Journal of Experimental Research.

March 2013, Vol 1 No 1
www.er-journal.com
Email; editor-in-chief@er-journal.com

Received: Sept. 7, 2012

Accepted for publication: Feb. 20, 2013

Comparative Study of the Oocyte structure, Fecundity and Sex ratio of two African catfishes in Idodo river basin (Nigeria) with comments on their Breeding biology.

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Abstract

A comparative study of the reproductive parameters (oocyte structure, fecundity and sex ratio) of two species of *Heterobrachus (H. longifilis is and H. bidorsalis)* from Idodo river basin were investigated. A bimodal size distribution was recorded for the two species which is indicative of the possibility of multiple spawning in a year. *H. bidorsalis* however demonstrated a significantly higher peak in oocyte diameter (P0<05). Spawnable oocytes in *H. bidorsoli*« ranged from 1.25 to 2.15mm in diameter while *H. longifilis* had a range of 1.15 to 1.85mm diameter. A higher clutch size which was not statistically significant (P>0.05) was observed in *H. hidorsalis* when compared with *H.longifilis*. In both species, fecundity was linearly related to total length, standard length, body weight and ovary weight. Similarly the equations Y = - 3731.699 + 28.383X (r=0.971) for H. *Longifilis* and Y= -382111 + 29.344X (r=0.971) for *H. bidorsalis* for fecundity and ovary weight showed more predictive relationship than the other parameters. The mean yearly sex ratio were 1:1.42 and 1:1.24 (male: female) for H. *bidorsalis* and *H. Longifilis* respectively. In both species sex ratios were not statistically significant (P<0.05). High spawning capacities were exhibited by both species which is indicated by their high fecundity. An overview of these reproductive parameters observed in this study lends credence to the high reproductive capacity observed in the field studies of these species and thus confirms the view that Heterobrancuus species along with other clarrids constitute the largest productive biomass in the ichthyofauna of African waters.

INTRODUCTION

The clariids and the various tilapine species constitute the most important aquaculture species in Africa (Teugels et al, 1992) and also contribute significantly to the ichthyo - fauna of the inland waters of the African continent (Anibeze, 1995). The biology of the clariids have been extensively studied and among the Heterobrauchue species (Anibeze (1995) was probably one of the first studies on the detailed morphology of *H. Longifilis*. Most of the earlier workers studied H. *Longifilis* species although most of the comparative studies (Anibeze and Eze. 2000; Anibeze and Anyanwu, 2005) did show similarity in various aspects between *H. Longifilis* and *H. bidorsalis*. The need to establish specie's different morphological studies will always enhance our critical understanding of factors that establish a basal dichotomy natural selection

Specialized reproductive strategies notably the production of large ova (Clay 1979), presence of two peak populations of oocytes (Clay and Clay, 1981; Eyo and Mgbenka, 1992; Ezenwaji, 1998), and absence of parental care which is reflected in their high fecundity (Sydenharn, 1980) are common features of African clariids. These observation have mainly been done on members of the Clariids species of the subgenera C (Dinoitnicroidcs) Fowler and C (Clarias) Gronovious (Clay, 1979: Clay and Clay, 1981; Sydenham, 1980, Eyo and Mgbenka, 1992) and on a member of the C (Ciaroides) Ezenwaji, 1998). The clariid genus Heterobranchus Geoffroy St. Hilaire, have received a comparatively basal treatment in terms of biological studies (Mgbenka and Evo, 1992). Among the species of this genus, *Heterobranchus Longifilis* appears to be relatively well studied (Legendre, 1986; Legendre and Tengels, 1991; Nwadukwe, 1995), Invang et al (1997) reported on some aspect of the reproductive biology of *H. Longifilis* but did not cover the diameter and frequency of distribution of the oocytes. the sex ratio and details of fecundity. These parameters are critical in establishing the biological factors which influence breeding in the species. This study compares the observations on

the oocyte structure and distribution, fecundity and sex of H.longiJilis and H. bidorsalis in Idodo River basin. It also gleans information from lnyang et a1 (1997) on H. lorzgiJilis in the same basin to make inferences on the breeding biology of the species.

