

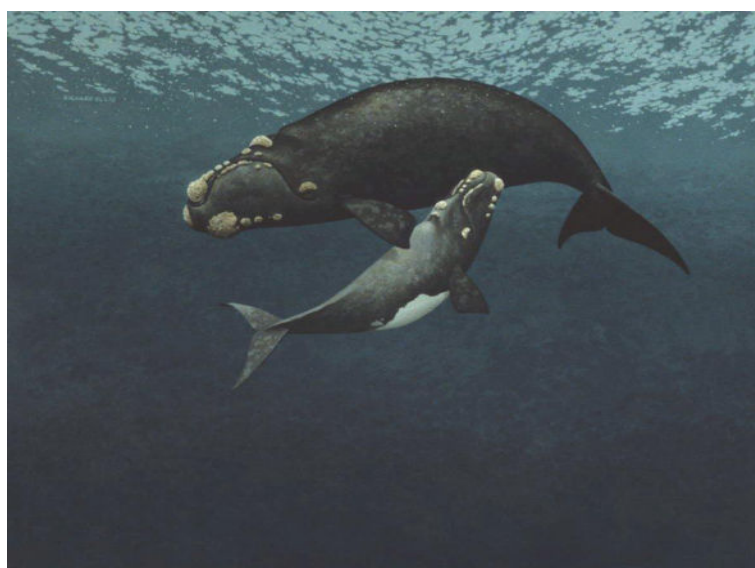
Face-ing Extinction: The North Atlantic Right Whale

**Power Point Presentation
Curriculum and Teacher's Guide**



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Right whale and Calf (1980) Richard Ellis

How to Use the Power Point

The goal of this curriculum is to evaluate and strengthen students' knowledge of North Atlantic right whales through a series of hands-on activities, teacher demonstrations, and a power point presentation. While some of the activities are independent of the power point, the majority are designed to coincide with and augment the presentation. Section VII contains a list of resources for both students and teachers to further their knowledge on the subject.

Section III contains activities that are designed to introduce the topics and terms used throughout the curriculum. The first suggested activity is the pre- and post-evaluation. Students will be asked to draw an image of a right whale in its habitat. This will give insight as to the students' prior knowledge and understanding of the North Atlantic right whale. In addition, it will provide a benchmark for information retention throughout the curriculum. They should be evaluated prior to receiving **any** information. Once the pre-evaluation is completed, it is recommended that the students follow up with the word search (to become familiar with the terms) and the online scavenger hunt (to become familiar with the topics).

The power point, aided by the list of resources, is designed to be self-sufficient. The slides that have correlating activities have an asterisk with the activity number in the lower right corner. To accurately prepare for the correlating activity, the entire slide should be discussed prior to the activity. This will ensure that students have all the information they need to understand and complete each activity.

It is important to look in the "notes" section for each slide; in most cases there are talking points pertaining to those slides. While the information can be overwhelming to someone unfamiliar with the topic, the talking points are meant to guide you towards the main idea of each individual slide, and consequently, the overarching goal of the power point: to motivate students to care about the plight of the species, get involved in protecting them, and educate their family and friends.

Comprehension of the information is evaluated by a number of supplemental activities to occur after the conclusion of the presentation. The crossword puzzle asks the students to fill in missing terms that have been covered during the power point. The rope measuring activity will test students' understanding of the actual size of the animals. Students will be able to compare familiar objects in their lives with right whales in the math and science activity. The final activity should be the same as the first- the drawing of a right whale in its environment. Assuming there is a significant level of retention, there should be a marked difference between the pre- and post-evaluation drawings. If the two drawings do not greatly differ, it is recommended that additional resources are implemented to further educate the student.

Any questions, concerns, or helpful tips should be directed to adimonti@asri.org or Monica.pepe@whales.org.

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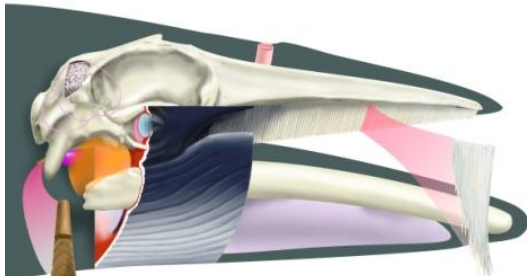
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Introduction to Whales

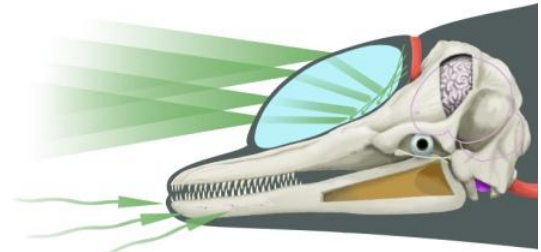
Whales are members of the Order Cetacea. Dolphins and porpoises are also cetaceans. All cetaceans are highly specialized, carnivorous mammals that share the following features or characteristics:

- ◆ Move air into and out of their lungs by swimming to the surface of the ocean
- ◆ Blubber layer to keep them warm
- ◆ Young are born live, typically tail first
- ◆ Mothers provide milk for their young
- ◆ Horizontal tails that are moved vertically in the water column by a very muscular spine
- ◆ Front flippers for steering
- ◆ Do not chew their food
- ◆ Fully aquatic, always living in the water
- ◆ Fusiform bodies, that is, they are shaped similarly to a torpedo

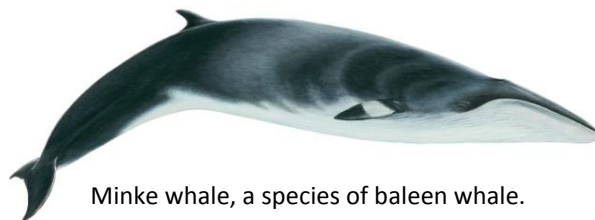
The Society for Marine Mammalogy currently recognizes 87 living species of cetaceans. Fourteen are known as mysticetes, or baleen whales. The remainder are considered odontocetes, or toothed whales. Mysticetes filter their prey from the water using flexible strips of fingernail like material, called baleen, that hang down from the roof of the mouth. The inside edges of baleen are hairy or bristly and trap small marine animals while allowing water to pass through, back into the ocean. Odontocetes are able to locate their prey using echolocation and typically swallow their prey whole.



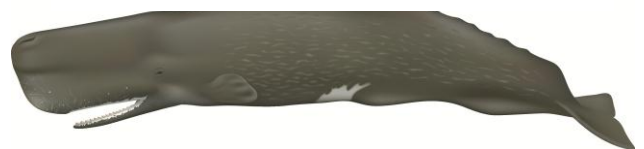
Cutaway view of the head of a typical baleen whale. Note the baleen plates that hang from the roof of the mouth.



Cutaway view of the head of a dolphin, with features typical of nearly all toothed whales.



Minke whale, a species of baleen whale.



Sperm whale, the largest species of toothed whale.

Cutaway and minke whale diagrams by Jon Baldur Hlidberg. Sperm whale diagram by Uko Gorter. Used with permission.

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Image of a Right Whale: Pre- and Post- Evaluation

Objective: To obtain a grasp of how much information the students retain after the lesson.

Background: To really understand right whales, their habitat has to be considered. Usually they can only be seen at the surface of the water, but there are a lot of things underwater with whales. Right whales also have some distinctive body features that are different from other whales. Refer to the power point for the activities in this lesson.

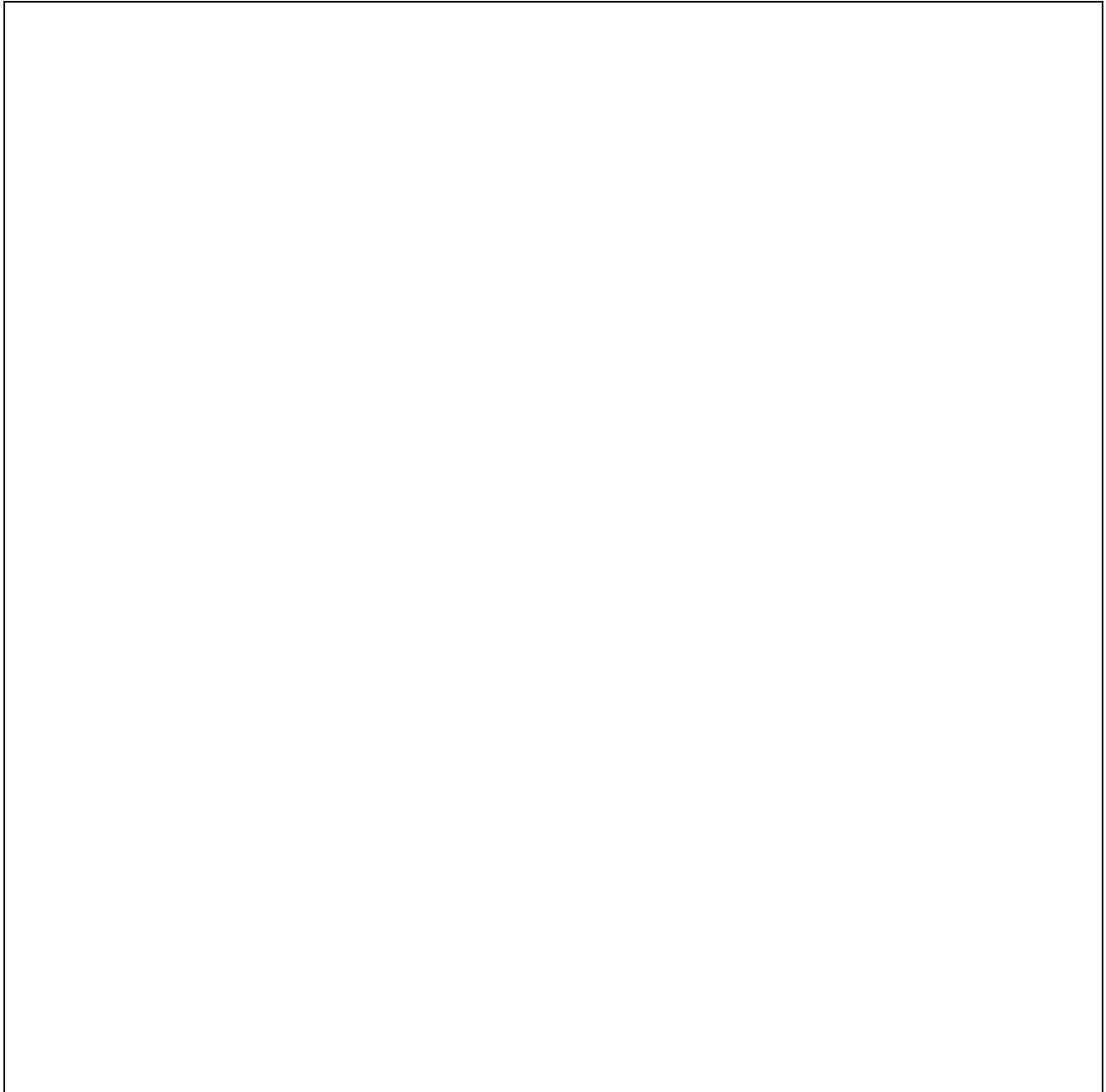
Activity: Prior to the lesson, have students draw a picture of a right whale in its environment as a means of a pre-evaluation. Their drawing should include anything and everything they perceive about a whale and its surroundings, whether it be at the surface or below, in a group or solo, with fish or other animals present, etc. Make sure they write their name and the date on the drawing.

At the conclusion of the lesson, have the students complete the exact same activity. Did their drawings change?

Evaluation: This pre- and post-evaluation will allow us to compare images and get ideas of what the students have learned throughout the lesson. An accurate retention should show things like fishing line, copepods, vessels, etc. in the environment. The whale itself should lack a dorsal fin and have blowholes, callosities on its rostrum, tail flukes and pectoral flippers. To verify that students have a good idea of an image of a right whale, display actual photos of whales in their environment and ask the students to compare them to their own depictions. For your own reference, make sure that you collect the drawings for comparison between the pre- and post-evaluations.

Image of a Right Whale

In the space below, please draw a right whale in its environment. Include anything that you think you would see if you went underwater and looked at a right whale. This can include other animals, plants, or anything else you can think of. Of course, it should also show the whale itself!



Date: _____ Your Name: _____

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Who, Why and What about Whales...

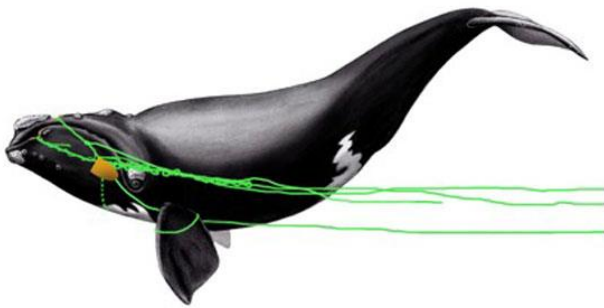
How much can you learn about the North Atlantic right whale?

With adult permission, venture online to find the answers to the questions.

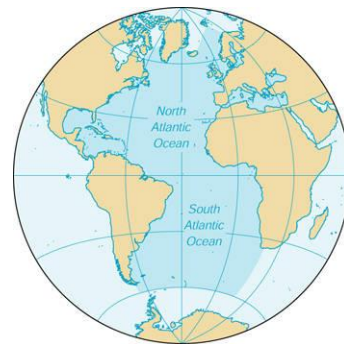
How big is a right whale calf when it's born?



Find a story about a right whale that was freed from entanglement and write a brief summary.



How far do North Atlantic right whales migrate? Why do they migrate?



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List three products that whale blubber was used for in the 1800's.



Find and download a picture of a North Atlantic right whale eating. Does it skim feed, gulp feed or bottom feed?



Why are right whales struck by ships?



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What is the current population size of North Atlantic right whales?



Find where right whales give birth.



List three things you can do to help the North Atlantic right whale.



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North Atlantic Right Whales

Find the words listed in the puzzle below:

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

- | | | | |
|-------------|--------------|---------|-------------|
| Baleen | Copepods | Fluke | Pollution |
| Blowholes | Endangered | Habitat | Scars |
| Blubber | Entanglement | Mammal | Ship Strike |
| Callosities | Flippers | Migrate | Urban Whale |

North Atlantic Right Whales

Find the words listed in the puzzle below:

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

Baleen	Copepods	Fluke	Pollution
Blowholes	Endangered	Habitat	Scars
Blubber	Entanglement	Mammal	Ship Strike
Callosities	Flippers	Migrate	Urban Whale

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Easy Whale Teaching Tools

Objective: To use everyday objects to gain a better understanding of whales and their importance in our ecosystem.

