
Sea Turtles, A Journey of Survival
An Educator's Guide to Sea Turtles
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WAVE Foundation

The WAVE Foundation, a nonprofit 501(c)3 organization, is an independent, educational foundation at the Newport Aquarium, created to further the Aquarium's efforts in educating communities about marine life and the conservation of natural resources and habitats. WAVE's goal is to create and provide meaningful learning opportunities and resources for the community in order to instill a sense of awareness, respect and appreciation for aquatic animals and their habitats.

Introduction

Sea turtles have populated the planet for approximately 100 million years. They have outlived almost all of the prehistoric creatures with whom they once shared the earth. Why is it that now, after all these years, all seven species of sea turtles may be facing extinction?

To assist in finding answers to this question, researchers are tagging sea turtles with satellite transmitters in order to track these elusive animals. As part of this effort, Newport Aquarium has partnered with the Marine Turtle Research Group, North Carolina Wildlife Resources Commission, the Bald Head Island Conservancy and the Karen Beasley Sea Turtle Hospital on a project that follows Loggerhead sea turtles in the Western Atlantic. Tagged turtles are monitored via an innovative, state-of the art website, www.seaturtle.org. Founded out of a desire to support research and conservation efforts in the sea turtle community, seaturtle.org has served as an effective format for researchers to share information. Because the most serious threats sea turtles face are directly caused by the actions of humans, disseminating this information to our communities is of utmost importance.

How to Use This Guide

This Educator's Guide is a resource designed to connect grade school children to the ocean using sea turtles as the ambassadors. Through these charismatic reptiles, the guide will serve to educate students about the biology and life history of sea turtles as well as the conservation issues surrounding them.

In addition to background information, lesson plans, and activities that are aligned with national standards, this guide offers your classroom the opportunity to make a personal connection to one of the tagged sea turtles on seaturtle.org. We have provided a map and outline of suggested activities for your classroom to "adopt" a tagged turtle to follow throughout the school year. The tracking pages available on seaturtle.org are updated daily and are an excellent resource to learn not only about sea turtles, but about weather, geography, currents, distance, etc. We have listed some ideas for you; however, we would love to hear your thoughts as well. Please email us at education@newportaquarium.com. We welcome comments on our teacher's guide and ideas on how the guide might be updated to make it a more useful teaching tool.

Cover Photo: Garry Walter; Illustrations: Meryle Lupinski; Activities: Audra Seladi, Erich Kuehnle & Pam Lyons; Content and Editing: Pam Lyons

The Evolutionary History of Sea Turtles

Sea turtles are some of the most mysterious yet enduring animals on earth. As with all turtles, sea turtles are reptiles. They are covered with protective scales, breathe air into a set of lungs and reproduce by laying amniotic eggs, eggs with fluid filled sacs and soft but tough calcareous shells that protect embryos from dehydration.

Reptiles evolved from small land animals known as the cotylosaurs, that lived about 250 million years ago. Evolving from the cotylosaurs, the ancestors of the turtles appeared during the Triassic period, a little over 200 million years ago. The "first" true turtle, *Proganochelys quenstedi*, appeared in the late Triassic period and shared many traits common to turtles today including a fully developed shell and a turtle-like skull and beak. *Proganochelys* also had some primitive features not found in modern turtles: small teeth, a clavicle (collarbone) and a simple ear. This primitive turtle could not pull its head into its shell, which left it vulnerable to predators.

As turtles evolved to withdraw their heads into their shells for protection, they became divided into two main groups: the side-necked turtles and the arch-necked turtles. Modern side-necked turtles are only found in the Southern Hemisphere and withdraw their heads sideways under their shell. The arch-necked turtles are the dominant group of turtles today and retract their heads in a s-shaped curve. These turtles represent the box and aquatic turtles, as well as the tortoises.

Not until late in the Jurassic period did sea turtles appear. The largest, *Archelon ischyros*, was a possible ancestor to the Leatherback and lived over 65 million years ago. *Archelon* reached lengths of about 13 feet. Fossil records indicate that many other sea turtles, including species living today, such as the Green and Loggerhead sea turtles, appeared during this time as well. Despite their later evolution, sea turtles share some characteristics with primitive turtles. They cannot retract their heads or limbs into their shells, although they developed from the arch-necked turtles.

While the ancestors have gone extinct, there are about 249 species of turtles living today: 180 freshwater turtles, about 62 land turtles and tortoises and seven sea turtles.

"Tow the Line" – Timeline Activity

Objectives

Students will:
- Use a model to reference common fractions

Materials

12 feet of rope or string
3 X 5 cards
Clothes-pins or tape

Procedure

1. Predetermine events that occured between the formation of the earth and today that you would like the students to analyze. Write these events on 3x5 cards for later use.
2. String a rope across the classroom, approximately 12 feet. Label the ends of the rope: "Formation of the Earth" and "Today."
3. Divide the rope with the appropriate year makers (i.e. 3000 million years ago, 1500 million years ago, 750 million years ago, etc.). Distribute the event cards to the students and have them place the cards on the rope in the correct order. You may wish to place a few events on the timeline first to give the students a head start.
4. Check the cards against their placement. Have students help in this. Ask for their thoughts and determine if the card was placed correctly. Discuss why or why not.
5. Once this is done, have the students go back to their desks to create a similar timeline of their own for turtles. Use dates of your own or ones mentioned in the text for them to place on their timelines.

Example dates and events

Oceans formed	- 3800	million years ago
Eukaryotic celled organisms developed	- 1500	million years ago
Triassic period begins	- 250	million years ago
Jurassic period begins	- 205	million years ago
Archelon lived	- 65	million years ago
Homo sapiens appeared	-.05	million years ago

(these are approximate dates)

Extension

- Vary the date on the end of the rope from "Earth Formed" to "Water Formed", etc…
- Use this activity to demonstrate fractions and portions
- Use this activity for other time-lined topics

The Seven Species of Sea Turtles

There are currently believed to be seven species of sea turtles inhabiting the oceans and seas of the world. Though they share many common characteristics, the seven types of sea turtles are each unique and have adapted specific strategies for survival. Migratory routes, nesting habits and locations, feeding techniques and diet, and physical traits all help to distinguish between the different species.

Loggerhead

The **Loggerhead** sea turtle is the one of the more recognized sea turtles and is listed as threatened in the US. It frequents estuaries, coastal plains and bays for feeding. Adults tend to be close to mainland shores, but may transit an ocean following migratory paths thousands of years old. They do this by using environmental cues such as the Earth's magnetic poles. The Loggerhead was named for the size of its head, which houses a large set of powerful jaw muscles used for cracking hard shelled prey. The carapace has a reddish-brown color. This coloration is also found on the top side of its flippers and head, while the Loggerhead's underside is pale yellow to dull brown in color.

Leatherback

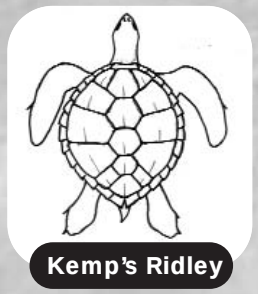
The **Leatherback** sea turtle is the largest turtle alive and is the only sea turtle without a hard shell. Instead of a shell, it has tough, rubbery skin. The black carapace, reinforced by thousands of tiny bone plates, has seven ridges marked with white spots running lengthwise. The plastron can be white to black in coloration. The head houses a fine knife-like beak, which the Leatherback uses to pursue its favorite meal, jellyfish. Food items such as crabs and mussels would damage the delicate jaw. Leatherbacks can tolerate cold water and are the most widespread of the sea turtles. These turtles are usually found in the open ocean coming to shore only to lay eggs. The Leatherback holds several sea turtle records: the largest, up to 10 feet in length; deepest diver, up to 3,000 feet; and the heaviest, weighing up to 2,000 pounds. This animal is endangered.

Flatback

The **Flatback** sea turtle is somewhat of a mystery as its restricted range is prohibitive of extensive research. Flatbacks are only located off of the northern Australian coast. The name "Flatback" refers to its compressed body. Like the Green sea turtle, this turtle has four lateral scutes. Each scute is an olive color with a brown to yellowish outer margin. The flippers are cream to white in color and have a single claw. Though information about this turtle is limited, it seems to prefer coastal waters, coral reefs and grass beds. Diet consists of softer animals such as jellyfish, sea cucumbers, prawns and seaweed. The IUCN lists flatbacks as "data deficient" because they are poorly understood. They are protected in Australia.

Green

The **Green** sea turtle does not get its name from the color of its shell, which is usually black, brown or gray, but from the color of its fat. The adult Green sea turtle is a strict herbivore, eating only sea grass and seaweed, which gives the fat its green color. Young Green sea turtles will eat crustaceans and worms as well as grass and seaweed, but they stop this omnivore behavior as an adult. Green sea turtles have serrated beaks, which aid in tearing plants and algae. Usually found near mainland coastlines or islands, they are indigenous to all temperate and tropical waters. They are the second largest sea turtle, averaging sizes over three feet in length and well over 300 pounds. Some populations of Green turtles in the eastern Pacific are known as Black turtles, due to their darker pigmentation.



Kemp's Ridley

The **Kemp's Ridley** sea turtle received its name from a researcher who was studying it, Richard Kemp. Ridley comes from the word riddle, as no one was sure what kind of turtle it was, and some thought it to be a cross between a loggerhead and a green. Nesting behavior was also a puzzle until 1947 when their lone nesting beach was finally discovered at Rancho Nuevo in Mexico. The Kemp's Ridley is the most endangered and the smallest of the sea turtle species, reaching an average length of two feet and a weight of about 100 pounds. The carapace is olive green while the plastron is yellowish. Kemp's Ridleys are carnivores, dining on crabs, clams, mussels, jellyfish, urchins and shrimp. Never venturing far from North America, this turtle ranges from the Gulf of Mexico to along the eastern U.S. Atlantic coast. Occasionally, they are found in European waters. Ridley turtles, Kemp's and olive, will lay approximately two clutches of about 100 eggs each. Both species participate in mass synchronized nesting called arribadas. However, the Kemp's nests during daylight; all other sea turtles nest at night.

