

LENGTH-WEIGHT RELATIONSHIP AND DISTRIBUTION OF  
*TYMPANOTONUS FUSCATA* (MOLLUSCA: POTAMIDIDAE)  
IN BRENU LAGOON, GHANA

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ABSTRACT

A total of 1894 specimens of *Tympanotonus fuscata* were obtained by random sampling with Ekman grab from Brenu Lagoon to determine the size distribution of the organism as a result of perceived human predation on the resource in the area. Samples of the edible snail were collected monthly from November 2003 to October 2004, and the physico-chemical parameters determined for the entire study period. Variations were observed in the quarterly mean density (numbers/cm<sup>3</sup>) of the snails in all the four sampling stations A to D with values ranging from 18.67±4.81 to 99.00±17.80 at station A, 21.67±7.06 to 29.33±4.41 at station B, 21.70±10.50 to 71.70±12.30 at station C and 9.67±7.22 to 41.30±5.70/cm<sup>3</sup> at station D. There were patchy distributions of the snail in the lagoon at replicate stations which might be due to the variation of physical conditions in the water. The height-weight relationship of the snail indicates negative allometric growth with high individual variability and the body weight was most closely related to the shell height ( $R^2 = 0.89$ ). The snails in Brenu Lagoon were not growing to the large size this was observed in size frequency distribution. The modal size class was 1.5 – 1.9 cm. The demination of smaller snail size could be due to human predation pressure on the larger snails and or the effect of physical and chemical factors that prevail in Brenu Lagoon.

INTRODUCTION

Many species vary in abundance at a hierarchy of different spatial and temporal scales (Beisel *et al.*, 1998; Downes *et al.*, 2000a,b). Underwood and Chapman (1998a,b) acknowledged that even at large scale, many observed spatial and temporal patterns of organisms are variable and inconsistent. According to Chapman (2002), in recent years there has been growing realization that most species, particularly intertidal organisms, are extremely patchily distributed at a range of spatial scales within any

height on a shore, among replicate sites and among microhabitats within a site. It is obvious from Underwood and Chapman (1998a,b) that abundances vary through time, frequently on short-term and non-seasonal bases, with different temporal patterns from station to station. These distribution patterns could occur in benthic molluscs population which are directly or indirectly affected by abiotic factors. There are instances whereby biotic factor influence cause marked effects on the distribution of populations.

The snail, *Tympantonus fuscata* (Family: Potamididae), is endemic to West Africa and very common in lagoons and estuaries (Edmunds, 1978; Yankson and Kendall, 2001). The organism is heavily exploited as a food resource in some lagoons in Ghana (Ntiamoah-Baidu, 1991). However, it is a taboo among other tribes (such as the people from Ningo in the Greater Accra Region) to eat the snail and therefore their collection from the Djange Lagoon is forbidden.

The objective of this preliminary study was to assess the size frequency and distribution of the snail due to the perceived high human predation on the organism in Brenu Lagoon and the fact that there has been a gold mining activity in the area before (pers. comm., Local inhabitants) that might influence the hydrographic parameters in the lagoon.

## MATERIALS AND METHODS

### Study site

Brenu Lagoon where the study was conducted is located about 13 km west of Cape Coast ( $1^{\circ}26'W$  and  $5^{\circ}04'N$ ) in the Central Region of Ghana. It is a classical lagoon (Yankson and

Obodai, 1999) which is fringed by green vegetation that provides a suitable nursery ground for molluscs, bivalves and juvenile finfishes. The lagoon is fed by five non-permanent streams namely Esuaku, Obuahu, Asenche, Asosi and Burabin (Fig. 1) which are normally not flowing during the dry season. Between the lagoon and the sea is a consolidated sand bar which is breached by the local inhabitants during the rainy season if the lagoon threatens to flood the nearby villages. At spring tides, sea water enters the lagoon and during an annual festival "Bakatue" of the area the inhabitants remove the sand bar manually to connect the lagoon to the sea apparently to allow more marine fishes to enter the lagoon.

The Brenu Lagoon has a fringing mangrove vegetation, which is heavily exploited for fuel wood and cut to create space for construction of salt ponds. The substrata sampled at the various stations were muddy at stations A and B; and sandy-mud at stations C and D (Fig. 1). The muddy stations contained some amount of allochthonous matter, mainly leaves from the surrounding vegetation.

