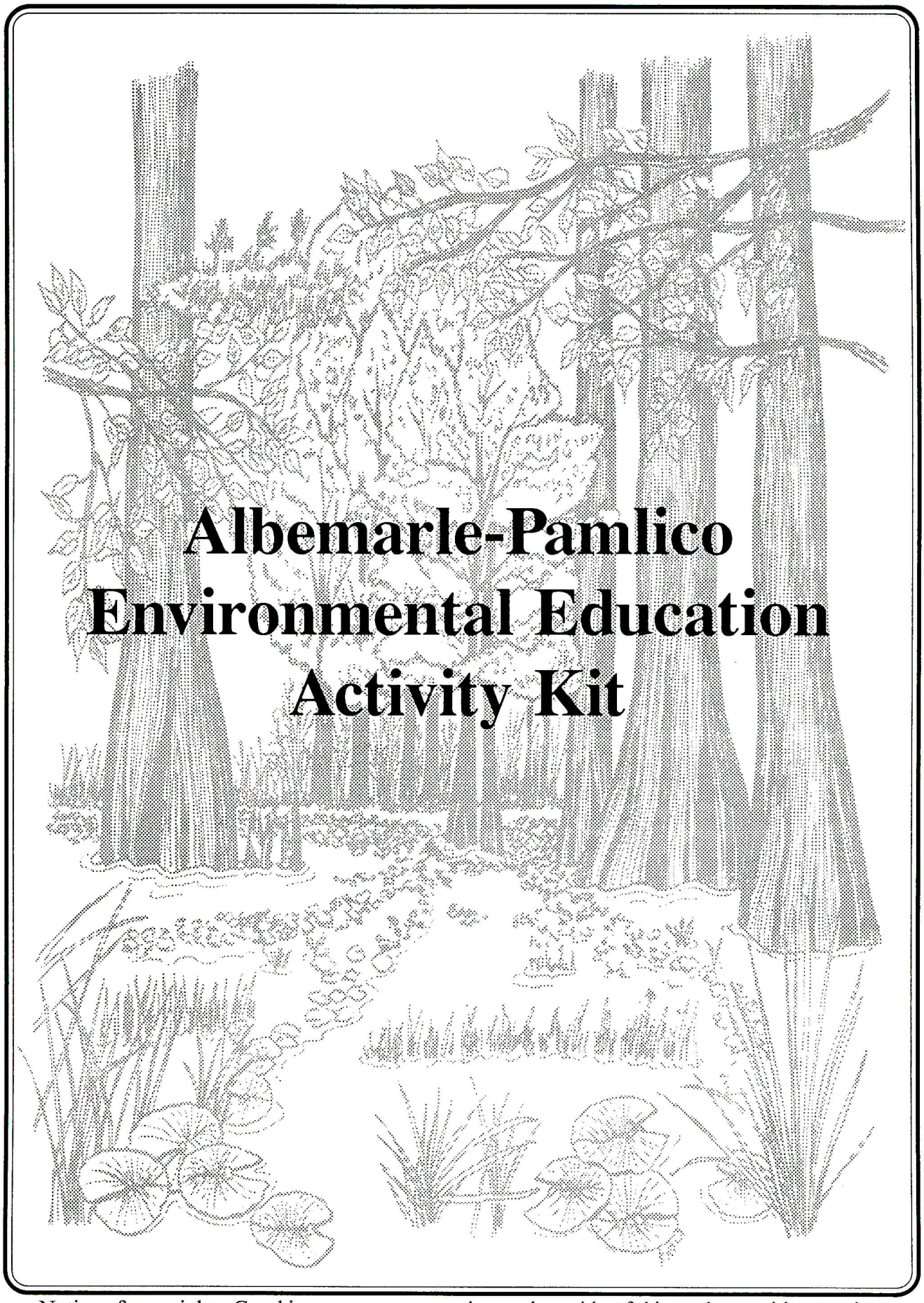

Albemarle-Pamlico Environmental Education Activity Kit

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On behalf of the United States Fish and Wildlife Service's Bay Estuary Program 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 the Albemarle-Pamlico Estuarine area. 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 Sounds. 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

Environmental Resources

There are many organizations you can contact for information about the Albemarle-Pamlico watershed or other environmental information. This partial listing highlights some of them.

INFORMATIONAL MATERIALS AND SITES

Albemarle-Pamlico National Estuary Program (APNEP)
943 Washington Square Mall, Washington, NC 27889
252-946-6481

US Fish and Wildlife Service
PO Box 33726, Raleigh, NC 27636-3726
919-856-4520

US Environmental Protection Agency, Public Affairs Office
61 Forsyth Street SW, Atlanta, GA 30303
404-562-8327

North Carolina Aquariums, Education Curators
Roanoke Island, Manteo, NC 27954
252-473-3493
Pine Knoll Shores, Atlantic Beach, NC 28512
252-247-4003
Fort Fisher, Kure Beach, NC 28449
910-458-8258

Partnership for the Sounds, Educational Centers
Columbia Theater Cultural Resources Center, Columbia, NC 27925
252-766-0200
Mattamuskeet Lodge, Swan Quarter, NC 27885
252-926-4021 (temporarily closed for repairs)
NC Estuarium, Washington, NC 27889
252-948-0000
Roanoke/Cashie River Center, Windsor, NC 27983
252-794-2001
Tyrell County Visitor's Center, Columbia, NC 27925
252-796-0723

PROJECT BOOKS

North Carolina Wildlife Resources Commission, Project Wild & Project Catch
1712 Mail Service Center, Raleigh, NC 27699-1712
919-733-7123

UNC Sea Grant, Ripples
NC Big Sweep, PO Box 126, Zebulon, NC 27597
800-277-9337

Who Do I Call?

The following list contains sources to contact with questions or concerns.

Hunting, Fishing and Boating Questions

North Carolina Wildlife Resource Commission:

Violations and Boating Accidents	800-662-7137
Boat Registration	800-628-3773
Hunting & Fishing License Information	919-662-4370

Concerns and Questions About Dredging or Filling of Wetlands

U.S. Army Corp of Engineers	910-251-4511

Fish Kills

Inland: North Carolina Wildlife Resources Commission	919-733-3633 Ext. 281 or 800-662-7137 (24-hour dispatcher)

Coastal: Division of Marine Fisheries

Albemarle Sound and Elizabeth City area	800-338-7805
Pamlico area	877-337-2383
Neuse area	888-764-7661
Morehead City area	800-682-2632
White Oak River to South Carolina	800-248-4536

Illegal Trash Dumping

Local Sheriff

Oil/Chemical Spills	800-424-8802

Recycling Information and Disposal of Household Hazardous Wastes

Local county recycling contact or State office	800-763-0136

Farming, Gardening, Yard Care Questions

Local agriculture extension agent or State office	919-515-2707
National Pesticide Information Center	800-858-7378

Getting Involved: A few ways to get involved are:

Big Sweep: an annual litter collection from our beaches, sounds, lakes, rivers, and streams. For information contact Big Sweep 800-27-SWEEP.

Stream Watch: adopt a stream and monitor the quality of its water. For information contact NC Division of Water Resources, 1611 Mail Service Center, Raleigh, NC 27699-1611, 919-733-4064.

Citizen's Water Quality Monitoring: monitor baseline water quality at sites in the Albemarle-Pamlico watershed. For more information contact Citizen's Water Quality Monitoring Program, Institute for Coastal and Marine Resources, East Carolina University, Greenville, NC 27858, 252-328-1747.

There are numerous citizen organizations involved in environmental issues. Groups often can accomplish more than individuals. Many have newsletters and education programs to share with the public. For a listing of groups involved in coastal issues see A Citizen's Guide to Coastal Water Resource Management available from The Coastal Federation, 3609 Hwy 24 (Ocean), Newport, NC 28570, www.nccoast.org, 252-393-8185.

When you hear the words "Albemarle Sound or Pamlico Sound," what do you think of? Places for boating? Big swimming and fishing holes? The homes of tasty blue crabs, oysters, and trout? Receiving places for treated sewage and industrial waste? Something to be crossed on your way to Nags Head or Ocracoke Island?

What Are the Albemarle and Pamlico Sounds?

The Sounds are more than just large bodies of water. They are an *estuary*, a shallow place where salty water from the ocean mixes with fresh water from rivers. The Albemarle-Pamlico estuary is the second largest estuary in the Eastern United States. The largest estuary is Chesapeake Bay. Like all estuaries, it is rich with plant and animal life. The estuary is home to young fish, oysters, crabs, and clams. Ninety-two percent of the fish landed in North Carolina depend on the estuary as a nursery habitat. When you visit the Sounds, see how alive the marshy places are with plants, fish, and birds.

The Sounds are also part of a larger system. The Albemarle-Pamlico system includes the sounds, the rivers and creeks which flow into the Sounds, and the land surrounding these rivers and creeks. This entire area is called the Albemarle-Pamlico *watershed*. The watershed includes thirty-six counties in North Carolina and sixteen counties in Virginia. Water in the watershed will eventually drain into the Sounds. This water can carry harmful things, such as improperly treated sewage, oil, fertilizer, and pesticides, from distant places into the estuary.

