On behalf of the United States Fish and Wildlife Service and the United States Environmental Protection Agency's National Estuary Program, thank you for showing an interest in the quality of our environment. Public education and involvement will play an important role in restoring fish and wildlife, and their respective habitats in and around our estuary. This packet contains information sheets with activities that present important issues relating to the area. The goal of this information is to develop an awareness of the problems, the skills, and the commitment needed to make responsible decisions that will enhance the productivity of our estuary. We hope you will utilize this material in your school, club, or organization. Thank you for all you are doing. Together, we can make a difference.

EPA

Household Hazardous Waste

ACTIVITY DESCRIPTION:

Many common household substances are toxic to the aquatic environment.

OBJECTIVE:

- ***The user will become aware that households as well as industries are responsible for our toxic contamination problems.***
- ***An excersise will help the user recognize toxic household substances.***

AGE GROUP:

Elementary through adult.

MATERIALS:

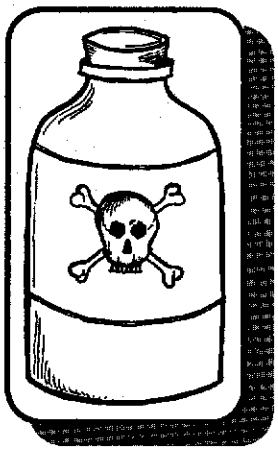
colored circle stickers (red, orange, blue and green)

REFERENCES:

- ***The Alliance for the Chesapeake Bay's "Baybook"***
- ***Chesapeake Bay Foundation's "Homeowner Series: Guide to Household Hazardous Waste"***
- ***Adapted from Long Island Sound Study fact sheet #10 "Toxic Contamination in Long Island Sound" by the Connecticut Sea Grant Marine Advisory Program and the New York Sea Grant Extension Program.***

Introduction:

Every time we open the newspaper or watch the evening news, we find out about yet another toxic waste site which is polluting the environment and endangering humans and wildlife. But there are hidden hazardous chemical sites which never make the news. You may even have one in your garage, under your sink, or in your bathroom!



Common household products often contain chemical ingredients that are potentially harmful to you and are a threat to our estuary. Sound environmental behavior starts with recognizing toxic materials in home products, limiting their use, and finding safer alternatives.

Down the Drain?

Materials poured down drains or flushed down toilets are carried to your septic system or a sewage treatment plant (STP). Neither is designed to completely remove toxic chemicals from wastewater.

Hazardous materials poured down stormdrains, or even spread on the land can enter local waters and our estuary. Pesticides and fertilizers used on plants and lawns, oil, road salt, and other pollutants can be washed into storm drains and creeks. The toxic materials carried in this water can harm aquatic life.

In the Trash?

Our troubles with hazardous materials don't end when we dispose of them in the trash can. If your community uses an incinerator, toxic fumes can be released when certain chemicals are burned. If your waste goes to a landfill, hazardous materials could leach into the soil. These may contaminate bodies of water if they wash into creeks or seep into aquifers.

The regulations concerning household hazardous waste are few and sketchy. It is up to us to clean up our own wastes. Hazardous chemicals in our households will poison our environment and us if we do not take precautions in their use and disposal.

There's a Toxic Dump Under the Sink!

Examples of Hazardous Substances:

Kitchen: Cleaners for oven, drain, floor; furniture polish.

Bathroom: Cleansers, medicine, nail polish remover.

Garage: Used motor oil, antifreeze, car wax, rat poison.

Workshop: Thinner, varnish, glue, rust remover.

Use the Least Toxic Product

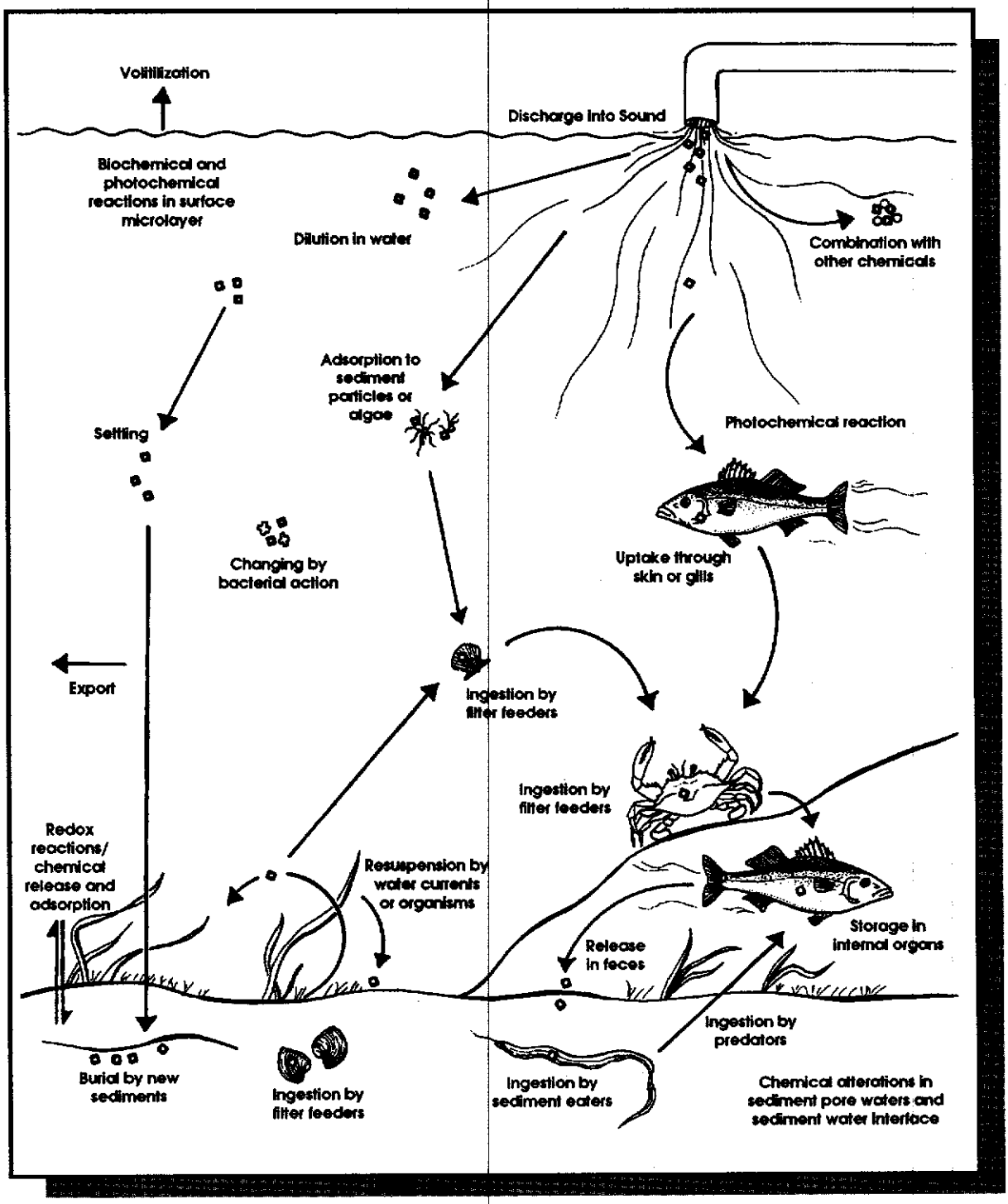
We can often get by with a less harmful product. For example, a combination of lemon oil and linseed oil can replace furniture polish. Buy only what you need of a chemical, store it in its original container, and read the label. Know what you are buying, how to use it, and what the potential hazards are.

Dispose of Wastes Carefully

Never pour hazardous wastes down the drain, on the ground, or into gutters. The best way to dispose of your household toxins is at a Hazardous Household Waste Collection Day. Call your county to see if one is scheduled or contact an expert with your state or county government.

What toxic chemicals do you have in your home?

Label the red stickers as "hazardous", the orange stickers as "toxic", the green stickers as "friendly", and the blue stickers as "safe." Go through all of your household chemicals and read the ingredient labels and warnings. Place the appropriate sticker on each container. Note that the red and orange sticker containers require special handling. Any product listing strong warnings against contact with skin or eyes must be labeled with a red or orange sticker. "Friendly" materials are those that have no special handling and can be safely used at all times. The blue sticker, "safe" materials are safely used if you follow the instructions. "Safe" materials may have warnings about ingestion or inhalation of the product.



Fate of Chemicals in Long Island Sound

Illustrations by Sandra Koch

Hypoxia

ACTIVITY DESCRIPTION:
Hypoxia has become a major problem in our estuary

OBJECTIVE:
To take the user's understanding of nutrification a step further and to examine the effects of nutrification in a demonstration.

AGE GROUP:
Elementary through adult.

MATERIALS:
- ***9 garden seeds (corn, peas, or beans)***
- ***3 six inch plant pots or other growing pot***
- ***sterile potting soil***
- ***liquid fertilizer mixed in two concentrations - (1) according to directions and (2) double strength***

REFERENCES:
Adapted from the Long Island Sound Study Status Report and Interim Actions for Hypoxia Management, 1990, by the Connecticut Sea Grant Marine Advisory Program and the New York Sea Grant Extension Program.

Introduction:

Hypoxia is the scientific term for low dissolved oxygen levels in the water. Generally, 3 parts per million (ppm) is considered to be the lowest dissolved oxygen level that can sustain marine life. When dissolved oxygen levels drop below this, hypoxia exists and marine organisms may become sick, die, or move to areas with more oxygen.

