Let's GO to the Ocean!

Field Trip Ideas and Activities to Explore Marine Environments in BC Parks and other Special Places in B.C.

GRADES 5-7 MODULE

BRITISH COLUMBIA | BC Parks | HCTF Education | HABITAT CONSERVATION TRUST FOUNDATION

In this Module

Advice from a Tide Pool

Be full of life

Look beneath the surface

Weather the storms

Follow the ebb and flow

Be a star!

- Yourtruenature.com

Meet the Ocean

Background

Did you know Canada has the longest coastline of any country in the world, stretching over 243,000 kilometres? If you straightened out our coastline it would stretch the same distance as just over half of the way from the Earth to the moon! In comparison, the second place prize for longest coastline goes to Norway, whose deep fjords and numerous islets give it a coastline of under 60,000 km. Canada's oceans and Great Lakes together have a surface area of approximately 5.7 million square kilometres— an area equivalent to about 56% of Canada's land mass.

Over 7 million Canadians live in coastal communities, and all of Canada relies on our oceans for food, jobs, clean air and much more. From coast to coast to coast—the Atlantic, the Arctic, and the Pacific— we are all connected to the ocean.

"We are tied to the ocean. And when we go back to the sea, whether it is to sail or to watch - we are going back from whence we came."

- John F. Kennedy

Why is the ocean important?

Maybe a better question would be how is the ocean not important! All of humanity- even those living inland- rely on a healthy ocean for survival. The majority of the oxygen in our atmosphere is produced by the photosynthetic activity of marine phytoplankton and seaweed. The ocean regulates climate through the water cycle, carbon cycle, and by moving heat across the globe in deep water currents. The ocean gives us food, medicine, jobs, recreation, and inspiration. The ocean is also a deep and mysterious, largely unexplored place that captures the imagination.

"The Sea, once it casts its spell, holds one in its net of wonder forever."

-Jacques Cousteau

British Columbia's coast

British Columbia's Pacific coast stretches over 25,000 km and is one of the world's most biodiverse marine environments. The coastline includes a great variety of habitats, ranging from deep fjords, shallow mudflats, saltwater estuaries, rocky island archipelagos, underwater forests of kelp, and eelgrass meadows. Much of the B.C. coast occurs in a zone where two major currents meet: the California current and the Alaska current. In this transition zone one may find great biodiversity representing a mix of species and habitats from regions further north and south. Nutrient upwellings along the B.C. coast also account for the rich and abundant life found in the northeast Pacific. These are some of the most productive seas on the planet.

These productive seas and coastlines sustained large communities of First Nations peoples for thousands of years. Coastal communities have a rich cultural history connected to the land and sea, with traditions and knowledge that has been passed down for generations.

"To stand at the edge of the sea, to sense the ebb and flow of the tides, to feel the breath of a mist moving over a great salt marsh, to watch the flight of shore birds that have swept up and down the surf lines of the continents for untold thousands of years, to see the running of the old eels and the young shad to the sea, is to have knowledge of things that are as nearly eternal as any earthly life can be."

- Rachel Carson

Things to Learn About at the Ocean

Why visit the ocean?

Everyone loves a visit to the seashore. Even those who go to the ocean frequently, may not be familiar with the unique life forms that can be encountered when the tide retreats to reveal a fascinating world of life adapted to waves, tides, salt, and shifting sands.

Learning at the seashore can deepen students' connections to our 'Blue Planet' and their understanding of how we all depend upon the ocean for the basic essentials in our lives including oxygen, food, and climate. It is at the sea where environmental impacts, such as plastic waste, can be easily seen and where students can take direct action to make a positive difference through their choices and behaviours.

Ocean Systems and Interconnections

"Why should I care about the ocean?... It's the blue heart of the planet - we should take care of our heart. It's what makes life possible for us."

- Dr. Sylvia Earle, Oceanographer

Some may wonder why we call our planet, 'Earth', when clearly a better name would be 'Sea'. Our Blue Planet is over 70% water, the vast majority (96%) of which is sea water. Scientific evidence reveals that life on our planet began in the ocean 3.5 to 4 billion years ago. And still today, we are intimately connected to this source of all life; the majority of the world's seven billion people are estimated to live within 300 km of a coastline.

Learning about the properties of the ocean helps us to gain a better understanding of our fundamental connection to the sea.

We are connected to the ocean with every breath we take—approximately 70% of our planet's oxygen is produced by photosynthetic plankton in the sea. Our climate is regulated by ocean currents that act like a global conveyor belt, transporting warm and cool waters around the world. By learning about the physical and chemical properties of salt- and freshwater, students can understand concepts such as salinity, density, and how ocean currents are formed. Students can also learn about how and why an increase in freshwater into the ocean — such as that coming from melting ice caps — results in changes to ocean currents and global climate patterns. The ocean tides, created by the gravitational pull of the moon and sun, connect us to our place in the universe.

The theme of ocean systems and interconnections can also include learning about sustainable and unsustainable activities on the ocean in the past and today, such as different types of fishing methods and how our food choices can make a difference. Coastal First Nations in British Columbia had a sophisticated and deep understanding of tides, currents, and marine life, which were passed down for thousands of years through the generations. By learning about First Nations' traditional practices, such as building clam gardens and fishing, students can gain an appreciation for the interconnections between ocean conditions, sea life, coastal peoples, and our own place in this web of life.

The intertidal zone is the area of the marine shoreline that is exposed to air at low tide, and covered with seawater when the tide is high.

Biodiversity and Adaptations

To explore where the land and sea meet is to discover a completely unique habitat: the intertidal zone. Intertidal habitats are varied and include rocky coasts, sandy beaches, eelgrass meadows, mudflats, and estuaries, each of which has its own unique assemblage of life.

The abundant life that thrives in the intertidal zone has evolved over the millenia to withstand the difficult environmental conditions that prevail. Twice a day intertidal life is met with forceful waves, shifting sand and rocks, and is submerged in cold, oxygen-rich salt

water. Then, as the tide recedes, the life in the intertidal zone is confronted with dramatic changes in salinity, oxygen, and temperature, drying sun and winds, as well as exposure to land predators.

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 are able to withstand. The stressors are more pronounced higher up on the shoreline, where organisms are exposed for longer periods of time. The characteristic vertical distribution patterns of organisms along the shoreline is called **intertidal zonation** and includes the following (from below the water surface to the area above the beach): subtidal zone, low tide zone, middle tide zone, high tide zone, spray zone, and above the beach. The greatest diversity of life is found where the coast is exposed for the least time, in the low tide zone, whereas only a few species of snails, barnacles, and crabs may be able to live in the spray or high tide zones, which are exposed for the longest period of time each day.

On a field trip to the ocean, students can become scientists and artists, measuring environmental conditions and biodiversity, and sketching the life that resides in different parts of the intertidal zone.

Stewardship and Personal Responsibility

"Even in the vast and mysterious reaches of the sea we are brought back to the fundamental truth that nothing lives to itself."

- Rachel Carson

No matter where we live, we are all connected to the ocean. All of us rely on the ocean for the most basic essentials of our survival: air, water, and food. As human populations grow there are increasing pressures and impacts on marine ecosystems. Ocean stewardship and our personal responsibility to make choices that benefit the ocean are therefore critical themes when learning about the sea.

Each of us lives in a watershed, and the water collected in and travelling through the watershed ultimately ends up at the sea. Rain falling in inland B.C. will flow through small streams, gather strength in rivers and eventually flow to the sea. A plastic wrapper from a snack at lunchtime that blows across the schoolyard could take the same path. What we do — or don't do — on land in our watershed will affect the quality and quantity of the freshwater joining our oceans.

First Nations were the first stewards along the coast of British Columbia, caring for its abundance for generations. Today's environmental problems connected to the ocean can be daunting, such as the amount of marine plastic waste, overfishing, and the impacts of ocean warming and acidification. These global problems are complex and require international cooperation to be properly addressed. However, individual choices and behaviours make a difference. Students will feel empowered by taking action to help the ocean. Beach cleanups not only result in a local shoreline with less plastic and other garbage, they also can make a powerful statement about our consumption choices and the consequences of our actions.

Field trips to the ocean 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.

Quick Facts: Did You Know These Things About the Ocean and Marine Life?

- **World Oceans Day.** Observed every June 8th since 1992, World Oceans Day honours and inspires people to help protect the world's oceans. Learn more and find an event near you- or around the world- here: *worldoceansday.org*
- **The Great Unknown.** Scientists estimate that over 90% of species in the ocean have yet to be classified, and that 95% of the ocean remains unexplored. More humans have walked on the moon than have been to the deepest point in the ocean, the Challenger Deep in the Mariana Trench at 10,994 meters deep—over 1.6 km deeper than the height of Mount Everest.
- **The Dawn of Life.** Scientific evidence reveals that the first life on our planet formed as single celled microorganisms in the early oceans, 3.5 to 4 billion years ago.
- **Snoozing in School?** Although they don't close their eyes (after all, they don't have eyelids), research shows that most fish have periods of "suspended animation" when they rest and reduce their metabolism while remaining alert to danger. Some fish rest under rocks or in holes, others float in place, and some create sleeping nests for themselves in the sand. And perhaps the safest place to sleep—for a fish at least— is in school, where there are others keeping a lookout for predators.
- **Powerful Tides.** Canada boasts the largest tides in the world at the funnel-shaped Bay of Fundy in Nova Scotia and New Brunswick. Over 160 billion tonnes of water move in and out of the bay twice each day, with a difference in high and low tide height of over 15 meters! The tremendous power of these tides has been harnessed at the Annapolis Royal Generating Station since 1984 —the only tidal generating station in North America and one of the few in the world.
- **Eelgrass Meadows.** Despite its name and appearance, eelgrass is neither a grass, nor a seaweed (and definitely not an eel!). Eelgrass is actually a flowering plant of the Genus *Zostera* that grows in shallow estuaries, bays, and inlets throughout the world, including along parts of the B.C. coast. When protected from industrial development and other human activities, eelgrass may grow in expansive "meadows" or "beds", which can look like a bright green grassy pasture at low tide. These eelgrass meadows are full of nutrients and are critically important as nurseries and refuges for countless marine species, as well as for resident and migratory birds who feed there. It is estimated that over 80% of commercial fish and shellfish species depend on eelgrass habitat during part of their life cycle. Eelgrass meadows also help to protect coastlines from flooding and erosion. One of the most extensive eelgrass communities in B.C. and globally is on the South Coast, extending along the Fraser Estuary, Robert's Bank, Sturgeon Bank and Boundary Bay.
- **Buffleheads.** North America's smallest diving duck is also the most punctual. Buffleheads migrate from their Interior breeding grounds to spend winter in sheltered bays along the B.C. coast. More than two decades of bufflehead observations at Shoal Harbour Migratory Bird Sanctuary in Sidney, Vancouver Island, have revealed that buffleheads are remarkably consistent in arriving on the 297th day of the solar year. Each year, locals celebrate "All Buffleheads Day" around October 14th to welcome back the beloved winter residents.

Curriculum Connections

Some Big Ideas that may be addressed on a field trip to the ocean include:

- *Multicellular organisms rely on internal systems to survive, reproduce, and interact with their environment (Science Grade 6 Big Idea)*
- *Evolution by natural selection provides an explanation for the diversity and survival of living things (Science Grade 7 Big Idea)*
- *Multicellular organisms have organ systems that enable them to survive and interact within their environment. (Science Grade 5 Big Idea)*

- **Marine Protected Areas.** Similar to a National or Provincial park on land, a Marine Protected Area (MPA) is a legally protected area of the ocean in which human activities are restricted in order to protect marine species and ecosystems. They may be designated by the provincial or federal government to protect a range of features and values, including ecological, social, cultural, spiritual, and economic. The first MPA on the Pacific Coast of British Columbia was designated in 1911, protecting the foreshore of Strathcona Provincial Park. Today there are more than 185 MPAs held on 28% of the coastline of B.C.

- **Hydrothermal Vents.** Only 250 kilometers off the shore of Vancouver Island an otherworldly web of life thrives on an underwater volcano, in the deep, dark sea, over 2,200 meters below the surface. The Endeavour hydrothermal vents are located on the Juan de Fuca Ridge where the Juan de Fuca and Pacific tectonic plates are moving apart, releasing hot, mineral-rich water as new ocean crust is formed. One of the microbes found here lives in temperatures up to 121 °C—the record for the upper limit for life. Without sunlight there's no photosynthesis. The bacteria and other microbes living on the vents are able to convert the volcanic minerals and chemicals, such as sulfide, into energy via the process of chemosynthesis. These microbes are the foundation of the hydrothermal vent food chain, which supports more than sixty unique species, including giant tubeworms, brittlestars, and sea spiders. And they sure are crowded in this high pressure, hot and dark world; over half a million animals may be found per square meter! Take a virtual trip to the Endeavor hydrothermal vents with Ocean Networks Canada, an initiative of the University of Victoria. *youtube.com/watch?v=Q71E2BezqOA*

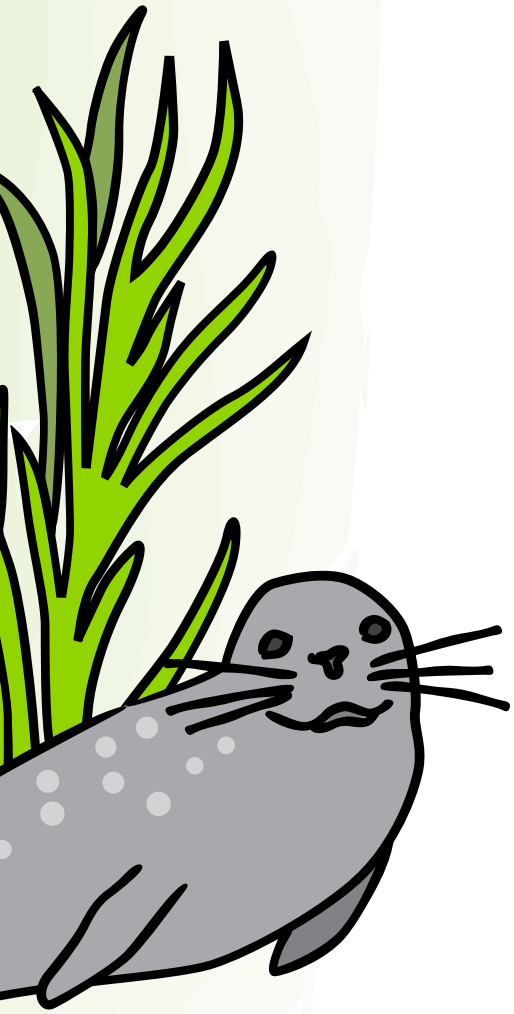
What is Ocean Literacy?

