PITTSBURGH ZOO
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Windows to Conservation
Grades 4-8
Teacher Packet

Contents:

Vocabulary

Adaptation – behavior or body part that improves a plant or animal's chance for survival

Bioaccumulation - the accumulation over time of metals [or other persistent substances] within an organism from both biotic (other organisms) and abiotic (soil, air, and water) sources

Biodiversity – the variety of life on the planet

Camouflage – an organism's ability to hide or blend with its surroundings using color, pattern or shape

Carnivore – an animal that eats other animals

Conservation – the wise use of natural resources in order to ensure continued availability to future generations

Cutaneous Respiration - exchange of gases between the skin and the air/water

Ecosystem – an ecological community together with its environment, functioning as a unit

Endangered – an animal or plant at risk for becoming extinct

Extinction – the complete loss of a species

Herbivore – an animal that eats only plants

Indicator species – a species that when it is present in an ecosystem indicates or designates the habitat is healthy

Metamorphosis – a process of change that amphibians and insects often go through from egg to adult

Migration – the movement of animals from one location to another

Omnivore – an animal that eats both plants and other animals

Pollution – any substance that destroys the purity of land, air, or water

Predator – an animal that kills other animals for food

Prey – an animal that is hunted and eaten by another animal (predator)

Runoff - water draining from land to surface waters such as rivers, lakes, ponds, or wetlands

Threatened – an organism whose population is declining in numbers, but has not yet become endangered

Waterfowl – term used for any bird that spends a large portion of its life in wetlands, in or at the edge of lakes, rivers, ponds, or streams

Wetlands – an area that has standing water for at least part of the year, can be identified by its plant life

Pennsylvania
Endangered Species List

Endangered Fish:
Shortnose sturgeon
Lake sturgeon
Northern brook lamprey
Gravel chub
Eastern sand darter
Longnose sucker
Spotted darter
Tippecanoe darter
Longhead darter
Threatened Fish:
Ohio lamprey
Mountain brook lamprey
Atlantic sturgeon
Mountain madtom
Northern madtom
Burbot
Bluebreast darter
Channel darter
Gilt darter

Endangered Reptiles:
Bog turtle
Massasauga rattlesnake
Kirtland's snake
Threatened Reptiles:
Red-bellied turtle
Rough green snake

Endangered Amphibians:
New Jersey chorus frog
Coastal plain leopard frog
Eastern mud salamander

Threatened Amphibians:
Green salamander
Endangered Invertebrates:
Northern riffle shell
Club shell
Regal fritillary

Endangered Birds:
Bald eagle
Black tern
King rail
Common tern
Least bittern
Great egret
Shot-eared owl
American bittern
Loggerhead shrike
Peregrine falcon
Yellow-crowned night heron
Threatened Birds:
Osprey
Sedge wren
Upland sandpiper
Yellow-bellied flycatcher
Dickcissel
Extinct Birds:
Passenger pigeon

Endangered Mammals:
Least shrew
Indiana bat
Delmarva fox squirrel
Threatened Mammals:
Allegheny woodrat
Small-footed myotis
West Virginia water shrew

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Otter Obstacles
Pre-Visit Activity

Objectives

1. The students will discover the conservation issues facing otters.
2. The students will be able to identify the four things that make a habitat.
3. The student will be able to define the phrase limiting factor.
4. The students will be able to list two limiting factors in the survival of river otters.

Materials

- 3 jump ropes (or lengths of rope)
- Boundary Cones
- Food Tokens – 40-50 in 4 different colors (plastic fish, poker chips, shells, etc.)
- Water Tokens – 40-50 cups (wooden sticks, blocks, etc.)
- Sticky Notes or Index Cards(1 per student)–half labeled "Trap" & half "Clear"
- Hard Hat or "Careless Land Developer" Sign/Label

Background Information

North American river otters were nearly extirpated from Pennsylvania for 50 or more years…erased by over harvesting, water pollution and habitat loss. Large tracks of wooded and clean river, stream, lake and wetland habitats are needed to sustain river otter populations. The less clean the water, the fewer the fish and the further otters must travel for food.

Dr. Tom Serfass helped launch the Pennsylvania River Otter Reintroduction program in 1982. Dr. Serfass has since gathered the support needed to reintroduce more than 150 river otters to the healthiest streams and rivers throughout Pennsylvania. Long-term survival will depend on the wellbeing of Pennsylvania's wetland, lake, stream and river habitats, as well as whether the small groups of otters around the state gradually merge together.

The Obstacles simulated in this lesson include habitat loss to development, trapping/hunting, and pollution. These obstacles can be limiting factors or circumstances that reduce the population of a living organism.