Hypoxia can occur naturally in the summer when the water stratifies, or forms distinct layers. Oxygen is added to the surface waters by wave action, but it is unable to mix into the lower levels of the water column. In the fall, the conditions change so that oxygen is restored to the deep water.

In recent years hypoxia has become so severe that there appears to be cause for concern. Surveys on marine life have resulted in **no fish** being found in any of the samples. Of the bottom samples, 80% of the bottom dwelling invertebrates such as starfish and crabs were dead.

Hypoxia periods coincide with algae "blooms"--situations where floating algae are so abundant that they color the water surface a deep red-brown. Natural algae blooms are short lived because they use up the nutrient resources around them and consequently die. However, in our estuary, nearly a billion gallons of treated sewage are discharged into the water daily, renewing the nutrients. The millions of tiny plants that die each day sink into the bottom waters and decompose. Decomposition uses up oxygen and creates the severe hypoxia.

Human-made sources of nutrients to our estuary exceed natural inputs of nutrients. In fact, 56% of nitrogen loading is "unnatural." Human waste from sewage treatment plants and septic systems, increased runoff resulting from land development in the watershed, and over-fertilization of lawns and agricultural fields all contribute to elevated levels of nutrients in the system. Identifying the source of nutrient enrichment has lead to a "**no net increase**" **policy** on nitrogen input. Nitrogen is the nutrient fueling the algae blooms, and over half of that nitrogen originates from point source pollution. Holding nitrogen input to current levels will stem the increase of hypoxia. Non-point source pollution contributes to the nitrogen loading, as well. This is harder to control, but attempts are being made to curb this source of nutrients.

Combined sewage systems are a point source for nitrogen loading. The redesign and restructuring of these systems are major public works projects, involving massive allocations of money, long construction periods, and inconvenient disruptions in service. Nonetheless, efforts are ongoing for the better operation of sewage treatment plants and stricter enforcement of laws regulating discharge.

Non-point Source Pollution...You can help!

Non-point sources of nitrogen are difficult to identify and to manage. They are often caused by individuals rather than industries and that is why everyone in our watershed can help to lower non-point sources of nitrogen loading.

Limit the use of chemical fertilizers on your lawn and garden. Decrease run-off from your lawn and yard by planting native

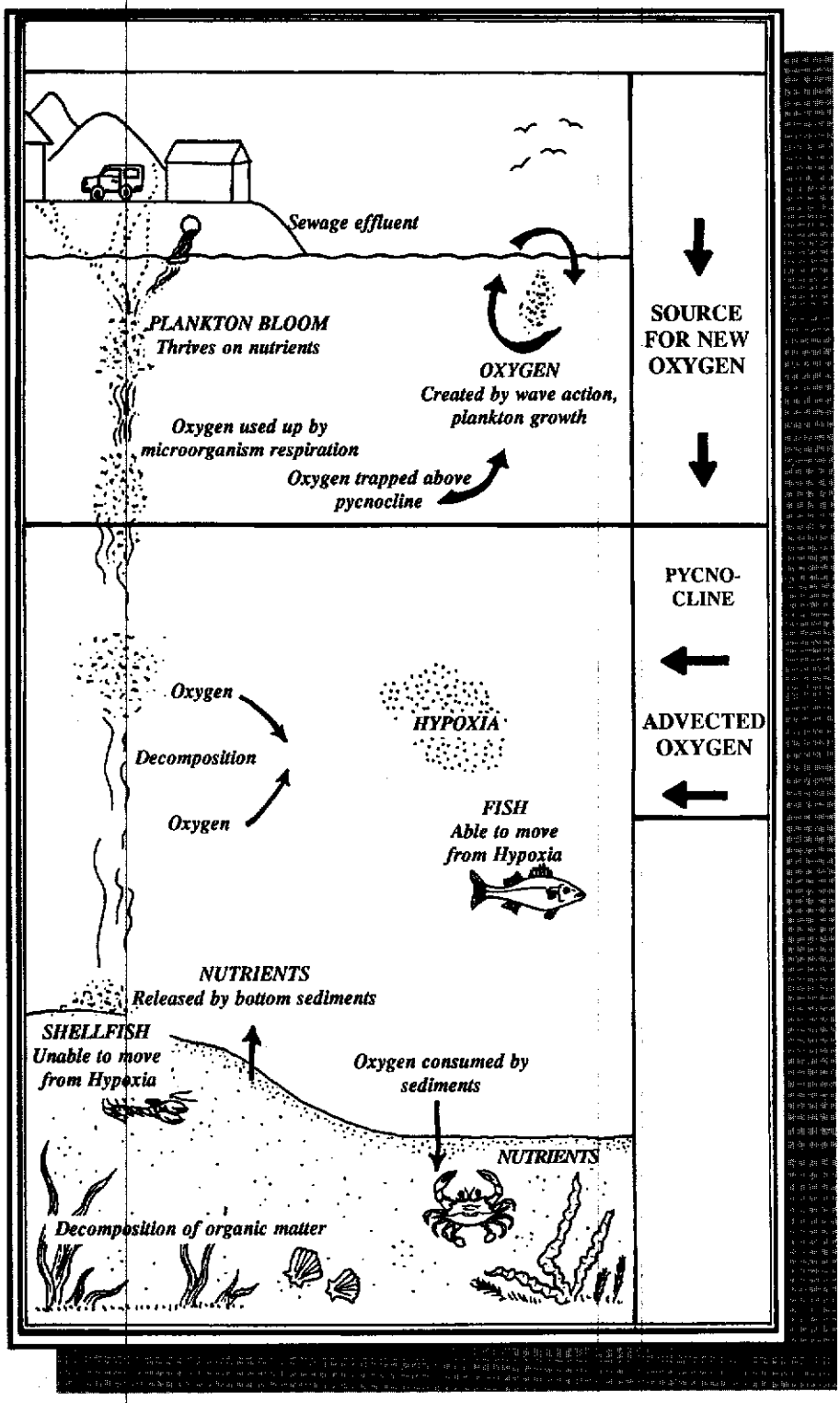
plants that hold soil and nutrients in place and do well in your area without heavy fertilizing and extra care.

Faulty septic systems can increase the input of nutrients into our estuary. What goes into your septic tank eventually comes out of it in one form or another. Make sure that septic systems are working at maximum efficiency. Monitor your septic system and have it pumped every three years. Do not poison your septic system by adding harsh chemicals to your waste water. Use soaps, particularly laundry soap, that is quickly biodegradable. Some advertized biodegradable soaps take two years to degrade! During that time the soap is reacting with paper to create a gummy froth that can damage the septic field.

Be an advocate! Support efforts by your community to upgrade waste treatment facilities.

Do nutrients really make a difference?

Plant three seeds in each of three pots. Label the pots as (1) "fertilized", (2) "2X fertilized", and (3) "control". Water pot #1 with the fertilizer mixed in water according to directions. Water pot #2 with a double dose of fertilizer mixed in water. Water pot #3 with plain water. Keep the soil moist and warm until the plants appear. Make sure that you fertilize the plants at least weekly. After the plants are several inches tall, measure them to see which plants are growing the fastest. You may wish to continue the experiment and measure the plants several times over a few weeks.



This activity works best if each student has three pots. The larger sample size will make up for experimental error. If you are near a freshwater tributary, add a fourth pot to the experiment and water it with tributary water. How do the plants in the fourth pot compare to the other plants?

Illustrations y Sandra Koch

Clean Water: *A PRECIOUS RESOURCE*

ACTIVITY DESCRIPTION:
An overnight assignment to record the amount of water you use.

OBJECTIVE:
To learn why water conservation is important.

AGE GROUP:
Grades 6-8

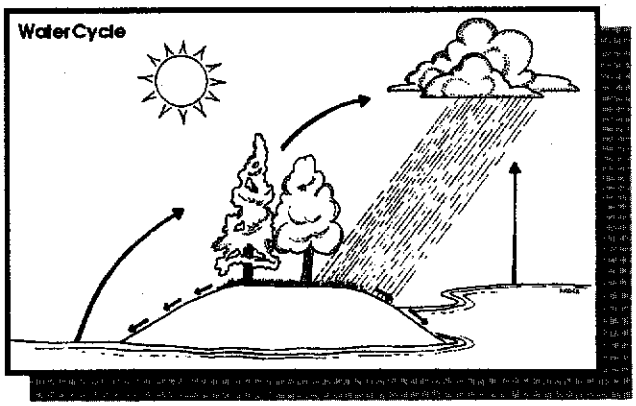
MATERIALS:
2 clean gallon jugs (i.e., milk jugs) per student (available at home)

Introduction:

Do you ever think about how much water you use? 183 gallons are treated every day for each person in the United States. We all need water to carry on our daily functions. We must remember that the water we use every day is the same water that many people reuse to drink, cook with, and bathe. It is also the same water in which we fish and swim as it reaches our estuary.

People and Water - It Adds Up

- A toilet flushes 5 gallons
- A dishwasher uses 16.5 gallons
- A bath uses 30-50 gallons
- A shower uses 5-10 gallons/ minute
- Washing clothes uses 40-60 gallons (permanent press uses 12-18 more gallons)



Water, Water Everywhere?

