Condition Factor and Length-Weight Relationship of Banana Mullet (*Mugil bananensis*) (Pellegrim, 1927) from St. Nicholas River, Bayelsa State, Niger Delta, Nigeria

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Abstract

The condition factor and length-weight relationship of Liza bananensis (Banana mullet) was studied from St. Nicholas River, Bayelsa State in the Niger Delta area of Nigeria from October 2020 to September 2021. The study was necessitated by the lack of basic information of the species from the study area which is high in socio-economic importance and nutritional value to the inhabitants of the communities along the river system. The studies were carried out on the full stretch of the river. The fish species was caught with cast net. The fish specimen was identified using keys and descriptions. The total of 84 mullets, 10 (males) and 64 (females) were caught measuring 13.4 – 17 cm and weighing 39.47 -64.43g (males) and 12 – 21cm and weighing 24.25– 130.97g (females). Specimens were stored in cooler containing ice and transported to the laboratory for further analysis. The mean lengths and weights of the classes were used for data analysis, the format accepted by FISAT. The studied mean condition factor ranged from 1.61 (Combined sex), 1.68 (males) to 1.59 (females) showed that there were more females than males showing fewer males mating with more females. The degree of association between length and weight was computed from linear regression analysis. The respective exponential equation for the length weight relationship are: Combined sex, male and female Liza bananensis are: Combined sex (W_1 *=0.9102(TL)*$^{1.6908)}$ *Male* (W_1 *= 0.964(TL)* $^{(1.399)}$ *and Female (W1= 0.9011(TL)*$^{(1.839)}$ *respectively. The species exhibit positive isometric growth with (b=2.7) combined sex, (b=2.7) male and (b=3.0) female respectively. The length-weight relationship of the species showed positive and isometric growth with good condition factor indicating species resistance to all the negative factors of the water.*

Keywords: *Condition factors, Length-weight Relationship, St. Nicholas River, Bayelsa State, Niger Delta*

1. INTRODUCTION

Banana mullet, *Mugil bananensis* is a bony fish of the family Mugilidae, Class Actinopterygii (ray-finned fishes) and Order Perciformes. It has maximum length of 40cm, greyish colored back as well as silvery belly and sides. This species inhabits coastal marine, estuaries, brackish waters and rivers. It is a benthic feeder which feeds on detritus, algae, diatoms and zooplankton [17] However, it serves as human food and is cultured in ponds in tidal areas. In Nigeria, mullets are widely distributed in all tropical and temperate seas of the world. They are demersal and chiefly marine or coastal [33] and brackish water; some like *Liza abu* are found in freshwater [31] and estuaries at shallow depth (less than 20m) for feeding purpose. In addition, they travel in schools. Juvenile mugilids prefer dark places is shallow coastal water, thus their distribution in the estuaries [20] The fish is very popular, well relished and forms a large proportion of the diet of the riparian communities. This is probably because of its high quality and highly flavored flesh [30].

Fish stocks are usually monitored through fisheries that are a vital economical component of maritime nations. However, fisheries are still collapsing in some areas of the world despite effects to sustain a healthy marine environment and preserve both fish biodiversity and biomass [36]

Fisheries management addresses, among others, the economic, social and biological factors affecting fish stock in order to adopt a strategy that fulfils the feeding requirements of societies without exploiting fish stocks [12]. Key tool for investigation and management include biometric studies that deliver information on fish species for an estimated assessment of their biomass [44]. In biometric studies, it is imperative to determine the growth characteristics related to weight and length of the fish [27], in addition to the condition of wellbeing of the species influenced by different biological and environmental factors. The importance of determining length-weight relationships (LWRS) in fish has been emphasized by many studies. It provides information about the growth pattern, general health, habitat conditions, life history, fish fatness and condition, as well as morphological characteristics of the fish [33,13].

LWRS are expressed in a formula which allows the estimation of the fish weight (W) using a particular length (L), and can be applied to studies on gonadal development, feeding rate and maturity condition [6]. It must be noted, however, that LWRS differ among fish species depending on the inherited body shape and the physiological factors such as maturity and spawning [33]. This relationship might change over seasons or even days [10]. It is argued that b may change during different time period illustrating the fullness of stomach, general condition of appetite and gonads stages [43]. In addition, the growth process can differ in the species dwelling diverse locations influenced by numerous biotic and abiotic factors. An additional biometric tool is the relative condition factors (K) that was derived from the LWRS [24]. K measures the deviation of an organism from the average weight in a given sample in order to assess suitability of specific water environment for growth of fish [42,25]. An overall fitness for fish species is assumed when K values are equal or close to 1.

