9-12 A Sea Turtle's Life Activity

South Carolina Aquarium

Overview

Focus Question
How can we distinguish between sea turtle species? What is the life cycle of a sea turtle?

Activity Synopsis
Students will use a dichotomous key to distinguish between sea turtle species based on external characteristics. Then they will learn the life cycle of a sea turtle by plotting and analyzing navigation data.

Time Frame
Two 60 minute sessions

Objectives
The learner will be able to:

- Use a dichotomous key to determine sea turtle species
- List the seven sea turtle species
- Describe the life cycle of a sea turtle from egg to adult
- Plot navigation data using latitude and longitude
- Analyze navigational data in terms of a sea turtle's life cycle

Student Key Terms

- Brackish water
- Carapace
- Crocodilian
- Ectothermic
- Life cycle
- Herbivore
- Plastron
- Invertebrate
- Reptile
- Sea turtle
- Scute
- Terrapin
- Tortoise
- Vertebrate

Teacher Key Terms

- Costal scutes
- Critically endangered species
- Endangered species
- Marginal scutes
- Nuchal scute
- Oviparous
- Prefrontal scale/s
- Sargasso Sea
- Temperate water
- Testudines
- Thermoregulation
- Threatened species
- Tropical water

- Vertebral scutes

Standards

South Carolina College- and Career-Ready Science Standards 2021

Biology: B-LS2-2, B-LS2-7, B-LS4-6

*** Bold standards are the main standards addressed in this activity**

2014 Academic Standards and Performance Indicators for Science

Biology: H.B.1A.4, H.B.1A.5, **H.B.1A.6**, **H.B.1A.7**, H.B.1A.8, H.B.6A.1, H.B.6C.1

*** Bold standards are the main standards addressed in this activity**

South Carolina College- and Career-Ready Science Standards 2021

Biology Performance Expectations

B-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

B-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on biodiversity and ecosystem health.

B-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

2014 Academic Standards and Performance Indicators for Science

Biology Performance Indicators

H.B.1A.4 Analyze and interpret data from informational texts and data collected from investigations using a range of methods (such as tabulation, graphing, or statistical analysis) to (1) reveal patterns and construct meaning, (2) support or refute hypotheses, explanations, claims, or designs, or (3) evaluate the strength of conclusions.

H.B.1A.5 Use mathematical and computational thinking to (1) use and manipulate appropriate metric units, (2) express relationships between variables for models and investigations, and (3) use grade-level appropriate statistics to analyze data.

H.B.1A.6 Construct explanations of phenomena using (1) primary or secondary scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.

H.B.1A.7 Construct and analyze scientific arguments to support claims, explanations, or designs using evidence and valid reasoning from observations, data, or informational texts.

H.B.1A.8 Obtain and evaluate scientific information to (1) answer questions, (2) explain or describe phenomena, (3) develop models, (4) evaluate hypotheses, explanations, claims, or designs or (5) identify and/or fill gaps in knowledge. Communicate using the conventions and expectations of scientific writing or oral presentations by (1) evaluating grade-appropriate primary or secondary scientific literature, or (2) reporting the results of student experimental investigations.

H.B.6A.1 Analyze and interpret data that depict changes in the abiotic and biotic components of an ecosystem over time or space (such as percent change, average change, correlation and proportionality) and propose hypotheses about possible relationships between the changes in the abiotic components and the biotic components of the environment.

H.B.6C.1 Construct scientific arguments to support claims that the changes in the biotic and abiotic components of various ecosystems over time affect the ability of an ecosystem to maintain homeostasis.

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Cross Curricular Standards

South Carolina College and Career Standards for ELA
Inquiry (I) – 2.1
Communications (C) – 1.1

Background

Key Points
Key Points will give you the main information you should know to teach the activity.

