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Stock Assessment and Distribution of Cod in Division 3L From 1990-1994 Trawl Survey Data

by

V. M. Kiseleva

Polar Research Institute of Marine Fisheries and Oceanography (PINRO)
6 Knipovich Street, 183763, Murmansk, Russia

Abstract

The paper deals with cod stock status assessed from June-July 1994 trawl survey. During recent decade cod stock was registered to be at the lowest level and constituted 2.1×10^6 fish in abundance and 0.9×10^3 tons in biomass.

Variations in catches distribution, size, age composition of cod in Div. 3L are considered on the basis of data collected in spring and summer 1990-1994.

Cod age range in catches changed from age 18 in 1990 to age 8 in 1994. Cod stock decline in Div. 3L mainly occurred through drastic reductions of mature fish.

Introduction

Annually for a series of years Polar Institute has been conducted surveys on the Grand Bank on Newfoundland with the aim of control over commercial fish stocks status. Cod stock in Div.3L despite imposition of moratorium in 1992 continue to decrease drastically. This paper deals with variations in catch distribution, size and age composition of cod in Div. 3L in spring and summer 1990-1994.

Materials and Methods

In 1990-1994 trawl stratified-random surveys were carried out (Doubleday, 1981; Bulatova, Chumakov, 1986). Tows were conducted using bottom trawl with a small-mesh insertion (12 mm mesh size) in the codend. Tows of 30 min duration were made at 3.5 knots.

To characterize year-to-year stock variations results from spring and summer trawl surveys of 1990-1994 were used. In 1992 there was no trawl survey in the Grand Bank of Newfoundland area. In 1993 because of the restirictions made by Canadian authorities, survey in Div. 3L was not completed (northeastern part was not covered). In 1994 only Div. 3L was surveyd.

Maturation of cod on the Grand Bank of Newfoundland begins at length 45-47 cm while mass maturation is observed in fish 63-68 cm long at age 7-9 (Postolakii, 1982). Therefore, to analyse distribution of mature and immature cod in catches, size frequences were organized as follows : shorter than 50 cm - immature cod, longer than 50 cm - mature cod.

Results and Discussion

In 1994 trawl survey in Div. 3L covered 24 824 sq. miles which constituted 65.5% of the total Division area. Cod distributed only in the area of 10 659 sq. miles, mainly along the northern and eastern slopes. On the shoal, from 51 m to 100 m depth, cod were not found, single catches were registered at 107-320 m depth. Maximum catch of 81 kg was taken at 415 m depth (Fig. 1, 2; Table 1). Immature fish 30-47 cm long at age 3-5 from 1991-1989 yearclasses dominated the catches (Table 2, 3). Fish longer than 60 cm and older than 8 years were not found in catches.

Cod stock in Div. 3L was estimated at 2.1×10^6 fish in abundance and 0.9×10^3 tons in biomass. Those parameters were the lowest for the recent 10 years (Kiseleva, Vaskov, 1994).

Analysis of cod catches distribution during spring and summer surveys in 1990-1994 showed that not only catch per tow decreased but cod distribution in Div. 3L experienced variation (Fig. 1, 2).

In April cod occurred on the bank shoal after their wintering on the slope and in May fish distributed in small schools on the shoal and in deeper waters of the Grand Bank northern slope (Bulatova, Savvatimsky, 1986). In 1990-1991, distribution of catches in Div. 3L was typical of spring. Cod were widely distributed over the whole Division and large catches were taken both on the slopes and shoal (Fig. 1, 2). There was no information on cod distribution in the northern Div. 3L in 1993. Cod were distributed along the eastern slope and negligible catches (up to 10 kg) were taken on the Division shoal. As it was said above, in 1994 there was no cod in catches on the bank shoal. The cod distributed mainly as a narrow belt along the northern and eastern slope at 300-500 m depth (Fig. 1, 2). Thus, during recent years in Div. 3L not only cod stock decline can be followed, but reduction of their area.

