LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF AFRICAN SNAKEHEAD PARACHANNA AFRICANA (STEINDACHNER, 1879) FROM IJEDE AND AGBOWA LAGOONS, LAGOS STATE, NIGERIA

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ABSTRACT

The knowledge of length-weight relationship parameters has numerous practical applications in fishery research and management. Currently, there is a dearth of information on the growth pattern and state of well-being of *Parachanna africana* in Ijede and Agbowa Lagoons. This study period was between December 2017, and June 2018 investigated the allometry and condition factor of *P. africana* inhabiting the Ijede and Agbowa Lagoons, South-western Nigeria. Two hundred fish samples of *P. africana* was gotten from fishermen at both locations. The length and weight measurements were taken to the nearest centimetres and grams. Descriptive, correlation and regression tools, was used to analyse the data collected. Results obtained showed that the length-weight relationship had r^2 values of 0.186, 0.196, 0.191 and 0.341, 0.001, 0.098 for Ijede and Agbowa respectively, at a significant level of $P<0.05$ for male, female and combined sexes. The b values of 0.193 for Ijede and 0.165 for Agbowa were not significantly different ($P> 0.05$). The mean condition factors of 0.365 ±0.141 and 0.329±0.169 were obtained in Ijede and Agbowa, respectively. It was observed that the species in both lagoons exhibited negative allometric growth patterns with values 0.365 and 0.330 for Ijede and Agbowa lagoons respectively with no variations in the condition factors of both locations which indicate the need to assess human and domestic activities surrounding these water bodies.

Keywords: Lagoon, *Parachanna africana*, Allometric growth, Condition factor, Lagos State.

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INTRODUCTION

African Snakehead are bony fishes and found in the freshwater of tropical Asia and Africa (Bailey, 1994), they thrive in a harsh environment and known to be Benthopelagic and potamodromous fish. (Riede, 2004). It has a flattened head with small scales, a torpedo-shaped body, long dorsal and anal fins, and toothed jaws. *P. africana* is a benthopelagic, carnivorous species and one of the two snakeheads commonly found in Western Africa (Lalèyè & Olaosebikan, 2010). *P. africana* is an inhabitant of large rivers, canals, lakes and other aquatic habitats along with other species of the same genus (Courtenay & Williams, 2004). This fish belongs to the genus *Channa* which contributes to the capture fishery of inland waters. Its tolerance to a variety of habitats and carnivorous feeding habits make it an essential component of fish farming with an understanding of their biology and ecological requirements (Latif *et al*., 2015).
However, this fish has been documented by (IUCN, 2016) as an endangered species. A better understanding of the natural populations of this fish is for proper conservation and exploitation (Osho & Usman, 2019).
Morphometric is the measurement of size and shape of fish (Kutlu *et al*., 2017). These analyses are commonly performed on organisms and are useful in analysing their fossil records, quantifying traits of evolutionary significance detecting changes in the fish shape and deductions on their ontogeny, functions or evolutionary relationships. Also, morphometrics is to statistically test hypothesis about the factor that affects the shape. Morphological characters have been commonly used in fisheries biology to measure discreteness and relationships among various taxonomic categories (Kutlu *et al*., 2017).

The studies on Length-Weight Relationship (LWR) and condition factor is imperative for fish stock assessment, proper management decisions and conservation of aquatic resources as they are essential prerequisites to a more detailed study on breeding and production (Kumolu-Johnson & Ndimele, 2010; Pepple & Ofor 2011; Dan-Kishiya, 2013; Osho & Usman, 2019). The condition factor is essential in understanding the life cycles of fish species and contributes to adequate management of these species (Akinsanya *et al*., 2010) while the length-weight relationship is a useful tool in fish growth pattern, estimation of mortality, recruitment and other parameters of the population (Pepple & Ofor 2011). The Lagos Lagoon is an intricate system of waterways and a source of revenue generation as it serves as a connection between the mainland and island, connects many fishing communities to the city. It is a significant source of *P. africana* and other aquatic foods as *P. obscura, Coptodon zilli*, *Sarotherodon galilaeus, Malapterurus electricus, and Clarias gariepinus* for people living in the communities and their environs (Imam *et al.,* 2010). Jamu and Ayinla (2003) reported that the fish yields of most of Nigeria's inland waters were generally on the decline. Channidae has over 29 recognised species (Musikasinthorn & Taki, 2001) and most of the species are going extinct. However, the paucity of information on *P. africana* in the water body and a sharp decline in the abundance rate, there was the need to study the present status of fishes in these water bodies. Therefore, this study was to give insight on the morphometric characterization, length-weight relationship and condition factor of *P. africana* in Ijede and Agbowa Lagoon.

