Florida Adopt-An-Estuary

Curriculum Guide

Silver Sands and New Smyrna Beach Middle Schools (Tonya Long)

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Introduction

Rose Bay (Ken Butler)

Rose Bay (Ken Butler)

Important Roles of the Wetland

Grade Levels: 3 – 12

Sunshine State Standards: 3rd (SC.3.N.1.1, SC.3.N.1.3), 4th (SC.4.N.1.1, SC.4.L.17.4), 5th (SC.G.2.2.3, SC.G.1.2.7), 6th (SC.6.N.1.5, SC.6.N.2.3), 7th (SC.7.L.17.2, SC.7.L.17.3), 8th (SC.8.N.4.1, SC.8.N.4.2), 9th – 12th (SC.912.L.17.2, SC.912.L.17.7, SC.912.L.17.8, SC.912.L.17.13, HE.912.C.1.3)

Focus Question:

- Why are wetlands important to nature and coastal communities?

Objectives: The students will:

- Identify important roles of wetlands in society.
- Identify ways that wetlands are important for nature.

Materials: (one set per group)

- Pacifier
- Sponge
- Cleaning product
- Sieve
- Can or box of food
- Hand mixer
- Toy bird
- Toy boat
- Basket or container

Key Words:

Diversity	Hydric Soils	Phytoplankton
Filtration	Migration	Productivity
Food Web	Natural Disasters	Toxin
Habitat	Nutrients	Zooplankton

Procedures:

1. Divide the class into groups of 4-8 students. Each student in each group should have at least one item from the above list of materials.
2. Have students collaborate as to the relationship of their object to the importance of a wetland.
3. Groups should present their findings to the class. There are many correct answers and this presentation allows students to gain new perspectives from other students on wetland roles.

Examples of possible answers:

- **Pacifier:** Wetlands act as nurseries to many fish and invertebrate species, providing protection that may not be provided by other habitats.

- **Pacifier:** Wetlands act as nurseries to many fish and invertebrate species, providing protection that may not be provided by other habitats.
- **Sponge:** Wetlands soak up excess water during storm surges and floods.
- **Cleaning product**: Wetlands clean runoff water as it makes its way through the wetland.
- **Sieve**: Wetlands filter out sediment during rainfall events.
- **Can or box of food:** Wetlands are home to many species of animals that are important food sources for humans; such as blue crabs and shrimp.
- **Hand mixer:** Wetlands constantly mix aquatic nutrients due to the ebb and flood tides.
- **Toy bird:** Georgia's wetlands are important resting and feeding areas for many migratory bird species.
- **Toy boat:** Wetlands provide areas for human recreation such as boating.
- **Basket or container:** Wetlands are a home to a large diversity of plants and animals.

Conclusions:

- Have the students write a short essay based on the following statement:
  "Wetlands play an important role in my life because_____"

Further Thinking:

Additional Relationships:

- Can your students find additional items that come to mind when discussing wetland roles and wetland importance?

Incorporate Metaphors:

- Instead of the actual items from the material list, simply utilize pictures and have the students pull a picture from a bag or conduct an open class discussion with the pictures.
- Either way, utilize metaphors to find similarities between the pictured items and the wetland.
- The student's statement should be similar to the following statement:
  "The marsh is like a bed (pictured item) because it provides a resting place for migratory birds (similarity)."

Source: Margaret Olsen and Angela Bliss (Coastal Georgia Adopt-a-Wetland Curriculum Guide) based on The Blue Crab in North Carolina found at http://www4.ncsu.edu/~gmparkin/Estuaries.html and Project Aquatic Wild printed by the Council for Environmental Education

Nature Writing

Grade Levels: 3 – 12

Sunshine State Standards: 3rd (SC.3.N.1.1, SC.3.N.1.5), 4th (SC.4.N.1.1), 5th (SC.G.1.2.7), 6th (SC.6.N.3.4, LA.6.2.2.3), 7th (LA.7.2.2.3, SC.7.E.6.6), 8th (LA.8.2.2.3), 9th – 12th (LA.910.2.2.3, LA.910.4.2.2)

Focus Question:

- What might the estuary be like from a different point of view?

Objective: Students will:

- Practice creative writing skills.
- Examine the estuary from different perspectives.

Materials:

- Pencils and paper

Key Words:
Estuary
Nature
Perspective
Point of view

Procedures:

1. Base a creative writing session on the estuary using one or more of the following prompts.
    - Have students imagine themselves to be a living or nonliving thing they have observed, and then write about their experiences from that perspective. What is it like to be a stick, bug, deer, water droplet, minnow, or boulder?
    - Ask students: If the wind - or the moon, the night, the sun, the ocean - were a person, who would it be? A saxophonist? A barber? A ballerina? Have children fill the board with possibilities, and as they begin their pieces, urge them to include imaginative details about clothing, hair, shoes, and so on.
    - Write about something in nature that has a rhythm: ocean waves, wind in trees, croaking frogs, a crackling fire. If it had a sound track what kind of song would it be? What kind of music?
2. Play a poetry game using descriptions of things found in an estuary.
    - Have students pick something in nature and write down 5 things that describe it.
    - Have students pass papers to the right. Be sure not to let students share the estuary item they picked to write about.
    - Have students guess what is being described on the paper they were given. Without confirming whether or not they are correct have each student add 5 more things to the list of descriptions.
    - Have them pass the paper to the right and again have each student (in their head) try to guess what is being described and add five more descriptions.

- Have students guess what is being described on the paper they were given. Without confirming whether or not they are correct have each student add 5 more things to the list of descriptions.
- Have them pass the paper to the right and again have each student (in their head) try to guess what is being described and add five more descriptions.
- Have the students pass the paper to the right for a final time. The students will then take the piece of paper they are given and write a poem using each of the 15 descriptions on the list. This activity can be fun because what was originally being described is not always what the poem ends up being about in the end. Kids think this is funny and enjoy building off each other's work. It also helps motivate kids to be involved because they are working as a team.

Conclusions:

- Have your thoughts about estuaries changed after thinking about them from a different perspective? How?

Further Thinking:

- Have the students trade their writing with a partner and draw an illustration to accompany the work. Use the writing activities and pictures to create a class book about estuaries.

Source: Tonya Long, adapted from "Nature Writing," Volusia County Schools Environmental Service Learning Legacy Project Learn & Serve

Visual Monitoring

New Smyrna Beach High School, Rose Bay (Tonya Long)

Adopt-An-Estuary Visual Survey Pre-Test

Name _____ Date _____

School _____ Teacher _____

1. Why would cloud cover be important to an estuary?
2. What factors can be influenced if it is raining during your survey?
3. What effect do air and water temperature have on estuaries?
4. Why do we need to know the moon phase in addition to the tidal conditions?
5. What is a GPS? Why should you use latitude and longitude for your site location?
6. What do whitecaps look like?
7. How does cloudy water look?
8. How does the depth of water relate to the color of water?
9. Why would the presence of dead organisms be a huge red flag?
10. What does marsh grass look like? What is a grass?
11. What is a substrate? Why would the type of substrate matter?
12. Why would we look at the color of the substrate?
13. How many shells does a snail have?
14. Give one example of a bivalve.
15. How do conchs differ from whelks?
16. How can you tell if a fiddler crab is male? How big are their holes? Why are their holes important to an estuary?

