CONSERVE WILDLIFE
FOUNDATION OF NEW JERSEY

Deadly Links

NJ Core Curriculum Content Standards addressed: 5.1.D, 5.3.A, 5.3.B, 5.3.C, 5.3.D, 5.3.E

Objectives: After participating in this activity, students will be able to:

- Give examples of ways in which pesticides enter food chains
- Describe possible consequences of pesticides entering food chains.

Materials: white and colored drinking straws; pipe cleaners; poker chips, paper clips, or any other material that students can easily pick up (30 pieces per student is recommended in a proportion of two-thirds white to one-third colored pieces); one paperbag, cup, or other container per shrimp (approximately 18); food chain ID cards (one for each student – for a class of 26 students: 2 bald eagles, 6 flounder, 18 shrimp)

Vocabulary: pesticide, insecticide, herbicide, food chain, accumulate, toxic, chemicals, organic, in-organic

Procedure:

1. Tell the students that this is an activity about "food chains." If they are not familiar with the term, then spend some time discussing it. (food chain = a sequence or "chain" of living things in a community, based on one member of the community eating the member above it, and so forth; e.g. crustaceans like shrimp eat phytoplankton or zooplankton, flounder eat shrimp and other crustaceans, and bald eagle eat flounder.

2. Divide the students into 3 groups. In a class of 26 students, there would be 2 bald eagles, 6 flounder, and 18 shrimp/crustaceans. (Work with approx. 3 times as many flounder as bald eagles, and 3 times as many shrimp as flounder). Provide each student with an ID card. (You can also eliminate the ID cards to make it more interesting).

3. Hand each shrimp a small paper bag or other small container. The container represents their stomach of whatever animal is holding it.

4. Distribute all the "food" (poker chips or any other material that can be picked up) in a large open space.

5. Give students these instructions: The shrimp will be the first to go looking for "food." The flounder and bald eagles are to sit quietly on the sidelines watching the shrimp (after all, the flounder and bald eagles are predators, and they watch their prey!)

    a. At a given signal, the shrimp are allowed to enter the area and collect food and place the food in their stomachs (the paper bags). The shrimp should move quickly to gather food. At the end of 30 seconds, the shrimp should stop collecting food.

b. The flounder are now allowed to hunt the shrimp. The bald eagles are still on the sidelines quietly watching. The amount of time available to the flounder to hunt shrimp should take into account the size of the area in which you are working. In a classroom, 15 seconds should be enough. On a large playing field, 60 seconds may be better. Each flounder should have enough time to catch one or more shrimp. Any shrimp caught by a flounder – that is tagged or touched by the flounder, must give its bag of food (its stomach) to the flounder, this simulates the shrimp being eaten by the flounder. The shrimp is then to go and sit on the sideline.

c. The next time period (from 15 to 60 seconds) is time for the bald eagle to hunt food. The same rules follow. Any flounder still alive may hunt for shrimp; any shrimp still alive can eat phytoplankton (or "chips"). If a bald eagle catches a flounder, the osprey gets the food bag(s) and the flounder moves to the sidelines. At the end of the designated time period, ask all the students to come together in a circle, bringing their food bags with them (if they have them).

6. Ask the students who are "dead," having been eaten, to identify what animal they are and what animal ate them. (If the students are labeled, this will be obvious). Next ask the animals that are still alive to empty their food bags (their "stomachs") onto the floor and have them count the number of food pieces that they have. They should count the total number of white food pieces and total number of multi-colored food pieces that they have in their "stomachs." List any shrimp left and the total number of white and multi-colored pieces each has; list the number of flounder left and the number of white and multi-colored pieces each has; and finally list the bald eagles and the number of white and multi-colored food pieces each has.

7. Inform the students that there is something called a "pesticide" in the environment. This pesticide was sprayed into the environment. This pesticide is one that is poisonous, accumulates in the food chain and stays in the environment for a long time. In this activity, all of the multi-colored food pieces represent the pesticide. All of the shrimp that were not eaten by the flounder are now dead if they have any multi-colored food pieces in their food supply. Any flounder for which half or more of their food supply was multi-colored pieces would also be considered dead. The one bald eagle with the highest number of multi-colored pieces will not die at this time; however, it has accumulated so much of the pesticide in its body that the egg shells produced by it and its mate during the next nesting season will be so thin that the eggs will not hatch successfully. The other bald eagles are not visibly affected at this time.

