BEACH STUDY

ASSATEAGUE ISLAND NATIONAL SEASHORE

Grades 4-6 School Visits
Pre and Post Visit Activities

INTRODUCTION

Thank you for selecting Assateague Island as a school visit location. What better way for students to learn about their environment than by experiencing a living classroom? You can make this visit an even more memorable one by creating a sense of anticipation. Try some of the pre and post visit activities in this packet to spark your students imaginations in preparation for their field trip.

Students arriving with prior knowledge of the resource will be better prepared to explore and retain what they learn during the program. Post visit activities can help students evaluate the experience and incorporate new information and ideas into relevant classroom discussion.

Please hold on to this set of materials so it can be used again next year.

Staff at Assateague Island National Seashore hope your school visit will be productive. Please fill out the attached evaluation. We are interested in your comments.

"Sandcerely"

Liz Davis
Education Coordinator
Assateague Island National Seashore
7206 National Seashore Lane
Berlin, MD 2181
liz_davis@nps.gov
410-641-1443 extension 232

Maryland Voluntary State Curriculum

Life on Sandy Shores
Grade 4
Assateague Island National Seashore Program

Science Content Standards

1. Skills and Processes – Students will demonstrate the thinking and acting inherent in the practice of science.
A. Scientific Inquiry. 1. Access and process information from readings, investigations, and/or oral communications.
B. Critical Thinking. 1. Describe and compare similarities and differences among objects and scientific concepts.
C. Applications of Science. 1. Apply scientific concepts to make decisions about a relevant science issue.
D. Technology. 1. Recognize and explain how the changes made to models can apply to real objects, events, and situations.

2. Earth/Space Science – Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe that occur over time.
E. Interactions of Hydrosphere and Atmosphere. 1. Recognize and explain the relationship of the sun to the water cycle.

3. Life Science – Students will use scientific skills and processes to explain the dynamic nature of living things.
C. Evolution. 1. Recognize and explain that organisms and groups of organisms that are best suited to an environment survive and reproduce.

6. Environmental Science – Students will 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.
B. Interdependence of Organisms. 1. Recognize and explain that Earth's surface features and environmental conditions limit what types of organisms can survive.
D. Environmental Issues. 1. Recognize and describe that people depend on, change, and are affected by the environment.

(Selected standards may vary and will be represented in pre/post visit materials and education programming)

Maryland Voluntary State Curriculum

Beach on the Move
Grade 5
Assateague Island National Seashore Program

Science Content Standards

1. Skills and Processes – Students will demonstrate the thinking and acting inherent in the practice of science.
A. Scientific Inquiry. 1. Access and process information from readings, investigations, and/or oral communications.
B. Critical Thinking. 1. Describe and compare similarities and differences among objects and scientific concepts.
C. Applications of Science. 1. Apply scientific concepts to make decisions about a relevant science issue.
D. Technology. 1. Recognize and explain how the changes made to models can apply to real objects, events, and situations.

2. Earth/Space Science – Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe that occur over time.
A. Materials and Processes That Shape A Planet. 1. Recognize and explain the processes that shape and reshape Earth's surface.

3. Life Science – Students will use scientific skills and processes to explain the dynamic nature of living things.
A. Cellular. 1. Recognize and explain that all organisms are made up of one or more cells.
D. Biochemistry. 2. Recognize and explain that some source of energy is needed for all organisms to grow, survive, and reproduce.
E. Ecology. 1. Recognize and explain that individuals and groups of organisms interact with each other and their environment.

6. Environmental Science – Students will 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.
C. Natural Resources and Human Needs. 1. Recognize and explain how renewable and nonrenewable natural resources are used by humans to meet basic needs.
D. Environmental Issues. 1. Recognize and explain that decisions influencing the use of natural resources may have benefits, drawbacks, unexpected consequences, and tradeoffs.

(Selected standards may vary and will be represented in pre/post visit materials and education programming)

Maryland Voluntary State Curriculum

Beach on the Move
Grade 6
Assateague Island National Seashore Program

Science Content Standards

1. Skills and Processes – Students will demonstrate the thinking and acting inherent in the practice of science.
A. Scientific Inquiry. 1. Access and process information from readings, investigations, and/or oral communications.
B. Critical Thinking. 1. Describe and compare similarities and differences among objects and scientific concepts.
C. Applications of Science. 1. Apply scientific concepts to defend a position relative to an issue.
D. Technology. 1. Recognize and explain that models vary in their effectiveness and may need to be changed for different purposes.

2. Earth/Space Science – Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe that occur over time.
A. Materials and Processes That Shape A Planet. 1. Identify and describe that some changes in Earth's surface occur rapidly while other changes occur very slowly.

3. Life Science – Students will use scientific skills and processes to explain the dynamic nature of living things.
E. Ecology. 1. Identify and describe that within ecosystems, organisms have different roles and functions.

6. Environmental Science – Students will 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.
B. Interdependence of Organisms. 1. Recognize and describe how biotic and abiotic factors influence an environment.
C. Natural Resources and Human Needs. 1. Recognize and compare how different parts of the world have varying amounts and types of natural resources and how the use of those resources impacts environmental quality.
D. Environmental Issues. 1. Recognize and explain that human-caused changes have consequences for the immediate environment as well as for other places and future times.

(Selected standards may vary and will be represented in pre/post visit materials and education programming)

Maryland Voluntary State Curriculum

Beach on the Move
Grade 7
Assateague Island National Seashore Program

Science Content Standards

1. Skills and Processes – Students will demonstrate the thinking and acting inherent in the practice of science.
A. Scientific Inquiry. 1. Access and process information from readings, investigations, and/or oral communications.
B. Critical Thinking. 1. Describe and compare similarities and differences among objects and scientific concepts.
C. Applications of Science. 1. Apply scientific concepts to defend a position relative to an issue.
D. Technology. 1. Recognize and explain that models vary in their effectiveness and may need to be changed for different purposes.

