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Comparative Morphological Analysis of *Pellonula Leonensis* Fished from Isaba Creek and New Calabar River, Niger Delta Region, Nigeria

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ABSTRACT

The samall-toothed pellonula, *Pellonula leonensis* is ecologically and economically important. It is good source of protein to rural coastal and riverine communities because of its taste. Despite the economic significance, information on its biology are scarce. We evaluated the morphometric and meristic traits of the species from two water bodies in the Niger Delta Region. The population obtained from ISABA Creek, Delta State were significantly ($P<0.05$) smaller in all the morphometric traits analysed relative to the population from New Calabar River with the exception of Pectoral Fin Length (PFL) and Pelvic Fin Length (PvFL). The range of total length, TL and weight respectively of 3.70-8.52cm ($\bar{X}=5.14\pm0.034$cm) and 0.20-3.40g ($\bar{X}=0.75\pm0.022$g) for ISABA Creek population and 6.5-9.80cm ($\bar{X}=8.35\pm0.06$cm) and 1.7-7.30 g ($\bar{X}=3.84\pm0.083$g) for New Calabar River population was observed. The range of meristic characters significantly differed between the two waters bodies ($p<0.05$). The observed intraspecies differences could be attributed to environmental variables, fishing pressure and genetic factors. This study reveals the need for developing conservation strategies and domestication programs for species distributed in different water system.

INTRODUCTION

The fresh and brackish waters of tropical Africa boast of about 20 species of clupeids and one of them is *Pellonula leonensis* with wide spread distribution in both remote Sahelian and coastal basins (Reid and Sydenham, 1979, Teugels, *et al*., 1992; Gourene & Teugels, 2003). Pellonula is essentially a riverine fish that can inhabit both fast-flowing and calm, muddy habitats, lakes and creeks (Lowe-McConnell, 1987), near the shore (Turner, 1994). Information on the biology of *Pellonula leonensis* are scarce in the rivers and coastal areas of the Niger Delta Region. However, Ikomi (1995) and Kingdom and Allison, (2007a; b) have reported on aspects of the species' biology in the Warri and Nun Rivers, respectively. The Small-toothed Pellonula is of commercial importance in communities around New Calabar River (NCR), Rivers State and Isaba Creek (ISC), Delta State, fetching good income on basis of account of its tasty characteristics. This study evaluates and compares the morphometric and meristic characteristics of P. leonensis from the two water bodies (NCR and ISC) in the Niger Delta Region. There is no record of any research on the species from the two water bodies.

MATERIALS AND METHODS

Samples Collection

The samples of pellonula species were procured from fishermen operating in Isaba Creek, Delta State and New Calabar River, Rivers State in the Niger Delta Region (Table 1).

Table 1: Sampling Location and Size

Sampling location	Latitude	Longitude	N
Isaba Creek	5.42749° or 5° 25' 39" north	5.69516° or 5° 41' 43" east	614
New Calabar River	4.41939° or 4° 25' 10" north	7.02001° or 7° 1' 12" east	168
Total			782

The species was identified according to Gourène and Teugels (1991, 2003) and specimens collected were stored in ethanol (97% alcohol). The morphometric characteristics were measured on each individual with a metre rule (Cm) and the body weight (g) was measured with a Mini-digital weighing scale for the following parameters: Anal Fin Length (AFL), Body Depth (BD), Caudal Fin Length (CFL), Caudal Peduncle (CP), Distance between the pectoral and anal fin (DBPAF), Dorsal Fin Length (DFL), Eye diameter (ED), Head Depth (HD), Head length (HL), Pectoral Fin Length (PFL), Pelvic Fin Length (PvFL), Pre-Dorsal Length (PrDL), Pre-Pectoral Length (PrPFL), Pre-Pelvic Length (PrPvFL), Pre-Orbital Length (PrOL), Standard Length (SL), Fork

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Length (FL), Total Length (TL) (Fig. 1) and Body Weight (BW). The meristic characteristics were the Anal Fin Ray count (AFR) and Dorsal Fin Ray count (DFR).

Statistical Analysis

Past 326b (Paleontological Statistics Software) was used to analyze the descriptive statistics such as the Minimum (Min.), Maximum (Max), Mean ($\bar{X}$), Standard Errors (SE), Standard Deviation (SD), Variance (V) and Coefficient of Variation (CV) of each characters, and students' T-test was run to compare between means of each characters by recording the significant difference of each character parameter recorded from both locations.

