

Marine Mammals

GRADE LEVEL: 6 - 8

TEACHING TIME: 1 HOUR

From dolphins to polar bears, marine mammals make up some of the most popular and well-known sea animals, but marine mammal diversity stretches far beyond the group's more familiar faces. Learn what characteristics make a mammal and discuss what defines a marine mammal.

Explore marine mammal diversity and introduce yourself to the four main types of marine mammals. Compare and contrast different species and see how marine mammals relate to humans!

This lesson is part of the NESS Tacklebox. This document was created by the education staff at New England Science and Sailing Foundation (NESS) using supplemental resources from the National Oceanic and Atmospheric Administration (NOAA) and financial support from a NOAA B-WET grant. Designed for students within an alternative setting, these activities were tested by NESS B-WET Teacher Cohort, tasked with investigating best practices of teaching experiential learning in alternative schools. We encourage you to learn from and adapt these activities to best fit the needs of your students.

STANDARDS ADDRESSED

NEXT GENERATION SCIENCE STANDARDS

- **MS-LS1-5** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
- **MS-LS4-1** Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
- **MS-LS1-4** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

OCEAN LITERACY PRINCIPLES

Principle #5: The ocean supports a great diversity of life and ecosystems

- **A.18.** Humans have changed environmental conditions in the ocean, which has had a generally negative impact on organisms adapted to the previous conditions.
- **A.19.** Changes to the climate will cause further changes to environmental conditions, which will likely have major impacts on many different ocean organisms.
- **B.5.** Organisms in the ocean exhibit an amazing variety of adaptations to sound, density, pressure, patchy food distribution, and other environmental factors.

- **B.9.** Many marine animals, from shrimp to whales, rely on sound to communicate, find prey and mates, and sense their environments. Sound travels through the ocean much better than light does.

CASEL SOCIAL-EMOTIONAL LEARNING STANDARDS

Relationship Skills: The abilities to establish and maintain healthy and supportive relationships and to effectively navigate settings with diverse individuals and groups Setting personal and collective goals

- Communicating effectively

Responsible Decision-Making: The abilities to make caring and constructive choices about personal behavior and social interactions across diverse situations.

- Demonstrating curiosity and open-mindedness
- Learning how to make a reasoned judgment after analyzing information, data, and facts

Self-Awareness: The abilities to understand one's own emotions, thoughts, and values and how they influence behavior across contexts.

- Having a growth mindset

PROGRAM SUMMARY

ESSENTIAL QUESTION

A question is essential when it: *Questions that probe for deeper meaning and set the stage for further questioning, ones that foster the development of critical thinking skills and higher order capabilities such as problem-solving and understanding complex systems.*

What are the defining characteristics of marine mammals? How do marine mammal species differ from one another?

ESSENTIAL LEARNING TARGETS

Educator Objectives

Students will be able to....

- **Define** a marine mammal.
- **Compare** and **contrast** similar species of marine mammals.
- **Identify** the four main marine mammal groupings and adaptations of each animal.
- **Visualize** how blubber acts as an insulator for marine mammals.

Student Objectives

I can...

- **Describe** a marine mammal.
- **Identify** species of marine mammals.
- **Recognize** key characteristics of different marine mammals.
- **Experiment** with insulators to **investigate** thermodynamics.

BACKGROUND INFORMATION

KEY CONCEPTS

There are several defining characteristics of a mammal. All must be met to be considered a mammal.

- Give birth to live young
- Hair/fur
- Females produce milk to nurse young (mammary gland)
- Warm-blooded
- Need to breathe air through lungs

Marine mammals are classified into 4 main groups:

- Pinnipeds (seals, sea lions, walruses)
- Cetaceans (whales, dolphins, porpoises)
- Fissipeds (sea otters, polar bears)
- Sirenians (manatees, dugongs)

Marine mammals have adapted to live in extreme environmental conditions. All species, except the sea otter, have a thick layer of blubber that is used for thermoregulation, as many marine mammals live in cold habitats and/or dive to deep depths.

