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Water Temperature and Strength of Cod Year-classes on the Flemish Cap

by

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Abstract

The connection between water temperature on standard hydrological section 4-A and strength of cod year classes on the Flemish Cap Bank is considered. The equations giving approximate predictions of year classes' strength for future are suggested.

Results and Discussion

As was said in author's previous papers (Konstantinov, 1975, 1977) there exists a natural connection between water temperature and strength of cod year classes on the Flemish Cap Bank. Hereafter, an attempt is undertaken to specify this connection, using 1968 - 1977 data on year classes.

As an indicator of the waters heating regime in the area under discussion we take spring water temperature at 0 - 200 m layer on standard hydrological section 4-A (between 45°57'N, 48°30'W and 45°20'N, 47°22'W), see Table I. We determine the strength of cod year classes by the results of their fry cosurvey. These data are available from annually printed reports on USSR investigations within ICNAF area - for example in recent report (Konstantinov and Noskov, 1979). The abundance of yearlings and two -year-olds is the most representative, three-year-olds being partly withdrawn by the fishery sometimes.

Table 2 gives mean catches of yearlings and two-year-olds per one fish-counting trawling (the duration of each trawling - 1 hour) The connection between water temperature and year class strength of cod is shown in Fig.1.It is expressed in the following way:

$$y = 144,8 - 56,6x \qquad (I)$$

$$y = 170,0 - 132,9x + 24,5x^2 \qquad (2)$$

where x - water temperature on standard hydrological section 4-A,

y - an index of year class strength,that is,arithmetical mean of average number of yearlings and two-year-olds per one fish-counting trawling (from fry survey).

Points in Fig.1 are dispersed,therefore discovered connection can not be used yet to give reliable quantitative estimate of future year classes although the connection expressed by equation (1) has considerably high correlation coefficient (-0,71).Only approximate estimate is possible.

No wonder that it is the decrease (not increase) in water temperature that favours abundant year classes. The Flemish Cap Bank is located in a southern part of cod range of distribution. The decreased (as compared to mean long-term norm) water temperature creates conditions in a southern part of a range of distribution which are close to optimum ones (i.e. to those typical of a central part of a range).

It was found in North-Eastern Atlantic that the decrease in water temperature favours the production of abundant year classes and the increase in stock in the southern part of cod range of distribution.Thus,during recent decades a tendency was observed in the North Sea towards water masses cooling with parallel growth of biomass and abundance of cod (and other boreal fishes) (Dickson,Pope and Holden,1974;Daan,1975; Southward,Butler, Pennycuik,1975;Hempel,1978). On the contrary,the water masses cooling in the north of distribution area of cod accounts for

the poor year classes.

On the basis of equation (I) we can obtain an approximate abundance estimation of those cod year classes on Flemish Cap Bank which had not yet been estimated by a fry survey. Apparently, a year 1978 gave a poor year class whereas the 1979 brought a year class whose abundance exceeded over a mean long-term level. This fact can be proved only when the 1980 summer fry survey of cod is carried out.

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Table 1. Water temperature on hydrological section 4-A.

Year	Hydrological vessel	Date	Water temperature in the 0–200 m layer, °C
I968	"Rossiya"	I6 May	2.04
I969	"Rossiya"	I5 May	3.93
I970	"Protsion"	22 May	2.40
I97I	"Protsion"	I8 May	I.92
I972	"Protsion"	I9 May	I.37
I973	"Protsion"	I9 May	-0.80
I974	"Gemma"	22 May	0.6I
I975	"Evergreen"	3I May	I.6I
I976	"Persey-III"	II May	0.68
I977	"Persey-III"	23 May	I.40
I978	"Protsion"	I2 May	3.40
I979	"Gemma"	27 April	I.73
Long-term mean			I.82

Table 2. Cod year-classes strength, by the results of survey of the young on Flemish Cap in 1969-1979.

