Peregrine Falcon Food Chain

Summary:
Students create a food chain for the Peregrine Falcon that includes the effects of a pesticide (DDT) on the food chain.

Learning Objective:
Students will:

1. place the Peregrine Falcon in a food chain.

2. turn the Peregrine Falcon food chain into a food pyramid.

3. learn how pesticides, such as DDT, build up (bioaccumulate) in the Peregrine Falcon food pyramid.

4. consider how to prevent making mistakes similar to the one that almost caused the extinction of the Peregrine Falcon.

Activity 8


Photo: Richard k

Materials: Student copies of Peregrine Falcon Fact Sheet, student copies of Peregrine Falcon Food Pyramid Worksheet, and a red marker or pencil crayon for each student

Location: Indoors

Time required: 2 classes

Background Information:

The Peregrine Falcon has always been a rare species in New Brunswick. Before 1950, scientists believed that there were only a handful of pairs, nesting mainly along the Fundy coast in summer and migrating to the southern US and Central and South America in winter. During the mid 1950's, this majestic bird of prey all but disappeared from the Maritime Provinces and other areas of North America. The cause was DDT, a pesticide used widely throughout North America in both the nesting and wintering grounds of this species.

Pesticides, including herbicides, fungicides, and insecticides, are made to control certain organisms. Herbicides control unwanted weeds, fungicides kill unwanted fungi, and insecticides control pest insects. When these substances contain chemicals that do not break down easily, they eventually build up or accumulate in nature. Pesticides can build up in a water or food source used by wild animals and humans. The full effects of a pesticide such as DDT are only realized after many years of use.

In New Brunswick, and in many other places where Peregines were found, DDT was used throughout the 1950's and 60's to kill the spruce budworm and other pests. Chemicals such as DDT travelled up the food chain through insects to their predators, eventually reaching top predators like the Peregrine Falcon. The higher up in the food chain an animal is, the greater the amount of pesticides that will build up in its tissues. As a result, concentrated toxins were ingested by the Peregrine Falcon with each pesticide-contaminated meal.

Curriculum Links:

Classify organisms according to their role in a food chain or web, and draw a diagram to illustrate the food chain.

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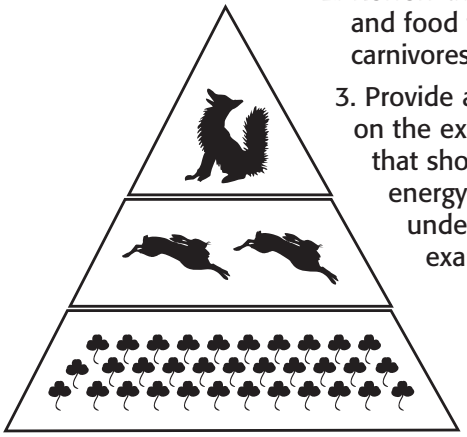
The use of the pesticide DDT didn't kill the Peregrine Falcon directly, but affected the Falcon's ability to reproduce. Sometimes, it prevented the female from laying eggs. Sometimes, it caused such thin shells in the eggs that they broke under the mother's weight in the nest (incubation).

In the late 1960s and early 1970s, use of DDT was either banned or restricted across North America. This ban, together with captive breeding and release programs, re-established Peregrine Falcon populations. Birds were obtained from falconers, raised in a central facility in Wainwright, Alberta, and shipped to areas where they had disappeared. After several years of carefully rearing and releasing birds, the species has come back in NB and other areas in eastern North America. This is one of the most successful recovery stories for species-at-risk.

DDT is still a threat to the Peregrine Falcon, since it continues to be used in some Central and South American countries where Peregrines spend the winter. DDT affects Peregrines that migrate to areas where it is still used. Other pesticides currently in use may also pose a threat to birds of prey such as the Peregrine Falcon.

Activity:

1. Explain the background information to the class. Have students read their copies of the Peregrine Falcon fact sheet.
2. Review the concept of a food chain. A food chain is the pathway of energy and food through an ecosystem that begins with plants and ends with carnivores. It shows who eats whom.

