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Results of the Soviet Acoustic Survey on Capelin Stock in Summer 1989 and 0-group

Capelin Survey in Autumn 1988 and 1989 in Div. 3LNO

by

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#### ABSTRACT

Results of acoustic survey on capelin stock assessment conducted in May-June 1989 in Divs. 3LNO are presented in the paper. The total abundance of capelin within the survey area amounted to  $188.4 \times 10^9$  specimens and the biomass was  $2.46 \times 10^6$  tons. The 1986 year-class was the most abundant, the one of 1987 was the second in abundance and the 1984 and 1985 year-classes followed them.

Assessment of a year-class strength by the trawl survey method indicated that the 1988 and 1989 year-classes at the 0-group stage were close in abundance to the strong year-class of 1983.

#### INTRODUCTION

Elaboration of scientifically grounded possible capelin annual yield requires permanent control of capelin stock status. For capelin with their short life cycle, significant fluctuation of year-class abundance and high natural mortality the most reliable method of stock assessment is a trawl survey. This method is especially good during the period of poor intensity of the fishery. The surveys within the Grand Newfoundland Bank area have been systematically conducted by the Soviet research vessels since 1975.

The works on 0-group capelin year-classes assessment are of great practical importance, since they allow to predict this year-class recruitment to the commercial stock with possible advance of 2-3 years. The 0-group capelin trawl surveys have been carried out by PINRO research vessels on a regular basis since 1983.

#### MATERIAL AND METHODS

The acoustic survey on capelin stock assessment was conducted by RV "Persey-III" during 18 May - 5 June 1989. Survey track was made

with regard for preliminary data on capelin concentrations distribution obtained from the bottom fish trawl survey in March-May within the Grand Newfoundland Bank area.

Echo sounder EK-400 and echointegrator SIORS were used during the survey. Survey methods and the data processed were similar to those applied previously during the same surveys (Mantlov, Bakanev, 1984; Bakanev, Korol, Mamylov, 1986). The surveys of prerecruits were carried out from 21 November to 9 December 1988 and from 19 November to 9 December 1989. The both were carried out by RV "Kapitan Shaitanov". Fishing gears and trawl survey method had no significant changes in comparison with those applied in the previous years when the similar surveys were conducted (Bakanev, Filin, Chechenin, 1984; Bakanev, 1987).

There were two ways of calculation of abundance index. The first one was to use the formula applied for 0-group fishes of some Barents Sea species:

$$T = A_S + KAd \quad (1),$$

where  $A_S$  - area with scattered concentrations, sq.mile;

$A_d$  - area with dense concentrations, sq.mile;

$K$  - densities ratio ( $\approx 10$ ), the ratio between fish densities classified as dense and scattered (Dragesund, 1970)

Scattered and dense concentrations of the Barents Sea capelin were separated using a criterion of 1050 spec. per trawling mile obtained from long-time materials collected during joint acoustic and trawl surveys (Anon., 1974).

The second way of abundance index calculation was an estimate of capelin larvae absolute abundance within the survey area (without trawl catchability calculation) (Bakanev, Gorchinsky, 1985). The index is calculated by the following formula:

$$N = \sum_{i=n}^1 \frac{S_i \cdot \bar{\rho}}{S_2} \quad (2),$$

where  $N$  - index of abundance (spec.  $\times 10^{-9}$ );

$S_1$  - an area of every grading with relatively equal density concentrations;

$\bar{\rho}$  - mean density, spec. per trawling mile;

$S_2$  - an area swept per hour (0.0108 sq.mile) at 20m trawl opening

This way the indices for the whole period of investigations were recalculated.

## RESULTS AND DISCUSSION

### Capelin acoustic survey

Fig.1 shows the survey track, check tows distribution and gradings of various density concentrations. The densest concentrations of capelin

were distributed in the north-west parts of Div.3L, they consisted, mainly, of immature fish from the 1987 year-class with length of 9-13cm (Fig.2). Specimens from the 1986 year-class with length of 11-16cm prevailed in other divisions.

