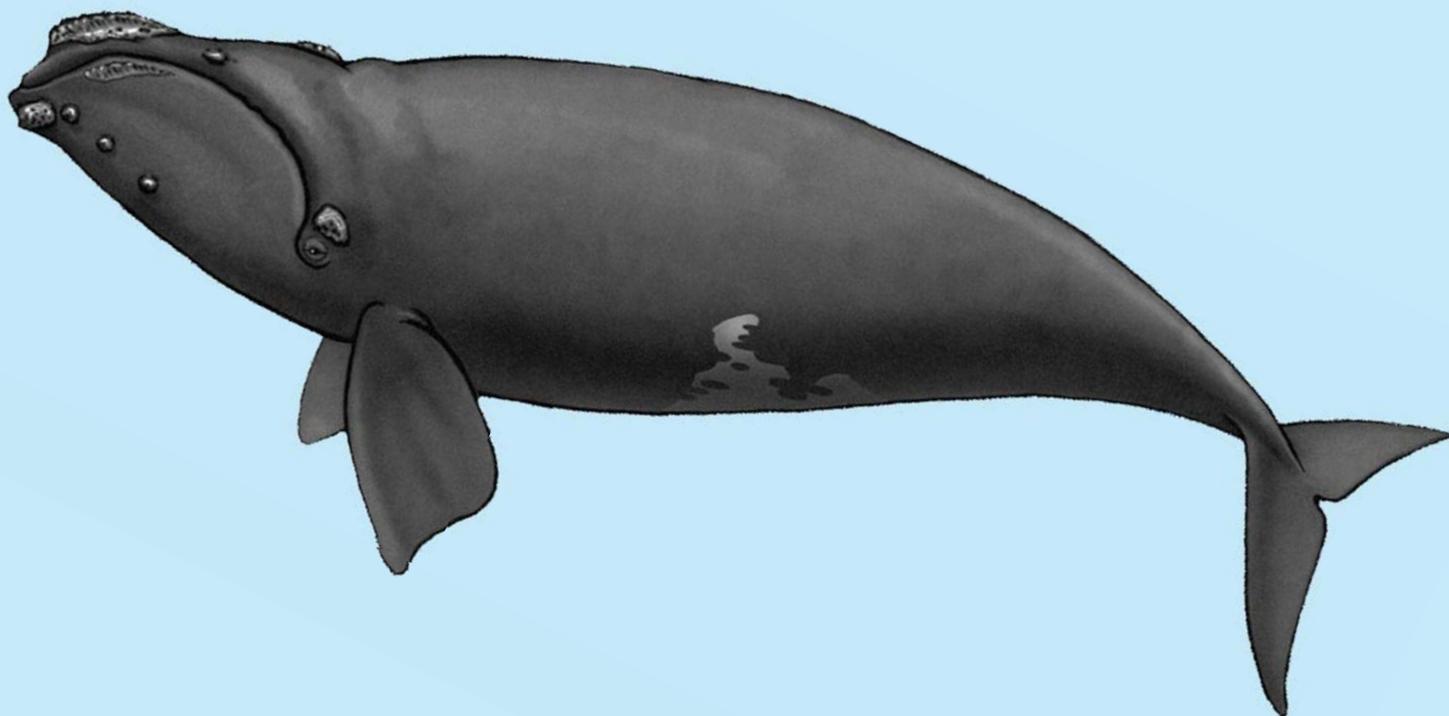




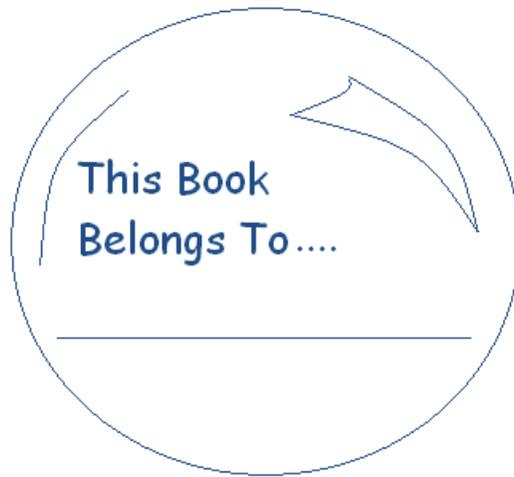
The World of North Atlantic Right Whales

Discover the fascinating world of the North Atlantic right whale (*Eubalaena glacialis*) through lessons and activities on the biology, ecology, and conservation of this endangered species.

Grades 6-8



Produced by NOAA Fisheries Service's Northeast Regional Office



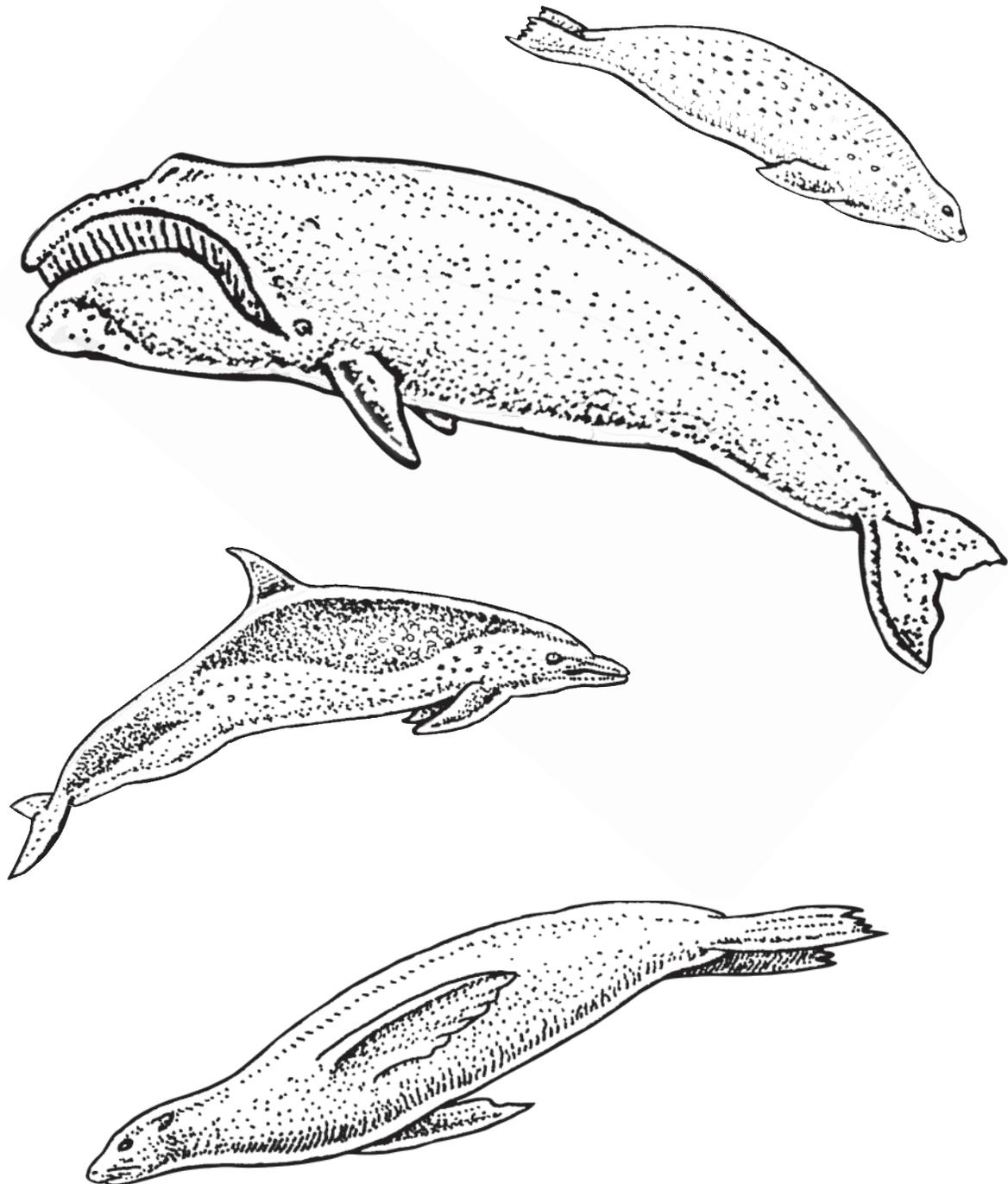
This activity book was created by the Protected Resources Division of NOAA Fisheries Service's Northeast Regional Office. NOAA's mission is to understand and predict changes in the Earth's environment, from the depths of the ocean to the surface of the sun, and to conserve and manage our coastal and marine resources.

Cover Right Whale Illustration Credit: Scott Landry, Provincetown Center for Coastal Studies

Table of Contents

Introduction to Marine Mammals	p. 1
North Atlantic Right Whales	p. 4
Activities	p. 15
Glossary & References	p. 25
Appendix for Activity 1	p. 31

Introduction to Marine Mammals



WHAT ARE MARINE MAMMALS?

Marine mammals are a diverse group of *mammals* that are well adapted for life in the marine environment. Like all mammals, marine mammals give live birth, nurse their young, breathe air, are warm-blooded, and possess hair. Marine mammals in the northeast region include whales, dolphins, porpoises, and seals. Though not found in the northeast U.S., polar bears, otters, manatee, walruses, dugong and sea lions are examples of other well known marine mammals. Marine mammals evolved from land-dwelling ancestors and typically have *hydrodynamic* bodies, modified limbs, and *adaptations* that allow for regulating body temperatures such as thick *blubber* layers.

Taxonomy
IS THE SCIENTIFIC
CLASSIFICATION OF
ORGANISMS INTO GROUPS
BASED ON SIMILARITIES.



Harbor seals. Credit: NOAA

majority of their lives swimming and eating in water and their bodies are adapted to move easily through their aquatic habitat. Pinnipeds do not move well on land, however pinnipeds do venture onto land or ice floes to bear their young, sunbathe, and molt.

PINNIPEDS

Seals, sea lions, and walruses belong to the taxonomic order of Pinnipedia, meaning “fin footed”. They are *carnivorous* aquatic mammals that use *flippers* for movement on land and in the water. *Pinnipeds* spend the



Walrus. Credit: FWS

Carnivores
ARE ANIMALS THAT EAT
OTHER ANIMALS.
Herbivores
ARE ANIMALS THAT EAT
ONLY PLANTS.

NORTHEAST PINNIPEDS

The only pinniped group found in the northeast U.S. are *seals*. Seals propel themselves through the water with their rear flippers and use their front flippers for steering. The front flippers of seals are short with sharp claws. Seals cannot use their rear flippers to walk on land or ice and most appear awkward when moving on these surfaces. Seals have a torpedo-like shape in the water and move rapidly to catch prey and escape predators. Unlike sea lions, seals do not have visible ear flaps.

Seal or Sea Lion?



Seals

HAVE EAR HOLES/NO VISIBLE EAR FLAPS.
DO NOT USE HIND FLIPPERS FOR WALKING.
STREAMLINED BODY, SHORT FRONT AND HIND FLIPPERS.
COMMON IN THE NORTHEAST.

