Chesapeake Bay Theme Day
Traveling Outreach Program
Pre- and Post-Visit Activities
Grades 3-4
The National Aquarium is a nonprofit organization whose mission is to inspire conservation of the world’s aquatic treasures.
Chesapeake Bay Theme Day
Auditorium programs and 20-minute lab sessions for Grades K-6

A school-wide package is a great way to give classes in multiple grade levels (K-6) the opportunity to benefit from a traveling outreach program. Each package includes:

- Two auditorium presentations (one for grades K-2 and one for grades 3-6)
- Ten interactive discovery sessions that allow students to explore the theme in depth and to investigate animals introduced in the auditorium presentation. Each 20-minute session is identical and is limited to one class (of up to 30 students maximum) to allow for optimal learning. Parent volunteers are required to assist with interactive discovery sessions. See Parent Volunteer Instructions on page 2 for more information.

OUTREACH PROGRAM DESCRIPTION

Marshland Mystery Auditorium Presentation
Grades K-2 (35 minutes)
What animals can you find in the marsh and what is happening to them? Investigate the animals of a marsh, how they live and the challenges they face.

The Waterman Auditorium Presentation
Grades 3-6 (60 minutes)
Explore the Chesapeake Bay through the experiences of a waterman. Costumes, artifacts and personal stories help students understand how the loss of habitat affects both animals and people.

Discovery Labs
Examine the Chesapeake Bay through artifacts, basic science experiments and live animals. (Live animals are subject to availability.)

PLANNING FOR THE OUTREACH PROGRAM

This lesson includes pre- and post-program activities that will supplement the auditorium program and discovery lab sessions. These activities can be incorporated into science, reading and social studies units about Maryland, the Chesapeake Bay, map studies or ecology lessons. This lesson should be covered in three days including the outreach program at your school.

AAAS Benchmarks

5D/E4-3-5: Changes in an organism’s habitat are sometimes beneficial to it and sometimes harmful.

12D/E7-3-5: Write a clear and accurate description of a real world object or event.

MD Voluntary Curriculum: Science

Grade 3 - 1.0 Skills and Processes B.1.a
Develop explanations possessed and evidence from observations, reliable print sources and investigations.

Grade 3 - 6.0 Environmental Science A.1.
Use scientific skills and processes to explain the interactions of environmental factors (living and non-living) and analyze their impact from a local to a global perspective.

Grade 4 - 3.0 Life Science F.1.
Explain ways that individual and groups of organisms interact with each other and the environment.

Grade 4 - 6.0 Environmental Science B.1.
Recognize and describe that people in Maryland depend on, change and are affected by the environment.
DAY 1: PRE-OUTREACH PROGRAM ACTIVITIES
Before educators from the National Aquarium's Outreach Department visit your school, read the Teacher Background section found on pages 4-7 and share with your students. As a class, complete Activity 1 – Making Tracks on pages 14-15 and Activity 2 – Oysters and Blue Crabs of the Chesapeake Bay found on pages 19-22.

These activities will allow students to familiarize themselves with vocabulary and material that will be taught during the Aquarium programs as well as reinforce what the students already know about the Chesapeake Bay. These activities incorporate content areas touched upon during the National Aquarium's outreach program including information about the Chesapeake Bay watershed, animals found in the Chesapeake Bay and current events associated with health of the Chesapeake Bay.

DAY 2: OUTREACH PROGRAM AT YOUR SCHOOL
On the day of your outreach program, the National Aquarium outreach staff will present two large-group auditorium programs—one for grades K-2 (35 minutes) and one for Grades 3-6 (60 minutes). Ten to twelve discovery lab sessions (depending upon what is written on the contract) will take place in a separate room throughout the school day. See sample schedule on page 3.

Auditorium Presentation Requirements:
1. One room large enough to hold all of the students scheduled to attend that presentation.
2. Students should be seated and ready to begin at the start time listed on the contract.
3. Allow 35 minutes for the K-2 presentation and 60 minutes for the Grades 3-6 presentation.

Discovery Lab Session Requirements:
1. Labs need to be in one room for the entire day. The room needs to contain four large tables (or desks that can be pushed together), a power outlet and, if possible, a sink.
2. Each individual class will come to this room approximately two minutes before their scheduled time. Teachers should have the class divided into four groups.
3. Lab sessions are 20 minutes each in duration. Each session is identical.
4. Parent volunteers are required for the lab sessions. See below for instructions.
5. National Aquarium outreach staff will need a copy of the schedule upon arrival.

Parent Volunteer Instructions:
1. Parent volunteers need to arrive approximately 30 minutes prior to the start time of the first lab session for training. (Some parents may only be able to stay for part of the day. You may wish to plan for one morning set of volunteers and one afternoon set. The afternoon set should arrive 30 minutes prior to the afternoon's first lab session.)
2. Each parent volunteer will be in charge of one station during the entire Discovery Lab session.
3. The parent volunteers' main task will be to guide the students through the assigned station and actively engage students with questions and fun facts.
4. Useful questions include: “Why is a marsh a great habitat for animals?” “How do watermen catch blue crabs?” or “Why might an animal have a shell?” Object comparisons are also useful (ex. find similarities, differences, etc.).
5. Please focus the students’ attention back on the National Aquarium instructor when it is time to rotate to the next station.
SAMPLE SCHEDULE

The outreach staff at the National Aquarium is happy to review your schedule to ensure that the program will run smoothly. Please send a copy of your schedule via fax to 410-659-0116 Attn: Outreach or e-mail outreach@aqua.org.

