The Length-weight relationship and condition factor of Chrysichthys nigrodigitatus (Lacepède, 1803) from Amassoma River flood plains.

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Key words

- Fin-fish
- Growth parameters
- Condition
- Wetland
- Niger delta
- Nigeria

Abstract

The length-weight relationship and condition factor of Chrysichthys nigrodigitatus from Amassoma flood plains from a data obtained 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 (2) was estimated for class mark 56.5cm with 452.0g. The modal frequency (56) was estimated for 20.5 class mark with 164.0g. The frequencies for the class marks: 2.5cm, 8.5cm, 14.5cm, 26.5cm, 32.5cm and 38.5cm, 44.5cm and 50.5cm with corresponding weight classes: 20.0g, 68.0g, 104.0g, 212.0g, 260.0g, 308.0g, 356.0 and 404.0 were 5, 16, 36, 46, 12, 13, 10 and 4 respectively. Generally, the frequency distribution of Chrysichthys nigrodigitatus from Amassoma flood plains was binomial. The length weight regression equation was Log \ W = 0.00471 + 3.21LogL 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 0.00471 and 3.21 respectively. The “r” value was positive (1.01). The condition index value range from 0.97 – 1.00 and the condition factor value was 0.99. Chrysichthys nigrodigitatus exhibited isometric growth. There was strong association between length and weight of the fish which was in a good condition.

Introduction

Chrysichthys nigrodigitatus (Plate 1) belongs to the family Claroteidae. C. nigrodigitatus is highly commercial and marketed fresh, smoked or dried. Apart from being a cheap source of highly nutritive protein, it also contains other essential nutrients required by the body (Abowei and Hart, 2008). Other essential nutrients it has is omega 3 fatty acid, which our body does not make significant amount of, thereby providing a number of health benefits in maintaining cardiovascular health and reduction in tissue inflammation (Abowei and Hart, 2009). The Fish can be used for aquaculture gamefish and in public aquariums. It is a demersal, potamodromous species. It occurs in shallow waters of lakes (less than 4 m), over mud and fine sand bottom, in rivers and in swamps. It is an omnivorous fish that feeds on seeds, insects, bivalves and detritus (Reed et al. 1967). Feeding becomes specialized with age and size; larger fish may feed on decapods and fish.

C nigrodigitatus occurs in shallow waters of lakes (less than 4 m), over mud and fine sand bottom. Omnivorous, feeds on seeds, insects, bivalves and detritus. Feeding becomes specialized with age and size, larger fish may feed on decapods and fish. It is basically a food fish in its native African waters where it can grow to excess of 50cm (18”). Its upitimum and pH range are 23-26°C (73-79°F) and 6.0-7.2 respectively. Its Synonyms are Pimelodus nigrodigitatus, Arius acutivelis, Melanodactylus nigrodigitatus, Chrysichthys acutirostris, C. büttkoferi, C.ogowensis, C.macrops, C. coriscanus and C.lagoensis. The males when fully grown usually have a broader head which they use to dig out their breeding nests in their native habitat. Its flesh is reported to be quite good and they are fished out of Lake Togo using all types of capture methods including nets and weirs. Aquarium care: Peaceful as youngsters but not to be trusted as they grow with smaller fish. Adults occur in shallow waters of lakes (less than 4 m), over mud and fine sand bottom. Omnivorous, feed on seeds, insects, bivalves and detritus. Feeding becomes specialized with age and size; larger fish may feed on decapods and fish.
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 (Beyer, 1987) and in assessing the relative well being of a fish population (Bolger and Connolly, 1989). Consequently length-weight studies on fish are extensive. Notable among these are the reports of Shenouda et al (1994) for Chrysichthys spp from the southern most part of the River Nile (Egypt); Alfred – Ockiya and Njoku (1995) for mullet in New Calabar River, Ahmed and Saha (1996) for carps in lake kapitel, Bangladesh; King (1996) for Nigeria fresh water fishes; Hart (1997) for Mugil cephalus in Bonny Estuarity and Diri (2002) for Tilapia guinensis in Elechi creek.

