

Subject Areas

Science

Duration

One class period

Additional time required if
research component is utilized

Setting

Classroom

Skills

Interpreting, simulating, analyzing,
applying, comparing, inferring

Charting the Course

The demise of the osprey and other birds of prey is an integral component of the story that describes the Down Jersey region. In fact, specific reference is made to the osprey and the efforts of Citizens United directly in the film when an osprey platform is shown being erected on the Maurice River.

Vocabulary

Bioaccumulation, biodegradable,
biomagnification, food chain, food web,
trophic level

Correlation to NJ Core Curriculum Content Standards

Science

5.1 (4, 5, 7)

5.6 (6, 11)

5.12 (1, 2, 3, 4, 7)

Biomagnification

■ Objectives

Students will be able to:

1. Understand how and why poisons in the environment accumulate in organisms higher in the food chain

■ Materials

Modeling clay in assorted colors or 16 small Styrofoam balls in assorted colors

16 large clear bags

16 three-foot lengths of string

Toothpicks

23 students

■ Making Connections

Just like the rest of New Jersey's wildlife, in particular the birds of prey, those that live along the Delaware estuary are subject to the impacts of society. One of the most well known examples that typify human impact on wildlife is the effect of DDT, a widespread pesticide, on the fertility of birds of prey. Throughout New Jersey, peregrine falcon, osprey and bald eagle suffered severe loss in population due to the devastating impact of DDT in the food chain. This toxin built

up (bioaccumulated) in the fatty tissue of these birds and caused a decrease in their egg shell density. As a result, these birds experienced a dramatic increase in embryo mortality which led to these species becoming endangered. This problem was (and is) especially prevalent along the Delaware Bay and its tributaries from along the southern Bayshore since these areas harbor a significant proportion of the state's population of these birds. This is mostly due to the fact that substantial available habitats exist in the Down Jersey region for these magnificent creatures.

■ Background

The natural shoreline of the Delaware Bay has been changed drastically by humans, from forests and tidal wetlands to residential communities, industrial areas, ports, and cities. Human activity has also dumped pollutants of all kinds into the local waters from quickly biodegradable organic pollutants like sewage to non-biodegradable chemical pollutants like the pesticide DDT. This is a problem in estuaries, which, by nature, trap pollutants. Sewage and nutrient pollution result in algae blooms, low dissolved oxygen and pathogenic bacteria, but the effects are relatively short-term provided the source of pollution is eliminated. More refractory materials remain in the estuary for very long periods of time because they are not used up or degraded, and they are either buried as they bind with sediment particles and sink to the bottom, or they enter the



food web. Chemicals that initially enter the food web through air, water, or sediment will accumulate at one level of the food web. Water-soluble chemicals will accumulate in food webs until they reach a concentration in organisms that is in balance with the environment. Fat-soluble chemicals bind to fatty tissues in organisms as they are ingested. Because organisms at higher trophic levels must eat a large number of organisms at lower trophic levels to get enough food, these chemicals tend to become bioaccumulated in organisms' bodies as they get passed up the food chain.

■ Procedure

Warm Up

Talk about the demise of the birds of prey in New Jersey. If possible, view the film *Back from the Brink* available from the Endangered and Nongame Species program at (609) 292-9400.

Also, review the portion of the video *Down Jersey* that focuses on the osprey. Discuss with the students why the osprey is a threatened species in New Jersey. Why is it necessary to erect nesting platforms for them?

The Activity

1. Take a piece of string and attach a bag to the string so that it forms a pouch when tied around your waist.

2. Form the clay into small balls and allow these or the Styrofoam to represent different chemical pollutants. More advanced students with a background in chemical bonds and molecules should try to create a DDT molecule using the balls and the toothpicks to emphasize how complex the more refractory pollutants are.
3. Have the class divide into groups that represent organisms at different trophic levels. Because consumers must expend energy to obtain food and maintain their bodies, and because some food is lost as waste material, it takes more organisms at lower trophic levels to nourish organisms at higher trophic levels. The groups that represent organisms

at lower trophic levels should be larger. Have sixteen students represent zooplankton, four represent bluefish, two represent Atlantic Silversides and one represent an osprey.

4. Imagine that zooplankton have accumulated chemical pollutants in their bodies from filtering the water to eat phytoplankton. Each zooplankton at this point should have one or more different colored balls in his or her pouch.

Biomagnification

5. The zooplankton are then eaten by the Atlantic Silversides. All chemical pollutants that each zooplankton has accumulated in his or her body (pouch) gets passed on to the fish that has eaten him or her. The Atlantic Silversides now have all the pollutants in their bodies (pouches).
6. The Atlantic Silversides get eaten by the Bluefish, and the pollutants get passed on to them. Lastly, the Bluefish gets eaten by the Osprey, who now has accumulated **all** of the pollutants originally ingested by the zooplankton in its body.

Wrap Up

Think about the concept of a food pyramid. Discuss the different pathways by which energy is lost from one trophic level to the next (i.e., why larger organisms need to eat more smaller organisms to get the amount of food they need to survive, grow and reproduce.) Discuss how this influences biomagnification.

Have the colored balls represent the pesticide DDT. Have students research or read about how the biomagnification of DDT in food webs has affected birds. When the osprey has all the DDT in its body (pouch), discuss the plight of the osprey in the area of the Delaware estuary and in fact, all of New Jersey. What has been done to help alleviate these problems? How has the osprey made a comeback in the state and in particular, the Down Jersey region?

Action

Students could create a display/ bulletin board that explains the osprey (bird of prey) dilemma in New Jersey. How did these birds of prey become endangered? What is being done to manage their populations? For how long will we and our environment feel the effects of DDT?

Using the plans for building an osprey platform included, have the students have their own Osprey Tower Raising. Contact Citizens United and the NJDEP Endangered and Nongame Species Program for more information and how to get involved in local efforts to help these threatened birds.

Assessment

Participation in classroom discussions and simulation of bioaccumulation. Students could be asked to write a summary and definition of bioaccumulation. Include a diagram and a food web to illustrate how this occurs.

Extensions

See *Action* at left.

Resources

NJDEP, Endangered and Nongame Species Program
CN 400, Trenton, NJ 08625
(609) 292-9400

Wetlands Institute
1075 Stone Harbor Boulevard
Stone Harbor, NJ 08247
(609) 368-1211

E-mail at
www.wetlandsinstitute.org