Table 1 presents the results of capelin abundance assessment all over the Grand Newfoundland Bank area. The total abundance of capelin amounted to  $188.4 \times 10^9$  spec. and the biomass - to  $2.46 \times 10^6$  t. More than 50% of the stock abundance and nearly 64% of its biomass belong to the 1986 year-class and 42% and 20%, respectively, - to the 1987 year-class.

That year capelin stock was 43.3% lower in abundance and 37.8% - in biomass in comparison with the data from similar survey in 1988. However, the analysis of long-term data doesn't show capelin stock reduction in 1989, but, on the contrary, testifies that the stock was overestimated during the 1988 survey; since the absolute abundance of the 1985 and 1984 year-classes at age 3 and 4 was significantly higher than the abundance of those aged 2-3 years during the 1987 survey, that contradicts with general regularity of long-time acoustic abundance estimates (Table 1).

#### Capelin prerecruits survey

A few capelin of age 1+ observed during capelin prerecruits surveys in 1988 and 1989, only at some stations of the northern Grand Newfoundland Bank, therefore the data presented further concerns only those from capelin larvae (0+) catches.

Distribution of trawl stations, the number of larvae per trawling mile and various density gradings are shown in Fig.3. Capelin larvae were distributed, mainly, to the south from 48°N, within the shallows of the Grand Newfoundland Bank. The greatest number of them was observed between the cold waters of Labrador Current and relatively warm waters of the continental slope with temperature of 4.5-6.5°C in 1988 and 3-7°C - in 1989 at the 50m layer (Fig.4).

Length composition of larvae is given in Fig.5. Value of larval mean lengths obtained from length frequencies of both surveys (combining the data from all the areas) were similar. However, mean length of larvae caught in the survey northern parts (3L) in 1988 was the least, while in 1989 the largest larvae were observed within the area. This peculiarity was, undoubtedly, due to hydrological conditions of 1989.

Table 2 shows indices of capelin year-classes abundance. Indices calculated by 2 different methods are, practically, similar, except the 1984 and 1986 year-classes, when the indices calculated by the Norwegian method were 3-5 times higher than those calculated by the method of larvae absolute number calculation. The comparison of relative values indices and the same data on yearlings abundance absolute estimate, obtained from the Soviet and Canadian acoustic surveys in Divs.3LNO in-

icates high correlation between these indices. An exception was the 1986 year-class estimated as a poor as the O-group, but, in fact, it turned out to be a strong one.

Thus, from the trawl survey data, the 1988 year-class at stage of O-group may be provisionally assessed as strong, its index is similar to that of 1983.

The 1989 year-class was found to be strong too and it should be considered to be not poorer in abundance, than those of 1983 and 1988, though the southern Grand Newfoundland Bank, where density distribution is supposed to be high, was not covered by the survey. These year-classes, undoubtedly, will recruit capelin commercial stock in the nearest future in the course of their growth and maturation.

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Table 1 Capelin abundance ( $10^9$  spec.) and biomass ( $10^3$ t) estimated from the Soviet acoustic surveys in Divs. 3LNO during 1984-89

Years	Age						Total
	1	2	3	4	5	6	
Abundance							
1984	360.0	123.6	50.2	16.2	1.7	-	551.7
1985	-	230.7	53.3	4.4	0.9	-	289.3
1986	-	18.4	70.9	5.9	-	-	95.2
1987	-	45.7	30.9	30.0	0.6	-	107.2
1988	21.5	177.5	91.7	34.1	6.6	1.0	332.4
1989	0.8	78.8	96.5	10.8	1.3	0.2	188.4
Biomass							
1984	375.0	808.3	977.6	439.3	55.1	-	2655.3
1985	-	1281.1	755.3	130.5	31.7	1.2	2199.8
1986	-	190.5	1164.3	136.7	-	-	1491.5
1987	-	373.7	710.0	1058.3	19.1	-	2161.1
1988	50.6	931.2	1508.2	1150.7	265.7	44.4	3950.8
1989	2.9	497.9	1562.5	337.7	48.9	8.3	2458.2