The conditions factor of fishes is the most important biological parameter which provides information on condition of fish species and the entire community and is of high significance for management and conservation of natural populations [32,28]. It is also a quantitative parameter

of the state of well-being of the fish that determines present and future population success because of its influence on growth, reproduction and survival [29].

Condition factor has been used as an index of growth and feeding intensity [11]. Condition factor decrease with increase in length [5,11] and also influenced by the reproductive cycle in fish [40]. Condition of different species of Mugilidae has been reported by [16], *Mugil Cephalus* in Bonny estuary; [9] on *Liza falcipinnis* from Elechi Creek, Niger Delta. Some condition factors reported for other families include: [2], *Channa channa* in freshwater swamps of Niger Delta, [15] on ten fish species from the lower Nun River and [1] *Clarotes lateceps* from the fresh water reaches of the lower Nun River.

2. MATERIALS AND METHODS

2.1 Study area

The St. Nicholas River is one of the major estuaries of the Niger River. It is situated between longitude 4° 23" E and 6° N 6° 21" E and latitude 4° 31" N and 4° 56" N (Fig. 1). The Stretch of the river is about 17km. and the average width is about 0.869km. The vegetation is predominantly mangrove, *Rhizophora racemosa*, *Rhizophora mangle*, Sparsely *Avicenia africana* and normal forest vegetation at the coastline.

Figure. 1: Map of the Niger Delta showing the St. Nicholas River, the study area.

2.2 Sampling method and population parameters analyses

The sampled 84 fishes were used for the study. The sampling was carried out for twelve (12) months from October 2020 to September 2021. The specimens were sampled with cast net of 20mm stretched mesh size [7] and were also bought from the Mugilidae fishers along the river. Sampling was carried out between low and high tides, at the mud and sand flats along the St. Nicholas River. Specimen collected were conveyed in cooler box containing ice chips to the laboratory, on each sampling day. Specimens were sexed into two sexes, male and female in the laboratory adopting standard method.

Lengths and weights of fish specimens were taken by use of meter rule and an electronic scale Professional Digital Table Top scale (500g X 0.1g) respectively. Measurements of mean length and mean weight recorded for each fish all year round were used in the calculation of the Fulton' s condition factor (K). formula used in the calculation of the condition factor was given by [4] as:

$$K = \frac{100W}{L^3}$$

Where:

K = Condition factor

W = Total weight of fish (g)

L = Total length of fish (cm).

Length-weight relationships of all samples collected were determined for the various sexes by the expression:

$W = aL^b$ [34].

Where: w

W = the derived weight (g)

a = the intercept of the regression curve

b = the regression coefficient (slope)

The parameters ' a' (intercept) and ' b' (slope) are easily estimated by the linear regression based on logarithm as:

LogW = Loga + bLogL [21].

3. RESULTS AND DISCUSSION

The sampled 84 fish specimens comprised of 11.90% males and 88.10% females. The results of the monthly mean condition factor (K) for combined sex, male, female of *L. falcipinnis* are shown on figure 2. The study provides information on *M. bananensis from* St. Nicholas River. [14] stated that the regression coefficient (b) for isometric growth is ' 3' while values greater or lesser than ' 3' indicate allometric growth. The value of *b* gives information on the kind of growth of fish: the growth is isometric if $b = 3$ and the growth is allometric if $b = 3$ (negative allometric if $b < 3$ and positive allometric $b > 3$) [21]. *Mugil bananensis* in this study displayed

isometric growth follow the cube law, therefore they get relatively bigger as they increase in length as reported by [41]. The values recorded in this report is contrary to [18] which reported negative allometry for *Mugil bananensis*, at the Cross River Estuary of Nigeria, [35] reported positive allometric growth for *Mugil cephalus* in Lagos Lagoon, Nigeria, [37] reported positive allometric growth for Striped red mullet *(Mullus surmuletus)* from the Bay of Edremit (Northern Aegean Sea, Turkey).