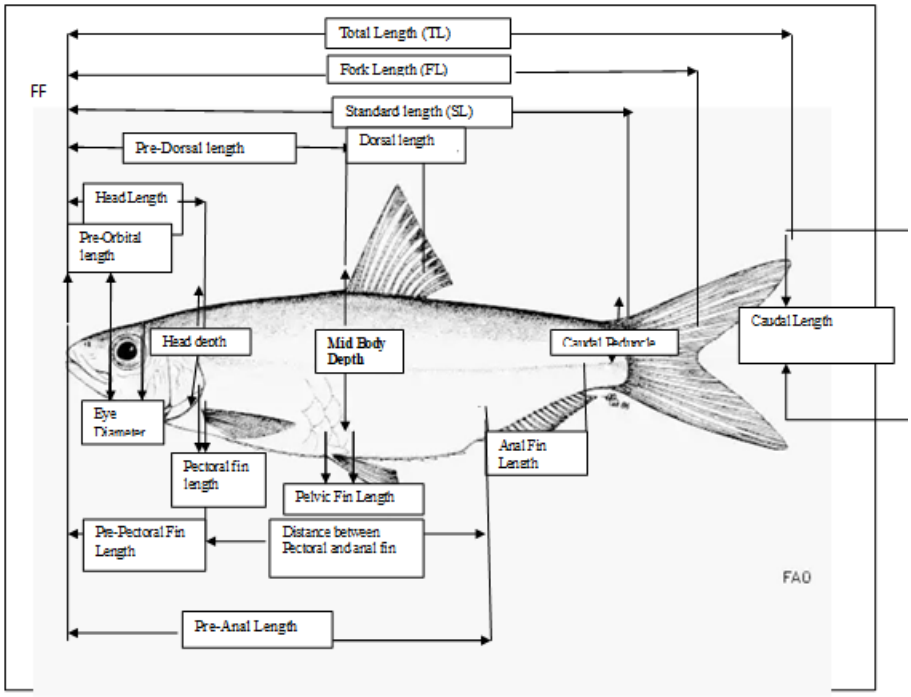

Figure 1: Morphometric Measurements Of *Pellonula Leonensis* Used For Study

RESULTS AND DISCUSSION

Morphological characteristics of P. leonensis from Isaba Creek and New Calabar River. A total of 782 individuals were sampled, 614 individuals from Isaba River and 168 from New Calabar River (Table 1). The range of mean ($\bar{X}$), Standard Error (SE), Standard Deviation (SD), Variance (V), and Coefficient of Variation (CV) of the morphological characters of P. leonensis are shown in Table 2. The size range of TL and weight respectively of 3.70-8.52cm ($\bar{X}$=5.14±0.034cm) and 0.20-3.40g ($\bar{X}$=0.75±0.022g) for ISABA Creek population and 6.5-9.80 cm ($\bar{X}$=8.35±0.06cm) and 1.7-7.30 g ($\bar{X}$=3.84±0.083g) for New Calabar River population were observed. It can be seen that individuals from the New Calabar River possessed higher comparative range and mean values for each character relative to Isaba Creek. For all 19 morphometric characters evaluated, 17 were significantly different between the Isaba Creek and the New Calabar River ($p<0.05$), except for the PFL and PvFL ($p>0.05$).

Meristic characteristics of P. leonensis from Isaba River and New Calabar River

Table 3 shows the descriptive statistics for the meristic characteristics of P. leonensis from Isaba Creek and New Calabar River. The range of Mean ($\bar{X}$) Standard Error (SE), Standard Deviation (SD), Variance (V) and Coefficient of variation of meristic characters observed in P. leonensis. The AFR and DFR showed significant differences between the two water bodies ($p<0.05$). For Isaba River population, the Anal Fin Ray (AFR) has a Range count of 10-22, and a Mean value of 17.33 ± 0.073, and the Dorsal fin Ray (DFR) has a Range count of 9-22, and a Mean value of 15.97 ± 0.085. While for the population of New Calabar River, the Anal Fin Ray has a Range count of 10-25 and a Mean Value of 19.18 ± 0.172, and the Dorsal Fin Ray has a Range count of 12-22 and a Mean value of 16.89 ± 0.168.

