LENGTH – WEIGHT RELATIONSHIP OF *Heterobranchus longifilis* REARED IN EARTHEN PONDS

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ABSTRACT

Length – weight relationship, condition factor and sex ratio of 90 specimens of Heterobranchus longifilis reared in earthen ponds of Nigerian Institute for Oceanography and Marine Research (NIOMR) integrated fish farm, Ijoyi – Badore were determined. The parameters "a" and "b" of the length – weight relationship were estimated using the formula $W = aL^b$ *while the condition factor was calculated from the equation,* $K = 100WL^3$*. The length-weight relationship of H. longifilis showed positive correlation (r = 0.96). The regression exponent for males, females and combined sexes were 3.0168, 3.2429 and 3.0446 respectively. The correlation coefficient "r" for males, females and combined sexes were 0.9354, 0.9474 and 0.9546 respectively. The species showed positive allometric growth. The average "K" value for the males was 0.8282 ± 0.1198, females 0.8266 ± 0.0798 while combined sexes were 0.8275 ± 0.1039. The sex ratio of males to females was 1.31:1 and there was no significant difference from the expected 1:1 ratio at 5% level of significance. The determination of "b" and "K" can be used in growth performance, feed utilization and well being of fish in earthen ponds assessment.*

Keywords: Allometry, broodstock, African catfish, aquaculture

INTRODUCTION

Fish farming has grown strongly as an effective way of generating food and income from dwindling land space, as fish supplies from open water and lagoons continue to fall and human population increases (Adebayo and Adesoji, 2008). This demand – supply gap is bridged by importation, at a colossal foreign exchange cost of US$594.4 million approximately ₦92.75 billion (FDF 2007). To reduce importation of fish, aquaculture has been identified as the next viable solution.

About 90% of farmed fish in Nigeria is *Clarias gariepinus*, which is now a major attraction to private sector investors in the country (Kemthorn and Miller 2006). Compared to all other animal food protein sector, aquaculture is growing more rapidly and when produced in a good culture system will promote natural resource conservation and reduce fish stock depletion. Our water bodies in addition to sustaining the gains of the maximization of the use of natural resources within the purvey of sustainable environmental management. Fish is a good source of animal protein and it plays a prominent role in the low income group (Allison, 2001).

World aquaculture (food fish and aquatic plants) has grown significantly during the past half century. From a production of below 1 million tonnes in the 1950's, production in 2004 was reported to have risen to 59.4 million tonnes, with a value of USD 70.3 billion (FAO, 2006). This represents an average annual increase of 6.9% in quantity and 7.7% in value over reported figures for 2002. In 2007, fish demand has been put at 2.66 million tonnes in Nigeria, while domestic production amounts to a paltry 620,000 metric tonnes, leaving a deficit of 2.04 million tonnes (83.2%).

Heterobranchus longifilis which belongs to the catfish family Clariidae, has also gained widespread recognition as a promising species in aquaculture production (Lenient *et al.*, 2008). *H. longifilis* is an economically important food fish, cultured primarily in fresh water ponds in tropical countries (Babalola and Apata, 2006). *H. longifilis* exhibits many qualities which makes it suitable for commercial culture. These include hardiness, rapid growth, high disease resistance, high yield potential, high fecundity, air-breathing characteristics and good market potential (Ayinla *et al.*, 1994).

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Pond culture of *H. longifilis* is the most prevalent mode of propagation (Akinwole and Faturoti, 2007). The absence of a fish feed industry is a major impediment to the development of aquaculture in Nigeria (Fagbenro, 2005). Because of this, traditional catfish grow-out in southeast Nigeria is semi intensive (Ofor, 2007).

The facts mentioned above necessitates a search for reliable information on the culture of *H. longifilis* which is a good candidate of aquaculture.

