

9-12 Dolphin Strandings Activity

Overview

Focus Question

Why do bottlenose dolphins strand? What can be done to protect bottlenose dolphins from stranding?

Activity Synopsis

The students will learn what it means when an animal strands. They will learn why bottlenose dolphins strand by analyzing stranding reports and they will identify natural and human-induced causes of strandings. They will also learn ways they can help protect bottlenose dolphins.

Time Frame

60 minutes

Objectives

The learner will be able to:

- Explain what happens when a bottlenose dolphin strands
- Identify causes of bottlenose dolphin strandings
- Determine if strandings are natural or human-induced
- Understand a dolphin stranding report
- Identify ways they can help protect dolphins

Key Terms

- Bottlenose dolphin
- Freeze brand
- Marine mammal
- Marine Mammal Protection Act
- Necropsy
- Red tide
- Rototag
- Sentinel species
- Sound pollution
- Stranding
- Toxins

Teacher Key Terms

- Biotoxin
- Decompression sickness
- Indicator species
- Mass stranding
- Soundscape
- South Carolina Marine Mammal Stranding Network
- Unusual Mortality Event (UME)

Standards

South Carolina College- and Career-Ready Science Standards 2021

Biology: B-LS2-1, B-LS2-2, **B-LS2-6, B-LS2-7**, B-LS2-8, **B-LS4-5, B-LS4-6**

* **Bold standards are the main standards addressed in this activity**

9-12 Dolphin Strandings Activity

Biology Performance Expectations

B-LS2-1 Use mathematical and/or computational representations to support explanations of biotic and abiotic factors that affect carrying capacity of ecosystems at different scales.

B-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

B-LS2-6 Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions but changing conditions may result in a new ecosystem.

B-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on biodiversity and ecosystem health.

B-LS2-8 Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.

B-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

B-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

Next Generation Science Standards (NGSS)

HS-LS2-2, HS-LS2-6, HS-LS2-7, HS-LS4-5

HS-ESS3-6

Cross Curricular Standards

South Carolina College and Career Standards for ELA

Inquiry (I) – 2.1

Writing (W) – 1.1, 2.1, 3.1

Communication (C) – 1.1, 1.2, 1.6, 3.2, 5.2, 5.3

Background

Key Points

Key Points will give you the main information you should know to teach the activity.

- **Marine mammals** are endothermic (warm blooded) vertebrate animals that give live birth, breath through lungs, have hair and feed young with milk.
- **Bottlenose dolphins** are the most common marine mammal off the east coast of the US and feed primarily on fish.
 - There are 2 species of bottlenose dolphins in SC. The larger Common bottlenose dolphin (*Tursiops truncatus*) is found offshore whereas the smaller Tamanend's bottlenose dolphin (*Tursiops erebennus*) is found inshore. For this activity we will just call them bottlenose dolphins.
- An animal **stranding** is when the animal swims or floats into shore and becomes stuck in shallow water.
- Many different marine mammal species can strand in South Carolina, but the majority of those that strand are dolphins.
- **Dolphins** become stranded for many different reasons. Some of the reasons are human-induced, such as boat strikes, and some are natural such as predator attacks.
- When a stranded marine mammal is found, the **South Carolina Marine Mammal Network** is called to come out to the scene.
- Data is taken at the site of a stranding and put into a dolphin stranding report
- When possible a **necropsy** is conducted on animals to determine the cause of stranding. These can occur on site or be conducted later in a laboratory setting.
- Marine mammals face many dangers including marine debris, entanglement, chemical pollutants, and human harassment
- All marine mammals are protected by the **Marine Mammal Protection Act**.
- Dolphins are an integral part of the ocean's food webs and they need to be protected around the world in order to save their populations.

9-12 Dolphin Strandings Activity

- The Charleston area bottlenose dolphin populations are perfect examples of a **sentinel species** showing us **toxin** levels specific to different areas in Charleston.

Detailed Information

Detailed Information gives more in-depth background to increase your knowledge, in case you want to expand the activity or you are asked detailed questions by students.

