Intertidal Exploration

Grade Level: 3-12
Length: 60-90 Minutes
www.pwsrcac.org/lessons

Adapted from Alaska Sea Week Curriculum, Vol VI

NGSS Standards

4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

Crosscutting Concepts

Patterns Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

Structure and Function The way an object is shaped or structured determines many of its properties and functions.

Related Resources

Virtual Field Trip
http://alaskafisheries.noaa.gov/shorezone
http://www.bigelow.org/mitzi/page_1.html

Pair With Invent an Invertebrate

Overview

Although life in the intertidal zone is challenging, a diverse range of invertebrates and algae have adapted to live there.

Objectives

- Students will identify invertebrates found in intertidal zone.
- Students will understand the different challenges of living in the intertidal zones, form the splash and upper intertidal zones to the lower and subtidal intertidal zones.

Materials

- ☐ Paper
- ☐ Pens or Pencils
- ☐ Markers, Colored Pencils, and/or Paint
- ☐ Posterboard or Whiteboard
- ☐ Invertebrate ID Guides
- ☐ Small, Clear Containers
- ☐ Worksheet: Intertidal Zonation

Background

Intertidal Exploration is a great, hands-on way to explore the different components of an ecosystem and to learn about the challenges to life in the intertidal zones. Ideally, this activity is done as a field trip to a local intertidal zone, where students get to discover first-hand the diversity of organisms living in the intertidal zone. If a field trip is not feasible, Alaska ShoreZone (http://alaskafisheries.noaa.gov/shorezone) can be used for a virtual look at the nearest coastline in southcentral Alaska and MITZI virtual

Notes

field trip (http://www.bigelow.org/mitzi/page_1.html) can be used as a virtual tour of the intertidal zones in Maine. Although the species are different, the categories and adaptations of organisms present in the Maine intertidal zone are commensurate to those existing along the rocky shores of Alaska. See the extra resources tab on the PWSRCAC searchable curriculum database for the most up-to-date virtual field trip options. After exploring the intertidal and learning about the different challenges and organisms in each zone of the intertidal, students can then discuss how an oil spill might affect intertidal organisms. Many intertidal invertebrates were heavily impacted by the Exxon Valdez oil spill because they were inundated with oil at every tide cycle. Many of these creatures are planktonic filter feeders, so if oil is present, they will ingest it during the high tides, which can result in death, deformities, and illness. Oil spill clean ups can have significant effects on the intertidal zone, as clean-up workers step on barnacles and mussels and generally cause a disturbance as they attempt to clean. During the response of the Exxon Valdez oil spill, workers used pressurized hot water clean-up technologies, which swept away and "cooked" intertidal life.

Preparation

1. If you are participating in a physical field trip to the intertidal zone, check the tides and arrange your trip around a low tide (there are usually two per day in Alaska, approximately 12 hours apart), up to two hours before and after the low tide time. Ideally, set the trip for a lower than average low tide. Check with local non-profits, parks, or agencies that might be able to provide a volunteer or paid guide to help students find, identify, and understand organisms.
2. If time allows, familiarize yourself with the different types of animals you might see and some information about their predator & prey relationships. Being able to identify these relationships in an ecosystem will help students to understand food webs and how ecosystems are interdependent.

   >>Educator Tip: If there is not a knowledgeable volunteer or paid guide who can lead your field trip, and if you don't have familiarity yourself, use field guides and natural history texts and resources to learn more about the area. You can contact the Center for Alaskan Coastal Studies for guidance on good resources for your region (info@akcoastalstudies.org, 907-235-6667).

3. Prepare students for the field trip by reviewing how to visit an intertidal zone without disrupting the ecosystem. Basic tide pool stewardship includes: putting everything (living and non-living)

back where you found it, keeping animals close to the ground if you pick them up, walking carefully and watching your step, cleaning up litter, being gentle if you touch organisms, and making sure that any rocks that were moved return to their original spot and orientation. Also, if students are going to be looking under rocks, it is best to put a limit on the size of rocks they can move (head size works well).

Introducing the Lesson

Pull apart the phrase "intertidal zone" so students understand that this phrase refers to the area that is underwater at high tides and exposed at low tides. Explain how animals that are normally covered by water at high tide are revealed at the lowest tides, and that most places in Alaska experience two high tides and two low tides a day. Ask students what sort of organisms they might expect to see in the intertidal zone.