Anticipatory Set

Give the students background information about the North American river otters found in Pennsylvania.

Development of Lesson

1. Have the students help set up the Otter Obstacle Course according to the chart.
2. Review the rules of the game.
3. Designate roles for the students, and explain that all students who are not developers or "Trap/ Clear Areas" will be river otters. Be sure to record the number of otters that start the course.
4. Have the students run the course a few times; taking turns being otters, trappers, and developers. Be sure to record the results, including the number and color of food and water tokens collected.

Summary

Review the results of the rounds, and reveal the differences in color for the water and food collections.

Otter Obstacles
Rules of the Game

1. All Otters must stay within the boundaries at all times.

2. At the first obstacle the otters must face the roads that transect their habitat. The "otters" must get past the swinging ropes without touching them.

3. The next Obstacle is the "Careless Land Developer". Choose one student to be the "Developer". Give the student the hard hat or Developer card, so the otters know who the developer is. The developer is taking over the habitat between the Trapping area and the "Water" Space.

4. Any otters caught by the developer turn into "Traps". The developer gives any caught otters a "Trap" or "Clear" sign, and sends them to join the Trap line.

5. The next obstacle for otter making it past the developer involves clean water. The students have to collect 4 water tokens before moving onto the Trap section.

6. When the otters reach the Trap Obstacle they must choose a path (student) to pass through. The chosen student shows the otter his sign. (The one that was handed to him by the Developer) If the sign says "Trap" the otter is out of the game. If the sign says "Clear" the otter moves on to the final obstacle.

7. The last challenge is to find food. The otters must grab 4 food tokens before moving to the finish line.

8. Record the number of surviving otters that cross the finish line.

9. Water Obstacle - Choose a color or have a mark on one of the Water tokens . After the game is over tell the students that any otters that drank/ collected this water did not survive because this water supply was polluted and unhealthy.

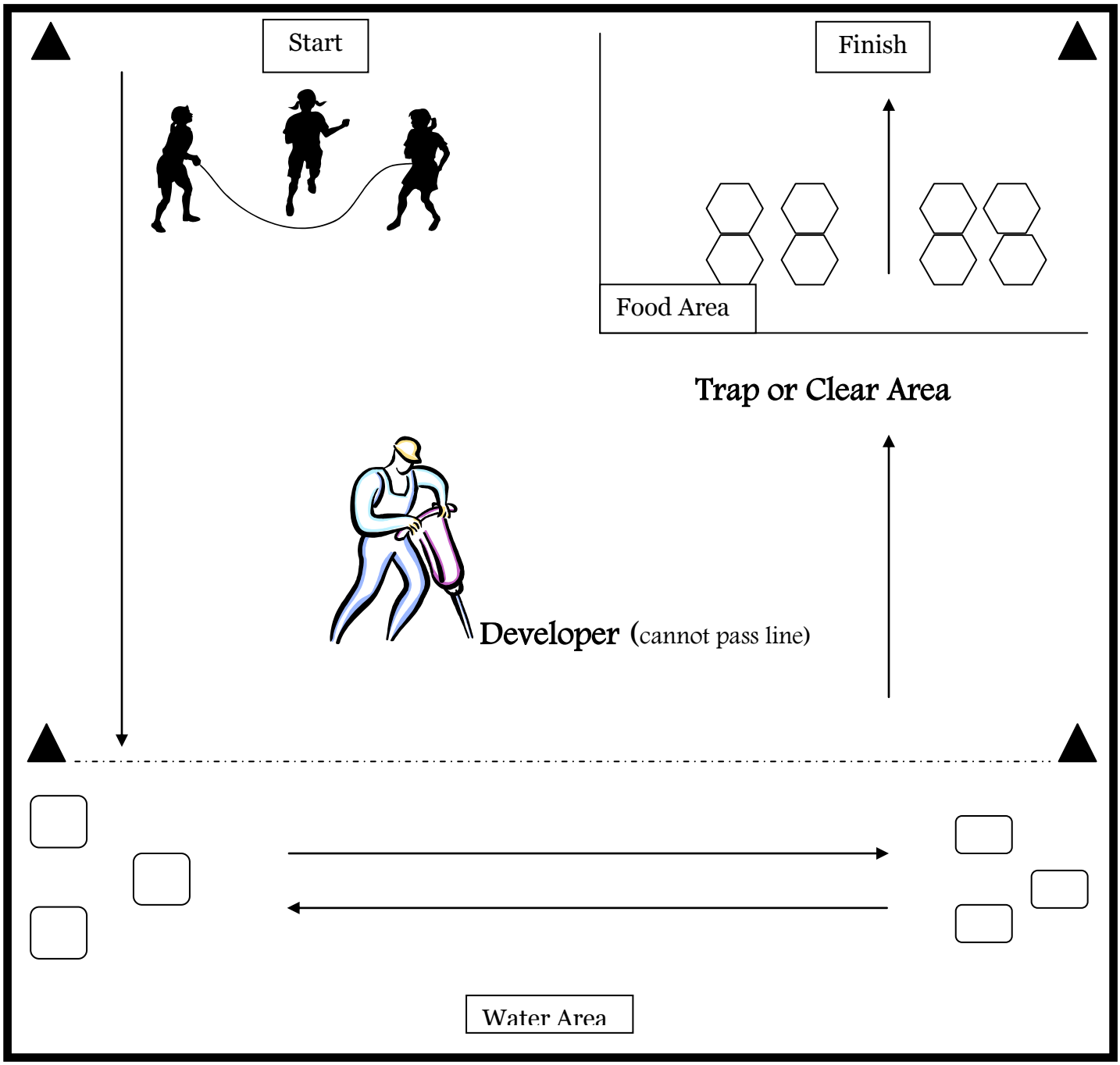
10. Food Obstacle – Choose one of the food token colors. Tell the students that any otter that captured 1 of these tokens is very sick and that any otter that captured 2 or more of these tokens has died due to poor water quality and the resulting lack of fish.

