Preliminary study of length-weight relationship of Flat Freshwater crab *Potamonutes bellarussus* (Daniels, Phiri and Bayliss, 2014) from Williams Falls, Zomba, Republic of Malawi, Central Africa (15º21'51.237'S and 35º18'22.747'E)

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Abstract

Potamonautes bellarussus (Daniels, Phiri, and Bayliss, 2014), a River Crab from Williams falls, Zomba, Republic of Malawi, Central Africa, the present study of length-weight relationship of potamonautid species occurring in the region. The slope value (b) estimated for *P. bellarussus* of both sexes was found to be 1.0377. The regression equations calculated for both sexes were Log W = -0.1598 + 1.0377 Log L. The correlations coefficient was found to be significant ($p < 0.01$). The significant difference between sexes of the species 'F' value was at 1% level. The b value differed from the ideal cube law of '3' as is with the case of length-weight relationship studied in this specific region (15º21'51.237'S and 35º18'22.747'E). The slope value was compared here could be very useful for comparison with the tilapia species in other geographical locations.

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Introduction

Potamonautes bellarussus (Daniels, Phiri, and Bayliss, 2014), is observed as one of the most extensive potamonautid species, stirring from the eastern parts of South Africa, northwards to Zimbabwe and Malawi (Daniels, Phiri, and Bayliss, 2014). Family Potamonautidae have represented by 18 genera and 133 species (Cumberlidge, 1999; Cumberlidge *et al*. 2008; Cumberlidge *et al*. 2009). Cumberlidge (1999) has reviewed that the morethan 70 species of *Potamonautes* are found throughout continental Africa, but very few are found to be in the northern African region in northern Egypt. According to Bott (1955) and Cumberlidge *et al*. (2002) has suggested that the Central Africa crab fauna 24 species, 5 genera. Genus *Potamonautes*, have been very poorly reviewed at Malawi. In freshwater medium only six crab species were recorded viz., *Potamonautes brincki* (Bott, 1960), *P. calcaratus* (Gordon, 1929), *P. depressus* (Krauss, 1843), *P. perlatus* (Milne Edwards, 1837), *P. sidneyi* (Rathbun, 1904), and *P. warreni* (Calman, 1918) were archeologically known to occur in South Africa (Barnard, 1935, 1950). *Potamonautes* is the most species rich and contains in excess of 60 species and is distributed throughout most of the continent from the Nile delta in Cairo-Egypt to river systems in South Africa, excluding only the Sahara Desert and the Mediterranean fringes of North Africa (Morocco, Algeria and Tunisia). The Natal River Crab is extensive throughout Central Africa stirring mainly in and around region of streams and rivers. IUCN has been highlighting this populations is "Least Concern" (LC) based on its wide habitat distribution and high degree of lenience, especially to pollutants and habitat modification accommodation (Cumberlidge, 2008; Cumberlidge *et al*., 2009).

According to Pauly (1993) reviewed that the length-weight relationship is required 1- The conversion of length of individual fish to weight. 2- Conversion of growth equation for length into growth equation for weight, and 3- Comparisons between populations of the same species or between species. Length-weight relationship revisions of any finfish species is a pre requisite for the study of its population by (Le Cren, 1951). According to Le Cren (1951) data of the length weight relationship of a fish is vital, since various significant biological characteristics namely, in general well-being of fish, appearance of first maturity, onset of spawning, the standing stock biomass, yield per recruit in prediction models, condition indices, analysis of ontogenetic changes and several other aspects of crustacean population dynamics, a derivative of this relationship *Potamonautes bellarussus* (Daniels, Phiri, and Bayliss, 2014).

Materials and methods

Twenty-two specimens both sexes were examined. Data on length-weight of *P. bellarussus* were collected from Williams falls, Zomba, Republic of Malawi. After collection, length and weight measurements (total length, TL; weight of sample) to the nearest mm and wet weight (W) to the nearest 0.1 g were measured for each specimen at a depth of 2 m. The

study site was selected to near stream (15º21'51.237'S and 35º18'22.747'E) located on the Willams falls, Zomba. Malawi at a depth of 2 m (Figs. 1, 2, and 3).

The length-weight relationship was estimated using the equation:

$$W = aL^b$$

Where W, is body weight of crab in (gm), and L, is Carapace length (mm). 'a' and 'b' are constant, 'a' is intercept and 'b' is slope of equation or known as growth constant. The equation is represented in log transformation. The parameters a (intercept) and b (slope) were estimated by linear regression based on logarithms; log (W)=log (a) + b long (L). The significance of regression was assessed by analysis of (ANOVA). For testing possible significant ($p>0.01$) differences between the both sexes F- test was used for comparison of the slope value.

