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Growth patterns of five marine, demersal fin and shell-fish from Nigerian coastal waters (Eastern Central Atlantic, FAO Area 34)

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Abstract

This study investigated the growth patterns, and condition factors of five demersal marine fin and shell fishes from the Nigerian coastal water (FAO, Area 34). These are: *Parapenaeopsis atlantica, Penaeus monodon, Penaeus notialis*, *Portunus validus* and *Cynoglossus browni*. Five hundred and six (506) specimens in all were sampled from 32 fishing trawlers owned by Olokun Pisces Limited (Lat N 6^0 28^{l} 24^{ll}, Long E 3^0 22^{l} 50^{ll}) and assessed fresh for morphometric data. Study revealed the Mean weight and standard error of *P. atlantica, P. monodon, P. notialis*, *P. validus* and *C. browni:* 9.42 ±0.26, 96.79 ± 2.38, 26.82 ± 1.34, 284.09 ± 7.34 and 411.09 ± 15.27g respectively. The Length - weight relationship (LWR) showed that all species had positively allometric growth, except for *P. atlantica,* which had a negative allometric growth of b = 1.03(<3). The condition factor (K-factor) was highest in *P. validus* with value of 8.77 and lowest in *C. browni* (0.412). Further analysis to determine the distribution of the individual species using boxplots depicts that the distribution for *P. atlantica* and *P. notialis* are similar for all the variable considered. Relatively weak positive correlation values were observed to exist between the body depth and weight. However, Environmental considerations should be given priority because the condition of well-being of the fish shows relative growth instead of abundant growth.

Introduction

The Nigerian coastal water is a home to some s104 species of fishes belonging to 50 families. Nigeria has an extensive coastline of approximately 900km and an Exclusive Economic Zone (EEZ) of about 217,313km^2 (SeaAroundUs, 2007). Marine fishing generally involves good knowledge of local geography, such as skills of wave maneuvering, knowledge of the wind direction, that of daily rising and falling of the tide, the ocean current, water colour, water nature, net mending and construction, aquatic culture (fish behavior), weather, the seasons, swimming skills etc. All these conditions are a prerequisite for effective and professional marine fishing (Omolere, 2014).

According to FAO (2011) demersal fishes (flounders, halibuts, soles, cods, hakes, haddocks and miscellaneous demersals) contributed 12 percent of the total catches in 2009 (10.9 million tons), compared with almost 26 percent in the 1950s and 1970s. Catches of crustaceans (crabs,

lobsters, shrimps, prawns, krill, etc.) contributed 6 percent (5.4 million tons) in 2009, slightly lower than 7 percent in 2002. Molluscs (abalones, conchs, oysters, mussels, scallops, clams, squids, octopus, etc.) increased slightly from 6 percent in the 1950s and 1970s to 7 percent (6.2 million tons) in 2009. Shrimps is an important seafood commodity representing a global industry with a market valued at over US $ 20 billion annually accounting for 19% of international trade (Anyanwu, P.E et al, 2011).

The Nigerian multispecies demersal stocks are exploited with a wide variety of artisanal gears; set gillnets, beach seines, large meshed shark drift nets, hooks on longlines and various traps. The demersal target species exploited by artisanal fishing units are: croakers (*Pseudotolithus*), threadins (*Galeoides*, *Pentanemus* and *Polydactylus*), Soles (*Cynoglossidae*), Marine catfish (*Arius*), brackish water catfish (*Chrysicthys*), Snapper (*Lutjanus*) grunters (*Pomadasyidae*), groupers (*Epinephelus*) and the estuarine white shrimp (*Palaemon*). Bonga dominates the pelagic fishery.

Though the broad distribution of the commercially exploited fish species groups is known, there is no adequate information on the composition of communities or on temporal and spatial distribution of stocks. In the circumstances of a very long coastline (about 800km), it is almost certain that many species form more than one stock. The distribution of demersal and pelagic fishes in the marine waters of Nigeria indicates discrete ecological fish communities, each of which is fairly homogenous. However, there is also ecological and micro geographical heterogeneity of fish communities, whilst migration of species from the estuaries and creeks to the open shelf areas and vice versa is known to occur (FAO, 1986).

The aim of this project is to assess the growth patterns of five sea-foods: *Parapenaeopsis atlantica, Penaeus monodon, Penaeus notialis*, *Portunus validus* and *Cynoglossus browni* from the Nigerian Coastal waters (FAO Area 34). This is done with respect to their biology: the morphometric features, length-weight relationship (LWR), growth patterns and condition factor (K-factor) of the species.

