Resource Management Committee

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REPORT OF THE

INTERNATIONAL BOTTOM TRAWL SURVEY IN THE NORTH SEA, SKAGERRAK AND KATTEGAT IN 1994: QUARTER 2, 3 AND 4

by

The International Bottom Trawl Survey Working Group

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 second, third and fourth quarter of 1994. 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 1994. 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 1994 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 1994 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 1994

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 1994 represent year class 1992.

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: 279 stations from 14 April to 11 June from four ships ("Walter Herwig", "Tridens", "Scotia", and "Argos")
Quarter 3: 273 stations from 6 August to 22 September from five ships ("Thalassa", "Tridens", "Cirolana", "Scotia", 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/1994. 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 1994.

Year 1994	Country	Vessel	Period	Number of Hauls ABD	GOV
Quarter 1	Sweden	Argos	31/1–17/2		48
	Denmark	Dana	2/2–20/2		48
	Norway	G.O. Sars	6/1–26/1		27
	UK Scotland	Scotia	12/2–4/3		56
	France	Thalassa	5/2–20/2		54
	Netherlands	Tridens	31/1–24/2		46
	Germany	Walter Herwig III	19/2–21/3		94
Quarter 2	Sweden	Argos	18/4–4/5		51
	Norway	Michael Sars	18/5–2/6		67
	UK Scotland	Scotia	14/4–3/5		76
	Netherlands	Tridens	2/5–26/5		52
	Germany	Walter Herwig III	12/5–9/6		71
Quarter 3	Sweden	Argos	5/9–22/9		50
	UK England	Cirolana	6/8–28/8		79
	UK Scotland	Scotia	2/8–21/8	89	
	France	Thalassa	4/9–19/9		55
	Netherlands	Tridens	15/8–26/8		42
Quarter 4	UK England	Cirolana	21/10–22/11		81
	Denmark	Dana	26/10–20/11		70
	Norway	G.O. Sars	11/10–8/11		78
	Netherlands	Isis	24/10–3/11		22
	Netherlands	Tridens	24/10–3/11		33

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 1994

Species	Roundfish area 1	2	3	4	5	6	7	8	9	Total
Quarter 1										
Herring	576	620	536	433	120	565	515	740	579	4,684
Sprat	71	184	180	135	98	292	-	161	284	1,405
Mackerel	-	32	2	-	-	-	-	-	-	34
Cod	451	634	157	259	30	246	98	244	267	2,386
Haddock	845	1,038	944	328	-	2	223	210	70	3,660
Whiting	621	818	701	362	410	559	126	163	175	3,935
Saithe	407	10	1	-	-	-	16	-	-	434
Norway pout	176	267	142	162	-	-	-	74	70	891
Quarter 2										
Herring	437	788	679	499	316	298	289	655	611	4,572
Sprat	18	120	179	177	116	187	148	192	293	1,430
Mackerel	126	36	19	7	14	56	5	-	-	263
Cod	497	410	96	184	13	173	303	233	243	2,1
Haddock	849	646	531	401	-	1	167	168	52	2,815
Whiting	638	505	453	462	165	311	169	142	181	3,026
Saithe	421	5	34	-	-	-	62	20	-	542
Norway pout	206	166	118	153	-	-	25	65	43	776
Quarter 3										
Herring	604	649	651	296	150	303	242	533	640	4,068
Sprat	25	175	197	233	153	183	76	110	174	1,326
Mackerel	166	139	173	76	214	387	-	-	-	1,155
Cod	802	872	136	451	109	451	265	270	236	3,592
Haddock	1,682	934	857	416	-	1	140	-	-	4,030
Whiting	985	705	581	483	329	483	172	-	-	3,738
Saithe	548	11	20	-	-	-	-	-	-	579
Norway pout	326	147	114	157	-	-	9	-	-	753
Quarter 4										
Herring	741	499	42	353	260	335	284	-	-	2,514
Sprat	19	145	91	124	142	183	94	-	-	79
Mackerel	173	91	40	72	50	182	46	-	-	6
Cod	650	509	120	305	48	503	374	186	146	2,841
Haddock	929	485	460	253	-	3	130	-	-	2,260
Whiting	230	258	253	198	85	464	118	127	133	1,866
Saithe	319	-	-	-	-	-	58	12	-	389
Norway pout	378	119	59	138	-	-	25	81	-	800

Table 4.2 Age composition of standard species in 1994 for the relevant standard areas.

		Age						
	Quarter	**0**	**1**	**2**	**3**	**4**	**5**	**6+**
Herring	1	.0	1,666.7	1,093.6	199.3	63.6	40.0	-
	2	.0	2,890.3	595.8	141.6	74.6	28.8	-
	3	1,552.0	1,653.1	889.0	197.0	180.5	133.0	-
	4	2,989.1	825.8	196.0	43.8	24.0	19.7	-
Sprat	1	.0	4,002.9	1,368.0	127.0	2.7	.6	-
	2	.1	2,402.5	1,019.7	330.2	18.8	.0	-
	3	5.2	4,298.1	500.8	131.1	12.3	.0	-
	4	1,051.0	7,958.7	6,166.0	654.9	.2	.6	-
Mackerel	1	.0	2.2	.1	.1	.0	.0	.0
	2	.0	2.5	3.7	1.7	.9	.2	.7
	3	.0	82.6	64.6	14.8	5.0	4.3	7.2
	4	.2	88.4	18.2	6.3	2.4	1.4	2.9
Cod	1	.0	14.8	4.4	3.0	.8	.5	.5
	2	.0	30.8	4.1	2.2	.5	.2	.2
	3	15.7	43.2	6.2	2.4	.2	.1	.1
	4	20.5	52.9	6.0	2.2	.3	.1	.1
Haddock	1	.0	228.7	503.9	98.3	23.3	1.6	.8
	2	.0	249.1	338.6	40.9	11.1	.7	.3
	3	1,771.9	194.3	264.8	32.4	8.4	.4	.1
	4	3,404.7	345.5	354.6	53.4	11.8	.7	.1
Whiting	1	.0	721.0	637.0	179.8	66.6	11.6	8.9
	2	.4	736.7	330.7	94.9	24.8	9.3	5.7
	3	609.9	674.5	222.5	76.3	19.8	4.8	3.2
	4	925.5	926.2	564.0	180.7	55.4	19.9	9.6
Saithe	1	.0	.1	.5	3.7	10.1	1.4	.6
	2	.0	.0	.1	1.3	6.0	1.2	.9
	3	.0	.0	.6	1.3	1.7	.9	.9
	4	.0	.0	.8	2.4	2.0	.5	.6
Norway pout	1	.0	1,867.8	375.4	67.0	2.9	.2	.0
	2	.0	2,813.7	436.6	59.7	2.3	.0	.0
	3	3,195.8	704.4	101.6	13.5	.3	.0	.0
	4	18,083.0	1,972.7	215.7	20.3	.3	.0	.0

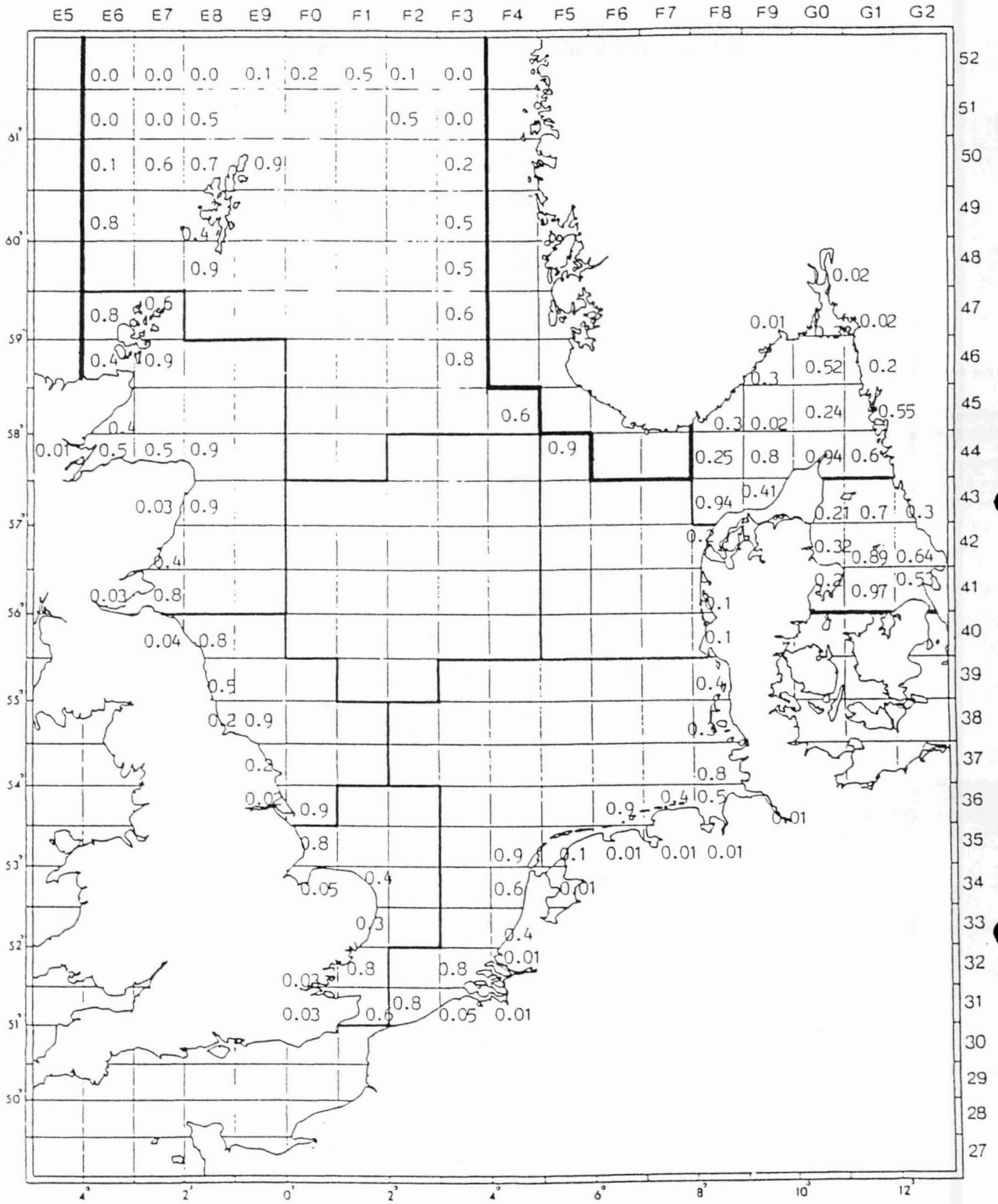


Figure 3.1 Weighting factors used in the calculation of the indices for herring and saithe. Numbers denote the relative weight of a given rectangle. Only weighting factors less than 1 are shown, other rectangles are given a weight of 1.

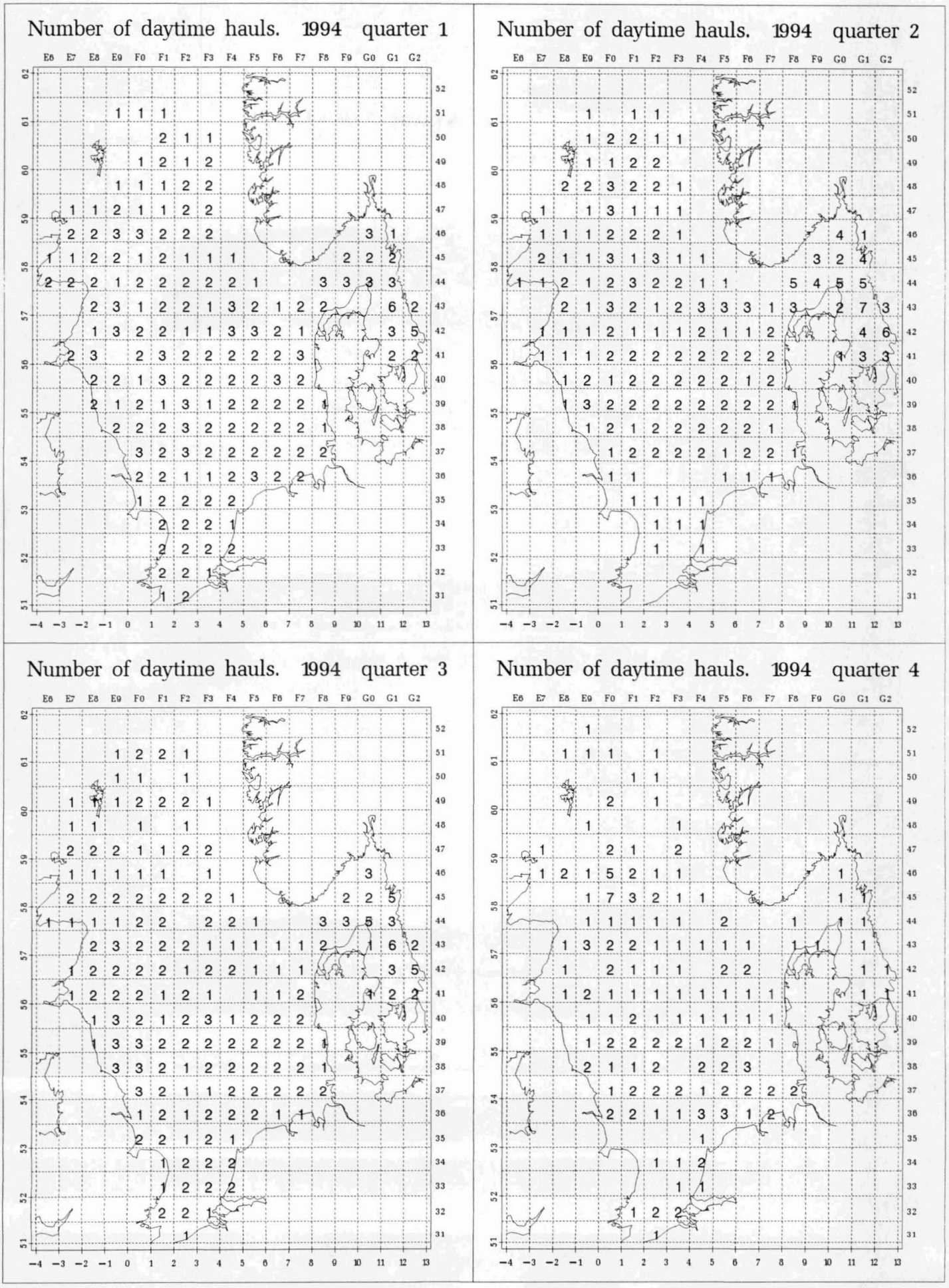


Figure 4.1 Number of valid daytime hauls.

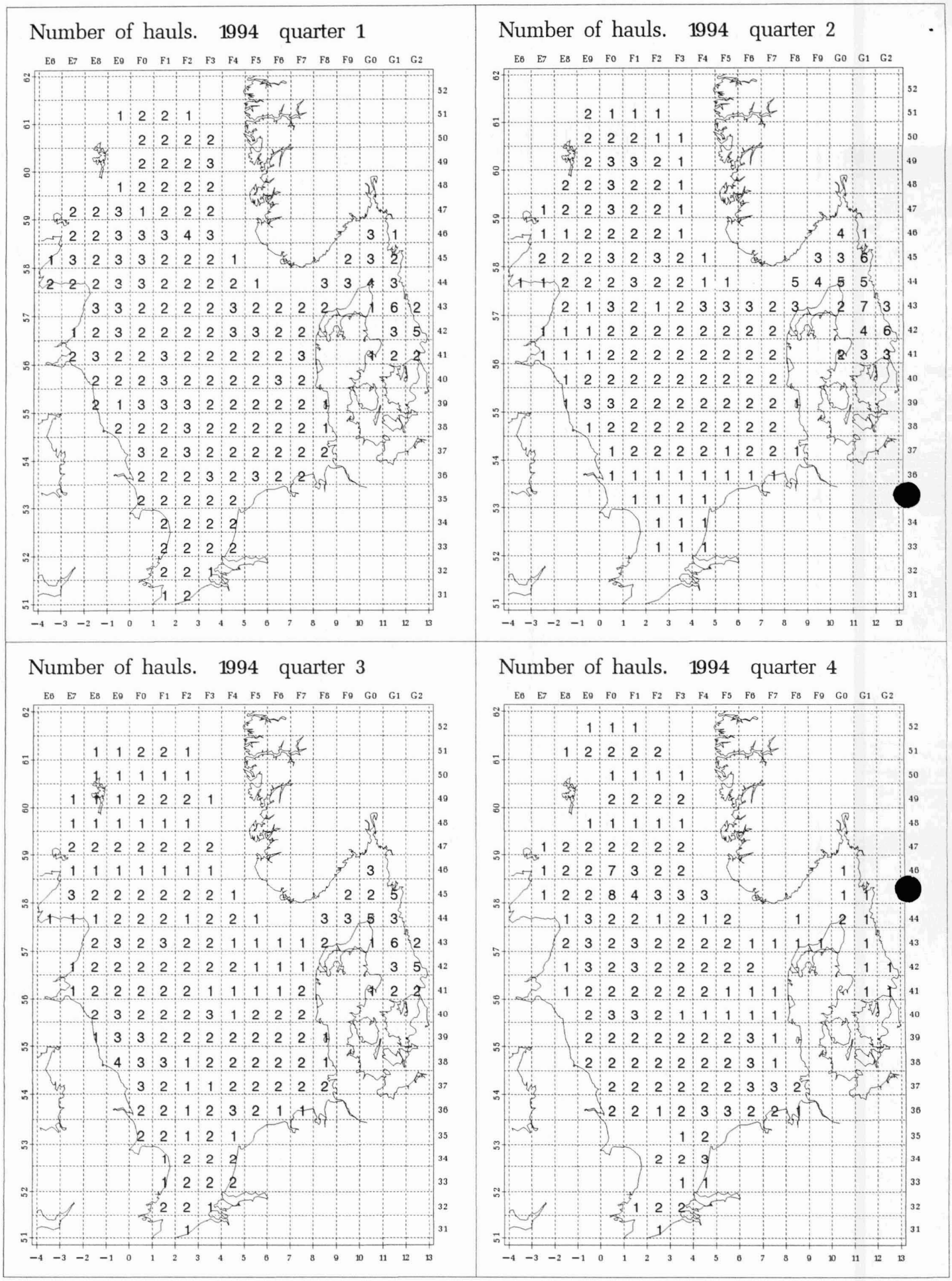


Figure 4.2 Number of valid day- and nighttime hauls.

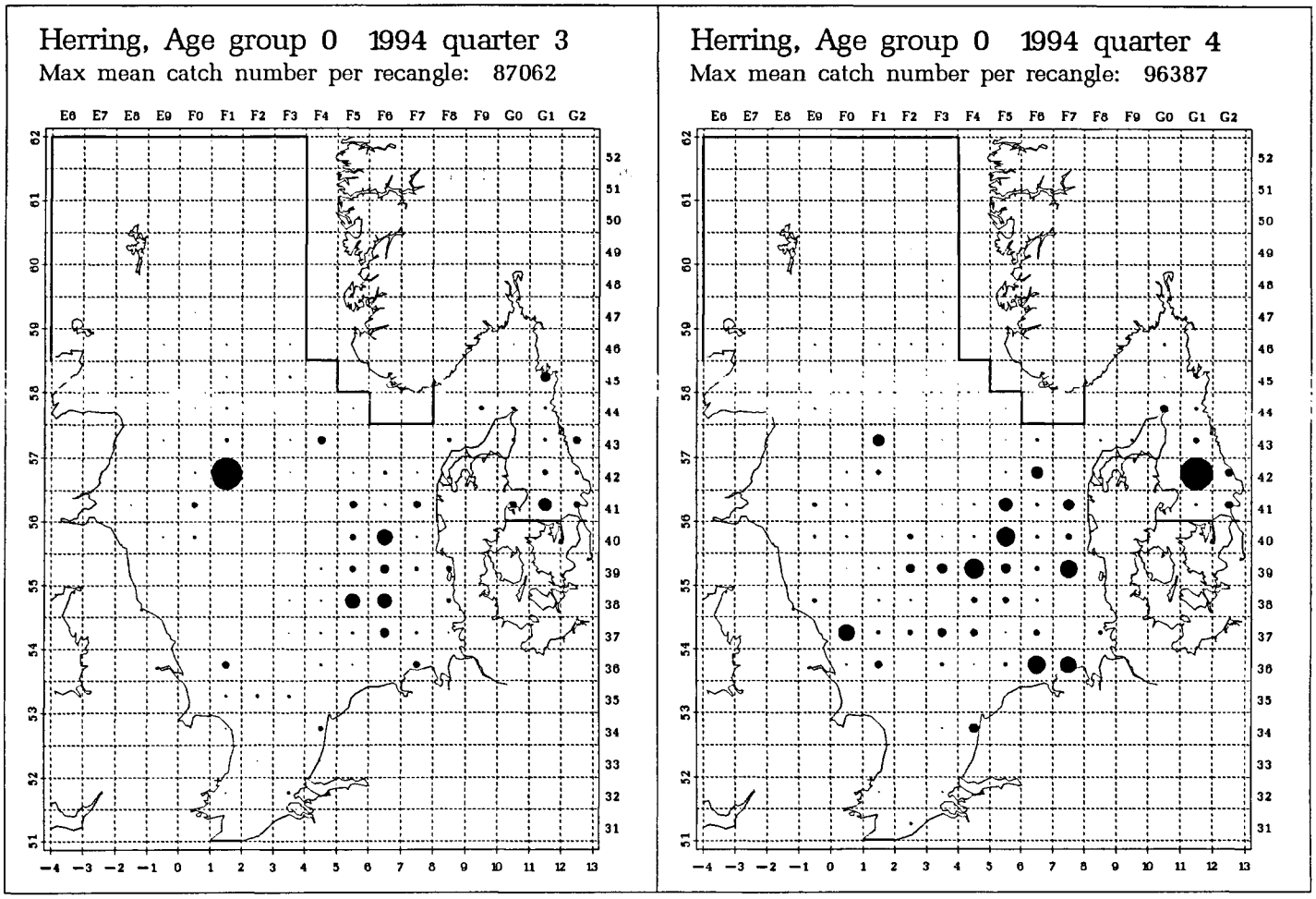


Figure 4.3 Herring: number per hour, 0-ringers.