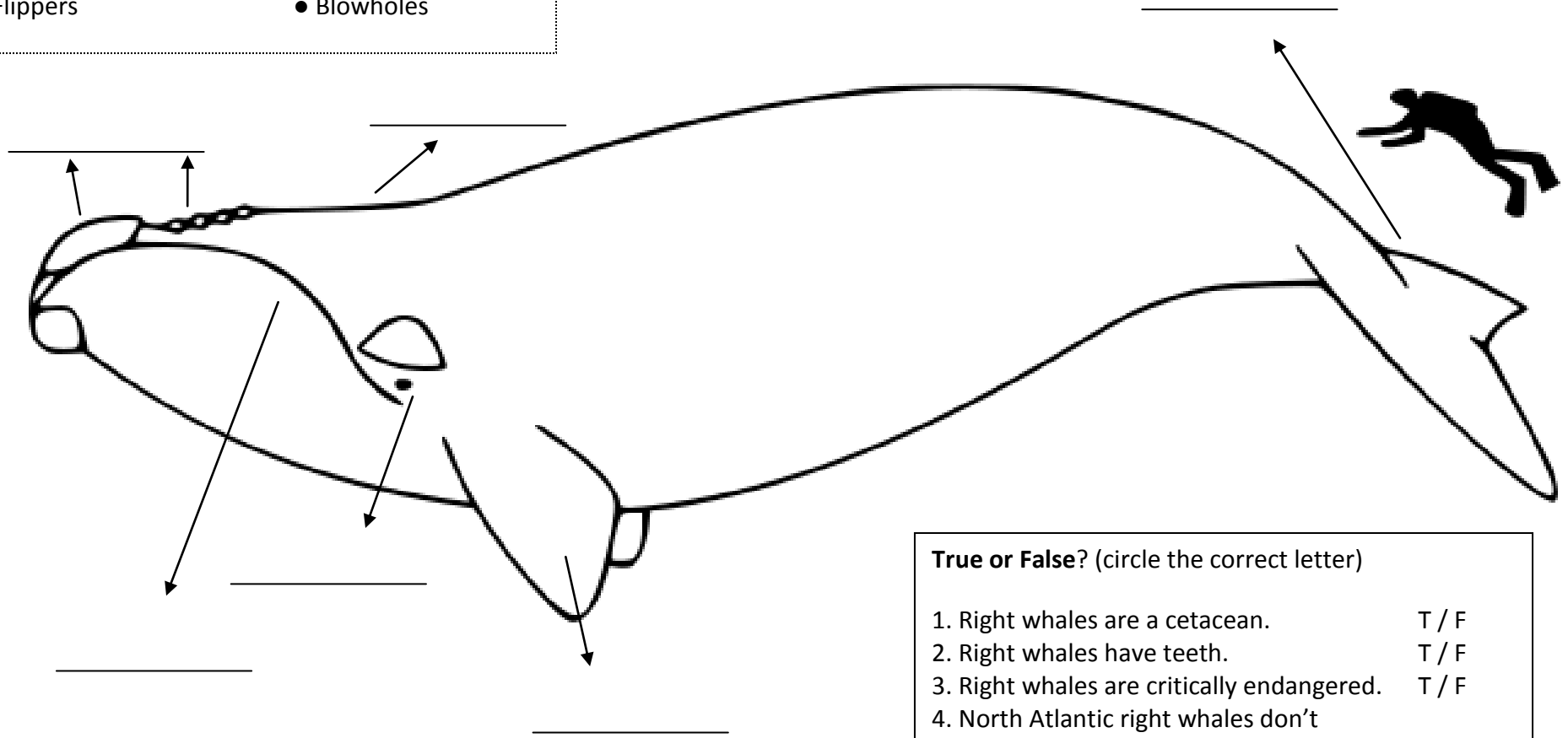
The chart below is a list of easy, everyday objects educators can use in the classroom to represent the various aspects and features of whales.

Teaching Prop	Whale representation	Additional comment
Tea Cup or Tennis Ball	Whale eye	
Dried Krill	Whale food	Can be found in any pet store
Dried rosemary, parsley or sesame seeds	Whale food	
Baby bottle	Whales drink milk	
Snorkel	Breathes air	
Thermometer	Whales are warm blooded	
Grapefruit	Size of a Right whale's throat	
Fake hair piece	All whales have hair	
Pencil tip eraser	Size of a whale's ear opening	
12 inch Ruler	Approximate size of blubber thickness of the North Atlantic right whale	
Fun foam	Feel of a whale skin	Can be found in any craft store
Crisco	Whale blubber	
Baby doll	Whales give birth to live young	
Paint brush or comb	Whale baleen	
Empty Milk Jugs (gallon size)	Right whale calf daily milk consumption	Right whale calves can drink up to 58 gallons of milk a day

Slide #2 North Atlantic Right Whale Activity Sheet

Use these terms to label the parts of the whale:

- Flukes
- Eye
- Flippers
- Lower jaw
- Callosities
- Blowholes



True or False? (circle the correct letter)

1. Right whales are a cetacean.	T / F
2. Right whales have teeth.	T / F
3. Right whales are critically endangered.	T / F
4. North Atlantic right whales don't swim across the equator.	T / F
5. Right whales have a huge dorsal fin.	T / F

Slide #4 Whale Blubber

Objectives:

1. Learn about the whale's layer of insulating fat, known as blubber.
2. Conduct a simple experiment to test the effectiveness of fat as an insulator.
3. Discuss how humans use insulating materials to protect themselves from cold exposure.

Background Information:

Whales are warm-blooded mammals that can survive in water temperatures as frigid as the low-40s F. How do they manage to stay warm, even in the ice-cold waters of the Atlantic? By wearing a thick layer of fat, called blubber just beneath the skin.

How does the whale acquire this fat layer? Being mammals, whales suckle their young. A baby right whale, for example, may drink up to 58 gallons of its mother's milk which has the consistency of soft margarine every day! An adult right whale, on the other hand, may eat 2,000 lbs of food each day. All of this intake is necessary to not only provide the whale with the energy it needs to swim great distances and dive to incredible depths, but to help maintain an essential layer of fatty insulation.

Materials:

- One box of large Ziploc freezer storage bags
- One box of smaller Ziploc sandwich bags
- Depending on class size, multiple cans of shortening
- Plastic buckets of ice water

Activity: Make a "Blubber Glove"

1. Let the students work in small groups, with each student taking one small Ziploc. Give each group one bucket of ice water, a large Ziploc bag and a can of shortening.
2. Have each group fill their large Ziploc bag with about six inches of shortening.
3. Instruct students to take turns placing their small Ziploc bags on one of their hands, and then placing hand in the ice water. Have students time one another to see how long they can withstand the cold.



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- Instruct students to keep precise records of the results.
4. Next, have students switch hands, placing their warm hand in the small bag and place that hand inside the larger bag containing the shortening. Run the ice-water dip test again, this time with the “insulated” hand. Again, keep exact time records of the results.



Evaluation:

Collect results of the two tests (uninsulated and insulated) and compare. Students should draw conclusions regarding the effectiveness of fat (shortening) as an insulator. Have them consider how effective a thick layer of blubber must be in order to keep a whale warm while submerged in cold water throughout its life.

Discuss the applications of insulation for cold protection in humans. Point out that long-distance swimmers, such as those who cross the English Channel, typically coat their bodies in shortening or other fatty compounds. Consider the fact that native peoples inhabiting arctic regions rely upon blubber and other fatty foods they harvest from marine mammals to help build and maintain a fat layer of their own. Discuss the effectiveness of a diver's wetsuit in providing the same sort of thermal protection for a submerged human. (Remember that a wetsuit is a snugly fitting suit of spongy rubber called neoprene that traps a layer of water between itself and the diver's skin. As the diver's body temperature raises the temperature level of the water, the water retains this heat and maintains the diver's body temperature at a comfortable level.) If available, try neoprene gloves in the above experiment.

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Slide #5 Whale Feeding

Objective: To demonstrate to students the basic feeding methods used by baleen whales.

Background Information: Whales feed using different methods. A baleen whale's skull shape, jaw size, and baleen plates determine the type of prey it catches and how it feeds. For instance, right whales have long and fine baleen which allows them to feed on small zooplankton called copepods. In comparison, gray whales have short coarse baleen which allows them to feed on small marine animals hidden in the ocean's muddy bottom. Humpback whales, on the other hand, use a gulp feeding method. Their baleen acts like a fishing net catching small fish and krill. The activity below will investigate right whales' feeding behavior, called skim feeding.

Materials:

- Clear plastic bin-about the size of a dish pan
- Water
- Dried rosemary or parsley
- Comb
- Open glass or jar

Activity:

Right whales are skim feeders. They move through the water with their mouths open allowing food and water to pass through their baleen as they move. To demonstrate this, fill a plastic container with water (this represents the ocean), drop in rosemary (this represents copepods-right whales' primary food source). Tell students they will need to use their imaginations. The glass will represent a whale's open mouth and the comb represents the baleen. Hold the comb at the top of the opening of the glass so that the teeth of the comb hang down towards the opening of the glass. Move the jar through the water so that the rosemary sticks to the teeth of the comb as you move it. This represents skim feeding.

Evaluation:

Discuss with students how feeding like this fills the whale's mouth with food and also water. Where does the water go? How does the whale get rid of the water and not the food? Do any of these feeding methods pose a risk to the whales? Why or why not?

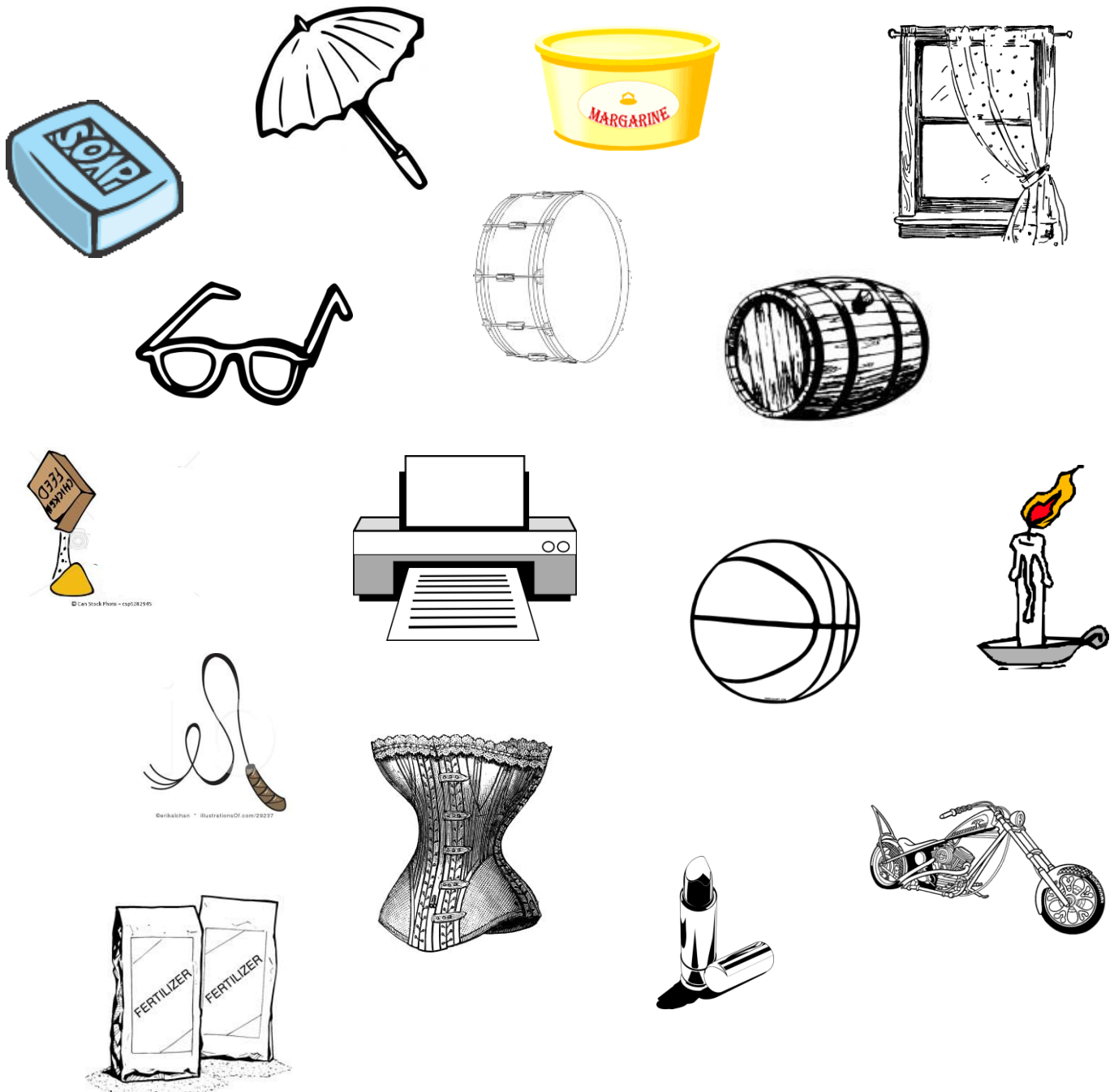
The baleen in right whales' mouths acts as a sieve or colander. It allows the water to pass through the baleen while their food, tiny marine plankton (copepods), gets trapped in the fringe of the whale's baleen. This method is so effective right whales can eat over a ton (2,000 lbs) of copepods a day-an amazing fact considering each copepod is no bigger than a grain of rice!

Slide #8 Circle the Products Made From Whales

Objective: Students will test their knowledge of how whales were processed into product.

Background: Once whales had been captured and killed, their blubber, bone, baleen and organs were turned into a variety of products. Refer to the slides on whaling in the power point for details on how whalers converted carcasses into products.

Activity: Circle the products that were once made from whales. Some were made during the time of whaling from sailing vessels. Others were made during the years of industrial, mechanized whaling.



