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RESEARCH **Open Access**

Length-weight Relationships and Condition Factor of *Parachanna Obscura* Gunther 1861 in Epe Lagoon, Lagos, Nigeria.

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Abstract

Background: The study of the length-weight relationship (LWR) and condition factor (K) are critical in fisheries research and management. However, there is currently a dearth of information on the growth pattern and state of health of *Parachanna obscura* in Epe lagoon

Methods: A total of 252 species of *P. obscura* ranging from 19.50 to 36.70 cm (standard length = 28.22 ± 4.95 cm) and 58.80 to 331.00 g (total weight = 267.69 ± 72.16 g) were obtained from the catches of local fishermen at the chief market fish landing station monthly for six months (January - June, 2018) at Epe lagoon, Lagos, Nigeria. Standard Length (SL) and Body Weight (BW) were measured to the nearest 0.1 cm and 0.01 g using digital Vernier calliper and electronic precision balance, respectively. Length-Weight Relationships and condition factor (K) were calculated using standard formula. Data were analysed using descriptive statistics and ANOVA at α0.05.

Results: The LWRs for males, females and combined sexes were 2.60, 2.70, and 2.65, respectively, indicating a negative allometric growth pattern. The mean K value in females (1.36±0.70) was higher than in males (1.18±0.48).

Conclusion: The findings indicated that *Parachanna obscura* in Epe lagoon, Nigeria were heavy and in good health within the study period

Keywords: Epe lagoon, *Parachanna obscura*, allometric growth, condition factor.

1.0 INTRODUCTION

Parachanna obscura (African Snakehead) is the commonest Snakehead and a commercially important fish in Nigeria. It has a paramount economic value for African aquaculture because it has few bones and high protein content [1, 2], its good flesh quality, and its rapid growth potential (2g/day) [3]. *Parachanna obscura* is very fleshy, has few bones, and is high in protein [1]. It is a hardy species that thrive under stressful environmental conditions [4]. *P. obscura* is a fish highly appreciated by Africans because of its high gastronomic quality but its production by wild natural continental water cannot meet local demands due to overexploitation [5, 6]. This fish was documented by IUCN [7] as an endangered species. Therefore, domestication and intensive breeding of *P. obscura* could help preserve and strengthen the natural stocks and produce food fish continuously. Thus, contributing to food security and improving the economic conditions of the increasing African population, and consequently ensuring the preservation of aquatic biodiversity and sustainable aquaculture in Africa [8].

Achieving this goal requires a better understanding of the length-weight relationship, growth, and condition factor of *P. obscura*. The length-weight relationship (LWR) and condition factor (K) are important tools in fish biology, conservation and physiology, ecology, fisheries assessment, and fish conservation. These studies are used as tools for fish conservation in several parts of the world to provide information on the condition, growth pattern, ontogeny changes, and fish population dynamics [9; 10; 11]. The length-weight relationship is also useful for the conversion of growth-in-length equations to growth-in-weight for use in stock assessment models; an estimation of biomass from length observations; an estimate of the condition of the fish (relative well-being of the fish), and also for useful comparison purpose [11, 12].

Fish can attain either isometric growth, negative allometric growth, or positive allometric growth. Isometric growth is associated with no change of body shape as an organism grows. Negative allometric growth implies the fish becomes more slender as its weight increases, while positive allometric growth implies the fish becomes relatively stouter or deeper-bodied as it increases in length [13]. The condition factor is an estimation of the general well-being of fish [14, 3]. It is based on the hypothesis that heavier individuals of a given length are better than less weighty fish [15,16]. Condition factors have been used as an index of growth and feeding intensity. This factor is a measure of various ecological and biological factors such as degree of fitness, gonad development, and the suitability of the environment concerning the feeding condition [17, 1]. When the condition factor value is higher, it means that the fish has attained a better condition. *Parachanna obscura* has been reported to be available in Epe lagoon in Lagos State, Nigeria. This is a lagoon that supports a major fishery in Lagos State and serves as the major source of water for Epe and other villages situated along its bank. Available information from literature on the length-weight relationship and condition factor of *P. obscura* in this lagoon is sparse. Hence, this study investigates the length-weight relationships and condition factors of *P. obscura* in Epe lagoon, Lagos, Nigeria. This is necessary for effective management and sustainable exploitation to make it a potential aquaculture candidate in Epe lagoon, Lagos, Nigeria.

