Virginia's Bay & Coastal Resources

Virginia's natural beauty is undeniable to those drawn to her shores. Here, sparkling water from diverse landscapes enters the majestic Chesapeake Bay and mighty Atlantic Ocean and, along the way, interacts with coastal plants and animals. Coastal plants and animals, or living resources, are fascinating to study because they live in starkly different environments and provide clues about life on the "edge."

Coastal Wetlands

Wetlands are combinations of land and water. They may be covered by water most of the time or only on occasion. Plants and animals living here must be specially adapted to survive the twice daily changes of incoming and outgoing tides, resulting mainly from the gravitational pull of the moon on the water as the earth turns. Virginia's tidal wetlands include salt marshes, brackish and freshwater marshes, and swamps.

Wetlands along the water's edge provide the following valuable services:

- Absorb excess flood water;
- Protect uplands from the storm damage of wind and waves;
- Provide constant, ideal habitat—including food and shelter for many animals and essential nursery habitat for others;
- Filter out pollution; and
- Mix oxygen into the water.

Tributaries & Watershed

When it rains in the Chesapeake's drainage basin, or watershed, most of that water flows across the land surface into streams and rivers, then into the Bay and, eventually, on to the Atlantic Ocean. More than half of Virginia's land base rests in the Chesapeake Bay watershed, as do portions of New York, Pennsylvania, West Virginia, Delaware, Maryland, and the District of Columbia. The whole watershed, in fact, drains 64,000 square miles!

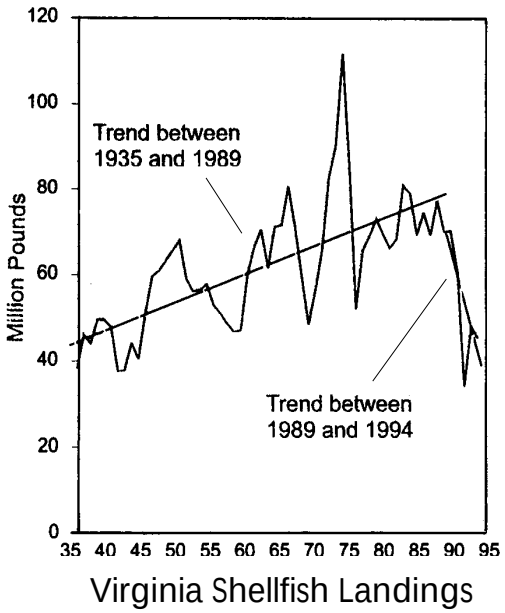
A tributary is a stream or river that contributes its water to another stream, river, or body of water. Everyone in Virginia lives fairly close to one. The main tributaries of the Chesapeake Bay flowing through Virginia are the James, York, Rappahannock, and Potomac rivers.

The names of the rivers in the basin reflect the early settlement of the Commonwealth. The Potomac, Rappahannock, Pamunkey, Mattaponi, and Chickahominy are tributaries with names originating from Algonquin, a Native American language spoken by the many tribes of the Powhatan Confederacy who first settled in the region. The Susquehanna River carries the largest amount of fresh water into the Bay; again, its name comes from Native American origins. Two other rivers, the James and the York, have English names given by European settlers. "Chesapeake" is yet another example of Native American influence, said to have meant "great shellfish bay."

Open Bay

The Chesapeake Bay is an estuary, a partly enclosed water body where fresh water from rivers meets ocean salt water, and the two mix. It is the largest estuary in our nation. Chesapeake Bay water is saltiest near the Bay's mouth and gradually becomes fresher to the north. This variation supports a wide array of plants and, as a result, the Bay is an essential nesting and nursery site for migratory waterfowl, small aquatic creatures, and fish.