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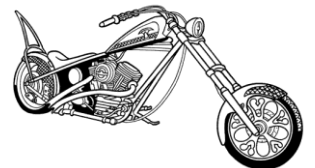
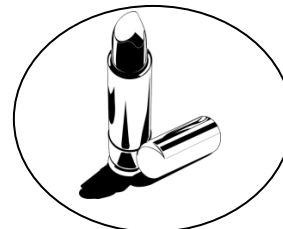
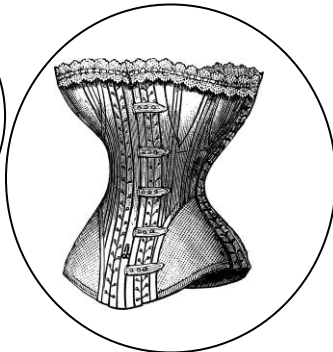
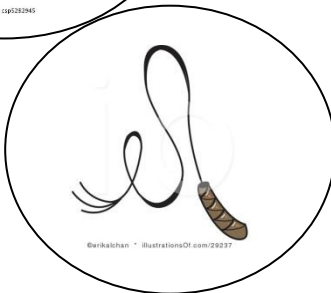
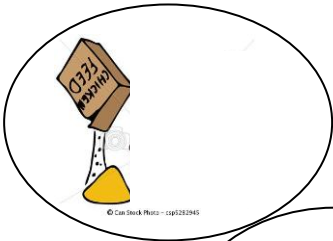
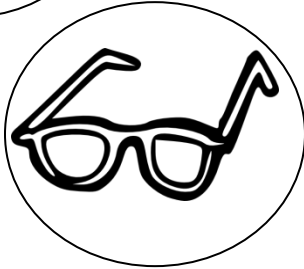
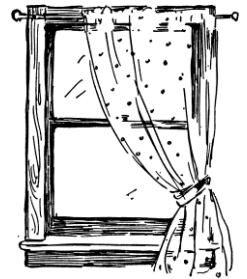
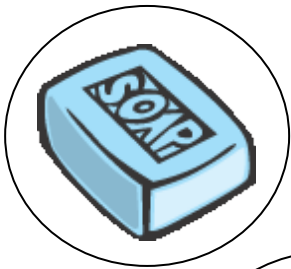
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Slide #8 Circle the Products Made From Whales

Objective: Students will test their knowledge of the how whales were processed into product

Background: Once whales had been captured and killed, their blubber, bone, baleen and organs were turned into a variety of products.

Activity: Circle the products that were once made from whales. Some were made during the time of whaling from sailing vessels. Others were made during the years of industrial, mechanized whaling.



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Slide #10 Whale of a View

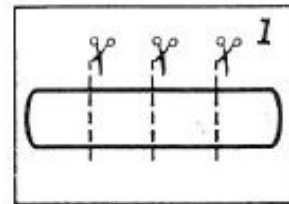
Objective: To view your surroundings from the perspective of a whale and understand the difficulty of finding things around you.

Background: Your eyes are in front of your head. So you see what is in front of you and some of what is on either side. With both your eyes you see one view. This is called *binocular vision*. But whales' eyes are on the sides of their heads. Each eye sees a separate view. This type of vision is called *monocular vision*. In this experiment, you'll find out what it's like to have monocular vision. You will need an adult helper for this project,

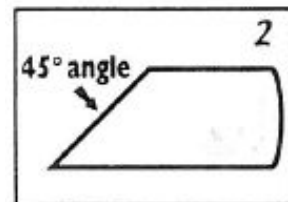
Materials: scissors, a paper towel tube, tape and two small mirrors that fit in paper towel tube (can be found in a craft store).

Activity:

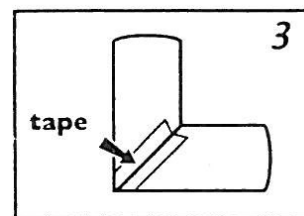
1. Have an adult cut the paper towel tube into four equal pieces.



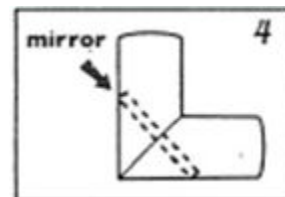
2. Have the adult cut one end of each piece at a 45-degree angle.



3. Tape the angled ends together as shown. Repeat with other two pieces.



4. Have the adult insert the mirror into a tube at a 45-degree angle, as shown.



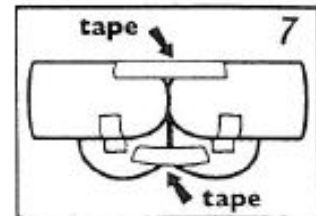
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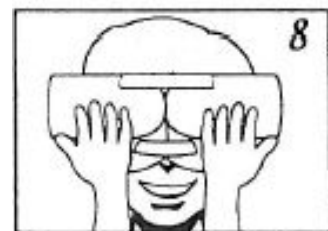
5. Hold your left hand up at eye level slightly to the left, under and in front of you. Look into the tube with your left eye, as shown. If you can't see a reflection of your hand at first, adjust the mirror until you can.



6. Repeat steps 4 and 5 with the other mirror and tube as shown.



7. Tape the pieces together.



8. Hold the “monoculars” up to your eyes

Evaluation:

Point your “monoculars” towards different points in the room. Place objects in different locations and take turns trying to walk over to them. Pose the following questions:

- Are you able to see what's in front of you?
- Can you simultaneously focus on everything you are seeing?
- Of all your senses, would you rely most on your sight if this is how well you were able to see?
- How is this helpful or harmful to whales? For instance, whales are often unable to see rope from fishing gear that is in front of them and may become entangled. However, having eyes on the side of the head enables whales to have a wider range of vision.

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Slide #13 All Tangled Up

Objective: To learn about North Atlantic right whale entanglement by experiencing what it might be like to be trapped in marine debris. The rope being presented in this activity is the type of rope in which right whales get entangled; students will feel this rope and analyze its structure and the possibility for entanglement.

Background: Approximately 75% of North Atlantic right whales exhibit scars from entanglements in fishing gear. Entanglements as well as ship strikes are the leading causes of North Atlantic right whale mortality. This problem is not limited to right whales. All Marine life can become entangled in marine debris. This can lead to suffocation, starvation, drowning, increased vulnerability to predators, or other injury. Volunteers participating in the 2008 International Coastal Cleanup event discovered 443 animals and birds entangled or trapped by marine debris (2008 ICC Report, Ocean Conservancy).

Materials:

- Rubber bands
- Fishing Rope*

*Recycled fishing rope can be purchased through Custom Cordage- <http://www.maineropemats.com/> 151 One Pie Road, PO Box 1387, Waldoboro, ME 04572, (207)-832-0569. If you live in a coastal community you may also be able to obtain used rope through your local fishermen's association.

Activity: Students perform an experiment in which they wrap a rubber band around their fingers and try to disentangle themselves. Distribute rubber bands to students and have them follow the procedure below.

- Hold your hands up in front of your face, with the back of your hands towards your face.
- Hold the rubber band in your right hand and hook one end of it over the little finger of your left hand.
- Hook the other end of the rubber band over the left-hand thumb. The rubber band should be taught and resting across the bottom knuckles on the back of your left hand.
- Place your right hand on the bottom of your left elbow, and keep it there. You can also ask students to sit on their right hand if they are tempted to use it.
- Try to free your hand of the rubber band without using your right hand, teeth, face, or other body parts.

Based on curriculum from Project Oceanography 1999.

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Next, using the fishing rope, explain to the students that this rope is used in commercial fishing. Make sure all students have a chance to feel the rope and understand that this is also the type of rope in which right whales get entangled.

Evaluation: While students are struggling, ask the class to imagine that they are North Atlantic right whales that have gotten pieces of fishing line, abandoned net, or other debris wrapped around their bodies. Ask them the following questions:

- How would you feel after struggling like this all morning?
- How would you feel after missing breakfast?
- What would happen if you continued to miss meals and spend all of your strength fighting to get free?
- Would you be able to care for your young or even surface for air?

Encourage students to share their thoughts and feelings about being entangled. Remind them that their experience is similar to marine animals that become entangled in debris.

Based on curriculum from Project Oceanography 1999.

North Atlantic Right whale Consortium Education Committee.

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Slide #19 Life as a Right Whale

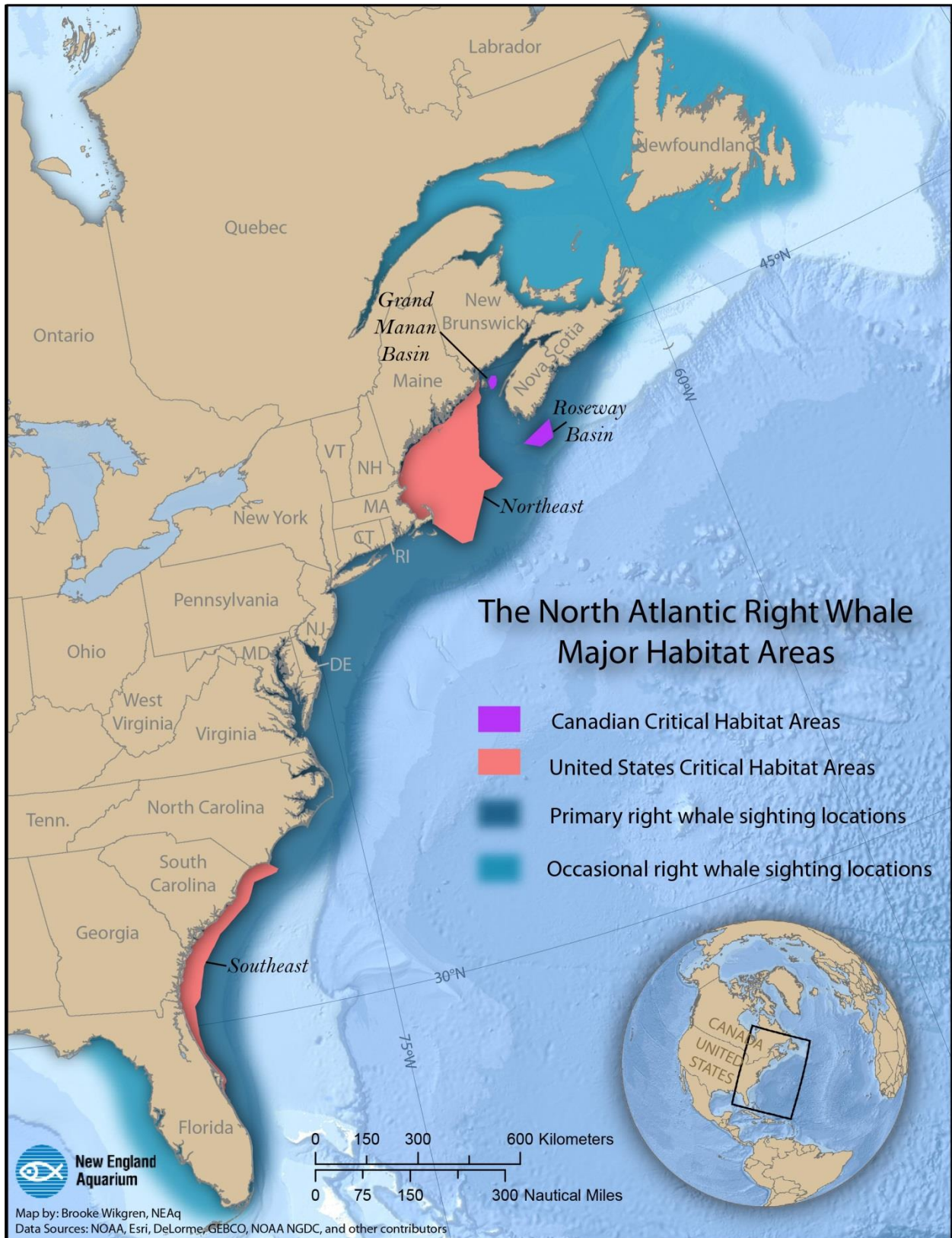
Objective: For students to complete a map that shows the threats and protections that whales have in each of their environments.

Background Information: Historical whaling is the main reason why right whales are endangered today. Even though they are currently protected under the Marine Mammal Protection Act and the Endangered Species Act, they still face a number of threats each and every day. The question remains whether or not there is sufficient protection for the whales from these threats, and if the designated protected areas cover enough area to be effective.

Materials: Printed copies of the map and questions below for each student and a marker.

Activity: This activity will help the students see a whale's year-round journey by filling in areas on a map that have a significance in the survival of the right whale population. Students will refer to the power point presentation to answer the questions below the map and follow the instructions given to populate the map with features that impact right whales.

Evaluation: Have the students discuss whether or not it looks easy to find food, travel, and mate off the east coast of the United States. Discussion topics can include the threats, protection measures, and migration path.



North Atlantic Right Whale Consortium Education Committee.

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Questions

1. On the map above, notice the purple and peach shaded areas that are designated as critical habitat. What is critical habitat?
2. Shade in and label the areas known as their mating/calving grounds. Then, do the same for their feeding grounds.
3. Draw arrows indicating the migration route. Try to keep in mind the approximate distance from the coast that the migration usually takes place. HINT: They are nicknamed the “urban whale”.
4. List three major cities along the US East Coast. How might daily human activities in these cities impact right whales?

5. Do you think there is enough protection for right whales? Why or why not?

Right Whale Match

Objective: To learn how scientists study the North Atlantic right whale by tracking the whales and photographing them.

Background: Each year new photos are taken and matched to a catalog maintained by the New England Aquarium. Each whale is given a number and sometimes a name. By matching photos scientists can learn more about individual whales and gain a better knowledge about the North Atlantic Right Whale population.

Right whales are matched by their callosity patterns on their heads as well as scars and other distinguishing features. What are callosities???. Callosities are raised patches of tissue on a right whale's body. These patches appear white but the actual callosities themselves are dark in color. The presence of light-colored cyamids, or "whale lice" gives the callosities a white appearance. The callosities of a right whale are completely unique; no two whales have the same pattern. Callosities begin to develop soon after birth, but do not mature until the whale is 7 to 10 months old.

Encourage students to visit the North Atlantic Right Whale Consortium Website at www.narwc.org to view the actual North Atlantic Right Whale Catalog maintained by the New England Aquarium.

Materials:

- Print out of Right Whales Images 1-6
- Right Whale Matching book
- Pencils

Activity:

Print out and hang right whale images 1-6 around the room. Ask students to move around the room and look closely at each image. They should observe the features of each whale and what makes them unique.

Next give each student or team of students a copy of the Right Whale Matching Book. Ask students to match the whales in the book to the whale images around the room. Write the whale's name above its picture.

Evaluation: Ask students what were the key features they noticed about the whales? Was it easy or difficult to match the whales in the book to their images? Would this be harder to do at sea? Why?

North Atlantic Right Whale Consortium Education Committee.

