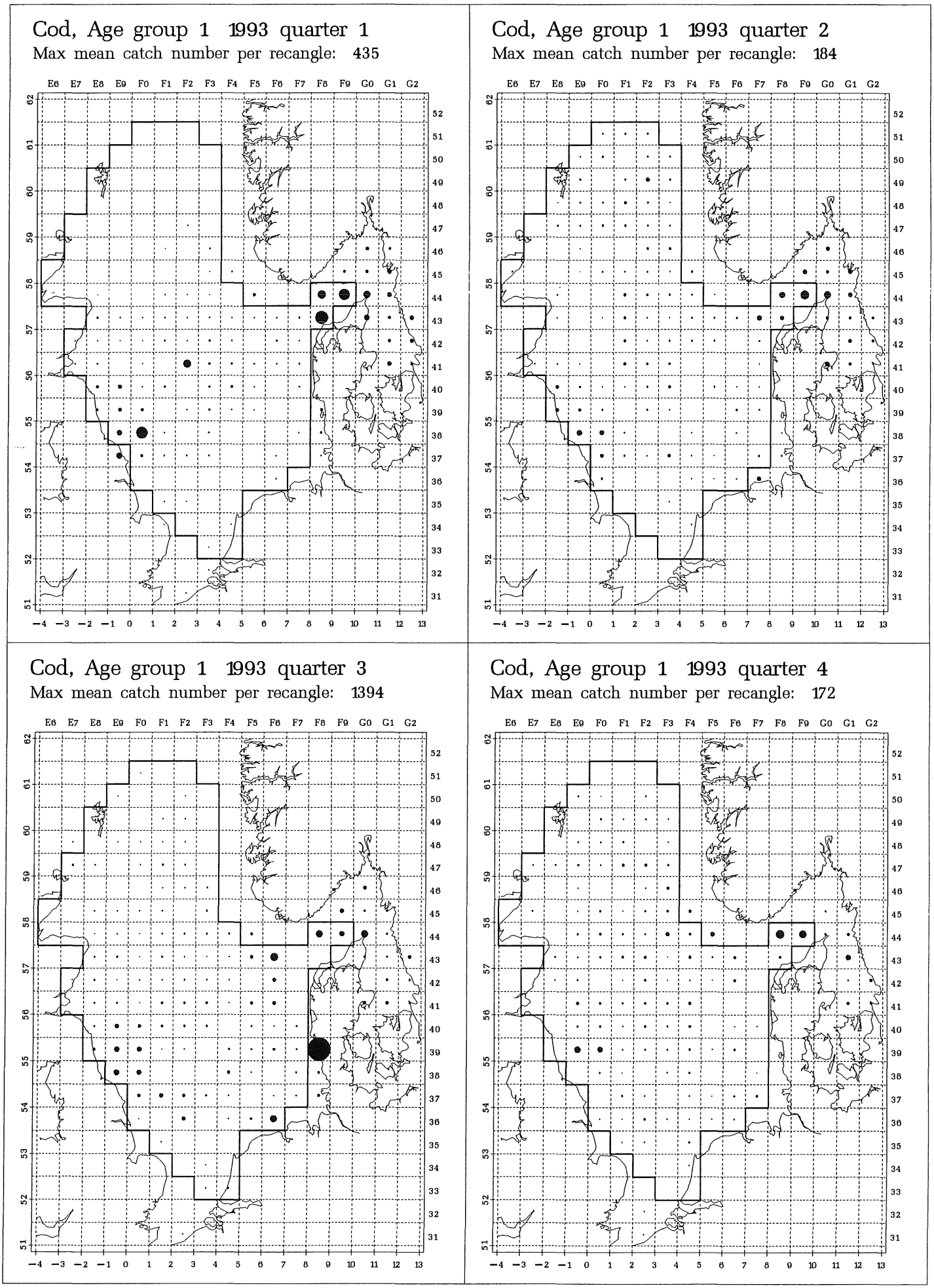

Figure 4.19 Cod: number per hour, age-group 1.

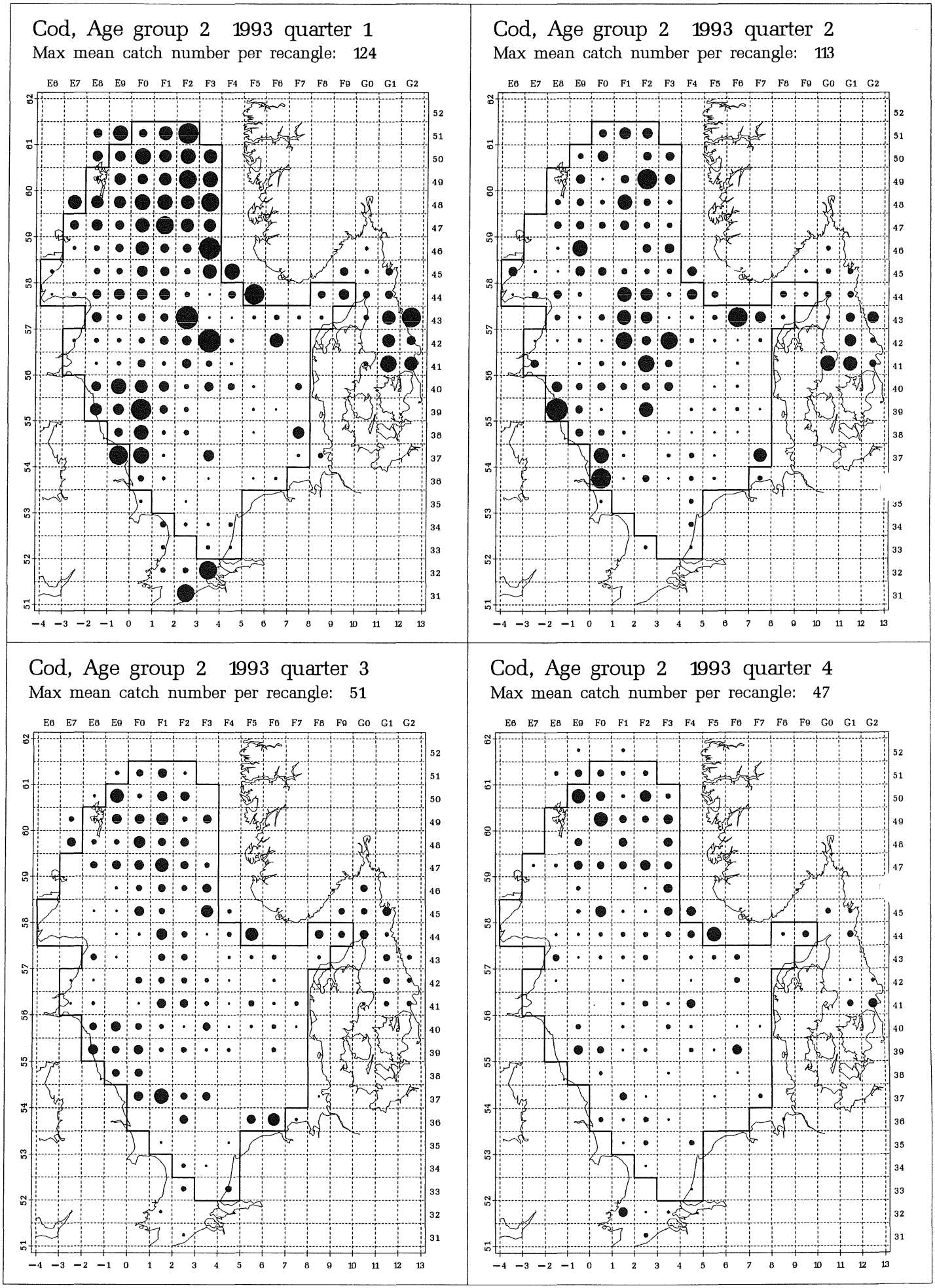

Figure 4.20 Cod: number per hour, age-group 2.

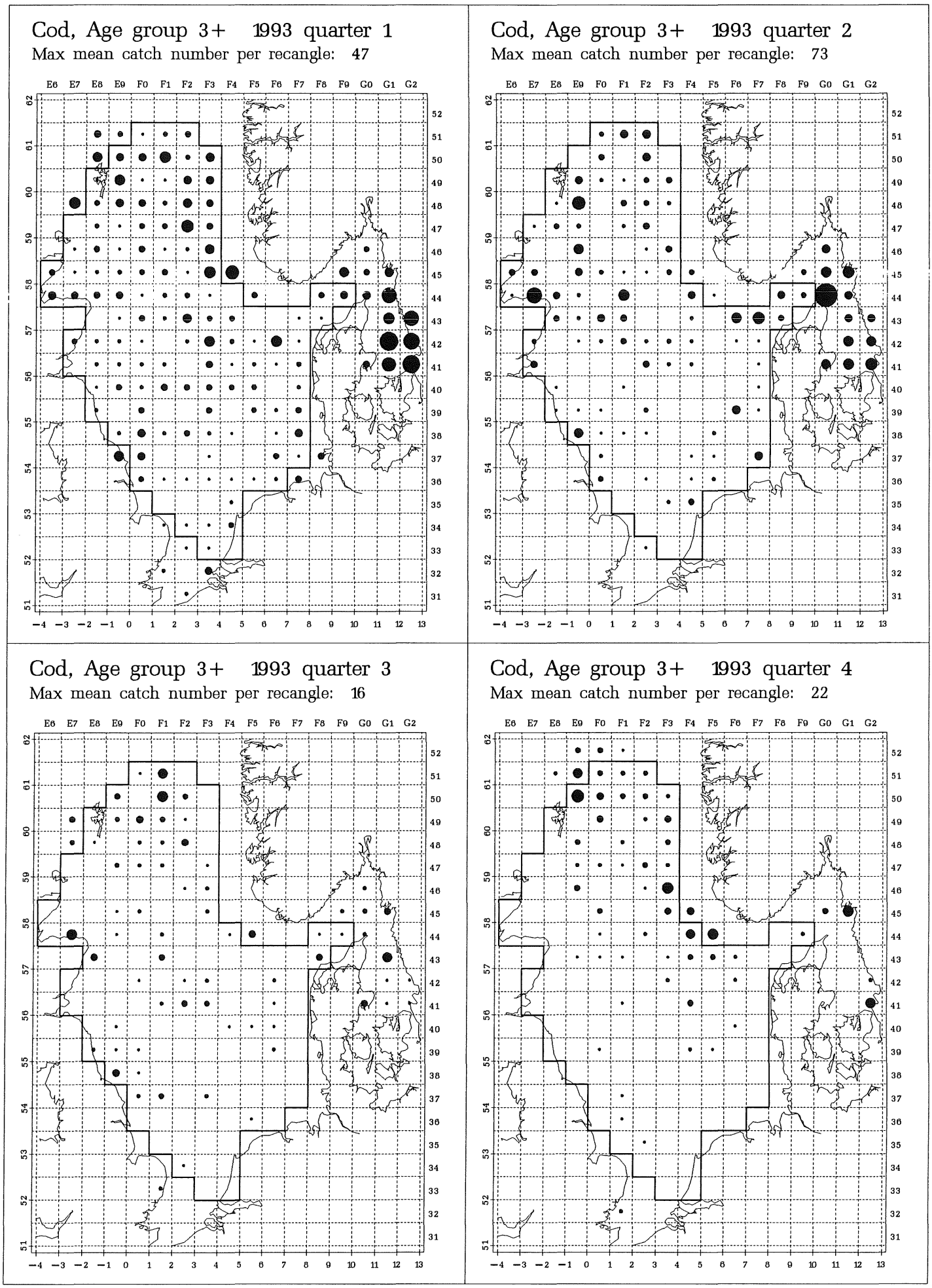

Figure 4.21 Cod: number per hour, age-group 3+.

