Students play a game to introduce them to the pressures that bring about the decline of populations of plants and animals.

Background

A visit to a state park, zoo, aquarium, or natural history museum can be a reminder of the great diversity of life on Earth. It is this diversity that provides a countless variety of foods, life-saving medicines and materials for daily life. The species around today have evolved and changed through time, and thousands of types of plants and animals once in existence have been lost to extinction. Some species have gone the way of the dinosaurs—wiped out by some natural change in ecological conditions—or by other natural causes such as disease or predation. In recent times, plants and animals have been rendered endangered or extinct by human activities—exploitation, habitat alteration or destruction, pollution, and the introduction of new species.

Why save endangered species? Congress answered this question with the Endangered Species Act of 1973. The act's preamble states that endangered species of fish, wildlife, and plants "are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people." This law works to preserve imperiled species and calls for the conservation of critical habitat—the areas of land, water, and air space that these species need for survival.

Species in trouble are identified and placed on a state or federal list of endangered and threatened wildlife and plants. An endangered species is defined as one that is in danger of extinction. A threatened species is one that is likely to become endangered within the foreseeable future.

Some of Virginia's endangered species include the shortnose sturgeon, bald eagle, peregrine falcon, red cockaded woodpecker, gray bat, Delmarva fox squirrel, northern flying squirrel, Kemp's ridley and leatherback sea turtles, several species of whales, and a wetland plant called swamp pink. Some of the state's threatened species are the yellowfin madtom (a fish similar to a catfish), piping plover (a shorebird), Dismal Swamp shrew, and loggerhead and Atlantic green sea turtles.

Grade Levels: 3 - 7

Objectives

Students will investigate changes in population levels by:

- modeling the behavior of a migrating species confronted with impediments to its survival.

Materials

- bases (2 for every 3 students, see "At the Park" step 3)
- flip chart and marking pen

Credits

The migration game was adapted with permission from: Aquatic Project WILD. 1987. "Migration Headache." Western Regional Environmental Education Council. Write: VA Dept. Game and Inland Fisheries, 4010 W. Broad St., Richmond, VA 23230. (804) 367-1000.
Illustrations of shortnose sturgeon and sea turtles used with courtesy of the artist, Richard Barnard. Illustration of piping plover used with permission of artist.
Swamp pink art by Megan Rollins.

When

At the Park: 30 to 45 minutes for game and discussion, 30 to 60 minutes for walk, daylight hours.

Time of Year: Year round.
Ups and Downs

Procedure

Before the Trip:

1. Review the park section of this guide or contact the park staff to locate an open area suitable for this activity.

2. Review with the class the concept of a habitat—the area in which a plant or animal finds the things it needs for survival, such as light or food, water, shelter, space and the opportunity to reproduce.

3. Students draw or describe their own habitats, depicting where they get their food, water, shelter, and space.

4. Lead into a discussion about extinction with questions such as:
   - What would happen if you were deprived of one of your basic needs?
   - What would you do?
   - What would an animal do? A plant?
   - What would happen if you, the plant or animal didn't fulfill that need?
   - What would happen if all members of a species couldn't fulfill that need?

5. Next, students brainstorm about ways some of these needs might not be met (in both healthy and disturbed environments). Write their ideas on the board.

At the Park:

1. Find an open space for active work.

2. Explain to the class that:
   - they will play a game in which they will act as a population of piping plovers.
   - the piping plover's habits and needs are described (in box).
   - in this simulation game, the piping plovers will be migrating back and forth from season to season between their nesting and wintering habitats.

3. At each end of a 70-90 foot playing field, place one base for every three students. (A base can be any small portable object that is not likely to blow away, is large enough for three students to get a foot on and is not likely to hurt feet or ankles moving in a frenzy. Plastic coffee can tops or rags should do fine.)

4. The plovers line up along the nesting habitat at one end, with one foot on any base.

5. On signal, the plovers must migrate to their wintering habitat by racing to the other end of the field and placing one foot on a base. Only three students may have a foot on one base at a time. If they cannot find a spot on a base, then they have not found suitable habitat, and they die and must sit out. For the first round, however, there should be enough habitat for all.

6. One student or an adult assistant jots down the numbers of plovers that survive each round of winter and spring migrations for graphing later.

7. Once the plovers have flown safely to their wintering habitat,

Where

Since endangered and threatened plants and animals are very uncommon, they can only be found in a few areas of the state. Before visiting one of the state parks for this activity, check with park staff to find out if any of these species can be seen there. Parks and National Wildlife Refuges manage lands to provide suitable habitat for many of these species.

Caledon: several fields near visitor center are ideal for game; visitor center has information about endangered bald eagle; Caledon has large concentrations of eagles during summer, and a nest used for many years; sometimes eagles can be spotted near visitor center; eagle tours offered seasonally.

Chippokes: best location for game is field between visitor center and pool; bald eagles can sometimes be seen flying overhead or perched in trees along river; best viewing area is in front of visitor center and along College Run Tr.

Eesytoaia: game can be played in open places near picnic area or on beach at Freestone Point; bald eagles frequent park and have nested nearby; chances of spotting an eagle are best in places with river view or Powell's or Neabsco Creeks.

Mason Neck: lawn near picnic area is suitable for game; visitor center has exhibits on bald eagle; eagles roost in park in large numbers during winter and are seen regularly flying near visitor center throughout year; special observation blind is available to small groups seasonally.

Seashore: lawn between office and amphitheater and beach are best locations for game; mounted leatherback sea turtle is in visitor center; park is a refuge for many species of locally endangered or threatened species of plants, insects and reptiles, including eastern chicken turtle; example of chicken turtle's critical habitat—cypress pools—can be seen near visitor center; bald eagles are sometimes spotted around Broad Bay near 64th Street boat ramp.
The piping plover is a threatened shorebird in Virginia. They spend the winters along the Gulf coast and along the Atlantic from Virginia southward and spend the summers around the Great Lakes and along the Atlantic coast from Virginia northward into Canada. They feed on small animals found on beaches and tidal flats such as marine worms, mollusks, fly larvae and beetles. They usually nest on beaches by making a simple depression in the sand, well above the high water line. If disturbed, as by people walking along the beach, the plowers take flight, leaving the eggs exposed to the sun. If exposed for long, the eggs can overheat, killing the developing embryos. Hence, piping plowers, as well as other shore nesting birds, need quiet beaches, free of people for successful nesting. They should turn around and prepare for the spring migration.

8. Before giving the signal for the return migration, however, explain that this year there has been a bridge built to their favorite nesting island, bringing lots of tourists to the beach, so some of their habitat is no longer safe.

9. Remove one base from the nesting end, and send them on their migration. When they reach this end, three students will be left out. (Have them sit on the sideline to watch the next round.)

10. Just before it's time for the fall migration, explain that there has been an oil spill near their favorite wintering beach.

11. Remove two or three bases from that end of the field, and make the signal to start the migration. This time, many more plowers will die, and the population will be much smaller.

12. Explain that a hurricane blew down the bridge to their nesting ground and there are fewer tourists to frighten them away.

13. Add one plate there and signal the migration. With lots of healthy habitat, the plowers will have a good nesting year. Some of the students may return to play as young plowers, but only as many as can fit on the plates in the nesting habitat.

14. Continue the game for at least six migration trips, with both good and bad cycles. Get students to help make up the course of events, introducing a variety of changes in food supply, disease, weather, human disturbance, efforts at protection, etc.

15. At the end of the game, discuss the events with the class:
   - Which factors caused the plover population to decrease? Increase?
   - Which events were caused by humans? Which were natural?

