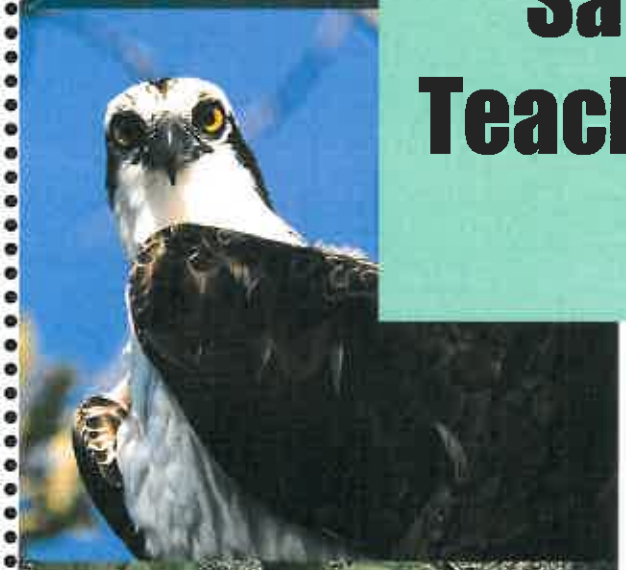

Manatee County
Conservation Lands
Management Department

Salt Marsh Teacher's Guide 2008

Program made possible by

Tampa Bay
Estuary Program

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Foundation

Introduction

Imagine a world where the earth is full of salt and covered in short, stubby plants with bloated leaves and tiny flowers. A place where tall grasses sway in the wind, soaked during high tide but left dry as the water recedes later in the day. A mangrove seed, carried by the tide, sprouts and gains a foothold in the salty soil, soaking up the sodium and excreting the crystals through its new leaves. Tall blue herons wade through the water, stalking through the grasses seeking tiny crabs and fish. Fiddler crabs dart into their holes to escape the predator and ospreys circle overhead.

This is the world of the beautiful, dynamic salt marsh. It is a truly unique native Florida habitat with diverse wildlife and a rich array of plant life. This Teacher's Guide is intended to help you and your classes explore this fascinating environment and meet its resident creatures while learning more about this incredible land of sea, salt, and soil. To supplement your use of this Teacher's Guide, please consider visiting Robinson Preserve for a "Marsh Mania" field trip. Please contact the Conservation Lands Management Department's office at (941) 748-4501 ext. 4605 for more information.

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Acknowledgements

Manatee County's Conservation Lands Management Department would like to thank the kind donors who made the Salt Marsh Teacher's guide possible. Funding for this program was provided by the United States Environmental protection Agency – Gulf of Mexico Program Office, National Oceanic and Atmospheric Administration Restoration Center, Gulf of Mexico Foundation and the Tampa Bay Estuary Program. These generous agencies demonstrate a firm commitment to environmental education and restoration.

Department staff would also like to thank the teachers and volunteers who edited and piloted this program. Thank you for your suggestions, guidance, and support!

Aquatic Collection

Overview: Salt marshes are a vital part of the world's coastal seashore environments. These areas where the land and water co-mingle provide valuable nursery habitat for 70% of the planet's important recreational and commercial marine wildlife. How do marine biologists find out these facts? In order to determine the number of fish and other marine creatures living in this habitat, scientists collect and examine the aquatic animals. The experts use a variety of collecting methods to capture and locate their subjects. During this hands-on lesson, students will become marine biologists and try out some of these techniques. They will learn about biodiversity, or the amount of variety within a system, and the importance of having diversity within the salt marsh habitat. They will also have the opportunity to create and test their own collection devices.

Objectives: The student will be able to:

1. Define and discuss biodiversity, explaining why scientists are interested in an area's degree of variety in species, habitat, etc.
2. Know that a location's biodiversity – the variety of species present – can provide clues as to the overall health of the system.
3. Understand that habitats such as the salt marsh are constantly changing environments and, therefore, scientists often undertake multiple study sessions in order to obtain reliable results.
4. Explain the purpose of utilizing different collection methods and describe which conditions suit each technique.
5. Work together to create one or more simulated scientific collection device(s).
6. Use a net designed to collect benthic (bottom-dwelling) marine organisms.
7. Use a simulated seine net to collect marine organisms.
8. Use a dip net to collect marine organisms.

Materials:

- Aquarium or butterfly nets
- 3 plastic tubs
- Scoop
- Water
- 2 dowel rods (per group)
- 2 yards mosquito netting or toile (per group)
- Stapler
- 1 package fishing bobbers (per group)
- 1 package small fishing weights (per group)
- Flour, sugar or salt
- Marbles
- String
- 1 package plastic fish and marine organisms
- 3-4 tennis balls
- 1 package of "growing" foam marine organisms

Grade Level: 6th- 8th grade

Duration: 1-2 hours

FCAT Benchmarks:

VA.A.1.3.1	SC.G.1.3.2
VA.A.1.3.2	SC.G.1.3.4
LA.C.1.3.1	SC.H.1.3.4
LA.C.1.3.4	SC.H.2.3.1

Background:

Scientists can utilize a variety of collection methods to assist with studying marine animals. Some of the methods are:

Dip Nets: Dip nets are a wonderful tool to use when working individually. As the name implies, this is a simple scoop-type net. Whether the net is small or large, the idea is to scoop into the water and catch creatures living in the local marsh area. Scientists can use these nets to capture organisms that are in floating plant matter (like water lilies) or catch fish that are swimming at the surface.

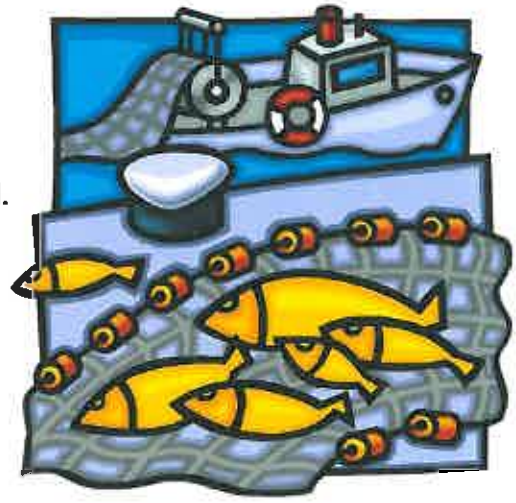
Dip nets are also very useful in serving the dual purpose of capturing two types of creatures at once! Scientists can place the flat edge along the bottom and push the net along in front as they walk. This method will catch organisms living on the bottom and those that are free swimming, giving researchers a wider variety of creatures to study.

Seine Nets: Seine nets are an excellent method of shallow water collecting, but they require two people to use. The net itself is a long, rectangular shape with each end attached to a pole. The collectors each hold a pole, standing with the net between them, facing in the same direction. The net must be positioned so that the line of weights is along the bottom and the floats are on top. The scientists with the net walk forward with it, dragging the bottom along the sea floor. When done, the collectors must work together in order to swing the net up from the bottom so that it is horizontal and the catch is on top.

This type of net is best used in areas without lots of rocks or other debris because when dragging the net, it can easily catch on these items.

Benthic Collecting: Not every aquatic animal swims through the water. Many creatures can be found living around, or even underneath, the sandy sea floor. Most of these animals are invertebrates, creatures without bones and spines, and are referred to as "benthic" because they live on the ocean bottom. Some, like tube-dwelling anemones, may have part of their body extended above the surface of the sandy bottom while the majority of their form is below. Others, such as snails, scallops, and other shellfish, simply rest on the bottom.

In order to study these types of organisms, scientists have developed special benthic collection methods. An easy example can be found in the form of the sifter. Scientists scoop up some substrate off the ocean floor and place it into a fine mesh sifter. They then run water through the sifter to wash away sand, mud, and other sediments until only the organisms are left behind. Researchers can then study and record those creatures living in and around the sandy bottom.



Other Collection Methods: There are a number of additional sampling methods available to scientists. In order to catch larger fish, researchers might use cast nets. These nets are useful when trying to catch schools of fish that are swimming near the surface. This is best done from a boat, dock or bridge, but can also be accomplished from land.

In order to survey large areas, scientists can conduct trawls. Trawl nets are attached to a boat, dropped into the water, and dragged behind the vessel as it moves through the sea. A trawl net is not species specific. These large nets will capture everything within the area of the net.

For the observation of species within their own habitat, researchers may choose to snorkel, SCUBA dive, or use submersibles (such as a mini submarine) depending upon the depth they need to reach.

Set Up:

Create 4 stations within the classroom. Each station will consist of a different "research activity" for your students. The station descriptions and set-up directions are outlined below:

1. Benthic Sampling: For this station you will need a plastic tub, colored marbles, a simple sifter, a scoop, and either flour, sand, or sugar – something sand-like to serve as the "ocean floor." The station will also need a card with directions.
    - Place the flour/sand/sugar in the tub.
    - Mix in and hide the marbles – scatter them throughout.
    - Place sifter and scoop in the bin.
2. Seine Net Creation: For this station you will need dowel rods, string, toile, fishing weights, fishing floats, stapler. The station will also need a card with directions.
    - Place the materials at the site for the students to use.
3. Seine Net Sampling: For this station you will need tennis balls and a card with directions.
    - Place tennis balls on the floor.
4. Dip Net Sampling: For this station you will need the aquarium or butterfly nets, plastic tub, water, and plastic marine animals. If you choose to have the students create their own dip nets, you will need additional materials. Directions on creating personal dip nets can be found in the reference section of this lesson plan. The station will also need a card with directions.
    - Place the water in the tub and float the marine animals in the water.

Procedure:

1. Begin by discussing marine biologists. Ask students to explain what they think a marine biologist might do during a normal day at their job. What types of assignments might this scientist try to tackle? Next, ask why a marine biologist's work would be important for studying a salt marsh. What types of creatures would these scientists look for in the marsh? What would you expect for them to learn from their studies?

2. Explain that, in the salt marsh, scientists have a *lot* to study! Marine biologists can stay busy studying the creatures that live along the bottom of the marsh, in the mud, and those that float or swim through the water. In order to try to discover all of the creatures living in the habitat, scientists use a number of different collection methods.

