PRELIMINARY CENSUS OF ZOOPLANKTONS AND PHYTOPLANKTONS COMMUNITY OF AJEKO STREAM, IYALE, NORTH CENTRAL NIGERIA

ADEYEMI, Samuel Olusegun
Department of Biological Sciences, Kogi State University, Anyigba, Kogi State, Nigeria.
Email: sadeyemi2003@yahoo.com **Phone:** +2348062221968

ABSTRACT

The zooplankton and phytoplankton community of Ajeko Stream, North Central Nigeria were assessed between October and December 2010. Prior to sampling, Temperature, Transparency, Dissolve Oxygen and pH were evaluated. Zooplankton and phytoplanktons were sampled using plankton net of 20µm diameter with a collecting bottle attached at the base. Water samples were collected between 8 and 9am every forth nightly from three different points on the stream namely the Lower Course, Middle Course and Upper Course and labeled Stations A, B and C, respectively. Water samples obtained were brought to the Biological Sciences Laboratory of the Kogi State University Ayingba in sampling bottles for analysis of zooplanktons and phytoplanktons. 4% of formalin was used for preservation of zooplanktons and phytoplanktons. Each sample was concentrated to 250ml volume of water using pipette. 10ml was put to Petri-disc and the 1ml was quickly drawn with a wide-bore dropper. Samples were then introduced carefully into the counting chamber with a cover slip and observed under light microscope. The result revealed that zooplanktons were made up of Rotifera (44%), Cladocera (23%), Copepoda (20%) and Protozoa (13%) respectively. Phytoplanktons were made up of Chlorophyta (79%), Bacillariophyta (17%), Euglenophyta (2.54%) and Cryptophyta (2.00%) respectively. The status of the stream could said to be eutrophic as indicated by the diversity of zooplankton and phytoplanktons.

Keywords: Zooplankton, Phytoplankton, Temperature, Transparency, Dissolve oxygen

INTRODUCTION

Zooplanktons are the heterotrophic detritivorous component of the plankton that drifts in the water column of oceans, seas and freshwater bodies. They are microscopic organisms that are suspended in water. They include many kinds of protozoa, micro-crustaceans and other micro-invertebrates that are planktonic in water bodies (Omudu and Odeh, 2006).

Freshwater zooplankton is an important component in aquatic ecosystem whose main function is to act as primary and secondary links in the food chain. They are important link in the transfer of energy from producers to carnivores (Thurman, 1997). Zooplankton due to their large density, drifting nature, shorter life span, high group or special diversity and different tolerance are used as indicator agent for the physical, chemical and biological process in the aquatic ecosystem. Zooplanktons occupy a strategic trophic level in aquatic ecosystem. Apart from their ability to exert a tremendous influence on phytoplankton abundance and succession by means of selective grazing, they form an important source of food for carnivorous and omnivorous fish (Adeyemi *et al.,* 2009a).

Zooplankton communities often respond quickly to environmental changes because most species have short generation time (usually days to week in length) (Adeyemi *et al.,* 2010).

Zooplankton responds to a wide variety of disturbances including nutrient load, sediment input, contaminant densities and acidification. Jude *et al.* (2005) stressed that the specie assemblages of the zooplankton are indications of environmental quality and ecological changes.

Phytoplanktons are tiny autrophic and microscopic organisms that live in the water. The plant portion of this complex aquatic organism is called phytoplankton. Though they can not be seen without special equipment, once they are clustered together in large groups in water can appear to have a green coloration due to the chlorophyll present in their cells (Pearl and Tucker, 1995).

Phytoplankton species composition and diversity changes with environmental conditions such nutrients level, temperature, light and predator pressure etc. The relative importance of these factors varies considerably among different taxa under conditions of nutrient enrichment or eutrophication, the blue green algae are known to proliferate and form noxious blooms in freshwater environments. The development of phytoplankton blooms in eutrophic lakes and streams is attributed to their ability to accommodate reduced nitrogen to phosphorus ratios, low edibility due to their large colony sizes coupled with large herbivore regulation of other taxa (Adeyemi *et al.,* 2009b).

Limnologists have over the year's undertaken pre and post-impoundment studies of reservoirs, rivers, streams and lakes not only to describe the species of zooplankton and phytoplankton present but also to describe the species present and to monitor changes in species composition and seasonal abundance (Adeyemi and Ipinjolu 1997; Okayi *et al.,* 2001; Ado *et al.,* 2004; Adeyemi *et al.,* 2009c).