2. Earth/Space Science – Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe that occur over time.
A. Materials and Processes That Shape A Planet. 2. Recognize and explain that physical weathering, chemical weathering and erosion cause changes to Earth materials.
B. Earth History. 2. Recognize and explain how fossils provide evidence of Earth's changing environmental history.

6. Environmental Science – Students will 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.
A. Flow of Matter and Energy. 1. Recognize and explain how matter is transformed between the physical environment and organisms.
C. Natural Resources and Human Needs. 1. Recognize and explain the impact of a changing human population on the use of natural resources and on environmental quality.
D. Environmental Issues. 1. Recognize and describe that environmental changes can have local, regional, and global consequences.

(Selected standards may vary and will be represented in pre/post visit materials and education programming)

Maryland Voluntary State Curriculum

Beach on the Move
Grade 8
Assateague Island National Seashore Program

Science Content Standards

1. Skills and Processes – Students will demonstrate the thinking and acting inherent in the practice of science.
A. Scientific Inquiry. 1. Access and process information from readings, investigations, and/or oral communications.
B. Critical Thinking. 1. Describe and compare similarities and differences among objects and scientific concepts.
C. Applications of Science. 1. Apply scientific concepts to defend a position relative to an issue.
D. Technology. 1. Recognize and explain that models vary in their effectiveness and may need to be changed for different purposes.

2. Earth/Space Science – Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe that occur over time.
D. Astronomy. 1. Identify and explain celestial phenomena using the regular and predictable motion of objects in the solar system.
E. Interactions of Hydrosphere and Atmosphere. 1. Describe the properties and structure of the hydrosphere and atmosphere.

6. Environmental Science – Students will 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.
D. Environmental Issues. 1. Recognize and explain how human activities can accelerate or magnify many naturally occurring changes.

(Selected standards may vary and will be represented in pre/post visit materials and education programming)

VIRGINIA STANDARDS OF LEARNING

Programs presented in the Chincoteague National Wildlife Refuge

Assateague Island National Seashore Virginia District

Beach Study Grades 4-6

Indicators (Programs will vary. Selected indicators will be represented in pre/post visit materials and education programming.)

- 4.4 The student will investigate and understand basic plant anatomy and life processes.
- 4.5 The student will investigate and understand how plants and animals in an ecosystem interact with one another and the nonliving environment.
- 4.8 The student will investigate and understand important Virginia natural resources.
- 5.5 The student will investigate and understand that organisms are made of cells and have distinguishing characteristics.
- 5.6 The student will investigate and understand characteristics of the ocean environment.
- 5.7 The student will investigate and understand how the Earth's surface is constantly changing.
- 6.8 The student will investigate and understand that organisms perform life processes that are essential for the survival and perpetuation of the species.
- 6.9 The student will investigate and understand that organisms depend on other organisms and the nonliving components of the environment.
- 6.11 The student will investigate and understand public policy decisions relating to the environment.

TEACHER'S BEACH VOCABULARY SHEET

- Please choose the appropriate vocabulary words to use with your class.
- The underlined portion of each definition is simplified and may be used with younger students.

Arthropods -- means "jointed legs"; these animals have exoskeletons; sea spiders, spiders, mites, horseshoe crabs, crustaceans, insects.

Beach – the area where the ocean meets the land; Assateague's beach is made of sand.

Bivalve – an animal with two shells; a mollusk with two valves.

Camouflage – animals that blend in with their surroundings; animals use their color, patterns and shapes to accomplish camouflage.

Carnivores – a meat eater.

Cartilage -- "rubbery" bones; sharks, rays and skates are cartilaginous fish.

Clam – an animal with two rounded shells and filters plankton for food; a bivalve that lives below the surface of the bottom, clams use siphons for filter feeding, clams are able to move with their muscular foot.

Consumers -- animals can not produce their own food; consumers must eat plants or other animals.

Decomposers – microscopic organisms that cause dead plants and animals to rot or decay; organisms, mainly bacteria, that break down dead plants and animals into simpler substances.

Dune – a large mound of sand formed around plants; sand moved by wind and waves collects around vegetation to form mounds known as dunes, dunes move and change with the wind and waves.

Endangered – only a few animals or plants of a certain kind are left alive; a plant or animal in danger of becoming extinct.

Exoskeleton – animals with bones on the outside of their body; animals with an external skeleton. Mollusks and arthropods have exoskeletons covering and protecting the animal.

Extinct -- a certain kind of animal or plant is completely gone from the earth.

Filter feeders – animals that filter water for food; microscopic plants, animals and detritus are filtered from the water for food.

Flounder – flat fish with excellent camouflage for survival; flounders have both eyes on one side of their body, the eyeless side faces down and is usually white.

Food chain -- sunlight helps plants grow, plants are eaten by animals, animals are eaten by other animals; a passage of energy, where plants or producers are food for animals (consumers).

Fresh water -- drinking water, rain water; water that does not contain dissolved salts.

Gastropod -- means "stomach foot", a univalve, a one-shelled animal.

Habitat -- an animal's natural home; must provide food, water, shelter and space.

Herbivore – plant eater.

Horseshoe crab – A crab that's not really a crab! Horseshoe crabs are more closely related to spiders, ticks and scorpions than true crabs; horseshoe crabs are harmless, ancient creatures surviving and living on earth since before the dinosaurs.

Invertebrate -- an animal without a backbone.

Island -- land surrounded on all sides by water.

Mollusk -- the group of animals containing univalves, bivalves and cephalopods.

