

Biometric Indices and Condition factors of *Pomadasys jubelini* (Cuvier, 1830) from Obuama Creek, Nigeria

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Abstract

Biometric indices of *Pomadasys jubelini* from Obuama Creek, Rivers state, Nigeria were investigated using length frequency distributions (LFDs), length-weight relationships (LWRs), length-length relationships (LLRs), condition factors (allometric, K_A , Fulton's, K_F and relative, K_R). Specimens were captured in a stretch of the creek from March to September 2019. A total of 229 specimens were examined with the total length (TL) and weight (W) ranging from 8.7 to 50.4 cm and 8.7 to 834.5 g respectively. The standard length (SL) ranged from 5.3 to 46.8 cm, fork length (FL) was between 6.5 to 48.7 cm and the girth length (GL) varied from 4.7 to 38.7 cm. The relationships of weight-length showed a negative allometric growth pattern with a value of "b" of 2,666. Fulton's condition factor (K_F) ranged from 0.10 to 5.45, with an average of 1.21 ± 0.66 indicating perfect wellbeing for the species. The LLR's allometric coefficient 'b' between TL vs. FL and TL vs. GL showed positive allometric growth, while SL vs. FL, SL vs. TL, SL vs. GL, and GL vs. TL showed negative allometric growth, although the values were close to 1. These findings also provided some new and updated information on some of the morphometric characters of *Pomadasys jubelini* in Obuama Creek that could be useful for fisheries management and fish species protection measures in the creek and adjacent habitats.

Keywords: Condition factors, Obuama Creek, *Pomadasys jubelini*, LWRs, LLRs

Introduction

The Sompat grunt *Pomadasys jubelini* (Family Haemulidae) is native to the waters of the east Atlantic Ocean and to the Pacific coast of the Americas through the Indian Ocean (Froese and Pauly, 2013). *Pomadasys jubelini* is a demersal species that inhabits most of Nigeria, North and other West African rivers, rivers, estuaries, coastal and brackish waters (Viveen et al., 1977; Idodo-Umeh, 2003). Of all the grunts found in Lower Guinea's coastal waters, this species tends to be found most upstream and best suited to freshwater habitats (Snoeks and Vreven, 2008). *Pomadasys jubelini* is important in the riparian community of the Delta of Niger due to its abundance, availability (all year round), tasteful flesh, economic and nutritional values (Agbugui and Oniye, 2016). *Pomadasys jubelini* is target species exploited by artisanal fishing and due to the increase in indiscriminate fishing, habitat destruction, pollution the species is waning in Nigeria. The annual catch of the family Haemulidae, increased from 4,902 tonne in 2010 to 8,721 tonne in 2014 and decreased slightly in 2015 to 8,362 tonne in Nigeria waters (NBS, 2017).

Morphometric relationships including length-weight relationships (LWRs), length-length (LLRs) and

different condition factors are important biological parameters for fishes to assess the health of the fish stock population (Hossain, 2010). Morphometric analysis helps to understand the relationship between the body parts (Carpenter, 1996). The relationships of length-weight and length-length are also used to measure fish stocks and provide information on fish health and growth patterns (Ricker 1968). For life history and morphological comparisons of populations from different regions, the length-weight relationship can be used (Petrakis and Stergiou, 1995). In addition, the LLRs are very significant because several ecological and physiological factors depend more on length (Hossain et al., 2006). The relationship between length and girth has been linked to fish feed guilds (Pet et al., 1995). Furthermore, the relationship between length and girth has an impact on selectivity and it is important to consider girth in order to be able to devise better management plans (Efanov et al., 1987).

Furthermore, the condition factor (K) is determined from the relationship between the weight of a fish and its length in order to describe the "condition" of that individual fish (Froese, 2006) and also to predict future population success due to its effect on development, reproduction and survival

(Richter, 2007). Condition factor helps to understand the life cycle of fish species and is also crucial to species management and therefore maintains an ecosystem balance (Iyabo, 2015). Different K values indicate the sexual maturity status, the degree of availability of food sources, age and sex, and environmental conditions (Gomiero, 2005).

From Nigeria only few reports on the length-weight relationship of *Pomadasys jubelini* collected from different localities has also been described by various other workers (Adebiyi, 2013; Daniels and Oyediran 2015; Oluwakayode et al., 2016) But a little literature is available on totality of biometric in Nigerian waters. Therefore, the present study aimed at investigating biometric relationships and condition factors of *Pomadasys jubelini* (allometric, K_A ; Fultons, K_F ; relative, K_R ; and relative weight, W_R) in Obuama Creek, Rivers State, Nigeria and the results of such analysis may provide information for proper management and optimal use of the species.