Materials and Methods

Study Area

The Nigerian Coastal waters which falls within Eastern Central Atlantic FAO Area 34. Nigeria is bordered to the North by the Republic of Niger and Chad, to the West by the Republic of Benin, to the East by the Republic of Cameroon and to the South by the Atlantic Ocean. Nigeria has a coastline of approximately 853km facing the Atlantic Ocean. This coastline lies between latitude $4^0 10^1$ to $6^0 20^1$ N and longitude $2^0 45^1$ to $8^0 35^1$ E. The terrestrial portion of this zone is about 28,000km in area, while the surface area of the continental shelf is 46,300km (Badejo and Nwilo, 2015). The Nigerian Coastal line has eight states it shares borders with (as shown in figure 1 below). They are Lagos, Ogun, Ondo, Rivers, Delta, Akwa Ibom, Bayelsa and Cross River States. A trawler voyage of about fifty (50) days to and fro covers the area and also the eight coastal states.

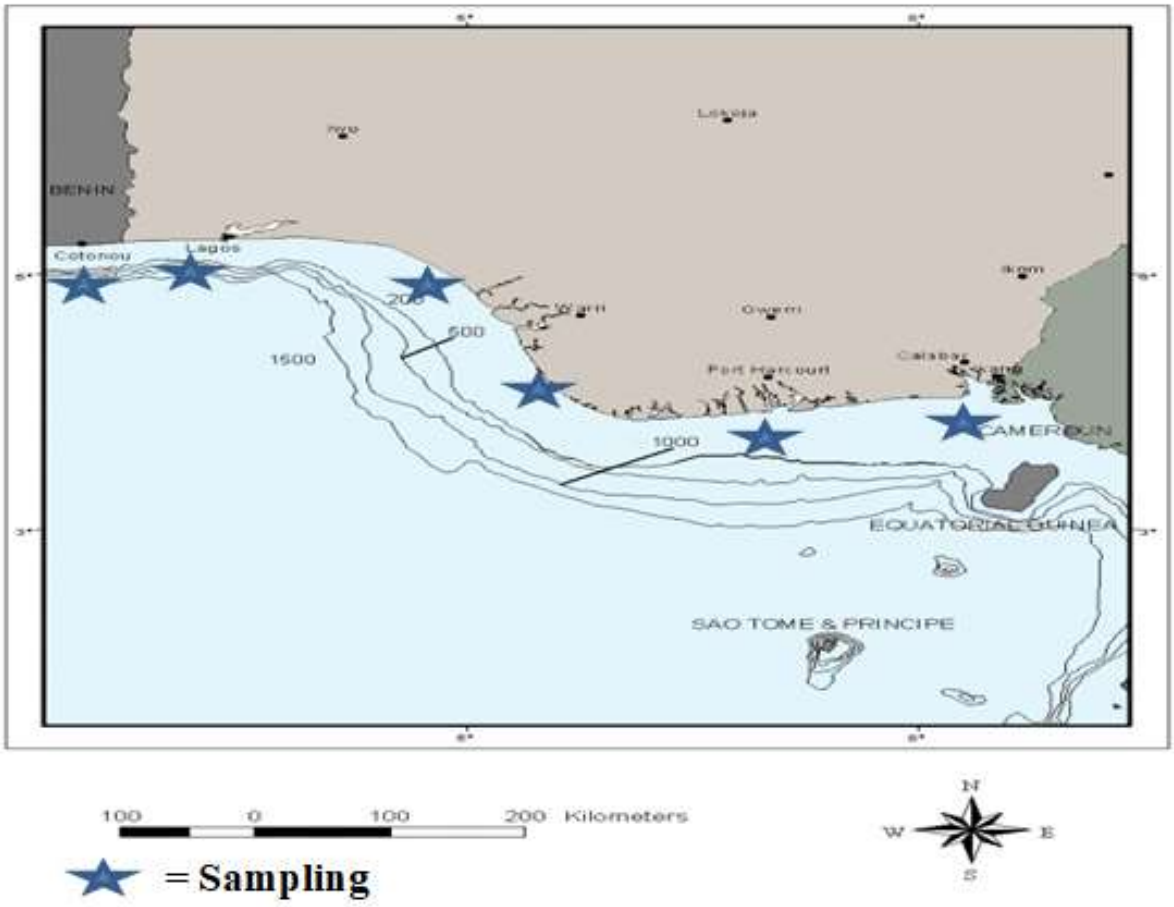

Figure 1: Map showing Nigerian Coastal water and Sampling Stations

Sampling

As shown in Plate 1 – 5, deep frozen samples (at -20^{0}C) of *Cynoglossus browni*(Nigerian tongue sole), *Parapenaeopsis atlantica* (Brown Shrimp), *Penaeus notialis* (White Shrimps), *Penaeus monodon* (Black tiger Shrimps) and *Portunusvalidus* (Smooth Swim Crab) were obtained from 32 fishing trawlers owned by a private fishing company. A total of 506 samples of each species for a period of 6 months collected were thawed. Sampling was done using bean trawls and other bottom trawls.

Plate 1: *Penaeus notialis*

Plate 2: *Penaeus monodon*

Plate 3: *Parapenaeopsis atlantica*

Plate 4: *Portunus validus*

Plate 5: *Cynoglossus browni*

Length Weight Relationships (LWR) and Condition Factor (K-factor)

The Total length (TL), Standard length (SL), Head length (HL), Carapace length (CL), Body depth (BD) were measured with a measuring ruler taken to the nearest 0.1cm as well as the weight of each sample was recorded. The length-weight relationship was calculated by least square method for each of the species using the parabolic equation:

$$W = aL^b$$

logarithmic form: **Log W = log a + b log L**

Where, W is weight in grams, L is total length in cm, a is intercept and b is slope.

The condition factor was determined by using the expression:

$$K = 100W/L^b$$

Where, W is weight in grams, L is in cm and b is exponent of the length-weight relationship

Statistical Analysis

