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The Fecundity of Georges Bank Herring

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This report presents the results of investigation on the fecundity of herring, which spawn in September - October on Georges Bank. It adds further observations to the studies by Yudenov (1966) and Perkins and Anthony (1969). The problem dealt with may be of great importance for the determination of the relation between spawning potential and the recruitment from a given stock.

Material and method

The sampling for this report was made in August 1968 in the central part of Georges Bank. The fish were derived from bottom-trawl catches. The length distribution of female herring in the samples was similar to the length distribution of fish in the catches. Length and age of all fish in the samples were determined. During the sampling period the female gonads were in the stage of maturity IV - V. The ovaries after being removed and marked were kept in the frozen state. In the laboratory they were defrosted and placed in Gilson's fluid. A few weeks later they were chopped into small bits. The eggs were separated from ovarian tissue and washed several times, then dried on filter paper at room temperature. Each dry sample, taken at random, was weighed and the number of eggs in it was determined. Having the number of eggs per unit weight it was possible to establish the number of eggs in the whole ovary. In this way the fecundity of 167 herring specimens was determined. The length of these fish ranged from 26.0 to 35.5 cm and the age between 3 and 11 years. Detailed data is given in Table 1.

Table 1. Number of examined fish, including length and age

Year-Class	Length in half centimetres																				Total
	26		27		28		29		30		31		32		33		34		35		
1965	1	-	-	-	1																2
1964			2	-	3	2	3														10
1963					2	3	5	6	4	3	3	1									27
1962					1	-	-	-	-	2	8	3									14
1961									2	-	7	3	6	6	3						27
1960											1	3	15	21	10	6	2				58
1959														5	5	-	1	3			14
1958																	1	3	-	1	5
1957																		2			2
Age not determined								1	-	-	-	-	1	1	-	2	1	1	-	1	8
Total	1	-	2	-	7	5	8	7	6	5	19	10	22	33	18	8	5	9	-	2	167

Results

The fecundity of each of the examined females was determined on the basis of three samples. The differences between the extreme values for the number of eggs, established in this way, did not exceed 5%. The individual fecundity varied between 21 and [illegible] thousand eggs. The fecundity of fish was related to their length and age. The increase of gonads in herring in August caused fast changes in

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... the weight of individual fish during sampling and therefore the relationship between the weight and the fecundity at that period could not give reliable data.

The data on the relation between length of fish and the number of eggs are given in Fig. 1. We note here considerable differences in the number of eggs in fish of the same size. The standard deviation from the mean number of eggs in fish, divided into 1 cm length-groups, ranges from 20 to 29 thousand.

For the equation

$$F = nL^{a} \quad \text{(Baxter, 1959)}$$

where

F - the fecundity
L - the length of herring
n and a - constants for a given population,

... the relationship between fecundity and fish length, the following ... have been found for Georges Bank herring: $n = 5.76$ and $a = 0.0001749$. These were derived from the results of investigation and calculated by the method of least squares.

It is more convenient, however, to use for calculations the logarithmic equation:

$$\log F = 4.2426 + 5.76 \log L$$

The mean fecundity of herring determined on the basis of this equation for the length-classes from 26 to 35.5 cm is given in Table 2.

Table 2 Mean number of eggs in the ovaries

Length of herring (cm)	Mean number of eggs
26.0	24,700
26.5	27,000
27.0	30,700
27.5	33,500
28.0	37,900
28.5	41,900
29.0	46,600
29.5	51,100
30.0	56,300
30.5	62,000
31.0	62,100
31.5	74,600
32.0	81,600
32.5	89,400
33.0	97,600
33.5	106,300
34.0	115,900
34.5	126,000
35.0	137,000
35.5	148,000

These results are lower than analogical ones obtained by Perkins and Anthony (1969). On the other hand the data obtained by these authors are in turn by similar magnitude lower than the results obtained by Yudanov (1966). The mean indices obtained for the fecundity of Georges Bank herring are slightly higher than analogical ones obtained by Sosinski (1970) for herring from the Norwegian Channel, spawning in the winter-spring period.

The variation in the mean number of eggs in the ovaries related to age is given in Table 3. There is only one deviation from the distinct regularity of increase of mean fecundity along with age, namely the phenomenon observed in the 1960 year-class in which the fecundity was lower while it was higher in the younger 1961 year-class. The 1960 year-class was the most abundant in the sample. Introducing the division into classes of 5,000 eggs this age-group was distributed in each one as shown in Fig.2.

Table 3 Mean number of eggs in herring in particular age groups

Age- group	III	IV	V	VI	VII	VIII	IX	X	XI
Mean number of eggs	26.3	42.2	58.5	69.7	96.7	90.4	97.7	98.5	109.3

This distribution shows all the features of a regular distribution with a large range of variations. Such distribution for other age groups is less regular in view of a small number of fish.