KEY WORDS

Marine Mammal: a mammal that relies on the ocean for survival, either to hunt or to live

Warm-blooded: organisms that can maintain a constant body temperature, not dependent on the environment

Characteristic: defining features of an organism

Adaptation: a change or the process of change by which an organism or species becomes better suited to its environment

Dichotomous Key: a scientific tool used to identify unknown organisms to the observer using external observations

MATERIALS

INTRODUCTION	ACTIVITY 1	ACTIVITY 2	ACTIVITY 3
<ul style="list-style-type: none"> ○ Marine Mammal Examples ○ Marine Mammal Evolution slides 	<ul style="list-style-type: none"> ○ Mammal classification labels ○ Dichotomous Key ○ Cetaceans Examples 	<ul style="list-style-type: none"> ○ Marine Mammal Examples ○ Audio from Discovery of Sound in the Sea 	<ul style="list-style-type: none"> ○ Crisco ○ Packing peanuts ○ Sand ○ Fake Fur ○ Duct Tape ○ Plastic Bags ○ Ice ○ Water ○ Thermometers ○ Towels ○ Datasheet

INTRODUCTION

EDUCATOR PREPARATION

Print-outs or projections of the [Marine Mammal Examples](#) and [Marine Mammal Evolutionary slides](#).

TASK

EDUCATOR ACTIONS	STUDENT ACTIONS
<p>Introduce the activity topic and record "Marine Mammals" on the board.</p> <p>Pass out marine mammal examples to students and facilitate student discussion as they share similarities between their organisms. Record student responses on the board.</p> <p>Ask students to identify which characteristics of mammals are present. Circle these in different colors on the board.</p> <p>Draw connections to student responses and clarify that marine mammals must have the following attributes to be considered marine mammals.</p> <ul style="list-style-type: none"> • Give birth to live young • Possess hair/fur • Females produce milk to nurse young (mammary gland) • Warm-blooded • Need to breathe air through lungs 	<p>Gain context to the upcoming activity theme.</p> <p>Draw connections between marine mammals and share observations as a group.</p> <p>Identify similarities and differences between mammal adaptations and marine mammal adaptations.</p> <p>Review characteristics of mammals.</p>

<p>Facilitate discussion on the environmental pressures a marine environment brings to mammals. Ask students to identify the adaptations their marine mammal has to survive in a marine environment.</p> <p>Expand the discussion and project Marine Mammal Evolution slides on the board. You can print out Figure 1 if you are unable to present.</p> <p>Starting with the first animal, ask students to identify the characteristics and adaptations they see. Encourage them to make a hypothesis about which modern marine mammal it will evolve into.</p> <p>Continue facilitating discussion as you move up from the bottom of the tree.</p> <p>Draw connections from responses along the evolutionary tree to the definition of marine mammals.</p>	<p>Analyze the external anatomy and activate prior knowledge as they identify adaptations of marine mammals.</p> <p>Observe the evolution of whales and draw connections from environmental pressures to marine mammal adaptations.</p>
---	---

DIFFERENTIATION

Students can place their mammals on the board and **identify** similarities on the whiteboard to visually represent their discussion.

Use the 360-degree view [dive with sea lions](#) to engage students during the introduction. Pause the video at times to have students identify the external anatomy of the sea lions and how it supports their survival.

ACTIVITY 1

Marine Mammal Identification

EDUCATOR PREPARATION

Print out [mammal classification labels](#), [dichotomous keys](#), and [example cards](#). Organize classroom space for round-table discussion or pods for group brainstorming.

TASK

EDUCATOR ACTIONS	STUDENT ACTIONS
<p>Explain to students that they will investigate the taxonomic groups of marine mammals, and then they will practice using a marine mammal dichotomous key to identify a mysterious marine mammal.</p> <p>Pass out marine mammal examples from earlier. Place marine mammal classification labels on the board.</p> <p>Explain that there are four major ways to group marine</p>	<p>Listen actively to differentiate the four groupings of marine mammals.</p>

mammals. **Recalling** the discussion from the introduction, we will sort the marine mammal examples into the four classifications.

- **Cetaceans**
- **Pinnipeds**
- **Fissipeds**
- **Sirenians**

Introduce each definition to their label. **Facilitate** time for students to brainstorm and hypothesize where their mammals belong and sort accordingly.

Review the results together, walking through each group at a time. **Ask** questions that provoke deeper thinking when in review and **provide** opportunities for students to adjust categories as you move through the review.

Inform students that they will model how to use a scientific tool to identify marine mammals: **a dichotomous key!**

Explain that a [dichotomous key](#) uses scientists' physical observations to narrow down options of the organism's species. This tool is helpful when identifying organisms that one might not be familiar with.