All data collected were subjected to one way Analysis of Variance (ANOVA) using SPSS v 23 and R v 3.6.1. Game and Howell's post HOC tests were used because data were heterogeneous in variances. A Levene's test was conducted for homogeneity. Also correlation matrices of the variables as well as the Principal Component Analysis were done.

Results

Length-Weight Relationships and Condition Factor

The Total lengths, standard lengths, body depth, carapace length, head length and weight were measured from five species of fin and shell fishes making up to 506 specimens as shown in table 1: Total Length of *Parapenaeopsis atlantica* ranged from 8.6 – 14.1cm and mean weight of 9.42g; Total Length of *Penaeus notialis* ranged from 10 – 19.2cm and mean weight of 26.82g; Total Length of *Penaeus monodon* ranged from 17.7 – 27.8cm and mean weight of 96.79g; Total Length of *Portunus validus* ranged from 11.1 – 17.8cm and mean weight of 284.09g; Total Length of *Cynoglossus browni* ranged from 36.9 – 64.3cm and mean weight of 46.32g.

The Length-Weight relationship and correlation coefficient (r) for the five demersal species was logarithmic transformation as shown in Figure 2 – 6. The value of 'b' for *Parapenaeopsis atlantica* was 1.83,*Peneaus notialis* was 5.17, *Peneaus monodon* was 10.84, *Portunus validus* was 39.42 and *Cynoglossus browni* was 20.72. The correlation coefficients 'r' for the species was 0.74, 0.95, 0.77, 0.75 and 0.7 respectively for the species. The equations for the length-weight relationship in this study were as follows:

Parapenaeopsis atlantica: Log W = -11.69 + 1.83 Log L (r = 0.74)
Penaeus notialis: Log W = -49.23 + 5.17 Log L (r = 0.95)
Penaeus monodon: Log W = -14.78 + 10.84 Log L (r = 0.77)
Portunus validus: Log W = -29.80 + 39.42 Log L (r = 0.75)
Cynoglossus browni: Log W = -54.87 + 20.72 Log L (r = 0.7)

Where W = Weight in grams, L = Total length

The weight of the species increased more in proportion or less to the cube of its length as depicted by the slope (b). *Portunus validus* has the highest growth in weight relatively to the other species. All the species showed a positive allometric growth except for *Parapenaeopsis atlantica* which showed negative allometric growth with 'b' value of 1.83

The condition factor (K) implies the state of general well-being of the species. The K factor for *P. atlantica* was 0.605; *P. notialis* 0.77; *P. monodon* 0.834; *P. validus* 8.77and*C.browni* 0.412. Figures 2 – 6 shows that the species had positive allometric growth except for *Parapenaeopsis atlantica* that exhibited negative allometric growth.

