Beach Exploration

Grades 3-4
Teacher Information including Pre-Post Activities

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Beach Exploration

For most people, going "down the Shore" means heading to the beach, with a car loaded with blankets, chairs, umbrellas, boogie boards, coolers, and all the other trappings of the modern vacation. By the time all that gear is spread across the sand, few people stop to think about the beach itself. Where did the sand come from? What else lives there? Why doesn't grass grow on the beach? How did the seashells get there?

Beaches are actually full of life, and changing constantly with the push and pull of Mother Nature. Not just a sandy wasteland, a beach is home to many kinds of marine life, not just the seagull that tries to steal your lunch. If you know what you're looking at, you can read the ever-changing story of the beach.

This booklet contains information and activities to help prepare you and your class for your trip to the Wetlands Institute. The activities are designed for pre and post-visit sessions; however, feel free to use the activities in a manner best suited to the needs of your class. Before your students see a sand dune, search for mole crabs, or pick up a surf clam, take a look at this guide to familiarize yourself with the environment you and your students will visit. The main body of text is designed to give scientific, yet understandable, background information. A vocabulary list at the end of the packet defines key words in the text, which are **bolded**.

PRE-VISIT ACTIVITIES

1. Before visiting the beach, students should hone their observation skills, so they'll be ready to look for the harder-to-see animals that live in the sand. **Outdoor Observer** lets them practice observing nature closer to home.

2. Many children's only knowledge of the beach comes from the Hollywood point-of-view. They may not realized that the beach isn't patrolled by "Baywatch" lifeguards, that Sponge Bob and Patrick don't really live there, and that "Free Willy" doesn't actually frolic in the surf. They'll compare their pre-trip expectations to what they actually see, in **Beach Before and After.**

3. All living things have similar needs for food, water, and shelter. In **All LivingThings Have Needs**, students will see that seashore plants and animals have needs much like those of humans, but that those needs are satisfied in different ways.

POST-VISIT ACTIVITIES

1. Animals can't live without all the components of their habitat. Students will make posters featuring an animal they saw at the beach, and its entire habitat, in **Who, What, Where?**

2. Students will create a **Beach In A Box**, making a shoebox diorama that illustrates the entire beach ecosystem that they've explored.

A Beach Ecosystem

A beach **ecosystem**—what is it? The word ecosystem has two parts. "Eco" is a part of the word **ecology**, which is the study of relationships among living things and their environment. A system is made up of parts that form an organized whole, so an ecosystem is an organization of living and non-living parts that interact with one another. Ecologists are people who study the interrelationships among living and nonliving parts.

Your students will be beach ecologists on their trip; they will examine both the living and non-living parts of an ecosystem. The non-living components we will discuss are sand, wind and water. The living parts of an ecosystem that we will look at include plants like trees, shrubs, and grasses, and animals, including both vertebrates and invertebrates. We will see how these parts form the beach ecosystem.

Sand

Sand is a non-living component of the beach ecosystem that affects every organism living there. It is the home for many a turtle and horseshoe crab egg, and the gritty end to our walk home from the beach. The texture, particle size, temperature, and even moisture content of the sand affect the organisms that live above as well as below it (which we will discuss later). Sand ranges from black to pink to beige to white in color, but every type of sand is a mixture of ground up rocks and/or shells. Sand on the shores of New Jersey is made primarily of **quartz**, a mineral that is white or clear in appearance. **Calcium carbonate**, derived from shells ground down by ocean wave action, is another large component of sand in New Jersey. Calcium carbonate gives the sand its glittery, shiny white appearance.

Wind & Water

The most important quality of the ocean water is its salinity. Salinity is a measure of the amount of salt in water. Ocean water is much saltier than rainwater or the water from a kitchen faucet; ocean water contains about 30-35 parts per thousand salts. To understand what this unit of measure means, imagine 30 pounds of salt added to 970 pounds of water to make a mixture totaling 1000 pounds. 30 parts out of the total 1000 parts are comprised entirely of salt.

