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GROWTH PATTERN OF ATYA GABONENSIS AND MACROBRACHIUM MACROBRACHION FROM LOWER RIVER BENUE, MAKURDI–NIGERIA

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ABSTRACT

Data on growth parameters of Atya gabonensis and Macrobrachium macrobrachion were collected over a period of 6 months from August 2021 to January 2022. A total of one hundred and seventy (170) specimens of M. macrobrachion and two hundred and forty (240) specimens of A.gabonensis were hand-picked under rocks and crevices under the water by the help of fishermen who dived in, while M. macrobrachium were trapped using unbaited local non-return basket trap made of bamboo and a non-return set trap. The collected samples were transported live to the fisheries laboratory, University of Agriculture, Makurdi in ice box containing water for further analysis using independent sample t-test to determine the mean values.The result of the length weight relationship revealed that apart from fig 4. Fig. 1, 2, 3 and 5 showed a strong correlation between the length and weight of the two (2) species (R2=0.8615), (R^2 = 0.8812), (R2=0.8761), (R2=0.5523), (R2=0.7482) and the b values were less than three (3) which shows a negative allometric growth.Apart from gut length ,gut weight and carapace length in table 2 the result for seasonal variation in some morphometric parameters in Atya gabonensis and Macrobrachun macrobrachion differed significantly in both seasons (wet and dry). The result for the morphormetric parameters for table 3 and 4 all showed significant differences. It was concluded that this species exhibit an allometric growth pattern. I therefor recommend more work be done in other areas of the biology of these prawns inorder to provide accurate informations for their domestication.

Keywords: Growth , Pattern and Season.

1. INTRODUCTION

Fisheries play a very significant role in the national economy (Sikoki and Otobotekere 1999). Fish and fish products provide over 10kg of protein per capital per annum, an equivalent of 40% of all animal protein consumed in the country (Sikoki and Otobotekere 1999). Apart from being cheap source of highly nutritive protein, it also contains other essential nutrients required by the body. The fisheries sub-sector is also a high foreign exchange earner generating about 20 million dollars annually through the export of shrimps alone and providing direct and secondary employment to more than one million Nigerians.

The shellfish are a major but cheap protein source for human consumption as well as source of income for coastal towns and villages of the Niger Delta environment. Nigeria's shrimp fisheries, both industrial and artisanal, are a major source of both direct and indirect employment (Okayi, Solomon, Ataguba, Chukwudi and Mbata, 2013). Shellfish of decapoda, comprise of crabs, prawns and shrimps. Thus several shellfish species from the three groups (crabs, prawns and shrimps); Macrobrachium sp, Nematopalaemonhastatus, Parapanaeopsissp, Pandalussp,

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Cardiosomaarmatum, Callinectesamnicola, Goniopsispelii and Ocypode africana have been reported in other coastal brackish water bodies environment in Nigeria (Marioghae, 1982, Powell, 1982, Enin, 1998, Lawal-Are and Kusemiju, 2000, Okayi et al., 2013, Olawusi-Peters and Ajibare, 2014, Lawal-Are and Igborgbor, 2015).

Prawns are entirely fished from the wild and harvested as far inland as 250km in the various river systems and lakes mainly in the southern part of Nigeria. Production areas are restricted to Asejire (Oyo state), Port-Harcourt (Rivers state), Calabar (Cross River state) and Lokoja (Kogi state). A few species such as Atyagabonensis occur inland around the Middle-Belt areas especially Makurdi.

Morphometric analysis and relative growth studies are widely used in decapod crustaceans (Loveth and Felder, 1989) because of the possibility of changes related to sex, environmental conditions, food consumption, reproduction and genetics (Konan *et al*., 2017). Jayachandran and Joseph (1988) also reported that variations in the growth of individual prawn or group of prawns can be measured using morphometric relationships. Furthermore, morphological studies are useful in the study of seasonal variations in growth (Rickter *et al*., 2000) and estimation of weight from length (Beyer, 1991). Santos *et al*.,(2002) and Rahman *et al*., (2004) also reported that allometry is an important factor for biological, physiological and ecological processes, and fisheries assessments. This work aims to determine the growth pattern of *Atya gabonesis* and *Macrobrachium macrobrachion* from Lower River Benue.

2. MATERIALS AND METHOD

The study was conducted at the lower River Benue axis at wadata Market in Makurdi.Makurdi the capital of Benue State in Nigeria, is located at Longitude 7°43°N and Latitude 8°32°E. The town is divided into the North and the South bank by the River Benue. The samples were collected for further analysis at the general purpose Laboratory Department of Fisheries and Aquaculture University of Agriculture Makurdi.