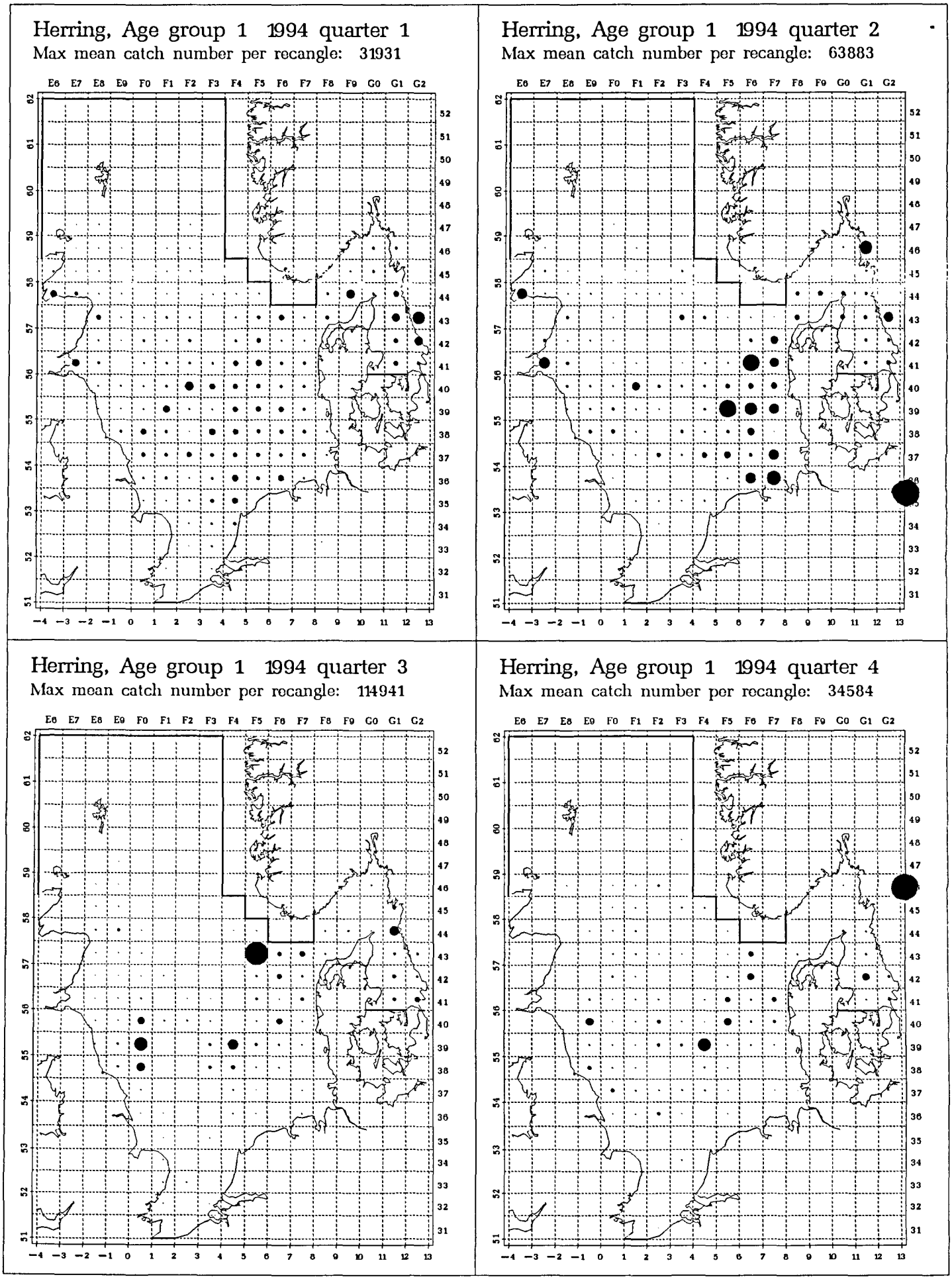


Figure 4.4 Herring: number per hour, 1-ringers.

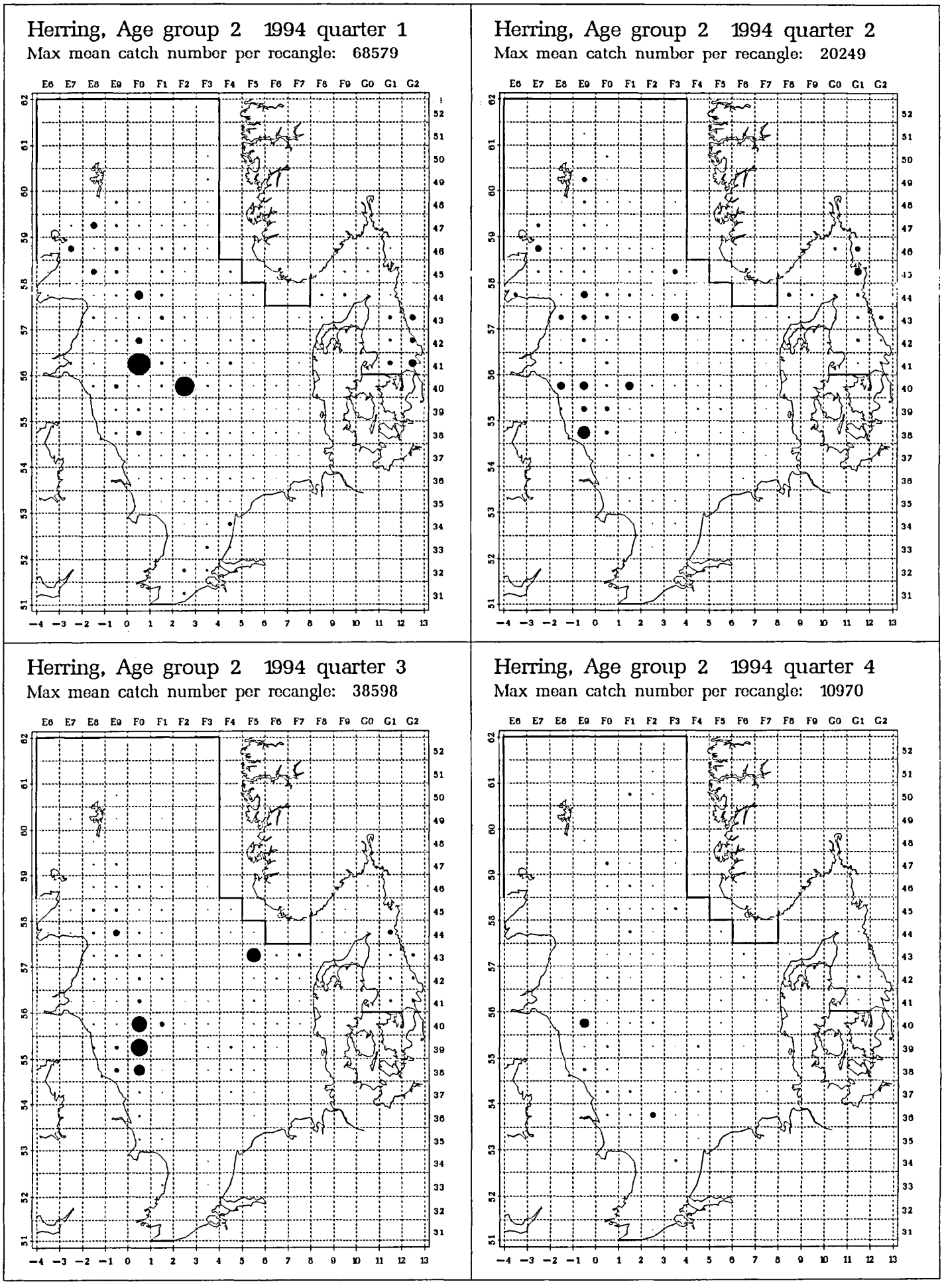


Figure 4.5 Herring: number per hour, 2-ringers.

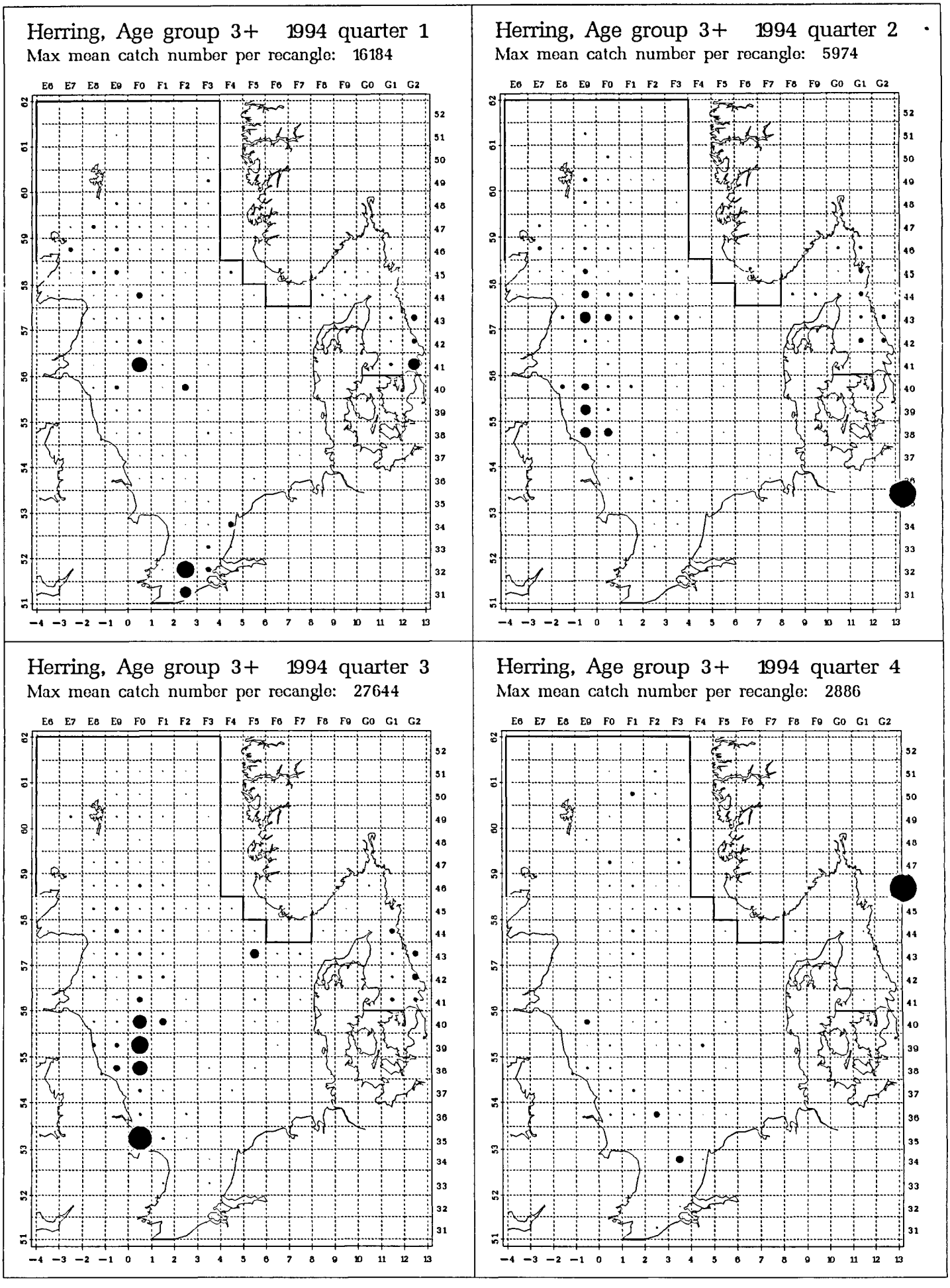


Figure 4.6 Herring: number per hour, 3+ringers.

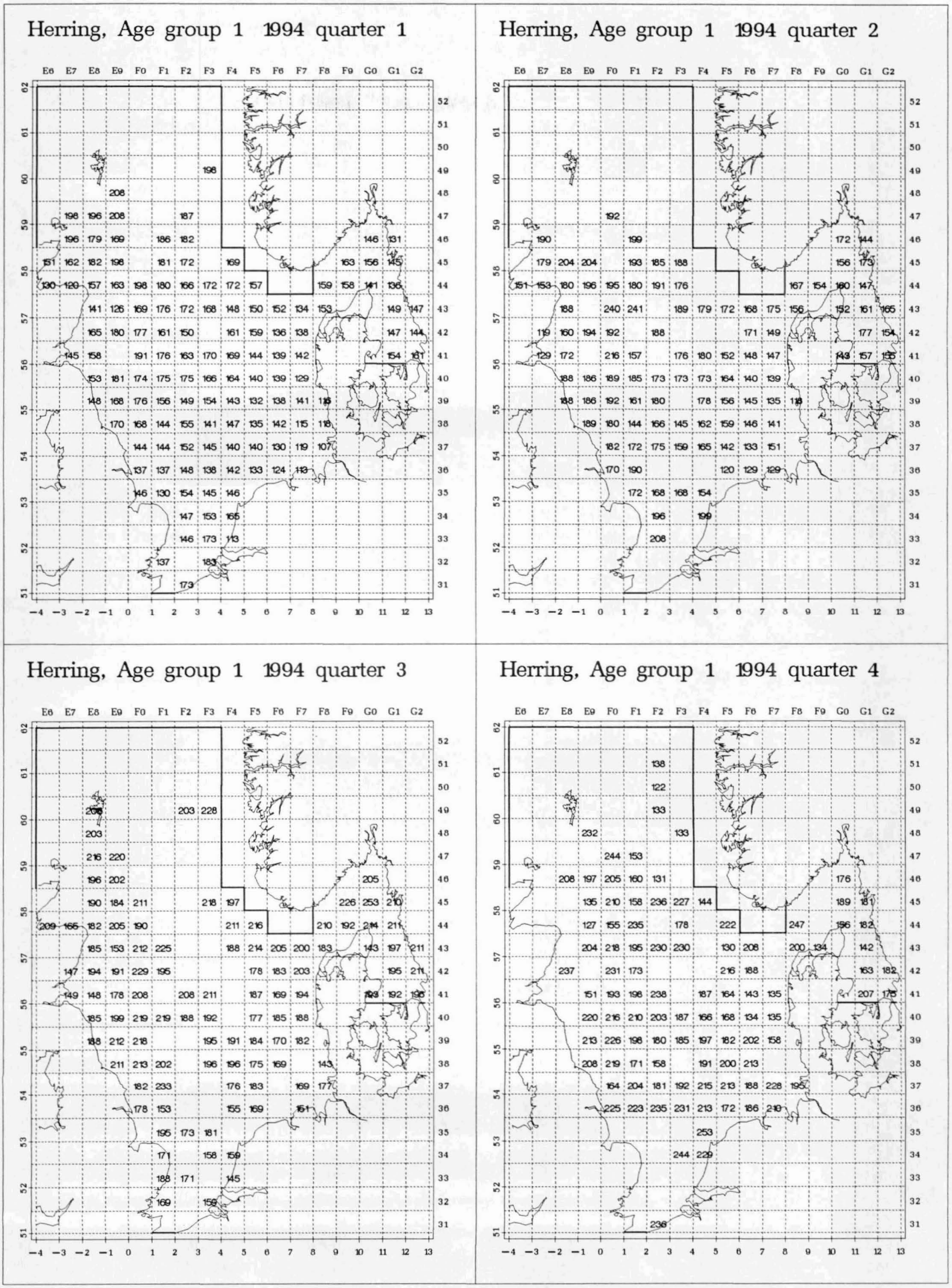


Figure 4.7 Herring: mean length (mm), 1-ringers.

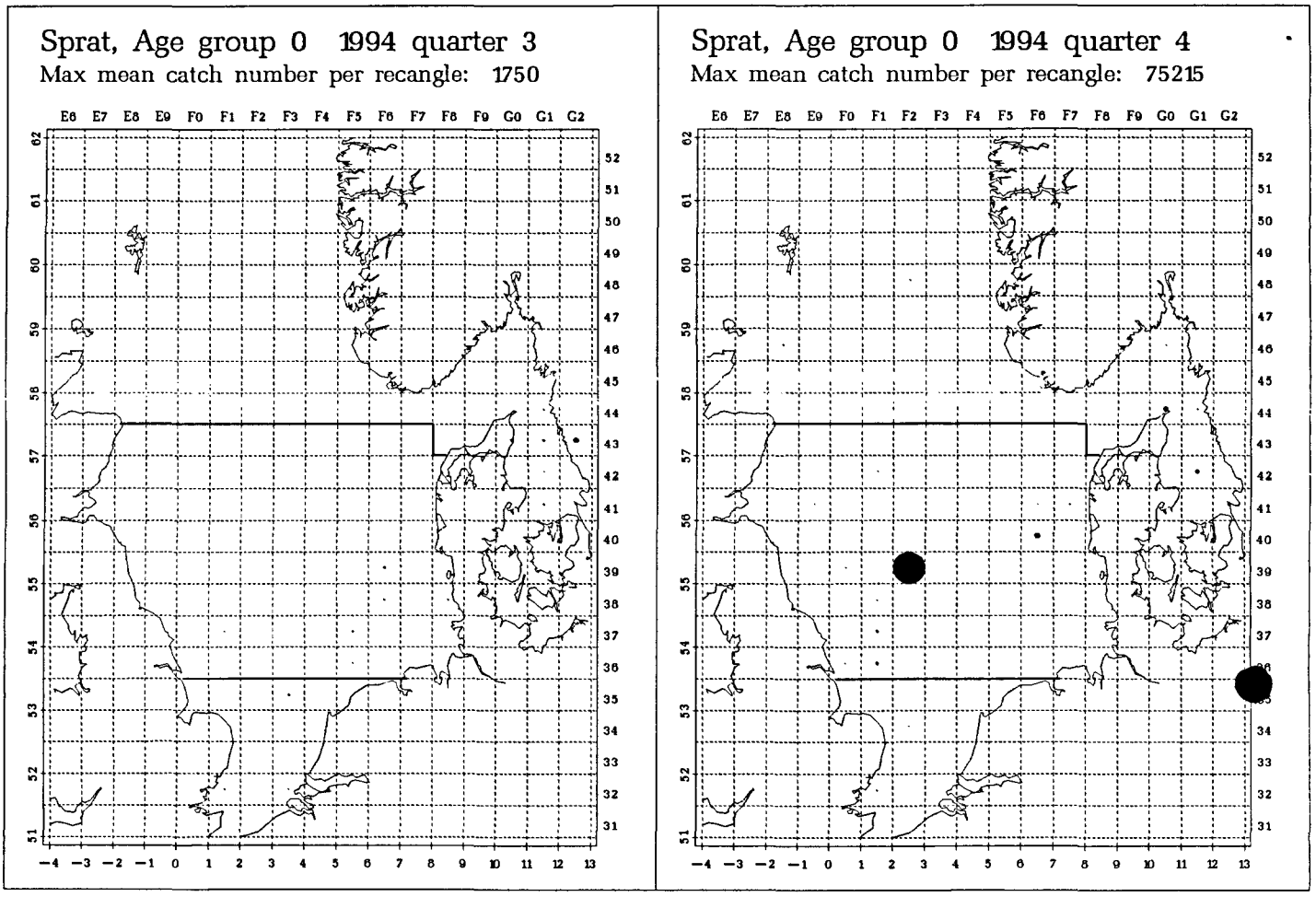


Figure 4.8 Sprat: number per hour, age-group 0.

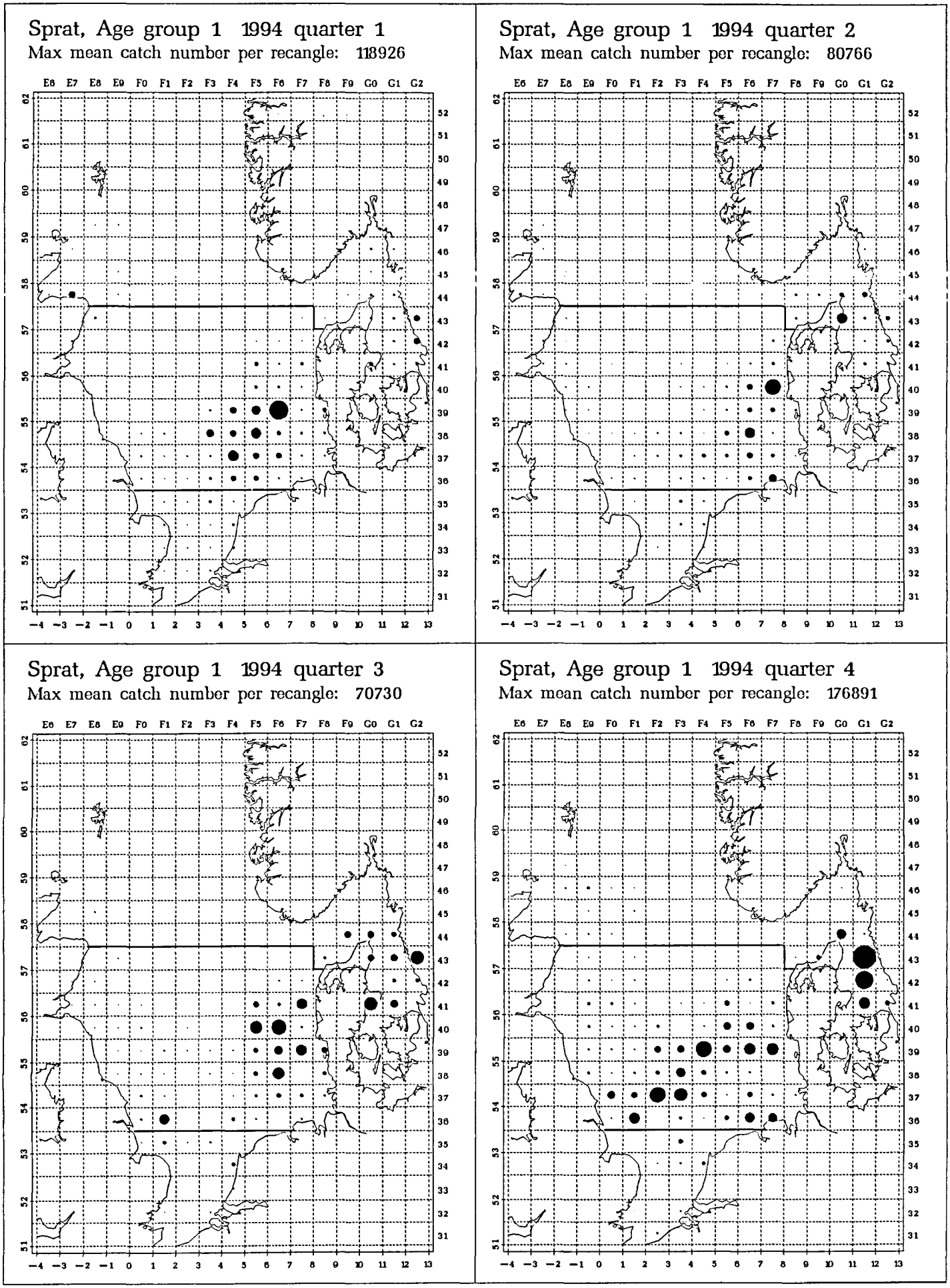


Figure 4.9 Sprat: number per hour, age-group 1.

