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IMPACT OF SOME HYDROLOGICAL FACTORS ON PHYTOPLANKTON COMMUNITY STRUCTURES IN AGAIE-LAPAI DAM RESERVOIR OF NIGER STATE, NIGERIA

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ABSTRACT

The impact of some hydrological factors (rainfall, inflow and depth of water) on phytoplankton biodiversity in Agaie - Lapai dam reservoir were studied by monthly sampling and measurements taken from May, 2013 to October, 2014. This reservoir is situated at 9° 39' N latitudes and 6° 33' E of longitudes. The reservoir is near Bakaje village at the confluence of the River Jatau and two other rivers, the Jimada and Chemi. Samples of phytoplankton were collected with plankton net of 50µm mesh size in designated stations within the reservoir. Seven (7) phytoplankton taxa are identified during the study belonging to Chrysophyta (with 99 spp), Bacillariophyta (104 spp), Chlorophyta (with 196 spp), Cyanophyta (with 21 spp), Euglenophyta (with 93 spp), Pyrrophyta (with 33 spp) and Cryptophyta (with 35spp). The highest level of impact of rainfall was corrected by the phytoplankton from the month of November to December. Cryptophyta recorded the highest respond while other phytoplankton taxa showed increase or decrease in the first and second seasons respectively. The Bacillariophyta and Euglenophyta taxa did not respond to the fall and rise of rainfall level while other phytoplankton taxa were significantly correlated by the rainfall.

KEY WORDS: Confluence, Impact, Phytoplankton, Inflow-rate.

INTRODUCTION

Algae are microphytes that are capable of carrying out process of photosynthesis due to the presence of chlorophyll-a. Phytoplankton form group of plants of different origin that share some similar characteristic such as autotrophic adapted to different modes of feeding where most are photoautotrophic (Sanet *et al.*,2006) They make a fundamental contribution by utilizing the radiant energy for the synthesis of organic compounds from inorganic ones of high potential energy (Morechev and Parr, 2010). Despite the economic importance of phytoplankton as a source of food and medicine, they also contribute to the world oxygen supply (Oghuagu and Ayoade, 2012). The magnitude of the influence of the inflow of water through lake reservoirs depends on the volume, the extent of catchment areas and the amount of rainfall (Shukla *et al.*, 2009).

MATERIALS AND METHODS

Study Area

Agaie/ Lapai dam is located at latitude 9° 39'N and longitude 6° 33'E southwest of Minna. It has a capacity of 38 million cubic meters and a crest length of 1,900 meters. Its average depth is about 10.8 meters and becomes progressively shallower towards the inflow part, where it measures less than 1.61 meters. The shore is not easily accessible during wet season. There are three tributaries and then one spillway on the side of the embankment of the dam.

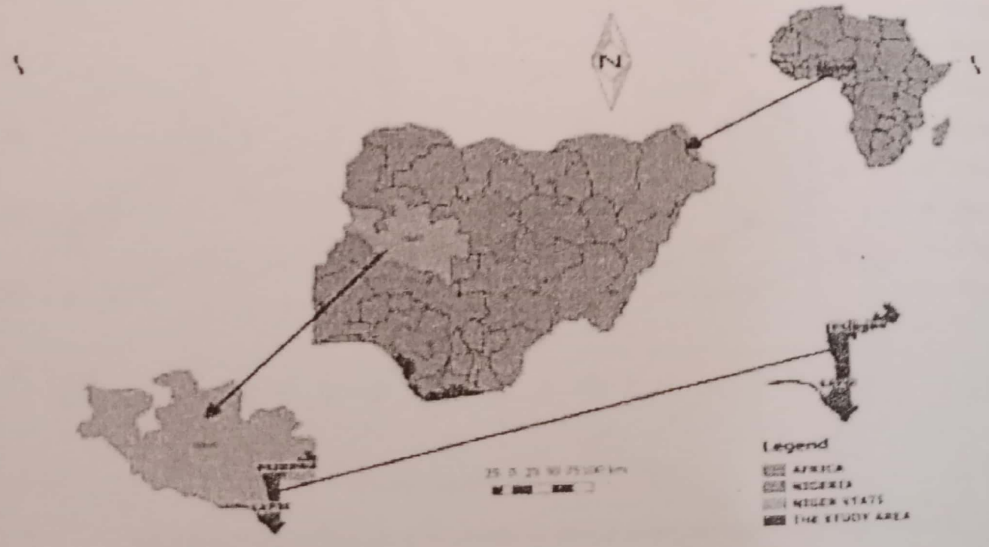

FIGURE 1: The location of Lapai dam reservoir (inset map of Nigeria and Africa)

Experimental procedure: The experiment was conducted on the surface water of the reservoir which comprised of five experimental units (stations).

