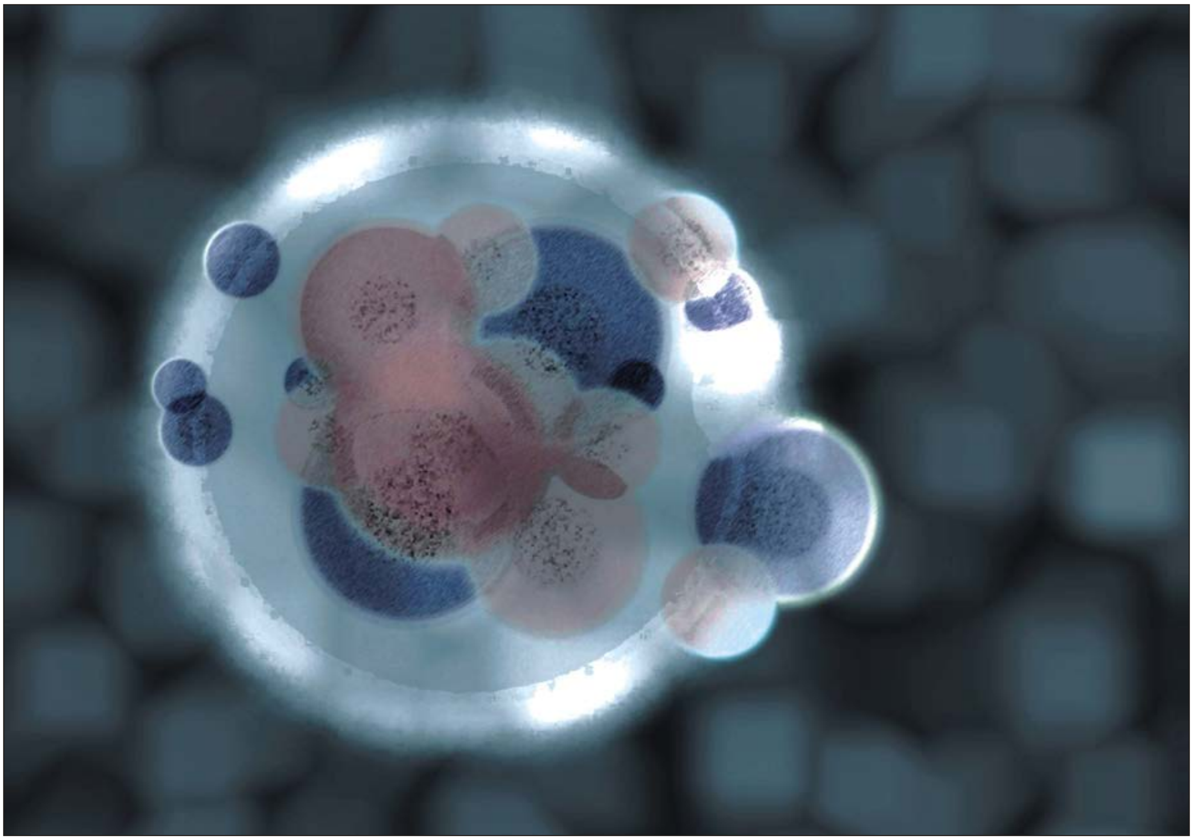

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The Ecology and Habits of *Tympanotonus fuscatus* var. *radula* (L.) (Prosobranchia: Potamididae)

Rosemary I. Egonmwan
Department of Zoology, University of Lagos, Akoka, Lagos, Nigeria

Abstract: The ecology of *Tympanotonus fuscatus* var. *radula* (L.) in the mangrove swamps of the Lagos lagoon is described. The salinity in the habitat was found to vary between 0.1‰ during the rains and 25‰ in March during the dry season when the habitat dries up. The fluctuating pH, low level of dissolved oxygen content, recorded in the study area could be an indication of the deteriorating water quality. The substratum consists of black mud which sometimes contains hydrogen sulphide. The species is amphibious. It is active in the rainy season and in dry season it congregates under objects or burrow into the soil in the habitat. The species is found only at the edges of the lagoon and not in the main body.