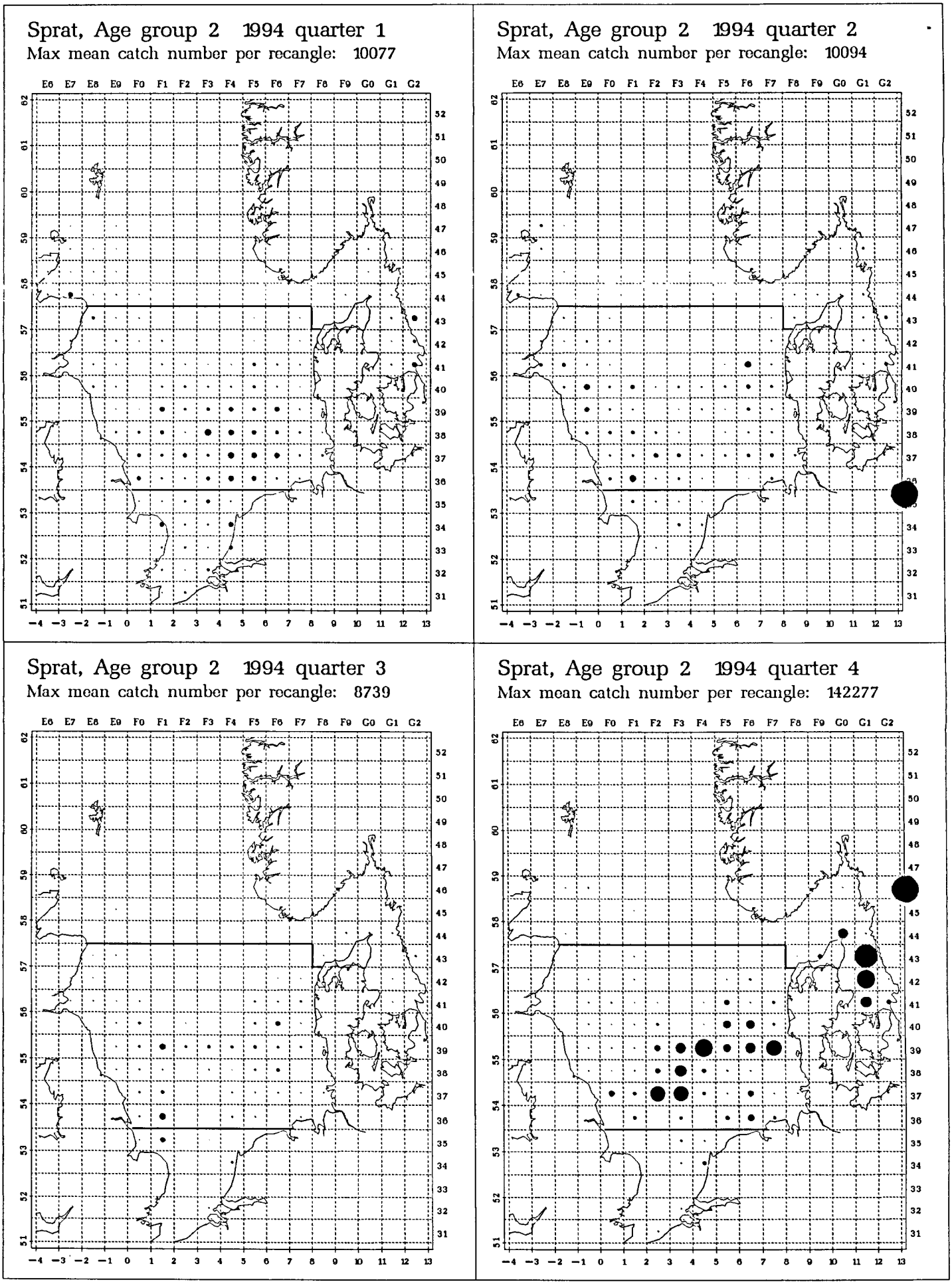


Figure 4.10 Sprat: number per hour, age-group 2.

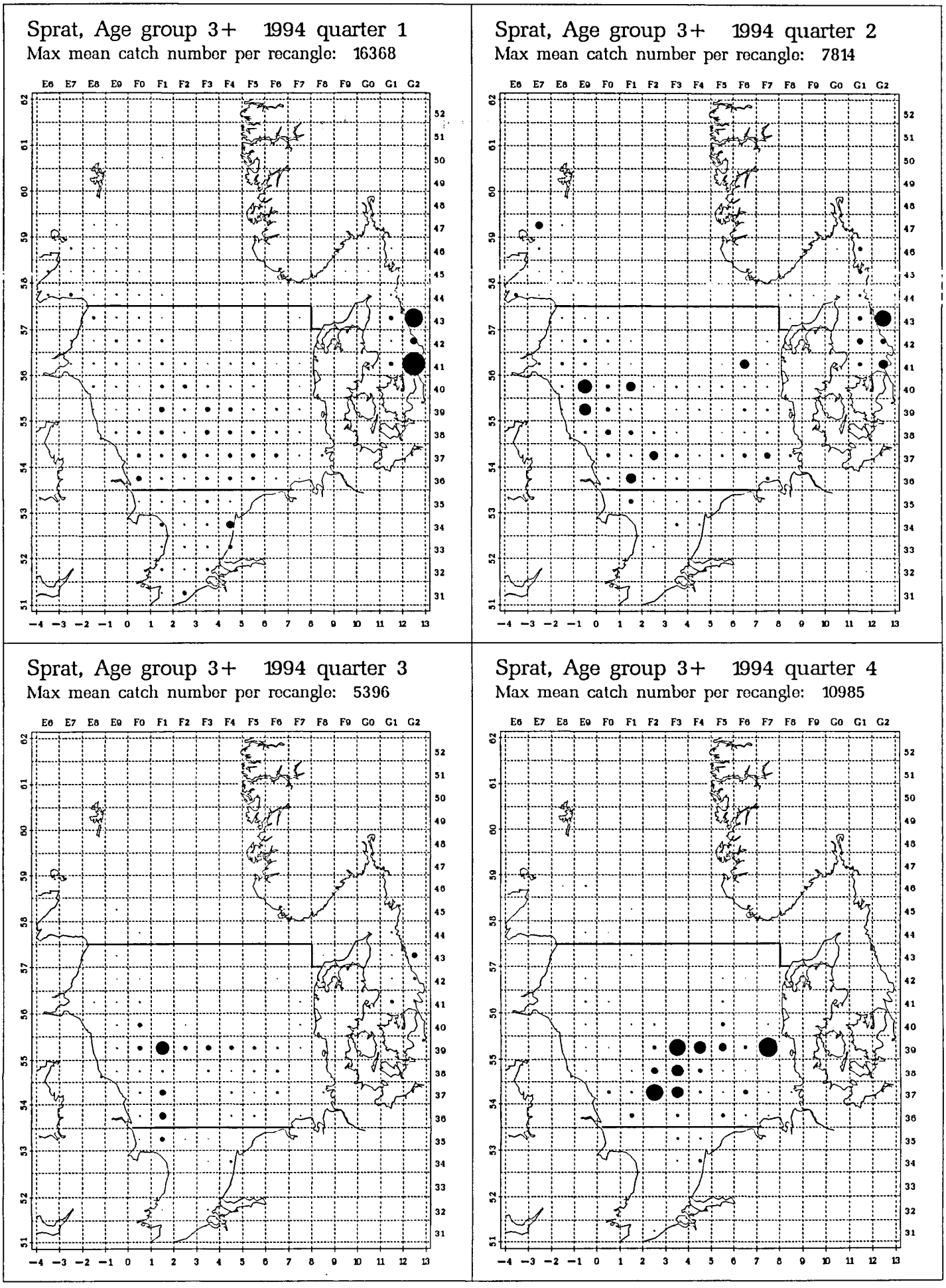


Figure 4.11 Sprat: number per hour, age-group 3+.

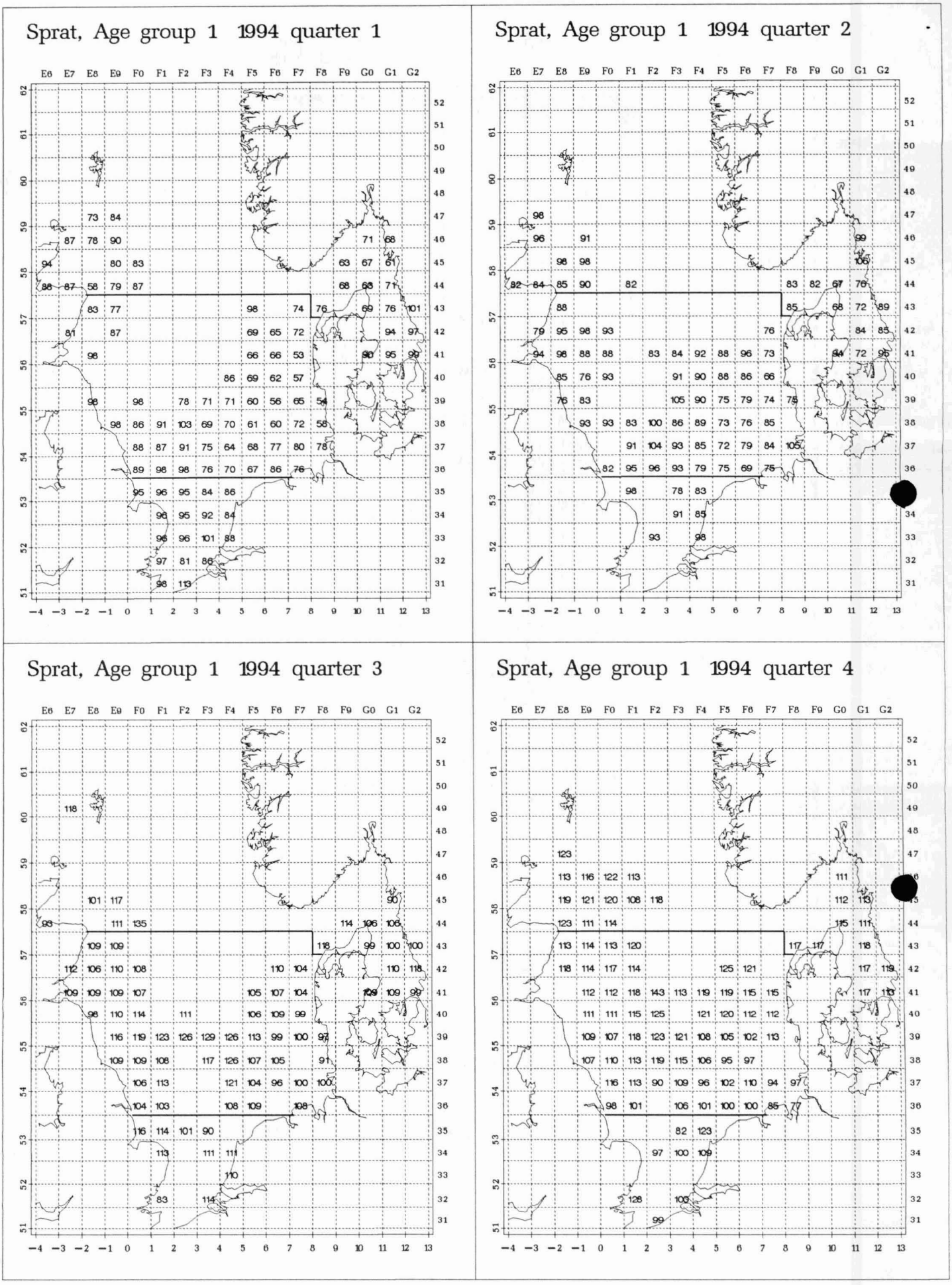


Figure 4.12 Sprat: mean length (mm), age-group 1.

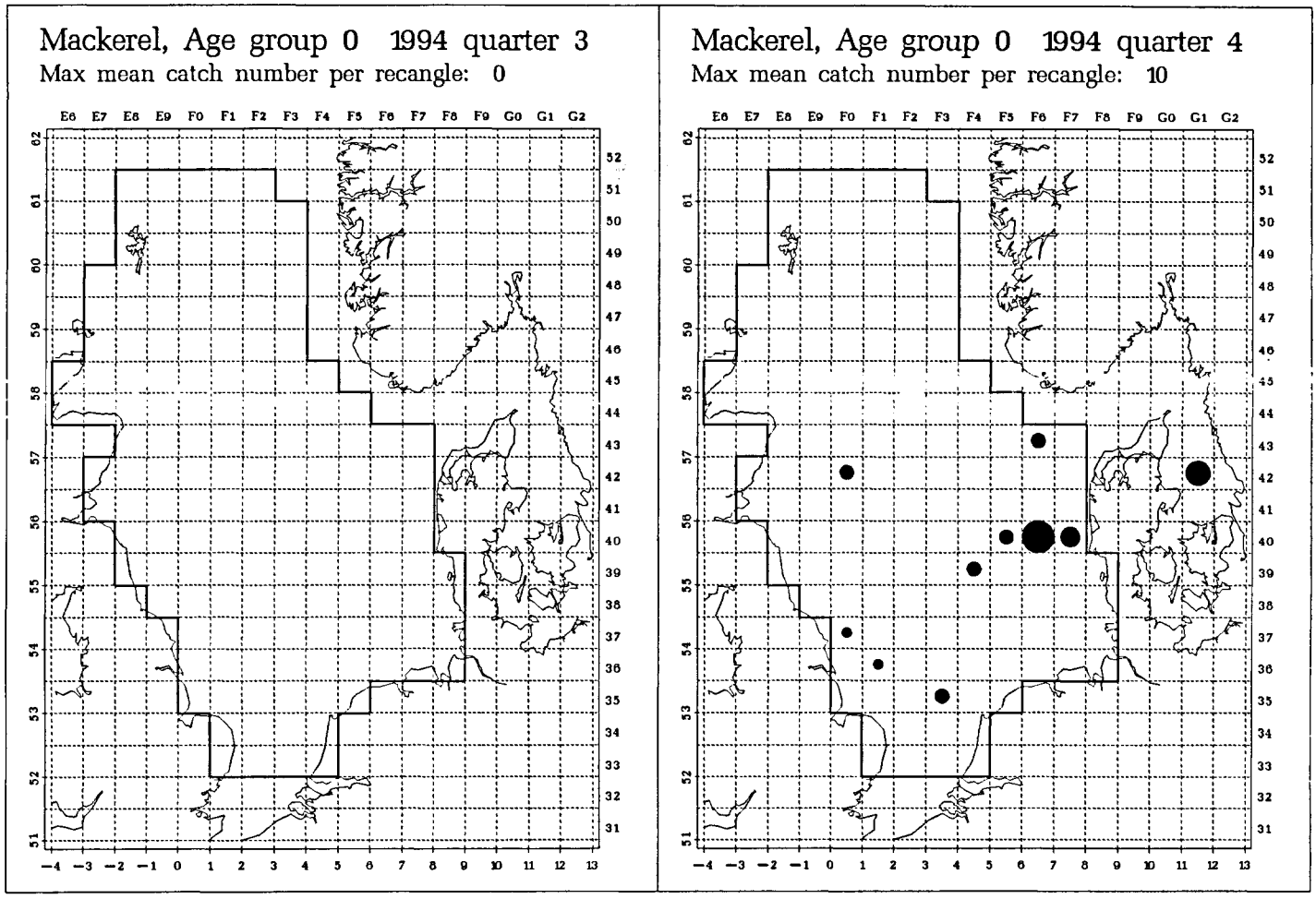


Figure 4.13 Mackerel: number per hour, age-group 0.

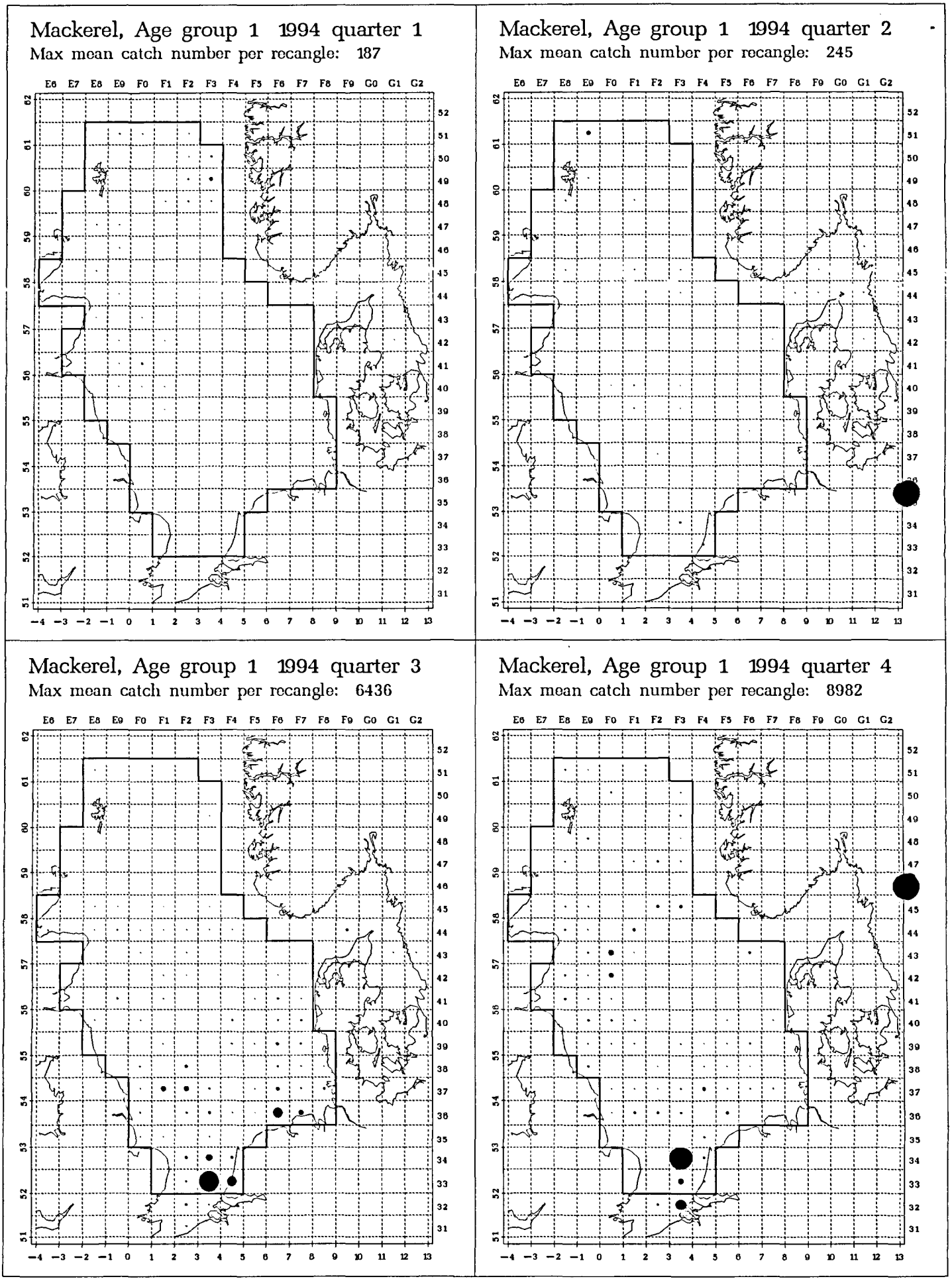


Figure 4.14 Mackerel: number per hour, age-group 1.

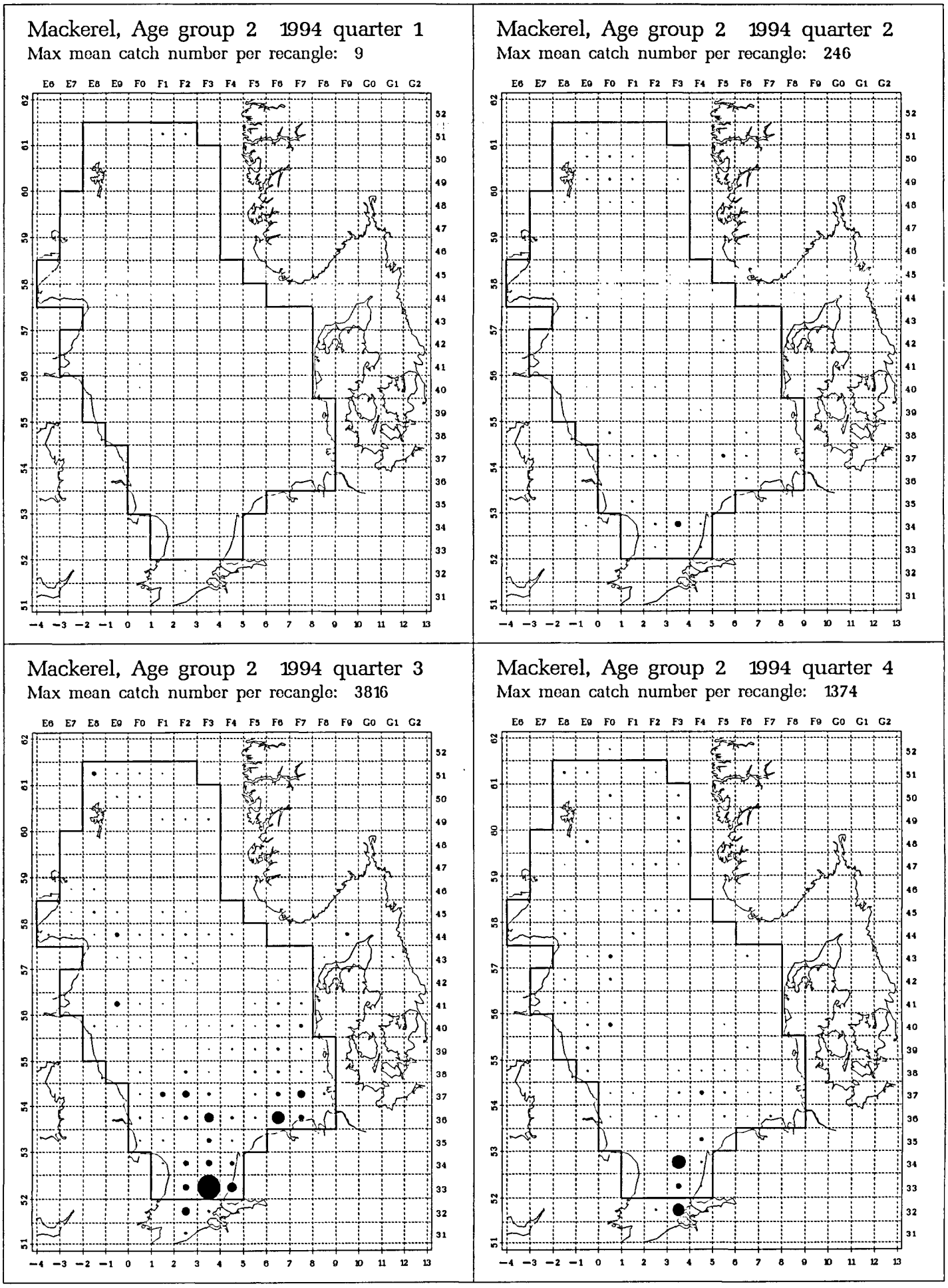


Figure 4.15 Mackerel: number per hour, age-group 2.