- **Reptiles** are cold blooded animals that lay eggs, breath air and have scaly skin.
- Reptiles include **crocodilians** (crocodiles, alligators, caimen and gharial), snakes, turtles and lizards.
- There are about 7300 reptile species in the world. About 285 of these are turtles, 7 (some say 8) are sea turtles.
- Turtles are reptiles with a hard shell for protection.
- Turtles live in every type of environment (land, fresh water, **brackish water** and salt water).
- **Sea turtles** are turtles that spend almost their entire life in a marine (salt water) environment.
- Sea turtles have 4 main stages to their **life cycle**; eggs, hatchlings, juveniles and adults.

Detailed Information
Detailed Information gives more in-depth background to increase your knowledge, in case you want to expand the activity or you are asked detailed questions by students.

Reptiles are **vertebrates** (have a backbone) animals with the following characteristics:

- Cold-blooded (**ectothermic**)
- Breath air
- Lay leathery shelled eggs
- Have scaly skin

Reptiles include **crocodilians** (crocodiles, alligators, caimen and gharial), turtles, snakes and lizards. All together there are over 7300 known species of reptiles in the world. About 23 are crocodilians, 285 are turtles and over 7200 species of snakes and lizards.

All reptiles are cold blooded or ectothermic. This means that their internal body temperature is controlled by the temperature of their environment. They are air breathers, using lungs to breathe. Reptiles have internal fertilization, resulting in leathery shelled eggs, layed outside their body (**oviparous**). There are a few species of snakes that have live birth, but this is the exception. Reptiles are also known for their scaly skin and internal ears that can feel sound vibrations.

Turtles are reptiles in the taxonomic order **Testudines** which includes about 285 species (living and nonliving). Turtles are characterized as having a hard, bony (or cartilaginous) shell developed from their ribs to cover their body for protection. This top shell is called the **carapace**. The bottom shell is called the **plastron**. Turtles include **sea turtles**, **tortoises**, **terrapins** and turtles. The earliest fossil record known is from 215 million years ago. This makes the turtles the oldest reptiles, older than lizards and snakes. Turtles are known to live in environment type; land, fresh water, **brackish water** and salt water. Some examples in South Carolina are; box turtles and gopher tortoises live primarily on land, yellow-bellied slider and snapping turtles live primarily in fresh water, diamondback terrapins only live in brackish water habitats like tidal creeks and salt marshes, and sea turtles such as the loggerhead and green sea turtles live in the ocean.

Because turtles can live in every environment, species greatly differ in many characteristics such as extremity and shell shape and body, pectoral muscle and salt gland size. Sea turtles have flippers whereas fresh water turtles have webbed feet and claws and land turtles only have claws. Sea turtles and fresh water turtles have a rounded shell, but compared to land turtles they look much flatter.

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Sea turtles also get much larger than most freshwater and land turtles. They can handle being so large because they spend almost their entire life in the water, which makes them buoyant. Sea turtles also have very large pectoral muscles. They are much larger than other turtles so that they can propel themselves through the water. Their pectoral muscles are so large that they are unable to go inside their shell like freshwater and land turtles. Lastly, sea turtles have large salt glands in their skull allowing them to excrete salt from their bodies. Other turtles don't have to remove salt from their bodies.

Sea turtles are reptiles. They have a top shell called the carapace and a bottom shell called the plastron. Sea turtles have a shell for protection, but they cannot pull their limbs inside. Along with their shell, their large size helps protect them from most predators once they are adults. The front legs are flipper shaped and help to propel the turtle in the water. The back legs are used mainly as rudders for steering.

There are 7 species of sea turtles in the world. The 7 species are Flatback, Green, Hawksbill, Kemp's Ridley, Leatherback, Loggerhead and Olive Ridley sea turtles. US Atlantic Ocean sea turtles species live their entire lives in the ocean except when they are developing in the egg and when females come on shore to lay their eggs. They can be found throughout the world and are listed as a **threatened species** or **endangered species** internationally.

Sea Turtle Anatomy

Sea turtles are some of the largest turtle species in the world. They bodies can get so large due to the fact that most of their life is spent in the ocean where the water makes them buoyant and the weight doesn't crush their organs. Usually the only time a sea turtle gets out of the water is the females in order to lay eggs.