Olive Ridley

The **Olive Ridley** sea turtle, named for the olive tone of its carapace, is very similar to the Kemp's except it travels in the open ocean waters of tropical Pacific, Atlantic and Indian Oceans. Olive Ridleys are more abundant than the Kemp's, but are still on the endangered species list because only a few nesting sites remain worldwide where they can congregate for the arribada.

Hawksbill

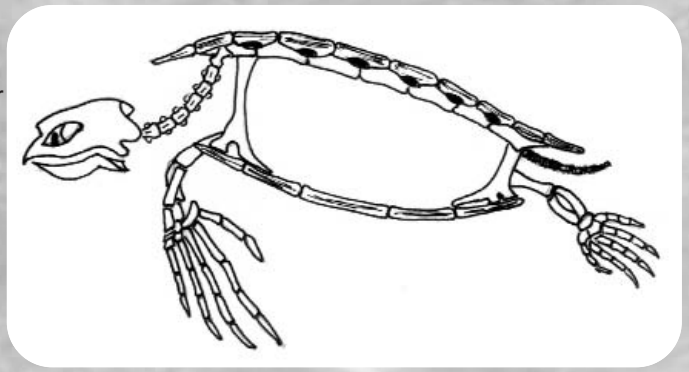
The **Hawksbill** sea turtle is so named because the shape of its head and beak resemble a hawk. They are usually found around rocky bottom areas and coastal reefs as well as in estuaries and lagoons in the tropical waters of the Atlantic, Pacific and Indian Oceans. Hawksbill sea turtles are endangered. They have been hunted for their shells to make jewelry and other personal items such as combs, brushes and eyeglass frames. The Hawksbill is slightly smaller than the Loggerhead, with an average length of 36 inches and weight of 150 pounds.

Turtle Parts

The Body

Most notably, sea turtles have shells. The shell encloses and protects the soft, inner body parts. From the shell, the head, flippers and tail protrude. The shell has two parts: the top, carapace, and the bottom, plastron. They are connected to each other on the sides by the bridge. The carapaces' bone plates that comprise the under layer are fused with the vertebrae and ribs of the turtle so that the turtle cannot leave its shell. The bone plates that make up the top of the carapace are covered with a protective keratin outer layer, much like our fingernails. This keratinous outer covering is called a scute. Through all of this armor, the sea turtle's shell may seem indestructible, but it is actually quite sensitive. Beneath the thin, keratin scutes is living tissue with sensitive nerve endings.

The sea turtle's appendages are paddlelike flippers (two large front flippers and two smaller rear flippers) and a tail. Sea turtles use their back flippers as rudders to maneuver while swimming. In adult sea turtles, the tail length is used to determine sex. Male characteristics include a longer tail and larger claws on the front flippers, which are used to grasp the female during mating.



The Head

The sea turtle's skull is solid and does not contain teeth. Turtles have horny beaks. The beak is adapted to the diet of the turtle: sharp for cutting and slicing and flat for crushing. Sea turtle beaks are species specific and so is their diet. A Loggerhead sea turtle's beak is very strong with powerful jaw muscles that enable it to crush crabs and other shellfish, while Leatherbacks have a beak with a special notch to grab and pierce soft jellyfish. Green sea turtles have a very finely serrated beak that enables them to cut sea grasses and seaweed for food.

The turtle's tongue is a large broad muscle anchored securely in the turtle's mouth and cannot be extended. The turtle swallows food whole or in large chunks without chewing. They will also use their beaks to test and explore new objects.

Food is located by means of an acute sense of smell. Sea turtles detect scents in the water by opening their mouths slightly and drawing in water through the nares. The water is not swallowed but is immediately expelled through the mouth. A sea turtle's sense of smell is so acute that some scientists believe it might help an adult turtle locate the beach where it hatched.

Sea turtles do not have externally visible ears, but they can hear low frequency sounds and vibrations underwater. Sea turtle eyes are well developed to see underwater, but they only provide nearsighted vision in the air. Large eyelids protect a sea turtle's eyes from predators.

Build a Geometric Turtle – Math Activity

Objectives

Students will:
- Recognize and identify geometric shapes
- Identify geometric patterns as specific shapes and as combined shapes
- Understand the relationship between adaptations and survival

Materials

Copies of Geometric Turtle activity sheet, one per student
White, green or brown construction paper
Paper plates (optional)
Glue or tape
Crayons or markers
Pencil
Ruler
Scissors
Eyes (optional)

Procedure

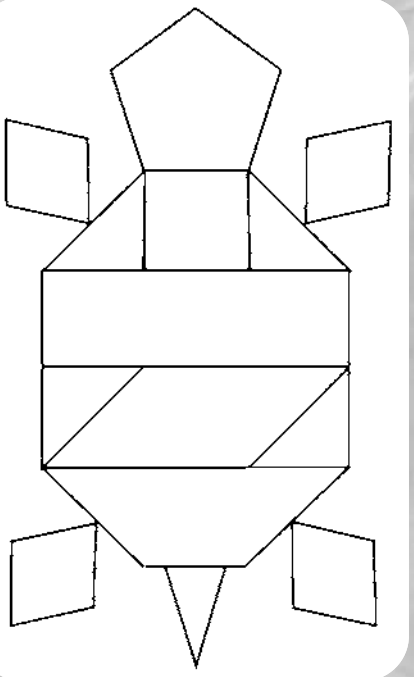
1. Give each student a geometric turtle activity sheet.
2. Have students decorate / color the geometric shapes.
3. Have students cut out shapes from the activity sheet.
4. Have students identify the geometric shapes and write that shape name on the back of the shape.
5. Have students arrange shapes for a turtle shell and attach them to one of the colored pieces of construction paper (or paper plate).
6. Have students cut off any construction paper that is not covered by the decorated shapes. (Omit this step if using a paper plate.)
7. Have students arrange shapes for the head, tail, front and rear flippers and attach these to the under side of the paper.
8. Glue on eyes or pieces of white paper.
9. Go over each body part describing its function as an adaptive characteristic; describe each part's positive and negative impacts to the animal.
   (Example: Flippers are used by the turtle to help him swim / fly through the water, how ever, they hinder the turtles movements on land).

Extension

- Use the shapes from the turtle sheet to teach about perimeter, volume and area. (Have the students measure the shapes sides and then determine the different values.)
- Use these shapes to teach about numerical prefixes: mono-, bi-, tri-, quad-…

Reinforcement and Evaluation suggestions
- Quiz on geometric shapes identifying each.
- Matching - adaptation to body part.
- Have students describe other shapes they see in everyday life.
- Have students describe other shapes they see in nature. Have some examples to demon strate to the students.

Geometric Turtle Activity



Survival at Sea: Sea Turtle Adaptations

Sea turtles have many adaptations that enable them to live in the seas throughout the world. As seaworthy as they are, sea turtles still have a strong tie to land and coastal habitats.

Sea turtle bodies are hydrodynamic, meaning that they can move swiftly through the water with minimal drag or resistance. Contributing to their streamlined design is the compact, flattened shell that they cannot retract into for safety. They also have flippers, which act like big paddles or oars, enabling the turtles to move through the water more like fish rather than lumbering reptiles.

Turtles use camouflage to hide from predators and avoid detection by prey. To help blend in with the ocean bottom, a sea turtle's carapace is usually dark or a combination of colors. The plastron is a lighter color, from a creamy white to a yellowish brown. This prevents them from being seen by prey living on the bottom looking skyward. This type of camouflage is called countershading.

Sea turtles are ectothermic or "cold blooded," which means that they cannot regulate their internal body temperature. Their metabolism is dependent on the surrounding environment. Being ectothermic enables them to lower their metabolic rate, so they need less oxygen and can stay submerged for longer periods of time. Being dependent on the temperature of the environment has its disadvantages. Most sea turtles are limited in range to tropical and temperate waters. If they reach cold waters, they can become cold-stunned and will become stranded or die. Leather-backs can venture farther and longer into colder waters, as their large size compared to their body surface area allows for a more efficient storage of heat. A layer of fat under the carapace insulates the turtle's insides from the cool water, and the oils in its body store heat. Diving deeper than other sea turtles, Leatherbacks reach depths of over 3,000 feet as they hunt for jellyfish. They have a higher number of red blood cells and higher concentrations of myoglobin in their muscles, enabling them to carry more oxygen and stay submerged for longer periods of time.

Despite their adaptations for life at sea, sea turtles must breathe air with lungs, like humans do. They can hold their breath for 30 minutes or several hours while in a resting state, but they must eventually surface to take a breath of air. Because they do not need a constant supply of oxygen-rich water in order to respire, sea turtles can return to land, although this usually only happens when females are nesting. Female sea turtles come ashore to lay their eggs in nest cavities they dig in the sand. It is here, on land, where all sea turtles begin life before crawling to the water.

Every living organism needs water to live. If we were to drink seawater and not freshwater, it would dehydrate us and lead to death. Sea turtles do not have this problem. They obtain water from their diet, and they can also metabolize saltwater. Specialized glands in their bodies concentrate and excrete the salt and retain the water. Folklore describes a sea turtle mother crying while she lays her eggs. Though nesting females look very much as though they are shedding tears, the drops are actually salt secretions from glands near their eyes. This adaptation also helps keep sand out of their eyes as they nest.

"Waiter, I didn't order the jellyfish" - Adaptations Activity

Objectives

Students will:

- Formulate research questions and develop a plan for obtaining answers
- Use scientific inquiry processes
- Compare changes in an ecosystem, food source and its relevance to survival
- Recognize that adaptations enhance survivability and reproduction

Materials

Nutcrackers, enough for 1 / 3 the class
Scissors, enough for 1 / 3 the class
Tweezers / forceps, enough for 1 / 3 the class
Nuts or small plastic eggs or other item that can be broken open like a nut.
Pieces of thread, approx. 6 inches long.
3X5 index cards (pieces of scrap paper same approximate size).

Background

Sea turtles use their beaks to obtain food. Their beaks are specialized and specific to the foods they eat. There is some overlapping in diets, but in general their jaws and beaks are designed for a specific type of food. This activity will demonstrate this idea of adaptation and specialization. Loggerhead sea turtles have a very strong jaw and their beak is designed for crushing their food, crabs, clams and mussels. The nutcracker will represent the Loggerhead's beak and jaw. The nuts represent their food. Students must crack open the nuts to get to the food, just as a Loggerhead would crack open a crab.