Measurement of water level (depth): Depth of the water was measured by lowering a weighted, measuring tape to the bottom of the reservoir and then taking the value from the surface line of the water.

Measurement of rainfall: Daily rainfall measurement was taken using standard Rain gauge stationed at the dam site.

Measurement of Flow-rate of water: It was done following the procedure described by Graffman, (2006) and calculated online at http://www.1728.org/flowrate.htm

Sampling: Zooplankton was collected by vertical hauling between distances of about 2 meters. Sample was fixed by the addition of lugol's solution to each sample volume. A bi-ocular microscope under a magnification of x10 to x100 was used. Taxonomic determination was made to species level in the three primary zooplankton groups. Zooplankton density (abundance) was computed using the following formula (APHA, 2005)

Community structure Analysis: The calculations of all the indices were done online at http://www.alyoung.com/labs/biodiversity_calculator.html

RESULTS

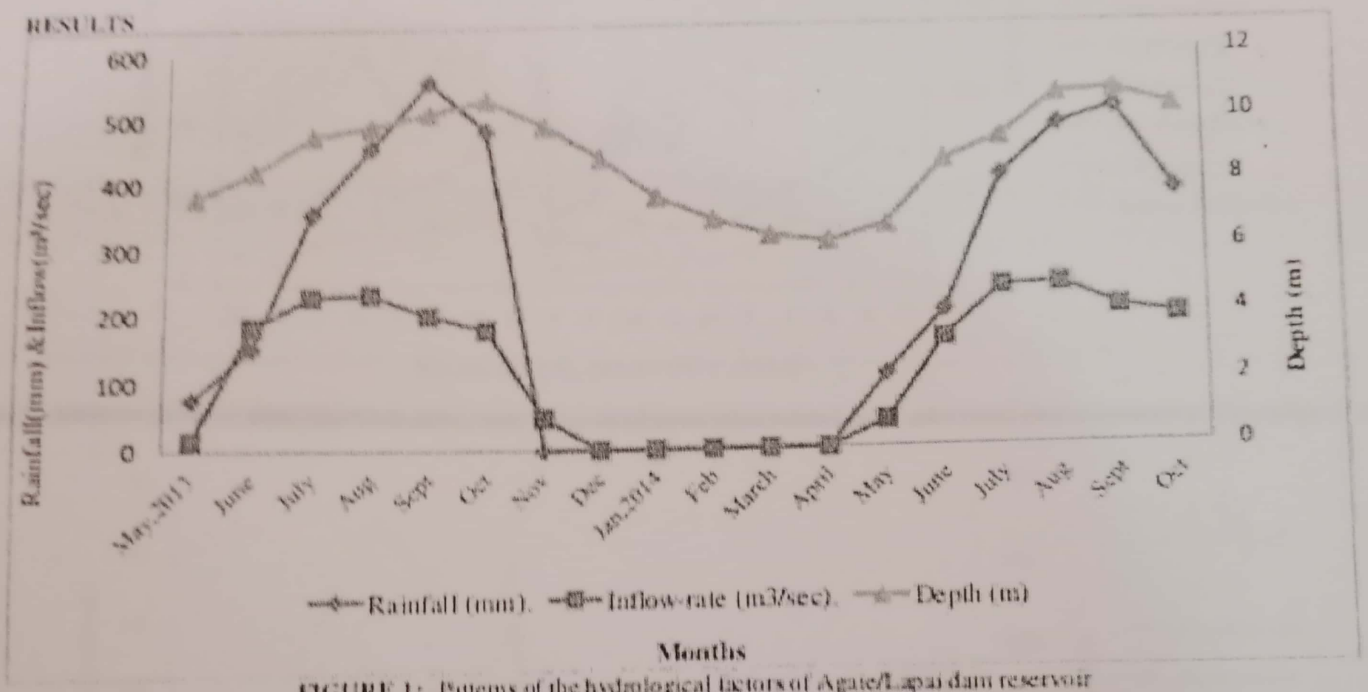

FIGURE 1: Patterns of the hydrological factors of Agate/Lapai dam reservoir

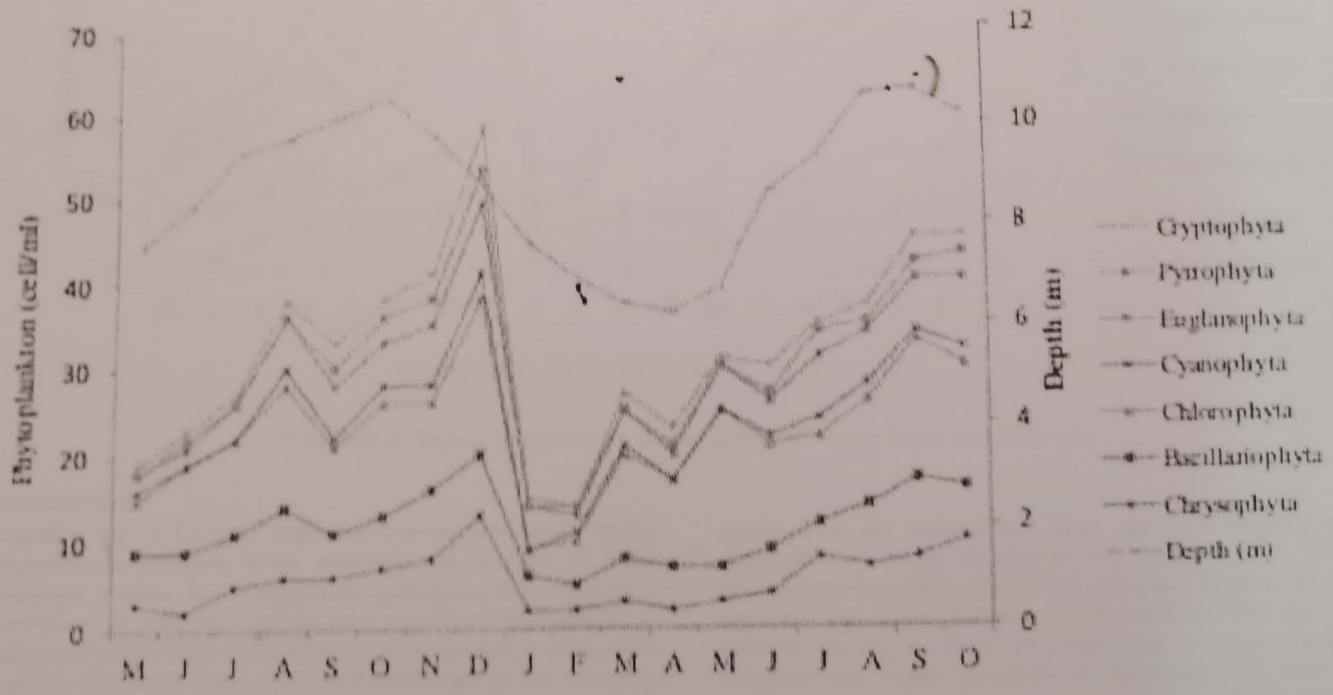

FIGURE 2: Impact of water level (depth) on phytoplankton in Agate - Lapai dam reservoir

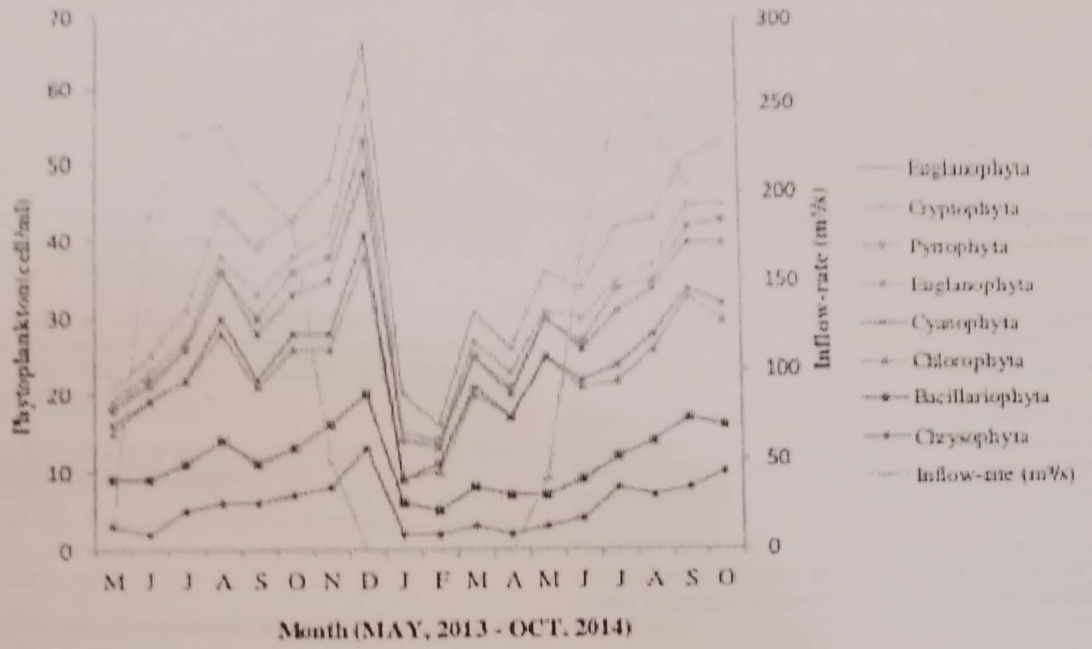

FIGURE 3: Impact of inflow-rate of water on phytoplankton in Agaie-Lapai dam reservoir

