

9-12 Sea Turtle Survivorship Activity

Overview

Focus Question

What threats do sea turtles face during the different stages of their lives?

Activity Synopsis

Students will run an experiment to look at the threats sea turtles face during the different stages of their lives. They will look at natural threats to sea turtle eggs, hatchlings, juveniles and adults as well as human induced threats. They will also discover some things that they can do to help sea turtle populations.

Time Frame

90 min.

Objectives

The learner will be able to:

- List the different stages of a sea turtles life.
- Explain the different threats to sea turtles during the different stages of their life.
- Determine if a sea turtle threat is natural or human induced.
- Calculate percentages and create graphs based on data collection.
- Name several things that can be done to protect sea turtles.

Student Key Terms

- Community
- Ecosystem
- Endangered species
- Food chain
- Life cycle
- Reptile
- Sargasso sea
- Sea turtle
- Threatened species

Teacher Key Terms

- Beach nourishment
- Carapace
- Cold-blooded
- Dredging
- Emergence
- Horizon
- Keystone species
- Migration
- Plastron
- Poachers

Standards

2014 Academic Standards and Performance Indicators for Science

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Biology: H.B.1A.1, **H.B.1A.4**, **H.B.1A.5**, **H.B.1A.6**, H.B.1A.7, H.B.6A.1, **H.B.6A.2**, H.B.6C.1, H.B.6D.1

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

Biology Performance Indicators

H.B.1A.1 Ask questions to (1) generate hypotheses for scientific investigations, (2) refine models, explanations, or designs, or (3) extend the results of investigations or challenge scientific arguments or claims.

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.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.6A.2 Use mathematical and computational thinking to support claims that limiting factors affect the number of individuals that an ecosystem can support.

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.

H.B.6D.1 Design solutions to reduce the impact of human activity on the biodiversity of an ecosystem.

Cross Curricular Standards

South Carolina College and Career Standards for ELA

Inquiry (I) – 1.1

Communication (C) – 1.1

Background

Key Points

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

- **Sea turtles** have 4 main stages to their **life cycle**; eggs, hatchlings, juveniles and adults.
- The environmental or natural threats to sea turtles change depending on their life stage. Sea turtles face more threats as eggs and hatchlings compared to juveniles and then even fewer threats as adults.
- Human induced threats have caused a drastic reduction in sea turtles populations around the world.
- All sea turtles are listed as either **threatened** or **endangered** by the Endangered Species Act.
- Sea turtles are an integral part of the ocean's **food chains** and they need to be protected around the world in order to save their populations.

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.

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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 flippers shaped and help to propel the turtle in the water. The back legs are used mainly as rudders for steering.

Like all reptiles, sea turtles are air breathers, lay leathery shelled eggs and are **cold-blooded**. They can be found throughout the world and are listed as **threatened** or **endangered species** internationally.

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 http://www.ccturtle.org/seaturtleinformation.php?page=species_world All 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.

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 all sea turtles species.

The **life cycle** of a sea turtle has 4 main stages. 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. 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 they 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.

Conservation

Sea turtles have been in existence for 65-145 million years according to fossil records. Today, they face many natural and human induced threats throughout their life. This is a breakdown of some of those threats:

Eggs:

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Natural threats to eggs include predators (fire ants, raccoons, domestic cats and dogs and ghost crabs), vegetation (roots smother eggs) and storms (high tides washing over nests).

Human threats to eggs include **poachers**, vandalism, **beach nourishment** and **dredging**.

Hatchlings:

Natural threats to hatchlings include predators (ghost crabs, raccoons, fire ants, birds and fish), disease and weather.

Human threats to hatchlings on the beach include poachers, beach obstacles (sand castles, holes and beach litter) and beach front lights (can confuse hatchlings to go in opposite direction of the ocean)

Human threats to hatchlings in the sea include fishing gear, litter and boats.

Juveniles:

Natural threats to juveniles include predators such as large fish and diseases such as Fibropapillomatosis (skin tumors), internal parasites (heavy loads of flatworms), external parasites (heavy loads of leeches, barnacles, worms or algae).

Human threats to juveniles include litter, boats and fishing gear (fishing line, ropes, nets and crab traps).

Adults:

Natural threats to adults include predators such as shark and diseases such as Fibropapillomatosis (skin tumors), internal parasites (heavy loads of flatworms) and external parasites (heavy loads of leeches, barnacles, worms or algae).

Human threats to adults include litter, boats and fishing gear.

Some people may wonder why it is so important to protect sea turtles. Sea turtles, just like all living things have their place in the ocean **ecosystem**. Without a balance of animal populations through **food chains**, communities and ecosystems could become unbalanced. People around the world rely on the ocean for food, oxygen, the earth's climate and medicines.