The condition factor is an estimation of the general well being of fish (Abowei, 2006). It is based on the hypothesis that heavier individuals of a given length are in better condition than les weightier fish. (Bagenal and Tesh 1978). Condition factors have been used as an index of growth and feeding intensity. (Abowei 2009a) posted that condition factors of different populations of same species is indicative of food supply and timing and duration of breeding. Pauly (1983) reported that the numerical magnitude of the condition factors can be influenced by factors such as:

- Sex
- Age
- Time of year
- Stage of maturity
- Stomach content of the organism

Comparisons therefore could be meaningful if these factors are roughly equivalent among the samples to be compared (Abowei, 2009b). The condition factor of a fish decrease will increase in length (Bakare 1970, Fagade 1979) and also influences the reproduction cycle in fish (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. (Beyer, 1987) and is assessing the relative well-being of a fish population (Bolger and Connolly, 1989). It is advantageous to use two measurable and convertible sizes of fish for estimating the condition factors.

The flood plain of Amassoma is one of the low lands in Niger Delta providing nursery and breeding grounds for variety of both finfish and shell fish species. The Amassoma flood plains receive water from the Nun River. The Nun River is one of the most important river systems in the Niger Delta providing nursery and breeding grounds for a large variety of fish. Fishing in the river is intensified and catch per unit effort is low. Consequent upon speedy industrialization and other human activities, the river is fast becoming degraded. Fishing is carried out indiscriminately with various traditional and modern fishing gears (Sikoki et al; 1999).

Accurate fisheries statistics in Amassoma flood plains; and its adjoining flood plains is vital for the formulation of a sound fisheries management programme in the Nun River and similar flood plains water bodies. Several studies have been carried out: Scott, 1966; Reed et al (1967); Otobo (1991); Ssentengo and Welcome (1985); FAO (1994); Otobo (1993); Ita and Medahili (1997) and Sikoki and Ototobekere (1999); Ezekiel et al (2002); Abowei and Ezekiel (2003); Abowei et al.(2007); Abowei and Hart (2007); Abowei et al (2008); Abowei and Hart (2008) and Abowei and Hart (2009), for different water bodies, there are no reliable data on the Fin- fish species distribution, abundance and seasonality. Length - weight relationships and condition factors of C senegalensis from Amassoma flood plains. This is essential for formulation of development plan in the fishing industry, Amassoma flood plains, and Nun River and Similar water bodies.

**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 (Abowei, 2006). 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°01’1 and 6°17’1E. The stretch of the river is a long and wide meander whose outer concave bank is relatively shallow with sandy point bars (Otobo, 1993). The depth and width of the river varies slightly at different points (Sikoki et al; 1998). 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, Nymphaea lotus, Lemna erecta, Cyclosorus sp, Commelia sp and Hyponea sp (Sikoki et al 1998).

The Amassoma flood plains 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 (Fig. 2). 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 (Abowei, 2006). 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 70,000km².

The area is economically important and rich in biodiversity over 80% Federal Government revenue is located with the Niger Delta region. The 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 (Fig.3).
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 (Daget, 1954; Boeseman, 1963; Reed et al; 1967; Holden and Reed 1972; Poll, 1974; Whyte, 1975; Jiri, 1976, Reed and Sydenhan, 1978, Alfred-Ockya, 1983; Whitehead, 1984 and Loveque et al, 1991). 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 metre 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 (Gayanilo and Pauly, 1997). The relationship between the length (l) and weight (w) of fish was expressed by the equation.

\[ W = al^b \]

(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.

\[ R = r^2 \]

(2)

The values of \( a \) and \( b \) were given a logarithm transformation according to the following formular.

\[ \log W = \log a + b \log L \] (Pauly, 1983)

(3)

The intercept “a” in the formular was estimated with the formular:
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\[
a = \left[ \frac{\sum y}{n} - \left( \frac{b \sum x}{n} \right) \right]
\]

Or logarithm transformed as:
\[
a = \left[ \frac{\sum \log W^y}{n} - \left( \frac{b \sum \log W^x}{n} \right) \right]
\]

