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Hydroacoustic Surveys of the Capelin Stocks in NAFO Div. 2J+3KLNO in 1987

by

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#### ABSTRACT

The results from two hydroacoustic surveys conducted in Divs. 3KLNO in summer and 2J3K - in autumn are presented. The capelin stock biomass in summer is noted to consist of about in half of the mature fish from the strong 1983 year class. The total capelin abundance in that area made up 107 bill.spec. and the biomass was about 2.2 mill.t.

The total stock was estimated at 1.2 mill.t in the survey conducted in autumn, which made up 64.7 bill.spec. The 1985 year class constituted the bulk of catches there. The 1984 year class proved to be at the level of the poor ones in two surveys.

#### INTRODUCTION

The acoustic survey of the estimation of the capelin stocks from the Newfoundland Bank are regularly conducted both by the Soviet and Canadian investigators in the recent 10 years. These surveys are specially important relative to a restoration of capelin stocks as a result of notable recruitment to the abundant 1979 and specially 1983 year classes. The data obtained in the Soviet and Canadian surveys enable to estimate the capelin stocks more realistically with the aim of an efficient exploitation of the commercial

stock by means of comparison of the results from two countries.

#### MATERIAL AND METHODS

The capelin acoustic survey was conducted from 15 May to 6 June in Divs. 3KLO and from 13 to 20 June 1987 - on the spawning grounds in Div. 3N. The survey was conducted by the research vessel "Persey-III" in the period between the total trawl survey of the bottom fishes off the Grand Newfoundland Bank (3LNO) and Notre Dame (3K).

The capelin acoustic survey was conducted from 2 to 18 November 1987 by the research vessel "Fridtjof Nansen" in Divs. 2J3K.

The capelin stocks were surveyed using the SIMRAD EK-S and EK-400 echo sounders with the frequency of 30 kHz and the digital integrator SIORS. The methods of conducting the survey and processing the data were on the whole similar to those applied in the previous capelin surveys (Mamylov, Bakanev, MS 1984; Bakanev et al., MS 1986).

The methods of the trawl acoustic survey of the bottom fishes applied in the recent years by the Soviet investigators when operating in the Barents Sea was used to assess the density of fish concentrations occurred close to the bottom in Divs. 3KLNO. For this purpose the width of the bottom channel of the integrator was set close to the vertical opening of a bottom trawl. The density of fish distribution in the near-bottom layer was estimated by two methods: by the acoustic method according to the results from the echointegrating ( $M_p$ ) and the method of the bottom trawl survey according to a catch size and the known fishing efficiency of the bottom trawl ( $M_{TR}$ ). In case of the mean density, estimated according to the trawl catches appeared to be 2 and more times higher than that one obtained by the echointegrating method, then the trawl method was applied when estimating the density of distribution in the near-bottom layer

at which the estimation ( $M_{TR}$ ) was made according to the following formula:

$$M_{TR} = \frac{P \times 4\sqrt{L} \times 1852 \times 10^{0.1 TS_{kg}}}{L_{TR} \times R} \frac{m^2}{mile^2},$$

where:

$M_{TR}$  - value of the echo intensity according to the catch from the bottom trawl;

P - catch, kg/mile;

$TS_{kg}$  - mean target strength, dB/kg;

$L_{TR}$  - horizontal opening of the bottom trawl equal to 14.3 m;

R - fishing efficiency of the trawl taken to be equal to 0.42 (Serebrov, 1986).

The values  $M_B$  along the survey tracks were determined by a linear interpolation of the data obtained at the nearby trawl stations. This method was especially necessary during the survey along the eastern slope of the Grand Newfoundland Bank in Divs. 3LN and 3K in the depths below 300 m where the capelin were often distributed in the bottom and were practically not recorded by the echo sounder.

The results from 22 pelagic and 17 bottom hauls from Divs. 3LNO and 9 pelagic hauls from Divs. 2J3K were used for biological sampling.

#### RESULTS AND DISCUSSIONS

The hydroacoustic survey tracks and the density of concentrations are presented in Figs. 1, 2 and 3. The survey tracks in Divs. 3KLO given in Fig.1 were plotted on the base of tentative information on capelin distribution obtained during conducting of the trawl survey of assessment of the stocks of the bottom fishes off the Grand Newfoundland Bank in April-May 1987.