11. Record the surviving number of otters.

12. Play again!

Pittsburgh Zoo & PPG Aquarium

Otter Obstacles Diagram



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Habitat Squeeze
Pre-Visit Activity

Subjects: Science, Social Studies
Skills: Analysis, application, discussion, inference, observation
Duration: <1 class period
Group Size: Any size
Setting: Classroom
Key Vocabulary: Habitat, carrying capacity, conservation, species

Materials:
Habitat Squeeze Sign(s)
Rope

Background:

Carrying capacity is defined as the population that a given area, such as a forest, will support without either the area or the population undergoing deterioration. It is a dynamic equilibrium established between any life form and its environment. For example, a particular forest may be capable of providing habitat (food resources, water, shelter and space) for 100 animals of one species. If the population is under 100, neither the animals nor the forest will suffer. If the population exceeds 100, the forest ecosystem will be strained, and each animal will be subject to stress with the possible death of some individuals.

Many factors can change an area by either increasing or decreasing the carrying capacity. Some factors are related to the size of the habitat, others are related to the quality of the habitat. For example, an increase in under story shrubs may provide habitat for a particular bird species or group of birds. This increases the carrying capacity of the forest for that bird population, but does not increase the size of the forest. In another example, a species may be dependent on a stream going through the forest for its water supply. If the stream flow is decreased or eliminated so that it no longer travels through the forest, that forest then has a decreased carrying capacity for that species.

Human habit may be considered in terms of carrying capacity as well. A researcher may indicate that a particular region has a carrying capacity of 10,000 humans. However, people often modify their surroundings in order to increase the carrying capacity of an area, for example, importing food from outside the area.

Some think we have exceeded the earth's carrying capacity for human population, the result being disease, starvation, war, and environmental degradation. A population exceeding the area's carrying capacity may continue to exist, but both the area and some individuals will be stressed. In the long run, a population that exceeds its carrying capacity of an area is considered unsustainable.

While converting land from forest to housing plans and shopping centers represents the loss of habitat for forest animals, it may simultaneously increase Pennsylvania's carrying capacity for people and other non-forest wildlife species. The question becomes, is there a balance that is sustainable for both animal and human populations?

Procedure:

1. Before students enter the classroom, stretch a rope across one small corner of the room and hang the "Off- Limits-Do Not Enter" sign on it. (Use an area that is not absolutely essential for the function of the class.) Any furniture that can be moved should be removed from this area and crowded into the rest of the room.
2. When students ask about the rope and the sign, explain that it is part of an experiment and you'll discuss it later in the week. Explain that until then the area behind the rope is indeed "off-limits" and no one is to enter it for any reason. The students simply will have to learn to function in a slightly smaller space than they have become accustomed. Continue your normal daily activities.
3. Before the students enter the class the next day, move the rope to slightly enlarge the restricted area and crowd them into the rest of the room.
4. Continue this process for the next two days (or as long as you and your students can tolerate it), but at least long enough to cause everyone to feel cramped.
5. Ask the students how they felt about the rope and the expanding restricted area. Ask why the rope was there. Discuss the effects of the rope. At what point did it interfere with student activities? How much more could the off-limits area have been expanded before it fully disrupted class function?
6. Introduce the term "carrying capacity." Ask how the rope affected the carrying capacity of the classroom. If their numbers exceeded the carrying capacity of their habitat how would animals be affected? How might habitat loss in one part of the world affect another part of the world? Make the point that solving these kinds of problems requires a global perspective.
7. Have students write a brief explanation for marking off part of the classroom with the "Keep Out" rope (i.e., why you did this).

