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Results of Soviet Investigations on Capelin in Northwest Atlantic in 1980

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Abstract

The report presents results of Soviet investigations on acoustic abundance and capelin biomass assessment in Divisions 3LNO, 2J and 3K. The materials collected by the R/V "Poisk" in the period from May 26 to June 14, 1980, showed that capelin were not found in the area of the Grand Newfoundland Bank Southeast slope spawning grounds (3NO). Only in Div. 3L a small aggregation of mature capelin was found in late May, this aggregation was distributed together with juvenile capelin and sand lance.

Capelin stock assessment made in autumn 1980 by a research vessel in the South Labrador Division 2J with regard for soviet BMRT experimental fishery showed that capelin abundance was at level as low as before and constituted  $782 \times 10^3$  in number and their biomass equals to 20.2 thousand tons. It can't be excluded that any part of the stock, possibly its greater part, was distributed in the costal area during the survey.

Introduction

Beginning from 1974 annually in October-November soviet research vessels carry out capelin abundance and biomass assessment in Divisions 2J and 3K. Beginning from 1975 similar investigations have been carried out in May-June on the Grand Newfoundland Bank (3LNO). Results of echo-surveys and also data on total catch of capelin for all the countries and catch per effort for soviet vessels of BMRT type are presented in Table I. From this Table it follows that the dynamics of total catch and efficiency of fishery corresponds to great extent to a change of capelin stock in Div. 2J and 3K than to that of Div. 3LNO. It is explained by the fact that up to 1977 echo-surveys had been carried out on prespawning aggregations of mature stock in Div. 3NO but later on with regard for an abrupt decrease of mature stock on those spawning grounds the fish were counted in Div. 3L where mixed aggregations of mature and juvenile fish were distributed. Besides, shoals of sand lance may be found in this area. It is to some extent difficult to decipher echograms of such aggregations and this, apparently,

resulted in stock overestimate during the last years.

In 1980 works on capelin stock acoustic assessment were continued in Div. 3LNO, 2J and 3K. This paper presents the results of these assessments with regard for the soviet vessels data on experimental fishery in Div. 2J in September-October, 1980.

#### Materials and methods

The acoustic survey on capelin stock assessment in Div. 3LNO was carried out by the R/V "Poisk" in the period from 26 May to 14 June. The survey was carried out by EK-38 echo sounder and MC-I echo integrator connected with it. At the same time EK-12 echo sounder was used as a control device. Operational conditions of echo sounder and echo integrator were similar to those which were observed during surveys in 1978 and 1979 carried out by the same vessel (Ermolchev et al. 1979, 1980).

An area from 44°20' to 48°00' N and 49°30' - 54°20' W was compassed by the survey. Control trawlings were carried out with mid-water trawls.

Capelin abundance assessment in Div. 2J and 3K was conducted from board of the R/V "Kononov" in the period October 29-November 7. The method of capelin stock assessment in this area differs from that applied in Div. 3LNO. It consists of echo sounding of a proper area and estimating of mean absolute density of shoals with a subwater automatic camera "Triton" (Bakanev, Seliverstov, 1978). Hydroacoustic apparatuses "Kalmar" and "Paltus" were used during this survey. While calculating specific abundance per square mile (as in 1979) long-term average data on absolute density of shoals for this period were used (Bakanev, 1980). During acoustic survey control trawlings were carried out with a midwater trawl rigged similarly to those trawls on commercial fishery vessels, that's why materials obtained from those vessels concerning age samples were combined.

#### Results of investigations

Div. 3LNO. Aggregations of mature capelin were found in Div. 3L in the last days of May. Fish were distributed in separate thinned out shoals, their extent was 20-50 meters horizontally and 10-30 meters vertically. Among dense shoals of mature fish there were distributed shoals of juvenile capelin, 5-10 cm in size, 1979 year-class. Besides, sand lance were sometimes found (up to 50%) in by-catches of control trawlings. An area covered by such aggregations totalled about 50 sq.miles (Fig.I). Maximal catch per trawling did not exceed 0.2 tons. Length and age composition of capelin are presented in

Tables 2 and 3.