Table 2 Abundance indices for larval capelin of the 1983-89 year-classes

Year	Number of stations	Area, thou. sq. miles	Index of abundance		Yearlings abundance estimated from acoustic survey		Against 1983			
			the 1 <sup>st</sup> method	the 2 <sup>nd</sup> method	USSR	Canada	Index		Yearlings abundance	
							the 1 <sup>st</sup> method	the 2 <sup>nd</sup> method	USSR	Canada
1983	48	59.8	254.2	10.91	231	369	1.00	1.00	1.00	1.00
1984	38	39.6	66.5	0.52	18	59	0.26	0.05	0.08	0.16
1986	33	22.6	45.1	0.55	177	380	0.18	0.05	0.77	1.02
1987	59	47.8	93.7	2.85	79	249	0.37	0.26	0.34	0.67
1988	48	39.4	286.0	10.63	-	-	1.13	0.97	-	-
1989	43	38.5	181.6	8.12	-	-	0.71	0.74	-	-

~~1~~ - Norwegian method

~~2~~ - method of absolute estimate of abundance

~~3~~ - Miller, Carscadden, 1989

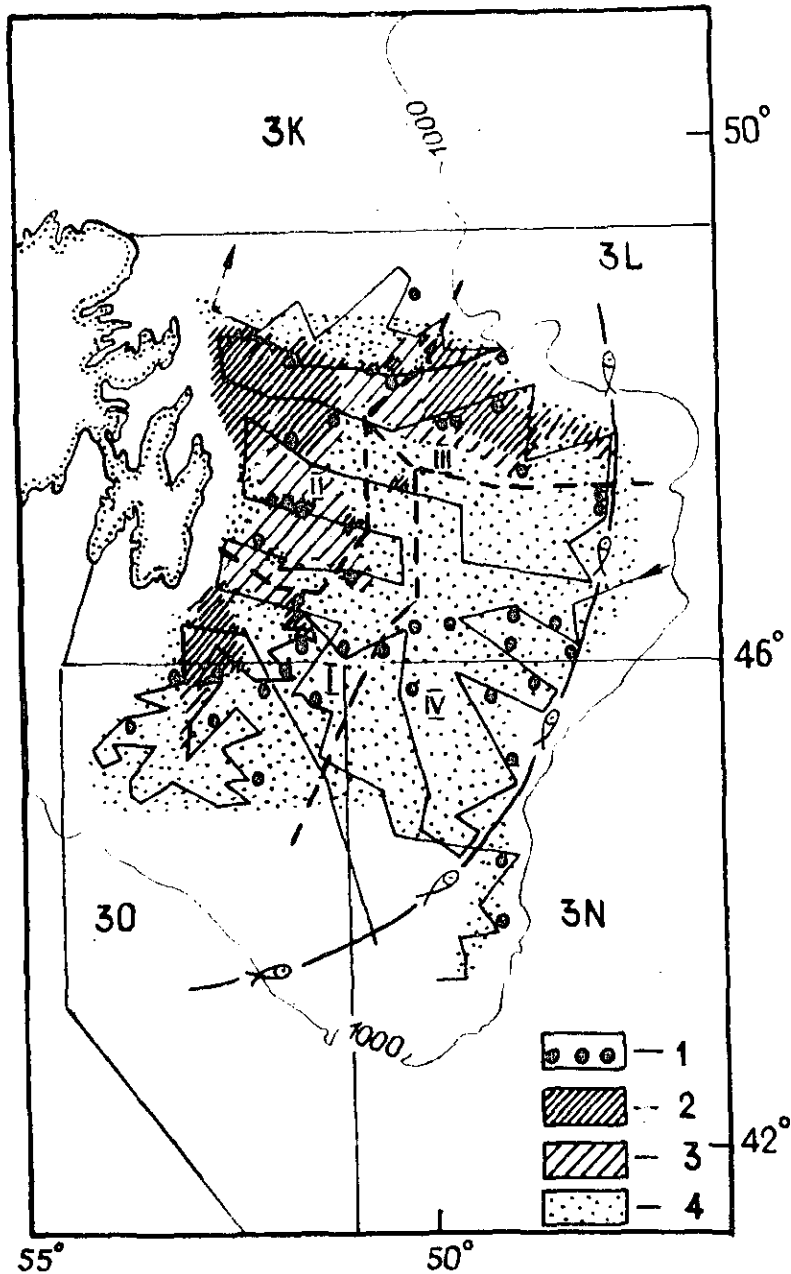


Fig.1 Position of tows during acoustic survey and capelin concentrations density in May-June 1989 in the Grand Newfoundland Bank area

- 1 - check tows
- 2 - 100 thou./sq.mile
- 3 - 26-100 thou./sq.mile
- 4 - 1-25 thou./sq.mile

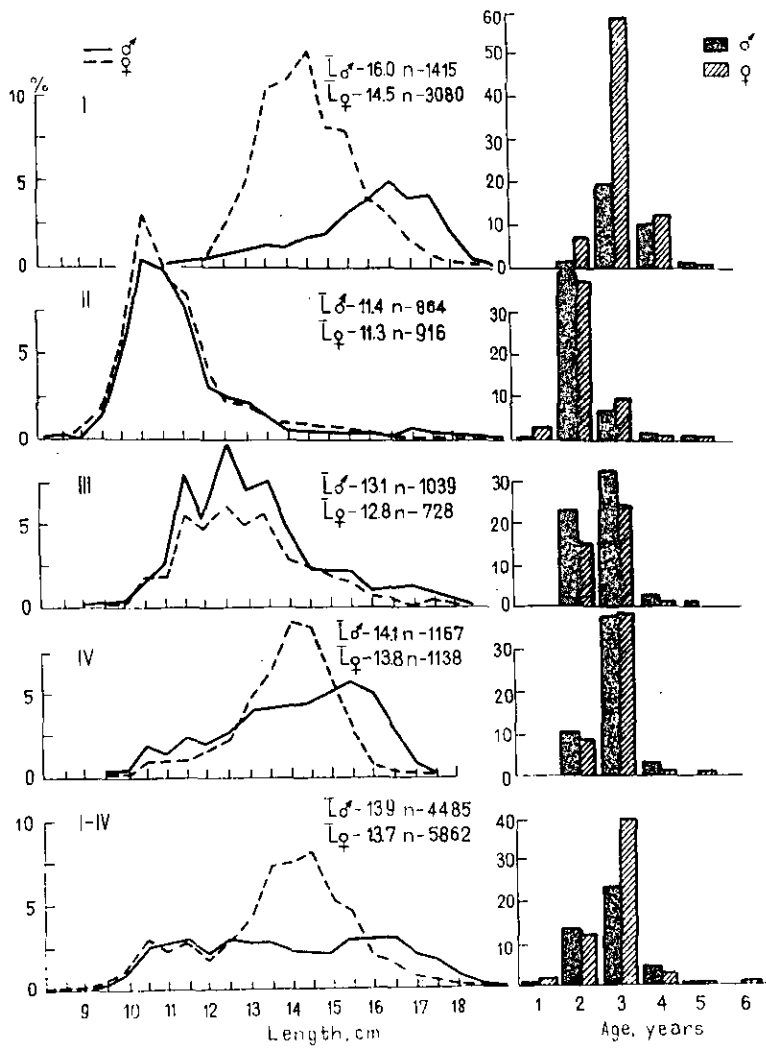


Fig.2 Length and age composition of capelin within the Grand Newfoundland Bank area to the data from the acoustic survey in May-June 1989