Ask for an example of a terrestrial animal from the group. **Challenge** students to tell you *why* and *how* they can identify the animal. What physical attributes do they use to identify it?

Explain that when using the dichotomous keys, we will use physical attributes to help identify an unknown cetacean.

Pass out [unlabeled cetaceans examples](#).

Demonstrate how to use a dichotomous key with an example. **Ask** students questions along the way to complete the example together. **Challenge** students to think about the physical attributes they use to identify the animal.

Note that: Baleen whales will have a small icon identifying that they have baleen

Distribute dichotomous keys to each group and **facilitate** investigation among groups. **Provide** time to switch organisms for further investigation.

Hypothesize how to sort the marine mammal examples.

Collaborate as a class, **identifying** adaptations that support their hypothesis.

Draw connections between adaptations and marine mammal classification.

Understand the purpose of a dichotomous key.

Provide an example of an animal they can easily identify.

Describe that they can identify the animal using only external, observable traits.

Observe cetacean examples and **practice** using the dichotomous key to identify the organism.

Collaborate in teams to agree upon identifications.

ACTIVITY 2

Sound Under the Sea

EDUCATOR PREPARATION

Print-outs or projections of the [Marine Mammal Examples](#) (remove the sea otter, polar bear, elephant seal, harp seal) and access to play audio from [Discovery of Sound in the Sea](#).

TASK

EDUCATOR ACTIONS	STUDENT ACTIONS
<p>Ask students to hold up their marine mammals around the room.</p> <p>Ask students, “What are the challenges of communication in the ocean for a marine mammal?”</p> <p>Ask students to brainstorm why marine animals use sound to survive.</p> <ul style="list-style-type: none"> • Communicate • Protect themselves • Locate food • Navigate underwater • Learn about their environment <p>Inform change in rate, pitch, and structure differentiate communication that can travel long distances. Challenge students to work together and identify the marine mammal that belongs to each sound.</p> <p>As you play the following sounds, encourage students to identify rate, pitch, and structure changes.</p> <p>Sound Bytes:</p> <ul style="list-style-type: none"> • Harbor Seal • Leopard Seal • Sea Lion • Walrus • Humpback Whale • Blue Whale • Sperm Whale • Beluga Whale • Bottlenose Dolphin • Spinner Dolphin • Narwhal • Manatee <p>Review with students their favorite sound and why. Ask students how humans might impact these noises.</p>	<p>Show the class examples of marine mammals to review.</p> <p>Brainstorm environmental challenges of communicating in the ocean.</p> <p>Brainstorm needs for sound in the ocean with marine mammals.</p> <p>Identify the different types of sound in communication methods.</p> <p>Collaborate as a group and hypothesize which marine mammal created the sounds played.</p>

<p>Introduce “anthropogenic impacts” (human impacts) as a new term on the board. Ask students what types of activity this could include. Play a few sound bytes for examples of Anthropogenic Sounds compared to Natural Sounds.</p> <ul style="list-style-type: none"> • Dredging • Explosive testing • Outboard motors • Cargo ship motors • Sonar • Tidal Turbines <p>Ask students what impacts they think might happen if there is too much sound disturbance.</p> <p>Connect student responses and expand that scientists discovered that man-made sounds impact behavior, the ability to understand the environment (masking), hearing loss, and strandings (dosits.org).</p> <p>Encourage students that federal laws such as the Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA), and the National Environmental Policy Act (NEPA) all share a common goal to minimize the impact of man-made sound on marine mammals. Scientists are working hard to provide data to decision-makers. The first steps to all of this are investigation and exploration! Activities that you are doing today!</p>	<p>Brainstorm and share ideas on human impacts on marine mammal sounds.</p> <p>Listen actively for differences between natural and man-made sound.</p> <p>Identify and explain differences in rate, pitch, and structure.</p> <p>Brainstorm the impacts that anthropogenic sounds might have on marine mammals.</p> <p>Draw connections to real-world impacts, and understand the importance of investigation and being curious learners.</p>
---	---

ACTIVITY 3 Blubber Glove Experiment

EDUCATOR PREPARATION

Print out [Blubber Glove Datasheets](#) per group.

To design the “glove”, students will fill a plastic bag with a chosen insulator. After filling a bag, you will take an additional plastic bag, and place it inside the other, meeting the seal together on the top. This will create a cavity for the students’ hands or thermometers to fit in. To make it waterproof, it is best to seal the tops with an additional layer of duct tape.