During further echometric survey in Div. 3O and 3N aggregations of mature capelin were not found. In these divisions juvenile capelin (1979 year-class) were found on large area. Total area covered by such aggregations was about 4 000 sq. miles (Fig.I). The densest

aggregations were found in the area from 44°30' to 47°00' N and 51°00' - 54°00' W.

Length composition of juvenile capelin in different divisions is presented in Table 4.

Thus, during acoustic survey carried out in an area accessible for soviet vessels a very small amount of mature capelin was found only in Division 3L. Because of capelin aggregations being thinned out and also because of difficulties in separating of juvenile capelin aggregations from those of sand lance it is almost impossible to assess capelin abundance.

It is necessary to mention that after the echo survey being finished (during the vessel's call at St. John's on June 25) our canadian colleagues kindly afforded us an opportunity to observe capelin spawning in one of the bays not far from the port. With a landing-net from the depth of 1.5-2.0 meters we caught and then analysed 210 specimens of capelin. Biologically these fishes differed from those of Div. 3L (Table 3). There were a lot of dead capelin and their eggs were mixed with sand along the coast of the bay.

It testifies that fish are distributed in a narrow area along the coast and the reason of it is a decrease of spawning stock. Div. 2J and 3K. In 1980, in order to collect biological material on capelin in Div. 2J and 3K soviet vessels were given a quota equal to 5 000 tons.

In mid-September one vessel of BMRT type initiated capelin fishery; from September 20 two BMRT-type vessels were already working. Capelin aggregations were distributed on a limited area in the Southwest part of the Hamilton Bank (Fig. 2). Day-time catches during 2-3 hours of trawling constituted 10-30 tons. Night-time catches brought only 5-10 tons per 3-5 hours of trawling.

In October a decrease of fishery efficiency was observed. In late October - early November due to low efficiency of fishery the mentioned vessels without having taken the quota were forced to leave the area and to start ground fish fishery.

The acoustic survey in Div. 2J and 3K took place, as mentioned, in late October - early November. The survey did not show any aggregations of capelin in Div. 3K. In the southern part of this Division only aggregations of juvenile polar cod, 10-15 cm in size, were found. Control trawlings made with a mid-water trawl brought from 0.5 to 3 tons of fish per 1-2 hours of trawling.

Mixed aggregations of large capelin and juvenile polar cod were found in Div. 2J. Catches per trawling were from 0.6 to 4 tons. Average abundance of capelin in aggregations covered by the survey was 48% and that of polar cod - 52%. Capelin abundance and biomass for the period of investigations were calculated with regard for the figures cited above.

The area compassed by the aggregations constituted 52.4 sq.miles. An approximate capelin abundance in this area was  $780 \times 10^6$  in number

and their biomass -  $20.2 \times 10^3$  tons. It can't be excluded that any part of the stock, possibly its greater part, was distributed in the costal area during the survey.

Capelin age composition according to commercial vessels catches and also to those of R/V "Kononov" are presented in Table 7. The main portion in these catches constituted fish of 1977 year class at the age of 3+ and to less extend there were fish of 1976 and 1978 year classes.

#### Discussion

Acoustic assessment of capelin stocks made by soviet vessels during the last 2 years in the Grand Newfoundland Bank area show that capelin stock in Div. 3L is rather low and that capelin are completely absent on spawning grounds of the Grand Newfoundland Bank South-east Slope (3N). The results of capelin stock assessment in autumn period in Div. 2J and 3K also testify that capelin stock here is in a depressive state.

It is usually considered that catch per effort is a relative index of commercial stock. High efficiency of fishery in 1980 does not characterize the stock state, it is most likely a consequence of total effort decrease which influences on the accessible part of the stock. Comparing with 1979 total effort has shortened more than 8 times and comparing with 1974 when the stock was at its highest level - more than 40 times (Table I). At the same time we observed that total area of capelin aggregations distribution is decreasing (Fig. 2) which testifies to a decrease of capelin stocks.

Age composition analysis in Div. 2J and 3L shows that during all the years of investigations only two rich year classes (1969 and 1973) recruited the stock. After 1978 the stock was recruited by

poor year classes which were not able, naturally, to maintain stock abundance at high level.

Portion of fish of 1977 and 1978 year classes in catches in 1979-1980 also indicates that these year classes are poor and their recruitment during the consequent years will also be poor.

