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Soviet Investigations of Capelin Stocks in Divisions 3LNO in May-June 1984

by

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ABSTRACT

The paper considers the results of the capelin acoustic survey conducted by the RV "Poisk" on the Grand Bank (3LNO) in May-June 1984. A brief description of hydrographic conditions in the area observed, the distribution and biological characteristics of capelin are given.

Survey results showed that the major part of capelin stocks was composed of juvenile and immature capelin, which constituted 507 billions spec., 1.4 mill. t by biomass. The abundance of mature capelin was estimated to be 44.7 bill. spec., their biomass - 1.2 mill. t.

INTRODUCTION

The annual acoustic survey of the Newfoundland capelin conducted since 1974 by both Soviet and Canadian research vessels is aimed at quantitative assessment of capelin stocks and collecting of biological data needed for rational fishery.

However, a complete closure of capelin fishery in Divs. 3LNO introduced for foreign fleet, including the Soviet vessels, sharply reduced the obtaining of biological and biostatistical data on this species and the collection of materials from research vessels during the acoustic surveys, as usual, was limited in time and did not cover a greater part of life cycle.

Therefore, along with the data on quantitative stocks assessment, the materials on the features of distribution and behaviour of fish and their size and age compositions are of considerable interest, these data are also briefly presented in the paper.

MATERIAL AND METHODS

An acoustic survey on capelin stocks assessment in Divs. 3LNO was carried out on board the RV "Poisk" from 1 May to 13 June.

On the whole, the survey methods, equipment (EK-38, "SIORS") and its working regime were analogous to those which were earlier applied in capelin surveys of the same area (Bakanev, Ermolchev, 1982; Mamylov, Bakanev, 1984). However, to increase the quality of the size-species identification of echo recordings, the Norwegian "Simrad" QD-200 digital echo integrator was connected for the first time in parallel to "SIORS" echo integrator. Such necessity was caused by the fact that while fishing for mixed concentrations of the young and adult capelin an essential effect of the trawl selectivity was observed and size frequency, as a rule, was shifted to large fish side.

Digital QD-200 echo integrator was used for measurement of target strength T by 8 layers within the range of 10-111 m depths. The width of each layer and threshold of echo signal for each of them were chosen aimed at convenient lead-in of the TVG corrections into the echo integrator readings. Such correction was needed because of significant difference between the TVG-function of EK-38 in the surveying process and the TVG $40 \lg R + 2AR$, which was necessary for normal operation of QD-200 echo integrator.

Graduation of echo integration system of EK-38 and echo integrators "SIORS" and QD-200 was determined through calibration with standard copper sphere (dia. - 60 mm). Re-calculation of echo integrator readings into the absolute values of density was performed according to well-known data on TS for the Barents Sea capelin.

$$TS = 19.1 \lg L - 74.4$$

This dependence was also used in assessment of size frequency of capelin by acoustic method with QD-200 of scale stratified into 5 grades.

- < - 62 dB - plankton organisms;
- from - 62.0 to 57.5 dB - capelin 4-7 cm long;
- from - 57.5 to 53.0 dB - capelin 8-12 cm long;
- from - 53.0 to 50.0 dB - capelin over 13 cm long;
- > - 50.0 dB - bottom fish (cod, haddock)

The final identification of echo recordings and quantitative relation of capelin size groups were determined taking into account a careful analysis of echo recordings character, control trawlings and data on size composition, obtained by means of QD-200.

Echo integrator readings were taken each 5 miles on the route. The survey route is given in Fig. 1. To calculate the capelin abundance, the whole surveyed area was divided into squares, the sides of which constituted approximately half a degree by latitude and longitude.

RESULTS AND DISCUSSION

A brief characteristic of hydrological conditions. The waters with surface temperature of 3-6°C occupied a considerable part of the area investigated (Fig. 2). Near-bottom temperature on the North Grand Bank fluctuated from -1.3° to 0°C, and on the South Grand Bank - from 1° to 3°C (Fig. 3). The typical features of the hydrological conditions in spring-summer this year were the following:

- a) intensified inflow of the cold Labrador Current waters far to the south with intensive bringing out of ice and icebergs;
- b) increased temperature conditions in Atlantic waters on the southern and southwestern slopes of the Grand Bank.

