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# Reproductive Biology of *Siluronodon auritus* (Geoffroy Saint-Hilaire, 1809) in the Mid Cross River Flood System, Southeastern Nigeria

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**Abstract**
Fecundity, egg, size, condition factor, gonad somatic index etc of the specie *Siluronodon auritus* were studied between the months of April- August 2008, in the mid Cross River flood system. The total of 350 fishes that were studied showed the specie to be a multiple spawner and the breeding period was identified to be between May and June. The fecundity of the population varied from 6031 eggs (L= 21.4cm, W= 35.3g) and 1130 eggs (L=16.0cm and W=23.1g). A mean relative fecundity of this population of 270 eggs/cm or 155 egg of the fish was obtained with the total length measured in (cm) and weight (g). The condition factor (k) of the population varied from 0.96-1.43 with 0.634 as the mean; 53.7% had higher condition factor than the mean and 46.1% had condition factor below unity indicating that the population was slightly in good condition. The fecundity and condition factor obtained in this study are evidence that the Cross- River basin population of *S. auritus* can make or provide excellent bloodstock.

## 1. Introduction

Reproduction can be defined as the birth of an offspring of a particular organism of the same specie and this in most cases involves two genders (male and female). Most fishes are egg-layers, but many bear living young. At least three mode of reproduction: heterosexual, hermaphroditic and parthenogenesis are found in fishes. In live bearing fishes and in some egg layers, fertilization occurs internally and methods have been evolved for introducing the sperm into the females' body (Piper *et al*., 1989). The family Schilbedae and specie *S. auritus*, reproduce heterosexually and this is the case where there's a separate male and female parents, but even here there's considerable variation. In general, species of small maximum size begin reproducing at an earlier age than those with a large maximum size. Age and size are major factors in the determination of adulthood. In most species of *Siluronodon*, sperm and eggs develop in separate male and female individuals. Fertilization can either be internal or external (Adewumi, 2006). The significance of fish as an important source of first class protein has been increasingly recognized. About one third (1/3) of the annual protein consumed in Nigeria comes from fish. The intensive frequency of feeding by fishes during the periods of abundance permits them to build up large stores of fat which are sufficient not only to tide the animals through the following winter or dry season, but to elaborate gonadal tissue in preparation for breeding starvation during the winter or dry season causes fishes to lose proper body

condition for breeding for example a tracing of the reproductive capability of *S. auritus* shows that variation in weight of the specie, affects the rate of reproduction in the river, relatively little change occurred over the dry season until the start of reproduction when there's a sudden reduction in weight corresponding to about 10.7 percent for the whole period (Barnes, 2003). Reproduction is generally cyclic in cat fishes. The duration of cycles may be as short as four weeks or as long as many year. Some species spawn continuously throughout the spring and summer. Some bony fishes may spawn many times a year. Some reproduce once a year until they die, other cat fishes may reproduce only once during their lifetime (Nwadiaro and Okorie 1986). Thus this study seeks to determine the sex-ratio and variation in the % female and male of *S. auritus* at each maturation stage, gonadosomatic index, fecundity and condition factor of the fish.

