



Salt Marsh Food Web

A food chain shows how each living thing gets its food. Some animals eat plants and some animals eat other animals. For example, a simple food chain links the plants, snails (that eats the plants), and the birds (that eat the snails). Each link in this chain is food for the next link.

Food Webs are networks of several food chains. They show how plants and animals are connected in many ways to help them all survive. Below are some helpful terms associated with food chains and food webs.

Helpful Terms

Ecosystem- is a community of living and non-living things that work together.

Producers- are plants that make their own food or energy.

Consumers-are animals, since they are unable to produce their own food, they must consume (eat) plants or animals or both.

There are three types of consumers:

Herbivores-are animals that eat only plants.

Carnivores- are animals that eat other animals.

Omnivores- are animals that eat both plants and animals.

Decomposers-are bacteria or fungi which feed on decaying matter. They are very important for any ecosystem. If they weren't in the ecosystem, the plants would not get essential nutrients, and dead matter and waste would pile up.

Salt Marsh Food Web Activities

The salt marsh houses many different plants and animals that eat each other, which is an intricately woven web of producers, consumers, and decomposers. Consumers usually eat more than one type of food, and they may be eaten by many other consumers. This means that several food chains become connected together to form a food web.

Use the “Helpful Terms” and the “Salt Marsh Inhabitants Guide” to help with the following activities.



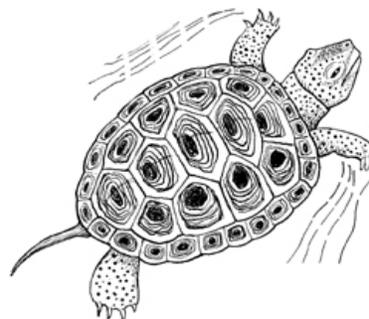
Salt Marsh Food Web Activity 1

Draw arrows from the prey to the predator(s).

Hint: Draw one food chain at a time.



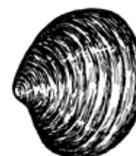
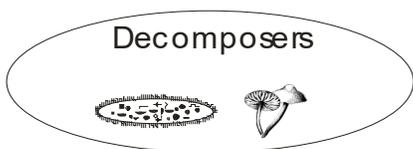
Plankton



Detritus



Decomposers





Salt Marsh Food Web Activity 2

Answer the following questions using the “Helpful Terms” and the “Salt Marsh Inhabitants Guide.”