On the whole, the hydrographic conditions on the North Grand Bank were at the level of the extremely cold years and somewhat above the norm - on the southern and southwestern slopes of the bank.

Distribution and biological state of capelin. In the first half of May the main mature capelin concentrations distributed in the southwestern part of Div. 3L. Northward of these sections, near the ice edge, which reached $51^{\circ}30'$ - $52^{\circ}00'W$, the immature fish dominated. Insufficient amount of pre-spawning and immature capelin distributed along the southern slopes of the Grand Bank (Fig. 4). The densest concentrations of juvenile capelin of the 1983 year class were observed in the central and southwestern parts of Div. 3L and in the north of Div. 3O (Fig. 5).

As for the character of fish distribution, the mature capelin migration in the southwestern direction was registered in the second half of May, and vice versa, the immature capelin migrations - in the northern and northeastern directions. In early June the dense concentrations of capelin were marked in the northern part of Div. 3N east of $50^{\circ}W$, where the immature capelin constituted a considerable portion.

The main concentrations of mature capelin distributed in the waters with a near-bottom layer temperature of $0-1^{\circ}C$, and of the young capelin - in the waters with a near-bottom layer temperature of $0.5-2^{\circ}C$.

The capelin 8-19 cm long were observed in the catches taken with control hauls (Fig. 6). Almost half of all the fishes analysed (mainly, 8-13 cm long), consisted of immature fish, but the rest specimens (12-19 cm long) were in the pre-spawning state - III-IV maturity stages of gonads.

The analysis of the age composition of capelin from control trawls showed, that the fish at age of 3-4 prevailed in Div. 3L, the fish at age of 3 - in Div. 3O, and the fish at age of 2-3 - in Div. 3N. Fairly insufficient percentage of fish at age of 5 was registered in all the samples; the specimens at age of 6 were practically absent.

Abundance and biomass of capelin. The survey method allowed to assess the stocks separately for juvenile, immature and mature fish. The juvenile capelin abundance of the 1983 year class constituted approximately 360 billions spec., and biomass - 375 thou t.

By means of the size-age key (Table 1) the total stocks of immature and mature capelin were divided into age groups. The immature fish stocks at age of 2 and 3 by their abundance exceeded the mature fish stocks more than 3 times, but together with juvenile - more than 10 times. The immature fish compared to the mature one, also dominated by biomass (Table 2). Two younger age groups (1-2 years) constituted by abundance 87.6% of the total stocks, but by biomass the fish at age of 2 and 3 dominated (67.3%).

In comparison with the analogous survey in 1983, (when because of technical reasons, the main immature capelin concentrations at age of 2 and 3 in Div. 3L were not assessed) the biomass of only mature capelin in 1984 was almost 3 times higher, that indicated a continuous renewal of the Newfoundland capelin stocks. A considerably lower amount of mature fish in the shallow waters of Div. 3N was the peculiarity of the 1984 survey.

The results of the survey showed that capelin commercial stock will be recruited with the 1982 and 1983 year classes of high abundance in the nearest years, and, consequently, the total commercial stocks will increase.

REFERENCES

- Bakanev V.S. and V.A. Ermolchev. 1982. Hydroacoustic assessment of capelin abundance in NAFO Divisions 3LNO in May-June 1981. NAFO SCR Doc. 82/VI/61.
- Mamylov V.S. and V.S. Bakanev. 1984. An acoustic assessment of capelin stocks in NAFO Div. 3LNO and 2J+3K in 1983. NAFO SCR Doc. 84/VI/39.