Sound Facts

- The Albemarle and Pamlico Sounds cover 2900 square miles of surface water. Approximately 30,880 square miles of land drain into the rivers which feed the Sounds.
- Ten major rivers and creeks too numerous to count are tributaries of the Sounds.
- Approximately 2,670,000 people live in the Albemarle-Pamlico watershed. By the year 2000, an estimated three million people will live there.
- The deepest hole in the estuary is in Pamlico Sound with a depth of 26 feet.

What Is Wrong With the Albemarle-Pamlico Estuary?

The Sounds are faced with several complex problems. They are made worse by the increasing pressures of population growth in the watershed. Each problem alone is troublesome, but together they can harm the Sounds and their resources if we do not help.

Excessive Nutrients:

Nutrients are substances which help plants and animals grow. Two nutrients, nitrogen and phosphorous, are present in plant fertilizer and wastes from animals and people. Rain can wash fertilizer from lawns and fields into streams and the Sounds. This type of pollution is called "nonpoint source" since it does not come from a single point, but it is from water running off a large land area. Sewage treatment plants and leaky septic systems can also add nutrients to the water. When pollution comes from a single point, such as an outfall pipe, it is called "point source" pollution.

When too many nutrients get into the water, they disturb the natural balance by allowing too much algae (microscopic plants) to grow. The algae cloud the water and block vital sunlight to underwater plants (submerged aquatic vegetation or SAV). When the algae die and decay, they use up much of the oxygen needed by fish and shellfish, often killing them.

Toxic Materials:

Toxics are chemicals that can cause cancer (carcinogens) or other harmful effects. Their effects can be immediate such as a poison, or occur very slowly such as with cancer. Streams and rivers are very effective at hiding the effects of poisons. Often the fish that are killed are not seen. They may be small and hard to see or eaten by turtles, snakes, crabs, or other scavengers. Modern pesticides (i.e., chemicals used to kill animals, insects, or plants) used on lawns and fields are very poisonous but, fortunately, they break down much more quickly than older pesticides such as DDT. Because these modern pesticides are toxic they should not be used near rivers or streams or along roads with storm drains which lead to a stream. Cancer-causing substances enter our rivers from municipal sewage treatment plants or industrial discharges and sometimes from nonpoint source discharges. Although we are usually exposed to low concentrations of carcinogens, there are thousands of cancer-causing agents. The cumulative effects of these agents is not fully understood.

Erosion and Sedimentation:

Every time it rains around the Albemarle-Pamlico watershed, water erodes the land. The precious soil which washes away into streams is called sediment. Sediments are carried downstream and may eventually enter the Sounds, where they settle out of the water and cover the bottom.

Sediments can harm Sound life in several ways. Sediment particles pick up toxic materials on their surface and concentrate them on the bottom of the Sound. Floating or suspended sediment clouds the water, cutting off light to SAV. Excess sediment smothers clams, oysters, and other bottom dwellers.

Habitat Loss:

An animal's habitat is its home. Habitat provides shelter, food, water, and space. As more and more people come to live and work around the Albemarle and Pamlico Sounds, more and more habitat is being lost. Some animals, such as squirrels, can adapt to these changes and learn to coexist with humans. But many others, such as black bears, bald eagles, and black ducks, do not adapt well to change. Habitat damage and loss can decrease a population of plants or animals or even cause extinction.

Wetlands, one of the most important types of habitat, are threatened all around the Albemarle-Pamlico watershed. They are filled in for development, drained for agriculture, or dredged for marinas. Pollution has degraded water quality in the Sounds and their rivers, resulting in declines of important SAV and scallops.

Where Are These Problems?

City Sewage Treatment Plants:

Due to an increase in population, many sewage treatment plants receive more wastewater than they have been designed to handle. Often this leads to discharge of poorly treated sewage into our rivers and streams.

Industry:
Treating wastewater to the extent that it does not harm the environment takes a special effort. Certain industries do excellent jobs of cleaning their wastewater, but others do not. Since industries release tens of millions of gallons of wastewater into our rivers every day, proper treatment is essential.

Agriculture and Forestry:
Farms and forestry operations that allow sediment or pesticides to enter our rivers and streams, or that infringe upon wetlands, damage our estuary.

Development:
Runoff during construction and from parking lots should be controlled to prevent erosion. Wetland areas should be preserved; they do not make good locations for homes and shopping centers.

Consumers:
Most environmental problems are ultimately caused by the consumer. Industry and business must make a profit to provide jobs. We, as individuals, can help by doing our share. We can buy environmentally sound products such as brown paper; do without immaculate lawns which require fertilizers and pesticides; and do not waste water.

How Do I Fit In The Picture?

Although you may not realize it, you do have an impact on the Albemarle-Pamlico Sound system. By living in its watershed, your individual actions affect the Sound's environment. You can harm the Sounds if you are not careful, or you can act responsibly to help the Sounds.

You might ask, "What can I do to help save the Sounds, I'm just one person?" The Sounds did not deteriorate overnight--the two and one-half million people living in the watershed contributed to the problems. It is estimated that the population will reach three million by the year 2000! But just as these people can harm the Sounds, they can also help them. If each person in the Albemarle-Pamlico watershed did just <u>one</u> positive thing for the environment, we would be well on our way to reversing the damage. Usually, when one person joins in others become interested and concerned, too.

The situation is not hopeless--far from it. In 1987, North Carolina and the Environmental Protection Agency began the Albemarle-Pamlico Estuarine Study. The agreement calls for a cooperative effort between science, government, and the public to restore and protect the living resources and water quality of the Sounds. This goal will be achieved through implementation of a Comprehensive Conservation and Management Plan for the Estuaries. Many citizen organizations and other federal agencies, including the U.S. Fish and Wildlife Service, have joined in on this crusade to make a difference in the Albemarle-Pamlico watershed.

The Sounds depend on us for life just as we depend on the Sounds. Therefore, it is extremely important that we exercise great care with our actions. We must become responsible citizen caretakers of the Albemarle-Pamlico watershed in order to restore and preserve our natural neighborhood.

- Conserve water. Take short showers; run dish and clothes washers only when full; and

place a plastic bottle in the toilet tank to reduce the amount of water flushed.

- Make certain your septic system is working well and is not overflowing.
- Use household chemicals and pesticides carefully. Choose the least toxic material, and buy only what you need. Follow instructions, and dispose of leftovers carefully.
- Plant vegetation along streams to prevent soil erosion and to absorb excess nutrients from fertilizers.
- Recycle used oil, paper, aluminum cans, and glass.
- Use a sewage pump-out station on land to empty boat toilets.
- Observe posted boat speed limits. Large wakes from boats can erode shorelines and banks.
- Clean up debris and trash from a local stream to improve stream flow and water quality.

Contents

These activities can be divided into two major parts: fish, wildlife, and their habitats; and water quality. However, in a system like the Albemarle and Pamlico Sounds they are all interrelated. This packet includes a general information sheet on the Albemarle-Pamlico watershed and the concerns about it (**So What's Wrong With The Sounds Anyway?**). Also there is a sheet of contacts for more information and contacts for problems you may encounter (**Who Do I Call?** and **Environmental Resources**, respectively).

PART I: Fish, Wildlife, and Their Habitats

1. More Than Just a Swamp - discusses the types of wetlands and their importance. The activities are a hidden word puzzle and a crossword puzzle.

2. Muddy Rivers, Murky Sounds - discusses erosion and sedimentation and how they harm the Sounds. The activity is a simulation of erosion and sedimentation.

3. Roadblocks For Fish - discusses the problems anadromous fish encounter during their spawning runs. The activity is an imagery exercise.

4. Fish Need Nurseries Too - discusses the lifecycle of migratory marine fish such as the flounder. The activity is an imagery exercise.

5. Ducks and Geese - discusses the importance of waterfowl and the problems they are encountering in North Carolina. The activity is a physically active simulation of some of the problems.

6. Who's Afraid of the Big Bad Wolf? - discusses the red wolf, an endangered species, and its restoration program in North Carolina. This is a matching activity separating fact from fiction.

PART II: Water Quality

7. Nutrients - Too Much of a Good Thing - discusses the problem of nutrient enrichment in the Albemarle-Pamlico system. The activity is an experiment to illustrate these problems.

8. Clean Water - A Precious Resource - discusses the importance of water conservation. The activity demonstrates how much water an individual uses daily.

9. Fit For A Fish: Dissolved Oxygen - discusses what dissolved oxygen is and why it is important. The activity is an experiment to illustrate the need for dissolved oxygen.

10. Fit For A Fish: Chlorine - A Hazardous Waste - discusses the use of chlorine in water treatment and why it can be harmful to fish. The activity is an experiment to show how easily chlorine can be removed from water.

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 the Albemarle-Pamlico Estuarine area.*
- *To learn why wetlands are important.*
- *To sharpen science and vocabulary skills.*

Age Group:

Grades 4-5

Materials:

Pencil

Introduction:

Wetlands are very important to the well-being of many plants and animals, including people. In North Carolina, wetlands make up approximately 17 percent of the State. 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.

