Length-Weight Relationship and Condition Factor of Heterotis niloticus from Amassoma flood plain, Niger Delta, Nigeria.

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Key words
Heterotis niloticus
Growth parameters
Condition
Wetland
Niger delta
Nigeria

A B S T R A C T
A study of length-weight relationship and condition factor of Heterotis niloticus from Amassoma River from was carried out 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). Length class marks 10cm and 15.5 were not caught. The Lowest frequency (1) was estimated for class mark 105.5cm with 10.6kg. The modal frequency (72) was estimated for 55.5 class mark with 5.6kg. The frequencies for the class marks: 25.5cm, 35.5cm, 45.5cm, 65.5cm, 75.5cm, 85.5cm, and 95.5cm with corresponding weight classes: 2.6kg, 3.6kg, 4.6kg, 6.6kg, 7.6kg, 8.6kg and 9.6kg were 6, 10, 30, 43, 15, 16 and 7 respectively. Generally, the frequency distribution of Heterotis niloticus from Amassoma flood plains was binomial. The length weight regression equation was Log W = 0.0974 + 3.17LogL with Correlation coefficient value of 0.960 and significance of correlation values of P < 0.05.

Introduction
Heterotis niloticus is the only plankton-feeders of the family Osteoglossidae, hence its usefulness in poly-culture with carnivorous fish species. They are highly regarded as both commercially and biologically important, because of their role in the pelagic food chain (FAO, 1997, Darcy, 1980). In Amassoma in particular and the Niger Delta at large, Heterotis niloticus is commonly consumed and therefore commands a very high commercial value and a major source of food (Scott, 1966). 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 shellfish species. Fish plays on important role in the development of a nation. Apart from being a cheap source of highly nutritive protein, it also contains other essential nutrients required by the body (Abowei, 2010).

This species has a wide distribution, with no known major widespread threats. It is therefore listed as Least Concern. It has also been assessed regionally as Least Concern for central, northern, north eastern and western Africa. In eastern Africa, it is a fairly widely distributed species which is thought to be heavily exploited by the local fisheries. A decline of 30% is anticipated over the next 10 years, and it has therefore been assessed as Vulnerable (A3d).

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 Connoly, 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 southernmost part of the River Nile (Egypt); Alfred – Okiya 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 Estuary 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 less weightier fish (Bagenal and Tesh 1978). 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. 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.

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 with 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 in assessing the relative well-being of a fish population (Bolger and Connoly, 1989). It is advantageous to use two measurable and convertible sizes of fish for estimating the condition factors.

A study of length-weight relationship and condition factor of Heterotis niloticus from Amassoma flood plains in the Niger Delta, Nigeria, plains would provide information on the amount of stock available for the fishery (King 1991), evaluation of production, (King, 1996), information for stock sizes (Krukpa, 1974), an important information for the evaluation of mortalities and status of the fish population, estimating the average weight at a given length group (Beyer 1987), and an index of growth and feeding intensity (Fedgade, 1978). An estimation of the size composition and condition factor of Heterotis niloticus 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.

Introduction

Species description

The African arowana, Heterotis niloticus, (Plate 1) is a member of the arowana family. Despite being called an "Arowana", the African arowana is more closely related to Arapaima gigas, the only other member in the subfamily Heterotidinae. The only plankton-feeding osteoglossid, the African arowana has a more terminal mouth than other species of arowana (Osteoglossum and Scleropages) (Paugy, 1990). Like the other Osteoglossids, the African arowana is a long-bodied fish with large scales, long dorsal and anal fins set far back on the body, and a rounded caudal fin. Its height is 3.5 to 5 times Standard Length (SL). It has been reported to reach up to 100 cm (39 in) SL and weigh up to 10.2 kg (22 lb). This fish is gray, brown, or bronze in color. Coloration is uniform in adults, but juveniles often have dark longitudinal bands. African arowanas have air-breathing organs on its branchiae, enabling them to survive in oxygen-depleted water. A suprabranchial organ allows it to concentrate small planktonic food particles and also has a sensory function (Paugy, 1990).

This species is widespread throughout Africa, where it is native to all the watersheds in Sahelo-Sudanese region, Senegal, and Gambia as well as parts of eastern Africa. This range includes the basins of the Corubal, Volta, Ouémé, Niger, Bénoué, and Nile Rivers as well as those of Lake Chad and Lake Turkana. It has been successfully introduced to Côte d'Ivoire, the Cross River in Nigeria, the Sanaga and Nyong rivers in Cameroon, and Ogoué River in Gabon, as well as the lower and middle Congo River basin, including Ubangi and Kasai Rivers. It has also been introduced in Madagascar. In some cases, introduction is reported to have had a negative impact on the local ecology.