3. Ask the students why they think it is important to try to find out what is living in an area. What can this tell us? Explain that, if scientists can find a variety of different plants and animals in an area, it can give clues as to the health of the system. If there are too few or too many of one type of creature, it might mean that there is a stress on the system. These clues can also help scientists predict future trends in the system. For example, if there is a sudden shortage of one type of fish, but an increase in the predators that eat it, then scientists can hypothesize, or guess, that the predators may also decline in numbers as their food source is diminishing.

   Habitats are very complex systems and require a number of different plants and animals, as well as non-living functions, such as temperature, humidity, soil, and water, in order to support life. Maintaining variety, or a high level of biodiversity, is important as it keeps the system moving. Scientists often study areas to find out the level of variety within the system. Explain that, in order to determine this as well as study the organisms that live in these habitats, scientists often need to collect them. Talk about the various methods of collection, how they are used, and for what conditions each method is best suited.

4. Divide the class into special "study team" groups. Review the directions for this activity. These groups will travel to each collection station and follow the directions to complete their "research." Groups will have to carefully and correctly use the "equipment" at each station, collect data, and record their results. Once the teams have finished with all of their collections, they will return to their seats and graph their results.

5. Now the students will have the opportunity to practice each collection method. You may wish to first demonstrate and then explain each technique before letting the groups try them.

   <u>Station A - Benthic Sampling:</u>

   - This station simulates bottom-floor sampling. The flour (sand or sugar, depending upon what you choose to use) is the "substrate." The marbles hidden within it represent sea creatures.
   - Place a scoop of flour-marble mixture into the sifter.
   - Sift out the "substrate," working over the tub until only the marbles remain.
   - Remove the marbles and count the total number of "sea creatures." Record the total number captured and the number of each color.
   - Set these marbles aside. Another member of the group should repeat the activity in a different spot in the tub.
   - Continue collecting samples, counting "sea creatures," and recording data until everyone in the group has had a chance to participate.

   <u>Station B - Seine Net Creation:</u>

   - Here the students will work together to build a model seine net.
   - Students will first need to take two dowel rods and lay them on the ground.
   - Stretch the toile netting between the rods. The shape will be much like the letter "H" with the rods forming the vertical part.
   - Tie 2-6 fishing bobbers or floats to the top of the net.
   - Tie 4-6 fishing weights to the bottom of the net.
   - Wrap the netting around each dowel rod and use the stapler to secure it to the rods.
   - Each group will make one net.

Station C - Seine Net Sampling:

- For this activity, students will join in pairs in order to use their newly created seine net. This station simulates use of a seine net in capturing larger "sea creatures."
- The tennis balls will be "fish" moving around on the sea floor.
- Each person will take one of the rods and hold the net up. It should look like a standing letter "H." The part of the net with the fishing weights should touch the floor.
- Now the pair will use the net to try to scoop up the tennis ball "fish."
- To make this activity more difficult, other members of the group can roll the balls around. Collectors will then have to work a bit faster to collect their catch!
- The group will rotate, changing pairs, until everyone has had an opportunity to participate.

Station D - Dip Net Sampling:

- At this final station, students will use dip nets to practice collecting plastic marine animals at a number of different levels (floating, sea floor, etc). Students can use either aquarium or butterfly nets provided or they can create and use their own dip nets.
- Each group member can use a dip net and try to scoop out the creatures within the tub.
- Once creatures are captured, students should record the type and number of each organism before releasing them back into the tub.

Wrap-Up:

After the class has tried their hand at collecting, ask them to share which method they enjoyed the most. Which one is the most effective? Which is the easiest? The most difficult? Which do you think would work best in a muddy, grass-filled salt marsh? You may also wish to quiz their understanding of the purpose of each of the different methods by asking specific scenario questions such as:

1. If I was on a dock and saw a school of fish, what would be the best way to collect them?

2. If I wanted to survey a shallow area by myself, what collection gear would I use?

3. How can I collect many fish at once?

4. What is the best item to use to collect benthic invertebrates?

Additional Resources:

Answers.com: *Marine Biology*. Retrieved March 22, 2007, from http://www.answers.com/topic/marine-biology?cat=technology

Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute: *Florida's Salt Marshes*. Retrieved March 22, 2007, from http://research.myfwc.com/products/products.asp

The Royal Society: *Measuring Biodiversity for Conservation*. Retrieved March 22, 2007, from http://www.marinebiodiversity.ca/en/pdfs/royalsoc.pdf

Virginia Institute of Marine Science: *Dip Net Crabbing*. Retrieved March 23, 2007, from http://www.vims.edu/adv/ed/crab/net.html

Virginia Institute of Marine Science: *Seine Net Crabbing*. Retrieved March 23, 2007, from http://www.vims.edu/adv/ed/crab/seine.html

Waterwatch Queensland: *How to Make a Dip Net*. Retrieved March 22, 2007, from http://www.qld.waterwatch.org.au/resources/howtomakeadipnet.html

Wikipedia: *Trawling*. Retrieved March 23, 2007, from http://en.wikipedia.org/wiki/Trawling

Australian Invaders

Overview: Utilizing an interdisciplinary approach, this lesson looks at the environmental effects of an introduced invasive species. An invasive plant from Australia, the Australian pine, is the focal point of this investigation. Students will explore the influence of man upon the environment by examining our purposeful introduction of this non-native species. By exploring the history, benefits, and negative effects of Australian pines, students will also learn about the effect of exotic species on the economy and southern society. The class will form an Australian Pine Task Force and investigate the positions of different groups regarding the trees. Each group will create a project and will share their findings with the class.

Objectives: The student will be able to:

9. Explain the difference between invasive and non-invasive species.
10. Give examples of the ways that species can be introduced into a new ecosystem.
11. Explain why invasive species are able to take over an ecosystem.
12. Discuss the negative and beneficial aspects of introducing non-native species.
13. Talk about the economic factors that influence the introduction of species.
14. Discuss the validity of seeking alternative uses for nuisance species.
15. Work together in teams to conduct research regarding an invasive species and its effects on society and the environment.

Materials:

- Computers with Internet access
- Reference materials (books, articles, magazines)
- Paper and pencils
- Copies of research questions and projects for each group
- Markers, pens and/or crayons
- Poster board or cardboard
- Photographs of Australian pine growth
- Chalkboard, white board, or other display board
- Copies of articles listed in "additional references" section (optional)

FCAT Benchmarks:

SC.D.1.3.4	VA.B.1.3.4	MA.A.3.3.2	LA.A.1.3.4
SC.D.2.3.1		MA.A.3.3.3	LA.A.2.3.5
SC.D.2.3.2	SS.A.1.4.3	MA.A.4.3.1	LA.A.2.3.6
SC.F.1.3.7	SS.A.1.4.4	MA.E.1.3.1	LA.B.2.3.2
SC.G.1.3.2	SS.B.1.4.1	MA.E.1.3.3	LA.B.2.3.3
SC.G.1.3.4	SS.B.2.4.4	MA.E.3.3.1	LA.B.2.3.4
SC.G.2.3.3	SS.D.1.4.1		LA.C.3.3.3
SC.G.2.3.4			
SC.H.1.3.3			
SC.H.1.3.4			

Grade Level: 6th - 8th grade

Duration: 1-2 hours (sharing projects may take additional class time)

Background:

Characteristics: The Australian pine, *Casuarina equisetifolia*, is not really a true pine. Its needle-like leaves and pinecone-like seed pods give it the name of "pine." But it is, instead, simply a deciduous tree. Of the 25 different types of Australian pine, 3 have been introduced into Florida.

History: Like many exotic plants, the introduction of Australian pine was often intentional. First introduced in the 1800s, these trees were frequently planted to create a buffer, either as a wall for privacy or a wind break. Australian pines were also planted along our beaches to secure the soil and prevent erosion.

It is interesting to note that, currently, there are several "Save the Pines" groups. These organizations are typically composed of individuals who appreciate the shade the trees provide and view them as an enhancement to the landscape, rather than as a bane to the local environment as some scientists suggest. The appearance of these groups has added a new facet to the problem of exotic plants since now there are groups advocating their preservation.

Economic Influences: Many of the earth's invasive species are closely linked to our economy. These species are often brought in to either improve the environment (as in the case of "natural controls" – predators that are introduced to control a pest) or accidentally through our activities (as in the case of stowaways on planes and ships that come into the country via our trade routes). Sometimes, as in the case of kudzu, there is actually a potential to make money from the exotic species. In this case we often see a quick and large-scale introduction of the species as interested parties work to establish it in the hopes of generating a supply for the market.

Problems: Hailing from the oceanic island-continent of Australia, this tree is highly adapted to live in salty conditions. This means that it grows quickly in areas where many native plants cannot survive. Without any natural predators, the tree thrives, sprouting new saplings in characteristic rows from each previous tree's roots. The Australian pine's "needles" coat the ground, creating a dense mat that prevents other plants from sprouting. Additionally, the tree has allopathic qualities, or chemical warfare, that allows it to change the soil's chemistry to suit its own growing preferences. This means that native plants that might normally grow there will not be able to adapt to the changes in the soil and are thus eliminated by the pines. Its shallow root system does not really secure the soil; these skimpy roots are often uprooted by high winds, storms, or hurricanes causing the trees to topple.

Uses: Throughout the world, cultures have found a variety of uses for this plant. In Thailand, the wood is used as fuel as the pines burn very hot. Elsewhere, the wood is used for pilings, beams, fences, boatbuilding, and furniture. It has even been used in folk medicine as a laxative!

Warm-Up Activity:

1. Write the words "native" and "exotic" on the board. Have the students stand up. Ask all of the students who were born in Florida to move to one side of the room. Everyone else who is from a different state or country should move to the other side of the room.

2. Once the class is divided, ask if anyone knows the definition of "indigenous." What about "native"? If a plant or an animal is "native" or "indigenous," what does that mean? Explain the definition of this word and label the students who were born in Florida as natives. Now inquire after the definition of "exotic." Explain that the other students are exotic species and allow the students to guess the definition. Exotic species, like the rest of the students, are not from the area. Ask the students to try and think of some exotic species that live in Florida (examples might include air potato, Cuban or brown anole lizard, Quaker or monk parakeets, Brazilian pepper tree and Australian pine).

