Length-Weight Relationship and Condition Factor of *Chrysichthys nigrodigitatus* (Lacepede: 1803) of Ebonyi River, South Eastern Nigeria

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Citation

Abstract
The study of length-weight relationship and condition factor of *Chrysichthys nigrodigitatus* (Lacepede: 1803) (Siluriformes; Bagridae) in Ebonyi River, South eastern Nigeria was carried out from September to November 2012. The FAO ICLARM Stock Assessment Tool (FiSAT II software) was implored for the mathematical and statistical analyses. A total number of sixty five (65) specimen of *C. nigrodigitatus* were sampled. Highest total length and weight of 29cm and 157g were recorded in the month of September. The exponential form of equation obtained was LogW = -0.3093+1.586 Log L. The value of the co-efficient of correlation (r = 0.930) estimated was high. The exponent (b) value indicated negative allometric growth. Total length class condition factor values of *C. nigrodigitatus* revealed that total length class (12-14) had the highest value (1.74) while class (14-18 and 28-30) had the lowest mean condition factor value(0.58). The highest condition of total weight was observed from class (33-48) with the maximum value of 1.74 and lowest mean value of 0.58 which is in class (48-78 and 153-168). Condition factor values indicated that the species are in good condition.

1. Introduction

Bagrid fishes of the genus Chrysichthys are widely distributed in freshwater system of tropical Africa, within latitudes 25% N and S, between tanzania in the east and Senegal in the west (Akinsanya et al., 2007). Over 40 species of Chrysichthys has been described, although there are some problems in their taxonomy and systematic. The silver catfish, *Chrysichthys* (Lacepede) occurs in most of the major rivers in Africa including Nigeria, Senegal etc (Ezenwa, 2003). They are highly valued food fish in this native Africa waters and are among the dominant fishers of commercial catches. Knowledge of the biology of chrysichthys is important for its management and sustainable utilization of their stock. They support thriving commercial fisheries of many West Africa waters such as the river Niger / Benue system (Fafioye and Oluajo, 2005). Apart from its importance in the capture fisheries, Chrysichthys is increasingly attracting attention as a potentially culturable fish in west Africa. Chrysichthys species are important resources in the aquatic system of tropical Africa. Bagrid is also widely known as one of the Asia catfish and their largest family is the family of bagridae and more species of this family are available in the hobby than any other asian catfish family. This family of bagrid can be found throughout all Asia, Africa and middle east (Fafioye and Oluajo, 2005). Fish size, length- weight relations help prediction of potential yield and determination of size at
capture for obtaining optimum yield, as there management parameters are directly related to weight of fish. The relation is also useful in differentiating populations as variations occurs in population of different localities. Condition factor (k) Chrysichthys species also provides information when comparing two populations of fish living in certain feeding density, climatic and other conditions (Idodo-umeh, 2002). Thus, condition factor is important in understanding the life cycle of fish species and it also contribute to adequate management of the species, hence maintaining the equilibrium in the ecosystem. This study aimed at length-weight relationship and condition factor of Chrysichthys species in Ebonyi River.

2. Materials and Methods

2.1. Study Area

The study area is the lower course of the river basin located at Onu Ebonyi Igbegu in Izzi Local Government Area of Ebonyi State. Its geographical coordinates are 6° 20' 0" North, 8° 06' 0" East. It is about 2km away from Abakaliki main town. The vegetation around the river is predominately grasses, tall trees and palm trees. Hence, the vegetation and ecological build-up of the area attract some activities such as fishing farming activities etc. There is a market called Iboko market where some of the fishes are marketed immediately they are caught. However, in most cases fishes are transported to other parts of Ebonyi State. The major Agricultural activities going on around the Ebonyi river are fishing and farming of rice, cassava, maize, yam, melon, groundnut etc during the wet season. There is also water fluctuation in the river basin with season which goes a long way to determine the agricultural activities of the inhabitants during each period. During the dry season i.e (November – march) some areas of the river floor is seen and covered with sands, thereby fishing activities will be abounded and most fisherman would change over to another agricultural activity. But during the raining season (April-October), water level will increase and reverses the activities of the people. Fishing operations in the river is by the use of locally available crafts and gears, mainly canoes, gill, lift nets, hooks and lines, etc.

Fig. 1. Map of Ebonyi river.
2.2. Sample and Data Collection

Random samples of the catch of the commercial artisinal fishers were obtained for the three species of *Chrysichthys*. A total of sixty five (65) samples of *C. nigrodigitatus* were collected using locally available crafts and fish gears which includes canoes, cast-nets, gill nets and lines. Samples were sorted and identified to species level using the guides of Olaosebikan and Raji (1998). The species samples were preserved in absolute ethanol as voucher specimens. Total length (TL) was measured to the nearest 0.1cm with a meter rule measuring board. Total weight measurements were made using a FEJ-1500A electronic compact weighing balance to the nearest 0.1g.

2.3. Morphometric Parameters

The relationship between length and weight was determined using the power curve:

\[ W = aTL^b \]  

(Sparre and Venema, 1998).