Table 1 Length composition of capelin by age

Length, cm	Age					n
	2	3	4	5		
9.5	5					5
10.0	10					10
10.5	19					19
11.0	19	I				20
11.5	62	5				67
12.0	93	16				109
12.5	90	36				126
13.0	60	67		2		129
13.5	25	III		3		139
14.0	7	100		11		118
14.5	6	89		14		109
15.0	4	83		30		117
15.5		78		37		115
16.0		34		79	2	115
16.5		19		66	6	91
17.0		10		89	9	108
17.5		5		59	17	81
18.0				21	12	33
18.5				2	7	9
19.0				1	1	2
n	400	650		414	54	1522
%	26.3	43.0		27.2	3.5	100.0
Mean	12.2	14.3		16.4	17.5	14.4

Table 2 Results of capelin acoustic survey in Divs. 3LNO in May-June 1984

Stocks	Maturity	Age					Total
		1	2	3	4	5	
Bill. spec.	Immature	360.0	119.7	27.3	-	-	507.0
	Mature	-	3.9	22.9	16.2	1.7	44.7
	Total	360.0	123.6	50.2	16.2	1.7	551.7
in % by age		65.3	22.4	9.1	2.9	0.3	100.0
Thou t	Immature	375.0	765.6	310.1	-	-	1450.7
	Mature	-	42.7	667.5	439.3	55.1	1204.6
	Total	375.0	808.3	977.6	439.3	55.1	2655.3
in % by age		14.1	30.3	37.0	16.5	2.1	100.0
Mean mass of 1 spec.		1.04	6.5	19.7	27.1	33.2	4.8

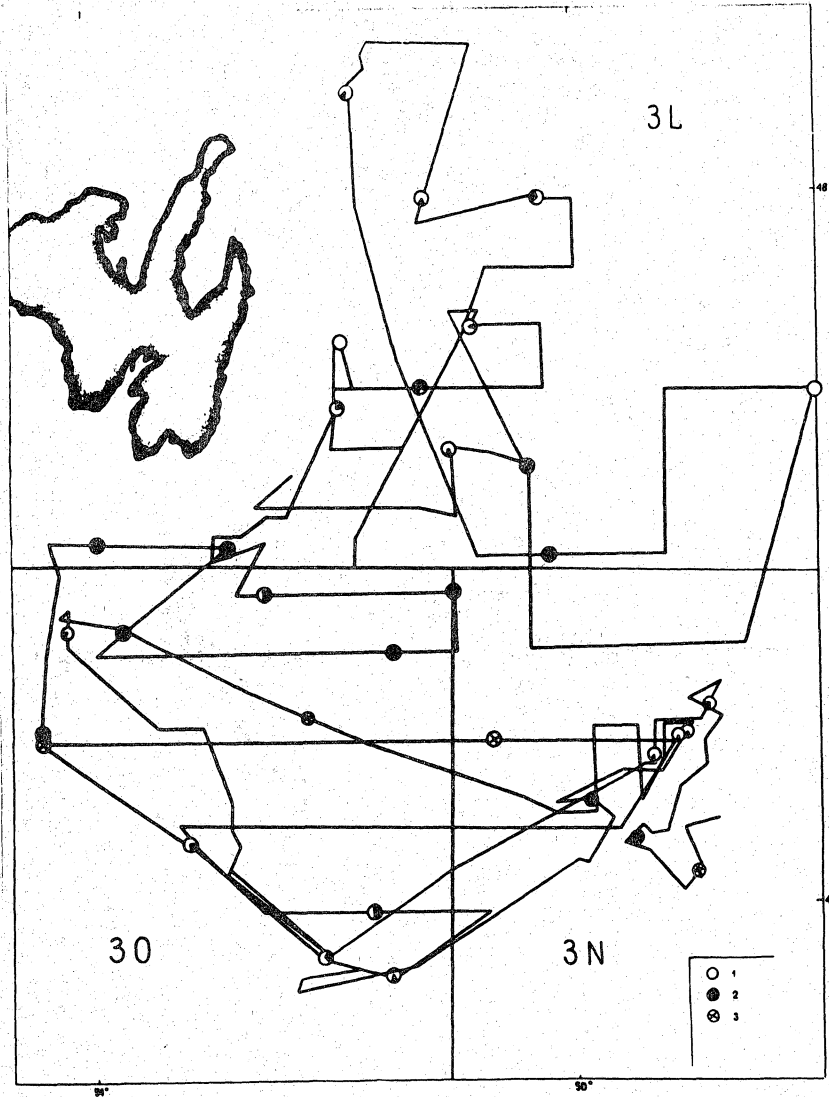


Fig. 1 Capelin acoustic survey route
in May-June 1984
Control trawlings and fish ratio
in catches:
1 - immature;
2 - mature;
3 - trawlings without catches.