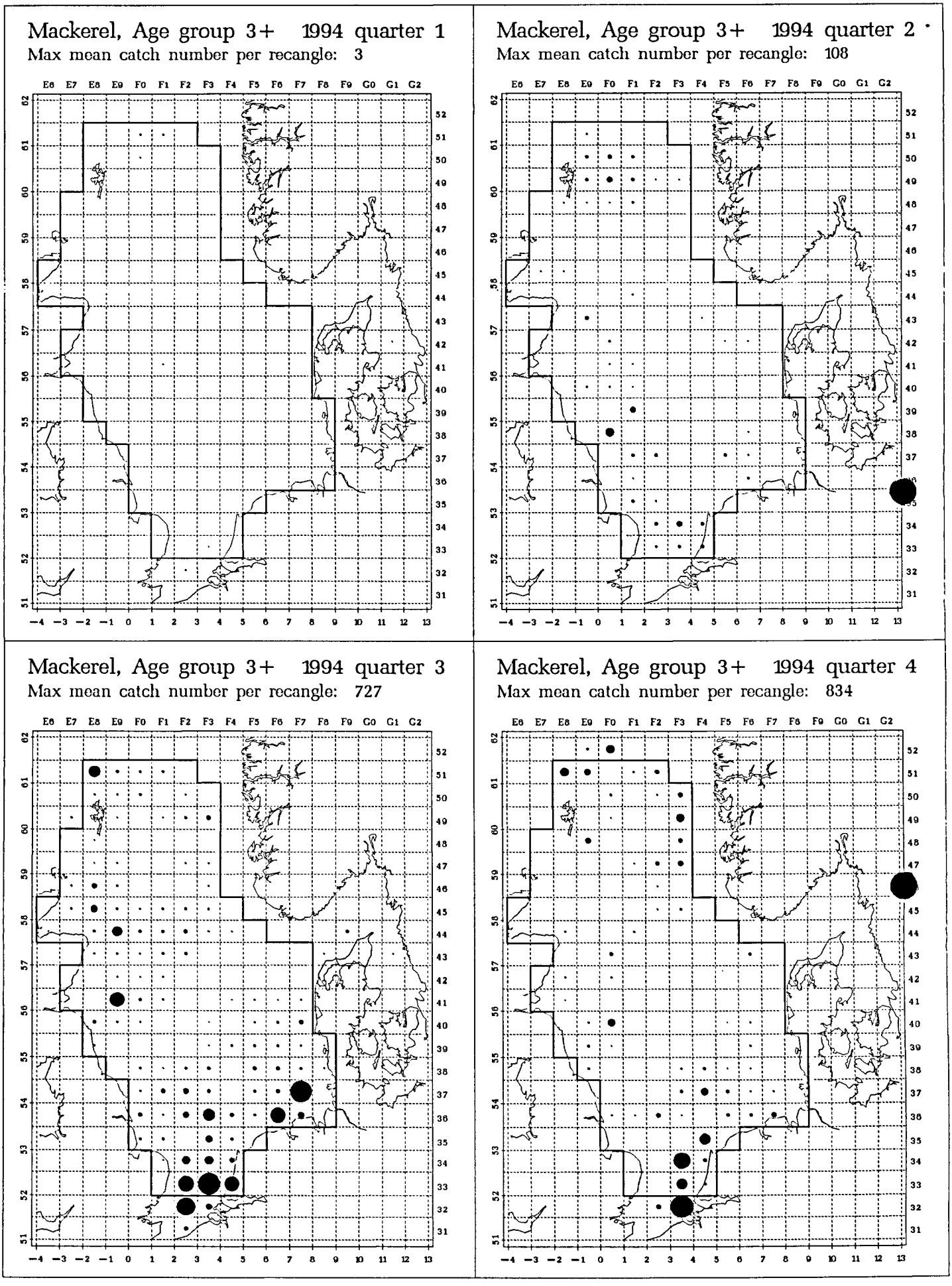


Figure 4.16 Mackerel: number per hour, age-group 3+.

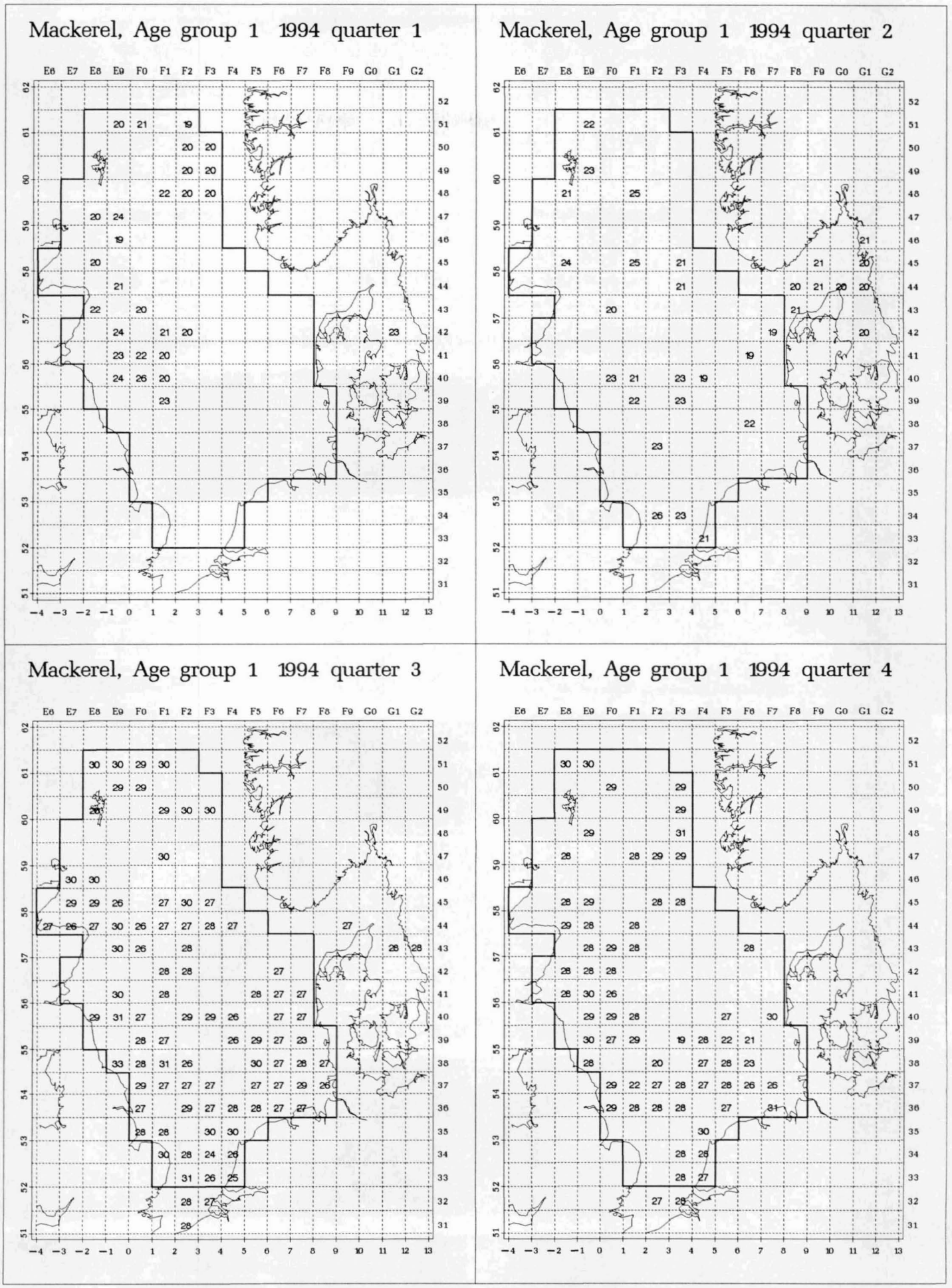


Figure 4.17 Mackerel: mean length (cm below), age-group 1.

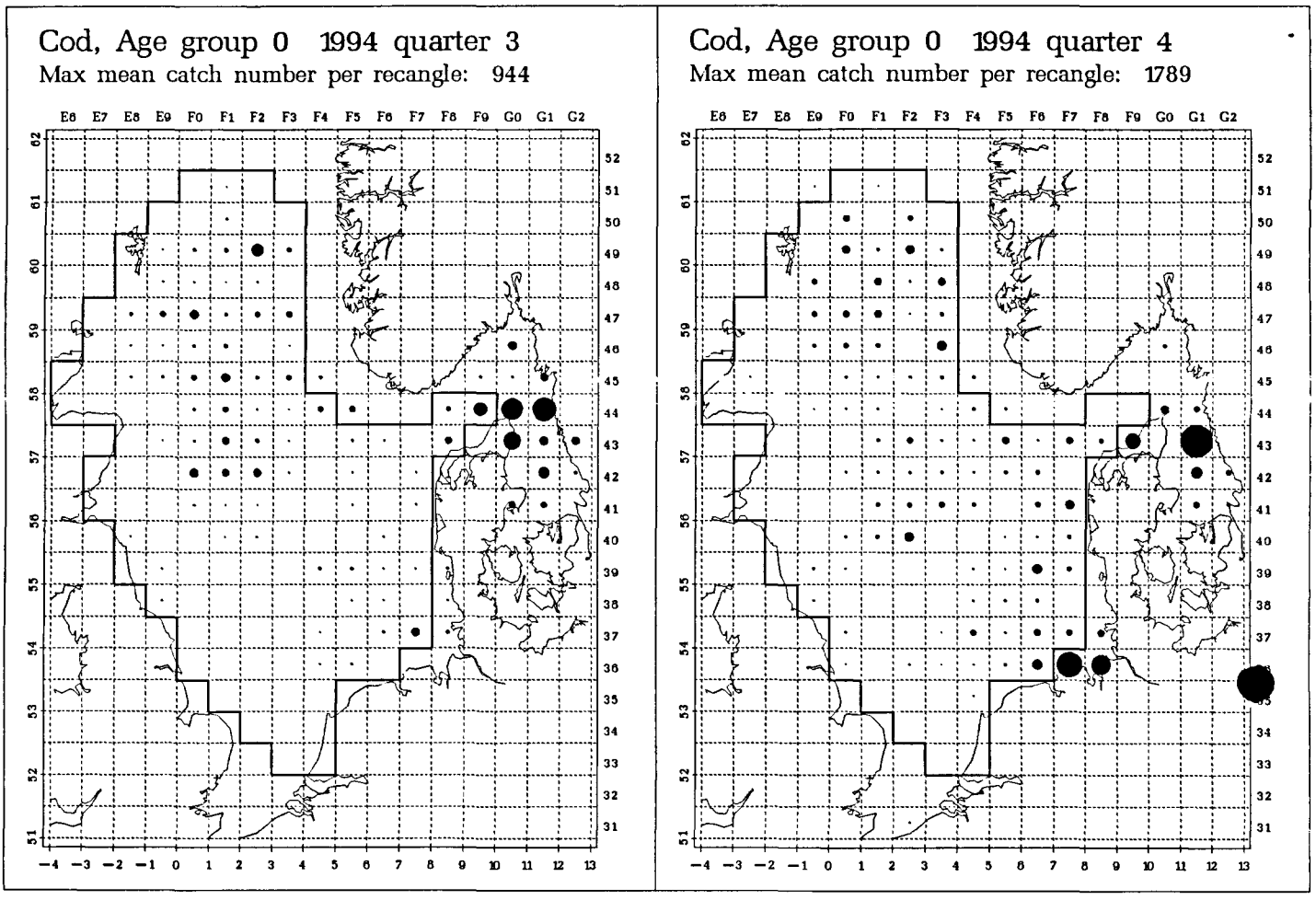


Figure 4.18 Cod: number per hour, age-group 0.

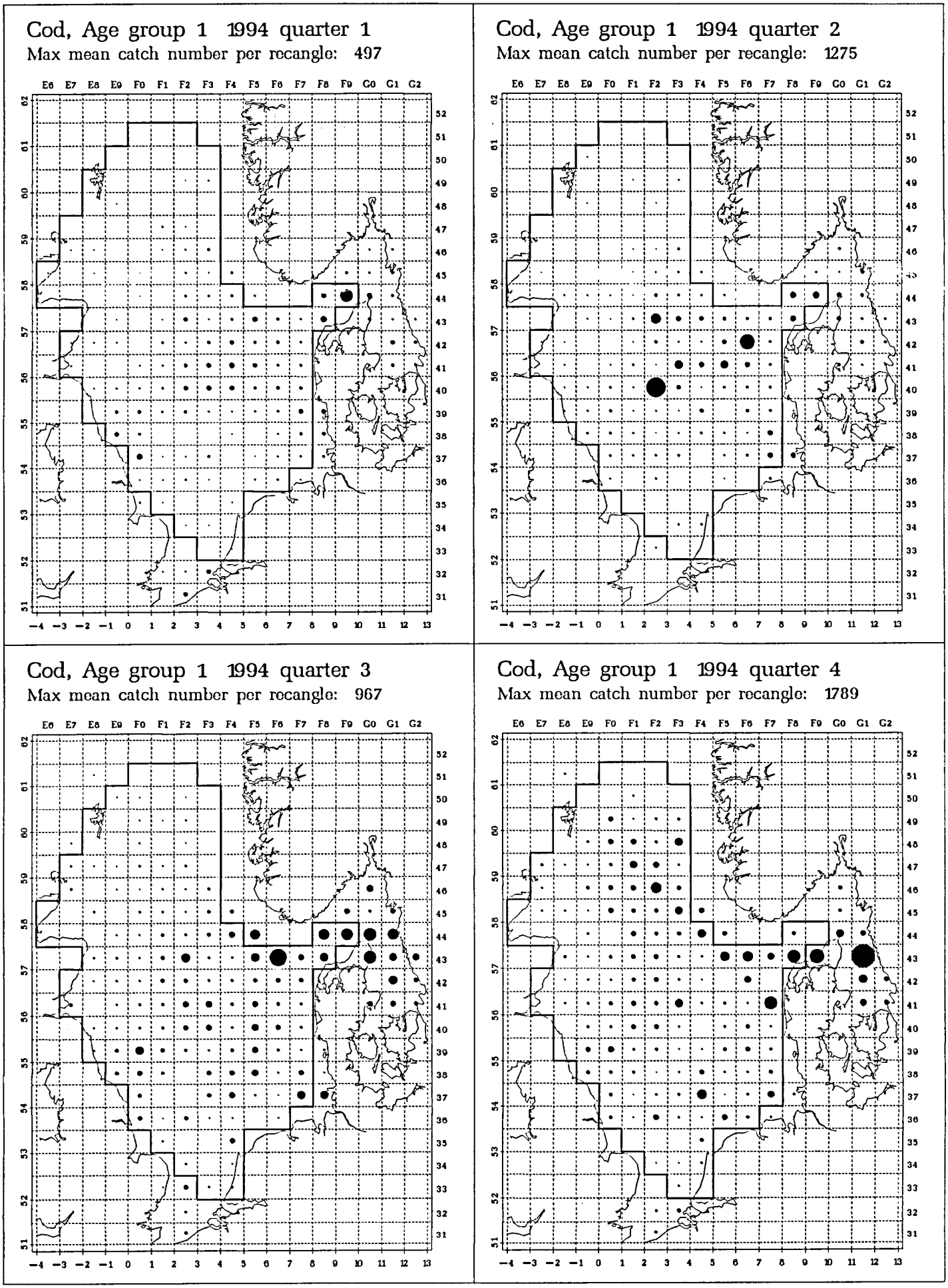


Figure 4.19 Cod: number per hour, age-group 1.

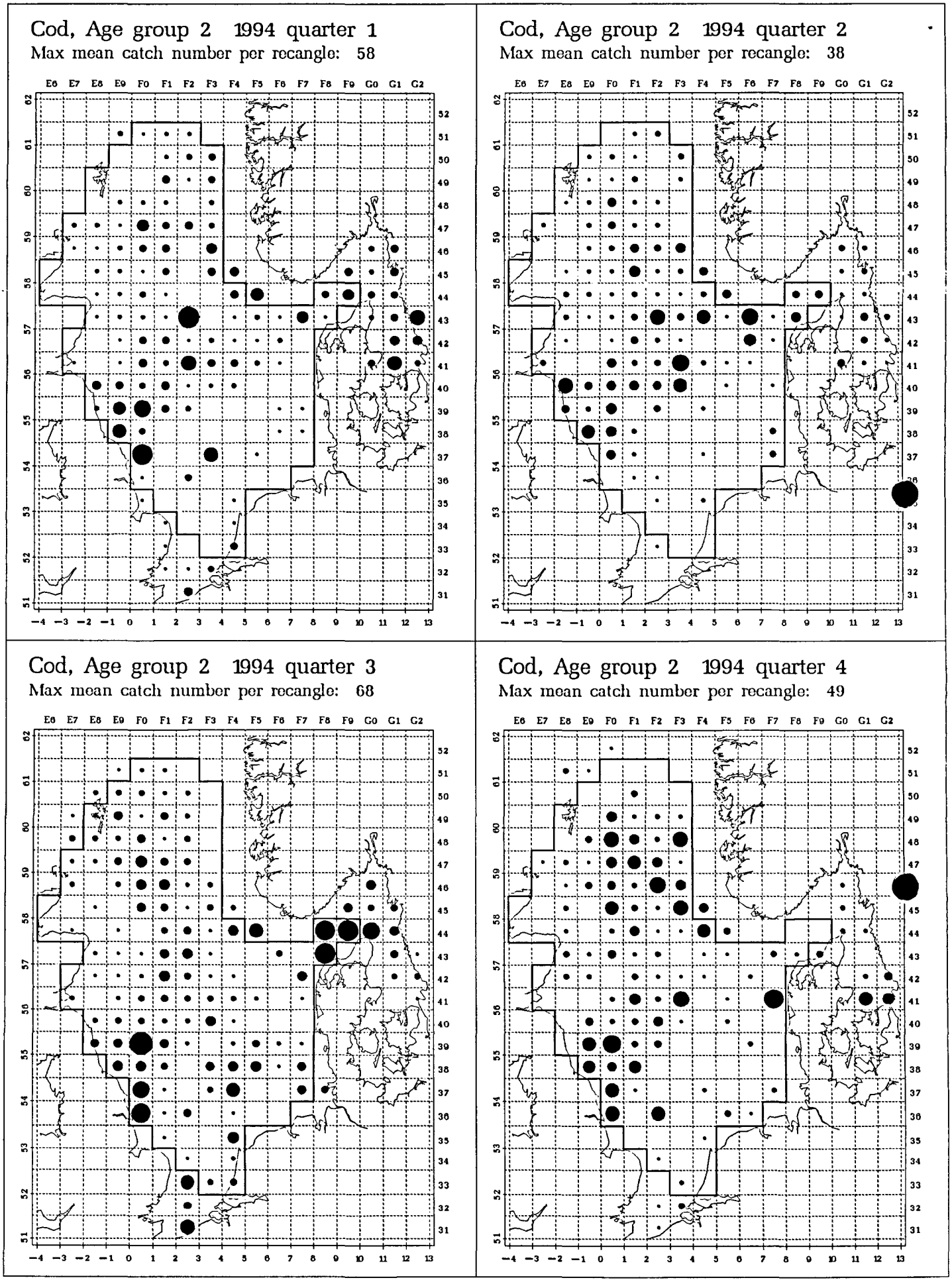


Figure 4.20 Cod: number per hour, age-group 2.

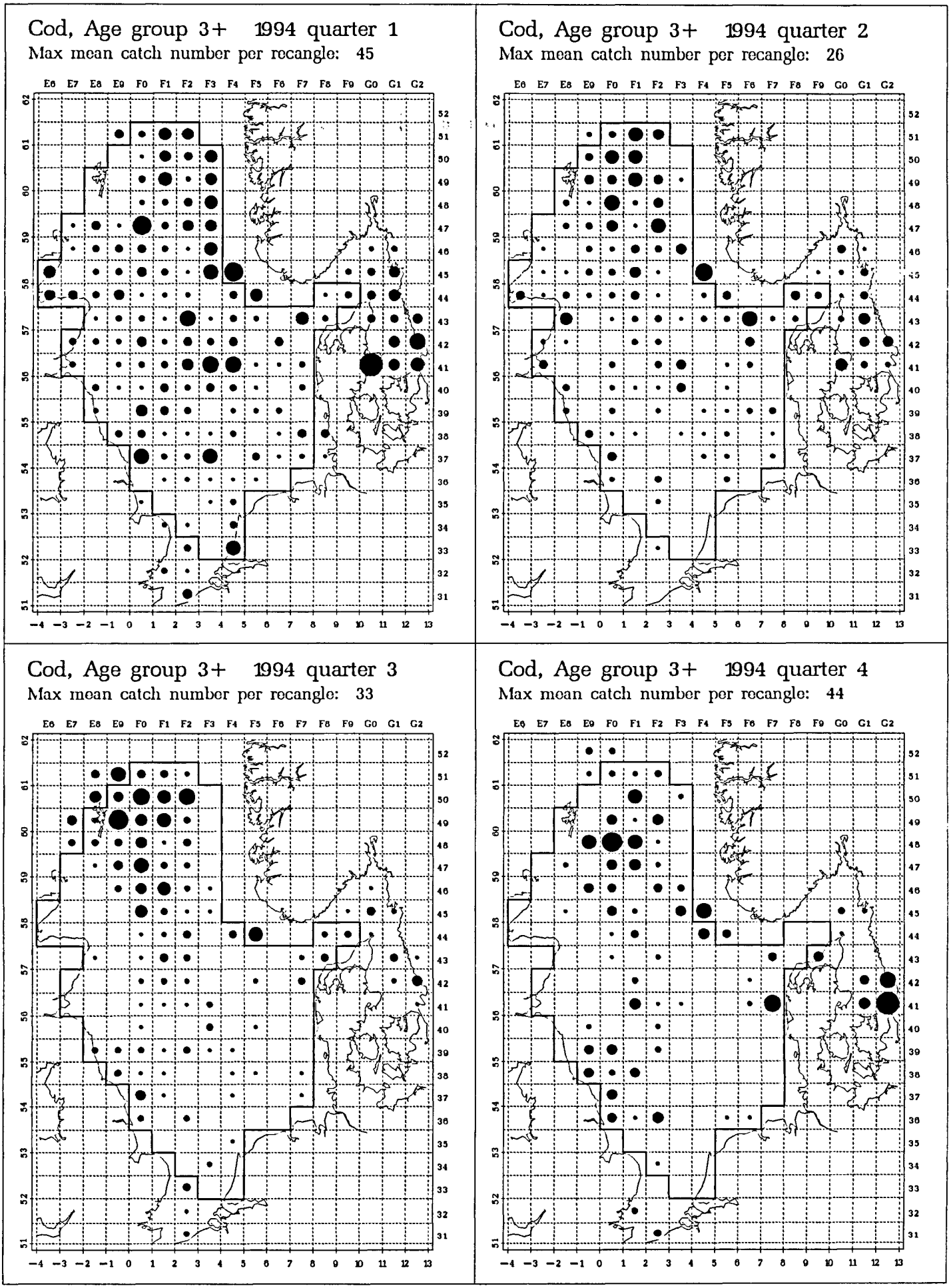


Figure 4.21 Cod: number per hour, age-group 3+.

