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Bay•B•C's

A multidisciplinary approach to teaching about the Chesapeake Bay

This book is a joint project of the National Aquarium in Baltimore, the U.S. Fish and Wildlife Service, and the Chesapeake Bay Program.

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Chesapeake Bay Program
A Watershed Partnership

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Introduction

To the Teacher:

In recent years, the restoration and protection of the Chesapeake Bay has garnered great attention. Adults, children, business people, farmers and citizens from all walks of life have developed a heightened awareness of the Bay's valuable resources and the threats to their existence. Federal, state and local agencies, as well as private organizations, have implemented programs aimed at management and restoration of the Bay and its species.

Vital to the success of these efforts is the cooperation of all individuals living within the Bay's region. Concerned citizens ask "How can we help?" Though progress is being made in the restoration and protection of the Bay, we must ensure that today's efforts are continued tomorrow by educating our next generation. Our children must learn to nurture the Bay as a resource. This curriculum contains an introduction to the Chesapeake and its inhabitants, discusses threats to the Bay and suggests some ways teachers and students can contribute to the Bay's restoration.

The materials presented in this booklet provide teachers with readily usable lessons for lower elementary students. Suggested grade ranges have been indicated on each lesson plan, but lessons can be altered to suit the needs of any level. The curriculum may be taught as a complete unit on the Chesapeake Bay or used to supplement other subjects. A variety of disciplines, particularly language skills, are incorporated into each activity. Any part of this booklet may be reproduced as needed for your class.

Educators are encouraged to use materials gathered from other agencies and organizations for instruction about the Bay. Some names and addresses are listed at the end of the booklet.

The background information needed to conduct these lessons can be found in the section entitled, "Our Chesapeake Bay." This article has been divided into three parts, designated by the following figures:

- *for fish and wildlife and other general Bay information;*

- *for material about water; and*

- *for pollution and conservation issues.*

These symbols will also be found in the upper right corner of corresponding lesson plans.

Our Chesapeake Bay

The Chesapeake Bay is one of our country's most vital resources. It is the largest estuary in North America. Its waters provide food and habitat for an abundance of fish and wildlife. It serves as a highway for commerce, a playground and a storehouse of food. The land that surrounds the Bay provides homes for nearly 16 million people that live here. The main body of the Bay is 200 miles long and as much as 30 miles wide, covering a surface of more than 2,200 square miles. The Bay's average depth measures less than 30 feet. The Bay is fed by fifty major tributaries that drain 64,000 square miles of land, the Bay's watershed. This watershed includes the District of Columbia and parts of Maryland, Virginia, Pennsylvania, New York, Delaware, and West Virginia.

The Chesapeake is an estuary, a body of water formed where freshwater from rivers meets saltwater from the ocean. This mixing results in varying degrees of salinity (amount of dissolved salts) - fresh or nearly fresh water in the upper Bay and rivers, brackish or partly salty water throughout the middle of the Bay, and the saltiest at the mouth of the Bay near the Atlantic Ocean. The salinity of the water, combined with other physical characteristics such as temperature, determine which species occupy different parts of the Bay. Therefore, plant and animal populations differ north to south, east to west and from year to year.

What lives in the Bay? Estuaries teem with a variety of plant and animal life. The constant movement of the tides sweeps away wastes and circulates nutrients and food, providing a favorable situation for sedentary animals such as oysters and clams. Estuaries are important nursery grounds for fish. Indeed, many kinds of aquatic animals spend some portion of their life cycle in estuaries. The biological productivity of estuaries is reflected in their immense commercial importance. Another indication of productivity is the constant activity of birds, mammals and other animals that visit estuaries in search of food.

Most of the living things in the Chesapeake Bay are too small to see with the naked eye. Microscopic plants and animals, known as plankton, are perhaps the most important species in the Bay. Without them, many other animals would not be able to survive. Why? Because these microscopic plants and animals provide the food base for so many others.

All living animals in an ecosystem, a community of organisms interacting with their environment, need energy in the form of food. Plants and animals continuously circulate energy in a complex network called a food web. Plants capture energy from sunlight and use it to manufacture food in the unique process of photosynthesis. The smallest plants in the Bay, called phytoplankton, float freely near the surface of the water where

sunlight is plentiful. Tiny animals called zooplankton, which also drift in the Bay currents, feed on phytoplankton, as do many other animals, including the early stages of mollusks (clams and oysters), crabs, and even some fish species. Small animals, in turn, provide food for somewhat larger animals. At the top of the food chain are species such as striped bass, ospreys and human beings.

Nutrients in an ecosystem are recycled when a plant or animal dies. Various kinds of decomposers, such as bacteria, feed on dead material and animal wastes. As plants capture new energy from the sun and decomposers return nutrients to the ecosystem, organisms in the food web thrive.

Home, Sweet Habitat

The Chesapeake Bay is an estuary, a body of water. It is also part of a much larger system that includes other bodies of water, as well as vast areas of land. This system is the Chesapeake Bay watershed. Besides water, the Bay watershed includes mountains, forests and fields. The interaction of the land, water, atmosphere and living things makes up the character of the Chesapeake.

The Bay watershed provides the habitat that plants and animals need to survive. Habitat includes the food, water, shelter and nesting or breeding areas that all living things require. The availability and quality of habitats are important to maintaining the health of the Bay and its inhabitants.

Soggy Settings

One of the most important habitats found in the Bay region, as well as across the Nation, are wetlands. "Wetlands" is a collective term that refers to special areas between open water and dry land. Wetlands are an interface, a transition zone. The water table in wetlands is at or near the surface. The land is, at least intermittently, saturated by water. Wetlands are characterized by plants that are adapted to living in moist or saturated conditions.

Wetlands are found along rivers, lakes, ponds, inlets, and bays in both coastal and inland areas. In the Bay region, there are saltwater wetlands, such as tidal salt marshes or mudflats, and freshwater wetlands, including nontidal marshes, wooded swamps, wet meadows and bottomland hardwood forests.

Treasured Terrain

In the past, wetlands have been given a "bad rap." Often regarded as unproductive areas, full of insects and unpleasant odors, wetlands have been filled, dredged or otherwise destroyed for other uses. Today, however, we realize the tremendous productivity of natural wetlands.

Wetlands are valuable because they:

- Contribute plant material to the Bay food web.
- Provide habitat for waterfowl (ducks and geese) and other birds, furbearers, and threatened and endangered species.
- Provide nursery grounds for waterfowl and economically important fish and shellfish.
- Control erosion and water pollution by trapping silt and filtering and absorbing chemicals and nutrients.
- Protect upland areas from the destructive power of floods and storms.
- Provide beautiful recreational areas!

Whose Home?

Residents of Bay wetlands may include fiddler crabs, periwinkle snails, oysters, clams, grass shrimp, minnows and other small fish, rails, redwing blackbirds and many microscopic animals. Throughout the seasons, wetlands may be visited by a variety of animals including dragonflies, blue crabs, shad, striped bass, menhaden, herring, flounder, wading birds (herons and egrets), waterfowl, birds of prey, beaver, nutria, muskrat or deer.

Sandy Surroundings

Another habitat typical to the Bay region is the beach, the sandy or pebbly shores of rivers and the Bay proper. Often altered by wind and water, beaches are an ever-changing habitat, so relatively few species settle there. Those that do must adapt to changes in water level, salinity and temperature. To escape the changing environment, many beach residents live underground or burrow when the tide is low. Residents may include clams, worms, insects and relatives of shrimp called beach hoppers. Beach visitors include gulls, terns, wading birds, raccoons and even foxes.

Riverine Realm

The freshwater streams and rivers that lead to the Bay are flowing systems made up of smaller habitats such as riffles, pools and meandering channels. Therefore, they support a variety of plants and animals, many of which are adapted to life within the currents. Rivers are longer and broader than the streams that feed them. The water in these bodies is carried downhill, transported by gravity, ultimately flowing to the ocean.

Many freshwater fish such as bass, catfish, carp, trout and sunfish inhabit these waters, along with turtles, frogs, muskrats, otters, wading birds, kingfishers, sandpipers and other birds. One would also find crayfish and the water-dwelling larvae (young) of insects such as the caddisfly. Visitors may include raccoons, deer, foxes and migratory fish, such as shad, herring, striped bass or perch.

Watery Woodland

Forests, found throughout the region, are familiar to most people. But forested areas are not often thought of as being important to the health of the water. They are. The trees, shrubs and other plants bordering bodies of water help to filter and trap sediments and absorb pollutants from the land. These forests house a great variety of wildlife. The plants offer an abundance of food, shelter, nesting places and even protective pathways for migrating animals. Turtles, water snakes, minks, otters, beavers, muskrats, deer, squirrels, rabbits, wood ducks, eagles, herons and songbirds call these forests "home." Temporary pools formed in forests are excellent breeding sites for frogs, toads and salamanders.

Living On the Edge

Another valuable habitat is the edge that is formed at the place where different types of plant communities meet. Some examples of edge habitats are where a forest meets a field or where a shrubby area meets an open grassy area. Some edges occur naturally through fire and floods, while others are formed by grazing animals, timber harvest or agriculture. Edges are usually rich in wildlife because animals can take advantage of more than one community. Some animals commonly found in edges are rabbits, deer, quail, pheasants and various songbirds.

A Balanced Environment

The existence of a diversity of animals and plants in the Chesapeake Bay region is critical to the future of our environment. An ecosystem must remain in balance to be healthy. The complex interconnections between living organisms and the environment weave an intricate ecological support system. Systems in balance have the ability to bounce back from most natural disturbances. When a system's balance has been disrupted by human activity, recovery may be difficult, if not impossible. Imagine a child building a tower out of wooden blocks. As blocks are carefully added, the tower teeters, yet finds a balancing point and stands at rest. If the child pulls a piece from the center of the structure, the entire tower crumbles to the floor.

Indicators of Trouble

Like the famous canary in a coal mine, the increase or decline of certain organisms can be used to judge the health of the Bay. One example is the canvasback duck, a historic Bay species. As the quality of water in the Chesapeake has degraded, the underwater bay grasses, known as submerged aquatic vegetation or SAV, have declined. SAV is a major source of food for canvasbacks. Therefore, as the grasses disappear, so do these ducks. Reduced numbers of canvasbacks in the Bay region is a warning sign that something is amiss in the ecosystem. The health of the Bay, in turn, is an indicator of the health of our environment.

Once a problem is recognized, tracking the cause can be difficult. There may be multiple causes of a single problem, and the solutions can be as numerous as the causes. We have to start somewhere. Simple conservation efforts, like those mentioned in the next section, can help a wide range of problems. Continuing preventive measures will help our efforts at environmental restoration.

The Chesapeake: A Limited Resource

Water: It's a fact of life!

Most of us are aware of the importance of water in our lives. We need water for drinking, for growing food, for bathing and for cleaning. Much of our recreation is centered around water, whether we go swimming, boating, fishing, crabbing, bird watching, ice skating or skiing. Many of our livelihoods are dependent upon water. Water, in various forms, covers 80% of the surface of the earth and makes up 97% of our bodies!

Water comes in three phases: solid, liquid and gas. Water can also come in different forms such as fresh, salty and brackish. We see surface water in lakes, ponds, creeks, streams, rivers, bays, seas and oceans. There is also groundwater. How are these forms different? How do these bodies of water relate to the land? How do human activities affect the land and the water? Which animals and plants are dependent upon water for homes or habitat as well as for their survival? These are questions that can be investigated in the classroom to heighten the awareness of our "future" citizens to the value of water.

Though there seems to be an abundance of water available for our use, most of the water on the earth is salty water and is not easily converted to drinking water. What many people do not realize is that there is not a limitless supply of clean freshwater, so what we use is recycled many times. If we were to lose our water supply, it would be very costly, in terms of money and energy, to restore it. It is important to conserve water now, so we'll have it for the future.

The first step in preserving our water is to understand how water becomes polluted. Most of us contribute to pollution without knowing that our actions are harmful. If people are aware of what causes pollution, they can alter certain behavior and help keep our water clean.

Just who is polluting the Bay, anyway?

People Are the Problem

The fact that we live in a watershed (the land that drains into the Bay) means that our actions on land will affect the water. Many threats to the health of the Bay and our environment begin with people.

The Chesapeake's watershed is home to nearly 16 million people. With so many people on the land surrounding our vital waterways, the demands are high on the land, the water and our energy resources.

The demand for housing increases the development of the land. Forests, wetlands, fields and shoreline, all critical to a clean environment and to the control of stormwater, are lost to housing and the inevitable accompanying roadways, shopping malls and other facilities.

This loss of natural lands leads to erosion (see below) and reduces habitat for numerous species of fish and wildlife. Increasing numbers of people means soaring energy needs, which further take a toll on our natural resources and contribute to air and water pollution. A higher population also means greater use of plastics and other products that add to litter and waste disposal dilemmas.

All of these factors act together in reducing the water quality of the Bay and its tributaries. The accumulation of millions of individual "small" acts of polluting, as well as the larger contributions from industry, farming and development, add up to an unhealthy system.

The connection between land and water

When rainwater, and the substances it collects, runs from the land into streams, rivers and the Bay, it is known as runoff. Manure washes off of the land from our pets, livestock and gardens. Fertilizers, insecticides and even oils and salt from streets enter waterways along with runoff.

Many substances, fertilizers in particular, are rich in nutrients, such as nitrogen and phosphorous. These nutrients supply algae and phytoplankton (tiny drifting plants) with what they need for growth. If excess nutrients enter the water, too much growth occurs, clouding the water and blocking sunlight from reaching SAV. When the algae die, they fall to the bottom where they are decomposed by bacteria. This process uses a good deal of oxygen, meaning that oxygen is not available for stationary, bottom-dwelling animals. Dead plants and animals, oxygen depleted water, and lots of bacteria do not make for a healthy body of water!

Erosion

Any exposed soil, whether on the shoreline or in upland areas, is prone to being washed away by rain or wave action. This is erosion. It is a prime source of trouble for Bay waters. Erosion is a natural process, but is accelerated by building, boats speeding close to the shoreline and other types of human activities that disturb the land.