Sea turtles (except leatherbacks) have a top shell called the carapace and a bottom shell called the plastron. The shell protects the animal from predators and streamlines the turtle for swimming. The carapace is covered by keratinous scales called **scutes**. Scutes differ in number and shape depending on the sea turtle species. The row of scutes down the center of the carapace is the **vertebral scutes**. The rows of scutes on both sides of the vertebral scutes are the **costal scutes**. The **marginal scutes** surround the carapace and are much smaller compared to the other scutes. The **nuchal scute** is located right behind the neck.

Sea turtles have 4 flippers. The front two flippers power and the lift the turtle through the water. The back two flippers are like rudders for steering (they are also used in digging nests). Sometimes sea turtles have claws on their flippers, mainly used to hold the female during mating.

The head or skull of the sea turtle is composed of fused bones for protection of the brain and the sensory structures. Sea turtles have **prefrontal scales** between their eyes (sometimes paired) and help identify species. Sea turtles generally have a small brain. Most of the space within their skull is taken up by the salt glands. Sea turtles uptake salt water when they are eating their prey. The salt glands filter salt out of the body through ducts near the eyes. The eyes of a sea turtle are made for seeing underwater, not out of water. Their vision is nearsighted above the water. Research has found that some species see all color wavelengths, but they see orange best.

Species Information

Flatback Sea Turtle (*Natator depressus*)

The flatback sea turtle is generally only 35 inches in carapace length. They only live in the **tropical waters** of Australia where they tend to stay close to shore. This species has a fairly flat carapace (hence the name flatback) compared to other sea turtles and a gray to pale green color.

They are mainly carnivorous and feed on jellies and other soft **invertebrates** (sea cucumbers, sea pens and soft corals). Females nest at night about every two weeks during the summer. When hatchlings emerge, they stay close to shore unlike most sea turtles

hatchlings that go off shore to find protection. It is thought that the larger hatchling size in this species is a way for young hatchling to be somewhat protected from predators.

At this moment scientist do not have enough data to tell the conservation status of this species. They are only found in Australia.

Green Sea Turtle (*Chelonia mydas*)

Green sea turtles are on average 40 inches in length and weigh between 200-500 lbs. They are the largest sea turtles species with a hard shell (Leatherbacks are the largest, but they don't have a hard shell). The shell is olive brown to black depending on where they live. They have a single claw on their front flippers. They usually live close to shore in coastal environments between 30o north and 30o south (latitude), which includes both subtropical and tropical waters.

Green sea turtles are marine **herbivores** feeding mainly on sea grasses, sea weeds and algae. They are also known to migrate large distances from their feeding grounds to their mating and nesting grounds. For example, there is a population of green sea turtles that feed in Brazil and then migrate over 1400 miles to Ascension Island (in the middle of the Atlantic Ocean) to mate and nest. Females lay on average 75-150 eggs per nest and several nests per season. Individual females nest every 2-5 years.

Green sea turtles are endangered globally and threatened in the US. Common threats are fisheries, egg harvesting, human interaction and disease.

Hawksbill Sea Turtle (*Eretmochelys imbricata*)

Hawksbill sea turtles average 100-150 pounds and are 25-35 inches in length. The name hawksbill comes from their bird-like shaped beak. Their carapace has a tortoiseshell pattern including the colors brown, red, black and orange. Each flipper has two claws. Hawksbills live globally in tropical waters, commonly in reef areas.

The diet of a hawksbill is primarily sponges, but they also feed on benthic invertebrates such as crabs, urchins, corals and jellies. The beak is hooked and perfect for getting into holes to find prey. Because of their smaller size, hawksbills are able to climb rockier beaches than other sea turtles in order to lay eggs in more obscure locations. Females can lay up to 200 eggs in each nest, usually waiting 14-16 days between nest laying. They do not lay eggs each year and the egg size is comparable to a ping-pong ball.