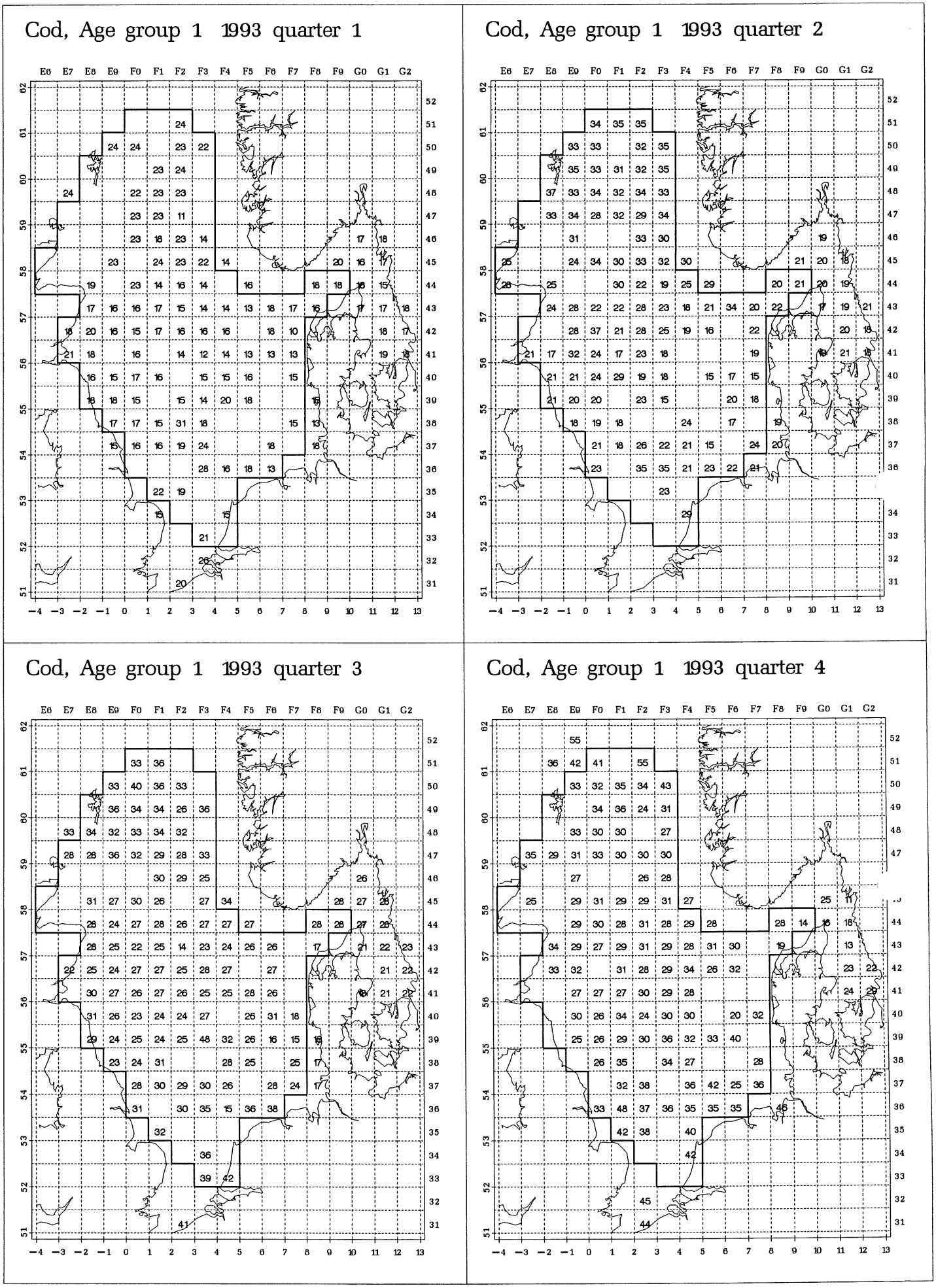

Figure 4.22 Cod: mean length (cm below), age-group 1.

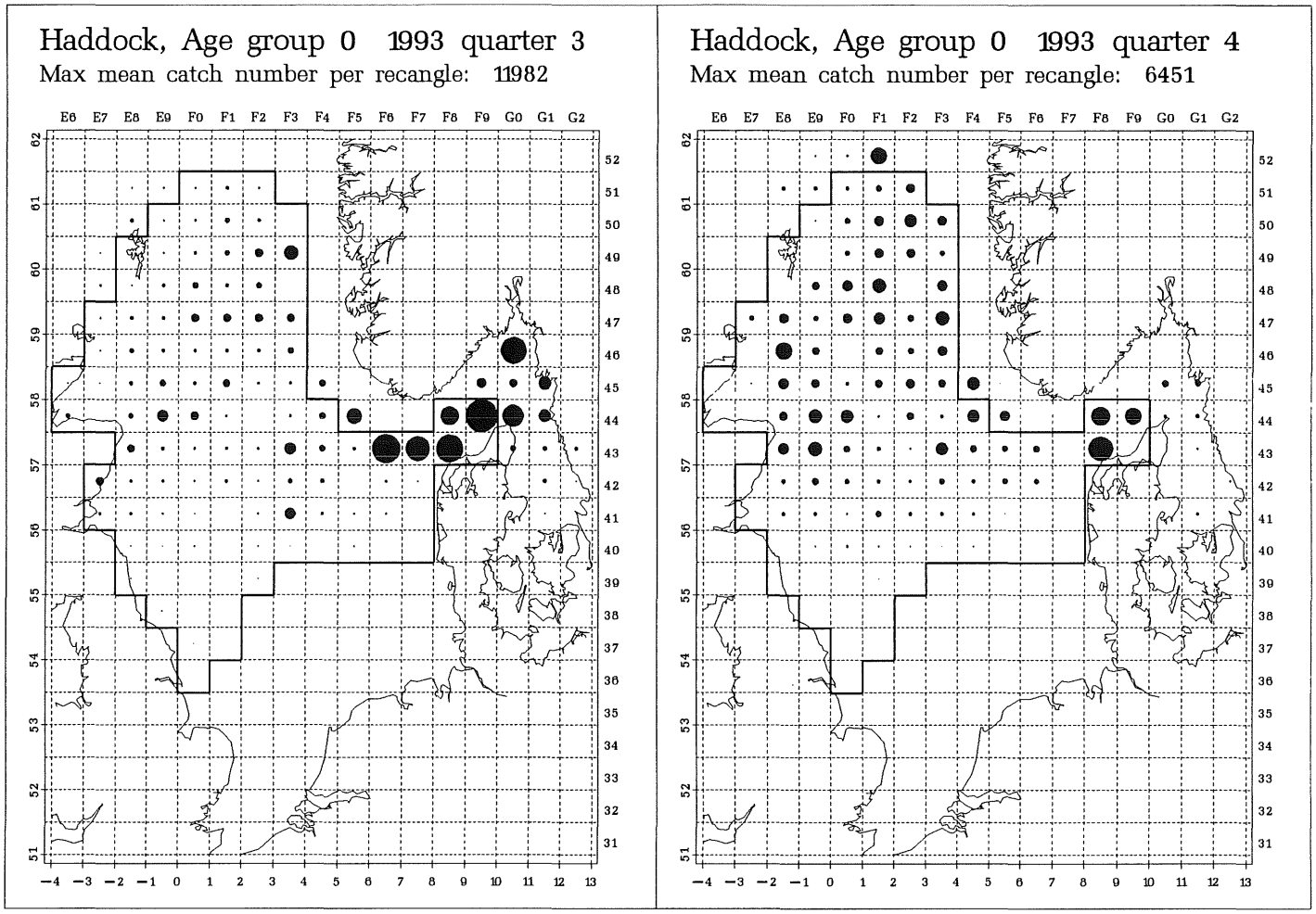

Figure 4.23 Haddock: number per hour, age-group 0.

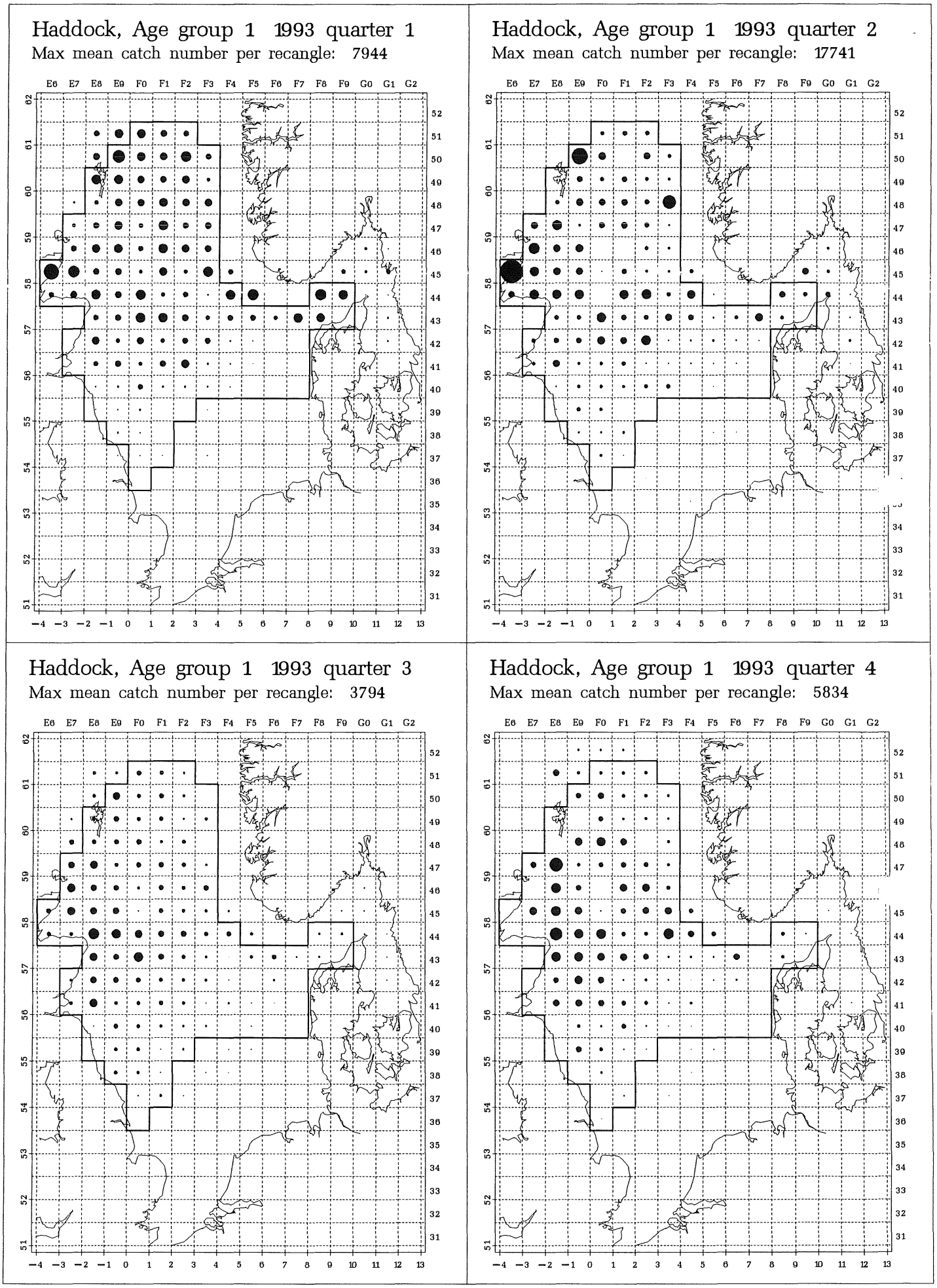

Figure 4.24 Haddock: number per hour, age-group 1.

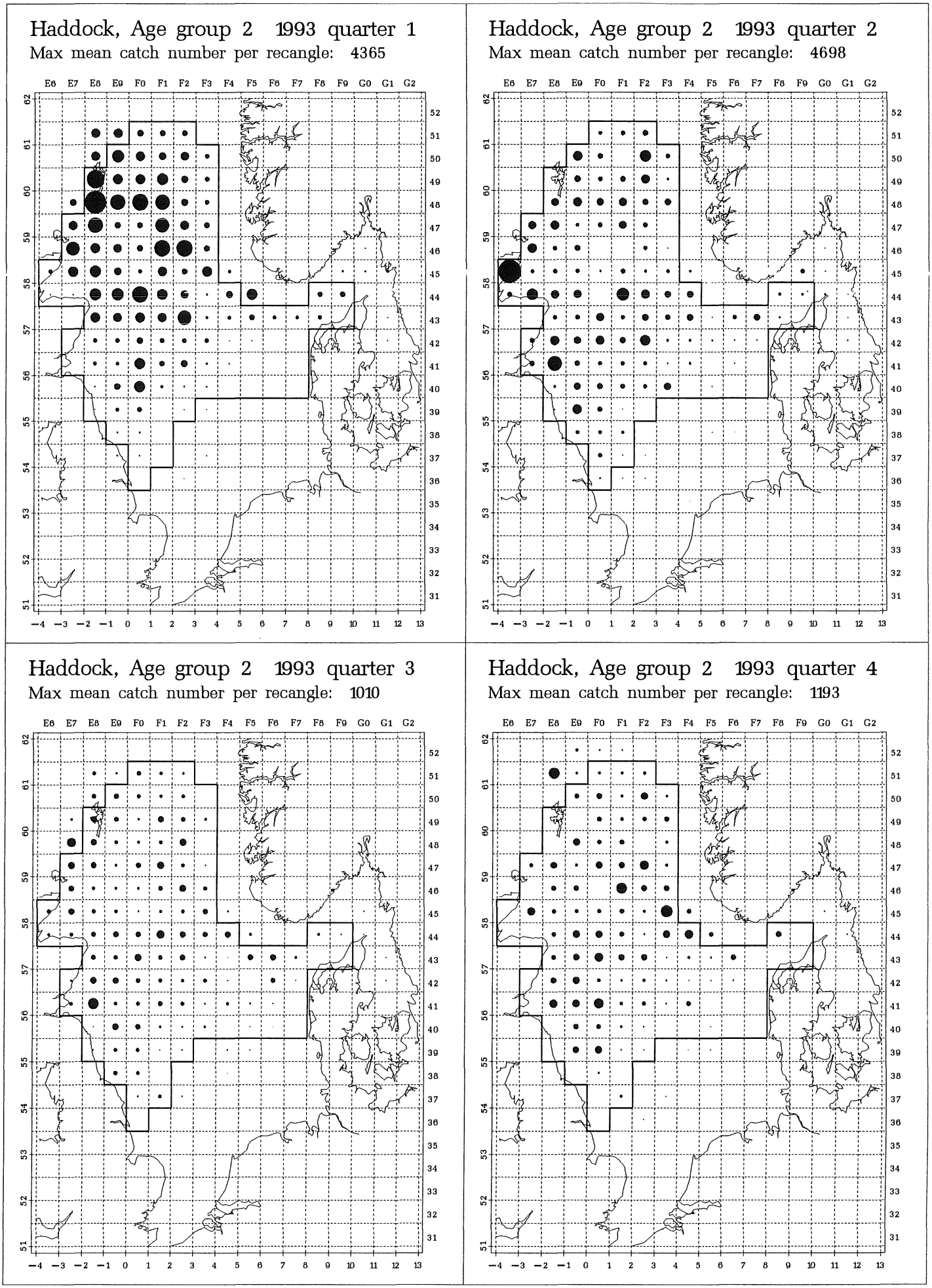

Figure 4.25 Haddock: number per hour, age-group 2.

