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ISSN: 2348-1927
CODEN(USA):

RESEARCH ARTICLE

Annals of Biological Sciences
2014, 2 (2):10-17

A study of length-weight relationship and condition factor of *Hepsetus odoe* (Bloch, 1794) from Amassoma flood plains

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ABSTRACT

A study of length-weight relationship and condition factor of Hepsetus odoe from Amassoma flood plains was studied for a period of six months (November – December, 2011 and January, 2012 for the dry season and May, June and July; 2012 for the Wet season).The Lowest frequency (1) was estimated for class marks 2.5cm and 62.5cm with 22.5g and 526.5g respectively. The modal frequency (52) was estimated for 32.5 class mark with 242.5g.The frequencies for the class marks: 8.5cm, 14.5cm, 20.5cm, 26.5cm, 38.5cm, 44.5cm, 50.5cm and 56.5cm with corresponding weight classes: 73.5g, 130.5g, 184.5g, 238.5g, 346.5g, 400.5g, 452.5g and 508.5g were 6, 10, 28, 46,36, 15, 7 and 3. Generally, the frequency distribution of Hepsetus odoe from Amassoma flood plains was binomial. The length weight regression equation was Log W = 0.977 + 3.16LogL with Correlation coefficient value of 0.850 and significance of correlation values of $P< 0.05, t = 29.2, df = 199$*.The "a" and "b" values were 0.977 and 3.16 respectively. The "r" value was positive (1.1). The condition index value range from 0.83 – 1.00 and the condition factor value was 0.94. Hepsetus odoe exhibited allometric growth. There was strong association between length and weight of Hepsetus odoe. Hepsetus odoe was in a good condition.*

Key words: *Hepsetus odoe*, growth parameters, flood plain, Niger delta, Nigeria.

INTRODUCTION

The African pike or Kafue pike *Hepsetus odoe* (Plate 1) is a predatory fish belonging to the kingdom: Animalia; Phylum: Chordata; Class: Actinopterygii; Order: Characiformes; Superfamily: Erythrinoidea and Genus: Hepsetus. It is an elongate fish with a pike-like body. This species can reach up to about 65 centimeters (26 in) SL. The Kafue pike inhabits tropical, freshwater lakes, coastal rivers, and swamps in Africa. It is widespread throughout central and west Africa, but is absent from the Nile river. The species prefers quiet and deep water, and may only live about five years. Kafue pike spawn in the summer. They are oviparous, and lay their eggs in a nest of floating foam, which they then guard. Fry and juveniles inhabit well-vegetated marginal habitats. The Kafue pike is a game fish. It also, on occasion, found as an aquarium fish, though its large size and piscivorous nature make it unsuitable for most aquarists.

It is a game fish and also, on occasion, found as an aquarium fish, though its large size and piscivorous nature make it unsuitable for most aquarists, but can be used in poly culture with *Tilapia guineensis* to check its overpopulation. *H. odoe* is the only member of the family. Yet, they are not highly regarded as commercially important fish [1]. They are however considered as biologically important, because of their role in the pelagic food chain [2] (Darcy,

1980), as a bait and limited aesthetic value as aquarium fishes. In Amassoma in particular and the Niger Delta at large, *H odoe* is commonly consumed and therefore commands a very high commercial value [3]. In addition to direct consumption, *H. odoe* is used as a component in feed formulation for the fishing and poultry industry as protein supplement.

Plate 1 ***Hepsetus odoe***
Source:htt://en.wikipedia.org/wiki/file:Hepsetus odoe_Odoe.jpg

The length-weight relationship of fish is an important fishery management tool. Its importance is pronounced in estimating the average weight at a given length group [4] and in assessing the relative well being of a fish population [5]. Consequently length-weight studies on fish are extensive. Notable among these are the reports of Shenouda *et al* (1994) for *Chrysichthys spp* from the southernmost part of the River Nile (Egypt) [6]; Alfred – Ockiya and Njoku (1995) for mullet in New Calabar River [7], Ahmed and Saha (1996) for carps in Lake Kapitel, Bangladash [8]; King (1996) for Nigeria fresh water fishes[9]; Hart (1997) for *Mugil cephalus* in Bonny Estuary[10] and Diri (2002) for *Tilapia guinensis* in Elechi creek[11].