In spring and summer, mature and immature cod in Div. 3L distributed variously. In June adult cod performed both feeding (to prey on spawning capelin) migrations (Postolakii, Maleev, 1973; Templeman, 1974; Akenhead et al., 1982) and, apparently, spawning migrations (Hutchings et al., 1993) from the slopes to the coast. Juveniles remained on the slopes, obviously througout the whole year (Bulatova, Savvatimsky, 1986).

In April-May 1990, mature cod occurred in catches in the northwestern area and on the shoal. In May-June 1991, they were found along the northern slope and on the shoal, and in the central part of the shoal catches consisted of mature or immature individuals alone. In May-June 1993 catches of mature cod on the shoal and on the eastern slope were negligible and did not exceed 15 cod per tow. In June-July, 1994 there was scarcely any mature cod in catches (Fig. 3).

In anomaly cold years, cod remained on the slopes longer and went on the shoal with a delay as it was observed in 1985 (Bulatova, Savvatimsky, 1986). Probably, cod redistribution and delay in leaving slopes in spring and summer 1990-1994 were partially connected with "cold" period on the Newfoundland shelf which has lasted since 1989. The second reason for the redistribution, in our opinion, can be a decline of cod spawning stock.

When analysing size and age composition of cod in spring and summer catches in 1990-1994 we observed year-to-year decrease of the maximum length and mean length in catches as well as reduction of age range of Labrador cod from 18 to 8 years, respectively (Table 2, 3). This indicate a sharp reduction in cod spawning stock which during spring and summer migrated to the shoal for both spawning and preying on spawning capelin.

Conclusions

Cod stock in Div. 3L was registered to be at the lowest level for the recent ten years and amounted to 2.1×10^6 fish in abundance and 0.9×10^3 tons in biomass.

A trend of the mean length decrease and sharp reduction of the older age-groups proportion was observed.

Variations in cod distribution in Div. 3L was apparently related to sharp reduction of mature cod abundance.

References

Akenhead, S.A., J. Carscadden, H. Lear, G. R. Lilly, R. Wells.1982. Cod-Capelin interactions off northeast Nefoundland and Labrador. Canadian Spec. Publication Fish. Aquat. Sci. No.59 pp. 141-148.

Bulatova, A. Yu., A.K. Chumakov. 1986. USSR trawl surveys in NAFO Subarea 0, 2, 3. NAFO SCR Doc., No. 86/66, serial No. N1183, 13 p.

Bulatova, A. Yu., P. I. Savvatimsky. 1986. Distribution of cod on the Labrador-Newfoundland shelf in the fishery zone of Canada and outside it. NAFO SCR Doc., No. 86/11, serial No. N111, 13 p.3.

Hutchings, J. A., R. A. Myers, and G. R. Lilly. 1993. geographic variations in the spawning of Atlantic cod, *Gadus morhua*, in the Northwest Atlantic. Can. J. Fish. Aquat. Sci., vol. 50, pp. 2457-2476.

Kiseleva, W. M., and A. A. Vaskov. 1994. Status of cod in NAFO Subarea 3 from 1993 trawl-acoustic survey data. NAFO SCR Doc. 94/12, serial No. N2375, 9 p.

Postolakii, A. I., and P. I. Maleev. 1973. On cod migrations in the Newfoundland area. Rybnoje khozyaistvo, No. 10, pp. 8-10.

Postolakii, A. I. 1982. Life cycle and and fishery of cod on the Grand Newfoundland Bank. PINRO Selected Papers, Abundance and way of living of commercial fish in the Northwest Atlantic, pp. 5-14.

Templeman, W. 1974. Migrations and intermingling of Atlantic cod (*Gadus morhua*)stocks of the Newfoundland area. Journ. FRB Canada, vol. 31, No. 6, p. 1073-1092.

