

Answering the Call of the Wild

Student Reading

Long before *Homo sapiens* walked the Earth, the planet belonged to an enormous array of mammals, reptiles, insects, fish, birds and plants. From the tiniest organism, these species evolved over hundreds of millions of years into a rich collection of flora and fauna. But in just the past few decades, untold numbers of plant and animal species have disappeared forever from the Earth and many more are threatened with **extinction**.

Scientists have named 1.8 million species, but estimate that between 4 million and 40 million share our planet.¹ If extinction trends observed for vertebrate animals (the most commonly studied group of species) hold true for all organisms, extinction is a very real possibility for about one-quarter of all species.²

Extinction and **endangerment** occur for a variety of reasons. Some species are lost through natural occurrences. No one knows for sure why the dinosaurs became extinct 65 million years ago or what happened to many mammals 10,000 years ago. The natural or “background” rate of extinction is believed to be from one to three species a year. However, the current rate of extinction is about 1,000 per year.³ Certain animals and plants may die out in our own time regardless of what we do. Extinction is a fact of life on Earth. However, premature extinction caused by human activities can and should be prevented.

The single biggest threat contributing to the premature extinction of the plants and animals is **habitat alteration**. Other causes of species endangerment include pollution, **over-harvesting** and introduction or **invasion of non-native species**.

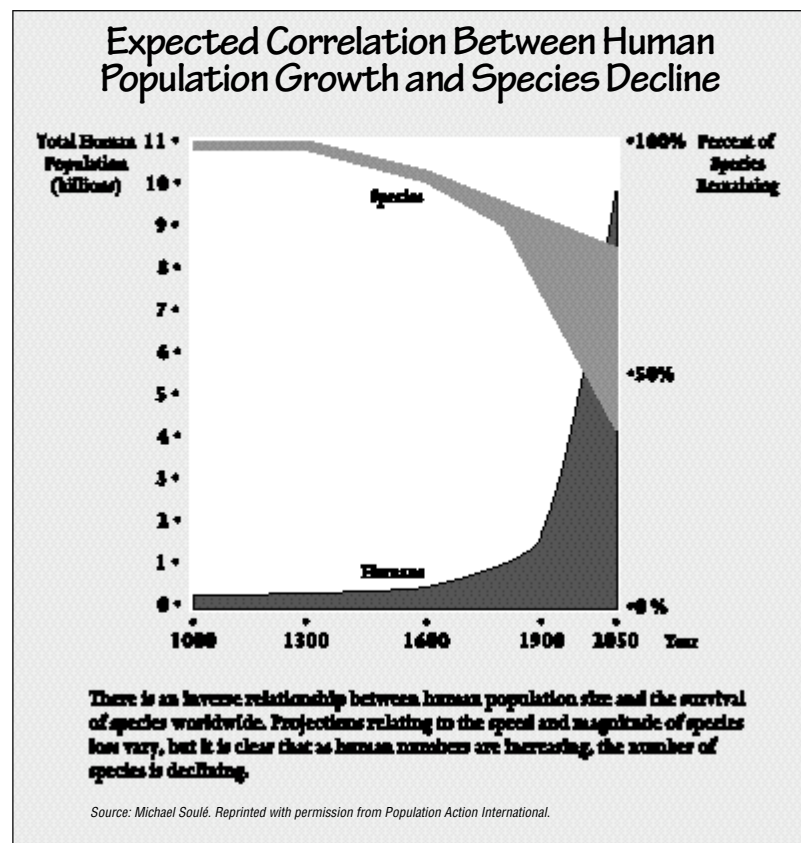
Human Homewreckers

Growth in human population is a leading cause of habitat destruction. As human numbers increase, more land is used for agriculture and development, destroying crucial wildlife habitat. Natural habitats are destroyed as they are paved over, built on, polluted, lumbered and mined. Most ecologists agree that reducing the size of its natural habitat increases a species' risk of extinction. Timber clear-cutting, mining, farming and the conversion of open space into

commercial and residential developments have squeezed many of our native plant and wildlife species into smaller and fragmented areas.

The destruction of a plant species is extremely serious, as it can harm an entire ecosystem. In the words of biologist Paul Ehrlich, “Every time we remove a plant species, we probably eliminate something on the order of ten animal species.”