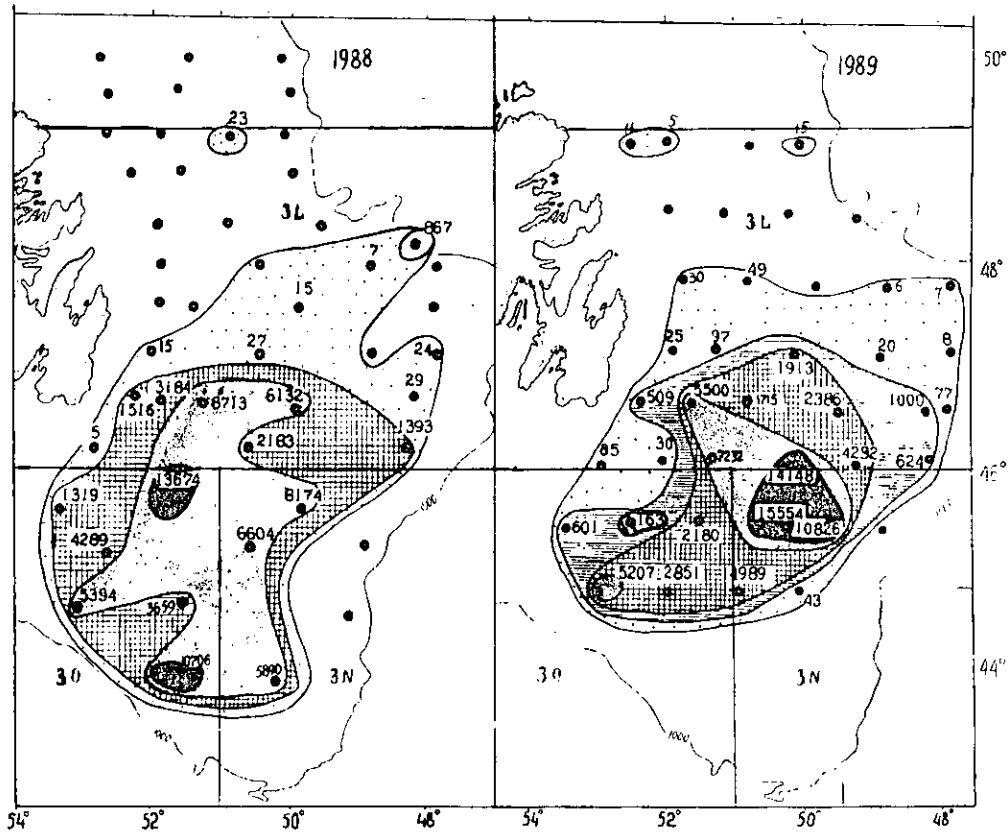


Fig.3 Position of trawl stations and larvae number per trawling mile within the Grand Newfoundland Bank area during 1988-89