A great amount of juvenile capelin of 1979 year class found in Div. 3LNO allows us to hope that in autumn 1981 the commercial stock will be well recruited.

Considering this it's necessary to continue investigations in summer period aimed to assess capelin stocks in Div. 3LNO which permits to estimate perspectives of fishery for autumn of 1981 and also for the following years.

# References

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- Ermolchev V.A., Kovalev S.M., Mamylov V.S. and Seliverstov A.S. Assessment of capelin stocks in Divisions 3LNO in May - June 1979. NAFO SCR Doc. 80/II/42 p;9.

Table 1

Stock, total catch taken by all countries and the Soviet fleet (vessels of a large refrigerator trawler type) fishery production in 1974-79

Indices	Division 3LNO					
	: 1974 :	1975 :	1976 :	1977 :	1978 :	1979* :
Stock, thou.t.		1050	680	1000	230	483
Total catch, thou.t.	158,5	165,9	144,0	76,9	28,9	12,3
Catch per fishing day, t.	42,9	41,4	43,5	40,3	31,1	
Division 2J+3K						
Stock, thou.t.	1334,0	981,8	748,9	505,7	59,0	14,5
Total catch, thou.t.	126,9	193,1	210,7	152,4	55,0	10,1
Catch per fishing day, t.	57,2	41,0	42,4	38,7	25,8	14,5

\* Note: Preliminary data

Table 2

Length composition of capelin in Division 3L in May-June 1980, %.

	M o n t h			
	M a y		June (sea coast, St. John's)	
	Males	Females	Males	Females
11,0		0,7		
11,5	0,3	0,5		
12,0		4,3		
12,5	1,2	5,7		0,9
13,0	2,3	11,2		2,4
13,5	1,3	11,4		5,7
14,0	4,7	10,9		7,1
14,5	5,0	6,5	4,8	2,9
15,0	9,7	5,3	20,0	3,3
15,5	5,3	1,9	18,6	
16,0	5,0	1,0	15,7	0,5
16,5	2,0	0,5	9,0	
17,0	1,8	0,2	6,2	
17,5	0,3		2,4	
18,0	0,5		0,5	
18,5				
19,0	0,3			
19,5	0,2			
Number	240	359	162	48

Table 3

Capelin age composition in Div. 3L in May-June, 1980, per cent

Month	Sex	A g e				n
		2	3	4	5	
May	Males		13	18	13	44
	Females		15	32	9	56
June (coast, port St. John's)	Males	2	30	37	6	75
	Females	1	11	12	1	25

Table 4

Length composition of juvenile capelin in Div. 3LNO in May-June, 1980, per cent

	L E N G T H , cm												
Div.	5,0:	5,5:	6,0:	6,5:	7,0:	7,5:	8,0:	8,5:	9,0:	9,5:	10,0	10,5	n
3N	1,9	27,9	40,4	19,2	7,7	2,9							104
3 O		0,5	4,4	13,8	16,0	18,2	18,9	11,3	7,8	5,3	3,4	0,4	550
3 L	0,5	4,9	16,7	17,7	22,0	19,1	10,3	6,9	1,4		0,5		204

Table 5

Capelin age composition in Div. 3L for the period  
1972-1980, per cent

Age	Y E A R									
	1972:	1973:	1974:	1975:	1976:	1977:	1978:	1979:	1980:	
1	9,9		1,1							
2	5,2	32,1	1,9	32,8		2,4	8,8	0,6		
3	48,5	7,1	36,7	31,0	66,4	32,3	8,1	41,5	28,0	
4	34,2	42,6	32,5	22,5	27,0	61,0	45,2	27,8	50,0	
5	22,0	18,0	25,8	3,5	5,6	4,0	36,2	25,1	22,0	
6		0,2	2,0	2,5	1,0	0,3	1,5	4,8		
7				0,7			0,2	0,2		
Number	595	396	786	400	300	300	900	550	100	

Table 6

Catches of the Soviet vessels (of a large refrigerator trawler type) per trawling hour and fishing day in Division 2J+3K by months for 1974-80, t.