The condition factor is an estimation of the general well being of fish [12]. It is based on the hypothesis that heavier individuals of a given length are in better condition than les weightier fish [13]. Condition factors have been used as an index of growth and feeding intensity. Abowei 2009a reported that condition factors of different populations of same species are indicative of food supply and timing and duration of breeding [14]. On the other hand, Pauly (1983) reported that the numerical magnitude of the condition factors can be influenced by factors such as: sex, age, and time of year, stage of maturity and stomach content of the organism [15]. Comparisons therefore could be meaningful if these factors are roughly equivalent among the samples to be compared [16]. The condition factor of a fish decrease with increase in length [17][18] and also influences the reproduction cycle in fish[19] (Abowei, 2009c). The length weight relationship of a fish is an important fishery management tool. Its importance is pronounced in estimating the average weight at a given length group [4] and in assessing the relative well-being of a fish population [5]. It is advantageous to use two measurable and convertible sizes of fish for estimating the condition factors.

Plate 1. Amassoma flood plain
Source:http://www.bing.com/images/search?q=Niger+flood+plain&qpvt=Niger+Delta+flood+plain

The Amassoma flood plain (Plate 1) is one of the numerous low land rivers in the Niger Delta (Fig. 1) with the most important drainage feature of the Niger Basin River system about 2% of the surface area of Nigeria. A floodplain is a broad, flat section of a valley floor filled with sand, gravel, and clay. Floodplains form when a river running along the valley floods and spills out of its channel. The river then deposits sediments as it flows over portions of the floodplain. Since floodplains are constructed of the material being carried by the river, they are composed of

relatively fine sediment. Most floodplains are composed of sand, silt, and clay, but floodplains of gravel occur where the water flows especially fast. As revealed in the sediments characteristics of the stations investigated, both the physical characteristics, the flora and fauna ecosystem were significantly affected by the flooding event, and this on further study and research is anticipated to have great effect on the local economy, especially as the primary occupation of most of the citizens in these settled areas are subsistence farming and fisheries.

The annual rainfall of the Niger Delta is between 2,000-3000mm per year [12]. The dry season lasts for four months from November to February with occasional rainfall. The Niger Delta region of Nigeria is bounded to the south by the Atlantic Ocean. This region, which is rich in biodiversity and organic mineral resources, has a coastline extending from the mouth of the Benin River in the west to the mouth of Imo River in the east and this spans about 500km. Since the early 1900s, this coastal region has been extensively used for navigation and port activities. The discovery of crude oil in commercial quantity in the region four decades ago further exacerbated developmental activities around the coast. Niger Delta is one of the world's largest wetlands covering an area of approximately 70, 000km^3.

Figure 1: The Niger Delta showing Niger River basin
Source:http://upload.wikimedia.org/Wikipedia/commons/9/9d/Niger_River_map.svg

The area is economically important and rich in biodiversity over 80% Federal Government revenue is located with the Niger Delta region. Mangrove swamps and flood plain border the river and it's' numerous creeks and all there are well exposed at low tides. Amassoma is the head quarters of Ogboin clan as well as Ogboin in the North Rural Development Authority in Southern Ijaw Local Government Area of Bayelsa State (Nigeria) and the host community to the Nigeria University (NDU), Wilberforce Island, Bayelsa State. Amassoma is located about 40km to the south of Yenegoa, the State capital with an altitude of 512m about sea level. It is bounded to the North by River Nun, West by Otuan and Wilberforce Island, East by Toru Ebeni and the South by Ogobiri. Amassoma has a diameter of about 6km East to West and approximately 2km North to South.

A study of length-weight relationship and condition factor of *Hepsetus odoe* from Amassoma flood plains in the Niger Delta, Nigeria, plains would provide information on the amount of stock available for the fishery [20], evaluation of production [9], information for stock sizes [21], an important information for the evaluation of mortalities and status of the fish population, estimating the average weight at a given length group [4], and an index of growth and feeding intensity[22]. An estimation of the size composition and condition factor of *Heptus odoe* from Amassoma flood plains, Niger Delta, Nigeria assess aspects of the fishery status will provide information on the amount of stock available for the fishery, evaluation of production, information for stock sizes, an important information for the evaluation of mortalities and status of the fish population, estimating the average weight at a given length group, and an index of growth and feeding intensity.

MATERIALS AND METHODS

Study area

The study was carried out in the Amassoma flood plains which receives water from the River Nun which bifurcates into the Nun and Forcados rivers about 20 miles (32 km) downstream from Aboh, the Nun flows through sparsely settled zones of freshwater and mangrove swamps and coastal sand ridges before completing its 100-mile (160-km) south-southwesterly course to the Gulf of Guinea, a wide inlet of the Atlantic Ocean, at Akassa.

River Nun is one of the numerous low land rivers in the Niger Delta with the most important drainage feature of the Niger Basin River system about 2% of the surface area of Nigeria. The annual rainfall of the Niger Delta is between 2,000-3000mm per year [12]. The dry season lasts for four months from November to February with occasional rainfall. The Niger Delta region of Nigeria is bounded to the south by the Atlantic Ocean. This region, which is rich in biodiversity and organic mineral resources, has a coastline extending from the mouth of the Benin River in the west to the mouth of Imo River in the east and this spans about 500km. Since the early 1900s, this coastal region has been extensively used for navigation and port activities. The discovery of crude oil in commercial quantity in the region four decades ago further exacerbated developmental activities around the coast.

