Length-Weight Relationship and Condition Factor of Dominant and Subdominant Fish Species in Ogba River, Edo State, Nigeria

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Abstract:
The length-weight relationship and condition factor of twelve dominant and subdominant fish species in Ogba River was studied from February 2018 to October 2018. A total of 637 specimens were obtained from the river from fishermen using five types of gears namely gill nets, hook and lines, bamboo traps, mesh net and basket traps. The fishes exhibited negative allometric growth (b<3) and the condition factor (k) varied between species and ranged from 0.83 – 4.06. The correlation coefficient (r) ranged from 0.065 – 0.68. There was strong correlation between the length and weight of all the species except Xenomystus nigri which was weakly correlated. Only one species Erpetoichthys calabaricus had condition factor (k) less than 1 indicating unhealthy condition. The higher number of fishes in healthy condition shows the river as a favourable habitat for the survival of fishes. Findings from this study will serve as baseline information of these fish species in Ogba River, and will contribute valuably to the existing data to enhance their management and conservation.

Keywords: Length – weight relationship, condition factor, Ogba River, fishes, growth pattern

1. Introduction

Fish is known to be an imperative food source especially in developing countries due to its high protein content and nutritional value. It may be the solely accessible and affordable source of protein for poor households in urban and semi-urban areas [7]. Fish is also widely acceptable because of its high palatability, low cholesterol and tender flesh [12]. According to FAO [15] fish contribute more than 60% of the world supply of protein, especially in the developing countries. The length – weight relationship of fish is of great importance in fishery assessment [12]. The importance of Length – weight relationship is pronounced in estimating the average weight at a given length group and in assessing the relative wellbeing of a fish population [8], [9]. Knowledge of Length – weight relationship of fish is important in fishery management tool as it gives information on the condition and growth patterns of fish. According to Diaz et al. [10], Length – weight measurement in addition to age data can give information on stock composition, age at maturity, life span, mortality, growth and production. Ecoutin et al. [11] stated that data from length – weight can also provide important clues to climatic and environmental changes and the change in human consumption practices.

The study of condition factor refers to the wellbeing of fish species and its degree of plumpness, which depends on the weight of fish sampled. Different values of the condition factor of a fish indicate the sexual maturity, the degree of food source availability, age and the system of the environment. It also reflects the effect of environmental changes on the fish species. This study is aimed to deal with Length – weight relationship and condition factor of dominant and subdominant fish species in Ogba River, to determine their growth pattern and suitability of the environment for their growth and reproduction.

2. Materials and Methods

2.1. Study Area

The study area, Ogba River is a river, located on the outskirts of Benin City; Edo State, Nigeria (Fig 1). The River is rising at Ekewan and flowing southeast to join the Ossiomo River and Benin River, which in turn empties into Atlantic Ocean. It lies between Latitude 6° 18'45.8992"N and Longitude 5° 35'6.7248E. Ogba River flows through a secondary...
rainforest belt. The study area is heavily shaded by forest and economic trees such as Brazilla joyweed (*Alternanthera brasiliana*), Ginger lily (*Costus afer*), Bamboo (*Bambusa vulgaris*), Mossfern, (*Dryopteris filix*), Slender dayflower (*Commelina erecta*), Cupscale grass (*Sacciolepis africana*), Floss flower (*Chromolaena odorata*), Mile-a-minute (*Mikania cordata*), Berry (*Adenopus berriflorus*), Hornwort (*Ceratophyllum*), Cabbage tree (*Antholeleista vagell*), Palm oil, (*Elaeis guineensis*) Pawpaw (*Carica papaya*), Raphia palm (*Raphia hookeri*), and Shrub. On the river are floating vegetation such as Water moss (*Salvinia nymphellula*), Duckweed (*Lemna pausicostata*) and Water hyacinth (*Eichhornia crassipes*), Water lily (*Nymphaea lotus*), African mahogany (*Lasiosperma senegalensis*).

![Figure 1: Map of the Study Area](image)

2.2. Sampling Stations

Three sampling stations selected for study was based on the extent of human activities and accessibility. The river flows from station 1 (upstream) to stations 2 (midstream) and 3 (downstream). Human activities in the stations include fishing, bathing, swimming, laundry, farming and ritual purposes.

2.3. Fish Collection/Sampling

Fish specimens were collected from fishermen who used gill nets, hook and lines, bamboo traps, mesh net and basket traps from the three sampling stations between February 2018 to October 2018. The fish samples were carried in a cooler and transported to the laboratory of University of Benin where they were identified to species level using the guides of Olasebikan and Raji [22] and Idodo-Umeh [17].

2.4. Length-Weight Measurement

Total and standard length was measured to the nearest 0.1 cm with a measuring board and the body weight was measured to the nearest 0.1 g by a Mettler digital weighing balance. The total length was measured from the tip of the snout to the tip of the longest lobe of the caudal fin while the standard length was measured from the tip of the snout to the caudal peduncle.

2.5. Length-Weight Relationship/Condition Factor

The Length – Weight Relationship was calculated by the equation:

\[ W = aL^b \]

Where \( W \) = weight of fish in (g), \( L \) = Standard length of fish in centimetre (cm), \( a \) = constant (intercept on the y axis) and \( b \) = the length exponent (slope). The values of “a” and “b” were given a logarithm transformation according to the following formula

\[ \log W = \log a + b \log L \] via least square linear regression which gives a straight line.