<table>
<thead>
<tr>
<th>AUDITORIUM PROGRAM</th>
<th>DISCOVERY LABS</th>
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<tbody>
<tr>
<td><strong>Time</strong></td>
<td><strong>Time</strong></td>
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<tr>
<td>9-10 a.m.</td>
<td>9-9:30 a.m.</td>
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<tr>
<td>(extra time allotted for transition and set-up for the next program)</td>
<td>Aquarium staff will also set up labs during the morning presentation</td>
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<td>Grades K-2</td>
<td>9:30-10 a.m.</td>
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<td>10-11 a.m.</td>
<td>Train morning set of volunteers</td>
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<td>Grades 3-6</td>
<td>10-10:20 a.m.</td>
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<td>Grade 1</td>
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<td>10:25-10:45 a.m.</td>
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<td>11:40 a.m.-12 p.m.</td>
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**DAY 3: POST-OUTREACH PROGRAM ACTIVITIES**

The day after the outreach program, complete Activity 3 – Bayscaping: Building an Environmentally Friendly Yard found on pages 25-26. This activity highlights current issues facing the Chesapeake Bay and conservation actions that can be taken to help. This activity also reinforces what students learned from the Aquarium’s presentation and discovery lab.
Teacher Background

THE CHESAPEAKE BAY

The Chesapeake Bay is about 200 miles long with an average depth of less than 25 feet (7.6 meters). The Bay itself lies entirely within the states of Virginia and Maryland. However, the water from rivers and streams that drains into the Bay (known as the watershed) comes from a much larger area. The Chesapeake Bay watershed covers over 64,000 square miles and includes parts of Maryland, Virginia, Pennsylvania, New York, West Virginia, Delaware and Washington, DC. More than 16 million people live in the Chesapeake Bay watershed.

The Chesapeake Bay is one of this country’s greatest resources. The Bay is home to many plants and animals that interact in a complex ecosystem. Many species of fish that live in the ocean as adults spawn and mature in the Bay. In the winter months, the Bay provides food and a much-needed resting place for migrating birds and waterfowl. For centuries, humans have reaped benefits from the Bay; we have eaten its animals, used it for commerce and shipping and participated in recreational activities along its beautiful banks. The Bay is home to one of the largest shipping centers on the East Coast, with more than 90 million tons of cargo traveling its waters each year. Millions of people head to the Bay every year to go boating, fishing, swimming or to enjoy some other water-related activity. However, human pollution threatens to destroy the Bay’s value as a home for wildlife as well as a source of food and recreation.

HABITATS OF THE BAY

A habitat describes the place where a particular species lives and contains the necessary food, water, shelter and space needed for an organism to survive. Three important habitats found in the Chesapeake Bay are SAV beds, oyster reefs and marshes.

In the shallow water of the Chesapeake Bay, underwater grasses—or submerged aquatic vegetation (SAV)—provide food and habitat for many fish, invertebrates and migratory birds. Blue crabs hide within the underwater grass beds after molting when their soft “shells” are most vulnerable to predators. Molting is the process by which crabs shed their outer covering (called an exoskeleton) in order to grow. Small fish find refuge from larger predators among the grass beds. SAV beds act as a nursery for crabs and fish, including menhaden, herring and shad. Bay grasses are also a valuable food source for migrating and resident bird species. Underwater grasses are important primary producers in the Bay, adding oxygen to the water through photosynthesis. They improve the Bay’s water quality by absorbing excess nutrients. SAV beds also reduce wave action that can erode shorelines and trap sediment that would otherwise cloud the water.

Oyster reefs can be found throughout the mid to lower Bay. These reefs, or bars, are formed when young oysters—called spat—settle on the firm surfaces of mature or dead oyster shells. The accumulation of oyster upon oyster results in the formation of clusters of oysters, which create refuges for small fish and invertebrates. The oyster shells offer a hard substrate where organisms such as barnacles, tunicates and sponges can attach. The natural ability of oysters to filter dirt from the water results in higher water clarity and light penetration in these areas. Fish such as gobies, blennies and skilletfish live in and among the oyster reef community.

Marshes are a type of wetland that contains mostly tall grasses, with some flowers and small bushes. Marshes have a natural supply of water—either from tides, flooding rivers or groundwater. Salt marshes are characterized by salt-tolerant plants and animals, while freshwater marshes contain the more salt-sensitive species. Brackish marshes—marshes with salinities ranging between those of freshwater and saltwater—are also marshes that are found along the Chesapeake Bay. In the Chesapeake Bay region, a tidal marsh experiences a change in the water level four times each day with the changing tides—two high tides and two low tides. The part of the marsh that is often submerged by incoming tides is termed the low marsh.
Plants that are found in this area, including salt marsh cordgrass, can tolerate oxygen-poor mud and have adapted to being partially or completely submerged by the tides. The upper part of the marsh—termed the high marsh—receives less tidal action, usually only from exceptionally high tides. Wetlands play numerous environmental roles. They prevent erosion by binding to soil and blocking runoff. They act as a sponge by preventing flooding and absorbing pollutants before they can enter the Chesapeake Bay. They also provide a valuable habitat for numerous species of animals and plants. Wildlife, such as beavers, muskrats, songbirds and wading birds, depend on wetlands for food and shelter. Fish and crustaceans utilize wetlands as well.