Adopt-An-Estuary Visual Survey Post-Test

Name _____ Date _____

School _____ Teacher _____

1. Why would cloud cover be important to an estuary?
2. What factors can be influenced if it is raining during your survey?
3. What effect do air and water temperature have on estuaries?
4. Why do we need to know the moon phase in addition to the tidal conditions?
5. What is a GPS? Why should you use latitude and longitude for your site location?
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Adopt-An-Estuary Visual Survey Answer Key

Name _____ Date _____

School _____ Teacher _____

1. Why would cloud cover be important to an estuary?
   Cloud cover reduces sunlight, which can affect air and water temperature and reduce productivity.

2. What factors can be influenced if it is raining during your survey?
   Rain can affect the species that are visible as well as the salinity, temperature, pH, and turbidity of the water.

3. What effect do air and water temperature have on estuaries?
   Temperature can affect the amount of dissolved oxygen in the water and the amount of oxygen in the air – cool air and water hold more oxygen than warm air and water. They can also affect plant productivity and the species that are visible during the survey.

4. Why do we need to know the moon phase in addition to the tidal conditions?
   The moon phase will affect how high the tides are. Spring tides occur during new and full moons and cause the highest high tides and lowest low tides. Neap tides occur during first and third quarter moons and cause the lowest high tides and highest low tides.

5. What is a GPS? Why should you use latitude and longitude for your site location?
   GPS stands for global positioning system. A GPS gives latitude and longitude for a location. This should be used for the survey so that it can be done from the same location each time in order to see changes over time.

6. What do whitecaps look like?
   Whitecaps are white and foamy.

7. How does cloudy water look?
   Cloudy water is opaque and difficult to see through.

8. How does the depth of water relate to the color of water?
   Different colors are absorbed at different depths of water. Blue is the last to be absorbed, so deep water appears very blue. In shallow water, some green light is still present making shallower water appear green.

9. Why would the presence of dead organisms be a huge red flag?
   This could indicate that something is wrong in the estuary.

10. What does marsh grass look like? What is a grass?

    Grasses are monocots in the family Gramineae and have jointed stems, sheathing leaves with ligules, and seed-like grains. Marsh grasses tend to be tall and more rounded.

11. What is a substrate? Why would the type of substrate matter?

    A substrate is the underlying layer or the layer that organisms attach to. Knowing the type of substrate gives information on how much water it absorbs, the type of organisms that live in it, the plants that it will support, and what zone of the estuary you are in.

12. Why would we look at the color of the substrate?

    The color can give information about what type of soil it is and its holding capacity (the amount of water it holds). The color can also indicate the amount of organic material in the soil.

13. How many shells does a snail have?

    One

14. Give one example of a bivalve.

    Oysters, clams, mussels, scallops

15. How do conchs differ from whelks?

    True conchs are from the family Strombidae. They are herbivores and have eyeballs. Whelks are carnivores and have eyespots. Many common names are not scientifically accurate – many species that are commonly referred to as conchs are actually whelks.

16. How can you tell if a fiddler crab is male? How big are their holes? Why are their holes important to an estuary?

    Males have one larger claw. They produce relatively small holes that are important to the estuary because they aerate the soil (similar to earthworms in a garden).

Adopt-An-Estuary Visual Survey Skills Assessment

Name _____ Date _____

School _____ Teacher _____

Skill	**Self**	**Partner**	**Teacher**
Gives correct cloud cover			
Measures correct temperature			
Tells correct incoming or outgoing tide			
Measures latitude and longitude correctly			
Gives correct description of water surface			
Can collect water sample properly			
Can describe foam			
Can identify correct water color			
Can identify marsh grass			
Can identify substrate type			
Can tell correct color of soil			
Can identify fiddler crabs			

Be the Pollution Solution

Grade Levels: 3 – 12

Sunshine State Standards: 3rd (SC.3.N.1.4), 4th (SC.4.N.1.2, SC.4.N.1.6, SC.4.L.17.4), 5th (SC.H.3.2.4, SC.H.3.2.1, SC.H.3.2.3), 6th (SC.6.N.1.4), 7th (SC.7.E.6.6), 8th (SC.8.N.4.1, SC.8.N.4.2), 9th – 12th (SC.912.N.4.2, SC.912.L.17.12, SC.912.L.17.14, SC.912.L.17.18)

Focus Questions:

- What are landfill alternatives for trash that litters our communities?
- How does litter affect the wetland habitat?

Objectives: The students will:

- Collect, identify and compile litter data.
- Decide landfill alternatives for collected objects.

Materials:

- Clipboards with data sheets (1 per group and 1 for class compilation)
- Trash bags or grocery sacks (Several per group)
- Pencils (1-2 per group)
- Latex gloves (Enough gloves for all students to have 2 with each group receiving extras in case any of their gloves rip)
- An area nearby in need of clean up

Key Words:

Biodegradable	Environmental Impacts	Restoration
Compost	Non-Biodegradable	Stewardship
Conservation	Non-Point Source Pollution	
Contaminate	Regulations	

Procedures:

1. Discuss safety issues and rules of litter pick up; such as, precautions on broken glass, cautions of nearby roadways, obvious boundaries of clean up, etc.
2. Divide class into groups of 3-5 students.
3. Have students select a RECORDER with all other students being responsible for picking up litter.
4. Pass out materials to groups (clip board, data sheet, gloves, and pencils).
5. Have students collect litter for 30-45 minutes. Make sure the RECORDER keeps track of the trash types and amounts of litter that each group collects.
6. When collection is over, have all groups record data on one data sheet while discussing their findings.
7. Have kids help separate and count trash into the following categories:
    - Recyclable
    - Reusable
    - Compostable

- Landfill

8. Properly dispose of items in trash or recycling bin.
9. Discuss findings:
    - What was the most common trash item each group found?
    - What was the most unusual item in each group?
    - How many pieces of trash were found by the entire class?
10. Have students calculate the percentage of trash items that could be recycled.

Conclusions:

- What were sources of the trash?
- Define biodegradable and non-biodegradable. What did we find that fits each of these categories?
- How can litter hurt us or the animals of the marsh, coast or beach?
- How can we prevent and or reduce litter?
- How can we become better stewards of our waterways and wetlands?

Further Thinking:

Trash Math:

- If each person in your family makes 4 pounds of trash a day, how many pounds of trash does your family make in a week? In a year? Most of this trash is most likely to end up in a landfill. If everyone on Earth produced 4 pounds of trash each day, how much trash is produced in the United States each day? How much is produced globally each day based on 4 pounds per person?

Stewardship Ideas:

- Stewardship means that you are responsible for taking care of the resources around you. Write a brief essay on valuable resources around you and how you can be a better steward of these resources.

Biodegrade Renegade:

- Biodegradable items break down over time if exposed to the proper amounts of light and water. Paper bags are typically biodegradable, except when placed in a landfill where the bags are not exposed to light or water. Should these bags be labeled as biodegradable? What about other items that we commonly see, such as a cotton sock, cigarette butt, glass bottle, Styrofoam cup, and aluminum can. Find the length of time for these items to decompose, complete the following chart based on a saltwater environment and answer the following questions:
    - Do items biodegrade equally in freshwater and saltwater environments?
    - Which will biodegrade first in a saltwater environment: an aluminum can or a cigarette butt?