Where

- \( W \) = Body weight in grams
- \( TL \) = Total length (cm)
- \( b \) = Slope of the regression line (regression constant).
- \( a \) = Intercept of the regression with the y - axis (regression coefficient).

Regression analysis was used in the estimation of the `a` and `b` values and the level of significance of the value of co-efficient of correlation(r) in FiSAT II.

2.4. Condition Factor (CF)

Fulton’s condition factor was computed according to Ricker (1975) is \( K = 100W/ L^3 \)

3. Results

A total of sixty five species of *C. nigrodigitatus* was collected from Ebonyi River which is composed of 13 fish for the month of September, 26 fish from the month of October and November, all are from the family of Claroteidae. Highest total length of 29cm was recorded from the month of September (Table 1). The specie also recorded highest weight more than the other two month from the month of September with (157g) (Table 1).

<table>
<thead>
<tr>
<th>Month</th>
<th>No of fish</th>
<th>Highest Length (cm)</th>
<th>Highest weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>September</td>
<td>13</td>
<td>29 (cm)</td>
<td>157 g</td>
</tr>
<tr>
<td>October</td>
<td>26</td>
<td>22.5 (cm)</td>
<td>112 (g)</td>
</tr>
<tr>
<td>November</td>
<td>26</td>
<td>20.3 (cm)</td>
<td>79 (g)</td>
</tr>
</tbody>
</table>

The length-weight relationship for the samples ranging in size from 10.8 cm to 29.0cm TL was estimated. The exponential form of equation obtained was \( W = 0.49 TL^{1.586} \) (Fig. 2). The value of the co-efficient of correlation \( r = 0.930 \) estimated was high. The exponent \( b \) value indicated negative allometric growth.

![Fig. 2. Length-Weight relationship of C. nigrodigitatus of Ebonyi river](image)

The overall monthly condition factor values in the respective abundance of the *C. nigrodigitatus* in Ebonyi River indicate an increase in the condition factor of the total length of fish caught from the month of September to November which had the maximum condition factor of 1.74. (Table 2)

<table>
<thead>
<tr>
<th>Month</th>
<th>Highest K</th>
<th>Lowest K</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>September</td>
<td>0.93</td>
<td>0.59</td>
<td>0.71</td>
</tr>
<tr>
<td>October</td>
<td>1.24</td>
<td>0.58</td>
<td>0.83</td>
</tr>
<tr>
<td>November</td>
<td>1.74</td>
<td>0.58</td>
<td>1.22</td>
</tr>
</tbody>
</table>

Total length class condition factor values of *C. nigrodigitatus* revealed that total length class (12-14) had the highest value while class (14-18 and 28-30) had the lowest mean condition factor value (Table 3).

<table>
<thead>
<tr>
<th>Class length</th>
<th>Highest k</th>
<th>Lowest k</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-12</td>
<td>1.67</td>
<td>0.78</td>
<td>1.23</td>
</tr>
<tr>
<td>12-14</td>
<td>1.74</td>
<td>0.79</td>
<td>0.86</td>
</tr>
<tr>
<td>14-16</td>
<td>1.03</td>
<td>0.58</td>
<td>0.74</td>
</tr>
<tr>
<td>16-18</td>
<td>1.09</td>
<td>0.58</td>
<td>0.69</td>
</tr>
<tr>
<td>18-20</td>
<td>1.24</td>
<td>0.59</td>
<td>0.78</td>
</tr>
<tr>
<td>20-22</td>
<td>0.99</td>
<td>0.63</td>
<td>0.84</td>
</tr>
<tr>
<td>22-24</td>
<td>0.74</td>
<td>0.60</td>
<td>0.72</td>
</tr>
<tr>
<td>24-26</td>
<td>0.63</td>
<td>0.61</td>
<td>0.62</td>
</tr>
<tr>
<td>26-28</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>28-30</td>
<td>0.64</td>
<td>0.58</td>
<td>0.61</td>
</tr>
</tbody>
</table>

The fork length class condition factor of *C. nigrodigitatus* recorded the highest condition factor in class (8-10) with the highest value of 1.74 and also record the lowest mean value of 0.58 which fall in the class of 18-20. (Table 4)
The highest head-length class condition factor of the specie \( C. \ nigrodigitatus \) was recorded in class (2-4) with value 1.74 and had the lowest mean value of 0.58 which is in class (8-10) (Table 5).

<table>
<thead>
<tr>
<th>Class length</th>
<th>Highest k</th>
<th>Lowest k</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-4</td>
<td>1.74</td>
<td>0.78</td>
<td>1.23</td>
</tr>
<tr>
<td>4-6</td>
<td>1.07</td>
<td>0.73</td>
<td>0.93</td>
</tr>
<tr>
<td>6-8</td>
<td>1.31</td>
<td>1.02</td>
<td>1.18</td>
</tr>
<tr>
<td>8-10</td>
<td>1.55</td>
<td>0.58</td>
<td>0.93</td>
</tr>
</tbody>
</table>

The highest standard length class condition factor was recorded in class (8-10) with the value 1.74 and lowest mean value of 0.58 was recorded in class (12-14 and 22-24) (Table 6).

