Exploring the Intertidal Zone

LESSON

GRADE LEVEL:
All

CATEGORY:
Earth, Ecosystems, and Ecology

TOPIC:
Ocean shoreline exploration

TIME:
Depending on grade, 1 to 1.5 hours +

SETTING:
Outdoors

GROUP SIZE:
Whole class, but in smaller groups with volunteers for younger students

SKILLS:
Observing, classifying, measuring, recording, identifying

SUBJECT AREAS:
Science, biology

KEYWORDS:
Intertidal zonation; tides; habitats; ocean; spray, high tide, middle tide, low tide, and subtidal zones.

Overview

Exploring and experiencing the intertidal zone is the highlight of a field trip to the ocean. In the intertidal zone students may learn about many topics such as tides, plankton and marine food webs, intertidal adaptations, and environmental impacts. Learning comes to life as students use all their senses to explore and make connections to place.

Objectives

Students will:

- Understand how actions during seashore visits can impact animals, seaweeds, and plants.
- Appreciate the unique intertidal zone habitat and its diversity of life.
- EExperience, interpret, and reflect upon their experience and personal connection to oceans.

Materials

- Marine species field guides or ID cards
- Class set of small, clear, and clean tupperware containers (like from the deli); with some extras
- 3-4 larger clear tupperware bins to use as temporary aquaria
- Dip nets (optional - to catch fish); Directions to make your own here: *(https://www.hctfeducation.ca/wp-content/uploads/2015/10/How-to-make-a-dip-net-1.pdf)*
- Garbage bags to collect trash and recyclables found during the exploration
- 1 or 2 beach umbrellas to shade organisms brought from tidepools held in temporary aquaria
- Thermometers to measure the temperatures of ocean water, tide pools, and the aquarium water

Inquiry Questions

- What happens to creatures when the tide goes out?
- Who lives in the intertidal zone and how are they adapted to the unique conditions found in their environment?
- How am I connected to the ocean?

Method

- Hands on exploration and experience

Background

Regardless of where one lives, we are all connected to the ocean. We depend upon the ocean for the essentials in our lives, including oxygen, food, and the regulation of our climate. Everything that we do on land ultimately affects the ocean through the water cycle, via the rivers and constructed sewers that lead to the sea. Environmental impacts, such as plastic waste, can easily be seen at the ocean and may mobilize people to take action to make a positive difference through their choices and behaviours. Visits to the ocean provide opportunities to deepen our understanding of the interconnectedness of earth systems and all life.

One of the most memorable experiences on a visit to the seashore is exploring the diversity of life found in between the high and low tides—the intertidal zone. The life that lives in this habitat is unique and adapted to extreme and highly variable conditions as the tides rise and fall. Can you imagine living in a place that twice a day is subjected to pounding waves and then left high and dry with huge fluctuations in temperature, oxygen level, salinity, drying winds and predators? It seems unlikely that anything could live under such difficult and changing conditions. But yet life thrives in British Columbia's intertidal zone and each animal, plant, and seaweed has its own ways to deal with such challenges.

On the seashore there are distinct zones of seaweeds and animals whose distribution from the low tide to high tide areas is determined by how much exposure to air and other environmental stressors they can withstand. Organisms living at the high tide line, such as snails, barnacles, and some crabs, must withstand long periods of stress, including dryness, lack of food, high temperatures, and low oxygen levels, because they must wait until the next high tide to receive food and cold, oxygen-rich water. This leads to a vertical distribution of organisms along the tideline moving from high tide to low, which can be seen in horizontal bands across the shoreline. This phenomenon is called intertidal zonation and is broken down into 'spray zone', 'high tide zone', 'middle tide zone', 'low tide zone', and 'subtidal zone'. The subtidal zone is always under water. As we move from the top of the beach down the tideline, the greatest diversity of life is found towards the 'subtidal zone'. Knowing the tides and the best time to look for life is essential for a safe and rewarding seashore experience.

Field trips to the ocean also provide an opportunity for students to practice being good stewards of the environment, to become aware of personal responsibilities, and to find ways to minimize impacts. Some intertidal areas are loved to death. Collection and trampling can diminish the ecological value and diversity of these places over time. In some areas, shorebirds nest on the ground and human activities may scare off birds or destroy nests during certain seasons. On field trips to the ocean, students will be among many (often overlooked) species in the intertidal zone and they may be temporarily collecting animals such as fish and crabs to examine them more closely. Following guidelines below allows students to learn how to tread lightly and to practice proper marine etiquette (see Intertidal Ethics and Safety Tip Sheet *https://www.hctfeducation.ca/wp-content/uploads/2015/10/Ocean-Conservation-Ethics-Lets-Go-Series.pdf*) including knowing when to visit, how often, and what activities are harmful.