Key words: Lagos lagoon, salinity, hydrogen ion concentration, dissolved oxygen, mangrove swamps, *Tympanotonus fusatus*, amphibious

INTRODUCTION

The most common and dominant molluscs in the brackish waters of West Africa are snails belonging the Super family Cerithioidea (Nicklés, 1950). The Super family is characterised by long, spired, trailing shells and two families, Potamididae and Melaniidae are represented in the lagoons, estuaries and mangrove swamps of West Africa by two genera, *Tympanotonus* (Klein) and *Pachymelania* which are endemic to West Africa (Buchanan, 1954). The genus *Tympanotonus* known locally as periwinkle comprises a single species which has two varieties *T. fuscatus* (L.) and *T. fuscatus* var. *radula* (L.). The genus *Tympanotonus* is characterised by turreted granular and spiny shells and tapering ends. *T. fuscatus* var. *radula* is distinguished from the other variety by the absence of spiny tubercles on the shell.

Most of the literature on the genus *Tympanotonus* in the Lagos lagoon is concerned with classification, geographic distribution and population dynamics (Oyenekan, 1987; Brown, 1991; Brown and Oyenekan, 1998). Recent studies have focused on the use of *Tympanotonus* for the biomonitoring of coastal water pollution (Ajao and Fagade, 1990; Otitoloju and Don-Pedro, 2002; Davies *et al*., 2006; Otitoloju *et al*., 2006).

The present study investigates the ecology and habits of this economically important species in a selected habitat in the Lagos lagoon system.

MATERIALS AND METHODS

The ecology of *T. fuscatus* var. *radula* was studied in the field and in aquaria set up in the laboratory. Ecological data were collected bi-monthly between 8 am and 1 pm from October 2004 to March 2006 from a non-tidal area of the lagoon, around the University of Lagos (lat N 06° 31.049, long E 003° 24.19) where this study was undertaken. Data collected included the following physical and chemical parameters: salinity, temperature, hydrogen ion concentration (pH), dissolved oxygen content, nature of substratum, water depth and associated macro flora and macro fauna.

Air and water temperatures were measured with a mercury-in-glass thermometer. Water samples were collected on each visit in a water sampling bottle for analyses of the physico-chemical properties. The salinity of each water sample was measured with a salinity meter (model EES 15-35). The pH of the water sample was determined with a Philip conductivity meter (model PW 405). Samples of water for the estimation of Dissolved Oxygen (DO) content were collected from the bottom with an insulated bottle and was analysed using the modified Winkler's method (Wright, 1981).

The depth of the water in four randomly selected locations in the study site was measured with a calibrated pole samples of the bottom deposits were collected from each of these sites with a Van Veen grab from an unanchored paddle boat. Four grab hauls were taken from the four selected areas of the study site. Each haul was sieved in the field with a 0.5 mm mesh sieve and preserved in 4% formalin and taken to the laboratory where the samples were washed and sorted into taxonomic groups. The top portion of the sediment of the first grab haul was preserved for sediment analysis of size of soil particles using the method described by Hill and Webb (1958) and Oyenekan (1987).

RESULTS

Ecology: Two salinity seasons were observed in Fig. 1. The salinity is low in the months of May to October and high from December to April. The lowest salinity recorded was 0.1% in October 2005 while the highest was 25% in March 2006. Salinity figure was exceptionally high in November 2004.

The temperature of the water was high and varied between 27.5°C and 30°C (Fig. 1), the highest temperature being 30°C in March 2006.

The Dissolved Oxygen (DO) content in the bottom water was between 0.5 mg L^{-1} and 2.5 mg L^{-1} (Fig. 2). The lowest figure of 0.5 mg L^{-1} was obtained in May and June 2004 and the highest figure of 2.5 mg L^{-1} obtained in February 2005.

The hydrogen ion concentration (pH) of the water was between 6.73 and 8.3 (Fig. 2). In December 2004, March 2005, August 2005, December 2005 and March 2006, the pH of the water was slightly below 7. During the other months, the value was slightly above 7.

Table 1 shows the analysis of the substratum of the mud flat. The blackish mud deposits have high silt, organic matter and fine sand content to a depth of between 0.5 to 0.76 m and the substratum also smelt strongly of hydrogen sulphide.

Habits: The species was never found in the main body of the lagoon. During the dry season, when the mud flats dried up, the species burrows into the mud. During the rainy season, the species was observed crawling about in the soft black mud. In the laboratory, the