Table 1. Results from the trawl survey for cod in Div. 3 L, 1994

Stratum	Depth, m	Area mile sq.	Nos of tows	Mean catch/ 1 valid tow: fish	Mean catch/ 1 valid tow: kg	Abundance '000	Biomass, tons
371	56 - 91	1121	3				
372	- " -	2460	3				
384	- " -	1120	3				
348	93 -182	2120	4	0,3	0,1	39,3	11,8
364	- " -	2817	3	0,3	0,1	69,6	20,9
365	- " -	1041	3				
370	- " -	1320	3				
385	- " -	2356	3				
390	- " -	1481	3				
347	184 -273	983	3	0,3	0,1	24,3	5,3
366	- " -	1393	3				
369	- " -	961	3	0,3	0,0	23,7	2,3
386	- " -	983	3				
389	- " -	821	3	5,3	0,1	324,3	5,2
391	- " -	282	3				
346	275 -364	865	3	0,3	0,1	21,4	3,8
368	- " -	334	3	1,3	0,4	32,9	10,3
387	- " -	718	3	3,3	1,7	177,3	92,5
388	- " -	361	3	8,0	3,5	213,9	92,7
392	- " -	145	3				
729	366-546	90	3	34,3	12,5	228,9	83,3
731	- " -	117	3	0,7	0,4	5,8	3,8
733	- " -	312	3	30,0	18,8	693,3	434,5
735	- " -	160	3	22,3	11,6	264,7	137,0
730	548-728	93	3				
732	- " -	96	3				
734	- " -	160	3				
736	- " -	114	3				
Area stimated total		24824	85	1,2	0,5	2119,4	903,4
Area except emply strata		10659	40	2,7	1,1	2119,4	903,4

Table 2. Length composition of cod in NAFO Subarea 3L by the data from the 1990 - 1994 trawl surveys, %.

Length, cm	Years			
	1990	1991	1993	1994
6- 8	-	-	-	3
9- 11	-	-	-	34
12- 14	+	1	-	25
15- 17	+	1	1	16
18- 20	5	3	15	6
21- 23	17	16	48	6
24- 26	30	19	49	22
27- 29	47	38	84	38
30- 32	75	46	121	165
33- 35	81	76	119	113
36- 38	112	137	102	144
39- 41	99	115	110	125
42- 44	113	118	82	113
45- 47	86	119	57	110
48- 50	67	83	46	84
51- 53	54	77	50	84
54- 56	36	47	46	6
57- 59	35	31	31	3
60- 62	30	19	15	3
63- 65	26	11	15	-
66- 68	22	10	1	-
69- 71	17	7	1	-
72- 74	13	6	6	-
75- 77	10	6	1	-
78- 80	6	4	-	-
81- 83	3	2	-	-
84- 86	3	3	-	-
87- 89	2	2	-	-
90- 92	2	1	-	-
93- 95	1	1	-	-
96- 98	+	+	-	-
99-101	1	1	-	-
102-104	-	-	1	-
105-107	+	-	-	-
108-110	1	+	-	-
111-113	2	+	-	-
114-116	1	-	-	-
117-119	1	+	-	-
120-122	+	+	-	-
123-125	+	+	-	-
126-128	-	-	-	-
129-131	-	-	-	-
132-134	+	-	-	-
135-137	-	-	-	-
138-140	+	-	-	-
No.of fish,%.	998	1000	1001	1000
No. of spec.	5248	8876	715	319
Mean length,cm	44,71	43,76	38,86	36,10

Table 3. Age composition of cod in NAFO Subarea 3L by the data from 1990 -1994 trawl-surveys, %.

AGE	YEARS			
	1990	1991	1993	1994
1	1	1	8	78
2	32	28	179	25
3	147	202	275	292
4	358	370	257	401
5	234	286	188	166
6	66	53	75	31
7	76	26	14	3
8	61	16	3	3
9	12	10	-	-
10	6	4	1	-
11	2	1	-	-
12	3	1	-	-
13	2	+	-	-
14	1	+	-	-
15	1	+	-	-
16	+	-	-	-
17	+	-	-	-
18	+	-	-	-
Fish number, %.	1002	1000	1000	1000
No. of fish in age sample, spec.	415	415	227	319
Mean age	4,79	4,37	3,74	3.60