Table 2: Summary Descriptive Statistics for the morphometric characteristics of P. leonensis from Isaba Creek and New Calabar River

Character	Isaba River (N=614)						New Calabar River (N=168)						Sig	
	Min	Max	$\bar{X}$ ±Se	Sd	V	Cv	Min	Max	$\bar{X}$ ±Se	Sd	V	Cv	t	Uneq. var. t
AFL	0.20	1.40	0.70 ± 0.009	0.23	0.05	32.83	0.6	1.9	1.11 ± 0.02	0.23	0.05	20.32	**	**

BD	0.50	2.85	1.10 ± 0.011	0.30	0.09	26.99	1.2	2.6	1.83 ± 0.020	0.26	0.07	14.32	**	**
CFL	0.30	1.80	0.77 ± 0.01	0.33	0.11	42.57	0.6	2.2	1.23 ± 0.026	0.33	0.11	27.08	**	**
CP	0.20	0.90	0.44 ± 0.004	0.11	0.01	24.13	0.4	5.00	0.67 ± 0.027	0.36	0.13	52.85	**	**
DBPAF	1.2	5.00	2.21 ± 0.031	0.76	0.58	34.46	2.4	4.1	3.23 ± 0.028	0.36	0.13	11.06	**	**
DFL	0.60	2.20	0.67 ± 0.01	0.27	0.07	40.57	0.5	1.4	0.98 ± 0.015	0.19	0.04	19.25	**	**
ED	0.2	1.5	0.40 ± 0.005	0.11	0.01	27.89	0.35	0.65	0.49 ± 0.003	0.05	0.002	9.15	**	**
HD	0.3	1.6	0.77 ± 0.009	0.22	0.05	28.77	0.9	2.1	1.44± 0.017	0.22	0.05	14.90	**	**
HL	0.4	2.00	1.03 ± 0.011	0.2	0.08	26.56	1.00	2.2	1.61± 0.019	0.24	0.06	14.91	**	**
PFL	0.05	1.15	0.11 ± 0.002	0.05	0.002	43.56	0.09	0.15	0.10± 0.0006	0.008	0.00006	7.61	N . Sig	#
PvFL	0.08	1.15	0.11 ± 0.002	0.005	0.002	43.41	0.1	0.15	0.10± 0.0006	0.008	0.00006	7.56	N . Sig	N. Sig
PrDFL	1.1	3.6	2.16 ± 0.017	0.43	0.18	19.82	2.7	4.20	3.51± 0.024	0.32	0.10	8.98	**	**
PrPFL	0.3	2.00	1.12 ± 0.012	0.30	0.09	26.81	1.10	2.50	1.73± 0.263	0.26	0.07	15.24	**	**
PrPvFL	0.7	5.00	2.09 ± 0.021	0.53	0.28	25.27	2.3	4.1	3.35± 0.025	0.33	0.11	9.74	**	**
PrOL	0.2	2.6	0.43 ± 0.011	0.28	0.08	66.58	0.4	0.9	0.54± 0.006	0.08	0.006	14.50	**	**
SL	3.00	7.30	4.43 ± 0.03	0.78	0.69	17.48	5.2	8.5	6.90± 0.047	0.60	0.36	8.74	**	**
FL	3.2	7.7	4.72 ± 0.033	0.82	O.67	17.29	5.6	8.7	7.28± 0.05	0.65	0.42	8.92	**	**
TL	3.70	8.52	5.41 ± 0.034	0.86	0.74	15.92	6.5	9.80	8.35± 0.06	0.71	0.50	8.50	**	**
BW(g)	0.20	3.40	0.75 ± 0.022	0.56	0.31	74.27	1.7	7.3	3.84 ± 0.083	1.08	1.16	28.04	**	**

*Where, MIN=Minimum, MAX=Maximum, $\bar{x}$ Mean, SE= Standard Error, SD= Standard Deviaton, V= Variance, CV= Coefficient of Variation, t=t-Test, **significant at p<0.05, #=p=0.05, N Sig= No Significant difference p>0.5*

Table 3: SSummary Descriptive Statistics for the Meristic characteristics of P. leonensis from Isaba Creek and New Calabar River

CHRS	Isaba River (N=614)						New Calabar River (N=168)						Sig	
	Min	Max	$\bar{X}$ ±Se	Sd	V	Cv	Min	Max	$\bar{X}$ ±Se	Sd	V	Cv	t	Uneq. var. t
AFR	10	22	17.33 ± 0.073	2.11	4.45	13.21	12	22	16.89 ±0.166	2.23	4.97	11.63	**	**
DFR	9	22	15.97 ± 0.085	2.11	4.45	13.21	12	22	16.89± 0.166	2.16	4.65	12.77	**	**

