SEA TURTLE Search & Rescue = Conservation

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LESSON MODULE
SEA TURTLE TRACKING & CONSERVATION

OBJECTIVES:

Students will:

- Identify various species of sea turtles and their relation to the Florida and Eastern Seacoast and the impact of human population on this species.
- Identify several species of marine animals that might become stranded; distinguish their characteristics and habitats.
- Practice through virtual interactive computer lessons and practical mock turtle nests the procedure of identifying nests, rescuing hatchlings, and releasing hatchling to the sea.
- Plot stranding sites onto a map using latitude and longitude as well as compass directions with respect to coastal features.
- Identify several coastal features and important currents. Form hypotheses and make analyses based on the data.
- Create a product that demonstrates understanding and symbiotic relationship with biomes and dioramas identified in this lesson.
- Participate in field trips of sea turtle sanctuaries and contribute to the effort of species conservation in a realm of service learning projects.

GOALS: (In accordance with Sunshine State Standards)

- Students will develop their sense of science process, investigation and data analysis and interpretation through personal research and use of data findings through technology.
- Students will understand the need for protection of the natural systems on Earth.
- Students will know the positive and negative consequences of human action on the Earth's systems.
- Students will know that behavior is a response to the environment and influences growth, development, maintenance, and reproduction.
- Students will know that generally organisms in a population live long enough to reproduce because they have survival characteristics.
- Students will understand the competitive, interdependent, cyclic nature of living things in the environment.
- Students will understand that the classification of living things is based on a given set of criteria and is a tool for understanding biodiversity and interrelationships.
- Students will understand that humans are a part of an ecosystem and their activities may deliberately or inadvertently alter the equilibrium in ecosystems.
- Students will know that the study of the events that led scientists to discoveries can provide information about the inquiry process and its effects.
- Students will know that accurate record keeping, openness, and replication are essential to maintaining an investigator's credibility with other scientists and society.

- ❖ Students will know that a change in one or more variables may alter the outcome of an investigation.
- ❖ Students will know that special care must be taken in using animals in scientific research.
- ❖ Students will know that technological design should require taking into account constraints such as natural laws, the properties of the materials used, and economic, political, social, ethical, and aesthetic values.
- ❖ Students will know that no matter who does science and mathematics or invents things, or when or where they do it, the knowledge and technology that result can eventually become available to everyone.
- ❖ Students will know that computers speed up and extend people's ability to collect, sort, and analyze data; prepare research reports; and share data and ideas with others.

Sunshine State Standards:

Science Standards 6-8:

SC.D.1.3.4	SC.D 2.3.1	SC.D 2.3.2	
SC.E.1.3.1	SC.E.1.3.		
SC.F.1.3.1	SC.F.1.3.7	SC.F.2.3.3	
SC.G.1.3	SC.G 2.3.2	SC.G 2.3.3	SC.G 2.3.4
SC.H.1.3	SC.H.2.3	SC.H.3.3	

Math Standards 6-8:

MA.A.1.3			
MA.B.1.3	MA.B.2.3	MA.B.3	MA.B.4
MA.C.1	MA.C.2	MA.C.3	
MA.E.1	MA.E.3		

SEA TURTLE Search & Rescue = Conservation

SUBJECTS: Science (Life & Environmental Conservation), Biology, Oceanography, Mathematics, Language Arts, Social science **Grades: 6-8**

Summary of Project

Science classes will work in small cooperative learning groups as environmental biologists researching sea turtle species behaviorally and physiologically, in regard to factors that impact their survival. They will participate in nesting activities and tracking real life migrating females on line through NOAA and seaturtles.org of Southern Georgia University. Students will track, observe, and determine species of wildlife using local coastline and ocean areas, associated field equipment, and lab spreadsheet components through computer technology. Students will work together to determine diversity and location of marine life through data with computer software programs. Service learning projects will be a focus of extended studies and lessons in regard to sea turtles' conservation in Florida, wrapping up with an excursion to a sea turtle sanctuary.

COURSE OUTLINE

Teachers may customize the following lesson module to accommodate and modify for individual classes. The goals refer to Sunshine State Standards and may be selectively emphasized for classes as per the teachers' professional judgment. Lessons may be accommodated or accelerated, depending on students' capabilities. This module may also be concluded with a field trip to sea turtle sanctuaries. Technology is incorporated throughout the lessons in application of real life situations and interaction with conservation societies and tracking exercises.

1. Informational Background
2. Lesson A- Sea Turtles
3. Lesson B- Tracking
4. Students worksheets
5. Optional project of art and/or hands on activity with mock turtle nest
6. Adopting your own class sea turtle through seaturtle.org
7. Tracking the class sea turtle throughout the year.

SEA TURTLE Search & Rescue = Conservation

LESSON MODULE ON SEATURTLE TRACKING & CONSERVATION

SUBJECTS

Science (Life & Environmental Conservation), Biology, Oceanography, Social science, mathematics, Language Arts

LESSON 1: Grades: 6-8

BRIEF DESCRIPTION OF LESSON

Students will track, observe, and determine species of wildlife using local wetlands, associated field equipment, and lab spreadsheet components through computer technology.

Students will work together to determine diversity and location of wildlife through data with computer software programs.

OBJECTIVES

- Plot stranding sites onto a map using latitude and longitude as well as compass directions with respect to coastal features.
- Identify various species of sea turtles and their relation to the Florida and Eastern Seacoast and the impact of human population on this species.
- Identify several species of marine animals that might become stranded; distinguish their characteristics and habitats.
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- Develop their sense of science process, investigation, data analysis and interpretation through personal research and use of findings through technology.
- Create a product that demonstrates understanding and symbiotic relationship with biomes and dioramas identified in this lesson.
- Participate in field trips of sea turtle sanctuaries and contribute to the effort of species conservation in a realm of service learning projects.

MATERIALS

- Student Pages A and B
- GPS Handheld Locators
- Materials for creating mock turtle nests
- Geological survey map of your area, compass
- Computer Technology & LCD Projector

PROCEDURE

1. Start a preliminary discussion by asking students if any of them has ever considered swimming a great distance-like across the thirty-mile English Channel, for example. Swimming the Channel between England and France is considered a great human feat, but for some of the champion swimmers of the animal world, thirty miles would be a drop in the bucket. Whales migrate over thousands of miles of ocean in just one season. Dolphins and seals play over hundreds of miles of coastal waters of the Atlantic and Pacific. But the real champs are sea turtles: because of their long life spans, they log hundreds of thousands of miles. It's not uncommon for a sea turtle from Mexico or South America to be found off the northeast Atlantic coast in summer. Green sea turtles swim thousands of miles to lay eggs on the same tiny island where their mothers laid their eggs. Their powers of navigation, however fantastic, if their journey is interrupted may cause the animals to become lost or stranded. "Stranded" originally meant "beached." A beach was (and in England, still is) called a "strand." Sometimes a stranded turtle is found washed up on a beach. Tell students that they will be plotting real data for the locations of some sea turtles that were sighted during the latter months of 1995.

2. Using a topographic map of your area, or other maps with which students are familiar, you might want to use them to review latitude and longitude. The accompanying map shows degrees of latitude and longitude divided into thirty-minute intervals; students will have to approximate between these intervals to plot some of their points. Using a compass or any navigational aids, bring them in to discuss their use.

3. Hand out student pages. To use the map, students may need to know the terms used to describe bodies of water and coastal features. Have them find the state names to get oriented to the map and perhaps show where this region is on a U.S. map. Ask them to read the names of the bodies of water and find an ocean, a gulf, a sound, and a bay. They should be able to distinguish among them and put them in size order. Tell them that bays are generally sheltered on three sides.