The densest capelin concentrations with the prevalence of the younger age groups from the 1985 and 1984 year clas-

ses were registered in the central part of Div. 3L (Sub-area II). The mature specimens from the 1983 year class predominated to the south of that area and to a lesser extent - from the 1984 year class (Fig. 4).

The total capelin stock was estimated at 2.2 mill.t which made up about 107 bill.spec. The 1985 year class was predominant in abundance and the strong 1983 year class accounted for about a half of all fishes in biomass (Table 1). These results are well agreed with the data from the Canadian survey conducted in the same period in Div. 3L when the biomass constituted 2.6 mill.t (Miller and Carscadden, MS 1987).

The capelin biomass was estimated at 315 thou.t according to the results from the survey conducted in the spawning grounds in Divs. 3NO. The 1983 year class made up the bulk of the spawning stock.

According to the results from the autumn acoustic survey in the feeding areas (2J3K) the capelin biomass proved to be about two times lower compared to the summer survey in Divs. 3KLNO. The total biomass of capelin there made up 1.2 mill.t and the abundance - 64.7 bill.spec. This reduction is partially accounted for that the abundant 1983 year class, constituting the bulk of the spawning stock, was mainly dead as a result of the high spawning mortality and partially withdrawn by fishery, and the following 1984 and 1985 year classes occurred to be much lower in abundance (Table 2).

During the survey capelin occurred from 50°30' to 53°50'N between 53°00' and 55°30'W. The densest concentrations were observed near-by the territorial waters of Canada and, hence, possibly a portion of fish was underestimated. The fish 13-15 cm long made up the bulk of the test hauls and the 1985 year class was predominant in the age composition (Fig. 5).

Thus, the results from the investigations indicate that the capelin stock from the Newfoundland Bank will consist of the poor 1984 and the mean abundant 1985 year classes, which compared to 1987 will specify somewhat reduction of the biomass and abundance of the commercial stock.

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Table 1. Results from the capelin acoustic surveys in Divs. 3KLNO and 2J3K in 1987

Divisions, Subarea	Area, sq.mile	Mean integral	Stock index, N-mill.spec. W-thou.t	YEAR CLASS					TOTAL
				1986	1985	1984	1983	1982	
3KLO	2666I	67	N	-	2604	6782	7342	142	16870
			W	-	26,4	161,3	261,0	4,8	453,5
II	5472	770	N	-	41050	11293	6314	112	58769
			W	-	324,0	226,7	211,9	3,7	766,3
III	2708	290	N	-	640	2519	3736	72	6967
			W	-	6,8	63,9	137,3	2,5	210,5
IV	592I	307	N	-	1232	7385	8055	147	16819
			W	-	14,4	179,9	282,4	4,8	481,5
V	5874	155	N	-	142	2978	4560	93	7773
			W	-	2,1	78,2	165,7	3,3	249,3
I-V	46636	204	N	-	45668	30957	30007	566	107198
			W	-	373,7	710,0	1058,3	19,1	2161,1
3NO	9924	115	N	-	272	2612	6331	401	9616
			W	-	5,6	73,9	219,8	15,7	315,0
2J3K I	1500	95	N	1528	1296	13	2	-	2839
			W	10,9	14,1	0,2	0,1	-	25,3
II	4400	625	N	4230	29856	3267	3097	70	40520
			W	38,4	491,0	85,1	86,7	2,1	703,3
III	4000	422	N	226	13503	3625	3909	97	21360
			W	2,7	221,7	98,3	109,7	2,9	435,3
I-III	9900	463	N	5984	44655	6905	7008	167	64719
			W	52,0	726,8	183,6	196,5	5,0	1163,9

Table 2. Capelin biomass and abundance according to the data on the Soviet acoustic surveys in Divs. 3LNO and 2J3K for 1984-1987

