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Fecundity of Silver Hake on the Scotian Shelf

by

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Introduction

The silver hake (*Merluccius bilinearis*) is among the most important species of the bottom fauna on the Scotian Shelf (ICNAF Div. 4VWX). It has been continuously studied since 1962, when the trawl fishery began. Much research effort has been devoted to studies on the distribution of eggs, larvae, and adults, and on the spawning season, fishery, etc. (Dannevig, 1919; Kuntz and Radcliffe, 1915; Bigelow and Schroeder, 1953; Serebryakov, 1962; Domanevsky and Nozdrin, 1963; Sauskan, 1965; and Sarnits and Sauskan, 1966), but only Sauskan and Serebryakov (1968) have provided some data on the fecundity of this species.

Knowledge of fecundity is very important from a practical viewpoint, since the highest catches are recorded in months preceding and during the spawning season, and such information can be included in mathematical models for stock assessments. This paper, therefore, provides additional information on the fecundity of silver hake on the Scotian Shelf.

Materials and Methods

The female gonads were collected from the Scotian Shelf, on board the R/V *Isla de la Juventud*, during July and August 1977. After the length and weight measurements of the specimens were recorded, the ovaries were extracted, weighed and slit longitudinally from one end to the other on the side opposite to that containing the large blood vessels, where the ovarian membrane is free from the germinal tissue of the follicles. The ovaries were then submerged in Gilson's fluid, as modified by Simpson (1951), and the jars were vigorously shaken 24 and 48 hours after putting the ovaries in them to facilitate the action of the fluid in breaking down the ovarian tissue (Alvarez-Lajonchere, personal communication).

When the eggs appeared to be totally separated, the contents of the jar were strained through 1.0 and 0.1 mm mesh bolting cloth. Washing with a jet of fresh water eliminated the residue of ovarian tissue from the meshes leaving the eggs completely clean. The eggs were then placed on filter paper in a funnel to drain. After filtering, the eggs from the different ovaries were placed in separate trays to dry. About three hours later, the eggs were moved around with the fingertips to avoid the formation of lumps when dry.

When dry, the total number of eggs from each ovary were weighed on a torsion balance (Torbal model) with a precision of 0.01 g and kept in a Petri dish in a dry place until processed. Five subsamples with replacement were taken from each sample. A fixed weight of 3 mg was used for each subsample. Before beginning the experiment, replicate counts of 40 subsamples from the same ovary were made by two persons and the results were compared statistically.

The number of eggs in each ovary was calculated by the equation

$$F = \frac{nW}{w}$$

where F = fecundity of the fish,
n = mean number of eggs counted,
W = weight of the sample,
and w = weight of the subsample.

In order to determine the accuracy of the method, 15 subsamples, with replacement, were taken, given a coefficient of variation of 7.0%. Comparing this figure with 10.5% obtained in fecundity studies by Bagenal (1957), 9.5% by Simpson (1951), and 6.8% by Alvarez-Lajonchere (1976), the precision of the method can be considered adequate, despite the use of the gravimetric method.

Results and Discussion

The spawning period for silver hake on the Scotian Shelf may extend from July to October. Sauskan and Serebryakov (1968) noted intense spawning during August and September (1962-65) over Sable Island Bank. During the cruise in July-August 1977, a high proportion of spent females were found to the south of Sable Island. However, to the west of this area on the Scotian Shelf, the majority of the females caught were in a ripe pre-spawning condition.

When the replicate counts of the two persons were compared, there was no significant difference ($t = 0.18$, $P = 0.05$). Thus, the work was speeded up considerably by having the egg counting carried out by the two persons.

The relationship between fecundity and total length, gonad weight, and total weight are shown in Fig. 1 to 3. The equations relating fecundity to total length, total weight and gonad weight with their correlation coefficients are given in Table 1.

In the t-tests performed to compare the correlation coefficients of the equations in Table 1, no significant difference was found for fecundity versus length and fecundity versus weight, but there was a significant difference for fecundity versus gonad weight, indicating that these data are best filled by a straight line.

The results presented in this paper indicate a lower fecundity than that found by Sauskan and Serebryakov (1968), but no further comparison with their data can be made because the equations relating fecundity and length were not given.