Ocean literacy is an understanding of the ocean's influence on you and your influence on the ocean. There are seven Essential Principles of Ocean Literacy, ideas scientists and educators agree everyone should understand about the ocean.

The Seven Ocean Literacy Principles and Fundamental Concepts of Ocean Sciences are:

1. *The Earth has one big ocean with many features.*
2. *The ocean and life in the ocean shape the features of Earth.*
3. *The ocean is a major influence on weather and climate.*
4. *The ocean made the Earth habitable.*
5. *The ocean supports a great diversity of life and ecosystems.*
6. *The ocean and humans are inextricably interconnected.*
7. *The ocean is largely unexplored.*

Incorporate the principles of Ocean Literacy into your teaching and learn more here: ***marine-ed. org/ocean-literacy/scope-and-sequence***



- **The Hidden Life of Barnacles.** Children learn all about metamorphosis from caterpillars and butterflies, but why not barnacles? A barnacle starts out its life as a microscopic, shrimp-like plankton called a nauplius, who swims and drifts with the ocean currents before becoming a cyprid, with super-powered cement glands on its head. Once the cyprid chooses its forever home and anchors itself upside-down on a rock (or boat, dock, bivalve, or even the body of a whale) then it transforms into the adult stage of the barnacle that we are most familiar with. Watch a barnacle carefully when it is under water. You may see what looks like eyelashes sweeping in and out from its protective armoured housing. These are the ten legs of the barnacle, used to gather plankton from the water and deliver it to its mouth, hidden from our sight. And that super strong cement that they use to glue themselves to their rock? It is stronger than any glue that humans have made. Scientists are studying barnacles for clues on how to make better synthetic cements that could be used in medicine, dentistry and for micro-electronics.

- **Sea Star Wasting Disease and Urchin Barrens.** In the summer of 2013, millions of sea stars on the Pacific coast from Alaska to Mexico suddenly began to wither and die, their bodies dissolving into mushy goo. Scientists called it Sea Star Wasting Disease (SSWD) and discovered that it was linked to a virus and a marine heatwave. The once abundant sunflower star was particularly hard hit and is now locally extinct across much of its range from British Columbia to California. The mass die-offs reveal the role that sea stars play as marine predators who maintain a balance in the ecosystem. Without predatory sea stars, the population of urchins skyrocketed in some regions where they had free reign to munch away on kelp. Biodiverse kelp forest ecosystems have been decimated by urchins in some regions, transforming them into expansive undersea barrens, covered only by spiky purple urchins. There is some hope that some species of sea stars are showing signs of a slow recovery from SSWD.

- **B.C.'s Living Fossils.** Two hundred million years ago the oceans were home to expansive, giant reefs composed of marine sponges made of glass (silica). Glass sponge reefs were thought to have gone extinct about 40 million years ago. That is, until 1987 when they were rediscovered off the coast of British Columbia by a team of Canadian scientists. Glass sponges are filter-feeding marine animals with rigid glass skeletons. After individuals die, new generations settle upon the skeletal mounds below them, creating reefs up to 19 meters high and over a kilometer wide. Like coral reefs, glass sponge reefs provide important habitat for other marine life, including spot prawns, rockfish, and sharks. Some of B.C.'s glass sponge reefs began forming 9,000 years ago. Although long-lived, glass sponge reefs are also very fragile. They can shatter and be destroyed by human activities that affect the seafloor, such as bottom trawling. In B.C., glass sponge reefs have been discovered in Hecate Strait, Howe Sound, Chatham Sound, and the southern Strait of Georgia, where efforts are being taken to protect these living global treasures. Learn more about glass sponge reefs from the Royal BC Museum: *learning.royalbcmuseum.bc.ca/pathways/glass-sponges/*

Planning and Preparation

You've decided to go on a field trip to the ocean. Exciting! But now what?

When to Go?

The best time to visit the ocean is in the spring or summer, when the low tides more frequently occur during the daytime, the weather is warmer and the seas are likely to be less stormy. However, a visit to the ocean at other times of the year can offer a rich learning opportunity and provide a great contrast to the summer seashore experience that many students may be familiar with.

Remember that the seashore that you are familiar with in the summer may not be suitable for a field trip in the winter! In the winter, waves and high tides may eliminate safe access points and exposed areas of the beach to walk on. Check the weather and tide charts and visit the site prior to your trip when conditions will be similar.

The seasonal rhythm of the oceans include some of the following natural highlights:

- **Fall:** Shorebirds are numerous as they start to migrate to the southern hemisphere, jellyfish often wash up on shore.
- **Winter:** Storm swells and surf, seabirds are most abundant and diverse at this time, seaweeds wash on shore after storms.
- **Spring:** Plankton blooms, grey and humpback whales migrate, herring spawn and sea lions follow the herring, Brant geese fuel up on the journey north in coastal eelgrass meadows.
- **Late Spring/Summer:** Lowest tides are in the daytime, permitting intertidal exploration. Time of animal growth and reproduction (e.g. crab moults and crabs with eggs common, whelk eggs on rocks), harbour seals have pups.

If your school is close to the shore, consider multiple field trips to offer comparisons and get to know the ocean as it changes with the tides and seasons.

Check the Tides!

This may seem obvious, but you can't explore tide pools if the tide isn't low enough! Use a tide table to plan the date and time of your field trip. The lower the number, the greater the variety of intertidal life that will be encountered and there will be more exposed beach to walk on and explore. The "lowest lows" (called spring tides) will occur close to the full or new moons. The best tidal levels are those that are 1 meter (3 feet) or less. If possible, plan to do your intertidal exploration an hour before low tide so that you have ample time to explore the farthest areas before the tide starts to come in.

Caution: Tides can rise much faster than expected in some areas. This could lead to dangerous situations such as stranding on rocks or being swept away. Always check for conditions with someone familiar with the shoreline you will be visiting. See the Intertidal Ethics and Safety Tip Sheet: *hctfeducation.ca/file/intertidal-ethics.pdf*

- When you know the date of your field trip, check a tide table to see what level the tide will be during your visit. If tide pooling try to work around tides that are between 0 to 2 metres. Then visit the site in advance at the same tidal level to see what the water levels and beach will be like during your visit. Keep in mind that site conditions

Start here by following this step-by-step checklist of outdoor field trip planning:

- *hctfeducation.ca/file/field-trip-checklist.pdf*

Learn how to incorporate place-based learning into your teaching and some easy solutions to overcome some challenges associated with outdoor learning.

- *hctfeducation.ca/file/c2c-place-based-activities.pdf*

Multiple trips? Try this:

- *Create a class seasonal wheel that can be added to after each trip to the seashore.*
- *See **earthzine.org/phenology-wheels-earth-observation-where-you-live/** for tips on using seasonal wheels and wheel templates (courtesy of Anne Forbes, Partners in Place, partnersinplace.com/wheels-of-time-and-place).*

may differ even with the same predicted tidal levels due to ocean swell, winds, and other factors. Nonetheless, visiting a site in advance at low tide will give you a good idea of what to expect on your field trip.

Tide Tables

Recommended resources for finding predicted tidal levels:

- *waterlevels.gc.ca*
- Free apps: My Tide Times or Tides Near Me.

If needed, ask a marine educator, naturalist, or other ocean enthusiast to help interpret the tide table or to identify good potential dates for the place that you are interested in visiting.

Where to Go?

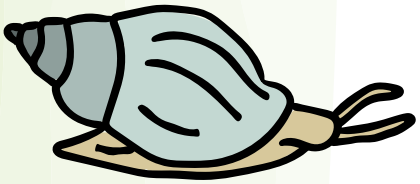
Where is a good field trip location to take your class? Some considerations for a suitable location for your field trip:

- Visit the site ahead of time, especially if you are not familiar with the location.
- Where will drivers park?
- Are there any hazards at the site? Can they be mitigated?
- Are there toilet facilities/outhouses on site?
- Are there any covered areas to gather in inclement weather, during nutrition breaks, and to leave belongings while exploring? If not, plan accordingly, such as by bringing a tarp to cover belongings or to sit upon.

Finding a Coastal Area to Explore with your Class

Here are some suggestions to identify an appropriate coastal area to explore that may be near your school.

- Find BC Parks near your school and filter by activity or facility: *https://bcparks.ca/recreation/marine_parks/*. It is recommended to contact your local BC Parks office to discuss ideal sites, obtain the most current information and special considerations, such as the best time to visit, sensitive habitats, and other specific considerations.
- Contact municipal or regional parks offices to see if their parks have shorelines and facilities suitable for a class field trip.
- Contact your local Naturalists' Club for suggestions. *https://bcnature.org/bc-nature-clubs/*



Do I need a permit?

As a courtesy (and in some cases, as required), notify the park office with your field trip date, activity plans, and number of people. This will ensure that your visit doesn't conflict with scheduled park activities and events or closures. Land managers may also be able to provide useful tips such as where drivers should park, best spots to explore, if there is a picnic area that you could reserve, or if the bathrooms will be under construction!

If visiting a Metro Vancouver Park, Email programs.info@metrovancouver.org to book and fill in a special use permit.

See the table below for some recommended beaches for ocean field trips in locations that are accessible or near schools and have facilities to support groups of students.

Nearby Towns	Beach Name, Management Agency	Habitats and Features
Vancouver Island, Victoria/Capital Regional District		
Central Saanich	Island View Beach Regional Park, Capital Regional District Parks	Cobbles with sandbars. High diversity of seaweeds. In late spring look for rocks covered in whelk eggs.
East Sooke	East Sooke Regional Park, Capital Regional District Parks	50 km of trails through forest, marsh & field. Pocket beaches, rocky bays & tide pools to explore. Aylard Farm entry: 5 minute walk to a pocket beach to discover intertidal life. Accessible toilet, picnic shelter & picnic area at trailhead, parking lot suitable for buses.
Esquimalt, Victoria West	Esquimalt Gorge Park, Township of Esquimalt	There is a small beach below the bridge on the east side suitable for intertidal studies, beach seine and observations of the reversing falls during tidal changes. In the main park there is a trail along the stream and estuary and a gravel beach. The Gorge Waterway Nature house has interpretive programs, a marine touch tank, and a watershed model.
Metchosin	Witty's Lagoon Regional Park, Capital Regional District Parks	Expansive sandy seashore with some areas of cobbles. Look for sculpins and flatfish in the tidepools on the sand.
North Saanich	Coles Bay Regional Park, Capital Regional District Parks	Douglas fir forest trail to a sheltered cove with cobbles and a sandy intertidal zone. Look for crabs, moon snails and sea stars.
Saanich	Mount Douglas Park beach, Saanich Parks	Sheltered shoreline with cobbles and sand bars. Adjoins a creek and forest with numerous trails.
Sooke	French Beach Provincial Park, BC Parks	Kid friendly oceanfront park with playground, picnic areas, hiking trails through second-growth and 1.6 km of sandy beach with pebbles and tidepools. Otters, seals, sea lions and whales may also be seen offshore. NOTE: Swimming not advised here due to strong undertow currents.
Victoria	Gonzales Beach, City of Victoria Parks	Primarily a sandy beach with a rocky intertidal area on the east end that has accessible tide pools when tidal levels are at or below 1 m.
Victoria	Willows Beach and Cattle Point, Oak Bay Parks	Sandy Willows beach is good for a beach seine. Nearby Cattle Point has a biodiverse rocky intertidal zone with many crabs and fish.

