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Short Communication

FECUNDITY AND SPAWNING FREQUENCY OF *SAROTHERODON GALILAEUS* IN A CONCRETE POND

JOHN BLAY, JR.

Institute of Aquatic Biology (C.S.I.R.), P.O. Box 38, Achimota (Ghana)

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ABSTRACT

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Fecundity of 26 specimens of *Sarotherodon galilaeus* cultured in a small concrete pond, 6.3 × 1.4 × 1.6 m, was determined by the "whole-count" method. The fish were not fed artificially but depended on natural phytoplankton growth, mainly *Chlorococcus* and *Chlorella*, for food. Pond water temperatures varied between 26° and 32°C. Fecundity ranged from 69 to 302 (mean = 149) for fish measuring 6.7 to 11.0 cm total length with body weights of 6.2 to 22.3 g and gonad weights of 0.32 to 1.23 g. The relationship between fecundity and total length was non-linear while fecundity—body weight and fecundity—ovary weight relationships were linear. The frequency distribution of ova diameters in mature ovaries showed two separate modes representing mature and immature ova, suggesting that the species has a restricted spawning period in the pond.

INTRODUCTION

Tilapias, including *Sarotherodon galilaeus*, are known to be prolific breeders and, in captivity, control over their breeding is usually a problem. On the other hand, under hatchery conditions it is often required to produce several thousands of fingerlings to stock production ponds in intensive fish culture. Studies on the fecundity of tilapias under various culture conditions are therefore essential in estimating their reproductive potential in order to determine the need or otherwise for measures to control their breeding.

In Ghana *S. galilaeus* promises to be of great value in future tilapia culture in view of its ready availability and abundance in many rivers and lakes in the country. This work aims at contributing to information on the reproductive potential of the species in captivity in small ponds.

MATERIALS AND METHODS

S. galilaeus was sampled from a small concrete pond (internal measurements, 6.3 × 1.4 × 1.6 m) at the Institute of Aquatic Biology in Ghana.

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The water level was maintained at 0.9 m. The fish had been cultured and maintained on natural phytoplankton production of the pond for nearly 3 years, and were not fed on artificial feeds during the sampling period. The main phytoplantons were *Chlorococcus* and *Chlorella*. The fish were measured for total and standard lengths to the nearest 0.1 cm and weighed to the nearest 0.1 g. Ripe ovaries were weighed and stored in Gilson's fixative and the eggs separated from the ovarian tissue by frequent vigorous agitation of the specimen bottles after a week. The eggs were cleaned thoroughly by rinsing with the fixative three or four times. The ripe eggs were counted with a tally-counter ("whole-count" method) as they were large and few in number.

The sizes of eggs (longest axis) of four mature ovaries were measured with the aid of a dissecting microscope fitted with a micrometer eyepiece, and their frequency distribution plotted.

RESULTS

Fecundity

The fecundity defined by Bagenal and Braum (1968) as the number of ripe ova in the female prior to the next spawning period was determined by counting all mature eggs in the ripe ovary. The fecundity was expressed in relation to the length, body weight and ovary weight. In 26 ripe females, the fecundity varied from 69 to 302 with a mean of 149. This was determined in fish of total lengths 6.7 to 11.0 cm with body weights of 6.2 to 22.3 g and ovary weights of 0.32 to 1.23 g. The fecundity—total length relationship (Fig. 1a) was curvilinear, described by the equation

$$F = 0.7244\ L^{2.36}$$

where F is fecundity and L is total length in centimetres. Fecundity increased rapidly in fish of 8.5 cm length and above. Both fecundity—body weight (Fig. 1b) and fecundity—ovary weight (Fig. 1c) relationships were rectilinear. The former is described by the equation

$$F = 8.89\ BW + 23.08$$

and the latter by the equation

$$F = 193.29\ GW - 10.77$$

where BW and GW are body weight and gonad weight, respectively, in grams.

Ova diameter frequency

The frequency distribution of ova diameters of four ovaries (Fig. 2) showed two distinct modes of small and large ova. The small ova had a modal diameter of 0.50 mm while the large ova had modal diameters ranging from