Diagnosis

Flat freshwater crab species, postfrontal crest deep and well defined, exorbital tooth prominent, anterolateral margins granulate (Figs 1 and 2). Carapace, periopods, chelipeds blood red when alive. The present specimens have confirmed and identified by Daniels, Phiri, and Bayliss, (2014).

Results and discussion

During the present study period it was observed that the length-weight relationship of *P. bellarussus* from Williams falls, Zomba, Malawi (Figs 1, 2, 3 and 4). The correlation coefficient derived for the length-weight relationship

for both sexes are given in Table.1. The regression equations derived for both the sexes are presented below Table 2.

Log W = -0.1598 + 1.0377 Log L

Figure 1: *Potamonautes bellarussus* **(Daniels, Phiri, and Bayliss, 2014)**, **(Dorsal Side).**

Figure 2: *Potamonautes bellarussus* **(Daniels, Phiri, and Bayliss, 2014) (Ventral Side).**

Figure 3: *Potamonautes bellarussus* **(Daniels, Phiri, and Bayliss, 2014) (Both sexes of crab)**

The results showed significant of the both sexes of the species and the 'F' values were found to be significant at 1% level (Table 3). The correlations coefficient was found to be significant ($p<0.01$).

Figure 4: Overview map of the Williams falls, Zomba, showing the sampling site of *Potamonautes bellarussus* (Daniels, Phiri, and Bayliss, 2014)

Table 1: Statistics in the length-weight relationship of both sexes, *Potamonautes bellarussus* (Daniels, Phiri, and Bayliss, 2014)

Sex	N	SX	SY	SX^2	SY^2	SXY
Both	22	22.5502	19.8844	23.3360	18.2515	20.6119

N= Number of fish.

SX^2, SY^2, SXY = Sum of squares and product.

SX, SY = Sum of logarithmic values of length and weight, respectively.

Table 2: Regression data for the length-weight relationship of both sexes, *Potamonautes bellarussus* (Daniels, Phiri, and Bayliss, 2014)

Sex	Sum of Squares and Products					
	DF	X^2	XY	Y^2	b	DF
Both	22	23.3360	20.6119	18.2515	0.1578	21

DF: Regression freedom

B: Regression Co-efficient

SS: Sum of Squares

Table 3: Test of Significance.

Source of Variation	DF	Sum of Square	Mean Square	Observed F
Deviation from individual with in sexes	1	41.5875	41.5875	20.9995
Difference between Regression	21	41.5875	1.9804	
Deviation from Total Regression	22	83.175		Significant at 1% level

The co-efficient of determination (R^2) was estimated 0.9 for both sexes. The present investigation has showed that *P. bellarussus* mature and juveniles are associated with different habitat region (Land to river channel and vice-versa). These crabs are affected or climatically changes in wide variety of mileu of ecosystem progressions and can, provide in general observations about ecosystem status. The present investigation study is also in agreement with the above view and it can be concluded that the cube formula $W = al^3$ will not be a proper representation of the length-weight relationship for *P. bellarussus* as the "t" value is significantly different and the growth is not isometric. According to Bagenal (1978), has highlighting that, when co-efficient of regression is greater and or less than 3, then growth is allometric but when equal to 3, then the growth is isometric.

The present study showed that less than 3, the slope value was estimated 1.0377. It has been changed of *b* (the slope value) depends mostly on the shape and fatness of the species. Several influences may be responsible for the differences in parameters of length-weight relationships among season and years, crab coming from terrestrial to riverine area, due to temperature, food (quantity and quality) sex and maturity stage. African freshwater crabs the breeding strategy (all have direct development from egg to hatchling crabs, and they all lack larval stages) but they have differed in their choice of habitat within freshwater ecosystems (Cumberlidge, 1999). According to this statement, length-weight relationship of *P. bellarussus* the slope value was 1.0377 and

intercept was estimated 0.1578 and coefficient was 0.9. Thus, comparing the slope of *P. bellarussus* with other crab species, it could be concluded that the slope value is less than 3 for the both sexes of *P. bellarussus.* Further research and development are monitored to extension survey of biodiversity assessment of Malawian species in especially crustacean fauna to increase knowledge of the native finfish and shellfish species. Moreover, to long-term studies of populations, it is also very essential for proper biodiversity assessment, conservation and management of resources, as well as, the crustaceans stock assessment and population dynamics methods are important for Willams Falls, in and around regions in the Malawian freshwaters.

Acknowledgements

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