This study is aimed at determining the composition and abundance of zooplankton and phytoplankton, the limnological factors that supports the presence of zooplankton and phytoplankton and determines the productivity status of Ajeko stream.

MATERIALS AND METHODS

Study Area: The study area (Figure 1) Ajeko stream is located between Latitude $7^0 36' 10'$ North and Longitude $7^0 13' 8'$ East. The stream is 2 km North of Iyale Village in Dekina Local Government Area of Kogi State.

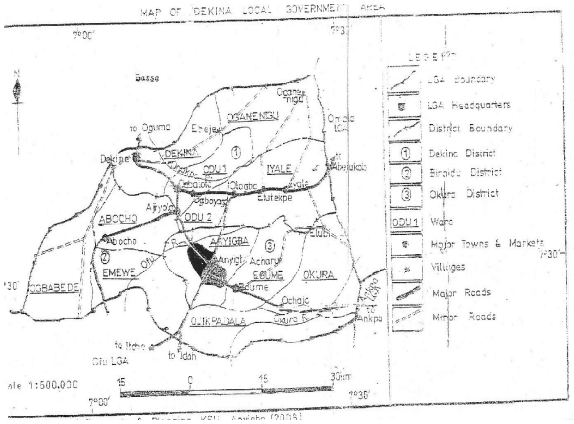

Figure 1: The study area showing Ajeko stream in Iyale Village, Dekina Local Government Area of Kogi State, Nigeria

It covers an area of $8{,}475^2$ meters with an approximate length of 150 m and breadth of 56.50 m. The stream has an average depth of 10 – 15 m depending on season, water enter the stream through various tributaries like Aji-Ite and Aji-Omachi during rainy season (Cartographic Laboratory, KSU 2010). The vegetation of the area is derived savanna which is characterized by grasses, shrubs and aquatic plants within the stream catchment's area. The average rainfall is between 850 – 16000 mm / annum. Iyale has two seasons viz rainy season which starts in April and ends in October and dry season which starts in November and end in March respectively.

Collection of Samples: With an aid of planktonic net of 20 µm diameter with a collecting bottle attached at the base water samples were collected between 8 and 9am every forth nightly from three different points on the stream namely the Lower Course, Middle Course and Upper Course and labeled Stations A, B and C, respectively, from October and December 2010.

Water samples obtained were brought to the Biological Sciences Laboratory in sampling bottles for analysis of zooplanktons and phytoplanktons. Physico-chemical parameters such as temperature and transparency were analyzed at the study site other parameters such as pH and dissolve oxygen were further analyzed in the laboratory and the mean reading recorded.

Determination of Physico-Chemical Parameters

Temperature: Water temperature was determined using mercury glass thermometer (range of 0^0 – 36^0C) which was calibrated at 0.2^0. The thermometer was immersed directly into the water for 5 minutes until a steady temperature was obtained.

Transparency: Transparency was determined using secchi disc as in Stirling (1985) with four graduant of alternate black and white on the upper surface and a long rope at the centre. Measurement was achieved by lowering the disc into the water the point of disappearance and re-appearance was noted and the distance was measured in a graduated rope and the results were recorded in centimeter.

Dissolved oxygen: Dissolved oxygen concentration of the sample area was determined using Winklers Titrimetric Method (Taylor *et al.,* 1996). Water samples were collected in a 250ml dissolve oxygen bottle, 2ml of manganese chloride and potassium iodide solution were added in order to fix the water. The bottle was carefully closed with a stopper to avoid air bubble and mixed thoroughly by shaking the bottle; this was done at the site. The precipitate formed was immediately transported to the laboratory for further analysis. In the laboratory 2ml of concentrated hydrogen chloride (HCl) acid was added and mixed thoroughly to dissolve. 50ml of this was titrated against (sodium thiosulphate solution) 0.0125 N_{a2}, S_2, 0_3. $5H_20$ inside a 50ml burette mounted on a tripod stand. 3 drops of starch solution was used as an indicator. The titration was repeated 3 times and the mean was determined this was calculated using the formula: $D0_2$ (cm^3/dm^3) = 0.056 x X x 100 at STP where X gives the volume of thiosulphate solution required for the titration of 50 ml samples and the dissolved oxygen in the water.

pH: Values were determined by the colorimetric method using the Lovibond comparator, with bromothymol blue as indicator.
Ten millilitres of each water sample was taken into each of the two glass tubes contained in the comparator. Ten drops of the indicator were added into the water sample contained in one of the tubes and thoroughly mixed. The indicator colour disc was then inserted in the comparator to compare with the colour in the tube containing the indicator and the water sample, the corresponding pH value was then read and recorded.

