



YUMSUK JOURNAL OF PURE AND APPLIED SCIENCES

PHYSICOCHEMICAL PARAMETERS AND SNAIL DISTRIBUTION AT WASAI AND BANGARE DAMS IN GEZAWA LOCAL GOVERNMENT AREA, KANO STATE

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Abstract

Physicochemical parameters play a crucial role in determining the habitat suitability, physiological health, and distribution of snail populations, influencing their growth, reproduction, and survival rates. Freshwater snails are intermediate hosts for many helminthic diseases because of their great diversity. A survey was carried out to determine the physico-chemical parameters influencing snail distribution at the Wasai and Bangare dams in late 2022. With the help of a long handle scoop net, between 7am -12 noon. Snails collected from each habitat were kept in labelled specimen bottle and transported to the laboratory. The water samples were taken from the sampling site using a plastic beaker. While other characteristics (pH, conductivity, magnesium, ion concentration and calcium) of the water samples were examined in the Biological Sciences laboratory, water temperatures were recorded at the sites. The results obtained showed a total 935 snails in all were collected. At Wasai dam, 217 snail species identified were; *Bulinus globosus* (49), *Melanoidestheria tuberculata* (78), *Bulinus succinoides* (59), *Bulinus jousseaumei* (32) and *Bulinus succinoides* (1) with 23% abundance, while a total of 718 species, thus; *Bulinus reticulatus* (13), *Bulinus globosus* (150), *Bulinus ovatus* (247), *Bulinus truncatus truncatus* (137) were identified in Bangare dam with 77% abundance. The findings suggest that Bangare Dam provides more favorable conditions for snail proliferation. Understanding these dynamics is crucial for managing snail populations and mitigating the risk of helminthic diseases, given the role of snails as intermediate hosts.

Keywords: Physicochemical parameters; Snail distribution; Helminthic diseases; Bangare and Wasai Dam.

INTRODUCTION

The ecological adaptations of freshwater snails are quite varied, ranging from physical traits to particular physiological and metabolic processes in addition to their ecological significance and variability. According to Ikpeze and Obikwelu (2016), various environmental conditions have an impact on snail ecology. These include chemical factors like iron concentration and water dissolution, physical factors like temperature, water current, turbidity, transparency, and suspended solids distribution, and biological factors like food

availability, competition, and predator-prey interactions.

It was found that in most settings, snail distribution was controlled by climatic variables such as dryness and rain (Garg *et al.* 2009). Freshwater snails have a wide range of ecological adaptations resulting from specific physiological and metabolic processes to physical features. In addition, they could be common in certain places but uncommon in others due to their ecological relevance and diversity.

Among the most endangered aquatic organisms are freshwater snails, with 12 percent of the population

in West Africa considered fragile (Cowper 1959). This makes examining how the climate affects the number of snails relevant. The diversity and abundance of snails have dramatically decreased during the last 80 years, particularly those species that live in streams and rivers ref. According to studies by Ezeh *et al.* (2019), about 60 species of freshwater snails are believed to be extinct, and their decline is believed to have begun in the early 1900s.

Freshwater snail diversity is rapidly declining as a result of various human habitat degradation activities which affects the physicochemical properties of water bodies (Strom *et al.* 2009). River ecosystems that support the majority of snail species have been devastated by siltation, industrial and agricultural pollutants, and the destruction of wetlands and other channel improvements. (Ezeh *et al.* 2019). Therefore investigating the environmental factors affecting snail distribution in the freshwater ecosystem is therefore crucial.

MATERIALS AND METHODS

Study Areas

The study was carried out at Bangare and Wasai Dams located at Gezawa Local Government Area of Kano state, Nigeria.

Site A: Bangare dam

Bangare dam is located at Gezawa Local Government Area, in Kano State, Nigeria, on coordinates N12° 7' 6" and E 8° 40' 50". Its headquarters are in the town of Minjibir, about 20 km northeast of the state capital Kano. It has an area of 416 km² and a population of 213,794 at the 2006 census (NPC, 2006).