Materials and Methods

The Obuama Creek is located in Obuama (Harris town) in Degema Local Government Area, Rivers State, Nigeria with an area of 1,011 km². Obuama Creek is a tributary of the Sombreiro River,

one of the series of rivers that drain into the Atlantic Ocean in the southern part of the State of the Rivers. The sampling sites were determined based on information from local fishermen. Poku (Station 1) is situated at Latitude 04°48.004' N and Longitude 006°46.565' E while Erimia Poku (Station 2) is situated at Latitude 04°48.033' N and Longitude 006°46.523' E (Figure 1.). In relation to the climate Rivers State is a tropical monsoon climate with high rainfall rates of between 3,420 mm and 7,300 mm (NMA, 2013). There is very short dry seasons, with only the months of December and January being considered as dry season months. Average temperatures typically range from 25 ° C to 28 ° C. The Obuama Creek is brackish and appears turbid during the rainy season.

Data collection

A total of 229 of *P. jubelini* were sampled on monthly basis from March to September 2019, from the two major landing sites with the assistance of local artisanal fishermen using beach seine nets (measuring 5.5m × 3 m, the mesh size ranges from 2.3- 10 mm). The specimens were immediately stored in an iced cooler and transferred to the Fisheries Laboratory, Faculty of Agriculture, University of Port Harcourt, Choba and immediately for further analysis. Proper identification was done with the aid of relevant

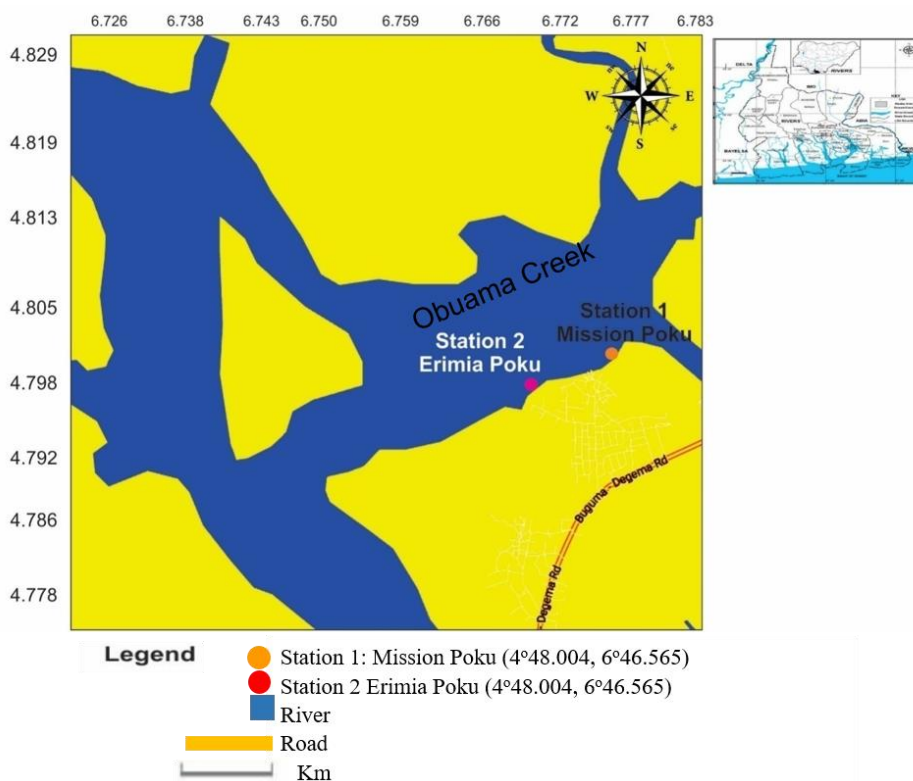


Figure 1. Map of the area of study showing the sampling stations

texts (Adesulu and Syndeham 2007, Froese and Pauly, 2011, Babatunde and Aminu, 2013).

Total lengths (TLs) and standard lengths (SLs), were measured with a precision of 0.01 cm using a measuring board. Measurements of girth (in front of first dorsal fin) were determined with a caliper at the nearest 0.01 cm. Weight of the fish was taken by means of an electronic precision balance of 0.1 g.