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Table 1. Relationships between fecundity and total length, total weight, and gonad weight for silver hake on the Scotian Shelf. (Equation numbers refer to curves in Fig. 1, 2, and 3. TL = total length; W = total weight; G = gonad weight.)

No.	Equation	Correlation coefficient (r)
1	$F = -578924.84 + 24190.74\ TL$	0.82
2	$F = 24148.3\ e^{0.06TL}$	0.84
3	$F = 15.82\ TL^{2.72}$	0.86
4	$F = -813416.14 + 30082.41\ TL$	0.89
5	$F = 31107.02\ e^{0.06TL}$	0.96
6	$F = 23.04\ TL^{2.61}$	0.97
7	$F = -851098.82 + 3174.76\ TL$	0.90
8	$F = 29481.03\ e^{0.06TL}$	0.98
9	$F = 23.02\ TL^{2.62}$	0.98
10	$F = 92087.05 + 560.10\ W$	0.81
11	$F = 146561.49\ e^{0.0015W}$	0.78
12	$F = 64275.18 + 548.86\ W$	0.78
13	$F = 199407.39\ e^{0.0010W}$	0.90
14	$F = 137051.05 + 25905.94\ G$	0.88
15	$F = 180735.87\ e^{0.06G}$	0.77

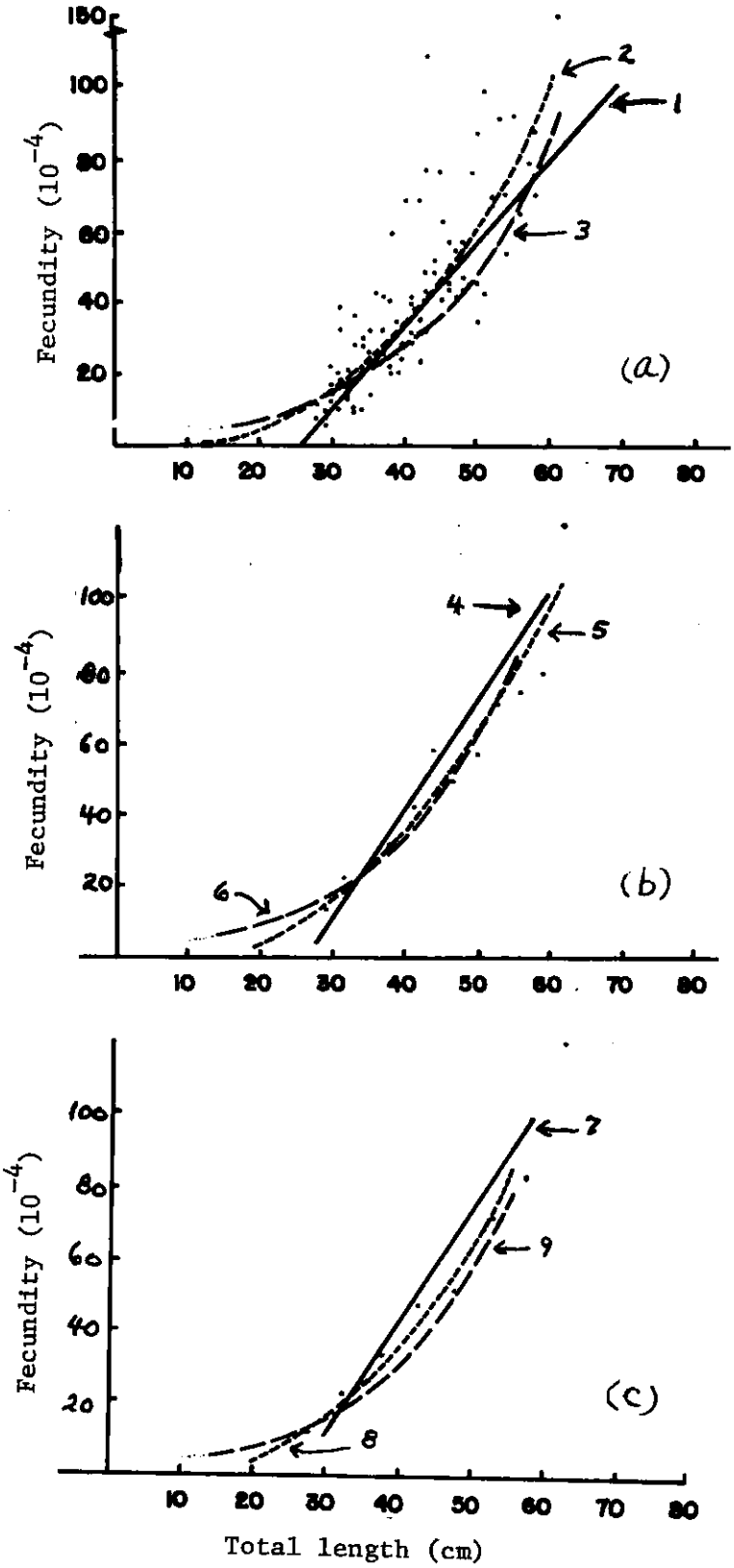

Fig. 1. Relationships between fecundity and total length for silver hake on the Scotian Shelf: (a) individual specimen lengths, (b) 3-cm length groups, and (c) 5-cm length groups. (Curves numbered 1 to 9 refer to equations listed in Table 1.)