1. Identify the producer(s): _____

2. Identify the consumer(s): _____

3. Identify the herbivores: _____

4. Identify the carnivores: _____

5. Identify the omnivores: _____

6. Why are decomposers important to an ecosystem? _____

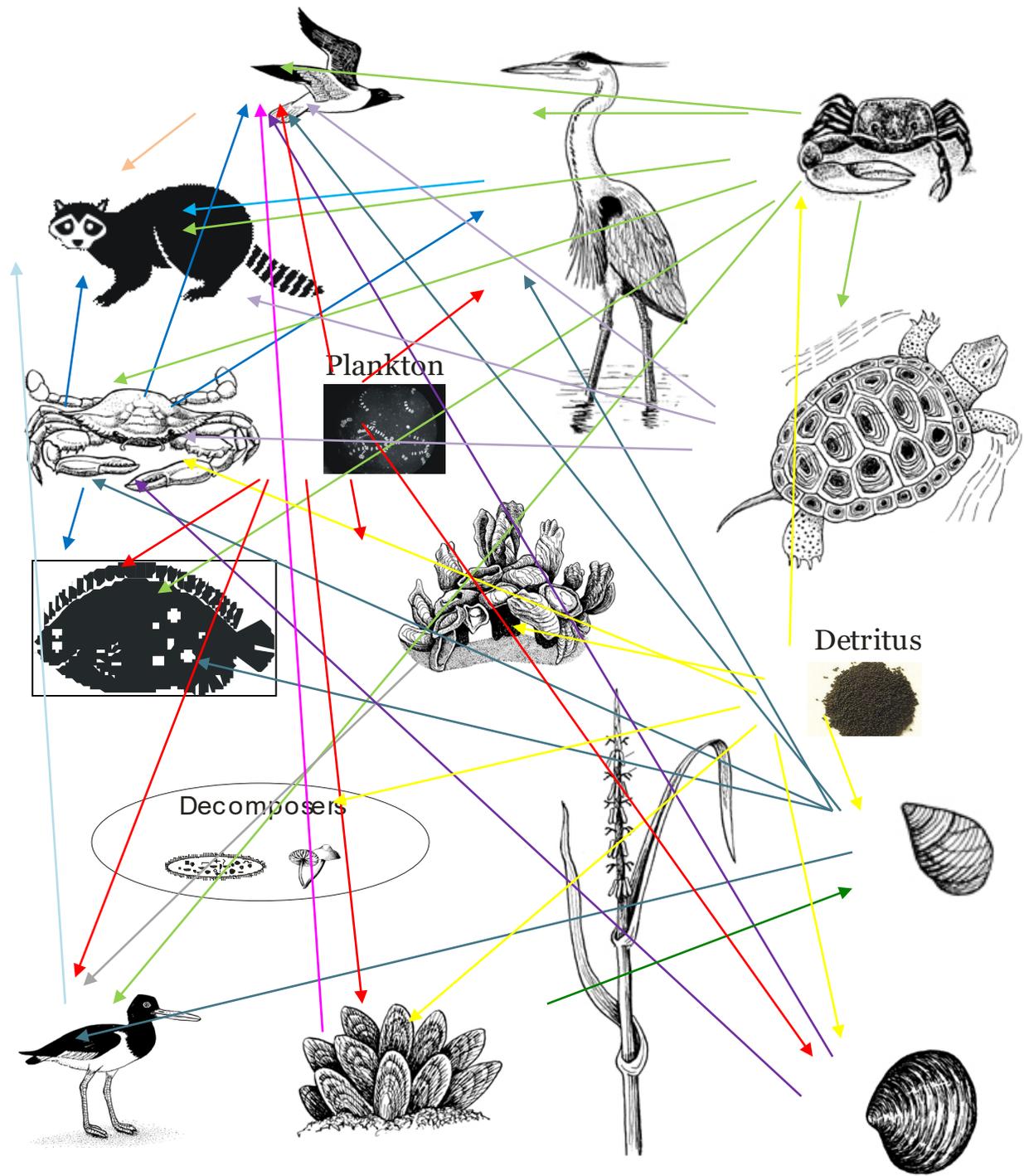


Teacher's Key

Salt Marsh Food Web Activity 1

Draw arrows from the prey to the predator(s).

Hint: Draw one food chain at a time.





Teacher's Key

Salt Marsh Food Web Activity 2

Answer the following questions using the “Helpful Terms” and the “Salt Marsh Inhabitants’ Guide.”

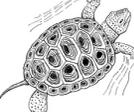
1. **Identify the producer (s):** Salt Marsh Cordgrass, phytoplankton
2. **Identify the consumer(s):** Blue Crab, Fiddler Crab, Marsh Periwinkle, Oysters, Quahog Clam, Mussels, Oystercatcher, Laughing Gull, Great Blue Heron, Diamondback Terrapin, Flounder, Raccoon, zooplankton
3. **Identify the herbivores:** Marsh Periwinkle, Fiddler Crab
4. **Identify the carnivores:** Oystercatcher, Laughing Gull, Great Blue Heron, Diamondback Terrapin, Flounder, Raccoon
5. **Identify the omnivores:** Blue Crab, Oysters, Quahog Clam, Mussels, zooplankton
6. **Why are decomposers important to an ecosystem?** Decomposers feed on decaying plant and animal matter, so the nutrients contained within the matter can be reused. If decomposers were not in the ecosystem, the plants would not get essential nutrients, and dead matter and waste would pile up.