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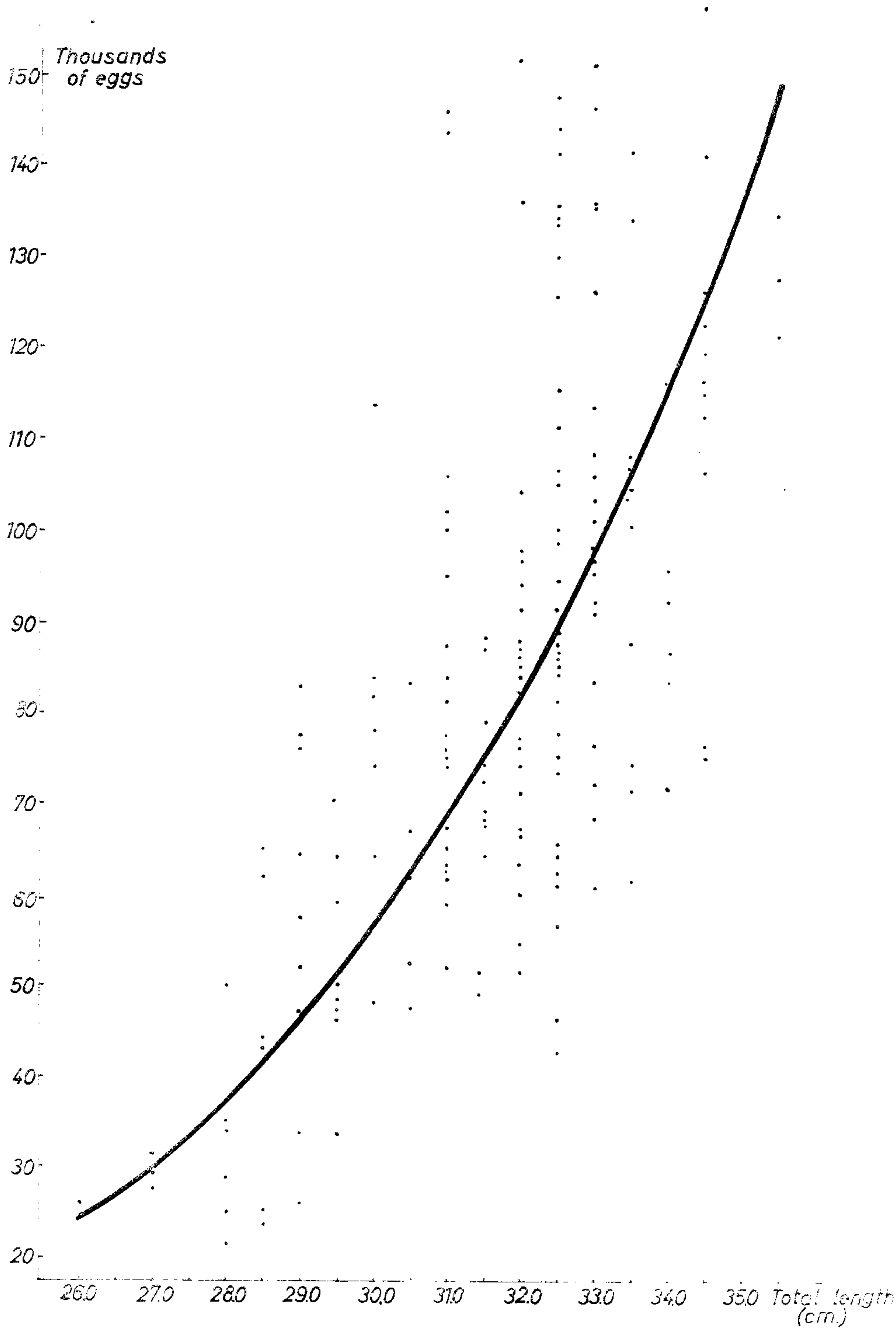

Fig. 1. The relationship between the number of eggs and the length of herring.

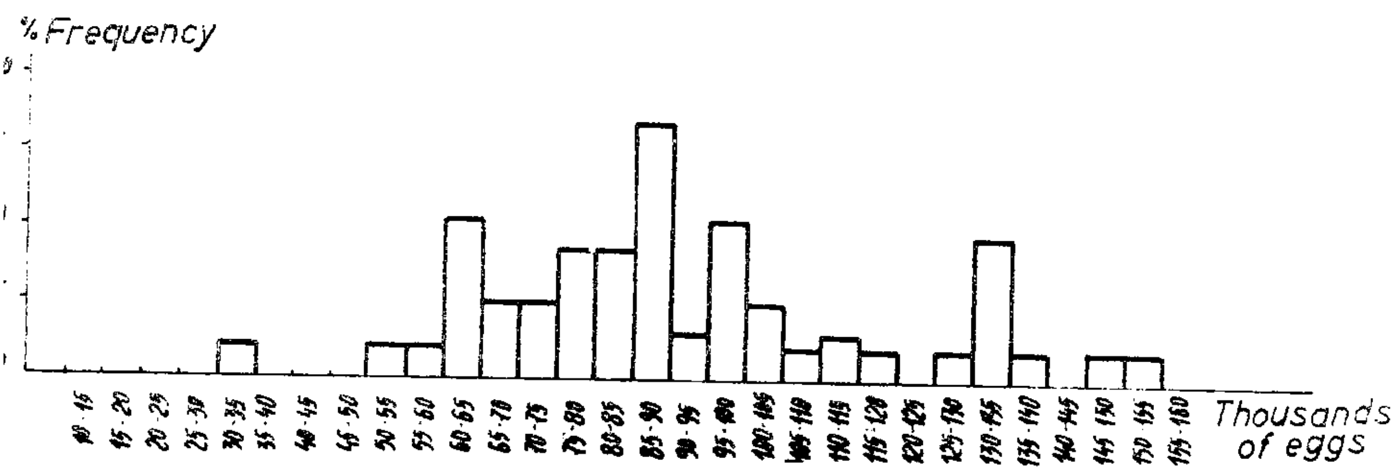

Fig. 2. The percentage of 8 year old herring with varying numbers of eggs.