Materials and Methods

Description of the study area

The Lagos lagoon located between Latitude 6° 26 - 6° 38' N and Longitude 3° 23 - 3° 43' E. It hosts different diversity of flora and fauna species with an abundance of fin and shellfishes (Akinnigbagbe & Osibona, 2017). The fish samples collected at two various landing sites; Ijede (Lat. 6° 33'N and Long. 3°35' E) and Agbowa (Lat. 6° 39'N and Long. 3° 43'E) in Lagos State. The selection of the study areas based on their similar vegetation and aquatic life because they share the same source which is the Lagos Lagoon, easy accessibility, high level of fishing activities, their prominence to their immediate environment as the fishing terminus and the effect of the thermal effluent at Egbin cannot but be recognised.

Fish Sample Collection

Two hundred (200) specimens were collected in all every week between December 2017 and June 2018, at the two different landing sites (120 samples at Ijede and 80 samples at Agbowa) with the aid of artisanal fisher-folks. The specimen was immediately preserved in ice-packed cooler and transferred to the laboratory for easy identifications. Precautions were taken to prevent damage to the fin and other characteristics of morphometric relevance.

Identification of Specimens

The Identification of the fish samples collected was made using the monograph descriptions, checklist and key provided by (Olaosebikan & Raji, 2013), while the sex of the specimens was identified by visual observation of its morphological characteristics after dissection of the internal organs and genital opening; the male having the milt in the sac lining the lower part of the abdomen towards the anal opening while the females have sacs lying close to the anal opening that is wider than the males (may contain eggs or not).

Morphometric Data

The morphometric characters were taken using meter rule to the nearest centimeter based on measurement,(Olaosebikan & Raji, 1998; Roberts & Khaironizam, 2008; Adaka, *et al*., 2016).The Total and standard lengths were taken to the nearest 0.1cm and weighed (Ohaus, FD Series®) to the nearest 0.01g for the two water bodies. For each location, the mean total length and weight with its corresponding standard error were calculated.

Length-Weight Relationship

The length-weight relationship of *P. africana* was calculated and represented by the equation:
$W = a + bL$ (Ricker, 1971)
Where W is the body weight (g), L is Standard length of the body in (cm), "a" is regression constant (intercept) and "b" is regression coefficient (Slope)

The equation was then transformed into the linear regression equation as:

The relationship betw$\text{Log}W = \text{Log}a + b\ \text{Log}L$ variables was calculated by determination variables (R).The correlation (r^2) is the degree of association between the length and weight was computed from the linear regression analysis: $R=r^2$

Condition Factor (K)

The condition factor which measures the relative well-being of the fish was calculated for both sexes using $K = 100W/L^3$ by (Froese, 2006):

K = Condition factor; W = Weight (g); L = Length (cm)

Data Analysis

The data of morphometric parameters were analysed using descriptive statistics and regression. The regression coefficient of the sexes was compared by analysis of Covariance (ANCOVA) to establish the variations in the 'b' values, if any, 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. Also, charts were plotted using SPSS version 23.0.

Results

Length-weight relationship

The results revealed that out of the 200 *P. africana* examined in this study 101(51%) were females and 99 (49%) were males from both water bodies given a sex ratio of 1:1.02. The samples ranged in total length from 23.00 to 50.40 cm with a mean of (35.44 ± 4.92) and from 23.00 to 50.40 cm with a mean of (36.09 ± 5.56) for Ijede and Agbowa waters respectively. The total weight ranged from 27.00 to 195.10g with mean and SD (95.50 ±32.67) and from 23.40 to 173.10g with (84.23 + 26.55) for Ijede and Agbowa lagoons respectively (Table 1).

The regression model (Figures 1-6) indicating the relationship between length-weight of male, female and combined sexes of *P. africana* had r^2 values 0.186, 0.196, 0.191 and 0.341, 0.001, 0.098 for Ijede and Agbowa respectively, at a significant level of $P<0.01$ is depicted in Table 2 and Figures 1-6 respectively below. The coefficients of length (b) of males in Ijede and Agbowa (with the value of 0.176 and 0.316) were positive with those of the females in Ijede (with values of 0.196) as well as combined sexes of Ijede and Agbowa (with values of 0.193 and 0.165 respectively) while the females in Agbowa (with values of 0.014) were negative (Table 2).