Year of the survey	Division	AGE						TOTAL
		I	2	3	4	5	6	
Abundance, bill.spec.	3LNO	360,0	123,6	50,2	16,2	1,7	-	551,7
	2J3K	41,3	19,3	3,8	1,4	0,2	-	66,0
1985	3LNO	-	230,7	53,3	4,4	0,9	+	289,3
	2J3K	0,8	81,0	18,1	2,6	0,2	-	102,7
1986	3LNO	-	18,4	70,9	5,9	-	-	95,2
	2J3K	0,5	19,0	44,6	3,6	0,1	0,1	67,9
1987	3KLNO	-	45,7	30,9	30,0	0,6	-	107,2
	2J3K	6,0	44,6	6,2	7,0	0,2	-	64,7
Biomass, thou.t	3LNO	375,0	808,3	977,6	439,3	55,1	-	2655,3
	2J3K	67,7	125,3	45,0	22,0	3,2	-	263,2
1985	3LNO	-	1281,1	755,3	130,5	31,7	1,2	2199,8
	2J3K	4,2	1016,9	406,1	78,9	7,6	-	1513,7
1986	3LNO	-	190,5	1164,3	136,7	-	-	1491,5
	2J3K	2,4	299,7	1113,3	111,0	4,0	4,9	1535,3
1987	3KLNO	-	373,7	710,0	1058,3	19,1	-	2161,1
	2J3K	52,0	726,8	183,6	196,5	5,0	-	1163,9

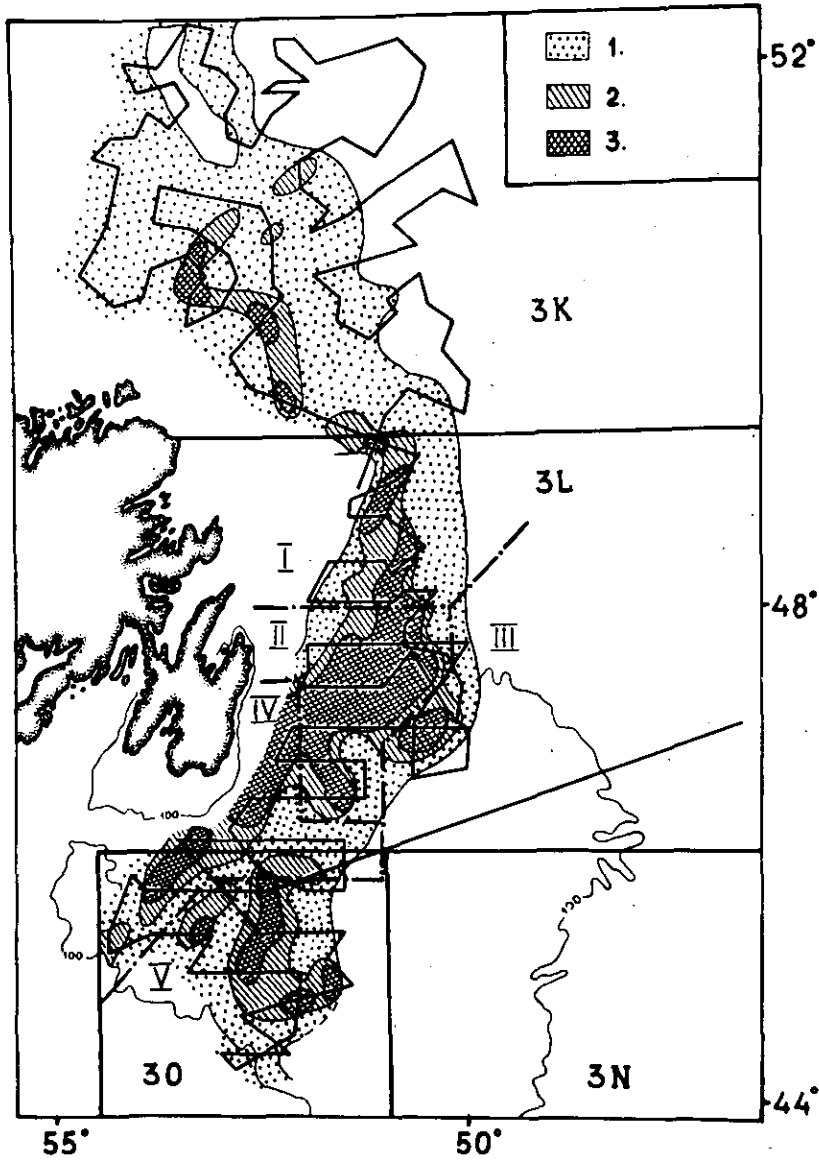


Fig.1. Survey tracks and density of capelin concentrations (in the echointensity units M) in Divs. 3KLN0