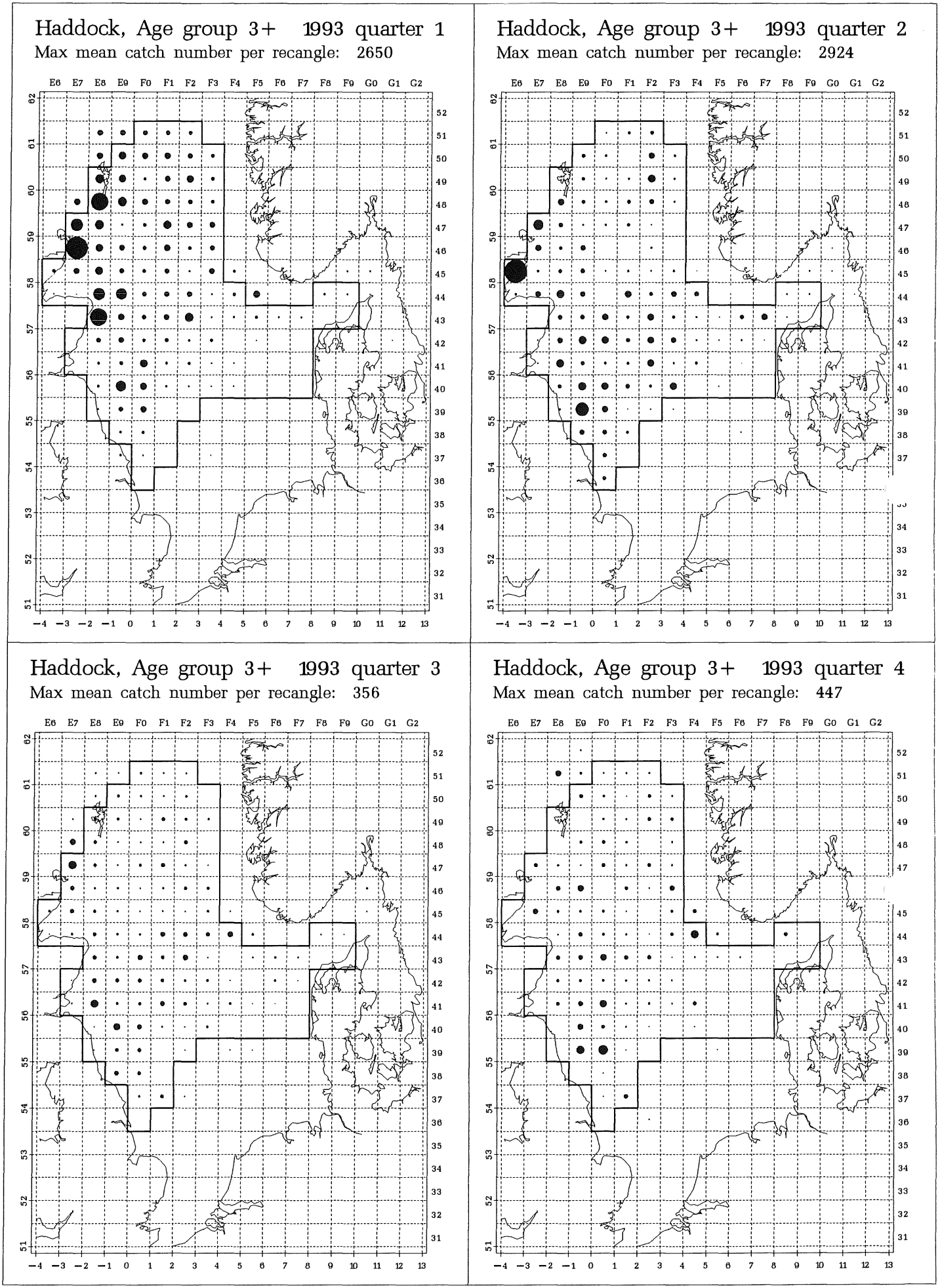

Figure 4.26 Haddock: number per hour, age-group 3+.

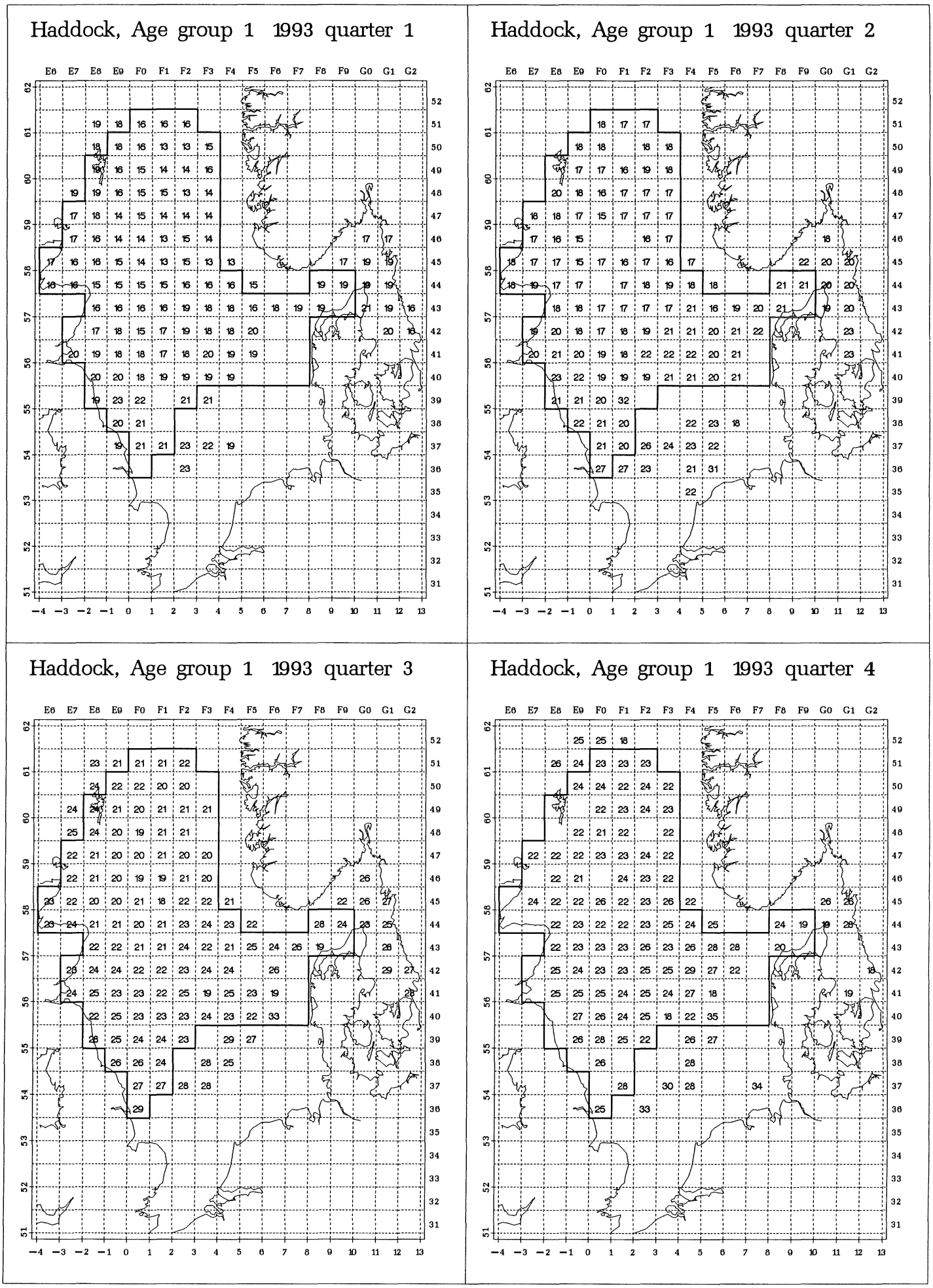

Figure 4.27 Haddock: mean length (cm below), age-group 1.

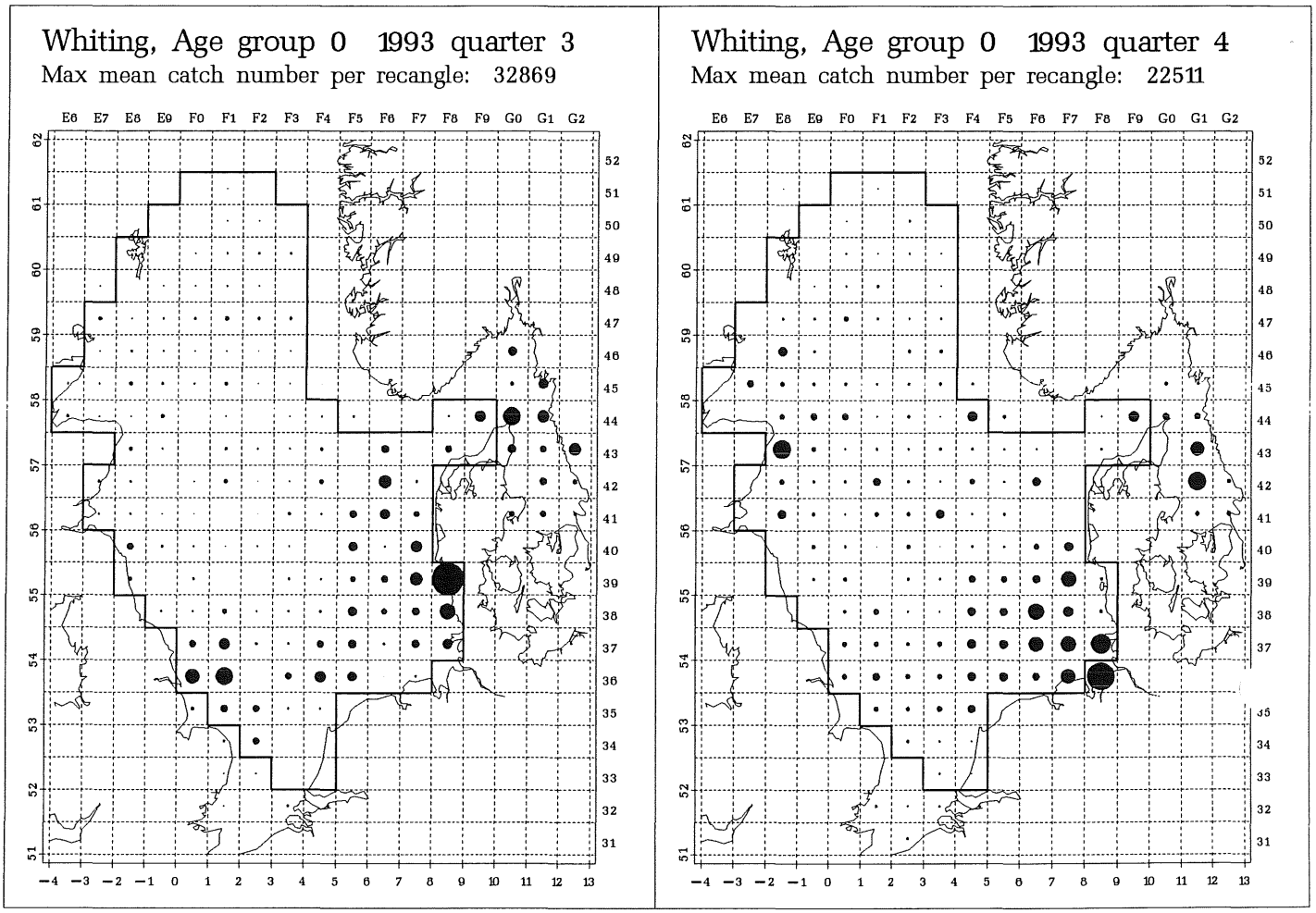

Figure 4.28 Whiting: number per hour, age-group 0.