Although all habitats play a role in the biosphere, the tropical rainforests are especially precious. Of the 1.8 million recorded species, greater than 50 percent live in tropical rainforests. Considering that more than half of the tropical forests have already been destroyed, the enormity of the destruction, in terms of both number of acres and number of plant and animal species, is staggering. Species found only or predominantly in rainforests, including most primates, are especially vulnerable. One half of all primate species on the planet are threatened.⁴



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climatologists now agree that human actions have a notable effect on the Earth's climate. Increases in concentrations of greenhouse gases in the atmosphere from the burning of fossil fuels like oil, coal and natural gas are driven in part by population growth, and are predicted to dramatically alter our future climate.

Species that are isolated to the coldest climates on mountain tops, as well as those who dwell on small islands may see their habitats disappear from increases in temperatures or rises in sea level. This habitat destruction will also put many more species in danger of extinction.

Presently, habitat destruction is the direct cause of decline for an estimated 75 percent of bird and mammal species in danger, 68 percent of all threatened reptile species and 60 percent of all threatened fish species.⁷ Human technology, too, has adversely affected certain species. Dams on rivers disrupt spawning patterns of salmon who live in the ocean, and lay their eggs up river in fresh-water streams. In order to help young salmon downstream past dams and the lakes that lie behind them, biologists have, on some rivers resorted to removing the fish from the rivers, transporting them around the dams, then putting them back. In Florida, hatching sea turtles are fatally lured away from the ocean when they mistake the reflected city lights for the starlit sky over the water.

In 1973, the U.S. government attempted to protect threatened wildlife by enacting the Endangered Species Act. This legislation, along with related acts such as the Marine Mammal Protection Act of 1972, was designed to protect species that were deemed threatened or endangered in the United States. Although this legislation has been instrumental in saving some species, it has not been effective in keeping species from becoming endangered in the first place. Yet, ecologists have found that, just as it is easier to treat a symptom before it becomes a serious medical condition, it is easier to help threatened wildlife before they become critically endangered. The list of endangered species recognized under the U.S. Endangered Species Act grew from approximately 380 when the law was passed in 1973 to 1,134 at the end of 1997.⁸ When written, the Endangered Species Act was

designed to be periodically reviewed by Congress. During past reviews, or reauthorizations, Congress has made changes that strengthen the Act. There is always the potential, however, for future changes that would diminish its effectiveness. At the time of writing, many countries, including Canada, did not even have their own national law for protecting endangered species.

Polluting the Ark

Humans have another devastating influence on wildlife — pollution. Birds, mammals, fish, shellfish and their food sources are all vulnerable to human-generated toxins that are released into the environment. Shellfish, and other organisms, that dwell at the bottom of bodies of water, are at serious risk of contamination by bacteria and toxins, and of death from oxygen depletion.

The Chesapeake Bay is the nation's largest estuary. Steady population growth in the Chesapeake watershed has turned the bay into a catch basin that collects the refuse of innumerable pollution sources, including factories, farms and sewage treatment plants. Runoff from lawns, roads, parking lots and farmland carries pesticides, petroleum, and other toxins into the bay. These pollutants have reduced the Chesapeake's seafood catch to a shadow of 19th century levels. Catches of crabs, oysters and fish decline, while jellyfish populations increase, as do bacterial counts.

During certain times of the year pollution causes a **dead zone** in the Gulf of Mexico. The dead zone, about the size of the state of New Jersey, is an area of oxygen-depleted water where no fish can live. As the Mississippi River empties into the gulf, the agricultural and industrial pollution it carries creates an excess of nutrients in the environment. This excess causes algae to bloom, which uses up all the available oxygen, making the water uninhabitable to fish and other marine life.⁹ Persistent toxic chemicals have proven deadly to aquatic ecosystems in North America's Great Lakes, where various species of fish now suffer from tumors, lesions and decreased reproductive capacities. Of the ten most highly valued

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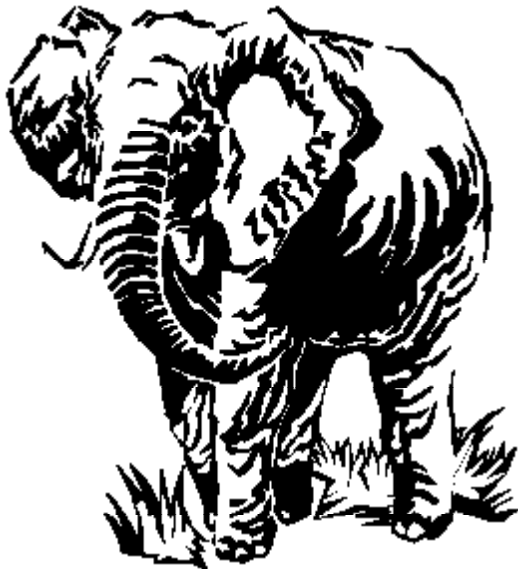
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species of fish in Lake Ontario, seven have now almost totally vanished.¹⁰