FEATURED ANIMALS IN THE BAY

Oysters are mollusks, and are in the same phylum as octopuses, squid, clams and snails. They are bivalves, which mean they have two shells held together by powerful adductor muscles. The animal itself is a filter feeder, which means that the oyster draws in water through its gills and filters out phytoplankton, its food. Pollutants and sediments are also sucked into the oyster’s body. The oyster packages the sediment into tiny pellets, which are then expelled from the oyster to settle on the bottom of the Bay, thus purging them from being suspended in the water column. An adult oyster can filter up to 60 gallons of water per day!

Blue crabs are perhaps the most famed residents of the Chesapeake Bay. The last pair of legs on the blue crab are modified into flattened paddles called “swimmerets” that assist the crabs in locomotion. Indeed, the blue crab’s scientific name, Callinectes sapidus, literally means “beautiful swimmer that tastes good.” The common name “blue crab” stems from the brilliant blue that mature males exhibit on the undersides of their claws. The blue crab is a crustacean and is related to lobsters, shrimp and hermit crabs, among others. Like most large crustaceans, blue crabs have a hard exoskeleton (often referred to as a shell) made of chitin and calcium. Because the exoskeleton does not grow with the crab, it must be shed and replaced periodically by a new, larger outer skeleton. During this process, called molting, the old exoskeleton cracks just below the crab’s eyes and all the way to the points of the shell. The exoskeleton also cracks along the backside and along the top of the claws. Once the exoskeleton is broken open, the crab backs out of it. The crab then draws in water, forcing its new soft exoskeleton to swell. The new exoskeleton will be about one-third larger than the old one. However, the newly exposed exoskeleton will not fully harden for about three days. During this time, the soft-shell crab is extremely vulnerable to predators, and it will hide in protected areas such as marshes and underwater grass beds.

The great blue heron is one of the largest and most measures up to 4 feet in height with a 6-foot wing span. Although many herons migrate through the Chesapeake Bay region, some remain in the Bay area year-round. More than half of the Atlantic Coast breeding population of great blue herons nests in the Chesapeake Bay area. These water birds hunt silently by stalking small fish and swallowing them head first. They also eat frogs, salamanders, lizards, snakes, crawfish, small birds, rodents and insects. Great blue herons are one of the top predators of the Bay food chain.

FOOD CHAIN

The organisms in a food chain are placed into one of three groups based on how they meet their energy requirements. 

Producers make their own food using simple chemicals and energy from the sun. Green plants, underwater grasses and microscopic phytoplankton are producers.

Consumers are animals that eat producers or other consumers. A consumer that eats plant matter is called an herbivore (ex. oyster); one that eats animal matter is called a carnivore (ex. great blue heron). A scavenger is a consumer that feeds on dead animals (ex. blue crab). A consumer that eats both plant and animal matter is called an omnivore.
**Decomposers** are organisms that break down dead plant or animal material into simple chemicals. These simple chemicals are recycled when used by producers to make food. Bacteria are the most important decomposers in the Bay.

A food chain starts with a producer, such as, phytoplankton (microscopic plants that drift with water currents). The phytoplankton may be eaten by zooplankton (microscopic animals), the second link in the food chain. The zooplankton may be eaten by a small fish like an Atlantic silverside, which may then be eaten by a larger fish like a bluefish. The zooplankton, silverside and bluefish are all primary, secondary and tertiary consumers, respectively. The bluefish in turn may be eaten by an osprey or another top predator. This is the fifth and final link in the food chain. Because the osprey is not eaten by any other animal, they are called the top predators. Humans are also often considered the top predator in a food chain. This is just one example of a food chain that exists in the Chesapeake Bay.

**HARVESTING OYSTERS IN THE BAY**

When Europeans first encountered the Bay, they found abundant oysters throughout. Indeed, the Powhatan Native Americans aptly named the Bay “Chesepioe” which means “the Great Shellfish Bay.” These American oysters formed reefs so vast they posed a hazard to incoming ships. There were so many oysters that they could filter the entire Bay in a few days. Now, the same process takes over a year due to increased sediment pollution and vastly lower numbers of oysters found in the Bay.

As early as the 1850s, New England oysters off the coasts of New York and New Jersey began to show signs of overharvesting. Yankee watermen turned to the Chesapeake Bay for their harvest. With them they brought their latest innovation—the oyster dredge—and completely changed the Bay’s oyster fishery. Local watermen, who up until then had been dependent on the awkward, heavy oyster tongs for their oyster catch, began turning to the dredge. The **dredge** combined an iron rake, used to scrape oysters from other shells, with a metal bag used to collect the oysters. When combined with steam-powered ships, this method of dragging the dredge behind the boat could be used in much deeper waters and resulted in a far greater catch than tonging. Dredging proved to be far more destructive to oyster bars as well. Maryland passed laws as early as 1865 in order to protect its valuable oyster beds. The first law banned dredging from a boat that is powered by anything other than sail, resulting in a fleet of specially designed sailboats called skipjacks being used to dredge oysters from the Bay.