I -  $M < 100$ , 2 -  $M = 100-400$ , 3 -  $M > 400$

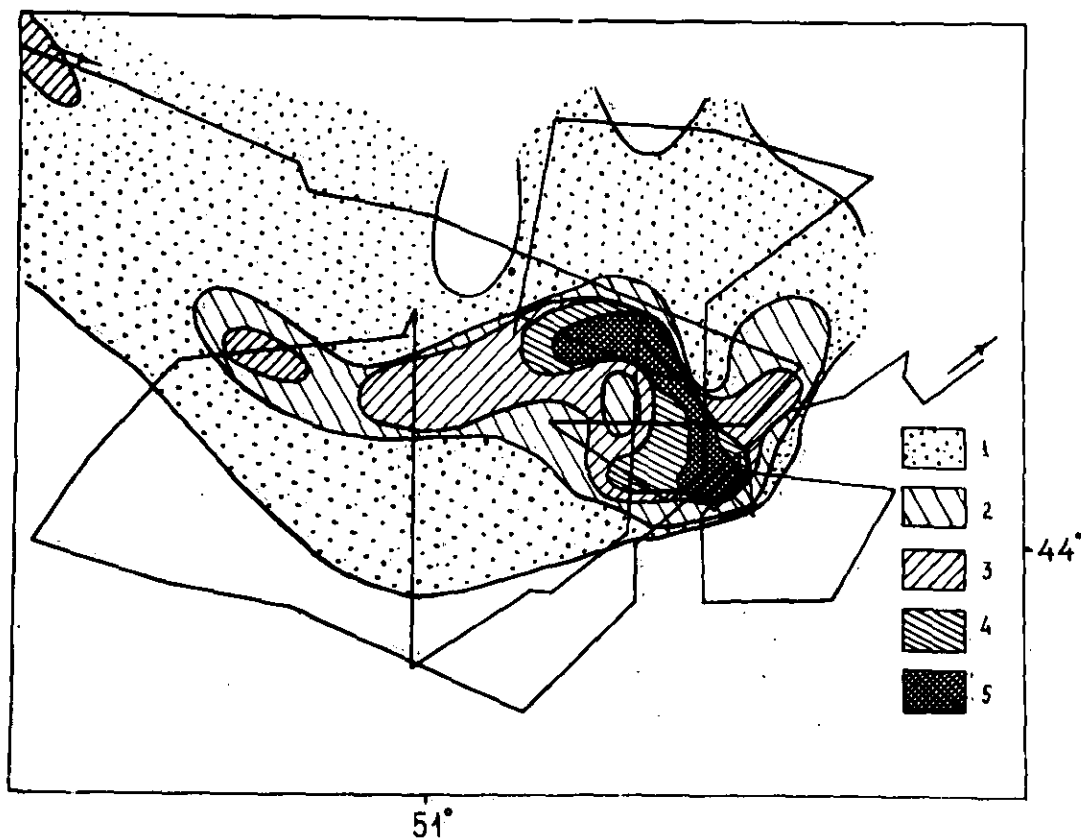


Fig.2. Survey tracks and density of capelin concentrations (in the echointensity units M) in Div.3N