Table 1: Summary of Morphometric Features and Regression Analysis of Fin and Shell Marine species from the Nigerian Coastal waters

Species	Mean Total Length (cm)	Mean Total Weight (g)	Range (Total Length)	Mean Condition Factor (K)	Regression Constant (a)	Regression Coefficient (b) slope	Correlation Coefficient (r)
Paraepnaoepsis atlantica	11.56	9.42	8.6 - 14.1	0.605	-11.69	1.83	0.74
Peneaus notialis	14.71	26.82	10 - 19.2	0.77	-49.23	5.17	0.95
Peneaus monodon	22.55	96.79	17.7 - 27.8	0.834	-14.78	10.84	0.77
Portunus validus	14.77	284.09	11.1 - 17.8	8.77	-29.8	39.42	0.75
Cynoglossus browni	46.32	411.09	36.9 - 64.3	0.412	-54.87	20.72	0.7

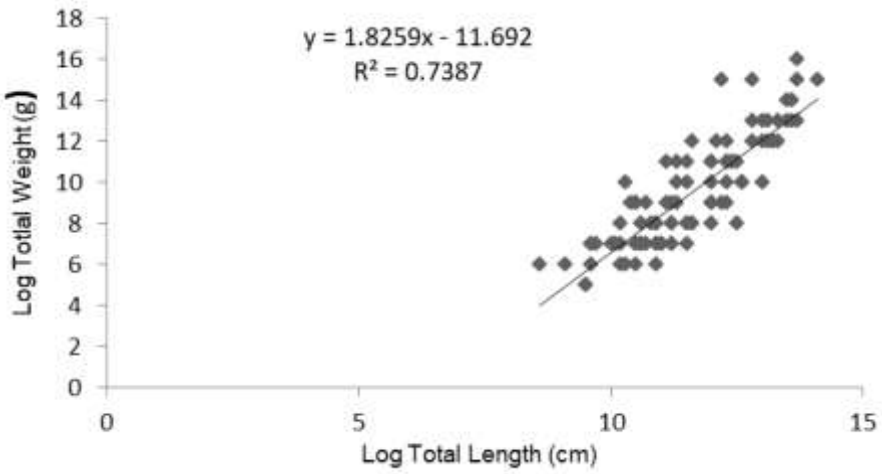

Figure 2: Length-Weight Relationship of Paraepnaeopsis atlantica from Nigerian waters

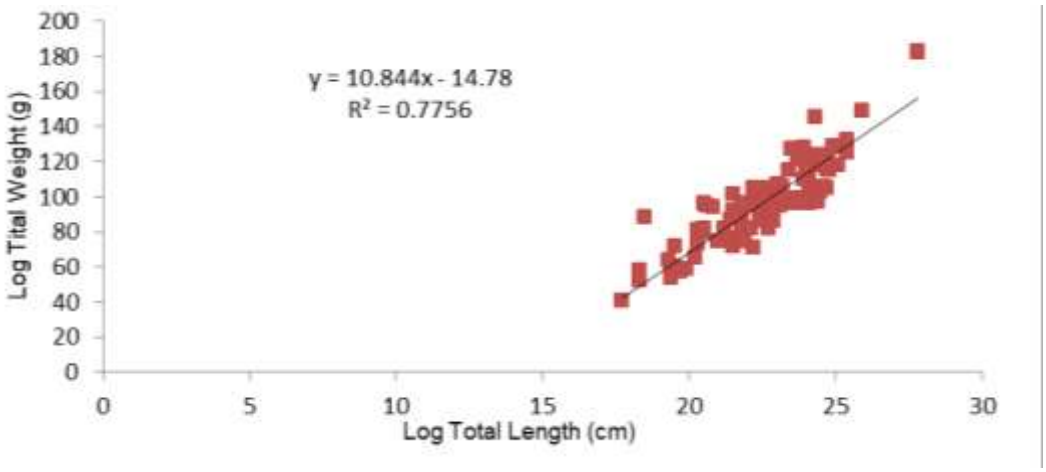

Figure 3: Length-Weight relationship of *Penaeus monodon* from Nigerian coastal waters

