

9-12 Sea Turtle Research Activity

Overview

Focus Question

Can sea turtle data help solve sea turtle problems?

Activity Synopsis

Students will use real sea turtle data from the South Carolina Aquarium Sea Turtle Care Center to create a scientific poster that looks into one of the issues that sea turtles face.

Time Frame

Five 90 minute classes

Objectives

The learner will be able to:

- Manipulate data to research a topic
- Analyze data in tables and graphs
- Create a scientific poster
- Communicate findings in a poster presentation
- Work in a team setting

Student Key Terms

- Cold-blooded
- Epibiont load
- Sea turtle

Teacher Key Terms

- Endangered species
- South Carolina Department of Natural Resources
- Threatened species

Standards

2014 Academic Standards and Performance Indicators for Science

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

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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.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.

Next Generation Science Standards (NGSS)

HS-LS2-2, HS-LS2-6, HS-LS2-7, HS-LS4-5

HS-ESS3-6

Cross Curricular Standards

South Carolina College and Career Standards for ELA

Inquiry (I) – 2.1, 3.1, 3.3, 3.4, 4.1, 4.2, 4.3

Reading-Informational Text (RI) – 4.1, 4.3, 5.1, 9.1, 12.2

Writing (W) – 1.1, 2.1, 3.1, 4.1, 5.1, 6.1, 6.4

Communication (C) – 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 2.1, 2.2, 2.3, 2.4, 3.2, 5.1, 5.2, 5.3

South Carolina College and Career Standards for Math

SPID.1, SPID.4, SPID.7, SPID.9

Background

Key Points

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

- The South Carolina Aquarium Sea Turtle Care Center is a rescue, rehabilitation and release center for injured and sick sea turtles in South Carolina (and sometimes other states).
- When a stranded sea turtle is found, **South Carolina Department of Natural Resources** is called to come out to the scene. Then, the turtle is brought to the South Carolina Aquarium Sea Turtle Care Center.
- The 10 primary causes of sea turtle strandings are debilitated turtle syndrome (DTS), boat strike, fisheries interaction – incidental, entanglement – passive gear, local cold stun, transferred cold stun, predator attack, buoyancy disorder, no apparent injury and other.
- All **sea turtles** are listed as either **threatened** or **endangered** by the Endangered Species Act.
- Data is collected throughout the rescue, rehabilitation and release of all sea turtles.
- Scientists share information with each other and the public through publications, scientific posters, conferences and seminars (to name a few).
- Scientific posters include the following: title, introduction, methods, results, pictures, graphs/tables, conclusion, literature cited and acknowledgements.

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.

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

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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). The four species found in South Carolina are the Loggerhead, Kemp's Ridley, Green and Leatherback. 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.

Stranding Events in South Carolina

Sea turtles have been known to strand, which means they swim or float into shallow water and become stuck. Once a sea turtle hatches from its nest as a baby, if it is a female, it should not return to a beach until it is time to lay a nest. If it is a male, it will never return to the beach. He will stay out in the ocean. It is abnormal for a sea turtle to return to the land if it is not nesting. Therefore, when a sea turtle strands it most likely means that something is wrong with the sea turtle.

When a sea turtle is found stranded on the beach, the **South Carolina Department of Natural Resources (SCDNR)** is called. If you ever find a stranded turtle, call 1-800-922-5431. When a SCDNR person arrives on the scene they fill out a stranding report. This is a data sheet where all of the information about the turtle is documented. The important pieces of information to gather are the species of sea turtle, the approximate age, if it is tagged, and the extent of the injuries or condition. It is also very important to document where the sea turtle stranded and the type of activity that is occurring. For instance, are a large number of people fishing or boating?

Sometimes a sea turtle is found on the beach already deceased. Whether a turtle is found dead or alive, DNR should be notified immediately. Injured turtles will be taken to the South Carolina Aquarium Sea Turtle Care Center for rehabilitation and hopefully a release back to the ocean. The Sea Turtle Care Center has 2 main areas; the Sea Turtle Hospital and Sea Turtle Recovery. The Sea Turtle Hospital is located in the Aquarium's basement and is the home for most new and critical patients. Sea Turtle Recovery is located on the first floor and includes the patients who are in recovery and can be viewed using a one way window by Aquarium visitors.

Patients at the South Carolina Aquarium

When a sea turtle comes to the Sea Turtle Care Center it is examined by a veterinarian and the sea turtle biologists. Treatments begin immediately. Blood samples are taken and fluids are given. If needed a newly admitted sea turtles are soaked in freshwater to kill any organisms living on them. This is called the **epibiont load**. The amount and type of organism living on a sea turtle can provide information. A sea turtle that is densely covered in organisms has been lethargic. It has not moved very much so many organisms were able to settle on it. The freshwater does not harm sea turtles, but it kills the organisms living on the sea turtles. All of the organisms will then be picked off of the sea turtle. When a sea turtle's condition improves, it is moved into a saltwater tank.