Killing for Profit

In addition to habitat destruction and pollution, **over-exploitation** of wildlife poses a significant threat to many species. Over-exploitation occurs when a plant or animal is killed or taken out of the environment faster than they can replace their numbers.

Many of the world's most beloved animals, such as tigers, gorillas, rhinoceros and elephants, are victims of illegal over-exploitation, commonly known as poaching. The result of this **poaching** brings precious ivory and fur coats to the black market, medicinal preparations to Asia and elsewhere, and artifacts to collectors worldwide. The bones and teeth of tigers are highly valued as ingredients in traditional Asian medicines. While the tiger is also threatened by habitat destruction, poaching has accelerated so much in recent years that it is now considered the leading threat to tiger's survival, according to the World Wildlife Fund. The tiger population has dwindled from around 100,000 in 1900 to about 6,000 individuals today. Three of the eight species of tiger have become extinct since the 1940s. Many other species fall victim to the same fate as well: Over-hunting affects 31 percent of threatened reptiles.¹¹



Not all over-exploitation happens illegally. Many species have been over-hunted or over-fished because they did not have adequate legal protection. As world population grows, pressure on these species will continue to increase. Marine species have been particularly hard-hit; two-thirds have declined because of over-harvesting. Cod, some sharks and sturgeons — the fish which supply high-quality caviar, have been particularly affected.¹²

Unwelcome Neighbors

Often species become endangered not because humans destroy their habitat, but because we change it, by introducing into an area species that weren't there before. Sometimes these new neighbors eat the native species; sometimes they just crowd the natives out. Either way, native species suffer.

Humans introduced the brown tree snake to the Pacific Island of Guam shortly after World War II. The snake, which feeds on small animals, including birds and their eggs, has no natural predators on the island, and so its population skyrocketed. One survey found densities of up to 12,000 snakes per square mile. The Guam rail is just one of the species devastated by the snakes. Now believed to be extinct in the wild, there were an estimated 80,000 of the birds as recently as 1968.¹³

The American chestnut was once one of the dominant trees of North America. Growing to nearly 100 feet, the wood was valuable for timber, and the trees produced abundant nuts that were important sources of food for people and wildlife alike. In 1904, scientists discovered a fungus growing on chestnuts in New York City. The fungus, which is fatal to American chestnuts, had been brought by humans to America, probably from Asia. It spread rapidly, 20 to 50 miles each year, killing virtually every tree it encountered. By 1950, the trees were essentially gone from our forests.¹⁴

Myriad other exotic pests exist, from Zebra mussels in the Great Lakes, to Mediterranean fruit flies in California. As our population increases, and our economies expand, more and more commerce and travel happens between different ecosystems. We are continu-

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ally increasing the chance that a person will, purposefully or accidentally, release the next unwelcome neighbor.

Key to Our Survival

Although humans have endangered so many plant and animal species, we depend on these and other species for our very survival. The planet's **biodiversity** provides the world with crucial **ecosystem services** — pollination, pest control, cleansing of water supplies and soil creation—upon which all species depend.¹⁵ The extermination of plant populations can change the climate locally and also have severe regional effects through disturbance of the water cycle.

Food, medicine and shelter are all derived from the abundant organic resources of the Earth. More than a quarter of the prescription drugs on the U.S. market are derived from plant species.¹⁶ Some of these drugs are used to fight cancer, malaria and heart disease.

Additionally, loss of biodiversity deprives us of tools that might help in the struggle to feed ever-increasing numbers of people. For example, only a few of the more than quarter million known plant species have been investigated for their potential as crops. The world's growing human population depends on fewer than 20 crop plants for 90 percent of its food supply. Genetic information from wild plants may help this limited, and therefore vulnerable food supply withstand the effects of disease, insects or climactic change. In the early 1970s, genetic information from a wild Mexican corn species was used to protect U.S. corn crops from a devastating fungus. Many other opportunities for creating new foods and medicine exist and are awaiting discovery and development. However, the continued destruction of the rainforests over the next few decades promises to permanently remove virtually all possibility of benefiting from this resource.

