ESSAY 3

Answers must be written out in paragraph form. Outline form is not acceptable. Labeled diagrams may be used to supplement discussion, but a diagram without a written explanation will not receive credit. You must cite the source of all outside information you include. Include the page number of information from the course textbook or the web address of information found online.

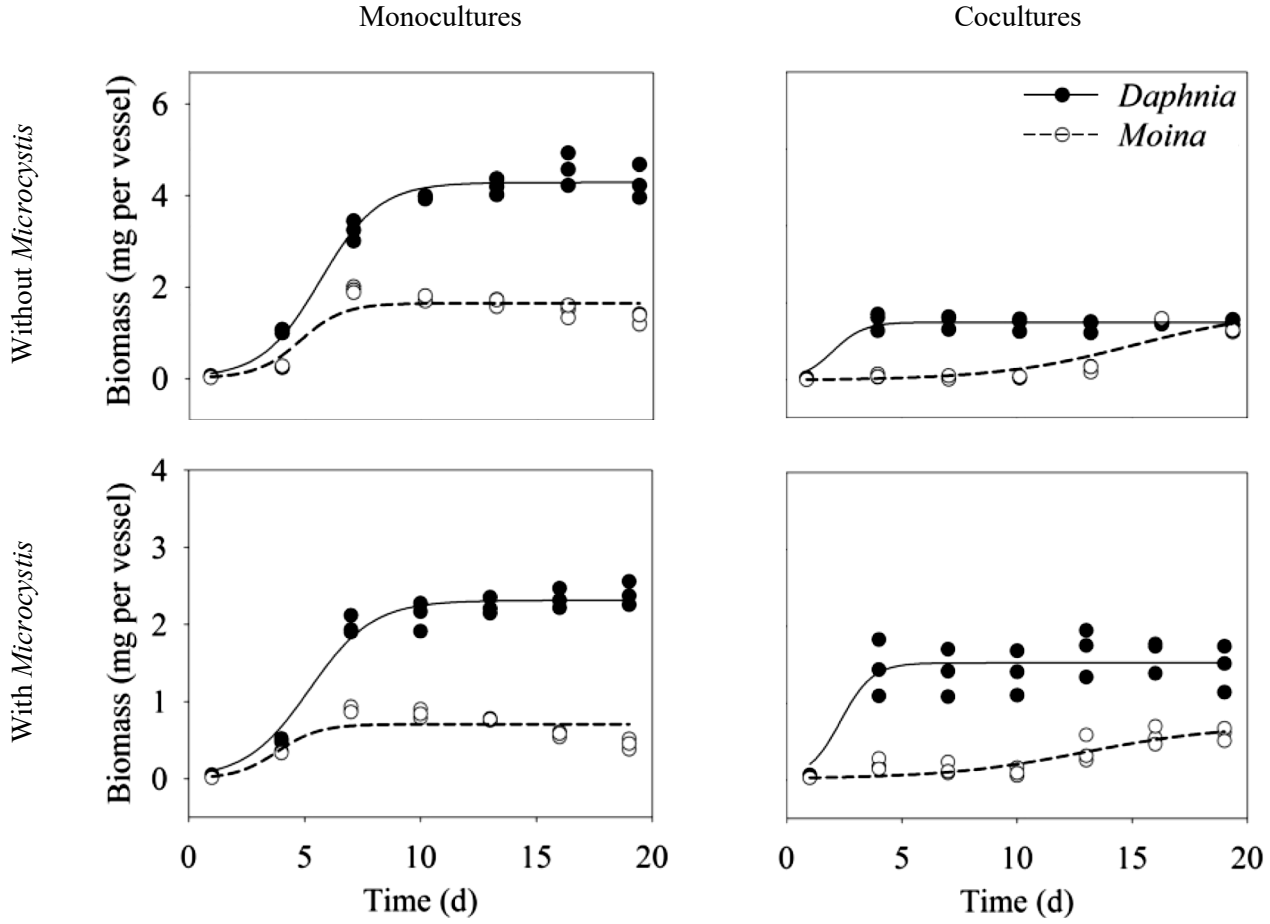

Figure 1. Population growth curves of *Daphnia similoides* and *Moina micrura* in monocultures and cocultures with and without *Microcystis aeruginosa* in the food source. Circles represent values from each of the three replicates on each day. Some of the data points overlap because they have almost identical values. Lines represent regression using a logistic model.

Cyanobacteria blooms occur with increased frequency and persistence due to the eutrophication associated with global warming. These aggravated blooms often lead to the production of toxic metabolites, including microcystins, which cause reduced fitness in zooplankton. In the context of an evolutionary arms race, selection for cyanobacteria-tolerant phenotypes occurs among zooplankton.

In an investigation into the effect of cyanobacteria blooms on interspecific relationships within the zooplankton community, the competitive responses between *Daphnia similoides* and *Moina micrura* zooplankton were evaluated in the presence and absence of the cyanobacterium *Microcystis aeruginosa* (Tang et al., 2017). Three groups of zooplankton taken from Taihu Lake in China were set up in separate 1-L beakers with 500-mL of liquid growth medium consisting of the green alga *Chlorella pyrenoidosa*: (1) 5 *Daphnia* grown alone, (2) 5 *Moina* grown alone, and (3) 5 *Daphnia* and 5 *Moina* grown together. The cultivation treatments were performed in triplicate, resulting in 9 beakers (3 *Daphnia* monocultures, 3 *Moina* monocultures, and 3 cocultures). The experiment was then repeated with a different liquid growth medium consisting of a mixture of *Chlorella pyrenoidosa* and *Microcystis aeruginosa*. The biomass of each beaker over 20 days is shown in Figure 1.

(a) **Identify** TWO factors that most likely limited the population growth of the *Moina* monoculture without *Microcystis*.

(b) **Identify** the dependent variable in the experiment. **Justify** the researchers' decision to represent the data using a regression model. **Explain** how analyzing the data from the coculture without *Microcystis* will increase the validity of the experimental results.

(c) **Estimate** the maximum biomass in $\frac{\text{mg}}{\text{vessel}}$ for the *Daphnia* monoculture with *Microcystis*. **Calculate** the biomass growth rate in $\frac{\text{mg}}{\text{vessel} \times \text{day}}$ of the *Daphnia* monoculture without *Microcystis* between days 5 and 10.

(d) **Provide TWO pieces of evidence** to support the claim that *Daphnia* and *Moina* compete for the same food source by comparing the carrying capacities AND the amount of time necessary to reach carrying capacity in the cultures without *Microcystis*. **Make a claim** about the ecological relationship between *Daphnia* and *Microcystis* when in the presence of *Moina*. **Provide support** for your claim.

Reference

Tang, H., Hou, X., Xue, X., Chen, R., Zhu, X., Huang, Y., & Chen, Y. (2017). *Microcystis aeruginosa* strengthens the advantage of *Daphnia similoides* in competition with *Moina micrura*. *Scientific Reports*, 7(1), 10245.