If erosion is natural, how can it hurt the water? Soil, chemicals and nutrients are carried into waterways. Nutrients dissolve, but large particles settle to the bottom as sediment. Too much sediment smothers bottom-dwelling plants and animals. The remaining suspended particles cloud the water, blocking sunlight and interfering with underwater plant growth.

Is there a solution to the problem of erosion? Erosion cannot be completely stopped because it is a natural process. However, certain actions can slow process of erosion.

Buffer strips, areas of vegetation along waterways, are helpful. Trees, shrubs and grasses trap loose soil before it reaches the water. These plants also act as filters, removing and using nutrients, such as those found in fertilizers, that can cause an over abundance of algae in the water.

What you can do

- *Bare areas should be planted with grass, shrubs and flowers to help hold soil.*
- *Driveways or walkways constructed of gravel, wood, or other materials that allow rainwater to penetrate are helpful in preventing erosion.*
- *Allowing grass to grow a bit longer before cutting helps to slow runoff.*
- *Wetlands should be preserved. They are excellent areas for retaining stormwater, sediments and nutrients.*

Water Abuse

Let's look at our daily water use habits. When we use water at home, most of it goes down a drain and then it's forgotten. If your house is connected to a public sewer system, the water and any soaps and chemicals that may be with it, travel through sewer pipes to a wastewater treatment plant. Here, water and wastes are filtered and treated before the clean water is sent back to a creek or river which eventually leads to the Chesapeake Bay. Wastewater treatment plants are built to handle a certain amount of water and waste. With increasing population and water use, the plants become overloaded and cannot effectively treat the water before discharging it. If the chemical and biological wastes that we put down our drains cannot be removed from the wastewater, these pollutants will end up in our water supply—in lakes, creeks, rivers and the Bay!

If your home has its own septic system, water and wastes are carried to an underground tank where solids settle out and are broken down by bacteria into less harmful substances. The remaining water is carried to a drainfield, an area where the water filters out into the ground. Here it will be mixed with groundwater and eventually be carried to a nearby water source, such as a creek. Chemicals that we dump in our sinks, such as drain cleaners or unused pesticides, will contaminate the groundwater. These chemicals will also kill the bacteria that "clean" the wastewater. Without this bacteria in the tank to break substances down, harmful wastes leach out into the groundwater and make their way into tributaries and the Bay.

How can we help? It's simple. First, use less water. If we do not overload treatment plants or septic tanks, they can do a better job.

- Turn off the faucet while brushing your teeth.
- Take short showers instead of baths.
- Run washing machines or dishwashers only when full.
- Wash dishes in a sink full of water, not under a running faucet.
- Water your lawn sparingly. Check the weather forecast. If it's going to rain, don't waste the water.

Second, remember that where your water goes, so does everything else.

Never dump pollutants down the drain! This includes old paint, turpentine, motor oil, fertilizers or insecticides. These substances will not be removed from wastewater and will pollute waterways.

Remember that many storm drains lead directly to a natural water source. They are meant for directing rainwater and have no means for removing chemical waste.

Waste

Waste is a growing problem in the Bay region. There are two types of waste, manmade and natural waste. Most manmade waste is made of plastic, paper, glass, metal and other solid items. Some kinds of manmade materials become hazardous waste, harmful to plants, animals and people. Natural waste refers to food substances, human wastes, manure and other matter that is easily broken down. Some of these materials can be harmful to the environment in indirect ways.

Litter is ugly, but how else could it be harmful? Plastics and other non-biodegradables that become "litter" are not only unsightly, but can be detrimental to the health of wildlife. Some of these materials are mistaken for food, while others entangle, trap and strangle animals, particularly aquatic species. Litter also clogs the flow of streams and interferes with both aquatic and terrestrial habitats. With solid waste production growing by tons, the problem of disposing of it without impact to the environment is becoming harder to solve. Many communities offer recycling services for paper, glass, aluminum and other metal products. Recycling materials saves natural resources, takes less energy than manufacturing new materials and helps to reduce litter.

Hazardous waste is a scary term. Toxic or hazardous waste is a serious factor endangering the health of our environment. Industries have been blamed for discharging toxic chemicals into our air and waterways, but many are now meeting restrictions on the cleanup of wastes before they are released to the environment. Still, tons of hazardous waste are generated yearly by industry, government, hospitals, laboratories, businesses and citizens.

Many household products, such as cleaning agents, pesticides and oil-based paints, are poisonous to people, plants and wildlife. Hazardous waste from homes reaches the environment in several ways. Dumping harmful chemicals down the drain is one way. Disposal, either intentionally or accidentally, directly to the groundwater or into storm drains causes toxic substances to be washed by rainwater into natural bodies of water.

So how do we stop pollution from wastes? As individuals, we must take a careful look at the products we use and the ways in which we dispose of them. Reading labels will help you to know which products are harmful. Fertilizers and other lawn care products should be used only according to directions, and never just before it rains. Using the correct amount of these materials can help save money and reduce nutrients in the water. Unused portions of some potentially harmful products should be carefully contained to prevent leakage and taken to a landfill. Others can be shared with a neighbor. Used motor oil should be taken to a service station or county facility for recycling. Check with a local environmental agency to see if your area offers services for hazardous waste collection.

We can be the solution

Think about the possible dangers to the environment before disposing of any trash, chemicals or natural materials.

Pollution is caused by a variety of factors, but we can all take action to help. Just as millions of small individual actions can add up to harm the Bay and the environment, millions of small helpful actions will have a positive effect!

It comes down to taking individual responsibility for the health of the Bay, thinking carefully and changing our daily habits.

Students assist with a "working" model of the Chesapeake Bay watershed. Grades 1-3

Objectives

- recognize that rivers and streams are connected to the Bay, and that water quality is affected by the condition of the land
- become aware of the water cycle
- use a simple map to locate bodies of water, towns and to trace the path of a local tributary

Materials

- aluminum foil
- large rectangular pan or basin
- two chalkboard erasers, wooden blocks or bricks
- food coloring
- small amount of loose soil or sand
- water
- watering can with "shower" spout, or several small paper cups with holes punched in the bottom (Note: test prepared cups to be certain that surface tension of water does not prevent flow of through holes)

Subjects

Science, social studies

Skills

Discussion, inference, interpretation, kinesthetic, concept development, mapping, observation, prediction

What is a Watershed?

Procedure

1) Review a simple idea of the water cycle. Then, introduce the class to the idea of a watershed (all of the land that sends water into a particular body of water). Stress the fact that by living in the Bay's watershed, we are connected to the Bay, even if we seem to live far away from the water. Begin with a simple map of the Chesapeake Bay (depending upon ability level of the class). There is a watershed map at the end of this booklet.

   Locate and name large rivers and familiar towns; point out the Atlantic Ocean.

   Find and mark the location of the school on the map. What is the nearest river or other body of water?

   Can the students trace that body of water to its source (beginning)? To its connection to the Bay?

2) Can you think of any ways that the water could be changed as it flows from its source to the Bay? Make a list. There could be many answers, but lead to impacts from human actions and from substances (natural or manmade) that run off of the land—remember to note cities, towns and natural areas through which the water flows.

3) To illustrate the watershed concept, set up the model as follows: Tear off a piece of foil to just fit inside the pan. Crumple the foil to make dips and gullies to represent stream and river beds. At one end of the foil, form a larger basin or pocket - this will be the Bay and will collect water that runs from the tributaries. Place blocks in the corners at the other end of the pan to make mountains (shape the foil over the blocks), and make a valley between them; raise this end of the pan a bit higher than the end with the Bay. Explain to the class what the model represents, noting that higher elevation or bumps in the foil are areas of land, while cracks and dips are bodies of water.

4) Students will make it "rain" with the cups filled with water or watering can. Observe how the water runs off of the land, into the tributaries and, eventually, into the Bay.

5) Next, create pollution with a drop of food coloring close to one of your rivers. Use a familiar town named earlier as the source of the pollution. You may want to use a more relevant example, such as someone in the town changing motor oil and dumping the used oil into the street.

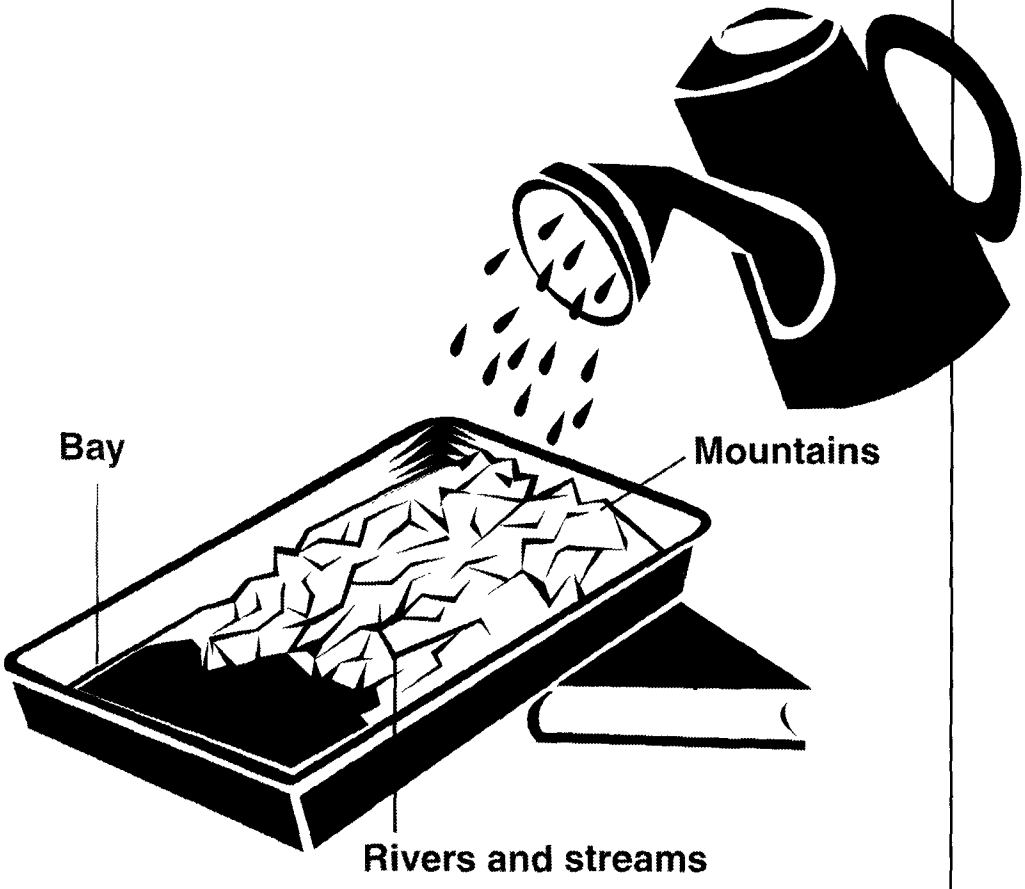
   What do you think will happen to the pollutant when it rains? Make it rain again and watch how the rainwater carries the waste into rivers and the Bay.

   What are some other manmade pollutants that get into the water this way?

6) Now pretend that someone builds his/her home too close to the bank of a body of water. The bulldozer clearing the land loosens soil. Place a small pile of soil or sand in your model. Make it rain again, and watch how the soil is washed away. Let it rain until the soil collects in the Bay and settles to the bottom. This loose soil in the water is called sediment.

   What effect would a large amount of sediment have on a river? On the Bay? On the plants and animals living in these waters?

7) Name some ways to prevent these harmful events from occurring.



This activity was adapted from River Times, published by the Mathematics and Science Center, 2401 Hartman Street, Richmond, Virginia, 23223.

A two-part activity: Students observe rain to view its effect on the land. Grade K-3

Students take a walk around the school grounds or neighborhood to find the closest connection to a water source. Note: You may want to "scout out" an area ahead of time. Grades 1-3

Objectives

- recognize that water travels from place to place and can be affected as it moves along
- discover that water (rainwater, creeks, streams, etc.) is our connection to the Bay
- become aware that we can help or harm the Bay through our treatment of any water source

Materials

- simple map of area around school
- map of larger area (state map) which includes all or parts of the Bay
- paper and pencils
- copies of "connectors" picture, page 16

Subjects

Science, social studies

Skills

Discussion, hypothesizing, identification, inference, mapping, observation

Pathway to the Bay

Procedure: Part 1— For a Rainy Day

Where Does the Rain Go?

Where does the rain go
when it falls on the land?
It makes plunking noises on our roof
and forms a puddle in my hand.

It dribbles down the windows
and trickles off our door.
When it gets on my galoshes
it makes puddles on our floor.

It plops on all the grass and trees
and makes the flowers grow.
I can watch it flowing down the street,
but then where does it go?

I think that all those drippy drops
have traveled here and there.
And when they've finished raining here
they'll meet again somewhere.

1) Read aloud the above poem. Ask the students if they can guess where the rain goes. Explain that they will be observing the rain and looking for ways that the rain changes things on the land. Questions for students to answer while looking out of the window (students will need pencil and paper):

   Write a word that describes how the rain makes things look (wet, shiny, muddy).

   List some things that rain washes away. What do you see floating in the rainwater? Find a place where rain is dripping from a building or other object. What is happening to the ground where the water lands?

   Can you find any places where the rain is forming a body of water?

   Can you find any places where the rainwater is joining a creek or other body of water?

2) After the class has finished the above, discuss their answers and observations.

   Does the rain change the land?

   Does the land change the water in any way?

3) Review with the class the idea that we live in a watershed. Even if the school seems far away from the Chesapeake Bay, you are connected to the Bay by all of the nearby creeks and streams that join the Bay, even in the city. The rain that you observed also joins the Bay in this way. Many things that are carried by rain will also get into these bodies of water.

   What sorts of things could water pick up as it runs through the land? (Soil, leaves, trash, spilled oil or other chemicals)

   Could some of these things harm the water or the animals that live in it?

Part 2: The Day After it Rains – Making the Connection

1) Review some of the things that were discussed in Part 1.

   Why is it important for us to know our connection to the Bay? Because many of us don't see the Bay itself every day, we don't realize that our actions affect the Bay. If we know how we are hurting the water, we know what to change.