Sampling of Zooplankton and Phytoplankton: Planktonic nets were immersed below water surface and then towed through the water for qualitative plankton sampling. The content of the bottle were then poured into a sampling bottle of the same capacity and brought to the laboratory for further study, 4% of formalin was used for preservation of zooplanktons and phytoplanktons.

Enumeration of Zooplankton and Phytoplankton: Quantitative estimations were made using the new improved Naeubaur counting chamber. Before a quantitative enumeration of different organisms in each group was carried out, each zooplankton and phytoplankton sample was concentrated to a 250 ml volume of water using pipette. After shaking the bottle thoroughly, 10ml was put to Petri-disc and the 1 ml was quickly drawn with a wide-bore dropper. The sample was then introduced carefully into the counting chamber with a cover slip and observed under light microscope.

The count of 3 drops was averaged and the total number of each zooplankton and phytoplankton in the entire collection was

calculated per liter of water using the following formula: Number of organisms per liter = Organism in 1 ml of concentrate / Volume of water filtered X Volume of concentrate. Identification of zooplankton and phytoplankton species was carried out based on the keys provided by Palmer (1980).

RESULTS AND DISCUSSION

Physico-Chemical Parameters of Ajeko Stream: The result of the physico-chemical parameters of Ajeko stream, Iyale is as shown in Figures 2 – 4. The result showed that temperature range during the period of study was between 25.3^0C to 30.1^0C while transparency ranges from 10.7 to 50.0cm, dissolve oxygen is between 2.01 to 4.90 mg/l. pH was between 5.30 to 7.09, respectively.

The temperature range in Ajeko stream during the study period corresponded to the temperature range in the works of Grass *et al.* (1987) in River Nile. These conform to the temperature range adopted in the tropics (Alabaster and Lloyd, 1966).

Low transparency was recorded in the month of October due to rains which causes turbulence resulting in high turbidity; this has a corresponding low primary productivity, because turbidity reduces the amount of light penetration which in turn reduces photosynthesis and hence primary productivity (APHA, 1980). High transparency was recorded in the month of December due to dry season which in turn increase photosynthesis and hence primary productivity as a result of increase in light penetration into the water.

The value for dissolved oxygen content of the stream falls within the range of 0.51mg/l - 9.25mg/l. The range is in line with finding of Adeyemi *et al.* (2009b), which was 1.26mg/l - 3.1mg/l in their limnological investigation of Gbedikere Lake.

pH values recorded were between 5.30 - 7.09. This showed that the stream is a little acidic and a little alkaline.

The pH values recorded during the period of study was optima for fish and other aquatic organisms.

Zooplankton of Ajeko Stream: Figure 5 showed the variation in abundance of zooplankton in station A. The rotifers accounted for the highest number of total zooplanktons found in this station during the period of study, followed by the Cladocerans and copepods while protozoa have slight difference. This is also same in Figure 6 and 7 showing the variation in abundance of zooplanktons in station B and C, respectively.

Figure 8 showed the variation in abundance of zooplanktons between stations. The highest total number of zooplanktons were recorded in Station A followed by Station C and Station B respectively. A total of 15 species of zooplanktons were identified in Ajeko stream with four taxa of zooplanktons: Rotifera, Cladocera, Copepoda and Protozoa. Out of fifteen species six belonged to Rotifera and three each belonged to the Cladocera, Copepod and Protozoa. Species of the divisions Rotifera were the most dominant: they accounted for approximately 44% within the zooplankton community of the stream during the period of study followed by the cladocera 23% copepods 20% and the protozoa 13%. This compared favourably with the study of Omudu and Odeh (2006) in Agi stream who reported that total zooplankton abundance may increase with increasing eutrophication.

Phytoplankton of Ajeko Stream: A total number of fifteen species of phytoplankton were identified. The four major division of algal collected and identified during the period of the study include Chlorophyta, Bacillariophyta, Euglenophyta and Crytophyta. Chlorophyta dominated the total number of species in the community followed by Bacillariophyta, Englenophyta and Cryptophyta respectively.

Figure 9 – 11 showed the variation in abundance of phytoplanktons in station A. The Chlorophyta accounted for the highest number of phytoplanktons found in this station followed by the Bacillariophyta and with the Euglanophyta, Crytophyta having the lowest number of phytoplankton.