Green sea turtles have a moderately strong jaw and a serrated, sharp beak that is designed for cutting sea grasses and sea weed. The scissors will represent the Green sea turtles beak and the 3 X 5 cards their food. Students must cut the cards in half, just as a Green sea turtle would grass or sea weed before eating.

Leatherbacks have a precise notch on their beak that can grab very soft jellyfish. The tweezers will symbolize the jaw and beak of a Leatherback, and the thread represents the tentacles of a jellyfish.

Procedure

1. Have students pick a represented beak, or pass them out randomly.
2. Have students sit in a circle with plenty of elbow room.
3. Explain how the students are to use their beaks to get the food.
4. Place the "food" items in the circle.
5. Have the students use their beaks to eat.
6. Now, place only one kind of "food" in the circle.
7. Have the students "eat."
8. Explain to the students that just because there is food, doesn't mean they will be able to eat it. (Scissors will have a hard time collecting thread without cutting it, and the nutcrackers will have a hard time cutting the paper to eat.)

Extension

- Ask students what would happen if they all had the same beak, but there was only enough food for a third of them?
- Try different variations in numbers or amounts of food items and beaks. Then pose questions about survivability.
- Ask students to come up with a universal food for the sea turtles. (They all like to eat jellyfish, except the Green turtle, which is a strict herbivore as an adult.)

Sea Turtle Life Cycle

Much has yet to be discovered about sea turtles. Because most of a sea turtle's life is spent submerged at sea, studying sea turtles in the wild is challenging. During nesting season, when females come ashore, we can get a rare glimpse of these animals. Decades of observing and researching nesting females coupled with advances in technology are gradually revealing the secret lives of sea turtles.

Sea turtles reach sexual maturity when they are 10-30 years of age. When it is time to mate, male and female turtles will congregate offshore of the beach where they were hatched. When a female is ready to lay her eggs, she will crawl ashore. This is usually done in the cover of night with the exception of the Kemp's Ridley.

A mother turtle is choosy about the location of her nest. She will carefully select a location above the high tide line. If she is not satisfied with the quality of the beach or if noises, strange objects or bright lights frighten her, she will return to the sea. This is called a "false crawl."

Once comfortable with the spot for her nest, the mother turtle uses her flippers to dig a body pit in the sand. With her body in position, she cups her rear flipper and uses them to scoop out an egg cavity in which to deposit her eggs. The eggs, which resemble rubbery ping-pong balls, are laid at a rate of two to three at a time. Females will lay anywhere from 80-120 eggs per nest, depending on their species.

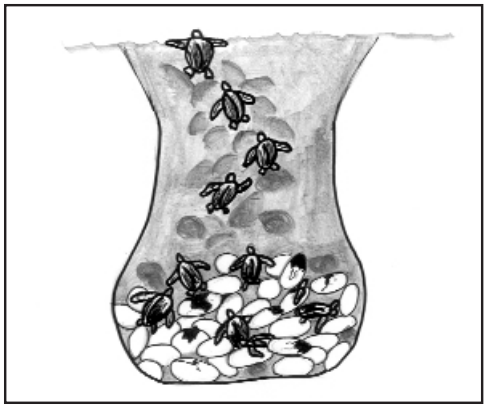
Matthew Godfrey 2004

A great deal of care is put into camouflaging the nest once the eggs are laid. The mother will pack sand over the egg cavity and will then use her front flippers to disguise the body pit. She throws sand in all directions, making the nest virtually impossible to recognize. When the mother turtle is content that the nest is concealed, she will head back to sea. She will repeat this procedure three to five times in a single nesting season, but will, in most cases, not return to nest again for two to three years.

The eggs will incubate within the nest for approximately 60 days. The average temperature of the nest during the course of incubation will determine whether or not the young hatchlings will be male or female. Females result from warmer temperatures; males develop when temperatures are cooler. Many factors such as the quality of the sand, weather and beach development can influence the incubation temperature of the eggs.

When the hatchlings have fully developed, they will hatch and crawl their way up and out of the nest *en masse*. This event is called a "boil," as it resembles a pot boiling over with sea turtles. Emerging hatchlings obtain bearings to the ocean by locating the horizon over the water, which is brighter than the landward horizon, and they scurry in that direction to their new home. Once these hatchlings reach the sea, their activities are a mystery to scientists. It is believed that they find floating masses of seaweed and sargassum to live within until they grow larger so they are not an easy meal for predators. Before the hatchlings leave the beach, they imprint the location so they can return again as adults.

"Temperature Will Tell" - Activity Sheet



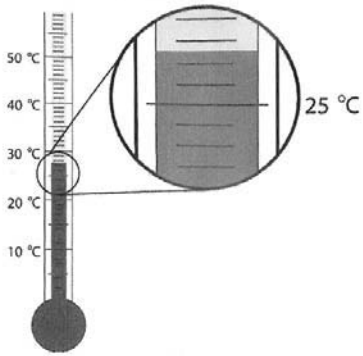
Sea turtles lay their eggs in nests that they have built in the sand. The eggs will take about 60 days to hatch, during which time they need to be kept warm, about 29 degrees Celsius (C). At this temperature 50% will be males and 50% will be females. The eggs in the bottom of the nest are more insulated but may be a little cooler. The eggs in the top of the nest have less insulation and may be exposed to changes in temperature, either cooler or warmer, depending on the weather. Generally speaking, eggs that develop at a cooler temperature, less than 29 degrees C, will be male turtles, and eggs that develop at a warmer temperature, more than 29 degrees C, will be females.

Use the following information to answer the questions.

- Each nest contains 100 eggs.
- At a temperature of 29 degrees C, eggs will develop 50% male, 50% female.
- Average temperatures above 29 degrees C will yield all females; average temperatures below 29 degrees C will yield all males.
- Eggs exposed to temperatures less than 25 degrees C and greater than 35 degrees C may not develop.
- Formula to convert from Celsius to Fahrenheit: Degrees Fahrenheit = (1.8 x degrees Celsius) + 32

1. A turtle lays her eggs in a nest with a bottom temperature of 28 degrees C. The top of half of the nest gets warmer because the sun is out every day. The top half of the nest develops at a temperature of 30 degrees C.

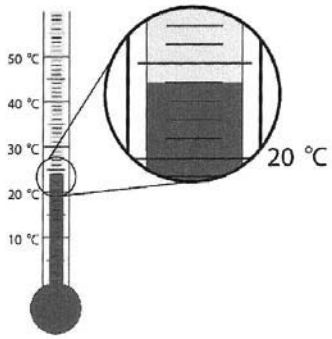
A. How many male sea turtles do you expect? _____
B. How many female sea turtles do you expect? _____



2. Sand has been brought to the beach in large trucks to help a beach erosion problem; it is very coarse and not as packed as the natural sand. This sand is a poor insulator and not able to maintain consistent temperatures. A turtle lays her eggs in the new sand. The temperature of the whole nest is pictured on the thermometer to the left.

A. Read the thermometer. What is the temperature in the nest?
In degrees Celsius _____
In degrees Fahrenheit_____
B. What do you think will happen to the eggs in the nest? _____
C. How many male sea turtles do you expect? _____
D. How many female sea turtles do you expect? _____

3. The number of storms has been uncommonly high this summer and the coastal area where turtles lay their eggs has had lots of rain and very high tides. This has cooled the sand and the nests where sea turtle eggs have been laid.



A. Read the thermometer to the left and determine the temperature of the nest. What is the temperature in
In degrees Celsius_____
In degrees Fahrenheit_____

B. What do you think will happen to the eggs in the nest? _____
C. How many male sea turtles do you expect? _____
D. How many female sea turtles do you expect? _____

4. A dog discovers the nest and uncovers it, exposing the eggs to the bright sunlight. The average temperature of the nest climbs to 37 degrees C.
A. Convert this temperature to Fahrenheit. _____
B. What do you think will happen to the eggs in the nest? _____

Which Way Did They Go? Turtle Tracking and Satellite Tagging

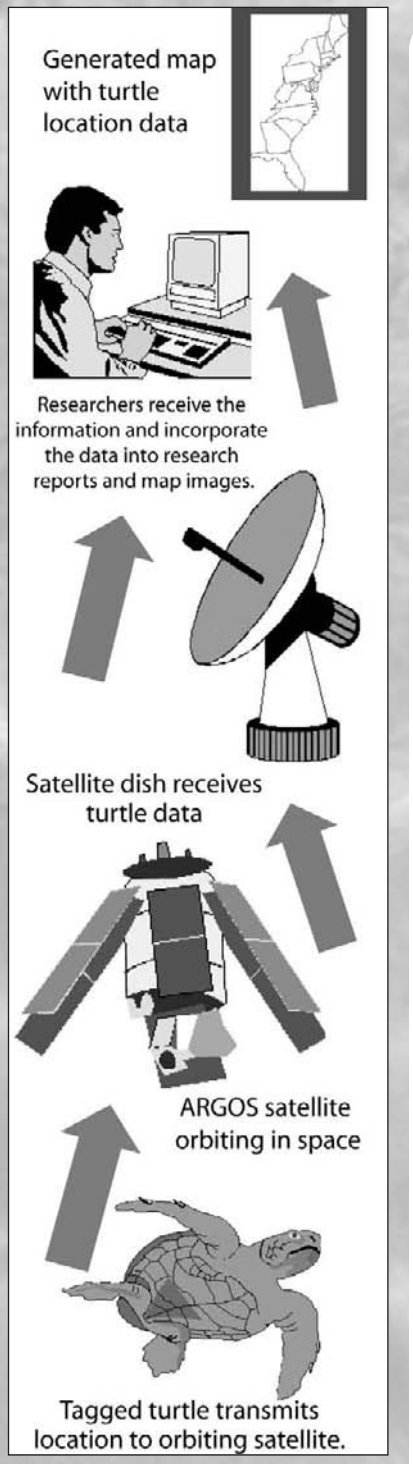
The Satellite Tags & Turtle Tracking

Satellite tags are anchored to the top of the turtles' carapace (shell) by an adhesive that will biodegrade with time and not harm the turtle. The tag will last for approximately one to two years before the batteries wear out. The tag has a saltwater switch to turn it on and off. While the turtle is underwater, the switch is turned off and the satellite tag does not transmit the turtle's position. When the turtle surfaces to breathe, the tag will come out of the water and the switch will turn the tag on and transmit its location to a satellite in space. This positional data will then be plotted on a map to show the turtle's progress and provide a historical record of its route.