Globally, hawksbill sea turtles are a **critically endangered species**. Throughout the world overharvesting is the main cause of population decrease. Humans hunt them for their shell to make jewelry and other products. It is thought that possibly 80% of the global hawksbill population has been depleted.

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

The kemp's ridley sea turtle normally weighs between 75-100 pounds with a shell length and width nearly equal at 24-28 inches. They are olive grey to grey in color, have a yellowish plastron, 5 pair of costal scutes and one claw per flipper. They reach sexual maturity at a younger age compared to other species at 10-15 years. Kemp's can be found mainly in the Gulf of Mexico, but also on the east cost of the US in coastal waters, less than 16o north.

Adult kemp's ridley's feed on crabs, snails, shrimp, fish and jellies. Females is usually lay 3 nests per nesting season, sometimes nesting during the day which is different than most sea turtles. A typical clutch size is 100-110 eggs which are laid between April and July.

About 95% of the kemp's ridley sea turtle population nests on one beach on the east coast of Mexico called Rancho Nuevo. Populations dropped dramatically between 1947 and 1978, mainly because of poaching and shrimp trawlers. Now, law states that all shrimp boats must use Turtle Excluder Devices (TED's) that will allow sea turtles to escape being caught in nets and they have put

limits on poaching. Populations are slowly recovering, but they are still considered critically endangered globally and endangered in the US.

Leatherback Sea Turtle (*Dermochelys coriacea*)

The leatherback sea turtle is the largest sea turtle species in the world. Adult males can weigh more than 2000 pounds and reach lengths over nine feet. The Carapace is leathery (hence the name) rather than hard with seven ridges running the entire length. The carapace is made up of tiny little bones that are embedded in dermal tissue. They do not have scutes like all other sea turtles species. The carapace is brown to black and has spots of pink, white or blue. The plastron is whitish with six ridges. Leatherbacks live all over the world, in every ocean. They can handle very cold temperatures, largely because of their ability to **thermoregulate**.

Leatherbacks eat mainly soft-bodied prey items like jellies. They have 3 cusps on their mouth for slicing prey and spines in their throat to aid in swallowing prey. They are able to dive to depths greater than 3900 feet in order to find prey. Scientists believe that their flexible body and size are what allow them to dive so deep. Females nest every 2-3 years and can lay up to 12 clutches per nesting season. Nest usually contain about 60-100 eggs that are 2 inches in diameter each.

This species is critically endangered around the world, endangered in the US. Some major threats include fishing gear injuries and egg harvesting.

Loggerhead Sea Turtle (*Caretta caretta*)

Loggerhead sea turtles are usually 30-42 inches in length and have a great range in weight from 200 to over 400 pounds. They are known for their large head size and powerful jaws. The carapace is reddish brown with white and the plastron is a creamy yellow. Each flipper has two claws the posterior part of the carapace is the thickest portion, helping to protect them from predators such as sharks. They live globally in **temperate waters** and are typically found near shore.

The powerful jaws of the loggerhead allow them to eat hard shelled prey such as crabs and snails, but they also feed on jellies, corals, urchins and sponges. Nesting season varies around the world and is controlled by temperature. For example, in Florida nesting season is from March-June whereas in South Carolina it is May-July. Females will nest 3-5 times per season, generally laying 95-150 ping-pong sized eggs. It is thought that females nest every 2-3 years.

Loggerheads are considered endangered globally, but threatened in the US waters. Major threats are egg harvesting, fishing gear injuries, pollution and artificial lighting on their nesting beaches.

Olive Ridley Sea Turtle (*Lepidochelys olivacea*)

The olive ridley sea turtle has a disk shaped carapace, similar to the kemp's ridley sea turtle. The carapace is 24-28 inches long and they weigh between 75-100 pounds. Olive ridley's are different than all other sea turtles because they have pores in the scutes that connect the carapace and the plastron. The purpose of these pores is still unknown to scientists. Olive Ridley's are a pelagic species living in tropical waters of the Pacific, Indian and South Atlantic oceans. Because they are pelagic, they are often associated with floating objects such as pollution, driftwood or even dead whales.