Discussion:

- Did the size of the off-limits area on one side of the room affect students on the other side of the room? When? How? Where would students have gone then? What effect would moving out of the classroom have on other people and on the way the class functioned?
- Do animals that depend on one type of habitat always have the option of moving somewhere else?
- What will animals do if there is not enough territory or food to sustain them? Humans may be pushing animal populations to the limits of sustainability by removing larger and larger sections of suitable habitat. What are people using the land for when forest is removed? Are these human actions increasing or improving habitat for other wildlife species?

- Is there a carrying capacity for people in a classroom? In a city? In Pennsylvania? In Nicaragua? In the world? How much loss of habitat is allowable? How much is too much?
- Have students discuss their reaction to the exercise.

Extensions:

- Have students research how much change has occurred in forests in their community over the last 200 years. County conservation districts or local environmental organizations might be able to provide information about pre-European-settlement vegetation in the area. Topography maps and aerial photos made years apart will show changes in forest cover. Another source of interesting, firsthand information about how the land use of the area has change over several generations can come from the elderly community. Have students visit nursing homes or senior centers and interview the residents to determine if they remember more or less forest intact when they were young. See if they have noticed any changes in the abundance of birds and other wildlife.
- Have students determine the carrying capacity of their school, town or neighborhood? What factors influenced their decision? Were they able to come to an agreement on the number? How do human population increases affect the carrying capacity for other species? How do humans expand their carrying capacity? Should humans limit their numbers and live within the natural carrying capacity?

Adapted with permission from:
Pennsylvania Songbird
Gilchrist, Susan; Row, Kadi and Borneman, David. *One Bird-Two Habitats,* Wisconsin Department of Natural Resources, 1993

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DO NOT CROSS

This habitat has been taken over by developers.

DO NOT CROSS

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Zoo Challenge
In Zoo Activity

Materials:
Animal Observation Worksheet (1 per group)
Pencils
Stopwatch or watch (1 per group)

Procedures:
1. Divide the class into small groups, with each responsible for one of the Zoo's local wildlife species.
2. While at the Zoo each group should observe their species, noting interesting behaviors and report back to the class.
3. During your zoo visit see which group of students can find the most endangered species the Zoo has, providing the species of the animal and where it is from.

Summary:
When you return to class have each group of students educate the class about their species.

Extension:
The groups can further research their species, write a jingle, poem, newscast, or magazine article, to share with the class.

Pittsburgh Zoo & PPG Aquarium
Local Species List

Kids Kingdom	**PPG Aquarium**
Northern Copperhead	Bullfrog
Timber Rattlesnake	Rainbow Trout
White-tail Deer	Brook Trout
North American River Otter	Blue Gill
Beaver	Bass
Wild Turkey	**Other**
Barn Owl	American Black Bear

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Animal Observation Sheet

Names:_____

Animal Species:_____

1. **Find your animal.**
2. **Answer the following questions:**
    a. **Where is you animal from? What type of habitat does it live in?**

    b. **Estimate your animal's weight (in pounds)**

    c. **Estimate how long or tall your animal is (in inches)**

    d. **How does the animal move from place to place?**

    e. **Name something about your animal that helps it to survive in its habitat.**

    f. **Observe your animal for 5 minutes. Make a check mark each time it does one of the following:**

Walks	**Drinks**
Runs	**Eats**
Lies Down	**Eliminates**
Swims	**Looks at people**
Jumps	**Other(name behavior)**
Grooms	

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Rachel Carson
Post-Visit Activity

Subjects: Science
Skills: Reading comprehension, organization
Duration: 2 class periods
Group Size: Individual Student or small groups
Setting: Classroom
Key Vocabulary: Conservation, species, chronologic,

Materials:
Rachel Carson worksheet
Rachel Carson background information
Rachel: The Story of Rachel Carson (Erlich, 2003)

