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Fecundity Of Synodontis Membranaceus (Geoffroy Saint-Hilaire, 1809) In The Lower River Benue At Makurdi.

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ABSTRACT

An investigation was carriedout on the fecundity and Gonado-somatic index (GSI) of Synodontis membranaceus from River Benue over a 24 month period from January, 2009 to December, 2010. A total of 106 fish were collected: 59 (55.66%) males; 47 (44.24%) females. 36 of the females had developing eggs of stages IV-VI. The standard lengths of the 36 females ranged from 18.40cm - 28.10cm with the mean of 23.34±0.39. Total weight ranged from 164.10g - 556.70g mean of 314.20±16.00; gonad weight ranged from 3.17g to 90.00g mean of 21.76±3.01. GSI ranged from 1.02 - 17.53 mean of 6.73±0.68 and absolute fecundity ranged from 1,327 to119,954 mean of 33,173±15.36. Fecundity was found to correlate positively with gonad weight (r2=0.7535) but not with GSI(r2=0.5728) and body weight (r2=0.2833).

Key words: *Synodontis membranaceus*, Fecundity, Gonado-somatic (GSI) index, Lower River Benue.

INTRODUCTION

Synodontis membranaceus is one of the species of the genus *Synodontis*. Teugels (1996) reported that this species was endemic to Africa. It is one of the most important commercial fish species in the artisanal fisheries in Nigeria (Reed *et al*., 1967). In River Benue it is not common throughout the year but it is one of the species that attains the biggest size. Because of their relatively large sizes they are generally preferred by fishermen and consumers and command higher market prices. *S. membranaceus*has a potential for culture (Owolabi, 2005).They are popular aquarium species (Teugels, 1996; Owolabi, 2008) as they exhibit the habit of swimming upside down. Bishai and Abu Gideiri (1965b) carried out on feeding and reproduction on *S. membranaceus* in River Nile at Khartoun; Imevbore (1970) on sex ratio and fecundity in River Niger, Nigeria prior to impoundment; .Other studies were on orientation and Swimming by Willoughby (1974) , and Owolabi (2005) on other aspects of the biology of the fish in Jebba Lake, Nigeria. In the lower River Benue, Akombo *et al*., (2011) worked on its Morphometric and growth pattern. This work is aimed at determining the fecundity of *S. membranaceus* in River Benue at Makurdi.

Fecundity is the number of eggs produced by a fish (Lagler *et al.*, 1977). Absolute fecundity is the number of ripe eggs found in the female just prior to the next spawning period.(Bagenal, 1978);Halim and Guma'a, 1989). The number of eggs developing in a female just prior to spawning and the survival of early stages after hatching plays an important part in fish production, population dynamics, mortality, and survival rates. For theevaluation of the commercial potential of the stock, life history, culture and management of a fishery, the knowledge about fecundity of a fish is essential.

MATERIALS AND METHODS

Study Area

The study was carried out in the Lower Benue River at Makurdi, Nigeria. The Lower Benue River is the portion of the Benue River that is contained within the Benue and Kogi States of Nigeria (Reid and Sydenhan, 1979). River Benue originates from the Adamawa Mountains of Cameroun and flows west across East-Central Nigeria (Nedeco, 1959). It joins at the River Niger Lokoja Nigeria which flows to the Atlantic Ocean.

The River has extensive alluvial plain stretching for many kilometers, which covers a distance of approximately 187 kilometers. The extensive flood plain forms breeding grounds for many fish species (Beadle, 1974). The highest water levels are in August to September and the Lowest are in March to April.

Sample Collection

S. membranaceus were purchased from the fish sellers at Wadata Market, Makurdi, which is one of the fish landing sites on the bank of River Benue. The fish were caught by fishermen on the river using different types of gear such as gill nets, cast nets, hooks and traps. The fishes were procured fortnightly for 24 months (Jan. 2009 to Dec. 2010) and transported to the Biology Laboratory in Benue State University for identification and measurements. Identification was done using the keys of Reed *et al*., (1967) Holden and Reed (1972), Babatunde and Raji (1998) and Idodo-Umeh (2003).

Length andWeight Measurements:

The standard lengths (SL) of the fish were measured using a measuring board. The anterior tip of the fish was

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placed against a stop at the beginning of the measuring scale with its mouth closed. SL was the length from the tip of the snot to the base of the tail fin rays and this was measured to the nearest 0.1 centimeter. The total weight (TWT) was measured using a digital electronic weighing balance (Adam AFP 4100L). This was read to the nearest 0.1 gramme.

