SEA TURTLES IN THE CLASSROOM: AN ACTIVITY GUIDE CORRELATED TO SOUTH CAROLINA STATE EDUCATION STANDARDS

by

Elizabeth J. Claiborne
Abstract

Many different factors have contributed to the decline of sea turtle populations around the world, but almost all of these factors have one attribute in common—they are human-induced. Therefore, the majority of conservation plans for sea turtles include a strategy for public education and outreach. From a sea turtle management and conservation standpoint, there are two main goals of public education: the first is to make people aware that they have an impact on the survival of sea turtles, and the second is to provide people with accurate knowledge about sea turtles. Once these two objectives have been met, people can then make informed decisions concerning their behavior towards sea turtles, evaluate and choose among management options, and participate meaningfully in local and national policy discussions.

The South Carolina Aquarium’s “Sea Turtle Rescue Program” sponsors outreach activities in support of public education. With an aim to expand these activities to embrace formal curricula designed for elementary school children, I developed a sea turtle activity guide designed to implement the state of South Carolina education standards for children ages 9 to 12. The guide provides students with knowledge of sea turtles, as well as the causal factors in population declines, and seeks to cultivate an informed citizen by communicating information to young people concerning the impact various human behaviors have on sea turtle survival. By gaining this knowledge early in life, the hope is that students will make more environmentally informed decisions about their own behavior(s) as they mature.

The activity guide consists of five sections: Introduction to Sea Turtles; Adaptations; Life Cycle; Nesting; and Sea Turtle Rescue and Care. All of the activities were created using a standard lesson plan format. Each activity features a title, focus question, activity synopsis, time frame, key terms, objectives, standards, background, materials, procedures, and assessment. Selected activities were classroom-tested at the aquarium during the summer of 2006.

Hard copies of the activity guide will be distributed to the aquarium, to South Carolina educators, and, in partnership with the Wider Caribbean Sea Turtle Conservation Network (WIDECAST), to Caribbean educators. In addition, an on-line version will be available on both the South Carolina Aquarium’s website and at WIDECAST’s website.
Introduction

Currently, there are seven species of sea turtles swimming in the oceans and nesting on the beaches of this Earth. However, each of them has a status of either endangered or threatened under the US Endangered Species Act (NOAA). Many different factors have contributed to the decline of sea turtle populations around the world, but almost all of these factors have one attribute in common—they are human induced. Therefore, the majority of conservation plans for sea turtles include a strategy for public education in order to both create awareness and share conservation methods. For example, the federal Recovery Plan for the U.S. Population of Loggerhead Turtle explicitly states that “public education is the foundation upon which a long-term conservation program will succeed or fail.” In addition, this statement resonates in all of the leading sea turtle conservation organizations – a part of each of their missions is to educate the public. Since most of the threats that sea turtles face are due to human activities, humans must be involved in the conservation efforts.

From a sea turtle management and conservation standpoint, there are two main goals of public education. The first goal is to make people aware that they have an impact on the survival of sea turtles, and the second goal is to provide people with accurate knowledge about sea turtles. Once these two objectives have been met, people can then make informed decisions concerning their behavior towards sea turtles, evaluate and choose among management options, and participate meaningfully in local and national policy discussions. It is also critical to understand that the conservation of sea turtles must be a global effort; therefore, public education again becomes a vital conservation tool because informational tools can be specifically designed for replication over large geographic scales.
The South Carolina Aquarium’s Sea Turtle Rescue Program recognizes how beneficial education can be to sea turtle conservation. The program has dedicated itself to sea turtle conservation. Initially, the program built a hospital and acquired medical equipment to care for sick and injured sea turtles. Educational programs at the aquarium were also designed and implemented to inform the public about sea turtles and their conservation. The program also wanted to implement outreach programs into schools and other public institutions in the community; however, they did not have the resources to make this possible. Therefore, I was invited by Kelly Thorvalson, the director of the Sea Turtle Rescue Program, to spend a summer at the aquarium and create an activity guide focused on sea turtles. The guide is geared towards fourth and fifth graders and focuses on sea turtle biology, conservation, and policy. All of the activities in the guide are also correlated to South Carolina State Education Standards.

To facilitate the development of the guide, I worked with the Wider Caribbean Sea Turtle Conservation Network (WIDECAST) in addition to the South Carolina Aquarium. Hard copies of the guide will be distributed to teachers in South Carolina and the Wider Caribbean. An on-line version will be placed on both the aquarium’s and WIDECAST’s websites so that any educator with access to the internet may use it.

**Objective**

*Sea Turtle’s in the Classroom: An Activity Guide Correlated to South Carolina State Education Standards* is designed to help the Sea Turtle Rescue Program at the South Carolina Aquarium implement outreach. It will also fill the requirement for public education included in both the federal *Recovery Plan for the U.S. Population of Loggerhead Turtle*, and it will also provide sea turtle conservation organizations with an educational tool. The guide will provide students with knowledge of sea turtles as well as the causal factors in population declines. It will
also cultivate an informed citizen by impairing knowledge to young people concerning the impact various human behaviors have on sea turtle survival. By gaining this knowledge early on in life, the students will grow-up making informed decisions about their behaviors.

**Methods**

The first phase of creating the guide was to brainstorm ideas for activities, including meetings with the education staff at the South Carolina Aquarium, talking with visitors to the South Carolina Aquarium, volunteering with local sea turtle nest monitoring groups, and working at the Aquarium’s sea turtle hospital. Upon the aquarium’s request, the guide was created for students in the fourth and fifth grade. The aquarium felt that this age group would be most impacted by the guide. However, I believe that the activities in the guide can be adapted to age groups outside of the fourth and fifth grade age range. The guide focuses on sea turtle biology, conservation, and policy.

The guide is divided into six sections and there are twenty-eight activities total. Each activity was created using a standard lesson plan format, and has the following sections: title, focus question, activity synopsis, objectives, time frame, key terms, materials, standards, background, procedures, and assessment (SC Department of Education 2006). The focus question is the main question answered by doing the activity, and the activity synopsis is a short summary of the lesson. It tells the educator what the students will be learning and what they will be doing during the activity. Each lesson also includes objectives; these help the educator understand what the students will gain by doing this activity. A time frame is given to help the user estimate how much time is needed to do the activity, and the key terms of the lesson are listed so that the user can identify the words that should be emphasized. The materials list is provided so that the educator knows exactly what he/she will need in order to do the activity.
The background information gives the user the information that is needed to both conduct and evaluate the activity. All of this information was primarily collected through literatures searches. The actual procedure is broken up into three different parts: warm-up, activity, and wrap-up. The warm-up is questions and discussions that get students thinking about the material included in the lesson. The actual activity is written in a step-by-step format. The wrap-up reemphasizes important points that were made in the activity and helps the students to fully grasp the concepts presented in the lesson. The assessment gives the educators a way to evaluate the students in order to determine if they have retained and understood the information. After the activities were created, the subsequent materials such as worksheets, diagrams, maps, etc were developed.

All of the activities in the guide are correlated to South Carolina State Education Standards for fourth and fifth grades. Specifically, the activities are correlated to Science, United States Studies, and Language Arts Standards (SC Department of Education 2006). The aquarium educators suggested correlating the activities to the South Carolina standards because teachers would be much more likely to use it. Having the guide correlated to the education standards would also make schools more willing to invite the rescue program to schools to conduct programs. The standards are created by the South Carolina State Board of Education, and they can be easily accessed from the Department of Education’s website (SC Department of Education 2006).

The guide was formatted using Microsoft Publisher. Although the guide is complete, it still needs to be reviewed and tested by educators to ensure its effectiveness. The compilation will be sent to teachers in both South Carolina and the Wider Caribbean for review. The activities will then be edited based on edits of the teachers, and any activities that do not work will be replaced with a different activity. When final revisions are completed, the guide will be
published as a WIDECAST Technical Report using grant money to cover the cost of production. On-line versions of the activity guide will be available on both the South Carolina Aquarium and WIDECAST websites. Upon the South Carolina Aquarium’s request, I will also develop a workshop for teachers in South Carolina to promote the guide and to demonstrate to teachers how to conduct the activities.

**Conclusion**

*Sea Turtles in the Classroom: an Activity Guide Correlated to South Carolina State Education Standards* will helpful to formal educators because of the array of standards correlated to the activities. It will provide them with activities that can easily be tied into their required areas of study. This guide will also be useful for non-formal educators because of the variety of activities in the guide. The activities can be taught in many different settings. Even though the guide is correlated to South Carolina education standards, it can still be used in other regions of the world. The information it provides about sea turtles and their conservation is not specific to South Carolina – it can be used to create awareness worldwide. Therefore, this guide will provide the Sea Turtle Rescue Program with material to implement a successful outreach program. The international and electronic distribution of the guide will also provide educators outside of South Carolina with an educational tool for sea turtle conservation. I believe that this guide will create awareness for both the sea turtle rescue program and sea turtle conservation as a whole.

**Acknowledgements**

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Literature Cited

NOAA Fisheries Office of Protected Resources – Marine Turtles  
<http://www.nmfs.noaa.gov/pr/about/>

South Carolina Department of Education. 2006. *Curriculum and Standards.*

Sea Turtles in the Classroom

An Activity Guide Correlated to South Carolina State Education Standards

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SECTION 1

AN INTRODUCTION TO SEA TURTLES
VERTEBRATE CHARADES

Focus Question: What are the different groups of vertebrates, and which vertebrate group includes sea turtles?

Activity Synopsis
This activity will help students learn the different groups of vertebrates and the characteristics of the animals that make up those groups. The students will divide into groups and each group will be responsible for learning the characteristics that define the different vertebrate groups. A game of charades will be played where each group of students will have to act out the characteristics that make their vertebrate group unique. When everyone has acted out their vertebrates, then pictures of vertebrates will be shown and the students will have to determine where the animals belong.

Objectives:
Students will:
1. Define a vertebrate, mammal, bird, amphibian, reptile, and fish
2. Identify a vertebrate as a mammal, bird, amphibian, reptile, or fish

Time Frame:
60 minutes

Key Terms:
Amphibian
Bird
Endothermic
Fish
Mammal
Poikilothermic
Reptile
Vertebrate

Standards

Fourth Grade Science Standards:
Standard 4-2 – Organisms and their Environment
4-2.1 Classify organisms into major groups (including plants or animals, flowering or non-flowering plants and vertebrates [fish, amphibians, reptiles, birds, and mammals] or invertebrates) according to their physical characteristics.

Fifth Grade Science Standards
Standard 5-2 – Ecosystems: Terrestrial and Aquatic
5-2.4 Identify the roles of organisms as they interact and depend on one another through food chains and food webs in an ecosystem, considering producers and consumers (herbivores, carnivores, and omnivores), decomposers (microorganisms, termites, worms, and fungi), predators and prey, and parasites and hosts.

Materials:
- Vertebrate charade cards (provided)
- Pictures of vertebrates (not provided)
- Vertebrate Worksheet (provided)
- Vertebrate Match-up Worksheet (provided)
- Colored pencils
- Drawing Paper
- Computers (optional)
**All animals are classified as either vertebrates or invertebrates**

An animal is defined as a vertebrate when it has an internal skeleton made up of bone or cartilage. This skeleton includes a backbone that is compromised of smaller bones called vertebrae. An invertebrate is an animal that does not have an internal bony skeleton and therefore does not have a backbone. Turtles, including sea turtles, are classified as vertebrates.

**All vertebrates are divided into 5 distinct groups**

Vertebrates can be divided into 5 distinct groups based on their body structure, method of reproduction, and whether or not they are warm or cold-blooded. These five groups are as follows: Fish, Amphibians, Reptiles, Mammals, and Birds. A helpful way to remember these five groups is using the phrase “FARM Birds.”

**Fish**

Fish live in water and breathe with gills. These animals have skin that is covered with scales, and they have fins for streamlining and movement. They generally lay soft eggs, but some give live birth. They are also poikilothermic. Examples: freshwater fish (trout, catfish, guppies) and saltwater fish (tuna, salmon, moray eel, sharks, sting rays, skate)

**Amphibians**

Amphibians have gills when they are young and then, as they grow, lungs form. Their skin is moist and scale-less and they have four legs. These vertebrates lay soft eggs and are poikilothermic. Examples: frogs, toads, salamanders, newts

**Reptiles**

Animals in this group mainly live on land; however, some species spend most of their lives in water. Reptiles breathe with lungs and they have scaly skin. With the exception of snakes, these animals have four limbs. They typically lay leathery eggs, but some do give live birth. They are also poikilothermic. Examples: sea turtles, tortoises, snakes, lizards, iguanas, alligators

**Mammals**

Mammals mainly live on the land and they breathe with lungs. Fur or hair covers their bodies. They are endothermic. Almost all mammals give birth to live young. There is one mammal that is an exception to this characteristic – the monotreme. Most of these vertebrates have four limbs (sometimes referred to as arms and legs). Mammals have mammary glands that produce milk, and they use this milk to feed their young. Examples: squirrels, bears, dogs, cats, sheep, horses, humans, dolphins, whales, manatees

**Birds**

Vertebrates in this group live generally live on land and all breathe with lungs. They have feathers that cover their body and most birds can fly made easier because their bones are hollow, meaning birds are very lightweight! These animals have two legs and two wings. They lay hard-shelled eggs and are endothermic. Examples: parrots, flamingoes, penguins, ducks, crows, ostriches, eagles
# VERTEBRATE CHARADES

## Procedure

### Warm Up

1. Ask the students if they know the definition of a vertebrate. Tell the students the most defining characteristic of all vertebrates. Ask the students if they are vertebrates.

2. Explain to the students that, in addition to a backbone (vertebral column), vertebrates have other characteristics in common.

3. Inform the students that there are five different groups of vertebrates. Ask the students if they can name these groups. Make a list of the groups on the board.

4. Explain to the students that animals are categorized into the different groups based on a set of physical features.

## Activity

### Part I

1. Start the activity by dividing the students into five different groups. Assign a vertebrate group to each group of students. The students should **not** know which vertebrate group has been assigned to the other students in the class.

2. Pass out the appropriate Vertebrate Charade Card to each group of students. Tell them to review the characteristics of their group. Give them about 20 minutes to discuss the characteristics with their group. They can ask questions or look up information on the computer. Inform them that they must also think about how they will act out or draw their characteristics for the rest of the class.

3. When the students are prepared, ask the first group to stand in front of the class. Instruct the students in the audience that they can (quietly) shout out the answer as soon as they think they know which vertebrate characteristic is being presented. If the correct answer is shouted out, then pause the game and restate the correct answer so the whole class can hear. If a characteristic is too hard to act out, the group may draw it on the board.

4. Provide a copy of the Vertebrate Worksheet to each student in the class. Instruct them to fill it out as each group is presenting their characteristics.

5. Teacher involvement may be necessary for the groups acting out or drawing their characteristics. For instance, the class may need to know if they are only guessing the first word of many words. If several minutes have passed and the students are not guessing the correct answer, then the teacher may shout out the correct answer.

6. Once the group has acted out their characteristics and the class has accurately guessed all of them, review the characteristics one more time, ensuring that each student has accurately completed his or her vertebrate worksheet.

7. Repeat this process with each group.
### Procedure

#### Part II

1. When the characteristics of each group of vertebrates have been presented, inform the class that they will now have to characterize individual animals into these different groups.

2. Hold up a picture of a vertebrate. Ask the class to describe the animal and pick out any characteristics that would place them in a certain vertebrate group. If the students are having trouble, point out the characteristics for them. It may be helpful to have the vertebrate groups, and the characteristics that go with each group, written on the board.

3. Repeat step 2 until the class has correctly identified at least two animals for each group. For the reptile group, make sure to include a picture of a sea turtle!

### Activity Continued

#### Wrap Up

1. Ask the students to create their own animal. Tell them that the animal must be a vertebrate, and that it **must** have all the characteristics from one of the vertebrate groups.

2. Once the students have drawn their animals, instruct them to give their animal a unique name. In addition, they should indicate what group their animal belongs to, and they should label the parts of their animal that place it in a certain vertebrate group.

3. Display the animal creations around the classroom.

### Assessment

1. Pass out the Vertebrate Match-up Worksheet for the students to complete. This worksheet tests the students to see whether they can place the correct characteristics with each vertebrate group based on these characteristics. It also tests whether the students can place animals into the appropriate vertebrate group.
# Vertebrate Charade Cards

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<tr>
<th><strong>FISH</strong></th>
<th><strong>AMPHIBIANS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Live in the water (freshwater or saltwater)</td>
<td>1. The young live in the water and adults live on land</td>
</tr>
<tr>
<td>2. Breathe with gills</td>
<td>2. The young breathe with gills and the adults breathe lungs</td>
</tr>
<tr>
<td>3. Skin covered with scales</td>
<td>3. Moist skin with no scales</td>
</tr>
<tr>
<td>4. Fins</td>
<td>4. Four legs</td>
</tr>
<tr>
<td>5. Typically lay soft eggs</td>
<td>5. Lay soft eggs</td>
</tr>
<tr>
<td>6. Poikilothermic</td>
<td>6. Poikilothermic</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>MAMMALS</strong></th>
<th><strong>REPTILES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mainly live on land</td>
<td>1. Mainly live on land</td>
</tr>
<tr>
<td>2. Breathe with lungs</td>
<td>2. Breathe with lungs</td>
</tr>
<tr>
<td>3. Fur or hair covers the body</td>
<td>3. Scaly skin</td>
</tr>
<tr>
<td>4. Four legs (or two legs and two arms)</td>
<td>4. Four limbs (or no limbs)</td>
</tr>
<tr>
<td>5. Give birth to live young, except Monotremes</td>
<td>5. Lay eggs with leathery shells</td>
</tr>
<tr>
<td>6. Produce milk</td>
<td>6. Poikilothermic</td>
</tr>
</tbody>
</table>
Vertebrate Charade Cards

**BIRDS**

1. Live on the land
2. Breathe with lungs
3. Body covered with feathers
4. Two legs and two wings
5. Most can fly
6. Lay eggs with hard shells
7. Endothermic
VERTEBRATE WORKSHEET

1. List the characteristics of FISH
   A. __________________________
   B. __________________________
   C. __________________________
   D. __________________________
   E. __________________________
   F. __________________________

2. List the characteristics of AMPHIBIANS
   A. __________________________
   B. __________________________
   C. __________________________
   D. __________________________
   E. __________________________
   F. __________________________

3. List the characteristics of REPTILES
   A. __________________________
   B. __________________________
   C. __________________________
   D. __________________________
   E. __________________________
   F. __________________________
4. List the characteristics of MAMMALS

A._________________________              B._________________________
C._________________________              D._________________________
E._________________________              F._________________________
G._________________________

2. List the characteristics of BIRDS

A._________________________              B._________________________
C._________________________              D._________________________
E._________________________              F._________________________
G._________________________
VERTEBRATE MATCH-UP

A. FISH  B. AMPHIBIANS  C. REPTILES  D. MAMMALS  E. BIRDS

1. Which group has wings? _____

2. What is a bear? _____

3. Which group nourishes its young with milk? _____

4. What is a shark? _____

5. Which group has scaly skin and four legs _____

6. What is a parrot? _____

7. Most animals in this group give birth to live young _____

8. What is a sea turtle? _____

9. Which group has smooth skin with no scales _____

10. What is a frog? _____

11. Which group has hair or fur? _____

12. What is a sting ray? _____

13. Which group has feathers? _____

14. What is a horse? _____

15. Which group has lungs only in adults? _____

16. Which group is streamlined by fins? _____

Extra Credit

17. Which group includes animals with their ribs fused together to form a shield? _____

18. Which group has hollow bones? _____

19. Which group, according to the fossil record, has been on Earth the longest? _____

20. Which group has the most advanced vocalization? _____
HOME SWEET HOME

Focus Question:
Are all turtles adapted to live in the same environment, or do turtles have physical characteristics that allow them to live in different environments?

Activity Synopsis
In this activity, the students will be introduced to three different environments, and to the types of turtles adapted to live in each of these environments. The students will identify these environments, and these turtles, based on descriptions. Through discussion of physical characteristics and adaptations, the students will gain experience relating animals to their preferred environments. A transformation picture will be constructed to help students visualize the different characteristics of marine and terrestrial turtles.

Objectives:
Students will be able to:
1. Identify saltwater, freshwater, and terrestrial Environments
2. Identify the type of environment an animal is best adapted for based on the animal's physical characteristics

Standards
Fourth Grade Science Standards
Standard 4-2 – Organisms and their Environment
4-2.2 Explain how the characteristics of distinct environments (including swamps, rivers and streams, tropical rain forests, deserts, and the polar regions) influence the variety of organisms in each.
4-2.5 Explain how an organism's pattern of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).

Fifth Grade Science Standards
Standard 5-2 – Ecosystems: Terrestrial and Aquatic
5-2.2 Summarize the composition of an ecosystem, considering both biotic factors (including populations at the level of microorganisms and communities) and abiotic factors.
5-2.3 Compare the characteristics of different ecosystems (including estuaries/salt marshes, ocean, lakes and ponds, forests, and grasslands).
5-2.4 Identify the roles of organisms as they interact and depend on one another through food chains and food webs in an ecosystem, considering producers and consumers (herbivores, carnivores, and omnivores), decomposers (microorganisms, termites, worms, and fungi), predators and prey, and parasites and hosts.

Time Frame:
60 minutes

Key Terms:
Adaptation
Environment
Freshwater
Habitat
Saltwater
Terrestrial
Tortoise

Materials:
• Paper rectangles
• Environment pictures (provided)
• Chalk or erasable markers
• Turtle pictures (provided)
• Construction Paper
• Cardboard rectangles
• Notebook paper
Three Different Types of Habitats

Around the world, turtles live in three different types of environments – saltwater, freshwater, and terrestrial. All species of sea turtle live in a saltwater environment, and each species specializes in a particular habitat within this environment. Sea turtles have different geographic ranges depending on the species, with some species ranging as far as Nova Scotia and Alaska and as far south as South Africa and New Zealand. The freshwater environment consists of marshes, lakes, ponds, wetlands, rivers, and streams. A wide variety of turtles occupy these freshwater habitats. Lastly, there is the terrestrial environment (deserts, forests) where tortoises and a smaller number of turtle species live.

The saltwater environment

The saltwater environment is the ocean. The most distinct characteristic of this environment is that it is salty! Sea turtles have adaptations that rid their bodies of excess salt so that they do not become dehydrated. The ocean is the largest environment on Earth, and sea turtles occupy many ocean habitats, including estuaries, coastal waters, and the high seas.

Freshwater Environment

This environment is characterized by habitats that include bodies of freshwater; for example, lakes, ponds, wetlands, rivers, and streams.

Terrestrial Environment

Turtles that live in the terrestrial environment are mainly be found in forest and desert habitats. Many turtles that inhabit the freshwater environment also inhabit this environment.

Three Different Types of Turtles

The different types of turtles in the world correlate with the different types of environments available to them. Therefore, turtles can be grouped into three broad categories: saltwater turtles, freshwater turtles, and terrestrial turtles. Sea turtles live in the ocean, freshwater turtles live in lakes, ponds, and rivers, and tortoises and a few turtle species spend their life lives entirely on land.

Saltwater Turtles

There are seven different species of saltwater turtles. These turtles have a shell that is flatter and more hydrodynamically shaped than freshwater or land turtles/tortoises. Unlike all other turtles, sea turtles cannot pull their head and limbs into their shell. They move very efficiently through the water, using flippers instead of legs, and many undertake long distance migrations.

Freshwater Turtles

Freshwater turtles are the largest group of turtles; there are a wide variety of species occupying this environment. Their shells are more flattened and streamlined that strictly land turtles; however, they are not as hydrodynamic as the shells of sea turtles. Instead of flippers, they have legs with webbed feet. Freshwater turtles can pull their head and limbs into their shell for protection.

Terrestrial Turtles

Tortoises and a few turtles species spend their entire life on land. They generally have very domed shells and can pull their head and limbs into their shell. They have stout legs and feet for walking, but they move rather slowly.
## Warm Up

1. Ask the students to name different environments and habitats within those environments.

2. Ask the students to name some animals that live in these environments (and habitats).

3. Ask the students if animals from one environment could live in another. Could a fish live comfortably in the desert?

4. Explain to the students that animals are adapted to survive in their environment, and that most animals cannot tolerate major changes to their environment.

5. Introduce to the class that this activity is about three different turtles that live in three different environments.

6. Draw a saltwater, freshwater, and terrestrial environment on the board and label these A, B, and C, respectively.

## Activity

### Part I

1. Read a description of each of the three environments (see "Background"). After reading each description, ask the students to correctly identify which environment you described.

2. As each description is read and correctly identified, write the name of this environment above the pictures you have drawn on the board.

3. Post the three turtle pictures (provided) in the front of the class, read the descriptions of saltwater, freshwater, and terrestrial turtles (see "Background"), and ask the students to identify the turtle illustrated in each picture.

4. Discuss the sea turtle’s adaptations and ask the students to guess which environment the sea turtle is most likely to inhabit. Ask the students to consider whether the sea turtle would survive if it were placed in a forest, or a freshwater lake.

### Part II

1. Explain to the students that they are going to make a picture that transforms from one turtle into another turtle.

2. Pass out photocopies of the two turtles (one sea turtle, one tortoise) included in this activity. These photos are marked with vertical cut-lines.

3. Have the students write the name of the turtle and the name of its preferred environment on each picture and then cut one of the pictures into the designed strips along the cut-lines. Set aside.

How are its adaptations uniquely correlated with an ocean lifestyle?

5. Repeat the discussion for freshwater and for terrestrial turtles.
### HOME SWEET HOME

#### Procedure

<table>
<thead>
<tr>
<th>Part II Continued</th>
<th>Wrap Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Provide each student with a piece of construction paper (11 x 14 inches). Ask the students to draw lines on the paper, one-half inch apart, to divide the paper into 28 sections. Label each section, alternating between “A” and “B.” Fold the paper along the lines, creating an accordion.</td>
<td>1. Discuss the differences in the environments featured in this activity, and the differences in the turtles adapted to each of these environments.</td>
</tr>
<tr>
<td>5. Have the students paste the strips cut from the sea turtle photo into each section marked “A” and the strips cut from the tortoise photo into each section marked “B.”</td>
<td>2. Ask the students what would happen if the turtles switched environments. Could a sea turtle live in a forest? Why or why not?</td>
</tr>
<tr>
<td>6. Show the students that moving the picture back and forth makes the picture change!</td>
<td>3. Discuss why turtles are so well-adapted to their particular environments. [Hint: talk about issues related to movement, availability of food, type of reproduction, protection against predators, etc.]</td>
</tr>
</tbody>
</table>

#### Assessment

1. On a blank sheet of paper, have the students write three characteristics that describe each environment featured in this activity. Ask the students to explain (in writing) how these characteristics influence the type of turtle that lives there.

2. Ask the students to name three adaptations for each of the three turtles featured in this activity, and explain how these adaptations help the turtle live in its particular environment.
NAME THAT SEA TURTLE

Focus Question:
How many different types of turtles are there, and what physical characteristics make each type of turtle unique?

Activity Synopsis
In this activity, students will identify the different types (species) of sea turtles by looking at pictures of these animals and answering a series of questions that will lead them to the correct identification. The students will present the sea turtles they have identified to the rest of the class. After researching sea turtles further, the students will make posters designed to inform other students about the different species of sea turtles living in the ocean.

Objectives:
Students will be able to:
1. Compare and contrast characteristics that distinguish different sea turtle species
2. Make an educated guess based on research, observations, and discussion

Time Frame:
60 minutes

Key Terms:
Binomial
Endemic
Flatback
Green turtle
Hawksbill
Kemp’s Ridley
Leatherback
Loggerhead
Olive Ridley
Scutes
Species

Standards

Fourth Grade Science Standards
Standard 4-2 – Organisms and their Environment
4-2.1 Classify organisms into major groups (including plants or animals, flowering or nonflowering plants, and vertebrates [fish, amphibians, reptiles, birds, and mammals] or invertebrates) according to their physical characteristics.

Fifth Grade Science Standards
Standard 5-1 – Scientific Inquiry
5-1.6 Evaluate results of an investigation to formulate a valid conclusion based on evidence and communicate the findings of the evaluation in oral or written form.

Materials:
- Sea Turtle Cards (provided)
- Name That Turtle Worksheet (provided)
- Answer Cards (provided)
- Computers (optional)
- Poster Board
- Notebook Paper
There are Seven Species of Sea Turtle

There are currently seven species of sea turtles swimming in the oceans today. These are the leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), kemp’s ridley (*Lepidochelys kempii*), olive ridley (*Lepidochelys olivacea*), and flatback (*Natator depressus*). Each sea turtle has a common name (ex: leatherback) and a scientific name, or binomial (ex: *Dermochelys coriacea*).

1. **Leatherback** (*Dermochelys coriacea*)
   Leatherbacks have unique physical characteristics when compared to other sea turtle species. They are the largest among all the sea turtles. Males can reach 9 feet and weigh more than 2000 pounds. These sea turtles are also unique from the rest of the sea turtle species because they do not have a hard shell (hence their common name); instead, the carapace (top shell) is made up of tiny bones embedded in a thick layer of dermal tissue composed of cartilage. As adults, leatherbacks lack scutes (the plates that give a turtle shell its color and pattern) and skin scales. These animals are black with pink, white, or bluish spots. Their plastron (belly) is pale. Efficient swimming is enabled by very long foreflippers and streamlining ridges that run the length of their bodies.

2. **Loggerhead** (*Caretta caretta*)
   These turtles average 3 to 4 ft (shell length), and they weigh between 200 to 400 lbs. As the name suggests, they have relatively large heads (associated with powerful jaws to crush prey). Loggerheads have a thick and slightly heart-shaped carapace, usually reddish-brown in color, often encrusted with barnacles and other “free-loaders”. The plastron is colored a creamy yellow.

