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Ichthyoplankton Investigations for the Capelin 1987 Year-class Strength in NAFO Div. 3KLNO

by

V. S. Bakanev and I. A. Oganin

Polar Research Institute of Marine Fisheries and Oceanography (PINRO)
6 Knipovich Street, 183763, Murmansk, USSR

ABSTRACT

According to the results from the ichthyoplankton survey of capelin prerecruits in Divs. 3KLNO the 1987 year class may be related to the higher abundant ones, as it considerably exceeded the poor 1984 and 1986 year classes by the amount of larvae caught and area of their distribution, while to the same extent it yielded to the abundant 1983 year class. As a result of the fry trawl selectivity the smallest larvae are noted to be underestimated, whereas vice versa mainly smaller larvae are sampled with the Bongo planktonsampler and the large ones remain underestimated.

INTRODUCTION

Estimation of the relative strength of capelin year classes at the early stages of life cycle (at age 0+, I+) is necessary to forecast the commercial fish stocks 2-3 years in advance and also is one of the important indices for the annual correction of the total allowable catch.

According to the Soviet/Canadian agreement the survey of prerecruits has been conducted since 1983 by the PINRO research vessels in November-December off the Grand Newfoundland Bank. The early results from the prerecruit surveys indicated that the assessment of larvae (0+) using the trawl survey method

resulted in the most correct estimate of the capelin strength. The assessment of these year classes at age I+ when the juveniles start to shoal into the separate shoals or shoal concentrations from a disperced distribution, remains the most complicated. In this case the trawl survey turns to be unaffective. At the same time when using the combined trawl-acoustic method some difficulties are observed in connection with a lack of reliable estimate of the target strength ("in situ") for the given length group of fish and also with the difficulty in the identification of fish concentrations among the sound scattering layers. Thus, the results from the larval survey conducted by the fry trawl as well as by the Bongo planktonsampler are presented in the paper. The results obtained by these fishing gears are compared.

MATERIAL AND METHODS

In total 59 trawl stations using the fry trawl (20 x 20) with a small-meshed netting in the codend (mesh size - 3.6 mm) were made when surveying the capelin prerecruits in Divs.3KLNO. Experimental researches on the assessment of capelin larvae abundance using the high-speed BONGO-61 with the opening of 61 cm and area - 0.29 m^2 were carried out in parallel.

The layers 0-20, 20-40 and 40-60 m were sampled in turn using the fry trawl. A duration of each haul was 10 minutes at each depth. Larvae were sampled over the layer 0-60 m by the Bongo net using the oblique haul method during 20-30 minutes with the speed of about 3.5 knots. A number of larvae per I m^2 (n) at the given station was estimated according to the formula:

$$n = NiH / (P_2 - P_I)\ q^{-I}, \quad \text{where}$$

Ni - number of larvae in a catch, spec.;

H - sampled water layer at the given station , m;

P_I, P_2 - the I and II measuring of the current meter, in grades;

q - value of one rotation of the current meter impeller, in grades;

Estimation of the total number of larvae (N) in the area surveyed was made according to the following formula:

$$N = (\sum_{i=1}^{k} Si\,\delta)d \quad , \text{ where}$$

Si - area with the similar density of larvae, sq.miles;

δ -mean number of larvae per a square m. , spec.;

K - area with the similar density, spec.;

i - number of areas with the interpolated mean density of larvae per a square meter;

d - coefficient of the conversion of a square mile into the square meters equal to 3429904 m^2.

As in the previous surveys the methods applied in the similar survey of fingerlings of the Barents Sea capelin and presented in details earlier, was used to determine the index of the year class strength (Anon., 1974; Bakanev et al., 1984; Bakanev, Gorchinsky, 1985).