Olive ridley's forage in sandy bottom areas looking for fish and invertebrates such as shrimp, crabs, urchins, barnacles, corals and jellies. Olive's form nesting groups in areas separated from the mainland. These groups are synchronized on a 28 day cycle. Females typically lay 2 nests per season, each nests holding about 100 eggs. Because hundreds come together to nest, eggs from one nest sometimes get dug up by other nest laying females.

They are globally endangered. Common threats are fishing gear, egg harvesting, oil spills and pollution.

*Black Sea Turtle (*Chelonia mydas agassizil*)

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The black sea turtle has not been described as its own species yet. They are a sub group from the green sea turtles. Scientists are still determining if this east Pacific Ocean population is its own species. They inhabit the bays and coastal waters of the east pacific and are black or grayish black, weighing up to 300 ponds and up to 35 inches in length.

Life Cycle

The loggerhead sea turtle is South Carolina's state reptile and the most common sea turtle found of South Carolina's coast. The following information is specific to the loggerhead species, but also very similar to other sea turtles species.

The **life cycle** of a sea turtle has 4 main stages (add life cycle diagram). The stages are eggs, hatchlings, juveniles and adults (technically there is another stage between juvenile and adult called sub-adult, but this activity focuses on the 4 main stages).

Male and female loggerhead sea turtles reach sexual maturity around 20-30 years of age. Once sexually mature, males and females will mate in the ocean and the female will come on shore and lay eggs (average 100-120 eggs for loggerheads) in the sand, creating a nest about 6-12 inches deep and shaped like an upside down light bulb (add picture of nest). She may come on shore 2-5 times a season to lay a clutch of eggs, usually waiting about 1-2 weeks in between each clutch. The sea turtle nesting season on the Atlantic Coast for loggerheads typically begins in May and ends in August. Once the female lays the eggs, she will not return to her babies. A female usually waits about 2 years before returning to lay eggs again.

Loggerhead sea turtle eggs usually hatch after 2 months (47-65 days). The hatchlings will come out of their eggs and fight their way up through the sand until they emerge from the nest. Hatching typically occurs at night because of the cooler temperatures. Emergence normally takes about 4 days. It is thought that the hatchlings use the light of the moon to find their way to the ocean. The bright light from the moon shines on the ocean, creating a lighter horizon for the turtles to follow.

Once hatchling loggerhead sea turtles make it to the ocean, they swim miles offshore to a convergence zone. Off the east coast of the United States, they travel to the **Sargasso sea**. The Sargasso sea is a huge convergence zone with a lot of Sargassum sea weed, where hatchlings can live and find shelter and food. It is thought that hatchlings will live in the safety of the Sargasso sea for 3-4 years, which is the when they are considered juvenile sea turtles.

The life of a loggerhead sea turtle from the time they leave the Sargasso sea at the age of 3-4 years to their adult years is very much a mystery. Ongoing research is being done using satellite tagging to monitor the migration pattern of loggerheads. Filling in the missing pieces will help in protecting the species.

Procedure

Materials

Class Period 1 - Sea Turtle Species

- Intro Presentation
- Sea Turtle External Anatomy Guide
- Sea Turtle ID Sheet (Dichotomous Key from seaturtle.org)
- Species Identification Cards
- Species Identification Answer Key (Teacher only)

Class Period 2 - Sea Turtle Life Cycle

- Navigation Worksheet
- Navigation Worksheet Answer Key (Teacher only)
- 4 different color writing utensils for each student (colored pencils or markers work best)

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Procedure

Class Period 1 – Sea Turtle Species

1. Start by using the Intro Presentation to go over general information.

2. Make sure all students understand the characteristics of a reptile (vertebrates, air breathers, cold-blooded, lay eggs (most), scaly skin and internal fertilization). Go a step further to explain to them that reptiles can be grouped as crocodilians (alligators, crocodiles, caimen and gharial), turtles, snakes and lizards.