Decomposition Rates for Common Types of Marine Debris

Paper Towel	Styrofoam	Monofilament Line
Cloth	Steel Can	Glass Bottle
Apple Core	Disposable Diaper	Aluminum Can
Juice Carton	Plastic 6-Pack Ring	Cigarette Butt

Answer Key to Student Decomposition Table

Paper Towel	4 weeks	Styrofoam	10 – 50 years*	Monofilament Line	600 years*
Cloth	1 - 5 months	Steel Can	50 years*	Glass Bottle	Never
Apple Core	2 months*	Disposable Diaper	450 years*	Aluminum Can	200 years
Juice Carton	3 months*	Plastic 6-Pack Ring	400years*	Cigarette Butt	80 years

*Indicates decomposition in saltwater. Freshwater degradation would take longer.
http://www.dgif.state.va.us/fishing/sarep/PDF/resp_litter.pdf

Source: Angela Bliss (Coastal Georgia Adopt-a-Wetland Curriculum Guide)

Being the Pollution Solution Data Sheet

Investigators_____ **Date**_____
Location:_____ **Length of Pick up**_____
Site Description:
Residential Area Business District Park/Green Space Schoolyard
Is water nearby? If so, is it Freshwater or Saltwater?

Directions:
Use gloves and DO NOT pick up sharp or unknown items
Record the numbers and identify the items until your collection time has ended.

PLASTICS:

Bottles	
Lids	
Straws/Wrappers	
Bags	
Other	

METALS:

Bottle tops	
Nails/Screws	
Other	

PAPER:

Food Wrappers	
Cigarette Butts	
Other	

ADDITIONAL ITEMS COLLECTED:

Thank you for being a good steward!

Tide Mobile

Grade Levels: 4, 5, 8 – 12

Sunshine State Standards: 4th (SC.4.E.5.3, SC.E.5.4), 5th (SC.H.1.2.2, SC.H.1.2.5), 8th (SC.8.E.5.6, SC.8.E.5.9), 9th – 12th (SC.912.P.10.20)

Focus Question:

- How do the phases of the moon relate to tidal cycles?

Objective: The students will:

- Understand how tides are affected by the moon phase.
- Model the positions of the Sun, Moon, and Earth during the moon phases that produce spring and neap tides.

Materials:

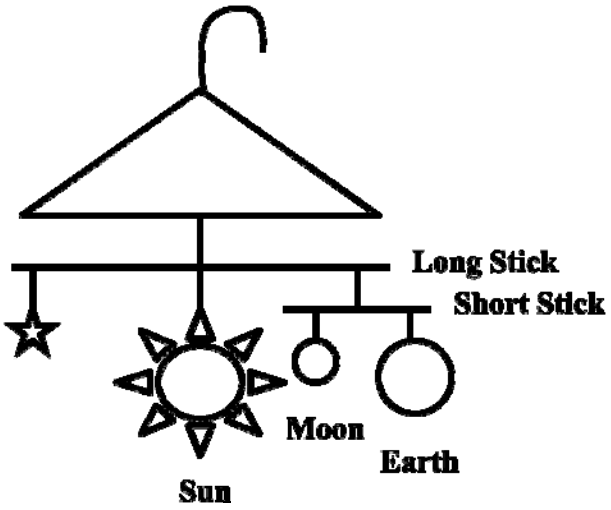
- One coat hanger
- Two sticks, one long and one short
- Construction paper
- String
- Markers or paint
- Tape
- Paper clips

Key Words:

Gravity	Neap tide
High tide	Outgoing
Incoming	Spring tide
Low tide	Tide
Moon phase	

Procedures:

1. On a piece of construction paper draw a star, Sun, Moon, and Earth.
2. Color or paint the Sun yellow, the Moon purple, the Earth blue and green, and the star white.
3. Hook the paper clip on to the star or fasten it with tape.
4. Punch a hole in the top of the star, Sun, Moon, and Earth and tie a short piece of string through each piece.
5. Construct the mobile according to the diagram below.
6. Ask the students to use the mobile to model various phases of the moon. What would the mobile look like during a spring tide? A neap tide?



Conclusion:

- Put students into groups of three and assign one to be the Sun, one to be the Moon, and one to be the Earth. Have the groups arrange themselves into different moon phases and model spring and neap tides.

Further Thinking:

- Go online and look up a moon phase calendar and the tide table for an area close to your school. Have students compare the predicted heights of high and low tide on different days to the moon phase during those times. How are they different? Are these spring tides or neap tides?

Additional Resources:

- Moon phase calendar from the U.S. Naval Observatory: http://www.usno.navy.mil/USNO/astronomical-applications/data-services/phases-moon

- Tide tables from NOAA: http://tidesandcurrents.noaa.gov/tides11/tpred2.html#FL

Source: Tonya Long, adapted from "Tide Mobile," unknown source

Are We There Yet?

Grade Levels: 3 - 12

Sunshine State Standards: 3rd (SC.3.N.1.4, SC.3.N.3.2, SC.3.N.3.3), 4th (SC.4.N.1.2, SC.4.N.1.5), 5th (SC.H.1.2.3, SC.H.3.2.4), 6th (SC.6.N.1.4, SC.6.N.3.4), 7th (SC.7.N.1.5), 8th (SC.8.N.1.5, SC.8.E.5.10), 9th – 12th (SC.912.N.3.5)

Focus Question:

- How can a GPS be used to geocache?

Objective: Students will:

- Learn to work as a team.
- Learn to navigate using a GPS.

Materials:

- GPS units
- Geocache items
- Geocache clues
- Geocache tickets (optional)

Key Words:

Degree	Global Positioning System	North
Direction	Latitude	South
East	Longitude	West
Geocache	Navigate	

Procedures:

1. Before class begins, find a few locations on your school campus and hide geocache prizes Record the latitude and longitude of each one. If you prefer, you can leave a ticket at each spot that the students will turn in to receive the prizes after finding all the locations. At each location also leave the latitude and longitude for the next cache.
2. In class explain to students that geocaching is a game played outside using a GPS where clues are given to find a hidden “cache” or prize. When the cache is found the player takes a prize from the spot and leaves a new prize for the next person to find. These are usually small items like stickers, pencils, or pins.
3. Show students how to read latitude and longitude on the GPS and how to navigate using the GPS.
4. Give students the latitude and longitude of the first geocache location and allow the students to navigate to it. When they find the location they may pick up the cache or ticket and move on to the next location.
5. Students will continue moving from location to location until they reach the last one. If they have picked up tickets, they can turn them in to receive the prizes for each location they found.

Conclusions:

- How accurate was the GPS? Did it take you to the exact location of each cache?
- How might a GPS be used when monitoring an estuary?

Further Thinking:

- Go to www.geocaching.com and enter the zip code for your school. Are there any geocaches near your school? On your campus? If possible, take a trip as a class to find the nearest geocache.
- Geocaching can also be done using written clues based on math, history, science, poetry, or any other subject area. For example:
    - Take 5 + 3 steps north then turn 90° west. Look 10 + 3 inches above the ground to find the prize.
    - Walk 10 steps to the bench by the tree.
      Look down at the prize next to your knee.

