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Fecundity, Gonadosomatic Index and Spawning Period of *Chrysichthys nigrodigitatus* of the Lower Cross River, Nigeria

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ABSTRACT

The estuarine catfish (*Chrysichthys nigrodigitatus*) is a prized food fish in Nigeria especially in the Niger Delta region. There is a growing concern over the sustainability of the fishery in the face of climate change and environmental variability. Studies were conducted on the fecundity, gonadosomatic index and the spawning period of the species. The objectives were to determine the average fecundity of the species and to use the gonadosomatic index to determine its spawning period with the aim of proffering management advice and aquaculture prerequisites of the species in the face of climate change. A total of 44 females and 40 males were used for the study which spanned the period from May 2011 to April 2012. The fecundity of the species ranged from 3,730.5-41,535.9 eggs. There was a positive correlation between the total fecundity and fish weight ($p \leq 0.01$, $r = 0.80$, $n = 44$). The regression model for the relationship was expressed as, fecundity = 4660.8 + 4.76 weight. The gonadosomatic index was highest in the month of May and dropped sharply in June, signifying that spawning in *Chrysichthys nigrodigitatus* starts around this period. The implications of these findings with respect to the sustainability of the species and its aquaculture in the face of climate change are discussed in this study.

Key words: *Chrysichthys nigrodigitatus*, reproduction, Cross River, climate change, sustainability

INTRODUCTION

The estuarine catfish (*Chrysichthys nigrodigitatus*) is a prized food fish in Nigeria especially in the Niger Delta region. The species is the most commercially important single freshwater species in the Niger Delta with all year round fishery especially in the Cross River system (Ama-Abasi and Okwara, 2012). Holzlohner *et al*. (2007) reported that the species is the third most abundant species in the artisanal fishery of the inner Cross River Estuary after *Pseudotolithus elongatus* and *Ethmalosa fimbriata*. Okwara (2013) reported that the fishery in the Cross River system is overexploited. Ajang *et al*. (2013) gave the exploitation rate in the lower reaches of the Cross River to be 0.81 per year. This indicates that the fishery is under excessive fishing pressure. There is therefore a growing concern over the sustainability of the fishery in the face of climate change and environmental variability.

Fecundity estimate is a staple of fisheries science (Hunter *et al*., 1992). Fishery scientists find fecundity study very germane in stock assessment because, according to Cuellar *et al*. (1996), fecundity data is needed to determine the spawning stock ratio in annual stock assessment to be able to formulate management regulations. The objective of this study was to determine the

fecundity, gonadosomatic index and the spawning period of the *Chrysichthys nigrodigitatus* to enable informed management decisions to be taken as a proactive measure and adaptation to climate change.

MATERIALS AND METHODS

A total of 84 specimens of *Chrysichthys nigrodigitatus*, comprising 44 females and 40 males were sampled from the artisanal fish landings at Ayadehe Bridge Head 54 Kilometers from Calabar, along Calabar-Itu Highway. The sexes were differentiated only after dissection to expose the gonads. Males were used in the study in order to determine their GSI too. The specimens were transported in ice cooled boxes to the Research Laboratory of the Department of Fisheries and Aquaculture, University of Uyo, Uyo.

Fish weight was taken with weighing balance model Scout Pro SPU402 (400×0.01 g) to nearest 0.1 g. Fish weighed were dissected to remove the gonads. The gonads were weighed with sensitive electronic balance to the nearest 0.01 g. These were subsequently cut into three longitudinal sub-sections of the posterior, middle and anterior points each weighing 1 g after the method of Ama-Abasi (2006). The subsections were preserved in modified Gilson fluid for two weeks. At the end of two weeks the eggs were washed in filter gauge over running water after the method of Friedland *et al.* (2005) and Ama-Abasi (2006). The separated eggs were then counted in petri dish using counter to get the number of eggs per gram weight. The mean of the result was multiplied by the weight of the gonad to get the total fecundity for each fish. The gonadosomatic index was determined by the equation:

$$GSI = \frac{\text{Gonad weight}}{\text{Fish weight} - \text{gonad weight}} \times 100$$

The relationship between weight and fecundity was determined using regression analysis. The regression was calculated from the following equation:

$$Y = a + bX$$

RESULT AND DISCUSSION

The fecundity of *Chrysichthys nigrodigitatus* ranged from 3,730.5-41,535.9 eggs per female. There was a direct linear relationship between fish weight and fecundity ($p \leq 0.05$, $r = 0.801$, $n = 44$). The relationship was expressed with the model, $F = 4660.8 + 4.7164$. This is shown in Fig. 1.