Nearby Towns	Beach Name, Management Agency	Habitats and Features
Vancouver Island, Cowichan Valley Regional District		
Mill Bay, Cobble Hill, Duncan	Bamberton Provincial Park, BC Parks	Salt marsh estuary, sandy beach and rocky intertidal zone.
Vancouver Island, Nanaimo		
Nanaimo	Departure Bay, City of Nanaimo Parks	Sandy beach with lots of shore crabs, sand dollars, clams, mussels, and rocks encrusted by barnacles.
Nanaimo	Neck Point Park, City of Nanaimo Parks	Rocky intertidal zone with high diversity. At low tides look for sea cucumbers, sculpins, and midshipman. Herring spawn here in spring.
Parksville	Rathtrevor Beach Provincial Park, BC Parks	Expansive sandy beach that retreats up to 1 km at low tides. Important area for migrating shorebirds. Look for mudsnails, clams, and sand dollars. Nature house.
Vancouver Island		
Campbell River	Willow Point Reef (near Hwy 19 and Larwood)	Sandstone reef. Wear gumboots and explore the shallows at low tide to discover moon snails, sea stars, sea urchins, gumboot chitons, nudibranchs and maybe even an octopus den.
Courtenay, Campbell River	Miracle Beach Provincial Park, BC Parks	Forest, creek, and expansive sandy intertidal zone. Nature house.
Courtenay, Comox	Seal Bay Nature Park, Comox Valley Regional District	Numerous trails along streams, wetlands, and through forest to a kilometer of cobbled beach.
Tofino	Pacific Rim National Park Reserve: Chesterman's Beach or MacKenzie Beach; Parks Canada	Beautiful beaches perfect for exploring tidal pools home to a wide variety of life, including tidepool fish, anemones, sea stars, crabs, mussels and goose neck barnacles. Easy access, washroom facilities and parking. Popular surfing location highlights humans enjoyment of the ocean.
Lower Mainland		
Belcarra, Anmore, Port Moody	Belcarra Regional Park, Metro Vancouver Parks	Rocky seashore as well as lake, wetland and forest habitats.
North Vancouver	Cates Park/Whey-ah-Wichen, District of North Vancouver	Large grassy area, forest trails and sandy beach. Tsleil-Waututh First Nations offer guided interpretive tours at this site.
South Surrey, White Rock	Blackie Spit, City of Surrey Parks	The northern tip of sandy crescent beach is a sand spit surrounded by tidal mudflats and eelgrass beds. Important feeding ground for migratory birds and other wildlife.

Nearby Towns	Beach Name, Management Agency	Habitats and Features
Tsawwassen	Boundary Bay Regional Park, Metro Vancouver Parks	Mudflats with eelgrass beds. Look for lugworm egg cases, bubble snails, and hooded nudibranchs.
Vancouver (UBC, Point Grey)	Acadia Beach in Pacific Spirit Regional Park, Metro Vancouver Parks	Rocky seashore with many crabs.
Vancouver (West End)	Lumbermen's Arch, Stanley Park, Stanley Park Ecology Society	Sandy beach easy to access below the Arch, a rock wall where you can look at intertidal zonation, and more rocky substrate further east. Good water quality and species diversity due to strong currents and tides. Forest nearby and grassy area that was a former First Nations village site, Whoi Whoi.
Southern Gulf Islands		
Galiano Island	Montague Harbour Marine Provincial Park, BC Parks	White shell beaches, open meadows, tidal lagoons, salt marsh, towering forests, craggy headlands and abundant bird life. The waters here attract flocks of wintering birds, including diving ducks like scoters, buffleheads, goldeneyes and mergansers. Evidence of First Nations land use, including shell middens, dates back more than 3,000 years. Easy access, washroom and picnic facilities.
North Coast		
Haida Gwaii	Naikoon Provincial Park, Graham Island	Coastal temperate rainforest ecosystems, wetlands and bogs, sand dunes and approximately 100 km of beaches. Tow Hill and Rose Spit are iconic natural features that are also prominent in Haida traditional stories.

Looking for a Guided Program?

This module is created so that you can confidently organize and facilitate hands-on, rich

learning experiences for your students at the ocean. Guided programs aren't available in all regions or parks and may be in high demand. However, if available, a guided program led by a local expert or park interpreter may enhance your students' learning. Some teachers like to do a combination of a guided program and one of their own design.

Here are some contacts to get you started.

Vancouver Island

- **BC Parks** - Guided programs led by RLC Park Services may be available at some Provincial Parks on Vancouver Island, such as Rathtrevor Beach and Miracle Beach. *naturehouse.ca/*
- **CRD Regional Parks** - Spring programs at Witty's Lagoon and Island View Beach Regional Parks. *crd.bc.ca/education/school-programs/for-k12-teachers/field-trips/park-interpretive-programs*
- **Victoria Natural History Society** - Offers volunteer naturalists to accompany school classes on field trips without charge. *vicnhs.bc.ca/?page_id=1437*

Lower Mainland

- **Metro Vancouver Parks** - *metrovancouver.org/services/parks/*
- **Stanley Park Ecology Society** - *stanleyparkecology.ca*
- **Vancouver Aquarium** - Take your students on a field trip to learn about ocean ecology: *vanaqua.org/education/*

Preparing for Your Trip

Checklist

Make your field trip plan early. Visit the site, gather all permissions and required forms, get your class prepared, and order or make your supplies.

Field Trip Materials

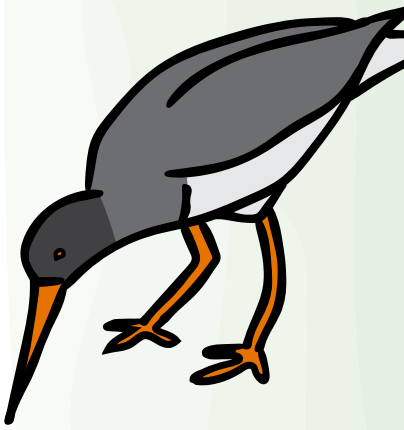
One of the most memorable experiences for anyone visiting the ocean is to explore the diversity of life found in the intertidal zone. It is essential that everyone on the field trip is sensitive about our potential impact on these creatures and that they are well versed in ways to avoid harming animals that are temporarily collected (such as keeping them in containers of water, don't pry animals off rocks; Refer to the Exploring the Intertidal Zone Ethics Tip Sheet: *hctfeducation.ca/file/intertidal-ethics.pdf*

Having "exploration tools" for your field trip to the ocean can help focus the students and enhance their learning. Basic materials, such as clipboards and sit-upons, can make outdoor learning more comfortable. Many tools are inexpensive and easy to make— making them together as a class can be a fun way to start learning about the field trip topics and activities.

Some Common Ocean Field Equipment and Materials

Suggested resources for schools to build a ready-to-go beach field study kit (using a tub and/or backpack):

- Class set of magnifiers
- Class set of clear, small collection containers (such as from the grocery store deli; get from the recycling bins)
- Several large clear bins to use as temporary aquaria
- Binoculars, if available. Useful for spotting wildlife, such as birds, seals, whales, and otters, and for looking at distant landforms
- A shovel or small trowel to find clams, worms, or other animals below the sand
- Field Guides (see Books and Other Resources section for some suggestions)
- Make or bring nature journals to record observations
- Outdoor microscope or discovery scope
- Lightweight clipboards
- Waterproof bag or container with a class set of pencils, erasers and a sharpener
- First Aid kit
- Dip nets for collecting small fish (don't use for crabs as they will get stuck in the net)
- Hula hoops or circle ropes for quadrat studies
- Rulers or measuring tape
- Garbage bag and gloves. Pick up trash that you find even if it isn't yours.



Other ideas for making your own field studies equipment:

- *Outdoor Classroom Essentials: materials to make or bring outdoors with your students.* ***hctfeducation.ca/file/outdoor-classroom-essentials.pdf***
- *Get Outdoors Basics Bag, available for purchase from HCTF Education.* ***resourceroom.hctfeducation.ca/products/get-outdoors-2***
- *Make your own dip nets to catch tidepool fish, shrimp, and other fast moving critters:* ***hctfeducation.ca/file/dip-net.pdf***

- Sit-Upons. Useful when doing quadrat studies to have something soft to kneel upon without getting damp. Have students make their own prior to the field trip. Make by filling a plastic bag with a cushion layer, such as cardboard folded in half and newspaper, and sealing all sides with duct tape.
- Plankton Nets or make your own, see How to Make a Plankton Net Copy Page. *hctfeducation.ca/file/plankton-net.pdf*
- Waterviewers or make your own, see How to Make an Underwater Viewer Copy Page, to discover the hidden life beneath the water's surface. *hctfeducation.ca/file/make-underwater-viewer.pdf*

Things to Know Before You Go: Setting the Stage for Curiosity and Wonder

Field trips in nature can be some of the most memorable and meaningful learning experiences for your students, opening a door of wonder and curiosity about the world. Help spark your students' interest by considering some inquiry questions before your trip. Foster a sense of social responsibility early to build appreciation for nature, encourage proper outdoor etiquette and minimize your impact in sensitive outdoor places.

Ocean Inquiry

Introduce students to the animals, plants, seaweeds, and habitats that you might see on your field trip to the ocean. Look at photographs, read books and watch videos about marine environments and the species that live there. Learn about local First Nations' lives along the coast, past and present. Play games to learn about marine ecosystems. Make a list of questions that students hope to learn from the field trip experience.

Sample Inquiry Questions

- How are sea creatures adapted to a life in saltwater? How would they be different in freshwater?
- How can so many animals live crowded on a rock?
- What are the abiotic conditions in the intertidal zone and how do they compare to that in the sea (subtidal zone)?
- How do animals move in water?
- How do animals breathe underwater?
- How are the senses of an intertidal animal different than our own?
- Why is there so much plastic in the ocean? How does marine plastic affect marine life?
- What types of marine plastic are most common? What are some things that we can do to reduce our consumption of plastic and the amount in the sea?
- What causes tides? How do tides change over the course of a day, a month, a season? How are tides different in different parts of the world?
- How are ocean currents formed and where do they go?

- How does the ocean regulate climate? How is climate change affecting the ocean?
- How did the First Nations who lived on this part of the coastline harvest the marine resources?
- What is being done to help protect the ocean and how can I help?

Social Responsibility

Start building an environmental ethic as early as possible in the school year to reinforce on outings in and around the schoolyard and on field trips. Have students collectively come up with rules on how to treat living things in the schoolyard and on the field trip (such as stay on the trail, leave flowers for all to enjoy, treat all animals with gentle care and respect.) Discuss with students the importance of minimizing their impact when they are outdoors.

See the Intertidal Ethics and Safety Tip Sheet: *hctfeducation.ca/file/intertidal-ethics.pdf*

Pre-Field Trip Learning

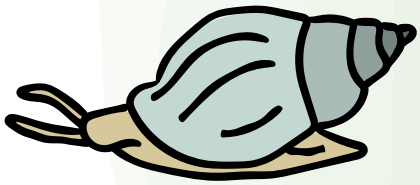
The three themes introduced in the previous section, Ocean Systems and Interconnections; Biodiversity and Adaptations; and Stewardship and Personal Responsibility, are ones in which you can focus upon with some activities prior to going on the field trip.

Pre-trip learning with your students will foster a deeper appreciation when you visit the ocean. Build upon these themes when you experience the ocean firsthand on your field trip and when you return to class.

Ocean Systems and Interconnections

"Even if you never have the chance to see or touch the ocean, the ocean touches you with every breath you take, every drop of water you drink, every bite you consume."

- Dr. Sylvia Earle, Oceanographer.



Blue Planet

Play catch with an inflatable Earth Ball to demonstrate how much of our planet is covered by the sea. Have all students gather in a large circle outside or in the gym. Assign someone to be the recorder. Ask the students if they think the Earth's surface is more water or land, and to estimate how much of the Earth is covered by water (Approximately 71%). Then play catch: toss the ball to someone and when they catch it, have them say out loud if their right thumb is on land or water. Record the results. Keep playing until everyone has a turn. Then calculate what percentage of the results were on land and water.

All About Tides

What causes tides? Over 300 years ago, Sir Isaac Newton explained that the ocean's tides are formed by the gravitational attraction of the sun and moon. Newton's law of universal gravitation revealed that the greater the mass of the objects and the closer they are to each other, the greater the gravitational attraction between them.

Our sun is 27 million times larger than our moon, so one might think that the gravitational force of the sun would be responsible for our tides. However, the sun is 390 times further from the Earth than is the moon. As a result, it is primarily the gravitational force of the moon that generates the tides, exerting about double the force upon our oceans than the sun.

The moon's gravity pulls the oceans towards the moon, forming a bulge of water on the area of ocean closest to the moon and also on the opposite side of the Earth. The bulge of water is high tide. Adjacent to these bulges, on either side of the earth, low tide is occurring. As the Earth rotates on its axis and as the moon revolves around Earth, the bulges and adjacent flat areas shift in location. Twice a month, at the new and full moon, the sun and moon are aligned and their gravitational forces are combined, creating more pronounced high and low tides (called spring tides). When the moon is at its first and third quarter phase, the gravitational forces of the sun and moon oppose each other, causing less pronounced tides (called neap tides). In addition to the gravitational forces of the moon and sun, winds, barometric pressure and local conditions such as the shape of the shoreline, also play a lesser role in determining the magnitude of the tides.

It is highly likely that you will plan your field trip to the ocean based on the tides. And the tidal levels will certainly affect what you will see and do on your field trip. So get your students involved in the field trip planning and in learning about tides! Here are some pre-field trip ideas on tidal forces. More can be found in the Additional Ocean Activities and Resources section.

Simulate the Tides

Have the students role play being the ocean surface, sun, and moon. Not only is it fun and active, but it will also help everyone to visualize and better understand the forces that create the tides and the factors that cause them to change over time. See the lesson Simulate the Tides for a complete description: *hctfeducation.ca/file/simulate-the-tides.pdf*

Tracking Tides - Read a Tide Chart

Have the students learn how to read a tide chart in both table and graph forms. At what time/s will the tide be high today? When will it be low? What will the tidal levels be during your field trip? Will the tide be rising (flow tide) or falling (ebb tide)? Challenge students to find the date and times when the lowest and highest tidal levels are predicted to occur within the next week. See the Additional Ocean Activities and Resources section to dig deeper into how tides change with phases of the moon and how they are different in coastal areas around the world.

