ABUNDANCE AND LENGTH-WEIGHT RELATIONSHIP OF FRESHWATER GASTROPODS IN RIVER ELEYELE, IBADAN, OYO STATE

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Abstract: The study centered on the population and length-weight relationship of gastropods from 5 sampling points at River Eleyele. Gastropods samples were collected from November 2010-April 2011. A total of seven (7) species were recorded, these included *Melanoides tuberculata* (Thiaridae), *Biomphalaria pfeifferi* (Planorbidae), *Lymnaea natalensis* (Lymnaeidae), *Physa marmorata* (Pysidae), *Gabriella senegalensis, Gabriella Aafricana* (Bithynidae) and *Lanistes varicus* (Pilidae). *Melanoides turberculata* was the most abundant (84.62%) followed by *Biomphalaria pfeifferi* with 7.69%. The value of b in the regression analysis for Planorbidae was significantly higher than 3 ($p<0.05$) which showed a positive allometry growth while b was significantly lower than 3 in the other organisms indicating a negative allometry growth. High degree of positive correlation between the total length and total weight was indicated by high values of the correlation coefficient (r) in all organisms (Thiaridae, r = 0.6883; Planorbidae, r= 0.9073; Lymnaeidae, r= 0.9894; Bithynidae, r=0.9790).

Keywords: Allometry, diversity, Eleyele, freshwater, gastropods, snails, length-weight

Introduction

Freshwater gastropods (snails) are important and diverse component of aquatic ecosystems worldwide (Johnson *et al*., 2013). Gastropods dominate more than half of the invertebrate biomass of the benthic stream communities (Brown *et al*., 2008; Brown and Lydeard, 2010). They play major roles in the food webs and nutrient cycling by significantly influencing the algal primary productivity in the aquatic environment (Brown and Lydeard, 2010).

According to Gérard *et al.* (2008); Cai and Gong (2012) Gastropods play a key role in connecting primary producers, herbivores, and dentritivores associated with macrophytes and grazers of periphyton and higher level consumers. Gastropods are widely used as bio-indicators of ecosystem health due to their significant response to environmental changes in lakes (Yin *et al*., 2017). The abundance, composition and diversity of gastropods present in lake sediments can act as a strong indicator for both ecological and hydrological changes (Francesco & Hassan, 2009). The structure, shapes and the chemical composition of the shells can give indications of the past conditions of lakes (Kattel *et al*., 2018).

The importance of length-weight relationship in fishery assessments cannot be over emphasized (Haimovici and Velasco, 2000). Measurements of length-weight in addition to age data can provide information on the composition of stock, age at maturity, life span, mortality, growth and production (Diaz *et al*., 2000). Length-weight relationship can be an instrument in assessing the well-being of individual and to evaluate the likely differences that exist between separate unit stocks of the same species (King, 2007). There are scanty information on the growth & length-weight relationship of benthic organisms and shell fishes generally in Nigeria, the research work intend to fill the knowledge gap.

The study therefore aimed at determining the abundance and length-weight relationships of Gatropods in River Eleyele, Ibadan.

Materials and Methods

Description of study area

The study area was a man-made lake, located on latitude 7º20` - 7º25`N, longitude $3^0$51` - $3^0$56`E and was constructed by Water Corporation of Oyo State in 1939 by damming River Ona within the Ibadan metropolis. The River is an important resource for fishery, domestic water supply and it is flood controlled with a maximum of 12 m during the rains (Olarenwaju *et al*, 2017; Bolaji, 2010).

Collection of benthic organisms

Benthic and water samples were collected bi-monthly from November 2010 to April 2011 at five different stations in the study area using a van Veen Grab (1933).

Identification of benthic Organisms

In the laboratory, the benthic organisms were extracted using a sieve of 0.5 mm mesh size. Water was transferred into a plastic bowl in which the sieve containing the sediment samples was swirled to facilitate the extraction of the benthic organisms. The organisms were poured into a white broad tray, stained with Rose Benger solution and sorted using forceps into their respective taxa and preserved by freezing (David and Macro, 2010). Identification of the different organisms was done using identification guides by Danish Bilharziasis laboratory: A field guide to African snails, 1980.

Length-weight measurement

The lengths of the identified Gastrpods were determined to the nearest 0.1 mm under a dissecting microscope fitted with an ocular micrometer and the weights were measured using a sensitive weighing balance. Body length was measured as the distance from the anterior of the labrum to the posterior of the last abdominal segment, and then weighed to the nearest 0.1 mg according to the method of Smock (1980). Biological indices such as Simpson's index of dominance, Margalef's index (d); Shannon-Weiner index (H) and Eveness (E) were used in determining of taxa richness, species diversity and eveness.