Table 1: Mean values of weight, total and standard length of different sexes of *Parachanna africana* collected from Ijede and Agbowa Lagoon.

	Sex	Male		Female		Combined sexes	
Location		Min-Max.	Mean±SD	Min -Max.	Mean±SD	Min.-Max.	Mean±SD
IJEDE	W (g)	27.00 -187.90	96.05±31.04	44.00- 195.1	95.01 ±34.27	27.00-195.1	95.50±32.67
	TL (cm)	27.00 -50.40	35.54±4.88	23.00 – 49.10	35.36 ± 4.99	23.00 –50.40	35.44 ± 4.92
	SL (cm)	23.20 -42.80	30.49±4.44	14.5- 44.8	30.18 ± 4.85	14.5 - 44.8	30.33±4.65
AGBOWA	W (g)	23.40 -126.30	81.19 ±21.09	42.9-173.10	87.75±31.69	23.40 - 173.10	84.23±26.55
	TL (cm)	23.00 - 50.40	35.07± 5.77	25.0 – 49.10	37.27±5.13	23.0 – 50.40	36.09 ± 5.56
	SL (cm)	21.40 - 47.80	29.42±5.11	22.80 – 44.80	31.74± 5.03	21.40 – 47.80	30.49±5.17

Weight (W), Total (TL) and Standard Length (SL)

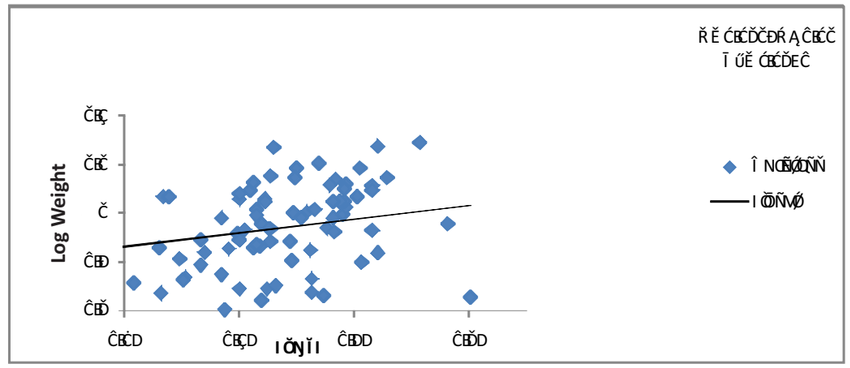

Figure 1: Length-weight relationship of *Parachanna africana* (combined sexes) collected from Ijede Lagoon.

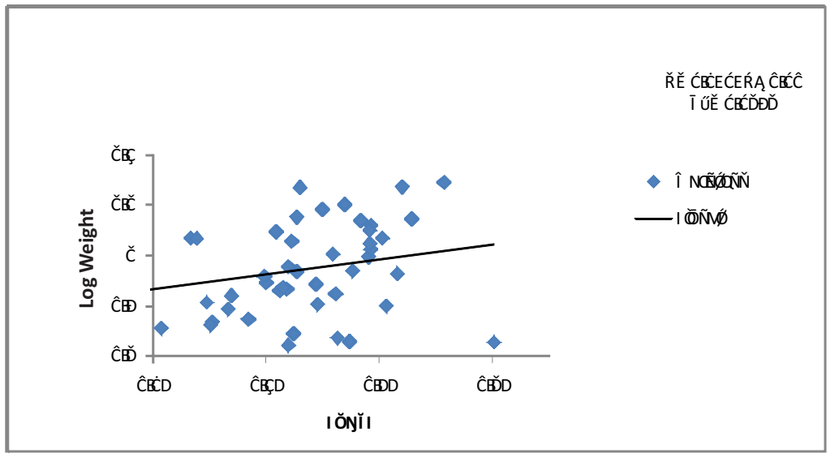

Figure 2: Length-weight relationship of *Parachanna africana* (Female) collected from Ijede Lagoon.

