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Fecundity and Gonadosomatic Index of *Synodontis ngrita* from River Osun Southwest Nigeria

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Abstract: A series of studies were conducted on *Syynodontis nigrita* to investigate its suitability for recruitment into aquaculture so as to boost fish protein production for human consumption. In this study, an investigation was conducted on the fecundity and Gonadosomatic Index (GSI) of *Synodontis nigrita* from River Osun in Nigeria over a 13 months period. About 166 specimens with total length ranging from 9.5-23.3 mm and body weight between 9.70 and 110.86 g were examined. The size at maturity was 95 mm for male and 115 mm for female. The maximum gonadosomatic index of the female was 1.859 while the fecundity varied between 216 and 9620 eggs with a mean of 4438. Condition factor ranged between 0.0000712 and 0.00894. The ovaries showed eggs at different stages of development. This suggests that *S. nigrita* is a multiple spawner, spawning all year round.

Key words: Fecundity, GSI, *Synodontis nigrita*, River Osun, aquaculture, Nigeria

INTRODUCTION

Synodontis nigrita (Family: Mochokidae) constitutes a commercial catch in the fisheries of Epe lagoon. With the rate of increasing global dependence on aquaculture for protein supply, *S. nigrita* has high potentials for incorporation into promising aquaculture. This study presents information on the fecundity and Gonadosomatic Indices (GSI) of *S. nigrita.* Although, there has been a lot of researches on the reproductive biology of temperate and tropical fishes (DeSilva, 1973; Blay and Eyeson, 1982; Rinne and Wanjala, 1983; Anetekhai *et al*., 1990; Ebochuo, 1991; King, 1998), little information exists on *S. nigrita.* This study is a follow up to the study on the food and feeding habits of *S. nigrita* by Olojo *et al.* (2003). Because of their economic importance to man occasioned by the rapid increase in protein demand, information on the reproductive biology of *S. nigrita* becomes important to ensure its regular availability as an animal protein source for man.

MATERIALS AND METHODS

About 166 specimens of *S. nigrita* were collected between March 2000 and 2001 from the freshly landed gill net catches of artisanal fishers at Epe lagoon. They were transported to the laboratory where the body length and weight of each specimen were measured. The specimens were cut open and their gonads carefully removed blotted with an absorbent paper and weighed using a top loading electric Mettler balance and were then stored in sample bottles containing 30% formalin.

The sample bottles were gently shaken daily to detach the eggs from the ovarian tissues. After a week, the ovaries were blotted dry with the aid of filter paper and the ovarian membrane and the connective tissues were removed. The eggs were observed and sorted according to their level of development as classified by Nikolsky. The eggs were then weighed using a top loading Mettler balance and fecundity was estimated using Gravimetric Method. A sub sample of eggs was weighed and the number of eggs in the sub sample was counted either with naked eye or with magnifying glass depending on the size of the eggs. The eggs were dried and their sizes were measured by using a calibrated micrometer. The Gonadosomatic Index (GSI) for each of the specimens was calculated as the gonad weight expressed as a percentage of body weight (Milton and Arthington, 1985):

$$GSI = \frac{\text{Gonad weight}}{\text{Body weight}} \times 100$$

Scatter plot of body weight against body length was made for the specimen. The regression coefficient of body weight on body length was computed from the relationship:

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$$W = aL^b$$

Where:
a = The intercept on y-axis
w = Weight (g)
l = Total body length (cm)
b = An exponent usually between 2-4 (Bagenal and Tesch, 1978)

A plot of log (weight) against log (length) gives a regression coefficient b and log a is the intercept on the y-axis.