Data analysis

Analysis was carried out on the data obtained from the samples. The following stages of analytical methods were used; i) Analysis of the length-weight relationship was performed using $W = aL^b$ (Pauly, 1983) Where W= weight of fish in grams (g) L= length of fish in centimeters (cm) a= rate of weight change with length (intercept) b= weight at unit length (slope) Note: the equation has been transformed into a log to approximate the parameters 'a' and 'b' (Nehemiah et al., 2012). ii) Length-length relationship analysis was performed using $Y = a + bX$, (Alam et al., 2012) Where, Y= different lengths of the body, X= total length, a= constant proportionality and b= coefficient of regression. iii) Condition factor $K = 100W / LB$ Where K= condition factor W= the weight of the fish in grams (g) L= the total length in centimeters (cm) b= the value obtained from the length-weight equation. iv) The condition factor (K_F) of Fulton was calculated using the equation: $K_F = 100 \times (W/L^3)$ Where W= total body weight (Bw, g) and L= total length (TL, cm). To put the K_F close to the unit, the scaling factor of 100 was used. v) The relative condition factor (K_R) for each individual was calculated using the Le Cren (1951) equation: $K_R = W / a \times L^b$, W= Bw, L= TL and a and b=

LWR parameters. v) The allometric condition factor (K) was calculated using the Tesch equation (1968): W / L^b , W= Bw, L= TL and b= LWRs. vi) The relative weight (W_R) was calculated using the equation given by Froese (2006) as $W_R = (W/WS) \times 100$. Where, W= weight of a particular individual and WS= standard weight predicted for the same individual as calculated by $WS = a L^b$ where the values a and b are obtained from the relationships between TL and Bw.

Statistical evaluation

Regression correlation coefficient (r^2) was used to evaluate the relationships strength of TL vs. FL, FL vs. SL, and SL vs. TL relationships (LLRs) were used to estimate the following. All data were analyzed using SPSS (Version 16.0) computer software.

Results and Discussion

The monthly distribution of fish species in Figure 2 shows that the lowest was recorded in June and the highest recorded in March. The *P. jubelini* caught in March > September > July > August > May > April > June. Bodji et al. (2013) noted the month September as the month with the highest *P. jubelini* individuals and August as the month with its lowest individuals in the Grand-Lahou lagoon Côte d'Ivoire. January was also noted to contain the highest number of *Pomadasys incisus* individuals (a member of the Haemulidae family) (59), closely followed by March (58), while June recorded its lowest number of individuals (19) at the gulf of Tunis Tunisia (Fehri-bedouland Gharbi, 2008). It should be noted that the number of species will vary depending

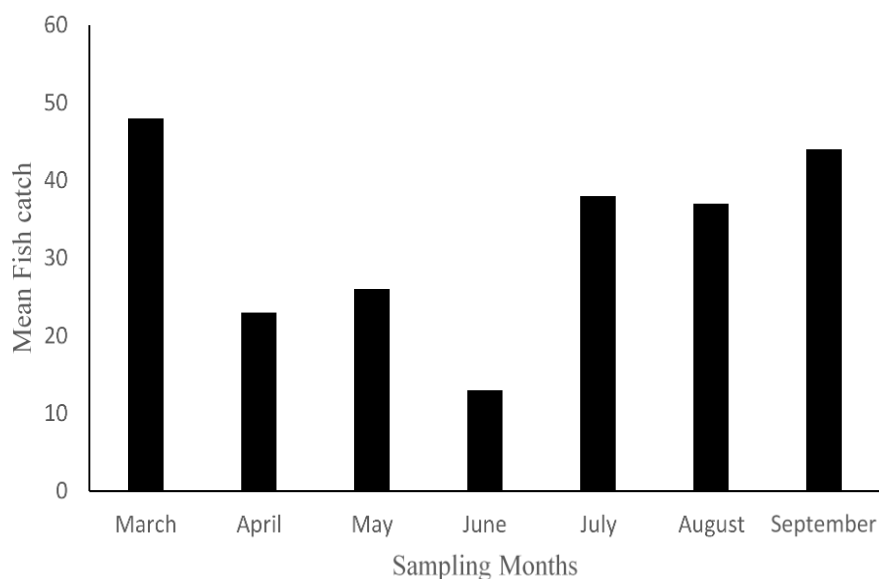


Figure 2. Mean monthly fish catch of *Pomadasys jubelini*

upon differences in the sampling methods and sampling effort (gear type, fishing time etc.), as well as fish abundance (usually affected by migration) (Olopade and Rufai, 2014), thus increasing or decreasing the abundance of species across the sample months.