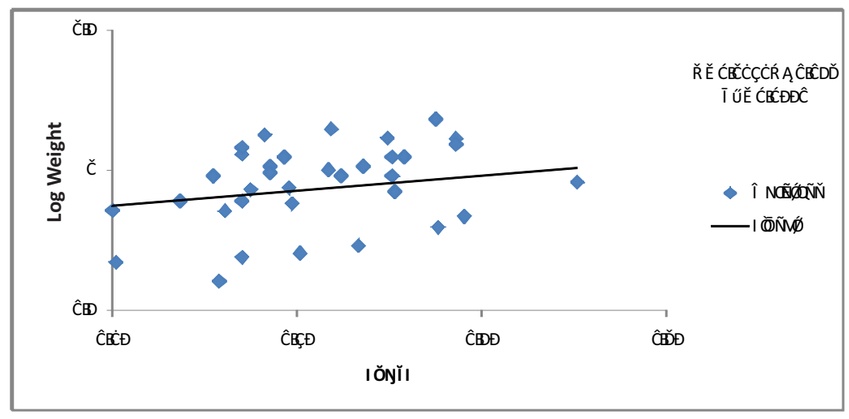

Figure 3: Length-weight relationship of *Parachanna africana* (Male) collected from Ijede Lagoon.

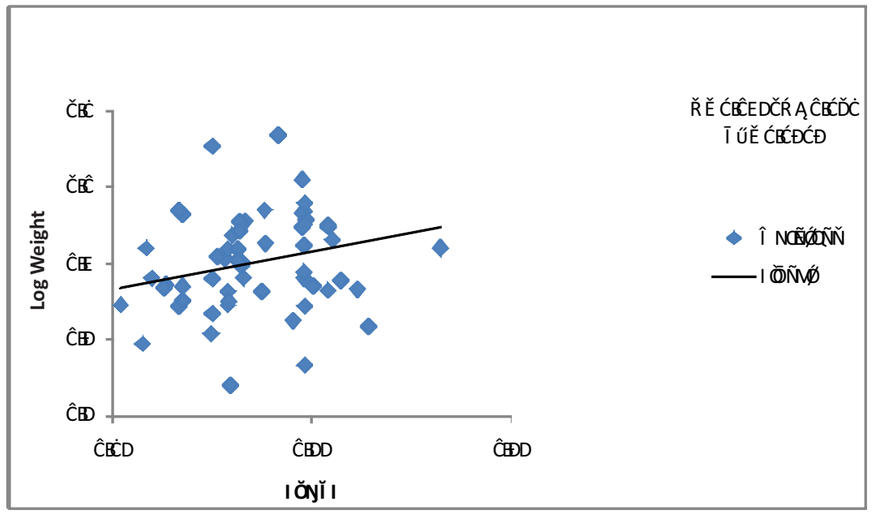

Figure 4: Length-weight relationship of *Parachanna africana* (Combined sexes) collected from Agbowa Lagoon.

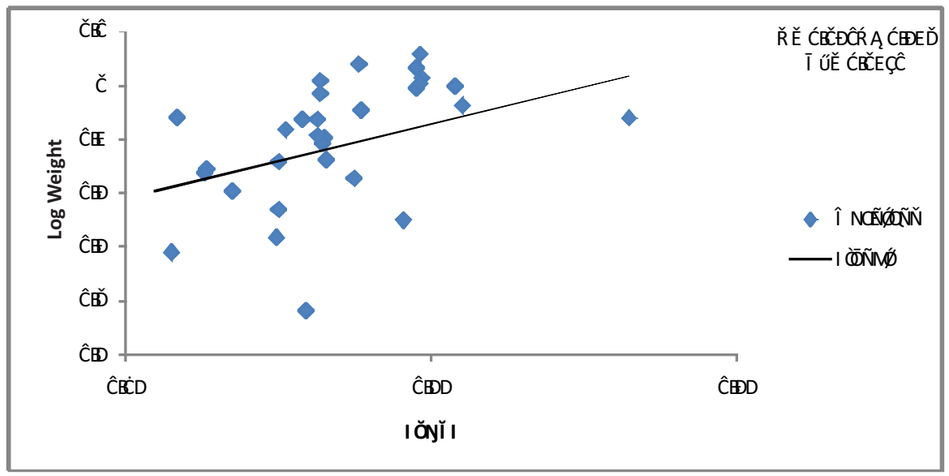

Figure 5: Length-weight relationship of *Parachanna africana* (Male) collected from Agbowa Lagoon.