3. **Green** (*Chelonia mydas*)
   The average size of green sea turtle shells is 3 to 4 ft (shell length) and they can weight between 200 and 500 lbs. The carapace varies in color from olive green or grey to black. These gentle herbivores eat seaweed, seagrasses, and algae, and the chlorophyll pigments tend to give their fat a greenish tinge (hence their common name). Green turtles have a yellowish plastron. These turtles are unique because they have a pair of large scales between their eyes known as prefrontal scales.

4. **Hawksbill** (*Eretmochelys imbricata*)
   Hawksbill sea turtles range from 2 to 3 ft in shell length, and the average weight of these sea turtles is between 100 and 150 lbs. The carapace color is often termed “tortoise shell” meaning that it has a blend of golden and dark brown with red, black, and orange streaks. The color of the plastron is golden, often flecked with black. These turtles have two pairs of prefrontal scales.

5. **Kemp’s Ridley** (*Lepidochelys kempii*)
   The kemp’s ridley is approximately 2 ft in shell length and weighs 75 to 100 lbs. The carapace, olive green or grey in color, is as wide as it is long. A single pore is found in each of the “bridge” scutes that connect the plastron to the carapace. The plastron is yellowish in color.

6. **Olive Ridley** (*Lepidochelys olivacea*)
   Olive ridley sea turtles average 2 feet in shell length and weigh 75 to 100 lbs. As with Kemp’s ridley, the carapace is round in shape and olive green or grey. A single pore is found in each of the “bridge” scutes that connect the plastron to the carapace. The plastron is pale.

7. **Flatback** (*Natator depressus*)
   Flatbacks reach a shell length of approximately 3 feet and weigh about 160 pounds. Compared to other sea turtles, they have a noticeably flattened profile. Their carapace can range in color from grey to pale green, and the plastron color is cream-colored. The species is endemic to Australia, meaning that it lives nowhere else in the world.

**Species are Differentiated Based on Physical Characteristics**

Sea turtles are usually identified by looking at the carapace (shell). Leatherbacks are easily identified because they lack a hard, bony carapace. The sea turtles that do have hard shells are identified by unique shell characteristics of their shells. The first characteristic to look for is the number and pattern of scutes. A scute is a horny external plate that overlays and protects the bony carapace. The costal scutes are the larger scutes positioned on either side of a midline of vertebral scutes. Small marginal scutes are located along the outer edge of the carapace; the marginal scute just behind the head is referred to as the "nuchal scute". The first (forward-most) costal scute touches the nuchal scute in loggerheads and ridleys, but not in the other species. The shape of the carapace can be used to distinguish a species (ex: ridleys are round!), with color and profile providing secondary cues. The scutes of hawksbills overlap one another. Finally, the number of scales between the eyes can be diagnostic.
NAME THAT SEA TURTLE

Procedure

Warm Up

1. Ask the students if they have ever heard the word: species. If so, ask them if they know what the word means. Refer to the glossary for a definition of species.

2. Inform the students that scientists have identified about two million distinct species on Earth, mostly mammals and birds, but it's estimated that the number of undiscovered species — primarily fish, fungi, insects, and microbes — ranges from ten million to more than one hundred million! There are about 285 species of turtle, seven of which are marine!

3. Ask the students if they can name any species of sea turtles, and ask them if they know how to tell different species apart. Has anyone ever seen a turtle up close?

4. Explain to the students how scientists often use special guides called taxonomic keys to help them tell species of animals and plants apart. Inform them that they will become scientists and try to figure out the species of a sea turtle!

Activity

Part I

1. Tell the students that they are going to become sea turtle detectives. Explain to them that you have pictures of seven unidentified species of sea turtle and that it's their responsibility to determine the species name in each case.

2. Show the students the different physical features that are important to identify sea turtles.

3. Divide the students into seven equal groups. Provide each group with a different Mystery Sea Turtle card and a Name That Turtle worksheet.

4. Inform the students that they must look at their picture and answer the questions, and that their answers will lead them to the identity of the sea turtle.

5. Once the students have answered the questions, pass out an answer sheet to each group. If the worksheet has been completed correctly, the Answer Card will reveal the name of the turtle!

6. After each group has identified their sea turtle, ask each group to give a short presentation to the rest of the class about their sea turtle species. For example, each group should give the name and share three characteristics (see "Background") of their sea turtle.

Part II

1. Have the students research more facts about their turtles at home, in the library, or at school.

2. When more facts have been collected, each group will design a poster about their sea turtle species. The poster should include an illustration or photo, "turtle facts," and the common and scientific names of their turtle. Extra Credit: Why is your sea turtle endangered?

3. Hang these posters in the classroom or in the hall to educate other students and teachers about the different species of sea turtles.
NAME THAT SEA TURTLE

Procedure

Wrap Up

1. Ask the students which characteristics are the same (and different) among the sea turtles. Do all of the sea turtles have the same color? Are they all the same size? Do they have different types (shape, color) of shells?

2. Discuss with the students how observing differences in sea turtles helps identify the different species of sea turtles. Inform students that this is a way to identify all animals and plants.

Assessment

1. Give the students a quiz on identifying sea turtles. Consider asking students to match common names with scientific names, associate species with particular physical characteristics, or identify species based on scute patterns.

2. Collect pictures of sea turtles from textbooks, magazines, or the Internet. Hold up pictures of different sea turtles and ask the students to write the species name of each turtle on a sheet of paper. Students should be able to list three physical characteristics of sea turtles that are used to tell them apart.
Name That Sea Turtle Worksheet

1. What color is the sea turtle? ________________

2. Does the sea turtle have scutes? ________________

3. If the turtle does have scutes, count the number of costal scutes. How many are there?
   Hint: These scutes are colored yellow.
   ________________

4. What is the shape of the shell? ________________

5. Count the number of scales between the turtle’s eyes. How many scales are there? ________________
   Hint: These scales are colored green.

6. Look at the sideview of the sea turtle. Is the carapace unusually flat? ________________

    The sea turtle is a ___________________________________________!
Mystery Sea Turtle A

Mystery Sea Turtle B
Mystery Sea Turtle G

Chloe Schauble
<table>
<thead>
<tr>
<th>1. Black or black with white spots</th>
<th>1. Brown or reddish brown</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. No</td>
<td>2. Yes</td>
</tr>
<tr>
<td>3. 0</td>
<td>3. 5</td>
</tr>
<tr>
<td>4. Very long</td>
<td>4. Elongated</td>
</tr>
<tr>
<td>5. 0</td>
<td>5.</td>
</tr>
<tr>
<td>6. No</td>
<td>6. No</td>
</tr>
</tbody>
</table>

It’s a Leatherback!  It’s a Loggerhead!

<table>
<thead>
<tr>
<th>1. Light or dark brown</th>
<th>1. Green or yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Yes</td>
<td>2. Yes</td>
</tr>
<tr>
<td>3. 4</td>
<td>3. 5</td>
</tr>
<tr>
<td>4. Rounded or oval</td>
<td>4. Circle</td>
</tr>
<tr>
<td>5. 2</td>
<td>5.</td>
</tr>
<tr>
<td>6. No</td>
<td>6. No</td>
</tr>
</tbody>
</table>

It’s a Green Turtle!  It’s a Kemp’s Ridley!
<table>
<thead>
<tr>
<th>ANSWER CARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Green or yellow</strong></td>
</tr>
<tr>
<td><strong>2. Yes</strong></td>
</tr>
<tr>
<td><strong>3. 6</strong></td>
</tr>
<tr>
<td><strong>4. Rounded or oval</strong></td>
</tr>
<tr>
<td><strong>5. No</strong></td>
</tr>
<tr>
<td><strong>6. No</strong></td>
</tr>
<tr>
<td><strong>It’s an Olive Ridley!</strong></td>
</tr>
</tbody>
</table>

| **1. Green or gray** | **1. Brown, dark brown, black** |
| **2. Yes** | **2. Yes** |
| **3. 4** | **3. 4** |
| **4. Rounded or oval** | **4. Rounded or oval** |
| **5. Yes** | **5. Yes** |
| **6. Yes** | **6. Yes** |
| **It’s a Flatback!** | **It’s a Hawksbill!** |
**LOGGERHEAD HISTORY**

**Focus Question:**
What is the history of the Loggerhead sea turtle, and how has it been influenced by events in human history?

**Activity Synopsis**
The students will do an information search using both the internet and reference books to collect historical facts about loggerhead sea turtles. In addition, students will research human events in history that may have affected loggerhead sea turtles. A provided worksheet will guide students and help them identify specific information and events. Finally, the students will draw a historical event of their choice and create a timeline that portrays the history of loggerhead sea turtles.

**Objectives:**
Students will be able to:
1. Place historical events in chronological order
2. Understand the Consequences of human exploration and colonization on sea turtles.
3. Discuss how historical knowledge can inform present-day conservation policy

**Standards**

**Fourth Grade United States Studies Standards**

**Standard 4-1** – The student will demonstrate an understanding of the exploration of the New World.

4-1.4 Explain the exchange of plant life, animal life, and disease that resulted from exploration of the New World, including the introduction of wheat, rice, coffee, horses, pigs, cows, and chickens to the Americas; the introduction of corn, potatoes, peanuts, and squash to Europe; and the effects of such diseases as diphtheria, measles, smallpox, and malaria on Native Americans.

**Fifth Grade United States Studies Standards**

**Standard 5-3** The student will demonstrate an understanding of major domestic and foreign developments that contributed to the United States' becoming a world power.

5-3.1 Explain how the Industrial Revolution was furthered by new inventions and technologies, including new methods of mass production and transportation and the invention of the light bulb, the telegraph, and the telephone.

**Standard 5-6** The student will demonstrate an understanding of developments in the United States since the fall of the Soviet Union and its satellites in 1992

5-6.2 Explain how humans change the physical environment of regions and the consequences of such changes, including use of natural resources and the expansion of transportation systems.

**Time Frame:**
60 minutes

**Key Terms:**
Civilization
Poaching

**Materials:**
- Computers (optional)
- Books about sea turtles
- Loggerhead History Hunt Worksheet (provided)
- 12 x 12 inch cardboard squares
Sea Turtles Appear

According to the fossil record, the first appearance of sea turtles was about 35 million years ago during the Cretaceous period. During the Cretaceous period. At that time there were four taxonomic “families” of sea turtles, but only two of those families are present today – Cheloniidae and Dermochelyidae. All of the modern-day hard shelled sea turtles belong to the Cheloniidae family. These sea turtles have survived while many other ancient sea turtle species have gone extinct from natural causes.

Humans Enter the Scene

Scientists estimate that past populations of loggerhead sea turtles may have totaled tens of millions. With an abundance of turtles such as this, it is no wonder why many ancient civilizations incorporated sea turtles into their diet and culture. Early civilizations clearly used sea turtles as a food source...and as the number of people increased, we can imagine that more and more sea turtles were hunted. About 4,000 years ago people started developing a trade system that involved sea turtles. Demand rose and sea turtle products were shipped inland. A thousand years later, we have evidence that sea turtles had become cultural symbols. Some cultures honored sea turtles as gods! Native Americans, especially those along the Atlantic seaboard (where loggerheads were most abundant), played a role in the loggerhead’s history. Native Americans used sea turtles for food, crafts, utilitarian items, and ornamental pieces. Caribbean cultures also utilized sea turtles in their diet, trade, and culture. Some civilizations, especially the Maya in Central America, viewed sea turtles as symbols of reproductive success because offshore mating rituals were easily observed and people saw the females laying large quantities of eggs.

Sea Turtles in the New World

The explorations of Christopher Columbus and other Europeans certainly contributed to the decline of once abundant sea turtle populations. Sea turtles provided seafarers with an abundant source of fresh meat, and are credited with enabling many expeditions. Archie Carr once observed that, “all early activity in the New World – exploration, colonization, buccaneering, and even the maneuverings of naval squadrons – was in some way or degree dependent on turtle.” As early as the 1800s, populations of sea turtles were already being decimated because of large number of colonizing and exploratory expeditions, international trade in sea turtle products, and expanded markets. Monetary value was being placed on sea turtles, and this caused them to be hunted for profit as well as food and cultural items. Eggs were also involved in this commerce. The invention of modern transportation (outboard motors, steamships, aircraft) further increased the demand for sea turtle meat and eggs and enabled hunters to travel further afield to harvest the turtles. With the advent (post-World War II) of mass tourism in the Caribbean Region, “exotic” dishes, including sea turtle meat and eggs were hugely popular as restaurant delicacies. In the southeastern U.S., sea turtle eggs were in large demand by commercial bakeries.

Present Day

The concept of protecting sea turtles was not prominent until the 1970s, and sea turtles were heavily harvested until that time. Although the direct take of loggerheads has largely stopped in the U.S. the species faces other threats caused by humans. The biggest pressures are coastal development and commercial fishing. Shrimp trawls, gill nets, and longlines unintentionally capture loggerheads and other sea turtles. Often, this capture results in death or severe trauma. Modifications to these fishing methods have been made and fishing limitations and restrictions have been set; however, fishing continues to pose a serious threat. Loggerheads are also affected by pollution. Oil spills, toxins, and other pollutants mix into the water and can cause sea turtles to become sick. In addition, extraordinary amounts of trash and debris can be found in the ocean. Loggerheads mistakenly eat this debris and this can cause intestinal blockage, organ damage, or poisoning. Finally, loggerheads are losing their nesting beaches to coastal development. Although sea turtle conservation is in the spotlight more now than it has been in the past, there are still many obstacles and challenges that scientists and conservationists must face in order to save sea turtles from extinction.
**Loggerhead History**

**Procedure**

**Warm Up**

1. Ask the students if they know the State Reptile of South Carolina. Inform them that it is the Loggerhead sea turtle, *Caretta caretta*.

2. Ask the students if they know any history about the loggerhead sea turtle. Do they know when loggerheads first appeared in literature? Do they know why people hunted the turtle, and how the turtle was used?

3. Discuss with the students why historical information is important to modern-day conservation measures. Can knowing the past help scientists better understand why loggerheads are endangered?

**Activity**

**Part I**

1. Have the students look up information on the internet about the history of loggerhead sea turtles. A list of books is provided to get the students started. Books in the classroom for researching information should also be available.

2. Pass out photocopies of the Loggerhead History Hunt worksheet to the students in order to guide them in their research into how human history has caused changes in the history of sea turtles.

**Part II**

1. Once the students have gathered information about the history of loggerheads, provide each student with a 12 x 12 inch piece of cardboard.

2. Have each student select an event from the history of loggerheads. The students should draw this event on the cardboard. Have them include a title as well as the date of the event.

3. When all the students have completed drawings ask them to create a timeline by placing the pieces of cardboard (in date order) around the classroom.
1D

**Loggerhead History**

**Procedure**

**Wrap Up**

1. Discuss with the students the major events in loggerhead history. Did students come across some events more than others?

2. How did human history affect the history of loggerheads? Ask the students if they think that human activities are still affecting loggerheads, and in what ways.

3. Discuss with the students why it is important to know the history of loggerhead sea turtles.

4. Ask the students to name other animals that have been affected by human activities. Have these animals been mainly helped or harmed by human activities, and why?

**Assessment**

1. Ask the students to create a timeline of the history of loggerheads.

2. Ask the students to place seven events in chronological order. The students should use illustrations and words to describe these events.

3. Ask the students to name a modern-day threat to sea turtle survival, and what might be done to reduce this threat.

**Suggested Books and Websites**

1. *Sea Turtles: A Complete Guide to their Biology, Behavior, and Conservation*  
   By: James R. Spotilla

2. *Sea Turtles: An Ecological Guide*  
   By: David Gulko and Karen Eckert

3. Federal Recovery Plans  
   <www.nmfs.noaa.gov/pr/recovery/plans.htm#turtles>
Loggerhead History Hunt

1. How many years ago did loggerhead sea turtles appear in the fossil record?
   ________________________________

2. What taxonomic family of sea turtles includes loggerheads?
   ________________________________

3. Did ancient civilizations hunt loggerheads and other sea turtles?
   ________________________________

4. How can scientists tell if a civilization hunted/used sea turtles?
   ________________________________

5. Name a civilization that hunted sea turtles.
   ________________________________

6. Loggerheads were used for many things, name two.
   ________________________________

7. Did Native Americans hunt loggerheads?
   ________________________________

8. How did Columbus and other explorers use sea turtles?
   ________________________________

9. What does poaching mean? Do people still poach sea turtles or eggs?
   ________________________________

10. Name two things that are currently threatening sea turtle survival.
    ________________________________
## SEA TURTLE PEN PALS

**Focus Question:**
What do other students around the world know about sea turtles, and how do they view them?

### Activity Synopsis

In this activity, the students will write letters to students in other countries to share their information about sea turtles and to learn more about sea turtles. The students will establish an on-going pen pal relationship and learn more information about sea turtles.

### Objectives:
- Students will be able to:
  1. Write letters of correspondence
  2. Understand that people have different views of sea turtles
  3. Locate different countries on a map

### Time Frame:
60 minutes

### Key Terms:
Pen Pal

### Materials:
- Notebook paper
- Pen or pencils
- Envelopes
- Stamps
- International addresses

### Standards

**Fourth Grade Language Arts Standards**

1. **Standard 4-W1**—The student will apply a process approach to writing.
   - 4-W1.5 Demonstrate the ability to edit for language conventions such as spelling, capitalization, punctuation, agreement, sentence structure (syntax), and word usage.
   - 4-W1.6.1 Demonstrate the ability to write multiple-paragraph compositions, friendly letters, and expressive and informational pieces.

2. **Standard 4-W2**—The student will write for a variety of purposes.
   - 4-W2.1 Demonstrate the ability to use writing to explain and inform.

**Fifth Grade Language Arts Standards**

1. **Standard 5-W1**—The student will apply a process approach to writing.
   - 5-W1.5 Demonstrate the ability to edit for language conventions such as spelling, capitalization, punctuation, agreement, sentence structure (syntax), and word usage.
   - 5-W1.6.1 Demonstrate the ability to write multiple-paragraph compositions, friendly letters, and expressive and informational pieces.

2. **Standard 5-W2**—The student will write for a variety of purposes.
Background

♦ **Sea Turtles in the United States**

In the U.S., sea turtles are viewed as a species that needs to be protected. Sea turtles have been protected under the Endangered Species Act since the 1970s. This makes it illegal to harass or kill a sea turtle in United States waters. The United States believes that sea turtles are a valuable resource to the marine environment; therefore, the country believes it is necessary to try to save sea turtles from going extinct. However, these views were not always held by this country. Native Americans living in North America hunted the animals for food and used their shells to make objects such as pins and combs.

♦ **Cultural Views of the Past**

In the past, many different countries incorporated sea turtles into their cultures. Some cultures hunted sea turtles for meat, while others developed beliefs that consuming certain parts of sea turtles give humans special powers. Sea turtle bones have been found among the remains of some of the earliest civilizations on Earth indicating that sea turtles were most likely a major food source for those people. In some cultures, sea turtle shells were found buried with individuals in graves. In some civilizations, sea turtles were worshiped as gods and symbols of turtles have been found in various temples and palaces.

♦ **Present Cultural Views**

The popularity of sea turtles and their significance to many cultures and civilizations around the world is a major factor in the decline of sea turtles. There are still cultures that do not believe in protecting sea turtles and continue to hunt them for food or other cultural purposes. However, some countries that once hunted sea turtles in great abundance are now beginning to take a more conservation-minded approach to sea turtles. Ecotourism programs have been a valuable conservation tool in some areas. This option allows countries to still receive profits from sea turtles without killing or harming them.
**Procedure**

**Warm Up**

1. Inform the students that they will be communicating with students from other countries about sea turtles.

2. Brainstorm with the students what they would like to include in their letters. Also, have the students think about questions that they would like to ask.

3. Have the students do a little research about sea turtles in the country where they will be sending their letters.

**Activity**

1. Find a school or organization that is willing to participate in this pen pal activity with your class. This can be arranged on the WIDECAST website <www.widecast.org>.

2. Once you’ve acquired addresses, give the students background information on the country or countries.

3. If possible, try to give each student a different pen pal. If not, then multiple students can have the same pen pal.

4. Have the students write a letter to their pen pals. They should include some facts that they’ve learned about sea turtles and they should ask their pen pals some questions about sea turtles. Make sure that the students ask how sea turtles were represented in the history of the country, and have the students ask if these views have changed.

5. Inform the students that they can draw or include pictures of the sea turtles they’ve been learning about.

6. When the students have composed their letters have them trade letters with another person in class. The students should go through and edit the letters for spelling, capitalization, punctuation, sentence structure, and word usage.

7. The students should give the letter to its owner when they are finished editing. After receiving the edits, the students should write a final copy of their own letter.

8. When all of the letters are finished pass out envelopes and have the students address them.

9. Collect the letters and envelopes from the students. Make sure the letters are appropriate and then seal them and put postage on them.
SEA TURTLE PEN PALS

Procedure

Wrap Up

1. Have the students discuss what they wrote in their letters.

2. When letters from the pen pals come to the students have them share information about their pen pals to the rest of the class.

3. Also, have the students talk about the sea turtle information that they learned from their letters.

Assessment

1. The letters that the students can be graded for grammar and spelling. In addition, they can also be graded for including the appropriate information.
Focus Question:
What is the cultural view of sea turtles in the United States, and do these views differ among countries?

Activity Synopsis
In this activity, students will be exposed to different cultural myths about sea turtles. The students will read a myth and share it with the rest of the class. Then, the students will be asked to create their own myth about sea turtles. The students will realize that these myths help explain why people value sea turtles in many different ways.

Objectives:
Students will be able to:
1. Read and summarize descriptive texts.
2. Respond to texts in a variety of methods
3. Write expressive and informal pieces of literature

Time Frame:
60 minutes

Key Terms:
Myth
Culture

Materials:
- Sea turtle myths (provided)
- Notebook paper
- Blank pieces of paper
- Colored pencils or crayons
- Pencils

Standards

Fourth Grade Language Arts Standards
Standard 4-R1 – The student will integrate various cues and strategies to comprehend what he or she reads.
  4-R1.4 Demonstrate the ability to summarize texts.
  4-R1.16 Demonstrate the ability to respond to texts through a variety of methods, such as creative dramatics, writing, and graphic art.

Standard 4-W1 – The student will apply a process approach to writing
  4-W1.6.1 Demonstrate the ability to write multiple-paragraph compositions, friendly letters, and expressive and informational pieces.

Fifth Grade Language Arts Standards
Standard 5-R1 – The student will integrate various cues and strategies to comprehend what he or she reads.
  5-R1.4 Demonstrate the ability to summarize and paraphrase texts.
  5-R1.15 Demonstrate the ability to respond to texts through a variety of methods, such as creative dramatics, writing, and graphic art.

Standard 5-W1 – The student will apply a process approach to writing
  5-W1.6.1 Demonstrate the ability to write multiple-paragraph compositions, friendly letters, and expressive and informational pieces.
What is a Myth?

A myth can be defined as a traditional story of ostensibly historical events that serves to unfold part of the world view of a people or explain a practice, belief, or natural phenomenon. Myths can take on many forms and serve many purposes. Many cultures have myths that explain the creation of the Earth; these are known as creation myths. Myths are also written to teach lessons and demonstrate how behavior can be rewarded or punished. Most myths began as oral stories and eventually were documented in order to endure the passing of time.

Turtle Myths

Many cultures have myths, including creation myths, that feature turtles. Turtles also serve as symbols in cultural myths; for example, representing wisdom in Chinese myths. Long life is an attribute typically associated with the turtle, as is reproductive prowess or success (apparently based on mating behavior and the large number of eggs laid).

Myths and Conservation

Understanding these cultural myths is important to conservation because myths can help to explain how people view turtles. Identifying people’s perceptions can strengthen the development of management plans and conservation strategies that enhance sea turtle survival without unduly compromising traditional lifestyles. It is also important to understand the different cultural views of turtles in order to cultivate respect between cultures and communities. Although many different cultural perceptions of sea turtles exist; there is no right or wrong view. All views deserve the same amount of respect.
SEA TURTLE MYTHOLOGY

Procedure

Warm Up

1. Ask the students how their North American culture views sea turtles. Overall, do we want to hunt sea turtles or protect sea turtles? Ask the students if they believe all people in the United States view sea turtles in the same way. Why, or why not?

2. Discuss with the students that sea turtles contribute significantly to cultures around the world, whether in providing commodities (meat, eggs, oil) or in serving as ambassadors for marine conservation. Inform them that many cultures have written myths or stories about sea turtles.

3. Discuss with the students that cultures value sea turtles in many different ways. For example, some cultures value sea turtles for food, while others believe that sea turtle eggs have (and can endow) special powers or plan uniquely important roles in coastal marine habitats.

Activity

1. Inform the students that they will be reading myths about sea turtles from different cultures.

2. Divide the students into equal groups and pass out a different myth to each group. Either one person in the group can read aloud to the group, or each person in the group can receive their own copy.

3. Give the students enough time to complete the reading. When the groups are done explain to them that they are now going to share their myth with the rest of the class. In preparation for this, ask the students to discuss the myth within their groups and pick out the main points to share with the rest of the class.

4. After the groups are done discussing, have each group stand in the front of the class and share their myth.
SEA TURTLE MYTHOLOGY

Procedure

Wrap Up

1. Begin a discussion about the similarities and differences between the myths. How are the sea turtles portrayed in the different myths? Is their role positive or negative? What is the message of the myth? Are other animals (other sea creatures?) involved in the myth?

2. Explain to the students that these myths show us that humans and sea turtles have been interacting for a very long time because myths generally pre-date written traditions.

3. Discuss with the students how the myths help to explain why all humans do not view sea turtles in the same way.

4. Ask the students, “Are myths important to modern societies? Why, or why not? Are there any modern-day myths? Do they involve sea turtles?”

Assessment

1. Have the students write their own myths about sea turtles. The myth should portray why sea turtles are important to them, or to people in their community. Perhaps a sea turtle swimming is what causes waves in the ocean or maybe touching a sea turtle brings a person good luck.

2. Ask the students to illustrate their myths, and compile them into a book for sharing on World Ocean Day.
IROQUOIS CREATION MYTH

Woman Who Fell From the Sky

In the beginning, in the Sky World, a pregnant wife asked her husband to fetch the delicacies she craved. But she wanted the bark of a root of the Great Tree in the middle of the Sky World, which none were permitted to touch. Finally, however, he gave in, and scraped away soil to bare the root of the Tree. Underneath was a hole, and as the woman peered down into it, she fell through. The birds helped transport her as she fell, and the great Sea Turtle received her on his back.

Here, on the Sea Turtle's back, she planted bits of the roots and plants she had brought from the Sky World. And she walked across the turtle's back, planting, praying and creating the Earth that we know as Turtle Island.

The woman who had fallen from the sky then had a daughter, who became impregnated by the West Wind. While in the womb, the daughter's unborn twins began to quarrel about how they should emerge, the left-handed twin refusing to be born in the usual way. Instead, he forced himself out of his mother's left armpit, killing her as a result. The newborn twins then buried their mother, who became Corn Mother, source of corn, beans and squash, the Three Sisters of the Iroquois. From her heart grew sacred tobacco, used to send messages and thanks to the Sky World.

The two brothers continued to compete with each other as they created the animals and plants, and in the process, represented different ways of living. Right-Handed Twin created the beautiful hills, lakes, blossoms, gentle creatures; Left-Handed Twin, the jagged cliffs and whirlpools, thorns and predators. Right-Handed Twin was always truthful, reasonable, goodhearted, and "straight-arrow"; Left-Handed Twin lied, fought, rebelled and made "crooked" choices.

Because Right-Handed Twin created human beings, he is known as "Our Creator," and "The Master of Life." But Left-Handed Twin helped, and invented rituals of sorcery and healing. The world they built included both cooperation and competition, loving-kindness and aggression.

After they finished their creations, the continued to compete in other ways - by gambling, by playing lacross, then fighting with clubs. One day, grasping a deer antler, Right-handed Twin finally prevailed, and killed his brother, throwing the body of Left-Handed Twin over the edge of the earth. As a result, Right-Handed Twin rules day and the Sky-World and Left-Handed Twin prevails over night and the lower world.

Grandmother Skywoman was furious that Right-Handed Twin murdered his brother, and accused him of wrongdoing. Angry, and believing that grandmother had always favored the errant Left-Handed Twin, he cut off her head and threw it up toward the sky, where it became the Moon. Then he threw her body into the ocean, where it became all the fish of the sea. The Iroquois believe that both Left-Handed Twin and Right-Handed Twin are necessary for the world to be in balance. During festivals, day activities honor Right-Handed Twin, and night activities such as feasting, singing and dancing honor Left-Handed Twin. This tension and struggle for balance between the two brothers and principles of life is incorporated into Iroquois festivals and cycles of life.

Source: http://www.webwinds.com/yupanqui/iroquoisdreams3.htm#Sky
HAWAIIAN SEA TURTLE MYTH

The Legend of Kauila at Punalu’u

Long, long ago, a magnificent turtle appeared on the moonlit shores of Punalu’u. Honu-po’o-kea was no ordinary sea turtle. Her head was as white as the snows of Mauna Kea. Honu-po’o-kea paused at the ocean's edge, searching for the perfect place to build a nest. Gentle waves tugged at the black sand beneath her. With a deep sigh, she pulled herself ashore.

Honu-po’o-kea dug a shallow hole and laid an egg, as dark and smooth as polished kaula wood. Her mate, Honu-'ea, had been waiting offshore, his reddish-brown shell bobbing in the surf. As Honu-po'o-kea covered her nest, Honu-'ea joined her. Together the turtles dug into the black sand and created a spring. Then, as silently as they had come, they disappeared into the ocean.