Salt Marsh Inhabitants Guide

Inhabitants	Information
 <p>Salt Marsh Cordgrass (Spartina)</p>	<p>Spartina is the dominant plant species in our salt marshes. They grow on solar radiation and minerals in the water and mud. They also need oxygen but unlike land plants that derive their oxygen from air in the soil, there is little oxygen in the sediment of the estuary, so these plants have to carry oxygen in their roots. Spartina is eaten by periwinkles when it is still alive. Once Spartina dies and decomposes to become detritus many small animals eat it including crabs, snails, fish, and worms.</p>
 <p>Blue Crab</p>	<p>Blue Crabs are swimming crustaceans that are highly adaptable and can live in everything from freshwater to high salinity ocean waters. They feed on nearly anything they can find including clams, oysters, fish, plant and animal detritus, and even other crabs. Blue crabs are eaten by human, gulls, raccoons, herons, and fish.</p>
 <p>Fiddler Crab</p>	<p>Fiddler Crabs dig burrows in the soft sediment of the salt marsh. They eat algae, bacteria, and detritus. Fiddler Crabs are eaten by fish, birds, diamondback terrapins, raccoons, and other crabs.</p>
 <p>Marsh Periwinkle</p>	<p>Periwinkles are found moving up the stalks of smooth cordgrass as the tide comes in and going down the stalk as the tides goes out. They feed on algae, bacteria, salt marsh cordgrass, and plant detritus. Periwinkles are eaten by fish, crabs, birds, and small mammals.</p>
 <p>Oysters</p>	<p>Oysters permanently cement themselves to hard surfaces, including other oysters. They are filter-feeders, they suck in water and filter out plankton and detritus to swallow, then they spit the water back out. Oysters are eaten by humans, rays, moon snails, oyster drills, and oyster catchers.</p>
 <p>Quahog Clam</p>	<p>Quahog Clams use their muscular foot to dig down in the sand/mud depending on the level of tidal waters. They are filter feeders, using one of two siphons to bring in water for oxygen and plankton to eat, the other siphon expels the waste products. Quahog Clams are eaten by humans, blue crabs, and gulls.</p>
 <p>Mussels</p>	<p>Mussels are usually found half-buried in the salt marsh mud. They are filter-feeders normally eating during high tide by opening their shells slightly and drawing water into their mouth, filtering out algae and plankton. Mussels are eaten by otters, humans, and gulls.</p>
 <p>Oystercatcher</p>	<p>Oystercatchers are usually found in small groups but not mingled with other shorebirds. They root through the mud to find and feed on oysters, clams, snails, worms, and fiddler crabs. Oystercatchers are eaten by large raptors (birds of prey), while raccoons and skunks prey on their eggs.</p>



Inhabitants	Information
 <p>Laughing Gull</p>	<p>Laughing Gulls are normally seen near the water, but also can be found inland. They eat crabs, fish, mussels, clams, and terrapin eggs. Laughing Gulls eggs and young are eaten by foxes, raccoons, and even by herring gulls, and great black backed gulls.</p>
 <p>Great Blue Heron</p>	<p>Great Blue Herons are wading birds that can grow up to 4ft tall making them the largest heron in North America. They feed mostly on small fish, amphibians, and crustaceans. Great Blue Herons are eaten by eagles, hawks, and raccoons when they are young and sometimes as adults.</p>
 <p>Diamondback Terrapin</p>	<p>Diamondback Terrapins are the only species of turtle in North America that spends its life in brackish water. They eat clams, snails, mussels, fish, shrimp, and crabs. Diamondback Terrapins females that are nesting are sometimes eaten by raccoons. Terrapin eggs and hatchlings are preyed upon by a wide variety of animals including crabs, gulls, foxes, and raccoons.</p>
 <p>Flounder</p>	<p>Flounder are bottom dwellers in muddy sediments. They eat shrimp, crabs, and other fish. Flounder are eaten by humans, sharks, rays, and goosfish.</p>
 <p>Raccoon</p>	<p>Raccoons live in sparsely wooded areas, near ponds, streams, and marshes. They eat mice, birds, oystercatcher eggs, terrapin eggs, crabs, fish, and frogs. Raccoons are eaten by bobcats, coyote, and great horned owls which primarily prey on the young.</p>
 <p>Bacteria and Fungi (Decomposers)</p>	<p>There are many kinds of decomposers and most are microscopic. Fungi can be seen for example: mushrooms. Each decomposer has different jobs in the ecosystem. Some kinds of bacteria prefer breaking down meat or waste from carnivores. Actinolites only break down dead plants, including hard to break down plants and the waste of herbivores. Certain kinds of fungi prefer fruits and vegetables.</p>
 <p>Detritus</p>	<p>Detritus is finely divided rock, animal, or plant remains. It fuels the marsh and its animals. Detritus is the base of a salt marsh food web.</p>
 <p>Plankton</p>	<p>Plankton are microscopic organisms that float freely with oceanic currents and in other bodies of water. They are made up of tiny plants called phytoplankton and tiny animals called zooplankton. Phytoplankton use chlorophyll to convert energy from sunlight, inorganic chemicals like nitrogen, and dissolved carbon dioxide gas into carbohydrates. Zooplankton eat other plankton. Plankton are eaten by clams, oysters, mussels, fish, birds, and many other organisms.</p>



Commonly Asked Questions About the Cape Fear Salt Marsh and Estuary



What is an estuary?

An estuary is defined as where the river meets the sea. It is often partially enclosed, with slow-moving currents and banked by low-lying lands covered in salt-tolerant grasses or salt marshes.