Once numbering perhaps in the thousands, the fleet of Chesapeake Bay skipjacks has been reduced to fewer than thirteen today. Only a handful of watermen still sail these historic beauties of the Bay. While some watermen still wrestle with hand tongs, most have turned to power-driven patent tongs to save them the toil of the days past. During the 1880s, watermen caught nearly 20 million bushels of oysters per year. Since then, the oyster harvest has declined steadily. The population of oysters in the Bay has been reduced by as much as 99 percent of its historic numbers.

**REASONS FOR DECLINE OF THE BAY**

Overharvesting of oysters in the Chesapeake Bay has threatened the oyster fishery with extinction. Both watermen and oyster connoisseurs have demanded a solution to restore the Bay’s
oysters without putting a suspension on harvesting them. The solution put forth by the Maryland Department of Natural Resources (DNR) was to regulate the industry. Methods of regulation include daily bushel limits, time limits, harvesting seasons, limited entries and periodic closures of harvesting sites. In addition, it is illegal to harvest oysters under 3 inches in length, and any boat carrying a dredge can only use a motor on certain days of the week.

The blue crab fishery is also suffering from overharvesting. To combat potential demise of the fishery, blue crab harvests are highly regulated based on size. Currently, hard shelled crabs must be 5 inches or larger to be harvested commercially. Please visit the State of Maryland’s Blue Crab Program website to learn about the Maryland DNR size regulations for blue crabs. [dnr.state.md.us/fisheries/crab/crabindex.html](http://dnr.state.md.us/fisheries/crab/crabindex.html) (Click on Regulations on the right hand side)

Land-clearing for developmental or agricultural purposes has led to increased sedimentation in the Bay. Sedimentation refers to sand, clay, or silt that gets into the water column and eventually settles on the bottom. Although sedimentation is a normal process, increased sediment from dirt runoff can be harmful to the Bay’s aquatic life. It can clog oysters’ gills if filtered in high quantities, suffocating them. It can also hinder spat (young oysters) from successfully attaching to hard substrates. The presence of sediment in the water can block sunlight from reaching the Bay’s underwater grasses, or SAV. Sedimentation in the water affects the turbidity of the Bay. Turbidity is a measurement of the clarity of water. It is usually measured with a Secchi (sek’ key) disc, a circular plate that is divided into an “X” pattern of alternating black and white quarters and is tied to a rope. The Secchi disc is lowered into the water, usually from a boat or pier. When the “X” pattern of the disc is no longer visible, the depth is recorded using length increments along the rope. High Secchi depth values mean that the water is clear. Low Secchi depth values indicate high turbidity, usually due to a large amount of sediment and phytoplankton in the water. Turbidity can also increase due to pollution, dredging or during periods of elevated freshwater input from rivers and streams.

Excess fertilizers wash off farm fields, golf courses and lawns into streams and rivers leading into the Chesapeake Bay. Once in the waterways, fertilizers designed to make crops healthy and lawns green promote the growth of harmful algae. As the algae grows, it blocks sunlight, thus preventing SAV from growing. After the algae dies, it sinks to the bottom and is broken down by bacteria. This process uses up much of the oxygen in the water, which threatens underwater life that needs oxygen.

Habitat loss has also caused major problems in the Chesapeake Bay. Coastal development has increased steadily since 1970, and currently more than half the population of the United States lives in coastal counties. In the Chesapeake Bay watershed, population growth and development pressures have led to an increase in pollution and habitat fragmentation.

WHAT YOU CAN DO FOR THE BAY

Everyone can do something to protect the Chesapeake Bay. For example, you can conserve water by turning faucets off when not in use and taking shorter showers instead of baths. This will reduce the amount of water that has to be pumped through sewage treatment plants or septic systems, which will conserve energy. You can also conserve energy by turning lights, radios and televisions off when not in use; running only full loads in the washing machine and dishwasher; and replacing ordinary light bulbs with energy-efficient bulbs. Conserving energy will reduce the demand placed on fossil fuel plants, thereby reducing the pollution they produce. Of course, “Reduce, Reuse, Recycle” is another important concept for Bay conservation. In addition, it is important to reduce the amount of fertilizer and pesticides we use in our gardens. In a practice called bayscaping, you can incorporate native vegetation into lawns and schoolyards. Planting native trees and plants will reduce the need for fertilizer while providing habitat for native animals and reducing the amount of runoff from lawns. Planting trees also prevents sedimentation. Tree roots keep soil in place so it does not run into the Bay. You can also limit sedimentation by slowing down the flow of rainwater. This can be done by installing a rain barrel to collect water as it flows off your roof from rain gutters. Simply picking up litter on the street will also help protect the Bay. Remember, the Bay’s watershed extends over 64,000 square miles and covers six states plus Washington, DC, so make sure to ask everyone you know to do their part to help the Bay!
**Glossary**

**Bayscaping** – a landscaping technique where native plants and trees are planted to provide habitat for animals.

**Bivalve** – a mollusk that has two shells; bivalves include mussels, scallops, oysters and clams.

**Blue crab** – an edible crustacean with a flat abdomen and ten legs; bluish-green in color on top and white on the underside; when a blue crab outgrows its exoskeleton, it molts.