The River Nun is situated between latitude $5^{0}01^{1}$ and $6^{0}17^{1}$E. The stretch of the river is a long and wide meander whose outer concave bank is relatively shallow with sandy point bars [23]. The depth and width of the river varies slightly at different points [24]. The minimum and maximum widths are 200 and 250 meters respectively. The river is subject to tidal influence in the dry season. Water flows rapidly in one direction during the flood (May to October). At the peak of the dry season, the direction is slightly reversed by the rising tide. At full tide the flow is almost stagnant. The riparian vegetation is composed of a tree canopy made up of *Raphia hokeri, Nitrogena sp, Costus afer, Bambosa vulgaris, Alchornia cordiffolla, Alstonia boonei, Antodesima sp* and submerged macrophytes which include: *Utricularia sp, Nymphea lotus, Lemna erecta, Cyclosorus sp, Commelia sp and Hyponea sp* [24].

Fin-fish Sample Collection

Fish specimens were obtained from fishers using gill nets, long lines, traps and stakes. Catches were isolated and conveyed in thermos cool boxes to the laboratory. Fish families were identified using monographs, descriptions checklist and keys[25-35]. The total length (TL) of the fish was measured from the tip of the anterior or part of the base of the pectoral fin to the caudal fin using meter rule calibrated in centimetre. Fish were measured to the nearest centimetre. Fish weight was measured after blot drying with a piece of clean hand towel. Weight was done with a table top weighing balance, to the nearest gram. The length measurements were converted into length frequencies with constant class intervals of 2cm. The mean lengths and weights of the classes were used for data analysis, the format accepted by FISAT [36]. The relationship between the length (h) and weight (w) of fish was expressed by the equation.

$$W = al^{b} \quad (1)$$

Where:

W	=	weight of fish in (g)
L	=	total length (TL) of fish in (cm)
a	=	constant (intercept)
b	=	the length exponent (slope)

The “a” and “b” values are obtained from a linear regression of the length and weight of fish. The correlation (r^2) that is the degree of association between the length and weight was computed from the linear regression analysis.

$$R = r^{2} \quad (2)$$

The values of a and b were given a logarithm transformation according to the following formular

$$\log W = \log a + b\log L \text{ [15].} \quad (3)$$

The intercept “a” in the formular was estimated with the formular:

$$a = \left[\frac{\sum y}{n} - \frac{(b \sum x)}{n} \right] \quad (4)$$

Or logarithm transformed as:

$$a = \left[\frac{\sum \log W^{y}}{n} - \frac{b \sum \log W^{x}}{n} \right] \quad (5)$$

While the slope "b" was estimated by the formular

$$b = \frac{\sum xg}{\sum x^2} - \frac{(\sum x)(\sum y)}{\frac{n}{\frac{(\sum x)^2}{n}}} \quad (6)$$

$$or\ b = \frac{n \sum xy}{n \sum x^2} - \frac{(\sum x)(\sum y)}{(\sum x)^2} \quad (7)$$

or log transformed as:

$$b = \frac{n \sum \log x - \log_{10} Y - (\sum \log_{10})(\sum \log_{10} Y)}{n \sum \log_{10} x^2 - \sum \log_{10} (x)} \quad (8)$$

Where
X = Length of fish
Y = Weight of fish
N = Number of fish (sample size)

The correlation i.e. the degree of association between the variables were determined by computing the correlation co-efficient (r) using the relationship.

The condition factor of the experimental fish was estimated from the relationship

$$K = \frac{100}{L^3} \quad (9)$$

Where:
K = Condition factor
W = Weight of fish
L = Length of fish (cm)

RESULTS

Table 1 shows the Length and frequency distribution of *Hepsetus odoe* from Amassoma flood plains. The Lowest frequency (1) was estimated for class marks 2.5cm and 62.5cm with 22.5g and 526.5g respectively. The modal frequency (52) was estimated for 32.5 class mark with 242.5g.The frequencies for the class marks: 8.5cm, 14.5cm, 20.5cm, 26.5cm, 38.5cm, 44.5cm, 50.5cm and 56.5cm with corresponding weight classes: 73.5g, 130.5g, 184.5g, 238.5g, 346.5g, 400.5g, 452.5g and 508.5g were 6, 10, 28, 46,36, 15, 7 and 3. Generally, the frequency distribution of *Hepsetus odoe* from Amassoma flood plains was binomial.