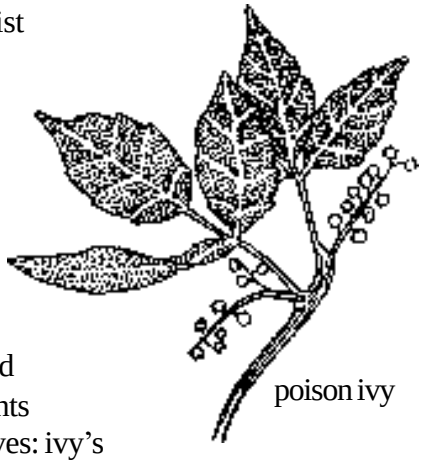
The billions of pounds of salt in the ocean originally came from rocks lying deep on the ocean floor that contained salts, which dissolved in the ocean water. Today, streams wash more salt into the ocean as they pass over salt-bearing rocks. The ocean's salinity levels remain fairly constant, however, because of the marine organisms that extract salt from the water they live in.

Wind and salt water act in concert in a beach ecosystem. Wind blows over the ocean's surface, and whips up salty spray which it carries over land. The saline spray dries and consequently "prunes" plants. Because only certain types of vegetation are able to withstand the pressure or stress that the wind and water cause, plants that grow close to the ocean have adaptations to their demanding environment.

Plants

A walk to the beach provides a great opportunity to see different vegetation types. Ecological succession to its fullest extent in a beach ecosystem produces three zones of vegetation, which, when grouped together, are called the **dune system**. Succession is a term that describes the evolution of vegetation types that inhabit an area. Grasses are some of the first plant types to grow on a bare patch of land. Grasses are followed by low-lying plants like shrubs, and after shrubs establish themselves, tree species are more likely to grow. The dune system is comprised of the **primary dune,** which contains grasses**,** the **secondary dune**, characterized by grasses and shrubs, and the **maritime forest,** which contains a unique mixture of shrub and tree species.

The zone closest to the ocean is the primary dune. Salt spray, wind, and hot sun eliminate all trees and shrubs from growing in this area. Beach grass, a tall and thin grass, exists almost exclusively in the primary dune. Beach grass slows the erosion of sand dunes by anchoring sand in place. Extensive root systems called rhizomes spread horizontally as well as vertically down into the soil, securing the grasses in the sand. The interwoven network of the roots below and the grasses above the sand slows the movement of sand across dunes, allowing the dunes to better hold their shape. Maintaining the geological integrity of sand dunes is important to animals that rely on the dunes, such as shorebirds that make their nests in the primary dune. Additionally, people who enjoy beaches for active and passive recreation depend on the dunes for their pleasure. Beaches do not exist without sand, and sand does not stay in place without plants in the dunes to anchor it.



poison ivy

The next zone that occurs in a fully developed dune system is the secondary dune. Stone Harbor Point, New Jersey contains the plants typical of a secondary dune. Shrubs, vines, grasses, and short flowering plants abound in this area. They experience greater amounts of sunlight, faster wind, and greater salt spray than plants in the maritime forest. Plants like bayberry, scrub pine, yarrow, and beach grass fare well in this area. Virginia creeper and poison ivy are also found in abundance in the secondary dune. These two plants have a similar appearance, but are distinguishable by the grouping of their leaves: ivy's leaves grow in groups of three, while virginia creeper has its leaves arranged in groups of five.

Tall trees and some shrubs define the maritime forest, the zone furthest from the beach. To say the maritime forest is a forest which grows close to the ocean is to tell a half-truth, for while this forest grows close to the ocean, so may other forest types. The maritime forest separates itself from other forest types by the presence of short, twisted-limbed trees, a lack of large-leafed trees (such as oak or maple), and an abundance of plants tolerant of salt water spray.