Sample collection

A total of one hundred and seventy (170) specimens of *M. macrobrachion* and two hundred and forty (240) specimens of *A.gabonensis* were hand-picked under rocks and crevices under the water by the help of fishermen who dived in, while *M. macrobrachium* were trapped using unbaited local non-return basket trap made of bamboo and a non-return set trap. The collected samples were transported live to the fisheries laboratory, University of Agriculture, Makurdi in ice box containing water. The prawns were identified to the species level, using keys provided by Fischer *et al.* (1981) and Powell (1982).

The samples of *M. macrobrachion* and *A gabonensis* were examined for morphometric and meristic features. The morphometric features examined were standard length, gut length total length (from tip of rostrum to the tip of telson) with a vernier calliper, carapace length (from eye socket to mid dorsal margin of carapace) were measured with dividers. Gut weight and gonad weight were also measured .The carapace length was then determined by putting the dividers to a 30cm ruler and the measurements recorded. The total length, was measured to the nearest 0.1cm while the body weight was measured to the nearest 0.01g with a top-loading Mettler balance (Model PE 1600).

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Total Length-Body Weight Relationship

The relationship between total length and body weight of *M.macrobrachion* and *A gabonensis* was studied and represented by the equation:

$W = a + L^b$ (Le Cren, 1951)

where W = body weight (g), L = total length (cm), a = regression constant and b = regression coefficient. The equation was further transformed into a linear regression equation as: Log W= Log a + b Log L

3. DATA ANALYSIS

All the data obtained from the length weight were subjected to independent sample t-test to determine the mean values

4. RESULTS

Figures 1-5 illustrates regressions relationship between the length and weight of *Atya gabonensis* and *Macrobranchium mmacrobranchion* from Lower River Benue for the period of study. Apart from fig 4. Fig. 1,2,3 and 5 showed a strong correlation between the length and weight of the two (2) species (R^2=0.8615) , (R^2 = 0.8812),(R^2=0.8761), (R^2=0.5523), (R^2=0.7482) and the b values are less than three (3) which shows a negative allometric growth.

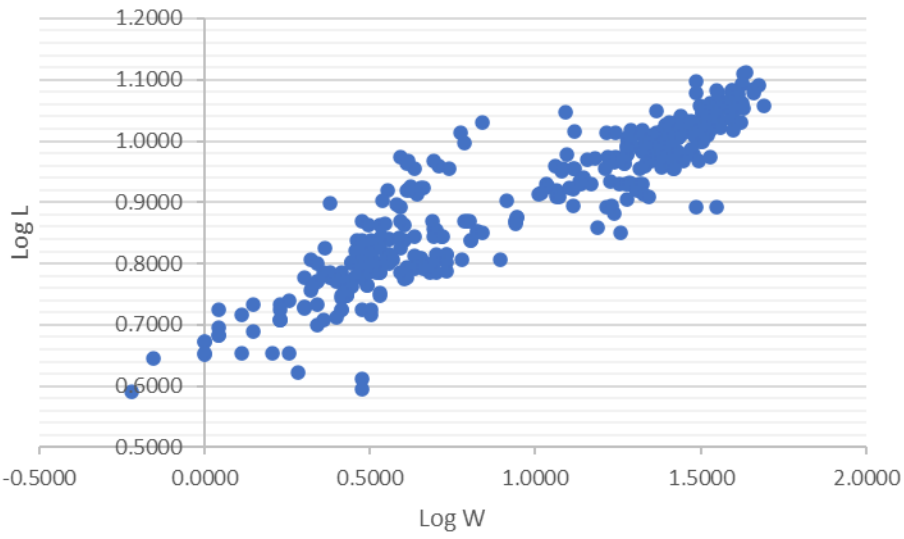

Figure 1: Regression relationship between the Length and Weight of *Atya gabonensis* and *Macrobranchium macrobranchiom* from Lower River Benue