Length-weight relationship (LWR) is useful tool in fish growth pattern or age determination and fishery assessment. When the b-value is < 3, a fish has negative allometric - growth, and when it is > 3, it has positive allometric - growth (Khairenizam and Norma-Rashid, 2002). Information on fish age data are used for stock composition, age at maturity, life span, mortality, growth and production (Beyer, 1987; Bolger and Connoly, 1989; King, 1996a, Kulbicki, *et al*., (1993), Garcia, *et al*., (1998) and Haimovic and Velasco (2000). The condition factor often referred to as "K factor" provides information on the well being of a fish and is usually influenced by the fish, sex, season, maturity stage etc. (Anyanwu, *et al*., 2007). Fulton (1902) proposed the use of a mathematical formula for quantifying the condition of fish as $K = 100w/L^3$**.**

Therefore we have attempted in this study to determine the length-weight relationship, condition factor and sex ratio of *H. longifilis* reared in earthen ponds fertilized with chicken droppings and dry mixed meadow grasses.

People want species other than Clarias *gariepinus* while *H. longifilis* and Tilapia are next viable cultivable species.

This study determined the length-weight relationship, condition factor and sex ratio of *H. longifilis* reared in earthen ponds fertilized with chicken droppings and dry mixed meadow grasses.

STUDY AREA

The study was carried out in the Nigeria Institute for Oceanography and Marine Research (NIOMR) Integrated fish farm located in Ijoyi-Badore, Lagos. It lies approx. between longitude 06º 3´ 25´´ E and 06º 31´ 0.88´´ E, Latitude 03º 36´ 19.0´´ N and 03º 36´ 197.12´´ N with an area extent of 30.829 hectares.

MATERIALS AND METHODS

Specimens of *H. longifilis* used for this study were bought from Sapele, Delta state, NIOMR outstation and reared in earthen ponds at NIOMR fish farm Ijoyi-Badore, Lagos, Nigeria.

Fingerlings of *H. longifilis* were stocked in three earthen ponds of 8.3 m x 3 m x 1.2 m each, at a stocking density 20 fish/m^2.

Soil was taken from each pond bottom at a depth of 3 cm. The soil was analyzed for lime requirement by method reported by Boyd *et al.* (2002). Agricultural limestone was spread uniformly over the ponds and the quantity used ranged from 5.0 kg - 6.2 kg per pond depending on the respective soil pH.

Organic fertilizer (chicken droppings) was applied weekly at the rate of 0.7 kg per pond weekly (Ita, 1980b). Dry mixed meadow grasses were also applied weekly at the rate of 1.2 kg per pond. (Boyd, *et al*., 2002). The chicken droppings and dry mixed meadow grasses were put in separate jute bags and left in the pond where they released nutrients into the pond water. These applications were done for the first three months. The dry mixed meadow grasses used were *Eleusine indica, Setaria longiseta, Panicum repens; Kullinga bulbosa; kyllinga squamutata; Panicum laxum and Eragrostis atrovinens.*

The fish were fed with commercial pelleted feed (45% crude protein) for a period of six months at 1.5% body weight three times daily for the first three months and then 1% body weight thereafter for another three months.

Collection of Fish Specimens

Ninety (90) fish were harvested randomly from the earthen ponds using a drag net. Their body weights were measured to the nearest 0.01g using a sensitive balance. The total length (TL), standard length (SL) and Head length (HL) was taken to the nearest 0.1cm using a measuring board, while the sex was recorded for all the fish sampled.

The length and weight of *H. longifilis* were measured in order to obtain the growth rate of the fish. The length-weight relationship is represented by using the equations:

(1) $W = aL^b$…… (Ricker, 1973).

Where W = Body weight of fish in grammes (g)

L = Total length of fish in centimeters (cm)

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a = Regression constant

b = Regression coefficient

(2) The values of "a" and "b" were estimated from the logarithmic transformation of length and weight i.e.

(3) $(log\ W = log\ a + b\ log\ L)$…… Bagenal and Tesch, 1978).

Where W = Weight in grammes (g)

L = Standard length in centimeters (cm)

"a" and "b" are regression constant

(4) Condition factor (K) for *H. longifilis* was calculated using the equation below:

$K = \frac{100W}{L^3}$ …… (Pauly, 1983).

Where K = the condition factor

L = Total length in centimeters (cm

W = Weight in grammes (g)

The condition factor is useful for investigating effects of seasonal and habitat differences in fish and general well being or robustness of the fish species.

