The Rocky Shore

1 LICHENS form splotches of gray, green, orange or black "paint" on the splash zone rocks. These unique plants—half-algae, half-fungi—slowly dissolve rock, creating soil for more complex plants that follow.

2 PERIWINKLES graze among barnacles or in small cracks. These tiny snails can withstand only occasional immersion in salt water—or they will drown!

3 ROCKWEED—If you hear a loud pop as you cross the intertidal zone, chances are you've stepped on rockweed. This yellow-brown seaweed can lose 90 per cent of its tissue moisture when exposed to the sun, but is quickly rejuvenated when the tide returns.

4 At high tide FINGER LIMPETS glide over the rocks rasping off the thin film of algae. An incredible homing instinct brings individual limpets back to the same spot on the rocks at each low tide.

5 ACORN BARNACLES—Picture yourself standing on your head fanning the water with 12 hairy legs. Using this technique the barnacle captures plankton in the water. When the tide falls it seals itself within its white shell fortress. Listen carefully; can you hear them clicking their trap doors tighter to conserve body moisture?

6 Blue-shelled MUSSELS dominate the mid-tide zone. Like clams, mussels are filter feeders, straining tiny plankton from the water. They anchor to the rocks by secreting thin strands of protein, called byssal threads.

7 SEA SAC—Water-filled sacs keep this seaweed moist during low tides. Gently squeeze one and observe a fine spray of water exit from pores in the body.

8 OCHRE STARFISH aren't fish at all, they're spiny-skinned animals called echinoderms. These voracious predators prefer mussels and barnacles. Instead of swallowing food, they push their stomachs out through their mouths, engulfing and digesting their prey inside its own shell!

9 CORALLINE ALGAE form either a pink "paint" layer or tiny branching structures in tidepools. Although they resemble corals, which are animals, the presence of chlorophyll for food manufacture confirms that they are in fact plants.

10 SEA URCHINS are the "pin cushions" found under rock ledges or in tidepools. Their needle-like spines deter would-be predators. Although related to starfish, urchins eat algae, chewing it with a unique 5-toothed jaw.

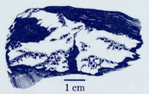
11 HERMIT CRABS have soft skeletons, so they use the shells of dead snails for armor. As they grow, they require ever-larger accommodation and often fight over desirable shells.

12 The TIDEPOOL SCULPIN, a master of disguise, can change color to match its tidepool decor or bury itself in sand with only the large eyes protruding. The sculpin is a "lunge feeder", using its large mouth and darting movements to snap up food.

13 What leaves a pattern of tiny "tire tracks" across the wet sand? It's the PURPLE SHORE CRAB, with its characteristic sideways scuttle. Peek under a loose rock in the intertidal zone and dozens of these feisty crabs will scramble for cover.

14 SEA LEMON—These yellow, shell-less animals secrete a distasteful substance. Their bright colors serve as a warning to predators that they aren't fit to eat.

15 Intertidal SPONGES form brightly-colored felt-like carpets under ledges and in surge channels. They draw seawater through tiny pores into a system of canals, obtain oxygen and food, then expel the water through larger openings.



16 GREEN ANEMONE—Not a green flower at all, but an animal attached to the rock, this creature stings its prey with microscopic barbs, then closes its ring of tentacles to pass the paralyzed prey to a centrally located mouth.

Tidal Tapestries

Tides affect all living things dwelling in the **intertidal zone,** that area which is sometimes land, sometimes sea. As the water level rises and falls, organisms must endure great changes in temperature, pressure, light and salinity, as well as exposure to wind, waves and predators. Despite these hazardous conditions, they have developed ways of protecting themselves from the elements and occupy almost every available space.