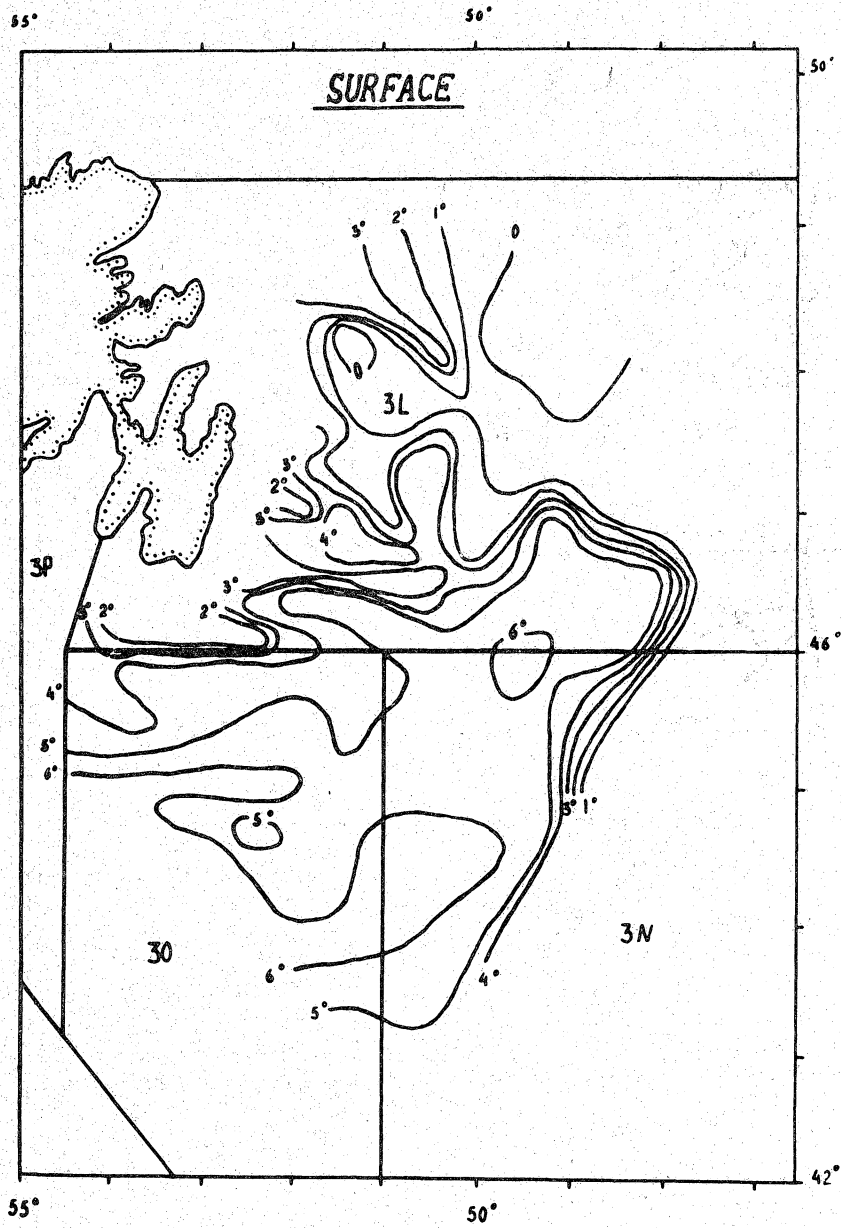


Fig. 2 Surface water layer temperature in May-June 1984.