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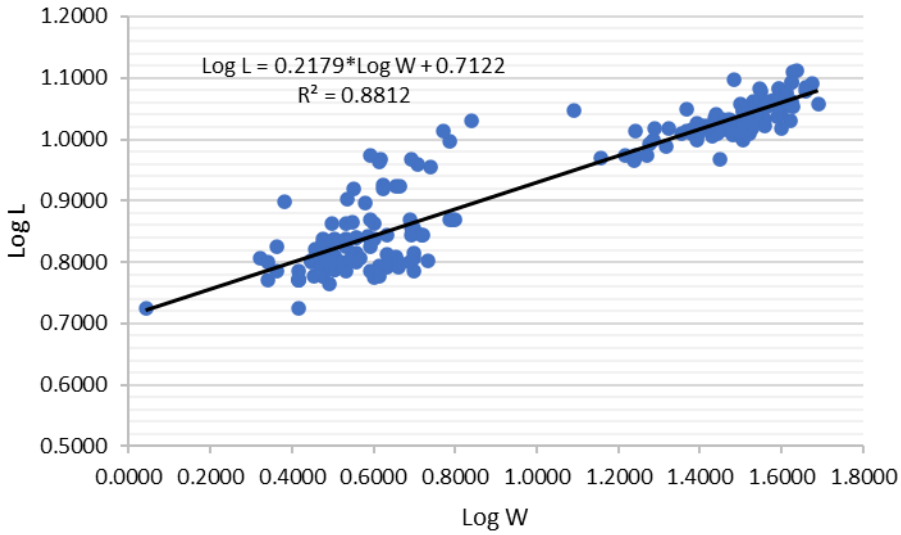

Figure 2: Regression relationship between the Length and Weight of male *Macrobranchium macrobranchiom* from Lower River Benue.

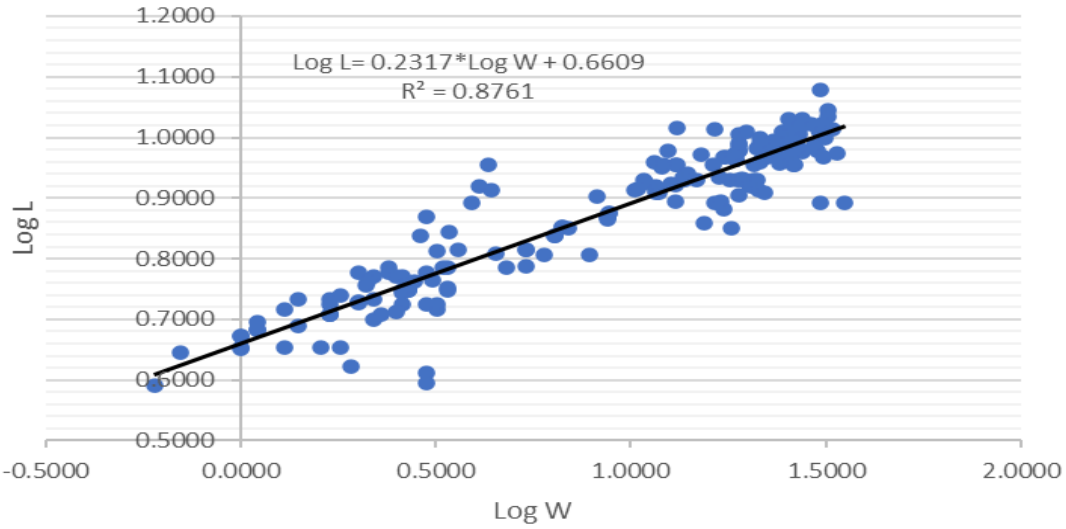

Figure 3: Regression relationship between the Length and Weight of male *Atya gabonensis* from Lower River Benue.

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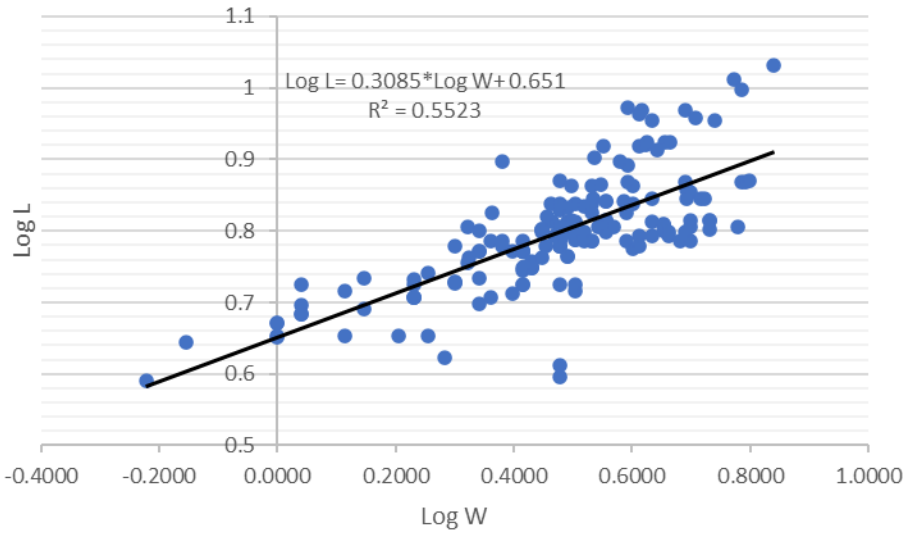

Figure 4: Regression relationship between the Length and Weight of female *Macrobrachium macrobrachium* from Lower River Benue.