The Gonadosomatic index is shown in Fig. 2. It was lowest in October. Highest GSI was in May having shown rising profile from March.

The direct linear relationship between fecundity and weight is a normal feature in fish (Elliot, 1995; Ama-Abasi, 2006). The highest GSI in May with a sharp drop in June shows that spawning in *Chrysichthys nigrodigitatus* begins between May and June and runs through October. Mayer *et al.* (1989) stated that spawning period theoretically is between the time of maximum GSI and the time when GSI attains a near minimum value. This study therefore shows that spawning in *Chrysichthys* spans from May to October. This period coincides with the rainy season which offers ample foraging opportunity for the species and the newly hatched larvae through the availability of allochthonous materials and expanded water habitat and also protection from intense predation (Welcome, 1976; Moses, 2001). Offem *et al.* (2008) observed that the

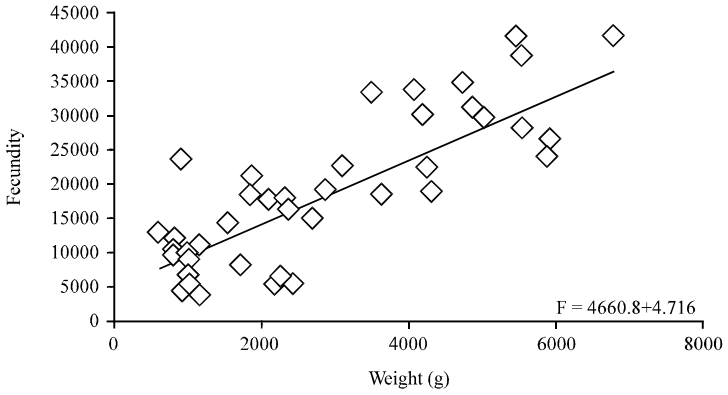

Fig. 1: Linear relationship between weight and fecundity of *Chrysichthys nigrodigitatus*

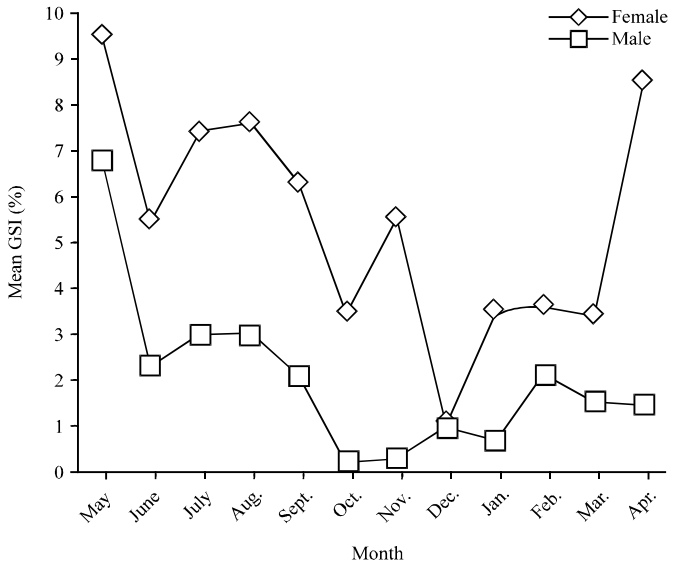

Fig. 2: Monthly variation in GSI of *Chrysichthys nigrodigitatus* of the Lower cross river

breeding period of *Chrysichthys nigrodigitatus* occurs between April and August, even though their data showed that the highest GSI was in May, as is the case in this study, breeding couldn't have started in April when GSI was still rising. Their lowest GSI was in August while in this study the lowest GSI was in October. The difference of two months may be an indication of impact of climate change already on the spawning period of this species. The FAO reported that longer growing seasons and increased rates of biological processes and often production will be some of the consequences of climate change on fisheries. It is yet to be determined whether such prolonged spawning period will be favourable to *Chrysichthys* fishery of the lower Cross River in the face of heavy flooding occasioned by climate change.

CONCLUSION

The information on the fecundity is enough to calculate the spawning biomass of *Chrysichthys nigrodigitatus* and with a known sex ratio, it can be used in stock assessment. This

is important in view of the reported overexploitation of the fishery. The linear relationship model between fecundity and weight can be employed to estimate the number of eggs from a known size by Chrysichthys aquaculturists without sacrificing the specimens. The aquaculture of the species can be done as adaptive measures in the coastal areas to ameliorate the negative impacts that may be created by climate change thereby ensuring food security.

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