Lab 11. Food Webs and Ecosystems: Which Member of an Ecosystem Would Affect the Food Web the Most If Removed?

Introduction

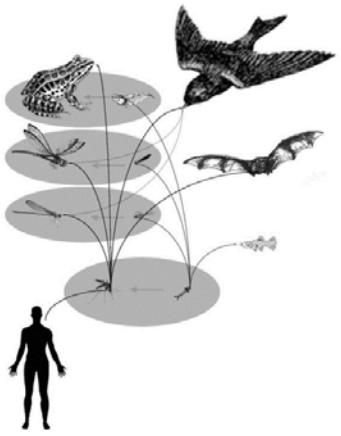
An *ecosystem* includes all the living and nonliving pieces of a particular area of the planet. Living things in an ecosystem must eat other living things in the ecosystem to get the energy they need to survive. The only organisms that do not have to eat other organisms for their energy are called *producers*. Producers are organisms that create their own food by harvesting energy from other sources, such as the Sun. Plants are the most common type of producers found in an ecosystem. If an organism is not a producer in an ecosystem, then it is considered a *consumer*. Consumers are organisms that have to eat other living things to get the energy they need to survive. Some consumers will eat only the plants in an ecosystem, some consumers will eat only other consumers, and still other consumers will eat both the plants and other consumers.

Different organisms have different energy needs, which will influence what food they eat. In any ecosystem, there can be multiple producers and types of consumers. One way that scientists try to understand these relationships in an ecosystem is through designing *food webs*. A food web is a diagram that models the feeding relationships in an ecosystem. It can also be considered the combination of all the unique *food chains* present in an ecosystem. Food chains are models that represent the eating relationship among a group of organisms present in an ecosystem. There can be many food chains present in a single ecosystem. One species of organism can be involved in multiple food chains. Food webs help show all the individual food chains operating in an ecosystem and how they overlap.

Figure L11.1 provides an example of a food web. Notice how each organism has line arrows pointed into them and other line arrows coming out from them. A line with an arrow coming out of an organism indicates what that organism eats; in contrast, a line with an arrow pointing into an organism indicates that the organism is eaten by the organism at the other end of the line. Also notice how one type of organism in the food web can be a food source for several other organisms in the same ecosystem.

FIGURE L11.1

Example of a food web diagram, showing the eating relationships in an ecosystem



By understanding the food web of a certain ecosystem, scientists can also understand the impact human activity can have on that ecosystem. There are many situations in which humans try to remove a certain type of organism from an ecosystem, often for reasons involving public health or managing resources. Humans can add chemicals to an ecosystem that can get rid of certain plants or insects from an ecosystem. They can also hunt larger organisms that may be a higher-level organism in an ecosystem's food web. However, eliminating one type of organism from an ecosystem will have an impact on other organisms in that system.

Your Task

Explore the different roles of organisms in a specific ecosystem. A town has to decide which organism it should remove from its local ecosystem, which includes a swampy marsh. Many residents are worried about the mosquitoes that heavily populate the marsh. Others are concerned with the growth in algae and other weedlike plants in the marsh. Still other residents believe that the ducks in the marsh are a problem and should be hunted. Removing any one of these organisms, or others present in the marsh, will change the food web of the ecosystem. Your investigation should determine which organisms the town should remove to limit the amount of change to the existing food web.

The guiding question of this investigation is, **Which member of an ecosystem would affect the food web the most if removed?**

Materials

You will use slides of marsh ecosystem organisms during your investigation.

Safety Precautions

Follow all normal lab safety rules.

Investigation Proposal Required? ☐ Yes ☐ No

Getting Started

Your teacher can provide you with a copy of slides that have information about the different organisms in the marsh ecosystem. Use these slides to analyze what changes might occur to the original food web for the marsh when any one of the organisms is removed from it.

To answer the guiding question, you must determine what type of data you need to collect, how you will collect it, and how you will analyze it. To determine *what type of data you need to collect*, think about the following questions:

- What information on the slides relates most to the food web of the marsh?
- How will you represent the data you use in different ways?
- What type of measurements or observations will you need to record during your investigation?

To determine *how you will analyze your data*, think about the following questions:

- How will you understand what the current food web looks like?
- Do you need to analyze all the different organisms, or should you focus on types of organisms?
- What type of graph could you create to help make sense of your data?

Connections to Crosscutting Concepts, the Nature of Science, and the Nature of Scientific Inquiry

As you work through your investigation, be sure to think about

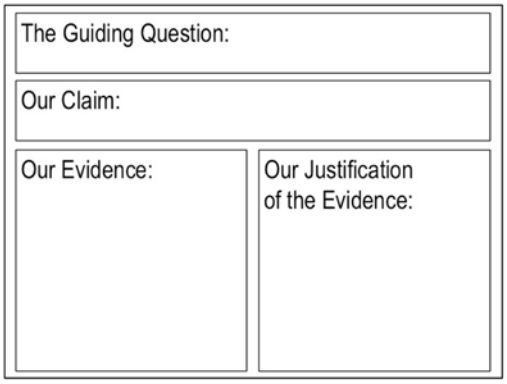
- the use of models to study systems,
- how tracking the flow of energy and matter through systems allows scientists to understand these systems,
- how science is influenced by society, and
- the role of imagination and creativity when solving problems in science.

Initial Argument

Once your group has finished collecting and analyzing your data, you will need to develop an initial argument. Your argument must include a claim, evidence to support your claim, and a justification of the evidence. The claim is your group's answer to the guiding question. The evidence is an analysis and interpretation of your data. Finally, the justification of the evidence is why your group thinks the evidence matters. The justification of the evidence is important because scientists can use different kinds of evidence to support their claims. Your group will create your initial argument on a whiteboard. Your whiteboard should include all the information shown in Figure L11.2.

FIGURE L11.2

Argument presentation on a whiteboard



Argumentation Session

The argumentation session allows all of the groups to share their arguments. One member of each group will stay at the lab station to share that group's argument, while the other members of the group go to the other lab stations one at a time to listen to and critique the arguments developed by their classmates. This is similar to how scientists present their arguments to other scientists at conferences. If you are responsible for critiquing your classmates' arguments, your goal is to look for mistakes so these mistakes can be fixed and they can make their argument better. The argumentation session is also a good time to think about ways you can make your initial argument better. Scientists must share and critique arguments like this to develop new ideas.

To critique an argument, you might need more information than what is included on the whiteboard. You will therefore need to ask the presenter lots of questions. Here are some good questions to ask:

- What did your group do to collect the data? Why do you think that way is the best way to do it?
- What did your group do to analyze the data? Why did your group decide to analyze it that way?
- What other ways of analyzing and interpreting the data did your group talk about?
- Why did your group decide to present your evidence in that way?
- What other claims did your group discuss before you decided on that one? Why did your group abandon those other ideas?
- How sure are you that your group's claim is accurate? What could you do to be more certain?

Once the argumentation session is complete, you will have a chance to meet with your group and revise your original argument. Your group might need to gather more data or design a way to test one or more alternative claims as part of this process. Remember, your goal at this stage of the investigation is to develop the most valid or acceptable answer to the research question!

Report

Once you have completed your research, you will need to prepare an investigation report that consists of three sections that provide answers to the following questions:

1. What question were you trying to answer and why?
2. What did you do during your investigation and why did you conduct your investigation in this way?
3. What is your argument?

Your report should answer these questions in two pages or less. The report must be typed and any diagrams, figures, or tables should be embedded into the document. Be sure to write in a persuasive style; you are trying to convince others that your claim is acceptable or valid!