Sea Lions

HAVE VISIBLE EAR FLAPS.
HIND FLIPPERS ROTATE FORWARD FOR WALKING ON
LAND.
ELONGATED NECK, LONGER FRONT AND HIND FLIPPERS.
NOT NATIVE TO THE NORTHEAST.



California seal lion (right) and harbor seal (left). Credit: NOAA

* DEFINITIONS FOR BOLDDED AND ITALICIZED WORDS CAN BE FOUND IN THE GLOSSARY

CETACEANS

Whales, dolphins, and porpoises belong to the taxonomic order called *Cetacea*. Over 70 species of whales, dolphins, and porpoises populate the world's oceans. *Cetaceans*, being mammals, are air breathing animals that hold their breath while under water and must surface to take a breath. To study cetaceans, scientists categorize the animals into two main suborders



Common dolphin. Credit: NOAA

or groups: baleen whales (*mysticetes*) and toothed whales (*odontocetes*). Whales are the largest of the marine mammals, and represent some of the largest animals ever to live on Earth.

ODONTOCETES (TOOTHED WHALES)

Nearly 90% of cetacean species are odontocetes, or toothed whales.

Toothed whales include small dolphins and porpoises, as well as large toothed whales such as the killer whale and the sperm whale. Sperm whales can reach 60 feet in length. The presence of teeth and one external *blowhole* distinguish toothed whales from baleen whales. Toothed whales typically feed on fish and squid species. Also, toothed whales use *echolocation* to locate food and "see" their environment. Some toothed whale species sighted in northeast U.S. waters include pilot whales, common dolphins, bottlenose dolphins, Atlantic white sided dolphins, harbor porpoise, sperm whales, and occasionally killer whales.

Echolocation
IS THE EMISSION OF SOUND AND RECEPTION OF ITS ECHO. THE SOUND IS EMITTED IN THE HEAD OF TOOTHED WHALES AND FOCUSED BY THEIR MELON, AN AREA LOCATED IN THE ANIMAL'S FOREHEAD. THE RECEIVED ECHOES PASS THROUGH SPECIAL SOUND-CONDUCTING TISSUE IN THE LOWER JAWBONE TO THE INNER EAR. RECEIVING THESE ECHOES ALLOWS TOOTHED WHALES TO "SEE" THE WORLD AROUND THEM, EVEN IN MURKY OR DARK ENVIRONMENTS.

Explore how bottlenose dolphins use echolocation to capture their prey by visiting the **Smithsonian National Zoo website:**

<http://nationalzoo.si.edu/scbi/AquaticEcosystems/Dolphins/AboutDolphins/Echolocation.cfm>

MYSTICETES (BALEEN WHALES)

Mysticetes, or *baleen* whales, are the largest creatures in the world. Some baleen whales, such as the blue whale can reach 100 feet in length- making them the largest creatures to have ever lived (they are even bigger than dinosaurs). Baleen plates and two blowholes help distinguish baleen whales from toothed whales. Instead of teeth, mysticetes were named for the long plates of baleen which hang in a row (like the teeth of a comb) from their upper jaws. Baleen plates are strong and flexible and are made of a protein called keratin. The protein keratin also makes up human fingernails and hair. Baleen plates are broad at the whale's gumline and taper into a fringe which forms a curtain or mat, resembling a mustache, inside the whale's mouth. This feeding adaptation allows the whales to feed on very small prey such as *krill*, small fish, *copepods*, and other *zooplankton*. In order to feed, ba-



Humpback whale. Credit: NOAA

leen whales open their mouths, engulf huge volumes of water, close their mouths and then strain the water out against the baleen plates using their tongues. When the water is expelled, large numbers of the small prey are trapped against the baleen. Unlike toothed whales, baleen whales are not known to use echolocation. Baleen whales sighted in the northeast U.S. waters include humpback whales, fin whales, minke whales, sei whales, blue whales, and North Atlantic right whales.



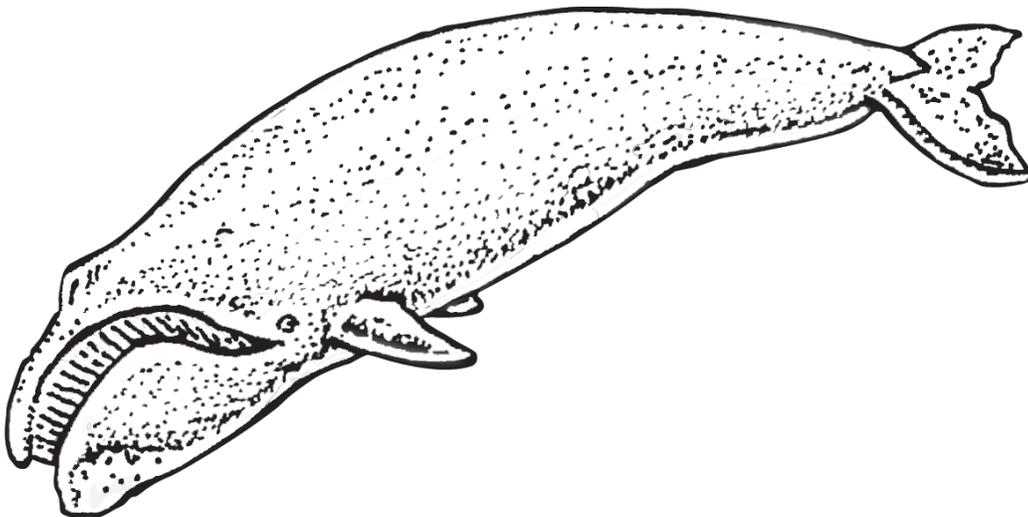
Humpback whale feeding. Credit: NOAA

Baleen plates hang down from the top of baleen whales' mouths.

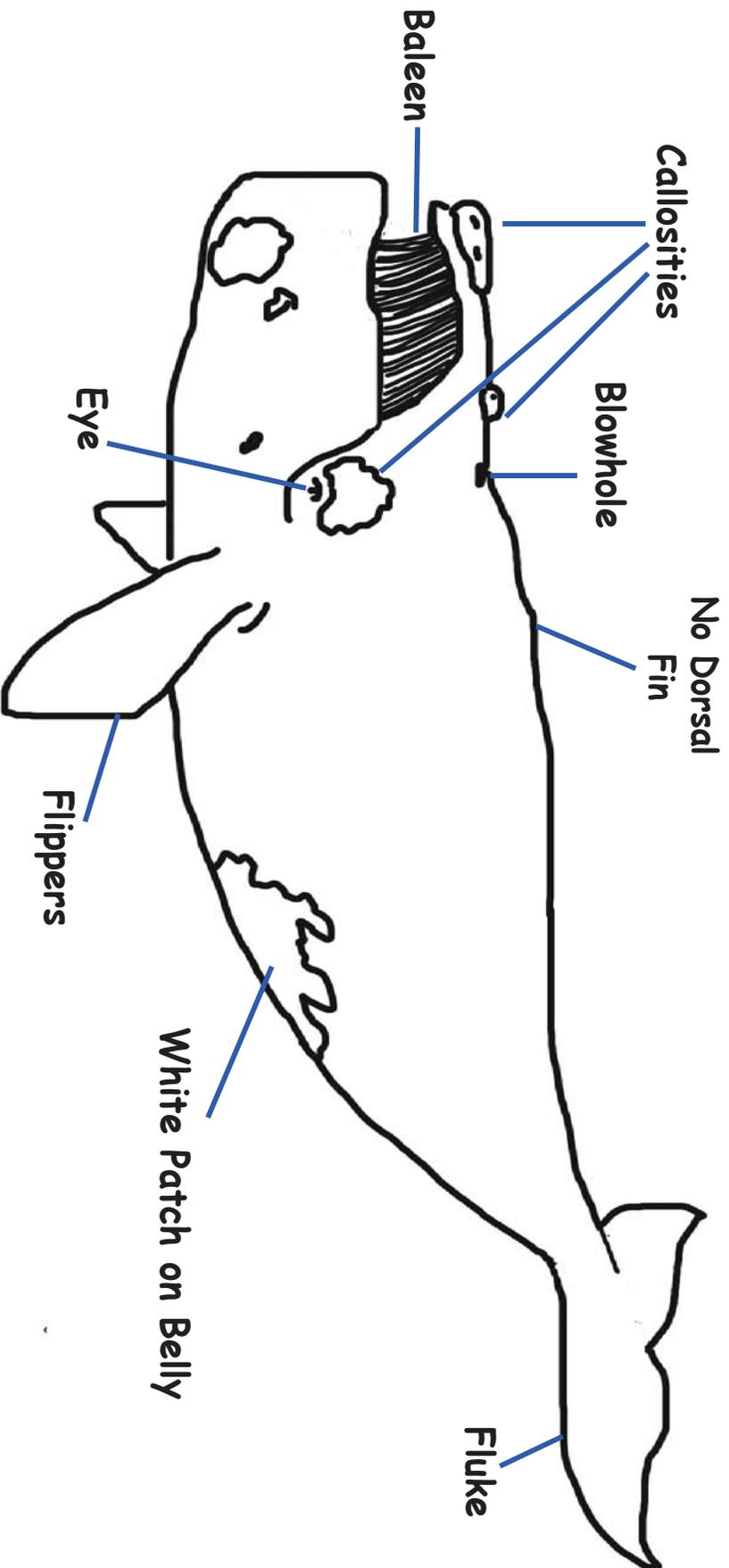
North Atlantic Right Whales



Right whales. Credit: NOAA



Right Whale Anatomy



RIGHT WHALE BIOLOGY

North Atlantic right whales (scientific name: *Eubalaena glacialis*) are large, black, baleen whales that can reach up to 55 feet in length and weigh up to 70 tons (the same as about 6-7 school buses). Right whales can also have white or gray spotty patches on their bellies, though not all right whales possess this characteristic. Unlike other baleen whales, they do not have a *dorsal fin*. Right whales have large heads that make up 1/3 of their bodies. The skull of one right whale was once measured at approximately 15 feet in length and weighed 2,200 pounds!



Two right whales. Credit: Provincetown Center for Coastal Studies

On top of their heads, above their eyes, and along their lower jaws, right whales have patches of tough, scaly skin called *callosities*. Callosities start to form soon after birth. Patterns of callosities are unique to each right whale and are how scientists distinguish and identify individual animals.

Right Whale Stats

Scientific Name: *Eubalaena glacialis*

Population: Fewer than 500

Adult Length: 55 feet

Adult Weight: 70 tons (140,000 pounds)

Swimming Speed: 6 miles/hour

Number of Baleen Plates: 220-250

Length of Adult Baleen: up to 9 feet

Like other whales, right whales must surface in order to breathe. They have two blowholes, typical of baleen whales, and when they exhale, the V-shaped *blow* is visible from a distance.

Right whales have thick blubber layers that can account for about 40% of their body weight. Blubber is a dense layer of fat that helps regulate the body temperature of marine mammals in

cold waters. This blubber layer also serves as a food “reservoir” in times when food is unavailable, such as when the whales migrate to warmer waters for calving.