2.0 METHODOLOGY

Figure 1. Map of Lagos State Showing Epe Lagoon,

2.1 The Study Area

Fish samples were collected from Epe lagoon (Figure 1) bounded between latitudes 03050'– 04010'N, and longitudes 005030' – 005040'E). It is a fresh, lotic, non-tidal tropical water body with a surface area of more than 243 km^2 located at the eastern part of the Lagos lagoon complex. The lagoon has a maximum depth of 6 m, though a large area of the lagoon is relatively shallow

with a minimum depth of 1m, and the vegetation surrounding the lagoon is of the swampy mangrove type [18,19]. Epe lagoon is sandwiched between two lagoons, the Lekki lagoon (freshwater) in the east and the Lagos lagoon (brackish water) in the west [20]. The lagoon opens into the Gulf of Guinea (the sea) via the Lagos Harbour.

2.2 Collection of Sample

A total of 252 fish samples of *P. obscura* comprising 163 females and 89 males were obtained from catches of artisanal fishermen at the Chief market fish landing station located at Epe lagoon. Samples were collected once monthly for six months, from January to June 2018. They were preserved in an ice-chest from the landing point and transferred into a deep freezer (temperature -20°C) at the Central Research Laboratory of Lead City University, Ibadan, Nigeria.

2.3 Laboratory Procedures

Fish identification and biometric features: Fish samples were sorted and identified following fish identification guides of Olaosebikan and Raji [21] and Idodo-Umeh [22]. Standard Length (SL) and Body Weight (BW) were measured to the nearest 0.1 cm and 0.01 g using digital Vernier caliper and electronic precision balance, respectively.

Length-weight relationships were estimated using the equation: W=aLb [23], the logarithmic transformation gives the well-known linear equation: log W=a+b log SL.

Where W = weight of the fish (g)

L = standard length of the fish (cm)

a = the regression constant which is also the intercept

b = the regression coefficient

2.4 Condition Factor (K)

The Fulton condition factor, which shows the degree of well-being or plumpness of the fish was determined by the formula: Condition Factor $K = 100\ W/L^3$

Where k = Fulton condition factor;

L = standard length in centimeters (cm); and

W = weight in grammes (g).

2.5 Statistical Analysis

The regression statistics was estimated by Analysis of Variance (ANOVA). Means were expressed as ± SD and compared using t-test. The regression coefficient of the sexes was compared by analysis of Covariance (ANACOVA) to establish the variations in the 'b' values between them. Relationships between variables (length vs. weight) were analysed using the t-test on 'r' values to reveal whether a significant correlation exists between length and weight. Values were considered significant at $P \leq 0.05$.

3.0 RESULTS

3.1 Length-weight Relationship

The length-weight frequency distribution of *P. obscura* sampled from Epe lagoon is shown in Table 1. The males ranged from 19.50 to 36.70 cm in SL and BW ranged between 58.80 to 313.00 g. In addition, for the females, the SL and BW ranged from 19.70 to 36.70 cm and 67.50 to 331.00 g, respectively. The mean SL and BW for the male were calculated as 27.40 ± 5.10 cm and 243.26 ± 92.34 g (n=89), respectively. The females were calculated as 28.62 ± 4.82 cm and 281.02 ± 53.77 g (n=163), respectively. The mean SL calculated for the combined sex is 28.22 ± 4.95 cm.

Table 1. Length-weight Relationship of *P. obscura* in Epe Lagoon, Nigeria

		Standard Length (cm)			Body Weight (g)		
Sex	n	Min	Max	Mean ± SD	Min	Max	Mean ± SD
Males	89	19.50	36.70	27.40 ± 5.10	58.80	331.00	243.26 ± 92.34*
Females	163	19.70	36.70	28.62 ± 4.82	67.50	331.00	281.02 ± 53.77*
Combined sex	252	19.50	36.70	28.22 ± 4.95	58.80	331.00	267.69 ± 72.16*

n=Number of fish sampled, **SD** = Standard Deviation.] *Significant at 0.05% ($p < 0.05$).