4. Discuss some of the terms used to describe coastal features, including barrier beaches. They are created by waves hitting the shore of the mainland, then dragging sand out and depositing it until it forms a sandbar. Eventually, the sandbar grows large enough to be an island, a buffer zone that protects the mainland from further erosion by water. On a U.S. map, have students find the barrier beaches along the coasts of Texas, Georgia, North Carolina. Waves deposit sandbars that extend the shoreline into the ocean, creating a "point" such as Race Point in Cape Cod or Montauk Point on Long Island. The currents around the sandbar may flow at such an angle that they create a hook, the "arm" extending northward from the "elbow" of Cape Cod. The entire region of Long Island, Cape Cod, Martha's Vineyard, was formed by glacial moraine and then modified by the ocean's waves. Many bays shown on the map contain salt marshes and estuaries (where rivers empty into salt water).

Marshes, estuaries, and barrier beaches are all important wetland habitats that require management and preservation rather than destruction or development.

5. Have students begin plotting the points of the turtle sightings. They will find that these turtles were sighted in four areas: along the south shore of Long Island near the barrier beach, along the north shore of Long Island, in Gardiner's Bay, and farther north in Cape Cod Bay. Give students some of the background on each of the following four turtle species. This will help them fill out their data tables and hypothesize about what caused each stranding.

ASSESSMENT:

- Students will demonstrate their understanding of field equipment and functions of navigation by locating wildlife using GPS and compass.
- Students will write an essay or summary regarding the scientific advancements' impact on environment and knowledge of a species, applying wildlife management or protection of endangered species.
- Students will prepare Power Point Presentations with graphs and Excel data interpretation to present information and findings of investigation and learning with narration.
- Graphs and data analysis will be graded based on completeness and accuracy of information and readability of location through estimated coordinates.
- Students will be able to utilize Microsoft Excel through data entry to analyze acquired information and interpret data pertaining to wildlife observed and documented.
- Students will build dioramas or terrariums demonstrating biomes studied.
- Students will create presentations through performing arts productions.

Sea Turtle Fact Sheet

Marine turtles live in almost all the oceans of the world and are descendants of the land turtles. It is believed that they had their origin 150 million years ago. At the present time there are 8 species of marine turtles that are in families: Dermochelyldae and Chelonildae.

Eggs of the marine turtles are spherical, with a soft shell similar in texture to parchment paper.

The average diameter of the egg and total quantity will vary depending on the species. Marine turtles are very sensitive to external influences and at any moment they may interrupt the egg laying process and return to the sea. Once eggs have been laid, they can be handled easily to mark, measure, or take them out for photographs without interrupting the incubation process. During night, they are more sensitive to light than to strange noises. Once mother has finished laying all her eggs, she immediately covers the eggs and the nest. She even tries to conceal that the nest is beneath the sand. Once finished hiding the nest, she heads directly back to the sea.

Once deposited in the sand, sea turtle eggs will need certain conditions of humidity and temperature to enable them to hatch. In general terms, if the temperature is kept around 30 – 40 degrees centigrade, they will be females and with lower temperatures (27-29 degrees centigrade) they will be males. In their breastplate, there is a quantity of nutrients that enable the embryo to develop. The rupture of the shells inside the incubation room can take -3 days, but once all have broken their shells, they begin to surface by means of active simultaneous movements. This constant movement causes the sand on top to come off little by little and fall to the floor, where it accumulates. In the wild, this constant motion would cause the eggs to slowly work their way to the surface of the sand. The small turtles finally escape from the egg after 45-60 days of incubation, making their way home to the ocean.

Leatherback Sea Turtles are one of the oldest reptiles on earth and, sadly, one of the most endangered. Leatherbacks are one of the largest turtles in the world, at 6 feet long, 4 feet wide, and over 1,000 pounds. They have a soft “leathery” shell instead of hard, boney ones. Leatherbacks are strong swimmers and spend most of their time in the ocean. They use their front flippers as paddles and their back one to steer. Leatherbacks eat jellyfish and other soft bodied animal. A floating plastic bag looks like a jellyfish, but will coke a sea turtle.

The female leatherback comes ashore to nest. She crawls up at night, digs a hole in the sand, and lays 80-150 eggs. Shortly after, she returns to the sea. While the turtles are on land, scientists measure their shells. They also count eggs, record the nest temperatures, and attach radio transmitters to track where the turtles go. The eggs look like billiard or ping pong balls. Their shells are soft and leathery. Scientists move nest that are too close to the water to safer areas or to hatcheries. Eggs hatch in about 2 months.

Scientists can predict if hatchlings will be male or female based on the temperature of the nest. Hatchlings wait until night to leave the nest. Predators like sea gulls, hermit crabs, raccoons, and other birds would eat them during the day. Babies head for the ocean by seeing the reflection of light on the water surface. When they get there, they ride out to sea.

Background information on Sea Turtles and life in wild habitat:

KEMP RIDLEY SEA TURTLE

(*Lepidochelys kempi*)-endangered.* This is an extremely endangered species globally. Ridleys have gone from a population of four hundred thousand nesting females in the 1940s and 1950s to only about four hundred today. Within the region of the accompanying map, they live in certain areas of Long Island Sound, Block Island Sound, and portions of the Peconic Estuary. Some also live in Great South Bay. Generally, juveniles from two to five years old live in these areas. They eat primarily spider crabs and green crabs.

LOGGERHEAD SEA TURTLE

(*Carretta carretta*)-threatened.** Long Island Sound and its bays are home to juvenile, or nonreproductive, loggerheads. Adults may be found along the south shore of Long Island and up to about forty miles offshore. Their diet consists of spider, horseshoe, green, and portunid crabs.

GREEN SEA TURTLE

(*Chelonia mydas*)-threatened (endangered in Florida). Green sea turtles are less abundant in this region than the other sea turtles, and their diet and habitat are not as well documented. They are usually found in shallow bays where there is more aquatic vegetation for food. Several age classes have been observed in this region.

LEATHERBACK SEA TURTLE

(*Dermochelys coriacea*)-endangered. Although they are endangered, leatherbacks are one of the most abundant species of sea turtles in the region. They are found on the south shore of Long Island and in Long Island Sound but rarely in the bays. The population of older juveniles and adults eats mainly jellyfish. Tagged animals are known to have come all the way from French Guiana in South America. In parts of the Atlantic, leatherbacks have been known to reach over eleven feet and four thousand pounds.

*Likely to become endangered.

**Likely to become extinct in the foreseeable future.

6. After students have plotted their points, ask them what they think might have caused the strandings in each area. (Actual data are used in this exercise because scientists were able to determine the probable cause of each stranding.) Tell them that the Labrador Current is a cold current that comes from the north. They may infer from the map that the turtles spotted in Cape Cod Bay may have been trapped there by this cold current. On Long Island, cold northwest winds trap the turtles against the shoreline.

7. The leatherbacks on the south shore of Long Island were both found dead along the barrier beach; one had ingested plastic, the other was entangled in a fishing line. Ask students why this might occur at this location. (Proximity to New York City and populated areas. Also, leatherbacks eat jellyfish and may have mistaken plastic for food.) Discuss how important barrier beaches are both as habitat and as protection for the mainland from ocean storms. The ridleys and loggerhead found along the north shore of Long Island were cold stunned. Explain what this means and describe how the turtles are slowly warmed, given warm liquids intravenously, and then force-fed until they revive. They are kept in tanks until they are healthy again, then they are released, usually with a tag that enables scientists to monitor their movement by satellite. These turtles were probably driven to shore by the prevailing northwest wind. The other Kemp's ridley and the green sea turtle found in Gardiner's Bay were also cold stunned. The three cold stunned turtles found in Cape Cod Bay were probably swept into the cold bay and trapped there by the Labrador Current.