MATERIALS AND METHODS

The study area

The Idodo river basin is approximately 240km in length and rises from the watershed created by the Umunko-Umulumgbe-Ukehe ridge. It has numerous tributaries especially at its upper reaches where the current is swift, although its two most important tributaries, the Iyoko and Obazi complex are lower down the river. The multi-order formed flows southwards to join the Abonyi River at Ishielu. The sampling sites were located around the major fishing sites of ldodo River. They include Imburu-Idodo, Idodo central and Iyionu (Fig. 1).

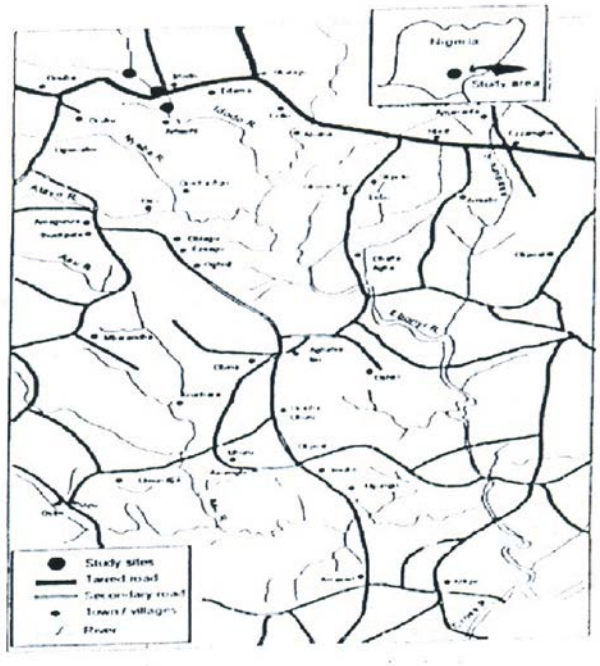

Fig. 1: ldodo River system showing locations

Physic-chemical Parameters

At each sampling station, the surface water temperature, PH and conductivity readings were recorded as the fish specimens were being collected. Water samples were collected at 25cm below the water surface for dissolved oxygen (DO) determinations using Winkler's titration method, water temperature (mercury thermometer) and pH (AOA - 40 portable pH meter). Conductivity was measured monthly using Tinsel - 125 meter. Graduated wooden stakes fixed vertically at each station along the River were used to record water levels.

Experimental Procedure

Fish specimens were collected forthnightly from each of the three sampling stations in Idodo River (Fig. 1) spanning a period of 18 months. Gill nets (5.1 and 7.3mm stretched mesh size) and traditional valve basket traps were used to collect fish.

The total length (TL cm), standard length (SL cm) and wet weight (g) of each fish were recorded. Sex was determined by examining the genital papilla or the gonads after dissection, particularly in small specimens. Ovaries were removed from each fish, dried on absorbent paper and weighted on Mettler PC 2000 balance. The overies were preserved in Gilsons reagent and the separated oocytes were run through a stack of seven graded sieves of 2.0 to 0.40mm aperture sizes, the largest of which retained the mesenteries and other tissues. The number of oocytes caught on each sieve was counted and weighed. Fecundity defined as the number of ripening oocytes in the female prior to the next spawning period (Bagental, 1978) was determined by counting all ripe oocytes in both ovaries. Regression analysis of fecundity (F) on total length, Standard length, Body weight and ovary weight (Wo) were performed using the least square method.

RESULTS

Physico-chemical parameters

The average monthly surface water temperature ranged from 23.TC in January to 29KC in March (fig 2). The pH values ranged between 6.0 in July and 7.4 in April. Higher pH values were recorded during the dry season months. Similarly

conductivity values were higher during the dry season than during the rainy months. The highest water level was observed in October while the least occurred in February.

