Asian Fisheries Science **25** (2012):124-132 ©Asian Fisheries Society ISSN 0116-6514 E-ISSN: 2073-3720 https://doi.org/10.33997/j.afs.2012.25.2.002



# Length-weight Relationship and Condition Factor of *Heterobranchus longifilis* Valenciennes, 1840, Reared in Tanks and Earthen Ponds

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## Abstract

Length-weight relationship and condition factor of *Heterobranchus longifilis* Valenciennes, 1840, reared in fibre-glass tanks and earthen ponds at the Nigerian Institute for Oceanography and Marine Research Lagos, Nigeria, were studied. Fish were stocked at a density of 20 fish m<sup>-2</sup> in triplicate  $25m^2$  ponds fertilised with chicken droppings and hay, and 250 fish m<sup>-3</sup> in triplicate  $2m^3$  fibre-glass tanks. The fish were fed with pelleted feed of 42% crude protein, at a mean rate of 1.3% fresh body weight thrice daily for 6 months. At the end of 6 months of culture, 30 *H. longifilis* were sampled from each replicate. They were weighed and total length measured. Fish reared in tanks had a mean length of  $30.3\pm0.5$ cm and a mean weight of  $1,344\pm155g$ . Fish reared in ponds had a mean length of  $32.6\pm1.5$ cm and a mean weight of  $1,360\pm40.6g$ . Mean "k" value was  $1.63\pm0.12$  and  $1.5\pm0.02$  in tanks and ponds respectively. Mean "b" values were lower in tanks at  $2.88\pm0.2$  in comparison with  $3.047\pm0.015$  obtained for ponds, indicating negative and positive allometry respectively. The length–weight relationship of *H. longifilis* reared in tanks and ponds showed positive correlation (r = 0.99).

## Introduction

Fish is a source of high quality animal protein and plays a prominent role in the diets of the low income group (Allison, 2001). Fish is the major source of animal protein intake for most (55%) of Nigeria's citizens (NIOMR, 2010). *Heterobranchus longifilis* Valenciennes, 1840, is cultured in Nigeria. It has a higher growth rate than other members of the family Clariidae (Legendre et al. 1992) and commands good market prices in Nigeria (Ayinla et. al. 1994).

Length-weight relationship is of great importance in fishery assessments, and is basically a measure of fish growth pattern or age (Garcia et al. 1998; Haimovici and Velasco, 2000). The condition factor often referred to as "k factor" provides information on the well-being of a fish and can be influenced by the age of the fish, sex, season, maturity and stage. (Anyanwu et al. 2007). Fish that exhibits higher weight at a given length is said to be in better condition.

The objective of this study was to determine the length–weight relationship and condition factor of *H. longifilis* reared in fibre-glass tanks and earthen ponds. The data obtained will provide baseline information for culture management, brood stock selection and development of the species.

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#### **Materials and Methods**

This study was conducted in the fish farm of the National Institute of Oceanography and Marine Research (NIOMR) at Ijovi-Badore, Lagos, Nigeria. Experimental units were earthen ponds of 8mx3mx1m dimensions in treatment 1, and fibre-glass tanks of 2m<sup>3</sup> volume in treatment 2. Each treatment was replicated thrice. A total of three ponds and three tanks were used. The earthen ponds were fertilised with chicken droppings and hay (500kg ha<sup>-1</sup>). The chicken droppings were tied with a jute bag at the corner of each pond. Heterobranchus longifilis fingerlings of 7.5±0.74 cm total length and  $3.7\pm0.2$  g mean weight were stocked. Stocking was at a density of 250 fish m<sup>-3</sup> in each tank, and 20 fish m<sup>-2</sup> fish in each pond. The fish were fed with extruded commercial feed of 42% crude protein content for a period of 6 months. Feeding was at a mean rate of 1.3% fresh body weight given three times daily for 6 months. At the end of culture at 6 months, 30 fish were sampled from each culture unit. The total length was taken to the nearest 0.1 cm, while the body weight was measured to the nearest 0.01g. The length-weight relationship of H. longifilis was estimated with the following equation:  $W = aL^{b}$  (Ricker, 1975), where W is the total body weight (g), L the total length (cm), and "a" and "b" are the coefficients of the functional regression between W and L. An allometric coefficient "b" value larger or smaller than 3.0 shows an allometric growth or isometric growth when it is equal to 3.0 (Bagenal and Tesch, 1978). The values of "a" and "b" were estimated from the logarithmic transformation of length and weight (log  $w = \log a + b \log L$ ). The condition factor was calculated using the formula  $k = 100W/L^3$  according to Pauly (1983), where "k" is the condition factor, "L" the total length in cm and "W" the weight in g.

#### Results

Parameters of length-weight relationship of fish reared in the two environments are given in replicates in Tables 1-3. The scatter diagrams of the LWR are presented also in replicates, in Figs 1 – 6. Fish reared in tanks had a mean length of  $30.3\pm0.5$  cm and a mean weight of  $1,344\pm155$  g. Fish reared in ponds had a mean length of  $32.6\pm1.5$  cm and a mean weight of  $1360\pm40.6$  g. Mean "k" value was  $1.63\pm0.12$  and  $1.5\pm0.02$  in tanks and ponds respectively. Mean "b" values were lower in tanks at  $2.88\pm0.2$  in comparison with  $3.047\pm0.015$  obtained for ponds. Correlation coefficient "r" for fibre-glass tanks ranged from 0.9955-0.9998 (Table 2) with a mean of 0.9997 (Table 3) while for earthen ponds it ranged from 0.9996-0.9997 (Table 2) and had a mean of 0.9997.