Mussels – an animal with two thin, narrow shells and filters plankton for food; mussels attach in one place with special threads called byssal, blue mussels and ribbed mussles are common at Assateague.

Omnivore – plant and animal eater.

Piping plover – a small endangered shorebird that nests on wild, natural beaches; piping plovers are small sandy-colored shorebirds, coastal development has destroyed most of the piping plover's habitat.
Predator -- an animal that hunts and kills other animals for food.

Plankton -- microscopic plants and animals living in salt water and fresh water.

Producers – plants; produce their own food with energy from the sun through the process of photosynthesis.

Salt water -- ocean water; contains dissolved salts.

Sand – rocks broken down into tiny pieces; Millions of years of rain and climatic changes break down mountains. Very small pieces of rock are carried down from mountain tops by streams and rivers and deposited along the coastline.

Scavenger -- an animal that eats dead leftover animals and plants.

School -- many of the same kind and same size of fish swimming together; fish swim in schools for protection from predators.

Scrape – a nest "scraped" on the beach by shorebirds; a shallow nest depression formed in the sand on a high area of beach by shorebirds.

Sea star – star-shaped animals with arms connected in the center of the body; sea stars have a mouth in the center of their arms on the bottom side of their body, sea stars move with rows of tiny tube feet, sea stars are predators.

Shell – the skeleton of a snail, clam or mussel; the exoskeleton made by a univalve or bivalve.

Skate – a flat harmless fish with "rubbery" bones; skates are cartilaginous fish related to rays and sharks.

Skate egg case – nicknamed "mermaid's purse"; a black casing that protects a baby skate during its development before it is born.

Skeleton – bones or shells that support and protect an animal's body; skeletons provide attachment for muscles.

Snail – large and small animals with one shell on their back; most snails have a large muscular foot for movement, a radula for feeding, tenacles, eyes, and an operculum to seal the opening in their shell.

Telson – a horseshoe crab's tail; the last abdominal segment in a crustacean or horseshoe crab.

Tides -- the periodic rise and fall of the sea level along the coasts resulting from gravitational forces of the moon and the sun on the earth.

Univalve --- an animal with a one piece shell.

Vertebrate -- animal with a backbone.

Waves -- wind moving over the surface of the water creates wave action.

Whelks – beautiful large sea snails found in the ocean near Assateague Island; Channeled whelks have smooth spiraled shells, Knobbed whelks have knobby spiral shells.

Wind -- the movement of air between two different places.

ASSATEAGUE ISLAND BEACH BINGO

Generalization: The place where land and water meet is a dynamic zone full of hidden treasures.

Objectives:
1. Students will be able to define at least 3 words or phrases from the Beach Vocabulary list.
2. Students will be able to identify some of the animals associated with the beach/ocean habitat.

Preparation: Make enough copies of the bingo sheet for each student. Select words or phrases from the vocabulary list to use in the bingo game. Collect a few prizes should you choose to present awards to winners.

Materials: Bingo sheets, chips (if you are doing the simplest form of the game), awards, colored pencils.

Procedure:
Have a little fun with vocabulary words while preparing students for their visit to the island. Assateague Island Bingo is designed to introduce students to vocabulary associated with the ocean/beach environment.

The game may be played in a variety of ways depending on age and ability.

<u>Youngest students</u>

1. Select 9 words from the vocabulary list and print them on the board.
2. Distribute bingo sheets and chips.
3. Discuss words and what they mean. (You might write a short definition next to each word.)
4. Have students print each vocabulary word in whichever block they choose so that each bingo sheet is different.
5. Make sure the students understand that every block should be filled with a word. When the students are ready, tell them that you will be calling out a definition. Students should match the definition to a word in one of the blocks and place a chip in that location.

6. When a student has 3 across, down or diagonally, he/she calls out "Assateague!"
7. Students must review their 3 vocabulary words and give each definition. If all three words and definitions are correct, the students wins!
8. Teachers! Remember to keep track of each word and definition called out!

More challenging

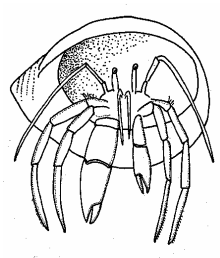
1. Select 9 words from the vocabulary list and print them on the board.
2. Distribute bingo sheets.
3. Discuss words and provide a short definition.
4. Have students write each definition (or descriptive phrase) in whichever block they choose so that each bingo sheet is different. They must also leave room to write the matching vocabulary word.
5. Make sure the students understand that every block should display a short definition (and room to write the matching vocabulary word). No empty blocks.
6. Once students are ready, begin calling out vocabulary words.
7. Students must match the correct definition to each vocabulary word. They should write these in a bright colored pencil so they can easily tell when they have 3 across, down, or diagonal.
8. A student should call out "Assateague!" when they have 3 in any direction. In order to win the game they must have matched the correct vocabulary word and definition.

Even more challenging

1. Select 10 or more words from the sheet or those you wish to cover from your own list. Explain to students that they will pick out 9 of these to write into blocks for the game.
2. Follow directions 3 through 8 from above description.
3. Moving fast and steady makes this game much more challenging.

Most challenging

1. Distribute the 16-block bingo sheet.
2. Select 16 vocabulary words.
3. Follow directions 3 through 8 from above description.



SHELLOOO TO SHELLS!

Generalization: Many ocean (and bay) creatures have shells. The shells are their "bones".

Objectives:
1. Students will learn why some creatures need shells.
2. Students will be able to distinguish between a univalve, bivalve and crustacean.
3. Students will identify creatures that make their own shells and those who use "old" shells.
4. Students will learn some mollusk and crustacean habits.

Preparation: This lesson will require a collection of Assateague shells and carapaces. Friends, neighbors and other teachers may be able to assist by loaning or donating items to your class.