People today use much more water than they did in times past. Did you know the amount of water in the world today is the same as it was billions of years ago? While from a spaceship, our Earth looks like it is mostly water, only one percent of all water is freshwater we can use. Cities, industry, and agriculture have huge water demands. Our streams and rivers have limited amounts of water during dry weather. Some of our streams contain mostly treated sewage. Since these streams are home for wildlife and we use them to fish and swim, cleaning wastewater before it reenters our streams and rivers is of vital importance.

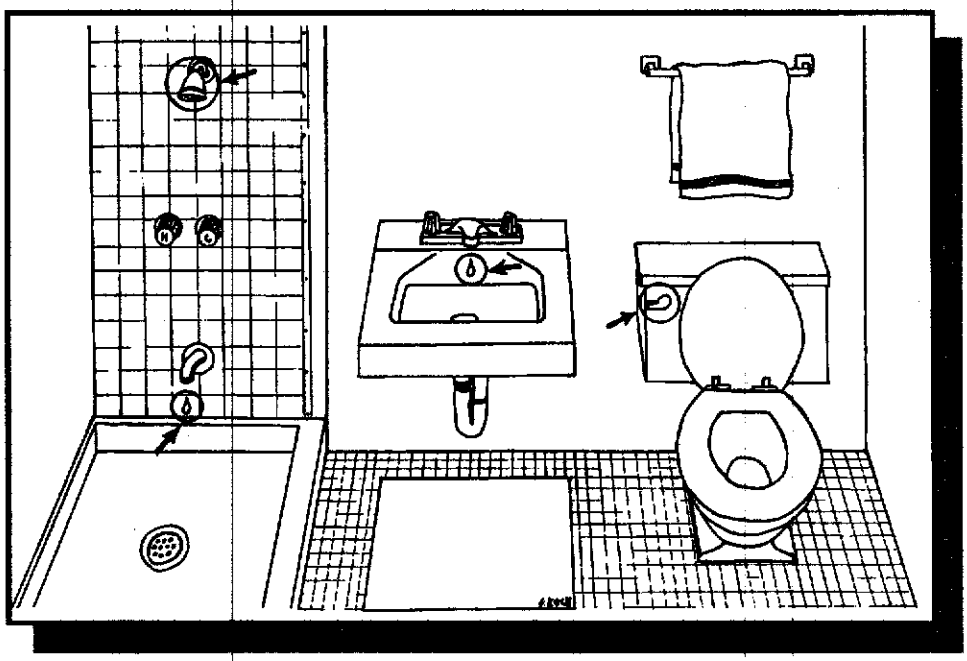
Wastewater Treatment

For those of us living in a town, whenever we turn on a faucet or flush a toilet, we send water to a sewage (wastewater) treatment plant. A well-engineered wastewater treatment plant that is not overloaded does an excellent job of cleaning wastewater. It is important to think about what you pour down the drain because wastewater treatment plants cannot take out all harmful things. Examples include paint products, solvents, or gasoline.

Human waste is also a big problem. Some homes use septic systems to handle their sewage. But if the septic tank is not cared for, it can overflow with nutrient-rich sewage. In more populated areas, human waste is treated at sewage treatment plants to produce clean water. Some sewage treatment plants clean the water well before returning it to our rivers, but some do not. These rivers, often containing nutrients, eventually flow into our estuary.

Clean Water = Clean Estuary

With so many people using water, some treatment plants have become overloaded. So much water is coming into these plants that it cannot be adequately cleaned. Remember, everything you pour down the drain goes to your septic system or a wastewater treatment plant, which may not be able to take out all of the harmful things. As a result, the water that enters our estuary is not clean and can even be unhealthy.



Why Conserve Water?

As droughts of past years have demonstrated, our water supply is not limitless. In many areas, water is difficult to obtain. And as pointed out above, wasted water is wastewater, which must be treated at no small expense. One solution is to build more treatment plants. But this is very costly and does not get at the root of the problem. Instead, we must be more careful with our precious resource. By conserving water, using it wisely, and not polluting it, we can ensure a safe and adequate supply for the future.

Every Drop Counts! How Much Water Do You Use?

We live in a country where finding clean water is not a daily difficulty. But this often leads us to take water for granted. To make you more aware of your water use habits, try this activity for an evening.

Fill two clean gallon jugs with water. This is your allowance for the night. Whenever you brush your teeth, drink a glass of water, or wash your hands, use only water from your jugs. Keep track of other uses as well--remember that flushing a toilet uses five gallons!

What do you think? Did this activity change how you use water? In what ways? How much water do you think you use in a regular day? Where can you cut back and save water?

Water Conservation Around Your Home

By using less water yourself and helping others eliminate wasteful water practices, you can reduce the amount of water that must be treated by wastewater plants. This, in turn, will reduce water pollution and help restore our estuary.

Water Tips

- Don't let water run when you are brushing your teeth or washing dishes.
- Place a plastic jug filled with water in the toilet tank to reduce the amount of water flushed.
- Take a quick shower instead of a long bath.
- Make sure leaky faucets are repaired in your home and school. A steady drip can waste 20 gallons or more each day.
- Use the dishwasher and clothes washer only when they are full.
- While waiting for tap water to warm up, collect the cold water that flows and use it to water plants.

Illustrations by Sandra Koch

Fish Need Nurseries Too!

ACTIVITY DESCRIPTION:

Learn basic biology of several types of coastal fish and why nursery areas are important.

OBJECTIVE:

- ***To learn about the life cycles of several types of coastal fish (spot, croaker, flounder, and menhaden).***
- ***To learn what a nursery area is and why it is important.***
- ***To exercise skills in science, language arts, and art.***

AGE GROUP:

Grades 1-6

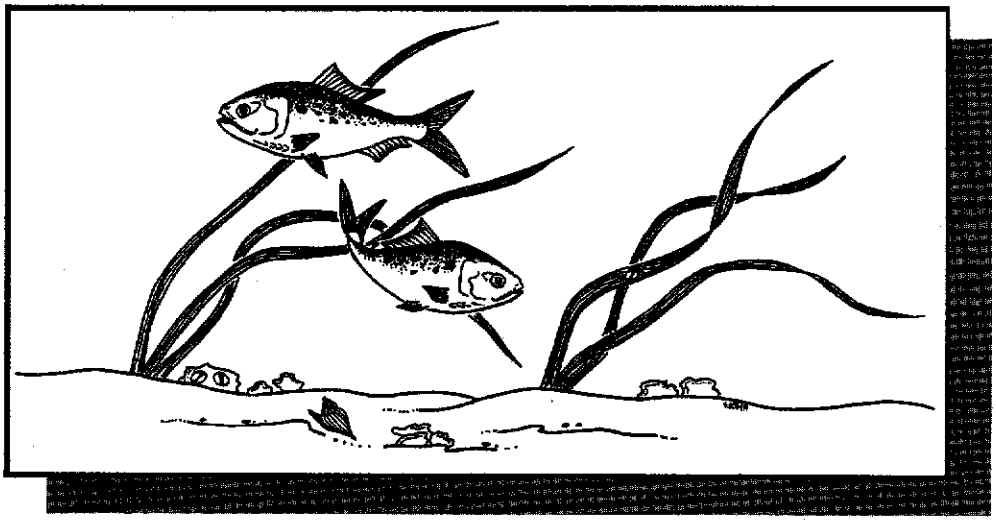
MATERIALS:

- *Paper*
- *Crayons or colored pencils*

Introduction:

Fish are many things to many people. Some types of fish are important sources of food. Commercial fishermen and tourist-related businesses depend on fish. Most of us enjoy thinking that our estuary and ocean are full of fish, even if we do not enjoy fishing or depend on fish for our jobs. Because fish are so important, we should learn about them so that our activities will not harm them.

Several common types of fish including flounder, spot, croaker, and menhaden depend on nursery areas within our estuaries and rivers. These are places for tiny young fish and shellfish to mature and grow before they are large enough to be caught or have families of their own.



During the cold winter months, flounder, spot, croaker, and menhaden travel in the ocean toward the Gulf Stream. The Gulf Stream is a large current of clear, warm water flowing up from the tropics. It is located approximately 25 to 50 miles off the North Carolina coast. Near the Gulf Stream, during the coldest time of year, the adult fish lay their eggs. The eggs are fertilized and drift in the ocean where they hatch. The ocean is like a big delivery room--much like a delivery room in a hospital, where you were probably born. After you were born, you were taken to a nursery. Currents take these tiny fish toward the coast where they travel through inlets in the outer banks such as Oregon Inlet, Hatteras Inlet, and Ocracoke Inlet.

After entering the sounds the tiny fish travel with the currents to coastal streams, rivers, bays, and grass beds. These places are called nursery areas because tiny fish and shrimp stay there while they are very young. Food and shelter are plentiful in these areas. They live in the nursery areas during the late winter, spring and early summer and grow very quickly. These nursery areas are filled with the food young fish need to grow and prosper.