How does it work?

As technology advances so does our ability to monitor the environment. Transmitters, about the size of a cell phone, are attached to the backs of turtles. The transmitters will send signals to orbiting satellites every time the turtle surfaces to breathe. This information is sent as a numeric code giving the latitude and longitude of the turtle, information about the water, and also the degree of reliability of the information. The satellite will then send the data to a station on Earth. Researchers can download this information from the station on their computers.

The U.S. National Oceanic and Atmospheric Administration (NOAA) operates six polar-orbiting satellites used for tracking weather. Also onboard are special instruments operated by a French company (ARGOS CLS) that are used for listening for transmitters, like the ones used in sea turtle research. Each satellite typically passes the same point three times a day. This only allows about 10 minutes for the satellite to detect and receive a transmission from a turtle transmitter; three to five minutes alone are needed just for the satellite to process the transmitter's data. Taking into account that the turtle must surface at the time that the satellite is passing, it can be difficult to receive a good transmission. However, the system does work, and the turtle's travels can be documented and plotted on a map to be used by scientists to learn more about sea turtles.



Sea Turtle Satellite Tracking via the Web – Research Activity

Your class can adopt or follow a sea turtle's progress as it moves about in the ocean. This student will also be responsible for updating the class at the end of the week as to the turtle's whereabouts, its travels and what the student thinks the turtle is doing.

Objectives

Students will:

- Use a two dimensional coordinate system.
- Use skills in a scientific inquiry process.
- Explore scientific ways of knowing and the difference between opinion and fact.
- Develop research and reporting skills.

Procedure

1. After learning about tracking animals, specifically sea turtles, your class can log onto www.seaturtle.org to find a turtle or learn more about other turtles that are being tracked. Your class can vote to adopt or follow one of the tracked sea turtles.
2. Select a junior researcher of the week to be in charge of locating the sea turtle on the web site and retrieving the data.
3. The junior researcher for the week will gather the data from the web site and plot the turtle's location on a map. Latitude and longitude can be recorded into a logbook.
4. Encourage the student to expand his/her research to include current weather and ocean conditions, or navigate www.seaturtle.org to get additional information about what the turtle is doing.
5. At the end of the week, have the junior researcher report his/her findings to the class and update them on the current location of the class' turtle.

Extensions

- This activity can be modified so the teacher or small groups of students act as the researcher rather than a single student. Teachers may also want to provide the data from an earlier tracked turtle to give the students practice in plotting the locations or so alternative and supplemental activities can be planned ahead of time.
- Supplemental activities such as research and reporting on species of turtle, building a life size turtle, various art or reading projects could also be incorporated.

The Struggle for Survival

Sea turtles have been around for approximately 100 million years, in numbers too large to count. However, within the last 100 years their numbers have dramatically declined, placing all seven species on the IUCN (The World Conservation Union) Red List of Threatened Species. Each year, The IUCN reviews the conservation status of thousands of plants and animals and lists those in danger of extinction on the Red List.

What is Happening to the Sea Turtles?

The Threats:
In the wild, sea turtles can live up to 40 or 60 years, but they face many dangers throughout their long life. It is estimated that only one in thousands will survive to adulthood and reproduce. Some of these dangers are natural threats such as disease, sickness, weather and predators. Until they can make it to the water from the nest, sea turtle hatchlings make a tasty meal for crabs, sea birds, raccoons and foxes, reptiles and ants. As young hatchlings in the ocean, they also have to contend with predators. It is not until they attain their adult size that the threat of predators declines to an occasional shark attack. Sea turtles have been enduring these natural threats for as long as they have been in the oceans, so it is not these threats that have created the current endangerment of the turtles. The turtles' plight is due to the actions of humans, both direct and indirect.


Matthew Godfrey 2004

Direct threats to sea turtles:
Sea turtles and their eggs have long been a staple in many cultures' diets. Even with laws to protect the endangered turtles, the poaching of the turtles and their eggs is still a large problem with little or no enforcement of these laws. Sea turtles, like the Hawksbill, have also been hunted and killed for their shells for use in jewelry and personal products like combs and eyeglass frames. As long as there is a market and demand for these products, turtles will continue to be killed to provide the materials.

Indirect threats to sea turtles:
Indirect threats can be difficult to pinpoint and can be even harder to prevent, but they are probably the most significant cause of the dwindling sea turtle populations. They include:

Commercial Fisheries. Turtles become entangled or ensnared in fishing gear and drown. Currently, trawl fisherman in many countries are required to use a Turtle Excluder Device (TED) to help keep turtles out of their nets. However, not all fisherman use these devices and turtles are still being killed.

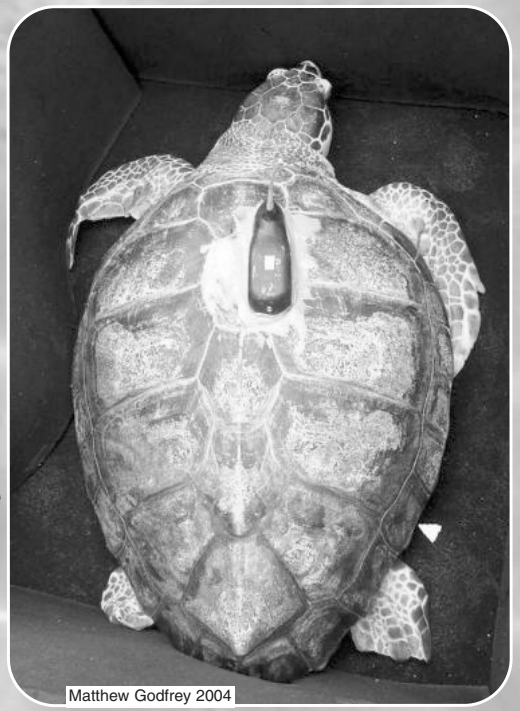
Habitat Degradation. The destruction of turtle habitats is limiting the ability of turtles to reproduce and repopulate. Turtles return to the same coast on which they hatched to mate and to lay their eggs. If the beach or habitat has changed or is perceived as dangerous, the turtle will abort the eggs at sea.

Pollution. Trash, debris, sewage and chemicals are being dumped into our oceans and water ways in alarming quantities. This pollution kills aquatic life. Chemical pollution may be to blame for causing diseases that are killing the turtles. Solid waste pollution can be mistaken for food such as jellyfish, and ingested, blocking the turtle's intestinal tract. Turtles can also become entangled in debris and die.

Boating. As we have learned, a sea turtle's shell is not as hard as it seems. It is made of living tissue and is comprised of the turtle's backbone and ribs. Because sea turtles must surface to breathe, they can be hit with passing boat propellers that can slice through the shell or skull. Boaters moving at fast speeds in the water usually do not see the surfacing turtles.

Erosion of beaches is a natural process, yet because beaches are perceived as valuable real estate, walls, jetties and other types of structures are constructed. These structures often inhibit the turtle from reaching the beach and nesting. Communities will replace eroded sand with new sand and/or compact the beach to make it more erosion proof. This practice can also inhibit turtle nesting and will affect the biological factors that determine a healthy and successful nest. Beach traffic, by vehicle or on foot, will also deter and/or destroy nest sites. Street, business and residential lighting create a false horizon, and hatching turtles may be drawn inland instead of to the sea. Many of these turtles become prey, dehydrated or road kill. A majority of sea turtle species nest at night, but artificial lights deter adult females from approaching the beach and nesting.

Even though there seem to be too many obstacles for the turtles to overcome, we can adapt our behaviors and actions to give them the best chance of survival. Listed at the end of this guide are some simple ways that we can teach others to be more responsible for sea turtles and our environment. Chances are that if the environment is harming its inhabitants, it will also harm us.



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To Know More...

The Karen Beasley Sea Turtle Rescue and Rehabilitation Center is committed to the care and release of sick and injured sea turtles. Have students check out the current patient list. How many are injured from boats, sickness, fishing equipment, etc.? Have students calculate the percentages. http://www.seaturtlehospital.org/

Turtle Tracking in Your Classroom – Discovery Activity

Objectives

Students will:
- Use a two dimensional coordinate system
- Use skills in a scientific inquiry process
- Explore scientific ways of knowing and the difference between opinion and fact.
- Develop research and reporting skills.

Purpose

This activity will help students develop an understanding of how researchers interpret data they receive from tracked turtles.

Procedure

1. Create a map of your classroom. Indicate special areas such as a reading area, a snack area and a play area on the map. You can also introduce a coordinate system as well, dividing the room up by latitude and longitude.
2. Once this is done, you can introduce your students to the turtle. The turtle could be a stuffed or plastic animal or a picture.
3. Start with a release point and a beginning latitude and longitude.
4. Each day "hide" the turtle somewhere in the classroom. The students must find the turtle, determine its latitude and longitude within the room, report this information and record it in either a log or on a computer.
5. Have the class track the turtle's movements by plotting them on the map of the classroom. The movements and coordinate points could make a shape or picture that is discovered at the end of the activity.
6. Have the students make suggestions as to what they think the turtle is doing: eating in the snack area, sleeping in the rest area, playing in the game area, etc. Upon their deductions as to what the turtle is doing, students can research that part of the turtle's life: How long does a turtle sleep and where, what does that turtle eat, etc.

Extensions

- Students can locate different turtle species and research different turtles' habits.
- Choose a different animal to follow and learn about. Other animals that are tracked include sharks, fish, marine mammals, birds, wolves and bears.

Glossary

Adaptation
a) Adjustment to environmental conditions: (b) modification of an organism or its parts that makes it more fit for existence under the conditions of its environment; often hereditary

Merriam-Webster Medical Dictionary, © 2002 Merriam-Webster, Inc.

