SA #16-17	Food Webs: "Biotic Community Portraits"

LOOKING BACK: In Chapter 16, we learned to characterize biotic communities by determining attributes such as *species richness*, *evenness*, *biodiversity*, and *community structure*. We learned in laboratory that it is not easy to restore a prairie community from an agricultural field. Even though some prairie species are catching hold, the restoration has a long way to go to match even the bikeway prairie remnant. What is it about a natural *biotic community* that makes it so complex and hard to "build?" What are the "threads" that attach to and draw so many species into relationship? What keeps one population from dominating? We will consider these questions in SA #16-17 through a study of *food webs*.

FORWARD: According to Molles (p. 419)"one of the most basic and revealing descriptions of community structure…is the food web, a "diagrammatic model" of the feeding interactions within a community. By studying these models of the *trophic structure* of communities, we will learn to appreciate even more of the complexity of natural communities and why it is essential that we conserve them.

READING: Textbook: Molles: Chapter 17, "Species Interactions and Community Structure" pages 419-438.

PROCEDURE: Before getting caught up in a "web" of details, read the three "Concepts" of Chapter 17 and the "Summary Concepts" on page 438. Then, skim the chapter and notice that each of the "Concepts" is fleshed out with one or more "Case Histories." The **Study Questions** below are grouped under the concepts and case histories. Write answers to them and come to class prepared to discuss what you have learned.

STUDY QUESTIONS: Arranged under each "Concept"; read pp. 393-397 and answer questions for Concept#1 for SA #16 (1st of 2 assignments):

Concept #1: A food web summarizes the feeding relations of a biotic community.

1. Why were Arctic islands chosen in the earliest attempts to "model" the food web of a community? What did Elton and others learn about complexity of food webs even there?

2. What was it about food webs such as that of Cano Volcan that caused Winemiller to focus on the "strongest trophic links?"

3. What is the *competitive exclusion principle* (see Ch. 13, page 327-28 ("Niches", and p. 332-333 on "Lab Models - *Paramecium*"). How did different parasitoids on *Phragmites* (reed grass) avoid competitive exclusion (Ch. 17, pp 422-423)?

4. What contribution did Tscharntke's *Phragmites*-supported food web on the Elbe River make to understanding community interactions?

Concept #2: The feeding activities of a few keystone species may control the structure of communities.

5. How did Paine reason that more predators might actually increase prey species richness?

6. What correlation did Paine find between species richness in intertidal pools and proportion of species that were predators?

7. Even though Paine found the above correlation true from subtropical (31° N at Gulf of CA) to the north temperate (49° N in Pacific NW), why was his hypothesis unconfirmed?

8. Describe Paine's approach to directly test his hypothesis by a manipulative approach. Did the results confirm his *keystone species* hypothesis?

9. How did Jane Lubchenko's manipulative experiments with the algae-eating snail, *Littorina*, illustrate the effect of consumers on algal species richness?

10. Large predatory fish in the Eel River in N. Calif. are carnivores but Mary Power demonstrated with her "river cages" that more predators means less algae. Please explain.

11. How do birds serve to increase growth of trees in Eureka, Missouri?

12. In view of the experiments presented above, what are *keystone species*? Distinguish *keystone* from *dominant species*.

Concept #3: Exotic predators can collapse and simplify the structure of food webs.

13. If predators are important keystone species in natural communities, how does the case history of Lake Victoria and Nile perch teach us that simply "adding a predator" does not add benefit to a biotic community? What *environmental factors* have also been implicated?

Concept #4: Mutualists can act as keystone species – See pages 434-435

14. How do the "services" provided by cleaner wrasse fish and seed-dispersing ants qualify them to be considered keystone species?

Applications to Game Hunting and Agriculture: See pages 435-438

15. Explain how the keystone species concept can be applied to properly understand and assess the effects of human on rain forest animals? As populations of animals are diminished, should we be more concerned about local extinction of some populations than others? Why?

16. Explain how the keystone species concept is being applied to agricultural pest control? How much would you need to know about a species before safely introducing it? Relate your answer to the concept of niche [see Ch. 13, page 327-328, "Concept Discussion – Niches"]

APPLICATION: In light of what you are learning about biotic communities and the complexity of food web relationships, return to your developing "environmental ethic" (SA #4) and add a few sentences to your original statement – e.g. What does "con-service" mean in light of you knowledge of "keystone species?"