About 16% of the world's food comes from the ocean. This might not seem like a large percentage, but it equals about 200 billion pounds each year. It is thought that about 90% of the world's oxygen is produced by the phytoplankton of the ocean. This is important because all living things need oxygen to breath. The ocean also plays a huge role in the climate of the earth. The ocean collects and mixes carbon dioxide, heat and water, which in turn will control the climate patterns around the world. Researchers are always discovering more about the living things in the ocean. New discoveries could lead to medical breakthroughs in cures for diseases and medicines.

Sea turtles are known as **keystone species**, a species that if removed could cause dramatic changes to the **community**. An example of this is the leatherback sea turtle and jellyfish keystone species interaction. Fishermen have noticed an increase in jellyfish populations in the Atlantic Ocean. Jellyfish feed on fish larva. With more jellies there is less fish growing to adult size and therefore less fish for fisherman to catch. The reason is most likely because of the dramatic decrease in the leatherback sea turtle populations. Leatherback sea turtles eat jellies and without them the jelly populations are increasing. The main cause of the decrease in leatherback sea turtle population is from being caught in fishing nets. It's a cycle that went on for so long that without drastic changes could mean an end to many fishing industries.

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Many efforts are being done to protect sea turtles around the world. Protecting sea turtles must include the protection of the beaches as well as the ocean. Sea turtles are federally protected by the Endangered Species Act.

The following list of some things that can be done to protect sea turtles:

1. Never touch a sea turtle if you see one in the wild (this is illegal).
2. Call your local Department of Natural Resources (DNR) if you find an injured or stranded sea turtle
 - a. South Carolina DNR – (800) 922-5431
3. Turn off beach front lights during nesting season (May-Oct.)
4. Fill in sand holes on the beach during nesting season
5. Knock down sand castles at the end of the day during nesting season
6. Don't let your dog dig in the sand dunes (this is illegal)
7. Don't walk on sand dunes (this is illegal)
8. Use canvas bags instead of plastic to reduce trash
9. Don't litter
10. Use caution when boating and always watch out for turtles
11. If you catch a turtle while fishing, call DNR
12. Fisherman must use Turtle Excluder Devices (TED's) on all fishing/shrimping nets so turtles can get out if caught (this is law in the US)
13. Join an Island Turtle Team
14. Support a Conservation Organization
15. Leave No Trace (be respectful of nature while you are enjoying it)

Procedures

Materials

- [Nest Cards](#) (1 set = 1 card per student)
- [Natural Conditions Data Sheet](#)
- [Natural Conditions and Human Impacts Data Sheet](#)
- Dice (1 dice per 2 students)
- Calculators
- [Graphs](#) (1 per student pair)

Procedures

1. Introduce students to a sea turtles life cycle. Females come on shore to lay eggs, eggs hatch after about 2 months, hatchlings crawl to the ocean and swim to the Sargasso sea. After about 3-4 years the juveniles will leave the Sargasso sea. They are considered adults when they are about 20 years old and are sexually mature.
2. Briefly discuss with the students what they think are some of the struggles sea turtles encounter at every stage of their life (eggs, hatchlings, juveniles, adults).
3. Keep in mind that this activity has 2 main parts; looking at sea turtle's survivorship during natural conditions and then looking at survivorship when human impacts are added. Students need to know the difference between natural threats (predations, ocean tides, weather,...) and human threats (boats, fishing, pollution,...)

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4. Let the students know that for this game they are going to represent sea turtles from egg to adult and try to survive from stage to stage. Each student will start out representing a nest of 120 eggs. They will go through 3 steps during the Survivorship game; 1) eggs to hatchlings, 2) hatchlings to juveniles and 3) juveniles to adults.

Step 1: Eggs to Hatchlings

1. Use the Nest Cards for the first step. To get the cards ready for the activity make sure you have enough cards for 1 per student. Also, make sure that you use a ratio of about 50% survival, 50% death. The activity is set up for 24 students, but you can add cards or take cards away to get the percentage right for your class size.
2. A good suggestion would be to, in advance, print out enough cards for your needs, cut them out and laminate them so you can use them over and over.
3. Have each student pick a card (out of a hat, box or just walk around with the pile upside down) and see if their nest survived or was destroyed. Have students raise their hand if their nest survived (write number on board) and have them raise their hands if their nest was destroyed (write number on the board). Why were their nests destroyed? Have the students explain what happened to their nest if it didn't hatch.
4. Next, have students figure out what percentage of nests survived and how many eggs made it to hatchlings (remember, each student has 120 eggs in their nest).
5. Discuss what these numbers mean. Why are so many nests lost? Can you understand why many beaches along the coast have turtle teams to protect nests?