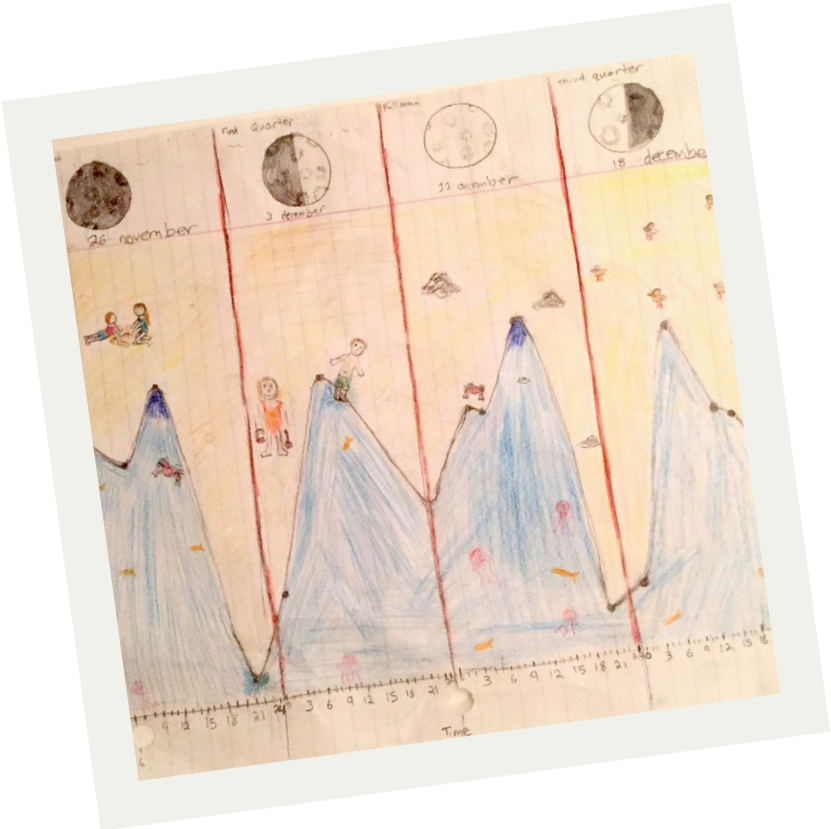
Check the local paper for the weekly tide chart in your area or refer to this website:

- Tides in British Columbia: *waterlevels.gc.ca*

Biodiversity and Adaptations

Discovering the diversity of life and species' adaptations to the intertidal zone is unforgettable and a highlight of any field trip to the ocean. How is it possible for so many species to live under such harsh and changing conditions? The animals that live in the intertidal zone have body systems and behaviours that help them to not only survive, but to thrive in their unique environment.

Learning about intertidal animals before the field trip provides an opportunity to discover their evolutionary relationships and fascinating adaptations to their habitats. Creatures that seem very different - such as sea stars and sea urchins; chitons and snails; or octopus and clams appear so different yet they are related! Most marine field guides are organized taxonomically (by evolutionary relationships) and can provide insights into how such seemingly different animals are related.



In contrast, distantly related species may have similar adaptations to help them to survive life in the intertidal zone. For example, many animals and seaweeds have structures that help them to cling to rocks so that they don't drift away in the waves. Clams and crabs have anatomy and behaviours that allow them to bury themselves in the sand. Other animals close-up or huddle together to retain moisture when the tides are out.

Make a Coastal Biodiversity Field Guide.

Divide the class into small groups. Each group should research a species that lives on the B.C. coast. See the Additional Resources section for recommended books and websites that could be used by students for their research.

Student research could include the following:

- Names (Scientific, common, First Nations)
- Taxonomy and related species
- Description and/or drawing of the species
- Predators and prey (what eats it, what it eats)
- Where it lives: range map and habitat description
- Adaptations to its environment
- First Nations connections to the species
- Conservation Status. What threatens the species and how can we help it survive the threats.

Compile all of the species descriptions and drawings to make a class field guide.

All About Plankton

Before going on the field trip, discover the fascinating and diverse world of plankton. Many of the species that you will see on your field trip to the ocean begin their lives as microscopic plankton, drifting in the ocean. Plankton are divided into two groups: phytoplankton (phyto meaning 'plant') and zooplankton (zoo meaning 'animal').

Most people don't realize that they are already familiar with one type of plankton: jellyfish. Jellyfish are considered plankton because they are not strong swimmers and drift with the ocean currents and tides. However, most plankton are not as well known and are single-celled, microscopic organisms. The ocean is like a soup full of these tiny drifters.

Did you know?

The word plankton comes from the Greek word for "drifter" or "wanderer". Over 70% of the oxygen in our atmosphere comes from the photosynthetic activity of phytoplankton, microscopic, single-celled plant-like algae. Plankton also feed the largest animal to have ever lived on earth, the blue whale. It is estimated that blue whales eat 4,000 kg of plankton and krill (tiny shrimp-like crustaceans) per day.

Phytoplankton

Phytoplankton are microscopic, photosynthesizing organisms that represent a diverse group of life, including plants, protists, and bacteria. Two of the major groups of phytoplankton are diatoms and dinoflagellates. Just like plants on land, phytoplankton need light, water, carbon dioxide, and nutrients (such as nitrogen and phosphorus) to grow and reproduce. By converting energy from sunlight into food, phytoplankton are the main primary producers and form the basis of the marine food chain. When ecosystems are out of balance and there are too many nutrients, a rapid population explosion of phytoplankton may result in a "bloom". Algal blooms change the color of the water and some are toxic, causing the death of large numbers of organisms.

Zooplankton

Zooplankton represent a diverse group of marine animals. Unlike phytoplankton, zooplankton cannot make their own food. Instead, they must eat other organisms to survive. Most of them eat phytoplankton; some eat smaller zooplankton. Each species has a preferred depth range.

Some zooplankton, such as copepods, spend their entire lives as plankton, drifting in the sea. Many other marine animals are zooplankton only during part of their life cycle. For example, zooplankton include the larval stage of sea anemones, snails, sea stars, crabs, barnacles, clams, sea urchins, bristle worms, and even some fish.

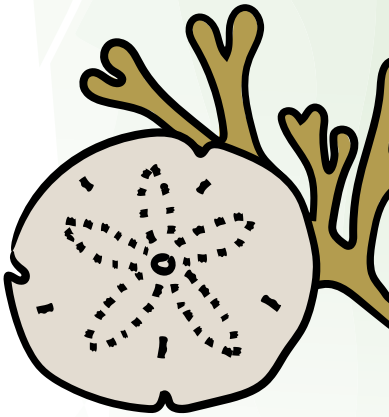
Some Plankton Activities:

Plankton Math

(adapted from National Geographic, *https://www.nationalgeographic.org/activity/save-the-plankton-breathe-freely/*)

One type of phytoplankton, *Prochlorococcus*, is the smallest and most abundant photosynthetic organism on Earth. It is so small that millions can fit into a single drop of water. Yet it is estimated that *Prochlorococcus* produces so much oxygen through photosynthesis that we can thank it for one out of five of our breaths. Try this activity to appreciate plankton while having fun with math.

- Divide students into groups of three and assign roles (timer, breather, and data recorder).
- Measure and record the number of breaths taken in 30 seconds.
- After all groups have collected and recorded their data, have students independently calculate how many breaths they take in one minute, one hour, and one day.
- Finally, have students calculate the number of breaths that come from the phytoplankton, *Prochlorococcus*.
- End the activity by thanking the plankton for our oxygen!



Make plankton nets to use on your field trip outing

Refer to the Copy Page for instructions on how to make a plankton net: *hctfeducation.ca/file/plankton-net.pdf*

Stewardship and Personal Responsibility

We are all connected to the ocean. We do not need to live near the sea to understand that wherever in the world we live, whether it is in a coastal area, a mountain town, interior region, or large urban city, our actions matter to the health of our oceans.

How are we all connected to the ocean?

- The ocean supplies freshwater in the form of rain and nearly all Earth's oxygen.
- The ocean regulates climate and influences weather.
- Food, medicines, and energy resources are provided by the ocean, which also supports jobs and national economies.
- The ocean acts as a highway for transportation of goods and people, and plays a role in national security.
- The ocean is a source of inspiration, recreation, rejuvenation, and discovery. It is also an important element in the heritage of many cultures.
- Much of the world's population lives in coastal areas which are susceptible to natural hazards (tsunamis, hurricanes, cyclones, sea level change, and storm surges).
- Even if you live far from the ocean, you live in a watershed. Watersheds are areas of land that share streams and rivers that all drain into a single larger body of water, such as a larger river, a lake or an ocean. This network of streams and rivers carries water that ultimately empties into the ocean.

How do our actions affect the ocean?

- Humans affect the ocean in a variety of ways. Laws, regulations, and resource management affect what is taken out and put into the ocean.
- Human development and activity leads to pollution changes to ocean chemistry (ocean acidification), and physical modifications (changes to beaches, shores, and rivers). In addition, humans have removed most of the large fish from the ocean.
- Changes in ocean temperature and pH due to human activities can affect the survival of some organisms and impact biological diversity (coral bleaching due to increased temperature and inhibition of shell formation due to ocean acidification).
- Waters that begin in watershed areas and flow into larger rivers, carry water pollution from the land and flow into lakes and oceans. All of the pollution that was in the rivers now is concentrated into these other bodies of water. The oceans of the world become the final resting place for tons of pollution.

Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

What can we do as Ocean Stewards?

Environmental stewardship is defined as the responsible use and protection of the natural environment through conservation and sustainable practices. Start building an environmental ethic as early as possible in the school year to reinforce on outings in and around the schoolyard and on field trips. Some easy ways to be ocean stewards:

- **Leave No Trace -** Take everything that you brought to the beach back home with you. It would be great if you took anything left by others as well, leaving the beach clean.
- **Respect Marine Wildlife -** Observe wildlife carefully and with respect. Keep a respectful distance from wildlife and don't chase or roughly handle creatures found on the shore or in the water. When we disturb wildlife, it can make it hard for them to hunt, rest, or avoid getting eaten.
- **Debris and pollution in our ocean** – specifically plastic pollution – is a serious concern for marine life. Animals like sea turtles, seabirds, and fish may mistake plastic and debris for food. By avoiding single use products and packaging and carefully recycling those you do use, the amount of plastic going into our oceans will be decreased.
- **Calculate Your Carbon Footprint -** You can help slow global warming and ocean acidification by reducing your "carbon footprint"—the amount of carbon dioxide released as you go about your daily activities. Calculate your carbon footprint and try to make small changes that will decrease your carbon emissions. *carbonfootprint.com/calculator.aspx*
- **Be the Ocean's Voice -** It is important to learn about the issues that are impacting your local area, and support groups that are working to positively affect the environment. The more you educate yourself on issues and share your knowledge with your friends and family, the more you can help make a difference in the ocean's health. One person can make a difference!

Building a Shoreline Code of Ethics

Field trips to the ocean 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. 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. These activities allow students to learn how to tread lightly and to practice proper marine etiquette. Creating a code of ethics before a trip to the seashore will help students to treat the life they discover there with respect and allow them a perspective that they may miss in the excitement of the field trip if not previously discussed.

Have students collectively come up with rules on how to treat living things in the schoolyard and on the field trip (keep shells and other "treasures" where they were found, watch your step and avoid walking on rocks covered in barnacles and snails, treat all animals with gentle care and respect and keep them in the water). Discuss with students the importance of minimizing their impact in the intertidal zone and making sure that they don't contribute to ocean plastic pollution (how to ensure that plastic wrappers and other garbage doesn't accidentally blow away).

See the Intertidal Ethics and Safety Tip Sheet for additional ideas:
hctfeducation.ca/file/intertidal-ethics.pdf
Share it with your students. What other guidelines can you add?

Watershed Walk

Not all of us live next to the ocean, but we all live in a watershed. A watershed is the area of land that drains into a common set of streams and rivers that all drain into a single larger body of water, such as a larger river, a lake or an ocean. If a drop of water falling into a watershed does not evaporate or become part of a plant or animal, it will flow out of the watershed through this outlet.

Learn about the watershed that your school is in. Find your watershed on a map. Your municipality may have watershed maps or you can start here: *https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/community-watersheds*. What is the watershed's name? What are the mountains or other landforms in the watershed? What streams and rivers are in your watershed? Where does it reach the sea?

You can make a simple watershed model using wax paper (or a larger one out of a shower curtain). Show the students the flat surface of the wax paper or shower curtain and tell them that it represents the surface of the land. But remind them that the land isn't entirely flat, there are mountains or hills, slopes and valleys. Crumple up the wax paper or shower curtain. If desired, you could draw the school or other local landmarks on your model. Using a watering can, trickle water over your model. Where does the water go? What would happen to things like paint, pesticides, soaps, and plastic that are discarded or sprayed in the watershed?

Go on a watershed walk starting from your schoolyard. Make a map of the school grounds showing impervious areas (paved) where water would flow quickly, and areas covered with vegetation (grass, trees, wetlands) that make it move more slowly, and filter and clean the water. Where are the downspouts and drains off the school? Can you tell which way the water would gather, collect, and flow? What areas are sloped? If there is a stream near your school that you can safely follow, walk along it. Which way is it flowing and what are the natural and human-made features along its path? Use your map as a prediction and then go out on the schoolyard again on a rainy day to see if your predictions were correct and what else you can discover.