Background:
Born on May 27, 1907, Rachel Carson grew up on 65 acres of pristine countryside in Springdale, Pennsylvania. Her mother, a former school teacher, encouraged Rachel's interest in all that lived in the grass, trees, and streams. One day Rachel would popularize the term *ecology*, and forever change the way the world viewed the environment. Rachel's life-long aspiration was to become a writer. She majored in English at the Pennsylvania College for Women where her teachers instantly recognized her talents. As a course requirement, Rachel took a class in biology. Suddenly, her life changed, and science became her passion. Her professors and fellow students warned her that the world would not embrace a woman scientist. Not persuaded, Rachel changed her major to zoology. She graduated from college with a B.A. in Science, magna cum laude. Later she attended Johns Hopkins University earning a M.A. in Zoology. The real test was yet to come. Could a woman find employment as a scientist? In the 1950s, Rachel began to see ominous signs of poisons in the environment. Pesticide manufacturers produced deadly products, such as DDT. Pesticides poisoned livestock which made its way to America's dinner tables. Silently, Rachel began her quest to warn the world of a coming disaster. During this time her beloved mother died, and Rachel suffered from arthritis, flu, and a stomach ulcer. Not even a diagnosis of terminal cancer kept her from her work.

Rachel Carson's crowning achievement came in 1962 with the publication of *Silent Spring*. She alerted the world to a future where spring would come in silence, and pesticides would devastate the earth's ecology. *Silent Spring* became an immediate bestseller. Scientists argued that Rachel was an alarmist, but no one could disprove her facts. *Silent Spring* prompted a congressional investigation, and Rachel spent her last days defending her work.

Rachel died on April 14, 1964, at the age of 56.

"Only within the moment of time represented
by the present century has one species—man—acquired
significant power to alter the nature of his world."
—Rachel Carson, *Silent Spring*

Procedures:

1. Give each student a copy of the blank Rachel Carson worksheet.
2. Discuss why it is important for us to record significant events in our lives.
3. Have the students label the center circle of the first worksheet with their own name, birth date, and one or two significant facts about their life (i.e. plays soccer, volunteers at the humane society, big sister, etc.).
4. Ask the students to fill in the circle at the 11:00 position with the most recent event in their life. (i.e. won a soccer tournament, awarded volunteer of the month, baby brother born, etc.)
5. Ask the students to complete the circle in the 12:00 position with as much information on their birth as possible.
6. Have the students complete the worksheet at home with the help of family members.
7. Review the completed worksheets. Have the students read their "life story" to a partner.
8. Give each student a second copy of the Rachel Carson worksheet.
9. Have the students fill in the center circle with the name Rachel Carson.
10. Ask the students if they have ever heard of Rachel Carson. Give the students a brief synopsis of her life and her importance to the environmental movement.
11. Hand each student a copy of the background information sheet on Rachel Carson and ask them to use the information to complete the worksheet on Rachel Carson's life.
12. Again, ask the students to use the worksheet to tell Rachel Carson's life story to a partner.
13. Discuss Rachel Carson's life with the students. Ask the following questions:
    a. What happened in the early part of Rachel Carson's life that influenced her later?
    b. How did Rachel's discoveries influence her writing?
    c. Why was her work and writing so important?
14. Ask the students what they aspire to accomplish in their future.

Extensions:

1. Visit the Rachel Carson Homestead in Springdale, PA.
2. Have the students write out their Rachel Carson stories.
3. Have the students decorate a poster/ bulletin board with a photo chronology of Rachel Carson's life.

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Biography

Rachel Louise Carson

Born: May 27, 1907
in Springdale, Pennsylvania

Died: April 14, 1964
in Silver Spring, Maryland

Rachel Carson, writer, scientist, and ecologist, grew up simply in the rural river town of Springdale, Pennsylvania. Her mother bequeathed to her a life-long love of nature and the living world that Rachel expressed first as a writer and later as a student of marine biology. Carson graduated from Pennsylvania College for Women (now Chatham College) in 1929, studied at the Woods Hole Marine Biological Laboratory, and received her MA in zoology from Johns Hopkins University in 1932.

She was hired by the U.S. Bureau of Fisheries to write radio scripts during the Depression and supplemented her income writing feature articles on natural history for the Baltimore Sun. She began a fifteen-year career in the federal service as a scientist and editor in 1936 and rose to become Editor-in-Chief of all publications for the U. S. Fish and Wildlife Service.

She wrote pamphlets on conservation and natural resources and edited scientific articles, but in her free time turned her government research into lyric prose, first as an article "Undersea" (1937, for the Atlantic Monthly), and then in a book, Under the Sea-Wind (1941). In 1952 she published her prize-winning study of the ocean, *The Sea Around Us*, which was followed by *The Edge of the Sea* in 1955. These books constituted a biography of the ocean and made Carson famous as a naturalist and science writer for the public. Carson resigned from government service in 1952 to devote herself to her writing.