3. Write the numbers in each group on the board under the headings and determine the percent of each. Which group is larger? Explain that, in nature, exotic species can quickly become invasive. An invasive species is one that is not native to an area, but moves in and takes over the habitat of the native creatures. Invasive species usually take over quickly because they have few natural predators and are usually not affected by the local diseases. Sometimes they might even prey on the native animals and/or plants.

4. To illustrate this concept, select one student from each group. Explain that, as an invasive species, Exotic Student would go to Native Student's house and move in. He or she would take over Native Student's room, eat his or her food, and take all of his stuff. Effectively, Exotic Student invades and takes over the habitat (the house and room, in this case) of Native Student. What if Exotic Student has friends that come with him or her? Have Exotic Student pick out several more children from the exotic group. Each of these students should then select a Native Student. This quickly illustrates how exotics move in and take over! Now look at the population. How many Native Students are left? Ask the students to consider the native students – what happens to them when the exotics invade and take their home? Where will they live? What will they eat? Remind students that the invasive species are not "bad." They're just trying to meet the same needs that the natives have of finding food, water, shelter, and space.

Procedure:

1. Talk a bit about the Australian pine tree, relating its history and growth potential. Explain that people were actually encouraged to grow this plant, and the government even helped to plant it! Do the students think that people knew the plant would grow like this? Even so, what would be the goal of planting a non-native plant? Why would we want to have it? Discuss the possibilities with the students. Explain that while there were great intentions, the plant has obviously gotten out of control and people are now seeking solutions to the problem. Talk about the different effects that the Australian pine tree has had on our local habitats and the creatures that live in these areas.

2. Explain that environmental issues often elicit varying opinions from people. In order to take all of these views into consideration, governments often create task forces to address problems. These groups serve as advisory panels and often have members from a variety of different backgrounds. Ask the students to brainstorm the types of experts that would be useful to have on an advisory panel. What sort of knowledge would be needed?

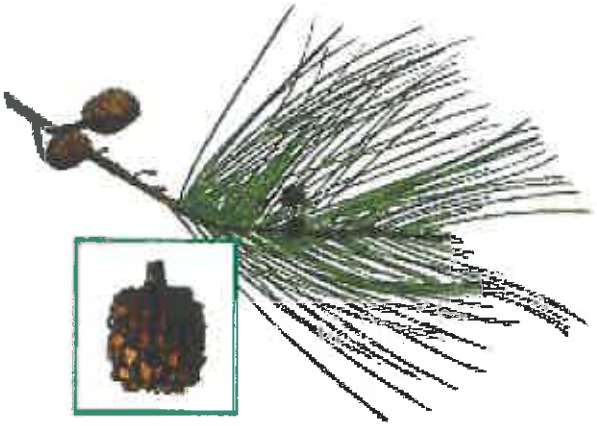
3. Now the class will form an Australian Pine Task Force in order to learn more about the tree and its effect on society and the economy. Place students into one of the following groups: Scientists, Historians, Economists, and Environmentalists. Just as a regular task force would work together to conduct research and make recommendations, the class will do the same. Each group will be given a list of research questions to guide their study (see attached worksheets). They will then complete a group project that will illustrate material comprehension.

   Give the students time and references in order to conduct their research. They can utilize books, magazines, the Internet, and the articles listed in the additional resource section at the end of this lesson.

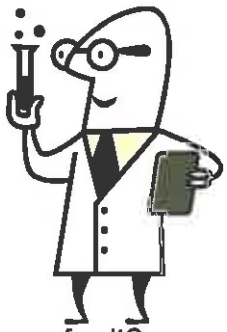
4. Once the students have finished their projects, call the task force together. Have one member from each group explain their project. Initiate discussion to review questions and share research between team members.

Wrap-Up:

The Australian Pine Task Force projects will be put on display in the classroom, and later compiled together into an informational packet. The class will donate the packet to the school's library for review by future students. In addition to the projects created by the teams, each student will submit a written piece to the packet. Every student will write a brief persuasive piece arguing either the benefits or negative effects of Australian pines. The student's goal will be to persuade the reader into either disagreeing or agreeing with his or her chosen side of the issue. They might choose to argue for the eradication of the Australian pine, citing its negative economic effects, or they might argue for the investigation of alternative uses of the plant. The teacher may assign a position to each student, or the students may be allowed to choose for themselves. These pieces will be added to the informational packet to give another dimension to the class' project.



Scientists!



1. What is the scientific name of this plant? What does it mean?

2. What is the common name for the plant? Are there any other nicknames for it?

3. How does it grow (as a vine, tree, shrub)?

4. What is the maximum recorded growth rate per day? Per year?

5. What type of environment does Australian pine prefer? What temperature and climate does it like?

6. What do Australian pine trees look like? Describe the leaves, flowers, and other physical characteristics of this plant.

7. Does this tree have any predators?

8. Why does this tree grow so well?

SPECIAL ASSIGNMENT: Create an informational poster about the Australian pine tree. Your poster should include illustrations of the plant, its structure and growth characteristics, as well as the information you've discovered in your research.

Historians!

1. When were Australian pine trees first *seen* in the United States?

2. Where in the world are Australian pine trees normally found?

3. When was the Australian pine tree first *introduced* into the United States?

4. How was the Australian pine tree introduced? What are some other ways non-native plants are introduced?

5. Where did this plant originally come from (country/area)?

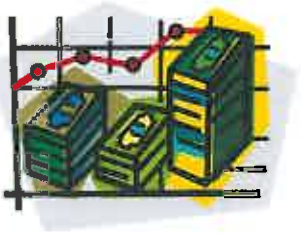
6. Why were people encouraged to grow Australian pine trees?

7. Why is the Australian pine tree perceived to be a problem?

8. Are there any arguments *against* removing this tree? Look for local examples.

SPECIAL ASSIGNMENT: Design and create a timeline that illustrates important events in Australian pine tree history. The timeline should include brief descriptions of each event along with the dates.

Economists!



1. People originally thought that Australian pine trees would be very valuable. What were the original uses for Australian pines?

2. How did the government help the spread of Australian pines? Why were they planted along the beaches?

3. How do Australian pine trees affect land that might be used to grow other cash crops?

4. How might the presence of Australian pine trees affect the property value? How might they damage or enhance property?

5. Our global economy can influence the spread of non-native species. What are some ways (besides intentional introduction) that exotic species are introduced through our business activities (consider travel and other ways people move from place to place)?

6. How much do Australian pine tree eradication programs cost?

SPECIAL ASSIGNMENT: Make a chart or graph that lists the costs per year of Australian pine control programs for the past five years. Estimate the costs of removal for the next ten years. Create an informative flier (to contrast with that created by the environmentalists) that highlights the problems associated with Australian pines.

Environmentalists!

1. What is the current distribution of this plant in the United States? Where is it most often found?

2. What is the estimated coverage of the plant (number of acres)?

3. What type of affects do Australian pine trees have on other plants? Does it help them or hurt them?

4. What affect can Australian pine trees have on an entire habitat?

5. What other effects do Australian pines have on the environment (particularly the soil)? Do you consider these to be positive or negative?

6. What is being done to control the Australian pine tree?

7. There are a number of other potential uses for Australian pine trees. Name at least four beneficial uses of this plant.

8. Do the negative environmental impacts of Australian pine trees exceed the benefits?

SPECIAL ASSIGNMENT: Design a map that shows the current distribution of Australian pines in the United States. Along with the map, create an informational flier (to contrast with that created by the economists) that talks about the benefits of Australian pine trees. This flier should be positive and really help people understand the various alternative uses of this plant.

Additional Resources:

Gilman, Edward F. and Dennis G. Watson: *Casuarina, spp.: Australian Pine.* Retrieved February 27, 2007, from: http://edis.ifas.ufl.edu/ST129

Global Invasive Species Database: http://www.invasivespecies.net/database/species/ecology.asp?si=365&fr=1&sts=sss

Harris, Larrissa: *Exotic Species in Florida: Australian Pine.* Retrieved February 27, 2007, from: http://www.floridaplants.com/casuarina_equisetifolia.htm

Holsinger, Michael J: *Australian Pine Sidebar Story.* Retrieved February 27, 2007, from: http://sarasota.extension.ufl.edu/Hort/Pubs/AustralianPine.htm

Plant Conservation Alliance's Alien Plant Working Group: http://www.nps.gov/plants/alien/fact/caeq1.htm

Save Our Pines. http://saveourpines.com/pages/f.a.q.html

The Nature Conservancy: *Element Stewardship Abstract for the Australian Pine.* Retrieved February 27, 2007, from: http://tncweeds.ucdavis.edu/esadocs/documnts/casuequ.pdf

Crabby Math

Overview: Scientific studies and mathematics go hand-in-hand. In the field, scientists utilize a variety of measurements and formulas to gather data about flora and fauna. In this lesson plan, students will utilize mathematical and scientific research skills to study different salt marsh crab species. During the lesson, students will gain practical experience measuring and recording data. They will take their information and use it to create a 1:1 ratio sketch, determine the area and volume of their specimen, and create a proportionately larger "monster crab." They will research their chosen species and learn to identify a variety of salt marsh crabs.

Objectives: The student will be able to:

1. Identify the basic anatomical parts of a crustacean.
2. Define "invertebrate" and explain how vertebrates and invertebrates differ.
3. Research different types of salt marsh crab species.
4. Recognize 6 salt marsh crab species.
5. Utilize measurements of their specimen to find the area and volume of the creature's body.
6. Use the measurements to create a life-size sketch of their animal.
7. Work with proportions to expand their crab to 5, 10, and 500 times its normal size.
8. Explain why a monster crab that was 500 times the original normal measurements could not exist.