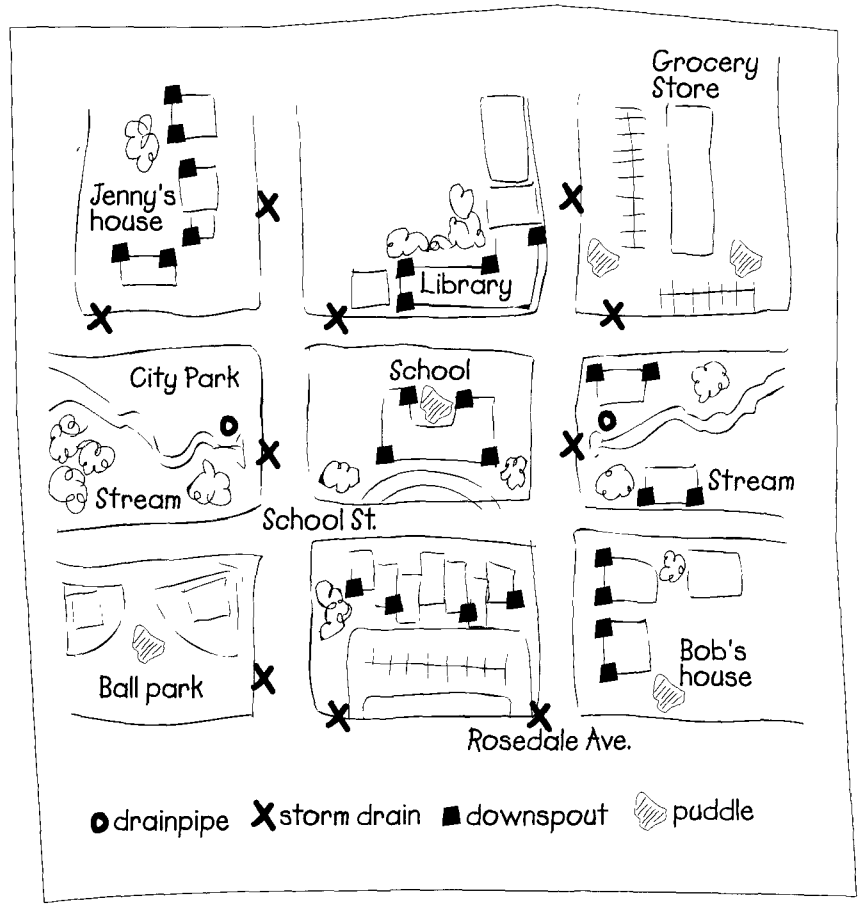
2) The class will go outside on an expedition to look for their connection(s) to the Bay. With the class, prepare a simple map or diagram of the expedition site—the schoolyard and its surroundings, marking landmarks. Ask if any of the children live very close to the school. Mark some of those houses on the map. You may wish to limit the map to the school grounds alone.

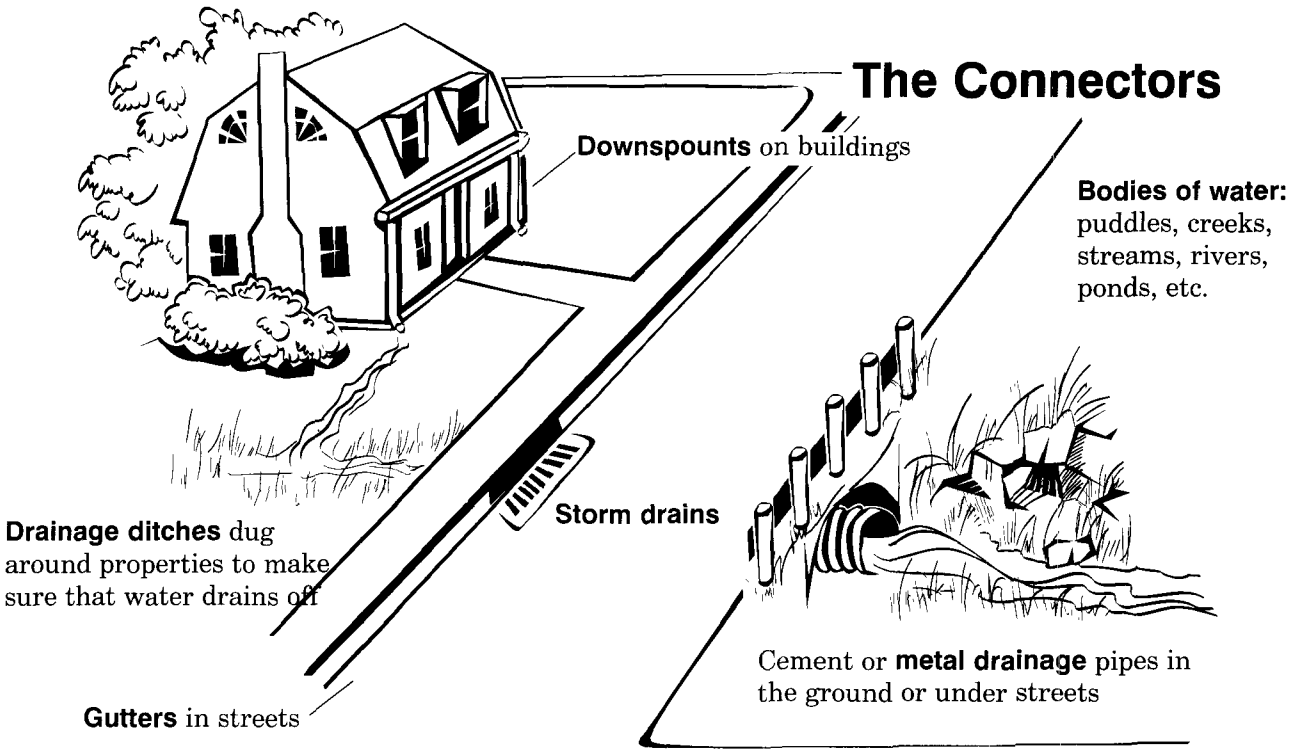
3) Hand out and read through the list of "connector" signs to look for. These are things that collect water and direct it somewhere else. As each item is found, mark its place on the map.

4) Back in the classroom, display the map for study. Review each symbol on the map.

   Can you trace where any of the downspouts, gutters, drainage ditches or pipes lead?

   Were you able to tell where they were sending water?





Did any of these connectors lead directly to the storm drains or bodies of water (if you found any)?

Where do you think the storm drains lead?

Did anyone find any soil, oil or trash in the water or in the connectors?

Where do you think these materials came from?

Where do you think the water and these materials will end up?

5) Locate and mark the school and the area studied on a larger map.

Can you find the nearest stream or other body of water on this map? These are where the "connectors" eventually send their water.

Have students trace the flow of these bodies of water from the school all the way to the Chesapeake Bay.

Why is it important for us to keep trash and other pollutants away from water?

Build a Bay Bulletin Board

Procedure

1) Prepare a background scene to represent an aquatic setting (the Bay). Include a large area of water with land on both sides or shores. Add some trees to edges of bulletin board, to help students remember that land and water are connected. Be sure to give the Bay a bottom surface, and include some underwater grasses to provide food and cover for the animals.

2) Discuss with students the relationship between land and water.

   How is water different from land?

   Where on land do we find water? Do we ever find land in (on) the water?

   Does water ever make changes in the land (hint: rain)?

   Imagine a land without any water at all. What would it be like? Would plants live there? Would animals live there? Would people live there?

   Make a short list of some kinds of plants and animals that would be found on land near the water; make another list for those found in or on the water.

3) Pass out copies of the cutouts provided (one or two per student). Have the students color the figures, then cut them out along the heavy outline. To make the figure stand out, cut a slit along the dotted line and lap the edges over in the direction of the arrow. Match the edge of the top piece to the mark on the bottom piece. Fasten in place. When the figures are complete, have the students find spots for them to be attached to the backdrop.

   Where would people fit into this scene? Draw yourself using water (fishing, swimming, boating, drinking, washing, etc.), and label your drawing. Add these drawings to the board.

Questions for (advanced) discussion:

   What changes do people often make to land (clear trees to build houses, leave trash, etc.)? Have the class decide which changes are "good" and "bad."

   How might these changes affect animals that live there? How about plants? Do you think these changes could affect the water? How?

Students color and cut out "3-D" figures to add life to a Bay backdrop.
Grades K-3

Objectives

- visualize some of the components of the Bay ecosystem
- distinguish between some aquatic and land-dwelling plants and animals
- discuss relationships between humans and natural resources

Materials

- copies of pages 18-19
- scissors
- glue, paste or clear tape
- rolls of colored construction paper for bulletin boards

