

International Commission for



the Northwest Atlantic Fisheries

Serial No. 5191  
(D.c.3)

ICNAF Res. Doc. 78/VI/30

ANNUAL MEETING - JUNE 1978

Capelin investigations in the waters off southern Labrador (Division 2J)  
and on the north Newfoundland Bank (Division 3K) in the Autumn of 1977

by

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### S U M M A R Y

The article includes data on the capelin distribution, their age and size compositions and biomass in the waters off South Labrador (2J) and the North Newfoundland Bank (3K) obtained as result of a research trip of R/V "Persey III" in October 1977.

### INTRODUCTION

An instrument estimate of the capelin stock was completed from board R/V "Persey III" in the South Labrador and the North Newfoundland Bank waters (2J and 3K) throughout the period from 19 up to 28 October. An instrument estimate was performed simultaneously with investigations on distribution, behaviour and age-size structure of the capelin stock like it was in 1974 - 1976. The autumn 1977 appeared to be the most unfavourable for organization and conduction of investigations compared to the period 1974 - 1976. Due to anomalous hydrologic conditions, capelin were keeping much closer to 12-mile territorial waters of Canada and one can suppose, therefore, that a considerable part of the capelin stock (apparently, much greater than that one in 1974 - 1976) could not be taken into account.

## MATERIAL AND METHOD

The method of investigations conducted in the autumn 1977 did not distinguish from that one accomplished in 1975 - 1977 (Bakanev, Seliverstov, Serebrov, 1976; Klochkov, Seliverstov, Zaferman, 1977; Seliverstov, Kovalev, 1976; Serebrov, Bakanev, Kovalev, 1975).

Studying of the capelin distribution, the age - size structure of their stock, their behaviour and acoustic - photogrammetric survey were performed throughout the area from 50°20' N up to 53°30' N along the territorial waters of Canada.

Underwater photographs were treated and interpreted according to the methods used for these purposes earlier (Bakanev, Seliverstov, Serebrov, 1976; Truskanov, Zaferman, 1973; Truskanov, Shcherbino, 1963, 1966), see Table I.

The capelin density was estimated for the intervals as follows: 0.1 - 10.0; 10.1 - 29.0; 25.1 - 50.0 and  $50.1 \times 10^6$  spec./mile<sup>2</sup> (Fig. I, Table 2).

## DISCUSSION OF RESULTS OBTAINED AND THE CONCLUSION

It is known that in October capelin come to an end with their feeding in the Southern Labrador and the Northern Newfoundland Bank, the fish are grouping into shoals and begin to shift slowly southwards.

Investigations conducted during the last four years showed that the fish stock is only partially covered by an echometric survey; that part is distributed easterner of 20-mile costal zone. Annually, a considerable number of capelin are inaccessible for counting, and this part of fish stock is not stable throughout some years, it depends on hydrobiological conditions of the year (Bakanev at al., 1976; Klochkov at all., 1977).

It was concluded that in case of the intensity relaxation of the ashore branch of the cold Labrador Current, capelin are keeping

closer to the shore and migrate to their feeding and growing grounds further to the north, to the area lying behind the Hamilton Bank. In the years with low heat content in water masses, the area of the capelin feeding and growing enlarges eastwards and the autumn capelin concentrations become more accessible for their quantitative counting.

In autumn 1977, small capelin concentrations began to migrate in the midst of October. Fish moved southwards along the territorial waters limit of Canada with speed of 10 - 15 miles per day.

The results of the echo survey by R/V "Persey III" and the analysis of the commercial vessels operations showed that capelin were encountered 18 miles easterner the Canadian coast but they formed no stable concentrations during the period of investigations. Fish migrated southwards with great speed by small shoals, those were registered along the Canada coast in a narrow area stretching more than 200 miles (Fig. I).

At the same time, the Canadian researchers reported on great capelin concentrations in the Notre Dame Gulf, approximately, in 10 miles from the coast over 140 m - 150 m depth.

Everything given above testifies to the fact that in autumn 1977, the character of the capelin distribution distinguished greatly from that one of the previous years. The tendency of fish to distribute much closer to the coast compared to that one in 1974 - 1976 period depended on some intensity relaxation of the Labrador Current. The hydrological section 8 A (Seal Island) showed that the water temperature appeared to be 2° higher in the ashore branch of the Labrador Current compared to three previous years (Table 3). A peculiarity of great importance in the capelin behaviour was found out during the echometric survey. The matter is that the capelin distributed partially sporadically throughout a large distance without forming their shoals. Fish could not be recorded by the echo sounders at such a character of their distribution. Control trawlings gave catches from 50 kg up to 500 kg, and they were made without any traces of the echo sounding recorders, and the photo camera attached to the trawl registered only singular fish individuals or,

rarily, little schools including 2 - 3 specimens.