Amniotic
Containing a thin membrane forming a closed sac around the embryo containing a fluid in which the embryo is immersed

Arribada
Great nesting aggregations

http://www.nmfs.noaa.gov/prot_res/species/turtles/olive.html 07/20/04

Beak
a) The bill or nib of a bird, consisting of a horny sheath, covering the jaws. The form varied much according to the food and habits of the bird, and is largely used in the classification of birds. (b) A similar bill in other animals, as the turtles

Webster's Revised Unabridged Dictionary, © 1996, 1998 MICRA, Inc.

Calcareous
Made of or containing calcium carbonate or calcium; associated with bones and egg shells

Carapace
A hard bony or chitinous outer covering, such as the fused dorsal plates of a turtle or the portion of the exoskeleton covering the head and thorax of a crustacean

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Characteristic
A feature that helps to identify, tell apart, or describe recognizably; a distinguishing mark or trait

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Circumglobal
Around or about the entire world

Clutch
The complete set of eggs produced or incubated at one time

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Cold-Stunned
Disoriented due to hypothermia; applies mainly to cold-blooded animals that are trapped in cold waters

Dehydrate
To lose water or bodily fluids

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Direct Action
Action that seeks to achieve an end directly and by the most immediately effective means

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Ectothermic
Of or relating to an organism that regulates its body temperature largely by exchanging heat with its surroundings; cold-blooded

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Endangered
To threaten with extinction

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Extinct
No longer in existence; lost or especially having died out leaving no living representatives

WordNet ® 1.6, © 1997 Princeton University

Flotilla
A group moving together comprised of a large number of individuals; commonly used to decribe a group of sea turtles

Habitat
The area or environment where an organism or ecological community normally lives or occurs

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Herbivore
An animal that feeds chiefly on plants

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Hydrodynamic
Deals with the motion of fluids and the forces acting on solid bodies immersed in fluids and in motion; moves through liquid with minimal resistance

Imprint
To fix permanently in the memory

Ingestion
To take into the body by the mouth for digestion or absorption

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Indirect
Not directly aimed or achieved

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Jurassic
From 135 million to 190 million years ago

WordNet ® 1.6, © 1997 Princeton University

Latitude
The angular distance between an imaginary line around a heavenly body parallel to its equator and the equator itself

WordNet ® 1.6, © 1997 Princeton University

Longitude
An imaginary great circle on the surface of the earth passing through the north and south poles at right angles to the equator

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Metabolism
The chemical processes occurring within a living cell or organism that are necessary for the maintenance of life. In metabolism some substances are broken down to yield energy for vital processes while other substances, necessary for life, are synthesized

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Myoglobin
A red iron-containing protein pigment in muscles that is similar to hemoglobin but differs in the globin portion of its molecule, only one fourth the molecular weight of the hemoglobin and has a greater tendency to combine with oxygen

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Orbit
The path of a celestial body or an artificial satellite as it revolves around another body

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Plastron
The ventral part of the shell of a turtle or tortoise

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Poaching
To take fish or game in a forbidden area

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Prehensile
Adapted for seizing, grasping, or holding, especially by wrapping around an object

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Southern Hemisphere
The half of the earth south of the equator

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Threatened
At risk of becoming endangered.

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Triassic
From 190 million to 230 million years ago

WordNet ® 1.6, © 1997 Princeton University

Trawl
A large bag net attached to a beam with iron frames at its ends, and dragged at the bottom of the sea; used in fishing, and in gathering forms of marine life from the sea bottom

Webster's Revised Unabridged Dictionary, © 1996, 1998 MICRA, Inc.

For more sea turtle terms, check www.seaturtle.org/glossary

Sea Turtle Identification Cards

Average size and weight:
27 inches and 85 pounds

Diet: Crabs, clams, mussels, shrimp as well as fish, sea urchins, squid and jellyfish

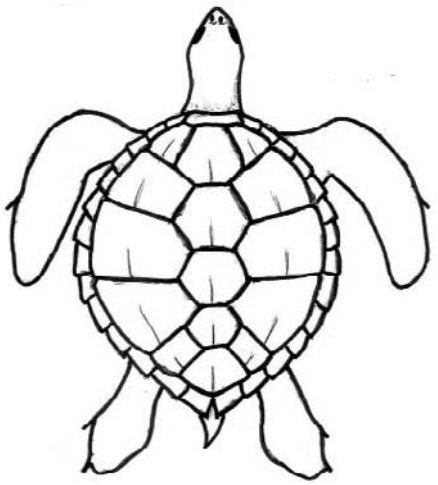
Range: Gulf of Mexico, Bahamas and western Atlantic Ocean, along the east coast from Florida to New York

Status: Critically Endangered

Fact(s): The smallest of the sea turtles; nests annually, laying about two clutches of 100 eggs each year

NEWPORT AQUARIUM

Kemp's Ridley
Lepidochelys kempii



Average size and weight:
27.5 inches and under 100 pounds

Diet: Crustaceans, mollusks and tunicates as well as seaweed and sea grasses

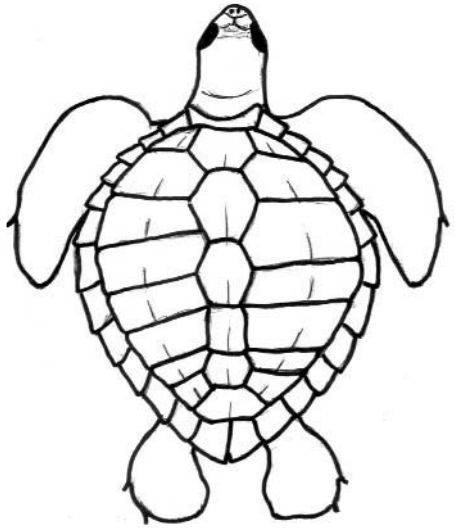
Range: Circumglobal- Found in tropical and subtropical coastal waters ; usually seen in large flotillas travelling between breeding and feeding grounds in the Eastern Pacific and Indian Ocean

Status: Endangered

Fact(s): Known to participate in arribadas and reproduce annually

NEWPORT AQUARIUM

Olive Ridley
Lepidochelys olivacea



Average size and weight:
36-40 inches and 300 pounds (largest was five feet and 871 pounds)

Diet: Strict herbivores, eating sea grasses and algae; juveniles eat worms and young sea creatures as well as grasses and algae

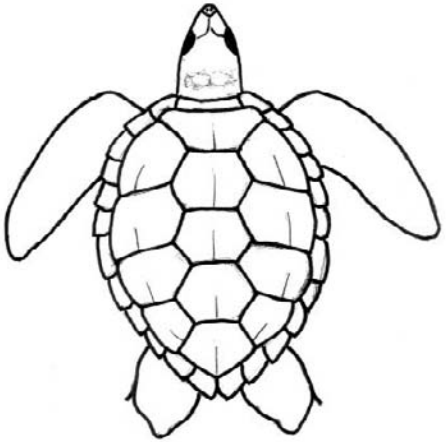
Range: Circumglobal in tropical and subtropical waters, near continental coasts and around islands

Status: Endangered (C.E. in Mediterranean)

Fact(s): Named for the color of its fat

NEWPORT AQUARIUM

Green
Chelonia mydas



Leatherback
Dermochelys coriacea

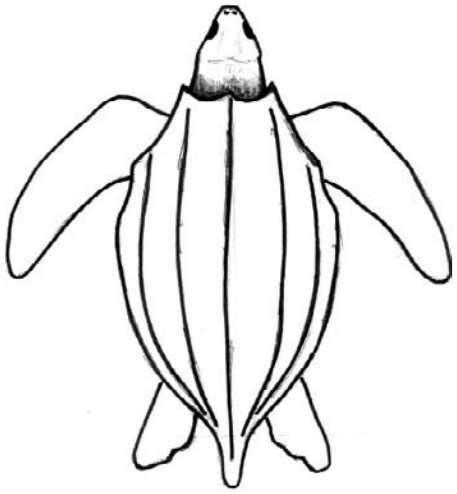
Average size and weight:
Up to eight feet and 1,300 pounds
(Largest was 10 feet and 2,019 pounds)

Diet: Jellyfish

Range: Circumglobal - ranging in most of the world's oceans, nests on beaches of the Atlantic, Indian and Pacific

Status: Critically Endangered

Fact(s): The largest, deepest diving and furthest traveled of all sea turtles; lack a hard shell but have a layer of tough, rubbery skin with tiny bone plates



NEWPORT AQUARIUM

Hawksbill
Eretmochelys imbricata

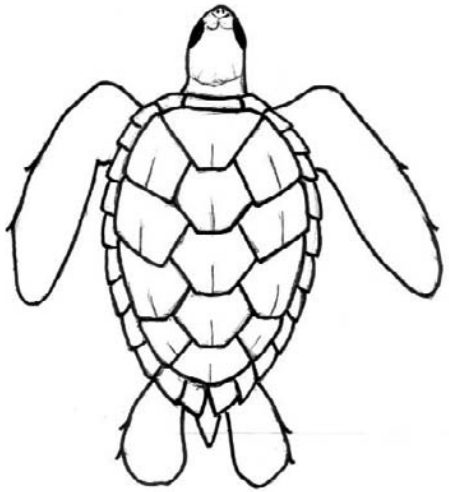
Average size and weight:
36 inches and 150 pounds

Diet: Sponges, anemones, squid and shrimp

Range: Circumglobal - the most tropical of all sea turtles; most common near coral reefs in the Atlantic and Indo-Pacific

Status: Critically Endangered

Fact(s): Were hunted to endangerment due to the desire for their shell; traditional tortoise shell products are made from the shell of these turtles



NEWPORT AQUARIUM

Flatback
Natator depressus

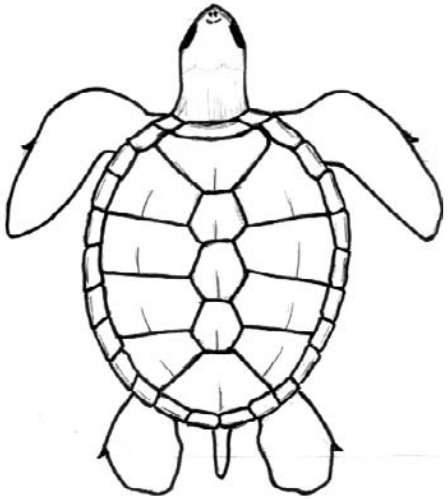
Average size and weight:
39 inches and 150 pounds