While the slope “b” was estimated by the formular
\[
b = \frac{\sum xy}{\sum x^2} - \left( \frac{\sum x}{n} \right) \left( \frac{\sum y}{n} \right)
\]

or
\[
b = \frac{n \sum xy - (\sum x)(\sum y)}{n \sum x^2 - (\sum x)^2}
\]

or log transformed as:
\[
b = \frac{n \sum \log x - \log_{10} Y - (\sum \log_{10} x)(\sum \log_{10} y)}{n \sum \log_{10} x^2 - \sum \log_{10} \left( x \right)}
\]

Where
\[
X = \text{Length of fish}
\]
\[
Y = \text{Weight of fish}
\]
\[
N = \text{Number of fish (sample size)}
\]

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
\[
K = \frac{100}{L^3}
\]

Where:
\[
K = \text{Condition factor}
\]
\[
W = \text{Weight of fish}
\]
\[
L = \text{Length of fish (cm)}
\]

Results

Table 1 shows the Length and frequency distribution of Chrysichthys nigrodigitatus from Amassoma flood plains. The Lowest frequency (2) was estimated for class mark 56.5cm with 452.0g. The modal frequency (56) was estimated for 20.5 class mark with 164.0g. The frequencies for the class marks: 2.5cm, 8.5cm, 14.5cm, 26.5cm, 32.5cm and 38.5cm, 44.5cm and 50.5cm with corresponding weight classes: 20.0g, 68.0g, 104.0g, 212.0g, 260.0g, 308.0g, 356.0 and 404.0 were 5, 16, 36, 46, 12, 13, 10 and 4 respectively. Generally, the frequency distribution of Chrysichthys nigrodigitatus from Amassoma flood plains was binomial.

<table>
<thead>
<tr>
<th>SL CLASS RANGE(cm)</th>
<th>SL CLASS MARK(CM)</th>
<th>WT CLASS RANGE(G)</th>
<th>WT CLASS MARK(G)</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 – 05.0</td>
<td>2.5</td>
<td>0.0 – 40</td>
<td>20.0</td>
<td>5</td>
</tr>
<tr>
<td>06.0 – 11.0</td>
<td>8.5</td>
<td>48 – 88</td>
<td>68.0</td>
<td>16</td>
</tr>
<tr>
<td>12.0 – 17.0</td>
<td>14.5</td>
<td>72 – 136</td>
<td>104.0</td>
<td>30</td>
</tr>
<tr>
<td>18.0 – 23.0</td>
<td>20.5</td>
<td>144 – 184</td>
<td>164.0</td>
<td>56</td>
</tr>
<tr>
<td>24.0 – 29.0</td>
<td>26.5</td>
<td>192 – 232</td>
<td>212.0</td>
<td>46</td>
</tr>
<tr>
<td>30.0 – 35.0</td>
<td>32.5</td>
<td>240 – 280</td>
<td>260.0</td>
<td>12</td>
</tr>
<tr>
<td>36.0 – 41.0</td>
<td>38.5</td>
<td>288 – 328</td>
<td>308.0</td>
<td>13</td>
</tr>
<tr>
<td>42.0 – 47.0</td>
<td>44.5</td>
<td>336 – 376</td>
<td>356.0</td>
<td>10</td>
</tr>
<tr>
<td>48.0 – 53.0</td>
<td>50.5</td>
<td>384 – 424</td>
<td>404.0</td>
<td>4</td>
</tr>
<tr>
<td>54.0 – 59.0</td>
<td>56.5</td>
<td>432 – 472</td>
<td>452.0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>200</td>
</tr>
</tbody>
</table>

Table 1. Length and weight frequency distribution of Chrysichthys nigrodigitatus from Amassoma flood plains
Table 2 and 3 show the length weight relationships and regression analysis values of *Chrysichthys nigrodigitatus* from Amassoma flood plains. The length weight regression equation was $\log W = 0.00471 + 3.21 \log L$ 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 0.00471 and 3.21 respectively. The “r” value was positive (1.01). The condition factor value ranged from 0.97 – 1.00 and the condition factor value was 0.99.