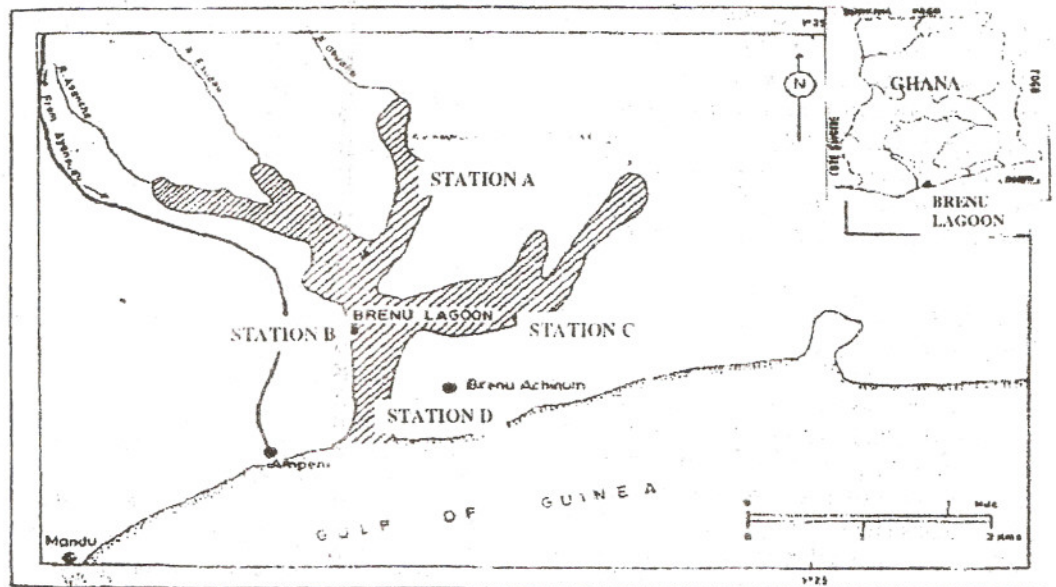
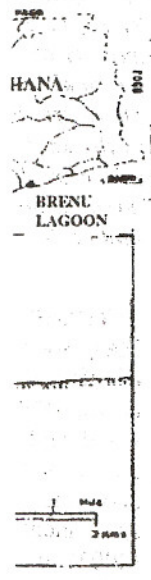


Fig. 1: Map showing locations of sampling stations A to D in Brenu Lagoon

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**Field sampling**

Four sampling stations were selected: station A was close to where Obuahu River enters the lagoon with sparse mangrove vegetation, station B was fringed by dense shrub and mangrove vegetation, station C was close to a salt mining site and station D adjacent to a heap of garbage and close to the mouth of the lagoon. Monthly samples of *T. fuscata* were collected with the Ekman grab (15×15×15 cm). Three sediment samples were randomly taken at each station every month. The samples were collected close to the banks at all the stations. Each sediment sample was sieved and washed in 1mm mesh net. The snails were then collected into sample bottles and preserved in 4% formalin for further analyses. The total number of organisms sampled at each station was recorded for the three replicates monthly during the study period. A water quality checker (model: WQC-20A) was used to determine hydrographic factors such as temperature, turbidity, pH, salinity and dissolved oxygen at the various stations for the entire study period.

**RESULTS**

**Hydrographic parameters**

Physico-chemical parameters determined in Brenu Lagoon ranged from temperature (26.15 – 32.90 °C), turbidity (38.00 – 141.25), pH (6.05 – 8.70), salinity (26.50 – 59.50 ‰) and dissolved oxygen (2.18 – 9.45 mg l<sup>-1</sup>) during the study period from Nov, 2003 to Oct, 2004. The mean temperature recorded throughout the study period showed minimal fluctuations. High range of turbidity recorded during the study with pH changes in the lagoon mostly above the neutral point. The general trend of salinity recorded was a little higher than that of the sea water. Dissolved oxygen range recorded was narrow in the lagoon during the study.

**Height-weight relationship**

Body weight (W) was related to the shell height (H) of the snails and the power function ( $W = 0.0979 H^{2.3}$ ) was obtained (Fig. 2). Individual variability was high and the body weight was most closely related to the shell height ( $R^2 = 0.89$ ).