Out of the vast array of species inhabiting the Earth, humanity uses only one-tenth of one percent. The potential for the other 99.9 percent is enormous and mostly unexplored. However, with every species that is driven to extinction, we lose some potential to cure disease, improve crop productivity and enhance our standard of living.



With the aid of public education, people of the United States and other countries need to realize the serious ramifications of these daily losses. Unlike many things in our lives today, once a species is gone, it can never be recreated.

Endnotes

¹ John Tuxill and Chris Bright. "Losing Strands in the Web of Life." *State of the World 1998*. Washington, DC, p. 42.

² Op. cit. note 1, p. 54-55.

³ Op. cit. note 1, p. 41.

⁴ Op. cit. note 1, p. 47.

⁵ John H. Cushman. "Million Wetland Acres Lost in 1985-1995: Loss is One-Third of the Previous Decade, Despite New Protections." *New York Times*. September 18, 1997.

⁶ The figure represents net migration (people moving in, minus people moving out) to Florida. Census Bureau Web page: www.census.gov/population/estimates/state/st9097t2r2.txt

⁷ Op. cit. note 1.

⁸ U.S. Fish and Wildlife Service web page: www.fws.gov

⁹ Op. cit. note 1, p. 53.

¹⁰ Environment Canada web page: www.ec.gc.ca

¹¹ Op. cit. note 1, p. 50.

¹² Ibid.

¹³ American Association of Zoological Parks and Aquariums. Guam Rail fact sheet: <http://aza.org/Programs/SSP/ssp.cfm?ssp=41>

¹⁴ North Carolina A&T State University School of Agriculture web site: <http://moore.ncat.edu/news/jul96/chestnut.html>

¹⁵ Op. cit. note 1.

¹⁶ Ibid.

Bye, Bye Birdie

Student Activity 19

Concept:

The rate of wildlife endangerment is increasing. Difficult decisions are required to determine how to prioritize our efforts to save endangered species.

Objectives:

- Students will be able to:
- Develop criteria that ecologists, wildlife managers and public officials might use to make decisions about protecting endangered species.
 - Conduct research on an endangered species through the Internet and other sources.
 - Present their findings to the class, showing how their species measured up against the chosen decision criteria.

Subjects:

Biology, environmental science, language arts

Skills:

Critical thinking, cooperation, research, writing, evaluation, public speaking

Method:

Students determine which factors should be considered in deciding the fate of endangered species. They then conduct research to find out about an endangered species, and prepare a short presentation, justifying the preservation of the species.

Materials:

Research materials from the library and/or Internet

Introduction:

Humankind is now precipitating the extinction of large numbers of animals, birds, insects and plants. Estimates are that without human influence, one species in a million would go extinct each year. Because of human activities, over 1,000 species out of a million go extinct each year. We stand a good chance of losing 20% of all species by the year 2020.¹

Scientists believe that many of the species being lost carry untold potential benefits for the health and economic stability of the planet. With limited funding available for conservation, many believe that humanity should make some tough choices and decide which species can and should be saved.

In the following activity, students will develop a method for making these tough choices on wildlife preservation and compare the relative “value” of different species.

Procedure:

1. Before beginning the activity, be sure that your class is familiar with the concept of biodiversity, the measure of variety of living things and their ecosystems. Emphasize that biological diversity provides us with products (including pharmaceuticals, foods, materials for building and clothing, etc), as well as crucial “ecosystem services,” such as clean water, breathable air, natural climate control, and providing stability to the environment. While humans are drawn to plants and animals that appeal to our hearts or our sense of beauty, often the ones that are valuable to us are the species that are most unique, regardless of their size or appearance. Then, working individually or in pairs, have students determine which factors should be considered before a decision is made to save a species or let it become extinct. They should list each reason they think is important and write a one-paragraph defense of each.
2. Students will now apply the criteria they developed. Working individually, students should “adopt” one of the endangered species listed on the next page (make sure that each student “adopts” a different species). Give

them time to research information about their species. The Web site of the U.S. Fish and Wildlife Service (www.fws.gov) contains extensive information about the ecology of most of these species.