This vast living resource base provides many recreational and commercial benefits to the Common-

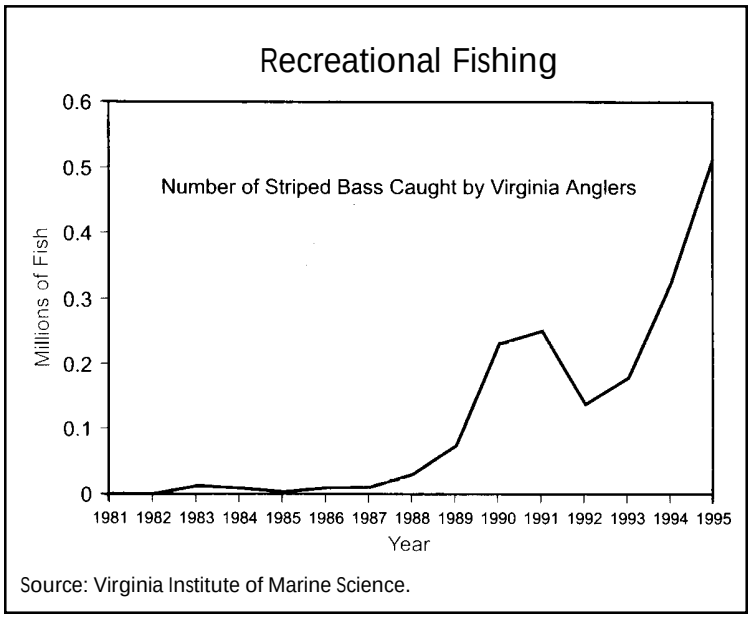


Virginia Shellfish Landings

Source: Virginia Institute of Marine Science.

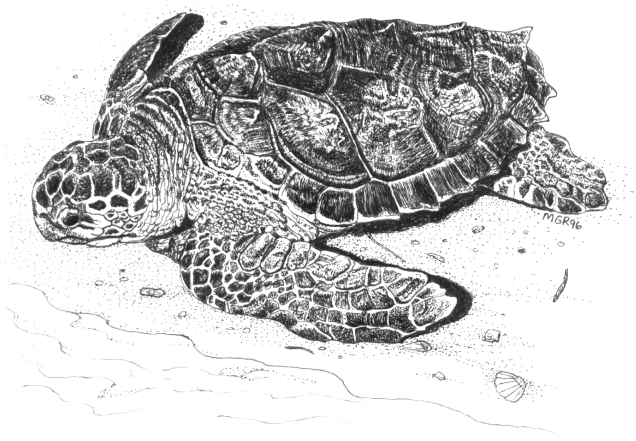
wealth. Virginia's commercial fisheries industry primarily includes finfish—menhaden, striped bass, croaker, and flounder; and shellfish—oysters, clams, scallops, and blue crabs from the Bay and ocean. The economic value of this annual commercial harvest is about $500 million. But the mix of the catch is changing. Several valuable commercial species of the Bay have declined over the years. Causes are attributed to pollution, disease, over-fishing, loss of habitat, or a combination of these factors.

For example, in the 1970s roughly 6 million pounds of oysters were harvested each year in Virginia. By 1997 the oyster harvest had dropped to a mere 300,000 pounds. The population of oysters in the Bay is now estimated to be only one percent of what it was prior to the Civil War. In 1998, the National Oceanic and Atmospheric Administration's stock assessment committee considered the blue crab stock "fully exploited" but not overfished. In its report, the committee found that the number of crabs three inches and greater in size has decreased since 1995. Other studies show that the average size of female crabs is also decreasing. Scientists attribute the declines to environmental conditions and increased fishing pressure.



Source: Virginia Institute of Marine Science.

The striped bass is an example of a resource whose fishery nearly collapsed but has recovered. Their numbers declined rapidly in the late 1970s through the 1980s, most likely because of over-harvesting and subsequent reproductive failure. Now, after several years of cooperative coastwide controls on striped bass fishing, their populations are rebounding.



The Atlantic Ocean and Barrier Islands

Virginia is fortunate to front the Atlantic Ocean. From Virginia Beach and the Eastern Shore, people can thrill at the sight of shorebirds, migratory birds, dolphins, or whales breaching. A wide assortment of marine mammal species swim off Virginia's shores. These include the Atlantic bottlenose dolphin, striped dolphin, harbor porpoise, humpback whale, and harbor seal, to name a few. Occasionally, Risso's dolphin and manatee will travel this far north as well. Five types of sea turtles join them: Kemp's ridley, Atlantic hawksbill, loggerhead, Atlantic green, and leatherback. Marine mammals, sea turtles, and pelagic (ocean) fish, then, are some of the important animals depending upon a clean ocean filled with species of plants and animals lower in their food chain to survive.

