

SIZE UP! ACTIVITY GUIDE

Overview:

How BIG is a blue whale, really? Engage participants to find out! Part 1 of the activity begins with a hands-on exploration in measuring their own bodies and then applying the principles of ratios to figure out a blue whale's length. Part 2 extends the learning to understand how scientists use drones and math to measure something so massive in the ocean.

Target Age:

All Ages, Family Multigenerational

Prep Time:

5 minutes

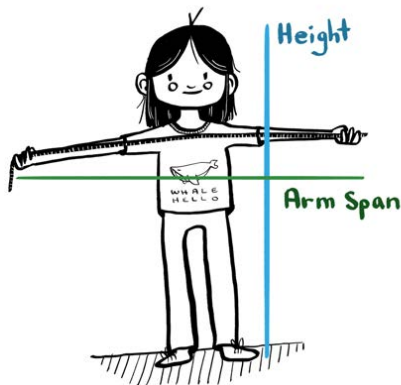
Activity Duration:

20-30 minutes

Perfect for:

Home, libraries, classrooms, outdoor learning, small groups

Supporting Videos & Interactive at
<http://bluewhalesfilm.com/education>



Materials & Set-Up:

- Pictures of blue whales
- Meter stick or measuring tape
- Yarn or rope
- Scissors
- 2 pieces of rope, one cut to 80 feet and one cut to 10 feet
- Blue whale plushy (optional)

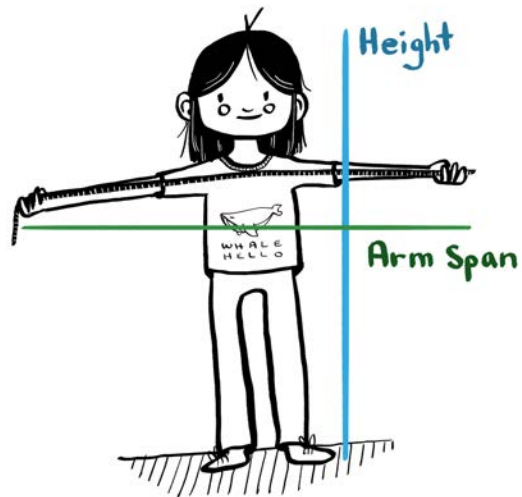
Size Up! Instructions Part I

Excite:

1. Invite guests to measure themselves with a measuring tape. See if they can guess their own height before measuring. Can they guess your height?
2. Show them the pictures of whales. Ask: How do you think scientists know how big these animals are? Wouldn't it be challenging to use a tape measure or ruler on them?
3. What are their ideas for how we measure whales?

Explore:

1. How do we know how big a whale is?
 - a. Blue whales are the biggest animal on the planet - we can't just use a measuring tape on them! But, we can use estimates.
 - b. We might know one smaller part of the whale and from there, can use math/ratios to figure out how long it is.
2. Spread out your arms - did you know that your arm span can be used as a way to estimate your height? This is called a 1:1 ratio.
3. Take a piece of yarn and use it to measure your arm span. Extend your arms straight out, and measure from one middle fingertip to the other on your front side.
4. Take that same length of yarn and hold it from the top of your head - it should be about the length of your body. How close is it?
5. Share with participants that we can use blue whale body parts and ratios to find out its entire length. For example, a blue whale's length is about 8 times the length of its pectoral fin. Use a whale model or plush to show this.
6. Have participant take one end of the 10-foot yarn and tell them this is the length of a blue whale pectoral fin. If we know the fin of a blue whale is about an eighth of the whale's size, how big might this whale be?
7. Help participants do the calculation (about 80 feet).
8. Unravel the 80-foot yarn to see how long that is!



Modify this activity for young learners!

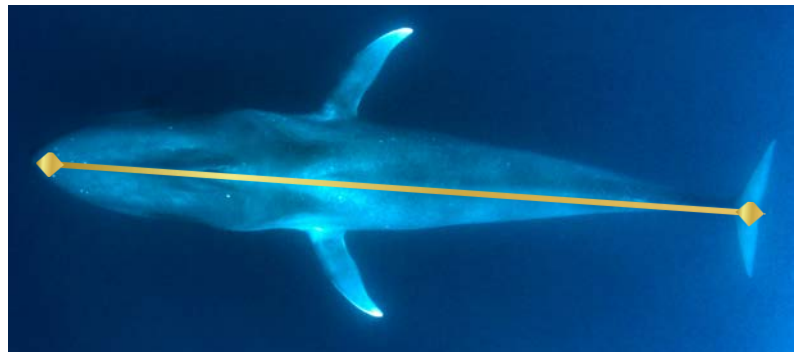
Instead of using yardsticks and rulers, young participants can use nonstandard units to measure arm spans, pictures of whales, and the body of the whale plushie. Have a variety of objects that are consistent in size. For example:

- blocks
- unsharpened pencils
- pennies
- paper clips
- erasers
- popsicle sticks