Maximum observed length in Lake Kainji: 100 cm, observed weight: 10000 g. Young found in swampy places among aquatic vegetation; adults live in the open water of rivers and lakes, where they can be found in the pelagic zone as well as the littoral zone. Are able to survive in deoxygenated waters; the hardiness of this fish, together with its great growth rate make it a candidate for aquaculture in Africa and it has been transported to a number of countries for this purpose. Escapees from ponds into the wild resulted in established populations, which form the basis for fisheries. They are considered as mud-feeders, but in West Africa also as phytoplankton feeders. Feed mostly on plankton, being the only plankton-feeders of the Osteoglossidae. It has a suprabranchial organ which has a sensory function, but also a mechanic function in concentrating the little food particles. During breeding, mature adults create a circular nest in swamps. The young leave the nest after a few days and are guarded by the male.
In Africa it is native in all the basins of the Sahelo-Sudanese region, the Senegal, Gambia, Corubal, Volta, Ouémé, Niger, Bénoue, Chad and Nile basins and Lake Turkana. Successful introductions in the storage reservoirs of Côte d’Ivoire, the Cross, Sanaga, Nyong and Ogowe rivers and lower and Middle Congo basin, including Ubangui and Kasai. They are also introduced in Madagascar. Several countries report adverse ecological impact after introduction.

Heterotis niloticus is natural distributed in savannah Rivers of the Nilo-Sudanese region from Ethiopia to Senegal. It is also naturally distributed in the Chad basin and Lake Turkana. The species current distribution is now far more wide-spread as a result of man-made introductions.

In Central Africa, the species has been widely introduced in the Lower Guinea area, for aquaculture purposes. The species was introduced from Fort-Lamy, Chad, or Northern Cameroon to Southern Cameroon (swamps of the Nyong River basin, Cameroon). It was used for the development of aquaculture in the fish culture station of Melen near Yaoundé in 1955; Bertoua in 1957 and Abong-Mbang in 1958. From 1968 onwards it was also found in the Lower Sanaga River basin. This was probably due to colonization originating from the Lower Nyong River basin and this through the mangroves during the high waters. In the 1950’s it was also introduced from Cameroon to the Lower Ogowe River basin, in the neighbourhood of Lambaréné, Gabon, and from Cameroon to Congo. It was reintroduced to Congo in 1960, with Sudan mentioned as country of origin. Olaosebikan and Raji (1998) report the introduction of the species in the Cross River basin, Nigeria.

In Eastern Africa, it is present in Lake Turkana. Northern Africa: This species is known from upper Egyptian Nile, but is now Regionally Extinct. It is found in the Ghazal and Jebel systems, White Nile to Khartoum, Sudan, as well as Baro River, Ethiopia. In Western Africa: In the case of this species, a distinction must be made between the present area of occurrence resulting from man-made introductions, and its original, natural geographical distribution area. Original (natural) distribution: all basins of the Nilo-Sudanese region: rivers Senegal, Gambia, Volta, Niger, Chad. Areas of successful introduction of the species: in the area considered, artificial reservoirs

In Morphology: Dorsal spines (total): 0; Dorsal soft rays (total): 32 - 37; Analspines: 0; Analsoft rays: 34 - 39; Vertebrae: 66 – 69; 100.0 cm SL (male/unsexed; max. published weight: 10.2 kg

It has Elongated and robust body, its height 3.5 to 5 times in standard length. The head is relatively short, its length 3.5 to 5 times in standard length. Dermal bones of the cranium are deeply carved by large sensory pits. The lips are thick and there is a dermal flaps on the border of the gill cover, conical teeth, dorsal and anal fins, which are spineless, elongated and posteriorly positioned, ending close to the small, rounded caudal fin. Caudal peduncle very short. strong, large scales, oval with the exposed portion thick and corrugated, with a more or less vermiciform sculpture: 34-40 lateral-line scales, 2.5/6 scales on the lateral side of the body before the pelvic fin, 5-6 scales between dorsal and anal fin. The lateral line is extending in a straight line from above the operculum to the middle of the caudal peduncle). The number of gill rakers increases with the length; 33 (young) to 98 on the ceratobranchial and 21 (young) to 76 on the epibranchial. Young specimens possess external gills, uniform gray, brown or bronze colored, darker during the reproduction-period. Young specimens are often marked with dark longitudinal bands and scales with an oval spot in the posterior zone of the anal and dorsal fin.