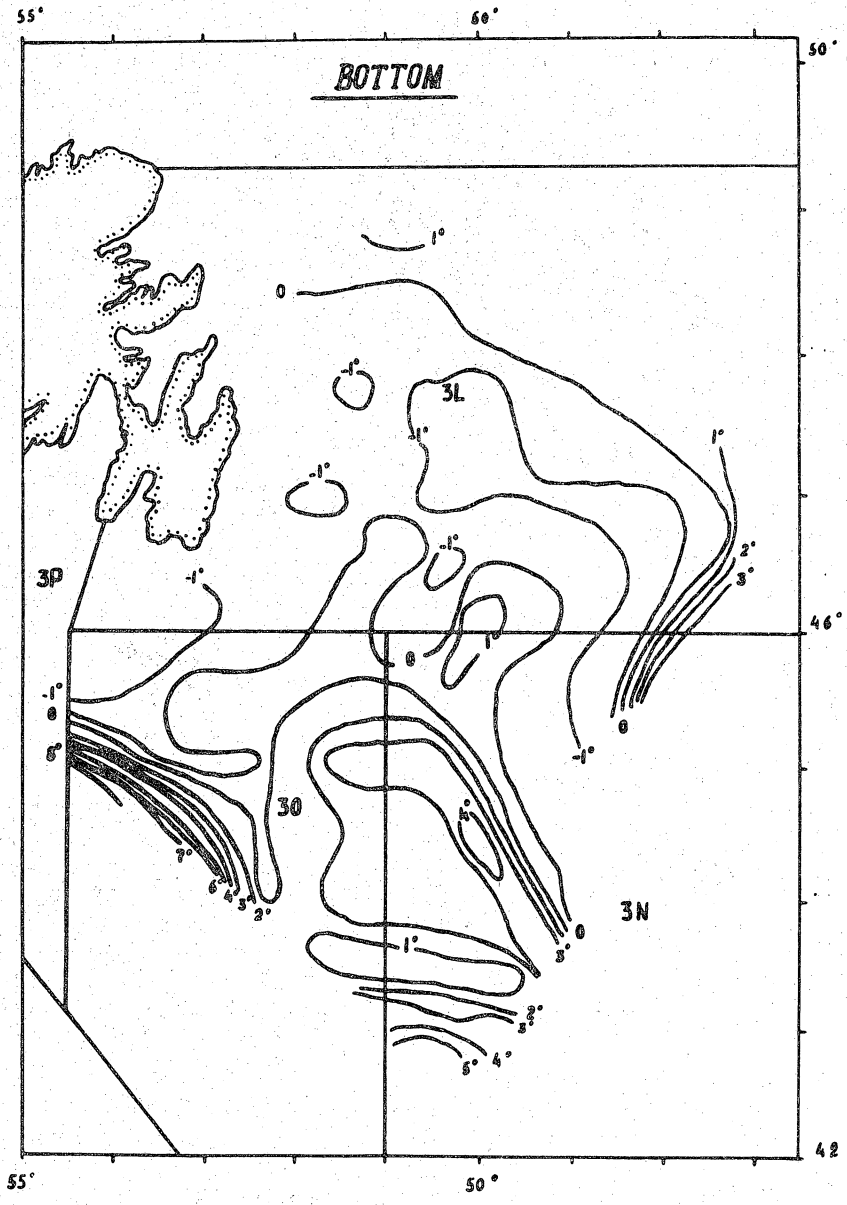


Fig. 3 Near-bottom water layer temperature in May-June 1984.