16. If available at the park, have students tour the visitor center to learn more about extinct, endangered or threatened species that live (or have lived) in the park.

17. Lead the class on a walk to try to spot an endangered or threatened species (see "Where") and to experience their habitat.

Follow-up:

1. Using the data recorded in the field, make a bar chart showing the changes in numbers of plowers for each migration.

2. Organize a library trip and help students find out more about a species chosen from the accompanying partial lists of threatened, endangered, extirpated and extinct species or from a more complete one provided by a state or federal agency (see "Resources"). Have them write short reports (with original art) or fictional stories about the species and their plights, bringing out such points as:
   - the species' needs for survival.
   - why the species became imperiled.
   - ways people can help (or could have helped) it to survive.

3. Tie in the "How 'Eagle Eyed' Are You?" activity by taking an eagle tour at Caledon.

Where (cont’d)

Westmoreland: field in front of visitor center is perfect for game; visitor center exhibits cover ancient extinct species, represented by fossil specimens, and imperilled modern species, represented by mounted specimens of striped bass, osprey and bald eagle; fossils can be found on park beaches and eagles can sometimes be spotted flying near river.

York River: field near visitor center is ideal for game; bald eagles are sometimes spotted in and over park.

Resources


Natural Heritage Program. Dept. of Conservation and Recreation. 203 Governor St., Suite 402, Richmond, VA 23219. (804) 786-7951.


VA Dept. of Game and Inland Fisheries. 4010 W. Broad St., Richmond, VA 23230. (804) 367-1000.

# Ups and Downs

## Shortnose Sturgeon

![Shortnose Sturgeon](image)

## Virginia Endangered and Threatened Species, 1990

<table>
<thead>
<tr>
<th>Amniibians</th>
<th>Mollusks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Endangered</strong></td>
<td><strong>Endangered</strong></td>
</tr>
<tr>
<td>Shenandoah salamander (<em>Plethodon shenandoah</em>)</td>
<td>Appalachian monkeyface (<em>Quadrula sparsa</em>)</td>
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<tr>
<td>Tiger salamander (<em>Ambystoma tigrinum</em>)</td>
<td>Birdwing pearly mussel (<em>Lemiox rimoris</em>)</td>
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<tr>
<td><strong>Birds</strong></td>
<td>*<em>Cumberland bean mussel (<strong>Villosa trabalis</strong></em>)</td>
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<tr>
<td>Endangered</td>
<td>**Cumberland combshell (<em>Epioblasma brevidens</em> )</td>
</tr>
<tr>
<td>Bald eagle (<em>Haliaeetus leucocephalus</em>)</td>
<td>**Cumberland monkeyface (<em>Quadrula intermedia</em> )</td>
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<tr>
<td>Bewick’s wren (<em>Thryomanes bewickii altus</em>)</td>
<td>**Dromedary pearly mussel (<em>Dromus dromas</em> )</td>
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<td>Loggerhead shrike (<em>Lanius ludovicianus</em>)</td>
<td>Fine-rayed pigtoe (<em>Fusconaia cuneolus</em>)</td>
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<tr>
<td>Migrant loggerhead shrike</td>
<td>**Green-blossom pearly mussel (<em>Epioblasma turulosa glabruraculum</em> )</td>
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<td>Peregrine falcon (<em>Falco peregrinus</em>)</td>
<td>**James spiny mussel (<em>Pleurobema collina</em> )</td>
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<tr>
<td>Red-cockaded woodpecker (<em>Dendrocopos torridus</em>)</td>
<td>**Litt.e-winged pearly mussel (<em>Pegasias fabula</em>)</td>
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<tr>
<td>Roseate tern (<em>Sterna dougallii</em>)</td>
<td>**Oystär mussel (<em>Epioblasma capaeformis</em> )</td>
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<tr>
<td>Wilson’s plover (<em>Charadrius wilsonia</em>)</td>
<td>**Shiny pigtoe (<em>Fusconaia corri</em> )</td>
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<tr>
<td><strong>Crustaceans</strong></td>
<td>**Sniuffbox (<em>Epioblasma triquetra</em> )</td>
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<tr>
<td>Threatened</td>
<td>**Tan rafflesshell (<em>Epioblasma florentina walker</em> )</td>
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<tr>
<td>Madison cave isopod (<em>Antrolana lina</em>)</td>
<td>**Virginia coil (<em>Polygyrus virginicus</em> )</td>
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<tr>
<td>Threatened</td>
<td><strong>Threatened</strong></td>
</tr>
<tr>
<td><strong>Fish</strong></td>
<td>Chittenango ovate amber snail (<em>Succinea chittenangoensis</em> )</td>
</tr>
<tr>
<td>Endangered</td>
<td><strong>Plants</strong></td>
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<tr>
<td>Blackbanded sunfish (<em>Enneacanthodes caudata</em>)</td>
<td><strong>Endangered</strong></td>
</tr>
<tr>
<td>Blueside darter (<em>Etheostoma jessiae</em>)</td>
<td>Harper’s fimbriylis (<em>Fimbriylis perpusilla</em>)</td>
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<td>Carolina darter (<em>Etheostoma colis</em>)</td>
<td>Long-stalked holly (<em>Ilex collina</em>)</td>
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<td>Sharphead darter (<em>Etheostoma aculeatum</em>)</td>
<td>Mat-forming water-hyssop (<em>Rapoca stragula</em>)</td>
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<td>Shortnose sturgeon (<em>Acipenser brevirostrum</em>)</td>
<td><strong>Nesokia</strong> (<em>Nesokia umbellata</em> )</td>
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<td>Tippecanoe darter (<em>Etheostoma tippecanoe</em>)</td>
<td>**Northeastern bulrush (<em>Scirpus ancistrochaitus</em> )</td>
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<tr>
<td><strong>Mammals</strong></td>
<td>**Peter’s Mountain Mallow (<em>Iliamna corei</em> )</td>
</tr>
<tr>
<td>Endangered</td>
<td>**Piratetush (<em>Buckleya distichophylla</em> )</td>
</tr>
<tr>
<td>Delmarva Peninsula fox squirrel (<em>Scriurus niger cinereus</em> )</td>
<td>**Shale-baron rockcress (<em>Arabis serotina</em> )</td>
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<tr>
<td>Eastern big-eared bat (<em>Plecitus rufinesus</em>)</td>
<td>**Small whorled pogonia (<em>Isotria medeoleides</em> )</td>
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<tr>
<td>Eastern cougar (<em>Felis concolor couguar</em> )</td>
<td>**Swamp-pink (<em>Helenium bullata</em> )</td>
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<tr>
<td>Fisher (<em>Martes pennanti</em> )</td>
<td>**Variable sedge (<em>Carex polymorpha</em> )</td>
</tr>
<tr>
<td>Gray bat (<em>Myotis grisescens</em> )</td>
<td>**Virginia round-leaf birch (<em>Betula aquifolia</em> )</td>
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<tr>
<td>Indiana or social myotis (<em>Myotis sodalis</em> )</td>
<td>**Virginia sneezeweed (<em>Helenium virginicum</em> )</td>
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<tr>
<td>Northern flying squirrel (<em>Glaucomys sabrinus coloratus</em> )</td>
<td>**Virginia spiraea (<em>Spiraea virginiana</em> )</td>
</tr>
<tr>
<td>Northern flying squirrel (<em>Glaucomys sabrinus fuscus</em> )</td>
<td><strong>Threatened</strong></td>
</tr>
<tr>
<td>Virginia big-eared bat (<em>Plecitus townsendi</em> )</td>
<td>American ginseng (<em>Panax quinquefolius</em> )</td>
</tr>
</tbody>
</table>

## Reptiles

**Endangered**

- Bog turtle (*Clemmys muhlenbergii* )
- Eastern chicken turtle (*Deirochelys reticularia* )
- Hawksbill sea turtle (*Eretmochelys imbricata* )
- Kemp’s ridley sea turtle (*Lepidochelys kempii* )

**Threatened**

- Green sea turtle (*Chelonia mydas* )
- Loggerhead sea turtle (*Caretta caretta* )
How “Eagle Eyed” Are You?