Month	Year of the fishery						
	: 1974 :	1975 :	1976 :	1977 :	1978 :	1979 :	1980 :
VIII	<u>7,57</u> 88,8	<u>5,91</u> 66,9	<u>3,07</u> 45,0	<u>4,16</u> 38,1	<u>2,71</u> 27,8	<u>1,43</u> 15,3	
IX	<u>6,70</u> 62,1	<u>6,7</u> 50,3	<u>3,40</u> 44,9	<u>4,74</u> 38,0	<u>2,37</u> 25,5	<u>0,32</u> 4,5	<u>6,16</u> 63,4
X	<u>3,64</u> 52,3	<u>3,82</u> 32,0	<u>3,14</u> 38,9	<u>3,58</u> 38,3	<u>3,26</u> 48,8	<u>1,38</u> 17,1	<u>4,57</u> 50,2
XI	<u>3,74</u> 57,3	<u>3,84</u> 28,9	<u>3,79</u> 43,6	<u>4,22</u> 39,2	<u>1,57</u> 16,6		<u>2,37</u> 19,9
XII		<u>1,77</u> 15,0	<u>3,93</u> 43,3	<u>3,54</u> 39,8			
Total	<u>3,74</u> 57,3	<u>5,07</u> 41,0	<u>3,59</u> 42,4	<u>4,00</u> 38,7	<u>2,45</u> 25,8	<u>1,15</u> 14,5	<u>4,92</u> 53,0
Total catch, thou. t.	126,9	193,1	210,7	152,4	55,0	10,1	4,9
Number of st. thou. hrs.	33,9	38,1	58,7	38,1	22,4	8,8	1,0
Number of st. thou. ds.	2,2	4,7	5,0	3,9	2,1	0,7	0,1

Note: enumerator - catch per trawling hour  
denominator - catch per fishing day

Table 7

Capelin age composition in Div. 2J in the period  
1972-1980, per cent

	Y E A R									
Age	1972:	1973:	1974:	1975:	1976:	1977:	1978:	1979:	1980:	
I+		0,1								
2+	2,4	22,4	14,0	47,4	1,7	1,5		5,0	12,4	
3+	74,4	24,7	61,2	38,4	89,8	25,6	14,0	32,6	53,0	
4+	18,1	47,3	13,9	10,4	6,8	63,2	83,0	41,0	28,3	
5+	5,1	5,2	9,9	2,8	1,3	8,6	3,0	15,4	5,9	
6+		0,3	1,0	1,0	0,2	0,9		5,8	0,4	
7+					0,2	0,2		0,2		
Total number	370	893	93	800	600	800	100	500	700	

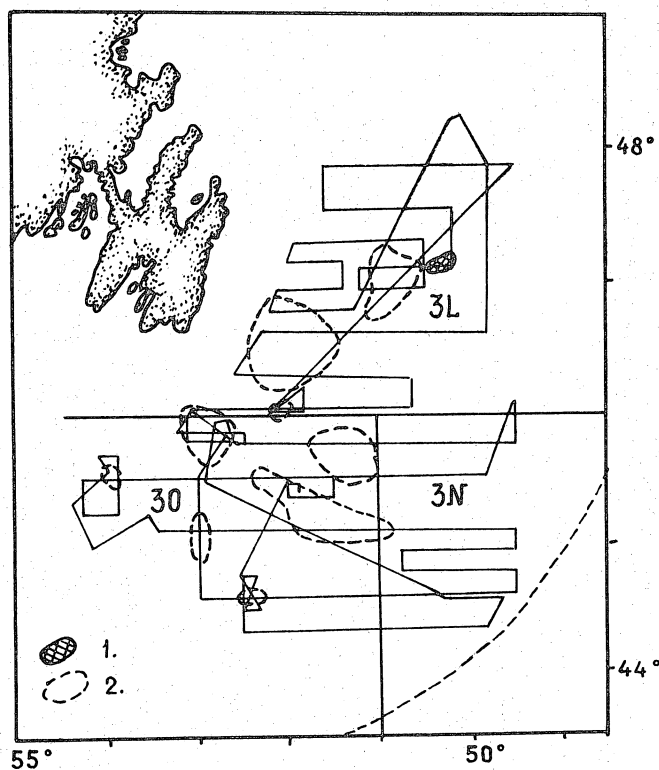


Fig. 1. Route of R/V "Poisk" and capelin aggregations distribution  
in May-June 1980.