In time, the egg hatched into a magical turtle named Kauila. Kauila made her home at the bottom of the freshwater spring that her parents had made. People called it Ka wai hu o Kauila, the rising water of Kauila. Children would come to play in the spring, and if they saw bubbles rising from its depths they knew that Kauila was sleeping. Sometimes Kauila would transform herself into a girl so that she could play among the keiki. Always, she kept a watchful eye on the children, insuring their safety.

Honu, or green sea turtles, still come to the black sands of Punalu'u on the Big Island. They can be seen grazing on seaweed in the surf or basking in the warm sun, oblivious to the people that gather to watch them. At night the rare honu ‘ea, or hawksbill turtle, has been known to nest in the area, just as Honu-po'o-kea did so long ago. Here and there the black sand bubbles as cool mountain water from Mauna Loa percolates through the porous lava. This was Kauila's gift: fresh water for the people of Punalu'u. Long ago Hawaiians would dive to the floor of the bay to collect the fresh water in gourds. Hence the name Punalu'u, which means diving spring.

Punalu’u is a favorite family stop on the long drive from Volcano to Na’alehu. My two boys are always eager to count the honu in the bay, and the occasional basking turtle. Inevitably, their attention is always drawn to the pahoehoe tide pools, and the chilly springs that arise within. As my boys build dams to channel the freshwater as it flows seaward, it is not difficult to feel Kauila's benign presence. Watching over the keiki, as she has done for eons.

Source:  http://www.tammyyee.com/tt-kauila.html
Section 1 References


Merriam-Webster On-line dictionary


SeaTurtle.Org Identification Key

South Carolina Department of Education <http://ed.sc.gov/agency/offices/cso/>


Turtle Kiss <www.turtlekiss.com/symbolism.htm>

Wellington Zoo Teacher Resources
   <http://www.wellingtonzoo.com/learn/teacher/groups.html>

Photo References

Barb Bergwerf
Carlos Rodriquez Munoz
Chloe Schauble
Cynthia Rubio, NPS Photo
Kedar Gore
Kellie Pendoley, 2003
Scott Eckert
Ted Demas
All Enthusiasts, Inc
www.yellowtangsoftwar.com - damselfish
www.tomuphoto.com - salamander
dnr.state.il.us - river otter
Www.rosssea.info - albatross
Microsoft Clipart
http://spot.colorado.edu - Tortoise Picture
www.minaxtarantulas.net - Desert Picture
www.muskokawildlifecentre.com - Wood Turtle Picture
SECTION 2

ADAPTATIONS
SEA TURTLE COMPARISON

Focus Question:
How does the physical structure of a sea turtle compare to that of a human, and how does that structure help them survive?

Activity Synopsis
The students will compare their own measurements of height, length, and width to those same measurements in sea turtles. The students will demonstrate the use of appropriate measurement tools. The students will also compare the structure of the human skeleton to the structure of the sea turtle skeleton in order to understand how sea turtles have adapted structurally to survive in their environment. Finally, students will discuss whether these adaptations are inherited, or whether they are learned or acquired over time.

Standards

Fourth Grade Science Standards
Standard 4-1 — Scientific Inquiry
4-1.2 Use appropriate instruments and tools (including a compass, an anemometer, mirrors, and a prism) safely and accurately when conducting simple investigations.
4-1.6 — Construct and interpret diagrams, tables, and graphs made from recorded measurements and observations.

Standard 4-2 — Organisms and Their Environments
4-2.4 Distinguish between the characteristics of an organism that are inherited and those that are acquired over time.
4-2.5 Explain how an organism’s patterns of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).

Fifth Grade Science Standards
Standard 5-1 — Scientific Inquiry
5-1.4 Use appropriate tools and instruments (including a timing device and a 10x magnifier) safely and accurately when conducting a controlled scientific investigation.
5-1.6 Evaluate results of an investigation to formulate a valid conclusion based on evidence and communicate the findings of the evaluation in oral or written form.

Objectives:
Students will be able to:
1. Identify and use the proper tools when measuring weight, length, and height
2. Collect, record, and interpret data
3. Understand how animals adapt structurally to their environment over time

Time Frame:
60 minutes

Key Terms:
Anterior
Carapace
Flipper
Homologous
Measurement
Posterior
Prehistoric
Streamlined
Vertebrate

Materials:
• 2 scales
• Tape measures
• Turtle Fact Sheets (provided)
• Comparison Data Table (provided)
• Turtle skeleton diagram (provided)
• Human skeleton diagram (provided)
• Blank sheets of paper
♦ Sea Turtles Evolved from Prehistoric Land Turtles

Through a process scientists call natural selection, sea turtles slowly evolved from land turtles in order to occupy a strictly aquatic environment. Many species would eventually become extinct, but two taxonomic “families” of sea turtles survived from prehistoric times and are still alive today.

♦ Natural Selection Results in Changes Over Time

Natural selection brings about the evolution of new species of plants and animals over time, and these changes usually reflect improvements in an animal’s ability to survive in its environment — or take advantage of new environments. Each of us is just a little bit different from everyone else, even though we are all human. The same is true for sea turtles. When the Earth was young, it was changing all the time. Turtles with features that allowed them, even in very small ways, to take advantage of new environments (like warm shallow seas) thrived and produced relatively more young than turtles still competing in the terrestrial environment. Over long periods of time, traits that allowed turtles to more efficiently exploit warm shallow seas were passed down from generation to generation (meaning that they were inherited, not learned). This process of natural selection ultimately gives rise to organisms distinctively different than the original...for example, with flippers instead of legs!

♦ Structures Important for Sea Turtle Survival

Sea turtles have three important structures (among many others) that enable their survival in the marine environment.

1. Streamlined form – the body of a sea turtle is very streamlined. This eliminates drag, which helps the sea turtle to move easily through the water without having to use a lot of energy. As a result, they have the ability to find food, escape predators, and make long distance migrations between feeding and nesting grounds.

2. Elongated front flippers – the “front legs” of a sea turtle are modified into flippers. Wing-like in shape, they enable the sea turtle to swim efficiently and to powerfully propel itself through the water.

3. Paddle-like hind flippers – the “back legs” of a sea turtle are paddle-like and serve an important purpose both in the water and on land. In the water, rear flippers are used as rudders to steer the turtle while swimming. On land, these flippers aid in pushing the egg-bearing female up the beach and then are used to dig the nest.

♦ Sea Turtles and Humans have the Same Basic Skeleton

The skeleton of a sea turtle actually contains most of the same bones that are found in the skeleton of humans. This is because both sea turtles and humans are vertebrates. However, the structure of these bones can be quite different. For example, sea turtles have ribs, but they are fused together to form a hard, bony and protective carapace (shell). In addition, sea turtles have phalanges (the bones that form our fingers), but their phalanges extend most of the length of their flippers and are much longer than yours.

♦ Measuring Sea Turtles

The curved carapace length and width are measured using a tape measure. The curved length is the measurement from edge of the shell behind the head to the opposite end of the shell (see diagram) taken along the curve of the shell with tape laying flat. The curved carapace width is the measurement across the shell at the widest part, typically just behind the front flippers. The straight-line carapace length and width measurement are recorded using calipers. The length is again measured from just behind the head (anterior edge) to the back (posterior edge) of the shell and the width is measured across the shell at the widest part. This measurement does not take into account the curvature of the carapace and is preferred by scientists because it tends to reduce measurement variance.
SEA TURTLE COMPARISON

2A

Procedure

Warm Up

1. Ask the students if they think they are as big as a loggerhead sea turtle would be at their age. Do the students think they weigh the same as the turtle? Are they the same height?

2. Tell the students to think about the lengths of their arms and legs compared to the flippers of a sea turtle. Would they expect them to be the same or different?

3. Discuss with the students if they think there is a difference in measurement size between male and female loggerheads. Is their a distinct difference in height and weight between the boys and girls in the classroom? Or are there differences between sexes more or less the same as the differences among the boys, or among the girls?

Activity

Part I

1. Explain to the students that they will be comparing themselves to a loggerhead sea turtle approximately their age (8-10 yrs), and that the turtle, very much like themselves, would be considered to be a young juvenile at that stage.

2. The first measurement the students will compare is their weight. Divide the students up into two groups: boys and girls. Provide each student with a copy of the Sea Turtle and Human Comparison Data Table (provided). In addition, each boy should get a copy of the Male Loggerhead Fact Sheet and each girl should get a copy of the Female Loggerhead Fact Sheet (provided).

3. Ask the students what tool would be the best to use in order to measure their weight. It should be decided to use a scale. Provide a scale for the boys and for the girls. Instruct each student to weigh themselves on the scale.

4. The students should record their weight on the Data Table. They should also find the weight of the turtle on the sea turtle fact sheet and record that weight in the data table.

5. Discuss the results with the class. Were the students heavier than the sea turtles? Did the average weight of the students differ from that of the sea turtle?

6. Instruct the students that they will now compare the length of their backs to that of a loggerhead sea turtle. Ask the students what tool they should use for these measurements. A ruler, measuring tape, yardstick, or meter stick would all be correct answers; however, a tape measure would be the best tool to use.

**If a student is uncomfortable taking his/her weight, give them the option of using a classmate’s weight.
7. Explain to the students how measurements are taken on a sea turtle. The students should take turns measuring the length of each others backs. The measurement should start at the base of the neck and end at the waist. If possible, the students should measure in centimeters because this is the standard preferred by scientists all over the world.

8. The students should record their back length measurements in the data table and record the carapace length of the sea turtle in the Data Table.

9. Next, instruct the students to measure the width of their back. Again, have the students use a flexible tape measure. One student will have to measure the back of another student and communicate the results. The students should measure, again in centimeters, the broadest part of the back (approximately the middle of the rib cage).

10. The students should record their back width measurements in the Data Table as well as the carapace width of the sea turtle.

1. Explain to the students that they are now going to compare the skeleton of a human to the skeleton of a sea turtle.

2. Pass out the skeletal diagrams of the human and the sea turtle to each student, along with a blank sheet of paper.

Instruct the students to study the two skeletons and note the similarities and differences between the two. On one side of the paper the students will write differences, and on the other side similarities. Give the students approximately 20 minutes to do this part.

4. Discuss with the students the similarities and differences that they observed. Make a large chart on the board to record these similarities and differences.

5. Now ask the students why sea turtles are structured the way that they are. Why are their “fingers” so long? Why aren’t their toes as long as their fingers? What do they notice about the loggerhead’s jaw structure, and might a large head and a powerful jaw be important to the turtle? [Hint: Loggerheads love shellfish!] Ask the students if they can find the rib cage on the sea turtle skeleton. How does it differ from that of a human? Ask them to feel their own ribs, are they fused together? Why not?
SEA TURTLE COMPARISON

Procedure

Wrap Up

1. Discuss with the students the adaptations humans have for living on land and the adaptations sea turtles have for living in the water.

2. Ask the students if humans would be able to survive for a long period of time in an aquatic environment. How could humans change to be more adapted to this environment?

3. Discuss with the students the similar structures (for example, flippers and arms) found in both sea turtles and humans. Ask the class if these structures are for similar functions or for different functions.

4. Introduce the concept of “homologous,” a term scientists use to describe features that share the same evolutionary origin, but may have been adapted for different uses. Examples: wing of bat and wing of bird, or arm of a human and front flipper of sea turtles.

Assessment

1. Have the students draw a picture of human that is able to survive in the marine environment. The students should draw a human with adaptations comparable to those of a sea turtle.

2. Hold up pictures of other structures that are similar to humans and ask the students to write if they are used for the same functions or different functions.
MALE LOGGERHEAD FACT SHEET

AGE: 8–10 YEARS
LIFE STAGE: JUVENILE
LOCATION FOUND: SOUTH SANTEE RIVER, SC
WEIGHT: 48 LBS

STANDARD CURVED CARAPACE LENGTH: 23 INCHES
STANDARD CURVED CARAPACE WIDTH: 20 INCHES

FLIPPER TAGS: Y_____ N____X___

PHYSICAL EXAM: SMALL BARNACLE LOAD
WOUNDS/ABNORMALITIES: WOUND AROUND FLIPPER
RESPIRATION: GOOD CONDITION
EYES: GOOD CONDITION
MOUTH: GOOD CONDITION
FLIPPERS: GOOD CONDITION EXCEPT FOR WOUND
FEMALE LOGGERHEAD FACT SHEET

AGE: 8-10 YEARS

LIFE STAGE: JUVENILE

LOCATION FOUND: SULLIVAN ISLAND, SC

WEIGHT: 57.4 LBS

STANDARD CURVED CARAPACE LENGTH: 26.4 IN
STANDARD CURVED CARAPACE WIDTH: 25.6 IN

FLIPPER TAGS: Y____ N___X_

PHYSICAL EXAM: LARGE BARNACLE LOAD

WOUNDS/ABNORMALITIES: LOW ENERGY LEVEL

RESPIRATION: FAIR

EYES: GOOD

MOUTH: GOOD

FLIPPERS: GOOD
<table>
<thead>
<tr>
<th>Sea Turtles</th>
<th><strong>Weight (lb)</strong></th>
<th><strong>Back/Carapace Length (cm)</strong></th>
<th><strong>Back/Carapace Width (cm)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea Turtles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## CARETTA SAYS SWIM!

### Focus Question:
How are sea turtles able to move both on the land and in the water?

### Activity Synopsis
Students will physically act out the different crawling and swimming movements of the different species of sea turtles. A game of “Caretta says” will test the students’ ability to recall and demonstrate different patterns of sea turtle movement. The students will discuss the origins of behaviors like movement, considering whether they are likely to be inherited or learned, and will explore reasons why sea turtles might change their patterns of behavior as they grow.

### Standards

#### Fourth Grade Science Standards

**Standard 4-2** – Organisms and Their Environment

**4-2.4** Distinguish between the characteristics of an organism that are inherited and those that are acquired over time.

**4-2.5** Explain how an organism’s patterns of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).

#### Fifth Grade Science Standards

**Standard 5-1** – Scientific Inquiry

**5-1.7** Use a simple technological design process to develop a solution or a product, communicating the design by using descriptions, models, and drawings.

### Objectives:
Students will be able to:
1. Practice and demonstrate coordination skills
2. Explain how a sea turtle’s behavior is related to its environment (land and sea)
3. Understand that animals sometimes change their behavior in different environments, and during different stages of life in order to achieve the same end (for example, locomotion)

### Time Frame:
60 minutes

### Key Terms:
- Asymmetrical
- Gait
- Symmetrical

### Materials:
- Open, grassy area
- Mats if activity is done indoors
Background

♦ Sea turtles must be able to swim and crawl

Although sea turtles spend the majority of their time in the aquatic environment, they still must come onto the land to lay their eggs on sandy beaches. Therefore, they must have the ability to both swim in the water and crawl onto land. However, sea turtles are much better (more efficient) at swimming than they are crawling. Since they spend a relatively small fraction of their lives out of water, it is more important for them to be efficient in their marine adaptations. They swim fast, dive deep, and effectively hide from predators at sea. In contrast, on land they crawl very slowly and are very vulnerable to predators.

♦ Crawling styles can change as sea turtles mature

Some species of sea turtles have different styles of crawling throughout their life. Three of South Carolina’s native sea turtles, the loggerhead, leatherback, and Kemp’s ridley, do not change their crawling style as they mature—it stays the same throughout their whole life. However, green turtles crawl in a different manner as hatchlings than they do when they are adults.

♦ Hatchling Crawl Styles

With the exception of the leatherback, all sea turtle hatchlings move diagonally opposing flippers (for example, front right and back left) together and at the same time to produce an asymmetrical gait or “zipper crawl”. Leatherbacks protract all four flippers at the same time; when their flippers hit the sand they twist them to the left and lift their body up. Unlike all other turtles, these turtles have a period where all four flippers are in the air simultaneously (swing and dance gait). The crawl marks in the sand are bilaterally symmetrical.

♦ Adult Crawl Styles

As adults (nesting females), loggerheads and Kemp’s ridleys crawl the same as they did as hatchlings, with an asymmetrical gait or “zipper crawl”. They are heavier, of course, so they don’t move as quickly. In contrast, green and leatherback turtles – perhaps not coincidentally the heaviest of sea turtles as adults – crawl on land using a “breast stroke”, moving their front and then their hind flippers in unison, dragging themselves up the beach, and producing symmetrical crawl marks in the sand. Leatherbacks crawled similarly as hatchlings, but green turtles made a major switch!

♦ Swimming styles can change as sea turtles mature

Some species of sea turtles have different styles of swimming throughout their life. Loggerhead, green, (hawksbill?), and leatherback sea turtles do not change their swim styles as they mature. However, Kemp’s ridley sea turtles swim in a different manner as hatchlings than they do as adults!

♦ Hatchling Swim Styles

**Loggerhead** - move both of their front flippers at the same time continually beating the water; also move flippers opposite from one another at the same time (dogpaddle)

**Green** - simultaneously beat their front flippers in the water; also move flippers opposite one another at the same time (dogpaddle)

**Leatherback** - swim by simultaneously beating their front flippers

**Kemp’s Ridley** - beat front flippers at the same time and kick rear flippers at the same, the front and rear flippers move at the same time.

♦ Adult Swim Styles

**Loggerhead** – swim the same as loggerhead hatchlings

**Green** – swim the same as green hatchlings

**Leatherback** – swim the same as leatherback hatchlings

**Kemp’s Ridley** – swim by beating their front flippers at the same time
CARETTA SAYS SWIM

Procedure

Warm Up

1. Show the students a picture of a sea turtle. Ask the students to identify what makes them such good swimmers. Do sea turtles move better on a beach or in the water? Discuss how their flippers have enabled them to be efficient swimmers.

2. Ask the students if all the species of sea turtles crawl and swim alike. Do hatchlings crawl and swim in the same manner that adults do?

3. Ask if students know how to tell what species of sea turtles has visited the nesting beach, based on the tracks left behind. Do different species leave different tracks in the sand? Would hatchlings have different tracks than adults?

Activity

Part I

1. Explain to the students that they are going to learn how the four species of sea turtles in South Carolina swim and crawl by acting it out themselves.

2. This activity requires that all the students lay down on the floor, so it would be best to do this activity in an open space. A large grassy area outdoors would work, or have the students lay down on mats or towels in the classroom.

3. First the students will learn how a hatchling crawls down the beach. Demonstrate the movement yourself (see “Background”) and then have the students copy you. Students should do these movements slowly in order to understand how difficult it is for sea turtles to move on land. Repeat as necessary.

4. Next, the students will learn how adult females crawl on the beach. Again, demonstrate the movement yourself (see “Background”) and then have the students copy you.

5. When students have mastered the crawling, demonstrate the swimming movements. Inform the students that they will first learn how hatchlings swim. Demonstrate the movement (see “Background”) and then have the students copy you. These movements should be done quickly to demonstrate how sea turtles move much better (more efficiently!) in the water.

6. The last movements the students will learn will be how adults swim. Demonstrate the movement (see “Background”) and then have the students copy you.

7. Review each movement with the students. Try to mix them up and see if they can remember how each species moves.
Part II

1. Ask the students if they know how to play the game “Simon Says.” Most students should know how to play this game, but a quick refresher might be in order. Instead of saying “Simon Says”, you will say “Caretta Says.” Caretta is the name of the loggerhead sea turtle resident at the South Carolina Aquarium.

2. Have the students spread out about an arm’s length apart from one another in an open area.

3. Before starting the game, review the commands you’ll be shouting out and the correct responses for each, as follows:

4. Continue playing the game until there is a winner. If the game is taking too long, it could be stopped with a couple players still left.

<table>
<thead>
<tr>
<th>COMMAND: “Caretta Says …”</th>
<th>CORRECT RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Swim like an adult turtle”</td>
<td>get down on ground and swim (see “Background”)</td>
</tr>
<tr>
<td>“Crawl like a loggerhead hatchling”</td>
<td>get down on ground and crawl (see “Background”)</td>
</tr>
<tr>
<td>“Crawl like a loggerhead adult”</td>
<td>get down on ground and crawl (see “Background”)</td>
</tr>
<tr>
<td>“Dog paddle like a loggerhead hatchling”</td>
<td>get down on ground and crawl (see “Background”)</td>
</tr>
<tr>
<td>“Make a fish face”</td>
<td>suck cheeks in and hold hands up to face, moving them back and forth against cheeks</td>
</tr>
<tr>
<td>“Stand like a sea star”</td>
<td>stand with feet spread apart and arms reaching up (diagonally) into the air</td>
</tr>
<tr>
<td>“Glide like a stingray”</td>
<td>extend arms out, twist left and right to “soar”</td>
</tr>
<tr>
<td>“Swim like an otter”</td>
<td>spin in circles like an otter spinning underwater</td>
</tr>
<tr>
<td>“Chomp like an alligator”</td>
<td>hold arms straight out in front, put one arm on top of the other and move arms “open and shut”</td>
</tr>
<tr>
<td>“Move like a ghost crab”</td>
<td>form hands like pinchers, spread feet apart, shift weight back and forth to simulate walking, open and close “pinchers”</td>
</tr>
</tbody>
</table>

4. Continue playing the game until there is a winner!
1. Discuss with the students the movement that is likely to be most difficult for sea turtles—is it swimming or crawling? Are these movements easy for a human? Would humans be able to swim like sea turtles, dodge sharks, and migrate thousands of miles … swimming day after day, even in the dark?

2. Why is it important to know how different species of sea turtle move? What can that tell us?

**Assessment**

1. Ask the students recollect how their movements have transformed in their lifetime. Have them describe in writing how they crawled, learned to walk, learned to run, skip and jump, and how they would characterize their ability to move at the present time.

2. After writing down their recollections, have the students describe in writing how a sea turtle moves at the different stages of its life. Does the hatchling learn this movement from its mother or father, or is it an inherited instinct?

3. Ask the students why it is important for sea turtles to be able to change their movement styles. For example, what force is acting on the sea turtle on land that is not (or not very much) acting on them at sea? Discuss the role of gravity, why can jellyfish live happily at sea but land animals usually have bones or support structure of some kind?
Focus Question:
Why can sea turtles become dehydrated even though they live in water, and what adaptations do they have for living in saltwater?

Activity Synopsis
This activity teaches students how sea turtles have adapted to living in a saltwater environment. In the first part of the activity, the students will visually see how the process of osmosis allows sea turtles to “drink”. In the second part of the activity, the students will construct a sea turtle throat in order to learn about the adaptation of sea turtle throat papillae and its importance for eating and “drinking.” The students will discuss other physical adaptations, including “turtle tears”, as well as adaptations present in other sea animals that serve to rid their bodies of excess salt.

Objectives:
Students will be able to:
1. Mix a solution
2. Differentiate between diffusion and osmosis
3. Understand why osmosis is important to living organisms
3. Identify adaptations that allow sea turtles to live in a saltwater environment

Time Frame:
60 minutes

Key Terms:
Dehydration
Diffusion
Keratinous
Osmosis
Papillae
Semi-permeable Membrane
Solute
Solvent

Standards
Fourth Grade Science Standards
Standard 4-2 – Organisms and Their Environment
4-2.4 Distinguish between the characteristics of an organism that are inherited and those that are acquired over time.
4-2.5 Explain how an organism’s pattern of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).

Fifth Grade Science Standards
Standard 5-2 – Ecosystems: Terrestrial and Aquatic
5-2.4 Identify the roles of organisms as they interact and depend on one another through food chains and food webs in an ecosystem, considering producers and consumer (herbivores, carnivores, and omnivores), decomposers (microorganisms, termites, worms, and fungi), predators and prey, and parasites and hosts.

Standard 5-4 – Properties of Matter
5-4.3 Summarize the characteristics of a mixture, recognizing a solution as a kind of mixture.

Materials:
- 6 potatoes
- Potato peeler
- Paper towels
- 500 ml cups or jars
- Tape
- Markers
- Table salt
- Scale
- Distilled water
- Data Table Worksheet (provided)
- Diffusion & Osmosis Worksheet (provided)
SALTWATER TRICKS

♦ All Sea Turtles Need Freshwater

Even though sea turtles spend the majority of their time in a saltwater environment, they must drink freshwater in order to survive. Sea turtles have developed a number of adaptations in order to overcome this obstacle.

♦ Diffusion and Osmosis

Diffusion is the process by which molecules spread from areas of high concentration to areas of low concentration. When equilibrium is reached, diffusion stops. For example, if two bodies of water were separated by a permeable membrane, the body of water that was greater in volume would flow into other body of water (through the permeable membrane) until their volumes were equal. Osmosis is a type of diffusion and can be defined as the movement of a solvent (like water) through a semi-permeable membrane into a solution of higher solute (the substance dissolved in the solvent, like salt) concentration. The process of osmosis tends to equalize the concentrations of solute on the two sides of the membrane. Osmosis is best explained using a freshwater and saltwater example. Most organisms contain large amounts of freshwater. When placed in saltwater environment, the freshwater from inside the organism flows into the saltwater because the saltwater has a higher concentration of salts. When an equilibrium is reached and the concentration is equal among the two bodies, the flow of water stops. Sea turtles have adaptations to significantly decrease the loss of freshwater from their internal body fluids to the outside environment.

♦ Adaptations for Dealing with Saltwater

Sea turtles have three major adaptations for dealing with saltwater. First, the skin and the shell of a sea turtle are resistant to the diffusion of water. Second, sea turtles have salt glands near their eyes (akin to our tear glands) and they “cry” very salty tears all the time, effectively ridding their bodies of excess salt. Sea turtles also have papillae in their throats that strain and retain prey items while expelling water during feeding. If sea turtles did not have these adaptations, they would dehydrate because precious internal fluids would be lost to the surrounding sea.

♦ Skin and Shell

The skin and the shell of sea turtles act as a barrier to keep freshwater from diffusing out of the body. This barrier is possible because there is a high concentration of fat in their skin and shell tissue. The skin and shell tissues also has keratinous proteins that help hold in the water. It is the combination of the proteins and high fat concentration that impede the diffusion of water.

♦ Salt Glands

The salt glands are located near the eyes of sea turtles, and they are quite a bit larger than the sea turtle’s brain. The salt glands continually pump salt out of the body in the form of tears. When sea turtles are out of the water (such as when they are nesting), the thick tears are visible and people think the turtle is “crying,” but this is actually just salt excretion and it also occurs when the turtles are swimming at sea. These glands allow sea turtles to excrete relatively large amounts of salt without losing large amounts of water.

♦ Papillae

Sea turtles also have papillae in their esophagus (throat). In leatherbacks, papillae are also present in the mouth. Papillae are rather hard projections that are conical in shape with a pointed tip. These papillae point “backward” (towards the stomach) and are used for entrapping food in the esophagus. This allows the sea turtle to expel excess saltwater out of its mouth and nostrils without losing dinner!
SALT WATER TRICKS

Procedure

Warm Up

1. Ask the students if their mouth has ever felt dry after eating salty foods. Do they feel like drinking something after eating popcorn, peanuts or pretzels? This is because the salty food tends to remove water from the inside of your mouth.

2. Explain the concept of diffusion, and how osmosis works (see “Background”). Relate the phenomenon of freshwater flowing into saltwater across a membrane to what happens when you put dye in water.

Activity

Part I

1. Explain to the students that they are going to simulate how water inside a sea turtle can flow across its soft tissues and into the surrounding saltwater. The simulation will be done using a potato and different solutions of saltwater.

2. Remove the skin from six potatoes and cut them into slices of approximately the same length and width.

3. Divide the students into groups of 3-4. Give each group a copy of the Potato Data Table (provided) and two potato slices.

4. Using a paper towel, have the students pat the slices to soak up any moisture on the potato slices.

5. Pass out two jars or cups (ideally with lids) to the students. Using tape and a marker, tell the students to label the jars “freshwater” and “saltwater.”

6. Have the students pour in 250 ml of distilled water into the first jar/cup.

7. Have the students weigh the potato slice that will be put in the freshwater jar. Record the weight in grams on the Potato Data Table. Place the potato slice into the jar/cup labeled “freshwater.”

8. Have the students pour 250 ml of distilled water into the jar/cup labeled “saltwater.” Add 1 tablespoon of table salt to this water and stir.

9. Have the students weigh the second potato slice and record the weight in the Potato Data Table. When the slice has been weighed, place it in the “saltwater” container.

10. Let the potato slices soak for 24 hours, at which time the students should remove the slices from the jars and weigh them again. Record the new weights in the Potato Data Table. Be careful not to mix the freshwater potato slice with the saltwater potato slice!
**SALTWATER TRICKS**

**Activity Continued**

**Part II**

1. Explain to the students that sea turtles have different adaptations that help them deal with living in and drinking saltwater – scaly skin, bony shell, salt glands, and throat papillae. Without these adaptations, sea turtles would become dehydrated and would be unable to survive in the ocean.

2. Explain to the students how sea turtles eat their food and how the throat papillae help them minimize their saltwater intake without losing their food (see “Background”).

3. Inform the students that they are going to construct a sea turtle throat. Show pictures of the leatherback’s papillae and other sea turtle’s papillae. This will give the students an idea of what they are going to create.

4. Provide each student with either a paper towel roll or a toilet paper roll and several long strips of plastic. Before passing out the rolls, there should be slits cut into the sides of the rolls. The slits should be big enough so that the plastic strips fit snugly.

5. Instruct the students to cut the plastic strips into skinny triangles. When all of the strips have been cut, the students should place the strips into the slits in the cardboard roll.

6. Provide each student with various items to place in the “throat”. For example, have the students place a rubber ball into the throat. Turn the throat (tube) upside down. Does the ball roll out, or is it trapped by the papillae?

7. Have the students place pieces of plastic bag in the throat. This can simulate jellyfish, or the consumption of plastic trash mistaken for jellyfish. Does it slide through the throat easily, or does it get trapped?

8. Ask students how they think that sea turtles force food down their throats. Have the students try to squeeze the tube. What happens to the trapped food?

9. What other uses might papillae serve? One consideration is that, in a weightless environment, papillae can help keep food, especially slippery food like jellyfish, “down”!