Heterotis niloticus is a pelagic species. It occurs in shallow water where it feeds on invertebrates, copepods and chironomids (Reed 1967). Young are found in swampy places among aquatic vegetation (Paugy, 1990); adults live in the open water of rivers and lakes, where they can be found in the pelagic zone as well as the littoral zone (Paperna, 1996). Its auxiliary branchial air breathing organs enable it to survive in de-oxygenated waters; the hardiness of this fish, together with its great growth rate make it a candidate for aquaculture in Africa and it has been transported to a number of countries for this purpose (Paperna, 1996). Escapees from ponds into the wild resulted in established populations, which form the basis for fisheries (Paperna, 1996).

This species is considered as a mud-feeder (Hickley and Bailey 1987), but in West Africa also as a phytoplankton feeder (Holden and Reed 1972, Olaosebikan and Raji 1998). It feeds mostly on plankton, being the only plankton-feeder of the Osteoglossidae (Reed et al. 1967). It has a suprabranchial organ which has a sensory function, but also a mechanic function in concentrating the little food particles. During breeding, it creates a circular nest in swamps (Reed et al. 1967, Balon 1975). The young leave the nest after a few days and are guarded by the male (Balon 1975). Heterotis niloticus breeds in the wet season in swamps and floodplains. It builds a circular nest about 1 m in diameter and 20 to 60 cm deep (Balon 1975), similar to a lagoon. The rim of the nest is a high wall formed out of plant chunks, about 15-20 cm thick and projecting above the water surface; the bottom is a clean platform of clay or mud (Balon 1975). After the spawning act the fish leave by way of a hole in the wall, through which, 5 days later, the young leave the nest and are guarded by the male.

Heterotis niloticus inhabits open water, fringing vegetation and swamps. It is predominantly microphagous and feeds on mud, phytoplankton, vegetable debris and small invertebrates. This fish is a non-specialized bottom-feeder. Its susceptible diseases and parasites are Sporozoa-infection (Myxobolus sp.). Parasitic - infestations (protozoa, worms, etc.). H niloticus breeds in the wet season in swamps and floodplains. It builds a circular nest about 1 m in diameter and 20 to 60 cm deep. The rim of the nest is a high wall formed out of plant chunks, about 15-20 cm thick and projecting above the water surface; the bottom is a clean platform of clay or mud. After the spawning act the fish leave by way of a hole in the wall, through which, 5 days later, the young leave the nest and are guarded by the male.
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 500 km. 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’ and 6°17’ E. 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 cordifolia, Alstonia boonei, Antodesima sp and submerged macrophytes which include: Utricularia sp, Nympha lotus, Lemna eretica, 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 situated in Southern Ijaw, Rivers, Nigeria, its geographical coordinates are 4° 58’ 13” North, 6° 6’ 35” East (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 500 km. 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 Niger Delta is one of the world’s largest wetlands covering an area of approximately 70, 000km^2. The area is economically important and rich in biodiversity over 80% Federal Government revenue is located with the Niger Delta region. Amassoma has a diameter of about 6km East to West and approximately 2km North to South (Fig.3).

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

\[ \log W = \log a + blog L \]  
(Pauly, 1983)  
(3)

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

\[ a = \left[ \frac{\sum y}{n} - \left( b \frac{\sum x}{n} \right) \right] \]  
(4)
Or logarithm transformed as:

\[ a = \left[ \frac{\sum \log W}{n} - b \frac{\sum \log W^x}{n} \right] \]  

While the slope “b” was estimated by the formular

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

or log transformed as:

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

or log transformed as:

\[ b = \frac{n \sum \log x - \log_{10} Y - (\sum \log_{10} x)(\sum \log_{10} Y)}{n \sum \log_{10} x^2 - \sum \log_{10} (x)} \]  

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

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

Where:

- \( K \) = Condition factor
- \( W \) = Weight of fish
- \( L \) = Length of fish (cm)

Results

Table 1 shows the length and frequency distribution of Heterotis niloticus from Amassoma flood plains. Length class marks 10cm and 15.5 were not caught. The lowest frequency (1) was estimated for class mark 105.5cm with 10.6kg. The modal frequency (72) was estimated for 55.5 class mark with 5.6kg. The frequencies for the class marks: 25.5cm, 35.5cm, 45.5cm, 65.5cm, 75.5cm, 85.5cm, and 95.5cm with corresponding weight classes: 2.6kg, 3.6kg, 4.6kg, 6.6kg, 7.6kg, 8.6kg and 9.6kg were 6, 10, 30, 43, 15, 16 and 7 respectively. Generally, the frequency distribution of Heterotis niloticus from Amassoma flood plains was binomial.