The length, weight and girth measurements with 95 % confidence limit (CL) of *P. jubelini* are presented in Table 1. The weight ranged from 8.7 to 834.5 g, with an estimated mean weight of 176.53 g and the total length varied from 8.7 to 50.4 cm with mean of 23.13 cm (Figure 2.). Further results showed that the standard length (SL) ranged from 5.3 to 46.8 cm with an estimated mean standard length of 19.47 ± 7.78 cm. The forked length ranged from 6.5 to 48.7 cm with mean of 21.43 ± 8.06 cm. The girth ranged from 4.7 to 38.7 cm with an estimated mean of 16.32 ± 6.71 cm. When comparing the fish size recorded by different authors, it is possible to observe variations in the sizes of *P. jubelini* recorded in different locations. In Adebisi (2013), the weight ranged from 26.8 g to 175.1 g (mean= 103.0 ± 5.5 g) and the total length ranged from 13.9 cm to 26.6 cm (mean= 16.75 ± 0.10 cm) on the coast of Lagos, Nigeria. Agbugui (2013) presented SL to individuals between 8.50 cm and 47.60 cm with a weight range of 16.0 g to 2320.0 g in the New Calabar-Bonny River, Nigeria. Bodji et al. (2013), recorded size range of

10.90 to 32.70 cm, in the Côte d'Ivoire lagoons complex, West Africa. These observed variations in length and weight may be related to the growth stages, the level of fish species exploitation in different water bodies, as well as other fish species predation, the nature of the aquatic environment, and the abundance of fish species food (Agbugui, 2013).

All LWRs were highly significant ($P < 0.001$) with r^2 values equal to 0.689 and were the best fitted model among 4 equations based on the highest values of r^2 , BW vs. TL. Figure 3 shows the scatter plot or regression graph of the species total length and weight relationship. The calculated b value exponent for TL vs. BW was 2,666, while for SL vs. BW 2,428 and the b values for FL vs. BW and GL vs. BW were 2,562 and 2,156, respectively, both indicating negative allometric growth (Table 2.). Generally, the b values in LWRs should remain within the range of 2.5–3.5 (Froese, 2006). The pattern of growth observed in this study was a negative allometry ($b < 3$), as shown by the regression coefficient 'b' value of 2.666. This negative allometry growth observed can be attributed to an observation made by King (1991) that the inland waters of Nigeria have fish population which are dominated by population having negative isometric

Table 1 The estimated length (cm) and weight (g) measurements of *P. jubelini* in Obuama Creek

Measurement	N	Min	Max	Mean±SD	CL95 %
Weight(g)	229	8.7	834.5	176.53±155.85	156.23 - 196.82
Total Length (cm)	229	8.7	50.4	23.13±8.40	22.04 - 24.22
Forked Length (cm)	229	6.5	48.7	21.43±8.06	20.38 - 22.47
Standard Length (cm)	229	5.3	46.8	19.47±7.78	18.45 - 20.48
Girth Length (cm)	229	4.7	38.7	16.32±6.71	15.44 - 17.19

