Phytoplankton and Alpine Lakes

Alpine lakes are delicate ecosystems for aquatic species, such as phytoplankton, resulting in increased susceptibility to chemical and climatic change. The most major events that predict phytoplankton growth in alpine lakes are temperature and precipitation. Droughts in the winter/spring snowfall months result in increased precipitation. Droughts in the growing season for phytoplankton. 2002 and 2012 were years of droughts but differed in the season of the drought, 2002 being a summer drought and 2012 being a spring/winter drought but an abnormally rainy summer.

Objectives

- Run and classify samples collected at Green Lake 4 between 2008 – 2013 for phytoplankton analysis.
- Interpret Green Lake 4 data from 2002 and 2012 to determine how seasonal droughts affect phytoplankton growth.
- Assist in sampling Green Lakes 1 and 4 for the 2015 season.

Methods

Field Sampling

Sampling begins as soon as the ice out occurs and is sampled weekly for 6 weeks.

- Grab samples are taken for chemical and biological analysis at the surface, 3 and 9 meters.
- Samples at 3 and 9 meters are collected using a Wisconsin net.
- Zooplankton is collected using a Van Dorn.
- Visibility is measured using a Secchi Disk.
- Photosynthetic active radiation (PAR) is measured using a LI-COR * Data Logger.
- pH, Dissolved Oxygen, Temperature, and Conductivity are measured using a YSI 550A.
- Readings are taken at every meter of depth until the deepest point of the lake ~12 meters.

Phytoplankton Analysis

Samples are stirred for 4 minutes at 150 rpm. 150 mL of sample is transferred to a centrifuge tube and left to be settled for 24 hours. After settling, the sample is concentrated to 30 mL by aspiration.

- Samples are run through the FlowCAM which takes pictures of cells and are stored into libraries.
- Pictures obtained by the FlowCAM are used to make filters to help classify each samples' cells into the proper taxa.

Results & Discussion

Graph 1 shows the average phytoplankton concentrations for varying years including the two drought years (2002 and 2012). The data shows the average concentration occurring in the lake's epilimnion, hypolimnion and as a whole. The summer drought of 2002 resulted in very high concentrations of phytoplankton at the epilimnion and as a whole. Whereas in 2012, compared to the normal precipitation years of 2004 & 2006, has a very low concentration, most likely due to rainy summer and the lake's low retention time.

Graphs 2 & 3 above show the composition of phyla of phytoplankton in Green Lake 4 in both drought seasons. The data shows that 2002 had primarily cyanophyceae being dominant and 2012 having chlorophyceae as the dominant phylum.

Conclusion

- Phytoplankton growth is greatly dependent on the amount of rainfall in the summer season.
- When retention time is greater phytoplankton concentration is increased at the epilimnion.
- Droughts have a major effect on the type of phytoplankton dominating the lake.

Future Work

- Studies are planned to be done looking at the interactions between zooplankton and phytoplankton.
- Comparative studies have started to be conducted in RMNP to see the effect of elevation on lake ecology.

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Figure 1: Map of Green Lakes Valley Colorado