POPULATION

Centuries ago, before whaling began, scientists believe there were thousands of right whales. As of 2009, there were at least 360 but fewer than 500 animals. Because of these low population numbers, the North Atlantic right whale is classified as an *endangered species* and is considered one of the rarest marine mammals in the world. Scientists are able to keep track of individual animals within the population based on the unique callosities patterns each whale has. All right whales are given identification numbers but some are also given names, based on recognizable features, that allow researchers to identify the animals from a boat. Keeping track of individuals within a population allows scientists to monitor population numbers and life history characteristics of the species such as how often the whales have calves, where they migrate, and how long they live.

Did You Know?

Scientific names are based on specific set of rules that allow scientists to categorize animals and plants based on their relationships, or shared characteristics, with other organisms. Scientific names are Latin and are italicized.



Right whale blow Credit: NOAA

Explore how scientists identify individual right whales by playing the **New England Aquarium's Online Right Whale Identification Game:**
www.neaq.org/education_and_activities/games_and_activities/online_games/

HISTORY

For centuries, right whales were hunted for their blubber and baleen. In New England, *whaling* began in the 1700s and continued until the 1930s, though commercial whaling began in other parts of the world much earlier. Massachusetts communities such as Gloucester, New Bedford, Cape Cod, and Martha's Vineyard were among the most prosperous whaling ports.

The right whales gained their name for being the "right" whale to hunt and were a main target of whalers because of their slow swimming speeds, close proximity to shore, and when the whale died the carcass would float-making it easy to tow to shore.

The whale blubber collected was turned into oil and used for making candles, lamp oil, and as a lubricant for maintaining mechanical equipment such as trains or clocks. One right whale could produce as much as 90 barrels of oil.

Baleen is highly flexible and strong. Baleen collected from whaling was used for making whips, skirt hoops, umbrella structures, brushes, and furniture. Commercial whaling continued in the United States until substitutes for the oil and baleen, such as petroleum and plastics, were readily produced. Commercial whaling is now illegal in the United States, though it still occurs in some countries. (Current commercial hunts do not target right whales but do harvest minke, fin, Bryde's, sei, sperm, and humpback whales).

Whaling had a major impact on the population of the North Atlantic right whale, as well as other whale species. By the time right whales were protected from whaling in 1935, some scientists believe the population had been reduced to only 100 animals.



Whaler from the 1800s standing next to racks of right whale baleen. Credit: NOAA

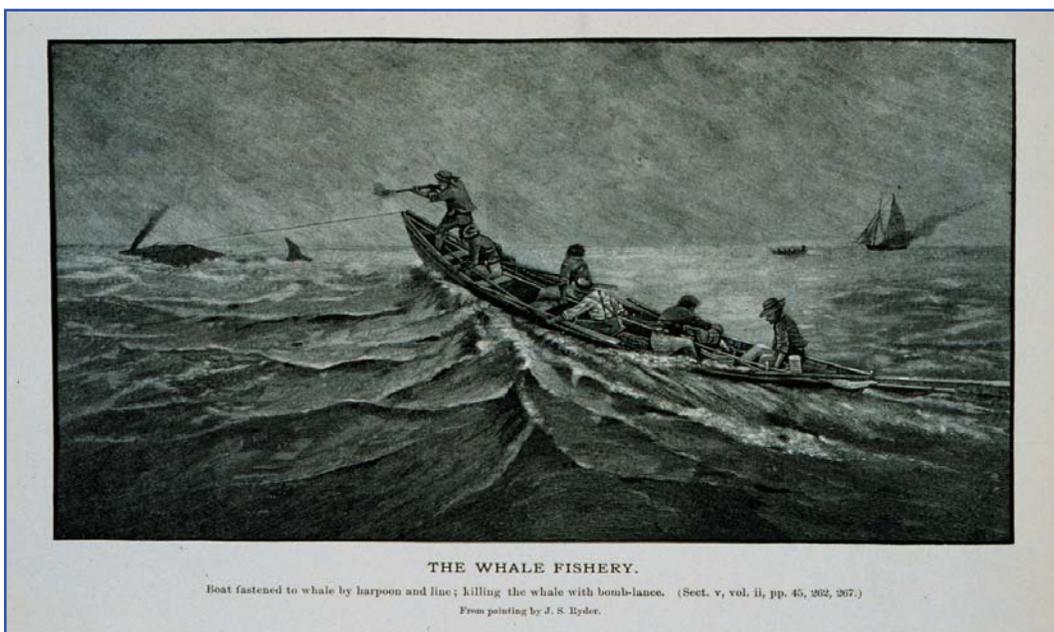


Illustration of historical whaling techniques from painting by J. S. Ryder. Credit: NOAA

More historical whaling images are available online on NOAA's Photo Library: www.photolib.noaa.gov/nmfs/methods.html



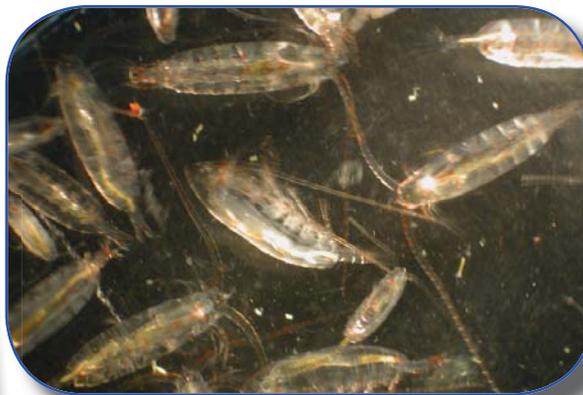
Right whale skim feeding below the water's surface. Credit: NOAA

FEEDING

Like other baleen whales, the right whale does not have teeth, but uses a mouthful of fringed baleen plates to filter food from the water. Most baleen whales have stiff broom-like baleen, but the baleen of the right whale has a greater amount of fine hair-like strands, which are used for filtering out their rice-sized planktonic prey from the water (usually copepods, juvenile krill, or other small zooplankton).

Right whales feed by skimming through dense aggregations of prey with open mouths. This behavior may occur at the water's surface or underwater. When feeding at the surface, right whales typically move in zig-zag patterns similar to a person mowing a lawn. Water containing high densities of their prey flows into the whale's open mouth. The whale then uses its tongue to force the water out of its mouth, trapping the prey against the dense, hairy mat of baleen. The whale then closes its mouth and uses its tongue to sweep food from the baleen plates.

Right whales must eat at least 1 million calories a day (4,400 pounds of plankton) to meet their energy demands and remain healthy. In contrast, on average, an adult human requires 3,000 calories each day. While these numbers are very different, since the right whale is so much larger than a person, a million calories to a right whale is equal to only about 1,500 calories to a person.



Photos: Scientists looking at microscopic zooplankton collections (left). Magnified photo of copepod zooplankton, the primary right whale prey. Actual copepods are about the same size as a grain of rice (center). Right whale skim feeding (right). Credits: NOAA NEFSC

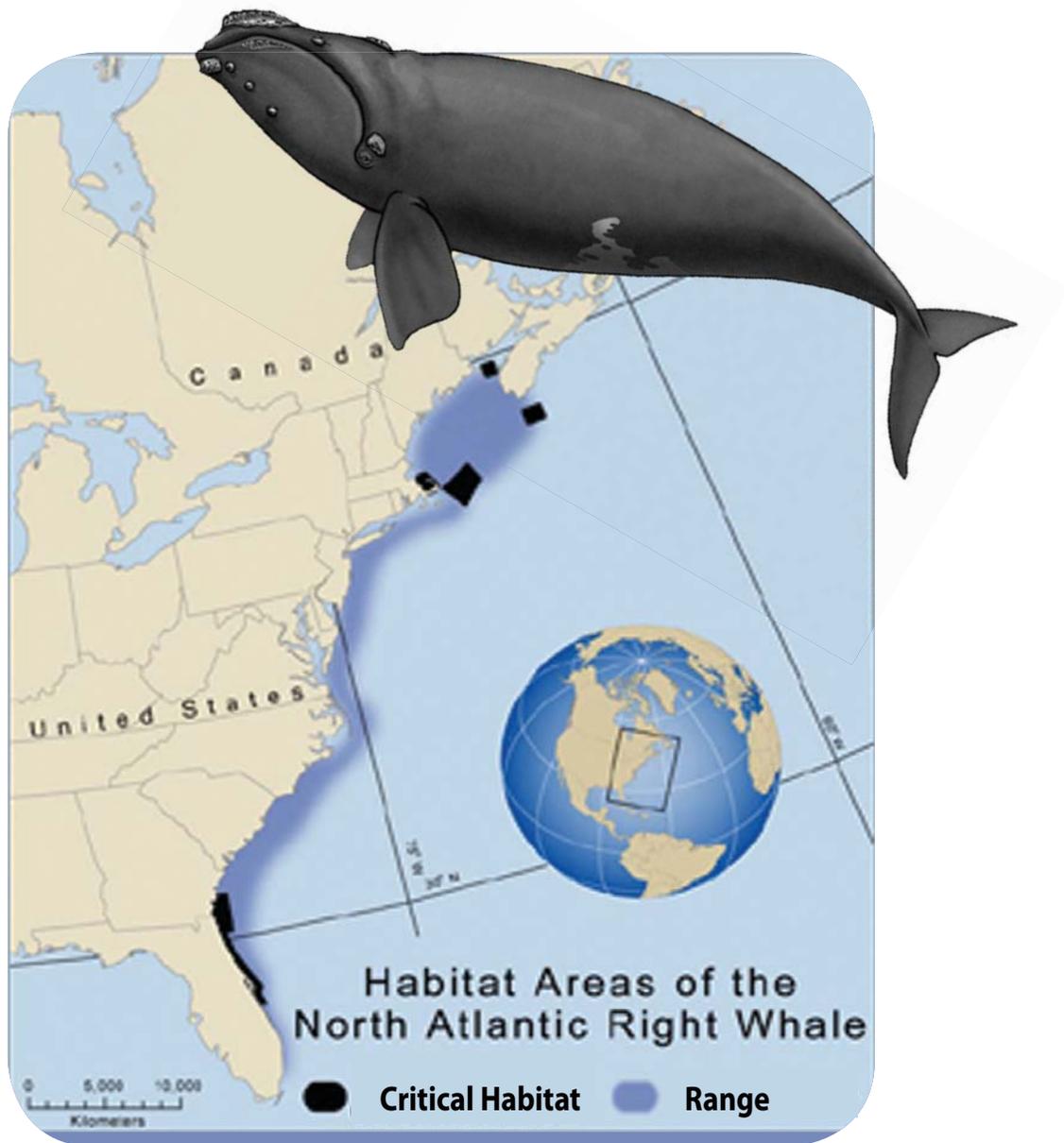


GEOGRAPHIC RANGE & MIGRATION

North Atlantic right whales typically range from Nova Scotia (Canada) to Florida (United States).

In the spring, most right whales can be found off the coast of New England, with a large percentage congregating off of Cape Cod, Massachusetts. As the spring progresses to summer, right whales move further offshore. By late summer/early fall, right whales are typically located in the Bay of Fundy and off the coast of Nova Scotia. New England and Canadian waters are important feeding *habitat* for right whales. These cold water areas are nutrient rich areas of *upwelling*, which provide for dense aggregations of nutritious plankton, like copepods. Right whales spend at least half the year in these nutrient rich waters, though some whales may remain in the area all year long.