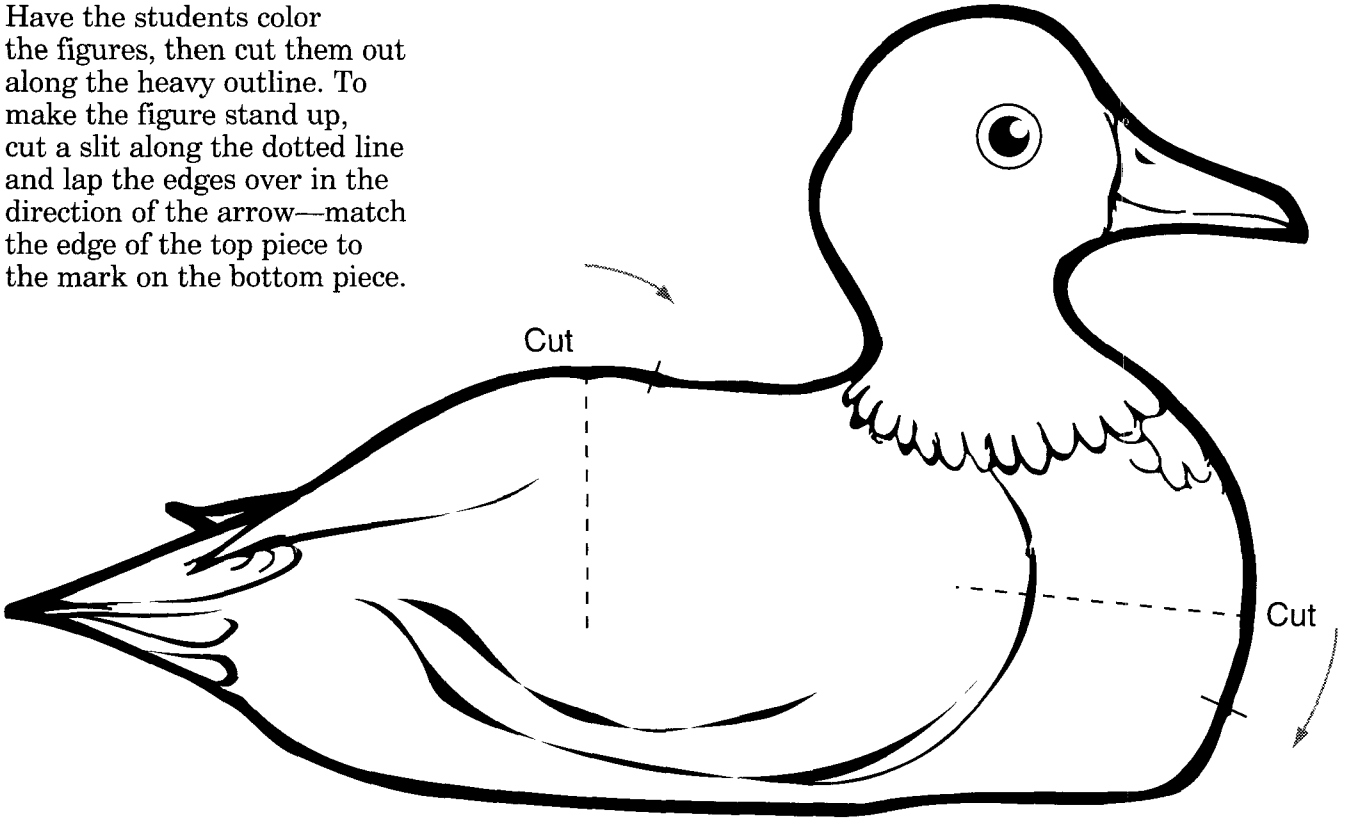
Subjects

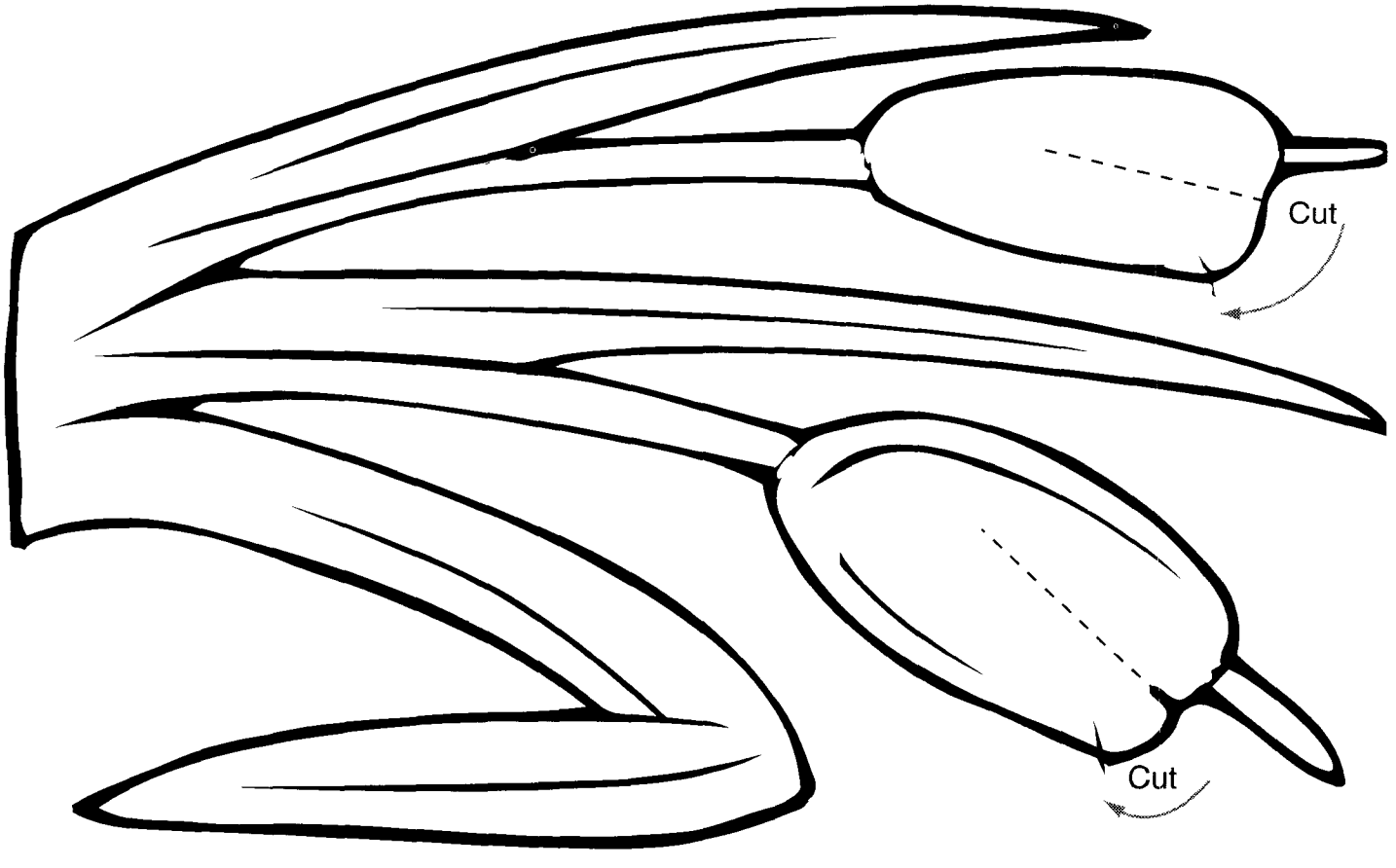
Science, social studies, art

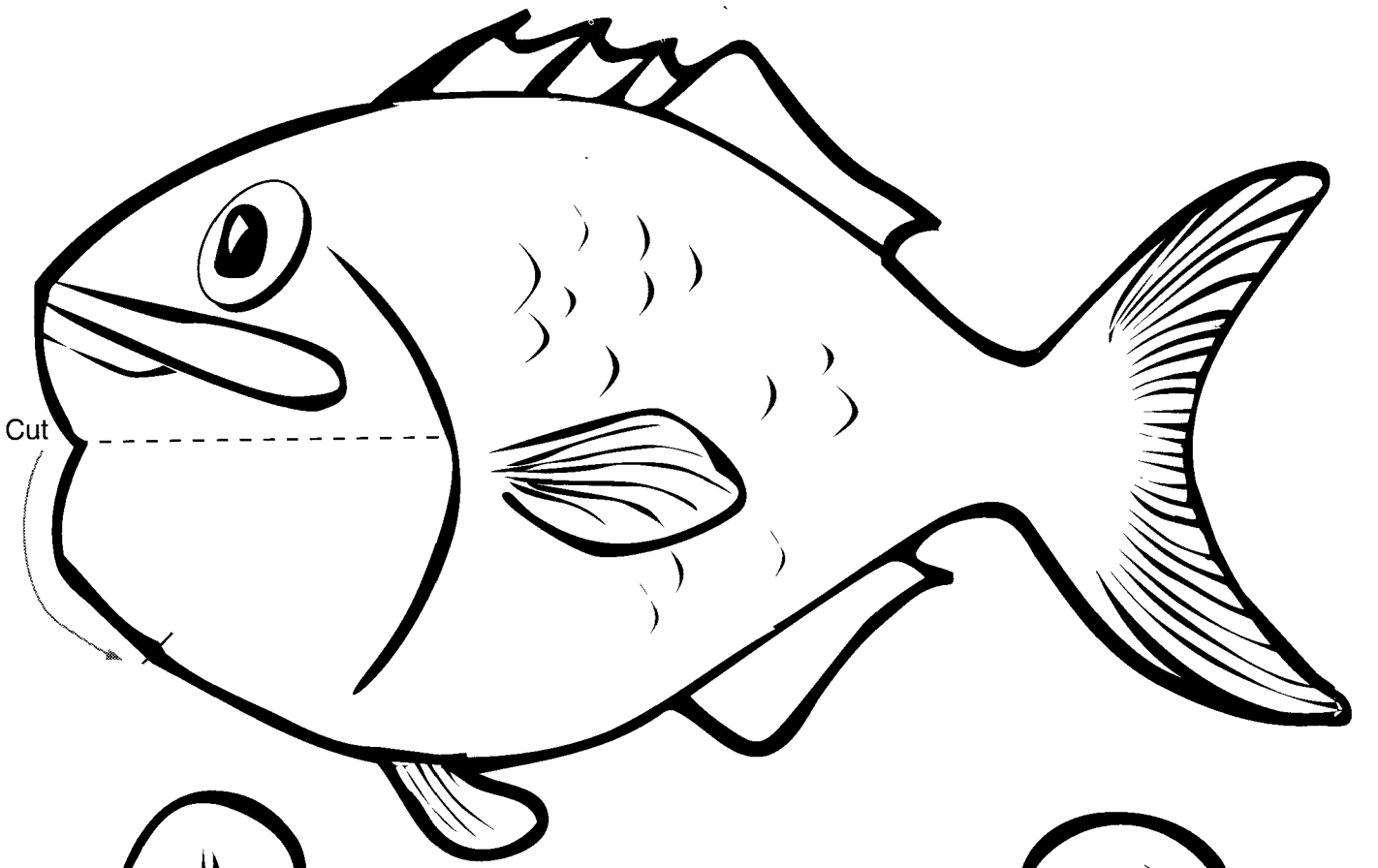
Skills

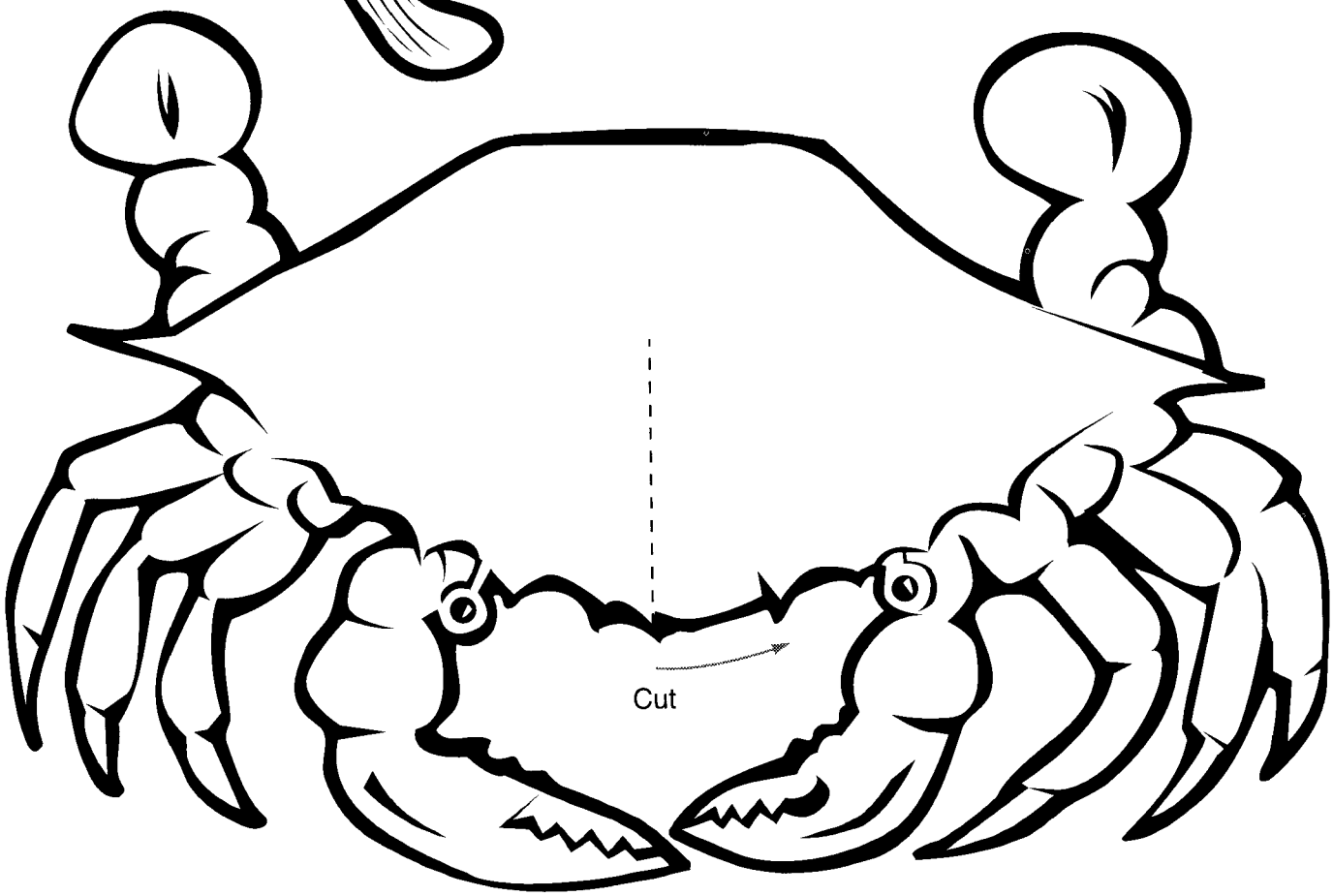
Discussion, drawing/crafts, identification, matching

Have the students color the figures, then cut them out along the heavy outline. To make the figure stand up, cut a slit along the dotted line and lap the edges over in the direction of the arrow—match the edge of the top piece to the mark on the bottom piece.






Cut


Cut

Alphabet Soup

Students name and draw plants and animals that relate to the Bay to make an alphabet banner for the classroom.
Grades K-3, as appropriate.

Objectives

- familiarize students with the variety of living things in and around the Bay
- match letters or sounds to names of things or (for older students) spell these names
- visualize and draw the words listed

Materials

- large pieces of drawing paper
- crayons
- alphabet stencils or other large letters for display
- chart of Bay animals provided
- (optional) magazine pictures of Bay plants and animals.

Subjects

Language (spelling), art.

Skills

Classification, drawing, identification, listing, visualization.

Procedure

1) Begin by asking the class to brainstorm a list of words relating to the Bay. Start with the letter 'A' and proceed through the alphabet. It might be helpful to work by category, for example, "Think of an animal that lives in the water, whose name begins with A" or "Name something that begins with B that's found on the land." For younger children, show a photo and ask for the subject's name. With what letter or sound does its name begin? The large letters can be used for a matching exercise. Make a list of the words on the board (see sample lists).

2) Next have students choose a word to illustrate (if you have used magazine pictures, pass them out for help with visualizing the words). Older students should label their drawings, making sure that spelling is correct; the younger ones may need the teacher to label for them.

3) When the drawings are completed, the class can help to put them in alphabetical order. Hang them beside the large letters to create an alphabet banner.

4) As an added exercise, older children may write sentences using these words.

Aquatic words

Alewife
anemone
barnacle
bass
bay
bluefish
catfish
carp
clam
crab
creek
drum
eel
estuary
fish
flounder
frog
herring
horseshoe
ice
jellyfish
killifish
lake
marsh
menhaden
minnow
needlefish
oyster
perch
pipefish
ray
river
rockfish
shad
shells
shrimp
snails
squid
stream
striped bass
sturgeon
toadfish
trout
turtle
terrapin
underwater grasses
zooplankton

Birds

canvasback
duck
eagle
egret
falcon
geese
gull
hawk
heron
ibis
kestrel
kingfisher
mallard
marsh hawk
nighthawk
osprey
old-squaw
peregrine
pigeon
quail
rail
redwing
scoter
scaup
sandpiper
widgeon

Other

animals
boats
Delaware
dragonfly
fossils
insects
island
land
mosquito
nature
nutrients
pollution
snakes
skipjack
vacation
wetland
wildlife

Plants

algae
flowers
grasses
lichen
lady's slipper
plants
trees
vegetation
wild rice
wild celery

Mammals

cow
deer
fox
goat
muskrat
nutria
otter
people
vole
You!

A Host of Habitats

Procedure

1) Begin with a general discussion of the Chesapeake region. Use the photos to help them envision what they're discussing.
   - What do the students already know about the Bay and its resources?
   - What kinds of places have they seen (or might they see) around the Bay? List or draw these places on the board (forest, beach, marsh, etc.).
   - Name some animals that might live in these places; add these to the list, or make a chart with two columns: habitats and animals.

2) Single out one or two of the above habitats for further discussion.
   - What does the habitat look like?
   - What kinds of plants might you see there?
   - What kinds of animals would live or visit there?
   - What kinds of things do these animals need to survive (food, water, shelter or home, space)? Describe how/where the animals can get these things in this habitat.
   - What benefit would people get from these types of places? (Advanced) How is each habitat important for the Bay itself?

3) What is your habitat? Draw the habitat where you get your own food, water, shelter, and space. How is this habitat different from those of the animals?

4) Hand out copies of pages 22-24. After the children color the pages, have them cut out the animal pictures and glue them to their respective habitat scenes. Where do the fish go? Where should the birds be placed? Students can use the photos or library books to find out how the plants and animals should be colored.

Students create scenes of Bay habitats by pasting pictures of animals to background scenes. Grades K-3

Objectives

- recognize and discuss the variety of habitats found in the Bay region.
- learn about the plants and animals that can be found in these areas, and discover their importance to the environment and to people
- match animals to habitats

Materials

- copies of pages 22-24
- crayons
- scissors
- glue or paste
- photos or magazine pictures of animals and/or habitats.