Size Up! Explanation

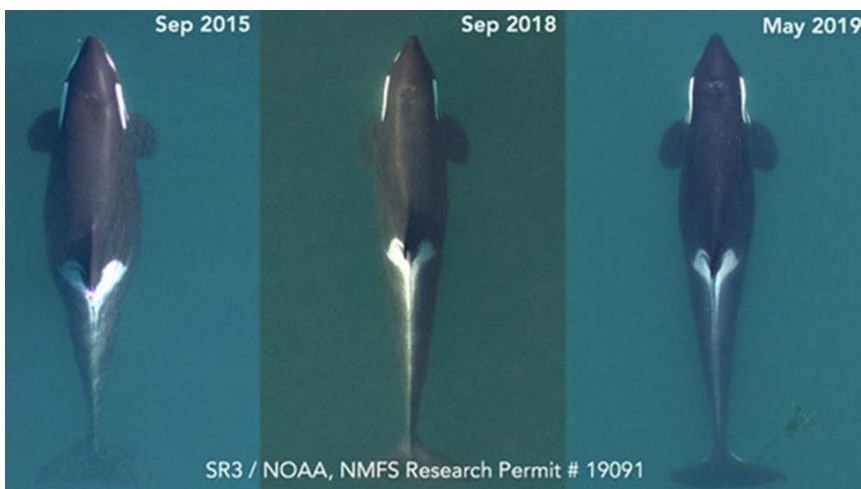
Explain:

1. Now that we know how to use ratios to make a pretty close guess as to how big the whale is, let's talk about what scientists in the field do. They measure the size of a whale from the tip of the jaw to the middle notch of the tail.
2. Researchers use drones to take photos of whales from an aerial view at a specific height or altitude above them. The photos are taken at different points along the whale's body to make accurate measurements. This is called **photogrammetry**.



Active Research & Conservation:

1. In addition to measuring the length of a whale, scientists use the same technique to measure a whale's body mass index or BMI. A whale's BMI can tell us if they are healthy and have enough to eat.
2. Extend the conversation by sharing that whales can be healthy or underweight, just like people. Discuss what we can learn about the whale's environment from a whale that is malnourished. What about one that is healthy?
3. Knowing the health of blue whales also help scientists understand the health of the ecosystem. If a location is a popular feeding ground for blue whales, informed decisions can be made to help protect those areas, as well as the path and routes leading to them.



The changes in the whale's BMI is noticeable in these images. It was well-fed in September, 2015, but underwent rapid weight loss in the next four years as seen in the photos taken in 2018 and 2019. Although, these are orcas and not blue whales, scientists use similar techniques with photogrammetry to learn more about the health of blue whales and the ecosystem.

Size Up! Instructions Part 2 (Optional)

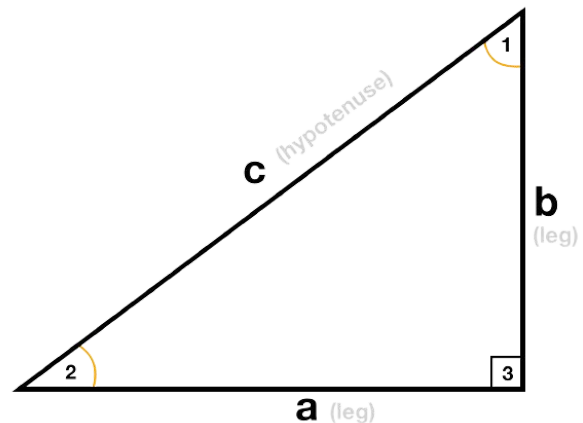
Materials & Set-Up:

- Blue whale printout
- 2 meter sticks
- Tablet - browser opened to www.piday.org/calculators/right-triangle-calculator/#
- Blue whale plush (optional)

Explore:

1. Let's try it with our measuring tools and the aerial view blue whale printout. The process uses the mathematical theory called the Pythagorean Theorem. Keep in mind that participants may not get accurate numbers at first - focus on the experimental process of doing science (trial and error).
2. Using the measurements of a right triangle and an online calculator, we can find the length of your whale printout.
 - a. Place your whale printout on a flat surface.
 - b. Stand a meter stick up from the tip of its head to create side B (refer to diagram below).
 - c. Use another meter stick to create side C by extending it from the notch of the whale's tail to touch side B's meter stick. (If using a tape measure, it may be more difficult to form the straight edges.)
 - d. Open the online calculator.
 - e. Record the measurements for side B and C.
 - f. Hit 'calculate' to find side A of the triangle, which is the length of the whale.
3. Now, measure your blue whale printout to get the actual measurement. How close was your calculated measurement compared to the actual measurement?
4. Repeat the steps to measure other objects or models.

Check out the facilitation video at <http://bluewhalesfilm.com/videos>



Right Triangle Calculator

a in

b in

c (Hypotenuse) in

Calculate

Size Up! Extension Activities

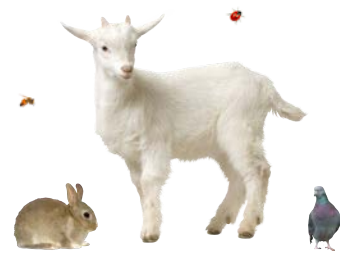


Go on a Whale Walk!

Use the AR app and walk the length of an entire blue whale. How many steps does it take you? How many steps does it take someone who has smaller or larger feet?

Size up with a local animal!

How big (or small) are the wildlife around you? Draw a local animal to scale. See how many can fit in a whale's tail or the length of a blue whale! What about you? Use the length of yarn for your arm span and find out how many of YOU can fit the size of a blue whale.



Small things are cool, too!!

Big animals, like blue whales, are neat to study, but small animals are just as fascinating. Go outside and explore tiny things with a magnifying lens or microscope.

Draw a life-size blue whale!

Go outside with some sidewalk chalk, and work as a team to draw an outline of a blue whale. How long does it take to walk around a blue whale?



How big is "big"? How small is "small"?

Sort different animals by size with young learners using picture cards. Which animals are big? Which animals are small? Can you put them in order from smallest to biggest?

Where can you fit a whale?

Take the 10 feet length of yarn to see where a whale's pectoral fin can fit in your space. What about the 80 feet of yarn - an entire blue whale?



Acknowledgements

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