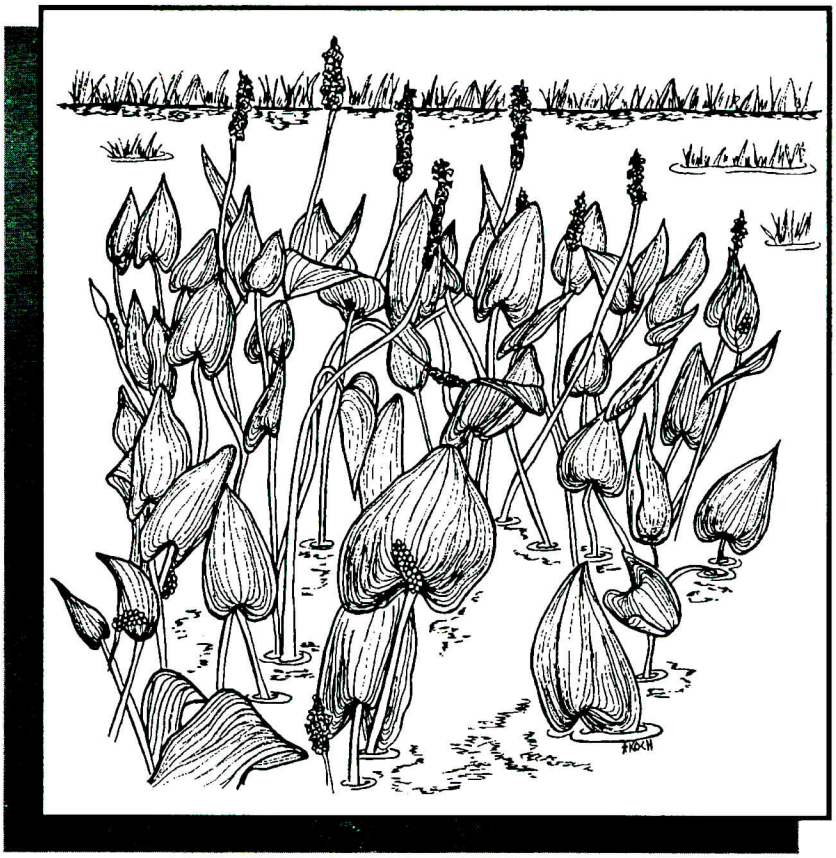
Wetland Types

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! In North Carolina, almost half of our wetlands have been lost. 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

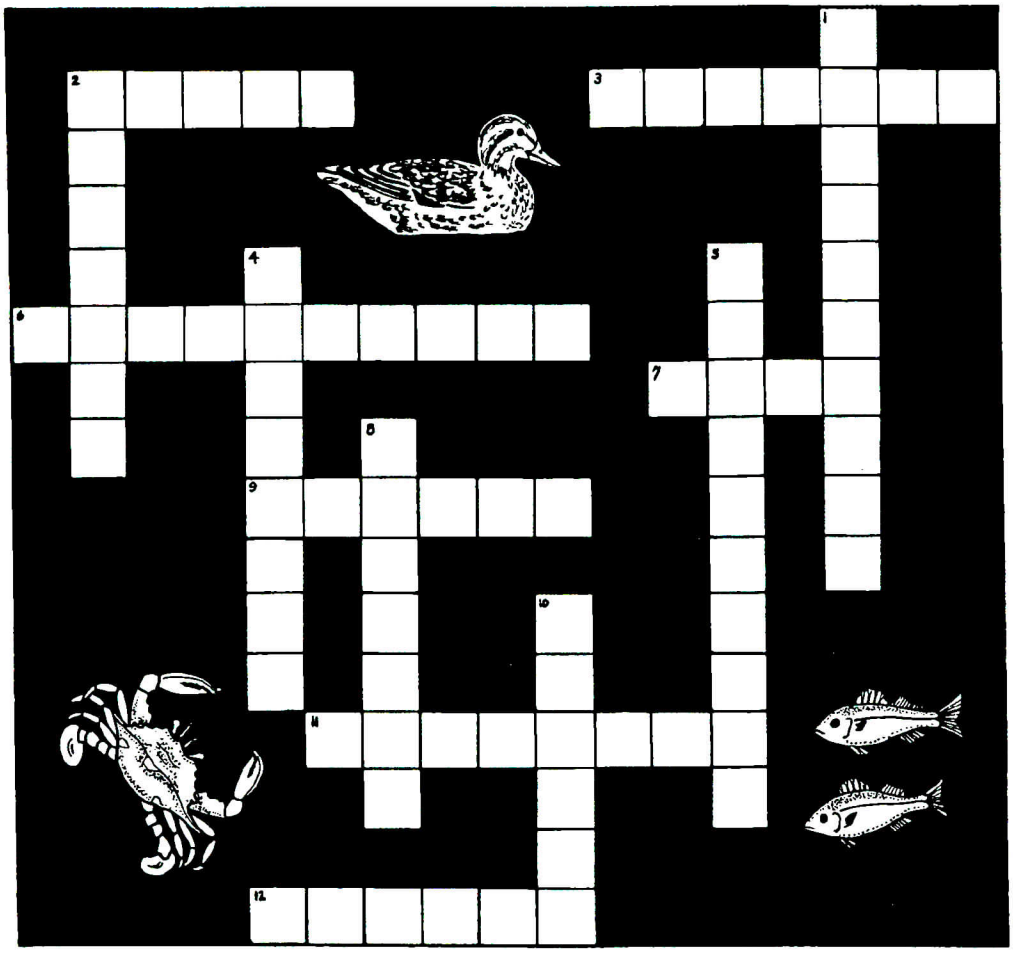
Test your wetlands knowledge by completing this wetlands crossword puzzle.

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

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:

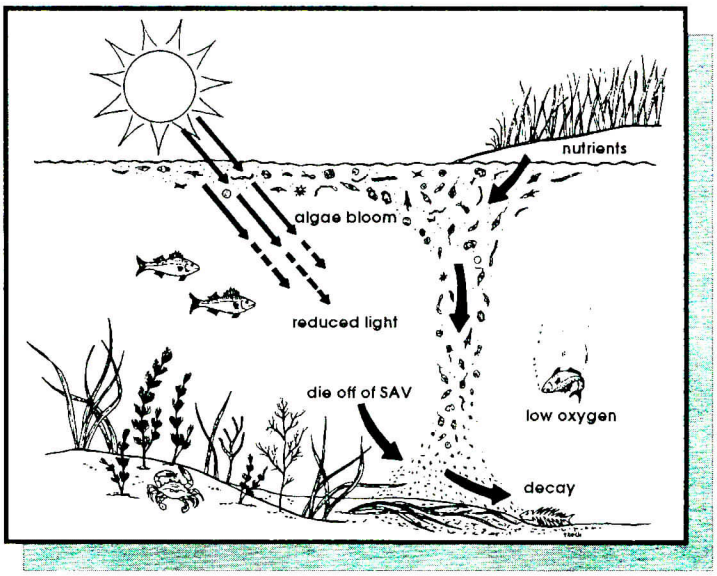
Grades 6-8

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.

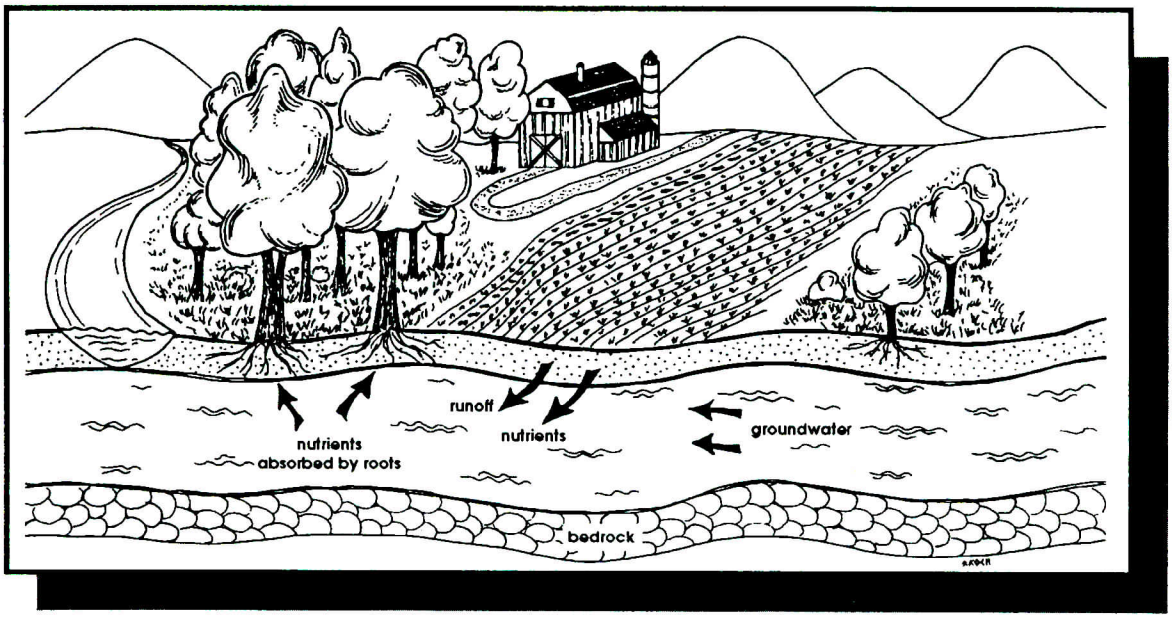
Sediments and Toxic Chemicals

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 the Sounds. 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 the booklet entitled "Sound Advice" available from WRAL-TV, Raleigh, NC. Erosion and sedimentation are Sound 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

Roadblocks for Fish

ACTIVITY DESCRIPTION:

Learning the types of problems encountered by a fish moving upstream to spawn.