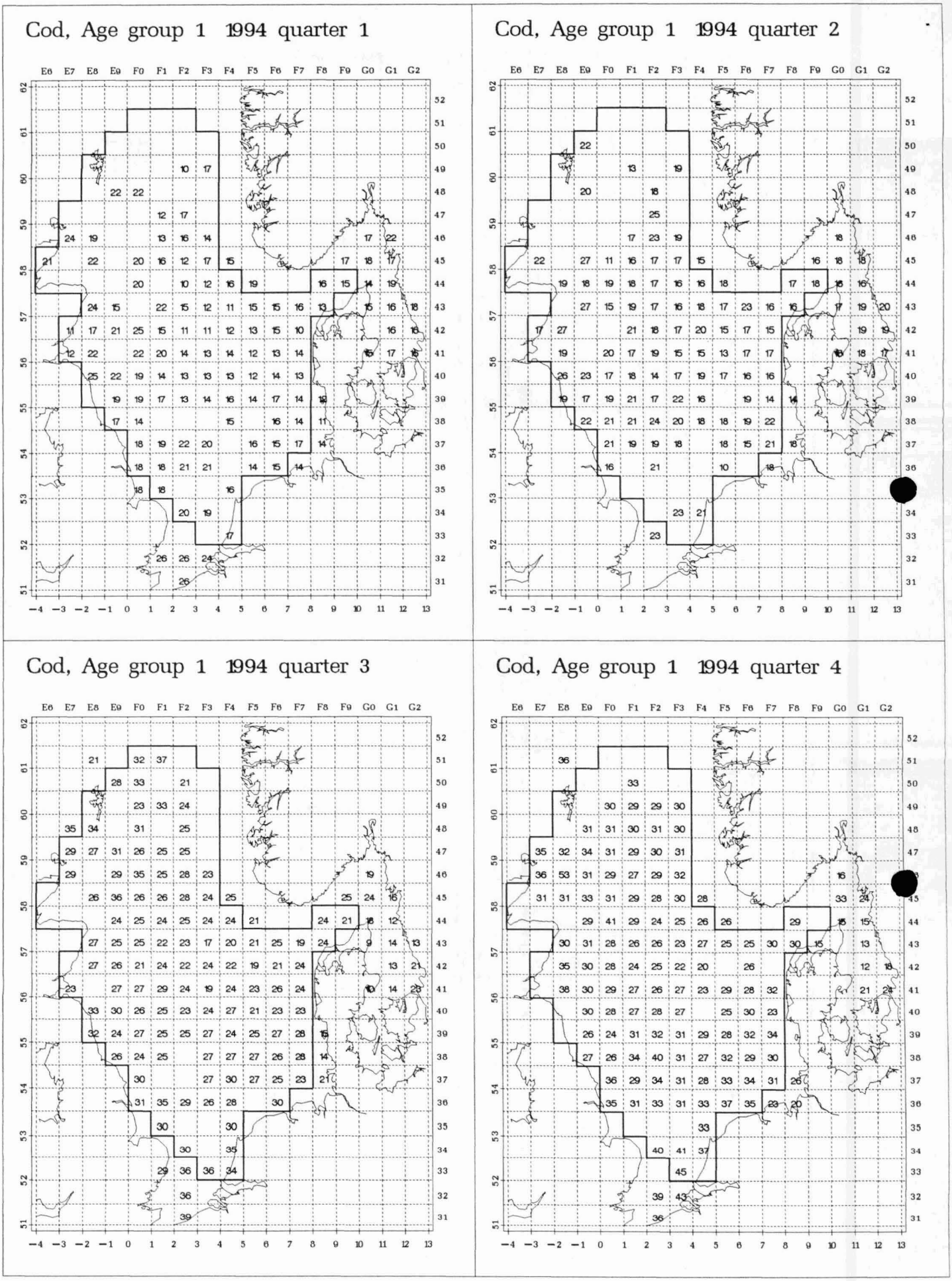


Figure 4.22 Cod: mean length (cm below), age-group 1.

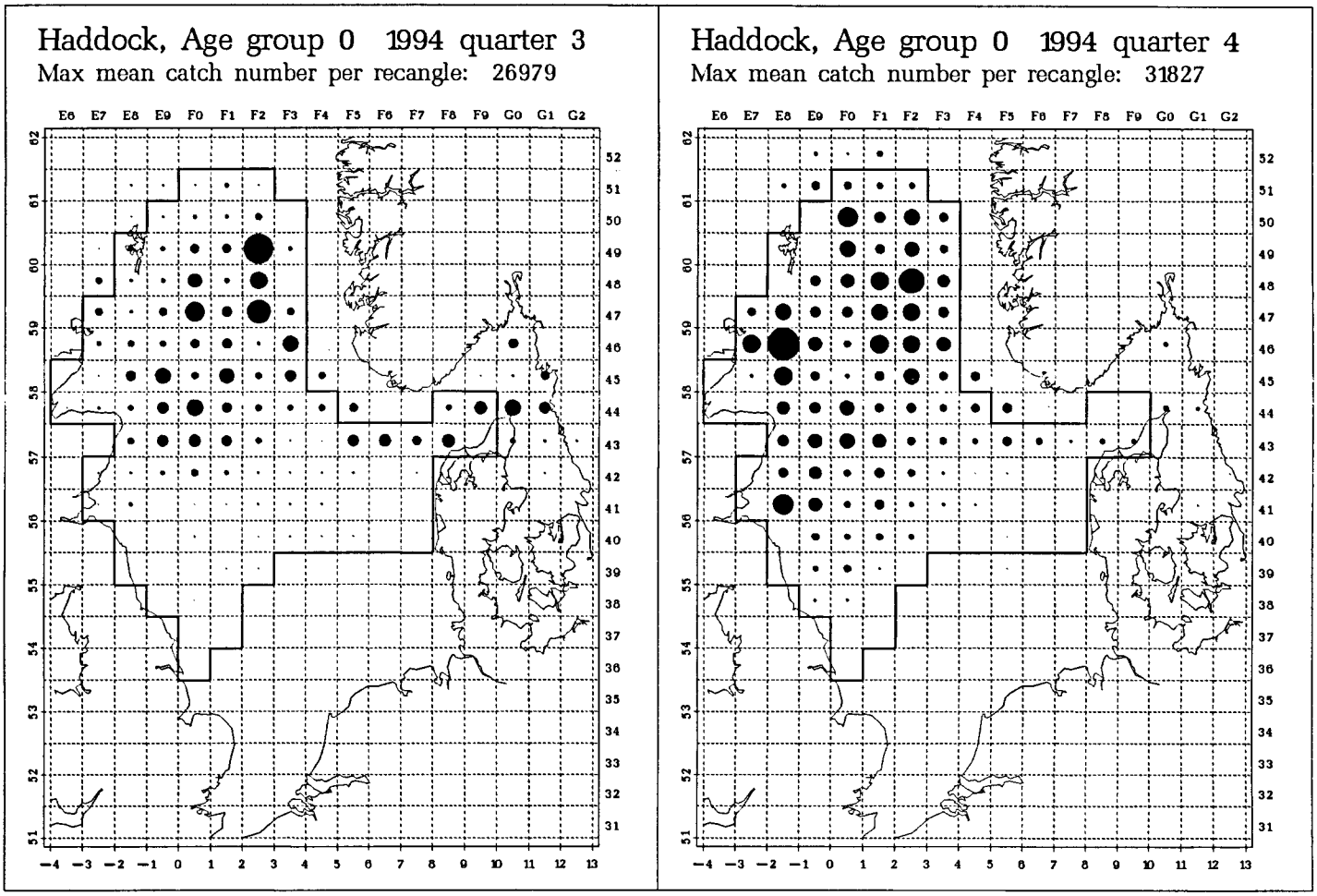


Figure 4.23 Haddock: number per hour, age-group 0.

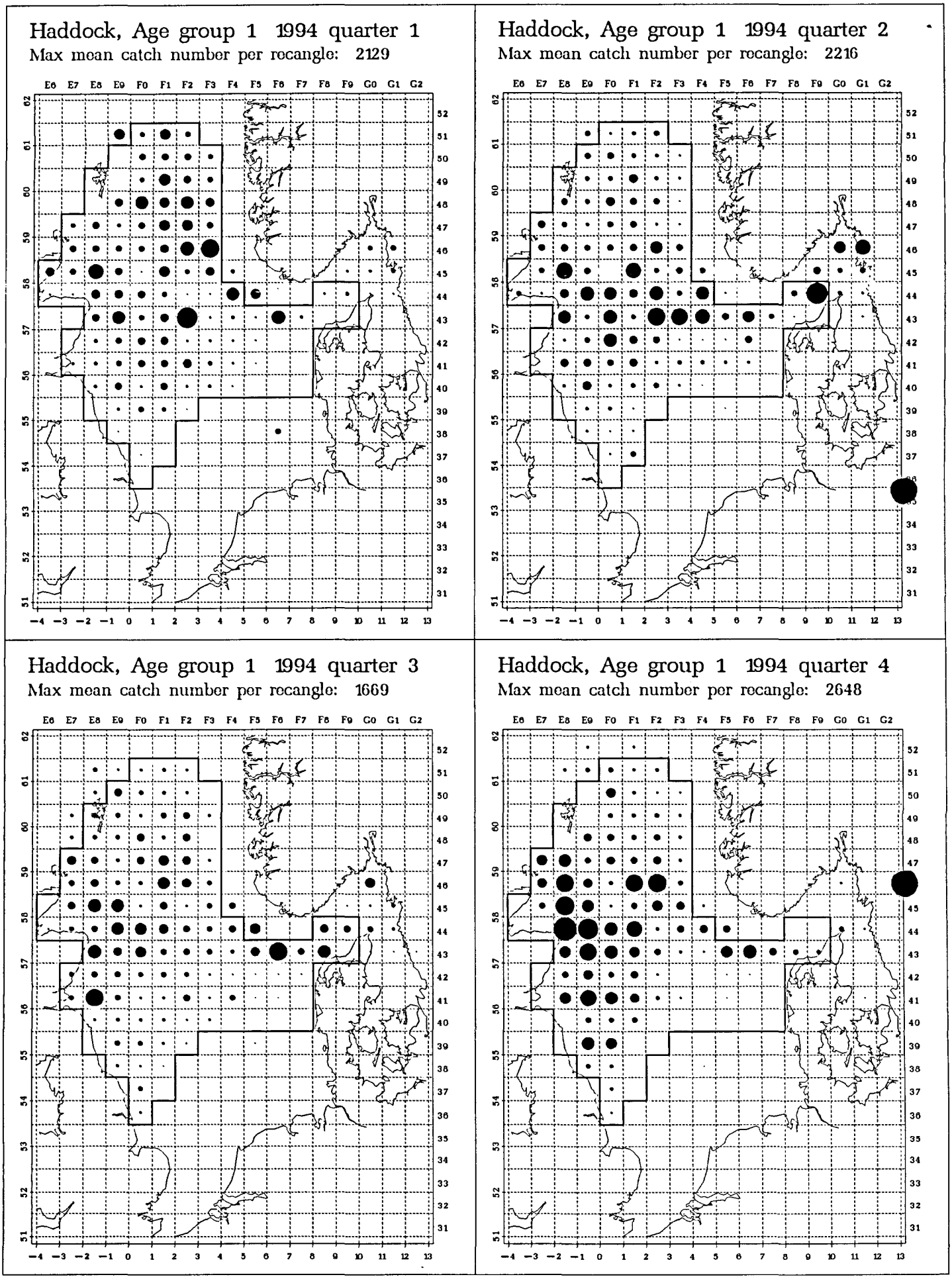


Figure 4.24 Haddock: number per hour, age-group 1.

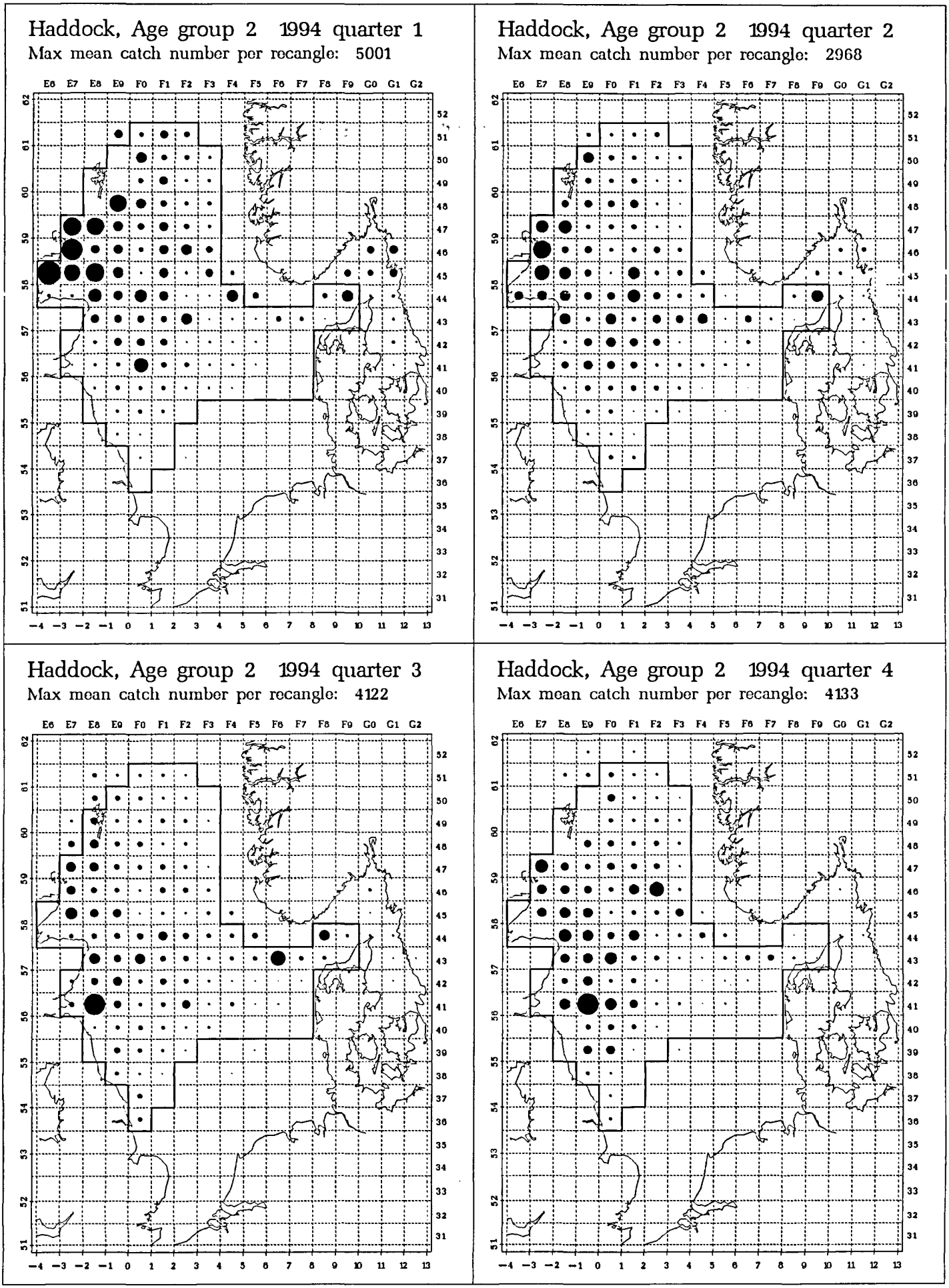


Figure 4.25 Haddock: number per hour, age-group 2.

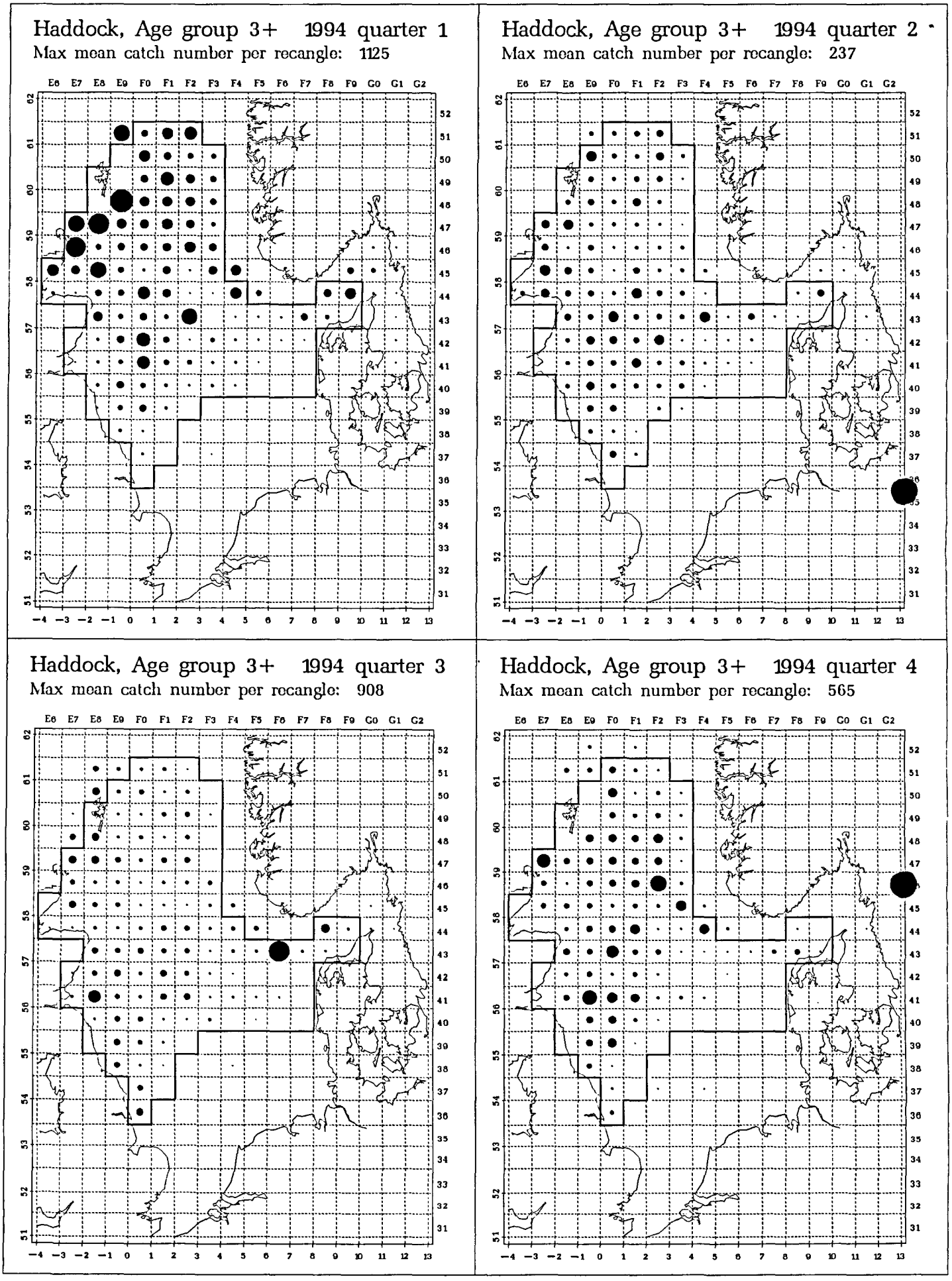


Figure 4.26 Haddock: number per hour, age-group 3+.

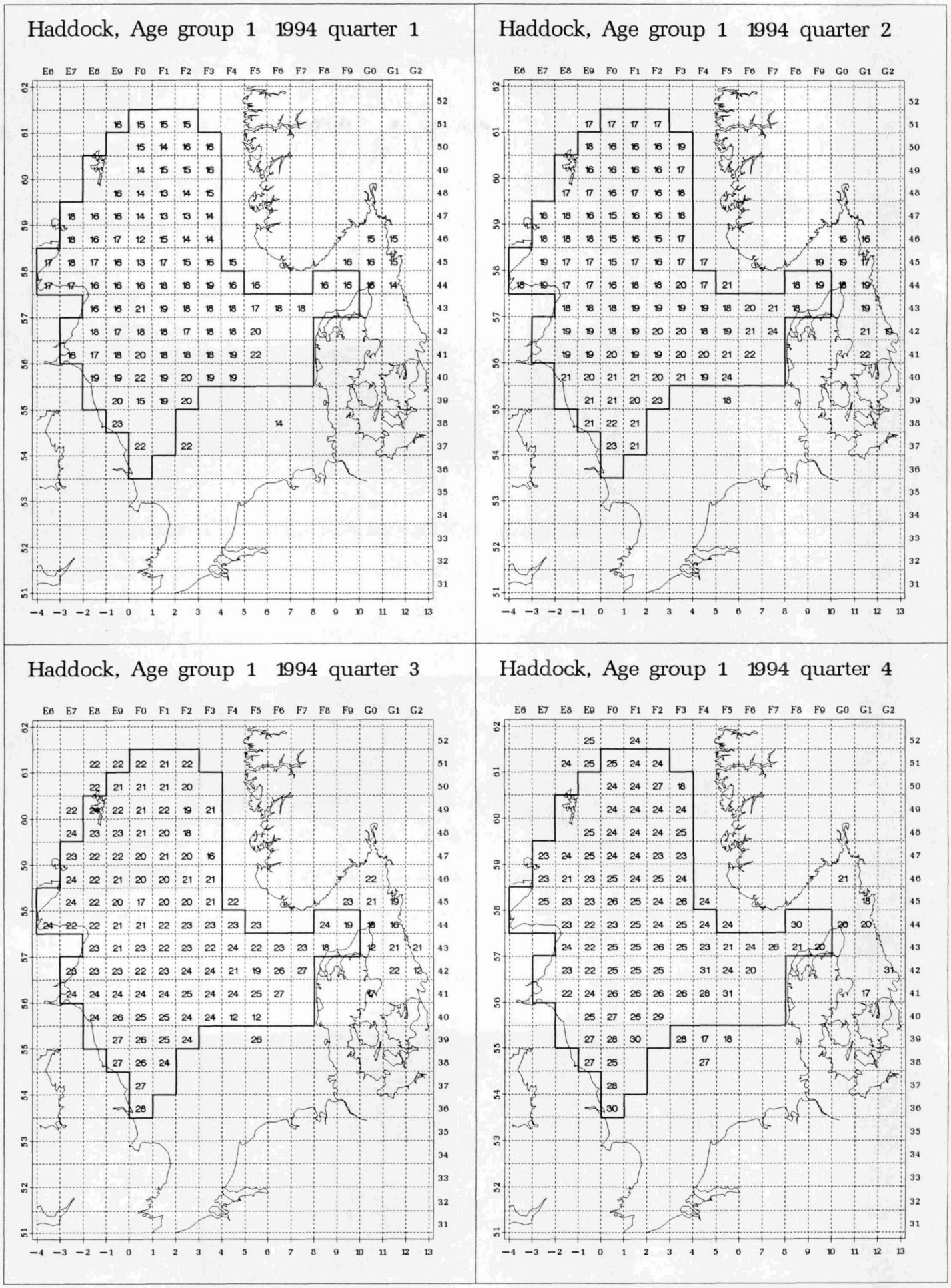


Figure 4.27 Haddock: mean length (cm below), age-group 1.

