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Full Length Research Paper

Reproductive biology, length–weight relationship and condition factor of the African snake head, *Parachanna obscura*, from River Oshun, South-west Nigeria

Olurin K. B.* and Savage O. D.

Department of Plant Science and Applied Zoology, Olabisi Onabanjo University, P. M. B. 2002, Ago – Iwoye, Ogun State, Nigeria.

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Aspects of the biology of the African snake head, *Parachanna obscura,* obtained from River Oshun, South-west Nigeria, from August 2006 to February 2007, were studied. Fish were captured with gill nets. The species attained a maximum total length of 36.4 cm and body weight of 389.36 g. The length/weight relationship indicated allometric growth for males and isometric growth for females. Gonado-somatic index ranged between 1.1 and 2.8% in the females. Values of condition factor were high for males. There were more females than males, and immature fish dominated the catch. Eggs ranged in size between 0.88 and 1.11 mm, while fecundity estimates ranged between 1711 and 4000 and were not related to length and body weight. *P. obscura* in this study did not show any distinct seasonal pattern of breeding.

Key words: *Parachanna obscura*, River Oshun, Nigeria, reproductive biology.

INTRODUCTION

A rational management of a fishery resource, requires an in-depth knowledge of its biology and ecology (Greiner and Gregg, 2010; Reuter et al., 2010). Literature is replete with information on the biology of fishes of temperate and tropical waters (Ecoutin et al*.,* 2005; Rutaisire and Booth, 2005; DeAngelis et al., 2010; Mwandya et al., 2010), providing baseline information for their breeding and production (Haylor, 1992; Yaakob and Ali, 1992; Marimuthu et al*.,* 2001; Mylonas et al., 2010). In tropical Africa, the common species of aquaculture are few, and include *Tilapia* spp. and *Clarias* spp. predominantly (Viveen et al*.,* 1986; Haylor, 1992; Collart and De Bont, 1997; Little and Edwards, 2004; Akinwole and Faturoti, 2007; De Lapeyre et al., 2010; Ibrahim and Nagar, 2010). It is therefore necessary to investigate new species for aquaculture, and one of such promising candidates is *Parachanna obscura.* While there is a body of information on Asian species of the family Channidae in terms of their biology and aquaculture potentials (Cui and Liu*,* 1998; Qin and Fast, 1998; Ali, 1999), there is a dearth of information on their African counterparts. However, the information available in literature on their biology indicates that the species is suitable for aquaculture based on its hardiness, good taste, and ability to breed in captivity (Victor and Akpocha, 1992). This paper was aimed at providing information on aspects of the biology of *P. obscura* which will aid in the culture of the species.

MATERIALS AND METHODS

Fish samples

A total of 75 fish specimens were collected from fishers at a landing site in Okun Owa, along River Oshun, between August 2006 and February 2007. The fish were caught using gill nets.

Measurements

Total length (cm) of each fish was taken from the tip of the mouth to the extended tip of the caudal fin using a measuring ruler to the nearest 0.1 cm. Standard length (cm) for each fish was taken as measurement from the tip of the mouth to the caudal peduncle to the nearest 0.1 cm. The total body weight in grams was measured for each fish species to the nearest 0.01 g using a top loading

*Corresponding author. E-mail: kbolurin@yahoo.com. Tel: +2348034106671.

Table 1. Stages of gonad development classified by Nikolsky (1963).

Variables	Stages	Gonad development
Immaturity	I	Young individuals which have not yet engaged in reproduction. Gonads of very small size.
Resting Stage	II	Sexual products have not yet begun to develop. Gonads of very small eggs not distinguished to the naked eyes.
Maturation	III	Eggs distinguishable to the naked eyes. A very rapid increase in weight of the gonad in progress, testes changes from transparent to a pale rose colour.
Maturity	IV	Sexual product, ripe gonads have achieved their maximum weights but the sexual products are not still extruded when light pressure is applied.
Reproduction	V	Sexual products are extruded in responses to very light pressure on the belly. Weight of the gonads decreases rapidly from the start of spawning to its completion.
Spent	VI	The sexual products have been discharged, genital aperture is inflamed, gonads have appearance of a deflated sac and ovaries usually containing a few left over eggs and the testes contain residual sperm.