Procedure

Getting Ready!

1. Visit the location prior to your field trip at the time of day when the tide height will be at the same level as when you plan to go with your group. (Check a tide chart for predicted tidal levels). Identify a suitable place for gathering and exploring. Delineate clear boundaries for students and notice any hazards, such as logs to climb over or slippery rocks, between the gathering area and the intertidal zone. Be prepared to mitigate as needed. Keep in mind that the seashore is a highly dynamic place and be prepared that conditions may have changed since your last visit.

2. Set objectives for your visit with the class. On your first visit to the shore, you may wish to have students record the sights, smells, and sounds that they experience in their journals instead of picking up or holding animals that they find. Will you bring ID guides for things they see and draw that they do not know, or will that be done back at the classroom? Are you there to measure something as part of a citizen science program or is this a new experience?

At the Intertidal Zone

1. Set your boundaries. Delineate areas where students should go and places to avoid. Avoid cliffs, caves, and sandbars that could become isolated as the tide rises. Students should be within sight and hearing distance at all time.

2. Identify a central area that will be your gathering place. Choose a location that will remain above the tideline throughout the duration of your fieldtrip. If you are at a sandy beach you could delineate the gathering place by making a circle in the sand. If you will be collecting animals, put the larger bins in the gathering area and fill them with seawater. Consider putting up a beach umbrella or two to provide shade and to keep the water from warming up. Enlist the help of students with setting up. These large bins will be used by the group to temporarily hold and observe creatures. Have several aquaria so that animals aren't crowded together and predators (such as crabs) can be separated from prey (such as fish).

3. Gather all the students in a circle in the central area. Discuss and remind them about safety rules and marine etiquette. See the "Intertidal Ethics and Safety" Tip Sheet (*https://www.hctfeducation.ca/wp-content/uploads/2015/10/Ocean-Conservation-Ethics-Lets-Go-Series.pdf*). For example:

    - Reinforce boundary areas.
    - Know when the tide is coming in and use this for the timing and location of your exploration.
    - Never turn your back on the ocean if you are in an area with waves. Avoid or walk very carefully on rocks that may be wet and slippery with seaweed.
    - Use a signal (such as a whistle) to indicate when students should return to the central gathering place. They won't want to stop exploring! So make sure to leave plenty of extra time to regroup.
    - Review if/how animals should be picked up and held. Hold small crabs by the back of its carapace or in a flat hand with one hand covering the other (as if you are scooping up water). Don't hold crabs by their legs or they could break and fall off. Observe large crabs rather than picking them up (or get help from an adult); they have large pincers that they will use to protect themselves! Avoid touching fish so that you don't harm the protective layer on their scales. Some bristle (polychaete) worms can deliver a painful bite.
    - Review which animals can be brought to you and which should be left, gather water in aquaria for this purpose with the whole class helping.

4. Before exploring and while still in a circle, have everyone crouch to practice how they will stay low to the ground when observing and/or picking up animals (do the "Biologist's Bend"). This way if an animal is accidentally dropped it will not be harmed.

5. Give a guideline on the largest size of rock that can be lifted safely (such as the size of one's head). Demonstrate how to carefully lift a rock and put it back. Emphasize that it is critical that overturned rocks are gently replaced to their original position to keep creatures there cool, moist, and protected from predators.

6. Animals that are attached to rocks should be left. Prying and tugging animals such as sea stars, limpets, barnacles, or chitons off rocks can harm or kill them. Instead have a signal to call others over to observe the animal in its habitat.

7. If you will be collecting animals for closer observation, once the students are fully aware of the beach etiquette and safety rules, pass out one small clear container to each student or pair of students. Instruct any volunteers to help keep the containers from becoming beach garbage, to ensure that everyone follows the safety and etiquette guidelines, and to help students look for animals. Share their enthusiasm! Emphasize how important it is that creatures are kept in seawater and that the intertidal zone is a stressful place to live. Other tips:

    - Make sure that the seawater in the containers doesn't sit for too long and that it isn't kept in the sun. Warm water has less oxygen than cold water and some animals can't tolerate the change in oxygen and temperature.
    - Demonstrate how to move animals from their small container of water to the larger aquarium by gently placing the small container into the aquarium, without creating waterfalls.