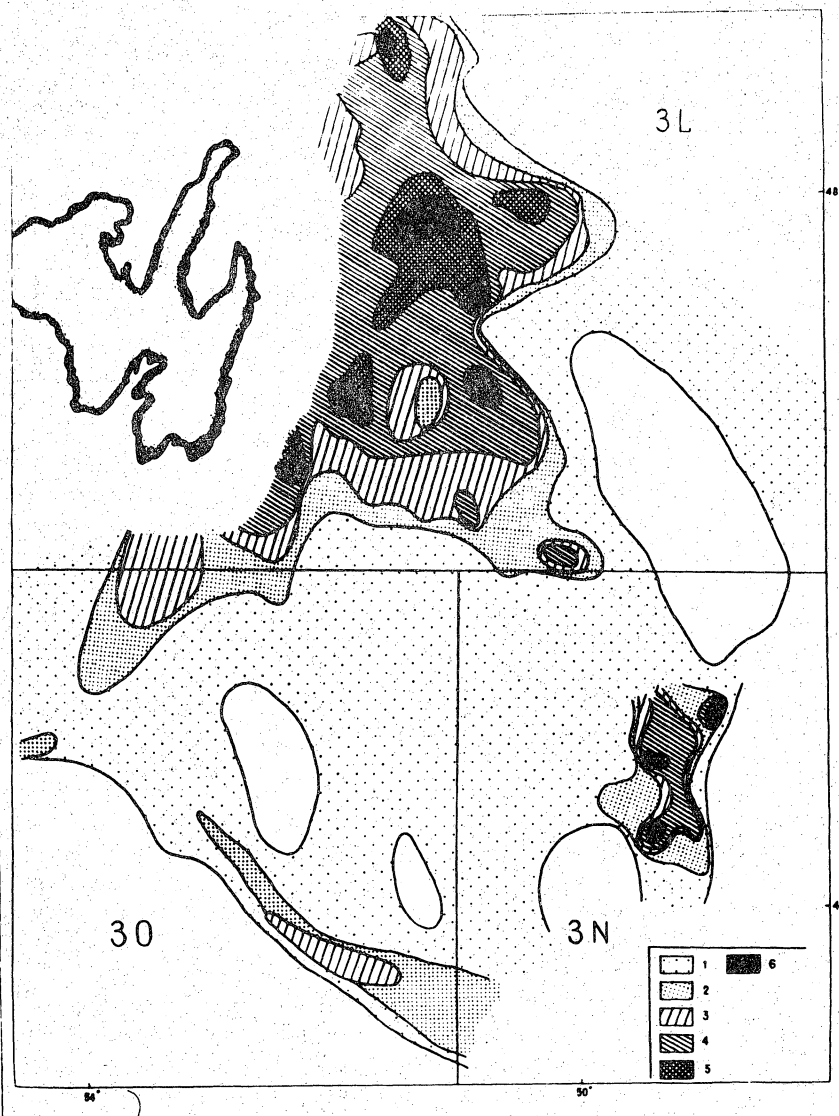


Fig. 4 Distribution of immature and pre-spawning capelin in May-June 1984
Concentrations density in tons per sq. mile
1 - up to 20,
2 - 21-50,
3 - 51-100,
4 - 101-250,
5 - 251-500,
6 - over 500.