  As a class, select a subject area (e.g. math, creative writing, etc.) and write a set of clues for a geocache trail around your school campus using that subject.

Source: Tonya Long

Physical/Chemical Monitoring

Mainland High School, Rose Bay (Ken Butler)

Mainland High School, Rose Bay (Ken Butler)

Adopt-An-Estuary Physical/Chemical Survey Pre-Test

Name _____ Date _____

School _____ Teacher _____

1. Why measure the temperature of both the air and the water?
2. How would pH of 7 differ from a pH of 5?
3. What does the pH tell us about the health of the aquatic system?
4. How does the pH of the sediment change from day to night? Why?
5. What is the most critical factor for determining the health of an aquatic system?
6. How does salinity influence oxygen levels?
7. Why is fertilizer such a terrible pollutant when concentrated in the estuary?
8. What is the average salinity of sea water? What is the range of salinity in an estuary?
9. What is turbidity? What does increasing turbidity do to light penetration in the water?

Adopt-An-Estuary Physical/Chemical Survey Post-Test

Name _____ Date _____

School _____ Teacher _____

1. Why measure the temperature of both the air and the water?
2. How would pH of 7 differ from a pH of 5?
3. What does the pH tell us about the health of the aquatic system?
4. How does the pH of the sediment change from day to night? Why?
5. What is the most critical factor for determining the health of an aquatic system?
6. How does salinity influence oxygen levels?
7. Why is fertilizer such a terrible pollutant when concentrated in the estuary?
8. What is the average salinity of sea water? What is the range of salinity in an estuary?
9. What is turbidity? What does increasing turbidity do to light penetration in the water?

Adopt-An-Estuary Physical/Chemical Survey Answer Key

Name _____ Date _____

School _____ Teacher _____

1. Why measure the temperature of both the air and the water?
   Air and water hold more oxygen when they are cool than when they are warm – a difference in air and water temperature will affect how oxygen moves between the air and the water. If the air is warmer than the water, oxygen will move from the warmer air to the cooler water.

2. How would pH of 7 differ from a pH of 5?
   Each unit of pH is a ten-fold change in the hydrogen concentration – the more hydrogen there is the more acidic the solution is. A solution with a pH of 5 is 100 times more acidic (100 times greater concentration of hydrogen) than one with a pH of 7.

3. What does the pH tell us about the health of the aquatic system?
   The pH can indicate whether the estuary is chemically balanced.

4. How does the pH of the sediment change from day to night? Why?
   During the day photosynthesis by algae increases O_2 in the soil and raises the pH. At night respiration increases the level of CO_2 and lowers the pH.

5. What is the most critical factor for determining the health of an aquatic system?
   Dissolved oxygen is the most critical factor because it is required for respiration in plants and animals and for decomposition of organic matter.

6. How does salinity influence oxygen levels?
   As salinity increases in the water the amount of dissolved oxygen decreases.

7. Why is fertilizer such a terrible pollutant when concentrated in the estuary?
   Fertilizer can trigger algal blooms, which temporarily increase dissolved oxygen due to photosynthesis but then die off. The decomposition depletes dissolved oxygen levels.

8. What is the average salinity of sea water? What is the range of salinity in an estuary?
   The average salinity of sea water is 35 ppt. The range of salinity closer to fresh water is 5 – 18 ppt and closer to the ocean is 18 – 30 ppt.

9. What is turbidity? What does increasing turbidity do to light penetration in the water?
   Turbidity is a measure of water clarity – the higher the turbidity is the cloudier the water is. High turbidity reduces light penetration into the water column, which reduces phytoplankton growth, slowing photosynthesis and decreasing dissolved oxygen.

Adopt-An-Estuary Physical/Chemical Survey Skills Assessment

Name _____ Date _____

School _____ Teacher _____

Skill	**Self**	**Partner**	**Trainer**
Measures correct air and water temperature			
Can collect water sample properly			
Measures correct dissolved oxygen			
Measures correct water pH			
Measures correct water salinity			
Uses proper equipment for each test			
Knows the correct way to dispose of samples			

Homemade Hydrometer

Grade Levels: 6 – 12

Sunshine State Standards: 6th (SC.6.N.1.1), 7th (SC.7.N.1.1), 8th (SC.8.N.1.1, SC.8.P.8.4, SC.8.P.8.8, SC.8.P.8.9), 9th – 12th (SC.912.P.8.6, SC.912.L.17.7, SC.912.L.18.12)

Focus Question:

- How does salinity relate to the density of water?

Objective: Students will:

- Learn to make a hydrometer.
- Measure the density of saltwater and freshwater.
- Learn how density and salinity are related.

Materials:

- Distilled water (1 gal)
- 100 mL graduated cylinder
- Modeling clay
- Permanent marker
- Straw
- Thermometer
- Laboratory balance
- Salt

Key Words:
Density
Hydrometer
Parts per thousand (o/oo)
Salinity
Salt

Procedures:

1. Press a small ball of clay into one end of a straw to form a plug. This straw will become a hydrometer.
2. Add fresh water to a graduated cylinder to the 100 ml line. (Note: in this investigation you will make all your readings on your hydrometer. The graduation lines on the cylinder are not used as data).
3. Put the hydrometer (straw) in the fresh water. Remove or add clay until the hydrometer floats with just the upper (approx. 1”) tip exposed to the air, the rest underwater.
4. Carefully make a small horizontal line to mark the point where the surface of the water meets the straw with a permanent marker and label it “0” because no salt has been added to the water yet.
5. Remove the hydrometer. Add 1 gram of salt to the cylinder water. Dissolve all salt. Replace the hydrometer.

6. Make a line where the straw meets the water line and label it “10” (because 1 g of salt was added to 100 ml of water to make a solution with a salinity of 10 o/oo).
7. Remove the hydrometer. Add 1 more gram of salt to the cylinder water. Dissolve all salt. Replace the hydrometer.
8. Make a line where the straw meets the water line and label it “20” (because a total of 2g of salt were added to 100 ml of water to make a solution with a salinity of 20 o/oo).
9. Remove the hydrometer. Add 1 more gram of salt to the cylinder water. Dissolve all salt. Replace the hydrometer.
10. Again, make a line where the straw meets the water line and label it “30.”
11. For your data observations, write a statement about the scale created on the straw.

Conclusions:

- Ask students to use the hydrometer to test unknown salt solutions that you have prepared. Write down the salinity of each. They will estimate if the water comes between the lines. How accurate are the homemade hydrometers?
- Why does the straw float?

Further Thinking:

- Research the average salinity for the brackish water of an estuary. How much salt would you need to use to make a hydrometer that could measure that salinity?

Source: “Making and Using Your Own Hydrometer,” UCLA Marine Science Center (http://www.msc.ucla.edu/oceanglobe/pdf/densitysalinity/density4.pdf)

Mystery Marsh Water

Grade Levels: 6 – 12

Sunshine State Standards: 6th (SC.6.N.1.1, SC.6.N.1.4, SC.6.N.1.5), 7th (SC.7.N.1.1, SC.7.N.1.4), 8th (SC.8.N.1.1, SC.8.N.1.2, SC.8.N.1.3, SC.8.P.8.4, SC.8.P.8.9), 9th – 12th (SC.912.N.1.1, SC.912.N.1.7, SC.912.P.8.6)

Focus Question:

- How can you identify whether a water sample is estuarine or non estuarine based on density properties?

