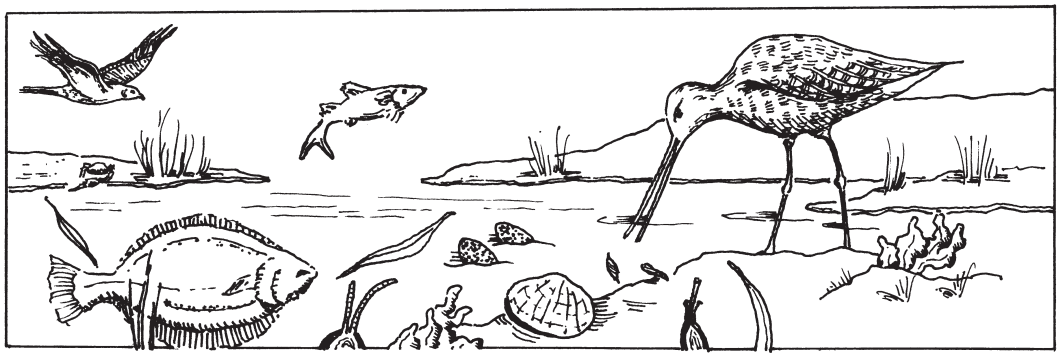


Activity #5: Food Webs

Objectives:

To understand the interactions between organisms living in an environment, and how energy flows from one organism and trophic level to another.

Time:

One - two 55-minute class periods.

Background:

For the most part, energy enters an environment from the sun, is converted to usable energy by the primary producers, and flows through each trophic level to primary consumers, secondary consumers, etc. As the energy moves from one trophic level to another, about 90% is lost as heat to the atmosphere. This means each trophic level has about 10% of the energy available to it than the one below it, and therefore usually has fewer organisms, or at least less production.

Because of the need for energy, populations are dependent on their prey. If a disturbance occurs in one population level, it will have consequences for all predators of that organism, and for all other trophic levels above it and below it.

This activity will help students understand this ripple effect when a population's size changes.

Materials:

Students need to have a notebook or journal to take notes, and art supplies such as construction paper, markers, and colored pencils.

Procedure:

1. Divide students into six groups. Assign each group a habitat of the Tijuana Estuary - beach, coastal sand dune, salt marsh, mud flat, riparian, and upland. Ask students to write down all of the organisms they can think of that might live in their assigned habitat. Each group should produce a list of at least 12 - 15 organisms, and should name specific organisms rather than groups of organisms, such as "cord grass" rather than "plants," or "Least Tern," rather than "birds". Students should use this estuary guide, other books, and/or the internet to find organisms that live in their Tijuana River Estuary habitat.

2. Each group of students should arrange their organisms into trophic levels:
   Primary producers - plants
   Primary consumers - things that eat plants
   Secondary consumers - things that eat the things that eat plants
   Tertiary consumers - things that eat secondary consumers
   Detritivores/scavengers - things that decompose organic matter
   If the students aren't sure into which category a certain organism belongs, they should use their best guess.

3. Display a food pyramid on an overhead, and tell students to make a poster of a food pyramid using their group's organisms. Each group should present their poster to the class. Discuss whether each trophic level contains the correct organisms.

4. Explain the difference between a food pyramid and a food web. A food pyramid doesn't show accurately what each organism eats, and therefore can't show the actual flow of energy through an environment. Demonstrate to the students how to construct a food web from a food pyramid.

5. Each student should construct a food web using their group's food pyramid. Arrows should be used to show the direction of the flow of energy. For example, a cricket eats plants. The arrow should point from the plant to the cricket.

6. Students will complete the questions at the end of the student sheet for this activity.

7. Student's food webs can be used in Activity #6: Constructing a virtual habitat.

<u>Answers to student questions</u>:

1. Pick one of your organisms from trophic level one, and one of its predators from troph ic level two. Explain what would happen to the organisms from trophic level two if all of the organisms you have chosen from trophic level one died.
   The organisms from trophic level two would have to adapt by eating other organisms, or they would die. In either case, their population numbers would decrease.

2. Using the organism you chose from trophic level two, pick a predator of that organism from trophic level three. What would happen to the level 2 organism if the population of the level 3 organism suddenly doubled? What would then happen to the level 1 organism?

   If the organism from level 3 doubled, there would be more predation of level 2 and the population of level 2 would decrease. This would cause less predation of level 1, and the population of level 1 would increase.

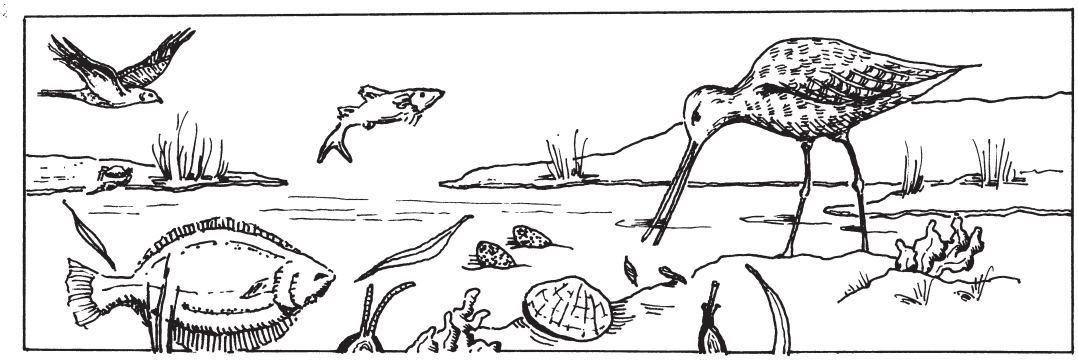
3. Select two separate level 3 organisms. Explain what would happen to all other organisms in your habitat if these two populations died?

