Asian Journal of Conservation Biology, December 2016. Vol. 5 No. 2, pp. 65-69 AJCB: FP0074
ISSN 2278-7666 ©*TCRP* 2016

Abundance and Distribution of Phytoplankton in Mainit Lake, Mainit, Surigao del Norte

Glorian B. Ederosas[1,*] Joycelyn C. Jumawan[2]

[1]*Graduate Studies, Caraga State University, Ampayon, Butuan City*
[2]*Department of Biology, Caraga State University, Ampayon, Butuan City*

(Accepted November 25, 2016)

ABSTRACT

Abundance and distribution of phytoplankton in four stations of Mainit Lake were studied. A total of 26 species comprising 9 species of diatoms, 9 species of green algae, 4 species of blue-green algae, 2 species of dinoflagellates, and 1 species of euglenophyta. Species were categorized taxonomically and into the nearest taxa showing their respective density (cells/mL). Diatoms of the division Bracillariophyta were the most dominant group in all areas. It is followed by the green algae species and dinoflagellates. The least distributed species is the euglenophyta. Moreover, the quantitative and qualitative distribution of diatom population can be used as bases in developing an effective environment assessment and monitoring. Furthermore, Shannon-Weiner (H') shows that the diversity of phytoplankton species is stable and that the species are evenly distributed in all areas.

Keywords: abundance, distribution, species diversity, phytoplankton, taxonomy

INTRODUCTION

Plankton are an important food source for organisms in aquatic environment. They are a major and crucial food source for a lot of aquatic lifeforms for they occupy the lower levels of all ocean and freshwater food chains. They occur in huge numbers composing a significant proportion of aquatic biomass. According to Prasad and Singh (2003), the zooplankton forms the principal food source for fish within the water body. On the other hand, Phytoplankton are at the base of the food web supporting higher organisms within water ecosystem (Campbell, 1999). Thus, a knowledge of the plankton community of any water body is therefore, not only important in assessing its productivity but would permit a better understanding of the population dynamics and life cycles of the fish community (Abohweyere 1990 and Ugwumba 1990).

Lake Mainit is considered to be the Philippine's deepest lake with a maximum depth reaching about 223 m (Lewis, 1973). It is geographically located between the Provinces of Surigao del Norte and Agusan del Norte wiith a surface area of 149.86 km2 and it ranks fourth to Laguna Lake as one of the Philippine's largest lakes (Tumanda et al., 2003). The lake receives inflows from several major and minor tributaries located in the municipalities of Mainit and Alegria (Surigao del Norte) and Kitcharao and Jabonga (Agusan del Norte). Many people depend on the lake for their livelihood. It plays a major role in the lives of the people for it serves as their source of food and income. The lake is home to many wildlife and various flora and fauna, such as migratory birds and fishes. It is reported to be the habitat of rare fish species: the puyo or climbing perch and gabot. Eels, mudfish, tilapia, gurami and bolinao are also found in the lake (Lake Mainit Development Alliance – Environmental Management Plan, 2014).

According to Mamaril (2001), the sustainable fisheries development partly depends on the adequate availability of planktons for they are the first link in any aquatic food chain. They also play a major role in the biogeochemical cycles of many important elements such as carbon cycle, nitrification, denitrification, remineralization and methanogenesis. Hence, planktons contributes a great importance in balancing aquatic ecosystem. As Harikrishnan et. al. (1999) said, the maintenance of a healthy aquatic ecosystem depends on the abiotic properties of water and biological diversity of the ecosystem. Thus, the study is conducted to assess the abundance of phytoplankton in Mainit Lake, Mainit, Surigao del Norte. The results may serve as bases for the development of an effective conservation and management of lake resources.

MATERIALS AND METHODS

Study Area and Period of Study

The study was conducted during the last week of January 2016 in Mainit Lake, Mainit, Surigao del Norte, Philippines (Figure 1).