Vegetation exists in the water, as well as on land in a beach ecosystem. Several different types of seaweed are evident in the shore areas of New Jersey. Sea lettuce is a one to two cell layer thick type of seaweed. It floats, unattached, in chartreuse-colored sheets often tattered with holes because of its delicate thinness. Another seaweed, rockweed, is beautifully designed. It contains visible air bubbles that allow it to float and receive sunlight close to the water's surface. While walking along a New Jersey shoreline, you may also see coarse red weed, a highly branched, thin, salmon red colored seaweed.

Animals

A beach ecosystem contains both **vertebrate** and **invertebrate** animals. The vertebrates are animals with a backbone like fish and birds. The animals lacking a backbone, the invertebrates, include animals like horseshoe crabs, ghost crabs, mussels, and clams.

Fish announce their presence on the beach usually only with skeletal remains. Even a dead fish that washes ashore isn't whole for long, as shore birds will pick away the meat, leaving the bones.

The most memorable animal on many trips to the beach may be the gull—the infamous sandwich stealer. In a beach ecosystem that doesn't include hungry sunbathers, however, gulls prefer eating crabs. There are many species of gull, each with different colors and names. The herring gull is a white bird with a grey back, a little smaller than a chicken. People see herring gulls feeding on crabs and mollusks on beaches or oceanside docks. The laughing gull, another gull species, is most easily recognized by its white body, black head and loud distinguishable call. Laughing gulls feed on shelled animals by the ocean, though they are known to eat a beachgoer's lunch if that person isn't watchful.

The invertebrate animals on a beach are divided, for our purposes, into two categories: **arthropods** and **mollusks**. The arthropods include insects, arachnids, and **crustaceans**, the group that we are most concerned with. The mollusks include both the **bivalve** and **univalve** animals.

Students walking along the sandy beach will find shells, which are protective coverings for soft-bodied mollusks. The surf clam and mussel are two mollusks that often wash up on New Jersey beaches. The surf clam is a whitish, plain looking mollusk. It is a bivalve, meaning its two shells join together with two valves to create a seal, covering the soft animal inside. Clams are a favorite food of the herring gull. Another commonly found bivalve shell is the mussel. Mussels often grow in groups, anchoring themselves along pilings and hard surfaces. Mussels and clams are called filter feeders, since they filter their food from the seawater by drawing water in, retaining organic matter, and expelling the excess water. Univalves (single-shelled animals with only one valve) on the beach include moon snail shells and whelks.

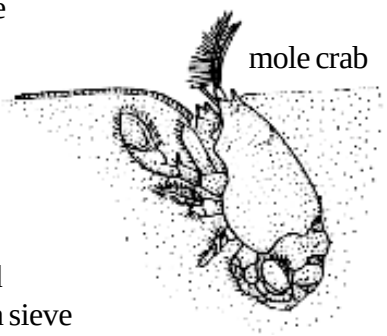
Dead crabs or their shells are another common beach find. Crabs are **crustaceans**, which means they have a hard exoskeleton covering their soft bodies, and jointed, paired legs. There is a possibility of seeing blue claw crab, lady crab, and spider crab shells while walking in the **intertidal zone**, though most often people find lone crab shells or individual claws. The intertidal zone covers the area of beach that stretches from the high tide water line to the low tide line.

Intact dead crabs are a rare find because herring gulls and laughing gulls quickly rip apart and gobble up dead crabs. The crab and shore bird interactions form an important part of the beach ecosystem. Without the shorebirds, dead crabs would pile up on the beach, and without the crabs, the shore birds would lose a large and important food source.

