

Exploring the Estuary!

**A Teacher's Guide to the
New York New Jersey Harbor Estuary Region**



**NEW YORK NEW JERSEY
HARBOR ESTUARY PROGRAM**

Harbor Estuary Program 2009

About this Guide

One of the NY-NJ Harbor Estuary Program's primary goals is to increase public awareness and appreciation of the environment. This guide highlights many of the region's estuary-related education programs - wonderful resources for teachers and students.

Readers are advised to visit organization web sites to keep current, as available education program content, schedules and program pricing change.

About the Harbor Estuary Program

The New York–New Jersey Harbor Estuary is a dynamic living ecosystem and center of human activity. The estuary was designated an “Estuary of National Significance” in 1988. The Harbor Estuary Program (HEP) is a partnership of federal, state, and local environmental agencies, businesses, scientists, environmental advocates, educators and citizens working together to protect and restore the estuary's natural resources and to establish and maintain a healthy and productive harbor ecosystem with full beneficial uses.

For more information about this publication or the Harbor Estuary Program, contact us at:



NEW YORK NEW JERSEY HARBOR ESTUARY PROGRAM

290 Broadway, 24th Floor
New York, NY 10007

Telephone: 212-637-3816
Fax: 212-637-3889
E-mail: info@harborestuary.org

www.harborestuary.org

Cover images (clockwise from left) Canoes (courtesy NY Sea Grant), Jamaica Bay (courtesy National Park Service), Aerial View of NY Harbor (courtesy NYC Parks), Fishing on the Harbor (courtesy NYSDEC I Fish NY), Miss New Jersey (courtesy NY Sea Grant), and Studying Harbor Life (courtesy NY Sea Grant)

Back Cover Images (l-r): Estuary Live (courtesy NY Sea Grant), Pelham Bay Lagoon (courtesy Sheila Buff), NYC Skyline (courtesy City-Data).



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Since 1971, New York Sea Grant, a partnership of the State University of New York, Cornell University, and the National Oceanic and Atmospheric Administration (NOAA) has been “Bringing Science to the Shore” through research, extension and education to improve the environmental and economic health of New York's marine and Great Lakes coasts.

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SECTION 1

Introduction

Where is the NY-NJ Harbor Estuary?

The NY-NJ Harbor Estuary encompasses the waters of New York Harbor and the tidally influenced portions of all rivers and streams flowing into it. The “core area” of the Estuary Program extends from Piermont Marsh on the Hudson River to an imaginary line at the mouth of the Harbor connecting Sandy Hook NJ and Rockaway Point on the East River. The core area extends to the Throgs Neck Bridge at the western end of Long Island Sound. It includes the Hudson, Passaic, East Harlem, Bronx, Hackensack, Raritan, Navesink and Shrewsbury Rivers as well as Raritan Bay, Newark Bay, Jamaica Bay, the Arthur Kill, the Kill Van Kull, and the Upper and Lower New York Bays.

Estuary Facts

Estuaries are transition zones between land and sea, fresh and salt water. The amount of freshwater flowing into an estuary varies from season to season and year to year. This variation coupled with the daily rise and fall of tides and resulting movement of salt water up and down river creates a unique environment.

- Estuaries are among the most productive of Earth’s ecosystems, creating more organic matter each year than comparably sized areas of forest or agricultural land



- A wealth of diverse habitats can be found in and around our local estuary including open waters, freshwater and saltwater marshes, sandy beaches mud and sand flats, rocky shores, oyster reefs, sea grass, wooded swamps, and adjacent upland habitats such as forests and grasslands.
- The protected waters of estuaries make them ideal breeding grounds for fish and shellfish.

- As water flows through estuarine wetlands, much of the sediment contaminants and pollutants that have been washed from the land are filtered out by surrounding marshes.
- Wetlands act as storm buffers to prevent flooding and minimize damage caused by hurricanes and other large storms
- Estuaries are excellent research laboratories for scientists and students alike.

What are some of the problems facing estuaries?

- Habitat loss and degradation
- Toxic Substances
- Pathogens
- Floatable Debris
- Nutrients and Organic Enrichment

Almost half of the US population lives in coastal areas and this number is rapidly increasing. Residential, industrial commercial and recreational development has increased pollution, altered land surfaces, reduced open spaces and restricted access to the shoreline.

Estuary Vocabulary

Aquatic: living or growing in or on water

Bight: a wide bay formed by a bend or a curve in the shoreline

Biochemical Oxygen Demand (BOD): a measure of pollution, a high BOD means there is a large amount of organic matter in the water, and a lot of dissolved oxygen is consumed in its decomposition

Biodiversity: the number of different varieties of life forms in a given area

Combined Sewer Overflow (CSO): event triggered by a heavy rain in which a portion of a combined sewer's contents are sent directly into a receiving water body instead of a treatment plant

Conservation: wise use and protection from depletion and pollution

Dissolved Oxygen (DO): oxygen that is present (dissolved) in water and therefore available for fish and other organisms

Dredging: the cleaning deepening or widening of a waterway using a machine (dredge) that removes materials with a scoop or suction device

Ecosystem: the interacting system of a biological community and its non-living environment; also the place where these interactions occur

Effluent: liquid waste discharged into the environment from a source such as an industry of sewage treatment plant; it can be treated or untreated

Erosion: the wearing away of the earth's surface by running water, wind, ice, or other geological agents

Estuary: a partly enclosed body of water where salt and freshwater meet and mix

Eutrophication : process whereby excess nutrients stimulate plant and algae growth which in turn can lead to hypoxia

Floatables: solid waste materials and natural debris that float on or just beneath the waters surface

Habitat: the place or type of site where a plant or animal naturally or normally lives and grows

Hypoxia: Low concentrations of dissolved oxygen in water. This condition is harmful to many aquatic organisms

Infiltration: process by which the earth is used to capture and filter stormwater

Marsh: A wetland without trees often having standing water

Natural Resources: raw materials supplied by the earth and its processes (e.g. nutrients, minerals, water plants and animals, etc.)

Nonpoint Source Pollution (NPS): pollution that comes from many diffuse sources. NPS pollution is caused by rainfall or snowmelt moving over or through the ground. As the runoff moves it picks up natural and human made pollutants.

Nutrients: essential chemicals needed by plants for growth (nitrogen, phosphorus, potassium) Excessive nutrients in water can contribute to massive growth, accu-

mulation and eventual decay of aquatic plants especially algae. This uses up oxygen which can lead to hypoxia.

Pathogens: microscopic disease causing organisms such as bacteria and viruses that are found in untreated human sewage and animal waste.

Pollution: contaminants in the air, water or soil that causes that cause harm to human health or the environment

Runoff: water (originating as precipitation) that flows across surfaces rather than soaking in; eventually enters the water; may pick up and carry a variety of pollutants.

Salinity: The amount of salt dissolved in water.

Saltmarsh: an estuarine habitat that is submerged at high tide, but protected from direct wave action and overgrown by saltmarsh herbaceous vegetation; aquatic grasslands affected by tides temperatures and salinity

Shoreline: a line where a body of water and land meet.

Tide: the alternate rising and falling of the surface of the ocean and of water bodies connected with the ocean, which occurs twice a day and is caused by the gravitational attraction of the sun and moon occurring unequally on different parts of the earth

Toxics: chemicals, such as PCBs, dioxin, pesticides and heavy metals which can be harmful to living things and can accumulate in the food chain.

Water (H₂O): Clear liquid solid or glass made up of tiny molecules of 2 parts hydrogen and one part oxygen.

Water Cycle: (hydrologic cycle) : the cycle of the earth's water supply from the atmosphere to the earth and back

Watershed: The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common point

Wetland: areas that periodically have waterlogged soils or are covered with a shallow layer of water; resulting in reduced soil conditions Wetland areas typically support plant life adapted to wet environments.

Estuary and Water Internet Resources

Exploring Estuaries:
New York New Jersey Harbor Estuary Program
www.harborestuary.org

National Estuary Program:
www.epa.gov/owow/estuaries
www.epa.gov/owow/estuaries/kids/index.htm

An excellent estuarine site tailored to the elementary audience. The site includes a basic explanation of estuaries and the problems they face. It hosts virtual tours of the Long Island Sound.

Virtual Field Trips:
www.estuarylive.org
Estuary Live has hosted online field trips to estuaries throughout the country. Recordings of estuary live events are posted on the site.

National Estuarine Research Reserve Programs:
(NERRS) www.nerrs.noaa.gov
The NYNJ Harbor Estuary Program Core area includes Piermont Marsh, part of the Hudson River Reserve NERR.

New York State Department of Environmental Conservation Hudson Estuary Program:
www.dec.ny.gov/lands/4920.html

EPA Environmental Education Pages

Children: www.epa.gov/kids
US EPA Environmental Kids Club. Projects, games art and helpful tips

Students: www.epa.gov/students/
US EPA Student Center environmental concepts activities and tips

Teachers: www.epa.gov/teachers/
US EPA Teaching Center for basic environmental concepts and teaching aids

Climate Change: www.epa.gov/climatechange/kids
Office of Environmental Education
www.epa.gov/enviroed/
Grants, training, fellowships, and the President's Environmental Youth Awards

OASIS

www.oasisnyc.net

The NYC Open Accessible Space Information System (OASIS) is a good resource for exploring the estuary. The OASIS guide will help you virtually travel to HEP restoration sites. OASIS is a partnership of more than 30 federal, state, and local agencies, private companies, academic institutions, and non-profit organizations that created a one-stop, interactive mapping and data analysis application accessed via the Internet. The maps highlight parkland, HEP sites and open spaces in the NY metropolitan area.

See related lesson plan on page 57.



Wildlife of the Harbor Estuary

The Harbor Estuary is home to many diverse plant and animal species. A number of these are depicted on the following page in an illustration by Kathy Johnston. Wildlife of the New York – New Jersey Harbor Estuary is available in poster format with an accompanying brochure that identifies and provides basic information about the species illustrated. The objective of the poster is to create an awareness of the rich natural resources that can be found in the Harbor Estuary region. The poster and brochure can be ordered by teachers free of charge by contacting the Harbor Estuary Program.

There are hundreds of ways that these local flora and fauna can be used in the classroom.

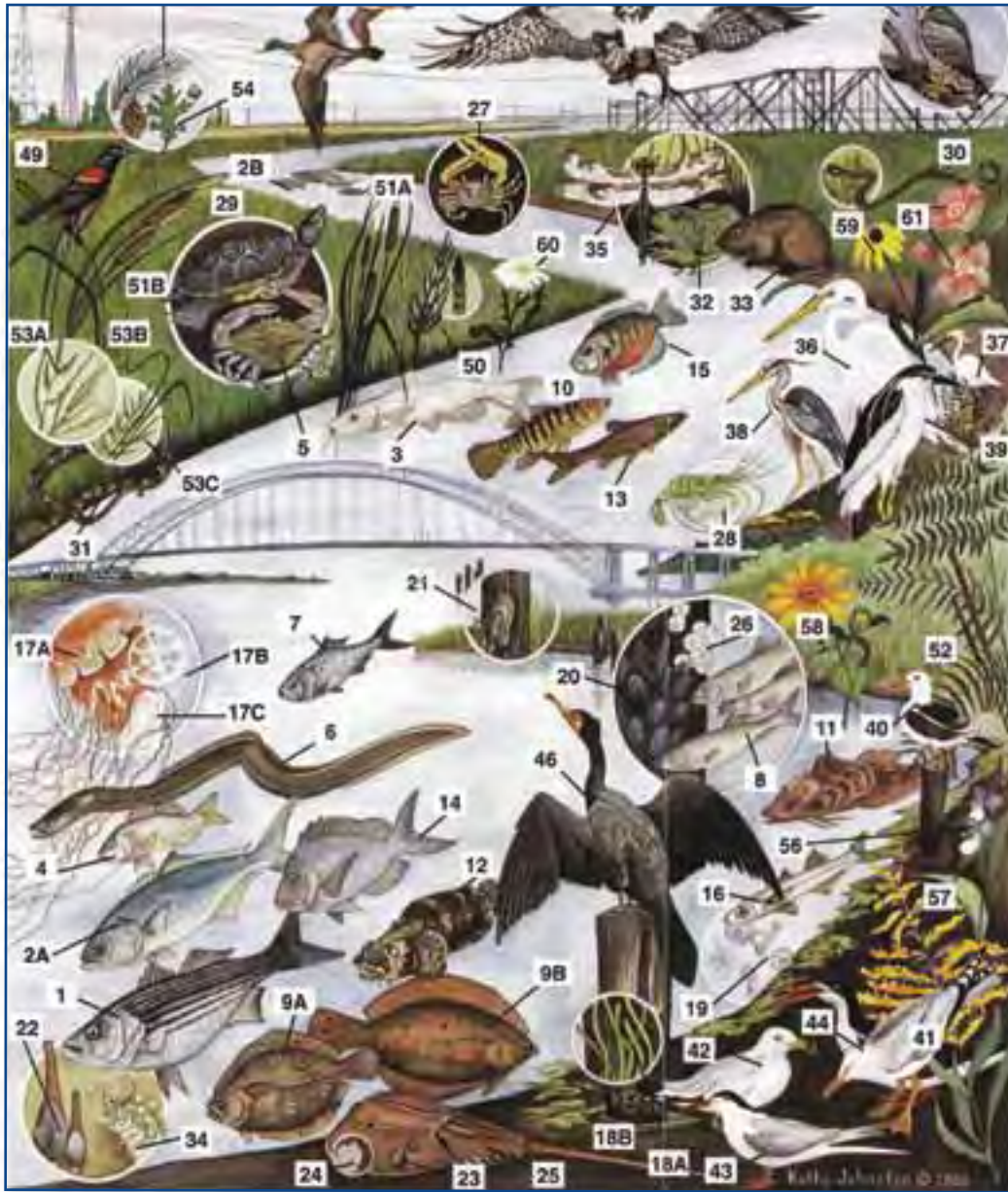
Here are a few suggestions:

- Break students into groups. Provide each of them with a copy of the picture and have them participate in a scavenger hunt. Develop a list of questions based on the students' grade level and the topics currently being studied (e.g. name three invertebrates).
- Have students identify food chains that exist among estuary species. Food chains should include the sun, producers, consumers and secondary consumers. Highlight how energy is transferred through the food chain accounting for why there are more producers than consumers. Talk about what would happen if one species were removed.
- Students can create a physical food web using a ball of yarn. Assign each student a species to represent (make sure to make someone the sun). Then have them stand in a circle, begin with the student who was assigned to the Sun. This student should hang on to the end of the yarn and pass the remainder of the ball of yarn to a producer and so on up the food chain. When you reach the top, simply begin a new chain, this time starting at the top. For more ideas on activities with the food chain see 'Nutrient Trap' in the sample lesson plan section.

- Have students choose a species that interests them and research that species. Students can present the information they find on the organism's life cycle, habitat, diet, etc. in a written or oral report.
- Many of the estuarine species in this picture are endangered or threatened. Have students research what it means for a species to be threatened or endangered and have them identify which organisms fall into each of these categories (at either the state or national level).
- Some of these species are important both commercially and recreationally. Have students research and write about how they are harvested and consumed or used in some way.
- It has been determined that some species of native fish and shellfish contain high levels of dioxins and polychlorinated biphenyls (PCBs) both of which are harmful if consumed by humans. As a result, states have implemented advisories to the public on safe consumption practices for recreationally caught fish. Have students research the health issues associated with PCBs and current fishing advisories.



Randolph Femmer



1. Striped Bass (*Morone saxatilis*) Moronidae
- 2A. Bluefish (*Pomatomus saltatrix*) Pomatomidae
- 2B. Snappers "Snapper Blues, Young Bluefish"
3. White Catfish (*Ameiurus catus*) Ictaluridae
4. White Perch (*Morone americana*) Moronidae
5. Blue Claw Crab (*Callinectes sapidus*) Portunidae
6. American Eel (*Anguilla rostrata*) Anguillidae
7. Atlantic Menhaden "Moonbunker, Bunker" (*Brevoortia tyrannus*) Clupeidae
8. Atlantic Herring (*Clupea harengus*) Clupeidae
- 9A. Summer Flounder "Fluke" (*Paralichthys dentatus*) Paralichthyidae
- 9B. Winter Flounder (*Pleuronectes americanus*) Pleuronectidae
10. Mummichog "Common Killie" (*Fundulus heteroclitus*) Cyprinodontidae
11. Striped Seerobin (*Promotus evolans*) Triglidae
12. Oyster Toadfish "Oyster Cracker" (*Opsanus beta*) Batrachoididae
13. Carp (*Cyprinus carpio*) Cyprinidae
14. Soup "Porgy" (*Stenotomus chrysops*) Sparidae
15. Bluegill "Sunfish" (*Lepomis macrochirus*) Centrarchidae
16. Atlantic Silverside (*Menidia menidia*) Atherinidae
- 17A. Lion's Mane "Red Jellyfish" (*Cyanea capillata*) Cyanidae
- 17B. Moon Jellyfish Ulmaridae
- 17C. Comb Jelly Ctenophora
- 18A. Spirogyra "Green Algae" Chlorophyta
- 18B. Sea Lettuce (*Ulva lactuca*) Ulvaceae
19. Plankton, Phytoplankton & Zooplankton

MORE AQUATIC & TERRESTRIAL SPECIES

20. Blue Mussel (*Mytilus edulis*) Mytilidae
21. Ribbed Mussel (*Geukensia demissa*) Mytilidae
22. Soft-Shell Clam (*Mya arenaria*) Myacidae
23. Slipper Shell (*Crepidula fornicata*) Calyptostes
24. Bryozoa
25. Horseshoe Crab (*Limulus polyphemus*) Limulidae
26. Barnacles (*Balanus* sp.) Balanidae
27. Fiddler Crab (*Uca pugnax*) Crustacea
28. Grass Shrimp (*Palaemonetes pugio*) Palaemonidae
29. Northern Diamondback Terrapin (*Malaclemys t. terrapin*) Emydidae
30. Eastern Garter Snake (*Thamnophis sirtalis*) Colubridae
31. Northern Water Snake (*Natrix sipedon*) Colubridae
32. Bull Frog (*Rana catesbeiana*) Ranidae
33. Muskrat (*Ondatra zibethica*) Cricetidae
34. Sandy-Mud Worm (*Streblospio benedicti*) Polychaeta
35. Dragonfly (*Libellula* sp.) Libellulidae

BIRDS

36. Great Egret (*Casmerodius albus*) Ardeidae
 37. Snowy Egret (*Egretta thula*) Ardeidae
 38. Great Blue Heron (*Ardea herodias*) Ardeidae
 39. *Black-Crowned Night Heron (*Nycticorax nycticorax*) Ardeidae
 40. Great Black-backed Gull (*Larus marinus*) Laridae
 41. Herring Gull (*Larus argentatus*) Laridae
 42. Ring-billed Gull (*Larus delawarensis*) Laridae
 43. *Common Tern (*Sterna hirundo*) Laridae
 44. **Black Skimmer (*Rynchops niger*) Rynchopidae
 45. Mallet (*Anas platyrhynchos*) Anatidae
 46. Double Crested Cormorant (*Phalacrocorax auritus*) Phalacrocoracidae
 47. *Osprey (*Pandion haliaetus*) Pandionidae
 48. ***Peregrine Falcon (*Falco peregrinus*) Falconidae
 49. Red-Winged Blackbird (*Agelaius phoeniceus*) Icteridae
- * NJ Threatened Species
 ** NJ Endangered Species
 *** NY Threatened Species
 **** NY Endangered Species

PLANTS

50. Horseshoe, common (*Equisetum arvense*) Equisetaceae
- 51A. Common Cattail (*Typha latifolia*) Typhaceae
- 51B. Narrow-Leaved Cattail (*Typha angustifolia*) Typhaceae
52. Cinnamon Fern (*Osmunda cinnamomea*) Osmundaceae
- 53A. Salt Meadow Grass "Salt Hay" (*Spartina patens*) Poaceae
- 53B. Salt Marsh Grass "Smooth Cordgrass, Saltwater Cordgrass" (*Spartina alterniflora*) Poaceae
- 53C. Salt Reed Grass "Big Cordgrass" (*Spartina cynosuroides*) Poaceae
54. Pin Oak (*Quercus palustris*) Fagaceae
55. Scotch Pine (*Pinus sylvestris*) Pinaceae
56. Asiatic Dayflower "Spiderwort" (*Commelina communis*) Commelinaceae
57. Seaside Goldenrod (*Solidago sempervirens*) Asteraceae
58. Sunflower (*Helianthus annuus*) Asteraceae
59. Black-Eyed Susan (*Rudbeckia hirta*) Asteraceae
60. Ox-Eye Daisy (*Chrysanthemum leucanthemum*) Asteraceae
61. Swamp Rose Mallow (*Hibiscus palustris*) Malvaceae

SECTION 2

Sample Activities and Lesson Plans

Lesson Plan Listing

The following section is a compilation of lessons and activities prepared by local organizations. They are intended to give you a sense of the many ways you can include estuary education in your classroom. As a result, lessons cover a variety of grade levels, topics and academic subjects. The sample lessons are also intended to highlight organizations in the Harbor Estuary Region which have curriculum materials available. On the first page of each activity you will find the name of the organization

that provided the lessons and, if applicable, the curriculum packet from which it was taken. Listed along side the organizations name is a reference to the page number where contact information for that particular organization can be found.

Please contact these organizations and request a complete copy of their curriculum packet or additional educational materials.

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Educational Standards

The sample lesson plans in this guide can be related to k-12 curriculum standards for New York and New Jersey and in most cases are included in the plan.

The most current curriculum and learning standards and drafts are available online.

New Jersey: www.state.nj.us/education

New York: www.emsc.nysed.gov

New York City: www.schools.nyc.gov



LESSON PLAN 1

Estuary Water

The Water Sourcebook

Provided by the EPA (www.epa.gov/ogwdw000/kids/wsb/)

OBJECTIVES

The student will do the following:

1. Observe the effects of varying concentrations of salt on the aquatic plant Elodea.
2. Define estuary and describe why estuaries are important.
3. Draw conclusions about Elodea and its ability to tolerate different concentrations of salt.

BACKGROUND INFORMATION

Estuaries are defined as partially enclosed bodies of marine water fed by freshwater sources, such as where a river flows into a bay. Their water is mixed with sea water. Salinity can vary with distance from the inflow of fresh water and other factors. Estuaries form a fragile boundary between marine and freshwater habitats. They are very valuable as breeding grounds for thousands of species of aquatic animals and plants, as recreational areas, as shipping lanes, and as commercial fisheries.

Estuary water will range from low salt concentrations where rivers empty into bays to high concentrations near the bay's opening to the sea. The aquatic plants present in different areas of estuaries also vary with these changing concentrations of salt. Elodea ("eh-loh-DEE-uh") is a common freshwater plant which can be found in estuaries where freshwater is abundant. It is often used in biological studies.

Terms

estuary (EHS-choo-eh-ee): an arm of the sea that extends inland to meet the mouth of a river.

ppt: parts per thousand; e.g., salt water having 10 parts salt per 1000 parts water has a concentration of 10 ppt.

salinity: salt, or the amount of salt, in a liquid.

ADVANCE PREPARATION

- A. Obtain water from a pond, lake, or stream. Fill four 2-L bottles about three-fourths full so that you will have plenty.

SUBJECT:

Science

TIME:

1 hour + observation time

MATERIALS:

four 2-liter bottles
three 1-liter bottles
test tubes or small baby food jars
test tube rack or plastic cups to hold
test tubes
pond water
salt (NaCl)
gram scales or balance
Elodea
1-liter measuring cup or bowl
masking tape
student sheet (included)

B. Prepare a set of stock solutions:

1. Dissolve 10g NaCl (salt) in 1000 mL pond water for 10 ppt salt water.
2. Dissolve 20g NaCl in 1000 mL pond water for 20 ppt salt water.
3. Dissolve 30g NaCl in 1000 mL pond water for 30 ppt salt water.
4. Pond water (control) (NOTE: Use water from a river, lake, or stream; do not use tap water.)

Measure the salt on a balance.

- C. Obtain Eloдея at a local aquarium shop. If you must order it from a science supplier, allow for shipping time.
- D. Have four test tubes or small jars for each team of students (baby food jars work fine).
- E. Copy the student sheet “Eloдея observations.”

PROCEDURE

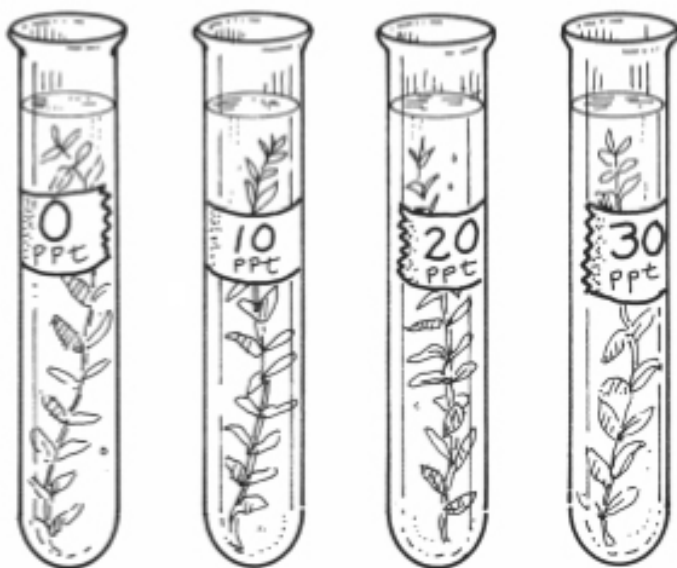
I. Setting the stage

Share the background information with the students. Write the word “estuary” on the board. (For more information, check the factsheets on wetlands.)

II. Activity

Have the students investigate the effects of various salt concentrations on a freshwater aquatic plant.

- A. Divide the students into teams of four and provide four test tubes or jars per lab team.



-
- B. Fill each test tube or jar with a different concentration of salt water. Have the students label each with a piece of masking tape and mark it with the salt concentration (ppt). Fill one jar with pond water. Remind the students of why it is important to have a control group in an experiment.
 - C. Put a short length of Elodea in each tube or jar.
 - D. Give each student a copy of the student sheet "Elodea Observations."
 - 1. Have each student write down his/her prediction of the experiment's outcome.
 - 2. Have the students observe the plants for four days and record their observations. Keep the test tubes in racks, or place the jars where they will be undisturbed.
 - E. Have the students answer and discuss the questions on the student sheet, "Elodea Observations."