The students should prepare a short presentation which describes the species, states its importance, and gives reasons why it should be preserved. Students should also discuss threats to the species’ survival. These might include habitat destruction, poaching or overhunting, disease, lack of adaptability to changes in climate or other ecological systems, increase in numbers of predators or competitors, etc. If they have difficulty finding information on lesser-known species, students may wish to bolster their research by looking into similar species.

3. Divide the class into groups of 6-8 students. Students in each group will present their findings on their “adopted” species to the group. As the presentations are made, students should rate each species using the criteria developed in the first part of the activity. Ask students if they would change the criteria they developed earlier after they researched their species and rated the others. Have students explain the changes they would make.
4. As the final part of the activity, students must decide which species they will “save” and why. Analysis should focus on the relative possibility of success, examine the value of the species and include less concrete factors such as the preservation or loss of beauty. In addition to the students’ individual ratings, each group should try to reach consensus on which species should be “saved.”

Follow-up Activity:

There are many endangered species of plants and animals throughout the United States. Students can contact the U.S. Fish and Wildlife Service (1849 C St, NW, Washington, DC 20240, www.fws.org) or your state fish and game agency to obtain a list of threatened or endangered species in your area. Contacting a nearby nature center or natural history muse-

Bye, Bye Birdie

Student Activity 19

um might also provide helpful information. Once students know which species are endangered in your area, they can research whether or not any efforts are being taken to protect the endangered animals or plants. Preservation projects could be initiated through your school, scouts, 4-H, nature clubs, or hunting and fishing clubs.

1. Wilson, E. O. (1992). *The Diversity of Life*. Cambridge, MA: Harvard.

2. An **indicator** species is one that shows the effects of habitat alteration before others. Miners used to bring canaries into coal mines because they acted as an indicator species. If the canary died, the miners knew the air was bad, and that they should vacate the mine.

3. By protecting an **umbrella** species, ecologists are able to protect many other species that share the ecosystem. This is usually because the umbrella species requires a large area of undisturbed habitat, which is also good for the other species that share the habitat.

4. A **keystone** species is one whose presence is necessary for other species to survive and thrive. Often, the keystone species provides some ecological service that no other species can provide, such as pollinating a certain type of plant.

Selected List Of Endangered Species

Species	Where found	Teacher's notes
Alabama cave shrimp	U.S.A.	Indicator ² for water quality
American burying beetle	U.S.A.	Decomposer: helps remove decaying animals
Asian elephant	Southeast Asia	Important for domesticated use
Attwater's prairie chicken	Texas	Indicator for healthy coastal prairie, potential game animal
Black rhinoceros	Africa	Threatened by poachers, important for tourism industry
California condor	U.S.A.	Carion eater: helps remove decaying animals
Cheetah	Africa	World's fastest land animal
Chinchilla	Bolivia	Valuable fur species
Chinook salmon	U.S.A.	Important food species for humans
Cracking pearly mussel	U.S.A.	Indicator species for clean water
Everglade kite	U.S.A.	Umbrella ³ species: eats snails, snails need healthy everglades
Giant panda	China	Umbrella species: undisturbed bamboo forest
Grizzly bear	U.S.A., Canada	Umbrella species: needs wilderness
Humpback whale	Oceania	Important for tourism industry
Indiana bat	U.S.A.	Eats mosquitos and other insects
Karner blue butterfly	U.S.A.	Umbrella species: endangered savanna/barrens ecosystem
Kirtland's warbler	U.S.A., Canada	Umbrella species: scrub pine habitat, valuable for tourism
Mexican long-nosed bat	U.S.A.	Keystone ⁴ species: important pollinator for cactus species
Mountain gorilla	Africa	One of Homo sapiens closest relatives
Mountain sweet pitcher plant	U.S.A.	Indicator species for healthy wetlands, valuable for collectors
Nene goose	Hawaii	State bird of Hawaii
Northern spotted owl	U.S.A., Canada	Umbrella species: old-growth forests
Peregrine falcon	U.S.A., Canada	Indicator species for pesticides in food chain
Piping plover	U.S.A., Canada	Requires undisturbed beaches for nesting
Przewalski's horse	China	Domesticated horses are descendants from this species
Red wolf	U.S.A.	Important predator
Scrub mint	U.S.A.	Potentially valuable for medicinal use
Snow leopard	Asia	Threatened by poachers
Utah prairie dog	U.S.A.	Keystone species: their towns offer habitat for other species
Vernal pool tadpole shrimp	U.S.A.	A living fossil: it has been around over 70 million years
West Indian manatee	U.S.A.	Helps keep seabeds from becoming overgrown
Whooping crane	U.S.A., Canada	Largest North American bird, important for tourism
Wood bison	Canada	Numerous historical uses for food, clothing, etc.