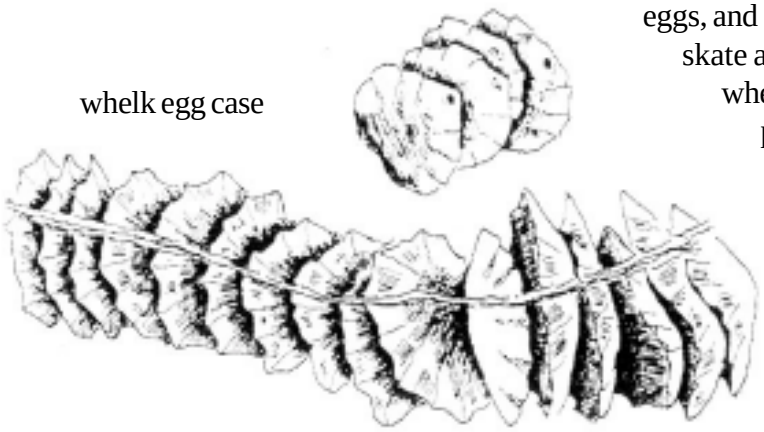
Speaking of birds and crabs, what about the horseshoe crab and the shorebirds that depend on it for food? The horseshoe crab, an arthropod related to scorpions and spiders, forms another vital piece of the ecological puzzle of a beach ecosystem. Horseshoe crabs come onto beaches to spawn, and leave hundreds of thousands of tiny olive green eggs that shore birds will eat to re-fuel after a 4-5 day migration from South America. You probably won't see any egg-laying activity during your trip, but look for horseshoe crab shells on the beach. If you're lucky, you may see a live horseshoe crab! Don't be afraid to touch the horseshoe crab; though it has 10 legs

and claws, and a pointed tail, it is not harmful in any way. Be careful not to pick up a horseshoe by its tail, though. Not only is the tail harmless, it is very fragile, and can break off if used to pick up the horseshoe.

Two other crustaceans, the ghost crab and mole crab, are often found live on the beach. Ghost crabs scuttle across the sand, almost undetectable, because of their sandy coloring. They spend most of their day excavating the holes they live in under the hot sand, sweeping out sand blown in by the wind. Another type of crab, a mole crab, is fairly easy to find and plentiful on most beaches. Unlike the spider and blue claw crabs, which live in the ocean water, a mole crab spends its life under the water in moist sand of the intertidal zone. A mole crab is an inch long blind creature with a beige translucent body. People can find mole crabs by digging several inches into the sand, and scooping that sand into a sieve and rinsing with seawater.



mole crab

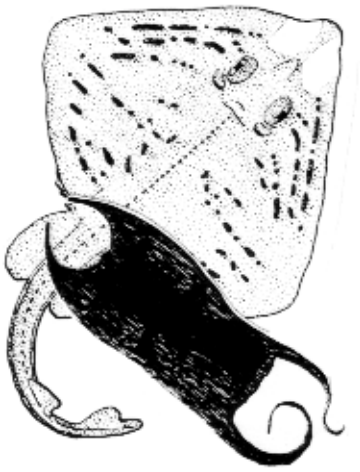


whelk egg case

Some beach animals have live birth of young, some have eggs, and some have egg cases. The whelk and the skate are part of the last group. Skate egg cases and whelk egg cases are both exciting surprises for people who have never seen them before. A skate egg case, also known as a mermaid's purse, is a remnant left by young skates that hatched out of the case. A skate is an animal with a similar shape to a manta ray. The knobbed whelk egg case is a series of flat beige discs strung together. Each individual disc contains 20-100 tiny whelk shells, a couple millimeters long at the largest. Carefully breaking the individual discs open reveals shells similar in appearance to a conch, the whelk's southern relative. Don't' worry about breaking the cases, the whelks aren't alive if they've been lying on the hot sand.

Now that we're done…..

You have the basic information to prepare you and your students for their trip. Check out the pre- and post-trip activities for ideas aimed at expanding the students' knowledge of ecology and habitats, and improving communication, creative, artistic, and logical skills.