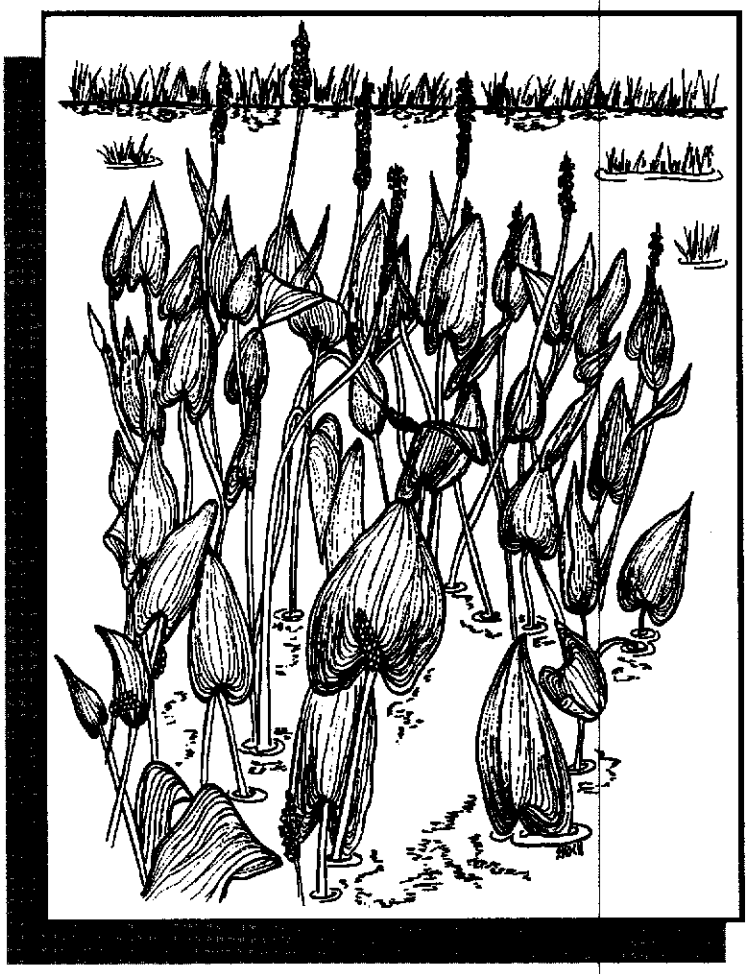
From mid-summer to fall, the partially grown fish and fully grown shrimp leave the nursery areas and enter the open sounds and the ocean.

It is important to protect these nursery areas for fish and shrimp living in our estuary and ocean. Several things we can all do to help include:

• Respect grass beds by not running your boat through them, which may damage their stems and leaves. These areas provide shelter and food for the young fish and shrimp.

• If you live on a sound or river, leave the edge of your yard in natural vegetation.

• Encourage farmers in your area to: use water control structures in their ditches; leave natural areas adjacent to streams and rivers; and use grassed terraces.



• If you live in a town, visit your sewage treatment plant and look at the treated wastewater as it is discharged into the river or stream. Is it clear? Does it smell? Do you think your town is being a good neighbor to those of us that fish and swim? Some wastewater treatment plants do excellent jobs of cleaning wastewater and some do very poor jobs.

Activity Text:

Have the children close their eyes, sit back in their chairs, and relax.

Slowly read the following:

Breath deeply and imagine that you are a tiny fish. Pretend the air you are breathing is cool, clear water going through your gills. Wiggle your feet and imagine they are fins. Slowly move your arms up and down, up and down; now your arms are fins. You can swim but you don't have to because you are in a deep sea of clear, blue ocean water. The current is gently taking you towards the coast. The water is filled with tiny, beautiful fish just like you, all moving together. Imagine the gentle rocking of the waves as you approach the coastline and the sandy white beaches near the inlets. Imagine looking up—it's night and you can see a million twinkling stars and a bright full moon. The waves are still rocking you gently. The current slows and you see even more beautiful little fish. Some of them are a little larger than you. You are in a grass bed full of food, and you are glad because you are hungry from having traveled so far. You have reached the nursery area. Wiggle your fins and pretend they are turning back into feet and arms. Breath deeply and imagine your gills are turning back into lungs. Slowly open your eyes. Think about what you saw and how you felt during your journey. Draw a picture of what you saw along the way. Explain to the class what each part of your drawing represents.

Illustrations by Sandra Koch

Muddy Rivers, Murky Sound

ACTIVITY DESCRIPTION:

Observe the erosion and sedimentation process, how it disrupts stream life, and one method to prevent it.

OBJECTIVE:

- ***To gain an understanding of what erosion and sedimentation are.***
- ***To learn why excessive erosion and sedimentation are harmful to fish and wildlife.***
- ***To learn ways to prevent erosion and sedimentation around our homes and communities.***
- ***To sharpen skills in science and language arts.***

AGE GROUP:

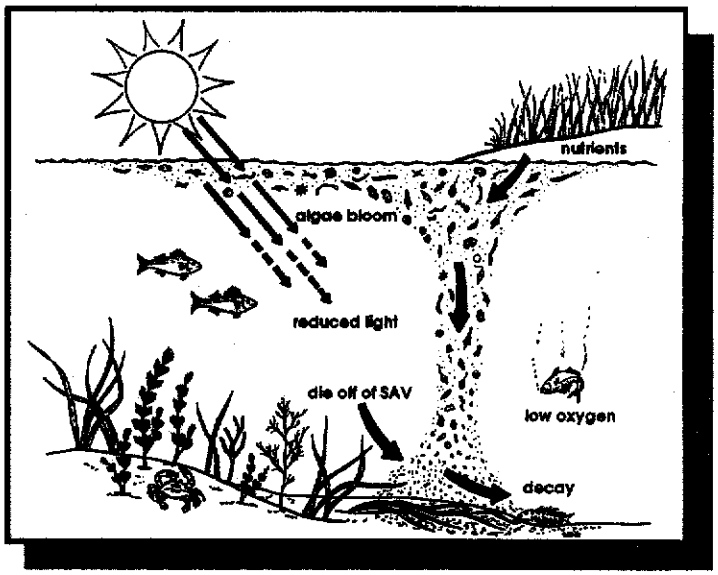
Grades 6-8

MATERIALS:

- ***One or two large pans approximately 3 feet long, and 6 inches deep; the width can vary***
- ***Enough fine sand to fill 1/2 of the pan to a depth of 2-3 inches***
- ***Several large dixie cups***
- ***A gallon milk container filled with water***
- ***A carpet section as wide as the pan and 4 inches long, or a similar-sized block of grass with the roots and soil attached (turf)***

Introduction:

Erosion and sedimentation are natural processes. However, due to man's activities these processes have increased and degraded the quality of water in our streams for fish and wildlife. The purpose of this activity is to illustrate that erosion problems can be easily solved.



Erosion and Sedimentation

The impact of water on land often changes the landscape. Rain, stream currents, and wind-swept waves wear away sediment (small particles of soil and other matter) from the land in a process called erosion. The sediment is then carried further away, and often deposited at the mouths of rivers or other areas where water flow is slower. This natural process is called sedimentation. However, human actions which remove natural vegetation (construction and development of land, and poor farming practices) increase erosion and sedimentation in our waterways. In this way, the land is lost in some places and gained in others.

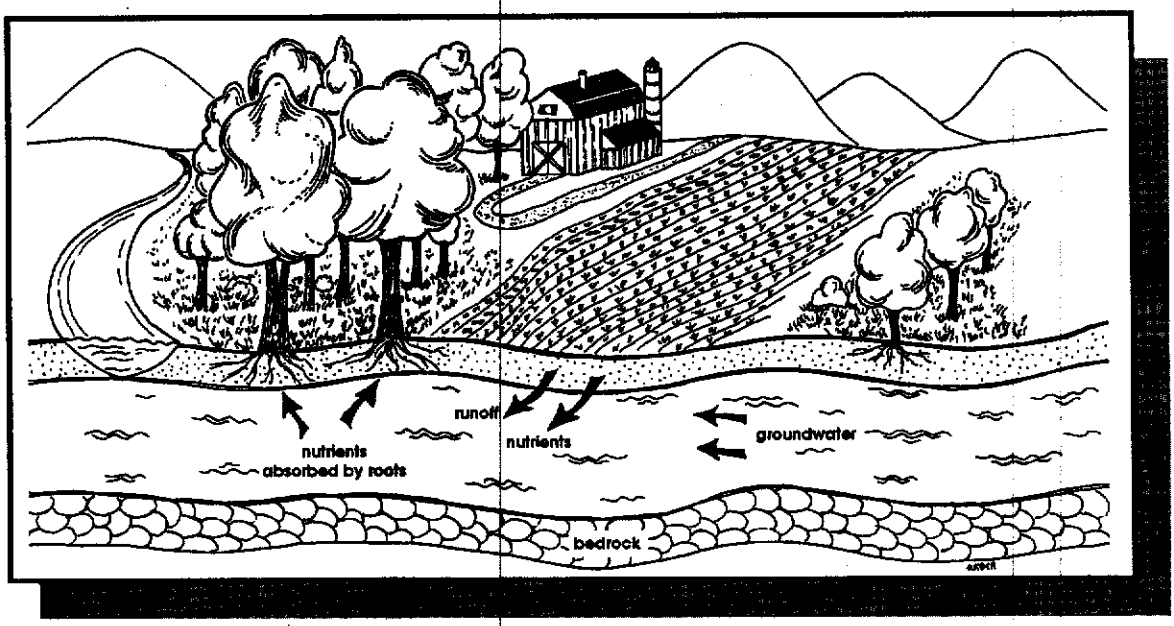
Sediments and Toxic Chemicals

Sediment particles can carry chemicals on their surface, much like a dog with burs caught in its fur. These chemicals can be nutrients, organic materials or metals. Scientists are particularly worried about the toxic materials that are trapped by sediments. A toxin is a substance that can cause cancer or other harmful health effects. These chemicals can accumulate to dangerous levels and harm fish and wildlife. Bottom dwelling animals can become contaminated or killed when exposed to chemicals such as dioxin and heavy metals like arsenic and lead.