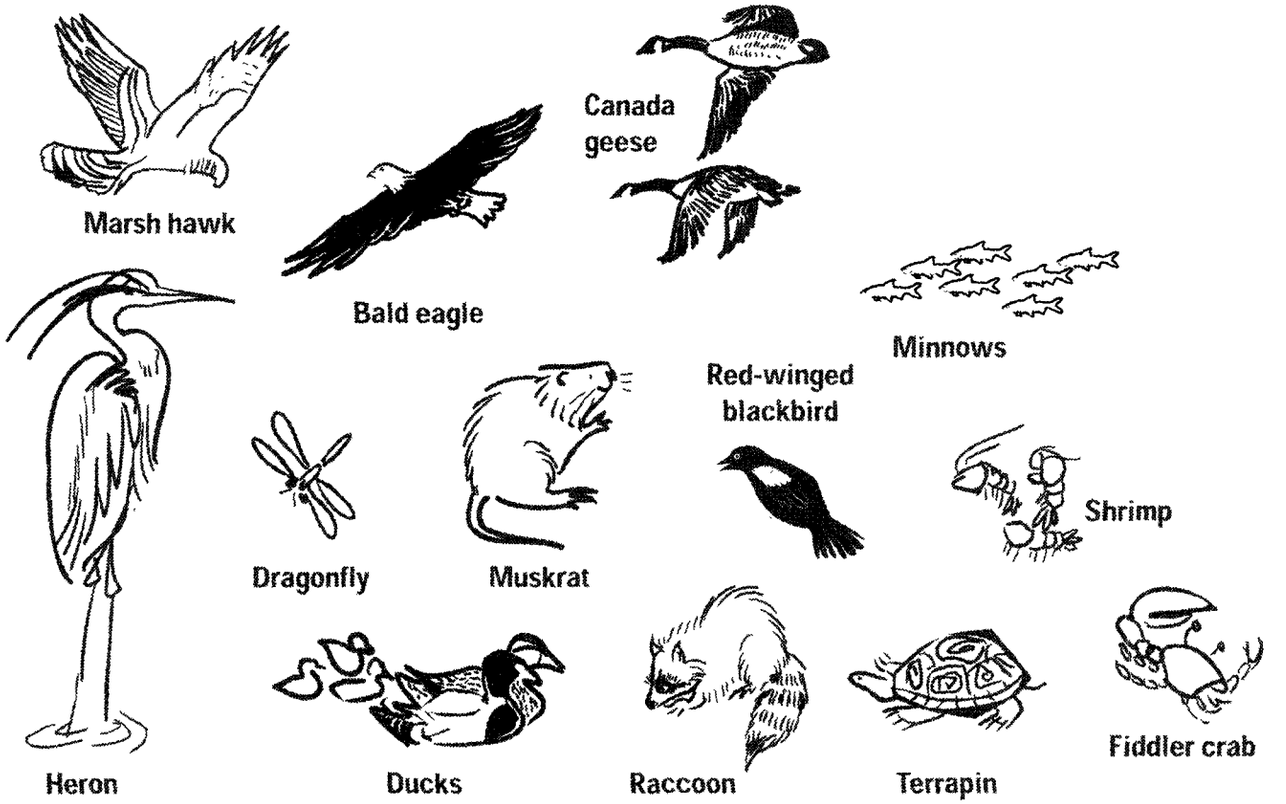
Subjects

Science, language (vocabulary), art

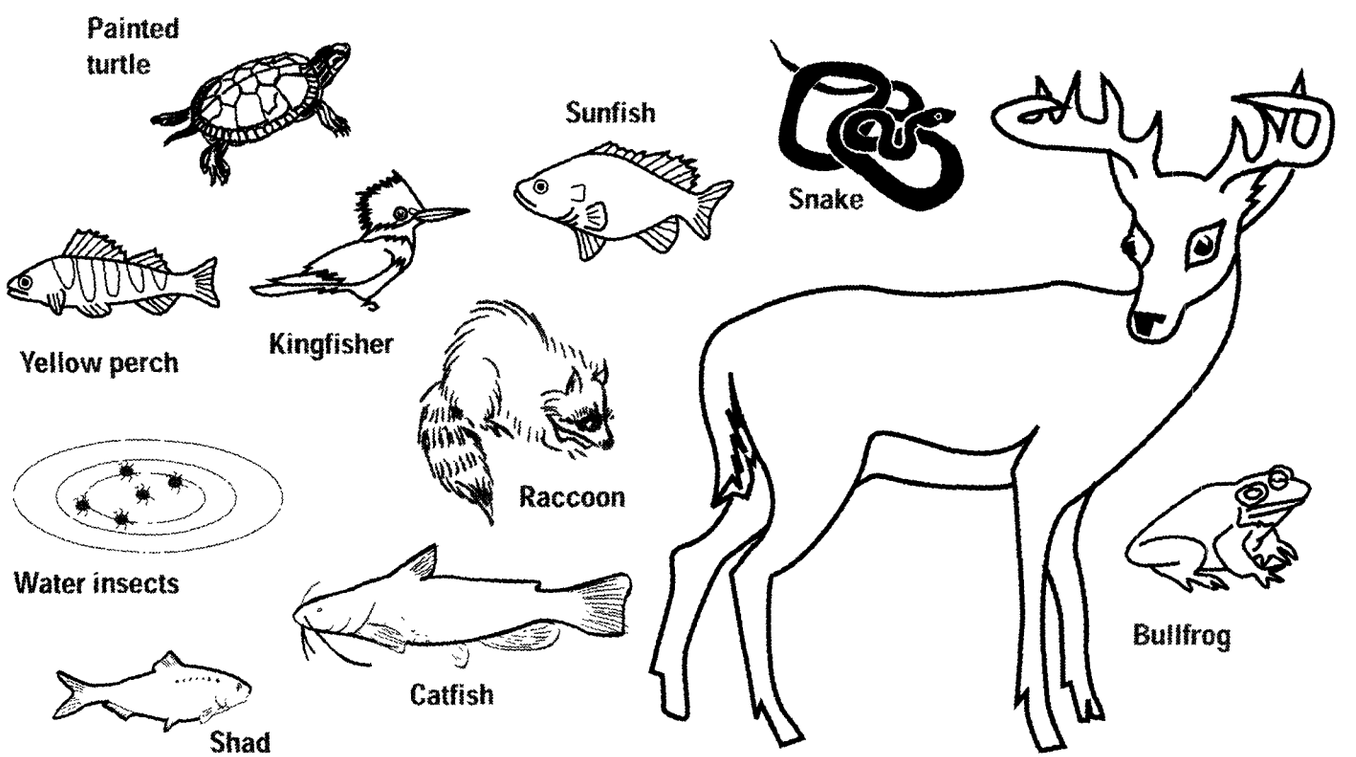
Skills

Classification, description drawing/coloring/ cut & paste, identification, listing matching, use of library references, visualization

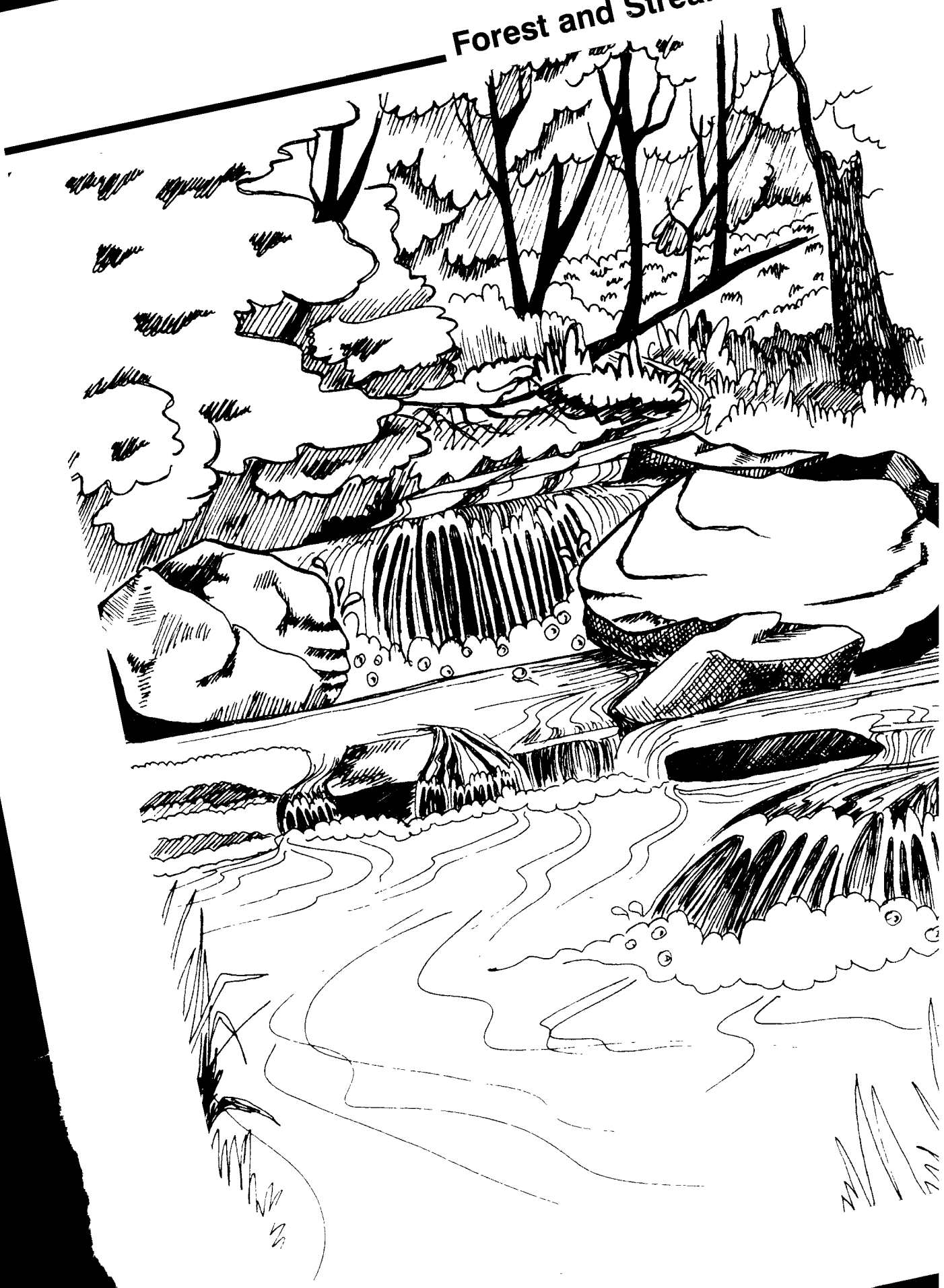
Marsh Animals



Forest and Stream Animals



Forest and Stream Habitat



Marsh Habitat

protect

Tools of the Trade

Background

Adaptations, for the purpose of this lesson, can be described as specialized tools that enable an animal to survive in its habitat or environment. These tools are part of the animal's body, not something that it can choose to use the way a human would use a hammer or an axe. These tools help the animal to find or catch food; move about in search of food or a mate, escape danger; see; breathe in air or water; or protect itself. *Note: adaptations develop gradually over long periods of time and through many generations of the species. Individuals with the strongest or more successful traits are usually the survivors who live on to reproduce further generations.*

Eyes enable an animal to see, but they are not really an adaptation. Eyes on stalks, for instance, help a crab to see all around itself because it does not have a head and neck which it can turn. Stalked eyes would be an adaptation.

Distinguish for the class between more passive protection and active defense. Most animals are more likely to flee or hide than to engage in battle. Examples of protective "devices" might be camouflage coloring, a hard outer shell, ability to flee quickly or outer spikes or spines that would not be palatable to a gobbling predator.

In this exercise, students will inspect drawings of animals, and answer questions about them. This may be done as a class, or individually, with some preparation.

Note: If you have a classroom aquarium, or would like to start one, its animals can be observed as examples during discussion.

Procedure

1) Begin with a class discussion of what animals need to survive —food, water, shelter, space, etc.
   - Do these resources differ for different animals?
   - Do they differ for animals that may occupy different habitats?
   - Would a rabbit survive if it had to stay under water? Why not? Would a fish be able to live in a tree? Why not?

2) Once the class catches on to this line of questioning, introduce the idea of adaptations, or "special tools." Have the students analyze their own adaptations.
   A few fun activities:
   - Ask someone to try walking on four limbs instead of just two feet. How would this limit their ability to do everyday human activities?
   - Working with partners, have students tape or tie (not too tight) their thumbs to the palms of their hands. Without the use of the thumbs, try picking things up, writing, or tying shoes.

3) Hand out copies of the activity sheet on page 27. If activity sheets are done individually, leave enough time at the end of

Students use animal drawings or photos, or live animals, if possible, to investigate various adaptations for survival. Grades 1-3

Objectives

- identify body parts of various animals
- recognize specially adapted body parts
- match adaptation to its function
- (advanced) in some instances, infer an animal's habitat, based on its adaptations.

Materials

- copies of activity sheet, page 27
- pencils

Subjects

Science

Skills

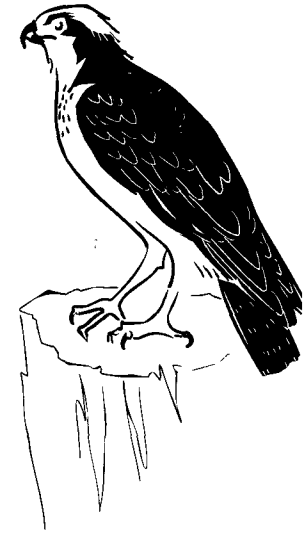
Discussion, evaluation, identification, inference, invention, matching, observation, relating form to function.

the lesson to discuss the answers to these questions. During discussion, have the children explain what makes particular "tools" special. Review the idea that these "tools" are "made to order" according to the animal's environment or habitat.

4) As a follow-up, distribute copies of the drawing below and review its instructions:

This animal is not well adapted to living under water. Make changes to its body so that it can live better in the Bay. Remember, it has to eat, see, breathe, move about and protect itself in order to survive.

