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| **Freshwater Ecology - Lab #2 - Trophic dynamics assignment** **Biology 3371; Dr. Dirnberger;  Kennesaw State University** |

This lab assignment will be done as a worksheet rather than a formal lab report.  
[**Click here for help on how to crunch the numbers for this lab**](TrophicCalculations%20with%20PP.html)

**Observations:** Nutrient loading has long been known to affect primary productivity and phytoplankton standing crop in aquatic systems (a "bottom-up" effect).  Ecologist studying interactions between trophic levels have suggested that trophic levels higher than phytoplankton could also effect phytoplankton. For example, more piscivorous fish would decrease planktivorous fish, which in turn would increase zooplankton and thereby decrease phytoplankton (a "top-down" effect known as the "trophic cascade hypothesis").  Historical data on Allatoona indicates that productivity and phytoplankton vary dramatically over the lake, potentially providing a test of the top-down versus bottom-up hypotheses.

**Central Question:** Is spatial variation in phytoplankton abundance (as estimated by chlorophyll concentration) within Lake Allatoona better explained by bottom-up effects or top-down effects?

**Questions to answer and turn in via Turnitin.com:**

**Question #1 (*10 points*):**Calculate primary productivity from the data set (the location of this station was **Uplake**).  State your results in mg C/m2/d.  Here are the net Primary Production (in mg C/m2/d) ranges that define the following trophic states: 50-300 for oligotrophic, 250-1000 for mesotrophic, and >1000 for eutrophic.  Do some research on the internet (I suggest googling "Carlson's Trophic State Index" or use the chart in our lecture notes) to determine trophic state based on each of the following parameters: **phosphorus**, **secchi depth**, and **chlorophyll concentration**.  Were these indirect estimates of trophic state similar to the trophic state classification derived by calculating productivity directly?

**Question #2 (*20 points*):**Make two graphs from our data set to investigate two hypotheses below.  Provide a written interpretation of the graphs.  Which hypothesis, if either, is more strongly supported.  Provide an explanation for why this might be.

* Spatial patterns chlorophyll concentration over 4 sites is a function of the distribution of nutrients.
* Spatial patterns chlorophyll concentration over 4 sites is a function of grazing resulting from the distribution of zooplankton.

**Question #3 (*5 points*):**What other parameters (besides total zooplankton density and nutrient concentration) might you measure to help support your conclusion?  Explain.

**Question #4 (*5 points*):**From one of the papers on the top-down management that you discussed in the literature review lab, find an explanation for why top-down management effects may not be detectable.  Summarize the argument that the author(s) makes and cite the paper that this argument comes from.

**Question #5 (*5 points*):**When you plotted the zooplankton data above, did you use individuals/m2 or individuals/m3?  Explain why you choose that unit of zooplankton density.  Keep in mind that zooplankton migrate vertically over 24 hours, most phytoplankton do not.

**Question #6 (*5 points*):**Are trends among stations (from uplake to downlake) in **chlorophyll**, **fluorescence**, and **phytoplankton abundance** similar? Explain why or why not?

**Extra Credit (*3 points*)  Choose one of the follow:**

*How might knowing primary productivity levels at each of the four station be useful in examining whether zooplankton affect phytoplankton biomass?*

**or**

*How might using the large ratio of small versus large bodied plankton be used to test the trophic cascade hypothesis?*