Cloudy Water, Choking Sediments

Sediments also harm aquatic life by clouding the water and covering the bottom. Submerged aquatic vegetation (SAV) must have light to survive. Sediments suspended in the water prevent light from reaching the plants. When the flow of the water slows, the sediments begin to settle to the bottom of our rivers. They can bury underwater plants, smother fish eggs, and suffocate clams, oysters, and other bottom dwellers.

The bottoms of rivers are covered by mud patches, rocks, logs, plants, and shells which allow many different types of animals to live in our streams. If silt covers the different structures, the bottom becomes one continuous mud patch, and animals living on anything other than mud will no longer have a home. For a river to be healthy, it must have many different types of animals living in it--much like our



towns must have many different types of people living in them.

Preventing The Problem

Erosion and sedimentation are natural processes, but today they often occur at unnaturally high rates. Bare soil is more exposed to the erosive forces of water than vegetated areas, much like your skin is exposed to cold on a windy, winter day without a coat. This loss of soil harms landowners, farmers, and our estuary. Excessive erosion can be prevented. Trees and plants growing along the sides of streams are beneficial in several ways. First, the plant stems and fallen leaves slow the flow of water and prevent it from easily washing away soil particles. The plant roots hold soil together. Finally, the plants absorb some chemicals and nutrients which can harm aquatic life while changing others to harmless forms. Both farmers and landowners can reduce erosion by simply allowing natural vegetation to grow in areas bordering rivers and streams. Most construction projects are required to control sediments. They use devices such as hay bales and filter cloth. Some towns are building stormwater detention ponds to prevent sediments from entering our waters. Rainwater is directed into these ponds where the flow slows. Here sediments and harmful chemicals settle out and the cleaner water is slowly released into our rivers. Many other ideas to prevent erosion are available in a booklet entitled "Sound Advice" available from WRAL-TV, Raleigh, NC. Erosion and sedimentation are problems that we can all help eliminate.

Activity:

Cover the bottom of one-half of a pan with a layer of sand two-three inches deep. Prop the filled end of the pan five inches in the air, creating a downhill slope. Punch five holes in the bottom of a large dixie cup. Hold the cup above one end of the pan. Pour water into the cup to simulate rain. Use at least 1/2 gallon of water. Watch how the water travels down the pan. Does the water erode the sand? Notice how the sand now covers the bottom of the lower section of the pan. What would happen to things living on the bottom in that end? To experiment with different rainstorms, vary the number and size of the holes in the cup, and the amount of water used.

Now cover the bottom of 1/3 of the pan with a layer of sand two-three inches deep. In the next section of the pan place a piece of turf or carpet to simulate a vegetated stream border. Add water as in the previous experiment. Does the "border" trap the sand? Do you think having grass borders near our waterways would help prevent sedimentation? Many communities are establishing parks along their streams. These parks are called **greenways**. They offer excellent recreational opportunities for people, such as bike paths, trails, and playgrounds. Can you think of any benefits they provide for for fish and wildlife?

Illustrations by Sandra Koch

Ducks & Geese

ACTIVITY DESCRIPTION:

A simulation of the effects of loss of nesting and wintering habitats on waterfowl.

OBJECTIVE:

- ***To gain an appreciation of the beauty and economic value of waterfowl.***
- ***To identify limiting factors (problems) affecting migrating waterfowl.***
- ***To learn ways to help waterfowl.***
- ***To exercise skills in science, social studies, and physical education.***

AGE GROUP:

Grades 6-8

MATERIALS:

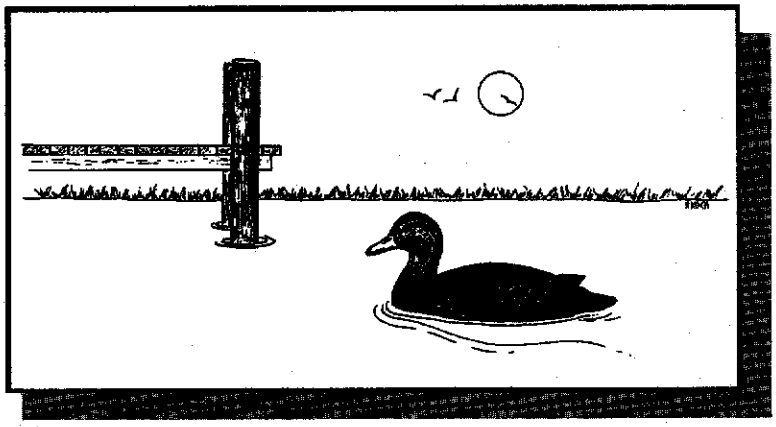
- ***Large room or field 70-90 feet long***
- ***Paper plates or carpet samples--enough for every three participants to have two (2) of either***

REFERENCES:

The activity was adapted with permission from "Migration Headache" in Aquatic Project WILD. Copyright 1983, 1985 Western Regional Environmental Education Council.

Introduction:

When the explorers from Europe first set foot upon the continent of North America, the skies and marshes were filled with millions of ducks and geese which the Indians hunted regularly. Even today, many people in our area enjoy watching ducks raise their young in a pond or look forward to fall when they can travel to estuarine and coastal marshes to hunt or watch ducks, geese, and swans. Even those who do not often see waterfowl like to know they are out there, somewhere, following their ancient migrational paths from north to south and back again.



Unfortunately, in our modern world this precious natural heritage needs our help to survive and flourish. Numbers of some of our most popular ducks are significantly lower than they were fifteen years ago and most of the Canada geese no longer migrate to our area. Millions of acres of wetlands and other vital habitat for ducks and geese have been lost, and more are destroyed each year.

In addition to the great enjoyment and beauty that viewing waterfowl may bring us, these birds are important to many of our families for income. People who work at hotels, restaurants, gas stations, as outdoor guides, and in vehicle and equipment sales make money from tourists and hunters during the seasonal migrations. In order to maintain these aesthetic and economic benefits, waterfowl populations must be large enough to provide enjoyment for millions of people. Currently, however, many species of ducks are at lower population levels than they have been in decades due to losses of critical wetland habitat and other limiting factors. Most of our ducks are raised in northern areas where many of the wetland nesting sites have been plowed into farmland or developed for homes, stores, or industry.

Historically, as the harsh northern winters approached, ducks, geese, and swans, came to our area to eat the grasses that grew abundantly in our estuary. In the 1970's, many of the underwater grasses (submerged aquatic vegetation or **SAV**) began dying due to changes in water quality. Since the availability of this food source was limited, many birds did not remain here. Geese that once wintered here now overwinter in northern areas such as the Chesapeake Bay where they find an abundant supply of corn to eat in farm fields.

What can we do to reverse these negative trends and insure that waterfowl populations are protected for future generations? We can use management practices which preserve wetland habitat quality and quantity. These include:

• Maintaining forested buffer strips along waterways to reduce erosion and sedimentation.

• Observing the proper fertilizer and herbicide/ pesticide application rates in order to reduce the amount of nutrients entering our streams and improve water clarity for SAV growth.

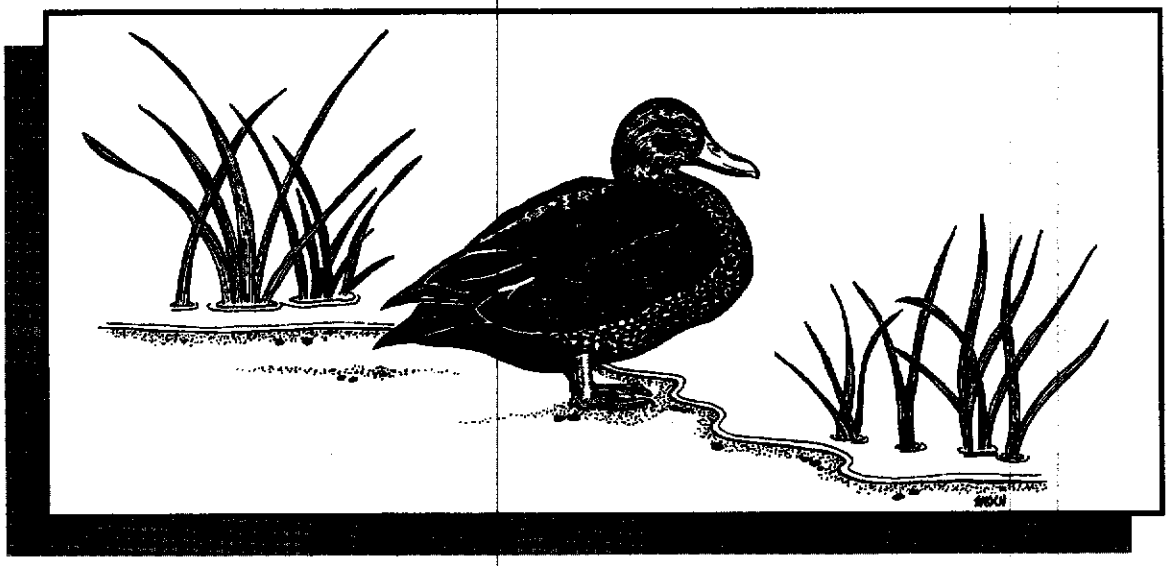
• Ensuring that sewage treatment facilities do not release waste that harm our waters.