   Answers will vary, but students should understand that the death of predators means an increase in the prey population, which causes a decrease in that population's prey.

4. A ship from China has docked in the San Diego Bay. An herbivorous organism had gotten into the ship's water supply in China, and was accidentally released into the bay while the ship was docked. The organism eventually made its way into the Tijuana Estuary and began to eat specific vegetation. However, there are no predators of this organism that live in the estuary or in San Diego Bay. What would happen to the plant(s) that are now being eaten by this new organism in the estuary? What would happen to the population size of this organism in the estuary? How do you think the organism could be brought under control?

   Students should understand that the plants being eaten by the new organism are in danger from this new predator. Since there are no natural predators of the organism in the estuary, the population of the organism will increase out of control, further endangering the plants.

5. Write a short essay (2 - 3 paragraphs) explaining why each organism is important to an environment.



Activity #5: Food Webs

PURPOSE:

After completing this activity, you will understand the interactions between organisms living in an environment, and the flow of energy from one trophic level to another.

Time:

One - two 55-minute class periods.

INTRODUCTION:

For the most part, energy enters an environment from the sun, is converted to usable energy by the primary producers, and flows through each trophic level to primary consumers, secondary consumers, etc. Some environments, such as deep sea hydrothermal vents and cold seeps, also have primary producers that convert usable energy from chemicals into organic matter. These are primary producers use chemosynthesis rather than photosynthesis. In the Tijuana Estuary, however, we will only consider the primary producers who use photosynthesis to fix energy into organic molecules.

As the energy from the primary producers moves from one trophic level to another, which occurs when predators eat their prey, about 90% is lost as heat to the atmosphere. This means each trophic level has about 10% as much energy available to it a the one below it, and therefore must have fewer organisms or less production of organic molecules.

Because of the need for energy, populations are dependent on their prey. If a disturbance occurs in one population level, it will have consequences for all predators of that organism, and for all other trophic levels above it.

This activity will help you understand this ripple effect when a population's size changes.

MATERIALS:

Students need to have a notebook or journal to take notes, and art supplies such as construction paper, markers, and colored pencils.

PROCEDURE:

1. Your teacher will assign your group a habitat of the Tijuana River Estuary. Working in your groups, write down all of the organisms you can think of that might live in this habitat. You should produce a list of at least 12 - 15 organisms, and should name specific organisms rather than groups of organisms, such as "cord grass" rather than "plants," or "Least Tern," rather than "birds." You may use the estuary guide, other books, and/or the internet to find organisms that live in your assigned Tijuana River Estuary habitat.

2. Once your list is complete, arrange your organisms into trophic levels:
    a. Primary producers - all of the plants (at least 4 different ones)
    b. Primary consumers - all of the things that eat plants (at least 3 different ones)
    c. Secondary consumers - all of the things that eat the things that eat plants (at least 2 different ones).
    d. Tertiary consumers - all of the things that eat secondary consumers (one or two)
    e. Detritivores/scavengers - all of the things that decompose organic matter in the estuary (one or two).

    If your group isn't sure into which category a certain organism belongs, use your best guess. You should have at least 3 organisms in each category.

3. Make a poster of a food pyramid using your group's organisms. Be prepared to present your poster to the class.

4. Each student in your group should construct a food web using the group's food pyramid. Draw arrows between organisms to show the direction of the flow of energy. For example, a cricket eats plants. The arrow should point from the plant to the cricket.

5. Complete the questions for this activity.

QUESTIONS:

1. Pick one of your organisms from trophic level one, and one of its predators from trophic level two. Explain what would happen to the organisms from trophic level two if all of the organisms you have chosen from trophic level one died.

2. Using the organism you chose from trophic level two, pick a predator of that organism from trophic level three. What would happen to the level 2 organism if the population of the level 3 organism suddenly doubled? What would then happen to the level 1 organism?

3. Select two separate level 3 organisms. Explain what would happen to all other organisms in your habitat if these two populations died?

4. A ship from China has docked in the San Diego Bay. An herbivorous organism had gotten into the ship's water supply in China, and was accidentally released into the bay while the ship was docked. The organism eventually made its way into the Tijuana Estuary and began to eat specific vegetation. However, there are no predators of this organism that live in the estuary or in San Diego Bay. What would happen to the plant(s) that are now being eaten by this new organism in the estuary? What would happen to the population size of this organism in the estuary? How do you think the organism could be brought under control?

5. Write a short essay (2 - 3 paragraphs) explaining why each organism is important to the environment it lives in.