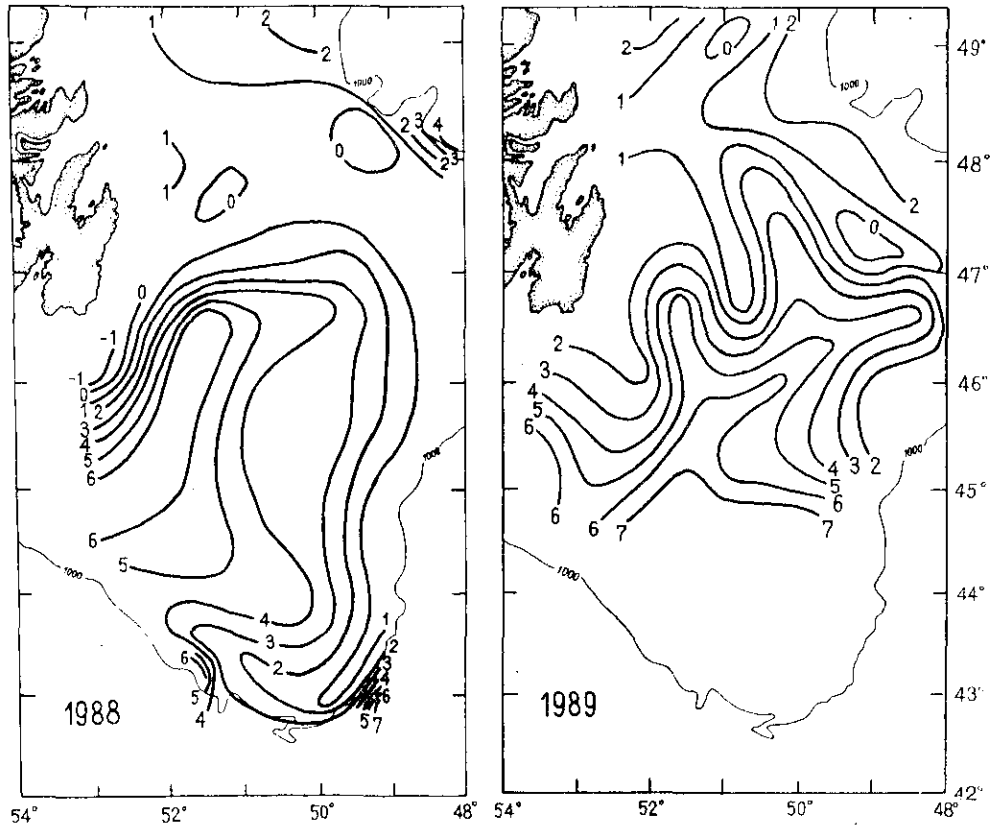


Fig.4 Water temperature at the 50m layer within the Grand Newfoundland Bank area during 1988-89

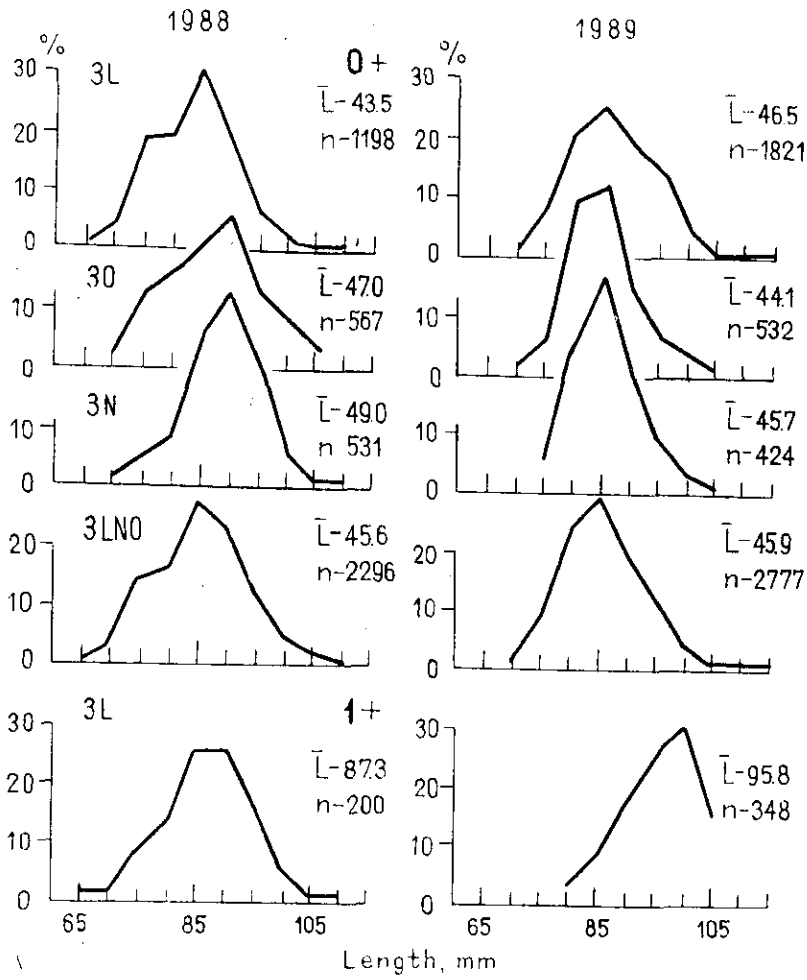


Fig.5 Larvae and yearlings length composition within the Grand Newfoundland Bank area during 1988-89