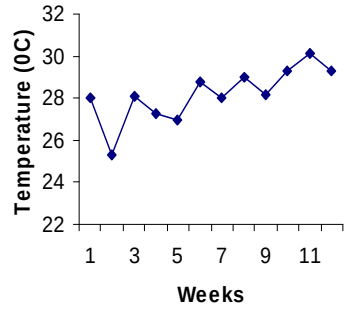

Fig. 2: Variation in Temperature at Ajeko stream, Iyale

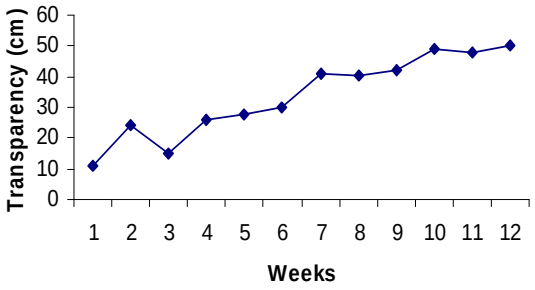

Fig. 3: Variation in Mean Transparency of Ajeko Stream, Iyale

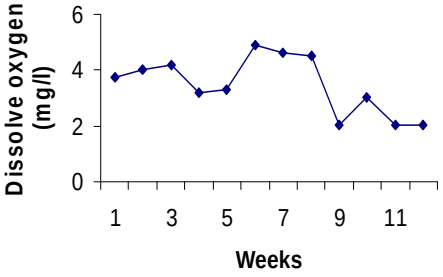

Fig. 3: Variation in Mean Dissolve Oxygen of Ajeko Stream, Iyale

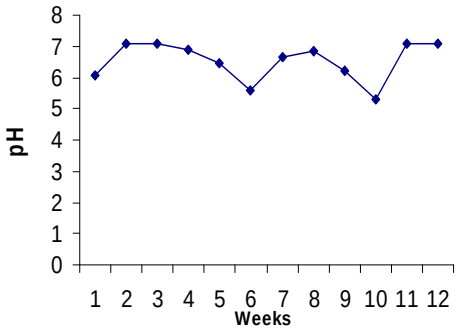

Fig. 4: Mean Variation in pH of Ajeko stream, Iyale

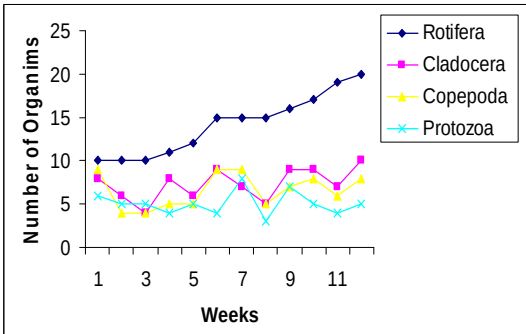

Fig. 5: Variation in Zooplankton Abundance in station A at Ajeko stream, Iyale

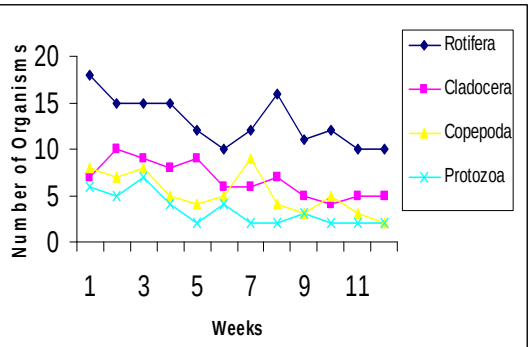

Fig. 6: Variation in Zooplankton abundance in station B at Ajeko Stream, Iyale

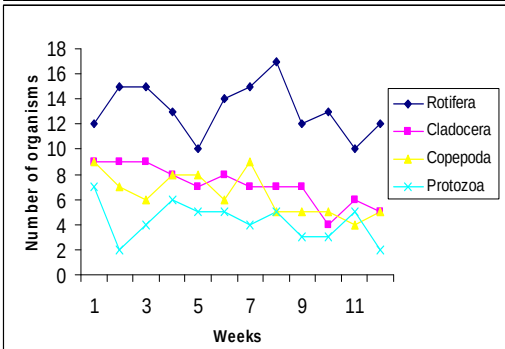

Fig. 7: Variation in Zooplankton Abundance in Station C in Ajeko stream at Iyale

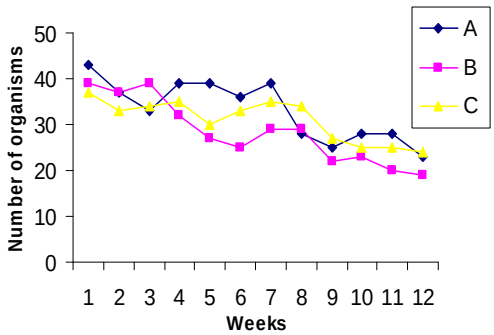

Fig. 8: Variation in Zooplankton abundance between stations in Ajeko stream, Iyale