Mettler balance. The specimens were cut open on the ventral side and the gonads were carefully removed and weighed on the top loading electric balance. The sex of each specimen was recorded and the gonads were classified into gonadal stages of development according to Nikolsky (1963) (Table 1).

Ovaries with gonadal stages III and IV were fixed in 10% formalin and sample bottles containing the gonads were shaken daily to ensure the detachment of eggs from the ovarian tissue. Length-weight relationship was estimated using the equation (Ricker, 1971):

$$W = a L^{b}$$

The values of constant '*a*' and '*b*' were estimated from the log transformed values of length and weight, that is, linear regression equation:

$$\log W = \log a + b \log L$$

where a = intercept on y-axis; b = an exponent between 2 and 4 (Bagenal and Tesch, 1978); W = Weight in grams; L = length in cm.

The condition factor which measures the state of well being was determined using the formula by Tesch (1971):

$$K = 100W/L^{b}$$

Where K = Condition factor; W = Weight in g; L = Length in cm

This value (K) is used in assessing the health condition of fish of different sex and in different seasons. The Gonado-somatic index (GSI) was calculated as the percentage of the gonad weight over the body weight (Lagler, 1971):

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

Fecundity is the number of ripening eggs found in the female fish prior to spawning. Fecundity estimates were made from ripe ovaries (Stages III and IV) by the gravimetric method (Lagler, 1971). Total fecundity (F) was estimated by counting the number of ova in 3 weighed subsamples (anterior, median, and posterior), calculating mean number of ova per gram, and multiplying the mean by the weights of the two ovaries.

Sizes of 20 randomly selected ova from each fish were measured in millimeters, with an ocular micrometer on a dissecting microscope.

Data analysis

Data were analysed using the statistical package (SPSS version 15). Means were expressed as ± SD and compared using *t*-test. Sex ratio was subjected to a Chi-square goodness of fit test to show any deviation from a ratio of 1:1. Relationships between variables (weight vs. length, fecundity vs. body weight/ length) were carried out using correlation and regression analyses. Values were significant at $p \leq 0.05$.

RESULTS

Length-weight distribution

Table 2 shows the length-weight distribution of 75 specimens caught and examined. There were significant differences in the lengths between males and females for total length ($t_{0.05, 73} = 2.079$) and standard length ($t_{0.05, 73} = 2.483$), and there was no difference in body weight with sex ($t_{0.05, 73} = 1.501$).

Length- weight relationship

Length- weight relationship is expressed by the following regression equations:

Table 2. Total length, standard length and body weight distribution.

Parameter	Sex	Number	Range	Mean ± S.D
Total length (cm)	Male	15	22.9-33.4	28.67± 2.67
	Female	60	15.4-36.4	25.73± 5.29
Standard length (cm)	Male	15	21.2-28.5	21.77± 4.57
	Female	60	11. 3-30.2	21.77± 4.57
Body weight (g)	Male	15	123.43-324.01	227.13± 49.59
	Female	60	25.26-389.36	186.71± 98.88

Table 3. Monthly occurrence of stages of gonadal development.

Months	N	I		II		III		IV	
		M	F	M	F	M	F	M	F
August	3		1		1		1		
September	10		10						
October	17	3	12		2				
January	17			5	10		2		
February	28			3	11	2	11	1	

N-number; F- female; M- male.

Males: $\log w = -0.24 + 1.77 \log TL \qquad r^2 = 0.48$

Females: $\log w = -1.88 + 2.91 \log TL \qquad r^2 = 0.85$.