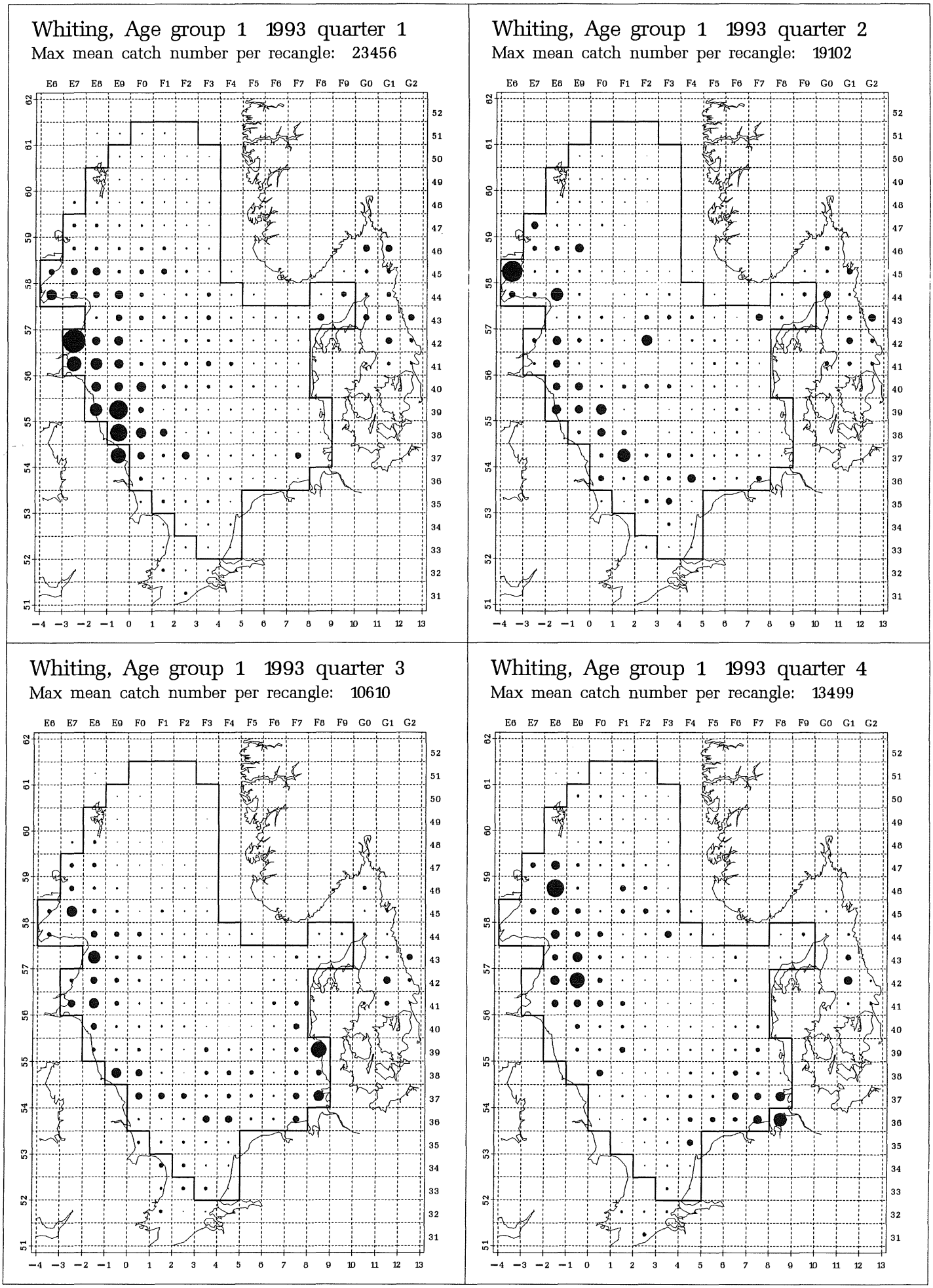

Figure 4.29 Whiting: number per hour, age-group 1.

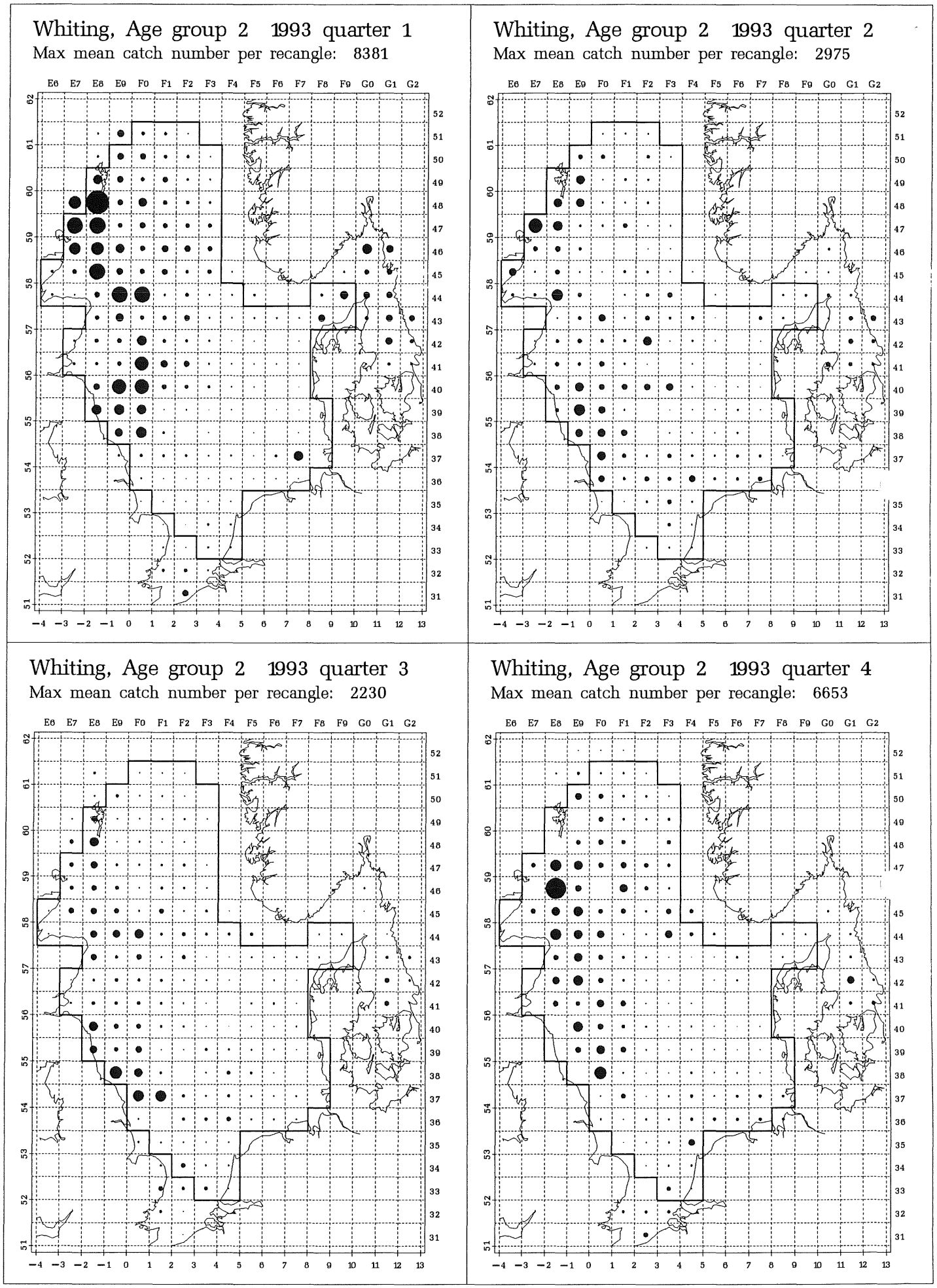

Figure 4.30 Whiting: number per hour, age-group 2.

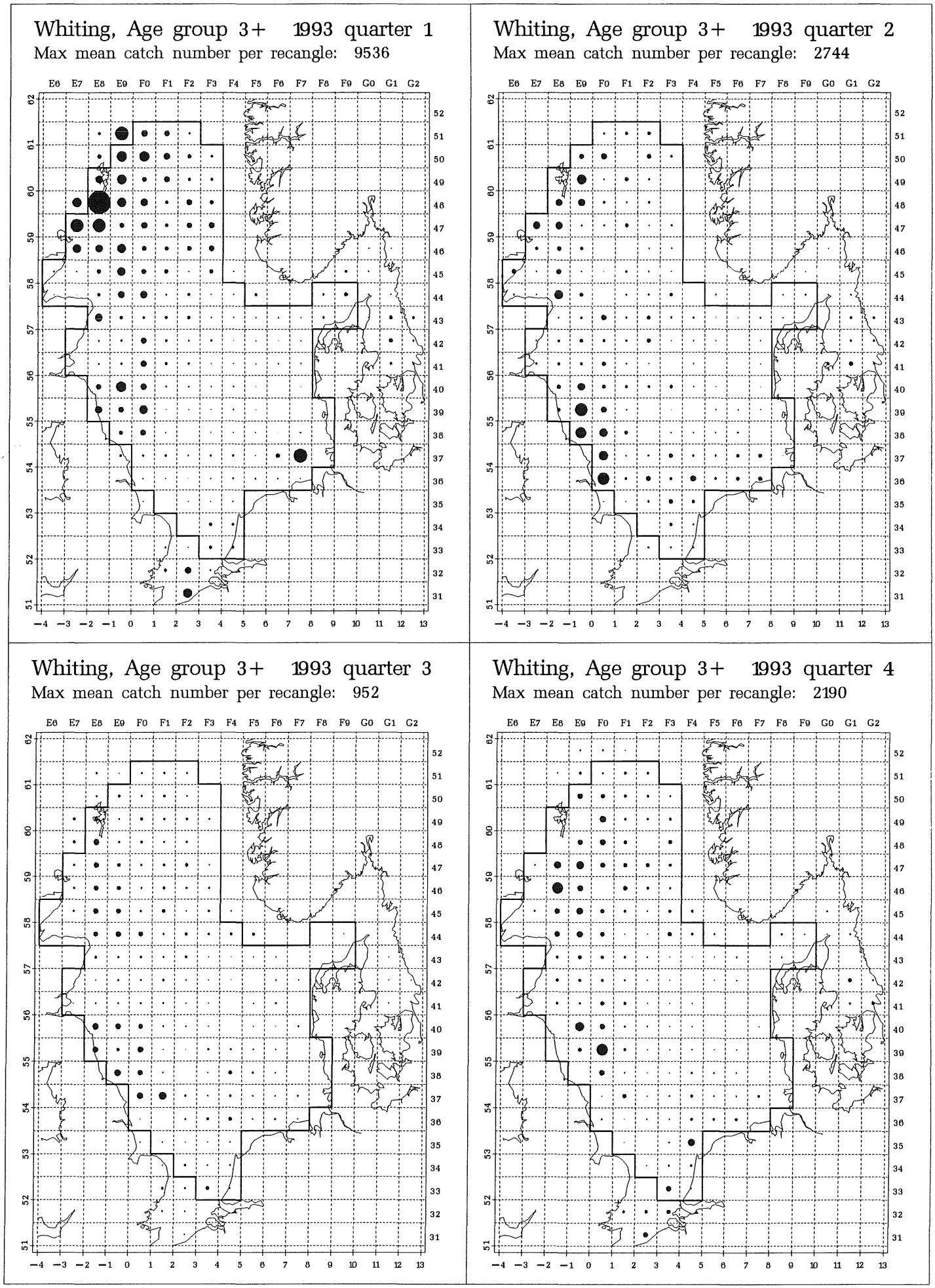

Figure 4.31 Whiting: number per hour, age-group 3+.

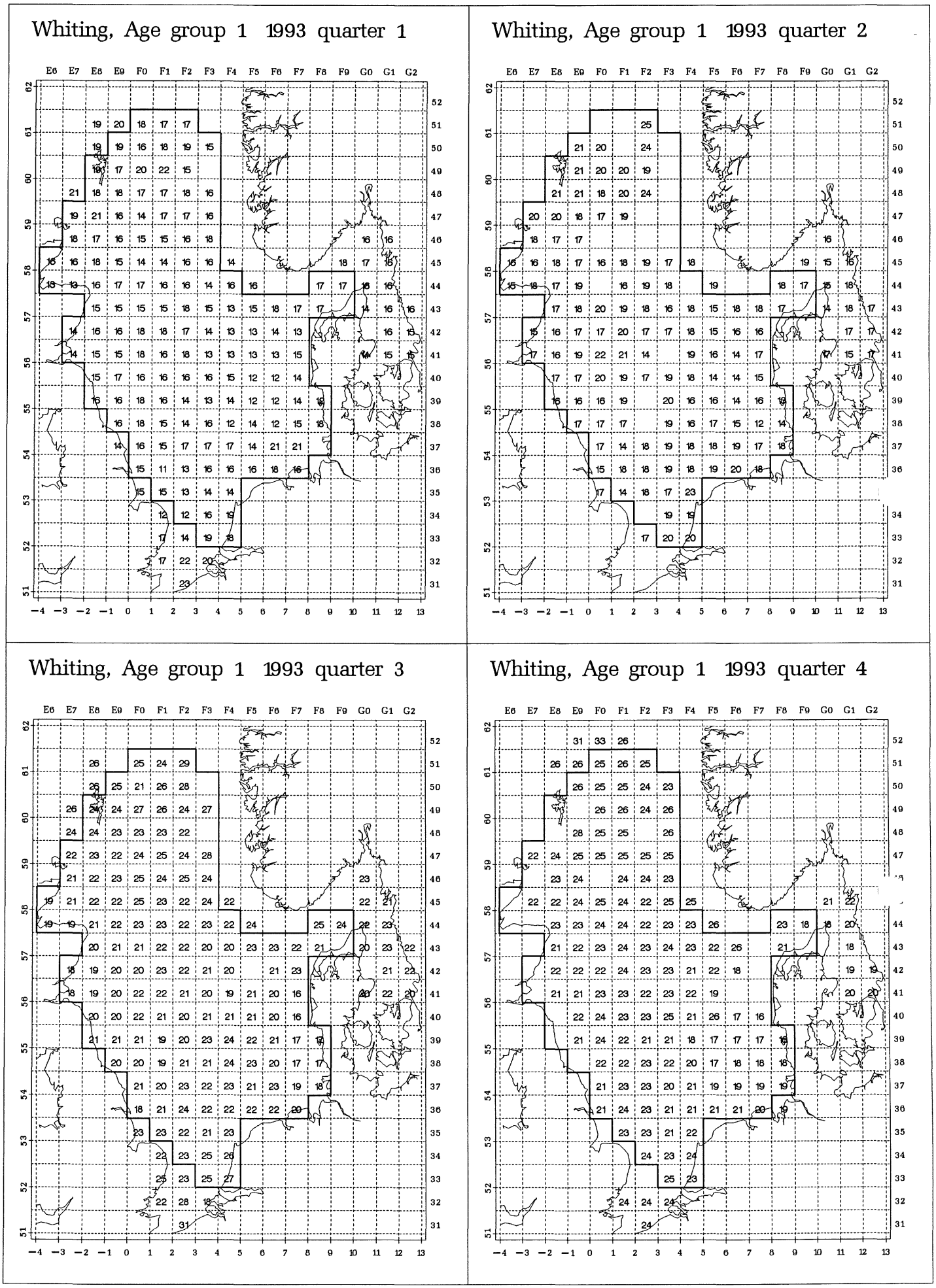

Figure 4.32 Whiting: mean length (cm below), age-group 1.