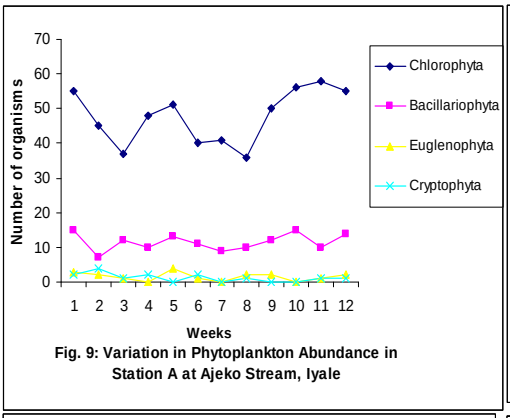

Fig. 9: Variation in Phytoplankton Abundance in Station A at Ajeko Stream, Iyale

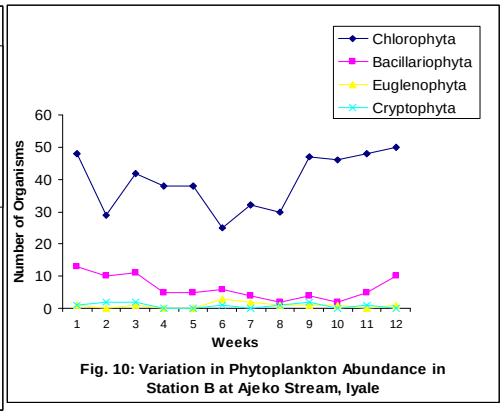

Fig. 10: Variation in Phytoplankton Abundance in Station B at Ajeko Stream, Iyale

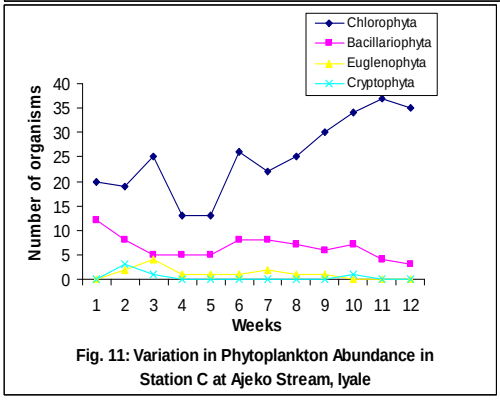

Fig. 11: Variation in Phytoplankton Abundance in Station C at Ajeko Stream, Iyale

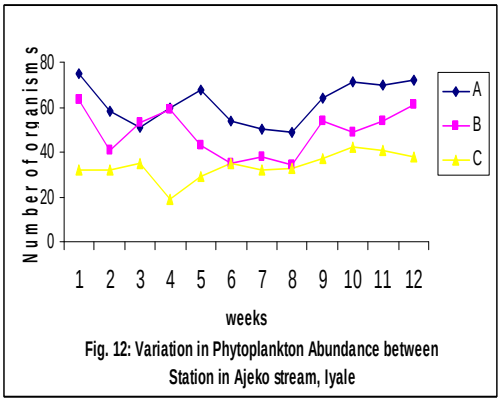

Fig. 12: Variation in Phytoplankton Abundance between Station in Ajeko stream, Iyale

Figure 12 showed the variation in abundance of phytoplankton between the three stations, station A was recorded as the highest number of phytoplankton and the lowest number was recorded for station C. A total of 15 species of phytoplanktons were identified. The major divisions of algal including Chlorophyta, Bacillariophyta, Euglenophyta and Cryptophyta: Nine species belong to Cholorophyta, four species for Bacillariophyta and one species each for Euglenophyta and Cryptophyta. Species of the divisions Chlorophyta were the most dominant they accounted for approximately 79% within the phytoplanktons community of the stream during the period of study followed by the Bacillariophyta 17%, Euglenophyta 2% and the Cryptophyta 2%. The availability of these planktonic algae could be attributed to the physico-chemical parameters which are within tolerable limits. These conform favourably with the report of Adeyemi (2011) who state that physical and chemical factors are known to influence the growth and survival of plants.

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