8. Ask students to look at Montauk Point, at the eastern end of Long Island. Tell them that the original lighthouse was surveyed and planned by George Washington; it has been moved a few times and just underwent another renovation to protect it. Ask students what the lighthouse needs protection from. They may guess that the erosion around the point has caused a change in the coastline and endangered the site of the lighthouse. Tell them that people who live in Provincetown (the community at the northernmost tip of Cape Cod) periodically "lose" their water wells. Ask for a hypothesis about this phenomenon. There is constant erosion and deposition in this area, which causes the location of groundwater to shift with the shifting sand dunes.

Reproduction.

A. Sexual maturity.

Researchers are still studying sexual maturity in sea turtles.

1. Estimates of sexual maturity in sea turtles vary not only among species, but also among different populations of the same species. Maturity may range from as early as three years in hawksbills; 12 to 30 years in loggerheads; to 20 to 50 years in green sea turtles.

2. Sexual maturity often is related to carapace size. Studies have shown that hawksbills reached sexual maturity at a carapace size of 60 to 95 cm (24-37 in.); loggerheads reached maturity at a carapace size of 79 cm (31 in.); and green sea turtles reached maturity at 69 to 79 cm (27-31 in.).

3. Evidence suggests that some turtles continue to grow after reaching sexual maturity, while some stop growing after reaching maturity.

Mating activity.

1. For most species, courtship usually occurs several weeks before the nesting season.

2. Two or more males may court a single female.

3. Males have enlarged claws on their front flippers. These aid males in grasping the shells of the females during mating.

4. Fertilization is internal. Copulation takes place in the water, just offshore.

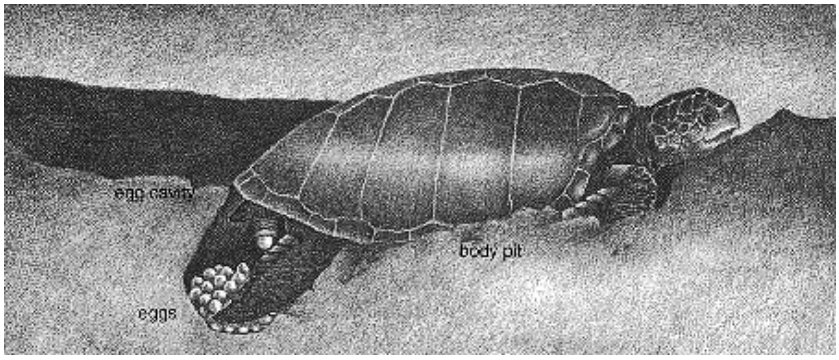
C. Nesting behavior.

1. Like other turtles, sea turtles lay eggs. They must come ashore to do so.

2. Females nest a few weeks after mating.

3. Depending on the species, sea turtle nesting follows a set pattern.

> a. Females usually nest during the warmest months of the year. The exception is the leatherback turtle, which nests in fall and winter.
>
> b. Most females return to the same nesting beach each year. Recent studies suggest that some females of some species will visit more than one nesting beach in a season.
>
> c. Females of most species usually come ashore at night, alone, most often during high tide. A female sea turtle crawls above the high tide line and, using her front flippers, digs out a "body pit." Then using her hind flippers, she digs an egg cavity. The depth of the cavity is determined by the length of the stretched hind flipper.
>
> d. Depending on the species, the female deposits 50 to 200 Ping Pong ball-shaped eggs into the egg cavity. The eggs are soft-shelled, and are papery to leathery in texture. They do not break when they fall into the egg cavity. The eggs are surrounded by a thick, clear mucus.



e. The female covers the nest with sand using her hind flippers. Burying the eggs serves three purposes: it helps protect the eggs from surface predators; it helps keep the soft, porous shells moist, thus protecting them from drying out; and it helps the eggs maintain proper temperature. Experts can identify the species of turtle by the type of mound left by the nesting female and by her flipper tracks in the sand.

f. Females may spend two or more hours out of the water during the entire nesting process.

g. Females usually lay between one and nine *clutches* (groups) of eggs per season.

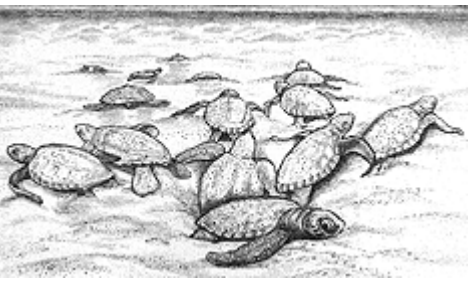
i. Females may nest every two to three years.

3. The Kemp's ridley and olive ridley form masses called *arribadas* (Spanish for "arrival"). Arribadas contain thousands of egg-bearing females that come ashore at the same time to lay eggs.

Hatching and Hatchlings.

A. Incubation.

1. Incubation time varies with species, clutch size, and temperature and humidity in the nest.



2. The incubation time for most species is 45 to 70 days.

3. Research indicates that the sex of an embryo is determined sometime after fertilization, as the embryo develops, and may be temperature dependent. Lower nest temperatures produce more males; higher temperatures produce more females.

B. Hatching.

1. Sea turtles hatch throughout the year but mostly in summer.

2. Hatchlings use a **caruncle** (temporary egg tooth) to help break open the shell.

3. After hatching, the young turtles may take three to seven days to dig their way to the surface.

4. Hatchlings usually wait until night to emerge from the nest. Emerging at night reduces exposure to daytime predators. They leave the nest and head to the water in groups. Studies have shown that some nests will produce hatchlings on more than one night.

C. Reaching the ocean.

1. There are several theories as to how hatchlings find the sea.

    a. Hatchlings may discriminate light intensities and head for the greater light intensity of the open horizon.

    b. During the crawl to the sea, the hatchling may set an internal magnetic compass, which it uses for navigation away from the beach.

2. When a hatchling reaches the surf, it dives into a wave and rides the undertow out to sea.

    a. A "swim frenzy" of continuous swimming takes place for about 24 to 48 hours after the hatchling enters the water.

    b. This frantic activity gets the young turtle into deeper water, where it is less vulnerable to predators.

    c. There have been reports of swimming hatchlings diving straight down when birds and even airplanes appear overhead. This diving behavior may be a behavioral adaptation for avoiding predation by birds.

D. The first year.

1. During the first year, many species of sea turtles are rarely seen. This first year is known as the "lost year."

2. Researchers generally agree that most hatchlings spend their first few years living an oceanic existence before appearing in coastal areas. Although the migratory patterns of the young turtles during the first year has long been a puzzle, most researchers believe that they ride prevailing surface currents, situating themselves in floating seaweed, camouflaged where they find food.

3. Research suggests that flatback hatchlings do not go through an oceanic phase. Evidence shows that young turtles remain inshore following the initial swim frenzy. Most remain within 15 km (9.3 miles) of land.

Longevity and Causes of Death.

A. Longevity.

Scientists are still researching sea turtle longevity. Once sea turtles reach sexual maturity, they may have an estimated reproductive life of about 30 years. Given that some species reach maturity at 50 years, an 80-year lifespan is feasible.

B. Aging. Currently there is not an adequate method of aging sea turtles. The most accepted method, aside from observing a turtle from the time it hatches, is to study growth rings of the scales on the carapace and plastron. Scientists count the rings and use a mathematical formula to estimate a turtle's age.