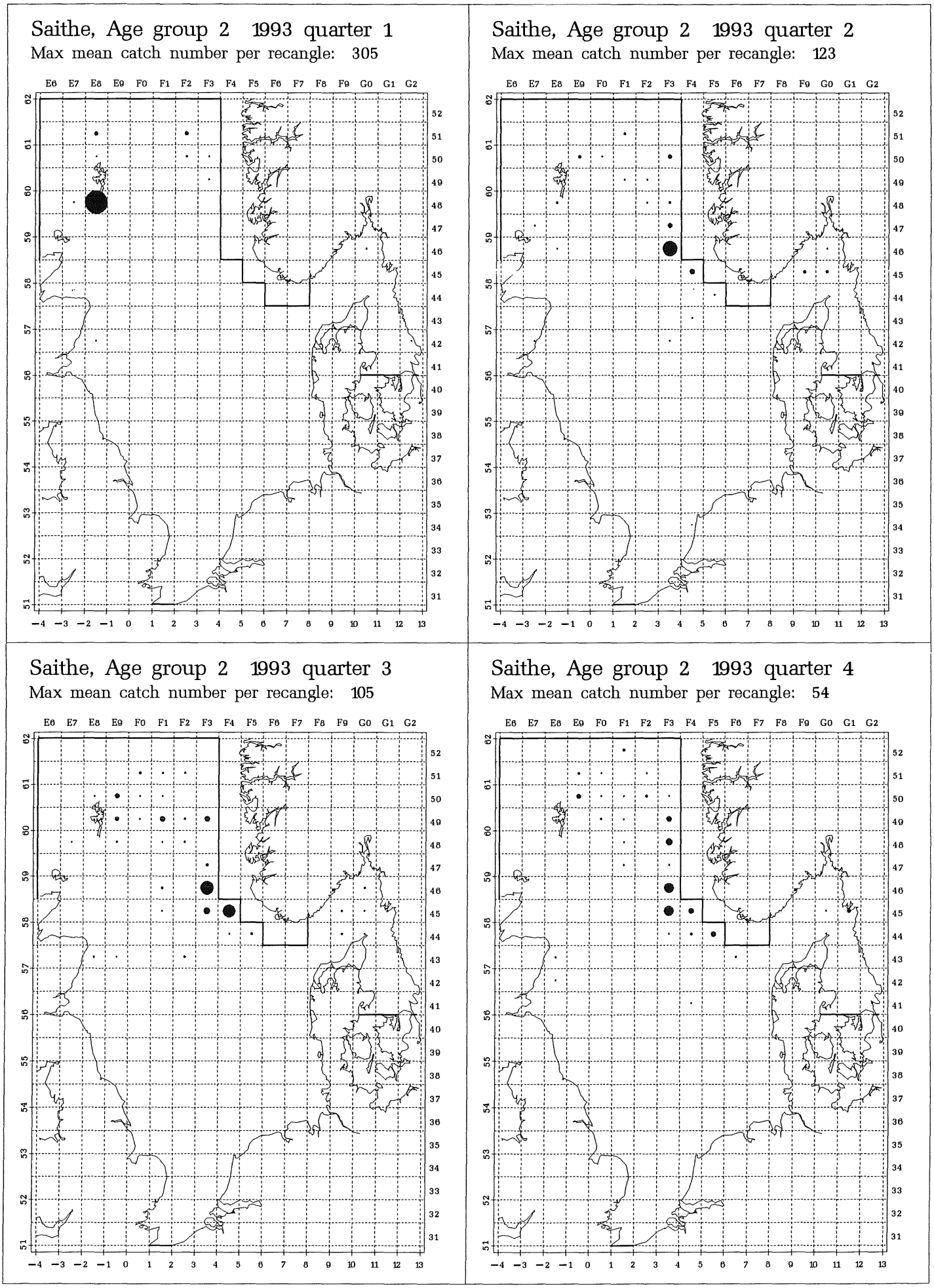

Figure 4.33 Saithe: number per hour, age-group 2.

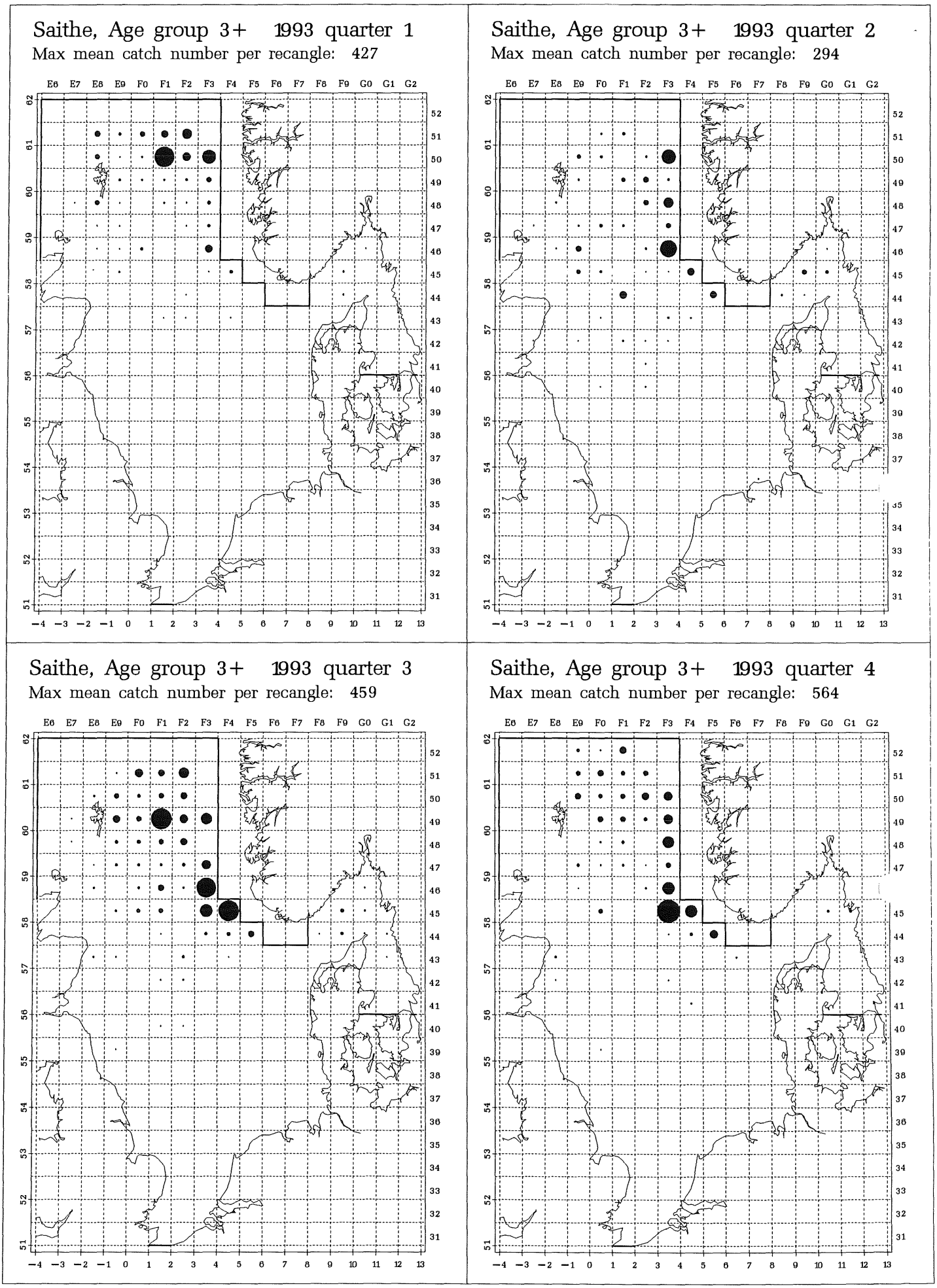

Figure 4.34 Saithe: number per hour, age-group 3+.

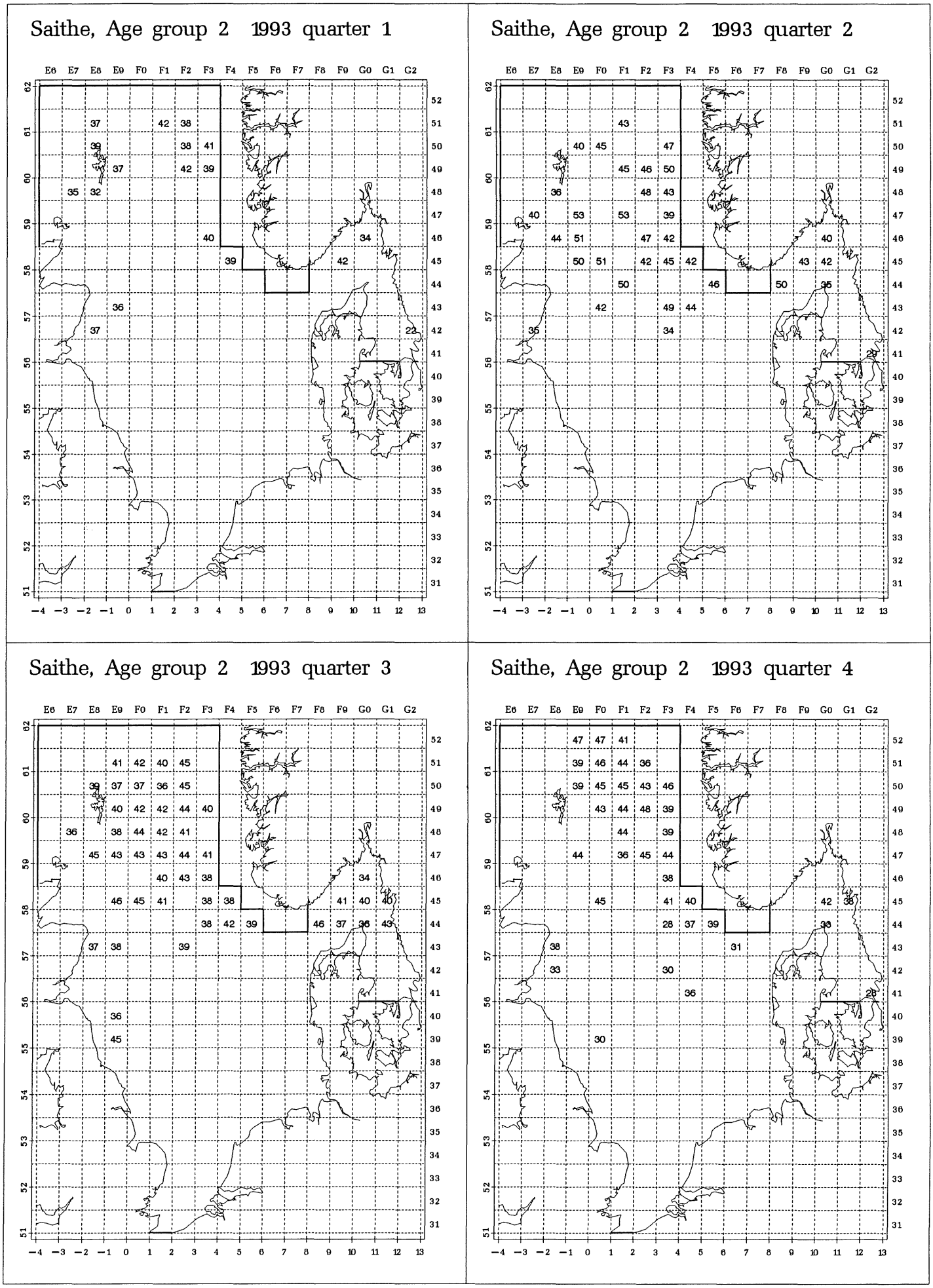

Figure 4.35 Saithe: mean length (cm below), age-group 2.