Objectives: The students will:

- Identify objects based on characteristics such as density.
- Determine salinity of a sample by using the density properties.
- Relate various salinities of wetland, oceanic, and freshwater systems.
- Design an experiment to solve a problem.

Materials:

- 4-5 whole clear straws
- 4-5 clear straws cut into 2-3 inch pieces
- Food coloring
- Pipettes or medical droppers
- Cups
- Salt

Key Words:

Brackish	Hyposaline	Sound
Density	Salinity	Tidal creek
Estuary	Solute	
Hypersaline	Solution	

Procedures:

1. Prepare, in advance, a series of four solutions in half-gallon containers for the students' experiments.
   A. In the first container marked R (for red), place 2 cups of coarse salt and one gallon of water. Add enough red food coloring to make a deep red solution.
   B. In the second container marked G (for green) place 1 and 1/3 cups of coarse salt to one gallon of water. Add green food coloring.
   C. In the third container marked B (for blue) place 2/3 of a cup of the coarse salt to a gallon of water. Add blue food coloring.
   D. In the fourth container marked C (for Clear) add no salt.
2. Divide students into groups or have them work independently.
3. Give students or groups containers of each solution, straws, and pipettes.
4. Read the following scenario and set of rules:

Scenario: A team of scientists collected a series of water samples from a freshwater river, a tidal creek, an estuary and the ocean. The team was interested in studying the salinity or saltiness of the water. On the way back to the laboratory, they ran into a sudden rain storm and the labels came off the samples. You have been assigned the task of figuring out which sample came from which collection site.

Information to help solve the mystery:

1. The only known fact about the samples is that, since they came from different locations, they should have different densities due to the varying amounts of salt present in the original water bodies.
2. Because the water samples are not clean and have not been purified, do not taste them.
3. Food coloring has been added to help you see the different water samples.
4. You are to use the materials provided and design an experiment or experiments to figure out which water sample came from which location. Remember you are a scientific assistant and you must keep accurate notes on the procedures used in your experiments**.**
5. Prior to beginning your investigation, predict which sample you think was collected from each site and record this hypothesis in your notes.
6. When finished, present your findings to the class. Explain which sample came from each location (freshwater river, tidal creek, estuary, or ocean). Also, describe the experimental design you used in your experimentation.

Conclusions:

- Where would you expect to find the densest water?
- Does a changing tide affect the salinity? Explain your answer.

Further Thinking:

- Explain how weather could affect salinity?
- How would the density of the marsh change if a heavy rain occurred?

Source: Margaret Olsen from the North Carolina National Estuarine Research Reserve Activity Guide Series. Reserve Education office Beaufort, North Carolina (www.ncnerr.org)

Sink or Swim

Grade Levels: 3 – 8

Sunshine State Standards: 3rd (SC.3.N.1.1, SC.3.N.1.2, SC.3.N.1.3), 4th (SC.4.N.1.2, SC.4.N.1.5), 5th (SC.H.1.2.2, SC.H.1.2.4, SC.H.3.2.2), 6th (SC.6.N.1.1, SC.6.N.1.4, SC.6.N.1.5), 7th (SC.7.N.1.1, SC.7.N.1.4), 8th (SC.8.N.1.1, SC.8.N.1.2, SC.8.N.1.3, SC.8.P.8.4, SC.8.P.8.9)

Focus Question:

- How do the properties of freshwater and saltwater differ?

Objective: Students will:

- Identify physical properties of matter.
- Compare freshwater to saltwater for their effect on buoyancy.

Materials:

- Two one-inch squares of modeling clay
- Two corks
- Two egg
- Two plastic containers with no lids
- Salt

Key Words:

Buoyancy	Float
Density	Solution

Procedures:

1. Fill one container with tap water and the other with a saltwater solution.
2. Put one cork in the saltwater and one in the tap water and record what happens.
3. Do the same with the eggs and the modeling clay.

Conclusions:

- Allow samples of each type of solution to sit in the classroom for several days until the water has evaporated.
- Determine which sample had the most salt by measuring the salt residue left in the containers.

Further Thinking:

- Create several solutions with various concentrations of salt and repeat the experiment. Record what happens.
- What are some other ways you could determine if a sample of water was freshwater or saltwater?

Source: Tonya Long, adapted from "4th Grade Water Activity," Volusia County Schools Environmental Service Learning Legacy Project Learn & Serve

Secchi Disk on a Budget

Grade Levels: 3 – 12

Sunshine State Standards: 3rd (SC.3.N.1.1, SC.3.N.1.3, SC.3.N.1.6, SC.3.P.10.3, SC.3.P.10.4), 4th (SC.4.N.1.1, SC.4.N.1.2, SC.4.N.1.7, SC.4.P.8.1), 5th (SC.H.1.2.2, SC.H.1.2.4, SC.A.1.2.1, SC.A.1.2.4, SC.G.1.2.7, SC.G.2.2.3), 6th (SC.6.N.1.1, SC.6.N.1.5), 7th (SC.7.N.1.1, SC.7.P.10.2), 8th (SC.8.N.1.1, SC.8.N.1.6, SC.8.P.8.4), 9th -12th (SC.912.N.1.1, SC.912.L.17.7, SC.912.L.17.8, MA.912.S.1.2)

Focus Question:

- How can classroom materials be used to make working scientific tools?

Objective: Students will:

- Learn to make a Secchi disk.
- Learn to measure turbidity.

Materials:

- Small white plastic bucket lids or white plastic plates
- Black spray paint
- Masking tape
- Thin rope (about 3 m in length)
- 4 oz fishing weight
- Sissors

Key Words:
Clarity
Secchi disk
Solution
Light
Turbidity

Procedures:

1. A typical secchi disk is 8” in diameter. Cut down the lid or plate if the size is much larger than this.
2. Place two pieces of masking tape perpendicular to each other across the width of the plate or lid to divide it into four quarters.
3. Use the masking tape to tape off two of the quarters that are diagonally opposite each other. Spray the other two sections black. When the paint is dry, remove the tape. The secchi disk should have alternating black and white quarters.
4. Make a small hole at the center of the disk, just large enough to thread through the rope.
5. Tie one end of the rope to the fishing weight. Thread the rope through the hole in the disk so that the fishing weight is on the bottom (unpainted) side of the disk. Tie a knot in the rope just above the top (painted) side of the disk to prevent it from slipping and separating from the weight in the water.
6. To use your new secchi disk:

- Lower the disk down into the water until the distinction between black and white sections disappears. Mark the rope at that point (at the water's surface).
- Pull the disk up and measure the distance from the mark to the top of the Secchi disk.
- Lower the disk back into the water beyond the first mark, then slowly pull it back up until you can just make out the difference between the black and white sections. Make a new mark on the rope and measure this second distance.
- The Secchi depth is the average of the two numbers. The shorter the Secchi depth is, the more turbid the water is.

Conclusions:

- Why is turbidity and important measurement to take when testing water quality?
- How might an estuary be affected if turbidity suddenly became very high?

Further Thinking:

- If you have access to a real secchi disk, compare the turbidity measurements you get using that disk to the measurements from the homemade secchi disk. Are they similar? Is one easier to use than the other?

