FRESHWATER SNAILS OF ANWAI RIVER

A. A. Okonta and A . O. Ogunbor
Department of Animal Science and Fisheries, Delta State University, Asaba, Delta State

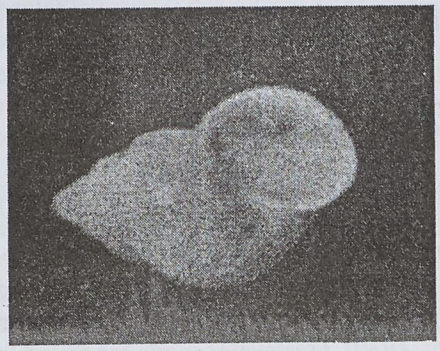
Introduction

Freshwater snails are gastropod molluscs with soft-bodies and often with coiled or cone-shaped shells. The scientific studies of freshwater snails have been necessitated by the need to know their taxonomy, ecology and distribution, particularly in relation to the transmission of diseases to man and domestic livestock (Brown, 1980). Freshwater snails are found in a great range of habitats from the tropics to the temperate regions (Thorp and Covich, 1991). Freshwater snails represent a variety of life styles including bottom feeders burrowers, borers and pelagic forms. Asumu (1975) and Okwuosa (1978), reported that the distribution, relative abundance and diversity of freshwater snails are influenced by environmental factors.

The importance of freshwater snails to humans, animals (livestock) and the aquatic environment is great. They are an important part of the aquatic food chain. They act as intermediate hosts for a great variety of human and animal parasites (Brues, 1992). Fresh water snails are considered strong indicators of stable aquatic habitat (Rosenberg and Resh, 1993). Edible freshwater snails are a good source of protein. Freshwater snails are also used in rituals as charms for protection and to assure fertility (Burch, 1989). They are also used extensively in research, their shells providing a variety of products. The diverse and beautiful shell forms are used in art, culture and as ornaments in the tradition of many races (Wells, 1983).

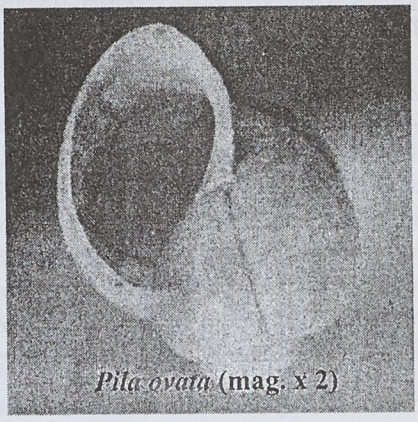
There is an immediate practical purpose, besides the control of parasitic diseases, in studying molluscs as members of the complex biological communities living in African freshwater. This is to obtain the improved knowledge of aquatic productivity on which hinges the wise exploitation of inland fisheries as a vital source of human food. The future of human societies in Africa and Nigeria for that matter, depends much on the conservation of adequate resources of water for domestic, agricultural and industrial uses.

It is therefore necessary to know the potentials of freshwater bodies close to human habitation, to determine their productivity as well as their status for use by human and animal lives. This study is the first of its kind in Anwai River and attempts to document information on distribution, relative abundance and diversity of freshwater snails as affected by environmental factors. The veterinary and medical importance of freshwater snails in Anwai River is also highlighted.

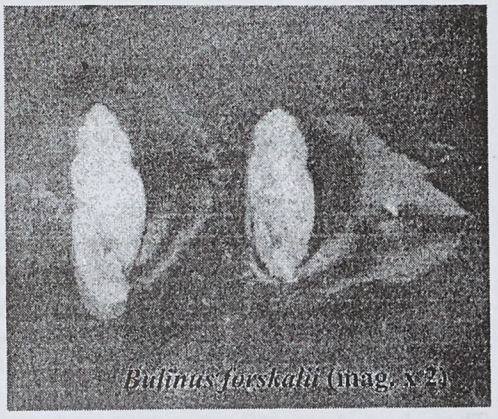


Gabbiella africana (mag. x 4)

Lanistes libycus (mag. x 5)

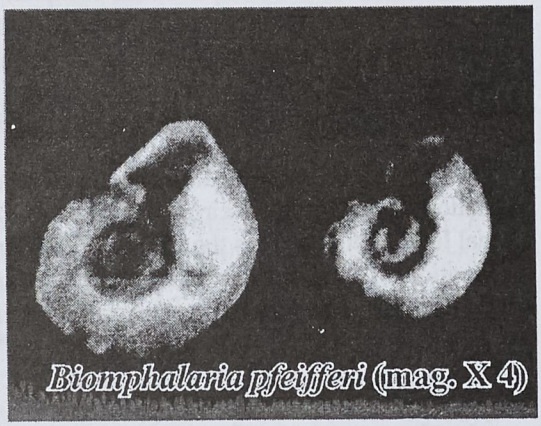


Pila ovata (mag. x 2)