C. Natural predators.

1. Adult sea turtles have few predators, mostly large sharks. Tiger sharks, in particular, are known for eating sea turtles. Killer whales have been known to prey on leatherback turtles.

2. Fishes, dogs, seabirds, raccoons, ghost crabs, and other predators prey on eggs and hatchlings. Most than 90% of hatchlings are eaten by these predators. Flatback turtle nests are susceptible to predation by monitor lizards, dingoes, and introduced foxes.

D. Fibropapillomas.

Green sea turtles are black sea turtles may develop lobed tumor like growths (fiborpapillomas) on the skin. These growths can result in reduced vision, obstruction of normal swimming and feeding, and increased susceptibility to secondary parasitism and infection.

E. Human impact.

1. Nesting areas are becoming scarce due to beach development and disturbances. Kemp's ridleys only nest on one beach in the entire world: on a remote beach in Mexico near the village of Rancho Nuevo (about 161 km, or 100 miles, south of the Texas border). In 1947, scientists witnessed an arribada of more than 40,000 Kemp's ridley turtles in one day. In the 1960s, numbers were reduced to less than 5,000 turtles. In 1973, the largest arribada contained only 200 individuals.

2. Although the population of olive ridley sea turtles is the most abundant in the world, their major nesting beach at Gahirmatha in Orissa, India is in jeopardy. The Government of India is planning to develop a major fishing port and processing plant 10 km (6.2 miles) from the critical nesting beach. More sea turtles nest on this beach than on any other beach in the world.

3. Nesting females and hatchlings are disturbed by the presence of trash on nesting beaches. If trash impedes its crawl up the beach, a female returns to the sea instead of nesting.

4. The noise and activity of people on the beach also may cause females to return to the sea instead of nesting.

5. Some sea turtles die when they ingest trash. Leatherbacks are especially susceptible to ingesting plastic, mistaking it for jellyfish.

6. Thousands of sea turtles drown in shrimp nets each year. Sea turtles forage in waters where commercial shrimpers' trawl. In 1947, 5,000 U.S. shrimping trawlers worked in the Gulf of Mexico. That number increased to 15,000 full-time and 40,000 part-time trawlers by 1989.

7. Artificial lighting on beaches may misrepresent the time of day to turtles attempting to nest. Most turtles are nocturnal nesters, and to a turtle that has not yet come ashore to nest, a brightly lighted beach may signify daylight and inhibit nesting.

8. Hatchlings can become disoriented by city and street lights when trying to find the surf. Many young turtles actually head away from the ocean and toward parking lots. These animals may be eaten by predators or crushed by cars. Some die from exposure.

9. Some people illegally collect turtle eggs for food and for their alleged aphrodisiac effect.

10. Sea turtles are hunted (illegally in this country and in some cases legally elsewhere) for their meat and shells, which are used to make combs, eyeglass frames, aphrodisiacs, and curious. The fat of green sea turtles, boiled with cartilage called **calipee**, made a popular soup, which led to the decline in green sea turtle population numbers.

11. Deforestation may indirectly threaten sea turtle nests. Costa Rica has one of the highest deforestation rates in the world. Some researchers fear that without the forest to draw up ground water, the water table will rise beneath the beaches and drown nests.

12. Propeller and collision injuries from boats are not uncommon. These types of injuries are more frequent in areas with a high level of recreational boating, such as South Florida, the Florida Keys, and the United States Virgin Islands.

Conservation.

A. Legal protection for sea turtles.

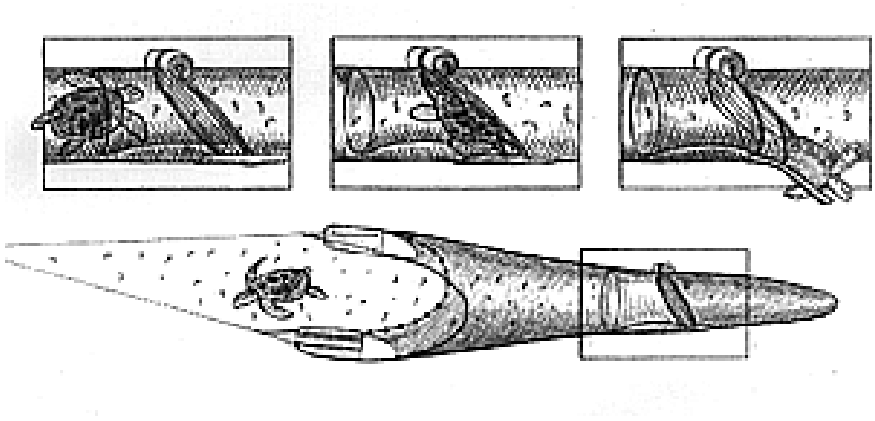
1. All eight species of sea turtles are listed as threatened or endangered on the U.S. Endangered and Threatened Wildlife and Plants List. It is illegal to harm, or in any way interfere with , a sea turtle or its eggs.

2. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international treaty developed in 1973 to regulate trade in certain wildlife species. CITES protects all species of sea turtles. The U.S. and 115 other countries have banned the import or export of sea turtle products.

B. Turtle Excluder Device.

1. At a cost of millions of dollars, the National Marine Fisheries Service developed the Turtle Excluder Device (TED).

2. The TED is a small, metal grid trapdoor inside a trawling net that allows shrimp to pass to the back while the turtles escape to safety before becoming entrapped or entangled.



3. Since 1989, federal law requires that this device be installed on the nets of all U.S. fishing trawlers working in areas populated by sea turtles.

C. Protecting nests.

1. Nests can be protected from predators by placing screens over them. Eggs laid too close to the water or in erosion zones can be relocated to safer areas.

2. In a bold conservation program, the townspeople of a small Costa Rican village are allowed to gather eggs laid during the first two nights of each olive ridley arribada. Scientists have calculated that a controlled harvest would leave enough protected eggs to rejuvenate the population (in one nesting season, 20 to 30 million olive ridley eggs may be laid in this beach village) while allowing villagers to maintain a livelihood. The program has the potential to stop poachers of other eggs on other beaches by keeping the prices of the "legal" eggs too low for poachers to compete.

D. Lighting.

Although eliminating beach lighting would be the most effective way to reduce disorientation of hatchlings, studies have shown that low pressure sodium vapor lights have a lesser effect on loggerhead and green sea turtle hatchlings. Many beach communities have encouraged the use of these lights.

E. Wildlife refuges.

1. Legislation is underway to allocate government funding for the Archie Carr National Wildlife Refuge on the east coast of Florida, between Melbourne Beach and Vero Beach. Full protection of the refuge would cost a total of $90 million dollars, of which $50 million would come from state and local sources. As of 1994, federal funding has reached $7 million.

    a. This 33-km (20.5 mile) section of beach is the most important nesting site for loggerheads in the Western Hemisphere.

    b. The refuge is the most important nesting beach in the United States for the green sea turtle.

    c. The refuge also is considered prime real estate for commercial development, making government funding essential to its preservation.

2. The governments of Nicaragua and Costa Rica have established, and are striving to expand, national parks and biological reserves where sea turtles forage and nest. Tortuguero, Costa Rica maintains the largest green sea turtle rookery in the Caribbean. Local economics is no longer based on turtle harvests, but on tourism. More than 15,000 visitors are expected each year.

F. Managing sex ratios.

Most conservationists believe that abundant nesting females are desirable to rejuvenate sea turtle populations. Researchers with Reproductive Sciences, Inc. and Reptile Conservation International have developed, and are patenting, a technique of applying an estrogen solution onto eggs to produce a higher number of females under normal incubation.

G. In zoological environments.

1. Having sea turtles at marine zoological parks provides an opportunity for the public to learn, up-close, about these animals and how human activities may impact their survival.