Diet: Sea cucumbers, mollusks, prawns, seaweed

Range: North coast of Australia and gulf of Papua New Guinea

Status: Data Deficient

Fact(s): The most poorly understood of all sea turtles because of its limited range; Will only lay approximately 50 large eggs up to four times a season



NEWPORT AQUARIUM

Loggerhead
Caretta caretta

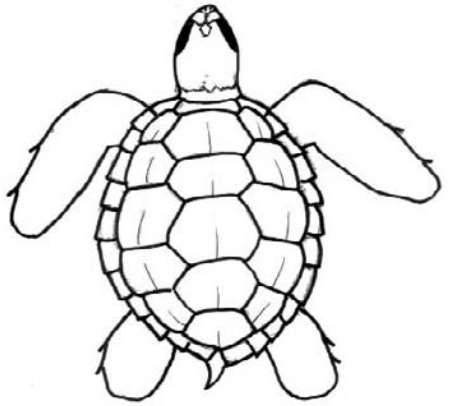
Average size and weight:
41 inches and 350 pounds

Diet: Primarily carnivorous feeding on crustaceans, horseshoe crabs, clams, mussels and shrimp

Range: Circumglobal - ranging in most of the worlds oceans; usually visible on continental shelves, in bays and estuaries and lagoons in temperate, subtropical and tropical waters

Status: Endangered

Fact(s): Named for their very large head; also the most numerous of the US Atlantic Coast sea turtles



NEWPORT AQUARIUM

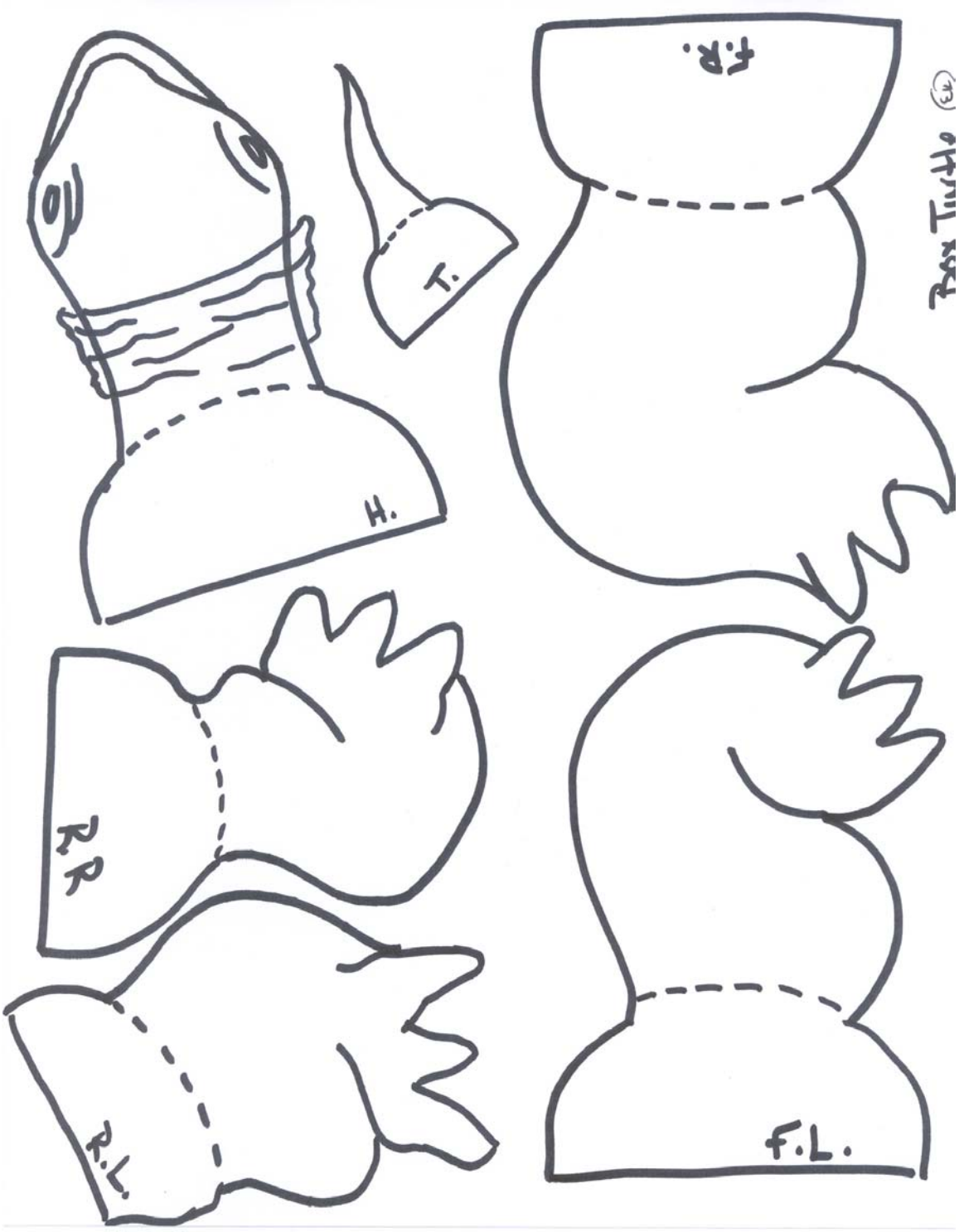
Paper Plate Turtles – Craft Activity
Box Turtle / Sea Turtle

Objectives:
Students will:
- Identify basic appendages of a turtle and explain their functions
- Be introduced to basic turtle morphology

Materials:
Paper plates, one per student
Crayons or markers
Glue or stapler
Scissors
Copies of turtle parts sheet, one per student
(Optional Items: Brads, googly eyes)

Procedure:
1. Choose a turtle type to color, either a sea turtle or a box turtle.
2. Take a paper plate and the turtle sheet.
3. Color the turtle sheet and plate bottom to resemble a real turtle and its shell.
4. Carefully cut out the turtle parts. One head (H), a left front leg (LF), a right front leg (RF), a left rear leg (LR), a right rear leg (RR) and a tail (T).
5. Place the area of the turtle cut out pieces behind the dotted line under the paper plate. Using glue or a stapler, attach the turtle cut out pieces in their appropriate places.

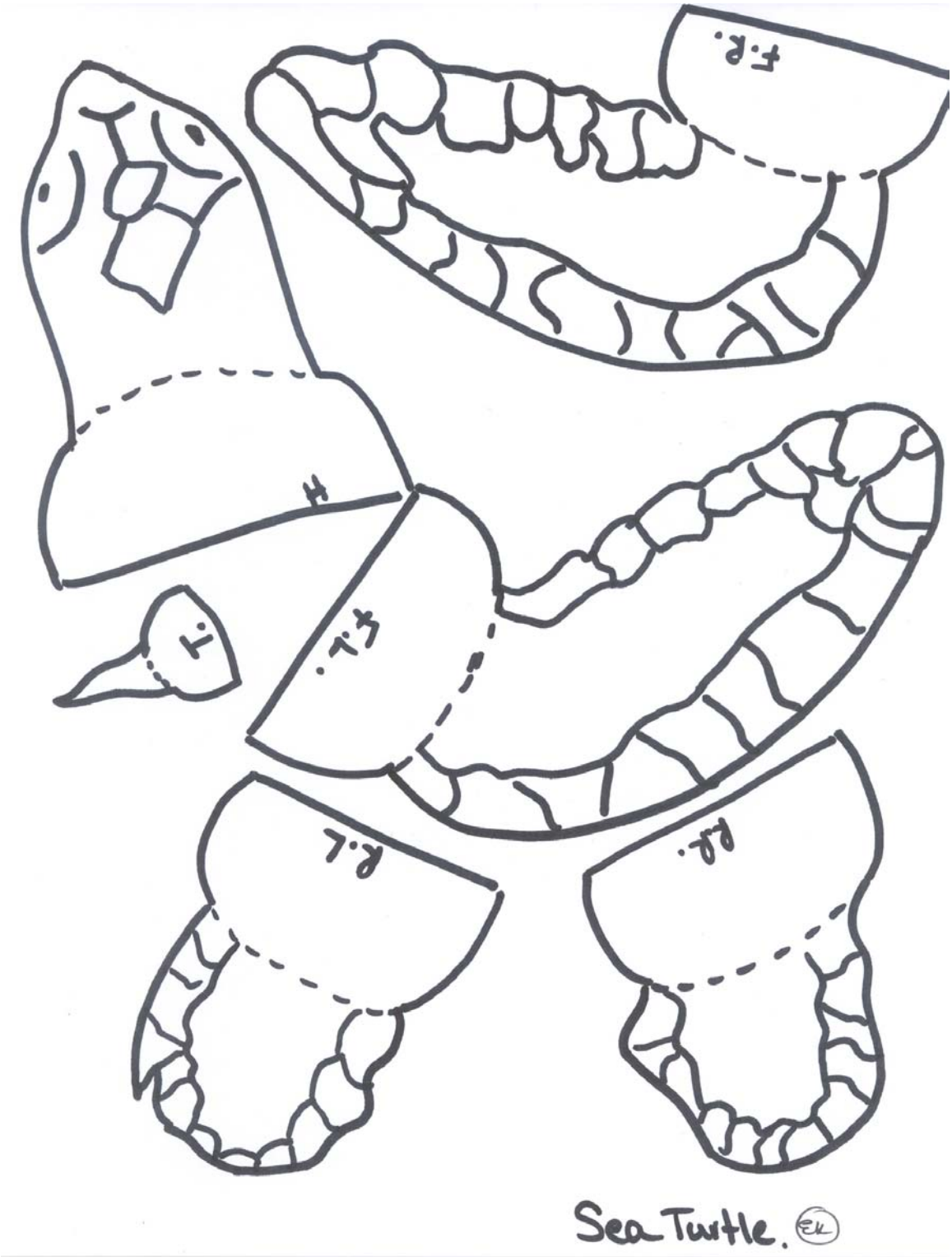
Extension:
- Use brads to attach head, legs and tail so they can move.
- Use an additional plate for the plastron and stuff the turtle.
- Use cloth and transfer the turtle designs to the cloth and make a turtle pillow.