**Corresponding Author's E-mail: glorian.ederosas@deped.gov.ph*

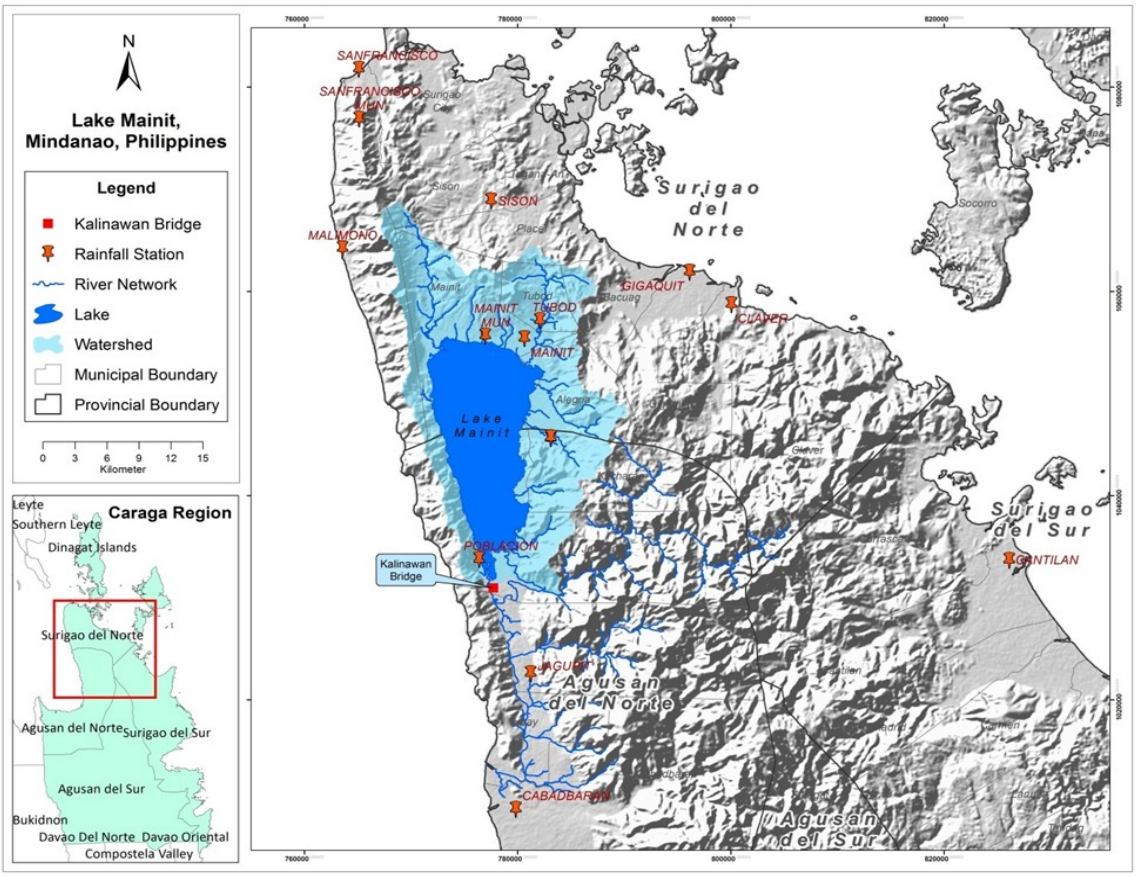

Figure 1. Map of Mainit Lake, Mindanao Philippines

Establishment of Sampling Stations

Within the Mainit Lake, four sampling sites were established with three replicate stations and three replicate sample bottles in every station. Site 1 is located in the south portion of Mainit Lake with 9˚ 25' 06.8" N and 125˚ 31' 20.4" E geographic coordinates. Site 2 is in the west side of the lake. It has 9˚ 27' 42.9"N and 125˚ 32' 40.8" E geographic coordinates. Site 3 is in the east part and has the geographic coordinates of 9˚ 29' 13.1" N and 125˚ 29' 06.9 E and Site 4 is in the mouth of the river with a geographic coordinates of 9˚ 31' 36.9" N and 125˚ 30' 27.3" E.

Collection of Phytoplankton Samples

The collection of plankton was conducted on daytime (approximately 0800 – 1700 hours) through vertical towing in each sampling sites. Conical plankton net (length: 0.45 m; mouth diameter: 0.35m; mesh size opening: 50 µm) was towed at a length of 1m from the water surface. The sample collected at the cod-end was transferred into the designated plastic sampling bottle wrapped with a carbon paper to avoid light exposure. In each station, 3 tows were carried for the three bottles prepared with different preservative in each bottle namely Lugol' solution (1 part Lugol's solution per 100 part sample), 10% formalin (2 parts 10% formalin in every 100 parts sample) and 95% ethanol (5 parts in every 100 parts sample). The samples were brought to the laboratory for identification and analysis. Identification was done with the aid of taxonomic keys and illustrations on Philippine plankton by Mamaril (1986) and Petersen (2007).