**Brackish** – a mixture of salt and fresh water.

**Bushel** – a basket that crabs, oysters, and other shellfish are sold in; 1 bushel equals 32 dry quarts.

**Consumer** – an animal that eats producers or other consumers; this includes herbivores, carnivores, omnivores and scavengers.

**Crustacean** – a mainly aquatic invertebrate that has jointed legs and must molt, or shed its exoskeleton, to grow; examples include crabs, lobsters and shrimp.

**Decomposer** – an organism that breaks down complex organic materials to get energy and nutrients needed for its own growth.

**Dredge** – a metal cage with small spikes on one side that is attached to a boat and dragged along the bottom of the Bay to harvest oysters.

**Ecosystem** – a community of living organisms and their relationships with the non-living materials in a given area.

**Exoskeleton** – the hard, shell-like covering of crustaceans (crabs, lobsters and shrimp); literally “outside skeleton;” must be cracked open and discarded (molted) for animal to grow.

**Filter feed** – a method of collecting food from the water; used by oysters, clams and other shellfish; involves drawing water in through an intake siphon, passing it over their gills, and expelling the water through an exit siphon.

**Food chain** – a sequence that shows how each living thing gets food and how energy is passed from organism to organism; organisms in a food chain can either be producers, consumers, or decomposers.

**Habitat** – the environment in which an organism or biological population lives or grows; there are four elements to a habitat: food, water, shelter and space.

**Habitat fragmentation** – the division of a large area into smaller, isolated patches, separating the organisms that lived there; causes of habitat fragmentation include development, road building, logging and agriculture.

**Harvest** – collecting animals to sell for profit.

**High marsh** – the portion of the marsh that is affected the least by the tides.

**Low marsh** – the portion of the marsh that is most often submerged during the tides; the plants in this area are most tolerant to the poorly oxygenated mud and daily submersion during high tides.

**Marsh** – a type of wetland that contains mostly tall grasses but few trees; serves as an important breeding ground for many animals.

**Maryland Department of Natural Resources (DNR)** – a government agency that manages the health and recreational use of Maryland’s natural resources, including fresh and saltwater fish and shellfish.

**Mollusk** – an invertebrate with a soft body covered by a thick membrane; can have 0, 1, 2 or 8 shells; examples of shelled mollusks include clams, oysters, snails and scallops; octopuses and squid are examples of mollusks without an external shell.

**Molting** – the process in which crustaceans grow larger; the exoskeleton splits and the animal backs out of it to reveal a new, larger, soft exoskeleton which hardens after a few days.
Oyster – a bivalve mollusk with one convex and one flat shell; eats by filtering phytoplankton from the water

Oyster reef – an aquatic reef consisting of individual oysters piled on top of each other; many other animals use the reef as habitat including oyster toadfish, skilletfish and sea squirts

Oyster tongs – large hand tongs with handles 12-30 feet in length used to harvest oysters; the tongs are held from a boat and are used like scissors to break apart and then trap the oysters

Phytoplankton – small (generally microscopic) single-celled aquatic plants that drift with the currents; includes many kinds (phyla) of organisms called algae

Producer – an organism that makes its own food; for example, plants

Rain barrel – a barrel designed to collect and store rainwater as it drips from a rooftop

Runoff – pollution associated with water washing over water-resistant surfaces and carrying loose soil, fertilizer, garbage or other pollutants into a body of water

Salinity – the amount of salt in the water, measured in parts per thousand (ppt); fresh water has a salinity of < 1 ppt while saltwater has a salinity between 30-35 ppt

Salt-sensitive plants – types of plants that do not survive well in areas with high salinity

Salt-tolerant plants – types of plants that are adapted to living in areas with high salinity

Secchi (sek’ key) disc – a tool used to measure water quality; a weighted white disc with a black ”X” on top attached to a calibrated line; high readings indicate clean water while low readings indicate dirty (or turbid) water

Sedimentation – the process of sand, clay or silt being deposited into the water column and accumulating on the bottom

Skipjack – a sailboat used to dredge for oysters; about 40-50 feet long

Soft-shell crab – a crab that is soft-bodied for a few days after molting; very popular seafood dish and are very profitable to watermen

Spat – a juvenile, newly attached oyster

Submerged Aquatic Vegetation (SAV) – underwater plants that are an important habitat for many of the Bay’s animals

Tide – changes in water level produced by the gravitational attraction of the moon and the sun

Turbidity – a measurement of the clarity or amount of dirt in the water; often measured with a Secchi disc

Watershed – an area of land from which water (rain or snow) drains into a stream, river, or other body of water

Wetland – land that is saturated with water and that contains plants and animals that are adapted to living on, near or in water; wetlands have hydric soils and are usually located between a body of water and land
Resources

NATIONAL AQUARIUM, BALTIMORE VENUE: HARRY & JEANETTE WEINBERG WATERFRONT PARK
aqua.org

Harry & Jeanette Weinberg Waterfront Park outside the entrance to the National Aquarium. Look for the map of the Chesapeake Bay watershed, as well as examples of flora found in various watershed habitats. Be sure to listen for watershed inhabitants like birds and frogs as you explore the park.