In the winter, a significant number of animals within the population migrate to the calving grounds off the coasts of Georgia and Florida, though some right whales have been found to calve as far north as off the coast of South Carolina as well. These warm waters are the only areas where right whales are known to give birth to their young. Outside of the whales that head to the calving grounds for the winter, scientists do not know where the majority of right whales go during these cold months.



Credits:

Map: Adapted from North Atlantic Right Whale Consortium. www.rightwhaleweb.org

Right Whale Illustration Credit: Scott Landry, Provincetown Center for Coastal Studies

RIGHT WHALE COMMUNICATION

Right whales communicate with each other through underwater vocalizations, or calls. They produce about half a dozen different types of calls. Types of calls include *up-calls*, *moan calls*, *scream calls*, and *gunshot sounds*.

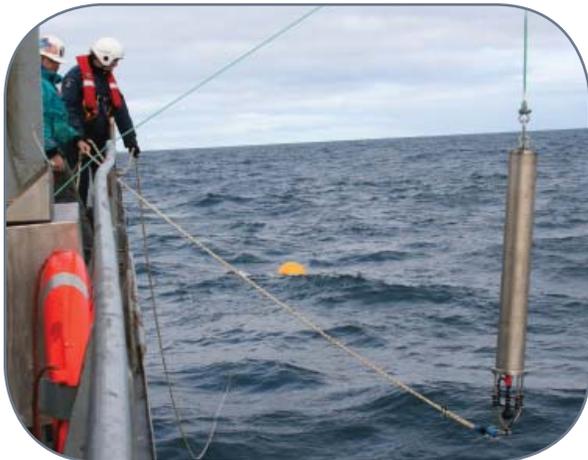
Up-call: The up-call is a type of “contact call,” the up call is a little like small talk--the sound of a right whale going about its day and letting others know it’s nearby. It resembles a deep, rising “whoop” that lasts about a second. (Source: Right Whale Listening Network)

Moan call: The moan call is an eerie, wavering note that lasts about 4 seconds. The purpose of this call is still not completely understood. (Source: Right Whale Listening Network)

Scream call: Right whales often make brief, shrill “scream” calls when they gather in groups at the surface. These common gatherings center around a particular female, but they can include 30 or more males, females, and calves, all milling around, splashing, and calling. (Source: Right Whale Listening Network)

Gunshot sound: Males also produce a peculiar “gunshot” sound--a very loud pop or bang that seems to be used as an aggressive call toward other males. They tend to make gunshot sounds one at a time when involved in a group of whales at the surface. At other times males give an elaborate display, swimming in circles or slapping the water while making dozens of loud gunshot sounds. (Source: Right Whale Listening Network)

Did You Know?
Sounds produced by baleen whales may be the loudest produced by any animal. These sounds may travel for tens or hundreds of kilometers underwater.



Scientists deploy an underwater hydrophone to record whale vocalizations. Credit: NOAA

LISTENING FOR RIGHT WHALES

Right whales can be difficult to see from the water’s surface, therefore scientists have discovered a way they can “look for” right whales by using sound instead of depending on visual surveys. *Acoustic buoys* and *hydrophones* are the equipment deployed underwater to listen for and record right whale calls. This is especially important in areas of high boating traffic. Off the coast of Massachusetts, buoys are used to determine when right whales are present. This information is communicated to boats in the area, so they can post look-outs and slow their speed down to reduce chances of colliding with the whales. Listening for right whales also helps scientists to gain a better understanding where and when the animals are traveling. For

example, in 2009, NOAA scientists discovered right whales were present off the coast of Greenland from listening to underwater acoustic recordings. This was an exciting discovery because the historic resident population in this area was believed to have been hunted to *extinction* in the early 20th century.

Explore Listen to right whale calls, other whale vocalizations, and learn more about underwater sound, by visiting the following websites:
Right Whale Listening Network: www.listenforwhales.org
Discovery of Sound in the Sea Project : www.dosits.org

THREATS TO RIGHT WHALES

The greatest threats to right whales are *entanglement* in certain types of fishing gear and collisions with boats or vessels. Pollution, habitat degradation, and climate change may also have future impacts on the right whale population, though the effects are not currently well understood.

LAWS PROTECTING RIGHT WHALES

North Atlantic right whales, are endangered and therefore are protected by two different national laws: the Marine Mammal Protection Act and the Endangered Species Act. Under these laws several specific *regulations*, or management plans, help to protect right whales and reduce the biggest threats to their survival. NOAA Fisheries Service (NMFS) is the federal government agency that is in charge of implementing these two laws as they apply to protected marine species in northeastern U.S. waters.

The **Marine Mammal Protection Act (MMPA)** was created in response to increasing concerns among scientists and the public that marine mammal populations were declining too quickly due to human activities. The MMPA applies to ALL marine mammals, including right whales. This law makes it illegal to “hunt, harass, or kill” any marine mammal, though some exceptions exist. The MMPA aims to prevent marine mammal populations from declining so far that they become ineffective contributors to their ecosystem.

The **Endangered Species Act (ESA)** protects endangered and threatened animals and plants from human impacts that could cause the species to become *extinct* and conserves the ecosystems on which they depend. The ESA makes it illegal to “take” (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to do any of these things) any endangered or *threatened* species, with few exceptions. The ESA does not apply to all marine mammals, but North Atlantic right whales are endangered due to their small population size and therefore are protected by this law as well as by the MMPA.

Did You Know?

It is illegal for anyone to approach a right whale closer than 500 yards (1,500 feet) unless they have special permission or exemptions from NOAA.



Two feeding right whales. Credit: NOAA

The ESA also attempts to protect habitat features that are important to endangered species' survival through the designation of *critical habitat*. Critical habitat designation requires that activities that occur in these special areas will not hurt these critical features. For example, in 1994, NMFS designated Cape Cod Bay, MA and the Great South Channel (off the coast of MA) as critical feeding habitat for North Atlantic right whales because of high concentrations of copepods essential to the right whale species' survival (the critical feature) can be found in these areas during spring and summer months. Activities that occur in these areas therefore cannot injure or harm the copepod populations that reside there.

As of 2011, NMFS is analyzing new scientific information on copepod populations essential to right whales. Based on this new assessment, NMFS may consider redefining and possible expanding the boundaries for these critical habitat areas in the future.



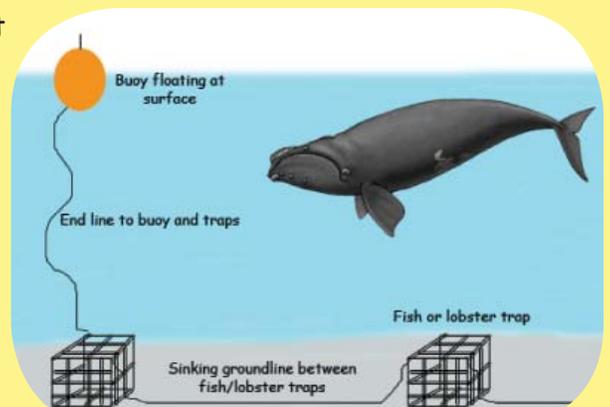
NOAA's Disentanglement Network Rescuers work to disentangle a right whale.
Credit: NOAA

Case Study: Reducing Entanglement of Right Whales

The Marine Mammal Protection Act (MMPA) specifies that NMFS develop and implement *take reduction plans* to assist in the recovery of certain marine mammal stocks that have high interaction rates (and are injured or killed from these interactions) with

certain fishing gear. To develop these plans, teams of people are put together to make decisions on how best to reduce potential entanglements. These teams include fishermen, scientists, conservationists, and state and federal government managers.

The take reduction plan that helps to reduce entanglement of right whales is the Atlantic Large Whale Take Reduction Plan. This plan also helps to protect humpback and fin whales, which are also endangered species that interact with fishing gear. The plan aims to reduce injury and death of whales caused by entanglement with commercial gillnet and trap/pot gear. In 2009, this plan implemented new regulations for fishermen that required them to use *sinking groundline* in between lobster/fish traps and gillnets. Since large whales, such as right whales, are known to feed at the bottom of the water column, it is hoped that this new requirement will prevent whales from getting tangled in fishing lines while feeding underwater.



Right whale illustration credit: Scott Landry,
Provincetown Center for Coastal Studies

Case Study: Reducing Vessel Collisions with Right Whales

Right whales are slow moving whales that spend time submerged close to the water's surface. This behavior, and the lack of a dorsal fin, make the whales difficult to see from a boat and therefore make them susceptible to being struck by vessels.

In 2008, NMFS issued a regulation that requires large vessels (65 feet in length or greater) slow down their speeds to 10 knots in areas and times when right whales are present. This should allow more time for vessels to see the whales and allow the whales more time to escape from the path of an oncoming vessel. NMFS also established a voluntary program called the "dynamic management areas" (DMAs) program. If right whales occur in areas where they are not expected, vessels are notified of their location so they can reroute around the area, or slow to safer speeds.



Humpback whales swimming near large tanker. Credit: Stellwagen Bank
National Marine Sanctuary

WHY ARE RIGHT WHALES IMPORTANT?

Right whales are important components of the marine *ecosystems* in the northeastern U.S. Right whales contribute to marine ecosystems by preying on zooplankton populations and contributing essential nutrients (nitrogen and carbon) to the system through defecation and death. Right whales also contribute to the ocean's *biodiversity*.

Impacts of removing right whales from the ecosystem are not known. However, given examples from other places in the world where important marine mammals have been removed from their ecosystem, we learn that the potential impacts from losing a marine mammal species can have long lasting, and unexpected consequences. Therefore it is important to protect right whales in order to maintain a healthy and balanced marine ecosystem.

LESSON LEARNED: SEA OTTERS & KELP FORESTS IN THE PACIFIC

In nature, all living things are in some way connected. Within each community each species depends on one or more of the others for survival. And at the core of individual ecosystems is a creature, or in some cases a plant, known as a *keystone species*. A keystone species operates much like a true keystone, which is the stone at the top of an arch that supports the other stones and keeps the whole arch from falling down. When a keystone species is taken out of its environment, the whole system could collapse.

In California's Monterey Bay National Marine Sanctuary the sea otter is a keystone species in the kelp forest ecosystem. Kelp is a special type of nutrient rich marine algae that consist of long bodies, or blades, and a holdfast, or root like system, that anchor the kelp in place. Underwater kelp forests provide food and shelter for large numbers of fish and shellfish. Kelp also protect coastlines from damage caused by waves. One of the sea otter's favorite foods is the sea urchin. The sea urchin's favorite food sources in this ecosystem is kelp.

When present in healthy numbers, sea otters keep sea urchin populations in check. When sea otter populations decline, urchin numbers explode and grab onto kelp. The urchins chew off the anchors that keep the kelp in place, causing them to die and float away, setting off a chain reaction that depletes the food supply for other marine animals causing their numbers to decline.