On rocky shores, animal and plant species naturally segregate into distinct bands of life, according to their ability to tolerate the elements and in response to predators. Those able to retain sea water for long periods live near the high tide line, while those less tolerant to air exposure cluster near the low tide line. This vertical tapestry of living color is referred to as **intertidal zonation.**

On a sandy beach most intertidal inhabitants burrow below the surface to avoid wave action. If you dig carefully you will find them distributed at different tide levels, even under this sandy mantle.

17 On surf swept rocks, clusters of GOOSE BARNACLES spread their feathery feet with each wave, attempting to capture plankton in the watery turmoil. A 16th century botanist incorrectly attributed the birth of geese to this animal, however, the name has remained.

18 SEA PALM—Your eyes haven't tricked you if you see palm trees at the edge of the sea. This brown algae grows only on wave-washed rocks.

19 The BLACK CHITON rasps away seaweed with a strap-like tongue bearing tiny teeth harder than some steels. A strong foot secures the chiton to the rocks and eight overlapping shells on the back provide flexible protection.

20 Imagine co-ordinating up to 24 arms and 10,000 feet! The SUNFLOWER STAR is the largest (up to one metre across) and fastest (up to two metres a minute) sea star. Generally a subtidal animal, it may wander into tidepools seeking sea urchins.

The Sandy Shore

21 BULL KELP—These unusual-looking plants have drifted ashore from rocky areas. The root-like holdfast anchors the kelp to a boulder while the buoyant stem-like stipe brings the fronds closer to sunlight. This remarkable plant attains a length of 5–25 metres in less than six months!

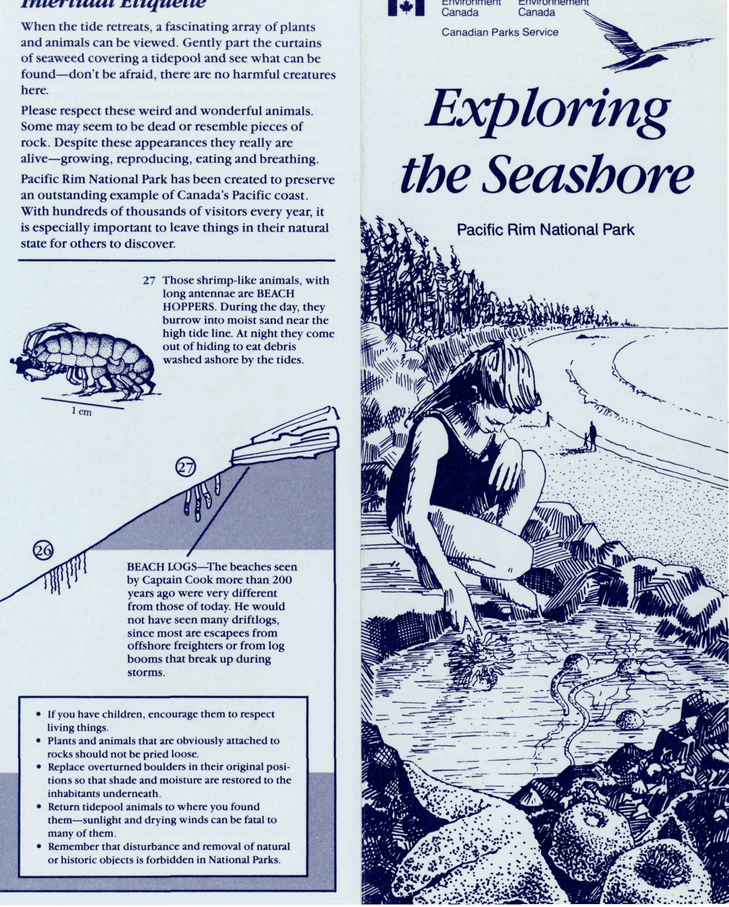
22 The DUNGENESS CRAB prefers offshore sand bottoms, but ventures inshore to molt. Here, the crab backs carefully out of its old suit through a slit in the abdomen. At the tide line the cast-off "clothes" are often mistaken for dead animals.