She wrote several other articles designed to teach people about the wonder and beauty of the living world, including "Help Your Child to Wonder," (1956) and "Our Ever-Changing Shore" (1957), and planned another book on the ecology of life. Embedded within all of Carson's writing was the view that human beings were but one part of nature distinguished primarily by their power to alter it, in some cases irreversibly.

Disturbed by the profligate use of synthetic chemical pesticides after World War II, Carson reluctantly changed her focus in order to warn the public about the long term effects of misusing pesticides. In *Silent Spring* (1962) she challenged the practices of agricultural scientists and the government, and called for a change in the way humankind viewed the natural world.

Carson was attacked by the chemical industry and some in government as an alarmist, but courageously spoke out to remind us that we are a vulnerable part of the natural world subject to the same damage as the rest of the ecosystem. Testifying before Congress in 1963, Carson called for new policies to protect human health and the environment.

Rachel Carson died in 1964, after a long battle against breast cancer. Her witness for the beauty and integrity of life continues to inspire new generations to protect the living world and all its creatures.

Name:

Years:

Significance:

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Rachel Carson

Years: 1907 - 1964

Significance: Studied interaction of humans on environment; wrote the book, *Silent Spring*

Event: As a child living in Pennsylvania on the Allegheny River, Rachel finds a fossil discovering science

Year: 1912

Event: Rachel reads and writes at a young age and has a story published with her mother's encouragement.

Year: 1918

Event: At college, Rachel changes her major from writing to biology.

Year: 1927

Event: Rachel studies at The Woods Hole Marine Biology lab on Cape Cod.

Year: 1929

Event: Needing to work to support her family, Rachel begins writing about nature.

Event: Rachel writes two books about exploring the ocean: *The Sea Around Us* & *The Edge of the Sea*.

Year: 1951

Event: From her cottage in Maine, Rachel collects ocean specimens to study, then returns them.

Year: 1953

Event: Rachel begins raising her niece's five-year-old son Roger and feels helpless.

Year: 1956

Event: The town near Rachel's cottage expands and Rachel grows more concerned about preserving nature.

Year: 1957

Event: Rachel realizes that mosquito poisons also are killing birds, insects, and animals and harming people.

Year: 1958

Event: After four years of writing, *Silent Spring* is published, upsetting some people, and pleasing others.

Year: 1962

Event: Rachel is diagnosed with cancer and dies in 1964; a 78-acre Salt Pond Preserve is named in her honor.

Year: 1964

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Deadly Links
Post-Visit Activity

Subjects: Social studies, science, physical education
Skills: Analysis, classification, comparison and contrast, computation, discussion, generalization, kinesthetic concept development, synthesis
Duration: 1 class period
Group Size: Minimum of 10 students
Setting: Outdoors or gymnasium
Key Vocabulary: Pesticide, insecticide, herbicide, food web, accumulate, toxic, chemicals, organic, inorganic

Materials:
Multi-colored pipe cleaners, wooden craft sticks, or other material that can be picked up by students easily (30 per student in a proportion of two-thirds white to one-third multi-colored)
Small bags (one bag per grasshopper)
Peregrine Falcon, Starling, and Grasshopper cards/nametags

Background:

People have developed pesticides to control organisms. Herbicides are used to control unwanted plants, insecticides to control unwanted insects, etc. When these pesticides involve the use of poisons, the poisons frequently end up going where they are not wanted. Many toxic chemicals have a way of persisting in the environment, and often become concentrated in unexpected and undesirable places, from food and water supplies to wildlife and people.

For example, a pesticide known as DDT used to be applied regularly to crops as a means to control damaging insects. Then it was discovered that DDT entered the food wed with damaging results. Fish ate insects that were sprayed with the chemical; hawks, eagles and pelicans ate the fish. The poisons became concentrated in the birds – sometimes weakening and killing them directly, and over time resulting in side effects such as egg shells so thin that the eggs would not hatch or were crushed by parents in the nesting process. Use of DDT is now prohibited in the United Sates, but is still legal in some foreign countries. Even after the application of DDT is stopped, DDT and its by-products can impact the environment for decades.

There are many other synthetic chemical pesticides that remain in use in the United States. They include 2,4-D; propoxur; diazinon and carbaryl. Many people use these pesticides in their own home, lawn or garden.

Damaging fertilizers are also used by farmers and home owners. Again, the use of such chemicals – particularly the inorganic, synthesized compounds – has varying side effects. Wildlife and people bioaccumulate pesticides and inorganic compounds; the chemicals do not pass out of their bodies, but concentrate in their systems over time.