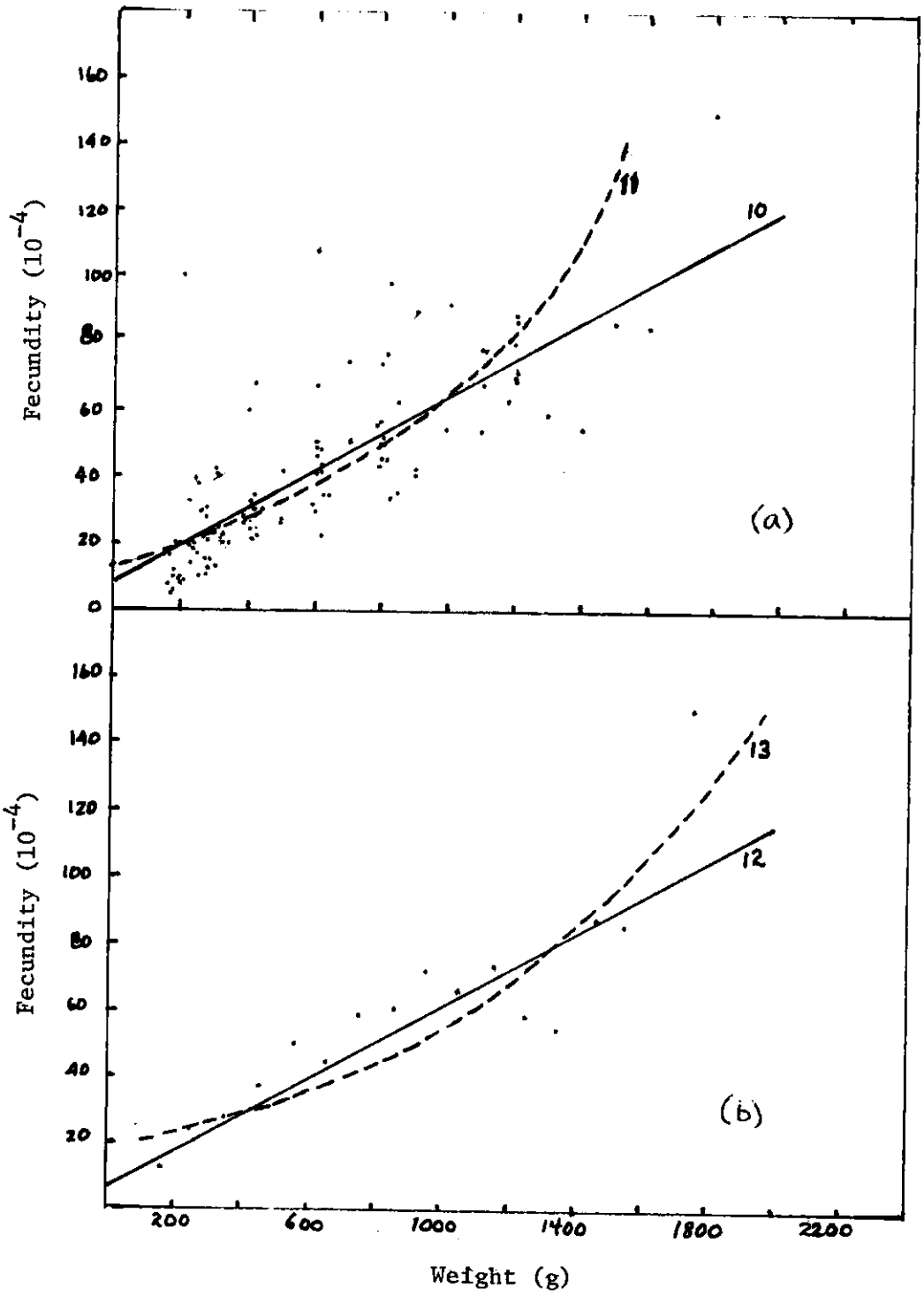

Fig. 2. Relationship between fecundity and total weight for silver hake on the Scotian Shelf: (a) individual specimen weights, and (b) 100-g intervals. (Curves numbered 10 to 13 refer to equations listed in Table 1.)