Materials:

- Computers with Internet access
- Reference materials (books, articles, magazines)
- Paper and pencils
- Rulers
- Markers, pens and/or crayons
- Calculators
- Crab ID sheet copies
- White drawing paper

FCAT Benchmarks:

MA.A.3.3.2	MA.B.1.3.3	SC.G.2.3.3
MA.A.3.3.3	MA.B.1.3.4	SC.H.1.3.4
MA.B.1.3.1	MA.B.4.3.2	VA.A.1.3.1
MA.B.1.3.3	MA.C.1.3.1	VA.A.1.3.4

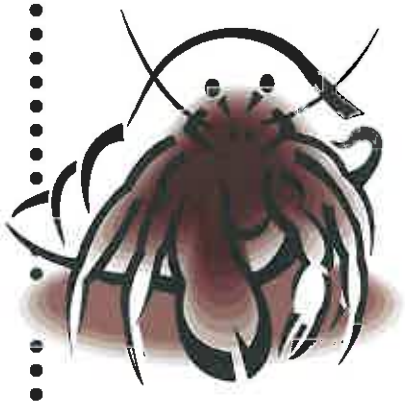
Grade Level: 6th - 8th grade

Duration: 1-2 class periods + homework time (homework = approximately 2-3 weeks)

Background:

Crabs play an important role in the salt marsh habitat. An incredible variety of different crab types have evolved to flourish in this salty zone where the sea and the land meet.

Anatomy: Crabs are invertebrates. They are creatures that lack internal bony or cartilaginous skeletons and, most importantly, spines. To protect their soft insides, crabs have developed a hard exoskeleton made of chitin (a material similar to your fingernails). This hard outer body covering acts like a suit of armor, protecting the animal from predators. In order to grow, a crab must shed its exoskeleton, similar to our need to buy new clothes. Underneath this body covering is a larger, soft shell that will eventually harden once the old armor is abandoned.



All crabs have 4 pairs of legs (for a total of 8) much like a spider. They also have two claws which vary in strength depending on the size of the crab. These claws are actually modified legs making the total count of legs at 5 pairs. Legs are jointed and allow these animals to swim and move quickly along the land.

Role: Some of the crabs that live in the salt marsh, such as the mangrove tree crabs and the fiddler crabs, prefer to live on land. Others, like the blue crab, are expert swimmers and utilize the shore and the water. Crab diets are just as varied as their housing preferences. Blue crabs are predators, lurking beneath the water to eat just about anything they can get their claws upon. Others are more peaceful and prefer to eat primarily plant matter. In either case, they are omnivores and will eat a little bit of everything. They will consume carrion, or dead and decaying organic matter and, therefore, help clean up the oceans and shoreline.

Crabs aren't just eating other creatures. Crabs are important to the salt marsh food chain as they not only break down matter, but are also subject to a variety of predators, including us! Wading birds, fish, and even other crabs will all prey upon the salt marsh's crustaceans. Certain species, like the stone and blue crabs, are famous for their flavor – we humans love to eat these crustaceans. Each year, millions of crustaceans are consumed, playing an extremely important role in our seafood economy.

Procedure:

1. Review the concepts of area and volume and the formulas for finding these dimensions. Explain that scientists utilize these measurements to keep track of different trends in species. Ask the students to brainstorm different ways scientists might use these measurements. Why would they be helpful information? Reveal that the class will study the crabs that live in the salt marsh using these formulas to practice their research skills. Each student will receive a "mystery" crab they will have to study and research. They will first use the measurements to collect data about the crab and will then go to the "lab" to attempt to gain more information on this crab.

2. Demonstrate the "research" technique with several examples commonly found in a classroom, such as a pencil, eraser, or ball. First, measure the object. Then use these measurements to find the area and volume of the object. Review different formulas for area and volume of different shapes. Ask the students to choose which formula would be appropriate for the object. Now utilize these measurements to draw an actual sketch of the object. For the next step, you will "blow up" the object to make a giant!

Using the original measurements, increase them by 5. Enlarge each dimension by 5 and find the new area and volume. Engage the class to help you repeat the example for a multiple of 10 and 100. Describe the relationship between ratios and the increasing measurements.

3. Pass out the Crab ID Sheets. Explain that the measurements for these crabs are already listed as we do not have real crabs to measure. Use 0.5 inch for the thickness of the fiddler crab, spider crab, and mangrove tree crab carapaces (upper body part or shell). Use 2 inches for the thickness of the blue crab, stone crab, and horseshoe crab. Have the students look at the pictures (not to scale) to determine what shape the crab's body is – what formula will they use to find the area and volume of this body part? Ask the students to first determine the area and volume of the crab's carapace and claws. They will need to use the shape that most closely fits the body part they are examining. Remind the students that, as good scientists, they'll need to write down this information!

4. After the students have used the information to find the area and volume of all of the crabs, pass out the white drawing paper. Their next task will be to use the given measurements to create a 1:1 scale drawing of the crab (it will be a different size than the photograph on the handout). Remind the students that the drawing will need labels.

5. Once the sketches are complete, the students should work on using the measurements to obtain data for specimens that would be 5, 10, and 100 times the normal size of their crab.

6. After all of the initial data has been collected, the students will need to utilize the information as clues to discovering the identity of their crab. The final step of this activity will be to use reference books and online resources, along with the photographs and original data on the Crab ID Sheets, to identify their mystery crab. All of the species used in the activity are readily identified online. Students will turn in their sketch and Crab ID Sheet.

Homework Extension:

Estimated Duration: 2-3 Weeks

This homework extension will allow children to use critical thinking skills and apply what they've learned about ratio and proportions in class to create a unique scale sculpture of their crab species. After all of the measurements have been calculated and verified for correctness, return the Crab ID Sheets to the students. Now challenge the students to get creative! They will take their ID Sheets home and use the measurements to create a scale model of their crab. They must decide on their own how to build it, but it will need to be an *enlarged* crustacean. Ask the students to build a sculpture of their crab that is 5 times its normal size. Models can include simply the carapace, or students can be challenged to measure the claws and legs (they would most likely use formulas for cylinders and cones) in order to create these additional appendages.

Students may complete the homework exercise with a class presentation about their model crab species, its habitat, habits, distinguishing characteristics, etc.

Crab ID Key: A. Blue Crab B. Spider Crab C. Mangrove Tree Crab
D. Stone Crab E. Horseshoe Crab F. Fiddler Crab

Resources:

American Museum of Natural History: *Horseshoe Crab BioBulletin*. Retrieved March 1, 2007, from http://sciencebulletins.amnh.org/biobulletin/biobulletin/story662.html

Delaware Division of Fish & Wildlife: *The Humble Horseshoe Crab*. Retrieved March 1, 2007, from http://www.state.nj.us/drbc/crab/crabhome.htm#

Fiddler Crab Forum. Retrieved March 1, 2007, from http://www.fiddlercrab.info/

Field Guide to the Indian River Lagoon, Florida. Retrieved March 1, 2007, from http://www.sms.si.edu/IRLFieldGuide/Crabs.htm

North Carolina Division of Marine Fisheries: *Crustaceans*. Retrieved March 1, 2007, from http://www.ncfisheries.net/kids/crustaceans.htm

University of Delaware: *Interactive Coastal Habitat*. Retrieved March 1, 2007, from http://www.ocean.udel.edu/kiosk/mural.html

Common Name:

Scientific Name:

Habitat Description:

Area of Carapace: Volume of Carapace:

Measurements x 5, Enlarged Area, Enlarged Volume

Measurements x 10, Enlarged Area, Enlarged Volume

Measurements x 100, Enlarged Area, Enlarged Volume

Carapace: 5 inches x 3.5 inches

Hint: Think of a color…

Common Name:

Scientific Name:

Habitat Description:

Area of Carapace: Volume of Carapace:

Measurements x 5, Enlarged Area, Enlarged Volume

Measurements x 10, Enlarged Area, Enlarged Volume

Measurements x 100, Enlarged Area, Enlarged Volume

Carapace: 3 inches x 3 inches

Hint: My namesake has 8 legs, too!

Common Name:

Scientific Name:

Habitat Description:

Area of Carapace: Volume of Carapace:

Measurements x 5, Enlarged Area, Enlarged Volume

Measurements x 10, Enlarged Area, Enlarged Volume

Measurements x 100, Enlarged Area, Enlarged Volume

Carapace: 2.5 inches x 2 inches

Hint: I'm named after my home…

Common Name:

Scientific Name:

Habitat Description:

Area of Carapace: Volume of Carapace:

Measurements x 5, Enlarged Area, Enlarged Volume

Measurements x 10, Enlarged Area, Enlarged Volume

Measurements x 100, Enlarged Area, Enlarged Volume

Carapace: 4 inches x 3.5 inches

Hint: I'm hard as a....

Common Name:

Scientific Name:

Habitat Description:

Area of Carapace: Volume of Carapace:

Measurements x 5, Enlarged Area, Enlarged Volume

Measurements x 10, Enlarged Area, Enlarged Volume

Measurements x 100, Enlarged Area, Enlarged Volume

Carapace: 4 inches x 6 inches

Hint: You might think I'm worn...

Common Name:

Scientific Name:

Habitat Description:

Area of Carapace: Volume of Carapace:

Measurements x 5, Enlarged Area, Enlarged Volume

Measurements x 10, Enlarged Area, Enlarged Volume

Measurements x 100, Enlarged Area, Enlarged Volume

Carapace: 2 inches x 1.5 inches

Hint: I make beautiful music!

Gone Fishin'

Overview: The scientists and rangers at Robinson Preserve actively work to track and measure the population of fish and invertebrates within the new lagoon. In this activity, the students will become marine biologists and work to implement a catch and release study of a "lagoon" filled with a variety of fish. Students will gain practical field experience that could be tested in the field at Robinson Preserve. They will work with proportions to tabulate their results.

Objectives: The student will be able to:

1. Perform a simple capture/recapture test study.
2. Collect and tabulate data during the study.
3. Find the mean, median, mode, and range of their data.
4. Estimate the population of their lagoon from their data.
5. Understand and explain how the capture/recapture method can help scientists estimate an unknown population in a large area.