23 A small "volcano" on the sand surface may betray the presence of an elusive RAZOR CLAM underneath. This inhabitant of hard packed, exposed beaches thrives on plankton-laden foam streaking the surf.

24 A LUG WORM usually excavates a J-shaped burrow capped by a spiral fecal casting—sand that has been ejected after the bacteria coating it have been digested.

25 What burrows through the sand with a snorkel to the surface? A PURPLE OLIVE SNAIL. At low tide you can discover its furrow as it ploughs the sand for tiny bits of nourishment.

26 Mazes of tiny pinholes below the debris-strewn high tide line indicate the presence of small red worms. Drag a finger through the sand and you'll see dozens. BLOODWORMS feed on sand bacteria and, in turn, feed thousands of sandpipers.



Intertidal Etiquette

When the tide retreats, a fascinating array of plants and animals can be viewed. Gently part the curtains of seaweed covering a tidepool and see what can be found—don't be afraid, there are no harmful creatures here.

Please respect these weird and wonderful animals. Some may seem to be dead or resemble pieces of rock. Despite these appearances they really are alive—growing, reproducing, eating and breathing.

Pacific Rim National Park has been created to preserve an outstanding example of Canada's Pacific coast. With hundreds of thousands of visitors every year, it is especially important to leave things in their natural state for others to discover.

27 Those shrimp-like animals, with long antennae are BEACH HOPPERS. During the day, they burrow into moist sand near the high tide line. At night they come out of hiding to eat debris washed ashore by the tides.

BEACH LOGS—The beaches seen by Captain Cook more than 200 years ago were very different from those of today. He would not have seen many driftlogs, since most are escapees from offshore freighters or from log booms that break up during storms.

- If you have children, encourage them to respect living things.
- Plants and animals that are obviously attached to rocks should not be pried loose.
- Replace overturned boulders in their original positions so that shade and moisture are restored to the inhabitants underneath.
- Return tidepool animals to where you found them—sunlight and drying winds can be fatal to many of them.
- Remember that disturbance and removal of natural or historic objects is forbidden in National Parks.

Environment Canada Environnement Canada
Canadian Parks Service

Exploring the Seashore

Pacific Rim National Park

Sometimes Land, Sometimes Sea

You never forget your first visit to the land's outer edge. Wandering along a sandy beach, scrambling over headlands, peering into tidepools, watching the fury of waves against rock. . .the shore invites exploration and discovery.

The shore is the meeting place of the land and the sea. It is a dynamic environment; when submerged at high tide it belongs to the sea, but as the water ebbs it is claimed by the land. The seashore is sometimes land, sometimes sea.

The saga of the shore is one of give and take. Sometimes this ocean is pacific in nature as well as in name. Quiet waves lap the shore, bringing countless sand grains from deeper water to the beach. At other times, the ocean becomes a foaming cauldron that shatters solid stone, drags sand offshore, and challenges the endurance of all living things. Tides, winds, waves and currents leave their marks daily upon the shore, and a winter beach is sharply different from that of summer.

Pacific Rim National Park invites you to explore the shoreline and discover its moods, its contrasts, and perhaps, some of its secrets.

In the Beginning. . . Fire and Ice

Where did Long Beach come from? How long has it been here? The answers, like the rocks, have been slow in forming but geologists generally agree its history goes something like this:

Formation of the Bedrock Basement: The rocks of the headlands and nearby hills are a chaotic mixture of sediments, volcanic ashes and lavas deposited in deep waters offshore. Over millions of years these rocks were uplifted, mixed and compressed against the island.

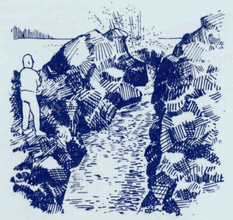
Addition of a Glacial Mantle: About 37,000 years ago, glaciers along Vancouver Island's mountainous spine expanded and slowly crept downhill. The area sagged under the weight of an ice sheet 300 metres thick which flowed right out to sea. About 12,000 years ago, the glaciers started to retreat, dropping their load of sands, clays and gravels scraped from the mountains. These deposits now form a **mantle** over most of the local bedrock.