**Wrap Up**

1. The students should draw diagrams of osmosis, such as might occur across the soft tissues of a sea turtle, to demonstrate that they understand the correct flow of water. Make sure the students also understand that saltwater is a mixture.

2. Discuss what would happen to a land turtle after prolonged exposure to saltwater. What would the land turtle need in order to live in saltwater? How would these adaptations keep the turtle from becoming dehydrated?
Assessment

1. Have the students complete the Diffusion and Osmosis Worksheet, drawing arrows to indicate flow direction.

2. Through readings provided by the teacher, ask students to present what they’ve learned about how other marine animals (sea birds or marine iguanas) rid their bodies of excess salt. Students should explain, through class discussion, how these adaptations work and how they are similar to (or different from) sea turtle adaptations.
<table>
<thead>
<tr>
<th>Day 2</th>
<th>Day 1</th>
<th>Day 0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Weight before placing potato in solution)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Freshwater Potato Weight (g)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Saltwater Potato Weight (g)</td>
<td></td>
</tr>
</tbody>
</table>
Diffusion & Osmosis Worksheet

1. Draw an arrow to show the direction that water would flow.

   A
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   \begin{array}{c}
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   \end{array}
   \]

2. When would the water stop flowing? ____________________________
   __________________________________________________________________

3. What is this called? ____________________________

4. Draw an arrow to show the direction that water would flow.

   A
   \[
   \begin{array}{c}
   \text{ } \\
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   \text{ } \\
   \text{ } \\
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   B
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   \text{ } \\
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   \end{array}
   \]

   SALTWATER

   FRESHWATER

5. When would the water stop flowing? ____________________________
   __________________________________________________________________

6. What is this called? ____________________________
**YOU ARE WHAT YOU EAT**

**Focus Question:**
What are the feeding adaptations of sea turtles, and how does this affect the environment that they live in?

**Activity Synopsis**

The students will play a game that investigates the different feeding adaptations of sea turtles. Different “mouth tools” will be used to forage on different types of food, and the students will determine which type of “mouth” best fits with which type of food source. Students will collect, tally, and interpret data derived from observation and experimentation. Finally, students will discuss the consequences of real sea turtle prey items being depleted in the ocean environment.

**Objectives:**

Students will be able to:
1. Compare and contrast the mouth shapes of different sea turtles.
2. Describe how a sea turtle is physically adapted to its food source.
3. Conduct an investigation and explain the results.

**Standards**

**Fourth Grade Science Standards**

**Standard 4-1** Scientific Inquiry  
**4-1.6** Construct and interpret diagrams, tables, and graphs made from recorded measurements and observations.

**Standard 4-2** Organisms and Their Environment  
**4-2.3** Explain how humans and other animals use their senses and sensory organs to detect signals from the environment and how their behaviors are influenced by these signals.  
**4-2.5** Explain how an organism’s pattern of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).

**Fifth Grade Science Standards**

**Standard 5-1** Scientific Inquiry  
**5-1.3** Plan and conduct controlled scientific investigations, manipulating one variable at a time.  
**5-1.6** Evaluate results of an investigation to formulate a valid conclusion based on evidence and communicate the findings of the evaluation in oral or written form.

**Standard 5-2** Ecosystems: Terrestrial and Aquatic  
**5-2.5** Explain how limiting factors (including food, water, space, and shelter) affect populations in ecosystems.

**Time Frame:**  
60 minutes

**Key Terms:**  
Adaptation  
Foraging  
Serrated  
Herbivore  
Omnivore  
Carnivore

**Materials:**  
- Pliers  
- Rat-tooth forceps  
- Scissors  
- Bag clips  
- Ziploc bags  
- Felt  
- Cardboard  
- Sponges  
- Pop cans  
- Small plastic bottles  
- Buckets  
- Foraging Tally Sheet Diagram (provided)  
- Sea Turtle Mouth & Food Source List (provided)
Depending on the species, sea turtles can be carnivores, herbivores, or omnivores

Carnivorous sea turtles eat meat, including mollusks and crustaceans, while herbivorous sea turtles eat only plants, including algae and sea grasses. Omnivorous sea turtles eat both meat and plants. Throughout their life, sea turtles may change their eating habits. For example, the green sea turtle is carnivorous as a hatching and young juvenile, but evolves into an herbivore when it outgrows the open ocean phases of its youth and recruits into continental shelf habitats to complete its maturation.

Green sea turtles are mainly herbivorous

These sea turtles eat a diet that is mainly sea grasses, sea weed and algae. In terms of mouth structure, green sea turtles have adapted to this food source by having a serrated upper jaw to assist in clipping grasses and other vegetation. Their mouth is primarily adapted for scraping.

Loggerhead sea turtles are omnivores

Loggerheads feed primarily on hard-shelled prey like molluscs and crustaceans; however, they sometimes feed on sea weeds. These sea turtles have very strong and wide upper and lower jaws. This allows them to grab moving prey. They also have bony plates inside their mouth that allow them to crush the shells of their prey, shells that are sometimes very thick and hard (whelk, conch). Their mouth is primarily adapted for crushing.

Hawksbill sea turtles are mainly carnivores

These sea turtles mostly feed on sponges. Scientists refer to them as “spongivores”, which is a very specialized niche in the carnivore world. Interestingly, this turtle feeds primarily on a relatively few species of sponge, even if other species are available. They have also been observed feeding on smaller crustaceans and will, like most sea turtles, consume sea weeds on occasion. Hawksbills have a narrow, bird-like beak. In fact, this feature gives the turtle its name. Their upper jaw protrudes slightly farther than their lower jaw—this allows the turtle to forage in small cracks and reef crevices and to bite pieces from soft sponges. Their mouth is primarily adapted for cutting.

Leatherback sea turtles feed on jellies

Leatherback sea turtles feed exclusively on sea jellies like jellyfish (and their relatives). They have a weak jaw structure and feeding on a hard-bodied food source would greatly damage their mouths. These sea turtles have sharply pointed cusps notched into their upper jaw that allow them to pierce and slice sea jellies, some of which can be very large. Their mouth is primarily adapted for piercing.

There is less competition for food

Since most species of sea turtle are specialized in the type of food that they eat, there is little competition for food among the different species of sea turtle. This is advantageous for sea turtles because, for example, the energy they would otherwise expend competing for food can be utilized elsewhere. However, having a specialized diet does present some risk. If the primary food source were to be depleted, then the animal would be forced to find another food source. The alternative food source might be energetically costly to the turtle because it might have to spend more time looking for it, it might be less nutritious, and/or it might be difficult to eat.
YOU ARE WHAT YOU EAT

Procedure

Warm Up

1. Inform the students that they are going to learn about how animals adapt to a certain food source.

2. Ask the students if they can eat any kind of food. Explain to them that you are talking about physically eating the food, not having to avoid certain foods because they do not like the taste or they are allergic to it. Are there certain foods that humans cannot eat, given our mouth structure?

3. Tell the students to think about eating over their life time. Could they eat hard, crunchy foods when they were babies? Would they be happy eating the exact same thing for every meal?

4. Ask the students if they know what sea turtles eat, or if they can name any physical adaptations that sea turtles might have for eating their favorite prey.

Part I

1. Inform the students that they are going to play a game that simulates how sea turtles eat food. Before doing the activity, draw a Foraging Tally Sheet on the board. An example of the tally is provided in this activity.

2. Divide the students into four groups. Give each student a bucket.

3. Each group of students should form a circle. Place a pile of the same food item in the middle of each circle.

4. Pass out a “mouth” tool to each student. Different mouth tools can be used, but each student in the group should have the same mouth tool.

5. Inform the students that they will have 20 seconds to use their mouth tool to pick up food items from the pile in the middle of their circle.

6. When the students are ready, tell them to start foraging!

7. After 20 seconds has passed, ask the students to count how many pieces of food they were able to collect. Tally the number of food items “consumed” and record this number in the appropriate place on the Foraging Tally Sheet.

8. Remove the food items from the center of the circle and replace them with another type of food.

9. Repeat the same process until each group has experienced each of the various food items and all of the different foods have been utilized.

Part II

1. Review the Foraging Tally Sheet. Ask the students to guess which tool was best for “eating” each of the different types of food. Refer to the Sea Turtle Mouth and Food Source List (provided) for the correct answers.

2. Match the mouth tool with the correct food source. Then, show pictures of the different sea turtles and pictures of their prey. Explain to the students how sea turtles use their mouths (not their hands!) to eat their meals.

3. Discuss with the students why these particular mouth tools were chosen for this activity. Ask the students if they think the tools represented the mouths correctly. Would they suggest different tools next time?
YOU ARE WHAT YOU EAT

Procedure

Wrap Up

1. Discuss with the students the benefits of adapting to a specific food source. Explain that this can help to reduce or even eliminate competition for food among the different species of sea turtles, and ensures that the turtle is able to be efficient in its hunting and foraging.

2. Discuss with the students what would happen if the preferred food source, to which the turtle is best adapted, was depleted. What if pollution killed all the sea grass, boats dropped their anchors on coral reefs, smashing the sponges, or fishing nets were able to remove all the large jellyfish from the sea? What would happen to the sea turtles?

3. Ask the class to think of other animals that have adaptations for eating a particular food source. Birds provide very good examples, as do some specialized mammals (such as an ant eater).

Assessment

1. Quiz the students on the mouth adaptations of sea turtles. Hold up pictures of sea turtle food (prey) items and ask the students to write down which type of sea turtle eats the item, based on the shape of their mouth.

2. Ask the students to predict what might happen if a leatherback at a hard snail, or a green turtle (with a system tuned to digesting vegetables) was fed only fish. As the students to predict what might happen to the hawksbill turtle if pollution killed all the reef sponges. Can they relate man’s actions to the environment, and the organisms that live there?

3. Have the students pretend that new species of sea turtle have been discovered. These turtles utilize different food sources, and therefore do not complete with existing sea turtle species. Tell the students that one species digs in the seabed, foraging in bottom sediments, while another species sucks up smaller marine animals like anemones or snails. Ask the students to conceptualize and draw these new sea turtle species, paying special attention to what kind of mouth would be suitable for eating in one of the environments just described.
## Foraging Tally Sheet

<table>
<thead>
<tr>
<th>Plastic Bag</th>
<th>Felt and Strips of paper</th>
<th>Sponge Pieces</th>
<th>Cans or Bottles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nail File</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scissors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calipers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bag Clip</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This is an example of the table that should be displayed in the classroom for the activity.
Sea Turtle Mouth and Food Source List

A. Green Sea Turtles
   - These sea turtles have shearing jaws and eat mostly algae, seaweeds, and sea grasses
   
   - The nail file represents the jaws of these sea turtles and the felt and pieces of paper represent their food source.

B. Hawksbill Sea Turtles
   - These sea turtles have a mouth that looks like a bird’s beak. Their jaws are adapted for cutting and tearing off pieces of sponge.

   - The scissors represents the jaws of these sea turtles and the sponge represents their food source.
Sea Turtle Mouth and Food Source
List Continued

C. Loggerhead Sea Turtles
- These sea turtles have very strong and wide jaws that help them crush the shells of their hard-bodied prey.

- The chip clip represents the jaws of these sea turtles and the cans and plastic bottles represent their food source.

D. Leatherback Sea Turtles
- These sea turtles have sharply pointed jaws that allow them to feed on jellies.

- The calipers represent the jaws of these sea turtles and the plastic bags represent their food source.
READY, SET, DIVE!

Focus Question:
How do sea turtles compare to humans and to other marine animals in their ability to dive, including dive depth and dive time?

Activity Synopsis
The students will make line graphs using actual scientific data on marine animal dive depth and dive duration (time). From these data, they will determine where the sea turtle “ranks” among breath-hold divers and discuss the importance of dive behavior.

Objectives:
Students will be able to:
1. Construct a line graph using actual data
2. Interpret graphs and results
3. Understand how the environment can affect an organism’s behavior

Time Frame:
60 minutes

Key Terms:
- Dive Depth
- Dive Duration
- The Bends

Materials:
- 2 blank graph sheets
- Diving Data Table (provided)
- Colored pencils
- Rank the Divers Worksheet (provided)

Standards

Fourth Grade Science Standards
Standard 4-1 – Scientific Inquiry
4-1.5 Recognize the correct placement of variables on a line graph.
4-1.6 Construct and interpret diagrams, tables, and graphs made from recorded measurements and observations.

Standard 4-2 – Organisms and Their Environment
4-2.3 Explain how humans and other animals use their senses and sensory organs to detect signals from the environment and how their behaviors are influenced by these signals.
4-2.5 Explain how an organism’s patterns of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).

Fifth Grade Science Standards
Standard 5-1 – Scientific Inquiry
5-1.5 Construct a line graph from recorded data with correct placement of independent (manipulated) and dependent (responding) variables.

Standard 5-5 – Forces and Motion
5-5.5 Use a graph to illustrate the motion of an object.
♦ **Sea Turtle Diving Records**

Sea turtles can make dives that are very deep and dives that are very long. Leatherbacks are champion divers, diving to depths exceeding 1000 meters. In contrast, Kemp’s ridleys rarely reach 50 meters, while olive ridleys have been documented at nearly 300 meters! Other sea turtle species fall somewhere in between, ranging from a maximum recorded depth of 110 meters for green turtles to 200-230 meters for hawksbills and loggerheads. Marine mammals are also accomplished divers, with sperm whales and beaked whales reaching depths that exceed 1500 meters. Certain seal species, including the northern elephant seal, can also dive to 1000 meters or more, while sea lions rarely exceed 100 meters. With a record free dive of 127 meters, humans cannot compete with vertebrates adapted to life in the ocean.

Seal turtles pull air into their lungs by moving their flipper muscles up and down. This motion allows for sea turtles to inhale and exhale. Sea turtles can have dive durations anywhere from 5 minutes to more than an hour. Similarly, sperm whales can remain submerged for approximately 75 minutes and blue whales for 40 minutes. Coming in last, humans can breathhold for 1 to 2.5 minutes.

♦ **Recording Diving Data**

Scientists are able to record dive duration and depth in sea turtles by placing transmitters on them. The transmitter records different types of data, such as location, dive depth and submergence time. The transmitter sends a signal to a satellite, the satellite receives the signal, and then scientists receive the data on their computers. Remote instruments such as these have allowed scientists to discover behavior and characteristics of sea turtles that were once unknown to anyone. These instruments are also used to study other animals, as well.
READY, SET, DIVE!

Procedure

Warm Up

1. Ask the students how deep they can dive. How long can they hold their breath while underwater?

2. Ask students which animal can dive the deepest in the ocean. Can animals that dive the deepest also stay down the longest? Is there a trade-off to deep diving; for example, would an animal that had made a really deep dive perhaps have to rest for a longer period of time before making another dive?

3. Discuss how scientists measure dive depth and submergence time in marine animals. What is the advantage of using remote instrumentation to study animals that live in the ocean?

Activity

Part I
1. Tell the students that they are going to plot real scientific data on a line graph to determine which marine animal can complete the deepest.

2. Pass out graphing paper and a copy of the Diving Data Table to each student. Ask them to identify the x-axis and y-axis on their graph paper.

3. Explain that they will be graphing dive depth – in 100 meter intervals starting with 0 and ending at 1200 meters – on the vertical axis (y-axis). They will be graphing the number of dives (a total of six dives per animal) on the horizontal axis (x-axis).

4. The students should give their graph a title; for example, “Diving Depth of Marine Animals and Humans”.

5. The students should first graph the data for the sea lion. This line should be blue. Proceed as follows: graph the dolphin data (this line should be red), graph average human dive data (this line should be green), graph the loggerhead sea turtle data (this line should be orange), graph

6. A legend box should be included on the graph to show which colored lines are associated with each animal.

Part II
1. Now the students will graph dive duration (submergence time) data for each animal.

2. Create axes similar to the first graph the students made: the vertical (y-axis) should be dive duration and the horizontal axis (x-axis) should be the number of dives (a total of six dives per animal).

3. The students should give their graph a title; for example, “Dive Duration for Marine Animals and Humans”.

4. Have the students graph the data using the same color scheme as in the previous graph.

5. The students should also include a legend depicting which animal each color represents.
READY, SET, DIVE!

Procedure

Wrap Up

1. Ask the students which animal is the deepest diver. Does this surprise them? Why does the leatherback dive to such deep depths?

2. Which animal dove for the longest amount of time? Ask them if they thought the leatherback was also going to be the animal that dove for the longest amount of time. Why is leatherback dive time comparatively short?

Assessment

1. Have the students complete a worksheet where they have to place the animals in order according to how deep they dive.

2. Graph diving data collected on an animal that the students have not previously graphed. Make sure both axes are labeled correctly.
<table>
<thead>
<tr>
<th>Organism</th>
<th>Dive Duration (minutes)</th>
<th>Diving Depth (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea Lion</td>
<td>20</td>
<td>1200</td>
</tr>
<tr>
<td>Loggerhead</td>
<td>20</td>
<td>233</td>
</tr>
<tr>
<td>Human</td>
<td>1</td>
<td>61</td>
</tr>
<tr>
<td>Harbor Porpoise</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Sea Lion</td>
<td>25</td>
<td>250</td>
</tr>
</tbody>
</table>
Rank the Divers Worksheet

A. Depth
1 = the deepest dive   6 = the shallowest dive

Leatherback ______
Harbor Porpoise ______
Sea Lion ______
Loggerhead ______
Human ______
Sperm Whale ______

B. Duration
1 = the longest dive   6 = the shortest dive

Leatherback ______
Harbor Porpoise ______
Sea Lion ______
Loggerhead ______
Human ______
Sperm Whale ______
TURTLE TEMPERATURES

Focus Question:
How does the environment affect the body temperature of a sea turtle, and does the turtle have the ability to modify its body temperature?

Activity Synopsis
Students will set up a demonstration that shows how sea turtles use thermoregulation to modify their body temperature in different environments.

Standards

Fourth Grade Science Standards
Standard 4-1 – Scientific Inquiry
4-1.2 Use appropriate instruments and tools (including compass, an anemometer, mirrors, and a prism) safely and accurately when conducting simple investigations.
4-1.6 Construct and interpret diagrams, tables, and graphs made from recorded measurements and observations.

Standard 4-2 – Organisms and Their Environments
4-2.1 Classify organisms into major groups (including plant or animals, flowering or nonflowering plants, and vertebrates [fish, amphibians, reptiles, birds, and mammals] or invertebrates) according to their physical characteristics.
4-2.3 Explain how humans and other animals use their senses and sensory organs to detect signals from the environment and how their behaviors are influenced by these signals.
4-2.5 Explain how an organism’s patterns of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).

Fifth Grade Science Standards
Standard 5-1 – Scientific Inquiry
5-1.4 Use appropriate tools and instruments (including a timing device and a 10x magnifier) safely and accurately when conducting a controlled scientific investigation.

Standard 5-2 – Ecosystems: Terrestrial and Aquatic
5-2.5 Explain how limiting factors (including food, water, space, and shelter) affect populations in ecosystems.

Objectives:
Students will be able to:
1. Use appropriate tools when conducting a scientific investigation
2. Record and analyze data
3. Define terms endothermic and poikilothermic and group organisms accordingly
4. Understand how the environment affects the organisms living in it and how those organisms adapt to their environment

Time Frame:
60 minutes

Key Terms:
Cold-stunned
Endothermic
Poikilothermic
Strand
Thermoregulation

Materials:
• Coffee cans with lids
• Drinking straws
• Thermometers
• Tape
• Heat lamp
• Tub
• Ice water
• Clay
• Thermoregulation Data Table Worksheet (provided)
• Pens/Pencils
Endothermic Versus Poikilothermic

Endothermic can be defined as having a relatively high and constant internally regulated body temperature, irrespective of the surrounding (ambient) temperature. This term typically refers to mammals and birds. These organisms do not have to behaviorally regulate their body temperature. Poikilothermic is defined as having a variable body temperature that tends to fluctuate with and is similar to or slightly higher than the temperature of its environment. Amphibians, fish, and reptiles are poikilotherms; therefore, sea turtles are poikilothermic. These organisms do not have a constant internal temperature and they can modify their body temperature through behavioral means.

What is Thermoregulation?

Thermoregulation is the maintenance of temperature in a body. Sea turtles and other organisms that are poikilothermic must use certain behavioral mechanisms for thermoregulation in order to regulate their body temperature and maintain an optimal temperature range. If sea turtles become too hot, the heat produced by the movement of their muscles is transported to blood vessels. These blood vessels are oriented vertically and extend to just below the scales. The heat can actually diffuse out of the blood vessels, through the scales, and into the external environment. This process allows sea turtles to decrease their body temperature. If sea turtles are in a cold water environment, they can restrict these blood vessels to impede blood flow. This causes a decrease in the volume of blood that reaches the outer tissues and decreases the amount of heat that is lost to the outside environment.

Behavioral Responses to Temperature

In order to deal with decreases in water temperature during the winter, most sea turtles migrate to warmer waters. However, leatherbacks can withstand colder temperatures because of their large body size and heat capacity. Some species of sea turtles will hibernate in the mud as a means of keeping warm. The mud serves as an insulator and heat loss is decreased. In addition, some species will bask on the surface of the ocean. Staying on the surface allows sea turtles to absorb sunlight, which can raise their internal body temperature. If a sea turtle’s internal body temperature drops too low, the turtle can become cold-stunned. This condition immobilizes sea turtles, and when this happens they often strand themselves on the beach.
TURTLE TEMPERATURES

Procedure

Warm Up

1. Begin talking about body temperature with the students. Does their body temperature stay the same during the day or does it constantly fluctuate? What is the average temperature for humans?

2. Do all groups of organisms have the same temperature? Explain that fish, amphibians, and reptiles are all poikilothermic and birds and mammals are endothermic.

3. Discuss mechanisms that humans and other mammals use to cool off or warm up (i.e. sweating, goosebumps, panting, etc).

4. Explain how amphibians, fish, and reptiles use thermoregulation to control their internal temperature.

Activity

Part I

1. Ask the students to name the group of vertebrates that include sea turtles. Explain to the class that they must use thermoregulation to control their temperature since they are reptiles.

2. Discuss with the class how thermoregulation works in sea turtles.

3. Explain to the students how sea turtle modify their behavior according to the temperature. For instance, they bask to absorb heat and bury themselves in mud to insulate themselves against cold temperatures.

Part II

1. Tell the students that they are going to take part in a demonstration that shows thermoregulation in sea turtles.

2. The first set up will be how sea turtles lose heat. If you can gather enough supplies, have the students create this in groups. Get a coffee can with a lid. In the lid there should be three holes. The holes should be small enough to hold a straw in place.

3. Place a drinking straw in two of the holes. The majority of the straws should be inside the coffee can. In the third hole, place a thermometer. Put tape around the hole of the thermometer to prevent air from escaping.

4. Position a heat lamp above the coffee can and turn it on.

5. Now set up another coffee can with only one hole in the lid. Place a thermometer in this hole and seal the hole around it with tape.

6. Position a heat lamp over this can also.

7. Record the temperature every ten minutes for thirty minutes in the provided data table. The internal temperature of the can with the straws should be cooler than the can without straws.
TURTLE TEMPERATURES

Procedure

Part III

1. Now set up a demonstration on how turtles retain heat. If you let the coffee cans from the previous part of the activity cool down, you can use them over again.

2. Place the coffee can with two holes for straws in a tub of ice water. Again, place the thermometer in the third hole and seal the hole with tape.

3. Place the coffee can without straws in a tub with ice water.

4. Again monitor the temperatures for thirty minutes recording the temperature every ten minutes.

5. After thirty minutes, take the coffee can without straws out of the water. Wrap clay or play-dough around the can. Explain to the students that this is to simulate sea turtles burying themselves in the mud to stay warm.

6. Empty out the water in the tub and fill it with new ice water. Place the can in the tub and let it sit for five minutes.

7. When the five minutes is up, begin monitoring the temperature. Record the temperature every ten minutes for thirty minutes. The temperature inside the can should be higher than in the previous experiment.

Activity Continued

Wrap Up

1. Discuss the results of the demonstration with the students. What was the can with the straws portraying? In the cooling off part of the experiment, why was the can with the straws cooler than the can without?

2. When the cans were placed in cold water, what happened to the cans with the straws in the lid? Was it cooler or warmer than the can without any straws? What did the can without any straws symbolize?

3. What happened to the temperature inside the can when the clay was put around it? Is this a good method for keeping heat inside a turtle?

Assessment

1. On a blank sheet of paper, have the students define the terms poikilothermic and endothermic. They should also give an example of an organism that is poikilothermic and an organism that is endothermic.

2. Ask the students to list ways that sea turtles keep warm.

3. Ask the students to describe how sea turtles can internally regulate their body temperature.
## Thermoregulation Data Table

<table>
<thead>
<tr>
<th>Cans</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 Min</td>
</tr>
<tr>
<td><strong>Warming Temperature</strong></td>
<td></td>
</tr>
<tr>
<td>Can A</td>
<td></td>
</tr>
<tr>
<td>Can B</td>
<td></td>
</tr>
<tr>
<td><strong>Cooling Temperature</strong></td>
<td></td>
</tr>
<tr>
<td>Can A</td>
<td></td>
</tr>
<tr>
<td>Can B</td>
<td></td>
</tr>
</tbody>
</table>
Section 2 References

Biology Corner <www.biologycorner.com/bio1/diffusion.html>


Sea World: The Wild World of Animals <www.seaworld.org>

South Carolina Department of Education <http://ed.sc.gov/agency/offices/cso/>


WordReference.com

Photo References

Caroline Rogers
Karumbe, Sea Turtles in Uruguay
Michael Carey
Microsoft Clipart
Scott Eckert
R. Van Dam
whyfiles.org/f192forensic.anthro/4.html
www.iptek.net.id/ind/pd_invertebrata/images/asteropus_sarassinorum.jpg
SECTION 3

SEA TURTLE LIFE CYCLES
SEA TURTLE FOOD CHAINS

Focus Question:
How is the food chain of sea turtles structured and does this food chain change as sea turtles mature?

Activity Synopsis
The students will construct food chains that exist in the different stages of a sea turtle’s life. They will compare and contrast these food chains and identify the predators and prey as well as omnivores, carnivores, and herbivores. The number of sea turtle predators in the different food chains will be counted and graphed.

Objectives:
Students will be able to:
1. Identify the roles of organisms in food chains
2. Interpret diagrams and collect and graph data from diagrams
3. Define food chains and understand how these change

Standards
Fourth Grade Science Standards
Standard 4-1 – Scientific Inquiry
4-1.6 Construct and interpret diagrams, tables, and graphs made from recorded measurements and observations.

Standard 4-2 – Organisms and Their Environment
4-2.1 Classify organisms into major groups (including plants or animals, flowering or nonflowering plants, and vertebrates [fish, amphibians, reptiles, birds, and mammals] or invertebrates) according to their physical characteristics.
4-2.5 Explain how an organism’s patterns of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).
4-2.6 Explain how organisms cause changes in their environment

Fifth Grade Science Standards
Standard 5-2 – Ecosystems: Terrestrial and Aquatic
5-2.4 Identify the roles of organisms as they interact and depend on one another through food chains and food webs in an ecosystem, considering producers and consumers (herbivores, carnivores, and omnivores), decomposers (microorganisms, termites, worms, and fungi), predators and prey, and parasites and hosts.

Time Frame:
60 minutes

Key Terms:
- Carnivore
- Consumer
- Food chain
- Herbivore
- Omnivore
- Predators
- Prey
- Producer

Materials:
- Cut-out Worksheets (provided)
- Magnets
- Glue
- Graph Paper
Components of Food Chains

Food chains represent how living organisms obtain their food. There are three major components to food chains: producers, consumers, and decomposers. Producers use the energy from the sun to make food. Plants are producers. Consumers eat plants or animals because they cannot make their own food. Animals are consumers. There are three types of consumers: herbivores, carnivores, and omnivores. Herbivores eat only plants while carnivores eat only meat (other animals). Omnivores eat a combination of plants and animals. Decomposers eat decaying matter and help that matter break down. This decaying process puts more nutrients into the soil and then those nutrients are ingested by plants and animals.

Predator and Prey Interactions

In every food chain, there are predator and prey interactions. The predators are those eating the food source and the prey are the food source the predators are consuming. Herbivores are predators to plants. Carnivores are predators to any other animal. Omnivores are predators to both plants and animals.

Sea Turtle Life Stages

Sea turtles go through three major life stages: hatchling, juvenile, and adult. Sea turtles are a part of different food chains at each of these life stages. In addition, their role as a predator and as prey changes as they grow. As hatchlings, they become the prey of raccoons, skunks, crabs, rats, birds, insects, foxes, dogs, and alligators. All of these organisms are considered carnivores since they eat hatchlings. Hatchlings are predators to algae, snails, jellies, Sargassum, and crustaceans. At this stage of their life, sea turtles are omnivores. As juveniles, sea turtles continue to eat a diet that is similar to when they are hatchlings. However, their predators change when sea turtles are juveniles. Sharks and fish prey on juveniles as well as birds. Adult sea turtles eat jellies, crabs, snails, squid, fish, shrimp, sea urchins, algae, sponges, and sea grasses. This makes adult sea turtles omnivores. The predators of adult sea turtles are sharks, alligators, and whales.
SEA TURTLE FOOD CHAINS

Procedure

Warm Up

1. Talk to the students about food chains. Define what a food chain is for the students.

2. Ask the students if they think an animal is a part of different food chains at different stages in the animal’s life.

Activity

Part I

1. Pass out the first cut-out worksheet to the students. Have them cut out the pieces.

2. Cut out the pieces yourself and glue a magnet to the back of them.

3. When the students have finished cutting out the pieces, go over them as a class. Identify the predators and the prey. Identify omnivores, carnivores, herbivores, producers, and consumers. Ask the students where the food chain starts and where it ends.

4. Pass out a blank sheet of paper and instruct the students to put the food chain cut-out pieces in the correct order. The students should draw arrows to show the progression of how organisms are eaten.

