

Tide Pools 1-2



Teacher's Guide

Topic: Tidepools

Grade level: 1-2

Aligned Standards

Next Generation Science Standards (NGSS):

Performance Expectations:

1-LS-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

NGSS Science and Engineering Practices:

Obtaining, evaluating, and communicating information

NGSS Cross-Cutting Concept:

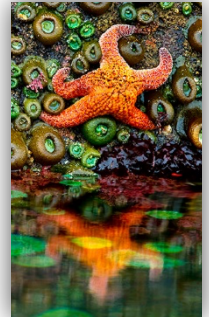
Structure and function

Ocean Literacy Principles:

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

d. Ocean biology provides many examples of life cycles, adaptations, and relationships among organisms that do not occur on land.

Program overview: How do tidepool animals thrive in Oregon's wild waves? Discover how through a hands-on investigation of these creatures and their amazing survival features!



Activity at a glance

Students will investigate how animals that live in tidepools hold on during the crashing waves.

Objectives

Students will be able to:

- Communicate how waves affect tidepool habitats.
- Describe how tidepool animals grip in a rocky shore environment with waves.
- Express excitement and appreciation for tidepool animals

Skills

Students will gain expertise in:

- Identifying specific adaptations and how they are used for survival
- Critical observation of natural phenomena and organisms
- Understanding how natural phenomena such as waves impact living things
- Proper techniques for interacting with live tidepool animals

Program features:

- Facilitated educational experience in our Classroom
- Opportunity to interact with live animals
- Time for self-guided exploration of the Aquarium

Extension activities Use to facilitate further discovery before, during, or after your field trip to Oregon Coast Aquarium.

In the Classroom

- After your field trip, conduct the provided Post Visit Activity with your students
- Dishpan Tidepool Lesson: <https://www.montereybayaquarium.org/for-educators/teacher-professional-development/curriculum/dishpan-tide-pool>
- Surveying mussel abundance activity- page 7: <https://www.boem.gov/sites/default/files/boem-education/Tidepool-Math-K8.pdf>
- Compare Tide Pools: How do the inhabitants and conditions of tide pools in the PNW compare to tide pools in other areas of the world?
- Make Your Own Tidepool Field Guide:
 - If done before a tidepool visit: Assign each student a common local tide pool organism to research, and write some interesting facts about each one. Gather each student’s organism and create a classroom field and print out a copy for each student to bring to the tidepools.
 - If done after a tidepool visit: students photograph and/or draw organisms that they find in the tidepools and then later research those organisms, writing down interesting facts about each. Each student produces a small tidepool field guide using their photographs and research.

At Oregon Coast Aquarium

- Have students complete the included Investigation Worksheet (page 3) to observe a rocky shore animal in our wave crash pool, describe its habitat, and create a sketch.
- Observe and discuss how other tidepool organisms present in the wave crash pool are holding on. You may also check the touch pool near the entrance to Passages of the Deep. Point out the sea stars and let students know that they are in the same group as one of the organisms that they met today (sea urchins). They grip in the same way – see if the students can figure it out...sea stars are also echinoderms and grip with tube feet.)
- Have students look at adaptations on animals in habitats that are very different from rocky shore life. (ex. Flatfish in Halibut Flats and/or jellies in coastal waters.)

Get Outside

- The Central Oregon Coast has a number of great tidepooling sites. Near Oregon Coast Aquarium, check out [Seal Rock State Recreation Area](#) or [Yaquina Head Outstanding Natural Area](#). Both sites have restrooms and picnic facilities. Yaquina Head also has an Interpretive Center, a great indoor alternative for poor weather.
 - Experiment that could be adapted for tide pools along our coast:
<http://www.parks.ca.gov/pages/735/files/tidepoolguide04lessons.pdf>
 - Hot Stuff! Tide Pool Temperatures Activity p. 20 – 23
 - Guide to exploring Oregon Tidepools:
[https://pacname.org/archive/OCEP/module_1/resources/Guided Tidepool Inquiry-updated.pdf](https://pacname.org/archive/OCEP/module_1/resources/Guided_Tidepool_Inquiry-updated.pdf)
 - Oregon Tidepool Brochure:
https://pacname.org/archive/OCEP/module_1/resources/tidepoolbrochure.pdf

Background Information on program topic:

Organisms have developed adaptations that enable them to survive in their living conditions and to feed, escape predators and reproduce. These adaptations include shape, size, coloration, defensive behaviors, breeding and feeding habits. Like organisms in other habitats, rocky intertidal organisms rely on a combination of adaptations to insure their survival. For example, a snail's muscular foot helps them to hold on tightly in heavily surging currents, move securely along the rocks or sand. Some snails will also grab food with their foot.

Zonation in the intertidal zone: Tidepool Organisms Have Limited Habitat Ranges. Usually the upper limit of an organism's habitat is determined by the amount of time it is able to withstand being out of the water and subject to desiccation (drying out) as well as the sun's ultraviolet rays. An organism's lower limit is set by biological controls (predation and competition). For example, if sea stars (The main predator of blue mussels) were experimentally excluded from a tide pool, the mussels would extend their range downwards but not upwards.

