

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 tidepools. 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

Stranded Along the Coast

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; if possible, a rescue team is dispatched. 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 "coldstunned"—chilled to the point where they are unresponsive and unable to eat to get their metabolic rate going.

Coldstunned 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.

Stranded Along the Coast *Lesson Plan*

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

social studies, biology, oceanography, mathematics

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. If you have 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. If you have a compass or any navigational aids, bring them in to discuss their use.

3. Hand out both 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. These include barrier beaches such as Fire Island. 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 and North Carolina.

Waves also 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, 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. You might also tell students that many of the 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.

Kemp's ridley sea turtle

(*Lepidochelys kempī*)—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 coldstunned. 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 coldstunned.

The three coldstunned turtles found in Cape Cod Bay were probably swept into the cold bay and trapped there by the Labrador Current.

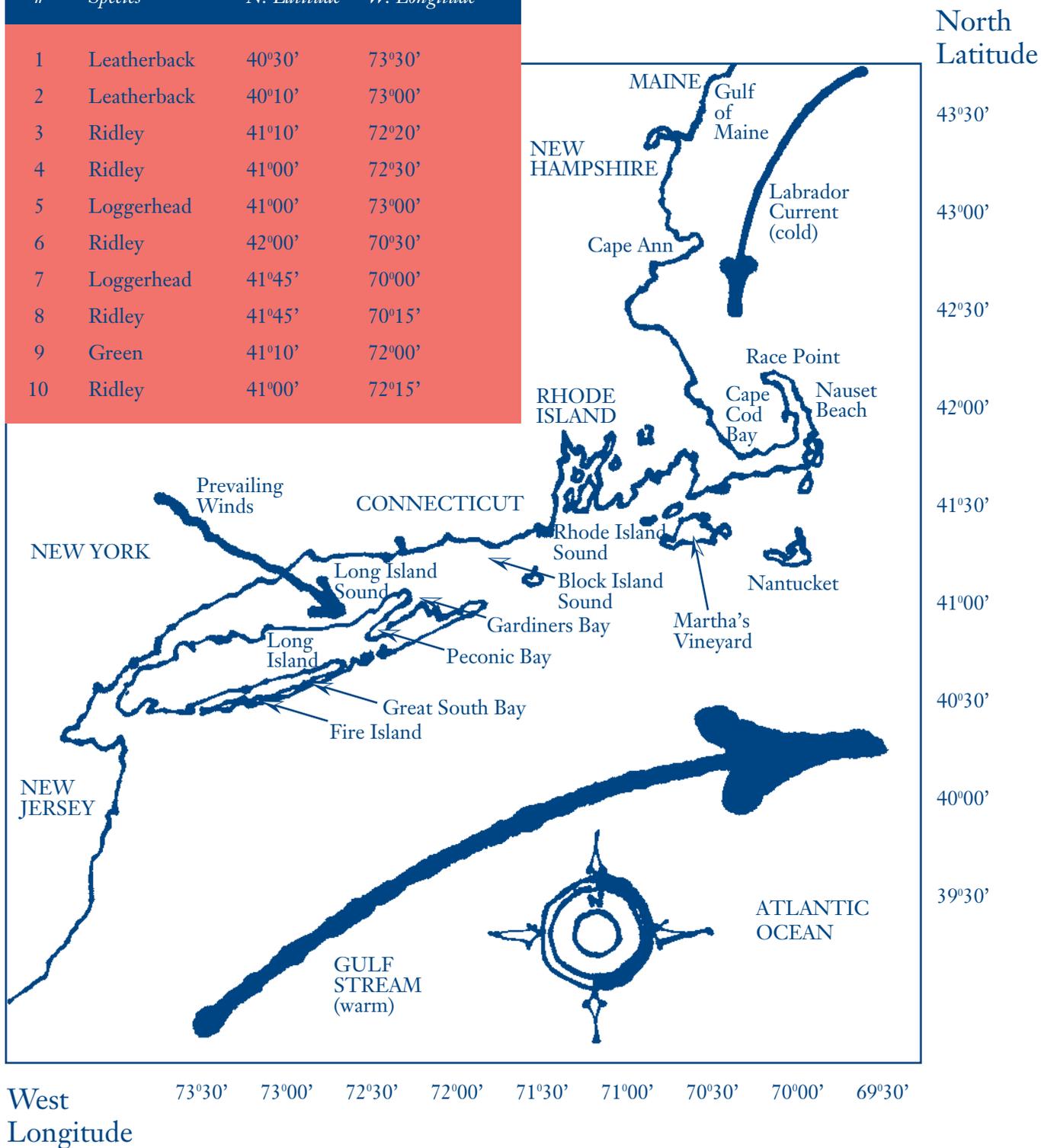
8. Ask students to look at Montauk Point, at the eastern end of Long Island. Tell them that the original lighthouse was surveyed and planned by George Washington; it has been moved a few times and just underwent another renovation to protect it. Ask students what the lighthouse needs protection from. 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.

Stranded Along the Coast—*Teacher's answers to stranding table*

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; coldstunned
4	Ridley	Long Island Sound	crabs	Wind; coldstunned
5	Loggerhead	Long Island Sound	crabs	Wind; coldstunned
6	Ridley	East side of Cape Cod Bay	crabs	Current; coldstunned
7	Loggerhead	East side of Cape Cod Bay	crabs	Current; coldstunned
8	Ridley	East side of Cape Cod Bay	crabs	Current; coldstunned
9	Green	Gardiner's Bay, Long Island	vegetation	Wind; coldstunned
10	Ridley	Gardiner's Bay, Long Island	crabs	Wind; coldstunned

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Stranding Data			
#	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'	73°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'



Student Page B

Stranded Along the Coast

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:

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

Resources

Online resources

Visit Ocean Planet online at http://seawifs.gsfc.nasa.gov/ocean_planet.html

Use the Exhibition Topic Outline to find Fishing Issues and Global Change (under Oceans in Peril). Look under Heroes to learn about some of the people who have worked to protect and preserve the oceans. Click on “Resource Room” to link to other related sites on the Internet such as Turtle Trax, a page dedicated to marine turtles. Also under Resource Room, the Image Catalog offers photographs and illustrations of specific images suggested by the activities in this section.

Resources for students

Tesar, Jenny. *Threatened Oceans*. New York: Facts on File, 1991.

Resources for teachers

America's Seashore Wonderlands. Washington, D.C.: National 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.