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Planktonic Composition of River Taraba in Bali Town, Taraba State, Nigeria

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Abstract
A qualitative study of the planktonic fauna of River Taraba at Bali town was carried out from August, 2018 to January, 2019. Samples were collected bi-monthly during the wet and dry seasons at different locations between 8:00 – 10:00am using standard methods. Four groups of phytoplankton and two groups of zooplankton were identified. The phytoplankton include Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae while the zooplankton are Protozoa and Nematodes. Seasonal variation indicates that *Closterium, Euglena, Navicula, Pinnularia, Synedra and spirogyra* were present across the seasons while *Chroococcus, Micrasterias and Eudorina* were only present during the dry season. More so, *Pandorina* was observed to be present during the wet season; *Paramecium* and *Vorticella* being the zooplankton were observed throughout the seasons while roundworm was present during the wet season. The presence of these plankton in the lotic water body is indicative of water pollution which render it unfit for human consumption. It is therefore recommended that uncontrolled discharge of agrochemicals via irrigation and other anthropogenic activities around the river should be controlled by relevant authorities so as to prevent pollution and improve the water quality of the river. Furthermore, similar study should be carried out continuously on the quantitative study of plankton and physicochemical parameters of the river so as to monitor environmental changes in the water body.

***keywords*:** Composition, Planktonic fauna, Pollution, water quality, qualitative, River Taraba

1. Introduction

Water is a common chemical substance that is essential for the survival of all known form of life (Thirumala *et al*., 2012). It functions as a solvent for a wide variety of chemical substances and facilitates industrial cooling and transportation (Eletta *et al.*, 2005; Imtiyaz *et al.*, 2012). Water bodies in Nigeria stretched from the Northern part to the Southern part of the country, which is mostly exploited by artisanal fishermen (Ibrahim and Ogueji, 2017) and is also polluted by human activities around the area. When a drop of water from the river, lake or pond is physically observed, it seems to be clear. However, when the same drop of water is observed under the microscope, it will be observed that the water is teeming with life. Every body of water is colonized by certain plants and animals depending on the ecological conditions prevalent. Representatives of virtually all major groups of organisms can be found in an aquatic environment: Producers, Consumers and decomposers (Reid and wood, 1976).

Plankton (singular plankter) is any drifting or wandering organisms (plants and animals) that spend either part or all of their life in a drifting state and have little or no ability to swim. They are usually found in the surface and upper layers of water where sunlight and nutrients are readily available (Peg *et al*, 2012). Plankton are divided into two groups: phytoplankton and zooplankton. Phytoplankton are small, free-floating, single–celled algae of lakes and oceans which are less than 5µm in diameter. Most of them are not visible to the naked eye but when concentrated, are responsible for the characteristic greenish colour and reduce transparency of some lake waters. They are

microscopic plants that convert sunlight and nutrient to starch and organic matter, they form the basis of food chain, and also produce at least 80% of the oxygen we breath (Alexander and Charles, 1994). Phytoplankton are very important as they are the primary producers in any aquatic ecosystem and at such, they supply the main source of primary nutrition for organisms such as the zooplankton (Solomon and Erondu, 2017).

On the other hand, zooplankton are microscopic organisms that are suspended in water and are composed of protozoans, microcrustaceans and other micro invertebrate that are planktonic in water bodies (Omudu and Odeh, 2006). The distribution and abundance of zooplankton is determined by the amount of food and extent of predation. Within the zooplankton, holoplankton spend their entire life cycle as plankton (e.g. most algae, copepods, salps and some jellyfish) while meroplankton (e.g. crustaceans, starfish, most fish and marine worms) are only planktic for part of their lives (usually the larval stage), and then graduate to either a nekic or benthic (sea floor) existence (Agouru and Audu, 2012). They play an important role in the aquatic ecosystem because of their link between phytoplankton and higher trophic level where they feed on phytoplankton and aid in the conversion of plant mineral into animal tissue and in turn form the basic food for higher animals such as fishes (Gajbhiye, 2002; UNESCO, 1968). Little or no information is available about plankton of the aquatic ecosystem of River Taraba in Bali town, Nigeria. Therefore the present study is aimed at carrying out a qualitative survey of zoo and phytoplankton present in this freshwater body during the wet and dry seasons which can be used as a tool for monitoring pollution and the population status of aquatic life.