RESULTS

The sex ratio of *Synodontus nigrita* from Osun river was 1 male to 1.47 females. The smallest and largest matured female of *S. nigirta* had a total length of 115 and 233 mm and a body weight of 29.90 and 110.86 g, respectively while the values for matured male were 95 and 222 mm with body weight of 9.70 and 78.35 g, respectively. The female of *S. nigrita* showed all the stages of gonad development. However, males in stages I-III were seen except in few cases where stage VI was seen. Sexually matured males were only obtained in the first catch when the rainy season was still on. But when the dry season set in, sexually mature males were rare. This may be due to reduction in water level. It was observed that when the water level was low, *S. nigrita* migrated back to the deeper water where fishing rarely took place. Investigation also showed that *S. nigrita* preferred fast flowing transparent and clear water to turbid water.

Fecundity: The number of egg calculated for each of the paired ovaries ranged from 216 in a specimen of 173 mm (total length) to 9,620 in a specimen with 205 mm (total length). Figure 1 shows that fecundity of *S. nigrita* is directly proportional to the GSI of the fish. The linearity of the fish weight-fecundity relationship was determined from the equation:

$$Y = a + bx$$

Where:
y = Number of eggs in the gonad
X = Total weight of the fish
a = A constant

The regression equation representing the least square line of the relationship is:

$$y = 686.78x + 893.03 \ (n = 166)$$

The co-efficient of regression (r) is 0.6024 ($p < 0.001$). The logarithmic transformation of this equation is:

$$\text{Log } y = 1.3458 + 0.9540 \log x \ (r = 0.7231, (p = 0.001)$$

which can be re-written as:

$$Y = 22.173x^{0.954}$$

Figure 2 shows that the fecundity in this species is variable among individual of the same body weight was more highly correlated with the fecundity than the body length of the fish.

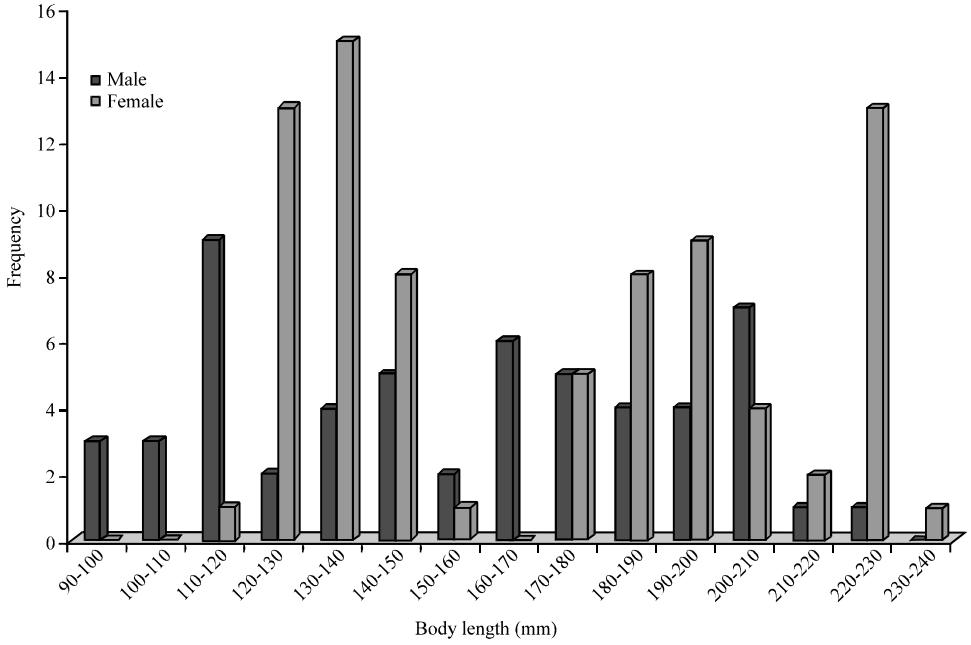

Fig. 1: Length-frequency distribution of *Synodontis nigrita* from River Osun, Southwest Nigeria