Source: Tonya Long, adapted from "Maia's Secchi Disk," Maia McGuire, Florida Sea Grant Extension Agent

Biological Monitoring

Mainland High School, Rose Bay (Ken Butler)

Bicentennial Youth Park (Ken Butler)

Adopt-An-Estuary Bird Survey Pre-Test

Name _____ Date _____

School _____ Teacher _____

1. List three characteristics used to identify a bird.
2. Why do birds sing?
3. What is one role of a bird in its environment?
4. Name two places where birds build nests.
5. Why do birds migrate?
6. What do birds eat?
7. Name one way birds adapt to their environment.
8. Why do birds lay eggs?

Adopt-An-Estuary Bird Survey Post-Test

Name _____ Date _____

School _____ Teacher _____

1. List three characteristics used to identify a bird.
2. Why do birds sing?
3. What is one role of a bird in its environment?
4. Name two places where birds build nests.
5. Why do birds migrate?
6. What do birds eat?
7. Name one way birds adapt to their environment.
8. Why do birds lay eggs?

Adopt-An-Estuary Bird Survey Answer Key

Name _____ Date _____

School _____ Teacher _____

1. List three characteristics used to identify a bird.
   Shape of beak, length of legs, color of feathers, shape of feet, wings, and feathers

2. Why do birds sing?
   Birds sing to communicate, especially as a warning or for mating.

3. What is one role of a bird in its environment?
   They can be consumers, predators, scavengers, and spread seeds.

4. Name two places where birds build nests.
   The ground, platforms, trees

5. Why do birds migrate?
   Birds migrate to find food at feeding grounds, for breeding, and to go to warmer weather.

6. What do birds eat?
   Birds may eat insects, berries, snakes, rodents, worms, fish, plants, and nuts/seeds.

7. Name one way birds adapt to their environment.
   They have adapted by migrating, changing feeding behavior, storing food, and adapting for flight (beaks, feathers, streamlined body, hollow bones, and external reproduction – eggs.)

8. Why do birds lay eggs?
   Birds lay eggs because they would be too heavy to fly if they carried live young.

Adapted from “Feathery Facts”

Adopt-An-Estuary Native/Exotic Plant Survey Pre-Test

Name _____ Date _____

School _____ Teacher _____

1. What constitutes a weed?

2. What is an exotic species?

3. What is a native species?

4. When is a species considered invasive?

5. List two exotic invasive plants in your area.

Adopt-An-Estuary Native/Exotic Plant Survey Post-Test

Name _____ Date _____

School _____ Teacher _____

1. What constitutes a weed?

2. What is an exotic species?

3. What is a native species?

4. When is a species considered invasive?

5. List two exotic invasive plants in your area.

Adopt-An-Estuary Native/Exotic Plant Survey Answer Key

Name _____ Date _____

School _____ Teacher _____

1. What constitutes a weed?
   A weed is any plant that is not where it is supposed to be. It crowds out native or cultivated plants and is considered a nuisance.

2. What is an exotic species?
   An exotic species is any species that is not native to an ecosystem.

3. What is a native species?
   A native species is endemic or indigenous to an area.

4. When is a species considered invasive?
   A species becomes invasive when its presence is detrimental to the native species in the ecosystem.

5. List two exotic invasive plants in your area.
   Answers will vary by location. Some examples are Brazilian pepper, Australian pine, air potato, kudzu, Mexican petunia, etc.

Wetland Sculpture Race

Grade Levels: 3 – 7

Sunshine State Standards: 3rd (SC.3.L.14.1, SC.3.L.15.1, SC.3.L.15.2), 4th (SC.4.L.16.2), 5th (SC.G.1.2.2, SC.G.2.2.2, SC.F.1.2.3), 6th (SC.6.L.15.1), 7th (SC.7.L.15.2, SC.7.L.15.3)

Focus Question:

- What types of animals utilize estuaries in Florida?

Objective: The students will:

- Learn and identify characteristics of a diversity of animals that utilize a Florida estuary.

Materials: (one set per group)

- One container of sculpting material, like playdough
- Animal Pictures (taken from the Estuary Classification Cards)

Key Words:

Adaptations	Characteristics	Food Web	Species	Wetland
Diversity	Food Chain	Invertebrate	Vertebrate	

Procedures:

1. Divide the class into groups of 4 or 5 and give each group a container of playdough.
2. Review the "Rules of the Race" carefully before beginning:
   - Each team will select one team member to be the first sculptor.
   - The teacher will call all the sculptors to the front of the room and show them the same picture from the Estuary Classification Cards.
   - The sculptors return to their team and all start to sculpt at the same time while their groups try to guess what is being sculpted.
   - The sculptor may not say a single word. The other students may ask questions, but the sculptor cannot answer with words. He/she may nod or shake their head. The sculptor continues to mold the organism until someone correctly identifies it.
   - The first team member from any group to say the correct name of the organism being sculpted wins that round of the race.
   - The next round begins with another person from each group being the sculptor.
   - Continue rotating sculptors until your appropriated time is over.
   - The team that wins the most rounds is the winner.

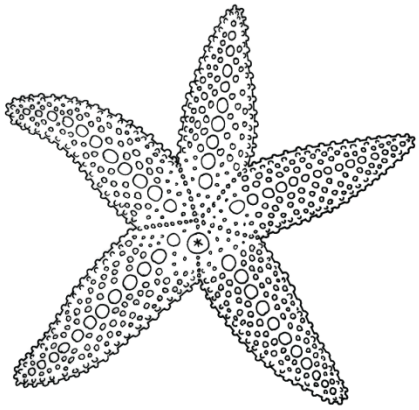
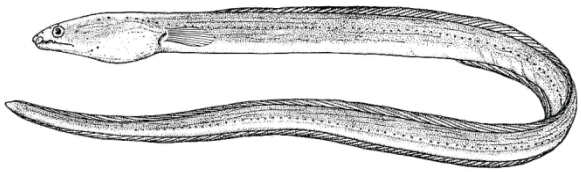
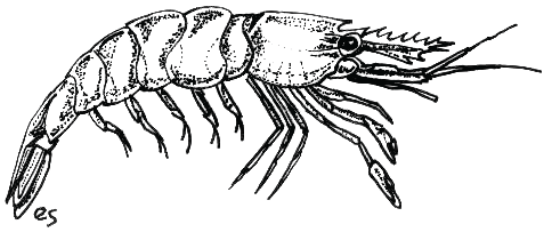
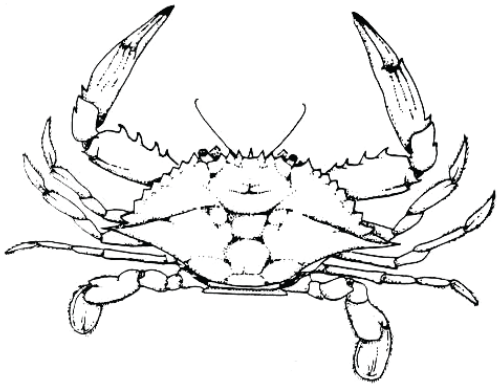
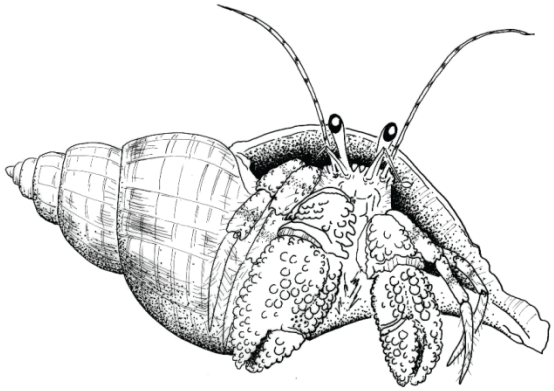
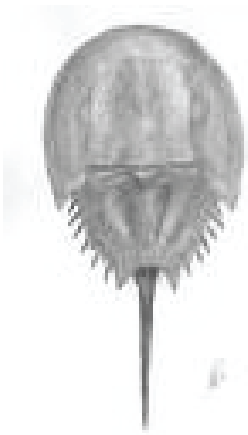
Conclusion:

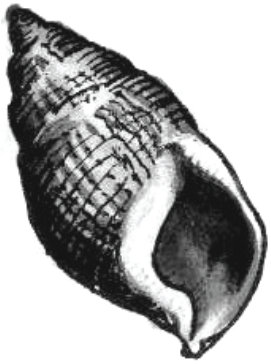
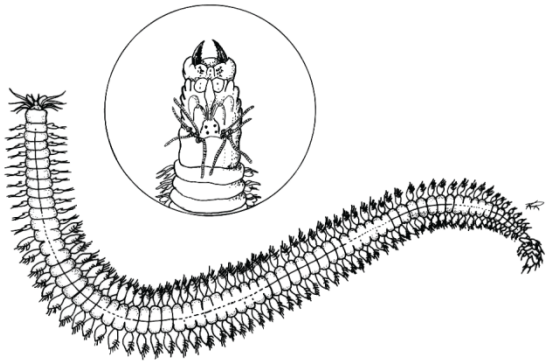
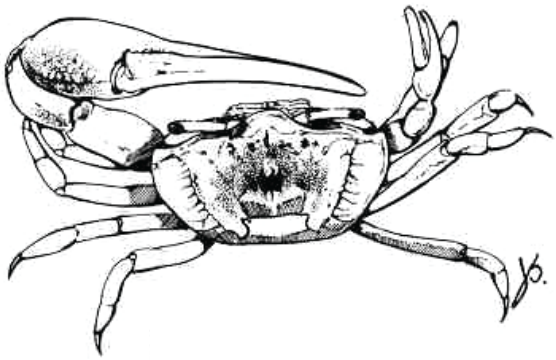
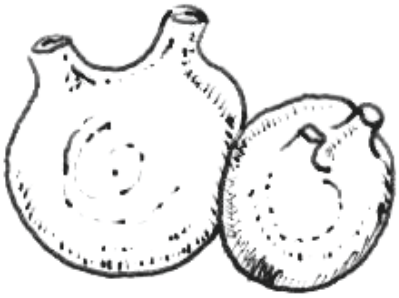
- Have the groups list the organisms that they sculpted during this activity and write a list of adaptations necessary for those organisms to survive in a wetland.

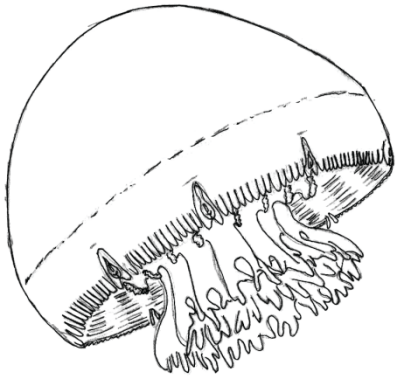
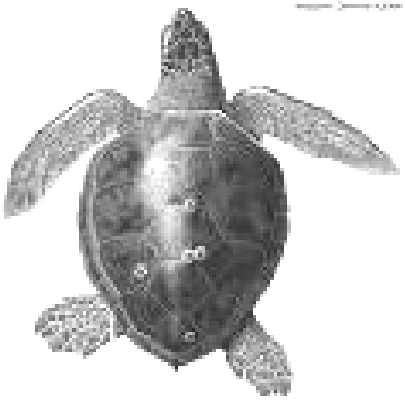
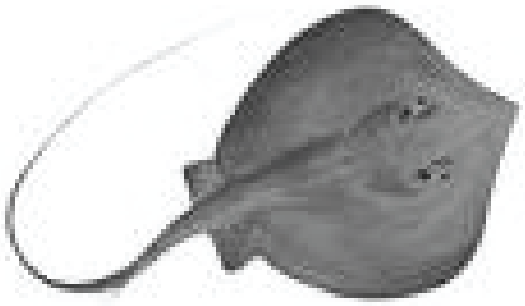
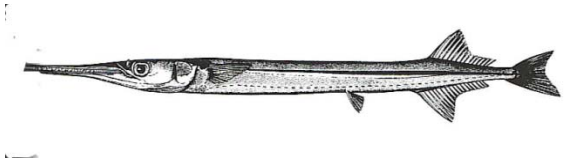
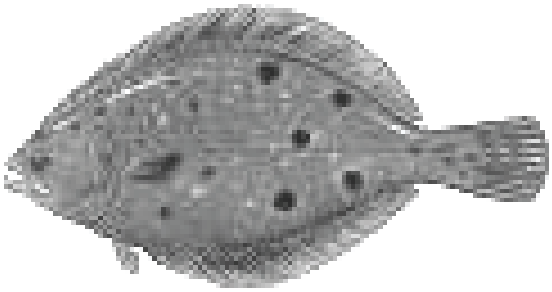
Further thinking:

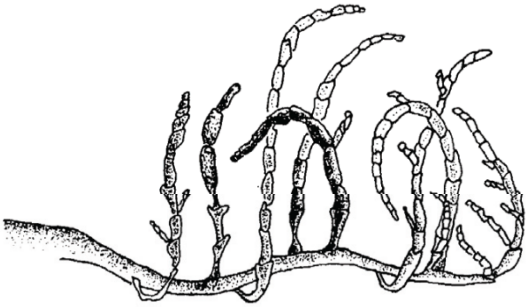
- Have students sculpt animals of a wetland food chain and share with the class.
- Have the class create a wetland food web from all sculptures.

Estuary Classification Cards

Sea Star 	**American Eel** 
Shrimp 	**Blue Crab** 
Hermit Crab 	**Horseshoe Crab** 

Barnacle 	**Mud Snail** 
Eastern Oyster 	**Polychaete Worm** 
Fiddler Crab 	**Tunicate** 

Knobbed Whelk 	**Cannon Ball Jelly** 
Sea Turtle 	**Stingray** 
Needlefish 	**Flounder** 

Spartina 	**Glasswort** 
Manatee 	**Great Blue Heron** 
Brown Pelican 	**Dolphin** 

Source: Margaret Olsen (Coastal Georgia Adopt-A-Wetland Curriculum Guide)

Parking Lot Biodiversity

Grade Levels: 9 – 12

Sunshine State Standards: SC.912.N.1.6, SC.912.L.17.4, SC.912.L.17.5, SC.912.L.17.8, SC.912.L.15.13, SC.912.L.15.14

Focus Question:
- How is the diversity of native species affected by the spread of invasive species?