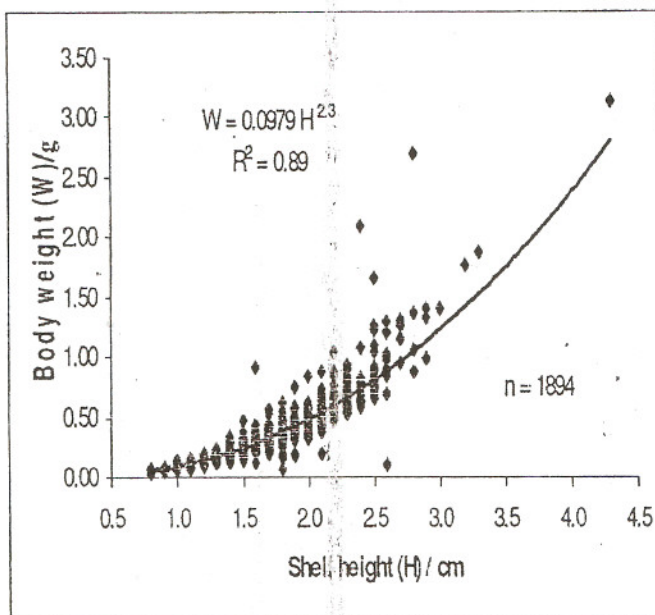


Fig. 2: Relationship between body weight and shell height of *Tympanotonus fuscata*

### Density

A total of 1894 specimens of *Tympanotonus fuscata* were collected during the study. Monthly total samples were pooled to obtain quarterly mean density (Table 1). The first quarter showed a high density ( $66.00 \pm 39.00 / \text{cm}^3$ ) of *T. fuscata* at station C and a low density ( $9.67 \pm 7.22 / \text{cm}^3$ ) at station D. There was a general decrease in density at almost all the four sampling stations in the second quarter such as  $21.70 \pm 10.50 / \text{cm}^3$  at station C. The third quarter showed a rise in density at all the stations with the highest increase ( $68.00 \pm 35.60 / \text{cm}^3$ ) at station C. The fourth quarter showed a decrease in density at stations B ( $26.33 \pm 2.40 / \text{cm}^3$ ) and D ( $26.33 \pm 5.70 / \text{cm}^3$ ) and an increase at stations A ( $99.00 \pm 17.80 / \text{cm}^3$ ) and C ( $71.70 \pm 12.30 / \text{cm}^3$ ).

### Size distribution

Figure 3 shows a quarterly size distribution of the snails. The first quarter showed a high number of 1.5-1.9 cm size class. The second quarter showed a decrease in all the size classes with few individuals emerging in the higher size class (3.0-3.4 cm). The 1.5-1.9 cm size class dominated in the third quarter samples with quite a few individuals appearing in the higher size class (4.0-4.4 cm). The larger snails were not common in the samples collected. The

fourth quarter showed an increase and domination of 1.5-1.9 cm size class of *T. fuscata* in Brenu Lagoon.

### DISCUSSION

For proportional increase in size, the growth of a fin- or shellfish should be isometric. This was not observed in this study in the growth of *Tympanotonus fuscata* in Brenu Lagoon as it showed negative allometry (power of shell height,  $H$  is less than 3). That means the increase in snail body weight,  $W$  is not proportional to the increase in  $H$ . Such a growth in the lagoon snail (Fig. 2) may be attributed to the effect of human predation on the organism. It is also likely that the physico-chemical conditions in the lagoon might be a contributing factor to the observed growth pattern in the snail. This is partially supported by the high quantities (above WHO standards) of mercury and other trace metals recorded in the shells and tissues of the snail and Blackchin tilapia in Brenu Lagoon (Essumang *et al.*, 2007).

The observed quarterly mean population densities of the snails (Table 1) varied in the sampling stations in Brenu Lagoon with time. This is in line with species abundance varying at different spatial and temporal scales as reported by Beisel *et al.* (1998) and Downes *et al.* (2000a,b). In this study, *T. fuscata* were patch-

Table 1: Quarterly mean density of *Tympanotonus fuscata* in Brenu Lagoon (Nov,03–Oct,04)

Quarter	Mean Density (Number/cm <sup>3</sup> ) ± SE Mean			
	Station A	Station B	Station C	Station D
1st Nov 03-Jan 04	39.70±14.30	21.67±7.06	66.00±39.00	9.67±7.22
2nd Feb 04-Apr 04	18.67±4.81	28.70±15.80	21.70±10.50	17.70±17.20
3rd May 04-Jul 04	45.67±6.33	29.33±4.41	68.00±35.60	41.30±21.90
4th Aug 04-Oct 04	99.00±17.80	26.33±2.40	71.70±12.30	26.33±5.70

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second dominant *T. fuscata* in

the growth of metric. This was the growth of the Lagoon as it shows the power of shell means the increase is not proportional to a growth in the attributed to the organism. It is under normal conditions limiting factor to the snail. This is due to high quantities of phytoplankton and other organisms in the water in Brenu La-

population density in the same with time. This is due to varying at different sites as reported by Downes *et al.* (1984) were patch-