Sex Determination

The sex of *Synodontis* species were identified from internal sex organs after dissection. The gonads were inspected and Examined using the keys of Nikolsky (1963). The maturing stages of the gonads were classified according to the classification of Kesteven (1960).The stages were : **Stage I**, immature; **Stage II**, developingeggs; **Stage III**, still developingeggs; **Stages IV-V** mature eggs; **VI** ripe-running eggs and **Stage VII,** spent fish. The female gonads in gonad stages of **IV-VI** were removed and preserved in Gilson's fluid as described in Bagenal and Tesch(1978).

FECUNDITY STUDIES

The fecundity of the fish was determined using the female gonads in developmental stages of IV-VI. The ovaries were removed, and preserved in labelled reagent bottles containing Gilson's fluid at room temperature for 12 weeksto liberateand harden the eggs. The Gilson's fluid was prepared by adding 100 ml of 60% alcohol, 15ml of 80% nitric acid, 18 ml of glacial acetic acid, 20g of mercuric chloride and made to 1000ml with distilled water (Bagenaland Tesch, 1978).

While in storage, they were vigorously shaken at intervals until all the eggs were released from the ovarian tissues.After storage the Gilson's fluid decanted. The ovarian tissues were removed by successive shaking of the eggs and decanting the water. The clean eggs were poured on filter paper to pick the remaining ovarian tissues and drain the water.

FECUNDITY ESTIMATION

The eggs were dried in an oven at 40^0 C for 24 hours. Counting was done manually for five similar subsamples. The mean number of eggs in the five subsamples gave the number of eggs per 0.1gram weight. Fecundity was calculated by multiplying the total weight of eggs by the number of eggs per gram weight to give the absolute fecundity:

Fecundity, F=Total Weight of eggs × 750

The size of the eggs was determined by measuring the diameter of 100 eggs, randomly selected per female fish. Measurement of egg diameter was done with a calibrated micrometer mounted in the eyepiece of a binocular microscopeLagler (1971).

. **GONADO-SOMATIC INDEX**

The gonado-somatic index (GSI) was calculated based on the formula by Lagler (1971):

$$\textbf{GSI} = \frac{\textbf{Gonad weight X 100}}{\textbf{Total body weight}}$$

RESULTS

A total number of 106 specimens of *S.membranaceus* were used for this study, out of which 59 (55.66%) were males while 47 (44.34%) were females. Out of the 47(44.34%) females, 36 (76.60) had developing eggs of stages IV-VI (plate 1- 8) which were used for the fecundity estimation.

Plate 1: STAGE I- IMMATURE GONADS 2: STAGE II - DEVELOPING EGGS


Plate 3: STAGE III -DEVELOPING EGGS Plate 4: STAGE IV - MATURING EGGS


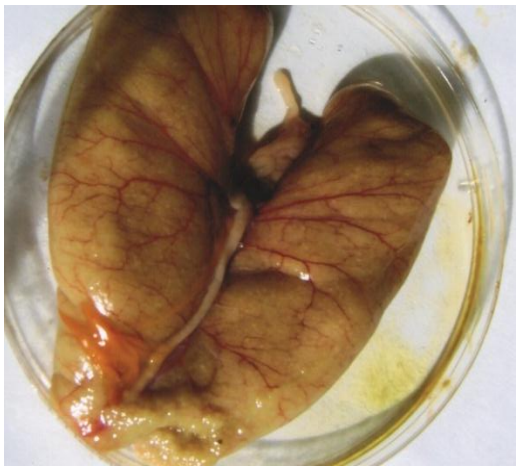

Plate 5:STAGE V - MATURING EGGS Plate 6: STAGE VI-RIPE-RUNNING EGGS


Plate 7: STAGE VII: SPENT Plate 8: MALE GONADS

The number of eggs in the female ranging from18.40cm to 23.30cm weighing 164.10g- 314.10g was 1,327eggsand the female ranging from 27.50cm-28.10cm with the weight of 314.30g to 556.69g was

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119,954eggs with the mean of 33,173± 15.36 (Table 1). These observations indicate that *S.membranaceus* is a species that is highly fecund. The low fecundity observed in fish of 18.40cm to 23.30cm could have been that the specimen had already shaded its eggs.