What is a salt marsh?

A salt marsh is a low, wet area that is flooded by saltwater during high tides. These salty wetlands support many kinds of plants (producers) and animals (consumers). When these plants and animals die, bacteria and fungi (decomposers) release the energy trapped in these tissues back into the salt marsh system.

Salt marsh cordgrass, or *Spartina*, a grass able to grow in salty areas, usually dominates North Carolina salt marshes. This primary producer creates its own food through photosynthesis, using sunlight as its energy source. The tall grass slows the flow of water, trapping the soils, plankton and other nutrients carried in by the tides. *Spartina* also provides both food and habitat for many animals.

Spartina is considered a “nutrient bank” because it is rarely eaten until it has begun to decay. Crabs and other animals will eat the decaying grasses and what they do not consume, bacteria and fungi will break down into its basic nutrient components. These nutrients become suspended in the next tidal flood. In estuarine waters, tiny plants called phytoplankton take in these nutrients. Tiny animals called zooplankton then eat the phytoplankton. Zooplankton is the basic food source of small fish, which are eaten by larger fish, which are eaten by larger animals like birds such as herons. This simple transfer of energy is called a food chain. When other birds, sea turtles and humans eat the same fish as the heron, this creates a more complicated energy transfer network called a food web.

Why is the bottom of the salt marsh muddy, instead of sandy like the ocean floor?

In calm water, tiny particles of silt settle to the bottom. Salt marshes can develop only in areas protected from the fury of ocean waves. The presence of salt marsh grasses in these low energy zones tends to further slow the flow of water. Decaying plant matter called detritus enriches the resulting “muck” on the bottom. This salt marsh is also in an area where freshwater mixes with saltwater. This mixing causes some particles that would normally stay suspended in the water to settle out.

Is the tide pattern in the salt marsh the same as that in the outer ocean?

While the tidal pattern is very similar, the tide times will vary greatly. In our area the tide in the salt marsh usually rises and falls later than in the outer ocean. This time difference is influenced by the width and depth of the connecting inlet.



How were the salt marshes formed?

Modern salt marshes in North Carolina began forming after the last Ice Age, about 10,000 years ago, when eroded soils from newly formed mountains were deposited along the coast. Today, sediment trapped by grasses continues to expand our marshes. Manmade inlets further upriver have led to processes that allow for the extension of salt marshes.

How have plants and animals adapted to salt marsh life?

Only a few higher plants have adapted to life in saltwater. Some grasses, like the common cordgrass (*Spartina*), can excrete salt, which forms crystals on their blades. These salt crystals are especially noticeable on very hot, dry days. Other plants, including the marsh elder, have fleshy leaves that store fresh water. This lowers the salt concentration within the plant.

The anatomy and behavior of salt marsh animals show their adaptation to changing tide levels. The periwinkle, a species of marsh snail that breathes air, climbs the marsh grass to escape rising water during high tide. Clams dig deeper into the marsh sediments as they become exposed during low tides. Fiddler crabs have gills but can remain out of water as long as their gills remain wet.

Why is the salt marsh important to sea animals that don't live in it all their lives?

The food, calm water, and shelter found in the marsh makes it a perfect nursery for many ocean birds, fish and shellfish. Some of these animals become food for other animals in a complex food web, which includes people. Ninety percent (90%) of the saltwater fish and shellfish that we eat spend the first few weeks or months of their lives in a salt marsh or estuary.

Why is the estuary and salt marsh important to people?

Many of the animals people eat begin their lives in the estuary. We dine on shrimps, clams, oysters, flounder, and many other animals, which spend all or part of their lives in the salt marsh. We hunt waterfowl that rely on the food and shelter of the estuary.

The salt marsh benefits us by serving as a buffer zone against very high tides and ocean storms. The silty bottom and deep tidal creeks trap extra water that the ocean would otherwise push inland, destroying homes and property. Salt marshes also act as natural filters to remove sediments and pollutants from the water.

Many people who visit the coast each year spend important tourist dollars at hotels, restaurants, and many other stores. We don't usually associate the aesthetic beauty of our salt marsh and estuary habitats with commercial gain, but it does exist. These complex connections abound on our coast.

Can marshland be re-created once it is destroyed?

A salt marsh, which has been filled can be dug out and replanted with marsh grass and will gradually age into a mature marsh. However, toxins, oil spills and other pollutants introduced by people may make the land unsalvageable until someone cleans up the pollutants. The best way to protect our marshes is to avoid harming them in the first place.