Site B; Wasai Dam

This site is situated 5m away from the regulated outlet of the dam, a fishing station and the banks, for informal irrigation farming. Located on 12° 08.766N, 008° 40.848E

Collection and identification of Snails Using a scoop net and handpicking, a large sample of snails were collected at Wasai dam and Bangare stream. The time for collection of the snails was from 7 a.m. until 12 p.m. Once gathered from each habitat, the snails were brought to the lab and stored in marked specimen containers. To aid better identification,

the snails' shells were cleaned with water to get rid of any algae, muck, and other material remnants Isah (2019). The individual snail species that were retrieved and enumerated for each body of water were morphologically identified in the laboratory using the Mandahl-Barth (1965) key and the WHO (2020). A snail's physical traits, such as its form, number of coils, opening size and direction and orientation of twisting, were used to identify the species of snail.

Laboratory Maintenance of the Snails

The live snail population brought to the laboratory were kept in plastic containers with dechlorinated tap water that was changed daily and kept at room temperature. The snails were fed with fresh lettuce and spinach (Muhammad *et al.*, 2019).

Physico-chemical analysis

In accordance, the methods of Dida *et al.* 2014 parameters examined from the water samples from the sites were pH, dissolve oxygen, temperature, turbidity, calcium, magnesium, and iron concentrations. A thermometer was used to measure the water temperature during collection at the sites. Turbidity was measured with a turbidity meter, while conductivity and pH were measured with a multi-probe meter (HQ30d single input multi-parameter digital meter Hach). A data-logging spectrophotometer (DR|2400) was used to calculate the concentrations of calcium, magnesium, and ions using 25mL of distilled water as the control.

Statistical Analysis

The distribution of snails is presented as mean SD t test was used to compare the relative abundance of fresh water snail, between the two locations correlation coefficient. Abundance is calculated by dividing the number of snails by total number collected.

RESULT AND DISCUSSION

The study revealed 74% of the total snails were collected from Bangare dam while only 26% were accounted at Wasai dam. A total number of eight (8) different snail species namely; *Bulinus globosus*, *Melanoidestheria*, *Bulinus succinoide*, *Bulinus rohlfsi*, *Bulinus jousseaumei*, *Bulinus succinoide*, *Bulinus reticulatus*,

Bulinus globosus, *Bulinus oviformis*, *Bulinus truncatus* were identified from the two study areas. Five (5) different species including *Bulinus globosus* (49), *Melanoideastuberculata* (78), *Bulinus succinoides* (59), *Bulinus rohlfsi* (0), *Bulinus jousseaumei* (32) and *Bulinus succinoides* were identified for 74% of the total snails collected in Wasai dam while at Bangare *Bulinus reticulatus* (13), *Bulinus globosus* (150), *Bulinus oviformis* (247), *Bulinus truncatus* (137) were identified accounting for 26%, this are as presented in Table 1. The study evaluated several physicochemical parameters of the water from Wasai and Bangare Dams to understand their impact on snail distribution. These parameters included pH, turbidity, temperature, calcium, magnesium, and iron concentrations (Table 3).

The pH levels in both dams were within the acceptable range for aquatic life, with Wasai Dam at 8.07 and Bangare Dam at 8.15. These slightly alkaline conditions are conducive to snail survival and reproduction. Similar findings were reported by Brown (1994), who noted that most freshwater snails prefer pH levels between 6.5 and 9.0 for optimal growth and reproduction.

Turbidity was higher in Wasai Dam (6 NTU) compared to Bangare Dam (4 NTU). High turbidity can affect light penetration and thus the growth of aquatic plants, which are essential for snail habitats. However, both values were within the recommended limits, suggesting that turbidity did not adversely affect snail populations in either location. This aligns with Wepnje *et al.* (2023), who found that snails could adapt to varying turbidity levels as long as the overall environment remains hospitable.

Water temperature was significantly different between the two sites, with Wasai Dam at 20°C and Bangare Dam at 30°C. Higher temperatures, like those in Bangare Dam, are known to enhance snail metabolism and reproduction rates, which may explain the higher snail abundance observed there. Studies by Dida *et al.* (2014) and McCreesh and Booth (2014) support this observation, indicating that higher temperatures can increase the reproductive rate of snails and the development of their parasites.