• Avoid boating through and disturbing shallow grass beds.

• Finally, habitat quantity can bepreserved if we support habitat purchasing and conservation efforts by private organizations, State, and Federal governments. Federal duck stamps, which support public lands and inform others about the importance of wetlands, can be purchased to show our committment to protecting these avian treasures for future generations

Activity:

Select a playing area 70-90 feet long. Place the paper plates in a grouping on each side of the area and designate one side as nesting habitat (north, spring) and the other side as wintering habitat (south, fall). Tell the students that the paper plates represent wetlands which they will migrate to (as waterbirds) and nest in during the spring and summer or find food in during the harsh winter. Up to three students may migrate to a plate. At the end of a journey, a student must have one foot on a plate in order to be allowed to continue. The instructor removes plates with each repeating sequence (change of seasons) to illustrate the loss of habitat. If a student cannot find a foothold as plates are removed, they have not found suitable habitat and must retire to the sidelines. The instructor may invent a scheme of limiting factors affecting the habitat and survival of the flock (drought year = fewer plates, wet year = more plates; oil spill--place an ink spot on the bottom of the plate and if a "duck" lands on this plate it can no longer fly). Allow the "dead ducks" on the sideline to reenter as hatchlings during good years with an overabundance of nesting habitat.



Illustrations by Sandra Koch

Nutrients: *TOO MUCH OF A GOOD THING*

ACTIVITY DESCRIPTION:

Observe how nutrient enrichment occurs in our estuary.

OBJECTIVE:

- ***To gain an understanding of what nutrients are.***
- ***To learn why excessive amounts of nutrients are bad.***
- ***To sharpen skills in science, vocabulary, and language arts.***

AGE GROUP:

Grades 6-8

MATERIALS:

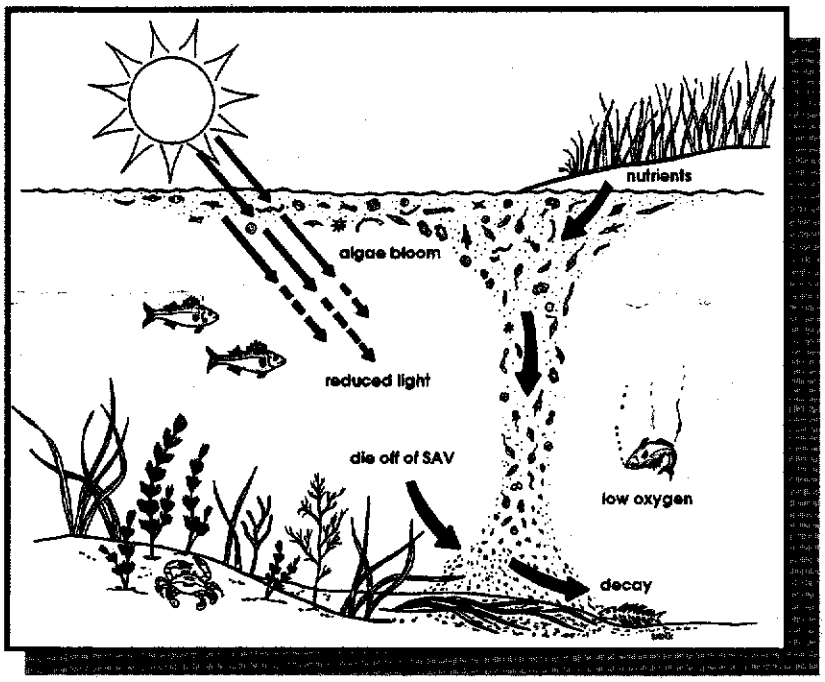
- ***5 one-quart clear glass jars***
- ***plant food***
- ***labels for the jars***
- ***5 spoons***
- ***aluminum foil***
- ***1.5 gallons of water from a stream, pond, sound, or aquarium***

Introduction:

Nutrients occur naturally in our soils and waters. They act as a fertilizer and are a necessity for plant growth. However like most things, they are harmful if they are present in excess amounts. Problems due to excessive amounts of nutrients occur in our waterways. The main purpose of this activity is to discuss and illustrate this problem.

Sound Soup!

Our estuary is like a soup with many ingredients. The water has many chemicals dissolved in it, such as salt and nutrients. But just as too much pepper can turn a tasty soup into a terrible soup, too much of a particular chemical can harm our waters. A current problem with the rivers is too many nutrients.



What Are Nutrients?

Nutrients are substances which help plants grow, much like vitamins help us grow. Two chemicals, nitrogen and phosphorus, are important to plant growth. Lawn and plant fertilizer and animal waste (including human sewage) contain nitrogen and phosphorus.

How Do Nutrients Get Into The Rivers?

Water which runs off the land into creeks and rivers can carry materials such as soil, toxic chemicals, and nutrients. When it rains, fertilizer and manure can be washed from fields and lawns into our streams.

Human waste is also a big problem. Some homes use septic systems to handle their sewage. But if the septic tank is not cared for, it can overflow with nutrient-rich sewage. In more populated areas, human waste is treated at sewage treatment plants to produce clean water. Some sewage treatment plants clean the water well before returning it to our rivers, but some do not. These rivers, often containing nutrients, eventually flow into our estuary.

What Is Wrong With Nutrients?

Once the nutrients are in the water, they help plants grow. But too many nutrients mean too much plant growth, especially of algae (microscopic floating plants). When there is too much algae, the water

becomes cloudy and blocks light to underwater grasses, which are called submerged aquatic vegetation (SAV). Algae can also grow on SAV leaves, like moss on a tree. However too much algae can further block light and kill the grasses. SAV is very important to many estuarine animals for food and shelter. Without SAV, the ducks, fish, crabs and other animals are in trouble.

All these algae cannot live forever. When they die and decompose, they use up a lot of oxygen in the water. This causes more problems for animals living in the water. They need oxygen just like we do to breathe. If too much oxygen is used, the animals can suffocate. You may have seen dead fish floating in green water during the summer.

Saving The Estuary!

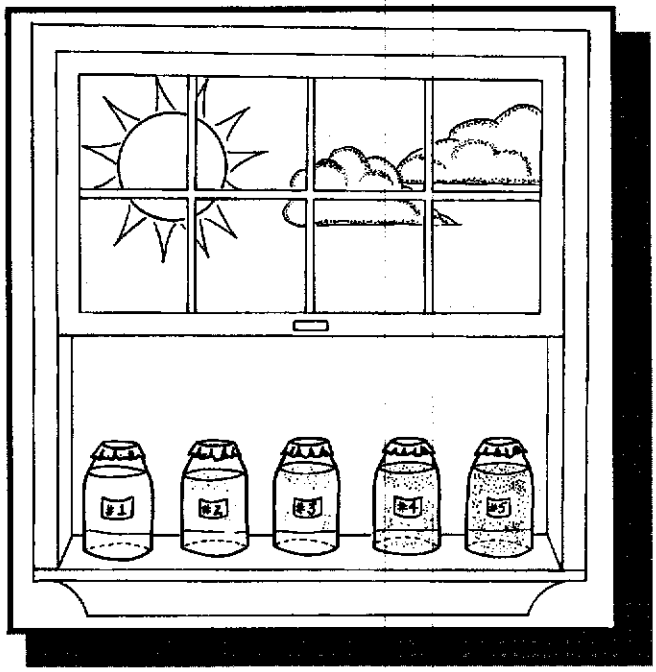
People are now trying to save the estuary by reducing the amount of nutrients which enter it. This involves responsible and limited use of fertilizers, proper treatment of sewage, and preventive measures to keep farm animal waste out of streams. There is still a lot of work ahead, but hopefully we can restore the health and wealth of our estuary.

Algae Soup!

You can be a scientist and see what happens when there are too many nutrients in the water by creating mini-estuaries in glass jars and testing the effects of different amounts of nutrients on algae growth.

Wash the jars, making sure to rinse them well. Fill a jar with tap water, label it "#1 - tap water" and set it aside. Fill the other jars with the water collected from a stream, pond, sound, or aquarium. Label one of these jars "#2 - no nutrients added" and set it aside.

Following the directions on the plant food label, mix enough fertilizer with the water in jar #3 to make a "regular solution" and label it as such. In jar #4, mix three times the regular amount of fertilizer and label it accordingly. In jar #5, mix a solution six times stronger than normal and correctly label it. Cover the jars lightly with foil to prevent water evaporation. Place all your jars in a sunny place at normal room temperature (but not in direct sunlight which will heat the water). Every two days, stir the water and check for algae growth. Tip the jar so you can see if any algae is growing on the glass. It will look like a thin grey or green film. Be patient; if your sample had only a little algae in it, it may take weeks for the algae to become visible.



Do all five jars look the same? Which jar has more algae? Does the water look cloudy? What happens after 1 week? After several weeks? Does the amount of fertilizer seem to have an effect? These are good things to notice while you observe the jars. We would expect that there would be more algae in the jars with more nutrients. There may be a leveling off of algae density at the higher nutrient samples, since algae can only grow so fast. In nature, over-enriched bodies of water produce too much algae. As these algae die they use oxygen to decompose. This is unhealthy for fish, plants and other animals. Look at a drop of water from each jar under a microscope or magnifying glass. Do you see any small creatures? How do the numbers of animals differ with the varying amounts of nutrients in the jars?

