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Assessment of abundance and biomass of the spawning stock of
capelin in ICNAF Division 3N in summer of 1977

by

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Abstract

This paper contains the data on the determination of abundance and biomass of capelin spawning on the south-eastern slope of the Great Newfoundland Bank (Division 3N). In June 1977 the abundance of capelin on the spawning ground proved to be equal to $38614 \cdot 10^6$ and biomass was 1.00 million tons. Besides, the data on age composition and maturity of capelin in Divisions 3L and 3N are given.

Introduction

Since 1975 the annual assessments of abundance and biomass of capelin on the spawning grounds of the south-eastern slope of the Grand Bank are being conducted. From 17 June to 6 July 1977 the estimate of abundance and biomass of capelin in Division 3N was carried out by FRV "Perseus III".

3-4-year olds of the 1973-1974 year classes (95%) predominated on the spawning grounds of this area as in recent years (Seliverstov, Kovalev, 1976), (Fig.1).

Material and methods

As a basis for assessment of abundance and biomass of the spawning fish there was used the method applied for these purposes in the previous years in Divisions 2J and 3K (Bakanov, Seliverstov, Serebrov, 1976; Klochkov, Seliverstov, Serebrov, 1977). Specific volume of capelin shoals per 1 sq. mile was determined by this method.

Investigations by stereophotogrammetric equipment and underwater

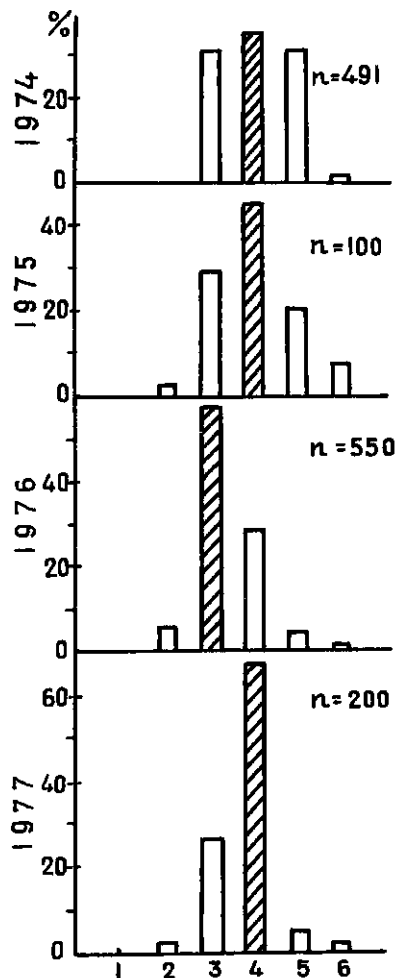


Fig.1 Age composition of capelin in the area of the spawning grounds (3N).

visual observations conducted earlier showed that there was the relationship between the average density of a school and length of fish (Serebrov, 1976):

$$\rho = \frac{1}{(\kappa \ell)^3} \quad (1)$$

where: ρ - density of the school,

ℓ - mean length of fish, equal in a given case to 0.163 m,

κ - coefficient, equal for capelin to 2.72.

$$\text{Therefore: } \rho = \frac{1}{(2.72 \cdot 0.163)^3} = 11.8 \text{ spec/m}^3 \quad (2)$$

In previous papers on estimation of abundance and biomass of capelin it has been shown that the average density of capelin shoals ^{the} in day time exceeds 3-4 times the average density at night (Klochkov,

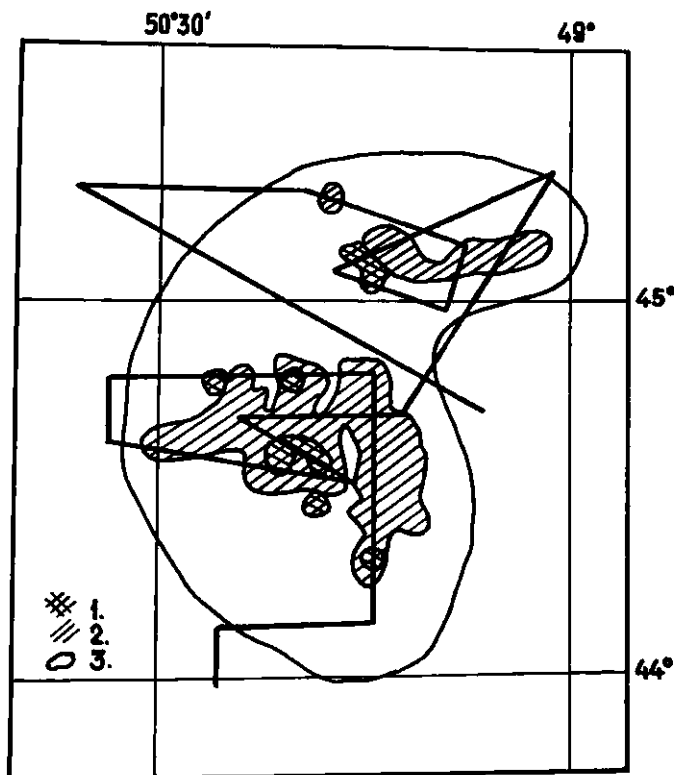


Fig.2 The route of the research vessel. 1,2,3 - zones of different specific abundance of capelin.