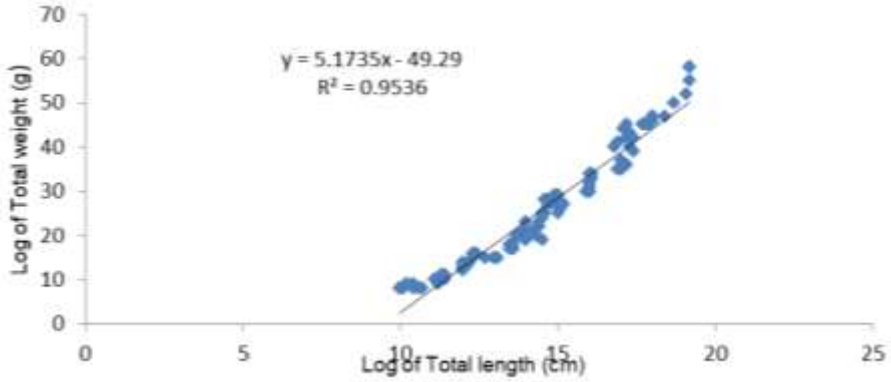

Figure 4: Length-Weight relationship of *Peneaus notialis* from Nigerian coastal waters

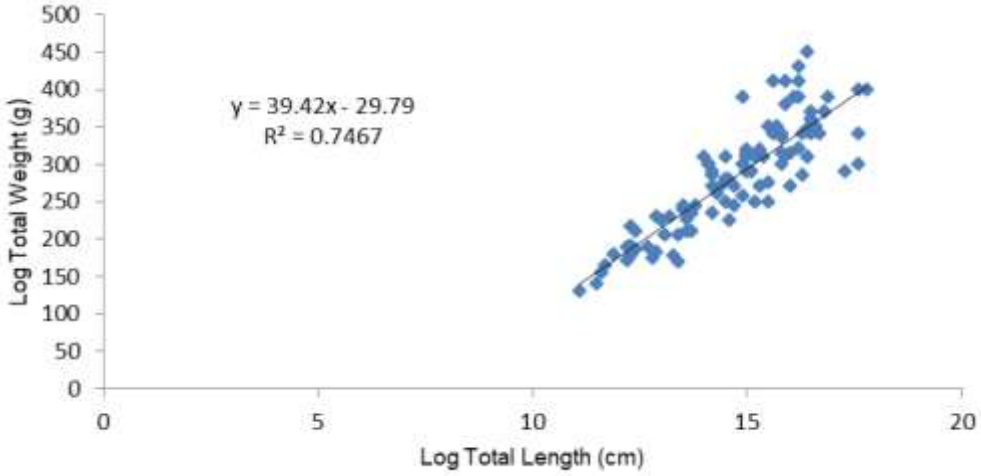

Figure 5: Length-Weight Relationship of *Portunus validus* from Nigerian coastal waters

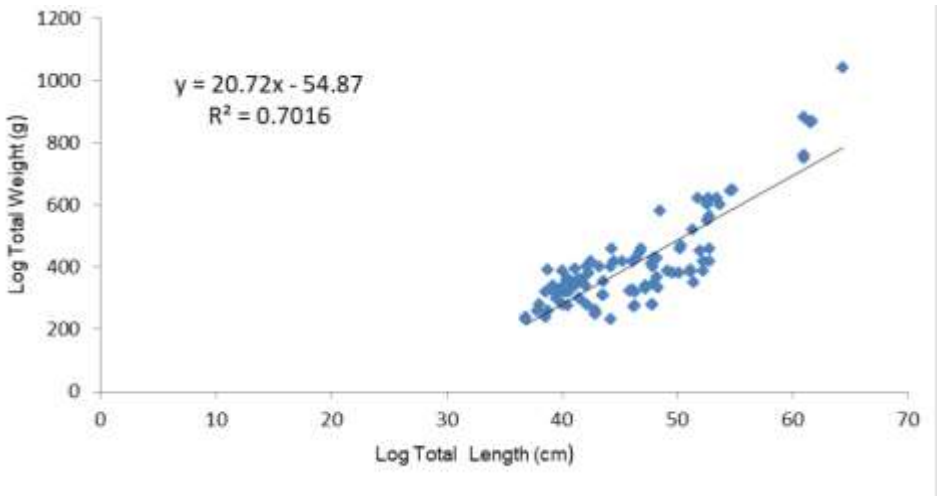

Figure 6: Length-Weight relationship of *Cynoglossus browni* from Nigerian coastal waters