Grade Level: 6th - 8th grade

Duration: 1 class period

Materials:

- Goldfish crackers, plain
- Goldfish crackers, colored
- Paper and pencils
- Paper cups
- Brown bags
- Napkins

FCAT Benchmarks:

MA.A.3.3.2	MA.D.2.3.2	SC.H.1.3.4
MA.A.3.3.3	MA.E.1.3.1	SC.H.1.3.7
MA.A.4.3.1	MA.E.1.3.2	
MA.D.2.3.1		

Background:

Long before Robinson became a preserve, the land was used for agricultural purposes. The beautiful central lagoon that the class will visit was actually once a borrow pit. This large hole was dug by farmers in order to obtain soil for use in the day-to-day activities on their land. Eventually, the hole they created filled with rainwater and became a land-locked lake. Oddly enough, this water was not fresh but was actually saltwater! How did a land-locked lake become salty? The borrow pit is located close to several saltwater features, including nearby Perico Bayou to the west and Palma Sola Bay to the south. These salty waters have tidal events that affect the nearby soil. Over the years, extremely high tides coupled with soil runoff from the surrounding salty soil created a lake that had an unusually high salinity.

The lake itself began to attract creatures that would normally be found in or around saltwater, such as blue and fiddler crabs. High tides helped populate the lake by depositing fish eggs into the water. Visiting wading birds assisted by bringing in eggs of fish and invertebrates attached to their legs and feathers. Before the lake was transformed into a lagoon, a baseline study revealed a total of 17 different fish and 12 invertebrate species living within the lagoon. The plans for Robinson Preserve included an expansion of this lake that would not only enlarge it but would also connect it to Palma Sola Bay and the Manatee River. In doing so, we hoped to increase marine habitat and attract a wider variety of species.

To discover whether or not the plan has worked, our rangers, scientists, and volunteers visit the lagoon on a regular basis to conduct fish surveys. Using the capture/re-capture method, staff can estimate the total number of each species found in and around the preserve. The appearance of new species, in addition to those found during the initial baseline survey, can indicate the success of the habitat expansion. Additionally, the appearance, or lack of, key species can indicate the overall health of the location.

Procedure:

1. Pass out the materials to the students. Each child should receive 1 bag of plain goldfish crackers (an unknown number of crackers for each child), 1 small cup, and 1 napkin. Explain that the bag represents the lagoon at Robinson Preserve. The student's task will be to study the fish in the lagoon and try to determine how many fish are living within the water.

2. Direct the students to take the cup and scoop out some fish. They have just "captured" their first group of fish. Have them dump the fish out on the napkin, count them, and record their results. These fish should be set aside now (and can be eaten!). They will not be used anymore during this activity. Ask the students to brainstorm ideas as to how they could continue to count fish. Does this initial number represent a good estimation of the total population? Why or why not?

3. Pass out the colored goldfish crackers. Now have the students count out enough colored goldfish crackers to equal the plain crackers previously removed from the bag. These fish are "tagged" because they have already been caught - we'll be able to tell because they're a different color. Place these colored fish back into the bag and shake it up.

4. Students will now take 5 samples of the lagoon. Each time, students should use the cup to scoop out fish. They will record the total number of fish and the number of colored fish collected. Once this data is recorded, they will "throw back" all of the fish.

5. The students will repeat this process 4 more times. If a sample is collected that does not have any colored fish, they will need to repeat it and not count it.

6. Once the students have taken 5 samples, they will tabulate their results. Ask the students to average each column and find the mean, median, mode, and range of each column. They can now create a ratio of the colored sample to the total sample. This ratio will be equal to the ratio of the original colored number to the total number of fish in the lagoon. Students should solve the proportion to find out how many fish were originally in the pond. To double check their answers, students can empty the lagoon and count the total number of fish.

References:

University of Pittsburgh: *Capture Recapture History.* Retrieved May 31, 2007, from http://www.pitt.edu/~yuc2/cr/history.htm

Wikipedia: *Mark and Recapture*. Retrieved May 27, 2007, from http://en.wikipedia.org/wiki/Mark_and_recapture

Marsh Menu

Overview: The salt marsh habitat supports a wide variety of consumers and producers, all of which come together to create a food web. In this lesson, students will learn about this dynamic system as they sharpen their research skills by searching for factoids about the salt marsh's resident wildlife. Once students have gathered their information, they will utilize creative writing techniques to develop a menu describing what each creature might eat from the "marsh's menu."

Objectives: The student will be able to:

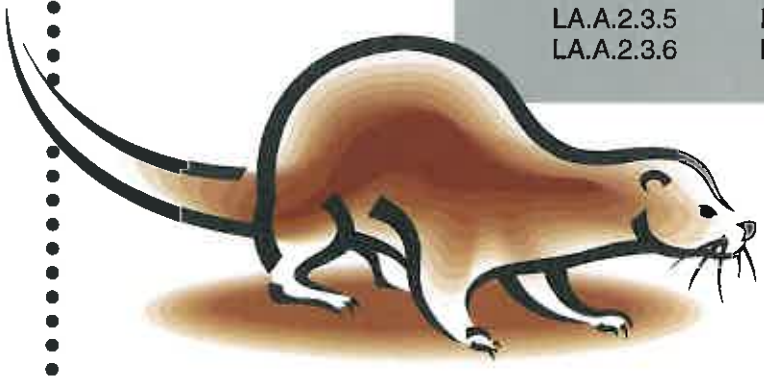
16. Define the concept of a food web and food chain.
17. Describe how creatures play the role of "consumer, producer, or decomposer."
18. Research salt marsh study topics using a wide variety of media including the Internet, periodicals, and reference books.
19. Use their creative writing skills to create descriptive writings that focus upon the specific dietary needs of salt marsh wildlife.
20. Create a "salt marsh menu" for a selected single, or group of, marsh creatures.
21. Identify and explain the difference between carnivores, herbivores, and omnivores in the salt marsh.

Materials:

- Examples of menus
- Markers
- White typing paper
- Crayons
- Construction paper
- Scissors
- Reference books
- Glue
- Tape
- Computers and Internet

FCAT Benchmarks:

LA A.1.3 3	LA B.1.3.1	LA.C.3.3 1	LA.D.2.3.4
LA A.1.3.4	LA B.1.3.2	LA.C.3.3.3	LA.D.2.3.6
LA.A.2.3.5	LA.B 1.3.3		
LA.A.2.3.6	LA.B.2.3.2		



Grade Level: 6th – 8th grade

Duration: 1-2 class periods

Background:

Like any habitat, the salt marsh has a fascinating and clearly defined food web connecting all of its inhabitants. It is, in fact, much like a giant restaurant with a number of different dining options for the creatures that live in and around the marsh. Even though the soil is super salty, a number of plants have developed adaptations to survive and that means that there are an equal number of consumers who have moved into the area to feast upon those green photosynthetic producers. A short listing of examples of each food web category follows:

Producers: Plants and algae that use photosynthesis to convert sunlight into energy in the form of sugar stored within their structures. These creatures produce their own food and do not rely upon other flora or fauna to survive. Examples of producers in the salt marsh include salt marsh cord grass, smooth cord grass, and macro algae.

Consumers: Organisms such as animals, and even humans, that cannot create their own food. In the salt marsh, this would generally be any non-plant organism.

Trophic Level: This term refers to the specific step or level of the food chain. Consumers, producers, and decomposers are all considered to be trophic levels.

Herbivores: Creatures that eat only plant material. They obtain their energy by consuming the producers and the energy that they have stored as sugar. Examples of herbivores in the salt marsh include the marsh rabbit, mullet, and periwinkle marsh snail.

Carnivores: A carnivore is a creature that eats other animals and only other creatures – no plant material for these consumers. Examples of carnivores in the salt marsh include the Bald Eagle, osprey, and the Atlantic salt marsh snake.

Omnivores: Omnivores have the luxury of eating *either* plants or other animals in order to obtain energy. Examples of omnivores in the salt marsh include raccoons, blue crabs, and *you* !

Decomposers: Creatures that eat dead, rotting material are known as decomposers. The dead organic matter can come from either plants or animals. In the salt marsh, decomposers are generally insects, grubs, or crabs.

Procedure:

1. This lesson plan is designed to complement the salt marsh food chain lesson plan. It is suggested that students perform the activities described in the food chain lesson first, either on the same day or prior to beginning the "Marsh Menu" activity.

2. Now that the students have a better understanding of a basic food chain and how the food chain is arranged in the salt marsh, they will use their research skills and creativity to apply what they have learned. Explain to the class that everyone will now create a "salt marsh menu." You can structure the requirements for this activity however you would like to do so, but we recommend that you suggest students produce a minimum of either four pages in their menu *or* a set number of pre-determined entries (such as menu items for two carnivores, two herbivores, two decomposers, etc). They may also wish to create a theme menu such as "Crab Cuisine" or "Fishy Foods." In this case, the menu items would reflect the tastes of a certain grouping of animals instead of a variety of creatures.

Once the students have received their directions, give them access to reference materials including books, periodicals, and the Internet. You can also provide them with the list of salt marsh animals included in this lesson plan. Students should select salt marsh animals to include in their menu and then use the reference materials to research the different creatures' dietary needs. They will utilize the information they collect about their animals' diets to create entrees on their menus.

6. Have the students write their entries on scratch paper before they create the actual menu. Each entry should include the dish's title, a description, and a clue as to its "suggested serving" – a bit of information as to whom the dish is intended. Ask students to write, proofread, and edit their entries just as a real restaurant owner would have to do. If you decide to use this lesson over a multiple-day period, this would be a good stopping point before moving on to creating the actual final project.

7. Pass out the craft materials to the students. Once everyone has completed the written portion of their menu, they will now have to design and build an attractive format to house their delicacies. Challenge the class to get creative! Remind the students that this is their time to really use their artistic abilities – request that they think about the features of the marsh and have them try to come up with something really innovative that reflects the habitat or its creatures and features. Each menu should include a front cover with the title of the student's restaurant, the interior pages of the menu, and a back cover. The students can use their own creativity to make a unique presentation that reflects the salty habitat. Pass out samples of different menus (take-out menus are great for this) to give the students ideas on how to set up their menu.

8. Once the students have finished their menus, invite them to take time to share them with the class. Each student can present his or her "restaurant," and highlight some of their location's special dishes.