Marine mammals can be found in all of the world's oceans and in all types of water. They are vertebrates (have a backbone) with the following characteristics:

- Warm-blooded
- Breathe air
- Give live birth
- Nurse young with milk
- Have hair

What separates marine mammals from other mammals is that they live in or by the ocean.

Marine mammals are endothermic or warm-blooded. This means that their body temperature is kept at a constant temperature and not controlled by their environment. They are air breathers, using lungs to breathe. Some marine mammals have a blow hole/s, an adaptation that allows them to breathe more efficiently at the surface of the water. Marine mammals have internal fertilization, resulting in a baby through live birth that was nourished by a placenta while in the womb. Mother marine mammals will nurse their young and take care of them for up to a few years, depending on the species. All marine mammals live in the ocean with a few exceptions, such as the river dolphins. Some species, like the bottlenose dolphin, also have the ability to live in brackish water, where salt and fresh water mix. Some marine mammals like those within the order Carnivora have hair for their entire life, while others like order Cetacea may only have hair as a newborn that quickly falls out.

Marine mammals include animals from three orders: Cetacea, Carnivora, Sirenia. The order Cetacea, the whales, dolphins and porpoises, has about 89 living species. Order Carnivora is divided into many suborders, but only two contain marine mammals adding 35 species. Those are the Pinnipedia or 'flipper-footed,' including seals and sea lions, and the Fissipedia or 'paw/pad-footed' including polar bears and sea otters. The order Sirenia or 'sea cows' comprises two aquatic, herbivorous families, the Dugongs and Manatees, and there are just four living species. In South Carolina, the most common marine mammal is the bottlenose dolphin.

Bottlenose Dolphins (*Tursiops truncatus* & *Tursiops erebennus*)

The bottlenose dolphin is the most common dolphin species found off the east coast of the USA. The Common bottlenose dolphin (*Tursiops truncatus*) is found in tropical to temperate waters offshore around the world in the Pacific, Atlantic, and Indian Oceans. Since they have a global habitat and live off the coast, this species has been extensively studied. In 2023, the Tamanend's bottlenose dolphin (*Tursiops erebennus*) was recognized as a new species specific to the inshore waters of the east Atlantic ocean to the Gulf of Mexico. The Common bottlenose dolphin is large in size and darker in color compared to the Tamanend's bottlenose dolphin. For this activity we will refer both SC species as bottlenose dolphins.



Common bottlenose dolphin range (light blue) from Voices in the Sea

9-12 Dolphin Strandings Activity

Bottlenose dolphins use **echolocation** to locate their prey and use their sharp cone-shaped teeth to feed primarily on fish. They have been known to strand feed in South Carolina, a feeding method where they chase fish onto the beach and then carefully come onshore to grab the fish before sliding back into the water. This feeding method can be dangerous because of the possibility of getting stuck on land.

The bottlenose dolphin, specifically the population around Charleston, have been labeled **sentinel species** as they can raise an early alarm against biomagnified toxins found within the food web. A sentinel species is similar to an **indicator species** in that both provide warning signs regarding health. The difference between the two terms is that a sentinel species usually gives a warning regarding human health, whereas an indicator species helps researchers evaluate the health of an ecosystem.

Identifying Bottlenose Dolphins

Photo identification is when a high-quality photo is taken of an animal, and it is cataloged into a database. Photo ID is a noninvasive identification method for cetaceans. It started in the 1970s and has become an established way of identifying individual cetaceans by either photographing the animal's dorsal fin or fluke (tail) depending on the species. When photo-identifying a dolphin, each dorsal fin has a unique blend of markings, scars, notches, and other characteristics that make it easier to identify an individual. The [parts of a dorsal fin](#) are the leading edge, trailing edge, upper third, middle third and lower third.

Tagging dolphins with either a **freeze brand** or a **rototag** or radio tag is conducted during catch and release health assessments conducted in partnership with the National Oceanic and Atmospheric Administration. Freeze brands involve supercooling the numbers in liquid nitrogen before being applied to the skin for 20 sec. The three-digit code is applied to both sides of the dorsal fin. The first digit represents location, and odd numbers are females, and even numbers are males. A rototag is a temporary tag applied to the trailing edge of a dolphin's dorsal fin. The tags are generally shed within a year of tagging, leaving a small notch or hole.