III. Follow-Up

- A. Have the students continue to observe the Elodea clippings each day for several days.
- B. Each student should write a paragraph stating his/her conclusions and the reasons for it.

IV. Extension

- A. Have the students research and report on members of estuary plant and animal communities.
- B. Have the students investigate other components of salt water and report on its minerals and nutrients and their effects on marine plants and animals.
- C. Have the students investigate how many seafood species live in estuaries for at least part of their life cycles..

RESOURCES

"Chesapeake Bay: Introduction to an Ecosystem," U.S. Environmental Protection Agency, Washington, DC, 1982.

"Estuaries and Tidal Marshes," U.S. Fish and Wildlife Service, Washington, DC, 1985.



ELODEA OBSERVATIONS

I predict that _____

Tube	Observations			
	Day 1	Day 2	Day 3	Day 4
Control 0 ppt				
#1 10 ppt				
#2 20 ppt				
#3 30 ppt				

Questions

- Which of the four containers had the healthiest looking plants? _____

- Describe in a paragraph what happened over four days to the other containers of Elodea. _____

- Based on the experiment, how much salt can Elodea tolerate and still remain healthy? _____

- What would this mean about where you would find Elodea in an estuary? _____

LESSON PLAN 2

Nutrient Trap

Beneath the Shell

Provided by NJ Department of Environmental Protection

AGE LEVELS: I, JH

OBJECTIVES: After performing this activity, students should be able to:

- 1) Describe the process of nutrient build-up in an estuary;
- 2) Construct a food chain and a food pyramid;
- 3) Relate the availability of nutrients and plants in an estuary to the number of a species of animals that it can or cannot support.

KEY WORDS: Estuary, Water Movement

SUBJECTS: Science, Math

SKILLS: Calculating, constructing, describing, predicting and relating

MATERIALS: Scissors, tape, pencils, and copies of the "Nutrient Trap" worksheets (one per person)

BACKGROUND INFORMATION:

Along New Jersey's coast exist 400,000 acres of estuarine waters. Estuaries are places where fresh water from rivers, streams and creeks mixes with salt water from the sea and creates an area under constant change. The many hearty plants and animals that thrive in an estuary must contend with changes in tidal levels. Inland waterways flow downward into an estuary, forming a layer atop the saline waters moving in from the ocean. As the waters mix, nutrients, plankton and decaying plants, or detritus, flow back and forth with the tide and become trapped animal species. Unfortunately, this ability also allows estuaries to accumulate waste, chemicals and other contaminants associated with human activity and development along the shoreline and further inland.

Estuaries are valuable and productive ecosystems for a variety of reasons. Productivity begins with the plankton, detritus and marsh plants that, though not consumed by humans, provide food for a number of species of shellfish, fish, crabs and shrimp. In turn, food is then provided for larger fish and mammals such as raccoons, who feed on the crabs and shellfish. The tall grasses offer cover for many animals for reproduction purposes. As a result, estuaries afford a number of recreational opportunities to clammers, crabbers, fishermen, boaters, hunters, hikers, photographers and birdwatchers.

PROCEDURE: (A metric conversion chart is included on pages 122-123.)

- 1) Pass out the scissors, tape and the "Nutrient Trap" sheets to each of the students. Give them time to work individually to read the directions on the sheets and construct their "Nutrient Trap." Share the "Background Information" with the class. Ask the students to explain, in their own words, how the Nutrient Trap works.
- 2) As mentioned, the Nutrient Trap provides an abundance of nutrients and plant material that form the foundation for many food chains (see Glossary). Tell the students that in an imaginary estuary there exists the following food chain: marsh hawk — eats seaside sparrow — eats grasshopper — eats cordgrass.

Distribute copies of the "Nutrient Trap" Worksheet to each student. Using the facts given at the top of the worksheet, have them work out the math problems. Compare their answers to the correct ones given below:

1. 600 grams (total weight of sparrows that one hawk eats) + 20 grams (weight of one sparrow) = 30 (number of sparrows needed to feed one hawk)
2. 50 grams (total weight of grasshoppers eaten by one sparrow) + 1 gram (weight of one grasshopper) = 50 (number of grasshoppers needed to feed one sparrow)
3. 15 grams (total weight of cordgrass eaten by one grasshopper) + 5 grams (weight of one plant) = 3 (number of plants needed to feed one grasshopper)
4. 30 sparrows (number needed to feed one hawk) x 50 grasshoppers (number needed to feed each sparrow) = 1,500 grasshoppers (number needed to feed the sparrows eaten by one hawk)
5. 3 plants (number eaten by one grasshopper) x 1,500 grasshoppers (number needed to feed the sparrows eaten by one hawk) = 4,500 plants (number needed to feed the grasshoppers eaten by the sparrows eaten by one hawk)

- 3) Using these final figures, have the students work together to create, on the board, a food pyramid (see Glossary) that would depict the number of plants, grasshoppers and sparrows needed to support one hawk.
- 4) Discuss:
 - How would the figures change in the food pyramid to support 3 hawks?
 - Describe the type of impact that the destruction of cordgrass, due to development or pollution, would have on the rest of the food pyramid.
 - Review the definition of "detritus," a common food source for shellfish. Predict what might occur, should acres of cordgrass be eliminated.

* To convert grams to ounces, see the Metric Conversion Charts in the "Additional Resources" Section on pages 122-123.

*This activity was adapted, by permission from:
 The Estuaries and Tidal Marshes Wildlife Habitat Conservation Teacher's Pac
 The National Institute for Urban Wildlife
 Columbia, Maryland*

Nutrient Trap Worksheet

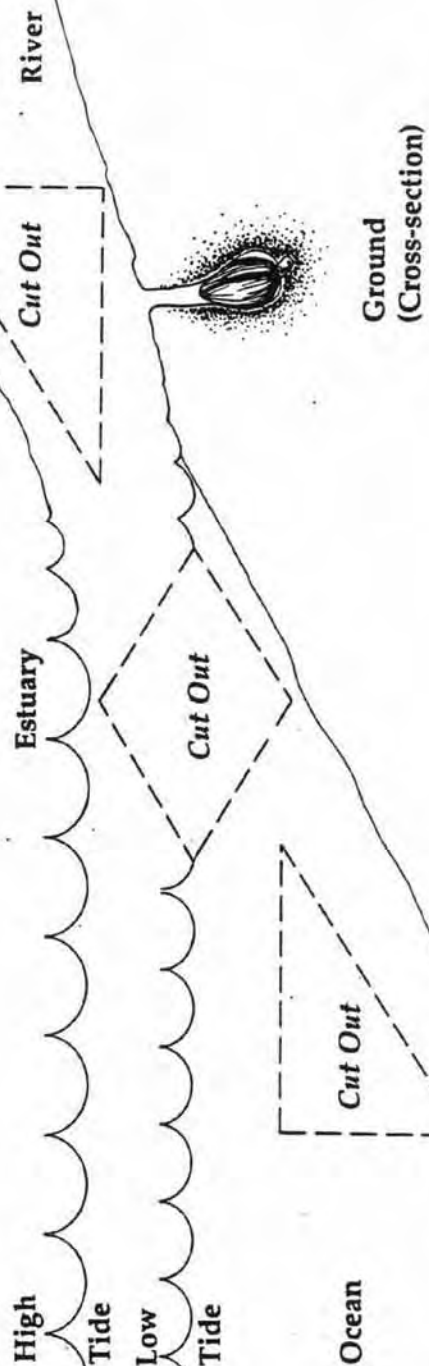
Cut around the outline and cut out the windows on this page. Then fold the page along the solid lines and tape down the flap to make a "sleeve."

Cut out slide A on page 2 and insert it in the sleeve so that you can still see column 1. Pull it through the sleeve. Steps 1, 2, 3 and 4 show how the estuary builds up nutrients.

Repeat with Slide B. What happens when people dump pollution into rivers that feed estuaries?

Fold Here

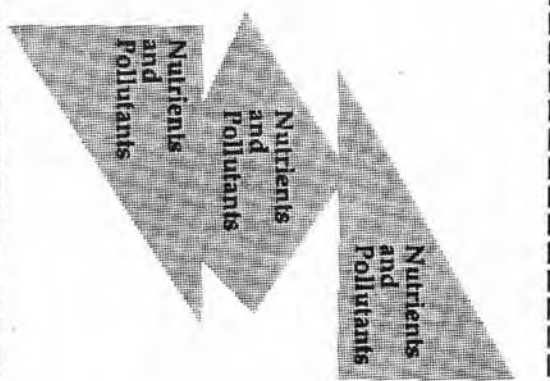
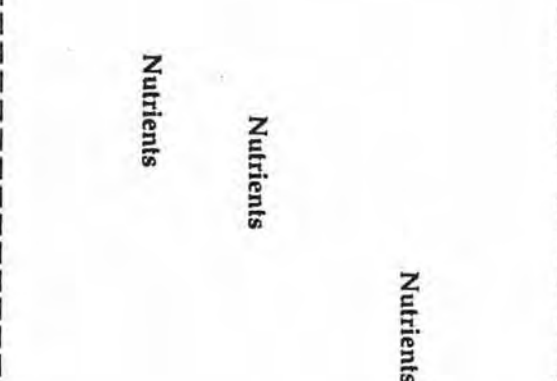
Nutrient Trap Model



Fold Here

Cut on Dotted Line

Nutrient Trap Worksheet

<p>Nutrients and Pollutants</p> <p>1. Pollution dumped in the river is also carried downstream... (pull to 2)</p>	<p>Nutrients</p> <p>1. Fresh water carrying nutrients flows downstream... (pull to 2)</p>
<p>2. ...through the estuary... (pull to 3)</p> <p>4. ...pollution is also carried back to the estuary.</p>	<p>2. ...through the estuary... (pull to 3)</p> <p>4. ...they are carried back to the estuary.</p>
<p>3. ...to the sea. When the tide comes up... (push back to 4)</p>	<p>3. ...to the sea. Nutrients mix with salt water and when the tide comes up... (push back to 4)</p>
 <p><i>Slide B</i></p>	 <p><i>Slide A</i></p>

Cut on Dotted Line

Nutrient Trap (cont)

Nutrient Trap Worksheet

- FACTS:**
- A marsh hawk weighs 600 grams and eats 600 grams of seaside sparrows each week
 - Each sparrow weighs 20 grams and eats 50 grams of grasshoppers each week
 - Each grasshopper weighs 1 gram and eats 15 grams of cordgrass each week
 - Each cordgrass plant weighs 5 grams

Use these facts to solve the following problems:

- 1) How many sparrows must the estuary have to feed one hawk for a week?

Hint:

Total weight of sparrows that one hawk eats divided by Weight of one sparrow = Number of sparrows needed to feed one hawk

- 2) How many grasshoppers must the estuary have to feed one sparrow for a week?

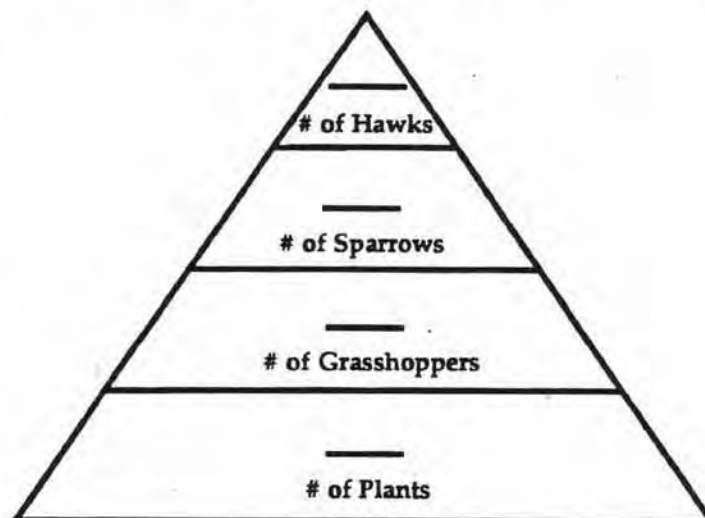
- 3) How many cordgrass plants must the estuary have to feed one grasshopper for one week?

- 4) How many grasshoppers are needed to feed the number of sparrows eaten by one hawk in a week?

Hint:

Number of sparrows needed to feed one hawk X Number of grasshoppers needed to feed each sparrow = Number of grasshoppers needed to feed all the sparrows eaten by a hawk

- 5) How many cordgrass plants are needed to feed all the grasshoppers that are eaten by all the sparrows that are eaten by one hawk in a week?



LESSON PLAN 3

Estuary Fishing

Provided by East River CREW

OVERVIEW

Students will select organisms characteristics of the estuary where they live. They will then draw life-size sketches, laminate, cut out and create magnets for a “fishing” game.

OBJECTIVES

Following completion of the lesson, students will be able to:

- Identify common fauna of the estuary by sight
- Describe predator and prey relationships among some of these animals
- Classify organisms selected to level of detail appropriate for student

GRADE LEVELS

3-6

NYS LEARNING STANDARDS FOR MATHEMATICS, SCIENCE AND TECHNOLOGY

S1.1b – Identify appropriate references to investigate a question

S1.b2 – Propose a model of a natural phenomenon

T1.4 – Develop plans, including drawings with measurements and details.

Process Skills:

General #1,3,5

Living environment skills #6,7,9

MATERIALS

- Drawing paper, rulers, pens, coloring materials, laminator and laminating sleeves, magnetic tape, dowel with string and magnet attached, foil tray.
- Reference books and/or photographs from a trip to the River project Estuarium or other excursions, like East River CREW go-fish festivals where fauna can be seen.

PROCEDURES

1. Using fish guides or other zoological references have each student select an organism and illustrate it (life-size) on paper.
2. Many fish and other animals can vary in size according to age so there is some flexibility here, but students should use rulers to measure height and width of their drawing for accuracy.
3. Laminate each organism and cut out around its body outline.
4. Use magnetic tape to create a magnet out of the organism.
5. Using a magnet surface, arrange organisms in food chains according to predator-prey relationships.
6. Discuss how humans can eventually be fed by the fauna of an estuary (e.g.: fish nursery).
7. Put magnet fauna in foil tray (or on “fishing area” designated on the ground). Have students fish for their organisms by using the magnet fishing pole. If they can’t identify the organism they “catch”, they must release it back into the pond and lose a turn. The level of difficulty can be increased according to the amount of detail required to know the organism.

Estuary Fishing (cont)

ASSESSMENT

Students can correctly identify the organisms they “caught” and state its prey and predators. The student with the most organisms can win the game.

BACKGROUND

Estuaries are the fish nurseries upon which larger ocean life depends. Fauna like sponges, shrimp, oysters, seahorses, and fish are found throughout the NY-NJ Harbor.

VOCABULARY

Vertebrate/Invertebrate — Animals with and without interior skeletons.

Predator — Animals that hunt other animals to survive.

Prey — Animals that die to supply other animals with food.

Food Chain — A series of organisms in the order in which they consume the others.

Fauna — Animal life.

Fish — Vertebrates with double-chambered hearts, fins, scales, and gills.

Mollusk — Invertebrates with soft unsegmented bodies usually enclosed in a calcareous shell.

Crustacean — Aquatic mandibulate arthropods that have a chitinous exoskeleton, a pair of often much modified appendages on each segment, and two pairs of antennae and that include the lobsters, shrimps, crabs, wood lice, water fleas, and barnacles.

Estuary — A water passage where the tide meets a river current; especially an arm of the sea at the lower end of a river.

EXTENSIONS

Using the knowledge acquired, students can plan to create a mini-estuarium in their classroom using a 10-gallon tank. They can plan how to use minnow traps and other fishing devices with bait to catch examples of the organisms they study. After a week, the organisms should be released to the river again.

LESSON PLAN 4

Nutrients and Water Quality

“The Water Sourcebooks”

www.epa.gov

OBJECTIVES

The student will do the following:

1. List changes in water conditions caused by various pollutants, such as household chemicals, that often end up in aquatic environments.
2. Describe potential effects on animals and plants caused by these pollutants.
3. Classify sources of pollution.

BACKGROUND INFORMATION

Two nutrients that are essential for the growth and metabolism of plants and animals are nitrogen (N), and phosphorus (P). Plant growth depends on the amount of phosphorus available. Phosphorus is present in low concentrations in numerous bodies of water, so it is a growth-limiting factor. Since nitrogen is found in several forms, it is frequently more available than phosphorus. Nitrogen is used by plants to make plant proteins, which animals convert into their own proteins when they eat the plants. Even though nutrients are needed, too much nutrient material in the water can cause pollution. Algae use up phosphorus quickly. When there is excess phosphorus, a vast growth of algae called an algal bloom can occur. The water may then look like pea soup. The algae rob the water of oxygen needed to sustain life. Some forms of nitrogen can cause similar problems in water.

There are several ways that excess nutrients get into the water. Both nitrogen and phosphorus are part of living plants and animals and become part of organic matter when the plants and animals die and decompose. Nutrients come from human, animal (including pet), and industrial wastes. Other sources of nutrients are human activities that disturb the land and its vegetation, such as road and building construction, farming, and draining of wetlands for development. Normally, nutrients are held in the soil and stored in the wetlands. When soil erodes and washes away, it carries the nutrients along until it ends up in the water. If wetlands are drained for development, they can no longer filter nutrients from runoff.

VOCABULARY

Nutrient — An element or compound, such as nitrogen, phosphorus, and potassium, that is necessary for plant growth.

Algal bloom — A heavy growth of algae in and on a body of water; usually results from high nitrate and phosphate concentrations entering water bodies from farm fertilizers and detergents; phosphates or algal blooms also occur naturally under certain conditions.

Point source pollution — pollution that can be traced to a single point source, such as a pipe or culvert (Example: industrial and wastewater treatment plant discharges).

Nonpoint source pollution (NPS) — pollution that cannot be traced to a single point, because it comes from many individual places or a widespread area (Example: urban and agricultural runoff).

Nutrients and Water Quality (cont)

SUBJECTS

Biology, Ecology

TIME

Takes place over the course of about one month. Set up approximately two weeks ahead of experiment.

MATERIALS

5 clear 1-qt or larger containers (plastic soda bottles or canning jars)
water with algae from a freshwater pond or purchased from a supply house
plant food
aged tap water (allow to sit about 48 hours)
light source (direct sunlight or strong artificial light)
pollutants: cooking oil (colored red), detergent (not green), vinegar
camera and film (optional)
student sheet

ADVANCE PREPARATION

- A. Set up jars at least two weeks before the experiment begins. Explain to the class that they are setting up model water environments for an experiment to be done later. Plants in a wetland or other aquatic system need nutrients to grow. Nutrients are found in all natural systems. Fill the jars with aged tap water. Add one teaspoon of plant food to each jar and stir well.
- B. To improve the quality of the model, use pond water or try adding a bit of soil from a pond or aquarium gravel along with the water. Place the jars in a window where they will get good indirect light or light provided by an incandescent or fluorescent light source. The jars should not be placed in a cold location.
- C. Explain to the students that they will be using the model aquatic environments to test the effects of certain pollutants that come from home. Students should decide on household products to use—products that they feel are used frequently, are often dumped down the drain, and thus end up in waterways. Students should bring samples of these materials from home.

PROCEDURE

I. Setting the stage

- A. Begin with a classification exercise explaining that students are to organize what they already know about pollution. Some water pollution comes from specific sources such as drains, pipes, effluent from industry—outfalls. This is called point source pollution. Other kinds of pollution come from many widespread sources and are called non-point source pollution. Write these terms on the chalkboard making two columns. Have students suggest things that pollute the water and place them in categories in the chart.
- B. Explain that students will conduct pollutant tests with the models set up two weeks ago.

II. Activity

- A. Take out the jars, which by now should have algae growing in them. Have the class decide on three safe pollutants to test—use more plant food for the fourth jar, use the fifth jar as a control. When the class has decided what to test, add the materials to the four jars. Add a reasonable amount: two tablespoons of a strong detergent; enough oil to just cover the surface; 1/4–1/2 cup of vinegar; one or two teaspoons of plant food. Ask students to explain how each pollutant could get into the environment in real life.

Nutrients and Water Quality (cont)

- B. Leave the jars in the light as before. Have the students write their predictions as to what will happen in each container. Photograph the jars (with labels and dates showing) two or three times each week for several weeks.

III. Follow-Up

- A. Results will depend on the type of pollutant used.
1. Some pollutants, such as the plant food, favor plant growth and will cause an algal population explosion. This is not healthy since it disrupts the balance of organisms. When the algae die and decompose, oxygen is used up. Ask students to name some plants and animals that would be affected by this situation. Oysters and clams would suffocate because they are unable to move to another location to get more oxygen. A thick mat of algae will block out sunlight needed by other plants.
 2. Other pollutants, such as acids, would cause the water to be clear since everything in the water would be killed.
 3. The sample with the oil spill may surprise students. If the algae have enough sunlight, they may produce enough oxygen to keep things alive below the oxygen-impervious oil layer. Ask students to consider the effects of a larger spill—ducks and other birds would become coated with oil and not be able to fly, fish gills would be clogged, etc. Ask the students for their conclusions.
- B. Human activities which result in water pollution can affect the water environment in ways that are disastrous for natural communities. Some nutrients are necessary for an aquatic habitat, but having too many is harmful. Have the students explain how.

IV. Extensions

- A. Ask students whether or not they can devise a method to reverse the pollution in their models. (Example: Add baking soda to the acid model to neutralize the acid, which is similar to adding limestone rocks to lakes or streams to lessen the effects of acid rain. Example: Mop up the oil spill with sawdust, cotton, etc. Could students skim off the oil from their model and let oxygen through again?)
- B. Discuss ways to keep pollutants from reaching the water and ways to reduce the amounts that do get through.

RESOURCES

“What’s In the Water?” *Living In Water*, pp. 55-57.

WOW!: *The Wonders of Wetlands*, pp. 80, 87-89.



NUTRIENTS AND WATER QUALITY

STUDENT SHEET

6-8

Directions: Record your observations of changes in water conditions caused by pollutants.

	3 days	6 days	9 days	12 days	15 days	18 days	21 days
Jar #1 (1 tsp. plant food added — pollutant added is motor oil)							
Jar #2 (1 tsp. plant food added — pollutant added is strong detergent)							
Jar #3 (1 tsp. plant food added — pollutant added is vinegar)							
Jar #4 (1 tsp. plant food added — pollutant is 2 more tsp. plant food)							
Jar #5 (1 tsp. plant food added — no pollutant added. This is the control.)							

LESSON PLAN 5

Salt Marsh in a Pan

NJMSC Lesson Plans

Provided by New Jersey Marine Sciences Consortium

OVERVIEW

Students create a model of a salt marsh to discover the impact of pollution and human activities on water-based habitats including bays and the ocean. Model may also be used to demonstrate salt marsh functions, non-point source pollution and watershed concepts.

OBJECTIVES

Following completion of this lesson, students will be able to:

- Recognize the relationship between natural and developed areas and the impact human activities have on those areas;
- Understand watershed concepts by observing what happens to an aquatic area during a rain event;
- Draw conclusions about what they can do to help reduce, reuse and recycle products in every day use
- Name several salt marsh functions (optional extension).

GRADE LEVELS

4th – 12th grades

NJCC STANDARDS

Science Indicators:

5.1: End of Grade 4: A1, A2, B1, B2, End of Grade 8: A2;

5.3: End of Grade 4: A1, End of Grade 8: A1;

5.4: End of Grade 2: C2, End of Grade 4: B1;

5.5: End of Grade 2: B1, End of Grade 4: B1, B2,

End of Grade 8: B2, B3; **5.7:** End of Grade 2: A2,

End of Grade 4: A1, A2, **5.8:** End of Grade 2: A3, B1,

End of Grade 4: A1, End of Grade 6: B1; **5.10:** End of Grade 2 A1,

End of Grade 4: A1, B1, End of Grade 6: A1, B1.

Mathematics Indicators:

4.1: 6C3; **4.2:** 4D5, 8A5, 12A4; **4.3:** 6C1, 12D3;

4.4: 2A1, 4A1, 6A1, 6B1, 12A5, 12C3; **4.5A:** 1, 2, 3, 4, 5;

4.5B: 1, 2, 4; **4.5D:** 1, 2, 3, 5, 6; **4.5E:** 1; **4.5F:** 5

Visual and Performing Arts:

1.6;

Language Arts:

3.4, 3.5;

Social Studies:

6.8, 6.9;

Cross-Content Workplace Readiness:

2, 3

MATERIALS

To make model you will need:

- One paint roller pan, non-hardening modeling clay to fill 1/3 the roller pan,
- sponges to fit across the width of the tray (optional),
- supplies to make a road, houses, birds
- and anything else found in a neighborhood including trees and grasses.

To complete demonstration you will need:

- Watering can, Green food coloring,
- Soy sauce or oil, Bits of paper,
- Ground coffee, Chocolate sprinkles.

PROCEDURES

Spend about 5 minutes discussing the causes of water pollution and the possible origins of litter found on the beach, riverbank or salt marsh. Divide students into three groups; Developers, Residents and Rainmakers. The Developers build the model in the roller pan by adding a 1/2" thick layer of clay to the shallow top third of the pan. This group should build creeks, a river, a storm drain, a road, houses, trees and plants into their clay terrain. The low end of the tray represents a large body of water, such as the bay or the ocean. The Residents add pollutants to the landmass built by the Developers by adding a few drops of food coloring to symbolize fertilizer, bits of paper to symbolize litter, chocolate sprinkles to symbolize pet waste, oil or soy sauce to symbolize motor oil dumped or leaked from automobiles and coffee grounds to represent loose sediment and topsoil which contribute to **turbidity**. All students then make predictions about what will happen when the model terrain is rained upon. After predictions are recorded, the Rainmaker group uses the watering can to make it rain. Students observe where their pollutants went and compare what happened to the model when it rained to their predictions. Pour dirty water into a clear container so students can see just how polluted the rainwater became.



BACKGROUND

Salt marshes help protect our **estuaries** from the impacts of nature and humans. The special grasses that grow in the marsh can tolerate flooding from salt water. These plants are effective storm buffers because they dissipate wave energy and soak up tidal surges. Salt marsh plants are also a defensive against the erosive power of tides because they have deep roots that hold soil in place. Salt marshes plants and mud also hold and trap pollutants and excess sediment, which helps to improve water quality. When we develop an area along a waterway, **effluents** such as fertilizers, sewage, and storm

drain runoff all enter the water. Left untreated or free-floating in the water, high levels of these nutrients cause **eutrophication** which causes an initial explosion of algal growth followed by decline in plant life and dissolved oxygen. Plants from the salt marsh help to handle pollutants in several ways. Marshes can take up and filter the pollutants while others settle into the soil strata and are chemically reduced over time. More are processed by bacterial action. When salt marshes are filled or lost, pollutants they could have rendered harmless remain in the water, free to move all over the water system and into the ocean. In addition to the great buffer zone and filtering capacity, the salt marsh is capable of absorbing and holding large quantities of water for use by wildlife in times of drought.

