

SES: Methods in Microbial Ecology, Fall 2011
Problem Set 6, Microbial Grazers
(Due 27 Oct 11)

- 1) From your incubation experiments, report: A) the average number of ciliates counted per field of view, B) the bacterial abundance (use week 2 DAPI count if you did not have time to conduct another count), C) the average number of 0.75 μm beads counted per ciliate. Calculate 1) the ciliate abundance (cells mL^{-1}), 2) the specific ciliate feeding rate (prey hr^{-1} ciliate $^{-1}$); make sure to account for “dilution” caused by bacteria. (10 pts)
- 2) A) Several of the methods to measure bacterial grazing rate (size fractionation, dilution, inhibitors) have the disadvantage of requiring long incubation times (order of days). Why are long incubations required? (5 pts) B) In the bacterial grazing experiment, why did we use 5 μm filters instead of 0.2 μm filters? (5 pts)
- 3) The mass balance equation for bacteria we discussed in class is given by,

$$\frac{dB}{dt} = \mu B - \phi G$$

where B is bacterial concentration, μ is their true specific growth rate, G is the concentration of the grazers, and ϕ is their specific grazing rate on bacteria. If the bacterial concentration does not change rapidly with time (i.e., $\frac{dB}{dt} \approx 0$), and their specific growth rate is of the order 5 d^{-1} , A) what does this equation tell you about the relative concentrations of bacteria versus grazers given the value you measured for ϕ for ciliates in part 2) of question 1? (8 pts). B) From all of your data in Question 1, does it appear that $\frac{dB}{dt} \approx 0$? (2 pts).

- 4) A) Explain how measuring bacterial specific growth rates in unfiltered and 0.8 μm filtered water can be used to obtain bacterial grazing rates? (8 pts) B) Why is the dilution technique superior to the 0.8 μm filtration method? (2 pts).
- 5) How are some ciliates able to conduct photosynthesis? (5 pts). B) Why don't copepods (i.e., the classic zooplankton) directly graze bacteria? (5 pts)
- 6) A) What are the two main discoveries that lead to the microbial loop conceptualization? (5 pts) B) What evidence was used in the Azam et al. paper to support the hypothesis that flagellates graze bacteria? (5 pts)?
- 7) What is one possible hypothesis for the increase in harmful algal blooms that is associated with eutrophication? (10 pts)

- 8) A) What is mixotrophy in the context of this week's lab? (5 pts) B) What does top-down and bottom-up control mean in food webs? (5 pts)
- 9) A) What requirement must be met for the microbial loop to provide significant amounts of carbon to zooplankton and higher trophic levels? (5 pts). B) What other function might the microbial loop provide to higher trophic levels? (5 pts).
- 10) A) What two processes control the concentration of bacteria in nature? (5 pts). B) Why is organism size so often used to characterize microbial food webs? (5 pts).