By the early 20th century when sea otters were hunted nearly out of existence for their fur, kelp forests disappeared and so did the marine life that depended on kelp. Years later, conservationists moved some remaining otters from Big Sur to Central California. Gradually, their numbers grew, sea urchin numbers declined, and the kelp began to grow again. As the underwater forests grew, other species reappeared.

Protecting keystone species and biodiversity, is a priority. Often, the extent of the functions of a species within their ecosystem aren't known until the species has been removed from its environment and the ecosystem changes. Rather than wait until it may be too late for the system's health and survival, scientists make every effort to keep an ecosystem working as nature intended.



Photos. (Top left) Sea otter, credit: FWS. (Bottom left) Sea urchins, credit: NOAA. (Right) Kelp forest, credit: NOAA

HOW CAN YOU HELP RIGHT WHALES?

There are many ways you can help North Atlantic right whales.

You Can Make a Difference!

Recycle, reuse, or dispose of garbage properly to prevent marine debris and participate in beach cleanups in your community. This will keep ocean waters clean, and provide a healthy environment for right whales.

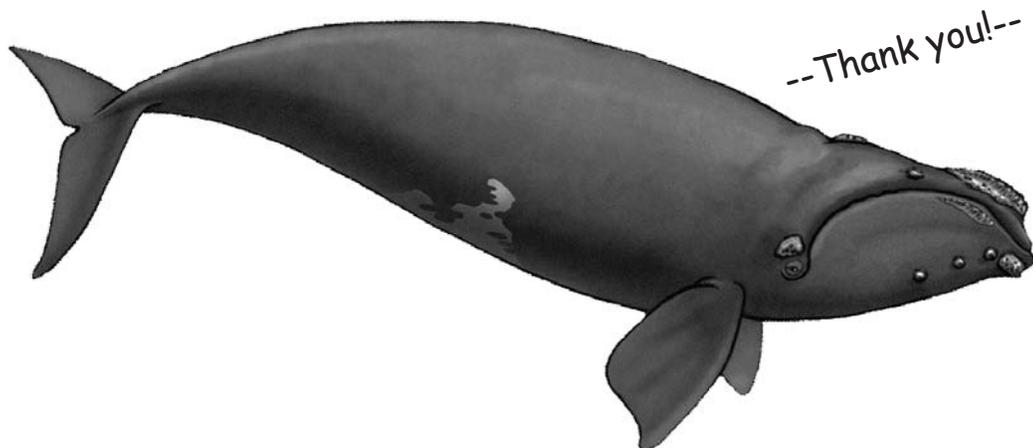
Learn more about why right whales are important and tell your friends, family, and neighbors what you've learned.

Learn more about the threats, especially entanglements and ship strikes, and talk to others about ideas to protect right whales.

Look out for right whales when boating. If you see one, slow down and stay 500 yards away. If you can't identify the whale species, assume it's a right whale and stay 500 yards away.

If you see a stranded, injured, or entangled right whale, report it to NOAA by calling 866-755-NOAA (6622).

Report all right whale sightings to the Right Whale Advisory Hotline Pager by calling 978-585-8473, or to the U.S. Coast Guard via Channel 16. By calling this hotline you'll help to inform other boaters of the presence of right whales.



Right Whale Illustration Credit: Scott Landry, Provincetown Center for Coastal Studies

Activities



Mother right whale with calf. Credit: NOAA

ACTIVITY:

WHALE OF A TALE



TEACHING TIME: 30 MIN

LEARNING OBJECTIVES:

Students will use observations to describe physical characteristics of marine mammals.

Students will use creative writing to create a “sea monster” story based on marine mammal physical characteristics.

BACKGROUND: The ocean’s first explorers did not know much about the animals living beneath the waves. Given that very little can be seen of these animals from the surface, imaginations mixed with fear and awe, may have resulted in some inaccurate descriptions of these animals and their behaviors leading to the creation of sea monster stories. Since studying marine mammals still takes place primarily at the water’s surface, scientists must be vigilant in their observations in order to make sure their assumptions can be supported by scientific data as they discover new ways to study these animals.

MATERIALS: Pictures of marine mammals (Appendix), paper, pencils.

INSTRUCTIONS:

1. Have students break into groups of 3-4.
2. Provide each group with a picture of a whale or dolphin that the students may not have seen before (example pictures provided in the Appendix) with the corresponding Whale of a Tale Mystery Scenario. Tell the students they will be using their imaginations to pretend that they are some of the first sailors to cross the Atlantic ocean. They have just come across an animal in the sea that they have never seen before (in the picture). Have them describe the animal. What do the animals look like? What conclusions can they draw about what the animal eats? Encourage creativity with how they describe the scene.
3. Allow students to work together for 15-20 minutes.
4. Have students present their descriptions.
5. After they complete their descriptions, tell each group the name of the whale that corresponds to their mystery animal picture.
6. Pass out cetacean identification cards to students and have them locate their whales on the card (if you do not have cards, have students conduct an online search for pictures).
7. Have students complete a short report describing their whale including, details they were not able to infer from the mystery animal picture.

ASSESSMENT QUESTIONS:

- Can students compare their description to the image from the identification card?
- Can students identify what part of the animal they were seeing and if their mystery picture contained multiple animals?
- Can students communicate what additional information would have been helpful to make their description more accurate?
- Can students identify what made coming up with a description of the animal difficult?
- Can students draw conclusions about the origins of sea monster stories?

FOLLOW-UP ACTIVITIES:

- Research new techniques for studying the underwater behavior of marine mammals.
- Research other sea monster stories and look for clues to determining what marine animals the stories’ authors might have really been describing.

ACTIVITY:

DOLPHIN ECHOLOCATION GAME

TEACHING TIME: 30 MIN

LEARNING OBJECTIVES:

Students will creatively visualize how echolocation is used by toothed whales and dolphins.

Students will identify how ocean noise may impact underwater communication and the ability for marine mammals to find food.

BACKGROUND: Living underwater has many challenges. Finding food and others of the same species would be difficult if marine mammals solely relied on vision as the only sense helping them to locate these important things. Sound travels much further than light underwater, therefore making hearing a very important sense for all marine mammals. Marine mammals rely very heavily on sound for their survival, either for communication or for locating prey. Toothed whales (odontocetes) have the extra capacity to create and receive sound waves that help them to locate specific items, such as the fish they feed on, through the process of echolocation (see page 3 for description). As underwater noise increases in the oceans due to increased ocean use by boats and other underwater activities, communication and the use of sound by marine mammals may face new challenges.

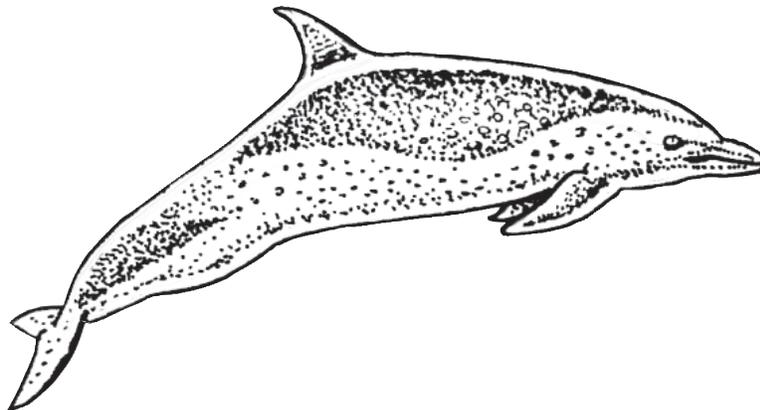
MATERIALS: Blindfold. Open space.

INSTRUCTIONS:

1. This game is similar to the game "Marco Polo".
2. Gather students in a circle and ask for a volunteer dolphin and a volunteer fish. Have the volunteers stand in the center of the circle.
3. Blindfold the dolphin to eliminate its sense of sight (students can cover their eyes if blindfolds are too scary). Explain that this game works like "Marco Polo" where the dolphin says "dolphin" and then the fish echoes "dolphin" (at a similar volume). The dolphin tries to gently "tag" the fish within the circle boundary.
4. After playing a few rounds this way, have students on the outside circle create extra noise as the game progresses. Start with having students whisper and progress to normal conversation volume. Does the dolphin have to adjust their volume to compensate for the extra noise?

ASSESSMENT QUESTIONS:

- Can the students communicate what they observed?
- Can students identify some of the challenges of being a predator and prey?
- Can students describe, in their own words, how the process of echolocation?
- How did the addition of noise make the dolphin's job of catching the fish more complicated?



ACTIVITY:

THE BLUBBER GLOVE



TEACHING TIME: 30-45 MINUTES

LEARNING OBJECTIVES:

Students will learn the biological function and benefits of blubber for whales.

Students will conduct an experiment and record their data.

BACKGROUND: Whales are warm-blooded marine mammals that can tolerate cold water temperatures. Whales use blubber as an insulation layer to help maintain energy and warmth when they dive to cool depths or travel to cold waters such as in the North Atlantic Ocean. The blubber layer is a thick layer of fat found under the skin.

MATERIALS: Baking sheet/pan (one per group), rubber gloves (one pair per group), ice, vegetable shortening, spoon (one per group), stopwatch or clock with second hand (one per group, water, pencils/pens, and paper.

INSTRUCTIONS:

1. Ask the kids if they've ever heard the word "blubber" and if they can they tell you what it means? (See glossary for definition.) Why do whales, and other animals need blubber? Explain to students that a thick layer of blubber, which is a type of fat, acts as an insulator to help keep animals, such as right whales, warm. Tell them they will prove it by making their own blubber glove.
2. Fill a baking pan with about 3-4 inches of cold water.
3. Add ice to the baking pan. This cold water will represent the cold ocean water.
4. Break students into groups of 2-4 students.
5. In each group, have one student put on a rubber glove.
6. A second student from each group should then cover the first student's gloved hand with shortening. The second glove should then be placed over the shortening. [This glove can also be prepared in advance by the teacher in order to save time during the lesson.]
7. One student with the glove on should then place his or her bare hand into the ice water.
8. Another student in the group should act as the timer, and keep track of how long the gloved student can keep the bare hand in the cold water. These results should be written down.
9. The gloved student should then place the gloved hand into the ice water. Again, the timer should keep track of how long the student can keep the hand in the cold water, and this time should be written down.
10. Each student should take a turn experimenting with the "blubber glove".
11. Ask each group to share their data and write the results on the board.

ASSESSMENT QUESTIONS:

- Are students able to identify which hand remained warm in the cold water?
- Can students describe how the blubber glove compares to whale blubber?
- Do students understand why blubber is important to whales & other marine mammals?

ACTIVITY:

RIGHT WHALE HEAT EXCHANGE

TEACHING TIME: 45 MINUTES.

LEARNING OBJECTIVES:

Students will compare heat loss in objects with different surface-to-volume ratios.

Students will learn the biological advantage for right whale body shape.

BACKGROUND: Animals that live in colder climates, including cold water, need several adaptations in order to stay warm. Even though blubber layers are essential for helping whales stay warm in the cold waters of the North Atlantic, whales also have other characteristics that help them to stay warm. Whales are large animals, and the larger the animal, the smaller the surface area-to-volume ratio is. Therefore, even though it is counter intuitive, the larger the animal is, the less area there is for the animal to lose heat from. Right whales also have torpedo shaped bodies, with limbs that are not very long. This adaptation helps the surface-to-volume ratio to remain low, therefore allowing for even less area where heat can be lost from.