VOCABULARY

Effluents - waste material discharged into the environment.

Estuary - a place where salt water and fresh water meet and mix.

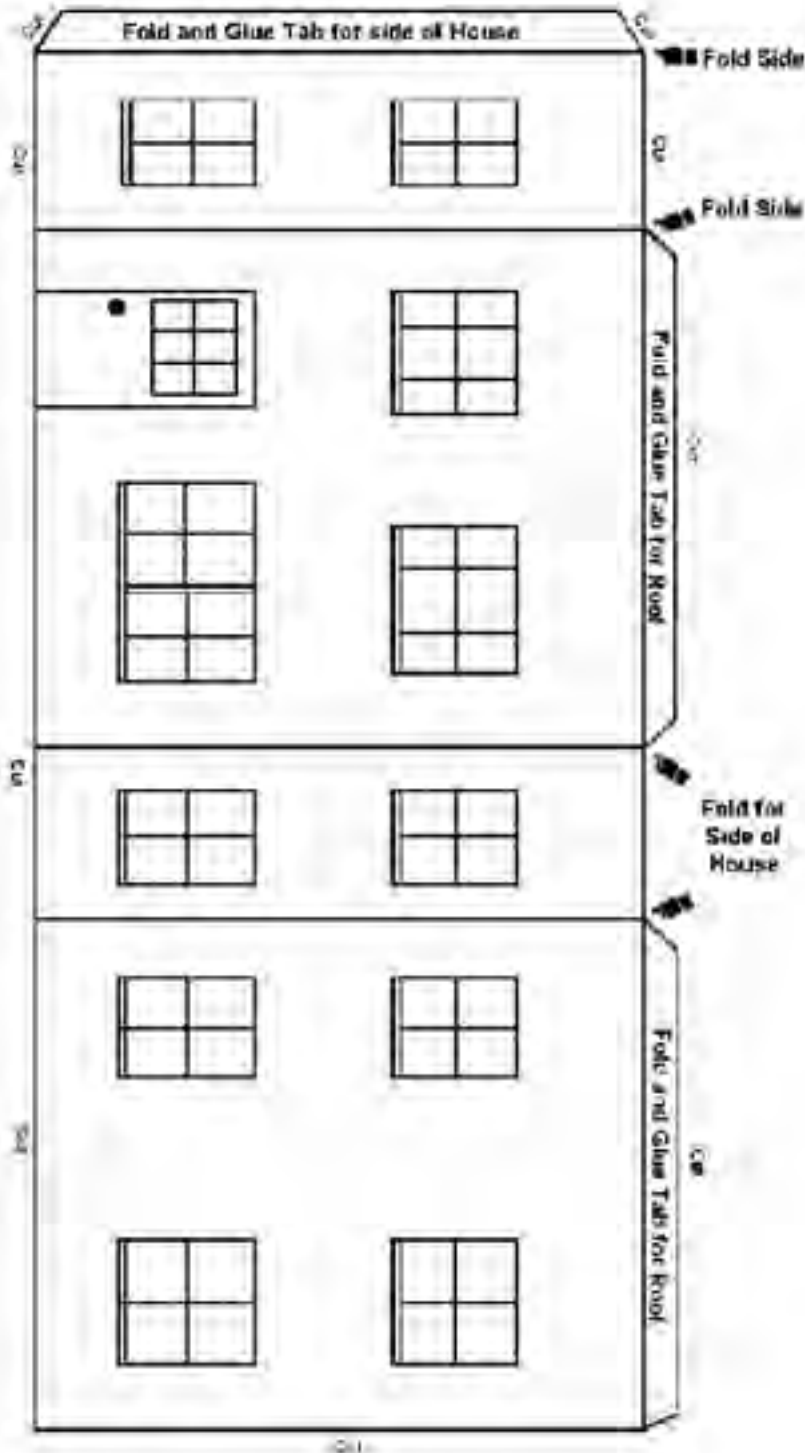
Eutrophication - the process by which a body of water becomes rich in dissolved nutrients either naturally or by pollution.

Turbidity - Thickness or opaqueness made by stirring up of sediment.

EXTENSIONS

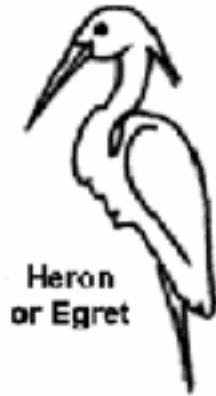
Add a salt marsh to the pan by putting damp sponges across the open edge of the clay terrain. Repeat the demonstration. Before rain event, record student predictions about how this demonstration will be different than the first round without the sponges (salt marsh). To demonstrate the ability of a salt marsh to absorb excess water and prevent flooding, use the same, pre-measured amount of water for your “rainstorm” each time (with and without sponges in place). Record predictions and re-measure “polluted” water after each round. Observe changes (less water, less pollution with salt marsh in place).

Salt Marsh In A Pan House Template



Salt Marsh in a Pan (cont)

Toothpick Animals



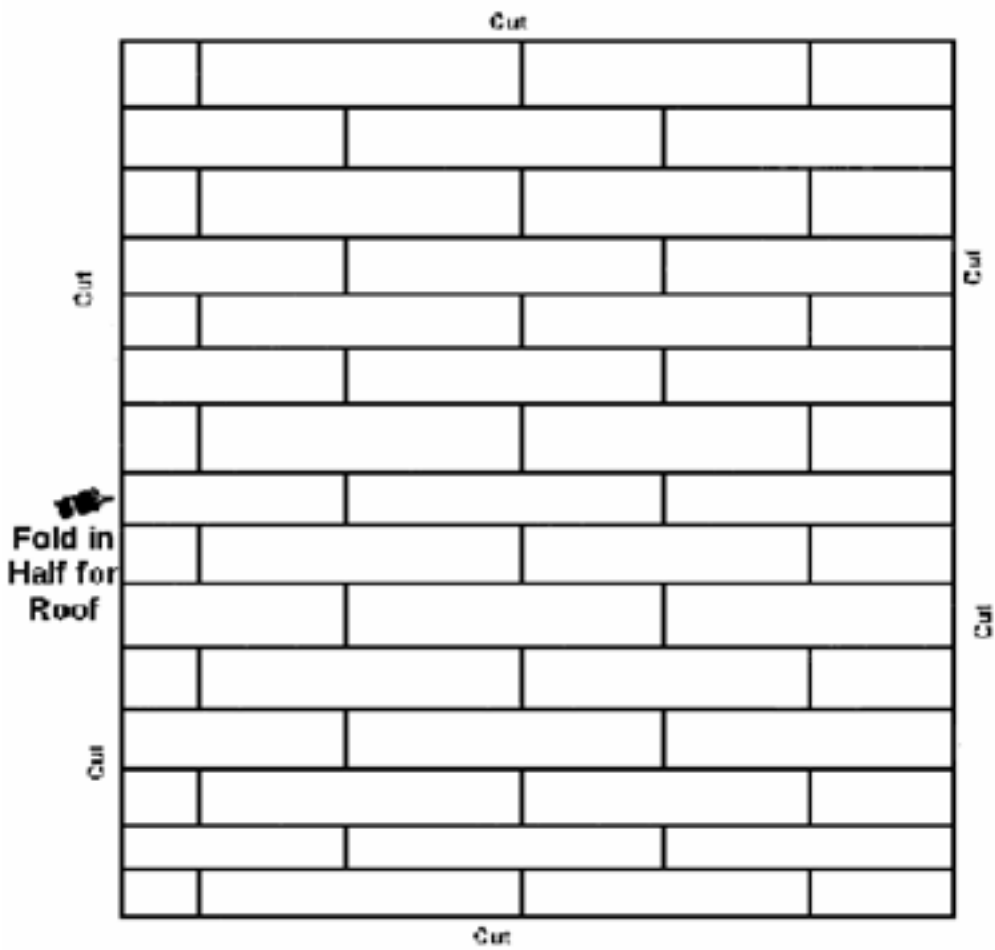
Heron
or Egret



Duck



Snail



LESSON PLAN 6

Recycle Your Motor Oil

'Pointless Pollution Packet'

Provided by Clean Ocean Action

HERE'S HOW

- Put all used motor oil in a clean leakproof container.
- Take used oil to a service station, which sells oil (all stations that sell oil are required to recycle it).
- Contact your local or county recycling coordinator to find out where to take used motor oil.

REMEMBER

- It's illegal to dispose used oil in a storm drain, sewer septic tank, or waterway.
- Used motor oil is the single largest source of oil entering our waterways, representing one million tons of the total amounts discharged.
- Motor oil, which is reprocessed, can be made into boiler fuel and lubricating oil. By recycling motor oil you are conserving a non-renewable resource.

MATH LESSON PLAN

Motor Oil Runoff Survey

LESSON OBJECTIVE

The student will design a survey to determine the amount of motor oil that leaks into our streets, storm drains and waterways. The student will use the results to determine the amount of motor oil that leaks from cars each year. That student will use the numbers obtained from this survey to generalize the study of runoff and water pollution.

PROCEDURE

During the study of storm drains and street runoff, the student will learn that motor oil frequently leaks or is poured into storm drains. As a math research project, the students will be asked to survey 25 car owners to determine the amounts of oil added to the "typical" car in a month to replace leakage. The student can then be asked to graph these numbers, analyze the results, and verify the statistics by questioning a local mechanic. To further pursue the topic, the student and teacher can contact the Division of Motor Vehicles to determine the number of cars in their county. The student can then estimate the amount of leaking oil that will end up as runoff in their county.

FOLLOW UP

The student will apply this information to the inter-disciplinary study of storm drain source pollution. Student-made charts, word problems, and graphs can be copied and distributed to other math classes. The students and teacher could call a "press conference" to present their findings to parents, local town councils, and/or school board officials. Students can encourage their friends to support a one-day "car-out" pledge or to chart their family's gas and oil consumption with the stated purpose of reduction and conservation.

LESSON PLAN 7

Above and Below

New Jersey WATERS

Provided by New Jersey Audubon Society

GOAL To understand how land use affects the quantity and quality of surface water and ground-water supplies.



TIME • (2) 45-minute periods

OBJECTIVES Students will:

- ✓ design land use maps based on urban, suburban, and rural land-use percentages
- ✓ describe how different land uses relate to each other
- ✓ explain how buffer zones help maintain good water quality of surface water supplies
- ✓ explain how the undeveloped recharge areas help maintain good water quality in underground aquifers

SKILLS calculate, organize, apply, infer, synthesize, justify

VOCABULARY	buffer zone	impervious surface
	confined aquifer	pervious surface
	ground water	recharge area
	ground-water table	surface water
	impermeable layer	unconfined aquifer

PRIOR KNOWLEDGE Students should have background in:

- how to create maps
- the water cycle
- working with percentages
- the difference between surface water and ground-water supplies and how they are replenished
- types of non-point source pollution that are associated with various land-use types

CORE CURRICULUM CONTENT STANDARDS

- Cross Content Workplace Readiness 3 (2,8,9,11-15) 4 (2)
- Language Arts 3.1 (14,15) 3.2 (8-11) 3.5 (8)
- Math 4.1 (11,13) 4.2 (9) 4.6 (14) 4.8 (11)
- Science 5.1 (4,5,6) 5.5 (15) 5.10 (10,14) 5.12 (4,5,6,9,10)
- Social Studies 6.6 (10,16) 6.9 (5,7)

MATERIALS

- Surface Water worksheet (Student Page #15)
- Ground Water worksheet (Student Page #16)
- Land-Use Percentage Cards (Figure 9A)
- Crayons or colored pencils

PREPARATION

1. Make enough copies of the Surface Water worksheet (Student Page #15) for half of the class and enough copies of the Ground Water worksheet (Student Page #16) for the other half of the class.
2. Prepare two sets of the Land-Use Percentage Cards (Figure 9A).



PROCEDURE

Period 1

1. Divide the class into two sections (one will work on the ground-water scenarios, one will work on the surface water scenarios).
2. Distribute the groundwater worksheets (Student Page #15) to the students in Section 1 and the surface water worksheets (Student Page #16) to the students in Section 2.
3. Review the definition of surface water and ground water by drawing a diagram of each on the chalkboard.
4. Divide each section into three subgroups (A, B, and C).
5. Distribute the appropriate Land-Use Percentage card (A, B, or C) and a set of crayons or colored pencils to each group.
6. Tell each group that they represent the planning boards of different communities. Discuss what a planning board does. On the chalkboard, write the following steps for the students to follow: (a) map the existing land use in the community based on the information on the Land-Use Percentage card; (b) assess how that land use might impact on water quality; (c) make recommendations for improving and / or maintaining current water quality.

Period 2

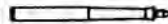
Have the students in each group discuss and answer the questions on each worksheet then summarize their findings to present to the rest of the class.



FURTHER DISCUSSION

1. How do you think each community in the watershed (urban / suburban / rural) could create and / or maintain buffer zones? [*Urban - reclaim stream side corridors, plant vegetation along stream banks and surface water bodies; suburban - purchase land along river and stream corridors, plant vegetation, encourage homeowners to landscape their properties to decrease surface runoff; rural - protect headwaters of streams and rivers by purchasing land along these waterways, create wooded corridors along agricultural fields*]
2. What actions could be taken to maintain and / or enhance the quantity and quality of groundwater in each community of the watershed? [*Urban - direct runoff to retention basins, create a mosaic of open space within the urban setting; suburban - direct*

runoff from parking lots to retention basins filled with vegetation, direct roof runoff to yards or lawns rather than to gutters and storm drains; diversify types of vegetation in open space area for more water filtration, identify and maintain open space over recharge areas]



ASSESSMENT

Have each student select and redo one of the maps based on their new knowledge of buffer zones and recharge areas. Have the students evaluate each others' maps to determine which maps represent the best placement of land use while also maintaining the quality and quantity of both ground-water and surface water supplies.

EXTENSION

Have the students determine the soil type of their school or community and assess its ability to recharge ground-water supplies.

EMPOWERMENT CHALLENGE

- Do a visual assessment of the community's surface waters to determine which (if any) could benefit from buffers.
- Participate with local watershed associations in stream side revegetation projects or other projects in which they are involved.



LESSONS FROM OTHER SOURCES

WOW! The Wonders of the Wetlands - Water Under Foot, How Thirsty is the Ground, Over Hill & Dale Project WET - Get the Groundwater Picture: Capture, Store & Release

REFERENCE

Center for Watershed Protection. 1998. *Rapid Watershed Planning Handbook: A Comprehensive Guide for Managing Urbanizing Watersheds*. Ellicott City, MD.

**Figure 9A
LAND USE
PERCENTAGE
CARDS**

LAND USE PERCENTAGES A

COLOR	LAND-USE	% OF COVER
Black	Transportation corridors (at least 1 block wide)	15
Orange	Business / commercial	30
Gray	Parking lots	10
Red	Residential (high density homes / apartments)	25
Dark Green	Park (recreation fields)	5
Purple	Industrial sites	10
White	Landfill	5

LAND USE PERCENTAGES B

COLOR	LAND-USE	% OF COVER
Black	Transportation corridors (at least 1 block wide)	20
Red	Residential (single family homes)	35
Orange	Business / commercial (office buildings / shopping malls)	20
Dark Green	Park (recreation fields, golf course)	10
Gray	Parking lots	10
Light Green	Open space	5

LAND USE PERCENTAGES C

COLOR	LAND-USE	% OF COVER
Black	Transportation corridors (at least 1 block wide)	10
Red	Residential (scattered single family homes)	20
Orange	Business / commercial	15
Yellow	Agricultural lands	30
Light Green	Open space	25

TEACHER'S NOTES

SUGGESTED ANSWERS FOR WORKSHEETS

(For Teacher Use)

1. Determine which group represented urban (A), suburban (B), and rural (C) communities. [*Compare the percent of built-up spaces (roads, parking lots, commercial/business/industrial sites) vs. open space.*]
2. Some land uses and the types of pollution they might generate. [**roads** - oil and gasoline spills, heavy metals left on the road from vehicle brake linings, air pollution that comes back to earth with rain/snow; **business/commercial** - impervious surfaces cause greater volume and speed of runoff; **parking lots** - litter, oil/gasoline/anti-freeze spills, impervious surfaces create more runoff; **residential** - impervious surfaces from roofs, driveways and parking lots, fertilizers and pesticides on lawns, animal waste, improper disposal of household materials; **parks** - fertilizers (if used); **industrial sites** - impervious surfaces, parking lots, potential for improper disposal of by-products, possible air pollution; **landfills** - litter, leachate; **agricultural lands** - fertilizers, pesticides, sedimentation]
3. What are the benefits / drawbacks to buffer zones? [*If the zone around the surface water is vegetated, it is referred to as a "buffer zone." It buffers the amount of water entering a waterway; it slows the velocity of water entering a waterway; it tempers the amount and concentration of pollutants entering the waterway. Vegetated buffer zones lessen the amount of pollution entering the waterway; tree, shrub and ground cover roots hold soil in place which prevents erosion and sediments entering the waterway; they allow precipitation to filter through the soil slowly and recharge ground-water supplies as well as prevent flooding to surface water supplies. Treed buffer zones block people's view of the waterway and they limit the amount of acreage upon which people can build.*]
4. What are the benefits / drawbacks to recharge areas? [*Recharge areas that have predominantly open space allow for the slow filtration of water into the ground. This process also cleanses some of the impurities out of the water before it reaches the aquifer. Protecting entire recharge areas ensures the greatest amount of water will be available for human use, but it also allows for the dilution of dissolved solids, ensuring high water quality. Since recharge areas are often not directly above the aquifer, it requires that planners from neighboring communities, counties, and states work with each other in designating recharge areas. Example: Since underground water often travels along rock bedding planes, if those planes are tilted, the recharge area for a community's aquifer may very well be tens or hundreds of miles away from the drill site.*]

Student Page

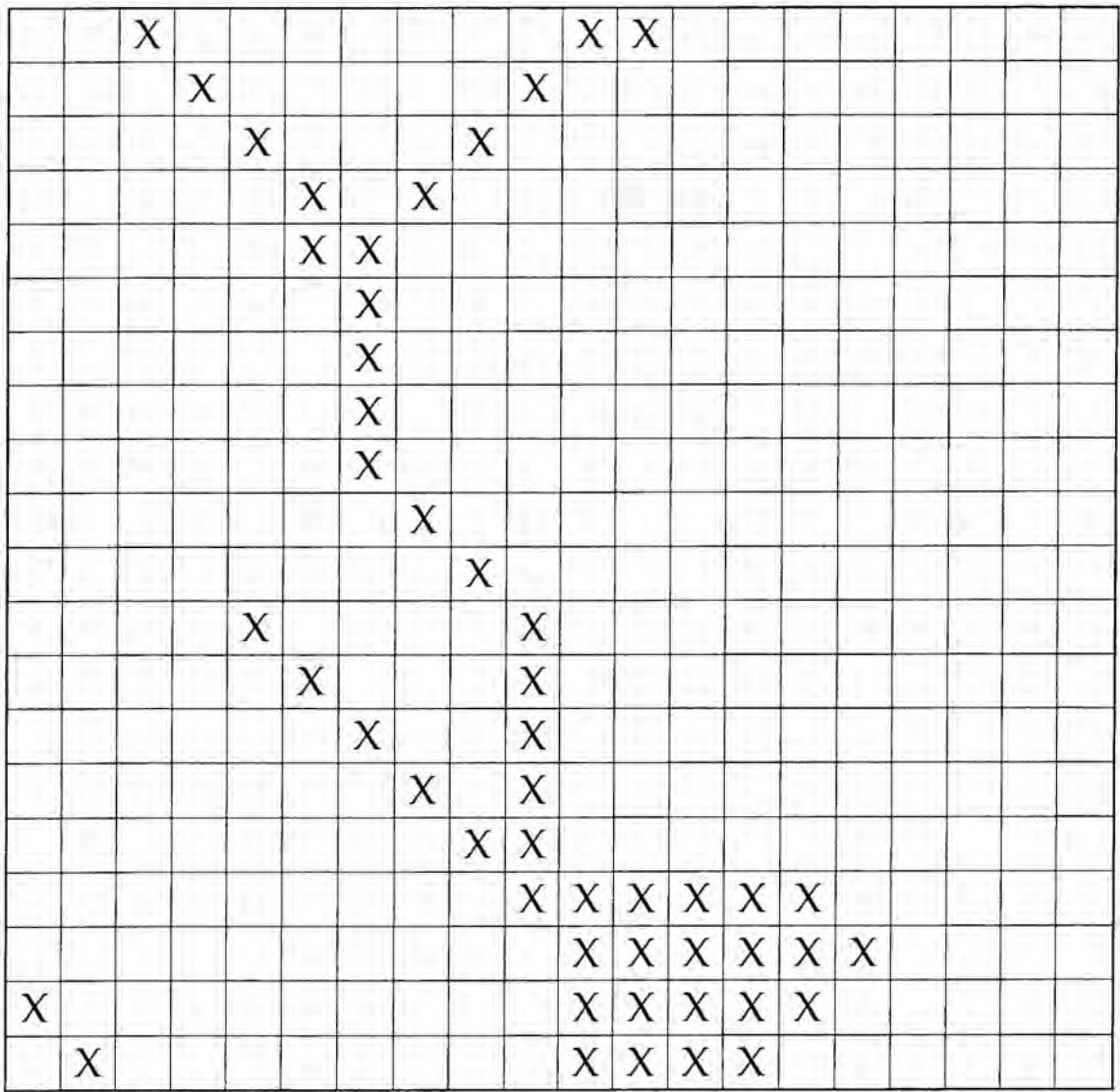
NAME:

DATE:

SURFACE-WATER SUPPLIES

DIRECTIONS:

1. Color all the "x" boxes on the worksheet blue. This represents the amount of surface water in your watershed.
2. Convert the land-use percentages on your card to the number of boxes they equal.
 Note: 12.5% of the total area has been used with the 50 boxes that represent the surface water supply.
3. Decide as a group how to arrange the land-use on the grid.
4. Fill in the grid boxes with the color that represents the specific land-use type. Create a color key for interpretation.



Student Page

NAME:

DATE:

SURFACE-WATER SUPPLIES

1. Each group represents an urban, a suburban, or a rural community. Which of these do you think your group represents? Why?

2. List your land uses and the types of pollution that each of these land-uses might generate.

3. Which of these land-uses represent impervious surfaces (where water runs off quickly) and which represent pervious surfaces (where water slowly filters down into the soil)?

Impervious surfaces

Pervious surfaces

4. A "buffer zone" is an area of undeveloped land surrounding a wetland. It helps protect the water from degradation. Describe the areas on your community map that could benefit from buffer zones.

5. Draw a thick line (one box out) around your entire grid's surface water. The land-use in this zone is critical to protecting water quality. Which land-uses (impervious or pervious surfaces) do you think would be the best to have in this zone? Why?

Student Page

NAME:

DATE:

GROUND-WATER SUPPLIES

DIRECTIONS:

1. Convert the land-use percentages on your card to the number of boxes they equal.
2. Decide as a group how to arrange the land use on the grid.
3. Fill in the grid boxes with the color that represents the specific land use type. Create a color key for interpretation.

20																				
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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T

Student Page

NAME:

DATE:

GROUND-WATER SUPPLIES

1. Each group represents an urban, a suburban, or a rural community. Which of these do you think your group represents? Why?

2. List your land uses and the types of pollution that each of these land uses might generate.

3. Which of these land uses represent impervious surfaces (where water runs off quickly) and which represent pervious surfaces (where water slowly filters down into the soil)?

Impervious surfaces

Pervious surfaces

4. Block out the following coordinates on your grid.

1 L-P	5 J-N	9 H-L	13 F-J	17 D-G
2 K-O	6 I-M	10 G-K	14 E-I	18 D-G
3 K-O	7 I-M	11 G-K	15 E-I	19 D-G
4 J-N	8 H-L	12 F-J	16 D-G	20 D-G

5. This blocked out section is called a “recharge area.” It is where the earth’s surface is linked to ground-water supplies. Which surface (impervious or pervious) do you think would be the best to have in this area? Why?

LESSON PLAN 8

The Treatment of Our Water

“Water Works”

Provided by Yale Society for Environmental Engineering and Sustainability

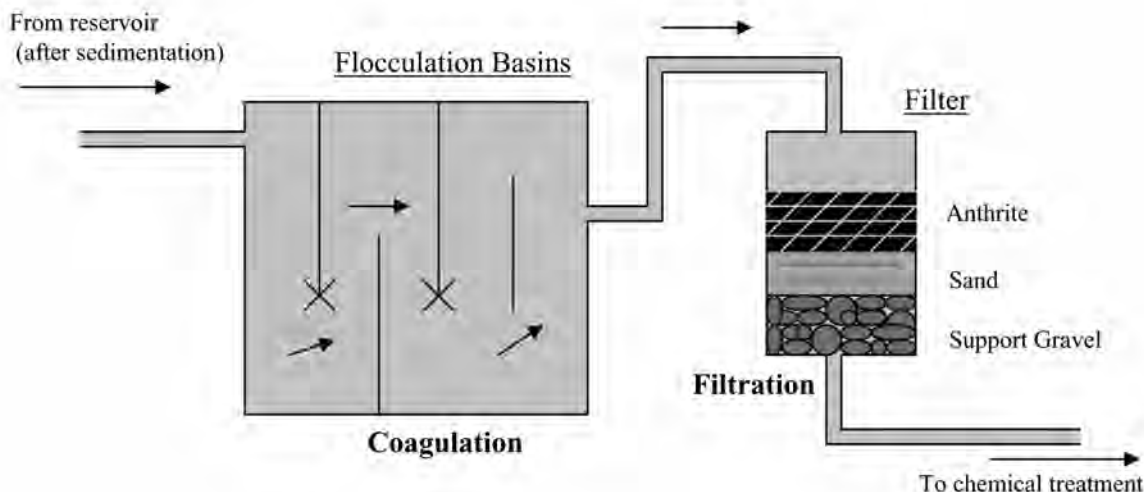
Week 2

The Treatment of Our Water Part I



We learned about different contaminants of water and concluded that unless water from the reservoir is treated, it is not safe to drink. The water treatment plant cleans the water so that we can use it without getting sick. How does the treatment plant purify water? Water treatment plants use several methods to clean the water. This week, we will explore the first half of the treatment process, which uses physical water treatment processes. There are three main steps:

- 1. Sedimentation:** This process allows big, heavy particles in the water to settle to the bottom. One place where sedimentation happens is in reservoirs. Particles sink to the bottom of the reservoir while the water waits to be drawn into the treatment plant.
- 2. Coagulation:** When a coagulant (a chemical that makes things stick together) is added to the water, it forms a harmless and sticky floc that sinks to the bottom. As it sinks, it carries with it fine particles, bacteria, and other substances down to the bottom of the flocculation basin.
- 3. Filtration:** In this process, suspended solids, bacteria, and other microbes are removed from the water by passing it through a bed of anthracite (coal), and and gravel.