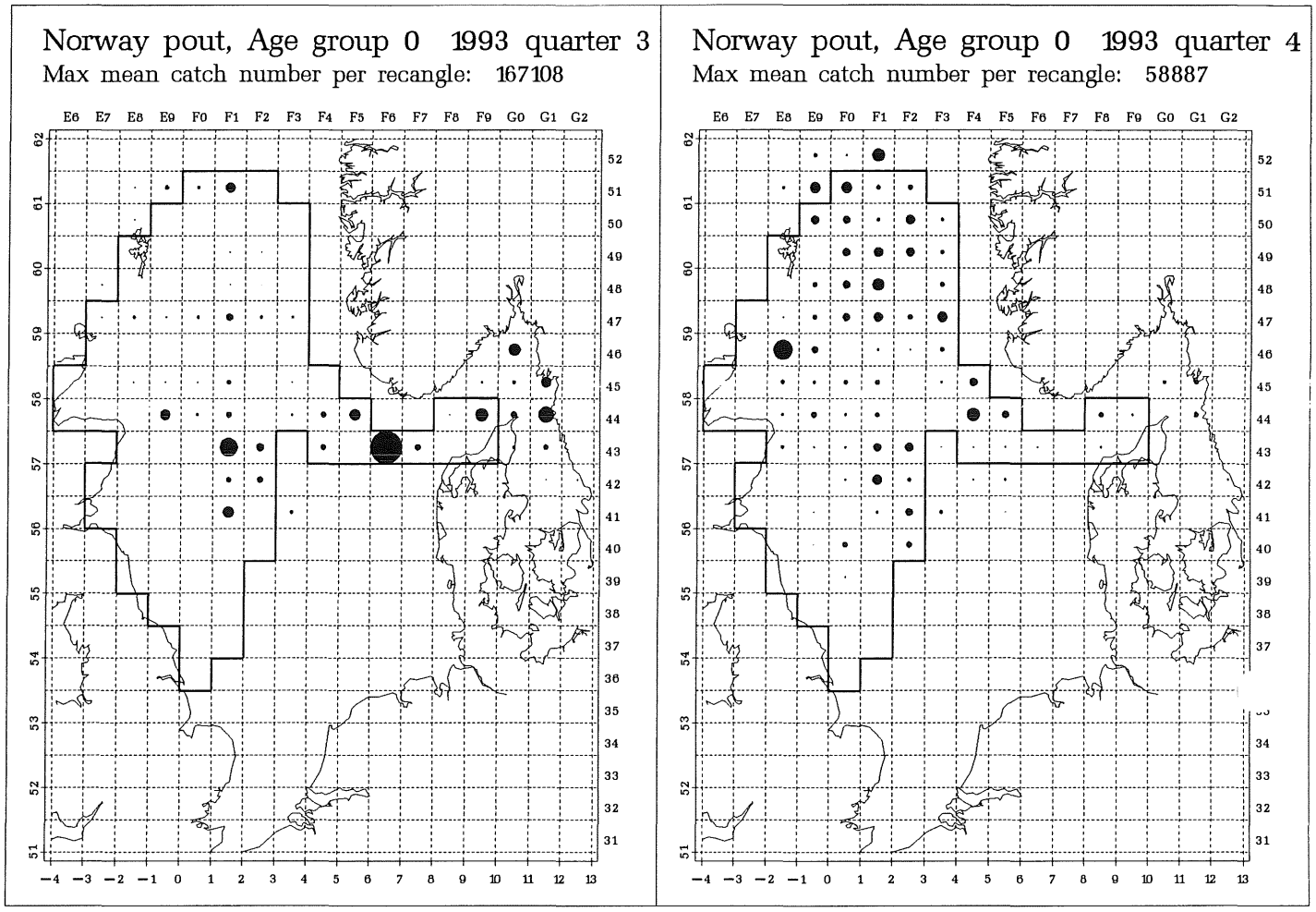

Figure 4.36 Norway pout: number per hour, age-group 0.

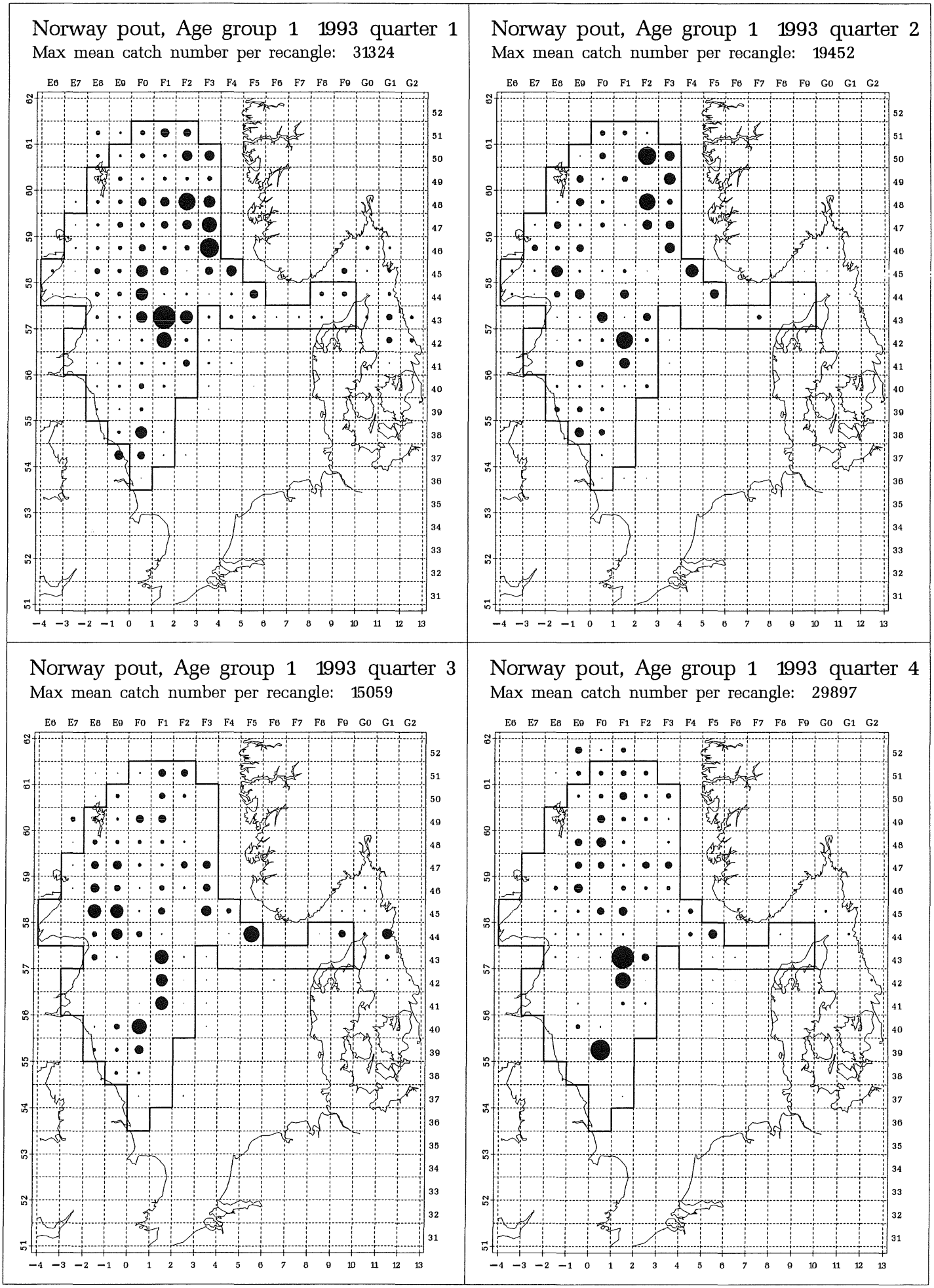

Figure 4.37 Norway pout: number per hour, age-group 1.

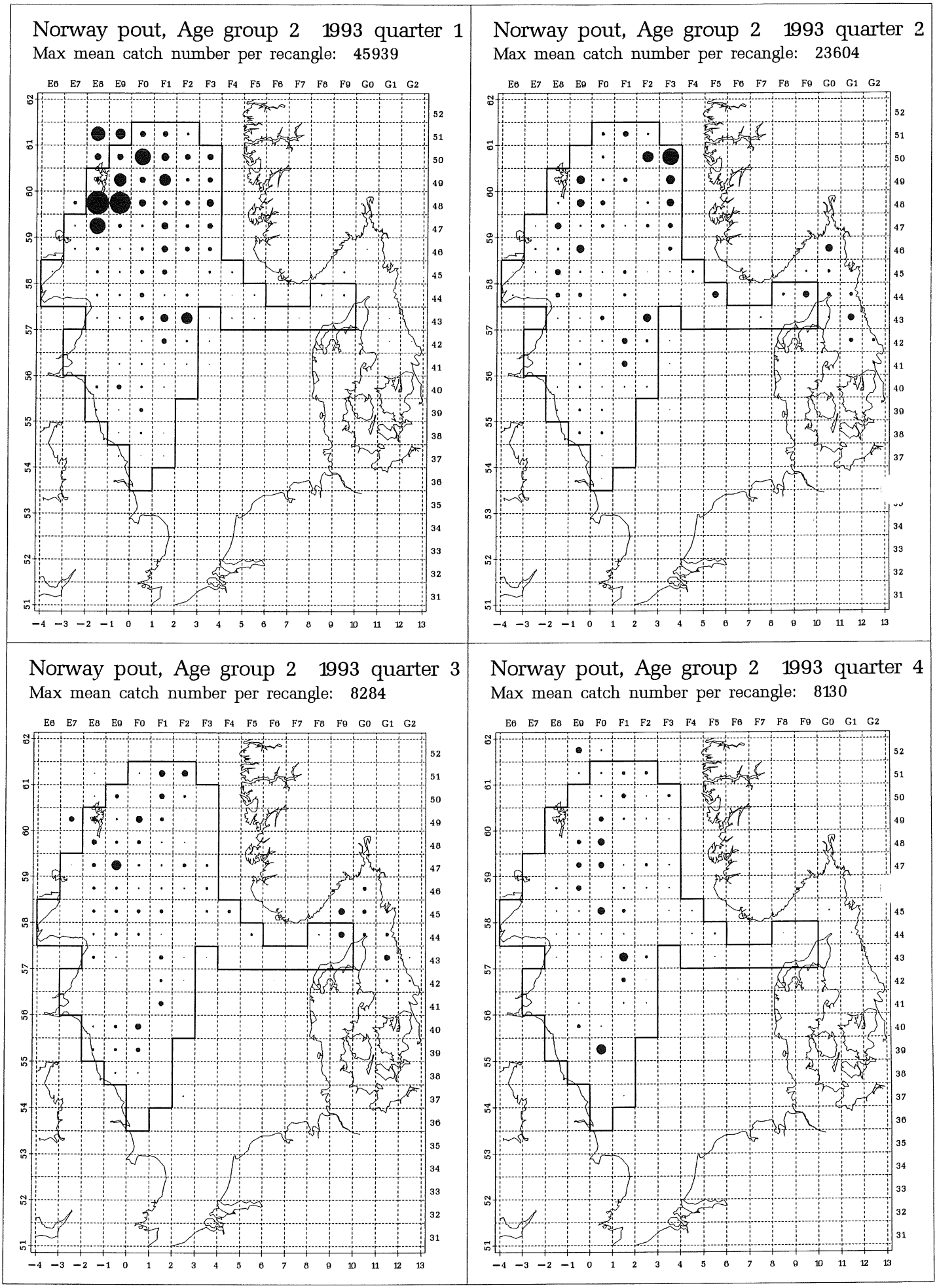

Figure 4.38 Norway pout: number per hour, age-group 2.

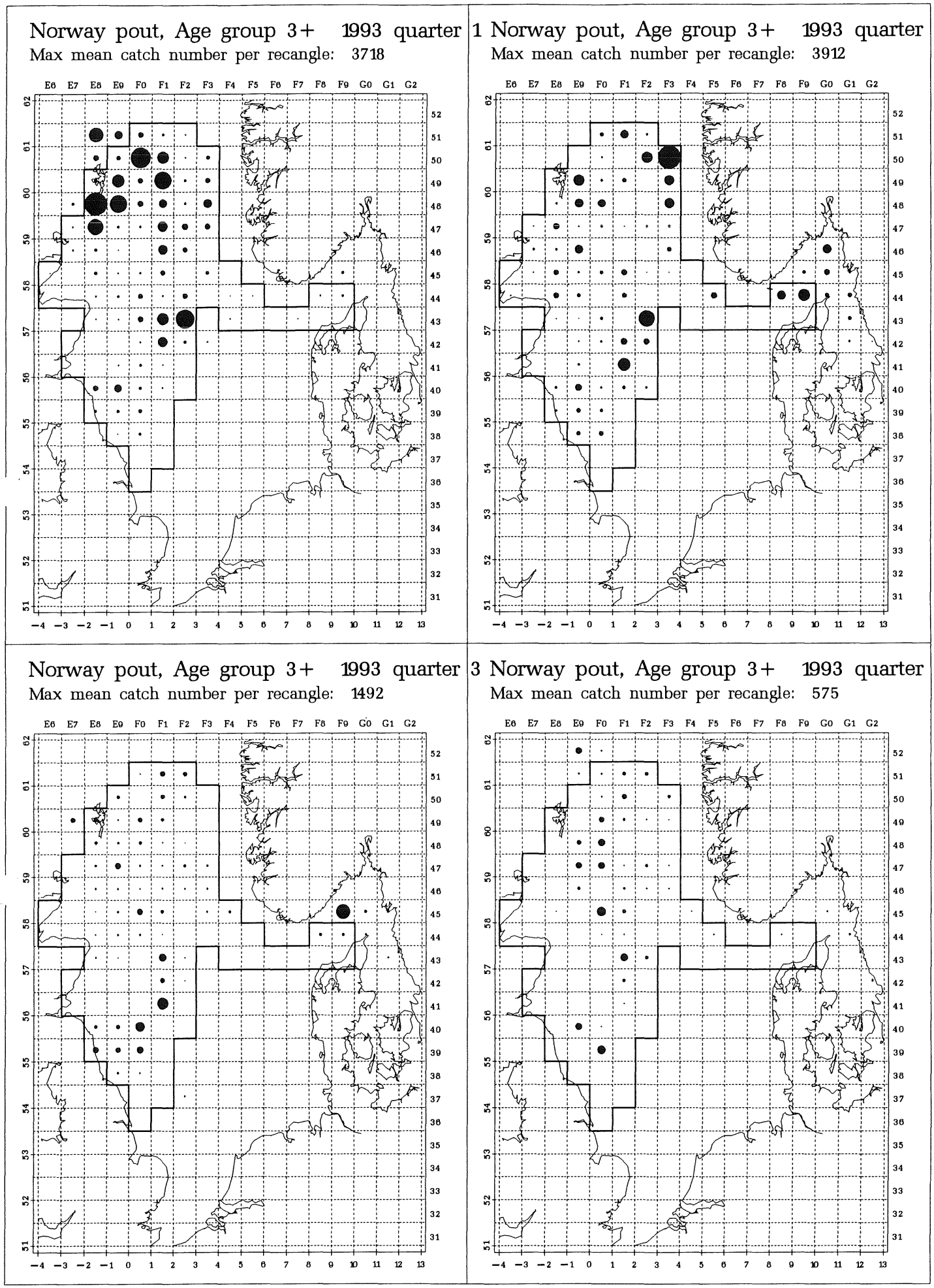

Figure 4.39 Norway pout: number per hour, age-group 3+.