Background

Bald Eagles and Man

The bald eagle is special to Americans. Bald eagles represent noble ideals such as courage and strength and are associated with wild, unspoiled places. Its image can be found on the Presidential Seal, currency, state flags, postage stamps, corporate letterheads and a vast array of commercial packaging from potato chip bags to peanut cans.

Unfortunately, despite its prominence in American life, the bald eagle has faced trouble from man even before its declaration as the national symbol in 1792. Considered a threat to livestock and game, eagles have been shot and poisoned. Dependent on mature, secluded, shoreline trees for nest sites and perches, they have steadily lost critical habitat to the development of waterfront homes, businesses and farms. Due to its position at the top of the food chain, pollutants such as heavy metals and pesticides have caused reproductive problems.

An especially infamous and devastating pollutant was DDT, a very popular insecticide with widespread use from the end of World War II until it was banned in this country in 1973. DDT is a “persistent pesticide,” meaning it doesn’t break down chemically into a less harmful substance for a long time. It accumulates in animal tissues and becomes increasingly concentrated as it moves up the food chain. For eagles and other fish-eating birds, the accumulation of DDT in their systems caused severe egg shell thinning. As a result, the birds could not incubate their eggs without breaking them and were thus rendered, for all practical purposes, reproductively sterile.

Fortunately, bald eagle populations are beginning to recover from the ravages of the past 200 years. Laws have been passed to protect them from being shot and poisoned; the release of toxic chemicals onto the land and into the waterways has been greatly regulated; and some shoreline areas have been set aside to provide nest and roost sites. Eagle relocation programs transplant young eagles from areas with healthy populations to areas with few or no eagles. Eventually, many of these eagles return to their release sites to nest and rejuvenate the area’s eagle population.

Today the Chesapeake Bay region has one of the healthiest eagle populations in the eastern United States. (The recovery region in-
How "Eagle Eyed" Are You?

![Graph showing number of young bald eagles produced in Chesapeake Bay (Virginia and Maryland)]

In the Bay region, nesting can begin as early as December and run until mid-June. Usually 1 to 3 eggs are incubated for about 35 days. The eaglets emerge helpless and blind but grow rapidly on a diet of fish and other meat foraged by both parents. After about 75 days they take their first flights. The parent birds continue to care for the fledglings for several more weeks before they finally disperse.

During the fledgling period, young eagles learn to find and catch their own food, which despite the eagle's image as a fierce predator, is most often carrion or animals very near death. By far, their main food is fish, but they also eat waterfowl, small mammals and occasionally reptiles. Sometimes eagles will rob other raptors (especially ospreys) of their catches, a practice which encouraged Ben Franklin to lobby for the wild turkey as the national symbol in preference to the eagle.

Bald Eagle Life History

Bald eagles typically mate for life. Their nests, called eyries, are usually built near the tops of tall trees (80-100 feet above ground). They are made of sticks and lined with moss, feathers or other soft material. A pair may return to the same nest each year, adding on new material each season. Some nests have been used for more than 35 years and have become as large as 8 feet across and 12 feet deep. (One nest was 20 feet deep, 10 feet wide, and weighed 2 tons!)

Where

Caledon is the only park with formally arranged eagle tours. However, the other six Chesapeake Bay estuarine state parks are used by bald eagles. For more information, see "Ups and Downs."

Resources


Flight Profiles

- Turkey Vulture
- Black Vulture
- Bald Eagle
- Osprey

131
How “Eagle Eyed” Are You?

the Bay area. However, when soaring, these birds can be easily differentiated, even at great distances, by their wing profiles. Turkey vultures hold their wings in a dihedral, or V-shape. Ospreys often have a crook in their wings and eagles hold their wings out almost flat.

Bald Eagles and Caledon Natural Area

Although bald eagles can be seen at all seven Virginia state parks in the Chesapeake Bay region, Caledon Natural Area is unique as a special eagle haven. (See park information section.) For years eagles have nested in the park and each summer, large numbers of eagles congregate there from all over the southeastern United States. More than 50 eagles have been spotted at or near Caledon in a single day!

Because of this abundance of eagles, visitor access to much of Caledon is carefully regulated. The park is divided into four zones, only one of which is accessible to visitors daily. The remaining three zones are preserved as eagle habitat, closed to the public completely from early fall through late spring to protect nesting areas. At other times, access is limited to small groups making brief visits to the shoreline for opportunities to view eagles. This access is provided in the form of eagle tours, conducted by the park staff.

Procedure

Before the Trip:

1. Begin planning early, preferably in the spring of the preceding school year, since tours are only offered in the summer and early fall. Fall trips usually get booked up fast!

2. Identify specific learning objectives for investigating topics of interest such as focusing on bald eagle life history, the effects of toxic substances in the food chain, or eagle management strategies. With advance notice, the park staff will tailor its presentation to help meet these objectives.

3. Contact the park to make reservations, and to discuss fees and specific field trip objectives.

4. Familiarize the class with key characteristics of the bald eagle.

5. If binoculars are available at school, have students use them on the school grounds, where they can learn to adjust the focus and practice bringing objects quickly into view. Spotting scopes will also be used at the park.

6. Explain that eagles are very alert and do not tolerate loud noises. Therefore, in order to have a good chance of seeing eagles and to avoid disturbing them, it is very important to be quiet and still while in the eagle viewing area.

At the Park:

1. Lead the class to the visitor center to tour the exhibits. Study the large aerial photograph of the park to see how the park is divided into special zones for protecting the eagle population.

2. A park ranger will give an introduction to the tour and lead the group out to the park bus.

3. After a short ride to Triangle Field, a staging area, students will examKnell a life-size replica of an eagle, be given eagle identification tips, and have an opportunity to practice using binoculars by taking a special field test. Discuss:

   - How can these birds shape such a nest structure?
   - Why do they pick treetops?
   - How much territory does a nesting pair need and why?
   - Why do the fact that eagles tend to choose mature trees for nests cause problems for them? (Often dead trees which humans tend to cut down.)

4. How could the eagles’ habit of returning to the same nesting area each year help or hurt the population?

4. The group will be driven closer to the Potomac shoreline, then walk about a 1/4 mile to the area where eagles are often observed.

5. At the conclusion of the tour, the park bus will return the group to the visitor center.

Follow-up:

1. Discuss the following:

   - If no eagles are seen, why weren’t they there? Where could they be?

   - What might they be doing?

   - How much space does an eagle need and how do we know (or how could one find out)?

Extensions

If adequate reference materials are available, research and present reports on important bald eagle issues such as its status on the endangered species list; the accumulation of toxic chemicals in the food chain; eagle migration routes; the importance of eagles to Native American cultures; and eagle relocation programs.

Variations

Younger students:
Talk about eagles before the trip—identification, food sources, where they can be found. Show pictures. After the field trip, do “Follow-up” activities Nos. 1 and 3.

Gifted/Advanced:
Distinguish between mature and immature birds and count the numbers of each. Record locations.