Plastic Jellyfish (Project WILD/ Atout-Faune)

In this Project WILD activity, students learn about the impacts of plastic waste on aquatic wildlife. They monitor plastic waste production in their own households or in their school classroom and organize a schoolyard or neighbourhood cleanup.

You Made it to the Ocean!

Safety and Conservation Ethics

No doubt the students are excited to get out and explore. Before you begin you should review with students the safety guidelines and conservation ethics. Remind the students that they are guests in a special place and they have a responsibility to treat this place with care and respect. Reinforce the importance of carefully watching where you walk, of putting animals that will be temporarily collected and observed into containers of water, and gently and of replacing any overturned rocks to their original positions. Be sure that students leave everything they find at the beach. Help by picking up any garbage you may find. Your example is very important!

Field Trip Activities

Begin with an Energy Burner!

Especially after a long drive it can be helpful to start a field trip off with an active "energy burner" game before settling down for some focused exploration. An active game makes learning fun and helps to bond students to each other, to their adult leaders, and to the place. Find an open space away from sensitive natural areas where the students can safely run around without disturbing wildlife, trampling plants, intertidal organisms, or other sensitive habitats such as dunes.

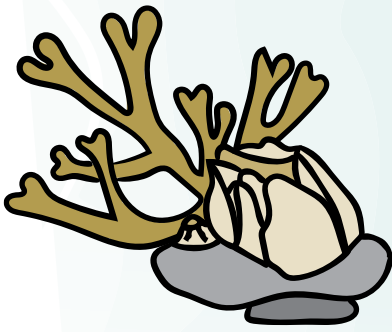
Orcas and Otters

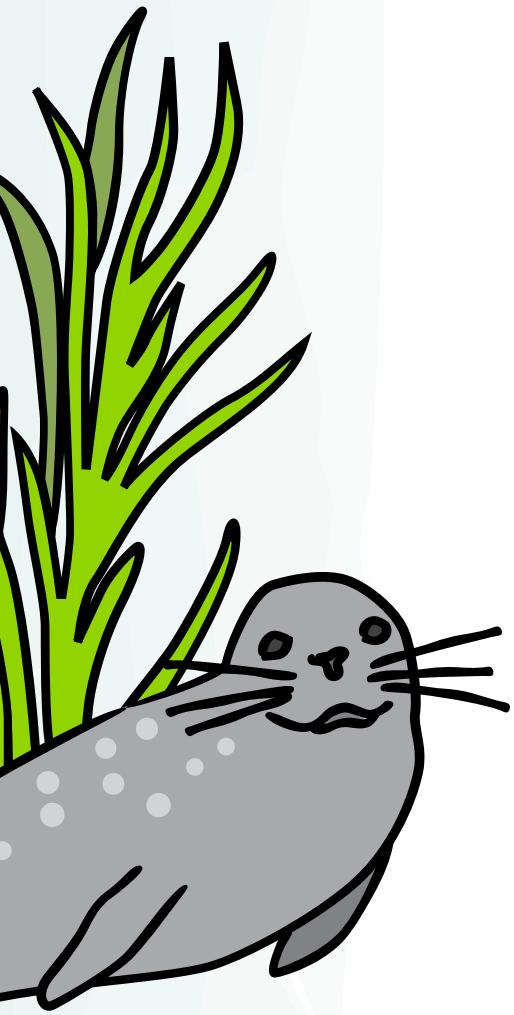
(adapted from Owls and Crows, in Sharing Nature with Children by Joseph Cornell. California: DAWN Publications, 1998.)

This is a tag game with a twist; a fun way to review in-class learning about the field trip topic.

1. Find a large, open area where students can run safely and without harming sensitive habitats, such as in a grassy field or an extensive sandy beach.
2. Identify your boundaries and create a "base" at each end of the playing area. (Lines could be drawn in the sand if playing at the beach, or use two different coloured cones). One end is the "True" side, the other is the "False" side.
3. Create a line in the middle of the playing area
4. Divide students into two groups: Orcas and Otters. All students gather along a centre line in the middle of the playing area, Orcas and Otters facing each other.
5. The teacher says a true/false statement based on something learned in class related to the field trip. For example: "Tides are created by the gravitational pull of the moon". Try to make your question unambiguous.
6. If the answer to the question is TRUE, the Otters chase the Orcas towards the True side of the playing field. If the answer to the question is FALSE, Orcas chase the Otters towards the False side of the playing field.
7. If a player is tagged before they cross to the appropriate safe side, they join the opposite team.
8. All players join back to the centre line with the new group of Orcas and Otters facing each other and repeat the process with a new questions.

Note that confusion is to be expected and is a fun part of the game!





Sensory Awareness

After burning off some energy, the students will be ready to focus their attention and start to explore the seashore. The activities outlined below instil a sense of calm and heightened awareness of the natural surroundings.

Sensory Wake Up Circle (Get Outdoors!)

Everyone in the class forms a circle in silence and the teacher guides them to slowly focus on one sense at a time, "waking up" each sense. Wake up the sense of touch by rubbing your hands together vigorously. Feel all the energy that you create by rubbing your hands together. Put your energized hands over your eyes to wake them up. Then take them off, look up high and down low. Do you notice anything that you didn't see before? Rub your hands together again as fast as you can. Wake up your sense of smell by putting your hands over your nose. Remove your hands and take a big sniff. What do you smell? How would you describe the smells in the air? Is it different than at the school? Continue to do the same for all the senses: taste the air (or raindrops), close your eyes and count how many sounds you can hear and in which directions they are coming from. Use "deer ears" to channel sounds from in front and then from behind you.

Touchstones (Get Outdoors!)

This activity heightens one's experience of the world by focusing on the sense of touch. Have the students stand or sit in a large circle with their hands behind their backs. Everyone is handed a stone that they feel and examine in detail without looking at it (they should keep their hands held behind their backs and with their eyes closed). After a minute or two, all the stones are then collected and placed in the centre of the circle. At this point students can look at the stones and try to determine which one was their stone, by first looking at it and then confirming by touching and holding it.

Take A Solo with a Mini Environment (Adapted from *Once Upon a Seashore* by Gloria Snively).

Find an area that looks interesting and where students can spread out safely and within hearing distance and sight of the teacher, such as a wooded area above the beach, a rocky shore, a sandy beach. Tell the students to spread out and find a "mini environment"- an object to explore that is about the size of one's hand.

Some mini environments to consider:

- A piece of driftwood
- A rock covered with barnacles or mussels
- A piece of seaweed
- An old oyster shell
- Mosses and lichens

Tell the students to take a solo with their mini environment (5-10 minutes).

- Watch the spot for several minutes. What happens? What things change? What moves? What stays the same?
- Look at the spot from different angles. What patterns and colours can you see?
- Explore the mini environment with your senses (except for taste). Touch the spot gently, smell it, listen to it.

- Close your eyes and try to picture the mini environment. Do this again and again until you can remember every detail.
- In your head, make up a story about your mini-environment.
- Share your mini environment with another person. Explain why you chose it and without looking at it, describe the details to a partner. Have your partner do the same about their mini environment. Tell your stories to one another.

Inquire and Investigate

Sensory awareness activities heighten one's connection with the outdoors and prime the students for some deeper inquiry and investigative activities, such as those described below.

Exploring Place with Inquiry

In this activity the students explore the ocean environment using their senses and simple tools. They think of and record all the questions that arise without answering them, and instead simply wonder and wonder some more. Discuss as a group the questions that arose and how they may go about further investigation during the field trip or back in class. See *https://hctfeducation.ca/file/exploring-place-with-inquiry.pdf* for a full description of the activity.

Exploring the Intertidal Zone

See the Lesson Exploring the Intertidal Zone for a step-by-step guide on how to conduct a safe and successful exploration of the intertidal zone with your students. *https://hctfeducation.ca/file/exploring-intertidal-zone.pdf*

Intertidal Transects

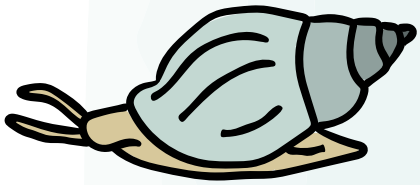
Looking for an activity that is more structured than a free exploration of the intertidal zone? Try doing an intertidal transect! This is a scientific method to collect data that helps to characterize the non-living (abiotic) and living (biotic) attributes along the shoreline from the low to high tidal zones. This activity is what best reveals the zonation along a seashore.

Essentially, a survey line (also called a transect, typically a 100 meter long rope) is placed from the low tide line up to the shoreline. Along the transect line at regular intervals, small groups of students collect data within hula hoops or one by one meter squares (quadrats). Within each quadrat, students can measure abiotic conditions such as water and air temperature, salinity (of tide pools), dissolved oxygen, and pH. They can also measure and describe substrate type and size (rocks, sand, and how much water covers the area). Within each quadrat students also identify and count the number of species found. Students can also map and draw the shoreline and the transect area.

Back in class, the data can be combined and analyzed. Students can identify gradients in the abiotic factors from low to high tide and look for corresponding changes in the species composition, abundance, and diversity across the transect.

Sampling the Plankton Soup

If you have learned about plankton and made plankton nets before your field trip, now is the time to sample the microscopic soup! Use plankton nets to sample the sea water by slowly dragging the net in the water, then transferring the sample from the bottle attached to the net into a collection container with a tight-fitting lid. Label the samples with the location where it was collected and the date. Keep the samples cold (bring a cooler) if you will bring them back to school to examine under a microscope. Or bring viewers into the field and observe onsite.



A Note on Field Identification

When your students bring something to you and ask, "What is this?"— don't worry about not being an expert or knowing the name. Rather than naming, try returning a question. "Where did you find it? What do you think those feathery things are? Does it have a mouth? Can you find the creature in the field guide?" Open-ended questions involve the students and encourage discovery. Students' can make up their own name for unknown organisms (such as the "pink-tipped, green, squishy tube"), which encourages observation. Remind your students that many scientific names are in fact Latin descriptions for what naturalists observed. Take photographs, use field guides, or consult with experts to help you identify what you found when you return to class.

Some tips and ideas for plankton sampling:

- Have students make predictions of what they will find.
- Sample different areas or habitats along the shoreline. Label the samples and compare.
- If you will be bringing the samples back to school to look at under the microscope, still observe them with the naked eye or magnifiers at the beach. What can you see? Is anything moving?
- Have students sketch what they see under the microscope.
- Try to identify what is seen using plankton guide. Look online for images of common zoo- and phytoplankton, such as this one: *https://akcoastalstudies.org/data/Curriculum-2020_out_of_school/marinephytoplanktonkachemakbay_studentguide.pdf*
- What else was collected? Are there any exoskeletons? Grains of sand? Microplastics? Unknown creatures? Keep a tally.

To add to your plankton investigations, you could also explore the seashore to survey for adult stages of the intertidal animals, many of which are planktonic as juveniles, such as gastropods (snails, sea slugs), crustaceans (crabs, shrimp and barnacles), bivalves (mussels, clams, oysters), and echinoderms (sea urchins, sea stars, sand dollars).

Easy Wrap-Up Activities at the Ocean

Before you leave to go back to school, take the time to share and reinforce the learning from the field trip. Some quick and easy wrap-up ideas include those that follow.

Sharing circle

Make sure to leave 5-10 minutes before you go back to school to form a sharing and gratitude circle. Pose the start of a question, such as:

- My favourite thing about this activity was…
- The coolest thing I saw today was…
- I got to know my friends better when…
- One thing I'll never forget about the activity is…
- Two words that describe how I feel about the activity are…
- For the first time in my life, I…

Have the students share something that was special to them about the field trip and what they are grateful that the ocean gave to them today. This is a wonderful way to bring closure to the day.

Trash Pass

Bring a garbage bag. Students can only leave the beach once they pick up and throw out at least one piece of trash. The sea life will be grateful!

3-2-1

Pair/share with a partner 3 things that you learned on the field trip, 2 questions that you have, and 1 way that you will help to make a difference. Come back to a whole class closing circle and invite those who would like to share one of these reflections with the group to do so.

Post Trip Learning Extensions and Connections

Back at school take some time to reflect upon and extend the field trip learning. Play ocean games. Do research to follow up on inquiry questions that arose on the field trip. Write stories or make artwork based on the field trip experience. Share your experiences with a buddy class. Here are some suggested activities to do with your class after the field trip.

Evaluate

- If a K/W/L (What I Know/Want to Know/Learned) chart and a list of inquiry questions were made prior to the trip, revisit them. What did you learn? What was different than you expected? What else do you want to know about the ocean?
- Compare and contrast the adaptations of various organisms in different niches or habitats, such as in the intertidal zone, in the sediments, on or under the rocks.

Communicate

- Design a mural or poster. Have the students work together to create a mural or poster reflecting the intertidal zone or other aspects from their visit to the ocean. If a class mural was made prior to the field trip, have the students add to it based on the field trip experience.
- Add to the ocean seasonal wheel showing the natural cycles and events throughout the year.
- Create a presentation. Have a slideshow with photos or artwork that the students created and including their comments, quotes and observations, and present it to another class.

Apply and Innovate

Now that you have learned so much from your field trip your students may be inspired to want to teach others about the importance of the ocean and to take action to help protect it.

