LAB 12 TROPHIC CHAIN DYNAMICS, 2

OBJECTIVES:

- Collect data from experimental microcosms
- Test data formally against original predictions
- Summarize data from entire class
- Infer conditions leading to stable or unstable ecosystem dynamics under these conditions

INTRODUCTION

Two weeks ago, we set up experimental two-species microcosms of *Platymonas* algae and brine shrimp (*Artemia salina*) to investigate how initial population densities of each species affects population dynamics over time. This week we will collect data from the experiment and test predictions. Review your hypotheses and predictions made with your group from two weeks ago.

EXPERIMENTAL PROCEDURE

1. With your group, recover your six experimental microcosm vials from your lab instructor. Examine each of them carefully and note your general observations of the vials in your lab notebook. Are your general observations consistent with your predictions? Do the vials seem different than when the microcosms were established? If so, how?

2. For each jar, count and remove living brine shrimp. Record these data in an appropriate table in your lab notebook, perhaps resembling something like Table 1 below. Compute the percentage change in brine shrimp in each vial and enter this number in your table.

3. Obtain a small amount of artificial sea water from your lab instructor. Use this to calibrate the spectrometers as we did previously during Lab 10. Review the procedure from Lab 10 for guidance or have another look at the YouTube instructional videos if needed (see lab 10).

4. After calibrating the spectrometer with a sea water blank, swirl one of the experimental microcosm vials to resuspend the algae. Using the micropipettor, carefully transfer 2 ml of the suspension into a clean cuvette. Wipe the clear plastic sides of the cuvette with a Kimwipe, place it into the spectrometer, being careful to align the clear sides of the cuvette with the light source. Use the coordinates tool to set the wavelength to $\lambda = 680$ nm, and record the absorbance in the table your lab notebook.

5. Repeat step #4 for the remaining experimental microcosm vials.

6. Calculate the algal concentration using the standard curve procedure outlined in Lab 10, and enter this into your data table.

7. Compute the percentage change in algal concentration for each of your experimental vials.

8. Calculate the mean percentage change in brine shrimp and algal concentration for each of your treatments. Also calculate the standard error for each treatment. Standard error is calculated as the standard deviation divided by the square root of the sample size (see Appendix A).

9. In your lab notebook, draw an appropriate graph of the mean percentage change in shrimp and algae for each of your treatments. Use the standard error as an estimate of variance for each treatment. Your lab instructor will provide you with the mean and standard error percentage change in algal concentration in the control treatment (no brine shrimp) to include with your graph.

10. Compare the percentage change in algal concentration among your treatments using a one-way ANOVA. Your lab instructor will provide you with the raw data from the control treatment vials to include with these calculations. You may use Excel or an online calculator to perform this test. Include the F-statistic value, the degrees of freedom, and the P-value from the ANOVA in your lab notebook. You may wish to include it in the caption to graph summary of your data.

11. Add your data to the class summary on the chalk board.

12. Write a paragraph in your lab notebook describing the patterns observed in your data. After all groups have finished their data collection, discuss the trends with the class and write another paragraph describing the patterns observed.

Table 1. Example of data collection table that you might use in your lab notebook.

Vial	Treatment	# brine shrimp (pre)	# brine shrimp (post)	% change brine shrimp	# algae cells/ml (pre)	# Algae cells/ml (post)	% change algae
1							
2							
3							
4							
5							
6							

QUESTIONS

1. Were your predictions supported? If not, how did the data differ from your predictions?

2. Is your initial hypothesis still valid? If so, what additional experiments could you perform to continue testing it? If not, reformulate a new hypothesis that is consistent with the data collected, and suggest at least one experiment that could test it.

3. Did any other student groups start microcosms with initial conditions similar to yours? If so, were their results similar or different than yours? If they were different, describe how they differed and what you think might have led to the disparity.

4. Did any of the micro-ecosystems “crash”? If so, which initial conditions seemed more likely to do so? What initial conditions seemed more likely to lead to ecosystem persistence?

5. In general, were algae populations more likely to increase or decrease in density in the microcosms? How did this change in algal density compare with the control treatments (with no brine shrimp) established by your lab instructor? What might explain the patterns you observed? Recall that the *Platymonas* is capable of rapid asexual reproduction within the experimental microcosms.

6. In reviewing the class data as a whole, does the initial density of brine shrimp appear to influence the final concentration of algae? If so, describe the patterns you observe. If not, how would you

explain the apparent lack of effect, given that brine shrimp are consumers of algae (consider the relative importance of top-down vs. bottom-up regulation of populations)?

7. Looking across all treatment combinations tested in the class, does the initial concentration of algae in the microcosms appear to influence the survival of brine shrimp? If so, what sort of patterns did you observe? If not, how might you explain the patterns you observed?

8. What results from this experiment were most surprising to you?

9. What are some of the advantages of using experimental microcosms to test the influence of species interactions on population dynamics over time? What are some of the limitations of using these models for understanding population regulation? How would you alter this experiment if you had the opportunity to do it again?

10. Write a paragraph in your lab notebook reflecting on this experiment and your overall conclusions regarding how initial population densities can affect population growth and decline, both in these simple two-species microcosms, but also more generally in natural and more complex ecosystems. Include in your paragraph what you learned from this project, and explain the connections between this experiment and activities in other portions of the class (such as lecture or readings).