Public pressure continues to force changes in the application and availability of pesticides. For example, there is now a growing interest in Integrated Pest Management (IPM). This is an approach that considers the entire ecosystem. IPM can include using a pest predator, as well as other biological controls, to reduce damage from pests. IPM can also include selective use of naturally-occurring and synthetic pesticides as well as habitat manipulation, and can be combined with times planting

(planting certain crops outside of the windows of time in which specific pests are most prolific and active).

The major purpose of this activity is for students to recognize the consequences of accumulation of some pesticides in the environment.

Procedure:

1. Tell the students that this is an activity about food webs. If they are not familiar with the term, spend time establishing a definition.
2. Divide the students into three groups. For example, in a class of 26, there would be two "peregrine falcons", 6 "starlings", and 18 "grasshoppers." (Three times as many grasshoppers than starlings, three times as many starlings as peregrine falcons.) Label grasshoppers, starlings and peregrine falcons so that they can be easily identified.
3. Hand each "grasshopper" a small bag or other container to represent the stomach of the animal or insect.
4. With the students' eyes closed, distribute the objects representing the food around in a large open space.
5. Give the students their instructions. The grasshoppers are the first to go looking for food. The falcons and starlings are still on the sidelines watching the grasshoppers – after all, the falcons and starlings are predators, and they are watching their prey! At a given signal, the grasshoppers are allowed to enter the area to collect food, placing it in their "stomachs." The grasshoppers have to move quickly to gather food. At the end of thirty seconds, the grasshoppers are to stop collecting food.
6. The starlings are now allowed to hunt the grasshoppers. The falcons are still on the sidelines quietly watching the activity. The amount of time available for the starlings to hunt grasshoppers should take into account the size of the area in which you are working. In a classroom, 15 seconds may be enough time; on a large playing field, 60 seconds might be better. Each starling should have time to catch one or more grasshoppers. Any grasshopper tagged by a starling must give its bag of food to the starling and sit on the sidelines.
7. It is now time for the falcons to hunt food, following the same time and rules as the starlings. Starlings may hunt for grasshoppers; grasshoppers are hunting for food chips; and the falcons are hunting the starlings. If a falcon catches a starling, the falcon gets the food bag and the starling sits on the sidelines. At the end of the time period, ask all the students to come together in a circle, bringing whatever food bags they have with them.
8. Ask the grasshoppers to empty their food bags and count the number of food pieces they have. They should count the number of white food pieces and the number of multi-colored food pieces. List the number of grasshoppers and the number of white and multi-colored pieces each has; list the number of starlings left and the number of white and multi-colored pieces each has; and, finally, list the falcons and the number of white and multi-colored pieces each has.
9. Inform the students there is something called a "pesticide" in the environment. This pesticide is sprayed onto the crop the grasshoppers were eating to prevent crop damage. If there were extensive crop damage, the farmer would have less to sell, his livestock may have less to eat, or it may increase the cost of food due to a shortage caused by grasshopper damage. This particular pesticide is the one that is poisonous, accumulates in food weds and stays in the environment for a long time. In this activity, all the multi-colored food pieces represent pesticide. Any grasshoppers not eaten by starlings that have colored pieces in their bag are now considered dead. Any starlings for which half or more of their food supply was multi-colored

would also be considered dead. The one peregrine falcon 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 season will be so thin they will not hatch properly. The other falcon(s) is/are not visibly affected at this time.

10. Talk with the students about what they have just experienced. Ask them about their observations on how a food web works, and how toxic substances can enter the food web, with a variety of results.

Summary:

Give three example of ways in which pesticides can enter the food we. What are the consequences of pesticides in the food web?

Extensions:

1. Consider and discuss possible reasons for the use of such chemicals. What are some of the tradeoffs? What are some of the consequences?
2. Offer and discus possible alternatives to pesticides.
3. Check newspapers for example of the issue.
4. Conduct the activity using different samples, with the ultimate predator being human.

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Paper Collectors
Related Activity

Subjects: Social studies, art, math
Skills: Estimations, measurements, graphing
Duration: Two class periods
Group Size: Small groups
Setting: Classroom
Key Vocabulary: Conservation, natural resources

Materials:
Waste paper generated in the classroom
Any of the following:
- grocery bag
- box
- magazine
- gift wrap paper
- cards
- newspaper
- lunch bag
- milk carton

Objective: Students will be able to suggest ways paper and other natural resources can be used and recycled in the classroom.