NATIONAL AQUARIUM, BALTIMORE VENUE: MARYLAND: MOUNTAINS TO THE SEA, LEVEL 2
aqua.org

These exhibits depict Maryland habitats in a water cycle that moves from an Allegheny stream through a tidal marsh and coastal beach and out to the continental shelf.

LIVING WATERS OF THE CHESAPEAKE CD-ROM, NATIONAL AQUARIUM

Living Waters of the Chesapeake CD-ROM is loaded with interactive learning activities about the Bay for teachers and students.

ALLIANCE FOR THE CHESAPEAKE BAY
acb-online.org/pubs.cfm

Contains information on bayscaping and rain barrels.

BALTIMORE COUNTY DEPARTMENT OF ENVIRONMENTAL PROTECTION AND RESOURCE MANAGEMENT
baltimorecountymd.gov/Agencies/environment/rowing-home/index.html

Includes tips on planting your own tree.

CHESAPEAKE BAY FOUNDATION
cbf.org

Provides information on the health of the Chesapeake Bay and its watershed.

CHESAPEAKE BAY PROGRAM
chesapeakebay.net/inyourbackyard.aspx?menuitem=16888

Provides information on Bay-friendly landscaping. Includes information on bayscaping, composting and reducing runoff.

LIFE IN THE CHESAPEAKE BAY
by Alice Jane and Robert L. Lippsen.
ISBN# 0-8018-5475-X

Life in the Chesapeake Bay is an excellent resource book about the plants and animals of the Chesapeake Bay.

MARYLAND COOPERATIVE EXTENSION’S HOME AND GARDEN INFORMATION CENTER
hgic.umd.edu/content/onlinepublications.cfm

Includes information on tree planting.

MARYLAND DEPARTMENT OF NATURAL RESOURCES
dnr.state.md.us/

Contains tips on storm drain stenciling.

MARYLAND SEA GRANT’S OYSTERS AND THE CHESAPEAKE IN THE CLASSROOM
mdsg.umd.edu/oysters/

U.S. FISH AND WILDLIFE SERVICE’S CHESAPEAKE BAY FIELD OFFICE
fws.gov/chesapeakebay/baysc2.html

Includes information on bayscaping.
Activity 1– Making Tracks

DESCRIPTION

In this activity, students will become animal detectives as they discover the different animals that live in a marsh habitat. They will also identify tracks made by animals that live either in or around the Chesapeake Bay.

PROCEDURE

Part A

1. Make a copy of Activity 1 – Making Tracks Part A found on page 14.

2. Show the picture to the class and ask the students what they see in the picture. Answers include tall grasses, sand, water and animals such as birds (a great blue heron in the water and a red-winged blackbird perched on the grass), periwinkle snails, fiddler crabs, oysters, a turtle (diamondback terrapin) and a fish (flounder). Another option is to distribute copies of the Student Page to all students and have them circle or color all the animals they see in the picture.

3. As a class, discuss that this is a picture of a marsh. Ask the students the following questions:
   a. What is a marsh? Refer to page 4 of the Teacher Background.
   b. Why is a marsh a good place for animals to live? A marsh provides food, water and a place to hide (shelter).
   c. How do we know animals are in a marsh if they are hiding? Look for clues, like tracks.

Part B

1. Discuss with students how all animals leave footprints or tracks. Ask students the following questions:
   a. Has anyone seen animal footprints or tracks before?
   b. Where have you seen them?
   c. What kind of tracks have you seen?
   d. Do you know which animals may have left those tracks?

2. Distribute copies of the Student Page found on page 20.

3. Have students complete Activity 1 – Making Tracks Part B individually or in pairs. If they need help, direct them to the pictures of each animal on their worksheet. Each picture shows a closer view of the animals’ foot. Also, you can share the hints listed on the left-hand side of the answer page with your students if they need additional clues.

4. Discuss the answers as a class. Ask students about some of the differences between the tracks (for example, different sizes, shapes, etc.). Why do different animals make different footprints? (Some answers include animals have different paw sizes, some may have claws, different animals have different numbers of feet and toes, and different uses for feet like webbed feet for swimming.) In addition to tracks, ask students what other signs animals leave behind to let you know they were there (for example, nests, eggs, feathers, teeth, droppings, sheds, shells, bones, claws, antlers, etc.).
Activity 1– Making Tracks

Part A
Activity 1– Making Tracks

DIRECTIONS
All of these animals live near the Chesapeake Bay. Each animal makes footprints or tracks when it moves. Draw a line from each animal to its matching track. You can share the hints written in the left-hand column with your students if they need clues.

**HINT:** This animal has hooves like a horse.

**HINT:** This animal has skinny feet with claws to help it catch its food.

**HINT:** This animal has four toes that are spread apart to help it stand up in the mud.

**HINT:** This animal has paws like a dog.

**HINT:** This animal has webbed feet.

Great Blue Heron

White-tailed Deer

Snapping Turtle

Raccoon

Red Fox
Activity 1– Making Tracks Part B

DIRECTIONS

All of these animals live near the Chesapeake Bay. Each animal makes footprints or tracks when it moves. Draw a line from each animal to its matching track.

Great Blue Heron
White-tailed Deer
Snapping Turtle
Raccoon
Red Fox
Activity 2 – Oysters and Blue Crabs of the Chesapeake Bay

DESCRIPTION
In this activity, students will read articles describing a waterman’s life. Using critical thinking, they will then answer questions pertaining to the articles.