1 -  $M < 25$ , 2 -  $M = 25-100$ , 3 -  $M = 100-400$ ,  
4 -  $M = 400-1000$ , 5 -  $M > 1000$



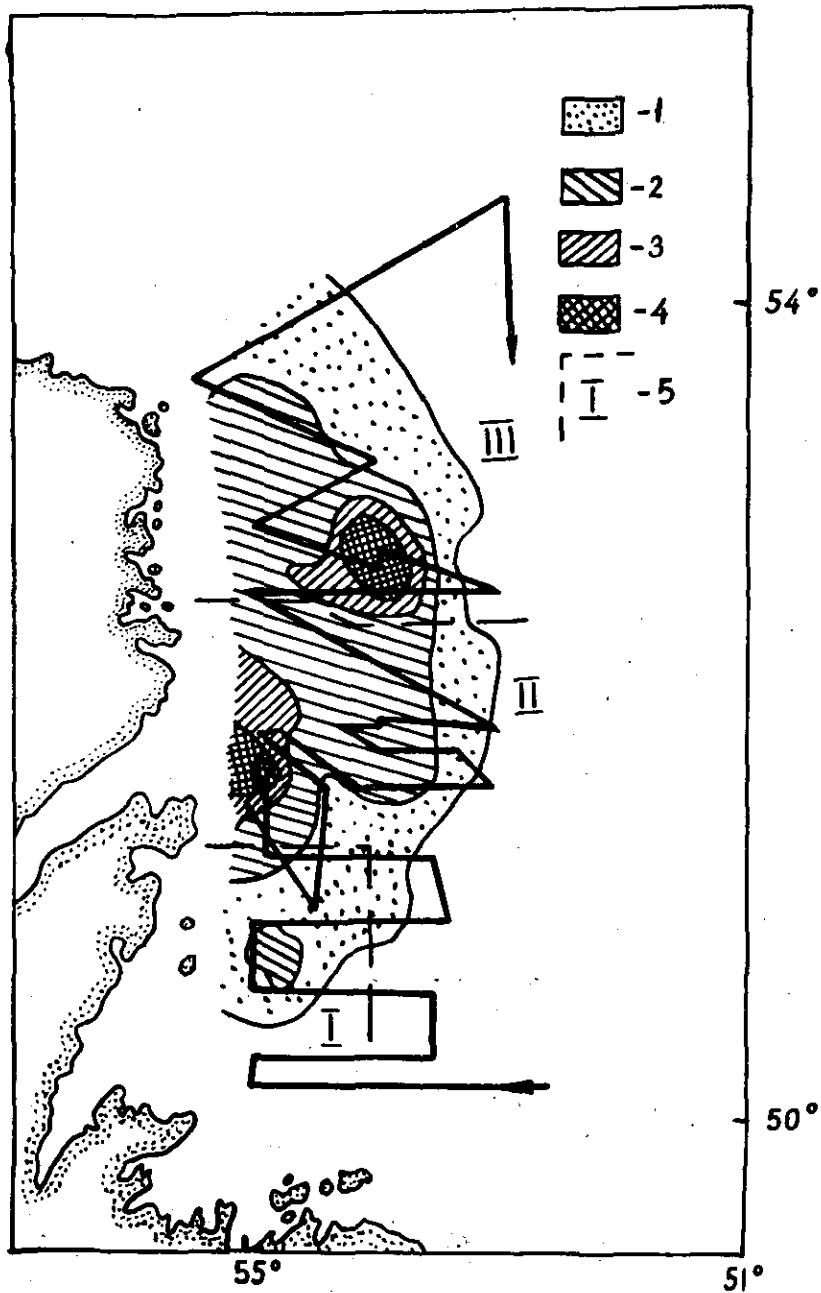


Fig.3. Survey tracks and density of capelin concentrations (in the echointensity units M) in Divs.2J3K

I -  $M < 50$ , 2 -  $M = 50-250$ , 3 -  $M = 250-1000$ ,  
4 -  $M > 1000$ , 5 - boundary of Subareas

