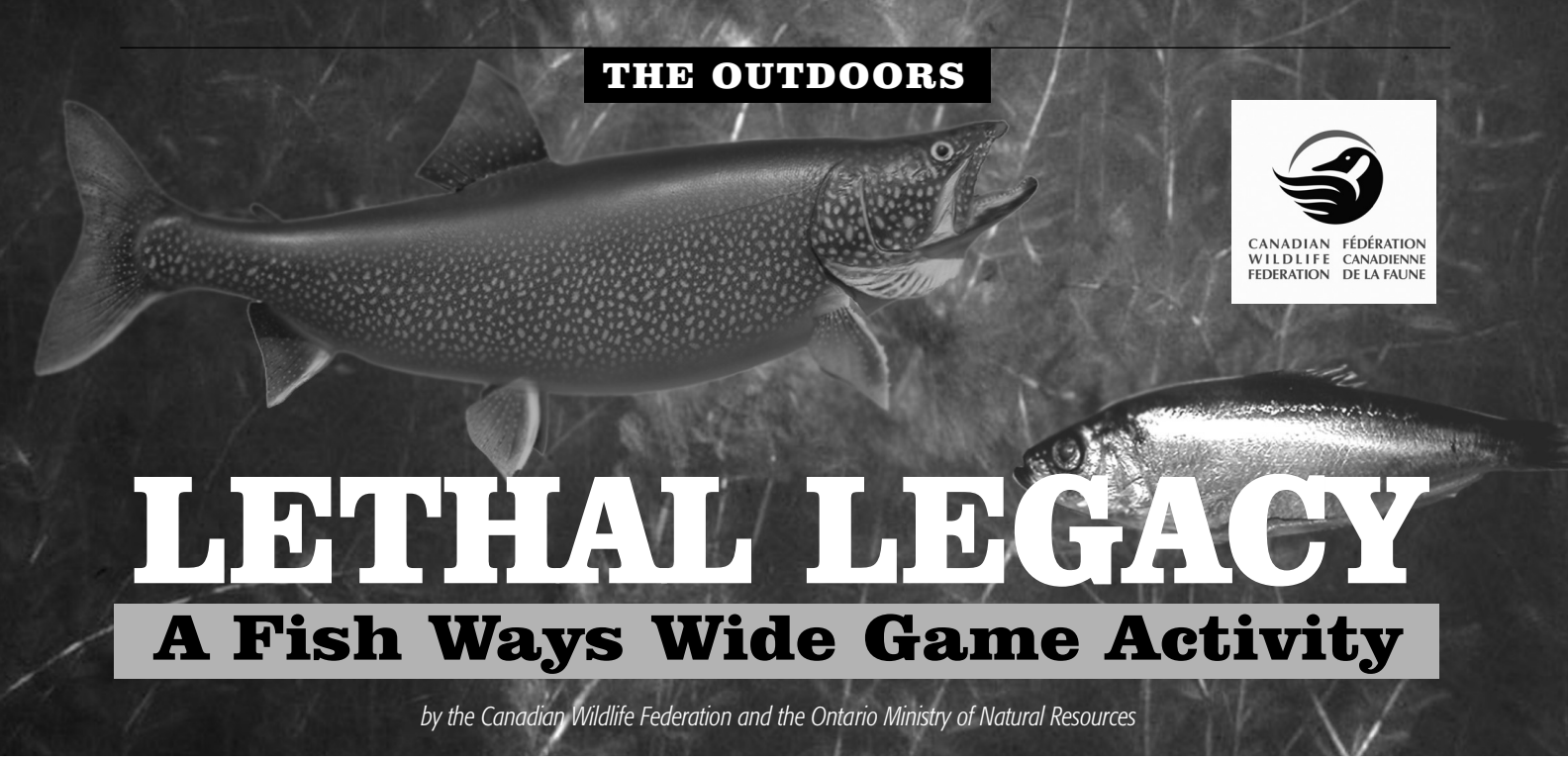

LETHAL LEGACY

A Fish Ways Wide Game Activity

by the Canadian Wildlife Federation and the Ontario Ministry of Natural Resources

Originally created for a school audience, this environmentally focussed wide game can easily be adapted for Scouting. Just substitute Cub, Scout or Venturer for "student" and get ready for fun.

Duration: One hour
Materials: At least 40 coloured tokens in at least 4 colours per student (bread bag holder tags, coffee or popsicle sticks, centicubes, marbles or coloured beads); hoops (1 per 4 students); paper cups, envelopes or baggies (1 per student); armbands or headbands (1 per 5 students).

Objectives:

Students will be able to:

1. become aware of pollutants in the Great Lakes;
2. describe how bio-accumulation works, and how it can affect people through eating fish; and
3. understand a food web and some of its links more clearly.

Summary:

Students will role play lake trout and alewife in a simulation of a simple Great Lakes food web to illustrate the bio-accumulation of toxins.

Background

The lake trout is native only to North America. Many of these stocks are disappearing because of human activity. The lake trout persists in all five of the Great Lakes, although its presence in some of them has declined.