2. In the protected environment of a marine zoological park, scientists can examine aspects of sea turtle biology that are difficult or impossible to study in the wild.

3. Sea World of Florida treats numerous green and loggerhead sea turtles each year.

> a. Sea turtles often are brought in after a cold weather snap. Low water temperatures cause a sea turtle's metabolism to slow - the hypothermic turtles become sluggish and are unable to feed. marine patrol officers may find the turtles floating at the surface of the water in a semi-dormant state.
>
> b. In December 1989, 95 hypothermic green sea turtles were rescued from Florida's Merritt Island. These turtles were housed in recovery pools at Sea World of Florida for about 10 weeks. Once the weather warmed up, the turtles were released in the same area that they were rescued.
>
> c. Sea World has rescued other sea turtles with injuries resulting from entanglement, motorboat collisions, ocean dredging, or ingestion of non-food items.

4. Data gathered through the Sea World Animal Rescue and Rehabilitation Program and similar programs can help scientists more accurately assess and recommend sea turtle population management programs in the wild.

References: www.seaturtle.org , Southern Georgia University
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Dixon, Dougal, et. al. *Macmillan Illustrated Encyclopedia of Dinosaurs and Prehistoric Animals. A Visual Who's Who of Prehistoric Life.* New York: Macmillan Publishing Co., 1988.
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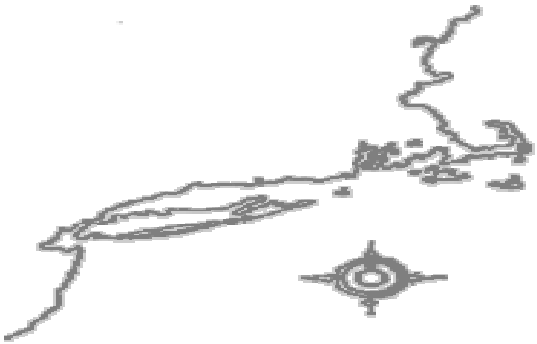
National Marine Fisheries Service and U.S. Fish and Wildlife Service. *Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic, and gulf of Mexico.* Washington, D.C.: National Marine Fisheries Service, 1992.

LESSON ON SEATURTLE TRACKING & CONSERVATION



ESSAY: A seacoast is the dynamic border between two worlds-the terrestrial and the marine. In the realm of life science, we can observe marine animals that inhabit the shoreline and tide pools. In the realm of Earth science, we can observe how the ocean's currents, waves, and winds sculpt the shoreline, alternately carrying off and depositing sand. From the air, you can actually see the waves create a perfectly scalloped beach on Nantucket Island.

Not only do these forces shape the land, they affect the living populations. Sometimes animals that inhabit deeper water are thrown off course. They come close to the shoreline and may actually be found on the beach. They may be injured, sick, or disoriented and soon become cold, hungry, or dehydrated. Such is the case for various species of dolphin, porpoise, seal, whale, and turtle that become stranded along the Atlantic coastline. But there is help for some animals. In many locations, when beached animals are sighted, professionals and volunteers are on the scene. Sick, cold, or injured animals are immediately placed in a rehabilitation program with the intent of getting them well enough to be returned to their natural habitat. Often the animals are tagged with a transmitter for future tracking.

Some of the large marine animals that are regularly tracked along the Atlantic coast are cetaceans, pinnipeds, and sea turtles. Cetaceans are marine mammals such as whales, dolphins, and porpoises; pinniped refers to seals and walruses. If an individual from one of these populations is seen on shore, the observer can call in the sighting to an agency that helps such creatures. Every acknowledged animal sighting is assigned a number and becomes part of the database for that species. If the animal requires treatment of an injury or disease, it may be given a temporary tank to live in until it can recuperate and be returned to the wild.

Sea turtles make up another group of marine animals that become stranded along the Atlantic coast. Turtle species are of particular interest because they are either endangered or threatened worldwide. (Endangered species are in danger of becoming extinct; threatened species could easily become endangered if present trends continue.) Sea turtles are reptiles that have existed virtually unchanged for eons; human activity has decimated their populations. In the days of the great sailing ships, these large reptiles often found their way into the cook's stewpot. Their heavy shell or carapace was a treasured source of decorative shell. Even in recent decades, their eggs have been plundered for food.

During their long lives (fifty years or more), these reptiles may travel great distances; tagging individuals is important for studying their behavior and monitoring their dwindling populations. Stranded sea turtles are sometimes reported up and down the Atlantic coast as well as on the Gulf Coast. The causes are many, including water pollution, disease, attack by a predator, or entanglement in fishing gear. To prevent turtles from getting caught and drowning in fishing nets, some Gulf shrimp trawlers use nets equipped with a turtle exclusion device that has been effective in protecting turtles.

On the northeast Atlantic coast, animals are sometimes found close to the beaches, especially in the winter months. They may be driven toward the shore by the cold Labrador current in Cape Cod Bay, or the northwest winds along Long Island's north shore may pin the turtles against the shore or trap them in bays. These animals become "cold stunned"-chilled to the point where they are unresponsive and unable to eat to get their metabolic rate going. Cold stunned turtles must be gradually warmed, given warm fluids intravenously, and then force-fed to give them the nutrition they need. When their body temperatures have increased, they are placed in tanks and fed and cared for until they are sufficiently recovered to be released. The data in the activity reflect actual turtle strandings during the winter months of 1995 reported by the Okeanos Foundation on Long Island and the New England Aquarium in Boston, agencies that are authorized to rescue and rehabilitate marine animals.

LESSON 2: SEATURTLE TRACKING & CONSERVATION

Background Information for Lesson on Seacoasts

A seacoast is the border between two worlds—the terrestrial and the marine. In life science, we can observe marine animals that inhabit the shoreline. In Earth science, we can observe how the ocean's currents, waves, and winds shape the shoreline, carrying off and depositing sand. Not only do these forces shape the land, they affect the living populations. Sometimes animals that inhabit deeper water are thrown off course. They come close to the shoreline and may actually be found on the beach. They may be injured, sick, or disoriented and soon become cold, hungry, or dehydrated. Such is the case for various species that become stranded along the Atlantic coastline, but there is help for some animals. When beached animals are sighted, professionals and volunteers are on the scene. Sick, cold, or injured animals are immediately placed in a rehabilitation program getting them well enough to be returned to their natural habitat. Often the animals are tagged with a transmitter for future tracking. Some large marine animals that are regularly tracked along the Atlantic coast are cetaceans, pinnipeds, and sea turtles. Cetaceans are marine mammals such as whales, dolphins, and porpoises; pinniped refers to seals and walruses. If an individual from one of these populations is seen on shore, the observer can call in the sighting to an agency that helps such creatures. Every acknowledged animal sighting is assigned a number and becomes part of the database for that species. If the animal requires treatment of an injury or disease, it may be given a temporary tank to live in until it can recuperate and be returned to the wild. Sea turtles make up another group of marine animals that become stranded along the Atlantic coast.

Turtle species are of particular interest because they are either endangered or threatened worldwide. (Endangered species are in danger of becoming extinct; threatened species could easily become endangered if present trends continue.) Sea turtles are reptiles that have existed virtually unchanged for eons. Human activity has decimated their populations. In the days of the great sailing ships, these large reptiles often found their way into the cook's stewpot. Their heavy shell or carapace was a treasured source of decorative shell. Even in recent decades, their eggs have been plundered for food. During their long lives (fifty years or more), these reptiles may travel great distances; tagging individuals is important for studying their behavior and monitoring their dwindling populations.