Rocky Intertidal Zones:

Spray zone

- The area just beyond the highest high tide
- Kept wet by salt water spray
- Flooded with water during storms
- Inhabitants include barnacles, snails and limpets

High tide zone

- Uncovered most of the time, except at high tide

- Hit by crashing waves at high tide
- Inhabitants include barnacles, snails, limpets, shore crabs and clingfishes
- Seaweeds include rockweed and sea moss

Middle tide zone

- Exposed to air twice a day during low tides
- Crashing waves occur as tide comes back in
- Inhabitants include mussels, snails, limpets, ochre sea stars, hermit crabs, gooseneck (leaf) barnacles, chitons, anemones, sponges, tube worms, ribbon worms, porcelain crabs, red rock crabs and sculpins (a small fish)
- Seaweeds include surf grass, sea palm, coralline algae

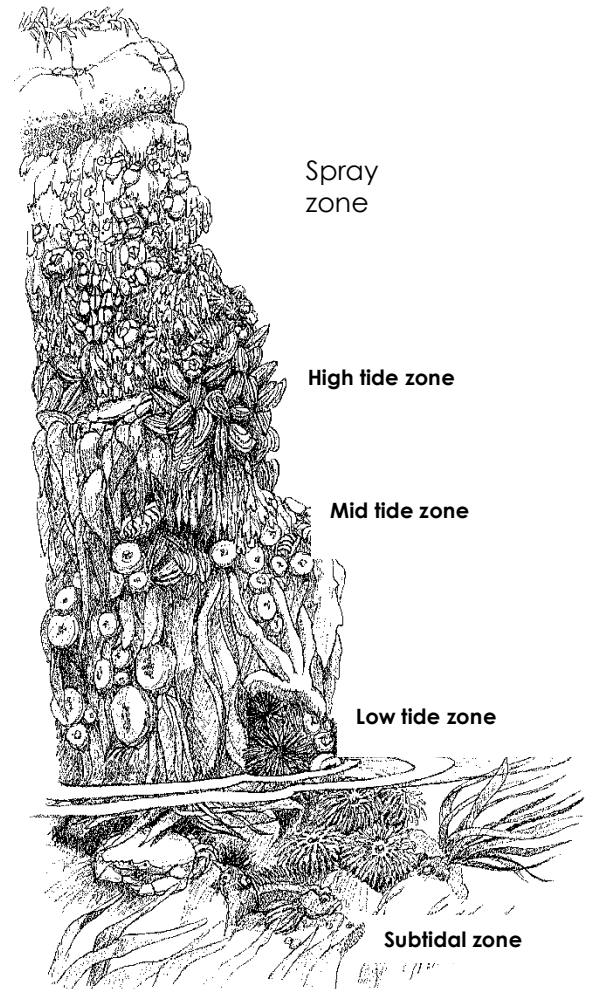
Low tide zone

- Occasionally exposed to air during low tides
- Covered by water most of the time
- Crashing waves as the tide comes back in
- Close to the edge of the water, even when uncovered

Subtidal zone

- Always submerged

Organisms found in this habitat are among the toughest in the survival business. This is because the conditions of their habitat change throughout the day.



Additional resources:

- Common inhabitants of the PNW intertidal zones

https://www.stewardscr.org/pdf/Tidepool_Docent_Manual.pdf

- Monterey Bay National Marine Sanctuary: [Tide Pool Species and Adaptations](#)

<https://montereybay.noaa.gov/visitor/TidePool/species.html>

- Oregon Coast Aquarium: [Rocky Shores](#)

- NOAA Ocean Explorer: [Virtual Tide Pool](#)

<https://oceanexplorer.noaa.gov/edu/learning/player/>

- Lesson 10-Tides – students can do a virtual tidepool exploration

- PBS American Field Guide Teacher Resource packet The Intertidal Zone

http://www.cosee.net/cosee-west/Dec2012/Activities%20and%20lessons/MS_intertidal_ecology_PBS.pdf
http://www.coseeca.net/files/coseeca/cosia_tide_pool_survival.pdf



Name: _____

Aquarium Animal Investigation

Choose an animal in the Wave Crash pool in the rockwork just outside of the Octopus cave.
Have a Chaperone or Aquarium Volunteer to help you answer the questions below.

Type of animal: _____

Describe its habitat (where it lives):

Does your animal (circle all that you can see)...

Stick to the rocks?

Have a hard shell?

Bend with the water?

Have a rounded body?

Draw your animal in the box below!

A large, empty rectangular box with rounded corners, intended for drawing the animal. A small icon of a pencil is positioned at the top right corner of the box.

Get a Grip – Post Visit Activity



At a glance: Students will design an object that can withstand waves inspired by the tidepool animals they learned about at the Oregon Coast Aquarium.

Objectives

Students will be able to:

- Apply prior knowledge gained at the Aquarium to create original object designs.
- Rebuild and improve their designs based on tests using miniature waves.
- Describe ways their design reflects how tidepool animals survive the waves.