RESULTS AND DISCUSSIONS

Position of the ichthyoplankton stations as well as the catches from the fry trawl and Bongo net are presented in Figs. 1 and 2. The total area occupied with the scattered concentrations (catch below 1050 spec. per a mile) made up 42.7 and that with the dense one - 5.1 thou.sq.miles. Substituting these values into the formula for the estimation of the abundance index (T) we obtain:

$$T = A_s + KA_d = 42.7 + 10 \times 5.1 = 93.7$$

Thus, the abundance index obtained enables the 1987 year class to be preliminarily referred to the mean abundant ones as it highly exceeds the index of the poor 1984 and 1986 year classes (the 1985 survey was not conducted due to the technical reasons) but about 3 times lower than the rich 1983 year class (Table). The mentioned methods for the estimation of the abundance index is not the optimal and later on, while accumu-

lating the data and elucidating the qualitative relationship between the catches of larvae and their subsequent abundance at different ages, will allow to find the more objective methods for the year class strength estimation.

The using of the high-speed planktonsampler BONGO permits the absolute abundance of larvae to be obtained in the area surveyed, as it indicates the volume of the filtered water. According to the estimated data the total abundance of larvae over the area surveyed made up 6.4×10^{II} spec. A number of larvae per I m^2 of the area varied from 0.40 to 31.8 spec., with the mean density of 3.52 spec./m^2.

However, attention is drawn to the fact that the total catch of larvae using the Bongo net was negligible and constituted in total 271 spec., whereas the maximum catches from the fry trawls made up some tens thousands of specimens.

Besides, an essential difference in the length composition of larvae from the Bongo net and fry trawl catches were observed. The length of larvae from the fry trawl varied from 20 to 74 mm, with the larvae 45–49 mm long predominant in the catches. The length composition of larvae obtained from the Bongo net catches varied from 20 to 64 mm and the larvae 30–34 mm long were predominant(Fig.3).

The main reason of the difference in the length compositions of larvae sampled by these fishing gears consists in above all in "escaping" of large larvae from the Bongo net and also in the selectivity of fry trawl which screens the smallest larvae. The latter is confirmed by the occurrence of larvae in the Bongo net catches taken in the central part of Div. 3L where the hauls made by the fry trawl occurred to be without catches (Fig.1). Temperature conditions of the surface and near-surface layers during the trawl larval survey are presented in Figs. 4 and 5.

The main larval concentrations were observed in the mixed waters of the banks in the central and southeast areas of the Grand Newfoundland Bank with the temperatures from 0.5 to 6.0°C.

In addition to the larvae capelin at age I+ from the 1986 year class were found in the catches from the fry trawl. Their length varied from 70 to 124 mm (Fig. 2). The specimens mainly occurred in the northwestern areas of the Grand Newfoundland Bank under the lower water temperatures compared to the larvae.

Thus, the results from the capelin larval survey indicated the 1987 year class to be referred to those with the higher strength from which, while growing and maturing in the nearest years, an essential recruitment to the commercial stock should be expected.

The experimental researches made for the comparative estimation of catches by the fry trawl and Bongo net elucidated the essential peculiarities of the fishing gears - the selectivity of the fry trawl relative to the smallest larvae and low catchability of the large ones by the Bongo net. One of the main problems of the following surveys is to find the most optimal fishing gears for the estimation of the year class strength for capelin at the stage of fingerlings or to improve the existing ones.

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Table. Estimation of the index for the capelin larval abundance for 1983-1984 and 1986-1987

Period of survey	Nos.of stations	Area (thou.sq.miles) occupied with catches spec./mile of trawling		Index of abundance	Index relative to 1983
		below1050 spec.	over 1050 spec.		
06.II-20.II.83	48	38,2	2I,6	254,2	I,00
II.I2.84 - I4.0I.85	38	36,3	3,3	66,5	0,26
30.II-I2.I2.86	33	20,I	2,5	45,I	0,I8
I9.II-07.I2.87	59	42,7	5,I	93,7	0,37