Birth of Beaches: As the ice melted, sea level rose. Surf beat against the glacial deposits, carving Florencia and Wickaninnish Bays and pulverizing loosened rocks into fine sand. At Florencia Bay, this mantle, seen as cliffs of sand, clay and gravel, is still crumbling onto the beach during storms. Two other sources have contributed to beach formation: **headlands** slowly fragmented by waves and weather and the millions of **seashells** churned and ground into white granules.

For more information on the geology of the park, pick up a copy of the free brochure, ***Are We on Solid Ground?*** at the Park Information Centre.

Stone Sculptures

On the headlands, pillars, pools, caves and channels have been sculptured by ocean, weather and time. Below, are examples of nature's on-going handiwork.



Storm waves attack headlands, scouring cracks and breaking down softer rock to form SURGE CHANNELS and tidepools.

Some surge channels end in SEA CAVES.

A sea cave may eventually wear through a bluff to form a SEA ARCH.

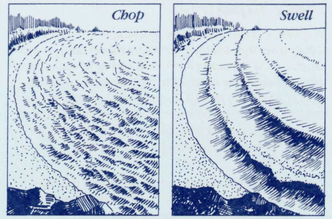
With time, the roof of a sea arch will collapse, leaving pillars of stone: SEA STACKS.

Waves

Every day, thousands of them roll in from the Pacific. Each arrival is a unique event, for like snowflakes, no two waves are identical.

Waves have a variety of shapes, sizes, speeds and origins. Some are too large to be observed, while others travel below the water's surface. They can be caused by wind, passing ships, earthquakes, seafloor disturbances or the passage of the sun and moon across the sky.

What are waves? Simply, they are packets of energy transmitted as rolling walls of water. Closely packed, steep irregular waves (called **chop**) are created when local winds ruffle the sea surface. In contrast, **swells** are long and regular. Swells are energy being dissipated from distant storms, travelling perhaps several days before expending themselves on the shore.



When exploring the seashore you can't help noticing the effect of tides, the world's largest waves. Thousands of kilometres long, yet so broad and low that a ship cannot feel their passing, tides are the perpetual result of the gravitational pull of the sun and moon upon ocean water.

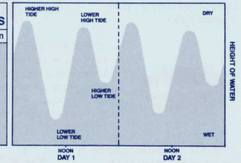
Tides

Long Beach experiences two high and two low tides in a typical day, corresponding to the crests and troughs of two enormous waves travelling around the world. The tidal cycle, from low to high tide and back to low tide, takes just over 12 hours. The times of the low and high tides are about 50 minutes later on each succeeding day.

Successive tides reach different levels on the beach in response to the changes in position of sun, moon and earth, the tilt of the earth's axis and local weather conditions.

TOFINO TIDE TABLES

Day	Time	Ht./m
1	0125	3.6
	0815	.1
	1455	3.1
	2010	1.5
2	0205	3.5
	0900	.6
	1540	3.1
	2100	1.4



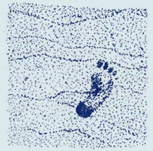
The tides of Pacific Rim National Park have an annual range of 4.1 metres—the vertical distance between the highest and lowest water levels. The average daily range is less—generally 2–3 vertical metres. On a gently sloping shore the tides may advance or retreat horizontally across several hundred metres. During winter, high tides and storm waves may cast driftlogs into the forest edge, while summer low tides may expose a vast expanse of glistening sand.

Tide tables are posted at various park facilities. Remember that "Time and the tide wait for no man", so it is best to plan activities according to the tides. While hiking on the headlands is more difficult during high tide periods, tidepool viewing is best when tide levels fall below 1.5 metres.