Calcium concentration was found to be 1.69 mg/L in Wasai Dam and absent in Bangare Dam. Calcium is crucial for snail shell development. The absence of calcium in Bangare Dam suggests that snails there might be deriving calcium from other sources, such as their diet or sediment, or that their shells are thinner and more fragile. Research by Appleton (1978) highlights the importance of calcium in the development of snail shells and overall health.

Magnesium levels were low in both dams, with Wasai Dam having 0.53 mg/L and Bangare Dam 0.15 mg/L. Magnesium is also important for snail physiology, though its lower concentration did not seem to limit snail abundance significantly in either dam. Rosemary 2008 observed that while magnesium is essential, snails can often tolerate lower levels if other conditions are favorable.

Iron concentrations were higher in Wasai Dam (0.196 mg/L) compared to Bangare Dam (0.047 mg/L). Excess iron can be toxic to aquatic life, but the levels observed were within safe limits. This is consistent with findings by Born-Torrijos *et al.* (2014), who noted that moderate iron levels do not adversely affect snail populations but can influence their distribution if levels become too high.

The physicochemical parameters of the water in both Wasai and Bangare Dams were within ranges that support snail habitation. The higher water temperature in Bangare Dam likely contributed to the greater snail abundance observed there. The absence of calcium in Bangare Dam raises questions for further research into snail shell development and population dynamics in such environments. Overall, these findings underscore the importance of monitoring physicochemical parameters to understand and manage snail populations effectively.

CONCLUSION

The study highlights the significant influence of physicochemical parameters on the distribution and abundance of snail species in freshwater habitats. The analysis revealed a diverse snail population in both Wasai and Bangare dams, with notable differences in species abundance between the two sites. The findings suggest that Bangare Dam provides more favorable conditions for snail

proliferation. Understanding these dynamics is crucial for managing snail populations and mitigating the risk of helminthic diseases, given the role of snails as intermediate hosts. Future research

should focus on the specific physicochemical factors contributing to these differences and explore strategies for controlling snail-borne diseases in these areas.

Table1: Diversity and Abundance of Snail species at Wasai and Bangare dams

Location	B.g	M.t	B.s.r	B.r.B.j	B.s	B.t.t	B.o	total	abundance	
Wasai	49	78	59	0	32	1	0	0	217	23%
Bangare	150	0	149	13	0	0	137	247	718	77%
Total	199	78	208	13	32	1	137	247	935	100%

B.g-Bulinus globous, *M.t-monoidstuberculate*, *B.s r-Bulinussuccinoide* Rolfs, *B.s-Bulinussuccinoide*, *B.r-Bulinus reticulate*, *B.o-Bulinus ovoidus*, *B.tt-B.truncatus truncate* *B.j-Bulinus jousseaumei*

Table 2 t- Test Result conducted for Wasai and Bangare Location.

S/N	SPECIES	WASAI	BANGARE
1	<i>Bulinus globous</i>	49	150
2	<i>Monoids tuberculate</i>	78	0
3	<i>Bulinus uccinoide Rolfs</i>	59	149
4	<i>Bulinus reticulate</i>	0	13
5	<i>Bulinus jousseaumei</i>	32	0
6	<i>B.truncatus truncate</i>	0	137
7	<i>Bulinus succinoide</i>	1	0
8	<i>Bulinus ovoidus</i>	0	247

Table 3: Physio-chemical parameters of the water samples at Wasai and Bangare dams

S/N	Parameters	Unit	Wasai Dam	Bangare Dam	Fment limit
1.	pH	-	8.07	8.15	6.5-8.5
2.	Turbidity	NTU	6	4	2-8
3.	Temperature	⁰ C	20	30	-
4.	Calcium	mg\L	1.69	0.00	NS
5.	Magnesium	mg\L	0.53	0.15	20
6.	Iron (fe)	mg\L	0.196	0.047	0.3

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