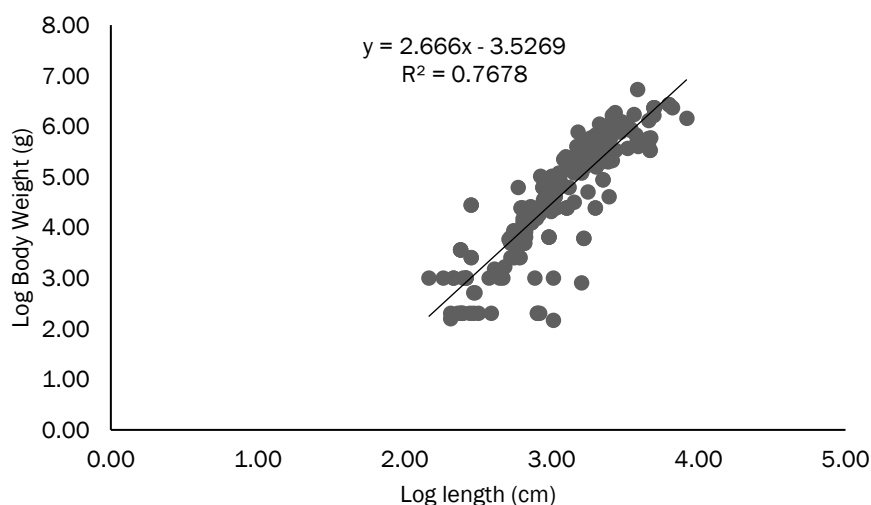


Figure 3. Length- weight relationship of *Pomadasys jubelini*

growth pattern. It should also be noted that multiple factors such as gonad maturity, diet, seasonal variability, environment and food availability may influence the length weight relationship in fishes. (Cheng *et al.*, 2006).

The relationship between TL, FL, GL and SL of *P. jubelini* with the LLR parameters and the coefficient of determination (r^2) is shown in Table 3. The calculated b values for all lengths ranged from 0.669 to 1.049 and all length-length relationships (LLRs) were also strongly correlated with (r^2) values varied between 0.702 and 0.977. Furthermore, LLR including the calculated b values recorded for GL vs TL was 0.669 (Figure 4.), SL vs GL was 0.973 and GL vs TL was 1.049 the best fitted model among 6 equations. In the present study, all LLRs indicated an allometric growth and were highly correlated with a regression coefficient b of SL vs TL of 0.911, while SL vs FL and TL vs FL of 0.948 and 1.019 were almost 1 (positive allometric), respectively. The results were consistent with Fiogbe (2003), which reported b values for SL vs TL, SL vs FL and TL vs FL as 1,200, 0,918 and 0,810, respectively, for the same species.

All morphometric measurements of fish will increase gradually, with an increase in the total length of fish (Tandon *et al.*, 1993). Calculated b values of 1,049 indicating positive allometric growth for TL vs. GL, SL vs. GL (0,973) and GL vs. TL (0,669) relations. Agbugui and Oniye (2013), noted that *P. jubelini*'s length-to-circle relationship showed positive allometric growth ($J > 1$). If the length-to-circle ratio in the sample is greater than 1 (*i.e.* $J > 1$), the length-to-circle of the fish is expected to increase faster than its total length (Agbugui and Oniye, 2013). Disparities in morphometric characteristics between the same species are due to ecological factors and variations in animal physiology or both. (Le Cren, 1951) or may have divergent morphologies in response to interspecific competition (Brown, 1971). Morphometric variations are also influenced by genetic diversity (Hebert *et al.*, 2003). There is therefore a strong relationship between morphology, genetics and fish ecology (Cavalcanti *et al.*, 1999).

Variations were observed in Obuama Creek's mean condition factors in *P. jubelini* (Table 4.). The variation in condition factors in a population may be

Table 2 The estimated parameters for length-weight relationships ($BW = a \times L^b$) of *P. jubelini* from the Obuama Creek

Equation	a	B	CL95% of a	CL95% of b	r ²	GT
$BW = aTL^b$	-3.519	2.666	-4.113 -2.925	2.471 - 2.855	0.767	-A
$BW = aFL^b$	-3.001	2.562	-3.6 -2.403	2.364 - 2.76	0.740	-A
$BW = aSL^b$	-2.343	2.428	-2.866 -1.82	2.248 - 2.607	0.758	-A
$BW = aGL^b$	-1.158	2.156	-1.676 -0.639	1.967 - 2.346	0.689	-A

Note: a and b are regression parameters of LWRs; CL, confidence limit for mean values; r², co-efficient of determination; GT, growth type; -A, negative allometric