Materials: Insides Out fact sheet, shell field guide, Horseshoe Crab fact sheet.

Possible Shells to use:

Univalves = moon snail, whelks
Bivalves = scallop, angel wing, arks, clams, mussels, coquina
Crustaceans = spider crab, lady crab, rock crab, mole crab, ghost crab (Horseshoe crabs are not in the class Crustacea, but are phylum Arthropoda like the crustaceans. Horseshoe crabs are class Merostomata. They are more closely related to spiders than crabs. If you choose to use the Horseshoe crab in this lesson be sure to make the distinction.)

Drawing paper, Shelloooo Worksheet, handwriting paper, and markers.

Procedures:

This is an orientation activity designed to introduce students to creatures that live in shells and to introduce the concept of "shells as skeletons." Divide class into cooperative learning groups. (Number of groups will depend on how many shells you choose to use) Give a shell to each group of students. Explain that these creatures live in or near the ocean or bay. Shells can function as an animal's home. Shells offer protection from predators and environmental conditions (weather conditions, wave action). Shells are the animal's "bones" or skeletons! They are made by the animal

living inside. Some shells “grow” as the animal grows and some “shells” (chitinous exoskeleton of arthropods) must be shed in order for the animal to grow.

Ask the students to imagine what lives in the shell given to their group. If the students know what lives in the shell, great! If they do not know what lives in the shell, even better! Let them use their imagination. As a group or individually, ask students to draw a picture of their creature (whether real or imaginary). Use the Shellooo Worksheet or the chalk board to make a list of questions for students to respond to:

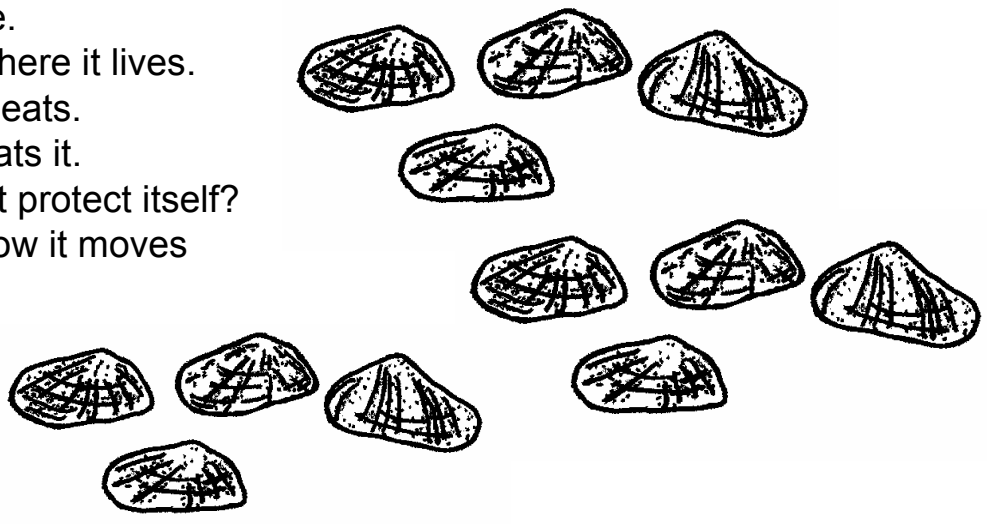
- What is the name of your creature?
- Where does it live?
- What does it eat?
- What eats it?
- How does it protect itself?
- How does it move?

Ask the students to consider these questions. The class will not have any prior information, so they will have to think about their creature and use their imaginations. Some creatures created by students may be very imaginative and unrealistic, this is fine. Provide worksheets for students to respond to each question. Have a few students from each group share their creature with the class and discuss its habits.

Discuss the “real” inhabitant of each shell.

Name each creature.

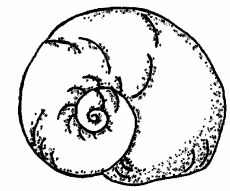
- Describe where it lives.
- Tell what it eats.
- Tell what it eats.
- How does it protect itself?
- Describe how it moves



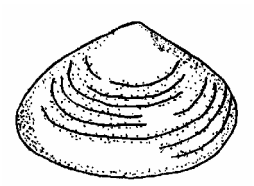
Discuss the different groupings of creatures:

Mollusks (univalves and bivalves) filter water through their body and extract calcium carbonate and other chemicals from the water. A part of the animal's body called the **mantle** secretes the shell material. These chemicals are secreted through the outer margin of the mantle to the edge of the shell in a building process. The shape of the shell is already determined by inheritance! Most mollusks reach their full size in 1 to 6 years. Growth rings may be present and represent changes in salinity and temperature and may coincide with the seasons, but do not necessarily indicate the age. Generally, shell growth is more rapid in warmer water.

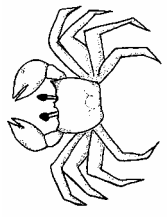
Univalves are mollusks that have one shell. (As a memory aid, this may be compared to a "unicycle" that has only one wheel.) Some univalves that live in the ocean habitat near the beach are moon snails, whelks and slipper shells (Slipper shells *look like* half of a bivalve). Periwinkles and Coffee Bean snails are associated with local salt marshes. Most univalves have a head, tentacles, eyes, a siphon and a radula (tongue-like organ for feeding), but there are exceptions. Univalves usually have a muscular foot for movement. Their single shell acts as a lifelong portable shelter and will grow with the animal. The muscular foot usually has a "door" or operculum attached and will close off the shell opening to protect the creature from a predator or drying out.