PROCEDURE
1. Ask your students the following questions:
   a. How many of you have eaten an oyster?
   b. How many of you have eaten a blue crab?
   c. Where did those animals come from?
   d. Who harvested (or caught) them?
2. Explain that watermen harvest both blue crabs and oysters to sell to markets.
3. Pass out copies of the reading activities, Harvesting Oysters and Chesapeake Bay Blue Crabs, and their corresponding worksheets on pages 19-22.
4. Explain the directions to the students. Make sure they realize that there are two activities: one about oysters and one about blue crabs.
5. Once all of the students have completed both activities, go over the answers as a class.
6. Explain to the students that the National Aquarium will be coming to your school to present a program and activities about watermen.
7. Write down any questions you are unable to answer so the students may ask staff from the Aquarium on the following day.
Activity 2A – Oysters of the Chesapeake Bay

STEP A
Use the word bank on the right to fill in the blanks.
Circle where you found the answer in the article Harvesting Oysters.

1. A skipjack is a(n) _b. sailboat_.

2. Oysters live underwater in groups on a(n) _f. oyster reef_.

WORD BANK
a. rivers and streams
b. sailboat
c. molts
d. filter
e. underwater grasses (SAV)
f. oyster reef

STEP B
In the space below, write a paragraph explaining why there are not many oyster reefs. Also include what the Department of Natural Resources (DNR) is doing to help. Remember to use complete sentences.

The Chesapeake Bay’s water is not very healthy. Diseases are killing oysters. Watermen over-harvested oysters.

The Department of Natural Resources (DNR) says that watermen can only keep oysters that are 3 inches or longer. Scientists are studying oysters to protect them from disease.

STEP C
Use the article Harvesting Oysters to list three facts about watermen. Remember to use complete sentences.

Fact #1
Watermen catch blue crabs and oysters to make money. They have been doing so for hundreds of years.

Fact #2
Watermen work on boats called skipjacks.

Fact #3
Watermen use a tool called a dredge to catch oysters.
Activity 2B – Blue Crabs of the Chesapeake Bay

STEP A
Use the word bank on the right to fill in the blanks.
Circle where you found the answer in the article Chesapeake Bay Blue Crabs.

1. As a blue crab grows it ______ c. molts ________, or loses its old exoskeleton.
2. Soft-shelled crabs hide in ______ e. underwater grasses (SAV) ________.

WORD BANK
a. rivers and streams
b. sailboat
c. molts
d. filter
e. underwater grasses (SAV)
f. oyster reef

STEP B
In the space below, write a paragraph explaining how the loss of underwater grasses (SAV) in the Chesapeake Bay harms blue crabs. Remember to use complete sentences.

Answers vary. Without underwater grasses (SAV), crabs do not have places to hide when they molt. They ______
become more vulnerable to predators.

STEP C
Use the article Chesapeake Bay Blue Crabs to list three facts about watermen. Remember to use complete sentences.

Fact #1
Blue crabs have an exoskeleton around the outside of their bodies to protect them.

Fact #2
Blue crabs grow by molting, a process in which they shed their exoskeleton.

Fact #3
A blue crab that has just molted is called a soft-shelled crab.
Activity 2A – Oysters of the Chesapeake Bay

DIRECTIONS

Read the article Harvesting Oysters and complete Steps A-C.

HARVESTING OYSTERS

Watermen catch oysters and blue crabs to sell to markets. This is called harvesting and it is how watermen make their living. Watermen have been harvesting oysters from the Chesapeake Bay for hundreds of years. Some watermen work on special sailboats called skipjacks to look for the places where oysters live.

Watermen on their boats will look for groups of oysters called oyster reefs. The skipjack drags a heavy tool called a dredge over the oyster reef. Once the dredge is full of oysters, a waterman will haul it up to the boat by hand or by using a machine.

Baby oysters, called larvae, do not look like the adults. The larvae drift around until it is time to settle down. They need to attach to a hard surface. The larvae often attach to other adult oysters. They are now called spat. When oysters land and pile up onto each other, it is called an oyster reef. As more oysters settle down, the oyster reef grows.

There are not many oyster reefs left any more. The Bay water is not very healthy. Oysters are getting sick from diseases. Also, watermen used to harvest the oysters faster than the oysters could grow. Now, the Maryland Department of Natural Resources (DNR) says that watermen can only keep oysters that are 3 inches long or larger. This gives the smaller oysters a better chance to grow up and produce more oysters. Scientists are studying oysters in order to help protect them from diseases.
Activity 2A – Oysters of the Chesapeake Bay

STEP A
Use the word bank on the right to fill in the blanks. Circle where you found the answer in the article Harvesting Oysters.

1. A skipjack is a(n) ____________________________.

2. Oysters live underwater in groups on a(n) ____________________________.

STEP B
In the space below, write a paragraph explaining why there are not many oyster reefs. Also include what the Department of Natural Resources (DNR) is doing to help. Remember to use complete sentences.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

STEP C
Use the article Harvesting Oysters to list three facts about watermen. Remember to use complete sentences.