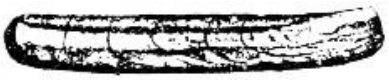


skate and egg case

On The Beach: A Few Common Things For Beachcombers

ATLANTIC SURF CLAM

ATLANTIC JACKKNIFE



ATlANTIC SLIPPER SHELL

COMMON BLUE MUSSEL

SOFT SHELL CLAM

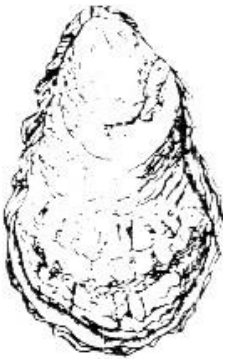
FALSE ANGEL WING

ATLANTIC RIBBED MUSSEL

NORTHERN QUAHOG

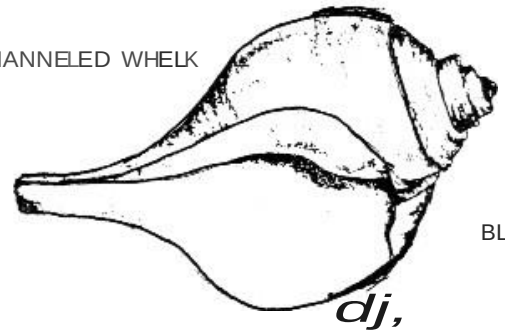
STOUT RAZOR

EASTERN OYSTER



JINGLE SHELL

CHANNELED WHELK



SKATE EGG CASE

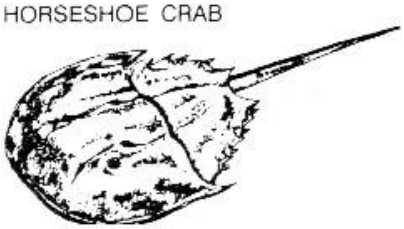
BLOOD ARK

COMMON PERIWINKLE

KNOBBED WHELK

NORTHERN MOON SNAIL

HORSESHOE CRAB



BAY SCALLOP


Sachuest, Point, RI


Narragansett, RI

This grouping of samples illustrates the gradual transition of sands from north to south along the East Coast. Because the predominant wave direction is from the northeast, sand is slowly transported south. With age, the darker minerals are broken down, leaving only the whitish quartz grains. Thus, the sand lightens with age as it moves south.


Avalon, NJ

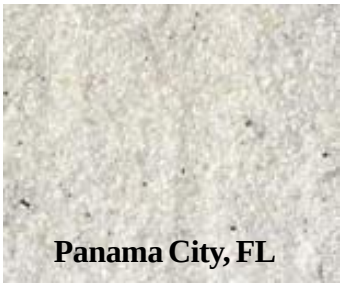

Bird Island, NC


Myrtle Beach, SC


Hilton Head, SC


Lantana, FL


St. Petersburg, FL


Panama City, FL

Outdoor Observer

Objective:
Outdoor Observer works well as a pre-trip activity. Students will practice their observation science techniques by observing and recording the different kinds of living things they find in a local natural area. Mindful observation is beneficial for the students' attention spans, patience, and sensitivity to material. It may also encourage their natural curiosity.

Materials:
Paper and pencil. An outdoor location is necessary. The student's backyard is a great and easily accessible choice if he/she lives in a suburban neighborhood. Students may also do this assignment in a local park or nature center. Anywhere they can sit down and observe wildlife outdoors is a suitable place for this activity.

Directions:
The objective of this activity is to make students more observant. The beach is a place that, upon first glance, doesn't seem to have many living things on it other than birds. The aim of the beach exploration trip is to have the children discover just how many living things they can find when they are observant

Before the students begin their exploration of a local habitat, have them guess (and write down) how many living things they think they will see. It will be interesting to look at this number later on. Once the individual has made a guess, he can find a nice spot to sit outside, and observe his surroundings for half and hour. Fifteen minutes should be suitable for every child; long enough to see a number of different organisms while holding their attention. Parents or older siblings may also participate in the observation or may simply be needed as clock watchers to tell the student when "time is up." While the student sits, he should be quiet and still and watching for living things. Remember that people and their pets don't count in the tally of living things—and don't forget that plants do!