1. Aggregation of mature capelin
2. Aggregation of juvenile capelin



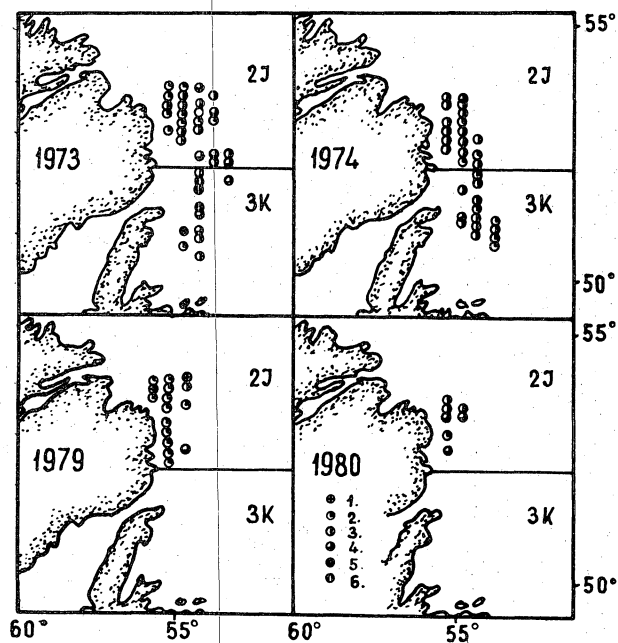


Fig. 2. Capelin aggregations distribution and production of the BMRT fishery in October 1973-1974 and 1979-1980.

1. catch up to 1 ton per hour of trawling

2.	- " - " -	1.1 - 2.5	- " -
3.		2.6 - 5.0	- " -
4.		5.1 - 10.0	- " -
5.		10.1 - 20.0	- " -
6.		over 20	- " -

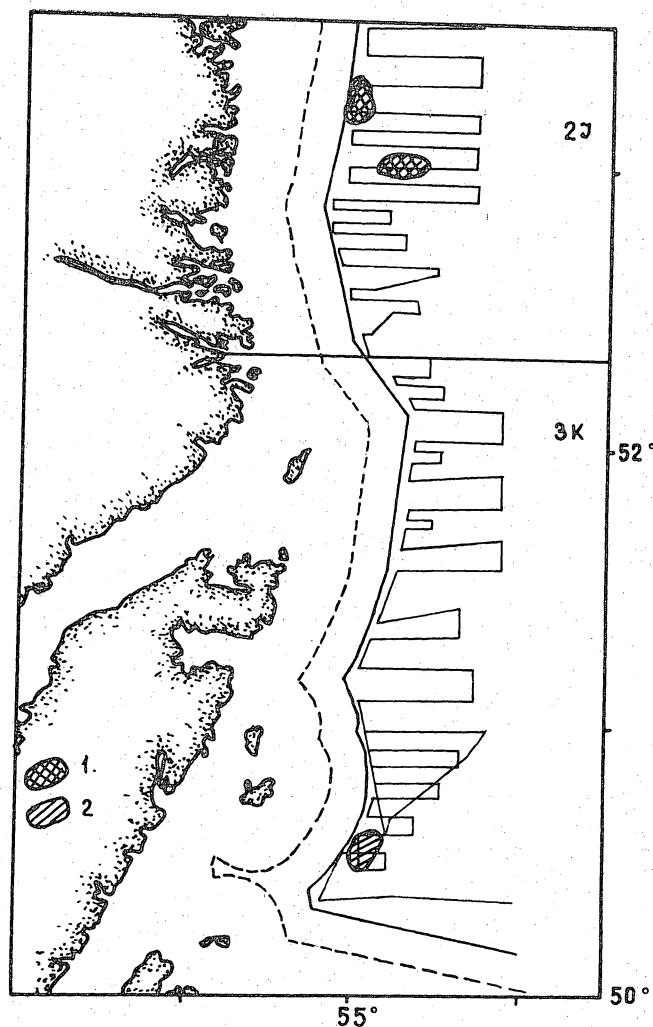


Fig. 3. Route of R/V "Kononov" and distribution of capelin aggregations and juvenile polar cod

1. Mixed aggregations of capelin and polar cod
2. Aggregations of juvenile polar cod