Bivalves are mollusks with two shells. (As a memory aid, this may be compared to a "bicycle" which has two wheels.) Some bivalves that live in the ocean habitat near the beach are scallops, arks, jingles, surf clams, and angelwings. Hardshell clams and oysters are bay creatures. Bivalves are hinged on one side and have a large muscle(s) that pulls the shell shut. Bivalves have soft bodies and some have a foot for burrowing. In burrowing bivalves, two siphons or tubes extend from the shell to the surface to draw in water in order to feed. Other bivalves open their shells and filter water across their bodies.

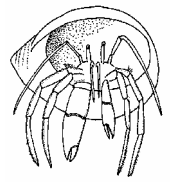


<u>Crustaceans</u> (crabs, shrimp, lobsters) must molt or shed their shell in order to grow, unlike mollusks. Crustaceans have a continuous shell covering over their bodies like a suit of armor that does not grow with the animal! Molting takes place at regular intervals, depending upon particular species and environmental conditions. When the crustacean is about to outgrow its shell, the outer shell, stomach lining, and gills are shed. The animal pulls itself out of its old shell, often with great difficulty, and emerges with a very soft new shell. The creature is left a defenseless and vulnerable creature until the new shell hardens. The crustacean circulates water to swell and stretch the new soft shell tight. The new shell will be markedly larger than the previous smaller shed (or molted) shell. It will completely harden in about 48 hours.



Discuss what might happen to empty shells.

- People might collect shells from the beach. Never collect any shell with a live creature inside.
- Hermit crabs may find an empty shell to live in. Hermit crabs have soft bodies and must find an empty shell for protection. Will they be looking for a bivalve or a univalve?



- Other creatures, like barnacles, tube worms, or slipper shells may make their home on discarded shells. They need a hard surface where they can attach.
- Shells will eventually break apart in the waves and become part of the sandy beach. As the shell material breaks down further, minerals will be released back into the water.

While the students are still in groups with their assigned shell, compare their creatures with the “real” creatures.

Questions to consider.....

1. How do the creatures differ in:
    - Appearance
    - where they live
    - what they eat
    - what eats them
    - how they protect themselves
    - how they move

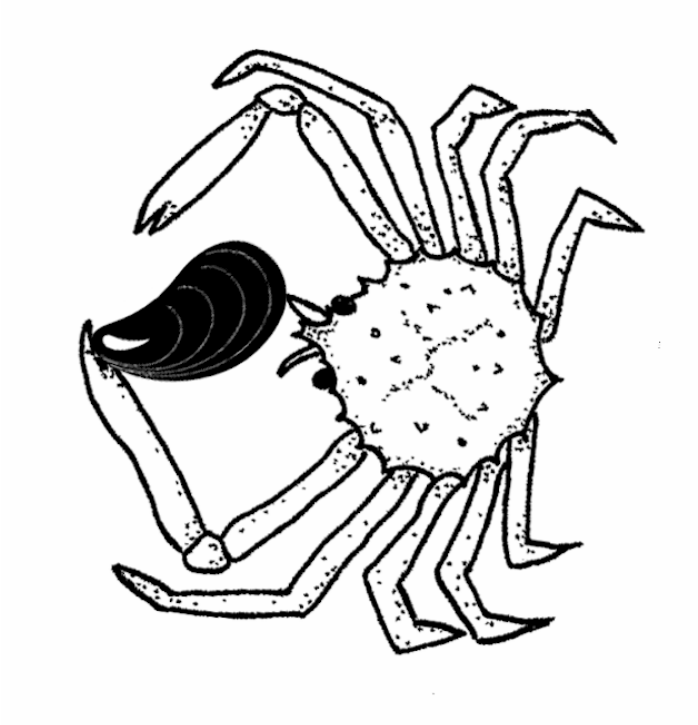
2. Which creatures are univalves, bivalves and crustaceans? If you used the Horseshoe crabs--Which creature is related to spiders?
3. How many of these creatures have students ever seen?
4. Do we eat any of these creatures? Have any of the students eaten any of these creatures or would they like to try?
5. Are any of these animals dangerous to humans? How?

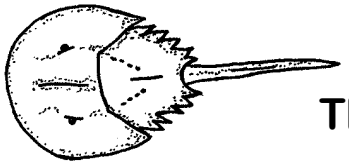
Extensions:

Prepare a bulletin board with pictures and descriptions of each “real” creature and students imaginary creature. Send copies of the imaginary creatures to park staff.

Visit the “Monster Exchange” web site. Keeping with the “Monster Exchange” idea, a “sea creature exchange” might be attempted. A sea creature could be described to another student, class, or school and a response (a picture) is made from the description. This type of activity could be performed between students (as an individual learning center activity), or between classrooms, or schools, or even long distance between classes/schools!
http://members.home.net/brunner/projects/monster.htm

Include mollusks and crustacean names in your vocabulary list.