Year class	Mean number of specimens per hour trawling		
	Yearlings	Two-year-olds	n
I968	I0	I06	58
I969	0	2	I
I970	0	I	0,5
I97I	22	87	54,5
I972	3	29	I6
I973	303	350	326,5
I974	I33	50	9I,5
I975	5	I7	II
I976	0	2	I
I977	8	5I	29,5
I978	3	-	-
Mean for I968-I977	48,4	69,5	58,9

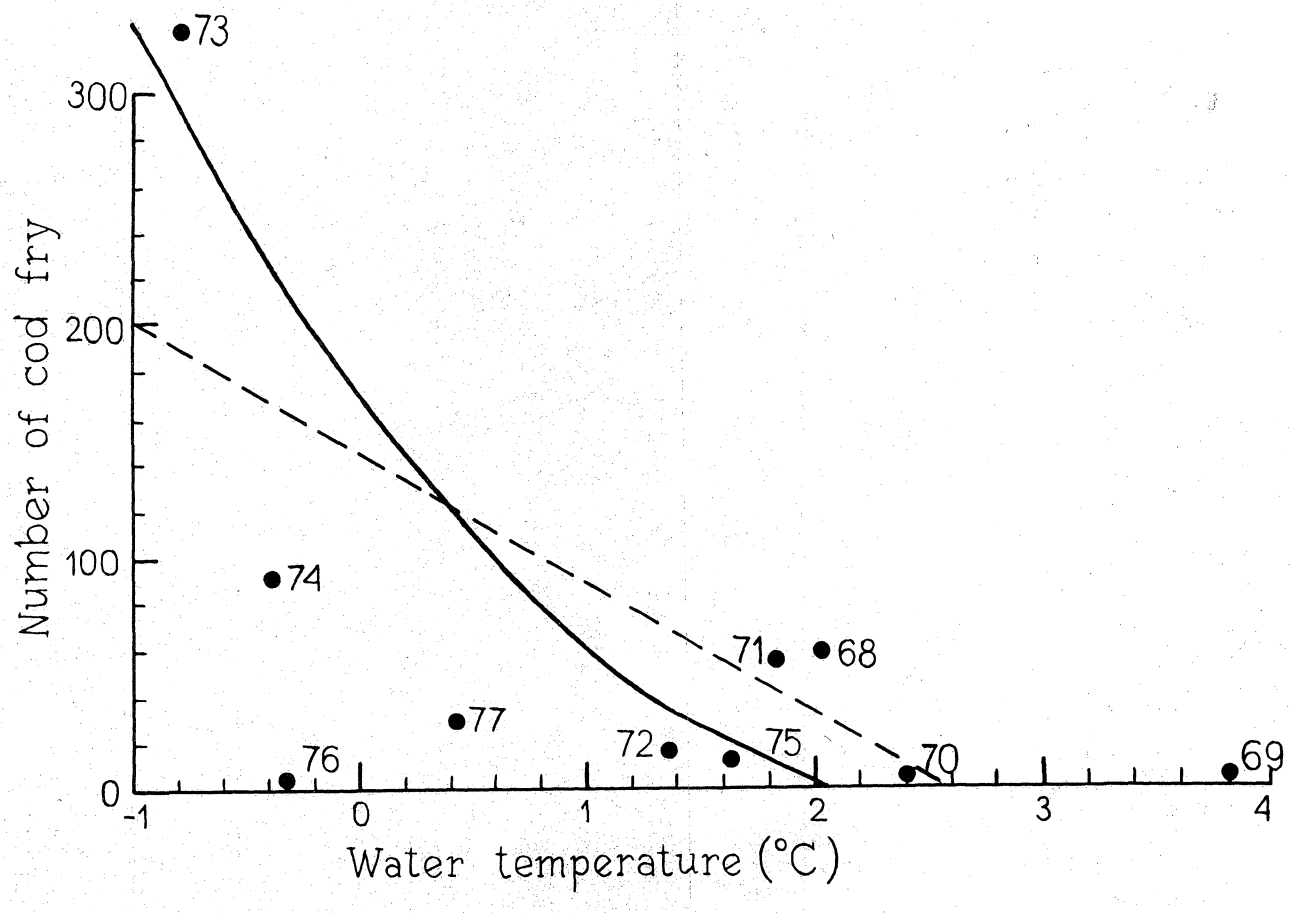

Fig. 1. Water temperature in the 0-200 m layer and on hydrological section 4-A and an indicator of the cod year-classes strength on the Flemish Cap Bank (an arithmetical mean of an average number of yearlings and two-year-olds per one fish counting trawling) in 1968-1977.