3. Explain to them that there are about 7300 species of reptiles in the world and about 285 of them are turtle species, including 7 sea turtle species.

4. Quickly review the external anatomy of a sea turtle using the Guide (carapace, plastron, scutes, head, eyes, front flippers, back flippers and tail). Let the students know that each species is different and this can be seen by looking at the external features of a sea turtle.

5. Go over the ways in which sea turtles differ from land turtles or freshwater turtles. Make sure to point out the flippers, body size, shell shape, pectoral muscles and salt glands.

6. Discuss that there are 7 different species of sea turtles in the world (some say 8 species, but we going to stick to 7 for the activities). Let them know that by looking at the external characteristics of the turtles, they can figure out which species is which.

7. Let the students know that they are going to use pictures of sea turtles to distinguish between each of the seven species using a dichotomous key.

8. Go over how to use a dichotomous key with the students (this should be a review from middle school). Tell them it's like a choose your own adventure book, where they will be offered 2 options and by picking the right answer it will take them to another 2 options and so forth until they get to the final answer (the correct species).

9. Give each student a set of Species Identification Cards and a Sea Turtle ID Sheet (dichotomous key). Go over one example with the class and then let them figure out the rest.

- Could set this up as a lab by cutting the cards apart, laminating them and setting them around the classroom making 7 stations (each with a Dichotomous Key and External Anatomy Guide)). Then students could rotate through and record their answers on a piece of paper numbered 1-7.

10. Once they are done, check their answers as a class using answer key.

Class Period 2 – Sea Turtle Life Cycle

1. Now that the students have a general understanding of the characteristics of a sea turtle as well as the seven species, lets move on to the life cycle. Define the term life cycle (continue using Intro Presentation). Have them walk through the steps of a human life cycle in order to make sure they understand (fetus, baby, toddler, child, teenager, adult and senior).

2. Next show them the life cycle diagram of a sea turtle. Have them study it for a few minutes and then see if someone from the class can describe each step starting with eggs and moving to hatchlings, juveniles, sub-adults, adults, mating adults, male adults, female adults and back to eggs.

3. Ask them to tell you the major difference between the male's life cycle and the female's life cycle. Make sure they understand that once a male sea turtle enters the ocean as a hatchling, it never comes back to land* whereas females do come back to land, only to

lay eggs. (* some male sea turtles have been known to bask in the sun, but this is rare)

4. Explain to the students that much of a sea turtle's life is still unknown, especially in the adult years. Research is being done to discover where sea turtles go and what they do during the many years out at sea as an adult, can also be called "the missing years".

5. Ask the students why it's so important for scientists to discover "the missing years"? See if anyone comes up with an answer and then tell them that it's important that we discover more about a sea turtle's life because in order to protect these endangered species, we need to understand where they go (to protect their environment) and what they eat (to protect their food sources).

6. Let them know that they are going to plot the latitude and longitude of a sea turtle's navigation route and try to discover which species it could be and what stage of life the sea turtle might be in based on where they are navigating.

7. Review latitude and longitude (use Latitude and Longitude of the World to help). Plot a couple points as a group so students understand how plotting latitude and longitude works.

8. Give the students each a Sea Turtle Navigation Worksheet. Each worksheet has 4 sets of plots (one per turtle) as well as a map to plot them on and a few questions to answer. It works best to have them plot each set using a different color pen/pencil. The plots represent different life stages of a Loggerhead including an adult male, nesting female, juvenile and hatchling. Have the life cycle slide up during the activity so students can reference it.

- Could set this up as a group project by laminating 4 Navigation Worksheet and breaking students into 4 groups. Each group could be assigned a sea turtle life stage to plot and figure out the life stage it is in. Could then share their plots and results with the rest of the class. (Note: best to use vis-a-vis markers on laminated worksheet to plot points)

9. Go over the answers. Do they see how looking at a map of a sea turtle's voyage can help scientists better protect them?