The logarithmic relationship between length and weight of males, females, and combined sexes of *P. obscura* together with correlation coefficient is depicted in Table 2 and Figures 2-4, respectively. The correlation

coefficient 'r' between log length and log weight was found to be 0.58 in males, 0.60 in females, and 0.62 in the combined sexes. The regression coefficient 'b' value for males, females, and the combined sexes were 2.60, 2.70, and 2.65, respectively, manifested a significant departure of 'b' value from 3 in all.

Table 2: Regression Statistics for Length-weight Relationship of *P. obscura* from Epe Lagoon, Nigeria

Sex	n	a	b	r
Male	89	0.804	2.60	0.58
Female	163	2.881	2.70	0.60
Combined Sex	252	2.099	2.65	0.62

n = Sample size; **a** = regression intercept; **b**= Regression coefficient; **r** = Correlation coefficient.

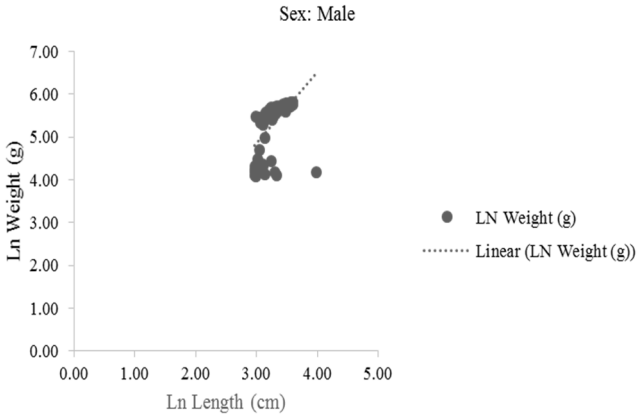

Figure 2: Length-weight Relationship of Male *P. obscura* in Epe Lagoon.

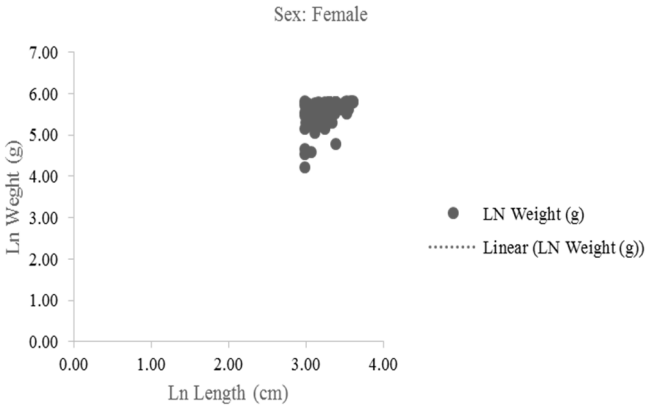

Figure 3: Length-weight Relationship of Female *P. obscura* in Epe Lagoon.

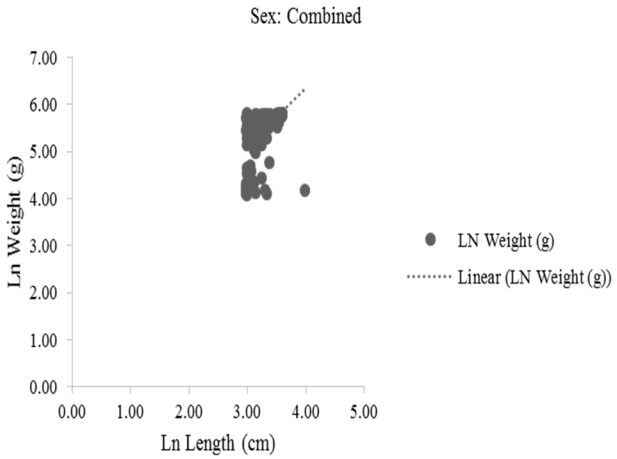

Figure 4: Length-weight Relationship of Combined sexes of *P. obscura* in Epe Lagoon.

Table 3: Condition Factor of *Parachanna obscura* in Epe Lagoon, Nigeria

Sex	Condition Factor	Mean ± SD
Males	$\frac{\Sigma K = 104.97}{n \quad 89}$	1.18±0.48*
Females	$\frac{\Sigma K = 220.91}{n \quad 163}$	1.36±0.70*
Combined sex	$\frac{\Sigma K = 325.88}{n \quad 252}$	1.29±0.64*

ΣK=Summation of condition factors, **n**=Number of fish samples used, **SD** = Standard deviation. * Significant at 0.05% ($p < 0.05$).