Condition factor was calculated by the formula: \( K = 100 \frac{W}{L^3} \) according to Le Cren [18], where \( K \) = condition factor, \( L \) = total body length of fish (cm), \( W \) = body weight of fish (g).
3. Results

A total of 637 individuals belonging to seven families, eleven genera and seventeen fish species were examined. Twelve fish species were dominant and subdominant. Dominant fish species have relative abundance of 10% and above, while sub – dominant have relative abundance of 1 – 9%. Three species were dominant namely Chromidotilapia guentheri, Clarias gariepinus and Parachanna obscura. Nine species were subdominant and are Tilapia zilli, Oreochromis niloticus, Tilapia mariae, Clarias pachynema, Clarias anguillaris, Xenomystus nigri, Erpetoichthys calabaricus, Parachanna africana and Ctenopoma kingsleyae. The values of the regression coefficient (a) and (b) and correlation coefficient (r) and condition factor (k) obtained are presented in Table 1. The regression coefficient (a) ranged from 0.24 – 33.9 and (b) ranged from 0.078 – 1.91. The correlation coefficient (r) ranged from 0.065 – 0.68. The values of Condition factor ranged from 0.83 in Erpetoichthys calabaricus – 4.06 in Chromidotilapia guentheri. Eleven species have their condition factor above one while Erpetoichthys calabaricus have condition factor of less than one.

| Species                        | Regression Coefficient | Correlation Coefficient | Condition Factor | Growth Type    |
|--------------------------------|------------------------|-------------------------|------------------|----------------|
| Chromidotilapia guentheri      | 10.7                   | 0.55                    | 0.43             | 4.06           |
| Tilapia zilli                  | 14.86                  | 0.42                    | 0.31             | 3.57           |
| Oreochromis niloticus          | 21.75                  | 0.24                    | 0.17             | 2.85           |
| Tilapia mariae                 | 0.24                   | 1.91                    | 0.68             | 3.15           |
| Clarias anguillaris            | 10.80                  | 0.53                    | 0.45             | 1.71           |
| Clarias gariepinus             | 16.98                  | 0.40                    | 0.44             | 2.89           |
| Clarias pachynema              | 13.58                  | 0.45                    | 0.41             | 1.99           |
| Ctenopoma kingsleyae           | 5.52                   | 0.74                    | 0.48             | 2.14           |
| Erpetoichthys calabaricus      | 17.14                  | 0.34                    | 0.40             | 0.83           |
| Parachanna obscura             | 20.49                  | 0.34                    | 0.29             | 1.83           |
| Parachanna Africana            | 11.01                  | 0.53                    | 0.41             | 2.27           |
| Xenomystus nigri               | 33.9                   | 0.078                   | 0.065            | 2.74           |

Table 1: Length-Weight Relationship Analysis of Dominant and Subdominant Fish Species in Ogba River

4. Discussion

Fishes are known to exhibit two types of growth pattern namely, the isometric and allometric growth. Their growth is determined through the combined effect of food quality, quantity and the environment. When the regression coefficient (b) is 3, it is termed isometric, a situation where fishes grow in length and weight simultaneously, while values less than or above 3 are termed negative and positive allometric growth, showing the rate of increase in body weight was not proportional to the rate of increase in body weight. Fagberon et al. [14] stated that isometric growth is rare in a majority of fishes. The values of (b) in this study showed that all the species exhibited negative allometric growth. This presented an increase in weight that was not proportional to an increase in length for all the species. Negative allometric growth was reported by Agali and Edema [2] in dominant and subdominant fishes in Obueyinomo River. Oboh and Omoigberale [14] reported a negative allometric growth in Parachanna obscura from Ovia River. Ezekiel and Abowei [13] reported a negative allometric growth in Hepsetus odoe from a tropical flood river and Amassoma flood plains in Nigeria respectively. Abdallah [1] stated that in the tropics, the b values of fishes range from 2.7 – 3.3. Length-weight relationships are not constant over the years and the parameters may vary significantly due to food availability, temporal and sampling factors, health and sex [16] all of which were not considered in this study. The difference in the result of this study and that of Abdallah [1] could be attributed to season, habitat, gonad, sex, diet, age and rate of feed intake [6]. There was positive correlation in the fishes with the exception of Xenomystus nigrit that showed weak correlation. Similar findings were recorded for fish species from different water bodies [2, 20], [4], [5]. The relationship of Length – weight can be used to estimate the condition factor of fish species. in fisheries science, condition factor is used to compare the condition, fatness or wellbeing of fish [3]. However, factors such as sex, age, stress, water quality all play significant roles in the condition of fish. The mean condition factor obtained in this study ranged from 0.83 – 4.06. This result is comparable with results from other studies. Agali and Edema [2] reported a range of 0.23 – 3.06 for dominant and subdominant fish species from Obueyinomo River, Edo state and contrast with the results of Nlewadim and Adaka [19], who reported a range of 0.91 – 8.46 for nine fish species from Orammiri Ukwa River. The values of condition factor of eleven (11) fish species were greater than 1 placing them in good health condition while one (1) species Erpetoichthys calabaricus had less than 1 placing it in unhealthy condition. Alhassan et al. [5] stated that a condition factor less < 1 means the fish is elongated, starving and not in good condition, 1 -1.2 shows the fish is doing well, 1.4 shows the fish is near spawning. The high condition factor in this study shows the fishes as doing well, and this is a reflection of abundant food sources and good water quality of the river, thus providing a suitable environment for the fishes [2]. The considerable difference between the values obtained in this study and those from other studies could be attributed to different environmental factors.
5. Conclusion

Samples collected between February – November did not represent the entire year, therefore computed b and k values properly reflect the rainy season (May – October) period. The length-weight characteristics in this study may be of considerable contribution in the ongoing studies of catches in Nigerian commercial fisheries.

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