No Water Off a Duck's Back

Student Activity 20

Concept:

Human actions, such as oil spills, can cause devastating environmental effects for wildlife.

Objectives:

Students will be able to:

- Conduct scientific experimentation.
- Analyze data, and draw conclusions from the results of their research.
- Depict data graphically.
- Calculate impacted area of large oil spills based on a small-scale observed model.

Subjects:

Biology, environmental science

Skills:

Lab preparation, mathematic calculations, analyzing data, drawing, estimation, graphing, observation

Method:

Students conduct experiments to identify ways oil spills can affect wildlife adversely and describe possible negative consequences to wildlife, people and the environment from human-caused pollutants.

Materials:

Cooking oil
Several shallow containers
Eye dropper
Hand lens
Feathers (natural)
Liquid detergent (dishwashing liquid)
Hard-boiled eggs

Introduction:

The impacts of environmental pollution often are difficult to see. A major oil spill, however, provides dramatic evidence of potential impact to wildlife. Examples include damage to feathers, killing of embryos when oil seeps into eggs, suffocation of fish when gills are clogged, and death to marine and terrestrial animals who ingest food and water contaminated by oil.

People are involved in efforts to prevent oil spills and their consequences. They also are involved in efforts to “clean up” after such spills take place. Such actions are not always successful, and sometimes they have unfortunate consequences as well. For example, the process of using detergents to clean oil from the feathers of birds caught in spills may also damage the birds’ feather structure and arrangement and thus the birds’ waterproofing. Birds may also be more susceptible to disease during this time of stress and may be weakened to the extent that it is more difficult for them to secure necessary food and water. Obviously, food and water sources may also be affected in quality.

Oil spills are just one example of pollution that can have adverse short- and long-term effects on wildlife, people and the environment. Students will examine some of the possible consequences for wildlife of human-caused pollution.

Procedure:

Divide the class into groups of three or four. Each group needs a shallow pan partially filled with water. Instruct students to complete the following instructions:

1. Add a known amount of oil, one drop to one dropper-full, depending on the size of the container. Observe the interaction of oil and water. Measure the area covered by the oil. Using this information, have students estimate the area that might be affected by an oil spill involving:
 - a) A tanker truck holding 8,000 gallons of oil
 - b) A ship holding 300,000 gallons of oil
 - c) A supertanker holding 83,000,000 gallons of oil

Discuss and compare estimates with other groups. Graph estimates and compute average figures.

2. Put enough oil in a small container to submerge three hard-boiled eggs. Add the eggs. Put the eggs under a good light and watch closely. Remove one egg after five minutes and examine it — before, during and after pulling off the shell. Try to remove the excess oil from the outside before attempting to peel the egg. Remove the second egg after 15 minutes and the third egg after 30 minutes, repeating the procedure, examining each carefully. Discuss observations. What effect could oil have on the eggs of birds nesting near the water?
3. Examine a feather with a hand lens. Sketch what you see. Dip the feather in water for one or two minutes, and examine again with a hand lens. Sketch and compare to the original observations. Place the feather in oil for one or two minutes, and then examine with a hand lens, sketch and compare with other sketches. Then dip the feather in water with detergent in it, rinse in clean water and examine again. Discuss changes in the feather after exposure to oil and then to detergents. What effect could these changes have on normal bird activity?
4. Discuss other possible effects on birds from an oil spill. Discuss possible impacts on other wildlife species, on humans and on the environment. What trade-offs are involved? Do we have to choose between oil and birds, as well as other wildlife? What are some alternatives? What are other examples of human-caused pollutants that can have negative consequences for wildlife, people and the environment? What is being done or can be done about these as well?

Follow-up Activity:

An extension of the activity might include using a variety of oils (cooking oil, motor oil, crude oil) to compare effects on feathers and eggs. Food coloring can be added to clear oils to facilitate observation of effects. Other pollutants can be used to see what, if any, effects they have on eggs and feathers. Exercise caution, however; do not use any unusually dangerous substances.

Adapted by permission from Project WILD. The original activity appears in Project WILD: K-12 Activity Guide, 2nd Ed., Council for Environmental Education, 1992.