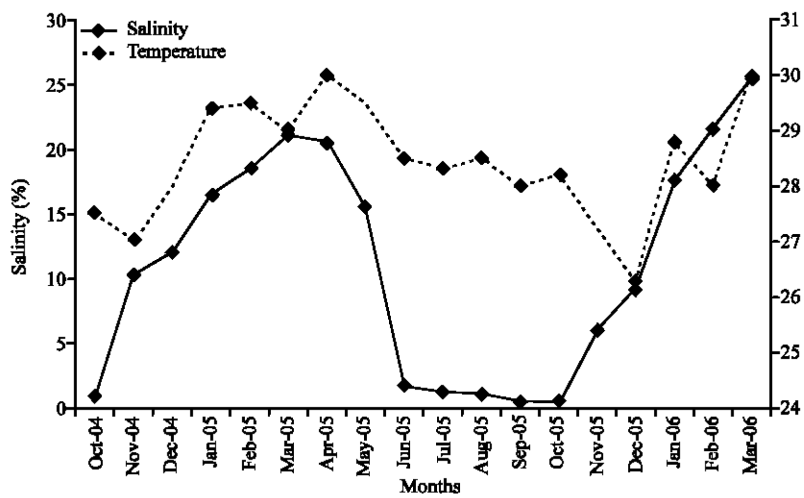

Fig. 1: Monthly variation in salinity and temperature in the study site (University of Lagos mangrove swamp)

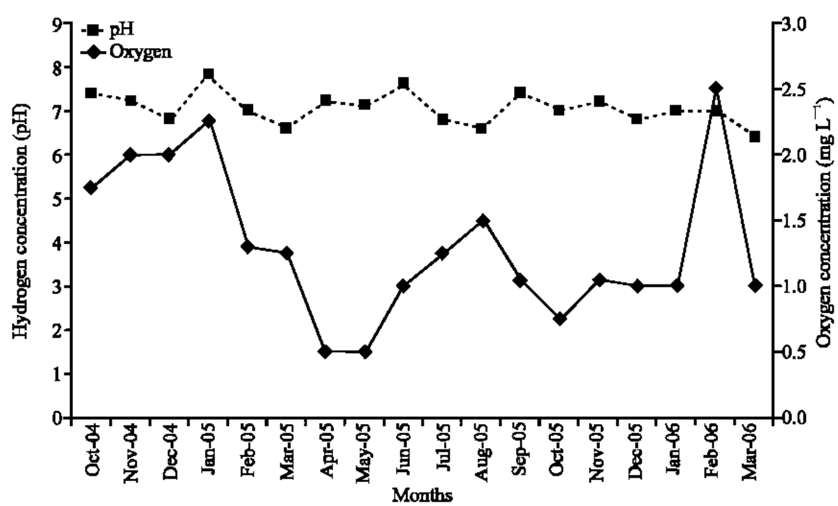

Fig. 2: Monthly variation in hydrogen ion concentration (pH) and Dissolved Oxygen (DO) content in the study site (University of Lagos mangrove swamp)

Table 1: The analysis of soil samples taken from the habitat of *T. fuscatus* var. *radula* in the University of Lagos mangrove swamp

Sample No.	% shell	% < 30 mesh grains	% 30 to 60 mesh grains	% 60 to 90 mesh grains	% > 90 mesh grains	% silt	Organic matter as % of silt	Depth of water (m)
1	-	3.0	12.0	19.5	44.4	21.1	23.0	0.76
2	12	5.6	9.4	31.8	51.2	0.8	13.5	0.76
3	-	0.1	6.5	15.5	77.8	0.1	15.8	0.61
4	-	-	-	5.0	7.0	8.8	25.0	0.50

Fig. 3: *Tympanotonus fuscatus* var. *radula* collected from the study site (University of Lagos mangrove swamp) Scale bar = 10.0 mm

species was observed to crawl to edge of the aquarium and protruded the anterior part out of water. It rasped the mud in the aquarium: it moved its snout from side to side and used the tentacles to feel the substratum before rasping the detritus contained in the mud. The apices of the shell of most specimens collected from the study area were decollated (Fig. 3).

The following macro fauna species were associated with *T. fuscatus* var. *radula* in the study habitat; *Cthamalus aestuarii*, *Littorina angulifera*, *Crassostrea gasar*, *Pachymelania fusca* (var. *quadriseriata*), *Clibernarius africanus*, *Neritina kuramoensis*, *Periophthalmus kolteuteri*, *Sesarma huzardi* and *Cardiosoma armatum*.

The dominant macro flora in the habitat is composed of *Dalbergia ecastophylum*, *Drepanocarpus lunatus*, *Ormocarpum verrucosum*, *Hibiscus tiliaceus*, *Acrostichum aureum*, *Paspalum vaginatum*, *Eragrostis linearis*, *Cyperus articulatus* and *Phoenix reclinata*.