The sex of the fish was determined by visual observation of the fish; Sex ratio was determined by counting numbers of males and female specimens monthly.

Sex Ratio

The sex of the fish was determined by visual observation of the fish, specimens that were classified as immature were those whose gonads could not be differentiated macroscopically as males or females. Sex ratio was determined by counting numbers of male and female specimens monthly.

(5) Test for goodness of fit was determined statistically using Chi – square (χ^2) test. The inference was tested at 95% confidence interval.

Chi – square χ^2 test

$\chi^2$1d.f, 5%

$$\chi^2(n-1) = \frac{E(Observed - Expected)^2}{Expected}$$

Where $_{(n-1)}$ is the degree of freedom.

The data analysis was carried out using Microsoft Excel.

RESULTS

Ninety specimens of *H. longifilis* were used for this study. The total length ranged from 44.5 cm – 69.8 cm while the total weight ranged from 800 – 3000 g.

The "b" value for the males was 3.0168 while that of the females was 3.2429 and combined sexes 3.0446. The correlation coefficient "r" for males, females and combined sexes were 0.9354, 0.9474, and 0.9546 respectively. The scatter diagrams of the length – weight relationship for the males, females, and combined sexes are shown in Figures. 1-3 respectively.

The log length-weight regression equation for *H. logifilis* was as follows:

Males

$log\ W = -2.1135 + 3.0168\ log\ L\ (r = 0.9354)$

Females

$log\ W = -2.4949 + 3.2429\ log\ L\ (r = 0.9474)$

Combined Sexes

$log\ W = -2.1612 + 3.0445\ log\ L\ (r = 0.9546)$

The condition factor "K" ranged from 0.5556 – 1.3971 for males while that of the females ranged from 0.6951 – 1.1348. Average "K" value for males, females and combined sexes were 0.8275 ± 0.1198, 0.8266 ± 0.0798 and 0.8275 ± 0.1039 respectively (Table 1).

The sex ratio of the 90 specimen of *H. longifilis* examined indicated that 51 were males (56.7%) and 39 were females (43.3%) giving a sex ratio of 1:1 (male: female).

A chi–square test carried out on the observed male and female specimens indicated that there was no significant difference from the expected 1: 1 ratio at 5% level of significance, as shown in Table 2.

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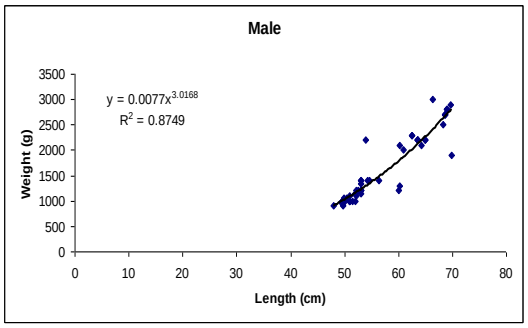

Fig. 1: Length-weight relationship of male *Heterobranchus longifilis* reared in earthen ponds

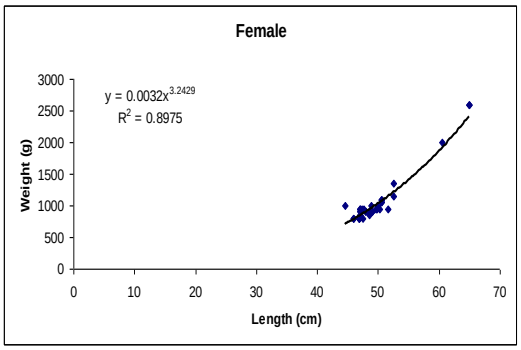

Fig. 2: Length-weight relationship of female *Heterobranchus longifilis* reared in earthen ponds

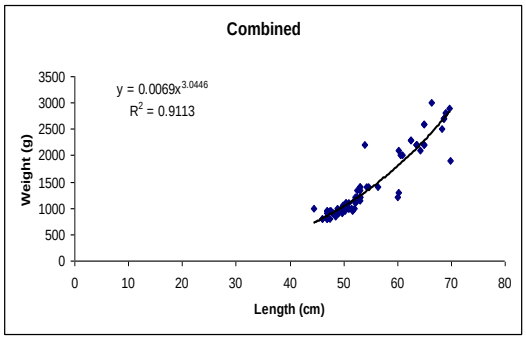

Fig. 3: Length-weight relationship of combined sexes of *Heterobranchus longifilis* reared in earthen ponds