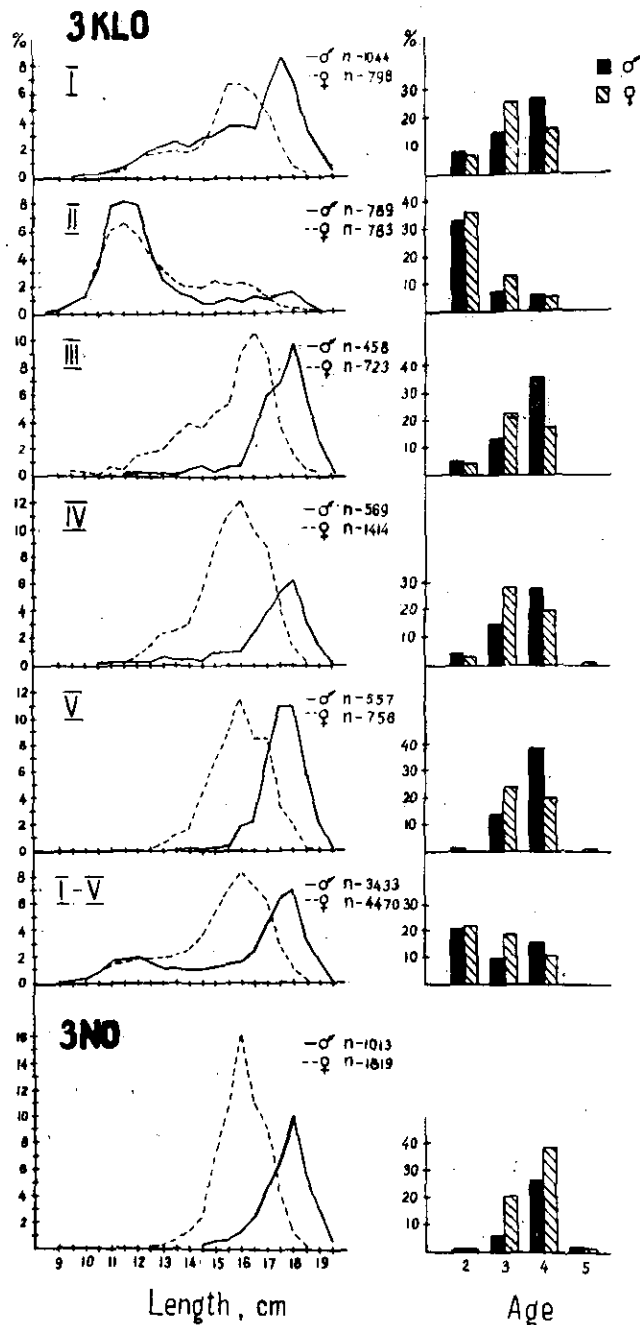


Fig.4. Length-age composition of capelin by Subareas in Divs. 3KLNO

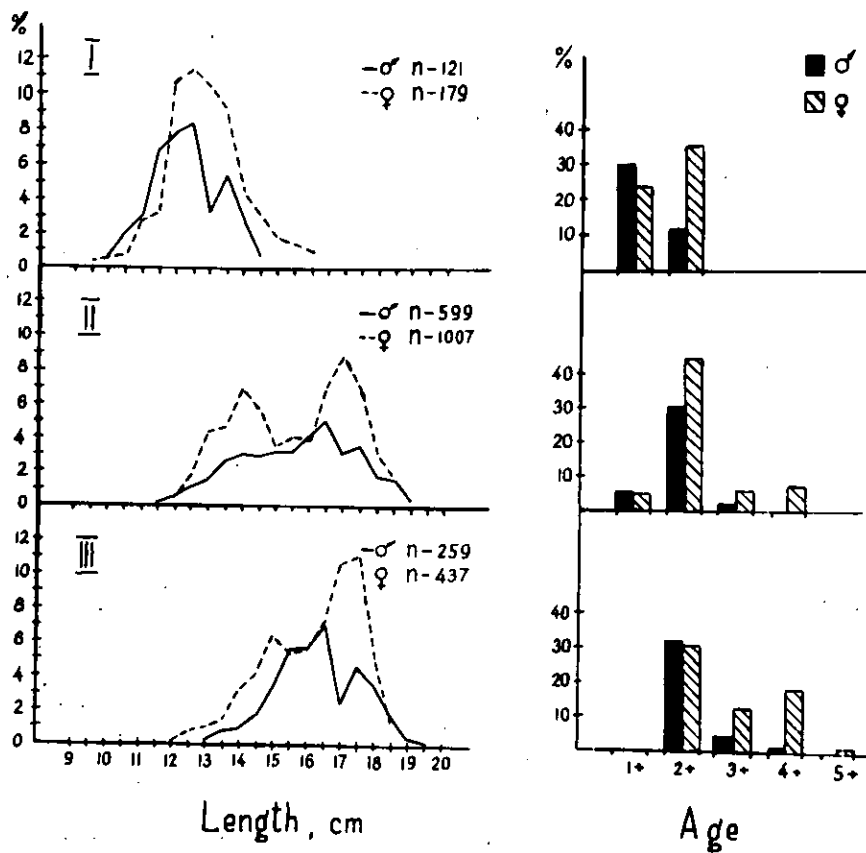


Fig.5. Length-age composition of capelin in Divs. 2J3K