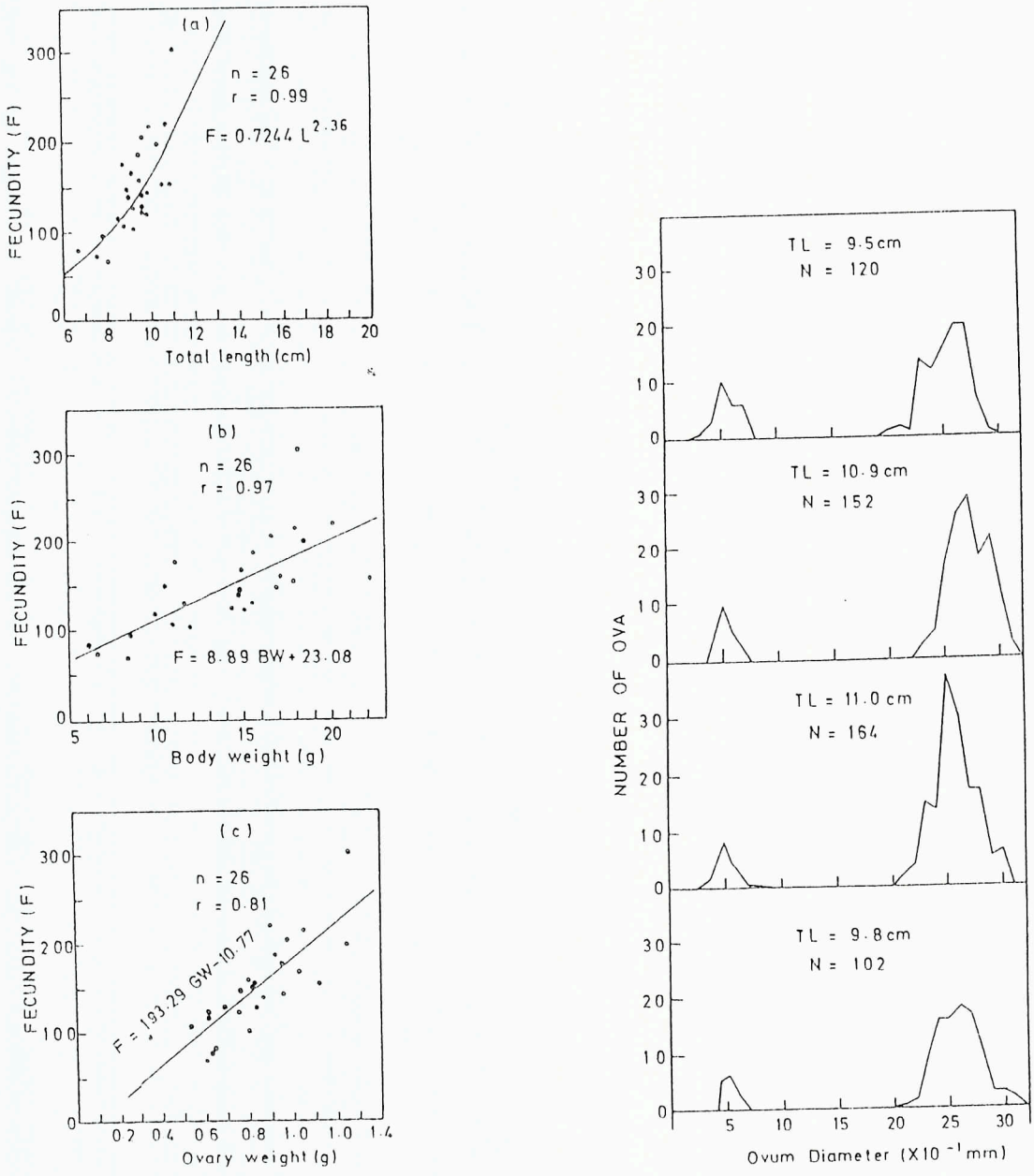

Fig. 1. Scatter diagrams showing relationship between (a) fecundity and total length, (b) fecundity and body weight, and (c) fecundity and ovary weight in *S. galilaeus*. The curve and lines were fitted by the calculated regressions. n = number of fish; r = correlation coefficient.

Fig. 2. The frequency distribution of ova diameters in ripe ovaries of *S. galilaeus*. TL = total body length; N = number of ova.

2.50 to 2.70 mm. The former are whitish and represent an immature egg stock while the latter are greenish or greenish-brown and represent mature eggs which may be ready to be spawned.

DISCUSSION

Fish that protect their brood in one way or another often have a low fecundity because of the presence of some mechanism for ensuring maximum survival of the brood. Siddiqui (1977), for example, attributes the low fecundity of *Tilapia leucosticta* in Lake Naivasha, Kenya, to its mouth-brooding habit. *Sarotherodon galilaeus* is a mouth-brooder in which both males and females participate in the brooding of eggs and fry. The fecundity of the fish in the pond increased with increasing length, body weight and ovary weight (Fig. 1). The presence of ripe ovaries in specimens of 6.7 to 11.0 cm total length indicates that females in this size range are mature. This conforms with the observation of Hickling (1962) that tilapias in fish ponds mature at a small size, a phenomenon referred to as "stunting". *S. galilaeus* matures at larger sizes in open environments (Ben-Tuvia, 1959; Lelek and Wuddah, 1968; Iles and Holden, 1969) but no report of mature specimens below 11.0 cm, the maximum length observed for females in this study, had been made. Recently, Blay (in preparation) observed specimens of 9.6 to 11.0 cm total length in the Dawhenya Reservoir, Ghana, with mature ovaries.

There are no comparative data on the fecundity of *S. galilaeus* in the size range encountered in this study. Fecundities of over 500 have been observed (Lowe, 1955; Ben-Tuvia, 1959) in specimens of total length 16.0 cm and above. Extrapolation of fecundity of specimens of 16.0 cm and longer from the equation,

$$F = 0.7244\ L^{2.36}$$

determined for the fish in this study reveals that if the pond fishes could attain larger sizes, their fecundity would be similar to that of the wild populations. If somatic growth of the fish could be enhanced by supplementary feeding and/or delayed maturation of the gonads, comparable sizes to the wild populations with a corresponding increase in fecundity could be achieved. This would be desirable in the production of large numbers of fry in hatchery practices.

Hickling and Rutenberg (1936) interpreted the occurrence of two separate groups of eggs in the ovary, one immature and the other mature, as indicative of a short and definite spawning period. Fryer and Iles (1972) have observed that tilapias exhibit protracted spawning, but the present results indicate a probable restricted spawning period. Studies on the actual spawning behavior of the species in small ponds would be more conclusive in determining its spawning frequency under such conditions.

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