5. Using your magnetic pieces, place them in the correct position on a magnetic board.

6. Have the students check their pieces to make sure they are placed correctly. Once they have checked the placement of their pieces have them glue down the pieces.

7. Repeat this process with the second and third food chains.

Part II

1. When the students have completed the food chains, inform them that they are now going to look at how the number of predators changes throughout the stages of a sea turtle’s life.

2. Pass out the graph paper to the students. Make a list of all of the predators of hatchlings on the board. Do the same for juveniles and adults. Help the students label the graph correctly. The x-axis should be “Hatchling Stages” and the y-axis should be “Number of Predators.”

3. The students should count the number of predators at the first stage of a sea turtle’s life. A bar should be drawn on the graph to represent this number. Have the students count the number of predators at the second and third stages of a sea turtle’s life. The students should mark these two numbers on the graph by drawing bars.
**SEA TURTLE FOOD CHAINS**

**Wrap Up**

1. Ask the students to describe the different food chains. What stays the same in the food chains? What changes?

2. Discuss the predator graph with the students. Does the number of predators increase or decrease as the sea turtles mature? How does this affect sea turtle populations?

3. Ask the students why sea turtles are still threatened even though they do not have a lot of predators. Have them identify other threats to sea turtles besides natural predators.

**Assessment**

1. Develop a quiz for the students about the food chains that include sea turtles.

2. The quiz should have the students identify predators and prey of sea turtles. It should also test the students knowledge of carnivores, omnivores, herbivores, producers, and consumers.

3. Ask the students to identify when sea turtles have the least amount of predators and when they have the most predators.
Hatchling Food Chain Cut-outs

Juvenile Food Chain Cut-outs
Adult Food Chain Cut-outs
Focus Question: What organisms make up a Sargassum ecosystem and what are the characteristics of this habitat?

Activity Synopsis
In this activity, students will learn about the organisms living in a Sargassum ecosystem by transforming the classroom into one. They will also construct the food web that exists within this ecosystem.

Objectives:
Students will be able to:
1. Identify characteristics of an ecosystem
2. Define the different roles in a food web
3. Plot coordinates on a map

Time Frame:
60 minutes

Key Terms:
- Food Web
- Sargassum

Materials:
- A Sea Within A Sea
- Construction paper
- Scissors
- Glue
- Colored pencils
- Ball of yarn
- Name tags
- Sargassum Creature Pictures (provided)

Standards

Fourth Grade Science Standards
Standard 4-2 — Organisms and Their Environment
  4-2.1 Classify organisms into major groups (including plants or animals, flowering or nonflowering plants, and vertebrates [fish, amphibians, reptiles, birds, and mammals] or invertebrates) according to their physical characteristics.
  4-2.5 Explain how an organism’s patterns of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).
  4-2.6 Explain how organisms cause changes in their environment.

Fifth Grade Science Standards
Standard 5-2 — Ecosystems: Terrestrial and Aquatic
  5-2.2 Summarize the composition of an ecosystem, considering both biotic factors (including populations to the level of microorganisms and communities) and abiotic factors.
  5-2.4 Identify the roles of organisms as they interact and depend on one another through food chains and food webs in an ecosystem, considering producers and consumers (herbivores, carnivores, and omnivores), decomposers (microorganisms, termites, worms, and fungi), predators and prey, and parasites and hosts.

  Standard 5-3 — Landforms and Oceans
  5-3.5 Compare the movement of water by waves, currents, and tides.
♦ **Sargasso Sea**

The Sargasso Sea is located between Florida and the Azores in the southwestern North Atlantic Ocean. The Gulf Stream and the North Equatorial Current encircles the Sargasso Sea and this causes it to flow in clockwise, circular drift. Warm water gets pushed into the center of this sea from the currents. The rotation of this sea causes the center to be approximately 1 meter above the level of the surrounding water! This sea gets its name from the brown seaweed that is found here in great masses.

♦ **Loggerhead Hatchlings and the Sargasso Sea**

Loggerhead hatchlings leave the beach and swim towards the Sargasso Sea. These turtles float in big mats of the *Sargassum* and eat animals that inhabit the seaweed. These hatchlings have also been observed lying motionless in the floating mats. The brown color of loggerhead hatchlings provides good camouflage in this environment as well. Scientists believe that this is where loggerhead hatchlings spend their “lost years.” The lost years refer to the time period between a turtle’s hatching and its return to coastal waters as juveniles.

♦ **Sargasso Sea Ecosystem**

The Sargasso Sea has many other inhabitants besides hatchlings. There are crabs, shrimp, and even freshwater eels that migrate there to breed and lay eggs. The majority of the creatures found in floating mats of *Sargassum* have adapted a body form and coloration that helps them blend in to their environment. *Sargassum* fish have many appendages extending from their body that are shaped like seaweed.

♦ **Sargassum Food Web**

The hatchlings and other organisms that make up these floating mats of seaweed are part of a large food web. The seaweed itself provides a food source for the hatchlings and other small invertebrates that live within these mats. Marine insects also provide food the organisms previously mentioned as well as fish. Larger fish species such as Jacks and Dolphin Fish hunt around these mats for hatchlings and other sources of prey.
SARGASSUM SHELTER

Procedure

Warm Up

1. Tell the class that they are going to be learning about a type of algae called Sargassum. Explain to the students how it accumulates into large masses and show them the location of the Sargassum Sea.

2. Discuss how these large floating mats of algae create an environment that supports an ecosystem. In addition, explain how important this environment is to sea turtles and why they call this stage of their life cycle the “lost years.”

3. Have the students read A Sea Within a Sea by Ruth Heller. Using pictures, identify the organisms present in these floating ecosystems.

Activity

Part I
1. Tell the students that the classroom is going to be turned into a Sargassum ecosystem.

2. The teacher will be responsible for making the Sargassum and the students will make all of the organisms found here.

3. Look at the pictures of the organisms that live in the Sargassum. Ask the students to make observations about them.
   - Are the organisms similar in color? Why would this help the animal?
   - Do they have extra appendages on them? What would their purpose be?
   - Talk about the shading of the sea turtle hatchlings. How does this help them survive in the Sargassum?

4. Assign each student an organism. The list of organisms below all live in the Sargassum ecosystem. Have the students construct their animal.
   - A. Sargassum fish
   - B. Flying fish
   - C. Pipefish
   - D. Nudibranch
   - E. Sargassum crab
   - F. Freshwater eel
   - G. Juvenile loggerhead sea turtle
   - H. Dolphin fish
   - I. Jack
   - J. Sargassum shrimp

5. Hang the Sargassum from the ceiling and attach the organisms to it.

Part II
1. Now explain to the students that they are going to construct a food web for the Sargassum ecosystem.

2. Have the students research the organism they created. The students should research what eats their organism and what their organism eats. Go over this information with them to make sure it is correct. This information should be shared with the entire class.
Part II Continued

3. When the students are comfortable with this information, the food web can be constructed. Have them make a simple name tag identifying what animal they have researched. Have the students stand up and form a circle.

4. You (the teacher) should include yourself as Sargassum. Start the ball of yarn with you. Pass the yarn to a student representing an animal that would eat you. Continue on in this manner until every student is included in the web.

5. Be sure to point out to the students how every organism is connected. A reverse of the food web can be done in order to emphasis how important each organism is to the overall survival of the ecosystem. This is done simply by removing an organism and then asking what effect this would have on other organisms.

Wrap Up

1. Have the students pretend they are juvenile loggerheads hanging out in the floating Sargassum. Since there is little information about what happens in the “lost years,” the students should write a story about being a juvenile loggerhead in the Sargassum.

2. The students should include other creatures they encounter, what they eat, when/how they sleep, what they’ve seen, what part of the Atlantic they are in, etc.

3. These stories could be compiled and made into a class book so everyone can read them.

Assessment

1. The stories can be the assessed to ensure accurate information about the topic that was presented.
Sargassum Creatures

Sargasso Sea

Sargassum Fish

Flying Fish

Pipefish

Nudibranch
**LOGGERHEAD BEHAVIOR**

**Focus Question:**
Does the location and movement of sea turtles indicate whether they are eating, nesting, or migrating?

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**Activity Synopsis**
The students will plot coordinates for three tracked sea turtles and determine their behavior based on the location and the movement of the tracks.

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**Objectives:**
Students will be able to:
1. Plot coordinates on a map
2. Identify the geological regions of the Atlantic ocean floor
3. Understand how locations and movements of animals can indicate their behavior

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**Standards**

**Fourth Grade Science Standards**

**Standard 4-1** – Scientific Inquiry
4-1.6 Construct and interpret diagrams, tables, and graphs made from recorded measurements and observations.

**Standard 4-2** – Organisms and Their Environment
4-2.5 Explain how an organism’s patterns of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).

**Fifth Grade Science Standards**

**Standard 5-3** – Landforms and Oceans
5-3.2 Illustrate the geological landforms of the ocean floor (including the continental shelf and slope, the mid-ocean ridge, rift zone, trench, and the ocean basin).

**Standard 5-5** – Forces and Motion
5-5.5 Use a graph to illustrate the motion of an object.

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**Time Frame:**
60 minutes

**Key Terms:**
Foraging

**Materials:**
- Sea Turtle Coordinate Worksheet (provided)
- Map of Eastern U.S. Worksheet (provided)
- Colored pencils
- Ocean Regions Worksheet (provided)
- Region Descriptions (provided)
♦ **Satellite Tracking**  
Scientists are able to observe the movements of sea turtles through the use of satellite tracking devices. A satellite transmitter that can continually record the location of a sea turtle is placed on its carapace. The transmitter sends a signal to a satellite, a satellite receives the signal, and then scientists receive the data on their computers. These data points can be plotted onto maps in order to determine the location of the turtle. This helps scientists in conservation efforts because satellite tracking can reveal areas of the ocean that are critical sea turtle habitat.

♦ **Three Major Ocean Regions**  
Sea turtles occupy three major regions of the ocean – the beach, coastal waters, and the open ocean. The beach regions range from the high tide line to the low tide line. The coastal waters are the area from the coastline to the edge of the continental shelf. The third region, the open ocean, is the area beyond the continental shelf.

♦ **Sea Turtle Behavior**  
Sea turtles display different types of behaviors in each of these regions. When turtles are on beaches they are either nesting or stranded. In some instances, sea turtles will come onto the beach to bask, but this is not a common behavior among all sea turtles. Sea turtles that are swimming in coastal waters are usually foraging. Since most of the sea grass beds and coral reefs are located in this region, the sea turtles spend their time in this region looking for food. Female sea turtles also inhabit this region when they are looking for nesting beaches. In the open ocean, sea turtles are completing migrations. These migrations can span entire oceans. When scientists look at the satellite tracks of sea turtles, they often note which oceanic region they are occupying. This gives them insight as to what sea turtles are doing in these areas.
**Loggerhead Behavior**

**Procedure**

**Warm Up**

1. Ask the students if they know how scientists know where sea turtles travel. Explain to them that their our devices that can be put on sea turtles in order to track where they swim.

2. Ask the students if they think turtles swim all over the ocean or if they only stay in one area.

3. Discuss with the students the fact that sea turtles usually inhabit certain areas of ocean for certain reasons. For instance, sea turtles only go to the beach to lay their eggs.

**Activity**

**Part I**

1. Inform the students that they will be plotting the location of sea turtles using satellite data and determining their behavior from their location in the ocean.

2. Pass out copies of the coordinate worksheet and the map worksheet to each student.

3. Demonstrate how to plot map coordinates by drawing a grid on the board or on an overhead projector.

4. Instruct the students to plot the three different sets of coordinates on the map. The sets of coordinates represent a different turtle so the students should plot each set in a different color. The students should also indicate which color belongs to each set of coordinates.

5. When the students have completed this step pass out the map that shows the different geological regions of the ocean off the coast of South Carolina to each student. The students should draw these boundaries on their maps and label them.

6. On the back of the geological map there is a description of the activities a sea turtle is participating in while in certain regions. The students should read this description and determine the activities of the sea turtles that they plotted based on their locations and movements. For example, the sea turtles will be nesting, eating, or migrating.
Wrap Up

1. Have the students make up their own set of map coordinates for a sea turtle. The map coordinates should be designed so that the path of the sea turtle indicates that it is eating, nesting, or migrating.

2. When the students finish developing their own coordinates they should trade with another student and plot the coordinates on their map.

Assessment

1. Ask the students to go to the SeaTurtle.Org website (www.seaturtle.org). This site has many different maps with different satellite tracked sea turtles.

2. Pick out a couple turtles beforehand and have the class go to these maps. The students should look at the tracks and determine what the different sea turtles are doing based on the regions they are occupying.

3. To challenge the students, have them look at maps other than the Eastern United States coastline.
# Sea Turtle Coordinates

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<td>31°W</td>
</tr>
<tr>
<td></td>
<td>79°N</td>
<td>32°W</td>
</tr>
</tbody>
</table>
Map of Eastern United States Worksheet
Ocean Regions

- Open Ocean
- Coastal Waters
- Beaches
Descriptions of Ocean Regions

1. Beaches

When turtles are on beaches, they are either nesting or stranded on the beach. Occasionally, sea turtles will bask on the beach. However, this is not common behavior among all sea turtles.

2. Coastal Waters

Sea turtles swimming in coastal waters spend most of their time foraging. Sea grass beds and coral reefs are present in coastal waters and sea turtles find most of their food in these places.

3. Open Ocean

When turtles are in the open ocean they are usually migrating. Their migrations can span entire oceans.
Focus Question: Do sea turtles inhabit the same ecosystem or are they a part of different ecosystems throughout their lives?

Activity Synopsis

The students will listen to a story about the travels of a loggerhead sea turtle and they will attempt to identify the different ecosystems the sea turtle occupies. They will then construct ecosystem wheels that provide the students with information about the ecosystems that sea turtles occupy throughout their lives. The students will learn the importance of identifying these ecosystems and habitats for sea turtle conservation efforts.

Objectives:
Students will be able to:
1. Define the terms ecosystem and habitat
2. Compare different ecosystems and habitats
3. Explain how the characteristics of ecosystems and habitats influence the types of organisms found in each

Standards

Fourth Grade Science Standards:
Standard 4-2 – Organisms and Their Environment
4-2.2 Explain how the characteristics of distinct environments (including swamps, rivers and streams, tropical rain forests, deserts, and the polar regions) influence the variety of organisms in each.
4-2.5 Explain how an organism’s patterns of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).

Fifth Grade Science Standards:
Standard 5-2 – Ecosystems: Terrestrial and Aquatic
5-2.2 Summarize the composition of an ecosystem, considering both biotic factors (including populations to the level of microorganisms and communities) and abiotic factors.
5-2.3 Compare the characteristics of different ecosystems (including estuaries/salt marshes, oceans, lakes and ponds, forests, and grasslands).
5-2.4 Identify the roles of organisms at they interact and depend on one another through food chains and food webs in an ecosystem, considering producers and consumers (herbivores, carnivores, and omnivores), decomposers (microorganisms, termites, worms, and fungi), predators and prey, and parasites and hosts.

Time Frame: 60 minutes

Key Terms:
Ecosystem
Habitat
Intertidal Zone
Migratory
Neritic Zone
Oceanic Zone

Materials:
- Brads
- White paper
- Notebook paper
- Crayons/colored pencils
- Loggerhead Journey Story (provided)
- Ecosystem Wheel Worksheet (provided)
- Ecosystem Assessment Worksheet (provided)
♦ **Ecosystems**

An ecosystem is a natural unit that includes living and nonliving parts interacting to produce a stable system in which the exchange of materials between living and nonliving parts follows closed paths. Ecosystems can be defined by biological interactions and physical interactions. Examples of biological interactions would be predation or competition, while physical interactions could consist of nutrient cycling or energy sources.

♦ **Marine Ecosystems**

There are many different marine ecosystems and sea turtles occupy many of these ecosystems. The ecosystems that sea turtles inhabit can be divided into three different zones – the intertidal zone, the neritic zone, and the oceanic zone. The intertidal zone is between the highest high tide point and the lowest low tide point on a shoreline. Within this zone, sea turtles occupy two different ecosystems: beaches and estuaries. The next zone that sea turtles occupy is the neritic zone. This is the areas of open water that are over the continental shelves. The ecosystems that sea turtles inhabit in this zone are sea grass beds and coral reefs. The oceanic zone is the areas of open water away from the shore that are past the continental shelf. Sea turtles inhabit the *Sargassum* Sea and the open ocean ecosystems, and these ecosystems are included in the oceanic zone.

♦ **Sea Turtles in Marine Ecosystems**

When sea turtles are hatchlings they emerge onto the beach ecosystem and then swim through the coral reef and sea grass bed ecosystems as they make their way to the *Sargassum* Sea ecosystem. Once they have matured, they leave the *Sargassum* Sea ecosystem and venture into the open ocean ecosystem. Sea turtles continue to travel between the open ocean ecosystem and the coral reef, sea grass bed, and estuary ecosystems throughout their entire lives. They inhabit coral reefs, sea grass beds, and estuaries to forage. When females are ready to deposit their eggs, they return to the beach ecosystem.

♦ **Conservation Efforts**

The highly migratory behavior of sea turtles is an important factor in their conservation. Since they inhabit many different ecosystems, it is crucial that all of these different ecosystems are protected. Conserving one ecosystem while allowing the degradation of others would ultimately be ineffective and it would not protect sea turtles. In turn, a decrease in sea turtles would also be harmful to these ecosystems. Sea turtles are an integral part of the ecosystems they inhabit, and their removal would cause the structure of these ecosystems to change.
Warm Up

1. Explain to the students the definition of an ecosystem. Give the students examples of different types of ecosystems.

2. Explain to the students the ocean is categorized into three different zones and that the ecosystems that sea turtles occupy are included in these zones.

3. Discuss with the students how ecosystems can change. Ask the students if animals stay in the same ecosystem their whole lives. Do they inhabit different ecosystems?

4. Explain to the students that sea turtles inhabit different ecosystems throughout their lives.

Activity

Part I

1. Pass out copies of the “Loggerhead Journey” story to each student. The students should also have a blank piece of notebook paper.

2. Inform the students that they must listen to the story and try to pick out all of the different ecosystems that sea turtles occupy.

3. Read the story out-loud to the class and have the students follow along. Alternatively, the students could read the story individually.

4. While listening or reading the story, the students should write down the different ecosystems that the students find in the story.

Part II

1. Pass out the ecosystem wheel worksheet to the students. Have the students color the wheel according to the directions.

2. Pass out one brad to each student so that the students can put the wheel together. The smaller circle should go on the larger circle and the brad should be placed through the center of the circles.

3. Once the students have completed their wheel, they should study the information on the wheels.

4. Have the students go back to the story and find any ecosystems that they may have missed. All of the ecosystems identified on the wheels are included in the story. They should also check to make sure the ecosystems that they previously identified are correct.

5. When the students have identified all of the ecosystems ask them to figure out which zone includes these ecosystems. This information can be gathered from the wheel.

6. When the students are finished write the three different marine zones on the board. Then, write the ecosystems that can be found within these zones.
SEAWORTHY SEA TURTLE ECOSYSTEMS

Wrap Up

1. Discuss with the students the different ecosystems that sea turtles occupy.

2. Ask the students why this is important for the conservation of sea turtles. Would only protecting one ecosystem help sea turtles? Do all of the ecosystems they occupy need to be protected?

3. Discuss with the students why it is important to collaborate in sea turtle conservation.

Assessment

1. Have the students research where sea turtles go that are born in other parts of the world. They could write their own stories about the journey of sea turtles born in different regions.

2. The students could research other animals that occupy different ecosystems. Highly migratory birds would be a good example.
Loggerhead Journey

The sun was now well below the horizon and the night was taking over. The darkness cooled the temperature and a slight breeze blew across the beach. A small depression in the sand began to crack. The fracture got wider and wider as the waves slowly crept up the shore. Finally, a small, dark flipper popped out of the sand and a frenzy began. All at once, hatchling loggerheads began emerging from their hole in the sand. Instinctively, the tiny sea turtles made their way down the beach towards the water’s edge. The gentle sound of flippers slapping against the beach got louder as more hatchlings made it out of the nest. A large wave crashed onto the shore and the hatchlings felt water for the first time. The first hatchling that clambered out of the nest instantly began swimming as the wave carried it out into the churning waters. This was the beginning of its journey across the ocean and back again.

The hatchling continued to swim for nearly three days. It knew that it could not stop until it reached the safety of the open ocean. While it swam to the open ocean, it passed over fields of grass growing from sandy bottoms, and the hatchling noticed large clusters of corals bustling with all different types of sea creatures! However, it didn’t stop to explore these fascinating places; it just kept swimming. Finally, when the hatchling felt like it could swim no more, it saw a large brown floating mass just ahead. The little turtle saw over to it and found all kinds of life hanging in the mass and swimming underneath it. There were fish, crabs, and tiny insects all around it. The floating mass was large amounts of seaweed called Sargassum. This seaweed was the perfect place for the hatchling to rest and eat after its journey from land. It nestled into the seaweed and took a nap. The hatchling had found a place to stay for quite some time. The seaweed floats along in a big circle that stretches across the Atlantic Ocean. As it travels, all of the inhabitants get carried along with it. The hatchling will stay here as it grows.

The sea turtle stayed in the seaweed for a long time. One day, when it was about the size of a dinner plate, the turtle decided to venture away from the seaweed. As it swam, it plucked jellies out of the water for food. It continued swimming until it came upon another large group of coral. It decided to swim down to find a nice resting spot among the rigid structures. Some fish swam up to it and nibbled on its shell, but the turtle did not seem to mind. When the fish were no longer interested in the turtle’s shell, it nestled under some coral and went to sleep. After awhile, the turtle decided to go looking for some food. It left the coral and ventured over a large area that was covered in grass dancing in the waves. The turtle noticed a whelk slowly moving on the sandy bottom. This whelk looked like good food to the turtle, so it dove down and grabbed the whelk in its powerful jaws. This was a good place for the turtle, and it stayed around these waters for many, many years.
Almost thirty years had passed since the turtle first emerged onto the beach. The turtle knew it was time to venture back to where it had first been born. However, it was going to be a long journey back – it was going to have to swim across the entire Atlantic Ocean! It set out across the Atlantic swimming slow and steady. Along the way, it would stop to rest. Sometimes, it floated at the surface to rest and bask in the warm sun. Soon, the turtle could no longer see any type of bottom. It was heading over the deep, open ocean. The turtle kept swimming and swimming and swimming. The turtle continued its journey for many, many months. It began to the bottom of the ocean again, and it even started to see coral and grass. The turtle was close to where it first ventured out into the ocean. It wanted to find some food, so it headed up a shallow channel in search of crabs or whelks. The water was calmer in this channel since it stretched inland. It found some food, and then it ventured back out into the coastal waters. The turtle was now very close to the beach it, but it waited until the sky grew dark before it started to crawl up the beach. As a wave rolled onto the shore, the turtle swam along with it. It felt the scratchy sand beneath it, and the turtle knew it had reached its destination. The turtle pulled itself up the beach with all its might until it found a nice spot to begin digging. After a while, there was a hole in the sand and white, round eggs began to plop into it. When all of the eggs were in the hole, the turtle began to cover the eggs with sand until the hole was no longer visible. Once the task was complete, the turtle slowly crawled back down the beach. With one last push, the turtle slipped back into the water leaving its eggs to incubate in the sand. In a couple months, those eggs would hatch and new loggerhead journeys would begin.
Instructions

1. Color the beach and estuary section red. Color the Intertidal section red.

2. Color the seagrass beds and coral reefs yellow. Color the neritic section yellow.

3. Color the open ocean blue.

4. Cut out both circles.

5. Cut out the rectangles on the smaller circle

6. Place the smaller circle over the bigger circle and place a brad in the center of the circles. Now the top circle should turn on top of the bottom circle.

6. Match-up the colors to determine which zone the different ecosystems are in.
Focus Question:
Do hatchlings need care from their mother when they are born, or are they born ready to survive on their own?

Activity Synopsis
The students will play a game that allows them to explore the difference between animals that take of their young and those that do not. By playing the game, the students will understand the benefits and costs associated with each parental method.

Standards

Fourth Grade Science Standards:
Standard 4-2 – Organisms and Their Environment
4-2.3 Explain how humans and other animals use their senses and sensory organs to detect signals from the environment and how their behaviors are influenced by these signals.
4-2.4 Distinguish between characteristics of an organism that are inherited and those that are acquired over time.

Fifth Grade Science Standards:
Standard 5-1 – Scientific Inquiry
5-1.6 Evaluate results of an investigation to formulate a valid conclusion based on evidence and communicate the findings of the evaluation in oral or written form.

Standard 5-2 – Ecosystems: Terrestrial and Aquatic
5-2.5 Explain how limiting factors (including food, water, space, and shelter) affect populations in ecosystems.

Standard 5-3 – Landforms and Oceans
5-3.6 Explain how human activity (including conservation efforts and pollution) has affected the land and the oceans of Earth.

Objectives:
Students will be able to:
1. Define the terms precocial and altricial
2. Understand the difference between inherited traits and acquired traits
3. Explain the ecological importance of an animal to a food chain or food web

Time Frame:
60 minutes

Key Terms:
Altricial
Clutch
Precocial

Materials:
- 60 paper squares
- Computers (optional)
- Ropes
- Open space (indoor or outdoor)
**Hatchlings Are Born Ready**

♦ **Altricial vs Precocial**

An animal is considered altricial when it needs a lot of care to develop. An altricial animal is born in an underdeveloped state. The animal cannot feed or care for itself. Also, the animal cannot move around on its own immediately after birth. Therefore, the female, male, or both must invest time and energy into rearing the young animal. For instance, many bird species are considered altricial. Herons, hawks, woodpeckers, and owls are a few examples. An animal is precocial when it is born either semi-independent or completely independent. Precocial animals do not require a lot of parental care. They are mobile and able to forage for themselves at birth. Camels, horses, and sheep are considered precocial animals.

♦ **Sea Turtle Hatchlings are Precocial**

When a female sea turtle deposits her eggs, covers them up with sand, and then leaves them on the beach for good. She does not stay on the beach until they hatch or take care of them once they hatch. When the hatchlings emerge from the eggs, they are capable of surviving on their own. They are born knowing how to take care of themselves – this is known as inherent behavior.

♦ **Benefits and Costs**

In precocial animals, the female must be able to obtain an abundant amount of food in order to produce eggs rich in energy. A yolk sac is the part of the egg that provides nutrients to the young. Precocial eggs must have a very energy-rich yolk sac because the young must undergo a longer development period in the egg so that they can hatch and be self-sufficient. Therefore, the female has to have an abundant food source in order to have enough energy to produce a very energy-rich yolk sac for all of the eggs. An altricial animal expends more energy after birth because she must feed and protect her offspring. Being precocial allows sea turtles to deposit multiple clutches in one breeding year. This enables them to produce more eggs than an altricial animal. Producing more eggs increases the probability that her offspring will survive to adulthood. Altricial animals invest a large amount of energy in teaching their offspring, and so these animals tend to produce fewer offspring. However, these animals invest a lot of energy into teaching their young to feed and protect themselves, which allows the young to be successful in survival.

♦ **Could Adults Take Care of Hatchlings?**

Since sea turtles spend the majority of their lives in the water, it would be impossible for female sea turtles to spend time on land incubating the eggs and taking care of hatchlings. The female turtle would most likely dehydrate, but she would also have trouble finding enough food to keep her alive. Staying on land would expose her to a greater level of predation as well. The physical limitations that sea turtles endure make it impossible for sea turtles to care for their hatchlings.

♦ **Inherent Behavior and Human Pressures**

Sea turtles have exhibited these behavioral patterns since they first appeared on Earth. This inherent behavior that all sea turtles are born with has not changed, and it has allowed them to be successful in their survival until relatively recently. Therefore, this signifies that their decline has been caused by external forces; it has not been their own behavior. Humans have been the greatest external pressure. The direct take of these animals, the decrease in nesting habitats, and the interactions with fisheries has greatly affected their survival. Global changes in the environment may also hinder sea turtle survival. Temperature fluctuations in both the air and the ocean could cause changes in the oceanic environment and the inherent behavior of sea turtles may not change quickly enough to ensure survival.
Warm Up

1. Ask the students if humans can survive on their own when they are first born. Can newborns get food for themselves? Do they know how to crawl or walk?

2. Discuss with the students that not every organism has to be cared for when young. Some animals are born with the ability to survive on their own. Sea turtles have this ability.

3. Talk to the students about why this is important for the survival of sea turtles. What would happen if sea turtles needed to receive care when they are born?

Activity

Part I

1. Before the activity begins, cut out small paper squares. Put an X on the back of 25% of the squares. These squares will represent food for sea turtles. Scatter the pieces of paper around the area that the game is going to be played.

2. The playing area should also be divided into 3 different sections: a beach, foraging grounds, and the Sargassum Sea.

3. Tell the students that they are going to act out what it’s like to be a hatchling by playing a game. Some hatchlings will have to take care of themselves and others will have to have their mothers take care of them.

4. Have the students break into two teams. The students should designate a mother for each group.

5. The objective of the game is to be the first team to get the greatest number of hatchlings to the Sargassum Sea in the time frame given. Designate a “Team A” and a “Team B.”

6. The mother in Team A just has to deposit her eggs on the beach and leave for the foraging grounds. The mother cannot return to the beach to lay another clutch of eggs until she has found 10 pieces of “food.” The hatchlings must count to 5 before they can leave the beach and head for the Sargassum Sea. The hatchlings can swim straight to the Sargassum Sea because they have their yolk sacs to nourish them while they swim. When the mother has found enough food she can return to the beach. When all of the hatchlings have made it to the Sargassum Sea, they can then return to the beach.