Gonadosomatic Index (GSI): The GSI shows that the gonad weight of the fish increase with the body weight however, the highest gonadal weight was not recorded in the specimen with the highest body weight. GSI varied from 0.26-10.94 with a mean at 1.69±0.35. In >55% of the specimens examined, GSI was >20. Figure 1 shows that the gonadal weight increases with the body weight of the fish although many specimens of similar weight exhibited wide variation in the weight of their ovaries. The regression equation describing this relationship is:

$$Y = 0.0254x + 1.9829 \ (n = 166)$$

Where:

Y = The gonad weight in g

x = The total weight of the fish in g

The coefficient of regression (r) of the relationship is 0.0159 ($p<0.001$). This suggests that the fish gonad weight and total body weight are significantly correlated. Figure 3 shows the relationship between the fecundity (y)

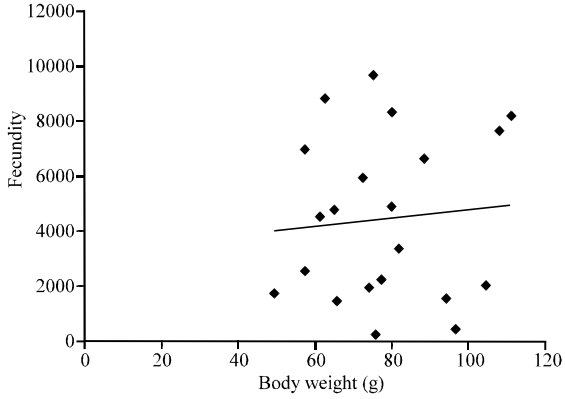

Fig. 2: Fecundity-body weight relationship in *Synodontis nigrita* from River Osun, Southwest Nigeria

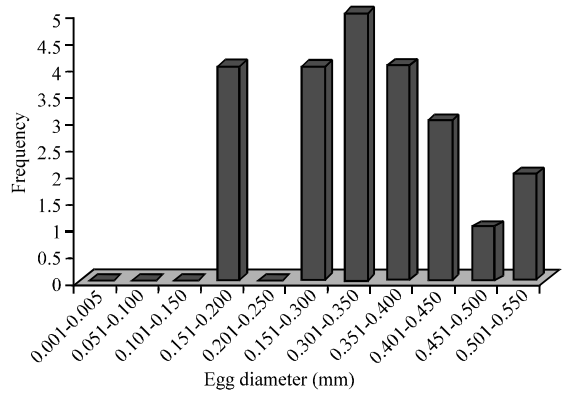

Fig. 3: Egg diameter frequency distribution in *Synodontis nigrita* from River Osun, Southwest Nigeria

and the total length (x) of *S. nigrita*. It is observed that the relationship is curvilinear. A logarithmic transformation will give a straight line which is represented by the expression:

$$\text{Logy} = 3.0528 \ \text{logx} - 3.6423 \ (N = 162)$$

The smallest and largest mature female of *S. nigrita* had a total length of 115 and 233 mm and body weight of 29.90 and 110.86 g, respectively. The smallest and largest mature male of *S. nigrita* had a total length of 95 and 222 mm and body weight of 9.70 and 78.37 g. The size at which a fish mature depends on a number of factors prominent among which are life span and the maximum size it can attain during its life. DeSilva (1973) observed that the life span of a fish is directly related to its minimum size at maturity. Ikusemiju (1973) got a similar maturity size of 133 mm (TL) for *Chrisychthys walkeri* in the Lekki lagoon. The total length of 87 and 99 mm was reported for the smallest matured male and female of *Tilapia guineensis* while 167 and 134 mm were recorded for *Sarotherodon galilaeus* (Fagade, 1979).