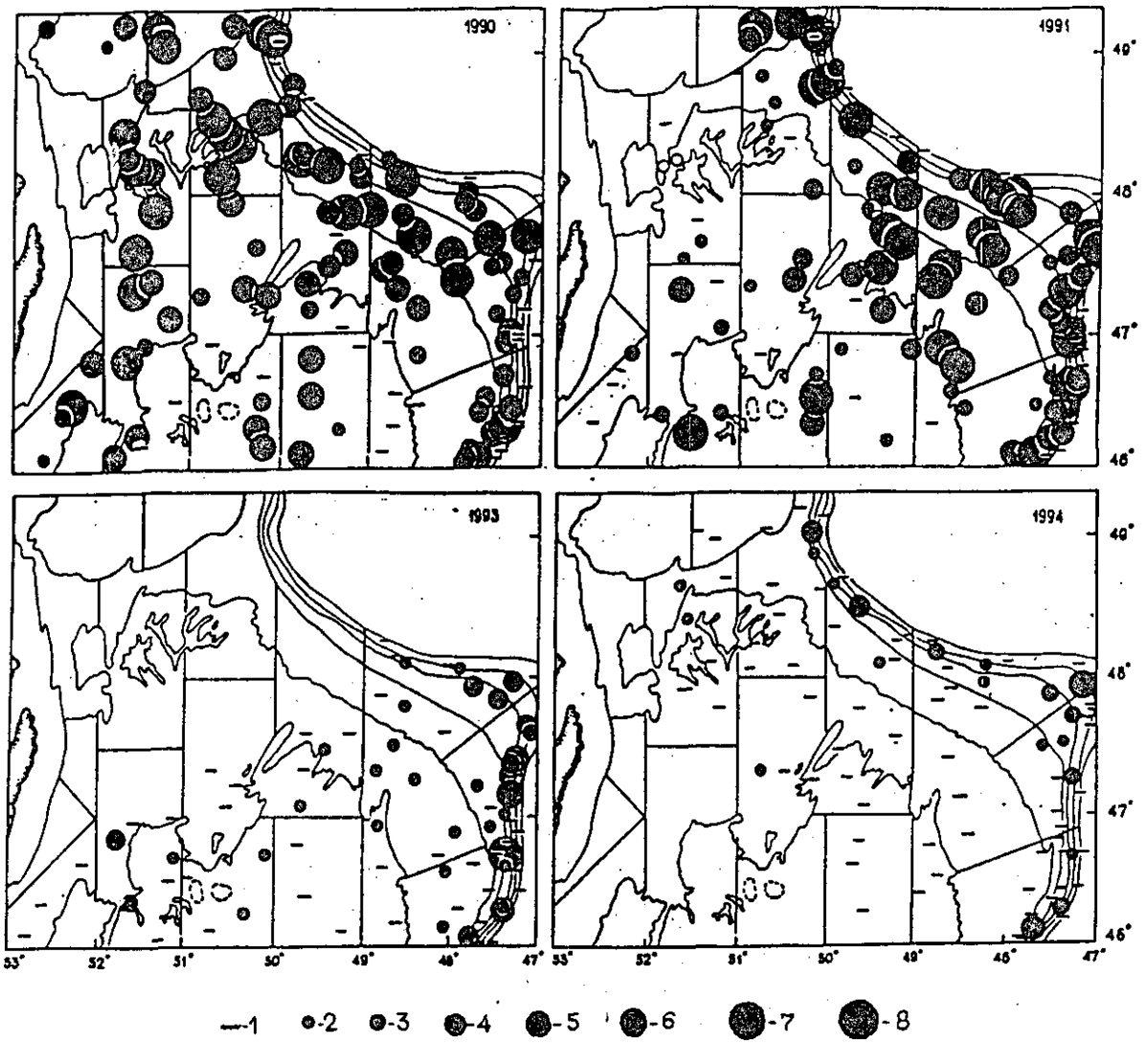

Fig. 1. Distribution of cod catches in Div. 3L in spring and summer 1990-1994(kg per tow).