Step 2: Hatchlings to Juveniles

1. Step 2 involves surviving from a hatchling to a juvenile sea turtle. Have the students whose nests did not hatch pair up with someone whose nest did hatch. Give each pair a Natural Conditions Data Sheet and a dice.
2. Explain that the data sheet has a place to record data for both steps 2 and 3, but they are only going to focus on step 2, from hatchling to juvenile. Each turtle number, 1-120, represents each of their turtle hatchlings try to survive to a juvenile.
3. Review with the students what can happen to a hatchling while crawling from the nest to the ocean, from their journey from the beach to the Sargasso sea and the first 3-4 years of their life.
4. Tell the students they are now going to roll the dice for each turtle hatchling and record the number on the data sheet. Each number represents whether that hatchling survives to be a juvenile or doesn't. Numbers 1, 2, 3, and 4 mean the hatchling died and numbers 5 and 6 mean the hatchling survived. After each student pair finishes rolling the dice, they will need to go back and write down whether the hatching lives or dies.
5. You might want to write Lives and Dies on the board with the appropriate numbers under each so that the students won't forget.

Dice number	What the number represents	What to write on data sheet
1, 2, 3 and 4	Hatchling Dies	Dies
5 and 6	Hatchling Lives to Juvenile	Lives

6. Lastly, on the last page of the data sheet, have students calculate how many hatchlings lived to be juveniles, how many died, the percentage that lived and the percentage that died.

Step 3: Juveniles to Adults

1. Step 3 involves surviving from a juvenile to an adult sea turtle. Review what can happen to juvenile turtles as they grow to be mature adult sea turtles.
2. Students are going to roll the dice again, but this time only for the juveniles who survived.

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3. Once they've rolled the dice let them know that this time the numbers represent a different outcome. As turtles get bigger, they have fewer predators and therefore a better chance of survival. This time numbers 1, 2 and 3 mean the juvenile dies and numbers 4, 5 and 6 mean it lives to be an adult. You might want to write these on the board to remind them.

Dice number	What the number represents	What to write on data sheet
1, 2 and 3	Juvenile Dies	Dies
4, 5 and 6	Juvenile Lives to Adult	Lives

4. Once they are done, each student pair will calculate how many juveniles lived to be adults, how many died and the total percent that lived and died and put answers on last page of data sheet.

5. Have students graph the data from step 1 and step 2 (bar graph).

Add in Human Impacts

1. The next part of this activity is to look at how human impacts influence turtle survivorship. Without human impacts, sea turtle population would be in balance with nature. When humans get involved, the populations are sometimes shattered beyond repair. Students will see that by adding in human impacts, survivorship decreases.

2. Review with the students human impact on turtles (lights, trash, boats, fishing,...) and how each stage of a turtles life can be impacted by humans.

3. Hand out the Natural Condition and Human Impacts Data Sheet and let them know that they are going to repeat steps 2 and 3, but the dice numbers will represent different outcomes.

a. Step 2: Hatchlings to Juveniles

Dice number	What the number represents	What to write on data sheet
1 and 2	Death by natural conditions	Dies (N)
3, 4 and 5	Death because of human impacts	Dies (H)
6	Lives	Lives

b. Step 3: Juveniles to Adults

Dice number	What the number represents	What to write on data sheet
1 and 2	Death by natural conditions	Dies (N)
3 and 4	Death because of human impacts	Dies (H)
5 and 6	Lives	Lives

4. This time on the data sheet they need to keep track of whether each turtle lives, dies of natural conditions [Dies (N)], or dies because of human impact [Dies (H)].

5. Calculations should be recorded on last page.

6. Have your students graph the data (bar graph) and compare it to the first set of data that only had natural conditions.

7. What did they notice once human impacts were factored in? Can they think of any ways they could help sea turtles?

Follow-up Questions

- What do the island turtle teams do to protect sea turtles?

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- Why is it important to turn off beach front lights, fill in sand holes and knock down sandcastles at the beach during the months of May-October?
- Why is it important to protect sea turtles?

Assessment

Give students the [Assessment Worksheet](#) and have them describe a sea turtle's life cycle, calculate percentages, graph the data, explain the results, list at least three natural and three human impacts to sea turtles and describe three things they can do to help sea turtles.

Scoring rubric out of 100 points

Correctly describes sea turtle life cycle:	10 points
Correctly calculates percentages:	10 points
Correctly completes natural conditions graph:	10 points
Correctly explains graph:	10 points
Correctly completes natural and human impacts graph:	10 points
Correctly explains graph:	10 points
Correctly explains difference between both graphs:	10 points
Correctly lists 3 natural threats to sea turtles:	10 points
Correctly lists 3 human threats to sea turtles:	10 points
Correctly describes 3 things they can do to help:	10 points

Cross Curricular Extensions

STEAM Extension

Survivorship is important to the society of the arts. Have students design a tattoo, coloring page or cartoon using the theme of sea turtle survival. Make sure students are anatomically correct in their design when it comes to the carapace, scutes, head and flippers.

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*. Henry 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.

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Teacher and Student Reference Websites

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 Endanger Species List.

Marine Bio

<http://marinebio.org/Oceans/Ocean-Resources.asp>

Good site for understanding ocean resources.

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>

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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/