- Why does the Natural Area have to be “zoned” with restricted access?
- Given that eagles take 4-5 years to mature—what impact does this have on repopulation? How can people help eagles?
- How do you suppose eagles catch fish? Waterfowl?
- Why do fish, as a primary food source, cause problems for eagles? (Pesticides wash into streams and rivers, easily entering the aquatic food chain.)
- How does coastal development negatively affect eagles?
- Do eagles migrate? What is the benefit to migratory behavior? The detriment?
- What are human perceptions of raptors in general?

2. Give students a special assignment related to bald eagles.

- Make a giant collage with eagle images collected in magazines, postage stamps, product packaging, etc.
- Build an eagle nest on the school grounds with materials gathered, with permission, from a local woodlot.

132
You, Too, Can Canoe!

Details are provided for what to expect with, and how to prepare for, park-conducted canoe trips into tidal wetlands. Tips and a model activity are given for maximizing student awareness and involvement.

Background

For some, the prospect of taking a class on a canoe trip brings on visions of kids floundering in the tide as they try to control unwieldy craft and returning with saturated clothes. Fortunately, canoes are remarkably stable and easy to control. With a little organization and by following a few basic precautions, a canoe trip into a Chesapeake Bay wetland can be a fun, easy, safe, and memorable experience.

Three state parks offer guided estuarine canoe trips: Leesylvania, Mason Neck, and York River. These trips are led by a park staff member and include a brief overview of canoeing safety and techniques, and detailed, on-the-water interpretations of estuarine and marsh features. Dip nets and buckets are provided for catching and holding some of the smaller estuarine inhabitants and there are usually opportunities to observe, from a distance, the larger, more agile residents.

Conducted canoe trips can be long or short, lasting from 1 1/2 to 4 hours. All students, grades 3 and up, are welcome. Groups with students under 14 years old should bring one adult chaperone for every two students. The number of people that can be accommodated on a trip ranges from 11 to 18, varying with the size of the participants and the size of the park canoes. Thus a class of 30 may need to schedule two or three canoe trips on the date that they visit. Fees apply and vary according to the canoe trip duration.

Check with the park well in advance for details and reservations.

The learning value of a canoe trip, like any field trip, increases significantly when students are prepared in advance, have well-defined objectives during the trip and have closely related follow-up activities. The following seven procedural steps describe ways to arrange a successful park-conducted canoe trip. The last step suggests a model for observing diversity of life forms found in a wetland. Other objectives, such as learning about tides and currents, variations in water chemistry, wetland plant adaptations or carrying out student-planned experiments are alternatives. For activity ideas to adapt or incorporate into a canoe trip, consider other units in this guide such as “Habitat Hunt,” “Marsh March,” “Water Motion and Commotion” and “Catch a Class Act.” With advance notice, the park ranger should be able to tailor the trip according to your specific objectives.

Procedure

Before the Trip:
1. Identify the learning objectives for the field trip.
2. Contact the park to make reservations, to discuss the learning objectives, and to determine the ideal group size and student-to-chaperone ratio. Visit the park for orientation.
3. Explain to the class all field trip plans, including when and how long they can expect to be in the canoes.
4. If the class is too large for one canoe trip, divide the class into smaller groups, including chaperones. (See “Where” for group sizes.) If the class must be divided, plan alternative activities for the students who are not canoeing.
5. Divide each group into teams of two or three canoeing partners. Team experienced canoeists with the inexperienced.
6. Review with the class some basic canoeing safety rules:
   - move into and out of the canoe in a crouched manner
   - remain seated at all times
   - keep your weight low and in the center of canoe
   - wear life jackets throughout the trip
   - alert the park ranger to any problems
   - no horseplay

Grade Levels: 3 - 12

Objectives

Students will investigate variation in estuarine life forms by:
- observing flora and fauna visible from a canoe.

Materials

To wear:
- old clothes and shoes that can get wet; cap

To take:
- change of clothes (just in case)
- insect repellent
- sun screen

For model activity:
- park map copies (one per student)
- 8 1/2 x 11” (or larger) poster board
- drawing pens, crayons, colored pencils, or markers
- note pad and pen or pencil

When

At the Park: 1.5 to 4 hours, daylight hours.

Time of Year: spring through fall.
7. Review with the class basic wetland and estuary information such as that described in “Marsh March” and in field guides. (See Lippson’s Life in the Chesapeake Bay and White’s Chesapeake, Nature of the Estuary.)

8. To encourage student investment and attentiveness during the canoe trip, organize a single project for the students. One example is:

- Students brainstorm a list of plants and animals they might expect to find on the canoe trip. The list is recorded on the board and on paper.
- Each student chooses one plant or animal to research and to exhibit with a poster. After learning the plant’s or animal’s life history and habitat requirements, they present their findings and poster to the class.

- During the canoe trip, students pay close attention to the types of plants and animals present in the wetland.
- Immediately after the canoe trip, students make a list of the species they saw.
- Upon returning to school, they compare this list to the predicted list made before the trip. The results are discussed with questions such as: What similarities or differences are there between lists? Why were some plants or animals not found that they expected to see?

At the Park:

Before the canoe trip departs, encourage students to be especially observant for marsh inhabitants and their signs, to ask the ranger questions, and to participate in discussions during the trip.

Where

Leesylvania: six canoes can accommodate 11 to 17 people; trips usually conducted on Powell’s Creek which passes through extensive freshwater tidal marsh.

Mason Neck: six canoes can accommodate 11 to 17 people; trips originate at visitor center on Belmont Bay and go up Kane’s Creek through extensive freshwater tidal marshes.

York River: six canoes can accommodate up to 18 people; trips originate near visitor center and are conducted on Taskinas Creek. Regular canoe trips are conducted in lower portion of creek in salt marsh; extended trips go to upper reaches of creek, providing opportunity to observe transition from salt marsh to fresh marsh to swamp.
Virginia’s State Parks . . . Your Backyard Classrooms

Water-Way to Get Around

Boats of all kinds have been key players in the Chesapeake Bay’s history. In this activity, students use a dichotomous key to learn about some types of boats used on the Bay, then build models of these boats and float them at the park.

Background

Native Americans of the Chesapeake region traveled and traded over a wide area. They used log canoes to travel by water. The larger loads of the early European settlers were most easily shipped by water. As a result, their farms and villages grew along the shores of the Chesapeake and on the banks of its rivers. For the first two hundred years of European settlement, ships and boats were the most important transportation in the Chesapeake region.

Towns for trading and shipping usually sprang up on rivers at the falls, where the rivers tumble through rapids and waterfalls on the edge of the Piedmont, before meeting the placid tidal waters of the coastal plain. Richmond, Alexandria, Fredericksburg, and Petersburg were all built on the fall lines.

Until the 1800s when canals were dug alongside the rivers, the fall line was the point at which goods and crops had to be moved over land. The remains of canals can be seen today along the James, Potomac and Susquehanna Rivers above the fall line. Boats were towed up and down the canal by mules or other animals. The C and D Canal which connects the upper Chesapeake Bay with Delaware Bay is still in use, not only by ships but also by migrating striped bass.

Hundreds of kinds of boats and ships have sailed the Chesapeake Bay, serving every possible use: transportation of people and cargo from across a creek or around the world, fishing, piracy, fighting wars and racing. Some boats and ships are unique to the Bay. Nine of these, the log canoe, sailing log canoe, skipjack, deadrise, yawl boat, Baltimore clipper, pungy, bugeye, and ram, are illustrated and described in this activity. Many of these traditional boats can be seen in Baltimore Harbor.