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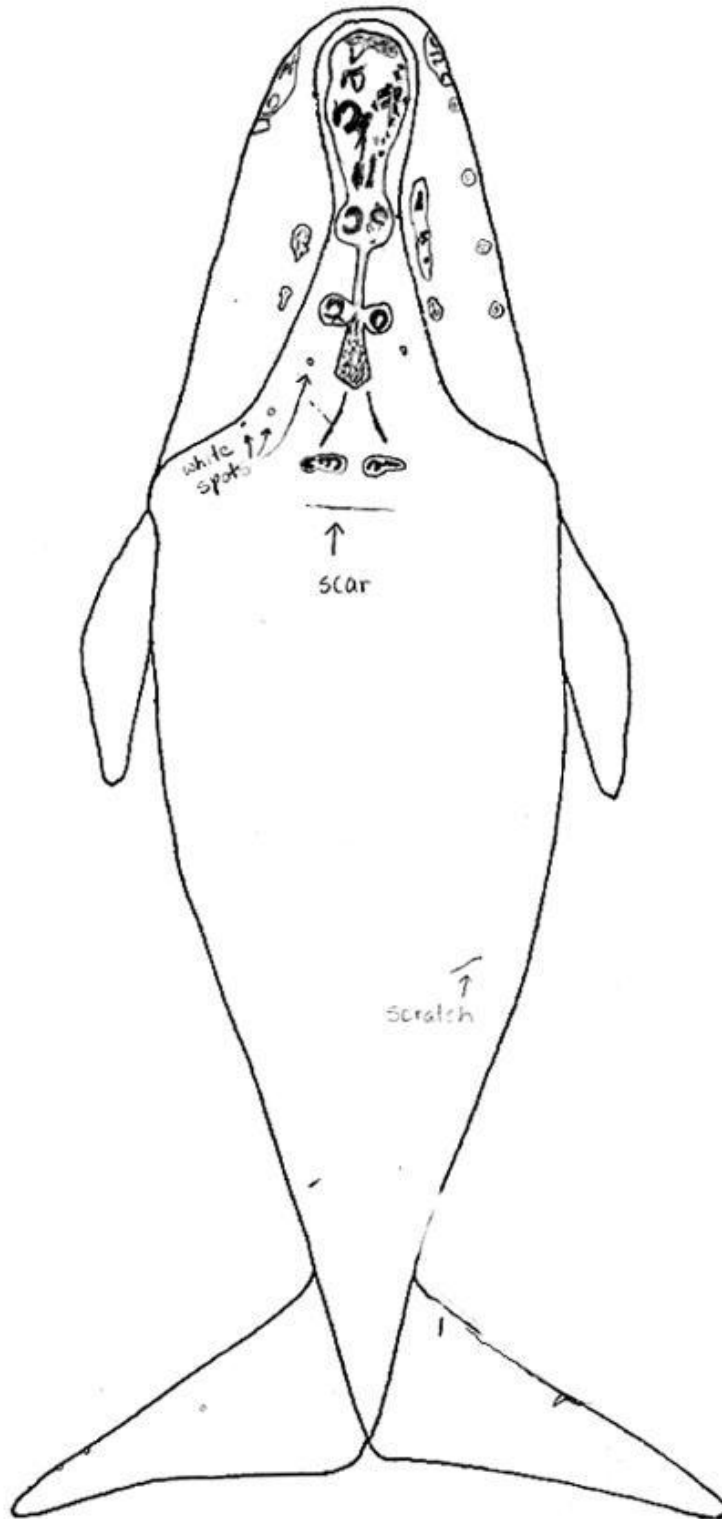
NUMBER: 1121

NAME: FIDDLE

YEAR OF BIRTH: UNKNOWN

SEX: MALE

COMMENTS: FIRST SEEN IN 1981, FIDDLE'S HORIZONTAL SCAR ON HIS HEAD MAKES HIM UNIQUE. HE WAS LAST SEEN IN 2011.



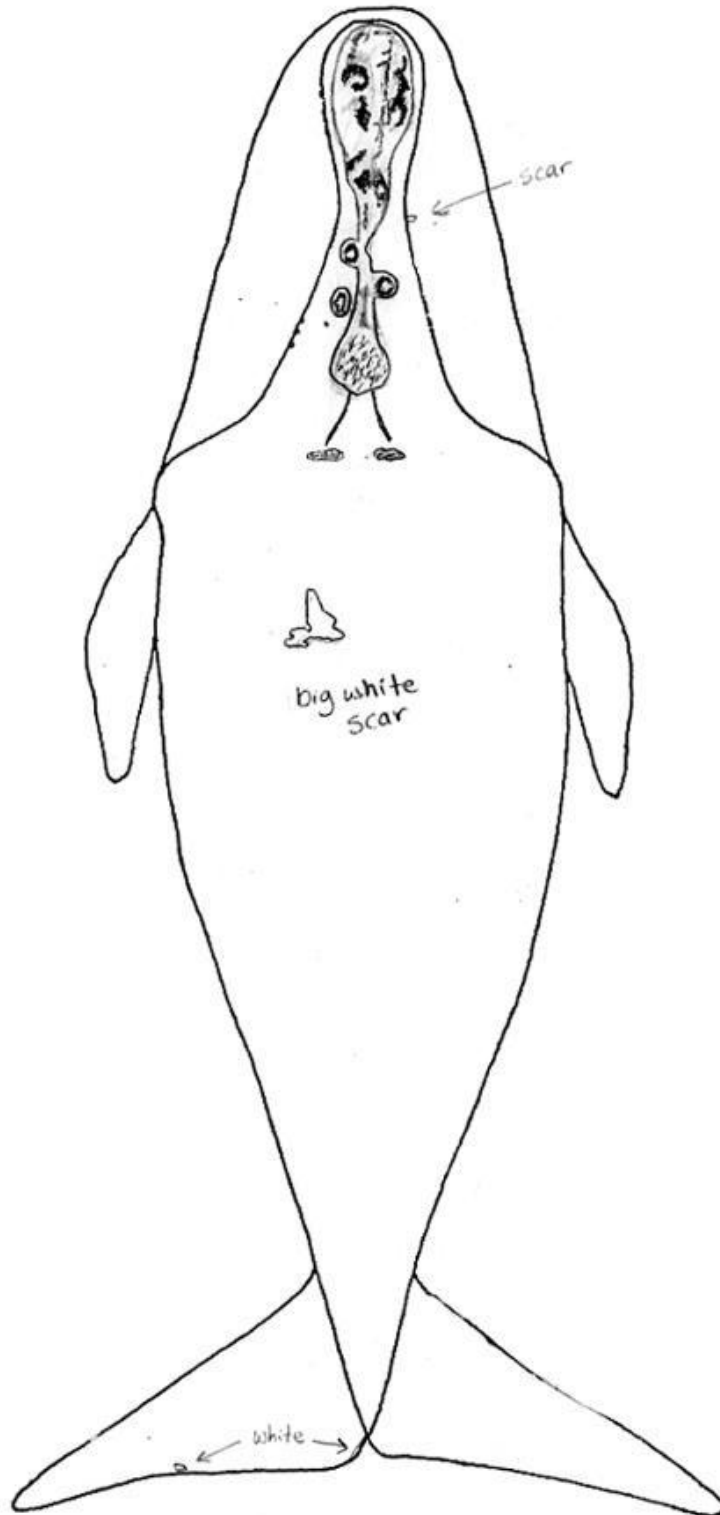
NUMBER: 1133

NAME: PORTER

YEAR OF BIRTH: UNKNOWN

SEX: MALE

COMMENTS: EASILY RECOGNIZED BY THE UNUSUAL SCAR ON HIS BACK. HE MADE ONE OF THE LONGEST DOCUMENTED JOURNEY OF A RIGHT WHALE: 3,500 MILES!



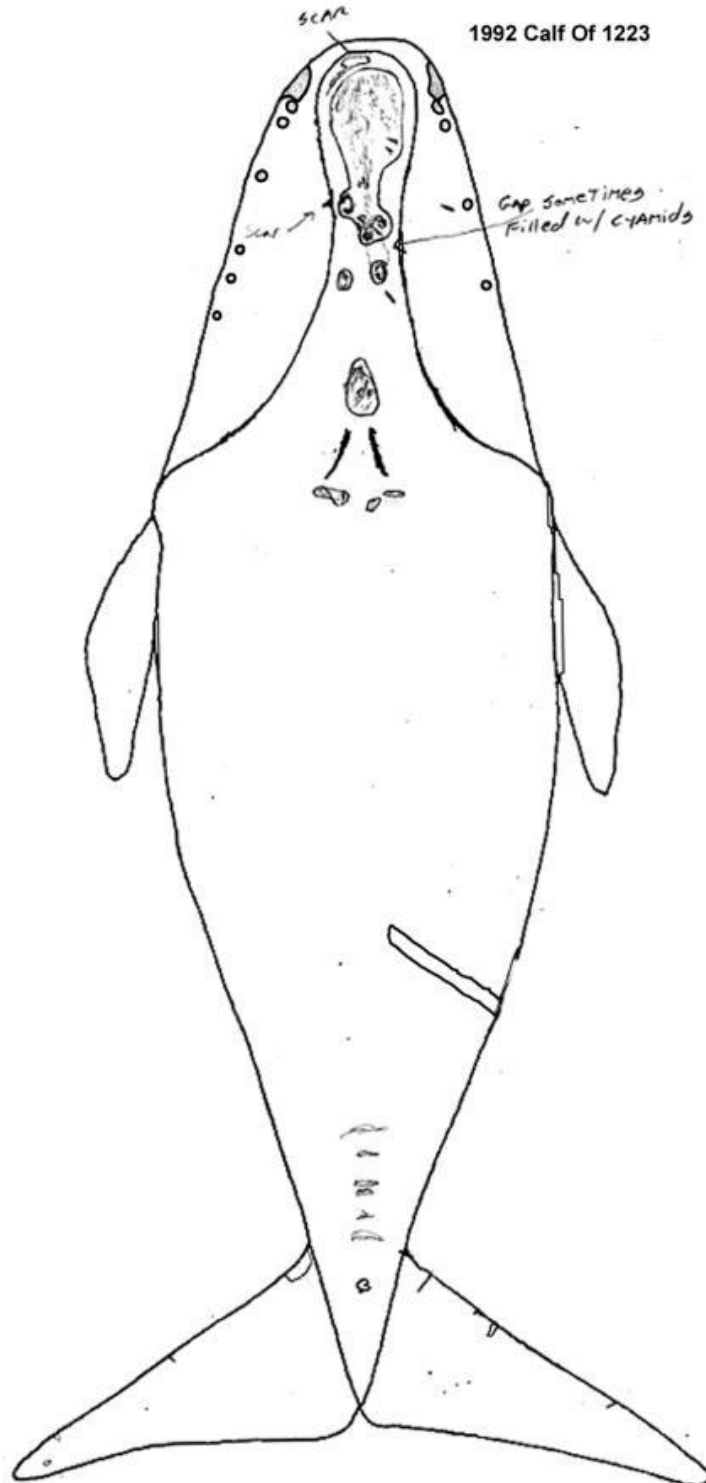
NUMBER: 2223

NAME: Calvin

YEAR OF BIRTH: 1992

SEX: FEMALE

COMMENTS: ORPHANED AS A CALF AFTER HER MOTHER WAS STRUCK AND KILLED BY A SHIP. NO ONE THOUGHT THIS WHALE WOULD SURVIVE. SHE PROVED EVERYONE WRONG AND GREW UP TO HAVE 2 CALVES OF HER OWN.



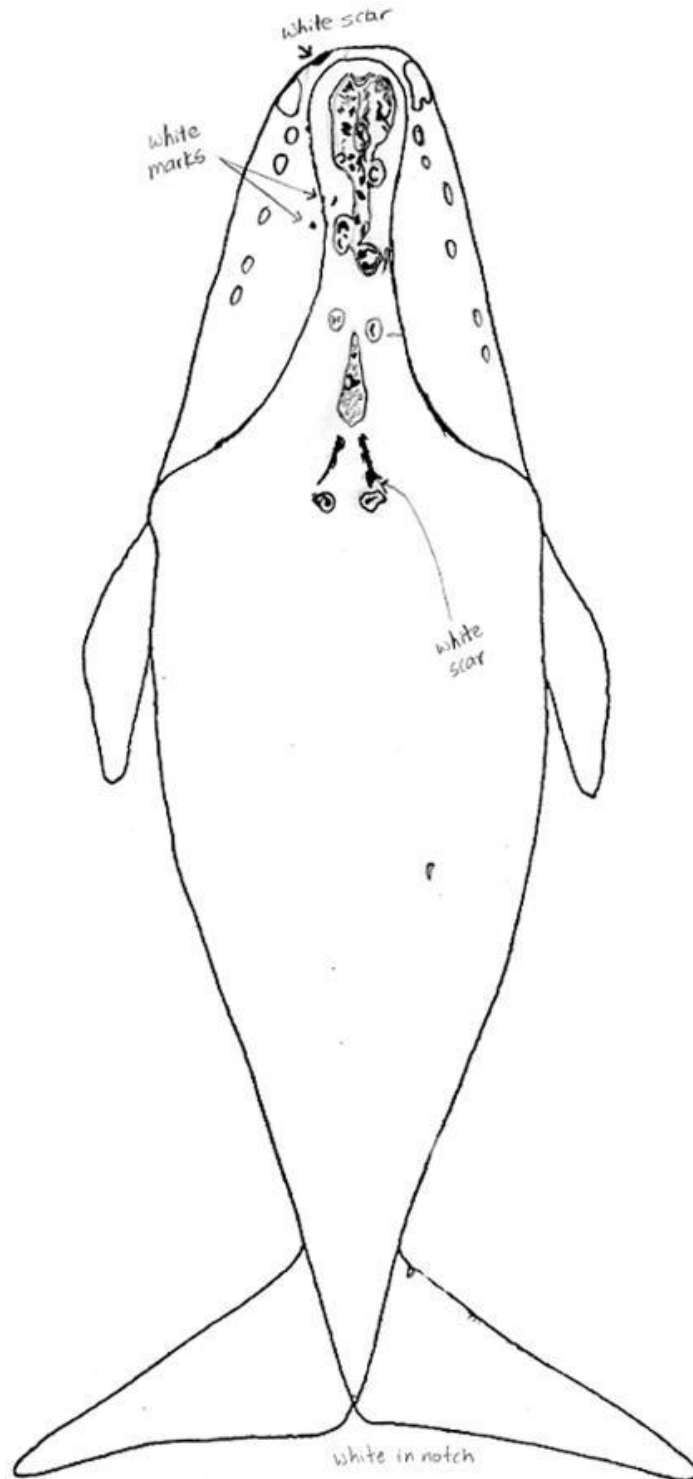
NUMBER: 1310

NAME: AMANDA

YEAR OF BIRTH: UNKNOWN

SEX: FEMALE

COMMENTS: LAST SEEN IN 2009, AMANDA IS DISTINGUISHED BY THE WHITE SCARS ON HER HEAD AND THE WHITE NOTCH AT THE CENTER OF HER TAIL.



