

Hixon, Mark A. and William N. Bronstoft. 1983. "Damselfish as keystone species in reverse: intermediate disturbance and diversity of reef algae." *Science* 220: 511-513.

Pre-discussion report. Due at the beginning of class, Tuesday, April 13.

1) Write thoughtful responses to *two* of the following questions. Responses should put ideas in your own words and should draw support both from the article and from your own knowledge and ideas.

- a) Hixon and Bronstoft used three treatments to test the effects of damselfish on coral reef algae. How did *species richness*, *species evenness*, and *species diversity* compare among the three treatments? Use data from the article and the figure to justify your answer. Based on these measures, which treatment showed the highest diversity? Why are different species of algae dominant in each of the three treatments? Be sure to explain how each treatment causes its effect. Suppose that a biologist wants to help algal diversity recover on a coral reef. Make a recommendation for how the biologist could promote high algal diversity on her reef.
- b) Hixon and Bronstoft suggest that damselfish act as a *keystone species* that maintains high algal diversity. How does the experiment described in this article compare with Paine's experiment using starfish, mussels, and barnacles that we discussed in class? Be sure to include at least two similarities and at least two differences. Identify an example of *competitive exclusion* and an example of *competitive release* in Paine's experiment that we discussed in class. Identify *two* examples of competitive exclusion and one example of competitive release in Hixon and Bronstoft's experiment.
- c) Hixon and Bronstoft claim that their results are also in agreement with the *intermediate disturbance hypothesis*. How do the data presented in Figure 1A and 1B support this claim? Figure 1A shows that the highest diversity was found in different treatments at different points in time. How do the authors explain this result? Explain how *keystone species* can contribute to the intermediate disturbance hypothesis.
- d) Sea otters have been suggested to be a *keystone species* in kelp forest ecosystems off the west coast of North America. The otters eat sea urchins, which eat kelp; without the otters, the kelp forests begin to disappear. How is this example similar to and different from the damselfish and starfish examples? Be sure to include at least one important similarity and at least one important difference. Given these three separate examples (damselfish, starfish, sea otters) come up with your own definition of keystone species. Be sure that your definition is broad enough to include these three examples, but narrow enough to exclude things that aren't keystone species. Make up an example of an imaginary keystone species that fits your definition.

3) Write one thoughtful question that you have about the article. Begin with a sentence or two that describes the context for the question (e.g., what the writer said, what you know about biology). Then ask a question that relates to the content of the article. Good questions will try to deepen your understanding of concepts, or will try to relate the content of the article to other ideas. The most interesting questions will be used to fuel our in-class discussion!