Summarizing the above facts, it is possible to conclude that in 1977, the method of the standard acoustic - photo survey of the capelin stock was not effective due to an extreme heat content of water masses of the ashore branch of the Labrador Current. That could be explained by the factors as follows:

1. The fish distributed much closer to the coast than previously including the territorial waters of Canada.

2. The fish migrated with great speed by separate schools through the territorial waters and along them.

3. The capelin concentrations were partially so dispersed that the fish could not be recorded by the echo sounders. All these unfavourable factors given above did not allow to perform a representative estimate of the capelin biomass and abundance in the waters of the South Labrador (2J) and the North Newfoundland Bank (3K) in autumn 1977.

The estimated abundance and biomass are considerably less than the actual ones. A discounted part of the capelin stock should be much higher in autumn 1977 than previously due to the facts mentioned above.

Data obtained with help of the underwater photosurvey testify to the fact that the density of the capelin stocks was much greater in autumn 1977 than in 1974 - 1976 (Serebrov, Bakanev, Kovalev, 1975; Bakanev, Seliverstov, Serebrov, 1976; Klochkov, Seliverstov, Serebrov, 1977), see Table I.

It appeared to be impossible even to outline the area occupied by the fish with application of the usual method due to the dispersed concentrations of a part of fish. It appears to be reasonable to perform a trawl survey in addition to the acoustic - photogrammetric survey to estimate the abundance of the dispersed capelin, but, the volume of work would be much greater, thus, to maintain the representativity of the survey, it would be necessary to have an additional number of vessels.

To avoid the situation like that one given in the paper, the survey of the capelin in the waters of the South Labrador and the

North Newfoundland Bank should cover Canada's territorial waters as well, and several vessels should work simultaneously according to the united program.

In autumn 1977, a rich 1973 year - class dominated in the catches taken in the waters of the South Labrador and the North Newfoundland Bank, the mean weight of an individual in the stock was 27.1 g (Fig. 2). The comparison of the dynamics of 1969 and 1973 year classes which dominated in 1971 - 1977 stock (the first year - class - in 1971 - 1973 and the second one - in 1976 - 1977) testifies to the fact that these year - classes were comparable by their abundance. It is a matter of interest to compare a relative dynamics of the abundance of these populations, as the fishery intensity was less while exploiting 1969 year - class compared to that one while exploiting 1973 year - class.

The total allowable catch was introduced from 1974 in the South Labrador Area and the North Newfoundland Bank (2J and 3K), when the catch reached 136 thousand tons. The total allowable catch was determined as high as 300 thousand tons by ICNAF for 1975 - 1977. But, throughout all the years of the fishery, the total number of the fish removal by the international fishery was less than quotas established by ICNAF (Table. 4).

Table 4 shows that the catch was determined not by the values of quotas, but, by commercial purposes, besides that, by specific operations within 200-mile economical Canada's zone and by unfavourable for the foreign fishery dislocation of the fishery operations (Fig. 1).

In 1972 - 1974, the fishery intensity was 42 percent less (the total catch was 309 thousand tons) than in 1975 - 1977 (the total catch was 553 thousand tons) in Div. 2J + 3K.

Nevertheless, the dynamics of the age/size compositions of 1969 year - class appeared to be very similar to that one of 1973 year - class relating 1977 (Fig. 2 and 3). Even in 1977, in spite of a high intensity of the fishery, the number of the big - sized fish was greater than in 1974.

If the effect of the fishery on the stock was too high, the

natural dynamics of the year - classes would be obligatory disturbed. The rest of 1973 year - class dominating in the stock must be less than that one of 1969 in 1973 at a grown fishery intensity in 1977. The decrease in number of the elder year - classes of fish in the stock effected by an intense fishery is a well - known phenomenon investigated thoroughly enough relating many commercial fish species.

Everything given above allows to consider that no reduction in the abundance and the biomass of capelin late in 1977 was observed. As result of the acoustic - photogrammetric survey, there was obtained the biomass equal to 0.86 mln tons, that was some 0.12 and 0.19 mln tons less compared to the values got in 1976 and 1977. The estimate obtained can not be interpreted as the reduction of the fish abundance even in the absolute values, especially if one take into account the abnormal capelin distribution and their behaviour in autumn 1977. The value of the possible annual removal can be recommended as high as 0.3 mln tons, i.e. it will be at the level of 1975 - 1977 period (if one take into account a <sup>relatively</sup> short life circle of this fish species, a rapid restoration of the fish abundance as <sup>the</sup> result of the entering into the stock of a rich recruitment, the absence of data confirmed the effect of the fishery on the natural dynamics of the age - size composition of the fish and only a partial counting of their stock).