Sand Signatures

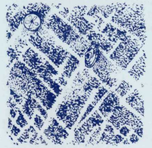
Waves and currents write their signatures upon the beach. When the tide retreats, they await deciphering:

RIPPLES: In the fluid sand, waves of water are transferred into waves of sand—a reflection of the water movements that formed them.



SWASH MARKS mark the limit of a wave's final advance up the sand. Swash marks are usually tiny ridges of sand but may also be marked by lines of foam, shell or beached seaweed.

As the tide retreats, water drains through the sand, emerging as tiny branching streams called RIVULETS and RILLS.



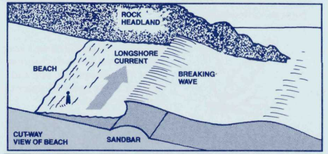
RHOMBOID PATTERNS, looking like diamonds etched in the sand, form when waves wash up the beach from one direction, then recede in another.

Words to the Wise

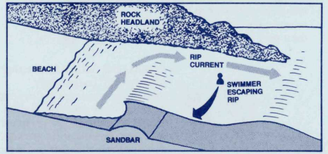
When hiking on the rocky shore beware of slippery rocks and keep an eye on wave conditions. Allow ample time for these walks, because irregularities in the shoreline will significantly slow progress. During conditions of high tide and large waves, travel on beaches may be hazardous. Always observe the beach before walking on it. Consider the possibility of rolling driftlogs or extra large waves sweeping to the top of the beach.

On hot summer days the waters of Long Beach may look inviting, but the Pacific is numbingly cold. Don't stay in the water too long, because the cold can rapidly render you helpless. Prolonged immersion can cause hypothermia—a potentially fatal condition where the body core temperature drops dangerously low.

Rip currents, strong seaward flows of water, are another hazard. They occur beside rock headlands and near submerged sand bars.



Breaking waves flow over a submerged sand bar. Water piles up on the beach side of the bar and drifts parallel to the shore.



Eventually, the water pressure near the beach carves a deep channel in the sand along the edge of a rock headland or a nearshore island, or through the sand bar itself. In each case, a swift current is formed, returning the trapped water seaward. This outward flow of seawater is known as a **rip current.**

For your safety, **AVOID SWIMMING NEAR ROCK HEADLANDS.** If caught in a rip current, stay calm; do not try to swim against the current. Swim parallel to the beach and away from any rocks until out of the current, then swim towards shore. Rip channels are not very wide and most swimmers will be able to escape using this procedure. Contact Park Wardens or the Park Surfguards, located at Long Beach, for further information on water conditions and safety.

Get More From Your Visit

During the summer, join Park Interpreters for a variety of free programs on topics ranging from seashore life to maritime history. Visit the Wickaninnish Centre and experience the open ocean through displays, films and presentations by friendly staff. For more information check bulletin boards in the park or contact the Park Information Centre (726-4212).

Additional Reading

Bascom, W.N. *Waves and Beaches: The Dynamics of the Ocean's Surface.*
New York: Anchor Books, 1980.

Carefoot, T.H. *Pacific Seashores: A Guide to Intertidal Ecology.*
Vancouver: J.J. Douglas, 1977.

Kozloff, E.N. *Seashore Life of the Northern Pacific Coast.*
Vancouver: Douglas and McIntyre, 1983.

Snively, G. *Exploring the Seashore.*
Vancouver: Gordon Soules Ltd., 1978.

Paralytic Shellfish Poisoning (P.S.P.)

Clams, oysters and mussels feed by straining plankton from the water. At times they digest and accumulate in their tissues a toxin from a plankton called ***Gonyaulax catenella.*** This toxin does not harm the shellfish but will affect humans eating them. P.S.P. symptoms range from tingling lips to paralysis and, occasionally, death. Check with Park Wardens, the Park Information Centre, or Federal Fisheries Offices to determine shellfish closures in effect during your visit.

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