Illustrations by Sandra Koch

Floatable Debris

Introduction:

Material that washes up on shores, or "floatables", have washed onto beaches for years, but only recently have they gained attention as a serious water quality threat. Floatable debris consists of bottles, paper, wood, sewage, garbage, street litter, and now the much publicized plastic and medical-related items. Floatable debris can be stopped.

Municipal garbage has not been legally disposed of in coastal waters for over 50 years and illegal disposal is not accountable for the sudden rise in beach debris. The source of floatables is, surprisingly, common household litter and household waste. This includes the medical waste, such as insulin syringes, that are flushed down toilets.

ACTIVITY DESCRIPTION

Floatable debris, including medical waste, is a controllable problem.

OBJECTIVE:

The user will discover that floatable debris can be stopped at its source. Unlike some forms of pollution, this problem begins at home.

AGE GROUP:

Elementary through adult.

MATERIALS:

- ***styrofoam pellets***
- ***small wading pool half filled with water***
- ***various small floatable and non-floatable objects.***

REFERENCES:

Adapted from Long Island Sound Study fact sheet #8 "Floatable Debris" by the Connecticut Sea Grant Marine Advisory Program and the New York Sea Grant Extension Program.

Litter washed off streets is carried either directly into the water or into storm sewers. Many storm sewers are combined with sanitary sewers and the debris passes into the sewage treatment plants (STP). With a combined system, moderate rainfall overloads the STP. Everything, sewage and floatables, is discharged as raw combined sewer overflow (CSO) directly into the waterways. CSO's are perhaps the greatest source of floatables in our area. Power outages or equipment failures also disable STPs and cause the discharge of raw sewage.

There are offshore sources of floatable trash and plastic. Naval, commercial shipping and fishing fleets have regularly dumped waste into the ocean. In 1989, the US entered an international agreement to control offshore disposal. Floatables also enter the water through mishandling solid wastes that are being on or off loaded on barges for transport to landfills. Our area supports a large recreational vessel fleet, and these pleasure boats contribute to the trash problem. Even beach-goers add significantly to the problem by littering.

Strong winds can collect floatables into large slicks that are pushed on-shore or float in open water masses. Although we don't always see the floatable debris, it is out there and its volume is increasing yearly. On top of that, since 1970, our use of plastics has tripled, increasing the percentage of persistent plastic in debris. Floatable debris by itself does not pose a great threat to human life, but it does threaten wildlife.

Debris epidemics can have a tremendous impact on the economy of our estuary. People can't visit the estuary and are afraid to eat the seafood that comes from it. Our area economy can suffer a 1-2 billion dollar loss during a debris epidemic.

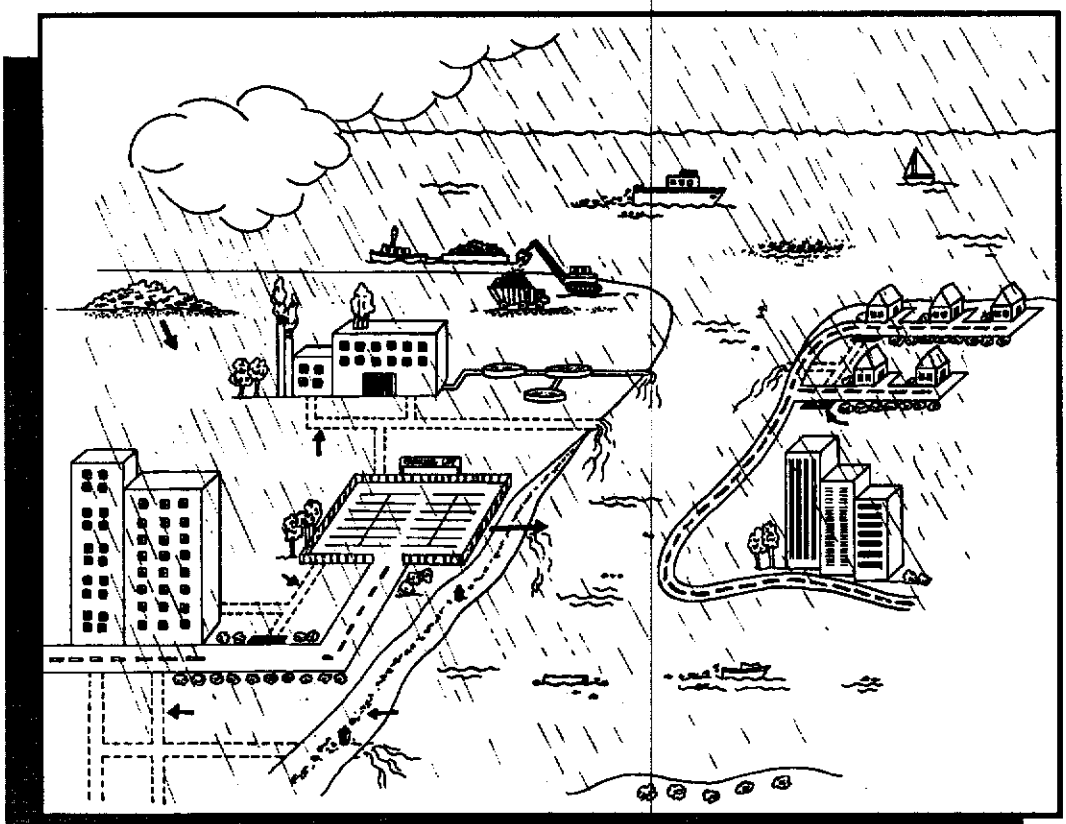
Medical waste

Medical wastes discovered on beaches in recent years has received much publicity. In reality, the amount of medical waste on beaches was very small. Insulin syringes originating from CSO and from intravenous drug users on the beach were a frightening discovery. Some isolated incidents of medical waste debris may have originated from illegal dumping.

Concern about medical debris stems from fears of infectious disease. However, only 1% of beach debris is medically related. Of that, only 10% of the debris has been in contact with infectious disease. Many infectious diseases, including the AIDS virus, are fragile and cannot survive the harsh ocean environment. The tremendous dilution that the ocean offers also decreases the virulence of the pathogen.

Floatable Debris - What can you do?

Unlike many pollution problems, the floatable debris problem and its source is well understood. Litter control, recycling, and enforcement of existing



Set up a miniature estuary in a small wading pool: Put various small objects in the water and use a small fan to push them around the pool. What types of objects float? Which objects sink? What does wave action do to the system? Do some things suspend in the water column beneath the water surface? What is buoyancy?

laws are the best controls of floatable debris. Because storm and combined sewers are a major source of debris, redesign and restructuring these systems are major public works projects that are underway and will greatly improve the situation. Relative to upgrading and better operation of STPs is teaching the public to only dispose of human waste in their sewage systems. The control of floatables must be incorporated into management plans for our estuary.

Plastic bags, monofilament line, and 6-pack rings can be deadly in the ocean. Beverage 6-pack holders have been estimated to cause the deaths of 6 million seabirds and 100,000 marine mammals annually, and have a life expectancy of 450 years. Fourteen billion pounds of garbage are dumped into the worlds oceans every year, most of it in the Northern Hemisphere. An International treaty (MARPOL Annex V) signed by Congress now prohibits the dumping of any plastic in our oceans.

If you see illegal (off-site) dumping, pinpoint the location and record discharge type and time of observance, as well as the violating vessel's name and ID number. Report it to the Coast Guard. If you see debris in the water, pinpoint the location by loran, latitude/longitude, or visual sightings. Be able to describe the nature of the material and the extent of the slick.

Fun Facts:

You can be of great assistance in preserving the water quality of our estuary, so that we can all ensure the future enjoyment of our most bountiful natural resource.

PLEASE:

- ***Do not discard trash overboard;***
- ***Use reusable containers and limit use of non-biodegradable materials;***
- ***Retrieve trash found in water;***
- ***Participate in beach clean-ups; and***
- ***Be aware of the dangers of plastics to the marine environment.***

Polystyrene foam looks like food to a sea turtle. When they eat it they become too buoyant to dive. It also clogs their digestive systems and they starve to death. Each American throws away 60 pounds of plastic packaging every year.

And remember...
STOW IT – DON'T THROW IT!

Illustration by Sandra Koch

More Than Just A Swamp

ACTIVITY DESCRIPTION:
To facilitate an understanding of wetlands by completing puzzles.

OBJECTIVE:
- *To gain an understanding of what a wetland is.*
- *To learn what types of wetlands are found in our estuarine area.*
- *To learn why wetlands are important.*
- *To sharpen science and vocabulary skills.*

GROUP:
Grades 4-5

MATERIALS:
Pencil

Introduction:

Wetlands are very important to the well-being of many plants and animals, including people. But what are these areas, and what do they do? A wetland is the area between dry land and open water. It is sometimes covered with a shallow layer of water, but there are also wetlands which can be dry for part of the year. The plants and animals which live there are adapted to this watery environment. There are many different types of wetlands.

