

COMUNICACIONES

A mathematical expression for the estimation of relative fish fecundity using oocyte size

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Resumen: Mediante una reevaluación de la fecundidad de diversos peces africanos de aguas continentales, se examina la relación entre fecundidad relativa y diámetro medio de los oocitos. Se presenta una expresión matemática de la fuerte correlación existente entre ambos valores, como medio de predecir su fecundidad rápidamente.

Key words: fish fecundity, mathematical models, oocytes.

Fecundity in fish has been given various definitions by different authors (Lowe 1955, Welcomme 1967, De Silva 1973, Bagenal 1978). Considering the importance of information on fish fecundity in basic and applied fishery sciences, as discussed by Bagenal (1978) and Albaret (1982), fish-biologists have determined the fecundity of several species. This paper re-examines available data on the fecundity of African inland water fishes with a view to identifying a mathematical expression for quick estimation of their fecundity.

Relative fecundity is defined as the number of oocytes in a fish's ovary or ovaries per its unit fresh body weight on the assumption that the fish's absolute fecundity and body weight are linearly related (Bagenal 1978). The relative fecundity taken as the number of oocytes expressed per unit kilogram body weight of African inland waters' fishes varies from 53 in *Papycrocranus after* to about 700,000 in *Synodontis membranaceous* (Albaret 1979, 1982, Adebisi 1987). It is observed that there is a high degree of homogeneity in the relative fecundity, especially among the different species that make up each family.

Ordinary predictive regression analyses of the relationship between the relative fecundity

and oocyte size of several species in inland waters of Africa indicate that strong correlations exist between these two parameters (Fig. 1).

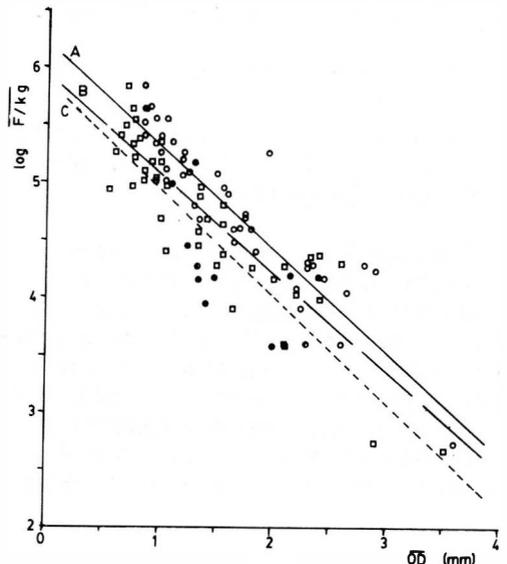


Fig. 1. Plots of relationships between mean oocyte diameter (\overline{OD}) and relative fecundity ($\overline{F/kg}$) for fishes of (A) rivers in the Ivory Coast - o, (B) Ogun River, Nigeria - • and (C) other inland waters of Africa. □

A. $\log \overline{F/kg} = -0.90 \overline{OD} + 6.22$ ($r = 0.93$, $n = 42$)

B. $\log \overline{F/kg} = -0.93 \overline{OD} + 5.89$ ($r = -0.70$, $n = 12$)

C. $\log \overline{F/kg} = -0.85 \overline{OD} + 5.93$ ($r = -0.88$, $n = 55$)

Mathematical expressions representing these relationships in the Ivory Coast (Albaret 1982) and Ogun River, Nigeria (Adebisi 1987) are:

$$\log F/kg = -0.90 \overline{OD} + 6.22 \quad (r = -0.93),$$

and $\log \overline{F/kg} = -0.93 \overline{OD} + 5.89$ ($r = -0.70$) respectively where $\overline{F/kg}$ = mean relative fecundity expressed per kilogram body weight,

\overline{OD} = the mean oocyte diameter of fish (mm),

and r = correlation of coefficient of the relationships.

Using available data of other workers as compiled by Albaret (1979) the expression:

$$\log \overline{F/kg} = -0.85 \overline{OD} + 5.93$$

with a high correlation coefficient ($r = -0.88$) was obtained, even though different techniques were used in handling oocytes prior to counting.

The log-log transformations of these relationships are

$$\begin{aligned} \log \overline{F/kg} &= 5.3988 - 3.4803 \log \overline{OD} \quad (r = -0.91) \\ \log F/kg &= 5.0694 - 3.6949 \log \overline{OD} \quad (r = -0.77) \\ \text{and} \\ \log F/kg &= 5.0442 - 2.857 \log \overline{OD} \quad (r = -0.84) \end{aligned}$$

based on the data obtained by Albaret (1982) and Adebisi (1987) and those compiled by Albaret (1979) respectively.

High correlation coefficient values of the relationship between mean relative fecundity and mean diameter of mature oocyte for different fish communities in Africa indicate a significant dependence of one of these two parameters on the other. It therefore seems probable that mathematical expressions representing this relationship can be applied in the theoretical estimation of the fish's mean relative fecundity if

its oocyte diameter is known. The value of r for the Albaret's (1982) expression relating relative fecundity to the mean diameter of fresh oocytes of fish, which is relatively high, suggests that using the diameters of fresh mature oocytes will give more accurate prediction than using the diameters of preserved oocytes.

Advantages of the use of mathematical expressions, albeit approximative, include the fact that such a technique will be time, labour and material saving. Oocytes can be easily obtained from female specimens of the experimental fish with running gonads, by stripping and their diameters measured preferably fresh. The mean of the diameters can be used in computing the mean relative fecundity while the fish is returned safely to its environment.

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