Have the students write down every animal and plant they see while outside—every bird, insect, chipmunk, squirrel, dandelion, and oak tree. If a student doesn't know a name for the living thing, have him write instead a description, or draw a picture of the living thing for possible identification later on. The goal is to have the student quiet and alert, listening and looking for living things.

All Living Things Have Needs

Concepts

1. An organism is a plant or an animal.

2. Seashore plants and animals have needs much like those of humans, although these needs are satisfied in different ways.

3. All living things have similar needs for food, water, shelter, and space to survive.

Understandings

The students will be able to 1) braimtorm questions about seashore animals, and 2) identify similarities and differences in basic needs of humans and seashore animals.

Teacher Information

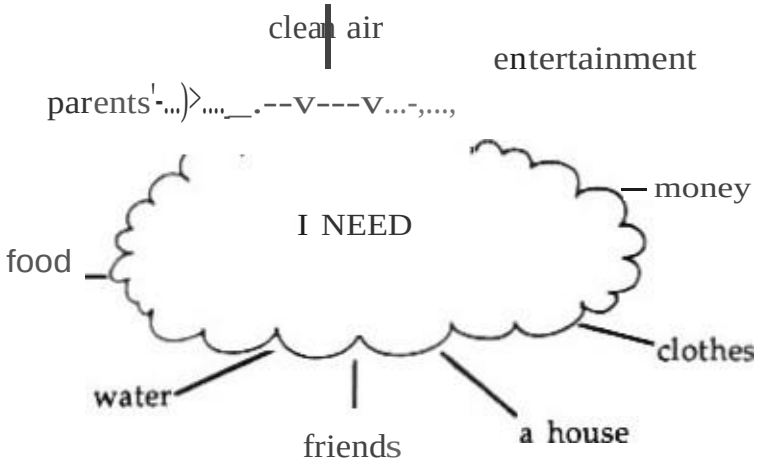
For the first field trip experience, it's important that students learn that all organisms have basic survival needs. All human beings and whales babies have basic needs. Both are mammals. All organisms need food, water, shelter, and space to survive. Sometimes we forget that all living things have basic needs and depend on one another for survival.

Procedures

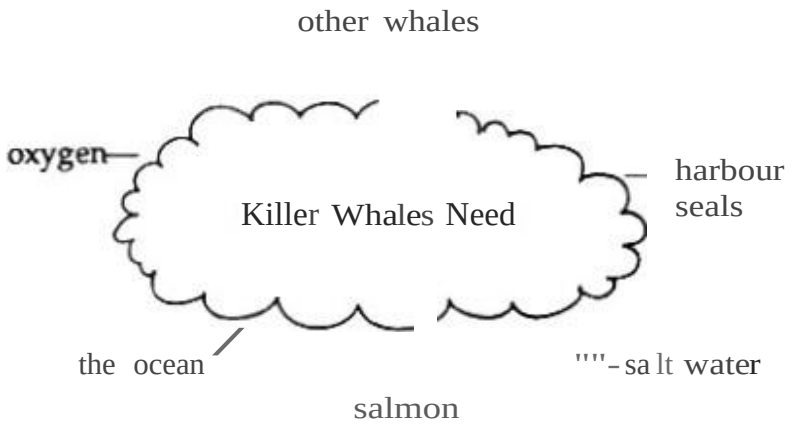
1. Write the words "plants" and "animals" on the blackboard. Ask the students to brainstorm the names of plants and animals. With the student's help, list them under the proper heading. Brainstorm the characteristics of plantand animals. Write the students' ideas on the blackboard.

2. What plants and animals do the students think they will find at the seashore? List these on the blackboard. Or challenge the students to make a list of all the seashore organisms they can think of. Who has the biggest list? The students can add to the list over the course of the unit.

3. How are humans and seashore organisms alike? How are they different? Write the students' ideas on the blackboard. What does it mean to survive? What do humans need in order to survive? Write their ideas on the blackboard.