Where, MIN=Minimum, MAX=Maximum, $\bar{X}$ *= Mean, SE= Standard Error, SD= Standard Deviaton, V= Variance, CV= Coefficient of Variation, t=t-Test **significant at p<0.05, N Sig= No Significant difference*

The morphometric and meristic characters of P. leonensis from Isaba Creek and New Calabar River were observed and compared in this study. A total of 782 individuals were sampled in this study. The size range of TL and total weight recorded for ISABA Creek population and New Calabar River population fall within the range reported by Ezenwaji and Offish (2003) and Ezenwaji (2004) for the Anambra River. Yao *et al.* (2015) also reported individual weight ranging from 0.26 g to 3.22 g, with an average of 0.81 ± 0.44 g and length varying from 31.67 to 65.35 mm with an average of 43.38 ± 6.31 mm in Taabo Lake.

The result from this study clearly demonstrates the variations between the two populations. For all the characters evaluated, individuals from the population from New Calabar River were bigger than the population those from Isaba Creek. Kurniawan *et al.* (2020) detected highly significant morphometric difference in Osteochilus spilurus from two separate water bodies. Solomon *et al.*, (2015) reported abundant significant variations in morphometric characters of Clarias gariepinus from different populations. Factors responsible for the differences between populations observed in this study are many and varied, including environmentally induced morphological and meristic changes due to stressors or pollution (Kurniawan *et al.* (2020). The two water bodies by their location in the Niger Delta have been under the influence of illegal exploration and exploitation of crude oil resulting in oil pollution of the water bodies, which is one of the causes of serious damages to water quality. Disparity in levels of exposure to these environmental stressors may underpin changes in phenotype and genotype that culminate in fish adaptation. Swain and Foote (1999) observed that the phenotypic variation in morphological characters and meristic count may not only be genetic but may be environmentally induced.

Krabbenhoft *et al.* (2009) described the environmental factors underlying the morphological changes as water clarity, water depth and flow, food availability and physical complexity. Environmentally induced differences can also include diet or feeding habit, resulting in within species morphological variations in fish (Ehlinger, 1988; Fermon and Cibert 1998; Parker *et al.*, 2009). Morphological divergence and intraspecific difference induced by habitat are reported to be common in fishes. For example, alteration in shape and fins can be influenced considering whether the water body is lentic or lotic. Physical characteristics can determine evolutionary changes and ecological conditions can drive changes in the morphological characteristics of resident fish populations (Haas *et al.*, 2010). Secondly, fishing pressure and utilization differential may mount spatial pressure on populations in natural habitats resulting in pronounced morphological differences (Kurniawan *et al.* (2020 citing Yang *et al.*, 2003). Thus, we assert that fishing intensity may be higher in Isaba Creek relative to New Calabar River. Geographic isolation is another reason for intraspecific morphometric differences. Over time isolation by distance and barriers to gene flow play major role in these differences. The NCR and ISC are connected to the Ocean at different points along the coastal waters of Nigeria, which has created an effective barrier to gene flow between the two populations. With DNA, more light could be shed from these species when these rivers and creeks came to be separated.

Sexual dimorphism observed in some species can manifest in wide range of morphometric differences between populations (Parker, 1992; Breder and Rosen. 1998; Kim *et al.*, 2008; Im *et al.*, 2016; Pramono *et al.*, 2019). Therefore, we suggest that in the studies employing the use of morphometric traits, individuals should identified by sex. This was not taken into cognizance in executing this research, which may account for the differences if sexual dimorphism exist in the species.

The meristic counts showed a very clear difference between the samples from the two population. Although it has been established that the meristic characters are independent of the fish size; hence, they should not change during growth (Strauss 1985). This study has shown that the population from Isaba Creek is far small in size than that from New Calabar River, this significant difference in size might be due to high level of fishing of mostly immature stock from the Isaba Creek. However, the morphometric and meristic variations examined in this reports are preliminary and provide an insight into

the population of the same species from two different water bodies.

CONCLUSION

Studies on the basis of morphometric traits with respect to aquaculture and potential aquaculture species and species of interest to capture fisheries should be initiated with the aim of determining sexual dimorphism. Such studies would be expedient and useful for developing conservation strategies and domestication programs.

Conflict of interest.

The authors confirm that this article content has no conflicts of interest.

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