DISCUSSION

The water in the study site was never fresh and two salinity seasons per annum were observed in the study area due to the influence of seasonal rainfall. Salinity was exceptionally high in November 2004 due to the scanty rainfall experienced that year. Thus the species occurs naturally in waters with very low salinity between June and November which have a large seasonal fluctuation. Salinity is a key factor responsible for the population dynamics of estuaries (Hill and Webb, 1958; Amadi, 1990).

The water temperatures were high and remained relatively stable throughout the period of observation, which may indicate that water temperature has no effect on the ecology of *T. fuscatus* var. *radula*.

The hydrogen ion concentration (pH) fluctuated during the period of observation. The study site exhibited alkaline properties in most of the months sampled except in few months when the values were below 7.

The values of dissolved oxygen recorded were low through out the period of observation when compared to values found in some lagoons. The amount of dissolved oxygen is an indication of the cleanliness of water; a high level correlates with water being clean and unpolluted (Escaravage, 1990). The levels obtained in this study compare to results from other lagoons and creeks with sewage and industrial wastewater and seafood discharge (Reyes and Merino, 1991; Obire *et al*., 2003). According to Escaravage (1990), amount of dissolved oxygen in water is controlled by biological processes and low level can kill fish and other organisms.

The fluctuating pH, low level of dissolved oxygen content, recorded in the study area could be an indication of the deteriorating water quality of the study. The discharge of industrial and domestic waste into the lagoon and bacterial degradation of organic waste from anthropogenic biodegradable waste which drains into the Lagos lagoon and adjacent creeks has been reported by Akpata *et al*. (1993), Chukwu and Nwankwo (2003) and Saliu and Ekpo (2006).

The blackish mud deposits have high silt, organic matter and fine sand content typical of a mangrove swamp (Longhurst, 1958; Ogunwenmo and Osuala, 2004). However, the characteristic smell of hydrogen sulphide observed in the substratum during this study is usually present in oxygen deficient mud and may be due to bacterial decomposition of decaying dead organisms (Capstick, 1957). It may also be due to bacterial degradation of anthropogenic biodegradable organic waste that drains into the swamp along with rain water.

Most of the primary mangrove swamp plants such as *Rhizophora racemosa* (red mangrove) and *Avicenia nitida* (white mangrove) reported by Sandison (1966) and Sandison and Hill (1966), were very few in the study area. Mangrove community is characteristically zoned but development and distributions of the trees are restricted in view of coastal geomorphic and hydrological processes (Ukpong, 1995; Amadi, 1990). These may among others be responsible for the absence of some macrobenthic species such as *Balanus pallidus*, *Mercierella enigmatica* and *Hydroides uncinata* from the study area. These species were present whenSandison (1966) and Sandison and Hill (1966) carried out the first survey of the mangrove swamps around the Lagos lagoon.

T. fuscatus var. *radula* inhabits the mudflats of the mangrove swamps at the edges of the Lagos lagoon. The species is absent from the main body of the lagoon and the adjacent sea. The mangrove community (Oyenekan, 1975) occurs on the mangrove plants and in the mudflats of the swamps at the edge of the lagoon and creeks. In the natural habitat, *T. fuscatus* var. *radula* were observed during this study to migrate to the edges of the water and congregates under tufts of grasses and breathing roots of the mangrove plants which shade it from the direct rays of the sun.

The species inhabits quiet waters where the substratum is muddy and rich in detritus. The preference for muddy deposits may be correlated with the fact that the species is a deposit feeder, taking in mud and digesting the detritus and other organic matter in it. Turbulent waters with fast bottom currents have sandy deposit containing little organic content.

It is interesting to note that the apices of the shells of the population in this habitat were eroded. This is in contrast to the population of the same species in the Niger Delta which had complete apices. The difference may be due to the physico-chemistry of the two habitats. The habitat of the species population in the Niger Delta never dries up because it is flooded daily at high tide and remains brackish all year round and the water never becomes acidic (Obire *et al*., 2003). The decollation of the shells of the Lagos lagoon population may be due to the drying up of the habitat during the dry season and the slightly acidic nature of the water during some months.

In the laboratory, the species were observed crawling to the water edge in the aquarium and keeping the anterior part out of water and were never permanently submerged. The amphibious habit observed in this study may account for the absence of *T. fuscatus* var. *radula* from the main body of the lagoon where suitable muddy substrates occur, but the animal may be submerged. Also, the tolerance of *T. fuscatus var radula* to high temperature and extreme dryness when they are exposed at low tide and during the period when its habitat in the mangrove swamp dries up reported by Egonmwan (2007), may contribute to the survival of the species in the shallow waters of the mangrove swamps that experience periodic dryness.

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