A sea turtle is released when it has a good appetite, a normal weight, and healthy blood work. The hospital's goal is to return healthy sea turtles back to the ocean and learn as much as possible about the issues sea turtles face in order to inform the public and help sea turtles species around the world. The shortest length of time a turtle would stay in the hospital is 3 months. The longest so far is over 2 years. Since all species of sea turtles are either threatened or endangered, it is important to return healthy turtles to existing populations so that they may help grow populations of sea turtles.

Primary Stranding Causes

There are many different reasons that a sea turtle becomes stranded and the South Carolina Aquarium organizes them into 10 primary stranding causes. Once admitted and diagnosed, it may be found that a turtle has many problems, but these are the main primary causes.

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1. Debilitated Turtle Syndrome
2. Boat Strike
3. Fisheries Interaction - incidental
4. Entanglement - passive gear
5. Local Cold Stun
6. Transferred Cold Stun
7. Predator Attack
8. Buoyancy Disorder
9. No Apparent Injuries
10. Other

1. Debilitated turtle syndrome (DTS) is when a turtle is very lethargic and underweight with low blood glucose. In short, a very sick turtle. The cause(s) of debilitated turtle syndrome has not been determined. These turtles are typically covered in epibionts and depending on how long they've been sick, extremely malnourished. At this time we are unable to say whether this is a natural condition or caused by human influence.
2. Boat strikes are the number one cause of strandings in South Carolina. Sea turtles are air breathers so as they surface to breathe, can sometimes get struck by a boat or boat propeller. If a turtle is floating on the surface for another reason (floaters syndrome, DTS,...) they become more susceptible to boat strikes. Boat strikes are more numerous in the summer due to more people enjoying the water and also because turtles come closer to shore during nesting season.
3. Sea turtles are sometimes caught by fishermen in South Carolina, which is one type of incidental fisheries interaction. It is highly illegal to possess a sea turtle because they are federally protected animals, but it does happen on accident that they are caught hook and line. Most occurrences in South Carolina are from juvenile Kemp's Ridley or Green Sea Turtles. Sometimes the hook is easy to get out of the mouth or throat, but other times it is swallowed. Those turtles will require surgery to reach the hook. Another type of incidental fishery interaction is a turtle getting stuck in a net. Shrimp boats are required by law to have a Turtle Excluder Device (TED). The TED allows the turtle to get free of the shrimp net. If a turtle does not escape it could drown, so keeping close watch is important.
4. Sea turtles can get entangled in passive gear. Passive gear is any fishery item that is loose in the water and not monitored by a person. Examples are abandoned crab pots, fishing line that has been cut and is floating through the water or old rope in the water. All marine animals are susceptible to entanglements. Once entangled, an animal's movement to escape will usually just make the situation worse.
5. Sea turtles are cold blooded which means that their internal temperature is going to match the temperature of their surroundings. If a turtle is found in water below 60 degrees, it will become cold stunned and unable to move because the muscles are too cold. Cold stunned turtles who remain in cold water too long will often times get pneumonia. Exposure to extreme low air or water temperatures can also cause frostbite. Cold stunned patients found in South Carolina would be called local cold stun.
6. Sea turtles who are cold stunned in other locations are often brought to the South Carolina Aquarium for rehabilitation. These are called transferred cold stuns. The South Carolina Aquarium partners with other aquarium's and rehab centers across the country. When a large cold stun event occurs, it is common for turtles to be spread out among many facilities so all turtles get the care they need without the burden being placed on just one organization. The most common transfers to the South Carolina Aquarium come from the New England area.
7. Sea turtles can also succumb to predator attacks. These attacks could be inflicted by sharks, stingrays or birds. As adults, sea turtles are large, but can still be preyed upon by large sharks. As hatchlings and juveniles, many marine creatures can prey on them including birds and fish. Stingrays have been known to use their barb on a sea turtle, but most cases have come from stingrays and sea turtles being caught in a net together.

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8. Buoyancy disorder in sea turtles is the inability to control their place in the water causing them to float. This disorder is usually used synonymously with floater syndrome. It can be caused by a myriad of different reasons such as boat strikes, lung trauma, gas in the gastrointestinal (GI) tract and impaction.

9. A sea turtle can sometimes be found with no apparent injury on first glance. In cases like this, observation and testing will help determine the cause of stranding.

10. Sea turtle strandings listed as “other” can include many different problems and issues, but none common enough to put in its own category. Examples are trismus (lock jaw), brevetoxicosis (red tide poisoning), Necrotic Ulcerative Disease (dead skin), metabolic bone disease (issues with bones), fibropapillomatosis (skin tumors) and pulmonary bulla (air space in lung).