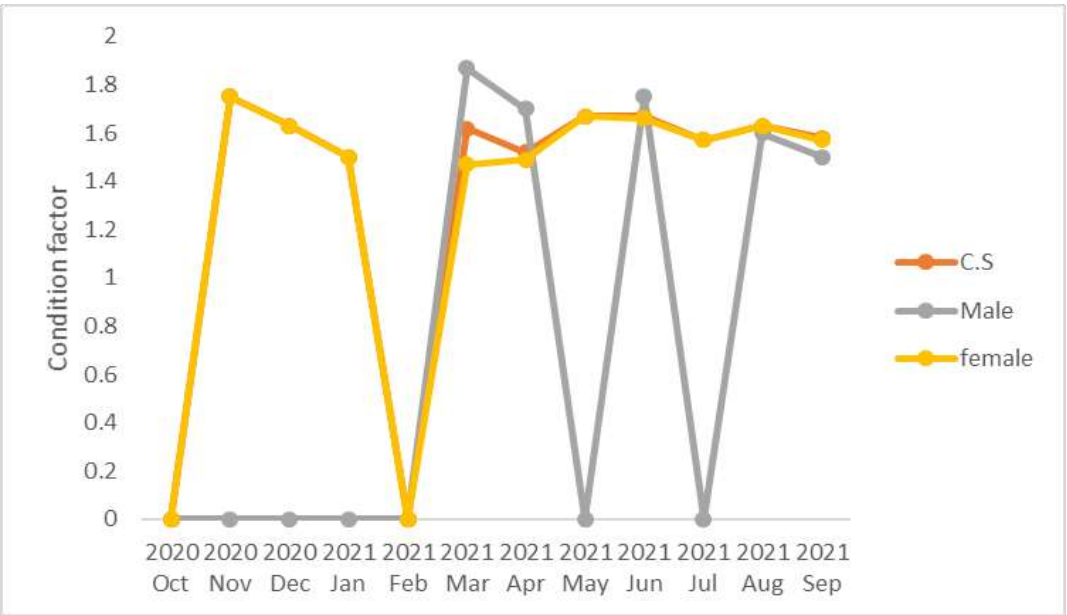

Figure 2: Monthly condition factor for combined sex, male and female *Mugil bananensis* from October, 2020 to September, 2021.

Table 1: Least square regression equation exponent (b), intercept (a), correlation coefficient and length-weight relationship of *Mugil bananensis* from St. Nicholas River, Bayelsa State, Niger Delta, Nigeria.

sex	Regression Equation	r	b	a
Combined sex	$1.6908L^{2.894}$	0.9102	2.894	1.6908
male	$1.3990L^{2.6563}$	0.9640	2.6563	1.3990
female	$1.8390L^{3.0171}$	0.9011	3.0171	1.8390

[26] reported negative allometric growth for *Liza tade* from Mawlamyine, Mon State, Myanmar. [19] reported allometric growth for coastal species of Nigeria and [24] reported that majority of fish species rarely exhibit Isometric growth. The isometric growth of this species might be as a

result of less competition of feeding and the positive physicochemical parameters of the environment on the species.

The K values obtained in this study indicated that the species is in good condition. It might be attributed to the availability of food, feeding time and changes in habitat. These factors are known to affect fish condition and in most cases it is hard to separate the effect of one from another. The no catch recorded in February and March in this study may be attributed to unavailability of food in these months or it may relate to the effect of certain physico-chemical parameters. The Least condition factor recorded in September might be attributed to gonad development and highest value in May and June to more of feeding. According to [38] the lowest K values during the more developed gonad stages might mean resource transfer to the gonads during the reproductive period. The condition factor (K) reflects, through its variations, information on the physiological state of the fish in relation to its welfare. From a nutritional point of view, there is the accumulation of fat and gonad development [24]. From a reproductive point of view, the highest K values are reached in some species [3]. K values also gives information when comparing two populations living in certain feeding, density, climate, and other conditions; when determining the period of gonad maturation and when following up the degree of feeding activity of a species to verify whether it is making good use of its feeding source [39] of the fish. Condition factor vary according to seasons and are influenced by environmental conditions. The same may be occurring in the environment under study since river is influenced by many biotic and abiotic factors, which favor equilibrium of all the species in the ecosystem [8]). The present study means and monthly condition factor agreed with that of [22] of 1.43 from Ologe Lagoon.

CONCLUSION/RECOMMENDATION

Mugil bananensis in St. Nicholas River has an isometric growth pattern while the condition factor is good, meaning its feeding was not affected by anthropogenic activities. This study suggests that the present level of exploitation of *Mugil bananensis* in St. Nicholas should be increase because the species is under fished. Specific gears should be used to harvest the species from the wild as the banana shape of the species enabled it to escape from the cast net used for it harvest with ease. This measures if applied will increase the catch of the fishers and thus, will increase the income level and the livelihood of the riparian communities will be improved and their nutrition will also be impacted thus their life expectancy will also be affected.

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