OBJECTIVE:

- *To learn what an anadromous fish is.*
- *To learn about the obstacles they face while trying to reproduce.*
- *To exercise skills in science and language arts.*

AGE GROUP:

Grades 4-5

MATERIALS:

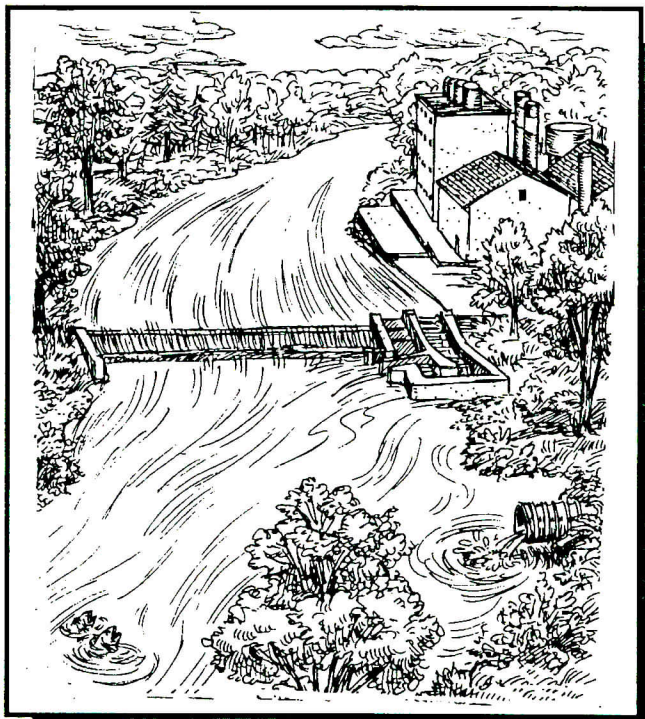
None needed

Introduction:

Fish that live in saltwater but return to freshwater to lay their eggs (spawn) are called anadromous fish. These fish are very important to the commercial and recreational fisheries in the Albemarle-Pamlico area. During their migrational travels they often face poor water quality problems and an obstacle course of stream and river blockages.

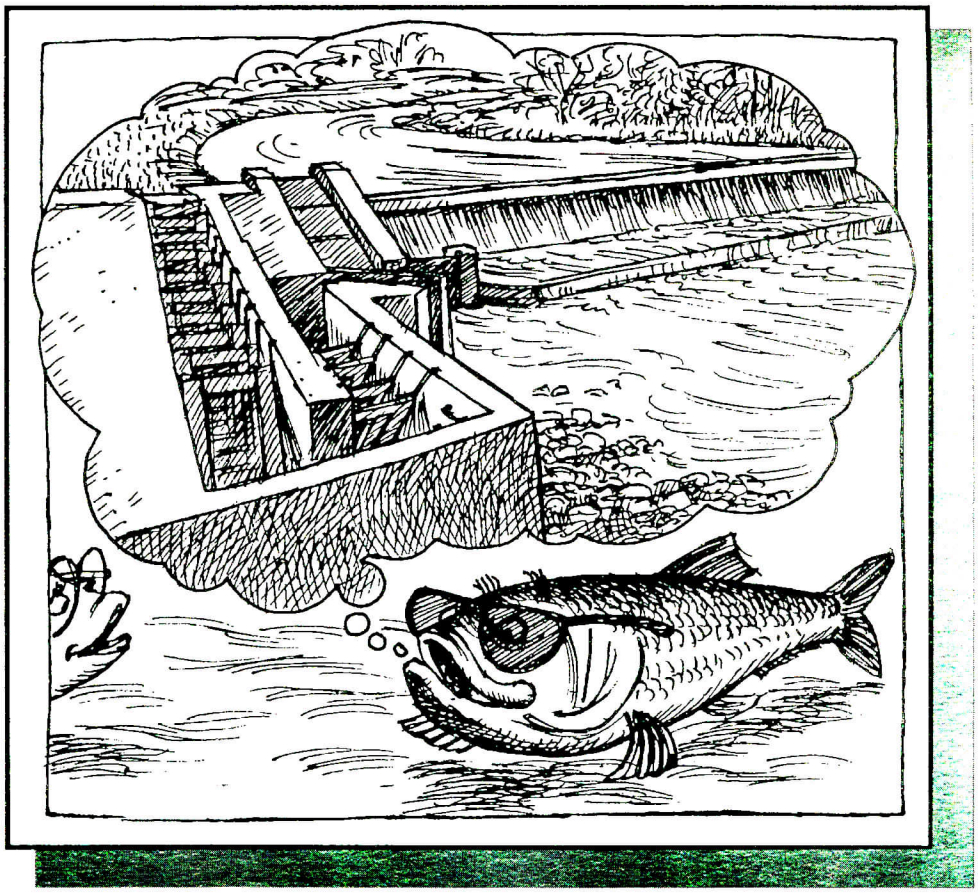
Every spring thousands of fish enter our sounds from the ocean following a natural urge to reproduce. These fish will move through the Sounds and into our rivers in an effort to reach their spawning grounds. Fish that live in the ocean but return to freshwater to spawn are called **anadromous** fish. An example you may know about is the salmon. Salmon are often shown leaping up waterfalls or being scooped up by bears during their spawning runs in the Northwestern United States. Salmon do not occur in the Albemarle-Pamlico system, but seven other types of anadromous fish occur in our rivers. They are the striped bass, Atlantic sturgeon, American shad, hickory shad, alewife, and blueback herring. The shortnose sturgeon once occured here but is now an endangered species and believed to no longer exist in the Albemarle-Pamlico system.

Along their routes they face many problems. As they swim through the sounds and up the rivers, the fish pass through a maze of sport and commercial fishermen. The fish that are not caught continue upstream and commonly encounter many problems with blockages. Dams on rivers are a good example; when a fish reaches a dam it cannot continue upstream. Culverts, which are pipes under roads that allow streams to pass through, are another example of blockages. Fish do not like to swim through them. Poor water quality is another problem encountered by migrating fish. Sometimes wastes from our homes and factories, which can kill adult fish, are released into the rivers, and also harm the eggs or the fragile young fish as they drift back downstream toward the Sounds. These materials may come from industries, or can be carried by the rain from our yards, farm fields, or sewage treatment plants. We must be sure that the things we release into the rivers and streams will not harm fish.



Activity: Traveling Fish

To better understand some of the problems encountered by migrating fish, pretend you are riding in a car. You are traveling down a busy road, on the way to your wedding, until you see a traffic jam. "What's wrong?" you ask. Soon you discover a bridge is out ahead and you cannot complete your journey. This is what happens when a migrating fish encounters a dam or culvert which it cannot swim past. How can the fish move upstream to spawn? Unfortunately, in a river there are usually no detours to take to travel around an obstacle.



Now imagine you are traveling along a road in your new jeep on a warm spring day. You removed the top of the jeep and left it at home on such a beautiful day. You drive by a large factory releasing lots of smoke into the air. The air burns your eyes and causes your throat and lungs to hurt when you breathe. You cannot escape the smoke, and you wish you had the jeep's top to provide you with some shelter. This is what an anadromous fish encounters as it passes a discharge of harmful chemicals into our streams. These discharges can sometimes kill the adult fish, their eggs, or young. Not all discharges into rivers are harmful, but we must be sure we clean water properly before allowing it to enter our rivers. Have you ever been in a smoked-filled room? Did the smoke burn your eyes? If the fish cannot spawn successfully, what will happen to their population?

If you have ever been outside near a busy road, you may have noticed how a line of trees or a wall helps lessen the amount of noise you hear from passing traffic. Areas of natural plants and trees along streams work much the same way to decrease the amount of harmful additions of soil, fertilizers, pesticides, and herbicides, that wash into streams and rivers. These borders make a river more pleasant for fish to swim in and also for people to enjoy on a hot summer day.

Illustrations by Bruce Van Patter

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

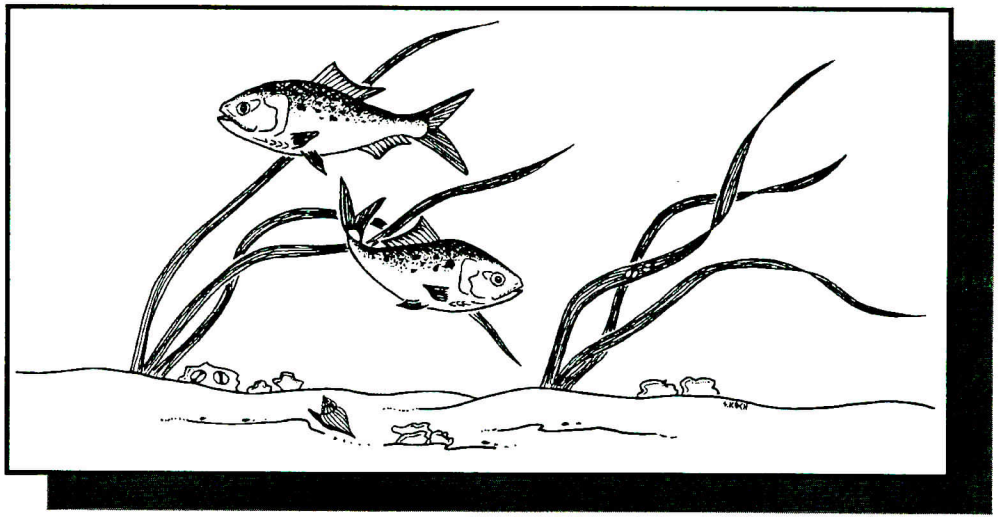
Materials:

- *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 the Sounds 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 sounds 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.