Bulinus forskali (mag. x 2)

Lymnaea natalensis (mag. x 4)



Biomphalaria pfeifferi (mag. X 4)

Materials and methods

Freshwater snails were collected from four stations on Anwai River ($5^{0}00^{1}$-$5^{0}15^{1}$N;$6^{0}15^{1}$-$6^{0}31^{1}$E) near Delta State University, Asaba Campus. The river takes its source from Akwukwu and flows south-east through Anwai before emptying into the River Niger at Asaba. The study sites were aquatic habitats with different ecological features. Station I had slow flowing water with small ditches around it. Station II had plenty of vegetation on the water surface and along the river banks. Station III and IV had fast flowing water without vegetation on the water surface but only on the banks of the river. Station IV in addition, has a motorable bridge and the river at this site is characterized by high level of human activities such as washing of clothes and swimming. Snail and water samples were collected fortnightly between January and December of 2002, between the hours of 7.00 and 11.00 am on sampling days from the four stations.

Snail sampling

Snails were collected with a sieve attached to a long handle of about 1.8m. The sieve was pushed through weeds at the edges of the water body to dislodge the snails on weeds. Snails scooped up were placed in open plastic bowls with the bigger and smaller sized snails in separate bowls to avoid breakage of shells of the smaller sized snails and taken to the laboratory for sorting and identification into species according to Brown (1980). The number of species and the station from which they were collected were noted.

Water sampling

Water samples were collected from the four stations and some of the physiochemical properties such as temperature, dissolved oxygen, hydrogen ion concentration (pH) and conductivity determined. Mercury in glass thermometer was used to measure the surface water temperature at each station during sampling days. This was done by dipping the thermometer into the water for some time and reading the temperature. Atmospheric temperature was also taken. Using the standard Winkler's Method (Allen, 1974), samples of water were collected in 250 ml reagent bottles by allowing water to flow gently into them to avoid air bubbles. Two mls each of Winkler's solutions A and B were added to the water samples and the concentration of dissolved oxygen was then titrimetrically determined in the laboratory by titrating against sodium thiosulphate solution. Battery powered conductivity meter (Jenway series, 4076 model) was used to test for water conductivity.

Lovidbond comparator was used to determine the pH of the water. To do this, 10mls of the water sample were taken and 10 drops of bromthymol blue indicator was added to it. Another 10mls of water sample was taken in another test-tube but no indicator was added. Both test-tubes were placed in the comparator and comparison made. A match was found and the corresponding reading gave the value of pH of the water. The effects of physiochemical properties of the water on snail abundance and distribution in the stations

were compared using analysis of variance test.

Results

Analysis of freshwater snails of Anwai River revealed a total of six species in five families. These are the Ampullariidae (Pilidae): *Pila ovata* and *Lanistes libycus;* Bithyniidae: *Gabbiella africana;* Planorbide: *Bulinus forskalii* and *Biomphalaria pfeifferi;* Lymnaeidae: *Lymnaea natalensis*. The family Ampullariidae constitutes about 70% of the total species collected and is the most dominant species of the molluscan fauna. Out of 364 snails collected within a 12-month period of malacological survey, 197 (54%) were obtained from station 1,146 (40%) from station II, 21 (6%) from station III and none from station IV. *Pila ovata* occurred most frequently in all the stations except in station IV. *Pila ovata* and *Bulinus forskalii* were most abundant in the month of July, while *Lanistes libycus* and *Gabbiella africana* were most abundant in the month of August. *Biomphalaria* and *Lymnaea* were found only in the month of March (Table 1).

A total of 251 (68.9%) *Pila ovata* were collected. Eighty-seven (23.9%) of *Lanistes libycus* were picked, while 15(4.12%) and 6 (1.6%) of *Gabbiella* africana and *Bulinus forskalii* were collected respectively. Three (0.82%) *L.natalensis* and 2(0.55%) *Biomphalaria pfeifferi* were also picked. The maximum temperature reading (38^{0}C) was recorded in station IV in the month of December while the minimum temperature reading (22^{0}C) was in station II in the month of August. A maximum value of 20.4mg/dm3 of dissolved oxygen was recorded in July in station I and minimum value of 2.2mg/m-3, in station IV in March. The value of pH ranged from between 7.0 and 7.8 in the sampling stations. Conductivity value was minimum (14 us cm-1) in March in station I and a maximum value (74 US cm-1) was reached in August in station III. See Tables 2-5.