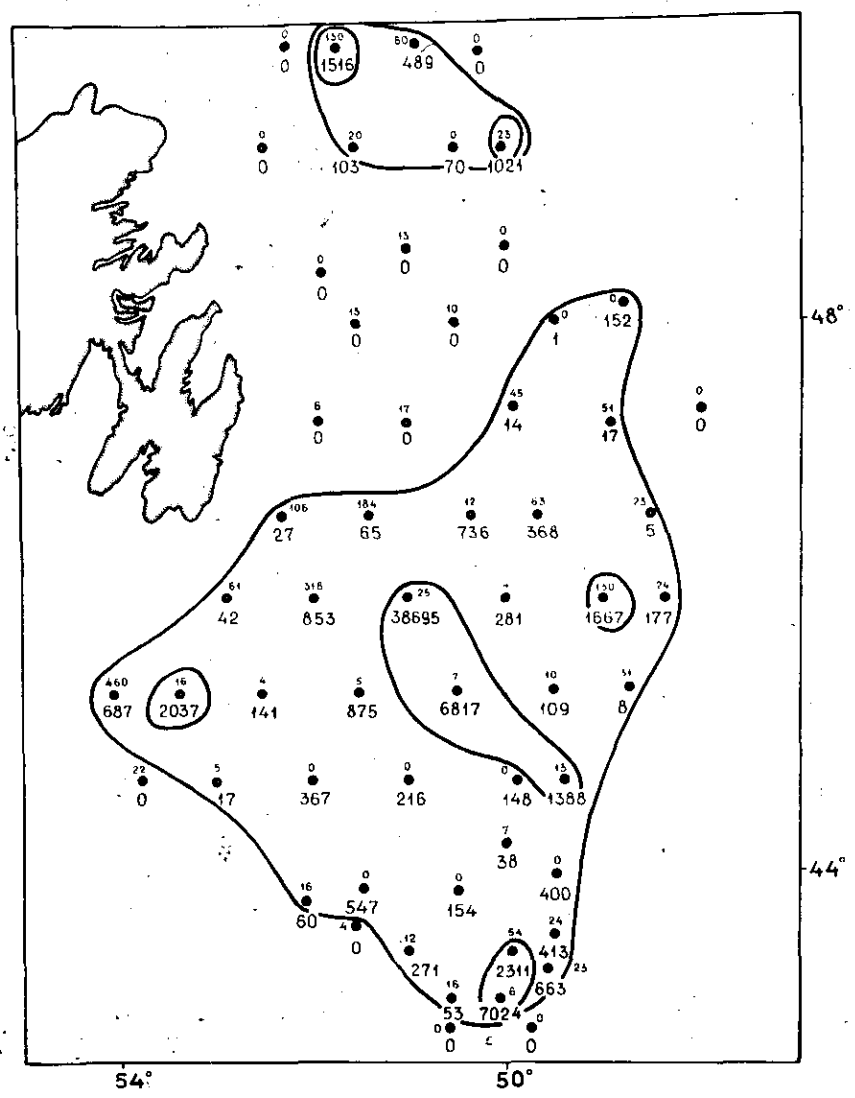

Fig.1. Position of the ichthyoplankton stations. Figure over a station is a number of larvae per I m^2 from the Bongo net;
Figure under a station is a number of larvae per 1 mile of trawling from the fry trawl catches .