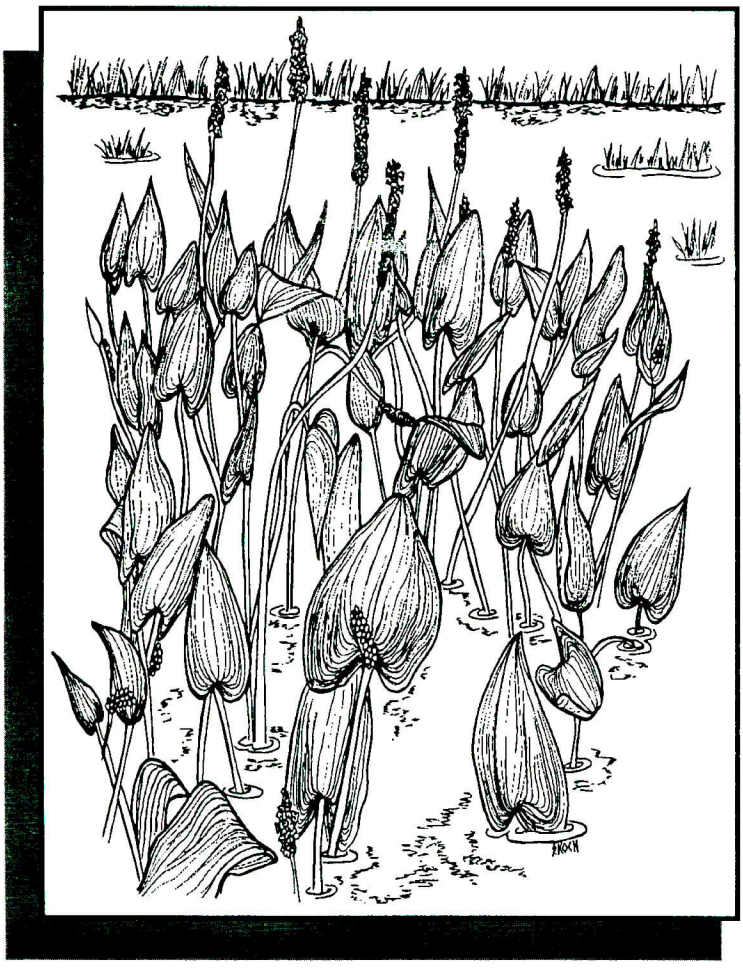
From mid-summer to fall, the partially grown fish and fully grown shrimp leave the nursery areas and enter the open sounds and the ocean.

It is important to protect these nursery areas for fish and shrimp living in the Sounds 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

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:

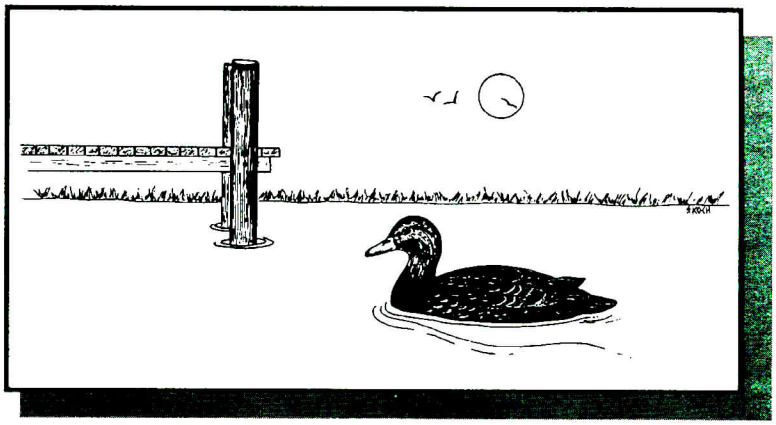
- *Large room or field 70-90 feet long*
- *Paper plates or carpet samples--enough for every three participants to have two (2) of either*

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 North Carolina enjoy watching ducks raise their young in a pond or look forward to fall when they can travel to the Sounds 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 as far south as North Carolina. 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. Even the two species of ducks that historically nest in North Carolina, wood ducks and black ducks, have experienced similar habitat losses. Only wood duck numbers in North Carolina have increased. Black duck populations are still in trouble.

Historically, as the harsh northern winters approached, ducks, geese, and swans, came to North Carolina to eat the grasses that grew abundantly in our Sounds. 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.

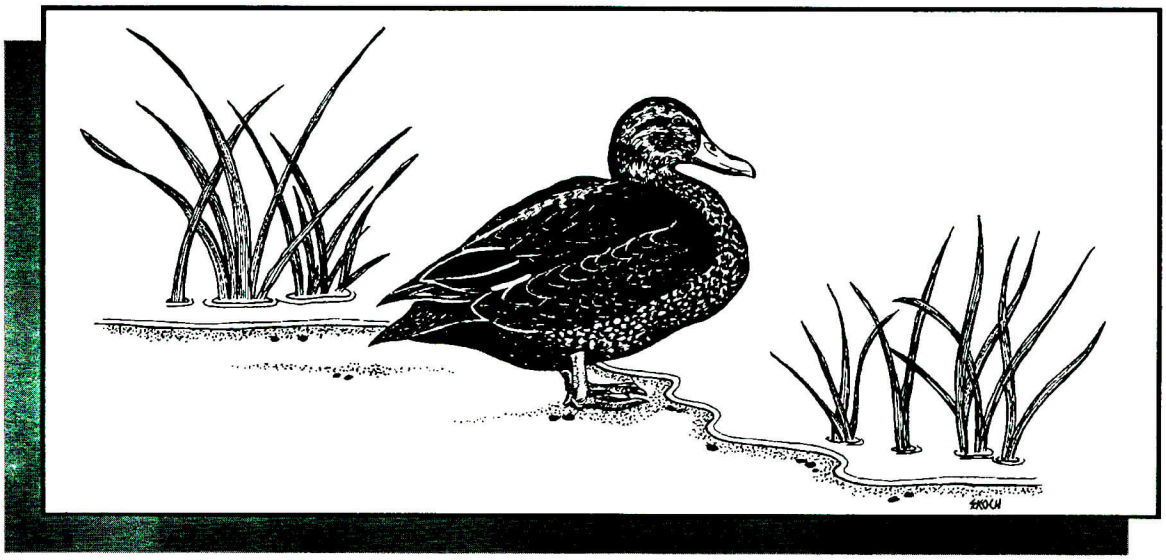
• Ensuring that sewage treatment facilities do not release waste that harm our waters.

• 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

Who's Afraid Of The Big Bad Wolf?

ACTIVITY DESCRIPTION:

To learn how to separate fact from fiction about red wolves.

OBJECTIVE:

- *To learn about wolves and where they live in North Carolina.*
- *To learn what predators and prey are and how they benefit each other.*
- *To discover how myths can eliminate a population of animals.*
- *To learn about an endangered species.*

AGE GROUP:

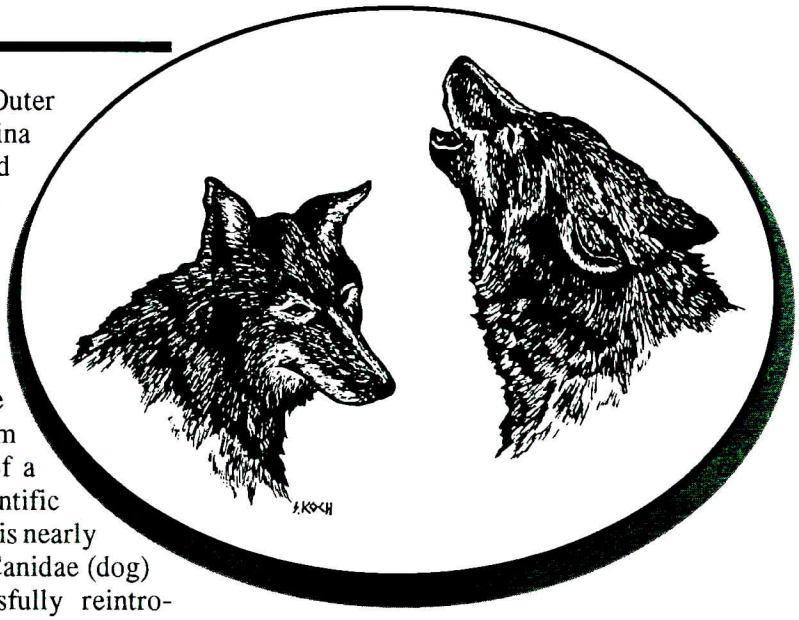
Grades 4-6

MATERIALS:

Pencil

Introduction:

When Sir Walter Raleigh's expedition first landed ashore on Roanoke Island near Manteo, North Carolina in 1584, the white man's battle against wolves in the New World began. Over 400 years of negative thinking and persecution against red wolves in the South and gray wolves in the North has nearly eliminated these impressive animals from the landscape! Today, through a unique twist of fate, red wolves are being restored to their native range in the very same place where man began to conquer this part of the new world.