Once across the Bay and on the Eastern Shore, Virginians set foot on one of the most unique coastal ecosystems in the world. The southern part of the Delmarva Peninsula (named for Delaware, Maryland, and Virginia, the three states that make it up) is dotted on the seaside by a unique chain of barrier islands and lagoons. This pristine island ecosystem provides critical habitat for a wide variety of songbirds, shorebirds, waterfowl, finfish, and shellfish.

Along Virginia's Atlantic coast and crossing the 17.6-mile Chesapeake Bay Bridge-Tunnel, fishing boats, container cargo ships, barges, and oil tankers are evidence of the commercial importance of our ports. The Hampton Roads complex, including Portsmouth, Norfolk, Hampton, and Newport News, is one of the nation's major North Atlantic ports for commerce, ship-building, and military presence.

Sources of Pollution Threatening Coastal Waters

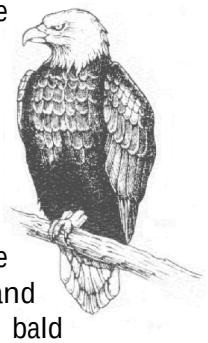
Pollution from an identifiable point, or "point source," comes from pipes, ditches, sewers, channels, tunnels, sewage treatment plants, factories, and containers of various types. While much of this pollution is treated, the wastewater still contains contaminants.

Non-point source pollution, by contrast, is difficult to identify since it is a mix of many things draining off the land. Muddy water flowing off of recently plowed farm fields or eroding construction sites blocks sunlight from reaching submerged plants that provide essential habitat for many young animals. It also is full of nutrients that lead to algae blooms, that later sink and die. During decomposition, oxygen is used and less remains available for other marine life. Sediment smothers fish eggs and clogs and tears the gills of young fishes. It settles on top of oysters and other bivalve mollusks, often killing them in the process.

Especially harmful to coastal wildlife is motor oil that leaks from cars and boats and, eventually, reaches the Bay and ocean. Oil improperly discarded from one car engine during an oil change (about one gallon) can produce an oil slick the size of six football fields! Motor oil is poisonous and likely to kill animals who ingest it. And oil that sticks to the feathers of ducks and birds prohibits them from flying.

Other toxics, or poisonous substances, may contaminate coastal waters, sediments, and body tissues in animals, especially near urban, industrial areas. These substances range from organic compounds produced during industrial processes to common household products, such as paint, battery acid, nail polish remover, and pesticides.

Since the 1972 ban on the pesticide, DDT, there is good news about bald eagles and pelicans. In the 1970s there were so few of these birds they were in danger of disappearing. The pesticide had run off land where it was used to control insects. It had gotten into rivers, bays, and the ocean, then into fish that bald eagles, pelicans, and other birds eat. Consequently, shells of eggs laid by these birds were not thick enough and broke before the young could completely develop and hatch. In 1970 there were about 50 bald eagle nests, but success in producing fledgling eaglets was very limited. By 1990 the number of "successful" nests in the Chesapeake Bay area had risen to 225.



Interesting Facts About the Chesapeake Bay:

- Has a drainage basin covering 64,000 square miles, extending into six states
- Is the largest estuary in the contiguous United States and one of the most productive in the world
- Has a main stem more than 195 miles long, which ranges from 3.4 miles near Aberdeen, Maryland, to 35 miles near the mouth of the Potomac River
- Receives 90 percent of its fresh water from five major tributaries: the Susquehanna, Potomac, James, Rappahannock, and York rivers, with the balance supplied by 150 smaller rivers and creeks
- Has 7,000 miles of shoreline and a surface area of more than 2,200 square miles
- Has a volume of some 18 trillion gallons of water and an average depth of less than 30 feet
- Is the home for 267 fish species and 2,700 plant and animal species, and is a major stop along the Atlantic Migratory Bird Flyway for songbirds and birds of prey
- Is a commercial and recreational resource for more than 13 million people living in its basin
- Receives 1.5 billion gallons of treated sewage effluent per day and waste from 3,000 point source dischargers in its upper drainage basin
- Hosts a commercial fishing industry that generates $269.4 million in annual income to the state

and about Virginia's Coast:

- Home to the Southern Watershed, located in southeastern Virginia and making up the southern portions of the cities of Chesapeake and Virginia Beach, which is one of the most biologically diverse regions of the state and supports more than 40 rare plant species and 10 terrestrial, estuarine, and palustrine wetland communities
- Also home to Back Bay National Wildlife Refuge and False Cape State Park, in the Southern Watershed, which attract tens of thousands of visitors each year
- Site of Northampton County, the southernmost county on the Eastern Shore, which has been designated a World Biosphere Reserve by the United Nationas due to the rich habitat it provides for over 260 species of birds and countless other fish and wildlife

Restoration Projects

Underwater grass restoration is very important, but is still considered relatively experimental. The Virginia Institute of Marine Science has been transplanting submerged aquatic vegetation, or SAV, into the Chesapeake and Magothy bays since 1978. Transplanting techniques have been perfected, but light is essential to SAV growth. Success depends on our ability to reduce hindrances like sediments and nutrients which can cloud these waters.

Coastal waters used to be filtered and cleaned courtesy of a thriving oyster population, and for years people across the country enjoyed eating oysters harvested from the Bay. Oyster reefs used to protrude above coastal waters and were so prevalent they were considered navigational hazards! Oyster reefs have always been home to many valuable sport fish and other aquatic animals such as blue crabs, grass shrimp, mussels, sponges, and barnacles. Because of their important ecological contribution, oysters are now being transplanted onto sanctuary reefs in the Great Wicomico and Piankatank rivers, and in Pungoteague Creek on Virginia's Eastern Shore, under a program launched by the Virginia Marine Resources Commission. Recently, the Virginia Coastal Program at DEQ and the Chesapeake Bay Foundation have joined in this effort. Many citizens are growing "oyster gardens" alongside their docks to supply more oysters to transplant, and students are helping to establish reefs in the Elizabeth River through school-sponsored programs. (See Water Resources chapter for volunteer opportunities.)

All of these projects offer hope for the future of the Bay and its marine life. As people become more aware of the direct links between actions at home and impacts on the waters of the Bay and ocean, we have a better chance of preserving the many treasures found along Virginia's shores.

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u Blankenship, Karl (editor). *Bay Journal*, Seven Valleys, PA: Alliance for the Chesapeake Bay.

u Horton, Tom and W. E. Eichbaum. 1991. *Turning the Tide - Saving the Chesapeake Bay*. Annapolis, MD: Chesapeake Bay Foundation, 328 pp.

u Reshetiloff, Kathryn (editor). September, 1997. *Chesapeake Bay Introduction to an Ecosystem*. EPA 903-R-97-024 & CBP/TRS 184/97, 30 pp.

u Barnes, Brooks Miles and Barry R. Truitt (editors). 1997. *Seashore Chronicles - Three Centuries of the Virginia Barrier Islands.* Charlottesville: University Press of Virginia.

Additional Resources

Web Sites:

u Virginia Marine Education Center; www.vims.edu/adv/ed

u The Bridge to locate other relevant on-line resources; www.marine-ed.org

u Chesapeake Bay Program; www.chesapeakebay.net

u Virginia Coastal Program at DEQ; www.deq.state.va.us

u The Nature Conservancy's Virginia Coast Reserve; www.tnc.org/infield/State/Virginia/vcr.htm

u NOAA's Coastal Zone Management Program; www.nos.noaa.gov/ocrm/czm/welcome.html, or www.deq.state.va.us/coastal/homepage.html

Other Resources:

u *WOW!: The Wonders of Wetlands* (latest ed.)

u Project WET, Curriculum & Activity Guide, 1995.

u *The Coastal Connection: Migratory Birds of Virginia,* A Curriculum Supplement for Virginia Educators, 1999. Richmond: Va. Department of Environmental Quality.

Fundamental Learnings Related to Bay & Coastal Resources

R Virginia's coastal resources are extremely valuable to the state's economy and environment.