MATERIALS: hot and cold water, 2 ziploc plastic sandwich bags, disposable plastic glove (similar material to the plastic bag), a styrofoam cup, a dishpan, bucket or similar container.

INSTRUCTIONS:

1. Fill the dishpan halfway with cold water. This container will represent the cold ocean water.
2. Put the same amount of hot water into the glove and each sandwich bag. Make sure the fingers of the glove are filled with water. Seal the bags and tie a knot in the glove to secure the water.
3. Have each student feel the bags and glove. Tell the students to remember how warm each bag/glove is (they should be the same temperature).
4. Put one bag of hot water in the styrofoam cup. Bend the top of the cup so that the bag is tightly contained inside the cup.
5. Place the glove, hot bag, and closed cup into the basin of cold water. Leave them in for about 5 minutes.
6. Remove the glove, plain bag, and styrofoam cup from the water.
7. Remove the bag from the cup.
8. Have students feel each again. The glove should feel the coolest and the bag from the styrofoam cup should feel the warmest. The glove represents an ocean animal with long legs. It has a lot of surface area, but little volume. If a whale had long legs, it would get too cold too quickly swimming in cold water. The plain sandwich bag represents an animal with no legs, but no insulation. It stays warmer than the animal with legs, but cooler than the bag that was insulated in the cup. The insulated cup/bag represents a whale: animal with no legs, and with insulation that acts like blubber.
9. OPTIONAL: You can conduct the same experiment with a thermometer and have students record the actual before and after temperatures.

ASSESSMENT QUESTIONS:

- Are students able to describe their observations?
- Can students draw conclusions about why whales are large and have flippers instead of hand and feet?

FOLLOW-UP ACTIVITY: Have students make a list of animals that live in the ocean. How many have long legs? Where in the world's oceans do they live (arctic, temperate, tropic, coastal, or open ocean)?

ACTIVITY:

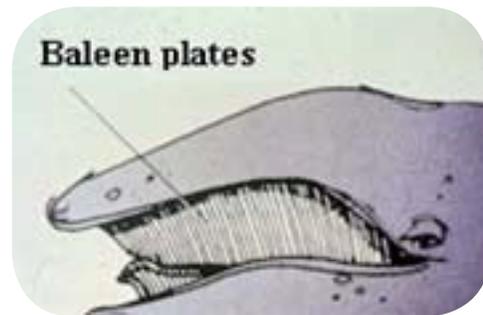
FEEDING ADAPTATIONS

TEACHING TIME: 20-40 MINUTES

LEARNING OBJECTIVES:

Students will learn the function of whale baleen.

Students will create a bar graph of results.



BACKGROUND: Feeding adaptations allow for each animal to become specialized at capturing the prey they need. Baleen whales have adapted a unique system for capturing their prey using the filtration of water through baleen plates, instead of teeth. This adaptation allows some of the largest animals on Earth to feed on some of the tiniest animals on Earth.

MATERIALS: Salad tongs, fork, spoon, strainer, candy sprinkles that will float, gummy fish candy, dishpan or bucket of water.

INSTRUCTIONS:

1. Fill container with water & add candy fish and sprinkles to water. Each utensil will represent different type of animal's tooth, with the strainer representing baleen. The candy represent small and large prey.
2. Have the students experiment, using each utensil to collect as many fish or sprinkles as possible within 1 minute.
3. Each student should create a table for each utensil he/she uses, and document how many of each prey item they are able to capture with each utensil. (See example below).
4. In a group, have students combine their results for each utensil and create a bar graph showing their combined results, identifying what tool was the most efficient for collecting each type of food (i.e. small versus large prey).
5. Have students describe how the tools worked.

ASSESSMENT QUESTIONS

- Do students understand the comparison of the strainer to baleen?
- Can students describe the function of how baleen works?
- Can students describe why the adaptation of baleen is more efficient for capturing small prey than teeth would be?
- Can students identify how specific feeding adaptations are related to prey type?

Example Table:

STUDENT 1	TONGS	FORK	SPOON	STRAINER
CANDY SPRINKLES				
GUMMY FISH				

FOLLOW-UP ACTIVITY: Provide students with various examples of animals from the same group (birds with different shaped beaks work well for this activity). Have students research the animal's prey and how the animal captures its prey. Have the students describe the animal's feeding adaptation that allow them to feed efficiently. Would a different feeding adaptation (ex. a differently shaped beak) work/not work for capturing this particular prey? Why or why not?

ACTIVITY:

ONLINE SCAVENGER HUNT

COMPLETE THE SENTENCES BY SEARCHING FOR THE ANSWERS ON WEBSITES LISTED BELOW.



1. MARINE MAMMALS ARE _____ THAT ARE WELL ADAPTED FOR LIFE IN THE MARINE ENVIRONMENT.
2. ALL MARINE MAMMALS ARE _____ UNDER THE MARINE MAMMAL PROTECTION ACT (MMPA).
3. THERE ARE APPROXIMATELY 125 MARINE MAMMAL _____ WORLDWIDE.
4. WHALES ARE THE LARGEST ANIMALS THAT EVER LIVED ON THE EARTH. THEY ARE EVEN LARGER THAN THE _____ OF PREHISTORIC TIMES.
5. THERE ARE 11 SPECIES OF _____ WHALES AND 67 SPECIES OF TOOTHED WHALES.
6. ALMOST ALL SPECIES OF BALEEN WHALES WERE EXPLOITED BY THE COMMERCIAL _____ INDUSTRY FROM THE 1700s TO THE MID-1900s.
7. WHALES, DOLPHINS, AND PORPOISES ALL BELONG TO THE SAME TAXONOMIC ORDER CALLED _____ .
8. RIGHT WHALES ARE LARGE _____ WHALES.
9. RIGHT WHALES ARE THE _____ OF ALL LARGE WHALE SPECIES AND AMONG THE RAREST OF ALL MARINE MAMMAL SPECIES.
10. USING CROSS-SECTIONS OF TEETH IS ONE WAY TO AGE MAMMALS. HOWEVER, RIGHT WHALES HAVE NO _____ .
11. MOST KNOWN RIGHT WHALE _____ AREAS ARE IN SHALLOW, COASTAL WATERS.
12. RIGHT WHALES ARE LARGE, ROTUND, BLACK WHALES WITH LARGE HEADS, LONG ROSTRUMS, AND NO DORSAL _____ .
13. RIGHT WHALES HAVE DISTINGUISHING HARD WHITE PATCHES CALLED _____ WHICH ARE THE BEST IDENTIFICATION BOTH FOR THE SPECIES AND FOR INDIVIDUAL RIGHT WHALES.

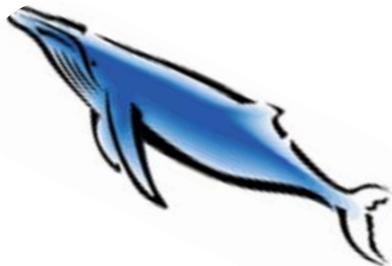
WEBSITES TO USE:

www.nmfs.noaa.gov/pr/species/mammals/
www.nmfs.noaa.gov/pr/species/mammals/cetaceans/
www.nmfs.noaa.gov/pr/species/mammals/cetaceans/rightwhale_northatlantic.htm
www.nero.noaa.gov/prot_res/mmv/regs.html
www.afsc.noaa.gov/nmml/education/cetaceans/
www.nmfs.noaa.gov/pr/education/whales.htm

ACTIVITY:

MARINE MAMMAL WORD SEARCH

T N M E I Q B A A N L R I A L N B B V L
 Z Y I Y T L V E R F A A A R A T B I A I
 C E X L U T B B I V H Z B B H A O E U X
 E V C B A A O R N A W Z U O W N S U F O
 Y Y B H L H I A E Z T Q C R K G I O B M
 H E Q E O H W L M W H J N S C L A W F H
 R P E E H L G O A I G O O E A E V Q E A
 T N L S Y N O P M M I Q I A B M G G S C
 W J Y Y U B K C M T R U O L P E W W A D
 C C I T N A L T A H T R O N M N Z L E M
 B F M R L P G V L T Q Q V L U T L R Y E
 D L V H N S R G P H I U E E H O E S U F
 O Z O M A E E T R F Y O M X S G T B Y I
 C N N W S R Q V O X R L N I N I A D U N
 E S I N H T Q P T S N X T A C L Z E S W
 P D O H D O R I E L T I D E A B Y D L H
 A C O Q P E L A C U E N T E I U O N L A
 C N C L S L D E T S E E N H Q P X F H L
 N B I P P I O O I N R A I E E K T C P E
 R I N F R H E D O V G S C P L A M M A M
 O Q K O L Z I O N L O D O N T O C E T E
 A K L N K A D N A O B C F G N I D E E F
 M F X Z P S S C C C M M S E A L I O N R
 A D L A Y N I R T C B M R X K J V M G V
 N O T K N A L P O O Z W O A X H W I N I
 A N D W L S C H C D I U A C W V S K D T
 T N A I R B R E A T H I N G B V N S Y S
 E I S C E T A C E A N N O I T A R G I M
 E A Y S T V K U C D R S N N W O B Y T N



Words to Find

AIR BREATHING
 BALEEN
 BLOWHOLE
 BLUBBER
 CALLOSITIES
 CAPECOD
 CETACEAN
 COMMON DOLPHIN
 CONSERVATION
 COPEPODS
 DOLPHIN
 DORSAL FIN