Counting of Phytoplankton

A drop (0.50mL/50µL) of sample preserved was placed into the Haemocytometer. Each plankton cell or individual species viewed under the compound microscope was identified but only cells of phytoplankton within the 4 large squares were counted. Two (2) drops from each of the collected samples were analyzed and the average was taken. Plankton species were identified from genus to species level if possible. Prior to the counting, the total volume of the collected sample was measured and recorded. The abundance of each plankton species was counted using the protocols of counting cells in a haemocytometer.

Phytoplankton Diversity Indices

The assessment of the diversity indices was conducted using Paleontological Statistics (PAST) software (Hammer et al 2001). Diversity indices include species richness and abundance.

Table 1. List of Phytoplankton found in Mainit Lake with its corresponding densities per stations.

DIVISION	SPECIES	Cells/mL			
		S1	S2	S3	S4
Bacillariophyta	Diatom 1	664.62	617.39	719.08	736.01
	Diatom 2	0.00	0.00	0.40	0.49
	Diatom 3	0.00	0.00	0.65	1.95
	Diatom 4	0.00	0.00	0.16	0.32
	Cymbella turgidula	0.49	0.75	2.91	1.79
	Diatom 5	0.00	0.00	0.00	0.16
	Diatoma vulgaris	0.00	0.32	0.32	1.30
	Surirella	0.00	0.00	0.32	0.00
	Synedra ulna	29.43	21.83	35.42	35.73
	Total	**694.54**	**640.29**	**759.26**	**777.75**
Chlorophyta	Ankistrodesmus	2.18	3.57	1.70	0.65
	Chlorella sp.	0.16	0.00	0.16	0.49
	Chlorophyte sp. 1	10.72	11.27	14.75	23.55
	Chlorophyte sp. 2	0.16	0.49	1.46	0.00
	Pandorina sp.	24.56	35.50	61.69	109.62
	Pediastrum simplex	13.48	20.66	22.92	40.11
	Scenedesmus sp.	6.50	1.30	4.55	13.80
	Spirogyra sp.	2.11	2.92	1.95	12.51
	Staurastrum sp.	46.87	35.11	45.32	53.11
	Total	**106.74**	**110.82**	**154.5**	**253.84**
Cyanophyta	*Anabaena* sp.	0.65	1.10	1.95	0.97
	Arthrospira platensis	4.38	0.32	4.22	0.00
	Cylindrospermopsis sp.	7.31	2.34	9.42	6.98
	Oscillatoria	0.00	0.00	0.65	0.00
	Total	**12.34**	**3.76**	**16.24**	**7.95**
Dinophyta	Dino 1	52.62	52.07	54.15	57.98
	Dino 2	0.00	0.00	0.32	8.77
	Total	**52.62**	**52.07**	**54.47**	**66.75**
Euglenophyta	*Trachelomonas* sp	0.00	0.00	0.00	0.32
Unidentified	Unidentified 1	1.30	2.08	2.27	2.76
	Unidentified 2	0.00	0.00	0.00	0.32
	Phyto 1	9.06	1.10	0.65	0.65
	Phyto 2	0.75	0.00	0.00	0.00
	Total	**11.11**	**3.18**	**2.92**	**3.73**

RESULTS AND DISCUSSION

A total of 26 phytoplankton species were recorded in Mainit Lake and distributed into 5 divisions. Out of these, 9 species belong to Division Bacillariophyta (diatoms), 9 to Chlorophyta (green-algae), 4 to Cyanophyta (blue-green algae), 2 to Dinophyta (dinoflagellates), 1 to Euglenophyta (euglenoids) and 4 unidentified species.

Phytoplankton species were categorized taxonomically and categorized into the nearest taxa showing their respective density (cells/mL) as presented in Table 1.

Diatom has the highest density with 2737 cells/ml. It is followed by the green algae species, *Pandorina sp (233)* and *Synedra ulna* (180), and there were 217 dinoflagellates collected from the sampling sites.