The length- weight relationship was significantly different for both sexes ($t_{0.05,\ 71} = 19.81$). The regression coefficient for male (length-weight relationship) was significantly different from ‘3’ ($t_{0.05,\ 13} = 2.38$ relationship) while the female value was not significantly different from ‘3’. ($t_{0.05,\ 58} = 0.56$) indicating allometric, and isometric growths in the males, and females, respectively.

Condition factor

Condition factor for males ranged between 35.26 and 79.18 (mean ± S.D; 59.49 ± 9.52), and for females ranged between 0.80 and 3.29 (1.357 ± 0.4305). There was sexual difference between male and female condition factors ($t_{0.05,\ 78} = 48.066$).

Reproductive biology

Sex ratio

Out of 75 specimens examined, 15 were males and 60 were females, giving a sex ratio of 1:4. The sex ratio showed a significant departure from the 1:1 sex ratio ($X^2 = 27.00$; $P < 0.05$).

Stages of gonadal development:

Four stages of gonadal development were obtained in fish sampled as shown in Table 3. Immature specimens dominated the catch. Mature females were found in January, February and August, while mature males were found in February.

Gonado- somatic index

The gonado–somatic index ranged in the females from 1.10 to 2.80 with a mean of 1.96 ± 0.63. The male gonads were very small, and the instrument available was not very sensitive.

Egg size

Fourteen male specimens had gravid ovaries. The eggs which were golden yellow ranged in diameter between 0.88 and 1.11 mm.

Fecundity

Fecundity estimates were made for 14 mature female fish; which ranged in length between 26.5 and 35.7 cm and corresponding body weights of 161.94 and 380.78 g. The eggs ranged in number from 1711 to 4000. The regression equations for fecundity/total length and fecundity/body weight are:

$$F = 146.41\,TL - 2043.10 \qquad r^2 = 0.49$$

$$F = 3.85\,W + 1534.85 \qquad r^2 = 0.22.$$

Where *F*=Fecundity; *TL* = Total Length; *W* = body weight.

There were no significant relationships between fecundity/body weight / body length.

DISCUSSION

Male specimens of *P. obscura* in this study were longer than the females, while the body weights were similar in both sexes. The maximum size of this fish reported by Bailey (1994) was 35 cm, but the largest specimen observed in this study was 36.4 cm. In this study, there was preponderance of females over males, which may be a mechanism for population regulation (Fagade et al., 1984). Wide disparities in findings exist in sex ratio among fishes. Specimens in this study were found to have mature gonads in the dry and wet season months, indicating no seasonality in breeding patterns. Victor and Akpocha (1992) reported highest reproductive activity in the species in October and November, under monoculture conditions in southern Nigeria. Seasonality strategy was observed in the fish of Baoule River (Mali) by Paugy (2002), characterized by high fecundity, absence of parental care, and limited breeding season. In most tropical fish, there is synchronization of sexual maturation and reproduction with the onset of the rainy season (Weyl and Booth, 1999). Also, deviations from rainy season synchronized spawning have also been reported in some species (Mitchell, 1984). Gonads for males were smaller than those of females. Similar trends have been reported for most African species (Munro, 1990). In this study, the eggs of this species were fairly large and numerous. Victor and Akpocha (1992) also reported that fecundity in the species ranged between 35 and 4010, while Kilambi (1986) observed a size range between 1.00 and 1.53 mm in stage IV ova. The relationships between fecundity/body and weight/length were not significant indicating that total length and body weight might not be useful in predicting fecundity. Conversely, Kilambi (1986) found total length and body weight as good predictors for fecundity in *O. striatus*. Fecundity was also correlated to length and weight in *P.obscura* (Victor and Akpocha, 1992).

This study was limited to a few months and specimens, because of our inability to access the river during the floods which inundated the surrounding environment. It is concluded that the results obtained, although not conclusive, have provided information on aspects of the reproductive biology of *P. obscura* which can be of practical application in its culture, and improve our understanding of reproductive processes in the species.

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