The lake trout (*Salvelinus namaycush)* is a predator, feeding mainly upon other fish. In parts of the Great Lakes, its main prey is a fish called the alewife. The alewife (*Alosa pseudoharrengus)* is much smaller than the lake trout and feeds upon even smaller aquatic organisms called plankton. During certain seasons of the year, and when alewives are less plentiful, lake trout will also feed upon other small fish and even plankton. The lake trout's dependency upon the alewife, and, in turn, the alewife's dependency upon the plankton, is part of the aquatic ecosystem's food web, or series of interconnected food chains.

In the late 1960s, the government became aware that harmful new substances were entering the food web. Such synthetic substances as PCBs (polychlorinated biphenyls, an insulating fluid) and Mirex (dechlorane, a fire retardant) were found to last a very long time in the environment; once they entered the Great Lakes, they found their way to plankton, then on through the food web to alewife, lake trout and finally to humans, who consumed the lake trout.

The effects of these and other contaminants on fish are not clear. Studies conducted in the Great Lakes have found an increased rate of lip and skin growths on coarse fish taken in polluted areas, and fish with liver and intestinal tumours where extreme pollution exists. These studies suggest that pollution may cause the tumours and may indirectly cause the skin growths. Deformities in fish and invertebrates also increase in polluted environments. Tracing a specific cause, however, is difficult.

Animal tests indicate that ingestion of PCBs and Mirex by people may, above certain amounts, cause cancer and birth defects. Other pollutants, such as lead and mercury are more systemic, affecting for example, the central nervous system.

Now there are laws preventing the emission of PCBs and Mirex. Virtual elimination of these contaminants from the environment is the goal of both Canada and the United States. Because of their long-lasting effects however, they continue to travel through the food web to top predators like lake trout. Since lake trout grow and mature slowly, they collect these materials in their tissues, especially fat tissues, over a long period of time. The longer they live, the more contaminants they tend to collect.

Fish are regularly collected and tested by scientists to measure the amount of contaminants they contain. The Ontario Ministry of the Environment recommends that fish with PCB levels at 0.3 parts per million or more should never be eaten by children or women of childbearing age and only occasionally by everyone else.

The contaminant problem has improved as studies show a decline in the level of many harmful substances found in fish. The lessons learned from this "lethal legacy" may help us to ensure an improved aquatic environment in the future.

Lethal Legacy Wide Game

1. Explain to students that this lesson models part of a simple Great Lakes food web illustrated in Student Sheet 1*. If the concept is new, help them define it.
2. Divide the class into two groups; one four times larger than the other (for example, in a class of 25 there should be a group of five students and a group of 20 students). The smaller group will play the role of lake trout and the larger group will play alewives. Identify the lake trout with an armband or headband.
3. Select a playing area to be a "lake" with a definite boundary to act as a shoreline, such as a baseball diamond infield, a basketball court or an area marked off with rope or string (60 to 80 m). Place five hoops randomly inside this lake. Scatter the coloured tokens (representing plankton) around the lake.
4. Give each "fish" a small paper cup (or envelope or baggy) to represent its stomach.
5. Explain the rules of the role-playing game to your students as follows:
   - When fish are released into the lake, the alewives begin to eat the plankton (tokens) by putting them into their stomachs (cups).
   - The lake trout may also eat plankton but are essentially predators and should concentrate on capturing alewives.
   - Any alewife that is touched or tagged by a lake trout has been eaten and must empty **all** of its plankton (tokens) into the lake trout's stomach (cup).
   - Since alewives are much more numerous than lake trout, captured alewives remain in the lake and continue to hunt for plankton.
   - The lake trout must capture another alewife before it can capture the same one again.
   - The hoops throughout the lake represent protective cover for the alewives, who can hide from lake trout by standing with both feet inside a hoop.
   - A hoop can only protect two alewives at a time.
6. Continue the lesson until there is a severe shortage of plankton, at which time students should stop and sort the tokens in their cups, counting the total of each colour. Explain that biologists often perform stomach content analyses to learn more about an organism.
7. Inform students that some of the plankton are contaminated by a toxic chemical that now resides in their stomach tissue. The chemical is represented by one colour of token (pre-selected by you). The contaminant has been in the lake for a long time and has moved through the food web. Have students compare tokens and note that larger fish (the ones that have consumed the most) often contain the greatest amount of contaminant. Explain that in the Great Lakes, two contaminants that have been found in lake trout are PCBs and Mirex. Have students hypothesize how these chemicals may have ended up in the lake.
8. Discuss the potential harm of eating many very large trout compared with eating fewer smaller lake trout. Discuss students' observations of the food web as a transport system for toxic chemicals. Ask them to think of ways in which the government can protect the public while still allowing people to fish for lake trout.

***Access the two student sheets at: www.RiverstoOceansWeek.ca**

Evaluation

Have students draw a flow chart, tracing the path of a contaminant through part of a food web and explaining the reason for different amounts of contaminants at each level.

Extensions

1. To modify the procedure, move hoops around so alewives must also move when their food supplies are limited.
2. Using graphs from Student Sheet 2, have students determine the length of each fish species that would not be safe to eat based on the consumption limits for Mirex is 0.16 parts per million, and for PCBs, 0.30 parts per million.
3. Have students find out about other animals that have been found to contain contaminants. Ask if these animals live in the same area as other contaminated fish. Have students conduct Internet research to check for guides to eating sport fish in their province or territory.

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