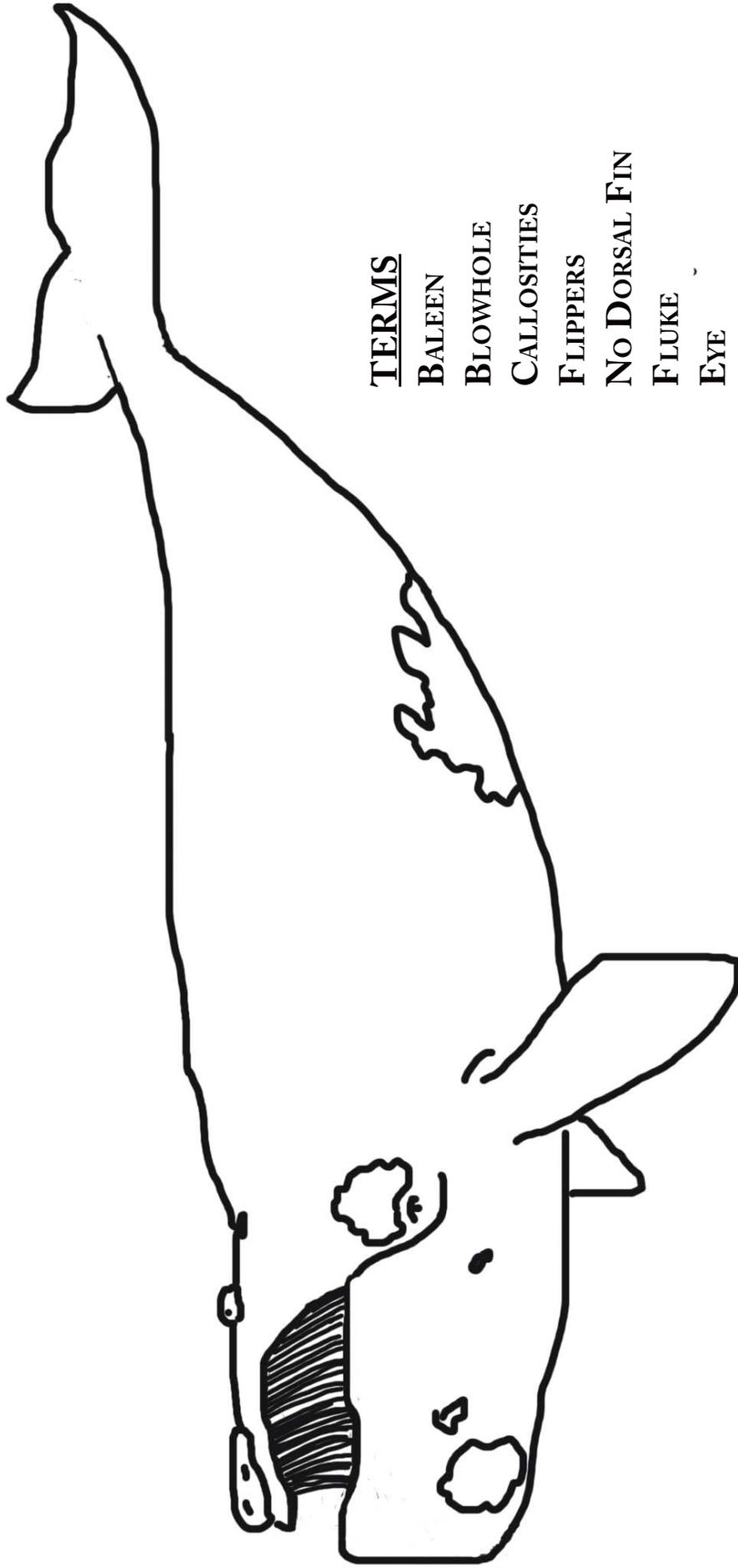
ECHOLOCATION
 ENDANGERED
 ENTANGLEMENT
 EUBALAENA GLACIALIS
 FEEDING
 FIN WHALE
 FLORIDA
 HARBOR SEAL
 HUMPBACK WHALE
 MAMMAL
 MANATEE
 MARINE MAMMAL PROTECTION
 ACT

MIGRATION
 MYSTICETE
 NORTH ATLANTIC
 ODONTOCETE
 OTTER
 POLAR BEAR
 RIGHT WHALE
 SEAL
 SEA LION
 SKIM
 WARM BLOODED
 WHALING
 ZOOPLANKTON



ACTIVITY: RIGHT WHALE ANATOMY

LABEL THE RIGHT WHALE DIAGRAM USING THE TERMS LISTED BELOW.



TERMS

BALEEN

BLOWHOLE

CALLOSITIES

FLIPPERS

NO DORSAL FIN

FLUKE

EYE

WHITE BELLY PATCHES

Glossary & References



Right whales. Credit: NOAA

GLOSSARY

ACOUSTIC BUOY- A buoy that collects and records information about underwater sound.

ADAPTATION- Physical and behavioral changes that occur slowly over time and help an organism to live more easily in an environment.

BALEEN- Rows of triangular plates hanging from the upper jaw of mysticetes. The plates are composed of a protein called keratin, similar to human hair and fingernails. The baleen filters planktonic prey and fish from the water.

BIODIVERSITY- The diversity of species.

BLOWHOLE- The nasal opening of a whale, located on the top of the head. Mysticetes have two external nasal openings and odontocetes have only one.

BLOW- Cloud of vapor and sea water that is exhaled by cetaceans, often called a "spout".

BLUBBER- The layer of fat and oil beneath the skin providing insulation for marine mammals.

BULL- A mature male whale.

CALF- A newborn, or young whale that is still dependent on its mother for protection and/or nourishment.

CALLOSITY- An area of hardened skin that forms irregular patterns unique to each right whale. Can be found on top of the heads, above the eyes, and along the lower jaw. Callosity patterns are used by researchers to identify individual animals.

CARNIVORE- An animal that feeds on other animals.

CETACEAN- Marine mammals of the order Cetacea which include all the great whales, dolphins, and porpoises.

COMPETITION- Competition is an interaction between organisms or species in which the fitness of one is lowered by the presence of another. Limited supply of at least one resource (such as food, water, or territory) used by both is required.

COPEPOD- Small planktonic crustaceans (shelled marine animals) that are the main prey source of right whales.

COW- A mature female whale.

DISENTANGLEMENT- The act of removing fishing gear or fishing line from an entangled whale. Disentanglements can be dangerous operations, and therefore only trained NOAA Disentanglement Network Rescuers are legally allowed to attempt these activities.

DORSAL FIN- A triangle-shaped fin found along the back of many whales, thought to help stabilize the whale during swimming and diving and possibly aid in maintaining internal body temperature.

ECHOLOCATION- The production of high frequency sound waves and reception of echoes to locate objects and investigate the surrounding environment.

GLOSSARY

ECOSYSTEM- An integrated system of living species, their habitat, and the processes that affect them.

ENDANGERED SPECIES- A species that is in danger of becoming extinct throughout all or a significant portion of its range.

ENDANGERED SPECIES ACT (ESA)- The federal (national) law that protects endangered and threatened species from extinction.

ENTANGLEMENT- When an animal becomes caught, wrapped, or entrapped in fishing gear or lines. Entanglements can be life threatening to marine mammals by cutting off the animal's circulation if wrapped tightly or by not allowing the animal to move naturally or feed (if the line is on the head or in the mouth).

EVOLUTION- Change in a population's inherited traits from generation to generation.

EXTINCT- No longer exists.

EXTANT- Currently alive, the opposite of extinct.

FITNESS- The ability of an organism to survive and to transmit genetic information to future generations through successful reproduction.

FLIPPER- The distinctive forelimb structures found on either side of many marine mammals' bodies (with the exception of sea otters and polar bears). They are used primarily for steering, turning, and controlling the animal's vertical position in the water.

FLUKE- Tail of cetaceans.

FOOD CHAIN/WEB- The feeding relationships between species in a living community. Food chains & webs refer to diagrams that illustrate "who eats who" within an ecosystem.

HABITAT- The environment or surroundings in which a plant or animal lives.

GUNSHOT SOUND- A very loud pop or banging noise made by right whales that may be an aggressive call toward other males.

HARASSMENT- Under the MMPA, any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or interrupt a marine mammal's natural behaviors (breathing, feeding, nursing, traveling, etc.).

HERBIVORE- An animal that feeds on plants.

HYDRODYNAMIC SHAPE- Shaped like a torpedo. This helps to reduce friction and allows the animals to move through the water quickly while using less energy.

HYDROPHONE- An underwater microphone.

KEYSTONE SPECIES- A species whose presence in (or absence from) a given ecosystem has a significant influence on the structure and function of the system, disproportionate to its numerical abundance.

KRILL- Shrimp like crustaceans that are an important food source for many filter feeding marine mammals.

GLOSSARY

MAMMAL- Warm-blooded animals with backbones (vertebrates) and hair, that nurse their young with milk. (Fine hair can be found on most juvenile marine mammals and adult whales possess sparse hair in the facial region).

MARINE MAMMAL- Diverse group of mammals that dwell primarily in the ocean or that depend on the ocean for food.

MARINE MAMMAL PROTECTION ACT (MMPA)- A federal(national) law that protects all marine mammal populations from declining to the point where they become ineffective contributors to their ecosystems.

MELON- The often bulging, fatty forehead of a toothed cetacean.

MIGRATION- Movement from one geographic region to another to feed or give birth, usually an annual pattern established in response to seasonal change.

MOAN CALL- An eerie, wavering note produced by right whales that lasts about 4 seconds.

MOLTING- A process in which pinnipeds shed their old coat of fur for a new one.

MYSTICETE- A taxonomic sub-order of whales that possess baleen instead of teeth. These whales strain food from the water with their baleen. Mysticetes have two external nasal openings. Right, humpback, fin, minke, blue, sei, and gray whales are examples of mysticete whales.

NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION (NOAA)- The Federal agency, within the Department of Commerce, whose mission is to understand and predict changes in Earth's environment and conserve and manage coastal and marine resources to meet our nation's economic, social, and environmental needs.

NOAA FISHERIES SERVICE (NMFS)- Within NOAA, is NOAA Fisheries Service (NMFS) which is charged with managing the nation's fisheries as well implementing the Marine Mammal Protection Act and Endangered Species Act in regards to most pinnipeds and all cetaceans.

ODONTOCETE- A taxonomic sub-order of whales with teeth of uniform shape and function. Odontocetes possess one external nasal opening. They also use echolocation for exploring their environment and finding food. Dolphins, porpoises, orca and sperm whales are examples of odontocetes. These animals primarily eat fish and squid, though orca whales may also eat other marine mammals.

OMNIVORE- An animal that feeds on both animals and plants.

PELAGIC- Living or occurring in the open sea.

PINNIPED- A taxonomic order of Pinnipedia, meaning "fin footed". This order includes seals, sea lions, and walrus. They are carnivorous aquatic mammals that use flippers for movement on land and in the water. Pinnipeds spend the majority of their lives swimming and eating in water and have bodies that are adapted for moving easily through their aquatic habitat. Pinnipeds do not move well on land, however pinnipeds do venture onto land or ice floes to bear their young, sunbathe, rest, and molt.

PISCIVORE- A carnivore that feeds only on fish.

PHYTOPLANKTON- Plant plankton.

GLOSSARY

PLANKTON- Drifting of passively swimming organisms.

POPULATION- Group of organisms of the same species populating a given area.

PREDATION- Biological interaction where a “predator” organism feeds on another living organism or organisms known as prey.

PREY- Organism that is eaten by a predator.

RANGE- Maximum extent of geographic area used by a species.

REGULATION- A law or rule implemented by the government.

SCREAM CALL- Brief, shrill “scream” calls right whales make when gathering in groups at the surface.

STOCK- A group of marine mammals of the same species in a common spatial arrangement, that interbreed when mature.

TAKE- Defined under the MMPA as “harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect.” Defined under the ESA as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.”

TAKE REDUCTION PLANS- Plans created by an advisory group that help reduce entanglement and injury of marine mammals in fishing gear. Advisory groups include scientists, federal and state managers, fishermen, and conservationists.

TAXONOMY- The scientific classification of organisms into groups based on similarities.

THERMOREGULATION- The ability of an organism to keep its body temperature within certain boundaries, even when the temperature surrounding it is very different.

THREATENED SPECIES- Defined under the ESA as “any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.”

THERMAL INSULATION- Materials or processes that reduce the rate of heat loss.

UP-CALL- Right whale contact call, resembling a deep, rising “whoop” that lasts about a second.

VERTEBRAE- Bones that make up the backbone of vertebrate animals.

VOCALIZATION- To communicate using sound.

WHALER- A person who hunts and kills whales.