References:

Quantified Marketing Design: *Restaurant Menu Design.* Retrieved April 26, 2007, from: http://www.quantifiedmarketing.com/learning_center/restaurant-menu-design.php

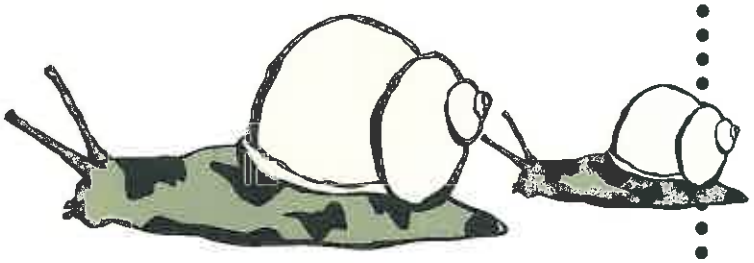
University of West Florida: *Flora and Fauna of Northwest Florida: Saltmarsh.* Retrieved April 26, 2007, from: http://www.uwf.edu/rsnyder/ffnwf/salmars/sltmars.html

Wiki-How: *How to Make a Menu.* Retrieved April 26, 2007, from: http://www.wikihow.com/Make-a-Restaurant-Menu

References:

Sample listing of creatures that live in and around the salt marsh:

Birds	Mammals	Reptiles/Amphibians	Fish	Invertebrates
Wood Stork	Otter	American Alligator	Mullet	Fiddler Crab
Great Blue Heron	Raccoon	Atlantic Salt Marsh Snake	Sheephead Minnow	Blue Crab
Osprey	Marsh Rabbit	Diamondback Terrapin	Longnose Killifish	Marsh Periwinkle Snail
Roseate Spoonbill	Florida Salt Marsh Mouse		Snook	Grass Shrimp
White Ibis			Redfish	Oysters
Bald Eagle			Pipefish	Stone Crab
Clapper Rail			Grouper	Mud Crab
Sandpiper			Snapper	Mangrove Tree Crab
Snowy Egret			Silversides	Midge
Tri-Colored Heron			Anchovy	Pink Shrimp
Marsh Wren			Flounder	Mosquito
Great White Heron			Sailfin Molly	Barnacle

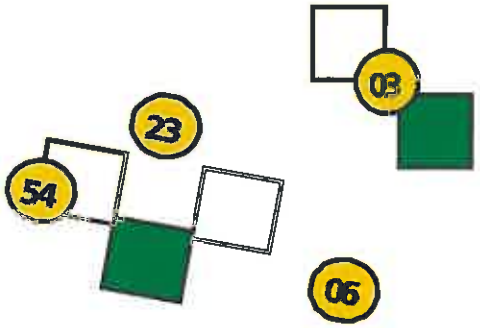


Salt Marsh Bingo

Overview: "Salt Marsh Bingo" is a fun game that challenges students to know their marsh inhabitants. In order to win the game, players must use their knowledge of the marsh and its creatures to properly identify the animals and plants on their Bingo card. This game is a wonderful way to reinforce the other lesson plans included in this curriculum.

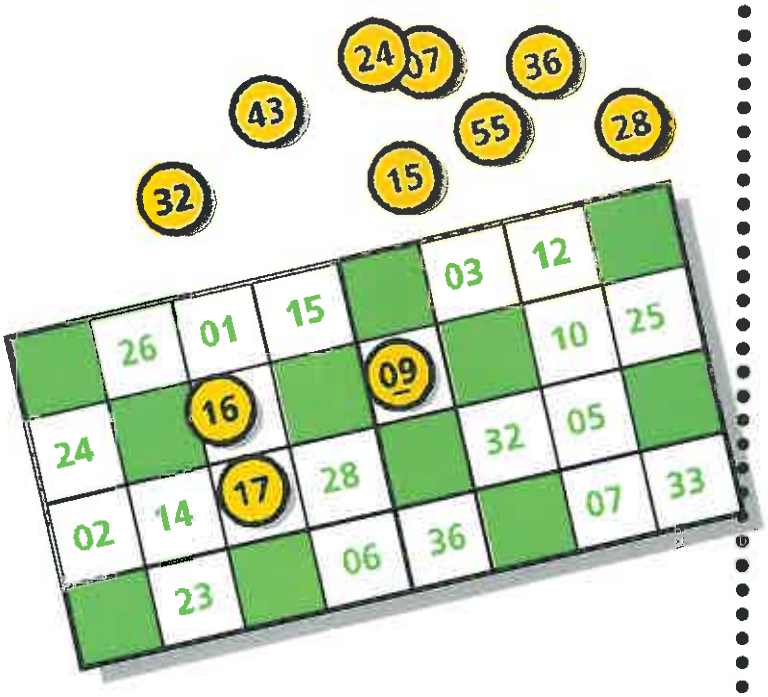
Objectives: The student will be able to:

22. Identify key mammals that inhabit the salt marsh.
23. Identify key reptiles that inhabit the salt marsh.
24. Identify key birds that inhabit the salt marsh.
25. Identify key invertebrates that inhabit the salt marsh.
26. Identify key fish that inhabit the salt marsh.
27. Identify key plants that are part of the salt marsh ecosystem.
28. Discriminate between different types of creatures including birds, fish, reptiles, and mammals.
29. Play the Salt Marsh Bingo Game in order to learn to identify the creatures noted above.



Materials:

- Salt Marsh Bingo cards
- Markers (coins, beans, etc) or pencils
- Species checklist
- Game prizes



FCAT Benchmarks:

LA C.1.3.1 SC.G.1.3.3
SC.G.1.3.4 SC.G.1.3.5

Grade Level: 6th- 8th grade

Time Duration: 1 class period

Background:

The diverse salt marsh habitat is a complex system that relies on a number of creatures to thrive. Nearly every type of animal class and a number of plants are represented on the cards. Vertebrates including mammals, reptiles, amphibians, fish, and birds can all be found, as well as a variety of spineless invertebrates. These creatures depend upon one another in order to survive, and together contribute to the habitat's rich biodiversity.

Salt Marsh Bingo can be played throughout the salt marsh unit, encouraging students to really study the different marsh creatures to better characterize and identify them during the game.

Procedure:

1. Pass out copies of the Salt Marsh Bingo cards and game markers. Each student should receive one card and a handful of markers. (By using place markers, such as coins, beans, or some other small tokens, students can reuse their game cards).

2. Explain the rules of the game:
    - The teacher will call out a plant or animal name. All of these creatures can be found in the salt marsh and they are pictured on the bingo cards.
    - Students will place a marker on the creature that is called if it is on their card.
    - Once a student has 5 markers in a row horizontally, vertically, or diagonally he or she should call out "bingo!"
    - Once bingo has been called, the teacher will check over the answers to be sure that the student has the markers in the correct location.
    - If the markers are correct, the student will receive a prize.

3. Instruct the students to place a marker on the "Free Space" on their cards.

4. Play the game with the students!

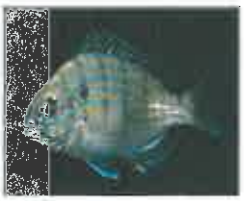
5. The class can play several rounds of the game, and use different variations. For instance, you can describe the animal or plant according to color, type, food source, etc. instead of simply stating the creature's name. Once a student claims "bingo," check their card to be certain they have the correct answers on their card. If they have everything correct, the game ends (unless the class decides to continue playing for second and third place). However, if they do not then the game can continue.

Salt Marsh Bingo Species Checklist

Image	Species Description
	Black Needle Rush Rush, Plant
	Fiddler Crab Invertebrate
	Roseate Spoonbill Bird
	Raccoon Mammal
	Marsh Periwinkle Invertebrate
	American Egret Bird
	Salt Meadow Cordgrass Grass, Plant

Image	Species Description
	Sand Cordgrass Grass, Plant
	Glasswort Plant
	Southern Bald Eagle Bird
	Osprey Bird
	Blue Crab Invertebrate
	Grass Shrimp Invertebrate
	Smooth Cordgrass Grass, Plant

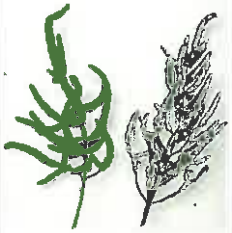
Image	Species Description
	American Alligator Reptile
	Great Blue Heron Bird
	Sea Purslane Plant
	Salt Marsh Water Snake Reptile
	Marsh Rabbit Mammal
	Diamondback Terrapin Reptile
	Saltwort Plant

Image	Species Description
	Juvenille Mullet Fish
	Pink Shrimp Invertebrate
	Pinfish Fish

Salt Marsh Bingo!

				
				
		FREE SPACE		
				
				

Salt Marsh Bingo!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Salt Marsh Bingo!

				
				
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Salt Marsh Bingo!

				
				
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Web of Intrigue

Overview: The salt marsh habitat supports a wide variety of consumers and producers, all of which come together to create a dynamic food web. In this lesson, students will learn about this dynamic system as they sharpen their research skills by searching for factoids about the salt marsh's resident wildlife. Once students have gathered their information, they will utilize creative writing techniques to develop a menu describing what each creature might eat from the "marsh's menu."