Stranding Events in South Carolina

Marine mammals and sea turtles have been known to strand, which means they swim or float into shallow water and become stuck. A stranding can be just one individual, a mom and a calf, or a **mass stranding**. Mass strandings consist of two or more animals stranding at the same time in the same general area. In some cases, strandings are designated as an **Unusual Mortality Event (UME)**. To be considered a UME, the event must be unexpected (i.e., a different location, a different time scale, a different age or species of marine mammals), involve a significant die-off of a population, and demand an immediate response.

There are many different causes of marine mammal strandings. These causes can be both natural and human-induced. Some leading natural causes of marine mammals' strandings are shark attacks, stingray barb punctures, and **biotoxins**. The following are causes of human-induced marine mammal strandings: boat strikes, fishery entanglements, pollution (trash or chemical toxins), marine debris ingestion, and **sound pollution**.

On average, around 50 marine mammals strand every year in South Carolina. Of those 50, 80% are bottlenose dolphins. When a dolphin or other marine mammal is found on the beach, the **Marine Mammal Stranding Network** will be called in to assess the situation. If you ever find a stranded marine mammal, call the South Carolina Department of Natural Resources Wildlife Hotline 1-800-922-5431. When someone from the Marine Mammal Network arrives on the scene, they will fill out a stranding report. This data sheet is where all of the information about the marine mammal is documented. The important pieces of information to gather are marine mammal species, the approximate age, if it is tagged, and the extent of the injuries or conditions. It is also essential to document where the marine mammal stranded and the type of activity in the area. For instance, are a many people boating or fishing, was there only one animal or multiple animals?

It can be difficult with marine mammals to determine the cause of stranding just from an external evaluation. Conducting a **necropsy** and taking samples on a deceased animal can help the stranding network determine what caused the stranding. During the necropsy, scientists take samples of the blood, blubber, organs, and skeleton along with swabs of any injuries,

9-12 Dolphin Strandings Activity

the blowhole, and the mouth. These samples will be further examined in a laboratory setting. During the examination, they conduct a number of studies to look for any disease in the tissues or cells, any evidence of viral or bacterial infections or parasites, and sample for contaminants and toxins. Finally, the researchers will conduct life history and genetic studies on the animal. They will take cross-sections of the teeth to determine age, examine the reproductive system and stomach contents, and use skin samples to obtain DNA for genetic analysis.

In South Carolina, it is illegal to have cetaceans like whales and dolphins in human care. This makes it difficult to rescue and rehabilitate an animal that strands. In most cases, when marine mammals strand on our coast, they have already passed away. If it is a live stranding, do not push the animal back into the water. If stranded for a reason, and pushing it back in means it will strand shortly further down the beach. If it is alive and safe for you to do so, you can try to keep it wet and shaded from the sun by placing wet towels on it.

Primary Stranding Causes

There are many different reasons that a dolphin could strand, and the South Carolina Aquarium organizes them into 10 primary stranding causes. Once studied, it may be found that a dolphin has many additional problems, but these are the ten primary causes.

- 1) Disease
- 2) Fisheries Interaction – incidental
- 3) Entanglement – passive gear
- 4) Boat Strike
- 5) Predators
- 6) Sound Pollution
- 7) Pollution (trash, chemical toxins)
- 8) Biotoxins
- 9) Unknown
- 10) Other

1) Disease is the number one cause of strandings in South Carolina. Bottlenose dolphins are susceptible to many viral and bacterial diseases, including many that affect people. These pathogens can either be naturally found in the environment or caused by human influence. Often disease leads to lesions and wounds on the body as well as emaciation as the dolphin doesn't feel well enough to hunt.