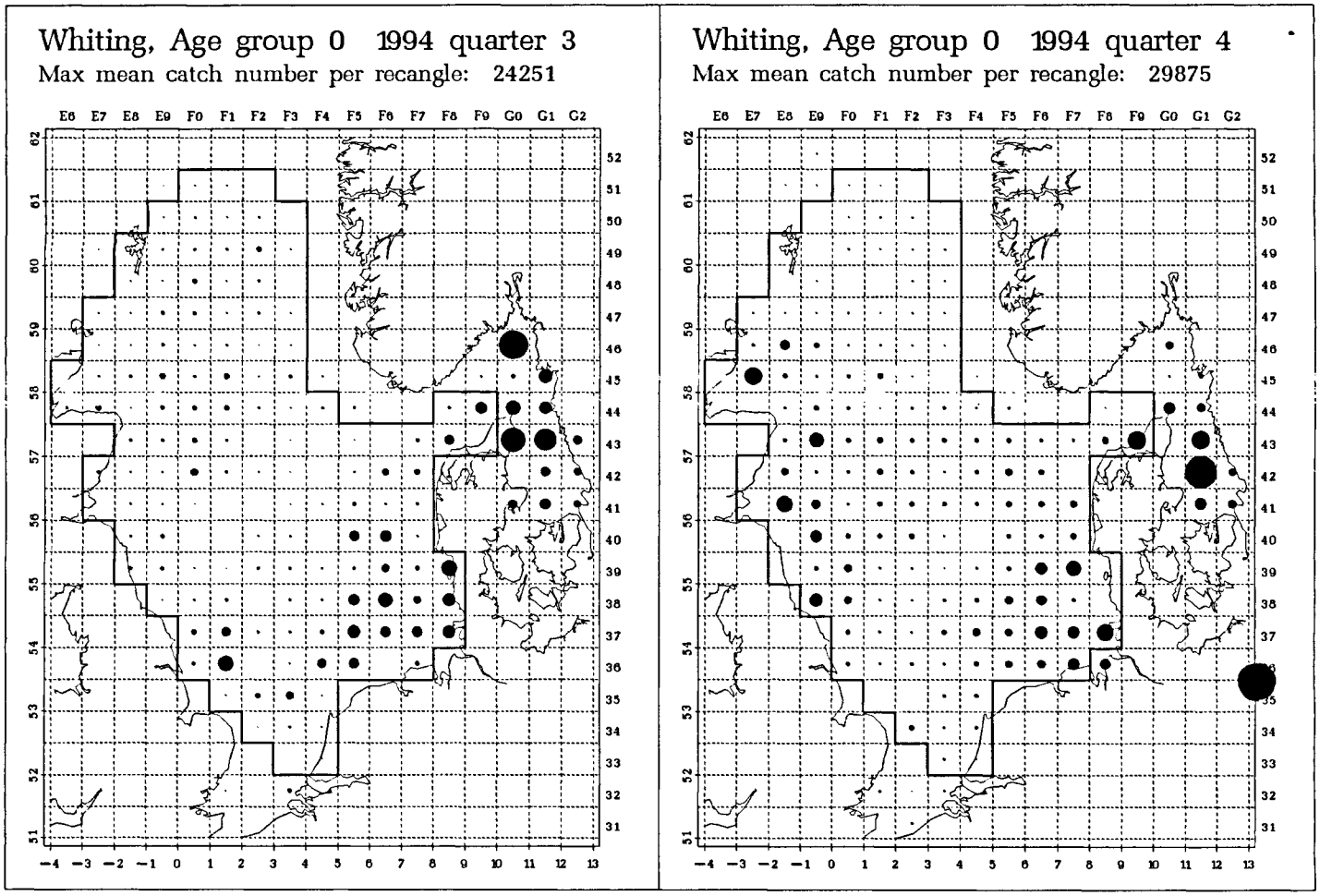


Figure 4.28 Whiting: number per hour, age-group 0.

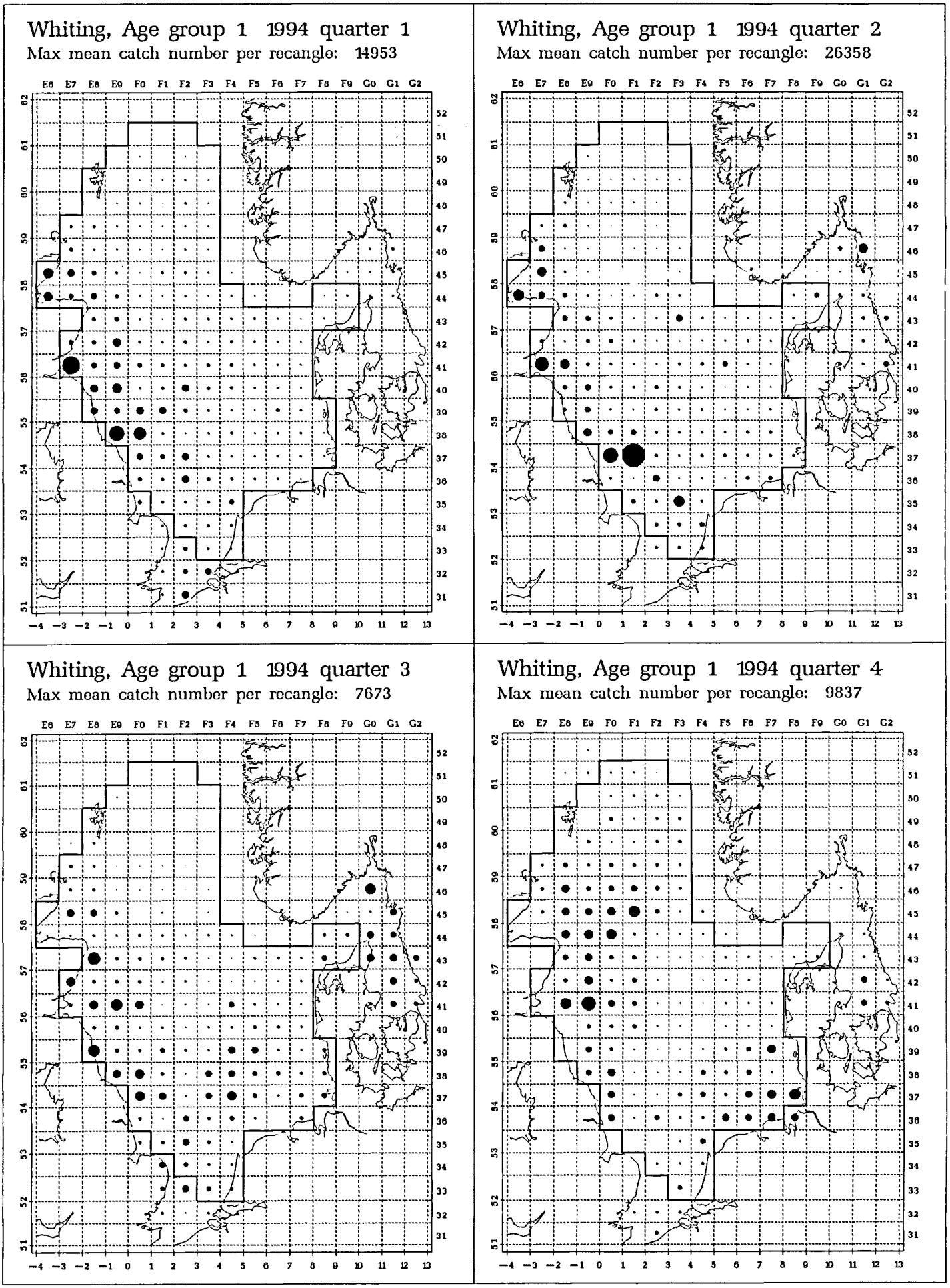


Figure 4.29 Whiting: number per hour, age-group 1.

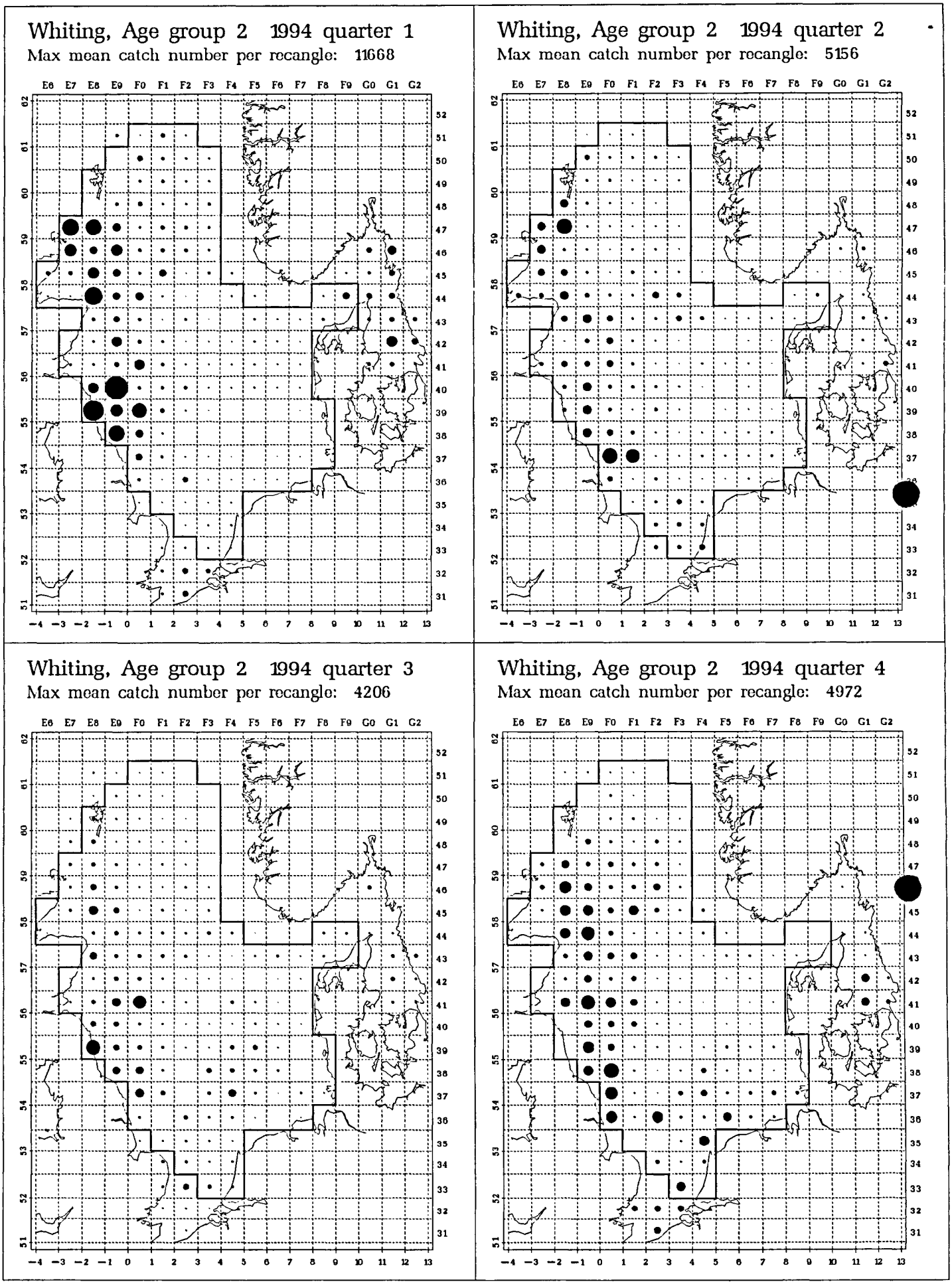


Figure 4.30 Whiting: number per hour, age-group 2.

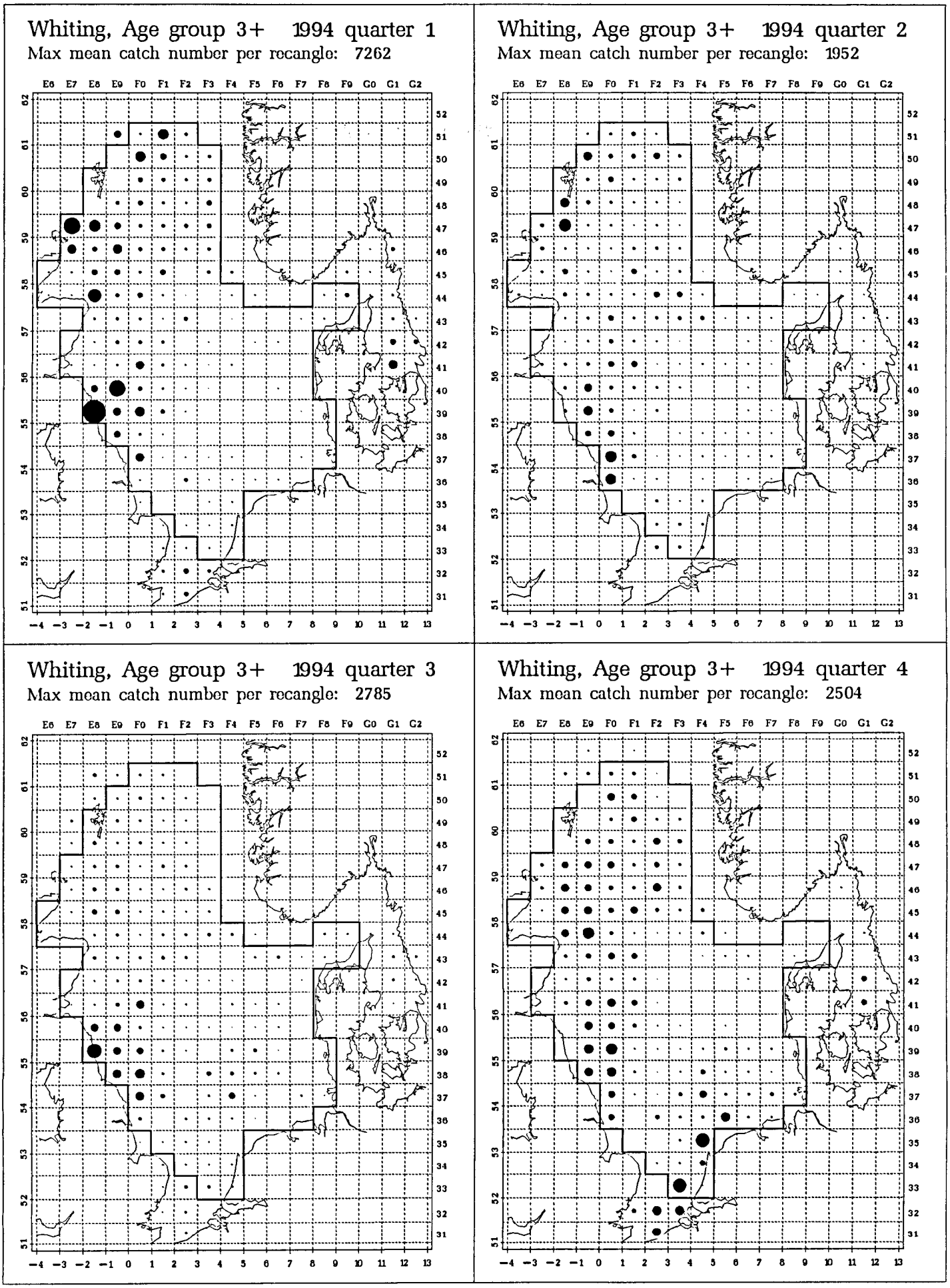


Figure 4.31 Whiting: number per hour, age-group 3+.

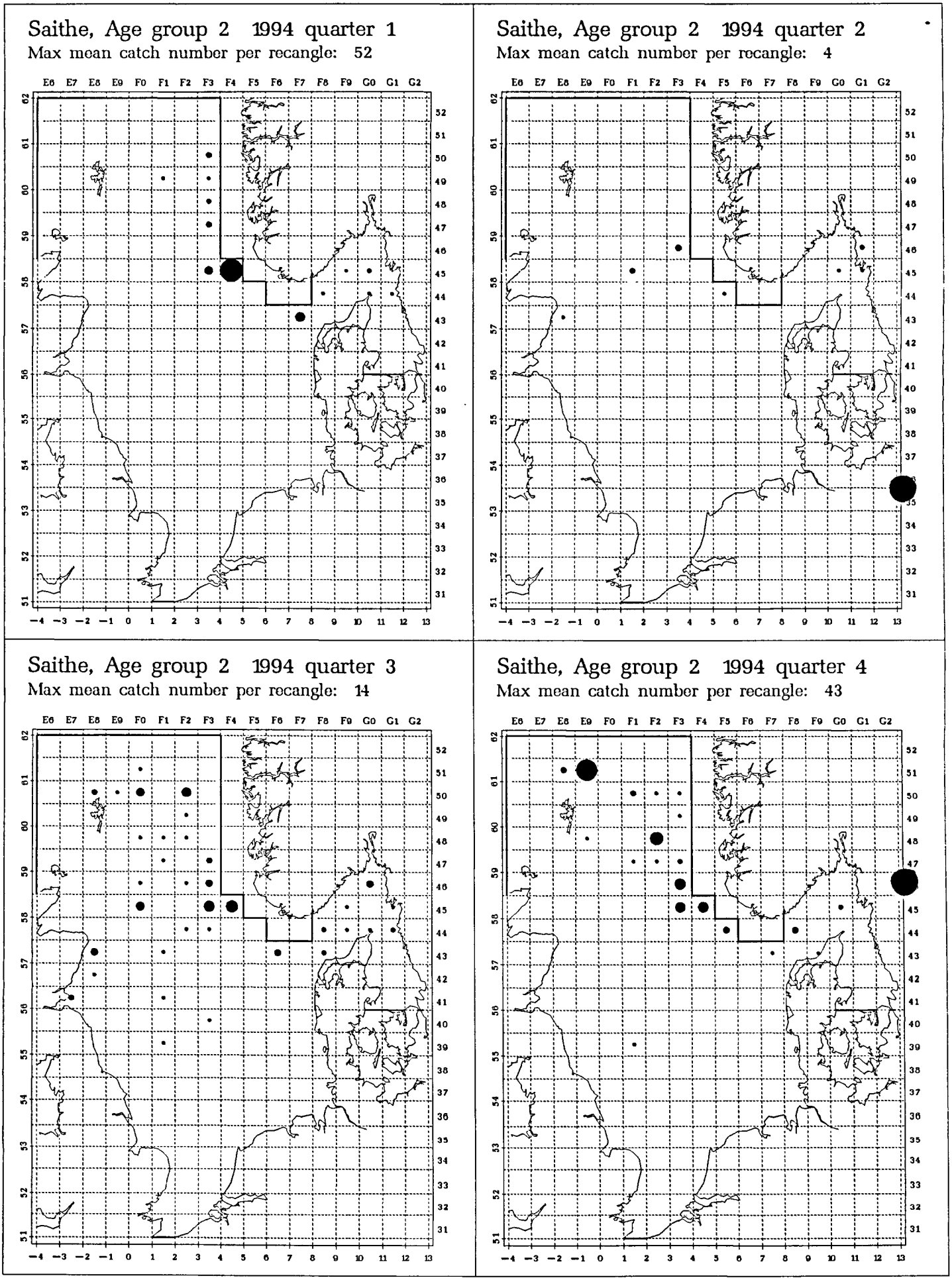


Figure 4.32 Saithe: number per hour, age-group 2.

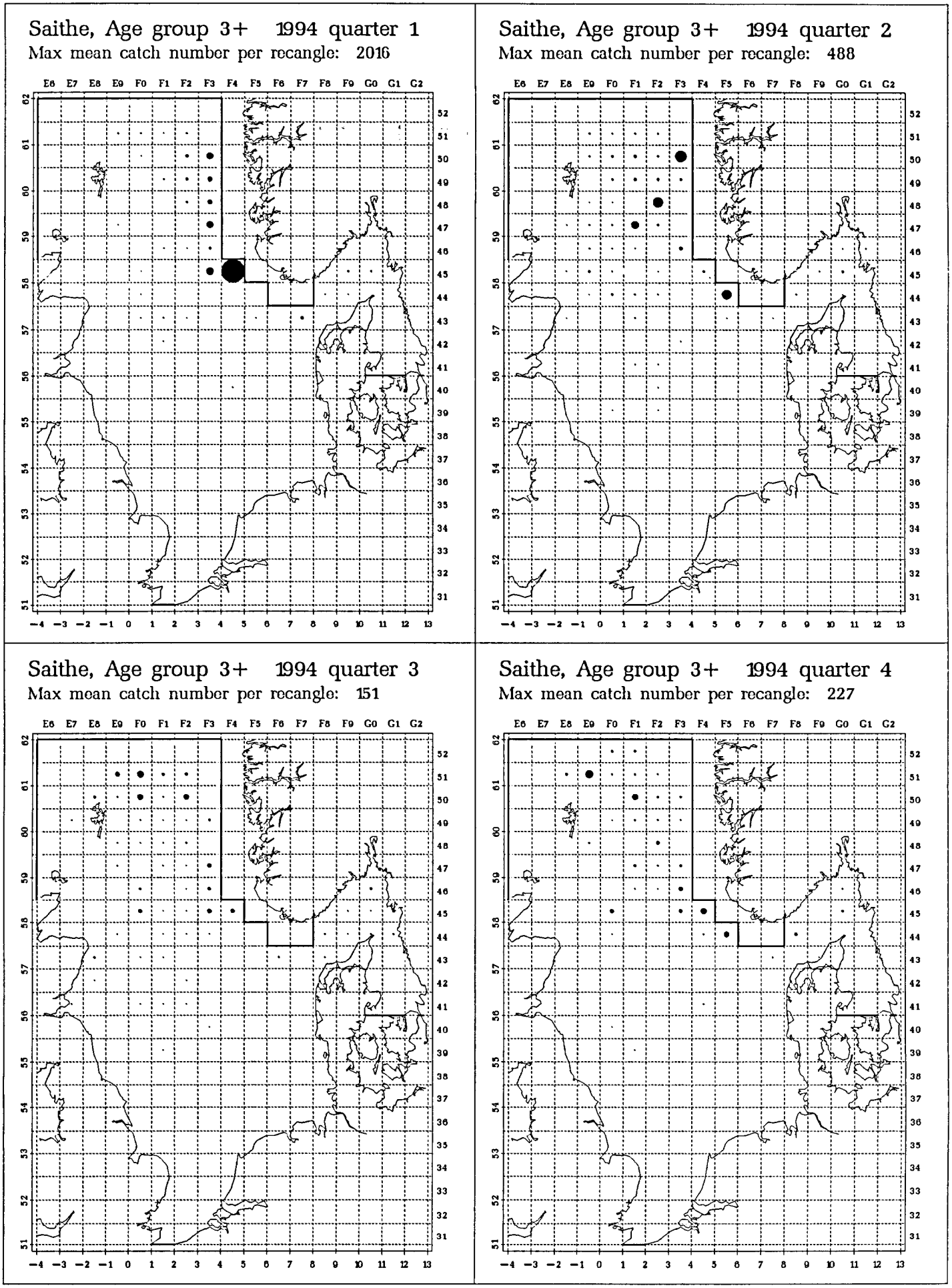


Figure 4.33 Saithe: number per hour, age-group 3+.