### Table 2. Length weight relationships of *Chrysichthys nigrodigitatus* from Amassoma flood plains

<table>
<thead>
<tr>
<th>S/no</th>
<th>Fish species</th>
<th>No</th>
<th>Length - weight relationship</th>
<th>Correlation coefficient</th>
<th>Significance of correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Chrysichthys nigrodigitatus</em></td>
<td>200</td>
<td>$\log W = 0.00471 + 3.21 \log L$</td>
<td>0.960</td>
<td>$P &lt; 0.005, \alpha = 0.05$</td>
</tr>
</tbody>
</table>

### Table 3. Regression analysis values of *Chrysichthys nigrodigitatus* from Amassoma flood plains

<table>
<thead>
<tr>
<th>s/no</th>
<th>Species</th>
<th>a-value</th>
<th>b-value</th>
<th>r-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Chrysichthys nigrodigitatus</em></td>
<td>0.00471</td>
<td>3.21</td>
<td>1.01</td>
</tr>
</tbody>
</table>

### Table 4. The condition factors of *Chrysichthys nigrodigitatus* from Amassoma flood plains

<table>
<thead>
<tr>
<th>s/no</th>
<th>Species</th>
<th>Condition index value</th>
<th>Condition factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Chrysichthys nigrodigitatus</em></td>
<td>0.97 - 1.00</td>
<td>0.99</td>
</tr>
</tbody>
</table>

**Discussion**

The maximum size attained by *Chrysichthys nigrodigitatus* in this study varied with those of other reported by Reed et al 1967. It had however been shown that the maximum size attainable in fishes generally is location specific (King, 1994). Sampling season is very important and determines the size of fish caught (Alfred-Ockiya, 2000). Another reason for the variation of fish size may either be genetic or environmental (Sikoki et al 1998). They attributed the differences to fishing pressure and environmental pollution in the freshwater reaches of the lower river.

The length exponent “b” = 3.21 *Chrysichthys nigrodigitatus* showed growth was allometric based on Bagenal and Tesch (1978) with the criteria of “b” = 3. The length weight relationship is curvilinear 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 (Bagenal and Tesch, 1978). Values of Length exponent in the length weight relationship of he 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 (King, 1994; Valantine, 1995).

The high correlation coefficient “r” =1.01 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 (Ginah, 2007, King, 1994; Valantine, 1995; The correlation coefficient “r” values was positive for *Chrysichthys nigrodigitatus*. This means that there was a positive correlation between length and weight of *Chrysichthys nigrodigitatus* from Amassoma flood plain.

The condition factor value “k” = 0.99 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 by Siddique, 1977; Fagade, 1978, 1979, 1983; Dadze and Wangila, 1980; Arawomo, 1982 and Oni et. al; 1983. Condition factors reported for some other species include: Alfred – Ockiya (2000) for Chana chana in fresh water swamps of Niger Delta and Hart (1997) for Mugil cephalus in bonny estuary. From a sample size of 81 specimens, K value was 0.999 and the exponential equation was $W_i = 0.05998 (TL)^{2.719}$, indicating an isometric growth pattern. There was no temporal variation in the condition of the fish with condition index value 0.97- 1.00 and condition factor value of 0.99 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” $\geq 0.5$, the fish is in a good condition.

**Conclusion**

*Chrysichthys nigrodigitatus* exhibited isometric growth

There was strong association between length and weight of *Chrysichthys nigrodigitatus* *Chrysichthys nigrodigitatus* was in a good condition

**References**


Diri MS. 2002. Length-weight relationship of Sarotherodon melanotheron and Tilapia guineensis in Elechi creek, Niger Delta, Nigeria. B.Sc Project. Rivers State University of Science and Technology, Port Harcourt. 22pp


Sardinella madernensis (Jenyns, 1842) from Nkoro River, Niger Delta, Nigeria. Advanced Journal of Food Science and Technology 1(1):65 - 70


Shenouder TS, Faten FA, Mohamoud MR, Rayazg AB. 1994; A detail study on the age


vol. 1 Musee Royale de. 1 afrique Centrale Tervurem, Belgique, Editions de L Ostrom. 384pp.