2) Dolphins are sometimes caught by fishermen in South Carolina. This is one type of incidental fisheries interaction. It is highly illegal to catch a marine mammal because they are federally protected animals. Most often, dolphins and marine mammals are caught as bycatch in gill net, shrimp net, and trawl net fisheries. If a dolphin does not escape, it could drown, so keeping close watch is important. It is estimated that have a million marine mammals are caught as bycatch in various fisheries each year.

3) Dolphins can get entangled in passive gear. Passive gear is any fishery item that is loose in the water and not monitored by a person. Examples are abandoned crab pots, fishing line that has been cut and is floating through the water, or old rope in the water. All marine animals are susceptible to entanglements. Once entangled, an animal's movement to escape will usually make the situation worse.

4) Boat strikes are a common cause of strandings. Dolphins are air breathers, so they can sometimes get struck by a boat or boat propeller as they surface to breathe. Boat strikes are also more likely if humans have fed dolphins as they associate the boat with food. Boat strikes are more numerous in the summer due to more people enjoying the water.

5) Dolphins can also succumb to predator attacks. Sharks or stingrays could inflict these attacks. Even as calves, dolphins are large, but can still be preyed upon by large sharks. Stingrays have been known to use their barb on dolphins. This may occur if a dolphin tries to eat a stingray.

9-12 Dolphin Strandings Activity

6) Sound Pollution is a growing concern for marine mammals as human activity in the ocean increases. The ocean is noisy and has a natural **soundscape** that marine mammals are accustomed to living in. Human or anthropogenic sounds from shipping, seismic surveying, and sonar are increasing in the ocean. These sounds can impact how marine mammals navigate their environment. Scientists have observed changes in swimming and diving behavior leading to **decompression sickness**. Decompression sickness occurs when an animal experiences a change in pressure too quickly. If a marine mammal comes up from a deep dive too quickly, the nitrogen dissolved in the blood and tissues can form bubbles that migrate to different parts of the body and block blood vessels. This migration can lead to pain, nausea, and paralysis.

7) Pollution such as oil spills or toxins from manufacturing runoff can make marine mammals sick, and this causes them to strand. If it is a surface pollutant, marine mammals interact with it when they come up to breathe. Other pollutants harm dolphins as they accumulate in their prey items. Meaning marine mammals get exposed to all the toxins in their prey, as well as their prey's prey. Marine mammals can also become strand from ingesting marine debris. They will eat trash that resembles their prey, causing them to starve.

8) Biotoxins are naturally occurring toxins created by dinoflagellates, diatoms, and other marine algae. Commonly found biotoxins include the neurotoxins domoic acid, brevetoxin, and saxitoxin. Brevetoxin, which is caused by the algae found in **red tides**, can affect the neurologic systems and cause respiratory problems leading to strandings.

9) A dolphin can sometimes be found with no apparent injury at first glance. In cases like this, the necropsy and additional specimen testing will help determine the cause of stranding.

10) Dolphin strandings listed as "other" can include many different problems and issues, but none common enough to put in its own category. Examples are cancer, unusual weather or oceanographic events, parasites, freshwater lesions, cetacean morbillivirus, and starvation.

Conservation

Bottlenose dolphins, just like all living things, have their place in the ocean ecosystem. Without a balance of animal populations through food chains, communities and ecosystems could become unbalanced. People worldwide rely on the ocean for food, oxygen, the earth's climate and medicines.

About 16% of the world's food comes from the ocean. This might not seem like a large percentage, but it equals about 200 billion pounds each year. It is thought that ocean phytoplankton produces about 90% of the world's oxygen. This is important because all living things need oxygen to breathe. The ocean also plays a huge role in the climate of the earth. The ocean collects and mixes carbon dioxide, heat and water which in turn will control the climate patterns around the world. Researchers are always discovering more about the living things in the ocean. New marine discoveries could lead to medical breakthroughs in cures for diseases and medicines. Many efforts are being done to protect marine mammals around the world.

Protecting dolphins and other marine mammals must include the protection of the waterways as well as the ocean. Marine mammals are federally protected by the **Marine Mammal Protection Act** that was passed in 1972. This act prohibits the take of marine mammals in U.S. Waters, as well as prohibits U.S. citizens from taking marine mammals outside of U.S. waters, or importing marine mammals or marine mammal products. In South Carolina, there is an additional law that prevents the display of wild-caught or captive-bred cetaceans.