TASK

EDUCATOR ACTIONS	STUDENT ACTIONS
Explain to students blubber is important for most marine mammals, such as whales and seals. It is the thick layer of fat that provides insulation from cold ocean	Connect blubber adaptations to the activity.

temperatures. Blubber is also important because it stores energy that can be broken down to provide energy when food is unavailable.

Explain to students that they will be doing an experiment to see how effective blubber is at keeping them warm. They will first make a hypothesis of which type of insulator will best protect them from the cold and why.

Provide the following (or more!) for students to investigate: sand, Crisco, feathers, polyfill, fur, trapped air, etc.

Ask students to connect each item to the adaptation an animal might have to stay warm.

- Sand (burrowing)
- Crisco (blubber)
- Feathers (down on birds)
- Polyfill (man-made impacts)
- Fur (winter coats)
- Trapped air (animals can fluff up their fur and feathers to trap a layer of air to keep them insulated)

Facilitate testing. **Demonstrate** how to measure water temperature and temperature in the gloves. Students can keep their hand inside the glove or hold the thermometer from the top. **Remind** students that they will be identifying the change in temperature, so the method must be the same for all trials.

Facilitate students' reflection with the following prompts:

- Which insulator had the largest change in temperature from the water to the glove?
- What animal could use this adaptation?
- What limitations does this experiment have when modeling marine mammal adaptations?
- What questions does this leave your group with for future investigation?

Brainstorm how the provided items are metaphors for adaptations that keep animals warm.

Hypothesize the ideal insulator and **design** blubber gloves.

Test and **record** data along the way.

Collaborate in teams to gather information.

Analyze results and **identify** the "best" insulator.

Communicate with teammates to think critically about connections to animals and future questions.

DIFFERENTIATION

For shorter time periods, you can record qualitative data instead. **Facilitate** safe testing with students placing their hands in the ice water and gloves to feel the physical difference in temperature.

WRAP UP
Environmental Action Project

TASK

EDUCATOR ACTIONS	STUDENT ACTIONS
<p>Reflecting on student investigations and discussions, facilitate a brainstorming activity to design an environmental action project.</p> <p>Prompt students to think deeper about some of the following discussion points:</p> <ul style="list-style-type: none"> • Which marine mammal was your favorite and why? • What surprised you about these activities? • How does this make you feel? • What would you like others to know that might not understand the importance and uniqueness of marine mammals? <p>Connecting their responses, record them on a brainstorming document.</p> <p>Provide opportunities for students to learn more and share with their peers. Encourage them to take the lead, and let your students' creativity shine!</p>	<p>Review and reflect on the activities using the discussion prompts.</p> <p>Connect with an animal and explain its unique attributes.</p> <p>Identify how humans are impacting the marine environments and their selected animals.</p> <p>Identify and design projects to spread awareness. This could take the form of:</p> <ul style="list-style-type: none"> • Advocacy posters • Art competitions • Initiatives to minimize plastic waste • Research presentations on a specific marine mammal

EXTENSION ACTIVITIES

For further support in facilitating Meaningful Watershed Education Experiences (MWEEs) with your students, use the [MWEE Educator Guide](#). This will provide a detailed framework for you to create an engaging, multi-step Environmental Action Project (EAP) with your students throughout the year. Use NESS B-WET lessons to support EAP development in the investigation phase!

RESOURCES

Ocean Mammals

<https://oceananimals.org/ocean-mammals/>

(last accessed 4/9/2024)

Explore the Blue: 360 Sea Lion Encounter (NMS)

<https://sanctuaries.noaa.gov/vr/channel-islands/sea-lion-encouter/>

(last accessed 4/9/2024)

Discovery of Sound in the Sea:

<https://dosits.org/>

(last accessed 4/9/2024)

NOAA B-WET MWEE Educator Guide

<https://www.noaa.gov/sites/default/files/2022-09/MWEE-Guide.pdf>

(last accessed 4/9/24)

Marine Mammal Graphics (Example Cards)

NOAA Fisheries Directory

<https://www.fisheries.noaa.gov/species-directory/marine-mammals>

(last accessed 4/9/24)

Center for Coastal Studies

<https://coastalstudies.org/connect-learn/stellwagen-bank-national-marine-sanctuary/marine-mammals/cetaceans/baleen-whales/>

(last accessed 4/9/24)