Application of the logarithmic transformation to the fecundity fish weight plot did not improve the value of correlation coefficient (r) between the two variables in the indicating that relationship is linear. This agrees with the finding of the previous worker on other fish species (DeSilva, 1973; Fagade and Adebisi, 1979). Data obtained shows that the females mature at a higher length than the male. The size at which a fish mature depends on the factors such as life span and the maximum size it can attain during its life. Beverton and Holt (1957) has shown that a low asymptotic length tends to give rise to a very small size at maturity and vice versa. DeSilva (1973) observed that the life span of a fish is directly related to its minimum size at maturity. The relatively small size at maturity of *S. nigrita* may therefore be an indication of a short life span and low asymptotic length (Fig. 4 and 5). Sexually matured males were only obtained in the first catch when the raining season was still on but at the onset of the dry season, sexually matured males became rare. This could be due to the reduction in water level. When the water level is low, *S. nigrita* will migrate to the deeper waters where fishing rarely takes place. Investigation also shows that *S. nigrita* does not like turbid water but transparent and clean water. GSI values obtained in this research showed that the gonad weight of the fish increased with the body weight of the fish. Data obtained shows that the females mature at a higher length than the male. The size at which a fish matures depends on factors such as lifespan and the maximum size it can attain during its life time. DeSilva (1973) observed that the lifespan of a fish is directly related to its minimum size at maturity. Sexually matured male were only obtained in the first catch during the raining season but became

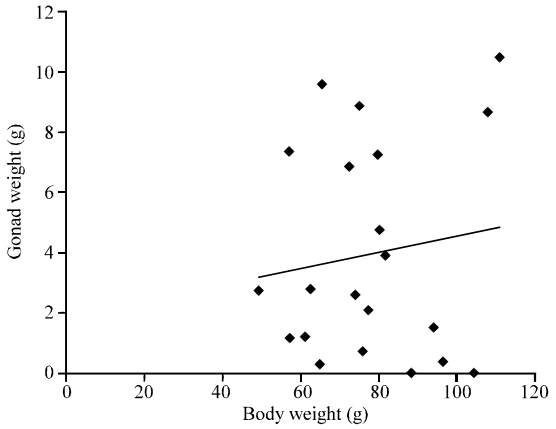

Fig. 4: Relationship between the Body weight (g) and gonad weight (g) of *Synodontis nigrita* from River Osun, Southwest Nigeria

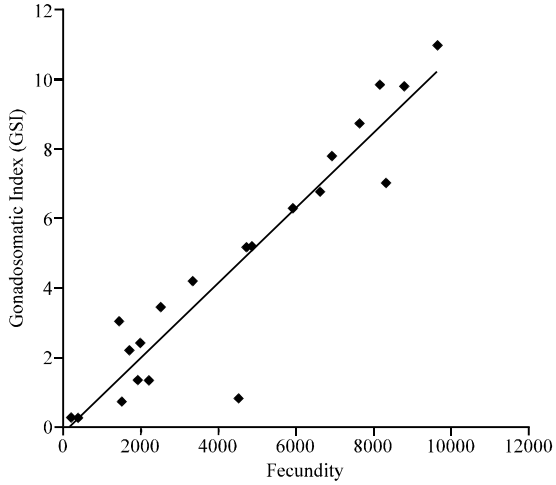

Fig. 5: Relationship between the GSI and fecundity in *Synodontis nigrita* from River Osun, Southwest Nigeria

rare at the onset of the dry season. This could be due to the reduction in water level. GSI shows that the gonad weight increases with the body weight of the fish. In some cases, all the eggs were counted. However with the more fecund specimens, it is more reliable to count the number of eggs in series of replicate sub samples. It is easy to make a gross error when counting several thousands of eggs but replicate sub samples of a few hundred should check against each other and yield more constant and reliable result. The regression coefficient (r) of this analysis is 0.6729 ($p = 0.001$). This suggests that the fecundity of *S. nigrita* increases at a rate close to the cube of the total length. Similar and other values have been obtained for other species, Fagade and Adebisi (1979) obtained the value of 3.0528 for *Chrysichthys nicrodigitatus* of Asejire dam in Ibadan.

CONCLUSION

In this study, the body weight is a more reliable indicator of the fish's potential egg production than body length (Wootton, 1973).

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