Osprey



1. Find the osprey's mouth (beak). Circle the words that describe it:
   Sharp dull curved straight large small

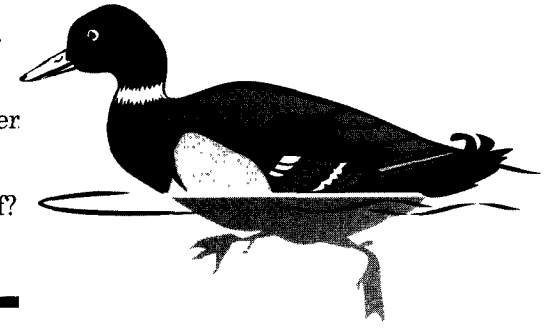
2. Study the osprey's feet. Circle the phrase that describes how this bird uses its feet:
   to perch (sit) in trees or on posts to swim in the Bay to catch food

3. The osprey lives near water. Look at the beak and feet again. What do you think that it eats? Little seeds twigs grass fish

4. Does this animal have any other special tools?

5. Fill in the blanks. To protect itself, this bird would _ _ _ away.

Duck



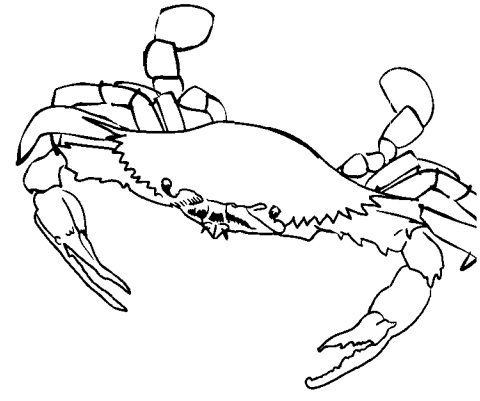
1. Look at the duck's mouth. Is it the same as the osprey's? Circle the words to describe it: sharp dull curved straight large small

2. Fill in the blanks. This bird's feet are used for s_ _mm _ _ _.
   We know this because they are webbed.

3. When this duck wants something to eat, it can dive under the water.
   What might it eat? Rocks shells Bay grasses

4. If a larger animal was chasing the duck , how could it protect itself?
   The duck could: fly away fight dive underwater
   swim away call (quack) for help

Blue Crab



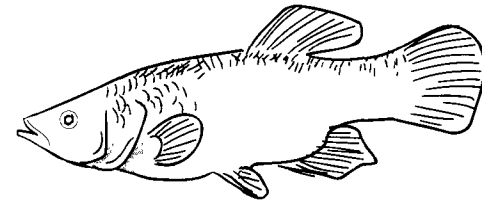
1. Can you find the crab's mouth? Circle it. What other part would help the crab to eat? Fill in the blanks. Its c_ _ _s could tear food apart.

2. The crab has two claws. How many legs does it have? Circle the two legs that are different than the rest. These are used for swimming. Fill in the blanks the pointed ones are used for w _ l _ _ng.

3. Circle the crabs eyes. What is special about these eyes?

4. Fill in the blanks. The crab's protection is its hard _ h _ _ l.

Fish

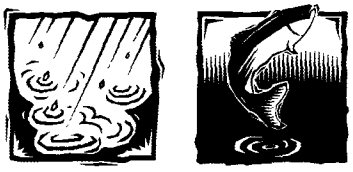


1. Fish don't have legs. What do they use to move around?

2. Fish that swim fast and have big mouths can catch and swallow other fish. This fish is a small fish that swims slowly. It has to eat bits of things off of the bottom. Draw the kind of mouth that would help it pick up tiny bits of food.

3. People breathe by using their lungs to take oxygen out of the air. Fish need oxygen, but they get it out of the water. Fish do not have lungs. Fill in the blanks. Fish breathe with g _ _ _ s. Circle this part on the fish.

A Watery Adventure

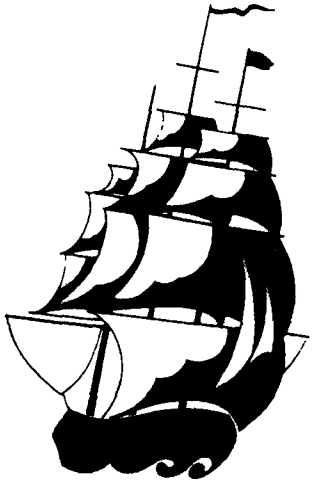


Students read or listen to a story about the Bay, then finish the story themselves.
Grades K -3, as appropriate

Note:
This can be an individual activity or one for the whole class. If the story is read aloud, students can each contribute a sentence or two to the ending, while the teacher writes the composition on a large piece of paper.

Subjects
Language, social studies.

Skills
Invention, imagination, listening, reading, visualization, writing.



Danny was lying on the shore, gazing at the cottony clouds above him. He'd been able to make out four shapes in the sky already — a whale, a horse, a giant, and an elephant. Now he could see a duck forming in the cloud directly over his head. All he needed was another good breeze to finish putting the head in place. There! It was a duck, sure enough. He let his eyes wander to the water in front of him. He hadn't realized it, but the tide was coming in and his feet were beginning to get wet. He sat up to move out of the way of the water, but quickly changed his mind and ran right in until he was knee deep in the cool lapping waves. Danny wished the waves here were big ones, like those in the ocean, but then his mother would never let him go swimming alone. He decided he'd settle for the calmer Bay water, as long as he didn't have to bring along his nagging big sister. She was always so bossy when his mother left her in charge! "I'll show her," he thought, "when I'm a big, tough pirate!"

Danny always liked to think he'd become a pirate when he grew up. He often imagined himself, armed with a shiny sword, a patch over one eye and two teeth missing (from battling other pirates), giving orders on a huge ship with twenty billowing white sails. He'd been dreaming about this ever since his teacher told the class about the pirates that used to sail in the Chesapeake Bay, many, many years ago. Now, he began daydreaming about another adventure on his ship...

It was a dark and stormy day on the water for Pirate Dan and his men. The water was rough and churning all about the ship as it forged on, heading after the enemy who'd stolen two chests of gold from Dan's ship the day before. Dan shouted out orders, trying to be heard above the roar of the splashing waves and the booming of the enemy cannons. He called for his trusted ship's mate, Lizzie. Lizzie was his real-life best friend, who loved to play pirates, too.

"Hey Lizzie," shouted Dan, "bring the cannons 'round for firing! We're closing in on them!"

"Cannons are ready, Cap'n Dan. We've already been knocking men down off of the stern. They snuck up on us from behind with a rowboat full of crew. But we're beating those rats!"

"Good work, Liz. A few direct hits with our cannonballs, and we'll sink 'em for sure!" The two saluted each other, and Lizzie charged off roaring like a lion.

"Lizzie! Watch out!" cried Dan. A dirty-looking, toothless pirate was creeping up behind her. Dan was too late to help her. He reached the rail just in time to see his friend get pushed overboard by the scoundrel. Without a second thought, Danny jumped overboard too, and dove in the frothy water below. He had to save his best friend!

"Lizzie, where are you? Can you hear me?"

"I'm over here, Danny. I'm all right. That rotten creep. I didn't even see him coming. Now what'll we do? The ship's sailing away without us."

The booming and cries coming from the two ships were beginning to die out as the vessels drifted farther away, leaving Dan and Liz floundering behind. They were right in the center of the Bay, with eleven miles between them and either shore. They couldn't swim that far, and there wouldn't be another ship coming by for days, maybe even weeks!

"Over there!" cried Dan, pointing behind his friend. "They've left that rowboat behind. Swim for it!"

So the two pirate friends climbed into the abandoned rowboat, and collapsed from exhaustion. They had no oars, so they'd have to drift with the current. There were a few useful things scattered on the floor of the boat — a pocket knife, some twine, an empty burlap sack, and some matches....

Now you finish the story! What happened to Dan and Liz on this imaginary adventure? How did they survive out there on the Bay? What did they eat? What kinds of things did they see as they drifted along? Were they ever rescued? You decide what happens next.

Here are some choices to help you decide how your story should end:

1) As Liz and Dan were drifting along, they saw many kinds of animals. Which animals did they see? Remember, this is the Chesapeake Bay. What were these animals doing?

- fish
- ducks
- sea gulls
- jellyfish
- polar bear
- cow nosed ray
- whale
- spider

2) What were they able to find to eat?

a) They didn't find anything to eat, and lost a lot of weight!

b) They fashioned a fake worm out of a thread from the burlap sack, used the twine as a fishing line and caught fish. They ate the fish raw.

c) They scooped up some Bay grasses that were floating by, and ate them. They let some of the plants dry in the sun to save for later.

d) They ate the burlap sack (but it was tough).

3) It was hot out on the Bay with no shade to protect them. Dan and Liz were very thirsty. Did they find anything to drink? Remember, they can't drink salt water.

a) They took off their shoes and caught dew and rainwater in them.

b) They found a bottle of fresh water floating by, and drank that, a little at a time.

c) They hid from the sun under the burlap sack, so they didn't really get that thirsty.

4) In your story, were the two pretend pirates ever rescued?

a) Yes, their shipmates came back for them the next day.

b) No, and legend has it that their ghosts still haunt the Bay.

c) Yes. They saw a ship in the distance, and lit the burlap sack on fire with their matches. The ship saw their signal and came to their rescue.

Students learn about the food sources available in and around the Bay, and how some of these have been used through history. Grades 1-3 , as appropriate.

Objective

- identify food sources, both natural and cultivated
- recognize that food does not originate in a grocery store
- read a recipe and measure ingredients.

Subjects

Social studies, language, mathematics.

Skills

Discussion, following a recipe, invention, listing, measuring, reading, research (library skills).

BayFood

Procedure

1) Discuss with the class where their food comes from. Most will say that it comes from a store or that a parent makes it.
   - Can you think of any other ways that people get their food?—make a list.
   - Have you or a friend or relative ever caught something that you later ate? (fish, crabs)

   Have them imagine that they are colonists and are coming to the shores of the Chesapeake Bay for the first time.
   - What kinds of things would they be able to find to eat?
   - How would they know what things were safe to eat? If they saw a crab for the first time, would they know how to eat it, or even if it was edible? You might want to suggest that perhaps the first settlers got the idea to eat certain things from watching animals eat.

2) In this lesson the children will be using the library or maybe a prepared classroom "library" to read about Bay plants and animals that are used for food, and a little about the history of these foods. These materials may be difficult to come by, so a substitute might be the story of the first Thanksgiving, or any material about hunting, fishing and farming.

3) After they have done their research, have the class collaborate on writing a BayFoods menu. The dishes on the menu can be made-up, such as duck feet fritters or French fried muskrat tails, as well as more traditional, such as roast Canada goose or rabbit stew. Try to include items representative of all animal categories: fish, bird, mammal, reptile, amphibian, and invertebrate (insects, shellfish). And don't forget the vegetables—wild or farm-raised.

4) Finally, choose a recipe for the class to make together. If this is not possible, maybe parents could help out with a potluck lunch for the class. Suggest that the children help at home in the preparation of these foods. To cut the cost of making dishes, try making mini-portions. This will give students an experience in tasting some different foods of the region.

Suggested Foods for Research:

"Wild" Foods
Birds, ducks, geese, quail, pheasant, wild turkey

Mammals
deer, muskrat, beaver, opossum, raccoon

Reptiles
diamondback terrapin, snapping turtle, snakes

Amphibians
frogs

Fish
striped bass (rockfish), drum, perch, bluefish, sea trout, rays, or any other kind of fresh or saltwater fish

Invertebrates
Aquatic: blue crabs, crayfish, oysters, clams, mussels, shrimp
Insects: grasshoppers, locusts

Plants
wild rice, cattails, blackberries, raspberries, blueberries, fiddleheads (young ferns), Jerusalem artichokes, "sea pickles" (glasswort), pickerel weed. There are many wild plants used for food.

See Roger Tory Peterson's field guide to wild edible plants, or another similar guide.

Agricultural Foods
Animals such as chickens, pigs, sheep, other domestic animals

Crops
corn, soybeans, cantaloupe and peaches are some of the more commonly grown Bay region cash crops

Jug•gle Your Water Supply

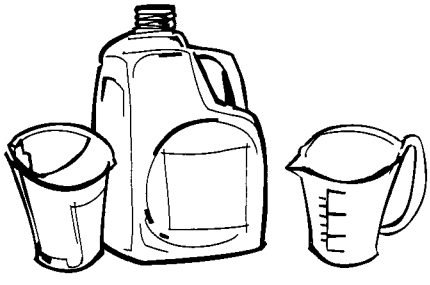
Students are introduced to the value of water as a limited resource.
Grades K-3

Objectives
- recognize water as an essential to daily living
- become aware our own water use habits
- recognize that we actually need less water than we use.

Materials
- measuring cup
- drinking cup
- clean gallon container

Subjects
Science, social studies.

Skills
Anticipating needs, conserving resources, measuring



Procedure
Here's an activity to be done in class, but some may want to try it at home, too:

1) Begin with a discussion of how our tap water is related to natural water sources.
   - Where does the water in your home or school come from?
   - How does it get to your house or school?
   - In what ways do you and your family use water at home?
   - Where does it go when it leaves the sink or toilet?

   Accept guesses, but lead to the idea that water comes from lakes, streams and the Bay, and is eventually returned there for reuse. Explain that water leaving the home is called wastewater and must be cleaned before it can be reused. If treatment plants become overloaded, they cannot properly clean the water before it is sent back to natural bodies of water.

   What would happen if we ran out of clean fresh water? Point out that fish and many kinds of wildlife also live in and use the same water.

   Can we make more water?

   How can we make sure that we don't run out? (conserve what we have)

2) Have students measure out and reserve in a clean container one gallon of tap water, or a half gallon, if more appropriate. This is their water supply for one day. They must use this for drinking, brushing teeth, washing hands and face, etc.

   You may want to plan this lesson with some messy activity, to be sure that students will need to wash their hands. They may, of course, use the toilet, but remind them that each flush uses five times as much water as their supply for the day. The container should not be refilled. Encourage them to anticipate activities which require water and to conserve their supply so that it will last throughout the day. At the end of the day, discuss:

   Did anyone run out of water early?

   If anyone has any water left, have them measure the amount. Help them subtract this amount from one gallon to find out how much was used.
   - What did they learn about their own water use habits?
   - Will this change the way in which they use water in the future?
   - What were some "tricks" that they learned for conserving water?
   - Make a list of things that can be done daily in school and at home to conserve water (see the Water Abuse section, page 10).

Down the Drain

Procedure

1) Review some of the reasons for helping to keep water clean from within our homes. Water from the sink must be cleaned at a wastewater treatment plant and must eventually reach a natural body of water again. Our water will later be home to fish and many kinds of wildlife. It may also become drinking water for other people in the future.

2) Ask: Do you ever add anything, such as toothpaste, to the water before it leaves the sink?

   Make a list of substances on the blackboard. Explain that the class will be playing a game that may give them an idea of how many things people add to wastewater every day.