## 2. Materials and Methods

### 2.1. Description of Study Area

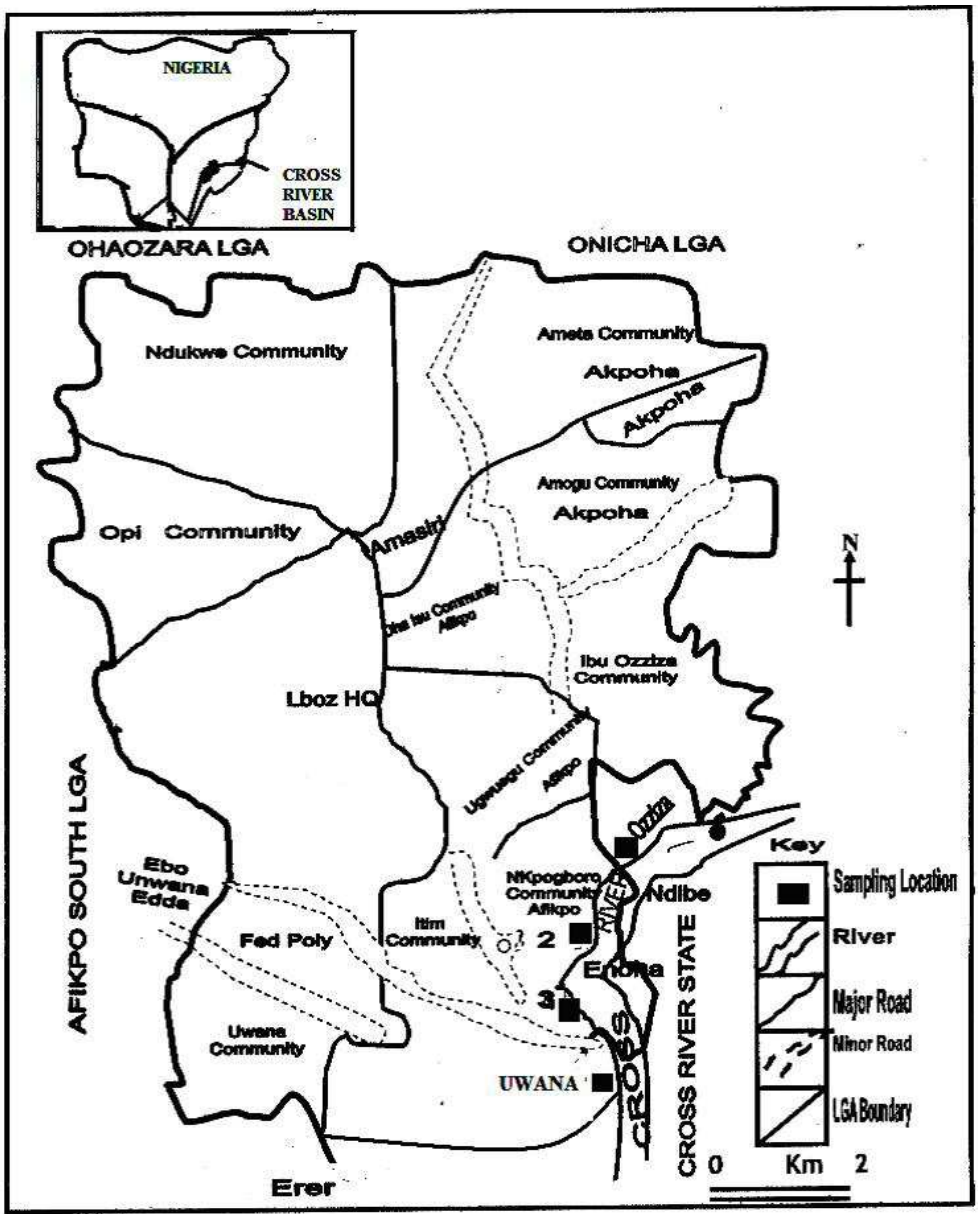


***Fig. 1.*** *Map of Afikpo North Local Government Area showing the sampling locations in the Cross River basin (Okoh et al., 2007).*

The study area is mid-Cross River flood system which lies between $5^0$57" latitude $5^0$30'20" North and$7^0$58" longitude $5^0$30'20" East (Okoh *et al*., 2007). During dry season (November- March) the water level reduces and increases water transparency. In the rainy season spanning from April-October, the water level increases so rapidly causing the water body to become muddy due to silt deposits of the river and in this period the fish folk leave the river bank where they live to the community until the season is over and the water returns to normal.

### 2.2. Collection of Fish Samples

The fish used in this study were wild fish bought from local fishermen as they landed at Cross River shore. Fishing gears include cast nets, set nets, lift net, hook and line. The fish were preserved in 10% formalin and transported to the practical bench of the Department of Applied Biology Laboratory, Ebonyi State University, Abakaliki, Ebonyi state, Nigeria.