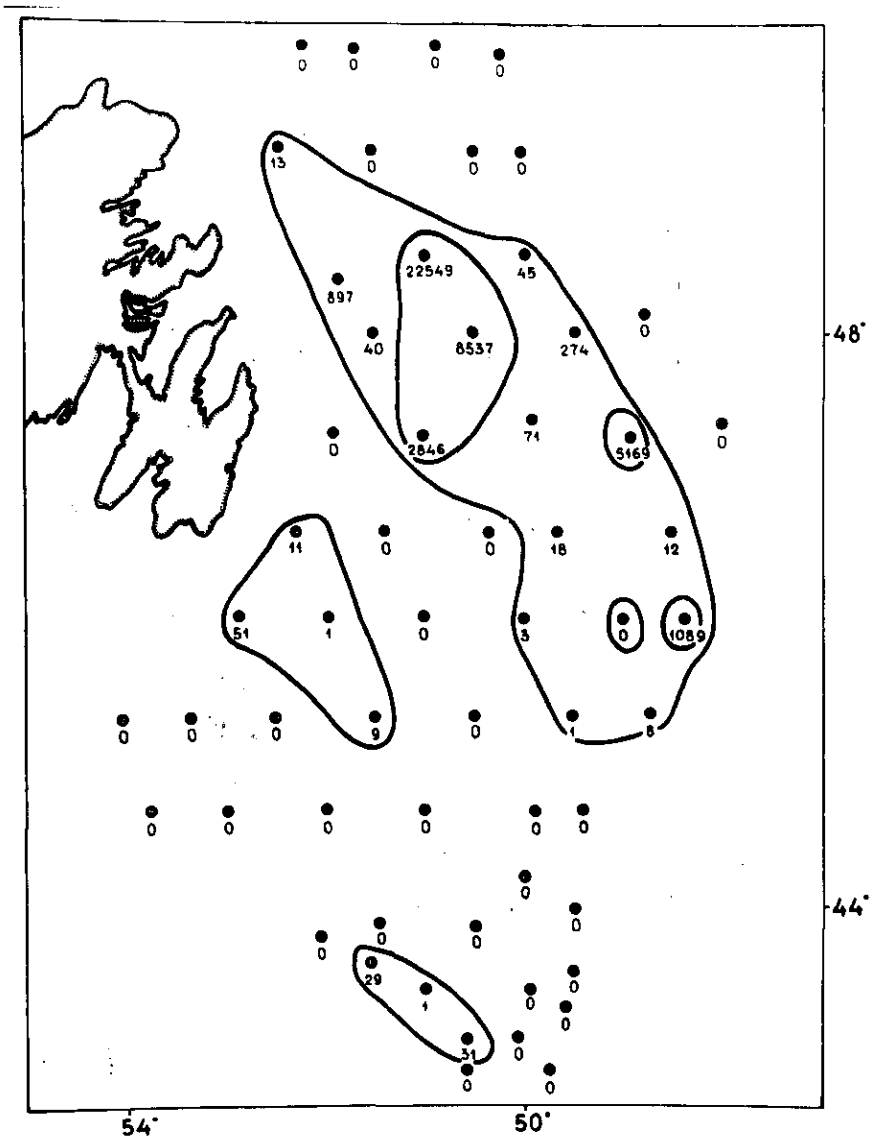

Fig. 2. Position of the stations and catches of capelin at age I+ estimated per trawling mile.