The Horseshoe Crab

Fact Sheet

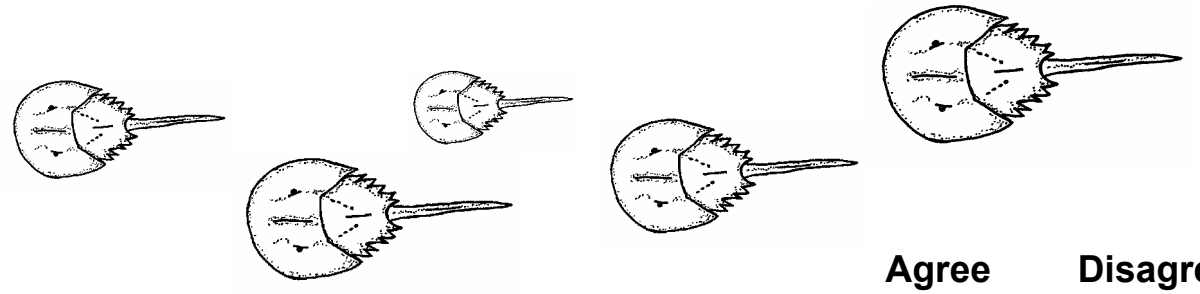
- **<u>Horseshoe Crabs are completely harmless creatures!</u>**
- **The Horseshoe Crab is more closely related to ticks, spiders and scorpions than other crabs.**
- **The Horseshoe Crab has been living in the ocean for at least 250 million years…well before dinosaurs roamed the earth! It is sometimes called a "living fossil" since the species has not changed in appearance over millions of years.**
- **The Horseshoe Crab can be found from the coast of Maine to the Yucatan Peninsula.**
- **The Horseshoe Crab can grow up to 36 inches in length including the tail.**
- **Horseshoe Crabs can live for at least 15 years.**
- **Female Horseshoe Crabs grow larger than the males and can weigh up to 10 pounds.**
- **Horseshoe Crabs are classified as invertebrates (they have no backbone).**
- **Horseshoe Crabs have an exoskeleton (external skeleton), which they must shed in order to grow larger.**
- **Their bodies are divided into three parts; a helmet-shaped front shell, a hinged middle section, and a long spike tail.**
- **The tail, or telson, is not a defense mechanism. It is used to turn themselves right side up when they are upside down.**
- **Horseshoe Crabs have many eyes. They have two large compound eyes on either side of the outer helmet which can magnify sunlight 10 times! Two simple eyes at the front of their helmet sense ultra violet rays from the moon. They also have 5 eye spots and light sensors on their tail!**
- **Horseshoe Crabs have 5 pairs of legs. The first four pairs of legs are for walking and each is out fitted with a claw at the tip. The fifth pair of legs are used for propulsion along the bottom and acts kind of like a ski pole. Each leg is joined at the opening to the mouth with bristly grinders. These bristles act as teeth and crush food as it moves into the mouth. This "chewing" action is only possible when the legs are moving. So the Horseshoe Crab has to move or wiggle its legs to eat!**
- **What do they eat? Mostly sea worms and clams, but they can go for up to a year with out eating anything at all. Horseshoe crabs serve as a primary food source for the juvenile loggerhead turtle.**
- **Male Horseshoe Crabs have "boxing glove" shaped claws on their first pair of legs. These specialized clasper claws are used for attachment at the back portion of the female Horseshoe Crab's shell during spawning.**

- **During high tide nights in May or June, the female will drag the attached male (or males, sometimes 3, 4, or 5!) up on ocean or bayside beaches. Here she will lay many clutches of eggs in the sand.**
- **Female Horseshoe Crabs can carry up to 88,000 eggs (each clutch can hold up to 4,000). After the eggs are laid, the female will then drag the male over them for fertilization.**
- **Many migratory shorebirds depend on this spectacular Horseshoe Crab spawning event for nourishment on their annual journey north to breeding grounds as far north as the arctic circle.**
- **In about two weeks, at high tide, baby horseshoe crabs will hatch from their eggs. These larval Horseshoe Crabs bear a striking resemblance to their parents, they are a much tinier, tailless, version.**
- **Once harvested by the ton in the 1900's to be dried and used for fertilizer, the Horseshoe Crab is now used by man for much more important reasons. It's copper based blood turns blue when exposed to oxygen. Medical researchers have discovered a component of this blue blood is capable of detecting poisons in human blood. The Horseshoe Crab's blood has become a precious resource in checking purity of medications intended for human use. Blood is drawn from the Horseshoe Crab and the crab is released unharmed!**
- **Chitin from the shell of the Horseshoe crab is used to help skin grafts of burn patients heal faster.**
- **The Horseshoe Crab can survive doses of radiation that would kill a human.**
- **The Horseshoe Crab can endure extremes in temperature and salinity.**
- **Researchers believe a cure for cancer may lie buried in the secrets of this fascinating animal.**

HORSESHOE CRAB WARM UP

This activity is designed to determine what students already know or believe about horseshoe crabs. It can also be well used to discover what students have learned after a field trip as well. Have they changed their minds about previous answers?

Ask the students to answer these questions as a class or individually, before their field trip to the park. Have the students read each of the statements and mark agree or disagree depending on what they believe to be true. Explain to the class that they should try to explain why they made their choices. Of course, there will be incorrect answers! That is okay.



		Agree	Disagree
1.	**Horseshoe crabs are related to spiders.** Horseshoe crabs are not really crabs at all but more closely related to spiders, ticks, and scorpions.	✓	
2.	**Horseshoe crabs have lived on earth for millions of years.** Horseshoe crabs have lived on earth since before the time of dinosaurs.	✓	
3.	**Horseshoe crabs are dangerous.** Horseshoe crabs are harmless. Their tails are not stingers.		✓
4.	**Horseshoe crabs should be picked up by their tails.** Holding a horseshoe crab by the tail can weaken it so that it becomes useless for turning over or comes off altogether.		✓
5.	**Horseshoe crabs have red blood like humans.** Horseshoe crabs have blue, copper based, blood.		✓
6.	**Horseshoe crabs lay their eggs on the sandy beach.** Horseshoe crabs must come up onto the shore to lay their eggs, which will hatch a couple of weeks later.	✓	

HORSESHOE CRAB WORD SEARCH

ANSWER SHEET

Find these words hidden below.