The mean values of the condition factors of male, females, and combined sexes of *P. obscura* in Epe lagoon were indicated in Table 3. The highest mean K value was found in females (1.36±0.70), while the lowest was in males (1.18±0.48), respectively. There was a significant difference between the condition factors of the females and the males' *P. obscura* ($p < 0.05$).

3.0 DISCUSSION

Length-Weight relationship (LWR) is an effective tool for properly exploiting and managing the fish stock population. According to Nagesh *et al*., [24], LWRs have significant importance in studying the growth and general well-being of the fish population. Ayoade [25] stated that during their development, fish are known to pass through stages in their life history which are defined by different length-weight relationships. In the present study, the correlation coefficient 'r' is moderately uphill, which indi-

cated a moderate positive relationship in the length-weight relationship of *Parachanna obscura* in Epe lagoon. This implied that some fishes were more slender as they increased in weight, while others were relatively stouter or bulky as they increased in length.

The regression analysis of the present study showed that *P. obscura* exhibited a negative allometric growth pattern with 'b' values less than 3 in males, females, and the combined sexes, respectively. Though the 'b' values for both sexes were not significantly different, the result conforms to the findings of Adeleke *et al.,* [26], where the negative pattern of allometric growth of 0.365 ±0.141 and 0.329±0.169 respectively was reported for Parachanna africana in Ijede and Agbowa lagoons, Lagos, Nigeria. The result also corroborated with the study of Obasohan *et al.,* [27], who reported negative allometric growth patterns in five different fish species, including *P. obscura* from Ibiekuma stream, Ekpoma, Edo State, Nigeria. Ayoade and Ikulala [28] also reported negative allometric growth patterns for Sarotherodon melanotheron and Hemichromis bimaculatus in Eleyele Lake. Negative allometric growth patterns were also observed in the study of Arnoglossus thori and Solea in the Aegean Sea [29]. Similar findings were made by Abowei and Davies [30], and Deekae *et al.,* [31], where negative allometric growth of b=0.88 and b=2.88 were recorded for the studies of Clarotes laticeps in the water reaches of the lower Nun River, Niger Delta, and Alectis alexandricus in Bonny River, Nigeria, respectively. Imam *et al.,* [32] also reported a negative pattern of allometric growth in the research conducted on four fish species (*Tilapia zilli, Oreochromis niloticus, Hemichromis bimaculatus* and *Clarias gariepinus*) from Wasai Reservoir in Kano. Olanrewaju *et al*., [33] also reported that the females exhibited negative allometric growth while males and combined sexes manifested a positive allometric growth pattern for *P. obscura* in Eleyele Reservoir, Ibadan, Nigeria.

The variation in the 'b' value herein of the present study and from other studies could be attributed to food abundance, season, age, sex, fishing pressures, habitat, geographical location, sampling methods, sample size, environmental conditions as well as adaptive responses to the depth and size of the river system [34, 35, 36, 27].

The obtained mean condition factor (K) suggests that the fish were heavy and in good condition throughout the experimental period, which was likely due to favourable environmental conditions, availability of food, age, and physiological state of the fish [37, 4, 38]. The condition factor recorded in this study conforms to the study of Oronsaye [39], who reported a mean condition factor of 1.76 for *P. obscura* obtained from Ossiomo River, Delta State. According to Nikolsky [40], "a fish is said to be in good condition when the condition factor is more than 1.0". This suggests the suitability of water quality parameters and environmental conditions affecting the growth and development of *P. obscura* in Epe lagoon.

Significant relationships were established between the fish body weight and standard length. The condition factor (k) value of *P. obscura* species indicated that the well-being of fish was good. Based on these findings, it is evident that the growth of *P. obscura* is negatively allometric. Therefore efforts by fish biologists should be directed to improve and maintain the environmental condition of the lagoon for sustenance of this species and others. These results will help further studies on the population assessment of the species in Epe lagoon and aid review of the human activities on the water bodies.

Conflict of interest

The Author declare that there is no conflict of interest

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