WAVE FOUNDATION

GBBN architects

NEWPORT AQUARIUM

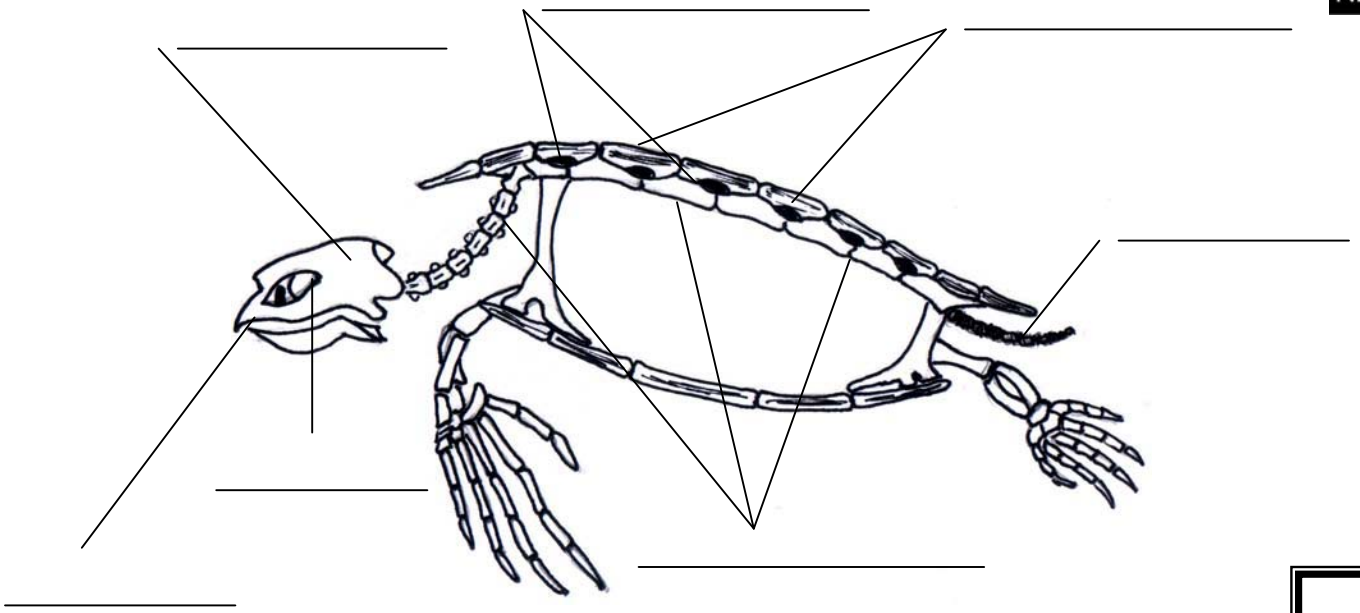


WAVE FOUNDATION

GBBN architects

NEWPORT AQUARIUM

“No Bones About It” – Skeleton Activity



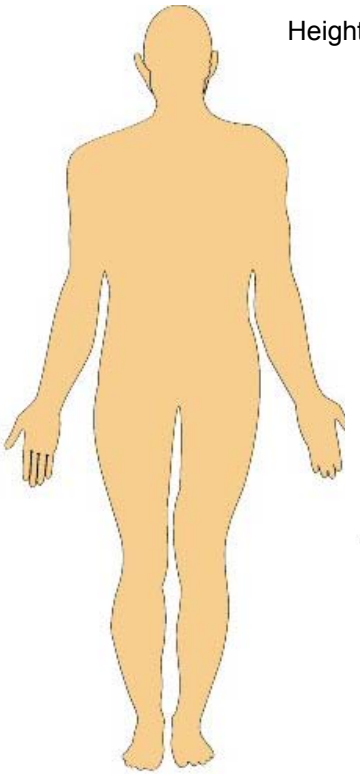
Word Bank

Skull
Tail
Ribs
Bone plate
Beak
Vertebra (Backbones)
Eye socket

1. Fill in the labels on the skeletal diagram using terms from the list.
2. What features look similar to a human skeleton?
3. What evidence do you see in the skeletal diagram that sea turtles evolved from land reptiles?

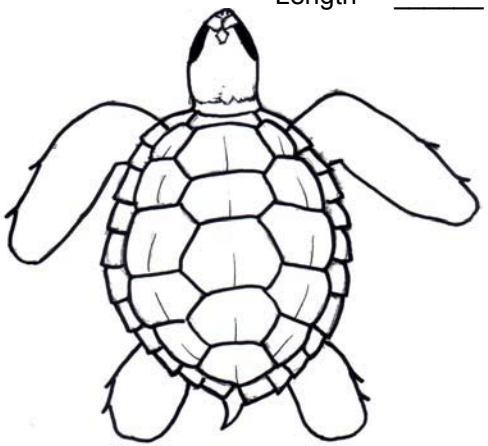
How do sea turtles measure up?

You are a junior sea turtle biologist in the field. Can you identify the species of sea turtles you see just by their size? Use the scale, **1 inch = 18 inches**, to estimate the turtles' sizes. Use the size statistics on your turtle ID cards to determine the identity of each species. Measure turtles from tip of nose to tail then convert from the scale length to actual length. This will give you the actual total length (TL) measurement.



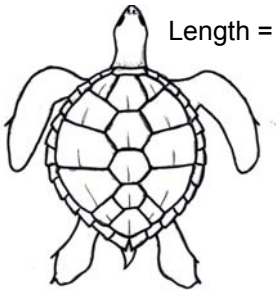
Height = 72 inches

Human



Length = _____

_____



Length = ____

_____

Length = _____

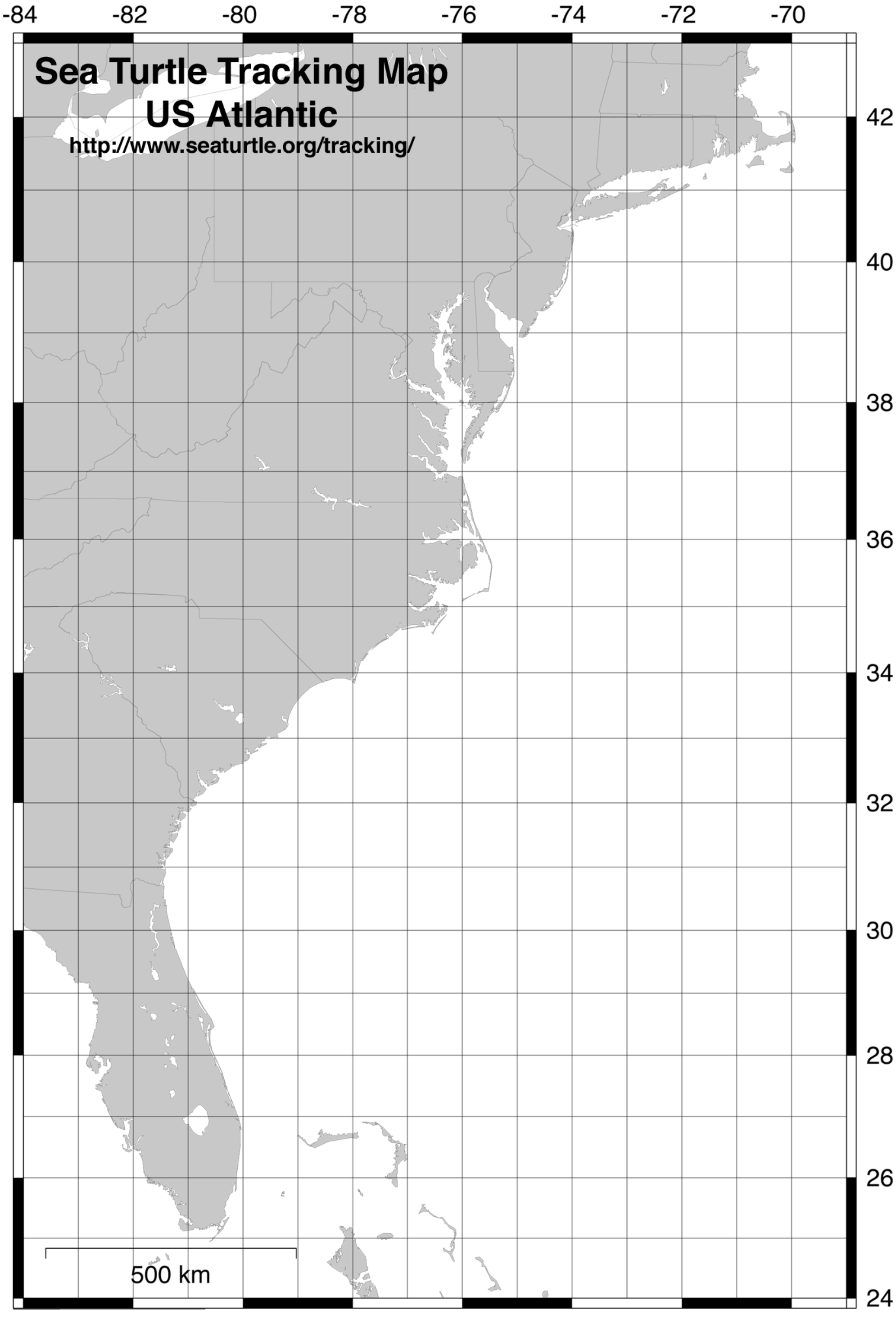
_____

Name: _____

Scale: 1 inch = 1.5 feet

Sea Turtle Tracking Map
US Atlantic

http://www.seaturtle.org/tracking/



National Education Standards for Sea Turtles, A Journey of Survival

	Science																			
Content/Activity	**A-1**	**A-2**	**C-1**	**C-2**	**C-3**	**C-4**	**C-5**	**C-6**	**C-7**	**C-8**	**C-11**	**C-12**	**C-14**	**D-1**	**D-5**	**E-2**	**F-3**	**F-10**	**F-11**	**F-12**
The Evolutionary History of Sea Turtles			x					x		x	x			x	x					
"Tow the Line" - Timeline Activity										x	x				x					
The Seven Species of Sea Turtles			x	x	x	x		x		x	x									
Turtle Parts			x		x	x		x		x	x									
Build a Geometric Turtle			x		x	x				x										
Survival at Sea: Sea Turtle Adaptations			x	x	x	x		x		x										
"Waiter, I didn't order the jellyfish"	x	x	x		x	x		x		x										
Sea Turtle Life Cycle			x	x	x		x	x					x							
"Temperature Will Tell"	x	x	x	x	x		x												x	
Which Way Did They Go?																x				
Sea Turtle Satellite Tracking via the Web	x	x			x			x								x				
The Struggle for Survival			x	x	x			x	x	x		x	x				x	x	x	x
Turtle Tracking in Your Classroom	x	x	x	x	x			x												
Paper Plate Turtles			x			x														
"No Bones About It"			x			x				x	x									
How do sea turtles measure up?	x	x	x																	