R Coastal resources include wetlands, rivers, dunes, the Chesapeake Bay, the Atlantic Ocean, the Barrier Islands, Back Bay Dismal Swamp, and all of their natural components such as soil, water, plants, and animals.

R All Virginians live in a watershed and can have a major impact on water quality in the Chesapeake Bay and upon all of our coastal resources, the Atlantic Ocean, and the Gulf of Mexico.

R The sun provides light and warmth to land, air, and water. When muddy water blocks light to green plants, such as eelgrass, they die.

R Blue crabs and fish need the protection and oxygen that underwater plants in their habitat provide.

R Oyster reefs are important to ocean ecology by providing habitat (shelter, food) and filtering capacity.

Let the Sun Shine In!

Grade Level: 1

Science SOLs:
1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8

Materials:
- 1 jar of clean water
- 1 jar of muddy water
- flashlight with batteries
- 1 bunch of artificial eelgrass
- 2 shells of blue crabs
- 1 dried seahorse specimen
- 3 stuffed animal blue crabs
- 1 small stuffed animal fish
- 1 t-shirt imprinted with blue crab image
- 1 t-shirt imprinted with large fish image
- 2 tree branches
- 1 bunch of artificial flowers
- 2 green mats rep. lawn grass
- 1 yellow painted "sun" shape on poster board or wood
- 7 eelgrass costumes, made of blue felt and green ribbons
- 8 brown cloth rectangles
- 1 blue paper blue crab shape per student
- 1 yellow paper, ~3" square, (~1/12th of standard construction paper) per student.
- 8 green paper strips, ~3/4" x 9", (16 strips cut from ea. std. construction paper) per student

Objectives:
1. Observe light blocking effect of soil in water.
2. Observe blue crab shells (or sheds).
3. Model blue crab and fish behavior in eelgrass; model the sun giving light to eelgrass.
4. Infer effects of muddy water on Bay habitats.

(continued back side)

Synopsis
Students will observe that muddy water blocks sunlight. They will consider ways that soil might get into water and make inferences about its effects on underwater grasses, crabs, and other animals. They will dramatize connections between the sun, the earth, and eelgrass; and between people on land and blue crabs in an eelgrass environment.

Background
When sediment from soil erosion enters the Chesapeake Bay and its tributaries, it blocks sunlight that eelgrass and other submerged aquatic plants need. Without these underwater plants, young aquatic animals lack protective habitat and sufficient dissolved oxygen. Some erosion occurs naturally, especially during severe storms; however, conserving trees and other rooted plants on land can help control much erosion.

Procedure (approx. 45 min.)
1. Show crab shells, seahorse, artificial eelgrass. Students discuss the value of eelgrass as habitat for crabs, seahorses, etc. If you were a little blue crab or little fish, why would you be happy to have eelgrass nearby? (as a hiding place, as a source of oxygen) *(5 minutes)*
2. Show jar of clear, clean water and jar of muddy water. How does river or Chesapeake Bay water become muddy? What problem could muddy water be to fish, or clams, or oysters? Can sunlight shine through both kinds of water? Demonstrate in darkened room using flashlight projecting through clean water onto wall and not passing through muddy water. In which kind of water would underwater green plants grow better? Why? *(10 minutes)*
3. Pass out costumes/props for play. Narrate and direct action of play. *(15 minutes)*
4. Pass out craft materials. Students assemble a paper collage of a blue crab in an eelgrass environment with sun overhead. *(15 minutes)*

Assessment
Pause at the conclusion of the play to ask:
- "Why are no more blue crabs or young fish left in our play?" *The jimmy crab and the big fish ate them.*
- "Why could the jimmy crab and big fish find the blue crabs and young fish so easily?" *The eelgrass died.*
- "Why?" *The sunshine did not go through the water.*
- "Why?" *Soil made the water muddy and light does not pass through muddy water.*
- "Is soil bad?" *No, soil is valuable on land. Soil was knocked off the land by the wind and rain.*
- "Are wind and rain bad?" *No, plants on land need rain water.*
- "How did the soil become loose, so that the natural wind and rain could take it into the water?" *People removed trees, dug up grass, and pulled up flowers by their roots. Roots could no longer hold soil securely on the land!*

Students will be able to construct the collage showing eelgrass providing protection for a blue crab and answer questions about how the parts of the collage relate to each other. For example:
u "Why do you need to include an image of the sun?" *To show that eelgrass needs sunlight.*
u "Why do you need to include images of eelgrass?" *To show that blue crabs need eelgrass for protection.*

Follow-up Suggestions
u Plant and care for grass, ground cover, flowers, trees, or shrubs.
u Mix different materials with water. See which mixtures allow light to pass through.
u Place some potted plants in light and others in dark. Observe.
u Read *Crabby & Nabby - A Tale of Two Blue Crabs* by Suzanne Tate.