As shown in Figure 1, the phytoplankton community in Mainit Lake was composed mainly of diatoms and green-algae with 31% each of the total composition while euglenoids contributed the least with 3%.

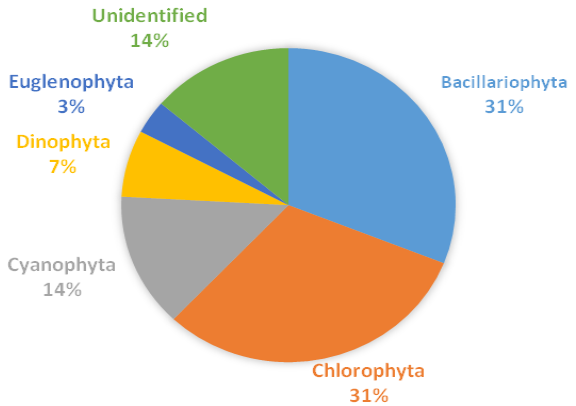

Figure 2. Percent composition of phytoplankton in Mainit Lake, Mainit, Surigao del Norte

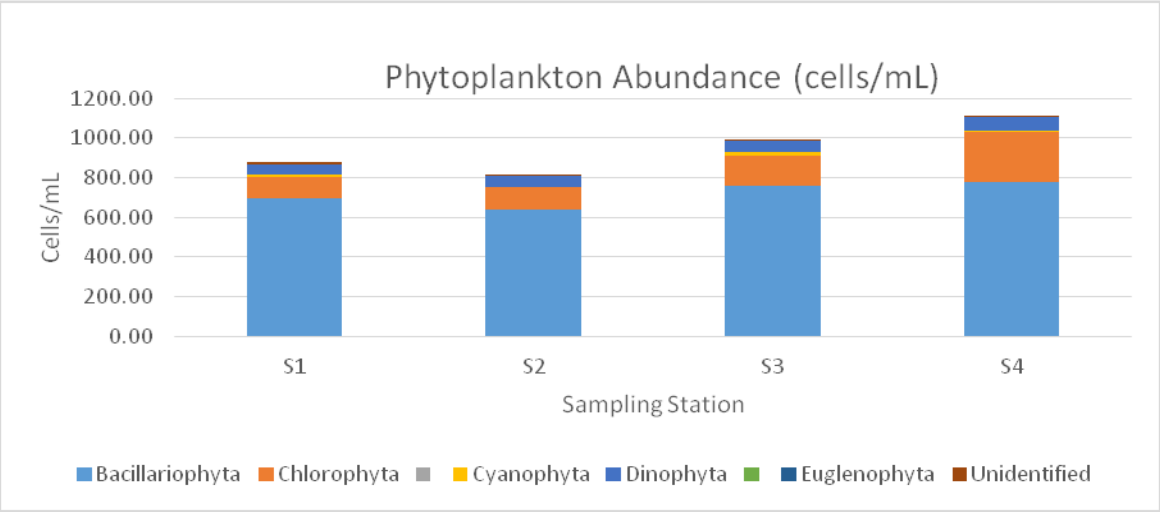

Figure 3. Phytoplankton Abundance by Division and Station

Phytoplankton population at the four sampling stations further shows that diatoms are the highest in abundance and occurrence (Figure 2). It occurred in all the 4 stations studied and constituted 76% (2872 out of 3757) of the total population. It was followed by *Pandorina* sp. with 6% (233 out of 3757) and 5% of *Synedra ulna* (180). Dinoflagellates were also collected in the lake with 6% (217). On the other hand, *Trachemonas* sp. under the division Euglenophyta appeared to be the least distributed for it is absent in station 3. Moreover the qualitative and quantitative dominance of Diatom in the water is important for they have been known to be indicators of water quality and environmental conditions (Kelly, 1998; Weckenson et. al, 1997). According to the study of Campbell (2008), higher phytoplankton density is expected in an area with greater eutrophication.

Diversity Indices

The selected diversity indices parameters such as species diversity, evenness and dominance give information about the community structure and organization of plankton. The indices values are used to understand the health status of the water system.

As shown in Fgure 3, the Shannon-Weiner (H') value in all sampling area #1, #2, #3 and #4 is 1.08, 1.03, 1.17 and 1.36 respectively. All H's values are greater than 1 but less than 3 which implies that the diversity of phytoplankton species is considered stable (Odum, 1993). The results further show that the phytoplankton species in all areas are less dominance which implies that no rare species were observed which could affect the diversity of species. This follows that the species are evenly distributed in all areas.