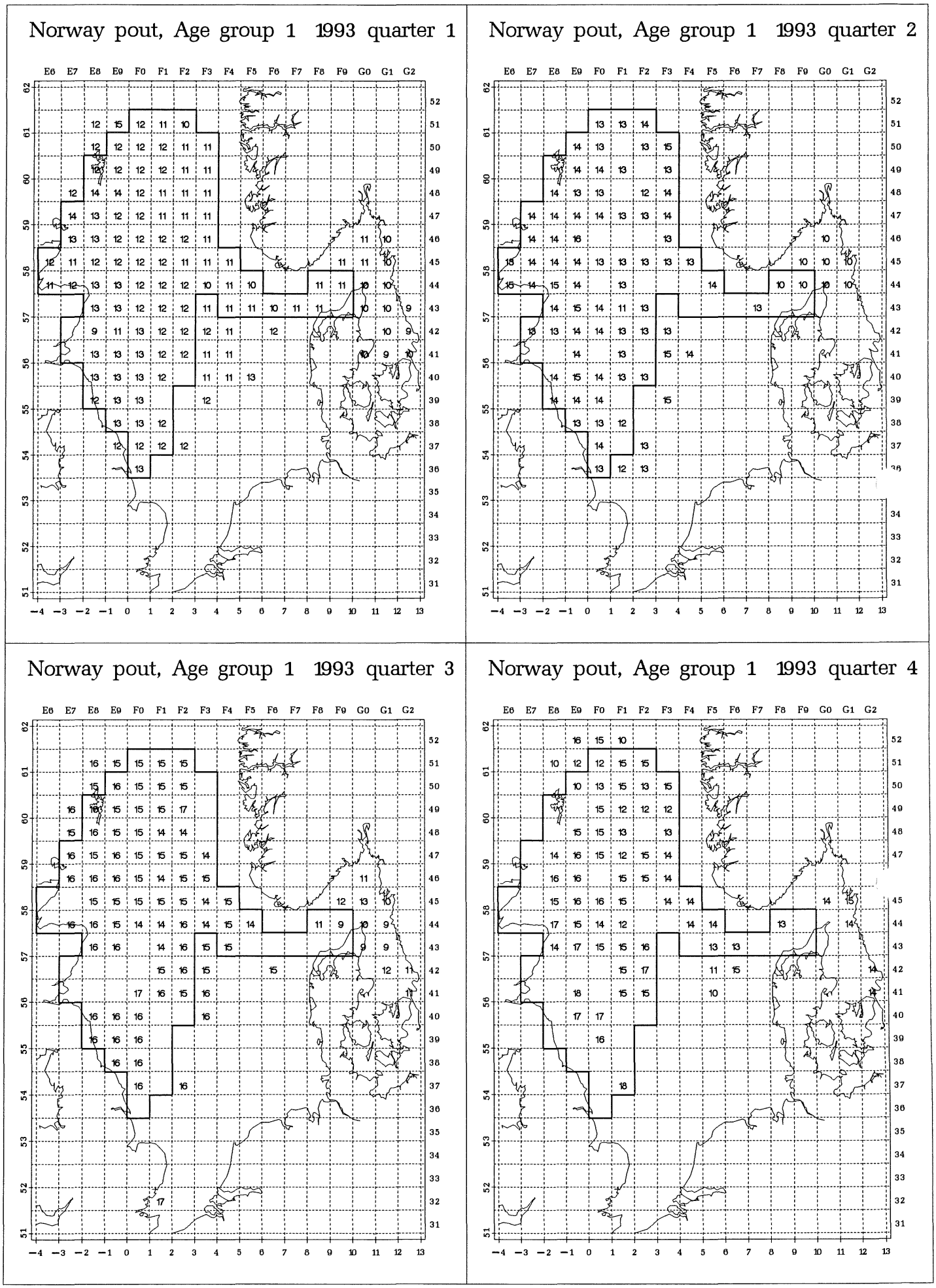

Figure 4.40 Norway pout: mean length (cm below), age-group 1.