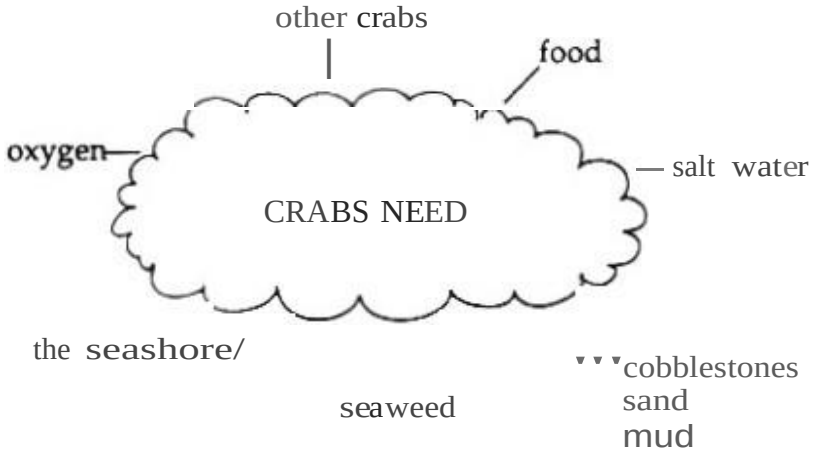


4. What do whales need in order to survive? \Nhat do sea stars, barnacles, and Tidepool Sculpins need to survive? Summt\rize the discussion by remind ing the students that although humans and marine anima ls a re obviously different, they all share many basic requirements.



5. What do gulls need to survive...sca stars...crabs? Summarize the discussion by reminding the students that although hu mans and seashore animals are obviously different, they all share basic requirement-; for food, water, shel ter, and space.

6. Brainstorm wha t Purple Shore Crabs need to survive.



7. Is there more than one kind (species) of crab? Who can name different species? Remind the students that although all crabs have similar basic needs, each species of crab has particular food, shelter, and space requirements. This is because there are many species of crabs and each species is equipped to survive in its own type of habi tat. Purple Shore Crabs, for example, live on rocky or cobblestone beaches, and could not survive tong on protl'Cted sandy beaches or mud flats. By comparison, the wide-ranging Edible Crab, or Dungeness Crab, prefers to live off-shore or on protected sandy beaches and in eelgrass beds, and the Kelp Crab prefers to live in kelp beds.

Snively, Gloria. Beach Explorations: A Curriculum for Grades 5-10. Oregon Sea Grant Program, Oregon, 1998.

Beach Before and After

Objective:
Students will write pre-and post-trip ideas about what they will find, and have found, on a beach. They will challenge representations of the beach in popular culture. They will also discover for themselves what kinds of animals live on beaches, and how people use beaches.

Materials:
Paper, pencils

Directions:
Before students explore the beach ecosystem, have them write a couple paragraphs about what they think they'll see on their trip. The students may base their essays upon images in movies and TV, or, alternatively, their own beach experiences.

Many people view the beach as sand and water, and not an ecosystem or habitat for animals. Beaches for swimming often have a large amount of foot traffic during the tourist season. The large amount of people displaces animals or alters the animals' habitat, making it unsuitable for living. Other activities associated with recreational beach enjoyment interfere with a healthy beach ecosystem. For example, beach replenishment projects destroy many types of life. During replenishment, people pour tons of sand onto existing beaches in an effort to slow erosion. The additional sand reduces the numbers and types of animals that live in and above the sand. Additionally, raking of beaches, which is done to smooth the surface appearance negatively affects animals like ghost crabs, which live in holes in the sand.

After their trip to the beach, students will write a second piece about what they noticed on the beach. They can write about anything that they remember seeing. Finally, have the students read over their previous statements about the beach, and compare their previous ideas with their new, more informed perspective.

Who, What, Where?

Objective:
Students will make a poster that displays pictures of an animal in its habitat accompanied by written information about the poster's art for this post-trip activity. This project will help reinforce the ideas of living and non-living components that comprise an ecosystem. It is geared toward those students that learn in visual, artistic, auditory, and active ways.