Table 1: Regression co-efficient of *Heterobranchus longifilis*

Sex	Mean condition factor("k")	Regression constant ("a")	Regression co-efficient ("b")	Correlation co-efficient ("r")
Male	0.8282±0.1198	-2.1135	3.0168	0.9354
Female	0.8266±0.0798	-2.4949	3.2429	0.9474
Combine	0.8275±0.1039	-2.1612	3.0446	0.9546

Table 2: Chi – squared test analysis on sex ratio of *H. longifilis*

Sex	Observed (O)	Expected (E)	O – E	$(O – E)^2$	$(O – E)^2/E$
Males	51	48	3	9	**0.1875^{ns}**
Females	39	42	-3	9	**0.2143^{ns}**
Total					**0.4018^{ns}**

ns – Not significant

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DISCUSSION

Length-weight relationship of *H. longifilis* reared in earthen ponds of Nigerian Institute for Oceanography and Marine Research, Victoria Island, Lagos, Nigeria (NIOMR) exhibited high positive correlation (r = 0.96) which indicated that as length increased, body weight also increased. This could be attributed to high protein content of feed used and plankton yield resulting from pond fertilization with chicken droppings and dry mixed meadow grasses.

The "b" value was higher in the females than in the males. Similar observation was made by Srisuwantach *et al*. (1980) who reported that the length-weight relationship and mean condition factor in *C. batrachus* were higher in females than in males. The values of "b" 3.2429 observed in females and 3.0168 in males. Abdullah, (2002) obtained "b" value between 2.5 and 3.44 for fishes from different marine water bodies while Pauly and Gayanilo (1997), reported "b" values range from 2.5 to 3.5.

H. longifilis reported in this study in earthen ponds showed positive allometric growth with regression equation for the combined sexes as $log\, W = -2.1612 + 3.0445\ log\, L\ (r = 0.9546)$, Srisuwantach *et al*. (1980) obtained regression equation of $log\, W = -2.1692 + 3.0857\ log\, L$ for *C. batrachus* culture.

The condition factor obtained for males, females and combined sexes were 0.8282 ± 0.1198, 0.8266 ± 0 0798 and 0.8275± 0.1039 respectively, and the values were lower than the values (2.9-4.8) for mature fresh water fish documented by Bagenal and Tresh (1978). The difference in the values obtained for the males and females could be because of egg development in the females and hence increase in body weight. Frota *et al*. (2004) also made similar observation. The sex ratio of males to females 1.31:1 observed was not significantly different from expected 1:1 ratio. The sex ratio obtained is highly desirable for broodstock development and hatchery operations for *H. longifilis*. The 1.31:1ratio will enhance adequate production of male female broodstock for successful fingerling production of *H. longifilis*. The determination of "b" and "k" can be used in growth performance, feed utilization of fish in earthen ponds assessment.

The combination of chicken droppings and dry mixed meadow grasses enhanced natural food supply in the ponds and made more natural food available for *H. longifilis* than ponds fertilized with chicken dropping alone.

CONCLUSION

The length–weight *of H. longifilis* determined in this study indicated high positive correlation with r = 0.96. The species exhibited positive allometric growth with the regression coefficient ("b" = 3.0446 – 3.2429) being greater than 3. The fish specimens were in good health condition.

ACKNOWLEDGEMENT

This project was supported by the Rivers State Government of Nigeria, through a Scholarship award to PEPPLE, Peace C. Godswill. The support of Nigerian Institute for Oceanography and Marine Research (NIOMR) in making some of the facilities available is acknowledged. The assistance of Mr. Matanmi, M. A. and Mr. A. B. Williams (in data analysis), Dr. Kadiri of University of Lagos, Department of Botany for identification of the meadow grasses and Badore Farm workers (in harvesting fish). Also Dr. P. E. Anyanwu for reviewing the manuscript is highly appreciated.

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