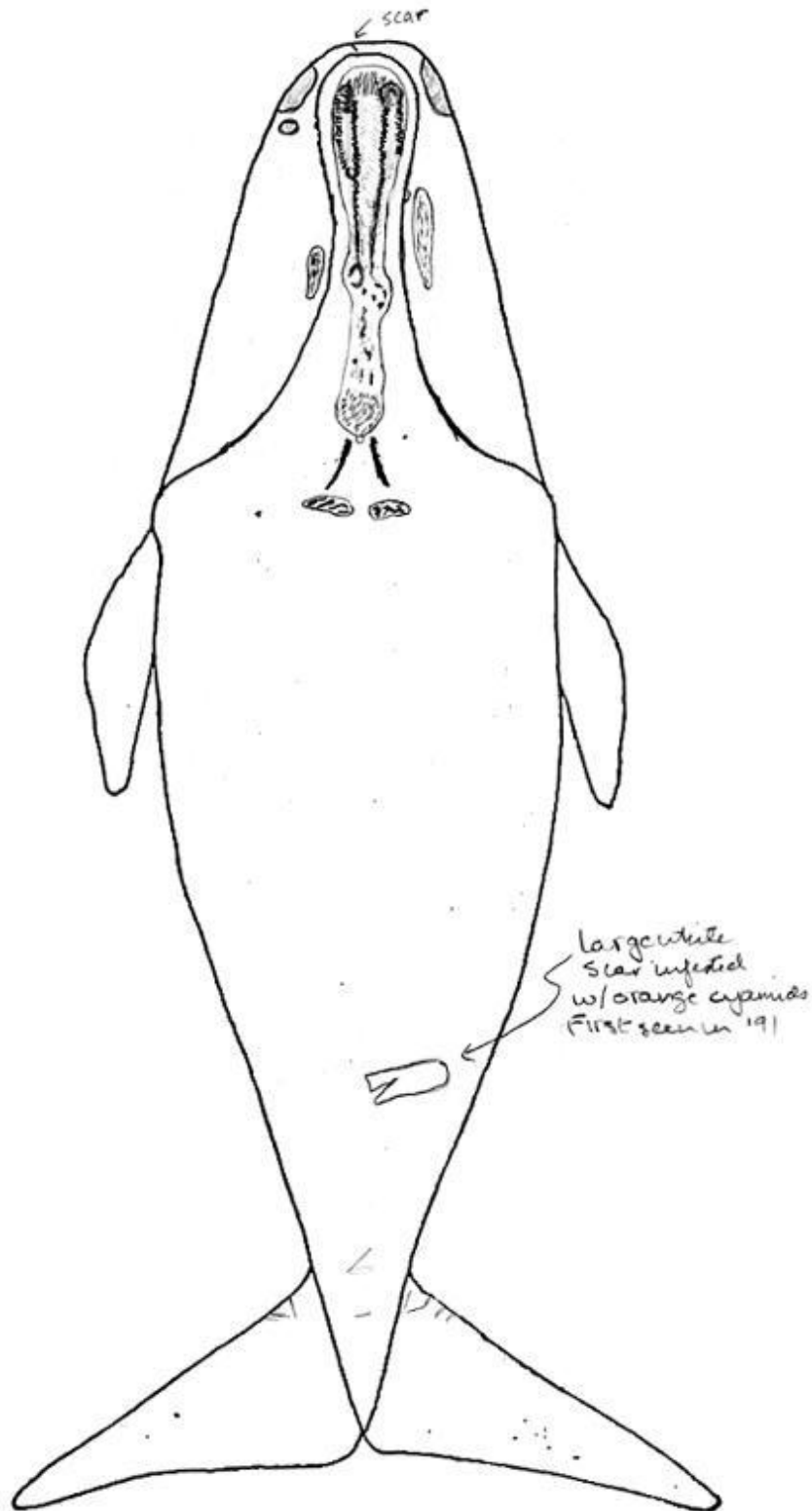
NUMBER: 1804

NAME: KATZ

YEAR OF BIRTH: 1988

SEX: MALE

COMMENTS: KATZ WAS LAST SPOTTED IN 2010; EASILY IDENTIFIED BY THE LARGE WHITE SCAR ON HIS BACK.



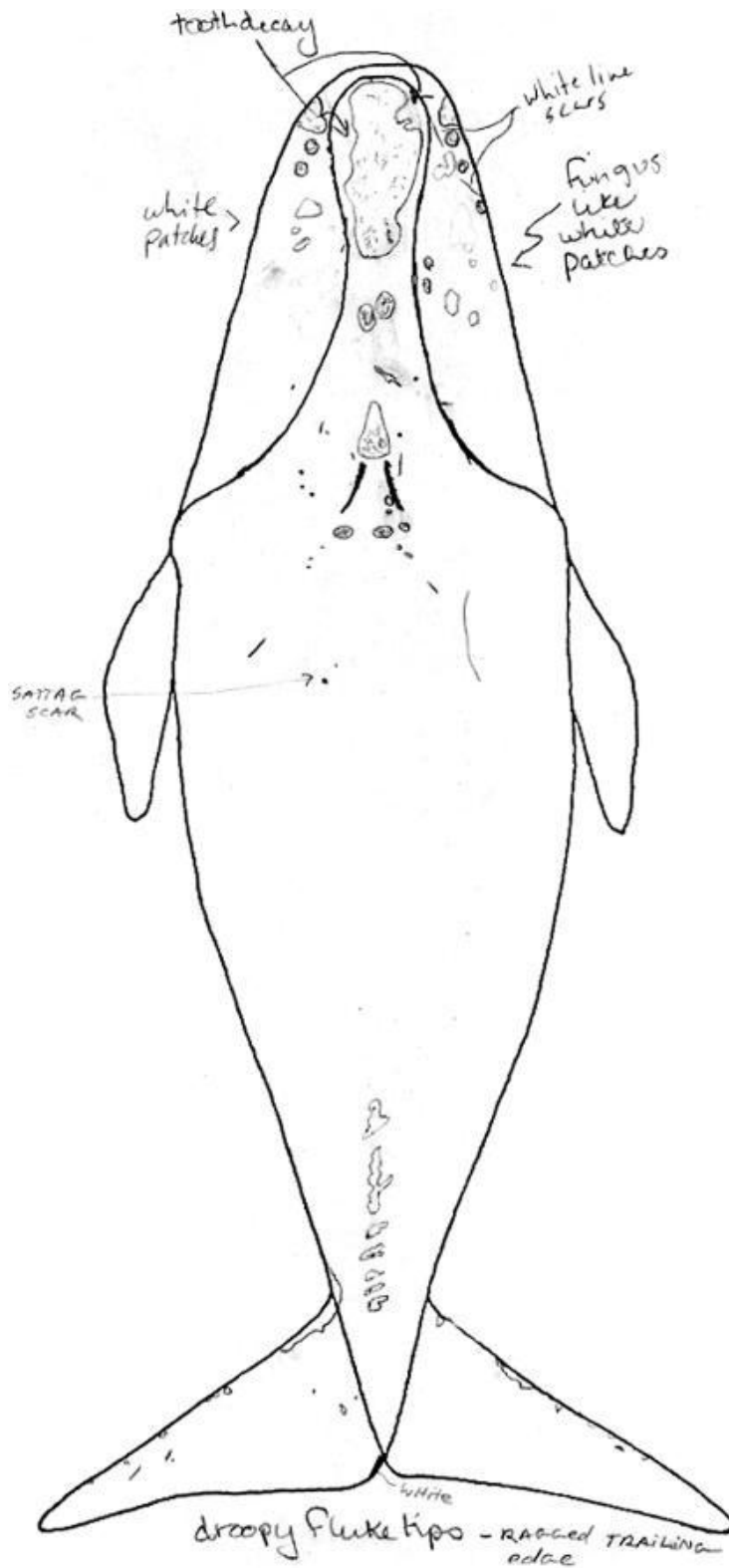
NUMBER: 1608

NAME: MORSE

YEAR OF BIRTH: 1986

SEX: FEMALE

COMMENTS: LOTS OF WHITE PATCHES ON HEAD, UNIQUE TAIL MARKINGS. LAST SEEN IN 2010.



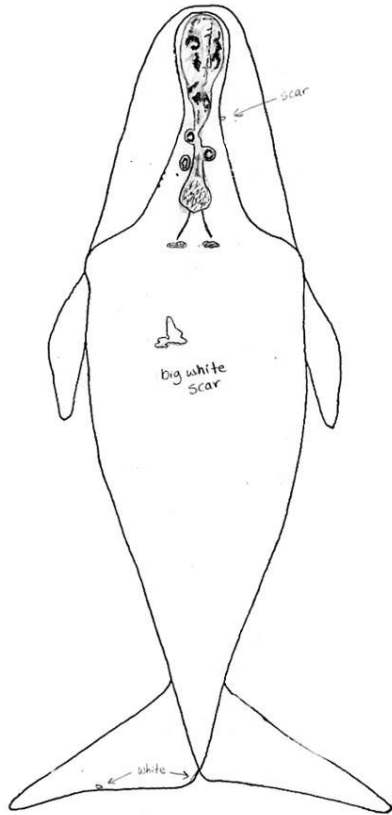
Be A Whale Scientist



Can you be a whale scientist?

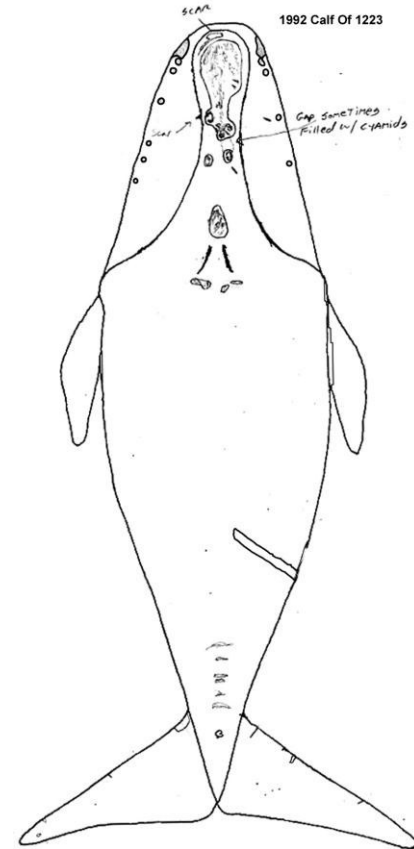
Match the whales in this book to the whale images and write the correct whale's name above its picture.

Whale's name _____



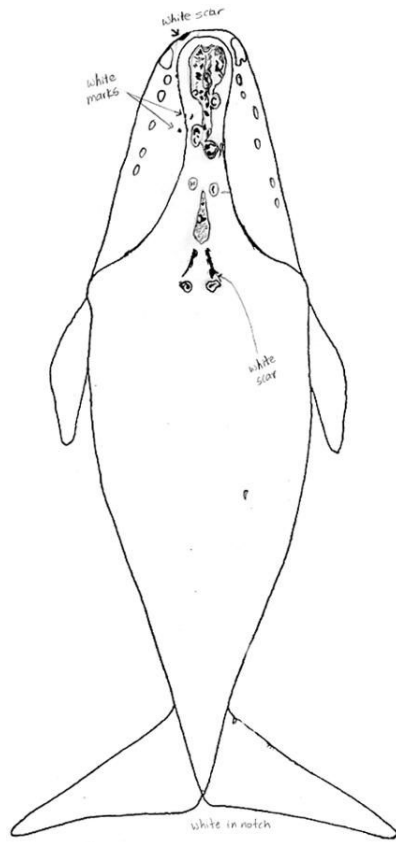
Scientists see this whale almost every year. It seems to enjoy traveling and exploring; it has been seen in northern Norway and North America! The scar on its back is probably from a harpoon injury. This whale was first sighted in 1981.

Whale's name: _____



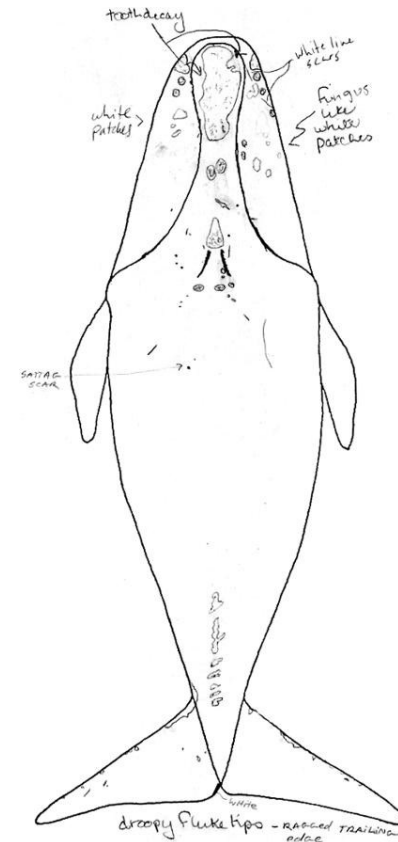
Born in 1992 to Delilah. This whale has a distinct scar across her back as well as scar across her flukes. She has had 2 calves, one named Hobbes born in 2005 and another born in 2009.

Whale's name: _____



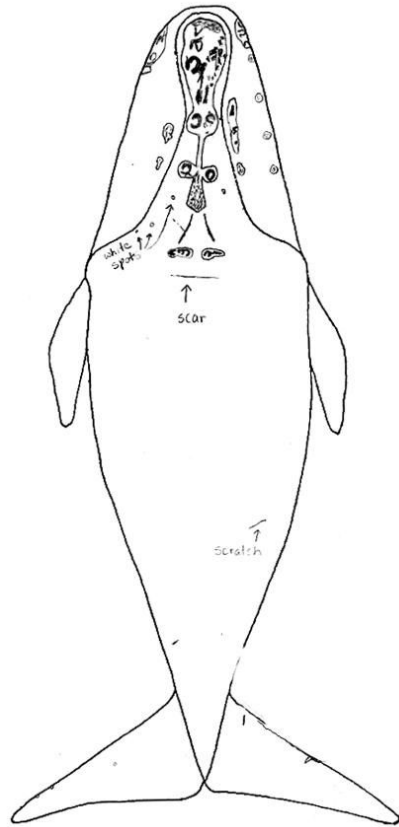
First spotted in 1979 in the Gulf of Maine, this right whale has an interesting tail notch. This whale was last seen in the Cape Cod Bay in Massachusetts.