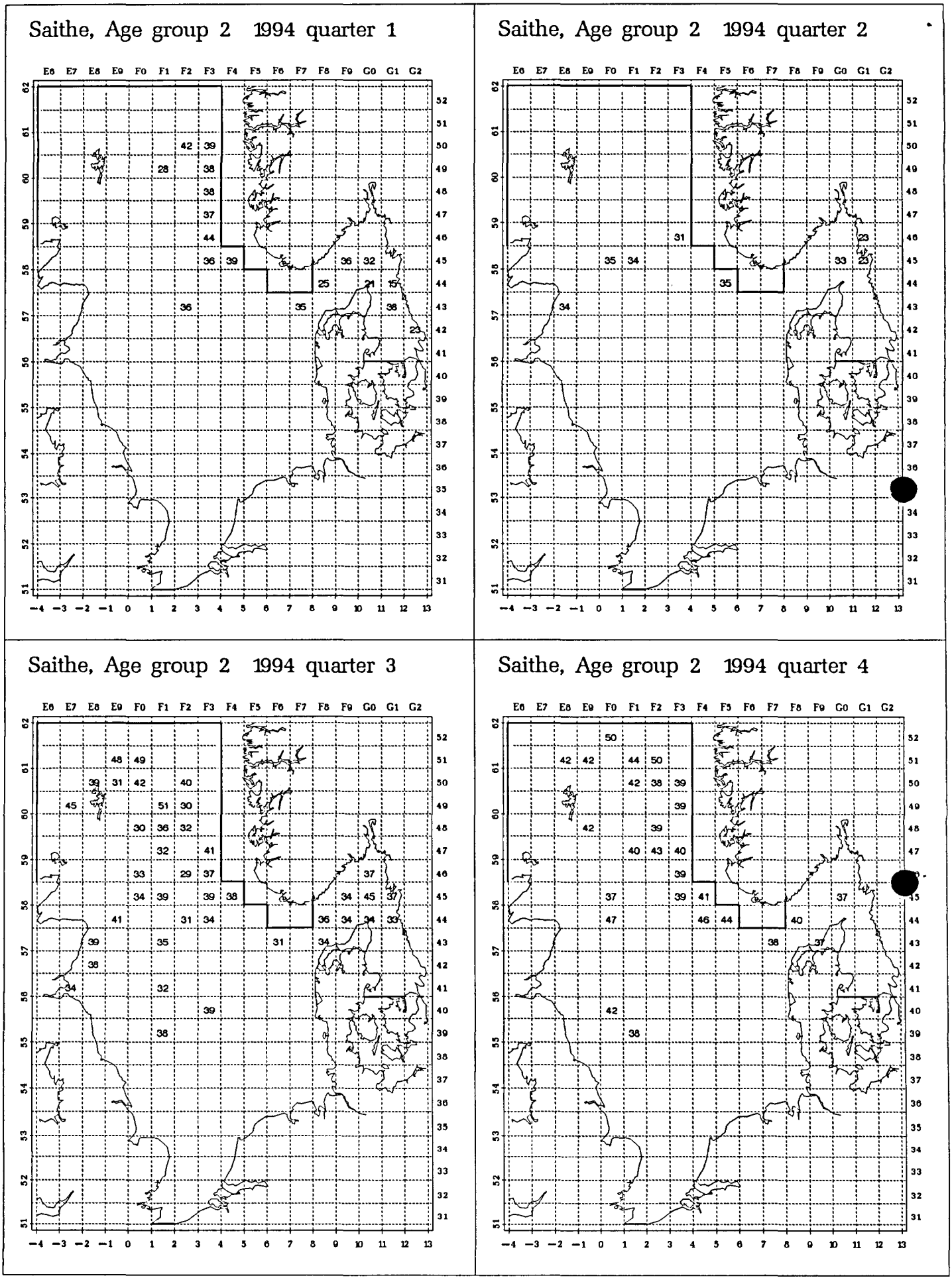


Figure 4.34 Saithe: mean length (cm below), age-group 2.

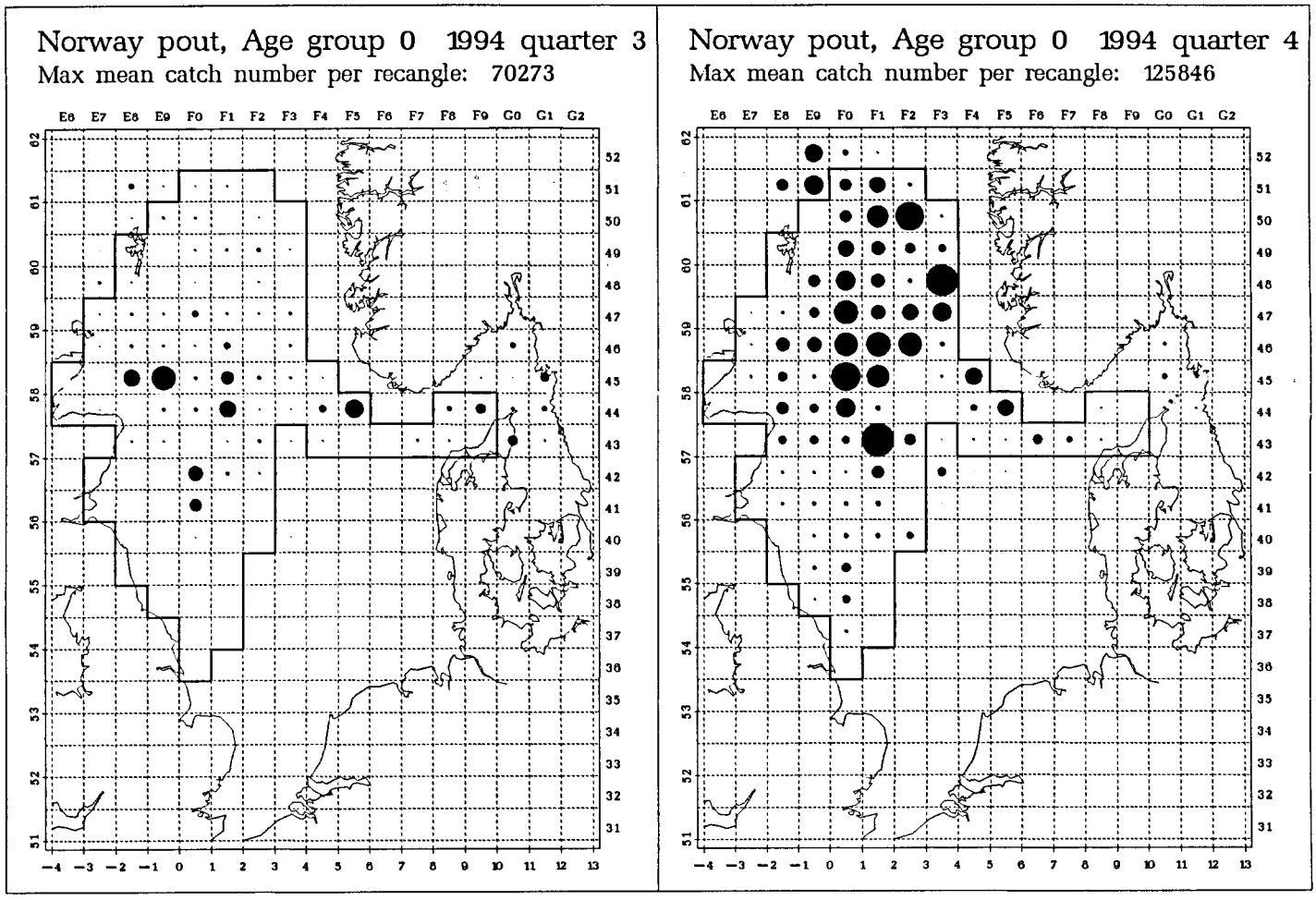


Figure 4.35 Norway pout: number per hour, age-group 0.

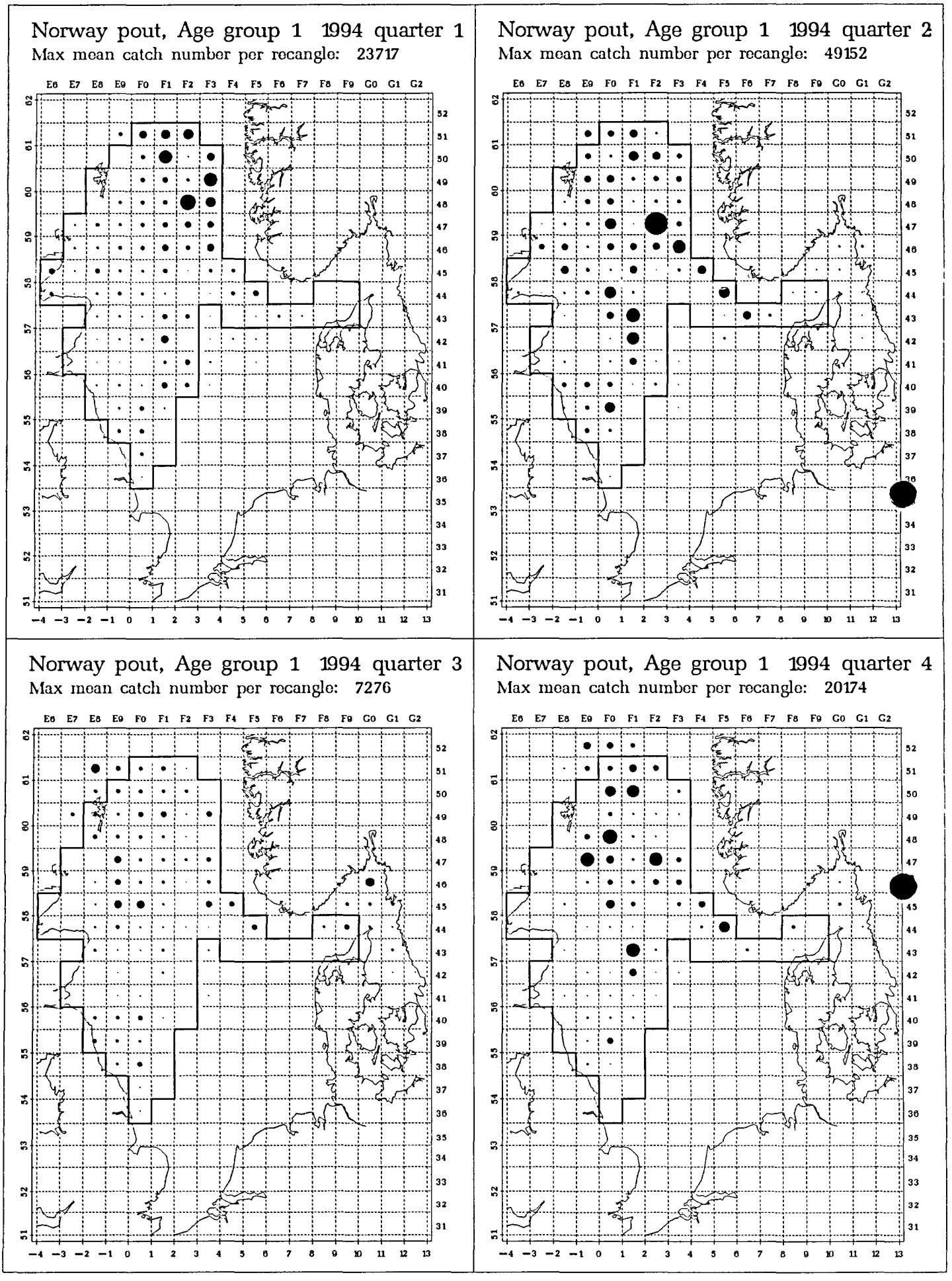


Figure 4.36 Norway pout: number per hour, age-group 1.

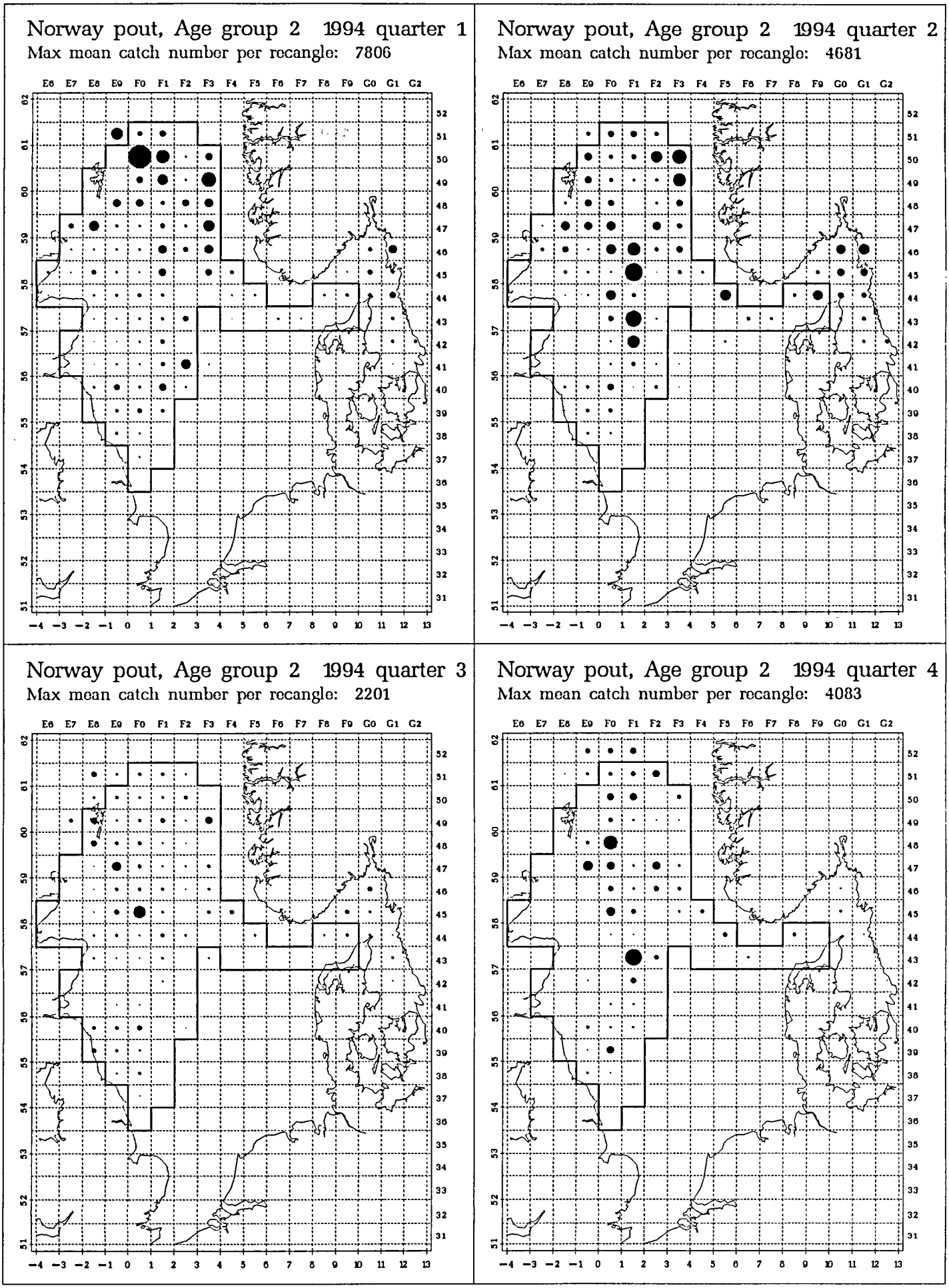


Figure 4.37 Norway pout: number per hour, age-group 2.

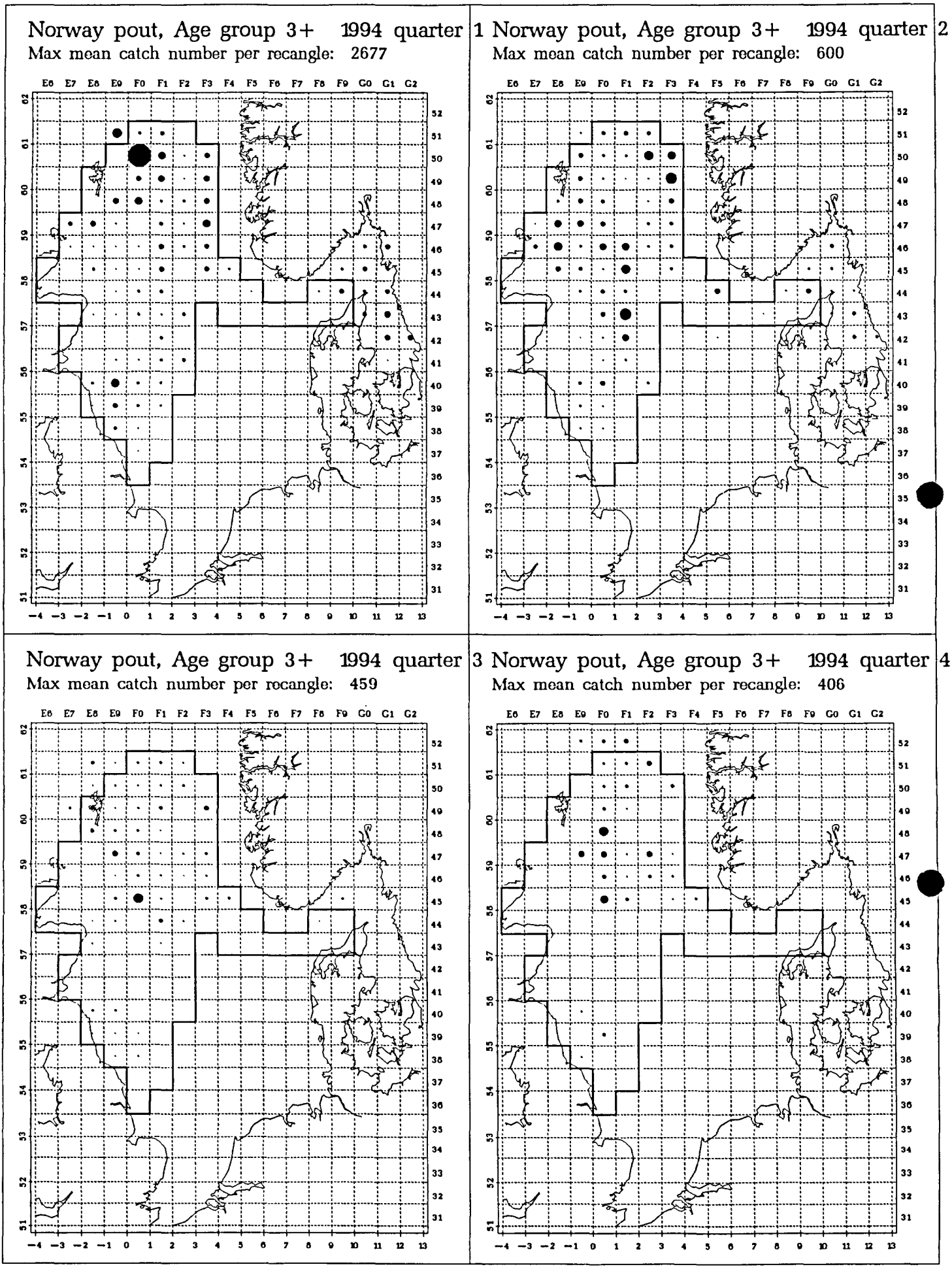


Figure 4.38 Norway pout: number per hour, age-group 3+.

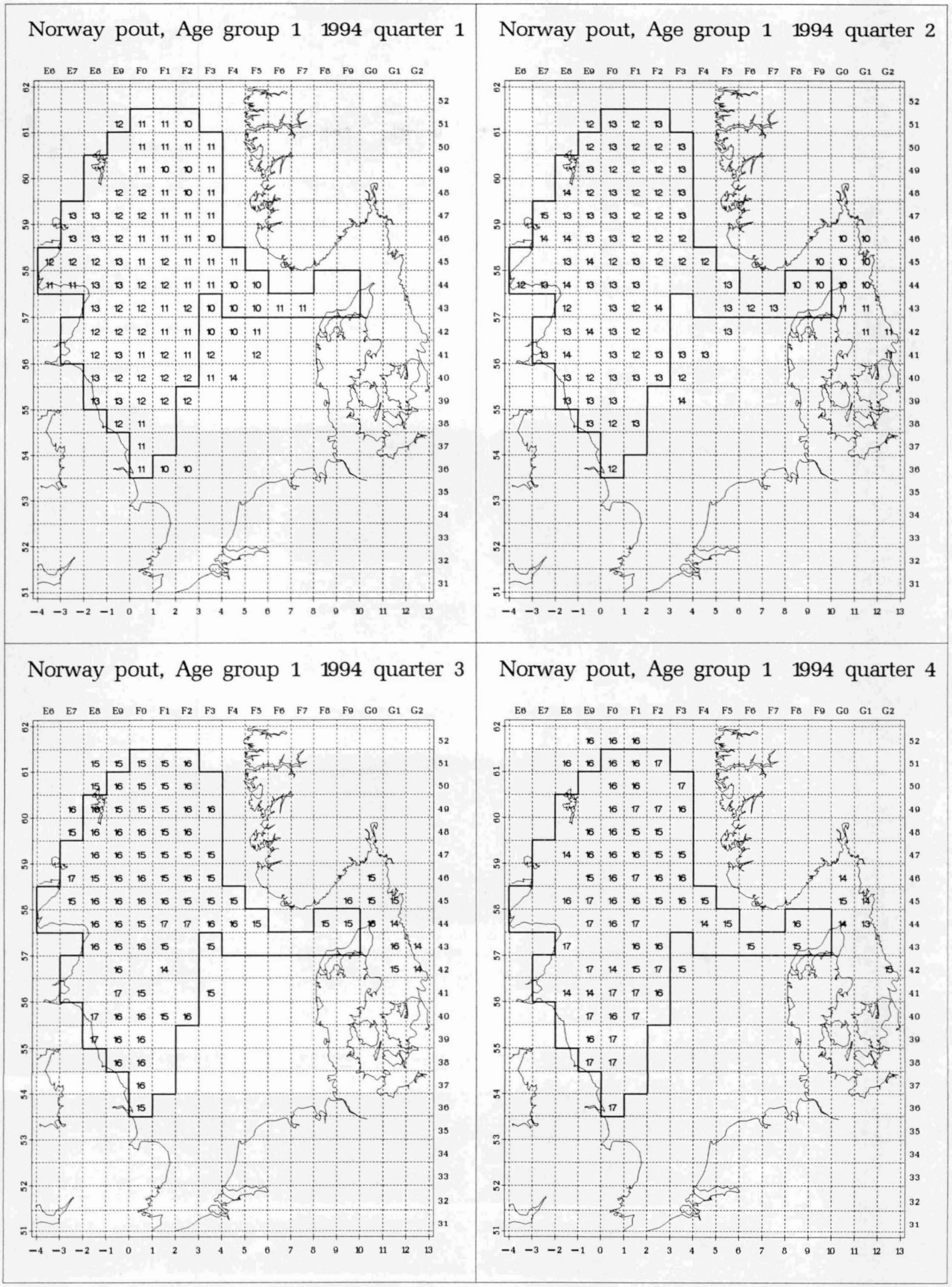
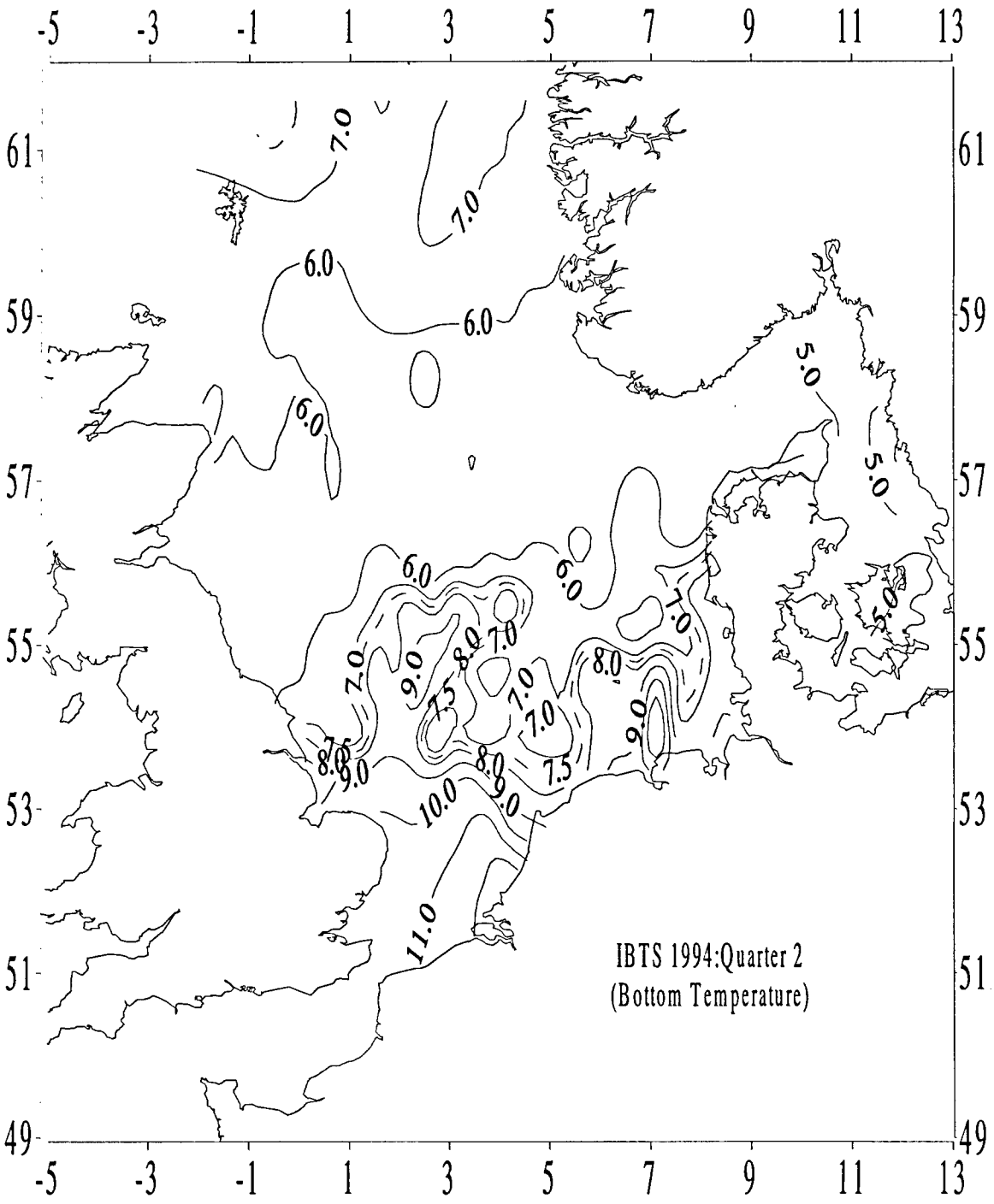