Objectives: The student will be able to:

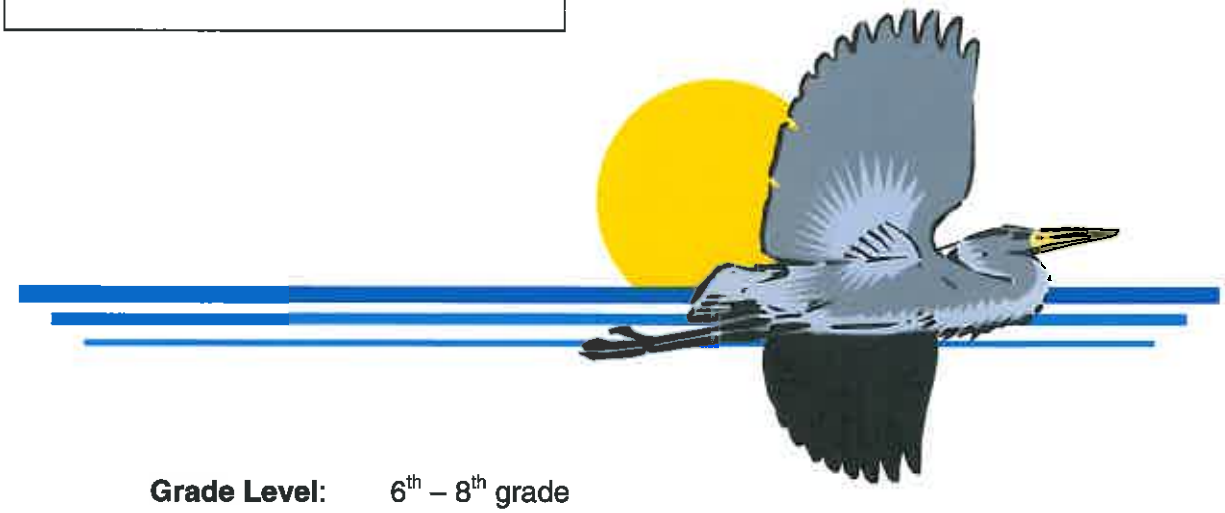
30. Define the concept of a food web and food chain.
31. Describe how creatures play the roles of "consumer, producer, and decomposer."
32. Research salt marsh flora and fauna using a wide variety of media including the Internet, periodicals, and reference books.
33. Take clear notes and organize them in order to do a brief presentation.
34. Make a brief presentation to the class about a plant or animal.
35. Play the salt marsh food chain game to learn about the connections between the plants and animals that live in the marsh.
36. Understand the connections between predator and prey.

Materials:

- Yarn
- Food chain cards
- Scissors
- Reference materials

FCAT Benchmarks:

LA.A.1.3.4	LA.B.1.3.1	LA.C.3.3.3
LA.A.2.3.1	LA.B.1.3.3	SC.B.1.3.3
LA.A.2.3.5	LA.B.2.3.1	SC.B.2.3.1
LA.A.2.3.6	LA.B.2.3.4	SC.D.1.3.4
LA.A.2.3.7	LA.C.1.3.1	SC.G.1.3.4
LA.A.2.3.8	LA.C.1.3.4	SC.G.1.3.5



Grade Level: 6th – 8th grade

Time Duration: 1 class period

Background:

Food webs, and the food chains that comprise them, are found throughout nature. The two are similar in concept but can be distinguished according to their size and complexity. Food chains generally only include one or two producers and consumers. They show a clear relationship between the interconnected "links" in the chain describing how one creature will eat the creature to which it is linked. In a food chain, energy is passed from one link to the next. When an herbivore eats a plant (a producer), it gains energy from the plant. When a predator (carnivore or an omnivore) eats that herbivore it gains energy from that plant-eater. When the predator dies, it is broken down by bacteria and other decomposers which return the energy to the soil and plants utilize it in order to grow. The chain is then continued and the cycle is begun again.

In a food web, the relationships are a bit more complicated. Instead of being linear, as described above in the food chain example, there are many inter-relations between the parts of the web. One carnivore, for instance, might be connected to several different herbivores. One plant producer may be utilized by several different herbivores. Most food chains have several links, but a web can have a number of different creatures in it as it represents the entire community. In a food web, each community of creatures is tied together by one giant food web connecting the flora and fauna to form a larger network.

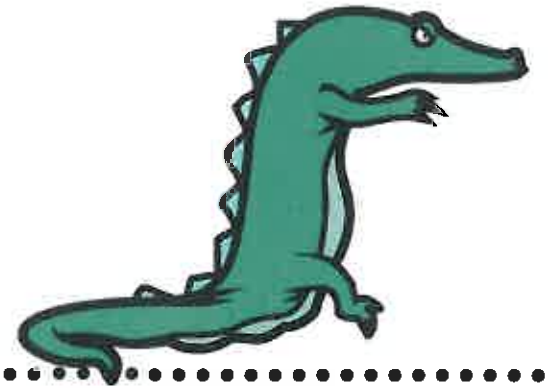
Procedure:

1. This lesson plan is designed to complement the Marsh Menu lesson plan. It is suggested that students perform the activities described in this lesson first, either on the same day or prior to beginning the "Marsh Menu" activity.

2. Explain to the students that each one of these creatures is a component in the salt marsh food web. Discuss the definition of "food web." Ask your students to explain a food chain, and discuss how these two concepts are different. Explain that the group will work together to create a classroom salt marsh food web.

3. Pass out copies of the Salt Marsh Food Web cards (included in this lesson plan). Each student should receive one. If you have a small class, consider assigning two or three food web components to each student. Alternately, if you are working with a particularly large group, the students may work together as a team.

4. Each student (or team) will now take the time to research his or her card. Some students will have carnivores and some will have herbivores. Some will have received producers or consumers and some will have received decomposers. Give the students time to study and research the creatures on their cards. Instruct them to take notes on their creature, reporting its physical description, distinguishing characteristics, role in the food web, role in the salt marsh habitat, and any other interesting qualities.



5. Once students have completed their note taking exercise, ask each participant to share their findings with the class.

6. Now it's time to play the salt marsh food web game! Ask the students to hold up their cards. Connect children using the yarn and discuss the connections as you go. Refer to the example below if needed.
    - Bob is the sun! He gives the planet warmth and light.
    - Susie is cordgrass, a plant that is made to grow in the marsh because it can withstand the harsh conditions. This type of grass grows in the low marsh and loves salt water. Its strong roots help hold the soil together, preventing erosion. The plants need the sun to grow (connect grass to sun – Susie holds one end of yarn and Bob holds the other).
    - Jim is a fiddler crab. During low tide, fiddler crabs run among the cordgrass – they can find food there and hide among the grasses for protection from predators. (Connect fiddler crab to grass.)
    - Brian is a marsh rabbit. He nibbles on some of the marsh plants and makes his home in the high marsh. (Connect mouse to grasses.)
    - Sam is an alligator. What might an alligator eat? Rabbits! (Connect snake to mouse.)
    - Lily is a great blue heron. She loves to eat fish, but will sometimes even eat a fiddler crab, mouse, or even a snake! (Connect heron to all aforementioned except alligator and rabbit.)
    - Continue on with all of the other consumers and producers, creating a complex food web.

7. Once everyone is connected, change the scenario. Remove the sections of the food web as described below and watch what happens!
    - Fishing Industry: Select a student to represent the fishing industry. They take out all/most of the fish, giving herbivores no predation, allowing them to become over populated. This also removes the food source from higher level predators like sharks.
    - Red Tide: Red tide first kills the fish, then the invertebrates, affecting everything within the food web.
    - Runoff: We are including pollution, silt, and freshwater in this category. All three can have effects on the salt marsh plants. Remove these plants from the system and the primary producer is removed from the area.
    - Construction and Development: People love to live near the water – right on the beach. But what is found in the area where the ocean meets the land? Salt marshes! When homes, condos, and businesses are built in this area it destroys the soil and the plants that live there. How does this affect the other creatures in the food web?

8. Once you've completed the game, discuss the results. Review the ideas of consumers, producers, and decomposers. Ask the students to identify each in the game. Discuss predators and prey. Once again, ask students to identify which creatures fit these roles.

References:

Geographyforkids.com: *Another Link in the Food Chain.* Retrieved June 6, 2007, from http://www.geography4kids.com/files/land_foodchain.html

Kimball, Dr. John W: *Online Biology Pages, Food Chains.* Retrieved June 5, 2007, from http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/F/FoodChains.html

SC Life Program: *Salt Marsh Virtual Field Trip.* Retrieved June 5, 2007, from http://www.knowitall.org/sclife/

The "Sense" Sational Salt Marsh: *Salt Marsh Food Web.* Retrieved June 5, 2007, from http://www.promotega.org/nsc30026/foodweb.html

American Alligator

Fiddler Crab

Raccoon

Blue Crab

Marsh Rabbit

Pink Shrimp

Diamondback Terrapin

Grass Shrimp

Roseate Spoonbill

Great Blue Heron

Osprey

Longnose Killifish

Salt Marsh Water Snake

Pinfish

Marsh Periwinkle

Juvenile Mullet

Black Needle Rush

Sea Purslane

Sea Blite

Sand Cordgrass

Glasswort

Saltwort

Smooth Cordgrass

Salt Meadow Cordgrass

Wild About Watercolors

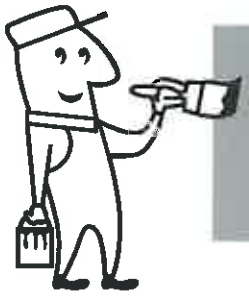
Overview: Participating in the fine arts allows us to sharpen and hone our observational skills as we learn to look closer at the world around us. During this activity, students will have an opportunity to first make observations and then translate their observations into a creative expression. As we are studying the salt marsh, students will experiment with a product of the habitat (salt) to enhance their marsh masterpieces.

Objectives: The student will be able to:

37. Learn and apply a new artistic technique for watercolor painting.
38. Utilize the technique and experiment to create unusual patterns and learn to incorporate textures into artwork.
39. Use observational skills to identify shapes in an outdoor site, take notes about that area, and then refer to those personal reference materials to create a piece of artwork.
40. Draw the observed shapes.
41. Use paint brushes properly.
42. Apply watercolor paint.
43. Create a watercolor landscape using appropriate principles of color theory and design.
44. Understand the usefulness of utilizing a reference journal for a number of different professionals including scientists, artists, reporters, and more.

Materials:

- Watercolor paints
- Watercolor paper
- Table salt
- Sketch paper
- Paper cups
- Water
- Pencils
- Paper or journals
- Watercolor brushes (flats and rounds)



FCAT Benchmarks:

VA.A.1.3.1 VA.B.1.3.2
VA.A.1.3.2 VA.B.1.3.3
VA.A.1.3.4

Grade Level: 6th – 8th grade

Duration: Time at Robinson Preserve and 1 class period

Background:

Scientists and artists have a long history of collaborating in order to record and study natural phenomenon. From the earliest Paleolithic cave paintings to James J. Audubon's beautifully detailed bird paintings, humans have utilized artistic methods to record and identify a variety of flora and fauna. Over the years, illustrations became essential for scientists to document their discoveries so that others might share in their finds. Scientists focused on producing accurate drawings, many of which were created to scale, that depicted an organism's size, shape, color, and other distinguishing features. These drawings complemented and accompanied a researcher's notes, providing greater detail about the creatures they studied.