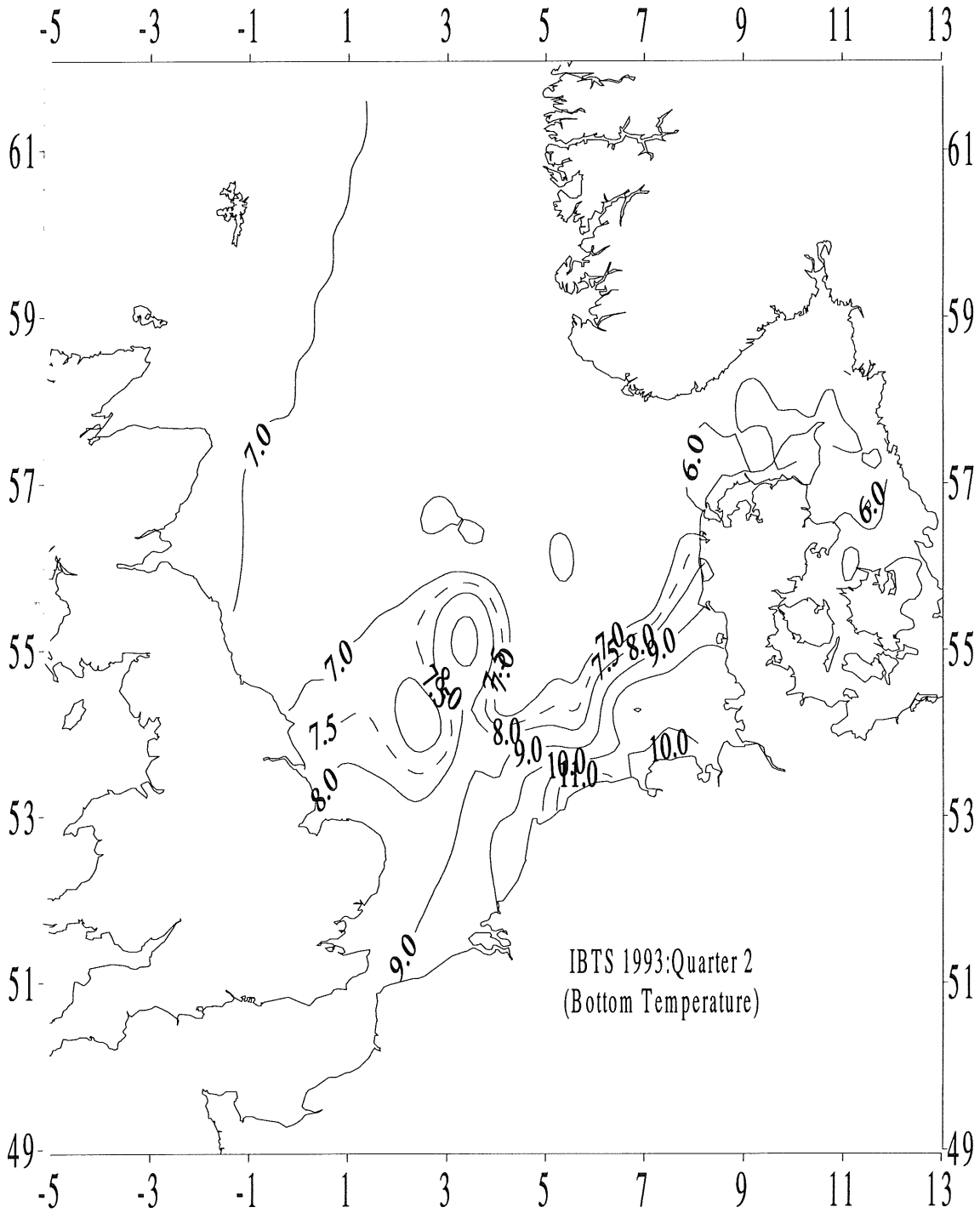

Figure 5.1

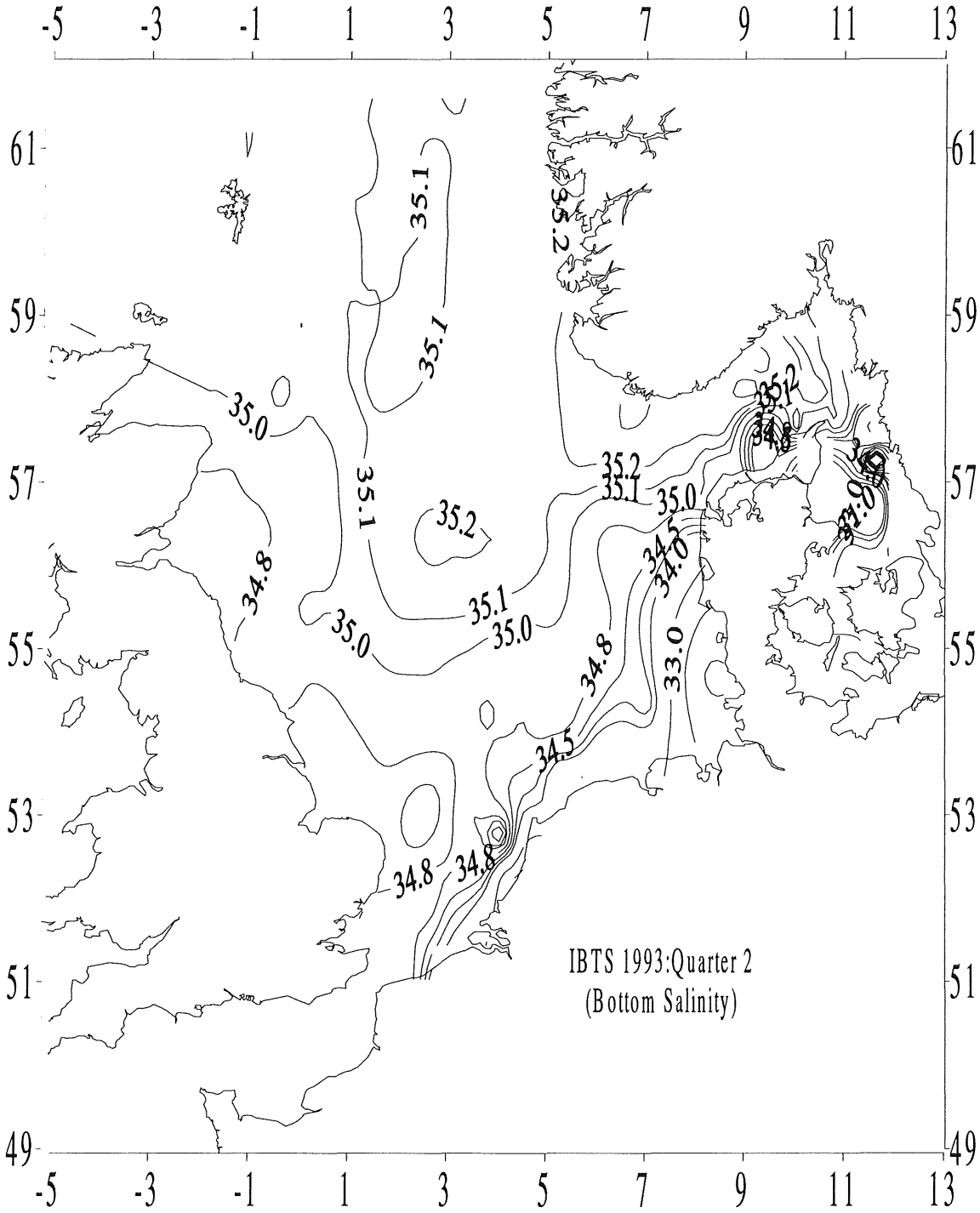

Figure 5.2

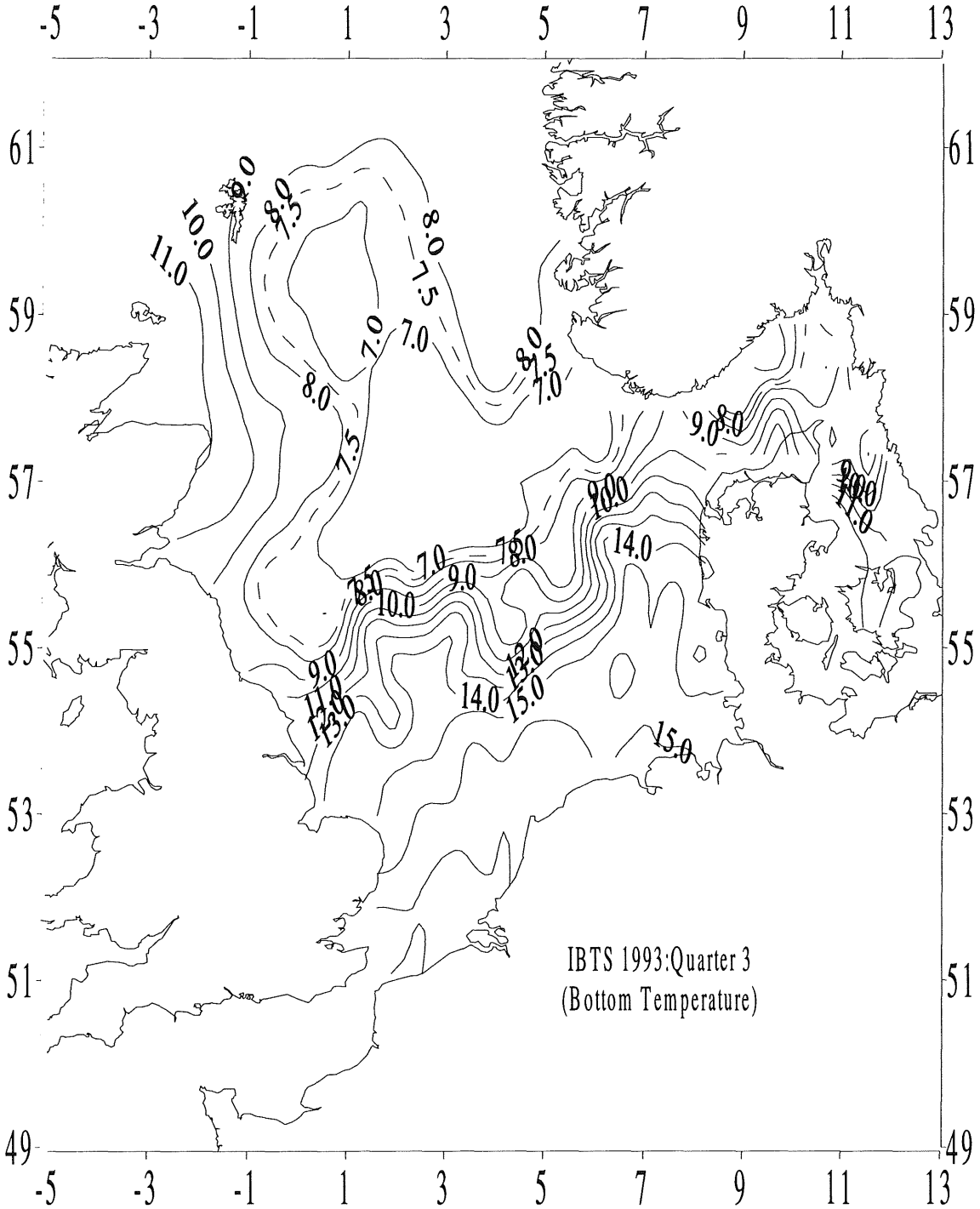

Figure 5.3

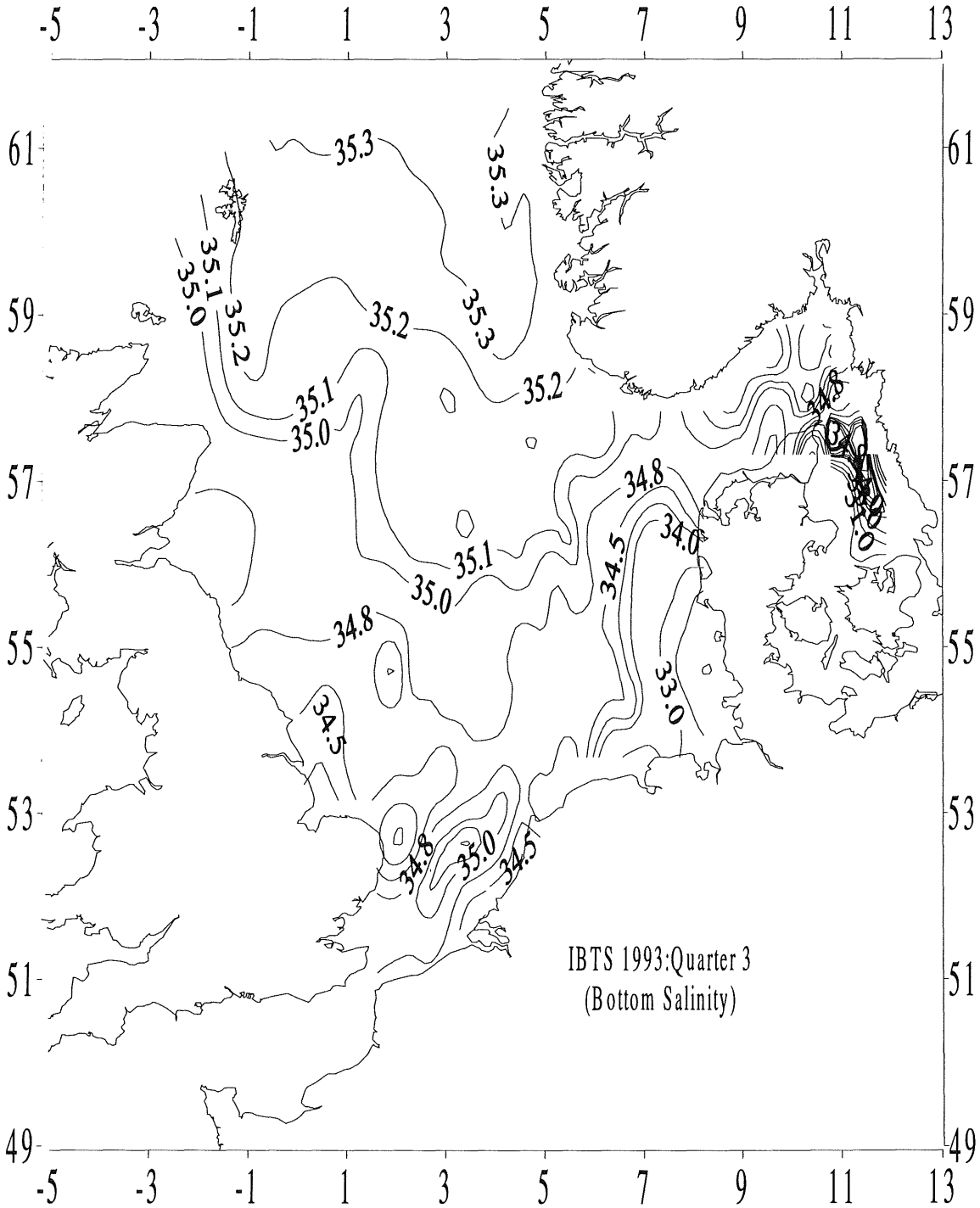
IBTS 1993:Quarter 3
(Bottom Salinity)
35.3
35.2
35.1
35.0
34.8
34.5
34.0
33.0

Figure 5.4

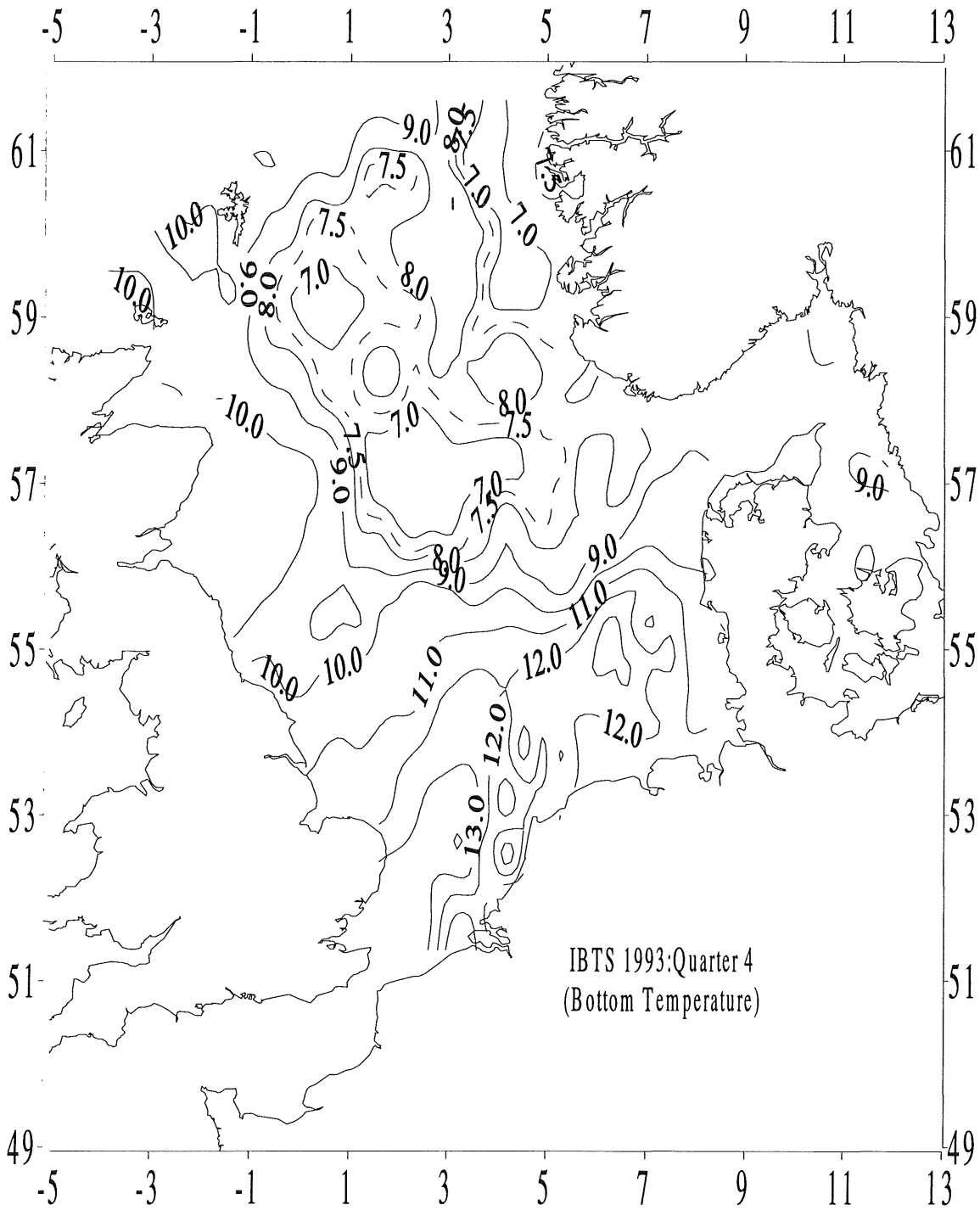

Figure 5.5

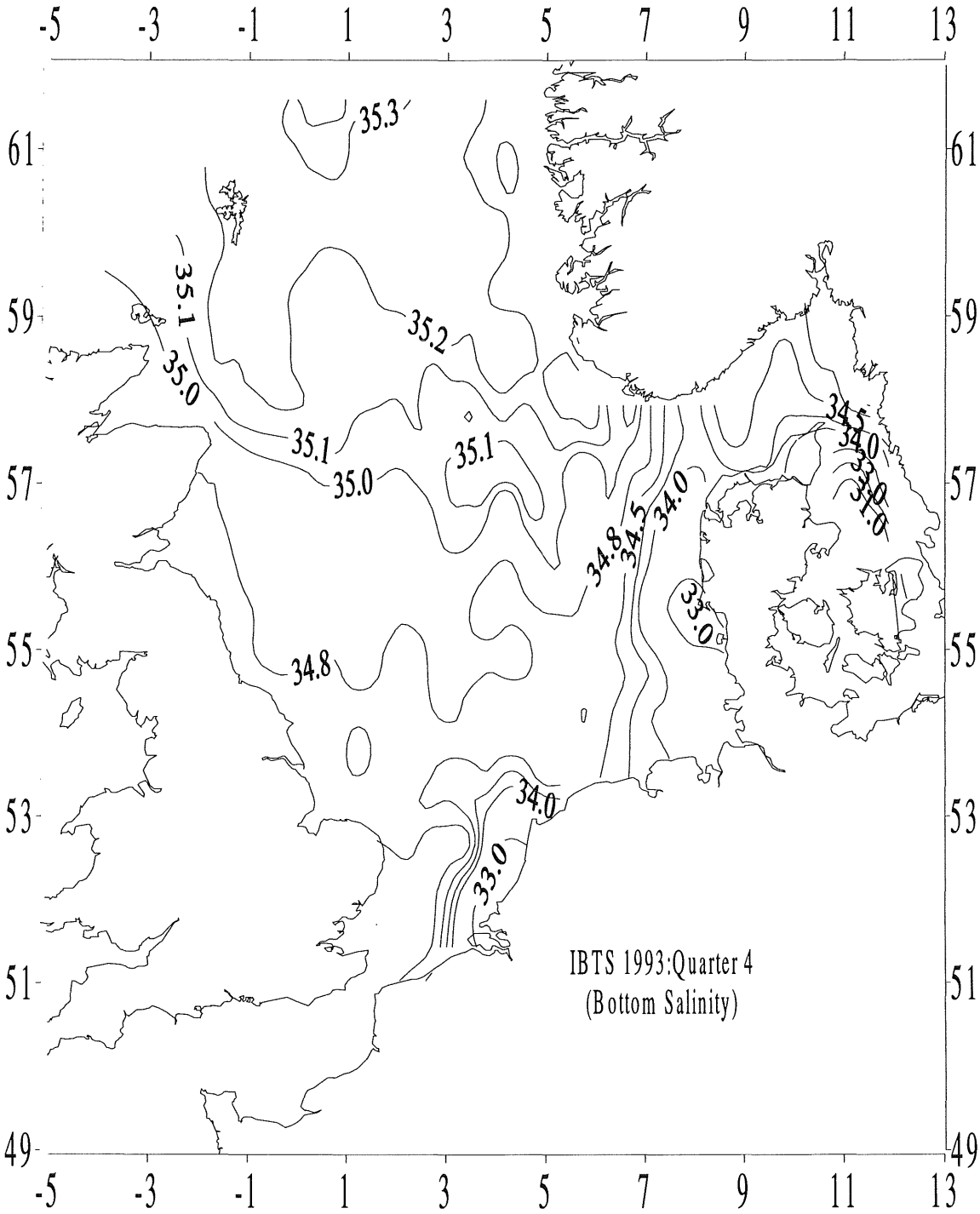
-5
-3
-1
1
3
5
7
9
11
13
61
59
57
55
53
51
49
35.3
35.1
35.0
35.2
35.1
35.0
35.1
34.8
34.5
34.0
33.0
34.8
34.0
33.0
IBTS 1993:Quarter 4
(Bottom Salinity)

Figure 5.6