Figure 4.39 Norway pout: mean length (cm below), age-group 1.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7.0
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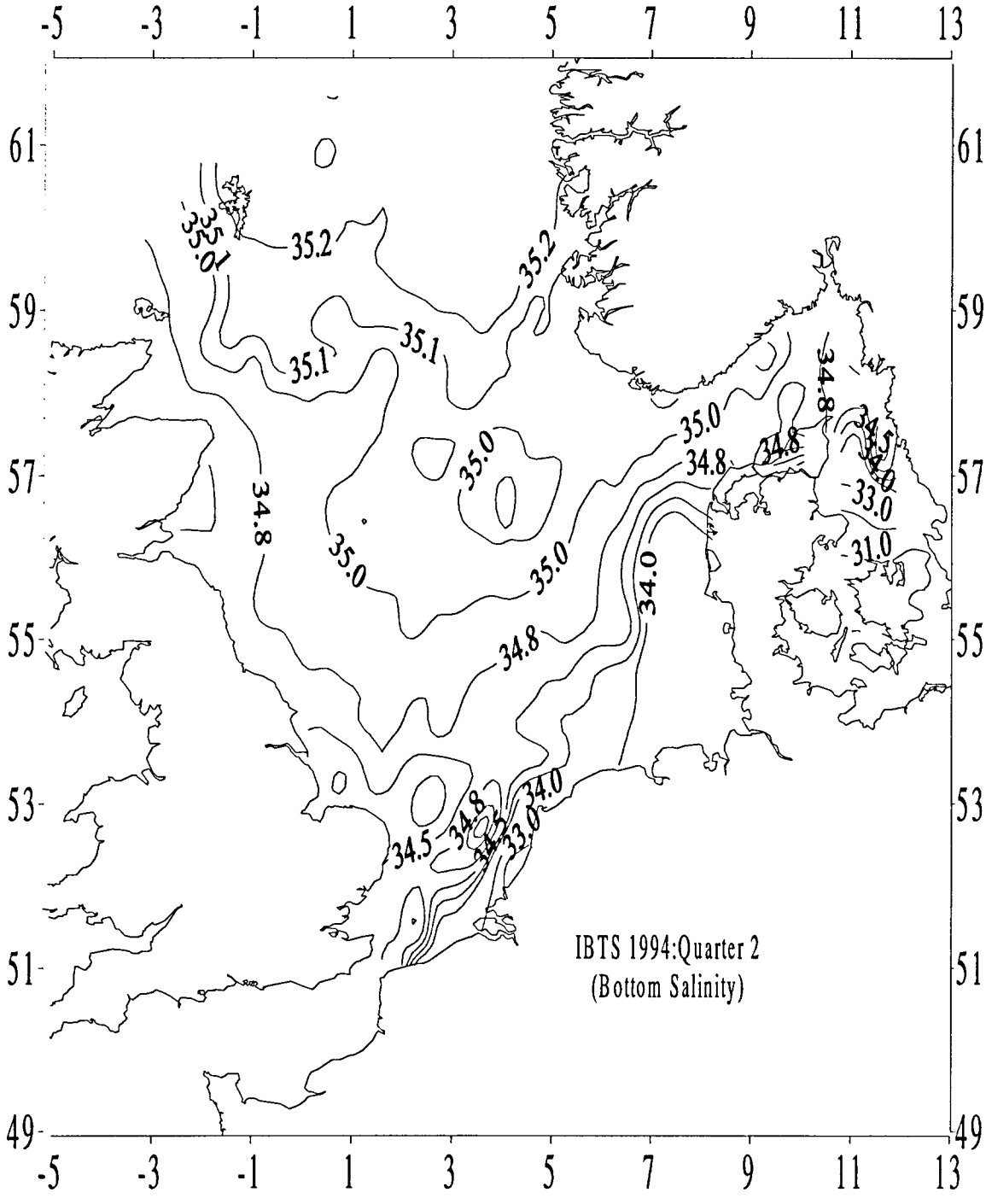
9.0
10.0
11.0
IBTS 1994:Quarter 2
(Bottom Temperature)

Figure 5.1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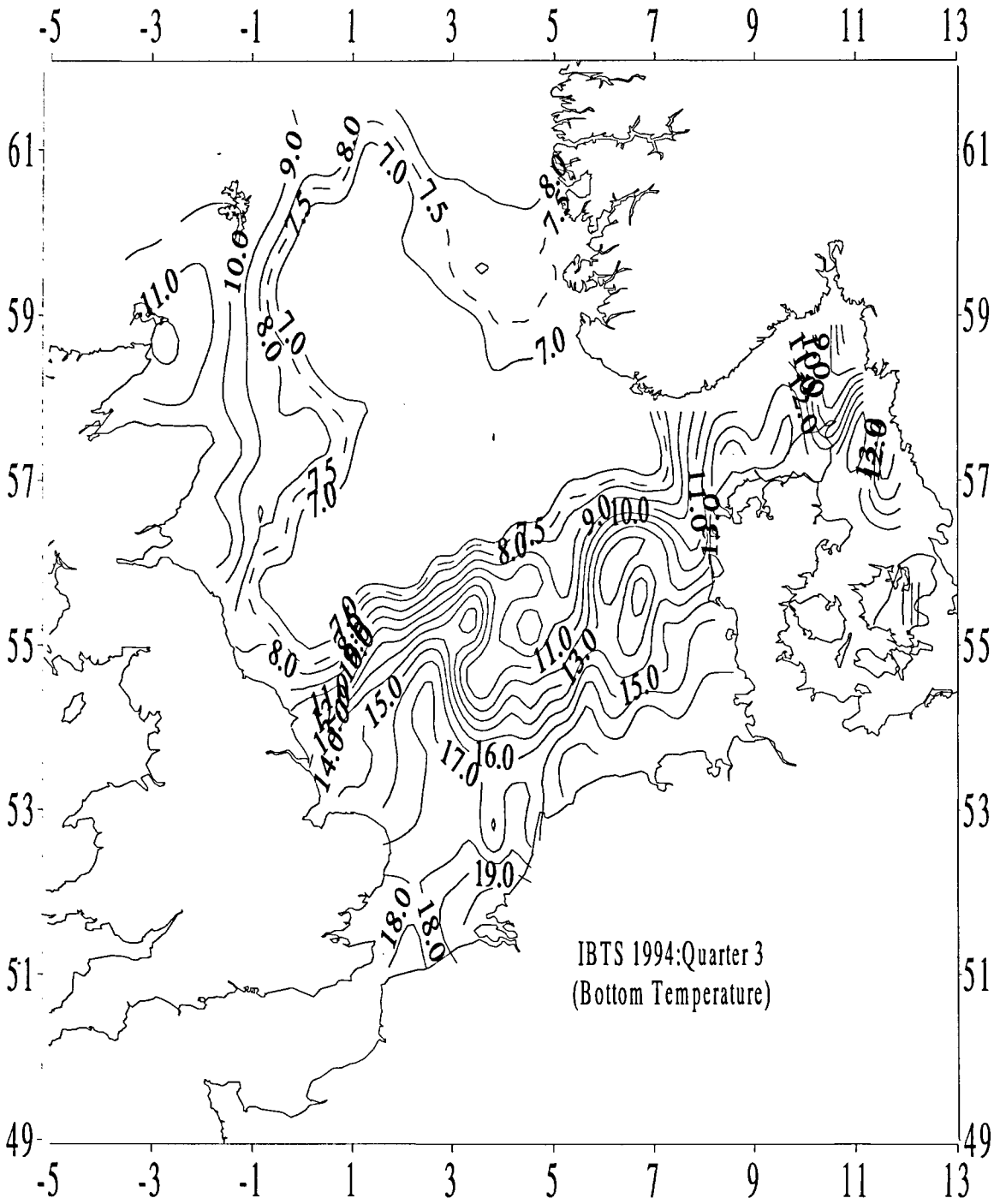
33.0
31.0
IBTS 1994:Quarter 2
(Bottom Salinity)

Figure 5.2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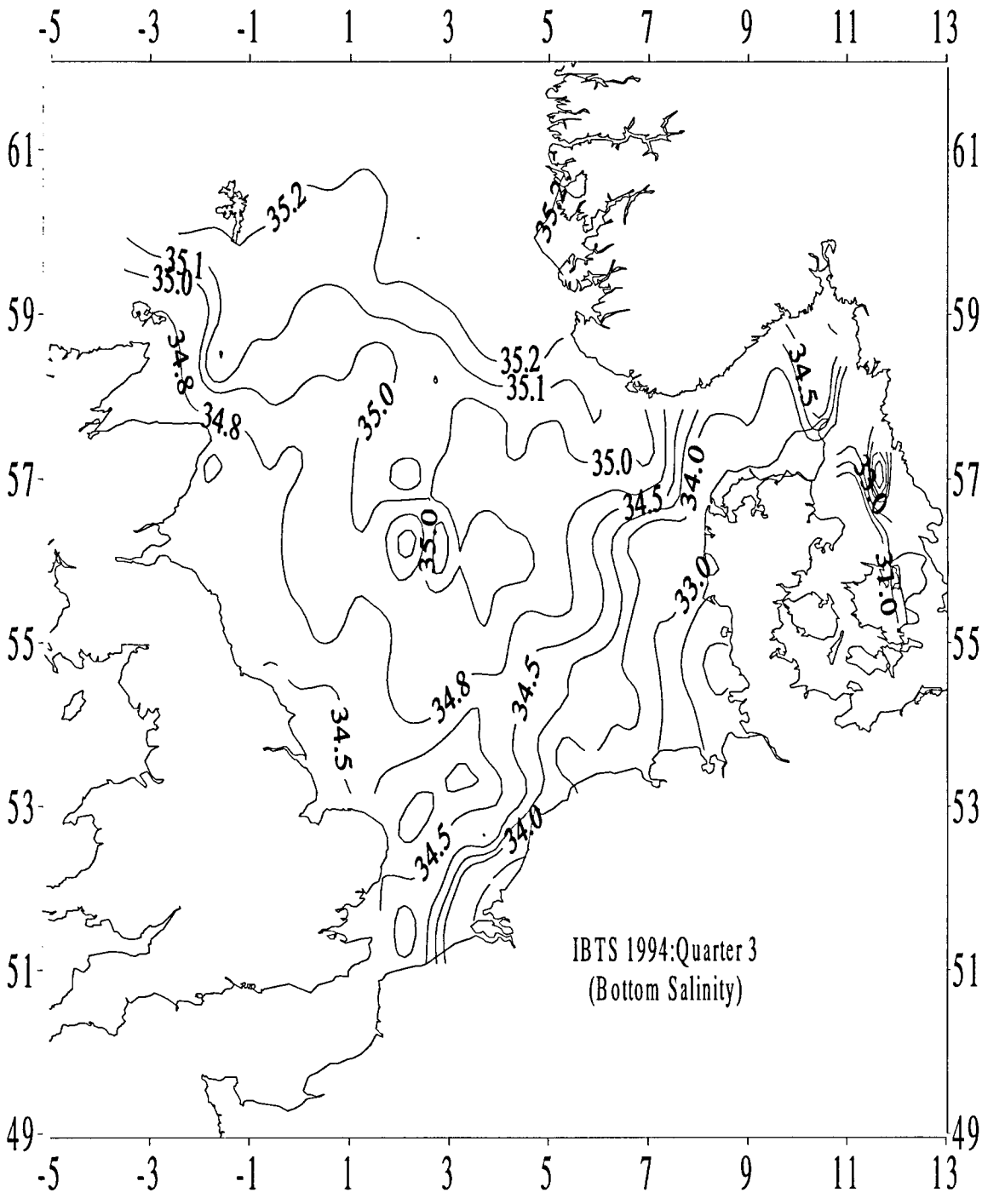
IBTS 1994:Quarter 3
(Bottom Temperature)

Figure 5.3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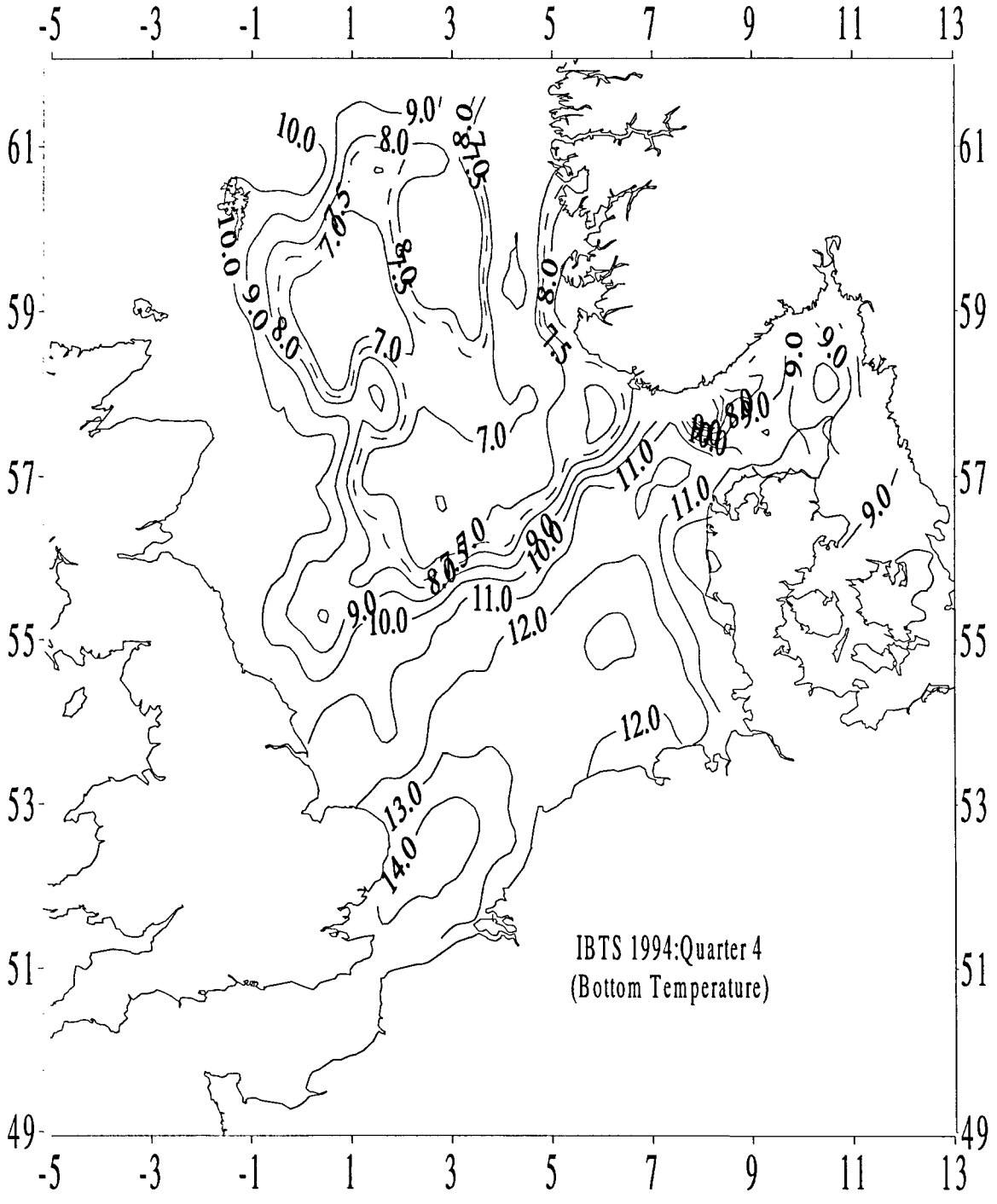
IBTS 1994:Quarter 3
(Bottom Salinity)

Figure 5.4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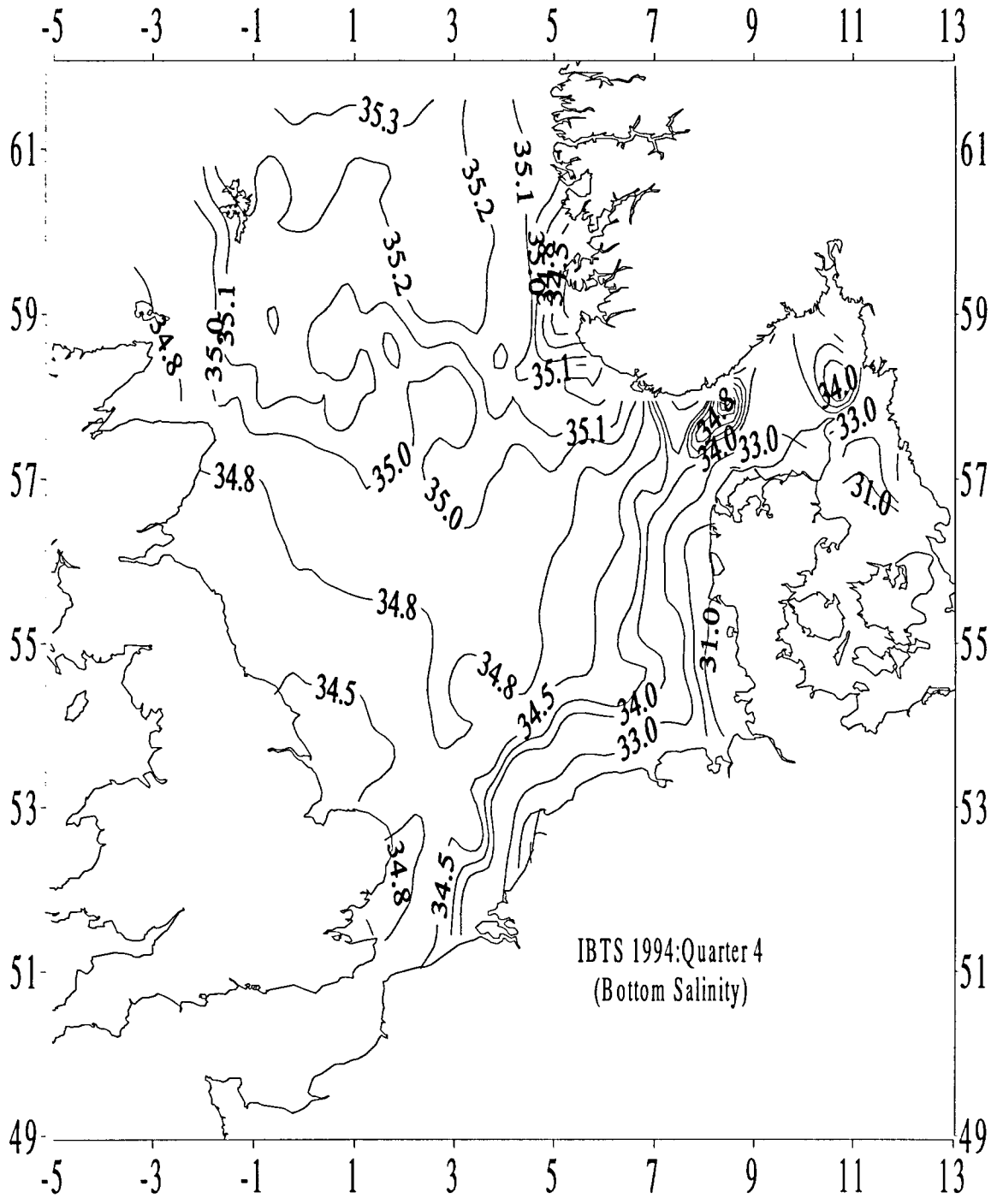
13.0
14.0
IBTS 1994:Quarter 4
(Bottom Temperature)

Figure 5.5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IBTS 1994:Quarter 4
(Bottom Salinity)

Figure 5.6