- **Become an ocean steward.** Connect with your local naturalist group, invasive species council, BC Parks or other park, land trust, or conservation organization to see if there are opportunities for your class to help restore a nearby coastal area.
- **Become a citizen scientist** and increase our collective knowledge of the ocean by contributing your observations and data on the natural places nearby. Some organizations include: *ebird.org/home* (birds), and *inaturalist.org* (biodiversity)
- **Raise money to help clean up and restore** the ocean near your school.
- **Undertake an ocean action project.** Need help with taking on an Action Project? Download the *Leap into Action* guide for ideas and guidance. *hctfeducation.ca/file/leap-into-action.pdf*
- **Organize a beach cleanup.** Involve your class, the whole school, and even the greater community to cleanup your the shoreline in your region. Connect with organizations such as the Great Canadian Shoreline Cleanup: *shorelinecleanup.ca* or Surfrider Foundation: *cleanups.surfrider.org*.
- **Monitor the coastlines** and help conserve B.C.'s coastal waterbird populations by learning about or joining the monthly BC Coastal Waterbird Survey with Bird Studies Canada. *birdscanada.org/birdmon/bccws/main.jsp*
- **Ocean day event.** Does your school have an end of the year beach day? Now that your students have learned so much, have them share some of their learning with another class on a school beach day, such as how to play an ocean-themed game or how to be gentle with intertidal creatures when exploring the seashore.

No Butts About It

Cigarette butts are one of the most common items of litter at the shore. They are toxic and the filters don't biodegrade. Many cigarettes arrive at the beach because they are improperly disposed of on land, and then are transported by water runoff to the sea. In 2017, volunteers with The Ocean Conservancy's International Coastal Cleanup collected more than 2.4 MILLION cigarette butts, worldwide. (Always use gloves when picking up trash!)

Additional Ocean Activities and Resources

There are so many learning opportunities at the ocean! If you are looking for more ideas, here are some other favourite activities and resources to support you before you go, during your field trip, and when you return.

Additional Classroom and Schoolyard Activities

Here are some additional activities that could be done in the classroom or schoolyard to introduce some concepts before the field trip or to reinforce learning afterwards.

Investigating Tides

Phases of the Moon

How does the phase of the moon affect tides? Choose one location to focus on, perhaps your field trip location or another site of interest. Look up the dates of the next New, First Quarter, Full, and Third Quarter phases of the moon. Look up the predicted low and high tides for 24 hours on each of those dates and write them down in a chart. Then make four graphs, one for each phase of the moon. On the horizontal (x-axis) put Time (hours, from 0 to 24, representing one day). The vertical (y-axis) is tidal height in meters. Make sure that all four graphs have the same scale. How does the tidal height change over the course of the day? Compare the tidal heights and their fluctuations at the different phases of the moon. Which are the Spring tides and which are Neap? On what day and phase of the moon will you find the greatest difference between low and high tide? The smallest difference?

Tides Around the World

Choose a date within the next two weeks. Choose three locations in different parts of the world. Graph the tidal heights at three locations in different parts of the world over a 24 hour period on the chosen date. Are the tides the same at all three locations? How do they compare? Do they all have two high and two low tides? Which place has the highest and lowest? What other factors might affect tidal levels? (Latitude, shoreline shape and depth).

Useful websites for tracking tides activities

- Tides in British Columbia: *waterlevels.gc.ca*
- Phases of the Moon: *almanac.com/astronomy/moon/calendar*
- Tides around the world: *tide-forecast.com/countries*
- Tide chart for the highest tides in the world at Burntcoat Head, Bay of Fundy: *waterlevels.gc.ca/eng/station?sid=270*

Ocean Systems and Interconnections

Water Wonders

Water is amazing! If not for the unique properties of water, life as we know it wouldn't exist. Learn about the physical and chemical properties of water and how fresh and seawater compare.

Read: the Water Primer from HCTF Education to learn the key concepts that water connects all earth systems through the water cycle, all living things depend upon water, and water is finite: *hctfeducation.ca/file/water-primer.pdf*

Watch: Why Water is Really, Really Weird. Did you know that the water inside you has previously been inside dinosaurs, bacteria, the oceans. Science journalist Alok Jha explains why water is so incredibly weird. BBC Ideas Video. 3 min. 16 sec. *bbc.co.uk/ideas/videos/why-water-is-one-of-the-weirdest-things-in-the-uni/p06y2c9k*

Do: Water Experiments to learn about how water density differs with temperature and salinity and the implications in natural systems.

- **Temperature: Comparing Warm and Cold Water**
    - Get two glass cups or beakers. Fill one with cold water and drop of blue food colouring and the other one with hot water and a drop of red food colouring. Gently tilt both cups so that the liquids almost touch (or use a dropper to add drops of hot water to the cold water). Allow the hot water to flow over the cold water. Look at the containers from the side and draw what you see. Which is more dense, cold or hot water? How does heat energy affect the movement of water molecules? When is it easier for molecules to stay close together, when they move slowly or quickly? Hold a straw at the edge of the top of the glass so that it is parallel to the water surface. Gently blow through the straw. What happens to the water?
    - Make ice cubes with food colouring. Put one in a glass of warm water and watch from the side. What happens to the colouring as the ice melts?
    - Discuss how the temperature of the ocean isn't uniform across the globe. Have the students predict where the sea is warmer and colder. The temperature of the water affects its density, which in turn affects how the water moves in the ocean and the way deep ocean currents move. What do you think will happen when cold water from the Polar regions meets with warmer water from the equator? (Cold water is more dense than warm water. Cold water sinks and warm water will sit on top. Wind will mix the layers of warm and cold water.)
- **Will Seawater and Freshwater Mix?**
    - Fill two glasses with water. Add salt to one of the glasses, stirring it and adding more until no more salt dissolves. Place a hard-boiled egg in each glass. (The egg should float in the salt water. If not, add more salt). How does salt affect the density of water? Consider what this means for the animals that live in seawater and saltwater.
    - Add food colouring to the cup of fresh water. Slowly and gently pour a bit of freshwater on top of the salt water or use an eyedropper to add droplets. What happens to the freshwater, does it mix? Does it sink or float? Discuss what might happen when it rains at sea? How might it affect salinity at the surface or at depth? How would the salinity change on a rainy and windy day compared to a calm and rainy day? Discuss the implications of this experiment for tidal estuaries, where freshwater and seawater regularly meet and mix.

Water Wonders Cont'd

- **What in the World is Water?** Students consider the molecular make-up of water and then discuss the three phases that water exists in on earth. Students then create their own mini water cycle model. To demonstrate their learning, students will develop either a mind map or Powerpoint presentation.
  Full lesson here: *hctfeducation.ca/file/what-is-water.pdf*

Did you know? The concentration of salt in seawater (salinity) is on average 35 parts per thousand. That means that about 3.5 percent of the weight of seawater comes from the dissolved salts. If the salt in the ocean could be removed and spread evenly over the Earth's land surface it would form a layer more than 150 meters thick--about the height of a 40-storey building!

Ocean Systems and Interconnections

Tending the Garden

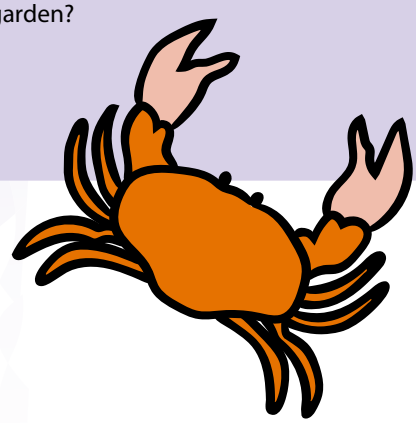
Along the coast of BC and from Alaska to Washington State, ancient rock walls reveal a deep connection between people and the seas that sustained their communities. For thousands of years, First Nations tended the coastline like a garden, caring for it like a dear family member to promote a preferred source of food: clams. These clam gardens are part of the belief system and food system of coastal First Peoples. Clam gardens were also a gathering place of connections, where knowledge was handed down from the elders.

All species in the intertidal zone live within their preferred zone, where nutrients, salinity, temperatures, and exposure to air and water are ideal. First Nations along the coast moved rocks to build long, low-lying rock walls along low tide sections of specific beaches. Over time, wave action along the rock walls caused changes to the beach, including gentler slopes, warmer water temperatures, and increased nutrients. And most importantly to the people who built them, the rock walls resulted in a faster growth rate and increase in the abundance of delectable clams, including littleneck, butter clams and cockles. Other intertidal species also benefited from the construction of clam gardens, with some studies showing greater biodiversity on shorelines with clam gardens than at those without.

Since colonization and the forced removal of indigenous people from the land, most clam gardens are unmaintained and many have been swept to sea. But evidence of First Nations peoples' hard work and intimate knowledge of the sea remains. Research shows that more than 35% of the coast of Quadra Island had clam gardens! Parks Canada is working with numerous First Nations groups in the Gulf Island National Parks Reserve to restore clam gardens.

What can you learn about clam gardens?

- **Research** clam gardens, how they were made, how their construction changed the abiotic (non-living) and biotic (living) elements on the shore. Start by watching this video from Hakai Magazine. *https://www.hakaimagazine.com/videos-visuals/wall-worth-building-making-clam-habitat-great-again/*
- **Connect** with local First Nations knowledge keepers to learn about clam gardens or other traditional practices at the ocean.
- **Discuss** what clam gardens reveal about the connection that the Coast Salish and other First Nations people have with the land and sea. What knowledge must one have in order to build a clam garden?
- **Discuss** the expression "When the Tide Goes Out, The Table is Set", which refers to the rich bounty of the coast and First Nations traditions. **Listen** to the song with the same title: *http://folklore.bc.ca/when-the-tide-goes-out/*. Does the expression imply a passive role in harvesting and is that accurate? (Perhaps Tide has a First Nations 'sous-chef' who builds a rock wall to make an even better feast!)
- **Make** a diorama or drawings of a cross section of two beaches: one with a clam garden and one without. Show the differences in the beach slope, substrates, and abundance of species living in the intertidal zones in both areas.
- **Learn about** clams and other species that would be found in a clam garden.



Biodiversity and Adaptations

Plankton

- **Watch videos.** Here are some recommended videos to learn about the fascinating forms and functions of plankton:
  - TedEd, The Secret Life of Plankton *ed.ted.com/lessons/the-secret-life-of-plankton*
  - Plankton Chronicles *planktonchronicles.org/en/*
- **Model plankton.** Use photos and drawings from the internet as a guide to make plankton models out of clay or plankton paintings displayed on a class bulletin board.

In the Zone

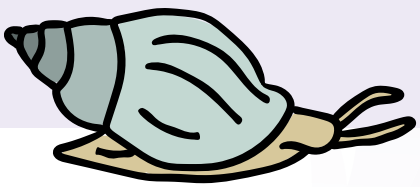
Create a class mural of a profile of a rocky or sandy intertidal zone. Include the splash zone, high tide, mid tide, low tide, and subtidal zones and the most commonly found organisms in each zone. Return to your creation after the field trip and add or modify it based on the field trip findings.
Sandy Shore Profile: *hctfeducation.ca/file/sandy-shore-profile.pdf*
Rocky Shore Profile: *hctfeducation.ca/file/rocky-shore.pdf*

Stewardship and Personal Responsibility

Marine Plastics

Have students do a research project on plastic pollution and its effect on marine life and the marine ecosystem. Here are some facts to get them started. Be solutions-oriented and have students discuss what can we do as individuals and as a society to help remedy this problem. (And then get started on making those changes!)

- Over 300 million tons of plastic are produced every year for use in a wide variety of applications.
- At least 8 million tons of plastic end up in our oceans every year, the equivalent of nearly 57,000 blue whales - every single year! By 2050, ocean plastic will outweigh all of the ocean's fish.
- Ocean trash can be broken into smaller pieces — known as microplastic — by sun exposure and wave action, after which it can find its way into the food chain. When it eventually degrades (which takes 400 years for most plastic), the process releases chemicals that further contaminate the sea.
- More than 800 animal species are negatively affected by marine debris. Marine species ingest or are entangled by plastic debris, which causes severe injuries and deaths. The number of animal species affected by marine debris (including microplastics, and lost or abandoned fishing gear) is on the increase. According to UNESCO, an estimated 100,000 marine mammals and 1 million seabirds die each year from plastic pollution. In B.C., biologists have observed over 900 sea lions entangled in plastic along our coast.
- Plastic pollution threatens food safety and quality, human health, coastal tourism, and contributes to climate change.



Sustainable seafood

Research how different seafood is harvested. Use resources from the Monterey Bay Aquarium Seafood Watch program: *seafoodwatch.org*

What makes it sustainable or not? Sustainable seafood is seafood fished or farmed in a manner that can maintain production of that species in the long term, while preserving the health and function of the web of life in the oceans. Learn about First Nations' fishing and harvesting methods, which species were eaten, and how they were eaten.Have students go to the grocery store seafood section and learn where the seafood was harvested (in what part of B.C. or other parts of the world) and how it was caught. Sample some sustainable seafood. Have a sustainable seafood feast using these recipes and resources from the Marine Stewardship Council*: msc.org/en-us/what-you-can-do/sustainable-recipes*

Oil Spill Cleanup Challenge!