Next Generation Science Standards

Performance Expectations

- 1-LS-1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.
- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Science and Engineering Practices

- Developing and using models
- Planning and carrying out investigations
- Defining problems and designing solutions



Ocean Literacy Principles

- 5. The ocean supports a great diversity of life and ecosystems.

Time: Approximately 30 minutes (NOTE: If your time or resources are limited, students can simply sketch their designs instead of building them.)

Materials:

- Photos or artifacts of tidepool animals (sea stars, urchins, anemones, barnacles, mussels, etc.)
- Design materials:
 - **Sticky**
 - Suction cups
 - Play dough
 - Sticky tac
 - Tape or glue
 - Velcro
 - **Hard shell**
 - Cardboard or cardstock
 - Yogurt cups or similar
 - **Bend/Flexible**
 - Hot glue sticks
 - Glow sticks
 - Pipe cleaners
 - **Rounded body shape**
 - Foam blocks that can be shaped
 - Plastic eggs
 - **Other**
 - Popsicle sticks
 - Toothpicks
 - Modeling clay
 - Felt or other fabric
 - Any other sort of crafty material you have on hand

Tips on collecting materials

- Start early! Ask other teachers and/or students to bring in recyclables from home.
- Ask the cafeteria if they have any materials they can save.
- Raid the recycle bins at school.

Background Information

Waves bring both vital resources (food, water, oxygen, cool temperatures) and challenges (big crashing waves, driftwood and other debris, predators) to animals living in rocky shore environments. Tidepool animals use a variety of physical features and behaviors to help them thrive in this habitat. The ability to **stick** with a muscular foot, byssal threads, or tube feet helps them hold on to the rocks and not get swept away. A **hard shell** provides protection from big crashing waves and any debris that might be in the water. The ability to **bend** helps them have a better grip on curved and bumpy rocks, and to flex with the waves. A **rounded body shape** allows water to easily flow over and around them. Most rocky shores animals use a combination of these abilities to survive.

Examples of animals in each category:

- **Stick:** Chitons, sea stars, urchins, turban snails, anemones, sea cucumbers, limpets
- **Hard shell:** Barnacles, mussels, hermit crabs, urchins, chitons, tube worms, turban snails, limpets
- **Bend (flexible):** Chitons, anemones, sea cucumbers
- **Rounded body shape:** Chitons, barnacles, urchins, mussels, sea stars, limpets

Procedures

Engage (about 5 minutes):

- With your students, watch the following tidepool video: <https://youtu.be/Az2Ct1UAEM>
- Ask students what they learned about tidepool animals during their classroom program at the Aquarium. Write down what they remember about how these animals survive in the tidepools on the white board. Solicit responses from students that describe *how* these animals withstand the waves in their environment (encourage descriptions such as sticking, hard shell, bending/flexible, rounded body shape).

Explore (about 15-20 minutes):

- Tell students they are going to design an object they think could survive crashing waves without falling apart or being washed away. (You can choose to have students work individually or in small groups.) Distribute the materials or give instructions for collecting them.
- They should use tidepool animals for inspiration, so remind them that they can refer to the whiteboard list you created as a class, and the pictures of tidepool animals.
- Give ample time for students to create their objects, encouraging them to think creatively and to make predictions about what might happen to their object if a big wave hit it.
- Allow students to test their creations by placing them in a tub or sink filled with 1-2 inches of water. Use a dustpan or their hands to create “waves” and see how their design holds up. If it falls apart, have students think about why it didn’t work and what they could do to improve the design.
- Build, test, and rebuild designs for as long as time allows!

Explain and Expand (about 5 minutes):

Tidepools

- Have students demonstrate their designs to their classmates, highlighting the ways their creation stands up to waves.
- Discuss how their designs stood up to the tub “waves” test and if they used what they learned to rebuild their objects.
- Ask students to compare these structural characteristics to specific tidepool animal adaptations.
- Ask students to think about things buildings have to withstand (wind, rain, fire, etc.) so that humans can live, go to school, and work safely inside. What are some ways people build buildings to be strong and stable?

Evaluate:

- Judge your students’ achievement of the Objectives based on their answers and language during the *Explain and Expand* segment. Pay close attention to:
 - Whether students reference prior knowledge/vocabulary gained at the Aquarium
 - If they are able to describe what they learned from tub tests and how that was applied to changes they made to their designs
 - How well students describe ways their design reflects how tidepool animals survive the waves
- Ask students: What was the most challenging part of this activity? What was your favorite part?

Extension activity (if time allows):

- Discuss how, like animals, people have to be able to survive challenges in their own “habitats” such as fire, rain, wind, cold, etc.
- Take a tour of the school and look for safety features such as fire sprinklers and fire extinguisher cubbies, explore windows and doors to see how rain and cold is kept out, look for rain gutters and drains, etc.
- Compare the structures you see to any similar animal features you have discussed, or the ways that students designed their own objects.