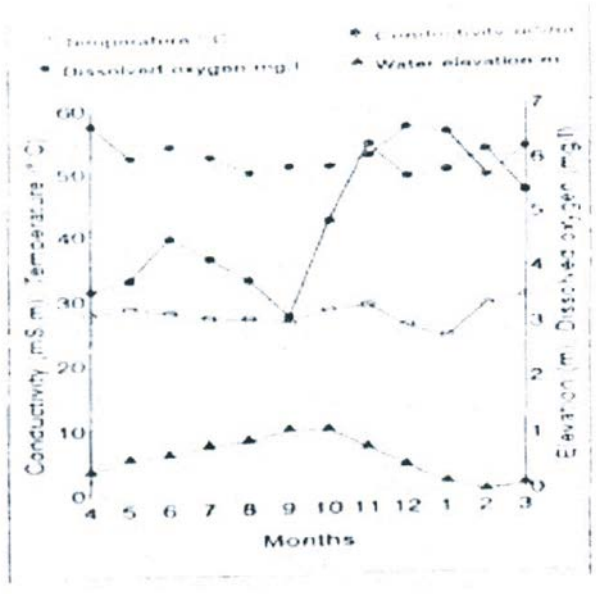

Fig 2 - Mean monthly values of the physico-chemical parameters of the ldodo River. X axis: figures 1 to 12 stand for the months of January to December; Y axis: elevation designate mean water level above dry season level .it sampling stations.

Oocyte, fecundity and sex ratio

Ova in *H. Longifilis* were found to have a bimodal distribution in oocyte diameter with peaks in the frequency of distribution at 0.5 and 1.5mm (fig 3). Ovaries from immature and maturing fish only contained small ova < 1.2mm diameter. Spawnable oocytes from mature fish which are ready to be shed in the current breeding season ranged from 1.2 to 1.9mm and contributed about 90% of ovary weight while non-spawnable oocytes provided only 10% .

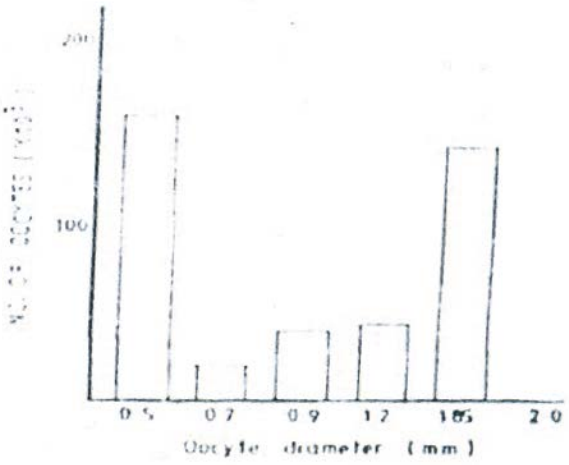

Fig. 3 Composite diameter variation and frequency of distribution of oocytes of *H. Longifilis* and Hbidorsali« in Idodo River, Nigeria.

Table 1: Relationship between fecundity and total length, standard length, body weight and ovary weight using the equation $F = \alpha + \beta$

Body parameter	**Fecundity parameters**					
	α		β		??	
	H. longifilis	***H. bidorsalis***	***H. longifilis***	***H. bidorsalis***	***H. longifilis***	***H. bidorsalis***
Total length	189.111	171.161	81.342	80.342	0.955	0.911
Standard length	6979.352	7101.311	45.887	47.891	0.937	0.951
Body weight	-296.112	-311.011	65.212	72.563	0.941	0.963
Ovary weight	-3751.699	-2223.40	2839.383	2996.314	0.984	0.978

Table 2: Monthly distribution in the sex ratio of H. Longifilis and H. bidorsalis in Idodo River basin, Nigeria.