ASSATEAGUE
BAY
BLUE BLOOD
BOOK GILLS
BOXING GLOVE
BROWN
CAMOUFLAGE
CLAMS
CLAWS
CRAWLS
EGGS
EYES
FOOD
HARMLESS
HORSESHOE CRAB
LIVING FOSSIL
OCEAN
PROTECTION
SANDY
SCISSOR SHAPED
SCORPION
SHELL
SHOREBIRDS
SPIDERS
SWIMS
TAIL
TELSON
TICKS
UPSIDE DOWN
WORMS

```
        H O R S E S H O E C R A B   B A Y
                          L           S
L I V I N G F O S S I L A   S W I M S
                          W           A
      W O R M S           S H E L L   T
            S H O R E B I R D S       E F
U P S I D E D O W N                   A O
            B O X I N G G L O V E S   G O
                                      U D
  S C I S S O R S H A P E D           E
B O O K G I L L S     C R A W L S
                      A           A
  P R O T E C T I O N M           N     S
S       A       I     O C E A N D     C
P       I       C     U             Y B     O
I       L       K     F               R     R
D H A R M L E S S   B L U E B L O O D P
E         Y           A               W     I
R         E           G               N     O
S   C L A M S       T E L S O N         N
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INSIDES OUT OR..... SHELLS ARE SKELETONS!

Seashells are probably more familiar to us than the creature living inside! Many of us may not realize that a living creature created a seashell. Just as humans have a skeleton that supports the body and provides attachment for muscles, so do mollusks and crustaceans. Their shells are exoskeletons, or external “bones.”

Mollusks

The soft bodies of mollusks need their shells for support and protection from predators and environmental conditions such as temperature, tides and weather. Mollusks do not discard their shell and find a new one. Larval (young) mollusks form a shell in their early stages and the shell will continue to grow as the mollusk grows for the rest of its life. A thin tissue layer surrounding the body called the mantle produces the shell. Shell material, calcium carbonate and other organic chemicals, are secreted into a space between the mantle and the shell in a successive building process. Colorful mollusk shells are produced by pigment cells in the mantle. The shape of a shell is genetically inherited.

When a mollusk dies, the shell is the skeletal remains of the creature. Empty shells are used by hermit crabs, which have no shell of their own, or as homes and hiding places for many other creatures. As a shell breaks down, it becomes part of the sand and eventually the minerals are returned to the ocean water. Collection of empty shells should be done in moderation, if at all. Return shells to the beach after examining or studying them. Unfortunately, many species of mollusk have almost vanished due to irresponsible collectors actually taking live mollusks and killing the animal for its shell.

Crustaceans

Crustaceans have an external skeleton or exoskeleton covering their body like a suit of armor. As a crustacean increases in size, its shell does not, so it must molt or shed its shell in order to grow. This periodic molting is hormonally controlled.

A layer of tissue underneath secretes the shell covering of a crustacean. When a crustacean is preparing for molting, the tissue layer separates from inside the hard exoskeleton and begins to secrete a new exoskeleton. At this time, the crustacean has two skeletons! The old outer shell is hard and too small to accommodate the creature, while the new soft inner skeleton is ready to emerge. The old outer skeleton will begin to split at certain weak spots (depending upon species). The crustacean will then pull its body out of the old shell, take in water and stretch the new soft-shell to its full size. The new shell will then harden in a short period of time.

Prior to a molt, crustaceans usually become sluggish and find a sheltered area. Once the creature has molted its shell, their soft bodies are vulnerable and defenseless until their new shell hardens. Some crustaceans eat their old shell to absorb needed calcium salts. Crustaceans are able to regenerate lost limbs through successive molts. Molting tends to be less frequent with age.

ODDS AND EVENS

Generalizations: The ability to make conjectures, hypotheses, and test predictions are important elements of scientific study.

Objectives:
1. Students will use the science skills of conjecturing, making a hypothesis, and testing predictions and learn that these skills are used in mathematics.
2. Students will use problem solving strategies to discover odd and even numbers and the addition patterns related to them.

Materials: 15 clam pieces for each pair of students **(These should be collected by students while they are visiting the island. Determine how many you will need for the class and collect thumbnail sized clam and other shell pieces. Purple pieces are from quahog clams. This collection should not be done during the ranger led program. Do not collect more than you need. If more than one class is visiting, consider collecting one set and share between classes. <u>As the Park Ranger why there are hard shell clams and oysters on the ocean side of the island if these creatures are associated with our bays</u>.)**, calculator, data sheet

Procedure: This is game that helps students gain a better understanding of odd and even numbers through investigating the patterns involved in adding odd and even numbers. It works best after the class has had a discussion on odd and even things. Try examining odd and even items found in nature.

Once students have an understanding of odd and even numbers, distribute the clam and shell pieces collected during your visit to Assateague. Have students work in pairs and distribute fifteen clam pieces to each pair of students. Let students know that they may take one, two, or three clam pieces each turn with the goal of trying to end up with an odd number of clam pieces.

By the end of the game students will discover that an odd plus and odd produces and even, an even plus and even produces and even, and that

an odd plus and even number produce an odd number. They will also see how these rules never change and stay the same for all numbers.

Students will:

1. Take turns with their partner taking 1, 2, or 3 clam pieces until there are not any clam pieces left. The object of the game is to be the one with the odd number of clam pieces.