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Table I. Mean density of the capelin concentrations according to underwater photosurvey in 1974 - 1975.

Year	Mean density, spec./m <sup>3</sup>		
	Day	I	Night
1974	0.810		0.480
1975	1.188		0.873
1976	1.320		0.380
1977	2.210		0.820

Table 2. The capelin abundance and biomass (Divisions 2J+3K).

Division	Density gradation 10 <sup>6</sup> spec/mile <sup>2</sup>	Mean specific number specimens/mile <sup>2</sup> 10 <sup>6</sup>	Area of concentration in miles <sup>2</sup>	Mean weight of one spec.	Mean number x 10 <sup>6</sup> specimens	Mean biomass, t
1	2	3	4	5	6	7
	0.1 - 10.0	7.18	156.31		1122.31	34791.6
2 J	10.1 - 25.0	23.70	142.00	31.0	3365.40	104327.4
	25.1 - 50.0	45.25	137.97		6243.74	193537.3
	50.1	168.24	30.35		5106.08	158288.6
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T o t a l		33.94	466.63		15836.92	490944.9
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	0.1 - 10.0	5.56	575.60		3200.37	83209.6
3 K	10.1 - 25.0	20.54	239.28		4914.81	127785.1
	25.1 - 50.0	40.10	12.85	26.0	515.28	13397.3
	50.1	132.12	42.95		5674.55	147538.3
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T o t a l		16.42	870.68		14305.01	371930.3
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Total for the both Divisions			1337.31		30141.93	862875.2

Table 3. Water temperature along the section 8A in 1974-1977.

Year	Depth, m	
	0 - 200	50 - 200
1974	0.27	-0.02
1975	0.70	0.51
1976	0.36	0.20
1977	2.34	2.52

Table 4. Actual catches and total allowable capelin catches in 1972-1977.

Division	Actual catches, thousand tons					Total allowable catches, thousand tons				
	1972	1973	1974	1975	1976	1974	1975	1976	1977	
2 J + 3 K	46	136	127	199	209	125 <sup>xx</sup>	110 <sup>x</sup>	160 <sup>x</sup>	160 <sup>x</sup>	212.5 <sup>x</sup>

<sup>x</sup> A country beginning the capelin fishery for the first time is allowable to take 10 thousand tons annually. The total allowable catch is 300 thousand tons.

<sup>xx</sup> ICNAF Circular letter 78/10. The catch - through November inclusive.