### 2.3. Laboratory Analysis

The total length of fishes were measured in the laboratory using the meter rule and the weight too using the triple beam balance and the total length of each gravid specimen was measured to the nearest 0.0cm on a measuring board, while the whole body weight (g) was measured to the nearest 0.0g. A total of 350 female S. *auritus* samples were examined and the ovaries of each fish were preserved in a solution of 10% formalin for a minimum of 5 days before the eggs were counted and measured. The gonad weight was also measured by weighing the gonad in a beaker containing a known volume of $H_2O$ the weight of the beaker is first taken then that of beaker and $H_2O$ secondly, thereafter the gonad is added and the beaker is weighed again. Then the weight of beaker and water is subtracted to give the gonad weight. The fecundity is absolute fecundity, which is the total number of eggs in the ovaries of a fish prior to spawning. The number of egg of the mature female were also counted by cutting a part of the mature female gonad gotten' weighed and then multiply it by the overall weight of Gonad earlier gotten (Hunter *et al*., 1989). Gonad maturation were evaluated macroscopically and categorized into four maturation stages (Ezenwaji and Offiah 2003) as follows: Immature stage (stage I), Mature stage (stage II), Ripe stage (stage III), Spent stage (stage IV). Chi square statistical analysis would be used to determine the significance difference in the sex ratio in all the stages.Gonadosomatic index (GSI ) was estimated according to De Vlaming *et al*., (1982) as:

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

Fecundity was also studied by gravimetric method (Hunter *et al*., 1989). The procedure is as follows; the subsamples of 1 or 2 g according to the size of the eggs were taken from the front, middle and back parts of the ovaries. The number of the sub-samples was multiplied up to the weight of the ovary. King (1991) described the relationship between fecundity and total length and weight as:

$$F = aTLb,\ F = aGW\ b \text{ and } F = aWT$$

where F = Fecundity

TL = Total length in cm

SL = Total length in cm

GW = Gonad Weight

WT = Body Weight

b = Slope of the regression line (regression constant).

a = Intercept of the regression with the y - axis (regression coefficient).

Regression analysis was used in the estimation of the a and b values and the level of significance of the value of co-efficient of correlation (r).

## 3. Results

A total of 350 samples of the specie *S. auritus* were studied. Total number of males sampled was 72 while females were 278 thus male/female sex ratio is 1:3.9. The highest number sampled within the maturation stages was in the mature stage with 34(9.7%) males and 109(31.1%) females. The least number of males was in the spent stage with 8(2.3%) males and 25(7.1%) females. Male/female sex ratio in the maturation stages showed that the ripe stage (1:7.2) had the highest sex ratio while the lowest sex ratio was in the spent stage (1:3.1) (Table 1). Monthly gonad weight and condition factor of the males of *S. auritus* showed the overall mean for gonad weight was 0.81 and condition factor was 0.80. Highest mean gonad weight (0.98) was in August and highest mean condition factor value (0.96) was in April while lowest mean gonad weight (0.63) was in May and lowest condition factor value (0.69) was in June for the male samples (Table 2). Overall mean for monthly gonad weight and condition factor of the females of *S. auritus* was 0.93 and 0.50 respectively. Highest mean gonad weight (1.02) and condition factor value (0.67) were in June and May respectively while lowest mean gonad weight (0.82) and condition factor value (0.40) were in August and June respectively for the female samples (Table 3). Overall mean fecundity was 206 eggs/cm and 133eggs/g. Highest mean fecundity (270 eggs/cm, 168 eggs/g) was in April while the lowest fecundity (115 eggs/cm, 75 eggs/g) was in July (Table 3). Overall mean gonadosomatic index, GSI was 0.039 and 0.032 for male and female respectively. The highest (0.046) and lowest (0.029) GSI values were in June and May respectively for male samples. Female samples had the highest (0.039) and lowest (0.026) GSI values in June and May respectively (Table 4). Regression analysis equation of the relationship between fecundity and length was $F = 14.17TL^{0.001}$ and correlation coefficient value (r) as 0.614. Regression analysis equation of the relationship between fecundity and weight was $F = 19.04TW^{0.002}$ and r value as 0.639.