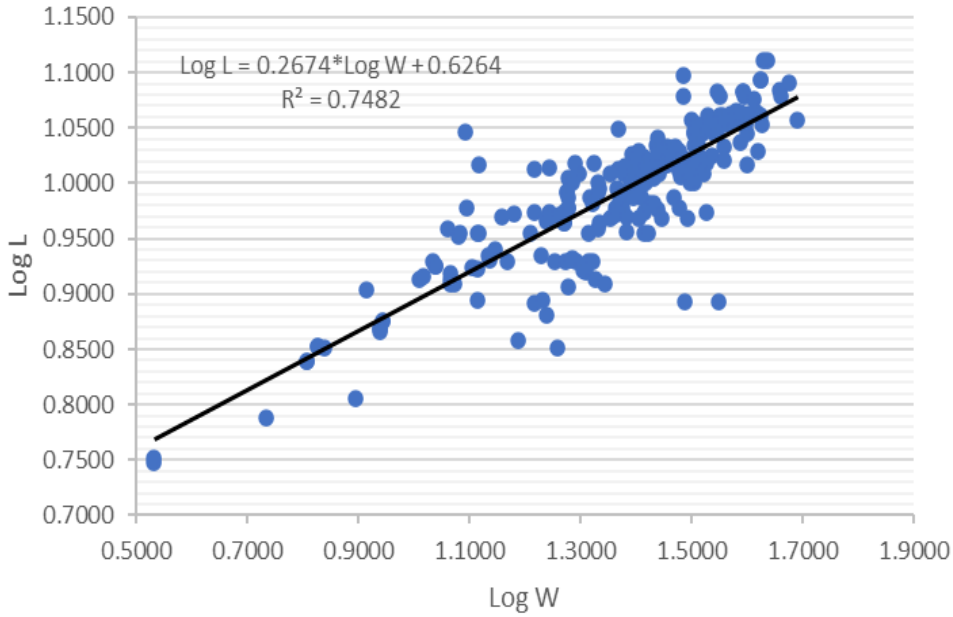

Figure 5: Regression relationship between the Length and Weight of female *Atya gabonensis* from Lower River Benue.

Table 1 presents the mean seasonal variation in some morphormetric parameters of M.macrobrachion from Lower River Benue.The result indicates a significant difference in both seasons (wet and dry) with a higher mean value (7.34±0.23) in dry than the wet season standard length also showed a significant difference in both wet and dry season with a higher mean value (6.39±0.24) in dry season,total length followed the same trend with a higher mean value

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(3.88±0.22),gut length also differed significantly in both seasons with hgher mean value (3.52±0.24) in dry season gut weight also showed significant difference in both seasons with a higher mean value (0.29±0.01) Carapace length and condition factor also differed significantly in both seasons with highest mean values (2.39±0.11) seen in carapace length for dry season but highest mean values (1.33±0.07) was seen in wet season for condition factor.

Table 2 presents the mean seasonal variation in some morphormetric parameters of *A.gabonensis* from Lower River Benue.The result for total length indicates a significant difference in both seasons (wet and dry) with a higher mean value (9.99±0.10) in dry than the wet season standard length also showed a significant difference in both wet and dry season with a higher mean value (8.66±0.10) in dry season,total length followed the same trend with a higher mean value (25.09±0.74),gut length also differed significantly in both seasons with hgher mean value (6.26±0.10) in dry season gut weight also showed significant difference in both seasons with a higher mean value (0.46±0.08) in wet season Carapace length and condition factor also differed significantly in both seasons with highest mean values (3.40±0.30) seen in carapace length for wet season but highest mean values (2.42±0.07) was seen in dry season for condition factor.