Whale's name: _____



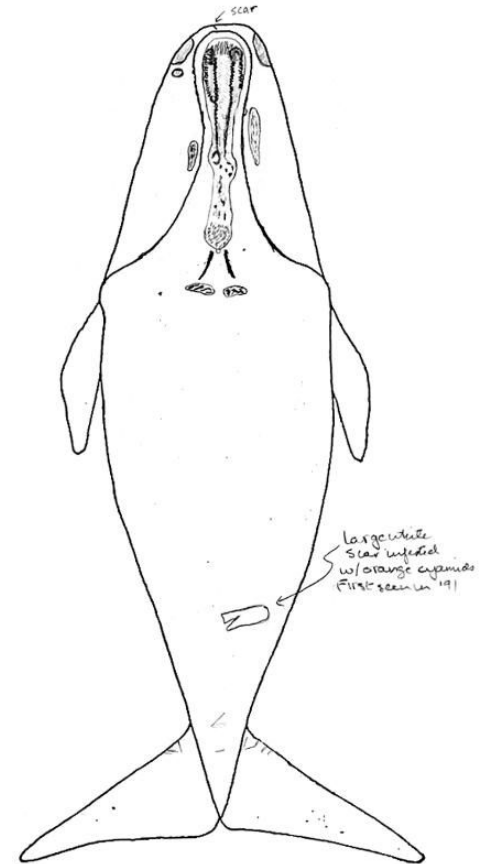
This whale is the calf of a whale named Stars. This whale is unique because of its white markings, tag scar on its back and droopy fluke tips.

Whale's name: _____



The name of this whale is another word for "violin". It has white spots and scars on its back and enjoys searching for food in the Bay of Fundy and Cape Cod Bay, but also likes the Gulf of Maine.

Whale's name: _____



Last seen in 2010, this whale has a large white scar that was not discovered until 1991. This whale is the offspring of a right whale named Bolo.

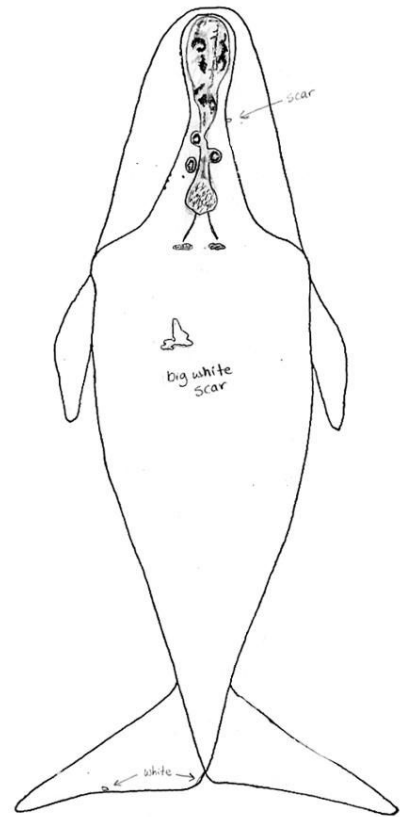
Be A Whale Scientist



Can you be a whale scientist?

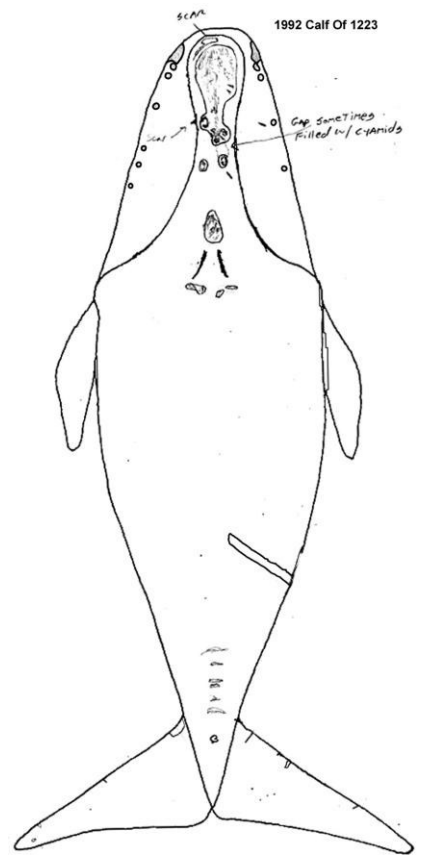
Match the whales in this book to the whale images and write the correct whale's name above its picture.

Whale's name Porter



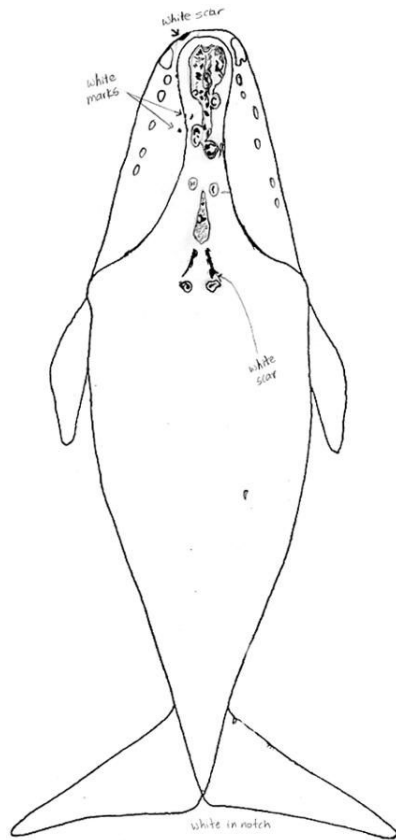
Scientists see this whale almost every year. It seems to enjoy traveling and exploring; it has been seen in northern Norway and North America! The scar on its back is probably from a harpoon injury. This whale was first sighted in 1981.

Whale's name: Calvin



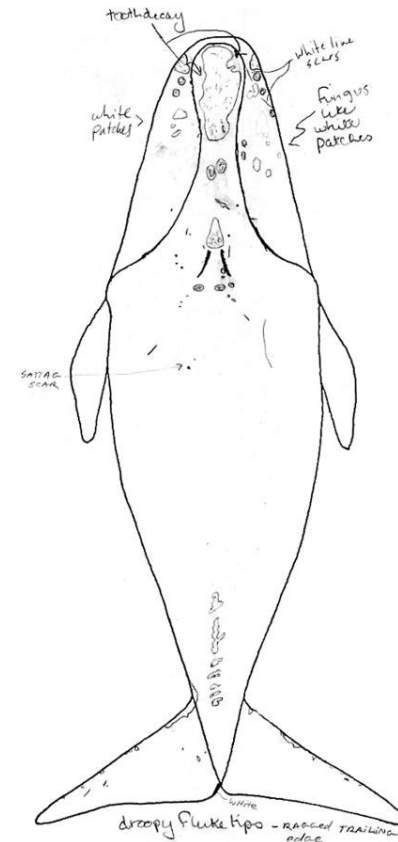
Born in 1992 to Delilah. This whale has a distinct scar across her back as well as scar across her flukes. She has had 2 calves, one named Hobbes born in 2005 and another born in 2009.

Whale's name: Amanda



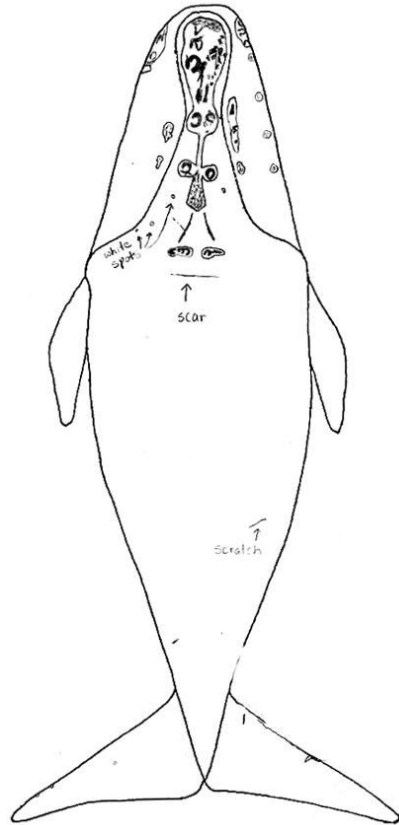
First spotted in 1979 in the Gulf of Maine, this right whale has an interesting tail notch. This whale was last seen in the Cape Cod Bay in Massachusetts.

Whale's name: Morse



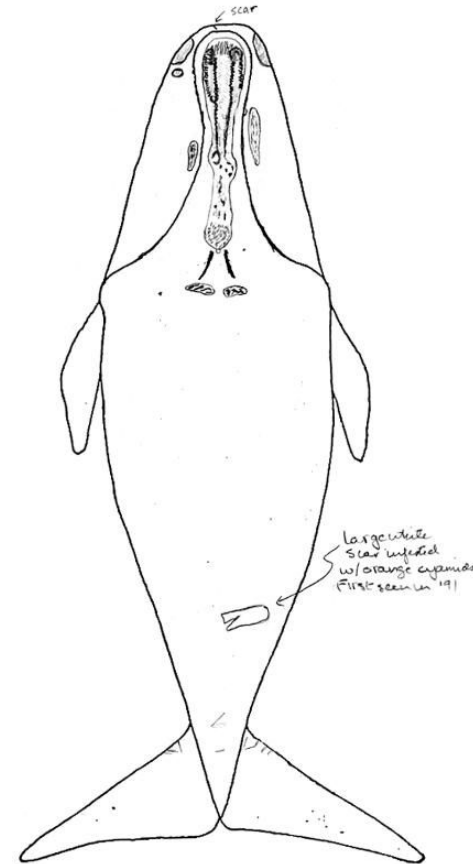
This whale is the calf of a whale named Stars. This whale is unique because of its white markings, tag scar on its back and droopy fluke tips.

Whale's name: Fiddle



The name of this whale is another word for "violin". It has white spots and scars on its back and enjoys searching for food in the Bay of Fundy and Cape Cod Bay, but also likes the Gulf of Maine.

Whale's name: Katz



Last seen in 2010, this whale has a large white scar that was not discovered until 1991. This whale is the offspring of a right whale named Bolo.

Rope Activity

Objective: To help students visualize the size of right whales, including the size of calves, baleen, and flippers. Students will measure and mark different lengths on a rope for visualization.

Background: Whales are the largest animals to have existed on Earth. Unlike large land animals that can be seen at a zoo, whales cannot be seen easily by an average person. Visualizing the size of a whale and comparing it to human size will help students better understand the difference.

Materials:

- 50 foot length of fishing rope*
- Measuring tape
- Marker or electrical tape

*Recycled fishing rope can be purchased through Custom Cordage- <http://www.maineropemats.com/> 151 One Pie Road, PO Box 1387, Waldoboro, ME 04572, (207)-832-0569. If you live in a coastal community you may also be able to obtain used rope through your local fishermen's association.

Activity: Follow these steps to represent the actual sizes of right whale anatomy:

1. 50 feet is the average length of a right whale. Have 2 students hold out the length of the rope to see how long it actually is.
2. Take the measuring tape and measure 15 feet down the rope from one end. This is the length of a newborn calf. Mark the rope with the marker/electrical tape.
3. Take the measuring tape and measure 8 feet down the rope. This is the average length of their baleen. Mark the rope with the marker/electrical tape.
4. Take the measuring tape and measure 6 feet down the rope. This is the height of a typical human male. Mark the rope with the marker/electrical tape.
5. Take the measuring tape and measure 5 feet down the rope. This is the length of a right whale flipper. Mark the rope with the marker/electrical tape.

Evaluation: Can the students figure out how many of them it would take to make up the length of an adult right whale? Have the students think about the size of other animals they are familiar with to help them put into perspective the size comparison.

North Atlantic Right Whale Consortium Education Committee.

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North Atlantic Right Whale Math and Science

Objective: Students will learn some basic biological facts about right whales by comparing and contrasting them with other familiar organisms.

Background: Right whales are enormous animals. Their dimensions and nutritional needs may be difficult to understand, especially for those who have never seen one up close. We provide comparisons to animals that are more familiar to students.

Activity: Compare North Atlantic right whales to other animals using the suggestions below.

Right whales weigh an average of 100,000 pounds (lbs.) or 45,454.5 kg
Calculate how the RW's weight compares to some other mammals.

1. An African elephant weighs a maximum of 13,200 lbs (6000 kg).
One right whale weighs as much as how many elephants?

2. A polar bear weighs 1,760 lbs (800 kg).
One right whale weighs as much as how many polar bears?

3. An NBA basketball superstar weighs approximately 220 lbs. (99.8 kg).
One right whale weighs as much as how many NBA basketball superstars?

4. A ring-tailed lemur weighs 6.6 lbs (3 kg).
One right whale weighs as much as how many ring-tailed lemurs?

5. A white-footed mouse weighs .81 ounces (23 g). This = 0.05 lbs.
One right whale weighs as much as how many white-footed mice?

Right whales consume approximately 395,000 calories daily.

Calculate how the RW's calorie consumption compares to some items you might enjoy eating.

1. How many pepperoni pizzas would a right whale eat if one pizza contains 1500 calories?

2. How many Big Macs would a right whale eat if one Big Mac contains 704 calories?

3. How many Milky Way bars would a right whale eat if one bar contains 130 calories?

4. How many apples would a right whale eat if each apple contains 44 calories?

All cetacean (whales, dolphins and porpoises) dive for their food. We have included some dive times from North Atlantic right whales. Calculate the average dive time for this species. You may want to convert the times to seconds to do the addition and division and then convert them back to minutes and seconds when you're finished.

First dive:	8 minutes 15 seconds
Second dive:	4 minutes 33 seconds
Third dive:	5 minutes 05 seconds
Fourth dive:	3 minutes 44 seconds
Fifth dive:	6 minutes 25 seconds
Sixth dive:	4 minutes 11 seconds
Seventh dive:	7 minutes 14 seconds
Eighth dive:	5 minutes 38 seconds

North Atlantic Right Whale Math and Science

Objective: Students will learn some basic biological facts about right whales by comparing and contrasting them with other familiar organisms.

Background: Right whales are enormous animals. Their dimensions and nutritional needs may be difficult to understand, especially for those who have never seen one up close. We provide comparisons to animals that are more familiar to students.