1 - empty, 2 - less than 1 kg, 3 - 1-5 kg, 4 - 5-10 kg, 5 - 10-30 kg, 6 - 30-50 kg, 7 - 50-100 kg, 8 - more than 100 kg

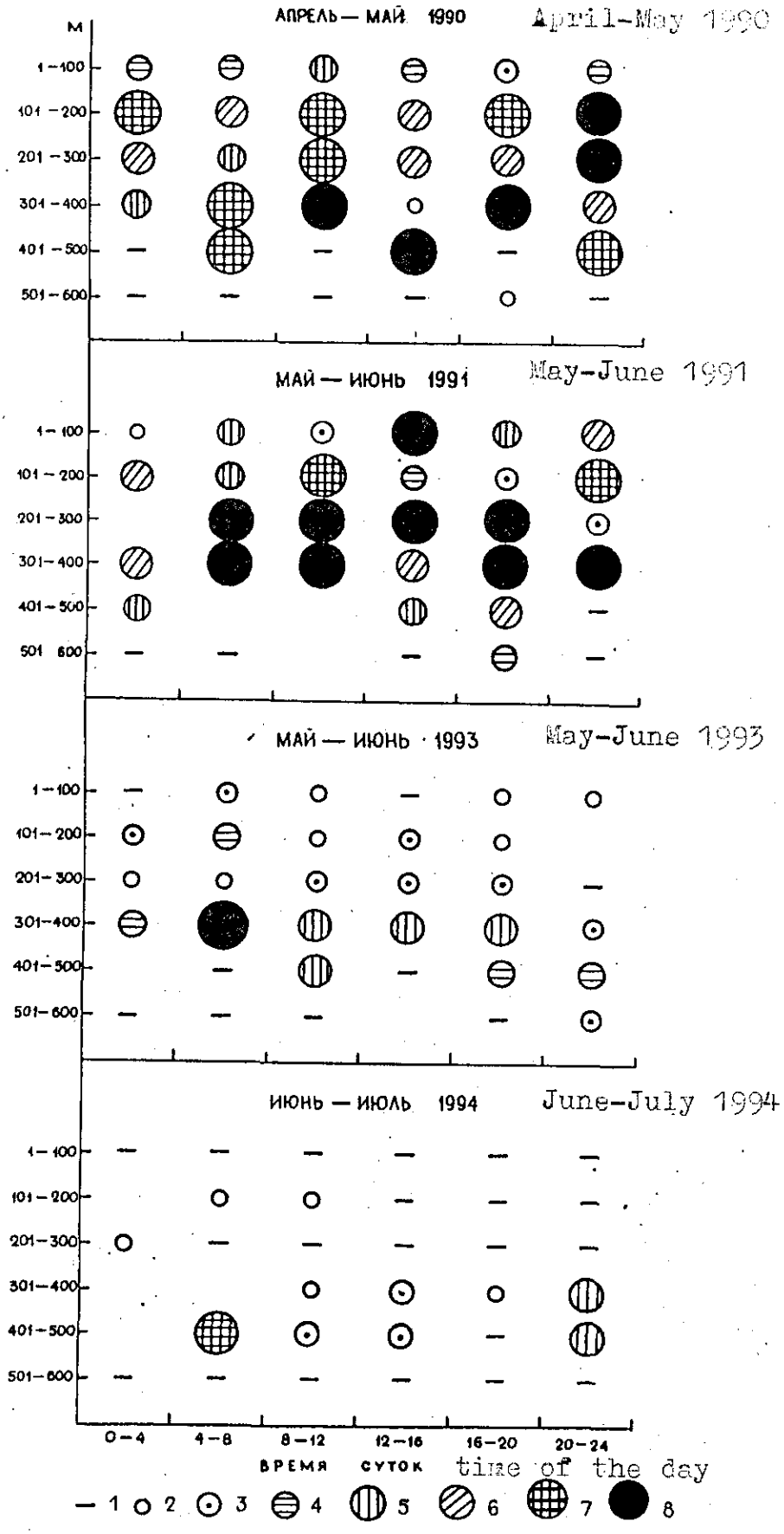

Fig. 2. Distribution of cod catches in Div. 3L in 1990-1994 by depth and time of the day.

See Fig. 1 legend.