Objectives:

By the end of this activity students will be able to define words that will be used during their visit to the aquarium as a Sea Scholar.

Additional activity:

Students may write sentences, look the words up in the dictionary, or doing mini-research papers on one of the words to increase their understanding of this vocabulary.

Sea Scholars Vocabulary List

Community	All the interacting plant and animal populations in a common area.
Consumer	An animal that eats plants or animals or both in a food chain, food web or energy pyramid. Consumers are unable to produce their own food.
Condensation	Is what occurs as water vapors come together, cool and form liquid water.
Decomposer	Bacteria or fungi, such as a mushroom, that breaks down decaying plants and animals into their basic components.
Detritus	Finely divided rock, animal or plant remains. Detritus is the base of one salt marsh food web.
Ecology	The study of the relationships between organisms and their environment.
Ecosystem	All the living and non-living things interacting in a defined area.
Environment	The surroundings in which a person, other animal, or plant lives, which can affect growth. The Aquarium makes each animal's tank like a natural environment.
Estuary	A semi-enclosed body of water where a river and ocean water meet and mix.
Evaporation	Water leaving the surface of an object after it is turned into a gas or vapor by the sun's heat.
Food web	Several connecting food chains represented by the decomposers, producers and consumers in a community.
Habitat	The place where a plant or animal lives.



	Maritime forest	A habitat containing trees, shrubs, vines, grasses and wildflowers, growing close to the ocean on relic dunes. Relic dunes are old dunes that were left behind as the ocean receded.
	Nutrients	The basic components needed by plants and animals to grow.
	pH	Is a measure of hydrogen ions in a solution. Acids have a pH below 7; bases or alkaline solutions have a pH above 7; neutral solutions have a pH of 7.
	Photosynthesis	A process plants use to make sugars from water and carbon dioxide. The sun provides the energy.
	Precipitation	Occurs when condensed water vapor becomes heavier than the surrounding air, changes to a liquid and falls to Earth. Depending upon conditions in the Earth's atmosphere, precipitation can occur as rain, sleet, snow or hail.
	Producer	Plants that make their own food or energy.
	Salinity	The amount of dissolved inorganic (salts) in seawater. It is commonly expressed in parts per 1000 (0/00). Ocean water is approximately 32 0/00 or 32 part of salt per 1000 parts of water.
	Salt	A water-soluble mineral that is found in seawater and in the earth. Sea salt is composed mostly of sodium chloride, but other salts are also present.
	Salt Marsh	Wetland area formed where oceans or estuaries meet the land.
	Succession	Changes in community structure, over time response to changing environmental factors. For example, a grassy field grows into a wooded forest.
	Tides	The regular rising and falling of coastal waters in response to the gravitational pull of the sun and moon. The tides are known as semi-diurnal, which means we experience two high and two low tides in a 24-hour cycle. In some places there are also wind driven tides.
	Transpiration	Evaporation of water that occurs from the leaves of a plant.



Objectives: By the end of this lesson students will have written one creative piece about the nature around them.

Vocabulary

Mode, Tone, Form, Purpose, Audience, Main character, Plot, Setting

Additional Activities:

Have the students research their organism prior to writing their story or poem. Have students present their research in class.

Have students draw or prepare illustrations for their creative writings.

Compile the class's poems, stories, drawings, and research papers into a book that they can take home as a memento.

For the Fun of Writing

Activity:

Tease your students' creativity out onto paper after your Sea Scholars experience at the aquarium.

1. As a class, review the plants, animals, and experiences of the salt marsh. Use the Salt Marsh Organisms sheet as a refresher if needed.
2. Give students 2 minutes to come up with as many adjectives as possible to describe the animals and plants they saw in the salt marsh.
3. Compile a class list of adjectives.
4. Ask students to pick their favorite plant or animal from the list.
5. Allow 1-2 minutes for students to come up with verbs for their plant or animal.
6. Including at least six words from their lists, have them write a poem or short story about the organism they chose. These may be either fiction or nonfiction.
7. Make sure students can identify the following found in their stories or poems: Main character, Plot, Setting, Mode, Tone, Form, Purpose, and Audience.
8. You may want students to switch papers with a classmate to edit each other's work, checking for correct spelling, grammar, capitalization, punctuation and readability.
9. Have students read their poems or stories to the class.

If you have students that were unable to experience North Carolina's salt marsh, the take a hike around the schoolyard or in a nearby natural area allowing at least 30 minutes for observing nature.