2. Play the game several times and then begin to look for ways to obtain an odd number of clam pieces at the end of the game.
3. With their partner discuss ideas for winning the game and then test those ideas on other pairs of students.
4. Make predictions on what will happen when they choose a certain number of objects or make a certain move. Also predict what to do to win the game.
5. Once students have finished experimenting with the game, they will begin a more formal investigation of odd and even numbers using calculators.
6. Using a calculator, students will be asked to add any two odd numbers together.
7. Write down the results and what was noticed about odds and evens. Try adding more odd numbers together. What is the result?
8. Pick any two even numbers and add them together.
9. Note results and try adding more even numbers together.
10. Add an odd number and an even number together and note the results.
11. Note what kind of patterns are can the students find?
13. What rules can be made regarding adding odd and even numbers?
14. Write out a way to end up with an odd number of clam pieces when playing the “odd and even game.”

Mathematicians, like scientists, must often make predictions and test out those predictions.

Extensions:

- Study other scientific truths and rules that never change, such as tides.
- Relate this game to how data collection takes place and then talk about what math skills resource management employees use.
- Quahog clams were once used for exchange purposes. Find out who did this and why.

SOLVING A TIDAL WAVE OF A PROBLEM

Generalization: Our problem solving skills are used on a daily basis in normal situations. The fisher, surfer, boogie boarder, or shell collector may have need to be able to determine tide movement. Having the knowledge that you can figure through dilemmas takes them from the "problem" category to the "challenge" category.

Objectives: The students will solve word problems based on what they have learned about daily tidal movement.

Procedures:
Have your students work on the word problems individually or in cooperative learning groups. Ask students to show all of their work. Allow for ten minutes at the end of class for students to share their answers on the board or overhead projector. Students should explain how they arrived at their answers.

Word problems:

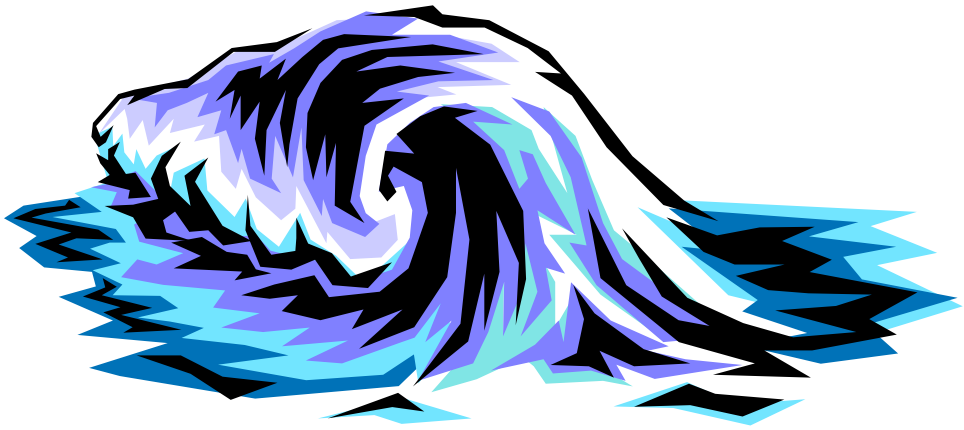
1. You are on the beach with your best friend and all sorts of surf fishing equipment when you realize that you forgot to bring a tide chart. You remember that you and your uncle went fishing five days ago and high tide was at 11:26 a.m. that day. What time will high tide be today? Answer: 3:36 p.m. You get this by adding 24 hours and 50 minutes to 11:26 a.m. 5 times.

2. The optimal time for surf fishing is one to two hours before high tide to one hour after high tide. Now that you have figured out what time high tide is, what time span is best for surf fishing today? Answer: 1:36 p.m. until 4:36 p.m. You get this by subtracting 2 hours from 3:36 p.m. for the earliest to fish and adding 1 hour to 3:36 p.m. for the latest time to fish.

3. High tide and low tide are approximately six hours apart. On Assateague Island, there are generally two high tides and two low tides each day. If the first tide of the day is at 4:52 a.m., at approximately what time will the rest of the tides occur? Answer: 10:52 a.m., 4:52 p.m., and 10:52 p.m. You get this by adding six hours to the first and each additional tide of the day.

Extensions:

- Discuss professions located in beach areas which might have a need to be able to work out tides. Try to think of those who may be involved in jobs from watermen to recreation.
- Research one of these professions and determine what other types of skills these individuals might need. What type of math, science, artistic, and language skills would they use?



STUDENT FIELD TRIP ASSESSMENT

Generalization: A student evaluation can be an effective assessment tool for teachers and park staff.

Objectives:

1. Students will describe whether or not they felt the experience was valuable to them as part of the curriculum.
2. Students will describe 3 things they learned during field trip or school visit.

Preparation: Make copies of the Student Evaluation sheet for each student.

Materials: Student and teacher evaluation sheets.

Procedure: This exercise is useful for both teachers and park staff. Students get an opportunity to share their thoughts and ideas with the education staff at Assateague Island. Teachers get another opportunity to observe what students take in during a field trip.

1. Distribute Student Evaluation worksheets.
2. Ask students to fill them out and explain that National Park education staff is interested in their comments.
3. Teachers might fill out the Teacher Evaluation while students are working on theirs.
4. Mail both sets of evaluations to:

   Liz Davis
   Education Coordinator
   Assateague Island National Seashore
   7206 National Seashore Lane
   Berlin, MD 21811

Classes sending in both teacher and student evaluations will receive additional classroom materials.

EVALUATION
Assateague Island National Seashore

Please share your thoughts with us. We need your help to provide the best educational experience possible.

School: _____

Grade Level: _____ Type of program: _____

Does the program relate to your curriculum? Explain.

_____

_____

Was the material presented at grade level? _____

Did the students enjoy the program? _____

Which activities were most effective and why? _____

_____

_____

Which activities were least effective and why? _____

_____

_____

Rate the extent to which the ranger was able to deliver the information in an interesting and enthusiastic manner.

Excellent Good Fair Poor Unable to Judge

Please comment if your response was "fair, poor, or unable to judge."

_____

_____

Please comment on any changes or additions that could be made to improve the visit.

_____

_____

_____

How did you use pre/post visit activities? Please comment on their effectiveness.

_____

_____

_____

Educators who fill out and return this evaluation to the address listed on the back will be sent additional classroom materials.

Thank you.
Please mail to:

Liz Davis
Education Coordinator
Assateague Island National Seashore
7206 National Seashore Lane
Berlin, MD 21811