Explore the zone!

1. Start with observations and not collection. If they need help, ask students where they think animals will be found. Explorations can be free or guided, such as:

    - What is under the seaweed?
    - Look for animal signs at a sandy beach such as tracks and holes in the sand.

- Can they find different types of seaweed and where are they located?
- Crouch or stand still and investigate a tidepool. The longer you look the more you see! Position yourself so that your shadow is not over the tidepool; some animals freeze or hide when a shadow passes overhead. When you are still and silent, you will start to see animals move around.
- Challenge students to find specific crabs, such as the most camouflaged crab, a large one, small one, male, female, hermit and shore crab, etc.
- Find a bird or other creature and watch its behaviour on the shore.
- Organize a trash collection group or identify where they should bring things that do not belong.

2. If you are allowing students to hold and bring animals to you, have them bring what they find to the aquaria/central gathering areas. Some students may prefer to observe rather than search for animals. They can help to sort animals into different aquaria, such as separating male and female crabs or putting them in labeled containers based on where they were found (such as under the rocks in the mid-tidal zone or on the sand in the high tide zone). Include an area to display interesting non-living treasures such as crab moults and different types of empty shells.

3. Use your signal/whistle to call everyone back to reconvene around the circle/central gathering area and share some of the highlights of the exploration. What behaviours or interactions were seen? What animals were abundant? Were there any animals that students saw but were not caught, like fish? Can they describe how they felt when they found something? Did anyone notice any interactions between animals? Students may wish to know the names of things they saw or brought to the aquaria, but don't let a lack of knowledge hinder your exploration.

4. Allow a few minutes for students to draw and write in journals. For things that they don't know the name of, have them describe its features, where it was found, and sketch it. Allow students to make up their own names for creatures they do not know and have them record questions they have about the creatures they saw. Finding the species names can be done back in the classroom using ID guides or expert assistance based on sketches, descriptions, or photographs taken in the field.

5. Release the animals. Everyone helps to gently release the animals back to where they were found (remember, no waterfalls!).

   - Animals should go back to their specific habitat and tidal zone (rocky areas, sandy tide pools, those found in lowest tidal areas).
   - Ensure that the animals are released away from the group and that they are not underfoot of other students. Give the students instructions to watch the animals' behaviour when released and predict what will happen. Fish may swim quickly away, clams may retreat into the sand, crabs may scurry to a rock or under seaweed. Others stay still. When placed in shallow water or wet sand, red rock crabs can do a fascinating "disappearing trick", using their pincers to dig a hole and bury themselves until all that remains is a small portion of their red carapace, looking like a red rock.
   - No collecting. Non-living beach treasures such as seashells and empty crab molts should stay at the beach. Many may have barnacles or other life attached to them, which will die and become stinky if brought home. Snail shells are important homes for hermit crabs who need to find a shell to house and protect them from predators as they grow. Also, the calcium carbonate that makes up shells is recycled in the ocean so that marine animals can create new shells.

Wrap up!

Ask for final observations and reflections about the field trip experience. Students may wish to think about and practice an action about how their creature swam away or dug themselves into the sand. Gather in a gratitude circle and have students identify what they experienced through their sense of sight, touch, smell, hearing, or their emotions. If there is time, create artwork from of the non-living things that were gathered in the center of the circle. When the tide washes in, it will carry these things back into the ocean. Consider using the concept of interconnectedness for this artwork in a mandala or medicine wheel formation.

Collect all of your belongings and don't forget to take the garbage that was found when you leave the beach.

Assessment

1. Students can write about the day in the life of a sea creature that lives in the intertidal zone.
2. Reflection can be continued in their journals on the theme of interconnectedness and what they learned through their senses.
3. Make a sketch of the intertidal zone showing the specific areas (on rocks, under the sand, high tide, subtidal zone) where some animals found on the field trip are most commonly found.

Extensions

1. Learn more about the organisms discovered on the field trip by trying to identify species, answering student questions, and conducting further research.
2. Play the Ocean Habitag activity to look at predator prey relationships.
3. Create a play about the intertidal creatures.
4. Find a local group to partner with to conduct a beach cleanup, participate in a citizen science project, or take part in an ocean celebration day.
5. Consider sharing your experiences with another school that is not near the ocean through HCTF's Environmental Exchange box program (*https://www.hctfeducation.ca/environmental-exchange-box/*).