Procedure

Before the Trip:
1. Introduce the topic of boats by compiling, as a class, a list of “boats we have been aboard.” For each, note its purpose, approximate size, and any special interesting features.
2. Obtain some historical material about the use of boats in the Chesapeake region. The Chesapeake Bay Teaching Resources Lending Library at VIMS has a number of books which are available for loan. Try: Chesapeake Notes and Sketches: This Was Chesapeake Bay, and The Lord’s Oysters.
3. Select and assign student readings (factual or fictional) about pirates, shipping, travel, or other use of boats on the Bay. For secondary students, many sections of James Michener’s novel, Chesapeake, or William Warner’s Beautiful Swimmers would be appropriate.
4. Divide the class into workgroups of two or three students.
5. Distribute copies of the accompanying Bay Boats Dichotomous Key and Bay Boats to each group.
6. Review the dichotomous key instructions and “Special Boat Words” with the class. Explain that the key is similar to the kind of key scientists use to identify plants and animals.
7. Compare the groups’ results. Did all groups arrive at the same identifications? Discuss.

Grade Levels: 4 - 8

Objectives

Students will investigate variation in boat design by:
- using a key to classify types;
- constructing models of various types;
- observing behavior of models on moving water.

Materials

- copies of information sheet and dichotomous key provided
- pencils and clipboards for each student or group
- a supply of cleaned trash, paper and cardboard, and/or natural materials for building models
- tape, glue, staples, string, rubber bands, and scissors
- fishing line
- stakes or other markers
- stopwatch
- tape measure
- “wettable” footwear

Credits

Adapted with permission from The Changing Chesapeake, 1989. “Travel and Trade in Early Times,” “Working Boats and Ships of the Chesapeake Bay.” V. Chase, National Aquarium in Baltimore, Baltimore, MD.

Resources

Chesapeake Bay Teaching Resources Lending Library Catalog. 1989. Sea Grant Communications, VA Institute of Marine Science, Gloucester Pt., VA 23062.

8. With the class, plan a boat-building session (or two). Students, working in small groups or individually, design and construct a facsimile of one of the nine boats pictured on the Bay Boats sheet. Discuss options for construction materials and assign responsibility for procurement. Materials could include cleaned pieces of trash (which would fit in with a lesson on litter pollution) or natural materials. Hulls could be made from plastic tubs, or plastic or cardboard milk cartons. Be sure to tie a long piece (several meters) of fishing line to each completed model, so that they will not sail away to become litter.

9. Do a "test float" in the sink or bathtub before field trip day. Students should tinker with their designs until they float with some stability.

At the Park:

1. Take the models to a stream or other body of water at the park. Find a location where the current seems to be moving gently. Float a leaf to check speed and direction. Be prepared for wet feet.

2. Mark a starting point and finish line along the bank (perhaps 2 or 3 m, depending on current speed).

3. Maneuver the vessels along a starting line so that their handlers are holding them and standing behind them (up current). Release the boats, but hold on to the fishing line. Select a few students to clock the amount of time it takes for the vessels to reach the finish line. Time no more than four or five boats together to minimize collisions.

4. Repeat this once or twice (time permitting) for a more accurate experiment and average the times for each vessel. Be sure to collect all boats from the water when the activity is over.

Follow-up:

1. Discuss:
   - If you had to make your boat go faster or slower, what are the options?
   - Are some designs better than others for certain purposes?
   - Which is more important, current, wind, or auxiliary power?
   - If you could own one of these boats, which would you want? Why?

   - How have boats changed/stayed the same over the last 200-300 years?
   - Are any non-power boats still used? Why?
   - What kinds of boats are most common today? Why?

2. Examine a map of the whole Bay or a tributary and identify places where these Bay boats may have actually worked. Select some points between which some of the boats may have traveled in a day. Consult the map legend for scale, and note how many miles this typical day's run might have been.

Where

Caledon: very small boats could be sailed in woodland streams reached by trails that start at visitor center; boats could also be sailed in tidal creek flowing through Caledon Marsh. Access to marsh is seasonally restricted to small groups and park transportation must be arranged.

Chippokes: boats could be sailed in College Run from bridge on College Run Tr.

Leesylvania: boats could be sailed by wading in some areas along Potomac shoreline; shoes or boots would be essential.

Mason Neck: boats could be sailed in pond near visitor center.

Seashore: older students could sail boats in Narrows at 64th St; younger students in small groups could sail them in tidal mosquito ditch close to boat ramp.

Westmoreland: students could wade, with shoes or boots, and sail their boats at beach near swimming pool.

York River: with life jackets on, two or three students at a time could sail boats from canoe launching dock on Taskinas Creek; other areas include beach below picnic shelter #5, and Woodstock Pond.

When

At the Park: Sailing trials could take from 20 minutes to an hour, depending on conditions, number of boats and number of trials.

Time of Year: Late spring through early fall is the safest time to work around the water.

Extensions

Gifted/Advanced:
Locate pictures and descriptions of several other Bay boats or ships. Expand the dichotomous key to classify them, or design original keys to classify the boats in other ways.
Bay Boats Dichotomous Key

Directions:
- Look at the pictures and read the descriptions on the Bay Boats page.
- Write the number listed for each boat under the word “Boats” below.
- Follow the arrows to the right and write the number under each heading for each boat that fits the description.
- When each arrow stops, and there is only one answer, write the name of the boat under the description.

Boats

- Powered by motor
  - Window cabin
    - No window cabin
  - One or more fixed masts
  - Has sails
    - No fixed masts
  - Double ended (both ends the same)
    - Has no sails
    - One mast
      - Not double ended (bow and stern different shapes)
        - More than one mast
          - Painted pink and green
            - Three or more masts
            - Not painted pink and green
              - Fewer than three masts

Not powered by motor

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Special Boat Words

- bow - front (forward) of boat
- stern - back (aft) of boat
- masts - poles that hold the sails upright
- sloop - boat with one mast
- double ended - identically shaped bow and stern
- schooner - boat with 2 or more masts close together
- topmasts - additions on top of masts
- raked masts - tilted backwards toward the stern

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137
Bay Boats

1. DEADRISE: Common watermen’s workboats which may be used for crabbing, oystering, clam dredging and fishing. Often up to 45' long with a small cabin in front. Motor powered.

2. SKIPJACK: Used for oyster dredging in Maryland, they are the last commercial sailing fleet in the U.S. Graceful boat with sharp bow, squared stern and a single mast with sloop rigged sails.

3. SAILING LOG CANOE: These fast boats were adaptations of the Native American log canoes. Bow and stern pointed, made from five logs, two removable masts.

4. BALTIMORE CLIPPER: Common in the early 1800s these very fast ships carried cargo all over the world. Two raked masts, schooner-rigged.

5. LOG CANOE: Native Americans made these open boats by repeatedly burning and scraping a single log. Both ends pointed, paddle powered, up to 50' long.

6. YAWL BOATS (“PUSH BOATS”): These little motor boats evolved from the small boats carried by large sailing ships. They are used today as mini tugs which provide power for skipjacks.

7. RAM: Three or four masts, long, narrow and slow, these narrow schooners were sailing barges used in the C & D Canal at the top of the Bay.

8. BUGEYE: Double ended with one fixed mast, these ships dredged oysters, hauled vegetables, lumber, coal and illegal whiskey.

9. PUNGY: Similar to the Baltimore Clipper, but designed for use on the Bay. Schooner-rigged, two curved masts, some were painted pink and green.
Great Bay Land Grab

Grade Levels: 7 - 12

Objectives

Students will investigate changes associated with land use decisions by:
- observing existing features;
- considering social impact;
- analyzing features of a site;
- planning use options;
- communicating persuasively;
- evaluating options;
- predicting effects of decisions;
- visualizing alternate uses.