Table 3 presents some morphometric parameters of prawn species from lower riuver benue.the result for total length showd a significant difference at ($p<0.05$) with *Atya gabonensis* having a higher mean value (9.88±0.09),a minimium value (3.90,10.74)for *Macrobrchium machrobrachion* and (5.60,12.92) for A.gabonensis standard length followed the same trend with a higher mean value forn A.gabonensis (8.58±0.08) with aminimium and maximum value (3.00,10.22) for *M.macrobrachion* and (4.80,12.00) for *A. gabonensis*.tatal weight also showe a significant difference with higher mean value (8.58±0.08) fo a.gabonensis and a minimum and maximum value of (0.60,6.92) for *M. macrobrachion* and (3.40,49.00) for *A. gabonensis* ,gut length of *M.macrobrachion* differed significantly from *A.gabonensis* with a higher mean value (5.95±0.10) and a minimum and mixiumum value 0f (1.00,5.31) for *M.macrobrachion* and (2.10,9.700 for A.gabonensis.gut weight of M. macrobrachion differed significantly from A.gabonensis with a higher mean value (0.43±0.01) carapace length and condition factor for *M.macrobrachion* and *A.gabonensis* also differed significantly with respective higher means of (3.26±0.06) and (2.53±0.04) and a minimum and maximum value of (0.95,4.60) for *M.macrobrachion* and (1.00,4.94) for *A.gabonensis*.miminimum and maximum value for condition factor was also seen to be (0.47,4.90)) for *M.macrobrachion* and (0.90,3.10) for *A. gabonensis*.

Table 4 presents the mean seasonal variation in some morphormetric parameters of prawns from Lower River Benue.The result for total length indicates a significant difference in both seasons (wet and dry) with a higher mean value (9.45±0.12) in dry than the wet season standard length also showed a significant difference in both wet and dry season with a higher mean value (8.19±0.11) in dry season,total length followed the same trend with a higher mean value (20.71±0.82),gut length also differed significantly in both seasons with higher mean value (5.70±0.11) in dry season gut weight also showed significant difference in both seasons with a higher mean value (0.39±0.01) in dry season Carapace length and condition factor also differed significantly in both seasons with highest mean values (3.04±0.07) seen in carapace length for wet season but highest mean values (2.14±0.06) was seen in dry season for condition factor.

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Table 1: Seasonal variation in some morphometric parameters of *Macrobrachium macrobrachium* from Lower River Benue

Parameters	*Wet Season*	*Dry Season*	P-Value
Total Length (cm)	5.94±0.11[b]	7.34±0.23[a]	0.00
Standard Length (cm)	5.16±0.11[b]	6.39±0.24[a]	0.00
Total Weight (g)	2.82±0.11[b]	3.88±0.22[a]	0.00
Gut Length (cm)	3.05±0.09[b]	3.52±0.12[a]	0.00
Gut Weight (g)	0.26±0.01[b]	0.29±0.01[a]	0.04
Carapace Length (cm)	2.04±0.05[b]	2.39±0.11[a]	0.00
Condition Factor, k	1.33±0.07[a]	1.06±0.07[b]	0.02

**mean in the same row with different superscripts differ significantly.*

Table 2 Seasonal variation in some morphometric parameters of Atya gabonensis from Lower River Benue

Parameters	*Wet Season*	*Dry Season*	P-Value
Total Length (cm)	9.06±0.67[b]	9.99±0.10[a]	0.02
Standard Length (cm)	7.81±0.58[b]	8.66±0.10[a]	0.02
Total Weight (g)	21.55±3.30[b]	25.09±0.74[a]	0.16
Gut Length (cm)	5.71±0.51[b]	6.26±0.10[a]	0.11
Gut Weight (g)	0.46±0.08[a]	0.42±0.01[b]	0.35
Carapace Length (cm)	3.40±0.30[a]	3.20±0.08[b]	0.42
Condition Factor, k	2.11±0.14[b]	2.42±0.05[a]	0.06

**mean in the same row with different superscripts differ significantly.*

Table 3: Some morphometric parameters of shrimp species from Lower River Benue

Parameters	*Macrobrachium macrobrachium*	*Atya gabonensis*	P-Value
Total Length (cm)	6.38±0.09[a] (3.90, 10.74)	9.88±0.09[b] (5.60, 12.92)	0.00
Standard Length (cm)	5.48±0.10[a] (3.00, 10.22)	8.58±0.08[b] (4.80, 12.00)	0.00
Total Weight (g)	3.25±0.10[a] (0.60, 6.92)	8.58±0.08[b] (3.40, 49.00)	0.00
Gut Length (cm)	3.26±0.06[a] (1.00, 5.31)	5.95±0.10[b] (2.10, 9.70)	0.00
Gut Weight (g)	0.30±0.01[a] (0.10, 0.60)	0.43±0.01[b] (0.10, 1.60)	0.00
Carapace Length (cm)	2.31±0.06[a] (0.95, 4.60)	3.26±0.06[b] (1.00, 4.94)	0.00
Condition Factor, k	1.30±0.04[a] (0.47, 4.90)	2.53±0.04[b] (0.90, 3.10)	0.00