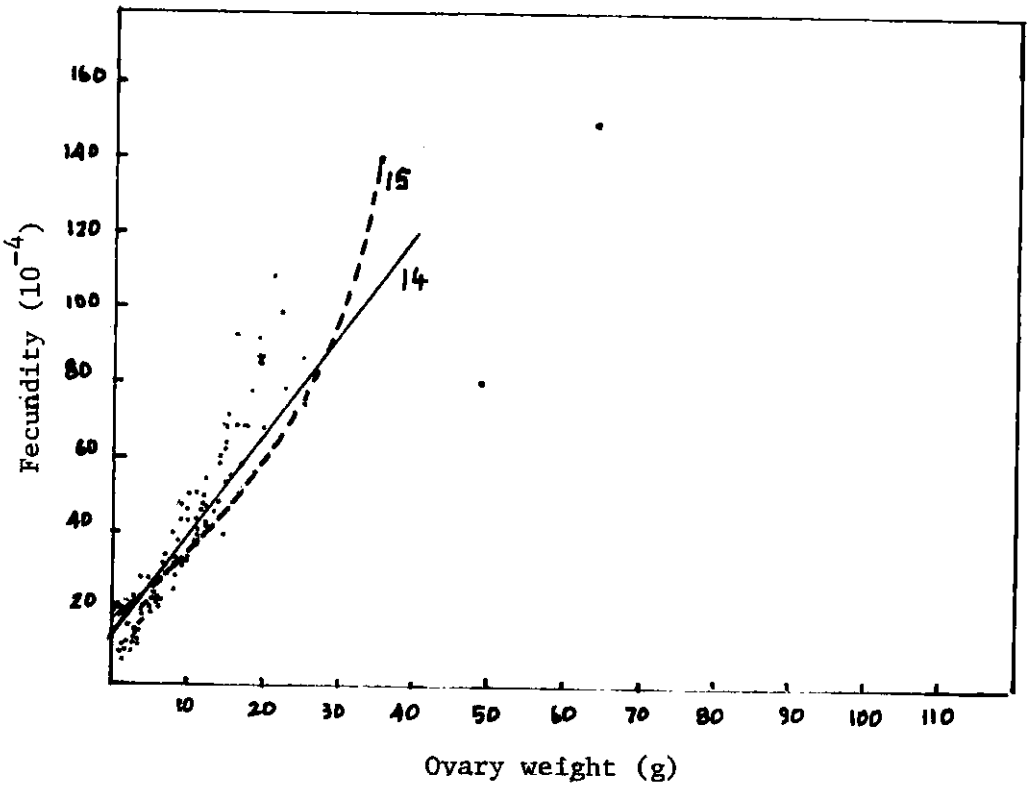

Fig. 3. Relationship between fecundity and ovary weight for silver hake on the Scotian Shlef. (Curves numbered 14 and 15 refer to equations listed in Table 1.)