Materials:
Poster board (1 large piece/every 4-5 children), markers or crayons, construction paper, pictures of animals/plants seen on trip.

Directions:
It may be helpful to group desks in blocks of four to allow the students enough working space. Otherwise, have them work on tables, or the floor, if you prefer. Since students will work in groups for this activity, you only need one piece of poster board for every four to five students, depending on the number of children per group. Gather pictures of animals the students saw on their trip to the beach. Search the Internet, or flip through magazines for pictures. Examples would be laughing gulls, blue claw crabs, mussels, and clams. Place pictures of one animal species underneath each piece of poster board located at different workstations around the room.

Assign groups to random posterboard stations, and tell them to lift up the posterboard to see what you have hidden underneath. They can glue or tape the pictures to the poster board. After this, they should draw the other elements (both living and non-living) in that animal's habitat. If the animal can be found in two places, say, alive in the ocean, or washed up dead on the beach, have the students draw the habitat that *they* found the animal in. Somewhere on the posterboard, have the students write a paragraph describing what the animal is and what the elements in the habitat are.

Beach in a Box

Objective:
In this post-trip activity, students will create shoebox dioramas modeled after the beach ecosystem they explored on their trip. The activity is a great way to reinforce the concept of an ecosystem. It is group work that requires creativity and originality. It allows the students to express themselves artistically and also communicate to others about their creations.

Materials:
Shoe boxes, construction paper, markers, pipe cleaners, cotton balls, clay, glue, foam, and any other material that can be cut, molded, or manipulated creatively.

Directions:
Have the students work in groups of 3 to 5 people. Set up a shoebox "diorama style" for each group. Tell the students that their job is to (as accurately as they can) recreate what they saw when they explored the beach ecosystem. While accuracy is important, emphasize to the students the utilization of lots of materials in a creative way, since this is also a creative project.

As far as detail and accuracy are concerned, look for models that include animals and plants in their proper habitat and ones that seem representative of the beach students visited on their trip. Tell the students that they will explain their models to the class when they are finished, so there must be reasoning as to why components are placed where they are. Allow an hour for model creation, then have the kids explain their models to the class. You, the teacher, serve as a facilitator, asking general questions like *What kind of animals live in the water?* and more specific ones like *Where is the intertidal zone?* or *What does a herring gull eat?*

Vocabulary

Arthropod literally translates to "jointed foot"; term that includes, insects, spiders and scorpions, and crustaceans.

Bivalve animal with two hard shells joined by two valves to seal in a soft-bodied animal; for example, an oyster.

Calcium carbonate mineral component of sea shells, which, when ground up, make up a portion of beach sand. $CaCO_3$

Crustaceans animals with an exoskeleton and jointed appendages like lobsters, crabs, and shrimp.

Dune system ecosystem comprised of the maritime forest, secondary dune, and primary dune, all of which contain differing vegetation types suited to sun, wind, and salt water.

Ecology study of relationships among organisms and their environments. **Ecosystem**

grouping of living and nonliving parts that interact to form a whole. **Intertidal zone**

area of sand that stretches from the high tide line to the low tide line. **Invertebrate**

animals without a backbone; for example, a squid or clam.

Maritime forest a part of the dune system; forested area close to the ocean that contains short trees with small leaves, and some vines and shrubs adapted to hot, windy, moderately salty conditions.

Mollusks category that includes soft-bodied animals with a shell, most of which have a muscular foot used for motion; clams, oysters, mussels, and whelks.

Primary dune collection of sand closest to the beach, covered only in beach grass; part of the dune system.

Secondary dune located between the maritime forest and primary dune; contains shrubs and grasses; part of the dune system.

Quartz a sparkly white mineral that, when ground finely, comprises a large portion of the sand on New Jersey.

Univalve animal with one valve and one hard shell covering its soft body; for example, a whelk or snail.

Vertebrate animal with a backbone, for example, a fish or horse.

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