Table 1 Length and weight frequency distribution of *Hepsetus odoe* from Amassoma flood plains

SL RANGE(cm)	SL CLASS MARK(CM)	WT CLASS RANGE(G)	WT MARK(G)	FREQUENCY
0.0 – 05.0	2.5	0.0 – 45	22.5	1
06.0 – 11.0	8.5	48 – 99	73.5	6
12 .0 – 17.0	14.5	108 – 153	130.5	10
18.0 – 23. 0	20.5	162 – 207	184.5	28
24. 0 - 29.0	26.5	216 – 261	238.5	46
30.0 – 35.0	32.5	270 – 315	242.5	52
36.0 – 41.0	38.5	324 - 369	346.5	36
42.0 – 47.0	44.5	378 - 423	400.5	15
48.0 – 53.0	50.5	432 – 473	452.5	7
54.0 – 59.0	56.5	486 – 531	508.5	3
60.0 – 65.0	62.5	540 – 585	562.5	1

Table 2 and 3 show the Length weight relationships and regression analysis values of *Hepsetus odoe* from Amassoma flood plains. The length weight regression equation was Log W = 0.977 + 3.16LogL with Correlation coefficient value of 0.850 and Significance of correlation values of $P< 0.05, t = 29.2, df = 199$.The "a" and "b" values were 0.977 and 3.16 respectively. The "r" value was positive (1.1). Table 4 shows the condition factors values of *Hepsetus odoe* from Amassoma flood plains. The condition index value range from 0.83 – 1.00 and the condition factor value was 0.94.

Table 2. Length weight relationships of *Hepsetus odoe* from Amassoma flood plains

S/no	Fish species	No	Length - weight relationship	Correlation coefficient	Significance of correlation
1	*Hepsetus odoe*	200	Log W = 0.977 + 3.16LogL	0.850	$P< 0.05, t = 29.2, df = 199$

Table 3. Regression analysis values of *Hepsetus odoe* from Amassoma flood plains

s/no	Species	a-value	b-value	r-value
1	*Hepsetus odoe*	0.977	3.16	1.1

Table 4. The condition factors of *Hepsetus odoe* from Amassoma flood plains

s/no	Species	Condition index value	Condition factor
1	*Hepsetus odoe*	0.83 - 1.00	0.94

DISCUSSION

The maximum size attained by *H. odoe* in this study varied with those of other reported [27]. It had however been shown that the maximum size attainable in fishes generally is location specific [37]. Sampling season is very important and determines the size of fish caught [38]. Another reason for the variation of fish size may either be genetic or environmental [24]. They attributed the differences to fishing pressure and environmental pollution in the freshwater reaches of the lower River. The length exponent "b" = 3.17 *H.odoe* showed growth was allometric based on Bagenal and Tesch (1978) with the criteria of "b" = 3 [13]. The length weight relationship is cuvililinear with the exponent ranging from 2.5 to 4.0. Growth is isometric when the length exponent is less than or equal to 3 and allometric when length exponent is greater than 3 [13]. Values of Length exponent in the length weight relationship of the fish studied increased in weight faster than the cube of its total length. Several other authors have reported allometric growths for other species of fish for different water bodies [37][39][40].

The high correlation coefficient "r" =1.1 obtained in this study showed that there was strong association between length and weight. This means that as the length of the fish increases, the weight also increases in the same proportion. High correlation coefficient "b" values have also been reported by different author in various fish species from different water bodies [41][37][39][40]. The correlation coefficient "r" values were positive for *H.odoe*. This means that there was a positive correlation between length and weight of *H.odoe* from Amassoma flood plain.

The condition factor value "k" = 0.94 estimated in this study compared favourably with other reports from similar studies in similar water bodies. Condition factors of different species of cichlid fishes have been reported [42][17][21][43][44][45][46]. Condition factors reported for some other species include: Alfred – Ockiya (2000) for

Chana chana in fresh water swamps of Niger Delta [38] and Hart (1997) for *Mugil cephalus* in Bonny estuary [10]. From a sample size of 81 specimens, K value was 0.999 and the exponential equation was $W_t == 0.05998\ (TL)^{2\ 719}$, indicating an isometric growth pattern. There was no temporal variation in the condition of the fish with condition index value 0.83- 1.00 and condition factor value of 0.94 is an indication of the fish species good condition. Although no study was carried out on the physical and chemical parameter to confirm this, Bagenal and Tesch (1978) reported that if the condition factor "k"≥ 0.5, the fish is in a good condition [13].

CONCLUSION

- *Hepsetus odoe* exhibited allometric growth
- There was strong association between length and weight of *Hepsetus odoe*
- *Hepsetus odoe* was in a good condition

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