CONCLUSION

Phytoplankton species identified were dominated by the species in the division bacillariophyta (diatoms). The least quantitative was the euglenophyta species, *Trachelomonas sp*. The considerable number of diatoms in Mainit Lake implies a positive indication that the lake has the potential to support dynamic forms of aquatic life. Dixit et. al (1999) claimed that diatoms can be used in water quality testing. Thus, it can be used extensively in the environment assessment and monitoring. According to Dugbeon et al (2006), the conservation and management of water ecosystem is critical to the management of the entire mankind. Hence, the results of the study will serve as a background database for future reference in the management of this water body.

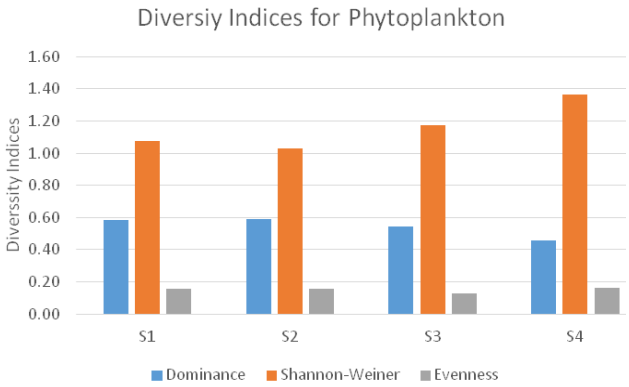

Figure 4. Graphical representation of the selected diversity indices for phytoplankton species

REFERENCES

Abohweyere, P.O. 1990. Study of Limnological parameters and potential fish yield in Kigera reservoir (Extensive system) in Kainji, New Bussa, Nigeria. Journal of Aquatic Sciences 5: 53 – 58.

Campbell, Primrose E, Manning, Janette A., Webber, Mona K., and Webber, Dale F. 2008.Planktonic communities as indicators of water quality in

mangroves lagoons; a Jamaican case study. Transitional Water Bulletins.

Dixit, Sushil S., John P Smol, Donald F Charles, Robert M Hughes. 1999. "Assessing Water Quality Changes in the Lakes of the Northeastern United States using Sediment Diatoms." Canadian Journal of Fisheries and Aquatic Sciences. Volume 56, pp 131-152.

Hammer, O., Harper, D. A. P., Ryan, P.D., 2001. PAST: Paleontological Statistics Software

Kelly, M. G. 1998. Use of the trophic diatom index to monitor eutrophication in rivers. Wat. Res. 32: 23 – 242.

Lake Mainit Development Alliance – Environmental Management Plan, 2014.

Lewis, W. M. (1973). A limnological survey of Lake Mainit, Philippines. Internationale Revue der

gesamtenHydrobiologie und Hydrographie, 58(6), 801-818.

Mamaril, AC SR. 1986. Vol. VII. Zooplankton. In: Guide to Philippine Flora and Fauna. Quezon City: National Resources Management Center and University of the Philippines Diliman. 268 p.

Mamaril AC. 2001. Zooplankton diversity in Philippine lakes, pp. 81-93. In CB Santiago, ML Cuvin-Aralar and ZU Basiao (eds.). Conservation and Ecological Management of Philippine Lakes in Relation to Fisheries and Aquaculture. Southeast Asian Fisheries Development Center, Aquaculture Department, Iloilo, Philippines; Philippine Council for Aquatic and Marine Research and Development, Los Baños, Laguna, Philippines; and Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines. 187 pp.

Prasad, B.B. & Singh, R.B.2003. Composition, abundance and distribution of phytoplankton and zoobenthos in a tropical water body. *Nat.Envin.Pollut.Technol*. **2**:255-258.

Tumanda, M. I., Jr., Roa E. C., Gorospe J. G., Daitia M. T., Dejarme S. M., and Gaid R. D. (2003),

Limnological and Water Quality Assessment of Lake Mainit, Mindanao State University, Naawan.

Weckenson, J., Korhola, A., and Blom, T. 1997. Diatoms as quantitative indicators of pH and water temperature in subartic fennoscandian lakes. Hydrobiologia. 347: 171-184.