**mean values in the same row with different superscripts differ significantly*

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Table 4:Mean Seasonal variation in some morphometric parameters of shrimps from Lower River Benue

Parameters	*Wet Season*	*Dry Season*	P-Value
Total Length (cm)	6.55±0.20 [a]	9.45±0.12[a]	0.00
Standard Length (cm)	5.68±0.18 [a]	8.19±0.11 [a]	0.00
Total Weight (g)	6.49±0.99 [a]	20.71±0.82 [a]	0.00
Gut Length (cm)	3.57±0.16 [a]	5.70±0.11 [a]	0.00
Gut Weight (g)	0.30±0.02 [a]	0.39±0.01 [a]	0.00
Carapace Length (cm)	2.31±0.09 [a]	3.04±0.07 [a]	0.00
Condition Factor, k	1.48±0.07 [a]	2.14±0.06 [a]	0.00

**mean in the same row with different superscripts differ significantly.*

5. DISCUSSION

Tesch (1971) reported that when the value of b = 3, fish is said to grow isometrically, and that values other than 3 show that the fish exhibit allometric growth, while Ricker (1975) reported that allometric relationship between total length and body weight imply that the body forms do not grow at the same rate. The values of the exponent „b" *A. gabonensis* and *M. macrobrachion* which were less than 3 in this study indicated negative growth pattern for the two species and this imply that both species becomes thinner with increase in length. The allometry growth pattern recorded in this study was different from the reports of Jimoh *et al.* (2005), and Anetekhai and Fagade (1989) who reported positive allometry for M. vollenhovenii in Ologe Lagoon and Asejire Lake respectively. Jimoh *et al.* (2012) also reported that *M. macrobrachion* and *M. vollenhovenii* from Badagry Creek exhibited positive allometry while Adite *et al*. (2013) reported that *M. macrobrachion* from two locations of the Mono-River Coastal Lagoon system exhibited allometric growth. However, Konan *et al.* (2017) reported that all the allometry types (negative allometry, isometry and positive allometry) were recorded for *M. macrobrachion* from the rivers of Cote d"Ivoire. The negative allometry recorded for both *M. macrobrachion* and *Atya gabonensis* from Lower River Benue might suggest reduction in natural productivity of the River as a result of anthropogenic activities and continued over-exploitation of these prawns in the River, since Jimoh *et al*. (2012) reported a possible over-exploitation of these prawns in Badagry creek. This is more so since Konan *et al.* (2017) had reported that allometric coefficient varied depending on the groups, environments and characters. From this study, higher values of body weight and total length were recorded for males of *M. macrobrachion* and *A.gabonensis* than for the females. These findings agreed with the reports of Anetekhai (1997) and Jimoh et al. (2005) who reported that males of *A.gabonensis* and *M. macrobrachion* were larger than females. According to Mariappan and Balasundaram (2004) the growth of total length and weight of a male M. nobili and that of the female differs significantly. The low body weight of *M. macrobrachion* recorded in this study could be as a result of exploitation pressure on the species in River Benue. Similar observation has been reported for Callinectes amnicola in Badagry creek (Lawal-Are and Kusemiju, 2000). Anetekhai (1997) reported that features such as carapace length and rostral length when expressed as proportion of total length are very useful in the identification of prawns since such features when expressed as percentage of total length give similar proportion in same species. The correlation coefficient values (r) for *M. macrobrachion* and *A.gabonensis* in this study indicated that there was positive correlation between the total length and carapace length. These findings are in agreement with

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Meye and Arimoro (2005) who reported high correlation for TL-BW in M. dux and Konan et al. (2017) who reported high values of coefficient of determination (0.66 – 0.97) in all length-length and weight-length relationships in *M. macrobrachion* from the rivers of Cote d"Ivoire. These high correlations suggest that an increase in total length also resulted into an increase in carapace length.

6. CONCLUSION AND RECOMMENDATION

It was concluded that this species exhibit an allometric growth pattern. I therefor recommend more work be done in other areas of the biology of these prawns inorder to provide accurate informations for their domestication

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