<table>
<thead>
<tr>
<th>Class length</th>
<th>Highest k</th>
<th>Lowest k</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-10</td>
<td>1.74</td>
<td>0.78</td>
<td>1.23</td>
</tr>
<tr>
<td>10-12</td>
<td>1.14</td>
<td>0.98</td>
<td>1.00</td>
</tr>
<tr>
<td>12-14</td>
<td>1.20</td>
<td>0.58</td>
<td>0.98</td>
</tr>
<tr>
<td>16-18</td>
<td>1.57</td>
<td>1.12</td>
<td>1.29</td>
</tr>
<tr>
<td>18-20</td>
<td>1.18</td>
<td>0.88</td>
<td>1.12</td>
</tr>
<tr>
<td>22-24</td>
<td>1.23</td>
<td>0.58</td>
<td>0.96</td>
</tr>
</tbody>
</table>

The highest condition of total weight was observed from class (33-48) with the maximum value of 1.74 and lowest mean value of 0.58 which is in class (48-78 and 153-168) (Table 7).

<table>
<thead>
<tr>
<th>Class length</th>
<th>Highest k</th>
<th>Lowest k</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-33</td>
<td>1.67</td>
<td>0.78</td>
<td>1.23</td>
</tr>
<tr>
<td>33-48</td>
<td>1.74</td>
<td>0.79</td>
<td>0.86</td>
</tr>
<tr>
<td>48-63</td>
<td>1.03</td>
<td>0.58</td>
<td>0.74</td>
</tr>
<tr>
<td>63-78</td>
<td>1.09</td>
<td>0.58</td>
<td>0.69</td>
</tr>
<tr>
<td>78-93</td>
<td>1.24</td>
<td>0.59</td>
<td>0.78</td>
</tr>
<tr>
<td>93-108</td>
<td>0.99</td>
<td>0.63</td>
<td>0.84</td>
</tr>
<tr>
<td>108-123</td>
<td>0.74</td>
<td>0.60</td>
<td>0.72</td>
</tr>
<tr>
<td>123-138</td>
<td>0.63</td>
<td>0.61</td>
<td>0.62</td>
</tr>
<tr>
<td>138-153</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>153-168</td>
<td>0.64</td>
<td>0.58</td>
<td>0.61</td>
</tr>
</tbody>
</table>

4. Discussion

This study demonstrated that the percentage distribution of \( C. \ nigrodigitatus \) specie from Ebonyi River varied considerably with the fish caught within the months. Largest sampled fish had length of 29.0cm and weight of 157g while smallest fish sampled had length and weight of 10.2 and 18.1g respectively indicating a well sampled population due to the size range. Maximum size encountered in this study varied with those reported by Reed et al. (1967). Accordig to King (1994) maximum size attainable in fishes are generally location specific. Sampling season and techniques, genetic and environmental variations are important and contributes to the differences in size of fish sampled (Sikoki et al., 1998). Length-weight relationship \( 'b' \) value of this study indicate a negative allometric growth pattern (1.586), an indication that fish are lighter than their body lengths (Wooten, 1998) which implies poor growths of length and weight respectively. Literatures of allometric growth in some Nigerian waters include that of Lawson (2010) who documented \( b=\ 2.806 \) (males) -2.915 (females) in the mudskipper (\textit{Periopthalmus papilio}) from Lagos lagoon. Lawson and Jimoh (2010) gave accounts of 2.968 (males) -2.929 (females) in the grey mullet (\textit{Mugil cephalus}) from Lagos lagoon, Lawson and Aguda (2010) reported 2.27 in ten pounder (\textit{Elops lacerta}) from Ologe lagoon, Lawson et al. (2010) recorded 2.48 (males)-2.91(females) in stripped mullet (\textit{Liza falcipinnis}) from Badagry Creek. In Giant African threadfin, \textit{Polydactylus quadrifilis} \( b=2.27 \) (males)-2.92 (females) were reported from Badagry creekby Lawson and Olagundoye (2011) and 1.43 in frillfin goby (\textit{Bathygobius soporator}) from Badagry Creek (Lawson et al., 2011). Correlation coefficient \( 'r' \) (0.930) was positive and highly significant \((p = 0.05)\) which implies that the sampled specie’s lengths and weights were growing proportionally. According to these authors (Mommsen, 1998; Henderson, 2005; Morey et al., 2003; Nieto-Navarro et al., 2010; Weatherley and Gill, 1987; Hossain, 2010; Dulcie and Kraljovic, 1996; Bayhan et al., 2008; Franco-Lopez et al., 2010 and Lawson, 2010b), ‘\( b \)’ value in fish can be affected by many factors such as gonad maturity, sex, food availability, health, seasonal variability of the environment, sample size, habitat suitability, growth increment, temperature and salinity of the environment, fishing activities, individual metabolism, age and maturity. In this study, the overall mean condition factor value “\( k \)” estimated was 1.21, indicating that the population was in good condition which compared favourably with other reports from similar studies. It is noteworthy that physicochemical parameters of water influence vertical and horizontal migration of fishes in aquatic ecosystem, their distribution and feeding pattern can affect the wellbeing of fish (Haruna and Bichi., 2005).

References