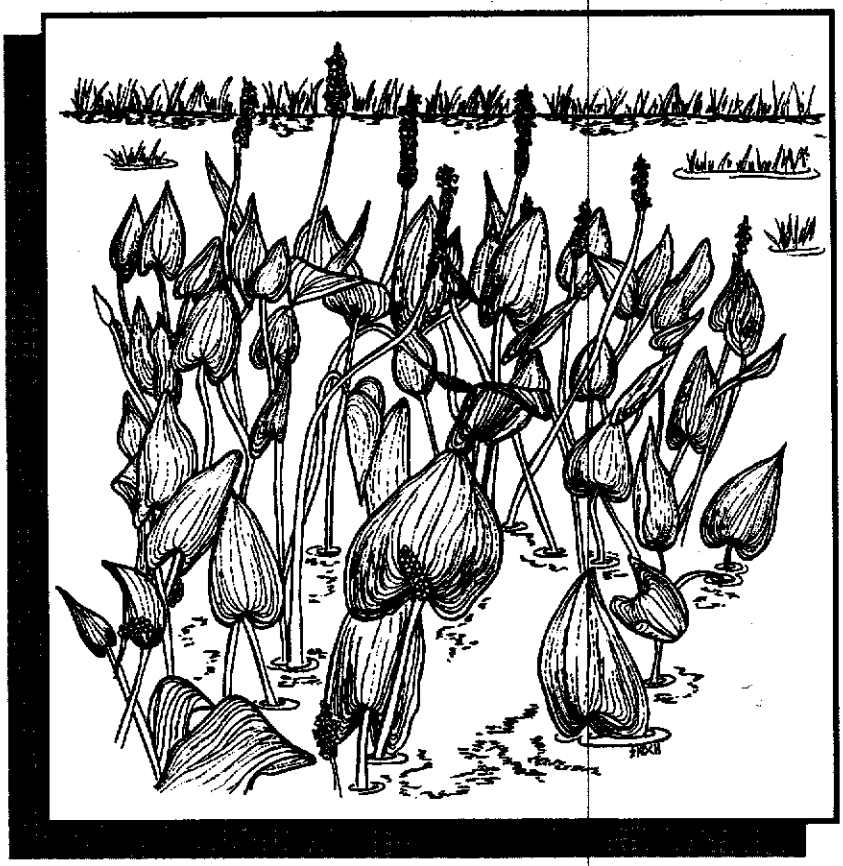
Wetland Types

Swamp - Wetland where trees and shrubs grow which are flooded throughout most of the year are considered swamp.

Bottomland - These are the lowlands along streams and rivers that experience both wet and dry periods during the year. They are often forested.

Marsh - Marshes are the wet areas filled with a variety of grasses and rushes. They can be found in both freshwater areas and in the saltwater areas near our coast.

Pocosin - These are the wet areas with evergreen trees and shrubs growing on peat or sandy soils. Peat is a spongy-feeling material made up of decaying plants. The word pocosin comes from the Algonquin Indian word meaning "swamp on a hill."



Wetland Functions

Flood Control - Excess water from heavy rains is slowed by wetland plants and stored in the low-lying areas of wetlands, preventing the waters of nearby rivers and streams from overflowing and damaging property.

Storm Buffer - Along our coast, wetlands take a beating from high winds and waves, yet remain intact. The thick vegetation buffers the force of storms and protects the land from erosion.

Water Banks - Wetlands hold water during the wet season. This water seeps through the soil into our underground water supplies.

Water Filter - Wetlands help purify runoff waters which carry pollutants. Silt and soil, which choke aquatic life, settle out. Wastes are broken down and absorbed by aquatic plants, as are many harmful chemicals.

Nurseries - Many fish and animals use wetlands as nurseries. They provide an abundant supply of food and shelter for the young.

Home Sweet Home - Wetlands are home to many animals. A thriving wetland probably has more life in it than any other kind of habitat.

Wildlife Pantry - Wetlands are so productive, many animals depend on them for food. Many migrating birds stopover in wetlands each spring and fall to rest and feed before continuing their trip, and some will spend the winter in the wetlands.

Recreational Opportunities - Wetlands provide us with places to watch birds and animals, and to fish, boat, and hunt.

Economics - Commercial fisherman depend on the wetlands to supply us with crabs and many other types of seafood.

Wetlands in Danger!

More than half of U.S. wetlands have been lost since the 1600's! They have been drained to make farm fields, or filled for developments, or dredged for waterways. Wetlands become "drylands" when people fill them, build dams, or divert the water that feeds these areas.

In the past, wetlands were considered useless wastelands. Now we know that they are very valuable to people and wildlife. Changing opinions are resulting in new laws to help save wetlands, but there is still much work to be done to stop the destruction and to restore our wonderful wetlands.

Illustrations by Sandra Koch

Wetland Inhabitant Word Search

Search for the types of animals found in wetlands. See if you can find:

beaver	**flounder**
wood duck	**clam**
crab	**crayfish**
mosquito	**raccoon**
heron	**bear**
frog	**egret**
dragonfly	**sunfish**
turtle	**mink**
shrimp	**salamander**

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

Wetland's Crossword

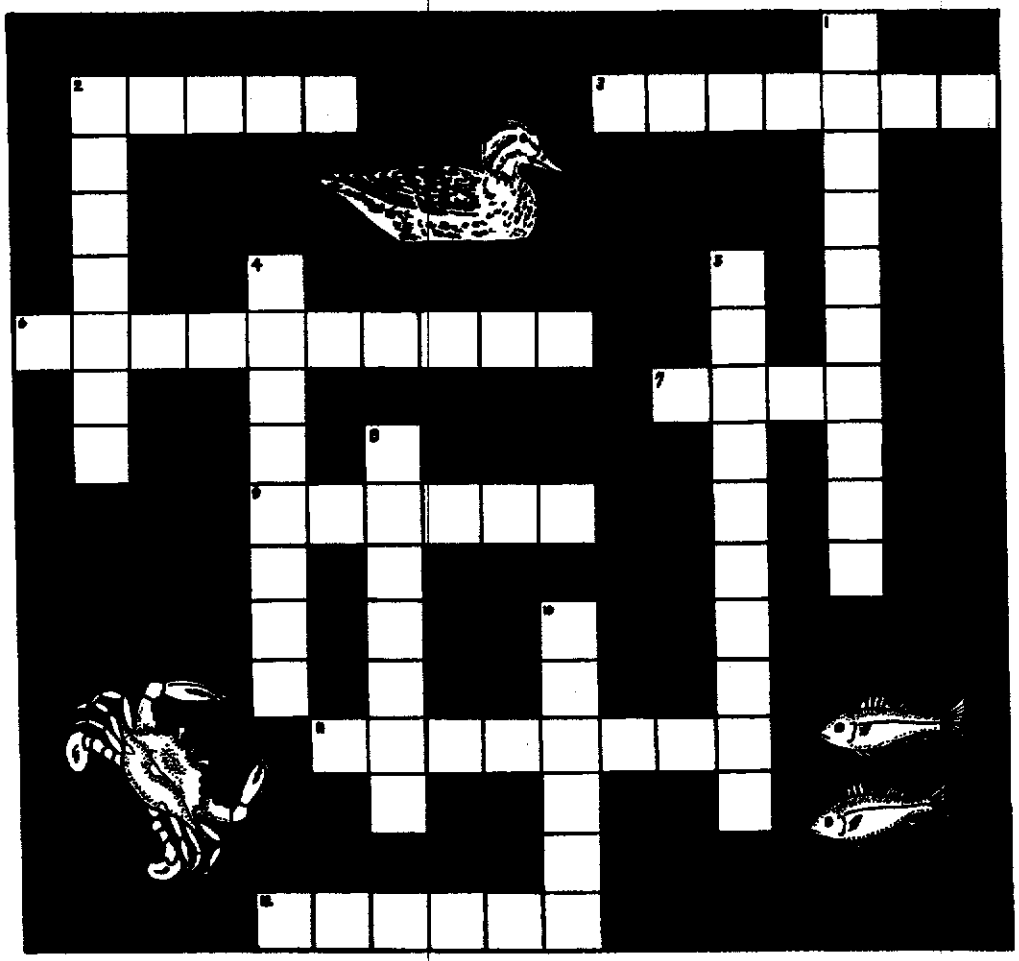
Test your wetlands knowledge by completing this wetlands crossword puzzle.

Across

2. _____ are wetlands that are flooded with water for most or all of the year, and are vegetated with trees and shrubs.
3. A use of wetlands for food and cover by young fish and other animals.
6. A wetland type found along streams and rivers. They are flooded for part of the year and dry for part of the year.
7. The type of soil often found in pocosin wetlands. It is made up of decayed plants.
9. Peat soil feels _____.
11. Many kinds of _____ use wetlands for sources of food, resting sites,and cover.
12. Wetlands along the coast may lessen the damage caused by storms, and protect land from erosion since they function as a _____.

Down

1. A use of wetlands by people.
2. Commercial fishermen depend on wetlands to supply us with _____ to eat.
4. Bottomland wetlands are often _____.
5. A _____ marsh does not contain salty water.
8. A wetland type with evergreen trees and shrubs. This word means "swamp on a hill" to the Algonquin Indians.
10. Wetlands have the ability to remove, or _____ out, pollutants from water.



Key:

Across - 2. swamp; 3. nursery; 6. bottomland; 7. peat; 9. spongy; 11. wildlife; 12. buffer

Down - 1. recreation; 2. seafood; 4. forested; 5. freshwater; 8. pocosin; 10. filter

Illustrations by Sandra Koch