

Zooplank-tivity

The Effect of Zooplankton on 5 Tully Kettle Lakes' Productivity

Author: Jessica Lee Tobia

Introduction: This experiment was performed to test whether *Daphnia* and other herbivorous zooplankton significantly affect algae biomass. Zooplankton are the main herbivores in the pelagic zone in Northern Temperate Lakes. In this experiment, 5 lakes with similar climate, depths, geology/underlying bedrock, formation/age and location were observed. Located in central New York, in Cortland and Onondaga counties the studied lakes include: Song, Tully, Crooked and Little York lakes and Gatehouse pond. Data were collected on the levels of chlorophyll a and the zooplankton abundance and diversity within the metalimnion of each lake. The total phosphorus content data for the three lakes for which there is data, was retrieved from the Citizen's Statewide Lake Assessment Program (CSLAP) from 2 years ago.

Hypothesis: In lakes with high *Daphnia* and other herbivorous zooplankton populations, the algae biomass will be lower than in lakes with lower herbivorous zooplankton populations.

Methods: To collect zooplankton from the lake, a sample was collected using a 80 um zooplankton net tow. The sample was preserved in 70% ethanol. The first 100 organisms were identified under a dissecting scope.

To gain data on the chlorophyll a levels within the lake, the phytoplankton were filtered from the lake water and later added to 10 mL of buffered acetone before being measured on the fluorometer. The fluorometer reading requires some analysis in order to attain the micrograms per liter of chlorophyll a within each lake. To gain data on the total phosphorus levels of each lake measurements from 2010 data were retrieved from the Citizen's Statewide Lake Assessment Program (CSLAP) from 2 years ago.

Results

Table 1: Parameter values of the 5 lakes

Lakes	Chlorophyll a (µg/L)	Depth (meters)	Total Phosphorus	ratio herbivores/ omnivore	Number of animals/Liter
Tully	4.89	9.4	-	1.67	26.0
Little York	2.04	22.4	0.011	1.79	8.2
Song	6.24	9.1	0.021	3	4.0
Crooked	6.28	23.9	0.016	0.59	0.9
Gatehouse pond	4.55	15.2	-	0.35	4.5

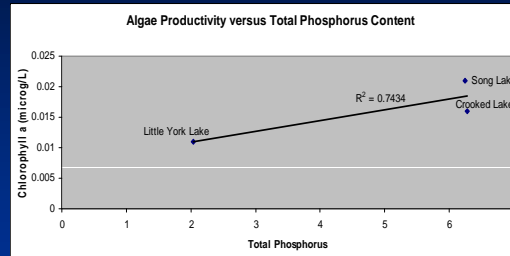


Figure 2: Chlorophyll a increases as total phosphorus increases

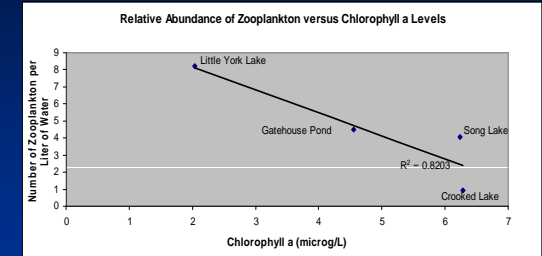


Figure 3: Number of zooplankton decreases as chlorophyll a increases

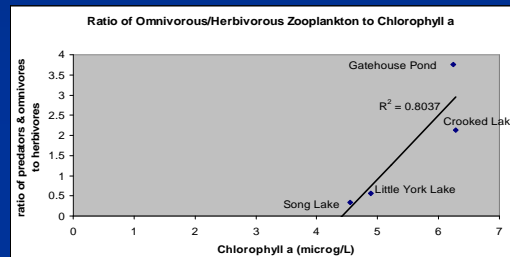


Figure 4: Ratio of predators & omnivores to herbivores increases as chlorophyll a increases