S t r a n d e d Along the Co a s t

Stranded sea turtles are sometimes reported up and down the Atlantic coast as well as on the Gulf Coast. The causes are many, including water pollution, disease, and attack by a predator, or entanglement in fishing gear. To prevent turtles from getting caught and drowning in fishing nets, some Gulf shrimp trawlers use nets equipped with a turtle exclusion device that has been effective in protecting turtles. On the northeast Atlantic coast, animals are sometimes found close to the beaches, especially in the winter months. They may be driven toward the shore by the cold Labrador current in Cape Cod Bay, or the northwest winds along Long Island's north shore may pin the turtles against the shore or trap them in bays. These animals become "cold stunned"—chilled to the point where they are unresponsive and unable to eat to get their metabolic rate going. Cold stunned turtles must be gradually warmed, given warm fluids intravenously, and then force-fed to give them the nutrition they need. When their body temperatures have increased, they are placed in tanks and fed and cared for until they are sufficiently recovered to be released. The data in the activity reflect actual turtle strandings during the winter months of 1995 reported by the Okeanos Foundation on Long Island and the New England Aquarium in Boston, agencies that are authorized to rescue and rehabilitate marine animals.

Lesson Plan Grades 6-8

Objectives

- Plot stranding sites onto a map using latitude and longitude as well as compass directions with respect to coastal features.
- Identify several species of marine animals that might become stranded; distinguish their characteristics and habitats.
- Identify several coastal features and important currents.
- Form hypotheses and make analyses based on the data.

Materials

Student Pages A and B
Optional: geological survey map of your area, compass

Subjects

Environmental Science, Biology, Oceanography,
Mathematics, Social Studies

Stranded Along the Coast

Procedure

1. Start a preliminary discussion by asking students if any of them has ever considered swimming a great distance—like across the thirty-mile English Channel, for example. Swimming the Channel between England and France is considered a great human feat, but for some of the champion swimmers of the animal world, thirty miles would be a drop in the bucket. Whales migrate over thousands of miles of ocean in just one season. Dolphins and seals play over hundreds of miles of coastal waters of the Atlantic and Pacific. But the real champs are sea turtles: because of their long life spans, they log hundreds of thousands of miles. It's not uncommon for a sea turtle from Mexico or South America to be found off the northeast Atlantic coast in summer. Green sea turtles swim thousands of miles to lay eggs on the same tiny island where their mothers laid their eggs. Their powers of navigation hold a fascination for us. But sometimes, for many different reasons, their journey is interrupted and the animals become lost or stranded. "Stranded" originally meant "beached." A beach was (and in England, still is) called a "strand." Sometimes a stranded turtle is found washed up on a beach. Other times, the animal is stranded inside a body of water and cannot get out into the open ocean. Tell students that they will be plotting real data for the locations of some sea turtles that were sighted during the latter months of 1995.

2. Obtain a topographic map of your area, or other maps with which students are familiar, you might want to use them to review latitude and longitude. The accompanying map shows degrees of latitude and longitude; students will have to approximate between these intervals to plot some of their points.

3. Hand out both student pages. Using the map, students need to know terms used to describe bodies of water and coastal features. Have them find the state names to get oriented to the map and perhaps show where this region is on a U.S. map. Ask them to read the names of the bodies of water and find an ocean, a gulf, a sound, and a bay. They should be able to distinguish among them and put them in size order. Tell them that bays are generally sheltered on three sides.

4. Discuss some of the terms used to describe coastal features. These include barrier beaches. They are created by waves hitting the shore of the mainland, then dragging sand out and depositing it until it forms a sandbar. Eventually, sandbars grow large enough to be an island, a buffer zone that protects the mainland from further erosion by water. On a U.S. map, have students find the barrier beaches along the coasts of Texas and North Carolina. Waves also deposit sandbars that extend shoreline into ocean, creating a “point” such as Race Point in Cape Cod or Montauk Point on Long Island. The currents around the sandbar may flow at such an angle that they create a hook, for example, the “arm” extending northward from the “elbow” of Cape Cod. The entire region of Long Island, Cape Cod, Martha’s Vineyard, Nantucket, and Block Island was formed by glacial moraine and then modified by the ocean’s waves. Many of the bays contain salt marshes and estuaries (where rivers empty into salt water). Marshes, estuaries, and barrier beaches, all important wetland habitats that require management and preservation.

5. Have students begin plotting the points of the turtle sightings. They will find that these turtles were sighted in four areas: along the south shore of Long Island near the barrier beach, along the north shore of Long Island, in Gardiner’s Bay, and farther north in Cape Cod Bay.

6. After students have plotted their points, ask them what they think might have caused the strandings in each area. (Actual data are used in this exercise because scientists were able to determine the probable cause of each stranding.) Tell them that the Labrador Current is a cold current that comes from the north. They may infer from the map that the turtles spotted in Cape Cod Bay may have been trapped there by this cold current. On Long Island, cold northwest winds trap the turtles against the shoreline.

7. The leatherbacks on the south shore of Long Island were both found dead along the barrier beach; one had ingested plastic, the other was entangled in a fishing line. Ask students why this might occur at this location. (Proximity to New York City and populated areas. Also, leatherbacks eat jellyfish and may have mistaken plastic for food.) Discuss how important barrier beaches are both as habitat and as protection for the mainland from ocean storms. The ridleys and loggerhead found along the north shore of Long Island were cold stunned. Explain what this means and describe how the turtles are slowly warmed, given warm liquids intravenously, and then force-fed until they revive. They are kept in tanks until they are healthy again, then they are released, usually with a tag that enables scientists to monitor their movement by satellite. These turtles were probably driven to shore by the prevailing northwest wind. The other Kemp's ridley and the green sea turtle found in Gardiner's Bay were also cold stunned. The three cold stunned turtles found in Cape Cod Bay were probably swept into the cold bay, trapped by the Labrador Current.

8. Ask students to look at Montauk Point, at the eastern end of Long Island. Tell them that the original lighthouse was surveyed and planned by George Washington; it has been moved a few times and just underwent another renovation to protect it. Ask students what the lighthouse needs protection from. They may guess that the erosion around the point has caused a change in the coastline and endangered the site of the lighthouse. Tell them that people who live in Provincetown (the community at the northernmost tip of Cape Cod) periodically "lose" their water wells. Ask for a hypothesis about this phenomenon.

Give students some of the background on each of the following four turtle species. This will help them fill out their data tables and hypothesize about what caused each stranding.

Kemp's Ridley Sea Turtle

(*Lepidochelys kempi*)—endangered.*

This is an extremely endangered species globally. Ridleys have gone from a population of four hundred thousand nesting females in the 1940s and 1950s to only about four hundred today. Within the region of the accompanying map, they live in certain areas of Long Island Sound, Block Island Sound, and portions of the Peconic Estuary. Some also live in Great South Bay. Generally, juveniles from two to five years old live in these areas. They eat primarily spider crabs and green crabs.

Loggerhead Sea Turtle

(*Carretta carretta*)— threatened.**

Long Island Sound and its bays are home to juvenile, or nonreproductive, loggerheads. Adults may be found along the south shore of Long Island and up to about 40 miles offshore. Their diet consists of spider, horseshoe, green, and portunid crabs.

Green Sea Turtle

(*Chelonia mydas*)—threatened (endangered in Florida). Green sea turtles are less abundant in this region than the other sea turtles, and their diet and habitat are not as well documented. They are usually found in shallow bays where there is more aquatic vegetation for food. Several age classes have been observed in this region.