Experiment 2

Sedimentation, Coagulation, & Filtration

Objective

The purpose of this experiment is to clean water by sedimentation, coagulation, and filtration.

Equipment

6 clear cups, clay mixture, stirring rod, coffee filter, baking soda, alum, and a funnel.

Procedure

Sedimentation

1. Put 1/2 teaspoon of clay mixture into a cup of water. Stir well with a stirring rod and let it stand.

Coagulation

1. Make a bicarbonate solution by adding 1/4 teaspoon of baking soda to a cup of water. Stir until it dissolves.
2. Make an alum solution by dissolving 1 teaspoon of alum into another cup of water.
3. Pour into a third cup the top part of the water containing unsettled particles. Pour half of this into a fourth cup and save for the filtration experiment.
4. Add 3 teaspoons of bicarbonate solution and 3 teaspoons of the alum solution into the mixture you made in step 3. Stir gently for a few minutes, and then let it stand. Record your observations. Did the floc form? How clear is the water?

Filtration

1. Place the coffee filter inside a funnel, and put the funnel into an empty cup.
2. Pour into the funnel the dirty water mixture you saved from the coagulation experiment. Record your observations.

Results

Record what happened after each step.

Discussion

Which method cleaned the water best? Why?

Conclusion

What can you say about the contaminants removed by each treatment process?

Experiment 2
Write Up

Sedimentation, Coagulation, & Filtration

Objective

Results

Discussion

Conclusion

Week 3 **The Treatment of Our Water Part II** 

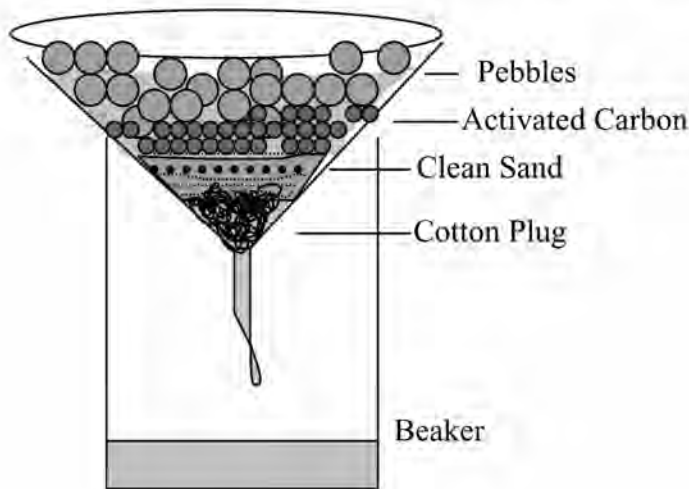
Last week, we learned about the physical water treatment processes. Today, we will explore two chemical water treatment processes: activated carbon treatment and chlorination.

Activated Carbon: Activated carbon is a special form of carbon that can remove unpleasant odor, color, and taste from water.

Chlorination: Chlorine is added to water to disinfect it. Chlorine kills bacteria and other microbes. Where else do we use chlorine to keep the water clean?

After the water is purified, it is stored in a clean water storage tank . Then, it is pumped to the consumers.

Activated Carbon Filter



Experiment 3

Chlorination and Activated Carbon

Objective

The purpose of this experiment is to purify water using activated carbon and to disinfect it by chlorination.

Equipment

5 cups, 2 test tubes, dried yeast, sugar, laundry bleach, a funnel, pebbles, cotton plug, clean sand, activated carbon, and food coloring.

Procedure

Chlorination

1. Pour yeast water mixture into two test tubes to about $\frac{3}{4}$ full.
2. Add 3 drops of laundry bleach to one of the test tubes.
3. Add $\frac{1}{2}$ teaspoon of sugar to both test tubes and stir.
4. Compare the reactions in the two cups.

Activated Carbon

1. Add 5 drops of laundry bleach to a cup of water
2. Add 1 drop of food coloring to a cup of water.
3. Make a filter with activated carbon as shown in the picture
4. Pour half the chlorine-smelling water through the filter and compare.
5. Pour half of the colored water through the filter and compare.

Results

Record what happened. Be sure to include what you see and smell.

Discussion

What does yeast represent in this experiment? Why did we add sugar? What happened to the yeast when you added bleach to it? How could you tell? What happened to the colored water when it passed through the carbon? What happened to the chlorine smell?

Conclusion

What can you conclude from the experiments you performed?

Design

Imagine you're a water treatment plant engineer. You've been asked by the city to design a new water treatment plant. How would you make drinking water? Make sure you indicate where the water comes from and the water treatment processes the water goes through. Would you drink the water coming out of your water treatment plant?

Experiment 3
Write Up

Chlorination and Activated Carbon

Objective

Results

Discussion

Conclusion

Experiment 3
Write Up

Chlorination and Activated Carbon

My Water Treatment Plant would look like this...

LESSON PLAN 9

New York City's Port Past, Present and Future

“The Waterfront Museum Education Packet”

Provided by the Waterfront Museum

Background: The NY-NJ Harbor and Bight are economic as well as ecological assets. Billions of dollars are generated annually in the regional economy from boating, commercial and sport fishing, swimming and beach going. The Port of New York and New Jersey is the largest port on the east coast of the United States and one of the largest in the world. Data from the Port Authority of NY-NJ indicate that 70.1 million metric tons of bulk and general cargo, valued at approximately \$89.8 billion, were shipped through the Port of NY-NJ in 2002. The regional economy also benefits from other uses of the Harbor/Bight, including ferry transportation, and sight-seeing. The following activity teaches students about the history of this world renowned port. It alerts students to the idea that we not only need to protect and value the natural aspects of the harbor but also appreciate and preserve its important economic function.

Grades: 6-8

Educational Objectives Met: History, Social Science and Reading Comprehension

Materials:

- Map of the NY-NJ harbor estuary region
- Pictures and maps of the Port of New York and activities that occur there
- Handouts of “New York’s Growth into Maritime Trade”
- Supplies for students to construct port timelines
- Access to research materials on the current status of the port

Procedures:

Step 1: Have students brainstorm and discuss associations with the word port. Chart and synthesize their responses. Explain what a port is, where it is located, and what its role is in terms of trade, travel, recreation, etc. Ask students if there is a port in New York and where it might be located. Show students a New York City map and ask them to identify ports or areas where they believe they are situated.

Step 2: Explain that the port was active even before New York was a city, and that it continued to grow, particularly during the industrial era, and was at its peak during World War II. Distribute or display maps and pictures that highlight the port’s makeup and activity. Direct students to read “New York’s Growth into Maritime Trade” (see attached), and then respond to the discussion questions.

Step 3: Divide students into small groups and instruct them to create a timeline documenting New York’s port activity to the present. Display the group timelines around the classroom for students to review and discuss.

Step 4: Have students conduct research on the present status of the port and waterfront by contacting metropolitan waterfront advocacy organizations. Based on their research and timelines, instruct students to share their predictions about the future of the port. They should add these predictions to their timelines.

Extensions:

Follow up with other Port and Lighterage lesson plans prepared by The Waterfront Museum. Other lessons include: Moving the Goods: The Port and its Railroads and Vessels, Types of Vessels, Work on the Barge and History of Lehigh Valley Railroad Barge #79. A lesson on the Port and Maritime Commerce is complimented by a class trip to the Waterfront Museum which is housed in the Lehigh Valley Railroad Barge #79. See page # of the guide for more information.

LESSON PLAN 10

New York's Growth into Maritime Trade

“The Waterfront Museum Education Packet”

Provided by the Waterfront Museum

Background:

Native Americans used Manhattan as an entrepot for a trading network, reaching north along the coast to the Canadian Maritime Provinces, and south to the Chesapeake. The Dutch came first to trade with the established Native American cultures. New York became the first seaport with European and native craft coming and going, ten years before there was any established settlement ashore. Native Americans and Europeans traded freely in the young Dutch settlement on Manhattan Island when the town was officially two years old. But conflicts arose, exacerbated as settlers from New England began to take Indian land for farming in Brooklyn and up the Hudson.

By the mid-1600s, New York was a thriving metropolitan community. By 1697, the British had taken over this bustling international seaport. The British built on Dutch foundations, using New York as a base for the wars that cleared the French from Canada and moved the frontier ever westward. Boston and Philadelphia, with their farming hinterlands, had much larger populations. But New York was by far the most diverse and contentious.

All this seafaring activity was based on the Royal Navy's dominance at sea...The brothers Howe brought into New York Harbor the largest invasion force ever sent overseas. With this force, they forced Washington's army out of New York... Despite a September 11th, 1776 meeting among Admiral Howe, John Adams, Benjamin Franklin, and Samuel Rutledge to consider ways to end the rebellion, the war went on until British forces gave up and left in December 1783, leaving George Washington's army to re-occupy a burnt-out city. Within weeks of the British departure, the city sent out the first ship to go to China under the American flag. When the Constitution was adopted, George Washington was inaugurated here as our first president. Freed of British colonial restrictions and challenged by a new sense of mission, New York grew prosperous on seaborne trade. By 1800, the city had overtaken Philadelphia and Boston as the nation's premier port...For New York, the War of 1812 was an interruption of its commerce, but the fortunes made by privateersmen fueled a tremendous postwar boom changed New York and the face of America.

The James Monroe--the first of what was called “packet ships”--sailed on January 5th, 1818 to open a new era in Atlantic travel... The wealth generated by shipping financed the digging of the Erie Canal, a tremendous capital undertaking that, from 1825 on, had a great effect on the city's growing economic base... The water link to the lakes made Chicago an outpost of that economy. New York rose to dominance in Atlantic trades. From the War of 1812 to the Civil War, the port handled 60 percent of all American East Coast trade...

Cunard opened regular transatlantic service on the news steamers in 1840 between Liverpool and Boston. However, within a few years, New York drew Cunard to its port. Designers improved the efficiency of steam liners and by 1851; American Collins liners crossed the Atlantic in ten days. These swift steamers took the cream of the carrying trade, but a rising tide of immigrants continued to come in by sail, providing business for the still-active packet ships.

New York's bustling harbor served more than just the great packet ships and steamers. The city's population increased through the 19th Century. The Revolutionary War had left the city with a population this population, New York's spacious harbor was home, host, and highway for an almost infinite variety of vessels. The survival of the vast numbers of people flowing into the city depended on the grain brought in on Erie Canal barges from the mid-western states, and produce coming from Connecticut, New Jersey, and Long Island farms in river schooners and sloops.

New York's Growth in Maritime Trade (cont)

The Civil War

The Civil War (1861-1865) brought draft riots and deep distress to New York. But America emerged from the all-consuming conflict as an industrial nation. The merchant marine was destroyed in the war, and after the war, New York's energies turned inland to railroad building and serving internal markets. Sailing ships built and owned in Maine were still on South Street, but the main action was in foreign steamers berthing on the North River or Hudson Shore...The liners also carried immigrants...

The 20th Century and the Harbor

America's entry into World War I in 1917 tipped the balance in a devastating conflict, but led to an uneasy peace. Liners kept sailing, sailing ships dwindled away, airplanes arrived on the scene. Depression followed the 1920s. President Wilson had been defeated in the U.S. Senate in his effort to keep the U.S. in the League of Nations; collective security broke down and renewed European war broke out, becoming worldwide after the entry of the U.S. in 1941 (World War II). The main effort was to contain and then smash Nazi, Germany, first by keeping Great Britain (and later Russia) in the war, then by going over to the offensive with an Anglo-American army. New York was the gateway for this effort—the result was the Battle of the Atlantic, which changed the fate of sailors returning to New York after the war.

During World War II, New York harbor was divided into six hundred individual ship anchorages able to accommodate ocean-going vessels awaiting berthing or already loaded and awaiting convoy assignment and sortie. On the peak day in March 1943, there were a total of 543 merchant ships at anchor in New York harbor, a figure very close to maximum capacity.

The Port of New York was really eleven ports in one. It boasted a developed shoreline of over 650 miles comprising the waterfronts of Manhattan, Brooklyn, Queens, the Bronx, and Staten Island as well as the New Jersey shoreline from Perth Amboy to Elizabeth, Bayonne, Newark, Jersey City, Hoboken and Weehawken. The Port of New York included some 1,800 docks, piers, and wharves of every conceivable size, condition, and state of repair. Some 750 were classified as "active" and 200 were able to berth 425 ocean-going vessels simultaneously in addition to the 600 able to anchor in the harbor. These docks and piers gave access to 1,100 warehouses containing some 41 million square feet of enclosed storage space. In addition, the Port of New York had thirty-nine active shipyards, not including the huge New York Naval Shipyard on the Brooklyn side of the East River. These facilities included nine big ship repair yards, thirty-six large dry-docks, twenty-five small shipyards, thirty-three locomotive and gantry cranes of fifty ton lift capacity or greater, five floating derricks, and more than one hundred tractor cranes. Over 575 tug-boats worked the Port of New York.

Between Pearl Harbor and VJ-Day, more than three million troops and their equipment and over 63 million tons of additional supplies and materials were shipped overseas through the Port of New York. Trucks working on a new national highway system replaced much coastal traffic by sea. The jet airliner replaced the ocean liner in the passenger trade. And very large, fast ships carried cargo in containers demanding huge parking areas, which were developed in new seaports in the Jersey marshes and Staten Island. By the 1960s, most commercial traffic had left Manhattan and the traditional seaport district was in danger of being wiped out and forgotten.

New York's Growth in Maritime Trade (cont)

Excerpted and adapted from:

New York is a Tall Ship: Showing How New York Grew to Greatness on Maritime Trade and What New Yorkers Learned Along the Way.

Meany Jr., Joseph F. Port in a Storm: The Port of New York in World War II. New York State Historical Society. 1992-present. <http://www.nysm.nysed.gov/hisportofnewyork.html>

Discussion Questions

1. Describe the beginnings of seaport trade in New York.
2. What role did the seaport play for the British? What occurred between the British and America? How did this affect New York's trade and port activity? After the British left New York, what happened to the port?
3. What type of sailing vessel boosted the harbor's activity? What was the result of the result in the growth of the shipping industry?
4. What role did steamers have in trade activity?
5. What products did railroads and barges carry that were useful to New Yorkers?
6. After the Civil War, what did New York begin to build? What types of sailing vessels were most popular?
7. What happened to the ports after the World Wars I and II?
8. Describe the port as it was during World War II.
9. Discuss what you think is happening to New York ports and waterfronts now.

Vocabulary

anchorage, boom, capital, coastal, consuming, contentious, convoy, dominance, entrepot, exacerbated, hinterlands, maritime, outpost, postwar, rebellion, schooner, seafaring, sloop, sortie, spacious, thriving, transatlantic, undertaking, vast, wharves



The US Coast Guard FireBush tendering buoys in the mid-1950s.

LESSON PLAN 11

Introduction to Estuaries

Education Program at the New Jersey Marine Sciences Consortium
NJMSC at 732-872-1300 or www.njmssc.org

Overview: This lesson provides background information to lead a discussion about estuaries including their environmental and economic benefits.

Objective: Following the completion of this lesson, students will be able to:

1. Describe what an estuary is and describe its value to the environment as well as our own well-being.
2. Name four estuarine types based on their formation and list examples of each type.
3. Name three categories that can be used to further describe an estuary.
4. Know that the NY/NJ Harbor Estuary is often termed an “urban-industrial” estuary and describe several reasons why.
5. Begin to become aware of the need to wisely manage estuaries to sustain their economic, aesthetic and recreational and ecological resources.

Grade Level: 5-12

Procedure: Discussion of background information followed by activity, “A Day in the Life of an Estuary” simulation game.

Materials: Goldfish crackers or other similar game markers (bingo chips), paper bowls or blue construction paper, game card sets (one per team).

Background: An estuary is a partially enclosed coastal body of water where salt water from the ocean mixes with fresh water draining from the land. Bays, inlets and tidal river valleys are all examples of estuaries. Estuaries are among the most productive ecosystems on the planet. Over 80% of the fish and shellfish we eat spend at least part of their lives in estuaries. Estuaries provide other important ecological functions too, acting as filters for pollution and providing protection from flooding. Finally, estuaries are often of great importance economically, providing us with food, jobs, consumer goods (through ocean-based shipping) and recreation.

Estuaries provide important habitat for many coastal organisms, providing them with food and shelter (habitat). Salt marshes are one of the habitats located within an estuary. They are ideal places for juvenile finfish and shellfish to hide, rest, eat and grow. Many of these animals later provide food for people. This “nursery function” of a salt marsh is critical to our continued supply of fresh seafood to eat.

Salt marsh are flooded and drained twice each day by the ocean’s tides. A special grass (*Spartina alterniflora* or salt marsh cord grass) that is salt water tolerant grows within the shallow “intertidal” areas that make up the salt marsh. Salt marsh cord grass dies off each year and its decomposition produces detritus. Detritus, along with microscopic plants (phytoplankton) near the marsh’s surface waters, provide food for many small organisms including Mummichogs (*Fundulus heteroclitus*) and Atlantic Silversides (*Menidia menidia*). Together the detritus, phytoplankton and small fish support not only the marsh food web, but because of the tides and the migration of fish and shellfish to adjacent bays and lagoons, contribute to the food web of the entire estuary and nearshore ocean zone.

Estuaries are divided into four types, depending on how they are formed:

1. Coastal Plain Estuaries are formed by sea level rising and filling an existing river valley. Chesapeake Bay in Maryland and the harbor of Charleston, South Carolina are two examples of Coastal Plain Estuaries.
2. Tectonic Estuaries are caused by the folding or faulting of land surfaces. These estuaries are found along major fault lines, like the San Francisco Bay area in California.
3. Bar-built Estuaries form when a shallow lagoon or bay is protected from the ocean by a sand bar or barrier island. Examples of these are found along the Eastern Seaboard and the Gulf Coast of North America.
4. Fjords are U-shaped valleys formed by glacial action. Fjords are found in areas with long histories of glacier activity, like northern Europe, Alaska and Canada.

Introduction to Estuaries (cont)

Estuaries can further be classified into the following three types:

1. Urban-Industrial Estuaries (NY/NJ Harbor Estuary, Upper Delaware Bay) are estuaries that support intense human use. Surrounded by millions of people and subject to many uses, including income-producing commerce, the NY/NJ Harbor Estuary is a prime example of an urban-industrial estuary. People depend on urban-industrial estuaries like NY/NJ Harbor and the areas surrounding them for living space, jobs (at port-related industries, for example), resources (energy production), recreational outlets (fishing, watersports) and transportation (ferries).

The natural habitats and biodiversity of a typical urban-industrial estuary are, not surprisingly, severely impacted by human use. In the case of NY/NJ Harbor, human use has meant major changes to the natural environment and a reduction in natural resources. It has also meant the development one of the largest, busiest ports in the world, generating hundreds of thousands of good paying jobs. Furthermore, as NY/NJ Harbor also demonstrates, an urban-industrial estuary that is successful at providing for human needs does not have to be of poor environmental quality. Instead, through sound management practices and careful conservation efforts, people can continue to use urban-industrial estuaries to serve their needs while maintaining the well-being of the natural environment.

2. Production Estuaries (Barnegat Bay and Lower Delaware Bay) are estuaries where seafood for human consumption is gathered or cultivated. These estuaries provide places for commercial and recreational fishing, and aquaculture, such as the cultivation or growing of oysters. In Barnegat Bay and Lower Delaware Bay species gathered or cultivated include oysters, hard clams, blue crabs, striped bass, flounders and weakfish. In a production estuary, it is important that the people caring for or managing the area care for or repair natural habitats (or, in some cases, create “new” habitats through the construction of artificial reefs) and monitor other conditions (such as water quality) that directly affect the health and growth of fish and shellfish. Production estuaries that are well cared for can also provide people

with other important resources including places for recreation, education, eco-tourism or simply enjoying the beauty of nature.

3. Conservation Estuaries (Mullica River Estuary) are for the most part undisturbed, self-sustaining ecosystems with minimal human use. They are usually in areas where human population is low. Estuarine Reserves, such as the Mullica River Estuary (Jacques Cousteau Estuarine Reserve) is an example of a conservation estuary in the United States. In these estuaries, priority is given to conservation and restoration efforts focused on habitats that support finfish and shellfish, wildlife, including endangered or threatened species, migratory birds, and resident species of the estuary. In many larger estuaries such as the Chesapeake Bay all three estuarine types may be present (as sub-estuaries) and are managed as a continuum.

Activity – “A Day in the Life of an Estuary” simulation game.

During the course of this game, students will experience a simulation of actions that can change estuaries in both positive and negative ways. To play this game, divide students into teams of four or five, with one student designated as the “fish” banker and card holder. Each team will need: a blue bowl or sheet of blue paper (this represents the estuary), one set of game cards (see below), goldfish crackers.

To set up for play, each team places 10 goldfish crackers in bowl or on sheet of blue paper. The “Fish” banker holds the additional crackers and deck of game cards. Then, the following passage should be read aloud: “Estuaries are places where the fresh water from rain, creeks, and rivers meets with the salty water from the ocean. This place is special for many animals. The shallow estuary water has saltmarsh areas that are nurseries for many young animals like fish, shrimp, and crabs. Pollution from people’s activities ends up in the estuary too. Sometimes pollution in the rivers makes tiny water plants, or algae, grow, and too much can grow sometimes. These algae use up the oxygen in the water. Like us, fish need oxygen to breath. When there is not enough oxygen there can be a “fish kill.” During a fish kill, many fish are found dead in the water—there simply wasn’t enough oxygen to go around! Good things

Introduction to Estuaries (cont)

happen, too. People can clean up the waterways, set aside habitat for wildlife, and make sure they only to catch fish when they are big enough and plentiful enough to catch.”

To play the game, one by one, each student will draw a card and complete the action, adding or subtracting “fish” as directed. Game continues until all cards have been drawn or each team’s “estuary” (represented by the bowl or blue paper), is depleted of “fish.”

Simulation game adapted from the North Carolina National Estuarine Research Reserve Education Office, January 2001. The North Carolina Coastal Reserve Program, within the Division of Coastal Management, was authorized by the NC General Assembly in 1989 to protect unique coastal sites. The program includes the North Carolina National Estuarine Research Reserve, part of the NOAA.

Closure Discussion Questions:

1. What are some things that effect estuaries in good ways? bad ways?
2. What kinds of things can we do to help preserve and protect estuaries?
3. Did your population completely die off? Why? Do you think that in real life this would happen? Why or why not?

<p>Bluefish closes in on school of smaller fish. Take out 3 fish.</p>	<p>Mr. Farmer sprayed for insects in his field on the edge of the waterway. When it rained, the runoff killed 3 fish.</p> <p>Take out 3 fish.</p>
<p>Legal protection for your fish species. Add 5 fish.</p>	<p>Volunteers do a “Clean Sweep” along the estuary. No fish lost.</p>
<p>Ms. Farmer fertilized her bean crop. Extra algae grew in the water. Fish die. Take out 2 fish.</p>	<p>The nursery has lost 3 fry. (fish babies)</p> <p>Take out 3 fish.</p>
<p>3 fish are caught in a gill net set by Ms. Jones.</p> <p>Take out 3 fish.</p>	<p>Salt marsh area set aside as nature reserve.</p> <p>Add 4 fish.</p>
<p>Seals feed in the estuary.</p> <p>Lose 2 fish.</p>	<p>New marina attracts 20 new boats to stay in the estuary.</p> <p>Lose 3 fish.</p>

<p>Great weather increases habitat.</p> <p>Add 2 fish.</p>	<p>A boater dropped a can of oil in the water and 3 fish died.</p> <p>Take out 3 fish.</p>
<p>A seagull flies over. It eats a fish for dinner.</p> <p>Take out 1 fish.</p>	<p>Salt marsh left undisturbed. Each player gets to add</p> <p>4 baby fish.</p>
<p>Something mysterious in the water kills fish.</p> <p>Take out 8 fish.</p>	<p>New fry hatch.</p> <p>Add 5 fish.</p>
<p>A vacationing family went fishing. Mr. and Mrs. Jones, little Jim and Judy each caught a fish. How many fish will you take out?</p>	<p>Area becomes protected for wildlife, fishing is prohibited.</p> <p>Add 3 fish.</p>
<p>A shark ate 3 fish.</p>	<p>Someone builds a new dock without a permit. 2 fish are killed when pilings hurt their habitat.</p> <p>Take out 2 fish.</p>
<p>Big algae bloom due to over fertilization of golf course nearby. No oxygen left.</p> <p>Take out 10 fish.</p>	<p>A fish ate a rubber worm Mr. Jones lost while fishing, the fish dies.</p> <p>Take out 1 fish.</p>

Additional Resources

A Birdseye View of the New York New Jersey Harbor Estuary Environment

Many free or low cost resources are available to educators that provide information to help better understand the changes occurring to urban coastlines and waterways over time. Through support from the NY-NJ Harbor Program, New York Sea Grant Extension (NYSGE) and Cornell Institute for Resource Information Sciences (CU IRIS) recently teamed up to provide professional development workshops for teachers working in the Harbor Estuary core area, providing information about the harbor habitats and a great array of geospatial teaching resources. NYC Oasis developed a Harbor Estuary Program specific guide teachers may use with the OASIS internet site. The lesson appears on the following pages.

The workshops focused on Harbor Estuary Restoration Sites. For additional information contact Nordica Holochuck at NYSGE; nch8@cornell.edu, or Susan Hoskins at CU IRIS, sbh1@cornell.edu



Comparing current and historic air photos and topographic maps is a great way to introduce students to local estuarine environments. Photo courtesy of NY Aquarium, Bird's Eye View Geospatial Workshop 9/2008.