Another way to help dolphins is to become dolphin SMART. This is a partnership developed by NOAA's office of National Marine Sanctuaries and National Marine Fisheries Service, the Whale and Dolphin Conservation, and the Dolphin Project. Their goal is to limit dolphin harassment and promote responsible stewardship.

- S: Stay back 50 yards from dolphins
- M: Move away cautiously if dolphins show signs of disturbance
- A: Always put your engine in neutral when dolphins are near
- R: Refrain from feeding, touching, or swimming with wild dolphins
- T: Teach others to be dolphin smart

9-12 Dolphin Strandings Activity

Procedure

Materials

- [Intro Presentation](#)
- [Dolphin Stranding Reports](#) (laminated is best)
- [Dolphin Stranding Reports Answer Key](#)
- Vis-à-vis markers (or markers if not laminated)

Procedure

1. Ask the students what it means when an animal strands. Can they remember hearing about strandings in the news? What kind of animals strand?
2. Start [Intro Presentation](#) by showing stranding pictures. Why do they think animals strand? Is it a normal behavior or abnormal behavior?
3. Explain to the students that marine mammals strand because something has happened to them. Briefly review the types of marine mammals we see in South Carolina on the presentation. Emphasize with the students that bottlenose dolphins are the most common marine mammal in South Carolina.
4. Ask them to brainstorm reasons why marine mammals and specifically dolphins might strand. Do you think they strand due to natural causes, human-induced causes, or both? Go through the primary reasons dolphins strand from the presentation.
5. Inform the students that they are going to be analyzing stranding reports to determine why dolphins stranded.
6. Have students get in pairs. Pass out all 6 stranding reports and ask them to analyze each report to determine why the dolphin stranded. At the top of the report, they should put the reason for stranding and if it was human-induced or a natural cause. Inform them to circle “clues” in the stranding report that led them to their final decision. *Note: You may want to put the Primary Strandings Causes slide from the Intro Presentation up on the screen for them to reference.*
7. When the students are finished, go over the correct answers for each stranding case using the answer key. Ask the students to look at the stranded reports for the dolphins that stranded for human-induced reasons. Could these strandings have been prevented? Is there anything they can do to minimize human impacts on dolphins?

Follow-up Questions

- How can people help reduce the number of dolphin strandings?
- Would you want to work in the field of animal rescue?
- What type of schooling do you think you would need for a career in animal rescue?

At-home Learning and Virtual Modifications

At-home Learning: Have students explore marine mammal strandings using this Wakelet: <https://wke.lt/w/s/l-N8he>

Wakelet contains the marine mammal stranding powerpoint, links to additional resources, and the stranding reports and worksheet for them to complete. Have students send you their completed worksheet after going through the material.

9-12 Dolphin Strandings Activity

Virtual: Use the following nearpod information to choose how to teach this activity. Activity will cover the major reasons that dolphins strand and allow them to look at stranding reports to determine how the animal stranded. We have recorded narration on this nearpod which you can access by selecting play on each slide, if you are teaching through a live platform you can bypass this and narrate as you see fit.

[Teacher led lesson without student interaction](#)

Teacher led lesson with student interaction - directions

1. Create a free nearpod account (<https://nearpod.com/>)
2. Ask Aquarium to send you Dolphin Strandings nearpod link (email education@scaquarium.org)
3. After you receive Aquarium link, add lesson to your nearpod activities by clicking "Add to My Library"
4. Send to students using Live Participation
5. You'll be able to see their answers and interactions

Assessment

Give students the [Dolphin Stranding Assessment Worksheet](#) and have them describe why they strand, what causes dolphin strandings, if a strand is a natural or human-induced and how people can help prevent dolphin strandings.

Scoring rubric out of 100 points

[Dolphin Stranding Assessment Worksheet Answer Key](#)

Each question is worth 10 points: 10 questions totaling 100 points.