2. Materials and methods

2.1 Study Area:

The study was carried out at River Taraba in Bali town, Bali local Government Area of Taraba State, Nigeria. (Fig.1).

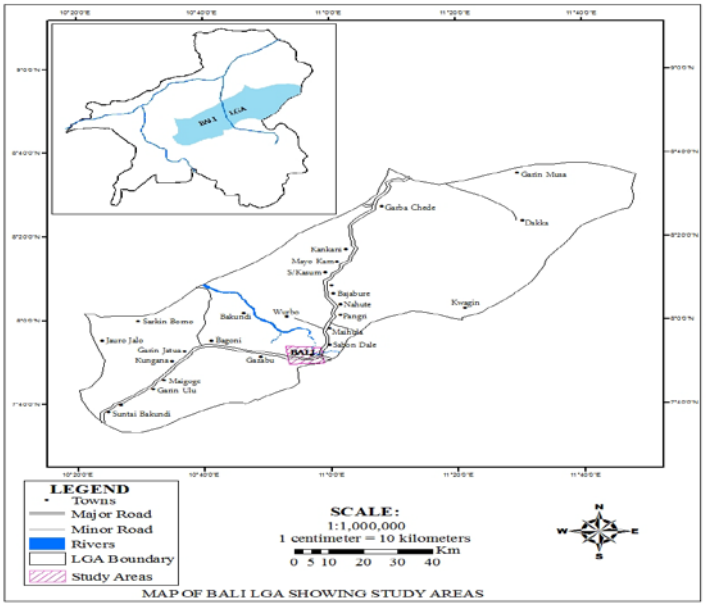

Figure 1: Map of Bali local Government Area showing the study Area (Source: Bureau for land and survey Jalingo, Taraba State).

Bali local Government lies between latitude 7°46' N and 7°54' N of the equator and longitude 10 °30' E and 11° 00' E of the prime meridian (Topographic sheet, 1968). It is found in dry guinea savannah. It is the largest local Government in Taraba State, with an estimated land area of 11,540 km^2. Based on the results of the 2006 National Population Census, Bali local Government had a population of about 211,024 persons (NPC, 2006). It has a tropical climate marked by two seasons; dry and rainy seasons. The rainy season starts around April and ends November occasionally, with 1350 – 1500mm rainfall annually. The dry season is from December to March. The major ethnic groups in the area include; Jibawa, Tiv, Chamba, Fulani, Hausa, Itchen etc. The major occupation of the inhabitants is farming, fishing and nomadism.

In addition, Public servants, traders and artisans also inhabit the area. Their water sources for domestic and agricultural uses are River Taraba, Borehole, ponds and wells.

2.2 Sample collection and Identification:

The samples were collected bi-monthly in the morning between 8.00am to 10.00am from August, 2018 to January, 2019. The plankton net (50µm mesh size) attached with a collecting bottle at the base was lowered into the water (about 10cm) and was towed slowly back and front to a distance for about three minutes after which it was lifted up from water with the mouth held at an upright position and the collecting bottle was slowly raised up and out of the net. The water sample (containing Plankton) collected was then transferred into a sample bottle containing 4% formalin which was then put into an ice box containing ice and was transported to the laboratory for identification (Peg *et al*., 2012). The preserved plankton sample was concentrated, a dropping pipette was used to place the concentrated plankton on a clean grease-free glass slide, covered with a cover slip and was viewed under a light binocular microscope (Olympus) using x10 and x40 objective lenses. The plankton were identified only to generic level using a standard identification keys and charts (Peg *et al*., 2012; Edward & David, 2015; Conway, 2015and Botes, 2003).

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3. Results and discussion

The plankton encountered in River Taraba at Bali town during the period of study is shown in Table 1. Four groups of phytoplankton and two groups of zooplankton were observed. The phytoplankton include Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae while the zooplankton are Protozoa and Nematoda. Table 2 summarized different phytoplankton identified during the wet and dry seasons in River Taraba at Bali town. They include *Pinnularia*, *Navicula*, *Synedra*, *Spirogyra*, *Closterium* and *Pandorina.* Others are *Eudorina*, *Micrasterias*, *Chroococcus and Euglena* (Fig. 2). Table 3 shows zooplankton encountered in River Taraba during the wet and dry seasons. They comprised of *paramecium*, *Vorticella* and roundworm (Fig. 3).