Treatment	Weight	Length	Condition factor	
	(g)	(cm)	( k) ±0.1066	
Treatment 1 replicate 1	1190	30.8	1.518	
Treatment 1 replicate 2	1500	30.4	1.757	
Treatment 1 replicate 3	1342	29.8	1.613	
Treatment 2 replicate 1	1318	31.3	1.516	
Treatment 2 replicate 2	1364	32.4	1.493	
Treatment 2 replicate 3	1399	34.2	1.476	

**Table 2.** Parameters of length-weight relationship of *H. longifilis* raised under intensive conditions, in triplicate fibreglass tanks (treatment 1) and earthen ponds fertilised with chicken droppings and hay (treatment 2) fed commercial 42% protein diets at 1.3% fresh body weight thrice daily for 6 months.

Treatment	a	b	r	k±0.1066	
Treatment 1 replicate 1	-1.5528	2.6567	0.9955	1.518	
Treatment 1 replicate 2	-1.9547	2.9393	0.9959	1.757	
Treatment 1 replicate 3	-2.1249	3.0433	0.9998	1.613	
Treatment 2 replicate 1	-2.1739	3.0632	0.9996	1.516	
Treatment 2 replicate 2	-2.1367	3.0459	0.9997	1.493	
Treatment 2 replicate 3	-2.1135	3.0329	0.9997	1.476	

**Table 3.** Parameters of length-weight relationship of *H. longifilis* raised under intensive conditions, in fibre-glass tanks (treatment 1) and earthen ponds fertilised with chicken droppings and hay (treatment 2) fed commercial 42% protein diets at 1.3% fresh body weight thrice daily for 6 months .

	Treatment 1	Treatment 2
Regression co-efficient ("b")	2.8798	3.0473
Correlation co-efficient (r)	0.9971	0.9997
Condition factor (k)	1.6293±0.1203	$1.4950 \pm 0.02007$



**Fig 1**. Length-weight relationship of *H. longifilis* reared under intensive culture conditions in fibre-glass tanks fed commercial 42% protein diets at 1.3% fresh body weight thrice daily for 6 months.



**Fig 2.** Length-weight relationship of *H. longifilis* reared under intensive culture conditions in fibre-glass tanks fed commercial 42% protein diets at 1.3% fresh body weight thrice daily for 6 months.



**Fig 3**.Length-weight relationship of *H. longifilis* reared under intensive culture conditions in fibre-glass tanks fed commercial 42% protein diets at 1.3% fresh body weight thrice daily for 6 months.



**Fig 4.** Length-weight relationship of *H. longifilis* reared under intensive culture conditions in earthen ponds fertilised with chicken droppings and hay, fed commercial 42% protein diets at 1.3% fresh body weight thrice daily for 6 months.



**Fig 5.** Length-weight relationship of *H. longifilis* reared under intensive culture conditions in earthen ponds fertilised with chicken droppings and hay, fed commercial 42% protein diets at 1.3% fresh body weight thrice daily for 6 months.



**Fig 6.** Length-weight relationship of *H. longifilis* reared under intensive culture conditions in earthen ponds fertilised with chicken droppings and hay, fed commercial 42% protein diets at 1.3% fresh body weight thrice daily for 6 months.

#### Discussion

The value of the variables "b" and "k" of culture fish can be useful tools in assessing the well-being, growth performance, and feed utilisation of fish in various culture systems and environments. The regression coefficient "b" shows that there was negative allometric growth pattern in the fish population in the tanks while the population in the earthen ponds exhibited positive allometry. The higher condition factor obtained for fish reared in tanks in comparison with fish reared in ponds indicates that fish in tanks may have grown shorter than fish in ponds. The fish in ponds fed at higher rates than fish in tanks, due to input from natural food, which explains the higher weight. Fish in ponds still grew longer notwithstanding, hence the apparent lower condition factor. This may have resulted from the restricted space in the higher stocking density of the tanks, in comparison with the low stocking density in earthen ponds. Condition factor "k" may thus be determined by both food and space availability. Comparison of condition between environments should take these two factors into consideration. The shorter body length of fish reared in tanks may profit aquaculture because of the resulting higher dress out percentage.

Abdullahi (2002) obtained "b" values between 2.5 and 3.44 for fishes from different marine water bodies. Srisuwantach et al. (1980) obtained values of (log W = -2.1692+3.0857 log L) indicating positive allometric growth in cultured *Clarias batrachus* (Linnaeus, 1758). Fafioye and Oluajo (2005) obtained similar results for *Chrysichthys nigradigitatus* (Lacepede, 1803) in Epe

lagoon. The condition factors obtained in this study fall into the range of 2.9-4.8 documented for mature freshwater fish by Bagenal and Tesch (1978).

### Conclusion

The length–weight relationship of *H. longifilis* reared in plastic tanks and earthen ponds at the Nigerian Institute for Oceanography and Marine Research (NIOMR) fish farm Ijoyi – Badore have a positive correlation (r = 0.99) in both plastic tanks and earthen ponds. Fish reared under high stocking density seem to have higher apparent condition factor "k" and exhibit negative allometry with "b" value less than 3, while fish reared under low stocking conditions have relatively lower condition factor and positive allometry, with "b" value more than 3.

#### 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 authors are grateful to Mr. M.A. Matanmi and Mr. A. B. Williams for statistical analysis and Dr P. E. Anyanwu for reviewing the manuscript. The assistance of the farm workers is highly appreciated. Thanks are also due to Mrs M.O. Ahmed, and Miss A.G. Osuji, for typing the manuscript.

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Received: 25/11/2011; Accepted: 12/02/2012 (MS11-89).