Cross-Curricular Extensions

STEM Extension

Design some sort of device that would help a dolphin and keep them from possible stranding. It could help them in anyway (reproductive success, pollution removal from the ocean, etc.). Students should research all the dangers dolphins face and then come up with some sort of device that would help them. Students should share their designs with the class and then modify them per suggestions.

STEM Extension

Design a device that would help muffle human caused ocean noise. Students should research what causes sound pollution in the ocean and the devise a device to help. Students should share their designs with the class and then modify them per suggestions. Have students test their devices to see if they work.

Social Studies

Have students research laws that protect endangered and threatened animals and report on how the laws have changed over time.

Resources

Teacher and Student Reference Books

Gubbins, Cara M. *The Dolphins of Hilton Head: Their Natural History*. University of South Carolina Press, Columbia, SC, 2002.

Jefferson, Thomas A., Marc A. Webber, Robert L. Pitman and Uko Gorter. *Marine Mammals of the World: A Comprehensive Guide to Their Identification*. Academic Press, Amsterdam, 2015.

Leatherwood, Stephen and Randall R. Reeves. *The Bottlenose Dolphin*. Academic Press, San Diego, CA, 1990.

9-12 Dolphin Strandings Activity

Mann, Janet, Richard C. Connor, Peter L. Tyack, and Hal Whitehead. *Cetacean Societies: Field Studies of Dolphins and Whales*. University of Chicago Press. Chicago, IL, 2000.

Pearce, Agustin G. and Lucia M. Correa. *Dolphins: Anatomy, Behavior, and Threats*. Nova Science Publishers, Inc., Hauppauge, NY, 2010.

Pryor, Karen and Kenneth S. Norris. *Dolphin Societies: Discoveries and Puzzles*. University of California Press, Berkeley, CA, 1998.

Reynolds III, John E., Randall S. Wells and Samantha D. Eide. *The Bottlenose Dolphin: Biology and Conservation*. University Press of Florida, Gainesville, FL, 2000.

Reynolds III, John E. and Sentiell A. Rommel. *Biology of Marine mammals*. Smithsonian Institution, Washington, D.C., 1999.

Ridgway, Sam H. and Richard Harrison. *Handbook of Marine Mammals, Vol. 6, the Second Book of Dolphins and Porpoises*. Academic Press. San Diego, CA, 1999.

Samuels, Joshua B. *Dolphins: Ecology, Behavior, and Conservation Strategies*. Nova Science Publishers, Inc., Hauppauge, NY, 2014.

Teacher and Student Reference Websites

Dolphin Research Center

<https://dolphins.org/>

Information on dolphins.

NOAA Fisheries

<https://www.fisheries.noaa.gov/species/common-bottlenose-dolphin>

Information on the common bottlenose dolphin.

South Carolina Marine Mammal Stranding Network

<http://bccmws.coastal.edu/stranding/>

Information on marine mammal strandings in South Carolina

National Oceanographic and Atmospheric Administration

<https://cetsound.noaa.gov/>

Information on cetaceans and sounds

Worldatlas

<https://www.worldatlas.com/articles/what-is-a-sentinel-species.html>

Information on sentinel species.

Charleston Magazine

https://charlestonmag.com/features/meet_the_locals

Articles on local dolphins in Charleston, SC

Online Curricula

Dolphin Research Center

https://dolphins.org/groups_curriculum

9-12 Dolphin Strandings Activity

Project Aquatic WILD

<https://www.fishwildlife.org/projectwild/aquatic-wild/activity-resources-aw>

Wild Animal Watch: Dolphins Teacher's Guide

<https://www.scholastic.com/teachers/lesson-plans/teaching-content/wild-animal-watch-dolphins-teachers-guide/>

Videos

Wildlife Survivors: A Tale of Two Turtles/Dolphins in Danger

National Geographic: Dolphins Even Smarter Than You Thought

<https://video.nationalgeographic.com/video/0000014c-1541-d376-a97f-d569098a0000>

Nature: Whales & Dolphins