Objective: The students will:
- Increase understanding of biodiversity.
- Understand how invasive species can affect an ecosystem.

Materials:
- Pencil and paper

Key Words:

Biodiversity	Native
Ecosystem	Non-native
Exotic	Species
Invasive	

Procedures:
- Take students out to the parking lot to record data.
- Assume that SUVs, trucks, and mini vans (SUV/T/M) are the invasive species.

  Part 1
  - Count all of the vehicles in the lot and complete the table below:

TYPE	NUMBER
Car	
SUV/T/M	

What is the % of SUV/T/M to cars?

  - List 2 characteristics that have allowed SUV/T/M to be successful in our "car habitat."

  Part 2
  - Identify 4 "different species" of cars and tabulate the numbers of each listing the identifying characteristics or name of each species.

SPECIES NAME	NUMBER

- Using the data collected above, which "species" is the most dominant? What characteristics contribute to the success of this "species?"

Conclusion:

- Make a bar graph displaying your data from Part 1. Remember to label the axes.

Further Thinking:

- List the ways that invasive species are introduced into an ecosystem.
- What can you do to help control the spread of invasive species?

Source: Center for Precollegiate Education and Training, University of Florida (http://www.cpet.ufl.edu/BestPractices/Diversity%20and%20Evolution%20of%20Living%20Organisms.html)

Build-a- Fish

Grade Levels: 3 – 7

Sunshine State Standards: 3rd (SC.3.N.1.1, SC.3.N.1.2, SC.3.N.1.3, SC.3.L.15.1), 4th (SC.4.L.16.2, SC.4.L.16.3), 5th (SC.G.1.2.2, SC.G.2.2.2, SC.G.2.2.3), 6th (SC.6.L.15.1), 7th (SC.7.L.15.2, SC.7.L.15.3)

Focus Question:

- Why do some fish look different from others?

Objective: Students will:

- Become familiar with parts of fish and their purposes.

Materials:

- Information on fish fins, body shapes, and fin types
- Materials for "building" a fish (choose one of the following):
    - Construction paper, scissors, glue, markers
    - Different colored clay
    - Paints, paper, paint brushes
    - Colored pencils, paper

Key Words:

Body Shape:	compresiform, depressiform, filiform, fusiform
Fins:	anal, caudal, dorsal, pectoral, pelvic
Shapes:	emarginated, forked, lunate, rounded, truncate

Procedures:

1. Review fish anatomy and explain that all fish have the same basic body parts; however those parts may look different. Discuss how the form and shape of a fish and its parts influence function, where it lives, how it eats and how it has adapted to its environment.
2. Have each student create their own fish. Each fish will have at least one eye, a caudal fin, a mouth, and a specific body shape.

Conclusion:

- After creating their fish have students describe where their fish will live, what they will eat, and how they will move (fast/slow) based on body shape, mouth location and fin shape.

Further Thinking:

- Tell students to look online or in a field guide to find a species of fish with the set of traits closest to the fish they created and research that species. Does it move and behave the same way that they described for the fish they created? Why might they be different?

Source: Donna Alvator with Volusia County Schools Environmental Service Learning Legacy Project Learn & Serve

School Yard Food Web

Grade Levels: 4 – 12

Sunshine State Standards: 4th (SC.4.L.17.2, SC.4.L.17.3), 5th (SC.B.1.2.1, SC.B.2.2.1, SC.G.1.2.3, SC.G.1.2.4, SC.G.1.2.5, SC.G.1.2.6, SC.H.1.2.5), 6th (SC.6.L.15.1), 7th (SC.7.L.17.1, SC.7.L.17.2, SC.7.L.17.3), 8th (SC.8.L.18.1, SC.8.L.18.2, SC.8.L.18.3), 9th – 12th (SC.912.L.17.8, SC.912.L.17.9, SC.912.L.17.10)

Focus Question:

Objective: Students will:

- Understand the interdependence of organisms.

Materials:

- Paper and pencil for field recording
- Poster paper
- Writing utensils - colored pencils or markers

Key Words:

Carnivore	Herbivore
Detritivore	Omnivore
Food web	Producer

Procedures:

1. Take students outside and have them record all the living organisms they see.
2. Back in the classroom organize students into groups of 3 or 4.
3. Have one student in each group begin by writing the name of an observed organism anywhere on the poster paper. After the organism name they will write one of these letters:

   P (producer), C (carnivore), H (herbivore), O (omnivore), D (detrivore).
4. Students take turns writing the name of observed organisms. As each student adds an organism to the web they draw an arrow <u>from</u> this organism to anything that eats it and an arrow <u>to</u> this organism from anything it would eat.
5. Continue until the food web gets too messy.

Conclusion:

- Have students select one organism in their food web and discuss what would happen if that organism became extinct.

Further Thinking:

- Students can draw a Graphic Organizer that summarizes the flow of energy from producer to herbivores, omnivores, carnivores, and detrivores.

Source: Donna Alvator with Volusia County Schools Environmental Service Learning Legacy Project Learn & Serve

Tree Top Math

Grade Levels: 4 – 12

Sunshine State Standards: 4th (SC.4.L.16.2), 5th (SC.G.1.2.2, SC.G.1.2.3, SC.G.2.2.2), 6th (SC.6.L.15.1, MA.6.S.6.2), 7th (SC.7.L.15.2, SC.7.L.17.3), 8th (SC.8.L.18.1), 9th – 12th (SC.912.L.14.7, SC.912.L.17.11, MA.912.S.1.2, MA.912.S.3.2)

Focus Question:

- How can the height of a tree be measured without reaching the top?

Objective: Students will:

- Use meter sticks to measure height.
- Learn to use the metric system.

Materials:

- Meter sticks
- Pencils and paper
- Calculator

Key Words:
Equation
Height
Length
Meter

Procedures:

1. Take students outside where there are trees with full shadows visible on the ground.
2. Divide students into pairs and give each pair a meter stick.
3. Have students measure the height of their partners in centimeters and record it. Then stand next to the shadow of a tree and measure the length of the partner's shadow and the length of the tree's shadow.
4. Students should calculate the height of the tree using the following equation:

$$\frac{\text{Height of student}}{\text{Shadow length of student}} = \frac{\text{Height of tree}}{\text{Shadow length of tree}}$$

For example: $\frac{150 \text{ cm}}{300 \text{ cm}} = \frac{X \text{ cm}}{700 \text{ cm}}$

$300X = 150 \times 700$
$X = (150 \times 700)/300$
$X = 350$ centimeters = height of tree
Convert to meters by dividing by 100. 350 / 100 = 3.5 meters

Conclusions:

- Research and identify the type of tree you measured. What kind is it? How does its height compare to other types of trees around your school? Why do you think these different kinds of trees grow to different heights?
- Imagine being the tree you measured. Think about what you would see from the top of the tree. Now tell a story including details about what you see, smell, and hear from the top of the tree.

Further Thinking:

- Use leaves collected from the trees you measured to do a leaf rubbing. Students will use newsprint paper and place various leaves under the paper. They will then rub the side of a crayon over the leaves to make an abstract print.

Source: Tonya Long, adapted from "4th Grade Tree Measuring Activity," Volusia County Schools Environmental Service Learning Legacy Project Learn & Serve