Materials

- copy of Roles for each student
- copies of site map, several per group
- cameras, film
- presentation supplies as needed (flip chart, posters, projector, etc.)

Confronted with the responsibility of planning for the sale and subsequent use of park lands, students analyze the resource and evaluate plans in terms of future impact.

Background

The Chesapeake Bay and its tributaries are very busy places. Waterfront property has become a premium commodity. The Bay supports important commercial fisheries, and is ranked third in the nation in overall fishery catch. It is the largest producer of blue crabs, and among the leaders in clams and oysters. The value of the Bay's fishing catch exceeds $100 million per year. It is also a key commercial waterway boasting two of the five major North Atlantic ports (Baltimore and Norfolk). Nearly $30 billion worth of cargo was shipped via the Bay in 1989. A variety of industries and power plants line the Chesapeake Bay shores to use the water for cooling and processing. The gentle climate, natural beauty and recreational opportunities are attracting more people who visit or make their homes here. The Bay also has value as a natural resource providing breeding and feeding grounds for marine life, serving as a major stopover for migratory waterfowl, and supporting the largest nesting population of bald eagles in the lower 48 states.

Development of waterfront property can fall into one of five categories: industrial, residential, recreational, commercial, or agricultural. Each type of development results in benefits and hazards. The benefits are generally economic and people-oriented and the hazards are often environmental.

Industrial development can include power generating plants, chemical manufacturers, chicken processing plants and others. Industries are attracted to the Bay because they generally require large quantities of water for cooling and processing. They provide jobs and economic stability but can introduce
Great Bay Land Grab

various pollutants into the Bay including toxic chemicals, excess nutrients, and heated water.

Residential development and commercial development are currently booming around the Bay. As waterfront housing developments go up they are accompanied by new shopping centers, stores, gas stations and other businesses. This type of development tends to increase waste water flow and surface runoff.

Recreational development includes marinas and boat landings providing access for fishermen and boaters, and land purchased for city parks, state parks and wildlife preserves. Increased use of the Bay by boaters can result in increases of floatable pollutants like plastics, and increases in oil pollution. Parks and refuges help maintain the environmental integrity of the land surrounding the Bay, but recent increases in property values of land adjacent to the Bay make it expensive for governments to purchase land for these purposes.

Agricultural development increases sediment runoff and can introduce pesticides and excess nutrients into the Bay. Fewer farms and the increase in environmentally sound farming practices have reduced the environmental impact of agriculture over the past few years.

Any type of development along the Bay that requires the clearing of land destroys wildlife habitat and increases sediment runoff in the Bay. In a 1975 study the Smithsonian Institution identified 113 sites around the Chesapeake Bay vital to wildlife. By 1980 over half of these sites were developed or being developed. Each square mile of land that is developed sends 25 to 50 thousand tons of soil into the water. An abundance of nutrients emptied in the Bay from sewage, runoff from farm fields, or other sources, triggers a chain of events beginning with increased algal growth which depletes oxygen supplies in the water and can result in major fish kills.

Over the years, the Bay and its tributaries have remained highly productive while absorbing considerable pressure from both natural and human sources. If human demands on the Bay continue to increase, the Bay may lose its ability to cleanse itself. Population projections through the year 2000 indicate a 24% increase in the number of people living in the Chesapeake Bay drainage area since 1980. This means 237 people per day will buy or build homes in this area, the need for water will rise 166%, exceeding current supplies, and these newcomers will generate 260 million gallons of sewage per day. In the words of William Ruckleshaus, past director of the E.P.A., "The Chesapeake, more than most bodies of water, is a people's Bay. Its survival is up to all of us" (1983).

Procedure

Before the Trip:
1. Prepare role assignments for students, filling in names for each role. Be careful to make some assignments which will allow students to play roles different from their present personas, e.g. assign some mediocr role Ph.D., or let the class brain play one of the school dropout roles. Modify role descriptions with local details if desired.
2. Copy the map of the park. Divide it into three approximately equal segments. Give each section some waterfront, and make dividing lines along present features (streams, roads) when possible. Label the sections A, B and C. Assemble references for classroom use.
3. Check a local newspaper for an article dealing with a local land use dispute. Assign it as a class reading and conduct a brief discussion, soliciting class opinions on what the central characters ought to do.
4. Explain that the class will be making some similar kinds of decisions. Read this aloud:
   It is now the year 2020.

Where

Caledon: access to most of park seasonally restricted and requires park-provided transportation; interior roads to sections of park along Potomac.
Chippokes: park roads and trails provide access to a variety of areas.
Leeysylvania: understanding of park's resources obtained by traveling slowly along park road and by walking trails and beach at Freestone Point.
Mason Neck: trails leading out from visitor center go to sections of park; some areas inaccessible; some characteristics can be inferred with topo map.
Seashore: park roads lead to representative areas including beach on Chesapeake Bay; cypress swamps, tidal marshes and beach on Broad Bay.
Westmoreland: most shoreline can be explored from road stretching from boat ramp to cabins; Big Meadows Tr. leads to extensive wetland area; Turkey Neck Tr. leads to hardwood forest.
York River: representative shoreline and wetland areas seen near visitor center and at Croaker Landing; all trails offer views of hardwood forests.

When

At the Park: 1 hour for on-site group work, plus time to tour the park any time of day.

Time of Year: Any season, in-class activities require 3-5 class periods.

Secretary of Natural Resources, the Attorney General, and a State Senator (the selection committee), who will select three worthy projects.

4. Distribute copies of the park maps showing A, B, and C plots, the role assignments, and background information to everyone.

5. Announce the proposal guidelines:
   - one page written summary
   - 5-10 minute oral presentation to selection committee; may include visuals (maps, graphs, photos, artist's conceptions, etc.);
Great Bay Land Grab

- must specify which park segment (A, B, or C);
- must offer the exact amount indicated in role description.

6. Provide the class with an overview of the project plan. Groups will work up preliminary plans for both site development and class presentations (using maps and available resources). They then will visit the park for in-depth exploration of the sites, and prepare and present their proposals after the field trip.

After the presentations, a public hearing (moderated by the selection committee) will be held for open discussion of the merits and drawbacks of the various proposals. The selection committee will meet in private and present its decisions on the proposed projects, and the reasons for those decisions, to the community.

7. Review with the class any maps and references obtained. Point out documents which provide guidelines for waterfront development.

8. Groups begin their planning. While the selection committee considers how to evaluate the proposals, development groups consider and prepare worksheets for:
   - size and locations for buildings, roads, etc.
   - compatibility with existing uses
   - erosion control
   - long-term impacts
   - pollution implications
   - impact on natural environment
   - community benefits
   - adherence to development guidelines
   - effective ways to “pitch” their sales presentation
   - what they need to do on site to prepare effective presentations

9. Check each team’s plans for the site visit to the park. Make sure plans are organized and contain sufficient detail to be helpful with planning.

At the Park:

1. Together, the class should become familiar with as much of the park as possible. This could include a canoe trip, a trail hike, a visit to the visitor center, and/or a chat with park staff about natural resources and land uses in the area. During this tour, locate the boundaries of plots A, B, and C.

2. The class then separates into the role groups to work on their plans on site. If everybody wants to develop site A, you will have to assign a few to the other sites. (Be fair, flip a coin.) Groups should take pictures, make sketches, locate facilities, and record information on their worksheets.