At-home Learning and Virtual Modifications

At-home Learning: Have students explore the Sea Turtle's Life Wakelet: https://wke.lt/w/s/CODBYZ . It contains two videos to introduce sea turtles and their life cycle and contains the two worksheets below. The first will have them use a dichotomous key to identify the seven species of sea turtles. The second worksheet will have them identify the stages of a sea turtle's life cycle through a navigation plotting activity.

Sea Turtle Identification Worksheet

Sea Turtle Life Cycle Navigation Worksheet

Virtual: Use the following nearpod information to choose how to teach this activity. Activity will introduce the species of sea turtles, have them work through a dichotomous key with 4 species of sea turtles, introduce a sea turtles life cycle and plot the navigation data.

Teacher led lesson without student interaction

Teacher led lesson with student interaction - directions

1. Create a free nearpod account (https://nearpod.com/)
2. Ask Aquarium to send you the A Sea Turtle's Life nearpod link (email education@scaquarium.org)
3. After you receive Aquarium link, add lesson to your nearpod activities by clicking "Add to My Library"
4. Send to students using Live Participation
5. You'll be able to see their answers and interactions

Follow-up Questions

- Why does it matter to scientists that we understand a sea turtle's life cycle?
- Do the ideas of latitude and longitude ever come up in your daily life? If so, explain.
- What is GPS? Does it have anything to do with latitude and longitude? Explain.

Assessment

Give students Assessment Worksheet and the Sea Turtle ID sheet. They should be able to determine the species using the ID sheet as well as come up with and explain migration patterns for the turtle based on the different life stages.

Scoring rubric out of 100 points

Correctly names the sea turtle species:	**10 points**
Correctly explains why they choose that species:	**10 points**
Correctly maps a path of a hatchling sea turtle:	**10 points**
Correctly explains navigation path drawn:	**10 points**
Correctly lists latitude and longitude points:	**10 points**
Correctly maps a path of an adult sea turtle:	**10 points**
Correctly explains navigation path drawn:	**10 points**
Correctly lists latitude and longitude points:	**10 points**
Correctly describes why scientists need to understand:	**20 points**

Cross-Curricular Extensions

STEM Extension
Design a model of a Protection Device for a sea turtle nest to protect it from predators. Things to think about in your design:

- It must be able to be anchored in the sand
- It must be easily transported to a "remote" site (where there are the most predators)
- It must provide a way for hatchlings to escape when they hatch
- It must be visible even after a storm that moves sand around
- It must be strong enough to withstand efforts by predators to get through it
- It must not litter the environment

STEM Extension
Have students use pictures to find geometric shapes in the carapace of a turtle. They should measure the shapes in inches and convert to centimeters and meters.

Resources

Teacher and Student Reference Books

Bolten, Alan B. and Blair E. Witherington. Loggerhead Sea Turtles. Smithsonian Institution, Washington, D.C., 2003.
Gulko, David and Karen Eckert. Sea Turtles: An Ecological Guide. Mutual Publishing, Hawaii, 2004.

Lutz, Peter L and John A. Musick. The Biology of Sea Turtles. CRC Press, Boca Raton, 1997.

Lutz, Peter L., John A. Musick and Jeanette Wyneken. The Biology of Sea Turtles, Volume II. CRC Press, Boca Raton, 2003.

Ruckdeschel, Carol and C. Robert Shoop. Sea Turtles of the Atlantic and Gulf Coasts of the United States. The University of Georgia Press, Georgia, 2006.

Safina, Carl. Voyage of the Turtles: In pursuit of the Earth's Last Dinosaur. Henery Holt and Company, 2007

Spotila, James R. Sea Turtles: A Complete Guide to Their Biology, Behavior and Conservation. Johns Hopkins University Press, 2004.