Activity: Compare North Atlantic right whales to other animals using the suggestions below.

**Right Whales weigh an average of 100,000 pounds (lbs.) or 45,454.5 kg
Calculate how the RW's weight compares to some other mammals.**

1. An African elephant weighs a maximum of 13,200 lbs (6000 kg).

One right whale weighs as much as how many elephants? *1 RW = 7.5 African elephants*

2. A polar bear weighs 1,760 lbs (800 kg).

One right whale weighs as much as how many polar bears? *1 RW = 57 polar bears*

3. An NBA basketball superstar weighs approximately 220 lbs. (99.8 kg).

One right whale weighs as much as how many NBA basketball star? *1 RW = 455 stars*

4. A ring-tailed lemur weighs 6.6 lbs (3 kg).

One right whale weighs as much as how many ring-tailed lemurs? *1 RW = 15,152 ring-tailed lemurs.*

5. A white-footed mouse weighs .81 ounces (23 g). This = 0.05 lbs.

One right whale weighs as much as how many white-footed mice? *1 RW = 2,000,000 white-footed mice.*

Right Whales consume approximately 395,000 calories daily.

Calculate how the RW's calorie consumption compares to some items you might enjoy eating.

1. How many pepperoni pizzas would a right whale eat if one pizza contains 1500 calories?

263 pepperoni pizzas

2. How many Big Macs would a right whale eat if one Big Mac contains 704 calories?

561 Big Macs

3. How many Milky Way bars would a right whale eat if one bar contains 130 calories?

3,038 bars

4. How many apples would a right whale eat if each apple contains 44 calories? *8,977 apples*

All cetacean (whales, dolphins and porpoises) dive for their food. We have included some dive times from North Atlantic right whales. Calculate the average dive time for this species. You may want to convert the times to seconds to do the addition and division and then convert them back to minutes and seconds when you're finished.

First dive:	8 minutes 15 seconds
Second dive:	4 minutes 33 seconds
Third dive:	5 minutes 05 seconds
Fourth dive:	3 minutes 44 seconds
Fifth dive:	6 minutes 25 seconds
Sixth dive:	4 minutes 11 seconds
Seventh dive:	7 minutes 14 seconds
Eighth dive:	5 minutes 38 seconds

Average dive time is 5 minutes 38 seconds

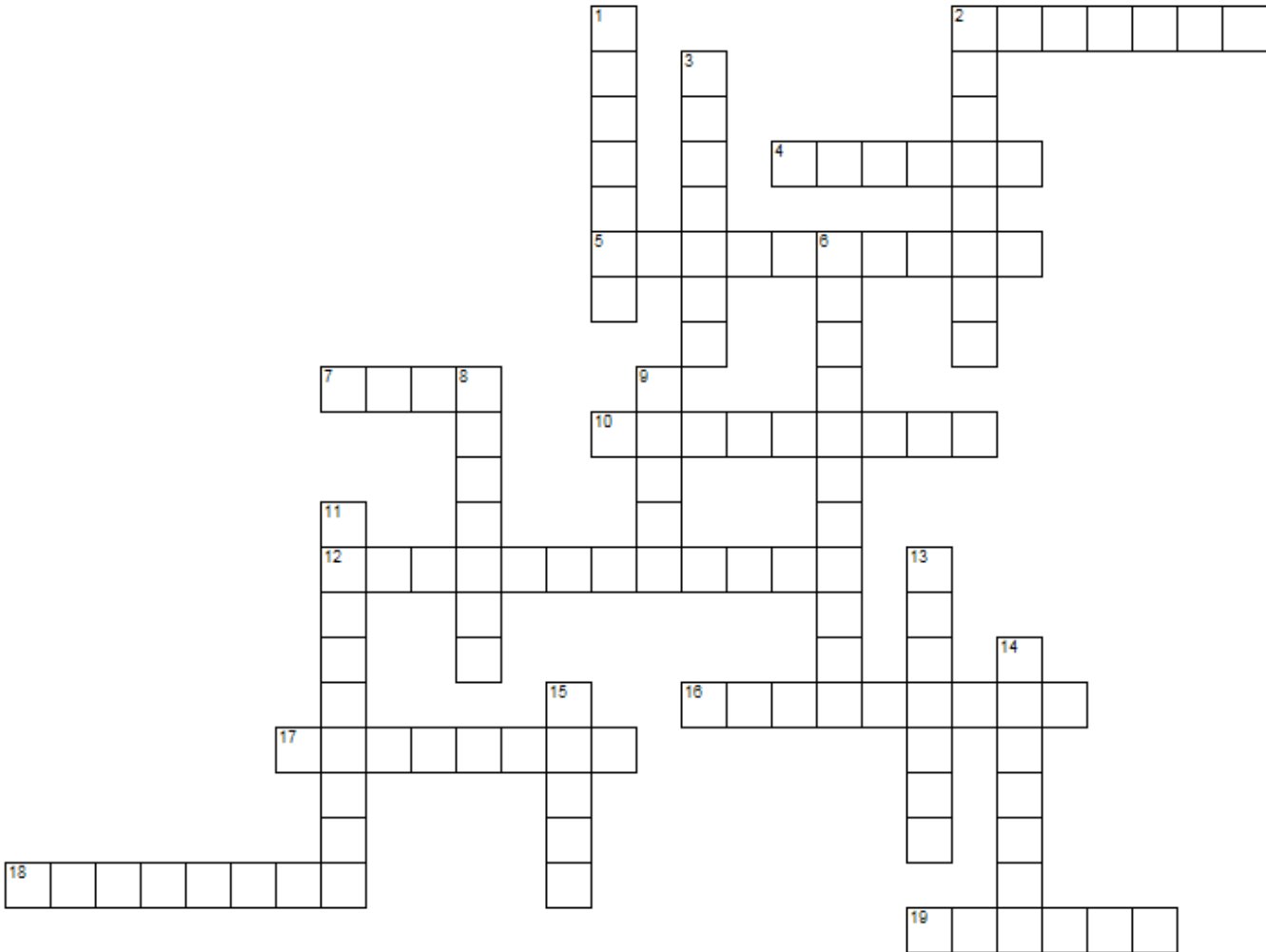
45 minutes and 5 seconds = 2705 total minutes

2705 total minutes / 8 dives = 338.125 seconds per dive

338.125 seconds per dive / 60 seconds = 5.64 minutes per dive = 5 minutes 38 seconds

North Atlantic Right Whales

Fill in the puzzle below using the clues on the next page.



ACROSS:

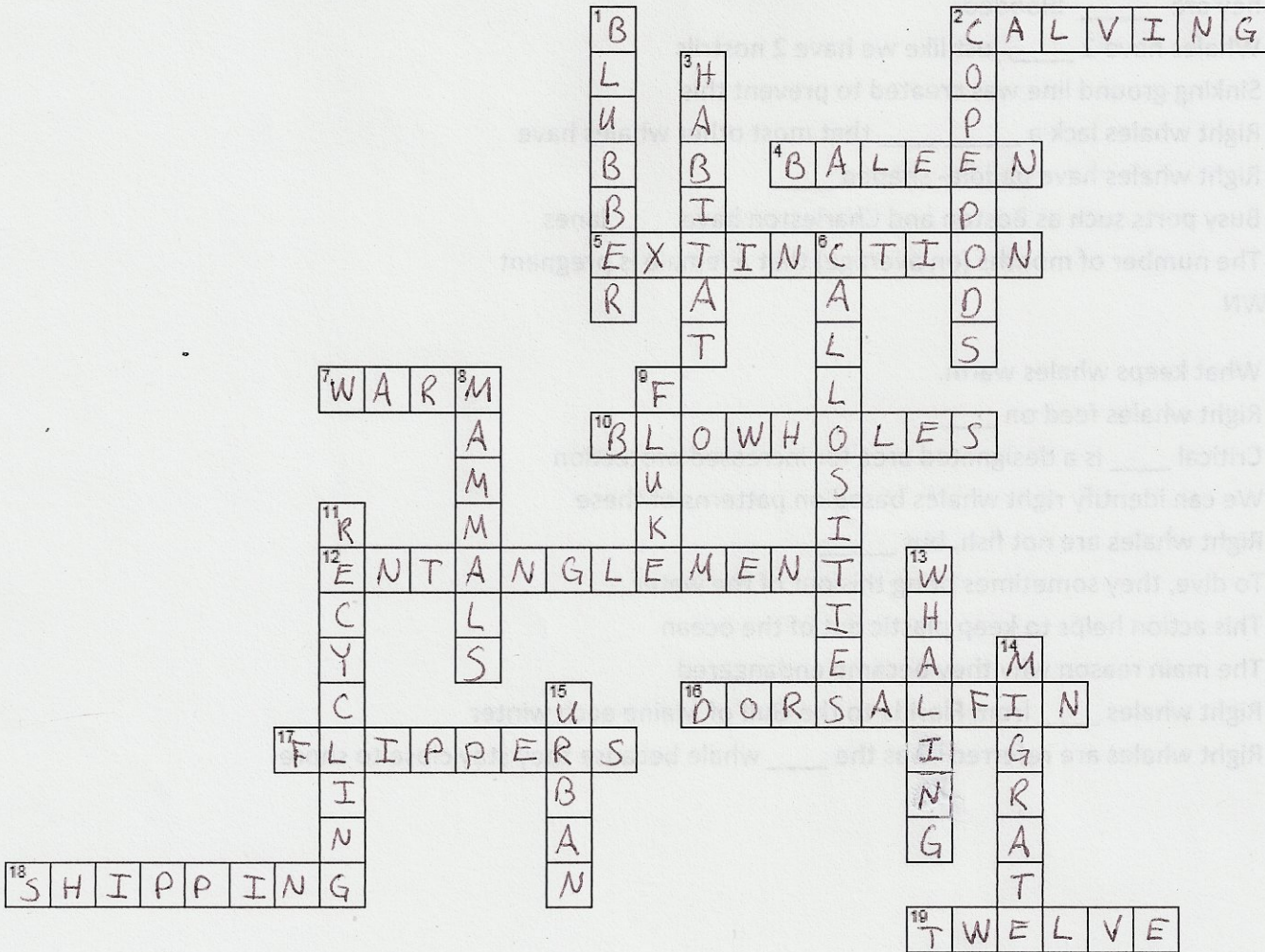
2. The Florida and Georgia coasts are their ____ grounds
4. What right whales have instead of teeth
5. Right whales are facing _____ if their numbers don't increase
7. They are _____-blooded
10. Whales have 2 _____, just like we have 2 nostrils
12. Sinking ground line was created to prevent this
16. Right whales lack a _____ that most other whales have
17. Right whales have paddle- shaped _____
18. Busy ports such as Boston and Charleston have _____ lanes
19. The number of months (on average) that a female is pregnant

DOWN

1. This keeps whales warm.
2. Right whales feed on _____
3. Critical _____ is a designated area for increased protection
6. We can identify right whales based on patterns of these
8. Right whales are not fish, but _____
9. To dive, they sometimes bring this out of the water
11. This action helps to keep plastic out of the ocean
13. The main reason why they became endangered
14. Right whales _____ from Florida to the Gulf of Maine each winter
15. Right whales are referred to as the _____ whale because they stay close to shore

North Atlantic Right Whales

Fill in the puzzle below using the clues on the next page.



North Atlantic Right Whale Consortium Education Committee.

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Resources

North Atlantic Right Whale Consortium: www.narwc.org
Audubon Society of Rhode Island: www.asri.org
Center for Coastal Studies: www.coastalstudies.org
Cornell's Right Whale Listening Network: www.listenforwhales.org
Discovery of Sound in the Sea: www.dosits.org
National Marine Mammal Laboratory:
<http://www.afsc.noaa.gov/nmml/education/cetaceans/right.php>
New Bedford Whaling Museum: <http://whalingmuseum.org/>
New England Aquarium Teacher Resources: [www.neaq.org/education and activities/](http://www.neaq.org/education_and_activities/)
NOAA 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: www.education.noaa.gov/students.html
NOAA National Marine Sanctuary Program: www.sanctuaries.noaa.gov
Whale Alert app: <http://www.whalealert.org/>
Whale and Dolphin Conservation: us.whales.org

Carwardine, Mark. Eyewitness Handbooks: Whales, Dolphins and Porpoises. Dorling Kindersley Publishing, Inc., 1995

Clapham, Phil. Right Whales. World Life Library, Voyageur Press. 72 pages; 2004

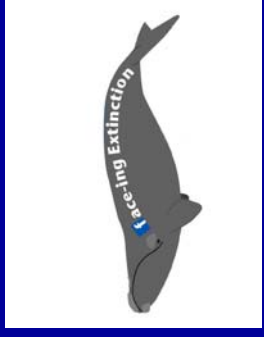
Kraus, Scott and Kenney Mallory. Disappearing Giants: The North Atlantic Right Whale. Bunker Hill Publishing in association with New England Aquarium. 2004

Kraus, Scott D. and Rosalind Rolland. The Urban Whale: North Atlantic Right Whales at the Crossroads. Cambridge, MA: Harvard UP, 2007.

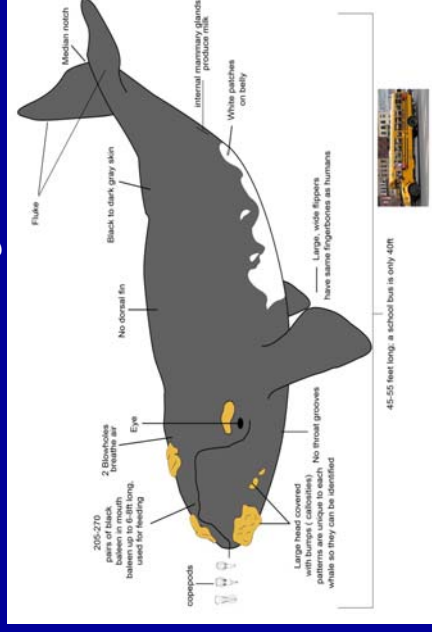
Leatherwood, Stephen and Randal Reeves. The Sierra Club Whales and Dolphins. Sierra Club Books. 1983

Perrin, William F., Bernd G. Würsig and J. G. M. Thewissen. Encyclopedia of Marine Mammals. Academic Press, 1316 pages. 2009

Face-ing Extinction: The North Atlantic Right Whale



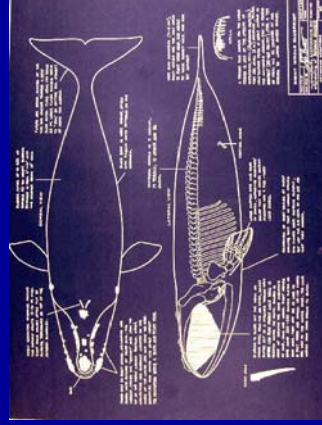
North Atlantic Right Whales: *Eubalaena glacialis*



12

Just Like Us

- Mammals:
- Breathe air
 - Give birth to live young
 - Females produce milk
 - Have hair
 - Similar skeletal set-up, including finger bones and vertebrae
 - 4-chambered heart
 - Modified middle ear



Right Whale, Lyle Bennett, 1980 NBWM Kendall Collection

Endangered, ~ 500 remain

- Life span less than 60 years
- Females are pregnant for 12 months
- Mothers give birth to a single offspring every 3 to 5 years.
- Begin reproducing around age 10.
- SE United States is the only known calving area
- Calves are born December-March and nurse for about 12 months.