This study reveals that the river which some residents of Bali town totally depend on for drinking, agricultural and domestic activities appears to be teeming with population of plankton. Khatri, (2004) opined that recreational activities, drinking water supply and fisheries can be impaired by high phytoplankton biomass. This can lead to unpleasant test especially if toxins are produced by these phytoplankton in drinking water (Waya and Mwambungu, 2004; Watson, 2004).

Table 1: Plankton identified in River Taraba at Bali town

Family/class	Species identified
A: Phytoplankton	
Bacillariophyceae (Diatom)	*Pinnularia* sp.
	Navicula sp.
	Synedra sp.
Chlorophyceae	*Spirogyra* sp.
	Closterium sp.
	Pandorina sp.
	Eudorina sp.
	Micrasterias sp.
Cyanophyceae (Blue-green algae)	*Chroococcus* sp.
Euglenophyceae	*Euglena* sp.
B: Zooplankton	
Protozoa	*Paramecium* sp.
	Vorticella sp.
Nematoda	Roundworm

Zooplankton that support the growth of *Vibro cholerae* can also aid in the spread of disease (cholera) through unfiltered or poorly filtered drinking water. However, the presence of phyto and zooplankton in the lotic water body supports the presence and availability of fishes across seasons as reported by Elijah *et al*., (2019) in the same river, and indicative of pollution. This could be as a result of the anthropogenic activities such as run-off of municipal effluent from homes and waste from nearby farmlands, washing of cloths and bathing into the river. Anago *et al*., (2013) made similar observation that, where domestic and agricultural activities in a water body persists, pollution is accelerated through the growth of Chlorophyta and Cyanophyta. The findings of the present study agrees with that of Yasmeen and Saboor, (2007) in Puzahal lake, Chennai, india and Ja'afaru & Abubakar (2015) in Dadin kowa dam, Gombe, Nigeria who also reported similar presence of the above mentioned plankton. Phytoplankton serves as the primary producers of any aquatic ecosystem and thus provide the basic source of nutrition to other organisms like the zooplankton which in turn are consumed by higher trophic level organisms like the fish. The presence of diatoms as observed in this research could be due to high concentration of silicate in the river as Akpan, (1997) observed a correlation between silicate and diatom abundance in Cross River water system. Sourina, (1978) opined that some phytoplankton, diatoms requires a form of silicon (Silicates, SiO_4) because they have a glasslike shell. The presence of Cyanophyceae (Blue-green algae) may be indicative of the influence of organic pollution on the plankton community (Atobatele *et al*., 2007).

The study also reveals that some phytoplankton such as *Closterium, Euglena, Navicula, Pinnularia, Synedra* and *spirogyra* were present across the seasons while *Chroococcus, Micrasterias* and *Eudorina* were present during the dry season but absent during the wet season. More so, *Pandorina* was observed to be present in wet season and absent during the dry season. *Paramecium* and *Vorticella* being the zooplankton encountered during the study were observed to be present throughout the seasons while roundworm was only present during the wet season. The presence of the above mentioned phytoplankton across the seasons could be attributed to the presence of high nutrients probably from human inputs which might have enriched the water body, supporting their growth and

existence across seasons. This might also be an indication that the river is productive as Jenkerson and Hickman (2007) opined that the relative abundance of chlorophyll is indicative of productive water. Freshwater zooplankton are the most important food source of newly hatched fishes and also play an important role in aquatic food chain (Das and Kar, 2013). The presence of zooplankton (roundworm) observed during the wet season might be due to indiscriminate defecation at the riverbank by infected person which are eventually washed into the water body by the rain, as the parasite is commonly found in human faeces.