Leatherback Sea Turtle

(*Dermochelys coriacea*)—endangered. Although they are endangered, leatherbacks are one of the most abundant species of sea turtles in the region. They are found on the south shore of Long Island and in Long Island Sound but rarely in the bays. The population of older juveniles and adults eats mainly jellyfish. Tagged animals are known to have come all the way from French Guiana in South America. In parts of the Atlantic, leatherbacks have been known to reach over eleven feet and four thousand pounds.

*Likely to become endangered.

**Likely to become extinct in the foreseeable future.

Teacher's answers to stranding table

Stranded Along the Coast—

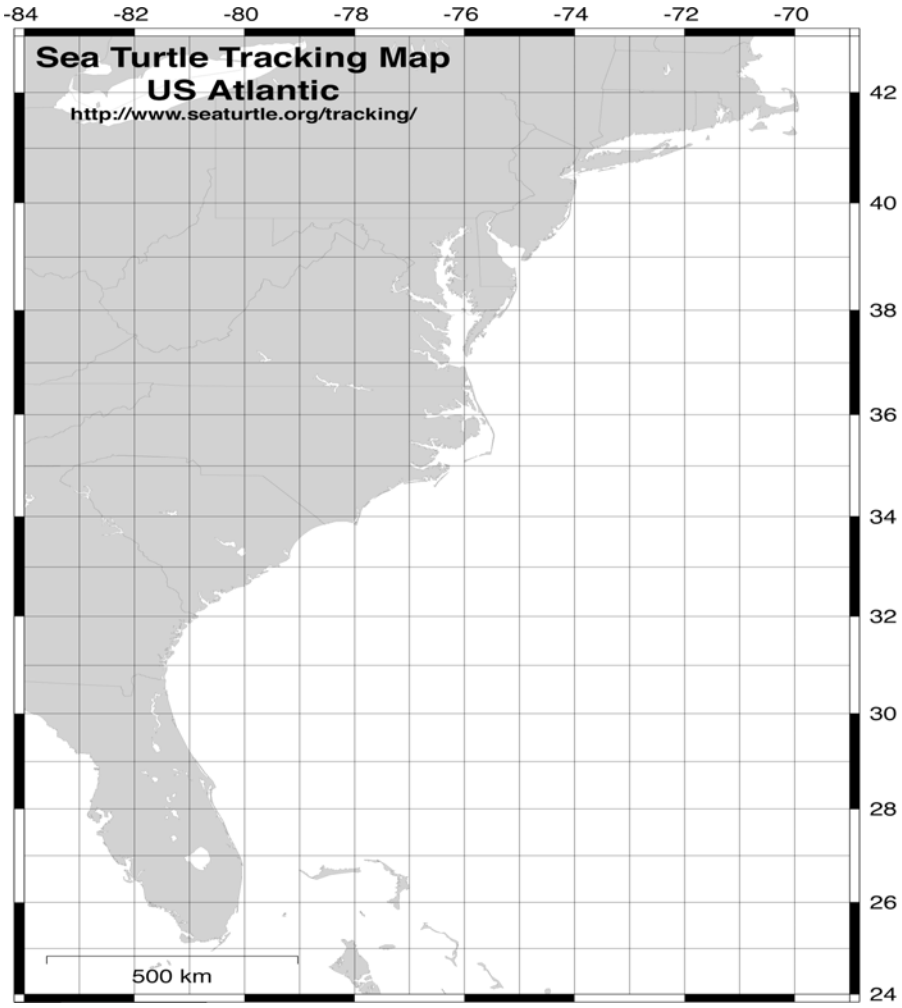
Number	Species	Body of water in which found	Diet	Probable cause of stranding
1	Leatherback	Atlantic Ocean near barrier beach	jellyfish	Plastic ingestion
2	Leatherback	Atlantic Ocean near barrier beach	jellyfish	Entanglement in line
3	Ridley	Long Island Sound	crabs	Wind; cold stunned
4	Ridley	Long Island Sound	crabs	Wind; cold stunned
5	Loggerhead	Long Island Sound	crabs	Wind; cold stunned
6	Ridley	East side of Cape Cod Bay	crabs	Current; cold stunned
7	Loggerhead	East side of Cape Cod Bay	crabs	Current; cold stunned
8	Ridley	East side of Cape Cod Bay	crabs	Current; cold stunned
9	Green	Gardiner's Bay, Long Island	vegetation	Wind; cold stunned
10	Ridley	Gardiner's Bay, Long Island	crabs	Wind; cold stunned

S t r a n d e d A l o n g t h e C o a s t

S t u d e n t P a g e A

Stranding Data

Number	Species	N. Latitude	W. Longitude
1	Leatherback	40° 30’	73° 30’
2	Leatherback	40° 10’	73° 00’
3	Ridley	41° 10’	72° 20’
4	Ridley	41° 00’	72° 30’
5	Loggerhead	41° 00’	71° 00’
6	Ridley	42° 00’	70° 30’
7	Loggerhead	41° 45’	70° 00’
8	Ridley	41° 45’	70° 15’
9	Green	41° 10’	72° 00’
10	Ridley	41° 00’	72° 15’



Stranded Along the Coast

Student Page B

Imagine that you are a volunteer at a rescue and release program for stranded marine animals. You get a call that an ocean-dwelling animal has been sighted along a beach. What should you do? Call in the professionals. Experienced scientists who understand the physiology and behavior of marine animals should be the only ones to move or care for a stranded or sick animal. As a volunteer, you would need to know how to give someone the location of the sighting.

Use the Stranding Data table to plot the location of sea turtles that actually were sighted and, when possible, rescued. You will need to approximate the latitude and longitude in some cases. Assume that each turtle was found close to the nearest shoreline. Draw a small turtle icon to represent each in the correct location and write its number on its shell.

After your class discussion, place additional data about the turtles in this table:

Number	*Species*	*Body of water in which found*	*Diet*	*Probable cause of stranding*
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Resources

Visit Ocean Planet online at
http://seawifs.gsfc.nasa.gov/ocean_planet.html
Click on "Resource Room" to link to other
related sites on the Internet such as
www.turtles.org , Turtle Trax, a page dedicated to marine turtles

Facts on File, 1991. *America's Seashore Wonderlands*. Washington, D.C.: Nat'l Geographic Society, 1985.
Stone, Roger D. *The Voyage of the Sanderling: Exploring the Ecology of the Atlantic Coast from Maine to Rio*. New York: Knopf, 1990.

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Adoption Program
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For Teachers
Tracking FAQ
Outputs NEW
TAMUG Kemp's Ridley Tracking 2007
RRV335/Lan Hai Yi
RRV333/Kuzya
Sunny (SSH496) +
Bennie (RRV371) +
TAMUG Green Turtle Tracking
Jeffy/YYG742
Katie/YYG718
Billy/YYG710
Stretch/TTX914
Ralphie/TTX906
Loggerhead Turtles: Bald Head Island 2007
Jimmy P +
Freedom
Thompson Plourde +
Billie +

Satellite Tracking

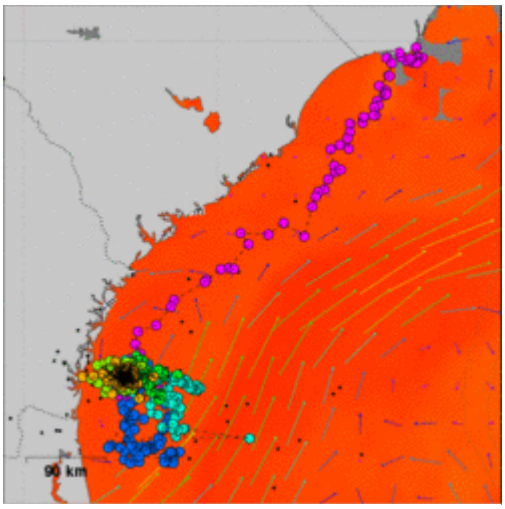
Seaside Sleuths

Loggerhead Turtles: Bald Head Island 2006

A project of the **Marine Turtle Research Group**.