The Drain Game

1) Pass out a container to each student, and have each decide what he/she will say about the item (see examples, below).

2) Students will make a circle. The teacher will be the "sink" and will move around the inside of the circle, with the box, collecting the items from each student.

3) *Proceed as follows:* The first student will hold up his item, such as a tube of toothpaste, and will announce to the class, "I brushed my teeth and added toothpaste to the water." Then he will place the item in the "sink." The next student will hold up his item and say, "I washed my face and added soap," and the first student will add, "and toothpaste to the water." Then the soap is placed in the "sink." Continue on thus, until reaching the last person, when a chain will have been formed, such as, "I mopped the floor and added floor wax," and "laundry detergent," "and window cleaner," "and soap," "and toothpaste to the water." By the end of the line the sink should be full of containers, illustrating the amount of items that could be added from one home.

4) While still standing in the circle, have the class categorize items:
   - Which items might be most harmful to water, plants or animals? Which would be least harmful?
   - Reading the labels on the containers will help in rating some of the substances. See the chart on the next page for additional help.

Students play an add-on game which illustrates a form of water pollution. Grades 2-3

Objectives
- recognize the addition of toxic substances through our sewer systems as a form of water pollution
- become aware that our every day actions are sometimes harmful to the environment
- recognize that individual helpful actions can add up to a cleaner Bay.

Materials
- clean, empty, if possible, sealed (with tape, etc.) containers from household goods (toothpaste, bar soap, shampoo, roll of toilet tissue, various detergents and cleansers, such as window cleaner, floor wax, etc., cooking oil, coffee grounds, motor oil, paint, anything that might end up being disposed of down a drain)—one for each student
- large box or other container that can represent a sink.

Subjects
Science, social studies.

Skills
Discussion, identification, kinesthetic concept development, listening, problem solving, public speaking.

Dish, laundry and bar soaps, toothpaste, etc.	These have been made so that they harm the environment or waters as little as possible (no phosphates).	These *can* go down the drain
Food items	Most foods, especially oil, fats, and coffee grounds, will clog pipes, and may not be removed from wastewater	Seal in a garbage bag, or put in a compost pile.
Motor oil, turpentine	These can be recycled. Keep in tightly closed containers, have adults take to a recycler (check with your county).	POISONOUS! Never dump down the drain!
Medicines, household cleaners, pesticides, other chemicals	Throw away leftovers or empty containers. Tightly cap original container. Wrap in many layers of newspaper. Put in tightly tied trash bag for regular collection.	POISONOUS! Never dump down the drain!

Remind the class that things dumped on the ground or in a storm drain will be washed into waterways when it rains. Overall, be careful about disposing of certain substances. Keep poison and potential pollutants out of the drain.

As a conclusion, you may want to move the "sink" back around the circle and have each student remove one item, until the sink is empty again.

Follow-up

Now that your students are more aware of what goes "down the drain," ask them to become involved citizens and to educate others about the dangers of improper disposal. Have them design posters for the school or classroom or to display at home. An example would be: "Think before you dump!" with a drawing of a sink.

Disposal Detectives

Procedure

1) Have students observe at home how things are disposed of. Ask them to make a list of items that are put into the trash can. Warn students not to go through a trash can without adult supervision, in case of toxic or sharp materials.

   Are any products or substances disposed of in the sink or in the toilet?

   Do they notice any other ways that family members dispose of items?

   Have students make a list and report back to the class after a given observation period (a weekend might be a good time). In class, categorize harmful or conservative habits.

2) After discussion, encourage students to suggest to their families alternatives to harmful practices (see chart from "Drain" activity). Students should help their families to implement new, more conservative, disposal methods.

3) Discuss recycling as a way to save energy and raw materials and to cut down on amounts of trash and litter. How does recycling help the Bay?

4) Start a paper and/or aluminum recycling drive in your classroom. Provide large containers for classroom collection and ask students to bring empty cans and newspapers from home. Paper trash from school can also be saved for recycling. Set a goal, and plan to take the material to a recycler when the goal has been reached.

Students become aware of waste problems through observing actual disposal methods at home (Best if done in conjunction with "Down the Drain"). Grades 2-3

Objectives
- learn to become more observant of daily practices.
- find another way to contribute to Bay cleanup from the home.

Subject
Social studies

Skills
Categorizing, observation, problem solving.

The Tale of the Troublesome Thing

Grades K-3

Objectives
- view the litter problem from a different perspective (that of the animals)
- learn some of the kinds of animals that inhabit the Bay's marshes.

Subjects
Social studies, language, drama.

Skills
Discussion, interpretation, listening, psychomotor development, reading.

This is not just another story about the Chesapeake Bay. This one is noisy. A noise story is part story and part play. The teacher or an older student reads the story while the children make the character's sounds. It's a fun way for young students to participate in a story without having to read or memorize long lines. The story has been divided into two parts, so that it may be done in one or two periods.

Have the whole group make every noise. It works best if you practice, first. The cue to make a noise is when a noise word appears in parentheses in the story, or when the children hear the reader pause. It helps to have the reader make the motions and noises, too, especially when incidental noises appear in the story.

Before you begin the story, practice acting out each character a few times.

The Characters (and their noises)

Silly Goose *(hold your nose and say honk! honk!)*

Grabby Crabby *(make crab claws with your hands and say clackity clack!)*

Wiggly Eel *(wiggle your body and make a wet slurpy noise—eels are slimy and slippery)*

Floppity Fishes *(flop hands front and back on your lap and say flip! flop!)*

Long Legged Heron *(flap your "wings" and squawk loudly—just one, loud squawk)*

Bald Headed Duck *(put a hand on top of your head and say quack! quack!)*

Majestic Eagle *("soar" with your arms outstretched—don't make any sound at all)*

Musky Muskrat, Who Gnaws On Things *(make lots of chewing or gnawing noises)*

Clapping Clam, Who Can't Come Out of His Shell *(hold the heels of your hands together and clap like a clam)*

Terrapin, the Turtle With the Funny Name *(curl up as though you're hiding in your shell)*

The Story

The Tale of the Troublesome Thing (Part 1)

Down by the edge of the Bay, where the water comes lap, lap, lapping into shore *(lap!lap!lap!)*, is a place where tall grasses grow higher than the sky. And in this place, where the ground is sometimes under water and sometimes just really mushy, and it smells kind of smelly, you can find lots of wonderful critters who like to live there.

This day was a beautiful day. The sky was blue and the water was wet and the breeze was just breezy enough. The Majestic Eagle *("soar" silently)* glided over the marsh hunting for prey. And all of the other animals went about their usual happy business.

"There's a lot of food over here!" called Grabby Crabby *(clackity clack!)* who swam in with the tide.

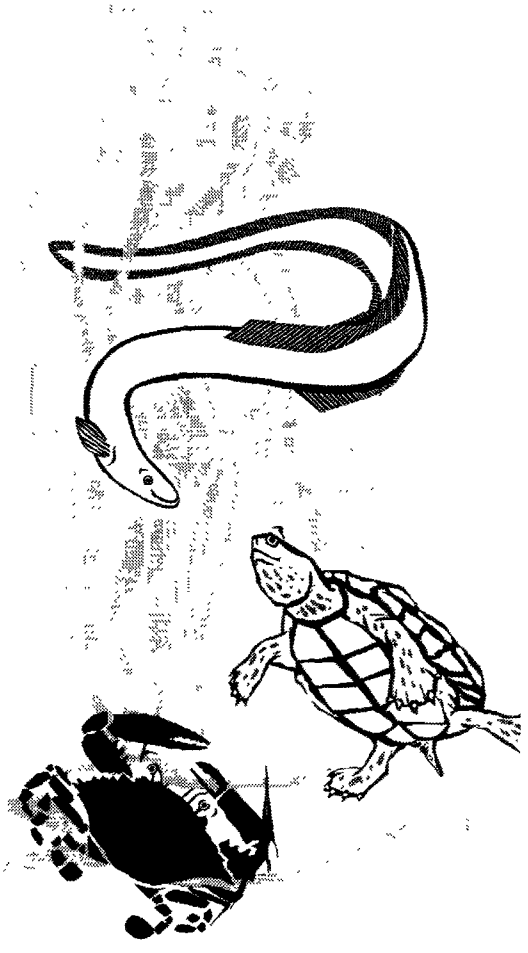
"Sure there is, if you like to eat dead stuff!" cried the little school of Floppity Fishes *(flip! flop!)*. "We'd rather find some nice floating bits of plants to swallow. We'll see you later!" And the Floppity Fishes *(flip! flop!)* turned and scooted off with their tails swishing behind.

So Grabby Crabby *(clackity clack!)* ate his fill, and moved off through the wet water weeds to find something else to get into. "Ouch!" yelped Grabby Crabby *(clackity clack!)* as he bumped into something strange and hard *(bagang! bong!)*. "Why, what's this strange and hard something?" wondered Grabby Crabby *(clackity clack!)*. "This doesn't belong here in our nice clean marsh." He climbed up on top of the Thing, then climbed down the other side of it. Then he crept his funny sideways crab creep all around the Thing. But with all this investigating, he still couldn't figure out what the Thing was.

Soon, along came Wiggly Eel *(slurp!)*, who wriggled her skinny, slimy body over to the Thing. "Why, what's this?" she asked Grabby Crabby *(clackity clack!)*.

"I think it's a Thing," he answered. "What sort of a Thing?" questioned Wiggly Eel *(slurp!)*. "It's a Thing that doesn't belong here!" Grabby said.

While Wiggly Eel *(slurp!)* was twirling 'round and 'round the Thing, inspecting every inch of it, Terrapin, the Turtle With the Funny Name *(curl up)* happened by.



"Well, well, my good companions. What's this unfamiliar item?" the turtle queried. Terrapin was rather intelligent, even though he seemed sort of slow.

"We don't know. It's a Thing. But we don't know what kind of a Thing it is. Maybe you can figure it out," explained Grabby Crabby *(clackity clack!)*.

There was silence while the turtle pondered the Thing. "I am certain," he paused, "that this Thing is quite a Troublesome Thing. Yes that's it—it's a Troublesome Thing," said Terrapin, the Turtle With the Funny Name *(curl up)*.

"That doesn't help us at all." sighed Wiggly Eel *(slurp!)*.

"No, not one bit." added Grabby Crabby *(clackity clack!)*. At that, the indignant Terrapin, the Turtle With the Funny Name *(curl up)*, turned and lumbered off, for his feelings were truly hurt.

"Let's go find Musky!" suggested Grabby, "He's been all over this marsh, maybe he'll know what this Troublesome Thing is."

So the two swimmers headed off to find their experienced friend. When they came to a hole in the mucky mud bottom, Wiggly Eel *(slurp!)* put her head in the hole and called out, "Hello *(hello!)* in there. Is anyone home?"

"Yes, I'm here! No need to shout." came the response, and out popped a furry creature with a long skinny tail. It was Musky Muskrat, Who Gnaws On Things *(chewing sounds)*. Musky Muskrat was a mammal of the marsh, who built tunnels under the water and was very good at chopping down tall grasses with his big front teeth. The other water animals didn't mind that he was so hairy, because he was a good swimmer, and besides, he was awfully friendly.

"Musky, you must come and see! We've found a Troublesome Thing! It doesn't belong here, and we don't know where it came from!" began the eel.

"We don't even know what it is. And it's ugly," Grabby complained *(he was a crabby crab)*.

"My, my!" gasped Musky Muskrat, Who Gnaws On Things *(chewing sounds)*, whistling through his buck teeth.

"We thought that since you've gnawed on so many things, you could gnaw on this Thing, and tell us what it is." Grabby was beginning to get crabbier.

"You've got me all wrong, my friends. I don't gnaw on just any old Thing. No, no. I only gnaw on twigs and marsh grasses. If I gnawed on a strange Thing, I might break a tooth, and then where would I be? A muskrat without a tooth? Why that's the silliest thing I ever heard!" And with that, Musky Muskrat, Who Gnaws On Things *(chewing sounds)* dove back into his tunnel with a pop *(pop!)*.

"Silly he says. Humph!" said the eel. "The only one around here who's silly is Silly Goose *(honk! honk!)*"

"That's it!" the crab brightened. "It's been getting colder and winter is coming. I'll bet we can find Silly Goose *(honk! honk!)* eating grain in that field. She must be back from the North by now."

The two picked up their spirits and sped for the other edge of the marsh. When they reached some shallower water, Wiggly Eel *(slurp!)* stopped.

"Wait, Grabby! I can't go up on land. I won't be able to breathe."

"You stay in the water, then, Wiggly. I can climb up onto the ground for a little while. I'll find Silly Goose *(honk! honk!)* and meet you back at the Thing."

So while the eel waited in the cool shady water, the crab climbed cautiously out onto the muddy shore. His stalked eyes waved frantically all around him, ever alerted to danger. He stopped dead in his tracks when he heard the flapping wings of The Heron With the Long Legs *(squawk!)*. That big bird would surely gobble him up if he were seen. When the old bird had passed, Grabby Crabby *(clackity clack!)* continued on in search of the goose. When he found her, she was nibbling away at some leftover corn kernels.

"Hey, there, my little pinching friend. It's been a long time, has it not? How've you been? How's your end of the Bay? Was the summer awfully hot here?" Silly Goose *(honk! honk!)* often babbled until she had to be interrupted.

"Silly, I'm glad to have found you. There's a strange and troublesome Thing in our water! We don't like having it there. Please come and help us!" cried the frustrated crab.

"Of course, I will help you," mumbled the goose, who's mouth was still full of grain. She swallowed with a gulp *(gulp!)*. "Now what's all this about a Thing?"

"I bumped into it," explained Grabby, "because it was in my way. I've never seen it before. You've flown hundreds of miles and you've seen lots of things. I thought that maybe you could tell us what this Thing is, and where it came from."

"Well, now, let's see. When you bumped into the Thing, what sort of noise did it make?" asked Silly Goose *(honk! honk!)*. "Did it thump? Or did it clank?"

"I think it clanked," said the crab, trying to recall. "No, wait! It was more of a bang. Or was it a bong?"

"I'll bet I know." honked the goose, flapping excitedly. "Did it go like this: bagang! bong! *(bagang! bong!)* and did it ring for a bit?"