LESSON PLAN 12

Identify a Harbor Estuary Program (HEP) Site

NYC OASIS Map Guides

For updates visit: www.oasisnyc.net

DEVELOPED BY: CMAP - Christy Spielman
Open Road - Paula Hewitt, Jake Li

TARGET AUDIENCE: Teenagers or adults

LENGTH OF TIME: 1 session 30-45 minutes

MATERIALS NEEDED: Pen or Pencil
Computer with internet
"Identify a Harbor Estuary Program Site" guide and worksheet for each person

GROUP SIZE: 1-30

BACKGROUND

OASIS is a city-wide coalition of many groups that have come together to create the www.oasisnyc.net website for you. Look on the website under "contact" to see who we all are. Information about special places in the New York/New Jersey Harbor Estuary can be identified on OASIS. The Harbor Estuary Program is multi-year effort to develop and implement a plan to protect, conserve, and restore the estuary.


GOALS AND OBJECTIVES:

Today you'll identify a Harbor Estuary Program (HEP) site near you and learn more about the Harbor Estuary Program. You'll move around the website and find information about your HEP site, including its location on the map, nearby wetlands, and political district.

VOCABULARY AND CONCEPTS:

Estuary, NY/NJ Harbor Estuary Program, HEP, acquisition, restoration, watershed, wetlands, impervious surface, land cover, coalition, political district, layers, labels.

STEPS:

1. Open www.oasisnyc.net
2. Click on "maps" from the menu on top. 

Identify a HEP (cont)

3. Under "Pick a Map Theme" click on the menu and choose "Natural Resources."
4. Under "Pick an Area" click on the "County/Borough" menu and choose your borough.
5. Click on "Go to the Map."
6. The map on the screen shows your borough. On the right is a menu of layers and checkboxes. A left box turns on/off a layer; a right box turns on/off a layer's label. Scroll down to Natural Areas. Notice that HEP sites are shown as yellow crosses for "acquisition sites" and orange crosses for "restoration sites." Click the the left checkbox for "Natural Areas" to uncheck this box. Now scroll up and click the right checkbox for "County/Borough" to uncheck this box. Click "Refresh Map." Now you can see the crosses more easily. Answer question 1 on the worksheet.
7. Click on the "+" icon next to "Zoom In" from the menu on top. Find the HEP site closest to your home. Zoom in on the site in one of two ways:
Note: The second choice may not work with Netscape browsers.
 1. Click once on the HEP site. Or,
 2. Move your pointer just above and to the left of the HEP site. Hold down your left mouse button and drag the pointer down and to the right, drawing a box around the site. Let go of the mouse button. The map will zoom to the area you boxed.
8. Now click on the "i" icon next to "Identify" from above the map.
9. Click once on the HEP site. The cross will become a red circle. Look below the map for information on your HEP site. Answer questions 2 through 7 on your worksheet.
10. Click the checkbox next to the "Classified Landcover" layer. Click "refresh map." Answer question 8 on your worksheet (you may need to zoom in more on the site).
12. Click the checkbox next to "Aerial Photo" and click "refresh map." You'll see an aerial photo of the HEP site. To see an aerial photo of the surrounding area, click the "-" icon next to "zoom out" and click anywhere on the map.

EVALUATION

If this guide is successful, you'll be comfortable moving around on www.oasisnyc.net. You'll be able to identify HEP sites, zoom in and out, use the identify tool, and switch between map and aerial views. Your worksheet will be completely filled out.

Identify a HEP (cont)

ADDITIONAL ACTIVITIES:

If you're comfortable moving around on the website, try these activities:

Print your NY/NJ Harbor Estuary Program site map and information by going to "Printable Layout." Type in a title for your map and print it.

Find and get information about another HEP site.

Go to the Harbor Estuary Program website by following the link to their site when you identify a HEP site. Learn more about what the Harbor Estuary Program is doing.

Explore the other layers in the menu. Turn them on and off and see what happens to the map!



Student Page

Worksheet: Identify a Harbor Estuary Program Site

Name: _____ Date: _____

1. What layers of information are shown on the map? (Hint: look at the checked boxes in the legend)
2. Did you identify an "Acquisition" or "Restoration" site?
3. What is the site's name? What is the name of the watershed it's in? (*Note: this information may not be available for some sites*).
4. What is the project status for the site? (*Note: this information may not be available for some sites*).
5. Who do you contact to find more information about this site or to get involved in helping to protect it from development?
6. Within which political districts is this site located?
7. What other information can you tell about this site's location? What other property is nearby?
8. Describe the land cover around the site you found? (*for example, mostly forested, mostly grassland, impervious surface, water*)

LESSON PLAN 13

From the Mountains to the Sea

From the NYSDEC Hudson River Estuary Program

For more information and additional lesson plans visit: www.dec.ny.gov/lands/4920.html

Name _____ Date _____

Read the following article and answer the questions.

From the Mountains to the Sea



Lake Tear of the Clouds

High in the Adirondack Mountains, surrounded by evergreen trees, is a little pond called Lake Tear of the Clouds. The tiny brook that flows from Lake Tear is starting a journey 315 miles long. Joining with many other streams, it will become the mighty Hudson River flowing to New York Harbor.

At first, the Hudson rushes downhill over waterfalls and rapids. The water from Lake Tear drops 4,000 feet as its course winds through the Adirondacks to the city of Glens Falls.



The Hudson in the Adirondacks



Closing the gates of a lock

The lock fills with water, raising the boat

In Fort Edward, a few miles south of Glens Falls, the Hudson becomes a canal. The river flows downstream over a set of dams, each with a lock that raises or lowers boats from one section of the river to the next.



The last of these dams and locks is at Troy. When the Hudson goes over this dam, it drops almost to sea level. Even though the Atlantic Ocean is more than 150 miles away, it influences the river all the way to Troy. The water level here goes up and down with ocean tides. These are the same high and low tides that affect beaches on Long Island and the New Jersey shore.



Closer to the Atlantic, the river flows through mountains called the Hudson Highlands. Here the ocean starts to influence the Hudson in another way. **Seawater** pushes into the Hudson and mixes with **fresh water**, making the river taste slightly salty. This mix of salt and fresh water is called **brackish water**. Places where this mixing occurs are called **estuaries**.



The Hudson River estuary becomes saltier as it nears New York City and the Atlantic Ocean. Here people catch flounder and other fish of the sea. Cruise ships sail in from the ocean to dock at river **piers**.

Perhaps the estuary's brackish water and tides gave the **explorer** Henry Hudson hope that this river would lead to the Pacific Ocean and China. He sailed up the river on his ship the *Half Moon* in 1609. He was disappointed in the end, but his voyage was remembered. This great river flowing from the Adirondacks to the Atlantic was named after him.



LESSON PLAN 14

Town Planning

Provided by Scenic Hudson — www.scenichudson.org

This lesson was developed with a field trip to a mid-Hudson park (Poughkeepsie), but it is transferable to any area or region.



Town Planning

Summary:

In this activity, the class is responsible for “developing” an imaginary town. When developing their town, students will have to take into consideration both the natural features of the area, as shown on a base map, as well as the interests of certain members of the community (scientist, farmer, businessman, etc.).

Objectives:

1. To introduce students to some of the trade-offs involved in making land-use decisions.
2. To give students an opportunity to apply what they have learned about the environment to hypothetical land-use decisions.
3. To raise students’ awareness of the impact that human decisions and activities have on the physical and living environment.
4. To challenge students to consider multiple perspectives on an issue.

Grades:

4th-5th

Time:

60 minutes

Location:

Classroom

Background:

This lesson should be taught after your class has visited Madam Brett Park to learn about the ecological significance of wetlands and streams, since it asks students to apply their knowledge of these ecosystems to hypothetical land-use decisions. Although Clear Creek is an imaginary place, the base map includes natural features that students can learn about by visiting Madam Brett Park. It therefore serves as a good assessment tool. This lesson could also be taught in conjunction with a historical study of past land-use in Beacon, particularly the use of the Fishkill Creek for various mills and the various uses of Mt. Beacon.

Materials:

Base map of Clear Creek (enclosed), Student Roles worksheet (enclosed), large paper for students’ drawings, crayons, pencils, and overhead transparencies (optional).

Procedure:

1. Explain to the class that today they are going to become developers of a new town called Clear Creek. Pass out copies of the base map, or make a transparency to show on the overhead projector (in this case, students can redraw the base map onto a piece of paper). Let students know that this is a map of the land on which they will be building their town. Point out the natural features on the base map (stream, wetland, etc.). They must consider these features when they develop their town.

Town Planning (cont)

2. Pass out the Map Key, showing the types of land-use, which students must place on their map (power plant, farm, houses, etc.). Students can cut out the icons on the map key, redraw them, or create their own. Discuss with students some of the pros and cons of each type of land use. What are the positive and negative effects of building houses or roads?
3. Divide the class into groups of three or four students who will work together to develop their town. Each group will assume the role of a particular interest group (gas station owner, farmer, etc.). Make copies of the "Student Roles" worksheet, cut them into strips, and pass one to each group (more than one group can assume the same role). Students must weigh these interests when making their land-use decisions.
4. As students are working, emphasize that they must have a reason for locating the power plant by the stream, etc., and that they will be asked to defend these decisions.
5. At the end of the activity they can come up in groups and present their maps. The rest of the class can comment or ask questions.

Variations/Extensions:

- Use this lesson as a springboard to teach your class more about maps and their different features, or in conjunction with a unit on geography.
- Rather than working with maps, students could debate the pros and cons of different land use decisions. Each group of students could formulate a position on how to develop the town, and would have to defend their ideas to the class. Several members of the class could represent the town board and have the power to make a final ruling.



New York State Learning Standards:

Mathematics Science and Technology

Standard 4 – Science: The Living Environment, Key Idea 7

Standard 6 – Interconnectedness: Common Themes: Systems Thinking, Key Idea 1

Social Studies

Standard 3 – Geography, Key Ideas 1 and 2

Standard 5 – Civics, Citizenship and the Government, Key Ideas 3 and 4

English Language Arts

Standard 3 – Language for Critical Analysis and Evaluation: Speaking and Writing

Source:

This lesson was adapted from "Dragonfly Pond," an activity found in Project WILD Aquatic.

Town Planning (cont)

Map Key

Power Plant



Park



Highway/Roads



Gas Station



Farm



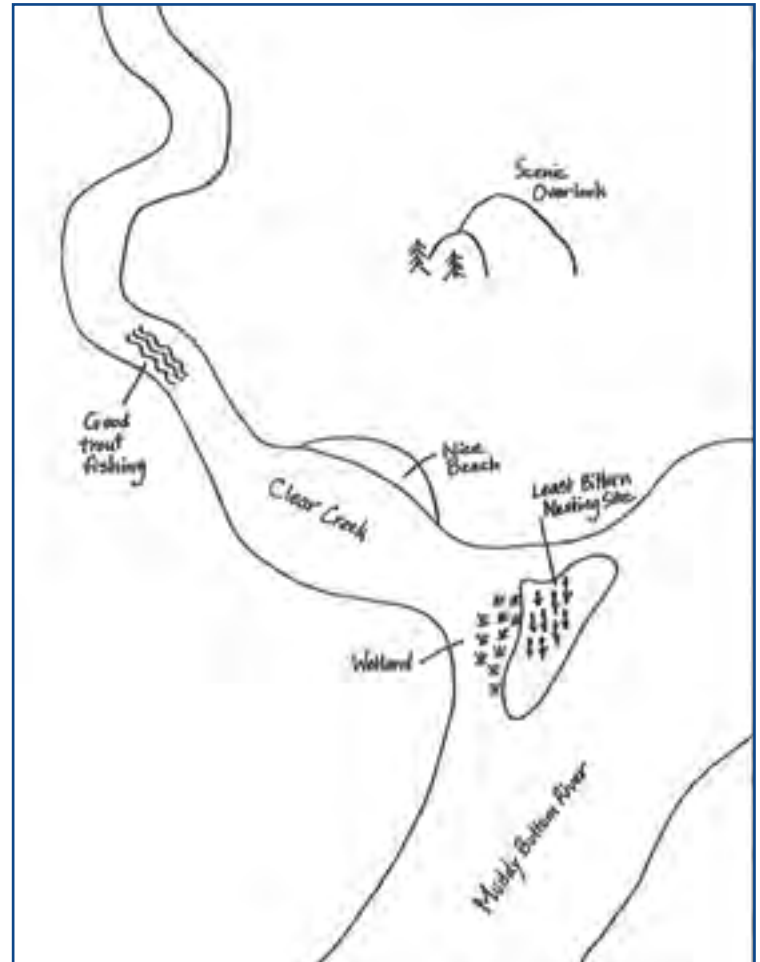
Houses (5)



Restaurant



Base Map of Clear Creek



Student Roles For Town Planning Activity



Scientist

You are a scientist studying the nesting patterns of the Least Bittern. Least Bitterns have been nesting at the mouth of Clear Creek for decades. Your research there is very important because other nearby wetlands where the Least Bittern nests have been threatened by human development.

Angler

You have been coming to the Clear Creek to fish for trout in the deep pools for as long as you can remember. Since the days of your youth, you have noticed a steady decline in the amount of trout you catch each year. You think this might be due to erosion of the stream banks and up-stream development. Out of concern that one day there won't be any more trout left, you joined a local chapter of Trout Unlimited to help protect trout habitat.



Farmer

It has always been your dream to start your own farm. You hope to realize your dream by buying land in Clear Creek and providing the town with fresh vegetables. You plan to grow tomatoes, cabbage and beans, as well as raise cows and sheep. Using the milk from your cows, you also plan to run a small cheese-making operation. All the food you grow on your farm will be organic, which means that you won't add any chemical fertilizers or pesticides to your crops.



Gas station owner

With the popularity of sport utility vehicles growing, which require a lot of gasoline to drive, you figure what better time to open a new gas station in the town of Clear Creek? You also plan to open a small convenience store so people can buy soda and candy when they fill up.



CEO of Light Up America

You have been CEO of Light Up America for 10 years and in that time you have made lots of money for the company and made the shareholders very happy. You are poised to build on these successes by building a new power plant near the Muddy Bottom River. In order to make electricity you need lots of water and so it is necessary for your factory to be located near a river. You are confident that your new factory will provide much needed electricity and jobs for the town of Clear Creek.



Resident

You think the town of Clear Creek would be a beautiful place to live, and your family plans to move up there from the city where you feel is becoming too crowded. In Clear Creek you plan to buy a nice house with a big backyard, and has access to the creek where you and your family can go swimming in the summertime.

Park Ranger

You have been assigned the job of patrolling the new park that will be opening in the town of Clear Creek. Part of your job will be leading natural history walks through the park, and educating people about the native animals and plants that rely on the creek and wetland there.



Introduction to Nature Poetry

Provided by Scenic Hudson — www.scenichudson.org



In Class Lesson Plan

Introduction to Nature Poetry

- Age:** 5th grade
- Time:** 45 minutes
- Source:** Rich Parisio, New York State Department of Environmental Conservation Environmental Educator and Debbie Lewis, Youth Resource Development Corporation
- Materials:** Unlined paper, pencils, clipboards, open minds
- Objective:** To help students break away from the rules of English and unleash their minds so that they can enjoy writing poetry outside.
- Procedure:** Introduce poetry. Ask the students why we use it and why it may be important.

Discuss roles of the poet. Ask how does a poet express or convey something to readers, and how is the role of a poet similar to that of a visual artist. The goal here is to get the students thinking about how artists convey a sense of feeling about their subjects and in particular how poets provide listeners with a scene and a feeling about subjects.

Discuss forms that poems may take. For example, poems do not always need to be in sentences or rhyme. The point of poetry often is to convey a feeling or thought to the listener. This can be accomplished in many ways and forms.

Discuss what makes a good subject for a poem. For example, particular things that one may experience while outdoors (such as the feeling of the wind, the sight of light shining on rustling leaves in the wind, the sound of water flowing over rocks, etc.) will be more recognizable to most readers.

Discuss the meaning of poetry. Cite Robert Frost who once read one of his poems and was then asked what it meant. His answer was to simply read the poem again.

Read poetry to the class and have them discuss what the poets may be trying to convey to the reader, the presence or lack of structure and grammar and other literary devices such as rhyme and rhythm. You may also benefit from sharing some information about the poets' lives.

Suggested Poems:

The Red Wheelbarrow

so much depends
upon

a red wheel
barrow

glazed with rain
water

beside the white
chickens.

~William Carlos Williams

Old Florist

That hump of a man bunching chrysanthemums
Or pinching-back asters, or planting azaleas,
Tamping and stamping dirt into pot, -
How he could flick and pick
Rotten leaves or yellowy petals,
Or scoop out a weed close to flourishing roots,
Or make the dust buzz with a light spray,
Or drown a bug in one spit of tobacco juice,
Or fan life into wilted sweet-peas with his hat,
Or stand all night watering roses, his feet blue in rubber boots.
~Theodore Roethke

I look into a dragonfly's eye
and see
the mountains over my shoulder.
~Issa

now listen you watermelons
if thieves come
turn into frogs
~Issa?

Introduction to Nature Poetry (cont)

Poem

As the cat
climbed over
the top of
the jamcloset
first the right
forefoot

carefully
then the hind
stepped down

into the pit of
the empty
flowerpot

~William Carlos Williams

Activities: *note: use unlined paper to help facilitate liberation of the student's mind*

1. Write your initials across the top of a blank piece of paper then write five words starting with that first letter for each initial.

D
dog
day
deliver

T
time
tick
tomorrow

L
lost
long
letter.....

Then have the students read their pieces out loud and discuss how they flow and have rhythm.

2. Create an acrostic poem. Write words vertically and write phrases or words starting with that letter horizontally.

Let us live as a one big family
Our lives are connected to every atom in the universe
Victory will be the earth's
Everywhere I go I see beauty

Read them out loud and discuss how they affect you as a reader.

Compare how everyone's poems do or do not make use of grammatical rules.

3. Go outside, find a quiet place, write about what you see, hear, smell and feel. Be specific, pay attention to small things and details. Refer to Nature Poetry Field Trip Lesson Plan,

Come back together and share.

LESSON PLAN 16

Climate Change

From the Lower East Side Ecology Center NYC Climate Coalition
www.LESEcologyCenter.org

The Lower East Side Ecology Center has a useful list of resources for educators regarding Climate Change. For more information and links, visit www.LESEcologyCenter.org or contact the NYC Climate Coalition, P.O. Box 20488, NY, NY 10009, 212-477 4022, or email: Tara@LESEcologyCenter.org

NYC Climate Change Curriculum Resources:

Green Map has produced a set of 6 new Energy & Environment Exploration Modules designed to help middle and high school age youth experience and interpret New York City's energy and environment from a sustainability perspective. Teachers and students can use these modules to map street trees and green space, get around car-free, find waste reduction sites and save energy at school.
www.GreenAppleMap.org/page/modules or email info@greenmap.org

The Metropolitan East Coast Assessment Educator's Pack is a package of GIS software, datasets and lesson plans designed for educators who are interested in using GIS technology to explore global climate change issues.

General Climate Change Curriculum Resources:

U.S. EPA Climate Change site includes links to detailed information on a wide range of climate change information:

Climate Change for Teens

(US EPA) Young people can become Climate Ambassadors by motivating friends, school, and community to address climate change and children's health.

Climate Change for Kids

(US EPA) includes child-friendly explanations of the terminology used in climate change reports, games, web links, plus information for teachers, including links to many web sites with lesson plans and activities

Climate Change Education

On-line resource center with links to many climate change web sites for teachers, kids and families.

Union of Concerned Scientists

Information related to climate change in the northeast US and California. Global Warming Materials for Educators is maintained by Union of Concerned Scientists and includes lesson plans

GLOBAL WARMING:

Early Warning Signs has a map that indicated local warning signs of global warming. There is also a “Global Warming Basics” section and other information on global warming. This site is a joint effort of Environmental Defense, Natural Resources Defense Council, Sierra Club, Union of Concerned Scientists, U.S. Public Interest Research Group, World Resources Institute, World Wildlife Fund

For Educators Section contains curriculum guide with high school lesson plans and impacts of climate change in U.S. and maintained by the Global Warming: Early Warnings Signs site.

Teachers’ Guide to High Quality Educational Materials on Climate Change and Global Warming provides guidance to understanding climate change materials on the web, and links to other sites

Paleontological Research Institution (affiliated with Cornell University)

Provides links to many other climate change sites for information, charts, photos, lesson plans.

National Wildlife Federation Global Warming Site contains detailed information on many related topics.



www.epa.gov/climateforaction/

SECTION 3

Directory of Organizations

Organizations at a Glance	Page Number	SCHOOL GROUPS			TEACHERS			YOUTH		
		Exhibits and Tours	Outdoor Field trips	In-School Programs	Classroom Activities	Curricula	Training Workshops	After School	Weekend	Summer
Alley Pond Environmental Center	76	✓	✓	✓	✓	✓	✓	✓	✓	✓
American Littoral Society	76		✓							
American Museum of Natural History	77	✓	✓			✓		✓	✓	✓
Battery Park City Parks Conservancy	78		✓		✓					
Beczak Environmental Education Center	78	✓	✓	✓			✓			
Bergen County Utilities Authority	79	✓	✓					✓	✓	✓
Bronx River Alliance, Inc.	79	✓	✓	✓	✓	✓	✓			
City of Clifton Environmental Protective Commission	80	✓	✓	✓	✓					
City Parks Foundation	81			✓	✓	✓	✓	✓		
Clean Ocean Action	81		✓	✓	✓	✓				
Coastal Marine Resource Center	83			✓	✓	✓	✓			
Coastal Research & Education Society of Long Island	84		✓	✓	✓		✓			
Council on the Environment of NYC	85		✓	✓	✓	✓	✓			
East River CREW	85		✓				✓			✓
Gateway National Recreation Area	86	✓	✓	✓	✓		✓	✓	✓	✓
Greater Newark Conservancy	86				✓	✓	✓			✓
Great Swamp Watershed Association	87			✓	✓	✓	✓			
Greenbelt Environmental Education Center	87	✓	✓		✓		✓			✓
Hackensack Riverkeeper	88	✓	✓	✓	✓	✓		✓	✓	✓
Hudson River Sloop Clearwater	89		✓	✓	✓	✓	✓	✓	✓	✓
Interpid Sea Air Space Museum	90	✓					✓		✓	✓
Liberty State Park Interpretive Center	90		✓				✓			
Lower Eastside Ecology Center	91		✓	✓	✓	✓	✓	✓	✓	✓
Meadowlands Environment Center	92	✓	✓		✓		✓			
Mercer County Soil Conservation District	92		✓	✓	✓		✓			✓
Monmouth Museum	93	✓			✓					
The Narrows Botanical Gardens	93	✓	✓							
Neighborhood Initiatives Development Corporation	94	✓	✓	✓	✓		✓	✓	✓	✓
New Jersey Audobon Society	94				✓					

	Page Number	SCHOOL GROUPS			TEACHERS			YOUTH		
		Exhibits and Tours	Outdoor Field trips	In-School Programs	Classroom Activities	Curricula	Training Workshops	After School	Weekend	Summer
New Jersey Department of Environmental Protection	95	✓	✓	✓	✓	✓	✓			
New Jersey Division of Parks and Forestry	95	✓	✓	✓			✓			
New Jersey Marine Sciences Consortium	96	✓	✓		✓	✓	✓	✓	✓	✓
New York Aquarium	97	✓		✓			✓	✓	✓	✓
New York City Audobon Society	97								✓	
New York City Department of Environmental Protection	98	✓	✓	✓	✓	✓	✓	✓		
New York City Soil and Water Conservation District	98			✓			✓			
New York State Department of Environmental Conservation	99		✓	✓						
New York Restoration Project	100		✓	✓						
Noble Maritime Collection	100	✓		✓	✓		✓		✓	
Ocean Institute at Sandy Hook	101		✓	✓	✓	✓	✓			
Project USE	101		✓		✓		✓		✓	✓
Queens Botanical Garden	102	✓	✓					✓	✓	✓
Randall's Island Sports Foundation	102		✓					✓		
The River Project	103	✓	✓					✓	✓	✓
Rocking the Boat, Inc.	103	✓	✓	✓	✓	✓	✓	✓	✓	✓
Scenic Hudson, Inc.	104	✓	✓	✓						
SoundWaters	104	✓	✓	✓	✓		✓	✓		✓
South Street Seaport Museum	105	✓	✓				✓		✓	✓
Staten Island Children's Museum	105	✓					✓	✓	✓	
Staten Island Institute of Arts & Sciences	106	✓	✓					✓	✓	✓
Stony Brook Millstone Watershed Association	106	✓	✓	✓				✓	✓	✓
Trout Unlimited	107		✓	✓	✓	✓	✓		✓	
Urban Divers Estuary Conservancy	107		✓				✓	✓	✓	
Urban Park Rangers	108	✓	✓		✓	✓		✓	✓	✓
US Environmental Protection Agency	108			✓	✓	✓				
Waterfront Museum		✓								
Waterfront Alliance	109		✓	✓						
Working Harbor Committee	110	✓	✓		✓					

Directory

Alley Pond Environmental Center

228 -06 Northern Blvd.
Douglaston, NY 11363
Contact: Education Staff
718-229-4000
Email: info@alleypond.com
www.alleypond.com

MISSION/DESCRIPTION

To encourage our urban neighbors to develop awareness, understanding, appreciation, and responsibility for our natural habitat through education.

PROGRAMS AVAILABLE

Estuaries and Endangered Wetlands

Grade: K-5
Duration: 1-2 hrs
Cost: \$5.00-5.50/student

Did you know that we have an estuary of national significance right in our backyard? This program explores the habitats, plants, and animals of the Little Neck Bay and Long Island Sound coastal region. Examine the functions and values of estuaries and wetlands. Visit one of the few remaining salt marshes in Northern Queens.

Pond Discovery

Grade: K-5
Duration: 1-2 hrs
Cost: \$5.00-5.50/student

Ponds may appear to be quiet areas where carefree insects and ducks spend their days--not so! Birth, death, struggle for territory, seasonal change, and a highly complex food web result in a constant struggle for life while holding this dynamic system together.

Wetland Systems

Grade: 6-12
Duration: 2 hrs
Cost: \$5.50/student

What is the importance of these ecosystems? Compare and contrast the complex ecology of saltwater and fresh water wetlands. Learn about the diversity of organisms that inhabit these ecologically sensitive areas. Students visit wetlands to perform population surveys and analyze the water quality of these magnificent wetlands.

American Littoral Society

28 West 9th Rd.
Broad Channel, NY 11693
Contact: Don Riepe, Chapter Director
718-318-9344
Email: donriepe@aol.com
www.alsnyc.org

MISSION/DESCRIPTION

ALS is a national, non-profit coastal conservation organization comprised of lay and professional naturalists. It seeks to encourage protection, restoration and enhancement of the delicate fabric of life along the shore.