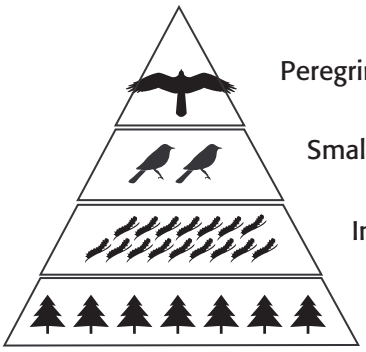


3. Provide a sample food chain, such as clover plants > rabbits > fox. Elaborate on the explanation to turn it into a food pyramid. A food pyramid is a diagram that shows the passing of energy from one organism to the other, with the energy always moving upward. A food pyramid is a good visual way of understanding the concepts behind a food chain. Explain the illustrated example of the food chain and pyramid.

In this example, energy is transferred upward through three levels of the food pyramid: from the sun to the clover plants, from the clover plants to the rabbits, and from the rabbits to the fox.

4. Distribute the Peregrine Falcon Food Pyramid Worksheet. Students will begin by making a food chain using the following organisms: plants, insects, smaller birds, and Peregrine Falcon.

5. Using the Peregrine Falcon Food Pyramid Worksheet, have students start at the top of the pyramid, and work their way down. Ask students to estimate the amount each species might eat on a given day. For example, how many insects would a small bird eat each day? Whatever amount students select should be drawn in as individual species in their food pyramids. There is no exact answer, but students can be reminded to be as realistic as possible.



Peregrines feed on small birds contaminated with DDT

Small birds feed on insects contaminated with DDT;

Insects feed on trees contaminated with DDT;

Trees and plants in forests or agricultural fields are sprayed with the pesticide DDT;

Make sure that students draw each of the species they estimate at each level of the food pyramid, as well as lines showing meals, for example which birds ate which insects.

6. Ask the students to identify each level as consumer, producer and decomposers.

Optional Activities:

7. Review the concepts of bioaccumulation and DDT. ***Bioaccumulation is the concentrating of substances, like DDT, in the food chain. It results from organisms repeatedly eating other organisms that contain amounts of the toxin. The higher up in the food pyramid that a species is, the greater the concentration of toxins.***
8. Using the Peregrine Falcon Food Pyramid Worksheet and the species already illustrated at each level, students will learn how DDT affected Peregrine Falcons. Tell students to assume that 1/3 of all the plants in their pyramid contained one unit of DDT. Circle the DDT affected plant species in red.
9. Following the lines already drawn by students, connect the insects to the plants and circle any DDT affected insects. If any insect ate more than one DDT affected plant, two or more units of DDT can be represented by drawing red circles next to the insect.
10. For the small birds, follow the lines connecting them to their prey insects. Show multiple units of DDT in small birds by drawing red circles next to the birds.
11. Then, calculate the total units of DDT that have accumulated in the Peregrine Falcon by counting the red circles.

Discussion

- Ask students how many units of DDT they think the Peregrine Falcon can handle without showing the negative effects of this accumulation.
- Ask students what happened when there was a large number of each species in the food chain? What happened when there was a small number of species in the food chain?
- Why doesn't the DDT disappear as energy is transferred from one species to the other in the food pyramid?
- Review the term "bioaccumulation". How does bioaccumulation affect the Peregrine Falcon?
- What else might bioaccumulate in the Peregrine food chain?

Variations:

1. Consider what would happen if there was one less, or one more, level in the Peregrine Falcon food pyramid.

Peregrine Falcon Food Pyramid Worksheet

Student Name: _____

A. Food chain

Make a food chain and put the following organisms in their correct place within the chain: plants, Peregrine Falcon, small birds and insects

_____ → _____ → _____ → _____

B. Food pyramid

Use the species in the food chain to make a food pyramid, starting at the top. Calculate the numbers of species that each would eat, working down the pyramid. Make sure that there is only one individual at the top of the pyramid.