Results and Discussion

The percentage relative abundance was used to express the relative contribution of the different species to the overall faunal abundance (Table 1). The Gastropoda population was represented by *Melanoides tuberculata, Biomphalaria pfeifferi, Lymnaea natalensis, Physa marmorata, Gabriella africana, Senegalensis lastly* and *Lanistes varicus.* Melanoides contributed 82.93% in sampling point A, 55.56% in sampling point E and 100% in point C. *Biomphalaria pfeifferi* contributed 10.98% in sampling point A and absent in all other sampling points B, C, D and E. *Lymnaea natalensis* accounted for 2.43% of organisms in sampling point A, 11.11% in sampling point E and no representative at sampling points B, C and D. *Physa marmorata* represented 22.22% of organisms at point E. *Gabriella Africana* and *senegalensis* were both represented in sampling point A contributing 1.22% each but only *Gabriella africana* was present in sampling point E with 11.11% contribution. *Lanistes varicus*

contributed 1.22% in point A. *Melanoides tuberculata* is the most dominant species with overall contribution of about 84.60% (Table 1) to the total population of organisms collected during the sampling period and was found in all the sampling points with exceptions of points of B and D. This was followed by *Biomphalaria pfefferi* with a contribution of 7.70% to the total population.

Table 1: Relative abundance of each species (%)

Family	Species	Total no of individuals	Relative abundance (%)
Thiaridae	*Melanoides tuberculate*	99	84.60
Planorbidae	*Biomphalaria pfeifferi*	9	7.70
Physidae	*Physa marmorata*	2	1.71
Lymaeidae	*Lymnaea natalensis*	3	2.56
Bithyniidae	*Gabriella senegalensis*	1	0.86
Bithyniidae	*Gabriella Africana*	2	1.71
Pilidae	*Lanistes varicus*	1	0.86
	Total	**117**	**100**

Table 2: Diversity of benthic macro-invertebrates in Eleiyele River during the study period

Parameter	A	B	C	D	E
No. of Species	6	0	1	0	5
No. of individuals	82	0	26	0	9
Margalef index of specie richness	1.14	0.00	0.00	0.00	1.82
Shannon Wiener diversity index	1.86	0.00	1.42	0.00	0.57
Equitability index	2.39	0.00	0.00	0.00	0.82

Ecological biometrics

Table 2 showed faunal diversity and dominance indices determined for the five sampling points. Margalef"s species richness (D), Shannon Wiener diversity index (H), and equitability index (J) were used in analyzing faunal diversity.

Length – weight relationship of organisms

Organisms from River Eleiyele used for the regression analysis are shown in Table 3. The organisms have lengths ranging from 5 to 20 mm and weights were between 10 - 550 mg. Table 4 shows Values for the constants *a* and *b*, with 95% confidence intervals, obtained from the equation of dry weight (W, mg) and body length (L, mm) of selected families and the combined families, Regressions obtained for each of the family using the equation ln W = ln a + b ln L were highly significant and explained a high proportion of variation of the dependent variable, as expressed by the coefficient of determination (R^2= 0.4375-0.9789) (Table 4). The coefficient of determination for the combined organisms is relatively low compared with each of the families. (R^2=0.41).

Table 3: Number of individuals and ranges of body lengths and dry weights according to families

Family	N	Range	
		Weight (mg)	Lenght (mm)
Thiaridae	99	10.00 - 550.00	5.00 - 20.00
Planorbidae	9	10.00 - 190.00	6.10 - 11.00
Lymnaeidae	3	30.00 -50.00	8.50 - 13.00
Bithyniidae	3	320.00 -480.00	12.00 - 14. 00
Combined	117	10.00 - 550.00	5.00 - 20. 00

Table 4: Regression Table

Family	N	Regression Constant					
		A	[1]Sa	b	[2]Sb	R^2	r
Thiaridae	99	-0.5954	0.515	1.9783	0.2116	0.4737	0.6883
Planorbidae	9	-3.6557	1.377	27.04	3.6426	0.8232	0.9073
Lymnaeidae	3	-1.0061	0.7221	2.0828	0.3056	0.9789	0.9894
Bithyniidae	3	-2.3690	1.2654	2.3481	0.4888	0.9585	0.9790
Combined	117	-0.3431	0.4772	1.8740	0.1981	0.43746	0.6614

[1] Sa: Standard deviation of 'a' [2]Sb: Standard deviation of 'b'
n = the number of individuals; *r* = the correlation co-efficient, R^2 = the coefficient of determination; All correlation coefficients were significant at the 0.1 and 0.05% levels.

The value of b was significantly ($p<0.05$) higher than 3 in Planorbidae while it was significantly ($p>0.05$) lower than 3 in Thiaridae, Bithyniidae, Lymnaedae and in the combination of all the organisms. The estimated values of b in Planorbidae higher than 3.0 ($p<0.05$) shows that the organisms exhibited a positive allometry growth while all other organisms exhibited a negative allometry growth. A high degree of positive correlation between total length and total weight of all organisms is indicated by high values of correlation coefficient (r) (Table 4).

Quite a number of factors could be responsible for the ratio between the shell weight and length and food availability in gastropods (Alunno-Bruscia *et al*., 2001). According to Froese (2006), the changes that occur in the values of b could not be unrelated to environmental factors such as food availability, competition for food, seasonal changes, temperature and sex. Differences in Morphology can also be explained by water temperature and abundance of predator according to Trussell (2000).

Conclusion

The water body has gastropods majorly of lower *b* value, which may be attributed to pollution status or anthropogenic activities that occurred in it. A comprehensive report on the species of gastropods in this river should be carried out to know the actual population, abundance and diversity in the river. Continuous evaluation should be constantly carried-out on the river and its resources to know its state at all time for proper management and control.

Conflict of Interest

Authors declare there is no conflict of interest related to this study.

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