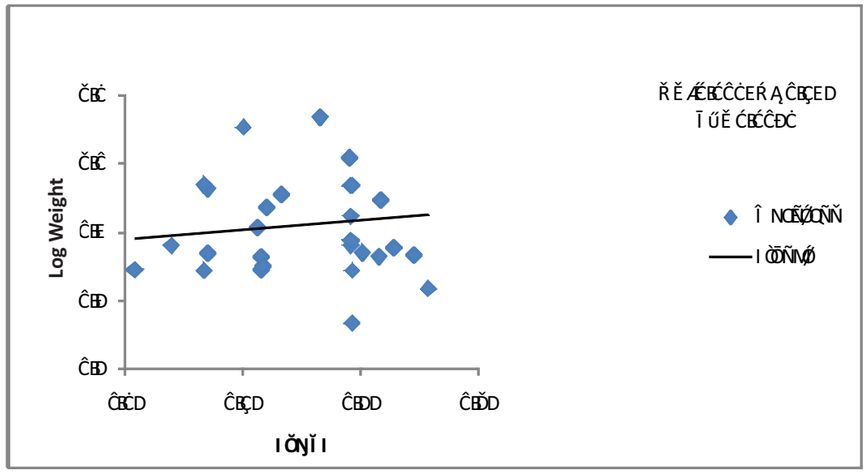

Figure 6: Length-weight relationship of *Parachanna africana* (female) collected from Agbowa Lagoon.

The 'r' values (Table 2) showed the existence of an excellent relationship between length and weight ($P<0.01$). The benefits of the regression coefficient 'b' in Ijede and Agbowa vary within the sexes as the highest value (0.209) observed in Ijede was amongst the females while a negative coefficient (-0.014) was observed amongst the females in Agbowa.

Table 2: The Length-weight relationship of *P. africana* population from Ijede and Agbowa Lagoons.

Location	Gender	n	a	b	r	r^2
Ijede	Male	56	1.136	0.176	0.432**	0.186
	Female	64	1.067	0.209	0.443**	0.196
	Combined Sex	120	1.102	0.193	0.437**	0.191
Agbowa	Male	43	0.864	0.316	0.584**	0.341
	Female	37	1.524	-0.014	0.029	0.001
	Combined Sex	80	1.163	0.165	0.313**	0.098

n -Sample size
b -Regression coefficient
r -Correlation coefficient; r^2-Correlation of determination.
**Significant at 1% (0.01) level.

Condition Factor (K)

The mean values of the condition factors of male, females and both sexes of *P. africana* in Ijede and Agbowa lagoons were indicated in Table 3. The condition factors ranged between 0.08 and 1.09 in Ijede with a mean value of 0.362 while it ranged between 0.07 to 0.72 in Agbowa with a mean value of 0.328. The highest K value was found in Ijede females, and the lowest in Agbowa female with values of 1.095 and 0.073, respectively. There was no significant difference between the condition factors of both locations ($p>0.05$).

Table 3: Condition factor (K) of *Parachanna africana* collected from the Ijede and Agbowa Lagoons.

Location	Sex	N	Min - Max	Mean ±S. E
Ijede	Male	56	0.082 - 0.549	0.356 ± 0.017
	Female	64	0.084 – 1.095	0.373 ± 0.022
	Combined Sex	120	0.082 - 1.095	0.365± 0.140
Agbowa	Male	43	0.080 - 0.698	0.343± 0.194
	Female	37	0.073 - 0.720	0.312± 0.026
	Combined Sex	80	0.073 - 0. 720	0.330± 0.169

N= No of Samples

Discussion

The rates of growth in animals are usually observed from the data of its length-weight relationship (LWR). Ayoade (2011) asserted that during their development, fish are known to pass through stages in their life history which are defined by different length-weight relationships. In this study, the correlation coefficient 'r' for LWR was highly significant for *Parachanna africana* in both Ijede and Agbowa rivers which implied that the length increased with an increase in weight of the fish. This result was in agreement with earlier studies involving fish species from different water bodies in Southwestern Nigeria (Osho & Usman, 2019; Olurin & Savage 2011; Olanrewaju *et al*., 2017).