Morphometric Characteristics

The morphometric characteristics are shown in figures 7, 8, 9 and 10. The mean and standard error values for the five different species: *P. atlantica, P. monodon, P. notialis* and *P. validus* had mean carapace lengths of 5.19 ± 0.09, 8.37 ± 0.08, 5.22 ± 0.11 and 14.77 ± 0.16 respectively. While *C. browni* had a mean head length of 7.66 ± 0.11. *P. atlantica, P. monodon, P. notialis, C. browni* and *P. validus* had mean body depths of 1.17 ± 0.02, 3.38 ± 0.04, 2.08 ± 0.04, 10.23 ± 1.28 and 6.96 ± 0.08 respectively. It further highlighted that they had mean body weights: 9.42 ± 0.26, 96.79 ± 2.38, 26.82 ± 1.34, 411.09 ± 15.27 and 284.09 ± 7.34 respectively. Also *P. atlantica, P. monodon, P. notialis and C. browni* had total lengths; 11.56 ± 0.12, 22.55 ± 0.19, 14.71 ± 0.25 and 46.32 ± 0.62 respectively. From this table *Parapenaeopsis atlantica* was observed to have the least carapace length, which is closely followed by *P. notialis*. In Figure 7, *C. browni* was observed to have the highest body depth. Figures 8 – 10 shows the mean weights, Total lengths and Standard lengths of the species different levels. A grouped bar chart for all these variables for the five species is given on Figure 11 below.

Table 3 reveals Games-Howell Post Hoc Test for the Morphometric characteristics since the observations were heterogeneous in variances. *P. atlantica* and *P. notialis* showed no significant difference in mean values except for their carapace lengths (5.19and 5.22cm), while both species showed statistically different observations for other variables (body depth, weight, Total length and standard length). *P. monodon, P. validus* and *C. browni* had statistically significant result for other variables.