MATERIALS AVAILABLE

Littorally Speaking

Grade: 4th and up
Cost: free with membership
A newsletter of environmental concerns, centering on coastal conservation.

Underwater Naturalist

Grade: 6th and up
Cost: free with membership
A magazine of marine life and coastal conservation issues

PROGRAMS AVAILABLE

New York State Beach Cleanup

Grade: all levels
Duration: 1 day
Cost: free
Annual volunteer effort held during the third weekend in September to document and remove debris from our beaches and waterways. Contact Barbara Cohen, Beach Cleanup Coordinator, at 718-471-2166 or als-beach@aol.com for more information.

Jamaica Bay Guardian

Grade: 6 and up
Provides habitat restoration and wildlife monitoring projects

American Museum of Natural History

Central Park West at 79th Street
New York, NY 10024
212-769-5200
www.amnh.org

MISSION/DESCRIPTION

The American Museum of Natural History's mission is to discover, interpret, and disseminate—through scientific research and education—knowledge about human cultures, the natural world, and the universe. The Museum's exhibition halls are rich in scientific and cultural content. We offer permanent and special exhibitions, IMAX films, and planetarium shows. Additional resources are available to enhance student's experiences: teaching volunteers, exhibition explainers, and curriculum materials. Many resources are available both online and in print to support learning at the Museum and in the classroom, before, during, after, or independent of a Museum visit.

MATERIALS AVAILABLE

Milstein Hall of Ocean Life Educator's Guide

Grade: K-12

Cost: Free

The educator's guide provides a focus for your visit to AMNH. The Exhibition section of the guide highlights six topics that can be readily integrated into your science curriculum. Activities and additional resources are available throughout the guide.

For further information and activities, visit AMNH's website at www.amnh.org/resources/halls/oceanlife and the Ology Marine Biology site at <http://ology.amnh.org/>.

PROGRAMS AVAILABLE

Milstein Hall of Ocean Life

Grade: K-12

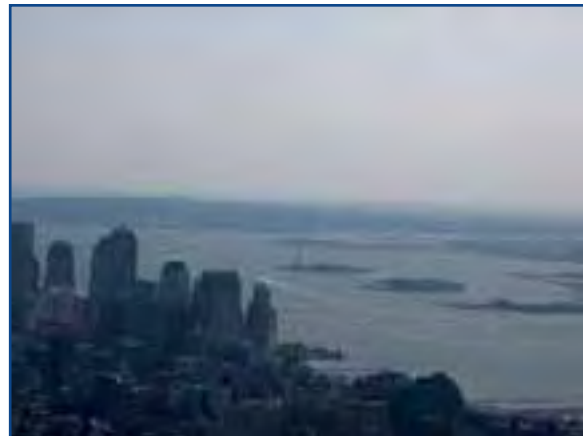
Cost: Free with school group registration

Independent focused field trips in the Milstein Hall of Ocean Life. On weekday mornings, Teaching Volunteers are stationed throughout the Hall with Saltz Expedition Centers to support independent focused field trips.

To register a school trip, contact the Central Reservations department at 212-769-5200. For further information, visit AMNH's website at http://www.amnh.org/education/school_groups/plan_your_visit.php.

OTHER OFFERINGS

Professional development programs at AMNH are designed to provide educators at all levels with opportunities to deepen content knowledge in areas of science and social studies through interactions with scientists and educators and use of AMNH research, exhibitions, and print and online resources. Programs are designed to support and complement the NY State Core Curriculum. Programs include educator events designed around new and special exhibitions, professional development days, multi-day institutes, graduate courses, and online courses: Seminars on Science. For a listing of yearly offerings, contact AMNH's Central Reservations Department (212-769-5200) for the "Programs for New York City Schools and Teachers" brochure.



Battery Park City Parks Conservancy

2 South End Ave.

New York, NY 10280

Contact: Bill Fink, Marine Education Coordinator

212-267-9700

Email: bpcparks@idt.net

MISSION/DESCRIPTION

To educate and inform the general public and school-children about the recovery and maintenance of the Hudson River Estuary.

PROGRAMS AVAILABLE

BPCPC's School Outreach Program

Grade: 3-12

Duration: 3 hrs (9:30 am-12:30 pm)

Cost: free

The program consists of three components:

- A pre-fishing discussion led by a BPCPC Marine Education Specialist on topics including the history, geography, and ecology of the Hudson River and New York Bay estuary, environmental considerations affecting the River, and how students can become personally involved in protecting and enjoying the River.
- A first-hand fishing experience in which all species caught are placed in aerated saltwater tanks where students observe and identify their catch. At the end of the program, students help release fish back into the River. Conducted April-June and September-November in Robert F. Wagner Jr. Park at the southern end of Battery Park.
- A post-fishing discussion allowing students to reflect on their new experiences and first-hand knowledge about the River. Classroom materials are given to each teacher to follow up upon return to school.

OTHER OFFERINGS

Go Fish days are catch and release fishing events for the entire family that provide recreational activity while raising awareness of the Hudson River's flourishing marine life, current health, and fragility. They are held several Saturdays each year in Robert F. Wagner Jr. Park. BPCPC provides a variety of equipment and bait. There are also displays, live demonstrations, art projects, and entertainment.

The six-session Master Angler training course on fishing safety, marine biology, and ecology is offered approximately every two years. In return for the training, volunteers assist BPCPC staff with programs throughout the season.

Beczak Environmental Education Center

"Learn to Love Your River"

35 Alexander St.

Yonkers, NY 10701

Contact: Cliff Schneider, Executive Director

914-377-1900 ext 15

Email: thehudson@beczak.org

www.beczak.org

MISSION/ DESCRIPTION

Beczak Environmental Education Center provides interactive educational experiences focused on the local watersheds. Our goal is to encourage stewardship of the environment within communities.

Coming Soon!

Beczak will be including the Saw Mill and Bronx River into their programs, curriculum, and mission. For information about our upcoming 3 Rivers of Yonkers lesson plans, contact Steve Ruff, Director of Programs 914-377-1900 ext 14.

PROGRAMS AVAILABLE

Our Hudson River Interpretive Center features a wet lab, interactive exhibits, Riverfront Park, tidal marsh, sandy beach and spectacular views of the river and Palisades. All programs are conducted inside our spacious, child-friendly facility or outside on our Hudson River waterfront. For an updated list of all education programs and fees go to www.beczak.org to download a copy. To schedule a program contact Vicky Garufi, Education Program Manager (914) 377-1900 ext 12.

Catch of the Day Seining Program

Grade: all levels

Duration: 2 hrs

Cost: \$320 per group of up to 25

Put on your waders! Hold onto a net! Find out who and what lives under the waves by dragging a 30-foot seine net through the water to catch fish and other remarkable Hudson River creatures. Students keep a tally of our catch and add the information to our indoor display. We provide chest waders to help keep dry. While waiting their turn at seining, students embark on a scavenger hunt to see how many Hudson River treasures they can find.

Bergen County Utilities Authority

P.O. Box 9
Foot of Mehrhof Rd.
Little Ferry, NJ 07643
Contact: Lori Russo, Solid Waste Education Advisor
201-807-8692
Email: Lrusso@bcua.org

MISSION/DESCRIPTION

To provide wastewater treatment and solid waste management services for the citizens of Bergen County and to do so with excellence and in accordance with all applicable laws, rules, and regulations.

MATERIALS AVAILABLE

Mehrhof Pond Revitalization

Grade: 4th and up

Cost: free

Brochure explaining watershed areas, the ecosystem, water pollution, and what all citizens can do to protect watershed areas.

About Wastewater Treatment

Grade: 4th and up

Cost: free

Pamphlet explaining the entire wastewater treatment process.

PROGRAMS AVAILABLE

ECO-WALK

Grade: all levels

Duration: 1.5 hrs

Cost: \$5/child, \$10/adult (Riverkeeper fee)

Sponsored by the Hackensack Riverkeeper's office, participants are taken on a tour of the nature preserve surrounding Mehrhof Pond. See page 23 for more details.

Wastewater Treatment Plant Tour

Grade: 6th and up

Duration: 2 hrs

Cost: free

Participants are taken on a tour of BCUA's sewage treatment plant.

OTHER OFFERINGS

Recycling and waste reduction programs can be coordinated at Bergen County schools for Pre-K through eighth grade classes.

Bronx River Alliance, Inc

Bronx River Education Director
1 Bronx River Parkway
Bronx NY 10462
718-430-4614
www.bronxriver.org

MISSION/DESCRIPTION

The Bronx River Alliance serves as a coordinated voice for the river and works in harmonious partnership to protect, improve and restore the Bronx River Corridor and greenway so that they can be healthy ecological, recreational, educational and economic resources for the communities through which the river flows. The Bronx River Alliance's Education Program enriches the learning experience of students in under-served schools by providing opportunities to learn by doing. It empowers student and resident volunteers by training them as water quality monitors. As they gather scientific data on the river's health and share it on the GLOBE database, they are also taught what they can do to improve it. As residents explore and connect with a river in their own back yard, their own quality of life improves. The program works towards its mission with the guidance of the Education Team, a committee of teachers, scientists and community educators who are actively involved with education programs along the River.

MATERIALS AVAILABLE

Please visit our website for electronic versions of many of our resources and to find out how to sign up for a canoe trip down the Bronx River

Bronx River Map and Guide

This self guided brochure with colorful maps, points of interest, restrooms and public transit stations is an ideal educational tool for leading students along the Bronx section of the River. The walk is continuous from the Westchester/NYC border to the NY Botanical Garden. The southern portion of the walk clearly demonstrates the lack of green space in the south Bronx and the need for new parks being developed along the southern reaches, including Hunts Point Riverside Park and Concrete Plant Park

Bronx River Classroom

The Inside Track for Educators

Grade 7-12

Cost: Free

The goal of the Bronx River Classroom: The Inside Track for Educators is to pique your professional and personal interest in river-related activities and to help you incorporate the local environment into your programs. This project originated with the Bronx River Alliance Education Team, a group of teachers, non-formal educators, scientists and community members who meet regularly to identify projects, share resources, and plan activities for educators who would like to use the river as a living laboratory. The aim of this guide is to provide you with an “inside track” on the Bronx River—how to get there, what to do once you arrive, what resources are available, and sample lessons to get your feet wet, so to speak.

PROGRAMS AVAILABLE

Bronx River Stewards Monitoring Program

Grade: All Levels

Cost: Free

School groups can adopt a section of the Bronx River and receive guidance in sound monitoring and restoration. To receive monitoring equipment, teachers must attend a training workshop offered twice a year and be a member of the Bronx River Education team.

Bronx River Classroom

Grade: 7-12

Cost: Free

The Bronx River Alliance will help teachers set up semester or longer Bronx River projects for their students. Teachers may receive assistance for up to 3 visits in the field with Bronx River Alliance staff or other resource experts.

OTHER OFFERINGS

Slideshow presentations, teacher training workshops, outdoor hands-on restoration projects and volunteer opportunities are available.

City of Clifton Environmental Protective Commission

900 Clifton Ave.

Clifton, NJ 07013

Contact: Macil Homza, Secretary

973-470-5754

MISSION/DESCRIPTION

CEPC is a municipal environmental commission (member of ANJEC) actively involved with a variety of environmental issues. It works with the Clean Communities Program and Clifton Health Department in watershed management and outreach/education areas.

MATERIALS AVAILABLE

Videos for Educational Loan

Grade: 6th and up

Cost: free

“The Ground Water Adventures of Walter Wet” and “Riparian Forest Buffers”

PROGRAMS AVAILABLE

Aquatic Habitat Studies & Management

Grade: all levels

Duration: 1 day

Cost: free

School groups can participate in stream monitoring, riparian buffer plantings, and cleanups. Teachers can also borrow kits and field equipment for macroinvertebrate biomonitoring studies.

OTHER OFFERINGS

CEPC members are trained in Project WET and Project WILD/Aquatic WILD (see pages 55 and 56 for program description), and can participate in teacher training workshops.

Recycling activities through the Clean Communities Program can be coordinated.

City Parks Foundation

1234 Fifth Ave. Rm. 232

New York, NY 10029

Contact: Senta Korb, Education Coordinator

212-360-1485

Email: senta.korb@parks.nyc.gov

MISSION/DESCRIPTION

To provide education programs to students, teachers, and families around NYC.

MATERIALS AVAILABLE

Woodlands, Wetlands, & Wildlife

Grade: all levels

Cost: \$5

A guide to New York City's natural areas.

PROGRAMS AVAILABLE

Training Workshops

Grade: teachers

Duration: 1 day

Cost: free

Hands-on environmental teacher training days specifically tailored to meet the needs of teachers and their students. Curriculum is supplied, and local environmentalists provide expertise and model age-appropriate lessons. Workshop topics include Coastal Ecology, Ponds & Lakes, and Watersheds.

OTHER OFFERINGS

Trees, Tales, & Woodland Trails is a citywide program designed to introduce K-3rd graders to nature and the importance of trees in the urban environment.

New Youth Conservationists After School Program allows high-school students to meet and conduct scientific research on real environmental issues in Van Cortlandt Park.

Internships are available for high school and college students.

The Sue Erpf Van De Bovenkamp Junior Bird and Nature Club helps participants learn to identify forest birds as they walk the nature trails using field techniques to train their eyes and ears.

Other publications available to educators in the environmental field include "Ecology Network" (a guide to environmental organizations in NY) and "Teacher's Guide to Forests." \$5 each.

Clean Ocean Action

18 Hartshorne Dr., Suite 2

Highlands, NJ 07732

Contact: Citizen Action & Activities Coordinator

732-872-0111

Email: SandyHook@CleanOceanAction.org

www.CleanOceanAction.org

MISSION/DESCRIPTION

To improve the water quality of the waters off the New Jersey/New York coast. COA identifies the sources of pollution and mounts an attack on each source by using research, public education, and citizen action to convince public officials to enact and enforce measures that will clean up and protect our ocean.

MATERIALS AVAILABLE

"You are the Solution to Pointless Pollution" Education Kit

Grade: all levels

Cost: free

A collection of interactive lessons, hand-on activities, and information about nonpoint source pollution -- the #1 cause of water pollution; includes lessons in math, science, social studies, geography, language arts, and creative writing.

Storm Drain Stenciling Kit & Education Package

Grade: all levels

Cost: free instruction cards, \$13.85 for complete kit (includes shipping and handling)

Learn how to stencil storm drains to alert the public about non-point source pollution with step-by-step instructions, two stencils (one fish image and one text stencil), and 50 educational door hangers.

Painting the Town Blue

Grade: all levels

Cost: \$5 rental fee, \$10 refundable deposit (upon return in 14 days). Two separate checks please. OR \$10 to purchase the video

A 22-minute VHS that follows a class learning about pointless pollution and coordinating a storm drain stenciling project.

Clean Beaches...Naturally

Grade: all levels

Cost: \$5 rental fee + \$10 refundable deposit (upon return in 14 days). Two separate checks please. OR \$10 to purchase the video. A 6-minute VHS that lays the groundwork for organizing a beach cleanup.

Clean Ocean Action's "10 Tips: Things You Can Do to Stop Pointless Pollution"

Grade: all levels

Cost: free

A series of "tip cards" designed to educate distinct groups of people. These cards teach people how they can minimize their contribution to the problem of non-point source pollution or "pointless pollution". Aimed at specific user groups (e.g., kids, drivers, boaters, homeowners, shore visitors), the cards are excellent educational tools to broadcast the pointless pollution message.

Various Fact Sheets

Grade: 5th and up

Cost: free

Fact sheets about current coastal concerns.

PROGRAMS AVAILABLE

Fishing for Solutions

Grade: K-4

Cost: \$75 + travel expenses

A one-hour, fun and interactive classroom presentation on ocean pollution sources and solutions with a COA representative. The lesson will increase awareness and give students a sense of how to improve their environment.

Our Habitat is Down the Drain

Grade: all levels

Cost: \$75 + travel expenses

A one-hour classroom slide show about "pointless" pollution, focusing on issues specific to NJ. A COA representative will discuss causes and effects and show how individuals and communities can work to ensure that NJ's waters are clean.

Annual Spring and Fall Beach Sweeps

Grade: all levels

Cost: free

COA organizes a statewide cleanup twice a year (April and October) at numerous locations in NJ, mainly along the beaches. School groups can participate in the cleanup at any of the designated sites. Volunteers collect data by recording what debris they find and the amount at each of the locations.

Annual Student Summits

Grade: 5-8

Cost: free (schools must provide transportation and lunch)

Teachers for grades 5-8 in New Jersey's public and private schools can apply for this program, which is designed to provide students from different areas of NJ with an opportunity to experience hands-on marine environmental education at the Jersey Shore.

OTHER OFFERINGS

The Clean Ocean Action Shore Tips (COAST) Campaign is an annual summer-long, volunteer-based campaign that informs citizens about the problems facing our coast and to give them the opportunity to get involved. Volunteers set up tables at beaches along the NJ coast and distribute educational materials.

Volunteer opportunities are available for all ages.





The Coastal Marine Resource Center

Education Programs

334 Furman St.

Brooklyn, NY 11201

718-757-1717

Email: connect@thecmrc.org

www.thecmrc.org

The Coastal Marine Resource Center provides educational programming for children through adults. Programming ranges from science topics for children related to the New York- New Jersey Harbor Estuary to sustainability education for adults. Programs can be customized and include:

- Wildlife and aquatic inhabitants of the Estuary
- Water quality and emerging challenges to the Estuary
- Seining at local parks with beach access
- How to be green in New York City - it's about protecting the blue!
- Horseshoe Crabs, New York City and New Jersey's marine living fossils
- Green roofs - what they do to protect the Estuary and prevent the Urban Heat Island Effect
- Management practices for artificial turf that protect the Estuary
- Climate changes - what are the challenges, how we can prevent and plan for climate change

Program formats include:

- Presentations
- Workshops
- Speaking events
- Classroom programming

The CMRC houses on its Virtual Estuary Project section of its website photographs of and related to the New York - New Jersey Harbor Estuary as well as publicly available images of Estuary and Hudson River fish and other aquatic organisms. The photographs and images are downloadable and available under a Creative Commons license for free use by educators, nonprofits, or any other non profit generating entity for educational or outreach purposes. Please visit the CMRC's Virtual Estuary Project on our website at <http://www.thecmrc.org>.

Please contact the CMRC for more information or to schedule a program.



Coastal Research and Education Society of Long Island, Inc.

Division of Natural Sciences and Mathematics
Kramer Science Center
Dowling College
Oakdale, NY 11769-1999
Contact: Dr. Arthur H. Kopelman, President
631-244-3352
Email: president@cresli.org
www.cresli.org

MISSION/DESCRIPTION

To promote and foster understanding and stewardship of coastal ecosystems through research and education. The Coastal Research and Education Society of Long Island, Inc., (CRESLI) was founded in the summer of 1996 by a group of professionals and experts in marine mammal science, environmental sciences, education and conservation. Originally based Southampton College of Long Island University, CRESLI now resides at Dowling College. CRESLI was formed for the purposes of conducting research, providing educational experiences and promoting conservation of coastal ecosystems. CRESLI and the Viking Fleet (Montauk, NY) have joined forces to provide an array of unparalleled marine and coastal educational experiences for you and your students for. The cooperative association between CRESLI, with its expertise in marine sciences and education, and the Viking Fleet, with its large assortment of vessels and highly experienced crews, allows us to offer the following types of on-board educational experiences:

- Bay and Coastal Cruises (Spring)
- Seal Cruises (Winter and Spring)
- Marine Discovery Science Excursions (Winter, Spring, Summer), Whale Watch (Summer)

If you would like more information, please call CRESLI's voice mail (631-244-3352) and leave a message with your name and phone number. You may also send an email to education@cresli.org. Please note that CRESLI programs have been accredited by STANYS for in-service credit. For more information, contact CRESLI.



MATERIALS AVAILABLE

CRESLI Educational Brochures and Education Booklets on marine life:

Please check website for brochures as as many are available free to download in PDF format. Strong spiral bound booklets are filled with age appropriate material pertaining to marine mammals, sea turtles, and other sea creatures and can be ordered through the website.

OTHER OFFERINGS

CRESLI's professional educators and scientists are available to give lectures (with demonstration material) to groups of various sizes and ages at various venues. Topics include (but are not limited to): Marine Mammals of NY, Sea Turtles of NY, Birds of Coastal NY, Sharks of NY, Marine Ecology, Endangered Species. All CRESLI projects use volunteers. Anyone interested in volunteering with whale, seal, or sea turtle research is trained via workshops.

CLASS OR SCHOOL CLUB MEMBERSHIP:

\$250 annually Membership is available for classes and school clubs. With a membership your class or club will receive a certificate suitable for framing, a customized lecture by a CRESLI scientist/educator, discounted rates on field trips and CRESLI's quarterly member newsletter.

Council on the Environment of NYC

51 Chambers St. Rm. 228

New York, NY 10007

Contact: Mike Zamm, Director of Environmental Education

212-788-7932

Email: cenyctso@hotmail.com, mzamm@cenyc.org

www.cenyc.org

MISSION/DESCRIPTION

To increase environmental awareness among New Yorkers and promote solutions to environmental problems.

MATERIALS AVAILABLE

Environmental Education Introduction Units

Grade: 4-12

Cost: \$1.50

Featuring “Water, Water Everywhere” – an introduction to the coastal environment and marine waters.

Urban Environmental Education

Grade: K-12

Cost: Free

General guide on teaching students about the urban environment, including many hands-on activities.

Training Student Organizers Curriculum

Grade: 7-12

Cost: \$15

Guides teachers and youth leaders initiating youth to organize environmental improvement projects on several environmental issues, including water and coastal environment related issues.

PROGRAMS AVAILABLE

Training Student Organizers

Grade: 6-12

Duration: school year

Cost: free

CENYC staff work in participating schools on a weekly basis to train 2-3 classes in how to organize environmental improvement projects. Coastal restoration is one of the main focus areas.

East River Crew

22 East 89th St.

New York, NY 10128

Contact: Mary Nell Hawk, President and on-water director at mnh2002@columbia.edu

Tony Archino, Vice President

Tori Gilbert, Ed.D, Sec.-Treas., Co-Founder, and curriculum coordinator at 212-427-3956 or tgilbert@eastrivercrew.org

PROGRAMS AVAILABLE

East River C.R.E.W. is a nonprofit organization that promotes the stewardship of the East River waterways through educational and recreational activities. By engaging the community in on-going waterfront activities, East River C.R.E.W. aims to impart a love for and an understanding of the East River and its communities, preserving the river for generations to come.





Greater Newark Conservancy

972 Broad Street 8th Floor
 Newark, NJ 07102
 Prudential Outdoor Learning Center, 32 Prince Street
 Contact: Kathleen V Salisbury, Director of Education
 973-642-4646 x21
 Email: ksalisbury@citybloom.org
www.citybloom.org

MISSION/DESCRIPTION

To educate, train, and support communities in creating environmentally safe neighborhoods. This is accomplished through four programs: education, community greening, job training, and environmental justice.

PROGRAMS AVAILABLE

Environmental Field Trips to the Outdoor Learning Center — Grade: Pre-K–12, special needs
 Duration: 2 hour programs, we can customize a program to suit your schedule
 Cost: \$200 for up to 25 students, chaperones free, scholarships available
 Field Trip programs are hands-on interactive interdisciplinary and correlate to NJCCCS. Topic include: Sensing Nature (Pre-K – 2), Urban Habitats, What’s the Buzz?, Measuring Up To Nature, All About Water, Gardening with Nelson Mandela, Walking through Winter, Nutrition, Our Changing Cities, Hikes for Tikes, We Need Bees!

Professional Development Workshops

Grade: K-12 teachers
 Duration: 3 -6 hrs
 Cost: Free - \$30 depending on Program
 Can customize a program for your needs, can do any of the programs listed below at your school for your teachers.
 Workshops Include: WOW, Literacy through Science, Math in the Garden, Nelson Mandela, Nurture Nature (for early childhood and special needs), Access Nature, Horticulture Therapy (for special needs), Nutrition in the Classroom, Gardening in the Classroom, Creating a School Yard Garden, Nature in All Subjects

OTHER OFFERINGS

“Discovery Boxes” address the following topics: Seeds, Lenape Life, Wonders of Weather, Urban Wildlife, Managing Our Garbage, Lead Awareness, Asthma, and Food Technology. Each box includes a teacher’s manual with hands-on, inquiry-driven activities that are correlated to the NJCCCS, display materials, and consumable materials for 25 students. FREE for teachers – Out of Newark – Pick up and Drop Off, in-Newark free delivery.

Gateway National Recreational Area

www.nps.gov/gate

MISSION/DESCRIPTION

Gateway National Recreation Area, comprised of three units in New York and New Jersey, was created by an Act of Congress in 1972 to bring the National Park Experience to urban dwellers. Gateway’s 26,000 acres of beaches, bays, dunes, wooded uplands and grassy fields are a perfect setting for outdoor and environmental education.

PROGRAMS AVAILABLE

Teachers and students can explore most park sites by participating in ranger guided programs or self guided trips. Professional development workshops for teachers are available. Distance learning opportunities are also available.

GNRA has lesson plans posted online learning materials and lesson plans. And learning materials posted online.

Jamaica Bay Unit

718-338-4306
 Jamaica Bay Wildlife Refuge
 Breezy point
 Ecology Village

Staten Island Unit

Great Kills Park 718-987-6790
 Fort Wadsworth 718-354-4500

Sandy Hook Unit

732-872-5970
 New Jersey

Great Swamp Watershed Association

PO Box 300
New Vernon, NJ 07976
Contact: Hazel England Director of Outreach/Education
973-538 3500 x 20
Email: hazele@greatswamp.org
www.greatswamp.org

MISSION/DESCRIPTION

The Great Swamp Watershed Association is dedicated to protecting and improving water resources in the region by monitoring local streams, advocating for intelligent land use, and educating our communities about water quality and quantity and their effect on the health and natural beauty of the local environment. The Association serves as an important environmental resource for individuals, organizations and governmental entities.

MATERIALS AVAILABLE

Teacher's Guide to the Great Swamp
Grade: K-12 teachers
Cost: free
Background information on the history of the Great Swamp, current threats to the watershed, a glossary, and seven hands-on activities.

PROGRAMS AVAILABLE

Watershed Model Demonstrations
Grade: 2-8
Duration: 45 min
Cost: free
Staff and volunteers bring the Terrine Institute's plastic watershed model to area schools to demonstrate point and non-point source pollution.