Table 1: Morphometric and Reproductive Parameters of *S.membranaceus* in Lower River Benue

Parameter	Min	Max	Mean±SE
Standard Length (cm)	18.40	28.10	23.34±0.39
Total Weight (g)	164.10	556.70	314.20±16.00
Gonad Weight (g)	3.71	90.00	21.76±3.01
Gonadosomatic Index (GSI)	1.02	17.53	6.73±0.68
Fecundity	1,327	119,954	33,173±15.36

Regressiongraphs of standard length-body weight (Fig 1), fecundity-body weight (Fig 2) fecundity-gonad weight (Fig 3) and fecundity-GSI relationships shows that there was positive correlation (P<0.01) between Standard length and body weight (r^2=0.7838),Fecundity and gonad weight(r^2=0.7535) but weak positive correlation in GSI andfecundity (r^2=0.5727).Fecundityand body weight were not correlated (r^2=0.2833)..

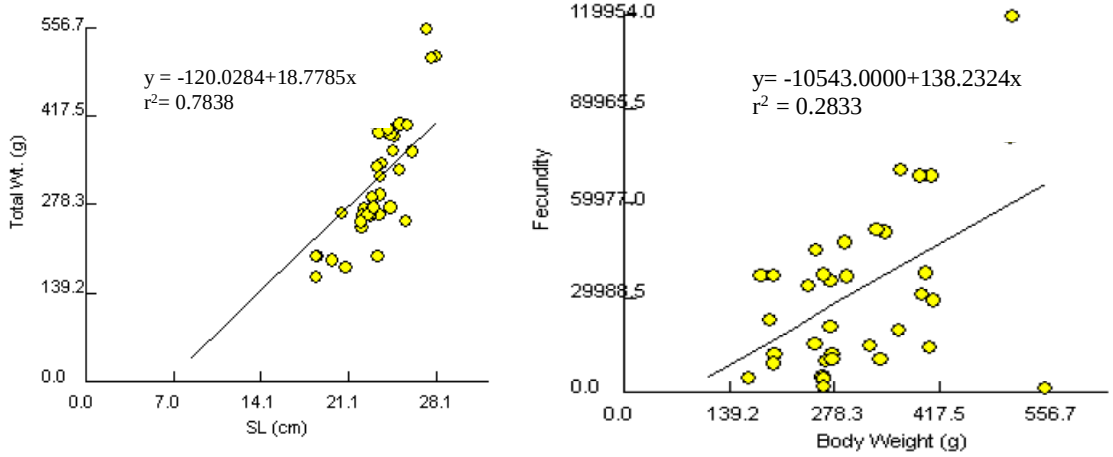

Fig.1: Body weight VS SL Fig. 2: Fecundity VS Body Weight

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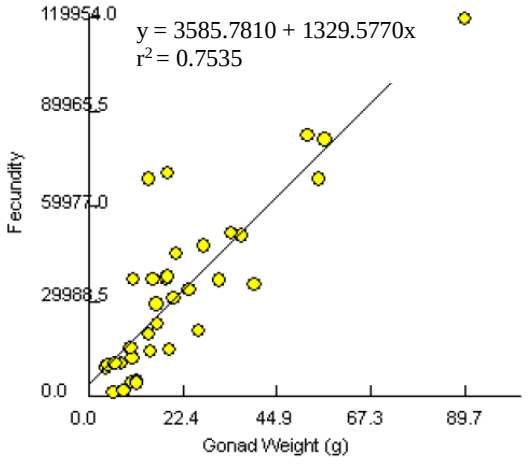

Fig. 3: Fecundity VS Gonad Weight

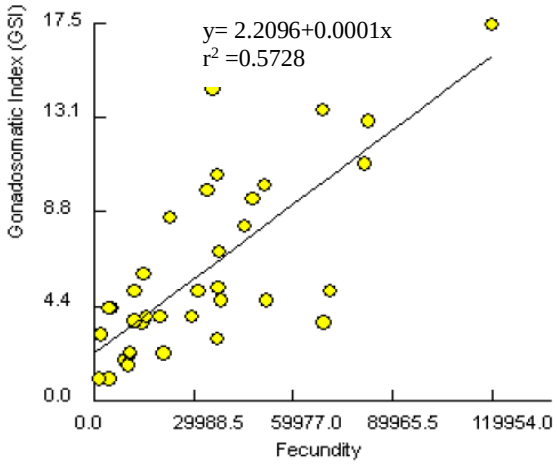

Fig.4: GSI VS Fecundity

Plate 1 above shows the fully matured or ripe-running stage of the female gonads of *S.membranaceus* while plate 2 is the male gonad at the maturing stage.