5. Assemble a collage, placing a crab in its habitat.

Vocabulary Words:
eelgrass
erosion

LET THE SUN SHINE IN - Script & Directions

***** "Soil was secure on the land . . .*(Characters stand in two lines facing each other across the space representing water.)*

***** . . .because flowers and grass and trees were growing on the land" *(These characters each stand behind a soil character with one hand holding a prop and the other hand on a soil character's shoulder.)*

***** "The sun was shining through the water of the Chesapeake Bay and on the trees, grass, and flowers on the land, making them warm." *(Character stands in front of a window facing other characters.)*

***** "Eelgrass was growing under the water of the Chesapeake Bay" *(Characters form circle holding hands in center of area representing water.)*

***** "Blue crabs were hiding in the eelgrass." *(Characters crouch inside the eelgrass circle.)*

***** "Young Fish were hiding in the eelgrass." *(Character crouches inside the eelgrass circle.)*

***** "Big 'ole Jimmy Crab couldn't find soft crabs or fish to eat." *(Character enters walking sideways; pinches the eelgrass ribbons; pretends not to see blue crabs or young fish.)*

***** "Big Fish couldn't find soft crabs or fish to eat." *(Character enters with swimming motion; circles the outside of the eelgrass circle; pretends not to see blue crabs or young fish.)*

***** "People came and chopped down trees; scraped up grass; pulled up flowers." *(Character models tree chopping with imaginary ax or chain saw, digging up grass with imaginary shovel, pulling up flowers by the roots. Tree, flower, and grass characters return to desks.)*

***** "Soil got loose; rain mixed with it. It became mud and slid into the water." *(Soil characters wiggle; walk slowly into water area; then form circle around the eelgrass circle, facing outward.)*

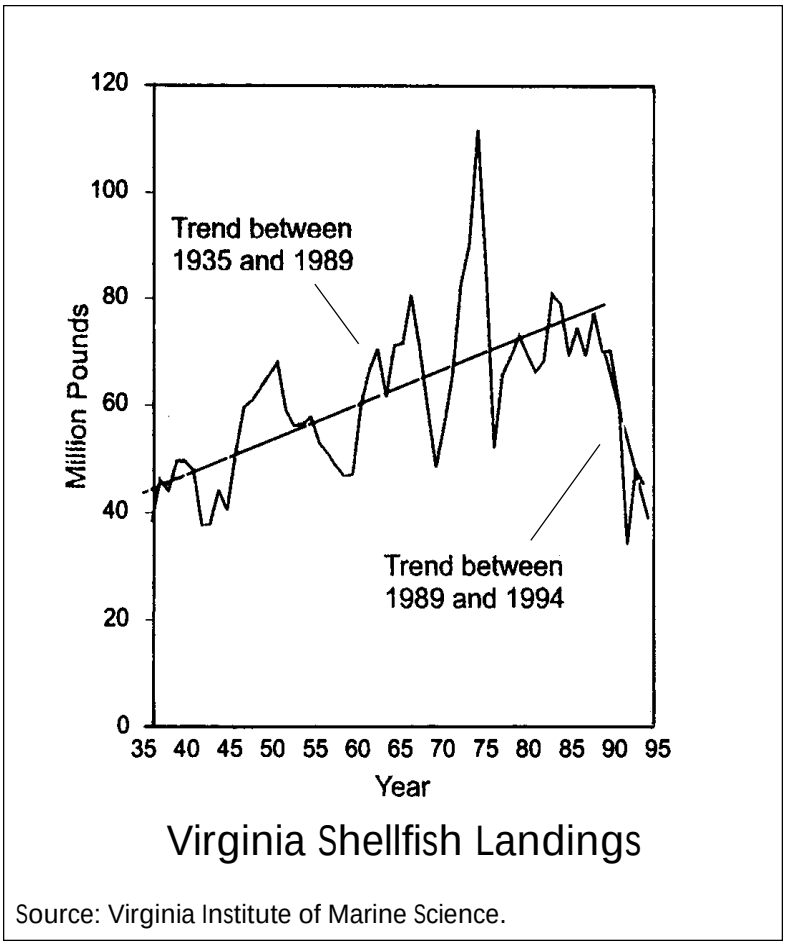
***** "Sunlight could not get through the muddy water to the eelgrass, so the eelgrass died." *(Sun character walks toward each soil character; each soil character blocks sun's passage. Eelgrass characters drop hands; then slowly sink down.)*