Projects: WET, WOW, Healthy Waters, Healthy People, Wild, PLT and School yard habitat enhancement
Grade: K-12 teachers
Duration: 6 hours, Professional development credits available
Cost: \$10-25 dependent on workshop

Greenbelt Environmental Education Center

Staten Island Greenbelt
200 Nevada Ave.
Staten Island, NY 10306
Contact: Maritza Cuevas, Director of Environmental Education
718-667-7475
Email: education@sigreenbelt.org
www.nyc.gov/parks

MISSION/DESCRIPTION

Our mission is to increase environmental literacy in our community, promote appreciation and respect for the environmental in general, and for the Greenbelt in particular.

MATERIALS AVAILABLE

Wetlands Teacher Resource Guide
Grade: 4-8 teachers
Cost: Free - with the participation of a professional development workshop
A useful wetland activity guide filled with background information and reproducible activities, lesson plans, and resources for school teachers to use in their classrooms.

PROGRAMS AVAILABLE

Aquatic Life
Grade: 2 – 6
Duration: 75 minutes
Cost: \$4/ student (call for Title I fees)
Students will examine aquatic animals and discover how their needs – water, air, light, food, space and shelter - are met by their wetland habitats. Program includes a pond dip (weather permitting) and is only available at High Rock Park in Spring.

The Wonders of Water
Grade: 4 - 8
Duration: 75 minutes
Cost: \$4/students (call for Title I fees)
Learn what makes water so special. Students will learn about the properties of water, the water cycle, and the role water plays on our planet. This program is offered throughout the year.



New York City Parks

Wetland Exploration

Grade: 5 – 12

Duration: 2 hours

Cost: \$7/student (call for Title I fees)

Using data collected through interactive explorations, students will conduct a study of a freshwater wetland: analyze pH levels and turbidity of water samples, and conduct wetland plant and animal indicator surveys. Weather permitting this program is only offered at High Rock Park in Spring.

OTHER OFFERINGS

Professional development, interactive explorations, winter outreach programs, art workshops, guided hikes, summer camp and naturalist in training programs are also offered at the Greenbelt.

Hackensack Riverkeeper

231 Main Street

Hackensack, NJ 07601

Contact: Hugh Carola, Program Director

201-968-0808

www.hackensackriverkeeper.org

MISSION/DESCRIPTION

To protect, preserve, and restore the natural, living, and recreational resources of the Hackensack River and watershed.

MATERIALS AVAILABLE

The Living Tidal Marsh

Grade: 3-12

Cost: free loan

Video and teacher's guide designed to teach students the value of salt marsh ecosystems.

PROGRAMS AVAILABLE

Eco-Programs: Bird walks, Paddling Center, River Clean-ups and Eco-cruises Walk Requested donations: \$10 for adults and teenagers (ages 13 and up) \$5 (ages 12 and under). There are two different ways you can take an Eco-Cruise with us: CHARTERS and OPEN ECO-CRUISES: CHARTER ECO-CRUISES are GROUP trips that engage an entire boat (or both boats) for your group, etc. Charters can be booked for any date or time May through October based upon availability. We ask the following donations: \$300.00 per boat for adult groups / family events (15 participants MAX). \$250.00 per boat for school /Scout groups (15-17 participants MAX). \$300.00 per boat for a Combination Program (school field trip including shore side activity for up to 34 students & adults lasting up to four hours duration). OPEN ECO-CRUISES are scheduled in advance and are appropriate for individuals, couples, families and the like. PLEASE NOTE: They are not for group outings.. For seats on Open Eco-Cruises, we ask the following donations: \$25 per adult (ages 13 and up), \$10 per child ages 4-12.*

*In determining what constitutes an "adult" we consider average size and weight for safety's sake. Also, Eco-Cruises are not recommended for children under the age of 4. Reservations are required

**In addition to the scheduled Bird-Walks Hackensack Riverkeeper staffers are also available to lead outings for your group at a date and time of your choice. Schools, Scout troops, nature clubs and more are welcome.

Hudson River Sloop Clearwater

112 Little Market St.
Poughkeepsie, NY 12601
Contact: Dave Conover
845-454-7673
Email: dave@clearwater.org
www.clearwater.org

MISSION/DESCRIPTION

Clearwater, a non-profit organization, is dedicated to the protection of the Hudson River and its watershed through education, advocacy, and celebration. Clearwater's education programs are designed to train and inspire the next generation of environmental leaders.

PROGRAMS AVAILABLE

Classroom of the Waves: sail programs on the sloop Clearwater

Grade: 3rd through College

Duration: 3 hour and 5 hour trips

Students board the sloop Clearwater or schooner Mystic Whaler and sail on the Hudson River, New York Harbor, or Long Island Sound. They participate in sailing and navigating the 106 ft. traditional sailboat and visit customized learning stations focusing on ecology, chemistry, physics, music, art, and history. Sails take place from mid-April through October.

Tideline Discovery Program: shore-based field trips

Grade: K-12

Duration: 3-5 hrs

Students visit the Esopus Meadows Environmental Center near Kingston, NY or other open spaces along the Hudson River. They seine for fish, collect plankton, explore water quality issues using chemical tests, and go beachcombing to sample the Hudson's natural and human history. Trips take place from April to November. Reserve by February 1 for priority Spring dates; May 1 for choice Fall date.

Clearwater in-school programs

Grade: all levels

Duration: 50 min

Clearwater educators bring a bit of the river to your school. They work with teachers to develop specific group plans and supply all materials, including curriculum.



Camp Clearwater

Grade: all levels

This new program is scheduled to begin in the summer of 2009 and will be based at the former University Settlement Camp in Beacon, NY. It will include day-camp programming and multi-day adventure education using kayaks and canoes. Contact the Clearwater office for more information.

Teacher training opportunities including Hudson River studies courses, workshops, and consultations are also available.

This new program is scheduled to begin in the summer of 2009 and will be based at the former University Settlement Camp in Beacon, NY. It will include day-camp programming and multi-day adventure education using kayaks and canoes. Contact the Clearwater office for more information.

Teacher training opportunities including Hudson River studies courses, workshops, and consultations are also available.

Intrepid Sea Air and Space Museum

Pier 86 W 46th St and 12th Avenue
New York, NY 10036-4103
www.intrepidmuseum.org

MISSION/DESCRIPTION

Honor our heroes, educate the public and inspire our youth

PROGRAMS AVAILABLE

The museum's education department has designed fresh thematic educational experiences, each of which explore recently opened areas of the ship, new artifacts, restored aircraft and interactive exhibits that investigate life aboard Intrepid space, flight and water by encouraging visitors to stop, think and do!

- Self guided and educator led tours and workshops Discover collections and exhibitions related to sea, air,space and life-themes that explore the history of technology- the hardware of those categories as well as the stories of the people behind them, the humanity behind the hardware.
- Lesson plans and activities in alignment with NYC, state and national standards
- Professional Development for Teachers, across the disciplines



Lower East Side Ecology Center

PO Box 20488
New York, NY 10009
Contact: Tara DePorte, Program Director
212-477-4022
Email: Tara@LESEcologyCenter.org
www.lesecologycenter.org

MISSION/DESCRIPTION

The Lower East Side Ecology Center (LESEC) is a 501(c)(3) non-profit organization located on the Lower East Side of Manhattan since 1987. Our mission has three main objectives:

- Stewardship of public open spaces
- Increasing community awareness, involvement, and activism through environmental education and
- Recycling and composting. For detailed information please visit our web site.

PROGRAMS AVAILABLE

Grade: Adaptable to All ages, duration, 1-2 hours
Cost: Free to the public, private groups and programs with educational funding, suggested donation \$100-\$200 per class, including materials.

Water Education Programs

We have teaching resources, hands-on workshops and field trip opportunities for local schoolchildren focusing on watershed protection, conservation, water supply education, and most importantly with appreciating the living and life-giving resources of local estuaries:

- Water Quality Monitoring (East River and Hudson River related)
- Water Infrastructure Curriculum, Urban Water Cycle
- Portable Make Your Own CSO Model (NYC combined sewer treatment plant, storm drains, overflows and all!)
- Citizen's Guide to the Sewershed printable handbook
- Climate Change Education (high school students)
- Coastal Infrastructure
- Youth Mentoring opportunities
- Other Offerings: The Lower East Side Ecology Center offers a diversity of hands-on education programs including waste prevention, composting, energy and climate change, gardening and habitat creation and more. We also provide composting, electronics recycling, stewardship and other environmental programs. Please, contact the center for more information.

Liberty State Park

Interpretive Center
Morris Pesin Drive
Jersey City, NJ 07305
Contact: Lori Garth
201-915-3409
E-mail: lsPIC@verizon.net
www.state.nj.us/dep/forestry/parks/liberty.htm

MISSION/DESCRIPTION

To provide quality education programs which improve environmental and cultural literacy.

PROGRAMS AVAILABLE

Save a Place for Wildlife

Grade: Pre-K through 6th

Duration: 2 hrs

Cost: free

A program designed to enhance the understanding of “habitat” and the importance of having a suitable variety of habitats to sustain wildlife. Upland and lowland habitats of Liberty State Park will be explored. Includes an interpretive walk and scavenger hunt on a beach habitat or nature path. Offered seasonally in autumn and spring.

Estuary Explorers

Grade: 4th and up

Duration: 2 hrs

Cost: free

A hands-on exploration of the life in and around the Upper New York Bay. Older students may seine in the river for fish and shrimp, and/or comb the beaches for shells and other treasures. Wetlands values, biological and economic, will be discussed. Offered seasonally in autumn and spring. Schools must provide transportation to and from study site.

The Urban Estuary for Young Scientists

Grade: 5th and up

Duration: 2.5-3 hrs

Cost: free

Similar to “Estuary Explorers” (see above) with water quality sampling experiments to test a variety of parameters, including pH, salinity, and dissolved oxygen. Offered seasonally in autumn and spring. Schools must provide transportation to and from study site.



Professional Development Workshops

Grade: K-12 teachers

Duration: 6.5 hrs

Cost: \$6

Project WET, Project WILD/Aquatic WILD (see pages 55 and 56 for program descriptions), WOW, Project Learning Tree (a PLT Trunk is available for loan), and Bridges to the Natural World. Lessons and activities from all programs have been correlated with the NJ Core Curriculum Content Standards.

OTHER OFFERINGS

The Interpretive Center offers additional environmental education programs focusing on the local natural resources and wildlife. Please contact us for a full list of programming or visit us at our website.

Outreach Programs (we come to your school) are offered from December through March to schools within our region. They can be scheduled for morning or afternoon, one class at a time, up to three classes of the same program per day. Public Interpretive Programs are offered throughout the year. Most programs are free of charge but do require pre-registration. Please call or visit our website for a schedule of events.

Meadowlands Environment Center

Two DeKorte Park Plaza
Lyndhurst, NJ 07071
201-460-8300
www.meadowlands.state.nj.us

MISSION/DESCRIPTION

HMEC encourages appreciation, enjoyment, and understanding of wetlands through public programs, school visits, and professional workshops for teachers. It is our goal to educate people on this wonderful and diverse local ecology so as to reverse the popular misconception that these areas are only wastelands.

PROGRAMS AVAILABLE

Marsh Explorers

Grade: K-1

Cost: \$3.50/student

Students will be able to: 1) describe a marsh habitat and its characteristic wildlife; 2) understand the interconnectedness of life by creating a food web; 3) understand and describe brackish water; 4) understand introductory concepts of adaptations through the exploration of physical and behavioral examples (in wildlife).

Ecology of an Estuary

Grade: 4-6

Duration: 1.5-2 hrs

Cost: \$3.50/student

Students will be able to: 1) describe a food web in an estuary; 2) describe some values of the salt-marsh estuarine system; 3) describe and identify brackish water; 4) discuss the salinity and pH of the water; 5) describe many of the native species of plants and animals commonly found in the estuarine ecosystem.

Wetlands Delineation Side Dish

Grade: 7-12

Duration: 1 hr

Cost: \$3.50/student

Students will be able to: 1) use a soil auger to collect a soil sample; 2) use a Munsell color chart to identify the type of soil; 3) use a field guide to identify wetland plants; 4) determine if the test area is a wetland.

Mercer County Soil Conservation District

508 Hughes Dr.
Hamilton Square, NJ 08690
Contact: Heather McNeil, Education Coordinator
609-586-9603
Email: mercersoil@aol.com
www.mercerscd.com

MISSION/DESCRIPTION

To prevent soil erosion on development sites, mitigate impacts to soil resources, and enhance water quality. The MCSCD also provides technical assistance to the agricultural community and has established the non-profit Assunpink Environmental Institute to further environmental education in Mercer County.

PROGRAMS AVAILABLE

Diving into Oceans

Grade: 4-8

Cost: free

The sea exhibits striking examples of adaptations to the environment. A slide show examines many curiosities of the sea. We will discuss mankind's dependence on the sea and the effects that our activities have on the saltwater world.

The Delaware Estuary

Grade: 5-9

Cost: free

From the rapids just north of Trenton to the Atlantic Ocean, the Delaware Estuary and its watershed comprise one of the most biologically productive places on Earth. Learn about the history, diversity, and impacts on this extensive ecosystem.

Project WILD/Aquatic WILD

Grade: K-12 teachers

Duration: varies

Cost: varies

OTHER OFFERINGS

Numerous tip sheets and brochures related to natural resource conservation, and a quarterly newsletter titled "The Horizon" are available.

Project Learning Tree workshops are also offered.

Internships and volunteer opportunities are available.

Monmouth Museum

PO Box 359

On the Brookdale Community College Campus
Lincroft, NJ 07738

Contact: Marion Kanaga, Education Coordinator
732-747-2266

Email: mkanaga@monmuseum.org
www.monmouthmuseum.org

MISSION/DESCRIPTION

The Museum is a major cultural and educational resource for the residents of the region. It serves more than 50,000 adults and children annually with changing exhibitions in the fields of art, science, nature, and cultural history.

MATERIALS AVAILABLE

Keep Our Water Clean

Grade: 1-8

Cost: \$25 (2-week rental)

A traveling trunk that can be rented by teachers as an adjunct to their curriculum.

It stresses non-point source pollution.

Salt Marsh Trunk

Grade: 1-8

Cost: \$25 (2-week rental)

A traveling trunk that can be rented by teachers as an adjunct to their curriculum.

It focuses on salt marsh habitats, and the plants and creatures that make up the food chain.

PROGRAMS AVAILABLE

WonderWing Exhibition (permanent)

Grade: 3-6

Cost: \$6/student

A hands-on exhibition with an under-the-sea theme. Our staff docents provide school groups with an interactive program of learning and activity, custom-designed for each age group.



The Narrows Botanical Gardens

69th St. and Shore Rd.

Bay Ridge, Brooklyn 11209

Contact: Helen Bruno, Education Coordinator

Phone: 718-238-1692

MISSION/DESCRIPTION

The NBG is a 4.5 acre public space whose mission is to enhance the community by providing free public gardens; sponsoring free cultural events like concerts and art shows; and educating the public on horticulture and the environment.

PROGRAMS AVAILABLE

From April to October, the Narrows Botanical Gardens offers a free educational program for elementary and middle school aged children. Through classes conducted in the Native Plant Gardens outdoor classroom, the Story Circle, students learn about nature's role in science, social studies and art, fostering a greater awareness of and appreciation for native plants and wildlife.

Fifteen students at a time participate in the 1-hr. 15 minute program, two consecutive programs can accommodate a total of 30 students.

For more information on how to participate, consult the web page or phone the NBG.

Neighborhood Initiatives Development Corporation

2523 Olinville Ave.
Bronx, NY 10467
718-231-9800

MISSION/DESCRIPTION

Not for profit multi-service community organization that offers a variety of programs: youth, housing, crime prevention, job readiness, commercial revitalization, and a special project to restore a section of the Bronx River.

PROGRAMS AVAILABLE

The Bronx River Project

Grade: K-5

Duration: varies

Cost: free

Field trips to the Bronx River and classroom instruction in ecology, safe drinking water, native plants, and wildlife. Journal writing and arts and crafts projects. Offered May – October.

The Bronx River Project

Grade: 6-8

Duration: varies

Cost: free

Field trips to the Bronx River and classroom instruction in ecology, safe drinking water, native plants, and wildlife. Removal of non-native plant species from designated site and planting of native plants in same site. Water and soil testing. Journal writing and arts and crafts projects. Offered May – October.

OTHER OFFERINGS

Community gardening and beautification projects.

NJ Audubon Society

Center for Research and Education
600 Route 47 North
Cape May Court House, NJ 08210
Contact: Dale Rosselet, Vice President for Education
609-861-0700 x14
Email: dale.rosselet@njudubon.org
www.njudubon.org

MISSION/DESCRIPTION

To preserve New Jersey's habitats and species biodiversity through conservation initiatives, educational programming and materials, and research projects.

MATERIALS AVAILABLE

Fishing for Answers in an Urban Estuary

Grade: 5-8

Cost: Free (in book/CD form); mailing extra

A teacher's guide with activities based on the estuarine ecosystems of the Newark Bay Complex. The activities range from those that teach about natural systems and the watershed to how land use through time has had an impact on the quality of the estuarine ecosystem. Developed in partnership with the NJ Department of Environmental Protection/Division of Science, Research and Technology.

OTHER OFFERINGS

NJ Audubon Society's Sandy Hook Bird Observatory, located at 20 Hartshorne Drive, Fort Hancock, offers student programming related to avian ecology and barrier island ecology.

Contact for more information: 732-872-2500

NJ Department of Environmental Protection Division of Watershed Management

PO Box 418

Trenton, NJ 08625

609-984-0058

www.state.nj.us/dep/watershedmgt

www.state.nj.us/dep/seeds

MISSION/DESCRIPTION

To assist the residents of NJ in preserving, restoring, sustaining, protecting, and enhancing the environment to ensure the integration of high environmental quality, public health, and economic vitality.

The NJ DWM has multiple resources and programs and materials to assist teachers and students in watershed education. These include:

- The New Jersey Watershed Ambassadors Program
- Project WET (Watershed Education for Teachers)
- Urban Watershed Education Program
- Clean Water Raingers and Other Publications
- NJ Water Monitoring and Education Summit

Seeds – the state environmental education website

Links to all of these programs are available through the NJDEP site



NJ Division of Parks & Forestry

Cheesequake State Park

Matawan, NJ 07747

Contact: James Faczak, Naturalist

732-566-3208

Email: jfaczak@monmouth.com

www.cheesequakestatepark.com

MISSION/DESCRIPTION

A state agency dedicated to enhancing public appreciation and stimulating public involvement in the protection of the natural and historical resources of New Jersey.

PROGRAMS AVAILABLE

Environmental Educational Programs

Grade: 2-12

Cost: free

In-park or on-site educational lessons on a variety of environmental science topics, such as fresh and salt water wetlands, water monitoring, watershed awareness, animal and plant diversity, and forest habitats. Lessons are correlated to the NJ Department of Education curriculum standards.

The Interpretive Center

Grade: all levels

Cost: free

Visitors are welcome to view displays and exhibits, as well as participate in scheduled activities. They will learn about the different habitats found in the park: white cedar swamp, tidewater salt marsh, and eastern hardwood forest.

OTHER OFFERINGS

Professional development workshops include Project WILD and Project Learning Tree.

Theme programs offered each Sunday focus on environmental topics. Check website for details.

Summer internships are available for environmental majors.

NJ Marine Sciences Consortium/ NJ Sea Grant

Sandy Hook Field Station, Bldg 22
Fort Hancock, NJ 07732
Contact: Claire Antonucci, Vice President, Education
732-872-1300 x22, 732-872-1300 x19
Email: cantonucci@njmsc.org
www.njmsc.org

MISSION/DESCRIPTION

To foster stewardship and wise management of NJ's and the region's marine and coastal resources. The NJMSC/NJSG provides research, outreach, and educational services to attain its mission.

MATERIALS AVAILABLE

Lesson Plans

Grade: K-12

Free: on the website

Examples include:

Beach Profiling	Ocean Currents
Beach Zonation	Oxygen in the Water
Classification/Identification	pH in the Water
Fish Morphology	Plankton
Food Web	Salinity
Longshore Current	Salt Marsh in a Pan
Mapping the Ocean Floor	Turbidity
Nearshore Community Sampling	

Recent additions include a lessons and fact sheets specifically directed toward the NY/NJ Harbor Estuary. Find those in the "Resources for Educators and Group Leaders" section under "Harbor Education Lesson Plans."

PROGRAMS AVAILABLE

The Coastal Experience

Grade: Pre-K-12

Duration: 2-5 hrs

Cost: \$150-\$210 per class

A variety of hands-on field programs for students are offered at the NJMSC's Sandy Hook field station. For more information or to book a program call 732-872-1300, ext. 16.

All Hands on Deck: A NY/NJ Harbor Education Program (AHOD)

Grade: 5-8

Duration: 2-2 1/2 hrs

Cost: \$8.00 per student/40 student min/55 max

The AHOD field trip features a "behind the scenes" tour of the inner-workings of the NY/NJ Harbor Estuary from the decks of a chartered ferry. AHOD students meet with guest speakers with jobs directed related to the Harbor Estuary, have the opportunity to explore a

"Harbor-species" touch-tank, and perform water quality tests. In support of this field trip, an in-school presentation and harbor-based curriculum materials for teachers and children are also provided. To receive an application or for more information call 732-872-1300, ext. 30.

Bring the Ocean Into Your Classroom

Grade: Teachers

Duration: 6 hrs

Cost: \$450 and up

A custom-designed professional development experience can be developed and offered to interested school districts. Interested district leaders should call 732-872-1300 x19 for information. In addition, open enrollment workshops are offered occasionally for individual educators. To learn of these opportunities call the number above or email rhiggins@njmsc.org.

Oceans To Go!

Grade: K-7

Duration: varies

Cost: \$325 and up

Oceans To Go! is NJMSC/NJSG's selection of marine science programs for in-school presentation. All programs feature hands-on activities and most feature live marine animal presentations. These programs can be offered during the school day or after-school including evenings. Most selections are ideal for "Family Science Nights."

OTHER OFFERINGS

Internships, day camps, undergraduate/graduate college courses, and family science programs are also available.

PUBLIC OUTREACH EVENTS:

The NJMSC/NJSG offers two annual public outreach events each year. Both are directed towards educating the public about NJ's marine and coastal resources.

OCEAN FUN DAYS are held the weekend before Memorial Day each year, on Saturday in Seaside Park at Long Beach Island State Park and on Sunday at NJMSC/NJSG's Headquarters within Gateway National Park, Sandy Hook. Both days feature exhibits, mini-classes, eco-tours, children's activities, touch tanks, crab races and more. Admission both days are free including free entrance to both parks.

COAST DAY NJ is held each October in Cape May. This free event features interactive exhibits and educational experiences all geared towards helping the public gain a better understanding and appreciation of NJ's coastal environment.

New York Aquarium, Wildlife Conservation Society

West 8th St. and Surf Ave.

Brooklyn, NY 11224

Education Department 718-265-3448

For program bookings, please contact: Polly Catanzaro,
Program Registrar.

718-265-3457

For self-guided group visits, in which reservations are re-
quired, please call Group Sales. Phone: (718) 741-1818
www.nyaquarium.com

MISSION/DESCRIPTION

To conserve, protect and teach about wild places and wild animals, aquatic habitats and to inspire a sense of stewardship for our environment. The NY Aquarium is a division of the Wildlife Conservation Society, which also operates the Bronx Zoo, Central Park Zoo, Prospect Park Zoo, the Queens Zoo, and is engaged in research in more than 300 conservation projects worldwide.

A great variety of programs are available for Pre K-12 students.

Program fees include admissions and free bus parking. Prices range from \$185 – 255, depending on the course. Maximum class size is 35. Please call 718-265-3457 for specific information.

OTHER OFFERINGS

Volunteer opportunities are available for ages 15 and up. Contact Kim Acevedo, Volunteer Coordinator, at 718-265-3450.

The Education Department also offers:
Professional Development on all grade levels Parent /science coordinator / school administrator workshops



New York City Audubon

NY City Audubon

71 West 23rd Street

Suite 1523

New York, NY 10010

212-691-7483

www.nycaudubon.org

MISSION DESCRIPTION

To protect and conserve wildlife, especially birds and wildlife habitat in New York City.

MATERIALS AVAILABLE

Look Around New York City

Fact sheets on wildlife in NYC, including many facts on wildlife in the Harbor (Grades 3-5).

Audubon has many volunteer opportunities to do citizen science; local trips and classes and ongoing events.

NYC Department of Environmental Protection

59-17 Junction Blvd.

Corona, NY 11368

Contact: Kim Estes-Fradis, Director of Education

718-595-3523

Email: kimestes@nysnet.net

www.nyc.gov/dep

MISSION/DESCRIPTION

The Department manages the City water supply and wastewater systems, carries out Federal Clean Water Act and Clean Air Act regulations, handles hazardous material emergencies and toxic site remediation, oversees asbestos monitoring and removal, enforces the City's noise code, and manages citywide water and energy conservation programs.

MATERIALS AVAILABLE

The Magic School Bus at the Waterworks, Scholastic, Inc.

Cost: \$4/book

Special NYC edition of the popular Scholastic book that takes Ms. Fizzle and her students on a colorful, raindrop-to-faucet tour of the NYC water supply system, including maps. A teacher's guide is also available.

The New York Water Saver's Workbook

Cost: free

Folder filled with thought-provoking activities on water conservation for grade school children.

Watershed Maps

Cost: free

Follow the flow of NYC's drinking water from the Catskill, Delaware, and Croton watersheds through aqueducts and tunnels into the five boroughs.

NYC's Wastewater Treatment System

Cost: free

A detailed exploration of how our wastewater is cleaned before it is released into our waterways. Beautiful graphics, maps, and photographs help to make the process easy to understand.

OTHER OFFERINGS

Outdoor field trips to reservoirs and wastewater treatment plants; in-school speakers and presentations; special exhibitions; a variety of publications available in class sets; teacher training workshops; assistance with curriculum development and student research; internships; an excellent website with a section for teachers and students; and an annual Water Conservation Art and Poetry Contest that is open to fifth and sixth grade students throughout NYC.

New York City Soil and Water Conservation District

121 Avenue of the Americas, Suite 501

New York, NY 10013

212.431.9676

Email: info@nycswcd.net

www.nycswcd.net

MISSION/DESCRIPTION

The NYC Soil and Water Conservation District – part of a nationwide system of 3000 conservation districts assists New Yorkers and local decision makers in making wise-use of the City's soil, water and related resources.