DISCUSSION

The peak (maximum) spawning in *S. membranaceus* was observed in August to October, becausemore matured gonad stages IV to VI were observed in these months. Araoye (2001) observed peak spawning in *S. schall* to be between June and August. Owolabi (2005) reported a spawning period of *S.membranaceus* in Jebba Lake to be from March to November with the peak between July and September. Lalèyè *et al*., (2006) observed one spawning season from August to October in *S.schall* and *S.nigrita* from the Ouémé River. Olele and Etim (2011) observed a spawning period of May to August in *S.nigrita* in Onah Lake. Midhat *et al*., (2012) reported that *S.schall* spawned once from May to August in River Nile at Gizza. Ogbe and Ataguba (2010) also observed that spawning began from June and ended in September in *Mormyrops anguilloides* with principal spawning taking place in August.The period of spawning usually coincides with the period of flooding and highest water volume.

The spawning activities observed in these months (August to October) was the peak of the rainy season being resulting in the expansion of the littoral zone. This is a breeding site for fishes because of availability of spawning substrates and abundant food (Olele, 2010). Food becomes more abundant during the rainy/flood seasons as increased water volume brings about increased food abundance and increased food availability improves fish health condition and thereby enhancing reproduction. Shinkafi and Daneji (2011) reported same, that flood among other things provided expanded habitat and abundant food. That most fishes spawned during this period so as to ensure the survival of the huge number of the young fish produced, provide reproductive niche and shelter for the juveniles, and consequently ensure reproductive success. Most fishes spawned during this period to maximize the production of recruits.Wooton (1992) stated that a fish should reproduce at that time of the year that will tend to maximize its life time production of offspring. The larval fish must hatch into a world that can provide appropriate foodand protection from predators.

The differences in timing observed in the different habitats could be explained on the different environmental and climatic conditions of the habitats.

In this study it was observed that *S.membranaceus* exhibited high fecundity ranging from 1,327 to 119,954 eggs. Willoughby (1974) reported the fecundity of 33,700-179,000 eggs in *S. membranaceus* from Lake Kainji, Nigeria. Owolabi (2005) reported the fecundity of 22,000-267,000 eggs in Jebba Lake, also in Nigeria. From these observations it is clear that *S.membranaceus* has a relatively high fecundity which is an advantage as continued existence of fish depends on the number of eggs hatched and their survival to the adult stage (Olatunde, 1989).

Studies on other species of *Synodontis* reveal that *S.membranaceus* is the most fecund of all the species. In *S.schall*, Araoye (2001) reported the fecundity of 7,910-64,450 eggs from Asa Lake, Ilorin while Lalèyè *et al*., (2006) reported the fecundity of 1,841-15,076 eggs from Ouémé River, Benin, while Mekkawy and Hassan (2011) reported the fecundity of 1,440-36,920 eggs from the Nile River, Egypt. Willoughby (1974) reported the fecundity of 7,130-73,000 eggs in Lake Kainji, Nigeria while Halim and Guma'a (1989) reported the fecundity of 10,000-90,000 eggs from the White Nile River near Khartoun in Sudan. Olatunde (1989) reported the fecundity of 2,014-13,262 eggs from Zaria while Ofori-Danson (1992) observed the fecundity of 14,000-16,500 eggs from Kpong Head pond, Ghana. In *S.nigrita*, Willoughby, (1974) reported the fecundity of 952-

11,400 eggs from Lake Kainji, Lalèyè *et al*., (2006) reported the fecundity of 2,647-9,212 eggs in Ouémé River, Benin. Olele and Etim (2011) observed a fecundity of 675-3,642 eggs in Onah Lake while Olojo and Olurin (2012) have reported the fecundity of 216-9,620 eggs from River Osun, Southwest Nigeria.

The great variations in the number of eggs produced by an individual of a certain species were demonstrated by a large number of other tropical fishes by Awachie and Ezenwaji (1981), Lalèyè *et al*., (1995), Baras and Lalèyè (2003) and many others. Apart from the environmental factors in the different localities, the differences observed may be, in part due to the methods used for fecundity estimation. Iyange and Ezewaji (2004) stated that the discrepancies in fecundity may be as a result of differences in fertility and food availability, disease condition or well-being of the fish and fish body chemistry.

Fecundity in this study revealed that fish of the same length and weight exhibited varied fecundity. This could be attributed to their body chemistry, differences in access to food, differences in their well-being and differences in adaptability to physical and chemical parameters of the water and habitat. Wide fecundity variation among fishes of the same length was reported by Ikomi and Sikoki (2004).

CONCLUSION

The result of this study shows that *S.membranaceus* in River Benue has higher fecundity that is capable of supplementing for losses through mortality and overfishing activities in other to enhance the sustainability of its species throughout the year round.

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