Witherington, Blair. Sea Turtles: An Extraordinary Natural history of Some Uncommon Turtles. Voyager Press, St. Paul, 2006.

Teacher and Student Reference Websites

Atlantic Herring
http://www.gma.org/herring/biology/distribution/comparing_oceans.asp
Wonderful explanation of the difference between temperate and tropic seas.

Caribbean Conservation Corporation
http://www.cccturtle.org/seaturtleinformation.php
This site has many links to sea turtle information. You will be able to link to basic sea turtle biology about life history, species information, nesting and behavior as well as learn why sea turtles are important.

Defenders of Wildlife
http://www.defenders.org/wildlife_and_habitat/wildlife/sea_turtles.php#
Good Site for information on sea turtle status on the Endangered Species List.

Florida Atlantic University
http://courses.science.fau.edu/~jwyneken/sta/SeaTurtleAnatomy_Species_Identification.pdf
Great description of how to tell sea turtle species apart for identification.

http://courses.science.fau.edu/~jwyneken/sta/
This site has a lot of links to sea turtle anatomy.

http://courses.science.fau.edu/~jwyneken/sta/SeaTurtleAnatomy-Standard_Measurements.pdf
Descriptions of how to measure different external features of a sea turtle (head, shell,…).

National Oceanic and Atmospheric Association (NOAA)
http://www.nmfs.noaa.gov/pr/species/turtles/
This site is a great resource for basic sea turtles information, but has many links to more in depth information as well. You will be able to click on links to each sea turtles species and get details information as well as click to other resource websites.

http://graysreef.noaa.gov/tw/turtles.html
Life history and basic information of the five sea turtle species found on the east and gulf coasts of the United States.

Sea Turtle.org
http://www.seaturtle.org
This website has all sorts of information to look through and updates the records daily (nesting numbers, stranding numbers,…). It also gives you the needed information to report sick or dead sea turtles found as well as satellite tracking maps.

http://www.seaturtle.org/documents/ID_sheet.pdf
Species dichotomous key pdf. Download this resource and it will show you how to identify each sea turtles species.

South Carolina Department of Resources (SCDNR)
http://www.dnr.sc.gov/seaturtle/outreach.htm
Good site for resources (curricula, field trip sites, links to other sea turtle sites and list of resource books).

http://www.dnr.sc.gov/marine/pub/seascience/pdf/seaturtle.pdf
Sea turtle life history and general facts as well as threats and conservation tips designed as a easy to print, pdf.

US Fish and Wildlife Service (USFWS)
http://www.fws.gov/northflorida/SeaTurtles/turtle-facts-index.htm
Information on each sea turtles species.

http://www.fws.gov/northflorida/SeaTurtles/20090700_You_Can_Help_ST.pdf
Link to brochure on ways people can help protect sea turtles. Brochure can be printed and folded as tri-fold or you can contact the USFWS to send you some.

Online Curricula

SEA K-12 Lesson Plans
http://www.sea.edu/academics/k12.aspx

NOAA's Aquarius Lesson Plans
http://www.uncw.edu/aquarius/education/lessons.html

NOAA's Learning Ocean Science through Ocean Exploration Curriculum
http://oceanexplorer.noaa.gov/edu/curriculum/welcome.html#curriculum

Project Oceanica Lessons
http://oceanica.cofc.edu/LoggerheadLessons/LoggerheadHome.htm
Project WILD
http://www.projectwild.org/resources.htm

Videos

Wildlife Survivors: A Tale of Two Turtles/Dolphins in Danger

National Geographic – Tales from the Wild: Cara the Sea Turtle

Nature – Voyage of the Lonely Turtles

The Sea Turtle: Threatened Vagabond of the Indian Ocean

Journey of the Loggerhead
http://www.envmedia.com/production/loggerhead/index.htm

Last Journey for the Leatherback
http://vimeo.com/7782397

The Turtle Ladies of Charleston County
http://www.scetv.org/index.php/carolina_stories/show/the_turtle_ladies_of_charleston_county/