Activity

1. On a physical field trip, provide students with ID guides to intertidal invertebrates and allow them to explore the intertidal zone as you travel as a group.
2. When students find something interesting, bring the group together to view and identify the organism and discuss how it is linked to other biotic and abiotic factors in the intertidal zone.
3. Fill a small, clear plastic container with saltwater and use it to carefully pass interesting organisms around the group for everyone to observe.
4. Do a focused observation by having students spend some time (1-5 minutes) counting the biodiversity (number of different types of organisms) or abundance (total number of organisms) count in a small space. Have each student pick a rock, tidepool, or 1-foot by 1-foot area and quietly observe and count the organisms within the area. Then have students share their total counts and something interesting they observed.
5. Spend time looking for indicators of the intertidal zones. In southcentral Alaska, you will find:
   - bare rocks or a black and orange band of blue-green algae and lichen in the splash zone
   - a white band of barnacles in the upper intertidal
   - a blue band of mussels and/or golden-green band of rockweed (*Fucus spp.)* in the mid intertidal zone

- the low intertidal zone will have more diverse red and brown algae
- the subtidal zone may have brown algae, sea grass, or pink coralline algae

6. Within each zone, spend some time looking at what sorts of animals live there. What environmental factors are challenging in this zone? What biological factors are challenging in this zone? What sorts of structures do organisms in each zone have to help them deal with those challenges and perform basic life functions?

>> Teacher note: Generally, the farther up in the intertidal zone you go the more organisms have to contend with being exposed to the air for long periods of time. This makes drying out a major risk and can also lead to challenges with temperature swings and lack of access to food. In the lower intertidal zones, organisms are exposed for less time. But there is a lot of competition for space, and more predators are present.

7. On a virtual field trip, have students use MITZI virtual field trip to explore Maine intertidal zones and compare them to the animals found in Alaska using the intertidal guides. Use ShoreZone to look for zone indicators such as the black and orange band of blue-green algae and lichen in the splash zone, white band of barnacles in the upper intertidal, and blue band of mussels and golden-green band of rockweed (*Fucus spp*.) in the mid intertidal zone.
8. Upon return to the classroom from the virtual or physical field trip, have students pick one organism they observed to draw or paint and research. Have students emphasize the external structures of the organism (and internal, if possible) and label how those structures help the organism perform necessary functions.
9. Have students present their drawings/paintings to the class, along with key information about the animal such as what it eats, predators, unique adaptations, and what intertidal zone it inhabits. Place their organisms on a large sheet of poster board (or whiteboard) according to intertidal zonation. When they place their organism on the poster board, they should make an argument to the class for why their organism belongs in that zone. Instruct them to support their argument with evidence from their observations and research about structures and function, as well as observations of where the organisms were found during the field trip.
10. Introduce the concept of ecosystem disruption by first adding some litter to the ecosystem on the poster board. Ask students how this litter might affect different organisms in the ecosystem and how that will in turn affect other animals. Remove some of the affected animals from the poster board.

11. Then, ask students what could be done to restore the ecosystem. Probe them to suggest things like picking up litter and reminding people not to litter with signs, posters, public service announcements, etc. Return the organisms to their spots in the intertidal zone.
12. If you would like, introduce the more complicated concept of an oil spill disrupting an ecosystem. Add drawings of oil sheen, mousse, and tar balls to the ecosystem. Discuss how these different products of an oil spill might affect different organisms, and how this might depend on the structures of organisms. For example, remove some of the filter feeders that might ingest toxins from the oil sheen through their siphons or other filter feeding structures. Cover some organisms with the thick mousse and discuss how this would affect organisms that move around the intertidal zone (like crab) compared to those that are attached (like mussels, barnacles, or sea anemones). Remove those affected from the ecosystem. Smother some other organisms with tar balls and remove them from the ecosystem. If appropriate for your class, discuss how even some clean-up techniques cause harm to intertidal organisms. Brainstorm ways that an ecosystem can be restored after an oil spill and/or how oil spills can be prevented; use these ideas to bring back parts of the ecosystem.

Wrap-up

Discuss how organisms in the intertidal zones are connected to each other and how even a small disturbance can ripple throughout the ecosystem. Ask students to brainstorm a list of ways to help protect intertidal organisms. Choose and complete a stewardship project as a class that will benefit an intertidal ecosystem or other important local ecosystem (i.e. creating a guide for respectful tide pool exploration).

Assessment

Evaluate the organism presentations on the quality of the arguments, the extent to which the arguments are supported by evidence, and a demonstration of understanding (1) about the relationships of individual structures as parts that function to support the survival of the organism as a living system and (2) about the ways in which adaptations allow some organisms to survive well in particular habitats while others will survive less well.

Pair With

- Invent an Invertebrate Lesson Plan