7. The process then starts all over again. When the hatchlings return to the beach, they represent a new clutch that has been laid by the female sea turtle. Again, the mother can leave and find food, but the hatchlings must count to 5 before they can leave to journey to the Sargassum Sea. Each student should keep track of how many times he/she made it to the Sargassum Sea.
Part I Continued

8. The mother in Team B cannot leave immediately after depositing her eggs. She must wait until the hatchlings count to five and then she can begin to look for food. However, she has to look for food for both the hatchlings and herself. The mother turtle in this group must find five pieces of food for each hatchling. If sea turtles had to take care of their young, it is unlikely that the eggs would develop a large yolk sac for the hatchlings. Therefore, the hatchlings will need more nutrients and energy to survive the swim. Once she has collected the food for the hatchlings, then the hatchlings and the mother can move into the ocean together. However, the hatchlings must follow the female around until she finds fifteen pieces of food for herself. Then, she can lead her hatchlings to the Sargassum Sea. Once they have all made it, they can come back to the beach and start over again. Each student should keep track of how many times he/she made it to the Sargassum Sea.

9. Give the students about 15 minutes to play this game. After the time is up, have the students come back together as a group.

Wrap Up

1. Discuss with the students which scenario they think is best for sea turtle survival. Which team had more success?

2. Discuss how this behavior towards young helps sea turtles survive. Explain that the female turtle does not have to expend as much energy taking care of her young. That is why the mother turtle in Team B had to find more food than the mother turtle in Team A. The Team B mother needed more energy because she had spent some much while taking care of her hatchlings.

3. Discuss the reality of this parental behavior. Could sea turtles actually take care of their young?

4. Talk to the students about how sea turtles have been surviving since prehistoric times. Why are sea turtle populations only recently declining in numbers? Discuss how they are behaving in the same manner they did in prehistoric times, but now they are facing many more human threats.

Assessment

1. Have the students research an animal that takes care of its young and an animal (besides a sea turtle) that does not.

2. The students should list the advantages and disadvantages to both of these methods.
SOLE SURVIVORSHIP

Focus Question:
Do sea turtles have the same amount of predators throughout their entire lives, and how do humans act like predators on sea turtles?

Activity Synopsis
The students will simulate the natural predation that sea turtles endure throughout different stages in their lives. The amount of human “predation” at the different life stages of sea turtles will also be simulated. These amounts will be graphed and compared in order to determine the impact that humans have on the survival of sea turtles. They will learn why knowing the life history of an animal is important to conservation efforts.

Objectives:
Students will be able to:
1. Explain how humans affect populations of sea turtles
2. Understand the relationship between predators and prey
3. Define the meaning of a life history and understand why it is important to the management of a species

Standards
Fourth Grade Science Standards:
Standard 4-2 – Organisms and Their Environment
  4-2.6 Explain how organisms cause changes in their environment

Fifth Grade Science Standards:
Standard 5-2 – Ecosystems: Terrestrial and Aquatic
  5-2.2 Summarize the composition of an ecosystem, considering both biotic factors (including populations to the level of microorganisms and communities) and abiotic factors.
  5-2.5 Explain how limiting factors (including food, water, space, and shelter) affect populations in ecosystems.

  Standard 5-3 – Landforms and Oceans
  5-3.6 Explain how human activity (including conservation efforts and pollution) has affected the land and the oceans of the Earth.

Time Frame:
60 minutes

Key Terms:
Life History

Materials:
- Clear cups
- Markers
- Beads (2 different colors)
- Graph paper
- Pencils
- Colored Pencils
- Sea Turtle Predator Graph (provided)
♦ **What is a Life History?**

An organism’s life history describes its physiological characteristics and behavior traits. The life history of an organism is usually defined by its maturational and reproductive characteristics. Life histories are important because they allow scientists to understand the behaviors of individuals; they can be fairly certain how an animal will behave in its lifetime. Life histories are also very helpful for management and conservation purposes. Understanding the life history of an organism can help identify the most crucial stages to the life of that individual and the rest of the population. The crucial stage is where the organism would need the most protection. From this information, one would be able to determine at what stage individuals can be harvested in a sustainable manner.

♦ **Life History of Sea Turtles**

Sea turtles are late maturing creatures, and thus they are slow growing. They have a high juvenile mortality rate that is naturally caused by a large amount of different predators. However, as they grow and mature the number of natural predators that prey on sea turtles decreases. When sea turtles make it to adulthood, there is little mortality. Sea Turtles also have high fecundity. This means that sea turtles have a high rate of reproduction. In one season, sea turtles can lay multiple clutches, and each clutch averages around 100 eggs. Since the survival rate of juveniles is low (only 1 in 1000 sea turtles make it to adulthood), it is very important to lay a large amount of eggs in order to keep the population growing or stable.

♦ **Natural Predators of Sea Turtles**

a.) **Eggs and Hatchlings**

- raccoons, skunks, crabs, insects, rats, birds, foxes, dogs, and alligators.

b.) **Juveniles**

- sharks, fish, and birds

c.) **Adults**

- sharks, alligators, and whales

♦ **Human Predation on Sea Turtles**

a.) **Eggs and Hatchlings**

- poaching, artificial lighting, beach development, and pollution

b.) **Juveniles**

- pollution, fishing, boat strikes

c.) **Adults**

- poaching, artificial lighting, beach development, pollution, fishing, boat strikes

♦ **Human Impacts on Sea Turtles**

Although sea turtles do not have many natural predators when they are adults, they have another type of predator – humans. In fact, humans impact sea turtles at every stage of their life. Humans impact the number of eggs hatched because poaching of eggs (taking eggs from the nest) occurs in various regions in the world. In addition, to taking the eggs, the nesting female is killed and used as a food source or for various other products. Adults are also affected by fishing and often become bycatch. The life history of sea turtles tells us that it is most harmful to the population to kill adults. Since there is a low number of adults and these are the sea turtles that are contributing to the population the most. Pollution caused by humans affects sea turtles at every life stage and artificial lighting can cause death in hatchlings.
SOLE SUVIVORSHIP

Procedure

Warm Up

1. Ask the students if they think sea turtles have the same type of predators throughout their entire lives.

2. Do the students think that the number of predators decreases or increases as they grow? Discuss with the students how human impacts can harm sea turtles just like predators.

Activity

Part I

1. Pass out 3 cups to each student. Also pass out 20 green beads, 20 orange beads, and a marker.

2. Explain to the students that they are going to simulate predator pressures on sea turtles throughout their life.

3. Discuss the different types of predators that sea turtles have as eggs and hatchlings. Tell the students to count the number of different predators.

4. Have the students write “eggs and hatchlings” on the outside of one of the cups. The students should drop green beads in this cup to represent the number of different predators that sea turtles have as hatchlings.

5. Now discuss the different types of predators that sea turtles have as juveniles. The student should count the number of predators.

6. Have the students write “juveniles” on the outside of a cup. The students should drop green beads in this cup to represent the number of different predators that prey on juvenile sea turtles.

7. Discuss different predators that sea turtles have as adults. Have the students count the number of predators.

8. Have the students write “adults” on the outside of a cup. The students should drop green beads in this cup to represent the number of predators that sea turtles have as adults.

9. Pass out graph paper to each student. The students should make a bar graph that depicts the number of predators at the different life stages. The x-axis should be the life stages and the y-axis should be the number of predators. Have the students look at the cups. What seems to be the trend?

10. Now discuss the human impacts that sea turtles must endure. Explain that these occur in addition to the natural predators.
11. Talk about the human predation on eggs and hatchlings. Have the students count the number of different human pressures at this stage. They should place orange beads in the cup labeled “eggs and hatchlings” to represent the number of human predators on eggs and hatchlings.

12. Graph this number of human predators on eggs and hatchlings on a separate graph. The x-axis should be the life stages and the y-axis should be the number of human predators.

13. Discuss the human impacts that occur on juvenile sea turtles. The students should count the number of pressures and put orange beads in the cup labeled “juveniles” to represent this number. The students should also graph this number.

14. Talk to the students about the human impacts that sea turtles endure as adults. The students should count the number of human predators and put orange beads in the cup labeled “adults.” The students should also graph this number.

15. Ask the students what happened to the predator pressures when the human impacts were included.

16. Have the students make a final graph that combines the natural and human predators.

Wrap Up

1. Discuss how the natural predator pressures decreases as sea turtles grow. Talk to the students about how this is important to the growth of the population. Discuss how the hatchlings are an important food source to other animals living in the ocean.

2. Talk about how human impacts increase the “predator” pressure throughout the lives of sea turtles. Populations cannot survive constant and increased predation throughout the entire lives of individuals.

Assessment

1. Pass out the graph provided at the end of this activity. Have the students interpret this graph based on the information that they learned in this lesson.

2. Ask the students what the graph would look like if human pressures were represented.
Sea Turtle Predator Graph
Section 3 References

Food Chains www.vtaide.com/png/foodchains.htm


South Carolina Department of Education <http://ed.sc.gov/agency/offices/cso/>


Standford Birds. Precocial and Altricial Young. <www.standford.edu/group/standfordbirds/text/essays/Precocial_and_Altricial.html>

Photo References

Barb Bergwerf
Scott Eckert
Google Maps
www.museums.org.za/bio/images/mb/mb0506x.jpg
http://yosemite.epa.gov/r10/oea.nsf/34090d07b77d50bd88256b79006529e8/71a10fa5f24efdaa88256c5a007573d0/$FILE/algae%20097.JPG
www.ottaky.com/images/d70_gallery/japan2005/jellyfish.jpg
www.linsdomain.com/totems/pictures/raccoon.jpg
www.sharkinfolch/images/si/bullshark.jpg
www.allthesea.com/img/western-sea-gull-01.jpg
www.aboututtila.com/Photos/AdamLaverty/Fish-Horse-Eye-Jack-02.JPG
www.naturalsciences.org/education/deepsea/images/sargassumL.jpg
www.dfo-mpo.gc.ca/speciesxespecies/images/species/full_killerWhale_1.jpg
www.ifga.org/images/Thalassia.jpeg
www.fisheries.vims.edu/femap/images/fish%20images/bluecrab.jpg
www.iptek.net.id/ind/pd_invertebrata/images/asteropus_sarassinorum.jpg
www.imagequest3d.com/photos/sargassum/k003.jpg
www.imagequest3d.com/pages/current/pictureoftheweek/flyingfish/Flying%20Fish.jpg
www.sargbay.ca/PipefishBirth.jpg
www.seaslugforum.net/images/scylpel1.jpg
www.dnr.sc.gov/marine/sertc/images/photo%20gallery/Potunis%20sai%20crop.jpg
www.niwasscience.co.nz/r/cr/freshwater/fishatlas/images/australianlongfin.jpg
www.sfondielfSKTOPcom/Images-Animals/Fish/Dorado-Coryphaena-Hippurus-Dolphin-Fish.jpg
www.reef.of/webex/gallery/carib/images/large/019.jpg
www.oceanexplorer.noaa.gov/explorations/05deepscope/logs/aug22/media/fluorescent_shrimp_600.jpg
www.mdsg.umd.edu/MarineNotes/May-June01/sargasso.gif
Www.ncl.ac.uk/tcmweb/remote/images/seagrass.htm
oshyan.ashundar.com
danny.oz.au
www.chbr.noaa.gov
SECTION 4

NESTING
NEST DETECTIVES

Focus Question:
How does a sea turtle nest become destroyed and what can you do to prevent it?

Activity Synopsis
Students will try to gather clues from a biologist’s field notes to figure out what caused a group of sea turtle nests to be destroyed. Students will then share the cause of the destruction with the rest of the class in order to identify nest predators and natural causes of destruction. In addition, students will also become aware of the impact that humans have on sea turtle nests. Finally, the students will develop their own conservation plan that would help save a nest from being destroyed.

Objectives:
Students will be able to:
1. Understand that scientists learn about nature through observation
2. Interpret field notes and observations to make an inference
3. Understand the relationship of organisms in an environment and how those organisms can cause changes in their environment

Standards

Fourth Grade Science Standards
Standard 4-1 – Scientific Inquiry
4-1.4 Distinguish among observations, predictions, and inferences.

Standard 4-2 – Organisms and Their Environment
4-2.6 Explain how organisms cause changes in their environment.

Standard 4-4 – Weather
4-4.4 Summarize the conditions and effects of severe weather phenomena (including thunderstorms, hurricanes, and tornadoes) and related safety concerns.

Fifth Grade Science Standards
Standard 5-1 – Scientific Inquiry
5-1.6 Evaluate results of an investigation to formulate a valid conclusion based on evidence and communicate the findings of the evaluation in oral or written form.
5-1.7 Use a simple technological design process to develop a solution or a product, communicating the design by using descriptions, models, and drawings.

Standard 5-3 – Landforms and Oceans
5-3.4 Explain how waves, currents, tides, and storms affect the geologic features of the ocean shore zone (including beaches, barrier islands, estuaries, and inlets).

Time Frame:
60 minutes

Key Terms:
Beach Renourishment
Clutch
Inference
Observation
Predators
Prey
Washout

Materials:
- Pens or pencils
- Field Notes Worksheets (provided)
- Answer Key (provided)
- Pictures of nest predators, beach processes, weather, and destroyed nests.
- Pictures of conservation methods
Once a sea turtle nest is laid on the beach, it is left unprotected and exposed to many destructive forces.

Each species of sea turtles must leave the ocean and crawl onto a beach to lay their eggs. When a female sea turtle is ready to deposit her eggs, she will emerge from the ocean at night and dig a hole in the sand using her flippers. Once the hole is deep enough, she will position her posterior end over the nest and release the eggs. Each nest contains approximately 100 eggs—this is called a clutch. When the eggs are in place, the female buries the eggs using her flippers. When a female sea turtle is finished depositing her eggs into the sand, she uses her back flippers to bury the eggs with sand. Then, she crawls back down the beach and returns to the ocean. The amount of time it takes the hatchlings to emerge is different depending on the species, but a normal range for incubation is around 50-80 days. During that period, the eggs are susceptible to many destructive forces.

Sea turtle nests can be destroyed by both natural and human disturbances.

1. **Predation** – There are a variety of animals that eat sea turtle eggs. In South Carolina, the top predator on loggerhead nests is raccoons. Crabs and even insects also make the eggs their prey.

2. **Beach Processes** – The natural processes that take place on a beach can also destroy a nest. Sand can accumulate on top of a nest and make it hard for the hatchlings to get out. If the female turtle does not dig the nest on an elevated portion of the beach, high tide could flood the nest or erode the sand away from the eggs.

3. **Weather** – Storms can drastically alter the beach habitat and greatly disturb nests. Similar to high tides, heavy rain can either flood the nest or cause erosion. **Washout** can also occur during a storm. This is when large waves roll over the nest and sweep the eggs out. In addition, nest failure can also be a result of extreme hot or cold temperatures.

4. **Human Impacts** – Humans are responsible for many forms of nest destruction as well. **Beach renourishment** is when sand is transported from the ocean onto the beach in order to keep the beach from eroding. This process can bury sea turtle nests. The use of off-road vehicles on the beach compacts the sand and disables hatchlings from emerging. Although **poaching** is not a problem in South Carolina, it is a severe problem in many other countries. Poaching is the illegal removal of eggs from nests.

Conservation methods have been taken to combat these destructive forces.

To keep raccoons and other predators out of the nests, plastic screens are placed on the nest. The slits in the screen are large enough for the hatchlings to escape, but small enough to prevent digging by the predators. These barriers are only put on the nests if the beach is monitored by NGO’s (non-government organizations) or by state DNRs (Department of Natural Resources). The relocation of eggs is another conservation strategy. In some cases, it may be necessary to remove the eggs from the nest and relocate them to a new nest.
NEST DETECTIVES

Procedure

Warm Up

1. Discuss sea turtle nesting with students. Where does a sea turtle build her nest? What does the nest look like? Does the sea turtle stay and protect the nest or does she leave the nest and return to the ocean? Explain to the students that a female sea turtle buries the eggs and then leaves them on the beach. Even though the female turtle tries to disguise the nest, the nest can still be detected and disturbed.

2. Ask students to think of ways that a sea turtle nest could be destroyed. Show the class pictures of possible nest disturbances included with this activity. Discuss possible ways a person might figure out how a nest was disturbed. Inform them that when a biologist finds a destroyed nest, they figure out how it was destroyed by writing down all of their observations. They look for animal or human tracks, note the weather and tides, and observe the condition of the eggs—do they look crushed, eaten, or covered with fungus? Biologists then go over their notes and make an educated guess about what destroyed the nest.

Activity

1. Tell the students that they are going to be responsible for helping biologists infer what happened to sea turtle nests that were destroyed. It will be their job to use the field notes to make an inference about what happened to the nest.

2. The students can either work individually or in groups. If you would like the students to work in groups, ask them to form groups of three.

3. If working individually, pass out one worksheet per student. Make sure that students sitting next to one another do not get the same worksheet. Try to vary the worksheets as much as possible making sure at least one copy of every worksheet will be used.

4. If working in a group, make sure each group has a worksheet. Make sure that each group has a different worksheet. Tell the groups to decide on roles.

5. Explain that each worksheet is from the field notes of a biologist who found a destroyed turtle nest.

6. Tell the students to read through all of the notes first and then go back and start circling parts of the notes that may explain what happened to the nest.

7. Have the students write on a piece of paper what destroyed the nest and how it destroyed the nest.

8. Once everyone has completed this activity, go around to each student (or each group) and ask them to share how their nest got destroyed. If they are correct, ask them what clues led them to that decision. If they are incorrect, have them read their clues to the rest of the class and ask if anyone else has other ideas about how it got destroyed.
Procedure

Wrap Up

1. Discuss all the possible threats a sea turtle nest faces. Ask the students to identify the threats that could have been prevented.

2. Have the students develop their own conservation strategy to protect another nest from what destroyed their nest. They should write this strategy on paper and include why they think it would work.

3. Have some of the students share their strategies and then discuss actual conservation strategies that are being used. This would be a good place to show them the pictures of conservation methods included with this activity.

Assessment

1. Have the students make observations about nature and document them in the form of field notes. Try to get the students to focus on an animal or insect interacting with its environment.

2. The students should make inferences about the behavior they observe. Why do they think the animal/insect is behaving in this manner?
Field Notes A

Date: May 15, 2006

Purpose: Investigating damage to Loggerhead nest #8

Location: Isle of Palms, SC
-- Very close to access path 5A
-- Nest is located at a low elevation on the beach
-- The nest is below the high tide line

Tides:
-- May 14, 2006 – high tide was 6.1 ft at 9:48 pm.
-- May 15, 2006 – low tide was .1 ft at 4:18 am

Weather:
Today (May 15, 2006):
-- 65° F, partly cloudy
-- strong onshore breeze (30 mph)
-- no rain

Last Night (May 14, 2006):
-- Strong storms began at 9:15 pm as high tide was coming in
-- Storm waves reached above the high tide line

Observations:
-- The nest is no longer present; there is no hole in the sand
-- The eggs are scattered around the beach
-- Stakes used to mark the location of the nest were pulled out of the sand and scattered on the beach
-- Most of the eggs are dented and damaged; nest will not survive
-- No sign of animal tracks on beach or near nest
Date: July 6, 2006

Purpose: Investigating damage to Loggerhead nest #16

Location: Folly Beach, Sc
-- Close to 911 West Ashley
-- The nest is above the high tide line

Tides:
-- July 6, 2006 – high tide was 4.2 ft at 4:00 am
-- July 6, 2006 – low tide was .4 ft at 10:06 am
-- July 6, 2006 – high tide was 5.3 ft at 4:57 pm

Weather:
Today (July 6, 2006)
-- 89° F; Sunny
-- Slight breeze
-- no rain

Tonight (July 6, 2006)
-- 70° F
-- Mild wind (10 mph)
-- no rain

Observations:
-- There is a small tunnel in the sand leading straight into the nest
-- Small, circle tracks in the sand are all around the nest
-- After removing sand, half of the eggs have been eaten
-- Pieces of eggs are still in the nest
Date: July 24, 2006  
Time: 7:23 am

Purpose: Investigating damage to Loggerhead nest #22

Location: Kiawah, SC
- The nest is above the high tide line

Tides:  
- July 23, 2006 – High tide was 6.4 ft at 7:58 pm
- July 24, 2006 – Low tide was 0.4 ft at 2:16 am

Weather:  
Today (July 23, 2006)  
- 79°F, mostly cloudy  
- Breezy (about 20 mph)  
- no rain

Observations:  
- Nest looks like it was dug up  
- Eggs exposed inside the nest  
- Animal tracks in the sand around the nest  
- Pieces of eggs are scattered around nest  
- Only 10 eggs are left
Date: August 19, 2006

Time: 6:05 am

Purpose: Investigating why loggerhead nest #45 is past the hatch date

Location: Cape Romaine, SC
  -- The nest is above the high tide line

Tides:
  -- August 18, 2006 - Low tide was 0.9 ft at 11:00 pm
  -- August 19, 2006 - High tide was 4.2 ft at 4:45 am

Weather:
  -- 78° F; partly cloudy
  -- no breeze
  -- no precipitation

Observations:
  -- Hatchlings were supposed to emerge from nest in late July or early August
  -- Sand has been sunken inward on the top of the nest for 2 weeks—hatchlings should have come out
  -- Fire ants crawling around the nest and some are crawling into the sand
  -- After digging into the nest, hatchlings were out of their shell but not alive.
  -- Severe damage to the bodies of the hatchlings
  -- Ants were also found inside of the nest
Date: September 5, 2004  

Time: 8:30 am  

Purpose: Investigating why loggerhead nest # 38 is past its hatch date  

Location: Edisto Beach, SC  
- The nest is above the high tide line  

Tides:  
- September 5, 2004 - Low tide was 0.6 ft at 12:21 am.  
- September 5, 2004 - High tide was 6.2 ft at 6:04 am  

Weather:  
- 64° F; mostly cloudy  
- Breezy (35 mph)  
- Drizzle  

Observations:  
- Nest is shaded by shadow of hotel building  
- Sand temperature only 69° F.  
- Uncovered the nest - eggs appear undisturbed  

Notes:  
- Summer has been unseasonably cool
Date: July 9, 2006       Time: 12:30 am

Purpose: Investigating damage to loggerhead nest #49

Location: Fripp Island, SC
-- Nest was placed above the high tide line

Tides:
-- July 8, 2006 – Low tide was 0.3 ft at 12:12 pm
-- July 8, 2006 – High tide was 6.7 ft at 6:47 pm

Weather:
-- 80° F
-- Slight breeze (10 mph)
-- Light rain

Observations:
-- Nest was uncovered
-- Nest chamber was empty – no eggs found in nest
-- No egg remains were found
-- No animal tracks were found around nest
-- Human footprints were found leading up to the nest and leading away from the nest

Notes:

Claiborne & Eckert (200x) Sea Turtles in the Classroom WIDECAST Technical Report No. xx
Answer Key

Notes A - The storm caused high waves to roll over the nest. The nest was washed out.

Notes B - Ghost crab predation on nest

Notes C - Raccoon predation on nest

Notes D - Fire ants preyed on the eggs

Notes E - Eggs did not hatch because temperatures were too low

Notes F - Eggs were taken by poachers
HATCHLING PREDICTION

Focus Question:
How does the environment affect whether or not a hatchling will be a male or female?

Activity Synopsis
A sea turtle nest will be created in the classroom in order to monitor the temperature of the nest for a week. Natural factors that influence the temperature of the nest will be simulated in order to understand how they impact both the temperature of the nest and the sex of the hatchlings.

Objectives:
Students will be able to:
1. Identify how the environment impacts animal populations
2. Observe and predict an outcome based on data gathered
3. Conduct simple scientific investigations manipulating one variable at a time
4. Record and graph Data

Time Frame:
60 minutes

Key Terms:
Clutch

Materials:
- 3 glass mason jars
- 3 heat lamps
- Sand
- Long thermometers
- Measuring cup
- Nest Temperature Data Table (provided)
- Large piece of cardboard

Standards
Fourth Grade Science Standards
Standard 4-1 – Scientific Inquiry
4-1.3 Summarize the characteristics of a simple scientific investigation that represent a fair test (including a question that identifies the problem, a prediction that indicates a possible outcome, process that tests one manipulated variable at a time, and results that are communicated and explained).
4-1.5 Recognize the correct placement of variables on a line graph.
4-1.6 Construct and interpret diagrams, tables, and graphs made from recorded measurements and observations.

Standard 4-4 – Weather
4-4.3 Compare daily and seasonal changes in weather conditions (including wind speed and direction, precipitation, and temperature) and patterns.

Fifth Grade Science Standards
Standard 5-1 – Scientific Inquiry
5-1.2 Identify independent (manipulated), dependent (responding), and controlled variables in an experiment.
5-1.4 Use appropriate tools and instruments (including a timing device and 10x magnifier) safely and accurately when conducting a controlled scientific investigation.
5-1.5 Construct a line graph from recorded data with correct placement of independent (manipulated) and dependent (responding) variables.

Standard 5-2 – Ecosystems: Terrestrial and Aquatic
5-2.5 Explain how limiting factors (including food, water, space, and shelter) affect populations in ecosystems.
Background

♦ Female sea turtles make their nests in the sand

Each species of sea turtle must leave the ocean and crawl onto a beach to lay their eggs. When a female sea turtle is ready to deposit her eggs, she will emerge from the ocean at night and dig a hole in the sand using her flippers. Once the hole is deep enough, she will position her posterior end over the nest and release the eggs. Each nest contains approximately 100 eggs — this is called a clutch. When the eggs are in place, the female buries the eggs using her flippers and then crawls back to the ocean. The amount of time it takes the hatchlings to emerge is different for each species, but a normal range for incubation is around 50-80 days.

♦ The sex of a sea turtle is temperature dependent

Unlike humans, the sex of a sea turtle is not determined at the time of conception. Instead, it is influenced by the temperature of the sand where the nest has been laid. For each species, there is a nest temperature range that will produce a mix of males and females. However, if the nest temperature falls below this range, the eggs will all become male hatchlings and if the temperature increases above the range all the eggs will become females.

♦ The nest environment heavily influences the temperature of the eggs

The environment surrounding the nest is critical to the temperature of the sand in the nest. The location of the nest on the beach impacts the temperature of the nest. Vegetation can provide shade for nests; therefore, the temperature of shaded nests will be cooler than nests that are always exposed to the sun. The weather also impacts the temperature of the nest. A cloudy or rainy day can cause the temperature to decrease while a hot, sunny day can make the nest temperature rise considerably. The sex of the hatchling can also be dependent on the location of the egg in the nest. Eggs in the middle of the nest will have a higher temperature than those eggs located around the perimeter. Thus, eggs in the middle are more likely to be female and those on the outside will most likely be male.
HATCHLING PREDICTION

Procedure

Warm Up

1. Begin by discussing sea turtle nesting with the students. Where do sea turtles build their nests? How many eggs are usually in one nest? How long do the eggs stay in the nest before they hatch?

2. Inform students that the sex of the hatchling is determined by the temperature of the sand. Ask them what would happen if the temperature in the nest became really hot and what would happen if it became really cold. Explain to them that there is a temperature range that will produce both males and females. Also, explain that there is one temperature that will produce an equal number of males and females.

3. Ask the students to name factors that could change the temperature of the nest. Show them pictures of examples of things on a beach that can alter the temperature of the sand (provided).

Activity

Part I

1. Explain to the students that they are going to create three different nesting habitats and monitor the temperature of each one for a week. Tell them that this week is important because it is when the temperature impacts the sex of the hatchlings the most.

2. Begin setting up the first nesting habitat (NEST 1). Tell the students that this nesting habitat will be exposed for the entire week. Pour sand into one of the mason jars so that it is about 2/3 full. Place the heat lamp over the mason jar and turn it on. Tell the students that the heat lamp represents the sun and explain to them how the sun can increase the temperature of the sand.

   Have the students pretend that this nesting habitat contains 100 loggerhead eggs. Ask each student to predict the number of male and female hatchlings in this jar. This should be recorded on the same sheet of paper as the Nest 1 prediction.

3. Next, set up the second habitat (NEST 2).

   This habitat will experience extreme weather conditions. Pour sand into the mason jar until it is 2/3 full and place the heat lamp over it. Throughout the week this nesting habitat will experience a lot of precipitation. The precipitation will be simulated by pouring a cup of cold water into the mason jar in the morning and afternoon each day.

   Have the students pretend that this nesting habitat contains 100 loggerhead eggs. Ask each student to predict the number of male and female hatchlings in this jar. This should be recorded on the same sheet of paper as the Nest 1 prediction.

4. Set-up the last nesting habitat (NEST 3). Pour sand into the mason jar until it is 2/3 full. Place a piece of cardboard over the mason jar to simulate vegetation shading the nest.

   Have the students pretend that this nesting habitat contains 100 loggerhead eggs. Ask each student to predict the number of male and female hatchlings in this jar. This should be recorded on the same sheet of paper.
HATCHLING PREDICTION

Procedure

Part I Continued
5. Follow the schedule provided for the nesting habitats. Have the students record the temperature in the morning and in the afternoon. For NEST #2, have the students take the temperature of the sand after the water has been poured into the jar.

6. The students should record the temperatures in the data sheet provided.

Part II
1. Once the temperature has been collected, the students should graph the data using a line graph. The x-axis should be time and the y-axis should be temperature in degrees Fahrenheit.

2. The students should then analyze the graph. After looking at the temperatures throughout the week, the students should make an inference as to the number of male and female hatchlings for each nest.

Wrap Up
1. Discuss with the students why it is important to have a nest produce both male and female hatchlings. Ask the students which nest habitat was the most likely to have produced a mixture of males and females. Discuss with the students ways that they can help the temperature of the sea turtle nest stay close to the pivotal temperature.

2. Discuss with the students their idea on an ideal spot for a sea turtle nest on the beach.

Assessment
1. Give students a description of a simple scientific experiment and have them identify the main parts of it as well as the different variables.