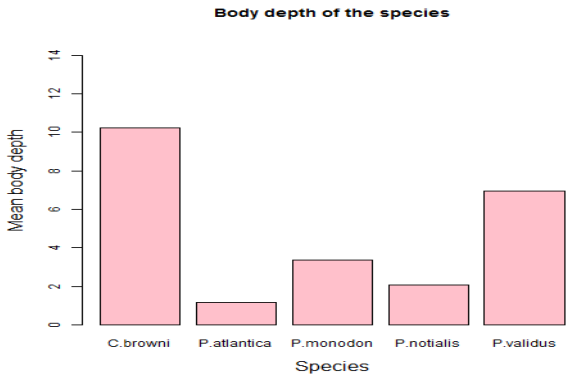

Figure 7: Body depth for the species

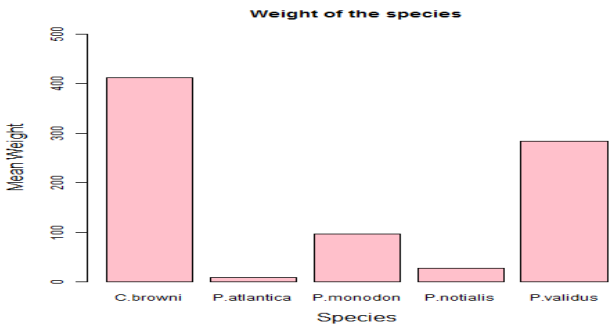

Figure 8: Weights for the species

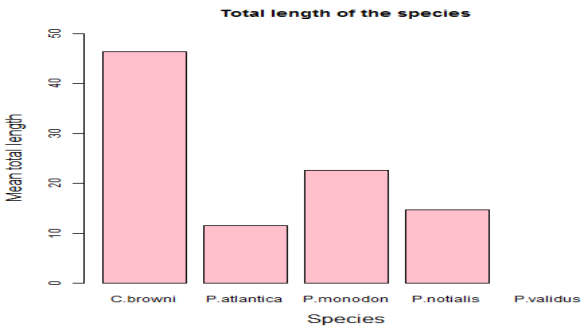

Figure 9: Total length for the species

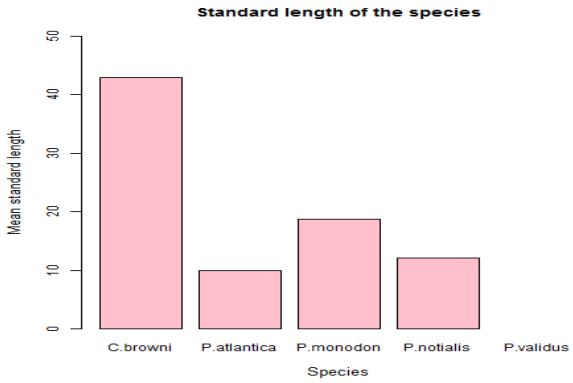

Figure 10: Standard length for the species

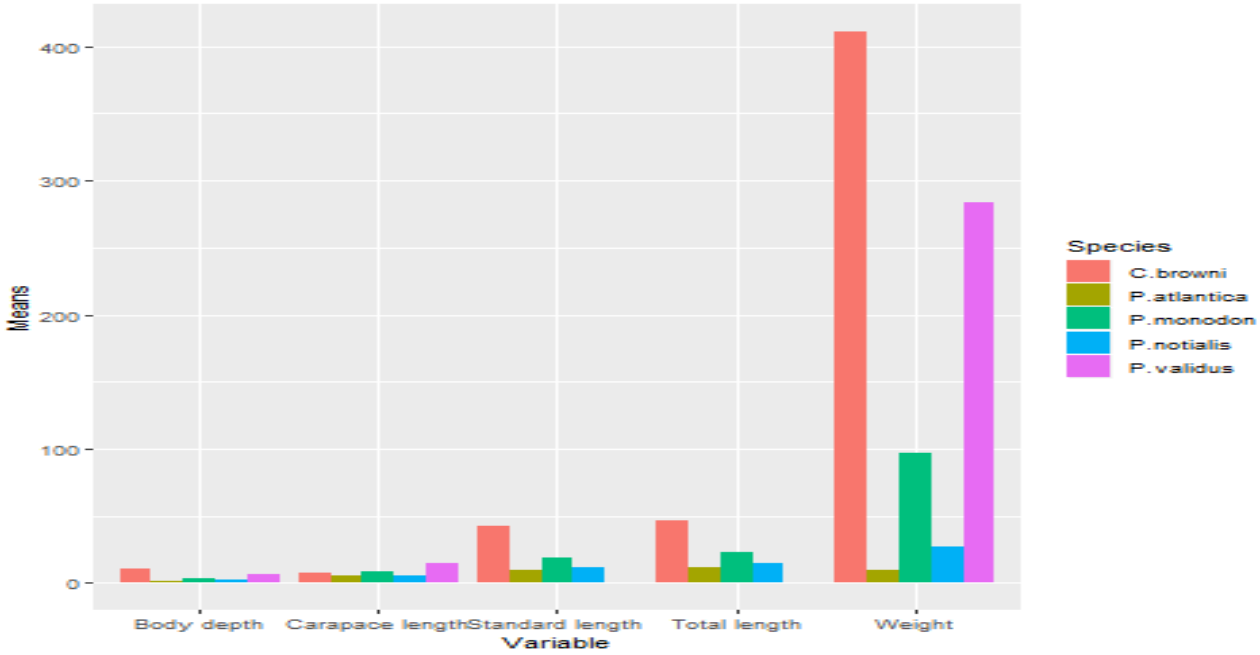

Figure 11: Grouped plot for the variables of the species

Table 3: Games-Howell Post Hoc Test for the Morphometric characteristics

Parameter	*P. atlantica*	*P. monodon*	*P. notialis*	*C. browni*	*P. validus*
Carapace/ head length (cm)	5.19^{a}	8.37^{c}	5.22^{a}	7.66^{b}	14.77^{d}
Body depth (cm)	1.17^{a}	3.38^{c}	2.08^{b}	10.23^{e}	6.96^{d}
Weight (g)	9.42^{a}	96.79^{c}	26.82^{b}	411.09^{e}	284.09^{d}
Total length (cm)	11.56^{a}	22.55^{c}	14.71^{b}	46.32^{d}	-
Standard length (cm)	9.91^{a}	18.68^{c}	12.09^{b}	42.84^{d}	-

^{a,b,c,d,e} *Means along the same row with different superscript are significantly different at p-value =0.05*

Discussion

Demersal species were gotten from Nigerian Coastal waters with the use of bottom trawl nets and collected in a deep frozen state (Temperature of -20^{0}C). The growth pattern of the species under study was based on the Length – Weight relationship (LWR) according to report of Moruf and Lawal-Are (2017). The weight of the species increased more in proportion or less to the cube of its length as depicted by the slope (b). *Portunus validus* has the highest growth in weight relatively to the other species with a condition factor (K) of 8.77. Morphometric characters of five (5) demersal species were taken into account in this present study. *P. validus* [crab] was exempted from both Total length (TL) and Standard length (SL), while a study by RajagopalSanthanam, *et al* (2011) investigated the relationship between fifteen (15) morphometric characters of *P. monodon* of Cultured and wild males and females. Species used for this present work were all from the wild and samples were collected and in deep frozen state and then thawed to enable accurate reading of morphometric features.

