Journal of Ecological Research, 3, 40-42 (2001)

DEPTH CHANGES OF THE PLANKTON COMMUNITY IN RAYSTOWN LAKE

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ABSTRACT

I compared plankton density, diversity, richness and evenness at three depth intervals in Juniata Bay, Raystown Lake, Pennsylvania. I also recorded turbidity, temperature, dissolved oxygen, and light penetration at each interval to correlate with plankton community data. Species diversity was significantly different among the depths. Changes in plankton populations may be due to temperature, dissolved oxygen and light differences throughout the water column that relate to the time of year the samples were taken and the turnover conditions of the lake.

Keywords: Oxygen, plankton, Raystown Lake, water quality.

INTRODUCTION

Plankton compose the base of the food chain of a lake, and thus ultimately provide food to top predators such as fish, birds, and humans. The greater the number of zooplankton species (richness), the more likely the lake is to have more species of fish, many of which are particularly important to sports fishermen (Waite 1996). To understand how plankton affect the top of the food chain, we must first understand the vertical distribution of plankton communities. This distribution of plankton is affected by the biannual lake turnover. Top predators often depend upon plankton blooms as a food source, such as those that occur with diatoms during spring turnover. The timing of the bloom can influence the survival of larval fish (Waite 1996).

I examined phytoplankton communities at three depth intervals. I tested the null hypothesis that plankton communities do not vary among depth levels in the early spring. I also examined abiotic factors that might influence plankton communities.

METHODS AND MATERIALS

I sampled plankton from Juniata Bay, a small inlet of Raystown Lake, near the main channel of the lake using a Birge Closing Net at three depths of 4 meters each: (1) 0-4m, (2) 5-9m, and (3) 10-14m. I identified and counted plankton by using a 1.05 microliter counting cell and microscope. I selected ten randomly generated fields of microscope view to estimate plankton densities. I calculated plankton density, richness and Simpson's Diversity (Brower et. al. 1998) for each depth interval. I took measurements on temperature, dissolved oxygen, and light penetration throughout the water column using a YSI oxygen meter and a photometer.

RESULTS

Plankton diversity differed significantly among depths ($F = 439.58$, df = 29, $P < 0.000$) with depth 1 having lower diversity than depths 2 and 3. Only three species were found at all three depths: *Asterionella, Fragilaria*, and *Closterium* (Table 1).

Table 1. Plankton species found at three depths of Raystown Lake, Pennsylvania in March, 2000

0-4 m	5-8 m	9-12 m
Asterionella	*Asterionella*	*Asterionella*
Fragilaria	Fragilaria	Fragilaria
Closterium	Closterium	Closterium
Phormidium	Spyrogyra	Melosira
Spyrogyra	Nitzschia	*Oedogonium*
Oscillatoria	Diatoma	*Ulothrix*
Melosira	*Tabelleria*	*Volvox*
Nitzschia	*Ankistrodesmus*	*Ploesoma*
Chaetophora	*Daphnia*	*Acanthocystis*
Protococcus	*Oedogonium*	*Microspora*
	Cladophora	*Stauroneis*
	Keratella	*Synedra*
	Naupalis	*Trichocera*
	Cyclops	*Pediastrum*
	Zygnema	

Plankton richness was also significantly lower at depth 1, but did not differ between depths 2 and 3 (F = 8.36, df = 29, P = 0.001). Species evenness differed significantly among depths, as well (F = 70.32, df = 29, P < 0.001). Temperature (Fig. 1), dissolved oxygen (Fig. 2), and light penetration (Fig. 3) decreased as depth increased. The depth at which all parameters drop off to less than 5% was at 14 meters.

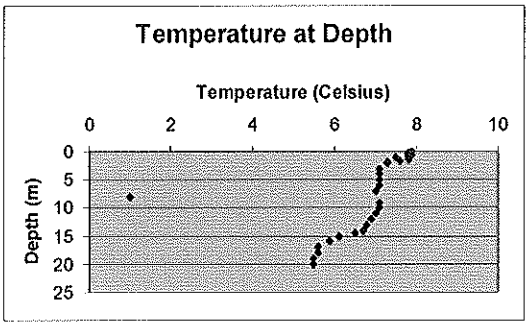

Figure 1: Temperature profile of Juniata Bay, Raystown Lake, April 2000.

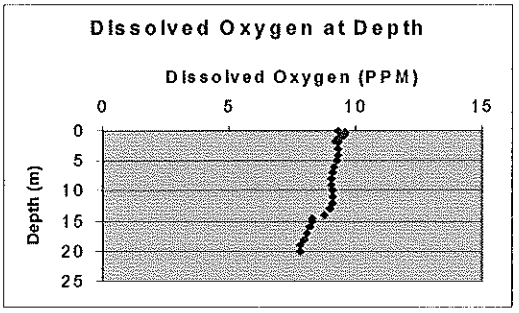

Figure 2: Dissolved oxygen profile in Juniata Bay, Raystown Lake, April, 2000.

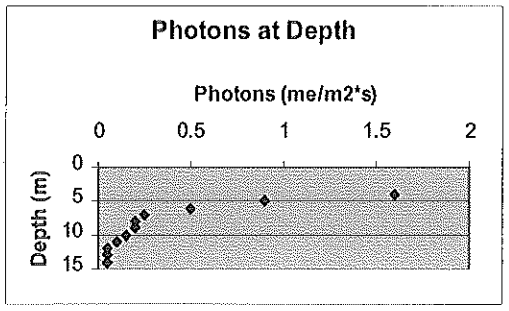

Figure 3. Light penetration through the water column at Juniata Bay, Raystown Lake

DISCUSSION

The low density of plankton at the lowest depths is probably caused by poor light penetration (Sprules and Munawar 1984). A limited amount of light, for example, might limit the range of a phytoplankton species in the water column. Light scatters in water, and thus the amount penetrating the bottom of the lake is less that 5% the amount of light at the surface. Temperature also decreases with depth, as well, because deeper water is less likely to pick up solar energy from the water surface. A completely mixed lake would have a more uniform temperature throughout the water column. Therefore, the temperature curve may indicate the beginning of a mixing period.

Correlating the environmental data with the plankton data supports the conclusion that the lake is mixing. The warm weather prior to collection on March 29, 2000 may have begun the mixing. The phytoplankton were increasing in abundance, but only where light was available. However, the lake was only in the early stages of mixing, as indicated by the presence of winter-only diatoms. The genera *Asterionella*, *Fragilaria*, and *Tabellaria* are present in abundance in the spring bloom because they grow faster than competing algae. One of the reasons these algae can grow faster is their ability to store phosphorus, a growth-limiting nutrient. However, they are also "holoplankton", which are always found in the plankton of lakes (Sprules & Munawar 1984). A further look at other forms of plankton will decipher which stage Juniata Bay was in at the time of sampling. The diatom *Melosira* benefits from low levels of competition and is thus abundant in the winter. It also takes advantage of the high nutrients in the spring bloom. *Melosira* is most abundant from October to May (Horne and Goldman 1994). The phytoplankton indicate that the lake was in the first stages of mixing at collection. *Asterionella* numbers increase 500 to 2000 times each spring, whereas *Melosira* can only increase to 200. This may explain why *Asterionella* was abundant in my plankton samples (Horne and Goldman 1994).

ACKNOWLEDGMENTS

I thank Chuck Yohn and Todd Gustafson for advising and equipment, Mary-Ann Galioto and Kristen Morrison for counting plankton, and Brian Olsen for operating the boat.

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