2. Provide students with a description of where a nest is on the beach and ask them if the nest is going to produce mostly males, females, or both.
<table>
<thead>
<tr>
<th>Nest 3</th>
<th>Nest 2</th>
<th>Nest 1</th>
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<tbody>
<tr>
<td><strong>DAY 1</strong>&lt;br&gt;Morning: Turn lamp on</td>
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<td><strong>DAY 4</strong>&lt;br&gt;Morning: Turn lamp on</td>
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<td><strong>DAY 5</strong>&lt;br&gt;Morning: Turn lamp on</td>
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<tr>
<td>Afternoon: Turn lamp off</td>
<td>Afternoon: Turn lamp off</td>
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- Nesting Habitat Schedule

- **Day 1**
  - Morning: Turn lamp on
  - Afternoon: Turn lamp off
- **Day 2**
  - Morning: Turn lamp on
  - Afternoon: Turn lamp off
- **Day 3**
  - Morning: Turn lamp on
  - Afternoon: Turn lamp off
- **Day 4**
  - Morning: Turn lamp on
  - Afternoon: Turn lamp off
- **Day 5**
  - Morning: Turn lamp on
  - Afternoon: Turn lamp off

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  - Morning: Turn lamp on
  - Afternoon: Turn lamp off
- **Day 4**
  - Morning: Turn lamp on
  - Afternoon: Turn lamp off
- **Day 5**
  - Morning: Turn lamp on
  - Afternoon: Turn lamp off

- **Procedure**

- **Hatching Prediction**

- **Claiborne & Eckert (200x) Sea Turtles in the Classroom WIDECAST Technical Report No. xx**
<table>
<thead>
<tr>
<th>DAYS</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEST</td>
<td>1</td>
<td>2</td>
<td>3</td>
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HATCHLING FRENZY

Focus Question:
Why do only a small number of sea turtle hatchlings make it safely to the ocean?

Activity Synopsis
Students will play a game of freeze tag in order to learn what happens on a beach when sea turtle hatchlings emerge from the nest and make their way to the ocean. Each student will be assigned a characteristic of the beach. They should research this role prior to the game and make a badge for themselves identifying their character. During the game, the students will have to act out their roles to simulate the actions that take place on a beach when hatchlings emerge.

Standards

Fourth Grade Science Standards
Standard 4-2 – Organisms and Their Environment
4-2.1 Classify organisms into major groups (including plants or animals, flowering or nonflowering plants, and vertebrates [fish, amphibians, reptiles, birds, and mammals] or invertebrates) according to their physical characteristics.
4-2.5 Explain how an organism’s patterns of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).
4-2.6 Explain how organisms cause changes in their environment.

Fifth Grade Science Standards
Standard 5-2 – Ecosystems: Terrestrial and Aquatic
5-2.4 Identify the roles of organisms as they interact and depend on one another through food chains and food webs in an ecosystem, considering producers and consumers (herbivores, carnivores, and omnivores), decomposers (microorganisms, termites, worms, and fungi), predators and prey, and parasites and hosts.
5-2.5 Explain how limiting factors (including food, water, space, and shelter) affect populations in ecosystems.

Standard 5-3 – Landforms and Oceans
5-3.6 Explain how human activity (including conservation efforts and pollution) has affected the land and the oceans of Earth.

Objectives:
Students will be able to:
1. Distinguish between predator and prey
2. Research and communicate information
3. Understand how predators and natural processes can shape ecosystems
4. Identify human impacts on populations and how to minimize those impacts

Time Frame:
60 minutes

Key Terms:
Predator
Prey

Materials:
- Large quantity of rope
- String
- Diagram of Game (provided)
- Access to outdoor, open field
- 5 x 7 in pieces of construction paper
Female sea turtles nest on beaches
Each species of sea turtles must leave the ocean and crawl onto a beach to lay their eggs. When a female sea turtle is ready to deposit her eggs, she will emerge from the ocean at night and dig a hole in the sand using her flippers. Once the hole is deep enough, she will position her posterior end over the nest and release the eggs. Each nest contains approximately 100 eggs—this is called a clutch. When the eggs are in place, the female buries the eggs using her flippers. She then crawls back down the beach and returns to the ocean. The amount of time it takes the hatchlings to emerge is different for each species, but a normal range for incubation is around 50-80 days.

Hatchlings will usually emerge at night
Sea turtle hatchlings wait until it becomes night to emerge from the nest. They use the decrease in temperature as a cue for when to emerge from the sand. It is advantageous for the hatchlings to make their trek down the beach at night for two reasons: 1.) It protects them from dehydration and 2.) There are less predators on the beach and in the water. If the hatchlings were to crawl to the ocean during the day, the heat and sunlight would cause them to desiccate. In addition, hatchlings would face more predators on the beach during the day.

Hatchlings are very susceptible to predation
Even though the hatchlings emerge at night when there is less predation, they must still contend with predators. In South Carolina, the biggest predator threat to hatchlings is ghost crabs. Raccoons are also a common predator and can eat multiple hatchlings. Night herons actually wait in the water for the hatchlings and attempt to snatch them up as soon as the sea turtles start swimming. Dogs, both domestic and feral, can also be a predator on the beach.

Human impacts can keep hatchlings from reaching the ocean
Humans and their activities can also hinder hatchlings from making it to the ocean. The greatest cause of disorientation among hatchlings is artificial lighting from houses, hotels, shops, or restraints on the beach. The hatchlings will start to crawl towards the artificial light instead of the ocean. This makes the hatchlings more vulnerable to predation and energy loss. This type of lighting has also been known to lead hatchlings to roads or sidewalks where they are hit by either cars or bikes. If a hatchling gets disoriented it loses too much energy trying to find the ocean and usually does not make it. Building sand castles or leaving holes dug in the sand unfilled becomes a huge obstacle to a tiny hatchling. Hatchlings may be unable to make it around the sound castle or fall in a hole and have no way of getting back out. Leaving trash or other debris on the beach can also hinder a hatchling from making it to the ocean. It’s very important to knock down all sand castles, fill in holes, and pick up trash and other debris before leaving the beach.
HATCHLING FRENZY

Procedure

Warm Up

1. Begin talking to students about where sea turtles nest and how long it takes for the hatchlings to emerge. Discuss how hatchlings find the ocean.

2. Find out what the students know about hatchling survival. Do most hatchlings make it to the ocean? Why don’t most hatchlings survive the journey down the beach? What preys on hatchlings? Show pictures of the predators that are provided.

3. Discuss any human impacts that make it harder for hatchlings to find the ocean. Introduce the negative effect of artificial lighting and other human impacts that are harmful to the hatchlings. Show pictures of human impacts on hatchlings.

Activity

Part I

1. Inform the students that they are going to become a character on the beach. The players will be sea turtle hatchlings, ghost crabs, raccoons, night herons, dogs, holes from sand castles, and artificial lighting.

2. Have slips of paper with the character names on them ready. This activity is designed for 20 students, but if you have more increase the number of ghost crabs and raccoons. The number of characters needed is below.

   10 – Sea turtle hatchlings
   2 – Ghost crabs
   1 – Dog
   1 – Raccoon
   1 – Night heron
   4 – Artificial lighting
   1 – Hole in sand

   *If need more characters, add more ghost crabs and raccoons

3. Place the slips of paper in a hat or some other container and mix them around. Go around to each student and let them pick a slip of paper out of the container. The character on the paper is what the student will become.

4. Inform the students that they need to find information for their character so that they can teach the class about it.

5. Once they complete the research, have the students make a tag for themselves with a picture and the name of their character. The tag will be worn during the game.

6. The students should complete this step the night before the activity is done in class. However, this activity could be done in one day if the students have sources to research their characters. If this is assigned as homework, students should bring in their researched information and tag on the day that the game is going to be played.

Part II

1. Before playing the game, have the students introduce their characters to the rest of the class. Start with the students that are hatchlings and have each of them give one fact that they found interesting about hatchling loggerheads. If the students are predators, they should introduce who they are and how they hunt the predators. Also, have each of the predators give an interesting fact. The students that are human impacts should explain how they affect the hatchlings. They should also explain ways in which they can be prevented.
HATCHLING FRENZY

Procedure

Activity Continued

Part II Continued

2. The best location to play the game would be outside in an open field. A playing area approximately 40 x 40 ft should be designated. The boundary between water and land needs to be marked as well as the nest area. The nest area could be easily designated by a hula hoop.

3. Make sure the students are wearing their tags and instruct them where they should stand on the playing field. See diagram below on how to position the students.

4. When they are in their places, show them how they are to move while playing the game. Refer to the list below:
   a. Hatchlings – crawl on stomach using only arms and legs to propel them.
   b. Ghost crabs – “crab crawl;” walk using hands and feet while lifting rear end off of the ground. They are free to roam and can use hands to tag hatchlings.
   c. Dog – walk on hands and feet with face pointing towards the ground. Theses students should make sniffing noises. They are free to roam around and tag hatchlings with their hands.
   d. Raccoon – crawl (like a baby). They are free to roam around and tag hatchlings with hands.
   e. Night heron – flap arms and pick up one foot and then the other. They are free to roam and can tag hatchlings using hands.
   f. Artificial lighting – Stand still with arms in the air. Their hands should continually make fists and then open their hands to stimulate flashing lights. These students can only take 5 steps in any direction to get to a hatchling. They can use their hands to tag the hatchlings.
   g. Hole in Sand – students must lie on the ground on their stomachs. They can try to reach out and tag the hatchlings with their hands.

5. The first time the game is played all the students should be involved. Make the beach wide by placing the beach/ocean boundary far from the playing area boundary (see diagram). This is to simulate the beach at low tide.

6. Once everything is set, the game can be played. The hatchling need to try to make it to the ocean and the predators and human impacts should try to tag the hatchlings. When a hatchling has become tagged, they must freeze. The game is over when all of the hatchlings have either been tagged or made it to the ocean. Be sure to count how many hatchlings made it safely to the ocean.

7. Move the beach/ocean boundary backwards so that the beach is rather thin. This is to simulate high tide. Play the game again. How many hatchlings made it this time? Is it more or less than during low tide?

8. Move the beach/ocean boundary so that the beach is in between wide and thin. Have the students play the game again. This time, ask the student who is the hole in the sand to step out. This should show that more hatchlings will survive if holes on the beach are filled in. Again note how many hatchlings made it safely to the ocean.

9. Play the game one more time. Ask the student who is the hole in the sand to remain sitting out and ask the students who are artificial lights to sit out. This game should have the most hatchlings making it to the ocean. Note how many hatchlings did make it to the ocean.

10. If there is time to spare, the students could switch roles and the game could be played again.
<table>
<thead>
<tr>
<th>HATCHLING FRENZY</th>
<th>Procedure</th>
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</thead>
<tbody>
<tr>
<td><strong>Wrap Up</strong></td>
<td></td>
</tr>
<tr>
<td>1. Ask the students if it was easy for the hatchlings to get to the ocean? Was it easier during the high tide or during the low tide?</td>
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<tr>
<td>2. Ask the students why the hatchlings usually emerge at night? Is this better than emerging during the day? What could happen to hatchlings if they left the nest during the day? Identify different threats during the day than at night.</td>
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<tr>
<td>3. What happened when the human impacts were removed? Did more hatchlings make it to the ocean? Discuss the importance of turning off oceanfront lights and filling in holes in the sand. In addition, have students think of other ways to reduce negative human impacts on hatchlings as they travel down the beach.</td>
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<tr>
<td><strong>Assessment</strong></td>
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<tr>
<td>1. Have the students complete a journal entry written from their character's point of view. Have them write about what happened on the beach and if they kept any of the hatchlings from reaching the ocean.</td>
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<tr>
<td>2. Have the students write a play about being on the beach when hatchlings emerge. The students should include all of the characters and accurately portray how those characters should behave. The students should write two scenes. One scene should be at high tide and the other scene at low tide.</td>
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</tbody>
</table>
Diagrams of Playing Field

“Low Tide” Field

OCEAN

X = taggers
O = hatchlings

BEACH

START

“High Tide” Field

OCEAN

X = taggers
O = hatchlings

BEACH

START
Focus Question: How do the phases of the moon relate to a hatchling’s success in finding the ocean?

Activity Synopsis
Students will first learn about the phases of the moon and how those phases can help sea turtles find the ocean. In addition, students will actively try to distinguish between natural light and artificial light to understand how sea turtles are affected by artificial lighting.

Objectives:
Students will be able to:
1. Identify and draw the four phases of the moon
2. Define the terms waxing, waning, artificial lighting, and misorientation
3. Understand that light reflects from surfaces and how that relates to brightness
4. Explain how the phases of the moon can impact sea turtle survival

Standards

Fourth Grade Science Standards

Standard 4-1 – Scientific Inquiry
4-1.6 Construct and interpret diagrams, tables, and graphs made from recorded measurements and observations.

Standard 4-2 – Organisms and Their Environment
4-2.3 Explain how humans and other animals use their senses and sensory organs to detect signals from the environment and how their behaviors are influenced by these signals.
4-2.5 Explain how an organism’s patterns of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).

Standard 4-3 – Astronomy
4-3.6 Illustrate the phases of the Moon and the Moon’s effect on ocean tides.

Standard 4-5 – Properties of Light and Electricity
4-5.1 Summarize the basic properties of light (including brightness and colors).
4-5.3 Summarize how light travels and explain what happens when it strikes an object (including reflection, refraction, and absorption).

Fifth Grade Science Standards

Standard 5-1 – Scientific Inquiry
5-1.6 Evaluate results of an investigation to formulate a valid conclusion based on evidence and communicate the findings of the evaluation in oral or written form.

Standard 5-3 – Landforms and Oceans
5-3.6 Explain how human activity (including conservation efforts and pollution) has affected the land and the oceans of Earth.

Time Frame:
60 minutes

Key Terms:
Artificial Lighting
Misorientation
Waning
Waxing

Materials:
- Flashlight
- Lamp
- Construction Paper
- Seafinding Behavior Worksheet (provided)
The moon has four main phases

The moon goes through four distinct phases: new, first quarter, full, and last quarter. The moon is always half illuminated by the sun, but as the moon orbits around the earth, we see different amounts of this illumination. The new moon phase is when the moon is not visible because the unilluminated side of the moon is facing the Earth. As the illuminated side of the moon begins to face Earth the moon is waxing. In other words, the moon is waxing when it appears as though the moon is growing. The first quarter is when one-half of the moon is illuminated by the sun. The full moon is when the whole illuminated side of the moon is facing the Earth. After the full moon phase, the illuminated side of the earth begins to face away from the Earth. This is called waning. When the illuminated portion of the Earth appears to be shrinking, it is waning. The last phase of the moon is the last quarter. Again, it appears as though half of the moon is illuminated. The illuminated side of the moon continues to shrink until it is back to the new moon phase. This entire cycle takes about 29.5 days.

- **Light reflection and brightness**

Light is emitted from both natural (sun, lightning bugs) and artificial sources (bulbs, lasers). When light is emitted from a source, it travels in waves. Those waves continue to travel from the source until they hit a surface.

- **Sea turtle hatchlings orient to the brightest direction on the beach**

When hatchlings finally emerge, they pause for a moment and then begin to scurry for the ocean. Hatchlings find their way to the ocean by orienting themselves towards the brightest direction. On a beach, the brightest direction is the horizon because that is where the largest amount of sky is visible. The sky is brighter over the water than the land due to the reflection of the sky off the water.

- **Artificial lighting causes hatchlings to crawl away from the ocean**

Artificial lighting is basically any light source that has been produced by humans such as hotel lights, house lights, street lamps, etc. Artificial lights appear extremely bright because the light is close and greatly directed. This light is overwhelmingly bright to the hatchlings and this causes them to either ignore other visual cues or be unable to perceive them. The hatchlings become misoriented by the light and move in directions away from the ocean. When this happens, the hatchlings are more susceptible to predators, getting hit by cars, and losing vital energy needed for swimming.

- **The moon phases can decrease the effects of artificial lighting**

The occurrence of misorientation in hatchlings is more frequent when there is a new moon. Other phases of the moon produce surrounding light that brighten the horizon and decrease the impact of the artificial light. During a full moon, artificial lighting has the least impact because this is when the horizon is the brightest. However, artificial light has a negative impact on hatchling orientation no matter what the moon phase and it is extremely important to diminish artificial lighting on the beaches during nesting season.
**Procedure**

**Warm Up**

1. Ask the students if they have observed the current phase of the moon. Inform them that there are four main phases of the moon: new, first quarter, full, and last quarter. In addition, explain to them the definition of waxing and waning.

2. Inform students why artificial lighting can inhibit hatchlings from making it to the ocean. Ask them which light is brighter the moonlight or a streetlight? Explain to them why the streetlight seems brighter than the moonlight even though the moonlight is brighter.

**Activity**

**Part I**

1. Inform the students that they are going to learn how to identify the different phases of the moon and whether or not it is waxing (growing) or waning (shrinking).

2. Take out the flashlight and explain to the students that the flashlight is the moon. Trace the head of the flashlight on a piece of construction paper. Make 2 tracings. Cut these pieces out. Leave one whole and cut one in half.

3. Place that cutout that covers all of the light on the flashlight. Ask the students what phase of the moon this represents. This will be the new moon.

4. Place the cutout that covers half of the flashlight across the light. Make sure the cutout is on the left side of the flashlight. Ask the students what phase of the moon this represents. This is the first quarter. Ask the students if the moon is waxing (growing) or waning (shrinking). The moon is waxing (growing) when it goes from a new moon to a first quarter.

5. Turn on the flashlight without any cutouts placed on it. Ask the students what phase of the moon this represents. This will be the full moon.

6. Place the cutout that covers half of the light on the flashlight. Make sure the cutout is on the right side of the flashlight. Ask the students what phase of the moon this represents. This will be the last quarter. Ask them if the moon is waxing (growing) or waning (shrinking). When the moon goes from full to last quarter it is waning (shrinking).

7. Place the cutout that covers the whole light on the flashlight. Inform the students that the moon is again new. Explain to them that those are the main phases of the moon and tell them that one cycle is completed every 29.5 days or approximately every month.

**Part II**

1. Tell the students that they are going to become hatchlings on a beach trying to find the brightest light.

2. Clear a space in the classroom that is free of any obstacles and close the blinds to make the room darker. Make a chart on the board to record the number of students that pointed to the lamp and the number that pointed to the flashlight during each of the three moon phases.
Activity Continued

Part II Continued

3. Divide the class into three equal groups. Ask half of the group to stand in a line and the other half to line up on the other side of the students. The students should be standing in a line back to back. At this time, ask the rest of the class to step outside of the classroom. Make sure there is someone to supervise them.

4. Place the blindfolds on the students. Explain to them that you are either going to turn on two lights. The students need to point in the direction that they see the brightest light.

5. Once the students are in place with blindfolds on, turn off the lights in the classroom. Turn on the flashlight with no cutout covering it and the lamp. Shine the lights on the walls that are to the right and left sides of the students. The flashlight should be shining on one wall and the lamp shining on the opposite wall. Tell the students to point to where they see the brightest light. Count how many students point to the lamp wall and how many students point to the flashlight wall. Record this number on the board.

6. Tell the group of students to remove their blindfolds. These students can have a seat in the classroom. Bring in the next group of students.

7. Position these students like the previous group and blindfold them. Attach the cutout that covers half of the light to the flashlight. Turn on the flashlight and the lamp. Shine the lights on the same walls as in Step 5. Tell the blindfolded students to point to where they see the brightest light. Ask the group sitting in the classroom to count how many students are pointing to the lamp wall and how many are pointing to the flashlight wall. Record the data on the board.

8. Tell the group of students to remove their blindfolds. These students can have a seat in the classroom. Bring in the last group of students.

9. Position these students like the previous group and blindfold them. Attach the cutout that covers all of the light to the flashlight. Turn on the flashlight and the lamp. Shine the lights on the same walls as in Step 5. Tell the blindfolded students to point to where they see the brightest light. Ask the students sitting the classroom to count how many students are pointing to the lamp wall and how many are pointing to the flashlight wall. Record the data on the board.

10. Ask the students to remove their blindfolds and have a seat. The lights can be turned back on and the blinds can be opened. At this time, you can also quickly put the room back into order.
Wrap Up

1. Observe the chart on the board. Determine if any students did not point to either of the walls where the lights were shining. Tell the students to copy this data onto the worksheet provided.

2. Analyze the data with the students. Did more students point to the artificial light or the moonlight (flashlight)? Was there a certain moon phase where more students pointed to the moonlight (flashlight)? Was there a certain moon phase were more students pointed to the lamp (artificial light)?

3. Discuss with the students why hatchlings more frequently become disoriented due to artificial lighting during a new moon than during a full moon. Talk about how hatchlings perceive artificial lighting as brighter than the moon.

4. Identify forms of artificial lighting on beaches and discuss ways of reducing artificial lighting.

Assessment

1. Have the students complete the worksheet provided that describes four different beach scenarios. The students should fill in the blank with the appropriate answer for each scenario. They should then illustrate each scenario drawing the beach and the ocean in the correct locations and placing the sea turtle hatchling in the correct direction. An example is shown below:
Seafinding Behavior Worksheet

*Which direction will the hatchling crawl towards?

1. Scene A: There is a new moon above the horizon. There is a lot of artificial lighting on the beach. _________________

2. Scene B: There is a full moon above the horizon and no artificial lighting. _________________

3. Scene C: There is a full moon above the horizon The beach looks brighter because of the artificial lighting. ______________

4. Scene D: There is a half moon on the horizon and only one source of artificial lighting on the beach. _________________
**TRACKS IN THE SAND**

**Focus Question:**
What types of tracks do sea turtles leave in the sand and what can be learned from those tracks?

**Activity Synopsis**
The students will identify tracks left in the sand by species of sea turtles and then create their own sea turtle tracks in the sand.

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<th>Standards</th>
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<td><strong>Fourth Grade Science Standards</strong></td>
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<tr>
<td><strong>Standard 4-2</strong> Organisms and Their Environments</td>
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<tr>
<td>4-2.4 Distinguish between the characteristics of an organism that are inherited and those that are acquired over time.</td>
</tr>
<tr>
<td>4-2.6 Explain how organisms cause changes in their environment</td>
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<tr>
<td><strong>Fifth Grade Science Standards</strong></td>
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<td><strong>Standard 5-1</strong> Scientific Inquiry</td>
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<td>5-1.7 Use a simple technological design process to develop a solution or a product, communicating the design by using descriptions, models, and drawings.</td>
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<tr>
<td><strong>Standard 5-3</strong> Landforms and Oceans</td>
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<td>5-3.6 Explain how human activity (including conservation efforts and pollution) has affected the land and the oceans of the Earth.</td>
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<table>
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<tr>
<th>Objectives:</th>
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<tr>
<td>Students will be able to:</td>
</tr>
<tr>
<td>1. Identify characteristics of animals from their tracks</td>
</tr>
<tr>
<td>2. Understand how animal tracks are used by humans for both conservation and hunting</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Time Frame:</th>
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<tbody>
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<table>
<thead>
<tr>
<th>Key Terms:</th>
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<tr>
<td>Body Pit</td>
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<tr>
<td>Emerging Crawl</td>
</tr>
<tr>
<td>Poaching</td>
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<tr>
<td>Returning Crawl</td>
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<table>
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<th>Materials:</th>
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<tbody>
<tr>
<td>Track Identification Worksheet (provided)</td>
</tr>
<tr>
<td>Sea Turtle Tracks Quiz (provided)</td>
</tr>
<tr>
<td>Sand</td>
</tr>
<tr>
<td>Glue</td>
</tr>
<tr>
<td>Cups</td>
</tr>
<tr>
<td>Sticks</td>
</tr>
<tr>
<td>Sheets of Styrofoam</td>
</tr>
<tr>
<td>Markers</td>
</tr>
<tr>
<td>Paintbrushes</td>
</tr>
<tr>
<td>Scissors</td>
</tr>
<tr>
<td>12 x 12 in pieces of cardboard</td>
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</tbody>
</table>
**Characteristics of a Nesting Female Crawl**

There are three basic parts to tracks of a nesting female. The first part is called the emerging crawl tracks. This is the set of tracks leading out of the ocean and to the nest. This is designated by A in the diagram. The second part of the tracks is the body pit. This is where the female makes a depression in the sand with her body; this is where the female lays while depositing her eggs. In the diagram, this is designated by B. The last part of the tracks is the returning crawl. These are the tracks the female leaves as she returns to the sea. The letter C marks this part in the diagram. Leaving these tracks both helps and hinders sea turtles. These tracks are very useful to conservationists because they can tell the approximate location of the nest under the sand. This allows them to locate the nest easily. When they know where the nest is, they can mark it and protect it or relocate the eggs to a safer, more suitable location. However, poachers are also able to identify where a nest is because of these tracks. This allows them to find the nest and remove the eggs.

**Identifying Tracks in the Sand – Adults**

All sea turtles leave a distinct mark in the sand caused by their flippers. They must use their flippers to pull and pushing their heavy bodies up and down beaches. Adult turtles leave two types of tracks in the sand – symmetrical or asymmetrical. The Flatback, Green, and Leatherback turtle all leave symmetrical tracks in the sand. Their front flippers move simultaneously in order to drag themselves up the beach. The flippers create diagonal depressions at the sides of the track. This is exemplified in the diagram. The Kemp’s Ridley, Olive Ridley, Hawksbill, and Loggerhead leave an asymmetrical track. One front flipper moves forward at the same time as the hind flipper on the opposite side. The diagonal depressions caused by the flippers are offset on these tracks. This can be seen in the diagram.

**Identifying Tracks in the Sand – Hatchlings**

Hatchlings leave both symmetrical and asymmetrical tracks in the sand. The Flatback, Green, Loggerhead, Hawksbill, Kemp’s Ridley, and Olive Ridley crawl on land by extending and contracting opposite front and hind flippers. This leaves an asymmetrical track in the sand. Leatherback hatchlings extend both front flippers at the same time. The flippers touch the ground and they sweep them back which causes them to lift their bodies off the ground. The hind limbs move with the front flippers. This leaves a symmetrical track in the sand.
**Warm Up**

1. Ask students if they have ever seen animal tracks before? What kind of tracks have students seen? Where they in the dirt, in the sand, or in the snow?

2. Ask students if sea turtles make tracks? Where can you find their tracks?

**Activity**

**Part I**

1. Inform students that they will be learning how to distinguish the tracks that each species of sea turtle leaves in the sand.

2. Go over a typical nesting crawl with the students. Draw tracks on the board being sure to include an entrance path, exit path, and body pit. Explain how female sea turtles make these in the sand.

3. Pass out the sea turtle tracks sheet to each student. Let them study the sheet for about 10 minutes. Tell them to try to find the differences between the adult tracks. Is it easy to distinguish between the different hatchling tracks? Which species have hatchling and adult tracks that look similar?

4. Now pass out the sea turtle tracks worksheet. Give students time to fill out the worksheet. Identify exit, entry, and body pit - what species - hatchling or adult

**Part II**

1. The students will now create their own sea turtle tracks in the sand.

2. Tell the students to pick two different species of sea turtles. The students will make the tracks of both the hatchlings and the adults of these two species.

3. Pass out the pieces of cardboard. Have the students divide the cardboard into four sections by drawing a cross in the middle of the cardboard. At the top of each square, the students should label which turtle made the track. For instance “Leatherback Hatchling Crawl Track.” The students should to tracks from both hatchlings and adults for their two species.

4. Pass a sheet of foam out to each student. Have them draw the turtle track that they chose onto the foam. They should then cut these out using scissors. These will become the stamps for making turtle tracks in the sand. Make sure the students label their stamps in order to distinguish the different tracks.

5. Pass out a cup to each of the students. Have the students pour sand and glue into their cups. Stir the mixture with a stick.

6. Using a paintbrush or spatula, they should spread the sand onto the first section of the cardboard.

7. While the sand is still wet, the students should start making tracks in the sand with their stamp. Pass out track diagrams as a reference for how the students should space each track.
Activity Continued

Part II Continued

8. Repeat this process with the three remaining sections of the cardboard.

9. Let the cardboard dry for about an hour. Display them in the classroom in order for the students to visualize their work.

Wrap Up

1. Discuss how sea turtle tracks have been both beneficial to their conservation and how it has caused populations to decline.

2. Take the students outside and have them look for other animal tracks.

3. Ask the students how scientists look for animals that do not leave tracks. How do scientists tell if a fish has been in a certain area?

4. Explain to the students other methods for tracking animals

Assessment

1. Cover up the sea turtle names on the tracks that the students created. Have the students go around the room and try to guess the tracks. They should write their guesses on a piece of paper.

2. If students cannot guess the tracks after about 10 minutes, then let them use an identification sheet.
TRACK IDENTIFICATION

Hawksbill Track

Green Track
TRACK IDENTIFICATION

Leatherback Track

Loggerhead Track
**NESTING SEA TURTLE CHALLENGE**

**Focus Question:**
What challenges do nesting females face on the beach, and how can humans help to reduce those threats?

**Activity Synopsis**
Students will learn about all of the obstacles that nesting female sea turtles must face on the beach. They will also learn about the different obstacles and how they are produced. The students will brainstorm how they can make these obstacles and then set up an obstacle course to simulate a nesting sea turtle on the beach.

**Objectives:**
Students will be able to:
1. Explain how humans and other organisms cause changes in the environment.
2. Understand the affect limiting factors have on populations.
3. Create simple objects from the imagination.

**Standards**

**Fourth Grade Science Standards**

**Standard 4-2** – Organisms and Their Environment
4-2.3 Explain how humans and other animals use their senses and sensory organs to detect signals from the environment and how their behaviors are influenced by these signals.
4-2.4 Distinguish between the characteristics of an organism that are inherited and those that are acquired over time.
4-2.5 Explain how an organism’s patterns of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).
4-2.6 Explain how organisms cause changes in their environment.