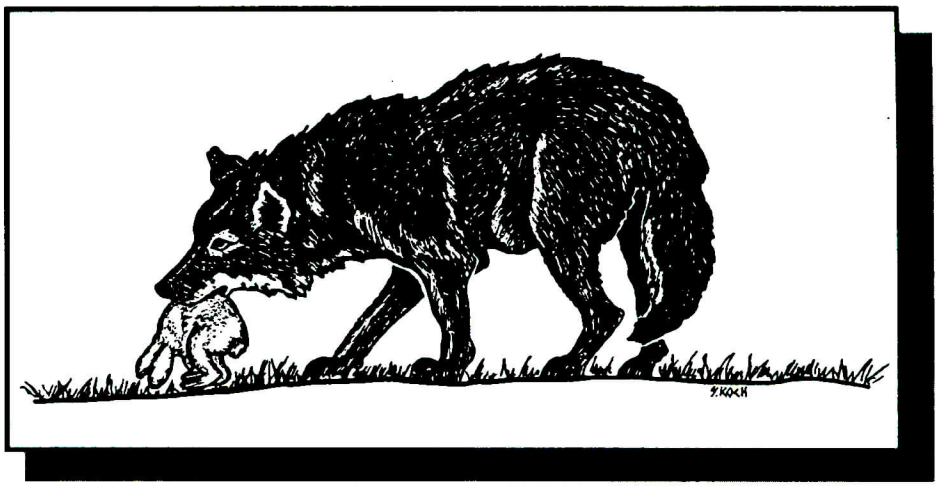
Many visitors to the Outer Banks of North Carolina don't realize that wild red wolves are roaming the woods and swamps only a few miles away from their beach site activities. This statement is really not as frightening as it may sound. These wary (shy) and seldom seen animals are part of a carefully controlled scientific project to determine if this nearly extinct member of the Canidae (dog) Family can be successfully reintroduced into the wild at Alligator River National Wildlife Refuge in Dare County, North Carolina.

The red wolf is one of three wild canids native to the United States. It inhabited the southeast part of the country before it was eliminated from most of its range, while the gray or timber wolf lived in much of the northern U.S. before its population decline. The coyote, which is abundant and has been moving east in recent years, originally occupied the western two-thirds of the U.S. When compared with the other two species, the red wolf is typically larger than the coyote but smaller than the gray wolf. It is usually cinnamon to gray in color and may weigh 40 to 80 pounds.

Along with the Florida panther and black-footed ferret, the red wolf is one of the most endangered species of animal in North America! Due to this designation, it is protected by The Endangered Species Act of the Federal Government which makes harming these animals or jeopardizing their habitat a serious offense.

Like all canids, the red wolf is a predator or animal that kills and eats other animals for food. It usually feeds on a wide variety of animals and birds that reproduce rapidly. Marsh rabbits, muskrat, and nutria are some of its favorite foods. Whatever they eat, however, wolves maintain a balance in the environment by controlling the populations

of prey animals. If prey animals were allowed to increase without control, they would eat the vegetation in the environment until there was very little remaining. Eventually, the small prey animals would starve or possibly die from an outbreak of disease. For many years, man did not realize the value of having large predators in the environment. Wolves were regarded as vermin and were shot on sight. Even in our childhood, stories such as "Little Red Riding Hood" and "Beauty And The Beast" depict wolves as villains that chase and threaten the central characters of the story. These wolves are "big and bad" like the myths of old. Today, the value of these animals is understood and appreciated by many more people. Some of the negative folk lore and fear of wolves is diminishing, making red wolf restoration in eastern North Carolina possible.



Activity:

Match the lore with the appropriate facts about red wolves.

LORE:

a) Red Wolves may attack small children or people.

b) Red Wolves will howl back at humans.

c) Wolves howl more at full moons.

d) Red Wolves are loners.

e) Red Wolves are very shy.

f) Red Wolves eat fast--as the expression "wolfing it down" implies.

g) Red Wolves mate for life.

FACTS:

h) Shy is an adjective used for man. Red Wolves are wary, that is, they are afraid of and try to avoid man.

i) Red Wolves will answer even poor imitations of their howls if they are 1/4 to 1/2 mile away.

j) Healthy Red Wolves do not see humans as prey.

k) Biologists are not sure if Red Wolves mate for life. They expect that some do and some don't.

l) Wolves are very social and prefer to live in packs or family groups.

m) Wolves may howl more during a full moon, but this fact has not been documented.

n) Red Wolves do eat large chunks of food quickly. A male Red Wolf in North Carolina died from choking to death on a raccoon kidney!

Key: a-j, b-i, c-m, d-l, e-h, f-n, g-k.

Illustrations by Sandra Koch

Nutrients: *TOO MUCH OF A GOOD THING*

ACTIVITY DESCRIPTION:

Observe how nutrient enrichment occurs in our sounds.

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:

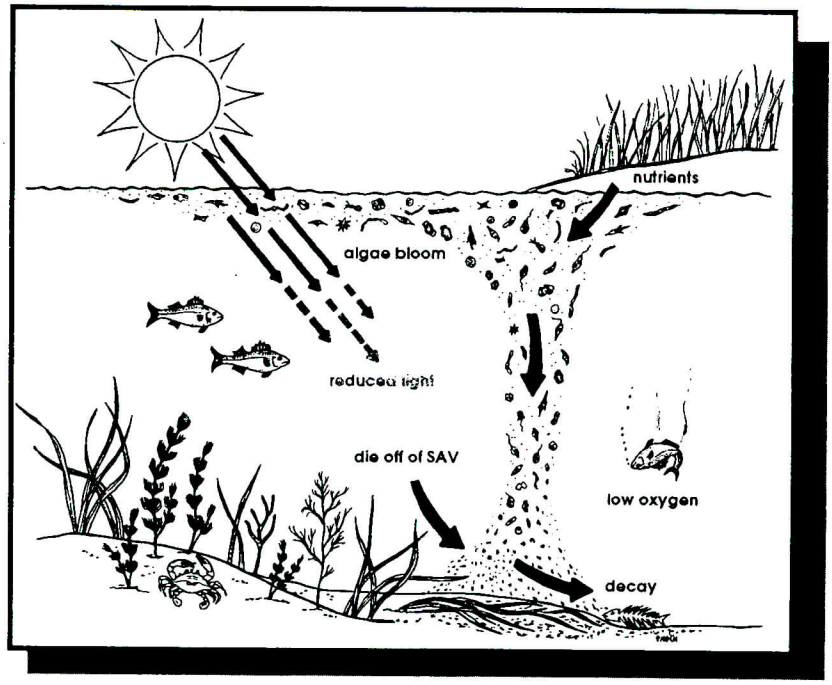
- *5 one-quart clear glass jars*
- *plant food*
- *labels for the jars*
- *5 spoons*
- *aluminum foil*
- *1.5 gallons of water from a stream, pond, sound, or aquarium*

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 the Albemarle and Pamlico Sounds. The main purpose of this activity is to discuss and illustrate this problem.

Sound Soup!

The Albemarle-Pamlico Sound system 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 rivers and sounds. 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 the Sounds.

What Is Wrong With Nutrients?

Once the nutrients are in the Sounds, 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 Sounds 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 Sounds!

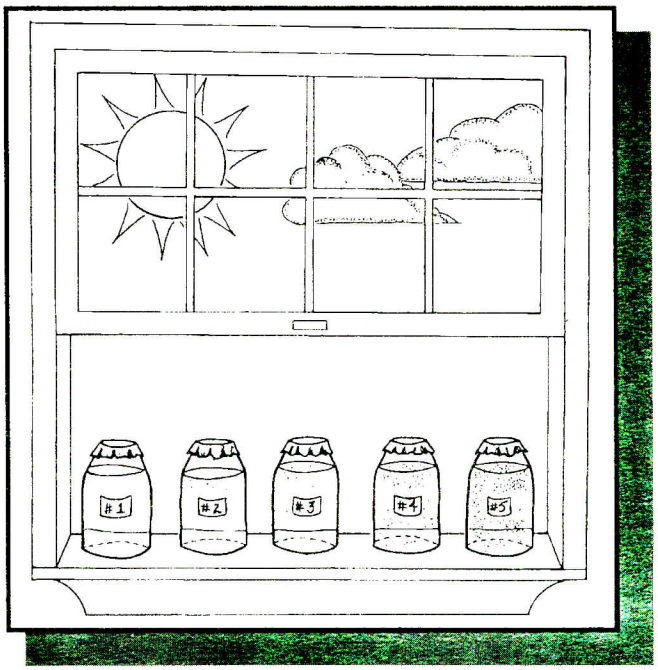
People are now trying to save the Sounds by reducing the amount of nutrients which enter them. This involves responsible and limited use of fertilizers, proper treatment of sewage, and preventive measures to keep farm animal waste out of streams. There is still a lot of work ahead, but hopefully we can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

Algae Soup!