Variations:

- Students write their poem or story as if they were the organisms. Make sure they think about what behaviors they observed and include these details in the story. Have the students read their story or "act" out their organism and challenge the class to guess what they are.
- Students may write and illustrate a story about their salt marsh organism to teach younger children. Have them read their story to younger students in the school. They may even want to include hand-made sock puppets and tell the story through puppet theatre.
- Have students use their imagination to "construct" an organism of their choosing. Include name, size, age, habitat, behaviors, menu and daily or seasonal habits. Draw pictures of their organisms adding habitat details by cutting out trees, grasses, water or clouds using construction paper or by coloring re-usable scrap paper. Introduce the organism by reading its description to the class. Make sure to have wall space to showcase the descriptions and illustrations.



SALT MARSH ORGANISMS

PLANTS

salt marsh cordgrass
black needle rush
yaupon
wax myrtle

marsh lavender
seaside goldenrod
phragmites
saltmeadow hay

glasswort
sea lettuce
sea oxeye

INVERTEBRATES

MOLLUSKS



mud snail
marsh periwinkle

false razor clam
quahog clam

oyster drill
lightning whelk

CRUSTACEANS



Amphipod
fiddler crab
hermit crab

mud crab
blue crab

pink shrimp
grass shrimp

INSECTS



salt marsh mosquito
tiger beetle

deerfly
horse fly
sand fly

rubber fly
dragon fly

VERTEBRATES

FISHES



spot
flounder
mullet
eel (larval stage)

mummichog
croaker
silverside
killifish

menhaden
pinfish
anchovy

REPTILES



diamondback terrapin
common snapping turtle

six-lined racerunner
legless lizard

coachwhip snake
rough green snake

BIRDS



brown pelican
common egret
red-winged blackbird
willet
American oystercatcher

snowy egret
great blue heron
laughing gull
black skimmer
least tern

marsh hawk
barn swallow
osprey
purple martin
royal tern

MAMMALS



North American river otter
white-tailed deer

raccoon
marsh rabbit

marsh rice rat
gray fox



Objectives:

By the end of this activity students will have created a herbarium that shows the relationship between nature and art.

Materials needed:

Crayons
Paper
Paint*
Paintbrush*
Scissors
Newspaper
Heavy books
Page protector
Clear cellophane tape
Plant species account worksheet
Glue
Pictures or illustrations
3x5 index card (optional)
Notebook

Additional Activity:

Instead of pressing or drying the leaves, you could try the ancient art of Nature Printing to document the leaf. This takes practice but is fun to learn.

Nature Printing Directions:

- Gently remove 1 or 2 leaves from the plant.
- Lay the leaves on newspaper.
- Paint the leaves with a brush and paint of your choice.
- Place the leaves on a clean section of newspaper.
- Place a clean piece of paper on top of the leaves and gently press.
- Remove the paper without smearing the paint.
- You should have a detailed impression of your leaf.
- Allow to the impression to dry.
- Cut out the impression.
- Glue in place on your herbarium sheet.

Herbariums

Herbariums are fun ways to learn about and document plants that you see in and around your home or schoolyard. It's a great activity for class projects. Herbariums combine nature with art.

Activity:

Preparing your Herbarium

- Look around your home or schoolyard for a tree or plant that catches your eye.
- Gently remove one or two leaves.
- Make a bark rubbing by placing a sheet of paper against the bark of the tree. Using a crayon lengthwise, rub the paper against the bark until you have a clear pattern. Keep this rubbing in a safe place for later use.
- Take a photograph and/or make a quick sketch of the tree.
- Jot down a few notes about the tree or plant so that you can identify it.
- Place the leaves between two sheets of newspaper. Place heavy books on top of the leaves and set aside in a cool dry place for two weeks.
- Identify the tree by looking at field guides for your area, asking a friend or family member or by speaking with someone at a local plant nursery.
- Once you think you have the plant identified, look up information about the plant in books or on the Internet.

Constructing the Herbarium

- Using a sheet of paper, plan where you will put the various items you have prepared for your herbarium.
- Transfer the information about the plant from your notes to the 3x5 card.
- Place the card where you would like it onto the paper.
- Place your photo or illustration on the paper where you would like it.
- Cut a section of the bark rubbing and place on the paper.
- Place the pressed leaves on the paper.
- Once you have everything arranged as you like it, take the glue and secure the items to the paper.
- Once the glue is dry, place the paper with everything on it into the page protector.
- Seal the page protector with cellophane tape.
- Place the pages from each student into a notebook to display.