8. Talk with students about what they just experienced in the activity. Ask them for their observations about how the food chain seems to work and how toxic substances can enter the food chain, with a variety of results. The students may be able to give examples beyond those of the shrimp-flounder-bald eagle food chain affected by the pesticide in this activity.

Adapted from: Project WILD, Deadly Links, p. 270. 1992 Western Regional Environmental Education Council.

Background info about bald eagles decline and subsequent restoration in New Jersey

Long before the introduction of the pesticide dichloro-diphenyl-trichloroethane, commonly known as DDT, after World War II, habitat destruction, shootings, and poisonings had greatly reduced the population of bald eagles in the lower 48 states. But the widespread use of DDT exacerbated the decline of bald eagles as well as many other birds of prey. DDT is a pesticide that was regularly used for mosquito control from the mid-1940s to the mid-1960s. Initially thought to be harmless, DDT was

later linked to devastating population declines in several bird species, including the bald eagle, peregrine falcon, and osprey. Once introduced into the environment, the concentration of DDT increased at each level of the food chain – a term known as "biomagnification." In top-level predators such as the bald eagle and other raptors, DDT had accumulated at levels high enough to impact reproduction. DDT, which prevents adequate calcium absorption, caused eggshell thinning in contaminated birds. So when the adults began incubating these thin-shelled eggs, the eggs would crack under the weight of the adults and cause the eggs not to develop. The egg shells were documented to be up to 23% thinner than normal pre-DDT eggshells.

In New Jersey, DDT was heavily used, in part for mosquito control. By 1970, only one eagle nest remained in the state. The use of DDT was banned in New Jersey in 1968 and in the United States in 1972. The bald eagle was listed as endangered under New Jersey's new Endangered Species Conservation Act in 1974, and listed as federally endangered throughout the lower 48 states in 1978.

The number of nesting pairs of bald eagles in the state remained at one pair into the early 1980s. Management of the last remaining bald eagle nest (found at Bear Swamp in Cumberland County) began in 1982, when state biologists removed the egg for artificial incubation in a lab. As a result of residual DDT contamination, the Bear Swamp eggs were too thin to withstand normal incubation. The pair had failed to produce young for at least six consecutive years. Biologists incubated the egg with the help of chickens, who being lighter that adult eagles were able to incubate the egg without crushing it. Once hatched, the eaglet was cared for and then returned to the nest at 10 days old. The adult eagles quickly took over caring for the chick. Artificial incubation and fostering of chicks continued with success until 1989, when the female of the pair was replaced and the pair was able to hatch eggs on their own.

Increasing the production from a single nest, however, was not enough to boost the state's population in a reasonable period of time. Additionally, mortality rates are high in young eagles (as high as 80%) and reproduction does begin until about 5 years of age. So the state launched a hacking project that resulted in the release of 60 young eagles (primarily from Canada) into the heart of New Jersey's bald eagle habitat between 1983 and 1989. These efforts paid off rather quickly, with the appearance of the state's second eagle nest in 1988.

Since then, the number of eagle nests has increased steadily. In 2009, the number of active eagle pairs increased to 69. Recovery efforts – implemented since the early 1980's – have resulted in an exceptional recovery as New Jersey's eagle population has rebounded from the edge of extirpation.

In 2007, a major milestone was reached for bald eagles in the U.S. In recognition of the national resurgence in the eagle population in the lower 48 states, the federal government removed the bald eagle from its list of Endangered Species in August 2007. The U.S. Fish and Wildlife Service will oversee a 20-year monitoring period (through 2027) to watch for and investigate any problems that could compromise the eagle recovery. The bald eagle's official New Jersey status remains state-endangered, and state regulatory protection remains unchanged by the federal action.

Bald eagles in New Jersey continue to face many threats, with disturbance and habitat loss the greatest threats in our state. In addition, contaminants in the food web still negatively affect bald eagle nesting in some areas of New Jersey.