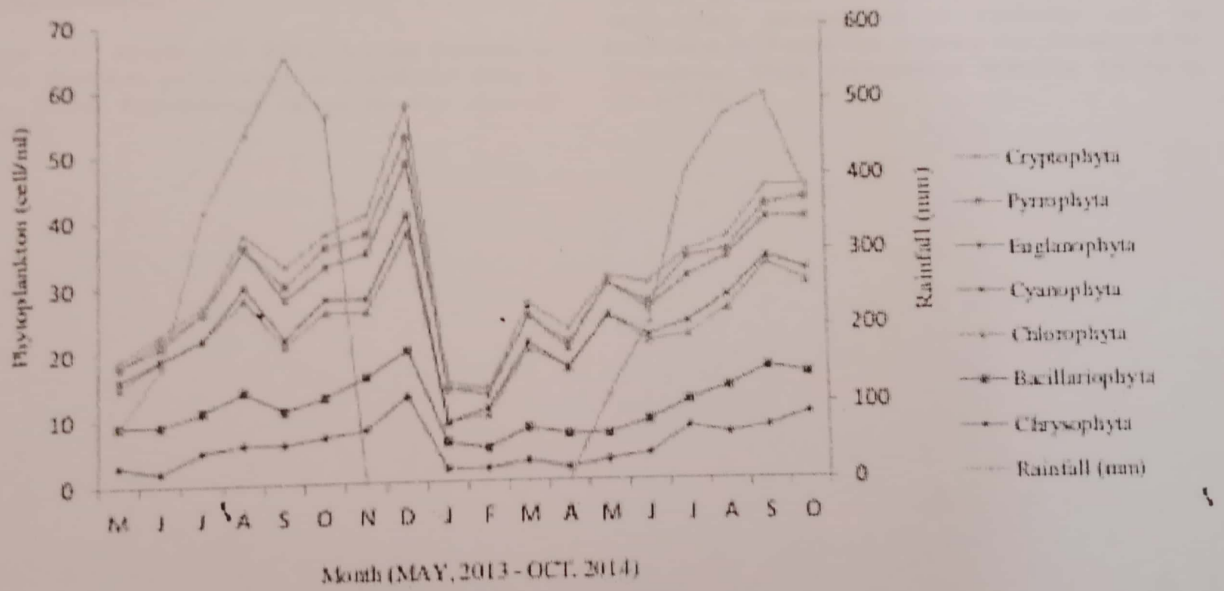

FIGURE 4: Impact of rainfall on phytoplankton in Agaie-Lapai dam reservoir

DISCUSSION

Rainfall is one of the more important hydrological factors of the phytoplankton diversity in the reservoir and in many of other freshwater system, has a significant impact on the organism's distribution. In contrast, rainfalls have not shown any significant impact on the abundance and diversity of zooplankton in the dam reservoir. The high water levels and discharges in the reservoir and consequent high loading of organic matter including human wastes into the reservoir caused some changes in the reservoir. There was positive impact between the rainfall and phytoplankton centrally to Weyhenmeyer *et al.* (2004) report. Perroche-Neves *et al.* (2012) reported the same observations of a typical rainfall on lotic zooplankton when comparing downstream of a reservoir and tributaries with free stretches. Rainfall is an important external factor influencing nutrient inputs from the surrounding areas and light penetration had changed the water condition and subsequently affecting phytoplankton proliferation in the reservoir. Sanet *et al.* (2006) reported the same findings while studying the correlation between the physico-chemical parameters and phytoplankton of Parappur and Tighra reservoirs in India.The high velocity of inflow of Lapai dam reservoir, did not triggered any significant proliferation of phytoplankton, hence the abundance of the organisms remain unchanged in contrast to the reports of Zhou, *et al.* (2011) and Castillo-Rivera (2013).

The environmental variable (rainfall and depth) was found to increase/decrease the proliferation and abundance of the phytoplankton. There was no positive impact observed in the

reservoir with increased flow-rate of water. There are important diverse species of phytoplankton in the dam reservoir.

RECOMMENDATIONS

i. Fish stock assessment should be measured regularly.
ii. Conservation plan should be identified for effective monitoring.

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