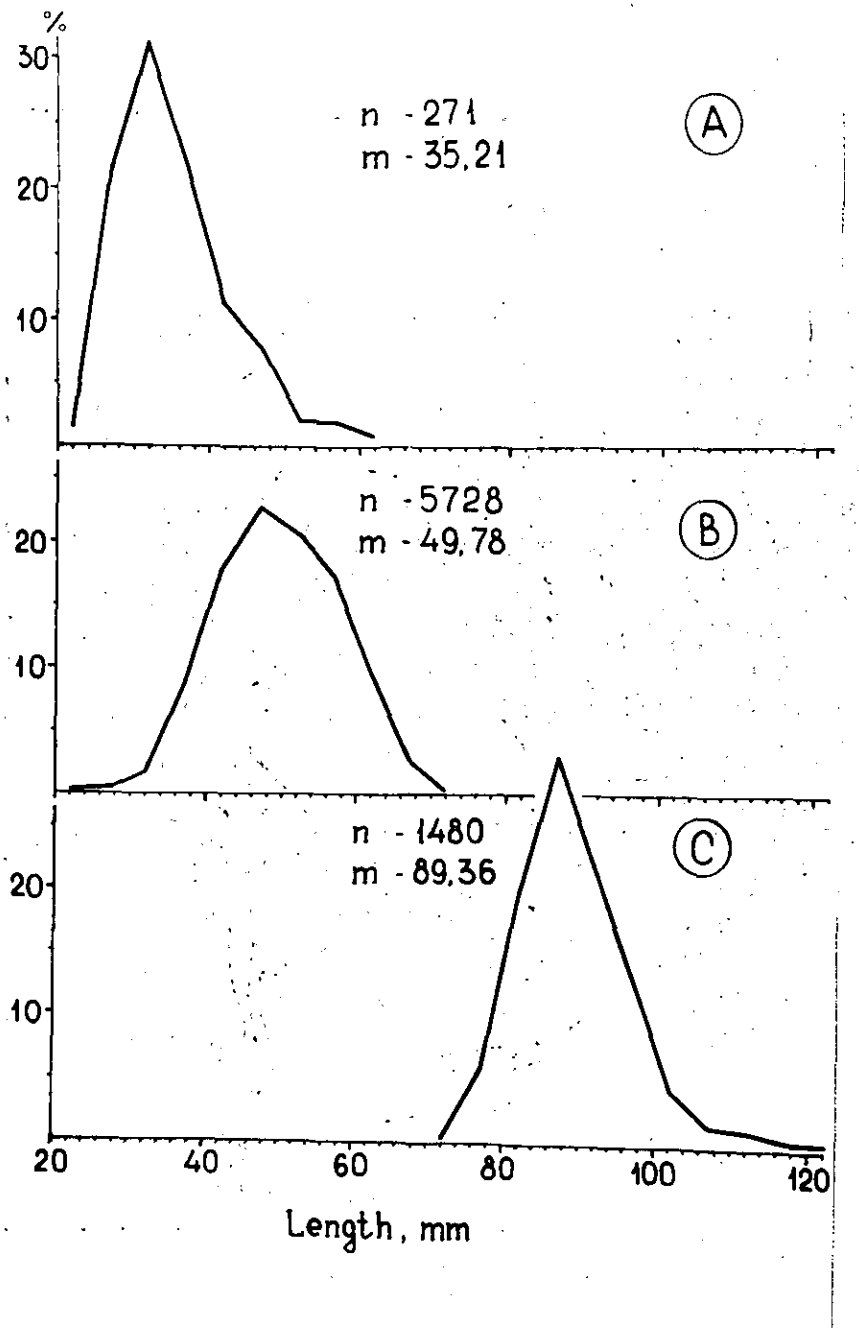

Fig.3. Length composition of larvae and capelin at age I+
A - larvae from the Bongo net;
B - larvae from the fry trawl;
C - capelin at age I+ from the fry trawl.