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. Strandings are not the only threats to sea turtles. They have many obstacles to overcome even before they hatch from the eggs. This is a breakdown of some sea turtle threats:

Eggs:

- 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 breathe. The ocean also plays a huge role in the climate of the earth. The ocean

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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.

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
 - o 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 (like the South Carolina Aquarium)
15. Leave No Trace (be respectful of nature while you are enjoying it)

Scientific Data

The South Carolina Aquarium Sea Turtle Care Center collects data from every turtle case that comes in. General data collected includes SCA (South Carolina Aquarium) turtle name, date admitted, date out, status (released, transferred, in hospital), species, sex, life stage (juvenile, adult), primary cause of stranding, stranding details, origin (location turtle was found), county, curved carapace length at arrival, weight at arrival, curved carapace length at release, and weight at release. Keep in mind that data collected is not perfect and sometime has points missing. It's also collected by humans so error can occur. With that in mind, every effort is taken to be consistent and thorough.

Data is kept and shared between scientists, with the general public and throughout the sea turtle network to help protect them. Scientist share data in way ways including writing publications, presenting at conferences, sharing through list serve networks, speaking at public or scientific seminars and creating scientific posters.

Scientific posters are a nice way to share findings because all the information is organized in one place and it doesn't require hours of reading. Good scientific posters include the following:

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- Title of research topic and names – a comprehensive title that could stand alone, student names in alphabetical order
- Introduction – should explain topic and why it was chosen
- Methods – explanation of how research was carried out
- Results – concise and thorough findings (do not explain why, save that for conclusion)
- Graphs/Tables – analysis of data that supports the results
- Pictures – can bring project to life with the right photos
- Conclusion – best explanation of the results
- Literature Cited – list of books, websites,... used during research
- Acknowledgements – a list of the people who helped with the project

Posters should include all of these sections and be pleasing to the eye with correct grammar. Scientists present their findings at conferences and to the public. It's important to be able to explain the project in a clear, concise manner. Good body language and eye contact go a long way to present research people want to hear about.

Procedure

Materials

- Computers w/ internet access
- Large poster board (one per group)
- Paper
- Markers
- Sea Turtle Books (if available)
- Access to data from the Sea Turtle Care Center (data is updated twice a year)
 - <https://docs.google.com/spreadsheets/d/1cgTsKLFq2sTWmWqFn1YCzPbZ9iU-AW0treHmDEEEtLO/edit?usp=sharing>
- [Scientific Poster Template](#)

Procedure

Note: Would be best if this activity followed the Sea Turtle Strandings Activity so students have a better understanding of the issues sea turtles face before starting this research based poster.

1. Introduce the students to the South Carolina Aquarium Sea Turtle Care Center. Let them know that data is kept on every sea turtle that enters the Aquarium.
2. Have them open the Sea Turtle Care Center Data on their computer and let them spend 15 minutes looking through the data.
3. Start a discussion on what they noticed. Did anything pop out? What information did they find interesting? Did they notice any trends?
4. Show them the Scientific Poster Template. Talk about each section and what information is included (see background for details).
5. Have students get into groups of 2-4 to work on the research project.
6. Now, have each group pick a topic to research and use the Sea Turtle Care Center Data as well as research online or in books to create their own scientific poster (on computer or on poster board). Be sure to give each group a poster template and grading rubric so they know the expectations of the project. Here are some potential topics if they need help:
 - Species trends

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- Annual or seasonal trends (in plastic ingestion, boat strikes,...)
- Relationships between or among the following: stranding causes, location, species, duration of recovery period, growth rates,...
- Negative human impacts versus natural stranding cause

7. Once poster is created, have the students present their findings to the class (or invite parents, administrators, staff) in a 5 minute presentation. All students should have a speaking part in the presentation.

8. Here is a suggested project timeline

- Day 1 – introduce project, form groups, look over data, pick topic
- Day 2 – research topic
- Day 3 – research topic and start creating poster
- Day 4 – finish poster
- Day 5 – present poster to class

Follow-up Questions

- What do you think is the best way for scientists to share research with the general public?
- Why do you think it's so hard for scientific research to reach the general public?

Assessment

Grade group posters and presentation using [Sea Turtle Research Grading Rubric](#). Members of the group will share points in all areas except group work. This is to encourage everyone to participate, but allow for individual grading if someone is not pulling their weight in the group.

Scoring rubric out of 100 points

Poster organization:	20 points
Poster topic coverage:	20 points
Poster design:	20 points
Presentation style:	20 points
Group work:	20 points

Cross-Curricular Extensions

STEM Extension

Have students create posters on computer including all graphs and tables.

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.

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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.

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).

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<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/