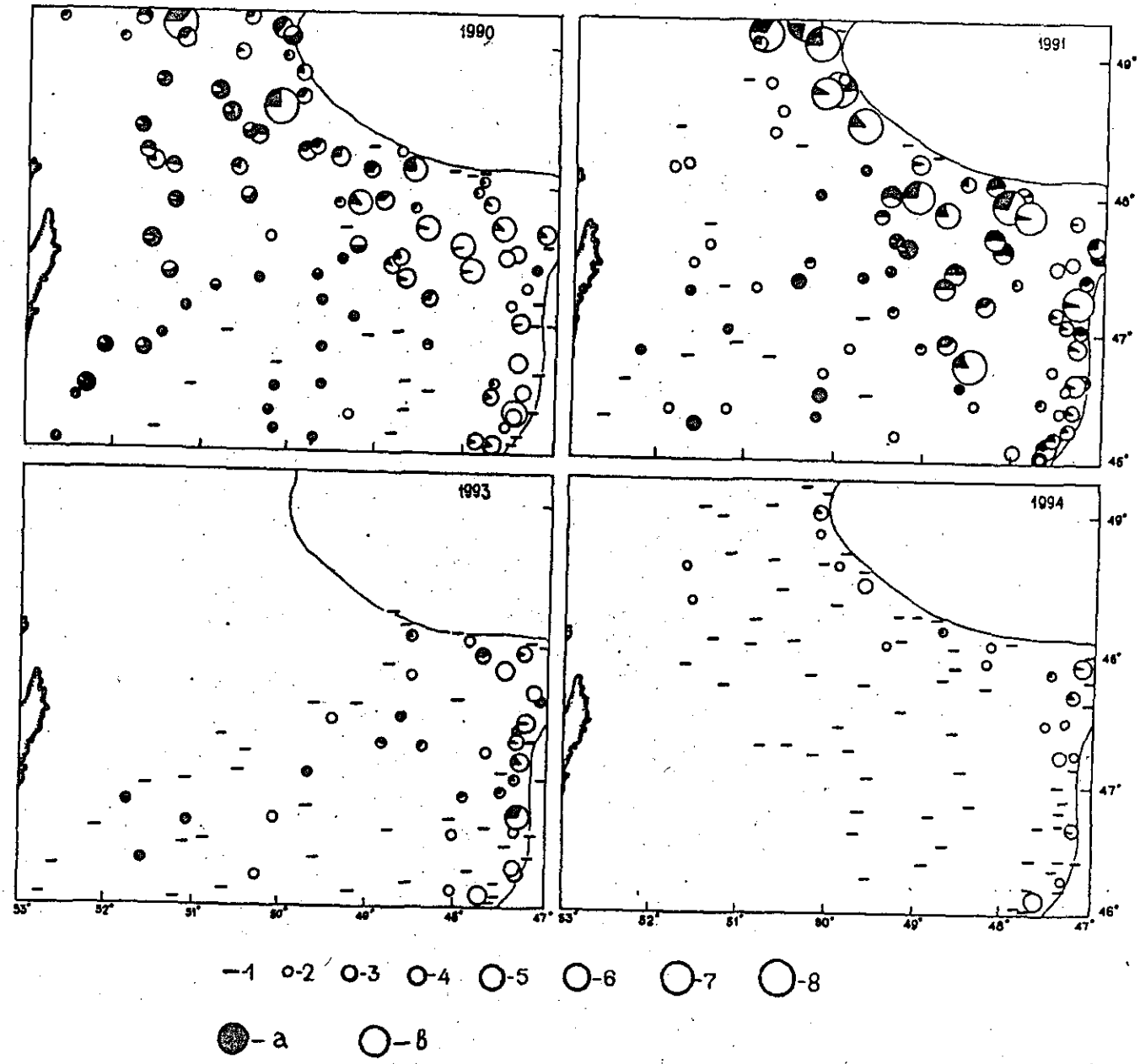

Fig. 3. Distribution of mature and immature cod in spring and summer catches in Div. 3L in 1990–1994; fish per 30 min.tow

1 - empty; 2 - 1-10; 3 - 11-50; 4 - 51-100; 5 - 101-200; 6 - 201-300; 7 - 301-500; 8 - more than 500.