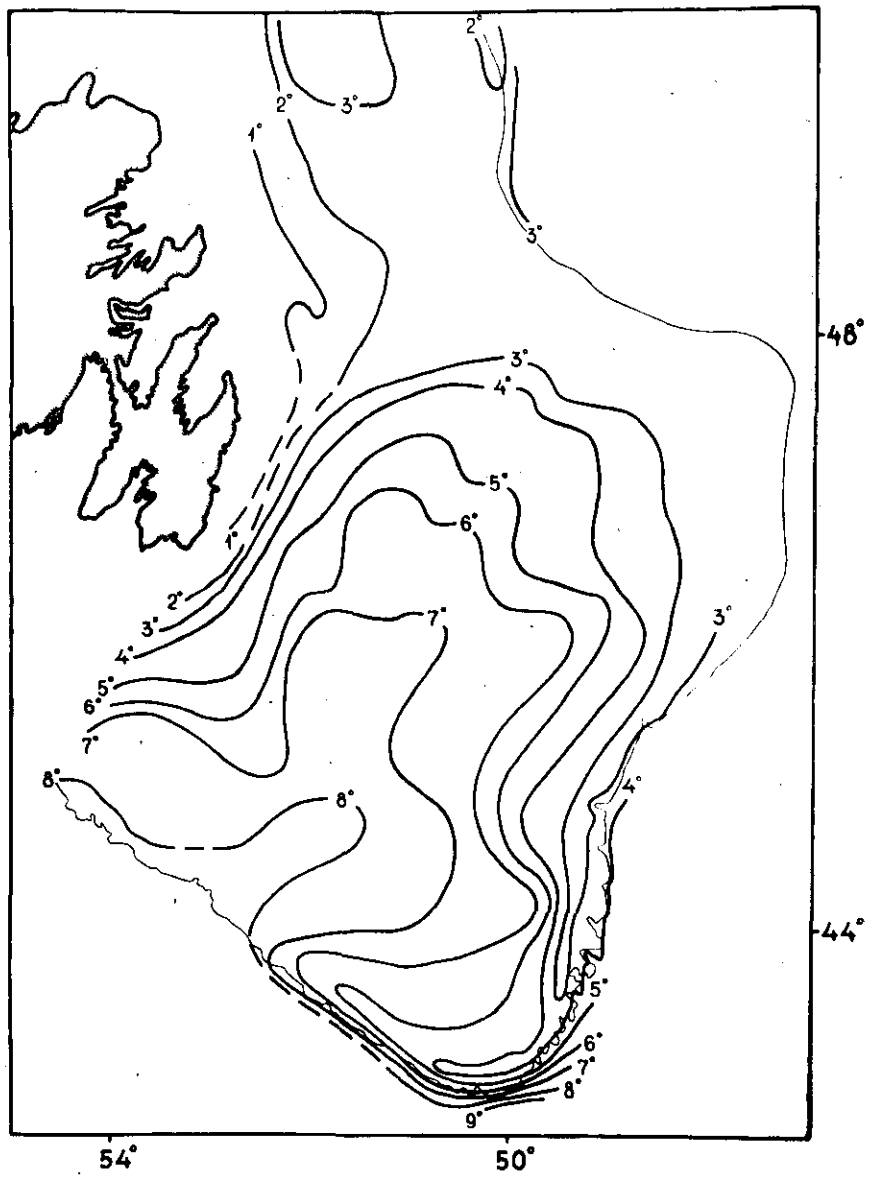

Fig.4. Water temperature of the surface layer.

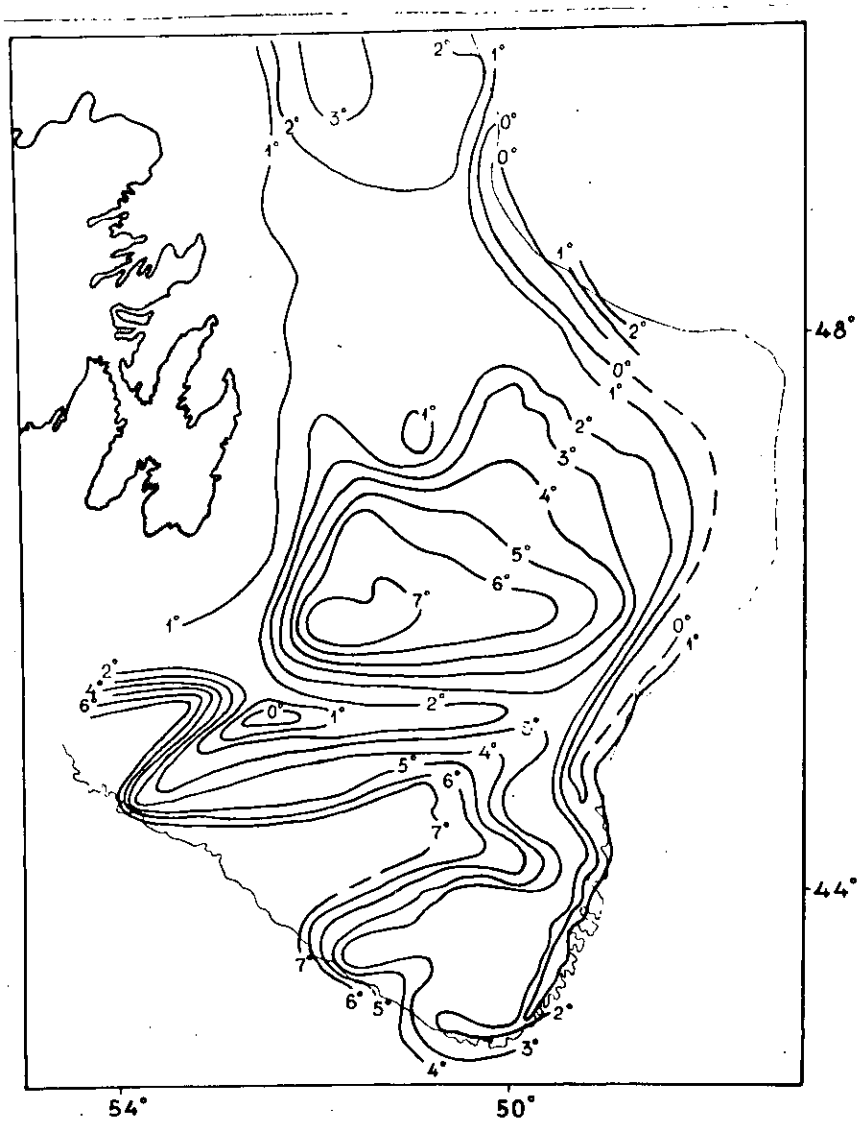

Fig.5. Water temperature in the 50 m layer.