(Adapted from Vivify STEM)

In this hands-on classroom activity, student teams are challenged to clean up "oil" from a simulated oil spill disaster. The learning objective is to increase understanding of an oil spill disaster and environmental consequences. Students are given this mission:

Your engineering company has been tasked with cleaning up a major oil spill disaster. You can only use the provided materials to clean up all the oil from the feathers and from the water. Place all collected oil into the provided container.

Materials needed: (divided evenly between 5 groups)

- 150 cotton balls
- 5 trays
- 15 sponges (large ones can be cut in half)
- Vegetable oil: amount depends on tray, use a 1:4 oil to water ratio
- 25 plastic spoons
- Dish soap
- 15 plastic cups: to put soap and cotton balls for each team
- Cocoa powder: to mix with oil and make it look like crude oil
- 50 bird feathers (The feathers may be reused if needed. Feather dusters are a good source of feathers.)
- 5 Tarps or tablecloths to put under each tray, as this activity can be messy.

Set up the trays with oil, water, cocoa, and bird feathers.

Give students about 15 minutes to clean as much of the oil from the water and feathers as possible. You can then qualitatively compare the bins and discuss the difficulties of removing the oil. Or students can be instructed to collect the oil in cups for measurement. Note that the oil will separate from the water, and a ruler can be used to measure the height of oil removed.

Discuss the difficulties in removing oil and how oil affects wildlife. Learn about some of the biggest oil spills. Discuss what we can do as individuals and a society to avoid disastrous oil spills.

Additional Field Trip Activities

Energy Burners

Marine Animal Race

This game is a good way to warm up on cool days at the shore and to quickly move students across a large field or flat, sandy beach to get to another area of investigation. It is a fun and active way to role play the ways that animals move in the water. Only play this in areas free from rocks or other tripping hazards.

Students spread out in a horizontal line. If you are on sand you can draw a line in the sand with your foot. Define your boundaries and the end point destination (such as "at the tidepool" or "at the circle drawn in the sand around the aquarium"). Review how some common animals move in the water and have the students practice the movements, such as:

- **Fish:** Quick swimmer, moving its fins (run quickly and use your hands as fins)
- **Crab:** Sideways walker (walk sideways on your feet, or get down on all fours with your back towards the ground)
- **Jellyfish:** floats with the tides and currents without direction, pulsating and spinning around. (Wave your arms like tentacles and drift slowly in a circle or back and forth)
- **Shrimp:** Has sudden, backwards bursts of movement. (Jump backwards— make sure to watch where you are going!)
- **Barnacle:** As an adult, it is permanently stuck to a rock and doesn't move. (Freeze).
- Students could come up with other animals and agree upon their movements, such as clams, scallops, sea stars, sea lions, or whales.

The teacher goes towards the end destination and faces the students. Call out an animal. The students move quickly across the playing area being that animal. Wait a couple of seconds and then call out a different animal. Call out "barnacle" (freeze) to control the pace of the students and to allow yourself time to move and keep in front of the group. If anyone doesn't freeze or move like the particular animal that you called, that student must go back to the starting line. The game ends when everyone reaches the end destination.

Ocean Habitag

See the lesson "Ocean Habitag" for a thinking game of tag that introduces students to some of the relationships and interconnections between marine animals and their preferred habitats, and First Peoples' connections to the ocean. *hctfeducation.ca/file/ocean-habitag.pdf*

Where the Wind Blows

(Adapted from David Suzuki Foundation OceanKeepers, Oceans Activity Kit for Kids, October 2013; *http://tnenvis.nic.in/WriteReadData/CMS/OCEAN%20ACTIVITY.pdf*)

This is a fast-paced game, similar to "musical chairs", that offers an opportunity for students to learn about their combined impact on and experiences with the ocean.

Procedure:

1. Students all stand in a circle with one person in the centre.
2. The person in the centre makes a statement about how he or she has connected with the ocean or something related to the ocean (such as, I have taken a ferry).
3. Then, all the students who relate to that statement (in this case, those who have been on a ferry) have to quickly switch places with another person in the circle.
4. The person who is left without a spot in the circle goes to the centre and becomes the next caller.
5. The statements continue for as long as you wish to play the game.
6. The caller can also choose to make one special statement ("Swim in the ocean!"). When this statement is called, everyone has to change places with someone else in the circle.

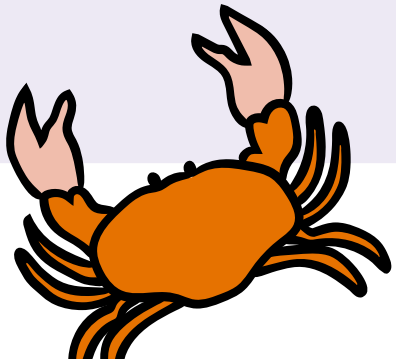
Some sample statements:

- I have been to ____ (Haida Gwaii, Bella Coola, Saltspring Island, Vancouver Island, Bamfield, etc)
- I have been on a ferry
- I have been to the Vancouver Aquarium (or to the Shaw Centre for the Salish Sea, or other local aquarium)
- I have seen a whale
- I have seen salmon spawning
- I have held a crab
- I have been fishing
- I have eaten sushi
- I have been on a boat
- I have been stung by a jellyfish
- I have picked up plastic garbage at the beach
- I have gone snorkeling/surfing/boogie boarding
- I have seen the Atlantic Ocean

Sensory Awareness

The wonders of nature are all around us. Discovering them simply requires a bit of patience and practice, and for us to take some time to unplug from our modern technological world and to reconnect with our senses. The following recommended activities are easily done in any location, including the schoolyard, and help to develop awareness and connections to nature.

- Sensory Awareness: For Good Mind and Body. A selection of simple and engaging activities to build sensory awareness. *hctfeducation.ca/file/c2c-sensory-awareness.pdf*
- Sense Walk. Students use their five senses, one at a time, on a nature walk. *hctfeducation.ca/file/sense-walk.pdf*



Sound Map (Get Outdoors!)

We are highly visual creatures and we perceive much of our world through our sense of sight. In this activity, students experience nature in a new way, by focusing on sounds and creating a map of what they hear. Students should spread out and sit on the ground. Have them write their name and an 'X' in the middle of a page and draw light lines dividing the pages into quarters. Students close their eyes. As each new sound is heard, a symbol is recorded on the map in the direction where it was heard relative to the X on the map. Use a different symbol for each of the different types of sounds (such as a wave for the ocean, wavy lines for the wind, music note for bird call, etc.) Make a legend/key for the symbols that are used.

An alternative sound activity that doesn't require pencil and paper is to do a "fist listen". With eyes closed and in silence, students listen to all the sounds around them. Students use their fingers to count every time they hear a new sound.

Ask the students what the experience was like for them. What sounds were heard and what directions were they were coming from? What sounds were from nature or created by humans? How does their experience compare to what they may have noticed with their eyes open?

Inquire and Investigate

High Tide Wonders

There are many discoveries to make at the shore even if much of the beach is under water. Here are some ideas:

- **Sand Studies.** The size, shape, and colour of sand can reveal much about the environmental history of a place. Most sand is made up of decomposed rocks, some which may have been carried thousands of miles from the ocean. The shape and size of sand grains can be measured and classified, revealing the weathering history and intensity of wave actions. Sand may also contain calcium carbonate from once living organisms, including molluscs, tube worms, sea urchins and corals. Bring some white vinegar to the ocean and add it to a small amount of sand in a jar. If it bubbles, that means the sand is composed of these once living animals. Find more information and activities to learn about sand here: *manoa.hawaii.edu/exploringourfluidearth/physical/coastal-interactions/beaches-and-sand*
- **Seaweed Sort.** How many different species can be found? Sort them by form and colour. Find their main parts (holdfast, stipe, blade, frond, bladder). Use field guides to identify them or take photos and submit to iNaturalist back in the classroom.
- **Beach Art.** Create beach mandalas or sculptures using natural objects such as seaweeds, driftwood, rocks and sand. Watch as the rising tide brings the creations back to wild nature. Back in class learn about other creators of "earth art", such as Andy Goldsworthy.
- **Gifts from the Tide.** Examine the "wrack zone" at the highest tide line. The wrack zone is the linear patch of living and non-living debris toward the upper part of a beach running parallel to the water's edge. What has the tide brought up and what clues can you find that reveal who lives at this beach? Look under the seaweeds and feel if it is moist. Look for beach hoppers, seaweed flies, other life in and around the seaweed. Look for crab moults, mollusc shells, and plastic garbage. What plastic debris is most common? How can we reduce and prevent trash from getting into the ocean?
- **Seashore Mapping.** Sketch and map the built and natural features of the coastline, the exposed rock, landforms, waterline, and waves. Map tidepools, their features and inhabitants.

High Tide Wonders Cont'd

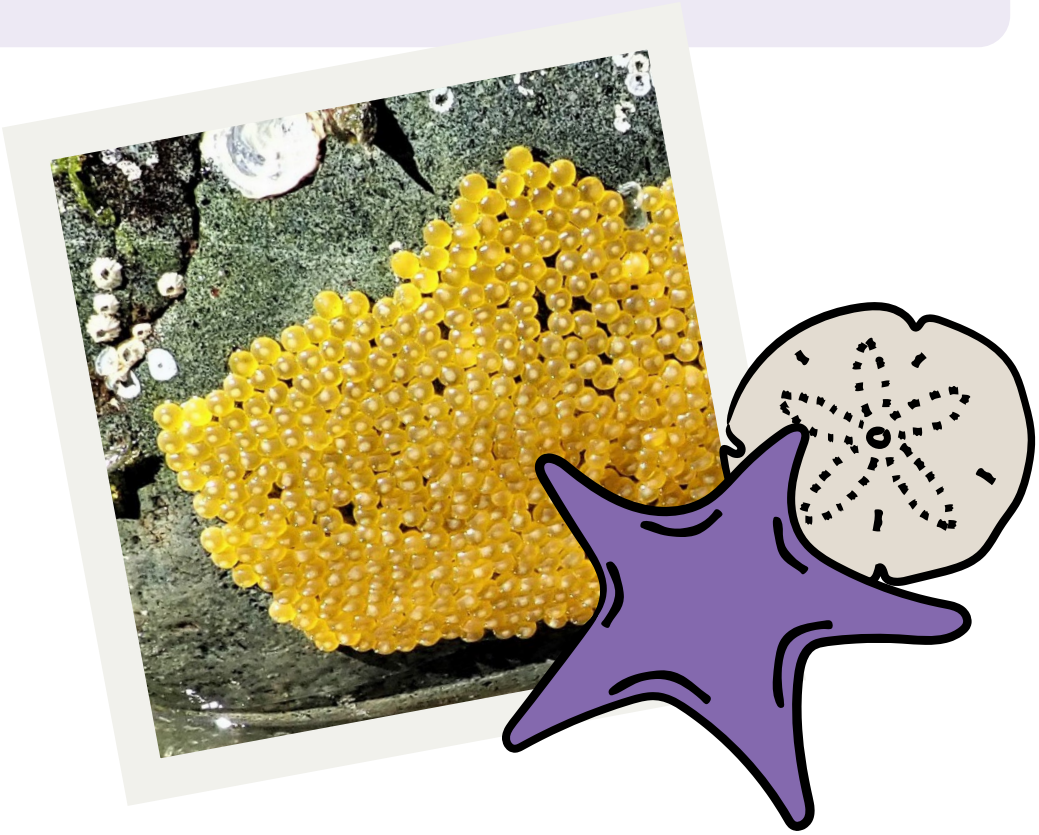
- **Waves and Weather.** Learn how to read ocean weather maps and surf charts then go to the ocean to record the wave height and wave period, wind speed and direction, and cloud cover.
- **Birdwatch.** Get out your binoculars and check out the birds! Bird watching at the beach is so much easier than in the forest, where they tend to be hidden by branches and leaves and flit around much more than at the sea. From late fall to early spring the ocean is home to an amazing diversity of seabirds who spend the winter on the sheltered bays and inlets of BC's coast. Look for murrelets, auklets, pigeon guillemots, mergansers, grebes, loons, and numerous species of diving ducks such as buffleheads, goldeneyes, scoters, and harlequin ducks. Year round feathered residents include great blue herons, cormorants, black turnstones, black oystercatchers, numerous species of gulls, northwestern crows, and bald eagles.

Go on a Coastal Plant Walk

What is growing at the edge of the seashore? What plants are farther away from the beach? Are the plants growing at the seashore the same or different than those found in other habitats that the students may be familiar with, such as in the forest or schoolyard? How do plants cope with wind, salt spray, sandy or rocky soils? Be sure to stay on trails and out of sensitive habitats, such as dunes. Some plants, such as Salicornia (also known as sea asparagus or pickleweed), grow right in the high tidal zones of sandy beaches and estuaries. They may also be found in the deli at your local grocery store, yum!