Table 2: Phytoplankton identified in River Taraba at Bali town during the wet and dry season

Species	Wet season	Dry season
Closterium sp.	+	+
Chroococcus sp.	-	+
Euglena sp.	+	+
Micrasterias sp.	-	+
Navicula sp.	+	+
Pinnularia sp.	+	+
Pandorina sp.	+	-
Eudorina sp.	-	+
Synedra sp.	+	+
Spirogyra sp.	+	+

Key: + = Present, - = Absent

Table 3: Zooplankton identified in River Taraba at Bali town during the wet and dry season

Species	Wet season	Dry season
Paramecium sp.	+	+
Vorticella sp.	+	+
Roundworm	+	-

Key: + = Present, - = Absent

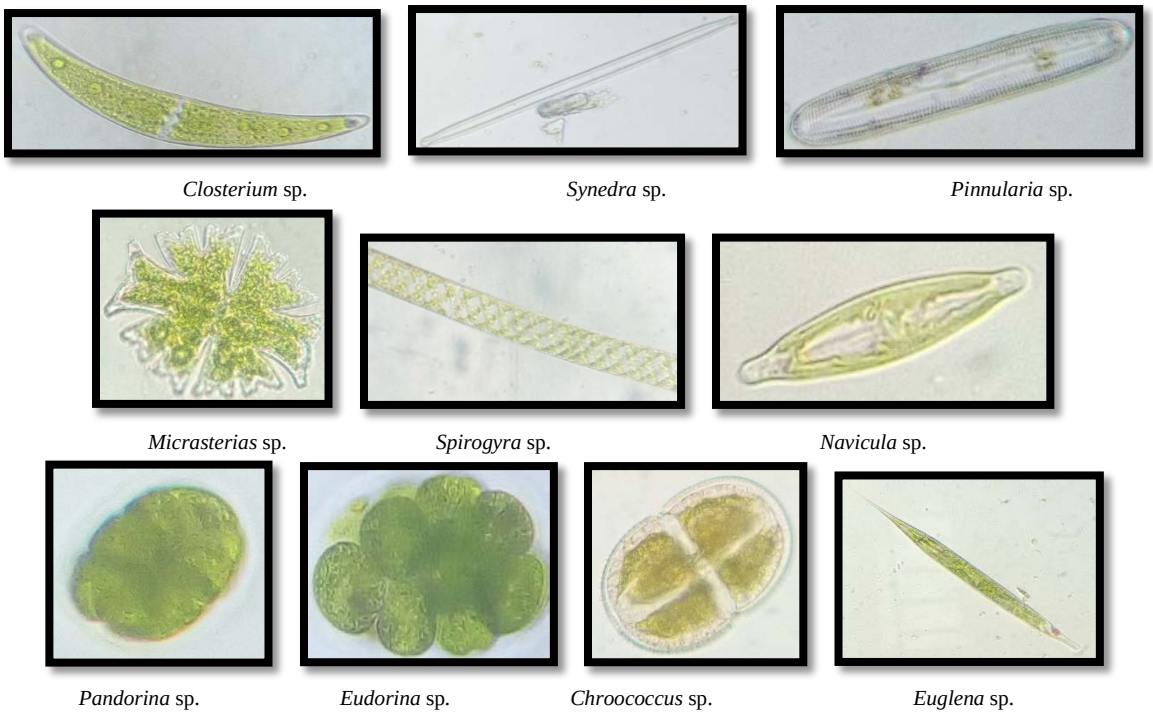

Fig. 2: Some phytoplankton encountered in River Taraba at Bali town, Taraba State, Nigeria

Nematode (Round worm) *Vorticella*

Fig. 3: Some zooplankton identified in River Taraba at Bali town, Taraba State, Nigeria

4. Conclusion

Based on the present study, River Taraba at the midstream of Bali town appears to have relatively rich ecological ecosystem with diverse planktonic fauna that can sustain fishery resources. This justified the presence of fishes in the lotic water body across the seasons as the encountered plankton plays an important role in the aquatic food chain. Nevertheless, their presence is indicative of pollution, it also indicate that the river is undergoing gradual decrease in water quality which is unfit for human consumption. However, the present state of the river can greatly be improved by enforcing rules and regulation by the authorities concerned to guide against undesirable anthropogenic activities and faecal discharge into the river with the view to avoiding the degradation of the aquatic biota. Furthermore, quantitative study of plankton and physicochemical parameters of the river should be carried out over a period of time to monitor environmental changes in the water body.

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