In a similar study off Lagos Coast by Lawal-Are and Bilewu (2009) on *Portunus validus*, after examining 618 specimens found the weight to be from 82.3g to 694.0g, while in this present study, the weight of the 101 specimens of *Portunus validus* ranged from 130 to 450g. Moruf and Lawal-Are (2017) showed that Portunid Crabs (*Callinectes amnicola* and *Portunus validus*) exhibited negative allometric growth while in this study, all the species exhibited positive allometric growth with 'b' values greater than 3 except for *Parapenaeopsis atlantica* that had a 'b' value of 1.83. Morphometric variables measured on *C. browni* had a strong positive correlation. However, a relatively weak positive correlation value (= 0.4901) was observed to exist between the body depth and weight of *P. validus*.

The Nigerian coastal water is a very large area that shares border with eight States in Nigeria. Further studies should be investigated as it will broaden the knowledge of environmental influence on the bio-integrity of fish (fin fish, crustaceans, Molluscs etc.) found within this territory. Based on the study and its results, I hereby recommend that Environmental consideration should be given priority because the condition of well-being of the fish shows relative growth instead of abundant growth given necessary environmental resources.

References

Abdulali K.A. Taweel, M. Shuhaimi-Othman and A.K. Ahmad (2012). Analysis of Heavy Metal Concentrations in Tilapia Fish (*Oreochromis niloticus*) From Four Selected Markets in Selangor, Pennisular Malaysia.*Journal of Biological Sciences 12 (3): 138-145*. Asian Network for Scientific Information.

Ajayi T O, Talabi S O (1984). The potential and strategies for optimum utilization of the fisheries resources of Nigeria *NIOMR Technical Paper* No 18, 25p

Anyanwu, P.E, Ayinla, O.A, Ebonwu, B.I, Ayaobu-Cookey, I.K, Hamzat, M.B, Ihimekpen, A.F, Matanmi, M.A, Afolabi, E.S, Ajijo, M.R and Olaluwoye, B.L (2011). Culture possibilities of *Penaeus monodon* in Nigeria.*Journal of Fisheries and Aquatic Science, 6: 499-505*

Chuma C. Okoro, Olusimbo O. Aboaba and Ola J. Babajide (2010).Quality Assessment of a common Nigerian Marine Fish, Croaker (*Pseudotolithuselongatus*) under different Storage conditions. *New york Science Journal*. Pp 29-36 http//www.sciencepub.net/newyork

Dwivedi AK, Dubey VK (2013) Advancements in morphormetric differentiation: a review on stock identification among fish populations. *Review in Fish Biology and Fisheries 2*3:23-39.

Elliott O (1993). Nigerian Coastal Fisheries Resources; In: Proceedings of the National Conference on Conservation of Aquatic Resources. *Sponsored by National Resources Conservation Council (NARESCON).*

FAO (Food and Agriculture Organization) (2001). Nigeria. Reducing the Impact of Tropical Shrimp Trawling Fisheries on the Living Marine Resources Through the adoption *of Environmentally Friendly Techniques and Practices in Nigeria by Mr. J.C*. Ogbonna

FAO (Food and Agriculture Organization) (2011) Review of the State of World Marine Fishery Resources. *FAO Fisheries and Aquaculture Technical Paper 569*. ISSN 2070-7010

FAO (Food and Agriculture Organization) (2014). Species Identification Guide for Fishery purposes. The living Marine resources of the sea.*FAO Fisheries and Aquaculture Technical Paper* 569. ISSN 2070-7010

FAO (Food and Agriculture Organization) (2018).*Parapenaeopsis atlantica*Balss, 1914 Guinea Shrimp\

FAO (Food and Agriculture Organization) (2018).Fisheries and Aquaculture Department.Species fact sheets.*Penaeus notialis* (Perez-Fartante, 1967)54

FAO/WHO (Food and Agriculture Organization/World Health Organization) (2015). Joint FAO/WHO food standards programme CODEX committee on contaminants in food. CODEX STAN 193-1995. 90Pp

Marine Species Identification portal (2018).Fishes of the NE Atlantic and the Mediterranean.*Nigerian tongue sole* (*Cynoglossus browni*)

Mojekwu TO and Anumudu CI (2015) Advanced Techniques for Morphometric Analysis in Fish. *J Aquaculture Research and Development* 6: 354

Moruf, R.O and Lawal-Are, A.O (2017). Size composition, Growth pattern and Condition factor of two Portunid crabs, *Callinectesamnicola* (De Rochebrune) and *Portunus validus* (Herklots) from Lagos Coast, Nigeria.