Seashore Scavenger Hunt

Discover the biodiversity at the seashore with a scavenger hunt.
See Copy Page: *hctfeducation.ca/file/intertidal-scavenger-hunt.pdf*



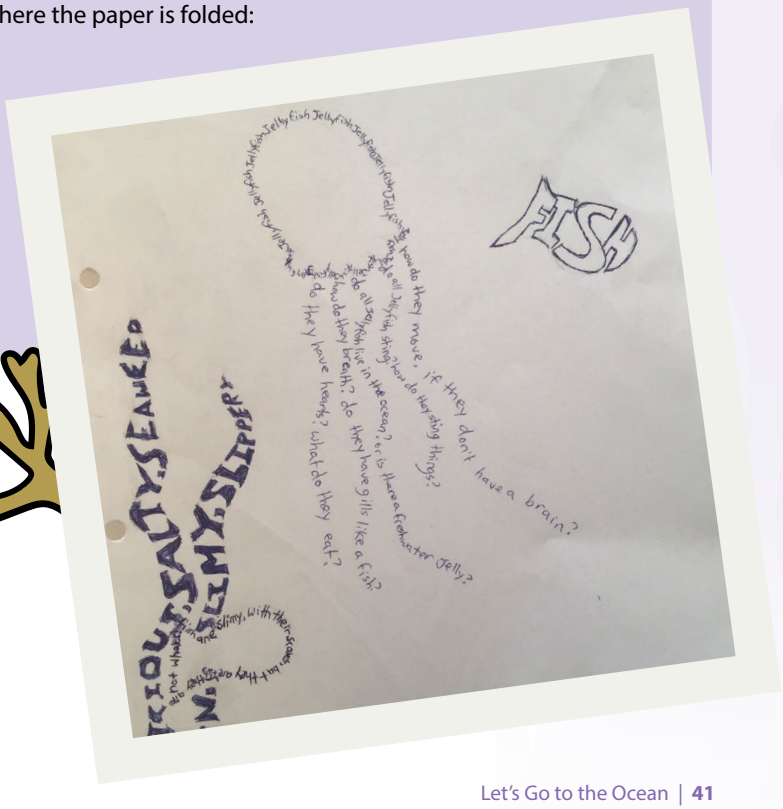
Back at School Activities

Communicate

By the Sea Poetry

Have the students write ocean poetry based on their field trip experience. Have a poetry slam, publish the poetry in a bound class book, or display on the walls. A recommended book of ocean-themed poems to read and be inspired by is Refugium: Poems for the Pacific, Edited by Yvonne Blomer. Caitlin Press, B.C., 2017. Here are some fun ideas for marine-themed poems:

- **Ocean Haiku** - A short form of Japanese poetry in three lines, in the order of 5 syllables, 7 syllables and then 5 syllables. Traditional characteristics of haiku are simplicity, intensity, and directness of expression.
- **Concrete Poem -** A great choice for students who may be reluctant writers but love to draw. The poem is written in a way such that the words create the shape of the subject of the poem (such as a marine animal or an ocean wave). Students can get creative and draw a picture to accompany the poem they've written.
- **Folding Poems** - (From Joseph Cornell, Sharing Nature with Children). A folding poem captures the inspiration from shared nature experiences. Divide students into groups of three and give each group a piece of paper and pencil. Each group creates a poem expressing their field trip experience. As the poem is being written each student has only a partial knowledge of the poem.
    - How to do a folding poem: The three people in the group are designated students A, B, and C. The first person for each team, A, writes the first line of the poem then passes it to B. Student B writes one line that responds to A's line, then writes another line, then folds the poem so that the third person, C, sees only the last line written. Student C writes a line responding to B's last line, then writes another, then folds the poem so that A sees only the last line. Student A writes the last line of the stanza. After about 10 minutes when all the groups are finished, have each group read their poem.
    - Below is a diagram of who writes what and where the paper is folded:
      Line 1: Written by Student A
      Line 2: Written by Student B
      ----- folded by Student B-----
      Line 3: Written by Student B
      Line 4: Written by Student C
      -------folded by Student C------
      Line 5: Written by Student C
      Line 6: Written by Student A



Books and Other Resources

Field Guides and Marine Species Cards

- **A Field Guide to Seashells and Shellfish of the Pacific Northwest** (Pamphlet) by Rick Harbo. Madeira Park, B.C.: Harbour Publishing, 2009. *https://resourceroom.hctfeducation.ca/products/field-guide-seashells-and-shellfish-of-the-pacific-northwest*
- **A Field Guide to Seaweeds of the Pacific Northwest** (Pamphlet) by Dr. Bridgette Clarkston. Madeira Park, B.C.: Harbour Publishing, 2015. *resourceroom.hctfeducation.ca/products/field-guide-seaweeds-of-the-pacific-northwest*
- **Biodiversity of the Central Coast:** An interactive field guide to the species of the Central Coast and Great Bear Rainforest of British Columbia. Use online or download as a free app: *centralcoastbiodiversity.org*
- **EFauna:** Atlas of the wildlife of British Columbia that provides a centralized source of scientifically accurate information for use in conservation, education and research. Includes interactive maps. *linnet.geog.ubc.ca/efauna/*
- **Explore the Rocky Shore at Stanley Park** by Sheila Byers. Vancouver Natural History Society, 2011. e-version available at *https://naturevancouver.ca/wp-content/uploads/2018/12/Nature_Vancouver_Intertidal_Pamphlet.pdf*
- **Fishes of the Salish Sea** (Folding Guide) by Val Kells. Wilton, New Hampshire: Earth Sky and Water, 2017. *www.earthskywater.net*
- **Mac's Field Guide to Northwest Coastal Invertebrates** by Craig MacGowan. (Waterproof, laminated sheet.) Seattle: Mountaineers Books, Seattle, 1988. *mountaineers.org/books/books/macs-field-guides-northwest-coastal-invertebrates*
- **Ocean Animal Clue Cards** by Gloria Snively. Victoria, British Columbia: Kingfisher Press, 2001. Available here: *kingfisherpress.ca/oac.html*
- ***The Beachcomber's Guide to Seashore Life in the Pacific Northwest*** by J. Duane Sept. British Columbia: Harbour Publishing, 2009.
- **The Phylo(mon) Project:** This Pokemon-like card game is hosted by Ocean Wise and the Vancouver Aquarium and was created by high school students. It includes a variety of organisms that are locally relevant to marine habitats in British Columbia, as well as species found in the Vancouver Aquarium space. The deck can be downloaded to print or can be purchased. *phylogame.org/decks/ocean-wise-west-coast-marine-life-deck/*
- **Uuathluk Ocean Knowledge Cards:** The Nuu-chah-nulth Ocean Knowledge Cards highlight 36 species of sea life found along Vancouver Island's west coast. The cards show the ways that Nuu-chah-nulth people harvest and prepare these sea foods, which have been culturally significant for millennia and remain so to this day. Any proceeds resulting from sales of the cards will be reinvested in capacity building programs in Nuu-chah-nulth communities. *uuathluk.ca/publications/ocean-knowledge-cards/*

- **Vic High Marine:** Online marine field guide with descriptions, photos and videos, created by Victoria High School students on Vancouver Island. They also have a YouTube channel. *vichighmarine.ca*
- ***Whelks to Whales: Coastal Marine Life of the Pacific Northwest*** by Rick M. Harbo. Madeira Park, B.C.: Harbour Publishing, 2011.

HCTF Education Resources and Educator Guides

- **Backyard Biodiversity and Beyond** by Susan Dulc. Canadian Heritage and Canada-British Columbia Partnership Agreement on Forest Resource Development: FRDA II. 1999. Biodiversity based activities adaptable for ocean and shoreline ecosystems. Available in English and French. *resourceroom.hctfeducation.ca/collections/books-and-guides-1/products/backyard-biodiversity-beyond*
- **Beach Explorations:** A Curriculum for Grades 5–10. Gloria Snively. 1998. Kingfisher Press, Sooke, B.C. Canada.
- **David Suzuki Ocean Activity Kit for Kids:** *http://tnenvis.nic.in/WriteReadData/CMS/OCEAN%20ACTIVITY.pdf*
- **Department of Ecology - State of Washington, teaching resources on estuaries, the Salish Sea, and coastal management.** *ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Padilla-Bay-reserve/Education-programs/Teachers-resources*
- **Department of Fisheries and Oceans: Education guides and tools** (K-12, Pacific Region, Stream to Sea program) *http://www.pac.dfo-mpo.gc.ca/education/resources-ressources-eng.html*
- **Get Outdoors! An Educator's Guide to Outdoor Classrooms in Parks, Schoolgrounds and Other Special Places.** Sue Staniforth. WildBC and BC Ministry of Environment. 2009. Outdoor activities including sensory and awareness building, hands-on mapping, cultural explorations of special places, values exploration and projects. Buy hardcopy: *resourceroom.hctfeducation.ca/collections/books-and-guides-1/products/get-outdoors* OR download free PDF: *https://hctfeducation.ca/file/get-outdoors.pdf*
- **Oceanwise, Ocean Education Resources**: Vancouver Aquarium and Partners. *education.ocean.org/kits*
- **Once Upon a Seashore:** A Curriculum for Grades K–6. Gloria Snively. 2001. Kingfisher Press, Sooke, B.C. Canada.
- **Project WILD.** Canadian Wildlife Federation, 2010. Published in French as Atout-FAUNE.
- **WILD about Sports: What is My Connection to Water?** Canadian Wildlife Federation. 2017.

Videos, Games and Apps

- **iBiome-Ocean** video game app by Springbay Studios. Students explore the natural balance of ocean habitats, building diverse and intricate ecosystems. Celebrate the rich diversity of sea life and study the human impact on our oceans. Sequel to the award-winning educational game – iBiome-Wetland. Available on iTunes stores (free Lite version; full or school versions have a small cost.)

https://springbaystudio.com/discover-the-ibiome-series-of-award-winning-scientist-games/

- **Salish Sea Intertidal Identification Quiz Game:** Intertidal organisms of the Salish Sea, online field guide and quiz game created by the Sound Water Stewards from Washington State University. *soundwaterstewards.org/education-center/marine-species-identification/*
- **The Deep Sea:** An enlightening, interactive visualization that reveals the common and little-known mysterious life living from the surface of the ocean to its deepest points. *neal.fun/deep-sea/*
- **The Intertidal Zone,** by David Denning, 1985. This 17 minute classic documentary film explores the ecosystems of the intertidal zone in British Columbia. The filmmakers study the ecology of this unique environment, including its life cycles and food chains. *nfb.ca/film/intertidal_zone/*
- **The Plankton Chronicles Project:** A short documentary series combining art and science, revealing the beauty and diversity of organisms adrift in the currents. *planktonchronicles.org/*
- **The Secret Life of Plankton, by Thierney Thys.** A TED-Ed animated film designed to ignite wonder and curiosity about the oceans' hidden microscopic ecosystem that underpins our own foodchain. *ed.ted.com/lessons/the-secret-life-of-plankton*
- **Welcome to Crazy Town:** Video from the Hakai Institute (02:56). January 27, 2020, By Grant Callegari. At first glance, the rocky shores of Calvert Island don't seem like a very hospitable place for an animal. And yet on these wave-battered rocks, we find life stacked on life layered on even more life. Come with us to explore a site ecologists affectionately call Crazy Town. *hakai.org/blog/welcome-to-crazy-town/*

Take Action, Citizen Science

- **GLOBE Canada protocols** for intertidal monitoring and shoreline mapping. *placebasedbasics.weebly.com/intertidal-monitoring1.html*
- **Great Canadian Shoreline Cleanup:** Lead or join a cleanup: *shorelinecleanup.ca*
- **iNaturalist:** A citizen science project and online social network of naturalists, citizen scientists, and biologists built on the concept of mapping and sharing observations of biodiversity across the globe. Website and app*: inaturalist.ca*
- **Jelly Watch:** Count jellyfish and report your findings to help determine if jellyfish are increasing across the world due to changes in the ocean, such as climate change and overfishing*: jellywatch.org*
- **The SeaDoc Society:** The mission of the SeaDoc Society is to ensure the health of marine wildlife and their ecosystems through science and education. Includes videos and Junior SeaDoctors, a free virtual club that provides young adventurers with the tools they need to interact with the wildlife of the Salish Sea: *seadocsociety.org/*
- **The Surfrider Foundation:** Dedicated to the protection and enjoyment of the world's oceans, waves and beaches through a powerful activist network. There are 3 chapters in Canada, all in British Columbia. *surfrider.org*

Organizations

- **Bamfield Marine Sciences Centre**: Educational resources from Vancouver Island's premier marine science research institution*: bamfieldmsc.com/resources/k12-educators*
- **CaNOE: Canadian Network for Ocean Education:** A network for the advancement of ocean literacy in Canada*: oceanliteracy.ca*
- **Hakai Institute**: Organization that conducts scientific research in remote locations of coastal BC. They also produce Hakai magazine with award-winning science journalism and videos *hakai.org* | *hakaimagazine.com*
- **NAME: Northwest Aquatic and Marine Educators:** A "family" of educators passionate about oceans and watersheds *pacname.org*
- **NOAA: National Oceanic and Atmospheric Association:** Their mission: Science, Service and Stewardship *oceanexplorer.noaa.gov/edu/welcome.html*
- **NMEA: National Marine Educators Association:** An organization of classroom teachers, informal educators, university professors, scientists, and more from around the world working together to advance the understanding and protection of our freshwater and marine ecosystems *marine-ed.org*
- **Ocean Networks Canada:** Enhances life on Earth by providing knowledge and leadership that deliver solutions for science, society, and industry. *oceannetworks.ca*
- **Pacific Wild:** A B.C. wildlife organization committed to protecting wildlife and their habitat in the Great Bear Rainforest through impactful communications, scientific research and community-led initiatives. *pacificwild.org*
- **Ucluelet Aquarium: Guide to Animals of Barkley and Clayoquot Sound** *uclueletaquarium.org/resources/*
- **Vancouver Aquarium:** *vanaqua.org/groups/education/school-field-trips/*