Photo: Florida Fish and Wildlife Conservation Commission/NOAA

14

Skim Feeding

- Baleen plates can be up to 9 feet long
- Skim feed along the surface
- Prey source is copepods- microscopic plankton
- During feeding season right whales will eat between 2,000-3,000lbs of copepods each day, which is about the weight of a VW Beetle



Credit: Provincetown Center for Coastal Studies



Hopcroft/UAF/Colin/NOAA

* 5

Hunting Right Whales

- Vikings and Basques (from coastal Spain) were the first to hunt right whales, along the shore. Basques later sailed after their prey.
- Dutch, French and British whalers hunted them in the 15th, 16th and 17th centuries.
- Commercial hunt for the North Atlantic right whale (NARW) effectively ended around 1750. Very few log books in the New Bedford Whaling Museum (NBWM) collection mention NARWs.
- Efforts were then put into hunting Southern and Pacific right whales.



Riche de la Baleine Gurney, A.L. 1838 NBWM collection



Example of a log book entry Kendall Collection: NBWM

Historical Uses of Whale Products



The capture of each whale was marked in the ship's log with a stamp and the relevant details.



Frames of parasols were made with baleen.



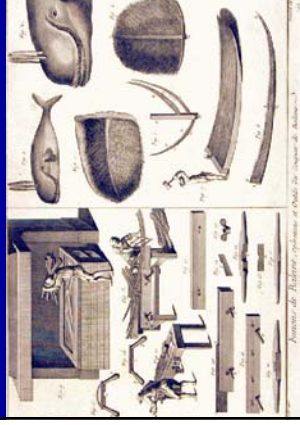
Baleen was pressed to create decorative sculptures



Whale oil was used to light lamps

* All objects from New Bedford Whaling Museum collections.

Whale Products



A depiction of the process of making products from baleen.

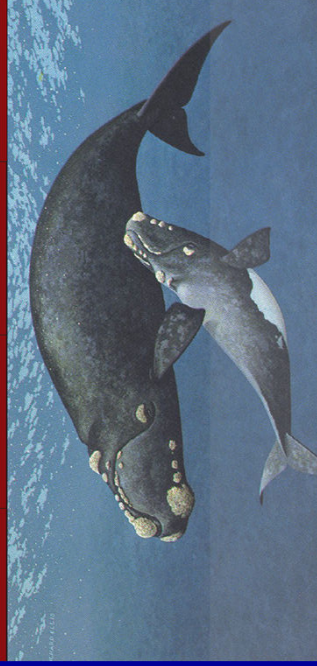


Advertisement for corsets made from baleen

* 8

That Was Then, This Is Now

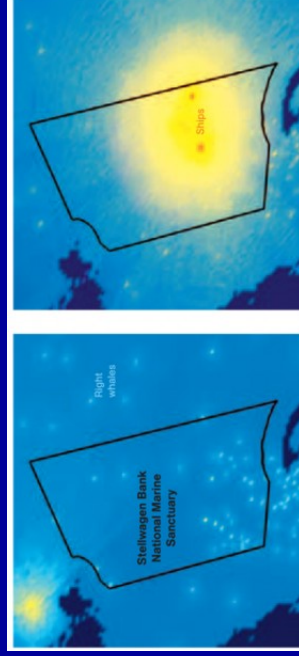
Pre-whaling: 10,000	Low: 100 (1935)	Current: 450-500	Total Hunted: 10,000
------------------------	--------------------	---------------------	-------------------------



*The figures presented in this panel are estimates based on the best scientific data available at the time of publication. It is not possible to account for every whale hunted, nor is it possible to count every living whale.

Habitat Invasion

- Noise pollution threatens the survival of the species.
- The sounds of a ship can mute whale calls for miles.



Right whales (pale dots) call to one another in Massachusetts Bay, off Cape Cod. It's a quiet day in April. A few hours later several ships traverse the area and "beach" the whales' communication.

• 10

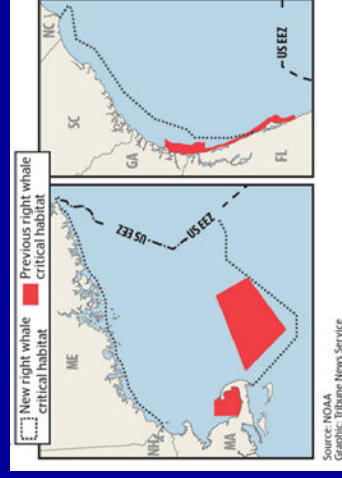
Habitat Degradation

Chemical pollution and offshore development may be hazards.



Provincetown Center for Coastal Studies. Taken under NOAA permit 14603.

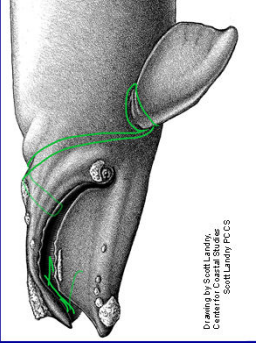
Habitat Protection



- Conservation groups petitioned to increase federally protected habitat along the eastern seaboard.
- Expanded in 2016 to cover almost 40,000sq. Nm.

Entanglements

About 3/4 of the population bears scars from entanglement in fishing gear



13

Long Term Impact



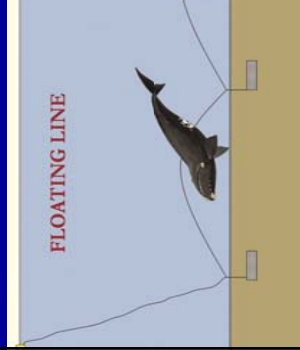
Some whales can be seen trailing fishing gear for days, weeks, months, or even years.

Credit: Florida Fish and Wildlife Conservation Commission

Sinking Ground Line

Line between lobster pots sinks instead of floating, making it safer for the whales.

Before:



After:



* Images courtesy of Scott Landry, FCCS

Hunting

- Last confirmed *hunting* in the US of a North Atlantic right whale was the calf of *Eg1045* in 1935.
- Last sighting of *Eg1045* was in 1995 east of Cape Cod, critically wounded by a ship strike. She was probably at least 70 years old.
- Can this accidental removal of whales from the population, by human activity, still be considered *hunting*?

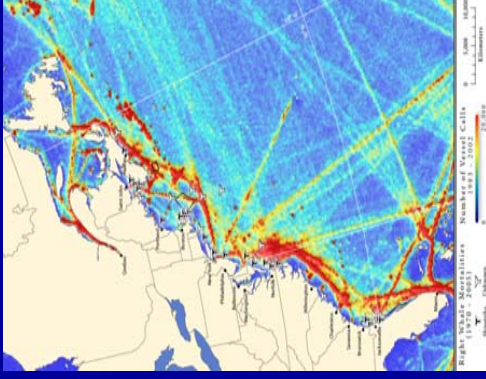


Ship Strike

The right whale skeletons in the New Bedford Whaling Museum are from a 15-year old female named Reyna and her fetus that were accidentally killed by a ship's propeller in November 2004, in the mouth of Chesapeake Bay.



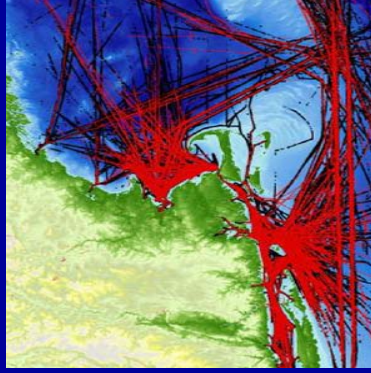
Modern Threats - Urban Life



- NARW is called the "Urban Whale" because its migration between calving and feeding grounds, and its other activities, take place within 50 miles of the coast
- Whales swim through high densities of fishing and shipping activity
- Colored lines on the graph indicate shipping traffic
- Bay of Fundy, Scotian Shelf, Cape Cod Bay, Great South Channel, North Atlantic feeding grounds
- Florida and Georgia coasts: only known calving grounds

Shipping

- Ship strikes are the leading cause of injury and mortality to the species.
- Red lines represent a busy highway of ship traffic in and out of the Northeast
- Image depicts traffic over a 1 month period



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Who Has the Right of Way?

- Along a crowded coastline, who has the right of way- ships or whales?
- It takes a fully loaded supertanker 14 min and ~2 mi to crash stop; realistic stop would take at least 20 min



How to Solve the Problem?

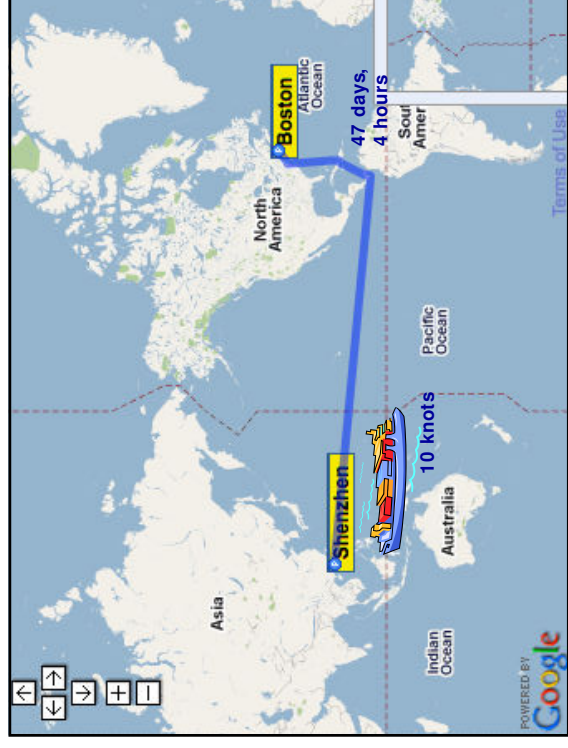
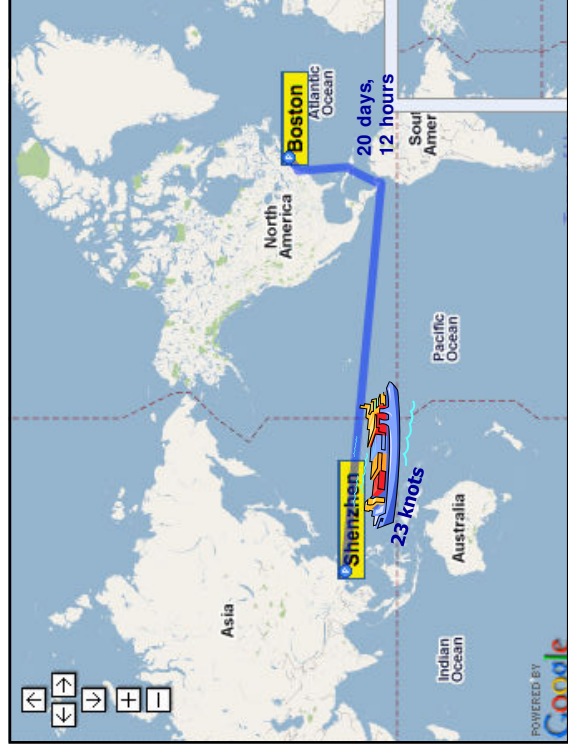
- Ship Strike Rule (2009): Requires large ships to reduce speeds to 10 knots in areas where the whales feed and reproduce, as well as along migratory routes. This was a 5 year rule.
- Combining reduced speeds with recommended routes reduces the probability of right whale mortality from ships by 71.9%.¹
- Compliance rates jumped when rule was made mandatory.
- According to an economic analysis report done by the Woods Hole Oceanographic Institution, the cost of the ship strike rule would equate to only \$1/cruise ship passenger.²
- The Ship Strike Rule was made permanent in December of 2013.



1. Lagueux, M.A., Zani, M.A., Knowlton, A.R., Kraus, S.D. (2011) Response by vessel operators to protection measures for right whales *Eubalaena glacialis* in the southeast US calving ground. *Ending Species Risk* 14:69-77
 2. Joffe-Powell, H. (2005) Economic Implications of Possible Reductions in Boston Port Calls due to Ship Strike Management Measures. 1-18

Benefits of Reducing Speed

- Shenzhen, China is the source of many electronics we have in the U.S.
- If a container ship traveled at 10 knots while shipping a product from Shenzhen to Boston, it would add 3 weeks to the travel time
- Would use less fuel and create less noise
- Reduce the chance of striking a whale



What Can You Do?

Keep trash off the streets and out of the ocean.



Buy Whale Friendly Products

- Buy a door mat
 - Formerly used floating rope is recycled and turned into colorful door mats and dog leashes by a company called Custom Cordage.
- Eat a Massachusetts lobster
 - Mass lobstermen use 3,000 miles of sinking line, which is safer for whales, to catch their lobster and voluntarily mark them with a green band.



Adopt A Right Whale

- The New England Aquarium supports a right whale adoption program
- Choose from 6 different whales and 4 different sponsorship levels
- Information can be found at www.nbeq.org

Starry Night (adult male)



Shackleton (male born in 1994)



Phoenix (female born in 1987)



Piper (adult female)



Snowball (adult male)



Calvin (female born in 1952)



Face the Facts

- NARWs are endangered, with only ~ 500 individuals remaining.
- Human activity both on land and on the water are threats to ocean life.
- You CAN get involved and make a difference.
- Slower shipping speeds would help prevent collisions with right whales.
- Mitigations are constantly being tested to determine the most efficient ways to protect NARWs.
- Write or call your legislators encouraging them to support measures protecting the North Atlantic right whale.



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To learn more, find us on Facebook:
Face-ing Extinction: The North Atlantic Right Whale