***Table 1.*** *The dynamics of male and female S. auritus in maturation stages.*

| Maturation stage | Number of males | Number of females | % of male | % of female | Sex ratio |
|---|---|---|---|---|---|
| Immature | 19 | 65 | 5.4 | 18.6 | 1:3.4 |
| Mature | 34 | 109 | 9.7 | 31.1 | 1:3.2 |
| Ripe | 11 | 79 | 3.1 | 22.6 | 1:7.2 |
| Spent | 8 | 25 | 2.3 | 7.1 | 1:3.1 |
| Total | 72 | 278 | 20.6 | 79.4 | 1:3.9 |

***Table 2.*** *Monthly gonad weight and condition factor of the males of S. auritus.*

| Months | Number of male samples | Mean total body length (cm) | Mean total body weight (g) | Gonad weight (g) | Condition factor (K) |
|---|---|---|---|---|---|
| April | 11 | 12.6 | 19.4 | 0.71 | 0.96 |
| May | 18 | 14.5 | 22.7 | 0.63 | 0.71 |
| June | 12 | 13.7 | 17.8 | 0.82 | 0.69 |
| July | 15 | 15.1 | 23.2 | 0.91 | 0.83 |
| August | 16 | 13.9 | 22.3 | 0.98 | 0.83 |
| Total | 72 | 14.0 | 21.1 | 0.81 | 0.80 |

***Table 3.*** *Monthly gonad weight and condition factor of the females of S. auritus.*

| Months | No. of female sample | Mean total body length (cm) | Mean total body weight (g) | Gonad weight (g) | Condition factor (k) | Fecundity Mean no. of eggs/cm | Mean no. of eggs/g |
|---|---|---|---|---|---|---|---|
| April | 59 | 19.7 | 32.8 | 0.98 | 0.43 | 270 | 168 |
| May | 53 | 17.3 | 24.5 | 0.87 | 0.67 | 183 | 129 |
| June | 67 | 21.4 | 35.3 | 1.02 | 0.40 | 281 | 170 |
| July | 54 | 18.1 | 27.6 | 0.95 | 0.46 | 115 | 75 |
| August | 45 | 16.0 | 23.1 | 0.82 | 0.56 | 238 | 165 |
| Total | 278 | 18.5 | 28.7 | 0.93 | 0.50 | 206 | 133 |

***Table 4.*** *Monthly gonad somatic index (GSI) of S. auritus.*

| Month | Mean GSI (male) | Mean GSI (female) |
|---|---|---|
| April | 0.037 | 0.030 |
| May | 0.029 | 0.026 |
| June | 0.046 | 0.039 |
| July | 0.039 | 0.034 |
| August | 0.044 | 0.035 |
| Total | 0.039 | 0.032 |

## 4. Discussion

The population of *S. auritus* sampled showed that the overall sex ratio of the male to female was (1:3.9) indicating that the area has higher females of the species and because of this, the female species are at the reproductive disadvantage because they have lower probability of getting male counterpart during mating for offspring production, thus an offspring production disadvantage. Ham (1981) attributed these disparities to differential survival over certain environmental conditions, while Fagade *et al*. (1984) explained the phenomenon as a mechanism for population regulation. Female dominance occurred in all the maturation stages. Data on gonad maturation of *S. auritus* in this study showed that 47.2% of males were in mature stage and 15.3% were in ripe stage. Therefore, 62.5% of total male fish were in the reproductive process. Female samples in mature stage were 39.2% and 28.4% were in ripe stage. So, 70% of the total female fish were in reproductive process. Fish with length of 21.4cm in this study had a mean fecundity of 6,031, which is comparable to 6,602 recorded for this specie of similar size in Badagry lagoon and 5316 in the Imo River. This is much lower than 8,300 recorded for fish of similar size in Warri Greek by Ezenwa *et al* (1986). In this respect the Warri Greek population is superior to all others. There's high degree of difference noted between the fecundity of fish at the .Cross-River basin and *S. auritus* population of lake Adejire where the maximum number of eggs counted was 2,654 (Fagade and Adebisi, 1979). This gives the evidence that the lake's population has lower fecundity. This could be due to the greater abundance of food in the river than in the lake or due to freer movement in search of food along the river, whereas food search and supply in the lake are limited by the area. Ezenwa *et al*. (1986) findings on this specie at Badagry lagoon, Warri River and Imo River, confirmed that there are differences in the fecundity of *S. auritus* regionally. In conclusion, findings from this study indicate that the population of *S. auritus* of this study was slightly in good condition. *S. auritus* in the mid Cross River flood system has female preponderance. Higher percentage of the species population was in their reproductive process thus making the sample population an excellent brood stock.

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