PROGRAMS AVAILABLE

NYCSWCD Environmental Education promotes hands-on field based environmental education for New York City's children, who are the future stewards of our natural resources. Topics for teachers and students include:

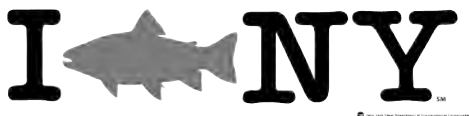
Environmental Monitoring

Technical Support and Networking for Teachers

Volunteer and Student Monitoring

Envirothon-regional portion of a national environmental competition for high school students.





New York State Department of Environmental Conservation: I FISH NY Program

Long Island Office:

50 Circle Road
SUNY-Stony Brook
Stony Brook, NY 11790
Contact: Malynda Nichol,
Recreational Fisheries Specialist
631-444-0283
Email: mjn36@cornell.edu

NYC Office:

Hunter's Point Plaza
47-40 21st Street
Long Island City NY 11101
Contact: Melissa Cohen, Regional Fisheries Manager I
Darin Alberry, Program Aide
718-482-4022, 718-482-4920
Email: mkcohen@gw.dec.state.ny.us
da275@cornell.edu

New Paltz Office:

NYSDEC Region 3
21 S. Putt Corners Road
New Paltz, NY 12561
Contact: Ryan Coulter, Aquatic Biologist
845-256-2204
Email: racoulte@gw.dec.state.ny.us

www.ifishnewyork.org

www.dec.ny.gov/outdoor/7752.html

MISSION/DESCRIPTION

I FISH NY is a New York State Department of Environmental Conservation (DEC) education initiative that introduces New York State's urban residents to their aquatic resources through fishing. On Long Island and in New York City, DEC has partnered with New York Sea Grant to help implement the program.

I FISH NY offers free classes for grades 3-12 during the school year. Class size ranges from 20-30 students. Multiple classes can be seen in one day. Classroom visits are accompanied by a fishing trip that same day or at a later date. Fishing trips are to a local fresh or salt waterbody. I FISH NY provides rods, tackle, and bait.

PROGRAMS AVAILABLE

Long Island Office:

I FISH NY educators visit classes for one 30-45 minute session. Teachers can select from existing lesson plans or work with staff to address related topics. Lessons include:

Classification

Grade: 3rd-8th

Using hand lenses and microscopes, students will act as scientists, identifying and classifying freshwater invertebrates. A portion of the lesson will also be geared towards vertebrate classification.

Form and Function

Grade: 3rd-8th

Through artwork, students will learn about a fish's external anatomy features, concentrating on functions and adaptations.

Food Web

Grade: 3rd-12th

Students will become local aquatic species while learning about food web relationships and terminology.

Internal Anatomy

Grade: 7th-12th

Working in groups, students will perform a dissection of a bony fish. Students will compare and contrast anatomy systems of fish and humans.

NYC Office:

In two 45 minute sessions, students receive instruction on fish biology and aquatic ecology. Topics covered for elementary school students may include: wetlands, fish anatomy, food webs, and local species. Middle school and high school topics may address: population sampling, consumption safety, fisheries management, and invasive species.

New Paltz Office:

During class visits, topics such as fish biology and basic fishing techniques are covered. Staff is flexible and different topics can be discussed based upon grade level. Call the office to set up a program!

OTHER OFFERINGS

In NYC, I FISH NY staff is available for professional development for groups 10 or more.

New York Restoration Project

254 West 31st Street
10th Floor
New York NY 10001
212-333-2552
www.nyrp.org

MISSION/DESCRIPTION

To reclaim and restore neglected parks and public space within NYC and to create programs to get the public involved in helping to maintain these public spaces.

PROGRAMS AVAILABLE

For Educators: NYRP's Environmental Education Programs are designed to assist NYC public school teachers. Programs are designed to capitalize on learning opportunities at Swindler Cove Park and the Peter Jay Sharp Boathouse

For Students: NYRP has developed instructional materials for students, including worksheets and activities. Educational curricula are organized into Forest Science, Aquatic Science and Garden Science

Noble Maritime Collection

1000 Richmond Terrace, Building D
Staten Island, NY 10301
718-447-6490
www.noblemaritime.org

MISSION/DESCRIPTION

The Noble Maritime Collection is a maritime museum and study center celebrating New York City's waterfront through art, artifacts and documents. Our Education programs offer history and art lessons using storytelling and hands-on workshops.

MATERIALS AVAILABLE

*The Traveling Maritime Library –
A Memorial to Kevin Sheehy*

Grade: all levels

Cost: free

Reserve a sea trunk of books related to maritime history and art for your classroom. Each trunk is specially designed for early elementary, upper elementary and secondary classrooms.

Noble Classroom Activity Package

Grade: all levels

Cost: free to all groups who book a lesson

Twenty-one pages of useful projects that involve poetry, art, history, maps, songs, and more for before and after your museum experience.

PROGRAMS AVAILABLE

History Programs

Grade: K-7

Duration: 75 min.

Cost: \$5/person

Young Jack's Voyage - Relive the experiences of young Jack, bound away on his first voyage aboard an early nineteenth century sailing ship.

Old Jack's Sailors' Home - Meet old Jack and share the stories, songs, and crafts of a proud but aging mariner as he comes to live at Sailors' Snug Harbor in 1870.

Lady Liberty - She is an expert on the history of New York Harbor, the vessels, occurrences and people who worked here, from the ice age until today.

The Noble Harbor Launch

Grade: all levels

Duration: 2 hours

Cost: Contact for rates

Board our tour boat and become part of New York Harbor. View the wooden ships' bone yard, observe wildlife, sketch the Bayonne Bridge, watch modern container-ship operations and a dry-dock, and marvel at Statue of Liberty.

Art Programs

Grade: 2-12

Duration: 2 hours

Cost: \$8/person

Printmaking – Your class will make preliminary drawings, pull original color prints on our press and analyze art from the Collection.

Watercolor Painting and Drawing – Students will prepare drawings, mix washes and learn to control and let loose this delicate and expressive medium.

OTHER OFFERINGS

The Noble Maritime Collection offers Teacher Workshops on integrating creative drama and visual arts into the core curriculum. Gallery Tours, Lectures, Printmaking, Studios for Artists and Adult Workshops in Poetry, Memoir Writing and Art are also available.

Ocean Institute at Sandy Hook

Brookdale Community College
Box 533, Sandy Hook
Highlands, NJ 07732
Contact: Dave Grant, Director
732-224-2435
Email: sandyhook@brookdale.cc.nj.us
www.brookdale.cc.nj.us/staff/sandyhook

MISSION/DESCRIPTION

The Ocean Institute, part of the Community Development Division of Brookdale Community College, offers marine science field trips, oceanographic boat trips, teacher workshops, pollution, wetlands protection and restoration, coastal problems, geology, botany, weather, classroom visits and other special programs on the environment.

PROGRAMS AVAILABLE

The Ocean Institute has several programs in addition to the few listed. Please visit the website for more information

Sea Creatures

Grade: K-6
Cost: \$7/student
Duration: 3-4 hrs

An introduction to marine life allows the students to explore the sea from its edge. Students collect algae, crabs, fish and shells. With these in hand, they discuss and discover the interrelationships between the sea and the land.

Explore the Shore

Grade: 7-12
Cost: \$7/student
Duration: 3-4 hrs

An in-depth view of the coast is offered for older students. Comparisons of the dynamic bay, beach and ocean, physical and biological environments are used to introduce ecological principles. Topics that can be emphasized include: coastal geology, water chemistry, erosion, local marine life, and marine careers.

OTHER OFFERINGS

The Ocean Institute offers evening and weekend family programs on a variety of science topics.



Project U.S.E. (Urban Suburban Environments)

76 E. Front St.
PO Box 837
Red Bank, NJ 07701
732-219-7300
Email: projectuse@monmouth.com
www.projectuse.com

MISSION/DESCRIPTION

Project Use inspires personal growth through experiential learning in diverse, safe and challenging settings. We provide the tools and the context that promote self-respect, strong character, and social and environmental consciousness that benefit individuals and their communities.

PROGRAMS AVAILABLE

Curriculum enhancement- programs support New Jersey's Core Curriculum Standards, including Wilderness Center, and in-school boat building programs.

Queens Botanical Garden

43-50 Main St.

Flushing, NY 11355

Contact: Lois Schuman, Manager of Education & Public Programs Coordinator

718-886-3800 x230

www.queensbotanical.org

MISSION/DESCRIPTION

The mission of the Queens Botanical Garden (QBG) is to present collections; education and research initiatives and programs that demonstrate environmental stewardship promote sustainability and celebrate the rich cultural connections between people and plants.

PROGRAMS AVAILABLE

QBG offers a suite of programs aligned with NYC Performance Standards. The full list is available at www.queensbotanical.org



Randall's Island Sports Foundation

24 West 61st St.

New York, NY 10023

www.risf.org

MISSION/DESCRIPTION

To restore parkland and improve and develop fields and facilities for sports, recreation, and nature activities at Randall's and Wards Island Park. Located in NYC's East River and accessible by the Triborough Bridge, the Park is positioned between East Harlem in Manhattan, the South Bronx, and Astoria, Queens.

PROGRAMS AVAILABLE

Kids Island Club Nature Program

Grade: 4-9

Duration: 2 hrs/day, 1 day/week during the school year

Cost: schools provide transportation only

Teachers and students participate in weekly, 2-hour visits to the Island for direct observation and hands-on experiences with the Park's natural environment. The Program is directed by a Bank Street College staff developer who works with the class teacher to jointly plan, lead and evaluate class trips to the Park. Visits to the Park can be during or after school hours. While enrollment is full for fall 2001 and spring 2002, we hope to expand the program for the following school year.

The River Project

Pier 40, North River
New York, NY 10013
212-233-3030
www.riverproject.org

MISSION/DESCRIPTION

The River Project is a private, non-profit marine biology field station for the protection and restoration of the Hudson Estuary through research, education, and hands-on programs in urban ecology.

PROGRAMS AVAILABLE

Field Trips: The River Project's Field Trips offer students from New York City schools the opportunity to experience the thriving ecosystem of the Hudson River Estuary. The program introduces students and teachers to marine science and issues of urban ecology through informative lectures on New York City waterway related topics and hands-on activities at the Picnic House at Pier 40 in Manhattan. Visits are designed by the River Project staff to fit the ages, goals and expectations of each participating group, and can be subject specific upon request. The programs enable teachers and students of all ages to experience field science at work in an urban environment with a non-urban feel. For more information or to book a field trip at the River Project, contact Chris Anderson at chris@riverproject.org or call.

An exhibit of fish and other animals caught at Pier 26.
Open 11-5 daily.

Marine Biology Field Trips

Grade: all levels

Duration: 1.5 hrs

Cost: \$10/student (\$100 minimum)

Field trips are led by guides involved in scientific research at The River Project, and are customized to fit the age, goals, and expectations of each group. A trip includes orientation and introduction to the regional ecology and an in-depth, interactive tour of the Estuary. Available April-October.

OTHER OFFERINGS

The Marine Biology Internship Program offers opportunities for high school and college students to become directly involved in research and study projects, with fieldwork focusing on the urban wildlife, habitat, and water quality of the lower Hudson River Estuary. A program of summer events for the public is available.

Rocking the Boat

60 E. 174th St.
Bronx, NY 10452
718-466-5799
www.rockingtheboat.org

Rocking the Boat uses traditional wooden boat building and on-water education to help young people develop into empowered and responsible adults. Through these mediums, *Rocking the Boat* enables South Bronx students to deal with everyday realities that are not often addressed at home or in school. Five levels of community and youth development programs operate during the fall and spring academic semesters and over the summer. Together the programs serve over 2,000 students and community members drawn from a range of New York City public middle schools high schools and neighborhoods, the majority being in the South Bronx.

PROGRAMS AVAILABLE

Boatbuilding program

Afterschool program 16 students construct a traditional full-size wooden boat from scratch.

On-water education program

Students use the handmade boats to practice a range of maritime skills and accomplish real habitat monitoring and restoration work on the Bronx River

On-water classroom program

Rocking the boat staff collaborate with teachers to design custom program content and influence curriculum.

Job skills program

16 former *Rocking the Boat* students are hired as Job Skills Apprentices

Community rowing program

Allows community residents free opportunities to get out in a wooden boat to row, fish and learn about the Bronx River.



Scenic Hudson, Inc.

9 Vassar St.
Poughkeepsie, NY 12601
845-473-4440 x232
Email: volunteer@scenichudson.org
www.scenichudson.org

MISSION/DESCRIPTION

A 37-year-old non-profit environmental organization and separately incorporated land trust dedicated to protecting and enhancing the scenic, natural, historic, agricultural, and recreational treasures of the Hudson River and its valley.

PROGRAMS AVAILABLE

For information about Scenic Hudson's volunteer programs please contact Parks Manager at 845-473- 4440 or info@scenichudson.org.

Volunteer internships are available for college students to help staff with research, publicity, and outreach.

SoundWaters

1281 Cove Rd.
Stamford, CT 06902
203-323.1978
www.soundwaters.org

MISSION/DESCRIPTION

To educate children and adults about the wonders and beauty of Long Island Sound and its watershed, and to provide people with an understanding and awareness of how they can restore, protect, and preserve the Sound and the environment as a whole.

PROGRAMS AVAILABLE

Soundwaters offers a wide array of educational opportunities for students from kindergarten to college. Programs are offered aboard the schooner SoundWaters, at the Soundwaters Coastal Education Center, and at classrooms and field sites throughout the area. Soundwaters offers hands-on, inquiry based educational opportunities designed to support and amplify CT and NY state mandated education standards.

The Schooner Soundwaters

Based in Stamford, the schooner allows passengers the chance to haul sails and put in the trawl net, observing the life of the Sound. Teachers can choose four learning station options, from saltmarsh to weather
Cost: \$1095 per 3-hour sail, max 42 people
(consult web site for more information/sail options)

Soundwaters Coastal Education Center

The Center hosts a wide variety of courses, seminars and activities for organizations, schools and corporations. School groups can visit the learning lab to take part in exciting hands on programs.

South Street Seaport Museum

207 Front Street
New York, NY 10038
212-748-8600
School Programs 212-748-8757
www.southstseaport.org

MISSION/DESCRIPTION

To preserve and interpret the history of New York City as a world port – a place where goods, labor, and cultures are exchanged through work, commerce, and interaction of diverse communities.

PROGRAMS AVAILABLE

South Street Seaport Museum's school programs use a variety of learning methods to help students formulate a personal response to history and science. All programs can accommodate approximately 30 students. Public, School and Teacher Professional Development, Special Event and In-school Residencies offered.



Staten Island Children's Museum

On the grounds of Snug Harbor Cultural Center
1000 Richmond Terrace
Staten Island, NY 10301
www.statenislandkids.org

MISSION/DESCRIPTION

To nurture the creativity and curiosity natural to all children, to recognize and celebrate many different learning styles, and to demonstrate that learning can be exciting and fun.

PROGRAMS AVAILABLE

Wonder Water Exhibit

Grade: all levels

Cost: \$3.00-\$3.50/student (minimum of 20)

Find out how much water is in your body, a diamond, a chair; go boating in the babbling brook; learn where water comes from and how every living thing depends on it.

Block Harbor

Grade: Pre-K through 1st

Cost: \$3.00-\$3.50/student (minimum of 20)

The focus of the visit may be (1) the kinds of animals that live in the water or (2) the kinds of ships/boats that exist and the "jobs" they do or (3) what it must be like to set sail for an unknown destination, like the explorers.

OTHER OFFERINGS

Preschool workshops combine creative play, music, art, and storytelling so caregivers and children can share in activities that nurture curiosity and creativity.

Afternoon and after-school programs encourage young people to learn with art, drama, and science in the museum's interactive exhibits.

Weekend workshops bring the whole family together for exhibit-related arts programs and exciting demonstrations.

Summer mini-camps include arts and crafts, games, and imaginative play.

Volunteer opportunities and a teen internship program are available.

Staten Island Institute of Arts & Sciences

75 Stuyvesant Place
Staten Island, NY 10301
718-727-1135

MISSION/DESCRIPTION

To preserve, collect, and display articles and artifacts relating to Staten Island. Founded in 1881, the non-profit Institute is dedicated to a museum function with a strong education mission.

PROGRAMS AVAILABLE

A Day at the Beach

Grade: K-3

Cost: \$4/student (minimum of 22)

Children will see, feel, and learn about the animals and plants that thrive in the beach community. Comparison of sands from assorted locations, discussion of the newest findings in Ocean Science and Technology for future sea products, and creation of a sand painting will all be featured.

Beach Field Experience

Grade: K-3

Cost: \$4/student (minimum of 22)

Kids get first hand experience observing what they learned about in the classroom, when they investigate seashells, driftwood, water worn rocks, bird tracks, and the bonny, blue sea.

The Ferry Tour

Grade: 3-8

Cost: \$4.00/student (minimum of 22)

Young sailors learn about the NY Harbor and the Staten Island Ferry during a riding tour on the world's most famous boat. Kids complete a NY Harbor map and receive tour certificates, while teachers receive a free copy of "New York Metropolitan Ferryboats."

OTHER OFFERINGS

Other programs include studies in art, architecture, history, nature, social studies, and more.

Stony Brook-Millstone Watershed Association

31 Titus Mill Rd.
Pennington, NJ 08534
609-737-7592
www.thewatershed.org

MISSION/DESCRIPTION

To protect the quality of the environment in the Millstone River Basin through a multi-faceted program of environmental education and advocacy.

PROGRAMS AVAILABLE

The Association offers year-round field trips for students, scouts and organized groups. Field trips provide children an opportunity to experience the wonders of nature while gaining an appreciation, understanding and knowledge of the world around them. Field trips are designed to meet New Jersey Core Curriculum Content standards. All of our programs include a language arts component in addition to the science or math NJCC specific to each program. Following are sample programs, see web site for more information

How Clean is Your Stream?

Grade: 5-12

Duration: 3-5 hrs

Students will examine stream life and discuss relationships between stream inhabitants and the effect of humans on their environment. They will determine stream health through visual assessment, chemical testing, and biological monitoring.

Exploring a Pond

Grade: 1-5

Duration: 2-4 hrs

Using a variety of tools, including seines, nets, and microscopes, students will learn about life in and around a pond. They will explore relationships between inhabitants and the human impact on aquatic habitats.

OTHER OFFERINGS

Volunteer Teacher Naturalist Program; Native Butterfly House



Trout Unlimited

Trout in the Classroom

Connecting students with their watersheds

www.troutintheclassroom.org

MISSION/DESCRIPTION

Trout in the Classroom is an environmental studies program that allows K-12 students to raise trout from eggs for up to six months, and then release them into upstate streams. In doing so, NYC children connect with children of the upstate watersheds and develop an understanding of their shared resource.

RESOURCES AVAILABLE

Trout Raising Equipment

Grade: K-12

Cost: free

Tank, chiller, trout eggs and food, licenses and permits, etc.

Trout in the Classroom Website

Grade: K-12

Cost: free

Each participating school has a page on the website where students can interact with their upstate counterparts. Resource materials such as curricula and texts can also be found on the website.

The Urban Divers Estuary Conservancy

718-901-3331, 718-802-9874

www.urbandivers.org

MISSION/DESCRIPTION

The Urban Divers Estuary Conservancy (UDEC, the Urban Divers) is a not for profit environmental and cultural organization committed to the restoration, conservation and protection of our rivers, oceans and marine wildlife with special focus on the restoration of NYC waterways.

PROGRAMS

Environmental education through recreation programs, clean water action events, stewardship opportunities, conservation support and scientific diving, ecocruise series, and annual art and environment festivals. Contact UDEC for more information. UDEC works in various locations along NY Harbor, including the Brooklyn Harbor Marine Field Station and the Harlem River Ecology Center. Workshop and Fieldtrip Opportunities are available

Contact UDEC for more information.

SAMPLE PROGRAM

Live From Beneath the Estuary

The Urban Divers underwater photographers and scientific divers transmit live underwater exploration images with live with live narration. Audience has the opportunity to engage in a Q/A with submerged diver.



Urban Park Rangers

Arsenal North
1234 Fifth Ave.
New York, NY 10029
www.nyc.gov/parks

MISSION/DESCRIPTION

To promote environmental stewardship and conservation through education, recreation, restoration, and enforcement. Rangers celebrate, preserve, and protect the natural and cultural resources in NYC's 28,000 acres of parks.

PROGRAMS AVAILABLE

The Natural Classroom

Grade: K-8

Duration: 1.5 hr

Cost: \$100

10 school programs are available, each of which provides students with a hands-on experience designed to heighten awareness of the environment and help them meet Board of Education Science Performance Standards. Programs are held in NYC's parklands, which include forests, salt marshes, shoreline and glacially formed lakes and ponds. To schedule a program, call a nature center near you.

OTHER OFFERINGS

The Ranger Conservation Corps is an after-school program for junior and high school students.

The Parks Conservation Corps is a summer employment program for high school and college students.

Explorer Programs are weekend and evening recreation activities for families and people of all ages, such as canoeing and fishing.

Volunteer opportunities are available in areas such as restoration, maintenance, and assistance with Ranger programs. There are currently 100+ active volunteers.

Monthly lectures are held on a variety of environmental topics.

US Environmental Protection Agency

290 Broadway
New York, NY 10007
Contact: Teresa Ippolito
212-637-3671
Email: ippolito.teresa@epa.gov
www.epa.gov/region02/ee/envi-ed.htm

MISSION/DESCRIPTION

To advance and support education efforts to develop an environmentally conscious and responsible public, and to inspire in all individuals a sense of personal responsibility for the care of the environment.

MATERIALS AVAILABLE

A variety of educational materials are available. Educators can receive a Teacher Packet or request materials on a specific topic. Call 212-637-3674 for more information.

Educators in the vicinity of Manhattan are invited to visit the EPA Region 2 Library at 290 Broadway (between Duane and Reade Streets) where an Environmental Education Resource Center is maintained for reference. Call 212-637-3185 or visit www.epa.gov/Region2/library for more information.

PROGRAMS AVAILABLE

Agency specialists are available to make classroom presentations on a variety of topics. Call 212-637-3674 for more information.

Workshops are provided to help educators incorporate environmental education into their educational programs. These workshops include an introduction to environmental education and hands-on experience with EPA's educational materials. Call 212-637-3674 for more information.

OTHER OFFERINGS

Young people can participate in the President's Environmental Youth Awards (PEYA) program. Students, working either individually or collectively as a class, have an opportunity to plan and carry out environmental projects.



The Waterfront Alliance

Solutions for a healthy shared harbor
457 Madison Ave.
New York, NY 10022
212-935-9831
www.waterfrontalliance.org

MISSION/DESCRIPTION

The Waterfront Alliance works to transform New York and New Jersey Harbor and Waterways to make them cleaner and more accessible, a vibrant place to play, learn and work with great parks, great jobs and great transportation for all. Incorporated in 2007, the Alliance was formerly known as the Metropolitan Waterfront Alliance.

MATERIALS AVAILABLE

The waterfront alliance produces a waterwire e-newsletter, online educational resources, post monthly calendar of public events. Teachers and students will benefit from the Alliances role as a Clearinghouse with more than 300 organizational members. improvement activities in their communities. Call 212-637-3678 for more information.

Waterfront Museum

290 Conover St. Garden Pier 45
Brooklyn, NY 11231
Contact: David Sharps, President
718-624-4719
Email: dsharps@waterfrontmuseum.org
www.waterfrontmuseum.org

MISSION/DESCRIPTION

The museum is housed aboard a 1914 covered wooden barge that is on the National Register of Historic Places. With a permanent exhibit of artifacts and hands-on experiences, the barge serves as a “floating classroom” for an excellent educational visit.

PROGRAMS AVAILABLE

Barge Tour

Grade: all levels

Duration: 1 hr

Cost: \$7/person (\$100 minimum)

Students can learn about one or more of the following topics:

- The history of the Tug and Barge “Lighterage Era” (1860-1960)
- The factors that have resulted in dilapidated shores and abandoned waterfronts
- How food and commercial goods were transported prior to today’s bridge and tunnels
- The rescue and restoration of the Lehigh Valley Railroad Barge #79
- The geography of the New York Harbor
Hear waterfront sounds, gain an understanding of the tides, and watch the captain perform an entertaining show. Tailored group tours and school and camp visits may be scheduled for almost any day of the year by appointment



Working Harbor Committee

For the heritage and future of the Harbor of New York and New Jersey

Contact: Meg Black, Program Director
Working Harbor Committee
455 West 43rd St.
New York, NY 10036
Email: meg@hiddenharbortours.com

Maritime Educational Programs For NY/NJ Public High Schools

The Working harbor Committee (WHC) is a not for profit organization whose mission is to strengthen awareness of the working harbor's history and vitality today and its opportunities for the future by involving people in learning how the harbor works and what it does. The

WHC has made great strides in creating awareness of the harbor of NY-NJ by sponsoring low cost boat tours of the North River, The Brooklyn Waterfront and the Staten Island Waterfront. These Tours, called hidden harbor tours, attract individuals and families alike.

In 2007 the WHC initiated an educational maritime program to introduce high school students to the opportunities afforded in the industry. The high school program is comprised of four parts: in school workshops, site visits to maritime industries, a mentoring program, and a database of jobs and their requirements.

In school workshops will consist of educational lectures about the past, present and future of working waterfronts worldwide: their impact on global economy; and types of jobs available in the industry. A team of maritime industry leaders and WHC staff will conduct the workshops.

Site visits to maritime industries may consist of visits to port terminals in NY and NJ tugboat companies maritime law firms and dry dock companies

A mentoring program is being designed with partners in the maritime industries so that students will have not only a ready resource for further questions and information, but also the opportunity for hands on experiences. Mentors will also serve to encourage students to keep up with their high school studies in order to pursue their careers.



SECTION 4

Evaluation

Tell us what you think!

We'd like to hear from you. Please help us evaluate the use of the guide!

1. I am a classroom teacher Grade Level _____
2. I teach in a non-formal setting Ages _____

How did you use Exploring the Estuary?

- Sample lessons/Activities _____
- Contacting Organizations _____
- Planning Field Trips _____

Email your responses with additional comments to sgulster@cornell.edu

Fax to: 845-340-3990

Or send to:
New York Sea Grant
Cornell Cooperative Extension
10 Westbrook Lane Kingston, NY 12401





**NEW YORK NEW JERSEY
HARBOR ESTUARY PROGRAM**

290 Broadway, 24th Floor
New York, NY 10007

Telephone: 212-637-3816
Fax: 212-637-3889
E-mail: info@harborestuary.org

www.harborestuary.org