Follow-up:

1. Get film developed as quickly as possible.

2. Allow several class periods for groups to prepare their presentations.

3. Schedule and conduct students’ presentations: up to 10 minutes each, with 3 minutes for questions.

4. The selection committee conducts a public hearing after the presentations. Do this in an organized manner: the chair must present an agenda, recognize each speaker and keep the discussion on track.

5. The selection committee meets and selects one project for each plot, making sure that they collect at least $4,000,000.

6. After the decision is announced, assign as homework a one-two page essay which discusses the probable effects on the community 20 years later. Consider pollution, environmental benefits, value to the community and economic implications.

Resources

Chesapeake Executive Council. Contact: EPA Chesapeake Bay Liaison Office. (301) 266-6873.

*Telephone the Chesapeake Regional Information Service (1-800-662-CRIS) to obtain these and similar publications. The staff can assist with specific informational needs. Many up to date informational resources are available at no cost.

Extensions

1. Use the video tape Coastal Growth, A Delicate Balance and some of the activities described in its study guide. The general instruction for dilemma discussions will be helpful in conducting “The Great Bay Land Grab” activities.

2. Conduct the activity “Researching the Bay” concurrently, using the specific informational needs for this project as the research topics. “The Great Bay Land Grab” can be conducted without extra references, but is enhanced by use of researched material.
ROLES

Selection Committee: all went to the University of Virginia together and studied environmental law. They have worked for state agencies and have risen to positions of power and prestige. is Virginia’s Secretary of Natural Resources, is the Attorney General of Virginia, and is a long-time State Senator. These three individuals must decide to whom the park will be sold. They must examine the site, devise a system for rating proposals (based on environmental impact, community interests, economic implications), hear proposals, and sell enough of the park to raise at least $4,000,000.

Realtors: won the lottery in 2007. At the time, she was living in an abandoned school bus with her good friends and . Having developed an appreciation for fine housing, they founded the international real estate firm “Tri Giggle, Inc.”, which specializes in exclusive luxury homes. Tri Giggle proposes to buy a plot for $2,000,000 to subdivide into large lots for elegant homesites.

Power Company: As everybody suspected she would, went to MIT, earned her Ph.D. at the age of 22, and became a famous authority on nuclear power. When she went to work for Virginia Power, she was delighted to find that an environmental engineer, and a public relations specialist, would be on her staff. All three are sincerely committed to nuclear power as environmentally sound, safe, and cost effective, and they would like to buy a park plot for $2,500,000 for a small nuclear power plant.

Restaurant Owners: have traveled a bit. After dropping out of school they worked as deck hands on a freighter. Eventually, in Casablanca, they were astonished to run into , who had just completed a book about international foods. Together they decided to return home and open a fine restaurant featuring foods from all over the world. With royalties from the book as financial backing, they are able to offer $1,000,000 for one of the park plots for their restaurant.

Environmentalists: always were the kind of people who escorted flies outdoors rather than swatting them. Their love of nature led them to become environmentalists, and they founded “Naturecare” in 1999. As astute as ever, they hired , a successful used car salesman, as general manager. Although “Naturecare” operates on a small budget, they are hopeful that they will be able to buy one of the park plots for $500,000 in order to set it aside as a wildlife refuge.

Local Politicians: If you want to hear the latest news and gossip, everyone knows to ask and . Naturally, they are local politicians. They love their work, but have to deal with some really difficult decisions. Local sewage treatment has become a crisis they can’t ignore. The old plant, just upriver of the park, overflows with every rain, pouring raw sewage into the river. Voters are demanding action. The community Board of Supervisors has authorized $1,750,000 for the purchase of land for a state-of-the-art sewage treatment facility.

Retirement Home: Nobody could believe it when they heard that had eloped with and that they had gone to Nags Head to sell timeshare condos. After the hurricane last year, they had nothing left but their savings, which they decided to come home with. They would like to start a condo-style retirement community on the park site, and have hired (who earned an MBA at VCU and has been business manager for three nursing homes) as general manager. They have $2,000,000 to purchase land.

Teen Center: went to JMU and to Longwood. Both earned scholarships for graduate study at Johns Hopkins, became psychologists, and went into business together ten years ago, specializing in teen counseling. They have come to believe that many teens with drug and alcohol problems need to get away from the situation at home during counseling and, with encouragement and financial backing from , a local philanthropist, hope to open a substance abuse residential center for teens. They have $900,000 to spend on land.

Estuarine Lab: who always loved to go fishing, worked as a waterman briefly after graduation, became interested in fisheries management, took a few biology courses, and the next thing he knew he was a graduate student at VIMS. Of course, and were already there. After completing their Ph.D.s none of them could find a job. So, they wrote a proposal to EPA to start their own laboratory for estuarine research. It was funded. They have $1,250,000 available to purchase waterfront land. With the lab, they plan to research aquaculture and population dynamics, with the objective of stabilizing Virginia’s fisheries.
Whose Flotsam is This?

Until fairly recently, trash was just a noun. Your students know trash as a transitive verb also. To trash: to ruin a person, place or thing. This activity untrashs a park site, and contributes data to a national program which is a leader in the fight to stop global trashing.

Background

Whether discarded intentionally, blown or washed overboard accidentally, or originating from land, the Chesapeake Bay receives tons of litter each year. Not only is the litter unsightly, it is hazardous. Sea turtles swallow plastic bags mistaking them for a favorite food, jellyfish, then slowly starve as their digestive systems are inactivated. Seagulls and other birds become entangled in discarded fishing line and scores of fish die in old nets drifting free with the tides. Swimmers cut their feet on broken bottles and boat engines and propellers are damaged by plastic bags, ropes, and fishing line. Small marsh animals perish in drink bottles that outwardly are inviting shelters or nooks to find food, but in reality may be inescapable death traps.

The ultimate fate of litter in the Bay is varied. Paper products and untreated wood decay. Glass and metals sink and are eventually covered by sediment. But plastics are, for the most part, non-degradable (will not disintegrate) and are light enough to float or remain suspended in the water. Thus a single piece of plastic litter might be a problem for hundreds of years.

Many organizations, government agencies and individuals are working to solve litter problems. Among the attempted solutions are anti-litter laws, public information campaigns and photodegradable (disintegrate in presence of sunlight) and biodegradable (eventually disintegrate biologically) plastics. While these may reduce some of the negative effects of plastic litter in the environment, they do pose other problems. They do not degrade if buried, as in a landfill, and they cannot be recycled with other non-degradable plastics.

In 1988, the Coast Guard issued regulations that prohibit the dumping of plastic in our oceans and waterways, implementing Annex V of MARPOL, an international treaty. The regulations apply to all U.S. vessels wherever they operate, and to foreign vessels operating within 200 miles of the U.S. coast. While these regulations will not eliminate waterborne litter, they should help mitigate the problem.

Grade Levels: K - 12

Objectives

Students will investigate inter-relationships between the environment and litter by:
- observing types and conditions of shoreline litter;
- inferring about possible sources and effects of litter;
- collecting, organizing, and reporting data.

Materials

To wear:
- "wettatable" sturdy footwear (no sandals or flip-flops)
- leather and rubber gloves
Per team:
- Beach Cleanup Data Card
- Guide to Marine Debris
- A Guide to Good Data Collection
- clip board
- pens or pencils
- five gallon bucket
- plastic trash bags (at least 1 per person)

Credits

Activity and background information adapted with permission from Aquatic Project WILD. 1987. "Plastic Jellyfish." Western Regional Environmental Education Council. Write: VA Dept. of Game and Inland Fisheries, 4010 W. Broad St., Richmond, 23230. (804) 367-1000.