	Mathematics												English and Reading				
Content/Activity	**NO-1**	**NO-2**	**NO-3**	**A-1**	**G-1**	**G-2**	**G-4**	**M-1**	**M-2**	**DA-1**	**CN-3**	**R-3**	**1**	**3**	**5**	**7**	**8**
The Evolutionary History of Sea Turtles													x	x			
"Tow the Line" - Timeline Activity	x			x								x	x	x			
The Seven Species of Sea Turtles													x	x			
Turtle Parts													x	x			
Build a Geometric Turtle				x	x		x	x	x		x	x	x				
Survival at Sea: Sea Turtle Adaptations													x	x			
"Waiter, I didn't order the jellyfish"	x												x	x			
Sea Turtle Life Cycle													x	x			
"Temperature Will Tell"	x	x	x					x	x	x	x		x	x		x	
Which Way Did They Go?						x							x	x		x	x
Sea Turtle Satellite Tracking via the Web						x				x		x	x	x	x	x	x
The Struggle for Survival								x			x		x	x		x	
Turtle Tracking in Your Classroom						x				x	x	x	x	x		x	x
Paper Plate Turtles													x				
"No Bones About It"													x				
How do sea turtles measure up?	x	x	x	x				x	x	x	x		x				

National Education Standards

NSTA National Science Education Standards

CONTENT STANDARD A: Science as Inquiry
1. Abilities necessary to do scientific inquiry
2. Understanding about scientific inquiry

CONTENT STANDARD B: Physical Science
1. Properties of objects and materials
2. Position and motion of objects
3. Light, heat, electricity, and magnetism
4. Properties and changes of properties in matter
5. Motions and forces
6. Transfer of energy
7. Structure of atoms
8. Structure and properties of matter
9. Chemical reactions
10. Conservation of energy and increase in disorder
11. Interactions of energy and matter

CONTENT STANDARD C: Life Science
1. The characteristics of organisms
2. Life cycles of organisms
3. Organisms and environments
4. Structure and function in living systems
5. Reproduction and heredity
6. Regulation and behavior
7. Populations and ecosystems
8. Diversity and adaptations of organisms
9. The cell
10. Molecular basis of heredity
11. Biological evolution
12. Interdependence of organisms
13. Matter, energy, and organization in living systems
14. Behavior of organisms

CONTENT STANDARD D: Earth and Space Science
1. Properties of earth materials
2. Objects in the sky
3. Changes in earth and sky
4. Structure of the earth system
5. Earth's history
6. Earth in the solar system
7. Energy in the earth system
8. Geochemical cycles
9. Origin and evolution of the earth system
10. Origin and evolution of the universe

CONTENT STANDARD E: Science and Technology
1. Abilities of technological design
2. Understanding about science and technology
3. Abilities to distinguish between natural objects and objects made by humans

CONTENT STANDARD F: Science in Personal and Social Perspectives
1. Characteristics and changes in populations
2. Types of resources
3. Changes in environments
4. Populations, resources, and environments
5. Risks and benefits
6. Science and technology in society
7. Personal and community health
8. Population growth
9. Natural resources
10. Environmental quality
11. Natural and human-induced hazards
12. Science and technology in local, national, and global challenges

CONTENT STANDARD G: History and Nature of Science
1. Science as a human endeavor
2. Nature of science
3. History of science
4. Nature of scientific knowledge
5. Historical perspectives

NCTM Standards for School Mathematics

Number and Operations Standard (NO)
1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems
2. Understand meanings of operations and how they relate to one another
3. Compute fluently and make reasonable estimates

Algebra (A)
1. Understand patterns, relations, and functions
2. Represent and analyze mathematical situations and structures using algebraic symbols
3. Use mathematical models to represent and understand quantitative relationships
4. Analyze change in various contexts

Geometry Standard (G)
1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships
2. Specify locations and describe spatial relationships using coordinate geometry and other presentational systems
3. Apply transformations and use symmetry to analyze mathematical situations
4. Use visualization, spatial reasoning, and geometric modeling to solve problems

Measurement Standard (M)
1. Understand measurable attributes of objects and the units, systems, and processes of measurement
2. Apply appropriate techniques, tools, and formulas to determine measurements

Data Analysis and Probability Standard (DA)
1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
2. Select and use appropriate statistical methods to analyze data
3. Develop and evaluate inferences and predictions that are based on data
4. Understand and apply basic concepts of probability

Problem Solving (Ps)
1. Build new mathematical knowledge through problem solving
2. Solve problems that arise in mathematics and in other contexts
3. Apply and adapt a variety of appropriate strategies to solve problems

Reasoning and Proof (RP)
1. Recognize reasoning and proof as fundamental aspects of mathematics
2. Make and investigate mathematical conjectures
3. Develop and evaluate mathematical arguments and proofs
4. Select and use various types of reasoning and methods of proof

Communication (CM)
1. Organize and consolidate their mathematical thinking through communication
2. Communicate their mathematical thinking coherently and clearly to peers, teachers and others
3. Analyze and evaluate the mathematical thinking and strategies of others
4. Use the language of mathematics to express mathematical ideas precisely

Connections (CN)
1. Recognize and use connections among mathematical ideas
2. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole
3. Recognize and apply mathematics in contexts outside of mathematics

Representation (R)
1. Create and use representations to organize, record, and communicate mathematical ideas
2. Select, apply and translate among mathematical representations to solve problems
3. Use representations to model and interpret physical, social and mathematical phenomena

NCTA and IRA Standards for English Language Arts

Standard 1 Read a wide range of print and nonprint text to acquire new information.

Standard 2 Read a wide range of literature from many periods in many genres.

Standard 3 Apply a wide range of strategies to comprehend, interpret, evaluate and appreciate text.

Standard 4 Communicate effectively with a variety of audiences for different purposes.

Standard 5 Write and use different process elements.

Standard 6 Create, critique and discuss print and nonprint texts.

Standard 7 Conduct, research and gather, evaluate and synthesize data.

Standard 8 Use a variety of technological and informational resources.

Standard 9 Develop an understanding of and respect for diversity in language use.

Standard 10 Use of first language for English Language Arts competency.

Standard 11 Participate as knowledgeable, reflective, creative and critical members of a variety of literacy communities.

Standard 12 Use spoken, written and visual language to accomplish their own purposes.

NEWPORT AQUARIUM

Conservation, How to Help

Become Aware – Get Informed – Use Influence - and Be Responsible.

We must be responsible for our actions and understand that we share the oceans and the Earth with many different living things. Once we are aware, then we can become informed. Learn what is endangering and harming the environment and the organisms living around us. Use what you have learned to influence others by making your voice heard. Lastly, be responsible. Pick up after yourself - dispose of waste correctly. Make environmental choices that are wise and beneficial, not cheap and convenient. Small changes can make a big difference in the sea turtles' journey for survival.

What You Can Do to Help Sea Turtles

There are a few simple things you can do with your classroom to help sea turtles:

1. Write an essay for the Newport Aquarium on why sea turtles are important to us and why we should protect them. Selected essays will be placed on display for Aquarium visitors to read.
2. Officially adopt a tagged turtle on www.seaturtle.org to have your classroom's name on the web page. Money from this program is used to support sea turtle conservation.
3. Stay informed about issues that affect turtles such as development of natural lands, particularly wetlands. Take action on the issues by writing letters to the appropriate authorities and elected officials.
4. Many families travel to the beaches for summer vacation. Before summer break, have students compile a list of what they can do while at the beach to help sea turtles and other ocean wildlife.
5. Reduce your use of plastic by reusing bags and containers. Recycle and pick up trash. Turtles may mistake plastic bags, styrofoam and trash floating in the water as food, which can cause serious health problems and in some cases death.
6. Celebrate events without the use of helium balloon releases. Like plastic trash, balloons end up in the ocean, especially when released near the coast. Sea turtles mistakenly eat the balloons and die.
7. Discuss biodegradable cleaners or distribute recipes for creating environmentally safe cleaners for the home. Household chemicals that are not biodegradable contribute to the pollution of our waterways and can kill plants and animals.
8. Support organizations that are working to save turtles or their habitats. We have listed a few good organizations on this page but there are many others.

Organizations Helping Sea Turtles

Newport Aquarium
http://www.newportaquarium.com

Seaturtle.org
http://www.seaturtle.org

Karen Beasley Sea Turtle Rescue and Rehabilitation Center http://www.seaturtlehospital.org

Bald Head Island Conservancy
http://www.bhic.org

Marine Turtle Research Group
http://www.seaturtle.org/mtrg/

North Carolina Wildlife Resources Commission
http://www.ncwildlife.org

Answer Guide

1. A. 50
   B. 50

2. A. 27.5 ; 81.5
   B. Eggs will experience more temperature fluctuation than eggs laid in regular beach sand.
   C. 100
   D. 0

3. A. 24 ; 75.2
   B. Eggs may rot or drown because of the excess rains and high tides. The cold temperatures will kill the developing embryos.
   C. 0
   D. 0

4. A. 98.6
   B. Eggs will dehydrate from exposure to the sun and will not develop at the higher temperatures.