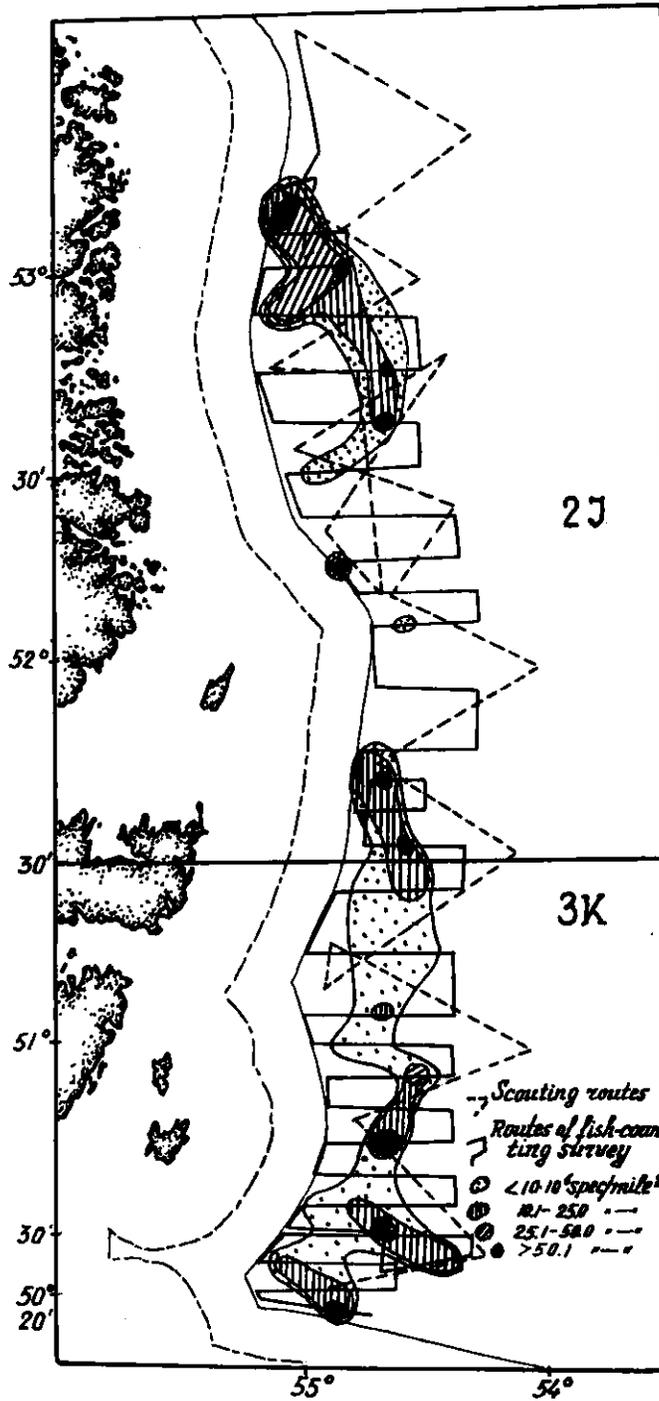


Fig. 1. The route of R/V "Persey III" and the capelin distribution in October 1977.

Density gradation in spec./mile<sup>2</sup>

1. 0.1 - 10.0 · 10<sup>6</sup>

2. 10.1 - 25.0 · 10<sup>6</sup>

3. 25.1 - 50.0 · 10<sup>6</sup>

4. 50 · 10<sup>6</sup>

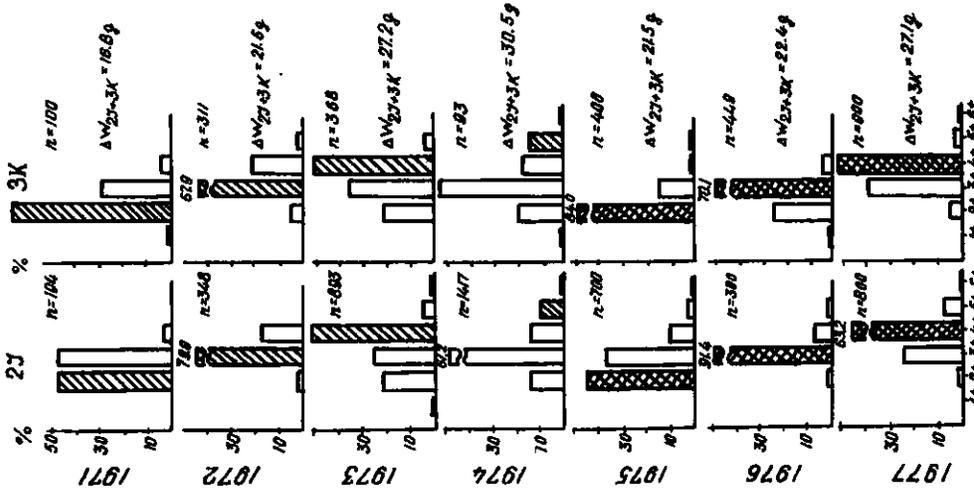


Fig. 2. Age composition and mean weight of capelin in Div. 2J and 3K, 1971-77.

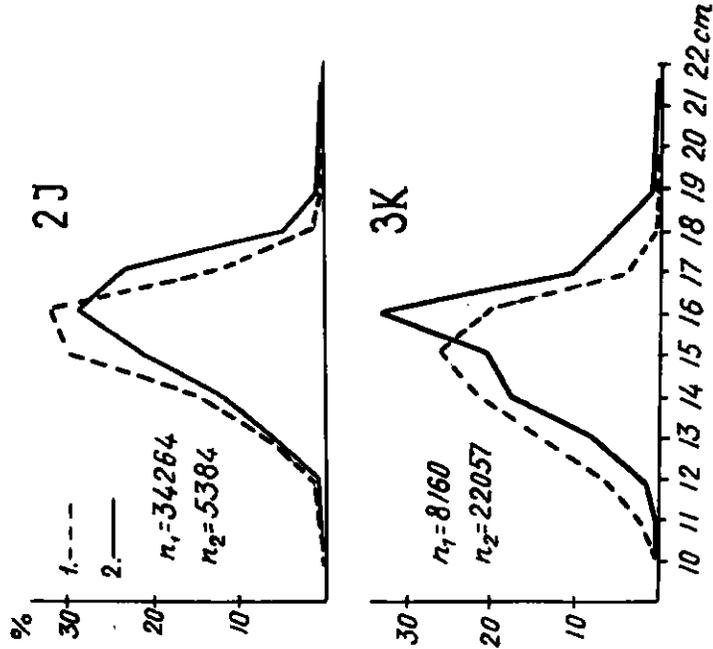


Fig. 3. Capelin size composition off South Labrador (Div. 2J) and North Newfoundland Bank (Div. 3K), the autumn 1973 (1) and 1977 (2).