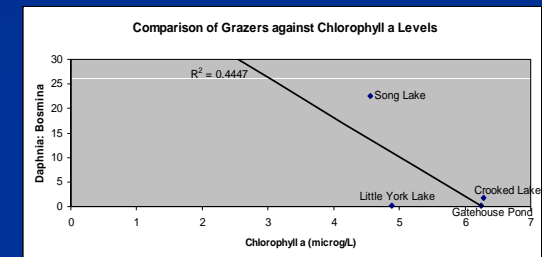


Figure 5: Ratio of *Daphnia* to *Bosmina* decreases as chlorophyll a increases

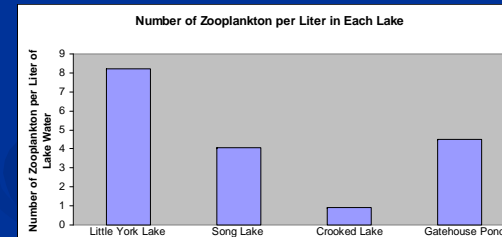
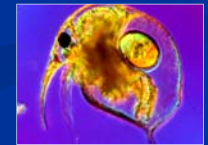


Figure 6: Abundance of zooplankton in each lake (Tully is not shown. Tully zooplankton abundance was 26 per liter)



Polyphemus



Bosmina

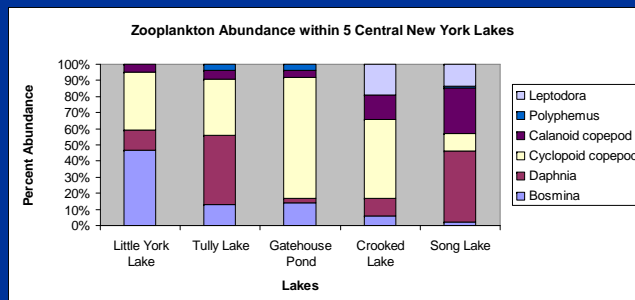


Figure 1: Relative abundance of zooplankton



Leptodora



Cyclopoid copepod



Daphnia

Conclusion: Overall, the analysis from the data and the graphs support my hypothesis that indeed, lakes with high *Daphnia* and other herbivorous zooplankton populations experience lower algae biomass than lakes with lower herbivorous zooplankton populations.

•Song Lake was found to have the highest zooplankton diversity and the most *Daphnia* of all the five lakes. Little York Lake was found to have the lowest zooplankton diversity and the highest zooplankton abundance.

•Tully Lake had the most zooplankton by far and the lake's data values were so different from the other lakes that it began to skew the data. Thus, Tully Lake was omitted from the graphs and from analysis. It is thought that this variation is due to human influences because out of the five lakes, Tully Lake has the most people living on it and the town of Tully releases their sewage treatment effluent into the lake.

•From the analysis it was found that chlorophyll a increases with increasing total phosphorus levels, which was expected. This means that overall with more of the nutrient phosphorus, more algae growth occurred. More zooplankton per liter of water correlated to lower levels of chlorophyll a which can be explained in that lakes that have higher populations of zooplankton have fewer algae. This was also expected because more zooplankton could mean more herbivorous zooplankton and more herbivory on the algae.

•There was a significant relationship between the ratio of omnivorous and predaceous zooplankton to herbivorous zooplankton versus the chlorophyll a levels in each lake. It can be observed that with a higher ratio of omnivores to herbivores, the chlorophyll a content increased. This is because with a higher ratio of omnivorous zooplankton to herbivorous zooplankton, there is more predatory stress on the herbivore and a decreased population which would decrease the amount of algae grazed upon. Thus the algae and chlorophyll a levels experience an increase. *Daphnia* are believed to be the best grazers of algae, far exceeding the abilities of *Bosmina*. Therefore, the ratio of the abundance of *Daphnia* to the abundance of *Bosmina* was graphed against chlorophyll a levels and found that a higher abundance of *Daphnia* to *Bosmina* strongly correlates with lower levels of chlorophyll a.

•Acknowledgements: Andrew Brainard, Kim Schulz, Steph Figary