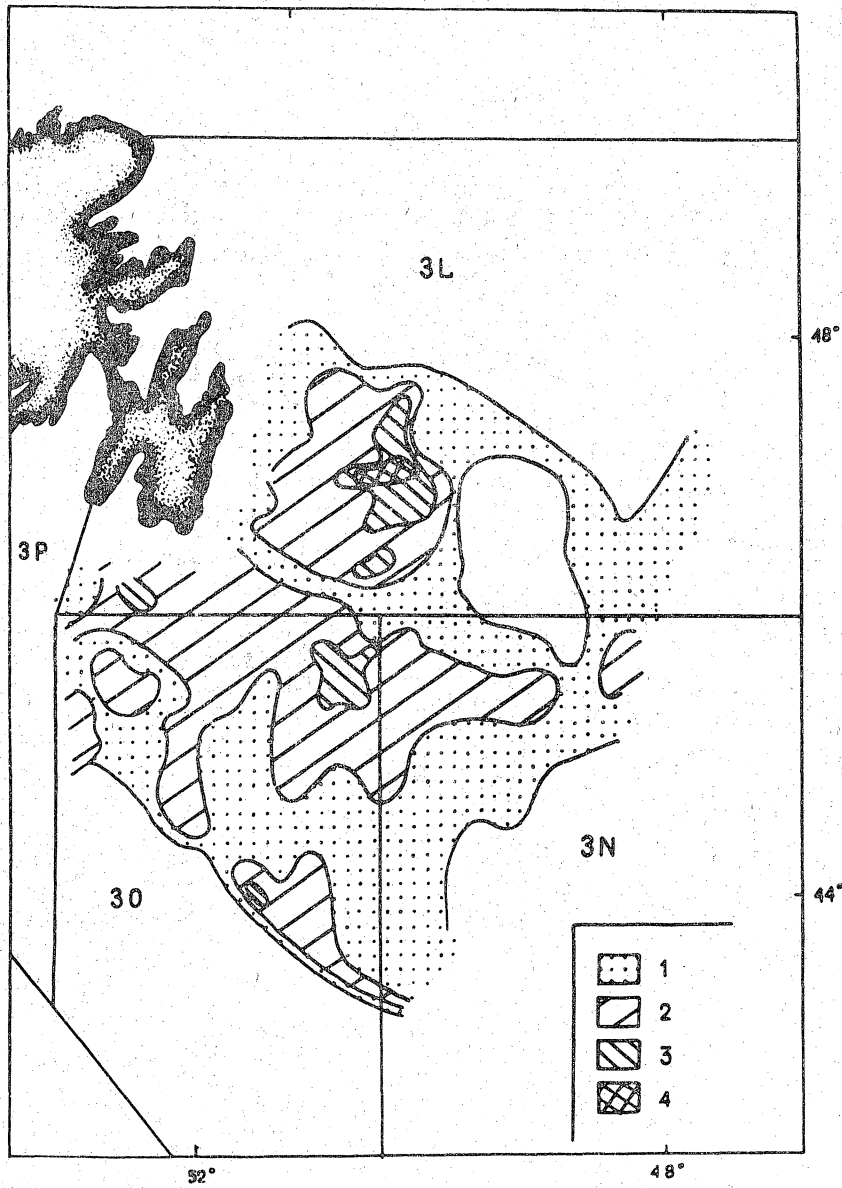


Fig. 5 Yearlings distribution (1983)
in May-June 1984
Density - in tons per sq. mile:
1 - less than 5;
2 - from 5 to 25;
3 - from 25 to 100;
4 - over 100.

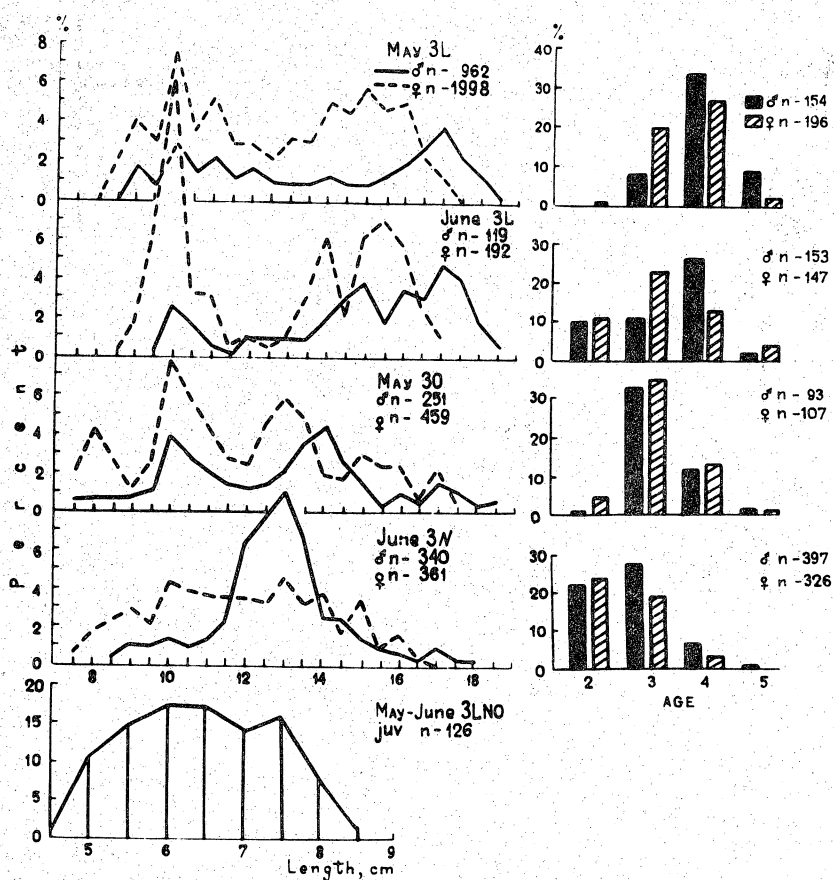


Fig. 6 Length and age compositions of capelin by areas in May-June 1984.