You can be a scientist and see what happens when there are too many nutrients in the water by creating Mini-Sounds 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

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

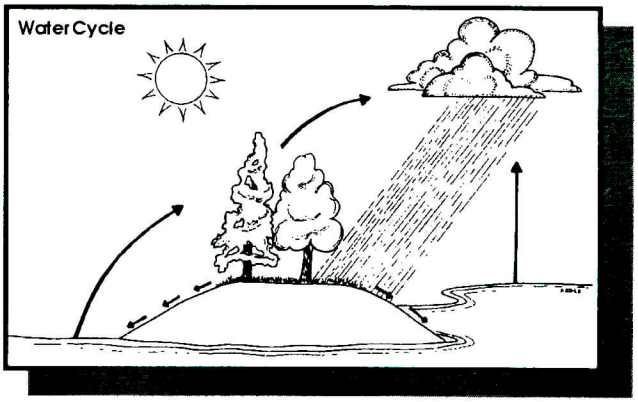
MATERIALS:
2 clean gallon jugs (i.e., milk jugs) per student (available at home)

Introduction:

Do you ever think about how much water you use? 183 gallons are treated every day for each person in the United States. There are an estimated 2.0 million people living in the Albemarle-Pamlico watershed. 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 the Sounds.

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.

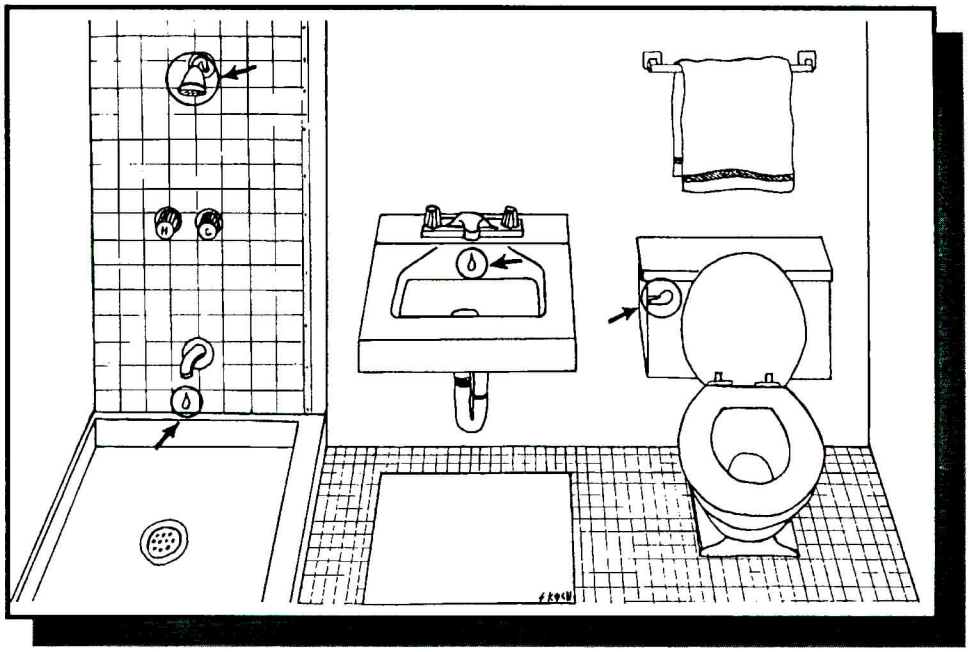
Wastewater Treatment

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 the Sounds.

Clean Water = Clean Sounds

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 the Sounds 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 the Sounds.

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

Fit For A Fish: *DISSOLVED OXYGEN*

ACTIVITY DESCRIPTION:
Learning why fish need dissolved oxygen to live.

OBJECTIVE:
To learn what dissolved oxygen is and why it is important.

AGE GROUP:
Grades 6-8

MATERIALS:
- *Two candles*
- *A glass jar large enough to place upside down over a candle*
- *Matches*

Introduction:

The air we breathe is 21 percent oxygen. It is oxygen that keeps us alive. Fish need oxygen too, but since they don't have lungs, they take oxygen from the water in which they live. The oxygen in the water available to fish is called dissolved oxygen (oxygen that is dissolved in the water). Fish use gills to take oxygen from water just as we use our lungs to take oxygen from the air. In a fish's world oxygen is a rare and precious resource. Although air is 21 percent oxygen, water has only a very tiny amount of dissolved oxygen. Most fish do well when the dissolved oxygen is five parts per million (ppm) (=5/1,000,000) or higher. When the dissolved oxygen is less than five ppm they become uncomfortable. Most fish will begin to suffocate and die when the dissolved oxygen is two ppm or lower. Because fish are so dependent on dissolved oxygen, it is important that we understand what dissolved oxygen is. Furthermore, we must not put things into our rivers and streams that will decrease the amount of dissolved oxygen below the level that fish need to be comfortable or, even more importantly, to stay alive.

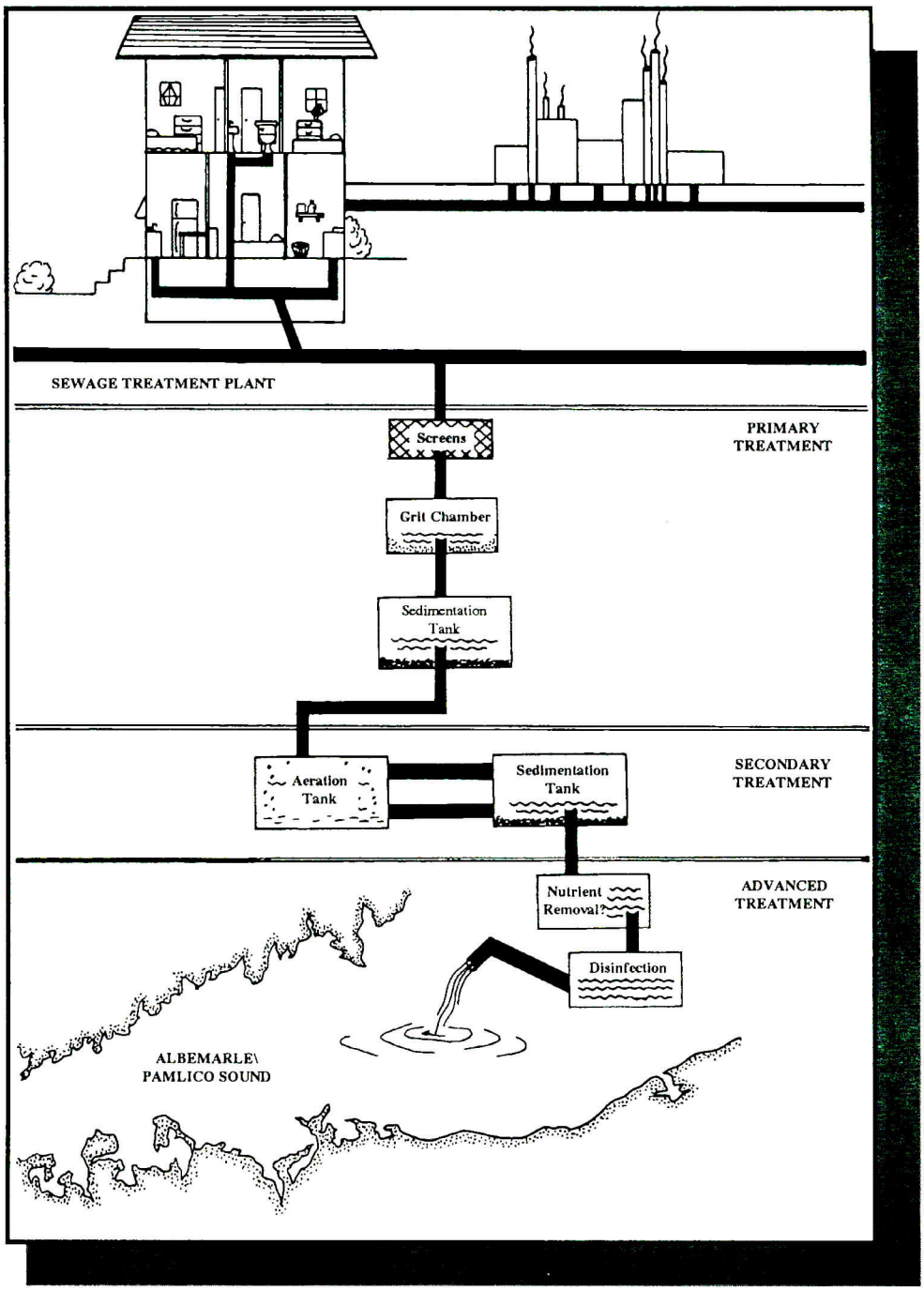
The 30,880 square-mile Albemarle-Pamlico watershed has about 600 dischargers that pour up to 368 million gallons per day of treated wastewater (sewage) into the rivers and streams that eventually run into our Sounds.

This sewage comes from homes, offices, and factories, and must be cleaned before it is returned to our rivers and streams. Raw sewage is not emptied into our rivers and streams because it carries germs and solid waste that can quickly take the dissolved oxygen out of the water in which it is poured causing fish to suffocate. Modern sewage treatment plants do a good job of killing the germs in sewage before it is poured into our rivers and streams. Some sewage treatment plants do an excellent job of taking the oxygen consuming wastes out of sewage so that it does not take the dissolved oxygen out of streams and rivers, but some plants do a poor job. In situations where the water is not sufficiently cleaned, it can cause large numbers of crabs and fish to suffocate.