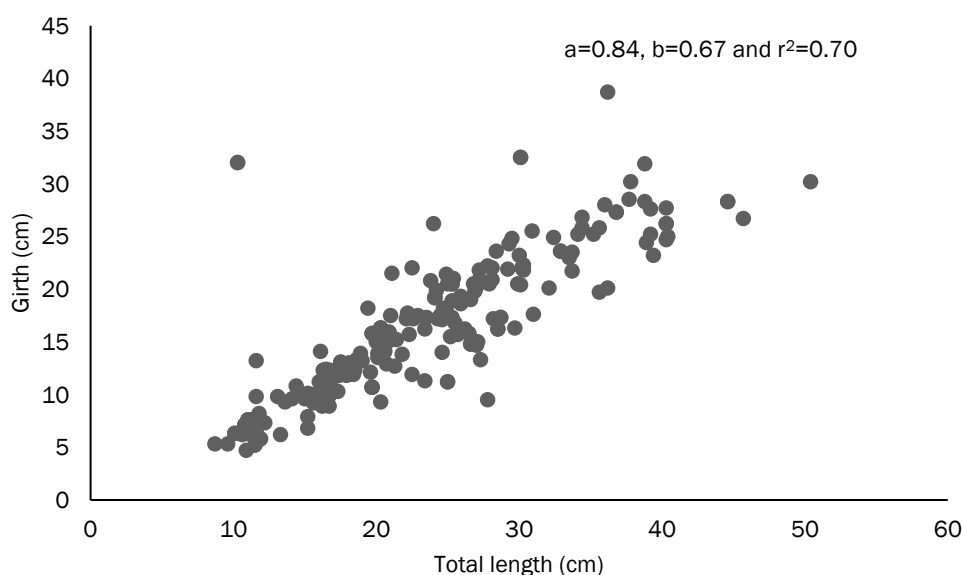


Figure 4 Length-girth relationship of *Pomadasys jubelini*

Table 3 The estimated parameters of the length-length relationships ($y = a + b \times x$) of *P. jubelini* from the Obuama Creek

Equation	a	B	CL95% of a	CL95% of b	r ²	GT
SL = a + bTL	-1.614	0.911	-2.137 - -1.091	0.890 - 0.933	0.969	-A
SL = a + bFL	-0.852	0.948	-1.400 - -0.304	0.924 - 0.972	0.964	-A
TL = a + bFL	1.298	1.019	0.627 - 1.969	0.990 - 1.048	0.977	+A
TL = a + bGL	6.018	1.049	4.441 - 7.594	0.959 - 1.138	0.702	+A
SL = a + bGL	3.599	0.973	2.146 - 5.053	0.890 - 1.055	0.704	-A
GL = a + bTL	0.836	0.669	-0.568 - 2.239	0.612 - 0.726	0.702	-A

Table 4 Condition Factors of *P. jubelini* from the Obuama Creek

Condition factor	N	Min	Max	Mean±SD	CL95%
K _F	229	0.10	5.45	1.21±0.66	1.12 - 1.30
K _R	229	0.00	0.04	0.01±0.00	0.01 - 0.01
K _A	229	0.00	0.12	0.03±0.02	0.03 - 0.04

Note: n, sample size; Min, minimum; Max, maximum; SD, standard deviation; CL, confidence limit for mean values; KA, allometric condition factor; KF, Fulton's condition factor; KR, relative condition factor.

attributed to sexual maturation and active spawning of the larger fish (El-Agami, 1988). *P. jubelini* was in good condition in the Obuama Creek as shown by the mean condition factor $K_F=1.21\pm0.66$, which is greater than 1, even though we recognize that in population dynamics studies that high condition factors indicate favorable environmental conditions and low values indicate less favorable environmental conditions (Blackwell et al., 2000). K_F is an index reflecting interactions between biotic and abiotic factors (Rahman et al., 2012). Fulton's condition factor (K_F) with an average of 1.21 ± 0.66 was observed to range from 0.10 to 5.45. The minimum relative condition factor (K_R) ranged from 0.00 to 0.04, while the estimated mean was 0.01 ± 0.00 . According to Rypel and Richter (2008), W_R helps judge the overall health and fitness, as well as ecosystem disturbances at the population-level. In the present study, relative weight (W_R) values were very low ranged from 0.08 to 3.50 with estimated mean of 0.95 ± 0.46 indicating that the community is not balanced in terms of prey and predator. This is not in accordance with Anderson and Newman (1996) who reported that the $W_R < 100$ values for an individual or population imply problems such as low prey availability or high predator density, whereas the values above 100 indicate prey surplus or low predator density.

However, the condition values for both W_R , K_R and K_A were very low with mean values of 0.95 ± 0.46 , 0.01 ± 0.00 and 0.03 ± 0.02 respectively. The three indices may have limited sensitivity and provide a rapid, non-invasive measure of the physiological status of the fish (Brown and Murphy, 1991).

Conclusions

The present study provided some new information on some of the morphometric characteristics of *P. jubelini* in Obuama Creek, such

as the length-weight, length-length, length-girth and condition factors that are central to the exploitation and conservation of the species.

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