SES: Methods in Microbial Ecology Fall 2017
Problem Set 8 (*Due 16 Nov 2017*)

1) List the measurement you were responsible for and plot its value for the two treatments versus time. Use day for the time axis unit and 11:05 am on 2 Nov 2017 as time zero; *use an Excel scatter plot, not a line or category plot*. **Email me your excel file with the RAW data, any equations and graph(s)** (i.e., please include all calculations). Obtain from your classmates the plots for the other measurements and include them in this problem set (you can put them in the directory: \\Diatom\ecoshare\SES\student access\Microbial Methods\Microcosm to share). Label the figures (numbers or letters) so that you can refer to them. Briefly, explain what happened (and WHY) in each treatment over the time course of the experiment as we did in class. Focus on explaining causal relationships between the various measurements, and how relationships compare between treatments. DO NOT just describe what happens with each measurement (that is what the graphs are for), but do include all measurements in your overall explanation of the experiment. All measurements may not be explainable due to problems that occurred. Email me your problem, or place it in my mailbox (**20** pts).

2) Briefly explain what we ***expected*** to occur in the two microcosms. Did the experiment work as was intended? Explain those components that did not go as expected.(10 pts)

3) If we had used glutamate (C:N ratio of 5:1) instead of glucose in treatment B, do you think the bacteria would still out compete the phytoplankton for nitrate? Please explain your answer. Note, assume the experiment worked as intended and excess phosphate was present (10 pts).

4) Say bacteria are consuming dissolved organic matter (DOM) at the rate of 20 μmol-C l^{-1} d^{-1}, and the DOM has a C:N ratio of 25:1. Assume that the bacteria have a growth efficiency of 30% and a C:N ratio of 5:1. Calculate the rate of dissolved inorganic nitrogen (DIN) consumption or production by the bacteria. Please state whether DIN is being consumed (i.e., immobilized) or produced (i.e., remineralized) by the bacteria. (10 pts)

5) A) Why is it considered paradoxical for phytoplankton to excrete dissolved organic carbon during growth? (5 pts) B) How might this paradox be resolved/explained? (5 pts).

6) Why were we not concerned about the dissolve organic carbon and inorganic nitrogen already present in the Woods Hole seawater affecting our experiment? (10 pts)

7) A) In treatment B of the microcosm experiment, the glucose concentration was adjusted to 450 μM-C. Why did we not use higher concentrations of glucose, such as 5000 μM-C? (Note, high glucose concentrations would lead to non-desirable results.) (5 pts) B) If the growth efficiency of the microbial loop organisms (i.e., bacteria, nanoflagellates, and ciliates) is very low, what will happen to the nitrate that is consumed by the bacteria in treatment B of the microcosm experiment? (5 pts)

8) A standard conversion factor between phytoplankton-carbon and Chlorophyll a is: 50 μg C (μg Chl a)$^{-1}$. Assuming the Redfield C:P ratio for phytoplankton, calculate the concentration of Chl a expected if all the added PO_4^{3-} had been consumed. How does this predicted value compare to that observed in each carboy? (10 pts)

9) In some years when this experiment is conducted (perhaps in this year too), we obtain results that differ from what we expect. Even though we conduct the experiment under the exact same conditions each year, how can it be that in some years we obtain very different results? Please explain your answer. (10 pts.)