<table>
<thead>
<tr>
<th>Ti class range(cm)</th>
<th>Ti class mark(cm)</th>
<th>Wt class range(Kg)</th>
<th>Wt class mark(Kg)</th>
<th>Frequency</th>
<th>Cumulative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 – 10.0</td>
<td>10.0</td>
<td>0.0 – 1.0</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11.0 – 20.0</td>
<td>15.5</td>
<td>1.1 – 2.0</td>
<td>1.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>21.0 – 30.0</td>
<td>25.5</td>
<td>2.1 – 3.0</td>
<td>2.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>31.0 – 40.0</td>
<td>35.5</td>
<td>3.1 – 4.0</td>
<td>3.6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>41.0 – 50.0</td>
<td>45.5</td>
<td>4.1 – 5.0</td>
<td>4.6</td>
<td>30</td>
<td>46</td>
</tr>
<tr>
<td>51.0 – 60.0</td>
<td>55.5</td>
<td>5.1 – 6.0</td>
<td>5.6</td>
<td>72</td>
<td>118</td>
</tr>
<tr>
<td>61.0 – 70.0</td>
<td>65.5</td>
<td>6.1 – 7.0</td>
<td>6.6</td>
<td>43</td>
<td>161</td>
</tr>
<tr>
<td>71.0 – 80.0</td>
<td>75.5</td>
<td>7.1 – 8.0</td>
<td>7.6</td>
<td>15</td>
<td>176</td>
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<tr>
<td>81.0 – 90.0</td>
<td>85.5</td>
<td>8.1 – 9.0</td>
<td>8.6</td>
<td>16</td>
<td>182</td>
</tr>
<tr>
<td>91.0 – 100.0</td>
<td>95.5</td>
<td>9.1 – 10.0</td>
<td>9.6</td>
<td>7</td>
<td>189</td>
</tr>
<tr>
<td>101.0 – 110.0</td>
<td>105.5</td>
<td>10.1 – 11.1</td>
<td>10.6</td>
<td>1</td>
<td>200</td>
</tr>
</tbody>
</table>

Total: 200
Table 2 and 3 show the Length weight relationships and regression analysis values of Heterotis niloticus from Amassoma flood plains. The length weight regression equation was Log W = 0.0974 + 3.17LogL with Correlation coefficient value of 0.960 and Significance of correlation values of P< 0.05, t = 23.2, df = 199. The “a” and “b” values were 0.0974 and 3.17 respectively. The “r” value was positive (1.26). Table 5 shows the condition factors values of Heterotis niloticus from Amassoma flood plains. The condition index value range from 0.95 – 1.00 and the condition factor value was 0.98.

Table 2. Length weight relationships of Heterotis niloticus 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>Heterotis niloticus</td>
<td>200</td>
<td>Log W = 0.0974 + 3.17LogL</td>
<td>0.960</td>
<td>P&lt; 0.05, t = 23.2, df = 199</td>
</tr>
</tbody>
</table>

Table 3. Regression analysis values of Heterotis niloticus 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>Heterotis niloticus</td>
<td>0.0974</td>
<td>3.17</td>
<td>1.26</td>
</tr>
</tbody>
</table>

Table 4. The condition factors of Heterotis niloticus 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>Heterotis niloticus</td>
<td>0.95 - 1.00</td>
<td>0.98</td>
</tr>
</tbody>
</table>

Discussion

The maximum size attained by Heterotis niloticus 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” = 3.17 for Heterotis niloticus showed growth was allometric based on Bagenal and Tesch (1978) with the criteria of “b” = 3. The length weight relationship is cuvilinear 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 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; Abowei and Hart, 2007).

The high correlation coefficient “r” = 1.26 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; Abowei and Hart, 2007). The correlation coefficient “r” values was positive for Heterotis niloticus. This means that there was a positive correlation between length and weight of Heterotis niloticus from Amassoma flood plain.

The condition factor value “k” = 0.98 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 Wt = 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 0.95 - 1.00 and condition factor value of 0.98 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.

Conclusion

Heterotis niloticus exhibited allometric growth
There was strong association between length and weight of Heterotis niloticus
Heterotis niloticus was in a good condition

References

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