Full-Size Map (66KB)
Zoom Map (23KB)
Animated Map (503KB)

Species: Loggerhead
Life Stage: Adult
Gender: Female
Release Date: 2006-07-28 03:00:00
Release Location: Bald Head Island
Last Location: 2007-08-13 03:54:16



click map for full-size version

Seaside Sleuths loves coastal Georgia! She continues to remain off the coast well into the summer of 2007, staying within 100 miles of land. She doesn't show any signs of moving north, but she may change her mind at some point. At least we know that she is dependable! Perhaps another turtle from Bald Head Island in 2007 will join her and go to Bald Head Island. Keep watching her map to find out.

Adoptive Parents:
Christopher Glenn
Elisa Prebble
Henry Darrell
Alan and Christine Briggs
Ann Barrow Fisher
Gene Johnson
Wally Holst
Ms. Foote's 8th Grade Science Class Nautilus MS
Will Johns
Mrs. Fair's 4th Grade Class

Background

Seaside Sleuths was the third turtle tagged from the 2006 Bald Head Island loggerhead tracking project. She came ashore to nest at about 11 pm on 27 July 2006. This turtle was 92.1 cm long (straight-carapace length) when she was tagged and was first seen nesting on Bald Head Island in 1992. The Wisner family of Bald Head Island won the naming rights for this turtle in a charity auction hosted by the Bald Head Island Conservancy on July 3rd and named her "Seaside Sleuths", after the new books written by Helyn Wisner.

- For more information please visit the project website.
- This map connects positions generated by the ARGOS system designated as location codes (lc) '3', '2', '1', '0', 'A', 'B'.
- The static maps also show locations of class 'Z' as small black circles which are not connected by a route line.
- Bathymetry layers are derived from the GEBCO Digital Atlas published by the British Oceanographic Data Centre on behalf of the IOC and IHO, 2003, and the ETOPO2 Global 2' Elevations published by NOAA's National Geophysical Data Center.
- Sea surface temperature is derived from NOAA's GOES Daily Sea Surface Temperature data.

seaturtle.org

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TAMUG Green Turtle Tracking

Jeffy/YYG742

Katie/YYG718

Billy/YYG710

Stretch/TTX914

Ralphie/TTX906

Casey Key Loggerheads-2007

Sweet Pea +

Kiko

Marge +

Splash +

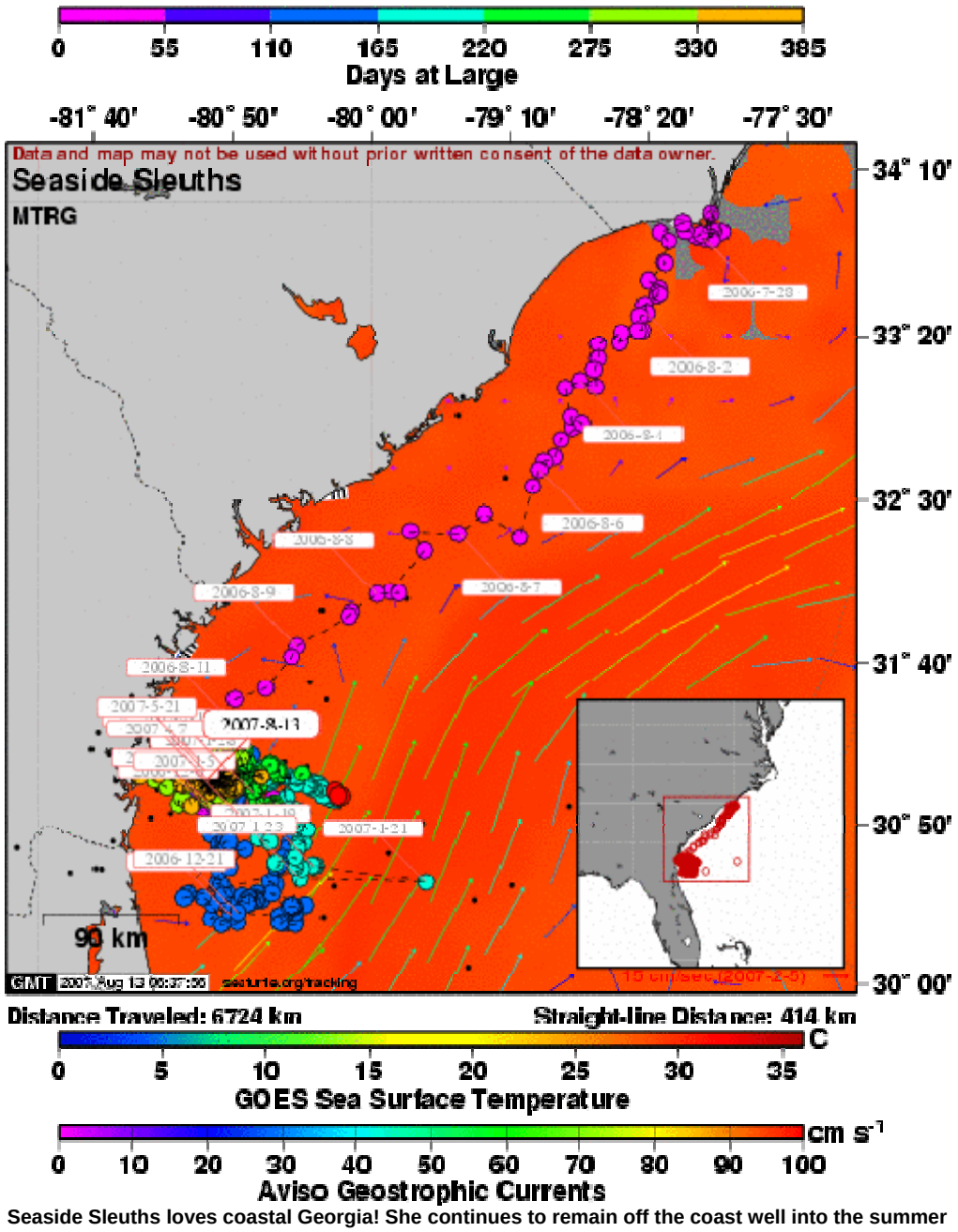
Loggerhead Turtles: Bald Head Island 2006

Kate +

Seaside Sleuths +

Satellite Tracking

Seaside Sleuths - Loggerhead Turtles: Bald Head Island 2006
project of the **Marine Turtle Research Group**.



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RESOURCE LIST

Resources for teachers:

www.seaturtle.org

www.seaturtle.org/documents/Educators_Guide.pdf

www.helpingseaturtles.org/funded/2006-2007_grant_awards.htm

www.seaturtles.org

www.turtles.org/overview.htm

www.fws.gov/northflorida/SeaTurtles/seaturtle-info.htm

www.cccturtle.org

www.seaworld.org

www.projectview.org/trackingseaturtles.htm

www.metacafe.com/watch/746024/sea_turtle_close_encounter/

www.dlese.org/library/query.do?s=760&re=0k

http://users.rcn.com/shaleo/web/ocean.html

www.nasa.gov/audience/foreducators/5-8/features/index.html

http://oceancolor.gsfc.nasa.gov/SeaWiFS/

http://oceancolor.gsfc.nasa.gov/cgi/image_archive.cgi?c=COASTAL

www.nationalgeographic.com

www.discoverychannel.com

www.pbs.org

www.nova.edu