WHALING- An expedition for the purpose of, or act of, killing whales.

ZOOPLANKTON- Animal plankton.

REFERENCES

ACTIVITY BOOKS & CURRICULUM

- Harr, Kendale E. North Atlantic Right whales in the New Millenium. Right whale Lesson Plans. 2009.
- NOAA National Marine Sanctuary Program. The Northern Right Whale: From Whaling to Watch Watching. 1996.

BOOKS

- Hoelzel, A. Rus, Ed. Marine Mammal Biology: An Evolutionary Approach. 2002.
- Perrin, W., Wursig, B., and J. Thewissen. Encyclopedia of Marine Mammals. 2002.
- Wynne, K. and M. Schwartz. Guide to Marine Mammals & Sea Turtles of the U.S. Atlantic & Gulf of Mexico. 1999.

WEBSITES

- Cornell's Right Whale Listening Network: www.listenforwhales.org
- Discovery of Sound in the Sea: www.dosits.org
- National Marine Mammal Laboratory: www.afsc.noaa.gov/nmml/education/
- New England Aquarium Teacher Resources: www.neaq.org/education_and_activities/
- NOAA Fisheries Service's Northeast Regional Office: www.nero.noaa.gov
- NOAA Fun for Kids: <http://oceanservice.noaa.gov/kids/>
- NOAA Games: www.games.noaa.gov
- NOAA Office of Education: <http://www.education.noaa.gov/students.html>
- NOAA National Marine Sanctuary Program: www.sanctuaries.noaa.gov
- North Atlantic Right Whale Consortium: www.rightwhaleweb.org
- Provincetown Center for Coastal Studies: www.coastalstudies.org
- Seaworld Infobooks: www.seaworld.org/animal-info/info-books/baleen/
- Whale and Dolphin Conservation Society: www.adoptawhale.org/kids
- Whale Center of New England: www.whalecenter.org/education/curriculum.html

ANSWERS

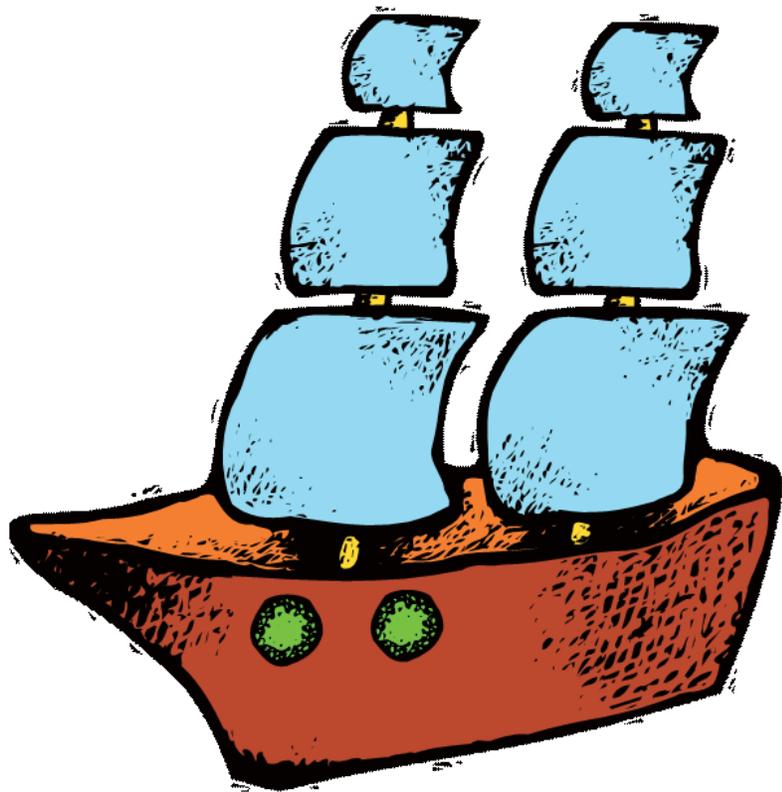
SCAVENGER HUNT:

1-MAMMALS, 2- PROTECTED, 3- SPECIES, 4- DINOSAURS, 5- BALEEN, 6-WHALING, 7-CETACEA, 8-BALEEN, 9- RAREST, 10- TEETH, 11- NURSERY, 12- FIN, 14- CALLOSITIES.

DOUBLE PUZZLE:

1- BLUBBER, 2-PLANKTON, 3-BALEEN, 4-NORTH ATLANTIC, 5-MIGRATION, 6-UP-CALL, 7-WHALING, 8- ENDANGERED, 9-CALF, 10- CALLOSITIES, 11-NO DORSAL FIN, 12-COPEPODS, 13-BLOWHOLE, 14-VOCALIZATION, 15-FLUKE. ANSWER: WHALE OF FORTUNE!

Appendix: Pictures for Activity 1

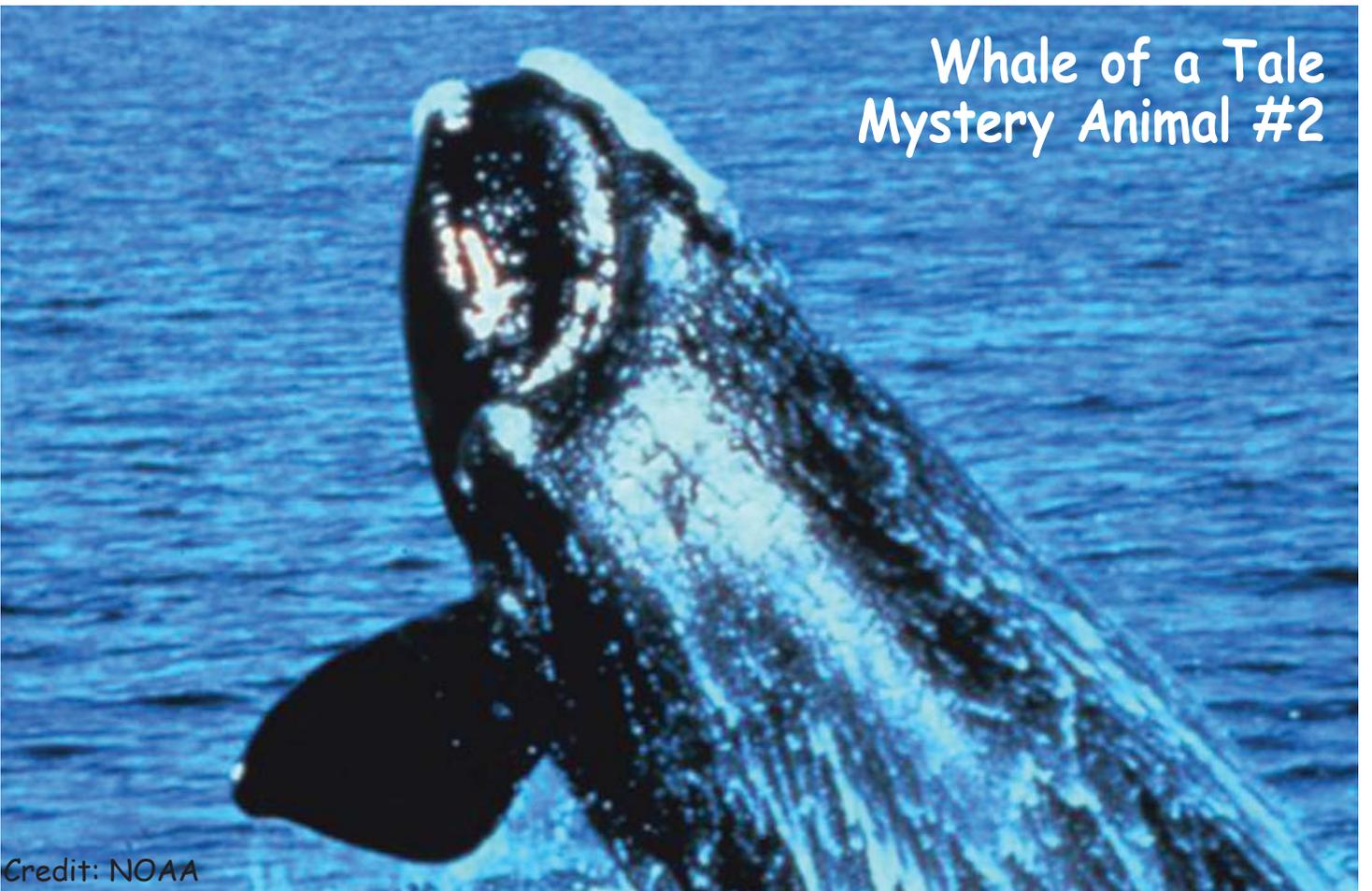


WHALE OF A TALE MYSTERY ANIMAL #1



Credit: NOAA

Whale of a Tale Mystery Animal #2



Credit: NOAA



Whale of a Tale Mystery Animal #1

Details of Sighting:

Seas are calm and you are scanning the horizon. You think you've sighted a boulder formation sticking out of the water. It suddenly moves, is followed by a puff of what looks like smoke, and then vanishes. When your vessel passes the area a few minutes later, you notice the air smells fishy.



Whale of a Tale Mystery Animal #2

Details of Sighting:

Seas are calm and you are scanning the horizon. A creature suddenly appears in the distance, propelling its huge body out of the water and creating a large splash as it hits the waters surface. It is at least the size of your vessel. It repeats this action twice more and then disappears from sight.



Credit: A. S. Friedlaender

Whale of a Tale Mystery Animal #3



Whale of a Tale Mystery Animal #4

Credit: NOAA



Whale of a Tale Mystery Animal #3

Details of Sighting:

You are looking through your spyglass, scanning the horizon for pirates. Suddenly, you see a splash and spy a mysterious object. You see four or five more splashes and the object disappears from your view.



Whale of a Tale Mystery Animal #4

Details of Sighting:

You are looking through your spyglass, scanning the horizon for pirates. Suddenly, you see a splash and spy a mysterious object. You see four or five more splashes and the object disappears from your view.

Whale of a Tale Mystery Animal #5



Credit: NOAA

Whale of a Tale Mystery Animal #6



Credit: NOAA



Whale of a Tale Mystery Animal #5

Details of Sighting:

You are looking through your spyglass, scanning the horizon for pirates. Suddenly, you see a splash and spy a mysterious object moving through the water. It continues for approximately 5 minutes. The long part crashes against the water surface multiple times causing quite the splash!



Whale of a Tale Mystery Animal #6

Details of Sighting:

You are looking through your spyglass, scanning the horizon for pirates. Suddenly, you see something moving, a puff of what looks like smoke, and movement under the water. It disappears. After 5 minutes you see the same thing, only further ahead of the area where you saw the first movement. After another 5 minutes you see it again!

Whale of a Tale Mystery Animals Solved:

1- North Atlantic right whale

2- North Atlantic right whale

3- Pilot whale

4- Narwhal

5- Humpback whale

6- Blue whale



For Additional Information, Please Contact:

NOAA's Fisheries Service
Northeast Regional Office
Protected Resources Division
55 Great Republic Drive
Gloucester, MA 01930
Phone: 978-281-9328

Web: www.nero.noaa.gov/prot_res