A significant difference ($P < 0.05$) was observed in monthly variation of snails from the different stations. A significant difference in values of pH and conductivity was also observed. There was however, no significant difference in values of temperature and dissolved oxygen. Freshwater snail species collected in the sampling stations are shown in plates A-E, while their data from the study are summarized in Tables 1-5.

Table 1: Abundance of freshwater snails collected from different stations in Anwai River (Figures in brackets are percentages)

SPECIES	STATIONS				
	I	II	III	IV	TOTAL (%)
Pila ovata	142	106	3	0	251 (68.9)
Gabbiella africana	9	4	2	0	15. (4.12)
Lanistes libycus	39	33	0	0	87 (23.90)
Bulinus foskalii	3	2	1	0	6 (1.65)
Biomphalaria pfeifferi	2	0	0	0	2 (0.55)
Lymnaea natalensis	2	1	0	0	3 (0.82)
TOTAL	**197 (54)**	**146 (40)**	**21 (6)**	**0 (0)**	**364**

Table 2: Monthly mean variation in Temperature (^{0}C)

Months	Station I	Station II	Station III	Station IV
January	33	32	29	34
February	29	31	32	32
March	29	27	29	35
April	29	26	30	34
May	29	25	28	32
June	25	24	27	30
July	24	23	28	30
August	24	22	30	32
September	30	24	32	35
October	32	24	34	36
November	32	26	35	28
December	33	29	37	38
Mean± S.D.	29.08± 3.26	26.08± 3.15	30.92± 3.12	33.0±2.86

Table 3: Monthly mean variation in Dissolved Oxygen (mg/dm-^{3})

Months	Station I	Station II	Station III	Station IV
January	9.8	6.2	7.9	2.3
February	8.8	7.2	7.5	2.4
March	8.2	5.8	8.0	2.2
April	8.5	7.2	9.0	2.7
May	11.8	9.5	13.2	3.2
June	15.4	12.4	14.2	3.6
July	20.4	13.2	15.3	4.2
August	18.5	14.3	11.2	4.8
September	17.5	9.0	10.2	4.6
October	15.7	8.5	9.7	3.6
November	12.5	8.3	8.1	2.6
December	9.6	7.8	7.1	2.5
Mean± S.D.	13.06± 4.29	9.12± 2.77	10.12± 2.78	3.23± 0.92

Table 4: Monthly mean variation in pH

Months	Station I	Station II	Station III	Station IV
January	7.2	7.2	7.4	7.2
February	7.1	7.2	7.3	7.6
March	7.0	7.3	7.2	7.7
April	7.0	7.1	7.3	7.5
May	7.2	7.2	7.4	7.4
June	7.1	7.3	7.3	7.6
July	7.1	7.2	7.2	7.5
August	7.0	7.0	7.2	7.5
September	7.1	7.1	7.2	7.6
October	7.1	7.2	7.3	7.6
November	7.2	7.2	7.4	7.8
December	7.2	7.4	7.5	7.8
Mean± S.D.	7.11± 0.08	7.20± 0.10	7.31± 0.10	7.57± 0.17

Table 5: Monthly mean variation in conductivity (uscm $^{-1}$)

Months	Station I	Station II	Station III	Station IV
January	29	45	50	28
February	20	41	46	25
March	14	40	44	20
April	25	41	52	24
May	27	42	56	29
June	30	48	62	35
July	32	45	68	41
August	35	50	74	43
September	40	64	72	39
October	39	66	66	35
November	30	59	54	29
December	28	45	54	25
Mean± S.D.	29.08± 7.35	48.83± 9.15	58.17± 10.03	31.08± 7.38

Discussion

All freshwater snails collected in this survey represent geographical races of species, which are already known elsewhere. The Ampullariidae was the most dominant family in Anwai River. The wide distribution of this family could be attributed to their ability to breathe in air and aestivate for long periods, especially in seasonally flooded swamps (Clark, 1996). Stations I and II are characterized by seasonal pools with relatively calm current, low temperatures and some aquatic vegetation such as *Nymphaea lotus* and *Potomageton species* to support the food source of these snails. The abundance of snails in these stations could also be due to the shelter and protection which the vegetation provides from intensive sunlight and mechanical effects of fast currents.