Month	Number Collected				Sex Ratio	
	Male		Female		Male	Female
	H. longifilis	*H. bidorsolis*	*H. longifilis*	*H. bidorsolis*	*H. longifilis*	*H. bidorsolis*
April	16	10	14	10	1:0.88	1:1
May	9	9	13	15	1:1.44	1:67
June	9	6	12	7	1:1.33	1:1.66
July	11	8	16	10	1:1.45	1:1.25
August	9	8	14	8	1:1.56	1:1
September	9	6	16	15	1:1.45	1:2.5
October	6	8	5	9	1:0.83	1:1.25
November	8	7	10	11	1:1.25	1:1.57
December	12	5	11	7	1:0.92	1:1.4
January	19	10	25	12	1:1.32	1:1.2
February	14	12	17	12	1:1.21	1:1
March	9	10	9	14	1:1.00	1:1.4
Total	**131**	**91**	**162**	**130**	**1:1.24**	**1:1.42**

Egg counts ranged from 6001 eggs in a32.3cm TL fish to 51,216 eggs in a 98.1cm TL fish (24,816 ± 14676, mean ± S.E) in *H. longifilis*. For *H. bidorsalis* egg counts ranged from 7203 eggs in a 36.9cm TL fish to 56,789 eggs in a 101.5cm TL fish (26,314+ 15,142, mean+ SE). Fecundity related linearly in both species to total length, standard length, body weight and ovary weight (Table 1). The relationships were significantly correlated (P< 0.001). Ovary weight was more reliable estimate for fecundity than other parameters. Table 2 presents the monthly variation in sex ratio of *H.longifilis* and *H. bidorsalis*. The catfishes did not depart significantly (P> 0.05) from a 1: 1 sex ratio. Within the months however, females dominated from May to September and in January/February.

DISCUSSION

The presence of mature gonads (Stage 111) in *H. longifilis* all year round (lnyang et al 1997), the bimodal peak in oocyte distribution and the high fecundity found in this study indicate the possibility of multiple spawning under favourable environmental conditions. Eyo and Mgbenka (1992) related bimodal distribution of ova in *C. garipinus* to restricted spawning in the catfish. This means that even when the endogenous conditions are favourable, spawning does not take place until it is triggered off by the right exogenous factors. Thus, the major and minor spawning in *H. Longifilis* reported by Inyang, et al (1997) in Idodo River basin from March to September and January/February when gonads were in breeding condition were only possible because of the exogenous environmental factors in the basin which triggered off spawning in the catfish. These exogenous factors which include rainfall (Welcome, 1985), flooding which is reflected in water levels in the basin and conductivity (fig. 2) were adequate in ldodo River during the recorded breeding activities of the species. Similar observation was reported on *C albopunctaius* in Anambra River basin by Ezenwaji (1998).

Although the bimodal distribution of ova observed in this study for the two species agrees with Clay (1981) and Ezenwaji (1988), the peaks of

frequencies at 0.5 and 1.5mm is higher than the modal peaks reported by the other workers on Clerics species. Similarly, the oocyte critical size of less than 1.85 found for *H. longifilis* is higher than the size reported by Clay (1979) and Eyo and Mgbenka (1992) on *C. gariepinus* These results suggest the production of larger oocvtes by the *Heterobranchus* species in comparism with the other clariids. This is also reflected in the growth rates of *Heterobranchus* species over the

other c1ariids (Anibeze and Eze 2000; Anibeze and Anyanwu, 2005).

Spawning capacity of fish is function of fecundity (Inyang et al 1997). Hence the high fecundity observed in Heterobranchus species of Idodo River basin is indicative of high reproductive capacity, a feature that ensures the species survival as the c1ariids do not exhibit parental care (Sydenham, 1980). The linearity and correlation shown by fecundity over the body parameters (Table 2) indicate that relative fecundity could be predicted with a fairly high degree of accuracy using these parameters. The y = -3751.699 + 28.383X (r=0.971) for H. longifilis and Y= -382111+ 29.344X (r=0.971) for H. bidorsalis for fecundity and ovary weight showed more predictive relationship than the other parameters.

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