Solid waste from poorly designed or operated wastewater plants will break down or decompose in the river or stream into which it is poured. The breaking down of solid wastes requires oxygen which is also needed by fish. Therefore, this waste must be removed from wastewater (sewage) before the

water is returned to the rivers and streams. When the waste is not sufficiently removed from wastewater, we turn our streams and rivers into wastewater treatment areas which degrades these areas for fish and wildlife. We should consider our fish and wildlife as good neighbors and feel free to borrow water as we do now, as long as we return it in the same condition as we found it.

The Journey of Wastewater to Albemarle-Pamlico Sounds



Activity:

Light two candles. Place a glass jar over one of the candles. What happens? Since we have lungs and abundant oxygen to breath we live in the same environment as the still burning candle (the candle without the jar over it). In a fish's world dissolved oxygen is a rare and precious resource. Watch the candle under the jar flicker and go out. When we pour oxygen-consuming waste into our streams, we are taking away the oxygen from fish. When too much waste is present, their lives flicker and fade just like the covered candle.

Illustrations by Sandra Koch

Fit For A Fish: *Chlorine-A Hazardous Waste*

ACTIVITY DESCRIPTION:

Learning how to test your tap water for chlorine and learning how to remove the chlorine, making your tap water fit for a fish.

OBJECTIVE:

- *To determine if your tap water is fit for a fish to live in.*
- *To learn some of the basic properties of chlorine.*
  - *a. Why is it used?*
  - *b. How can it be removed?*
  - *c. Why is it important to the environment to not pour it into our rivers and streams?*

AGE GROUP:

Grades 6-8

MATERIALS:

- *Chlorine test kit which can be purchased from a pool supply store for approximately $6.00*
- *12 glass or plastic jars with lids (baby food or peanut butter jars work fine)*
- *A straw for each student*
- *A clean gallon jug with lid*
- *1/8 teaspoon*
- *household bleach will be needed if you use unchlorinated well water*

Introduction:

Chlorine is used by most towns and cities to help make drinking water safe. Its use began in 1879 when Englishman Thomas Soper used chlorine to kill typhoid bacteria. It is a very good disinfectant and kills many of the germs that could make us sick. Chlorine is also used by towns and cities to disinfect treated sewage before it is returned to our streams and rivers. Unfortunately, chlorine kills fish just as effectively as it kills germs. If you have ever brought a fish home from the pet store and placed it in fresh water from the tap only to find it mysteriously dead the following day, chlorine was the likely culprit. These fish deaths and those that occur in our rivers and streams are a terrible waste because we can easily remove chlorine from water. Chlorine is similar to many hazardous wastes in that exposure to air or sunlight is very effective in making contaminated water safe. However, many other hazardous wastes are poisonous to people as well as fish.

Poison, In *Our* Water?

Generally, when we think of poisons we do not think of the water we drink. Although safe for us to drink, tap water in most towns and cities is poisonous to fish because of the chlorine that it contains. We need to realize that many animals are different in their response to different chemicals, and we can kill them unintentionally. There are about 600 wastewater (sewage) dischargers in the Albemarle-Pamlico Estuary, which discharge a total of 368 million gallons of wastewater per day. A good portion of those chlorinate their wastewater before it is discharged into rivers and streams. If the chlorine is not removed it can kill fish.

Why Worry About Chlorine?

Chlorine is poisonous to fish at very low levels. Imagine adding only one pint of vanilla ice cream to a tanker truck of root beer to make a root beer float! No one would be able to see or taste any of the ice cream. If this same amount of chlorine (1 pint) was added to the tanker (20,000 gallons), the water would be poisonous to fish. Because chlorine is so deadly to fish and other aquatic animals, it is essential that this form of hazardous waste be removed from our treated sewage before it is poured back into our streams and rivers. Fortunately, water containing chlorine and many other forms of hazardous waste can be made safe by aerating it (stirring it vigorously) and exposing it to sunlight. If chlorine isn't removed, chlorine can remain in our deep, slow flowing, shaded rivers and streams long enough to travel downstream and kill fish and other animals as it goes.

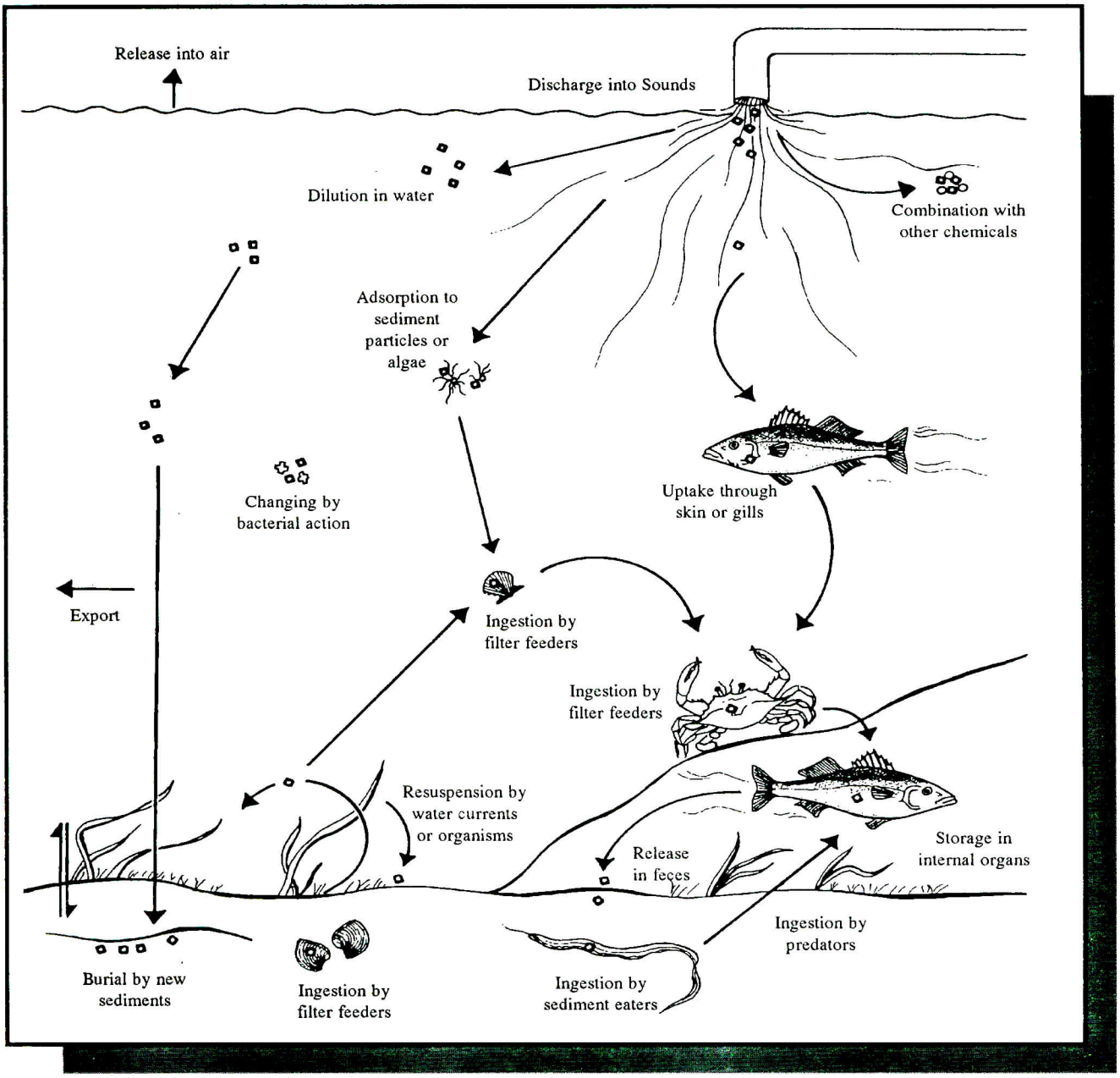
Ways To Make Water Fit For A Fish

Collect a gallon of fresh tap water and place a lid on the container so the chlorine will not escape. Before you cover the container, smell the water. If it contains chlorine you will probably be able to smell it since it smells like a swimming pool. Using your test kit (instructions should be included with the kit you purchased), test a small sample of this water for chlorine. If your water is not chlorinated, you can simulate city water by adding one-eighth teaspoon of household bleach to a gallon of water. The active ingredient in household bleach is chlorine. Divide your class into four groups. Each of the

student groups should be provided with several ounces of water, three jars with lids, straws, spoons, and access to a window sill. Give the students enough water for a chlorine test. The groups (pretending they are scientists) should devise tests on how to rid their water of the hazardous waste chlorine. Allow the students enough time (20-30 minutes) to discuss ideas within their groups and conduct their experiments. After the experiments, groups should be prepared to answer the following questions for each technique:

How long did it take to rid the water of chlorine? Which method would be the easiest for a town to use? Could the different techniques be combined? If they were combined, would that more effectively remove the chlorine?

Some students may want to bring water in from home to be tested. If you have time, this might be an interesting follow up experiment especially if some students have well water at home.



FATE OF CHLORINE AND OTHER CHEMICALS IN THE SOUNDS

Illustrations by Sandra Koch