Fact #1
________________________________________________________________________
________________________________________________________________________

Fact #2
________________________________________________________________________
________________________________________________________________________

Fact #3
________________________________________________________________________
________________________________________________________________________

WORD BANK
a. rivers and streams
b. sailboat
c. molts
d. filter
e. underwater grasses (SAV)
f. oyster reef
Activity 2B – Blue Crabs of the Chesapeake Bay

DIRECTIONS
Read the article Chesapeake Bay Blue Crabs and complete Steps A-C.

CHESAPEAKE BAY BLUE CRABS

Blue crabs may be the most famous animals that live in the Chesapeake Bay. Blue crabs grow a hard shell-like covering called an exoskeleton on the outside of their body for protection.

As the crab gets bigger, it has to get rid of, or molt, its old shell to make room to grow. After molting, the crab will be soft. It needs to find shelter in underwater grasses called submerged aquatic vegetation (SAV). In just a few hours the new, larger exoskeleton begins to harden. A crab that has an exoskeleton that has not hardened yet is called a soft-shell crab.

In some areas in the Chesapeake Bay, the underwater grasses have died. As a result, the crabs have fewer places to hide. Predators find them more easily and more crabs are eaten. Humans may be over-harvesting them, too.
Activity 2B – Blue Crabs of the Chesapeake Bay

STEP A
Use the word bank on the right to fill in the blanks. Circle where you found the answer in the article Chesapeake Bay Blue Crabs.

1. As a blue crab grows it ___________________, or loses its old exoskeleton.

2. Soft-shelled crabs hide in ____________________________.

STEP B
In the space below, write a paragraph explaining how the loss of underwater grasses (SAV) in the Chesapeake Bay harms blue crabs. Remember to use complete sentences.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

STEP C
Use the article Chesapeake Bay Blue Crabs to list three facts about watermen. Remember to use complete sentences.

Fact #1
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Fact #2
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Fact #3
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Activity 3 – Bayscaping: Building an Environmentally Friendly Yard

DESCRIPTION
Bayscoping is another great activity you can do to help the Bay. It can include many different activities and can be performed in many different settings. For more information on bayscoping, refer to page 7 in the Teacher Background.

In this lesson, students are exposed to the concept of bayscoping and explore how they can help the environment by making environmentally friendly landscaping improvements. Students compare bayscaped and non-bayscaped areas and will practice writing complete sentences to describe improvements they can make.

PROCEDURE
1. Distribute copies of the Bayscoping worksheets on pages 25-26 to the students.
2. Read What is Bayscoping?, located on page 25, as a class.
3. Review the bayscoping improvements mentioned in the reading and discuss how each strategy helps the environment. (For example: plant roots hold dirt in place, rain barrels save and slow the flow of rain water, native plants require less watering and fewer chemical pesticides and fertilizer, gravel paths slow down the flow of water into rivers, etc.)
4. Instruct students to color or circle the differences between the two pictures of bayscaped and non-bayscaped schoolyards found on page 26.
5. After they have pointed out the differences between the two pictures, have the students write a short paragraph describing ways they can help the environment. (For example: students may decide to plant trees, write letters to government officials, use less water, set up rain barrels, recycle, clean up litter, encourage their parents to use less fertilizer on their lawns, etc.).
Activity 3 – Bayscaping: Building an Environmentally Friendly Yard

STEP A
There are two pictures below. One picture is of a bayscaped schoolyard and the other picture is of a schoolyard that has not been bayscaped. Color or circle the differences between the two pictures.

STEP B
Write three complete sentences about what you and your family can do to help bayscape your yard at home, neighborhood or schoolyard.

Answers will vary but may include: planting gardens, trees, grass, and other plants; putting fences around areas that can spread dirt or sand; picking up litter; putting recycling bin in yard; putting up a rain barrel at the base of the gutter.
Activity 3 – Bayscaping: Building an Environmentally Friendly Yard

DIRECTIONS
Read the article What is Bayscaping? and complete Steps A and B.

WHAT IS BAYSCAPING?

Bayscaping is changing an area to make it better for the environment. Bayscaping includes changes that help the environment by stopping dirt pollution and saving water.

One example of bayscaping is using native plants in your yard. Native means that they can grow on their own. Therefore, they need less water to grow well. Plants and trees make good habitats for animals to live. Plants also help to keep dirt from washing into streams and rivers when it rains. Too much dirt in the water can hurt underwater plants. It blocks sunlight that underwater plants need to grow.

Rain barrels are also a part of bayscaping. These large barrels are put next to rain gutters to catch rain water. The rain water is saved in the large barrel. It can be used to water plants when it is very dry. Saving rain water before it reaches the ground also keeps it from washing dirt into rivers and streams.

Another part of bayscaping is making paths out of gravel. Gravel is better than blacktop, asphalt, or cement. Gravel paths allow rain to soak into the ground more slowly. This keeps extra dirt (called runoff) from moving into rivers and streams.
Activity 3 – Bayscaping: Building an Environmentally Friendly Yard

STEP A
There are two pictures below. One picture is of a bayscaped schoolyard and the other picture is of a schoolyard that has not been bayscaped. Color or circle the differences between the two pictures.

STEP B
Write three complete sentences about what you and your family can do to help bayscape your yard at home, neighborhood or schoolyard.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

National Aquarium
Chesapeake Bay Theme Day – Grades 3-4