"Yes! You do know what kind of a Thing that is. I knew you could help!" Grabby wasn't so crabby any more.

"You won't be so excited when I tell you what it is. It's not a very nice Thing. It's a Thing that doesn't belong in our marsh, or even in the water at all. It's TRASH! *(gasp!!)* Something that a human probably threw away. Those humans don't think that it bothers us or hurts our homes to throw old, unwanted things in our marsh or even in the Bay. We can't let that Thing stay. Not for one more minute! If we let them put one Thing into our water, they'll keep on dumping more and more Things in, until there's no more room for us."

Comprehension questions (as a review before beginning Part II):

Why are the animals so upset about the Thing?

Do you think the marsh animals should do something about the Thing? What should they do?

Do you think that anyone else should do something about the Thing? (Who?)

What do you think will happen in the next part of the story?

Part 2

"Come on, then, Silly Goose *(honk! honk!)*, we've got to hurry back. The Thing has been there for a while, already!"

Grabby Crabby *(clackity clack!)* grabbed onto the goose as she headed for the runway, flapping as she ran so she could get up into the air. The crab, eyes tucked in tightly, held onto her tail feathers for dear life.

"Fly more to your left, Silly!" yelled Grabby over the noise of her flapping *(flap! flap! flap!)*. Grabby had dared to poke his eyes out of his shell just a little. "The Thing should be right over there."

As they flew frantically back over the marsh, they passed over Musky Muskrat, Who Gnaws On Things *(chewing sounds)*, who looked up from his chewing and waved.

"Where are you going?" Musky shouted up to them.

Silly Goose *(honk! honk!)* was too busy flapping to answer, and Grabby Crabby *(clackity clack!)* was too scared to bother. So the muskrat followed them from below, wondering if all the commotion was still about that silly Thing.

On his way, Musky Muskrat, Who Gnaws On Things *(chewing sounds)* nearly ran over Terrapin, the Turtle With the Funny Name *(curl up)*.

"Watch where you're going, Speedy!" grumbled the terrapin.

"I'm sorry, Terrapin, but I'm hurrying to see where Silly Goose *(honk! honk!)* and Grabby Crabby *(clackity clack!)* are going. I think it's about that Thing the crab found." explained Musky.

"Oh, that Thing is a Troublesome Thing, all right! I told them it was a Troublesome Thing. I'll come with you." And the worried terrapin climbed on Musky's back, because he knew that he could never keep up with the muskrat.

As the airborne pair came closer to the spot where the Thing had been found, Grabby directed his friend to land.

"Hold on tightly, then," instructed the goose, and she bent her wings and dropped in for a landing. The two came down on the water with a tremendous splash Silly Goose *(honk! honk!)* was so excited that she hadn't looked down before hitting the water.

"Hey! What do you think you're doing?" someone quacked from underneath the goose. "Why don't you watch where you're landing?" It was the Bald Headed Duck *(quack! quack!)*, who was more than a bit annoyed.

"Excuse us," began Grabby, "but we were hurrying to the Thing. We want to get it out of our marsh."

Just then, Musky and Terrapin swam up to the group. "Is that Thing still troubling you?" asked Musky, panting.

"Still troubling us? Still troubling us?" babbled Silly Goose *(honk! honk!)*. "Why, it should bother you, too. This marsh is your home. Do you want it polluted with trash and other Things?"

"Of course not! I hadn't thought of that before," said Musky.

"I never wanted it here," Terrapin chimed in, "it's a Troublesome Thing."

"What are we waiting for?" asked the Bald Headed Duck *(quack! quack!)*. "If it's so troublesome let's go and get rid of it." So Grabby Crabby *(clackity clack!)* led the way, with Silly Goose *(honk! honk!)* next in line. Musky Muskrat, Who Gnaws On Things *(chewing sounds)* came next, and then the Bald Headed Duck *(quack! quack!)*, who was still a little dizzy. Floppity Fishes *(flip! flop!)* were curious and came along, and trailing behind came Terrapin, the Turtle With the Funny Name *(curl up)*.

When they reached Wiggly Eel *(slurp!)*, who was waiting for them, Grabby looked around, but couldn't find the Thing.

"What happened to the Thing?" asked the crab.

"You won't believe it," said the eel. "Come with me and you'll find out." So Wiggly squirmed off, with the others following behind her.

Soon, they came upon Clapping Clam, Who Can't Come Out of His Shell *(clap)*. "Clapping Clam can tell you why the Thing isn't here," announced the eel.

"But why are you here, Clapping Clam?" asked the Bald Headed Duck *(quack! quack!)*. "You belong out in the Bay, not here in the marsh."

"I'm convinced," claimed the clam, "that it was quite a close call. I was snatched from the Bay by a big old gull. He was about to gobble me up! But I'm smarter than that bird. I saw some trash down here in the water, and I know how those gulls love trash! So I said, 'Listen, you gull, why eat me? I'm only a small snack. Look down there. There's a big hunk of trash. What a clever trade it would be, to exchange little me for all that wonderful trash!' And wouldn't you know, that stupid bird fell for it. He dropped me right away and swooped down and plucked that Thing right out of the water!"

"That was awfully lucky! But where do you think that gull will go with the Thing? He'll soon find out that he can't really eat it!" said the Bald Headed Duck *(quack! quack!).*

"Don't worry about that," laughed Clapping Clam, Who Can't Come Out of His Shell *(clap)*, "he was headed right for the dump. He'll probably leave it there, he knows where trash belongs!"

"I wish people knew where to put their trash. Then we wouldn't have to worry about it messing up our home!" said Musky Muskrat, Who Gnaws On Things *(chewing sounds).*

And the group, relieved, but still looking a little worried, began to split up and go about their business again.

"Hey, Clam," called the goose, "I'll give you a ride back to the Bay. I've got to catch up with the other geese out in the field." Silly Goose *(honk! honk!)* picked up the little clam and flew away, waving goodbye to her other friends *(wave)* . . .

As they took off, they saw the Heron With the Long Legs *(squawk!)* flapping over the marsh. And off in the distance was the silhouette of the Silent and Majestic Eagle, *("soar" silently),* still patrolling the scene.

The End

Comprehension Questions:

How would you feel if someone dumped trash in your bedroom?

How did the animals feel about having the Thing in their home?

What would happen to the marsh if many more Things were put there?

The animals were lucky that the Thing was taken away. Do you think that this is what usually happens to trash?

The animals in this story stuck together when there was trouble. Discuss ways that people could stick together to keep the water clean for the animals.

Chesapeake Bay Organizations and Agencies

Federal Agencies

U.S. Fish and Wildlife Service
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401
410/573 4500 www.fws.gov/r5cbfo

Environmental Protection Agency
Chesapeake Bay Program Office
410 Severn Avenue, Suite 109
Annapolis, MD 21403
410/267 5700
1 800/YOUR BAY www.chesapeakebay.net

National Oceanic and Atmospheric Administration
Chesapeake Bay Office
410 Severn Avenue, Suite 107
Annapolis, MD 21403
410/267 5660 noaa.chesapeakebay.net

State Agencies

Maryland Department of the Environment
2500 Broening Highway
Baltimore, MD 21224
410/631 3000 www.mde.state.md.us

Maryland Department of Natural Resources
Tawes State Office Building
580 Taylor Avenue
Annapolis, MD 21401
410/260 8019 www.dnr.state.md.us

Pennsylvania Bay Education Office/PACD
4999 Jonestown Road, Ste. 203
Harrisburg, PA 17109
717/545 8878 www.dep.state.pa.us/pacd/pacd.htm

Pennsylvania Department of Environmental Protection
400 Market Street
Harrisburg, PA 17105
717/787 2814 www.dep.state.pa.us

Virginia Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240
804/698 4000 www.deq.state.va.us

Virginia Department of Game and Inland Fisheries
4010 West Broad Street
Richmond, VA 23230
804/367 1000 www.dgif.state.va.us

Other Organizations

Alliance for the Chesapeake Bay, Maryland Office
6600 York Road, Suite 100
Baltimore, MD 21212
410/377 6270 www.alliancechesbay.org

Alliance for the Chesapeake Bay, Pennsylvania Office
600 Second Street, Suite 300B
Harrisburg, PA 17101
717/236 8825

Alliance for the Chesapeake Bay, Virginia Office
P.O. Box 1981
Richmond, VA 23218
804/775 0951

Chesapeake Bay Foundation
162 Prince George Street
Annapolis, MD 21401
410/268 8816 www.cbf.org

Chesapeake Bay Trust
60 West Street, Suite 200A
Annapolis, MD 21401
410/974 2941 www.chesapeakebaytrust.org

National Aquarium in Baltimore
501 E. Pratt Street, Pier 3
Baltimore, MD 21202
410/576 3800 www.aqua.org

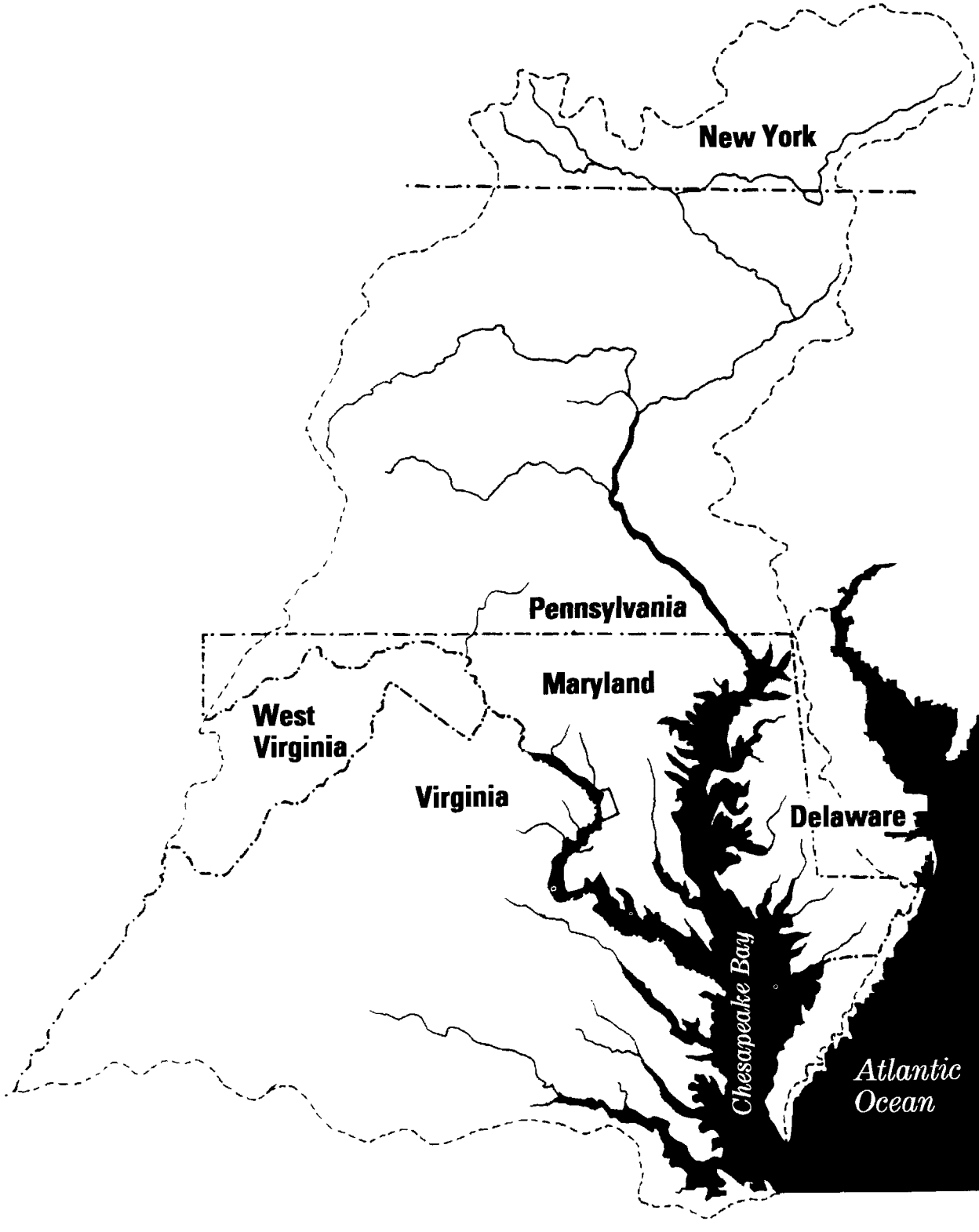
Save Our Streams
761 Aquahart Road, Suite 100
Glen Burnie, MD 21061
410/766 9443 www.saveourstreams.org

The Chesapeake Bay Watershed

A vast network of rivers and streams drains 64,000 square miles of land, meanders across six state boundaries, and pours billions of gallons of fresh water into Chesapeake Bay daily. This fresh water, carrying essential minerals and nutrients, mixes with salty ocean water to form an estuary with ideal conditions for an abundance of plant and animal life. This huge drainage basin or watershed is home to nearly 16 million people and several thousand species of animals. The watershed encompasses a diverse landscape stretching from the Appalachian mountains, through the rolling hills of the Piedmont region, to the flat coastal plain of the Delmarva Peninsula.

As the water winds its way through the landscape, it may pick up pollutants that will affect life in Chesapeake Bay. Rain carries soil, excess nutrients, including fertilizers, and other pollutants from streets, lawns, construction sites, and farm fields into the streams and rivers, and eventually into the Bay. Aquatic life, including oysters and submerged aquatic vegetation, is sensitive to the effects of excess soil and nutrients. Impacts to these vital species upset the natural balance of the Bay.

During the past decade, citizens, private groups, businesses and government agencies have intensified efforts to restore the Bay. Now, more than ever, people realize that what they do on the land directly affects life in the Chesapeake. In order to protect and restore the Bay, all of us living in the watershed need to become better stewards of the land.


New York
Pennsylvania
Maryland
West Virginia
Virginia
Delaware
Chesapeake Bay
Atlantic Ocean

Chesapeake Bay Program

A Watershed Partnership

410 Severn Avenue
Suite 109
Annapolis, Maryland 21403
1-800-YOUR BAY

www.chesapeakebay.net