The Bithyniidae represented by *Gabbiella africana* in African freshwater systems (Brown, 1980), was also very common in these stations. Planorbidae snails: *Bulinus forskalii* and *Biomphalaria pfiefferi* were also identified in this survey. Both species have been incriminated in schistosomaisis transmission (Abdallah and Thompson, 1997). The presence of *Lymnaea natalensis* in the river is a strong indication that fascioliasis transmission exists in and around the river. Often time, nomadic rearers bring their cattle to drink from the river. The immediate and remote implication of the presence of these snails is that persons

who have contact with the river for domestic chores and cattle taken to the river to drink water stand the risk of becoming infected with schistomomiasis and fascioliasis respectively.

This survey showed that more snails were collected at the beginning and during the rains with the highest number recorded in July. This report is similar to the finding of Okwuosa (1978), who noted that freshwater snails bred rapidly at the onset and during main rains. Values obtained for temperature and dissolved oxygen showed that there was no significant difference ($p>0.05$) in the sites of sampling. This implies that temperature and dissolved oxygen may not be determining factors for diversity and abundance of snails in Anwai River. Conductivity and pH levels however, showed that the river contains soft water. A similar observation has earlier been made by Powell (1979) in his study of shrimp ecology in the Niger Delta. Conductivity and pH were determining factors of diversity and abundance in Anwai River. According to Okwuosa (1989), pH and conductivity are the most likely factors to consider in snail distribution and abundance. No snail was found in station IV during the period of study. This was probably due to high level of human activity in this station. Human activity such as washing of clothes, vehicles and other items with detergents could have adverse effects on the rate of survival of snails in this station. The absence of snails in station IV, could also be attributed to the fast flow of the river coupled with increase in depth at this point. Due to high level of human activities, snails may tend to migrate to the calmer part of the riverbanks. The preference of snails for non-flowing waters was probably due to some ecological factors such as conducive bottom substratum, suitable water temperature, vegetation and availability of food (Frank, 1984).

Anwai River can be noted as a source of *Pila ovata* which is a snail eaten by some riverine tribes (Burch, 1989). The river is also a potential source of human schistosomiasis and fascioliaisis as it harbours the intermediate snail host of schistosomes and fasciola. It is therefore recommended that human and nomadic activities in and around the river be reduced to the barest minimum in order to prevent outbreaks of schistosomiasis and fascioliaisis in communities around the river. With a reduction in the transmission of diseases by freshwater snails, perhaps one day a rich and varied snail fauna may be appreciated as a sign of health in aquatic ecosystems.

REFERENCES

Abdallah, A. and Thompson, C. (1997). *Effects of Heavy Metals on Survival and Growth of Biomphalaria glabrata (Gastropod: Pulmonata) and interaction with Schistosome Infection.* Cambridge University Press, Cambridge. UK. 509pp.

Allen, S. E. (1974). *Chemical Analysis of Ecological Materials.* Blackwell London. 565pp.

Asumu, D. I. (1975). *Studies on the Biology of Snails and their Larval Trematodes in Ibadan Fresh Water Systems.* Ph.D. Thesis, University of Ibadan, Ibadan.

Brown, D. S. (1980). *Fresh Water Snails of Africa and their Medical Importance.* Taylor and

Francis, London. 251-67pp.

Brues, C. P. (1992). Fresh Water Molluscs of the Canadian Interior Basin. *Malacologia* 13:1-509.

Burch, J. P. (1989). *North America Fresh Water Snails*, Malacological Publications, Hamburg M. I. 365pp.

Clarke M. (1996). A monographic Survey of the South African non-marine Mollusc. *Ann S. Afr.* 3: 1-66.

Frank, G. H. (1984). Observations on the distribution of freshwater mollusc and chemistry of the natural waters in Northern Switzerland. *Bull W. H. O.* 30: 389-400.

Okwuosa, V. N. (1989). Ecological Studies of freshwater snails with particular reference to Schistosome vector. *Ann. Trop. Med. Parasite 60:* 100-105.

Powell, C. B. (1979). Three alpheid shrimp of a new genus from West African Fresh and Brackish Waters: Taxonomy and Ecological Zonation. *Rev. Zool Afr. 93*: 116-150.

Rosenberg, D. M. and Resh, V. H. (1993). *Freshwater biomonitoring and Benthic Macro Invertebrates*. Champman and Hall. New York. 58pp

Thorp, J. H. and Covich, A. P. (1991). *Ecology and Classification of North American Freshwater Invertebrates.* Academic Press San Diego California. 239pp.

Wells, W. (1983). Priorities in Mullusc Conservation *Proc. 8th Inter. Malacological Congress* Budapest 291-294pp.