Results also revealed that *P. africana* exhibited negative allometric growth pattern with regression analysis exponent b values less than 3 in Ijede and Agbowa fishes. The regression coefficient 'b' of a male in Agbowa (0.316) was found to be highest while that of the Agbowa female is negative (-0.014). The 'b' values in length-weight relationships determine the growth pattern of the fish species. According to (Wootton, 1990), who reported that if the fish retains the same shape and its specific gravity remain unchanged during a lifetime, it is growing isometrically. The value of exponent 'b' would be exactly 3.0. However, an amount significantly larger or smaller than 3.0 indicates allometric growth. A value of less than 3.0 shows that the fish has become lighter (negative allometric) and greater than 3.0 indicate that the fish become heavier (positive allometric) for a particular length as it increases in size (Olanrewaju *et al*., 2017).

Reports on the LWR of Channid fishes divulge that many of them strictly follow cube law while there are many in which the weights of fishes either tend to increase or decrease in proportion to the cube of length. The results found in this study was different with that of (Osho & Usman, 2019) that reported exponential 'b' value of 3.133 for male and 2.674 for female in *Parachanna obscura* population in Anambra River, and also disagrees with the work of (Olurin & Savage, 2011) reported that male *P. obscura* showed positive allometric growth while females grew isometrically in River Oshun, South-west Nigeria.

The results also corroborated the findings of (Obasohan *et al.,* 2012) who reported negative allometric growth pattern in five different fish species, including *P. obscura* from Ibiekuma stream, Ekpoma, Edo State, Nigeria. Imam *et al.* (2012) also reported a negative pattern of allometric growth in the research conducted on four fish species, including *Coptodon zilli, Oreochromis niloticus* and others from Wassai Reservoir in Kano. However, Garba & Arome, (2006) reported isometric growth pattern for *Malapterurus electricus* from the Lower Benue River and as well as similar findings on *Ethmalosa fimbriata* and *Ilisha africana* from the Nkoro River (Abowei & Hart, 2009). Although positive allometry in Eleiyele was reported by Olanrewaju *et al.* (2017) and in *Chrysichthys nigrodigitatus* of Epe Lagoon, Nigeria (Fafioye & Oluajo, 2005) as against the results in Ijede and Agbowa lagoons, these might be due to the decline in the population of snakeheads as a result of factors such as unethical fishing, habitat alterations and diseases (Zakariya *et al.,* 2013). The changes in b value of the fishes may be attributed to certain environmental factors such as over fishing, food competition, age, sex, sampling methods, sample size, as well as the prevailing ecological conditions in the water (Obasohan *et al*., 2012 and Kpogue *et al.,* 2012).

The study showed the condition factor of *P. africana* from Ijede and Agbowa Lagoons were 0.364 and 0.328, respectively. Condition factor is an index used for monitoring feeding intensity, age and growth rate in fish. It is strongly influenced by both abiotic and biotic environmental conditions and can be used to assess the status of the aquatic ecosystem where the fish live (Anene, 2005). The results of the condition factor were less than one and are in tandem with the findings of Obasohan *et al*. (2012) who recorded values less than 0.5 and 0.9 for *Papyrocranus afers* and *P. obscura*, respectively. Bassey & Ajah, (2010) also documented condition factors ranging between 0.63 and 0.79 for pond cultured *P. obscura* has given different feed types in Calabar, Nigeria, while Oyelese (2006) recorded a value of 0.80 for *P. obscura* from Ibadan, Southwest Nigeria. Results from the present work were, therefore, within the ranges that have been documented for captured and cultured *P. obscura* in Nigeria. These patterns of obtained results might be owed to the fact that the species is highly streamlined and not a robust fish or round. Froese (2006); Treer *et al.* (2009) concluded that different body forms of fish such as elongated, fusiform and short or deep body types have a significant effect on condition factors. It might also be attributed to different factors such as sex, age, state of maturity, size, state of the stomach fullness and environmental factors affecting fish in water bodies (Ama-Abasi & Affia, 2010; Yem *et al.*, 2007; Adeyemi *et al*., 2009).

Conclusion

The *P. africana* fishes in Ijede are longer and more significant in weight than the fishes in Agbowa. Also, the species in Ijede and Agbowa exhibited a negative allometric growth pattern. There were no variations in the condition factors of both locations as they are both less than 1, these confirmed that the species are not in good condition of well-being though Ijede fishes are more robust than Agbowa fishes. These results will help in further studies on the population assessment of the species in both water bodies and aid review of the human activities on the water bodies.

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