Procedure:
1. For one week ask students to save all waste paper generated by class activities. Assign groups to separate papers into two stacks daily: one that has been completely used (e.g. on both sides) and one, for paper that could be used again.
2. At the end of the week, compare the amount of paper in the stacks and lead a class discussion on "Are we wasting paper?" Give each group some of the reusable paper, pencils, and one of these articles: grocery bag, box, magazine, gift wrap paper, cards, newspaper, lunch bag, or milk carton.
3. Ask each group to list on the paper all the ways they can think of to reuse the article, or list alternatives to these items that could be used over and over again (e.g. reusable plastic containers instead of sandwich bags, thermos instead of milk carton, etc). After ten minutes, share the ideas.

Extensions:
1. Continue to maintain a room recycling center. Use the recycled papers to make gifts, models, table decorations, collages, bookmarks, name tags, etc.
2. Use chalkboards or dry erase boards in class instead of paper for practicing writing and drawing skills or math calculations.

3. Reuse homework papers for scratch paper.
4. Instead of using new construction paper for art projects, use color cut from magazine pictures.

Waste Free Lunch
Related Activity

Subjects: Science, Math
Skills: Estimations, measuring
Duration: One class period
Group Size: Entire class
Setting: Classroom
Key Vocabulary: Conserve, waste, landfill, recycle

Materials:
Student lunches
Scale
Paper and pencil

Background:

It has been estimated that on average a school-age child using a disposable lunch generates 67 pounds of waste per school year. That equates to 18,760 pounds of lunch waste for just one school.

Tips for waste free lunches:

1. Use a lunch box or nylon bag instead of a paper bag to carry your lunch.
2. Keep your drink in a thermos instead of a box or can. Tetra-pack juice containers are not recyclable.
3. Pack your sandwich in a reusable container instead of a plastic bag.
4. Look for alternatives to individually wrapped or over-packaged items. Certain items can be bought in bulk and then brought to school in a small container.
5. Fruit and vegetable scraps can be composted to further reduce the amount of garbage produced.
6. Encourage your students to write down their conservation ideas to show to their parents. They can ask their parents to help make their lunches trash-free!

Procedures:

1. Weigh and record each student's lunch waste.
2. Lead a discussion on how the students can reduce the amount of waste they produce. Examples may be to use reusable containers, nylon or plastic lunch bags, fresh fruit, washable flat wear, and drink containers.
3. Allow a few days for the students to adjust to the way they pack their lunch, re-weigh, and record the findings.
4. Discuss the differences between the two measurements and also the environmentally friendly choices the students made.

Extensions

1. Conduct a school wide waste reduction project.
2. Complete the "What a Waste" lesson.
3. Have the students create posters to display in the cafeteria to educate the other classes on lunch box conservation.
4. Examine the amount of waste that is produced by the school bought lunches and the possibilities of reducing it.
5. Encourage the students to pack a waste free lunch for field trips as well.
6. Weigh the amount of paper waste that is produced in the classroom each day. Discuss possible solutions on how to lower the amount of paper that is being used.

PITTSBURGH ZOO
& PPG AQUARIUM

River Otter Word Search

RIVER	**OTTER**	**MUSTELID**	**STREAMLINED**	**CRAWFISH**
TRACK	**SCAT**	**DIVE**	**SLIDE**	**WEBBED**
ADAPTATION	**POLLUTION**	**REINTRODUCE**	**PREDATOR**	**CONSERVATION**
PROTECT	**WILD**	**WETLAND**		

T X Q R N T O I S L U Y K T I U R T H C
A T R U X R E T T O B Q R A U Z Y N R Q
L Z S R T D Y B M H T E D P X S G T P F
C L B S F X C D A Z J A X L Y P T I T Q
H L Y S F Q E I G O P H K F M R T F V F
H N A Q M G I L A T Q N H A A M C D I U
H X P W V C J E A G M L S C N C P N V D
E F M I M C X T H I H N K D O S R A T C
D H Y N V A I S J R I S M C I Z H L R O
E D I L S O L U O O N E K T T Q S T E N
T W R P N R W M O I I U M J U D I E I S
C L S T R E A M L I N E D A L Q F W N E
E X Q G D W S A G V T H W Z L A W S T R
T K J K M O N R U M C N E N O P A C R V
O K S J Z D E Y I E L A B V P F R A O A
R T Z E G V Y T W X S I B N H M C T D T
P J D Q I O Q D K E F N E L O M G Q U I
E T L R K V A I W M H D D N E J V V C O
P A I R F Z Z V P R E D A T O R C R E N
U J W Q I L Q E R U M Q O R P B H W D X

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