1725 DeSales Street, NW, Washington, DC. 20086. (202) 429-5609.
Solutions to a complex problem like waterborne litter require a thorough understanding of the problem. One non-profit marine conservation group, the Center for Marine Conservation (CMC), is building a database on marine debris for the entire United States. The CMC receives much of its information by encouraging groups to collect shoreline litter, keep count of the types of litter collected and send in the statistics. With a little ingenuity, a coastal-field trip can contribute to this valuable research and be a great learning experience.

Procedure

Before the Trip:
1. Write to the Center for Marine Conservation (use form provided) to request copies of their beach cleanup handouts—Beach Cleanup Data Card, A Guide to Good Data Collection, and Guide to Marine Debris. Ask for at least one copy of each handout for every team of two to four students.
2. Make an extra copy of the list side of the Beach Cleanup Data Card. On the copy, cross out the word “COLLECTED” and write “PREDICTED.” Use this modified copy to make enough for each team.
3. Divide the class into teams of two to four students each.
4. Lead a class discussion on the problems of waterborne litter.
   - What, to you, is litter...? a gum wrapper, cigarette filter, 20 feet or 1/2 inch of fishing line?
   - What types of litter did you see the last time you were on a public beach?
   - Have any of you ever been injured by beach litter or do you know anyone who has?
   - Have you ever seen animals trapped or killed by litter?
   - Have you ever observed animals making use of litter in lieu of natural materials?
5. Distribute the handouts. On the “Items Predicted” sheet, each team marks the number of each item they predict they will find during the field trip. Review the other handouts, the activity, and field trip plans with the class.
6. Emphasize important safety procedures:
   - Wear gloves.
   - Do not go near large drums. Report these to park rangers.
   - Be careful with sharp objects.
   - Be careful with potential hazards such as tampon applicators, condoms, and syringes. (Note: Discussion of these materials is at the discretion of each teacher, depending on the age and maturity of the students. Decide whether to just list them or avoid them altogether, and see that chaperones understand the policy.)

At the Park:
1. Be sure each team has a Beach Cleanup Data Card, a clipboard and pen or pencil. (Bring some extras.)
2. Each team chooses a data recorder to tabulate on the data card the litter they find.
3. Equip each team with receptacles for carrying litter. Use garbage bags for most items and a five-gallon bucket for the items that might cut through garbage bags.
4. At the shoreline, set boundaries, such as “from the water’s edge to the high tide mark” and “from the tidal creek to the big log.” Do not avoid marshes, if the footing is sound, since waterborne debris readily collects there.
5. The teams spread out and collect litter within the boundaries for a designated period of time.
6. Regroup the class. The teams sort their litter on the beach or lawn in groups, as classified on the data card.
7. A member from each team selects a piece of their litter to discuss the following points:
   - How might the litter have gotten into the water or onto the shore and how could it have been avoided?
   - If not picked up, what might happen to the litter in 1 year, 5, 20, 400 years?
   - How could the litter affect wildlife and man, both negatively and positively, if left in the water or along the shore?
   - Identify at least one way that the litter can be recycled.
   - What appears to be the source of the majority of litter collected by each team (i.e. picnickers, fishermen, boats, etc.)?

Where

Note: High use areas of parks are kept clean. Try less frequently used park shorelines or conduct this activity on another public beach.

Caledon: four miles of shoreline along the Potomac River; access is restricted to summer and fall; requires park-provided transportation.

Chippokes: two miles of shoreline along the James River.

Lessepsia: about one mile of easily accessed beach along the Potomac.

Mason Neck: more than one mile of easily accessed beach on the Potomac’s Belmont Bay.

Seashore: about one mile of open sandy beach at Bay mouth; salt marshes near boat ramp on Broad Bay.

Westmoreland: about 1.5 miles on the Potomac; most accessible area is near pool and boat landing; most productive litter collecting area is beach at end of Big Meadows Tr.

York River: about 3.5 mile of shoreline, most bordered with salt marshes and most easily accessed at visitor center and Croaker Landing.

When

At the Park: 60-90 minutes, near low tide.

Time of Year: All seasons.

Resources


Whose Flotsam is This?

- What was each team’s most interesting, surprising, or unusual litter-related observation of the day?
  
  8. When the discussion is completed, together gather the litter and dispose of it appropriately (preferably by recycling).

Follow-up:

1. Each team compares their “Items Collected” lists with their “Items Predicted” lists and makes bar graphs showing the relative amounts of the types of litter predicted and collected.
2. On the blackboard or with overhead transparencies, compile all the lists and graphs into one.
3. Each team completes its Beach Cleanup Data Card.
4. Collect the cards and send them to the CMC.

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The most abundant types of trash collected during “Clean the Bay” Day in 1989. (Source: Center for Marine Conservation).

**THE DIRTY DOZEN**

<table>
<thead>
<tr>
<th>Number of Pieces</th>
<th>Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pieces of paper</td>
<td>8894</td>
</tr>
<tr>
<td>2. Cigarette filters</td>
<td>7144</td>
</tr>
<tr>
<td>3. Pieces of glass</td>
<td>6972</td>
</tr>
<tr>
<td>4. Metal beverage cans</td>
<td>5642</td>
</tr>
<tr>
<td>5. Pieces of plastic</td>
<td>5591</td>
</tr>
<tr>
<td>6. Plastic cups, spoons, forks, straws</td>
<td>5399</td>
</tr>
<tr>
<td>7. Small pieces of foam plastic</td>
<td>5042</td>
</tr>
<tr>
<td>8. Glass beverage bottles</td>
<td>4508</td>
</tr>
<tr>
<td>9. Plastic caps and lids</td>
<td>3902</td>
</tr>
<tr>
<td>10. Pieces of wood</td>
<td>3694</td>
</tr>
<tr>
<td>11. Miscellaneous types of plastic bags</td>
<td>3297</td>
</tr>
<tr>
<td>12. Foamed plastic cups</td>
<td>3110</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>63,195</strong></td>
</tr>
</tbody>
</table>

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To: Center for Marine Conservation
1725 DeSales St. NW
Washington, DC 20036

Please send the indicated number of copies of the following:

___ Beach Cleanup Data Cards
___ Guides to Marine Debris
___ Guides to Good Data Collection

Teacher’s Name: ____________________________

School Name: ______________________________

Address: __________________________________

Grade: ____________________ Cleanup Date: __________________

Cleanup Location: __________________________

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**Extensions**

1. Encourage independent exploration of topics such as:
   - Status of local, state and federal litter-related legislation. (E.g. investigate the progress of a bottle bill in the VA General Assembly over the last decade.) What groups favor and oppose which bills and why?
   - Recent innovations with plastics such as recycling, biodegradable and photodegradable. Debate the pros and cons of using these materials.
2. Students write letters to their lawmakers, stating their own positions on litter-related legislation.
3. Students create litter art in the form of posters showing the effects of litter on the Bay, or sculptures or mobiles from litter collected during the field trip.
4. Students are challenged to invent useable products from recyclable plastics.
5. Start a class recycling project.

**Variations**

Social studies classes write a description of the culture of people from the area by analyzing the types of litter collected.

Younger students:
Each team of students must have an adult monitor to pick up and carry all potentially hazardous litter, as well as record data, as the students collect and sort the litter.

Gifted/Advanced:
1. Students keep a file on the consequences of pollution disasters like oil spills, etc. using newspapers, magazines, and TV as sources of information.
2. Obtain further data from the CMC so students can perform statistical comparisons between their findings and the baseline data.