Frequency (Numbers)

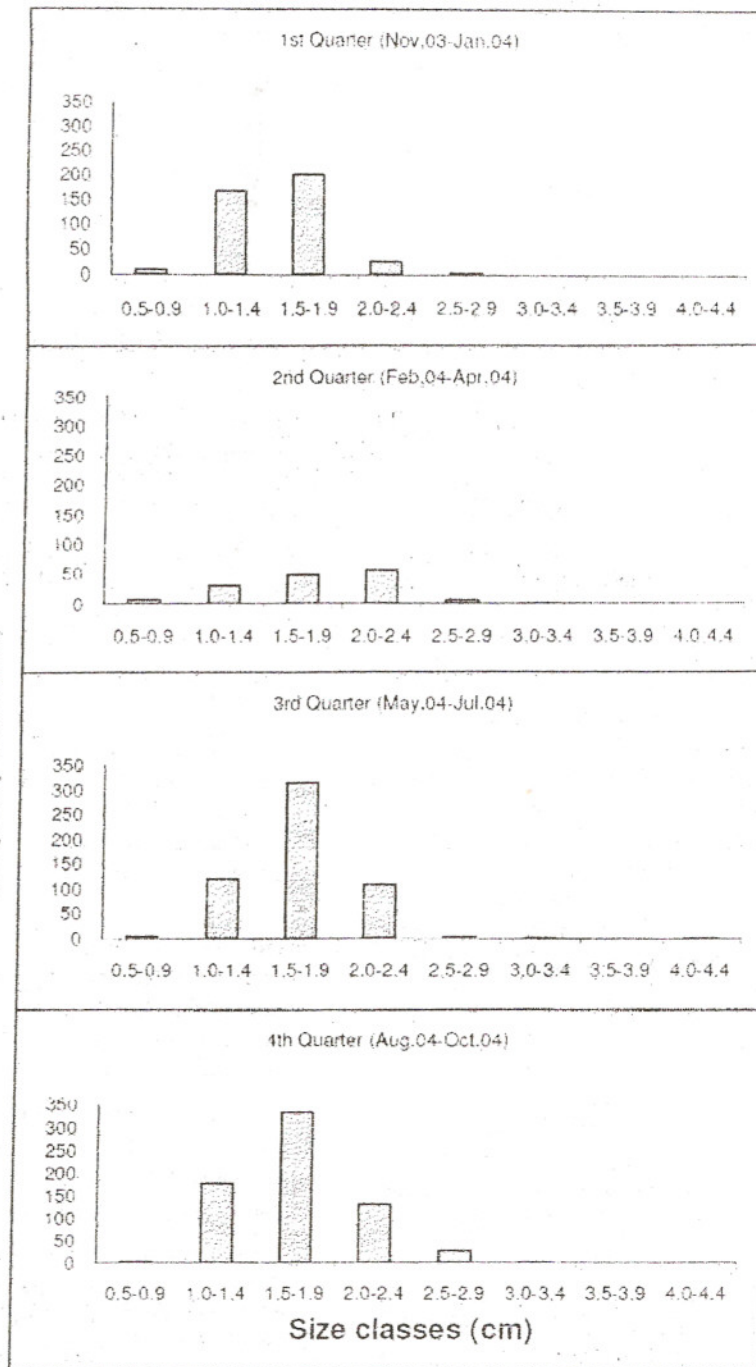


Fig. 3: Quarterly size distribution of *Tympanotonus fuscata* in Brenu Lagoon

ily distributed among replicate stations and microhabitats within a station. This was probably due to the slight movement showed by the snail. The patchy distribution might be due to variations in the physico-chemical parameters recorded in Brenu Lagoon during the study. Temperature might be a possible physical factor regulating the distribution of snails in the water as the organisms tend to move away slightly from the banks of the lagoon to deeper portions as the water temperature increases. The snails might be adapted to brackishwater (Edmunds, 1978) salinities and therefore changes in salinities are likely not to have significant effect on the distribution of the snails in the lagoon. The muddy and sandy-mud substrata in Brenu Lagoon might not be a strong factor for regulating densities of the snails at various stations.

#### CONCLUSION

It is evident that the snail in Brenu Lagoon is harvested throughout the year by humans and this is shown by the absence of large snails in the size distribution. The human predation could affect the spatial and temporal distribution of the organism which should be highlighted in further studies. This will mean that detail studies on the lagoon snails to understand their production in brackishwater habitats are important. It may be that the resource is being under-utilized (Ntiamo-Badu, 1991) in some parts of Ghana or over-exploited in other areas.

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