***** "Now the crabs and fish have no place to hide."

***** "Will the big, hungry Jimmy Crab and Big Fish find and eat them?" *(Jimmy Crab and Big Fish catch the remaining stuffed animal blue crabs and fish; then return with stuffed animals to desk.)*

***** "Why are no more blue crabs or fish left in our play?"

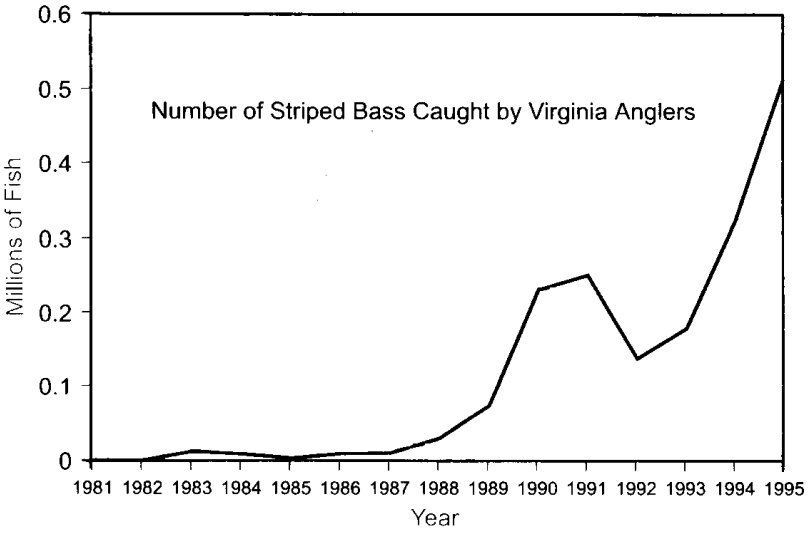
***** Return costumes/props. Remaining students return to tables or desks.



Virginia Shellfish Landings

Source: Virginia Institute of Marine Science.

Recreational Fishing



Source: Virginia Institute of Marine Science.

♦ CONSERVATION ♦

Whether you live close to the shore or farther inland, you can conserve Virginia's coastal treasures. Some ways to save precious, clean water follow:

- ♦ Repair leaky faucets.
- ♦ Sweep, rather than hose down, walkways and driveways.
- ♦ Turn water off when not needed.
- ♦ Wash cars on grass surfaces.
- ♦ Maintain your septic tank in good condition.
- ♦ Plant native species in your yard. They require less water, fertilizer, and pesticides.

You can help prevent chemical and biological contamination of waterways by:

- ♦ Disposing of hazardous household wastes at special collection centers.
- ♦ Using these products sparingly and not pouring them down sinks or storm drains.
- ♦ Seeking and using safe alternatives to toxic products.
- ♦ Maintaining your septic tank in good condition.

You can help protect ocean and Chesapeake Bay wildlife by:

- ♦ Being careful to recycle or discard fishing line, nets, or other plastic debris properly in a container. Plastics that entangle or become ingested by wildlife have deadly results.
- ♦ Not putting potentially harmful substances into ditches or down storm drains.
- ♦ Learning and obeying fishing and boating regulations, which are designed to protect both people and animals.
- ♦ Planting native vegetation along the shoreline to provide food and shelter for migratory birds and a filter for water entering the Chesapeake Bay and Atlantic Ocean.