Seliverstov, Serebrov, 1977). The capelin investigations in the Barents Sea confirm this conclusion. Thus, density of capelin shoals at night is assumed by us to be equal approximately to 3.4 spec/m^3 . The specific abundance of capelin in specimens per 1 sq.mile was determined with the help of data on density of shoals in the day time and at night. After having plotted these data on the chart of the survey route, 3 zones with the following intervals of specific abundance were singled out (Fig.2):

1. $> 100 \cdot 10^6 \text{ spec/mile}^2$
2. $10-100 \cdot 10^6 \text{ spec/mile}^2$
3. $1-9.9 \cdot 10^6 \text{ spec/mile}^2$

Then the average specific abundances in each zone, the area of these zones, abundance and biomass of capelin by zones were calculated (Table 1).

Table 1. Abundance and biomass of capelin

Divisions	Intervals of spec. abundance spec/mile ² ·10 ⁶	Average spec. abundan- spec/mi- le·10 ⁶	Area of the di- vision miles ²	Abundance of capelin by divisions spec·10 ⁶	Biomass of capelin in tons
I	> 100	150.6	66.5	10014.9	260387
II	10 - 100	31.1	508.7	15820.6	411365
III	1 - 9.9	5.2	2457.5	12779.0	332254
Total		62.3	3032.7	38614.5	1003976

Discussion

In 1977 the behaviour of capelin in the spring-summer period differed from that of the previous years. Till late May the fish concentrations kept close to the east of Avalon (3L) intensively feeding with Euphausiids and Galanus. The number of specimens at the maturity stage IV of the sexual products, which stayed in this area in May, was much greater compared to that of 1976 (Fig.3). In 1977 the first concentrations of capelin on the spawning grounds (3N) were registered on June 10. Contrary to 1976, when the spawning start was observed on June 20, fish with the running sexual products were taken in the first catches in 1977. The spawning in 1977 can be characterized as a short one, but intensive because already in early July there was practically no fish on the spawning ground though usually the spawning continues till August (Templeman, 1948). The explanation of the situation should apparently be sought in hydrological conditions observed in the spawning area in June 1977.

The water temperature near the bottom on the capelin spawning grounds in 1971-1972 was equal from 2.8 to 3.4°, in 1973 it was equal from 1 to 1.7° and in 1974-1976 it was equal approximately to 2-3° (Borovkov, Kovalev, 1976). In 1977 an increased heat content of the near-bottom waters in the capelin spawning area was observed: on June 17-19 the near-bottom temperature was registered to be 4.3° and on June 25-29 - to 4.2°. All that caused the reduction of spawning period of capelin as a cold-loving fish.

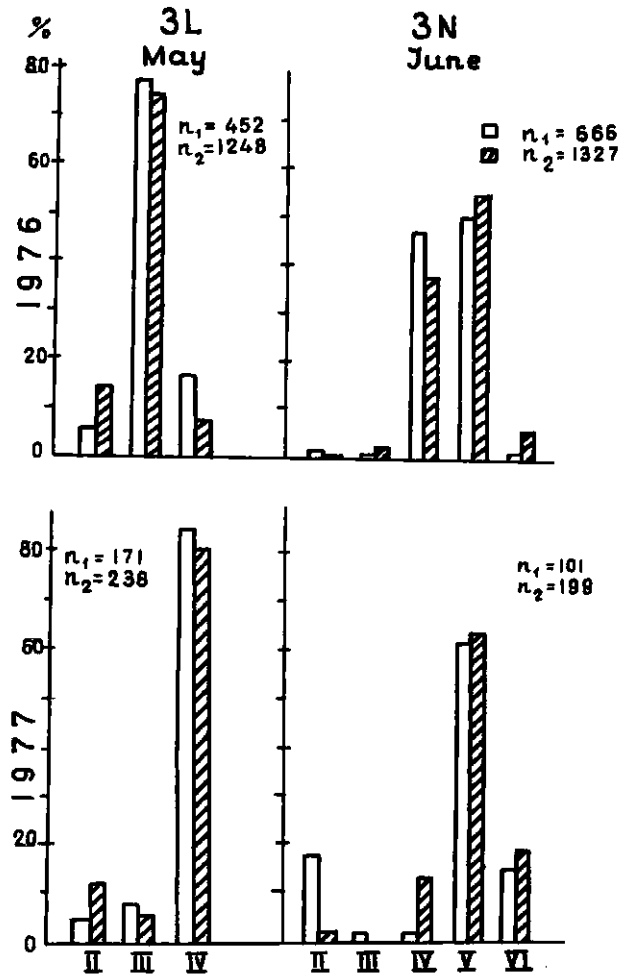


Fig.3 The maturity of capelin, Divisions 3L and 3N.

The length frequency of capelin on the spawning ground is from 12 to 21 cm; mean length of males is 17.10 cm and that of females is 15.54 cm. Mean weight of capelin is 26.0 g.

The spawning stock consisted mainly of fish of the abundant 1973 year class (68%) and the recruits at the age of 3 years of the 1974 year class (26%), (Fig.1). In connection with the reduction of the spawning period the stocks assessment carried out in June 1977 provides the amount of the main part of the spawning stock and confirms at present the good condition of the stocks (Seliverstov, Kovalev, 1976; Kovalev, Seliverstov, Zaferman, 1977), (Table 2).

Table 2. Amount of the capelin spawning stock on the south-eastern slope of the Grand Bank (3N), by years

Years	Abundance (spes)	Biomass (mln.t.)
1975	29829.2 · 10 ⁶	1.05
1976	35561.8 · 10 ⁶	0.685
1977	38614.5 · 10 ⁶	1.00

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