Artists, too, strive to represent items, but might not always attempt the realism scientific artwork seeks. Often, artwork displays not only the image itself, but also a mood or meaning, a "deeper layer" beyond the image itself. This differs from a scientific representation as the latter is concerned primarily with creating a depiction of the original observed item that is as close to it as possible. An "artistic" approach to rendering may at times be considered more expressive and abstract. The goal of representing an object is still achieved; however the interpretation of the object itself is not necessarily realistic. In this activity, either approach works well when creating a landscape that features the salt marsh. Students may be encouraged to try either one or even both!

Warm-Up Activity:

Both scientists and artists rely upon their powers of observation to depict or describe objects. Consider trying a warm-up activity with your students before entering the field at Robinson Preserve. In this exercise students will practice their observational skills as well as their sketching abilities.

1. Pass out a general and familiar item, such as an apple, pencil, crayon, etc.
2. Ask students to write down any words or phrases they can think of that describe this item. Encourage them to consider shape, size, color, weight, and texture.
3. Now have the students sketch the item. Remind them of the purpose of a "sketch" – it should be a quick, loose drawing that shows a general representation of the object.
4. Once the students have completed their first sketch, ask them to turn the object and look at it from a different angle and create a second sketch. Continue on in this fashion, encouraging students to try to create sketches from several different vantage points.

Procedure:

1. This lesson plan is comprised of two activities. During the first section, students will practice their observational skills at Robinson Preserve. While at the preserve, give your class time to study the actual marsh. Provide students with paper and pencils, or request that they bring their own study journal, and allow them time to make notes.

   Explain to the students that their assignment is to take a "snapshot" of the location without using a camera. How might this be done? Before the invention of computers, cameras, and video recorders, scientists and artists relied upon their own writing and artistic abilities to help record the natural wonders that they saw. Many times, scientists would record their observations for future study and reference. Today, the students will become the observers and rely upon their senses and the notes they take from their observations to help them in future studies just as the scientists of old once did.

2. Ask the students to engage their senses and write down what they see, smell, feel, and hear. What shapes are the plants and/or animals that they see? What types of colors are around? How are the plants structured? What other types of creatures can be seen? What is the water like? Where is the grass growing in relationship to the water? To the land? Ask students to take the time to sketch out the details of the features of the salt marsh habitat, playing close attention to the tiny features that make the area unique.

   Alternate: If you are unable to complete the observational exercise at Robinson Preserve, provide the class with access to reference materials that have images of different salt marshes. Give the students time to study the photographs and make notes on the marshes' different features.

3. The second part of this activity involves using the students' notes to create an artistic interpretation of the salt marsh. Upon returning to the classroom, the students will have the opportunity to work with watercolor paints and use a technique of salt application to make artwork that reflects the marsh and its major saline feature. Pass out white sketch paper and ask the students to sketch out the salt marsh. Remind them to think in terms of using shapes to help them properly draw the different features. Ask the students to practice drawing their landscapes. They may also choose to do a painting that has creatures that inhabit the salt marsh.

4. Next, you will review (or explain) how to paint with watercolors. Begin by reviewing the proper method for watercolor paint application. Remind students that they can apply the paint as straight color (dry on dry), or dab the brush into the water and then into the paint to create a thin wash of color on their paper (wet on dry). They can also wet the paper slightly and dab the brush into the water and the wet paint (wet on wet). Encourage students to experiment when they paint, using different brush sizes, strokes, and pressure applications to get different results. Ask students to look at their notes and think about their observations. What did the grass look like? How might this be represented in their artwork? What shapes could be used to represent what they saw?

5. Demonstrate the salt application technique for the class. First, lay down a wet wash of watercolor paint on the paper. Sprinkle table salt over the wash. As the paint begins to dry, it will collect around the grains of salt, causing a darker color to form in these areas. After the paint has dried completely, gently brush off the salt.

   As you display the technique, ask students to watch as you use the salt to create a variety of patterns in the watercolor paint. Remind the class that they will need to leave the salt on the paint as the underlying color dries in order to create the pattern. Ask the students to brainstorm different methods of incorporating the salt into their artwork. What could this technique be used to represent? (It is often a popular technique used to denote rippled water, soil, sand, and/or a cloudy sky.)

6. Now the students are ready to paint! Pass out the materials to the students. Each class participant will need a paintbrush, several blobs of watercolor paint, and a surface upon which to work. Watercolor paper is recommended, but if it is not available, white copy paper will still give the desired effect. Copy paper will be, however, *very* susceptible to water – if the students apply too much water, the paper might become too wet and disintegrate. The students will also need a minimum of 1-2 tablespoons of salt.

   Students can choose to work with either warm colors or cool colors. Ask the students to choose one series and work accordingly, using the appropriate colors. As students work on their painting, discuss how the choice of warm colors versus cool can change the mood and intention of a piece of artwork. What are they conveying about the salt marsh if they use cool colors? What do warm colors "say"? Ask students to brainstorm other ways colors can influence a painting. Can they imply a certain time of day or year?

Students should refer to their notes and observations to closely replicate the features of the salt marsh. You may also wish to encourage students to attempt to convey a mood, season, or time of day through their use of color in their painting. Consider allowing students to do several paintings: one that is expressionistic and one that is more realistic.

References:

Nita Leland's Exploring Color and Creativity: *Watercolor FAQ*. Retrieved May 1, 2007, from: http://www.nitaleland.com/faq/watercolorfaq.htm

Princeton Online "Artist in Schools" Program: *Watercolor Techniques*. Retrieved May 1, 2007, from: http://www.princetonol.com/groups/iad/Files/water.htm

Vocabulary

Allopathic: method of treating disease with remedies that produce effects different from those caused by the disease itself.

Bane: a person or thing that ruins or spoils.

Benthic: relating to the bottom of a sea or lake or to the organisms that live there.

Biodiversity: the number and variety of organisms found within a specified geographic region; the variability among living organisms on the earth, including the variability within and between species and within and between ecosystems.

Borrow Pit: a pit from which construction material, as sand or gravel, is taken for use as fill at another location.

Carapace: a hard outer covering or shell made of bone or chitin on the back of animals such as turtles, armadillos, lobsters, and crabs.

Carnivore: an animal that feeds chiefly on the flesh of other animals. Carnivores include predators such as lions and alligators, and scavengers such as hyenas and vultures. In a food chain, carnivores are either secondary or tertiary consumers.

Cartilage: A strong, flexible connective tissue that is found in various parts of the body, including the joints, the outer ear, and the larynx. During the embryonic development of most vertebrates, the skeleton forms as cartilage before most of it hardens into bone. In cartilaginous fish, the mature fish retains a skeleton made of cartilage.

Chitin: a tough, semitransparent substance that is the main component of the exoskeletons of arthropods, such as the shells of crustaceans and the outer coverings of insects. Chitin is also found in the cell walls of certain fungi and algae. Chemically, it is a nitrogenous polysaccharide (a carbohydrate).

Consumer: an organism, usually an animal, that feeds on plants or other animals.

Crustacean: having the body covered with a hard shell or crust, including the lobsters, shrimps, crabs, barnacles.

Deciduous: shedding leaves at the end of a growing season and regrowing them at the beginning of the next growing season. Most deciduous plants bear flowers and have woody stems and broad rather than needlelike leaves. Maples, oaks, elms, and aspens are deciduous. Falling off or shed at a particular season or stage of growth, as antlers.

Decomposer: an organism, usually a bacterium or fungus, that breaks down the cells of dead plants and animals into simpler substances, thus making organic nutrients

Exotic: of foreign origin or character; not native; introduced from abroad, but not fully naturalized or acclimatized.

Factoid: a piece of unverified or inaccurate information that is presented factual and that is then accepted as true because of frequent repetition.

Food Chain: the sequence of the transfer of food energy from one organism to another in an ecological community. A food chain begins with a **producer**, usually a green plant or alga that creates its own food through photosynthesis. In the typical predatory food chain, producers are eaten by **primary consumers** (herbivores) which are eaten by **secondary consumers** (carnivores), some of which may in turn be eaten by **tertiary consumers** (the top carnivore in the chain).

Food Web: a complex of interrelated food chains in an ecological community. Also called *food cycle*.

Herbivore: an animal that feeds mainly or only on plants. In a food chain, herbivores are primary consumers.

Indigenous: originating and living or occurring naturally in an area or environment.

Invertebrate: of or pertaining to creatures without a backbone.

Lagoon: a shallow body of water, especially one separated from a sea by sandbars or coral reefs.

Linear: involving measurement in one dimension only; pertaining to length.

Mean: something having a position, quality, or condition midway between extremes.

Median: noting or pertaining to a plane dividing something into two equal parts, esp. one dividing an animal into right and left halves.

Mode: a manner of acting or doing; method; way.

Native: being the place or environment in which a person was born or a thing came into being.

Nuisance: an obnoxious or annoying person, thing, condition, practice, etc.

Omnivores: an animal that feeds on both animal and vegetable substance.

Photosynthesis: use by green plants of the energy in sunlight to carry out chemical reactions, such as the conversion of carbon dioxide into oxygen. Photosynthesis also produces the sugars that feed the plant.

Producer: an organism, as a plant, that is able to produce its own food from inorganic substances.

Proportion: a part considered in relation to the whole; a relationship between things or parts of things with respect to comparative magnitude, quantity, or degree.

Range: the area or sphere in which an activity takes place; An amount or extent of variation.

Substrate: the surface on or in which plants, algae, or certain animals, such as barnacles or clams, live or grow. A substrate may serve as a source of food for an organism or simply provide support.

Trawl: a strong fishing net for dragging along the sea bottom.

Trophic: relating to the feeding habits of different organisms in a food chain or web.

Vertebrate: having a backbone or spinal column.