**Fifth Grade Science Standards**

**Standard 5-1** – Scientific Inquiry
5-1.7 Use a simple technological design process to develop a solution or a product, communicating the design by using descriptions, models, and drawings.

**Standard 5-2** – Ecosystems: Terrestrial and Aquatic
5-2.5 Explain how limiting factors (including food, water, space, and shelter) affect populations in ecosystems.

**Standard 5-3** – Landforms and Oceans
5-3.6 Explain how human activity (including conservation efforts and pollution) has affected the land and the oceans of the Earth.

**Time Frame:**
60 minutes

**Key Terms:**
Artificial Lighting
Poaching

**Materials:**
- Open, grassy field
- Obstacles List (provided)
- Various objects that will be made into obstacles
- Paper
- Colored pencils/Crayons
### Background

- **Sea Turtles Return to their Birth Place**
  
  Sea turtles return to the same beach they were born on to lay their eggs. Since it takes a long time for sea turtles to mature, the beach that they were born on could be drastically changed by the time they return. The beach could have undergone natural transformations such as sand erosion or sand accretion. The beach could also have human impacts such as beach development, beach lighting, and increased human populations on the beach. When female sea turtles return to the beach, it is highly likely that they will have to contend with some type of obstacle.

- **Nesting Takes a Great Amount of Energy**
  
  It requires a large amount of energy for females to nest. They must emerge from the ocean, crawl up the beach, dig a hole, deposit the eggs, cover the hole, and crawl back down the beach and into the ocean. Female sea turtles do this multiple times in one nesting season too! Nesting females often return to the ocean when the beach seems too dangerous or there are too many obstacles. If this happens, the female sea turtle expends a lot of wasted energy because she did not deposit eggs. If this happens multiple times, then a sea turtle may not be able to lay as many clutches as she could. Sometimes, sea turtles will lay their eggs in the water if they cannot find a suitable beach to nest. The eggs cannot survive in water; therefore, this is a wasted clutch of eggs.

- **Nesting Obstacles**
  
  Female nesting sea turtles face many obstacles when they crawl onto the beach. These obstacles are both natural and human impacts. Natural obstacles include: logs or fallen branches, holes in the sand, and predators. Human obstacles include: lighting, development, holes dug in the sand by beach visitors, poaching, and debris or pollution. These obstacles can be faced by sea turtles when they are crawling up the beach to nest and crawling back down the beach to return to the ocean. Predators and poaching can occur while sea turtles are depositing eggs.
NESTING SEA TURTLE CHALLENGE

Procedure

Warm Up

1. Explain to the students how female sea turtles come to the beach to lay their eggs. This information can be found in the background material.

2. Inform the students that this is not an easy task for female sea turtles. They have to spend a lot of energy to nest. Explain to the students that it is really important that sea turtles lay their eggs when they come up on a beach. If they crawl onto the beach and do not lay eggs this is a huge energy cost to sea turtles.

3. Discuss with students that there are both natural and artificial obstacles that female nesting turtles face when they come onto a beach. The artificial obstacles are caused by humans.

Part I

1. Ask the students to think of obstacles that nesting females may face on the beach. Have a brainstorming session. Keep a list of all the obstacles that the students think up.

2. When the students are done listing obstacles, discuss with them any obstacles that they did not mention.

3. Inform the students that they are in charge of designing an obstacle course designed like a nesting sea turtle beach. It is their job to figure out what objects can be used to represent obstacles on the beach.

4. Narrow down the list of which obstacles that the class wants to construct and then have them brainstorm for about 20 minutes.

5. Refer to the list of suggested objects to use to help the students get started.

6. After the students have been given time to think of ways to create the obstacles, make another list of their ideas. Decide upon the obstacles that the class is going to create. The number of activities should range from 6 to 10.

Activity

Part II

1. Now it’s time to create the obstacle course!

2. Assembling and gathering the objects for the course could be done all at once or a little at a time. This activity could be spread out over a week or done in just a few days.

3. Once all of the obstacles have been created, find a place to set up the course.

4. Tell the students that they are going to become nesting female sea turtles on the beach. They will have to try to crawl through the obstacle course up the “beach” to find a good place to nest.

5. Have each student go through the obstacle course one time. When all of the students have completed the course, take out all of the obstacles that are human induced. Then, have all of the students go through the course one more time.

6. Clean up the course when finished.
NESTING SEA TURTLE CHALLENGE

Procedure

Wrap Up

1. Ask the students if they thought the course was easier the first or second time through. Were there more human or natural obstacles?

2. Discuss with the students how humans are hindering nesting sea turtles and inform them about how they can help to decrease some of the human obstacles.

3. Talk to the students about programs that have been started to clean up beaches and help sea turtles.

Assessment

1. Have the students make a brochure that tell people how they can help sea turtles on the beach. Have them write about threats to sea turtles on the beach and ways that the public can help reduce those threats.
Possible Nesting Beach Obstacles

1. Logs/Fallen Trees - Natural
   This could be a row of chairs that the students would have to crawl over.

2. Lights - Human
   Students would have to cover their eyes during the course when the instructor yells “lights!”

3. Hole in the Sand - Natural/Human
   Use rope to make a circle on the ground. When the students step in it, they have to count to 20 before they can get out.

4. Predators - Natural
   Instructor could stand in a certain area and try to tag students as they passed.

5. Poacher - Human
   Select a student to act as a poacher, but do not let the other students know who is the poacher. This student would be responsible for sneaking up on the nesting females and tagging them. This would represent a poacher taking the turtle.

6. Fishing Net - Human
   Lay a bed sheet on the ground to represent a discarded fishing net. The students would have to lay down on one side of the sheet. Have the students hold the sheet and roll to the opposite side of the sheet so that they become rolled up in the sheet. The students would then have to unroll themselves to continue on with the course.

* These are just ideas to get the students started. Encourage them to think up their own obstacles!
Section 4 References


South Carolina Department of Education <http://ed.sc.gov/agency/offices/cso/>


Photo References

Scott Eckert
Microsoft Clipart
http://www.nb bd.com/npr/fcr/brochure/2tracks.jpg
SECTION 5

SEA TURTLE CARE
# STRANDING DATA ANALYSIS

## Focus Question:
What types of injuries and illnesses occur in sea turtles, and how many sea turtles have the North Carolina and South Carolina sea turtle hospitals treated?

## Activity Synopsis
Students will analyze data on sick and injured sea turtles collected by the South Carolina Aquarium Sea Turtle Hospital and the Jean Beasley Sea Turtle Hospital in North Carolina. The students will construct graphs, charts, and tables to present the data and write a letter with their personal recommendations on how to prevent certain illnesses or injuries from happening. All of this information will be compiled into a report for either the South Carolina Department of Natural Resources or the North Carolina Department of Natural Resources.

## Objectives:
Students will be able to:
1. Analyze data by making graphs, charts, and tables
2. Draw results and conclusions from data
3. Compile information into a report formats

## Time Frame:
60 minutes

## Key Terms:
Necropsy
Stranding

## Materials:
- Carolina’s Story by Barb Bergwerf
- Hospital Data Worksheet (provided)
- Stranding Data Worksheet (provided)
- Graph paper
- Pencils/colored pencils

## Standards

### Fourth Grade Science Standards:

**Standard 4-1** – Scientific Inquiry  
4-1.4 Distinguish among observations, predictions, and inferences.  
4-1.6 Construct and interpret diagrams, tables, and graphs made from recorded measurements and observations.

**Standard 4-2** – Organisms and Their Environment  
4-2.5 Explain how an organism’s pattern of behavior are related to its environment (including the kinds and the number of other organisms present, the availability of food and other resources, and the physical characteristics of the environment).

### Fifth Grade Science Standards:

**Standard 5-1** – Scientific Inquiry  
5-1.6 Evaluate results of an investigation to formulate a valid conclusion based on evidence and communicate the findings of the evaluation in oral or written form.

**Standard 5-2** – Ecosystems: Terrestrial and Aquatic  
5-2.5 Explain how limiting factors (including food, water, space, and shelter) affect populations in ecosystems.

**Standard 5-3** – Landforms and Oceans  
5-3.6 Explain how human activity (including conservation efforts and pollution) has affected the land and the oceans of Earth.
STRANDING DATA ANALYSIS

Background

♦ Why Do Sea Turtles Strand?

Sea turtles usually strand on the beaches or in shallow waters close to the shore. They come to these areas because they are dead, injured, or debilitated. Sea turtles that have stranded because of an injury usually have infection around the wound. Injuries can include: shark bites, fishing gear injuries, boat strikes. Fishing gear can wrap around sea turtles causing deep wounds or the inability to swim and hunt for food. Sea turtles also run the risk of having boat propellers cut their carapaces. Sometimes sea turtles survive boat strikes, but some can be so severe that they kill the turtle. Sea turtles that have drowned also strand. The cause of drowning is usually fishing gear entanglement. Sea turtles strand due to sickness as well. Sea turtles can get sick from toxins or pollution in the water or by swallowing too much debris. Sea turtles often mistake trash in the water for food. When they eat this trash it can make them sick or it can block their digestive systems so that they can no longer eat real food. Sea turtles that are very lethargic, emaciated, and anemic also strand. Scientists and veterinarians have labeled this Debilitated Turtle Syndrome (DTS), but the cause of this sickness has not been determined yet.

♦ Stranding Protocol

In 1980, the Sea Turtle Stranding and Salvage Network (STSSN) was established in order to collect information on sea turtle strandings and document strandings along the Atlantic coast and the U.S. Gulf of Mexico coasts. The coastal areas of eighteen states from Maine to Texas participate as well as parts of the U.S. Caribbean. The data is collected by participants in this program, and then it is compiled into a large database. This is the website http://www.sesco.noaa.gov/seaturtleSTSSN.jsp/ to look up further information. When a sea turtle is found stranded on the beach, a state biologist is called to the area to assess the condition of the sea turtle. If the turtle is dead, the biologist performs a necropsy on the beach to try to determine why the turtle died. A necropsy is an external and internal examination of an organism. If the sea turtle is alive, the biologist will transport the sea turtle to a nearby facility that can care for it. The staff at the facility helps the sea turtle get healthy, and then they release it back into the ocean.

♦ Why is Stranding Data Important?

Collecting stranding data on sea turtles helps scientists estimate the population sizes of sea turtles. The number of sea turtles that have died in a population is a crucial part of determining if populations are decreasing, stable, or increasing. Stranding data also helps in the conservation of sea turtles. It can help to identify threats to sea turtles. Once these threats are identified, then scientists and conservationists can work to minimize these threats.
STRANDING DATA ANALYSIS

Procedure

Warm Up

1. Have the students read Carolina’s Story by Barb Bergwerf or read the book to the students.

2. Explain to the students that sea turtle hospitals have been set up in order to help sick and injured turtles. Also explain that the hospitals collect data on the turtles in order to document their injuries and illnesses.

3. Inform the students that scientists use this data to gather information about the health of sea turtle populations and to develop ways to stop them from getting sick or injured.

Activity

Part I

1. Tell the students that the South Carolina Department of Natural Resources (SCDNR) and the North Carolina Department of Natural Resources (NCDNR) need their help in order to analyze the stranding data gathered by participants in the Sea Turtle Stranding and Salvage Network and the South Carolina Sea Turtle Rescue Program.

2. These two organizations need to know the following: types of injuries and illnesses, types of injuries or illness seen most often, and the number of sea turtles that stranded in South Carolina compared to the number that stranded in North Carolina.

3. Have the students predict the types of illnesses and injuries that occur in sea turtles. Ask the students to predict which illness and injury happens most often to sea turtles.

4. Divide the students into two equal groups. One group should analyze the stranding data and the other group should analyze the hospital data. Pass out the appropriate data to each group. The stranding group should gather the following information:
   a.) the number of strandings per species.
   b.) the total number of strandings for North Carolina
   c.) the total number of strandings for South Carolina
   d.) the total number of strandings for each year

The hospital group should gather the following information:
   a.) a list of all the injuries and illnesses
   b.) the number of turtles that had each injury or illness
   c.) a list of each species and the number of each species that have been at the Hospital
   d.) a list of where the turtles came from and how many turtles came from each Location

5. The students should make bar graphs, pie charts, and data tables to display this information. Each student should make her/his own graphs, charts, and tables. Pass out the worksheets for the data analysis to each student.

6. Instruct the students to find a partner from the other group. They should share their results with their partner.
### STRANDING DATA ANALYSIS

#### Procedure

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<th>Activity Continued</th>
<th>Wrap Up</th>
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<tbody>
<tr>
<td>Part II</td>
<td>1. Discuss with the students the results of their analysis. Ask them to give you a summary of what they found.</td>
</tr>
<tr>
<td>1. Once the data has been analyzed, the students should pick either an injury or an illness that has been seen in the sea turtle hospitals.</td>
<td>2. Ask the students if they were surprised with the results of the analysis. What seems to be the biggest threat to sea turtles? Where should conservation efforts be focused?</td>
</tr>
<tr>
<td>2. The students should explain what caused the illness or injury they picked and how it could be prevented in a letter to the NCDNR, SCDNR, or the Sea Turtle Rescue Program. The students should also discuss ways that they could help prevent sea turtles from getting sick or injured.</td>
<td>3. Display this data on posters or large paper to hang in the hallways so the rest of the school will be informed as well.</td>
</tr>
<tr>
<td>3. The students should compile all of their documents together and turn it in as a report.</td>
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#### Assessment

1. The report that each student turns in would serve as the assessment.
# North Carolina and South Carolina Stranding Data

<table>
<thead>
<tr>
<th></th>
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SEA TURTLE PARASITES

Focus Question:
What type of organisms live on sea turtles, and how do these organisms affect sea turtles?

Activity Synopsis
This activity will introduce students to the organisms that can live on sea turtles. It will help them understand the relationship between these organisms and sea turtles. The students will also learn how these organisms can be harmful to sea turtles and what scientists do to help sea turtles that are covered in these organisms.

Objectives:
Students will be able to:
1. Understand the difference between commensal and parasitic relationships
2. Identify the roles of organism in food webs

Standards

Fourth Grade Science Standards:
Standard 4-2 – Organisms and Their Environment
4-2.1 Classify organisms into major groups (including plants or animals, flowering or nonflowering plants, and vertebrates [fish, amphibians, reptiles, birds, and mammals] or invertebrates) according to their physical characteristics.
4-2.6 Explain how organisms cause changes in their environment.

Fifth Grade Science Standards:
Standard 5-2 – Ecosystems: Terrestrial and Aquatic
5-2.2 Summarize the composition of an ecosystem, considering both biotic factors (including populations to the level of microorganisms and communities) and abiotic factors.
5-2.4 Identify the roles of organisms as they interact and depend on one another through food chains and food webs in an ecosystem, considering producers and consumers (herbivores, carnivores, and omnivores), decomposer (microorganisms, termites, worms, and fungi), predators and prey, and parasites and hosts.

Time Frame:
60 minutes

Key Terms:
Barnacle
Commensal
Epibiont
Leech
Parasitic

Materials:
- 15x21 in poster board pieces
- Pencils/pens
- Scissors
- Glue
- Paper Circles Worksheet (provided)
- Popsicle sticks
- Word Decoder Worksheet (provided)
- Mix of small shells, buttons, and bottle caps
- Straws
- Cups
- Red-colored water or red fruit drink
- Large containers to hold water
Epibionts

Sea turtles and other large organisms often have epibionts attached to them. Epibionts are smaller organisms that attach to larger organisms. These organisms cause little to no harm to the host. The major epibionts for sea turtles are barnacles, leeches and algae. These organisms are often found on a sea turtle’s carapace (shell). Another example of an epibiont is a shark and a remora. Remoras attach to sharks and use the sharks for transportation and food. A remora will feed on pieces of the prey that a shark has not eaten, and they also attach to sharks in order to catch a ride. Remoras have also been found on sea turtles as well.

Sea Turtles and Epibionts

Epibionts can have two different types of relationships with sea turtles – commensal and parasitic. A commensal relationship is when an organism benefits from another organism without hurting or affecting the other organisms in any way. Barnacles and sea turtles form a commensal relationship. When a barnacle attaches to a sea turtle, it can pull food from the water as the sea turtle swims more easily than if it were sedimentary. This benefits the barnacle, but does not affect the sea turtle. A commensal relationship is also seen in leeches. A leech can get nutrients by attaching itself to a sea turtle, but the sea turtle is not affected by the leech. However, when a large amount of leeches or barnacles attach themselves to sea turtles, then the relationship shifts to being parasitic. A parasitic relationship is when an organism benefits from harming another organism.

Too many barnacles on a sea turtle creates drag when the sea turtle swims and does not allow for the turtle to swim as efficiently. Too many barnacles can also cause infection to occur in sea turtles. Too many leeches cause a sea turtle to become anemic because of the amount of the blood that is being consumed by the leeches.

Barnacles as Location Identifiers

Recent research has shown that barnacles may be helpful in identifying regions in the ocean that sea turtles have inhabited. It may be that certain species of barnacles only occur in specific regions of the ocean. Therefore, scientists could examine the barnacles on a sea turtle and determine their species. Then, they could determine where those barnacles originated based on the species identification, which would also portray where the sea turtle had inhabited. This could greatly help in the conservation of sea turtles because scientists and conservationists would be able to identify areas that were important to sea turtles. Then, protection of these areas could be implemented.

Caring for Parasitic Turtles

When a sea turtle comes into the hospital with a heavy barnacle or leech load, the first procedure is to put the turtle in freshwater. The freshwater kills the leeches and the barnacles and it causes the leeches to detach themselves from the turtle. The barnacles must be pulled off of the turtle by hand. Usually, a tool that has a flat, thin head is used in order to get under the barnacle and pop it off. Once all of the barnacles are removed, Betadine© is put on the turtle to fight infection.
# SEA TURTLE PARASITES

## Procedure

### Warm Up

1. Introduce the students to leeches and barnacles. Show them pictures of these organisms and have the class identify them as either vertebrates or invertebrates.

2. Explain to the students that barnacles and sea turtles can have either a commensal or parasitic relationship. Explain what each of these terms means to the students. Explain to them how barnacles and leeches can affect sea turtles and how they can harm sea turtles. Pictures of leeches and barnacles on sea turtles can be shown to the students.

3. Explain to the students that barnacles attach themselves to sea turtles so they can feed as the sea turtle swims through the water. Most barnacles do not harm the sea turtles, but too many barnacles can cause sea turtles to swim more slowly. Explain that leeches do harm sea turtles by sucking blood from their bodies and making them anemic.

4. Inform the students that these barnacles and leeches are removed from the turtles when they come into the hospital and explain how this process is done. Then, tell the students that they are going to remove the barnacles from their own sea turtles and determine where they have been in the world.

## Activity

### Part I

1. Pass out pieces of poster board to the students. The students should draw the outline of a sea turtle onto their poster board and cut it out. It may help to draw an outline of a sea turtle on the board for reference.

2. The students should each receive a sheet of paper with the decoder circles. Mix up the three different sheets among the students. The students should cut out these pieces and glue them to various parts of their turtle. Pass out the corresponding decoder worksheet to the students as well.

3. As the students are gluing the pieces down, begin to pass out the shells, bottle caps, and buttons to the students.

4. Inform the students that these items are the barnacles and the circle pieces indicate where the sea turtle picked up the barnacles. The students should glue the buttons, shells, and bottle caps on top of the circle pieces trying to cover up as much of that piece as possible.

5. When the glue has dried, the students should trade their sea turtles and their decoder worksheet with a partner. Now pass out a Popsicle stick to each student. Instruct the students that they need to try to remove the “barnacles” from the turtles using the Popsicle stick.

6. Once the barnacles have been removed, the students should look at the circles under the barnacles to decode what region of the world that this turtle has visited.
### Procedure

**Part I Continued**

7. Have a map hanging in the class so that the students can visually identify where the sea turtles have been.

8. Each student could then share with the rest of the class the region of the world that their sea turtle inhabited.

**Part II**

1. Inform the students that they are going to become a leech sucking blood from a turtle!

2. Tell the students that each group represents leeches sucking blood from one turtle. Have the students form groups of 5 or 6 and pass out a straw and two cups to each student. Fill one of the cups half full with red-colored water. Kool-aid or another red fruit drink could also be used. Leave the other cup empty.

3. Instruct the students to suck up a straw's worth of liquid and place it into their empty cup. They should repeat this process four times in order to suck up the approximate amount that a leech would suck up.

### Activity

4. Place a large container in the middle of each group. Have the students pour the liquid from their cups into the container. Inform them that this represents the amount of blood that 5 or 6 leeches (depending on how many students are in the group) would take out of a turtle. This small amount would probably not harm a turtle.

5. Empty out the containers that were given to each group, and then place them back in the middle of each group. Explain to the students that they are going to be leeches again, but this time, tell them that they are all leeches on the same turtle. Again, have the students suck up the liquid with their straw four times and put it into their empty cup. Then, the students should pour that liquid into the container given to each group. Now, pour the liquid from each group into one container. Hold it up so that the class can see how much blood was taken from the turtle. Explain to the class that this would most likely harm the turtle and make it anemic. This would be a parasitic relationship.

6. Explain to the students how the hospital removes leeches from sea turtles.

### Wrap Up

1. Go over the difference between a symbiotic and parasitic relationship again. Explain to the students that when a turtle is covered with barnacles, it means that it is sick because it is not moving around enough to keep barnacles from settling on it. Also, explain that too many leeches can make sea turtles sick.

2. Explain to the students that barnacles and leeches are important parts of ecosystems and food webs. Make sure the students do not think that barnacles and leeches are bad.

### Assessment

1. Have the students write a story about a turtle and its relationship with both a leech and a barnacle. The students should explain the role of each animal in the ecosystem.
SEA TURTLE DECODER (1)

KEY

A  B  C  D  E  F  G  H  I  J  K  L  M
*  «  ▲  ☀  ♦  ☺  △  ■  ♥  ♣  ♠  #

N  O  P  Q  R  S  T  U  V  W  X  Y  Z
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DECODER CIRCLES (2)

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2 ♠
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Sea Turtles in the Classroom
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**KEY**

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**Hint: This place is all one word**
DECODER CIRCLES (3)

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5 ≈
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7 ↑
8 ↑
9 *
10 +
11 ◊
12 *
13 +
Section 5 References


Sea Turtle Stranding and Salvage Network <http://www.sefsc.noaa.gov/seaturtleSTSSN.jsp>

South Carolina Aquarium Sea Turtle Rescue Program Data Log

South Carolina Department of Education <http://ed.sc.gov/agency/offices/cso/>

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GLOSSARY

A

Adaptation
change in an organism or its parts that fits it better for the conditions of its environment.

Altricial
species whose young are relatively immobile and must be cared for by adults for a long time.

Amphibian
any organism that is able to live both on land and in water; especially, any of a class of poikilothermic vertebrate animals that in many respects are between fishes and reptiles.

Artificial Lighting
any light source other than natural light.

Asymmetrical
not symmetrical.

Bird
any of a class of endothermic egg-laying vertebrate animals with the body covered with feathers and the forelimbs modified as wings.

Body Pit
depression in the sand caused by a nesting female sea turtle.

Carnivore
a flesh-eating animal, especially, any of an order of flesh-eating mammals.

Civilization
the way of life of a people.

Clutch
a nest or batch of eggs.

Cold-stunned
the state that turtles enter when they are suddenly exposed to very cold water. They become lethargic and begin to float on the surface of the water.

Commensal
an adjective for the relation between two kinds of plants or animals in which one obtains a benefit (as food) from the other without damaging or benefiting it.

Consumer
a plant or animal that requires complex organic compounds for food which it obtains by preying on other living things or eating particles of organic matter.

Barnacle
any of numerous small saltwater crustaceans with feathery outgrowths for gathering food that are free-swimming as larvae but as adults are permanently fastened (as to rocks or the bottoms of ships).

Body Renourishment
Taking sand from elsewhere and putting it on a beach to prevent erosion.

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Culture
the beliefs, social practices, and
characteristics of a racial, religious, or
social group

Dehydration
to lose water or body fluids

Diffusion
the mixing of particles of liquids, gases,
or solids so that they move from a
region of high concentration to one of
lower concentration

Ecosystem
a system made up of an ecological
community of living things interacting
with their environment especially
under natural conditions

Emerging Crawl
the crawl track a nesting female
makes as she crawls onto the beach
to find a nesting location

Endothermic
characterized by or found with
absorption of heat

Environment
the whole complex of factors (as
soil, climate, and living things) that
influence the form and the ability to
survive of a plant or animal or
ecological community

Epibiont
an organism that attaches itself
another organism (host) without
benefit or harm to the host, such as
lichen on the barks of trees.

Fish
a poikilothermic vertebrate animal
with a typically long scaly tapering
body, limbs developed as fins, and a
vertical tail fin that lives and breathes
in water

Flatback Sea Turtle
essentially confined to the waters of
Australia, the flatback turtle nests
mainly on undeveloped and remote
nesting beaches on the north coast
of Australia. The flatback has a
rather squat profile.

Food Chain
a series of organisms in which each
uses the next usually lower member
of the series as a food source

Food Web
the whole group of interacting food
chains in an ecological community

Foraging
to make a search especially for food

Freshwater
relating to or living in or consisting
of water that is not salty

Endothermic
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absorption of heat

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Green Sea Turtle
it is a herbivore and feeds on
seagrasses and algae. Consequently it is
the species of marine turtle favored for its
meat and is sometimes known as the
edible turtle
Habitat
the place or type of place where a plant or animal naturally or normally lives or grows

Hawksbill Sea Turtle
it is typically found on and around coral reefs and has a hawk like beak for feeding on sponges and corals.

Herbivore
a plant-eating animal

Homologous
showing likeness between corresponding parts of different plants or animals due to evolution from a common ancestor in the distant past

Inference
the act or process of arriving at a conclusion

Intertidal Zone
the region on the shore that extends from the high tide line to the low tide line

Kemp’s Ridley Sea Turtle
the smallest and most endangered of the sea turtle species. The only nesting site for this species is at Rancho Nuevo, Mexico. They nest in arribadas, coming ashore in masses to nest during the day

Keratinous
relating to being made out of the protein keratin

Leatherback Sea Turtle
the largest of the seven species of marine turtle. This is the only marine turtle that does not have a hard shell and it takes its name from its leathery shell. It roams the oceans feeding on jellyfish

Leech
any of numerous flesh-eating or bloodsucking usually flattened worms that are made up of segments and have a sucker at each end

Life History
a history of the changes through which a living thing passes in its development from the first stage to its natural death

Loggerhead Sea Turtle
it has a large logger head to support its large jaw muscles for crushing mollusks and crustaceans

Mammal
any of a class of endothermic vertebrates that include human beings and all other animals that nourish their young with milk produced by mammary glands and have skin usually more or less covered with hair

Migratory
having a way of life that includes moving from one region or climate to another usually on a regular schedule for feeding or breeding
Misorientation
the directed movement of an Organism towards an inappropriate object or goal. When hatchlings that emerge from the nest are attracted to an artificial light at night on a beach, it is a form of misorientation

Myth
a story often describing the adventures of superhuman beings that attempts to describe the origin of a people's customs or beliefs or to explain mysterious events

N

Necropsy
an autopsy (an examination of a body to find out the cause of death) performed on an animal

Neritic Zone
The region of the ocean that extends from the shore to the edge of the continental shelves

Observation
an act of gathering information (as for scientific studies) by noting facts or occurrences

Oceanic Zone
the region of the open ocean; beyond the continental shelves

Olive Ridley Sea Turtle
this is the most numerous sea turtle in the world. It can nest in masses in arribadas that can take place during the day or night.

Omnivore
an organism that feeds on both animal and vegetable substances

Osmosis
the passage of material (as a solvent) through a membrane (as of a plant or animal cell) that will not allow all kinds of molecules to pass

P

Papillae
a small bodily structure (as one on the surface of the tongue that often contains taste buds) that resembles a tiny nipple in form

Parasitic
the act of living in or on another living thing in parasitism. Harming another organism while deriving personal benefits

Pen Pal
a friend made and kept through letter-writing

Poaching
hunting or fishing unlawfully

Poikilothermic
having a body temperature that varies with the temperature of its surroundings.

Precocial
species whose young are well developed at birth and can usually feed and be mobile on their own

Predator
an animal that lives by killing and eating other animals
Prey
an animal hunted or killed by another animal for food

Producer
a living thing (as a green plant) that makes its food from simple inorganic substances (as carbon dioxide and nitrogen) and many of which are food sources for other organisms

Reptile
any of a group of poikilothermic air-breathing vertebrates (as snakes, lizards, turtles, and alligators) that usually lay eggs and have skin covered with scales or bony plates

Returning Crawl
the tracks left in the sand by a nesting female returning to the ocean after depositing or trying to deposit a nest

Saltwater
water containing salts

Sargassum
any of a genus of brown algae that have a leafy branching body and air bladders and that grow in free-floating masses in the ocean

Scute
horny or keratinized plate that is part of the shell of a turtle. The number and particular grouping of carapace scutes can be used to distinguish the different species of sea turtle.

Semi-permeable Membrane
a membrane that will allow certain molecules or ions to pass through it by diffusion

Serrate
notched or toothed on the edge

Species
a category of living things that ranks below a genus, is made up of related individuals able to produce fertile offspring, and is identified by a two-part scientific name

Stranding
to run aground

Symmetrical
having, involving, or showing close agreement in size, shape, and relative position of parts on opposite sides of a dividing line or plane or around a central point

Terrestrial
Living on or in or growing from land

The Bends
A type of decompression sickness that occurs when nitrogen bubbles form in the blood stream

Thermoregulation
ability of an organism to keep its body temperature within certain boundaries, even when temperature surrounding it is very different

Tortoise
A land-dwelling turtle
V

Vertebrate
  Having a spinal column

W

Waning
  To grow gradually smaller or less

Washout
  The washing away of earth

Waxing
  To grow larger, stronger, fuller, or more numerous